Microsoft

Second Edition

A Guide to Claims-Based Identity and Access Control

Authentication and Authorization for Services and the Web

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patterns & practices

A GUIDE TO CLAIMS-BASED IDENTITY AND ACCESS CONTROL

A GUIDE TO

Claims-Based Identity and Access Control

SECOND EDITION

Authentication and Authorization for Services and the Web

patterns & practices
Microsoft Corporation

Contents

Foreword

Claims-based identity seeks to control the digital experience and allocate digital resources based on claims made by one party about another. A party can be a person, organization, government, website, web service, or even a device. The very simplest example of a claim is something that a party says about itself.

As the authors of this book point out, there is nothing new about the use of claims. As far back as the early days of mainframe computing, the operating system asked users for passwords and then passed each new application a "claim" about who was using it. But this world was based to some extent on wishful thinking because applications didn't question what they were told.

As systems became interconnected and more complicated, we needed ways to identify parties across multiple computers. One way to do this was for the parties that used applications on one computer to authenticate to the applications (and/or operating systems) that ran on the other computers. This mechanism is still widely used—for example, when logging on to a great number of Web sites.

However, this approach becomes unmanageable when you have many co-operating systems (as is the case, for example, in the enterprise). Therefore, specialized services were invented that would register and authenticate users, and subsequently provide claims about them to interested applications. Some well-known examples are NTLM, Kerberos, Public Key Infrastructure (PKI), and the Security Assertion Markup Language (SAML).

If systems that use claims have been around for so long, how can claims-based computing be new or important? The answer is a variant of the old adage, "All tables have legs, but not all legs have tables." The claims-based model embraces and subsumes the capabilities of all the systems that have existed to date, but it also allows many new things to be accomplished. This book gives a great sense of the resultant opportunities.

For one thing, identity no longer depends on the use of unique identifiers. NTLM, Kerberos, and public key certificates conveyed, above all else, an identification number or name. This unique number could be used as a directory key to look up other attributes and to track activities. But once we start thinking in terms of claims-based computing, identifiers were not mandatory. We don't need to say that a person is associated with the number X, and then look in a database to see if number X is married. We just say the person is married. An identifier is reduced to one potential claim (a thing said by some party) among many.

This opens up the possibility of many more directly usable and substantive claims, such as a family name, a person's citizenship, the right to do something, or the fact that someone is in a certain age group or is a great customer. One can make this kind of claim without revealing a party's unique identity. This has immense implications for privacy, which becomes an increasingly important concern as digital identity is applied to our personal lives.

Further, while the earlier systems were all hermetic worlds, we can now look at them as examples of the same thing and transform a claim made in one world to a claim made in another. We can use "claims transformers" to convert claims from one system to another, to interpret meanings, apply policies, and to provide elasticity. This is what makes claims essential for connecting our organizations and enterprises into a cloud. Because they are standardized, we can use them across platforms and look at the distributed fabric as a real circuit board on which we can assemble our services and components.

Claims offer a single conceptual model, programming interface, and end-user paradigm, whereas before claims we had a cacophony of disjoint approaches. In my experience, the people who use these new approaches to build products universally agree that they solve many pressing problems that were impossibly difficult before. Yet these people also offer a word of advice. Though embracing what has existed, the claims-based paradigm is fundamentally a new one; the biggest challenge is to understand this and take advantage of it.

That's why this book is so useful. It deals with the fundamental issues, but it is practical and concise. The time spent reading it will be repaid many times over as you become an expert in one of the transformative technologies of our time.

Kim Cameron
Distinguished Engineer—Microsoft Identity Division

Foreword

In the spring of 2008, months before the Windows® Identity Foundation made its first public appearance, I was on the phone with the chief software architect of a Fortune 500 company when I experienced one of those vivid, clarifying moments that come during the course of a software project. We were chatting about how difficult it was to manage an environment with hundreds, or even thousands of developers, all building different kinds of applications for different audiences. In such an environment, the burden of consistent application security usually falls on the shoulders of one designated security architect.

A big part of that architect's job is to guide developers on how to handle authentication. Developers have many technologies to choose from. Microsoft® Windows Integrated Authentication, SAML, LDAP, and X.509 are just a few. The security architect is responsible for writing detailed implementation guidance on when and how to use all of them. I imagined a document with hundreds of pages of technology overviews, decision flowcharts, and code appendices that demonstrate the correct use of technology *X* for scenario *Y*. "If you are building a web application, for employees, on the intranet, on Windows, use Windows Integrated Authentication and LDAP, send your queries to the enterprise directory...."

I could already tell that this document, despite the architect's best efforts, was destined to sit unread on the corner of every developer's desk. It was all just too hard; although every developer knows security is important, no one has the time to read all that. Nevertheless, *every* organization needed an architect to write these guidelines. It was the only meaningful thing they could do to manage this complexity.

It was at that moment that I realized the true purpose of the forthcoming Windows Identity Foundation. It was to render the technology decision trivial. *Architects would no longer need to create complex guidelines for authentication.* This was an epiphany of sorts.

Windows Identity Foundation would allow authentication logic to be factored out of the application logic, and as a result most developers would never have to deal with the underlying complexity. Factoring out authentication logic would insulate applications from changing requirements. Making an application available to users at multiple organizations or even moving it to the cloud would just mean reconfiguring the identity infrastructure, not rewriting the application code. This refactoring of identity logic is the basis of the claims-based identity model.

Eugenio Pace from the Microsoft patterns & practices group has brought together some of the foremost minds on this topic so that their collective experience can be yours. He has focused on practical scenarios that will help you get started writing your own claims-aware applications. The guide works progressively, with the simplest and most common scenarios explained first. It also contains a clear overview of the main concepts. Working source code for all of the examples can be found online (http://claimsid.codeplex.com).

I have truly enjoyed having Eugenio be part of our extended engineering team during this project. His enthusiasm, creativity, and perseverance have made this book possible. Eugenio is one of the handful of people I have met who revel in the challenge of identity and security and who care deeply that it be done right.

Our goal is for this book to earn its way to the corner of your desk and lie there dog-eared and much referenced, so that we can be your identity experts and you can get on with the job that is most important to you: building applications that matter. We wish you much success.

Stuart Kwan
Group Program Manager, Identity and Access Platform

Foreword

As you prepare to dive into this guide and gain a deeper understanding of the integration between claims authentication and Microsoft® SharePoint® 2010, you may find the following admission both exhilarating and frightening at the same time: two years ago I knew virtually nothing about claims authentication. Today, I sit here writing a foreword to an extensive guide on the topic. Whether that's because a few people think I know a thing or two about claims, or just that no one else could spare the time to do it, well, I'll leave that for you to decide.

Fortunately, this guide will give you a big advantage over what I had to work with, and by the time you're finished reading it you'll understand the symbiotic relationship between claims and SharePoint 2010; the good news is that it won't take you two years to do so.

I'll be the first to admit that claims authentication, in different flavors, has been around for a number of years. Like many technologies that turn into core platform components though, it often takes a big bet by a popular product or company to get a technology onto the map. I think SharePoint 2010 has helped create acceptance for claims authentication. Changes of this magnitude are often hard to appreciate at the time, but I think we'll look back at this release some day and recognize that, for many of us, this was the time when we really began to appreciate what claims authentication offers.

From Windows claims, or authentication as we've always known it, to the distributed authentication model of SAML claims, there are more choices than ever before. Now we can use federated authentication much more easily with products such as Active Directory® Federation Services (ADFS) 2.0, or even connect our SharePoint farms to authentication providers in the cloud, such as the Windows Azure™ AppFabric Access Control Service. We aren't authenticating only Windows users anymore; we can have users authenticate against our Active Directory from virtually any application—SiteMinder, Yahoo, Google, Windows Live, Novell eDirectory. Now we can even write our own identity provider using Microsoft Visual Studio® and the Windows Identity Foundation framework. We can use those claims in SharePoint; we can add our own custom claims to them, we can inject our own code into the out-of-the-box people picker, and much more.

I believe this guide provides you with the foundation to help you take advantage of all of these opportunities and more. Many people from around the company either directly or indirectly helped to contribute to its success. Here's hoping you can build on it and turn it into your own success.

Steve Peschka
Principal Architect
Microsoft SharePoint Online—Dedicated

Preface

As an application designer or developer, imagine a world in which you don't have to worry about authentication. Imagine instead that all requests to your application already include the information you need to make access control decisions and to personalize the application for the user.

In this world, your applications can trust another system component to securely provide user information, such as the user's name or email address, a manager's email address, or even a purchasing authorization limit. The user's information always arrives in the same simple format, regardless of the authentication mechanism, whether it's Microsoft® Windows® integrated authentication, forms-based authentication in a web browser, an X.509 client certificate, or something more exotic. Even if someone in charge of your company's security policy changes how users authenticate, you still get the information, and it's always in the same format.

This is the utopia of claims-based identity that *A Guide to Claims-Based Identity and Access Control* describes. As you'll see, claims provide an innovative approach for building applications that authenticate and authorize users.

Who This Book Is For

This book gives you enough information to evaluate claims-based identity as a possible option when you're planning a new application or making changes to an existing one. It is intended for any architect, developer, or information technology (IT) professional who designs, builds, or operates web applications and services that require identity information about their users. Although applications that use claims-based identity exist on many platforms, this book is written for people who work with Windows-based systems. You should be familiar with the Microsoft .NET Framework, ASP.NET, Windows Communication Foundation (WCF), Microsoft Active Directory® directory service, and Microsoft Visual C#® development system.

Why This Book Is Pertinent Now

Although claims-based identity has been possible for quite a while, there are now tools available that make it much easier for developers of Windows-based applications to implement it. These tools include the Windows Identity Foundation (WIF) and Microsoft Active Directory Federation Services (ADFS) 2.0. This book shows you when and how to use these tools in the context of some commonly occurring scenarios.

A Note about Terminology

This book explains claims-based identity without using a lot of new terminology. However, if you read the various standards and much of the existing literature, you'll see terms such as *relying party, STS, subject, identity provider,* and so on. Here is a short list that equates some of the most common expressions used in the literature with the more familiar terms used in this book. For additional clarification about terminology, see the glossary at the end of the book.

RELYING PARTY (RP) = APPLICATION
SERVICE PROVIDER (SP) = APPLICATION

A relying party or a service provider is an application that uses claims. The term *relying party* arose because the application relies on an issuer to provide information about identity. The term *service provider* is commonly used with the Security Assertion Markup Language (SAML). Because this book is intended for people who design and build applications, it uses *application*, or *claims-aware application*, when it is discussing the functionality of the application, and *relying party* or *RP*, when it is talking about the role of the application in relation to identity providers and federation providers. It does not use *service provider* or *SP*.

SUBJECT = USER
PRINCIPAL = USER

A subject or a principal is a user. The term *subject* has been around for years in security literature, and it does make sense when you think about it—the user is the subject of access control, personalization, and so on. A subject can be a non-human entity, such as printer or another device, but this book doesn't discuss such scenarios. In addition, the .NET Framework uses the term *principal* rather than *subject*. This book talks about *users* rather than *subjects* or *principals*.

SECURITY TOKEN SERVICE (STS) = ISSUER

Technically, a security token service is the interface within an issuer that accepts requests and creates and issues security tokens containing claims.

IDENTITY PROVIDER (IdP) = ISSUER

An identity provider is an issuer, or a *token issuer* if you prefer. Identity providers validate various user credentials, such as user names, passwords, and certificates; and they issue tokens.

RESOURCE SECURITY TOKEN SERVICE (R-STS) = ISSUER

A resource security token service accepts one token and issues another. Rather than having information about identity, it has information about the resource. For example, an R-STS can translate tokens issued by an identity provider into application-specific claims.

ACTIVE CLIENT = SMART OR RICH CLIENT
PASSIVE CLIENT = BROWSER

Much of the literature refers to *active* versus *passive* clients. An active client can use a sophisticated library such as Windows Communication Foundation (WCF) to implement the protocols that request and pass around security tokens (WS-Trust is the protocol used in active scenarios). In order to support many different browsers, the passive scenarios use a much simpler protocol to request and pass around tokens that rely on simple HTTP primitives such as HTTP GET (with redirects) and POST. (This simpler protocol is defined in the WS-Federation specification, section 13.)

In this book, an active client is a rich client or a smart client. A passive client is a web browser.

How This Book Is Structured

You can think of the structure of this book as a subway that has main lines and branches. Following the Preface, there are two chapters that contain general information. These are followed by scenarios that show how to apply this knowledge with increasingly more sophisticated requirements.

Here is the map of our subway.

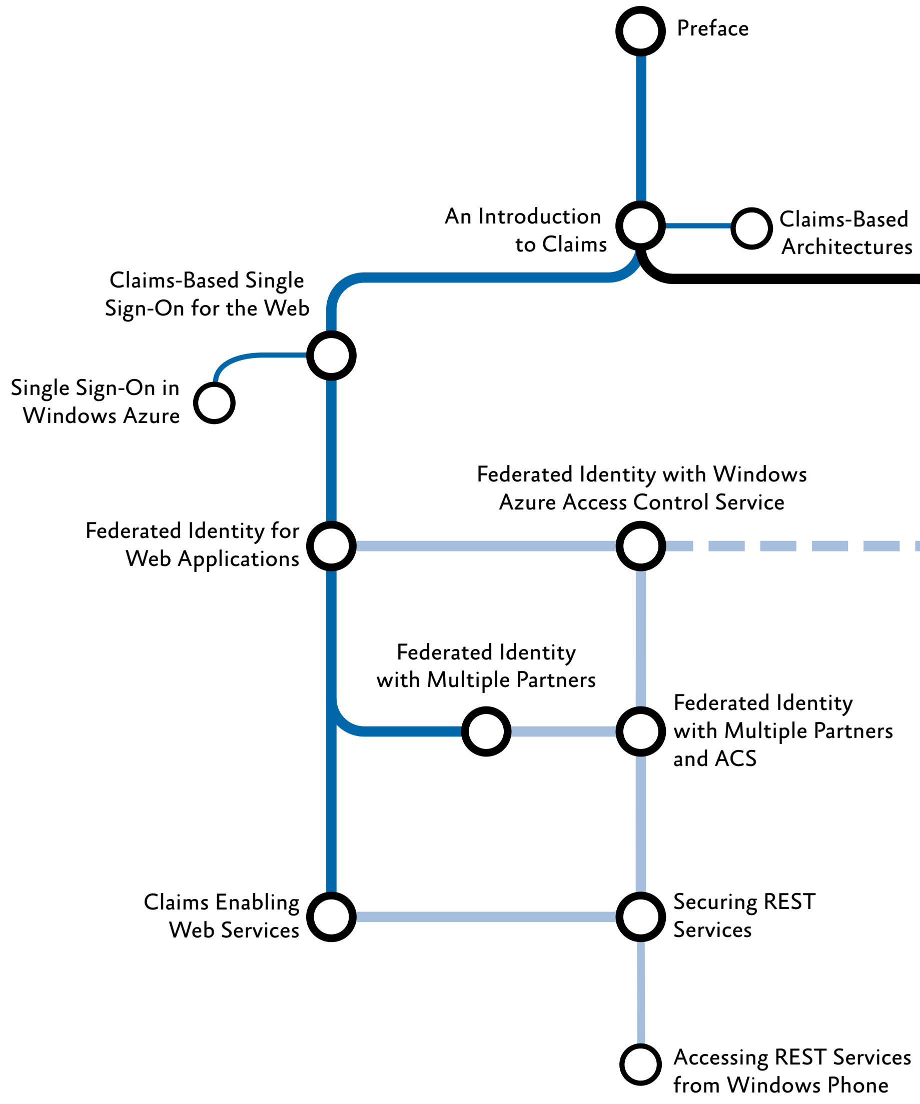

Preface
An Introduction to Claims
Claims-Based Architectures
Claims-Based Single Sign-On for the Web
Single Sign-On in Windows Azure
Claims-Based Single Sign-On for SharePoint
Federated Identity with Windows Azure Access Control Service
Federated Identity for Web Applications
Federated Identity for SharePoint Applications
Federated Identity with Multiple Partners
Federated Identity with Multiple Partners and ACS
Claims Enabling Web Services
Securing REST Services
Accessing REST Services from Windows Phone

FIGURE 1
Map of the book

An Introduction to Claims explains what a claim is and provides general rules on what makes good claims and how to incorporate them into your application. It's probably a good idea that you read this chapter before you move on to the scenarios.

Claims-Based Architectures shows you how to use claims with browser-based applications and smart client applications. In particular, the chapter focuses on how to implement single sign-on for your users, whether they are on an intranet or an extranet. This chapter is optional. You don't need to read it before you proceed to the scenarios.

Claims-Based Single Sign-On for the Web and Windows Azure is the starting point of the path that explores the implementation of single sign-on and federated identity. This chapter shows you how to implement single sign-on and single sign-out within a corporate intranet. Although this may be something that you can also implement with Integrated Windows Authentication, it is the first stop on the way to implementing more complex scenarios. It includes a section for Windows Azure® technology platform that shows you how to move the claims-based application to the cloud.

Federated Identity for Web Applications shows how you can give your business partners access to your applications while maintaining the integrity of your corporate directory and theirs. In other words, your partners' employees can use their own corporate credentials to gain access to your applications.

Federated Identity with Windows Azure Access Control Service is the start of a parallel path that explores Windows Azure AppFabric Access Control Service (ACS) in the context of single sign-on and federated identity. This chapter extends the scenarios described in the previous chapter to enable users to authenticate using social identity providers such as Google and Windows Live® network of Internet services.

Federated Identity with Multiple Partners is a variation of the federated identity scenario that shows you how to federate with partners who have no issuer of their own as well as those who do. It demonstrates how to use the ASP.NET MVC framework to create a claims-aware application.

Federated Identity with Multiple Partners and Windows Azure Access Control Service extends the scenarios described in the previous chapter to include ACS to give users additional choices for authentication that include social identity providers such as Google and Windows Live.

Claims Enabling Web Services is the first of a set of chapters that explore authentication for active clients rather than web browsers. This chapter shows you how to use the claims-based approach with web services, whereby a partner uses a smart client that communicates with identity providers and token issuers using SOAP-based services.

Securing REST Services shows how to use the claims-based approach with web services, whereby a partner uses a smart client that communicates with identity providers and token issuers using REST-based services.

Accessing REST Services from a Windows Phone Device shows how you can use claims-based techniques with Windows Phone™ wireless devices. It discusses the additional considerations that you must take into account when using claims-based authentication with mobile devices.

Claims-Based Single Sign-On for Microsoft SharePoint 2010 begins a path that explores how you can use claims-based identity techniques with Microsoft SharePoint 2010. This chapter shows how SharePoint web applications can use claims-based authentication with an external token issuer such as ADFS to enable access from both internal locations and externally over the web.

Federated Identity for SharePoint Applications extends the previous chapter to show how you can use federated identity techniques to enable users to authenticate using more than one identity provider and token issuer.

About the Technologies

In this guide, you will find discussion on several technologies with which you may not be immediately familiar. The following is a brief description of each one, together with links to where you can find more information.

Windows Identity Foundation (WIF). WIF contains a set of components that enable developers using the Microsoft .NET Framework to externalize identity logic from their application, improving developer productivity, enhancing application security, and enabling interoperability. Developers can apply the same tools and programming model to build on-premises software as well as cloud services without requiring custom implementations. WIF uses a single simplified identity model based on claims, together with interoperability based on industry-standard protocols. For more information see "Windows Identity Foundation Simplifies User Access for Developers," at http://msdn.microsoft.com/en-us/security/aa570351.aspx.

Active Directory Federation Service (ADFS). ADFS is a server role in Windows Server® that provides simplified access and single sign-on for on-premises and cloud-based applications in the enterprise, across organizations, and on the web. It acts as an identity provider and token issuer to enable user access with native single sign-on across organizational boundaries and in the cloud, and to easily connect applications by utilizing industry-standard protocols. For more information, see "Active Directory Federation Services 2.0," at **http://www.microsoft.com/windowsserver2008/en/us/ad-fs-2-overview.aspx**.

Windows Azure. Windows Azure is a cloud services platform that serves as the development, service hosting and service management environment. It is a flexible platform that supports multiple languages and provides developers with on-demand compute and storage services to host, scale, and manage web applications over the Internet through Microsoft datacenters. For more information, see "Windows Azure," at **http://www.microsoft.com/windowsazure/windowsazure/default.aspx**.

Windows Azure AppFabric Access Control Service (ACS). ACS is an easy way to provide identity and access control to web applications and services while integrating with standards-based identity providers. These identity providers can include enterprise directories such as Active Directory, and web identities such as Windows Live ID, Google, Yahoo! and Facebook. ACS enables authorization decisions to be moved out of the application and into a set of declarative rules that can transform incoming security claims into claims that applications understand, and can also be used to manage users' permissions. For more information, see "Windows Azure Access Control," at **http://www.microsoft.com/windowsazure/appfabric/overview/default.aspx**.

What You Need to Use the Code

You can either run the scenarios on your own system or you can create a realistic lab environment. Running the scenarios on your own system is very simple and has only a few requirements, which are listed below.

- Microsoft Windows Vista® SP1, Windows 7, Windows Server 2008 (32-bit or 64-bit), or Windows Server 2008 R2 (32-bit or 64-bit)
- Microsoft Internet Information Services (IIS) 7.0 or 7.5
- Microsoft .NET Framework 4.0
- Microsoft Visual Studio® 2010 (excluding Express editions)
- Windows Azure Tools for Microsoft Visual Studio
- Windows Identity Foundation

NOTE: *If you want to install the Windows Azure Tools on Windows Server 2008 R2 you must first install the .NET Framework version 3.5.1. This is also required for the HTTP Activation features. The .NET Framework version 3.5.1 can be installed from Windows Update.*

Running the scenarios in a realistic lab environment, with an instance of Active Directory Federation Services (ADFS) and Active Directory, requires an application server, ADFS, Active Directory, and a client system. Here are their system requirements.

Application Server

The application server requires the following:

- Windows Server 2008 or Windows Server 2008 R2
- Microsoft Internet Information Services (IIS) 7.0 or 7.5
- Microsoft Visual Studio 2010 (excluding Express editions)
- .NET Framework 4.0
- Windows Identity Foundation

ADFS

The ADFS server requires the following:

- Windows Server 2008 or Windows Server 2008 R2
- Microsoft Internet Information Services (IIS) 7.0 or 7.5
- .NET Framework 4.0
- Microsoft SQL Server® 2005 or 2008 Express Edition

Active Directory

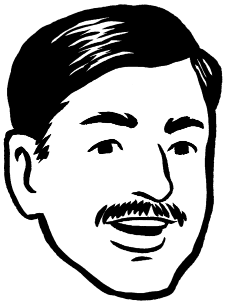
The Active Directory system requires Windows Server 2008 or Windows Server 2008 R2 with Active Directory installed.

Client Computer

The client computer requires Windows Vista or Windows 7 for active scenarios. Passive scenarios may use any web browser that supports HTTP redirection as the client.

Who's Who

As we've said, this book uses a number of scenarios that trace the evolution of several corporate applications. A panel of experts comments on the development efforts. The panel includes a security specialist, a software architect, a software developer, and an IT professional. The scenarios can be considered from each of these points of view. Here are our experts.



Bharath is a security specialist. He checks that solutions for authentication and authorization reliably safeguard a company's data. He is a cautious person, with good reason.

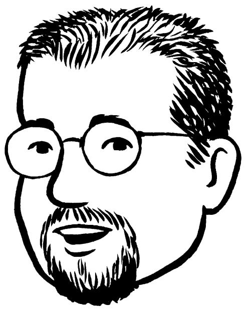
Providing authentication for a single application is easy. Securing all applications across our organization is a different thing.

Jana is a software architect. She plans the overall structure of an application. Her perspective is both practical and strategic. In other words, she considers not only what technical approaches are needed today, but also what direction a company needs to consider for the future.

It's not easy, balancing the needs of users, the IT organization, the developers, and the technical platforms we rely on.

Markus is a senior software developer. He is analytical, detail-oriented, and methodical. He's focused on the task at hand, which is building a great claims-based application. He knows that he's the person who's ultimately responsible for the code.

I don't care what you use for authentication, I'll make it work.



Poe is an IT professional who's an expert in deploying and running in a corporate data center. He's also an Active Directory guru. Poe has a keen interest in practical solutions; after all, he's the one who gets paged at 3:00 AM when there's a problem.

Each application handles authentication differently. Can I get a bit of consistency please?!?

If you have a particular area of interest, look for notes provided by the specialists whose interests align with yours.

Acknowledgments

This book marks a milestone in a journey I started in the winter of 2007. At that time, I was offered the opportunity to enter a completely new domain: the world of software delivered as a service. Offerings such as Windows Azure™ technology platform were far from being realized, and "the cloud" was still to be defined and fully understood. My work focused mainly on uncovering the specific challenges that companies would face with this new way of delivering software.

It was immediately obvious that managing identity and access control was a major obstacle for developers. Identity and access control were fundamental. They were prerequisites for everything else. If you didn't get authentication and authorization right, you would be building your application on a foundation of sand.

Thus began my journey into the world of claims-based identity. I was very lucky to initiate this journey with none other than a *claims Jedi,* Vittorio Bertocci. He turned me into a convert.

Initially, I was puzzled that so few people were deploying what seemed, at first glance, to be simple principles. Then I understood why. In my discussions with colleagues and customers, I frequently found myself having to think twice about many of the concepts and about the mechanics needed to put them into practice. In fact, even after longer exposure to the subject, I found myself having to carefully retrace the interactions among implementation components. The principles may have been simple, but translating them into running code was a different matter. Translating them into the *right* running code was even harder.

Around this time, Microsoft announced Windows Identity Foundation (WIF), Active Directory® Federation Services (ADFS) 2.0, and Windows Azure AppFabric Access Control Service (ACS). Once I understood how to apply those technologies, and how they dramatically simplified claims-based development, I realized that the moment had come to create a guide like the one you are now reading.

Even after I had spent a significant amount of time on the subject, I realized that providing prescriptive guidance required greater proficiency than my own, and I was lucky to be able to recruit for my quest some very bright and experienced experts. I have thoroughly enjoyed working with them on this project and would be honored to work with this fine team again. I was also fortunate to have skilled software developers, software testers, technical writers, and others as project contributors.

I want to start by thanking the following subject matter experts and key contributors to this guide: Dominick Baier, Vittorio Bertocci, Keith Brown, and Matias Woloski. These guys were outstanding. I admire their rigor, their drive for excellence, and their commitment to practical solutions.

Running code is a very powerful device for explaining how technology works. Designing sample applications that are both technically and pedagogically sound is no simple task. I want to thank the project's development and test teams for providing that balance: Federico Boerr, Carlos Farre, Diego Marcet, Anant Manuj Mittal, Erwin van der Valk, and Matias Woloski.

This guide is meant to be authoritative and prescriptive in the topics it covers. However, we also wanted it to be simple to understand, approachable, and entertaining—a guide you would find *interesting* and you would *enjoy* reading. We invested in two areas to achieve these goals: an approachable writing style and an appealing visual design.

A team of technical writers and editors were responsible for the text. They performed the miracle of translating and organizing our jargon- and acronym-plagued drafts, notes, and conversations into clear, readable text. I want to direct many thanks to RoAnn Corbisier, Colin Campbell, Roberta Leibovitz, and Tina Burden for doing such a fine job on that.

The innovative visual design concept used for this guide was developed by Roberta Leibovitz and Colin Campbell (Modeled Computation LLC) who worked with a team of talented designers and illustrators. The book design was created by John Hubbard (Eson). The cartoon faces and chapter divisions were drawn by the award-winning Seattle-based cartoonist Ellen Forney. The technical illustrations were adapted from my Tablet PC mock-ups by Veronica Ruiz. I want to thank the creative team for giving this guide such a great look.

I also want to thank all the customers, partners, and community members who have patiently reviewed our early content and drafts. You have truly helped us shape this guide. Among those, I want to highlight the exceptional contributions of Zulfiqar Ahmed, Michele Leroux Bustamante (IDesign), Pablo Mariano Cibraro (Tellago Inc), Hernan DeLahitte (DigitFactory), Pedro Felix, Tim Fischer (Microsoft Germany), Mario Fontana, David Hill, Doug Hiller, Jason Hogg, Ezequiel Jadib, Brad Jonas, Seshadri Mani, Marcelo Mas, Vijayavani Nori, Krish Shenoy, Travis Spencer (www.travisspencer.com), Mario Szpuszta (Sr. Architect Advisor, Microsoft Austria), Chris Tavares, Peter M. Thompson, and Todd West.

Finally, I want to thank Stuart Kwan and Conrad Bayer from the Identity Division at Microsoft for their support throughout. Even though their teams were extremely busy shipping WIF and ADFS, they always found time to help us.

Eugenio Pace
Senior Program Manager – *patterns & practices*
Microsoft Corporation

Acknowledgements to Contributors to this Second Edition

All our guides are the result of great work from many people. I'm happy to see that so many of the original contributors and advisors of our first guide also worked on this one. The interest in this particular area has increased notably since the first edition was published. Proof of that is the continued investment by Microsoft in tools, services, and products.

As our scope increased to cover SharePoint and Windows Azure Access Control Service, we also added new community members and industry experts who have significantly helped throughout the development of this new edition.

We'd like to acknowledge the following individuals who have exceptionally contributed to it: Zulfiquar Ahmed, Dominic Betts, Federico Boerr, Robert Bogue, Jonathan Cisneros, Shy Cohen, David Crawford, Pedro Felix, David Hill, Alex Homer, Laura Hunter, Chris Keyser, Jason Lee, Alik Levin, Masashi Narumoto, Nicolas Paez, Brian Puhl, Paul Schaeflein, Ken St. Cyr, Venky Veeraraghavan, Rathi Velusamy, Bill Wilder, Daz Wilkin, Jim Zimmerman, Scott Densmore, Steve Peschka, and Christian Nielsen

We also want to thank everyone who participated in our CodePlex community site.

[illegible]

Eugenio Pace
Sr. Program Manager Lead – *patterns & practices*
Microsoft Corporation, May 2011

1 An Introduction to Claims

This chapter discusses some concepts, such as *claims* and *federated identity,* that may sound new to you. However, many of these ideas have been around for a long time. The mechanics involved in a claims-based approach have a flavor similar to Kerberos, which is one of the most broadly accepted authentication protocols in use today and is also the protocol used by Microsoft® Active Directory® directory service. Federation protocols such as WS-Federation and the Security Assertion Markup Language (SAML) have been with us for many years as interoperable protocols that are implemented on all major technology platforms.

Claims-based identity isn't new. It's been in use for almost a decade.

What Do Claims Provide?

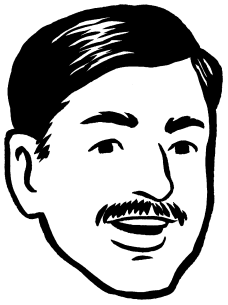
To see the power of claims, you might need to change your view of authentication. It's easy to let a particular authentication mechanism constrain your thinking. If you use Integrated Windows Authentication (Kerberos or NTLM), you probably think of identity in terms of Microsoft Windows® user accounts and groups. If you use the ASP.NET membership and roles provider, you probably think in terms of user names, passwords, and roles. If you try to determine what the different authentication mechanisms have in common, you can abstract the individual elements of identity and access control into two parts: a single, general notion of claims, and the concept of an issuer or an authority.

> *A **claim** is a statement that one subject makes about itself or another subject. The statement can be about a name, identity, key, group, privilege, or capability, for example. Claims are issued by a provider, and they are given one or more values and then packaged in security tokens that are issued by an **issuer**, commonly known as a **security token service** (STS). For a full list of definitions of terms associated with claims-based identity, see "Claims-Based Identity Term*

Definitions" at http://msdn.microsoft.com/en-us/library/ee534975.aspx.

Thinking in terms of claims and issuers is a powerful abstraction that supports new ways of securing your applications. Because claims involve an explicit trust relationship with an issuer, your application believes a claim about the current user only if it trusts the entity that issued the claim. Trust is explicit in the claims-based approach, not implicit as in other authentication and authorization approaches with which you may be familiar.

The following table shows the relationships between security tokens, claims, and issuers.



You can use claims to implement role-based access control (RBAC). Roles are claims, but claims can contain more information than just role membership. Also, you can send claims inside a signed (and possibly encrypted) security token to assure the receiver that they come from a trusted issuer.

Security token	**Claims**	**Issuer**
Windows token. This token is represented as a security identifier (SID). This is a unique value of variable length that is used to identify a security principal or security group in Windows operating systems.	User name and groups.	Windows Active Directory domain.
User name token.	User name.	Application.
Certificate.	Examples can include a certificate thumbprint, a subject, or a distinguished name.	Certification authorities, including the root authority and all authorities in the chain to the root.

The claims-based approach to identity makes it easy for users to sign in using Kerberos where it makes sense, but at the same time, it's just as easy for them to use one or more (perhaps more Internet-friendly) authentication techniques, without you having to recode, recompile, or even reconfigure your applications. You can support any authentication technique, some of the most popular being Kerberos, forms authentication, X.509 certificates, and smart cards, as well as information cards and others.

Claims provide a powerful abstraction for identity.

Not Every System Needs Claims

Sometimes claims aren't needed. This is an important disclaimer. Companies with a host of internal applications can use Integrated Windows Authentication to achieve many of the benefits provided by claims. Active Directory does a great job of storing user identities, and because Kerberos is a part of Windows, your applications don't have to include much authentication logic. As long as every application you build can use Integrated Windows Authentication, you may have already reached your identity utopia.

However, there are many reasons why you might need something other than Windows authentication. You might have web-facing applications that are used by people who don't have accounts in your Windows domain. Another reason might be that your company has merged with another company and you're having trouble authenticating across two Windows forests that don't (and may never) have a trust relationship. Perhaps you want to share identities with another company that has non-.NET Framework applications or you need to share identities between applications running on different platforms (for example, the Macintosh). These are just a few situations in which claims-based identity can be the right choice for you.

Claims Simplify Authentication Logic

Most applications include a certain amount of logic that supports identity-related features. Applications that can't rely on Integrated Windows Authentication tend to have more of this than applications that do. For example, web-facing applications that store user names and passwords must handle password reset, lockout, and other issues. Enterprise-facing applications that use Integrated Windows Authentication can rely on the domain controller.

But even with Integrated Windows Authentication, there are still challenges. Kerberos tickets only give you a user's account and a list of groups. What if your application needs to send email to the user? What if you need the email address of the user's manager? This starts to get complicated quickly, even within a single domain. To go beyond the limitations of Kerberos, you need to program Active Directory. This is not a simple task, especially if you want to build efficient Lightweight Directory Access Protocol (LDAP) queries that don't slow down your directory server.

Claims-based identity allows you to factor out the authentication logic from individual applications. Instead of the application determining who the user is, it receives claims that identify the user.

*Claims help you to factor authentication logic **out** of your applications.*

A Familiar Example

Claims-based identity is all around us. A very familiar analogy is the authentication protocol you follow each time you visit an airport. You can't simply walk up to the gate and present your passport or driver's license. Instead, you must first check in at the ticket counter. Here, you present whatever credential makes sense. If you're going overseas, you show your passport. For domestic flights, you present your driver's license. After verifying that your picture ID matches your face (authentication), the agent looks up your flight and verifies that you've paid for a ticket (authorization). Assuming all is in order, you receive a boarding pass that you take to the gate.

A boarding pass is very informative. Gate agents know your name and frequent flyer number (authentication and personalization), your flight number and seating priority (authorization), and perhaps even more. The gate agents have everything that they need to do their jobs efficiently.

There is also special information on the boarding pass. It is encoded in the bar code and/or the magnetic strip on the back. This information (such as a boarding serial number) proves that the pass was issued by the airline and is not a forgery.

In essence, a boarding pass is a signed set of claims made by the airline about you. It states that you are allowed to board a particular flight at a particular time and sit in a particular seat. Of course, agents don't need to think very deeply about this. They simply validate your boarding pass, read the claims on it, and let you board the plane.

It's also important to note that there may be more than one way of obtaining the signed set of claims that is your boarding pass. You might go to the ticket counter at the airport, or you might use the airline's web site and print your boarding pass at home. The gate agents boarding the flight don't care how the boarding pass was created; they don't care which issuer you used, as long as it is trusted by the airline. They only care that it is an authentic set of claims that give you permission to get on the plane.

In software, this bundle of claims is called a *security token*. Each security token is signed by the *issuer* who created it. A *claims-based application* considers users to be authenticated if they present a valid, signed security token from a trusted issuer. Figure 1 shows the basic pattern for using claims.

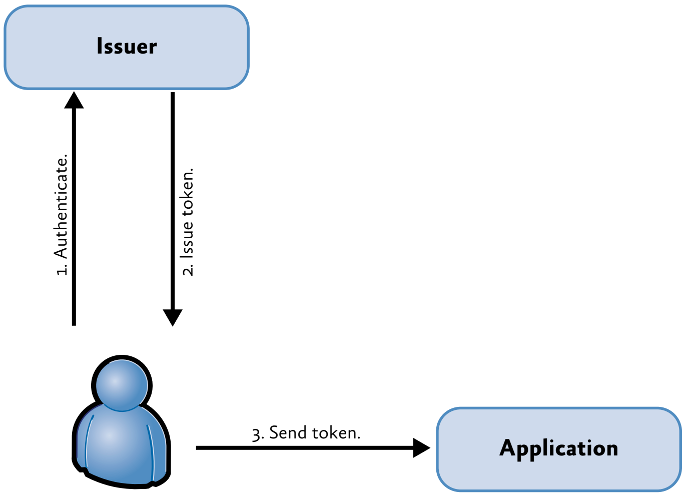


FIGURE 1
Issuers, security tokens, and applications

For an application developer, the advantage of this system is clear: your application doesn't need to worry about what sort of credentials the user presents. Someone who determines your company's security policy can make those rules, and buy or build the issuer. Your application simply receives the equivalent of a boarding pass. No matter what authentication protocol was used, Kerberos, SSL, forms authentication, or something more exotic, the application gets a signed set of claims that has the information it needs about the user. This information is in a simple format that the application can use immediately.

When you decide what kinds of claims to issue, ask yourself how hard is it to convince the IT department to extend the Active Directory schema. They have good reasons for staying with what they already have. If they're reluctant now, claims aren't going to change that. Keep this in mind when you choose which attributes to use as claims.

What Makes a Good Claim?

Think about claims the same way you think about attributes in a central repository such as Active Directory, over which you have little control. Security tokens can contain claims such as the user's name, email address, manager's email address, groups, roles, and so on. Depending on your organization, it may be easy or difficult to centralize lots of information about users and issue claims to share that information with applications.

It rarely makes sense to centralize data that is specific to only one application. In fact, applications that use claims can benefit from storing a separate table that contains user information. This table is where you can keep application-specific user data that no other application cares about. This is data for which your application is *authoritative*. In other words, it is the single source for that data, and someone must be responsible for keeping it up to date.

Another use for a table like this is to cache non-authoritative data that you get from claims. For example, you might cache an email claim for each user so that you can send out notification email without the user having to be logged in. You should treat any cached claims as read-only and refresh them the next time the user visits your application and presents fresh claims. Include a date column that you update each time you refresh the record. That way, you know how stale the cached claims have become when it comes time to use them.

Claims are like salt. Just a little bit flavors the broth. The next chapter has more information on what makes a good claim.

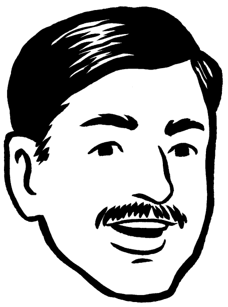
Understanding Issuers

Today, it's possible to acquire an issuer that provides user information, packaged as claims.

ADFS as an Issuer

If you have Windows Server® 2008 R2 Enterprise Edition, you are automatically licensed to run the Microsoft issuer, Active Directory Federation Services (ADFS) 2.0. ADFS provides the logic to authenticate users in several ways, and you can customize each instance of your ADFS issuer to authenticate users with Kerberos, forms authentication, or certificates. Alternatively, you can ask your ADFS issuer to

A good issuer can make it easier to implement authorization and personalization in your applications.



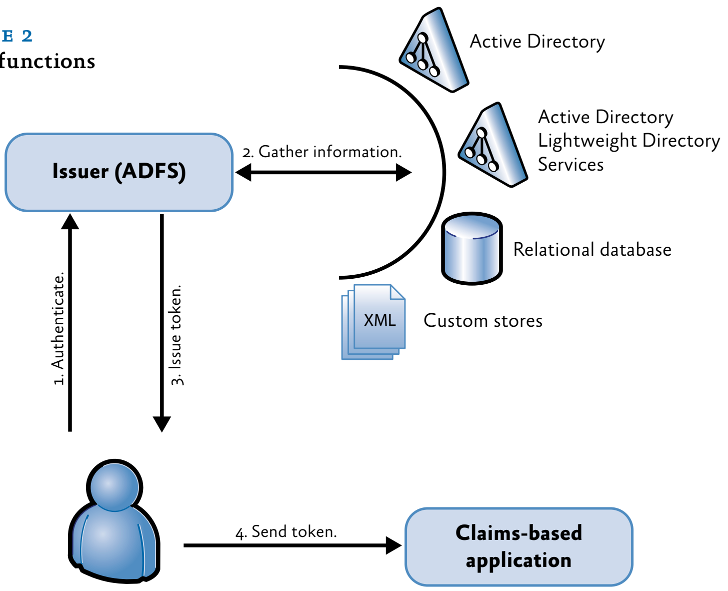
You can also receive tokens that were generated outside of your own realm, and accept them if you trust the issuer. This is known as federated identity. Federated identity enables single-sign on, allowing users to sign on to applications in different realms without needing to enter realm-specific credentials. Users sign on once to access multiple applications in different realms.

accept a security token from an issuer in another realm as proof of authentication. This is known as *identity federation* and it's how you achieve single sign-on across realms.

In identity terms, a ***realm*** *is the set of applications, URLs, domains, or sites for which a token is valid. Typically a realm is defined using an Internet domain such as microsoft.com, or a path within that domain, such as microsoft.com/practices/guides. A realm is sometimes described as a* ***security domain*** *because it encompasses all applications within a specified security boundary.*

Figure 2 shows all the tasks that the issuer performs.

FIGURE 2
ADFS functions



After the user is authenticated, the issuer creates claims about that user and issues a security token. ADFS has a rules engine that makes it easy to extract LDAP attributes from the user's record in Active Directory and its cousin, Active Directory Lightweight Directory Services (AD LDS). ADFS also allows you to add rules that include arbitrary SQL statements so that you can extract user data from your own custom database.

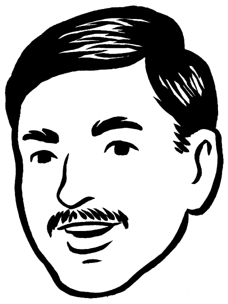
You can extend ADFS to add other stores. This is useful because, in many companies, a user's identity is often fragmented. ADFS hides this fragmentation. Your claims-based applications won't break if you decide to move data around between stores.

External Issuers

ADFS requires users to have an account in Active Directory or in one of the stores that ADFS trusts. However, users may have no access to an Active Directory-based issuer, but have accounts with other well-known issuers. These issuers typically include social networks and email providers. It may be appropriate for your application to accept security tokens created by one of these issuers. This token can also be accepted by an internal issuer such as ADFS so that the external issuer acts as another ADFS store.

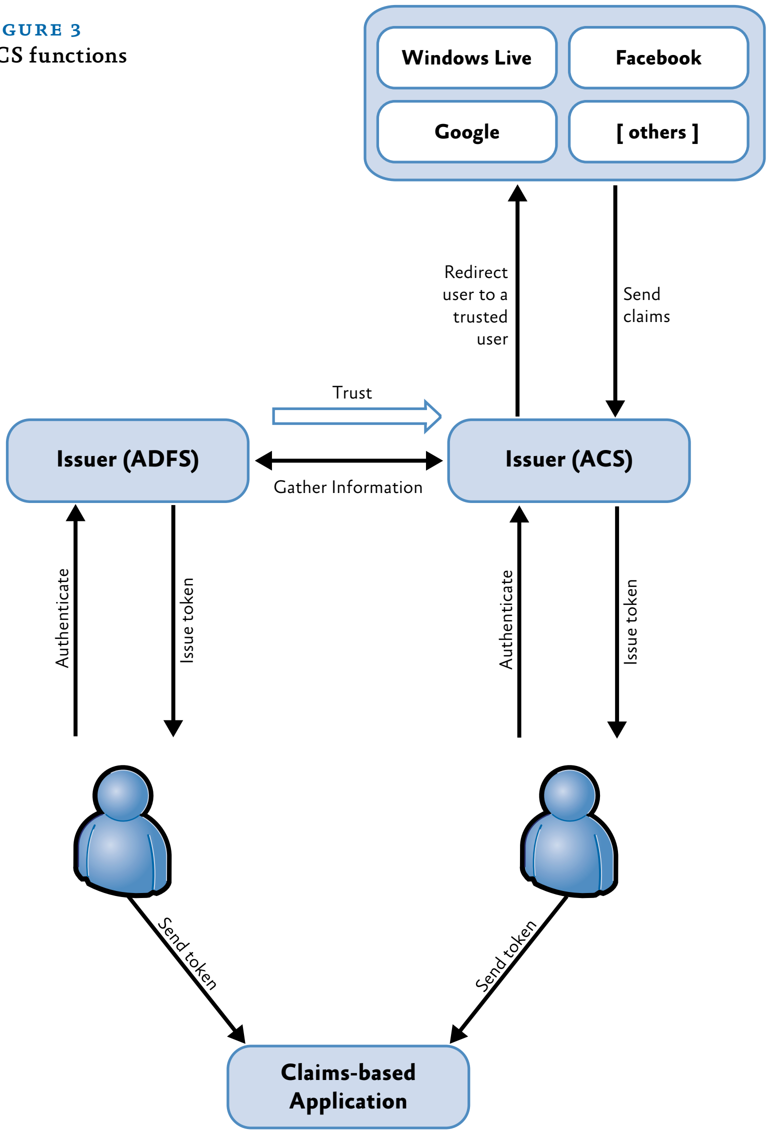
To simplify this approach, you can use a service such as Windows Azure™ Access Control Service (ACS). ACS accepts tokens issued by many of the well-known issuers such as Windows Live® network of Internet services, Google, Facebook, and more. It is the responsibility of the issuer to authenticate the user and issue claims. ACS can then perform translation and transformation on the claims using configurable rules, and issue a security token that your application can accept.

Figure 3 shows an overview of the tasks that ACS performs, with options to authenticate users in conjunction with a local issuer such as ADFS, and directly without requiring a local issuer.



ACS can be configured to trust a range of social networking identity providers that are capable of authenticating users and issuing claims, as well as trusting enterprise and custom identity providers.

figure 3
ACS functions



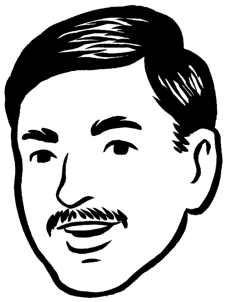
For more information about obtaining and configuring an ACS account, see Appendix E, "Windows Azure Access Control Service."

Claims-based applications are loosely coupled to identity.

Claims-based applications expect to receive claims about the user, but they don't care about which identity store those claims come from. These applications are loosely coupled to identity. This is one of the biggest benefits of claims-based identity.

User Anonymity

One option that claims-based applications give you is user anonymity. Remember that your application no longer directly authenticates the users; instead, it relies on an issuer to do that and to make claims about them. If user anonymity is a feature you want, simply don't ask for any claim that personally identifies the user. For example, maybe all you really need is a set of roles to authorize the user's actions, but you don't need to know the user's name. You can do that with claims-based identity by only asking for role claims. Some issuers (such as ADFS and Windows Live ID) support the idea of private user identifiers, which allow you to get a unique, anonymous identifier for a user without any personal information (such as a name or email address). Keep user anonymity in mind when you consider the power of claims-based identity.



To maintain user anonymity, it is important that the issuer does not collude with the application by providing additional information.

Implementing Claims-Based Identity

There are some general set-up steps that every claims-based system requires. Understanding these steps will help you when you read about the claims-based architectures.

STEP 1: ADD LOGIC TO YOUR APPLICATIONS TO SUPPORT CLAIMS

When you build a claims-based application, it needs to know how to validate the incoming security token and how to parse the claims that are inside. Many types of applications can make use of claims for tasks such as authorizing users and managing access to resources or functionality. For example, Microsoft SharePoint® applications can support the use of claims to implement authorization rules. Later chapters of this guide discuss the use of claims with SharePoint applications.

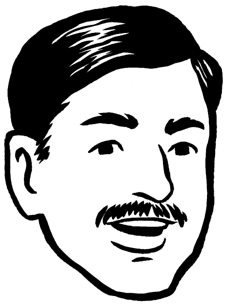
The Windows Identity Foundation (WIF) provides a common programming model for claims that can be used by both Windows Communication Foundation (WCF) and ASP.NET applications. If you already know how to use methods such as **IsInRole** and properties such as **Identity.Name**, you'll be happy to know that WIF simply adds one more property: **Identity.Claims**. It identifies the claims that were issued, who issued them, and what they contain.

There's certainly more to learn about the WIF programming model, but for now just remember to reference the WIF assembly (**Microsoft.IdentityModel.dll**) from your ASP.NET applications and WCF services in order to use the WIF programming paradigm.

STEP 2: ACQUIRE OR BUILD AN ISSUER

For most teams, the easiest and most secure option will be to use ADFS 2.0 or ACS as the issuer of tokens. Unless you have a great deal of security experience on your team, you should look to the experts to supply an issuer. If all users can be authenticated in ADFS 2.0 through the stores it trusts, this is a good option for most situations. For solutions that require authentication using external stores or social network identity providers, ACS or a combination of ADFS and ACS, is a good choice. If you need to customize the issuer and the extensibility points in ADFS 2.0 or ACS aren't sufficient, you can license third-party software or use WIF to build your own issuer. Note, however, that implementing a production-grade issuer requires specialized skills that are beyond the scope of this book.

> *While you're developing applications, you can use a stub issuer that just returns the claims you need. The Windows Identity Foundation SDK includes a local issuer that can be used for prototyping and development. You can obtain the SDK from http://www.microsoft.com/downloads/en/details.aspx?FamilyID=c148b2df-c7af-46bb-9162-2c9422208504. Alternatively, you can create a custom STS in Microsoft Visual Studio® and connect that to your application. For more information, see "Establishing Trust from an ASP.NET Relying Party Application to an STS using FedUtil" at http://msdn.microsoft.com/en-us/library/ee517285.aspx.*



Trust is unidirectional. The application trusts the issuer, and not the other way around.

STEP 3: CONFIGURE YOUR APPLICATION TO TRUST THE ISSUER

After you build a claims-based application and have an issuer to support it, the next step is to set up a trust relationship. An application trusts its issuer to identify and authenticate users and make claims about their identities. When you configure an application to rely on a specific issuer, you are establishing a *trust* (or *trust relationship*) with that issuer.

There are several important things to know about an issuer when you establish trust with it:

- What claims does the issuer offer?
- What key should the application use to validate signatures on the issued tokens?
- What URL must users access in order to request a token from the issuer?

Claims can be anything you can imagine, but practically speaking, there are some very common claims offered by most issuers. They tend to be simple, commonly available pieces of information, such as first name, last name, email name, groups and/or roles, and so on. Each issuer can be configured to offer different claims, so the application (technically, this means the architects and developers who design and build the application) needs to know what claims are being offered so it can either select from that list or ask whoever manages the issuer to expand its offering.

All of the questions in the previous list can easily be answered by asking the issuer for *federation metadata*. This is an XML document in a format defined by the WS-Federation standard that the issuer provides to the application. It includes a serialized copy of the issuer's certificate that provides your application with the correct public key to verify incoming tokens. It also includes a list of claims the issuer offers, the URL where users can go to get a token, and other more technical details, such as the token formats that it knows about (although in most cases you'll be using the default SAML format understood by the vast majority of issuers and claims-based applications). WIF includes a wizard that automatically configures your application's identity settings based on this metadata. You just need to give the wizard the URL for the issuer you've selected, and it downloads the metadata and properly configures your application.

SharePoint applications are a typical example of the type of application that can be configured to trust claims issued by an enterprise or a federated claims issuer, including issuers such as ADFS and ACS. In particular, SharePoint applications that use BCS to access remote services can benefit from using federated claims issuers.

STEP 4: CONFIGURE THE ISSUER TO KNOW ABOUT THE APPLICATION

The issuer needs to know a few things about an application before it can issue it any tokens:

- What Uniform Resource Identifier (URI) identifies this application?
- Of the claims that the issuer offers, which ones does this application require and which are optional?
- Should the issuer encrypt the tokens? If so, what key should it use?
- What URL does the application expose in order to receive tokens?

Issuers only provide claims to authorized applications.

There are, of course, many reasons why an application shouldn't get any more information about a user than it needs. Just two of them are compliance with privacy laws and the design practice of loose coupling.

Each application is different, and not all applications need the same claims. One application might need to know the user's groups or roles, while another application might only need a first and last name. So when a client requests a token, part of that request includes an identifier for the application the user is trying to access. This identifier is a URI and, in general, it's simplest to just use the URL of the application, for example, http://www.fabrikam.com/purchasing/.

If you're building a claims-based web application that has a reasonable degree of security, you'll require the use of secure sockets layer (SSL) (HTTPS) for both the issuer and the application. This will protect the information in the token from eavesdroppers. Applications with stronger security requirements can also request encrypted tokens, in which case the application typically has its own certificate (and private key). The issuer needs a copy of that certificate (without the private key) in order to encrypt the token issued for that application.

Once again, federation metadata makes this exchange of information easy. WIF includes a tool named FedUtil.exe that generates a federation metadata document for your application so that you don't have to manually configure the issuer with all of these settings.

A Summary of Benefits

To remind you of what you've learned, here's a summary of the benefits that claims can provide to you. Claims decouple authentication from authorization so that the application doesn't need to include the logic for a specific mode of authentication. They also decouple roles from authorization logic and allow you to use more granular permissions than roles might provide. You can securely grant access to users who might have previously been inaccessible because they were in different domains, not part of any corporate domain, or using different platforms or technologies.

Finally, you can improve the efficiency of your IT tasks by eliminating duplicate accounts that might span applications or domains and by preventing critical information from becoming stale.

Moving On

Now that you have a general idea of what claims are and how to build a claims-based system, you can move on to the particulars. If you are interested in more details about claims-based architectures for browser-based and smart client-based applications, see the Chapter 2, "Claims-Based Architectures." If you want to start digging into the specifics of how to use claims, start reading the scenarios. Each of the scenarios shows a different situation and demonstrates how to use claims to solve the problem. New concepts are explained within the framework of the scenario to give you a practical understanding of what they mean. You don't need to read the scenarios sequentially, but each chapter presumes that you understand all the material that was explained in earlier chapters.

Questions

1. Under what circumstances should your application or service accept a token that contains claims about the user or requesting service?
   a. The claims include an email address.
   b. The token was sent over an HTTPS channel.
   c. Your application or service trusts the token issuer.
   d. The token is encrypted.
2. What can an application or service do with a valid token from a trusted issuer?
   a. Find out the user's password.
   b. Log in to the website of the user's identity provider.
   c. Send emails to the user.
   d. Use the claims it contains to authorize the user for access to appropriate resources.
3. What is the meaning of the term *identity federation*?
   a. It is the name of a company that issues claims about Internet users.
   b. It is a mechanism for authenticating users so that they can access different applications without signing on every time.
   c. It is a mechanism for passing users' credentials to another application.
   d. It is a mechanism for finding out which sites a user has visited.

4. When would you choose to use Windows Azure AppFabric Access Control Service (ACS) as an issuer for an application or service?

    a. When the application must allow users to sign on using a range of well-known social identity credentials.

    b. When the application is hosted on the Windows Azure platform.

    c. When the application must support single sign-on (SSO).

    d. When the application does not have access to an alternative identity provider or token issuer.

5. What are the benefits of using claims to manage authorization in applications and services?

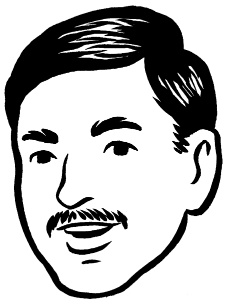
    a. It avoids the need to write code specific to any one type of authentication mechanism.

    b. It decouples authentication logic from authorization logic, making changes to authentication mechanisms much easier.

    c. It allows the use of more fine-grained permissions based on specific claims compared to the granularity achieved just using roles.

    d. It allows secure access for users that are in a different domain or realm from the application or service.

2 Claims-Based Architectures



The web is full of interactive applications that users can visit by simply clicking a hyperlink. Once they do, they expect to see the page they want, possibly with a brief stop along the way to log on. Users also expect websites to manage their logon sessions, although most of them wouldn't phrase it that way. They would just say that they don't want to retype their password over and over again as they use any of their company's web applications. For claims to flourish on the web, it's critical that they support this simple user experience, which is known as single sign-on.

For claims-based applications, single sign-on for the web is sometimes called *passive federation*.

If you've been a part of a Microsoft® Windows® domain, you're already familiar with the benefits of single sign-on. You type your password once at the beginning of the day, and that grants you access to a host of resources on the network. Indeed, if you're ever asked to type your password again, you're going to be surprised and annoyed. You've come to expect the transparency provided by Integrated Windows Authentication.

Ironically, the popularity of Kerberos has led to its downfall as a flexible, cross-realm solution. Because the domain controller holds the keys to all of the resources in an organization, it's closely guarded by firewalls. If you're away from work, you're expected to use a VPN to access the corporate network. Also, Kerberos is inflexible in terms of the information it provides. It would be nice to extend the Kerberos ticket to include arbitrary claims such as the user's email address, but this isn't a capability that exists right now.

Claims were designed to provide the flexibility that other protocols may not. The possibilities are limited only by your imagination and the policies of your IT department. The standard protocols that exchange claims are specifically designed to cross boundaries such as security realms, firewalls, and different platforms. These protocols were designed by many who wanted to make it easier to securely communicate with each other.

Claims decouple your applications from the details of identity. With claims, it's no longer the application's responsibility to authenticate users. All your application needs is a security token from the issuer that it trusts. Your application won't break if the IT department decides to upgrade security and require users to submit a smart card instead of submitting a user name and password. In addition, it won't need to be recoded, recompiled, or reconfigured.

There's no doubt that domain controllers will continue to guard organizational resources. Also, the business challenges, such as how to resolve issues of trust and how to negotiate legal contracts between companies who want to use federated identity techniques, remain. Claims-based identity isn't going to change any of that. However, by layering claims on top of your existing systems, you can remove some of the technical hurdles that may have been impeding your access to a broad, flexible single sign-on solution.

Claims work in conjunction with your existing security systems to broaden their reach and reduce technical obstacles.

A Closer Look at Claims-Based Architectures

There are several architectural approaches you can use to create claims-based applications. For example, web applications and SOAP web services each use slightly different techniques, but you'll quickly recognize that the overall shapes of the handshakes are very similar because the goal is always the same: to communicate claims from the issuer to the application in a secure fashion. This chapter shows you how to evaluate the architectures from a variety of perspectives, such as the user experience, the performance implications and optimization opportunities, and how the claims are passed from the issuer to the application. The chapter also offers some advice on how to design your claims and how to know your users.

The goal of many of these architectures is to enable federation with either a browser or a smart client. Federation with a smart client is based on WS-Trust and WS-Federation Active Requestor Profile. These protocols describe the flow of communication between smart clients (such as Windows-based applications) and services (such as WCF services) to request a token from an issuer and then pass that token to the service for authorization.

Federation with a browser is based on WS-Federation Passive Requestor Profile, which describes the same communication flow between the browser and web applications. It relies on browser redirects, HTTP GET, and POST to request and pass around tokens.

Browser-Based Applications

The Windows Identity Foundation (WIF) is a set of .NET Framework classes that allow you to build claims-aware applications. Among other things, it provides the logic you need to process WS-Federation requests. The WS-Federation protocol builds on other standard protocols such as WS-Trust and WS-Security. One of its features is to allow you to request a security token in browser-based applications.

WIF makes claims seem much like forms authentication. If users need to sign in, WIF redirects them to the issuer's logon page. Here, the user is authenticated and is then redirected back to the application. Figure 1 shows the first set of steps that allow someone to use single sign-on with a browser application.

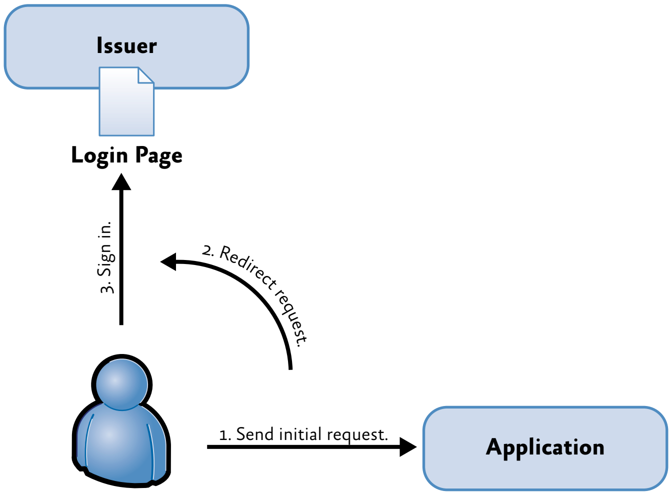


FIGURE 1
Single sign-on with a browser, part 1

If you're familiar with ASP.NET forms authentication, you might assume that the issuer in the preceding figure is using forms authentication if it exposes a page named Login.aspx. But this page may simply be an empty page that is configured in Internet Information Services (IIS) to require Integrated Windows Authentication or a client certificate or smart card. An issuer should be configured to use the most natural and secure method of authentication for the users that sign in there. Sometimes a simple user name and password form is enough, but obviously this requires some interaction and slows down the user. Integrated Windows Authentication is easier and more secure for employees in the same domain as the issuer.

When the user is redirected to the issuer's log-on page, several query string arguments defined in the WS-Federation standard are passed that act as instructions to the issuer. Here are two of the key arguments with example values:

wa=wsignin1.0

The **wa** argument stands for "action," and indicates one of two things—whether you're logging on (wsignin1.0) or logging off (wsignout1.0).

wtrealm=http://www.fabrikam.com/purchasing/

The **wtrealm** argument stands for "target realm" and contains a Uniform Resource Indicator (URI) that identifies the application. The issuer uses the URI to identify the application the user is logging on to. The URI also allows the issuer to perform other tasks, such as associating the claims for the application and replying to addresses.

After the issuer authenticates the user, it gathers whatever claims the application needs (using the **wtrealm** parameter to identify the target application), packages them into a security token, and signs the token with its private key. If the application wants its tokens encrypted, the issuer encrypts the token with the public key in the application's certificate.

The issuer is told which application is in use so that it issues only the claims that the application needs.

Now the issuer asks the browser to go back to the application. The browser sends the token to the application so it can process the claims. Once this is done, the user can begin using the application.

To accomplish this, the issuer returns an HTML page to the browser, including a **<form>** element with the form-encoded token inside. The form's **action** attribute is set to submit the token to whatever URL was configured for the application. The user doesn't normally see this form because the issuer also emits a bit of JavaScript that auto-posts it. If scripts are disabled, the user will need to click a button to post the response to the server. Figure 2 shows this process.

If this sounds familiar, it's because forms authentication uses a similar redirection technique with the **ReturnURL** parameter.

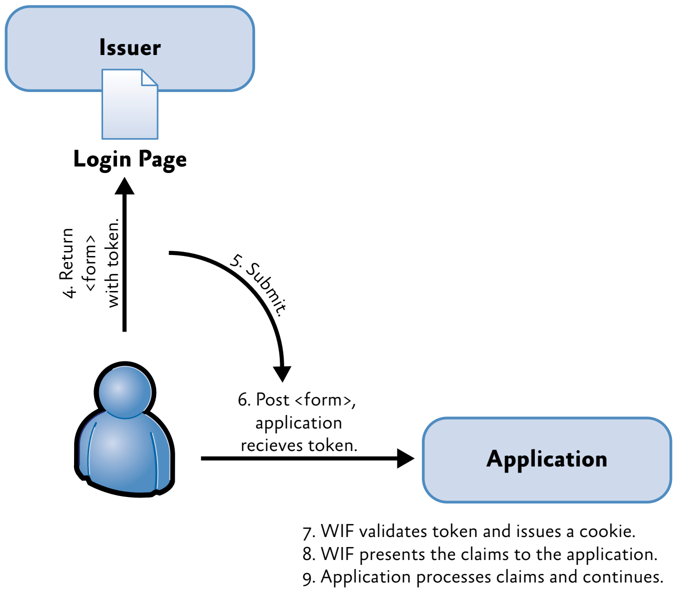

Issuer
Login Page
4. Return <form> with token.
5. Submit.
6. Post <form>, application recieves token.
Application
7. WIF validates token and issues a cookie.
8. WIF presents the claims to the application.
9. Application processes claims and continues.

FIGURE 2
Single sign-on with a browser, part 2

Now consider this process from the user's experience. If the issuer uses Integrated Windows Authentication, the user clicks the link to the application, waits for a moment while the browser is first redirected to the issuer and then back to the application, and then the user is logged on without any additional input. If the issuer requires input from the user, such as a user name and password or a smart card, users must pause briefly to log on, and then they can use the application. From the user's point of view, the logon process with claims is the same as what he or she is used to, which is critical.

Understanding the Sequence of Steps

The steps illustrated in the preceding illustrations can also be depicted as a sequence of steps that occur over time. Figure 3 shows this sequence when authenticating against Active Directory Federation Services (ADFS) and Active Directory.

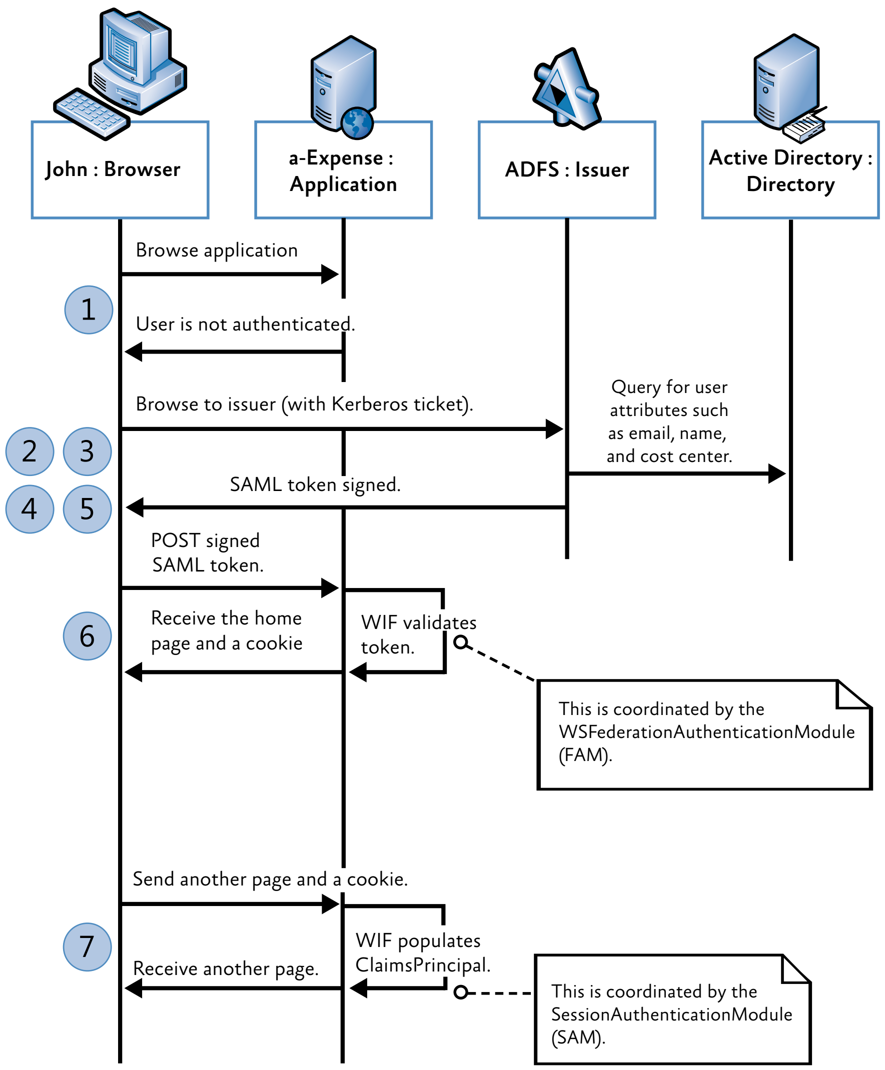

John : Browser
a-Expense : Application
ADFS : Issuer
Active Directory : Directory
Browse application
1
User is not authenticated.
Browse to issuer (with Kerberos ticket).
Query for user attributes such as email, name, and cost center.
2
3
SAML token signed.
4
5
POST signed SAML token.
Receive the home page and a cookie
6
WIF validates token.
This is coordinated by the WSFederationAuthenticationModule (FAM).
Send another page and a cookie.
7
Receive another page.
WIF populates ClaimsPrincipal.
This is coordinated by the SessionAuthenticationModule (SAM).

FIGURE 3
Browser-based message sequence

An audience restriction determines the URIs the application will accept. When applying for a token, the user or application will usually specify the URIs for which the token should be valid (the ***AppliesTo*** *value, typically the URL of the application). The issuer includes this as the audience restriction in the token it issues.*

If a user is not authenticated, the browser requests a token from the issuer, which in this case is Active Directory Federation Services (ADFS). ADFS queries Active Directory for the necessary attributes and returns a signed token to the browser.

After the POST arrives at the application, WIF takes over. The application has configured a WIF HTTP module, named **WSFederationAuthenticationModule** (FAM), to intercept this POST to the application and handle the processing of the token. The FAM listens for the **AuthenticateRequest** event. The event handler performs several validation steps, including checking the token's audience restriction and the expiration date. Audience restriction is defined by the **AudienceURI** element.

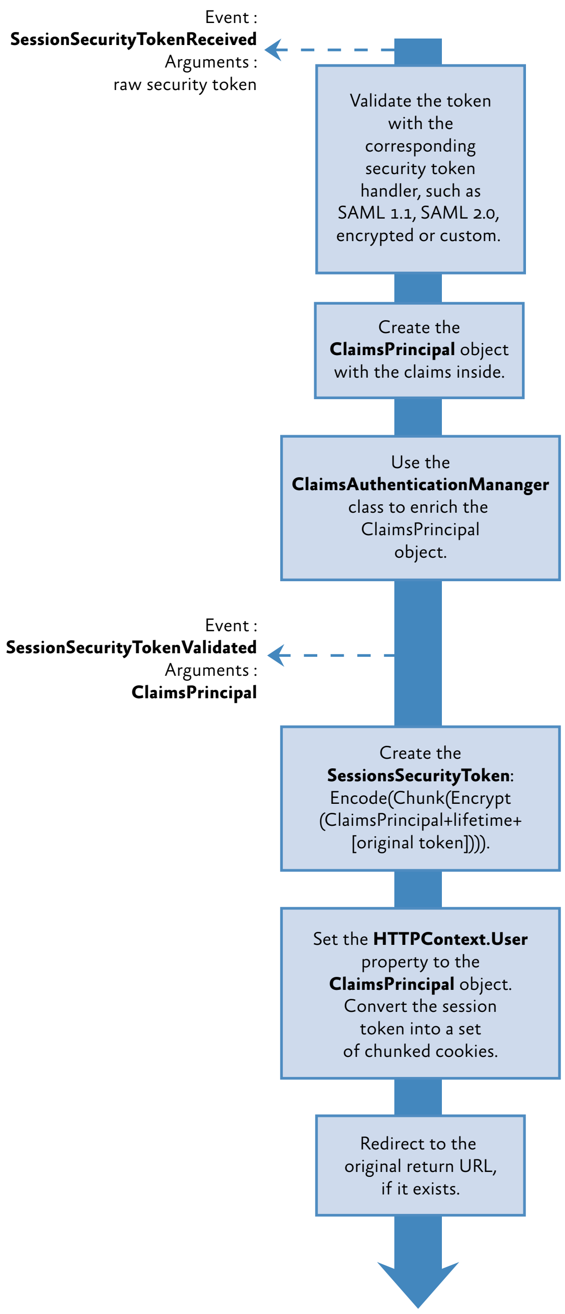
The FAM also uses the issuer's public key to make sure that the token was signed by the trusted issuer and was not modified in transit. Then it parses the claims in the token and uses the **HttpContext.User.Identity** property (or equivalently the **Page.User** property) to present an **IClaimsPrincipal** object to the application. It also issues a cookie to begin a logon session, just like what would happen if you were using forms authentication instead of claims. This means that the authentication process isn't repeated until the user signs off or otherwise destroys the cookie, or until the session expires (sessions are typically designed to last for a single workday).

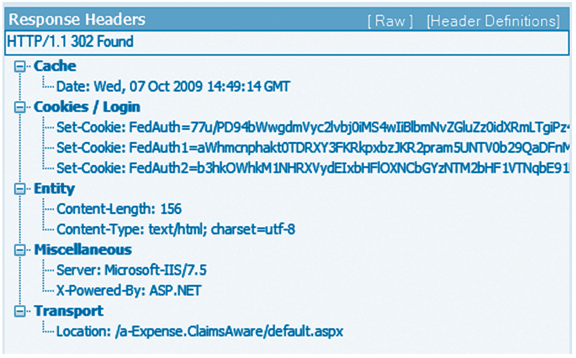
Figure 4 shows the steps that WIF takes for the initial request, when the application receives a token from the issuer.

One of the steps that the FAM performs is to create the session token. On the wire, this translates into a sequence of cookies named **FedAuth[n]**. These cookies are the result of compressing, encrypting, and encoding the **Claims Principal** object, along with any other attributes. The cookies are chunked to avoid overstepping any size limitations.

Figure 5 shows what the network traffic looks like for the initial request.

FIGURE 4
Sequence of steps for initial request

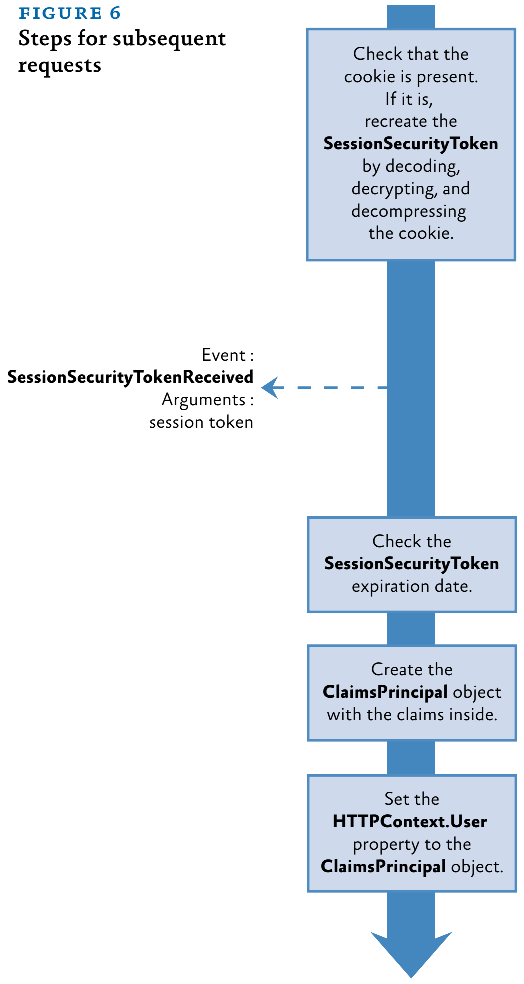

Event :
SessionSecurityTokenReceived
Arguments :
raw security token
Validate the token with the corresponding security token handler, such as SAML 1.1, SAML 2.0, encrypted or custom.
Create the **ClaimsPrincipal** object with the claims inside.
Use the **ClaimsAuthenticationMananger** class to enrich the ClaimsPrincipal object.
Event :
SessionSecurityTokenValidated
Arguments :
ClaimsPrincipal
Create the **SessionsSecurityToken**: Encode(Chunk(Encrypt (ClaimsPrincipal+lifetime+ [original token]))).
Set the **HTTPContext.User** property to the **ClaimsPrincipal** object. Convert the session token into a set of chunked cookies.
Redirect to the original return URL, if it exists.



```
HTTP/1.1 302 Found
Cache
  Date: Wed, 07 Oct 2009 14:49:14 GMT
Cookies / Login
  Set-Cookie: FedAuth=77u/PD94bWwgdmVyc2lvbj0iMS4wIiBlbmNvZGluZz0idXRmLTgiPz
  Set-Cookie: FedAuth1=aWhmcnphakt0TDRXY3FKRkpxbzJKR2pram5UNTV0b29QaDFn
  Set-Cookie: FedAuth2=b3hkOWhkM1NHRXVydEIxbHFlOXNCbGYzNTM2bHF1VTNqbE91
Entity
  Content-Length: 156
  Content-Type: text/html; charset=utf-8
Miscellaneous
  Server: Microsoft-IIS/7.5
  X-Powered-By: ASP.NET
Transport
  Location: /a-Expense.ClaimsAware/default.aspx
```

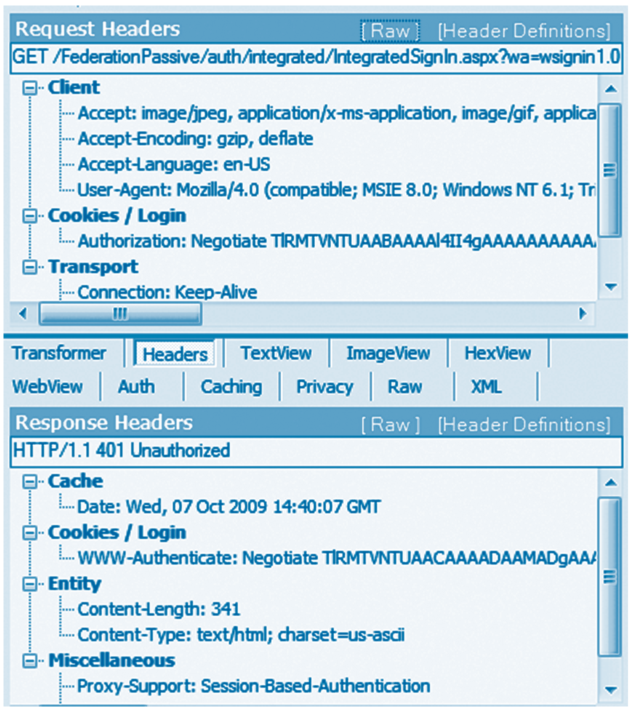
FIGURE 5
Sequence of cookies

FIGURE 6
Steps for subsequent requests


Check that the cookie is present. If it is, recreate the **SessionSecurityToken** by decoding, decrypting, and decompressing the cookie.
Event : **SessionSecurityTokenReceived** Arguments : session token
Check the **SessionSecurityToken** expiration date.
Create the **ClaimsPrincipal** object with the claims inside.
Set the **HTTPContext.User** property to the **ClaimsPrincipal** object.

On subsequent requests to the application, the **SessionAuthenticationModule** intercepts the cookies and uses them to reconstruct the **ClaimsPrincipal** object. Figure 6 shows the steps that WIF takes for any subsequent requests.

Figure 7 shows what the network traffic looks like for subsequent requests.



```
GET /FederationPassive/auth/integrated/IntegratedSignIn.aspx?wa=wsignin1.0
Client
    Accept: image/jpeg, application/x-ms-application, image/gif, applica
    Accept-Encoding: gzip, deflate
    Accept-Language: en-US
    User-Agent: Mozilla/4.0 (compatible; MSIE 8.0; Windows NT 6.1; Tr
Cookies / Login
    Authorization: Negotiate TlRMTVNTUAABAAAAl4II4gAAAAAAAAAA
Transport
    Connection: Keep-Alive
```

```
HTTP/1.1 401 Unauthorized
Cache
    Date: Wed, 07 Oct 2009 14:40:07 GMT
Cookies / Login
    WWW-Authenticate: Negotiate TlRMTVNTUAACAAAADAAMADgAA
Entity
    Content-Length: 341
    Content-Type: text/html; charset=us-ascii
Miscellaneous
    Proxy-Support: Session-Based-Authentication
```

FIGURE 7
Network traffic for subsequent responses

All of the steps, both for the initial and subsequent requests, should run over the Secure Sockets Layer (SSL) to ensure that an eavesdropper can't steal either the token or the logon session cookie and replay them to the application in order to impersonate a legitimate user.

Optimizing Performance

Are there opportunities for performance optimizations here? The answer is a definite "Yes." You can use the logon session cookie to cache some state on the client to reduce round-trips to the issuer. The issuer also issues its own cookie so that users remain logged on at the issuer and can access many applications. Think about how this works—when a user visits a second application and that application redirects back to the same issuer, the issuer sees its cookie and knows the user has recently been authenticated, so it can immediately issue a token without having to authenticate again. This is how to use claims to achieve Internet-friendly single sign-on with a browser-based application.

Applications and issuers use cookies to achieve Internet-friendly single-sign on.

Single sign-on is also possible using ACS when a local issuer such as ADFS is not available. However, ACS is primarily aimed at federated identity scenarios where the user is authenticated in a different realm from the application. ACS is discussed in more detail in the section "Federated Identity with ACS" later in this chapter.

Smart Clients

When you use a web service, you don't use a browser. Instead, you use an arbitrary client application that includes logic for handling claims-based identity protocols. There are two protocols that are important in this situation: WS-Trust, which describes how to get a security token from an issuer, and WS-Security, which describes how to pass that security token to a claims-based web service.

Recall the procedure for using a SOAP-based web service. You use the Microsoft Visual Studio® development system or a command-line tool to download a Web Service Definition Language (WSDL) document that supplies the details of the service's address, binding, and contract. The tool then generates a proxy and updates your application's configuration file with the information discovered in the WSDL document. When you do this with a claims-based service, its WSDL document and its associated WS-Policy document supply all the necessary details about the issuer that the service trusts. This means that the proxy knows that it needs to obtain a security token from that issuer before making requests to the service. Because this information is stored in the configuration file of the client application, at run time the proxy can get that token before talking to the service. This optimizes the handshake a bit compared to the browser scenario, because the browser had to visit the application first before being redirected to the issuer. Figure 8 shows the sequence of steps for smart clients when the issuer is ADFS authenticating users against Active Directory.

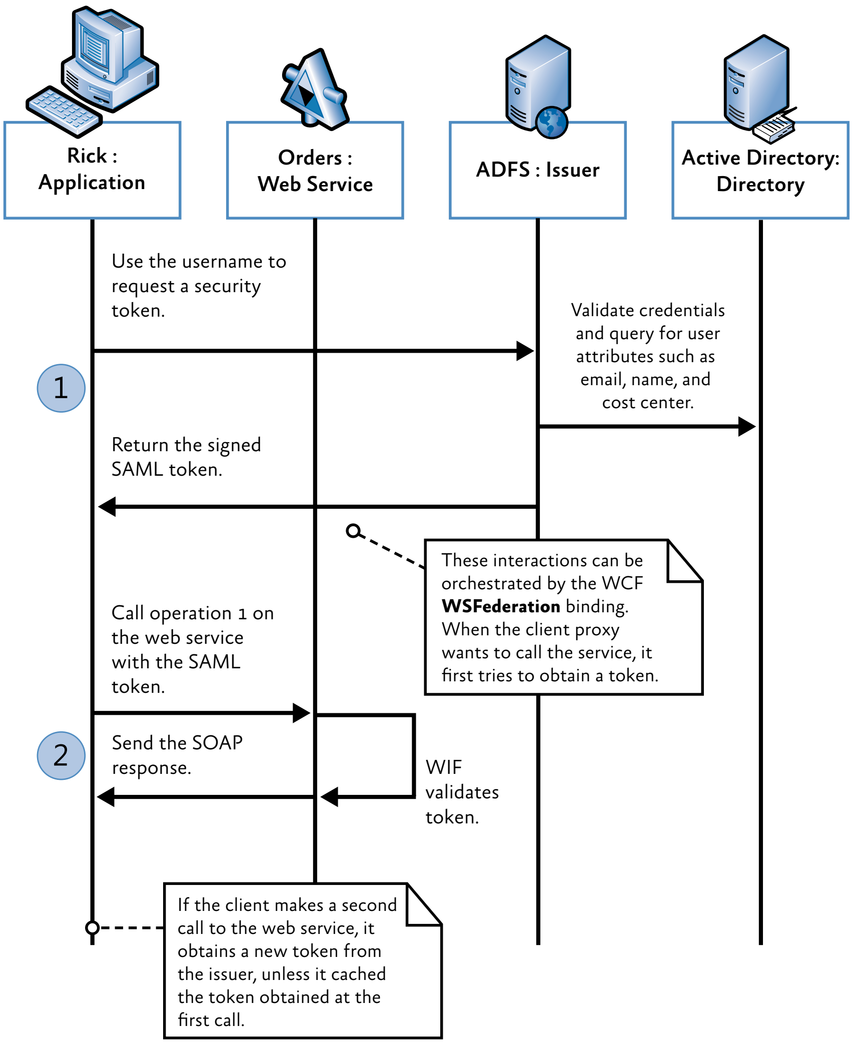
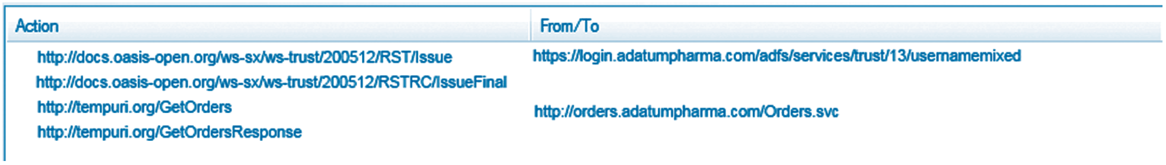

Rick : Application
Orders : Web Service
ADFS : Issuer
Active Directory: Directory
Use the username to request a security token.
1
Validate credentials and query for user attributes such as email, name, and cost center.
Return the signed SAML token.
These interactions can be orchestrated by the WCF **WSFederation** binding. When the client proxy wants to call the service, it first tries to obtain a token.
Call operation 1 on the web service with the SAML token.
2
Send the SOAP response.
WIF validates token.
If the client makes a second call to the web service, it obtains a new token from the issuer, unless it cached the token obtained at the first call.

FIGURE 8
Smart client-based message sequence

The steps for a smart client are similar to those for browser-based applications. The smart client makes a round-trip to the issuer, using WS-Trust to request a security token. In step 1, The Orders web service is configured with the **WSFederationHttpBinding**. This binding specifies a web service policy that obligates the client to attach a SAML token to the security header to successfully invoke the web service. This means that the client will first have to call the issuer with a set of credentials such as a user name and password to get a SAML token back. In step 2, the client can call the web service with the token attached to the security header.

Figure 9 shows a trace of the messages that occur in the smart client scenario.



Action	From/To
http://docs.oasis-open.org/ws-sx/ws-trust/200512/RST/Issue	https://login.adatumpharma.com/adfs/services/trust/13/usernamemixed
http://docs.oasis-open.org/ws-sx/ws-trust/200512/RSTRC/IssueFinal	
http://tempuri.org/GetOrders	http://orders.adatumpharma.com/Orders.svc
http://tempuri.org/GetOrdersResponse	

FIGURE 9
Smart client network traffic

The WS-Trust request (technically named a Request for Security Token, or RST for short) includes a field named **AppliesTo**, which allows the smart client to indicate a URI for the web service it's ultimately trying to access. This is similar to the **wtrealm** query string argument used in the case of a web browser. Once the issuer authenticates the user, it knows which application wants access and it can decide which claims to issue. Then the issuer sends back the response (RSTR), which includes a signed security token that is encrypted with the public key of the web service. The token includes a *proof key*. This is a symmetric key randomly generated by the issuer and included as part of the RSTR so that the client also gets a copy.

Now it's up to the client to send the token to the web service in the **<Security>** header of the SOAP envelope. The client must sign the SOAP headers (one of which is a time stamp) with the proof key to show that it knows the key. This extra cryptographic evidence further assures the web service that the caller was, indeed, the one who was issued the token in the first place.

At this point, it's typical to start a session using the **WS-Secure Conversation** protocol. The client will probably cache the RSTR for up to a day in case it needs to reconnect to the same service later on.

SharePoint Applications and SharePoint BCS

A common requirement for single sign-on and federated identity is in Microsoft SharePoint® applications, including those that use the Business Connectivity Services (BCS) to work with data exposed by remote services. Microsoft SharePoint Server 2010 implements a claims-based identity model that supports authentication across users of Windows-based and non-Windows -based systems, multiple authentication types, a wide set of principal types, and delegation of user identity between applications.

SharePoint 2010 can accept claims provided as SAML tokens, and can use them to make identity-related decisions. These decisions may consist of simple actions such as personalization based on the user name, or more complex actions such as authorizing access to features and functions within the application.

SharePoint also includes a claims provider that can issue claims and package these claims into security tokens. It can augment tokens by adding additional claims, and expose the claims in the SharePoint people picker tool. The ability to augment existing tokens makes it easier to build SharePoint applications that use BCS to access remote services for which authentication is required.

Chapter 10, "Accessing REST Services from a Windows Phone Device" and Chapter 11, "Claims-Based Single Sign-On for Microsoft SharePoint 2010" provide more information about using claims and issuers in SharePoint 2010. A guide to using claims in SharePoint is available at "Getting Started with Security and Claims-Based Identity Model" on the MSDN® website (http://msdn.microsoft.com/en-us/library/ee536164.aspx).

Federating Identity across Realms

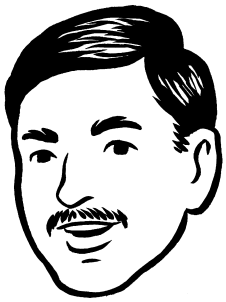
So far you've learned enough about claims-based identity to understand how to design and build a claims-based application where the issuer directly authenticates the users.

But you can take this one step further. You can expand your issuer's capabilities to accept a security token from another issuer, instead of requiring the user to authenticate directly. Your issuer now not only issues security tokens, but also accepts tokens from other issuers that it trusts. This enables you to federate identity with other realms (these are separate security domains), which is truly a powerful feature. Much of the federation process is actually accomplished by your IT staff, because it depends on how issuers are configured. But it's important to be aware of these possibilities because, ultimately, they lead to more features for your application, even though you might not have to change your application in any way. Also, some of these possibilities may have implications for your application's design.

The Benefits of Cross-Realm Identity

Maintaining an identity database for users can be a daunting task. Even something as simple as a database that holds user names and passwords can be painful to manage. Users forget their passwords on a regular basis, and the security stance taken by your company may not allow you to simply email forgotten passwords to them the way many low-security websites do. If maintaining a database for users inside your enterprise is difficult, imagine doing this for hundreds or thousands of remote users.

Managing a role database for remote users is just as difficult. Imagine Alice, who works for a partner company and uses your purchasing application. On the day that your IT staff provisioned her account, she worked in the purchasing department, so the IT staff assigned her the role of Purchaser, which granted her permission to use the application. But because she works for a different company, how is your company going to find out when she transfers to the Sales department? What if she quits? In both cases, you'd want to know about her change of status, but it's unlikely that anyone in the HR department at her company is going to notify you.



Alice's identity is an asset of Alice's organization, so her company should manage it. Also, storing information about remote users can be considered a liability for your company.

It's unavoidable that any data you store about a remote user eventually becomes stale. How can you safely expose an application for a partner business to use?

One of the most powerful features of claims-based identity is that you can decentralize it. Instead of having your issuer authenticate remote users directly, you can set up a trust relationship with an issuer that belongs to the other company. This means that your issuer trusts their issuer to authenticate users in their realm. Their employees are happy because they don't need special credentials to use your application. They use the same single sign-on mechanism they've always used in their company. Your application still works because it continues to get the same boarding pass it needs. The claims you get in your boarding pass for these remote users might include less powerful roles because they aren't employees of your company, but your issuer will be responsible for determining the proper assignments. Finally, your application doesn't need to change when a new organization becomes a partner. The fan-out of issuers to applications is a real benefit of using claims—you reconfigure one issuer and many downstream applications become accessible to many new users.

Claims can be used to decentralize identity, eliminating stale data about remote users.

Another benefit is that claims allow you to logically store data about users. Data can be kept in the store that is authoritative rather than in a store that is simply convenient to use or easily accessible.

Identity federation removes hurdles that may have stopped you from opening the doors to new users. Once your company decides which realms should be allowed access to your claims-based application, your IT staff can set up the proper trust relationships. Then you can, for example, invite employees from a company that uses Java, to access your application without having to issue passwords for each of them. They only need a Java-based issuer, and those have been available for years. Another possibility is to federate identity with Windows Live® network of Internet services, which supports claims-based identity. This means that anyone with a Windows Live ID can use your application.

How Federated Identity Works

You've already seen how federated identity works within a single realm. Indeed, Figure 2 is a small example of identity federation between your application and a local issuer in your realm. That relationship doesn't change when your issuer interacts with an issuer it trusts in a different realm. The only change is that your issuer is now configured to accept a security token issued by a partner company instead of directly authenticating users from that company. Your issuer trusts another issuer to authenticate users so it doesn't have to. This is similar to how your application trusts its issuer.

Figure 10 shows the steps for federating identity across realms.

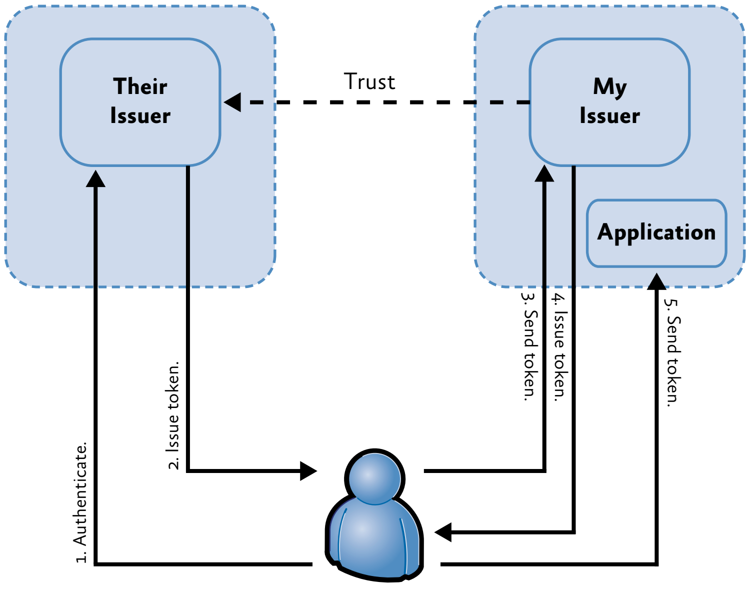


FIGURE 10
Federating identity across realms

Federating identity across realms is exactly the same as you've seen in the earlier authentication techniques discussed in this chapter, with the addition of an initial handshake in the partner's realm. Users first authenticate with an issuer in their own realm. They present the tokens they receive from their exchanges to your issuer, which accepts it in lieu of authenticating them directly. Your issuer can now issue a token for your application to use. This token is what the user sends to your application. (Of course, users know nothing about this protocol—it's actually the browser or smart client that does this on their behalf). Remember, your application will only accept tokens signed by the one issuer that it trusts. Remote users won't get access if they try to send a token from their local issuer to your application.

At this point, you may be thinking, "Why should my company trust some other company to authenticate people that use my application? That doesn't seem safe!" Think about how this works *without* claims-based identity. Executives from both companies meet and sign legal contracts. Then the IT staff from the partner company contacts your IT staff and specifies which of their users need accounts provisioned and which roles they will need. The legal contracts help ensure that nobody abuses the trust that's been established. This process has been working for years and is an accepted practice.

Another question is why should you bother provisioning accounts for those remote users when you know that data will get stale over time? All that claims-based identity does is help you *automate the trust*, so that you get fresh information each time a user visits your application. If Alice quits, the IT staff at her company has great personal incentive to disable her account quickly. They don't want a potentially disgruntled employee to have access to company resources. That means that Alice won't be able to authenticate with their issuer anymore, which means she won't be able to use your application, either. Notice that nobody needed to call you up to tell you about Alice. By decentralizing identity management, you get better information (authoritative information, you could say) about remote users in a timely fashion.

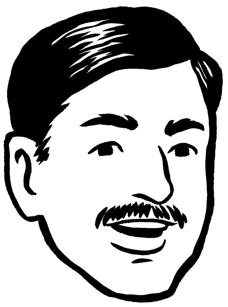
Claims can be used to automate existing trusts between businesses.

One possible drawback of federating identity with many other companies is that your issuer becomes a single point of failure for all of your federation relationships. Issuers should be as tightly guarded as domain controllers. Adding features is never without risk, but the rewards can lead to lower costs, better security, simpler applications, and happier users.

Federated Identity with ACS

Many users already have accounts with identity providers that authenticate users for one or more applications and websites. Social networks such as Facebook, and email and service providers such as Windows Live ID and Google, often use a single sign-on model that supports authentication for several applications. Users increasingly expect to be able to use the credentials for these identity providers when accessing other applications.

ACS is an issuer that can make use of many of these identity providers by redirecting the user to the appropriate location to enter credentials, and then using the claims returned from that identity provider to issue a token to the applications. ACS can also be used to supplement a local issuer by retrieving claims from a social networking or email provider and passing these to the local issuer for it to issue



It is important for users to understand that, when they use their social identity provider credentials to log in through ACS, they are consenting to some information (such as their name and email address) being sent to the application. However, giving this consent does not provide the application with access to their social network account—it just confirms their identity to the application.

the required token. ACS effectively allows a broad range of identity providers to be used for user authentication, both in conjunction with a local issuer and when no local issuer is available.

Figure 11 shows the overall sequence of steps for a user authenticating with an identity provider through ACS after a request for authentication has been received by ACS. ACS redirects the user to the appropriate identity provider. After successful authentication, ACS and ADFS map claims for the user and then return a token to the relying party (the claims-based application). Steps 5 and 6, where the intervention of a local issuer takes place, will only occur if the application is configured to use a local issuer such as ADFS that redirects the user to ACS.

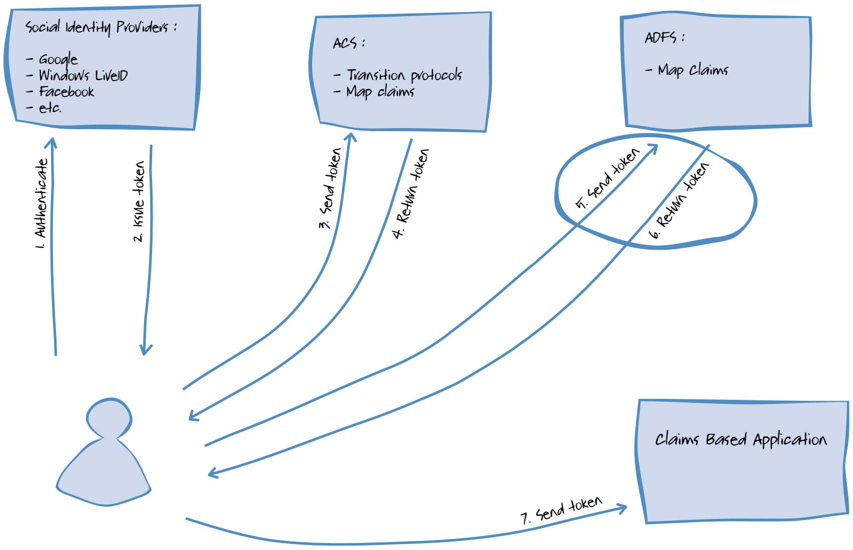
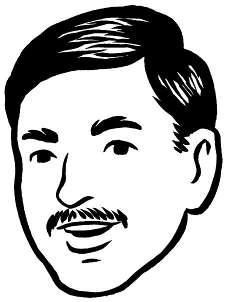


FIGURE 11
Federated identity with ACS as the issuer, optionally including an ADFS local issuer

For more details about ACS and the message sequences with and without a local issuer, see Appendix B, "Message Sequences," and Appendix E, "Windows Azure Access Control Service."

A major consideration when using ACS is whether you should trust the identity providers that it supports. You configure ACS to use only the identity providers you specifically want to trust, and only these will be available to users when they log into your application. For example, depending on your requirements, you may decide to accept authentication only through Windows Live ID and Google, and not allow users to log in with a Facebook account. Each identity provider is an authority for users that successfully authenticate, and each provides proof of this by returning claims such as the user name, user identifier, and email address.

ACS generates a list of the configured identity providers from which users can select the one they want to use. You can create custom pages that show the available identity providers within your own application if required, and configure rules within ACS that transform and map the claims returned from the identity provider. After the user logs in at their chosen identity provider, ACS returns a token that the application or a local issuer such as ADFS can use to provide authorization information to the application as required.



Each identity provider will return a different set of claims. For example, Windows Live ID returns a user identifier, whereas Google returns the user name and email address.

Understanding the Sequence of Steps

Figure 12 shows the sequence of steps for ACS in more detail when there is no local issuer.

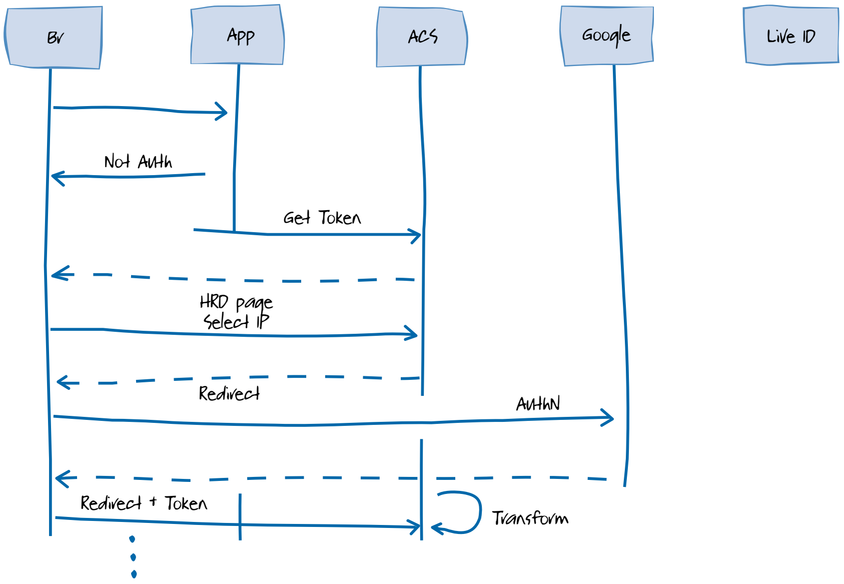


FIGURE 12
ACS federated identity message sequence

The user accesses the application and fails authentication. The browser is redirected to ACS, which generates and returns the list of accepted identity providers (which may include custom issuers or another ADFS instance as well as social identity providers and email services). The user selects the required identity provider, and ACS redirects the user to that identity provider's login page. After the identity provider authenticates the user, it returns a token to ACS that declares the user to be valid. ACS then maps the claims and generates a token that declares this user to be valid, and redirects the user to the application. The application uses the token to authorize the user for the appropriate tasks.

This means that the authority for the user's identity differs at each stage of the process. For example, if the user chooses to authenticate with Google, then the Google token issuer is the authority in declaring the user to be valid with them, and it returns proof in the form of a name and email address. When redirected to ACS, the browser presents the Google token and ACS becomes the authority on issuing claims about the user based on the valid token from Google (called a copy claim). ACS can perform transformation and mapping, such as to include the claim that this user works in a specific company and has a specific role in the application.

Combining ACS and ADFS

If, instead of authenticating with ACS, the user was originally redirected by the application to a local issuer such as ADFS, which includes ACS amongst its trusted issuers, the local issuer receives the token from ACS and becomes the authority in declaring the user valid based on the claims returned from ACS. The local issuer can also perform transformation and mapping, such as to include the claim that this user works in a specific company and has a specific role in the application. A scenario that illustrates when this is useful is described in detail in Chapter 5, "Federated Identity with Windows Azure Access Control Service."

I think of an issuer as an "identity transformer." It converts incoming identities into something that's intelligible to the application.

Identity Transformation

The issuer's job is to take some generic incoming identity (perhaps from a Kerberos ticket, an X.509 certificate, or a set of user credentials) and transform it into a security token that your application can use. That security token is like the boarding pass, in that it contains all of the user's identity details that your application needs to do its job, and nothing more. Perhaps instead of the user's Windows groups, your boarding pass contains roles that you can use right away.

On the other end of the protocol are users who can use their single sign-on credentials to access many applications because the issuer in their realm knows how to authenticate them. Their local issuer provides claims to applications in their local realm as well as to issuers in other realms so that they can use many applications, both local and remote, without having to remember special credentials for each one.

Consider the application's local issuer in the last illustration, "Federating identity across realms." It receives a security token from a user in some other realm. Its first job is to reject the request if the incoming token wasn't issued by one of the select issuers that it trusts. But once that check is out of the way, its job now becomes one of *claims* *transformation*. It must transform the claims made by the remote issuer into claims that make sense for your application. For a practical example, see Chapter 4, "Federated Identity for Web Applications."

Transformation is carried out with rules such as, "If you see a claim of this type, with this value, issue this claim instead." For example, your application may have a role called Managers that grants special access to manager-specific features. That claim may map directly to a Managers group in your realm, so that local users who are in the Managers group always get the Managers role in your application. In the partner's realm, they may have a group called Supervisors that needs to access the manager-specific features in your application. The transformation from Supervisors to Managers can happen in their issuer; if it does not, it must happen in yours. This transformation simply requires another rule in the issuer. The point is that issuers such as ADFS and ACS are specifically designed to support this type of transformation because it's rare that two companies will use exactly the same vocabulary.

ADFS uses a rules engine to support claims transformation.

In ACS, the transformation and mapping rules are configured using the web-based administration portal or by making OData-formatted calls to the management API.

Home Realm Discovery

Now that you've seen the possibility of cross-realm federation, think about how it works with browser-based applications. Here are the steps:

1. Alice (in a remote realm) clicks a link to your application.
2. You redirect Alice to your local issuer, just like before.
3. Your issuer redirects Alice's browser to the issuer in her realm.
4. Alice's local issuer authenticates and issues a token, sending Alice's browser back to your issuer with that token.
5. Your issuer validates the token, transforms the claims, and issues a token for your application to use.
6. Your issuer sends Alice's browser back to your application, with the token that contains the claims your application needs.

The mystery here is in step 3. How does the issuer know that Alice is from a remote realm? What prevents the issuer from thinking she's a local user and trying to authenticate her directly, which will only fail and frustrate the user? Even if the issuer knew that Alice was from a remote realm, how would it know which realm it was? After all, it's likely that you'll have more than one partner.

This problem is known as home realm discovery. Your issuer has to determine if Alice is from the local realm or if she's from some partner organization. If she's local, the issuer can authenticate her directly. If she's remote, the issuer needs to know a URL to redirect her to so that she can be authenticated by her home realm's issuer.

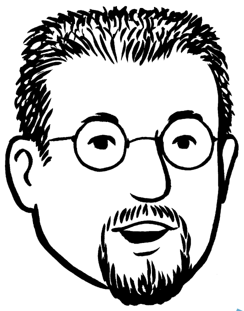
There are two ways to solve this problem. The simplest one is to have the user help out. In step 2, when Alice's browser is redirected to your local issuer, the authentication sequence pauses and the browser displays a web page asking her what company she works for. (Note that it doesn't help Alice to lie about this, because her credentials are only good for one of the companies on the list—her company.) Alice clicks the link for her company and the process continues, since the issuer now knows what to do. To avoid asking Alice this question in the future, your issuer sets a cookie in her browser so that next time it will know who her issuer is without having to ask.

If the issuer is ACS, it will automatically generate and display a page containing the list of accepted identity providers. Alice must select one of these, and her choice indicates her home realm. If ACS is using a trusted instance of an ADFS security token service (STS) as an identity provider, the home realm discovery page can contain a textbox as well as (or instead of) the list of configured identity providers where a user can enter a corresponding email address. The user is then authenticated by the ADFS STS.

The second way to solve this problem is to add a hint to the query string that's in the link that Alice clicks in step 1. That query string will contain a parameter named **whr** (**hr** stands for home realm).

The issuer looks for this hint and automatically maps it to the URL of the user's home realm. This means that the issuer doesn't have to ask Alice who her issuer is because the application relays that information to the issuer. The issuer uses a cookie, just as before, to ensure that Alice is never bothered with this question.

Take a look at Chapter 3, "Claims-Based Single Sign-On for the Web," to see an example of this technique.



My IT people make sure that the links to remote applications always include this information. It makes the application much friendlier for the user and protects the privacy of my company by not revealing all of its partners.

Take a look at Chapter 4, "Federated Identity for Web Applications," to see an example of this technique.

Design Considerations for Claims-Based Applications

Admittedly, it's difficult to offer general prescriptive guidance for designing claims because they are so dependent on the particular application. This section poses a series of questions and offers some approaches to consider as you look at your options.

What Makes a Good Claim?

Like many of the most important design decisions, this question doesn't always have a clear answer. What's important is that you understand the tensions at play and the tradeoffs you're facing. Here are some concrete examples that might help you start thinking about some general criteria for what makes a good claim.

First, consider a user's email address. That's a prime candidate for a claim in almost any system, because it's generally very tightly coupled to the user's identity, and it's something that everyone needs if you decide to federate identity across realms. An email name can help you personalize your system for the user in a very meaningful way.

What about a user's choice of a skin or theme for your website? Certainly, this is "personalization" data, but it's also data that's particular to a single application, and it's hard to argue that this is part of a user's identity. Your application should manage this locally.

What about a user's permission to access data in your application? While it may make sense in some systems to model permissions as claims, it's easy to end up with an overwhelming number of these claims as you model finer and finer levels of authorization. A better approach is to define a boundary that separates the authorization data you'll get from claims from the data you'll handle through other means. For example, in cross-realm federation scenarios, it can be beneficial to allow other realms to be authoritative for some high-level roles. Your application can then map those roles onto fine-grained permissions with tools such as Windows Authorization Manager (AzMan). But unless you've got an issuer that's specifically designed for managing fine-grained permissions, it's probably best to keep your claims at a much higher level.

Before making any attribute into a claim, ask yourself the following questions:

- Is this data a core part of how I model user identity?
- Is the issuer an authority on this information?
- Will this data be used by more than one application?
- Do I want an issuer to manage this data or should my application manage it directly?

How Can You Uniquely Distinguish One User from Another?

Because people aren't born with unique identifiers (indeed, most people treasure their privacy), differentiating one person from another has always been, and will likely always be a tricky problem. Claims don't make this any easier. Fortunately, not all applications need to know exactly who the user is. Simply being able to identify one returning user from another is enough to implement a shopping cart, for example. Many applications don't even need to go this far. But other applications have per-user state that they need to track, so they require a unique identifier for each user.

Traditional applications typically rely on a user's sign-in name to distinguish one user from the next. So what happens when you start building claims-based applications and you give up control over authentication? You'll need to pick one (or a combination of multiple) claims to uniquely identify your user, and you'll need to rely on your issuer to give you the same values for each of those claims every time that user visits your application. It might make sense to ask the issuer to give you a claim that represents a unique identifier for the user. This can be tricky in a cross-realm federation scenario, where more than one issuer is involved. In these more complicated scenarios, it helps to remember that each issuer has a URI that identifies it and that can be used to scope any identifier that it issues for a user. An example of such a URI is http://issuer.fabrikam.com/unique-user-id-assigned-from-fabrikams-realm.

Email addresses have convenient properties of uniqueness and scope already built in, so you might choose to use an email claim as a unique identifier for the user. If you do, you'll need to plan ahead if you want users to be able to change the email address associated with their data. You'll also need a way to associate a new email address with that data.

How Can You Get a List of All Possible Users and All Possible Claims?

One thing that's important to keep in mind when you build a claims-based application is that you're never going to know about all the users that could use your application. You've given up that control in exchange for less responsibility, worry, and hassle over programming against any one particular user store. Users just appear at your doorstep, presenting the token they got from the issuer that you trust. That token gives you information about who the user is and what he or she can do. In addition, if you've designed your authorization code properly, you don't need to change your code to support new users; even if those users come from other realms, as they do in federation scenarios.

So how can you build a list of users that allows administrators to choose which users have permission to access your application and which don't? The simple answer is to find another way. This is a perfect example of where an issuer should be involved with authorization decisions. The issuer shouldn't issue tokens to users who aren't privileged enough to use your application. It should be configured to do this without you having to do anything at all in your application.

When designing a claims-based application, always keep in mind that a certain amount of responsibility for identity has been lifted from your shoulders as an application developer. If an identity-related task seems difficult or impossible to build into your application logic, consider whether it's possible for your issuer to handle that task for you.

Where Should Claims Be Issued?

The question of where claims should be issued is moot when you have a simple system with only one issuer. But when you have more complex systems where multiple issuers are chained into a path of trust that leads from the application back to the issuer in the user's home realm, this question becomes very relevant.

Always get claims from authoritative sources.

The short answer to the question of where claims should be issued is "by the issuer that knows best."

Take, for example, a claim such as a person's email name. The email name of a user isn't going to change based on which application he or she uses. It makes sense for this type of claim to be issued close to the user's home realm. Indeed, it's most likely that the first issuer in the chain, which is the identity provider, would be authoritative for the user's email name. This means that downstream issuers and applications can benefit from that central claim. If the email name is ever updated, it only needs to be updated at that central location.

Now think about an "action" claim, which is specific to an application. An application for expense reporting might want to allow or disallow actions such as **submitExpenseReport** and **approveExpenseReport**. Another type of application, such as one that tracks bugs, would have very different actions, such as **reportBug** and **assignBug**. In some systems, you might find that it works best to have the individual applications handle these actions internally, based on higher-level claims such as roles or groups. But if you do decide to factor these actions out into claims, it would be best to have an issuer close to the application be authoritative for them. Having local authority over these sorts of claims means you can more quickly implement policy changes without having to contact a central authority.

What about a group claim or a role claim? In traditional RBAC (Role-Based Access Control) systems, a user is assigned to one or more groups, the groups are mapped to roles, and roles are mapped to actions. There are many reasons why this is a good design: the mapping from roles to actions for an application can be done by someone who is familiar with it and who understands the actions defined for that application. For example, the mapping from user to groups can be done by a central administrator who knows the semantics of each group. Also, while groups can be managed in a central store, roles and actions can be more decentralized and handled by the various departments and product groups that define them. This allows for a much more agile system where identity and authorization data can be centralized or decentralized as needed.

Issuers are typically placed at boundaries in organizations. Take, for example, a company with several departments. Each department might have its own issuer, while the company has a central issuer that acts as a gateway for claims that enter or leave it. If a user at this company accesses an application in another, similarly structured company, the request will end up being processed by four issuers:

Issuers are typically found at organizational boundaries.

- The departmental issuer, which authenticates the user and supplies an email name and some initial group claims
- The company's central issuer, which adds more groups and some roles based on those groups
- The application's central issuer, which maps roles from the user's company to roles that the application's company understands (this issuer may also add additional role-claims based on the ones already present)
- The application's departmental issuer, which maps roles onto actions

You can see that as the request crosses each of these boundaries, the issuers there enrich and filter the user's security context by issuing claims that make sense for the target context, based on its requirements and the privacy policies. Is the email name passed all the way through to the application? That depends on whether the user's company trusts the application's company with that information, and whether the application's company thinks the application needs to know that information.

What Technologies Do Claims and Tokens Use?

Security tokens that are passed over the Internet typically take one of two forms:

- Security Assertion Markup Language (SAML) tokens are XML-encoded structures that are embedded inside other structures such as HTTP form posts and SOAP messages.

- Simple Web Token (SWT) tokens that are stored in the HTTP headers of a request or response.

The tokens are encrypted and can be stored on the client as cookies.

Security Assertion Markup Language (SAML) defines a language for exchanging security information expressed in the form of assertions about subjects. A subject may be a person or a resource (such as a computer) that has an identity in a security domain. A typical example of a subject is a person identified by an email address within a specific DNS domain. The assertions in the token can include information about authentication status, specific details of the subject (such as a name), and the roles valid for the subject that allow authorization decisions to be made by the relying party.

The protocol used to transmit SAML tokens is often referred to as **SAML-P**. It is an open standard that is ratified by Oasis, and it is supported by ADFS 2.0. However, at the time of this writing it was not natively supported by Windows Identity Foundation (WIF). To use SAMP-P with WIF requires you to create or obtain a custom authentication module that uses the WIF extensibility mechanism.

Simple Web Token (SWT) is a compact name-value pair security token designed to be easily included in an HTTP header.

The transfer of tokens between identity provider, issuer, client, and the relying party (the application) may happen through HTTP web requests and responses, or through web service requests and responses, depending on the nature of the client. Web browsers rely mainly on HTTP web requests and responses. Smart clients and other services (such as SharePoint BCS) use web service requests and responses.

Web service requests make use of a suite of security standards that fall under the heading of the **WS* Extensions**. The WS* standards include the following extensions:

- **WS-Security**. This specification defines a protocol for end-to-end message content security that supports a wide range of security token formats, trust domains, signature formats, and encryption technologies. It provides a framework that, in conjunction with other extensions, provides the ability to send security tokens as part of a message, to verify message integrity, and to maintain message confidentiality. The WS-Security mechanisms can be used for single tasks such as passing a security token, or in combination to enable signing and encrypting a message and providing a security token.
- **WS-Trust**. This specification builds on the WS-Security protocol to define additional extensions that allow the exchange of security tokens for credentials in different trust domains. It includes definitions of mechanisms for issuing, renewing, and

validating security tokens; for establishing the presence of trust relationships between domains, and for brokering these trust relationships.

- **WS-SecureConversation**. This specification builds on WS-Security to define extensions that support the creation and sharing of a security context for exchanging multiple messages, and for deriving and managing more efficient session keys for use within the conversation. This can increase considerably the overall performance and security of the message exchanges.
- **WS-Federation**. This specification builds on the WS-Security and WS-Trust protocols to provide a way for a relying party to make the appropriate access control decisions based on the credibility of identity and attribute data that is vouched for by another realm. The standard defines mechanisms to allow different security realms to federate so that authorized access to resources managed in one realm can be provided to subjects whose identities are managed in other realms.
- **WS-Federation: Passive Requestor Profile**. This specification describes how the cross trust realm identity, authentication, and authorization federation mechanisms defined in WS-Federation can be utilized used by passive requesters such as web browsers to provide identity services. Passive requesters of this profile are limited to the HTTP protocol.

WS is a suite of standards where each builds on other standards to provide additional capabilities or to meet specific scenario requirements.*

Security Association Management Protocol (SAMP) and Internet Security Association and Key Management Protocol (ISAKMP) define standards for establishing security associations that define the header, authentication, payload encapsulation, and application layer services for exchanging key generation and authentication data that is independent of the key generation technique, encryption algorithm, and authentication mechanism in use. All of these are necessary to establish and maintain secure communications when using IP Security Service or any other security protocol in an Internet environment.

For more information about these standards and protocols, see Appendix C of this guide.

Questions

1. Which of the following protocols or types of claims token are typically used for single sign-on across applications in different domains and geographical locations?
    a. Simple web Token (SWT)
    b. Kerberos ticket
    c. Security Assertion Markup Language (SAML) token
    d. Windows Identity
2. In a browser-based application, which of the following is the typical order for browser requests during authentication?
    a. Identity provider, token issuer, relying party
    b. Token issuer, identity provider, token issuer, relying party
    c. Relying party, token issuer, identity provider, token issuer, relying party
    d. Relying party, identity provider, token issuer, relying party
3. In a service request from a *non*-browser-based application, which of the following is the typical order of requests during authentication?
    a. Identity provider, token issuer, relying party
    b. Token issuer, identity provider, token issuer, relying party
    c. Relying party, token issuer, identity provider, token issuer, relying party
    d. Relying party, identity provider, token issuer, relying party
4. What are the main benefits of federated identity?
    a. It avoids the requirement to maintain a list of valid users, manage passwords and security, and store and maintain lists of roles for users in the application.
    b. It delegates user and role management to the trusted organization responsible for the user, instead of it being the responsibility of your application.

c. It allows users to log onto applications using the same credentials, and choose an identity provider that is appropriate for the user and the application to validate these credentials.

d. It means that your applications do not need to include authorization code.

5. How can home realm discovery be achieved?

    a. The token issuer can display a list of realms based on the configured identity providers and allow the user to select his home realm.

    b. The token issuer can ask for the user's email address and use the domain to establish the home realm.

    c. The application can use the IP address to establish the home realm based on the user's country/region of residence.

    d. The application can send a hint to the token issuer in the form of a special request parameter that indicates the user's home realm.

3 Claims-Based Single Sign-On for the Web and Windows Azure

This chapter walks you through an example of single sign-on for intranet and extranet web users who all belong to a single security realm. You'll see examples of two existing applications that become claims-aware. One of the applications uses forms authentication, and one uses Windows authentication. Once the applications use claims-based authentication, you'll see how it's possible to interact with the applications either from the company's internal network or from the public Internet.

For single sign-on, the issuer also creates a session with the user that works with different applications.

This basic scenario doesn't show how to establish trust relationships across enterprises. (That is discussed in Chapter 4, "Federated Identity for Web Applications.") It focuses on how to implement single sign-on and single sign-off within a security domain as a preparation for sharing resources with other security domains, and how to migrate applications to Windows Azure™. In short, this scenario contains the commonly used elements that will appear in all claims-aware applications.

The Premise

Adatum is a medium-sized company that uses Microsoft Active Directory® directory service to authenticate the employees in its corporate network. Adatum's sales force uses a-Order, Adatum's order processing system, to enter, process, and manage customer orders. Adatum employees also use aExpense, an expense tracking and reimbursement system for business-related expenses.

Both applications are built with ASP.NET 4.0 and are deployed in Adatum's data center. Figure 1 shows a whiteboard diagram of the structure of a-Order and a-Expense.

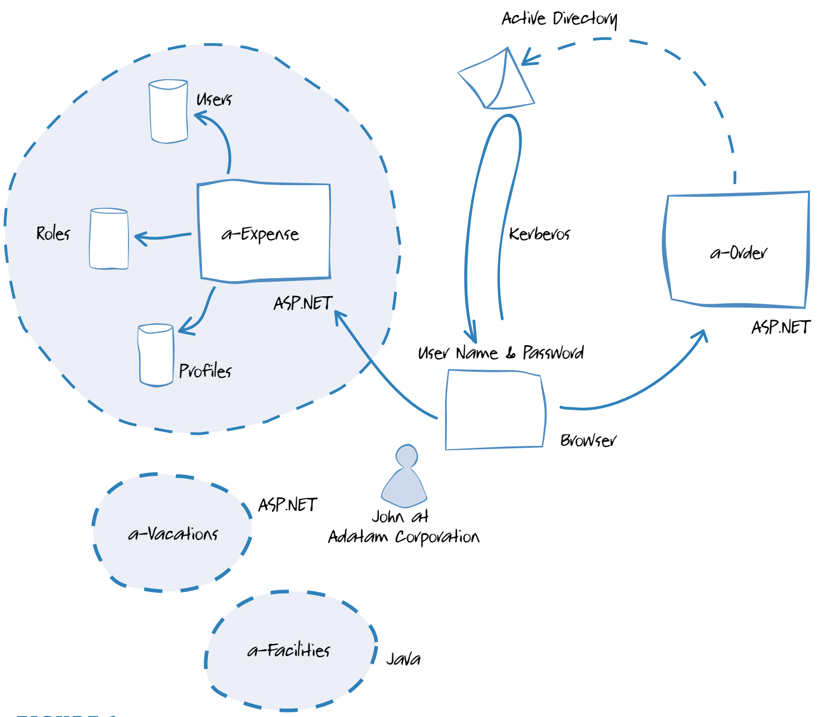
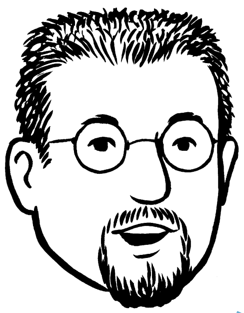


FIGURE 1
Adatum infrastructure before claims



Keeping the user database for forms-based authentication up to date is painful since this maintenance isn't integrated into Adatum's process for managing employee accounts.

The two applications handle authentication differently. The a-Order application uses Windows authentication. It recognizes the credentials used when employees logged on to the corporate network. The application doesn't need to prompt them for user names and passwords. For authorization, a-Order uses roles that are derived from groups stored in Active Directory. In this way, a-Order is integrated into the Adatum infrastructure.

The user experience for a-Expense is a bit more complicated. The a-Expense application uses its own authentication, authorization, and user profile information. This data is stored in custom tables in an application database. Users enter a user name and password in a web form whenever they start the application. The a-Expense application's authentication approach reflects its history. The application began as a Human Resources project that was developed outside of Adatum's IT department. Over time, other departments adopted it. Now it's a part of Adatum's corporate IT solution.

The a-Expense access control rules use application-specific roles. Access control is intermixed with the application's business logic.

Some of the user profile information that a-Expense uses also exists in Active Directory, but because a-Expense isn't integrated with the corporate enterprise directory, it can't access it. For example, Active Directory contains each employee's cost center, which is also one of the pieces of information maintained in the a-Expense user profile database. Changing a user's cost center in a-Expense is messy and error prone. All employees have to manually update their profiles when their cost centers change.

Goals and Requirements

Adatum has a number of goals in moving to a claims-based identity solution. One goal is to add the single sign-on capability to its network. This allows employees to log on once and then be able to access all authorized systems, including a-Expense. With single sign-on, users will not have to enter a user name and password when they use a-Expense.

Your choice of an identity solution should be based on clear goals and requirements.

A second goal is to enable Adatum employees to access corporate applications from the Internet. Members of the sales force often travel to customer sites and need to be able to use a-Expense and aOrder without the overhead of establishing a virtual private network (VPN) session.

Dealing with change is one of the challenges of IT operations.

A third goal is to plan for the future. Adatum wants a flexible solution that it can adapt as the company grows and changes. Right now, a priority is to implement an architecture that allows them to host some applications in a cloud environment such as Windows Azure. Moving operations out of their data center will reduce their capital expenditures and make it simpler to manage the applications. Adatum is also considering giving their customers access to some applications, such as a-Order. Adatum knows that claims-based identity and access control are the foundations needed to enable these plans.

While meeting these goals, Adatum wants to make sure its solution reuses its existing investment in its enterprise directory. The company wants to make sure user identities remain under central administrative control and don't span multiple stores. Nonetheless, Adatum wants its business units to have the flexibility to control access to the data they manage. For example, not everyone at Adatum is authorized to use the a-Expense application. Currently, access to the program is controlled by application-specific roles stored in a departmentally administered database. Adatum's identity solution must preserve this flexibility.

Finally, Adatum also wants its identity solution to work with multiple platforms and vendors. And, like all companies, Adatum wants to ensure that any Internet access to corporate applications is secure.

With these considerations in mind, Adatum's technical staff has made the decision to modify both the aExpense and the a-Order applications to support claims-based single sign-on.

Overview of the Solution

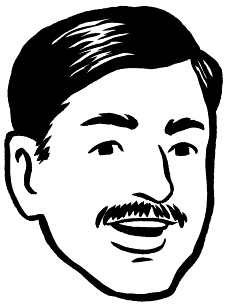
Claims can take advantage of existing directory information.

The first step was to analyze which pieces of identity information were common throughout the company and which were specific to particular applications. The idea was to make maximum use of the existing investment in directory information. Upon review, Adatum discovered that their Active Directory store already contained the necessary information. In particular, the enterprise directory maintained user names and passwords, given names and surnames, e-mail addresses, employee cost centers, office locations, and telephone numbers.

Since this information was already in Active Directory, the claims-based identity solution would not require changing the Active Directory schema to suit any specific application.

They determined that the main change would be to introduce an issuer of claims for the organization. Adatum's applications will trust this issuer to authenticate users.

Adatum envisions that, over time, all of its applications will eventually trust the issuer. Since information about employees is a corporate asset, the eventual goal is for no application to maintain a custom employee database. Adatum recognizes that some applications have specialized user profile information that will not (and should not) be moved to the enterprise directory. Adatum wants to avoid adding application-specific attributes to its Active Directory store, and it wants to keep management as decentralized as possible.



Nobody likes changing their Active Directory schema. Adding app-specific rules or claims from a non–Active Directory data store to a claims issuer is easier.

For the initial rollout, the company decided to focus on a-Expense and a-Order. The a-Order application only needs configuration changes that allow it to use Active Directory groups and users as claims. Although there is no immediate difference in the application's structure or functionality, this change will set the stage for eventually allowing external partners to access a-Order.

The a-Expense application will continue to use its own application-specific roles database, but the rest of the user attributes will come from claims that the issuer provides. This solution will provide single sign-on for aExpense users, streamline the management of user identities, and allow the application to be accessible remotely from the Internet.

Staging is helpful. You can change authentication first without affecting authorization.

You might ask why Adatum chose claims-based identity rather than Windows authentication for a-Expense. Like claims, Windows authentication provides single sign-on, and it is a simpler solution than issuing claims and configuring the application to process claims.

There's no disagreement here: Windows authentication is extremely well suited for intranet single sign-on and should be used when that is the only requirement.

Adatum's goals are broader than just single sign-on, however. Adatum wants its employees to have remote access to a-Expense and a-Order without requiring a VPN connection. Also, Adatum wants to move aExpense to Windows Azure and eventually allow customers to view their pending orders in the aOrder application over the Internet. The claims-based approach is best suited to these scenarios.

Figure 2 shows the proposal, as it was presented on Adatum's whiteboards by the technical staff. The diagram shows how internal users will be authenticated.

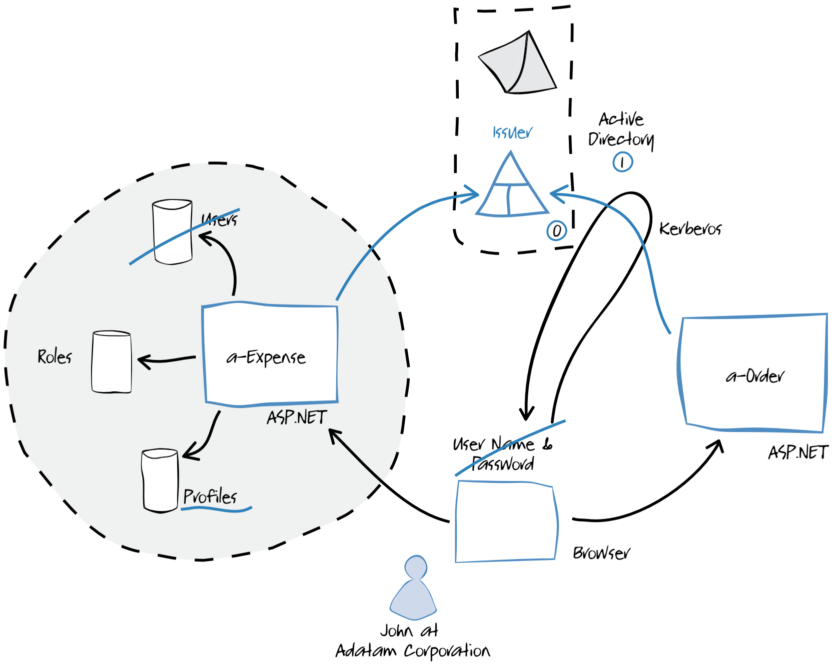


FIGURE 2
Moving to claims-based identity

This claims-based architecture allows Adatum employees to work from home just by publishing the application and the issuer through the firewall and proxies. Figure 3 shows the way Adatum employees can use the corporate intranet from home.

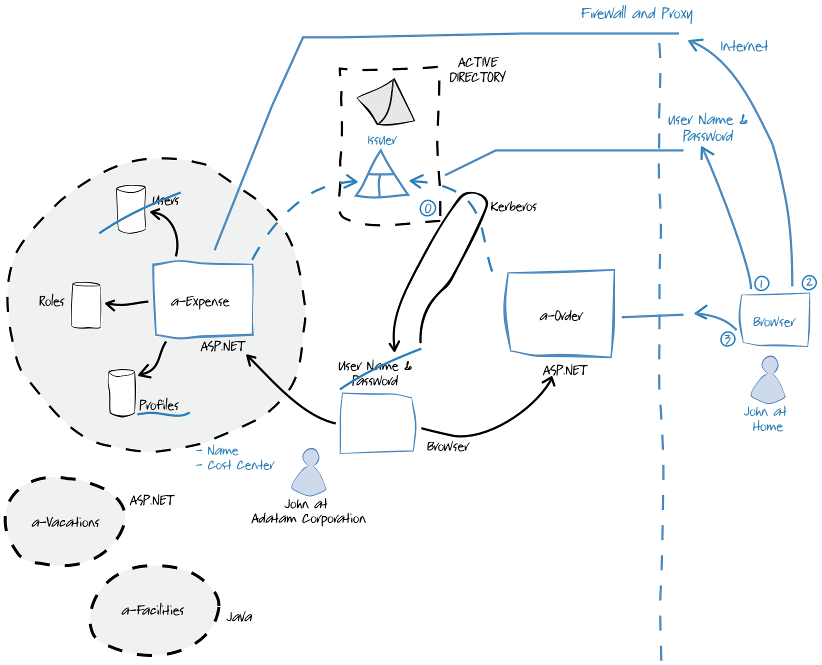
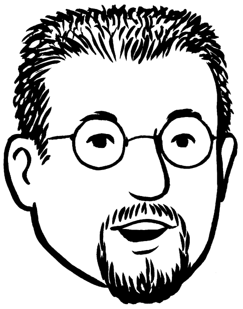


FIGURE 3
Claims-based identity over the Internet



The Active Directory Federation Services (ADFS) proxy role provides intermediary services between an Internet client and an ADFS server that is behind a firewall.

Once the issuer establishes the remote user's identity by prompting for a user name and password, the same claims are sent to the application, just as if the employee is inside the corporate firewall.

This solution makes Adatum's authentication strategy much more flexible. For example, Adatum could ask for additional authentication requirements, such as smart cards, PINs, or even biometric data, when someone connects from the Internet. Because authentication is now the responsibility of the issuer, and the applications always receive the same set of claims, the applications don't need to be rewritten. The ability to change the way you authenticate users without having to change your applications is a real benefit of using claims.

You can also look at this proposed architecture from the point of view of the HTTP message stream. For more information, see the message sequence diagrams in Chapter 2, "Claims-Based Architectures."

Inside the Implementation

Now is a good time to walk through the process of converting a-Expense into a claims-aware application in more detail. As you go through this section, you may want to download the Microsoft Visual Studio® solution 1SingleSignOn from http://claimsid.codeplex.com. This solution contains implementations of a-Expense and a-Order, with and without claims. If you are not interested in the mechanics, you should skip to the next section.

By default, the downloadable implementations run standalone on your workstation, but you can also configure them for a multi-tiered deployment.

a-Expense before Claims

Before claims, the a-Expense application used forms authentication to establish user identity. It's worth taking a moment to review the process of forms authentication so that the differences with the claims-aware version are easier to see. In simple terms, forms authentication consists of a credentials database and an HTTP redirect to a logon page.

Figure 4 shows the a-Expense application with forms authentication.

Many web applications store user profile information in cookies rather than in the session state because cookies scale better on the server side. Scale wasn't a concern here because a-Expense is a departmental application.

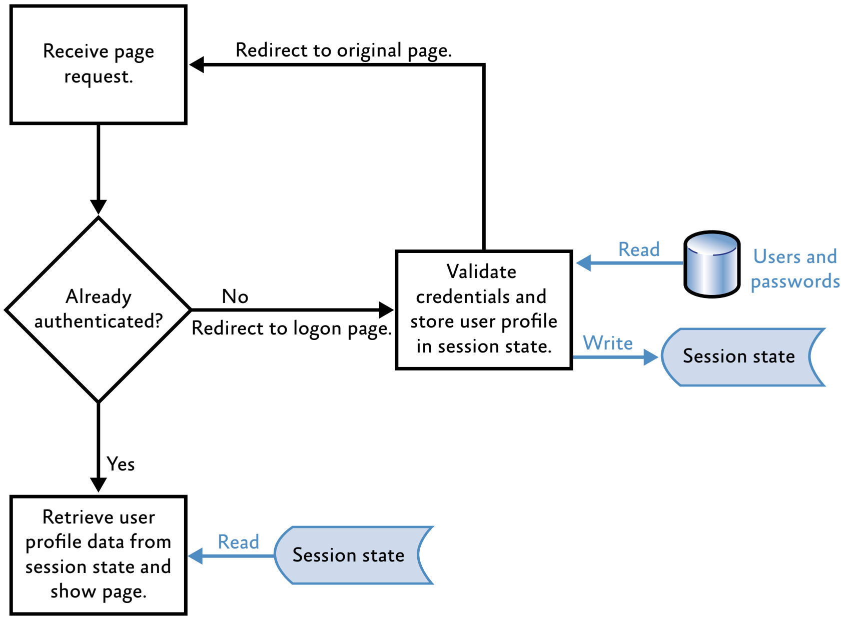

Receive page request.
Redirect to original page.
Already authenticated?
No
Redirect to logon page.
Validate credentials and store user profile in session state.
Read
Users and passwords
Write
Session state
Yes
Retrieve user profile data from session state and show page.
Read
Session state

FIGURE 4
a-Expense with forms authentication

The logon page serves two purposes in a-Expense. It authenticates the user by asking for credentials that are then checked against the password database, and it also copies application-specific user profile information into the ASP.NET's session state object for later use. Examples of profile information are the user's full name, cost center, and assigned roles. The a-Expense application keeps its user profile information in the same database as user passwords, which is typical for applications that use forms authentication.

a-Expense intentionally uses custom code for authentication, authorization, and profiles instead of using Membership, Roles, and Profile providers. This is typical of legacy applications that might have been written before ASP.NET 2.0.

In ASP.NET, adding forms authentication to a web application requires three steps: an annotation in the application's Web.config file to enable forms authentication, a logon page that asks for credentials, and a handler method that validates those credentials against application data. Here is how those pieces work.

The Web.config file for a-Expense enables forms authentication with the following XML declarations:

```
<authentication mode="Forms">
     <forms loginUrl="~/login.aspx"
            requireSSL="true" ... />
</authentication>

<authorization>
    <deny users="?" />
</authorization>
```

The **authentication** element tells the ASP.NET runtime (or Microsoft Internet Information Services (IIS) 7.0 when running both in ASP.NET integrated mode and classic mode) to automatically redirect any unauthenticated page request to the specified login URL. An **authorization** element that denies access to unauthenticated users (denoted by the special symbol "?") is also required to make this redirection work.

Next, you'll find that a-Expense has a Login.aspx page that uses the built-in ASP.NET **Login** control, as shown here.

```
<asp:Login ID="Login1" runat="server"
           OnAuthenticate="Login1OnAuthenticate" ... >
</asp:Login>
```

Finally, if you look at the application, you'll notice that the handler of the Login.aspx page's **OnAuthenticate** event looks like the following.

```
public partial class Login : Page
{
  protected void Login1OnAuthenticate(object sender,
                                    AuthenticateEventArgs e)
  {
     var repository = new UserRepository();
     if (!repository.ValidateUser(this.Login1.UserName,
                                         this.Login1.Password))
     {
         e.Authenticated = false;
         return;
     }
     var user = repository.GetUser(this.Login1.UserName);
     if (user != null)
     {
         this.Session["LoggedUser"] = user;
         e.Authenticated = true;
     }
  }
}
```

This logic is typical for logon pages. You can see in the code that the user name and password are checked first. Once credentials are validated, the user profile information is retrieved and stored in the session state under the **LoggedUser** key. Notice that the details of interacting with the database have been put inside of the application's **UserRepository** class.

Setting the **Authenticated** property of the **AuthenticateEvent Args** object to **true** signals successful authentication. ASP.NET then redirects the request back to the original page.

At this point, normal page processing resumes with the execution of the page's **OnLoad** method. In the a-Expense application, this method retrieves the user's profile information that was saved in the session state object and initializes the page's controls. For example, the logic might look like the following.

```
protected void OnLoad(EventArgs e)
{
    var user = (User)Session["LoggedUser"];

    var repository = new ExpenseRepository();
    var expenses = repository.GetExpenses(user.Id);
    this.MyExpensesGridView.DataSource = expenses;
    this.DataBind();

    base.OnLoad(e);
}
```

The session object contains the information needed to make access control decisions. You can look in the code and see how a-Expense uses an application-defined property called **AuthorizedRoles** to make these decisions.

a-Expense with Claims

The developers only had to make a few changes to a-Expense to replace forms authentication with claims. The process of validating credentials was delegated to a claims issuer simply by removing the logon page and configuring the ASP.NET pipeline to include the Windows Identity Foundation (WIF) **WSFederationAuthentication Module**. This module detects unauthenticated users and redirects them to the issuer to get tokens with claims. Without a logon page, the application still needs to write profile and authorization data into the session state object, and it does this in the **Session_Start** method. Those two changes did the job.

You only need a few changes to make the application claims-aware.

Figure 5 shows how authentication works now that a-Expense is claims-aware.

Making a-Expense use claims was easy with WIF's FedUtil. exe utility. See Appendix A.

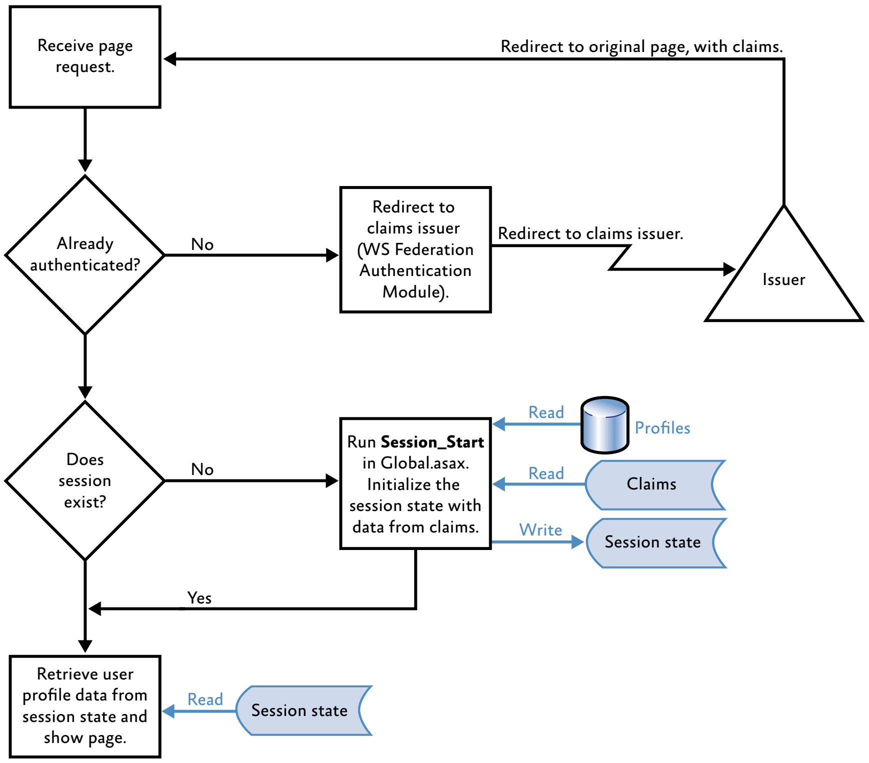

Receive page request.
Redirect to original page, with claims.
Already authenticated?
No
Redirect to claims issuer (WS Federation Authentication Module).
Redirect to claims issuer.
Issuer
Does session exist?
No
Run Session_Start in Global.asax. Initialize the session state with data from claims.
Read
Profiles
Read
Claims
Write
Session state
Yes
Retrieve user profile data from session state and show page.
Read
Session state

FIGURE 5
a-Expense with claims processing

The Web.config file of the claims-aware version of a-Expense contains a reference to WIF-provided modules. This Web.config file is automatically modified when you run the FedUtil wizard either through the command line (FedUtil.exe) or through the **Add STS Reference** command by right-clicking the web project in Visual Studio.

If you look at the modified Web.config file, you'll see that there are changes to the authorization and authentication sections as well as new configuration sections. The configuration sections include the information needed to connect to the issuer. They include, for example, the Uniform Resource Indicator (URI) of the issuer and information about signing certificates.

The first thing you'll notice in the Web.config file is that the authentication mode is set to **None**, while the requirement for authenticated users has been left in place.

```
<authentication mode="None" />

<authorization>
    <deny users="?" />
</authorization>
```

The forms authentication module that a-Expense previously used has been deactivated by setting the authentication mode attribute to **None**. *Instead, the* **WSFederationAuthenticationModule** *(FAM) and* **SessionAuthenticationModule** *(SAM) are now in charge of the authentication process.*

The application's Login.aspx page is no longer needed and can be removed from the application.

Next, you will notice that the Web.config file contains two new modules, as shown here.

```
<httpModules>
    <add name="WSFederationAuthenticationModule"
         type="Microsoft.IdentityModel.Web.
                       WSFederationAuthenticationModule, ..." />

    <add name="SessionAuthenticationModule"
         type="Microsoft.IdentityModel.Web.
                            SessionAuthenticationModule, ..." />
</httpModules>
```

When the modules are loaded, they're inserted into the ASP.NET processing pipeline in order to redirect the unauthenticated requests to the issuer, handle the reply posted by the issuer, and transform the

We're just giving the highlights here. You'll also want to check out the WIF and ADFS product documentation.

This may seem a little weird. What's going on is that authentication has been moved to a different part of the HTTP pipeline.

The **ClaimsPrincipal** object implements the **IPrincipal** interface that you already know. This makes it easy to convert existing applications.

user token sent by the issuer into a **ClaimsPrincipal** object. The modules also set the value of the **HttpContext.User** property to the **ClaimsPrincipal** object so that the application has access to it.

The **WSFederationAuthenticationModule** redirects the user to the issuer's logon page. It also parses and validates the security token that is posted back. This module writes an encrypted cookie to avoid repeating the logon process. The **SessionAuthenticationModule** detects the logon cookie, decrypts it, and repopulates the **Claims Principal** object.

The Web.config file contains a new section for the **Microsoft. IdentityModel** that initializes the WIF environment.

```
<configSections>
<section name="microsoft.identityModel"
         type="Microsoft.IdentityModel.Configuration.
                                MicrosoftIdentityModelSection,
                                Microsoft.IdentityModel, ..." />
</configSections>
```

The identity model section contains several kinds of information needed by WIF, including the address of the issuer and the certificates (the **serviceCertificate** and **trustedIssuers** elements) that are needed to communicate with the issuer.

```
<microsoft.identityModel>
  <service>
    <audienceUris>
      <add value=
              "https://{adatum hostname}/a-Expense.ClaimsAware/"
      />
    </audienceUris>
...
```

The value of "adatum hostname" changes depending on where you deploy the sample code. In the development environment, it is "localhost."

Security tokens contain an audience URI. This indicates that the issuer has issued a token for a specific "audience" (application). Applications, in turn, will check that the incoming token was actually issued for them. The **audienceUris** element lists the possible URIs. Restricting the audience URIs prevents malicious clients from reusing a token from a different application with an application that they are not authorized to access.

```
<federatedAuthentication>
   <wsFederation passiveRedirectEnabled="true"
       issuer="https://{adatum hostname}/{issuer endpoint} "
       realm="https://{adatum hostname}/a-Expense.ClaimsAware/"
       requireHttps="true" />
   <cookieHandler requireSsl="true"
                  path="/a-Expense.ClaimsAware/" />
</federatedAuthentication>
```

The **federatedAuthentication** section identifies the issuer and the protocol required for communicating with it.

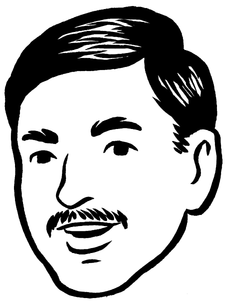
```
<serviceCertificate>
  <certificateReference x509FindType="FindByThumbprint"
    findValue="5a074d678466f59dbd063d1a98b1791474723365" />
</serviceCertificate>
```

The service certificate section gives the location of the certificate used to decrypt the token, in case it was encrypted. Encrypting the token is optional, and it's a decision of the issuer to do it or not. You don't need to encrypt the token if you're using HTTPS, but encryption is generally recommended as a security best practice.

```
<issuerNameRegistry
   type="Microsoft.IdentityModel.Tokens.ConfigurationBasedIssuer
NameRegistry,
         Microsoft.IdentityModel, ... >
   <trustedIssuers>
      <add thumbprint=" f260042d59e14817984c6183fbc6bfc71baf5462"
           name="adatum" />
   </trustedIssuers>
 </issuerNameRegistry>
```

A thumbprint is the result of hashing an X.509 certificate signature. SHA-1 is a common algorithm for doing that. Thumbprints uniquely identify a certificate and the issuer. The **issuerNameRegistry** element contains the list of thumbprints of the issuers it trusts. Issuers are identified by the thumbprint of their signing X.509 certificate. If the thumbprint does not match the certificate embedded in the incoming token signature, WIF will throw an exception. If the thumbprint matches, the **name** attribute will be mapped to the **Claim.Issuer** property.

In the code example, the name attribute **adatum** is required for the scenario because the a-Expense application stores the federated user name in the roles database. A federated user name has the format: adatum*username*.



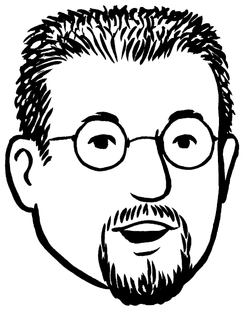
Using HTTPS mitigates man-in-the-middle and replay attacks. This is optional during development, but be sure to use HTTPS in production environments.

The following procedure shows you how to find the thumbprint of a specific certificate.

TO FIND A THUMBPRINT

1. On the taskbar, click **Start**, and then type **mmc** in the search box.
2. Click **mmc**. A window appears that contains the Microsoft Management Console (MMC) application.
3. On the **File** menu, click **Add/Remove Snap-in**.
4. In the **Add or Remove Snap-ins** dialog box, click **Certificates**, and then click **Add**.
5. In the **Certificates snap-in** dialog box, select **Computer account**, and then click **Next**.
6. In the **Select Computer** dialog box, select **Local computer**, click **Finish**, and then click **OK**.
7. In the left pane, a tree view of all the certificates on your computer appears. If necessary, expand the tree. Expand the Personal folder. Expand the Certificates folder.
8. Click the certificate whose thumbprint you want.
9. In the **Certificate Information** dialog box, click the **Details** tab, and then scroll down until you see the thumbprint.

In Windows 7, you'll need to double-click to open the dialog, which has the title **Certificate**, *not* **Certificate Information**.



This may seem like a lot of configuration, but the FedUtil wizard handles it for you.

The changes in the Web.config file are enough to delegate authentication to the issuer.

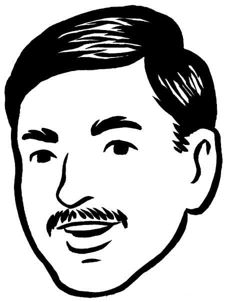
There's still one detail to take care of. Remember from the previous section that the logon handler (which has now been removed from the application) was also responsible for storing the user profile data in the session state object. This bit of logic is relocated to the **Session_Start** method found in the Global.asax file. The **Session_Start** method is automatically invoked by ASP.NET at the beginning of a new session, after authentication occurs. The user's identity is now stored as claims that are accessed from the thread's **CurrentPrincipal** property. Here is what the **Session_Start** method looks like.

```
protected void Session_Start(object sender, EventArgs e)
{
  if (this.Context.User.Identity.IsAuthenticated)
  {
    string issuer =
         ClaimHelper.GetCurrentUserClaim(
            System.IdentityModel.Claims.ClaimTypes.Name).
                                                      OriginalIssuer;
    string givenName =
         ClaimHelper.GetCurrentUserClaim(
               WSIdentityConstants.ClaimTypes.GivenName).Value;

    string surname =
         ClaimHelper.GetCurrentUserClaim(
                 WSIdentityConstants.ClaimTypes.Surname).Value;

    string costCenter =
         ClaimHelper.GetCurrentUserClaim(
                          Adatum.ClaimTypes.CostCenter).Value;

    var repository = new UserRepository();
    string federatedUsername =
        GetFederatedUserName(issuer, this.User.Identity.Name);
    var user = repository.GetUser(federatedUsername);
    user.CostCenter = costCenter;
    user.FullName = givenName + " " + surname;

    this.Context.Session["LoggedUser"] = user;
  }
}
```

Note that the application does not go to the application data store to authenticate the user because authentication has already been performed by the issuer. The WIF modules automatically read the security token sent by the issuer and set the user information in the thread's current principal object. The user's name and some other attributes are now claims that are available in the current security context.

The user profile database is still used by a-Expense to store the application-specific roles that apply to the current user. In fact, a-Expense's access control is unchanged whether or not claims are used.

The preceding code example invokes methods of a helper class named **ClaimHelper**. One of its methods, the **GetCurrentUserClaim** method, queries for claims that apply in the current context. You need to perform several steps to execute this query:



Putting globally significant data such as names and cost centers into claims while keeping app-specific attributes in a local store is a typical practice.

1. Retrieve context information about the current user by getting the static **CurrentPrincipal** property of the **System.Threading.Thread** class. This object has the run-time type **IPrincipal**.
2. Use a run-time type conversion to convert the current principal object from **IPrincipal** to the type **IClaimsPrincipal**. Because a-Expense is now a claims-aware application, the run-time conversion is guaranteed to succeed.
3. Use the **Identities** property of the **IClaimsPrincipal** interface to retrieve a collection of identities that apply to the claims principal object from the previous step. The object that is returned is an instance of the **ClaimsIdentityCollection** class. Note that a claims principal may have more than one identity, although this feature is not used in the a-Expense application.
4. Retrieve the first identity in the collection. To do this, use the collection's indexer property with 0 as the index. The object that is returned from this lookup is the current user's claims-based identity. The object has type **IClaimsIdentity**.
5. Retrieve a claims collection object from the claims identity object with the **Claims** property of the **IClaimsIdentity** interface. The object that is returned is an instance of the **ClaimsCollection** class. It represents the set of claims that apply to the claims identity object from the previous step.
6. At this point, if you iterate through the claims collection, you can select a claim whose claim type matches the one you are looking for. The following expression is an example of how to do this.

   ```
   claims.Single(c => c.ClaimType == claimType)
   ```

   Note that the **Single** method assumes that there is one claim that matches the requested claim type. It will throw an exception if there is more than one claim that matches the desired claim type or if no match is found. The **Single** method returns an instance of the **Claim** class.
7. Finally, you extract the claim's value with the Claim class's **Value** property. Claims values are strings.

Look at the implementation of the **ClaimHelper** class in the sample code for an example of how to retrieve claims about the current user.

a-Order before Claims

Unlike a-Expense, the a-Order application uses Windows authentication. This has a number of benefits, including simplicity.

Enabling Windows authentication is as easy as setting an attribute value in XML, as shown here.

```
<authentication mode="Windows" />
```

The a-Order application's approach to access control is considerably simpler than what you saw in aExpense. Instead of combining authentication logic and business rules, a-Order simply annotates pages with roles in the Web.config file.

```
<authorization>
   <allow roles="Employee, Order Approver" />
   <deny users="*" />
</authorization>
```

The user interface of the a-Order application varies, depending on the user's current role.

```
base.OnInit(e);

this.OrdersGrid.Visible =
    !this.User.IsInRole(Adatum.Roles.OrderApprover);
this.OrdersGridForApprovers.Visible =
    this.User.IsInRole(Adatum.Roles.OrderApprover);
```

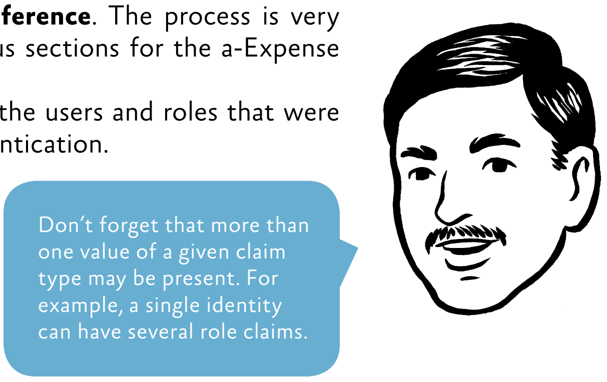
a-Order with Claims

Adding claims to a-Order is really just a configuration step. The application code needs no change.

Converting Windows authentication to claims only requires a configuration change.

If you download the project from http://claimsid.codeplex.com, you can compare the Web.config files before and after conversion to claims. It was just a matter of right-clicking the project in Visual Studio and then clicking **Add STS Reference**. The process is very similar to what you saw in the previous sections for the a-Expense application.

The claims types required are still the users and roles that were previously provided by Windows authentication.


Don't forget that more than one value of a given claim type may be present. For example, a single identity can have several role claims.

Signing out of an Application

The **FederatedPassiveSignInStatus** control is provided by WIF. The following snippet from the Site.Master file shows how the single sign-on scenario uses it to sign out of an application.

```
<idfx:FederatedPassiveSignInStatus
    ID="FederatedPassiveSignInStatus"
    runat="server"
    OnSignedOut="OnFederatedPassiveSignInStatusSignedOut"
    SignOutText="Logout"
    FederatedPassiveSignOut="true"
    SignOutAction="FederatedPassiveSignOut" />
```

The **idfx** prefix identifies the control as belonging to the **Microsoft.IdentityModel.Web.Controls** namespace. The control causes a browser redirect to the ADFS issuer, which logs out the user and destroys any cookies related to the session.

In this single sign-on scenario, signing out from one application signs the user out from all the applications they are currently signed into in the single sign-on domain.

For details about how the simulated issuer in this sample supports single sign-out, see the section "Handling Single Sign-out in the Mock Issuer" later in this chapter.

The a-Expense application uses an ASP.NET session object to maintain some user state, and it's important that this session data is cleared when a user signs out from the single sign-out domain. The a-Expense application manages this by redirecting to a special CleanUp.aspx page when the application handles the **WSFederationAuthenticationModule_SignedOut** event in the global.asax.cs file. The CleanUp.aspx page checks that the user has signed out and then abandons the session. The following code example shows the **Page_Load** event handler for this page.

```
protected void Page_Load(object sender, EventArgs e)
{
    if (this.User.Identity.IsAuthenticated)
    {
        this.Response.Redirect("~/Default.aspx", false);
    }
    else
    {
        this.Session.Abandon();
        var signOutImage = new byte[]
                            {
                                71, 73, …
                                …
                            };

        this.Response.Cache.SetCacheability
                      (HttpCacheability.NoCache);
        this.Response.ClearContent();
        this.Response.ContentType = "image/gif";
        this.Response.BinaryWrite(signOutImage);
    }
}
```

The Cleanup.aspx page must be listed as unauthenticated in the Web.config file.

The byte array represents a GIF image of the green check mark that the SignedOut.aspx page in the simulated issuer displays after the single sign-out is complete.

An alternative approach would be to modify the claims issuer to send the URL of the clean-up page in the **wreply** parameter when it sends a **wsignoutcleanup1.0** message to the relying party. However this would mean that the issuer, not the relying party, is responsible for initiating the session clean-up process in the relying party.

Setup and Physical Deployment

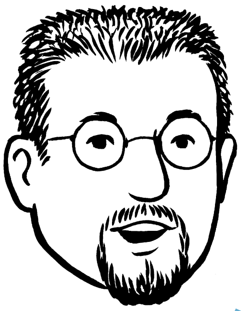
The process for deploying a claims-aware web application follows many of the same steps you already know for non-claims-aware applications. The differences have to do with the special considerations of the issuer. Some of these considerations include providing a suitable test environment during development, migrating to a production issuer, and making sure the issuer and the web application are properly configured for Internet access.

Using a Mock Issuer

Mock issuers simplify the development process.

The downloadable versions of a-Expense and a-Order are set up by default to run on a standalone development workstation. This is similar to the way you might develop your own applications. It's generally easier to start with a single development machine.

To make this work, the developers of a-Expense and a-Order wrote a small stub implementation of an issuer. You can find this code in the downloadable Visual Studio solution. Look for the project with the URL https://localhost/Adatum.SimulatedIssuer.1.



Using a simple, developer-created claims issuer is a good practice during development and unit testing. Your network administrator can help you change the application configuration to use production infrastructure components when it's time for acceptance testing and deployment.

When you first run the a-Expense and a-Order applications, you'll find that they communicate with the stand-in issuer. The issuer issues predetermined claims.

It's not very difficult to write such a component, and you can reuse the sample that we can provide.

Isolating Active Directory

The a-Order application uses Windows authentication. Since developers do not control the identities in their company's enterprise directory, it is sometimes useful to swap out Active Directory with a stub during the development of your application.

The a-Order application (before claims) shows an example of this. To use this technique, you need to make a small change to the Web.config file to disable Windows authentication and then add a hook in the session authentication pipeline to insert the user identities of your choosing. Disable Windows authentication with the following change to the Web.config file.

```
<authentication mode="None" />
```

The Global.asax file should include code that sets the identity with a programmer-supplied identity. The following is an example.

```
<script runat="server">

void Application_AuthenticateRequest(object sender, EventArgs e)
{
  this.Context.User = MaryMay;
}

private static IPrincipal MaryMay
{
  get
  {
    IIdentity identity = new GenericIdentity("mary");
    string[] roles = { "Employee", "Order Approver" };
    return new GenericPrincipal(identity, roles);
  }
}

</script>
```

Remove this code before you deploy your application.

Handling Single Sign-out in the Mock Issuer

The relying party applications (a-Order and a-Expense) use the **FederatedPassiveSignInStatus** control to allow the user to log in and log out. When the user clicks the log out link in one of the applications, the following sequence of events takes place:

To find out more about the message flow when a user initiates the single sign-out process, take a look at Appendix B.

1. The user is logged out from the current application. The WSFederationAuthenticationModule (FAM) deletes any claims that the user has that relate to the current application.
2. The FAM sends a **wsignout1.0** WS-Federation command to the issuer.
3. The mock issuer performs any necessary sign-out operations from other identity providers, for example, by signing the user out from Active Directory.
4. The mock issuer sends a **wsignoutcleanup1.0** message to all the relying party applications that the user has signed into. The mock issuer maintains this list for each user in a cookie.

   Note: *The mock issuer sends the* **wsignoutcleanup1.0** *message to the relying party applications by embedding a specially constructed image tag in the sign out page that includes the* **wsignoutcleanup1.0** *message in the querystring.*

5. When the FAM in a relying party application intercepts the **wsignoutcleanup1.0** message, it deletes any claims that the user has that relate to that application.

Converting to a Production Issuer

When you are ready to deploy to a production environment, you'll need to migrate from your simulated issuer that runs on your development workstation to a component such as ADFS 2.0.

Remove the mock issuers when you deploy the application.

Making this change requires two steps. First, you need to modify the web application's Web.config file using FedUtil so that it points to the production issuer. Next, you need to configure the issuer so that it recognizes requests from your web application and provides the appropriate claims.

Appendix A of this guide walks you through the process of using FedUtil and shows you how to change the Web.config files.

You can refer to documentation provided by your production issuer for instructions on how to add a relying party and how to add claims rules. Instructions for the samples included in this guide can be found at http://claimsid.codeplex.com.

Enabling Internet Access

One of the benefits of outsourcing authentication to an issuer is that existing applications can be accessed from the external Internet very easily. The protocols for claims-based identity are Internet-friendly. All you need to do is make the application and the issuer externally addressable. You don't need a VPN.

If you decide to deploy outside of the corporate firewall, be aware that you will need certificates from a certificate authority for the hosts that run your web application and issuer. You also need to make sure that you configure your URLs with fully qualified host names or static IP addresses. The ADFS 2.0 proxy role provides specific support for publishing endpoints on the Internet.

Variation—Moving to Windows Azure

The last stage of Adatum's plan is to move a-Expense to Windows Azure. Windows Azure uses Microsoft data centers to provide developers with an on-demand compute service and storage to host, scale, and manage web applications on the Internet. This variation shows the power and flexibility of a claims-based approach. The a-Expense code doesn't change at all. You only need to edit its Web.config file.

It's easy to move a claims-aware application to Windows Azure.

As you go through this section, you may want to download the Visual Studio® solution from http://claimsid.codeplex.com.

Figure 6 shows what Adatum's solution looks like.

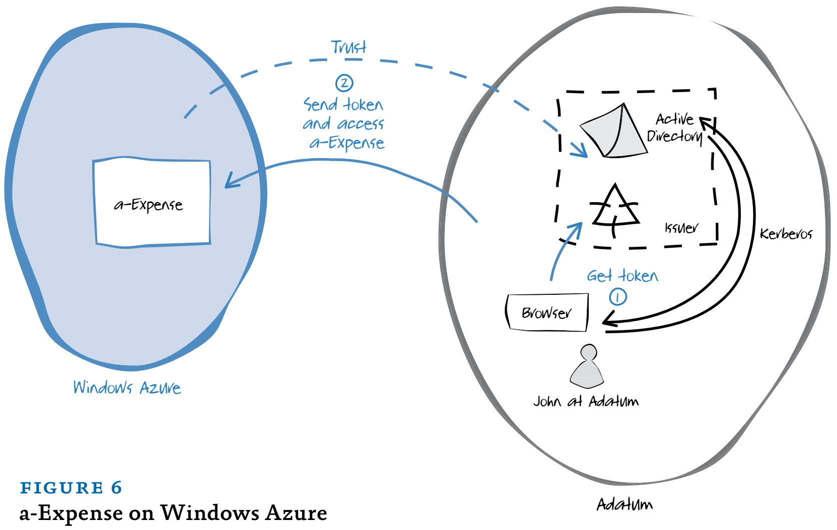


FIGURE 6
a-Expense on Windows Azure

From the perspective of Adatum's users, the location of the a-Expense application is irrelevant except that the application's URL might change once it is on Windows Azure, but even that can be handled by mapping CNAMEs to a Windows Azure URL. Otherwise, its behavior is the same as if it were located on one of Adatum's servers. This means that the sequence of events is exactly the same as before, when a-Expense became claims-aware. The first time a user accesses the application, he will not be authenticated, so the WIF module redirects him to the configured issuer that, in this case, is the Adatum issuer.

The issuer authenticates the user and then issues a token that includes the claims that a-Expense requires, such as the user's name and cost center. The issuer then redirects the user back to the application, where a session is established. Note that, even though it is located on the Internet, aExpense requires the same claims as when it was located on the Adatum intranet.

Obviously, for any user to use an application on Windows Azure, it must be reachable from his computer. This scenario assumes that Adatum's network, including its DNS server, firewalls, and proxies, are configured to allow its employees to have access to the Internet.

Notice however, that the issuer doesn't need to be available to external resources. The a-Expense application never communicates with it directly. Instead, it uses browser redirections and follows the protocol for passive clients. For more information about this protocol, see chapter 2, "Claims-Based Architectures" and Appendix B.

Hosting a-Expense on Windows Azure

The following procedures describe how to configure the certificates that you will upload to Windows Azure and the changes you must make to the Web.config file. These procedures assume that you already have a Windows Azure token. If you don't, see http://www.microsoft.com/windowsazure/getstarted/ to learn how to do this.

TO CONFIGURE THE CERTIFICATES

1. In Visual Studio, open the Windows Azure project, such as a-expense.cloud. Right-click the a-Expense.ClaimsAware role, and then click **Properties**.
2. If you need a certificate's thumbprint, click **Certificates**. Along with other information, you will see the thumbprint.
3. Click **Endpoints**, and then select **HTTPS**:. Set the **Name** field to **HttpsIn**. Set the **Port** field to the port number that you want to use. The default is **443**. Select the certificate name from the **SSL certificate name** drop-down box. The

default is **localhost**. The name should be the same as the name that is listed on the **Certificates** tab.

Note that the certificate that is uploaded is only used for SSL and not for token encryption. A certificate from Adatum is only necessary if you need to encrypt tokens.

Both Windows Azure and WIF can decrypt tokens. You must upload the certificate in the Windows Azure portal and configure the web role to deploy to the certificate store each time there is a new instance. The WIF **<serviceCertificate>** *section should point to that deployed certificate.*

The following procedure shows you how to publish the a-Expense application to Windows Azure.

TO PUBLISH A-EXPENSE TO WINDOWS AZURE

1. In Microsoft Visual Studio 2010, open the a-expense.cloud solution.
2. Upload the localhost.pfx certificate to the Windows Azure project. The certificate is located at [samples-installation-directory]\Setup\DependencyChecker\certs\localhost.pfx. The password is "xyz."
3. Modify the a-Expense.ClaimsAware application's Web.config file by replacing the **<microsoft.identityModel>** section with the following XML code. You must replace the **{service-url}** element with the service URL that you selected when you created the Windows Azure project.

```
<microsoft.identityModel>
  <service>
    <audienceUris>
      <add value="https://{service-url}.cloudapp.net/" />
    </audienceUris>
    <federatedAuthentication>
      <wsFederation passiveRedirectEnabled="true"
        issuer=
         "https://{adatum hostname}/{issuer endpoint}"
        realm="https://{service-url}.cloudapp.net/"
         requireHttps="true" />
         <cookieHandler requireSsl="true" />
    </federatedAuthentication>
    <issuerNameRegistry
      type=
       "Microsoft.IdentityModel.Tokens.
                ConfigurationBasedIssuerNameRegistry,
                Microsoft.IdentityModel, Version=3.5.0.0,
            Culture=neutral,
            PublicKeyToken=31bf3856ad364e35">
      <trustedIssuers>
      <!--Adatum's identity provider -->
        <add thumbprint=
              "f260042d59e14817984c6183fbc6bfc71baf5462"
             name="adatum" />
      </trustedIssuers>
    </issuerNameRegistry>
   <certificateValidation
             certificateValidationMode="None" />
  </service>
</microsoft.identityModel>
```

4. Right-click the a-expense.cloud project, and then click **Publish**. This generates a ServiceConfiguration file and the actual package for Windows Azure.
5. Deploy the ServiceConfiguration file and package to the Windows Azure project.

Once the a-Expense application is deployed to Windows Azure, you can log on to http://windows.azure.com to test it.

If you were to run this application on more than one role instance in Windows Azure (or in an on-premise web farm), the default cookie encryption mechanism (which uses DPAPI) is not appropriate, since each machine has a distinct key.

In this case, you would need to replace the default **Session SecurityHandler** *object and configure it with a different cookie transformation such as* **RsaEncryptionCookieTransform** *or a custom one. The "web farm" sample included in the WIF SDK illustrates this in detail.*

Questions

1. Before Adatum updated the a-Expense and a-Order applications, why was it not possible to use single sign-on?
    a. The applications used different sets of roles to manage authorization.
    b. a-Order used Windows authentication and a-Expense used ASP.NET forms authentication.
    c. In the a-Expense application, the access rules were intermixed with the application's business logic.
    d. You cannot implement single sign-on when user profile data is stored in multiple locations.
2. How does the use of claims facilitate remote web-based access to the Adatum applications?
    a. Using Active Directory for authentication makes it difficult to avoid having to use VPN to access the applications.
    b. Using claims means that you no longer need to use Active Directory.
    c. Protocols such as WS-Federation transport claims in tokens as part of standard HTTP messages.
    d. Using claims means that you can use ASP.NET forms-based authentication for all your applications.
3. In a claims enabled ASP.NET web application, you typically find that the authentication mode is set to **None** in the Web.config file. Why is this?
    a. The **WSFederationAuthenticationModule** is now responsible for authenticating the user.
    b. The user must have already been authenticated by an external system before they visit the application.
    c. Authentication is handled in the **On_Authenticate** event in the global.asax file.
    d. The **WSFederationAuthenticationModule** is now responsible for managing the authentication process.

4. Claims issuers always sign the tokens they send to a relying party. However, although it is considered best practice, they might not always encrypt the tokens. Why is this?
    a. Relying parties must be sure that the claims come from a trusted issuer.
    b. Tokens may be transferred using SSL.
    c. The claims issuer may not be able to encrypt the token because it does not have access to the encryption key.
    d. It's up to the relying party to state whether or not it accepts encrypted tokens.
5. The **FederatedPassiveSignInStatus** control automatically signs a user out of all the applications she signed into in the single sign-on domain.
    a. True.
    b. False. You must add code to the application to perform the sign-out process.
    c. It depends on the capabilities of the claims issuer. The issuer is responsible for sending sign-out messages to all relying parties.
    d. If your relying party uses HTTP sessions, you must add code to explicitly abandon the session.

More Information

Appendix A of this guide walks through the use of FedUtil and also shows you how to edit the Web.config files and where to locate your certificates.

MSDN® contains a number of helpful articles, including *MSDN Magazine*'s "A Better Approach For Building Claims-Based WCF Services" (http://msdn.microsoft.com/en-us/magazine/dd278426.aspx).

To learn more about Windows Azure, see the Windows Azure Platform at http://www.microsoft.com/windowsazure/.

4 Federated Identity for Web Applications

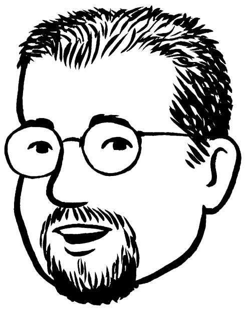
Many companies want to share resources with their partners, but how can they do this when each business is a separate security realm with independent directory services, security, and authentication? One answer is federated identity. Federated identity helps overcome some of the problems that arise when two or more separate security realms use a single application. It allows employees to use their local corporate credentials to log on to external networks that have trust relationships with their company. For an overview, see the section "Federating Identity across Realms" in Chapter 2, "Claims-Based Architectures."

Federated identity links independent security realms.

In this chapter, you'll learn how Adatum lets one of its customers, Litware, use the a-Order application that was introduced in Chapter 3, "Claims-Based Single Sign-On for the Web."

The Premise

Now that Adatum has instituted single sign-on (SSO) for its employees, it's ready to take the next step. Customers also want to use the a-Order program to track an order's progress from beginning to end. They expect the program to behave as if it were an application within their own corporate domain. For example, Litware is a longstanding client of Adatum's. Their sales manager, Rick, wants to be able to log on with his Litware credentials and use the a-Order program to determine the status of all his orders with Adatum. In other words, he wants the same single sign-on capability that Adatum's employees have. However, he doesn't want separate credentials from Adatum just to use a-Order.

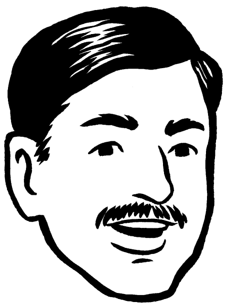


Adatum does not want to maintain accounts for another company's users of its web application, since maintaining accounts for third-party users can be expensive. Federated identity reduces the cost of account maintenance.

Goals and Requirements

The goal of this scenario is to show how federated identity can make the partnership between Adatum and Litware more efficient. With federated identity, one security domain accepts an identity that comes from another domain. This lets people in one domain access resources located in the other domain without presenting additional credentials. The Adatum issuer will trust Litware to authoritatively issue claims about its employees.

In addition to the goals, this scenario has a few other requirements. One is that Adatum must control access to the order status pages and the information that is displayed, based on the partner that is requesting access to the program. In other words, Litware should only be able to browse through its own orders and not another company's. Furthermore, Litware allows employees like Rick, who are in the Sales department, to track orders.



Security Assertion Markup Language (SAML) is another protocol you might consider for a scenario like this. ADFS 2.0 supports SAMLP.

Another requirement is that, because Litware is only one of Adatum's many partners that will access the program, Adatum must be able to find out which issuer has the user's credentials. This is called *home realm discovery*. For more information, see Chapter 2, "Claims-Based Architectures."

One assumption for this chapter is that Litware has already deployed an issuer that uses WS-Federation, just as the Adatum issuer does.

WS-Federation is a specification that defines how companies can share identities across security boundaries that have their own authentication and authorization systems. (For more information about WS-Federation, see chapter 2, "Claims-Based Architectures.") This can only happen when legal agreements between Litware and Adatum that protect both sides are already in place. A second assumption is that Litware should be able to decide which of its employees can access the a-Order application.

Overview of the Solution

The application can be modified to accept claims from a partner organization.

Once the solution is in place, when Rick logs on to the Litware network, he will access a-Order just as he would a Litware application. From his perspective, that's all there is to it. He doesn't need a special password or user names. It's business as usual. Figure 1 shows the architecture that makes Rick's experience so painless.

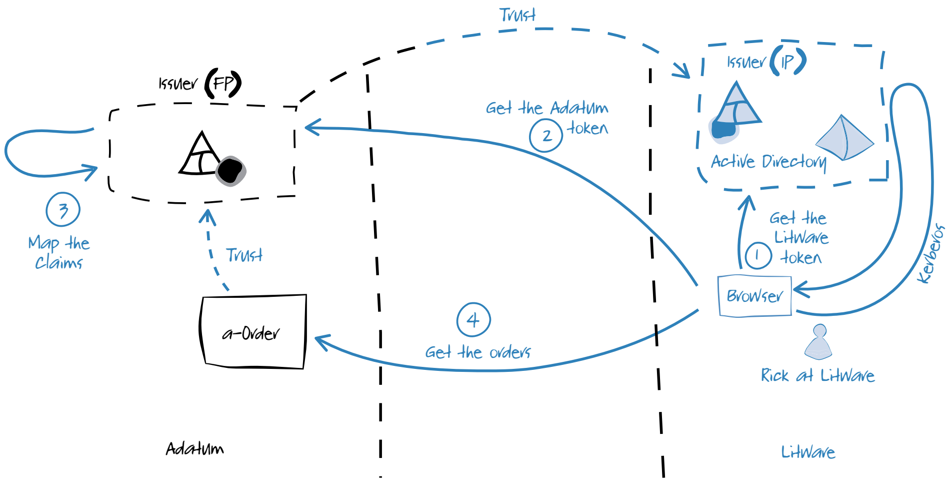


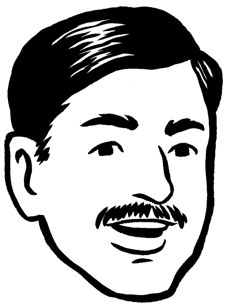
FIGURE 1
Federated identity between Adatum and Litware

As you can see, there have been two changes to the infrastructure since Adatum instituted single sign-on. A trust relationship now exists between the Adatum and Litware security domains, and the Adatum issuer has been configured with an additional capability: it can now act as a federation provider (FP). A federation provider grants access to a resource, such as the a-Order application, rather than verifying an identity. When processing a client request, the a-Order application relies on the Adatum issuer. The Adatum issuer, in turn, relies on the Litware issuer that, in this scenario, acts as an identity provider (IdP). Of course, the diagram represents just one implementation choice; separating Adatum's identity provider and federation provider would also be possible. Keep in mind that each step also uses HTTP redirection through the client browser but, for simplicity, this is not shown in the diagram.

In the sample solution, there are two Adatum issuers: one is the Adatum identity provider and one is the Adatum federation provider. This makes it easier to understand how the sample works. In the real world, a single issuer would perform both of these roles.

The following steps grant access to a user in another security domain:

1. Rick is using a computer on Litware's network. He is already authenticated with Active Directory® directory service. He opens a browser and navigates to the a-Order application. The application is configured to trust Adatum's issuer (the

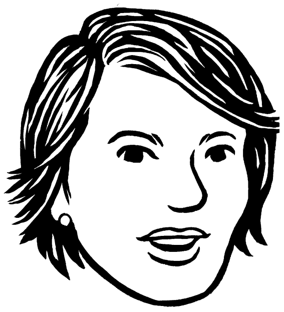


In the sample code, home realm discovery is explicit, but this approach has caveats. For one, it discloses all of Adatum's partners, and some companies may not want to do this.

Notice that Adatum's federation provider is a "relying party" to Litware's identity provider.

federation provider). The application has no knowledge of where the request comes from. It redirects Rick's request to the federation provider.

2. The federation provider presents the user with a page listing different identity providers that it trusts. At this point, the federation provider doesn't know where Rick comes from.
3. Rick selects Litware from the list and then Adatum's federation provider redirects him to the Litware issuer to verify that Rick is who he says he is.
4. Litware's identity provider verifies Rick's credentials and returns a security token to Rick's browser. The browser sends the token back to the federation provider. The claims in this token are configured for the Adatum federation provider and contain information about Rick that is relevant to Adatum. For example, the claims establish his name and that he belongs to the sales organization. The process of verifying the user's credentials may include additional steps such as presenting a logon page and querying Active Directory or, potentially, other attribute repositories.
5. The Adatum federation provider validates and reads the security token issued by Litware and creates a new token that can be used by the a-Order application. Claims issued by Litware are transformed into claims that are understood by Adatum's a-Order application. (The mapping rules that translate Litware claims into Adatum claims were created when Adatum configured its issuer to accept Litware's issuer as an identity provider.)
6. As a consequence of the claim mappings, Adatum's issuer removes some claims and adds others that are needed for the a-Order application to accept Rick as a user. The Adatum issuer uses browser redirection to send the new token to the application. Windows® Identity Foundation (WIF) validates the security token and extracts the claims. It creates a **ClaimsPrincipal** and assigns it to **HttpContext.User**. The a-Order application can then access the claims for authorization decisions. For example, in this scenario, orders are filtered by organization— the organization name is provided as a claim.



You can see these steps in more detail in Appendix B. It shows a detailed message sequence diagram for using a browser as the client.

The Adatum federation provider issuer mediates between the application and the external issuer. You can think of this as a logical role that the Adatum issuer takes on. The federation provider has two responsibilities. First, it maintains a trust relationship with Litware's issuer, which means that the federation provider accepts and understands Litware tokens and their claims.

Second, the federation provider needs to translate Litware claims into claims that a-Order can understand. The a-Order application only accepts claims from Adatum's federation provider (this is its trusted issuer). In this scenario, a-Order expects claims of type **Role** in order to authorize operations on its website. The problem is that Litware claims don't come from Adatum and they don't have roles. In the scenario, Litware claims establish the employee's name and organizational group. Rick's organization, for example, is Sales. To solve this problem, the federation provider uses mapping rules that turn a Litware claim into an Adatum claim.

Check out the setup and deployment section of the chapter to see how to establish a trust relationship between issuers in separate trust domains.

The following table summarizes what happens to input claims from Litware after the Adatum federation provider transforms them into Adatum output claims.

Input Conditions	**Output claims**
Claim issuer: Litware *Claim type*: Group, *Claim value*: Sales	*Claim issuer*: Adatum *Claim type*: Role; *Claim value*: Order Tracker
Claim issuer: Litware	*Claims issuer*: Adatum *Claim type*: Company; *Claim value*: Litware
Claim issuer: Litware *Claim type*: name	*Claims issuer*: Adatum *Claim type*: name; *Claim Value*: Copied from input

Active Directory Federation Services (ADFS) 2.0 includes a claims rule language that lets you define the behavior of the issuer when it creates new tokens. What all of these rules generally mean is that if a set of conditions is true, you can issue some claims.

These are the three rules that the Adatum FP uses:

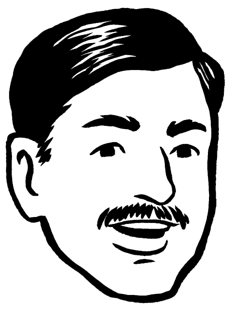
- => issue(Type = "http://schemas.adatum.com/claims/2009/08/organization", Value = "Litware");
- c:[Type == "http://schemas.xmlsoap.org/claims/Group", Value == "Sales"] => issue(Type = "http://schemas.microsoft.com/ws/2008/06/identity/claims/role", Issuer = c.Issuer, OriginalIssuer = c.OriginalIssuer, Value = "Order Tracker", ValueType = c.ValueType);
- c:[Type == "http://schemas.xmlsoap.org/ws/2005/05/identity/claims/name"]=> issue(claim = c);

There are **no** partner-specific details in the a-Order application. Partner details are kept in the FP.

In all the rules, the part before the "=>" is the condition that must be true before the rule applies. The part after the "=>" indicates the action to take. This is usually the creation of an additional claim.

The first rule says that the federation provider will create a claim of type **Organization** with the value **Litware**. That is, for this issuer (Litware) it will create that claim. The second rule specifies that if there's a claim of type **Group** with value **Sales**, the federation provider will create a claim of type **Role** with the value **Order Tracker**. The third rule copies a claim of type **name**.

An important part of the solution is home realm discovery. The a-Order application needs to know which issuer to direct users to for authentication. If Rick opens his browser and types **http://www.adatum.com/ordertracking**, how does a-Order know that Rick can be authenticated by Litware's issuer? The fact is that it doesn't. The a-Order application relies on the federation provider to make that decision. The a-Order application always redirects users to the federation provider.



It also increases the risk of a phishing attack.

This approach has two potential issues: it discloses information publicly about Litware's relationship with Adatum, and it imposes an extra step on users who might be confused as to which selection is appropriate.

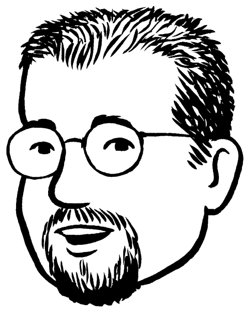
You can resolve these issues by giving the application a hint about the user's home realm. For example, Litware could send a parameter in a query string that specifies the sender's security domain. The application can use this hint to determine the federation provider's behavior. For more information, see "Home Realm Discovery" in Chapter 2, "Claims-Based Architectures."

An issuer can accept the **whr** parameter as a way to specify someone's home realm.

Benefits and Limitations

Federated identity is an example of how claims support a flexible infrastructure. Adatum can easily add customers by setting up the trust relationship in the federation provider and creating the correct claims mappings. Thanks to WIF, dealing with claims in a-Order is straightforward and, because Adatum is using ADFS 2.0, creating the claim mapping rules is also fairly simple. Notice that the a-Order application itself didn't change. Also, creating a federation required incremental additions to an infrastructure that was first put in place to implement single sign-on.

Another benefit is that the claims that Litware issues are about things that make sense within the context of the organization: Litware's employees and their groups. All the identity differences between Litware and Adatum are corrected on the receiving end by Adatum's federation provider. Litware doesn't need to issue Adatum-specific claims. Although this is technically possible, it can rapidly become difficult and costly to manage as a company adds new relationships and applications.



Federated identity requires a lot less maintenance and troubleshooting. User accounts don't have to be copied and maintained across security realms.

Inside the Implementation

The Microsoft® Visual Studio® development system solution named 2-Federation found at http://claimsid.codeplex.com is an example of how to use federation. The structure of the application is very similar to what you saw in Chapter 3, "Claims-Based Single Sign-On for the Web." Adding federated identity did not require recompilation or changes to the Web.config file. Instead, the issuer was configured to act as a federation provider and a trust relationship was established with an issuer that acts as an identity provider. This process is described in the next section. Also, the mock issuers were extended to handle the federation provider role.

Adding federated identity to an existing claims-aware application requires only a configuration change.

Setup and Physical Deployment

The Visual Studio solution named 2-Federation on CodePlex is initially configured to run on a stand-alone development machine. The solution includes projects that implement mock issuers for both Litware and Adatum.

Procedures for establishing trust can be automated by using metadata. For example, in ADFS 2.0, you can use the FederationMetadata.xml file if you prefer a more automated approach. The mock issuers provided in the sample code do not provide this metadata.

Using Mock Issuers for Development and Testing

Mock issuers are helpful for development, demonstration, and testing because they allow the end-to-end application to run on a single host. The WIF SDK includes a Visual Studio template that makes it easy to create a simple issuer class that derives from the **SecurityToken Service** base class. You then provide definitions for the **GetScope** and **GetOutputClaims** methods, as shown in the downloadable code sample that accompanies this scenario.

When the developers at Adatum want to deploy their application, they will modify the configuration so that it uses servers provided by Adatum and Litware. To do this, you need to establish a trust relationship between the Litware and Adatum issuers and modify the a-Order. OrderTracking application's Web.config file for the Adatum issuer.

Establishing Trust Relationships

In the production environment, Adatum and Litware use production-grade security token issuers such as ADFS 2.0. For the scenario to work, you must establish a trust relationship between Adatum's and Litware's issuers. Generally, there are seven steps in this process:

1. Export a public key certificate for token signing from the Litware issuer and copy Litware's token signing certificate to the file system of the Adatum's issuer host.
2. Configure Adatum's issuer to recognize Litware as a trusted identity provider.
3. Configure Litware's issuer to accept requests from the Adatum issuer.
4. Configure the a-Order Tracking application as a relying party within the Adatum issuer.
5. Edit claims rules in Litware that are specific to the Adatum issuer.
6. Edit claims transformation rules in the Adatum issuer that are specific to the Litware issuer.
7. Edit claims rules in the Adatum issuer that are specific to the a-Order Tracking application.

You can refer to documentation provided by your production issuer for instructions on how to perform these steps. Instructions for the samples included in this guide can be found at http://claimsid.codeplex.com.

Questions

1. Federated identity is best described as:
    a. Two or more applications that share the same set of users.
    b. Two or more organizations that share the same set of users.
    c. Two or more organizations that share an identity provider.
    d. One organization trusting users from one or more other organizations to access its applications.
2. In a federated security environment, claims mapping is necessary because:
    a. Claims issued by one organization are not necessarily the claims recognized by another organization.
    b. Claims issued by one organization can never be trusted by another organization.
    c. Claims must always be mapped to the roles used in authorization.
    d. Claims must be transferred to a new **ClaimsPrincipal** object.
3. The roles of a federation provider can include:
    a. Mapping claims from an identity provider to claims that the relying party understands.
    b. Authenticating users.
    c. Redirecting users to their identity provider.
    d. Verifying that the claims were issued by the expected identity provider.
4. Must an identity provider issue claims that are specific to a relying party?
    a. Yes
    b. No
    c. It depends.

5. Which of the following best summarizes the trust relationships between the various parties described in the federated identity scenario in this chapter?
   a. The relying party trusts the identity provider, which in turn trusts the federation provider.
   b. The identity provider trusts the federation provider, which in turn trusts the relying party.
   c. The relying party trusts the federation provider, which in turn trusts the identity provider.
   d. The federation provider trusts both the identity provider and the relying party.

More Information

For more information about federation and home realm discovery, see "Developer's Introduction to Active Directory Federation Services" at http://msdn.microsoft.com/en-us/magazine/cc163520.aspx. Also see "One does not simply walk into Mordor, or Home Realm Discovery for the Internet" at http://blogs.msdn.com/vbertocci/archive/2009/04/08/one-does-not-simply-walk-into-mordor-or-home-realm-discovery-for-the-internet.aspx.

For a tool that will help you generate WS-Federation metadata documents, see Christian Weyer's blog at http://blogs.thinktecture.com/cweyer/archive/2009/05/22/415362.aspx.

For more information about the ADFS 2.0 claim rule language, see "Claim Rule Language" at http://technet.microsoft.com/en-us/library/dd807118%28WS.10%29.aspx.

For a simple tool that you can use as a test security token service (STS) that can issue tokens via WS-Federation, see the SelfSTS tool at http://archive.msdn.microsoft.com/SelfSTS.

5 Federated Identity with Windows Azure Access Control Service

In Chapter 4, "Federated Identity for Web Applications," you saw how Adatum used claims to enable users at Litware to access the a-Order application. The scenario described how Adatum could federate with partner organizations that have their own claims-based identity infrastructures. Adatum supported the partner organizations by establishing trust relationships between the Adatum federation provider (FP) and the partner's identity provider (IdP).

Adatum would now like to allow individual users who are not part of a partner's security domain to access the a-Order application. Adatum does not want to manage the user accounts for these individuals: instead, these individuals should be able to use an existing identity from social identity providers such as Microsoft® Windows® Live®, Google, Yahoo!, or Facebook. How can Adatum enable users to reuse an existing social identity, such as Facebook ID, when they access the a-Order application? In addition to establishing trust relationships with the social identity providers, Adatum must find solutions to these problems:

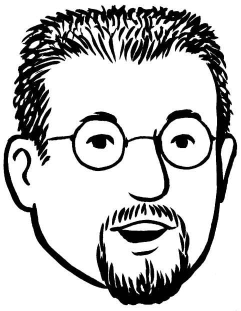
In this chapter, the term "social identity" refers to an identity managed by a well-known, established online identity provider.

- Different identity providers may use different protocols and token formats to exchange identity data.
- Different identity providers may use different claim types.
- The Adatum federation provider must be able to redirect users to the correct identity provider.
- The a-Order application must be able to implement authorization rules based on the claims that the social identity providers issue.
- Adatum must be able to enroll new users with social identities who want to use the a-Order application.

The Windows Azure™ AppFabric Access Control Service (ACS) is a cloud-based federation provider that provides services to facilitate this scenario. ACS can transition between the protocols used by different identity providers to transfer claims, perform mappings between different claim types based on configurable rules, and help locate the correct identity provider for a user when they want to access an application. For more information, see Chapter 2, "Claims-Based Architectures."

ACS currently supports the following identity providers: Windows Live, Google, Yahoo!, and Facebook. In addition, it can work with ADFS 2.0 identity providers or a custom security token service (STS) compatible with WS-Federation or WS-Trust. ACS also supports OpenID, but you must configure this programmatically rather than through the portal.

In this chapter, you'll learn how Adatum enables individual customers with a range of different social identity types to access the a-Order application alongside Adatum employees and employees of an existing enterprise partner. This chapter extends the scenario described in Chapter 4, "Federated Identity for Web Applications," and shows Adatum building on its previous investments in a claims-based identity infrastructure.



Consumer users will benefit from using their existing social identities because they won't need to remember a new set of credentials just for accessing the a-Order application. Adatum will benefit because they won't have the overhead of managing these identities—securely storing credentials, managing lost passwords, enforcing password policies, and so on.

The Premise

Now that Adatum has enabled federated access to the a-Order application for users at some of Adatum's partners such as Litware, Adatum would like to extend access to the a-Order application to users at smaller businesses with no identity infrastructure of their own and to individual consumer users. Fortunately, it is likely that these users will already have some kind of social identity such as a Google ID or a Windows Live ID. Smaller businesses want their users to be able to track their orders, just as Rick at Litware is already able to do. Consumer users want to be able to log on with their social identity credentials and use the a-Order program to determine the status of all their orders with Adatum. They don't want to be issued additional credentials from Adatum just to use the a-Order application.

Goals and Requirements

The goal of this scenario is to show how federated identity can make the partnership between Adatum and consumer users and users at smaller businesses with no security infrastructure of their own work more efficiently. With federated identity, one security realm can accept identities that come from another security realm. This lets people in one domain access resources located in the other domain without presenting additional credentials. The Adatum issuer will trust the common social identity providers (Windows Live ID, Facebook, Google, Yahoo!) to authenticate users on behalf of the a-Order application.

Adatum trusts the social identity providers indirectly. The federation provider at Adatum trusts the Adatum ACS instance and that in turn trusts the social identity providers. If the federation provider at Adatum trusted all the social identity providers directly, then it would have to deal with the specifics of each one: the different protocols and token formats. ACS handles all of this complexity for Adatum and that makes it really easy for Adatum to support a variety of social identity providers.

In addition to the goals, this scenario has a number of other requirements. One requirement is that Adatum must control access to the order status pages and the information that the application displays based on the identity of the partner or consumer user who is requesting access to the a-Order application. In other words, users at Litware should only be able to browse through Litware's orders and not another company's orders. In this chapter, we introduce Mary, the owner of a small company named "Mary Inc." She, of course, should only be able to browse through her orders and no one else's.

Another requirement is that, because Adatum has several partner organizations and many consumer users, Adatum must be able to find out which identity provider it should use to authenticate a user's credentials. As mentioned in previous chapters, this process is called *home realm discovery*. For more information, see Chapter 2, "Claims-Based Architectures."

One assumption for this chapter is that Adatum has its own identity infrastructure in place.

Although using ACS simplifies the implementation of the Adatum issuer, it does introduce some running costs. ACS is a subscription service, and Adatum will have to pay based on its usage of ACS (ACS charges are calculated based on the number of Access Control transactions plus the quantity of data transferred in and out of the Windows Azure datacenters).

Overview of the Solution

With the goals and requirements in place, it's time to look at the solution. As you saw in Chapter 4, "Federated Identity for Web Applications," the solution includes the establishment of a claim-based architecture with an issuer that acts as an identity provider on the customer's side and an issuer that acts as the federation provider on Adatum's side. Recall that a federation provider acts as a gateway between a resource and all of the issuers that provide claims about the resource's users.

In addition, this solution now includes an ACS instance, which handles the protocol transition and token transformation for issuers that might not be WS-Federation based. This includes many of the social identity providers mentioned earlier in this chapter.

Figure 1 shows the Adatum solution for both Litware that has its own identity provider, and Mary who is using a social identity—Google, in this example.

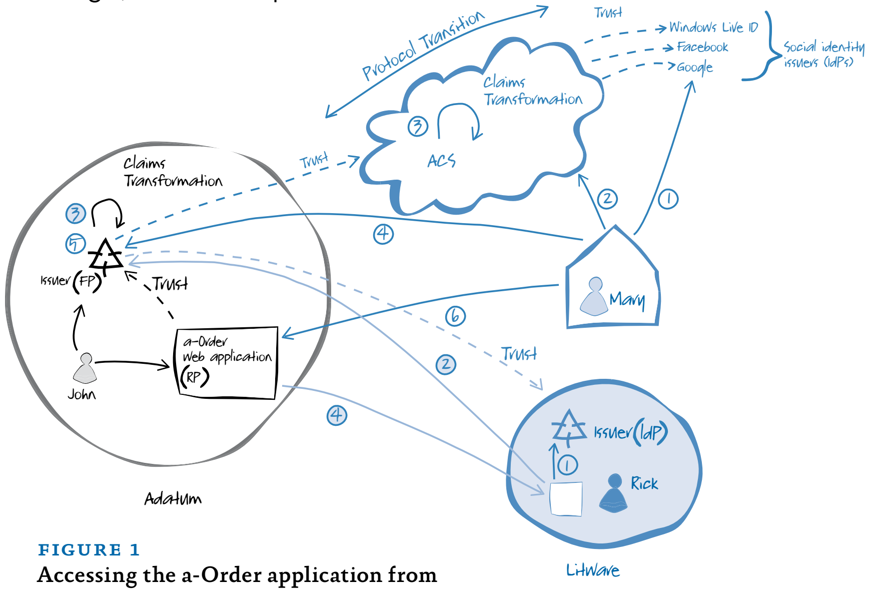


FIGURE 1
Accessing the a-Order application from Litware and by using a social identity

The following two sections provide a high-level walkthrough of the interactions between the relying party (RP), the federation provider, and the identity provider for customers with and without their own identity provider. For a detailed description of the sequence of messages that the parties exchange, see Appendix B.

Example of a Customer with its Own Identity Provider

To recap from Chapter 4, "Federated Identity for Web Applications," here's an example of how the system works for a user, Rick, at the partner Litware, which has its own identity provider. The steps correspond to the shaded numbers in the preceding illustration.

STEP 1: AUTHENTICATE RICK

1. Rick is using a computer on Litware's network. Litware's Active Directory® service has already authenticated him. He opens a browser and navigates to the a-Order application. Rick is not an authenticated user in a-Order at this time. Adatum has configured a-Order to trust Adatum's issuer (the federation provider). The application has no knowledge

of where the request comes from. It redirects Rick's request to the Adatum federation provider.

2. The Adatum federation provider presents the user with a page listing different identity providers that it trusts (the "Home realm Discovery" page). At this point, the federation provider doesn't know where Rick comes from.
3. Rick selects Litware from the list and then Adatum's federation provider redirects him to the Litware issuer that can verify that Rick is who he says he is.
4. Litware's identity provider verifies Rick's credentials and returns a security token to Rick's browser. Litware's identity provider has configured the claims in this token for the Adatum federation provider and they contain information about Rick that is relevant to Adatum. For example, the claims establish his name and that he belongs to the sales organization in Litware.

STEP 2: TRANSMIT LITWARE'S SECURITY TOKEN TO THE ADATUM FEDERATION PROVIDER

1. Ricks' browser now posts the issued token back to the Adatum federation provider. The Adatum federation provider validates the token issued by Litware and creates a new token that the a-Order application can use.

STEP 3: TRANSFORMING THE TOKEN

1. The federation provider transforms the claims issued by Litware into claims that Adatum's a-Order application understands. (The mapping rules that translate Litware claims into Adatum claims were determined when Adatum configured its issuer to accept Litware's issuer as an identity provider.)
2. The claim mappings in Adatum's issuer remove some claims and add others that the a-Order application needs in order to accept Rick as a user, and possibly control access to certain resources.

STEP 4: TRANSMIT THE TRANSFORMED TOKEN AND PERFORM THE REQUESTED ACTION

1. The Adatum issuer uses browser redirection to send the new token to the application. In the a-Order application,

In the sample, the simulated issuer allows you to select between Adatum, partner organizations, and social identity providers.

Windows Identity Foundation (WIF) validates the security token and extracts the claims. It creates a **ClaimsPrincipal** object and assigns it to **HttpContext.User** property. The a-Order application can then access the claims for authorization decisions. For example, in this scenario, the application filters orders by organization, which is one of the pieces of information provided as a claim.

Example of a Customer Using a Social Identity

Here's an example of how the system works for a consumer user such as Mary who is using a social identity. The steps correspond to the un-shaded numbers in the preceding illustration.

STEP 1: PRESENT CREDENTIALS TO THE IDENTITY PROVIDER

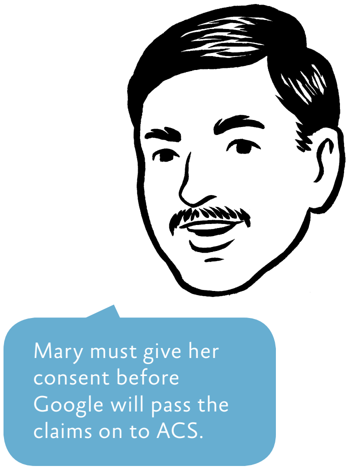
1. Mary is using a computer at home. She opens a browser and navigates to the a-Order application at Adatum. Adatum has configured the a-Order application to trust Adatum's issuer (the federation provider). Mary is currently un-authenticated, so the application redirects Mary's request to the Adatum federation provider.
2. The Adatum federation provider presents Mary with a page listing different identity providers that it trusts. At this point, the federation provider doesn't know which security realm Mary belongs to, so it must ask Mary which identity provider she wants to authenticate with.
3. Mary selects the option to authenticate using her social identity and then Adatum's federation provider redirects her to the ACS issuer to verify that Mary is who she says she is. Adatum's federation provider uses the **whr** parameter in the request to indicate to ACS which social identity provider to use—in this example it is Google.

In this sample, the Adatum simulated issuer allows users to enter the email address associated with their social identity provider. The simulated issuer parses this email address to determine the value of the **whr** *parameter. Another option would be to let the user choose from a list of social identity providers. You should check what options are available with the issuer that you use; you may be able to query your issuer for the list of identity providers that it currently supports.*

4. ACS automatically redirects Mary to the Google issuer.

Mary never sees an ACS page; when ACS receives the request from the Adatum issuer, ACS uses the value of the **whr** *parameter to redirect Mary directly to her social identity provider. However, if the* **whr** *parameter is missing, or does not have a valid value, then ACS will display a page that allows the user to select the social identity provider that she wants to use.*

5. Google verifies Mary's credentials and returns a security token to Mary's browser. The Google identity provider has added claims to this token for ACS: the claims include basic information about Mary. For example, the claims establish her name and her email address.


Mary must give her consent before Google will pass the claims on to ACS.

STEP 2: TRANSMIT THE IDENTITY PROVIDER'S SECURITY TOKEN TO ACS

1. The Google identity provider uses HTTP redirection to redirect the browser to ACS with the security token it has issued.
2. ACS receives this token and verifies that it was issued by the identity provider.

STEP 3: TRANSFORM THE CLAIMS

1. If necessary, ACS converts the token issued by the identity provider to the security assertion markup language (SAML) 2.0 format and copies the claims issued by Google into the new token.
2. ACS returns the new token to Mary's browser.

STEP 4: TRANSMIT THE IDENTITY PROVIDER'S SECURITY TOKEN TO THE FEDERATION PROVIDER

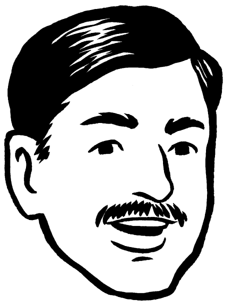
1. Mary's browser posts the issued token back to the Adatum federation provider.
2. The Adatum federation provider receives this token and validates it by checking that ACS issued the token.

STEP 5: MAP THE CLAIMS

1. Adatum's federation provider applies token mapping rules to the ACS security token. These rules transform the claims into claims that the a-Order application can understand.
2. The Adatum federation provider returns the new claims to Mary's browser.

STEP 6: TRANSMIT THE MAPPED CLAIMS AND PERFORM THE REQUESTED ACTION

1. Mary's browser posts the token issued by the Adatum federation provider to the a-Order application. This token contains the claims created by the mapping process.
2. The application validates the security token by checking that the Adatum federation provider issued it.
3. The application reads the claims and creates a session for Mary. It can use Mary's identity information from the token to determine which orders Mary can see in the application.



Different social identity providers return different claims to ACS: for example, the Windows Live ID identity provider only returns a guid-like **nameidentifier** claim, the Google identity provider returns **name** and **email** claims in addition to the **nameidentifier** claim.

Because this is a web application, all interactions happen through the browser. (See the section "Browser-Based Scenario with ACS" in Appendix B for a detailed description of the protocol for a browser-based client.)

The principles behind these interactions are exactly the same as those described in Chapter 4, "Federated Identity for Web Applications."

Adatum's issuer, acting as a federation provider, mediates between the application and the external issuers. The federation provider has two responsibilities. First, it maintains a trust relationship with partner issuers, which means that the federation provider accepts and understands Litware tokens and their claims, ACS tokens and their claims, and tokens and their claims from any other configured partner. Second, the federation provider needs to translate claims from partners and ACS into claims that a-Order can understand. The a-Order application only accepts claims from Adatum's federation provider (this is its trusted issuer). In this scenario, a-Order expects claims of type **Role** and **Organization** in order to authorize operations on its web site. The problem is that ACS claims don't come from Adatum and they don't have these claim types. In the scenario, the claims from ACS only establish that a social identity provider has authenticated the user. To solve this problem, the Adatum federation provider uses mapping rules that add a Role claim to the claims from ACS.

Trust Relationships with Social Identity Providers

The nature of a trust relationship between Adatum and a business partner such as Litware, is subtly different from a trust relationship between Adatum and a social identity provider such as Google or

Windows Live. In the case of a trust relationship between Adatum and a business partner such as Litware, the trust operates at two levels; there is a *business* trust relationship characterized by business contracts and agreements, and a *technical* trust relationship characterized by the configuration of the Adatum federation provider to trust tokens issued by the Litware identity provider. In the case of a trust relationship between Adatum and a social identity provider such as Windows Live, the trust is only a technical trust; there is no business relationship between Adatum and Windows Live. In this scenario, Adatum establishes a business trust relationship with the owner of the social identity when the owner enrolls to use the a-Order application and registers his or her social identity with Adatum. A further difference between the two scenarios is in the claims issued by the identity providers. Adatum can trust the business partner to issue rich, accurate claims data about its employees such as cost centers, roles, and telephone numbers, in addition to identity claims such as name and email. The claims issued by a social identity provider are minimal, and may sometimes be just an identifier. Because there is no business trust relationship with the social identity provider, the only thing that Adatum knows for sure is that each individual with a social identity has a unique, unchanging identifier that Adatum can use to recognize that it's the same person returning to the a-Order application.

An individual's unique identifier is unique to that instance of ACS: if Adatum creates a new ACS instance, each individual will have a new unique identifier. This is important to be aware of if you're using the unique identifier to map to other user data stored elsewhere.

Description of Mapping Rules in a Federation Provider

The claims that ACS returns from the social identity provider to the Adatum federation provider do not include the **role** or **organization** claims that the a-Order application uses to authorize access to order data. In some cases, the only claim from the social identity provider is the **nameidentifier** that is a guid-like string. The mapping in rules in the Adatum federation provider must add the **role** and **organization** claims to the token. In the sample, the mapping rules simply add the **OrderTracker** role, and "Mary Inc." as an organization.

The following table summarizes the mapping rules that the Adatum federation provider applies when it receives a token from ACS when the user has authenticated with Google.

Input claim	Output claim	Notes
nameidentifier		A unique id allocated by Google.
emailaddress		The users registered email address with Google. The user has agreed to share this address.
name	name	The users name. This is the only claim passed through to the application. The **issuer** property of the claim is set to **adatum**, and the **originalissuer** is set to **acs\Google**.
identityprovider		Google
	Role	The simulated issuer adds this claim with a value of "Order Tracker."
	Organization	The simulated issuer adds this claim with a value of "MaryInc."

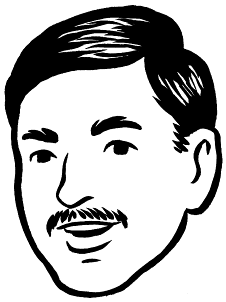
The following table summarizes the mapping rules that the simulated issuer applies when it receives a token from ACS when the user has authenticated with Windows Live ID.

Input claim	Output claim	Notes
nameidentifier		A unique id allocated by Windows Live ID.
identityprovider		uri:WindowsLiveID
	name	The simulated issuer copies the value of the nameidentifier claim to the name claim. The **issuer** property of the claim is set to **adatum**, and the **originalissuer** is set to **acs\LiveID**.
	Role	The simulated issuer adds this claim with a value of "Order Tracker."
	Organization	The simulated issuer adds this claim with a value of "MaryInc."

The following table summarizes the mapping rules that the simulated issuer applies when it receives a token from ACS when the user has been authenticated by a Facebook application.

Input claim	Output claim	Notes
nameidentifier		A unique id allocated by the Facebook application.
identityprovider		Facebook-194130697287302. The number here uniquely identifies your Facebook application.
name	name	The users name. This is the only claim passed through to the application. The **issuer** property of the claim is set to **adatum**, and the **originalissuer** is set to **acs\Facebook**.
	Role	The simulated issuer adds this claim with a value of "Order Tracker."
	Organization	The simulated issuer adds this claim with a value of "MaryInc."

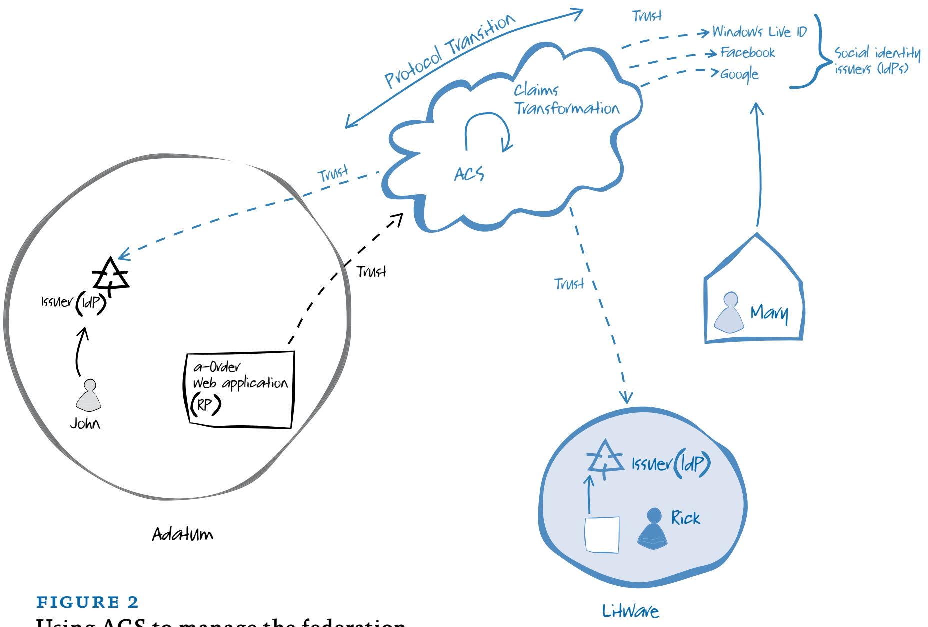
In the scenario described in this chapter, because of the small numbers of users involved, Adatum expects to manage the enrolment as a manual process. For a description of how this might be automated, see Chapter 7, "Federated Identity with Multiple Partners and Windows Azure Access Control Service."

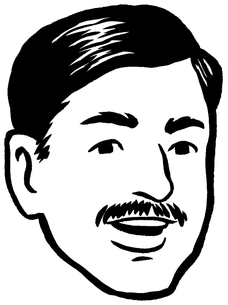


These mappings are, of course, an example and for demonstration purposes only. Notice that as they stand, *anyone* authenticated by Google or Windows Live ID has access to the "Mary Inc." orders in the a-Order application. A real federation provider would probably check that the combination of **identityprovider** and **nameidentifier** claims is from a registered, valid user and look up in a local database their name, role, and organization.

Alternative Solutions

Of course, the solution we've just described illustrates just one implementation choice; another possibility would be to separate Adatum's identity provider and federation provider and let ACS manage the federation and the claims transformation. Figure 2 shows the trust relationships that Adatum would need to configure for this solution.



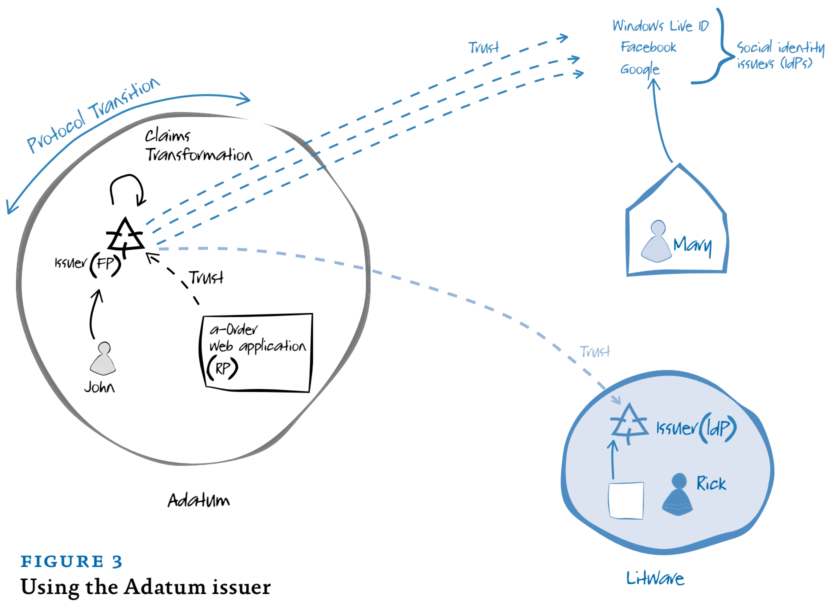


Adatum has already invested in its own identity infrastructure and has an existing federation provider running in their own datacenter. As a rather risk-averse organization, Adatum prefers to continue to use their tried and tested solution rather than migrate the functionality to ACS.

FIGURE 2
Using ACS to manage the federation with Adatum's partners

In this alternative solution, ACS would trust the Adatum and Litware identity providers and there is no longer a trust relationship between the Litware and Adatum issuers. Adatum should also evaluate the costs of this solution because there will be additional ACS transactions as it handles sign-ins from users at partners with their own identity providers. These costs need to be compared with the cost of running and managing this service on-premises.

A second alternative solution does away with ACS leaving all the responsibilities for protocol transition and claims transformation to the issuer at Adatum. Figure 3 shows the trust relationships that Adatum would need to configure for this solution.



This alternative removes a dependency on ACS: an external, third-party service. It still relies on the social identity providers for their authentication services.

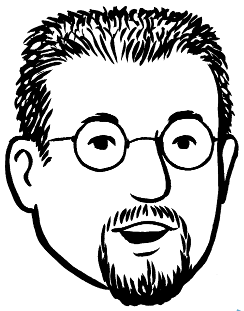
FIGURE 3
Using the Adatum issuer for all federation tasks

Although this alternative solution means that Adatum does not need to pay any of the subscription charges associated with using ACS, Adatum is concerned about the additional complexity of its issuer, which would now need to handle all of the protocol transition and claims transformation tasks. Furthermore, implementing this scenario would probably take some time (weeks or months), while Adatum could probably configure the solution with ACS in a matter of hours. The question becomes one of business efficiency: would Adatum get a better return by investing in creating and maintaining infrastructure services, or by focusing on their core business services?

Inside the Implementation

The Visual Studio solution named 6-FederationWithAcs found at **http://claimsid.codeplex.com** is an example of how to use federation with ACS. The structure of the application is very similar to what you saw in chapter 4, "Federated Identity for Web Applications." There are no changes to the a-Order application: it continues to trust the Adatum simulated issuer that provides it with the claims required to authorize access to the application's data.

The example solution extends the Adatum simulated issuer to handle federation with ACS, and uses an ACS instance that is configured to trust the social identity providers. The next section describes these changes.



You can select the certificate that ACS uses to sign the token it issues to the Adatum federation provider in the Windows Azure AppFabric portal.

Setup and Physical Deployment

You can run the Visual Studio solution named 6-FederationWithAcs found at **http://claimsid.codeplex.com** on a stand-alone development machine. As with the solutions described in the previous chapters, this solution uses mock issuers for both Adatum and Litware. There are no changes to the Litware mock issuer, but the Adatum mock issuer now has a trust relationship with ACS in addition to the existing trust relationship with Litware, and offers the user a choice of authenticating with the Adatum identity provider, the Litware identity provider, or ACS.

You can see the entry for ACS (https://federationwithacs-dev.accesscontrol.windows.net/) in the **issuerNameRegistry** section of the Web.config file in the Adatum.SimulatedIssuer.6 project. This entry includes the thumbprint used to verify the token that the Adatum federation provider receives from ACS. This is the address of the ACS instance created for the sample.

When the developers at Adatum want to deploy their application, they will modify the configuration so that it uses the Adatum federation provider. They will also modify the configuration of the Adatum federation provider by adding a trust relationship with the production ACS instance.

Establishing a Trust Relationship with ACS

Establishing a trust relationship with ACS is very similar to establishing a trust relationship with any other issuer. Generally, there are six steps in this process:

1. Configure Adatum's issuer to recognize your ACS instance as a trusted identity provider.

   You may be able to configure the Adatum issuer automatically by providing a link to the FederationMetadata.xml file for the ACS namespace. However, this FederationMetadata.xml will not include details of all the claims that your ACS namespace offers, it only includes the **nameidentifier** *and* **identityprovider** *claims. You will need to configure details of other claim types offered by ACS manually in the Adatum issuer.*

2. Configure the social identity providers that you want to support in ACS.
3. Configure your ACS instance to accept requests from the Adatum issuer (the Adatum issuer is a relying party as far as ACS is concerned.)
4. Edit the claims rules in ACS to pass the claims from the social identity provider through to the Adatum issuer.
5. If necessary, edit the claims transformation rules in the Adatum issuer that are specific to the social identity providers.
6. If necessary, edit the claims rules in the Adatum issuer that are specific to the a-Order application.

You can refer to documentation provided by your production issuer for instructions on how to perform these steps. You can find detailed instructions for the ACS configuration in Appendix E of this guide.

Reporting Errors from ACS

You can specify a URL that points to an error page for each relying party that you define in ACS. In the sample, this page is called ErrorPage.aspx and you can find it in the Adatum.FederationProvider.6 project. If ACS detects an error during processing, it can post JavaScript Object Notation (JSON) encoded error information to this page. The code-behind for this page illustrates a simple approach for displaying this error information; in practice, you may want to log these errors and take different actions depending on the specific error that occurs.

An easy way to generate an error in the sample so that you can see how the error processing works is to try to authenticate using a Google ID, but to decline to give consent for ACS to access your data by clicking on **No thanks** *after you have logged into Google.*

It's important to mark ErrorPage.aspx as un-authenticated in the web.config file to avoid the risk of recursive redirects.

Initializing ACS

The sample application includes a set of pre-configured partners for Fabrikam Shipping, both with and without their own identity providers. These partners require identity providers, relying parties, and claims-mapping rules in ACS in order to function. The ACS.Setup.6 project in the solution is a basic console application that you can run to add the necessary configuration data for the pre-configured partners to your ACS instance. It uses the ACS Management API and the wrapper classes in the ACS.ServiceManagementWrapper project.

You will still need to perform some manual configuration steps; the ACS Management API does not enable you to create a new service namespace. You must perform this operation in the ACS management portal.

For more information on working with ACS, see Appendix E.

Working with Social Identity Providers

The solution described in this chapter enables Adatum to support users with identities from trusted partners such as Litware, and with identities from social identity providers such as Google or Windows Live ID. Implementing this scenario in the real world would require solutions to two additional problems.

First, there is the question of managing how we define the set of identities (authenticated by one of the social identity providers) that are members of the same organization. For example, which set of users with Windows Live IDs and Google IDs are associated with the organization Mary Inc? With a partner such as Litware with its own identity provider, Adatum trusts Litware to decide which users at Litware should be able to view the order data that belongs to Litware.

Second, there are differences between the claims returned from the social identity providers. In particular, Windows Live ID only returns the **nameidentifier** claim. This is a guid-like string that Windows Live guarantees to remain unchanged for any particular Windows Live ID within the current ACS namespace. All we can tell from this claim is that this instance of ACS and Windows Live have authenticated the same person, provided we get the same **nameidentifier** value returned. There are no claims that give us the user's email address or name.

The following potential solutions make these assumptions about Adatum.

- Adatum does not want to make any changes to the a-Order application to accommodate the requirements of a particular partner.
- Adatum wants to do all of its claims processing in the Adatum federation provider. Adatum is using ACS just for protocol transition, passing through any claims from the social identity providers directly to the Adatum federation provider.

Managing Users with Social Identities

Taking Litware as an example, let's recap how the relationship with a partner organization works.

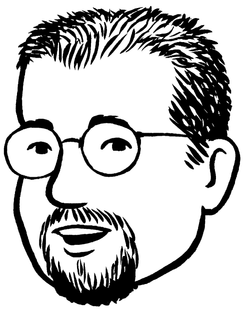
- Adatum configures the Adatum federation provider to trust the Litware identity provider. This is a one-time, manual configuration step in this scenario.

- Adatum adds a set of claims-mapping rules to the Adatum federation provider, to convert claims from Litware into claims that the Adatum a-Order application understands. In this scenario, the relevant claims that the a-Order application expects to see are **name**, **Role** and **Organization**.
- Litware can authorize any of its employees to access the Adatum a-Order application by ensuring that Litware's identity provider gives the user the correct claim. In other words, Litware controls who has access to Litware's data in the Adatum a-Order application.

The situation for a smaller partner organization without its own identity provider is a little different. Let's take MaryInc, which wants to use Windows Live IDs and Google IDs as an example.

- Unlike a partner with its own identity provider, there is no need to set up a new trust relationship because Adatum already trusts ACS. From the perspective of the Adatum federation provider, ACS is where the MaryInc employee claims will originate.
- The Adatum federation provider cannot identify the partner organization of the authenticated user from the claims it receives from ACS. Therefore, Adatum must configure a set of mapping rules in the federation provider that map a user's unique claim from ACS (such as the **nameidentifier** claim) to appropriate values for the **name**, **Role** and **Organization** claims that the a-Order application expects to see.
- If MaryInc wants to allow multiple employees to access MaryInc data in the a-Order application, then Adatum must manually configure additional mapping rules in its federation provider.

This last point highlights the significant difference between the partner with its own identity provider and the partner without. The partner with its own identity provider can manage who has access to its data in the a-Order application; the partner without its own identity provider must rely on Adatum to make changes in the Adatum federation provider if it wants to change who has access to its data.



The Adatum federation provider should generate the **Organization** claim rather than pass in through from Litware. This mitigates the risk that a malicious administrator at Litware could configure the Litware identity provider to issue a claim using another organization's identity.

Working with Windows Live IDs

Unlike the other social identity providers supported by ACS that all return **name** and **emailaddress** claims, Windows Live ID only returns a **nameidentifier** claim. This means that the Adatum federation provider must use some additional logic to determine appropriate values for the **name**, **Role** and **Organization** claims that the a-Order application expects to see.

This means that when someone with a Windows Live ID enrolls to use the Adatum a-Order application, Adatum must capture values for the **nameidentifier**, **name**, **Role** and **Organization** claims to use in the mapping rules in the federation provider (as well as any other data that Adatum requires). The only way to discover the **nameidentifier** value is to capture the claim that Windows Live returns after the user signs in, so part of the enrollment process at Adatum must include the user authenticating with Windows Live.

It is possible to access data in the user's Windows Live ID profile, such as the user's name and email address, programmatically by using Windows Live Messenger Connect. *This would eliminate the requirement that the user manually enter information such as his name and email address when he enrolled to use the a-Order application. However, the benefits to the users may not outweigh the costs of implementing this solution. Furthermore, not all users will understand the implications of temporarily giving consent to Adatum to access to their Windows Live ID profile data.*

With ADFS you can create custom claims transformation modules that, for example, allow you to implement a mapping rule based on data retrieved from a relational database. With this in mind, the enrollment process for new users of the Adatum a-Order application could populate a database table with the values required for a user's set of claims.

Working with Facebook

The sample application enables you to use Facebook as one of the supported social identity providers. Adding support for Facebook did not require any changes to the a-Order web application. However, there are differences in the way the Adatum federation provider supports Facebook as compared to the other social identity providers, and differences in the ACS configuration.

Configuring Facebook as an identity provider in ACS requires some additional data; an Application ID that identifies your Facebook application, an Application secret to authenticate with your Facebook application, and a list of claims that ACS will request from Facebook. The additional configuration values enable you to configure multiple Facebook applications as identity providers for your relying party.

Each set of Facebook application credentials is treated as a separate identity provider in ACS.

The implication for the Adatum federation provider is that it must be able to identify the Facebook application to use for authentication in the **whr** parameter that it passes to ACS. The following code sample from the **FederationIssuers** class in the Adatum federation provider shows how the Facebook application ID is included in the **whr** value.

```
// Facebook
homeRealmIdentifier = "facebook.com";
issuerLocation = Federation. AcsIssuerEndpoint;
whr = "Facebook-194130697287302";
this.issuers.Add(homeRealmIdentifier,
  new IssuerInfo(homeRealmIdentifier, issuerLocation, whr));
```

Questions

1. Which of the following issues must you address if you want to allow users of your application to authenticate with a social identity provider such as Google or Windows Live® network of Internet services?
    a. Social identity providers may use protocols other than WS-Federation to exchange claims tokens.
    b. You must register your application with the social identity provider.
    c. Different social identity providers issue different claim types.
    d. You must provide a mechanism to enroll users using social identities with your application.
2. What are the advantages of allowing users to authenticate to use your application with a social identity?
    a. The user doesn't need to remember yet another username and password.
    b. It reduces the features that you must implement in your application.
    c. Social identity providers all use the same protocol to transfer tokens and claims.
    d. It puts the user in control of their password management. For example, a user can recover a forgotten password without calling your helpdesk.
3. What are the potential disadvantages of using ACS as your federation provider?
    a. It adds to the complexity of your relying party application.

   b. It adds an extra step to the authentication process, which negatively impacts the user experience.
   c. It is a metered service, so you must pay for each token that it issues.
   d. Your application now relies on an external service that is outside of its control.

4. How can your federation provider determine which identity provider to use (perform home realm discovery) when an unauthenticated user accesses the application?
   a. Present the user with a list of identity providers to choose from.
   b. Analyze the IP address of the originating request.
   c. Prompt the user for an email address, and then parse it to determine the user's security domain.
   d. Examine the **ClaimsPrincipal** object for the user's current session.

5. In the scenario described in this chapter, the Adatum federation provider trusts ACS, which in turn trusts the social identity providers such as Windows Live and Google. Why does the Adatum federation provider not trust the social identity providers directly?
   a. It's not possible to configure the Adatum federation provider to trust the social identity providers because the social identity providers do not make the certificates required for a trust relationship available.
   b. ACS automatically performs the protocol transition.
   c. ACS is necessary to perform the claims mapping.
   d. Without ACS, it's not possible to allow Adatum employees to access the application over the web.

More Information

Appendix E of this guide provides a detailed description of ACS and its features.

You can find the MSDN® documentation for ACS 2.0 at **http://msdn.microsoft.com/en-us/library/gg429786.aspx**.

6 Federated Identity with Multiple Partners

In this chapter, you'll learn about the special considerations that apply to applications that establish many trust relationships. Here you will also see how use the ASP.NET Model View Controller (MVC) framework to build a claims-aware application.

Although the basic building blocks of federated identity—issuers, trust, security tokens and claims—are the same as what you saw in the previous chapter, there are some identity and authorization requirements that are particular to the case of multiple trust relationships.

Special considerations apply when there are many trust relationships.

In some web applications, such as the one shown in this chapter, users and customers represent distinct concepts. A customer of an application can be an organization, and each customer can have many individual users, such as employees. If the application is meant to scale to large numbers of customers, the enrollment process for new customers must be as streamlined as possible. It may even be automated. As with the other chapters, it is easiest to explain these concepts in the context of a scenario.

The Premise

Fabrikam is a company that provides shipping services. As part of its offering, it has a web application named Fabrikam Shipping that allows its customers to perform such tasks as creating shipping orders and tracking them. Fabrikam Shipping is an ASP.NET MVC application that runs in Fabrikam's data center. Fabrikam's customers want their employees to use a browser to access the shipping application.

Fabrikam has made its new shipping application claims-based. Like many design choices, this one was customer-driven. In this case, Fabrikam signed a deal with a major customer, Adatum. Adatum's corporate IT strategy (as discussed in chapter 3, "Claims-Based Single Sign-On for the Web") calls for the eventual elimination of identity silos. Adatum wants its users to access Fabrikam Shipping without presenting separate user names and passwords. Fabrikam also signed agreements with Litware that had similar requirements. However, Fabrikam also wants to support smaller customers, such as Contoso, that do not have the infrastructure in place to support federated identity.

Goals and Requirements

Larger customers such as Adatum and Litware have some particular concerns. These include the following:

- **Usability**. They would prefer if their employees didn't need to learn new passwords and user names for Fabrikam Shipping. These employees shouldn't need any credentials other than the ones they already have, and they shouldn't have to enter credentials a second time when they access Fabrikam Shipping from within their security domain.
- **Support**. It is easier for Adatum and Litware to manage issues such as forgotten passwords than to have employees interact with Fabrikam.
- **Liability**. There are reasons why Adatum and Litware have the authentication and authorization policies that they do. They want to control who has access to resources, no matter where those resources are deployed, and Fabrikam Shipping is no exception. If an employee leaves the company, he or she should no longer have access to the application.

Fabrikam has its own goals, which are the following:

- **To delegate the responsibility for maintaining user identities to its customers, when possible**. This avoids a number of problems, such as having to synchronize data between Fabrikam and its customers. The contact information for a package's sender is an example of this kind of information. Its accuracy should be the customer's responsibility because it could quickly become costly for Fabrikam to keep this information up to date.
- **To bill customers by cost center if one is supplied**. Cost centers should be provided by the customers. This is also another example of information that is the customer's responsibility.
- **To sell its services to a large number of customers**. This means that the process of enrolling a new company must be streamlined. Fabrikam would also prefer that its customers self-manage the application whenever possible.

- **To provide the infrastructure for federation if a customer cannot**. Fabrikam wants to minimize the impact on the application code that might arise from having more than one authentication mechanism for customers.

Overview of the Solution

With the goals and requirements in place, it's time to look at the solution. As you saw in Chapter 4, "Federated Identity for Web Applications," the solution includes the establishment of a claims-based architecture with an issuer that acts as an identity provider (IdP) on the customers' side. In addition, the solution includes an issuer that acts as the federation provider (FP) on Fabrikam's side. Recall that a federation provider acts as a gateway between a resource and all of the issuers that provide claims about the resource's users.

Figure 1 shows Fabrikam's solution for customers that have their own identity provider.

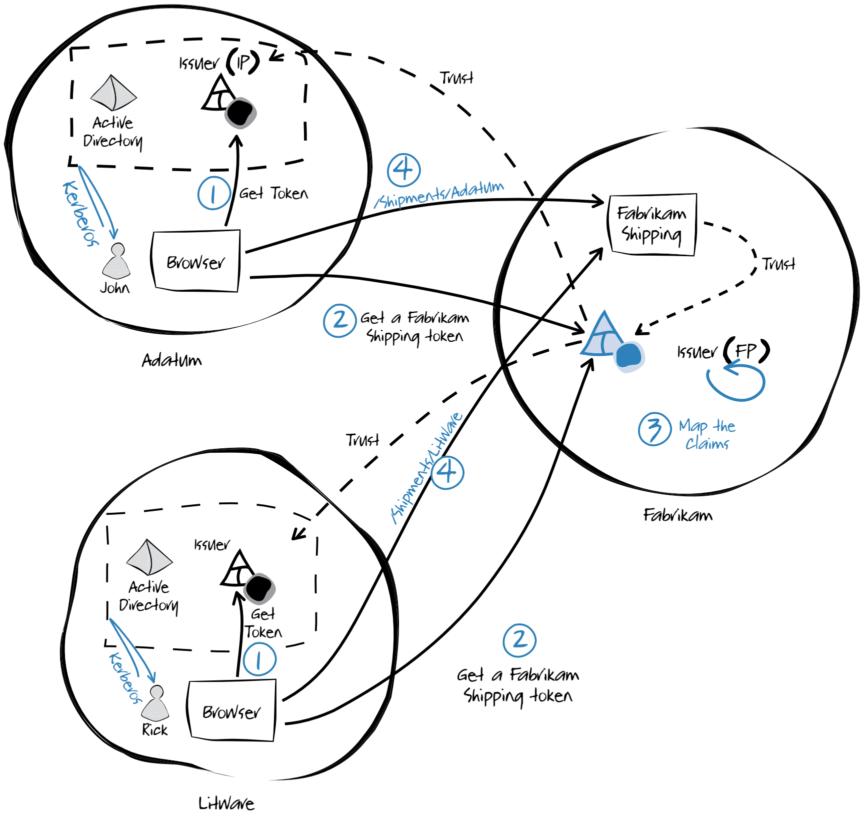


FIGURE 1
Fabrikam Shipping for customers with an identity provider

In this scenario, discovering the home realm is automated. There's no need for the user to provide it, as was shown in Chapter 4, "Federated Identity for Web Applications."

Here's an example of how the system works. The steps correspond to the numbers in the preceding illustration.

STEP 1: PRESENT CREDENTIALS TO THE IDENTITY PROVIDER

1. When John from Adatum attempts to use **Fabrikam Shipping** for the first time (that is, when he first navigates to https://{fabrikam host}/f-shipping/adatum), there's no session established yet. In other words, from Fabrikam's point of view, John is unauthenticated. The URL provides the Fabrikam Shipping application with a hint about the customer that is requesting access (the hint is "adatum" at the end of the URL).
2. The application redirects John's browser to Fabrikam's issuer (the federation provider). That is because Fabrikam's federation provider is the application's trusted issuer. As part of the redirection URL, the application includes the **whr** parameter that provides a hint to the federation provider about the customer's home realm. The value of the **whr** parameter is http://adatum/trust.
3. Fabrikam's federation provider uses the **whr** parameter to look up the customer's identity provider and redirect John's browser back to the Adatum issuer.
4. Assuming that John uses a computer that is already a part of the domain and in the corporate network, he will already have valid network credentials that can be presented to Adatum's identity provider.
5. Adatum's identity provider uses John's credentials to authenticate him and then issue a security token with a set of Adatum's claims. These claims are the **employee name**, the **employee address**, the **cost center**, and the **department**.

STEP 2: TRANSMIT THE IDENTITY PROVIDER'S SECURITY TOKEN TO THE FEDERATION PROVIDER

1. The identity provider uses HTTP redirection to redirect the security token it has issued to Fabrikam's federation provider.
2. Fabrikam's federation provider receives this token and validates it.

STEP 3: MAP THE CLAIMS

1. Fabrikam's federation provider applies token mapping rules to the identity provider's security token. The claims are transformed into something that Fabrikam Shipping understands.
2. The federation provider uses HTTP redirection to submit the claims to John's browser.

STEP 4: TRANSMIT THE MAPPED CLAIMS AND PERFORM THE REQUESTED ACTION

1. The browser sends the federation provider's security token, which contains the transformed claims, to the Fabrikam Shipping application.
2. The application validates the security token.
3. The application reads the claims and creates a session for John.

Because this is a web application, all interactions happen through the browser. (See Appendix B for a detailed description of the protocol for a browser-based client.)

The principles behind these interactions are exactly the same as those described in Chapter 4, "Federated Identity for Web Applications." One notable exception is Fabrikam's automation of the home realm discovery process. In this case, there's no user intervention necessary. The home realm is entirely derived from information passed first in the URL and then in the **whr** parameter.

Automated home realm discovery is important when there are many trust relationships.

Litware follows the same steps as Adatum. The only differences are the URLs used (http://{fabrikam host}/f-shipping/litware and the Litware identity provider's address) and the claims mapping rules, because the claims issued by Litware are different from those issued by Adatum. Notice that Fabrikam Shipping trusts the Fabrikam federation provider, not the individual issuers of Litware or Adatum. This level of indirection isolates Fabrikam Shipping from individual differences between Litware and Adatum.

Fabrikam also provides identity services on behalf of customers such as Contoso that do not have issuers of their own. Figure 2 shows how Fabrikam implemented this.

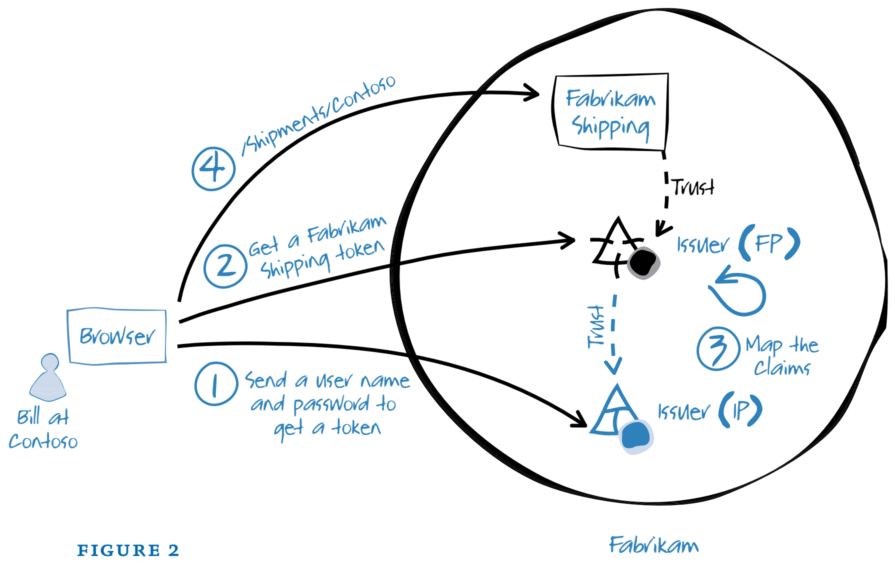


FIGURE 2
Fabrikam Shipping for customers without an identity provider

Smaller organizations may not have their own issuers.

Contoso is a small business with no identity infrastructure of its own. It doesn't have an issuer that Fabrikam can trust to authenticate Contoso's users. It also doesn't care if its employees need a separate set of credentials to access the application.

Fabrikam has deployed its own identity provider to support smaller customers such as Contoso. Notice, however, that even though Fabrikam owns this issuer, it's treated as if it were an external identity provider, just as those that belong to Adatum and Litware. In a sense, Fabrikam "federates with itself."

Because the identity provider is treated as an external issuer, the process is the same as that used by Adatum and Litware. The only differences are the URLs and the claim mappings.

By deploying an identity provider for customers such as Contoso, Fabrikam accepts the costs associated with maintaining accounts for remote users (for example, handling password resets). The benefit is that Fabrikam only has to do this for customers that don't have their own federation infrastructure. Over time, Fabrikam expects to have fewer customers that need this support.

It would also be possible for Fabrikam to support third-party identity providers such as LiveID or OpenID as a way to reduce the cost of maintaining passwords for external users.

Using Claims in Fabrikam Shipping

Fabrikam Shipping uses claims for two purposes. It uses role claims to control access and it also uses claims to retrieve user profile information.

Fabrikam uses claims for access control and for user profiles.

Access control to Fabrikam Shipping is based on one of three roles:

- **Shipment Creator**. Anyone in this role can create new orders.
- **Shipment Manager**. Anyone in this role can create and modify existing shipment orders.
- **Administrator**. Anyone in this role can configure the system. For example, they can set shipping preferences or change the application's appearance and behavior ("look and feel").

The sender's address and the sender's cost center for billing are the pieces of profile information that Fabrikam Shipping expects as claims. The cost center allows Fabrikam to provide more detailed invoices. For example, two employees from Adatum who belong to two different departments would get two different bills.

Fabrikam configures claims mappings for every new customer that uses Fabrikam Shipping. This is necessary because the application logic within Fabrikam Shipping only understands one set of role claims, which includes Shipment Creator, Shipment Manager, and Administrator. By providing these mappings, Fabrikam decouples the application from the many different claim types that customers provide.

The following table shows the claims mappings for each customer. Claims that represent cost centers, user names, and sender addresses are simply copied. They are omitted from the table for brevity.

Partner	Input conditions	Output claims
Adatum	Claim issuer: Adatum Claim type: Group, Claim value: Customer Service	Claim issuer: Fabrikam Claim type: Role, Claim value: Shipment Creator
	Claim issuer: Adatum Claim type: Group, Claim value: Order Fulfillments	Claim issuer: Fabrikam Claim type: Role, Claim value: Shipment Creator
		Claim issuer: Fabrikam Claim type: Role, Claim value: Shipment Manager
	Claim issuer: Adatum Claim type: Group, Claim value: Admins	Claim issuer: Fabrikam Claim type: Role, Claim value: Administrator
	Claim issuer: Adatum	Claim issuer: Fabrikam Claim type: Organization, Claim value: Adatum
Litware	Claim issuer: Litware Claim type: Group, Claim value: Sales	Claim issuer: Fabrikam Claim type: Role, Claim value: Shipment Creator
	Claim issuer: Litware	Claim issuer: Fabrikam Claim type: Organization, Claim value: Litware
Contoso	Claim issuer: Fabrikam identity provider Claim type: e-mail, Claim value: **bill@contoso.com**	Claim issuer: Fabrikam Claim type: Role, Claim value: **Shipment Creator**
		Claim issuer: Fabrikam Claim type: Role, Claim value: **Shipment Manager**
		Claim issuer: Fabrikam Claim type: Role, Claim value: **Administrator**
		Claim issuer: Fabrikam Claim type: Organization, Claim value: **Contoso**

As in Chapter 4, "Federated Identity for Web Applications," Adatum could issue Fabrikam-specific claims, but it would not be a best practice to clutter Adatum's issuer with Fabrikam-specific concepts such as Fabrikam roles. Fabrikam allows Adatum to issue any claims it wants, and then it configures its federation provider to map these Adatum claims to Fabrikam claims.

Inside the Implementation

Now is a good time to walk through some of the details of the solution. As you go through this section, you may want to download the Microsoft® Visual Studio® development system solution 3FederationWithMultiplePartners from http://claimsid.codeplex.com. If you are not interested in the mechanics, you should skip to the next section.

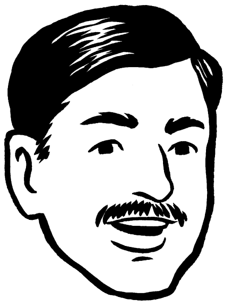
The Fabrikam Shipping application uses the ASP.NET MVC framework in conjunction with the Windows® Identify Foundation (WIF). The application's Web.config file contains the configuration information, as shown in the following XML code. The **<system.webServer>** section of the Web.config file references WIF-provided modules and the ASP.NET MVC HTTP handler class. The WIF information is the same as it was in the previous scenarios. The MVC HTTP handler is in the **<handlers>** section.

Fabrikam Shipping is an ASP.NET MVC application that uses claims.

```
<system.webServer>
  ...
  <modules runAllManagedModulesForAllRequests="true">
    ...
    <add name="WSFederationAuthenticationModule"
         preCondition=" integratedMode"
         type="Microsoft.IdentityModel.Web.
                      WSFederationAuthenticationModule, ..." />

   <add name="SessionAuthenticationModule"
         preCondition=" integratedMode"
         type="Microsoft.IdentityModel.Web.
                           SessionAuthenticationModule, ..." />
  </modules>
  <handlers>
    ...
    <add name="MvcHttpHandler"
         preCondition="integratedMode"
         verb="*"
         path="*.mvc"
         type="System.Web.Mvc.MvcHttpHandler, ..."/>
    ...
  </handlers>
</system.webServer>
```

Fabrikam chose ASP.NET MVC because it wanted improved testability and a modular architecture. They considered these qualities important for an application with many customers and complex federation relationships.

Fabrikam Shipping is an example of the finer-grained control that's available with the WIF API. Although Fabrikam Shipping demonstrates how to use MVC with WIF, it's not the only possible approach. Also, WIF-supplied tools, such as FedUtil.exe, are not currently fully integrated with MVC applications. For now, you can edit sections of the configuration files after applying the FedUtil program to an MVC application. This is what the developers at Fabrikam did with Fabrikam Shipping.



If you set **passive RedirectEnabled** to **false**, WIF will no longer be responsible for the redirections to your issuers. You will have complete control of these interactions.

Fabrikam Shipping needs to customize the redirection of HTTP requests to issuers in order to take advantage of the ASP.NET MVC architecture. It does this by turning off automatic redirection from within WIF's federated authentication module. This is shown in the following XML code:

```
<federatedAuthentication>
   <wsFederation passiveRedirectEnabled="false"
     issuer="https://{fabrikam host}/{issuer endpoint}/"
     realm="https://{fabrikam host}/f-Shipping/FederationResult"
     requireHttps="true"
   />
   <cookieHandler requireSsl="true" path="/f-Shipping/" />
</federatedAuthentication>
```

By setting the **passiveRedirectEnabled** attribute to **false**, you instruct WIF's federated authentication module not to perform its built-in redirection of unauthenticated sessions to the issuer. For example, Fabrikam Shipping uses the WIF API to perform this redirection under programmatic control.

ASP.NET MVC applications include the concept of *route mappings* and controllers that implement handlers. A route mapping enables you to define URL mapping rules that automatically dispatch incoming URLs to application-provided action methods that process them. (Outgoing URLs are also processed.)

The following code shows how Fabrikam Shipping establishes a routing table for incoming requests such as "http://{fabrikam host}/f-shipping/adatum". The last part of the URL is the name of the organization (that is, the customer). This code is located in Fabrikam Shipping's Global.asax file.

```
public class MvcApplication : System.Web.HttpApplication
{
  // ...
  public static void RegisterRoutes(RouteCollection routes)
  {
    // ...
    routes.MapRoute(
          "OrganizationDefault",
          "{organization}/",
          new { controller = "Shipment", action = "Index" });
  }
    // ...
}
```

The **RegisterRoutes** method allows the application to tell the ASP.NET MVC framework how URIs should be mapped and handled in code. This is known as a routing rule.

When an incoming request such as "http://{fabrikam host}/f-Shipping/adatum" is received, the MVC framework evaluates the routing rules to determine the appropriate controller object that should handle the request. The incoming URL is tested against each route rule. The first matching rule is then used to process the request. In the case of the "f-Shipping/adatum" URL, an instance of the application's **ShipmentController** class will be used as the controller, and its **Index** method will be the action method.

There's a lot of good information about APS.NET.MVC concepts at http://www.asp.net.

```
[AuthenticateAndAuthorize(Roles = "Shipment Creator")]
public class ShipmentController : BaseController
{
   public ActionResult Index()
   {
      // ...
   }
}
```

The **ShipmentController** class has been decorated with a custom attribute named **AuthenticateAndAuthorize**. This attribute is implemented by the Fabrikam Shipping application. Here is the declaration of the attribute class.

```
[AttributeUsage(AttributeTargets.Class | AttributeTargets.Method)]
public sealed class AuthenticateAndAuthorizeAttribute :
                       FilterAttribute, IAuthorizationFilter
{
  // ...

  public void OnAuthorization(AuthorizationContext filterContext)
  {
    if (!filterContext.HttpContext.Request.IsSecureConnection)
    {
       throw /* ... */
    }

    if (!filterContext.HttpContext.User.Identity.IsAuthenticated)
    {
      AuthenticateUser(filterContext);
    }
    else
    {
      this.AuthorizeUser(filterContext);
    }

  // ...
}
```

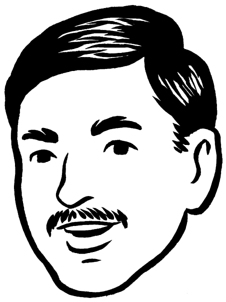
The **AuthenticateAndAuthorizeAttribute** class derives from the **FilterAttribute** class and implements the **IAuthorizationFilter** interface. Both these types are provided by ASP.NET MVC. The MVC framework recognizes these attribute types when they are applied to controller classes and it calls the **OnAuthorization** method before each controller method is invoked. The **OnAuthorization** method detects whether or not authentication has been performed already, and if it hasn't, it invokes the **AuthenticateUser** helper method to contact the application's federation provider by HTTP redirection. The following code shows how this happens.

```
private static void AuthenticateUser(AuthorizationContext context)
{
  var organizationName =
                (string)context.RouteData.Values["organization"];

  if (!string.IsNullOrEmpty(organizationName))
  {
    if (!IsValidTenant(organizationName)) { throw /* ... */ }

    var returnUrl = GetReturnUrl(context.RequestContext);

    var fam =
        FederatedAuthentication.WSFederationAuthenticationModule;

    var signIn =
        new SignInRequestMessage(new Uri(fam.Issuer), fam.Realm)
        {
          Context = returnUrl.ToString(),
          HomeRealm =RetrieveHomeRealmForTenant(organizationName)
        };

    context.Result =
                  new RedirectResult(signIn.WriteQueryString());
  }
}
```

The **AuthenticateUser** method takes the customer's name from the route table. (The code refers to a customer as an organization.) In this example, "adatum" is the customer. Next, the method checks to see if the customer has been enrolled in the Fabrikam Shipping application. If not, it raises an exception.

Then, the **AuthenticateUser** method looks up the information it needs to create a federated sign-in request. This includes the URI of the issuer (that is, Fabrikam's federation provider), the application's realm (the address where the issuer will eventually return the security token), the URL that the user is trying to access, and the home realm designation of the customer. The method uses this information to create an instance of WIF's **SignInRequestMessage** class. An instance of this class represents a new request to an issuer to authenticate the current user.

In the underlying **WS-Federation** protocol, these pieces of information correspond to the parameters of the request message that will be directed to Fabrikam's federation provider. The following table shows this correspondence.



To keep your app secure and avoid attacks such as SQL injection, you should verify all values from an incoming URL.

Parameter	Name	Contents
wrealm	Realm	This identifies the Fabrikam Shipping application to the federation provider. This parameter comes from the Web.config file and is the address to which a token should be sent.
wctx	Context	This parameter is set to the address of the original URL requested by the user. This parameter is not used by the issuer, but all issuers in the chain preserve it for the Fabrikam Shipping application, allowing it to send the user to his or her original destination.
whr	Home realm	This parameter tells Fabrikam's federation provider that it should use Adatum's issuer as the identity provider for this request.

The **GetReturnUrl** method is a locally defined helper method that gives the URL that the user is trying to access. An example is **http://{fabrikam host}/f-shipping/adatum/shipment/new**.

After using the WIF API to construct the sign-on request message, the method configures the result for redirection.

At this point, ASP.NET will redirect the user's browser to the federation provider. In response, the federation provider will use the steps described in the Chapter 3, "Claims-Based Single Sign-On for the Web," and Chapter 4, "Federated Identity for Web Applications," to authenticate the user. This will include additional HTTP redirection to the identity provider specified as the home realm. Unlike the previous examples in this guide, the federation provider in this example uses the **whr** parameter sent by the application to infer the address of the customer's identity provider. After the federation provider receives a security token from the identity provider and transforms it into a token with the claim types expected by Fabrikam Shipping, it will POST it to the **wrealm** address that was originally specified. This is a special URL configured with the **SignInRequestMessage** class in the **AuthenticateAndAuthorizeAttribute** filter. In the example, the URL will be f-shipping/FederationResult.

The MVC routing table is configured to dispatch the POST message to the **FederationResult** action handler defined in the **Home Controller** class of the Fabrikam Shipping application. This method is shown in the following code.

```
[ValidateInput(false)]
[AcceptVerbs(HttpVerbs.Post)]

public ActionResult FederationResult(string wresult)
{
  var fam =
        FederatedAuthentication.WSFederationAuthenticationModule;
  if (fam.CanReadSignInResponse(
                   System.Web.HttpContext.Current.Request, true))
  {
    string returnUrl = this.GetReturnUrlFromCtx();

    return new RedirectResult(returnUrl);
  }

  // ...
}
```

Notice that this controller does not have the **AuthenticateAnd Authorize** attribute applied. However, the token POSTed to this address is still processed by the WIF Federation Authentication Module because of the explicit redirection of the return URL.

The **FederationResult** action handler uses the helper method **GetReturnUrlFromCtx** to read the **wctx** parameter that contains the original URL requested by the user. This is simply a property lookup operation: **this.HttpContext.Request.Form["wctx"]**. Finally, it issues a redirect request to this URL.

The **ValidateInput** custom attribute is required for this scenario because the body of the POST contains a security token serialized as XML. If this custom attribute were not present, ASP.NET MVC would consider the content of the body unsafe and therefore raise an exception.

The application then processes the request a second time, but in this pass, there is an authenticated user. The **OnAuthorization** method described earlier will again be invoked, except this time it will pass control to the **AuthorizeUser** helper method instead of the **AuthenticateUser** method as it did in the first pass. The definition of the **AuthorizeUser** method is shown in the following code.

```
private void AuthorizeUser(AuthorizationContext context)
{
  var organizationRequested =
     (string)context.RouteData.Values["organization"];
  var userOrganiation =
     ClaimHelper.GetCurrentUserClaim(
          Fabrikam.ClaimTypes.Organization).Value;

  if (!organizationRequested.Equals(userOrganiation,
                     StringComparison.OrdinalIgnoreCase))
  {
    context.Result = new HttpUnauthorizedResult();
    return;
  }

  var authorizedRoles = this.Roles.Split(new[] { "," },
                          StringSplitOptions.RemoveEmptyEntries);
  bool hasValidRole = false;
  foreach (var role in authorizedRoles)
  {
    if (context.HttpContext.User.IsInRole(role.Trim()))
    {
      hasValidRole = true;
      break;
    }
  }

  if (!hasValidRole)
  {
    context.Result = new HttpUnauthorizedResult();
    return;
  }
}
```

The **AuthorizeUser** method checks the claims that are present for the current user. It makes sure that the customer identification in the security token matches the requested customer as given by the URL. It then checks that the current user has one of the roles required to run this application.

Because this is a claims-aware application, you know that the user object will be of type **IClaimsPrincipal** *even though its static type is* **IPrincipal**. *However, no run-time type conversion is needed in this case. The reason is that the code only checks for role claims, and these operations are available to instances that implement the* **IPrincipal** *interface.*

If you want to extract any other claims from the principal, you will need to cast the **User** *property to* **IClaimsPrincipal** *first. This is shown in the following code.*

```
var claimsprincipal =
         context.HttpContext.User as IClaimsPrincipal;
```

If the user has a claim that corresponds to one of the permitted roles (defined in the **AuthenticateAndAuthorizeAttribute** class), the **AuthorizeUser** method will return without setting a result in the context. This allows the original action request method to run.

In the scenario, the original action method is the **Index** method of the **ShipmentController** class. The method's definition is given by the following code example.

```
[AuthenticateAndAuthorize(Roles = "Shipment Creator")]
public class ShipmentController : BaseController
{
   public ActionResult Index()
   {
     var repository = new ShipmentRepository();

     IEnumerable<Shipment> shipments;
     var organization =
         ClaimHelper.GetCurrentUserClaim(
                         Fabrikam.ClaimTypes.Organization).Value;

     if (this.User.IsInRole(Fabrikam.Roles.ShipmentManager))
     {
       shipments =
             repository.GetShipmentsByOrganization(organization);
     }
     else
     {
       var userName = this.User.Identity.Name;
       shipments =
          repository.GetShipmentsByOrganizationAndUserName(
                                         organization, userName);
```

```
    }

    var model =
        new ShipmentListViewModel { Shipments = shipments };

    return View(model);
  }
 // ...
}
```

The **Index** action handler retrieves the data that is needed to satisfy the request from the application's data store. Its behavior depends on the user's role, which it extracts from the current claims context. It passes control to the controller's **View** method for rendering the information from the repository into HTML.

Setup and Physical Deployment

Applications such as Fabrikam Shipping that use federated identity with multiple partners sometimes rely on automated provisioning and may allow for customer-configurable claims mapping. The Fabrikam Shipping example does not implement automated provisioning, but it includes a prototype of a web interface as a demonstration of the concepts.

Automated provisioning may be needed when there are many partners.

Establishing the Trust Relationship

If you were to implement automated provisioning, you could provide a web form that allows an administrator from a customer's site to specify a URI of an XML document that contains federation metadata for ADFS 2.0. Alternatively, the administrator could provide the necessary data elements individually.

If your application's federation provider is an ADFS 2.0 server, you can use Windows PowerShell® scripts to automate the configuration steps. For example, the **ADFSRelyingParty** command allows you to programmatically configure ADFS to issue security tokens to particular applications and federation providers. Look on MSDN® for the ADFS 2.0 commands that you can use in your PowerShell scripts.

Processing a federation request might initiate a workflow process that includes manual steps such as verifying that a contract has been signed. Both manual and automated steps are possible, and of course, you would first need to authenticate the request for provisioning.

If you automate provisioning with a federation metadata XML file, this file would be provided by a customer's issuer. In the following example, you'll see the federation metadata file that is provided by Adatum. The file contains all the information that Fabrikam Shipping would need to configure and deploy its federation provider to communicate with Adatum's issuer. Here are the important sections of the file.

Organization Section

The organization section contains the organization name.

```
<Organization>
  <OrganizationDisplayName xml:lang="">
     Adatum
  </OrganizationDisplayName>
  <OrganizationName xml:lang="">Adatum</OrganizationName>
  <OrganizationURL xml:lang="">
     http://{adatum host}/Adatum.Portal/
  </OrganizationURL>
</Organization>
```

Issuer Section

The issuer section contains the issuer's URI.

```
<fed:SecurityTokenServiceEndpoint>
    <EndpointReference
        xmlns="http://www.w3.org/2005/08/addressing">
        <Address>
            https://{adatum host}/{issuer endpoint}/
        </Address>
…
    </EndpointReference>
</fed:SecurityTokenServiceEndpoint>
```

Certificate Section

The certificate section contains the certificate (encoded in base64) that is used by the issuer to sign the tokens.

```
<RoleDescriptor ...>
    <KeyDescriptor use="signing">
        <KeyInfo xmlns="http://www.w3.org/2000/09/xmldsig#">
            <X509Data>
               <X509Certificate>
```

```
                    MIIB5TCCAV ... Ukyey2pjD/R4LO2B3AO
                </X509Certificate>
            </X509Data>
        </KeyInfo>
    </KeyDescriptor>
</RoleDescriptor>
```

After Adatum registers as a customer of Fabrikam Shipping, the customer's systems administrators must also configure their issuer to respond to requests from Fabrikam's federation provider. For ADFS 2.0, this process is identical to what you saw in Chapter 4, "Federated Identity for Web Applications," when the Litware issuer began to provide claims for the a-Order application.

User-Configurable Claims Transformation Rules

It's possible for applications to let customers configure the claims mapping rules that will be used by the application's federation provider. You would do this to make it as easy as possible for an application's customers to use their existing issuers without asking them to produce new claim types. If a customer already has roles or groups, perhaps from Microsoft Active Directory, that are ready to use, it is convenient to reuse them. However, these roles would need to be mapped to roles that are understood by the application.

An application with many partners may require user-configurable claims transformation rules.

If the federation provider is an ADFS 2.0 server, you can use Windows PowerShell scripts to set up the role mapping rules. The claims mapping rules would be different for each customer.

Questions

1. In the scenario described in this chapter, who should take what action when an employee leaves one of the partner organizations such as Litware?
   a. Fabrikam Shipping must remove the user from its user database.
   b. Litware must remove the user from its user database.
   c. Fabrikam must amend the claims-mapping rules in its federation provider.
   d. Litware must ensure that its identity provider no longer issues any of the claims that get mapped to Fabrikam Shipping claims.

2. In the scenario described in this chapter, how does Fabrikam Shipping perform home realm discovery?
    a. Fabrikam Shipping presents unauthenticated users with a list of federation partners to choose from.
    b. Fabrikam Shipping prompts unauthenticated users for their email addresses. It parses this address to determine which organization the user belongs to.
    c. Fabrikam Shipping does not need to perform home realm discovery because users will have already authenticated with their organizations' identity providers.
    d. Each partner organization has its own landing page in Fabrikam Shipping. Visiting that page will automatically redirect unauthenticated users to that organization's identity provider.
3. Fabrikam Shipping provides an identity provider for its smaller customers who do not have their own identity provider. What are the disadvantages of this?
    a. Fabrikam must bear the costs of providing this service.
    b. Users at smaller customers will need to remember another username and password.
    c. Smaller customers must rely on Fabrikam to manage their user's access to Fabrikam Shipping.
    d. Fabrikam Shipping must set up a trust relationship with all of its smaller customers.
4. How does Fabrikam Shipping ensure that only users at a particular partner can view that partner's shipping data?
    a. The Fabrikam Shipping application examines the email address of the user to determine the organization they belong to.
    b. Fabrikam Shipping uses separate databases for each partner. Each database uses different credentials to control access.

   c. Fabrikam shipping uses the **role** claim from the partner's identity provider to determine whether the user should be able to access the data.

   d. Fabrikam shipping uses the **organization** claim from its federation provider to determine whether the user should be able to access the data.

5. The developers at Fabrikam set the **wsFederation passive RedirectEnabled** attribute to false. Why?

   a. This scenario uses active redirection, not passive redirection.

   b. They wanted more control over the redirection process.

   c. Fabrikam Shipping is an MVC application.

   d. They needed to be able to redirect to external identity providers.

7 Federated Identity with Multiple Partners and Windows Azure Access Control Service

In Chapter 6, "Federated Identity with Multiple Partners," you saw how Fabrikam used claims to enable access to the Fabrikam shipping application for multiple partners. The scenario described how Fabrikam supported users at large partner organizations with their own claims-based identity infrastructure, and users from smaller organizations with no claims-based infrastructure of their own. Fabrikam provided support for the larger partner organizations by establishing trust relationships between the Fabrikam federation provider (FP) and the partner's identity provider (IdP). To support the smaller organizations, it was necessary for Fabrikam to implement its own identity provider and manage the collection of enrolled employees from smaller partners. This scenario also demonstrated how Fabrikam had taken steps to automate the enrollment process for new partners.

Users at smaller partners had to create new accounts at Fabrikam, adding to the list of credentials they have to remember. Many individuals would prefer to reuse an existing identity rather than create a new one just to use the Fabrikam Shipping application. How can Fabrikam enable users to reuse existing identities such as Facebook IDs, Google IDs, or Windows Live® IDs? In addition to establishing trust relationships with the social identity providers, Fabrikam must find solutions to these problems:

- Other identity providers may use different protocols to exchange claims data.
- Other identity providers may use different claim types.
- Fabrikam Shipping must be able to use the claims data it receives to implement authorization rules.
- The federation provider must be able to redirect users to the correct identity provider.
- Fabrikam must be able to enroll new users who want to use the Fabrikam Shipping application.

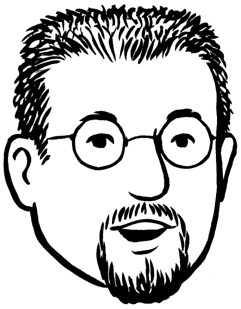
In Chapter 5, "Federated Identity with Windows Azure Access Control Services," you saw how Adatum extended access to the a-Order application to include users who wanted to use their social identity to authenticate with the a-Order application. In this chapter, you'll see how Fabrikam replaced its on-premises federation provider with Windows Azure™ AppFabric Access Control services (ACS), to enable users at smaller organizations without their own identity infrastructure to access Fabrikam Shipping.

You can use ACS to manage multiple trust relationships.

Unlike the scenario described in Chapter 5, "Federated Identity with Windows Azure Access Control Services," users from smaller partners who use social identity providers will be able to enroll themselves with the Fabrikam Shipping application. They will access the Fabrikam Shipping application alongside employees of existing enterprise partners. This chapter extends the scenario described in Chapter 6, "Federated Identity with Multiple Partners."

The Premise

Fabrikam is a company that provides shipping services. As part of its offering, it has a web application named Fabrikam Shipping that allows its customers to perform such tasks as creating shipping orders and tracking them. Fabrikam Shipping is an ASP.NET MVC application that runs in the Fabrikam data center.



Managing the accounts for users at organizations such as Contoso adds to the complexity of the Fabrikam ADFS implementation.

Fabrikam has already claims-enabled the Fabrikam Shipping web application, allowing employees from Adatum and Litware to access the application without having to present separate usernames and passwords. Users at Contoso, a smaller partner, can also access Fabrikam Shipping, but they must log in using credentials that the Fabrikam identity provider, Active Directory® Federation Services (ADFS) 2.0, authenticates. Users at Contoso have complained about the fact that they must remember a set of credentials specifically for accessing the Fabrikam Shipping application. All of Contoso's employees have either Windows® Live IDs or Google accounts, and they would prefer to use these credentials to gain access to the application. Users at other Fabrikam customers have echoed this request, mentioning Facebook IDs and Yahoo! IDs as additional credential types they would like to be able to use.

Goals and Requirements

The primary goal of this scenario is to show how Fabrikam can use ACS as a federation provider to enable both employees of large partners such as Adatum and Litware, and smaller partners whose employees use identities from with social identity providers, to access the Fabrikam Shipping application.

To recap from Chapter 6, "Federated Identity with Multiple Partners," larger customers such as Adatum and Litware have some particular concerns. These include the following:

- **Usability**. They would prefer if their employees didn't need to learn new passwords and user names for Fabrikam Shipping. These employees shouldn't need any credentials other than the ones they already have, and they shouldn't have to enter credentials a second time when they access Fabrikam Shipping from within their security domain. The solution described in Chapter 6, "Federated Identity with Multiple Partners," addresses this concern and introducing ACS as a federation provider must not change the user experience for the employees of these customers.
- **Support**. It is easier for Adatum and Litware to manage issues such as forgotten passwords than to have their employees interact with Fabrikam. The solution described in Chapter 6, "Federated Identity with Multiple Partners," addresses this concern and introducing ACS as a federation provider must not change the user experience for the security administrators of these customers.
- **Liability**. There are reasons why Adatum and Litware have the authentication and authorization policies that they have. They want to control who has access to their resources, no matter where those resources are deployed, and Fabrikam Shipping is no exception. If an employee leaves the company, he or she should no longer have access to the application. Again, the solution described in Chapter 6, "Federated Identity with Multiple Partners," addresses this concern.
- **Confidentiality**. Partners of Fabrikam, such as Adatum, do not want other partners, such as Litware, to know that they are using the Fabrikam Shipping service. When a user accesses the Fabrikam Shipping site, they should not have to choose from a list of available authentication partners; rather, the site should automatically redirect them to the correct identity provider without revealing a list of partners.

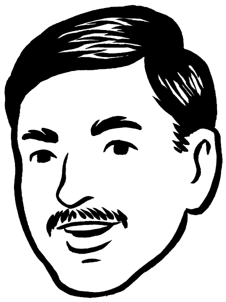
Fabrikam has its own goals, which are the following:

- **To delegate the responsibility for maintaining user identities to its customers, when possible**. This avoids a number of problems, such as having to synchronize data between Fabrikam and its customers. The contact information for a package's sender is an example of this kind of data. Its accuracy should be the customer's responsibility because it could quickly become costly for Fabrikam to keep this information up to date. The solution described in Chapter 6, "Federated Identity with Multiple Partners," addresses this concern.
- **To bill customers by cost center if one is supplied**. Customers should provide the cost center information. This is another example of information that is the customer's responsibility. The solution described in Chapter 6, "Federated Identity with Multiple Partners," addresses this concern.
- **To sell its services to a large number of customers**. This means that the process of enrolling a new company must be streamlined. Fabrikam would also prefer that its customers self-manage the application whenever possible. The automated enrollment process must be able to support both large organizations with their own identity infrastructure, and smaller organizations whose employees use a social identity provider. Furthermore, Fabrikam would like to support the widest possible range of social identity providers.
- **To provide the infrastructure for federation if a customer cannot**. Fabrikam wants to minimize the impact on the application code that might arise from having more than one authentication mechanism for customers. However, Fabrikam would prefer not to have to maintain an on-premises identity provider for smaller customers. Instead, it would like users at smaller customers to use existing social identities.

Smaller customers and individual users have some particular concerns. These include the following:

- **Usability**. Individual users would prefer to use existing identities such as Windows Live IDs or Google account credentials to access the Fabrikam Shipping website instead of having to create a new user ID and password just to access this site.

- **Support**. If individual users forget their passwords, they would like to be able to use the password recovery tools provided by their social identity provider rather than interacting with Fabrikam.
- **Privacy**. Individual users do not want their social identity provider to reveal to Fabrikam private information maintained by the social identity provider that is not relevant to the Fabrikam shipping application.



Fabrikam must be careful to explain to individual users the implications of allowing their social identity provider to release details to ACS and be clear about exactly what information Fabrikam Shipping and ACS will be able to access.

Overview of the Solution

With the goals and requirements in place, it's time to look at the solution. As you saw in Chapter 6, "Federated Identity with Multiple Partners," the solution includes the establishment of a claims-based architecture with issuers that act as an identity providers on the customers' side. In addition, the solution includes an issuer that acts as the federation provider on the Fabrikam side. Recall that a federation provider acts as a gateway between a resource and all of the issuers that provide claims about the resource's users. In this chapter, Fabrikam replaces the on-premises federation provider with ACS in order to support authenticating users with social identities. This change also means that Fabrikam no longer has to host and manage a federation provider in its own datacenter.

Although this solution brings the benefits of easy support for users who want to use their social identities, and a simplification of the implementation of the on-premises Fabrikam issuer, there are some trade-offs that Fabrikam evaluated.

This solution relies on access to ACS for all access to Fabrikam Shipping. Fabrikam is satisfied by the SLAs in place with the ACS subscription.

Using ADFS on-premises meant that Fabrikam could support federation with organizations using the SAMLP protocol. ACS does not currently support this protocol, but Fabrikam anticipates that all of its federation partners will support the WS-Federation protocol.

Figure 1 shows the Fabrikam Shipping solution using ACS.

In the solution described in Chapter 6, "Federated Identity with Multiple Partners," Fabrikam used an on-premises federation provider (FP). Now Fabrikam is using ACS in the cloud instead.

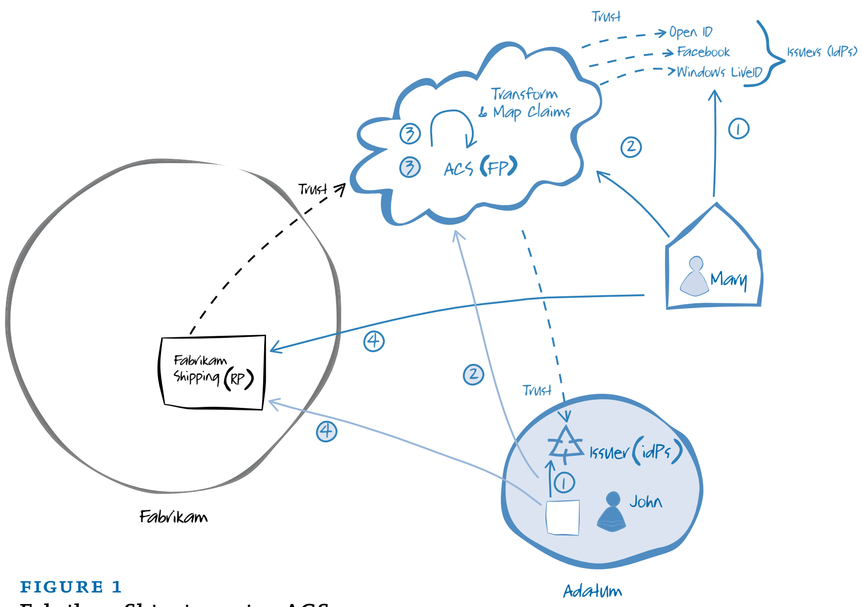


FIGURE 1
Fabrikam Shipping using ACS

Here's an example of how the system works for a user at an organization such as Adatum with its own identity provider. This process is similar, but not identical to the process described in Chapter 6, "Federated Identity with Multiple Partners." The steps correspond to the shaded numbers in the preceding illustration.

STEP 1: PRESENT CREDENTIALS TO THE IDENTITY PROVIDER

1. When John from Adatum attempts to use **Fabrikam Shipping** for the first time (that is, when he first navigates to https://{fabrikam host}/f-shipping/adatum), there's no session established yet. In other words, from Fabrikam's point of view, John is unauthenticated. The URL provides the Fabrikam Shipping application with a hint about the customer that is requesting access (the hint is "adatum" at the end of the URL).
2. The application redirects John's browser to the Fabrikam ACS instance in the cloud (the federation provider). That's because the Fabrikam ACS instance is the application's trusted issuer. As part of the redirection URL, the application includes the **whr** parameter that provides a hint to ACS about the customer's home realm. The value of the **whr** parameter is https://localhost/Adatum.SimulatedIssuer.7/.

It's important to use the **entityID** *value from the identity provider's FederationMetadata.xml file as the* **whr** *value if you want ACS to automatically redirect the user to the partner's identity provider.* **entityID** *is an attribute in the issuer's federation metadata: ACS uses this attribute value to uniquely identify identity providers that it trusts.*

3. ACS uses the **whr** parameter to look up the customer's identity provider and redirect John's browser to the Adatum issuer.
4. Assuming that John uses a computer that is already part of the domain and on the corporate network, he will already have valid network credentials that his browser can present to the Adatum identity provider.
5. The Adatum identity provider uses John's credentials to authenticate him and then issue a security token with a set of Adatum claims. These claims are the **employee name**, the **employee address**, the **cost center**, the role, and the group.

   Although the identity provider may also issue an organization claim, Fabrikam will always generate the organization claim value in ACS. This prevents a malicious administrator at a partner organization from impersonating a user from another partner.

This scenario automates home realm discovery. There's no need for the user to provide his home realm details, as was the case in Chapter 4, "Federated Identity for Web Applications."

STEP 2: TRANSMIT THE IDENTITY PROVIDER'S SECURITY TOKEN TO THE FEDERATION PROVIDER

1. The Adatum identity provider uses HTTP redirection to redirect the browser to the Fabrikam ACS instance, delivering the security token issued by the Adatum identity provider to the Fabrikam ACS instance.
2. The Fabrikam ACS instance receives this token and validates it.

STEP 3: MAP THE CLAIMS

1. The Fabrikam ACS instance applies claim-mapping rules to the claims in the identity provider's security token. ACS transforms the claims into claims that Fabrikam Shipping expects and understands.
2. ACS returns a new token with the claims to John's browser and uses HTTP redirection to return John's browser the Fabrikam Shipping application.

The redirection should be to a secure HTTP address (HTTPS) to prevent the possibility of session hijacking.

STEP 4: TRANSMIT THE MAPPED CLAIMS AND PERFORM THE REQUESTED ACTION

1. The browser sends the security token from ACS, which contains the transformed claims, to the Fabrikam Shipping application.
2. The application validates the security token.
3. The application reads the claims and creates a session for John.

Because this is a web application, all interactions happen through the browser. (See Appendix B for a detailed description of the protocol for a browser-based client.)

Litware follows the same steps as Adatum. The only differences are the URLs used (https://{fabrikam host}/f-shipping/litware and the Litware identity provider's address) and the claims-mapping rules, because the claims issued by the Litware identity provider are different from those issued by the Adatum identity provider. Notice that the Fabrikam Shipping web application trusts the Fabrikam ACS instance, not the individual issuers at Litware or Adatum; this level of indirection isolates Fabrikam Shipping from individual differences between Litware and Adatum.

In the scenario described in Chapter 6, "Federated Identity with Multiple Partners," Fabrikam managed and hosted an identity provider for smaller customers such as Contoso to enable users from these customers to authenticate before accessing the Fabrikam Shipping application. Users at organizations such as Contoso would now prefer to reuse an existing social identity rather than maintaining a separate set of credentials just for use with Fabrikam Shipping.

Here's an example of how the system works for a user at an organization such as Contoso where the users authenticate with an online social identity provider. The steps correspond to the un-shaded numbers in the preceding illustration. ACS treats the online social identity providers in almost the same way it treats the Adatum and Litware identity providers. However, it will use a different set of claims-mapping rules for the social identity providers and, if necessary, perform protocol transition as well. Fabrikam didn't need to change the Fabrikam Shipping application in order to support users with social identities; the application continues to trust ACS and ACS continues to deliver the same types of claims to Fabrikam Shipping.

STEP 1: PRESENT CREDENTIALS TO THE IDENTITY PROVIDER

1. When Mary from Contoso attempts to use Fabrikam Shipping for the first time (that is, when she first navigates to https://{fabrikam host}/f-shipping/Contoso), there's no session established yet. In other words, from Fabrikam's point of view, Mary is unauthenticated. The URL provides the Fabrikam Shipping application with a hint about the customer that is requesting access (the hint is "Contoso" at the end of the URL).
2. The application redirects Mary's browser to the Fabrikam ACS instance in the cloud (the federation provider). That's because the Fabrikam ACS instance is the application's trusted issuer. As part of the redirection URL, the application includes the **whr** parameter that provides a hint to the federation provider about the customer's home realm. The value of the **whr** parameter is uri:WindowsLiveID.

   In the current implementation, this means that all the employees at a small partner must use the same social identity provider. In this example, all Contoso employees must have a Windows Live ID to be able to access Fabrikam Shipping. You could extend the sample to enable users at partners such as Contoso to each use different social identity providers.

3. ACS uses the **whr** parameter to look up the customer's preferred social identity provider and redirect Mary's browser to the social identity issuer; in this example, Windows Live.
4. The social identity provider, Windows Live in this example, uses Mary's credentials to authenticate her and then returns a security token with a basic set of claims to Mary's browser. In the case of Windows Live ID, the only claim returned is **nameidentifier**.

STEP 2: TRANSMIT THE SOCIAL IDENTITY PROVIDER'S SECURITY TOKEN TO ACS

1. The social identity provider uses HTTP redirection to redirect Mary's browser with the security token it has issued to the Fabrikam ACS instance.
2. The Fabrikam ACS instance receives this token and validates it.

The types of claims that ACS sends to Fabrikam Shipping from a user with a social identity are the same claims types as it sends for users at Adatum and Litware.

STEP 3: MAP THE CLAIMS

1. The Fabrikam ACS instance applies token mapping rules to the social identity provider's security token. It transforms the claims into claims that Fabrikam Shipping understands. In this example, it adds new claims: **name**, **organization**, **role**, and **costcenter**.
2. If necessary, ACS transitions the protocol that the social identity provider uses to the WS-Federation protocol.
3. ACS returns a new token with the claims to Mary's browser.

STEP 4: TRANSMIT THE MAPPED CLAIMS AND PERFORM THE REQUESTED ACTION

1. ACS uses HTTP redirection to redirect Mary's browser with the security token from ACS, which contains the claims, to the Fabrikam Shipping application.
2. The application validates the security token.
3. The application reads the claims and creates a session for Mary.

Enrolling a New Partner Organization

Partners, both with and without their own identity providers, can enroll themselves with Fabrikam Shipping.

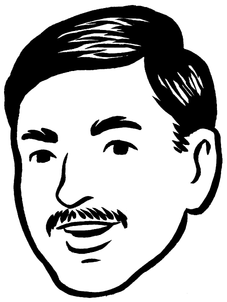
One of Fabrikam's goals was to enable partner organizations to enroll themselves with the Fabrikam Shipping application, and enable them to manage their own users. Both larger partners with their own identity providers and smaller partners whose employees use identities from social identity providers should be able to perform these operations.

The enrollment process must perform three key configuration steps:

- Update the Fabrikam Shipping list of registered partners. The registration data for each partner should include its name, the URL of a logo image, and an identifier for the partner's home realm.
- For partners using their own identity provider, create a trust relationship so that the Fabrikam ACS instance trusts the partner's identity provider.
- Create suitable claims-mapping rules in the Fabrikam ACS instance that transform the claims from the partner's identity provider to the claims that Fabrikam Shipping expects to see.

Fabrikam uses the partner name and logo that it stores in its list of registered partners to customize the UI of Fabrikam Shipping when an employee from the partner visits the site. The partner's home realm is important because when Fabrikam Shipping redirects a user to ACS for authentication, it includes the home realm as a value for the **whr** parameter in the request's querystring. To enable ACS to automatically redirect the user to the correct identity provider, the partner's home realm value should be the value of the **entityID** in the partner identity provider's FederationMetadata.xml.

Partners without their own identity provider use one of the pre-configured social identity providers in ACS; enrolling a new partner in this scenario does not require Fabrikam to configure a new identity provider in ACS. For partners with their own identity provider, the enrollment process must configure a new identity provider in ACS.



We can use ACS to handle the differences in the tokens and protocols that the various social identity providers use.

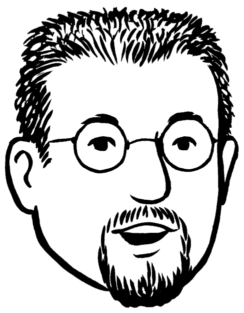
Partners with their own identity provider must configure their identity provider; a configuration example might be defining a relying party realm. The details of this will be specific to the type of identity provider that the partner uses.

Different identity providers return different claims. For example, Windows Live only returns a **nameidentifier** claim, while a custom provider might include **name**, **organization**, **costcenter,** and **role** claims. Regardless of the claims that the identity provider issues, the rules that the enrollment process creates in ACS must be sufficient to return **costcenter**, **name**, **organization**, and **role** claims, all of which the Fabrikam Shipping application requires. ACS can issue these claims to Fabrikam Shipping either by transforming a claim from the identity provider, by passing a claim from the identity provider through unchanged, or by creating a new claim.

Managing Multiple Partners with a Single Identity

A user, such as Paul, may work for two or more partners of Fabrikam Shipping. If those partners have their own identity providers, then Paul will have two separate identities, such as paul@contoso.com and paul@adventureworks.com, for example. However, if the partner organizations do not have their own identity providers, then it's likely that Paul will want to use the same social identity (paul@gmail.com) with both partners. This raises a problem if Paul has different roles in the two partner organizations; in Contoso, he may be in the **Shipment Manager** role, and in AdventureWorks he may be in the **Administrator** role. If ACS assigns roles based on Paul's identity, he will end up with both roles assigned to him, which means he will be in the **Administrator** role in Contoso.

To handle this scenario, Fabrikam first considered using a different service namespace for each partner in ACS. To access Contoso data at Fabrikam Shipping, Paul would need a token from the Contoso namespace, to access AdventureWorks data he would need



Enabling partners to manage their own users reduces the amount of work Fabrikam has to do to manage the Fabrikam Shipping application.

a token from the AdventureWorks namespace. To automate the enrollment process for new partners, Fabrikam would need to be able to create new service namespaces in ACS programmatically. Unfortunately, the ACS Management API does not currently support this operation.

The solution adopted by Fabrikam was to create a different relying party (RP) in ACS for each partner. In ACS, each relying party can have its own set of claims-mapping rules, so the rule group in the Contoso relying party in ACS can assign the **Shipment Manager** role to Paul, while the rule group in the AdventureWorks relying party in ACS can assign him the **Administrator** role. If Paul signs in to Fabrikam Shipping using a token from the Contoso relying party and he then tries to access AdventureWorks data he will need to re-authenticate in order to obtain a token from the AdventureWorks relying party in ACS.

A single service namespace in ACS can have multiple relying parties. The **wtrealm** *parameter passed to ACS identifies the relying party to use, and each relying party has its own set of claims-mapping rules that include a rule to add an* **organization** *claim. Fabrikam Shipping uses the* **organization** *claim to authorize access to data.*

Managing Users at a Partner Organization

For a partner organization with its own identity provider, the partner can manage which employees have access to its data at Fabrikam Shipping using the partner's identity provider. By controlling which claims its identity provider issues for individual employees, the partner can determine what level of access the employee has in the Fabrikam Shipping application. This approach depends on the claims-mapping rules that the enrollment process created in ACS. For example, mapping the **Order Tracker** role in Adatum to the **ShipmentManager** role in Fabrikam Shipping would give anyone at Adatum with the **Order Tracker** role the ability to manage Adatum shipments at Fabrikam.

In the case of a partner without its own identity provider, such as Contoso where employees authenticate with a social identity provider, the claims-mapping rules in ACS must include the mapping of individuals to roles within Fabrikam. To manage these mappings for these organizations, one user should be a designated administrator who can edit their organization's claims-mapping rules. The administrator would use an administration page hosted on the Fabrikam Shipping enrollment web site to manage the list of users with access to Contoso data in Fabrikam Shipping and edit the rules that control access levels. This page will use the ACS Management API to make the necessary configuration changes in ACS.

The sample does not implement this feature: each partner without its own identity provider has only a single user. The enrollment process configures this user. The sample implementation also assumes that if a partner did have more than one user, then all the users must use the same social identity provider.

Inside the Implementation

Now is a good time to walk through some of the details of the solution. As you go through this section, you may want to download the Microsoft Visual Studio® solution, 7FederationWithMultiplePartnersAndAcs from http://claimsid.codeplex.com. If you are not interested in the mechanics, you should skip to the next section.

The scenario described in this chapter is very similar to the scenario described in Chapter 6, "Federated Identity with Multiple Partners." The key difference is that ACS, rather than an issuer at Fabrikam, now provides the federation services. The changes to the Fabrikam Shipping application all relate to the way Fabrikam Shipping interacts with ACS; in particular, how the application enrolls new partners and handles the log on process. The logic of the application and the authorization rules it applies using the claims from the identity providers is unchanged.

Modifying Fabrikam Shipping to use ACS instead of the Fabrikam federation provider was mostly a configuration task.

Getting a List of Identity Providers from ACS

When a partner wants to enroll with the Fabrikam Shipping application, part of the sign-up process requires the partner to select the identity provider they want to use. The choice they have is either to use their own identity provider (at this stage in the enrollment process Fabrikam Shipping and ACS know nothing about the partner or its identity provider), or to use one of the pre-configured social identity providers: Google, Yahoo!, or Windows Live. It's possible that the list of available social identity providers might change, so it makes sense for Fabrikam to build the list programmatically by querying the Fabrikam ACS instance. However, there's no way to ask ACS for only the list of social identity providers and exclude any custom identity providers from other partners. The following code sample shows how Fabrikam implemented an extension method, **IsSocial,** to check whether an identity provider is a social identity provider.

```
public static class SocialIdentityProviders
{
  public static readonly SocialIdentityProvider
    Google = new SocialIdentityProvider {
                   DisplayName = "Google",
                   HomeRealm = "Google",
                   Id = "10008641" };
  public static readonly SocialIdentityProvider
    WindowsLiveId = new SocialIdentityProvider {
                   DisplayName = "Windows Live ID",
                   HomeRealm = "uri:WindowsLiveID",
                   Id = "10007989" };
  public static readonly SocialIdentityProvider
    Yahoo = new SocialIdentityProvider {
                   DisplayName = "Yahoo!",
                   HomeRealm = "Yahoo!",
                   Id = "10008653" };
  public static Ienumerable<SocialIdentityProvider> GetAll()
  {
    return new SocialIdentityProvider[3] {
                   Google, Yahoo, WindowsLiveId };
  }

  public static string GetHomeRealm(string socialIpId)
  {
    var providers = new[] { Google, Yahoo, WindowsLiveId };
    return providers.Single(p => p.Id == socialIpId).HomeRealm;
  }

  public static bool IsSocial(this IdentityProvider ip)
  {
    if (ip.Issuer.Name.Contains(Google.HomeRealm) ||
        ip.Issuer.Name.Contains(Yahoo.HomeRealm) ||
        ip.Issuer.Name.Contains(WindowsLiveId.HomeRealm))
    {
      return true;
    }
    return false;
  }
}
```

A separate web application called f-Shipping. Enrollment.7 handles the enrollment tasks.

The solution includes an ACS.ServiceManagementWrapper project that wraps the REST calls that perform management operations in ACS. The enrollment process builds a list of available social identity providers by calling the **RetrieveIdentityProviders** method in this wrapper class.

The ACS.ServiceManagementWrapper project uses password authentication over HTTPS with the calls that it makes to the ACS management API. As an alternative, you could sign the request with a symmetric key or an X.509 certificate.

Adding a New Identity Provider to ACS

When a partner with its own identity provider enrolls with Fabrikam Shipping, part of the enrollment process requires Fabrikam to add details of the partner's issuer to the list of identity providers in ACS. The enrollment process automates this by using the ACS Management API. The wrapper class in the ACS.ServiceManagementWrapper project includes two methods, **AddIdentityProvider** and **AddIdentityProviderManually** for configuring a new identity provider in ACS. During the enrollment process, if the user provides a FederationMetadata.xml file that contains all of the necessary information to configure the trust, the **EnrollmentController** class uses the **AddIdentityProvider** method. If the user provides details of the identity provider manually, it uses the **AddIdentityProviderManually** method. The enrollment process then adds a relying party and mapping rules to the identity provider, again using methods in the **ServiceManagementWrapper** wrapper class.

Managing Claims-Mapping Rules in ACS

The automated enrollment process for both larger organizations that have their own identity provider, and smaller partners who rely on a social identity provider requires Fabrikam to add claims-mapping rules to ACS programmatically. The wrapper class in the ACS.ServiceManagementWrapper project includes an **AddSimpleRuleToRuleGroup** method that the enrollment process uses when it adds a new claims-mapping rule. The application also uses the **AddPassthroughRuleToRuleGroup** when it needs to add a rule that passes a claim through from the identity provider to the relying party without changing it, and the **AddSimpleRuleToRuleGroupWithoutSpecifyInputClaim** method when it needs to create a new claim that's not derived from any of the claims issued by the identity provider.

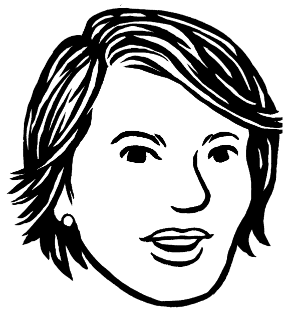
It's important that the mapping rules don't simply pass through the **organization** *claim, but instead create a new* **organization** *claim derived from the identity of the identity provider. This is to prevent the risk of a malicious administrator at the partner spoofing the identity of another organization. When registering a new organization, the code should verify that the organization name is not already is use, so that a new registration cannot override an existing organization name or add itself to an existing organization. The Fabrikam*

Shipping application uses the **organization** *claim in its authorization and data access management logic (for example, when creating and listing shipments).*

For partners without their own identity provider, the enrollment process must also create a new relying party in ACS. The wrapper class in the ACS.ServiceManagementWrapper project includes an **AddRelyingParty** method to perform this operation.

The **EnrollmentController** class in the f-Shipping.Enrollment.7 project demonstrates how the Fabrikam Shipping application handles the automated enrollment process.

Because Fabrikam uses multiple relying parties in ACS to handle the case where a user with a social identity is associated with multiple partners, the sample solution disables checking audience URIs in the Web.config file:



Each partner without an identity provider still needs a relying party so that Fabrikam Shipping can recognize when the same user is associated with two or more different partner organizations.

```
XML
<microsoft.identityModel>
  <service>
    <audienceUris mode="Never">
    </audienceUris>
    …
  </service>
</microsoft.identityModel>
```

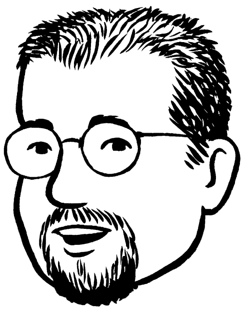
Normally, you should not set the **audienceUris mode** to "Never" because this introduces a security vulnerability: the correct approach is to add the audience URIs at run time as Fabrikam Shipping enrolls new partners. You would also need to share the list of Uris between the f-Shipping.Enrollment.7 web application and the f-Shipping.7 web application. Furthermore, to avoid the possibility of one tenant impersonating another, you would use a separate symmetric key for each tenant. However, as described previously, in this solution ACS adds an **organization** claim to the token that it issues that the REST service can check.

Displaying a List of Partner Organizations

For the purposes of this sample, the home page at Fabrikam Shipping displays a list of registered partner organizations. In a real application, you may not want to make this information public because some partners may not want other partners to know about their business relationship with Fabrikam Shipping, so each partner would have their own landing page.

In ACS 2.0 (the current version at the time of this writing), it's not possible to keep this information private because ACS publishes a public feed of all the identity providers associated with each relying party.

For this example, the Fabrikam Shipping application generates the list of partners from a local store instead of querying ACS. Because Fabrikam Shipping maintains this data locally, there is no need to query ACS or use the login page that ACS can generate for you.



You can find the address of the feed that contains a list of all the identity providers in the ACS portal in the "Application integration" section under "Login Page Integration."

Authenticating a User of Fabrikam Shipping

The Fabrikam Shipping application uses the **AuthenticateAndAuthorizeAttribute** attribute class to intercept requests and then ask the **WSFederationAndAuthenticationModule** class to handle the authentication and to retrieve the user's claims from ACS. The **AuthenticateUser** method builds the redirect URL that passes the WS-Federation parameters to the ACS instance that Fabrikam Shipping uses. The following table describes the parameters that the application passes to ACS.

Parameter	Example value	Notes
wa	wsignin1.0	The WS-Federation command.
wtrealm	https://localhost/f-Shipping.7/FederationResult	The realm value that ACS uses to identify the relying party.
wctx	https://localhost/f-Shipping.7/Contoso	The return URL to which ACS should post the token with claims.

The Fabrikam Shipping application does not send a **whr** *parameter identifying the home realm because Fabrikam configures each tenant in ACS as a relying party with only a single identity provider enabled.*

The following code example shows the **AuthenticateUser** method in the **AuthenticateAndAuthorizeAttribute** class.

```
private static void AuthenticateUser(AuthorizationContext context)
{
  var organizationName =
      (string)context.RouteData.Values["organization"];

  if (!string.IsNullOrEmpty(organizationName))
  {
    …
    var returnUrl = GetReturnUrl(context.RequestContext);

  // User is not authenticated and is entering for the first time.
  Var fam =
    FederatedAuthentication.WSFederationAuthenticationModule;
  var signIn = new SignInRequestMessage
      (new Uri(fam.Issuer), fam.Realm)
      {
        Context = returnUrl.ToString(),
        Realm = string.Format
          ("https://localhost/f-shipping.7/{0}",organizationName)
      };
  context.Result =
    new RedirectResult(signIn.WriteQueryString());
  }
  else
  {
    throw new ArgumentException("Tenant name missing.");
  }
}
```

Authorizing Access to Fabrikam Shipping Data

The Fabrikam Shipping application uses the same **AuthenticateAnd Authorize** attribute to handle authorization. For example, Fabrikam Shipping only allows members of the **Shipment Manager** role to cancel orders. The following code example from the **Shipment Controller** class shows how this is declared:

```
[AuthenticateAndAuthorize(Roles = "Shipment Manager")]
[AcceptVerbs(HttpVerbs.Post)]
public ActionResult Cancel(string id)
{
  …
}
```

The **AuthorizeUser** method in the **AuthenticateAndAuthorize Attribute** class determines whether a user has the appropriate **Organization** and **Role** claims:

```
private void AuthorizeUser(AuthorizationContext context)
{
    var organizationRequested =
      (string)context.RouteData.Values["organization"];
    …

    var userOrganization = ClaimHelper
      .GetCurrentUserClaim(Fabrikam.ClaimTypes.Organization).Value;
    if (!organizationRequested.Equals(
        userOrganization, StringComparison.OrdinalIgnoreCase))
    {
        context.Result = new HttpUnauthorizedResult();
        return;
    }

    var authorizedRoles =
        this.Roles.Split(new[] { "," },
             StringSplitOptions.RemoveEmptyEntries);
    bool hasValidRole = false;
    foreach (var role in authorizedRoles)
    {
        if (context.HttpContext.User.IsInRole(role.Trim()))
        {
            hasValidRole = true;
            break;
        }
    }

    if (!hasValidRole)
    {
        context.Result = new HttpUnauthorizedResult();
        return;
    }
}
```

For a discussion of some alternative approaches to authorization that Fabrikam Shipping could have taken, see Appendix G, "Authorization Strategies."

In a multi-tenant application such as Fabrikam Shipping, the authorization rule that checks the **Organization** *claim ensures that a tenant only has access to its own data.*

Setup and Physical Deployment

The following sections describe the setup and physical deployment for the Fabrikam Shipping websites, the simulated claims issuers, and the initialization of the ACS instance.

Fabrikam Shipping Websites

Fabrikam has two separate websites: one for Fabrikam Shipping and one to manage the enrollment process for new partners. This enables Fabrikam to configure the two sites for the different expected usage

Using two separate sites also circumvents a problem that can occur during the enrollment process for a partner that uses a social identity provider. During the enrollment process, a user must sign into their social identity provider so that Fabrikam can capture the claim values that prove that user's identity. The enrollment process then creates the new claims-mapping rules in ACS for the partner. Unless the user running the enrollment process signs out and then signs in again (not a great user experience), they will not get the full set of claims that they require to access the Fabrikam Shipping application.

patterns: Fabrikam expects the usage of the shipping site to be significantly higher than the usage of the enrollment site.

In the sample application, Fabrikam Shipping maintains a list of registered partner organizations using the **Organization** and **OrganizationRepository** classes. The following code sample shows the **Organization** class:

```
C#
public class Organization
{
    public string LogoPath { get; set; }
    public string Name { get; set; }
    public string DisplayName { get; set; }
    public string HomeRealm { get; set; }
}
```

Both the f-Shipping.Enrollment.7 and the f-Shipping.7 web applications need access to this repository, which the sample implements by using a simple file called organizations.txt stored in a folder called SharedData.

The implementation of the enrollment functionality in this sample shows only a basic outline of how you would implement this functionality in a real application.

Sample Claims Issuers

The sample comes with two, pre-configured, claims issuers that act as identity providers for Adatum and Litware. These simulated issuers illustrate the role that a real issuer, such as ADFS 2.0, would play in this scenario. If you want to experiment and extend the sample by enrolling additional partners with their own identity providers, you will need additional issuers. You can either create your own new STS using the WIF "WCF Security Token Service" template in Visual Studio and using either the Adatum.SimulatedIssuer.7 or Litware.SimulatedIssuer.7 projects as a model to work from, or you could use one of the simple issuers for Northwind or AdventureWorks in the Assets folder for this sample.

These simple issuers use the SelfSTS sample application that you can read about here: **http://archive.msdn.microsoft.com/SelfSTS**.

Initializing ACS

The sample application includes a set of pre-configured partners for Fabrikam Shipping, both with and without their own identity providers. These partners require identity providers, relying parties, and claims-mapping rules in ACS in order to function. The ACS.Setup project in the solution is a simple console application that you can run to add the necessary configuration data for the pre-configured partners to your ACS instance. It uses the ACS Management API and the wrapper classes in the ACS.ServiceManagementWrapper project.

You will still need to perform some manual configuration steps; the ACS Management API does not enable you to create a new service namespace. You must perform this operation in the ACS management portal.

Questions

1. Why does Fabrikam want to use ACS in the scenario described in this chapter?

    a. Because it will simplify Fabrikam's own internal infrastructure requirements.

    b. Because it's the only way Fabrikam can support users who want to use a social identity provider for authentication.

    c. Because it enables users with social identities to access the Fabrikam Shipping application more easily.

    d. Because ACS can authenticate users with social identities.

2. In the scenario described in this chapter, why is it necessary for Fabrikam to configure ACS to trust issuers at partners such Adatum and Litware?

    a. Because Fabrikam does not have its own on-premises federation provider.

    b. Because Fabrikam uses ACS for all the claims-mapping rules that convert claims to a format that Fabrikam Shipping understands.

    c. Because partners such as Adatum have some users who use social identities as their primary method of authentication.

    d. Because a relying party such as Fabrikam Shipping can only use a single federation provider.

3. How does Fabrikam Shipping manage home realm discovery in the scenario described in this chapter?
    a. Fabrikam Shipping presents unauthenticated users with a list of federation partners to choose from.
    b. Fabrikam Shipping prompts unauthenticated users for their email addresses. It parses each address to determine which organization the user belongs to.
    c. ACS manages home realm discovery; Fabrikam Shipping does not.
    d. Each partner organization has its own landing page in Fabrikam Shipping. Visiting that page will automatically redirect unauthenticated users to that organization's identity provider.
4. Enrolling a new partner without its own identity provider requires which of the following steps?
    a. Updating the list of registered partners stored by Fabrikam Shipping. This list includes the home realm of the partner.
    b. Adding a new identity provider to ACS.
    c. Adding a new relying party to ACS.
    d. Adding a new set of claims-mapping rules to ACS.
5. Why does Fabrikam use a separate web application to handle the enrollment process?
    a. Because the expected usage patterns of the enrollment functionality are very different from the expected usage patterns of the main Fabrikam Shipping web site.
    b. Because using the enrollment functionality does not require a user to authenticate.
    c. Because the site that handles enrolling new partners must also act as a federation provider.
    d. Because the site that updates ACS with new relying parties and claims-mapping rules must have a different identity from sites that only read data from ACS.

More Information

Appendix E of this guide provides a detailed description of ACS and its features.

8 Claims Enabling Web Services

In Chapter 4, "Federated Identity for Web Applications," you saw Adatum make the a-Order application available to its partner Litware. Rick, a salesman from Litware, used his local credentials to log onto the a-Order website, which was hosted on Adatum's domain.

To do this, Rick needed only a browser to access the a-Order website. But what would happen if the request came from an application other than a web browser? What if the information supplied by aOrder was going to be integrated into one of Litware's in-house applications?

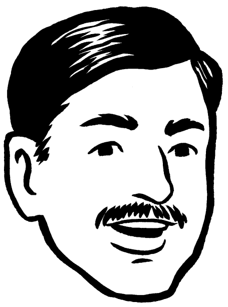
Federated identity with an active (or "smart") client application works differently than federated identity with a web browser. In a browser-based scenario, the web application requests security tokens by redirecting the user's browser to an issuer that produces them. (This process is shown in the earlier scenarios.) With redirection, the browser can handle most of the authentication for you. In the active scenario, the client application actively contacts all issuers in a trust chain (these issuers are typically an identity provider (IdP) and a federation provider (FP)) to get and transform the required tokens.

Active clients do not need HTTP redirection.

In this chapter, you'll see an example of a smart client that uses federated identity. Fortunately, support for Microsoft® Windows® Communication Foundation (WCF) is a standard feature of the Windows Identity Foundation (WIF). Using WCF and WIF reduces the amount of code needed to implement both claims-aware web services and claims-aware smart clients.

The Premise

Litware wants to write an application that can read the status of its orders directly from Adatum. To satisfy this request, Adatum agrees to provide a web service called a-Order.OrderTracking.Services that can be called by Litware over the Internet.



If Active Directory® Federation Services (ADFS) 2.0 is used, support for federated identity with active clients is a standard feature.

Active clients use claims to get access to remote services.

Adatum and Litware have already done the work necessary to establish federated identity, and they both have issuers capable of interacting with active clients. The necessary communications infrastructure, including firewalls and proxies, is in place. To review these elements, see Chapter 4, "Federated Identity for Web Applications."

Now, Adatum only needs to expose a claims-aware web service on the Internet. Litware will invoke Adatum's web service from within its client application. Because the client application runs in Litware's security realm, it can use Windows authentication to establish the identity of the user and then use this identity to obtain a token it can pass along to Adatum's federation provider.

Goals and Requirements

Both Litware and Adatum see benefits to a collaboration based on claims-aware web services. Litware wants programmatic access to Adatum's a-Order application. Adatum does not want to be responsible for authenticating any people or resources that belong to another security realm. For example, Adatum doesn't want to keep and maintain a database of Litware users.

Both Adatum and Litware want to reuse the existing infrastructure as much as possible. For example, Adatum wants to enforce permissions for its web service with the same rules it has for the browser-based web application. In other words, the browser-based application and the web service will both use roles for access control.

Overview of the Solution

Figure 1 gives an overview of the proposed system.

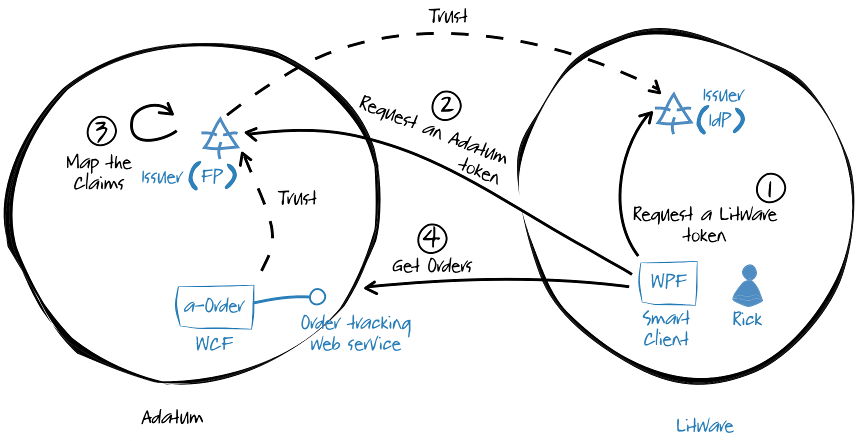


FIGURE 1

Federated identity with a smart client

The diagram shows an overview of the interactions and relationships among the different components. It is similar to the diagrams you saw in the previous chapters, except that no HTTP redirection is involved.

Litware's client application is based on Windows Presentation Foundation (WPF) and is deployed on Litware employees' desktops. Rick, the salesman at Litware, uses this application to track orders with Litware.

Adatum exposes a SOAP web service on the Internet. This web service is implemented with WCF and uses standard WCF bindings that allow it to receive Security Assertion Markup Language (SAML) tokens for authentication and authorization. In order to access this service, the client must present a security token from Adatum.

The sequence shown in the diagram proceeds as follows:

1. Litware's WPF application uses Rick's credentials to request a security token from Litware's issuer. Litware's issuer authenticates Rick and, if the authentication is a success, returns a **Group** claim with the value **Sales** because Rick is in the sales organization.
2. The WPF application then forwards the security token to Adatum's issuer, which has been configured to trust Litware's issuer.
3. Adatum's issuer, acting as a federation provider, transforms the claim **Group:Sales** into **Role:Order Tracker** and adds a new claim, **Organization:Litware**. The transformed claims are the ones required by Adatum's web service, a-Order. OrderTracking.Services. These are the same rules that were defined in the browser-based scenario.
4. Finally, the WPF application sends the web service the request to return orders. This request includes the security token obtained in the previous step.

This sequence is a bit different from a browser-based web application because the smart client application knows the requirements of the web service in advance and also knows how to acquire the claims that satisfy the web service's requirements. The client application goes to the identity provider first, the federation provider second, and then to the web service. The smart client application actively drives the authentication process.

Inside the Implementation

Now is a good time to walk through some of the details of the solution. As you go through this section, you may want to download the Microsoft Visual Studio® solution, 4ActiveClientFederation, from **http://claimsid.codeplex.com**. If you are not interested in the mechanics, you should skip to the next section.

You can implement a claims-based smart client application using the built-in facilities of WCF, or you can code at a lower level using the WIF API. The a-Order.OrderTracking web service uses WCF standard bindings.

The a-Order.OrderTracking web service uses WCF standard bindings.

Implementing the Web Service

The web service's Web.config file contains the following WCF service configuration.

```
<services>
   <service
      name="AOrder.OrderTracking.Services.OrderTrackingService"
      behaviorConfiguration="serviceBehavior">
     <endpoint
        address=""
        binding="ws2007FederationHttpBinding"

        bindingConfiguration=
              "WS2007FederationHttpBinding_IOrderTrackingService"
        contract=
           "AOrder.OrderTracking.Contracts.IOrderTrackingService"
        />
     <endpoint address="mex" binding="mexHttpBinding"
               contract="IMetadataExchange" />
   </service>
</services>
```

If your service endpoints support metadata exchange, as a-Order tracking does, it's easy for clients to locate services and bind to them using tools such as Svcutil.exe. However, some manual editing of the configuration that is auto-generated by the tools will be necessary in the current example because it involves two issuers: the identity provider and the federation provider. With only one issuer, the tool will generate a configuration file that does not need editing.

The Web.config file contains binding information that matches the binding information for the client. If they don't match, an exception will be thrown.

The Web.config file also contains some customizations. The following XML code shows the first customization.

```
<extensions>
   <behaviorExtensions>
      <add name="federatedServiceHostConfiguration"
           type="Microsoft.IdentityModel
           .Configuration.ConfigureServiceHostBehaviorExtensionElement,
          Microsoft.IdentityModel, ..." />
   </behaviorExtensions>
</extensions>
```

Adding this behavior extension attaches WIF to the WCF pipeline. This allows WIF to verify the security token's integrity against the public key. (If you forget to attach WIF, you will see a run-time exception with a message that says that a service certificate is missing.)

The service's Web.config file uses the **<Microsoft.identity Model>** element to specify the configuration required for the WIF component. This is shown in the following code example.

```
<microsoft.identityModel>
  <service>
     <issuerNameRegistry
        type=
          "Microsoft.IdentityModel.Tokens.
                ConfigurationBasedIssuerNameRegistry,
                Microsoft.IdentityModel, Version=3.5.0.0,
             Culture=neutral,
             PublicKeyToken=31bf3856ad364e35">
       <trustedIssuers>
         <add
          thumbprint="f260042d59e14817984c6183fbc6bfc71baf5462"
          name="adatum" />
       </trustedIssuers>
     </issuerNameRegistry>
     <audienceUris>
        <add value=
          "http://{adatum host}/a-Order.OrderTracking.Services/
                                        OrderTrackingService.svc"
        />
     </audienceUris>
...
```

Because the Adatum issuer will encrypt its security tokens with the web service's X.509 certificate, the **<service>** element of the service's Web.config file also contains information about the web service's private key. This is shown in the following XML code.

```
<serviceCertificate>
   <certificateReference
      findValue="CN=adatum"
      storeLocation="LocalMachine"
      storeName="My"
      x509FindType="FindBySubjectDistinguishedName"/>
</serviceCertificate>
```

Implementing the Active Client

The client application, which acts as the WCF proxy, is responsible for orchestrating the interactions. You can see this by examining the client's App.config file. The following XML code is in the **<system.serviceModel>** section.

```
<client>
  <endpoint
     address=
       "http://{adatum host}/a-Order.OrderTracking.Services/
                                       OrderTrackingService.svc"
     binding="ws2007FederationHttpBinding"
     bindingConfiguration=
               "WS2007FederationHttpBinding_IOrderTrackingService"
     contract="OrderTrackingService.IOrderTrackingService"
     name="WS2007FederationHttpBinding_IOrderTrackingService">
     <identity>
        <dns value="adatum" />
     </identity>
   </endpoint>
</client>
```

The address attribute gives the Uniform Resource Identifier (URI) of the order tracking service.

The binding attribute, **ws2007FederationHttpBinding**, indicates that WCF should use the WS-Trust protocol when it creates the security context of invocations of the a-Order order tracking service.

The Domain Name System (DNS) value given in the **<identity>** section is verified at run time against the service certificate's subject name.

The App.config file specifies three nested bindings in the **<bindings>** subsection. The following XML code shows the first of these bindings.

```
<ws2007FederationHttpBinding>
  <binding
     name="WS2007FederationHttpBinding_IOrderTrackingService">
    <security mode="Message">
      <message>
        <issuer
          address="https://{adatum host}/{issuer endpoint}"
          binding="customBinding"
          bindingConfiguration="AdatumIssuerIssuedToken">
        </issuer>
      </message>
    </security>
  </binding>
</ws2007FederationHttpBinding>
```

The issuer address changes depending on how you deploy the sample. For an issuer running on the local machine, the address attribute of the **<issuer>** *element will be:*

https://localhost/Adatum.FederationProvider.4/Issuer.svc

For ADFS 2.0, the address will be:

https://{adatum host}/Trust/13/IssuedTokenMixed SymmetricBasic256

This binding connects the smart client application to the a-Order.OrderTracking service. Unlike WCF bindings that do not involve claims, this special claims-aware binding includes a message security element that specifies the address and binding configuration of the Adatum issuer. The address attribute represents the active endpoint of the Adatum issuer.

The message security element identifies the issuer.

The nested binding configuration is labeled **AdatumIssuerIssuedToken**. It is the second binding, as shown here.

```
<customBinding>
  <binding name="AdatumIssuerIssuedToken">
    <security
       authenticationMode="IssuedTokenOverTransport"
       messageSecurityVersion=
          "WSSecurity11WSTrust13WSSecureConversation13
                        WSSecurityPolicy12BasicSecurityProfile10"
    >
      <issuedTokenParameters>
        <issuer
           address=
               "https://{litware host}/{issuer endpoint}"
```

The federation binding in the Microsoft .NET Framework 3.5 provides no way to turn off a secure conversation. (This feature is available in version 4.0.) Because ADFS 2.0 endpoints have secure conversation disabled, this example needs a custom binding.

```
          binding="ws2007HttpBinding"
          bindingConfiguration="LitwareIssuerUsernameMixed">
       </issuer>
     </issuedTokenParameters>
   </security>
   <httpsTransport />
  </binding>
</customBinding>
```

The issuer address changes depending on how you deploy the sample. For an issuer running on the local machine, the address attribute of the **<issuer>** *element will be:*

https://localhost/Litware.SimulatedIssuer.4/Issuer.svc

For ADFS 2.0 the address will be:

https://{litware host}/Trust/13/UsernameMixed

The **AdatumIssuerIssuedToken** binding configures the connection to the Adatum issuer that will act as the federation provider in this scenario.

The **<security>** element specifies that the binding uses WS-Trust. This binding also nests the URI of the Litware issuer, and for this reason, it is sometimes known as a *federation binding*. The binding specifies that the binding configuration labeled **LitwareIssuerUsername Mixed** is used for the Litware issuer that acts as the identity provider. The following XML code shows this.

```
<ws2007HttpBinding>
  <binding name="LitwareIssuerUsernameMixed">
     <security mode="TransportWithMessageCredential">
       <message
         clientCredentialType="UserName"
         establishSecurityContext="false"
       />
     </security>
  </binding>
</ws2007HttpBinding>
```

This binding connects the Litware issuer that acts as an identity provider. This is a standard WCF HTTP binding because it transmits user credentials to the Litware issuer.

In a production scenario, the configuration should be changed to **clientCredentialType="Windows"** *to use Windows authentication. For simplicity, this sample uses* **UserName** *credentials. You may want to consider using other options in a production environment.*

When the active client starts, it must provide credentials. If the configured credential type is **UserName**, a **UserName** property must be set. This is shown in the following code.

```
private void ShowOrders()
{
  var client =
          new OrderTrackingService.OrderTrackingServiceClient();

  client.ClientCredentials.UserName.UserName = "LITWARE\\rick";
  client.ClientCredentials.UserName.Password =
                                      "thisPasswordIsNotChecked";

  var orders = client.GetOrdersFromMyOrganization();

  this.DisplayView(new OrderTrackingView()
                   {
                     DataContext =
                         new OrderTrackingViewModel(orders)
                   });
}
```

Using the WIF **WSTrustChannel** gives you more control, but it requires a deeper understanding of WS-Trust.

This step would not be necessary if the application were deployed in a production environment because it would probably use Windows authentication.

WCF federation bindings can handle the negotiations between the active client and the issuers without additional code. You can achieve the same results with calls to the WIF **WSTrustChannel** *class.*

Implementing the Authorization Strategy

The Adatum web service implements its authorization strategy in the **SimpleClaimsAuthorizationManager** class. The service's Web.config file contains a reference to this class in the **<claimsAuthorization Manager>** element.

A claims authorization manager determines which methods can be called by the current user.

```
<claimsAuthorizationManager
   type="AOrder.OrderTracking.Services.
                               SimpleClaimsAuthorizationManager,
             AOrder.OrderTracking.Services" />
```

Adding this service extension causes WCF to invoke the **Check Access** method of the specified class for authorization. This occurs before the service operation is called.

The implementation of the **SimpleClaimsAuthorization Manager** class is shown in the following code.

```
public class SimpleClaimsAuthorizationManager :
                                    ClaimsAuthorizationManager
{
  public override bool CheckAccess(AuthorizationContext context)
  {
    return context.Principal.IsInRole(Adatum.Roles.OrderTracker);
  }
}
```

WIF provides the base class, **ClaimsAuthorizationManager**. Applications derive from this class in order to specify their own ways of checking whether an authenticated user should be allowed to call the web service methods.

The **CheckAccess** method in the a-Order order tracking service ensures that the caller of any of the service's methods must have a role claim with the value **Adatum.Roles.OrderTracker**, which is defined in the **Samples.Web.ClaimsUtilities** project elsewhere as the string, "Order Tracker."

In this scenario, the Litware issuer, acting as an identity provider, issues a **Group** claim that identifies the salesman Rick as being in the Litware sales organization (value=**Sales**). The Adatum issuer, acting as a federation provider, transforms the security token it receives from Litware. One of its transformation rules adds the role, **Order Tracker,** to any Litware employee with a group claim value of **Sales**. The order tracking service receives the transformed token and grants access to the service.

Debugging the Application

The configuration files for the client and the web service in this sample include settings to enable tracing and debugging messages. By default, they are commented out so that they are not active.

If you uncomment them, make sure you update the **<sharedListeners>** section so that log files are generated where you can find them and in a location where the application has write permissions. Here is the XML code.

```
<sharedListeners>
  <add
    initializeData="c:\temp\WCF-service.svclog"
    type="System.Diagnostics.XmlWriterTraceListener"
    name="xml">
    <filter type="" />
  </add>
  <add
    initializeData="c:\temp\wcf-service-msvg.svclog"
    type="System.Diagnostics.XmlWriterTraceListener, System,
               Version=2.0.0.0, Culture=neutral,
               PublicKeyToken=b77a5c561934e089"
    name="ServiceModelMessageLoggingListener"
    traceOutputOptions="Timestamp">
    <filter type="" />
  </add>
</sharedListeners>
```

Setup and Physical Deployment

By default, the web service uses the local host for all components. In a production environment, you would want to use separate computers for the client, the web service, the federation provider, and the identity provider.

To deploy this application, you must substitute the mock issuer with a production-grade component such as ADFS 2.0 that supports active clients. You must also adjust the Web.config and App.config settings to account for the new server names by changing the issuer addresses.

Remove the mock issuer during deployment.

Note that neither the client nor the web service needs to be recompiled to be deployed to a production environment. All of the necessary changes are in the respective .config files.

Configuring ADFS 2.0 for Web Services

In the case of ADFS 2.0, you enable the endpoints using the Microsoft Management Console (MMC).

To obtain a token from Litware, the **UsernameMixed** or **Windows Mixed** endpoint could be used. **UsernameMixed** requires a user name and password to be sent across the wire, while **WindowsMixed** works with the Windows credentials. Both endpoints will return a SAML token.

The "Mixed" suffix indicates that the endpoint uses transport security (based on HTTPS) for integrity and confidentiality; client credentials are included in the header of the SOAP message.

To obtain a token from Adatum, the endpoint used is Issued TokenMixedSymmetricBasic256. This endpoint accepts a SAML token as an input and returns a SAML token as an output. It also uses transport and message security.

In addition, Litware and Adatum must establish a trust relationship. Litware must configure Adatum ADFS as a relying party (RP) and create rules to generate a token based on Lightweight Directory

Access Protocol (LDAP) Active Directory attributes. Adatum must configure Litware ADFS as an identity provider and create rules to transform the group claims into role claims.

Finally, Adatum must configure the a-Order web service as a relying party. Adatum must enable token encryption and create rules that pass role and name claims through.

Questions

1. Which statements describe the difference between the way federated identity works for an active client as compared to a passive client:
    a. An active client uses HTTP redirects to ask each token issuer in turn to process a set of claims.
    b. A passive client receives HTTP redirects from a web application that redirect it to each issuer in turn to obtain a set of claims.
    c. An active client generates tokens to send to claims issuers.
    d. A passive client generates tokens to send to claims issuers.
2. A difference in behavior between an active client and a passive client is:
    a. An active client visits the relying party first; a passive client visits the identity provider first.
    b. An active client does not need to visit a federation provider because it can perform any necessary claims transformations by itself.
    c. A passive client visits the relying party first; an active client visits the identity provider first.
    d. An active client must visit a federation provider first to determine the identity provider it should use. Passive clients rely on home realm discovery to determine the identity provider to use.

3. The active scenario described in this chapter uses which protocol to handle the exchange of tokens between the various parties?
    a. WS-Trust
    b. WS-Transactions
    c. WS-Federation
    d. ADFS
4. In the scenario described in this chapter, it's necessary to edit the client application's configuration file manually, because the Svcutil.exe tool only adds a binding for a single issuer. Why do you need to configure multiple issuers?
    a. The metadata from the relying party only includes details of the Adatum identity provider.
    b. The metadata from the relying party only includes details of the client application's identity provider.
    c. The metadata from the relying party only includes details of the client application's federation provider.
    d. The metadata from the relying party only includes details of the Adatum federation provider.
5. The WCF service at Adatum performs authorization checks on the requests that it receives from client applications. How does it implement the checks?
    a. The WCF service uses the **IsInRole** method to verify that the caller is a member of the **OrderTracker** role.
    b. The Adatum federation provider transforms claims from other identity providers into **Role** type claims with a value of **OrderTracker**.
    c. The WCF service queries the Adatum federation provider to determine whether a user is in the **Order Tracker** role.
    d. It does not need to implement any authorization checks. The application automatically grants access to anyone who has successfully authenticated.

9 Securing REST Services

In Chapter 8, "Claims Enabling Web Services," you saw how Adatum exposed a SOAP-based web service to a client application. The client used the WS-Trust active federation protocol to obtain a token containing the claims that it needed to access the web service. The scenario that this chapter describes is similar, but differs in that the web service is REST-based rather than SOAP-based. The client must now send a Simple Web Token (SWT) containing the claims to the web service using the OAuth protocol instead of a SAML token using the WS-Trust protocol. The client will obtain an SWT token from Windows Azure™ AppFabric Access Control services (ACS) v2.

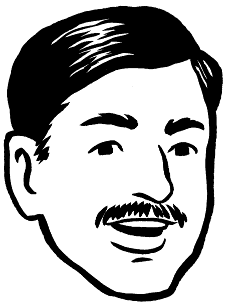
Like Chapter 8, "Claims Enabling Web Services," this chapter describes an active scenario. In an active scenario, the client application actively contacts all issuers in a trust chain; these issuers are typically an identity provider (IdP) and a federation provider (FP). The client application communicates with the identity provider and federation provider to get and transform the tokens that it requires to access the relying party (RP) application.

The client application must actively call all the issuers in the trust chain.

In this chapter, you'll see an example of a Windows® Presentation Foundation (WPF) smart client application that uses federated identity. In Chapter 8, "Claims Enabling Web Services," the Windows Communication Foundation (WCF) bindings determined how the client application called the issuers in the trust chain; in this chapter, you'll see how the client must call the identity provider and federation provider programmatically because WCF does not support the calling of RESTful web services.

The Premise

Litware wants to write an application that can read the status of its orders directly from Adatum. To satisfy this request, Adatum agrees to provide a web service called a-Order.OrderTracking.Services that



If Active Directory® Federation Services (ADFS) 2.0 is used, you'll get support for federated identity with active clients as a standard feature.

users at Litware can access by using a variety of client applications over the Internet.

Adatum and Litware have already done the work necessary to establish federated identity, and they both have issuers capable of interacting with active clients. The necessary communications infrastructure, which includes firewalls and proxies, is in place. To review these elements, see Chapter 4, "Federated Identity for Web Applications."

Now, Adatum only needs to expose a claims-aware web service on the Internet. Litware will invoke Adatum's web service from within its client application. Because the client application runs in Litware's security realm, it can use Microsoft® Windows® authentication to establish the identity of the user and then use this identity to obtain a token it can pass along to Adatum's federation provider. In this scenario Adatum uses ACS as its federation provider.

Goals and Requirements

Active clients use claims to get access to remote services.

Both Litware and Adatum see benefits in a collaboration based on claims-aware web services. Litware wants programmatic access to Adatum's a-Order application. Adatum does not want to be responsible for authenticating any people or resources that belong to another security realm. For example, Adatum doesn't want to keep and maintain a database of Litware users.

Both Adatum and Litware want to reuse the existing infrastructure as much as possible. For example, Adatum wants to enforce permissions for its web service with the same rules it has for the browser-based web application. In other words, the browser-based application and the web service will both use roles for access control.

Adatum has decided to expose the a-Order order tracking data as a RESTful web service to expand the range of clients that can access the application. Adatum anticipates that partners will implement client applications on mobile platforms; in these environments partners will prefer a lightweight REST API to a SOAP-based API.

SWT tokens are smaller than SAML tokens because they do not include any XML markup. It is also much easier to manipulate SWT tokens in JavaScript, making SWT the preferred token format for rich JavaScript clients.

Overview of the Solution

Figure 1 gives an overview of the proposed solution.

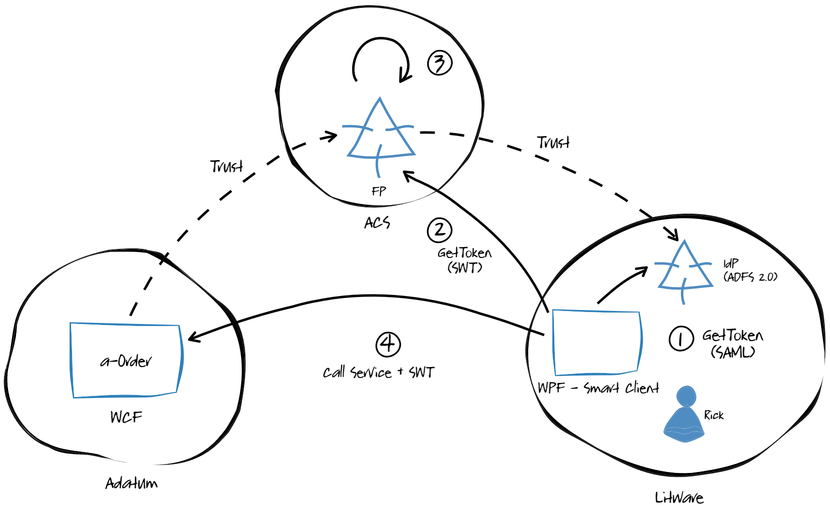


FIGURE 1
Federated identity with a smart client

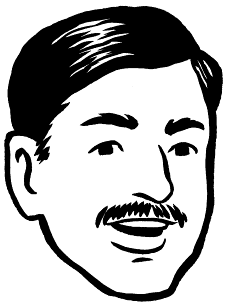
The diagram presents an overview of the interactions and relationships among the different components. It is similar to the diagrams you saw in the previous chapters.

Litware has a single client application based on Windows Presentation Foundation (WPF) deployed on Litware employees' desktops. Rick, a Litware employee, uses this application to track orders with Adatum.

Adatum exposes a RESTful web service on the Internet. This web service expects to receive Simple Web Token (SWT) tokens that it will use to implement authorization rules in the a-Order application. In order to access this service, the client must present an SWT token from the Adatum ACS instance.

The sequence shown in the diagram proceeds as follows:

1. The Litware WPF application uses Rick's credentials to request a security token from the Litware issuer. The Litware issuer authenticates Rick and, if the authentication succeeds, it returns a **Group** claim with the value **Sales** because Rick is in the sales organization. The Litware issuer returns a SAML token to the client application.



It's also possible to wrap SWT tokens in the WS-Trust and WS-Federation protocols by using a **BinarySecurity TokenElement**.

2. The WPF application then forwards the SAML token to ACS (the Adatum federation provider), which trusts the Litware issuer.
3. ACS, acting as a federation provider, transforms the claim **Group:Sales** into **Role:Sales** and adds a new claim, **Organization:Litware**. The transformed claims are the ones required by the Adatum a-Order RESTful web service. These are the same rules that were defined in the browser-based scenario. ACS also transitions the incoming SAML token to an SWT token that it returns to the client WPF application. The interaction between the client application and ACS uses the OAuth protocol.
4. Finally, the WPF application sends the web service the request for the order tracking data. This request includes the SWT token obtained in the previous step. The web service uses the claims in the token to implement its authorization rules.

This sequence is a bit different from the scenario described in Chapter 8, "Claims Enabling Web Services." In this scenario, the federation provider is an ACS instance that performs token format transition from SAML to SWT in addition to mapping the claims from the identity provider into claims that the relying party expects to see.

Inside the Implementation

Now is a good time to walk through some of the details of the solution. As you go through this section, you may want to download the Visual Studio® development system solution called 8ActiveRestClientFederation from http://claimsid.codeplex.com. If you are not interested in the mechanics, you should skip to the next section.

WCF does not provide built-in support for REST on the client or for SWT on the server so this sample requires more code than you saw in Chapter 8, "Claims Enabling Web Services."

The following sections describe some of the key parts of the implementation of the active client, the RESTful web service, and ACS.

The ACS Configuration

In this scenario, in addition to handling the claims mapping rules, ACS is also responsible for transitioning the incoming token from the Litware identity provider from the SAML format to the SWT format. This is partially a configuration task, but the active client application must be able to receive an SWT token from ACS. For more details, see the section, "Implementing the Active Client," later in this chapter.

The configuration step in ACS is to ensure that the token format for the aOrderService relying party is set to SWT. This makes sure that ACS issues an SWT token when it receives a token from any of the identity providers configured for the aOrderService relying party.

Implementing the Web Service

In this scenario, Adatum exposes the order-tracking feature of the a-Order application as a RESTful web service. The following snippet from the Web.config file shows how the application defines the HTTP endpoint for the service.

```
<services>
  <service name=
           "AOrder.OrderTracking.Services.OrderTrackingService"
           behaviorConfiguration="serviceBehavior">
    <endpoint
        address=""
        binding="webHttpBinding"
        contract=
        "AOrder.OrderTracking.Contracts.IOrderTrackingService"
        behaviorConfiguration="orders" />
  </service>
</services>
<behaviors>
  <serviceBehaviors>
    <behavior name="serviceBehavior">
      <serviceDebug includeExceptionDetailInFaults="true" />
      <serviceMetadata httpGetEnabled="true" />
    </behavior>
  </serviceBehaviors>
  <endpointBehaviors>
    <behavior name="orders">
      <webHttp />
    </behavior>
  </endpointBehaviors>
</behaviors>
```

In this scenario, the web service does not use Windows Identity Foundation (WIF) to handle the incoming tokens. However, the service does use WIF for some claims processing; for example, it uses it in the **CustomClaimsAuthorizationManager** class. You will see the details in the microsoft.identityModel section in the Web.config file.

The Global.asax file contains code to route requests to the service definition. The following code sample from the Global.asax.cs file shows the routing definition in the service.

```
protected void Application_Start(object sender, EventArgs e)
{
  RouteTable.Routes.Add(new ServiceRoute("orders",
    new WebServiceHostFactory(), typeof(OrderTrackingService)));
}
```

The Adatum a-Order application must also extract the claims information from the incoming SWT token. The application uses the claims to determine the identity of the caller and the roles that the caller is a member of in order to apply the authorization rules in the application. The following code sample from the **OrderTracking Service** class shows how the **GetOrdersFromMyOrganization** method retrieves the current user's **organization** claim to use when it fetches a list of orders from the order repository.

```
public Order[] GetOrdersFromMyOrganization()
{
  string organization = ClaimHelper.GetClaimsFromPrincipal(
         HttpContext.Current.User,
         Adatum.ClaimTypes.Organization).Value;
  var repository = new OrderRepository();
  return repository.GetOrdersByCompanyName(organization).
                                            ToArray();
}
```

This method retrieves a claim value from the **IClaimsPrincipal** object. In the scenarios described in previous chapters, WIF has been responsible for populating the **IClaimsPrincipal** object with claims from a SAML token: in the current scenario, we are using SWT tokens and the OAuth protocol, which are not directly supported by WIF. The Visual Studio solution, 8ActiveRestClientFederation, includes a project called DPE.OAuth that implements an extension to WIF to provide support for SWT tokens and the OAuth protocol.

The following snippet from the Web.config file in the a-Order. OrderTracking.Services.8 project shows how Adatum installed the modules for the extension to WIF.

In addition to the extension module, **Microsoft.Samples.DPE. OAuth.ProtectedResource.ProtectedResourceModule***, it's necessary to install the standard* **WSFederationAuthentication Module** *and* **SessionAuthenticationModule** *modules.*

```
…
<configSections>
  <section name="microsoft.identityModel"
    type="Microsoft.IdentityModel.Configuration.MicrosoftIdentity
    ModelSection,
    Microsoft.IdentityModel, Version=3.5.0.0, Culture=neutral,
    PublicKeyToken=31bf3856ad364e35" />
</configSections>
…
```

```
<system.webServer>
  <validation validateIntegratedModeConfiguration=”false” />
  <modules runAllManagedModulesForAllRequests=”true”>
    <add name=”UrlRoutingModule” type=”System.Web.Routing.
      UrlRoutingModule,
      System.Web, Version=4.0.0.0, Culture=neutral,
      PublicKeyToken=b03f5f7f11d50a3a” />
    <add name=”ProtectedResourceModule”
      type=”Microsoft.Samples.DPE.OAuth.ProtectedResource.
      ProtectedResourceModule,
      Microsoft.Samples.DPE.OAuth, Version=1.0.0.0,
      Culture=neutral” />
    <add name=”WSFederationAuthenticationModule”
      type=”Microsoft.IdentityModel.Web.
      WSFederationAuthenticationModule,
      Microsoft.IdentityModel, Version=3.5.0.0, Culture=neutral,
      PublicKeyToken=31bf3856ad364e35”
      preCondition=”managedHandler” />
    <add name=”SessionAuthenticationModule”
      type=”Microsoft.IdentityModel.Web.
      SessionAuthenticationModule,
      Microsoft.IdentityModel, Version=3.5.0.0, Culture=neutral,
      PublicKeyToken=31bf3856ad364e35”
      preCondition=”managedHandler” />
  </modules>
</system.webServer>
```

You use the **microsoft.identityModel** section to configure the extension module to handle SWT tokens and the OAuth protocol.

```
<microsoft.identityModel>
  <service name="OAuth">
    <audienceUris>
      <add value="https://localhost/a-Order.OrderTracking.
           Services.8" />
    </audienceUris>
    <claimsAuthorizationManager
      type="AOrder.OrderTracking.Services.
      CustomClaimsAuthorizationManager,
      AOrder.OrderTracking.Services.8, Culture=neutral" />
    <securityTokenHandlers>
      <add type="Microsoft.Samples.DPE.OAuth.Tokens.
        SimpleWebTokenHandler,
        Microsoft.Samples.DPE.OAuth" />
    </securityTokenHandlers>
    <issuerTokenResolver
      type="Microsoft.Samples.DPE.OAuth.ProtectedResource
     .ConfigurationBasedIssuerTokenResolver, Microsoft.Samples.
     DPE.OAuth">
      <serviceKeys>
        <add serviceName="https://localhost/a-Order.
          OrderTracking.Services.8"
          serviceKey=
          "lJFL02dwy9n3rCe2YETob1DFHdZmbecmFK1QB88ax7U=" />
      </serviceKeys>
    </issuerTokenResolver>
    <issuerNameRegistry type="Microsoft.Samples.DPE.OAuth.
      ProtectedResource
      .SimpleWebTokenTrustedIssuersRegistry, Microsoft.Samples.
      DPE.OAuth">
      <trustedIssuers>
        <add issuerIdentifier="https://aorderrest-dev.
          accesscontrol.windows.net/"
          name="aOrder" />
      </trustedIssuers>
    </issuerNameRegistry>
  </service>
</microsoft.identityModel>
```

This section also configures a custom claims authorization manager that Adatum uses to apply custom authorization rules in the service. The following code example shows how the service implements the custom claims authorization manager class that checks the caller's role membership and the resource the caller is requesting. The **IOrderTrackingService** interface defines the mapping from the paths "/all" and "/frommyorganization" to the service methods **Get AllOrders** and **GetOrdersFromMyOrganization**.

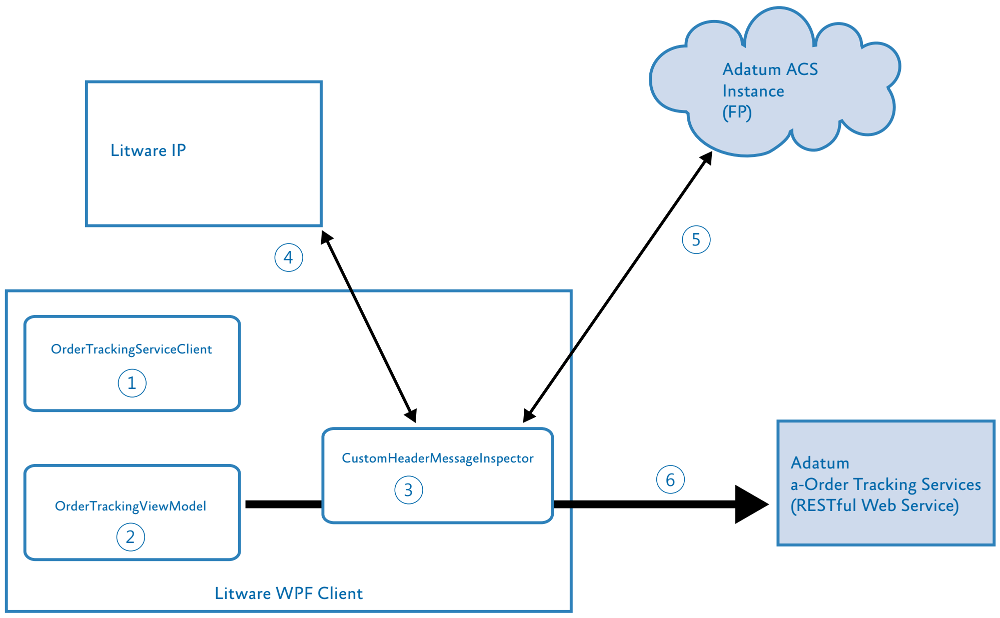
```
public class CustomClaimsAuthorizationManager :
ClaimsAuthorizationManager
{
  public override bool CheckAccess(AuthorizationContext context)
  {
    Claim actionClaim =
      context.Action.Where(x => x.ClaimType == ClaimTypes.Name).
                                                  FirstOrDefault();
    Claim resourceClaim =
      context.Resource.Where(x => x.ClaimType == ClaimTypes.
                                            Name).FirstOrDefault();
    IClaimsPrincipal principal = context.Principal;

    var resource = new Uri(resourceClaim.Value);
    string action = actionClaim.Value;

    if (action == "GET" && resource.PathAndQuery.Contains
                                    ("/frommyorganization"))
    {
      if (!principal.IsInRole(Adatum.Roles.OrderTracker))
      {
        return false;
      }
    }

    if (action == "GET" && resource.PathAndQuery.Contains
                                                  ("/all"))
    {
      if (!principal.IsInRole(Adatum.Roles.OrderApprover))
      {
        return false;
      }
    }

    return true;
  }
}
```

You can also use a custom **ClaimsAuthentication Manager** class to modify the set of claims attached to the **IClaimsPrincipal** object in the context.

To find out more about authorization strategies, take a look at Appendix G, "Authorization Strategies."

Implementing the Active Client

The ACS configuration ensures that the token format for the Adatum a-Order relying party application is set to SWT. ACS issues an SWT token when it receives a token from any of the identity providers configured for the Adatum a-Order relying party (the client obtains the token from the identity provider and sends it ACS). The client application uses a custom endpoint behavior to intercept all outgoing requests; the behavior obtains the token that the relying party requires and attaches it to the request. Figure 2 shows an overview of


Adatum ACS Instance (FP)
Litware IP
4
5
OrderTrackingServiceClient
1
CustomHeaderMessageInspector
3
6
Adatum a-Order Tracking Services (RESTful Web Service)
OrderTrackingViewModel
2
Litware WPF Client

this process.

FIGURE 2
Attaching an SWT token to the outgoing request

The inspector caches the SWT token to avoid having to revisit the identity provider and ACS for every request to the a-Order application. The sample caches the token for 30 seconds, but you should adjust this to a suitable value for your application.

The sequence shown in Figure 2 proceeds as follows.

1. The service client, the **OrderTrackingServiceClient** class, attaches a new behavior to the channel endpoint. This **CustomHeaderBehavior** behavior class instantiates a custom message inspector that has access to every outgoing request on the channel.
2. The client application invokes the **GetOrdersForMy Organization** method that sends a request to the a-Order order tracking Service.
3. The **CustomHeaderMessageInspector** class intercepts the message before it is sent.
4. The **CustomHeaderMessageInspector** class requests a SAML token from the Litware identity provider.
5. The **CustomHeaderMessageInspector** class sends the SAML token to ACS and receives an SWT token.
6. The **CustomHeaderMessageInspector** class attaches the SWT token to the outgoing message header.

Adatum chose to use WCF in the client to manage the call to the REST-based service rather than the **WebClient** *or* **HttpWeb Request** *classes because it was a convenient way to attach the SWT token. For an example that uses the* **HttpWebRequest** *class (because WCF is not available on the Windows® Phone 7 platform), see Chapter 10, "Accessing REST Services from a Windows Phone Device."*

Although WIF does not provide full support for REST-based web services, the sample client application uses WIF to handle some of the token processing. This reduces the amount of code required to implement this sample client application. One of the reasons for using a RESTful web service is to support other client environments, and Chapter 10, "Accessing REST Services from a Windows Phone 7 Device," shows you how to implement a client application without using WIF.

The inspector must first obtain a SAML token from the identity provider. The following code example from the **CustomHeader MessageInspector** class shows how the a-Order.OrderTracking.Client application uses WIF to perform this task. This method takes three arguments; the service endpoint, the STS endpoint, and the user's credentials.

```
private static SecurityToken GetSamlToken(
  string realm, string stsEndpoint, ClientCredentials
  clientCredentials)
{
  using (var factory = new WSTrustChannelFactory(
    new UserNameWSTrustBinding(SecurityMode.
        TransportWithMessageCredential),
    new EndpointAddress(new Uri(stsEndpoint))))
  {
    factory.Credentials.UserName.UserName =
        clientCredentials.UserName.UserName;
    factory.Credentials.UserName.Password =
        clientCredentials.UserName.Password;

    factory.TrustVersion = TrustVersion.WSTrust13;

    WSTrustChannel channel = null;

    try
    {
      var rst = new RequestSecurityToken
        {
          RequestType = WSTrust13Constants.Request
```

```
                        Types.Issue,
          AppliesTo = new EndpointAddress(realm),
          KeyType = KeyTypes.Bearer,
        };

      channel = (WSTrustChannel)factory.CreateChannel();

      return channel.Issue(rst);
    }
    finally
    {
      if (channel != null)
      {
        channel.Abort();
      }

      factory.Abort();
    }
  }
}
```

The token request specifies a bearer token; ACS expects to receive a bearer token and not a holder-of-key token. For this reason it's important to use Secure Sockets Layer (SSL) to secure the connections between the client application and the identity provider, and between the client application and ACS in order to mitigate the threat of a man-in-the-middle attack.

The inspector can then send the SAML token to ACS. The following code example from the **CustomHeaderMessageInspector** class shows how the client application sends the SAML token to ACS and receives the SWT token in return. The application uses the OAuth protocol to communicate with ACS.

```
private static NameValueCollection GetOAuthToken(string
  xmlSamlToken, string serviceEndpoint, string acsRelyingParty)
{
  var values = new NameValueCollection
    {
      { “grant_type”, “urn:oasis:names:tc:SAML:2.0:assertion” },
      { “assertion”, xmlSamlToken },
      { “scope”, acsRelyingParty }
    };
  var client = new WebClient { BaseAddress = serviceEndpoint };

  byte[] acsTokenResponse = client.UploadValues(“v2/Oauth2-13”,
                                   “POST”, values);
  string acsToken = Encoding.UTF8.GetString(acsTokenResponse);
  var tokens = new NameValueCollection();
  var json = new JavaScriptSerializer();
  var parsed = json.DeserializeObject(acsToken) as
                              Dictionary<string, object>;

    foreach (var item in parsed)
    {
        tokens.Add(item.Key, item.Value.ToString());
    }

    return tokens;
}
```

The inspector attaches the SWT token in the **Authorization** header in the HTTP request message that the client application is sending to the a-Order order tracking service. The following code example shows how the client application performs this task in the **BeforeSendRequest** method.

```
var oauthAuthorizationHeader =
  string.Format("OAuth {0}", oauthToken["access_token"]);
httpRequestMessageProperty.Headers.Add(
  HttpRequestHeader.Authorization, oauthAuthorizationHeader);
```

The SWT token expiry time is accessible in the response from ACS and the code in the sample checks the expiry time on the SWT token before attaching it to the outgoing request. With a SAML token, the expiry time is in the token (not part of the response); if the issuer encrypts the SAML token, the client application may not have access to the contents of this token. In this solution, the client application simply forwards the SAML token on to ACS.

You can read the expiry time of a SAML token using the following code:

```
var rst = new RequestSecurityToken
  {
    RequestType = WSTrust13Constants.RequestTypes.Issue,
    AppliesTo = new EndpointAddress(realm),
    KeyType = KeyTypes.Bearer,
  };

channel = (WSTrustChannel)factory.CreateChannel();
RequestSecurityTokenResponse response;
var token = channel.Issue(rst, out response);
var expires = response.Lifetime.Expires.Value;
```

Setup and Physical Deployment

By default, the web service uses the local host for all components. In a production environment, you would want to use separate computers for the client, the web service, the federation provider, and the identity provider.

To deploy this application, you must substitute the mock issuer with a production-grade component such as ADFS 2.0 that supports active clients. You must also adjust the settings in the client application's App.config file to account for the new server names: the addresses for the identity provider and ACS are located in the app Settings section.

Remove the mock issuer during deployment.

Note that neither the client nor the web service needs to be recompiled to be deployed to a production environment unless you are changing the ACS service namespace that your solution uses; in this case, you must update the service namespace name and key in the **CustomServiceHostFactory** class in the a-Order order tracking web service.

Configuring ADFS 2.0 for Web Services

In the case of ADFS 2.0, you enable the endpoints using the Microsoft Management Console (MMC).

To obtain a token from the Litware issuer, you could use the **UsernameMixed** or **WindowsMixed** endpoint. **UsernameMixed** requires a user name and password to be sent across the wire, while **WindowsMixed** works with the Windows credentials. Both endpoints will return a SAML token.

The "Mixed" suffix indicates that the endpoint uses transport security (based on HTTPS). For integrity and confidentiality, client credentials are included in the header of the SOAP message.

Configuring ACS

As a minimum, you should configure the aOrderService relying party in ACS to issue **name** and **organization** claims. If you implement any additional authorization rules, you should ensure that ACS issues any additional claims that your rules require.

To avoid the risk of a partner spoofing an organization name in a token, you should configure ACS to generate the **organization** *claim and not simply pass it through from the identity provider.*

Questions

1. In the scenario described in this chapter, which of the following statements best describes what happens the first time that the smart client application tries to use the RESTful a-Order web service?
    a. It connects first to the ACS instance, then to the Litware IP, and then to the a-Order web service.
    b. It connects first to the Litware IP, then to the ACS instance, and then to the a-Order web service.
    c. It connects first to the a-Order web service, then to the ACS instance, and then to the Litware IP.
    d. It connects first to the a-Order web service, then to the Litware IP, and then to the ACS instance.
2. In the scenario described in this chapter, which of the following tasks does ACS perform?
    a. ACS authenticates the user.
    b. ACS redirects the client application to the relying party.
    c. ACS transforms incoming claims to claims that the relying party will understand.
    d. ACS transitions the incoming token format from SAML to SWT.
3. In the scenario described in this chapter, the Web.config file in the a-Order web service does not contain a <microsoft.identity> section. Why?
    a. Because it configures a custom **ServiceAuthorization Manager** class to handle the incoming SWT token in code.
    b. Because it is not authenticating requests.
    c. Because it is not authorizing requests.
    d. Because it is using a routing table.

4. ACS expects to receive *bearer* tokens. What does this suggest about the security of a solution that uses ACS?
    a. You do not need to use SSL to secure the connection between the client and the identity provider.
    b. You should use SSL to secure the connection between the client and the identity provider.
    c. The client application must use a password to authenticate with ACS.
    d. The use of bearer tokens has no security implications for your solution.
5. You should use a custom **ClaimsAuthorizationManager** class for which of the following tasks.
    a. To attach incoming claims to the **IClaimsPrincipal** object.
    b. To verify that the claims were issued by a trusted issuer.
    c. To query ACS and check that the current request is authorized.
    d. To implement custom rules that can authorize access to web service methods.

More Information

To learn more about proof tokens and bearer tokens, see the blog posts at: http://blogs.msdn.com/b/vbertocci/archive/2008/01/02/on-prooftokens.aspx and http://travisspencer.com/blog/2009/02/what-is-a-proof-key.html.

For more information about the DPE.OAuth project used in this solution, see: http://www.fabrikamshipping.com/.

10 Accessing REST Services from a Windows Phone Device

In Chapter 9, "Securing REST Services," you saw how Adatum exposed a REST-based web service that used federated authentication and SWT tokens. The scenario described there also included a rich desktop client application that obtained a Simple Web Token (SWT) token from Windows Azure™ AppFabric Access Control services (ACS) to present to the web service. The scenario that this chapter describes uses the same web service, but describes how to implement a client application on the Windows® Phone platform.

Creating a Windows Phone client raises some additional security concerns. You can't assume that the Windows Phone device is protected with a password; if the device is stolen or used without the owner's consent, a malicious user could access all of the applications and data on the device unless you introduce some additional security measures. Such security measures could include requiring the user to enter a password or PIN to access either your application, or a feature within your application. The problem here is that any of these security measures are likely to reduce the usability of the application and degrade the overall user experience.

This chapter describes two alternative implementations of the Windows Phone client: a passive federation approach and an active federation approach. The active federation implementation shows how the client application uses the OAuth protocol and contacts all of the issuers in the trust chain in turn to acquire a valid SWT token to access the a-Order Tracking application. The passive implementation shows how to use an embedded web browser control to handle the redirect messages that are used by the WS-Federation protocol to coordinate the exchange of messages with the issuers.

The active federation implementation described in this chapter differs from the implementation shown in Chapter 9, "Securing REST Services." Because there is no version of WIF available for Windows

Phone to help with the token processing, the client code in the Windows Phone application is slightly more complex than you'd typically find in a Microsoft® Windows® operating system desktop application.

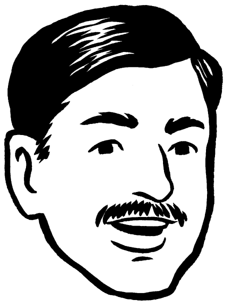
The sample client application demonstrates both active and passive federation approaches.

The Premise

Litware wants a mobile application that can read the status of its orders directly from Adatum. To satisfy this request, Adatum agrees to provide a web service called a-Order.OrderTracking.Services that users at Litware can use from a variety of client applications over the Internet.

Adatum and Litware have already done the work necessary to establish federated identity; Litware has an issuer that is capable of interacting with both active and passive clients, and Adatum has configured an ACS service namespace with the necessary relying parties (RPs) and identity providers (IdPs). The necessary communications infrastructure, including firewalls and proxies, is in place. To review these elements, see Chapter 5, "Federated Identity with Windows Azure Access Control Service."

Adatum also has a RESTful web service in place that exposes order-tracking data. This web service is claims-aware and expects to receive claims in an SWT token. For a description of how the web service handles SWT tokens, see Chapter 9, "Securing REST Services."



If ADFS 2.0 is used, support for federated identity with both active and passive clients is a standard feature.

Goals and Requirements

Both Litware and Adatum see benefits in enabling mobile access to the a-Order tracking data, and Litware already has plans to adopt Windows Phone as its preferred mobile platform. Adatum originally decided to expose the a-Order tracking data using a RESTful web service in anticipation of developing client applications on mobile platforms.

Adatum wants to ensure that the Windows Phone client application follows best practices in terms of integration with the platform and design for optimal battery use. Adatum and Litware are concerned about addressing the possible security issues that arise from using a mobile platform—in particular, the risks associated with someone gaining unauthorized access to a device.

Adatum wants to simplify the process of configuring new identity providers for the Windows Phone application.

Overview of the Solution

The following sections describe two solutions: one that uses an active federated authentication approach, and one that uses a passive federated authentication approach. There is also a discussion of the advantages and disadvantages of each.

Passive Federation

Figure 1 gives an overview of the proposed solution that uses a passive federation model to obtain an SWT token from ACS.

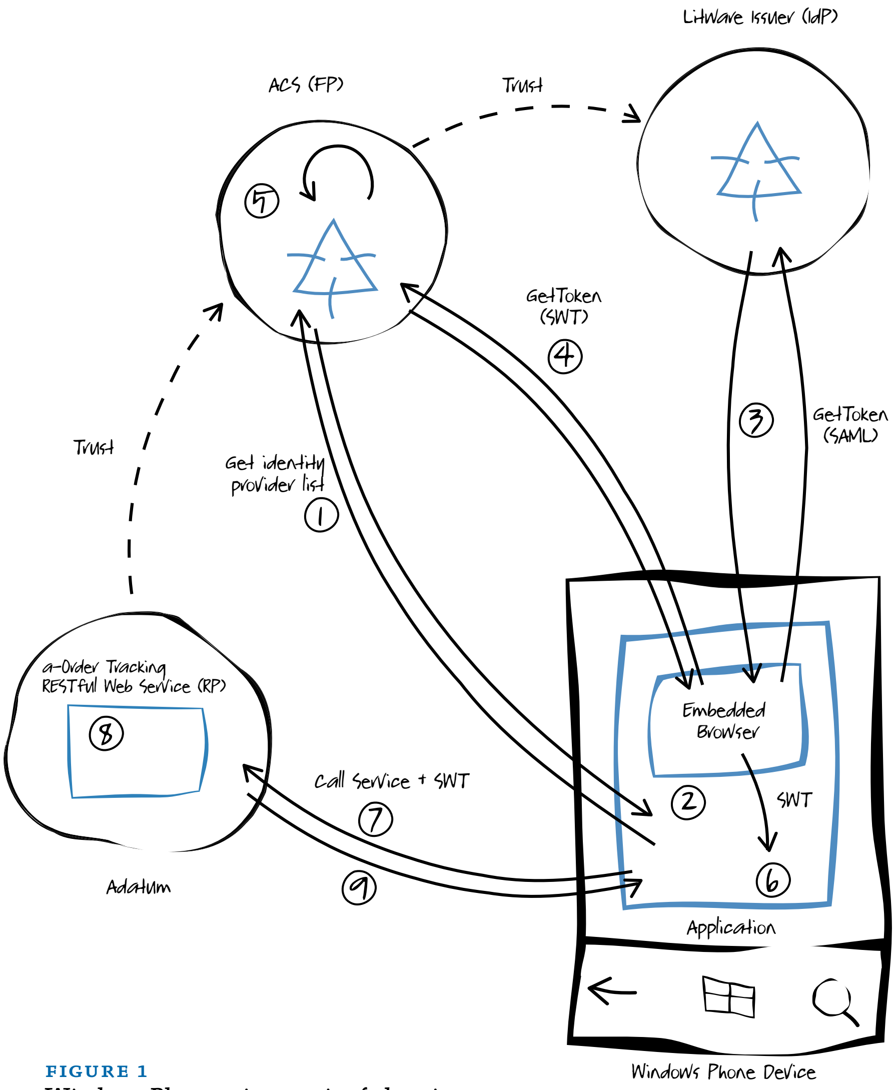


FIGURE 1
Windows Phone using passive federation

Adatum has configured the a-Order tracking web service to trust the Adatum ACS instance.

The diagram presents an overview of the interactions and relationships among the different components. It is similar to the diagrams you saw in previous chapters.

Litware has a Windows Phone client application deployed on Litware employees' phones. Rick, a Litware employee, uses this application to track orders with Adatum.

Adatum exposes a RESTful web service on the Internet. The a-Order tracking web service expects to receive SWT tokens that contain the claims it will use for authorization. In order to access this service, the client must present an SWT token from the Adatum ACS instance.

The sequence shown in the diagram proceeds as follows:

1. The Windows Phone application connects to a service namespace in ACS. It obtains a list of configured identity providers for the relying party (RP) application (Adatum a-Order tracking) as a JavaScript Object Notation (JSON) formatted list. Each entry in this list includes the identity provider's name and the address of the sign-in page at the identity provider. You can find the URL for this list on the ACS Application Management page.
2. The Windows Phone application displays this list for Rick to select the identity provider he wants to use to authenticate.

   In the sample, there is only one identity provider (Litware), so Rick has only one choice.

3. When Rick selects an identity provider, the Windows Phone application uses an embedded web browser control to navigate to the identity provider's sign-in page (based on the information retrieved in step 1).
4. Because the client application initiates the sign-in passively, after the Litware identity provider authenticates Rick it automatically redirects the embedded web browser control back to ACS, passing it the Security Assertion Markup Language (SAML) token from the Litware identity provider.
5. ACS transforms the tokens based on the rules in the service namespace, and transitions the incoming SAML token to an SWT token. ACS returns the SWT token to the embedded browser.
6. The Windows Phone application retrieves the SWT token from the embedded web browser control and then caches it on the Windows Phone device.

7. The Windows Phone application then makes a REST call to the a-Order tracking web service, including the SWT token in the request header.
8. The a-Order tracking web service extracts the SWT token from the request. It uses the claims in the token to implement authorization rules in the a-Order tracking web service.
9. The service returns the order tracking data to the Windows Phone application.

This scenario uses the passive WS-Federation protocol; the interaction between the identity provider and ACS (the federation provider) is passive and uses an embedded web browser control on the phone to handle the redirects. The Windows Phone application invokes the RESTful web service directly, sending the SWT token to the web service (the relying party) along with the request for tracking data.

The only configuration data that the Windows Phone application needs is:

- The URL the phone uses to access the list of identity providers in JSON format from ACS. The Windows Phone application uses this URL in step 1 in the sequence shown in Figure 1.
- The URL the phone uses to access the a-Order tracking RESTful web service. This happens in step 7 in the sequence shown in Figure 1.

The sample application installs a self-issued certificate on the Windows Phone device so that it can use SSL when it communicates with the Litware identity provider and the a-Order tracking application. In a real-world scenario, the Litware identity provider and the a-Order tracking applications will be protected by certificates from a trusted third-party issuer.

This scenario uses Secure Sockets Layer (SSL) to protect all the interactions from the Windows Phone device including accessing the Litware identity provider, the ACS instance, and calling the Adatum web service.

To improve its usability, the Windows Phone application caches the SWT token so that for subsequent requests it can simply forward the cached SWT token instead of re-authenticating with the identity provider, and obtaining a new SWT token from ACS.

Active Federation

Figure 2 shows an alternative solution for the Windows Phone client application that uses a pure active federation approach.

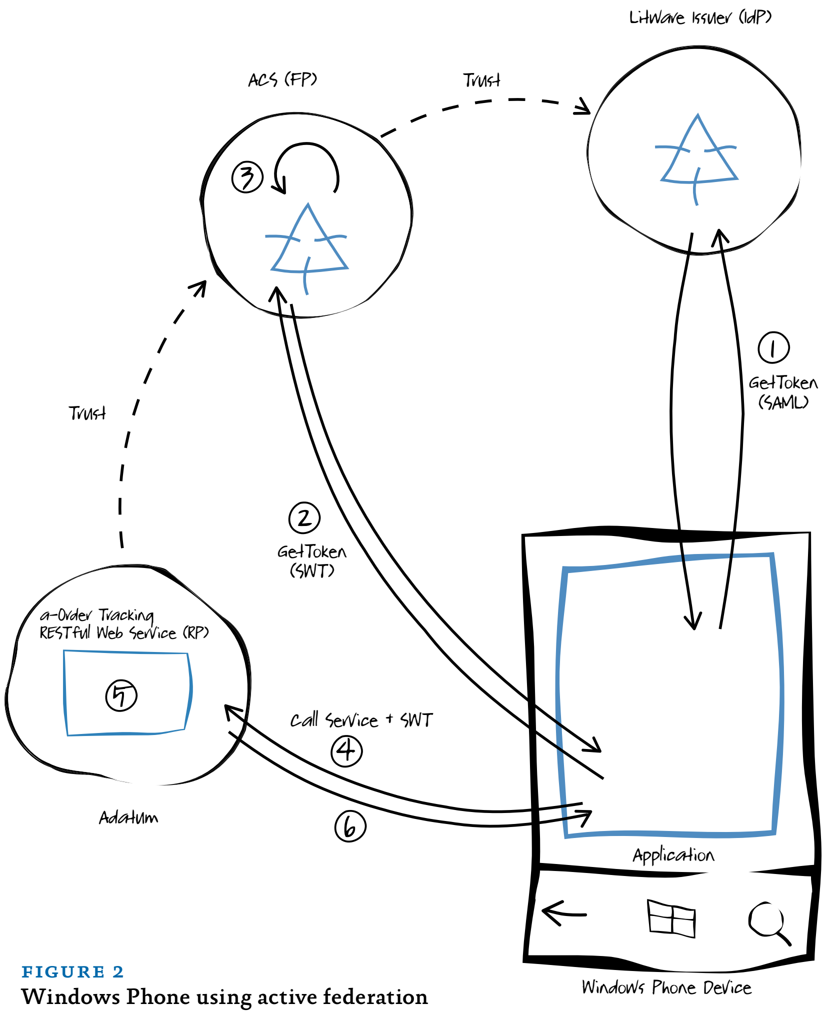


FIGURE 2
Windows Phone using active federation

The diagram presents an overview of the interactions and relationships among the different components in the active federation solution.

Litware has a Windows Phone client application deployed on Litware employees' phones. Rick, a Litware employee, uses this application to track orders with Adatum.

Adatum exposes a RESTful web service on the Internet. This web service expects to receive Simple Web Token (SWT) tokens that it will use to implement authorization rules in the a-Order application. In order to access this service, the client application must present an SWT token from the Adatum ACS instance.

The sequence shown in the diagram proceeds as follows:

1. The Windows Phone application connects the Litware identity provider. It sends Rick's credentials and receives a SAML token in response. This SAML token includes the claims that the Litware identity provider issues for Rick.
2. The Windows Phone application sends the SAML token from the Litware issuer to ACS.
3. The ACS service instance applies the mapping rules for the Litware identity provider to the incoming claims and transitions the incoming SAML token to an SWT token. ACS returns the new SWT token to the Windows Phone client application.
4. The Windows Phone application caches the SWT token so it can use it for future requests. The Windows Phone application then makes a REST call to the a-Order tracking web service, including the SWT token in the request header.
5. The a-Order tracking web service extracts the SWT token from the request. It uses the claims in the token to implement authorization rules in the a-Order tracking web service.
6. The service returns the order tracking data to the Windows Phone application.

In this solution, the Windows Phone application controls the process of obtaining the SWT token and invoking the web service directly. The application code includes logic to visit all of the issuers in the trust chain in the correct order. It uses the WS-Trust protocol when it communicates with the Litware identity provider to obtain a SAML token, and the OAuth protocol to communicate with ACS and the a-Order tracking service.

As in the passive solution, all the interactions from the Windows Phone device are secured using SSL.

Comparing the Solutions

The passive federation solution that leverages an embedded browser control offers a simpler approach to obtaining an SWT token because the embedded web browser control in combination with the WS-Federation protocol handles most of the logic to visit the issuers and obtain the SWT token that the application needs to access the a-Order tracking service. In the active federation solution, the Windows Phone application must include code to control the interactions with the issuers explicitly. Furthermore, the active solution must include

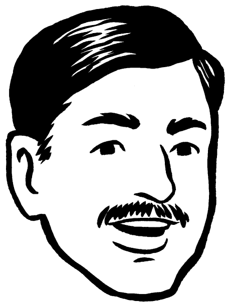
In a WPF application, you can use Windows Identity Foundation (WIF) to perform some of the token handling, even though WIF does not provide full support for RESTful web services.

code to handle the request for a SAML token from the Litware issuer; this is more complex on the Windows Phone platform than on the desktop because there is not currently a version of WIF for Windows Phone. The sample described in Chapter 9, "Securing REST Services," shows you how to do this in a Windows Presentation Foundation (WPF) application.

However, there is some complexity in the passive solution in the way that the application must interact with an embedded web browser control to initiate the sign-in with the Litware identity provider and retrieve the SWT token issued by ACS from the browser control.

For some scenarios, an advantage of the passive federation approach is that it enables the Windows Phone application to dynamically build the list of identity providers for the user to choose from. If you add an additional identity provider to your ACS configuration, the Windows Phone client application will detect this the next time it requests the list of identity providers from ACS. You could use this to quickly and easily add support for additional social identity providers to an already deployed Windows Phone application. In the active federation solution, the application is responsible for choosing the identity provider to use, and although you could design the application to dynamically build a list of identity providers, this would add considerably to the complexity of the solution. The active federation solution is much better suited to scenarios where you have a fixed, known identity provider for the Windows Phone application to use.

If you compare Figures 1 and 2, you can see that the passive solution requires more round trips to obtain an SWT token, which will make this approach slower than the active approach. You should bear in mind that this applies only to the initial federated authentication. If the application caches the SWT token, it can reuse it for subsequent requests to the a-Order tracking web service.



The lifetime of the SAML token is determined by the token issuer.

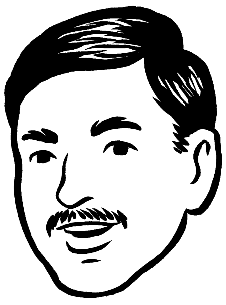
Another potential disadvantage of the active solution is that it only works with a WS-Trust compliant Security Token Service (STS). If the Windows Phone device needs to authenticate with a different protocol, then you'll have to implement that protocol on the phone.

You must explicitly add any SWT token caching behavior to the Windows Phone application for both the active or passive federation solutions; there is no automatic caching provided in either solution. However, in the passive federation solution, the embedded web browser control will automatically cache the SAML token it receives from the Litware identity provider; after the initial authentication with the Litware identity provider, the application will not prompt the user will to re-enter their credentials for as long as the cached SAML token remains valid.

Inside the Implementation

Now is a good time to walk through some of the details of the solution. As you go through this section, you may want to download the Microsoft Visual Studio® development system solution called 9WindowsPhoneClientFederation from http://claimsid.codeplex.com. The following sections describe some of the key parts of the implementation; some of these are specific to either the active or passive federation solution.

For details about the implementation of the a-Order tracking web service, see Chapter 9, "Securing REST Services."



ADFS 2 does not support the OAuth protocol, so the Windows Phone application must use the WS-Trust protocol to obtain a SAML token.

Active SAML Token Handling

The active federation solution must handle the request for a SAML token that the Windows Phone application sends to the Litware identity provider. There is no version of WIF available for the Windows Phone platform, so the application must create the SAML sign-in request programmatically. In the sample application, the **GetSamlTokenRequest** method in the **HttpWebRequestExtensions** class, illustrates a technique for requesting a SAML token when WIF is not available to perform this task for you.

See chapter 9, "Securing REST Services," for an example of an active client that can use WIF to request a SAML token.

The following code sample from the **HttpWebRequestExtensions** class shows how the Windows Phone application creates the SAML token request to send to the identity provider.

```
private static string GetSamlTokenRequest
(string samlEndpoint, string realm)
{
  var tokenRequest =
    string.Format(
    CultureInfo.InvariantCulture,
    samlSignInRequestFormat,
    Guid.NewGuid().ToString(),
    samlEndpoint,
    DateTime.UtcNow.ToString(
      "yyyy'-'MM'-'ddTHH':'mm':'ss'.'fff'Z'"),
    DateTime.UtcNow.AddMinutes(15).ToString(
      "yyyy'-'MM'-'ddTHH':'mm':'ss'.'fff'Z'"),
    "LITWARE\\rick",
    "PasswordIsNotChecked",
    "https://aorderphone-dev.accesscontrol.windows.net/");
    return tokenRequest;
}

/// Format:
/// {0}: Message Id - Guid
/// {1}: To - https://localhost/Litware.SimulatedIssuer.9/
Issuer.svc
/// {2}: Created - 2011-03-11T01:49:29.395Z
/// {3}: Expires - 2011-03-11T01:54:29.395Z
/// {4}: Username - LITWARE\rick
/// {5}: Password - password
/// {6}: Applies To - https://{project}.accesscontrol.
windows.net/
private const string samlSignInRequestFormat =
  @"<s:Envelope xmlns:s=""http://www.w3.org/2003/05/
soap-envelope""
  xmlns:a=""http://www.w3.org/2005/08/addressing""
xmlns:u=""http://docs.oasis-
  open.org/wss/2004/01/oasis-200401-wss-wssecurity-utility-
  1.0.xsd""> … </s:Envelope>";
```

The following code example shows how the client posts the SAML token request to the identity provider and retrieves the SAML token from the response.

```
public static IObservable<string> PostSamlTokenRequest
(this HttpWebRequest request, string tokenRequest)
{
  request.Method = "POST";
  request.ContentType = "application/soap+xml; charset=utf-8";

  return
    Observable
      .FromAsyncPattern<Stream>(request.BeginGetRequestStream,
      request.EndGetRequestStream)()
      .SelectMany(
        requestStream =>
        {
          using (requestStream)
          {
            var buffer = System.Text.Encoding.UTF8.
                                             GetBytes(tokenRequest);
            requestStream.Write(buffer, 0, buffer.Length);
            requestStream.Close();
          }
          return
            Observable.FromAsyncPattern<WebResponse>(
              request.BeginGetResponse,
              request.EndGetResponse)();
        },
        (requestStream, webResponse) =>
        {
          string res = new StreamReader
                                (webResponse.GetResponseStream(),
            Encoding.UTF8).ReadToEnd();
          var startIndex = res.IndexOf("<Assertion ");
          var endIndex = res.IndexOf("</Assertion>");
          var token = res.Substring(
            startIndex, endIndex + "</Assertion>".
                                          Length - startIndex);
          return token;
        });
}
```

Web Browser Control

The passive federation solution uses an embedded web browser control to handle the passive WS-Federation interactions between the client application and the issuers. The application wraps the web browser control in a custom control that you can find in the SL.Phone.Federation project. The Windows Phone application passes the address of the JSON-encoded list of identity providers into this control, and then retrieves the SAML token from the control when the federated authentication process is complete. The following code sample from the MainPage.xaml.cs file shows how the application interacts with the custom sign-in control.

```
private void OnGetMyOrdersPassiveButtonClicked
  (object sender, RoutedEventArgs e)
{
  …

  var acsJsonEndpoint = "https://aorderphone-dev.
         accesscontrol.windows.net/v2/metadata/IdentityProviders.
         js?protocol=wsfederation&
         realm=https%3A%2F%2Flocalhost%2Fa-
         Order.OrderTracking.Services.9&context=&version=1.0";
  SignInControl.RequestSecurityTokenResponseCompleted +=
    new EventHandler<SL.Phone.Federation.Controls
    .RequestSecurityTokenResponseCompletedEventArgs>(
    SignInControl_RequestSecurityTokenResponseCompleted);
  SignInControl.GetSecurityToken(new Uri(acsJsonEndpoint));
}

void SignInControl_RequestSecurityTokenResponseCompleted
(object sender,
  SL.Phone.Federation.Controls.RequestSecurityTokenResponse
  CompletedEventArgs e)
{
  this.GetOrdersWithToken(e.RequestSecurityTokenResponse.
                                                   TokenString)
    .ObserveOnDispatcher()
    .Catch((WebException ex) =>
      {
        …
      }
    .Subscribe(orders =>
      {
        …
      });
}
```

The catch block in the **SignInControl_RequestSecurityToken ResponseCompleted** method enables the client to trap errors such as "401 Unauthorized" errors from the REST service.

The custom control that contains the embedded web browser control must raise the **RequestSecurityTokenResponseCompleted** event after the control receives the SWT token from ACS. The control recognizes when it has received the SWT token because ACS sends a redirect message to a special URL: https://break_here. The ACS configuration for the aOrderService RP includes this value for the "Return URL" setting. The following code sample shows how the **Navigating** event in the custom control traps this navigation request, extracts the SWT token, and raises the **RequestSecurityToken ResponseCompleted** event to notify the Windows Phone application that the SWT token is now available.

```
private void SignInWebBrowserControl_Navigating(object sender,
NavigatingEventArgs e)
{
  if (e.Uri == new Uri("https://break_here"))
  {
    e.Cancel = true;
    var acsReply = this.BrowserSigninControl.SaveToString();

    Regex tagRegex = CreateRegexForHtmlTag
                                     ("BinarySecurityToken");
    var acsBinaryToken = tagRegex.Match(acsReply).Groups[1].
                                                       Value;
    var acsTokenBytes = Convert.FromBase64String(acsBinaryToken);
    var acsToken = System.Text.Encoding.UTF8.GetString(
      acsTokenBytes, 0, acsTokenBytes.Length);

    tagRegex = CreateRegexForHtmlTag("Expires");
    var expires = DateTime.Parse(tagRegex.Match(acsReply).
                                            Groups[1].Value);

    tagRegex = CreateRegexForHtmlTag("TokenType");
    var tokenType = tagRegex.Match(acsReply).Groups[1].Value;

    if (null != RequestSecurityTokenResponseCompleted)
    {
      var rstr = new RequestSecurityTokenResponse();
      rstr.TokenString = acsToken;
      rstr.Expiration = expires;
      rstr.TokenType = tokenType;
      RequestSecurityTokenResponseCompleted(this,
        new RequestSecurityTokenResponseCompletedEventArgs
                                               (rstr, null));
    }
  }
  …
}
```

You must also explicitly enable JavaScript in the embedded web browser control on the phone; otherwise the automatic redirections will fail. The following snippet from the AccessControlServiceSignIn.xaml file shows how to do this.

```
<phone:WebBrowser x:Name="BrowserSigninControl"
IsScriptEnabled="True" Visibility="Collapsed"  />
```

Asynchronous Behavior

Both the active and passive scenarios make extensive use of the Reactive Extensions (Rx) for the Windows Phone platform to interact with issuers and the a-Order tracking web service asynchronously. For example, the active federation solution uses Rx to orchestrate the interactions with the issuers and ensure that they are visited in the correct sequence. The **GetOrders** method in the MainPage.xaml.cs file shows how the client application adds the SWT token to the request header that it sends to the a-Order tracking web service, sends the request, and traps any errors such as "401 Unauthorized" messages, all asynchronously.

```
public IObservable<Order[]> GetOrders()
{
  var stsEndpoint =
         "https://localhost/Litware.SimulatedIssuer.9/Issue.svc";
  var acsEndpoint =
    "https://aorderphone-dev.accesscontrol.windows.net/
                                                  v2/OAuth2-13";

  var serviceEnpoint =
            "https://localhost/a-Order.OrderTracking.Services.9";
  var ordersServiceUri = new Uri
                 (serviceEnpoint + "/orders/frommyorganization");

  return
    HttpClient.RequestTo(ordersServiceUri)
      .AddAuthorizationHeader
                      (stsEndpoint, acsEndpoint, serviceEnpoint)
      .SelectMany(request =>
        {
          return request.Get<Order[]>();
        },
        (request, orders) =>
        {
          return orders;
        })
        .ObserveOnDispatcher()
        .Catch((WebException ex) =>
        {
          var message = GetMessageForException(ex);
          MessageBox.Show(message);
          return Observable.Return(default(Order[]));
        });
}
```

This example uses the **SelectMany** *method instead of the simple* **Select** *method because the call to the* **Get** *method itself returns an* **IObservable<Orders[]>** *instance; using* **Select** *would then return an* **IObservable<IObservable<Orders[]>>** *instance. The* **Select**

Many *method flattens the* **IObservable<IObservable <Orders[]>>** *instance to an* **IObservable<Orders[]>** *instance.*

The following list outlines the nested sequence of calls in the active federated authentication scenario. The process starts when the application calls the **MainPage.GetMyOrdersButton_Click** method, and uses Rx to manage the nested sequence of asynchronous calls.

1. Call the **MainPage.GetOrders** method asynchronously on a background thread.
    a. Create an **HttpWebRequest** object to send to the a-Orders tracking web service.
    b. Call the **HttpWebRequestExtensions.Add AuthorizationHeader** method to add the SWT token to the **HttpWebRequest** object asynchronously.
        i. Create a SAML token request.
        ii. Call the **HttpWebExtensions.PostSamlToken Request** to send the SAML request asynchronously to the Litware identity provider.
            a. Send the SAML request to the Litware identity provider.
            b. Extract the SAML token in the response from the Litware identity provider.
            c. Return the SAML token.
        iii. Call the **HttpWebExtensions.PostSwtToken Request** method to send the SAML token to ACS asynchronously.
            a. Create an SWT token request that contains the SAML token.
            b. Send the SWT token request to ACS.
            c. Extract the SWT token in the response from ACS.
            d. Return the SWT token.
        iv. Add the SWT token to the **HttpWebRequest** object.
        v. Return the **HttpWebRequest** object.

- c. Invoke the a-Orders tracking web service by calling the **HttpWebRequest.Get** method asynchronously.
  - i. Send the web request to the a-Orders tracking web service.
  - ii. Use the **BeginGetResponse** and **EndGet Response** methods to capture the response data.
  - iii. Deserialize the response data to an **Order[]** instance.
  - iv. Return the **Order[]** instance.
- d Return the results as an **Order[]** instance.

2. Update the UI with the result of the call to **MainPage. GetOrders.**

The following list outlines the nested sequence of calls in the passive federated authentication scenario. The process starts when the application calls the **MainPage.OnGetMyOrdersPassive Button_Click** method, and uses Rx to manage the nested sequence of asynchronous calls.

1. Call the **AccessControlServiceSignIn.GetSecurityToken** method to obtain an SWT token.
2. Handle the **AccessControlServiceSignIn.RequestSecurity TokenResponseCompleted** event.
   - a. Call the **MainPage.GetOrdersWithToken** method asynchronously. The SWT token is available in the *EventArgs* parameter.
     - i. Create an HTTP request to send to the a-Order tracking web service.
     - ii. Call the **HttpWebRequestExtensions.Add AuthorizationHeader** method asynchronously to add the SWT token to the request.
     - iii. Invoke the a-Orders tracking web service by calling the **HttpWebRequest.Get** method asynchronously.
       - a. Send the web request to the a-Orders tracking web service.
       - b. Use the **BeginGetResponse** and **EndGet Response** methods to capture the response data.

c. Deserialize the response data to an **Order[]** instance.

d. Return the **Order[]** instance.

iv. Return the **Order[]** instance.

b. From the background thread, update the UI with the **Order[]** instance data by calling the **UpdateOrders** method.

Setup and Physical Deployment

For the sample Windows Phone application to be able to use SSL when it communicates with the sample Litware issuer and Adatum a-Order tracking applications on localhost, it's necessary to install the localhost root certificate on the Windows Phone device. To do this, the Litware sample issuer includes a page that has a link to the required certificate: **http://localhost/Litware.SimulatedIssuer.9/RootCert/Default.aspx**. If you navigate to this address on the Windows Phone device, you can install the root certificate that enables SSL. In a production environment, you should secure your web service and issuer with a certificate from a trusted third-party certificate provider rather than a self-issued certificate; if you do this, it won't be necessary to install a certificate on the Windows Phone device in order to access your issuer and web service using SSL.

In the passive federation scenario, the Windows Phone application uses an embedded web browser control to navigate to the Litware identity provider so that the user can enter her credentials. It's important that the sign-in page at the issuer is "mobile friendly" and displays clearly on the Windows Phone device. You should verify that your issuer renders a suitable sign-in page if you are planning to use a Windows Phone client in a passive federated authentication scenario.

Questions

1. Which of the following are issues in developing a claims-aware application that access a web service for the Windows Phone 7™ platform?

    a. It's not possible to implement a solution that uses SAML tokens on the phone.

    b. You cannot install custom SSL certificates on the phone.

   c. There is no secure storage on the phone.
   d. There is no implementation of WIF available for the phone.

2. Why does the sample application use an embedded web browser control?
   a. To handle the passive federated authentication process.
   b. To handle the active federated authentication process.
   c. To access the RESTful web service.
   d. To enable the client application to use SSL.
3. Of the two solutions (active and passive) described in the chapter, which requires the most round trips for the initial request to the web service?
   a. They both require the same number.
   b. The passive solution requires fewer than the active solution.
   c. The active solution requires fewer than the passive solution.
   d. It depends on the number of claims configured for the relying party in ACS.
4. Which of the following are advantages of the passive solution over the active solution?
   a. The passive solution can easily build a dynamic list of identity providers.
   b. It's simpler to create code to handle SWT tokens in the passive solution.
   c. It's simpler to create code to handle SAML tokens in the passive solution.
   d. Better performance.

5. In the sample solution for this chapter, how does the Windows Phone 7 client application add the SWT token to the outgoing request?
    a. It uses a Windows Communication Foundation (WCF) behavior.
    b. It uses Rx to orchestrate the acquisition of the SWT token and add it to the header.
    c. It uses the embedded web browser control to add the header.
    d. It uses WIF.

More Information

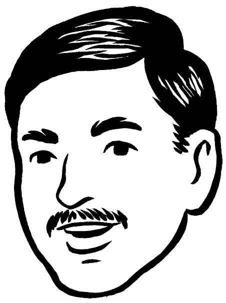
To learn more about developing for Windows Phone 7, see the "Windows Phone 7 Developer Guide" at: **http://msdn.microsoft.com/en-us/library/gg490765.aspx**.

11 Claims-Based Single Sign-On for Microsoft SharePoint 2010

This chapter walks you through an example of integrating two Microsoft® SharePoint® services web applications into a single-sign on (SSO) environment for intranet and extranet web users who all belong to a single security realm. These users can already access other ASP.NET web applications in the SSO environment. You'll see examples of SharePoint applications that Adatum has made claims-aware so that Adatum employees can access the SharePoint applications from the company intranet or from the web.

This basic scenario doesn't show how to establish a trust relationship between enterprises that would allow users from another company to access the SharePoint site; that is discussed in Chapter 12, "Federated Identity for SharePoint Applications." Instead, this chapter focuses on how to implement single sign-on and single sign-off within a security domain as a preparation for sharing resources with other security domains, and how to configure SharePoint to use claims-based authentication and authorization. In short, this scenario contains the commonly used elements that will appear in all claims-aware SharePoint applications. For further information about integrating ASP.NET web applications into an SSO environment and making them claims-aware, you should read Chapter 3, "Claims-Based Single Sign-On for the Web."

For additional information about SharePoint and claims-based identity, see Appendix F, "SharePoint 2010 Authentication Architecture and Considerations."



Most of what you'll see described in this chapter about SharePoint and claims could be achieved without needing to claims-enable SharePoint. However, the claims-based infrastructure that this chapter introduces forms the basis of more advanced scenarios, such as the federated scenario described in the next chapter, which can only be implemented using claims.

The Premise

Adatum is a medium sized company that uses Microsoft Active Directory® to authenticate the employees in its corporate network. Adatum is planning to implement two applications as SharePoint 2010 web applications that employees will access from both the intranet and the Internet:

1. One application is a portal, named a-Portal, where Adatum stores the product documentation that's used by its sales force when they engage with customers. This SharePoint web application consists of a single site collection based on the "Team Site" template.
2. The other is a web application, named a-Techs, where field staff access scheduling information, tasks, and technical data. It also includes a blog where field technicians can capture tips and techniques to share with other team members (and possibly partners in the future). This SharePoint web application consists of two site collections; one based on the "Team Site" template, and one based on the "Blog" template. This web application also uses SharePoint user profile data.

Adatum has already established an SSO environment that includes existing ASP.NET web applications such as the a-Order and a-Expense applications. As part of this environment, Adatum has configured Active Directory Federation Services (ADFS) to act as an identity provider (IdP).

Goals and Requirements

The goals of this scenario are to show how to configure a SharePoint environment to use a claims-based identity model to control access, and how to customize SharePoint to provide a way for a SharePoint farm administrator to effectively manage access to the claims-enabled SharePoint applications.

Configuring a SharePoint environment to use claims includes configuring the trust relationship between SharePoint and ADFS and configuring which claims ADFS passes to SharePoint.

Users must be able to access the SharePoint web applications from both the intranet and Internet as part of an SSO realm that includes other ASP.NET web applications. The environment should also support single sign-out, so that logging out from any ASP.NET or SharePoint web application logs the user out from all applications that are part of the SSO domain.

SharePoint site collection administrators should be able to control access to site collections and sites based on role memberships defined in AD. For example, only users in the Sales role should have access to the a-Portal web application and only users in the Team Leader role should be able to post to the blog in the a-Techs application.

Overview of the Solution

Adatum has created two claims-enabled SharePoint web applications: one for salespersons and one for field technical employees. These applications are available on the intranet and Internet. The following diagram shows the main components of the solution suggested by Adatum.

In SharePoint, you configure an STS by creating a SharePoint trusted identity token issuer.

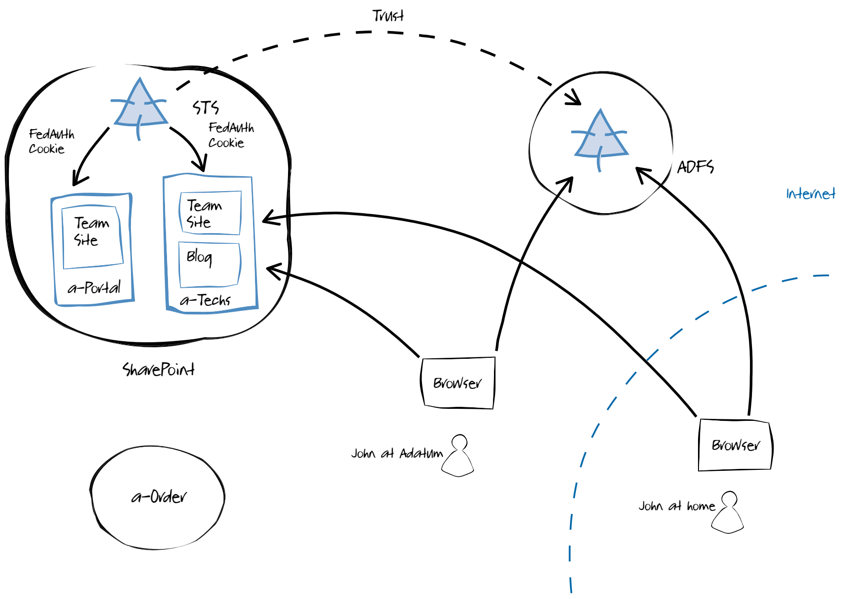


FIGURE 1
Claims-enabled SharePoint applications at Adatum

Authentication Mechanism

Adatum has configured both SharePoint web applications to use ADFS as a Trusted Identity Provider. Adatum has also configured ADFS to use different authentication types depending on where the user is accessing the applications from: intranet users will sign-in automatically using Integrated Windows Authentication, and Internet users will enter their Adatum Windows credentials into a web form. In this way, all users authenticate with Active Directory through ADFS.

During development, it's useful to be able to see the set of claims that a user has. See the section "Displaying Claims in a Web Part" for one way to do this.

An alternative approach that Adatum considered was to configure two authentication types in each web application in SharePoint. SharePoint 2010 allows you to configure multiple authentication mechanisms for a single web application; for example, you could configure a SharePoint web application to use both Windows Authentication and a trusted identity provider. Figure 2 shows the two alternative routes by which user attributes from Active Directory become claims belonging to a SharePoint user in this alternative scenario. The SharePoint security token service (STS) is an instance of a SharePoint trusted identity token issuer; the custom claims providers are optional components.

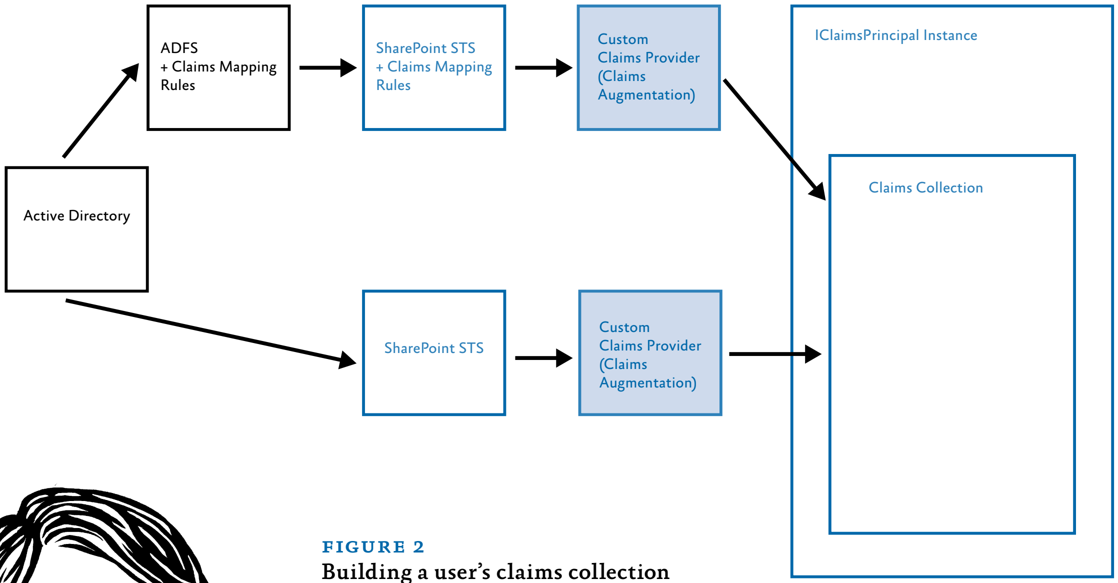

ADFS
+ Claims Mapping Rules
SharePoint STS
+ Claims Mapping Rules
Custom Claims Provider (Claims Augmentation)
IClaimsPrincipal Instance
Claims Collection
Active Directory
SharePoint STS
Custom Claims Provider (Claims Augmentation)

FIGURE 2
Building a user's claims collection

You can use the claims augmentation offered by the custom claims providers to programmatically add additional claims to a user's claims set.

The difficulty with this approach is that although both authentication mechanisms result in a set of claims for the **IClaimsPrincipal Instance** associated with the user, without additional code they are unlikely to generate the same types of claims. For example, the claims from Windows authentication will include **groupsid** claims, while the claims from the trusted identity provider will include **role** claims. An additional complexity of this approach is that you'll probably want to customize the page that SharePoint displays, offering users a choice of authentication provider.

For an example of how a custom claims provider converts SIDs to group names, see this blog post: http://blogs.technet.com/b/speschka/archive/2010/09/12/a-sharepoint-2010-claims-provider-to-convert-role-sids-to-group-names.aspx.

For an example of how to customize the default SharePoint page that presents a choice of authentication providers to the user, see this blog post: http://blogs.msdn.com/b/brporter/archive/2010/05/10/temp.aspx.

For these reasons, Adatum selected the first approach that uses a single trusted identity provider in SharePoint so that they can use the claims-mapping rules in ADFS and ensure that a consistent set of claims reach SharePoint.

End-to-End Walkthroughs

The following sections outline two scenarios for a user who accesses a claims-enabled SharePoint environment: the first scenario describes what happens when a user accesses two different site collections in the same SharePoint web application, the second scenario describes what happens when a user accesses two SharePoint web applications hosted in the same domain.

The walkthroughs below describe the experience of Internet users who must provide their username and password to ADFS in order to authenticate. ADFS will not prompt intranet users (inside the corporate firewall) for their credentials, but will authenticate them using Integrated Windows Authentication: intranet users will not see the sign-in page for ADFS.

Visiting Two Site Collections in a SharePoint Web Application

In this walkthrough, John visits the Document Library and then the Team Site in the a-Techs SharePoint web application.

1. John browses to the Team site in the a-Techs SharePoint web application.
2. John has not yet been authenticated so SharePoint redirects his browser to ADFS. There are several intermediate steps—the SharePoint authentication endpoint and the SharePoint sign-in endpoint—before it arrives at ADFS.
3. John enters his Adatum domain credentials; ADFS validates the credentials, creates a token that contains John's claims, and redirects the browser to the SharePoint STS (the "/_trust/" endpoint in the SharePoint web application references the trusted identity token issuer).
4. The SharePoint STS validates the token from ADFS and issues a FedAuth cookie for the a-Techs SharePoint web application. This cookie contains a reference to the token that contains John's claims; the token itself is stored in the SharePoint token cache.

5. SharePoint checks that John has adequate permissions to access to the Team site collection, and redirects his browser to the site (the "/_layouts/Authenticate.aspx" endpoint in the SharePoint web application performs the permissions check).
6. John browses to the Blog site in the a-Techs SharePoint web Application. He does not require a new token for this site collection because it is part of the same SharePoint web application.

In Chapter 12, "Federated Identity for SharePoint Applications," you can see a sequence diagram that illustrates this process in relation to sliding sessions.

Visiting Two SharePoint Web Applications

In this walkthrough, John visits the a-Portal SharePoint web application and then visits the a-Techs SharePoint web application.

1. John visits the a-Portal SharePoint web application.
    a. John browses to the Team site in the a-Portal SharePoint web application.
    b. John has not yet been authenticated, so SharePoint redirects his browser to ADFS.
    c. John enters his Adatum domain credentials; ADFS validates the credentials, issues a SAML token that contains his claims, and redirects the browser to the SharePoint STS (the "/_trust/" endpoint in the SharePoint web application). ADFS also creates an SSO cookie so that it can recognize if it has already authenticated John.
    d. The SharePoint STS validates the token from ADFS and issues a FedAuth cookie for the a-Portal SharePoint web application that contains a reference to John's claims in the SharePoint token cache.
    e. SharePoint checks that John has access to the Team site collection, and redirects his browser to the site.
2. John visits the a-Techs SharePoint web application.
    a. John browses to the Team site in the a-Techs SharePoint web application.
    b. John has not yet been authenticated for this SharePoint web application so SharePoint redirects his browser to ADFS.

c. ADFS detects the SSO cookie that it issued in step 1-c, and redirects the browser with a new SAML token to the SharePoint STS.

d. The SharePoint STS validates the token from ADFS and issues a FedAuth cookie for the a-Techs SharePoint web application that contains a reference to John's claims in the SharePoint token cache.

e. SharePoint checks that John has sufficient permissions to access to the Team site collection, and redirects his browser to the site.

In this example, it's important to ensure that each SharePoint web application uses its own FedAuth token. If the web applications have different host names, this will happen automatically. However, if in a test environment the web applications share the same host name, the second web application will try to use the existing FedAuth token, which will not be valid for that web application. Each web application must have its own FedAuth token. See the section, "Setup and Physical Deployment," in this chapter for more details.

Authorization in SharePoint

This scenario uses standard SharePoint groups to control access to the sites in the two SharePoint web applications. The following table summarizes the permissions.

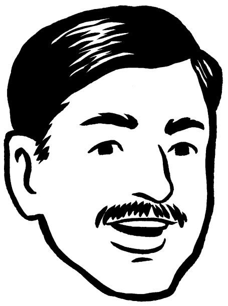
Site	SharePoint Group	Permission level	Role Claim
a-Portal Team site	SalesSite Members	Contribute	sales
a-Techs Team site	TechSite Members	Contribute	techleaders
a-Techs Team site	TechSite Members	Contribute	techs
a-Techs Blog site	TechBlog Members	Contribute	techleaders
a-Techs Blog site	TechBlog Visitors	Read	techs

In SharePoint, a site administrator can add users to a SharePoint group to grant those users the permissions associated with the group. In a claims-based environment, a site administrator can add users to a SharePoint group based on the users' claims; for example, a site administrator could add all authenticated users in the **sales** role to the SharePoint Site Members group by using the Site Permissions Tools.

Mapping claims to SharePoint groups simplifies the administration tasks in SharePoint. There is no need to add individual users to SharePoint groups.

Adatum has modified the SharePoint People Picker to make it easier for site administrators to map role and organization claims to SharePoint groups.

If your identity provider does not provide the claims that you need to implement your authorization rules, you can use claims augmentation in the SharePoint STS to modify existing claim values or to add additional claims to an authenticated user.



In a claims-enabled application, the application receives a set of claims from a trusted issuer about the person accessing the application. This contrasts with the approach whereby the application queries a directory service to discover information about the user. The claims-based approach is much more flexible: the claims can come from many different issuers and be used in a federated identity environment. However, in a claims-based scenario the application may not have direct access to lists of users in a directory.

The People Picker

It is difficult for site administrators at Adatum to use the default people picker to reliably assign permissions in the a-Portal and a-Techs web applications. The default behavior of the people picker is to allow the user to enter part of a user name or group name and then use the search function to locate the user or group. In a claims-enabled SharePoint web application this does not work as expected because there is no repository of users and groups for the people picker to search; the only information SharePoint has is the claims data associated with the current user. The default people picker implementation works around this by always finding a match and resolving the name even if the name is incorrect, which makes it easy for an administrator to make a mistake. For example, let's say the site administrator would like to assign a permission to anyone in the **techs** role. If he makes a typing mistake and searches for **techz** in the people picker he will get a match and be able to assign a permission to a non-existent role.

To prevent this type of error, Adatum implemented a custom **SPClaimsManager** component that can search for role and organization values in a pre-defined list of valid values. Figure 3 shows the overall architecture of the solution that Adatum adopted. There is a central store of valid role and organization names that both ADFS and the SharePoint people picker use: this way Adatum can configure ADFS to issue **role** and **organization** claims that the SharePoint people picker will recognize.

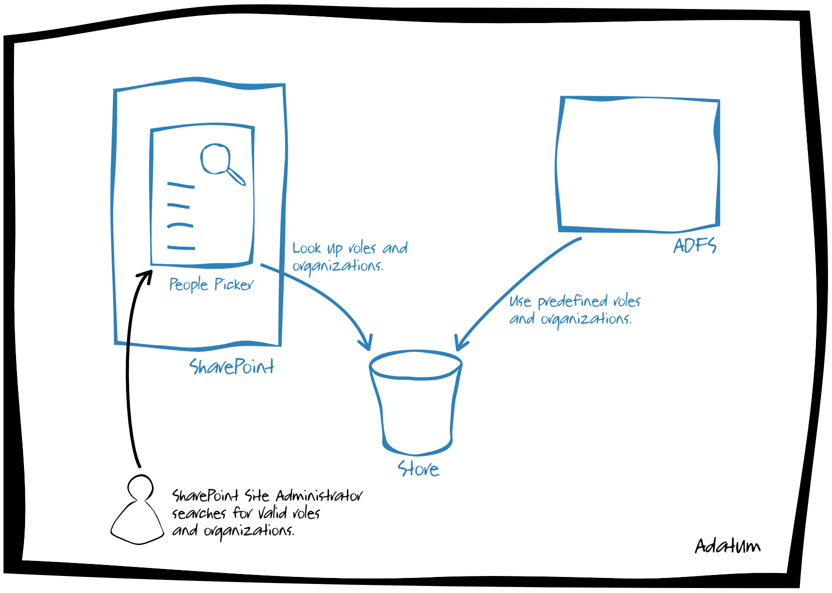

People Picker
SharePoint
Look up roles and organizations.
ADFS
Use predefined roles and organizations.
Store
SharePoint Site Administrator searches for valid roles and organizations.
Adatum

FIGURE 3
Architecture of the Adatum people picker solution

SharePoint and ADFS both run inside the Adatum corporate network. If SharePoint is running in a separate network from ADFS and the store, then a slightly more complex solution is needed. This might arise if SharePoint is running in the cloud, or if SharePoint needs to resolve values used by a partner's directory services. In this case, the architecture might include a lookup service as shown in Figure 4; in SharePoint you can use Business Connectivity Services to make the call to the lookup service, which introduces a useful layer of indirection into the architecture.

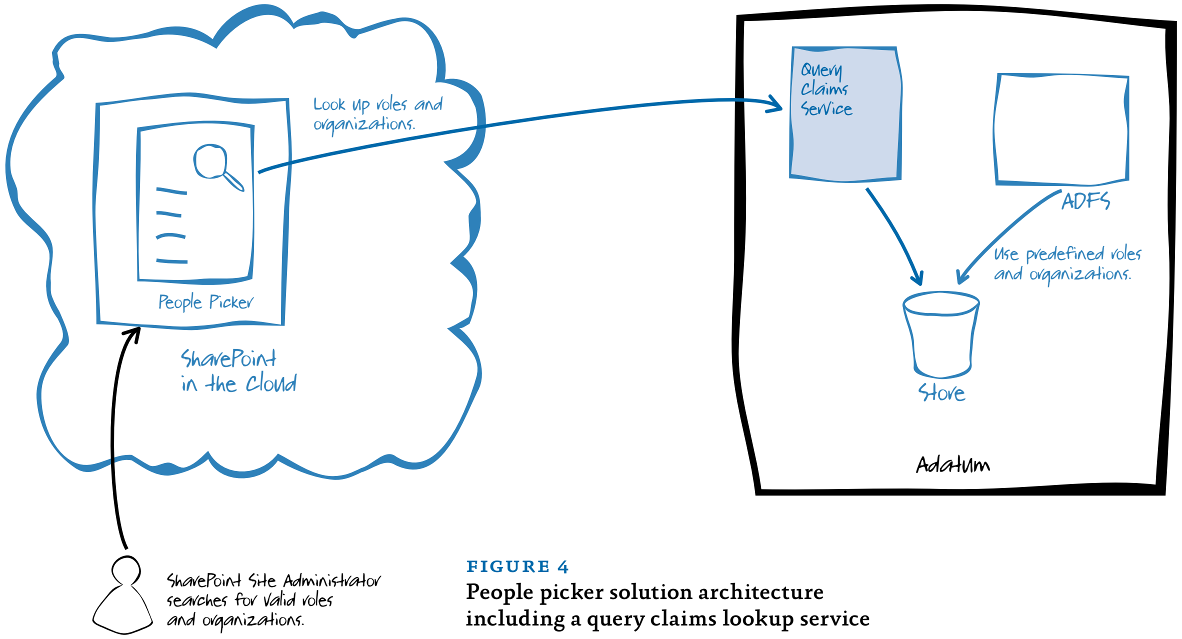
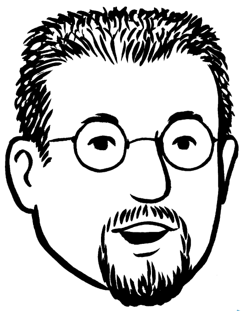

Look up roles and organizations.
People Picker
SharePoint in the Cloud
Query Claims Service
ADFS
Use predefined roles and organizations.
Store
Adatum
SharePoint Site Administrator searches for valid roles and organizations.

FIGURE 4
People picker solution architecture including a query claims lookup service



Adatum plans to use **role** and **organization** claims to assign permissions in SharePoint, and wants to avoid assigning permissions to individual users. However, some organizations may prefer to use names or email addresses to assign permissions in some circumstances. It is still possible to do this in a claims-enabled SharePoint site, but with the standard people picker component, site administrators will face the same problem whereby the people picker resolves both valid and invalid names. To work around this problem you can again create a custom people picker component that resolves **name** and **email address** claim values against your directory service.

In the long run, it's more maintainable to manage permissions based on roles (and organizations) rather than on individuals in SharePoint. You can use Active Directory and ADFS to manage an individual's role and organization membership, while in SharePoint you can focus on mapping roles and organizations to SharePoint groups.

Single Sign-Out

For a SharePoint web application to participate in the single sign-out process, it must be able to handle the following scenarios. For more information about single sign-out and the WS-Federation protocol see Chapter 3, "Claims-Based Single Sign-On for the Web and Windows Azure."

1. The user should be able to initiate the single sign-out from within the SharePoint web application. Adatum modified the behavior of the standard sign-out process to send the WS-Federation **wsignout** message to the token issuer. In the Adatum scenario, this token issuer is ADFS.

2. SharePoint web applications should handle WS-Federation **wsignoutcleanup** messages from the issuer and invalidate any security tokens for the application. For this to work in SharePoint you must configure the SharePoint security token service to use session cookies rather than persistent cookies.

If the user is signing in using Windows authentication in ADFS, then revisits the web application after having signed out, he or she will be signed in automatically and silently. Although the single sign-out has happened, the user won't be aware of it.

By default, SharePoint uses persistent cookies to store the session token, and this means that a user can close the browser and re-open it and get back to the SharePoint web application as long as the cookie has not expired. The consequence of changing to session cookies is that if a user closes the browser, she will always be required to authenticate again when she next visits the SharePoint web application. Adatum prefers this behavior because it provides better security.

The default name for the session cookie is FedAuth.

Inside the Implementation

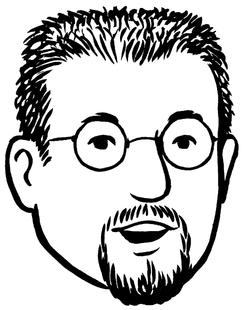
The following sections describe the key configuration steps that Adatum performed in order to implement the scenario that this chapter describes.

Relying Party Configuration in ADFS

Each SharePoint web application is a separate relying party (RP) from the perspective of ADFS. Adatum has configured each of the relying parties to use the WS-Federation protocol and to issue the **emailaddress** and **role** claims for users that it authenticates, passing the values of these claims through from Active Directory. The following table shows the mapping rules that Adatum configured for each relying party in ADFS.

LDAP Attribute	Outgoing claim type
E-Mail-Addresses	E-Mail Address
Token-Groups – Unqualified Names	Role

It's important that the claims issued to SharePoint by ADFS (or any other claims issuer) are SAML 1.x compliant. For a description of the correct name format for claims that will be consumed by SharePoint, see this blog post: http://social.technet.microsoft.com/wiki/contents/articles/ad-fs-2-0-the-admin-event-log-shows-error-111-with-system-argumentexception-id4216.aspx.



SharePoint will send these identifier values in the wtrealm parameter. It's important to make sure that these identifiers match the configuration in SharePoint. These examples show the recommended format for these identifiers; however, there is no specific required format.

ADFS must be able to identify which relying party a request comes from so that it can issue the correct set of rules. The sample scenario uses the identifiers shown in the following table:

Relying Party	Identifiers
a-Portal SharePoint web application	urn:adatum-portal:sharepoint
a-Techs SharePoint web application	urn:adatum-techs:sharepoint

As part of the configuration in ADFS, you must specify the URL of the relying party WS-Federation protocol endpoint: this URL will be the "/_trust/" path in your SharePoint web application.

You must enter the required information in ADFS manually (or create Windows® PowerShell® command-line interface scripts); SharePoint does not expose a FederationMetadata.xml document that you can use to automate the configuration.

SharePoint STS Configuration

You must configure the SharePoint STS to trust the ADFS issuer, and map the incoming claims from ADFS to claims that your SharePoint applications will use. The following sections describe the steps you must perform to complete this configuration.

Remember to install the SharePoint PowerShell snap-in before attempting to run any SharePoint PowerShell scripts. You can do this with the following PowerShell command:

Add-PSSnapin Microsoft.Sharepoint.Powershell

Create a New SharePoint Trusted Root Authority

ADFS signs the tokens that it issues with a token signing certificate. You must import into SharePoint a certificate that it can use to validate the token from ADFS. You can use the following PowerShell commands to import a certificate from the adfs.cer file:

```
$cert = New-Object System.Security.Cryptography.X509Certificates.
X509Certificate2("C:\adfs.cer ")
New-SPTrustedRootAuthority
-Name "Token Signing Cert"
-Certificate $cert
```

You can export this certificate from ADFS using the certificates node in the ADFS 2.0 Management console.

If the signing certificate from ADFS has one or more parent certificates in its certificate chain, you must add these to SharePoint as well. You can use the same SharePoint command to do this.

Notice that you must import any certificates that SharePoint uses into SharePoint; SharePoint does not use the trusted root authorities in the certificate store on the local machine.

Create the Claims Mappings in SharePoint

To map the incoming claims from ADFS to claims that SharePoint uses, you must create some mapping rules. The following PowerShell commands show how to create rules to pass through the incoming **emailaddress** and **role** claims.

```
$map = New-SPClaimTypeMapping
-IncomingClaimType "http://schemas.xmlsoap.org/ws/2005/05/
identity/claims/emailaddress"
-IncomingClaimTypeDisplayName "EmailAddress"
-SameAsIncoming

$map2 = New-SPClaimTypeMapping
-IncomingClaimType "http://schemas.microsoft.com/ws/2008/06/
identity/claims/role" -IncomingClaimTypeDisplayName "Role"
–SameAsIncoming
```

You can choose to perform your claims mapping either as a part of the relying party definition in ADFS, or in the SharePoint STS. However, the rules-mapping language in ADFS is the more flexible of the two.

For an example of how to add additional claim types, see the "People Picker Customizations" section later in this chapter.

Create a New SharePoint Trusted Identity Token Issuer

A SharePoint trusted identity token issuer binds together the details of the identity provider and the mapping rules to associate them with a specific SharePoint web application. The following PowerShell commands show how to add the configuration settings for the scenario that this chapter describes. This script uses the **$cert**, **$map**, and **$map2** variables from the previous script snippets.

```
$ap = New-SPTrustedIdentityTokenIssuer
-Name "SAML Provider"
-Description "Uses Adatum ADFS as an identity provider"
-Realm "urn:adatum-portal:sharepoint"
-ImportTrustCertificate $cert
```

Don't forget to call the **Update** method to save the changes that the **Provider Realms.Add** method makes.

```
-ClaimsMappings $map,$map2
-SignInUrl "https://DC-adatum/adfs/ls/"
-IdentifierClaim http://schemas.xmlsoap.org/ws/2005/05/identity/
claims/emailaddress

$uri = New-Object System.Uri("https://adatum-sp:31242/")

$ap.ProviderRealms.Add($uri, "urn:adatum-techs:sharepoint")
$ap.Update()
```

The following table describes the key parameters in the PowerShell commands.

Parameter/command	Notes
-Realm	The realm is the value of the relying party identifier in ADFS. In this example, the realm parameter identifies the a-Portal SharePoint web application. The Add method of the ProviderRealms object adds the identifier for the a-Techs SharePoint web application. The URI is the address of the SharePoint web application.
-ImportTrustCertificate	This associates the token-signing certificate from ADFS with the token issuer.
-ClaimsMappings	This associates the claims-mapping rules with the token issuer.
-SignInUrl	This identifies the URL where the user can authenticate with ADFS.
-IdentifierClaim	This identifies which claim from the identity provider uniquely identifies the user.

This example uses the email address as the identifier. You may want to consider alternative unique identifiers because of the possibility that email addresses can change.

Figure 5 summarizes how the SharePoint trusted identity token issuer uses the configuration data to issue a SAML token to the SharePoint web application.

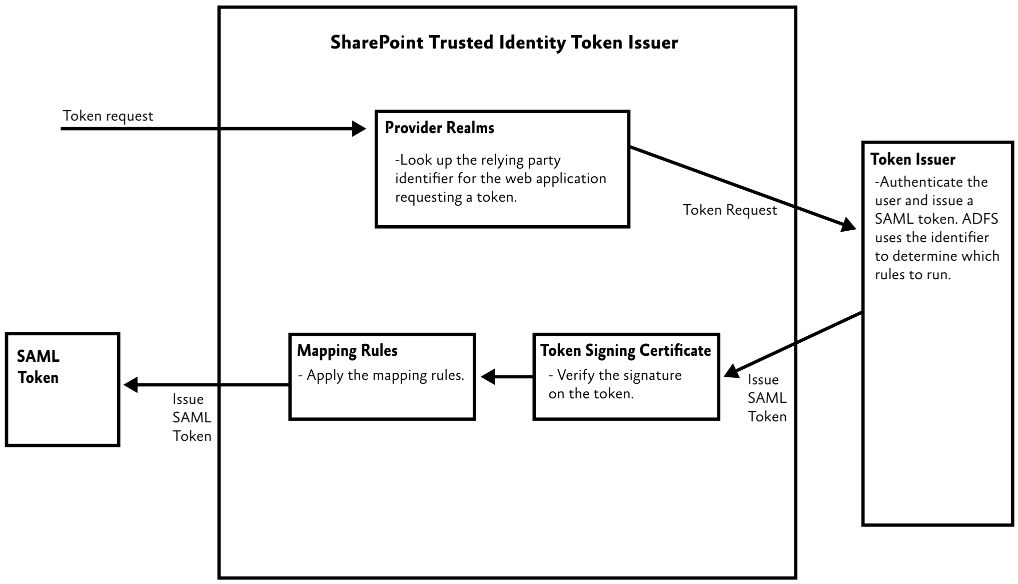

SharePoint Trusted Identity Token Issuer
Token request
Provider Realms
-Look up the relying party identifier for the web application requesting a token.
Token Request
Token Issuer
-Authenticate the user and issue a SAML token. ADFS uses the identifier to determine which rules to run.
SAML Token
Issue SAML Token
Mapping Rules
- Apply the mapping rules.
Token Signing Certificate
- Verify the signature on the token.
Issue SAML Token

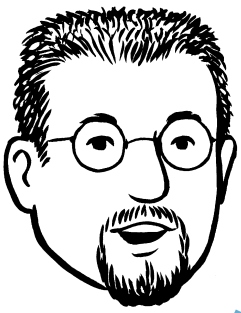
FIGURE 5
The SharePoint trusted identity token issuer

When a SharePoint web application requests a token from a trusted identity provider, the SharePoint trusted token issuer first looks up the unique identifier of the web application. It passes this identifier to the external token issuer in the **wtrealm** parameter of the request. When the external token issuer returns a SAML token, the SharePoint trusted identity token issuer verifies the signature, applies any mapping rules, and places the new SAML token in the SharePoint token cache. It also creates a FedAuth cookie that contains a reference to the SAML token in the cache. Whenever the user access a page in the SharePoint web application, SharePoint first checks if a valid SAML token exists for the user, and then uses the claims in the token to perform any authorization checks.

There is a one-to-one mapping between SharePoint trusted identity token issuers and trust certificates from the external token issuer. You cannot configure a new SharePoint trusted identity token issuer using a token-signing certificate that an existing SharePoint trusted identity token issuer uses.

SharePoint Web Application Configuration

Each web application in SharePoint defines which authentication mechanisms it can use. In the scenario described in this chapter, Adatum has configured both SharePoint web applications to use a SAML-based trusted identity provider. Both intranet and internet users use the SAML-based trusted identity provider.



You can configure the authentication methods that SharePoint will use for a web application in the "SharePoint 2010 Central Administration" site. Just navigate to **Manage Web Applications**, select the application you want to change, and click on **Authentication Providers**.

People Picker Customizations

To customize the behavior of the standard people picker to enable site administrators to reliably select role and organization claims, Adatum created a custom claim provider to deploy to SharePoint. The Microsoft Visual Studio® development system solution, SampleClaimsProvider, in the 10SharePoint folder from **http://claimsid.codeplex.com** includes a custom claim provider that demonstrates how Adatum extended the behavior of the people picker. For reasons of simplicity, this sample does not use a store to maintain the list of **role** and **organization** claims that Adatum uses, the lists of valid claims are maintained in memory. In a production-quality claims provider you should read the permissible claims values from a store shared with the identity provider. For more information, see the section "The People Picker" earlier in this chapter.

Use a custom **SPClaimProvider** *class to override the default people picker behavior.*

The **SampleClaimsProvider** class extends the abstract **SPClaim Provider** class and overrides the methods **FillHierarchy**, **FillResolve**, and **FillSearch**. The **SPTrustedClaimsIssuer** class, which derives from the **SPClaimProvider** class, implements the default UI behavior in the people picker.

The **GetPickerEntry** method is responsible for building an entry that will display in the people picker. The following code sample shows this method.

```
private PickerEntity GetPickerEntity(string ClaimValue, string
                                     claimType, string GroupName)
{
  PickerEntity pe = CreatePickerEntity();

  var issuer = SPOriginalIssuers.Format(
    SPOriginalIssuerType.TrustedProvider, TrustedProviderName);
  pe.Claim = new SPClaim(claimType, ClaimValue,
    Microsoft.IdentityModel.Claims.ClaimValueTypes.String,
                                                        issuer);
  pe.Description = claimType + "/" + ClaimValue;
  pe.DisplayText = ClaimValue;
  pe.EntityData[PeopleEditorEntityDataKeys.DisplayName] =
                                                    ClaimValue;
  pe.EntityType = SPClaimEntityTypes.Trusted;
  pe.IsResolved = true;
  pe.EntityGroupName = GroupName;

  return pe;
}
```

This method uses the **ClaimValue**, **claimType**, and **GroupName** strings to create a claim that the people picker can display. The **Trusted ProviderName** variable refers to the name of the SharePoint trusted identity token issuer that you are using: the **SPOriginal Issuers.Format** method returns a string with the full name of the original valid issuer that you must use when you create a new claim.

Notice that a claim definition includes the claim issuer as well as the claim type and value. SharePoint will check the source of a claim as a part of any authorization rules.

If you are creating an identity claim, you must ensure that the **claimType** *that you pass to the* **SPClaim** *constructor matches the identity claim type of your trusted identity token issuer, and that you set the* **EntityType** *property to* **SPClaimEntityTypes.User**.

The people picker uses the value of the **Description** property to display a tooltip in the UI when a user hovers the mouse over a resolved claim.

If you deploy this solution to SharePoint, then the people picker will display search results from this custom claim provider in addition to results from the default, built-in claim provider. This means that if a site administrator searches for a non-existent **role** or **organization** claim, then the default claim provider will continue to resolve this non-existent claim value. To prevent this behavior, you can make your custom claim provider the default claim provider. If the name of the trusted identity token issuer is "SAML Provider" and the name of the custom claim provider is "ADFSClaimProvider," then the following PowerShell script will make the custom claim provider the default.

Adatum made the custom claim provider the default claim provider in the SharePoint web applications.

```
$ti = Get-SPTrustedIdentityTokenIssuer "SAML Provider"
$ti.ClaimProviderName = "ADFSClaimsProvider"
$ti.Update()
```

It's also important to ensure that the claim types that the site administrator will use in the custom people picker exist in the trusted identity token issuer. You can use the following PowerShell script to list the claims that are present in the configuration.

```
$i = Get-SPTrustedIdentityTokenIssuer "SAML Provider"
$i.ClaimTypes
```

You can add claim types to an existing trusted identity token issuer using the technique shown in the following PowerShell script.

```
$map = New-SPClaimTypeMapping -IncomingClaimType
  "http://schemas.microsoft.com/ws/2008/06/identity/claims/
                                                    organization"
  -IncomingClaimTypeDisplayName "Organization" -LocalClaimType
  "http://schemas.microsoft.com/ws/2008/06/identity/claims/
                                                   organization"
$ti = Get-SPTrustedIdentityTokenIssuer "SAML Provider"
$ti.ClaimTypes.Add(
  "http://schemas.microsoft.com/ws/2008/06/identity/claims/
                                                  organization")
Add-SPClaimTypeMapping –Identity $map
   -TrustedIdentityTokenIssuer $ti
```

This script maps an incoming claim and defines the new claim type in the trusted identity token issuer.

Single Sign-Out Control

To implement single sign-out behavior, you must be able to send the WS-Federation **wsignout** message to the token issuer when the user clicks either the "Sign out" or "Sign in with a different user" link on any page in the a-Portal or a-Techs SharePoint web applications. Adatum implemented the single sign-out logic in the **SessionAuthentication Module's SignedIn** and **SigningOut** events. The Visual Studio solution, SingleSignOutModule in the 10SharePoint folder from http://claimsid.codeplex.com, includes a custom HTTP module to deploy to your SharePoint web application that includes this functionality.

The following code sample shows the **DoFederatedSignOut** method that the **SigningOut** event handler invokes to perform the sign-out.

```
private void DoFederatedSignOut()
{
  string providerName = GetProviderNameFromCookie();
  SPTrustedLoginProvider loginProvider = null;
  SPSecurity.RunWithElevatedPrivileges(delegate()
  {
    loginProvider = GetLoginProvider(providerName);
  });

  if (loginProvider != null)
  {
    string returnUrl = string.Format(
      System.Globalization.CultureInfo.InvariantCulture,
      "{0}://{1}/_layouts/SignOut.aspx",
      HttpContext.Current.Request.Url.Scheme,
      HttpContext.Current.Request.Url.Host);
      HttpCookie signOutExpiredCookie =
        new HttpCookie(SignOutCookieName, string.Empty);
      signOutExpiredCookie.Expires = new DateTime(1970, 1, 1);
      HttpContext.Current.Response.Cookies.
```

```
                                   Remove(SignOutCookieName);
      HttpContext.Current.Response.Cookies.
                                   Add(signOutExpiredCookie);
      WSFederationAuthenticationModule.FederatedSignOut(
        loginProvider.ProviderUri, new Uri(returnUrl));
  }
}
```

This method performs the sign-out by calling the SharePoint **SPFederationAuthenticationModule.FederatedSignOut** method, passing the address of the claims provider and the address of the SharePoint web application's sign-out page as parameters. To discover the address of the claims provider, it uses an **SPTrustedLogin Provider** object: however, to get a reference to the **SPTrustedLogin Provider** object it needs its name, and it discovers the name by reading the custom sign-out cookie.

This method uses the **SPSecurity.RunWithElevatedPrivileges** method to invoke the **GetLoginProvider** method with "Full Control" permissions.

The following code sample shows how Adatum creates the custom sign-out cookie in the **Session_SignedIn** event.

```
private const string SignOutCookieName = "SPSignOut";
void WSFederationAuthenticationModule_SignedIn(object sender,
EventArgs e)
{
 IClaimsIdentity identity =
    HttpContext.Current.User.Identity as IClaimsIdentity;

  if (identity != null)
  {
    foreach (Claim claim in identity.Claims)
    {
      if (claim.ClaimType == SPClaimTypes.IdentityProvider)
      {
        int index = claim.Value.IndexOf(':');
        string loginProviderName = claim.Value.Substring(
          index + 1, claim.Value.Length - index - 1);
        HttpCookie signOutCookie = new HttpCookie(
            SignOutCookieName,
            Convert.ToBase64String(
              System.Text.Encoding.UTF8.
                GetBytes(loginProviderName)));
        signOutCookie.Secure = FederatedAuthentication
            .SessionAuthenticationModule
              .CookieHandler.RequireSsl;
```

This method reads the provider name from a custom sign-out cookie rather than from the **IClaimsIdentity** object associated with the current user: this is because if the user's session has expired, there will be no **IClaims Identity** object. Also, it's not safe to read the provider name from the FedAuth cookie.

One of the key reasons that Adatum selected this approach for handling single sign-out was its compatibility with the sliding-sessions implementation that Adatum chose to use. The sign-out process must be initiated when the user is inactive for more than the defined period of inactivity and when the user's SAML token **ValidTo** time is reached. For details about how Adatum implemented sliding sessions in the a-Portal web application see Chapter 12, "Federated Identity for SharePoint Applications."

```
            signOutCookie.HttpOnly = FederatedAuthentication
                .SessionAuthenticationModule.CookieHandler
                .HideFromClientScript;
            signOutCookie.Domain = FederatedAuthentication
                .SessionAuthenticationModule.CookieHandler
                .Domain;
            HttpContext.Current.Response.Cookies.Add(signOutCookie);
            break;
        }
      }
    }
}
```

The custom sign-out cookie is not encrypted or signed. It is transported using SSL, and only contains the name of the user's login provider.

You can find a complete listing of the global.asax file that Adatum use in the a-Portal web application at the end of this chapter.

Displaying Claims in a Web Part

When you're developing a claims-enabled SharePoint solution, it's useful to be able to view the set of claims that a user has when he visits a SharePoint web application. The Visual Studio solution called DisplayClaimsWebPart in the 10SharePoint folder from **http://claimsid.codeplex.com** includes a SharePoint Web Part that displays claims data for the current user. The Web Part displays the following claims data:

- The claim type.
- The claim issuer (this is typically SharePoint).
- The original claim issuer (this might be a trusted provider or the SharePoint STS).
- The claim value.

This is a standard Web Part that you can deploy to a SharePoint web application directly from Visual Studio or through the SharePoint UI. After the Web Part is deployed to SharePoint you can add it to any SharePoint web page. It does not require any further configuration.

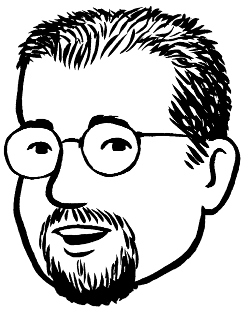
User Profile Synchronization

A claims-enabled SharePoint environment can synchronize user profile data stored in the SharePoint profile store with profile data that is stored in directory services and other business systems in the enterprise. The important difference in the way that user profiles work in a claims-enabled web application such as the Adatum a-Techs Share-

Point application is how SharePoint identifies the correct user profile from the claims data associated with an **SPUser** instance.

To make sure that SharePoint can match up a user profile from the current **SPUser** instance, you must ensure that three user properties are correctly configured.

Property name	Property value
Claim User Identifier	This is the unique identifier for a user. For Adatum, this is the value it used for the *IdentifierClaim* parameter when it configured the SharePoint trusted identity token issuer: http://schemas.xmlsoap.org/ws/2005/05/identity/claims/emailaddress.
Claim Provider Identifier	This identifies the trusted identity token issuer. For Adatum this value is "SAML Provider." This value is set automatically when you configure the user profile synchronization service.
Claim Provider Type	This specifies the token provider type. For Adatum this value is "Trusted Claims Provider Authentication." This value is set automatically when you configure the user profile synchronization service.



To test this, you must have SharePoint 2010 Server (not Foundation) installed in Farm (not Standalone) mode.

Setup and Physical Deployment

To run this scenario in a lab environment you may want to change some of the default configuration options in SharePoint and ADFS.

FedAuth Tokens

Each SharePoint web application must have its own FedAuth cookie if it is to function correctly in an single sign-on environment. In a production environment, this is not normally an issue because each SharePoint web application has a separate host name: for example, a-portal.adatum.com, and a-techs.adatum.com. However, in a lab environment you may not want to configure the necessary DNS infrastructure to support this; if your SharePoint web applications share the same host name, for example lab-sp.adatum.com:31242 and lab-sp.adatum.com:40197, then you must make a configuration change to make sure that each application uses a different name for the FedAuth cookie. You can change the name of the FedAuth cookie in the microsoft.IdentityModel section of the Web.config file. The following snippet shows how to change the token name to "techsFedAuth" from its default name of "FedAuth."

```
<federatedAuthentication>
  …
  <cookieHandler mode="Custom" path="/" name="techsFedAuth">
  …
</federatedAuthentication>
```

ADFS Default Authentication Method

By default, an Active Directory Federation Services (ADFS) server installation uses Integrated Windows Authentication, and an ADFS proxy installation uses an ASP.NET form to collect credentials. In a lab environment, if you do not have an ADFS proxy installation, you may want to change the default behavior of the ADFS server to use an ASP.NET form. To change this, edit the Web.config file in the /adfs/ls folder. The following snippet shows "Forms" at the top of the list, making it the default. This means that in a simple lab environment you will always need to sign in explicitly.

```
<microsoft.identityServer.web>
<localAuthenticationTypes>
  <add name="Forms" page="FormsSignIn.aspx" />
  <add name="Integrated" page="auth/integrated/" />
  <add name="TlsClient" page="auth/sslclient/" />
  <add name="Basic" page="auth/basic/" />
</localAuthenticationTypes>
…
</microsoft.identityServer.web>
```

Server Deployment

ADFS enables you to deploy proxy instances that are intended to handle authentication requests from the web rather than the internal corporate network which are handled by the main ADFS server instances. This provides an addition layer of security because the main ADFS server instances can be kept inside the corporate firewall. For more information about deploying ADFS servers and ADFS server proxies, see this section on the TechNet website: **http://technet.microsoft.com/en-us/library/gg982491(WS.10).aspx**. You will also need to ensure that your SharePoint web application is exposed to the internet to allow Adatum employees to access it remotely.

Questions

1. Which of the following roles can the embedded STS in SharePoint perform?
   a. Authenticating users.
   b. Issuing FedAuth tokens that contain the claims associated with a user.
   c. Requesting claims from an external STS such as ADFS.

   d. Requesting claims from Active Directory through Windows Authentication.

2. Custom claim providers use claims augmentation to perform which function?
   a. Enhancing claims by verifying them against an external provider.
   b. Enhancing claims by adding additional metadata to them.
   c. Adding claims data to the identity information in the **SPUser** object if the SharePoint web application is in “legacy” authentication mode.
   d. Adding additional claims to the set of claims from the identity provider.
3. Which of the following statements about the FedAuth cookie in SharePoint are correct?
   a. The FedAuth cookie contains the user’s claim data.
   b. Each SharePoint web application has its own FedAuth cookie.
   c. Each site collection has its own FedAuth cookie.
   d. The FedAuth cookie is always a persistent cookie.
4. In the scenario described in this chapter, why did Adatum choose to customize the people picker?
   a. Adatum wanted the people picker to resolve **role** and **organization** claims.
   b. Adatum wanted the people picker to resolve **name** and **emailaddress** claims from ADFS.
   c. Adatum wanted to use claims augmentation.
   d. Adatum wanted to make it easier for site administrators to set permissions reliably.
5. In order to implement single sign-out behavior in Share-Point, which of the following changes did Adatum make?
   a. Adatum modified the standard signout.aspx page to send a **wsignoutcleanup** message to ADFS.
   b. Adatum uses the **SessionAuthenticationModule SigningOut** event to customize the standard sign-out process.

c. Adatum added custom code to invalidate the FedAuth cookie.

d. Adatum configured SharePoint to use a session-based FedAuth cookie.

More Information

For more information about SharePoint and claims-based identity, see Appendix F, "SharePoint 2010 Authentication Architecture and Considerations."

For a detailed, end-to-end walkthrough that describes how to configure SharePoint and ADFS, see this blog post: http://blogs.technet.com/b/speschka/archive/2010/07/30/configuring-sharepoint-2010-and-adfs-v2-end-to-end.aspx.

The following resources are useful if you are planning to create a custom people picker component for your SharePoint environment:

- People Picker overview (SharePoint Server 2010): http://technet.microsoft.com/en-us/library/gg602068.aspx
- Custom claims providers for People Picker (SharePoint Server 2010): http://technet.microsoft.com/en-us/library/gg602072.aspx
- Creating Custom Claims Providers in SharePoint 2010: http://msdn.microsoft.com/library/gg615945.aspx
- Claims Walkthrough: Writing Claims Providers for SharePoint 2010: http://msdn.microsoft.com/en-us/library/ff699494.aspx
- How to Override the Default Name Resolution and Claims Provider in SharePoint 2010: http://blogs.technet.com/b/speschka/archive/2010/04/28/how-to-override-the-default-name-resolution-and-claims-provider-in-sharepoint-2010.aspx

For further information about using profiles in a claims-enabled SharePoint environment, see this blog post: http://blogs.msdn.com/b/brporter/archive/2010/07/19/trusted-identity-providers-amp-user-profile-synchronization.aspx.

12 Federated Identity for SharePoint Applications

In previous chapters, you saw ways that federated identity can help companies share resources with their partners. The scenarios have included small numbers of partners as well as large numbers of constantly changing partners, sharing web applications and web services, and supporting multiple client platforms. These scenarios share an important feature: they all use claims.

In Chapter 11, "Claims-Based Single Sign-On for Microsoft SharePoint 2010," you saw how Adatum could expand its single sign-on domain to include Microsoft® SharePoint® services web applications. The SharePoint web applications at Adatum used claims-based authentication, using claims from an external token issuer Microsoft Active Directory® Federation Services (ADFS).

Adatum wants to allow selected partners access to its SharePoint a-Portal web application.

In this chapter, you'll learn how Adatum lets employees at one of its customers, Litware, use the a-Portal SharePoint application that was introduced in Chapter 11, "Claims-Based Single Sign-On for Microsoft SharePoint 2010."

The Premise

The a-Portal SharePoint application has given Adatum sales personnel access to up-to-date and accurate product information during the sales process, which has resulted in improved customer satisfaction. However, there have been complaints from customers who make purchases through of Adatum's partners that some of the product information has been out of date. This is because Adatum's partners are responsible for keeping the product information that they use up to date. One of these sales partners is Litware. Rick, the CIO of Litware, has seen the a-Portal SharePoint application and he is keen for his sales staff to use a-Portal instead of their own copy of the product information. Adatum has already claims-enabled the a-Portal SharePoint application (for further information see Chapter 11, "Claims-

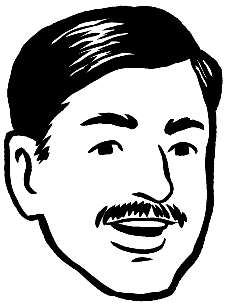
Based Single Sign-On for Microsoft SharePoint 2010") and made it available to Adatum employees who work remotely on the Internet. Litware has already deployed ADFS, so most of the required federation infrastructure is already available.

Goals and Requirements

The primary goal of this scenario is to show how to create a SharePoint site that uses federated identities, so that users from Litware can access the Adatum a-Portal SharePoint application without having to sign in again to the Adatum security realm. The types of claims issued by Litware are not the same types as the claims used by a-Portal at Adatum, so it's necessary to include some claims transformation logic to convert the claims issued by Litware. Adatum anticipates that other sales partners will also want to use the a-Portal application, so the solution must be able to accommodate multiple identity providers.

The solution should also ensure that partners are kept isolated. For example, there may be some product information that only Adatum and not Litware sales personnel should see.

For security, Adatum wants to have SharePoint automatically sign users out of the a-Portal application after a period of inactivity. In addition, because users will be accessing the a-Portal application on computers outside the Adatum corporate network, when a user closes the browser and then re-opens it, the user must re-authenticate to gain access to the a-Portal web application.



Adatum has deployed an ADFS proxy to support authenticating users outside of the Adatum corporate network.

Overview of the Solution

Figure 1 shows an overview of the solution adopted by Adatum and Litware. It shows a new trust relationship between Adatum's issuer, and Litware's issuer. In addition to acting as an identity provider (IdP) for Adatum employees, the Adatum ADFS instance now functions as a federation provider (FP) for partners such as Litware.

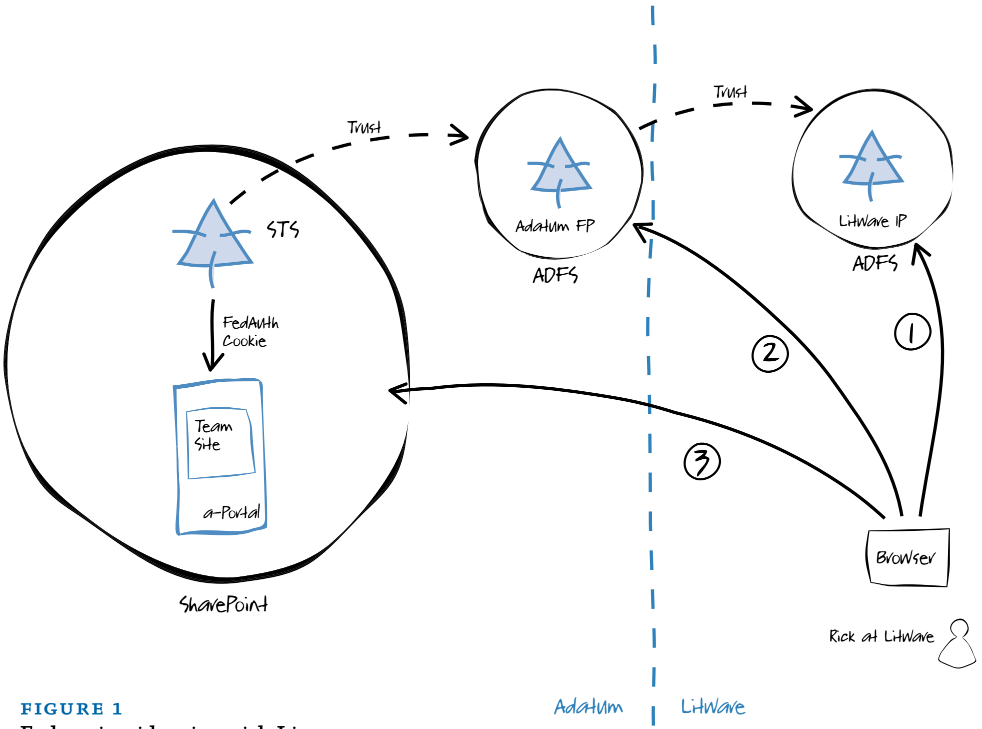


FIGURE 1
Federating identity with Litware

When Rick, a user from Litware, browses to the a-Portal SharePoint web application, SharePoint detects that Rick is not authenticated, and redirects his browser to the Adatum federation provider. The Adatum federation provider then redirects Rick's browser to the Litware issuer.

For details about how to customize the way that SharePoint redirects a user to a token issuer, see the section "The Sign-In Page" in Chapter 11, "Claims-Based Single Sign-On for Microsoft SharePoint 2010."

The numbers in the following list correspond to the numbers in Figure 1.

1. Rick authenticates with the Litware identity provider and obtains a SAML token with claims issued by Litware.
2. Rick's browser redirects back to the Adatum issuer. This federation provider can apply some custom claims mapping rules to the set of claims from Litware to create a set of claims suitable for the a-Portal web application. The federation provider issues this new set of claims as a SAML token.

3. Rick's browser redirects back to SharePoint. SharePoint validates the token, checks any authorization rules that apply to the page that Rick requested, and if Rick has permission, displays the page.

Adatum considered two alternative models for federating with partners. The first, which is the one Adatum selected, is shown in Figure 2.

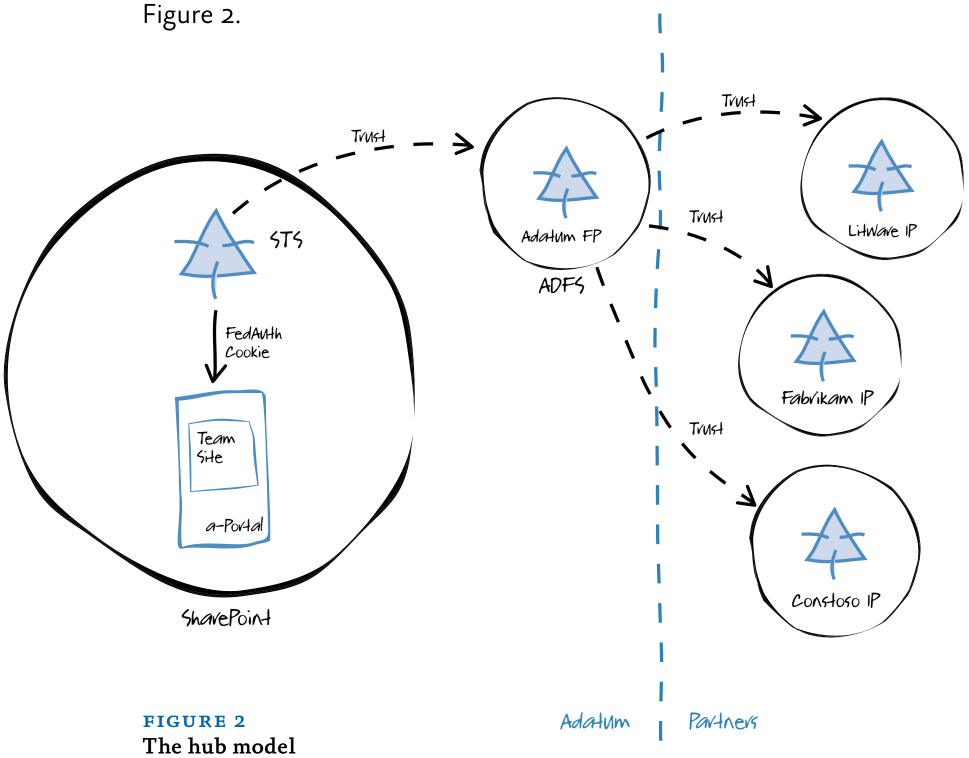


figure 2
The hub model

In the hub model, SharePoint has a single trust relationship with the Adatum federation provider. The Adatum federation provider then trusts the partners' issuers. The Adatum federation provider can apply rules to the claims from the different identity providers to create claims that the SharePoint web application understands.

Figure 3 shows the alternative model.

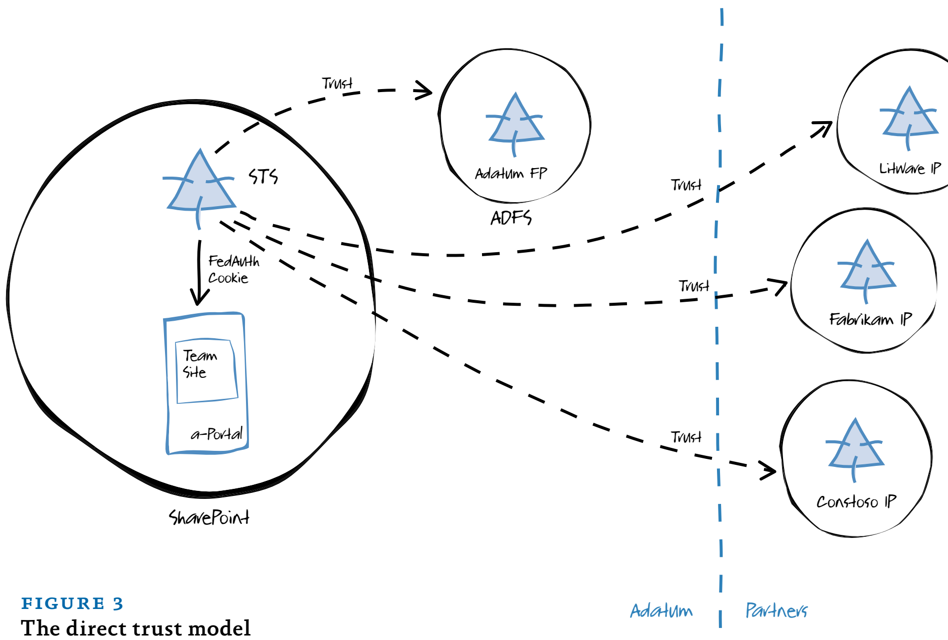
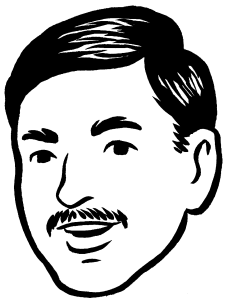


FIGURE 3
The direct trust model

In the direct trust model, SharePoint manages a trust relationship with each issuer directly, and uses custom claims providers to manipulate the incoming claims to a common set of claims that the a-Portal web application understands.

The advantages of the hub model adopted by Adatum are that:

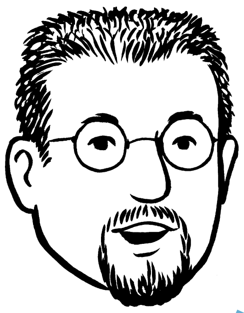
1. It's easier to manage multiple trust relationships in ADFS rather than SharePoint.
2. It's simpler to manage a single trust relationship in SharePoint and it avoids the requirement for multiple custom claims providers.
3. You can reuse the trust relationships in the federation provider with other relying parties.
4. You can leverage ADFS features such as integration with auditing tools to track token issuing.
5. ADFS supports the Security Assertion Markup Language protocol (SAMLP) in addition to WS-Federation.



An advantage of the SAMLP protocol over WS-Federation is that it supports initializing the authentication process from the identity provider instead of the relying party, which avoids the requirement for either the relying party (RP) or the federation provider to perform home-realm discovery.

Strictly speaking, the session cookie doesn't contain the SAML token, it contains a reference to the SAML token in the SharePoint token cache.

It's important that the sliding-session implementation is compatible with the single sign-out solution that Chapter 11, "Claims-Based Single Sign-On for Microsoft SharePoint 2010," describes.



The main configuration changes were in ADFS: adding the trust relationship with Litware and adding the rules to convert Litware claims to Adatum claims.

The disadvantage of the hub approach is its performance: it requires more hops to acquire a valid SAML token. With this in mind, Adatum made some changes to the token caching policy in the a-Portal web application to reduce the frequency at which it's necessary to refresh the SAML token. However, Adatum is using session cookies rather than persistent cookies to store the SAML token references so that if the user closes his browser, then he will be forced to re-authenticate when he next visits the a-Portal web application.

Adatum implemented sliding sessions for users of the a-Portal web application: after a token issuer authenticates a user, the user can continue using the a-Portal web application without having to re-authenticate if he remains active. If a user becomes inactive in the web application for more than a defined period, then he must re-authenticate with the claims issuer and obtain a new SAML token. With the sliding-sessions solution in place:

- Provided a user remains active in the a-Portal web application, SharePoint will not interrupt the user and require him to re-authenticate with the SAML token issuer.
- The a-Portal web application remains secure because users who become inactive must re-authenticate when they start using the application again.

Inside the Implementation

The following sections describe the key configuration steps that Adatum performed in order to implement the scenario that this chapter describes. The hub model that Adatum selected meant that the changes in SharePoint were minimal: there is still a single trust relationship with the Adatum issuer.

The following sections describe the changes Adatum made to the a-Portal web application in SharePoint to support access from partner organizations.

Token Expiration and Sliding Sessions

One of the Adatum requirements was that the a-Portal application automatically sign users out after a defined period of inactivity, but allow them to continue working with the application without re-authenticating so long as they remain active. To achieve this, Adatum implemented a sliding-session mechanism in SharePoint that can renew the SharePoint session token. For performance reasons, Adatum wanted to be able to extend the lifetime of the session token without having to revisit ADFS (the federation provider) or the partner's token issuer.

A cookie (usually named FedAuth) that can exist either as a persistent or in-memory cookie represents the SharePoint session token. This cookie contains a reference to the SAML token that SharePoint stores in its token cache. The SAML token contains the claims issued to the user by any external identity and federation providers, and by the internal SharePoint security token service (STS).

Before showing the details of how Adatum implemented sliding sessions, it will be useful to understand how token expiration works by default in SharePoint.

SAML Token Expiration in SharePoint

This section describes the standard behavior in SharePoint as it relates to token expiration.

When Rick from Litware first tries to access the a-Portal web application, his browser performs all of the following steps in order to obtain a valid SAML token:

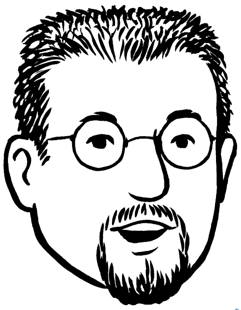
1. Rick requests a page in the a-Portal web application.
2. Rick's browser redirects to the SharePoint STS.
3. Because Rick is not yet authenticated, the SharePoint STS redirects Rick's browser to the Adatum issuer to request a token.
4. The Adatum issuer redirects Rick's browser to the Litware issuer to authenticate and obtain a Litware token.
5. Rick's browser returns to the Adatum issuer to transform the Litware token into an Adatum token.
6. Rick's browser returns to the a-Portal web application to sign in to SharePoint.
7. Rick's browser returns to the page that Rick originally requested in the a-Portal web application to view.

All SAML tokens have a fixed lifetime that the token issuer specifies when it issues the token; in the Adatum scenario, it is the Adatum ADFS that sets this value. Once a token has expired, the user must request a new SAML token from the token issuer. For Rick at Litware, this means repeating the steps listed above. Because this takes time, Adatum does not want users such as Rick to have to reauthenticate too frequently. However, using a token with a long lifetime can be a security risk because someone else could use Rick's computer while he wasn't there and access the a-Portal web application with Rick's cached token.

When Rick's SAML token expires he may, or may not, need to re-enter his credentials at the token issuer (ADFS): this depends on the configuration of the issuer. In ADFS, you can specify the web single sign-on (SSO) lifetime that determines the lifetime of the ADFS SSO cookie.

The following table describes the two configuration options that directly affect when SharePoint requires a user to get a new SAML token from the issuer.

Configuration value	Notes
SAML token lifetime	The token issuer sets this value. In ADFS, you can configure this separately for each relying party by using the **Set-ADFSRelyingPartyTrust** PowerShell command. Once the SAML token expires, the SharePoint session expires, and the user must re-authenticate with the token issuer to obtain a new SAML token. By default, SharePoint sets the session lifetime to be the same as the SAML token lifetime.
LogonTokenCache-ExpirationWindow	This SharePoint configuration value controls when SharePoint will consider that the SAML token has expired and ask the user to re-authenticate with the issuer and obtain a new token. SharePoint checks whether the SAML token has expired at the start of every request. For example, if ADFS sets the SAML token lifetime to ten minutes, and the **LogonTokenCacheExpirationWindow** property in SharePoint is set to two minutes, then the session in SharePoint will be valid for eight minutes. If the user requests a page from SharePoint seven minutes after signing in, then SharePoint checks whether the session is set to expire during the time in minutes represented by **LogonTokenCacheExpirationWindow**: in this case the answer is no because seven plus two is less than ten. If the user requests a page from SharePoint nine minutes after signing in, then SharePoint checks whether the session is set to expire during the time in minutes represented by **LogonTokenCacheExpirationWindow**: in this case the answer is yes because nine plus two is greater than ten.



Make sure that the value of the **Logon TokenCache ExpirationWindow** property is always less than the SAML token lifetime; otherwise, you'll see a loop whenever a user tries to access your SharePoint web application and keeps being redirected back to the token issuer.

The following script example shows you how to change the lifetime of the SAML token issued by the "SharePoint Adatum Portal" relying party in ADFS to 10 minutes.

```
Add-PSSnapin Microsoft.ADFS.PowerShell
Set-AdfsRelyingPartyTrust -TargetName "SharePoint Adatum Portal"
-TokenLifeTime 10
```

The following script example shows you how to change the **LogonTokenCacheExpirationWindow** in SharePoint to two minutes.

```
$ap = Get-SPSecurityTokenServiceConfig
$ap.LogonTokenCacheExpirationWindow = (New-TimeSpan -minutes 2)
$ap.Update();
IIsreset
```

These two configuration settings will cause SharePoint to redirect the user to the issuer to sign in again eight minutes after the user last authenticated with ADFS.

The sequence diagram in Figure 4 shows how SharePoint manages its session lifetime and the SAML token that it receives from the token issuer.

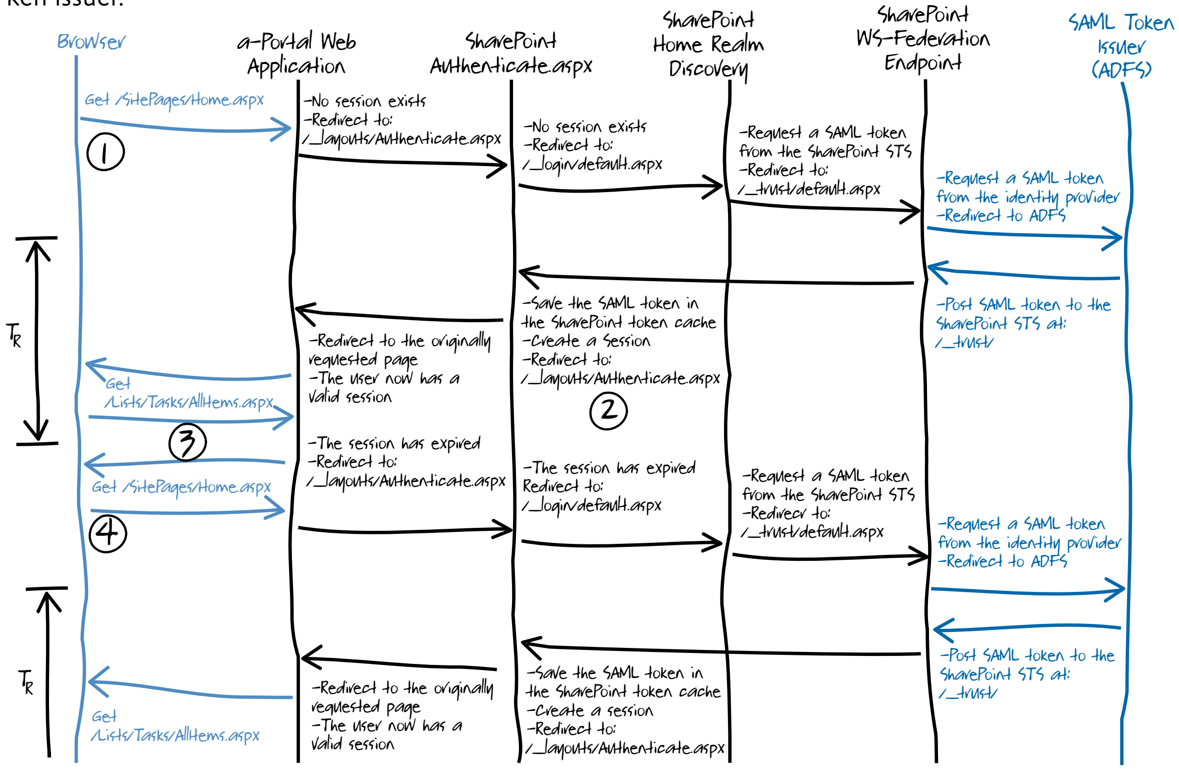

Browser
a-Portal Web Application
SharePoint Authenticate.aspx
SharePoint Home Realm Discovery
SharePoint WS-Federation Endpoint
SAML Token Issuer (ADFS)
Get /SitePages/Home.aspx
1
-No session exists
-Redirect to:
/_layouts/Authenticate.aspx
-No session exists
-Redirect to:
/_login/default.aspx
-Request a SAML token from the SharePoint STS
-Redirect to:
/_trust/default.aspx
-Request a SAML token from the identity provider
-Redirect to ADFS
-Post SAML token to the SharePoint STS at:
/_trust/
-Save the SAML token in the SharePoint token cache
-Create a Session
-Redirect to:
/_layouts/Authenticate.aspx
2
-Redirect to the originally requested page
-The user now has a valid session
Get /Lists/Tasks/AllItems.aspx
3
T_R
-The session has expired
-Redirect to:
/_layouts/Authenticate.aspx
Get /SitePages/Home.aspx
4
-The session has expired
Redirect to:
/_login/default.aspx
-Request a SAML token from the SharePoint STS
-Redirecr to:
/_trust/default.aspx
-Request a SAML token from the identity provider
-Redirect to ADFS
-Post SAML token to the SharePoint STS at:
/_trust/
-Save the SAML token in the SharePoint token cache
-Create a session
-Redirect to:
/_layouts/Authenticate.aspx
-Redirect to the originally requested page
-The user now has a valid session
Get /Lists/Tasks/AllItems.aspx
T_R

FIGURE 4
Standard token expiration in SharePoint

Figure 4 shows a simplified view of the sequence of interactions. In reality, SharePoint and the WS-Federation protocol use browser redirects and automatic posts to manage the interactions between the various components so that all of the requests go through the browser.

In the sequence diagram, T_R represents the time from when ADFS issues the SAML token to when SharePoint will try to renew the token. Based on the configuration settings described above, T_R is set to eight minutes.

The following notes refer to the numbers on the sequence diagram:

1. This is the first time that the user visits the a-Portal web application; there is no valid session so SharePoint redirects the user to begin the sign-in process.
2. SharePoint creates a session for the user. The lifetime of the session is the same as the lifetime of the SAML token issued by ADFS.
3. SharePoint uses the session lifetime and the **LogonToken CacheExpirationWindow** property to determine when the user must sign in again. At this point, the session is still valid. While the session is valid, the user can continue to visit pages in the SharePoint web application.
4. SharePoint uses the session lifetime and the **LogonToken CacheExpirationWindow** property to determine when the user must sign in again. At this point, SharePoint determines that the session has expired, so it begins the sign-in process again. If the ADFS SSO cookie has expired, Rick will have to enter his credentials to obtain a new SAML token.

To force users to re-enter their credentials whenever they are redirected back to ADFS, you should set the web SSO lifetime in ADFS to be less than or equal to **SAMLtokenlifetime** *minus the value of* **LogonTokenCacheExpirationWindow**. *In the Adatum scenario, the web SSO lifetime in ADFS should be set to eight minutes to force users to re-authenticate when SharePoint redirects them to ADFS.*

Sliding Sessions in SharePoint

Adatum wanted to implement sliding sessions so that SharePoint can extend the lifetime of the session if the user remains active. Adatum wanted to be able to define an inactivity period, after which SharePoint forces the user to re-authenticate with ADFS. In other words, a user will only need to sign in again if the session is allowed to expire or if the SAML token expires. In this scenario, the session lifetime will be less than the SAML token lifetime.

To implement this behavior, Adatum first configured ADFS to issue SAML tokens with a lifetime of eight hours. The following Microsoft Windows® PowerShell® command-line interface script shows how you can configure this setting in ADFS for the SharePoint Adatum Portal relying party.

```
Add-PSSnapin Microsoft.ADFS.PowerShell
Set-AdfsRelyingPartyTrust -TargetName "SharePoint Adatum Portal"
-TokenLifeTime 480
```

By setting the **LogonTokenCacheExpirationWindow** value to 470 minutes, Adatum can effectively set the session duration to 10 minutes.

```
$ap = Get-SPSecurityTokenServiceConfig
$ap.LogonTokenCacheExpirationWindow = (New-TimeSpan -minutes 470)
$ap.Update();
IIsreset
```

Adatum then modified the way that SharePoint manages its sessions. SharePoint now recreates a new session before the existing session expires (as long as the user visits the SharePoint web application before the existing session expires). A user can continue to recreate sessions up to the time that the SAML token finally expires; in this scenario, the user could continue using the a-Portal web application for eight hours without having to re-authenticate. If the user doesn't visit the web application before the session expires, then on the next visit he must sign in again. The Microsoft Visual Studio® development system solution, SlidingSessionModule, found in the 10SharePoint folder from **http://claimsid.codeplex.com** includes a custom HTTP module to deploy to your SharePoint web application that includes this functionality. The following code sample from the Adatum custom HTTP module shows the implementation.

```
public void Init(HttpApplication context)
{
  // Sliding session
  FederatedAuthentication.SessionAuthenticationModule
    .SessionSecurityTokenReceived +=
    SessionAuthenticationModule_SessionSecurityTokenReceived;
  ...
}

private void SessionAuthenticationModule_
               SessionSecurityTokenReceived(
                 object sender,
                 SessionSecurityTokenReceivedEventArgs e)
{
  double sessionLifetimeInMinutes
    = (e.SessionToken.ValidTo -
         e.SessionToken.ValidFrom).TotalMinutes;
```

Remember:
A reference to the SAML token in the SharePoint token cache is stored in the session. The session is represented by the FedAuth cookie.

```
  var logonTokenCacheExpirationWindow = TimeSpan.FromSeconds(1);
  SPSecurity.RunWithElevatedPrivileges(delegate()
  {
    logonTokenCacheExpirationWindow =
      Microsoft.SharePoint.Administration.Claims
      .SPSecurityTokenServiceManager
      .Local.LogonTokenCacheExpirationWindow;
  });
  DateTime now = DateTime.UtcNow;
  DateTime validTo = e.SessionToken.ValidTo
                   - logonTokenCacheExpirationWindow;
  DateTime validFrom = e.SessionToken.ValidFrom;
  if ((now < validTo) &&
      (now > validFrom.AddMinutes(
        (validTo – validFrom).TotalMinutes / 2)))
  {
    SessionAuthenticationModule sam
      = FederatedAuthentication.SessionAuthenticationModule;
    e.SessionToken = sam.CreateSessionSecurityToken(
      e.SessionToken.ClaimsPrincipal,
      e.SessionToken.Context, now,
      now.AddMinutes(sessionLifetimeInMinutes),
      e.SessionToken.IsPersistent);
    e.ReissueCookie = true;
  }
}
```

This method first determines the *valid from* time and *valid to* time of the existing session, taking into account the value of the **Logon TokenCacheExpirationWindow** property. Then, if the existing session is more than halfway through its lifetime, the method uses the **SPSessionAuthenticationModule** instance to extend the session. It does this by creating a new session that has the same lifetime as the original, but which has a **ValidFrom** property set to the current time.

The sequence diagram in Figure 5 shows how SharePoint handles Adatum's sliding-sessions implementation.

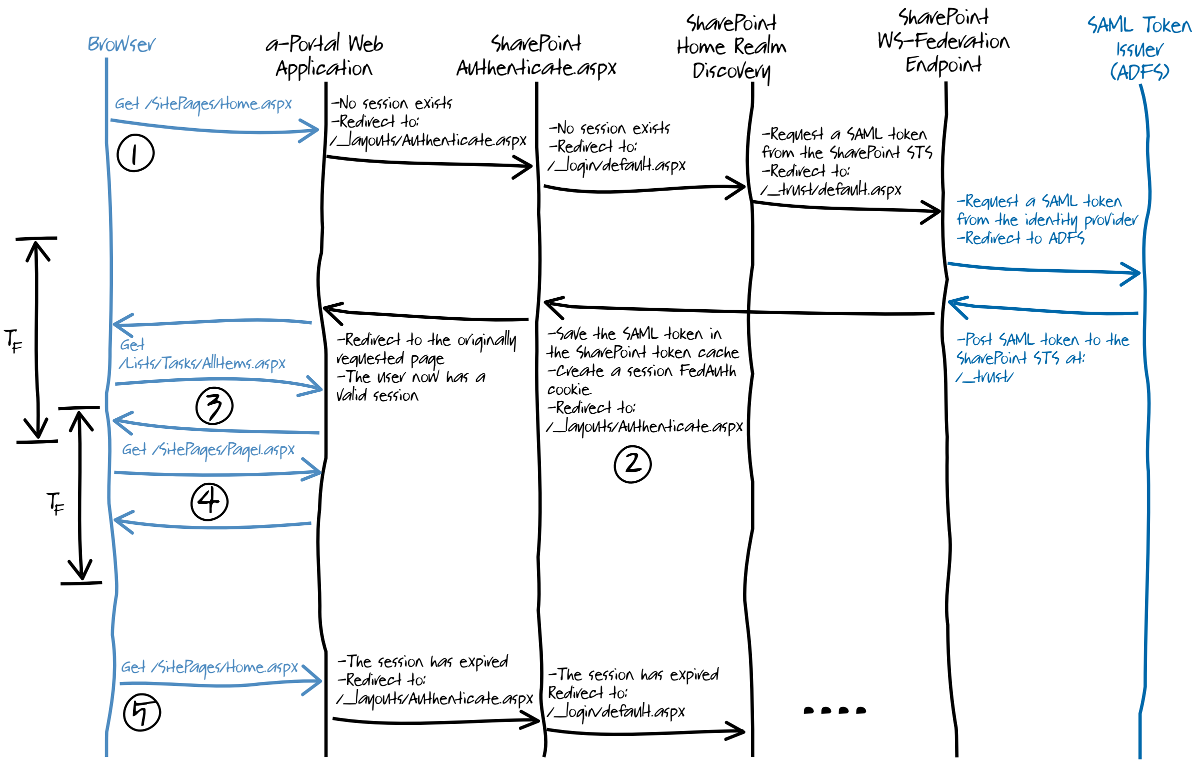

Browser
a-Portal Web Application
SharePoint Authenticate.aspx
SharePoint Home Realm Discovery
SharePoint WS-Federation Endpoint
SAML Token Issuer (ADFS)
Get /SitePages/Home.aspx
1
-No session exists -Redirect to: /_layouts/Authenticate.aspx
-No session exists -Redirect to: /_login/default.aspx
-Request a SAML token from the SharePoint STS -Redirect to: /_trust/default.aspx
-Request a SAML token from the identity provider -Redirect to ADFS
-Post SAML token to the SharePoint STS at: /_trust/
-Save the SAML token in the SharePoint token cache -Create a session FedAuth cookie -Redirect to: /_layouts/Authenticate.aspx
2
-Redirect to the originally requested page -The user now has a valid session
T_F
Get /Lists/Tasks/AllItems.aspx
3
Get /SitePages/Page1.aspx
4
T_F
Get /SitePages/Home.aspx
5
-The session has expired -Redirect to: /_layouts/Authenticate.aspx
-The session has expired Redirect to: /_login/default.aspx
....

FIGURE 5
Sliding sessions in the a-Portal web application

The sequence diagram shows a simplified view of the sequence of interactions. In reality, SharePoint and the WS-Federation protocol use browser redirects and automatic posts to manage the interactions between the various components so all of the requests go through the browser.

In the sequence diagram, T_F represents the session lifetime. The session lifetime also defines the inactivity period, after which a user must re-authenticate with ADFS.

The following notes refer to the numbers on the sequence diagram:

1. This is the first time that the user visits the a-Portal web application; there is no valid session so SharePoint redirects the user to begin the sign-in process.
2. SharePoint creates a session for the user. The effective lifetime of the session is the difference between the lifetime of the SAML token issued by ADFS and the value of the **LogonTokenCacheExpirationWindow** property. For Adatum, the lifetime of the session is 10 minutes:

the lifetime of the SAML token is 480 minutes, and the value of the **LogonTokenCacheExpirationWindow** property is 470 minutes.

3. SharePoint checks the age of the session. At this point, although the session is still valid, it is nearing the end of its lifetime so SharePoint creates a new session, copying data from the existing session.
4. SharePoint checks the age of the session. At this point, it is still near the beginning of its lifetime so SharePoint continues to use this session.
5. SharePoint checks the age of the session. At this point, the session has expired so SharePoint initiates the process of re-authenticating with the identity provider.

Closing the Browser

The default behavior for SharePoint is to use persistent session cookies. This enables a user to close the browser, re-open the browser, and re-visit a SharePoint web application without signing in again. Adatum wants users to always re-authenticate if they close the browser and then re-open it and revisit the a-Portal web application. To enforce this behavior, Adatum configured SharePoint to use an in-memory instead of a persistent session cookie. You can use the following PowerShell script to do this.

```
$sts = Get-SPSecurityTokenServiceConfig
$sts.UseSessionCookies = $true
$sts.Update()
iisreset
```

Authorization Rules

With multiple partners having access to the a-Portal SharePoint web application, Adatum wants to have the ability to restrict access to documents in the SharePoint document library based on the organization that the user belongs to. Adatum wants to be able to use the standard SharePoint groups mechanism for assigning and managing permissions, so it needs some way to identify the organization a user belongs to.

Adatum achieves this objective by using claims. Adatum has configured ADFS to add an **organization** claim to the SAML token it issues based on the federated identity provider that originally authenticated the user. You should not rely on the identity provider to issue the organization claim because a malicious administrator at a partner organization could add an **organization** claim with another partner's value and gain access to confidential data.

Chapter 11, "Claims-Based Single Sign-On for Microsoft SharePoint 2010," describes how to add the organization claim to the SharePoint people picker to make it easy for site administrators to set permissions based on the value of the **organization** claim.

Home Realm Discovery

If Adatum shares the a-Portal web application with multiple partners, each of those partners will have its own identity provider, as shown in Figure 2 earlier in this chapter. With multiple identity providers in place, there must be some mechanism for selecting the correct identity provider for a user to use for authentication, and that's the home-realm discovery process.

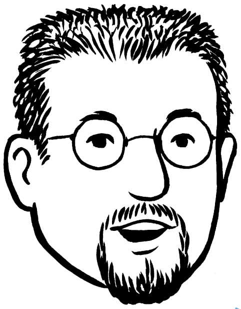
Adatum decided to customize the home-realm discovery page that ADFS provides. The default page in ADFS (/adfs/ls/HomeRealmDiscovery.aspx) displays a drop-down list of the claims provider trusts configured in ADFS (claims provider trusts represent identity providers in ADFS) for the user to select an identity provider. ADFS then redirects the user to the sign-in page at the identity provider. It's easy to customize this page with partner logos to make it easier for users to select the correct identity provider. In addition, this page in ADFS has access to the relying party identifier in the **wtrealm** parameter so it can customize the list of identity providers based on the identity of the SharePoint relying party web application. After a user has selected an identity provider for the first time, ADFS can remember the choice so that in the future, the user bypasses the home-realm discovery page and redirects the browser directly to the identity provider's sign-in page.

Claims provider trusts represent identity providers in ADFS.

For details about how to customize the ADFS home-realm discovery page and configure how long ADFS will remember a user's selection, see this page on the MSDN® web site: http://msdn.microsoft.com/en-us/library/bb625464(VS.85).aspx.

Adatum also considered the following options related to the home-realm discovery page.

- Automatically determine a user's home realm based on the user's IP address. This would remove the requirement for the user to specify her home realm when she first visits ADFS; however, this approach is not very reliable, especially with mobile and home workers and does not provide any additional security because IP addresses can be spoofed.



You should be sure to keep your SharePoint environment up to date with the latest patches from Microsoft.

- Perform the home-realm discovery in SharePoint instead of ADFS. Adatum could customize the standard SharePoint login page (usually located at C:\Program Files\Common Files\Microsoft Shared\Web Server Extensions\14\template\identity-model\login\default.aspx) to display the list of identity providers, and then append a **whr** parameter identifying the user's home realm to the address of the ADFS sign-in page. However, the SharePoint login page only displays to the user if multiple authentication types are configured in SharePoint; Adatum only has a single authentication type configured for the a-Portal web application so Adatum would need to override the behavior of the standard login page so that it always displays. By default, all SharePoint web applications share this login page, so SharePoint would display the same list of identity providers regardless of the SharePoint web application the user is accessing. You can override this behavior and display a separate login page for each SharePoint web application.

Questions

1. In the scenario described in this chapter, Adatum prefers to maintain a single trust relationship between SharePoint and ADFS, and to maintain the trust relationships with the multiple partners in ADFS. Which of the following are valid reasons for adopting this model?
   a. It enables Adatum to collect audit data relating to external sign-ins from ADFS.
   b. It allows for the potential reuse of the trust relationships with partners in other Adatum applications.
   c. It allows Adatum to implement automatic home realm discovery.
   d. It makes it easier for Adatum to ensure that SharePoint receives a consistent set of claim types.
2. When must a SharePoint user reauthenticate with the claims issuer (ADFS in the Adatum scenario)?
   a. Whenever the user closes and then reopens the browser.

   b. Whenever the ADFS web SSO cookie expires.
   c. Whenever the SharePoint FedAuth cookie that contains the SAML token expires.
   d. Every ten minutes.

3. Which of the following statements are true with regard to the Adatum sliding session implementation?
   a. SharePoint tries to renew the session cookie before it expires.
   b. SharePoint waits for the session cookie to expire and then creates a new one.
   c. When SharePoint renews the session cookie, it always requests a new SAML token from ADFS.
   d. SharePoint relies on sliding sessions in ADFS.

4. Where is the **organization** claim that SharePoint uses to authorize access to certain documents in the a-Portal web application generated?
   a. In the SharePoint STS.
   b. In the identity provider's STS; for example in the Litware issuer.
   c. In ADFS.
   d. Any of the above.

5. Why does Adatum rely on ADFS to perform home realm discovery?
   a. It's easier to implement in ADFS than in SharePoint.
   b. You can customize the list of identity providers for each SharePoint web application in ADFS.
   c. You cannot perform home realm discovery in Share-Point.
   d. You can configure ADFS to remember a user's choice of identity provider.

More Information

For information about Windows Identity Foundation (WIF) and sliding sessions see this post: **http://blogs.msdn.com/b/vbertocci/archive/2010/06/16/warning-sliding-sessions-are-closer-than-they-appear.aspx.**

For more information about automated home-realm discovery, see Chapter 6, "Federated Identity with Multiple Partners," and Chapter 7, "Federated Identity with Multiple Partners and Windows Azure Access Control Service."

Appendix A Using Fedutil

This appendix shows you how to use the FedUtil wizard for the scenarios in this book. Note that a Security Token Service (STS) is equivalent to an issuer.

Using FedUtil to Make an Application Claims-Aware

This procedure shows how to use FedUtil to make an application claims-aware. In this example, the application is a-Order.

First you'll need to open the FedUtil tool. There are two ways to do so. One way is to go to the Windows Identity Foundation (WIF) SDK directory and run **FedUtil.exe**. The other is to open the single sign-on (SSO) solution in Microsoft® Visual Studio® development system, right-click the a-Order.ClaimsAware project, and then click **Add STS Reference**. In either case, the FedUtil wizard opens.

TO MAKE AN APPLICATION CLAIMS-AWARE

1. In the **Application configuration location** box, enter the location of the a-Order Web.config file or browse to it. In the **Application URI** box, enter the Uniform Resource Indicator (URI) for aOrder, and then click **Next**.
2. In the **Security Token Service** dialog box, select **Use an Existing STS**. Alternatively, you can select **Create a new STS project in the current solution** to create a custom STS that you can modify.
3. In the **STS federation metadata location** box, enter the URI of the federation metadata or browse to it, and then click **Next**.

4. In the **Security token encryption** dialog box, select **No encryption**, and then click **Next**.
5. In the **Offered claims** dialog box, click **Next**.
6. On the Summary page, click **Finish**.

Along with using FedUtil, you must also make the following changes:

- In the a-Expense Web.config file, change the name of **Trusted Issuer** to **Adatum**. This is necessary because a-Expense uses a custom data store for users and roles mapping. Names should be formatted as Adatum\name. For example, Adatum\mary is correctly formatted.
- Place the ADFS token signing certificate into the Trusted People store of the local machine.

Appendix B Message Sequences

Appendix B shows in detail the message sequences for the passive (browser-based) and active (smart) client scenarios. It also includes information about what the HTTP and, where applicable, Kerberos, traffic looks like as the browser or client, the application, the issuer, and Microsoft® Active Directory® directory service communicate with each other.

The Browser-Based Scenario

Figure 1 shows the message sequence for the browser-based scenario.

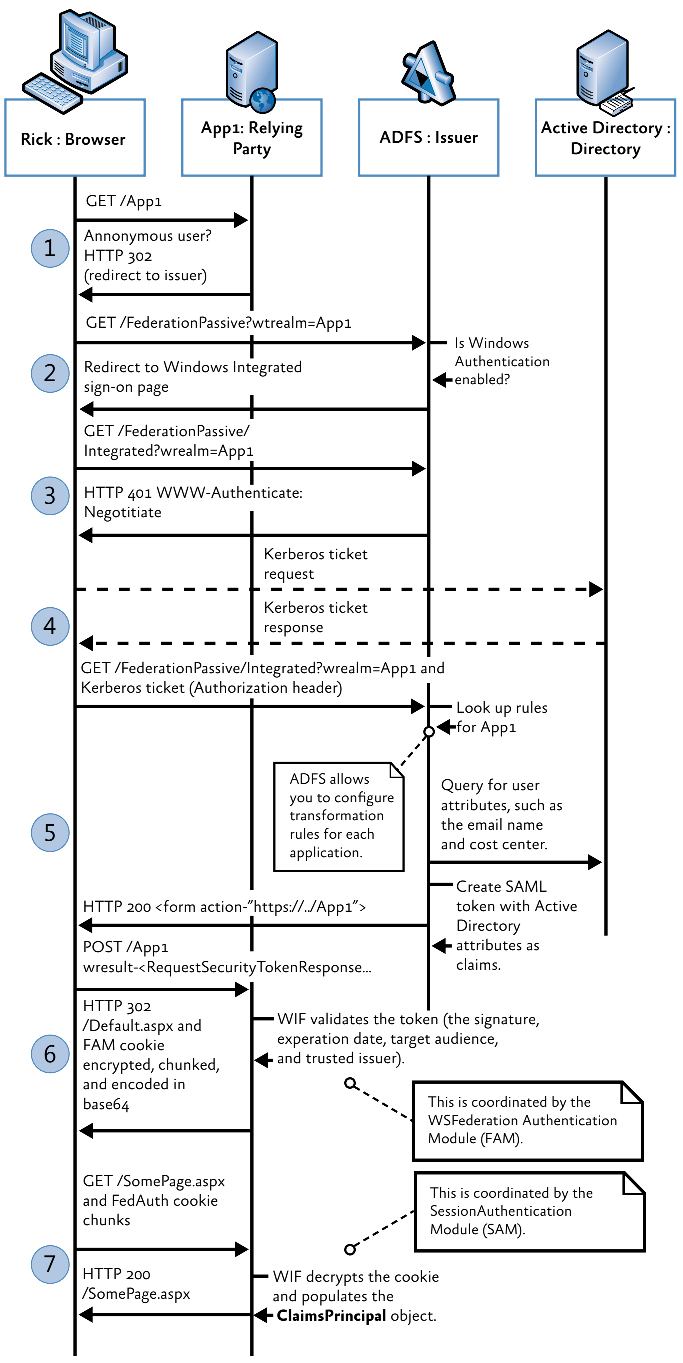
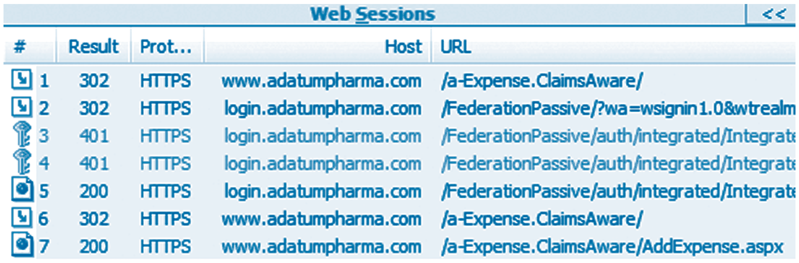

Rick : Browser
App1: Relying Party
ADFS : Issuer
Active Directory : Directory
GET /App1
1
Annonymous user? HTTP 302 (redirect to issuer)
GET /FederationPassive?wtrealm=App1
Is Windows Authentication enabled?
2
Redirect to Windows Integrated sign-on page
GET /FederationPassive/ Integrated?wrealm=App1
3
HTTP 401 WWW-Authenticate: Negotitiate
Kerberos ticket request
4
Kerberos ticket response
GET /FederationPassive/Integrated?wrealm=App1 and Kerberos ticket (Authorization header)
Look up rules for App1
ADFS allows you to configure transformation rules for each application.
5
Query for user attributes, such as the email name and cost center.
Create SAML token with Active Directory attributes as claims.
HTTP 200 <form action-"https://../App1">
POST /App1 wresult-<RequestSecurityTokenResponse...
6
HTTP 302 /Default.aspx and FAM cookie encrypted, chunked, and encoded in base64
WIF validates the token (the signature, experation date, target audience, and trusted issuer).
This is coordinated by the WSFederation Authentication Module (FAM).
GET /SomePage.aspx and FedAuth cookie chunks
This is coordinated by the SessionAuthentication Module (SAM).
7
HTTP 200 /SomePage.aspx
WIF decrypts the cookie and populates the ClaimsPrincipal object.

FIGURE 1
Message sequence for the browser-based scenario

Figure 2 shows the traffic generated by the browser.



Web Sessions

#	Result	Prot...	Host	URL
1	302	HTTPS	www.adatumpharma.com	/a-Expense.ClaimsAware/
2	302	HTTPS	login.adatumpharma.com	/FederationPassive/?wa=wsignin1.0&wtrealm
3	401	HTTPS	login.adatumpharma.com	/FederationPassive/auth/integrated/Integrate
4	401	HTTPS	login.adatumpharma.com	/FederationPassive/auth/integrated/Integrate
5	200	HTTPS	login.adatumpharma.com	/FederationPassive/auth/integrated/Integrate
6	302	HTTPS	www.adatumpharma.com	/a-Expense.ClaimsAware/
7	200	HTTPS	www.adatumpharma.com	/a-Expense.ClaimsAware/AddExpense.aspx

FIGURE 2
HTTP traffic

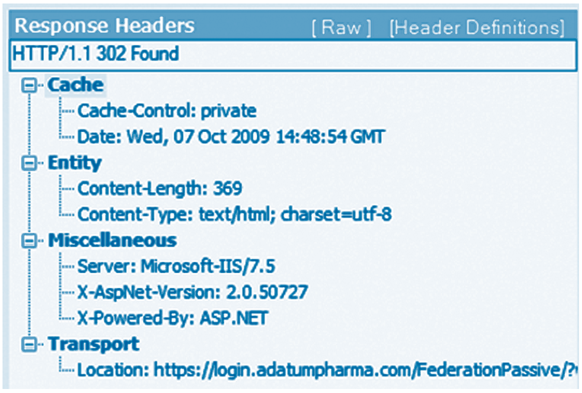
The numbers in the screenshot correspond to the steps in the message diagram. In this example, the name of the application is a-Expense.ClaimsAware. For example, step 1 in the screen shot shows the initial HTTP redirect to the issuer that is shown in the message diagram. The following table explains the symbols in the "#" column.

Symbol	Meaning
Arrow	An arrow indicates an HTTP 302 redirect.
Key	A key indicates a Kerberos ticket transaction (the 401 code indicates that authentication is required).
Globe	A globe indicates a response to a successful request, which means that the user can access a website.

STEP 1

The anonymous user browses to a-Expense and the Federation Authentication Module (FAM), **WSFederatedAuthenticationModule,** redirects the user to the issuer which, in this example, is located at https://login.adatumpharma.com/FederationPassive. As part of the request URL, there are four query string parameters: **wa** (the action to execute, which is wsignin1.0), **wtrealm** (the relying party that this token applies to, which is a-Expense), **wctx** (context data such as a return URL that will be propagated among the different parties), and **wct** (a time stamp).

Figure 3 shows the response headers for step 1.

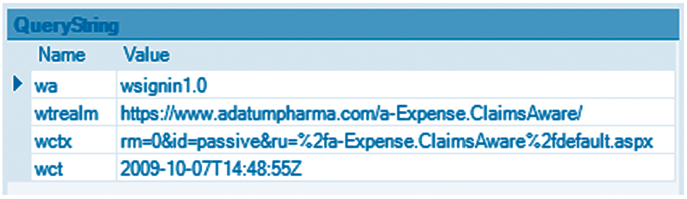


```
Response Headers                [ Raw ]  [Header Definitions]
HTTP/1.1 302 Found
⊟ Cache
    Cache-Control: private
    Date: Wed, 07 Oct 2009 14:48:54 GMT
⊟ Entity
    Content-Length: 369
    Content-Type: text/html; charset=utf-8
⊟ Miscellaneous
    Server: Microsoft-IIS/7.5
    X-AspNet-Version: 2.0.50727
    X-Powered-By: ASP.NET
⊟ Transport
    Location: https://login.adatumpharma.com/FederationPassive/?
```

FIGURE 3
Response headers for step 1

The FAM on a-Expense redirects the anonymous user to the issuer.

Figure 4 shows the parameters that are sent to the issuer with the query string.



QueryString

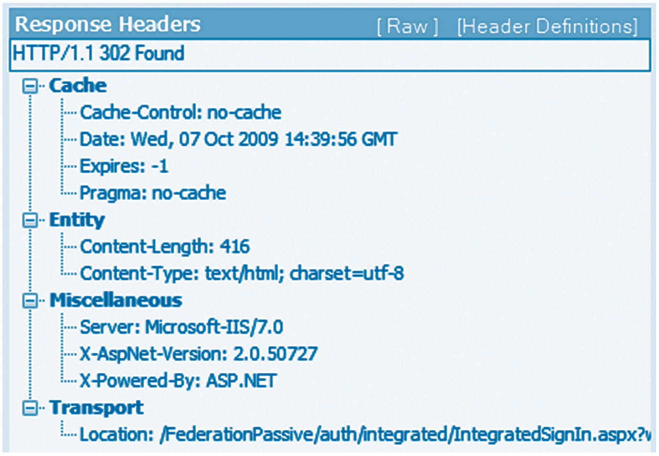
Name	Value
wa	wsignin1.0
wtrealm	https://www.adatumpharma.com/a-Expense.ClaimsAware/
wctx	rm=0&id=passive&ru=%2fa-Expense.ClaimsAware%2fdefault.aspx
wct	2009-10-07T14:48:55Z

FIGURE 4
Query string parameters

STEP 2

The issuer is Active Directory Federation Services (ADFS) 2.0 configured with Integrated Windows® Authentication only. Figure 5 shows that ADFS redirects the user to the integrated sign-on page.

ADFS can be configured to allow Integrated Windows Authentication and/or client certificate authentication and/or forms-based authentication. In either case, credentials are mapped to an Active Directory account.

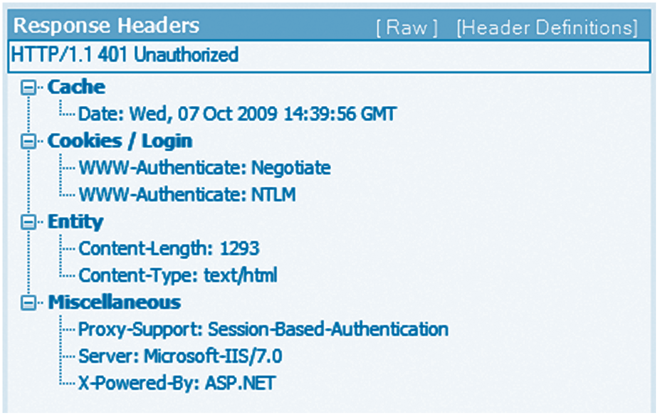


```
Response Headers                    [ Raw ]  [Header Definitions]
HTTP/1.1 302 Found
⊟ Cache
    Cache-Control: no-cache
    Date: Wed, 07 Oct 2009 14:39:56 GMT
    Expires: -1
    Pragma: no-cache
⊟ Entity
    Content-Length: 416
    Content-Type: text/html; charset=utf-8
⊟ Miscellaneous
    Server: Microsoft-IIS/7.0
    X-AspNet-Version: 2.0.50727
    X-Powered-By: ASP.NET
⊟ Transport
    Location: /FederationPassive/auth/integrated/IntegratedSignIn.aspx?v
```

FIGURE 5
ADFS redirecting the user to the Integrated Windows Authentication page

STEP 3

The IntegratedSignIn.aspx page is configured to use Integrated Windows Authentication on Microsoft Internet Information Services (IIS). This means that the page will reply with an HTTP 401 status code and the “WWW-Authenticate: Negotiate” HTTP header. This is shown in Figure 6.



```
Response Headers                    [ Raw ]  [Header Definitions]
HTTP/1.1 401 Unauthorized
⊟ Cache
    Date: Wed, 07 Oct 2009 14:39:56 GMT
⊟ Cookies / Login
    WWW-Authenticate: Negotiate
    WWW-Authenticate: NTLM
⊟ Entity
    Content-Length: 1293
    Content-Type: text/html
⊟ Miscellaneous
    Proxy-Support: Session-Based-Authentication
    Server: Microsoft-IIS/7.0
    X-Powered-By: ASP.NET
```

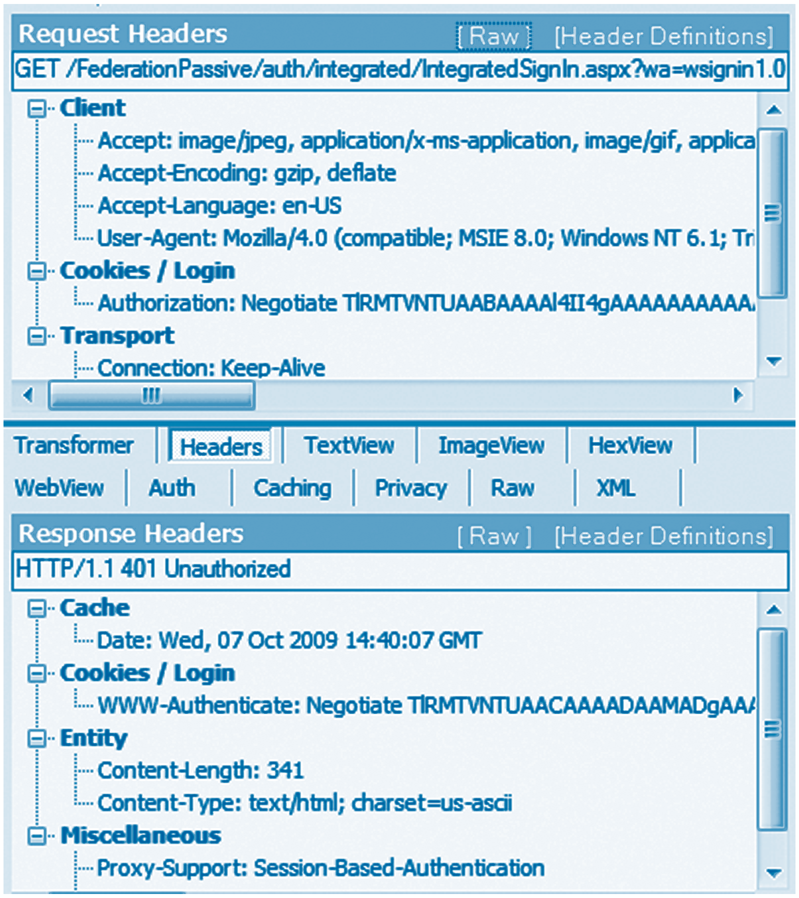
FIGURE 6
ADFS returning WWW-Authenticate: Negotiate header

IIS returns the WWW-Authenticate:Negotiate header to let the browser know that it supports Kerberos or NTLM.

STEP 4

At this point, the user authenticates with Microsoft Windows credentials, using either Kerberos or NTLM. Figure 7 shows the HTTP traffic for NTLM, not Kerberos.

If the infrastructure, such as the browser and the service principal names, are correctly configured, the client can avoid step 4 by requesting a service ticket from the key distribution center that is hosted on the domain controller. It can then use this ticket together with the authenticator in the next HTTP request.



```
Request Headers                                  [Raw]  [Header Definitions]
GET /FederationPassive/auth/integrated/IntegratedSignIn.aspx?wa=wsignin1.0
Client
    Accept: image/jpeg, application/x-ms-application, image/gif, applica
    Accept-Encoding: gzip, deflate
    Accept-Language: en-US
    User-Agent: Mozilla/4.0 (compatible; MSIE 8.0; Windows NT 6.1; Tr
Cookies / Login
    Authorization: Negotiate TlRMTVNTUAABAAAAl4II4gAAAAAAAAAA
Transport
    Connection: Keep-Alive
```

```
Response Headers                                 [Raw]  [Header Definitions]
HTTP/1.1 401 Unauthorized
Cache
    Date: Wed, 07 Oct 2009 14:40:07 GMT
Cookies / Login
    WWW-Authenticate: Negotiate TlRMTVNTUAACAAAADAAMADgAA
Entity
    Content-Length: 341
    Content-Type: text/html; charset=us-ascii
Miscellaneous
    Proxy-Support: Session-Based-Authentication
```

FIGURE 7
NTLM handshake on the ADFS website

The Cookies/Login node for the request headers shows the NTLM handshake process. This process has nothing to do with claims, WS-Federation, Security Assertion Markup Language (SAML), or WS-Trust. The same thing would happen for any site that is configured with Integrated Windows Authentication. Note that this step does not occur for Kerberos.

STEP 5

Now that the user has been successfully authenticated with Microsoft Windows credentials, ADFS can generate a SAML token based on the Windows identity. ADFS looks up the claims mapping rules associated with the application using the **wtrealm** parameter mentioned in step 1 and executes them. The result of those rules is a set of claims that will be included in a SAML assertion and sent to the user's browser.

The following XML code shows the token that was generated (some attributes and namespaces were deleted for clarity).

```
<t:RequestSecurityTokenResponse
  xmlns:t="http://schemas.xmlsoap.org/ws/2005/02/trust">
  <t:Lifetime>
    <wsu:Created>2009-10-22T14:40:07.978Z</wsu:Created>
    <wsu:Expires>2009-10-22T00:40:07.978Z</wsu:Expires>
  </t:Lifetime>
  <wsp:AppliesTo>
    <EndpointReference>
      <Address>
        https://www.adatumpharma.com/a-Expense.ClaimsAware/
      </Address>
    </EndpointReference>
  </wsp:AppliesTo>
  <t:RequestedSecurityToken>
    <saml:Assertion
        MinorVersion="1"
        AssertionID="_9f68..." Issuer="http://.../Trust">
      <saml:Conditions
        NotBefore="2009-10-22T14:40:07.978Z"
        NotOnOrAfter="2009-10-22T00:40:07.978Z">
        <saml:AudienceRestrictionCondition>
          <saml:Audience>
            https://www.adatumpharma.com/a-Expense.ClaimsAware/
          </saml:Audience>
        </saml:AudienceRestrictionCondition>
      </saml:Conditions>
      <saml:AttributeStatement>
        <saml:Subject>
          <saml:SubjectConfirmation>
            <saml:ConfirmationMethod>
               urn:oasis:names:tc:SAML:1.0:cm:bearer
```

*The **RequestSecurityToken Response** is defined in the WS-Trust specification. It's the shell that will enclose a token of any kind. The most common implementation of the token is SAML (version 1.1 or 2.0). The shell contains the lifetime and the endpoint address for this token.*

The token expiration date (for WS-Fed).

The token audience (for WS-Fed).

The SAML token is represented by an assertion that contains certain conditions, such as the expiration time and audience restrictions.

The token audience (for SAML).

*Because the browser does not hold a key that can prove its identity, the token generated is of type **bearer**. In this scenario, enabling HTTPS is critical to avoid potential attacks.*

```
            </saml:ConfirmationMethod>
          </saml:SubjectConfirmation>
        </saml:Subject>
        <saml:Attribute
           AttributeName="name"
           AttributeNamespace=
               "http://.../ws/2005/05/identity/claims">
          <saml:AttributeValue>mary</saml:AttributeValue>
        </saml:Attribute>
        <saml:Attribute
           AttributeName="CostCenter"
           AttributeNamespace=
                "http://schemas.adatumpharma.com/2009/08/claims">
          <saml:AttributeValue>394002</saml:AttributeValue>
        </saml:Attribute>
      </saml:AttributeStatement>
      <ds:Signature>
       <ds:SignedInfo>
       ...
       </ds:SignedInfo>
       <ds:SignatureValue>
          dCHtoNUbvVyz8...n0XEA6BI=
       </ds:SignatureValue>
       <KeyInfo>
         <X509Data>
          <X509Certificate>
             MIIB6DCC...gUitvS6JhHdg
         </X509Certificate>
         </X509Data>
       </KeyInfo>
     </ds:Signature>
    </saml:Assertion>
  </t:RequestedSecurityToken>
  <t:TokenType>
     http://docs.oasis-open.org/wss/
         oasis-wss-saml-token-profile-1.1#SAMLV1.1
  </t:TokenType>
  <t:RequestType>
     http://schemas.xmlsoap.org/ws/2005/02/trust/Issue
  </t:RequestType>
  <t:KeyType>
     http://schemas.xmlsoap.org/ws/2005/05/identity/NoProofKey
  </t:KeyType>
</t:RequestSecurityTokenResponse>
```

The claims are represented by the SAML attributes, where ***ClaimType*** *equals the* ***AttributeNamespace*** *and the* ***AttributeName****. The* ***ClaimValue*** *equals the* ***AttributeValue****.*

The signature and the public key (an X.509 certificate that is encoded in base64) that will be used to verify the signature on the website. If the verification was successful, you have to ensure that the certificate is the one you trust (either by checking its thumbprint or its serial number).

The token generated is SAML 1.1.

STEP 6

Once ADFS generates a token, it needs to send it back to the application. A standard HTTP redirect can't be used because the token may be 4 KB long, which is larger than most browsers' size limit for a URL. Instead, issuers generate a **<form>** that includes a POST method. The token is in a hidden field. A script auto-submits the form once the page loads. The following HTML code shows the issuer's response.

```
<html>
  <head>
    <title>Working...</title>
  </head>
  <body>
    <form
      method="POST"
      name="hiddenform"
      action=
        "https://www.adatumpharma.com/a-Expense.ClaimsAware/">
      <input type="hidden" name="wa" value="wsignin1.0" />
      <input
         type="hidden"
         name="wresult"
         value="&lt;t:RequestSecurityTokenResponse
                  xmlns...&lt;/t:RequestSecurityTokenResponse>"
      />
      <input
         type="hidden"
         name="wctx"
         value="rm=0&amp;id=passive&amp;
                   ru=%2fa-Expense.ClaimsAware%2fdefault.aspx"
      />
      <noscript>
        <p>Script is disabled. Click Submit to continue.</p>
        <input type="submit" value="Submit" />
      </noscript>
    </form>
    <script language="javascript">
      window.setTimeout(‘document.forms[0].submit()'’’’’, 0);
    </script>
  </body>
</html>
```

When the application receives the POST, the FAM takes control of the process. It listens for the **AuthenticateRequest** event. Figure 8 shows the sequence of steps that occur in the handler of the **AuthenticateRequest** event.

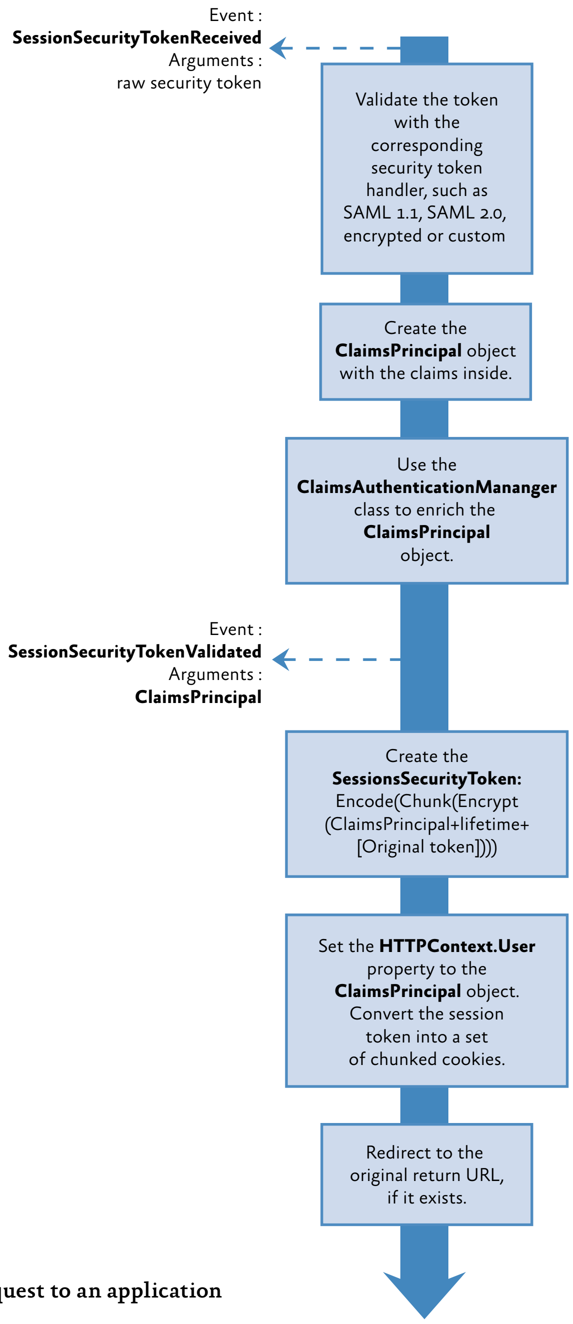
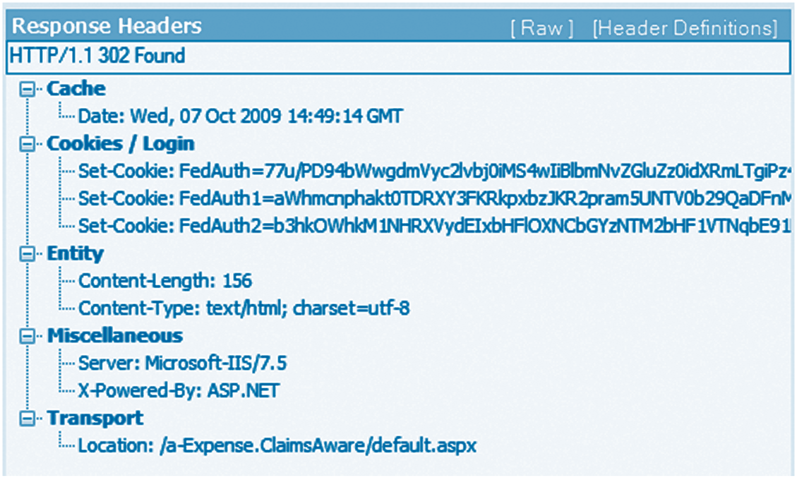

Event :
SessionSecurityTokenReceived
Arguments :
raw security token
Validate the token with the corresponding security token handler, such as SAML 1.1, SAML 2.0, encrypted or custom
Create the **ClaimsPrincipal** object with the claims inside.
Use the **ClaimsAuthenticationMananger** class to enrich the **ClaimsPrincipal** object.
Event :
SessionSecurityTokenValidated
Arguments :
ClaimsPrincipal
Create the **SessionsSecurityToken:** Encode(Chunk(Encrypt (ClaimsPrincipal+lifetime+ [Original token])))
Set the **HTTPContext.User** property to the **ClaimsPrincipal** object. Convert the session token into a set of chunked cookies.
Redirect to the original return URL, if it exists.

FIGURE 8
Logic for an initial request to an application

Notice that one of the steps that the FAM performs is to create the session security token. In terms of network traffic, this token is a set of cookies named **FedAuth[n]** that is the result of compressing, encrypting, and encoding the **ClaimsPrincipal** object. The cookies are chunked to avoid exceeding any cookie size limitations. Figure 9 shows the HTTP response, where a session token is chunked into three cookies.



```
HTTP/1.1 302 Found
Cache
    Date: Wed, 07 Oct 2009 14:49:14 GMT
Cookies / Login
    Set-Cookie: FedAuth=77u/PD94bWwgdmVyc2lvbj0iMS4wIiBlbmNvZGluZz0idXRmLTgiPz
    Set-Cookie: FedAuth1=aWhmcnphakt0TDRXY3FKRkpxbzJKR2pram5UNTV0b29QaDFn
    Set-Cookie: FedAuth2=b3hkOWhkM1NHRXVydEIxbHFlOXNCbGYzNTM2bHF1VTNqbE91
Entity
    Content-Length: 156
    Content-Type: text/html; charset=utf-8
Miscellaneous
    Server: Microsoft-IIS/7.5
    X-Powered-By: ASP.NET
Transport
    Location: /a-Expense.ClaimsAware/default.aspx
```

FIGURE 9
HTTP response from the website with a session token chunked into three cookies

STEP 7

The session security token (the FedAuth cookies) is sent on subsequent requests to the application. In the same way that the FAM handles the **AuthenticationRequest** event, the SAM executes the logic shown in Figure 10.

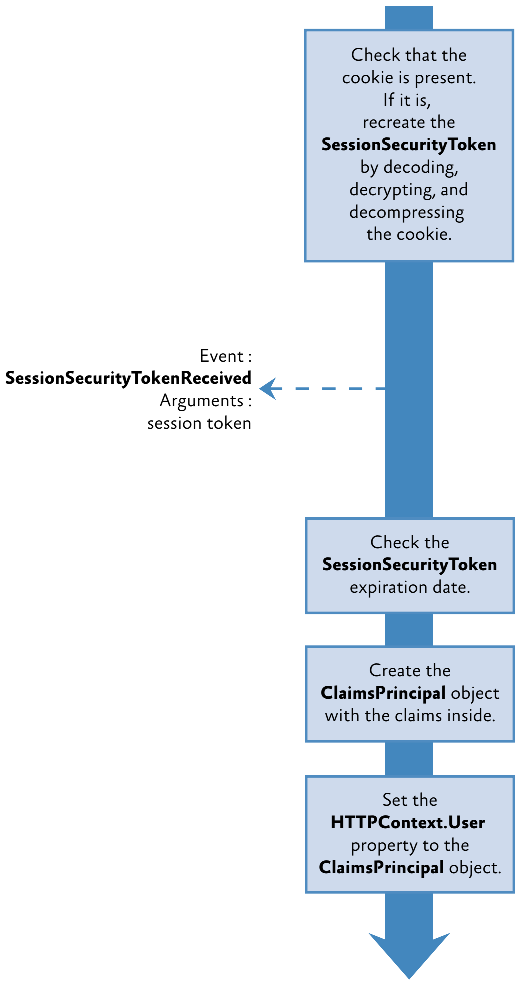
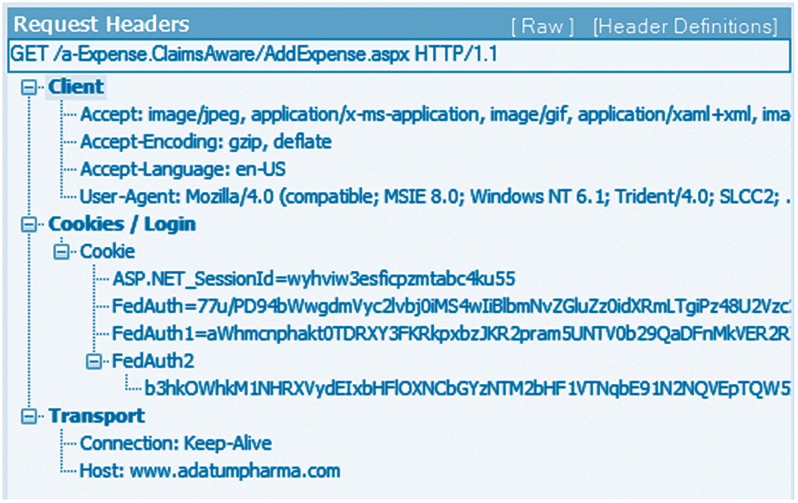

Check that the cookie is present. If it is, recreate the **SessionSecurityToken** by decoding, decrypting, and decompressing the cookie.
Event : **SessionSecurityTokenReceived** Arguments : session token
Check the **SessionSecurityToken** expiration date.
Create the **ClaimsPrincipal** object with the claims inside.
Set the **HTTPContext.User** property to the **ClaimsPrincipal** object.

FIGURE 10
Logic for subsequent requests to the application

The **FedAuth** cookies are sent on each request. Figure 11 shows the network traffic.


Request Headers [Raw] [Header Definitions]

```
GET /a-Expense.ClaimsAware/AddExpense.aspx HTTP/1.1
Client
    Accept: image/jpeg, application/x-ms-application, image/gif, application/xaml+xml, ima
    Accept-Encoding: gzip, deflate
    Accept-Language: en-US
    User-Agent: Mozilla/4.0 (compatible; MSIE 8.0; Windows NT 6.1; Trident/4.0; SLCC2; .
Cookies / Login
    Cookie
        ASP.NET_SessionId=wyhviw3esficpzmtabc4ku55
        FedAuth=77u/PD94bWwgdmVyc2lvbj0iMS4wIiBlbmNvZGluZz0idXRmLTgiPz48U2Vzc
        FedAuth1=aWhmcnphakt0TDRXY3FKRkpxbzJKR2pram5UNTV0b29QaDFnMkVER2R
        FedAuth2
            b3hkOWhkM1NHRXVydEIxbHFlOXNCbGYzNTM2bHF1VTNqbE91N2NQVEpTQW5
Transport
    Connection: Keep-Alive
    Host: www.adatumpharma.com
```

FIGURE 11
Traffic for a second HTTP request

The Active Client Scenario

The following section shows the interactions between an active client and a web service that is configured to trust tokens generated by an ADFS issuer. Figure 12 shows a detailed message sequence diagram.

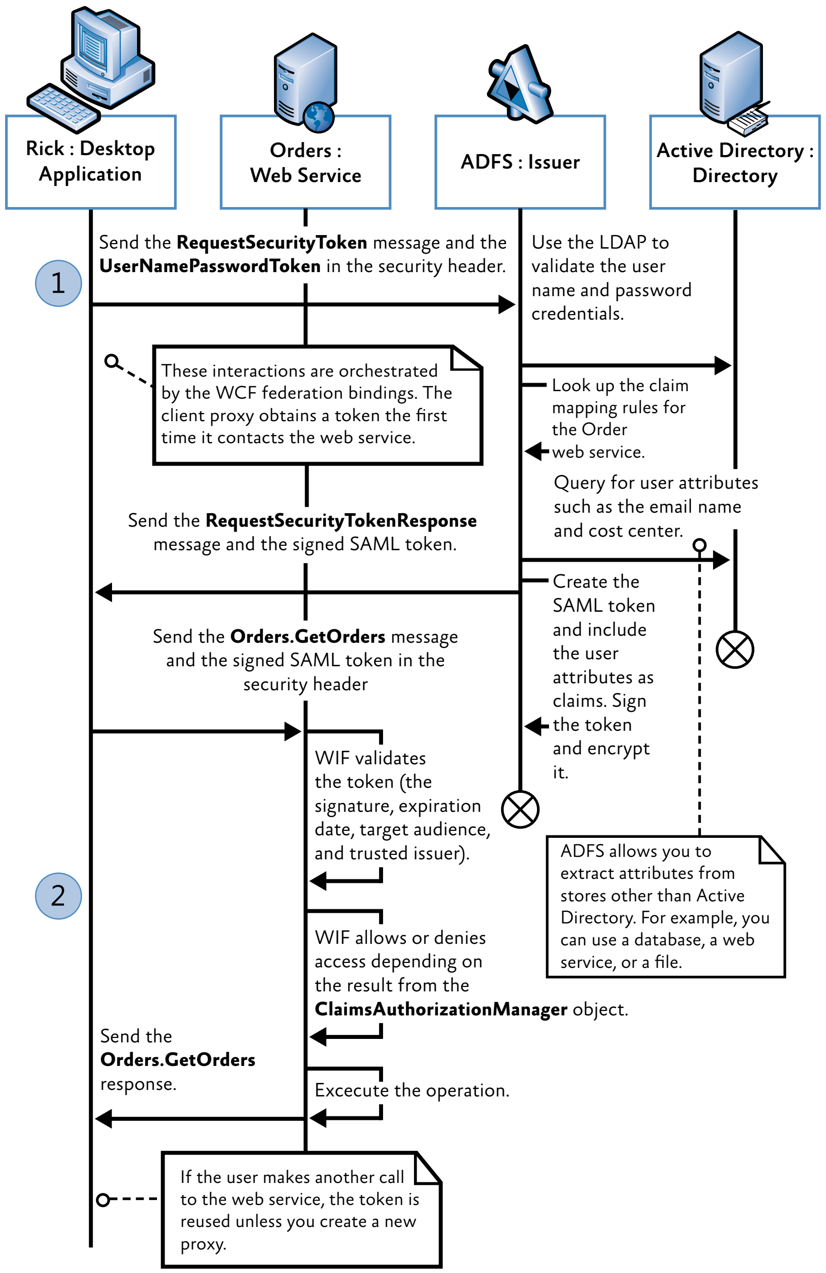
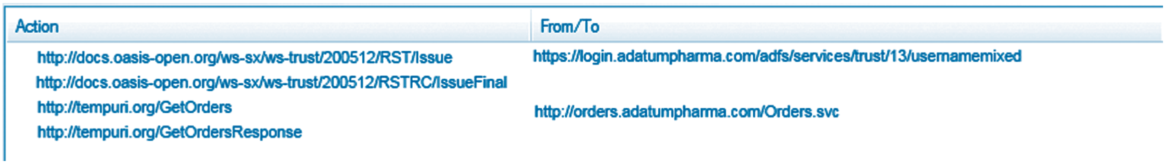

Rick : Desktop Application
Orders : Web Service
ADFS : Issuer
Active Directory : Directory
1
Send the **RequestSecurityToken** message and the **UserNamePasswordToken** in the security header.
Use the LDAP to validate the user name and password credentials.
These interactions are orchestrated by the WCF federation bindings. The client proxy obtains a token the first time it contacts the web service.
Look up the claim mapping rules for the Order web service.
Query for user attributes such as the email name and cost center.
Send the **RequestSecurityTokenResponse** message and the signed SAML token.
Create the SAML token and include the user attributes as claims. Sign the token and encrypt it.
Send the **Orders.GetOrders** message and the signed SAML token in the security header
WIF validates the token (the signature, expiration date, target audience, and trusted issuer).
ADFS allows you to extract attributes from stores other than Active Directory. For example, you can use a database, a web service, or a file.
2
WIF allows or denies access depending on the result from the **ClaimsAuthorizationManager** object.
Send the **Orders.GetOrders** response.
Excecute the operation.
If the user makes another call to the web service, the token is reused unless you create a new proxy.

FIGURE 12
Active client scenario message-diagram

Figure 13 shows the corresponding HTTP traffic for the active client message sequence.



Action	From/To
http://docs.oasis-open.org/ws-sx/ws-trust/200512/RST/Issue	https://login.adatumpharma.com/adfs/services/trust/13/usernamemixed
http://docs.oasis-open.org/ws-sx/ws-trust/200512/RSTRC/IssueFinal	
http://tempuri.org/GetOrders	http://orders.adatumpharma.com/Orders.svc
http://tempuri.org/GetOrdersResponse	

FIGURE 13
HTTP traffic

Following are the two steps, explained in detail.

STEP 1

The Orders web service is configured with the **wsFederationHttpBinding**. This binding specifies a web service policy that requires the client to add a SAML token to the SOAP security header in order to successfully invoke the web service. This means that the client must first contact the issuer with a set of credentials (the user name and password) to get the SAML token. The following message represents a **RequestSecurityToken** (RST) sent to the ADFS issuer (ADFS) hosted at **https://login.adatumpharma.com/adfs/services/trust/13/usernamemixed**. (Note that the XML code is abridged for clarity. Some of the namespaces and elements have been omitted.)

```
<s:Envelope>
  <s:Header>
    <a:Action>
      http://docs.oasis-open.org/ws-sx/ws-trust/200512/RST/Issue
    </a:Action>
    <a:To>
      https://login.adatumpharma.com/adfs/
                                   services/trust/13/usernamemixed
    </a:To>
    <o:Security>
      <o:UsernameToken
        u:Id="uuid-bffe89aa-e6fa-404d-9365-d078d73beca5-1">
        <o:Username>
          <!-- Removed-->
        </o:Username>
        <o:Password>
          <!-- Removed-->
        </o:Password>
      </o:UsernameToken>
    </o:Security>
```

*This is the endpoint of the issuer that accepts a **UsernameToken**.*

These are the credentials that are sent to the issuer.

```
  </s:Header>
  <s:Body>
    <trust:RequestSecurityToken
      xmlns:trust=
              "http://docs.oasis-open.org/ws-sx/ws-trust/200512">
      <wsp:AppliesTo>
        <EndpointReference>
          <Address>
             https://orders.adatumpharma.com/Orders.svc
          </Address>
        </EndpointReference>
      </wsp:AppliesTo>
      <trust:TokenType>
         http://docs.oasis-open.org/wss/
            oasis-wss-saml-token-profile-1.1#SAMLV1.1
      </trust:TokenType>
      <trust:KeyType>
         http://docs.oasis-open.org/ws-sx/
                                ws-trust/200512/SymmetricKey
    </trust:KeyType>
    </trust:RequestSecurityToken>
  </s:Body>
</s:Envelope>
```

The client specifies the intended recipient of the token. In this case, it is the Orders web service.

The issuer expects a SAML 1.1 token.

The issuer uses the credentials to authenticate the user and executes the corresponding rules to obtain user attributes from Active Directory (or any other attributes store it is configured to contact).

```
<s:Envelope>
  <s:Header>
<a:Action>http://docs.oasis-open.org/ws-sx/ws-trust/200512/RSTRC/
IssueFinal</a:Action>
  </s:Header>
  <s:Body>
    <trust:RequestSecurityTokenResponseCollection
xmlns:trust="http://docs.oasis-open.org/ws-sx/ws-trust/200512">
      <trust:RequestSecurityTokenResponse>
        <trust:Lifetime>
          <wsu:Created>2009-10-22T21:15:19.010Z</wsu:Created>
          <wsu:Expires>2009-10-22T22:15:19.010Z</wsu:Expires>
        </trust:Lifetime>
        <wsp:AppliesTo>
          <a:EndpointReference>
            <a:Address>
               https://orders.adatumpharma.com/Orders.svc
```

The issuer specifies the lifetime of the token.

The issuer specifies the intended recipient of the token. In this case, it is the Orders web service.

```
        </a:Address>
      </a:EndpointReference>
    </wsp:AppliesTo>
    <trust:RequestedSecurityToken>
      <xenc:EncryptedData>
        <xenc:EncryptionMethod
          Algorithm=
             "http://www.w3.org/2001/04/xmlenc#aes256-cbc" />
        <KeyInfo>
          <e:EncryptedKey>
            <KeyInfo>
              <o:SecurityTokenReference>
                <X509Data>
                  <X509IssuerSerial>
                    <X509IssuerName>
                       CN=localhost
                    </X509IssuerName>
                    <X509SerialNumber>
                     -124594669148411034902102654305925584353
                    </X509SerialNumber>
                  </X509IssuerSerial>
                </X509Data>
              </o:SecurityTokenReference>
            </KeyInfo>
            <e:CipherData>
               <e:CipherValue>
                    WayfmLM9DA5....u17QC+MWdZVCA2ikXwBc=
               </e:CipherValue>
            </e:CipherData>
          </e:EncryptedKey>
        </KeyInfo>
        <xenc:CipherData>
          <xenc:CipherValue>
              U6TLBMVR/M4Ia2Su....../oV+qg/VU=
          </xenc:CipherValue>
        </xenc:CipherData>
      </xenc:EncryptedData>
    </trust:RequestedSecurityToken>
    <trust:RequestedProofToken>
      <trust:ComputedKey>
         http://docs.oasis-open.org/ws-sx/
                                ws-trust/200512/CK/PSHA1
      </trust:ComputedKey>
    </trust:RequestedProofToken>
    <trust:TokenType>
```

The token was encrypted using an X.509 certificate (public key). The web service must have the corresponding private key to decrypt it. This section acts as a hint to help the web service select the correct key.

This is the encrypted token. The token is a SAML assertion that represents claims about the user. It's signed with the issuer's private signing key (see below for the decrypted SAML assertion).

```
          http://docs.oasis-open.org/wss/
                oasis-wss-saml-token-profile-1.1#SAMLV1.1
       </trust:TokenType>
       <trust:KeyType>
          http://docs.oasis-open.org/ws-sx/
                                          ws-trust/200512/SymmetricKey
       </trust:KeyType>
     </trust:RequestSecurityTokenResponse>
   </trust:RequestSecurityTokenResponseCollection>
  </s:Body>
</s:Envelope>
```

The token that is generated is a SAML 1.1 token.

If you had the private key to decrypt the token (highlighted above as "<e:CipherValue>U6TLBMVR/M4la2Su…"), the following is what you would see.

```
<saml:Assertion
  MajorVersion="1"
  MinorVersion="1"
  AssertionID="_a5c22af0-b7b2-4dbf-ac10-326845a1c6df"
  Issuer="http://login.adatumpharma.com/Trust"
  IssueInstant="2009-10-22T21:15:19.010Z ">
  <saml:Conditions
     NotBefore="2009-10-22T21:15:19.010Z "
     NotOnOrAfter="2009-10-22T22:15:19.010Z ">
     <saml:AudienceRestrictionCondition>
       <saml:Audience>
          https://orders.adatumpharma.com/Orders.svc
       </saml:Audience>
     </saml:AudienceRestrictionCondition>
  </saml:Conditions>
  <saml:AttributeStatement>
    <saml:Subject>
      <saml:SubjectConfirmation>
        <saml:ConfirmationMethod>
          urn:..:SAML:1.0:cm:holder-of-key
        </saml:ConfirmationMethod>
        <KeyInfo>
           <trust:BinarySecret>
              ztGzs3I...VW+6Th38o=
           </trust:BinarySecret>
        </KeyInfo>
      </saml:SubjectConfirmation>
    </saml:Subject>
    <saml:Attribute
```

This is the issuer identifier (it's a URI). It is different than the actual issuer sign-on URL.

The holder-of-key provides proof of ownership of a signed SAML token. SOAP clients often use this approach to prove that an incoming request is valid. Note that a browser can't access a key store the way a smart client can.

```
      AttributeName="name"
      AttributeNamespace=
         "http://schemas.xmlsoap.org/ws/2005/05/identity/claims">
      <saml:AttributeValue>rick</saml:AttributeValue>
    </saml:Attribute>
    <saml:Attribute
      AttributeName="role"
      AttributeNamespace=
       "http://schemas.xmlsoap.org/ws/2005/05/identity/claims">

      <saml:AttributeValueOrderTracker</saml:AttributeValue>
    </saml:Attribute>
  </saml:AttributeStatement>
  <ds:Signature>
    <ds:SignedInfo> ... </ds:SignedInfo>
      <ds:SignatureValue>
          dCHtoNUbvVyz8...n0XEA6BI=
      </ds:SignatureValue>
      <KeyInfo>
        <X509Data>
          <X509Certificate>
            MIIB6DCC...gUitvS6JhHdg
          </X509Certificate>
        </X509Data>
      </KeyInfo>
   </ds:Signature>
</saml:Assertion>
```

*The claims are represented by the SAML attributes. The **ClaimType** equals the **AttributeNamespace** and the **AttributeName**. The **ClaimValue** equals the **AttributeValue**.*

This is the signature and public key (an X.509 certificate encoded in base64) that will be used to verify the signature on the web service. If the verification is successful, you must ensure that the certificate is the one you trust, by checking either its thumbprint or its serial number.

STEP 2

Once the client obtains a token from the issuer, it can attach the token to the SOAP security header and call the web service. This is the SOAP message that is sent to the Orders web service.

```
<s:Envelope>
  <s:Header>

    <a:Action>http://tempuri.org/GetOrders</a:Action>
    <a:To>https://orders.adatumpharma.com/Orders.svc</a:To>
    <o:Security>
      <u:Timestamp u:Id="_0">
        <u:Created>2009-10-22T21:15:19.123Z</u:Created>
        <u:Expires>2009-10-22T21:20:19.123Z</u:Expires>
      </u:Timestamp>
      <xenc:EncryptedData >
        ... the token we've got in step 1 ...
```

Here are the SOAP action and the URL of the web service.

This is the token from step 1, but encrypted.

```
      </xenc:EncryptedData>
      <Signature xmlns="http://www.w3.org/2000/09/xmldsig#">
        ...
        <SignatureValue>
          oaZFLr+1y/I2kYcAvyQv6WSkPYk=
        </SignatureValue>
        <KeyInfo>
          <o:SecurityTokenReference>
            <o:KeyIdentifier
               ValueType=
                 "http://docs.oasis-open.org/wss/
                    oasis-wss-saml-token-profile-1.0#
                    SAMLAssertionID">
              _a5c22af0-b7b2-4dbf-ac10-326845a1c6df
            </o:KeyIdentifier>
          </o:SecurityTokenReference>
        </KeyInfo>
      </Signature>
    </o:Security>
  </s:Header>
  <s:Body>
    <GetOrders xmlns="http://tempuri.org/">
      <customerId>1231</customerId>
    </GetOrders>
  </s:Body>
</s:Envelope>
```

This is the signature of the message generated using the SAML assertion. This is a different signature from the token signature. This signature is generated for any security token (not just a SAML token) to protect the message content and source verification.

Windows Identity Foundation (WIF) and Windows Communication Foundation (WCF) will take care of decrypting and validating the SAML token. The claims will be added to the **ClaimsPrincipal** object and the principal will be added to the WCF security context. The WCF security context will be used in the authorization manager by checking the incoming claims against the operation call the client wants to make.

The Browser-Based Scenario with Access Control Service (ACS)

Figure 14 shows the message sequence for the browser-based scenario that authenticates with a social identity provider and uses ACS for protocol transition.

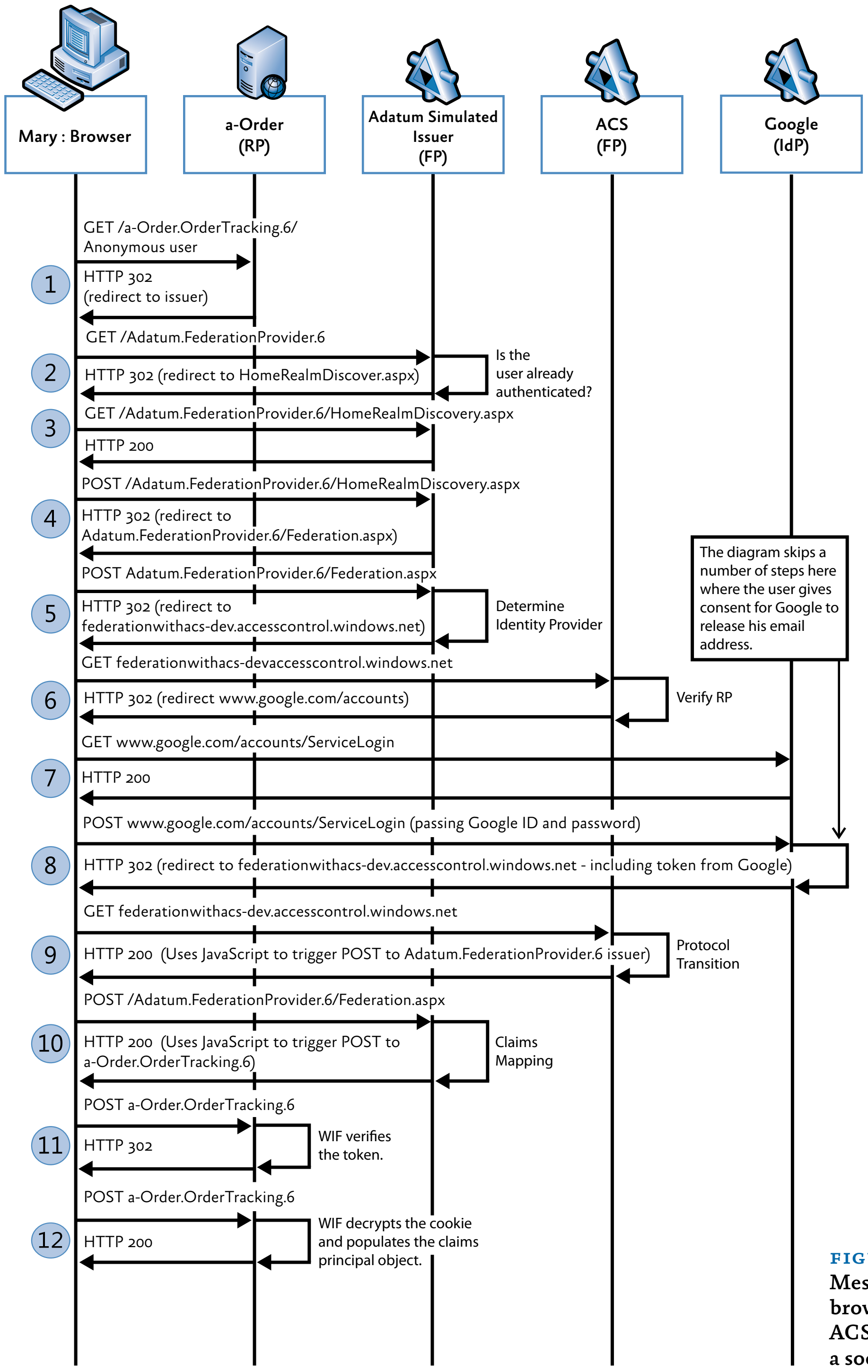
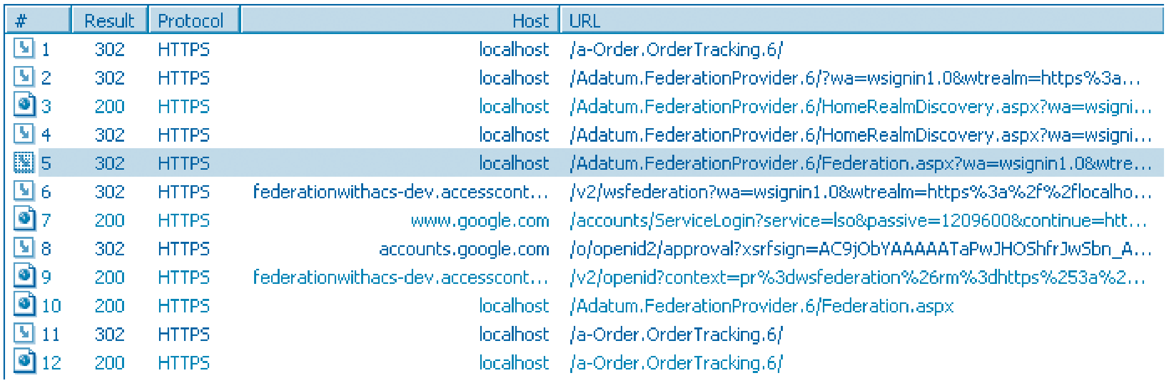

Mary : Browser
a-Order (RP)
Adatum Simulated Issuer (FP)
ACS (FP)
Google (IdP)
1
GET /a-Order.OrderTracking.6/ Anonymous user
HTTP 302 (redirect to issuer)
2
GET /Adatum.FederationProvider.6
HTTP 302 (redirect to HomeRealmDiscover.aspx)
Is the user already authenticated?
3
GET /Adatum.FederationProvider.6/HomeRealmDiscovery.aspx
HTTP 200
4
POST /Adatum.FederationProvider.6/HomeRealmDiscovery.aspx
HTTP 302 (redirect to Adatum.FederationProvider.6/Federation.aspx)
5
POST Adatum.FederationProvider.6/Federation.aspx
HTTP 302 (redirect to federationwithacs-dev.accesscontrol.windows.net)
Determine Identity Provider
The diagram skips a number of steps here where the user gives consent for Google to release his email address.
6
GET federationwithacs-devaccesscontrol.windows.net
HTTP 302 (redirect www.google.com/accounts)
Verify RP
7
GET www.google.com/accounts/ServiceLogin
HTTP 200
8
POST www.google.com/accounts/ServiceLogin (passing Google ID and password)
HTTP 302 (redirect to federationwithacs-dev.accesscontrol.windows.net - including token from Google)
9
GET federationwithacs-dev.accesscontrol.windows.net
HTTP 200 (Uses JavaScript to trigger POST to Adatum.FederationProvider.6 issuer)
Protocol Transition
10
POST /Adatum.FederationProvider.6/Federation.aspx
HTTP 200 (Uses JavaScript to trigger POST to a-Order.OrderTracking.6)
Claims Mapping
11
POST a-Order.OrderTracking.6
HTTP 302
WIF verifies the token.
12
POST a-Order.OrderTracking.6
HTTP 200
WIF decrypts the cookie and populates the claims principal object.

FIGURE 14
Message sequence for the browser-based scenario with ACS and authentication with a social identity provider

Figure 15 shows the key traffic generated by the browser. For reasons of clarity, we have removed some messages from the list.



#	Result	Protocol	Host	URL
1	302	HTTPS	localhost	/a-Order.OrderTracking.6/
2	302	HTTPS	localhost	/Adatum.FederationProvider.6/?wa=wsignin1.0&wtrealm=https%3a...
3	200	HTTPS	localhost	/Adatum.FederationProvider.6/HomeRealmDiscovery.aspx?wa=wsigni...
4	302	HTTPS	localhost	/Adatum.FederationProvider.6/HomeRealmDiscovery.aspx?wa=wsigni...
5	302	HTTPS	localhost	/Adatum.FederationProvider.6/Federation.aspx?wa=wsignin1.0&wtre...
6	302	HTTPS	federationwithacs-dev.accesscont...	/v2/wsfederation?wa=wsignin1.0&wtrealm=https%3a%2f%2flocalho...
7	200	HTTPS	www.google.com	/accounts/ServiceLogin?service=lso&passive=1209600&continue=htt...
8	302	HTTPS	accounts.google.com	/o/openid2/approval?xsrfsign=AC9jObYAAAAATaPwJHOShfrJwSbn_A...
9	200	HTTPS	federationwithacs-dev.accesscont...	/v2/openid?context=pr%3dwsfederation%26rm%3dhttps%253a%2...
10	200	HTTPS	localhost	/Adatum.FederationProvider.6/Federation.aspx
11	302	HTTPS	localhost	/a-Order.OrderTracking.6/
12	200	HTTPS	localhost	/a-Order.OrderTracking.6/

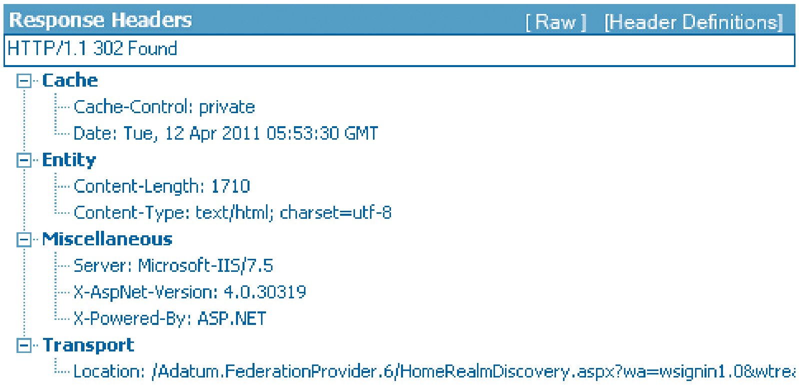
FIGURE 15
HTTP traffic

The numbers in the screenshot correspond to the steps in the message diagram. In this sample, the name of the application is a-Order.Tracking.6 and it is running on the local machine. The name of the mock issuer that takes the place of ADFS is Adatum.FederationProvider.6 and it is also running locally, and the name of the ACS instance is federationwithacs-dev.accesscontrol.windows.net. The sample illustrates a user authenticating with a Google identity.

STEP 1

The anonymous user browses to a-Order.OrderTracking.6, and because there is no established security session, the **WSFederatedAuthenticationModule** (FAM) redirects the browser to the issuer which, in this example is located at https://localhost/Adatum.FederationProvider.6/. As part of the request URL, there are four query string parameters: **wa** (the action to execute, which is wsignin1.0), **wtrealm** (the relying party that this token applies to, which is a-Order.OrderTracking), **wctx** (context data, such as a return URL that will be propagated among the different parties), and **wct** (a time stamp).

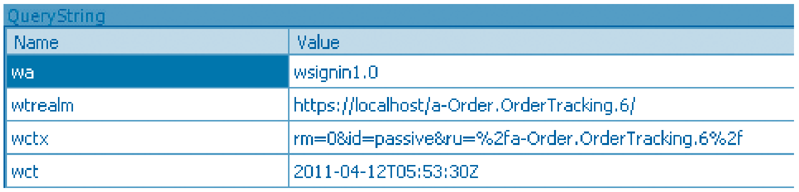
Figure 16 shows the response headers for step 1.



```
Response Headers                                  [ Raw ]  [Header Definitions]
HTTP/1.1 302 Found
Cache
    Cache-Control: private
    Date: Tue, 12 Apr 2011 05:53:30 GMT
Entity
    Content-Length: 1710
    Content-Type: text/html; charset=utf-8
Miscellaneous
    Server: Microsoft-IIS/7.5
    X-AspNet-Version: 4.0.30319
    X-Powered-By: ASP.NET
Transport
    Location: /Adatum.FederationProvider.6/HomeRealmDiscovery.aspx?wa=wsignin1.0&wtre
```

FIGURE 16
Response headers for step 1

Figure 17 shows the parameters that are sent to the issuer with the query string.



QueryString

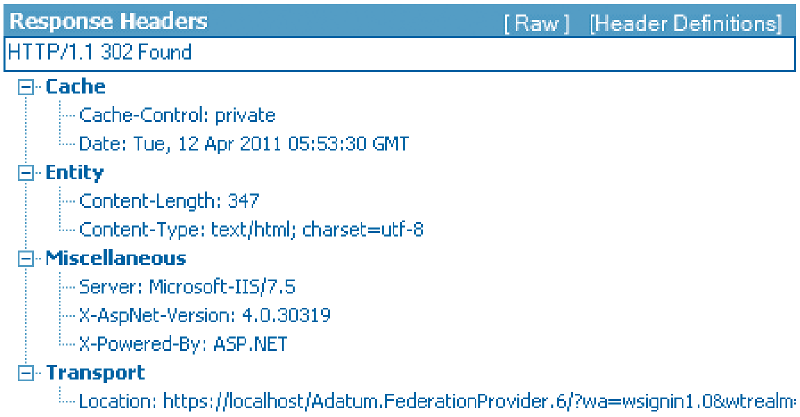
Name	Value
wa	wsignin1.0
wtrealm	https://localhost/a-Order.OrderTracking.6/
wctx	rm=0&id=passive&ru=%2fa-Order.OrderTracking.6%2f
wct	2011-04-12T05:53:30Z

FIGURE 17
Query string parameters

STEP 2

The issuer is a simulated issuer that takes the place of ADFS for this sample. Figure 18 shows that the simulated issuer redirects the user to the home realm discovery page where the user can select the identity provider she wants to use.

The simulated issuer is built using the WIF SDK.



```
HTTP/1.1 302 Found
Cache
    Cache-Control: private
    Date: Tue, 12 Apr 2011 05:53:30 GMT
Entity
    Content-Length: 347
    Content-Type: text/html; charset=utf-8
Miscellaneous
    Server: Microsoft-IIS/7.5
    X-AspNet-Version: 4.0.30319
    X-Powered-By: ASP.NET
Transport
    Location: https://localhost/Adatum.FederationProvider.6/?wa=wsignin1.0&wtrealm
```

FIGURE 18
Simulated issuer redirecting the user to the HomeRealmDiscovery page

STEP 3

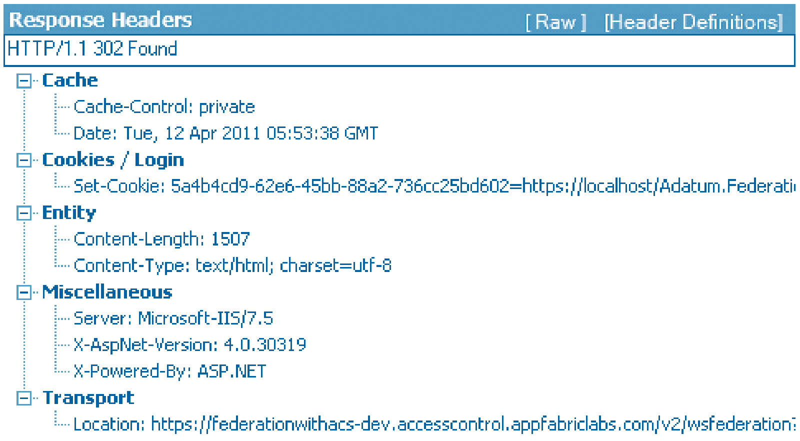
On the home-realm discovery page, the user can elect to sign in using the Adatum provider, the Litware provider, or a social identity provider. In this walkthrough, the user opts to use a social identity provider and provides an email address. When the user submits the form, the simulated issuer parses the email address to determine which social identity provider to use.

STEP 4

The home-realm discovery page redirects the browser to the Federation.aspx page.

STEP 5

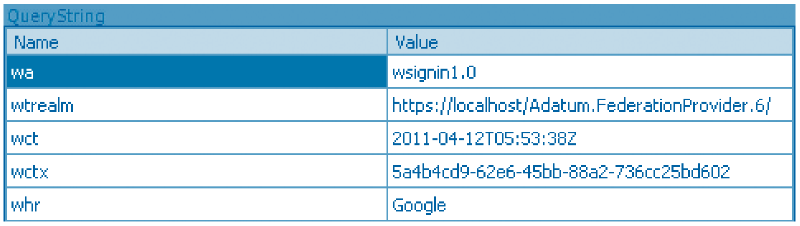
The Federation.aspx page at the simulated issuer returns a cookie to the browser that stores the original **wa**, **wtrealm**, **wctx**, and **wct** querystring parameters, as was shown in Figure 17. The simulated issuer redirects the user to the ACS instance, passing new values for these parameters. The simulated issuer also sends a **whr** querystring parameter; this is a hint to ACS about which social identity provider it should use to authenticate the user. Figure 19 shows that the simulated issuer redirects the user to ACS.



```
Response Headers                                  [ Raw ]  [Header Definitions]
HTTP/1.1 302 Found
⊟ Cache
    Cache-Control: private
    Date: Tue, 12 Apr 2011 05:53:38 GMT
⊟ Cookies / Login
    Set-Cookie: 5a4b4cd9-62e6-45bb-88a2-736cc25bd602=https://localhost/Adatum.Federati
⊟ Entity
    Content-Length: 1507
    Content-Type: text/html; charset=utf-8
⊟ Miscellaneous
    Server: Microsoft-IIS/7.5
    X-AspNet-Version: 4.0.30319
    X-Powered-By: ASP.NET
⊟ Transport
    Location: https://federationwithacs-dev.accesscontrol.appfabriclabs.com/v2/wsfederation?
```

FIGURE 19
The simulated issuer redirects the user to ACS

Figure 20 shows the new values of the querystring parameters that the simulated issuer sends to ACS. This includes the value "Google" for the **whr** parameter. The value of the **wctx** parameter refers to the cookie that contains the original values of the **wa**, **wtrealm**, **wctx**, and **wct** querystring parameters that came from the relying party—a-Order.OrderTracking.



QueryString

Name	Value
wa	wsignin1.0
wtrealm	https://localhost/Adatum.FederationProvider.6/
wct	2011-04-12T05:53:38Z
wctx	5a4b4cd9-62e6-45bb-88a2-736cc25bd602
whr	Google

FIGURE 20
Querystring parameters sent to ACS from the simulated issuer

STEP 6

ACS verifies that the **wtrealm** parameter value, https://localhost/Adatum.FederationProvider.6, is a configured relying party application. ACS then examines the **whr** parameter value to determine which identity provider to redirect the user to. If there is no valid **whr** value, then ACS will display a page listing the available identity providers. ACS forwards the **wtrealm** parameter value to Google in the **opened.return_to** parameter, so that when Google returns a token to ACS, it can tell ACS the address of the relying party (for ACS, the relying party is https://localhost/Adatum.FederationProvider.6.)

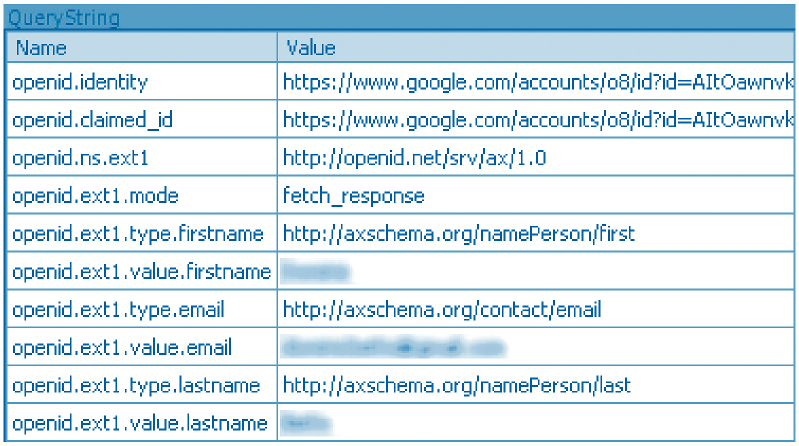
STEP 7

Google displays a login form that prompts the user to provide credentials. This form also indicates to the user that the request came from ACS.

STEP 8

After Google has authenticated the user and obtained consent to return the users email address to the relying party (ACS), Google redirects the browser back to ACS.

Figure 21 shows the querystring parameters that Google uses to pass the claims back to ACS.



QueryString

Name	Value
openid.identity	https://www.google.com/accounts/o8/id?id=AItOawnvk
openid.claimed_id	https://www.google.com/accounts/o8/id?id=AItOawnvk
openid.ns.ext1	http://openid.net/srv/ax/1.0
openid.ext1.mode	fetch_response
openid.ext1.type.firstname	http://axschema.org/namePerson/first
openid.ext1.value.firstname	[illegible]
openid.ext1.type.email	http://axschema.org/contact/email
openid.ext1.value.email	[illegible]
openid.ext1.type.lastname	http://axschema.org/namePerson/last
openid.ext1.value.lastname	[illegible]

FIGURE 21
Querystring parameters sent from Google to ACS

In addition to the claims data, there is also a **context** parameter that enables ACS to associate this claim data with the original request from a-Order.OrderTracking.6. This **context** parameter includes the address of the Adatum simulated issuer, which sent the original request to ACS.

STEP 9

ACS transitions the token from Google to create a new SAML 1.1 token, which contains a copy of the claims that Google issued. ACS uses the information in the **context** parameter to identify the relying party application (Adatum.FederationProvider.6) and the rule group to apply. In this sample, the rule group copies all of the claims from Google through to the new SAML token.

The following XML code shows the token that ACS generates (some attributes and namespaces were deleted for clarity).

```
<t:RequestSecurityTokenResponse
  Context="6d67cfce-9797-4958-ae3c-1eb489b04801"
  xmlns:t="http://schemas.xmlsoap.org/ws/2005/02/trust">
  <t:Lifetime>
    <wsu:Created>2011-02-09T15:05:17.355Z</wsu:Created>
    <wsu:Expires>2011-02-09T15:15:17.355Z</wsu:Expires>
  </t:Lifetime>

  <wsp:AppliesTo>
    <EndpointReference>
      <Address>
       https://localhost/Adatum.FederationProvider.6/
      </Address>
    </EndpointReference>
  </wsp:AppliesTo>

  <t:RequestedSecurityToken>
    <saml:Assertion
      AssertionID="_592d..."
      Issuer="https://federationwithacs-dev.accesscontrol.
                                            windows.net/">
      <saml:Conditions
        NotBefore="2011-02-09T15:05:17.355Z"
        NotOnOrAfter="2011-02-09T15:15:17.355Z">
        <saml:AudienceRestrictionCondition>
          <saml:Audience>
            https://localhost/Adatum.FederationProvider.6/
          </saml:Audience>

        </saml:AudienceRestrictionCondition>
      </saml:Conditions>

      <saml:AttributeStatement>
        <saml:Subject>
          <saml:NameIdentifier>
                                 https://www.google.com/accounts/o8/
                      id?id=AItOawnvknktThEaScLj34MPreTLfOKqrQazL20
          </saml:NameIdentifier>
          <saml:SubjectConfirmation>
            <saml:ConfirmationMethod>
              urn:oasis:names:tc:SAML:1.0:cm:bearer
            </saml:ConfirmationMethod>
          </saml:SubjectConfirmation>
        </saml:Subject>
```

*The **RequestSecurityToken Response** is defined in the WS-Trust specification. It's the envelope that encloses a token of any kind. The most common implementation of the token is SAML (version 1.1 or 2.0). The envelope contains the lifetime and the endpoint address for this token.*

The token expiration date and time (for WS-Fed).

The token audience (for WS-Fed).

The token audience (for SAML).

*Because the browser does not hold a key that can prove its identity, the token generated is of type **bearer**. In this scenario, enabling HTTPS is critical to avoid potential attacks.*

```
        <saml:Attribute
          AttributeName="emailaddress"
          AttributeNamespace=
          "http://schemas.xmlsoap.org/ws/2005/05/identity/claims">
          <saml:AttributeValue>mary@gmail.com
          </saml:AttributeValue>
        </saml:Attribute>

        <saml:Attribute
          AttributeName="name"
          AttributeNamespace="http://schemas.xmlsoap.org/
                                          ws/2005/05/identity/claims">
          <saml:AttributeValue>Mary</saml:AttributeValue>
        </saml:Attribute>

        <saml:Attribute
          AttributeName="identityprovider"
          AttributeNamespace="...">
        <saml:AttributeValue>Google</saml:AttributeValue>
      </saml:Attribute>

      </saml:AttributeStatement>

      <ds:Signature xmlns:ds="http://www.w3.org/2000/09/xmldsig#">
        <ds:SignedInfo>
          ...
        </ds:SignedInfo>
        <ds:SignatureValue>
          euicdW...UGM7rA==
        </ds:SignatureValue>
        <KeyInfo xmlns="http://www.w3.org/2000/09/xmldsig#">
          <X509Data>
            <X509Certificate>
              MIIDO...jVSbv/3
            </X509Certificate>
          </X509Data>
        </KeyInfo>
      </ds:Signature>
    </saml:Assertion>
  </t:RequestedSecurityToken>
  <t:RequestedAttachedReference>
    <o:SecurityTokenReference>
      <o:KeyIdentifier
        ValueType=
        "http://docs.oasis-open.org/wss/oasis-wss-saml-token-profile-
```

*The claims are represented by the SAML attributes, where **ClaimType** equals the **AttributeNamespace** and the **AttributeName**. The **ClaimValue** equals the **AttributeValue**.*

The signature and the public key (an X.509 certificate that is encoded in base64) that will be used to verify the signature on the website. If the verification was successful, you have to ensure that the certificate is the one you trust (by checking either its thumbprint or its serial number).

```
                                              1.0#SAMLAssertionID">
        _592d8e3a-8f42-4f14-9552-4617959dbd77
      </o:KeyIdentifier>
    </o:SecurityTokenReference>
  </t:RequestedAttachedReference>
  <t:RequestedUnattachedReference>
    <o:SecurityTokenReference>
      <o:KeyIdentifier
        ValueType=
        "http://docs.oasis-open.org/wss/oasis-wss-saml-token-profile-
                                              1.0#SAMLAssertionID">
        _592d8e3a-8f42-4f14-9552-4617959dbd77
      </o:KeyIdentifier>
    </o:SecurityTokenReference>
  </t:RequestedUnattachedReference>
  <t:TokenType>
    urn:oasis:names:tc:SAML:1.0:assertion
  </t:TokenType>
  <t:RequestType>
    http://schemas.xmlsoap.org/ws/2005/02/trust/Issue
  </t:RequestType>
  <t:KeyType>
    http://schemas.xmlsoap.org/ws/2005/05/identity/NoProofKey
  </t:KeyType>
</t:RequestSecurityTokenResponse>
```

This step returns a form to the browser with an HTTP 200 status message. The user does not see this form because a JavaScript timer automatically submits the form, posting the new token to the Adatum simulated issuer. It obtains the address of the simulated issuer from the **Return URL** setting in the Adatum.SimulatedIssuer relying party definition in ACS. The token data is contained in the hidden **wresult** field. The following HTML code shows the form that ACS returns to the browser. Some elements have been abbreviated for clarity.

```
<html>
<head>
    <title>Working...</title>
</head>
<body>
  <form method="POST"
    name="hiddenform"
    action="https://localhost/Adatum.FederationProvider.6/
                                                  Federation.aspx">
    <input type="hidden" name="wa" value="wsignin1.0" />
    <input type="hidden" name="wresult"
```

```
        value="&lt;t:RequestSecurityTokenResponse
                                           Context=&quot;..." />
    <input type="hidden" name=
          "wctx" value="6d67cfce-9797-4958-ae3c-1eb489b04801" />
    <noscript>
      <p>
        Script is disabled. Click Submit to continue.
      </p>
      <input type="submit" value="Submit" />
    </noscript>
  </form>
  <script language="javascript">
      window.setTimeout('document.forms[0].submit()', 0);
  </script>
</body>
</html>
```

STEP 10

The Adatum simulated issuer applies the claims mapping rules to the claims that it received from ACS. The following XML code shows the token that ACS generates (some attributes and namespaces were deleted for clarity).

```
<trust:RequestSecurityTokenResponseCollection
  xmlns:trust="http://docs.oasis-open.org/ws-sx/ws-trust/200512">
  <trust:RequestSecurityTokenResponse
    Context="rm=0&amp;id=passive&amp;ru=%2fa-Order.
                                              OrderTracking%2f">
    <trust:Lifetime>
      <wsu:Created>2011-02-09T15:05:17.776Z</wsu:Created>
      <wsu:Expires>2011-02-09T16:05:17.776Z</wsu:Expires>
    </trust:Lifetime>
    <wsp:AppliesTo>
      <EndpointReference>
        <Address>
          https://localhost/a-Order.OrderTracking.6/
        </Address>
      </EndpointReference>
    </wsp:AppliesTo>
    <trust:RequestedSecurityToken>
      <saml:Assertion
        AssertionID="_3770..."
        Issuer="adatum"
        IssueInstant="2011-02-09T15:05:17.776Z"
        xmlns:saml="urn:oasis:names:tc:SAML:1.0:assertion">
        <saml:Conditions
```

The token expiration date and time (for WS-Fed).

```
        NotBefore="2011-02-09T15:05:17.776Z"
        NotOnOrAfter="2011-02-09T16:05:17.776Z">
        <saml:AudienceRestrictionCondition>
          <saml:Audience>
            https://localhost/a-Order.OrderTracking.6/
          </saml:Audience>
        </saml:AudienceRestrictionCondition>
      </saml:Conditions>
      <saml:AttributeStatement>
        <saml:Subject>
          <saml:SubjectConfirmation>
            <saml:ConfirmationMethod>
              urn:oasis:names:tc:SAML:1.0:cm:bearer
            </saml:ConfirmationMethod>
          </saml:SubjectConfirmation>
        </saml:Subject>
        <saml:Attribute
          AttributeName=”name”
          AttributeNamespace=”...”
          a:OriginalIssuer=”acs\Google”>
          <saml:AttributeValue>
            Mary
          </saml:AttributeValue>
        </saml:Attribute>
        <saml:Attribute
          AttributeName="role"
          AttributeNamespace="http://schemas.microsoft.com/
                                       ws/2008/06/identity/claims">
          <saml:AttributeValue>
            Order Tracker
          </saml:AttributeValue>
        </saml:Attribute>
        <saml:Attribute
          AttributeName="organization"
          AttributeNamespace="http://schemas.adatum.com/
                                                    claims/2009/08">
          <saml:AttributeValue>
            Contoso
          </saml:AttributeValue>
        </saml:Attribute>
      </saml:AttributeStatement>
      <ds:Signature xmlns:ds="http://www.w3.org/2000/09/
                                                          xmldsig#">
        <ds:SignedInfo>
          ...
```

The token audience (for SAML).

*The claims are represented by the SAML attributes, where **ClaimType** equals the **AttributeNamespace** and the **AttributeName**. The **ClaimValue** equals the **AttributeValue**. These claims also have an **OriginalIssuer** attribute showing where the claim came from.*

```
          </ds:SignedInfo>
          <ds:SignatureValue>ZxLyG...2uU=</ds:SignatureValue>
          <KeyInfo xmlns="http://www.w3.org/2000/09/xmldsig#">
            <X509Data>
              <X509Certificate>MIIB5...2B3AO</X509Certificate>
            </X509Data>
          </KeyInfo>
        </ds:Signature>
      </saml:Assertion>
    </trust:RequestedSecurityToken>
    <trust:RequestedAttachedReference>
      <o:SecurityTokenReference
        k:TokenType="http://docs.oasis-open.org/wss/oasis-wss-
                               saml-token-profile-1.1#SAMLV1.1" >
        <o:KeyIdentifier
          ValueType="http://docs.oasis-open.org/wss/oasis-wss-
                         saml-token-profile-1.0#SAMLAssertionID">
          _377035cf-c44a-4495-a69c-c4b4951af18b
        </o:KeyIdentifier>
      </o:SecurityTokenReference>
    </trust:RequestedAttachedReference>
    <trust:RequestedUnattachedReference>
      <o:SecurityTokenReference
        k:TokenType="http://docs.oasis-open.org/wss/oasis-wss-
                                saml-token-profile-1.1#SAMLV1.1">
        <o:KeyIdentifier
          ValueType="http://docs.oasis-open.org/wss/oasis-wss-
                         saml-token-profile-1.0#SAMLAssertionID">
          _377035cf-c44a-4495-a69c-c4b4951af18b
        </o:KeyIdentifier>
      </o:SecurityTokenReference>
    </trust:RequestedUnattachedReference>
    <trust:TokenType>
      urn:oasis:names:tc:SAML:1.0:assertion
    </trust:TokenType>
    <trust:RequestType>
      http://docs.oasis-open.org/ws-sx/ws-trust/200512/Issue
    </trust:RequestType>
    <trust:KeyType>
      http://docs.oasis-open.org/ws-sx/ws-trust/200512/Bearer
    </trust:KeyType>
  </trust:RequestSecurityTokenResponse>
</trust:RequestSecurityTokenResponseCollection>
```

This step returns a form to the browser with an HTTP 200 status message. The user does not see this form because a JavaScript timer automatically submits the form, posting the new token to the a-Order.OrderTracking.6 application. The token with the new claims is contained in the **wresult** field. The following HTML code shows the form that ACS returns to the browser. Some elements have been abbreviated for clarity.

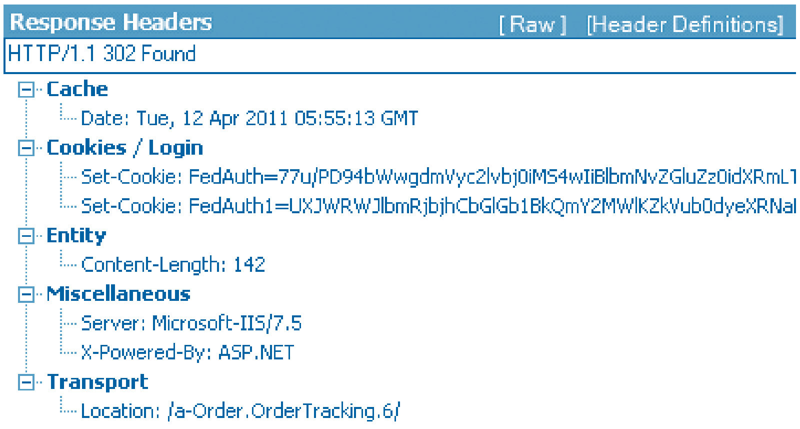
```
<html>
<head>
    <title>Working...</title>
</head>
<body>
  <form method="POST" name="hiddenform"
        action="https://localhost/a-Order.OrderTracking.6/">
    <input type="hidden" name="wa" value="wsignin1.0" />
    <input type="hidden" name="wresult"
        value="&lt;trust:RequestSecurityTokenResponse
                                               Collection..." />
    <input type="hidden" name="wctx"
           value="rm=0&amp;id=passive&amp;ru=%2fa-Order.
                                            OrderTracking%2f" />
    <noscript>
      <p>
        Script is disabled. Click Submit to continue.
      </p>
      <input type="submit" value="Submit" />
    </noscript>
  </form>
  <script language="javascript">
      window.setTimeout('document.forms[0].submit()', 0);
  </script>
</body>
</html>
```

The simulated issuer determines the address to post the token to (https://localhost/a-Order.OrderTracking.6/) by reading the original value of the **wtrealm** parameter that the simulated issuer saved in a cookie in step 4.

STEP 11

The Federation Authentication Module (FAM) validates the security token from the simulated issuer, and creates a **ClaimsPrincipal** object using the claim values from the token. This is compressed, encrypted, and encoded to create a session security token which the application returns to the browser as a set of **FedAuth[n]** cookies. The cookies are chunked to avoid exceeding any cookie size limitations.

Figure 22 shows the response headers, which include the **FedAuth** cookies.

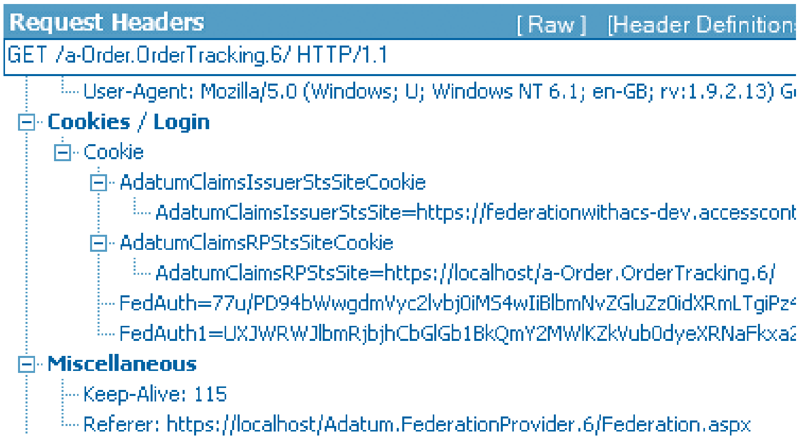


```
Response Headers                         [ Raw ]   [Header Definitions]
HTTP/1.1 302 Found
⊟ Cache
    Date: Tue, 12 Apr 2011 05:55:13 GMT
⊟ Cookies / Login
    Set-Cookie: FedAuth=77u/PD94bWwgdmVyc2lvbj0iMS4wIiBlbmNvZGluZz0idXRmLT
    Set-Cookie: FedAuth1=UXJWRWJlbmRjbjhCbGlGb1BkQmY2MWlKZkVub0dyeXRNal
⊟ Entity
    Content-Length: 142
⊟ Miscellaneous
    Server: Microsoft-IIS/7.5
    X-Powered-By: ASP.NET
⊟ Transport
    Location: /a-Order.OrderTracking.6/
```

FIGURE 22
Response headers, including the FedAuth cookies

STEP 12

On subsequent requests to the a-Order.OrderTracking.6 application, the browser returns the security session data to the application. Figure 23 shows the **FedAuth** cookie in the request headers.



```
Request Headers                          [ Raw ]   [Header Definition
GET /a-Order.OrderTracking.6/ HTTP/1.1
    User-Agent: Mozilla/5.0 (Windows; U; Windows NT 6.1; en-GB; rv:1.9.2.13) G
⊟ Cookies / Login
    ⊟ Cookie
        ⊟ AdatumClaimsIssuerStsSiteCookie
            AdatumClaimsIssuerStsSite=https://federationwithacs-dev.accesscont
        ⊟ AdatumClaimsRPStsSiteCookie
            AdatumClaimsRPStsSite=https://localhost/a-Order.OrderTracking.6/
        FedAuth=77u/PD94bWwgdmVyc2lvbj0iMS4wIiBlbmNvZGluZz0idXRmLTgiPz
        FedAuth1=UXJWRWJlbmRjbjhCbGlGb1BkQmY2MWlKZkVub0dyeXRNaFkxa2
⊟ Miscellaneous
    Keep-Alive: 115
    Referer: https://localhost/Adatum.FederationProvider.6/Federation.aspx
```

FIGURE 23
FedAuth cookies in the request header

The **WSFederatedAuthenticationModule** (FAM) decodes, decrypts, and decompresses the cookie and verifies the security session data before recreating the **ClaimsPrincipal** object.

Single Sign-Out

Figure 24 shows the single sign-out message sequence for the browser-based scenario.

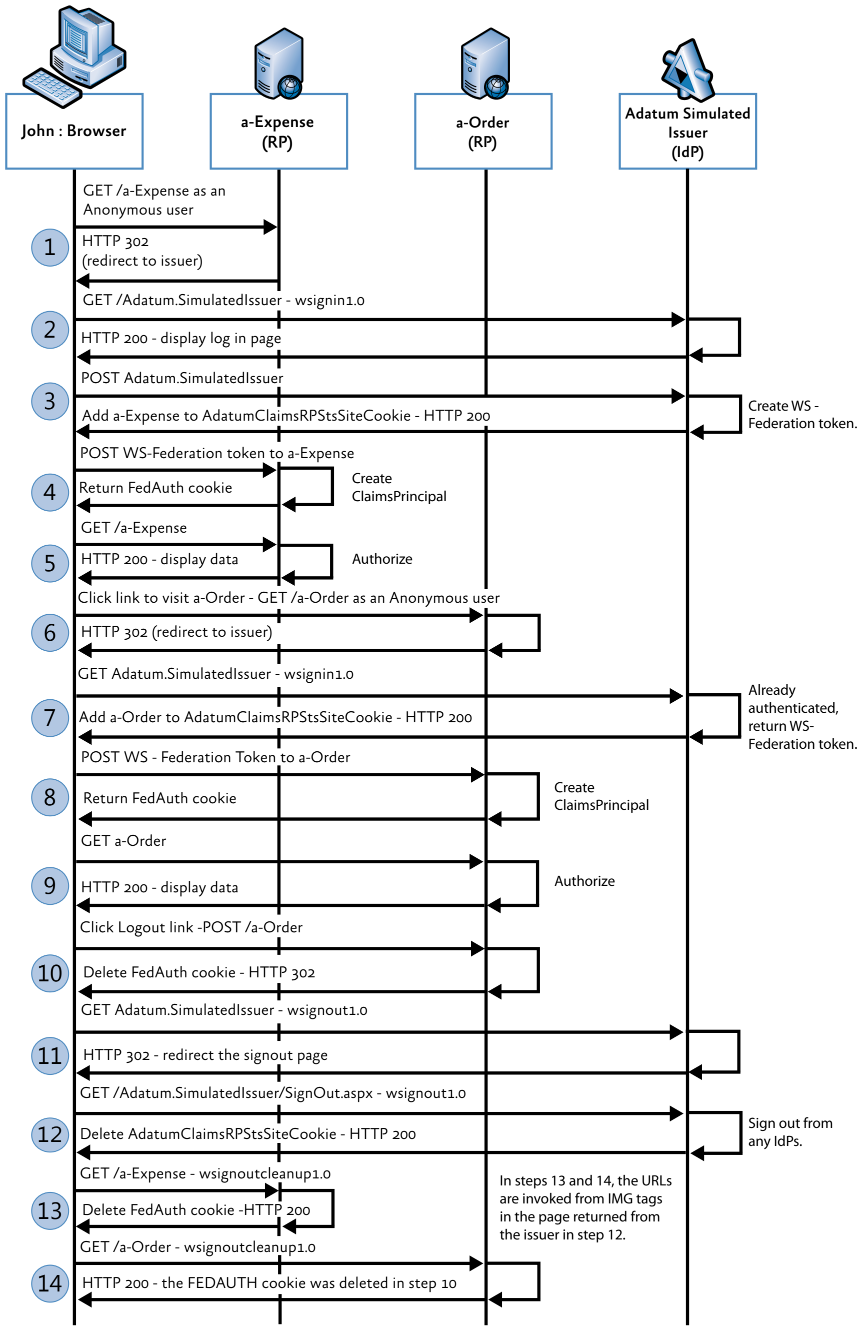
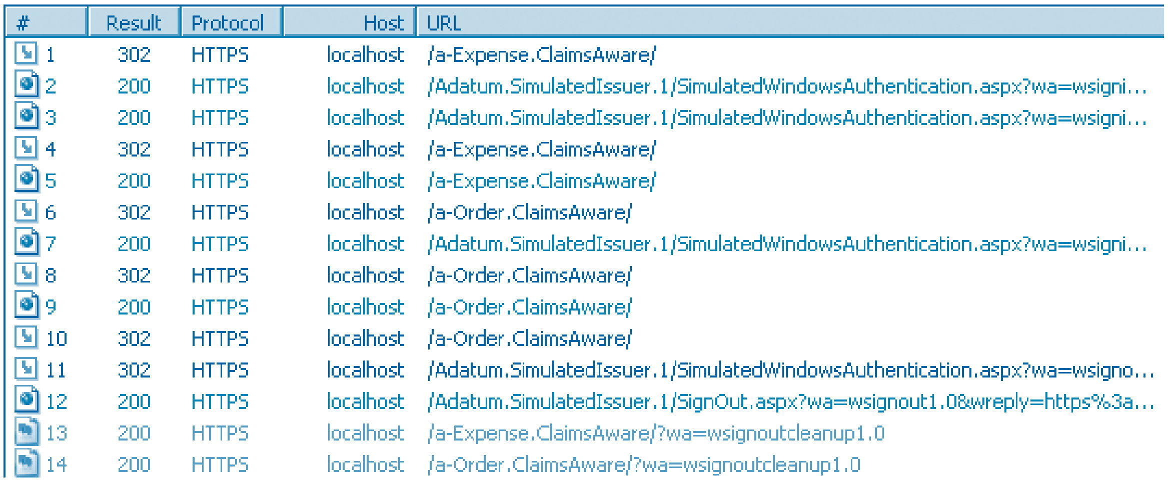

John : Browser
a-Expense (RP)
a-Order (RP)
Adatum Simulated Issuer (IdP)
1
GET /a-Expense as an Anonymous user
HTTP 302 (redirect to issuer)
2
GET /Adatum.SimulatedIssuer - wsignin1.0
HTTP 200 - display log in page
3
POST Adatum.SimulatedIssuer
Add a-Expense to AdatumClaimsRPStsSiteCookie - HTTP 200
Create WS - Federation token.
4
POST WS-Federation token to a-Expense
Return FedAuth cookie
Create ClaimsPrincipal
5
GET /a-Expense
HTTP 200 - display data
Authorize
6
Click link to visit a-Order - GET /a-Order as an Anonymous user
HTTP 302 (redirect to issuer)
7
GET Adatum.SimulatedIssuer - wsignin1.0
Add a-Order to AdatumClaimsRPStsSiteCookie - HTTP 200
Already authenticated, return WS-Federation token.
8
POST WS - Federation Token to a-Order
Return FedAuth cookie
Create ClaimsPrincipal
9
GET a-Order
HTTP 200 - display data
Authorize
10
Click Logout link -POST /a-Order
Delete FedAuth cookie - HTTP 302
11
GET Adatum.SimulatedIssuer - wsignout1.0
HTTP 302 - redirect the signout page
12
GET /Adatum.SimulatedIssuer/SignOut.aspx - wsignout1.0
Delete AdatumClaimsRPStsSiteCookie - HTTP 200
Sign out from any IdPs.
13
GET /a-Expense - wsignoutcleanup1.0
Delete FedAuth cookie -HTTP 200
In steps 13 and 14, the URLs are invoked from IMG tags in the page returned from the issuer in step 12.
14
GET /a-Order - wsignoutcleanup1.0
HTTP 200 - the FEDAUTH cookie was deleted in step 10

FIGURE 24
Message sequence for single sign-out in the browser-based scenario

Figure 25 shows the key traffic generated by the browser. For reasons of clarity, we have removed some messages from the list.



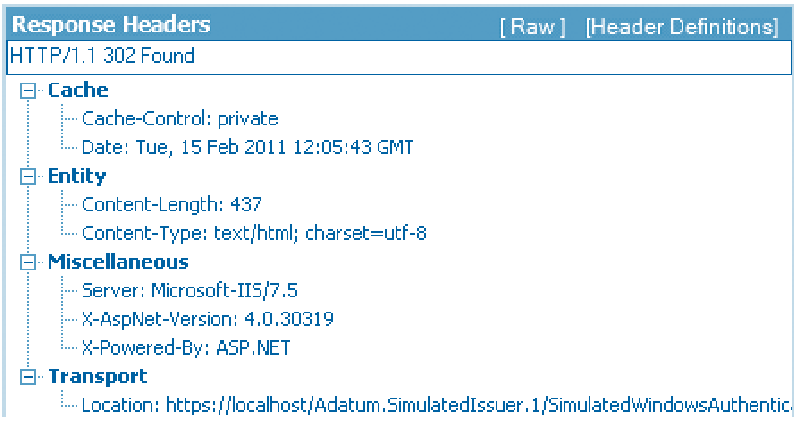
#	Result	Protocol	Host	URL
1	302	HTTPS	localhost	/a-Expense.ClaimsAware/
2	200	HTTPS	localhost	/Adatum.SimulatedIssuer.1/SimulatedWindowsAuthentication.aspx?wa=wsigni…
3	200	HTTPS	localhost	/Adatum.SimulatedIssuer.1/SimulatedWindowsAuthentication.aspx?wa=wsigni…
4	302	HTTPS	localhost	/a-Expense.ClaimsAware/
5	200	HTTPS	localhost	/a-Expense.ClaimsAware/
6	302	HTTPS	localhost	/a-Order.ClaimsAware/
7	200	HTTPS	localhost	/Adatum.SimulatedIssuer.1/SimulatedWindowsAuthentication.aspx?wa=wsigni…
8	302	HTTPS	localhost	/a-Order.ClaimsAware/
9	200	HTTPS	localhost	/a-Order.ClaimsAware/
10	302	HTTPS	localhost	/a-Order.ClaimsAware/
11	302	HTTPS	localhost	/Adatum.SimulatedIssuer.1/SimulatedWindowsAuthentication.aspx?wa=wsigno…
12	200	HTTPS	localhost	/Adatum.SimulatedIssuer.1/SignOut.aspx?wa=wsignout1.0&wreply=https%3a…
13	200	HTTPS	localhost	/a-Expense.ClaimsAware/?wa=wsignoutcleanup1.0
14	200	HTTPS	localhost	/a-Order.ClaimsAware/?wa=wsignoutcleanup1.0

FIGURE 25
HTTP traffic

The numbers in the screenshot correspond to the steps in the message diagram. In this sample, the names of the two relying party applications are a-Expense.ClaimsAware and a-Order.ClaimsAware and they are running on the local machine. The name of the mock issuer that takes the place of ADFS is Adatum.SimulatedIssuer.1 and it is also running locally. The sample illustrates a user signing in first to a-Expense.ClaimsAware, then accessing the a-Order.ClaimsAware application, and then initiating the single sign-out from a link in the a-Order.ClaimsAware application.

STEP 1

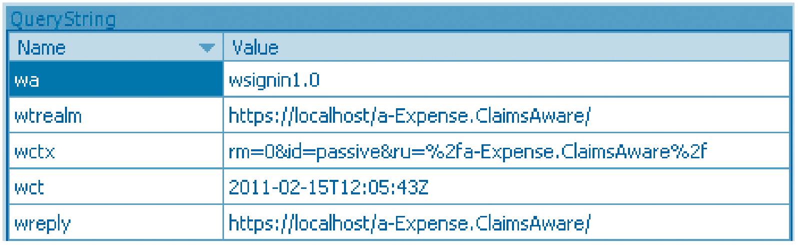
The anonymous user browses to a-Expense.ClaimsAware, and because there is no established security session, the **WSFederatedAuthenticationModule** (FAM) redirects the browser to the issuer which, in this example, is located at https://localhost/Adatum.SimulatedIssuer.1/.



```
Response Headers                         [ Raw ]   [Header Definitions]
HTTP/1.1 302 Found
⊟ Cache
    Cache-Control: private
    Date: Tue, 15 Feb 2011 12:05:43 GMT
⊟ Entity
    Content-Length: 437
    Content-Type: text/html; charset=utf-8
⊟ Miscellaneous
    Server: Microsoft-IIS/7.5
    X-AspNet-Version: 4.0.30319
    X-Powered-By: ASP.NET
⊟ Transport
    Location: https://localhost/Adatum.SimulatedIssuer.1/SimulatedWindowsAuthentic
```

FIGURE 26
Redirect to the issuer

As part of the request URL, there are four query string parameters: **wa** (the action to execute, which is wsignin1.0), **wtrealm** (the relying party that this token applies to, which is a-Expense.ClaimsAware), **wctx** (this is context data such as a return URL that will be propagated among the different parties), and **wct** (a time stamp).



QueryString

Name	Value
wa	wsignin1.0
wtrealm	https://localhost/a-Expense.ClaimsAware/
wctx	rm=0&id=passive&ru=%2fa-Expense.ClaimsAware%2f
wct	2011-02-15T12:05:43Z
wreply	https://localhost/a-Expense.ClaimsAware/

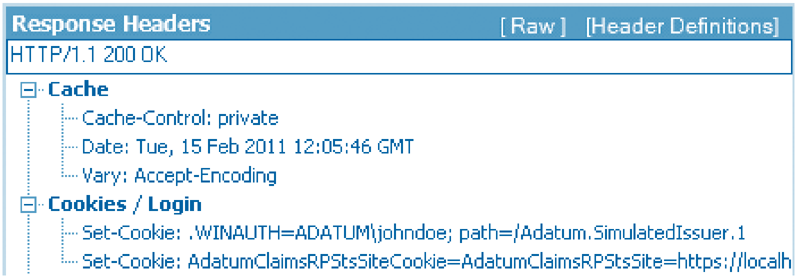
FIGURE 27
WS-Federation data sent to the issuer

STEP 2

The simulated issuer allows the user to select a User to sign in as for the session; in this example the user chooses to sign in as John.

STEP 3

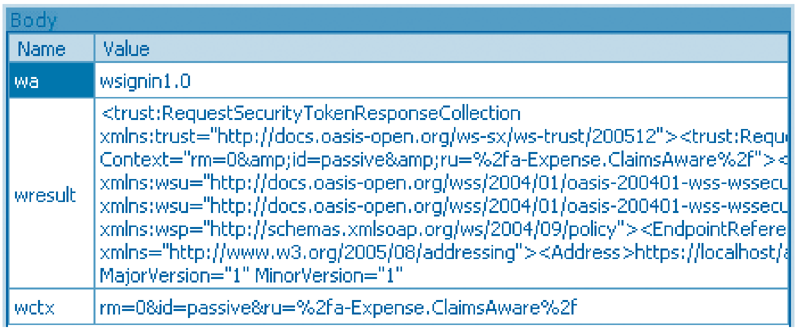
The simulated issuer stores the name of the relying party (which it can use in the log-out process) in a cookie named AdatumClaimsRPStsSite-Cookie, and details of the user in the .WINAUTH cookie.



```
Response Headers                                    [ Raw ]   [Header Definitions]
HTTP/1.1 200 OK
⊟ Cache
    Cache-Control: private
    Date: Tue, 15 Feb 2011 12:05:46 GMT
    Vary: Accept-Encoding
⊟ Cookies / Login
    Set-Cookie: .WINAUTH=ADATUM\johndoe; path=/Adatum.SimulatedIssuer.1
    Set-Cookie: AdatumClaimsRPStsSiteCookie=AdatumClaimsRPStsSite=https://localh
```

FIGURE 28
Cookies containing the user ID and a list of relying parties

The simulated issuer then posts the token back to the a-Expense. ClaimsAware application using a JavaScript timer, passing the WS-Federation token in the **wresult** field.



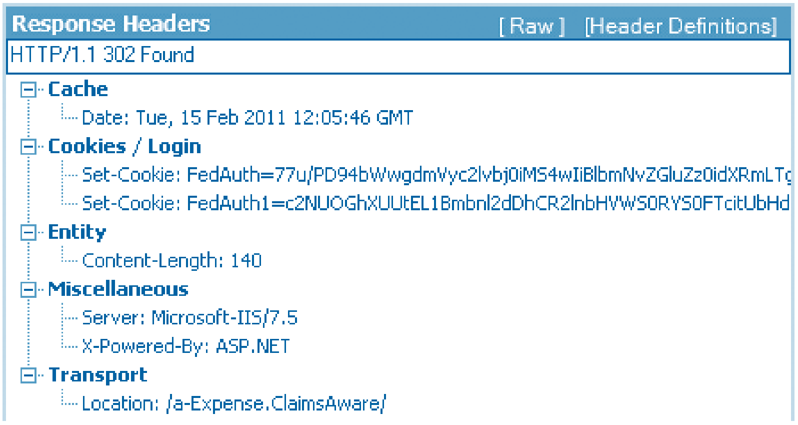
Body

Name	Value
wa	wsignin1.0
wresult	<trust:RequestSecurityTokenResponseCollection xmlns:trust="http://docs.oasis-open.org/ws-sx/ws-trust/200512"><trust:Requ Context="rm=0&amp;id=passive&amp;ru=%2fa-Expense.ClaimsAware%2f">< xmlns:wsu="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-wssecu xmlns:wsu="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-wssecu xmlns:wsp="http://schemas.xmlsoap.org/ws/2004/09/policy"><EndpointRefere xmlns="http://www.w3.org/2005/08/addressing"><Address>https://localhost/ MajorVersion="1" MinorVersion="1"
wctx	rm=0&id=passive&ru=%2fa-Expense.ClaimsAware%2f

FIGURE 29
Sending the WS-Federation token to the relying party

STEP 4

The relying party verifies the token, instantiates a **ClaimsPrincipal** object, and saves the claim data in a cookie named FedAuth. The application sends an HTTP 302 to redirect the browser to the a-Expense. ClaimsAware website.



```
Response Headers                                   [ Raw ]   [Header Definitions]
HTTP/1.1 302 Found
⊟ Cache
    Date: Tue, 15 Feb 2011 12:05:46 GMT
⊟ Cookies / Login
    Set-Cookie: FedAuth=77u/PD94bWwgdmVyc2lvbj0iMS4wIiBlbmNvZGluZz0idXRmLTg
    Set-Cookie: FedAuth1=c2NUOGhXUUtEL1BmbnI2dDhCR2InbHVWS0RYS0FTcitUbHd
⊟ Entity
    Content-Length: 140
⊟ Miscellaneous
    Server: Microsoft-IIS/7.5
    X-Powered-By: ASP.NET
⊟ Transport
    Location: /a-Expense.ClaimsAware/
```

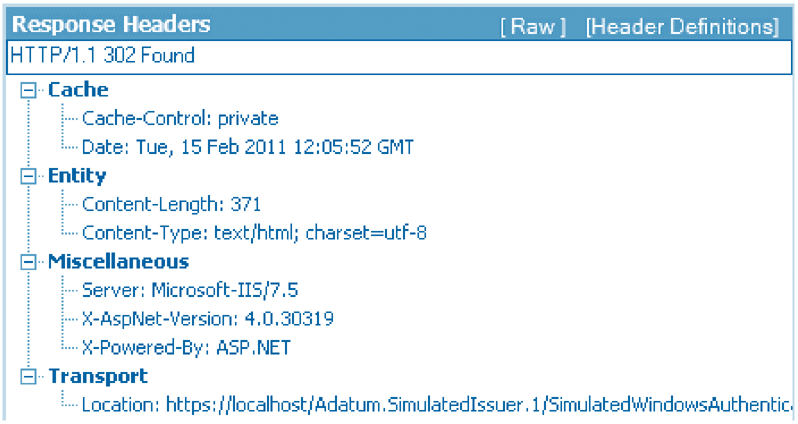
FIGURE 30
Creating the FedAuth cookie in the a-Expense.ClaimsAware application

STEP 5

The a-Expense.ClaimsAware application uses the claims data stored in the FedAuth cookie to apply the authorization rules that determine which records John is permitted to view.

STEP 6

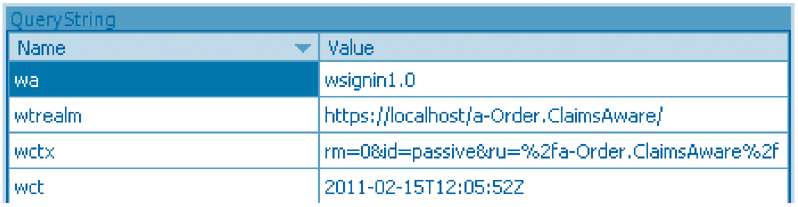
John clicks on the link to visit the a-Order.ClaimsAware application. From the perspective of the application, the request is from an anonymous user, so it redirects the browser to the simulated issuer.



```
Response Headers                              [ Raw ]   [Header Definitions]
HTTP/1.1 302 Found
⊟ Cache
    Cache-Control: private
    Date: Tue, 15 Feb 2011 12:05:52 GMT
⊟ Entity
    Content-Length: 371
    Content-Type: text/html; charset=utf-8
⊟ Miscellaneous
    Server: Microsoft-IIS/7.5
    X-AspNet-Version: 4.0.30319
    X-Powered-By: ASP.NET
⊟ Transport
    Location: https://localhost/Adatum.SimulatedIssuer.1/SimulatedWindowsAuthentic
```

FIGURE 31
Redirecting to the issuer

As part of the request URL, there are four query string parameters: **wa** (the action to execute, which is wsignin1.0), **wtrealm** (the relying party that this token applies to, which is a-Order.ClaimsAware), **wctx** (context data, such as a return URL that will be propagated among the different parties), and **wct** (a time stamp).



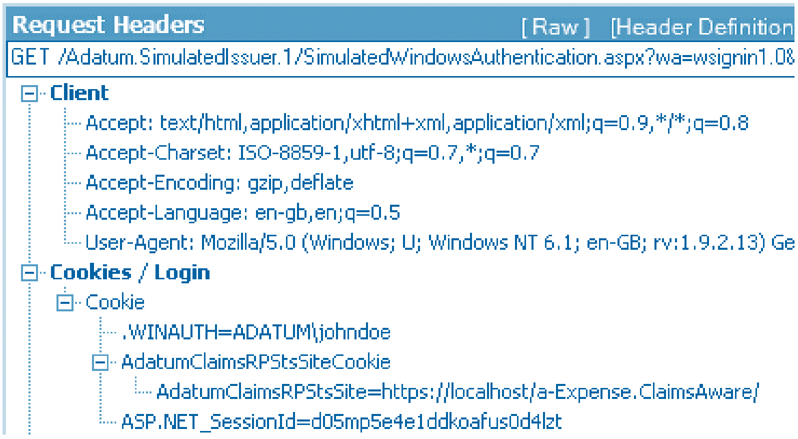
QueryString

Name	Value
wa	wsignin1.0
wtrealm	https://localhost/a-Order.ClaimsAware/
wctx	rm=0&id=passive&ru=%2fa-Order.ClaimsAware%2f
wct	2011-02-15T12:05:52Z

FIGURE 32
WS-Federation data sent to the issuer

STEP 7

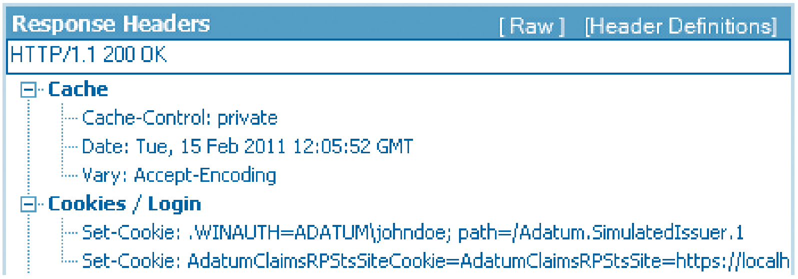
The simulated issuer recognizes that John is already authenticated because the browser sends the .WINAUTH cookie.



```
Request Headers                                  [ Raw ]  [Header Definition
GET /Adatum.SimulatedIssuer.1/SimulatedWindowsAuthentication.aspx?wa=wsignin1.0&
⊟ Client
    Accept: text/html,application/xhtml+xml,application/xml;q=0.9,*/*;q=0.8
    Accept-Charset: ISO-8859-1,utf-8;q=0.7,*;q=0.7
    Accept-Encoding: gzip,deflate
    Accept-Language: en-gb,en;q=0.5
    User-Agent: Mozilla/5.0 (Windows; U; Windows NT 6.1; en-GB; rv:1.9.2.13) Ge
⊟ Cookies / Login
  ⊟ Cookie
      .WINAUTH=ADATUM\johndoe
    ⊟ AdatumClaimsRPStsSiteCookie
        AdatumClaimsRPStsSite=https://localhost/a-Expense.ClaimsAware/
      ASP.NET_SessionId=d05mp5e4e1ddkoafus0d4lzt
```

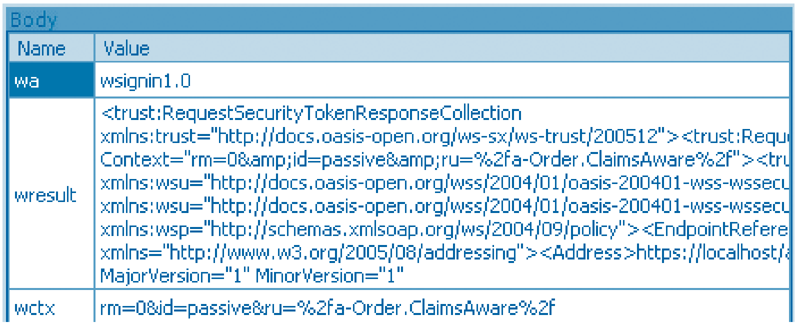
FIGURE 33
The browser sends the .WINAUTH cookie to the issuer

The application updates the AdatumClaimRPStsSiteCookie with details of the new relying party application, and posts a WS-Federation token back to the relying party.



```
Response Headers                             [ Raw ]  [Header Definitions]
HTTP/1.1 200 OK
⊟ Cache
    Cache-Control: private
    Date: Tue, 15 Feb 2011 12:05:52 GMT
    Vary: Accept-Encoding
⊟ Cookies / Login
    Set-Cookie: .WINAUTH=ADATUM\johndoe; path=/Adatum.SimulatedIssuer.1
    Set-Cookie: AdatumClaimsRPStsSiteCookie=AdatumClaimsRPStsSite=https://localh
```

FIGURE 34
The browser updates the cookie with the new relying party



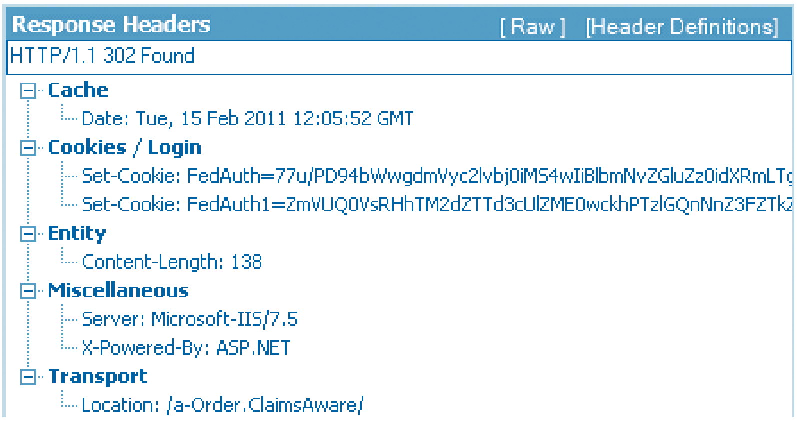
Body

Name	Value
wa	wsignin1.0
wresult	<trust:RequestSecurityTokenResponseCollection xmlns:trust="http://docs.oasis-open.org/ws-sx/ws-trust/200512"><trust:Requ Context="rm=0&amp;id=passive&amp;ru=%2fa-Order.ClaimsAware%2f"><tru xmlns:wsu="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-wssecu xmlns:wsu="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-wssecu xmlns:wsp="http://schemas.xmlsoap.org/ws/2004/09/policy"><EndpointRefere xmlns="http://www.w3.org/2005/08/addressing"><Address>https://localhost/ MajorVersion="1" MinorVersion="1"
wctx	rm=0&id=passive&ru=%2fa-Order.ClaimsAware%2f

FIGURE 35
The issuer posts the WS-Federation token to the relying party

STEP 8

The relying party verifies the token, instantiates a **ClaimsPrincipal** object, and saves the claim data in a cookie named FedAuth. The application sends an HTTP 302 to redirect the browser to the a-Order. ClaimsAware website.



```
Response Headers                              [Raw]  [Header Definitions]
HTTP/1.1 302 Found
⊟ Cache
    Date: Tue, 15 Feb 2011 12:05:52 GMT
⊟ Cookies / Login
    Set-Cookie: FedAuth=77u/PD94bWwgdmVyc2lvbj0iMS4wIiBlbmNvZGluZz0idXRmLTg
    Set-Cookie: FedAuth1=ZmVUQ0VsRHhTM2dZTTd3cUlZME0wckhPTzlGQnNnZ3FZTk
⊟ Entity
    Content-Length: 138
⊟ Miscellaneous
    Server: Microsoft-IIS/7.5
    X-Powered-By: ASP.NET
⊟ Transport
    Location: /a-Order.ClaimsAware/
```

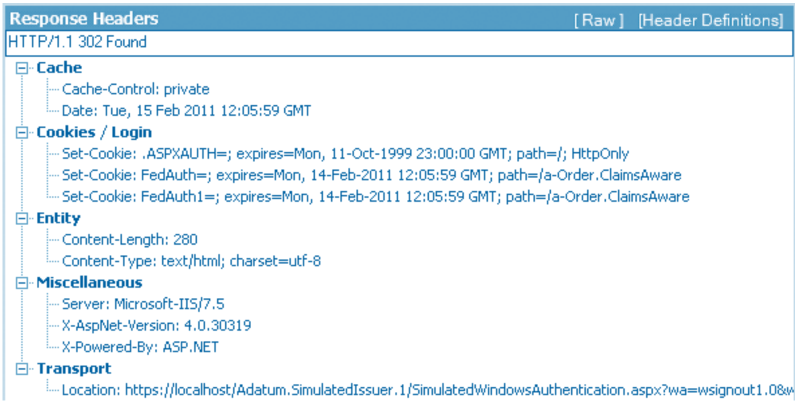
FIGURE 36
The a-Order.ClaimsAware site creates a FedAuth cookie

STEP 9

The a-Order.ClaimsAware application uses the claims data stored in the FedAuth cookie to apply the authorization rules that determine which records John is permitted to view.

STEP 10

John clicks on the Logout link in the a-Order.ClaimsAware application. The application deletes the FedAuth cookie and redirects the browser to the simulated issuer to complete the sign-out process.

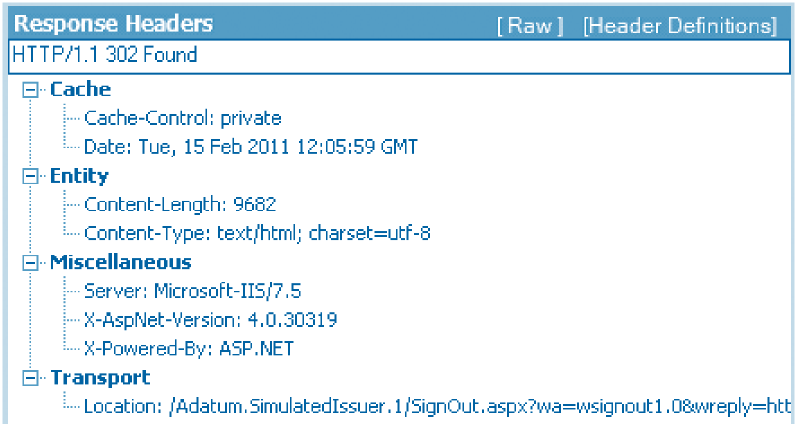


```
Response Headers                                   [Raw]  [Header Definitions]
HTTP/1.1 302 Found
Cache
    Cache-Control: private
    Date: Tue, 15 Feb 2011 12:05:59 GMT
Cookies / Login
    Set-Cookie: .ASPXAUTH=; expires=Mon, 11-Oct-1999 23:00:00 GMT; path=/; HttpOnly
    Set-Cookie: FedAuth=; expires=Mon, 14-Feb-2011 12:05:59 GMT; path=/a-Order.ClaimsAware
    Set-Cookie: FedAuth1=; expires=Mon, 14-Feb-2011 12:05:59 GMT; path=/a-Order.ClaimsAware
Entity
    Content-Length: 280
    Content-Type: text/html; charset=utf-8
Miscellaneous
    Server: Microsoft-IIS/7.5
    X-AspNet-Version: 4.0.30319
    X-Powered-By: ASP.NET
Transport
    Location: https://localhost/Adatum.SimulatedIssuer.1/SimulatedWindowsAuthentication.aspx?wa=wsignout1.0&w
```

FIGURE 37
Deleting the FedAuth cookie and redirecting to the issuer

STEP 11

The simulated issuer redirects the browser to itself, sending a WS-Federation wsignout1.0 command.

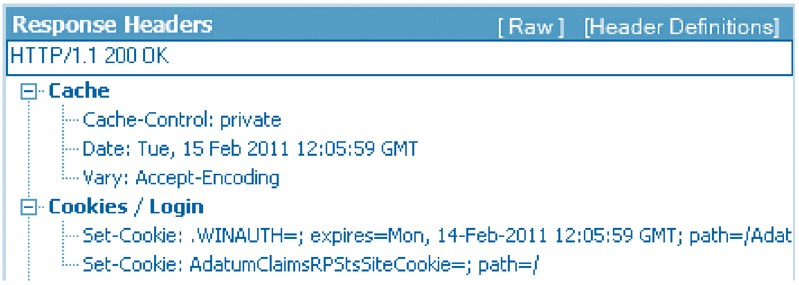


```
Response Headers                                   [Raw]  [Header Definitions]
HTTP/1.1 302 Found
Cache
    Cache-Control: private
    Date: Tue, 15 Feb 2011 12:05:59 GMT
Entity
    Content-Length: 9682
    Content-Type: text/html; charset=utf-8
Miscellaneous
    Server: Microsoft-IIS/7.5
    X-AspNet-Version: 4.0.30319
    X-Powered-By: ASP.NET
Transport
    Location: /Adatum.SimulatedIssuer.1/SignOut.aspx?wa=wsignout1.0&wreply=htt
```

FIGURE 38
Sending the wsignout1.0 command

STEP 12

The simulated issuer signs out from any identity providers and deletes the contents of the AdatumClaimsRPStsSiteCookie cookie.



```
Response Headers                    [Raw]  [Header Definitions]
HTTP/1.1 200 OK
⊟ Cache
    Cache-Control: private
    Date: Tue, 15 Feb 2011 12:05:59 GMT
    Vary: Accept-Encoding
⊟ Cookies / Login
    Set-Cookie: .WINAUTH=; expires=Mon, 14-Feb-2011 12:05:59 GMT; path=/Adat
    Set-Cookie: AdatumClaimsRPStsSiteCookie=; path=/
```

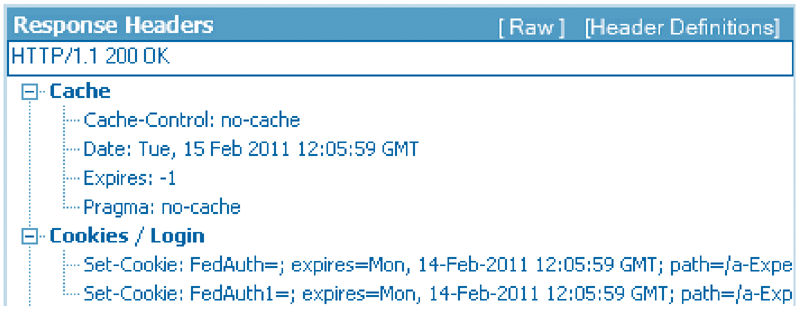
FIGURE 39
Clearing the cookie with the list of relying parties

STEPS 13 AND 14

The simulated issuer uses the list of relying parties from the Adatum-ClaimsRPStsSiteCookie cookie to construct a list of image URLs:

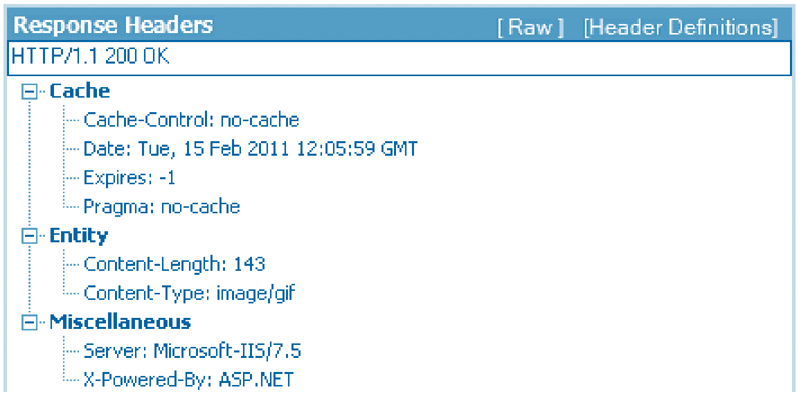
```
<img src='https://localhost/a-expense.ClaimsAware/
                                       ?wa=wsignoutcleanup1.0'  />
<img src='https://localhost/a-Order.ClaimsAware/
                                       ?wa=wsignoutcleanup1.0'  />
```

These URLs pass the WS-Federation wsignoutcleanup1.0 command to each of the relying party applications, giving them the opportunity to complete the sign-out process in the application and perform any other necessary cleanup.



```
Response Headers                                  [ Raw ]   [Header Definitions]
HTTP/1.1 200 OK
⊟ Cache
    Cache-Control: no-cache
    Date: Tue, 15 Feb 2011 12:05:59 GMT
    Expires: -1
    Pragma: no-cache
⊟ Cookies / Login
    Set-Cookie: FedAuth=; expires=Mon, 14-Feb-2011 12:05:59 GMT; path=/a-Expe
    Set-Cookie: FedAuth1=; expires=Mon, 14-Feb-2011 12:05:59 GMT; path=/a-Exp
```

FIGURE 40
Clearing the FedAuth cookie in the a-Expense.ClaimsAware application



```
Response Headers                                  [ Raw ]   [Header Definitions]
HTTP/1.1 200 OK
⊟ Cache
    Cache-Control: no-cache
    Date: Tue, 15 Feb 2011 12:05:59 GMT
    Expires: -1
    Pragma: no-cache
⊟ Entity
    Content-Length: 143
    Content-Type: image/gif
⊟ Miscellaneous
    Server: Microsoft-IIS/7.5
    X-Powered-By: ASP.NET
```

FIGURE 41
The FedAuth cookie was cleared for the a-Order.Claims application in step 10

Appendix C Industry Standards

This appendix lists the industry standards that are discussed in this book.

Security Assertion Markup Language (SAML)

For more information about SAML, see the following:

- The OASIS Standard specification, "Assertions and Protocol for the OASIS Security Assertion Markup Language (SAML) V1.1"
  http://www.oasis-open.org/committees/download.php/3406/oasis-sstc-saml-core-1.1.pdf

(Chapter 1, "An Introduction to Claims," and Chapter 2, "Claims-Based Architectures," cover SAML assertions.)

Security Association Management Protocol (SAMP) and Internet Security Association and Key Management Protocol (ISAKMP)

For more information about these protocols, see the following:

- The IETF draft specification, "Internet Security Association and Key Management Protocol (ISAKMP)"
  http://tools.ietf.org/html/rfc2408

WS-Federation

For more information about WS-Federation, see the following:

- The OASIS Standard specification,
  http://docs.oasis-open.org/wsfed/federation/v1.2/
- "Understanding WS-Federation" on MSDN®
  http://msdn.microsoft.com/en-us/library/bb498017.aspx

WS-Federation: Passive Requestor Profile

For more information about WS-Federation Passive Requestor Profile, see the following:

- Section 13 of the OASIS Standard specification, "Web Services Federation Language (WS-Federation) Version 1.2"
  http://docs.oasis-open.org/wsfed/federation/v1.2/os/ws-federation-1.2-spec-os.html#_Toc223175002
- "WS-Federation: Passive Requestor Profile" on MSDN
  http://msdn.microsoft.com/en-us/library/bb608217.aspx

WS-Security

For more information about WS-Security, see the following:

- The OASIS Standard specification, "Web Services Security: SOAP Message Security 1.1 (WS-Security 2004)"
  http://docs.oasis-open.org/wss/v1.1/wss-v1.1-spec-os-SOAPMessageSecurity.pdf

WS-SecureConversation

For more information about WS-SecureConversation, see the following:

- The OASIS Standard specification, "WS-SecureConversation 1.3"
  http://docs.oasis-open.org/ws-sx/ws-secureconversation/v1.3/ws-secureconversation.pdf

WS-Trust

For more information about WS-Trust, see the following:

- The OASIS Standard specification, "WS-Trust 1.3"
  http://docs.oasis-open.org/ws-sx/ws-trust/200512/ws-trust-1.3-os.html

XML Encryption

For more information about XML Encryption (used to generate XML digital signatures), see the following:

- The W3C Recommendation, "XML Encryption Syntax and Processing"
  http://www.w3.org/TR/2002/REC-xmlenc-core-20021210/

Appendix D Certificates

This appendix lists the digital certificates that are used in claims-based applications. To see this in table form, see "Claims Based Identity & Access Control Guide" on CodePlex (http://claimsid.codeplex.com).

Certificates for Browser-Based Applications

In browser-based scenarios, you will find certificates used on the issuer and on the computer that hosts the web application. The client computer does not store certificates.

On the Issuer (Browser Scenario)

In browser-based scenarios, you will find the following certificates on the issuer.

Certificate for TLS/SSL (Issuer, Browser Scenario)

The Transport Layer Security protocol/Secure Sockets Layer protocol (TLS/SSL) uses a certificate to protect the communication with the issuer—for example, for the credentials transmitted to it. The purpose is to prevent man-in-the-middle attacks, eavesdropping, and replay attacks.

Requirements: The subject name in the certificate must match the Domain Name System (DNS) name of the host that provides the certificate. Browsers will generally check that the certificate has a chain of trust to one of the root authorities trusted by the browser.

Recommended certificate store: LocalMachine\My

Example: CN=login.adatumpharma.com

Certificate for Token Signing (Issuer, Browser Scenario)

The issuer's certificate for token signing is used to generate an XML digital signature to ensure token integrity and source verification.

Requirements: The worker process account that runs the issuer needs access to the private key of the certificate.

Recommended certificate store: LocalMachine\My and if Microsoft® Active Directory® Federation Services (ADFS) 2.0 is the issuer, the ADFS 2.0 database will keep a copy.

Example: CN=adatumpharma-tokensign.com

The subject name on the certificate does not need to match a DNS name. It's a recommended practice to name the certificate in a way that describes its purpose.

Optional Certificate for Token Encryption (Issuer, Browser Scenario)

The certificate for token encryption secures the SAML token. Encrypting tokens is optional, but it is recommended. You may opt to rely on TLS/SSL, which will secure the whole channel.

Requirements: Only the public key is required. The private key is owned by the relying party for decrypting.

Recommended certificate store: LocalMachine\TrustedPeople, LocalMachine\AddressBook or if ADFS 2.0 is the issuer, the ADFS 2.0 database will keep it.

Example: CN=a-expense.adatumpharma-tokenencrypt.com

Encrypting the token is optional, but it is generally recommended. Using TLS/SSL is already a measure to ensure the confidentiality of the token in transit. This is an extra security measure that could be used in cases where claim values are confidential.

On the Web Application Server

In browser-based scenarios, you will find the following certificates on the web application server.

Certificate for TLS/SSL (Web Server, Browser Scenario)

TLS/SSL uses a certificate to protect the communication with the web application server—for example, for the SAML token posted to it. The purpose is to prevent man-in-the-middle attacks, eavesdropping, and replay attacks.

Requirements: The subject name in the certificate must match the DNS name of the host that provides the certificate. Browsers will generally check that the certificate has a chain of trust to one of the root authorities trusted by the browser.

Recommended certificate store: LocalMachine\My

Example: CN=a-expense.adatumpharma.com

Token Signature Verification (Web Server, Browser Scenario)

The web application server has the thumbprint of the certificate that is used to verify the SAML token signature. The issuer embeds the certificate in each digitally signed security token. The web application server checks that the digital signature's thumbprint (a hash code) matches that of the signing certificate. Windows® Identity Foundation (WIF) and ADFS embed the public key in the token by default.

Requirements: The thumbprint of the issuer's certificate should be present in the **<issuerNameRegistry>** section of the application's Web.config file.

Recommended certificate store: None

Example: ↱d2316a731b59683e744109278c80e2614503b17e (This is the thumbprint of the certificate with CN=adatumpharma-tokensign.com.)

If the certificate (issuer public key) is embedded in the token, the signature verification is done automatically by WIF. If not, an **IssuerTokenResolver** *needs to be configured to find the public key. This is common in interop scenarios; however, WIF and ADFS will always embed the full public key.*

Token Signature Chain of Trust Verification (Web Server, Browser Scenario)

The web application server has a certificate that is used to verify the trusted certificate chain for the issuer's token signing certificate.

Requirements: The public key of the issuer certificate should be installed in LocalMachine\TrustedPeople certificate store unless the certificate was issued by a trusted root authority.

Recommended certificate store: LocalMachine\TrustedPeople only if the certificate was not issued by a trusted root authority.

The chain-of-trust verification is controlled by an attribute of the <**certificateValidation**> *element of the WIF configuration section of the application's Web.config file. WIF has this setting turned on by default.*

Optional Token Decryption (Web Server, Browser Scenario)

The web application has a certificate that it uses to decrypt the SAML token that it receives from an issuer (if it was encrypted). The web application has both public and private keys. The issuer has only the public key.

Requirements: The certificate used to decrypt the SAML token should be configured in the **<serviceCertificate>** element of the **<microsoft.identityModel>** section of the application's Web.config file. Also, the App Pool account of the website should have permission to read the private key of the certificate.

Recommended certificate store: LocalMachine\My

Example: CN=a-expense.adatumpharma-tokenencrypt.com

Cookie Encryption/Decryption (Web Server, Browser Scenario)

The web application server has a certificate that it uses to ensure the confidentiality of the session cookie created to cache the token claims for the whole user session.

Requirements: The default WIF mechanism uses the Data Protection API (DPAPI) to encrypt the cookie. This requires access to a private key stored in the profile of the App Pool account. You must ensure that the account has the profile loaded by setting the **Load User Profile** to **true** in the App Pool configuration.

Recommended certificate store: None

A more web farm-friendly option is to use a different **Cookie Transform** *to encrypt/decrypt the token (such as* **RsaEncryption CookieTransform***) that uses X.509 certificates instead of DPAPI.*

Certificates for Active Clients

In scenarios with active clients that interact with web services, you will find certificates used on the issuer, on the machine that hosts the web service, and on the client machine.

On the Issuer (Active Scenario)

In active client scenarios, you will find the following certificates on the issuer.

Certificate for Transport Security (TLS/SSL) (Issuer, Active Scenario)

TLS/SSL uses a certificate to protect the communication with the issuer—for example, for the credentials transmitted to it. The purpose is to avoid man-in-the-middle attacks, eavesdropping, and replay attacks.

Requirements: The subject name in the certificate must match the DNS name of the host that provides the certificate. Browsers will generally check that the certificate has a chain of trust to one of the root authorities trusted by the browser.

Recommended certificate store: LocalMachine\My
Example: CN=login.adatumpharma.com

Certificate for Message Security (Issuer, Active Scenario)

A certificate will be used to protect the communication between the client and the issuer at the message level.

Requirements: For a custom issuer that you implement, the service credentials are configured in the Windows Communication Foundation (WCF) issuer—for example, through the **<serviceCertificate>** section of the issuer's Web.config file.

For an ADFS 2.0 issuer, this is configured using the Microsoft Management Console (MMC).

Recommended certificate store: LocalMachine\My or ADFS database

Example: CN=login.adatumpharma.com

Certificate for Token Signing (Issuer, Active Scenario)

The issuer's certificate for token signing is used to generate an XML digital signature to ensure token integrity and source verification.

Requirements: The worker process account that runs the issuer needs access to the private key of the certificate.

Recommended certificate store: LocalMachine\My and the ADFS 2.0 database

Example: CN=adatumpharma-tokensign.com

The subject name on the certificate does not need to match a DNS name. It's a recommended practice to name the certificate in a way that describes its purpose.

Certificate for Token Encryption (Issuer, Active Scenario)

The certificate for token encryption secures the SAML token. This certificate is required when an active client is used.

Requirements: Only the public key is required on the client. The relying party owns the private key, which it uses to decrypt the SAML token.

Recommended certificate store: LocalMachine\TrustedPeople, LocalMachine\AddressBook or the ADFS 2.0 database

Example: CN=a-expense.adatumpharma-tokenencrypt.com

Encrypting the token is optional, but it is generally recommended. The use of TLS/SSL is already a measure to ensure the confidentiality of the token in transit. This is an extra security measure that could be used in cases where claim values must be kept confidential.

On the Web Service Host

These are the certificates used on the machine that hosts the web service.

Certificate for Transport Security (TLS/SSL) (Web Service Host, Active Scenario)

TLS/SSL uses a certificate to protect the communication with the web service—for example, for the SAML token sent to it by an issuer. The purpose is to mitigate and prevent man-in-the-middle attacks, eavesdropping, and replay attacks.

Requirements: The subject name in the certificate must match the DNS name of the host that provides the certificate. Active clients will generally check that the certificate has a chain of trust to one of the root authorities trusted by that client.

Recommended certificate store: LocalMachine\My

Example: CN=a-expense-svc.adatumpharma.com

Certificate for Message Security (Web Service Host, Active Scenario)

A certificate will be used to protect the communication between the client and the web service at the message level.

Requirements: The service credentials are configured in the WCF web service—for example, through the **<serviceCertificate>** section of the web service's Web.config file.

Recommended certificate store: LocalMachine\My

Example: CN=a-expense-svc.adatumpharma.com

Token Signature Verification (Web Service Host, Active Scenario)

The web service host has the thumbprint of the certificate that is used to verify the SAML token signature. The issuer embeds the certificate in each digitally signed security token. The web service host checks that the digital signature's thumbprint (a hash code) matches that of the signing certificate. WIF and ADFS embed the public key in the token by default.

Requirements: The thumbprint of the issuer's certificate should be present in the **<issuerNameRegistry>** section of the web service's Web.config file.

Recommended certificate store: None

Example: d2316a731b59683e744109278c80e2614503b17e (This is the thumbprint of the certificate with CN=adatumpharma-token-sign.com.)

If the certificate (issuer public key) is embedded in the token, the signature verification is done automatically by WIF. If not, an

IssuerTokenResolver *needs to be configured to find the public key. This is common in interop scenarios; however, WIF and ADFS will always embed the full public key.*

Token Decryption (Web Service Host, Active Scenario)

The web service host has a certificate that it uses to decrypt the SAML token that it receives from an issuer. The web application has both public and private keys. The issuer has only the public key.

Requirements: The certificate used to decrypt the SAML token should be configured in the **<serviceCertificate>** element of the **<microsoft.identityModel>** section of the web service's Web.config file. Also, the App Pool account of the web server should have permission to read the private key of the certificate.

Recommended certificate store: LocalMachine\My

Example: CN=a-expense-svc.adatumpharma-tokenencrypt.com

Token Signature Chain Trust Verification (Web Service Host, Active Scenario)

The web service host has a certificate that is used to verify the trusted certificate chain for the issuer's token signing certificate.

Requirements: The public key of the issuer certificate should be installed in LocalMachine\TrustedPeople certificate store unless the certificate was issued by a trusted root authority.

Recommended certificate store: LocalMachine\TrustedPeople only if the certificate was not issued by a trusted root authority.

The chain-of-trust verification is controlled by an attribute of the <**certificateValidation**> *element of the WIF configuration section of the web service's Web.config file. WIF has this setting turned on by default.*

On the Active Client Host

These are the certificates that are used on the active client computer.

Certificate for Message Security (Active Client Host)

A certificate will be used to protect the communication between the client and the web service or issuer at the message level.

Requirements: If **negotiateServiceCredentials** is enabled, the client will obtain the public key of the web service or issuer at run time. If not, the certificate for message security is configured in the WCF client by setting the **ClientCredentials.ServiceCertificate** property at run time or configuring the **<serviceCertificate>** element of the active client's App.config file. The service credentials are configured in the WCF web service—for example, through the **<service**

Certificate> section of the web service's Web.config file.

Recommended certificate store: LocalMachine\TrustedPeople or LocalMachine\AddressBook

Example: CN=a-expense-svc.adatumpharma.com

Appendix E Windows Azure AppFabric Access Control Service

This appendix provides background information about ACS and shows you how to obtain and configure a Windows Azure™ App Fabric Access Control Service (ACS) account. ACS makes it easy to authenticate and authorize website, application, and service users and is compatible with popular programming and runtime environments. It allows authentication to take place against many popular web and enterprise identity providers. Users are presented with a configurable page listing the identity providers that are configured for the application, which assists in the home realm discovery (HRD) process by permitting the user to select the appropriate identity provider.

ACS also integrates with Windows Identity Foundation (WIF) tools and environments and Microsoft Active Directory® Federation Services (ADFS) 2.0. It can accept SAML 1.1, SAML 2.0, and Simple Web Token (SWT) formatted tokens, and will issue a SAML 1.1, SAML 2.0, or SWT token. ACS supports a range of protocols that includes OAuth, OpenID, WS-Federation, and WS-Trust. Rules configured within ACS can perform protocol transition and claims transformation as required by the website, application, or service.

ACS is configured through the service interface using an OData-based management API, or though the web portal that provides a graphical and interactive administration experience.

This appendix discusses the ways that ACS can be used by showing several scenarios and the corresponding message sequences. It also contains information about creating an ACS issuer service instance, configuring applications to use this service instance, creating custom home realm discovery pages, error handling, integrating with ADFS, security considerations, and troubleshooting ACS operations.

What Does ACS DO?

ACS can be used to implement federated authentication and authorization by acting as a token issuer that authenticates users by trusting one or more identity providers. The following list contains definitions of the important entities and concepts involved in this process:

- **Realm or Domain**: an area or scope for which a specific identity provider is authoritative. It is not limited to only an Active Directory directory service domain or any similar enterprise mechanism. For example, the Google identity provider service is authoritative for all users in the Google realm or domain (users who have an account with Google); but it is not authoritative for users in the Windows Live® realm or domain (users with an account on the Windows Live network of Internet services).
- **Home Realm Discovery**: the process whereby the realm or domain of a user is identified so that the request for authentication can be forwarded to the appropriate identity provider. This may be accomplished by displaying a list of available identity providers and allowing the user to choose the appropriate one (one that will be able to authenticate the user). Alternatively, it may be achieved by asking the user to provide an email address, and then using the domain of that address to identify the home realm or domain of that user for authentication purposes.
- **Identity Provider**: a service or site that accepts credentials from a user. These credentials prove that the user has a valid account or identity. ACS redirects users to the appropriate identity provider that can authenticate that user and issue a token containing the claims (a specific set of information) about that user. The claims may include only a user identifier, or may include other details such as the user name, email address, and any other information that the user agrees to share. An identity provider is authoritative when the authentication takes place for a user within the provider's realm or domain.
- **Security Token Service (STS) or Token Issuer**: a service that issues tokens containing claims. ACS is an STS in that it issues tokens to relying parties that use ACS to perform authentication. The STS must trust the identity provider(s) it uses.
- **Relying Party**: an application, website, or service that uses a token issuer or STS to authenticate a user. The relying party trusts the STS to issue the token it needs. There might be several trust relationships in a chain. For example, an application trusts STS A, which in turn trusts another STS B. The application is a relying party to STS A, and STS A is a relying party to STS B.

- **Trust Relationship**: a configuration whereby one party trusts another party to the extent that it accepts the claims for users that the other party has authenticated. For example, in the scope of this appendix, ACS must trust the identity providers it uses and the relaying party must trust ACS.
- **Transformation Rules**: operations that are performed on the claims in a token received from an STS when generating the token that this entity will issue. ACS includes a rules engine that can perform a range of operations on the claims in the source token received from an identity provider or another STS. The rules can copy, process, filter, or add claims before inserting them into a token that is issued to the relying party.
- **Protocol Transition**: the process in an STS of issuing a token for a relying party when the original token came from another STS that implements different token negotiation protocols. For example, ACS may receive a token from an identity provider using OpenID, but issue the token to the relying party using the WS_Federation protocol.

In essence, when the user is requesting authentication in a web browser, ACS receives a request for authentication from a relying party and presents a home realm discovery page. The user selects an identity provider, and ACS redirects the user to that identity provider's login page. The user logs in and is returned to ACS with a token containing the claims this user has agreed to share in that particular identity provider.

ACS then applies the appropriate rules to transform the claims, and creates a new token containing the transformed claims. It then redirects the user back to the relying party with the ACS token. The relying party can use the claims in this token to apply authorization rules appropriate for this user.

The process for service authentication is different because there is no user interaction. Instead, the service must first obtain a suitable token from an identity provider, present this token to ACS for transformation, and then present the token that ACS issues to the relying party. The following sections of this chapter describe the message sequence in more detail, and explain how you can configure ACS to perform federated authentication.

Message Sequences for ACS

ACS can be used as a stand-alone claims issuer, but the typical scenario is to combine it with one or more local issuers such as ADFS or custom issuers. The sequence of messages and redirections varies depending on the specific scenario; however, the following are some of the more common scenarios for ACS.

ACS Authenticating Users of a Website

ACS can be used to authenticate visitors to a website when these visitors wish to use a social identity provider or another type of identity provider that ACS supports. Figure 1 shows a simplified view of the sequence of requests that occur.

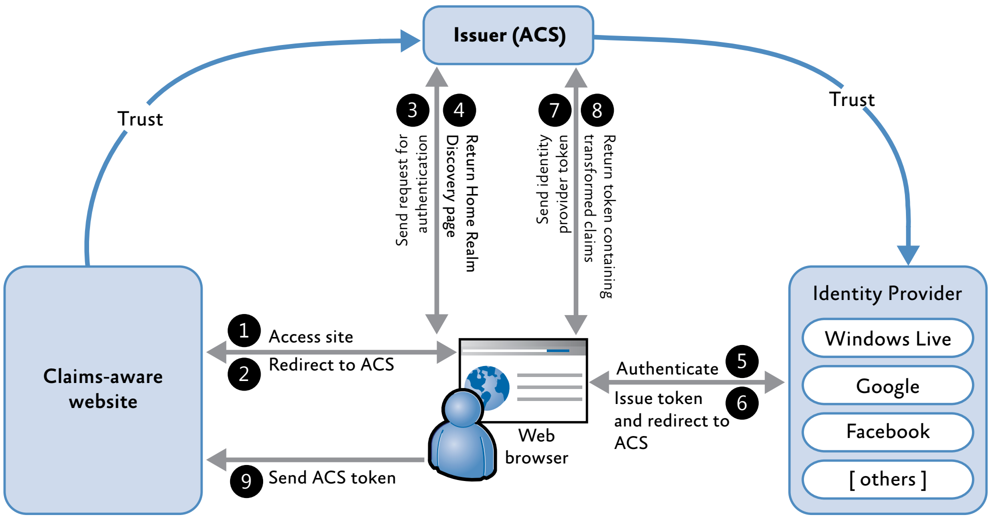

Issuer (ACS)
Trust
Trust
3 Send request for authentication
4 Return Home Realm Discovery page
7 Send identity provider token
8 Return token containing transformed claims
Claims-aware website
1 Access site
2 Redirect to ACS
9 Send ACS token
Web browser
Authenticate 5
Issue token and redirect to ACS 6
Identity Provider
Windows Live
Google
Facebook
[others]

FIGURE 1
ACS authenticating users of a website

On accessing the application (1), the visitor's web browser is redirected to ACS, the trusted source of security tokens (2 and 3). ACS displays the home realm discovery page (4) containing a list of identity providers configured for the website or web application. The user selects an identity provider and ACS redirects the visitor's web browser to that identity provider's login page (5).

After entering the required credentials, the visitor's browser is eventually redirected back to ACS (6) with the identity provider's token in the request (7). ACS performs any necessary transformation of the claims in the identity provider's token using rules configured for the website or application, and then returns a token containing these claims (8). The visitor's browser is then redirected to the claims-aware website that was originally accessed (9).

This scenario is demonstrated in Chapter 7, "Federated Identity with Multiple Partners and Windows Azure Access Control Service."

ACS Authenticating Services, Smart Clients, and Mobile Devices

ACS can be used to authenticate service requests for web services, smart clients, and mobile devices such as Windows Phone when the service uses a social identity provider or another type of identity provider that ACS supports. Figure 2 shows a simplified view of the sequence of requests that occur.

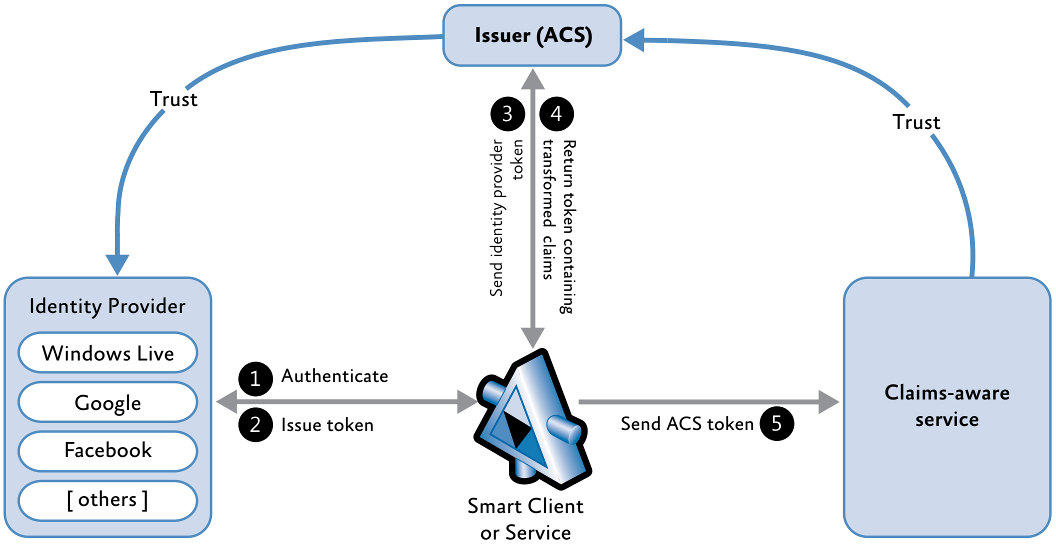


FIGURE 2
ACS authenticating services, smart clients, and SharePoint BCS

Because the service cannot use the ACS home realm discovery web page, it must be pre-configured to use the required identity provider or may query ACS to discover the trusted STS to use. The service first authenticates with the appropriate identity provider (1), which returns a token (2) that the service sends to ACS (3). ACS performs any necessary transformation of the claims in the identity provider's token using rules configured for the service, and then returns a token containing these claims (4). The service then sends the token received from ACS to the relying party service or resource (5).

This scenario is demonstrated in Chapter 8, "Claims Enabling Web Services."

Combining ACS and ADFS for Users of a Website

ACS can be used to authenticate visitors to a website when these visitors will access an ADFS STS first to establish their identity, but the ADFS STS trusts ACS so that visitors who wish to use a social identity provider or another type of identity provider can be authenticated. Figure 3 shows a simplified view of the sequence of requests that occur.

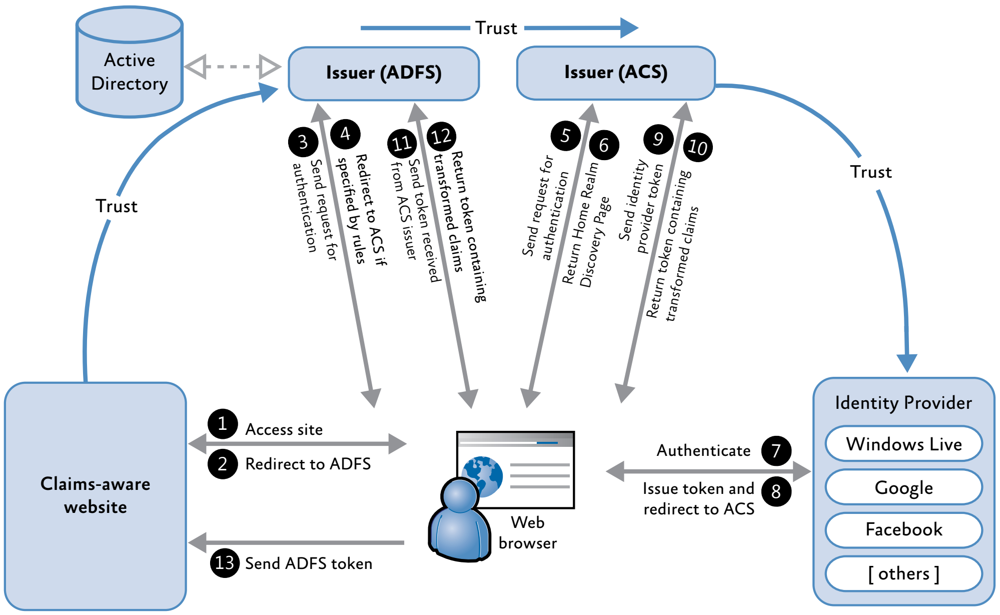

Active Directory
Trust
Issuer (ADFS)
Issuer (ACS)
Trust
Trust
3 Send request for authentication
4 Redirect to ACS if specified by rules
11 Send token received from ACS issuer
12 Return token containing transformed claims
5 Send request for authentication
6 Return Home Realm Discovery Page
9 Send identity provider token
10 Return token containing transformed claims
Claims-aware website
1 Access site
2 Redirect to ADFS
13 Send ADFS token
Web browser
Authenticate 7
Issue token and redirect to ACS 8
Identity Provider
Windows Live
Google
Facebook
[others]

FIGURE 3
ACS and ADFS authenticating users of a website

Upon accessing the application (1), the visitor's web browser is redirected to ADFS (2 and 3). ADFS will contain preconfigured rules that redirect the visitor to ACS (4 and 5), which displays the home realm discovery page (6) containing a list of identity providers configured for the website or web application. The user selects an identity provider and ACS redirects the visitor's web browser to that identity provider's login page (7).

After entering the required credentials, the visitor's browser is redirected back to ACS with the identity provider's token in the request (8 and 9). ACS performs any necessary transformation of the claims in the identity provider's token using rules configured for the website or application, and then redirects the browser to ADFS with a token containing these claims (10). ADFS receives the token (11), performs any additional transformations on the claims, and returns a token (12). The visitor's browser is then redirected to the claims-aware website that was originally accessed (13).

Combining ACS and ADFS for Services, Smart Clients, and SharePoint BCS

ACS can be used to authenticate service requests for web services, smart clients, and Microsoft SharePoint® Business Connectivity Services (BCS) applications when the service uses an ADFS STS as the token issuer, but the service requires a token provided by ACS. Figure 4 shows a simplified view of the sequence of requests that occur.

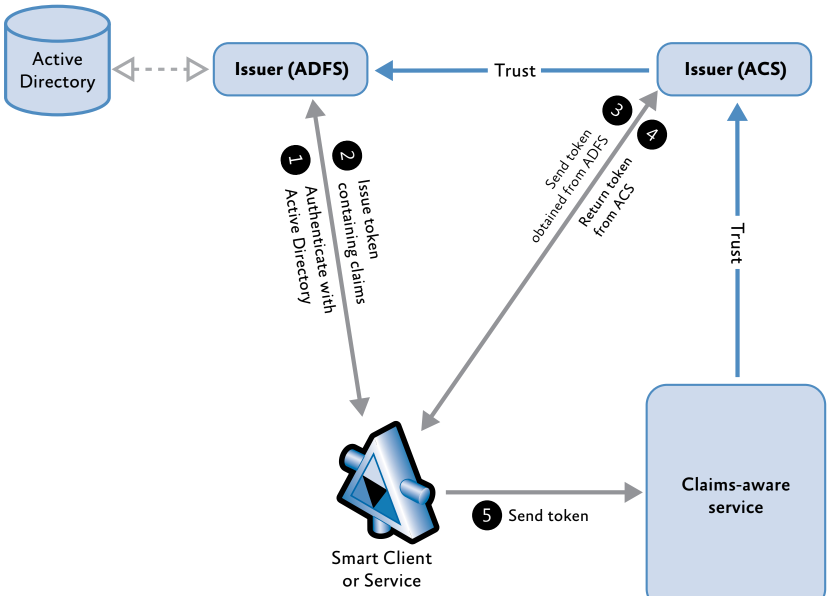


FIGURE 4
ACS authenticating services, smart clients, and SharePoint BCS

The service is preconfigured to use ADFS and Active Directory as the identity provider. The service first authenticates through ADFS (1), which returns a token (2) that the service sends to ACS (3). ACS trusts ADFS, and performs any necessary transformation of the claims in the token using rules configured for the service; then it returns a token containing these claims (4). The service then sends the token received from ACS to the relying party service or resource (5).

This scenario is demonstrated in Chapter 9, "Securing REST Services."

Creating, Configuring, and Using an ACS Issuer

The complete process for creating and configuring an ACS account to implement a token issuer requires the following steps:

1. Access the ACS web portal.
2. Create a namespace for the issuer service instance.
3. Add the required identity providers to the namespace.
4. Configure one or more relying party applications.
5. Create claims transformations and pass-through rules.
6. Obtain the URIs for the service namespace.
7. Configure relying party applications to use ACS.

The following sections explain each of these steps in more detail.

STEP 1: ACCESS THE ACS WEB PORTAL

The initial configuration of ACS must be done using the web portal. This is a Microsoft Silverlight® browser plug-in application that provides access to the access control, service bus, and cache features of the Azure AppFabric for your account. You must log into the portal using a Windows Live ID associated with your Windows Azure account. If you do not have a Windows Live ID, you must create and register one first at **http://www.live.com**. If you do not have a Windows Azure account, you must create one at **http://www.microsoft.com/windowsazure/account/** before you can use ACS.

ACS is a subscription-based service, and you will be charged for the use of ACS. The cost depends on the type of subscription you take out. At the time of writing, the standard consumption charge was $1.99 per 100,000 transactions.

STEP 2: CREATE A NAMESPACE FOR THE ISSUER SERVICE INSTANCE

After you sign into the ACS web portal, you can begin to configure your service instance. The first step is to define a namespace for your service. This is prepended to the ACS URI to provide a unique base URI for your service instance. You must choose a namespace that is not already in use anywhere else by ACS (you can check the availability before you confirm your choice), and choose a country/region where the service will be hosted.

For example, if you choose the namespace **fabrikam**, the base URI for your ACS service instance will be **https://fabrikam.accesscontrol.appfabric.com**. Endpoints for applications to use for authentication will be paths based on this unique URI.

After you have created the namespace, you see the main service management page for your new service instance. This provides quick access to the configuration settings for the trust relationships (the relying party applications, identity providers, and rule groups), the service settings (certificates, keys, and service identities), administration, and application integration.

You must use the Certificates and Keys page either to upload an X.509 certificate with a private key for use by ACS when encrypting tokens, or specify a 256-bit symmetric key. You can also upload a different certificate for signing the tokens if required. You can use certificates generated by a local certificate authority such as Active Directory Certificate Services, a certificate obtained from a commercial certification authority, or (for testing and proof of concept purposes) self-signed certificates.

STEP 3: ADD THE REQUIRED IDENTITY PROVIDERS TO THE NAMESPACE

Next, you must specify the identity providers that you will trust to authenticate requests sent to ACS from applications and users. By default, Windows Live ID is preconfigured as an identity provider. You can add additional providers such as Google, Yahoo!, Facebook, your own or other ADFS issuers, and more. For each one, you can specify the URL of the login page and an image to display for the identity provider when the user is presented with a list of trusted providers.

For known identity providers (such as Google, Yahoo!, and Facebook) these settings are preconfigured and you should consider using the default settings. If you want to trust another identity provider, such as a Security Token Service (STS) based at an associated site such as a partner company, you must enter the login page URL, and optionally specify an image to display.

By default, ACS uses Windows Live ID as the identity provider to determine the accounts of ACS administrators. You configure a rule that identifies administrators through the claims returned by their identity provider (claim transformation and filtering rules are described in step 5). You can also use any of the other configured identity providers to determine which accounts have administrative rights for this ACS service instance.

STEP 4: CONFIGURE ONE OR MORE RELYING PARTY APPLICATIONS

You can now configure the ACS service to recognize and respond to relying parties. Typically these are the applications and web services that will send authentication requests to this ACS service instance. For each relying party you specify:

- A name for the application or service as it will appear in the authentication portal page where users select an identity provider.
- The URIs applicable to this application or service. These include the realm (URI) for which tokens issued by ACS will be valid, the URI to redirect the request to after authentication and, optionally, a different URI to redirect the request to if an authentication error occurs.

  It is good practice to always configure the redirection addresses, even though they are mandated by ACS to be in the same realm as the token that ACS delivers, in order to mitigate interception attacks through rerouting the posted token

- The format, encryption policy, and validity lifetime (in seconds) for the tokens returned from ACS. By default the format is a SAML 2.0 token, but other formats such as SAML 1.1 and SWT are available. SAML 1.1 and SAML 2.0 tokens can be encrypted, but SWT tokens cannot. If you want to return tokens to a web service that implements the WS-Trust protocol you must select a policy that encrypts the token.
- The binding between this relying party and the identity providers you previously configured for the service namespace. Each relying party can trust a different subset of the identity providers you have configured for the service namespace.
- The token signing options. By default, tokens are signed using the certificate for the service namespace, and all relying parties will use the same certificate. However, if you wish, you can upload more certificates and allocate them to individual relying parties.

Each option in the configuration page has a "Learn more" link that provides more information on that setting. You can, as an alternative, upload a WS-Federation metadata document that contains the required settings instead of entering them manually into the portal.

If you only configure a single identity provider for a relying party, ACS will not display the Home Realm Discovery page that shows a list of configured identity providers. It will just use the identity provider you configured.

STEP 5: CREATE CLAIMS TRANSFORMATIONS AND PASS-THROUGH RULES

By default, ACS does not include any of the claims it receives from an identity provider in the token it issues. This ensures that, by default, claims that might contain sensitive information are not automatically sent in response to authentication requests. You must create rules that pass the values in the appropriate claims through to the token that will be returned to the relying party. These rules can apply a transformation to the claim values, or simply pass the value received from the identity provider into the token.

The rules are stored in rule groups. You create a rule group and give it a name, then create individual rules for this group. The portal provides a Generate feature that will automatically generate a pass-through rule for every claim for every configured identity provider. If you do not require any transformations to take place, (which is typically the case if the relying party application or service will access ACS through another STS such as a local ADFS instance), this set of generated rules will probably suffice as all of the claims mapping and transformations will take place on the local STS issuer.

If you want to perform transformation of claims within ACS, you must create custom rules. For a custom rule, you specify:

- The **rule conditions** that match an input claim from an identity provider. You can specify that the rule will match on the claim type, the claim value, or both.
- For the claim type, you can specify that it will match any claim type, one of the standard claim types exposed by this identity provider, or a specific claim type you enter (as a full XML namespace value for that claim type).
- For the claim value, you can specify that it will match any value or a specific value you enter. Claim types and values are case-sensitive.
- The **rule actions** when generating the output claim. You can specify the output claim type, the output claim value, or both.
- For the output claim type you can specify a pass-through action that generates a claim of the same type as the input claim, select one of the standard claim types exposed by this identity provider, or enter a specific claim type (as a full XML namespace value for that claim type).
- For the output claim value you can choose to pass through the original value of the claim, or enter a value.
- The **rule description** (optional) that helps you to identify the rule when you come to apply it.

STEP 6: OBTAIN THE URIS FOR THE SERVICE NAMESPACE

After you configure your ACS service instance, you use the Application Integration page of the portal to obtain the endpoints to which relying parties will connect to authenticate requests. This page also lists the endpoints for the management service (the API for configuring ACS without using the web portal), the OAuth WRAP URI, and the URIs of the WS-Federation and WS-Metadata Exchange documents.

STEP 7: CONFIGURE RELYING PARTY APPLICATIONS TO USE ACS

To add an ACS service reference to an application in Microsoft Visual Studio® development system, you must download and install the Windows Identity Foundation SDK. This adds a new option to the Visual Studio menus to allow you to add an STS reference to a project. It starts a wizard (the FedUtil utility) that asks for the URI of the WS-Federation document for your ACS service instance, with can be obtained from the application integration page of the portal in the previous step. The wizard adds a reference to the **Microsoft.Identity Model** assembly to the project and updates the application configuration file.

If the application is a web application, users will be redirected to ACS when they access the application, and will see the ACS home realm discovery page that lists the configured identity providers for the application that are available. After authenticating with their chosen identity provider, users will be returned to the application, which can use the claims in the token returned by ACS to modify its behavior as appropriate for each user.

For information and links to other resources that describe techniques for using claims and tokens to apply authorization in applications and services, see "Authorization In Claims Aware Applications – Role Based and Claims Based Access Control" at http://blogs.msdn.com/b/alikl/archive/2011/01/21/authorization-in-claims-aware-applications-role-based-and-claims-based-access-control.aspx.

Custom Home Realm Discovery Pages

By default, ACS displays a home realm discovery page when a user is redirected to ACS for authentication. This page contains links to the identity providers configured for the relying party application, and is hosted within ACS. If you have configured an ADFS instance as an identity provider, you can specify email suffixes that are valid for this ADFS instance, and ACS will display a text box where users can enter an email address that has one of the valid suffixes. This enables ACS to determine the home realm for the authenticated user.

As an alternative to using the default ACS-hosted login page, you can create a custom page and host it with your application (or elsewhere). The custom page uses the Home Realm Discovery Metadata Feed exposed by ACS to get the list and details of the supported identity providers. To make this easier, you can download the example login page (which is the same as the default page) from ACS and modify it as required.

If you are integrating ACS with ADFS, the home realm discovery page will contain a text box where users can enter an email address that is valid within trusted ADFS domains. ACS will use this to determine the user's home realm. You can create a custom page that contains only a text box and does not include the list of configured identity providers if this is appropriate for your scenario.

Configuration with the Management Service API

Windows Azure AppFabric exposes a REST-based service API in AtomPub format that uses X.509 client certificates for authentication. The URI of the management service for your ACS instance is shown in the application integration page of the web portal after your configure the instance. You can upload any valid X.509 certificate (in **.cer** format) to the ACS portal and then use it as a client certificate when making API requests.

The Windows Azure management API supports all of the operations available through the web portal with the exception of creating a namespace. You can use the management API to configure identity providers, relying parties, rules, and other settings for your namespaces. To create new namespaces, you must use the web portal.

Chapter 7, "Federated Identity with Multiple Partners and Windows Azure Access Control Service" and the associated ACS wrapper used in this sample to configure ACS demonstrate how you can use the management API to configure identity providers, relying partiers, and rules.

For more information, see "Access Control Service Samples and Documentation" at http://acs.codeplex.com/releases/view/57595.

For examples of adding identity providers such as ADFS, OpenID, and Facebook using the management API, see the following resources:

- "Adding Identity Provider Using Management Service" at http://blogs.msdn.com/b/alikl/archive/2011/01/08/windows-azure-appfabric-access-control-service-v2-adding-identity-provider-using-management-service.aspx.

- "Programmatically Adding OpenID as an Identity Provider Using Management Service" at http://blogs.msdn.com/b/alikl/archive/2011/02/08/windows-azure-appfabric-access-control-service-acs-v2-programmatically-adding-openid-as-an-identity-provider-using-management-service.aspx.
- "Programmatically Adding Facebook as an Identity Provider Using Management Service" at http://blogs.msdn.com/b/alikl/archive/2011/01/14/windows-azure-appfabric-access-control-service-acs-v2-programmatically-adding-facebook-as-an-identity-provider-using-management-service.aspx.

Managing Errors

One of the configuration settings for a relying party that can be provided is the URI where ACS will send error messages. ACS sends details of the error as a JavaScript Object Notation (JSON)-encoded object in the response body when the original request was an OAuth request; or a SOAP fault message if the original request was a WS-Trust request. The response includes a **TraceId** value that is useful in identifying failed requests if you need to contact the ACS support team.

For information about handling JSON-encoded responses, see "*How To: Use Error URL*" at http://acs.codeplex.com/wikipage?title=How%20To%3a%20Use%20Error%20URL and "Returning Friendly Error Messages Using Error URL Feature" at http://blogs.msdn.com/b/alikl/archive/2011/01/15/windows-azure-appfabric-access-control-service-acs-v2-returning-friendly-error-messages-using-error-url-feature.aspx.

Errors that arise when processing management API requests throw an exception of type **DataServiceRequestException**.

A list of error codes for ACS is available from "ACS Error Codes" at http://acs.codeplex.com/wikipage?title=ACS%20Error%20Codes&version=8.

Integration of ACS and a Local ADFS Issuer

You can configure ACS to use an ADFS issuer as a trusted identity provider. This is useful in scenarios where you want users of a local application to be able to authenticate against an Active Directory installation (typically within your own organization) when they access the local application, and then access other services that require a SAML or other type of claims token. For example, a locally installed customer management application may use a partner's externally hosted service to obtain credit rating information for customers.

The procedure for configuring this scenario is to use the WS-Federation document that can be created by ADFS to configure ACS so that it can use the ADFS service as a trusted identity provider. ACS can accept encrypted tokens from ADFS identity providers as long as the appropriate X.509 certificate with a private key is hosted by ACS. The ADFS identity provider receives the public key it will use to encrypt tokens when it imports the WS-Federation metadata from ACS.

Afterwards, when users first access the local application they are authenticated by the local ADFS STS. When the application must access the externally hosted service, it queries ACS. ACS then authenticates the user against their local ADFS STS and issues a token that is valid for the remote service. The customer management application then passes this token to the remote service when it makes the call to retrieve rating information (see Figure 5).

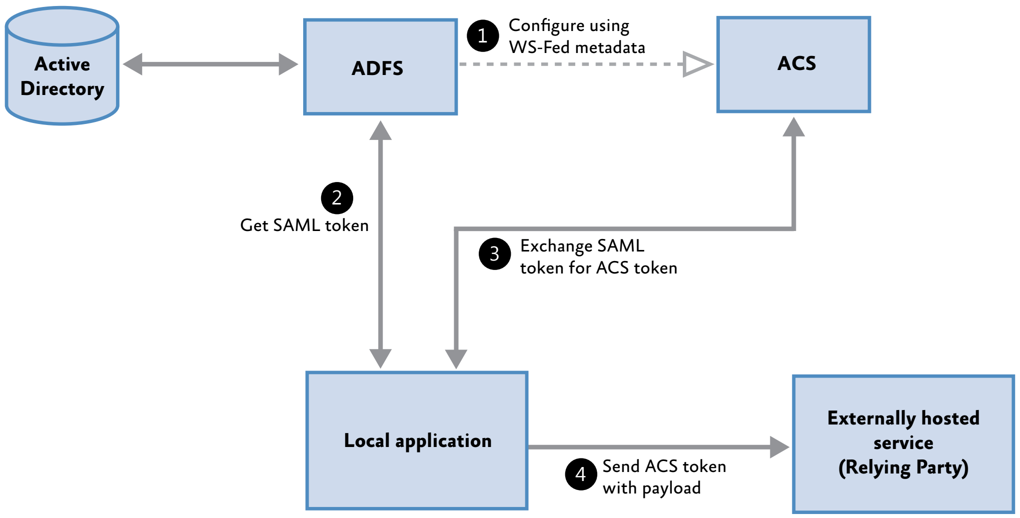

Active Directory
ADFS
1 Configure using WS-Fed metadata
ACS
2 Get SAML token
3 Exchange SAML token for ACS token
Local application
4 Send ACS token with payload
Externally hosted service (Relying Party)

FIGURE 5
ACS using an ADFS issuer as a trusted identity provider

An alternative (reverse) scenario is to configure ADFS to use ACS as a trusted issuer. In this scenario, ADFS can authenticate users that do not have an account in the local Active Directory used by ADFS. When users log into the application and are authenticated by ADFS, they can choose an identity provider supported by ACS. ADFS then accepts the token generated by ACS, optionally maps the claims it contains, and issues a suitable token (such as a Kerberos ticket) to the user that is valid in the local domain (see Figure 6).

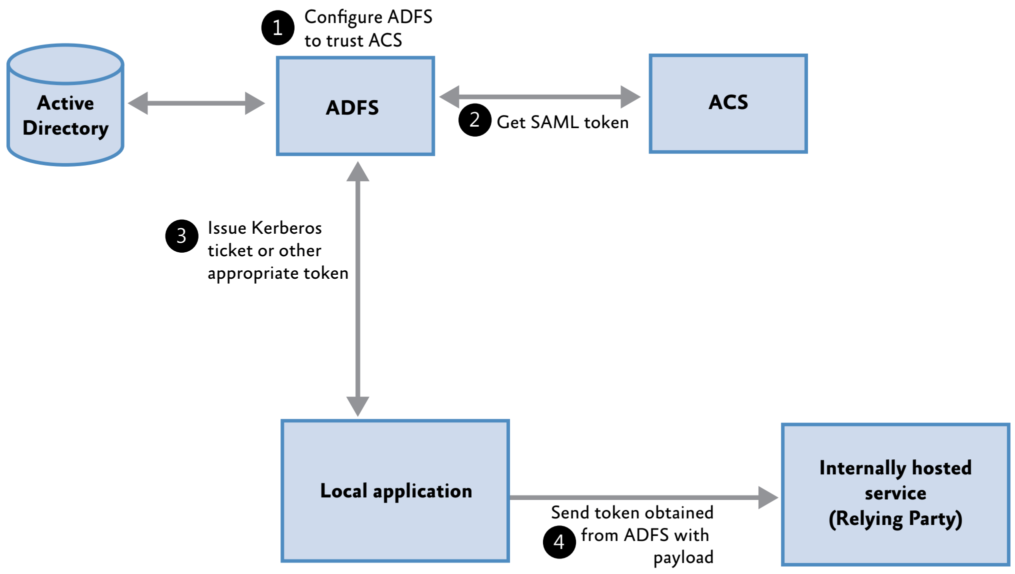

1 Configure ADFS to trust ACS
Active Directory
ADFS
ACS
2 Get SAML token
3 Issue Kerberos ticket or other appropriate token
Local application
Send token obtained 4 from ADFS with payload
Internally hosted service (Relying Party)

FIGURE 6
ADFS using ACS as a trusted issuer

Security Considerations with ACS

You must ensure that your applications and services that make use of ACS for authentication and claims issuance maintain the requisite levels of security. Although your applications do not have access to users' login credentials, ACS does expose claims for the user that your application must manage securely.

You must ensure that credentials and certificates used by applications and services, and for access to ACS, are stored and handled in a secure manner. Always consider using SSL when passing credentials over networks. Other issues you should consider are those that apply to all applications, such as protection from spoofing, tampering, repudiation, and information disclosure.

For more information and links to related resources that describe security threats and the relevant techniques available to counter them see the following resources:

"Windows Azure AppFabric Access Control Service (ACS) v2 – Threats & Countermeasures" at http://blogs.msdn.com/b/alikl/archive/2011/02/03/windows-azure-appfabric-access-control-service-acs-v2-threats-amp-countermeasures.aspx

"Windows Identity Foundation (WIF) Security for ASP.NET Web Applications – Threats & Countermeasures" at http://blogs.msdn.com/b/alikl/archive/2010/12/02/windows-identity-foundation-wif-security-for-asp-net-web-applications-threats-amp-countermeasures.aspx

"Microsoft Application Architecture Guide, 2nd Edition" at http://msdn.microsoft.com/en-us/library/ff650706.aspx

Tips for Using ACS

The following advice may be useful in resolving issues encountered when using claims authentication with ACS.

ACS and STSs Generated in Visual Studio 2010

Custom STSs created from the Visual Studio 2010 template assume that the **ReplyToAddress** is the same as the **AppliesToAddress**. You can see this in in the **GetScope** method of the **CustomSecurityTokenService**, which sets **scope.ReplyToAddress = scope.AppliesToAddress**. In the case of ACS, the **ReplyToAddress** and the **AppliesToAddress** are different. The STS generates a redirection to the wrong place and an error occurs when an application accesses ACS to perform authentication.

To resolve this, replace the line that sets the **ReplyToAddress** with the following code.

```
C#
if (request.ReplyTo != null)
{
    scope.ReplyToAddress = request.ReplyTo.ToString();
}
else
{
    scope.ReplyToAddress = scope.AppliesToAddress;
}
```

Error When Uploading a Federation Metadata Document

When adding a new ADFS token issuer as a trusted identity provider to ACS, you may receive an error such as "ACS20009: An error occurred reading the WS-Federation metadata document" when uploading the federation metadata file. ACS validates the signature of the file, and if you have modified the file that was generated by Visual Studio this error will occur. If you need to modify the metadata file, you must re-sign it. A useful tool for this can be found at "WIF Custom STS Metadata File Editor" (http://botsikas.blogspot.com/2010/06/wif-custom-sts-metadata-file-editor.html).

Avoiding Use of the Default ACS Home Realm Discovery Page

When using ACS with multiple identity providers, ACS will display a page with the list of identity providers that are configured the first time you attempt to sign in. You can avoid this by sending the appropriate **whr** parameter with the authentication request. The following table lists the different values for this parameter for each of the identity providers.

Identity provider	whr parameter value
Windows Live ID	**urn:WindowsLiveID**
Google	**Google**
Yahoo!	**Yahoo!**
Facebook	**Facebook-<*application-ID*>**
Custom STS	The value should match the **entityid** declared in the **FederationMetadata** file of the identity provider.

More Information

For more information about setting up and using ACS, see the following resources:

- "Windows Azure AppFabric" at http://www.microsoft.com/windowsazure/AppFabric/Overview/default.asp
- "Access Control Service Samples and Documentation" at http://acs.codeplex.com/documentation
- "Windows Azure Team Blog" at http://blogs.msdn.com/windowsazure/

Appendix F SharePoint 2010 Authentication Architecture and Considerations

This appendix provides background information about the way that Microsoft® SharePoint® 2010 implements claims-based authentication. This is a major change to the authentication architecture compared to previous versions, and makes it easier to take advantage of federated authentication approaches for SharePoint websites, applications, and services. It also contains information on some of the important factors you should consider when creating and deploying claims-aware SharePoint applications and services.

Versions prior to SharePoint 2010 use the techniques for authentication provided by the Microsoft Windows® operating system and ASP.NET. Applications can use Windows authentication (with the credentials validated by Microsoft Active Directory® directory service), ASP.NET forms authentication (with credentials typically validated from a database), or a combination of these techniques.

To make claims-based and federated authentication easier, SharePoint 2010 can use a claims-based model for authentication. This model still fully supports Windows and forms authentication, but does so by integrating these approaches with the claims-based authentication mechanism. This appendix provides background information that will help you to understand how this model is implemented within SharePoint 2010.

Benefits of a Claims-Based Architecture

Users often require access to a number of different applications to perform daily tasks, and increasingly these applications are remotely located so that users access them over the Internet. ASP.NET forms authentication typically requires the maintenance of a separate user database at each location. Users must have accounts registered with all of the Active Directory domains, or in all of the ASP.NET forms authentication databases.

The use of tokens and claims can simplify authentication by allowing the use of federated identity—users are authenticated by an identity provider that the organization and application trusts. This may be an identity provider within the organization, such as Active Directory Federation Services (ADFS), or a third party (a business partner or a social identity provider such as Windows Live® or Google).

As well as simplifying administration tasks, claims-based authentication also assists users because it makes it possible for users to use the same account (the same credentials) to access multiple applications and services in remote locations, hosted by different organizations. This allows for single sign-on (SSO) in that users can move from one application to another, or make use of other services, without needing to log on each time.

The integration of claims-based authentication with the existing architecture of SharePoint provides the following benefits:

- Support for single sign-on over the Internet in addition to the existing location-dependent mechanisms such as Active Directory, LDAP, and databases.
- Automatic and secure delegation of identity between applications and between machines in a server farm.
- Support for multiple different authentication mechanisms in a single web application without requiring the use of zones.
- Access to external web services without requiring the user to provide additional credentials.
- Support for standard authentication methods increasingly being used on the web.
- Support for accessing non-claims-based services that use only Windows authentication.

Windows Identity Foundation

SharePoint 2010 uses the Windows Identity Foundation (WIF) for authentication irrespective of the authentication approach used by the individual applications and services. This is a fundamental change in the architecture of SharePoint in comparison to previous versions. WIF is a standards-based technology for working with authentication tokens and claims, and for interacting with security token services (STSs). It provides a unified programming model that supports both the Passive and Active authentication sequences.

The **Passive** *authentication sequence uses the WS-Federation protocol for authentication in web browser-based scenarios, such as ASP.NET applications. It depends on redirection of the browser between the relying party, token issuers, and identity providers.*

The **Active** *authentication sequence uses the WS-Trust protocol for authentication in web service scenarios, such as Windows Communication Foundation (WCF) services. The service "knows" (typically through configuration) how to obtain the tokens it requires to access other services.*

Implementation of the Claims-Based Architecture

The claims-based architecture in SharePoint 2010 comprises three main themes and the associated framework implementations. These three themes correspond to the three main factors in the flow of identity through SharePoint applications and services.

- The first theme is the **extension of authentication** to enable the use of multiple authentication mechanisms. Authentication is possible using tokens containing claims, ASP.NET forms authentication, and Windows authentication. External authentication is implemented though an STS within SharePoint 2010.
- The second theme is **identity normalization**, where the identity verified by the different authentication mechanisms is converted to an **IClaimPrincipal** instance that the Windows Identity Foundation authorization mechanism can use to implement access control.
- The third theme is **supporting existing identity infrastructure**, where the identity can be used to access external services and applications that may or may not be claims-aware. For non-claims-aware applications and services, WIF can generate an **IPrincipal** instance to allow other authentication methods (such as Windows authentication) to be used even when the original identity was validated using claims. This is implemented though the Services Application Framework within SharePoint 2010.

Figure 1 shows a conceptual overview of these three themes, and the mechanisms that implement them in SharePoint 2010.

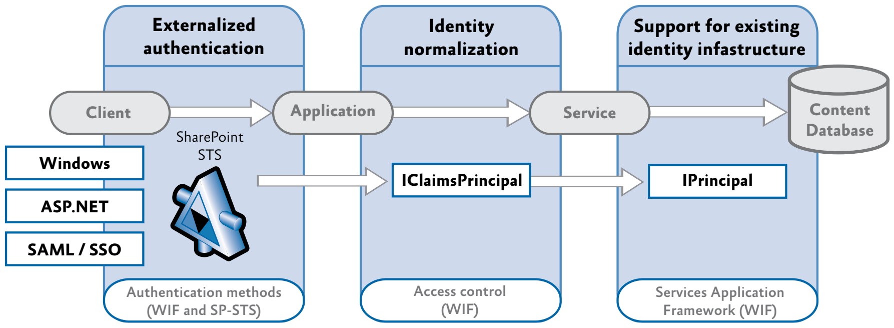


FIGURE 1
The three authentication themes in SharePoint 2010

SharePoint 2010 User Identity

Internally, SharePoint 2010 uses the **SPUser** type to manage and flow identity through applications and services. The fundamental change in this version of SharePoint compared to previous versions is the provision of an external authentication mechanism that supports identity verification using claims, as well as ASP.NET forms and Windows authentication. The external authentication mechanism converts claims it receives into a SAML token, then maps this token to an instance of the **SPUser** type.

The claims may be received in the form of a SAML token from ADFS, Windows Azure™ AppFabric Access Control Service (ACS), or another STS; as a Windows NT token; or from the ASP.NET forms authentication mechanism. An application can be configured to use more than one authentication mechanism, allowing users to be authenticated by any of the configured mechanisms.

Previous to version 2010, supporting more than one authentication method for a SharePoint application typically required the use of zones; each of which is effectively a separate Microsoft Internet Information Services (IIS) web site and URL pointing to the application. Zones are no longer required in SharePoint 2010 because applications can be configured to use a combination of authentication methods, although they can still be used if required (for example, if a different application URL is required for each authentication method).

It is also possible to configure the SharePoint 2010 authentication mechanism in "Classic" mode for existing applications or services that are not claims-aware, and which present a Windows NT token that SharePoint can map to an instance of the **SPUser** type. If you select classic mode, you can use Windows authentication in the same way as in previous versions of SharePoint, and the user accounts are treated as Active Directory Domain Services (AD DS) accounts.

However, services and service applications will use claims-based identities for inter-farm communication regardless of the mode that is selected for web applications and users.

Figure 2 shows an overview of the sign-in methods supported by the SharePoint 2010 authentication mechanism.

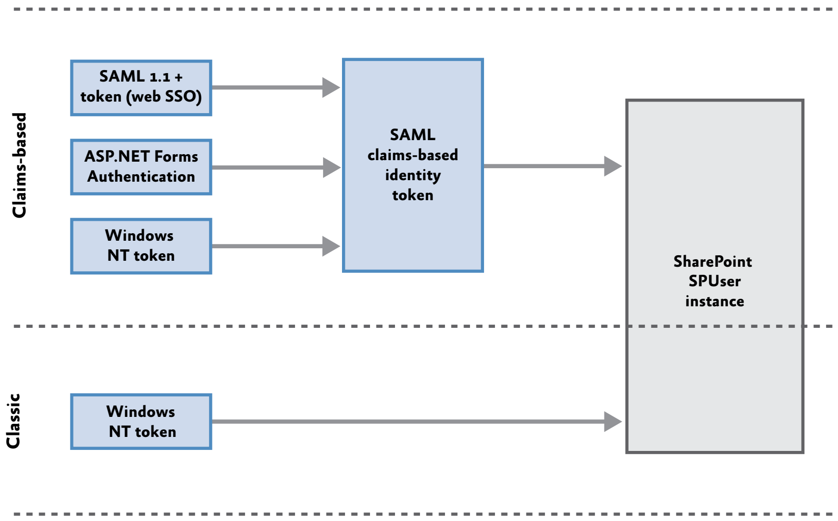

Claims-based
SAML 1.1 + token (web SSO)
ASP.NET Forms Authentication
Windows NT token
SAML claims-based identity token
SharePoint SPUser instance
Classic
Windows NT token

FIGURE 2
Authentication methods in SharePoint 2010

Windows certificate-based authentication is not supported by the SharePoint 2010 claims-based authentication mechanism.

The SharePoint 2010 Security Token Service

The conversion of claims received in the different formats is carried out by an STS within SharePoint 2010. This is a fairly simple STS that can map incoming claims to the claims required by the relying party (the target application or service). It can also be configured to trust external STSs such as ADFS, ACS, and other token issuers.

Applications and services running within SharePoint 2010 access the local SharePoint STS to discover the claims for each user or process that requires authorization. For example, applications can verify that the current user is a member of one of the required Active Directory groups. This is done using the WIF authorization mechanisms, and works in much the same way as (non-SharePoint) applications that access ADFS or ACS directly to obtain a token containing the claims.

For example, when a user accesses a SharePoint-hosted ASP.NET application that requires authentication, the request is redirected to an identity provider such as ADFS or ACS. The token received from the identity provider is then posted to the SharePoint STS (which the application must be configured to trust). The SharePoint STS authenticates the user and augments (transforms) the claims in the token or request. It then redirects the request back to the application with the augmented claims. Inside the application, the claims can be used to authorize the user for specific actions. Figure 3 shows this process.

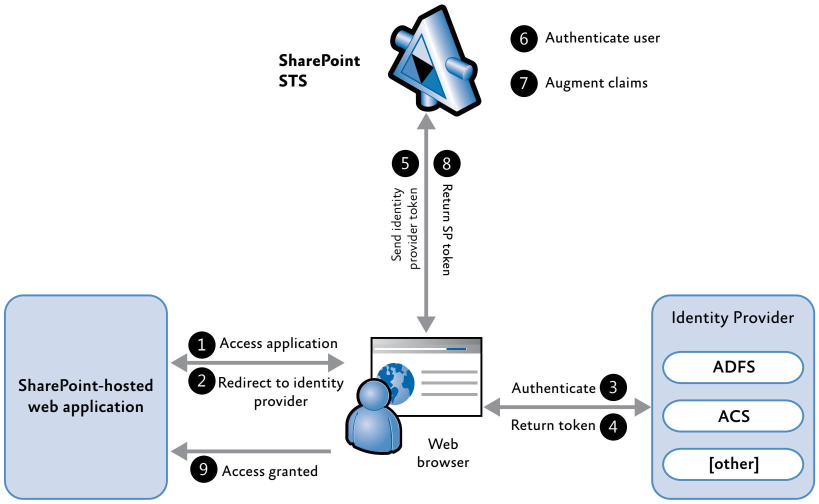


FIGURE 3
Claims authentication sequence in SharePoint 2010

The SharePoint 2010 Services Application Framework

One of the typical scenarios for a SharePoint application is to access both internal (SharePoint hosted) and external services to obtain data required by the application. Internal services include the Search Service, Secure Store Service, Excel Services, and others. External services may be any that expose data, either on a corporate network or from a remote location over the Internet.

Accessing these services will, in most cases, require the application to present appropriate credentials to the services. In some cases, the services will be claims-aware and the application can present a SAML token containing the required claims. As long as the external service trusts the SharePoint STS, it can verify the claims.

Some services may not, however, be claims aware. A typical example is when accessing a Microsoft SQL Server® database. In these cases, the SharePoint Services Application Framework can be used to generate a Windows token that the application can present to the service. This is done using the Claims to Windows Token Service (C2WTS), which can create a suitable Windows NT token.

Microsoft Visual Studio® development system provides support and features to make building and deploying SharePoint 2010 applications easier. This support is included in all editions of Visual Studio 2010 (Professional, Premium, and Ultimate). It is not available in the Express versions of Visual Studio.

Considerations When Using Claims with SharePoint

The following sections provide specific guidance on topics related to using claims authentication in SharePoint 2010 applications and services.

Choosing an Authentication Mode

Claims-based authentication is now the recommended mechanism for SharePoint, and all new SharePoint applications should use claims-based authentication; even if the operating environment will include only Windows accounts. SharePoint 2010 implements Windows authentication in the same way regardless of the mode that is selected, and there are no additional steps required to implement Windows authentication with the claims-based authentication mode.

If you are upgrading an application that uses ASP.NET forms-based authentication, you must use claims-based authentication. Classic mode authentication cannot support ASP.NET forms-based authentication.

The only scenario where choosing classic mode authentication is valid is when upgrading to SharePoint 2010 and existing accounts use only Windows authentication. This allows existing applications to continue to operate in the same way as in previous versions of SharePoint.

The default authentication mode for a new SharePoint application is classic mode. You must specifically select claims-based authentication mode when creating a new application or website.

Supported Standards

SharePoint 2010 supports the following claims-related standards:

- WS-Federation version 1.1
- WS-Trust version 1.4
- SAML Tokens version 1.1

SharePoint 2010 does not support SAML Protocol (SAMLP).

Using Multiple Authentication Mechanisms

When multiple authentication methods are configured for an application, SharePoint displays a home realm discovery page that lists the authentication methods available. The user must select the method to use. This adds an extra step into the authentication process for the user. It is possible to create a custom home realm discovery (sign-in) page if required.

SharePoint 2010 does not discriminate between user accounts when different authentication methods are used. Users that successfully authenticate with SharePoint 2010 using any of the claims-based authentication methods have access to the same resources and services as would be available if that user was authenticated using classic Windows authentication.

Users who access a SharePoint 2010 application that is configured to use claims-based authentication and has multiple authentication methods set up will have the same access to resources and services when using any of the authentication methods. However, if the user has two different accounts configured (in other words, has accounts in two different repositories, such as a social identity provider and ASP.NET), and the authentication method used validates the user against one of these accounts, the user will have access to only resources and services configured for the account that was validated.

You can configure multiple SAML authentication providers for a server farm and application. However, you can configure only a single instance of an ASP.NET forms-based authentication provider. If you configure Windows authentication when using claims-based authentication mode, you can use both a Windows integrated method and a Basic method, but you cannot configure any additional Windows authentication methods.

For a discussion on the merits of using multiple identity providers for authentication, see Chapter 12 of this guide, "Federated Identity for SharePoint Applications."

SharePoint Groups with Claims Authentication

To simplify administration tasks when setting authorization permissions on resources, it is recommended that you use SharePoint Groups. Setting permissions for resources based on membership of a specific group means that it is not necessary to continually update the permissions as new users are added to groups or existing users are removed from groups.

The SharePoint STS automatically augments the claims in the tokens it issues to include group membership for users when Windows authentication is used. It also automatically augments the tokens to include the roles specified for users when ASP.NET forms-based authentication is used; with each role translated into a SharePoint group name (the SharePoint groups are not created automatically).

When using SAML tokens issued by external identity providers and STSs, you must create a custom claims provider that augments the tokens to include the relevant roles. For example, you could create a custom claims provider that augments the SharePoint STS token with specific roles based on a test of the claims in the token received from the identity provider. This may be done by checking the incoming token to see if it was issued by a specific partner's STS, or that the email address is within with a specific domain.

SharePoint Profiles and Audiences with Claims Authentication

SharePoint user profiles are not populated automatically when using claims-based authentication methods. You must create and populate these profiles yourself, typically in code. Users that map to existing accounts when you migrate to claims-based authentication will use any existing profile information, but other users and new users will not have profile information. For information about how you can populate user profiles when using claims-based authentication, see "Trusted Identity Providers & User Profile Synchronization" at **http://blogs.msdn.com/b/brporter/archive/2010/07/19/trusted-identity-providers-amp-user-profile-synchronization.aspx**.

The same limitation occurs when using SharePoint Audiences. You cannot use user-based audiences directly unless you create custom code to support this, but you can use property-based audiences that make use of claims values. For information, see "Using Audiences with Claims Auth Sites in SharePoint 2010" at **http://blogs.technet.com/b/speschka/archive/2010/06/12/using-audiences-with-claims-auth-sites-in-sharepoint-2010.aspx**.

Rich Client, Office, and Reporting Applications with Claims Authentication

Claims-based authentication methods in SharePoint support almost all of the capabilities for integration with Office client applications and services. Office 2007 clients can use forms-based authentication to access SharePoint 2010 applications that are configured to use forms-based authentication and Office 2010 clients can use claims to access SharePoint 2010 applications that are configured to use claims-based forms-based authentication. However, there are some limitations when using claims-based authentication:

- Microsoft Office Excel® Services can use only the Classic or the Windows claims-based authentication methods. When using other claims-based authentication methods you must use the Secure Store Service for external data connections and unattended data refresh.
- Microsoft Visio® Services can use the Secure Store Service, but only for drawings that use an Office Data Connection (ODC) file to specify the connection. The Unattended Service Account option can also be used with the same limitation.
- PowerPivot can be used in workbooks with embedded data, but data refresh from a data source is not possible when using any of the claims-based authentication methods.
- SQL Server 2008 R2 Reporting Services integration is only possible when using classic Windows Authentication. It cannot use the Claims to Windows Token Service (c2WTS), which is a feature of Windows Identity Foundation.
- PerformancePoint must use the Unattended Service Account option in conjunction with Secure Store Service when using claims-based authentication.
- Project Server maintains a separate user database containing logon information, and so migrating users when using claims-based authentication is not sufficient.

Other Trade-offs and Limitations for Claims Authentication

When upgrading existing applications to SharePoint 2010, be aware of the following factors that may affect your choice of authentication type:

- Claims-based authentication requires communication over HTTPS with a token issuer and identity provider. It typically also requires multiple redirects for clients that are using a web browser. These are likely to be slower than Windows Authentication or ASP.NET forms-based authentication lookup. Even after initial authentication, as users move between applications taking advantage of single sign-on, the applications and services must make calls over HTTPS to validate the authentication tokens.
- Web Parts or custom code that relies on or uses Windows identities must be modified if you choose claims-based authentication. Consider choosing classic mode authentication until all custom code is updated.
- When you upgrade a web application from classic mode to claims-based authentication, you must use Windows PowerShell® command-line interface to convert Windows identities

to claims identities. This can take time, and you must factor in time for this operation as part of the upgrade process.

- Search alerts are currently not supported with claims-based authentication.
- You cannot use custom ISAPI extensions or HTTP modules with the forms-based authentication method because the SharePoint STS communicates directly with the forms authentication provider by calling its **ValidateUser** method.
- Some client-hosted applications may attempt to authenticate with the server when displaying content linked from SharePoint application web pages. If you are using claims-based authentication and the client-hosted application is not claims-aware (as in the case of Windows Media Player), this content might not be displayed.
- Managing the session lifetime is not a trivial exercise when using claims-based authentication. For details of how you can manage session lifetime, see Chapter 11, "Claims-Based Single Sign-On for Microsoft SharePoint 2010."
- The External Content Type Designer in SharePoint Designer 2010 cannot discover claims aware WSDL endpoints. For more information, see MSDN® Knowledge Base article 982268 at http://support.microsoft.com/default.aspx?scid=kb;EN-US;982268.

Applications are not changed to claims-based authentication mode automatically when you upgrade to SharePoint 2010. If you later convert an application from classic authentication mode to claims-based authentication mode, you cannot convert it back to classic authentication mode.

Claims-based authentication validates users from a variety of realms and domains, some of which do not provide the wealth of information about users that is available from Windows authentication against Active Directory. This has some impact on the usability of SharePoint in terms of administration and development.

Primarily, the People Picker user experience is different when using claims-based authentication. It does not provide the same level of support, such as browsing repositories (lists of accounts are not stored or available in the people picker). This means that locating accounts involves using the search feature against known attributes. However, the people picker UI does provide some assistance using pop-up tool tips. Alternatively, you can create a custom implementation of the **SPClaimProvider** class to extend the people picker and provide an enhanced user experience.

Administrators must also configure and manage the SharePoint STS to implement the appropriate trust relationships and the rules for augmenting claims. This can only be done using PowerShell. In addition, the order for configuring items and the provision of the correct claim types is critical.

The SharePoint STS is fairly simple compared to an STS such as ADFS or ACS, and basically implements only rules for copying claims. It requires the STSs and identity providers it trusts to implement the appropriate claims. It also runs in the same domain as SharePoint, and the FedAuth cookies it exposes are scoped to that domain. It does provide a token cache.

You may need to configure a SharePoint server farm to use affinity for web applications to ensure that users are directed to the server on which they were authenticated. If users are authenticated on more than one server, the token may be rejected in a subsequent request, and the continual re-authentication requests may resemble a denial-of-service attack that causes the identity provider or STS to block authentication requests.

Configuring SharePoint to Use Claims

Many configuration tasks in SharePoint, especially when configuring a SharePoint server farm, are performed using Windows PowerShell commands and scripts. Many of the required scripts are provided with SharePoint or are available for download from the SharePoint resource sites listed at the end of this appendix.

The main tasks for configuring SharePoint web applications to use claims are the following:

- Configure an identity provider STS web application using PowerShell
- Configure a relying party STS web application
- Establish a trust relationship with an identity provider STS using PowerShell
- Export the trusted identity provider STS certificate using PowerShell
- Define a unique identifier for claims mapping using PowerShell
- Create a new SharePoint web application and configure it to use SAML sign-in

The following resources provide step-by-step guides to setting up claims authentication for a web application in SharePoint:

- "Claims-based authentication Cheat Sheet Part 1" at http://blogs.msdn.com/b/spidentity/archive/2010/01/04/claims-based-authentication-cheat-sheet-part-1.aspx.

- "Claims-based authentication Cheat Sheet Part 2" at http://blogs.msdn.com/b/spidentity/archive/2010/01/23/claims-based-authentication-cheat-sheet-part-2.aspx.
- "Claims-Based Identity in SharePoint 2010" at http://blogs.technet.com/b/wbaer/archive/2010/04/14/claims-based-identity-in-sharepoint-2010.aspx.
- "Configure authentication using a SAML security token (SharePoint Server 2010)" at http://technet.microsoft.com/en-us/library/ff607753.aspx.
- "Configure the security token service (SharePoint Server 2010)" at http://technet.microsoft.com/en-us/library/ee806864.aspx.

Tips for Configuring Claims in SharePoint

The following advice may be useful in resolving issues encountered when configuring a SharePoint application to use claims authentication:

- The SharePoint PowerShell snap-in requires developers and administrators to have special permissions in the SharePoint database. It is not sufficient just to be an administrator or a domain administrator. For information on how to configure the SharePoint database for the PowerShell snap-in, see "The local farm is not accessible Cmdlets with FeatureDependencyId are not registered" at http://www.sharepointassist.com/2010/01/29/the-local-farm-is-not-accessible-cmdlets-with-featuredependencyid-are-not-registered/.
- When you use ADFS 2.0, the setting for enabling single sign-on (SSO) is not available in the ADFS management interface. By default SSO is enabled. You can change the setting by editing the Web.config file for the ADFS website. The element to modify is **<singlesignon enabled ="true" />**. It is located in the **microsoft.identityserver.web** section.
- When you create a new web application and configure it to work over HTTPS, you must edit the website bindings. This cannot be done in the SharePoint management tools. Instead, you must select the SSL certificate to use for the website in the IIS Manager Microsoft Management Console (MMC) snap-in.
- It is possible to create more than one SharePoint application with the same alias, although this is generally unlikely. However, the authentication cookie served by the application uses the alias as the cookie name. The result is that single sign-on authentication will fail when users access one of the applications if they have previously accessed another application with

the same alias because the authentication cookie is not valid for the second application. To resolve this, create each application under a different domain name and use DNS to point to the SharePoint application, or modify the **cookieHandler** element in the **federatedAuthentication** section of Web.config for each application to specify a different cookie name.

More Information

For more information about SharePoint 2010, see the following resources:

- "Getting Started with Security and Claims-Based Identity Model" at http://msdn.microsoft.com/en-us/library/ee536164.aspx.
- "Using the New SharePoint 2010 Security Model - Part 2" at http://technet.microsoft.com/en-us/sharepoint/ff678022.aspx#lesson2.
- "Plan Authentication Methods (SharePoint Server 2010)" at http://technet.microsoft.com/en-us/library/cc262350.aspx.
- "Claims Tips 1: Learning About Claims-Based Authentication in SharePoint 2010" at http://msdn.microsoft.com/en-us/library/ff953202.aspx.
- "Claims-Based Identity in SharePoint 2010" at http://blogs.technet.com/b/wbaer/archive/2010/04/14/claims-based-identity-in-sharepoint-2010.aspx.
- "Replace the Default SharePoint People Picker with a Custom People Picker" at http://www.sharepointsecurity.com/sharepoint/sharepoint-security/replace-the-default-sharepoint-people-picker-with-a-custom-people-picker/.
- "Understanding People Picker and Custom Claims Providers" at http://blogs.technet.com/b/tothesharepoint/archive/2011/02/03/new-understanding-people-picker-and-custom-claims-providers.aspx.

Glossary

access control. The process of making authorization decisions for a given resource.

access control rule. A statement that is used to transform one set of claims into another set of claims. An example of an access control rule might be: any subject that possesses the claim "Role=Contributor" should also have the claim "CanAddDocuments=True". Each access control system will have its own rule syntax and method for applying rules to input claims.

access control system (ACS). The aspect of a software system responsible for authorization decisions.

account management. The process of maintaining user identities.

ActAs. A delegation role that allows a third party to perform operations on behalf of a subject via impersonation.

active client. A claims-based application component that makes calls directly to the claims provider. Compare with passive client.

Active Directory Federation Services (ADFS). An issuer that is a component of the Microsoft® Windows® operating system. It issues and transforms claims, enables federations, and manages user access.

active federation. A technique for accessing a claims provider that does not involve the redirection feature of the HTTP protocol. With active federation, both endpoints of a message exchange are claims-aware. Compare with passive federation.

assertion. Within a closed-domain model of security, a statement about a user that is inherently trusted. Assertions, with inherent trust, may be contrasted with claims, which are only trusted if a trust relationship exists with the issuer of the claim.

authentication. The process of verifying an identity.

authority. The trusted possessor of a private key.

authorization. See *authorization decision*.

authorization decision. The determination of whether a subject with a given identity can gain access to a given resource.

back-end server. A computing resource that is not exposed to the Internet or that does not interact directly with the user.

blind credential. A trusted fact about a user that does not reveal the identity of the user but is relevant for making an authorization decision. For example, an assertion that the user is over the age of 21 may be used to grant access.

bootstrap token. A security token that is passed to a claims provider as part of a request for identity delegation. This is part of the ActAs delegation scenario.

certificate. A digitally signed statement of identity.

certificate authority. An entity that issues X.509 certificates.

claim. A statement, such as a name, identity, key, group, permission, or capability made by one subject about itself or another subject. Claims are given one or more values and then packaged in security tokens that are distributed by the issuer.

claims model. The vocabulary of claims chosen for a given application. The claims provider and claims-based application must agree on this vocabulary of claims. When developing a claims-based application, you should code to the claims model instead of calling directly into platform-specific security APIs.

claims processing. A software feature that enables a system to act as a claims provider, claims requester, or claims-based application. For example, a security token service provides claims processing as part of its feature set.

claims producer. A claims provider.

claims provider. A software component or service that generates security tokens upon request. Also known as the issuer of a claim.

claims requester. The client of a security token service. An identity selector is a kind of claims requester.

claims transformer. A claims provider that accepts security tokens as input; for example, as a way to implement federated identity or access control.

claims type. A string, typically a URI, that identifies the kind of claim. All claims have a claims type and a value. Example claims types include **FirstName**, **Role**, and the **private personal identifier (PPID)**. The claims type provides context for the claim value.

claims value. The value of the statement in the claim being made. For example, if the claims type is **FirstName**, a value might be Matt.

claims-based application. A software application that uses claims as the basis of identity and access control. This is in contrast to applications that directly invoke platform-specific security APIs.

claims-based identity. A set of claims from a trusted issuer that denotes user characteristics such as the user's legal name or email address. In an application that uses the Windows Identity Foundation (WIF), claims-based identity is represented by run-time objects that implement the **IClaimsIdentity** interface.

claims-based identity model. A way to write applications so that the establishment of user identity is external to the application itself. The environment provides all required user information in a secure manner.

client. An application component that invokes web services or issues HTTP requests on behalf of a local user.

cloud. A dynamically scalable environment such as Windows Azure™ for hosting Internet applications.

cloud application. A software system that is designed to run in the cloud.

cloud provider. An application hosting service.

cloud service. A web service that is exposed by a cloud application.

credentials. Data elements used to establish identity or permission, often consisting of a user name and password.

credential provisioning. The process of establishing user identities, such as user names and initial passwords, for an application.

cryptography. The practice of obfuscating data, typically via the use of mathematical algorithms that make reading data dependent on knowledge of a key.

digital signature. The output of a cryptographic algorithm that provides evidence that the message's originator is authentic and that the message content has not been modified in transit.

domain. Area of control. Domains are often hierarchically structured.

domain controller. A centralized issuer of security tokens for an enterprise directory.

DPAPI. The Data Protection API (DPAPI) is a password-based data protection service that uses the Triple-DES cryptographic algorithm to provide operating system-level data protection services to user and system processes via a pair of function calls.

enterprise directory. A centralized database of user accounts for a domain. For example, the Microsoft Active Directory® Domain Service allows organizations to maintain an enterprise directory.

enterprise identity backbone. The chosen mechanism for providing identity and access control within an organization; for example, by running Active Directory Federation Services (ADFS).

federated identity. A mechanism for authenticating a system's users based on trust relationships that distribute the responsibility for authentication to a claims provider that is outside of the current security realm.

federatedAuthentication attribute. An XML attribute used in a Web.config file to indicate that the application being configured is a claims-based application.

federation provider. A type of identity provider that provides single sign-on functionality between an organization and other identity providers (issuers) and relying parties (applications).

federation provider security token service (FP-STS). A software component or service that is used by a federation provider to accept tokens from a federation partner and then generate claims and security tokens on the contents of the incoming security token into a format consumable by the relying party (application). A security token service that receives security tokens from a trusted federation partner or identity provider (IdP-STS). In turn, the relying party (RP-STS) issues new security tokens to be consumed by a local relying party application.

FedUtil. The utility provided by Windows Identity Foundation for the purpose of establishing federation.

forest. A collection of domains governed by a central authority. Active Directory Federation Services (ADFS) can be used to combine two Active Directory forests in a single domain of trust.

forward chaining logic. An algorithm used by access control systems that determines permissions based on the application of transitive rules such as group membership or roles. For example, using forward chaining logic, an access control system can deduce that user X has permission Z whenever user X has role Y and role Y implies permission Z.

home realm discovery. The process of determining a user's issuer.

identity. In this book, this refers to claims-based identity. There are other meanings of the word "identity," so we will further qualify the term when we intend to convey an alternate meaning.

identity delegation. Enabling a third party to act on one's behalf.

identity model. The organizing principles used to establish the identity of an application's user. See *claims-based identity model.*

identity provider (IdP). An organization issuing claims in security tokens. For example, a credit card provider organization might issue a claim in a security token that enables payment if the application requires that information to complete an authorized transaction.

identity security token service (I-STS). An identity provider.

information card. A visual representation of an identity with associated metadata that may be selected by a user in response to an authentication request.

input claims. The claims given to a claims transformer such as an access control system.

issuer. The claims provider for a security token; that is, the entity that possesses the private key used to sign a given security token. In the **IClaimsIdentity** interface, the **Issuer** property returns the claims provider of the associated security token. The term may be used more generally to mean the issuing authority of a Kerberos ticket or X.509 certificate, but this second use is always made clear in the text.

issuer name registry. A list of URIs of trusted issuers. You can implement a class derived from the abstract class **IssuerNameRegistry** (this is part of the Windows Identity Foundation) in order to pick an issuer-naming scheme and also implement custom issuer validation logic.

issuing authority. Claims provider; the issuer of a security token. (The term has other meanings that will always be made clear with further qualification in the text.)

Kerberos. The protocol used by Active Directory domain controllers to allow authentication in a networked environment.

Kerberos ticket. An authenticating token used by systems that implement the Kerberos protocol, such as domain controllers.

key. A data element, typically a number or a string, that is used by a cryptographic algorithm when encrypting plain text or decrypting cipher text.

key distribution center (KDC). In the Kerberos protocol, a key distribution center is the issuer of security tickets.

Lightweight Directory Access Protocol (LDAP). A TCP/IP protocol for querying directory services in order to find other email users on the Internet or corporate intranet.

Local Security Authority (LSA). A component of the Windows operating system that applications can use to authenticate and log users on to the local system.

Local Security Authority Subsystem Service (LSASS). A component of the Windows operating system that enforces security policy.

managed information card. An information card provided by an external identity provider. By using managed cards, identity information is stored with an identity provider, which is not the case with self-issued cards.

management APIs. Programmable interface for configuration or maintenance of a data set. Compare with portal.

moniker. An alias used consistently by a user in multiple sessions of an application. A user with a moniker often remains anonymous.

multiple forests. A domain model that is not hierarchically structured.

multi-tenant architecture. A cloud-based application designed for running in multiple data centers, usually for the purpose of geographical distribution or fault tolerance.

on-premises computing. Software systems that run on hardware and network infrastructure owned and managed by the same enterprise that owns the system being run.

output claims. The claims produced by a claims transformer such as an output control system.

passive client. A web browser that interacts with a claims-based application running on an HTTP server.

passive federation. A technique for accessing a claims provider that involves the redirection feature of the HTTP protocol. Compare with active federation.

perimeter network. A network that acts as a buffer between an internal corporate network and the Internet.

permission. The positive outcome of an authorization decision. Permissions are sometimes encoded as claims.

personalization. A variant of access control that causes the application's logic to change in the presence of particular claims. Security trimming is a kind of personalization.

policy. A statement of addresses, bindings, and contracts structured in accordance with the WS-Policy specification. It includes a list of claim types that the claims-based application needs in order to execute.

portal. Web interface that allows viewing and/or modifying data stored in a back-end server.

principal. A run-time object that represents a subject. Claims-based applications that use the Windows Identity Foundation expose principals using the **IClaimsPrincipal** interface.

private key. In public key cryptography, the key that is not published. Possession of the correct private key is considered to be sufficient proof of identity.

privilege. A permission to do something such as access an application or a resource.

proof key. A cryptographic token that prevents security tokens from being used by anyone other than the original subject.

public key. In public key cryptography, the key that is published. Possession of a user's public key allows the recipient of a message sent by the user to validate the message's digital signature against the contents of the message. It also allows a sender to encrypt a message so that only the possessor of the private key can decrypt the message.

public key cryptography. A class of cryptographic algorithms that use one key to encrypt data and another key to decrypt this data.

public key infrastructure (PKI). Conventions for applying public key cryptography.

realm. A security realm.

relying party (RP). An application that relies on security tokens and claims issued by an identity provider.

relying party security token service (RP-STS). See *federation provider security token service*.

resource. A capability of a software system or an element of data contained by that system; an entity such as a file, application, or service that is accessed via a computer network.

resource security token service (R-STS). A claims transformer.

REST protocols. Data formats and message patterns for representational state transfer (REST), which abstracts a distributed architecture into resources named by URIs connected by interfaces that do not maintain connection state.

role. An element of identity that may justify the granting of permission. For example, a claim that "role is administrator" might imply access to all resources. The concept of role is often used by access control systems based on the role-based access control (RBAC) model as a convenient way of grouping users with similar access needs.

role-based access control (RBAC). An established authorization model based on users, roles, and permissions.

SAML 2.0. A data format used for encoding security tokens that contain claims. Also, a protocol that uses claims in SAML format. See *Security Assertion Markup Language (SAML)*.

scope. In Microsoft Access Control Services, a container of access control rules for a given application.

Security Assertion Markup Language (SAML). A data format used for encoding security tokens that contain claims. Also, a particular protocol that uses claims in SAML format.

security attribute. A fact that is known about a user because it resides in the enterprise directory (thus, it is implicitly trusted). Note that with claims-based identity, claims are used instead of security attributes.

security context. A Microsoft .NET Framework concept that corresponds to the **IPrincipal** interface. Every .NET Framework application runs in a particular security context.

security infrastructure. A general term for the hardware and software combination that implements authentication, authorization, and privacy.

security policy. Rules that determine whether a claims provider will issue security tokens.

security token. An on-the-wire representation of claims that has been cryptographically signed by the issuer of the claims, providing strong proof to any relying party of the integrity of the claims and the identity of the issuer.

security token service (STS). A claims provider implemented as a web service that issues security tokens. Active Directory Federation Services (ADFS) is an example of a security token service. Also known as an issuer. A web service that issues claims and packages them in encrypted security tokens (see *WS-Security* and *WS-Trust*).

security trimming. (informal) The process of altering an application's behavior based on a subject's available permissions.

service. A web service that adheres to the SOAP standard.

service provider. A service provider is an application. The term is commonly used with the Security Assertion Markup Language (SAML).

session key. A private cryptographic key shared by both ends of a communications channel for the duration of the communications session. The session key is negotiated at the beginning of the communication session.

SOAP. A web standard (protocol) that governs the format of messages used by web services.

social identity provider (social IdP). A term used in this book to refer to identity services offered by well-known web service providers such as Windows Live®, Facebook, Google, and Yahoo!

software as a service (SaaS). A software licensing method in which users license software on demand for limited periods of time rather than purchasing a license for perpetual use. The software vendor often provides the execution environment as, for example, a cloud-based application running as a web service.

subject. A person. In some cases, business organizations or software components are considered to be subjects. Subjects are represented as principals in a software system. All claims implicitly speak of a particular subject. The Windows Identity Foundation type, **IClaimsPrincipal**, represents the subject of a claim.

System.IdentityModel.dll. A component of the .NET Framework 3.0 that includes some claims-based features, such as the **Claim** and **ClaimSet** classes.

token. A data element or message.

trust. The acceptance of another party as being authoritative over some domain or realm.

trust relationship. The condition of having established trust.

trusted issuer. A claims provider for which trust has been established via the WS-Trust protocol.

user credentials. A set of identifying information belonging to a user. An example is a user name and password.

web identity. Authenticated identifying characteristics of the sender of an HTTP request. Often, this is an authenticated email address.

web single sign-on (web SSO). A process that enables partnering organizations to exchange user authentication and authorization data. By using web SSO, users in partner organizations can transition between secure web domains without having to present credentials at each domain boundary.

Windows Communication Foundation (WCF). A component of the Windows operating system that enables web services.

Windows identity. User information maintained by Active Directory.

Windows Identity Foundation (WIF). A .NET Framework library that enables applications to use claims-based identity and access control.

WS-Federation. A standard that defines mechanisms that are used to enable identity, attribute, authentication, and authorization federation across different trust realms. This standard includes an interoperable use of HTTP redirection in order to request security tokens.

WS-Federation Authentication Module (FAM). A component of the Windows Identity Foundation that performs claims processing.

WS-Federation Passive Requestor Profile. Describes how the cross-trust realm identity, authentication, and authorization federation mechanisms defined in WS-Federation can be used by passive requesters such as web browsers to provide identity services. Passive requesters of this profile are limited to the HTTP protocol.

WS-Policy. A web standard that specifies how web services may advertise their capabilities and requirements to potential clients.

WS-Security. A standard that consists of a set of protocols designed to help secure web service communication using SOAP.

WS-Trust. A standard that takes advantage of WS-Security to provide web services with methods to build and verify trust relationships.

X.509. A standard format for certificates.

X.509 certificate. A digitally signed statement that includes the issuing authority's public key.

Answers to Questions

Chapter 1, An Introduction to Claims

1. Under what circumstances should your application or service accept a token that contains claims about the user or requesting service?

    a. The claims include an email address.

    b. The token was sent over an HTTPS channel.

    c. Your application or service trusts the token issuer.

    d. The token is encrypted.

    Answer: *Only* **(c)** *is strictly correct. While it is good practice to use encrypted tokens and send them over a secure channel, an application should only accept a token if it is configured to trust the issuer. The presence of an email address alone does not signify that the token is valid.*

2. What can an application or service do with a valid token from a trusted issuer?

    a. Find out the user's password.

    b. Log in to the website of the user's identity provider.

    c. Send emails to the user.

    d. Use the claims it contains to authorize the user for access to appropriate resources.

    Answer: *Only* **(d)** *is true in all cases. The claims do not include the user's password or other credentials. They only include the information the user and the identity provider choose to expose. This may or may not include an email address, depending on the identity provider.*

3. What is the meaning of the term *identity federation*?
    a. It is the name of a company that issues claims about Internet users.
    b. It is a mechanism for authenticating users so that they can access different applications without signing on every time.
    c. It is a mechanism for passing users' credentials to another application.
    d. It is a mechanism for finding out which sites a user has visited.

    Answer: *Only* **(b)** *is correct. Each application must query the original issuer to determine if the token a user obtained when they originally authenticated is valid. The token does not include the users' credentials or other information about users' browsing history or activity.*

4. When would you choose to use Windows Azure™ AppFabric Access Control Service (ACS) as an issuer for an application or service?
    a. When the application must allow users to sign on using a range of well-known social identity credentials.
    b. When the application is hosted on the Windows Azure platform.
    c. When the application must support single sign-on (SSO).
    d. When the application does not have access to an alternative identity provider or token issuer.

    Answer: *Only* **(a)** *and* **(d)** *are correct. Applications running on Windows Azure can use ACS if they must support federated identity, but it is not mandatory. SSO can be implemented using a range of mechanisms other than ACS, such as a Microsoft Active Directory® domain server and Active Directory Federation Services.*

5. What are the benefits of using claims to manage authorization in applications and services?
    a. It avoids the need to write code specific to any one type of authentication mechanism.

b. It decouples authentication logic from authorization logic, making changes to authentication mechanisms much easier.

c. It allows the use of more fine-grained permissions based on specific claims compared to the granularity achieved just using roles.

d. It allows secure access for users that are in a different domain or realm from the application or service.

Answer: *All of the answers are correct, which shows just how powerful claims can be!*

Chapter 2, Claims Based Architectures

1. Which of the following protocols or types of claims token are typically used for single sign-on across applications in different domains and geographical locations?

    a. Simple web Token (SWT)

    b. Kerberos ticket

    c. Security Assertion Markup Language (SAML) token

    d. Windows Identity

    Answer: *Only* **(a)** *and* **(c)** *are typically used across domains and applications outside a corporate network. Kerberos tickets cannot contain claims, and they are confined within a domain or Active Directory forest. Windows Identities may contain role information, but cannot carry claims between applications.*

2. In a browser-based application, which of the following is the typical order for browser requests during authentication?

    a. Identity provider, token issuer, relying party

    b. Token issuer, identity provider, token issuer, relying party

    c. Relying party, token issuer, identity provider, token issuer, relying party

    d. Relying party, identity provider, token issuer, relying party

    Answer: *Only* **(c)** *is correct. The claims-aware application (the relying party) redirects the browser to the token issuer, which* *either redirects the browser to the appropriate identity provider for the user to enter credentials (ACS) or obtains a token on the user's behalf using their correct credentials (ADFS). It then redirects the browser back to the claims-aware application.*

3. In a service request from a *non*-browser-based application, which of the following is the typical order of requests during authentication?
    a. Identity provider, token issuer, relying party
    b. Token issuer, identity provider, token issuer, relying party
    c. Relying party, token issuer, identity provider, token issuer, relying party
    d. Relying party, identity provider, token issuer, relying party

    Answer: *When authenticating using ADFS and Active Directory (or a similar technology), only* **(b)** *is correct. ADFS obtains a token on the application's behalf using credentials provided in the request. When authenticating using ACS,* **(a)** *and* **(b)** *are correct.*

4. What are the main benefits of federated identity?
    a. It avoids the requirement to maintain a list of valid users, manage passwords and security, and store and maintain lists of roles for users in the application.
    b. It delegates user and role management to the trusted organization responsible for the user, instead of it being the responsibility of your application.
    c. It allows users to log onto applications using the same credentials, and choose an identity provider that is appropriate for the user and the application to validate these credentials.
    d. It means that your applications do not need to include authorization code.

    Answer: *Only* **(a)***,* **(b)***, and* **(c)** *are correct. Even if you completely delegate the validation of users to an external federated system, you must still use the claims (such as role membership) in your applications to limit access to resources to only the appropriate users.*

5. How can home realm discovery be achieved?

    a. The token issuer can display a list of realms based on the configured identity providers and allow the user to select his home realm.

    b. The token issuer can ask for the user's email address and use the domain to establish the home realm.

    c. The application can use the IP address to establish the home realm based on the user's country/region of residence.

    d. The application can send a hint to the token issuer in the form of a special request parameter that indicates the user's home realm.

    Answer: *Only* **(a)**, **(b)**, *and* **(d)** *are correct. Home realms are not directly related to geographical location (although this may have some influence). The home realm is the domain that is authoritative for the user's identity. It is the identity provider that the user must be redirected to when logging in.*

Chapter 3, Claims-Based Single Sign-On for the Web and Windows Azure

1. Before Adatum updated the a-Expense and a-Order applications, why was it not possible to use single sign-on?

    a. The applications used different sets of roles to manage authorization.

    b. a-Order used Windows authentication and a-Expense used ASP.NET forms authentication.

    c. In the a-Expense application, the access rules were intermixed with the application's business logic.

    d. You cannot implement single sign-on when user profile data is stored in multiple locations.

    Answer: *Only* **(b)** *is correct. The key factor blocking the implementation of single sign-on is that the applications use different authentication mechanisms. Once users authenticate with a claims issuer, you can configure the applications to trust the issuer. The applications can use the claims from the issuer to implement any authorization rules they need.*

2. How does the use of claims facilitate remote web-based access to the Adatum applications?

   a. Using Active Directory for authentication makes it difficult to avoid having to use VPN to access the applications.

   b. Using claims means that you no longer need to use Active Directory.

   c. Protocols such as WS-Federation transport claims in tokens as part of standard HTTP messages.

   d. Using claims means that you can use ASP.NET forms-based authentication for all your applications.

   Answer: *Only* **(a)** *and* **(c)** *are correct. Protocols that use claims such as WS-Federation make it easy to provide web-based access to your applications. ADFS makes it easy to continue to use Active Directory in a claims-based environment, while using just Active Directory on its own with the Kerberos protocol is not well suited to providing web-based access.*

3. In a claims enabled ASP.NET web application, you typically find that the authentication mode is set to **None** in the Web.config file. Why is this?

   a. The **WSFederationAuthenticationModule** is now responsible for authenticating the user.

   b. The user must have already been authenticated by an external system before they visit the application.

   c. Authentication is handled in the **On_Authenticate** event in the global.asax file.

   d. The **WSFederationAuthenticationModule** is now responsible for managing the authentication process.

   Answer: *Only* **(d)** *is correct. The* **WSFederationAuthenticationModule** *is responsible for managing the authentication process. It intercepts requests in the HTTP pipeline before they reach the application and coordinates with an external claims issuer to authenticate the user.*

4. Claims issuers always sign the tokens they send to a relying party. However, although it is considered best practice, they might not always encrypt the tokens. Why is this?

a. Relying parties must be sure that the claims come from a trusted issuer.

b. Tokens may be transferred using SSL.

c. The claims issuer may not be able to encrypt the token because it does not have access to the encryption key.

d. It's up to the relying party to state whether or not it accepts encrypted tokens.

Answer: *Only* **(a)** *and* **(b)** *are correct. A key feature of claims-based authentication is that relying parties can trust the claims that they receive from an issuer. A signature proves that the claim came from a particular issuer. Using SSL helps to secure the tokens that the issuer transmits to the relying party if the issuer does not encrypt them.*

5. The **FederatedPassiveSignInStatus** control automatically signs a user out of all the applications she signed into in the single sign-on domain.

   a. True.

   b. False. You must add code to the application to perform the sign-out process.

   c. It depends on the capabilities of the claims issuer. The issuer is responsible for sending sign-out messages to all relying parties.

   d. If your relying party uses HTTP sessions, you must add code to explicitly abandon the session.

   Answer: *Only* **(c)** *and* **(d)** *are correct. It is the responsibility of the claims issuer to notify all relying parties that the user is signing out. Additionally, you must add any necessary code to abandon any HTTP sessions.*

Chapter 4, Federated Identity for Web Applications

1. Federated identity is best described as:

   a. Two or more applications that share the same set of users.

   b. Two or more organizations that share the same set of users.

c. Two or more organizations that share an identity provider.

d. One organization trusting users from one or more other organizations to access its applications.

Answer: *Only* **(d)** *is correct. Federation is about trusting the users from another organization. Instead of creating special accounts for external users, you trust another organization to authenticate users on your behalf before you give them access to your applications.*

2. In a federated security environment, claims mapping is necessary because:

   a. Claims issued by one organization are not necessarily the claims recognized by another organization.

   b. Claims issued by one organization can never be trusted by another organization.

   c. Claims must always be mapped to the roles used in authorization.

   d. Claims must be transferred to a new **ClaimsPrincipal** object.

   Answer: *Only* **(a)** *is correct. The claims used by one organization may not be the same as the claims used by another. For example, one organization may use a claim called role while another organization uses a claim called group for a similar purpose. Mapping enables you to map the claims used by one organization to the claims used in another. Although role claims are often used for authorization, the authorization scheme could depend on other claims such as organization or cost center.*

3. The roles of a federation provider can include:

   a. Mapping claims from an identity provider to claims that the relying party understands.

   b. Authenticating users.

   c. Redirecting users to their identity provider.

   d. Verifying that the claims were issued by the expected identity provider.

   Answer: *Only* **(a), (c)** *and* **(d)** *are correct. A federation provider can map claims, redirect users to the correct identity provider,* *and verify that the claims were issued by the correct identity provider.*

4. Must an identity provider issue claims that are specific to a relying party?

   a. Yes

   b. No

   c. It depends.

   Answer: *Only* **(b)** *is correct. It is the job of the federation provider to map the claims issued by the identity provider to claims recognized by the relying party. Therefore, the identity provider's issuer should not issue claims specific to the relying party. Using a federation provider helps to decouple the identity provider from the relying party.*

5. Which of the following best summarizes the trust relationships between the various parties described in the federated identity scenario in this chapter?

   a. The relying party trusts the identity provider, which in turn trusts the federation provider.

   b. The identity provider trusts the federation provider, which in turn trusts the relying party.

   c. The relying party trusts the federation provider, which in turn trusts the identity provider.

   d. The federation provider trusts both the identity provider and the relying party.

   Answer: *Only* **(c)** *is correct. The trust relationships described in this chapter have the relying party trusting the federation provider that trusts the identity provider.*

Chapter 5, Federated Identity with Windows Azure Access Control Service

1. Which of the following issues must you address if you want to allow users of your application to authenticate with a social identity provider such as Google or Windows Live® network of Internet services?

   a. Social identity providers may use protocols other than WS-Federation to exchange claims tokens.

b. You must register your application with the social identity provider.

c. Different social identity providers issue different claim types.

d. You must provide a mechanism to enroll users using social identities with your application.

Answer: *Only* **(a), (c)** *and* **(d)** *are correct. Your solution must be able to transition protocols; the solution described in this chapter uses ACS to perform this task. The scenario described in this chapter also uses ACS to map the different claim types issued by the social identity providers to claim types that Adatum understands. You must provide a mechanism to enroll users with social identities.*

2. What are the advantages of allowing users to authenticate to use your application with a social identity?

   a. The user doesn't need to remember yet another username and password.

   b. It reduces the features that you must implement in your application.

   c. Social identity providers all use the same protocol to transfer tokens and claims.

   d. It puts the user in control of their password management. For example, a user can recover a forgotten password without calling your helpdesk.

   Answer: *Only* **(a), (b),** *and* **(d)** *are correct. Reusing a social identity does mean that the user doesn't need to remember a new set of credentials. Also, the authentication and user account management is now handled by the social identity provider.*

3. What are the potential disadvantages of using ACS as your federation provider?

   a. It adds to the complexity of your relying party application.

   b. It adds an extra step to the authentication process, which negatively impacts the user experience.

   c. It is a metered service, so you must pay for each token that it issues.

   d. Your application now relies on an external service that is outside of its control.

   Answer: *Only* **(c)** *and* **(d)** *are correct. Although ACS is a metered service, you should compare its running costs to the costs of implementing and running your own federation provider. ACS is a third-party application outside of your control; again, you should evaluate the SLA associated with ACS against the service-level agreement (SLA) your IT department offers for on-premises services.*

4. How can your federation provider determine which identity provider to use (perform home realm discovery) when an unauthenticated user accesses the application?
   a. Present the user with a list of identity providers to choose from.
   b. Analyze the IP address of the originating request.
   c. Prompt the user for an email address, and then parse it to determine the user's security domain.
   d. Examine the **ClaimsPrincipal** object for the user's current session.

   Answer: *Only* **(a)** *and* **(c)** *are correct. The scenario described in this chapter lets the user select from a list of identity providers. It's also possible to analyze the user's email address; for example, if the email address were paul@gmail.com, the federation provider would determine that the user has a Google identity.*

5. In the scenario described in this chapter, the Adatum federation provider trusts ACS, which in turn trusts the social identity providers such as Windows Live and Google. Why does the Adatum federation provider not trust the social identity providers directly?
   a. It's not possible to configure the Adatum federation provider to trust the social identity providers because the social identity providers do not make the certificates required for a trust relationship available.
   b. ACS automatically performs the protocol transition.
   c. ACS is necessary to perform the claims mapping.
   d. Without ACS, it's not possible to allow Adatum employees to access the application over the web.

Answer: *Only* **(b)** *is correct. Using ACS simplifies the Adatum federation provider, especially because ACS performs any protocol transitioning automatically. It is possible to configure the Adatum federation provider to trust the social identity providers directly and perform the claims mapping; however, this is likely to be complex to implement.*

Chapter 6, Federated Identity with Multiple Partners

1. In the scenario described in this chapter, who should take what action when an employee leaves one of the partner organizations such as Litware?

    a. Fabrikam Shipping must remove the user from its user database.

    b. Litware must remove the user from its user database.

    c. Fabrikam must amend the claims-mapping rules in its federation provider.

    d. Litware must ensure that its identity provider no longer issues any of the claims that get mapped to Fabrikam Shipping claims.

    Answer: *Only* **(b)** *is correct. If the employee leaves Litware, the simplest and safest action is to remove the employee from its user database. This means that the ex-employee can no longer authenticate with Litware or be issued any claims.*

2. In the scenario described in this chapter, how does Fabrikam Shipping perform home realm discovery?

    a. Fabrikam Shipping presents unauthenticated users with a list of federation partners to choose from.

    b. Fabrikam Shipping prompts unauthenticated users for their email addresses. It parses this address to determine which organization the user belongs to.

    c. Fabrikam Shipping does not need to perform home realm discovery because users will have already authenticated with their organizations' identity providers.

    d. Each partner organization has its own landing page in Fabrikam Shipping. Visiting that page will automatically redirect unauthenticated users to that organization's identity provider.

Answer: *Only* **(d)** *is correct. Each organization has its own landing page in Fabrikam Shipping. For example, Adatum employees should navigate to https://{fabrikam host}/f-shipping/adatum.*

3. Fabrikam Shipping provides an identity provider for its smaller customers who do not have their own identity provider. What are the disadvantages of this?

   a. Fabrikam must bear the costs of providing this service.

   b. Users at smaller customers will need to remember another username and password.

   c. Smaller customers must rely on Fabrikam to manage their user's access to Fabrikam Shipping.

   d. Fabrikam Shipping must set up a trust relationship with all of its smaller customers.

   Answer: *Only* **(a), (b)** *and* **(c)** *are correct. Unless Fabrikam Shipping charges for the service, they must bear the costs. It does mean that users will have to remember a new set of credentials. All of the user management takes place at Fabrikam, unless Fabrikam implements a web interface for smaller customers to manage their users.*

4. How does Fabrikam Shipping ensure that only users at a particular partner can view that partner's shipping data?

   a. The Fabrikam Shipping application examines the email address of the user to determine the organization they belong to.

   b. Fabrikam Shipping uses separate databases for each partner. Each database uses different credentials to control access.

   c. Fabrikam shipping uses the **role** claim from the partner's identity provider to determine whether the user should be able to access the data.

   d. Fabrikam shipping uses the **organization** claim from its federation provider to determine whether the user should be able to access the data.

Answer: *Only* **(d)** *is correct. It's the* **organization** *claim that Fabrikam Shipping uses to control access.*

5. The developers at Fabrikam set the **wsFederation passive RedirectEnabled** attribute to false. Why?

    a. This scenario uses active redirection, not passive redirection.

    b. They wanted more control over the redirection process.

    c. Fabrikam Shipping is an MVC application.

    d. They needed to be able to redirect to external identity providers.

    Answer: *Only* **(b)** *is correct. For this scenario, they needed more control over the passive redirection process.*

Chapter 7, Federated Identity with Multiple Partners and Windows Azure Access Control Service

1. Why does Fabrikam want to use ACS in the scenario described in this chapter?

    a. Because it will simplify Fabrikam's own internal infrastructure requirements.

    b. Because it's the only way Fabrikam can support users who want to use a social identity provider for authentication.

    c. Because it enables users with social identities to access the Fabrikam Shipping application more easily.

    d. Because ACS can authenticate users with social identities.

    Answer: *Only* **(a)** *and* **(c)** *are correct. Using ACS means that Fabrikam Shipping no longer requires its own federation provider. Also, ACS handles all of the necessary protocol transition for the tokens that the social identity providers issue. ACS does not perform the authentication; this task is handled by the social identity provider.*

2. In the scenario described in this chapter, why is it necessary for Fabrikam to configure ACS to trust issuers at partners such Adatum and Litware?

    a. Because Fabrikam does not have its own on-premises federation provider.

    b. Because Fabrikam uses ACS for all the claims-mapping rules that convert claims to a format that Fabrikam Shipping understands.

    c. Because partners such as Adatum have some users who use social identities as their primary method of authentication.

    d. Because a relying party such as Fabrikam Shipping can only use a single federation provider.

    Answer: *Only* **(a)** *and* **(b)** *are correct. In this scenario, Fabrikam decided to use ACS as its federation provider, so ACS holds all of its claims-mapping rules.*

3. How does Fabrikam Shipping manage home realm discovery in the scenario described in this chapter?

    a. Fabrikam Shipping presents unauthenticated users with a list of federation partners to choose from.

    b. Fabrikam Shipping prompts unauthenticated users for their email addresses. It parses each address to determine which organization the user belongs to.

    c. ACS manages home realm discovery; Fabrikam Shipping does not.

    d. Each partner organization has its own landing page in Fabrikam Shipping. Visiting that page will automatically redirect unauthenticated users to that organization's identity provider.

    Answer: *Only* **(d)** *is correct. Although the sample application does have a page that displays a list of partners, this is just to simplify the use of the sample. In practice, each partner would use its own landing page that would redirect the use to ACS, passing the correct value in the* **whr** *parameter.*

4. Enrolling a new partner without its own identity provider requires which of the following steps?

a. Updating the list of registered partners stored by Fabrikam Shipping. This list includes the home realm of the partner.

b. Adding a new identity provider to ACS.

c. Adding a new relying party to ACS.

d. Adding a new set of claims-mapping rules to ACS.

Answer: *Only* **(a)**, **(c)** *and* **(d)** *are correct. A partner without its own identity provider will use one of the pre-configured social identity providers in ACS.*

5. Why does Fabrikam use a separate web application to handle the enrollment process?

   a. Because the expected usage patterns of the enrollment functionality are very different from the expected usage patterns of the main Fabrikam Shipping web site.

   b. Because using the enrollment functionality does not require a user to authenticate.

   c. Because the site that handles enrolling new partners must also act as a federation provider.

   d. Because the site that updates ACS with new relying parties and claims-mapping rules must have a different identity from sites that only read data from ACS.

   Answer: *Only* **(a)** *is correct. The number of new enrolments may be only one or two a day, while Fabrikam expects thousands of visits to the Shipping application. Using separate web sites enables Fabrikam to tune the two sites differently.*

Chapter 8, Claims Enabling Web Services

1. Which statements describe the difference between the way federated identity works for an active client as compared to a passive client:

   a. An active client uses HTTP redirects to ask each token issuer in turn to process a set of claims.

   b. A passive client receives HTTP redirects from a web application that redirect it to each issuer in turn to obtain a set of claims.

   c. An active client generates tokens to send to claims issuers.
   d. A passive client generates tokens to send to claims issuers.

   Answer: *Only* **(b)** *is correct. The relying party, federation provider, and identity provider communicate with each other through the client browser by using HTTP redirects that send the browser with any tokens to the next step in the process.*

2. A difference in behavior between an active client and a passive client is:
   a. An active client visits the relying party first; a passive client visits the identity provider first.
   b. An active client does not need to visit a federation provider because it can perform any necessary claims transformations by itself.
   c. A passive client visits the relying party first; an active client visits the identity provider first.
   d. An active client must visit a federation provider first to determine the identity provider it should use. Passive clients rely on home realm discovery to determine the identity provider to use.

   Answer: *Only* **(c)** *is correct. A passive client visits the relying party first; the relying party redirects the client to an issuer. Active clients know how to obtain the necessary claims so they can visit the identity provider first.*

3. The active scenario described in this chapter uses which protocol to handle the exchange of tokens between the various parties?
   a. WS-Trust
   b. WS-Transactions
   c. WS-Federation
   d. ADFS

   Answer: *Only* **(c)** *is correct. WS-Trust is the protocol that WIF and Windows Communication Foundation (WCF) use for active clients.*

4. In the scenario described in this chapter, it's necessary to edit the client application's configuration file manually, because the Svcutil.exe tool only adds a binding for a single issuer. Why do you need to configure multiple issuers?

    a. The metadata from the relying party only includes details of the Adatum identity provider.

    b. The metadata from the relying party only includes details of the client application's identity provider.

    c. The metadata from the relying party only includes details of the client application's federation provider.

    d. The metadata from the relying party only includes details of the Adatum federation provider.

    Answer: *Only* **(c)** *is correct. The metadata from the relying party only includes details of the Adatum federation provider and the client application also needs the metadata from its identity provider.*

5. The WCF service at Adatum performs authorization checks on the requests that it receives from client applications. How does it implement the checks?

    a. The WCF service uses the **IsInRole** method to verify that the caller is a member of the **OrderTracker** role.

    b. The Adatum federation provider transforms claims from other identity providers into **Role** type claims with a value of **OrderTracker**.

    c. The WCF service queries the Adatum federation provider to determine whether a user is in the **OrderTracker** role.

    d. It does not need to implement any authorization checks. The application automatically grants access to anyone who has successfully authenticated.

    Answer: *Only* **(a)** *and* **(b)** *are correct. The WCF service checks the role membership of the caller. The role value is created from the claims received from the federation provider.*

Chapter 9, Securing REST Services

1. In the scenario described in this chapter, which of the following statements best describes what happens the first time that the smart client application tries to use the RESTful a-Order web service?

   a. It connects first to the ACS instance, then to the Litware IP, and then to the a-Order web service.

   b. It connects first to the Litware IP, then to the ACS instance, and then to the a-Order web service.

   c. It connects first to the a-Order web service, then to the ACS instance, and then to the Litware IP.

   d. It connects first to the a-Order web service, then to the Litware IP, and then to the ACS instance.

   Answer: *Only* **(b)** *is correct. The Active client first obtains a SAML token from the Litware IP, it then sends the SAML token to ACS where it is transitioned to an SWT token, it then attaches the SWT token to the request that it sends to the web service.*

2. In the scenario described in this chapter, which of the following tasks does ACS perform?

   a. ACS authenticates the user.

   b. ACS redirects the client application to the relying party.

   c. ACS transforms incoming claims to claims that the relying party will understand.

   d. ACS transitions the incoming token format from SAML to SWT.

   Answer: *Only* **(c)** *and* **(d)** *are correct. The only tasks that ACS performs in this scenario are claims transformation and claims transitioning.*

3. In the scenario described in this chapter, the Web.config file in the a-Order web service does not contain a <microsoft.identity> section. Why?

   a. Because it configures a custom **ServiceAuthorization Manager** class to handle the incoming SWT token in code.

b. Because it is not authenticating requests.

c. Because it is not authorizing requests.

d. Because it is using a routing table.

Answer: *Only* **(a)** *is correct. The incoming tokens are handled by the custom* **SWTAuthorizationManager** *class that is instantia ted in the* **CustomServiceHostFactory** *class.*

4. ACS expects to receive *bearer* tokens. What does this suggest about the security of a solution that uses ACS?

   a. You do not need to use SSL to secure the connection between the client and the identity provider.

   b. You should use SSL to secure the connection between the client and the identity provider.

   c. The client application must use a password to authenticate with ACS.

   d. The use of bearer tokens has no security implications for your solution.

   Answer: *Only* **(b)** *is correct. A solution that uses bearer tokens is susceptible to man-in-the-middle attacks; using SSL mitigates this risk.*

5. You should use a custom **ClaimsAuthorizationManager** class for which of the following tasks.

   a. To attach incoming claims to the **IClaimsPrincipal** object.

   b. To verify that the claims were issued by a trusted issuer.

   c. To query ACS and check that the current request is authorized.

   d. To implement custom rules that can authorize access to web service methods.

   Answer: *Only* **(d)** *is correct. The* **CheckAccess** *method in a custom* **ClaimsAuthorizationManager** *class has access to the* **IClaimsPrincipal** *object and URL associated with the current request. It can use this information to implement authorization rules.*

Chapter 10, Accessing REST Services from a Windows Phone 7 Device

1. Which of the following are issues in developing a claims-aware application that access a web service for the Windows Phone® 7 platform?

    a. It's not possible to implement a solution that uses SAML tokens on the phone.

    b. You cannot install custom SSL certificates on the phone.

    c. There is no secure storage on the phone.

    d. There is no implementation of WIF available for the phone.

    Answer: *Only* **(c)** *and* **(d)** *are correct. Because there is no secure storage on the phone, you cannot securely store any credentials on the phone; either the user enters his credentials whenever he uses the application, or you accept the risk of the phone being used by an unauthorized person who will be able to use any cached credentials. There is no version of WIF available for the phone, so you must manually implement any token handling that your application requires.*

2. Why does the sample application use an embedded web browser control?

    a. To handle the passive federated authentication process.

    b. To handle the active federated authentication process.

    c. To access the RESTful web service.

    d. To enable the client application to use SSL.

    Answer: *Only* **(a)** *is correct. The embedded web browser control handles the passive federated authentication process, enabling redirects between ACS and the Litware IP.*

3. Of the two solutions (active and passive) described in the chapter, which requires the most round trips for the initial request to the web service?

    a. They both require the same number.

    b. The passive solution requires fewer than the active solution.

c. The active solution requires fewer than the passive solution.

d. It depends on the number of claims configured for the relying party in ACS.

Answer: *Only* **(c)** *is correct. For the initial request to the web service, the active solution requires fewer round trips: the active solution first calls the Litware identity provider, then ACS, and finally the web service; the passive solution first calls ACS, the Litware identity provider, then goes back to ACS, and finally calls the web service.*

4. Which of the following are advantages of the passive solution over the active solution?

   a. The passive solution can easily build a dynamic list of identity providers.

   b. It's simpler to create code to handle SWT tokens in the passive solution.

   c. It's simpler to create code to handle SAML tokens in the passive solution.

   d. Better performance.

   Answer: *Only* **(a)** *and* **(c)** *are correct. The passive solution can retrieve a list of configured identity providers from ACS to display to the user. In the passive solution, the embedded web browser manages the SAML token as part of the automatic redirects between the identity provider and the federation provider.*

5. In the sample solution for this chapter, how does the Windows Phone 7 client application add the SWT token to the outgoing request?

   a. It uses a Windows Communication Foundation (WCF) behavior.

   b. It uses Rx to orchestrate the acquisition of the SWT token and add it to the header.

   c. It uses the embedded web browser control to add the header.

   d. It uses WIF.

Answer: *Only* **(b)** *is correct. The sample solution makes extensive use of Rx to orchestrate asynchronous operations. Both the active and passive solutions use Rx to add the authorization header at the right time.*

Chapter 11, Claims-Based Single Sign-On for Microsoft SharePoint 2010

1. Which of the following roles can the embedded STS in SharePoint perform?

    a. Authenticating users.

    b. Issuing FedAuth tokens that contain the claims associated with a user.

    c. Requesting claims from an external STS such as ADFS.

    d. Requesting claims from Active Directory through Windows Authentication.

    Answer: *Only* **(b), (c)** *and* **(d)** *are correct. The embedded STS does not perform any authentication itself, but it can request that external token issuers such as ADFS or Windows Authentication issue tokens. The claims are then added to the user's FedAuth token.*

2. Custom claim providers use claims augmentation to perform which function?

    a. Enhancing claims by verifying them against an external provider.

    b. Enhancing claims by adding additional metadata to them.

    c. Adding claims data to the identity information in the **SPUser** object if the SharePoint web application is in "legacy" authentication mode.

    d. Adding additional claims to the set of claims from the identity provider.

    Answer: *Only* **(d)** *is correct. Claims augmentation is the function of a custom claims provider that adds to the set of claims from an identity provider.*

3. Which of the following statements about the FedAuth cookie in SharePoint are correct?
    a. The FedAuth cookie contains the user's claim data.
    b. Each SharePoint web application has its own FedAuth cookie.
    c. Each site collection has its own FedAuth cookie.
    d. The FedAuth cookie is always a persistent cookie.

    Answer: *Only* **(a)** *and* **(b)** *are correct. Each SharePoint web application has its own FedAuth token because you can configure each SharePoint web application to have a different token provider. By default, the FedAuth cookie is persistent, but you can configure it to be a session cookie.*

4. In the scenario described in this chapter, why did Adatum choose to customize the people picker?
    a. Adatum wanted the people picker to resolve **role** and **organization** claims.
    b. Adatum wanted the people picker to resolve **name** and **emailaddress** claims from ADFS.
    c. Adatum wanted to use claims augmentation.
    d. Adatum wanted to make it easier for site administrators to set permissions reliably.

    Answer: *Only* **(a)** *and* **(d)** *are correct. Adatum wanted the people picker to correctly resolve* **role** *and* **organization** *claims so that site administrators could assign permissions based on these values.*

5. In order to implement single sign-out behavior in SharePoint, which of the following changes did Adatum make?
    a. Adatum modified the standard signout.aspx page to send a **wsignoutcleanup** message to ADFS.
    b. Adatum uses the **SessionAuthenticationModule SigningOut** event to customize the standard sign-out process.

c. Adatum added custom code to invalidate the FedAuth cookie.

d. Adatum configured SharePoint to use a session-based FedAuth cookie.

Answer: *Only* **(b)** *and* **(d)** *are correct. The relying party must send a* **wsignout** *message to its identity provider; the identity provider sends* **wsignoutcleanup** *messages to all of the currently logged-in relying parties. If the FedAuth cookie is session-based, SharePoint will automatically invalidate it.*

Chapter 12, Federated Identity for SharePoint Applications

1. In the scenario described in this chapter, Adatum prefers to maintain a single trust relationship between SharePoint and ADFS, and to maintain the trust relationships with the multiple partners in ADFS. Which of the following are valid reasons for adopting this model?

   a. It enables Adatum to collect audit data relating to external sign-ins from ADFS.

   b. It allows for the potential reuse of the trust relationships with partners in other Adatum applications.

   c. It allows Adatum to implement automatic home realm discovery.

   d. It makes it easier for Adatum to ensure that SharePoint receives a consistent set of claim types.

   Answer: *Only* **(a), (c)** *and* **(d)** *are correct. There is nothing in the model chosen by Adatum that specifically enables home realm discovery, though it may be easier to implement by customizing the pages in ADFS. It is easier for Adatum to manage the authentication and claims issuing in ADFS.*

2. When must a SharePoint user reauthenticate with the claims issuer (ADFS in the Adatum scenario)?

   a. Whenever the user closes and then reopens the browser.

   b. Whenever the ADFS web SSO cookie expires.

c. Whenever the SharePoint FedAuth cookie that contains the SAML token expires.

d. Every ten minutes.

Answer: *Only* **(a)** *and* **(c)** *are correct. Whether or not a user must re-authenticate after closing and re-opening the browser depends on whether the SAML token is stored in a persistent cookie; the Adatum single sign-out implementation requires session cookies to be enabled. The ADFS web SSO cookie determines when a user must reauthenticate with ADFS, not with SharePoint. The time period between authentications will depend on the lifetime of the SAML token as specified by ADFS and whether sliding sessions are in use.*

3. Which of the following statements are true with regard to the Adatum sliding session implementation?

    a. SharePoint tries to renew the session cookie before it expires.

    b. SharePoint waits for the session cookie to expire and then creates a new one.

    c. When SharePoint renews the session cookie, it always requests a new SAML token from ADFS.

    d. SharePoint relies on sliding sessions in ADFS.

    Answer: *Only* **(a)** *and* **(c)** *are correct. SharePoint tries to renew the session cookie before it expires. If the cookie expires, then SharePoint will request a new SAML token from ADFS.*

4. Where is the **organization** claim that SharePoint uses to authorize access to certain documents in the a-Portal web application generated?

    a. In the SharePoint STS.

    b. In the identity provider's STS; for example in the Litware issuer.

    c. In ADFS.

    d. Any of the above.

    Answer: *Only* **(c)** *is correct. The solution relies on ADFS to generate the* **organization** *claim. It's important not to rely on the partner's identity provider because a malicious administrator could spoof another partner's identity.*

5. Why does Adatum rely on ADFS to perform home realm discovery?

    a. It's easier to implement in ADFS than in SharePoint.

    b. You can customize the list of identity providers for each SharePoint web application in ADFS.

    c. You cannot perform home realm discovery in SharePoint.

    d. You can configure ADFS to remember a user's choice of identity provider.

Answer: *Only* **(a)**, **(b),** *and* **(d)** *are correct. (a), (b), and (d) are all reasons for Adatum to implement home realm discovery in ADFS. It is possible to implement it SharePoint.*

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