ComponentSpace

SAML v2.0 for.NET Developer Guide

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1 Introduction

The ComponentSpace SAML v2.0 component is a .NET class library that provides SAML v2.0 assertions, protocol messages, bindings and profiles functionality.

You can use this functionality to easily enable your ASP.NET applications to participate in SAML v2.0 federated single sign-on (SSO) either as an Identity Provider (IdP) or Service Provider (SP). Samples applications with full source code are included.

If you're looking for SAML v1.1 support, please refer to the separate ComponentSpace SAML v1.1 component.

1.1 Features

The class library supports the SAML v2.0 Assertions, Protocol, Bindings and Profiles as defined by the OASIS standard (www.oasis-open.org) including:

- SAML 2.0 assertions and all protocol messages
- SAML 2.0 metadata
- All bindings (SOAP, PAOS, HTTP Redirect, HTTP POST, HTTP Artifact and SAML URI)
- Web browser single sign-on profile
- Single logout profile
- Artifact resolution profile
- Identity provider discovery profile
- Authentication, attribute, assertion query profiles
- Name identifier management and mapping profiles
- Generation and verification of XML signatures
- XML encryption

The library features classes for:

- Creating, modifying and accessing SAML assertions and protocol messages
- Sending and receiving SAML protocol messages across the various SAML bindings.
- Supporting the SAML profiles

1.2 Benefits

- Easy to use class library enabling single sign-on support to be quickly added to your ASP.NET applications
- Developer based licensing with no runtime royalties meaning you don't pay per deployment or end user
- Developed in C# with full source code available for purchase

- Includes class library reference and example applications with full source code

1.3 Prerequisites

The class library requires the .NET v2.0 framework or above and is for use with Visual Studio 2005 or above.

The class library has been tested with .NET 2.0, .NET 3.0, .NET 3.5, .NET 4.0 and .NET4.5 using Visual Studio 2005, 2008, 2010, 2012 and 2013.

It has been tested on 32-bit and 64-bit Windows Server 2003, 2008, and 2012, as well as Windows 7 and 8.

2 Getting Started

1. If you haven't already done so, install this product by double clicking the Microsoft Installer (MSI) file and following the installation steps.

   A free evaluation copy is available from our web site.
2. If you're not familiar with SAML single sign-on, refer to section 3 for a brief introduction to SAML.
3. See section 5 for assistance in determining the most applicable example project to review.
4. Compile and run the example applications (see section 9).
5. See section 12 for assistance in enabling single sign-on in your own applications.

Please feel free to contact us if you need any assistance (see section 24).

3 An Introduction to SAML SSO

This is a brief introduction to SAML single sign-on (SSO). For more detailed information you should contact us or refer to the SAML v2.0 specification documents at www.oasis-open.org.

SAML single sign-on's goal is to minimize the number of times a user has to login at various web sites. It does this by having the user manually login at one site (called the identity provider or IdP) and then automatically logging in, without having to provide credentials, at one or more other sites (called the service providers or SPs).

A trust relationship must exist between the identity provider and service providers. Service providers trust that the identity provider has authenticated the user.

SAML supports two single sign-on flows – IdP-initiated SSO and SP-initiated SSO.

3.1 IdP-Initiated SSO

In IdP-initiated SSO, the user starts at the IdP site, logs in and clicks a link to the SP site which initiates SSO.

The following diagram outlines the IdP-initiated SSO flow.

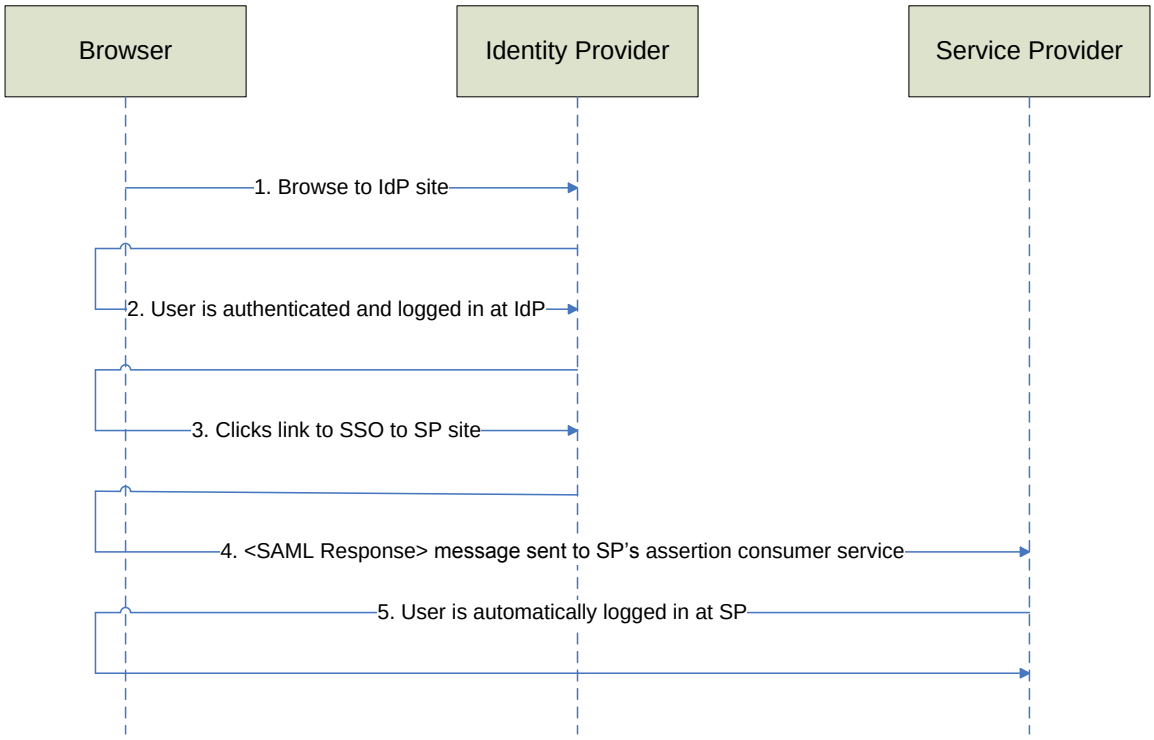


Figure 1 IdP-initiated SSO

1. The user browses to the IdP site.
2. If the user is not already authenticated at the IdP, the user must present their credentials and login.
3. The user clicks a link to the SP site.
4. The IdP sends a SAML response containing a SAML assertion to the SP.
5. The SP uses the information contained in the SAML assertion, including the user's name and any associated attributes, and performs an automatic login.

Note that steps 2 and 3 may be in reverse order.

3.2 SP-Initiated SSO

In SP-initiated SSO, the user starts at the SP site and, instead of logging in at the SP site, SSO is initiated with the IdP.

The following diagram outlines the SP-initiated SSO flow.

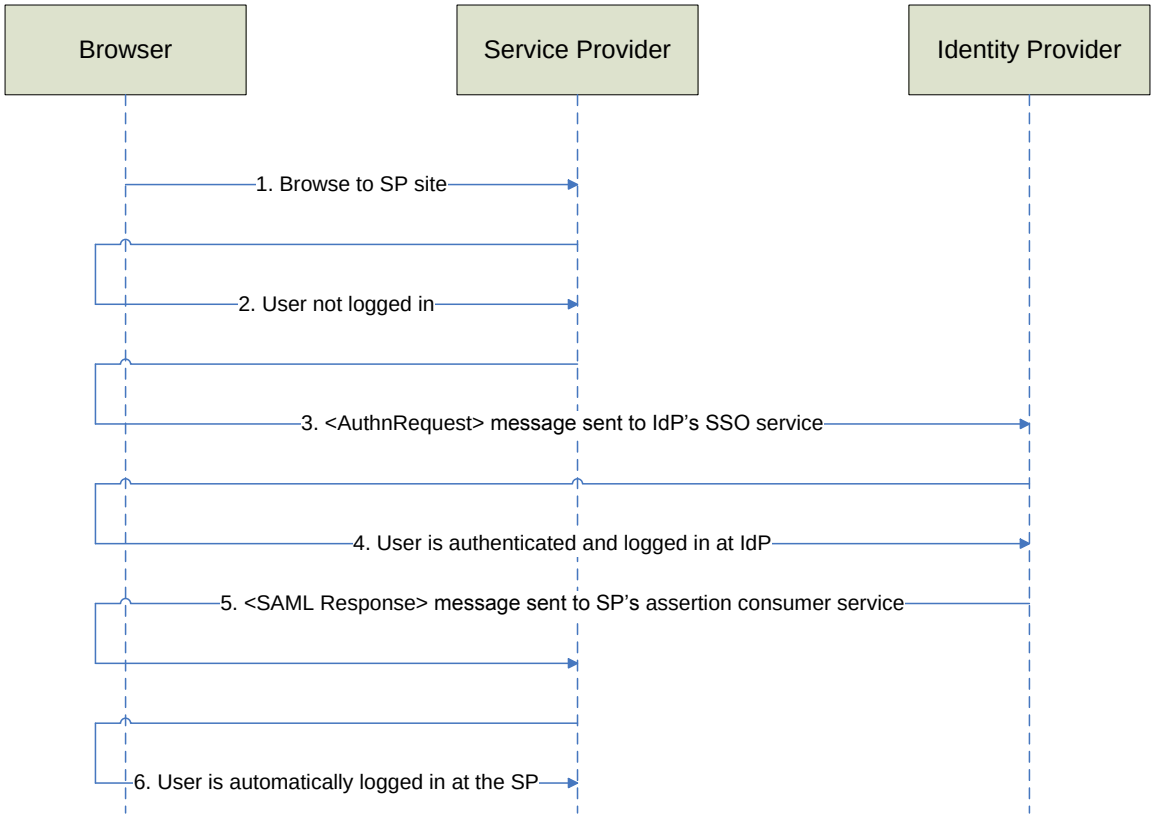


Figure 2 SP-initiated SSO

1. The user browses to the SP site.
2. The user attempts to access a protected page requiring the user to be authenticated.
3. The SP sends an authentication request to the IdP's SSO service endpoint.
4. If the user is not already authenticated at the IdP, the user must present their credentials and login.
5. The IdP sends a SAML response containing a SAML assertion to the SP.
6. The SP uses the information contained in the SAML assertion, including the user's name and any associated attributes, and performs an automatic login.

3.3 IdP-Initiated SLO

In IdP-initiated single logout (SLO), the user starts at the IdP site, and clicks a link to logout out of the IdP site and every SP site to which there is an SSO session.

The following diagram outlines the IdP-initiated SLO flow.

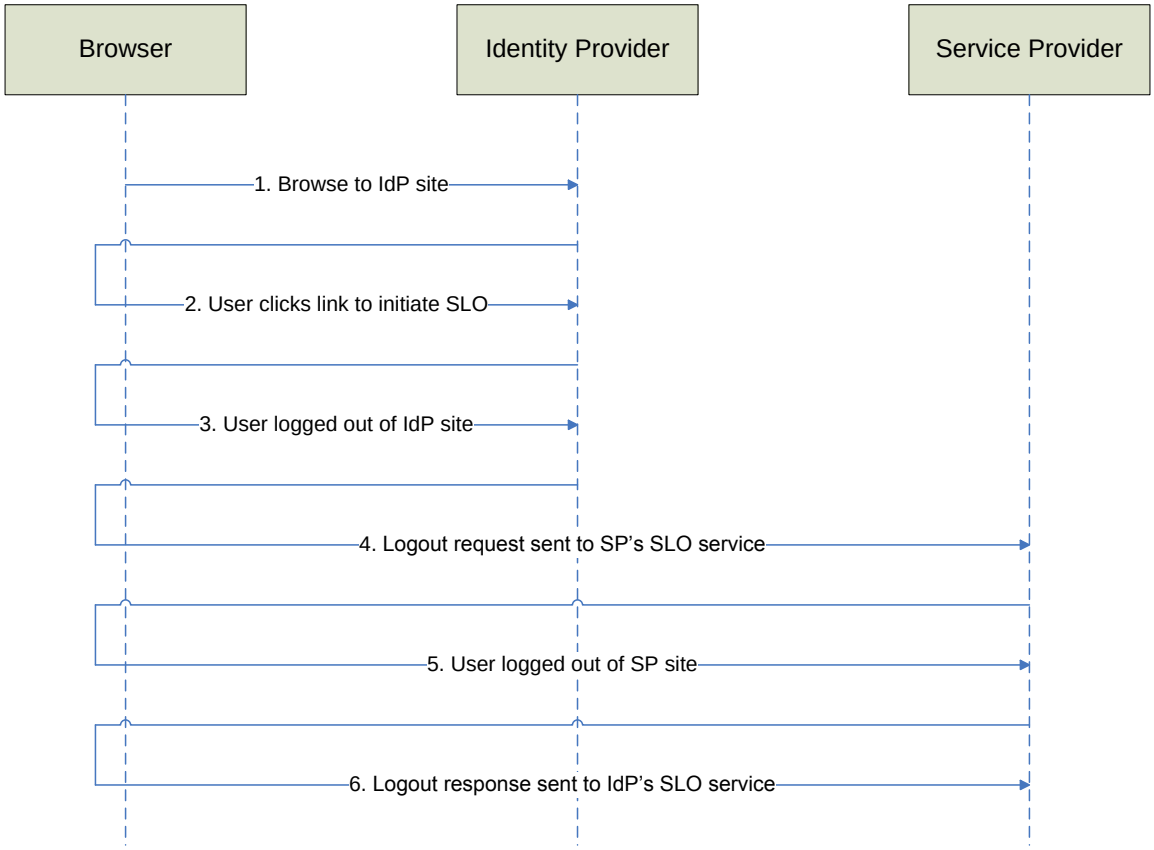


Figure 3 IdP-initiated SLO

1. The user has already SSO'd to one or more service providers.
2. The user clicks a link at the IdP site to initiate SLO.
3. The user is logged out of the IdP site.
4. A logout request is sent to the SP site.
5. The user is logged out of the SP site.
6. A logout response is sent to the IdP site.

Note that steps 4 through 6 are repeated for each service provider.

3.4 SP-Initiated SLO

In SP-initiated single logout (SLO), the user starts at the SP site, and clicks a link to logout out of the IdP site and every SP site to which there is an SSO session.

The following diagram outlines the SP-initiated SLO flow.

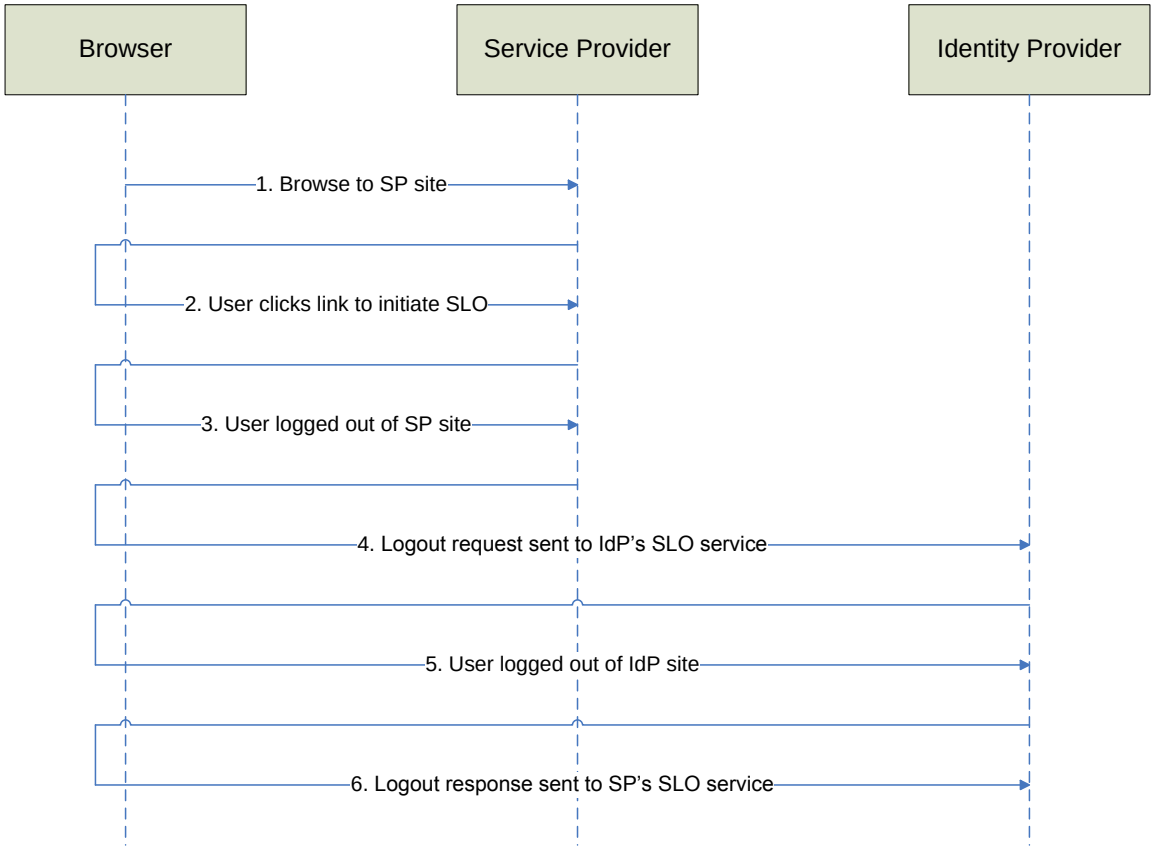


Figure 4 SP-initiated SLO

1. The user has already SSO'd to one or more service providers.
2. The user clicks a link at the SP site to initiate SLO.
3. The user is logged out of the SP site.
4. A logout request is sent to the IdP site.
5. The user is logged out of the IdP site.
6. A logout response is sent to the SP site.

Note that the identity provider sends a logout request and expects a logout response from every other service provider apart from the initiating service provider. This occurs between steps 5 and 6.

3.5 Security Considerations

3.5.1 Transport Level Security

The SAML specification recommends that all communications are over HTTPS.

3.5.2 XML Signatures

XML signatures may be used to sign SAML messages, assertions and metadata. For example, a SAML response containing a SAML assertion may be signed. Alternatively, just the SAML assertion may be signed.

An XML signature is contained within a <Signature> element.

An XML signature ensures any changes to the signed XML may be detected and it identifies who signed the XML.

For example, when an SP receives a signed SAML response from an IdP, if the signature verification performed by the SP is successful, then the SP is assured that the SAML response came from the IdP and that it hasn't been modified after signing. Therefore, having previously established a trust relationship with the IdP, the SP can safely consume the SAML response sent by the IdP.

The following is an example of a signed SAML response.

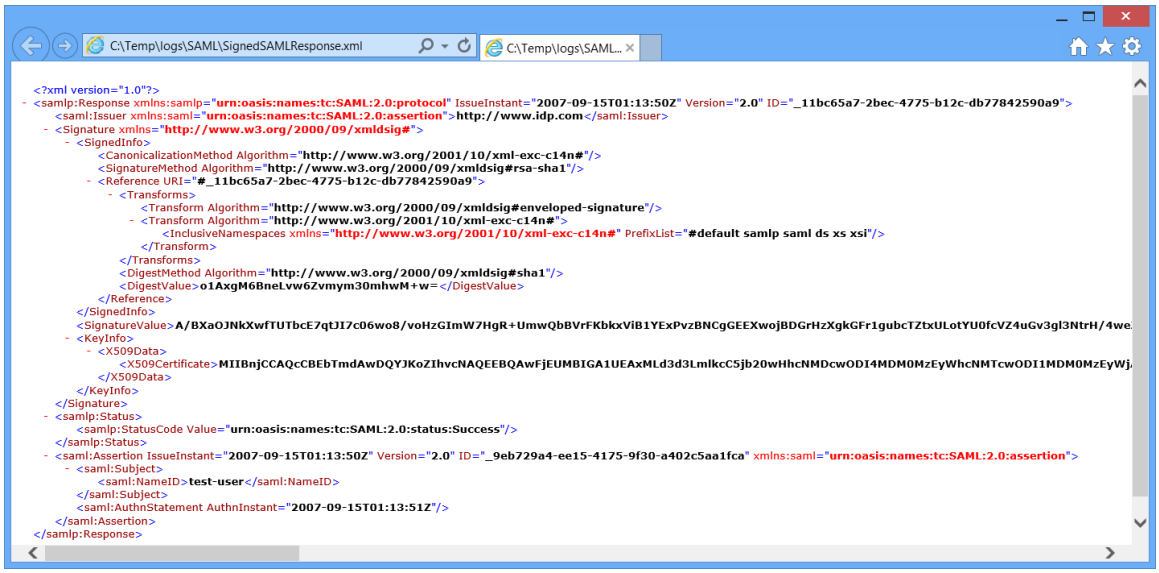


Figure 5 Signed SAML Response

A signer signs with their private key and the verifier verifies with the signer's public key. For example, the IdP signs the SAML response using the IdP's private key. The SP verifies the SAML response signature using the IdP's public key or certificate.

3.5.3 XML Encryption

XML encryption may be used to encrypt SAML assertion, attributes and certain identifiers.

XML encryption ensures the privacy of any confidential data contained within the XML.

For example, an encrypted assertion is contained within an <EncryptedAssertion> element. The SAML assertion may be encrypted because it contains sensitive user information.

Note that, in some circumstances, HTTPS transport level security may be considered sufficient for the protection of any confidential data.

The following is an example of an encrypted SAML assertion.

Figure 6 Encrypted Assertion

An encrypter encrypts with the decrypter's public key and the decrypter decrypts with their private key. For example, the IdP encrypts the SAML assertion using the SP's public key or certificate. The SP decrypts the SAML assertion using the SP's private key.

XML encryption involves the creation of a random symmetric key which is used to encrypt the data. The symmetric key is then encrypted using the public asymmetric key. To decrypt, the private asymmetric key is used to decrypt the random symmetric key which in turn is used to decrypt the data. A symmetric key is used for performance reasons.

4 Using the Class Library

4.1 Adding a Reference

To use the class library in Visual Studio, you need to add a reference to the class library DLL from within your project.

With your project open, in the Solution Explorer right click the project and click *Add Reference...*. Click the *Browse* button and browse to the class library DLL.

You will find the DLL in the bin directory under the installation directory (e.g. under C:\Program Files (x86)\ComponentSpace SAML v2.0 for .NET\Bin\dotNET20 or C:\Program Files (x86)\ComponentSpace SAML v2.0 for .NET\Bin\dotNET40).

There are minor differences between the .NET 2.0 and .NET 4.0 versions of the DLL which make the class library easier to use for the specific version of the .NET framework.

If you are using the .NET framework v2.0 or above, use the DLL in the Bin\dotNET20 directory.

If you are using the .NET framework v4.0 or above, use the DLL in the Bin\dotNET40 directory.

Once the reference has been added you can refer to the various SAML v2.0 classes from within your project.

4.2 Distribution

The class library's runtime is royalty free which means it may be freely distributed with your application. The only file that should be distributed is the class library DLL.

5 SAML High Level API

The class library includes both high level and low level APIs. For the majority of use cases, it's recommend the high level APIs are used as these provide the greatest ease of use. The low level APIs are available for when maximum flexibility is required.

The following sub-sections outline the high level API.

Refer to the class library reference (see section 21) for more information on the high level and low level APIs.

5.1 SAML Identity Provider APIs

The following APIs may be called when acting as an identity provider.

5.1.1 SAMLIdentityProvider.InitiateSSO

The InitiateSSO method sends a SAML response to the specified service provider as part of IdP-initiated SSO.

For example:

```
SAMLIdentityProvider.InitiateSSO(
        Response,
        "testuser",
        new Dictionary<string, string>() {
            { "membership-level", "platinum" },
            { "membership-number", "12345678" } },
        null,
        null);
```

The Response is used to send the SAML response to the service provider via the browser.

The second parameter is the name of the user.

The third parameter is the user's optional attribute names and values.

The fourth parameter is the target service provider URL or null if the default page should be displayed.

The fifth parameter is the partner service provider's name or null if there's only one configured partner service provider.

5.1.2 SAMLIdentityProvider.ReceiveSSO

The ReceiveSSO method receives an authn request from a service provider as part of SP-initiated SSO.

For example:

```
SAMLIdentityProvider.ReceiveSSO(
        Request,
        out partnerSP);
```

The Request is used to receive the authn request.

The partnerSP receives the name of the service provider that sent the authn request.

5.1.3 SAMLIdentityProvider.SendSSO

The SendSSO method sends a SAML response to the service provider as part of SP-initiated SSO.

For example:

```
SAMLIdentityProvider.SendSSO(
        Response,
        "testuser",
        new Dictionary<string, string>() {
            { "membership-level", "platinum" },
            { "membership-number", "12345678" } });
```

The Response is used to send the SAML response to the service provider via the browser.

The second parameter is the name of the user.

The third parameter is the user's optional attribute names and values.

5.1.4 SAMLIdentityProvider.InitiateSLO

The InitiateSLO method sends a logout request to each service provider in session as part of IdP-initiated SLO.

For example:

```
SAMLIdentityProvider.InitiateSLO(
        Response,
        null);
```

The Response is used to send the logout request to the service provider via the browser.

The second parameter is the logout reason or null if none.

5.1.5 SAMLIdentityProvider.ReceiveSLO

The ReceiveSLO method receives a logout request from a service provider as part of SP-initiated SLO or a logout response from a service provider as part of IdP-initiated SLO.

For example:

```
SAMLIdentityProvider.ReceiveSLO(
        Request,
        Response,
        out isRequest,
        out hasCompleted,
        out logoutReason,
        out partnerSP);
```

The Request is used to receive the logout message.

The Response is used to send a logout message.

The isRequest receives the flag indicating whether a logout request or response has been received.

The hasCompleted receives the flag indicating whether the IdP-initiated SLO has completed.

The logoutReason receives the logout reason.

The partnerSP receives the name of the service provider that sent the logout message.

5.1.6 SAMLIdentityProvider.SendSLO

The SendSLO method sends a logout message to the service provider.

For example:

```
SAMLIdentityProvider.SendSLO(
        Response,
        null);
```

The Response is used to send the logout message to the service provider via the browser.

The second parameter is the error message or null if none.

5.2 SAML Service Provider APIs

The following APIs may be called when acting as a service provider.

5.2.1 SAMLServiceProvider.InitiateSSO

The InitiateSSO method sends an authn request to the specified identity provider as part of SP-initiated SSO.

For example:

```
SAMLServiceProvider.InitiateSSO(
        Response,
        null,
        null);
```

The Response object is used to send the authn request to the identity provider via the browser.

The second parameter is the relay state (e.g. target URL) or null if not required.

The third parameter is the partner identity provider's name or null if there's only one configured partner identity provider.

5.2.2 SAMLServiceProvider.ReceiveSSO

The ReceiveSSO method receives a SAML response from an identity provider as part of either IdP-initiated SSO or SP-initiated SSO.

For example:

```
SAMLServiceProvider.ReceiveSSO(
        Request,
        out isInResponseTo,
        out partnerIdP,
        out userName,
        out attributes,
        out targetUrl);
```

The Request is used to receive the SAML response.

The isInResponseTo receives the flag indicating whether SAML response is in response to an authn request (i.e. SP-initiated SSO) or not (i.e. IdP-initiated SSO).

The partnerIdP receives the name of the identity provider.

The userName receives the name of the user.

The attributes receives the user's optional attribute names and values.

The targetUrl receives the target service provider URL or null if the default page should be displayed.

5.2.3 SAMLServiceProvider.InitiateSLO

The InitiateSLO method sends a logout request to the identity provider as part of SP-initiated SLO.

For example:

```
SAMLServiceProvider.InitiateSLO(
        Response,
        null,
        null);
```

The Response is used to send the logout request to the service provider via the browser.

The second parameter is the logout reason or null if none.

The third parameter is the partner identity provider's name or null if there's only one configured partner identity provider.

5.2.4 SAMLServiceProvider.ReceiveSLO

The ReceiveSLO method receives a logout request from a service provider as part of SP-initiated SLO or a logout response from a service provider as part of IdP-initiated SLO.

For example:

```
SAMLServiceProvider.ReceiveSLO(
        Request,
        out isRequest,
        out logoutReason,
        out partnerIdP);
```

The Request is used to receive the logout message.

The isRequest receives the flag indicating whether a logout request or response has been received.

The logoutReason receives the logout reason.

The partnerIdP receives the name of the identity provider that sent the logout message.

5.2.5 SAMLServiceProvider.SendSLO

The SendSLO method sends a logout message to the identity provider.

For example:

```
SAMLServiceProvider.SendSLO(
        Response,
        null);
```

The Response is used to send the logout message to the identity provider via the browser.

The second parameter is the error message or null if none.

5.3 Configuration Management

The SAML configuration is defined in section 6.

For the majority of use cases, maintaining the SAML configuration in the saml.config configuration file, located in the application directory, is the simplest strategy. In this case, the configuration is loaded automatically.

Alternatively, configuration may be specified programmatically if, for example, it's stored in a database rather than the saml.config file. Refer to section 6.8 for more details.

5.4 ICertificateManager Interface

Both local and partner X.509 certificates may be specified by configuration. See section 6 for more details. For most uses cases, this is the preferred method. However, if required, certificates may be managed programmatically through the ICertificateManager interface.

The ICertificateManager interface permits retrieval of X.509 certificates required as part of the single sign-on process.

The LocalIdentityProviderCertificate property returns the local identity provider certificate.

The LocalServiceProviderCertificate property returns the local service provider certificate.

The GetPartnerCertificate returns the partner identity provider or service provider certificate as specified by the partner provider's name.

5.4.1 CertificateManager

A default implementation, CertificateManager, is included which supports X.509 certificates specified by configuration.

5.4.2 Custom ICertificateManager

If required, a custom ICertificateManager may be implemented.

The following example code outlines a custom certificate manager which retrieves certificates that are stored in a database.

```
class CustomCertificateManager : AbstractCertificateManager {
    public CustomCertificateManager() {
        // Retrieve the local certificate raw data
        // and password from a database.
        // Implementation not shown.
        byte[] rawData = null;
        string password = null;

        // Save the local provider certificate.
        LocalIdentityProviderCertificate = new X509Certificate2(
            rawData, password, X509KeyStorageFlags.MachineKeySet);

       // Retrieve the partner providers' certificate raw data
       // from a database.
       // Implementation not shown.
       IDictionary<string, byte[]> partnerProviderRawData = null;

       // Save the partner providers' certificates.
       foreach (string partnerProviderName in
                partnerProviderRawData.Keys) {
           AddPartnerCertificate(partnerProviderName,
               new X509Certificate2(
                   partnerProviderRawData[partnerProviderName],
                   (string)null, X509KeyStorageFlags.MachineKeySet));
       }
    }
}
```

The following code assume a CustomCertificateManager class has been implemented and configures this as the certificate manager.

```
SAMLConfiguration.Current.CertificateManager =
    new CustomCertificateManager();
```

5.5 IIDCache Interface

The IIDCache interface manages identifiers used as part of the single sign-on process. This includes checking SAML assertion identifiers as part of replay attack detection at the service provider.

5.5.1 InMemoryIDCache

A default implementation, InMemoryIDCache, is included.

The InMemoryIDCache stores identifiers in an in-memory cache which is suitable in a single server configuration but is not suitable in a web farm.

5.5.2 DatabaseIDCache

In a web farm, an IIDCache implementation backed by a database, for example, is required.

The DatabaseIDCache stores identifiers in a database table which is suitable in a web farm.

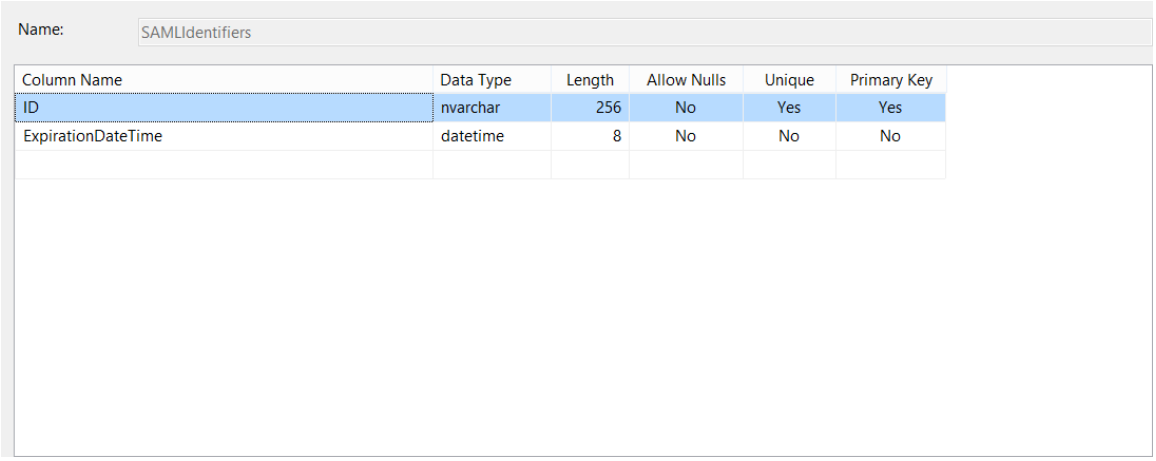
The following code configures the database ID cache.

```
SAMLConfiguration.IDCache = new DatabaseIDCache();
```

The IDCache property should be set in the application's Global.asax straight after having loaded the configuration.

An example SQL Server compact edition database, SAML.sdf, is included. To use this database for testing, copy the SAML.sdf to the application's App_Data folder. Ensure that the account the application runs under has the correct file permissions to access this file. For example, give the IIS_IUSRS group full control.

The database consists of a single table, SAMLIdentifiers, with the following schema.



The ID column is the SAML identifier e.g. the SAML assertion ID. The ExpirationDateTime is the date/time when the SAML identifier expires.

The default DatabaseIDCache constructor assumes a web.config connection string named SAML and that the table name is SAMLIdentifiers.

The high-level API MVC and web forms example service providers include a connection string in web.config for the example database.

It's anticipated that, in many instances, the SAMLIdentifiers table would be added to an application's existing database.

Alternatively, a separate database deployed to SQL Server or some other DBMS may be used.

The only requirement is that the table includes the specified columns.

Additional DatabaseIDCache constructors are available to specify the connection string name and table name.

The DatabaseIDCache class includes a DeleteExpired method that removes any expired IDs from the table. This method should be called periodically to maintain the table.

The StartDeletingExpired method may be called to schedule the removal of expired IDs on a regular basis as a background task.

Alternatively, the DeleteExpiredPriorToAdd property may be set to true to have the removal of expired IDs occur prior to adding a new ID.

There is also the option to maintain this table independently as part of general database maintenance.

However it is done, care should be taken to ensure this table doesn't grow too large with expired rows.

5.5.3 Custom IDCache

If required, a custom IIDCache may be implemented.

The following code assume a CustomIDCache class has been implemented and configures this as the ID cache.

```
SAMLConfiguration.IDCache = new CustomIDCache();
```

5.6 ISSOSessionStore Interface

The ISSOSessionStore interface manages the storage of SSO session state information used as part of the single sign-on process.

5.6.1 SSOSessionStore

A default implementation, SSOSessionStore, is included.

The SSOSessionStore stores SSO session state information as part of the ASP.NET session state.

The SSOSessionStore is suitable in a single server configuration using the ASP.NET InProc session mode or in a web farm using the StateServer, SQLServer or equivalent Custom mode.

5.6.2 Custom ISSOSessionStore

If required, a custom ISSOSessionStore may be implemented.

The following code assume a CustomSSOSessionStore class has been implemented and configures this as the SSO session store.

```
SAMLConfiguration.SSOSessionStore = new CustomSSOSessionStore();
```

6 SAML High Level API Configuration

Configuration information associated with the high level API is found within the saml.config file in the application's root directory.

The following XML schema defines the saml.config syntax.

Any errors in the configuration will be reported when the configuration is loaded.

The utility application, ValidateConfig.exe, which is described in section 11.13.1, may be used to validate the configuration.

```
<?xml version="1.0" encoding="utf-8"?>
<!-- This schema defines the SAML configuration syntax. -->
<schema targetNamespace="urn:componentspace:SAML:2.0:configuration"
        xmlns="http://www.w3.org/2001/XMLSchema"
        xmlns:saml="urn:componentspace:SAML:2.0:configuration"
        elementFormDefault="qualified">

  <!-- SAML configuration -->
  <element name="SAMLConfiguration"
type="saml:SAMLConfigurationType"/>

  <complexType name="SAMLConfigurationType">
    <sequence>
      <element name="IdentityProvider"
               type="saml:IdentityProviderType" minOccurs="0"/>
      <element name="ServiceProvider" type="saml:ServiceProviderType"
               minOccurs="0"/>
      <element name="PartnerIdentityProvider"
               type="saml:PartnerIdentityProviderType" minOccurs="0"
               maxOccurs="unbounded"/>
      <element name="PartnerServiceProvider"
               type="saml:PartnerServiceProviderType" minOccurs="0"
               maxOccurs="unbounded"/>
    </sequence>
    <attribute name="ReloadOnConfigurationChange" type="boolean"
               default="true"/>
    <attribute name="TraceLevel" type="saml:TraceLevelType"/>
  </complexType>

  <!-- Identity Provider -->
  <complexType name="IdentityProviderType">
    <complexContent>
      <extension base="saml:LocalProviderType"/>
```

```
    </complexContent>
  </complexType>

  <!-- Service Provider -->
  <complexType name="ServiceProviderType">
    <complexContent>
      <extension base="saml:LocalProviderType">
        <attribute name="AssertionConsumerServiceUrl" type="string"
                   use="required"/>
      </extension>
    </complexContent>
  </complexType>

  <!-- Partner Identity Provider -->
  <complexType name="PartnerIdentityProviderType">
    <complexContent>
      <extension base="saml:PartnerProviderType">
        <attribute name="SingleSignOnServiceUrl" type="string"
                   use="required"/>
        <attribute name="SingleSignOnServiceBinding"
                   type="saml:SAMLBindingType"
         default="urn:oasis:names:tc:SAML:2.0:bindings:HTTP-
Redirect"/>
        <attribute name="SignAuthnRequest" type="boolean"
                   default="false"/>
        <attribute name="ForceAuthn" type="boolean"
                   default="false"/>
        <attribute name="WantResponseSigned" type="boolean"
                   default="false"/>
        <attribute name="WantAssertionSigned" type="boolean"
                   default="false"/>
        <attribute name="WantAssertionEncrypted" type="boolean"
                   default="false"/>
        <attribute name="DisableAudienceRestrictionCheck"
                   type="boolean" default="false"/>
        <attribute name="OverridePendingAuthnRequest"
                   type="boolean" default="false"/>
        <attribute name="RequestedAuthnContext" type="string"/>
        <attribute name="ProviderName" type="string"/>
      </extension>
    </complexContent>
  </complexType>

  <!-- Partner Service Provider -->
  <complexType name="PartnerServiceProviderType">
    <complexContent>
      <extension base="saml:PartnerProviderType">
        <attribute name="AssertionConsumerServiceUrl" type="string"/>
        <attribute name="WantAuthnRequestSigned" type="boolean"
                   default="false"/>
        <attribute name="SignResponse" type="boolean"
default="false"/>
        <attribute name="SignAssertion" type="boolean"
                   default="false"/>
        <attribute name="EncryptAssertion" type="boolean"
                   default="false"/>
        <attribute name="AssertionLifeTime" type="string"
```

```
                    default="00:03:00"/>
        <attribute name="AuthnContext" type="string"
default="urn:oasis:names:tc:saml:2.0:ac:classes:unspecified"/>
      </extension>
    </complexContent>
  </complexType>

  <!-- Local and partner provider types -->
  <complexType name="LocalProviderType" abstract="true">
    <complexContent>
      <extension base="saml:ProviderType"/>
    </complexContent>
  </complexType>

  <complexType name="PartnerProviderType" abstract="true">
    <complexContent>
      <extension base="saml:ProviderType">
        <attribute name="SingleLogoutServiceUrl" type="string"/>
        <attribute name="SingleLogoutServiceBinding"
                   type="saml:SAMLBindingType"
        default="urn:oasis:names:tc:SAML:2.0:bindings:HTTP-Redirect"/>
        <attribute name="LogoutRequestLifeTime" type="string"
                   default="00:03:00"/>
        <attribute name="DisableInboundLogout" type="boolean"
                   default="false"/>
        <attribute name="DisableOutboundLogout" type="boolean"
                   default="false"/>
        <attribute name="DisableInResponseToCheck" type="boolean"
                   default="false"/>
        <attribute name="SignLogoutRequest" type="boolean"
                   default="false"/>
        <attribute name="SignLogoutResponse" type="boolean"
                   default="false"/>
        <attribute name="WantLogoutRequestSigned" type="boolean"
                   default="false"/>
        <attribute name="WantLogoutResponseSigned" type="boolean"
                   default="false"/>
        <attribute name="UseEmbeddedCertificate" type="boolean"
                   default="false"/>
        <attribute name="NameIDFormat" type="string"
     default="urn:oasis:names:tc:SAML:1.1:nameid-format:unspecified"/>
        <attribute name="DigestMethod"
               type="saml:DigestMethodType"
               default="http://www.w3.org/2000/09/xmldsig#sha1"/>
        <attribute name="SignatureMethod"
               type="saml:SignatureMethodType"
               default="http://www.w3.org/2000/09/xmldsig#rsa-sha1"/>
        <attribute name="KeyEncryptionMethod"
               type="saml:KeyEncryptionMethodType"
               default="http://www.w3.org/2001/04/xmlenc#rsa-1_5"/>
        <attribute name="DataEncryptionMethod"
               type="saml:DataEncryptionMethodType"
               default="http://www.w3.org/2001/04/xmlenc#aes128-cbc"/>
        <attribute name="ClockSkew" type="string" default="00:00:00"/>
      </extension>
    </complexContent>
```

```
  <complexType name="ProviderType" abstract="true">
    <attribute name="Name" type="string" use="required"/>
    <attribute name="CertificateFile" type="string"/>
    <attribute name="CertificatePassword" type="string"/>
    <attribute name="CertificatePasswordKey" type="string"/>
    <attribute name="CertificateSerialNumber" type="string"/>
    <attribute name="CertificateThumbprint" type="string"/>
    <attribute name="CertificateSubject" type="string"/>
  </complexType>

  <!-- Bindings -->
  <simpleType name="SAMLBindingType">
    <restriction base="string">
      <enumeration value="urn:oasis:names:tc:SAML:2.0:bindings:HTTP-
POST"/>
      <enumeration value="urn:oasis:names:tc:SAML:2.0:bindings:HTTP-
Redirect"/>
    </restriction>
  </simpleType>

  <!-- Security -->
  <simpleType name="KeyEncryptionMethodType">
    <restriction base="string">
      <enumeration value="http://www.w3.org/2001/04/xmlenc#rsa-1_5"/>
      <enumeration value="http://www.w3.org/2001/04/xmlenc#rsa-oaep-
mgf1p"/>
    </restriction>
  </simpleType>

  <simpleType name="DataEncryptionMethodType">
    <restriction base="string">
      <enumeration value="http://www.w3.org/2001/04/xmlenc#tripledes-
cbc"/>
      <enumeration value="http://www.w3.org/2001/04/xmlenc#aes128-
cbc"/>
      <enumeration value="http://www.w3.org/2001/04/xmlenc#aes192-
cbc"/>
      <enumeration value="http://www.w3.org/2001/04/xmlenc#aes256-
cbc"/>
    </restriction>
  </simpleType>

  <simpleType name="DigestMethodType">
    <restriction base="string">
      <enumeration value="http://www.w3.org/2000/09/xmldsig#sha1"/>
      <enumeration value="http://www.w3.org/2001/04/xmlenc#sha256"/>
    </restriction>
  </simpleType>

  <simpleType name="SignatureMethodType">
    <restriction base="string">
      <enumeration value="http://www.w3.org/2000/09/xmldsig#rsa-
sha1"/>
      <enumeration value="http://www.w3.org/2001/04/xmldsig-more#rsa-
sha256"/>
    </restriction>
```

```
  </simpleType>

  <!-- Trace -->
  <simpleType name="TraceLevelType">
    <restriction base="string">
      <enumeration value="Off"/>
      <enumeration value="Verbose"/>
    </restriction>
  </simpleType>
</schema>
```

Figure 7 Saml.config XML Schema

6.1 SAML Configuration

IdentityProvider

The optional IdentityProvider element specifies the configuration for the application when acting as an identity provider.

ServiceProvider

The optional ServiceProvider element specifies the configuration for the application when acting as a service provider.

PartnerIdentityProvider

The optional PartnerIdentityProvider element specifies the configuration for a partner identity provider.

PartnerServiceProvider

The optional PartnerServiceProvider element specifies the configuration for a partner service provider.

ReloadOnConfigurationChange

The optional ReloadOnConfigurationChange attribute specifies whether the application should be reloaded if the configuration changes. The default is true.

TraceLevel

The optional TraceLevel attribute specifies the trace level for logging.

Tracing configuration is specified in the application's web.config. Refer to section 15.1 for more details. The trace switch value in the <system.diagnostics> section specifies whether verbose trace is enabled or not.

The trace switch may be overridden by specifying a trace level. For example, if the trace switch value in <system.diagnostics> is Off, the trace level may be set to Verbose to enable trace without modifying web.config.

In most scenarios, it's preferable to modify the trace switch value in <system.diagnostics>.

By default, the trace level is not specified and therefore the trace switch value in <system.diagnostics> applies.

6.2 Identity Provider Configuration

There is no identity provider specific configuration.

6.3 Service Provider Configuration

AssertionConsumerServiceUrl

The AssertionConsumerServiceUrl attribute specifies the application's assertion consumer service (ACS) URL. SAML responses will be received at the ACS.

6.4 Partner Identity Provider Configuration

SingleSignOnServiceUrl

The optional SingleSignOnServiceUrl attribute specifies the partner identity provider's single sign-on (SSO) service URL. Authentication requests will be sent to the SSO service. This is only required for SP-initiated SSO.

SingleSignOnServiceBinding

The optional SingleSignOnServiceBinding attribute specifies the transport binding to use when sending authentication requests to the partner identity provider's SSO service. The default is to use the HTTP-Redirect binding.

SignAuthnRequest

The optional SignAuthnRequest attribute specifies whether authentication requests sent to the partner identity provider should be signed. The default is false.

ForceAuthn

The optional ForceAuthn attribute specifies whether to set the force authentication attribute in authentication requests. The default is false.

WantResponseSigned

The optional WantResponseSigned attribute specifies whether the SAML response from the partner identity provider should be signed. The default is false.

WantAssertionSigned

The optional WantAssertionSigned attribute specifies whether the SAML assertion from the partner identity provider should be signed. The default is false.

WantAssertionEncrypted

The optional WantAssertionEncrypted attribute specifies whether the SAML assertion from the partner identity provider should be encrypted. The default is false.

DisableAudienceRestrictionCheck

The optional DisableAudienceRestrictionCheck attribute specifies whether the audience restriction condition in the SAML assertion should be checked. This attribute should only be set to true to work around limitations in the partner identity provider. The default is false.

OverridePendingAuthnRequest

The optional OverridePendingAuthnRequest attribute specifies whether a pending authentication request may be overridden and an IdP-initiated SAML response received. Setting this flag to true supports an SP-initiated SSO flow being supplanted by an IdP-initiated SSO. The default is false.

RequestedAuthnContext

The optional RequestedAuthnContext attribute specifies the requested authentication context to include in authentication requests sent to the partner identity provider. The default is none.

ProviderName

The optional ProviderName attribute specifies the provider name to include in authentication requests sent to the partner identity provider. The default is none.

6.5 Partner Service Provider Configuration

AssertionConsumerServiceUrl

The optional AssertionConsumerServiceUrl attribute specifies the partner service provider's assertion consumer service (ACS) URL. SAML responses will be sent to the ACS.

An AssertionConsumerServiceUrl must be configured for IdP-initiated SSO.

For SP-initiated SSO, the assertion consumer service URL included in the authn request from the service provider will be used. If no assertion consumer service URL is included in the authn request then the AssertionConsumerServiceUrl must be configured for SP-initiated SSO.

WantAuthnRequestSigned

The optional WantAuthnRequestSigned attribute specifies whether the authentication request from the partner service provider should be signed. The default is false.

SignResponse

The optional SignResponse attribute specifies whether SAML responses sent to the partner service provider should be signed. The default is false.

SignAssertion

The optional SignAssertion attribute specifies whether SAML assertions sent to the partner service provider should be signed. The default is false.

EncryptAssertion

The optional EncryptAssertion attribute specifies whether SAML assertions sent to the partner service provider should be encrypted. The default is false.

AssertionLifeTime

The optional AssertionLifeTime attribute specifies the NotBefore/NotOnOrAfter time interval for the SAML assertion. The format is hh:mm:ss. The default is 3 minutes.

AuthnContext

The optional AuthnContext attribute specifies the authentication context to include in SAML assertions sent to the partner service provider. The default is urn:oasis:names:tc:saml:2.0:ac:classes:unspecified.

6.6 Partner Provider Configuration

SingleLogoutServiceUrl

The SingleLogoutServiceUrl attribute specifies the partner provider's single logout (SLO) service URL. Logout messages will be sent to the SLO service.

SingleLogoutServiceBinding

The optional SingleLogoutServiceBinding attribute specifies the transport binding to use when sending logout messages to the partner provider's SLO service. The default is to use the HTTP-Redirect binding.

LogoutRequestLifeTime

The optional LogoutRequestLifeTime attribute specifies the NotOnOrAfter time interval for the logout request. The format is hh:mm:ss. The default is 3 minutes.

DisableInboundLogout

The optional DisableInboundLogout attribute specifies whether logout requests sent by the partner provider are not supported. The default is false.

DisableOutboundLogout

The optional DisableOutboundLogout attribute specifies whether logout requests sent to the partner provider are not supported. The default is false.

DisableInResponseToCheck

The optional DisableInResponseToCheck attribute specifies whether the SAML message's InResponseTo should be checked. This attribute should only be set to true to work around limitations in the partner provider. The default is false.

SignLogoutRequest

The optional SignLogoutRequest attribute specifies whether logout requests sent to the partner provider should be signed. The default is false.

SignLogoutResponse

The optional SignLogoutResponse attribute specifies whether logout responses sent to the partner provider should be signed. The default is false.

WantLogoutRequestSigned

The optional WantLogoutRequestSigned attribute specifies whether the logout request from the partner provider should be signed. The default is false.

WantLogoutResponseSigned

The optional WantLogoutResponseSigned attribute specifies whether the logout response from the partner provider should be signed. The default is false.

UseEmbeddedCertificate

The optional UseEmbeddedCertificate attribute specifies whether the certificate embedded in the XML signature should be used when verifying the signature. If false then a configured certificate retrieved from the certificate manager is used. The default is false.

NameIDFormat

The optional NameIDFormat attribute specifies the name identifier format to include in SAML assertions sent to the partner service provider or in authn requests sent to the partner identity provider. The default is urn:oasis:names:tc:SAML:1.1:nameid-format:unspecified.

DigestMethod

The optional DigestMethod attribute specifies the XML signature digest method. The default is http://www.w3.org/2000/09/xmldsig#sha1.

SignatureMethod

The optional SignatureMethod attribute specifies the XML signature method. The default is "http://www.w3.org/2000/09/xmldsig#rsa-sha1.

KeyEncryptionMethod

The optional KeyEncryptionMethod attribute specifies the XML encryption key encryption method. The default is http://www.w3.org/2001/04/xmlenc#rsa-1_5.

DataEncryptionMethod

The optional DataEncryptionMethod attribute specifies the XML encryption data encryption method. The default is http://www.w3.org/2001/04/xmlenc#aes128-cbc.

ClockSkew

The optional ClockSkew attribute specifies the time span to allow for differences between local and partner computer clocks when checking time intervals. The default is no clock skew.

6.7 Provider Configuration

Name

The Name attribute specifies the name of the provider.

CertificateFile

The optional CertificateFile attribute specifies the X.509 certificate file for this provider. The certificate file name may be an absolute path or a path relative to the application folder.

CertificatePassword

The optional CertificatePassword attribute specifies the password associated with the X.509 certificate file for this provider.

Certificate files (*.pfx) that include the private key should be protected by a password.

Certificate files (*.cer) that do not include a private key are not password protected.

The certificate password must be kept secure. In a test environment using a test certificate, specifying the password using the CertificatePassword attribute is acceptable.

For a production certificate, the password should be stored encrypted in web.config. Refer to the CertificatePasswordKey attribute for more details.

CertificatePasswordKey

The optional CertificatePasswordKey attribute specifies the web.config's appSettings key for the certificate file password.

For example, if the CertificatePasswordKey attribute value is localCertificatePassword, then under the web.config's appSettings section, an entry with the key name localCertificatePassword is expected and the entry value is used as the password.

By encrypting the appSettings section using the aspnet_regiis utility, the certificate file password is secured.

CertificateSerialNumber

The optional CertificateSerialNumber attribute specifies the X.509 certificate by serial number for this provider. The certificate is retrieved from the local computer's X.509 certificate store.

CertificateThumbprint

The optional CertificateThumbprint attribute specifies the X.509 certificate by thumbprint for this provider. The certificate is retrieved from the local computer's X.509 certificate store.

CertificateSubject

The optional CertificateSubject attribute specifies the X.509 certificate by subject name for this provider. The certificate is retrieved from the local computer's X.509 certificate store.

6.8 Specifying Configuration Programmatically

For the majority of use cases, maintaining the SAML configuration in the saml.config configuration file is the simplest strategy.

However, there may be circumstances where configuration must be stored elsewhere (e.g. in a database).

Rather than defining configuration in the saml.config configuration file, the configuration may be specified programmatically. A good place to do this is in the Global.Application_Start method.

For example, the following code configures the local service provider and one partner identity provider.

```
SAMLConfiguration samlConfiguration = new SAMLConfiguration();

samlConfiguration.ServiceProviderConfiguration = new
ServiceProviderConfiguration() {
    Name = "urn:componentspace:ExampleServiceProvider",
    AssertionConsumerServiceUrl =
"~/SAML/AssertionConsumerService.aspx",
    CertificateFile = "sp.pfx",
    CertificatePassword = "password"
};

samlConfiguration.AddPartnerIdentityProvider(
    new PartnerIdentityProviderConfiguration() {
        Name = "urn:componentspace:ExampleIdentityProvider",
        SignAuthnRequest = false,
        WantSAMLResponseSigned = true,
        WantAssertionSigned = false,
        WantAssertionEncrypted = false,
        SingleSignOnServiceUrl =
"http://localhost/ExampleIdentityProvider/SAML/SSOService.aspx",
        SingleLogoutServiceUrl =
"http://localhost/ExampleIdentityProvider/SAML/SLOService.aspx",
        CertificateFile = "idp.cer"
    });

SAMLConfiguration.Current = samlConfiguration;
```

And the following code configures the local identity provider and one partner service provider.

```
SAMLConfiguration samlConfiguration = new SAMLConfiguration();

samlConfiguration.IdentityProviderConfiguration =
    new IdentityProviderConfiguration() {
        Name = "urn:componentspace:ExampleIdentityProvider",
        CertificateFile = "idp.pfx",
        CertificatePassword = "password"
    };

samlConfiguration.AddPartnerServiceProvider(
    new PartnerServiceProviderConfiguration() {
        Name = "urn:componentspace:ExampleServiceProvider",
        WantAuthnRequestSigned = false,
        SignSAMLResponse = true,
        SignAssertion = false,
```

```
        EncryptAssertion = false,
        AssertionConsumerServiceUrl =
"http://localhost/ExampleServiceProvider/SAML/AssertionConsumerService.
aspx",
        SingleLogoutServiceUrl =
"http://localhost/ExampleServiceProvider/SAML/SLOService.aspx",
        CertificateFile = "sp.cer"
    });

SAMLConfiguration.Current = samlConfiguration;
```

7 SAML High Level API Certificate Configuration

X.509 certificates are used for XML signatures (see section 3.5.2) and XML encryption (see section 3.5.3).

Certificates may be specified either programmatically (see section 5.2.3) or through configuration (see section 6). For most use cases it's simpler to specify certificates through configuration.

A certificate may be stored in a file or in the Windows certificate store.

The following sections provide instructions of configuring X.509 certificates.

7.1 Local Provider Certificate File

The following configuration entry specifies the local provider's certificate is contained in the file idp.pfx which is protected by password.

```
<IdentityProvider Name="ExampleIdentityProvider"
                  CertificateFile="idp.pfx"
                  CertificatePassword="password"/>
```

The certificate file path is not an absolute path and therefore is assumed to be relative to the application's folder.

The following configuration entry specifies an absolute file path.

```
<IdentityProvider Name="ExampleIdentityProvider"
                  CertificateFile="C:\\Certificates\\idp.pfx"
                  CertificatePassword="password"/>
```

7.2 Partner Provider Certificate File

The following configuration entry specifies the partner provider's certificate is contained in the file sp.cer.

```
<PartnerServiceProvider Name="ExampleServiceProvider"
                        CertificateFile="sp.cer"/>
```

The certificate file path is not an absolute path and therefore is assumed to be relative to the application's folder.

No password is required with a partner certificate file as the file does not contain the private key.

The following configuration entry specifies an absolute file path.

```
<PartnerServiceProvider Name=" ExampleServiceProvider"
                        CertificateFile="C:\\Certificates\\sp.cer"/>
```

7.3 Encrypting the Certificate File Password

When using production certificate files the password should be encrypted. To do this, the ability to encrypt sections of web.config is employed.

The following configuration entry specifies the local provider's certificate is contained in the file idp.pfx which is protected by an encrypted password.

```
<IdentityProvider Name="ExampleIdentityProvider"
                  CertificateFile="idp.pfx"
                  CertificatePasswordKey="certificateFilePassword"/>
```

The application's web.config appSettings section must include the certificate password key.

```
<appSettings>
  <add key="certificateFilePassword" value="password"/>
</appSettings>
```

The .NET framework's aspnet_regiis utility application is used to encrypt the appSettings section. You must be run this utility as an administrator.

```
aspnet_regiis –pef appSettings
C:\inetpub\wwwroot\ExampleIdentityProvider
```

The aspnet_regiis utility also is used to decrypt the section.

```
aspnet_regiis –pdf appSettings
C:\inetpub\wwwroot\ExampleIdentityProvider
```

The IIS account under which the application runs must be granted permission to decrypt web.config.

```
aspnet_regiis -pa NetFrameworkConfigurationKey "IIS_IUSRS"
```

7.4 Managing the Windows Certificate Store

The Microsoft Management Console may be used to install and manage certificates in the Windows certificate store.

7.4.1 Running the MMC Certificates Snap-in

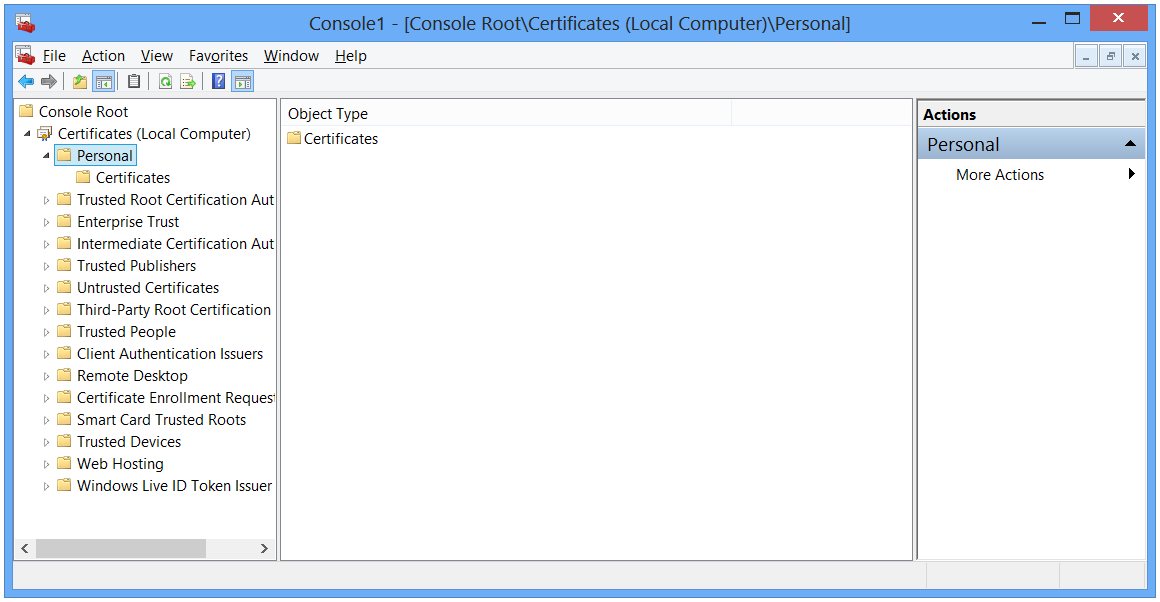
To run the MMC Certificates snap-in:

1. Run the Microsoft Management Console (MMC) as an administrator.
2. From the menu, click File > Add/Remove Snap-in…
3. Select Certificates from the list of available snap-ins.
4. Specify that the computer account for the local computer is to be managed.

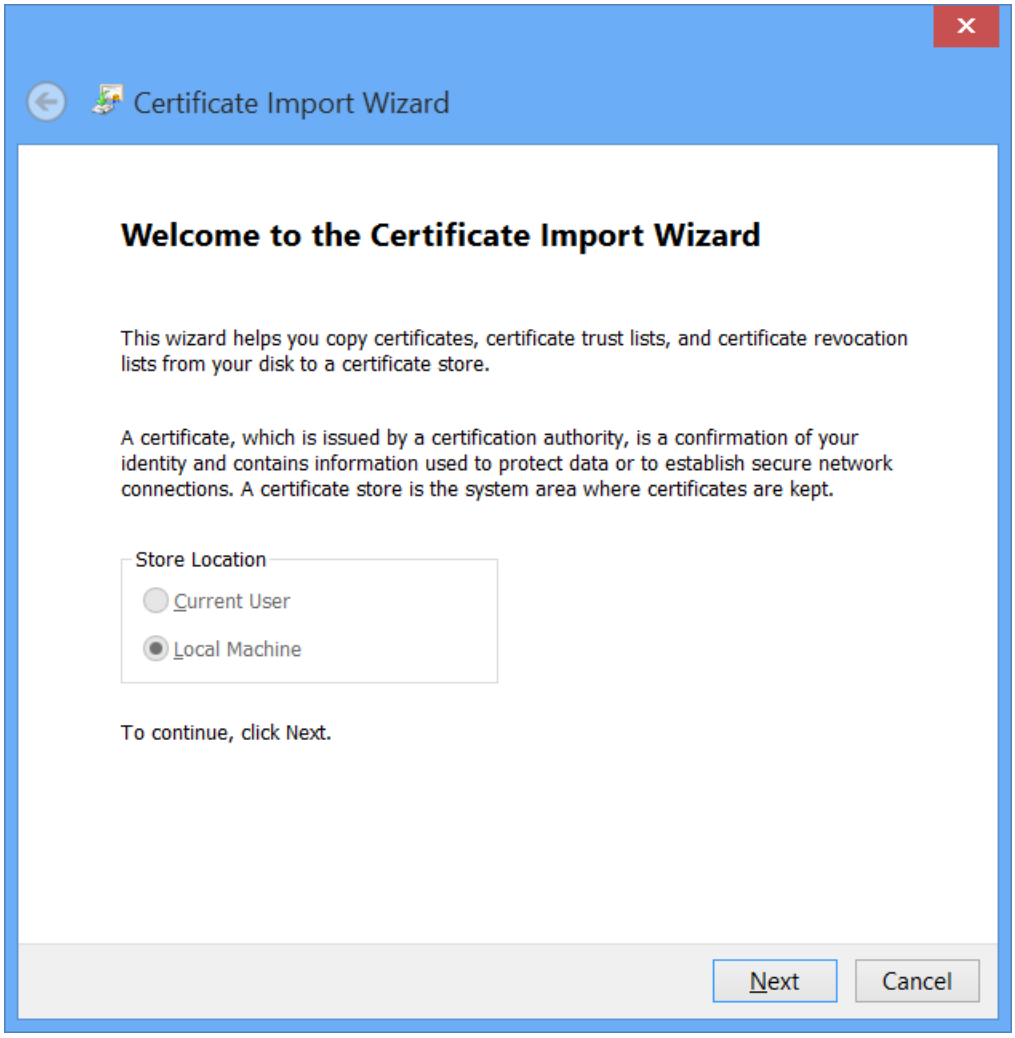
7.4.2 Importing a PFX File

To import a certificate and private key contained in a pfx file into the Windows certificate store:

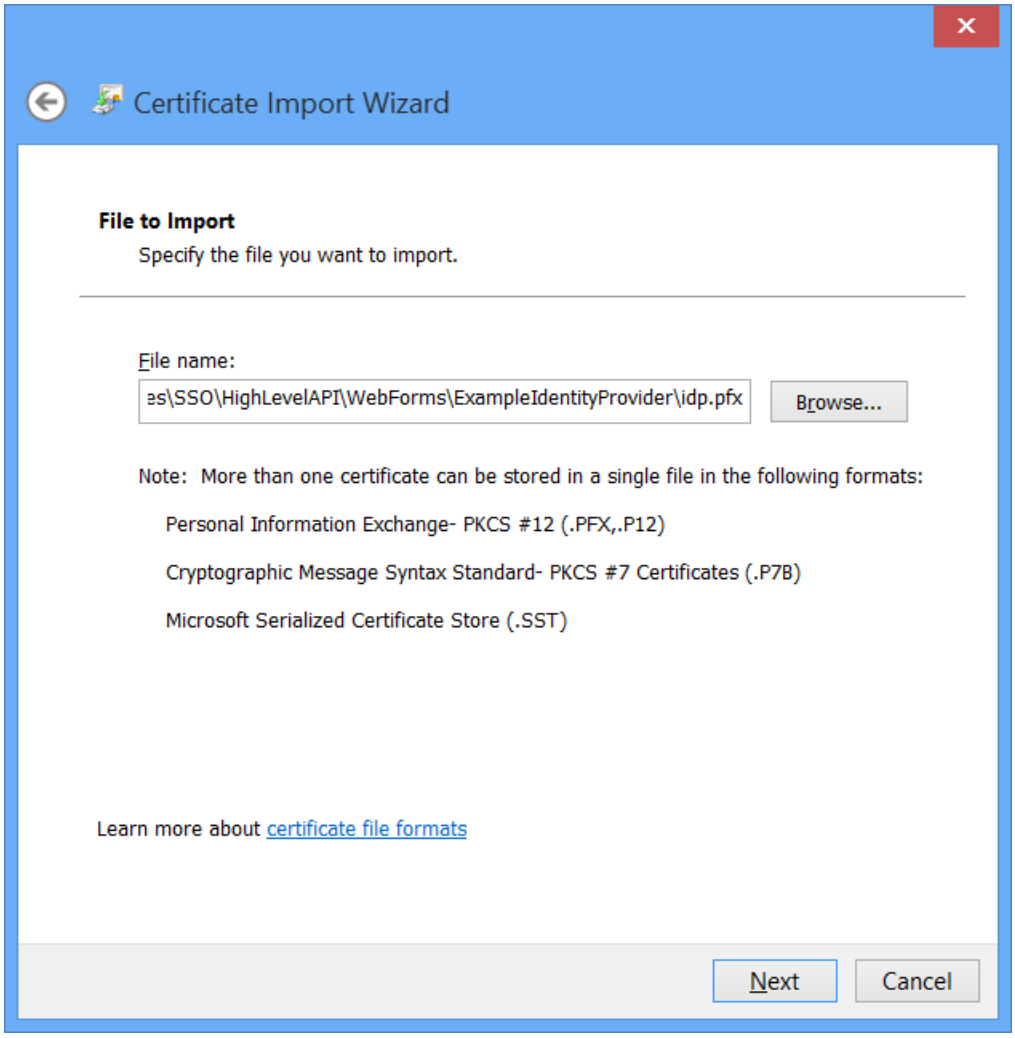
1. Select the Personal folder in the certificates tree.



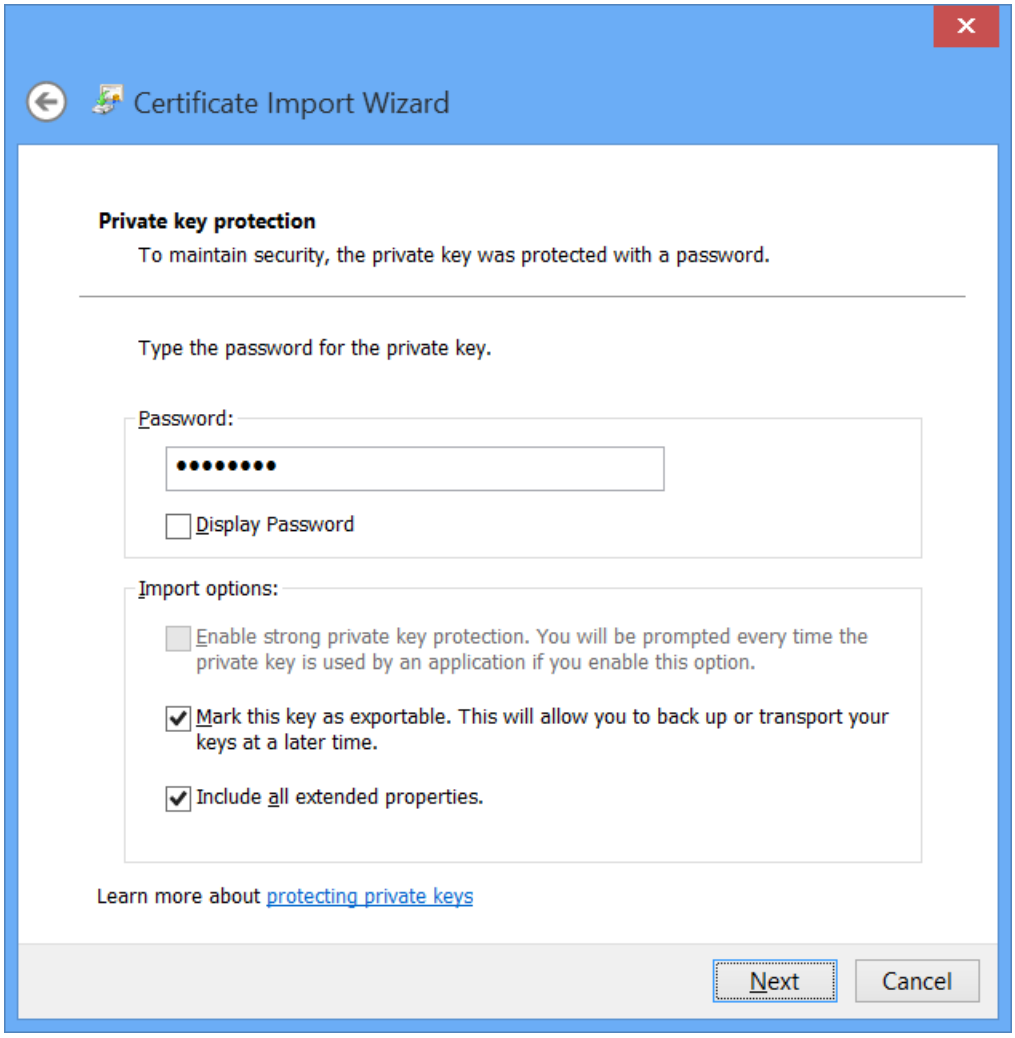
2. From the menu, click Action > All Tasks > Import…



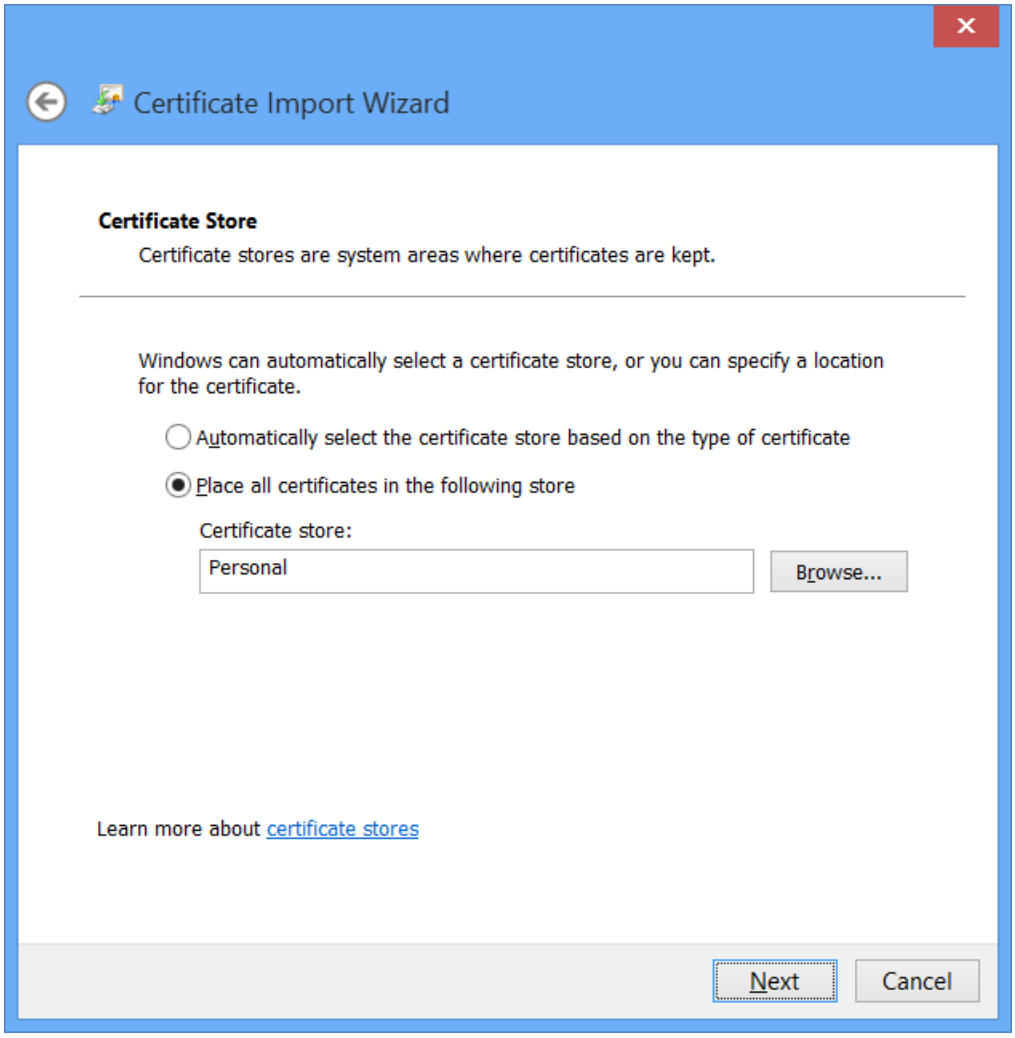
3. Browse to the pfx file to import.



4. Supply the password and optionally check the check box to mark the key as exportable.

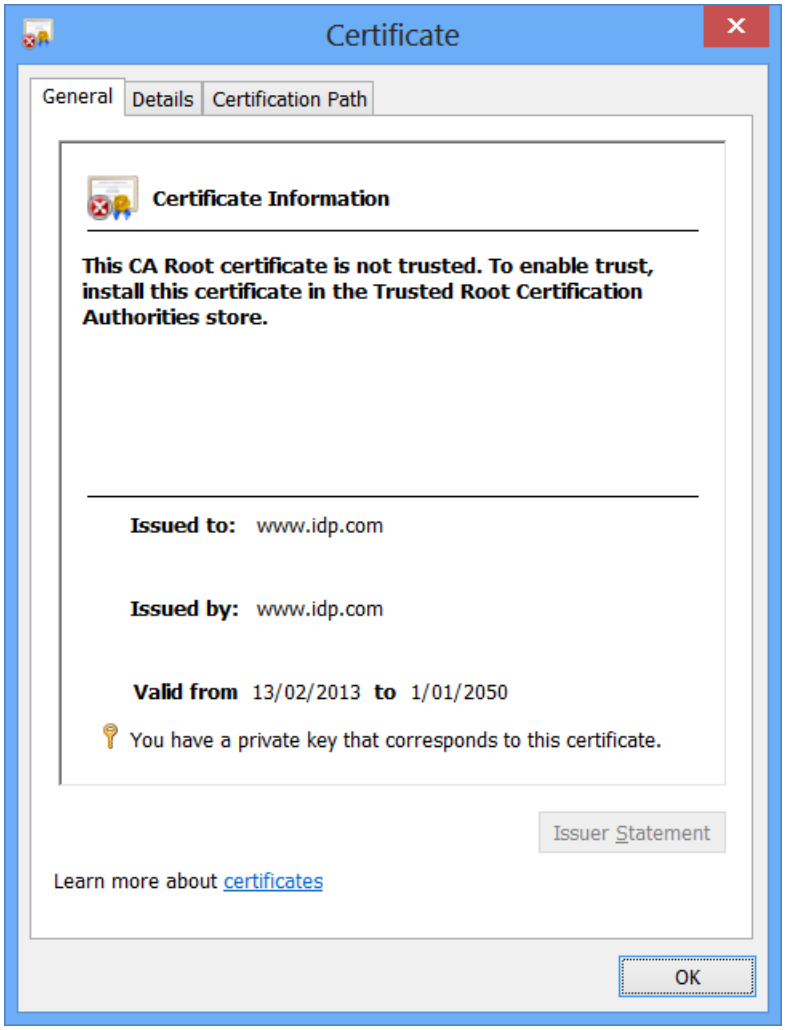


5. Place the certificate in the Personal certificate store.

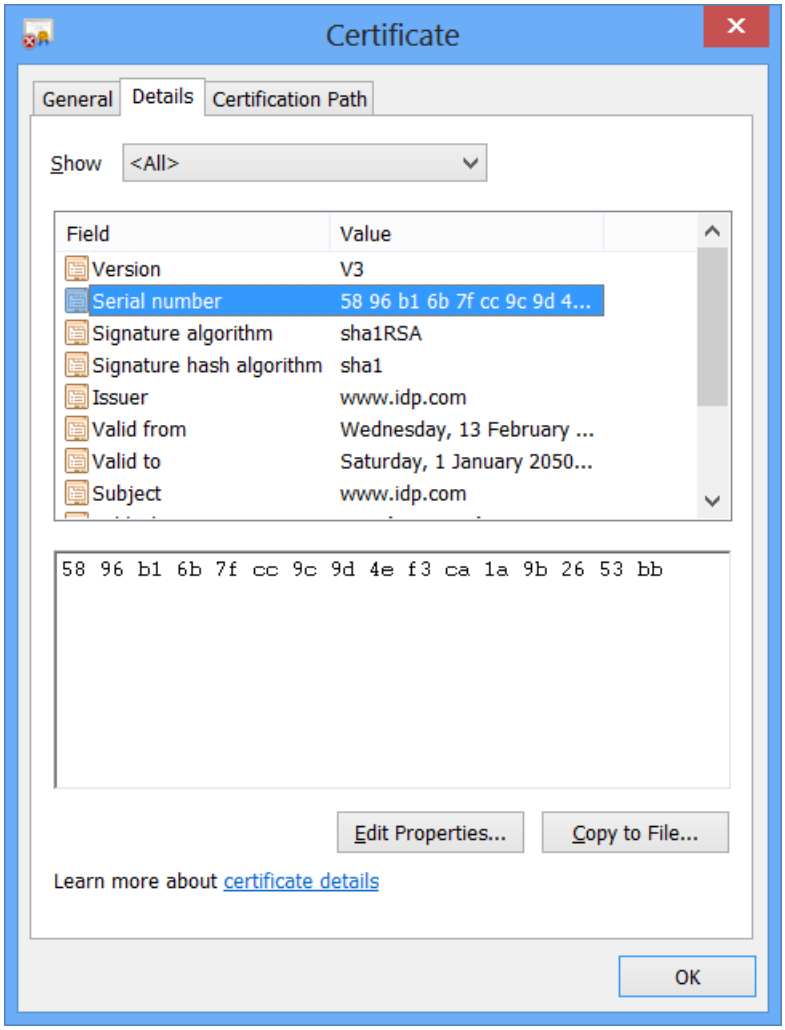


6. Click Finish to complete the import.

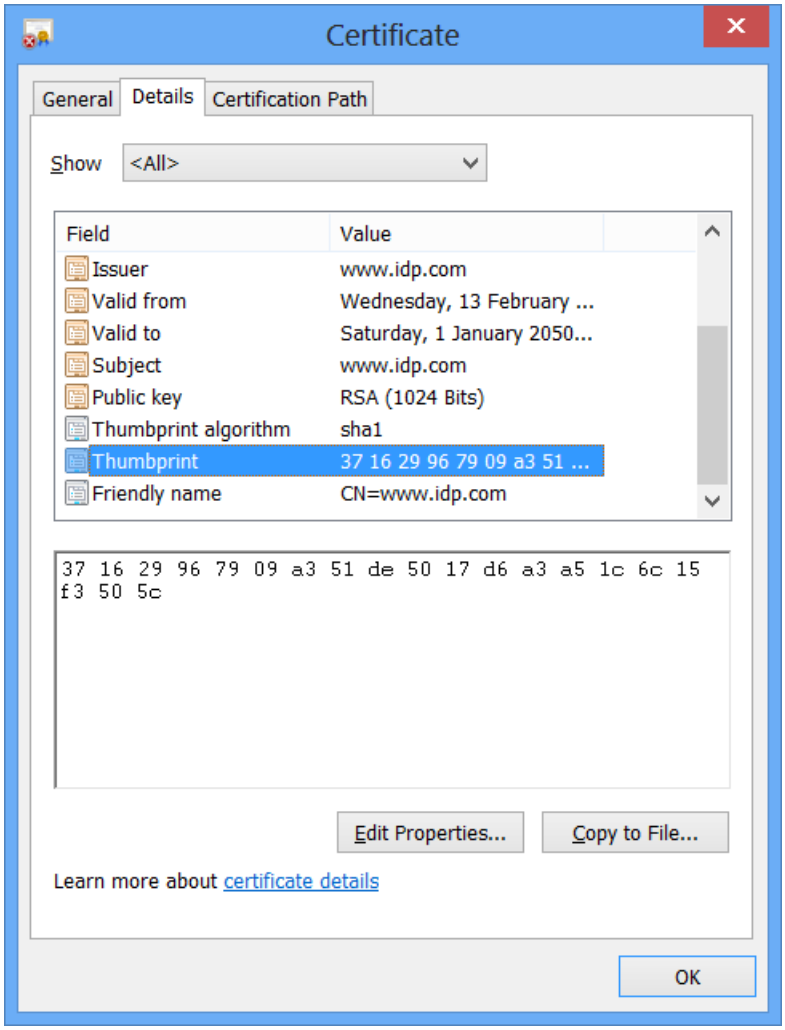
7. Confirm the certificate is listed and open it to review its details.



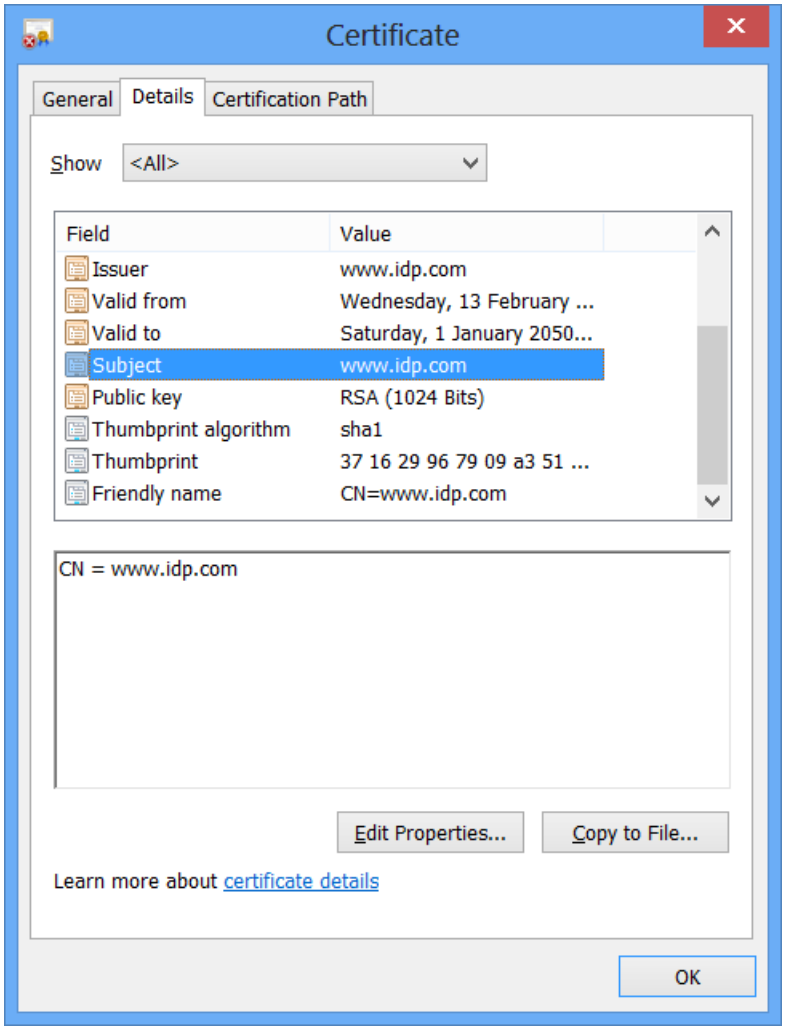
8. Note the certificate's serial number.



9. Note the certificate's thumbprint.



10. Note the certificate's subject name.

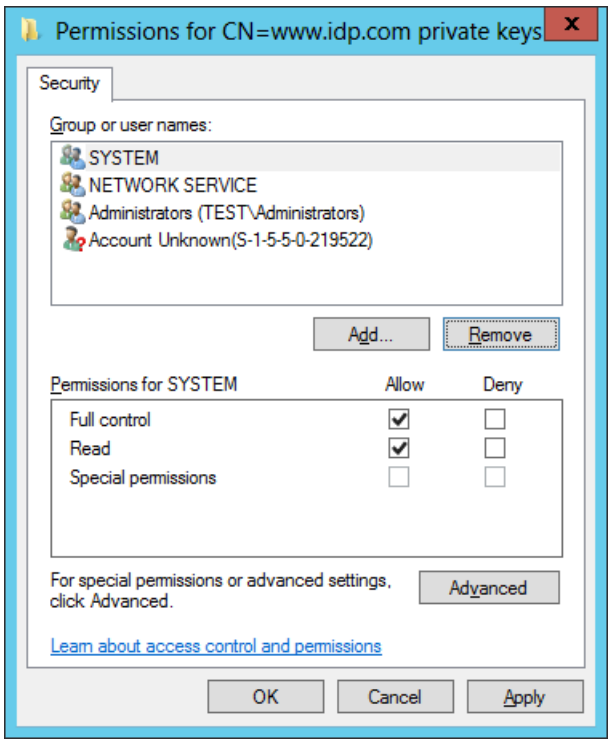


7.4.3 Private Key Security

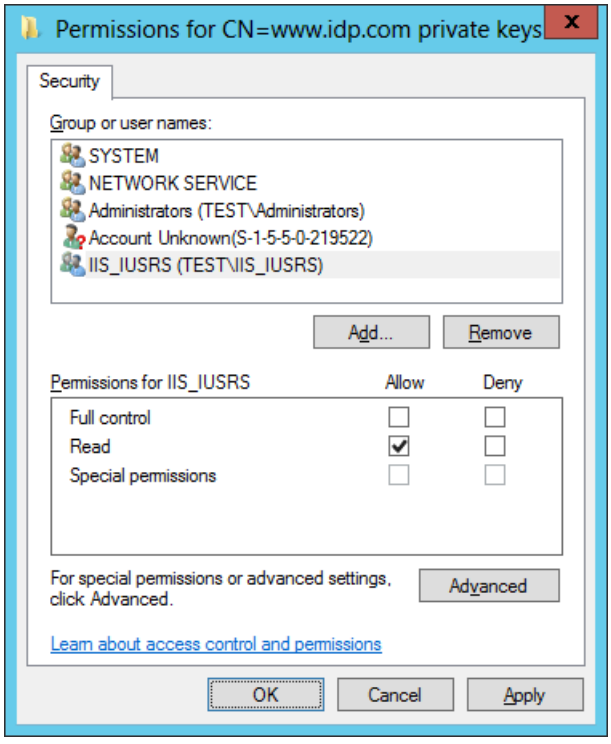
If your application will be accessing the private key (e.g. signature generation or decryption) then the account under which it runs must have read access to the private key.

To add read permission for the private key:

1. Right click on the certificate to bring up the context menu and select All Tasks > Manage Private Keys…



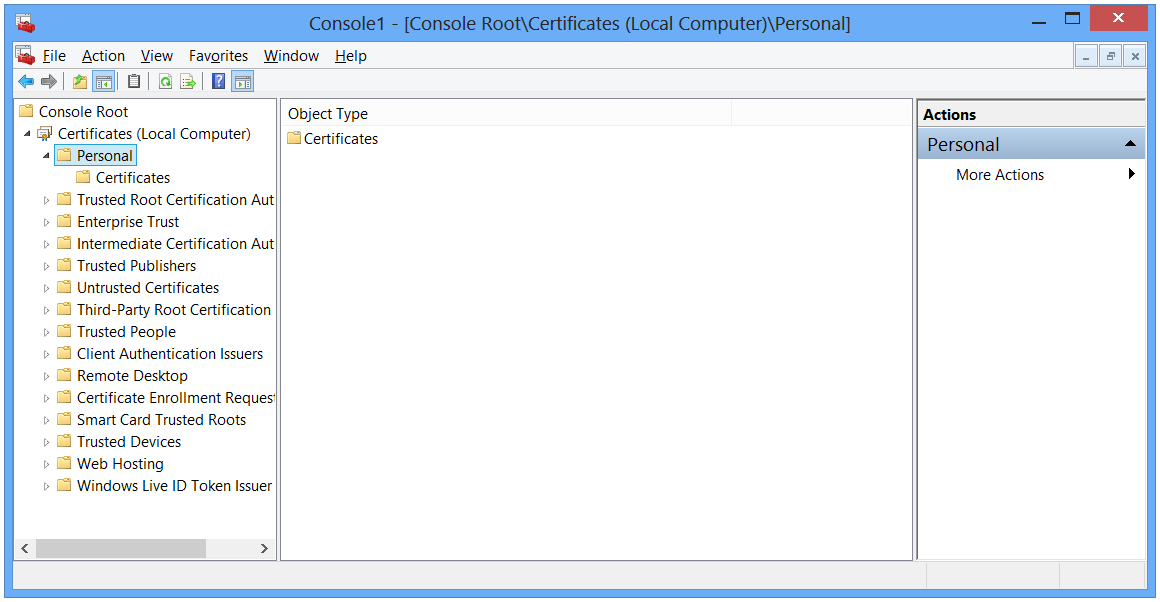
2. Add permissions for the application account. For example, give the IIS_IUSRS group read permission. The user or group to permit is dependent on the version of IIS and its configuration.



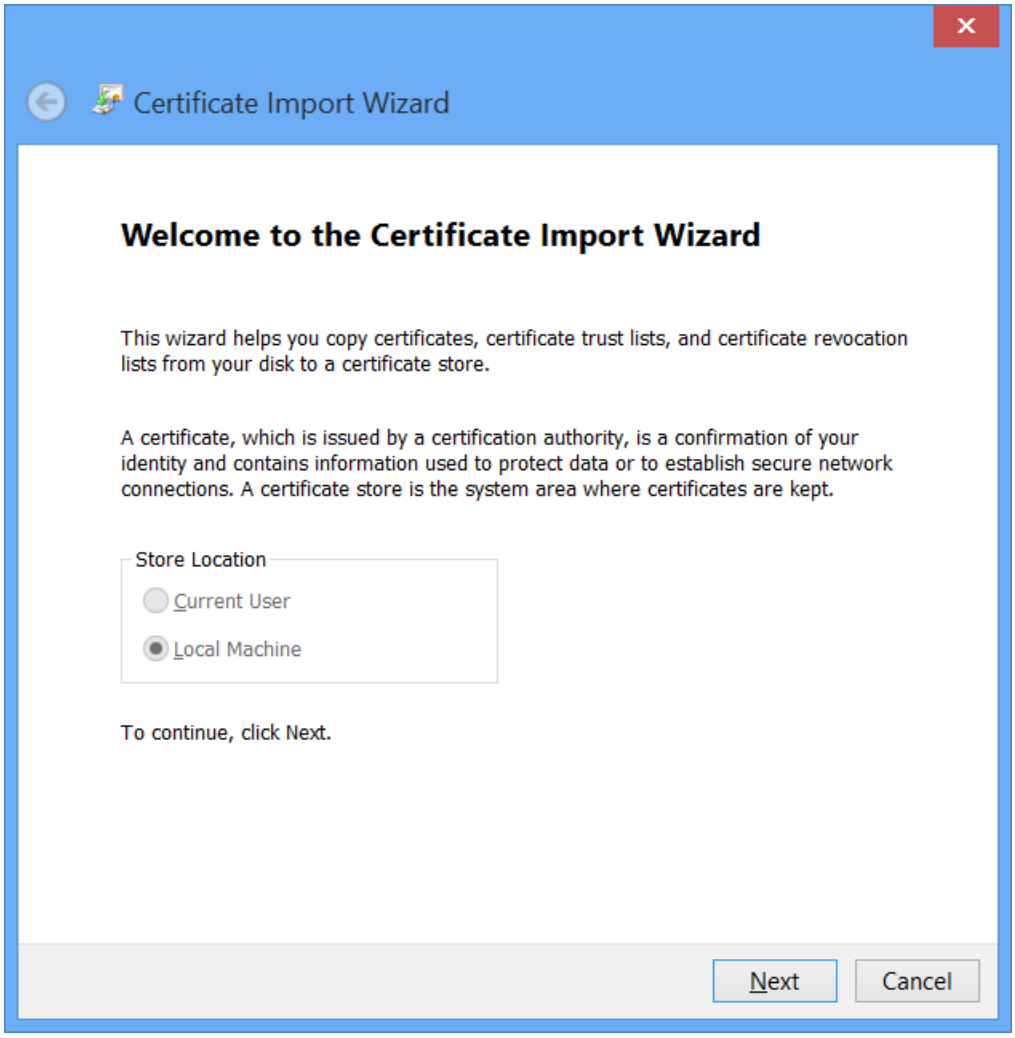
7.4.4 Importing a CER File

To import a certificate contained in a cer file into the Windows certificate store:

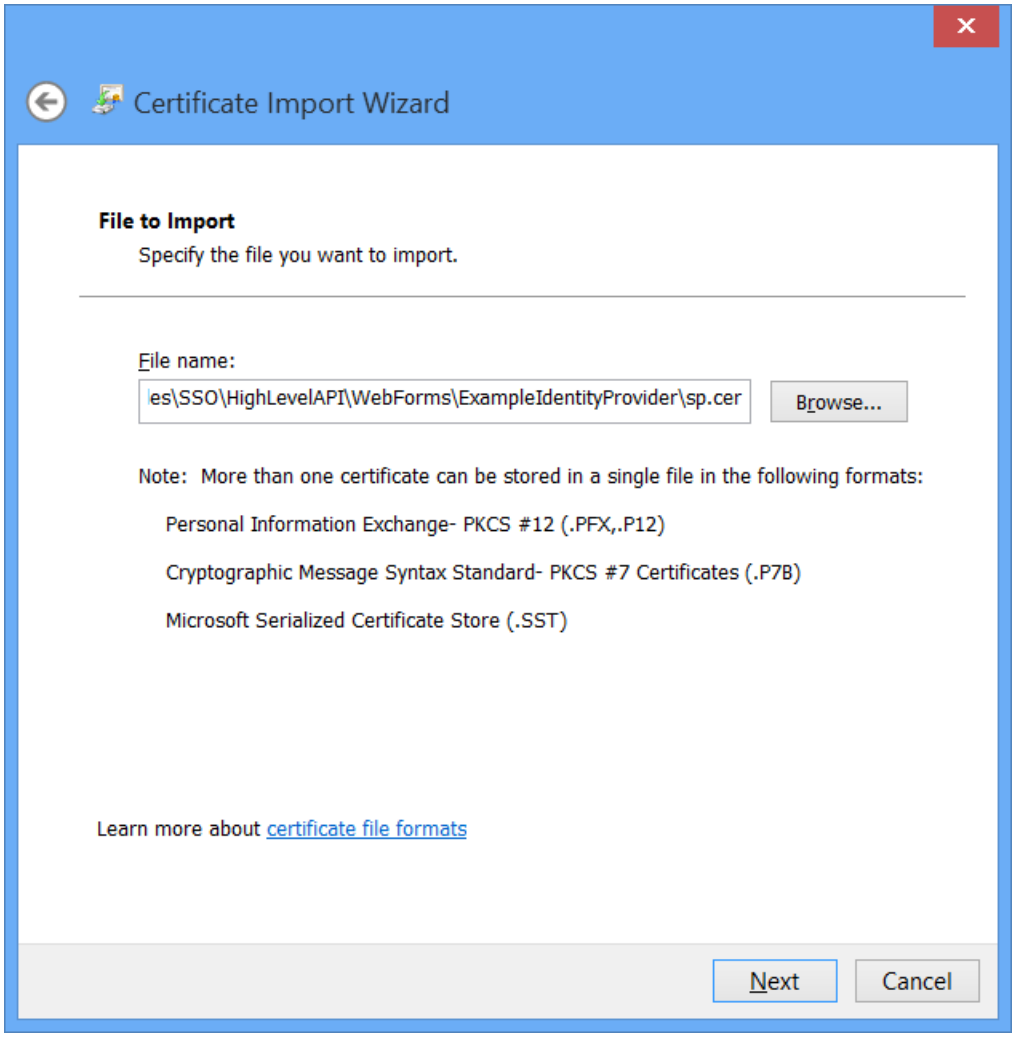
1. Select the Personal folder in the certificates tree.



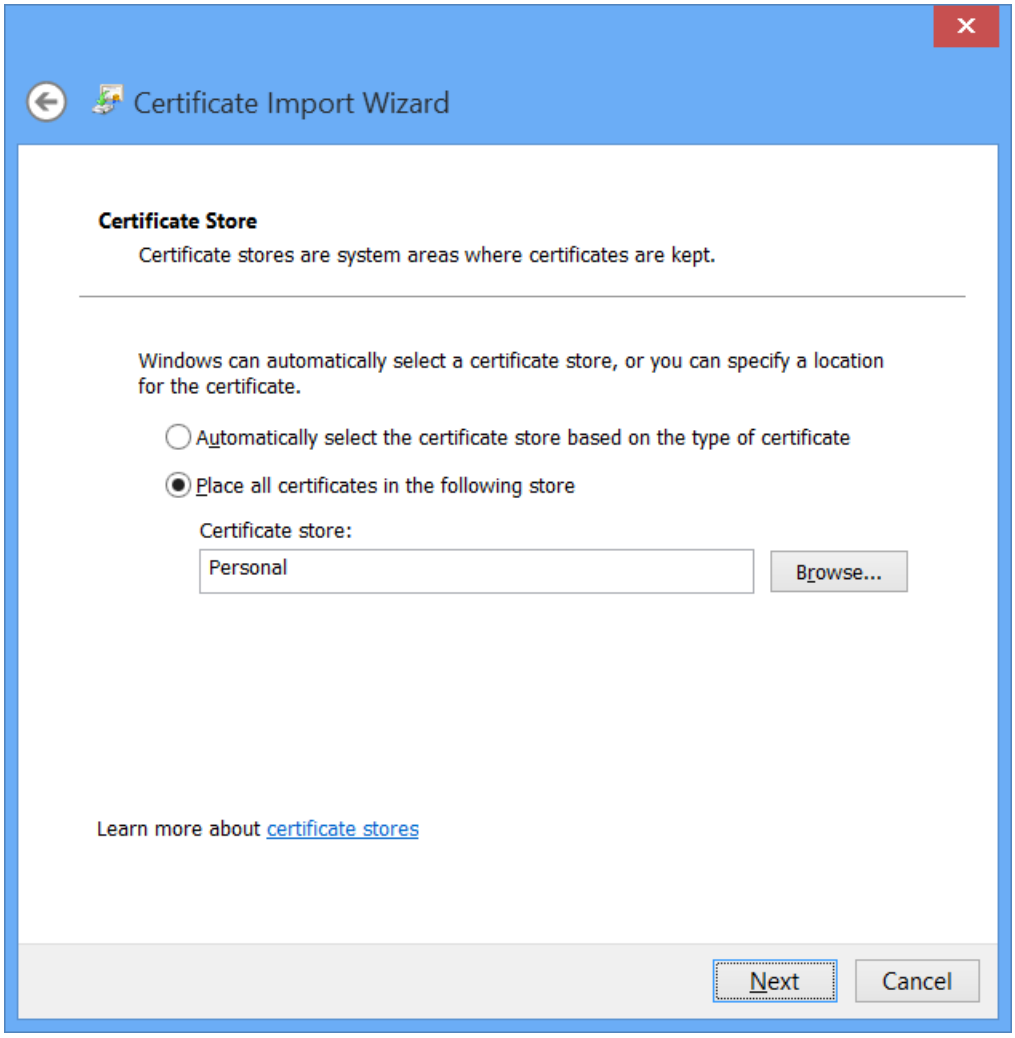
2. From the menu, click Action > All Tasks > Import…



3. Browse to the cer file to import.

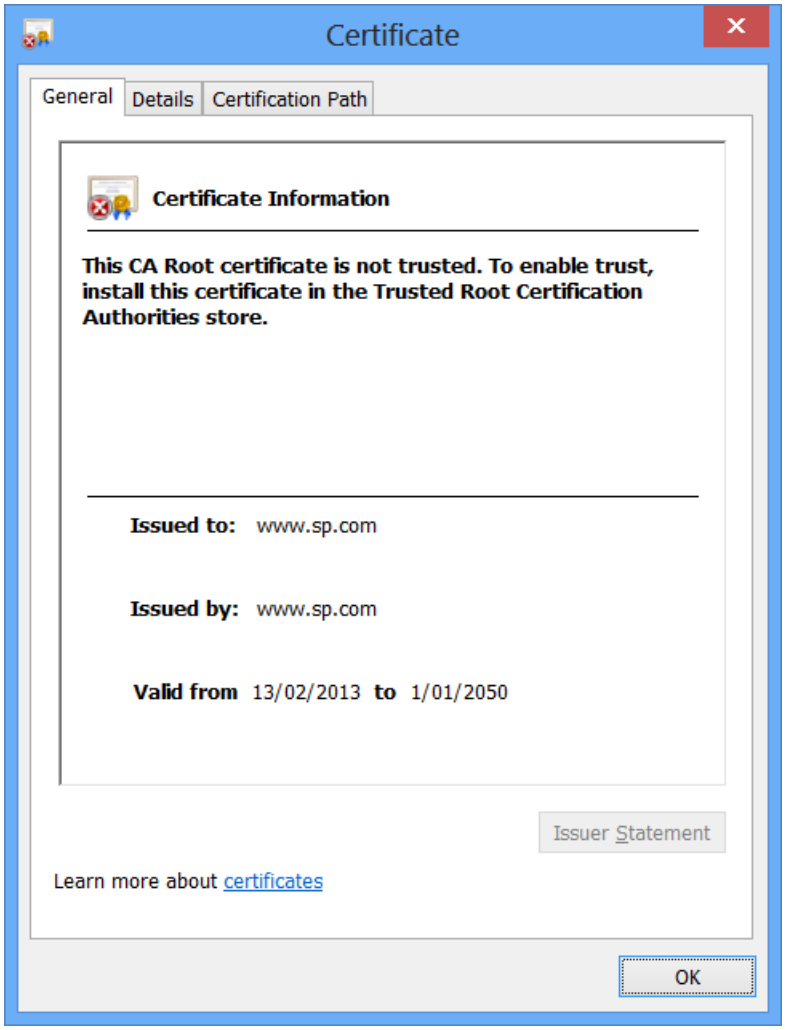


4. Place the certificate in the Personal certificate store.

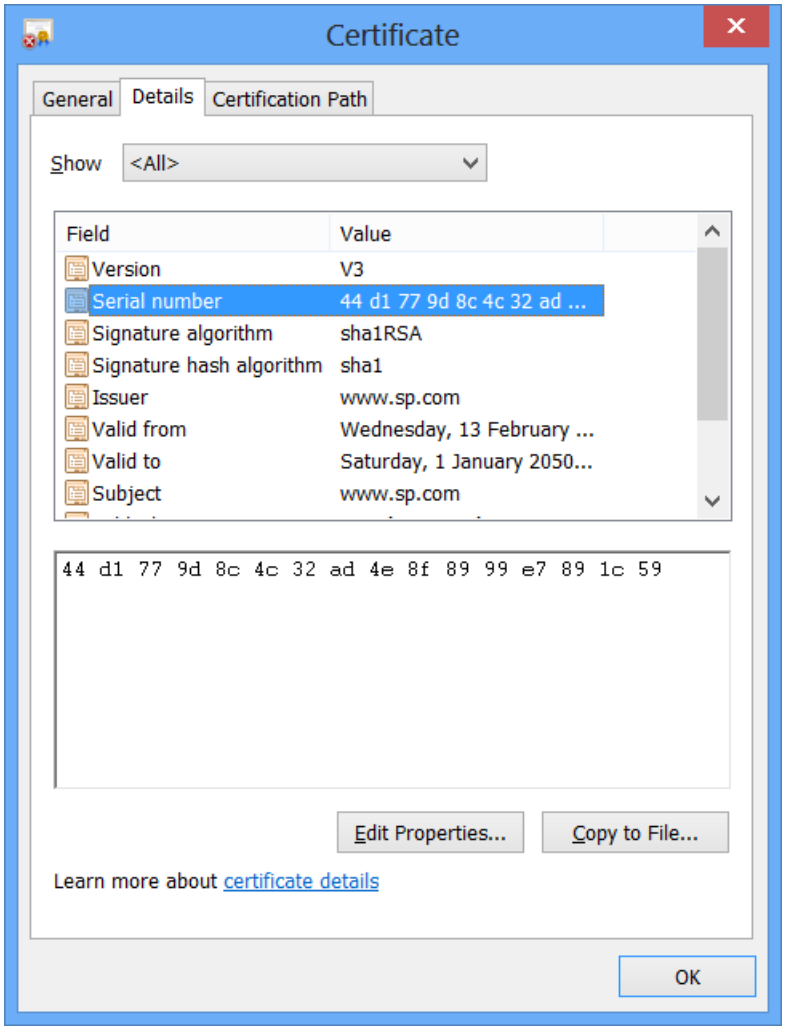


5. Click Finish to complete the import.

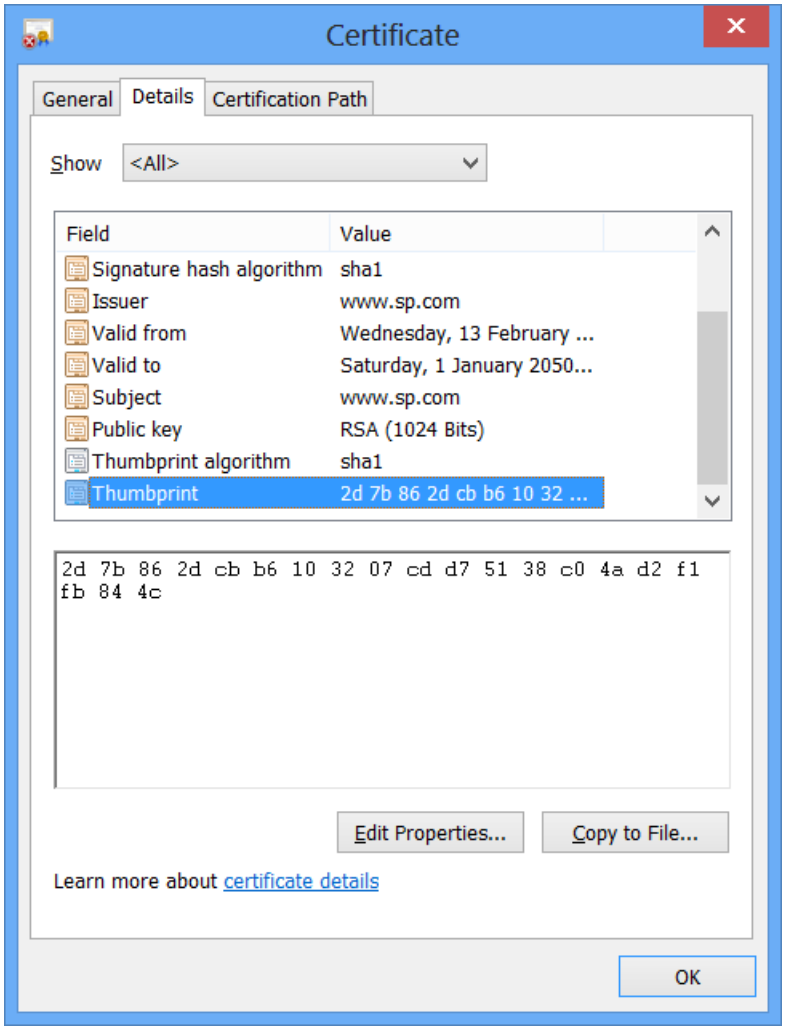
6. Confirm the certificate is listed and open it to review its details.



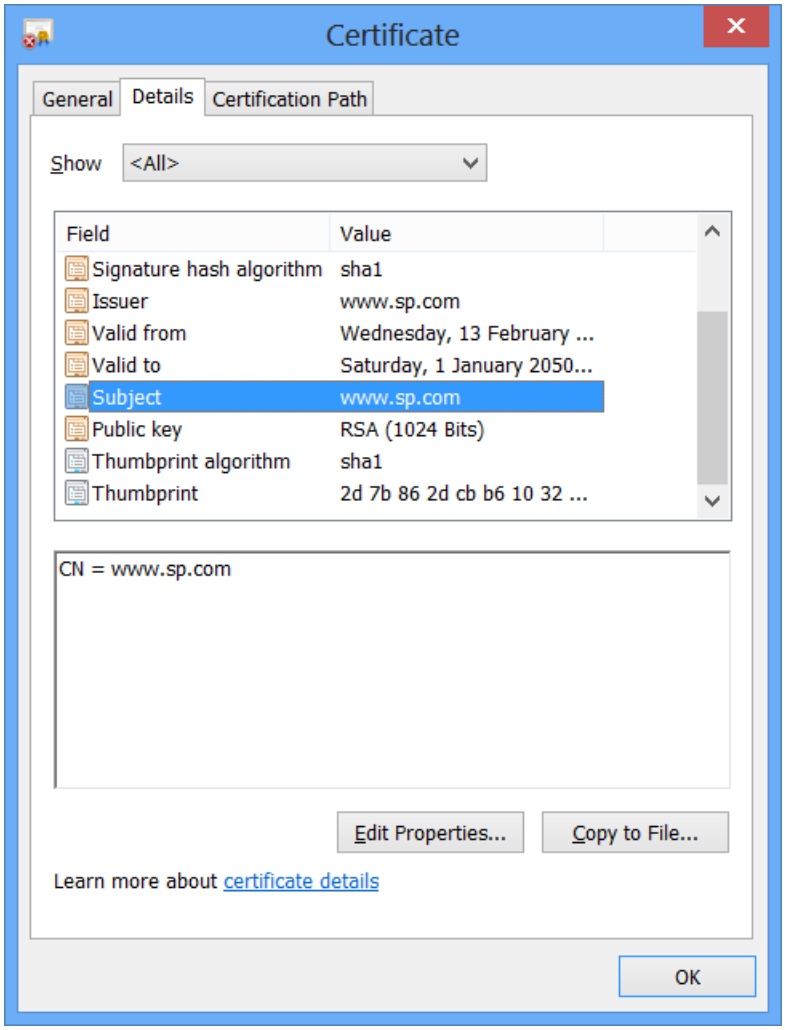
7. Note the certificate's serial number.



8. Note the certificate's thumbprint.



9. Note the certificate's subject name.



7.5 Local Provider Certificate Store

Refer to sections 7.4.1, 7.4.2 and 7.4.3 for instructions on importing a PFX file into the Windows certificate store.

The following configuration entry specifies the local provider's certificate is contained in the Windows certificate store and is identified by the certificate's serial number.

Serial numbers optionally may include separating space characters for readability.

If copying/pasting from the Windows certificate store, invisible Unicode characters may be included. It's best to first paste to Notepad etc. to avoid these issues.

```
<IdentityProvider Name="ExampleIdentityProvider"
                  CertificateSerialNumber=
                    "5896b16b7fcc9c9d4ef3ca1a9b2653bb"/>
```

The following configuration entry specifies the local provider's certificate is contained in the Windows certificate store and is identified by the certificate's thumbprint.

Thumbprints optionally may include separating space characters for readability.

If copying/pasting from the Windows certificate store, invisible Unicode characters may be included. It's best to first paste to Notepad etc. to avoid these issues.

```
<IdentityProvider Name="ExampleIdentityProvider"
                  CertificateThumbprint=
                    "371629967909a351de5017d6a3a51c6c15f3505c"/>
```

The following configuration entry specifies the local provider's certificate is contained in the Windows certificate store and is identified by the certificate subject's distinguished name.

```
<IdentityProvider Name="ExampleIdentityProvider"
                  CertificateSubject="CN=www.idp.com"/>
```

Alternatively, some subset of the subject's distinguished name that uniquely identifies the certificate may be used.

```
<IdentityProvider Name="ExampleIdentityProvider"
                  CertificateSubject="www.idp.com"/>
```

7.6 Partner Provider Certificate Store

Refer to sections 7.4.1 and 7.4.27.4.4 for instructions on importing a CER file into the Windows certificate store.

The following configuration entry specifies the partner provider's certificate is contained in the Windows certificate store and is identified by the certificate's serial number.

```
<PartnerServiceProvider Name="ExampleServiceProvider"
                        CertificateSerialNumber=
                          "44d1779d8c4c32ad4e8f8999e7891c59"/>
```

The following configuration entry specifies the partner provider's certificate is contained in the Windows certificate store and is identified by the certificate's thumbprint.

```
<PartnerServiceProvider Name="ExampleServiceProvider"
                        CertificateThumbprint=
                          "2d7b862dcbb6103207cdd75138c04ad2f1fb844c"/>
```

The following configuration entry specifies the partner provider's certificate is contained in the Windows certificate store and is identified by the certificate subject's distinguished name.

```
<PartnerServiceProvider Name="ExampleServiceProvider"
                        CertificateSubject="CN=www.sp.com"/>
```

Alternatively, some subset of the subject's distinguished name that uniquely identifies the certificate may be used.

```
<PartnerServiceProvider Name="ExampleServiceProvider"
                        CertificateSubject="www.sp.com "/>
```

8 Selecting the Most Applicable Example

For the majority of use cases, it's recommend the high level APIs are used as these provide the greatest ease of use.

8.1 High Level APIs

Use the following flow chart to determine the most suitable high level API example project to review.

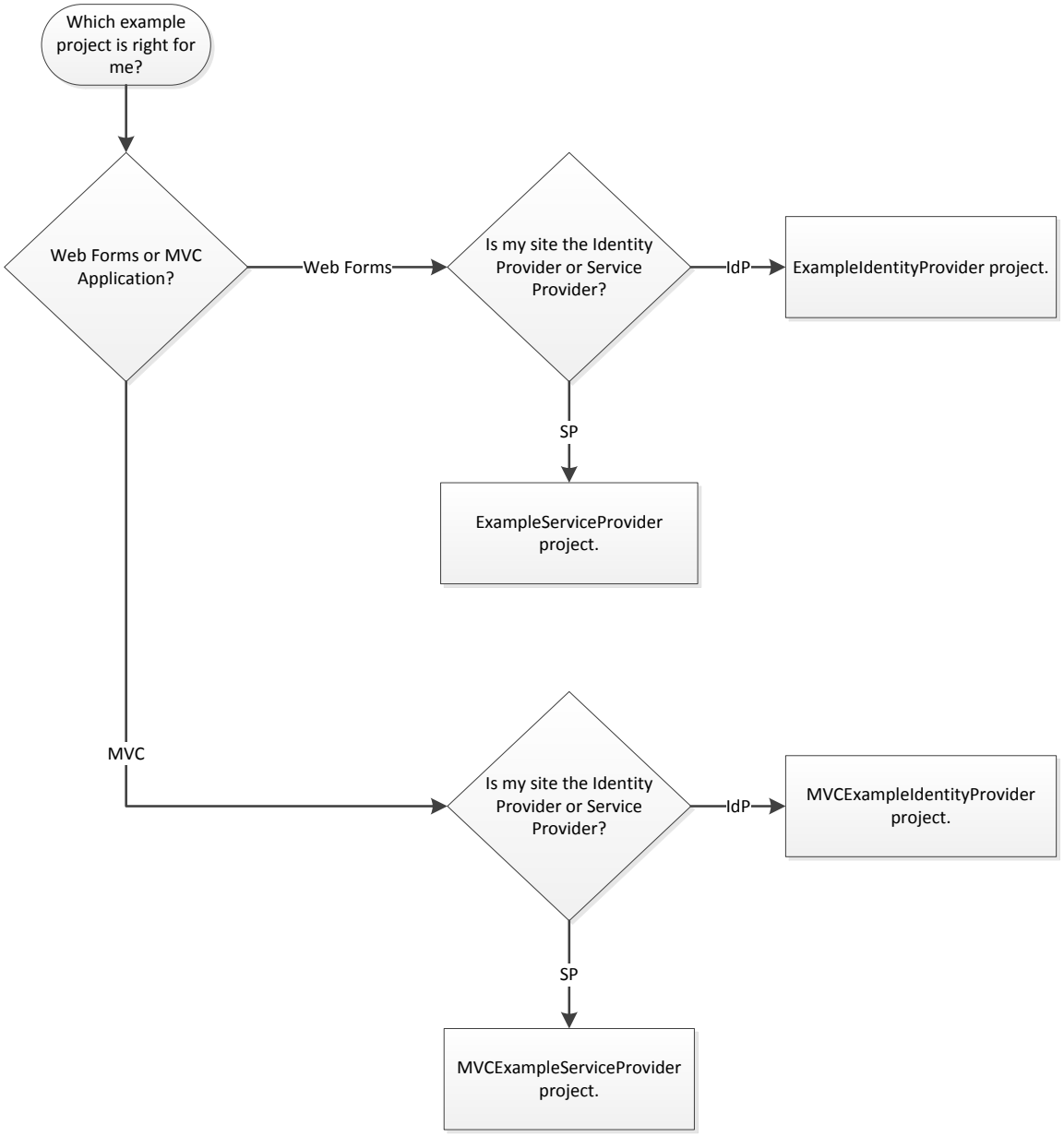


Figure 8 High Level API Project Selection Flow Chart

If your application is an ASP.NET web forms application then refer to the ExampleIdentityProvider or ExampleServiceProvider project depending on whether your site is the identity provider or service provider. See section 10.1 for more information.

If your application is an ASP.NET MVC application then refer to the MvcExampleIdentityProvider or MvcExampleServiceProvider project depending on

whether your site is the identity provider or service provider. See section 10.1.7 for more information.

8.2 Low Level APIs

Use the following flow chart to determine the most suitable low level API example project to review.

Note that the high level API examples include support for Google Apps, Salesforce, ADFS and Shibboleth, as well as IdP-initiated and SP-initiated SSO.

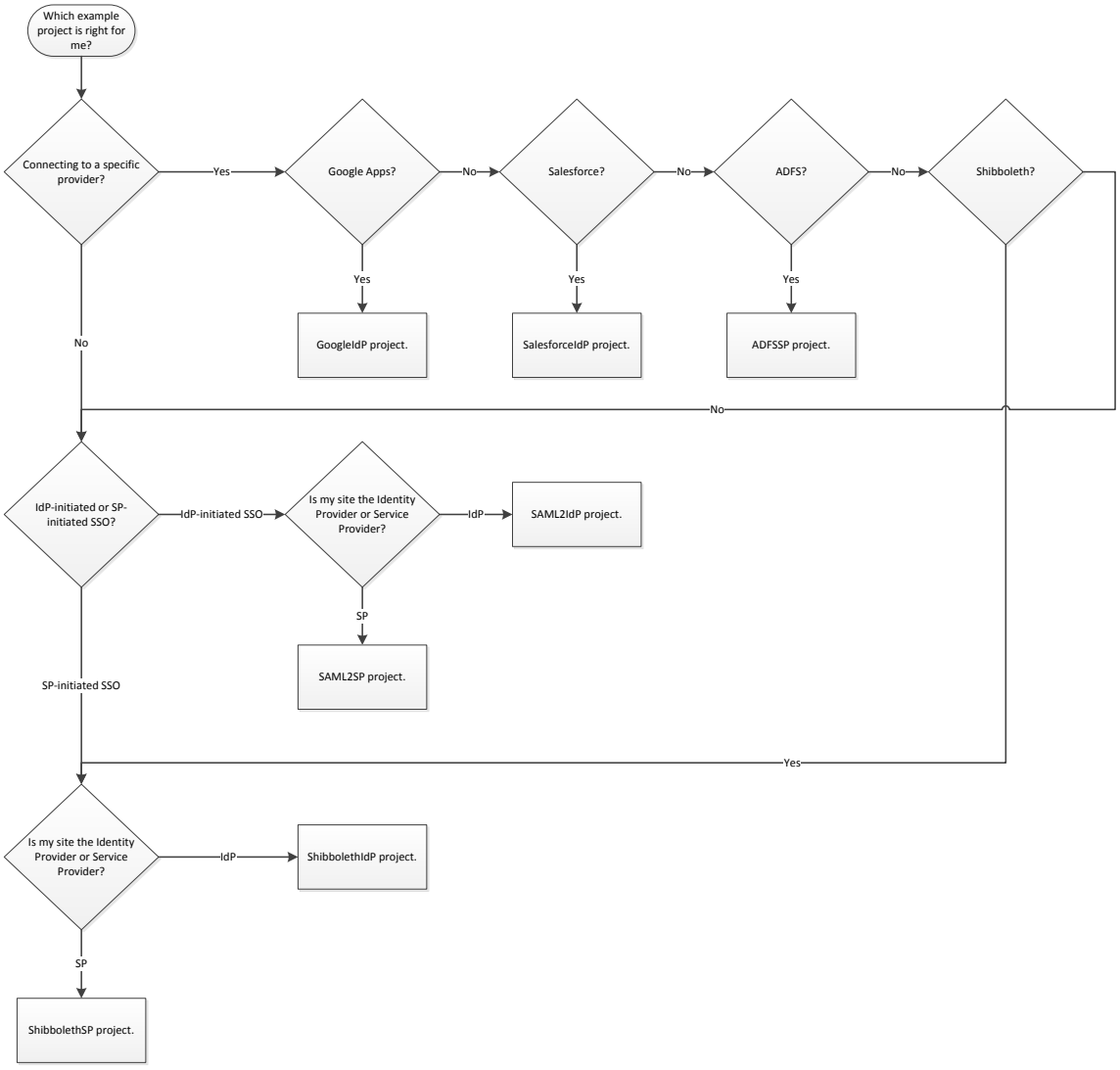


Figure 9 Low Level API Project Selection Flow Chart

If you're connecting to a specific provider such as Google Apps etc then refer to the corresponding example project. If the provider is not listed then use one of the generic projects or contact us for assistance.

For IdP-initiated SSO, refer to the SAML2IdP or SAML2SP project depending on whether your site is the identity provider or service provider.
For SP-initiated SSO, refer to the ShibbolethIdP or ShibbolethSP project depending on whether your site is the identity provider or service provider.

The ShibbolethIdP and ShibbolethSP projects have been tested against the Shibboleth test servers at https://www.testshib.org/testshib-two/. In some senses, Shibboleth is a reference implementation for the SAML specification.

9 Building the Example Applications

Solution files for Visual Studio 2005, 2008, 2010 and 2012 may be found in the root folder (e.g. C:\Program Files (x86)\ComponentSpace SAML v2.0 for .NET).

- SAMLExamplesVS2012.sln – Visual Studio 2012
- SAMLExamplesVS2010.sln – Visual Studio 2010
- SAMLExamplesVS2008.sln – Visual Studio 2008
- SAMLExamplesVS2005.sln – Visual Studio 2005

Select the appropriate solution file to build the example projects.

The Visual Studio 2012 solution includes publish definitions for publishing to the default web site on the local host.

The projects should build and run without error.

10 Example Applications – High Level APIs

The class library ships with a number of example applications. They are a good way to become familiar with the SAML v2.0 web browser SSO profile and using the class library. You may use the examples solution to build these projects.

The example applications must be built and published prior to their use.

The following sections describe the installation and execution of these example applications.

The example web forms applications described in section 10.1 demonstrate IdP-initiated and SP-initiated SSO. These applications are written in C#.

The example MVC applications described in sections 10.1.7 demonstrate IdP-initiated and SP-initiated SSO. These applications are written in C#.

10.1 Web Forms Identity Provider and Service Provider

The ExampleIdentityProvider and ExampleServiceProvider web applications demonstrate IdP-initiated and SP-initiated single sign-on.

10.1.1 Installing the Web Forms Identity Provider

1. Using Visual Studio, build and publish the web application.

2. Open the Internet Information Services management console.
3. Under the default web site for the local computer, create an application with an alias of ExampleIdentityProvider.
4. For the physical path, browse to the directory where ExampleIdentityProvider was built and published.
5. Ensure the web application has been successfully installed by browsing to http://localhost/ ExampleIdentityProvider.

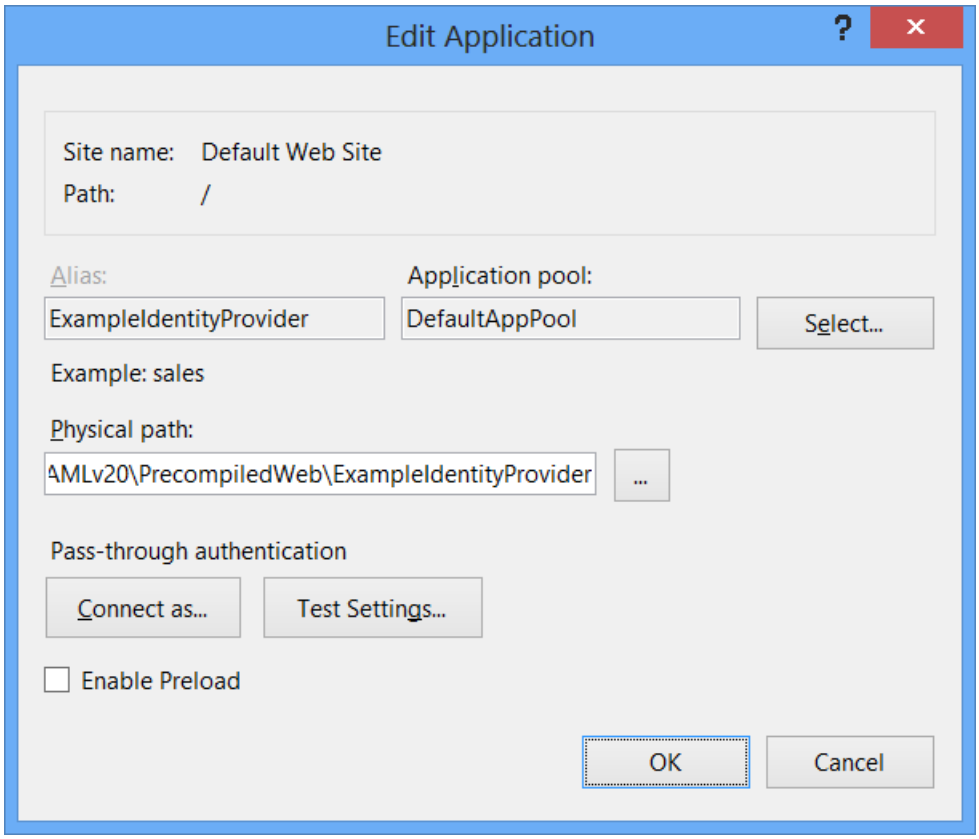


Figure 10 ExampleIdentityProvider Installation

10.1.2 Installing the Web Forms Service Provider

1. Using Visual Studio, build and publish the web application.
2. Open the Internet Information Services management console.
3. Under the default web site for the local computer, create an application with an alias of ExampleServiceProvider.
4. For the physical path, browse to the directory where ExampleServiceProvider was built and published.
5. Ensure the web application has been successfully installed by browsing to http://localhost/ ExampleServiceProvider.

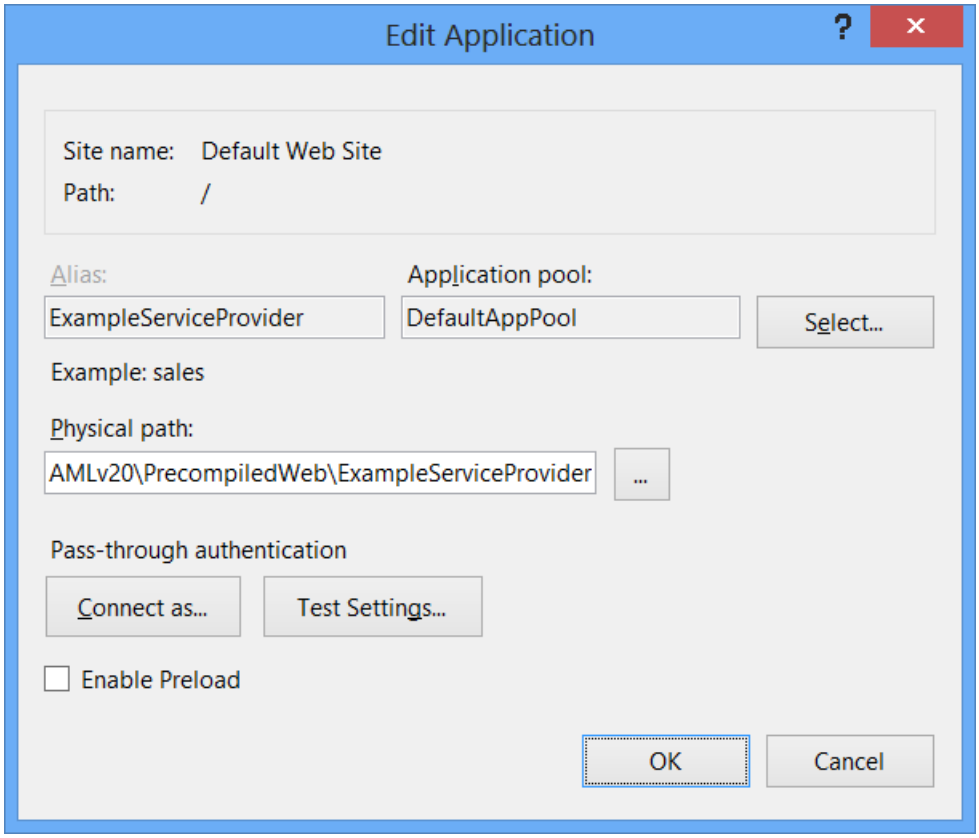


Figure 11 ExampleServiceProvider Installation

10.1.3 Configuring the Web Forms Identity Provider

The identity provider configuration is contained within its web.config file's <appSettings> section and the saml.config file.

The saml.config includes the local identity provider configuration as well as partner service provider configuration.

The web.config's *PartnerSP* setting specifies the partner service provider for IdP-initiated SSO.

The default configuration supports single sign-on with the ExampleServiceProvider.

10.1.4 Configuring the Web Forms Service Provider

The service provider configuration is contained within its web.config file's <appSettings> section and the saml.config file.

The saml.config includes the local service provider configuration as well as partner identity provider configuration.

The web.config's *PartnerIdP* setting specifies the partner identity provider for SP-initiated SSO.

The default configuration supports single sign-on with the ExampleIdentityProvider.

10.1.5 IdP-Initiated SSO from the Web Forms Identity Provider

In this example, the user starts at the identity provider site and is attempting to access a protected resource on the service provider. Rather than performing a local login at the service provider, SSO is initiated with a local login occurring at the identity provider and the asserted identity, passed to the service provider in a SAML assertion, is used to perform an automatic login at the service provider.

1. Browse to http://localhost/ExampleIdentityProvider.
2. You should be presented with the form shown in Figure 12.

   If you are not then you must already have logged in at the identity provider. To force a login, close the browser and start again.
3. Login using the user name *idp-user* and a password of *password*.
4. You should then be presented with the identity provider's default page (see Figure 13).
5. Click the link to single sign-on to the service provider.
6. You should then be presented with the service provider's default page (see Figure 14).

   This means you've successfully completed a SAML v2.0 SSO and are logged in at the service provider with your identity provider user name.

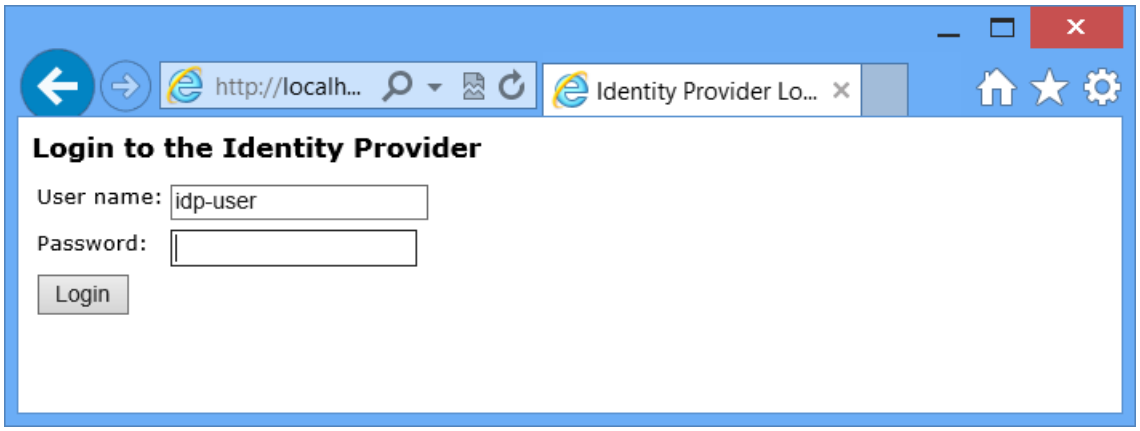


Figure 12 Web Forms Example Identity Provider Login Page

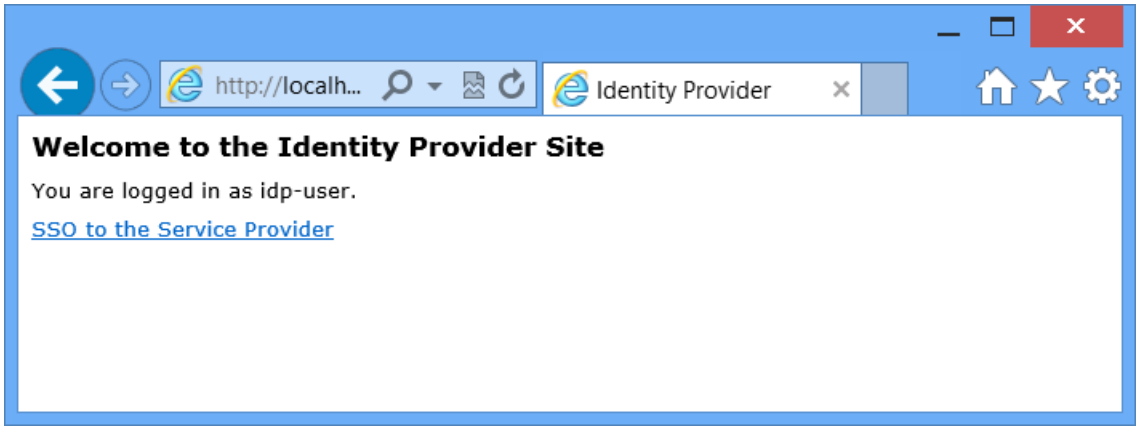


Figure 13 Web Forms Example Identity Provider Default Page

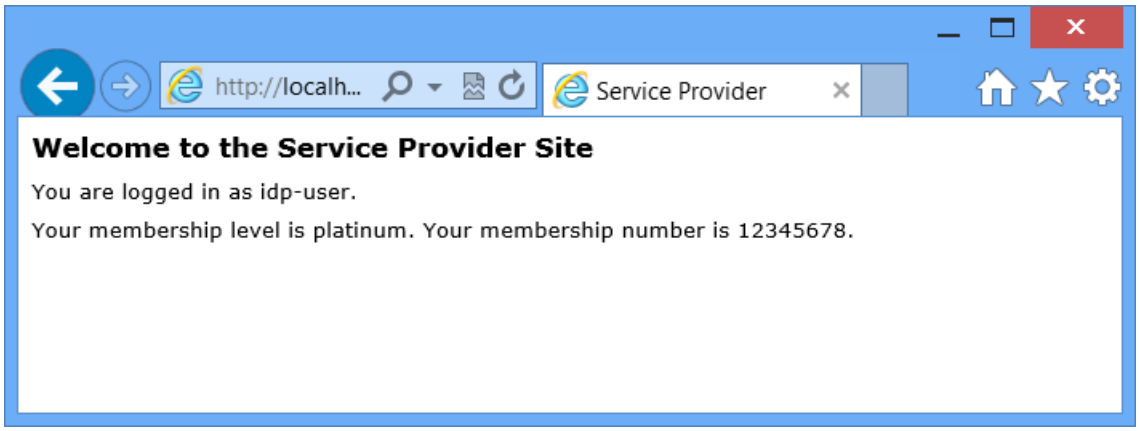


Figure 14 Web Forms Example Service Provider Home Page

10.1.6 SP-Initiated SSO from the Web Forms Service Provider

In this example, the user starts at the service provider site and is attempting to access a protected resource on the service provider. Rather than performing a local login at the service provider, SSO is initiated with a local login occurring at the identity provider and the asserted identity, passed to the service provider in a SAML assertion, is used to perform an automatic login at the service provider.

1. Browse to http://localhost/ExampleServiceProvider.
2. You should then be presented with the service provider's login page.
3. Click the link to single sign-on to the identity provider.
4. You should be presented with the form shown in Figure 15.

   If you are not then you must already have logged in at the identity provider. To force a login, close the browser and start again.
5. Login using the user name *idp-user* and a password of *password*.

6. You should then be presented with the service provider's default page (see Figure 16).

   This means you've successfully completed a SAML v2.0 SSO and are logged in at the service provider with your identity provider user name.

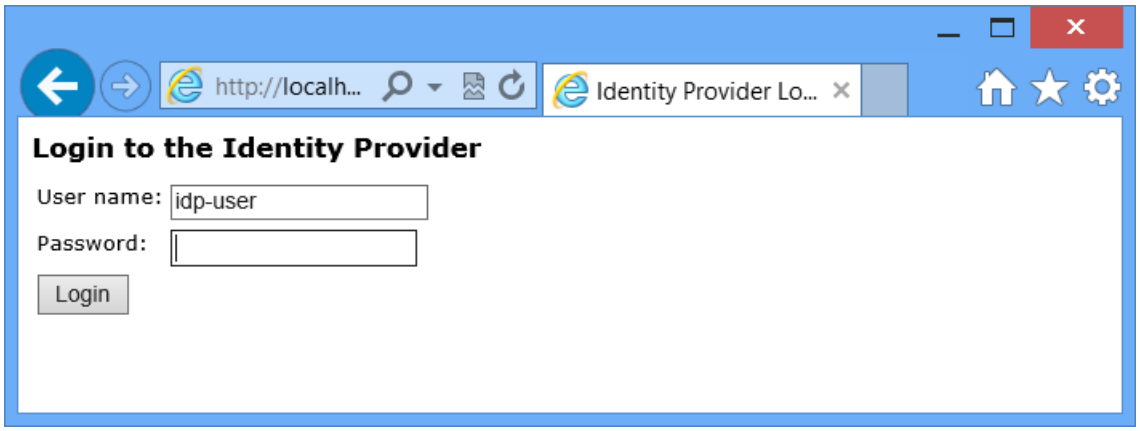


Figure 15 Web Forms Example Identity Provider Login Page

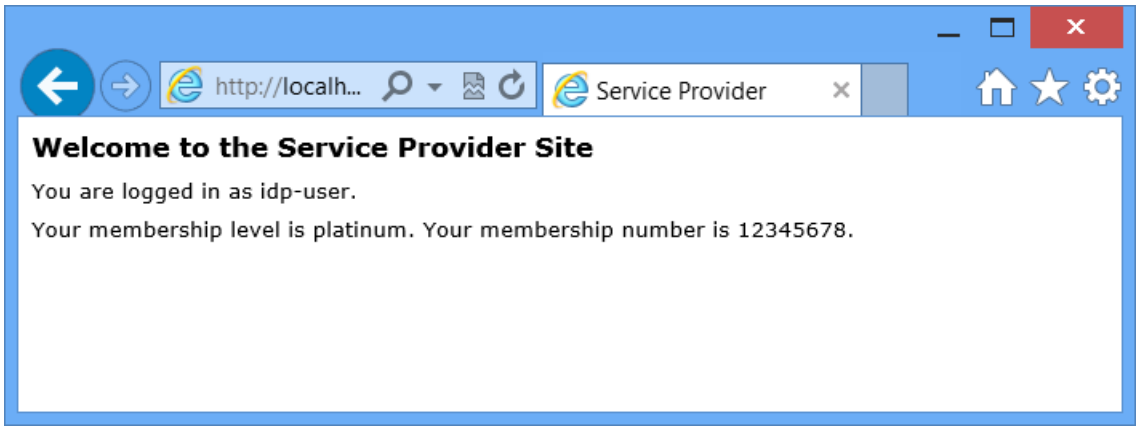


Figure 16 Web Forms Example Service Provider Home Page

10.1.7 Code Walkthrough - IdP-Initiated SSO

The following section follows the flow of IdP-initiated SSO between the ExampleIdentityProvider and ExampleServiceProvider.

1. The user clicks the link on the ExampleIdentityProvider's Default.aspx page and the SAMLIdentityProvider.InitiateSSO method is called to initiate SSO.
2. A SAML response containing a SAML assertion is constructed and sent to the service provider's assertion consumer service URL.

3. The ExampleServiceProvider's SAML/AssertionConsumerService.aspx page calls the SAMLServiceProvider.ReceiveSSO method to receive and process the SAML response.
4. The user is logged in automatically at the ExampleServiceProvider.

10.1.8 Code Walkthrough - SP-Initiated SSO

The following section follows the flow of SP-initiated SSO between the ExampleIdentityProvider and ExampleServiceProvider.

1. The user browses to the ExampleServiceProvider's Default.aspx page and the SAMLServiceProvider.InitiateSSO method is called to initiate SSO.
2. An authentication request is constructed and sent to the identity provider's SSO service URL.
3. The ExampleIdentityProvider's SAML/SSOService.aspx page calls the SAMLIdentityProvider.ReceiveSSO method to receive and process the authentication request.
4. The user is prompted to login at the ExampleIdentityProvider if not already logged in.
5. The ExampleIdentityProvider's SAML/SSOService.aspx page calls the SAMLIdentityProvider.SendSSO method.
6. A SAML response containing a SAML assertion is constructed and sent to the service provider's assertion consumer service URL.
7. The ExampleServiceProvider's SAML/AssertionConsumerService.aspx page calls the SAMLServiceProvider.ReceiveSSO method to receive and process the SAML response.
8. The user is logged in automatically at the ExampleServiceProvider.

10.2 MVC Identity Provider and Service Provider

The MvcExampleIdentityProvider and MvcExampleServiceProvider web applications demonstrate IdP-initiated and SP-initiated single sign-on.

The applications use MVC4 but the SAML v2.0 component may be used with earlier versions of MVC.

The MVC examples require Visual Studio 2012, or Visual Studio 2010 with the MVC4 upgrade.

10.2.1 Installing the MVC Identity Provider

1. Using Visual Studio, build and publish the web application.
2. Open the Internet Information Services management console.
3. Under the default web site for the local computer, create an application with an alias of MvcExampleIdentityProvider.

4. For the physical path, browse to the directory where MvcExampleIdentityProvider was built and published.
5. Ensure the web application has been successfully installed by browsing to http://localhost/ MvcExampleIdentityProvider.

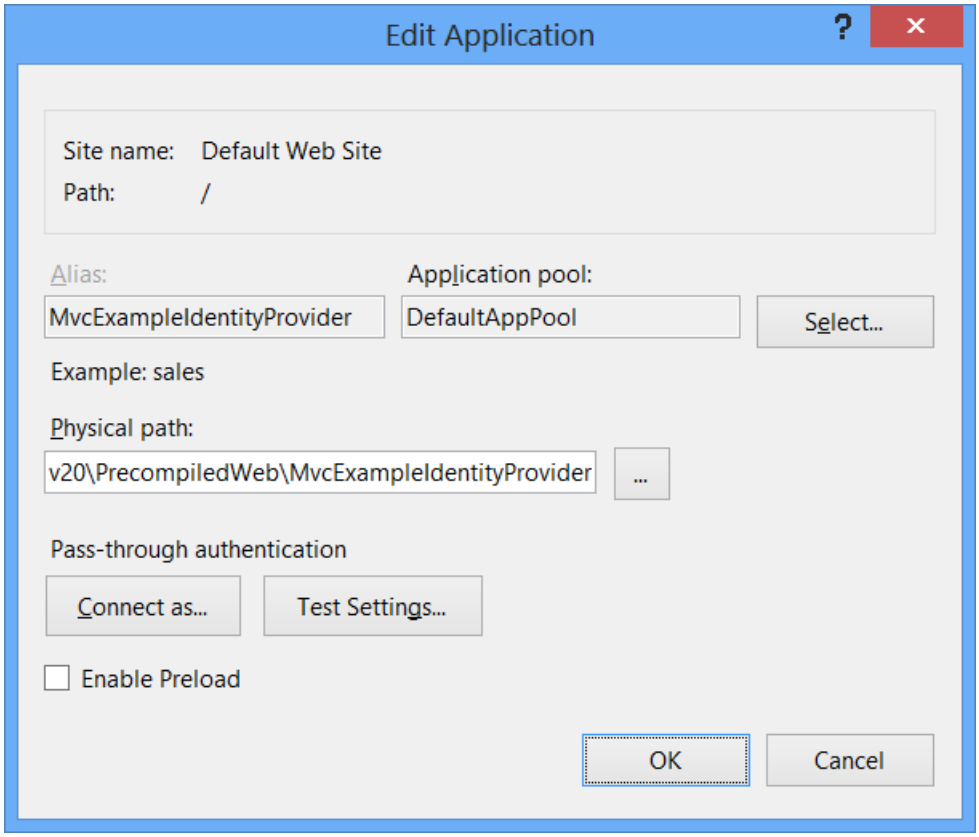


Figure 17 MvcExampleIdentityProvider Installation

10.2.2 Installing the MVC Service Provider

1. Using Visual Studio, build and publish the web application.
2. Open the Internet Information Services management console.
3. Under the default web site for the local computer, create an application with an alias of MvcExampleServiceProvider.
4. For the physical path, browse to the directory where MvcExampleServiceProvider was built and published.
5. Ensure the web application has been successfully installed by browsing to http://localhost/ MvcExampleServiceProvider.

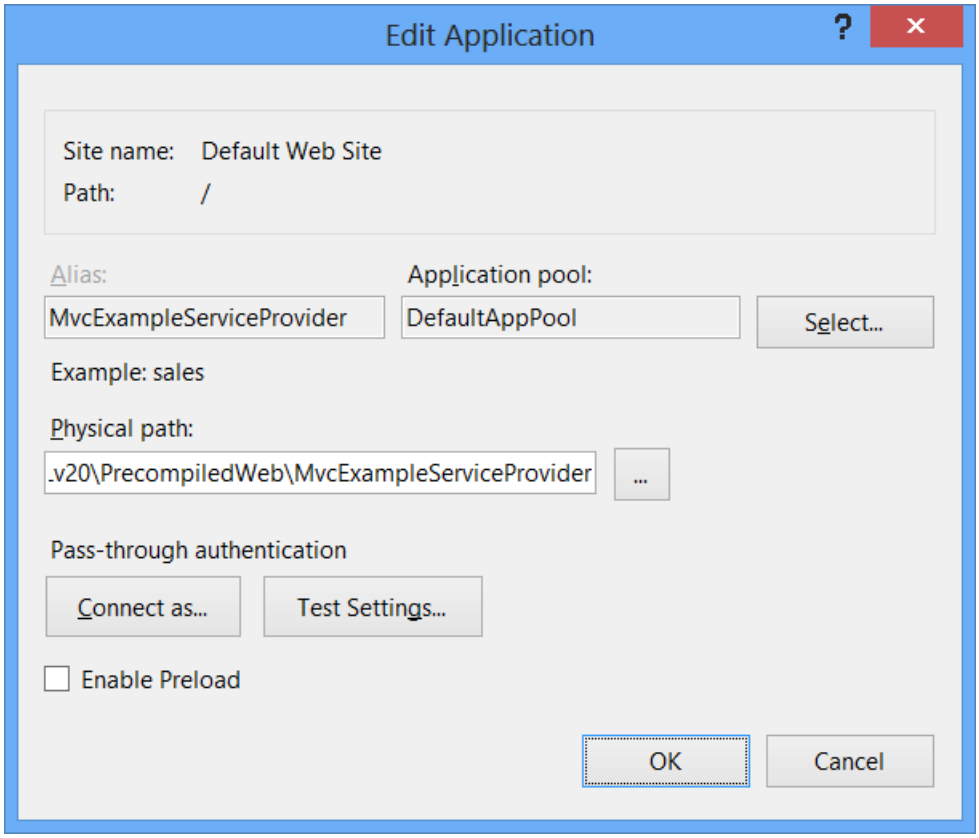


Figure 18 MvcExampleServiceProvider Installation

10.2.3 Configuring the MVC Identity Provider

The identity provider configuration is contained within its web.config file's <appSettings> section and the saml.config file.

The saml.config includes the local identity provider configuration as well as partner service provider configuration.

The web.config's *PartnerSP* setting specifies the partner service provider for IdP-initiated SSO.

The default configuration supports single sign-on with the MvcExampleServiceProvider.

10.2.4 Configuring the MVC Service Provider

The service provider configuration is contained within its web.config file's <appSettings> section and the saml.config file.

The saml.config includes the local service provider configuration as well as partner identity provider configuration.

The web.config's *PartnerIdP* setting specifies the partner identity provider for SP-initiated SSO.

The default configuration supports single sign-on with the MvcExampleIdentityProvider.

10.2.5 IdP-Initiated SSO from the MVC Identity Provider

In this example, the user starts at the identity provider site and is attempting to access a protected resource on the service provider. Rather than performing a local login at the service provider, SSO is initiated with a local login occurring at the identity provider and the asserted identity, passed to the service provider in a SAML assertion, is used to perform an automatic login at the service provider.

1. Browse to http://localhost/MvcExampleIdentityProvider.
2. You should be presented with the form shown in Figure 19.

   If you are not then you must already have logged in at the identity provider. To force a login, close the browser and start again.
3. Login using the user name *idp-user* and a password of *password*.
4. You should then be presented with the identity provider's default page (see Figure 20).
5. Click the link to single sign-on to the service provider.
6. You should then be presented with the service provider's default page (see Figure 21).

   This means you've successfully completed a SAML v2.0 SSO and are logged in at the service provider with your identity provider user name.

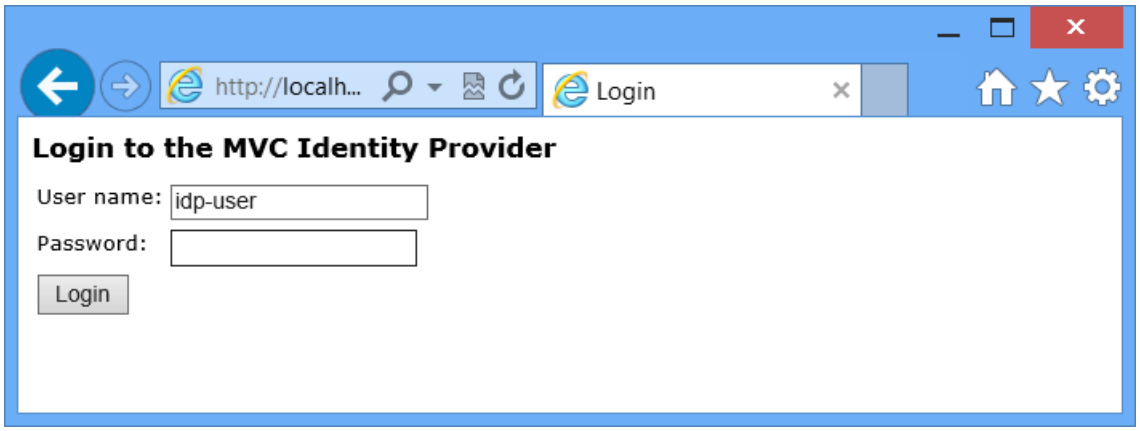


Figure 19 MVC Example Identity Provider Login Page

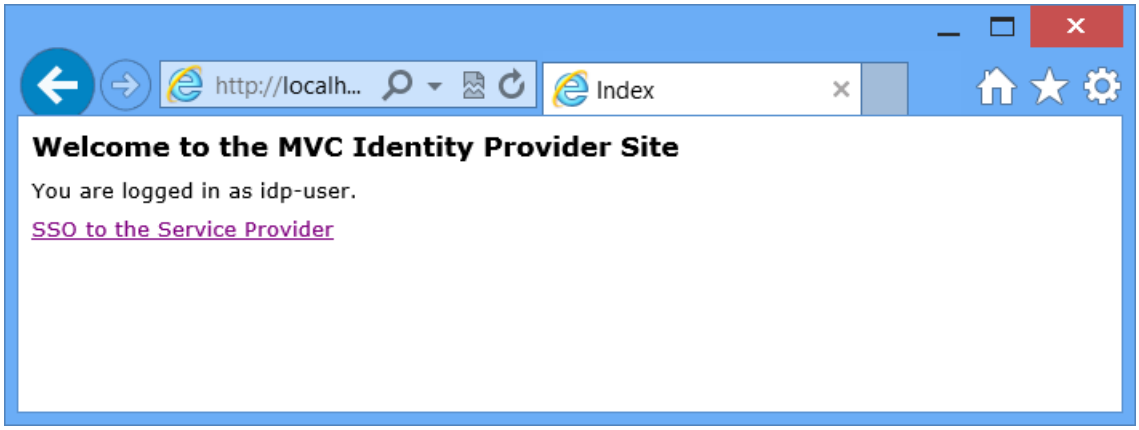


Figure 20 MVC Example Identity Provider Default Page

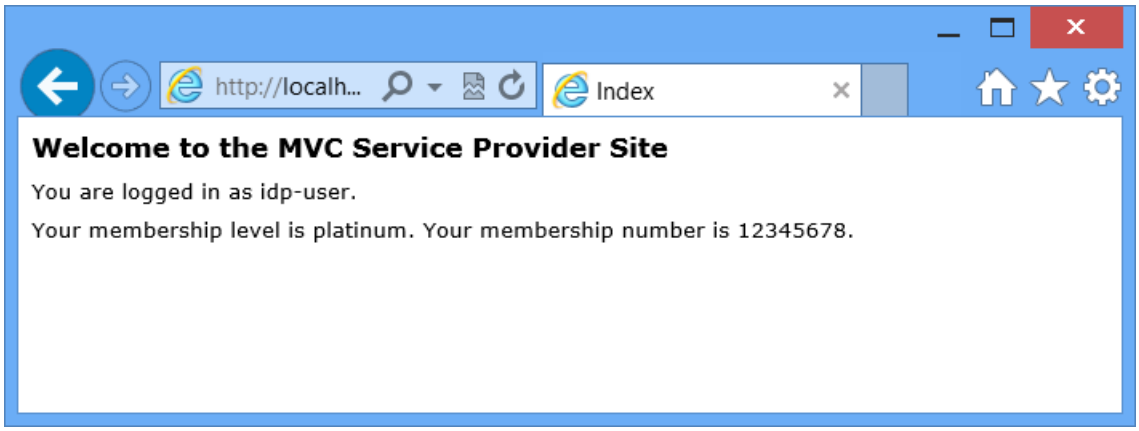


Figure 21 MVC Example Service Provider Home Page

10.2.6 SP-Initiated SSO from the MVC Service Provider

In this example, the user starts at the service provider site and is attempting to access a protected resource on the service provider. Rather than performing a local login at the service provider, SSO is initiated with a local login occurring at the identity provider and the asserted identity, passed to the service provider in a SAML assertion, is used to perform an automatic login at the service provider.

1. Browse to http://localhost/MvcExampleServiceProvider.
2. You should then be presented with the service provider's login.
3. Click the link to single sign-on to the identity provider.
4. You should be presented with the form shown in Figure 22.

   If you are not then you must already have logged in at the identity provider. To force a login, close the browser and start again.
5. Login using the user name *idp-user* and a password of *password*.

6. You should then be presented with the service provider's default page (see Figure 23).

   This means you've successfully completed a SAML v2.0 SSO and are logged in at the service provider with your identity provider user name.

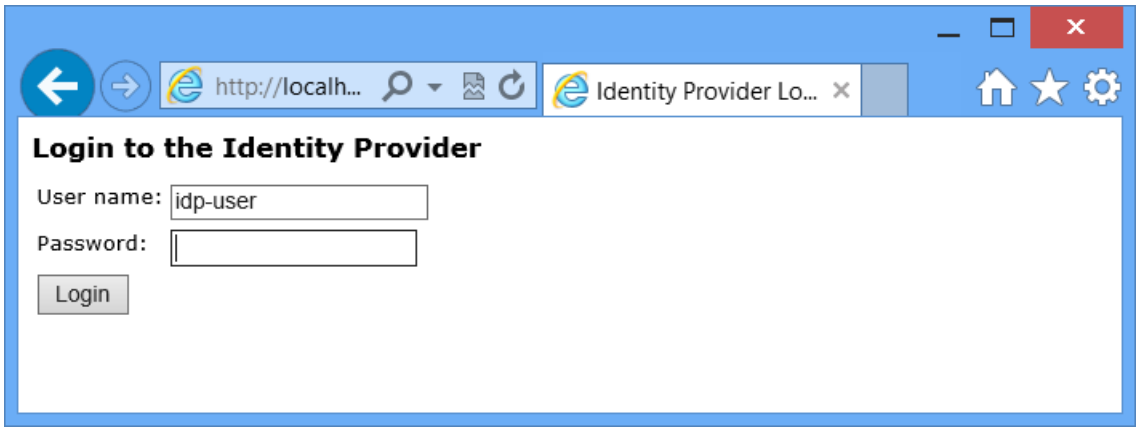


Figure 22 MVC Example Identity Provider Login Page

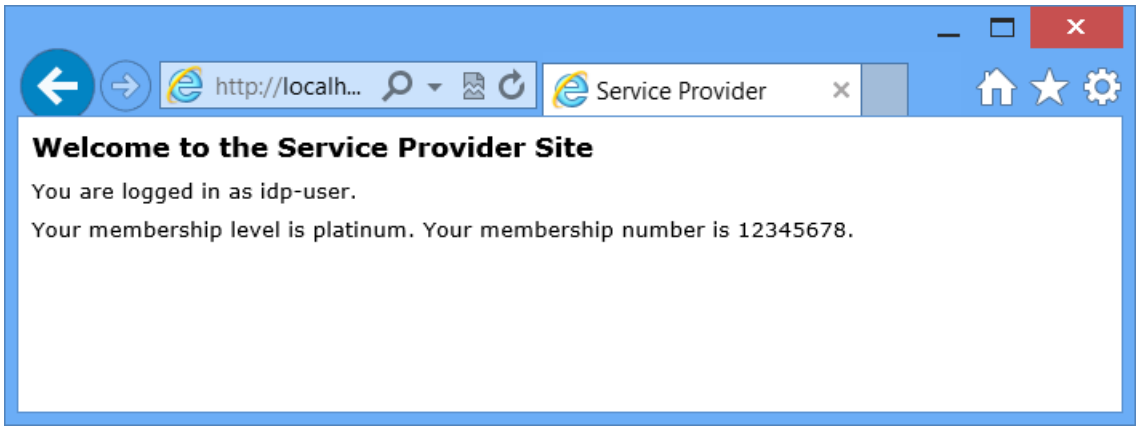


Figure 23 MVC Example Service Provider Home Page

10.2.7 Code Walkthrough - IdP-Initiated SSO

The following section follows the flow of IdP-initiated SSO between the MvcExampleIdentityProvider and MvcExampleServiceProvider.

1. The user clicks the link on the MvcExampleIdentityProvider's home page and the HomeController calls the SAMLIdentityProvider.InitiateSSO method to initiate SSO.
2. A SAML response containing a SAML assertion is constructed and sent to the service provider's assertion consumer service URL.

3. The MvcExampleServiceProvider's SAMLController calls the SAMLServiceProvider.ReceiveSSO method to receive and process the SAML response.
4. The user is logged in automatically at the MvcExampleServiceProvider.

10.2.8 Code Walkthrough - SP-Initiated SSO

The following section follows the flow of SP-initiated SSO between the MvcExampleIdentityProvider and MvcExampleServiceProvider.

1. The user browses to the MvcExampleServiceProvider's home page and the AccountController calls the SAMLServiceProvider.InitiateSSO method to initiate SSO.
2. An authentication request is constructed and sent to the identity provider's SSO service URL.
3. The MvcExampleIdentityProvider's SAMLController calls the SAMLIdentityProvider.ReceiveSSO method to receive and process the authentication request.
4. The user is prompted to login at the MvcExampleIdentityProvider if not already logged in.
5. The MvcExampleIdentityProvider's SAMLController calls the SAMLIdentityProvider.SendSSO method.
6. A SAML response containing a SAML assertion is constructed and sent to the service provider's assertion consumer service URL.
7. The MvcExampleServiceProvider's SAMLController calls the SAMLServiceProvider.ReceiveSSO method to receive and process the SAML response.
8. The user is logged in automatically at the MvcExampleServiceProvider.

10.3 ADFS Interoperability

The Web Forms and MVC example identity and service providers demonstrate single sign-on with Windows Active Directory Federation Services (ADFS).

The following sections describe the configuration for the Web Forms example identity provider and service provider but, with the appropriate changes, apply equally to the MVC examples.

Refer to sections 10.1 and 10.2 for instructions on installing and configuring the Web Forms and MVC example identity and service providers.

10.3.1 Miscellaneous Configuration

For the purposes of these examples, the host name of the ComponentSpace example applications is cs.test and the host name of the ADFS server is adfs.test.

If using these host names, update the Windows\System32\drivers\etc\hosts file on the test and ADFS servers to include entries for cs.test and adfs.test. For example:

192.168.1.20 cs.test
192.168.1.21 adfs.test

10.3.2 Configuring the Service Provider

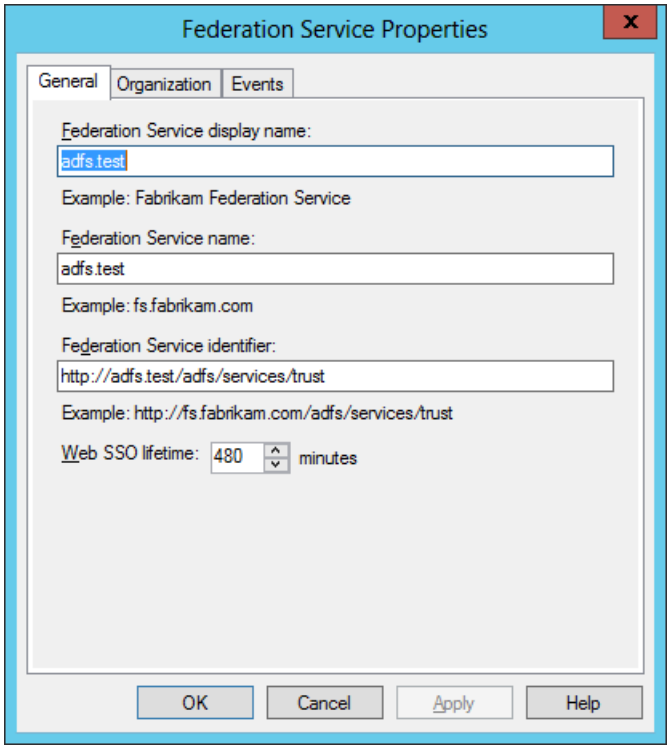
The following sections describe interoperability between the example service provider and ADFS acting as the claims provider (i.e. identity provider).

The saml.config file includes the following entry for the ADFS partner identity provider.

```
<PartnerIdentityProvider Name="http://adfs.test/adfs/services/trust"
                         SignAuthnRequest="true"
                         WantResponseSigned="false"
                         WantAssertionSigned="true"
                         WantAssertionEncrypted="true"
                         UseEmbeddedCertificate="true"
                         SingleSignOnServiceUrl=
                             "https://adfs.test/adfs/ls/"/>
```

The name must match with the issuer name ADFS uses in the returned SAML response. For example, if ADFS is deployed to the myadfs server then the name must be http://myadfs/adfs/services/trust.

The ADFS federation services properties lists the federation service identifier.



The *UseEmbeddedCertificate* flag is set to simplify the configuration. If not set then the ADFS signature certificate needs to be imported to the service provider and configured in the SAML configuration certificate manager.

The web.config's *PartnerIdP* setting specifies the partner identity provider for SP-initiated SSO and should be set to http://www.idp.com/adfs/services/trust.

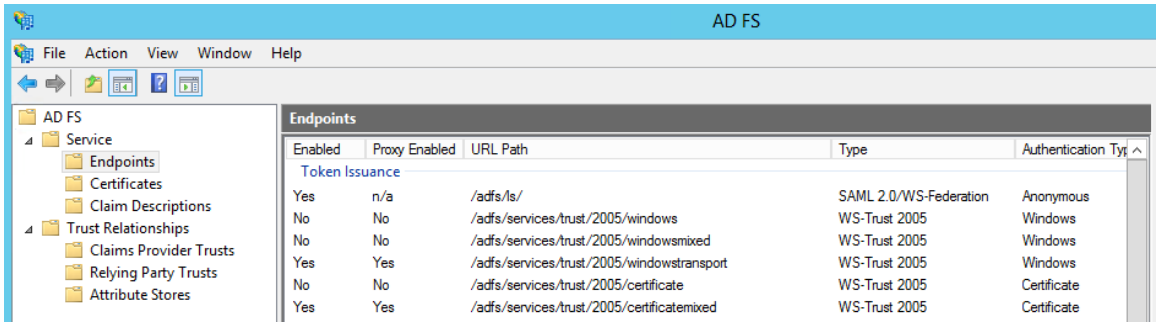
```
<add key="PartnerIdP" value="http://adfs.test/adfs/services/trust"/>
```

10.3.3 Configuring ADFS – Adding a Relying Party

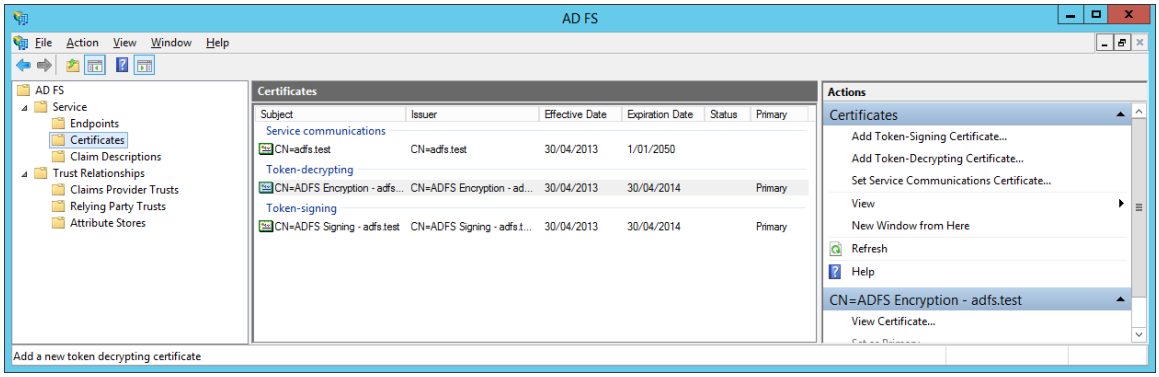
In the ADFS terminology, the service provider is a relying party. Using the ADFS management console, add a relying party trust for the service provider.

Note that strings in ADFS, including URLs, are case sensitive.

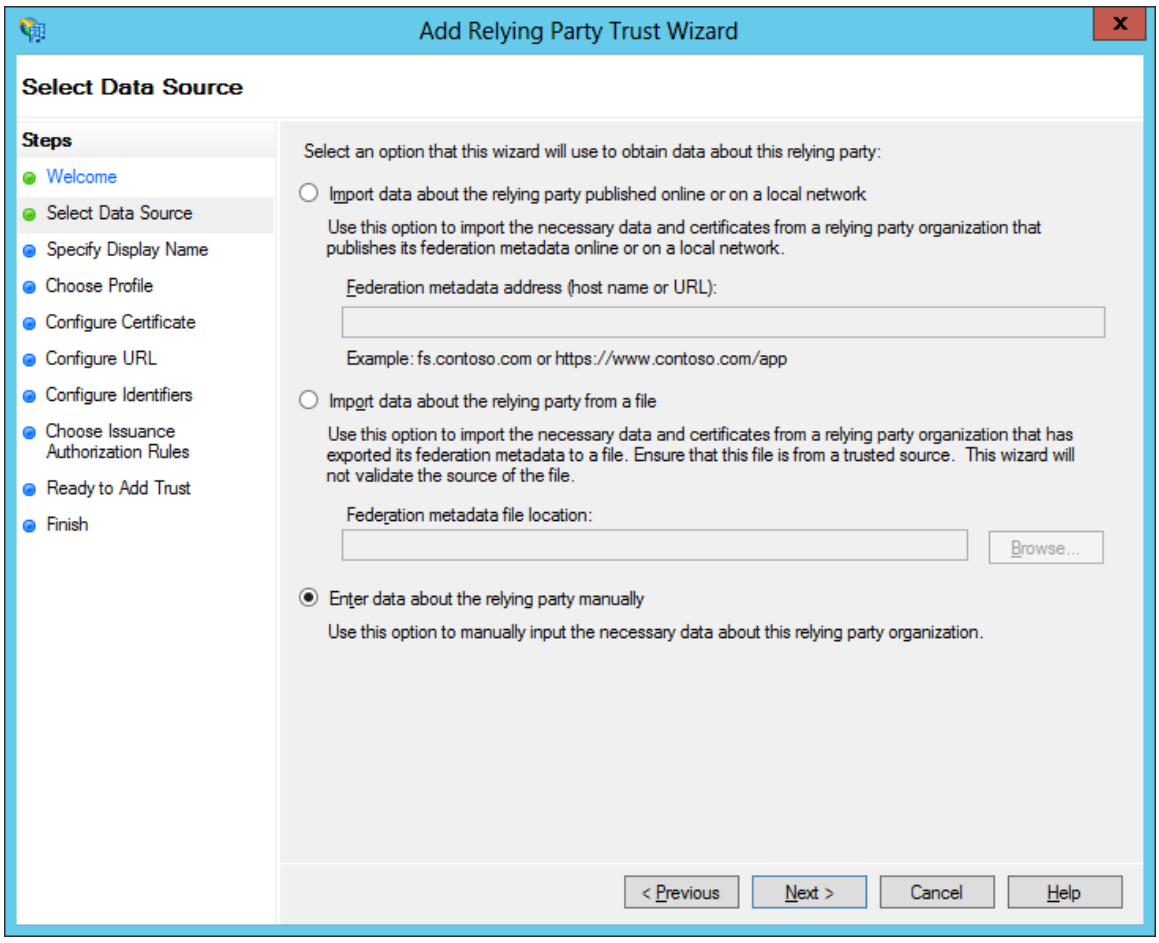
Confirm that the /adfs/ls endpoint for SAML v2.0 exists. If it doesn't, refer to the ADFS documentation.



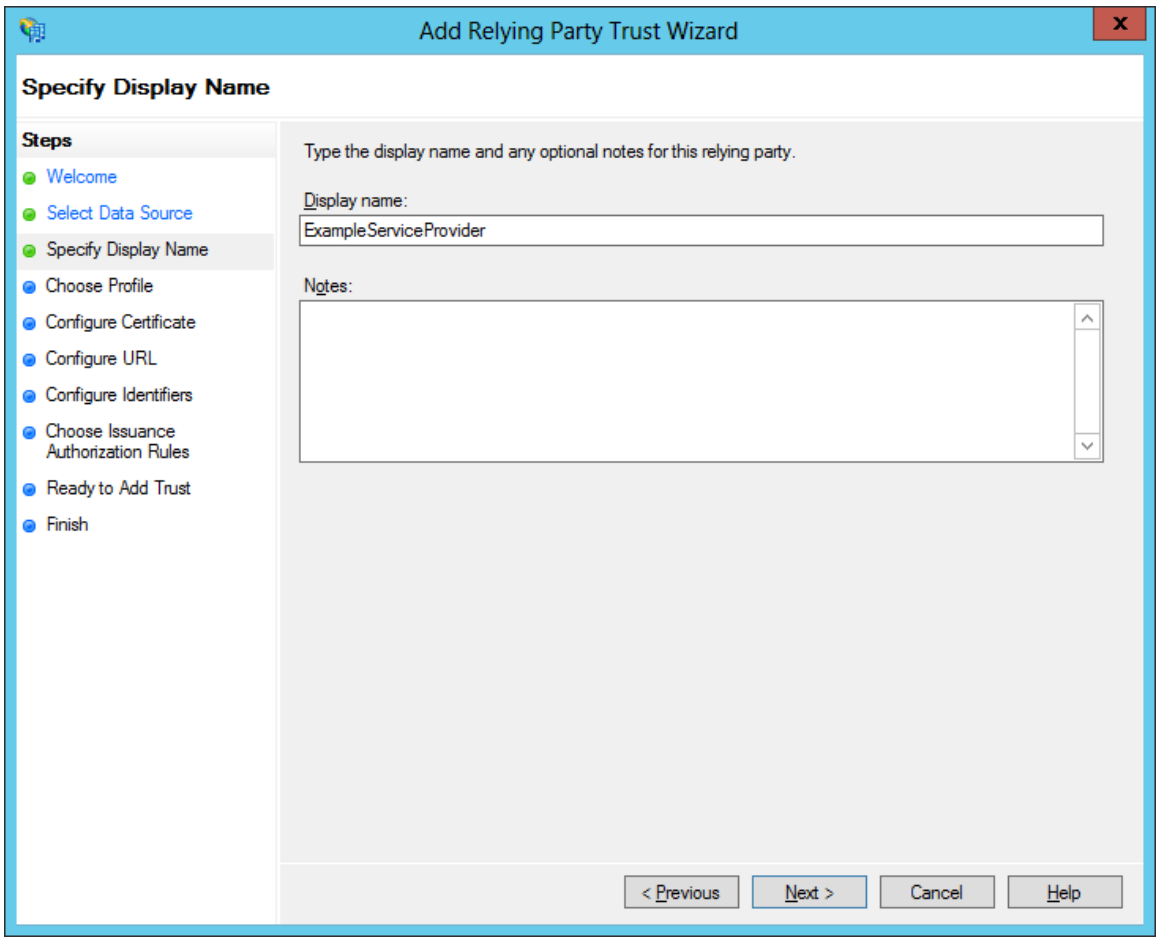
Confirm that the service communications, token decrypting and token encrypting certificates exist. If they don't, refer to the ADFS documentation.



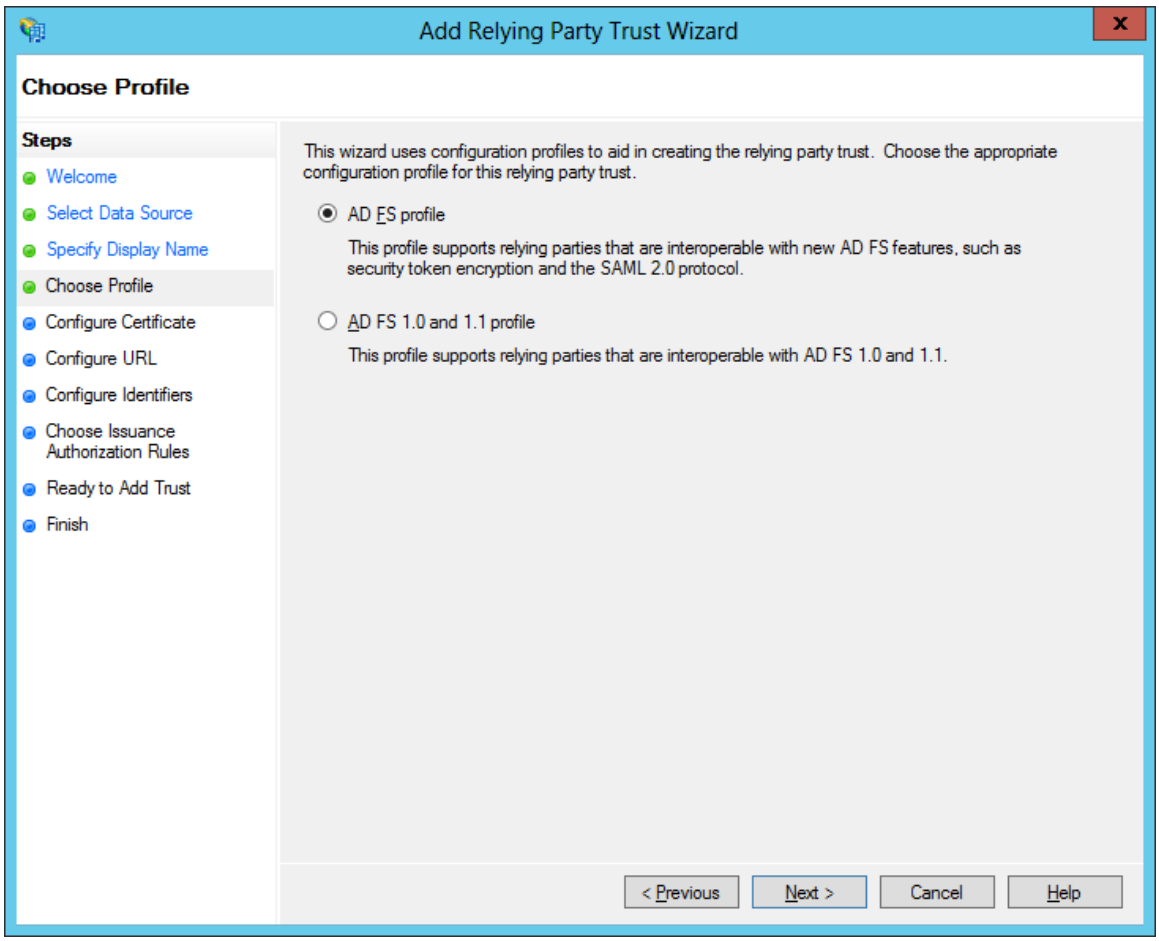
Add a relying party trust and select the option to enter the relying party information manually.



Specify a display name. The display name does not have to match with any other configuration.

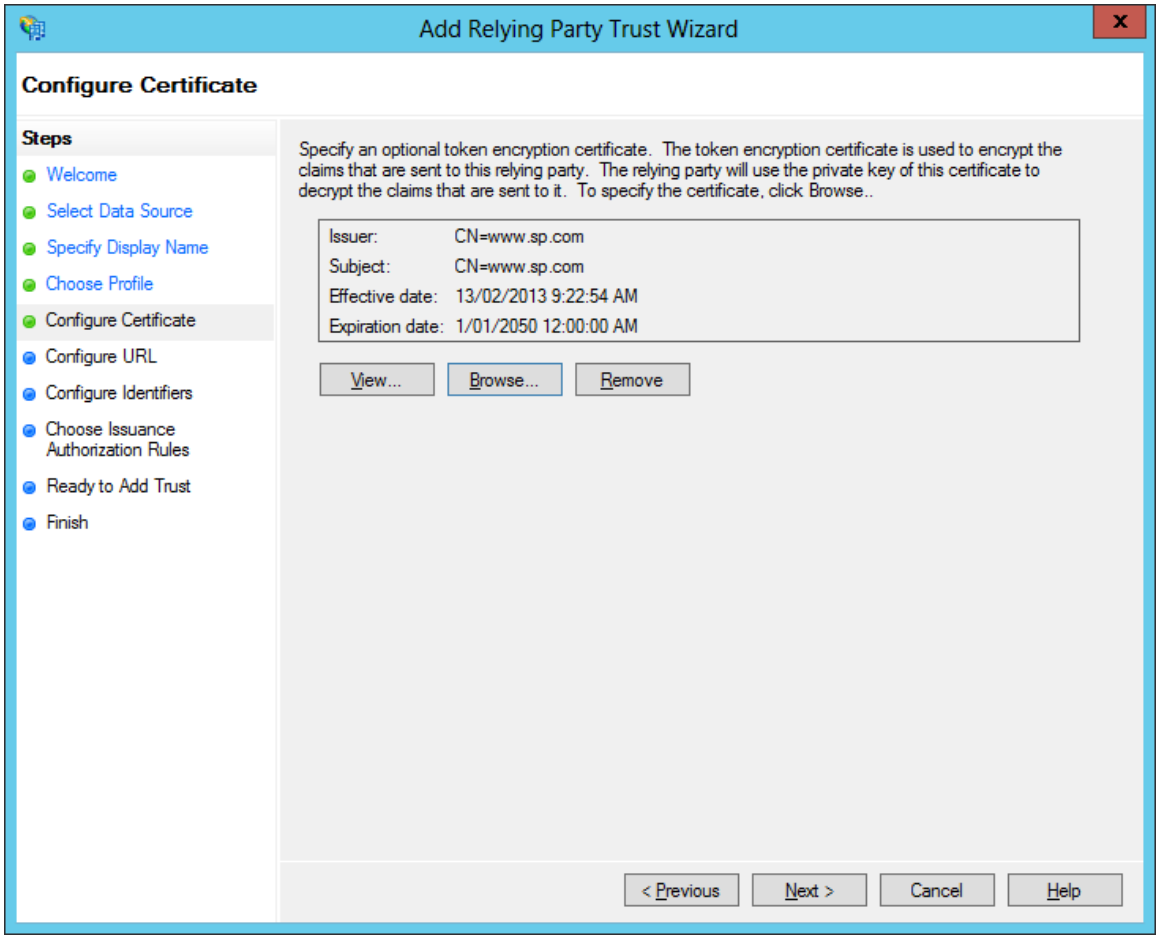


Choose the ADFS profile.



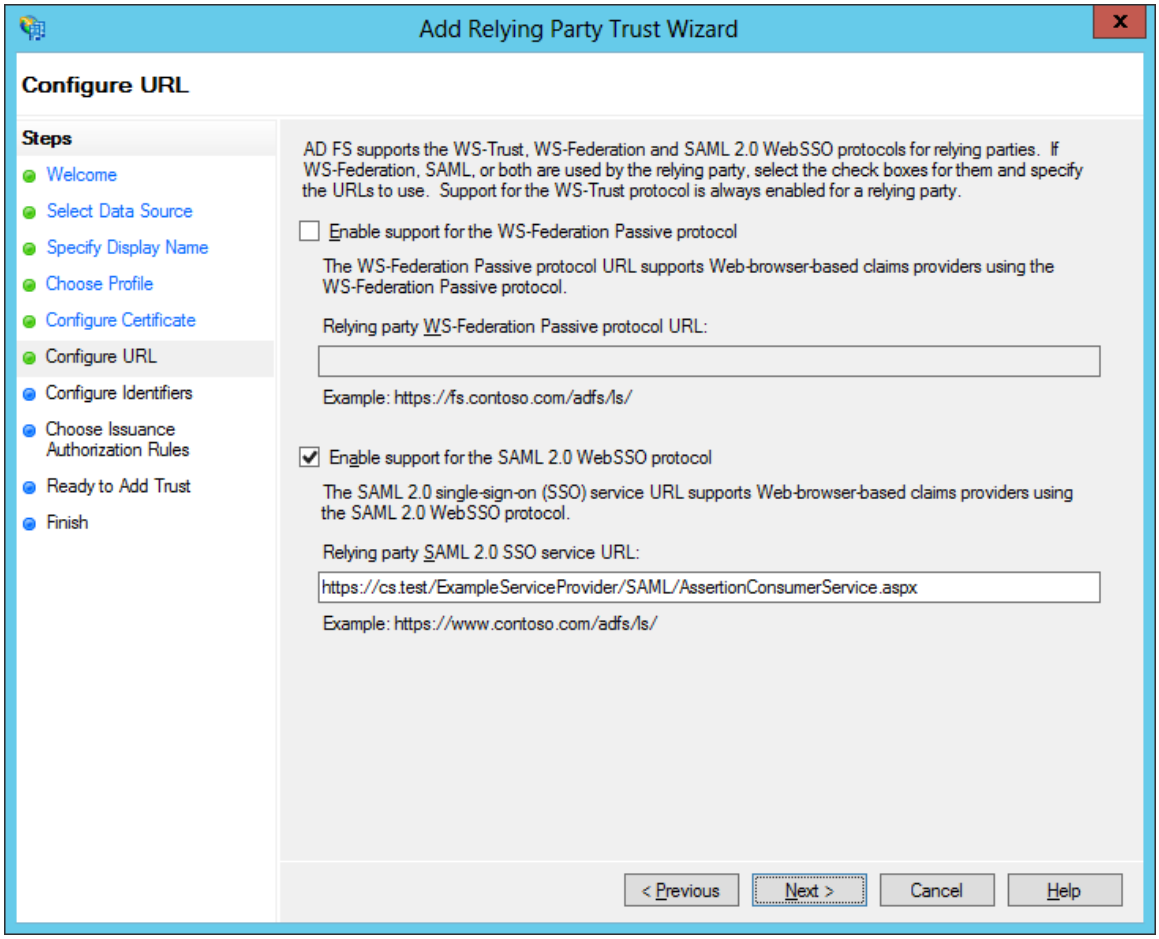
Browse to sp.cer to specify it as the token encryption certificate. Ignore any warnings about the key length.

The token encryption certificate is used to encrypt the SAML assertion. The service provider decrypts the SAML assertion using the associated private key.



Enable support for SAML v2.0 and specify the service provider's assertion consumer service URL. ADFS sends the SAML response to this URL. For example:

https://cs.test/ExampleServiceProvider/SAML/AssertionConsumerService.aspx



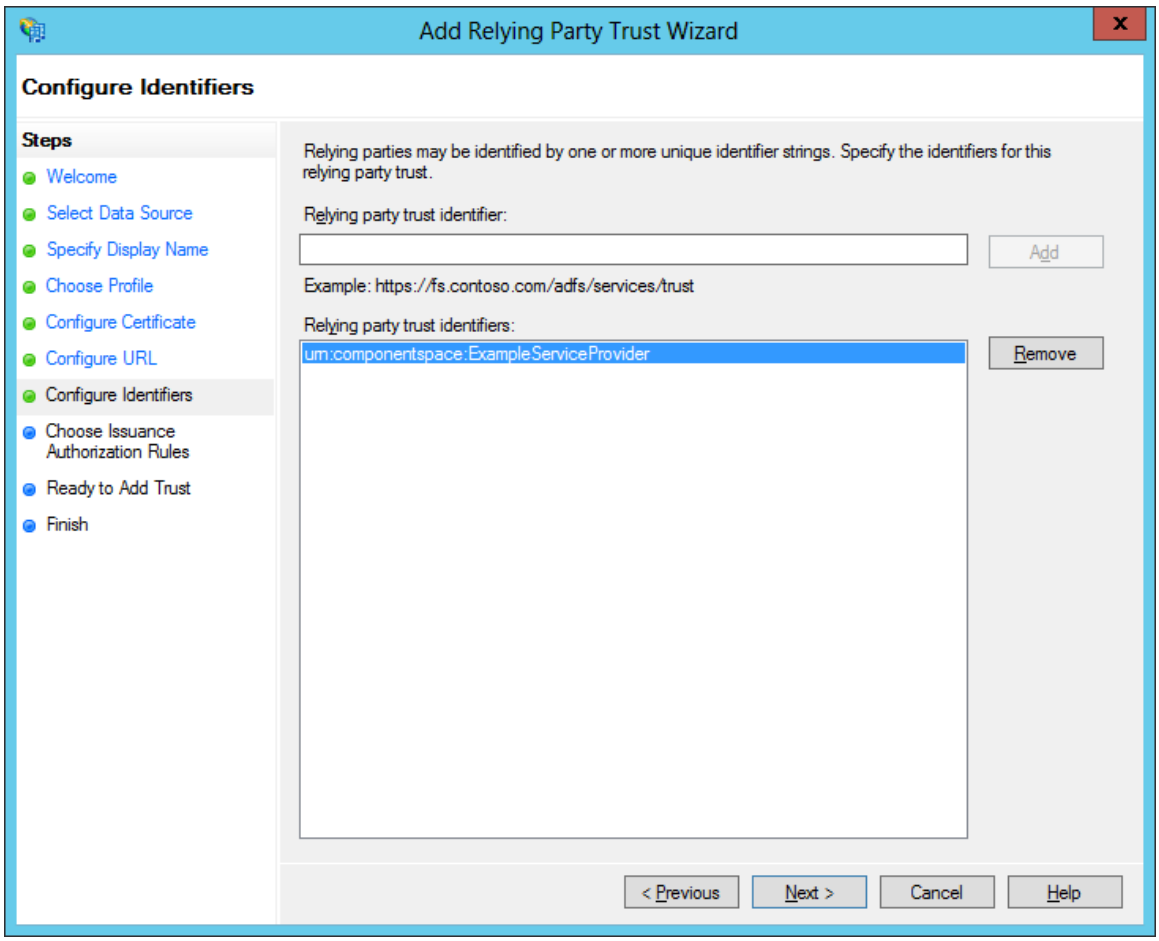
Specify the relying party trust identifier. This identifier must match the issuer field in the authn request sent by the service provider. The ServiceProvider name attribute in the saml.config configuration file is used as the issuer and so this name and the relying party trust identifier must match.

For example, if the saml.config includes:

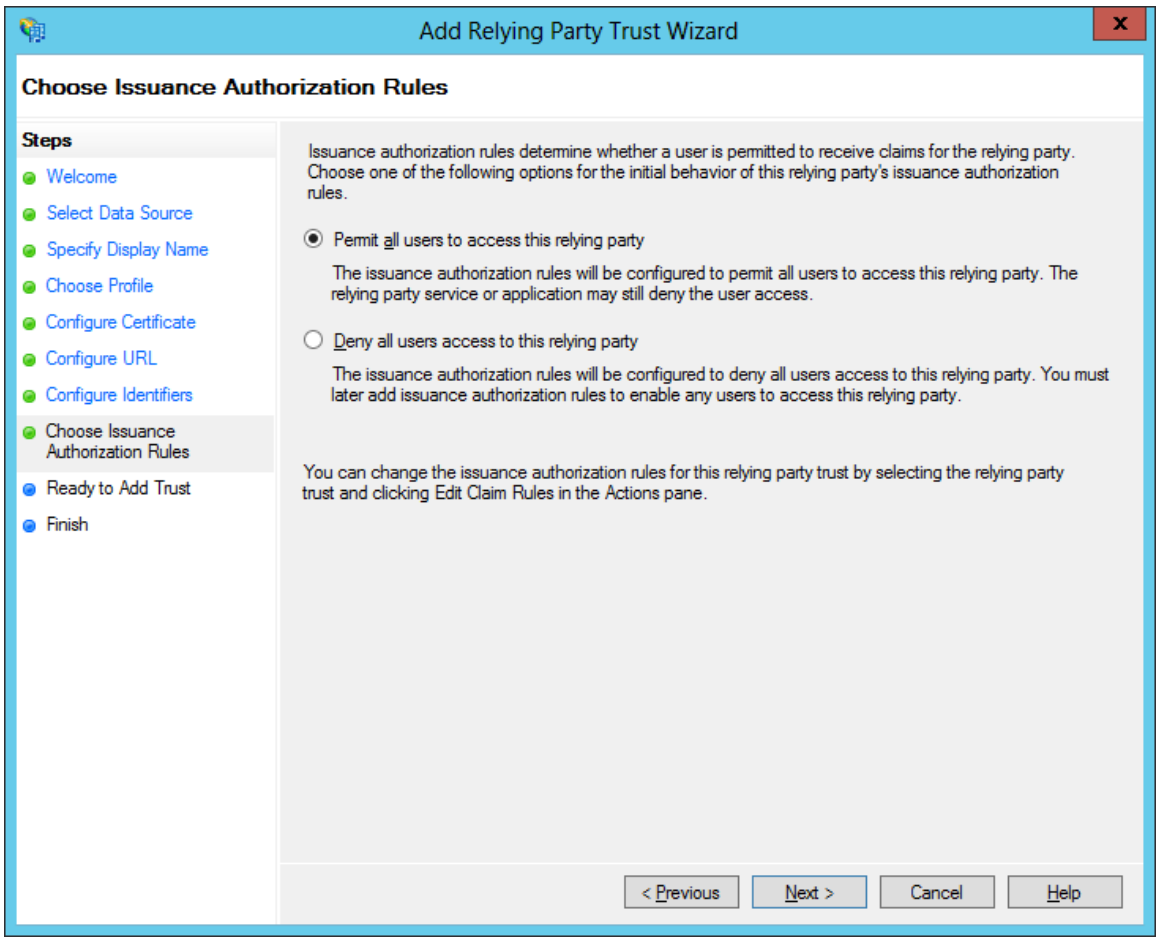
```
<ServiceProvider Name="urn:componentspace:ExampleServiceProvider"
                 AssertionConsumerServiceUrl=
                   "~/SAML/AssertionConsumerService.aspx"/>
```

Then the relying party trust identifier must be:

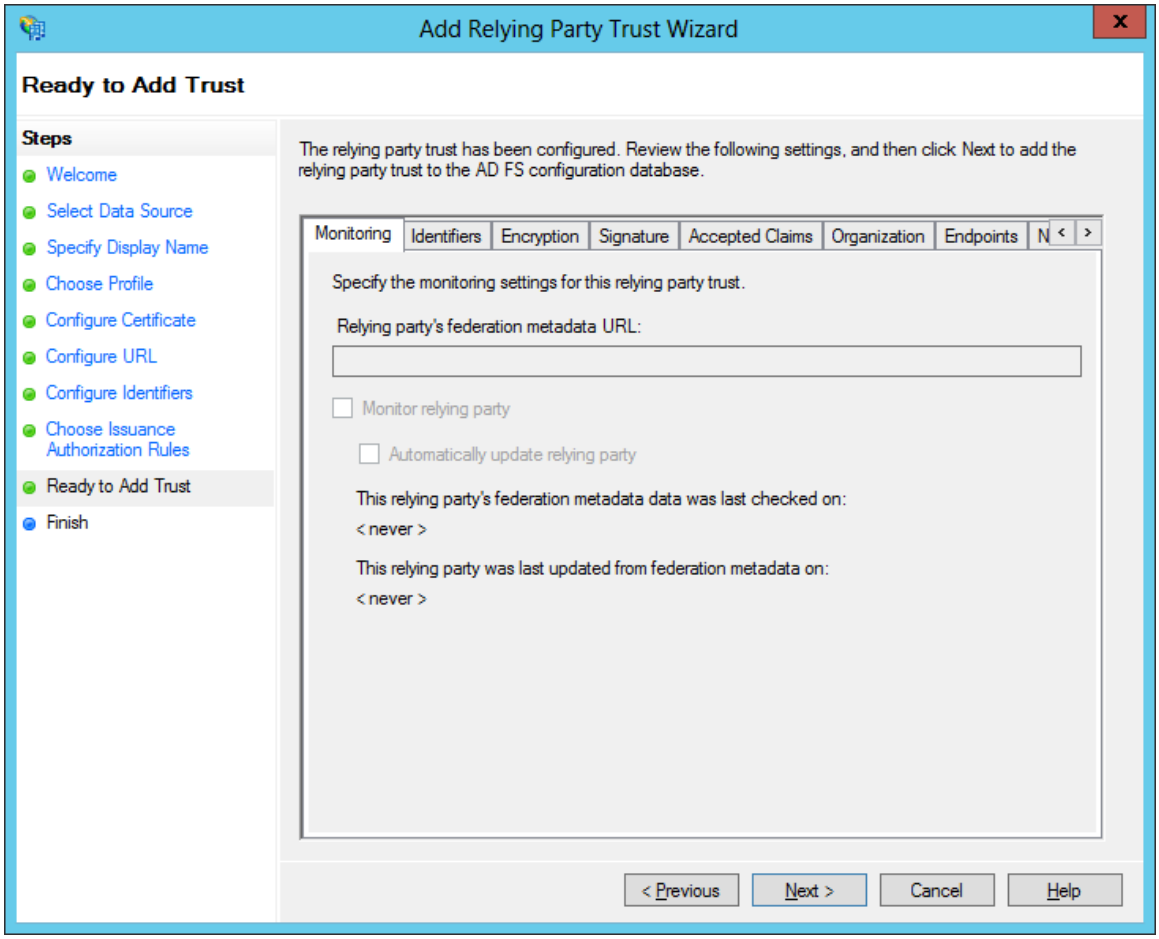
urn:componentspace:ExampleServiceProvider.



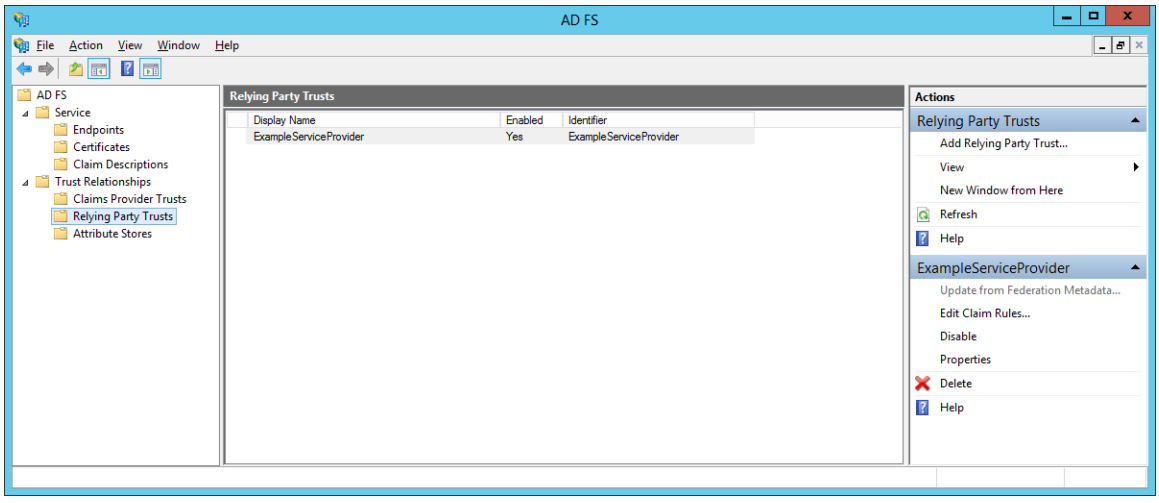
Permit all users access to this relying party.



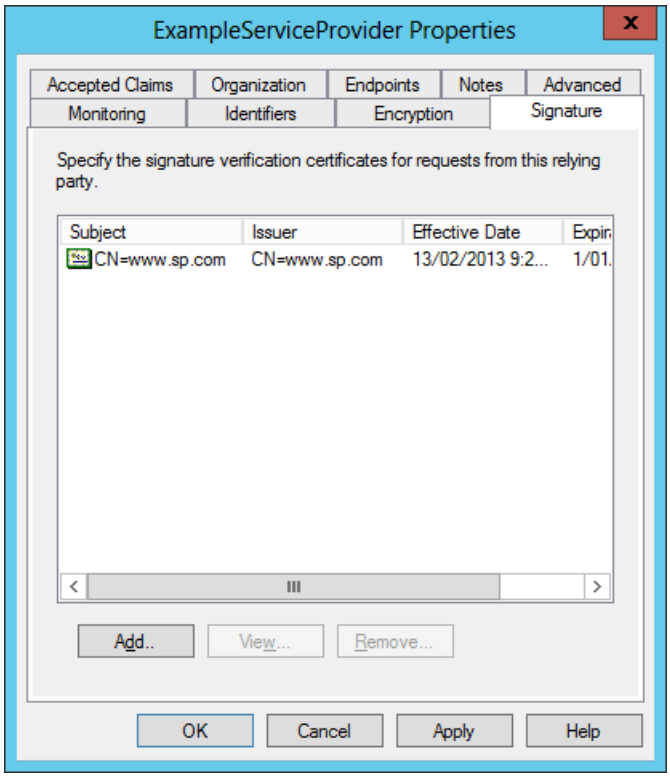
Review the configuration and close the wizard.



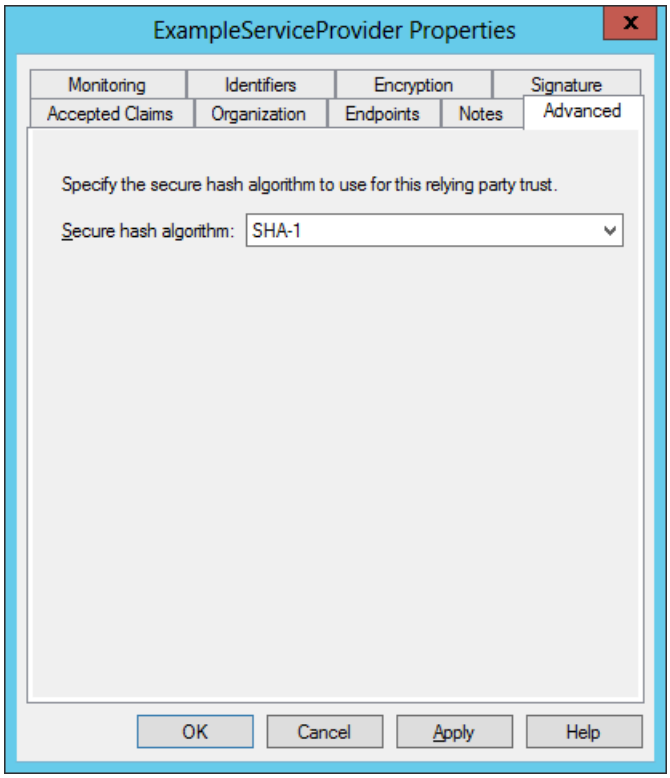
The service provider should be included in the list of relying party trusts.



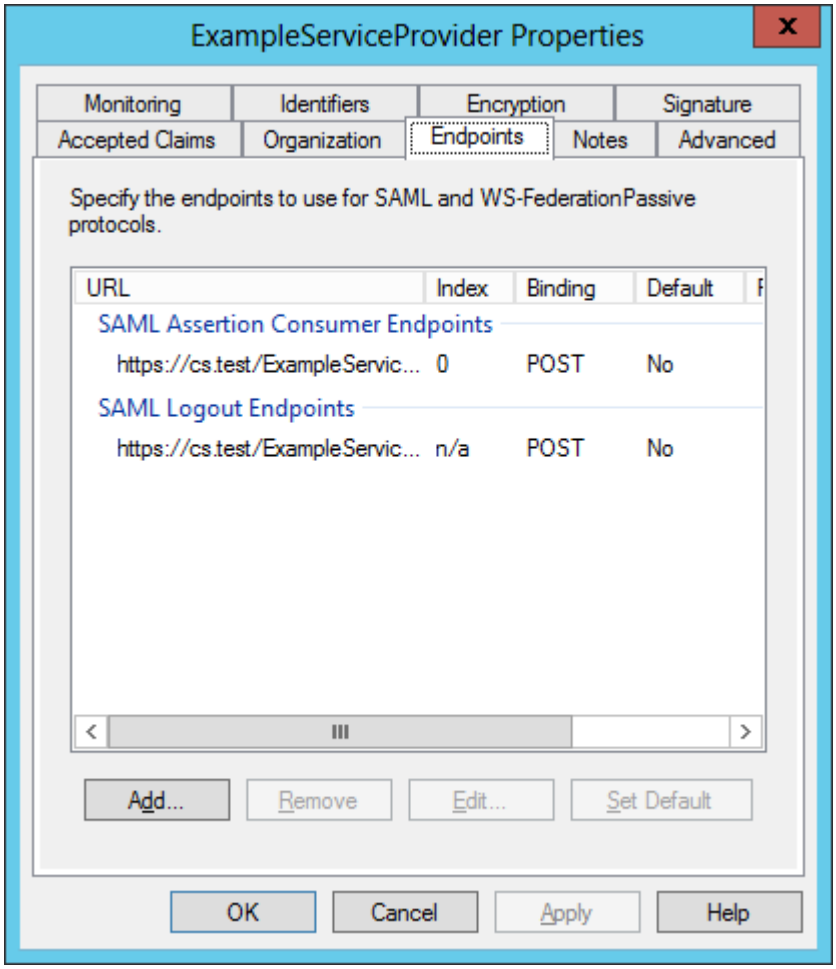
The authn request sent by the service provider is signed. To specify the certificate to use to verify the signature, open the relying party trusts' properties and, under the Signature tab, add the service provider certificate.

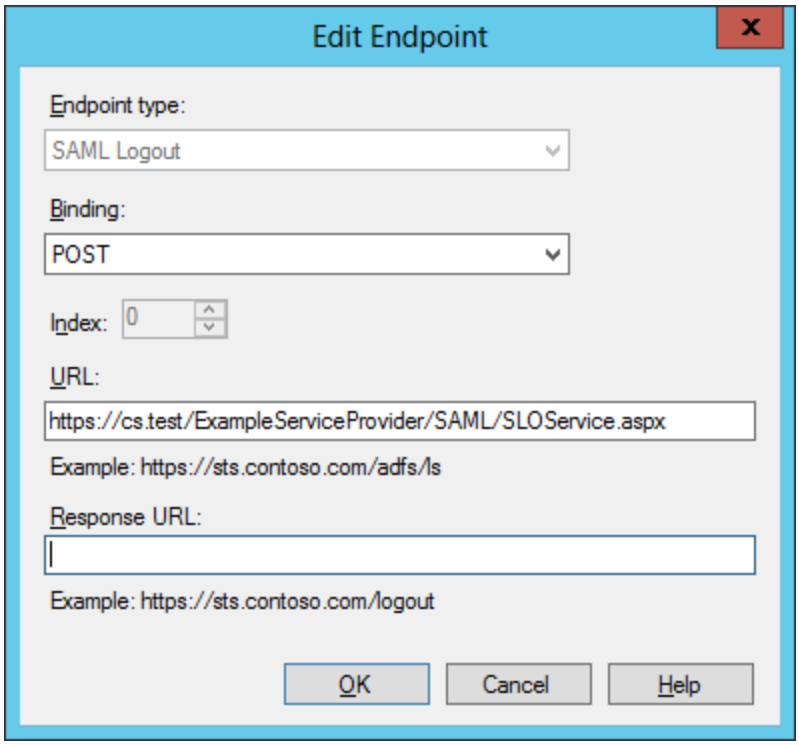


Although the SAML v2.0 component supports SHA-256 signatures, for this example SHA-1 is used. To specify this, under the Advanced tab, select SHA-1.



To support SAML logout, specify the logout endpoint.

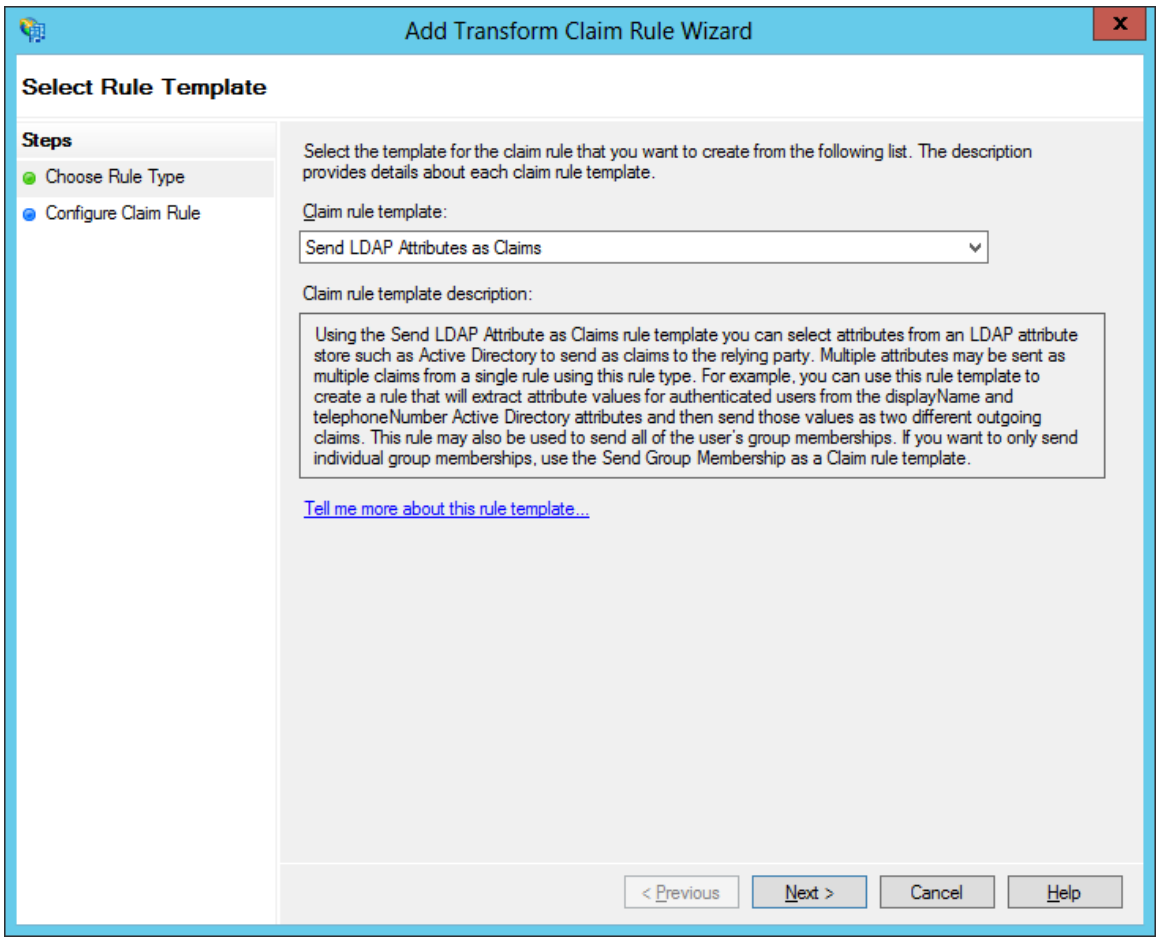




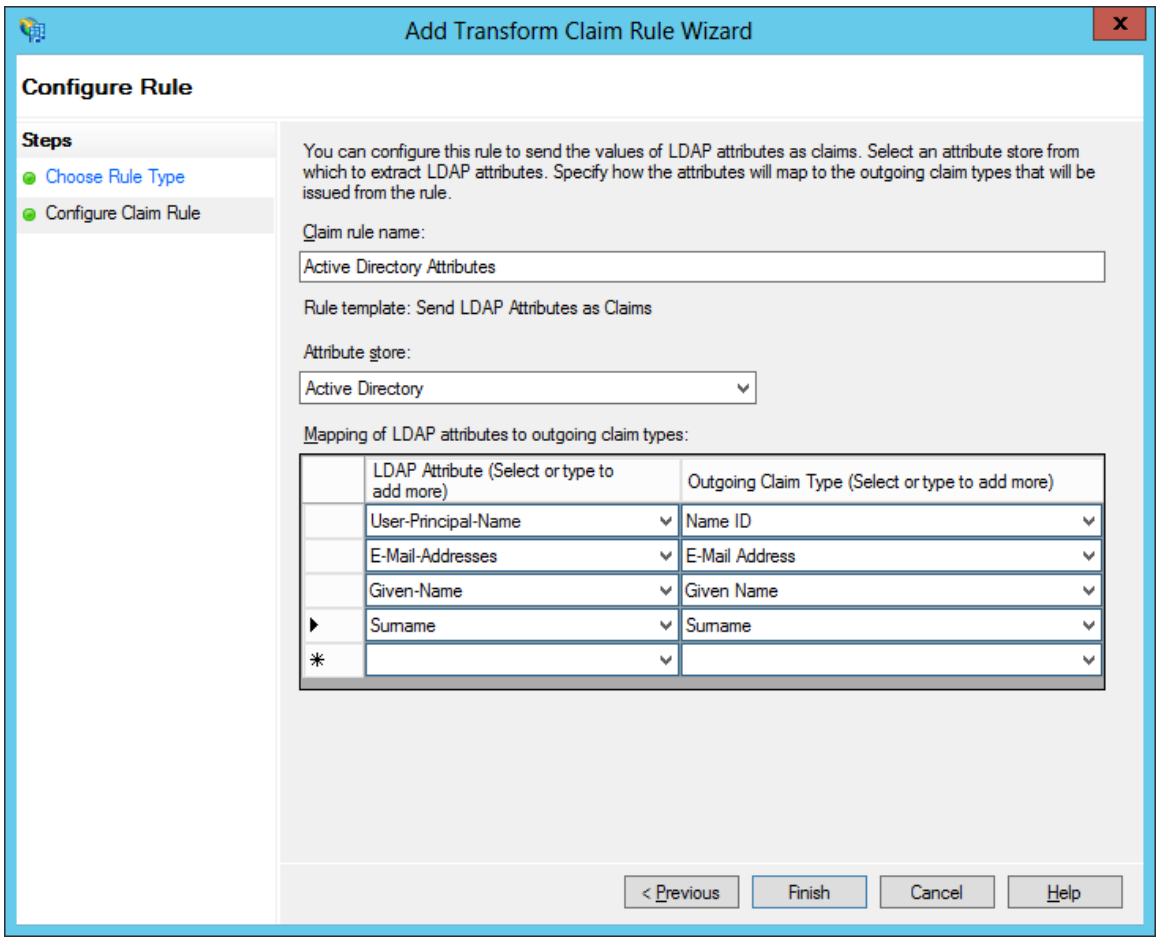
Note that even after logout, ADFS may persist the authentication session depending on which local authentication type is used. For example, if Integrated authentication is used then after logout the next login, in the same browser session, uses the persisted authentication session and the user doesn't have to re-enter their credentials. If Forms authentication is used then a login is required after logout. The following section from the adfs/ls web.config shows the Forms authentication taking precedence over the Integrated authentication.

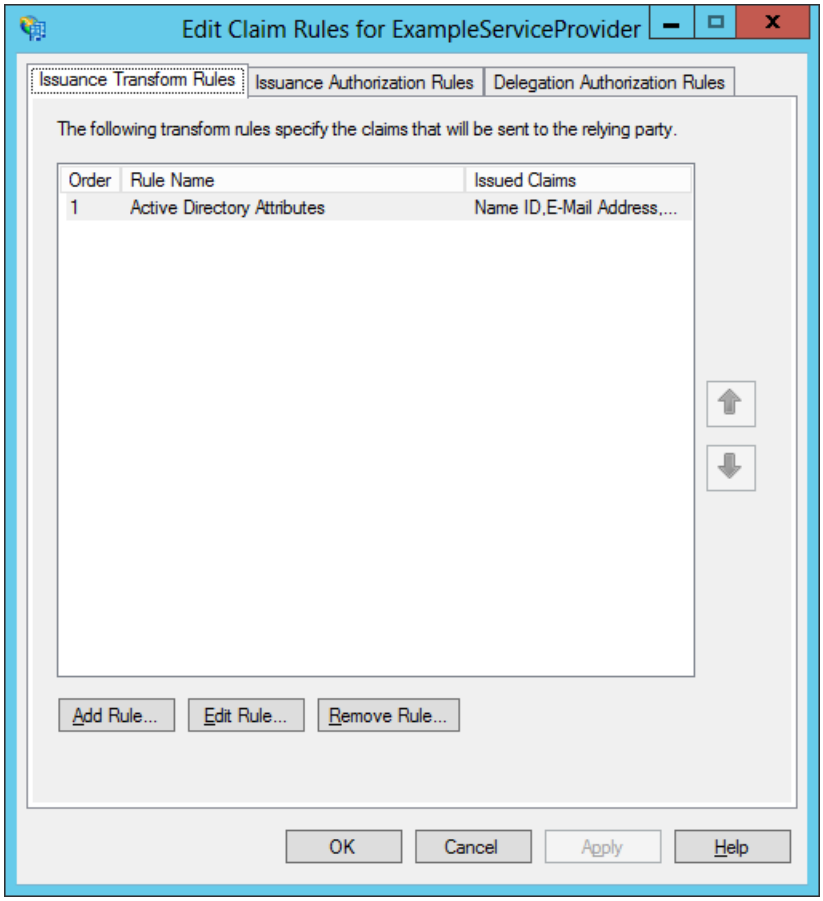
```
<localAuthenticationTypes>
  <add name="Forms" page="FormsSignIn.aspx" />
  <add name="Integrated" page="auth/integrated/" />
  <add name="TlsClient" page="auth/sslclient/" />
  <add name="Basic" page="auth/basic/" />
</localAuthenticationTypes>
```

Edit the claim rules and add a rule.



Map the Active Directory user principal name to the outgoing Name ID. Map additional Active Directory attributes to include in the SAML assertion as SAML attributes.


Add Transform Claim Rule Wizard
Configure Rule
Steps
Choose Rule Type
Configure Claim Rule
You can configure this rule to send the values of LDAP attributes as claims. Select an attribute store from which to extract LDAP attributes. Specify how the attributes will map to the outgoing claim types that will be issued from the rule.
Claim rule name:
Active Directory Attributes
Rule template: Send LDAP Attributes as Claims
Attribute store:
Active Directory
Mapping of LDAP attributes to outgoing claim types:
LDAP Attribute (Select or type to add more)
Outgoing Claim Type (Select or type to add more)
User-Principal-Name
Name ID
E-Mail-Addresses
E-Mail Address
Given-Name
Given Name
Surname
Surname
< Previous
Finish
Cancel
Help



ADFS should now be ready to communicate with the example service provider.

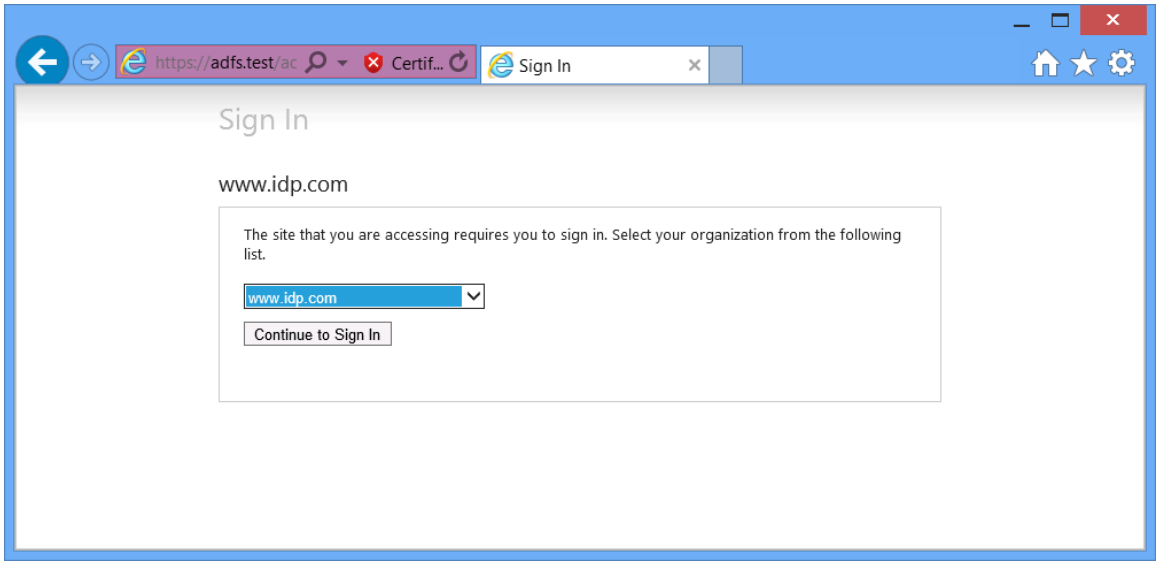
To review the metadata published by ADFS browse to:

https:/adfs.test/FederationMetadata/2007-06/FederationMetadata.xml

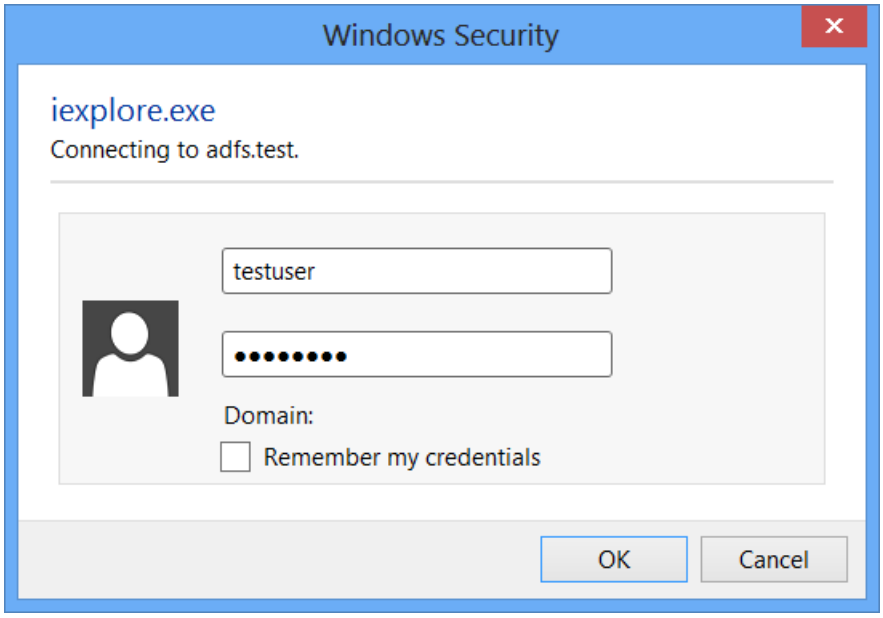
10.3.4 Running the Service Provider with SP-Initiated SSO

In this example, the user is attempting to access a protected resource on the service provider and, rather than performing a local login at the service provider, SSO is initiated with a local login occurring at the ADFS identity provider and the asserted identity, passed to the service provider in a SAML assertion, is used to perform an automatic login at the service provider.

1. Browse to https://cs.test/ExampleServiceProvider, ignoring any browser certificate warnings.
2. If more than one claim provider is configured on ADFS, you will be presented with the following page. Select the appropriate claim provider for authentication against Active Directory. For example, adfs.test.

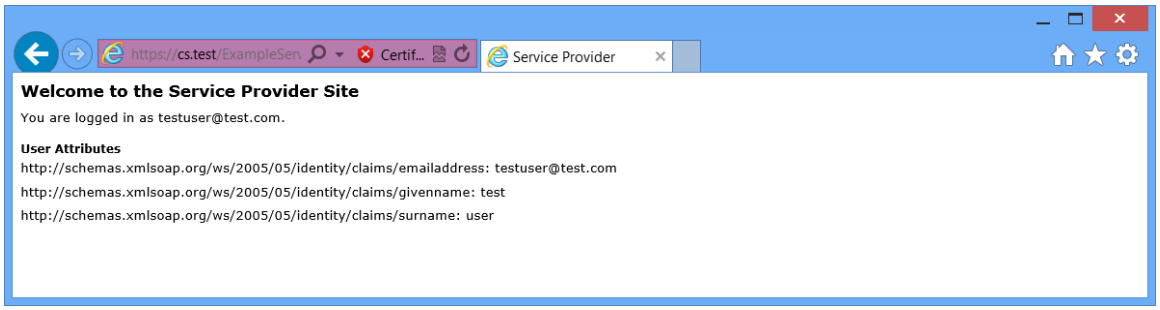


3. You should then be presented with the identity provider login prompt.



4. Login using the user name and password of a user defined in Active Directory.
5. You should then be presented with the service provider's default page.

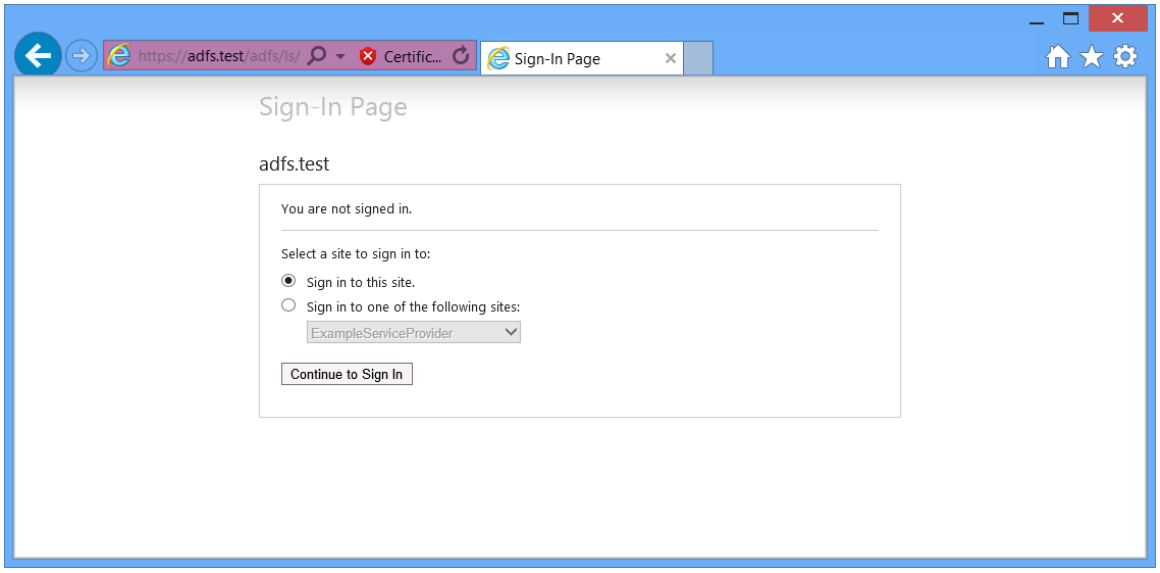
   This means you've successfully completed a SAML v2.0 SSO and are logged in at the service provider with your identity provider user name.



10.3.5 Running the Service Provider with IdP-Initiated SSO

In this example, the user logs in at ADFS and initiates SSO to the service provider. The asserted identity, passed to the service provider in a SAML assertion, is used to perform an automatic login at the service provider.

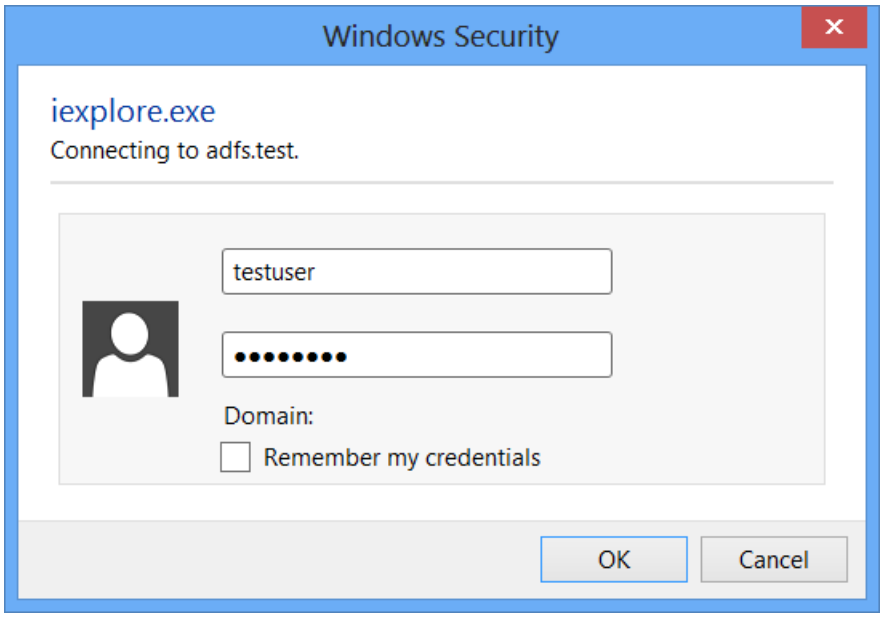
1. Browse to https://adfs.test/adfs/ls/IdpInitiatedSignon.aspx, ignoring any browser certificate warnings.
2. You should then be presented with the identity provider sign-in page.



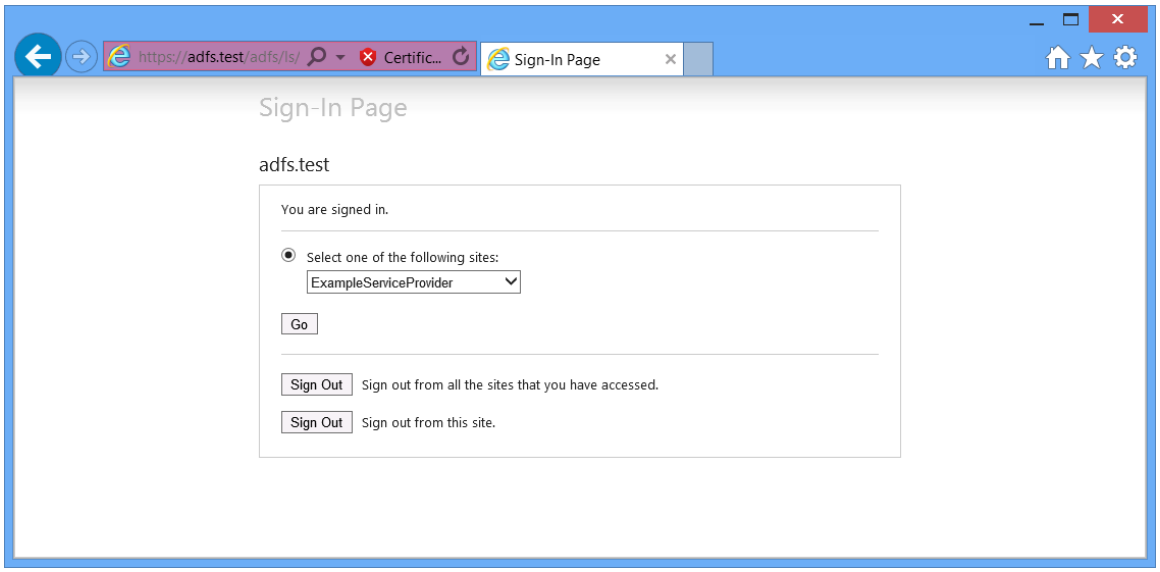
3. Select the “sign in to this site” radio button and click the continue button.

   Alternatively, selecting the “sign in to one of the following sites” radio button performs SSO to the selected service provider immediately after login.

   You should then be presented with the identity provider login prompt.

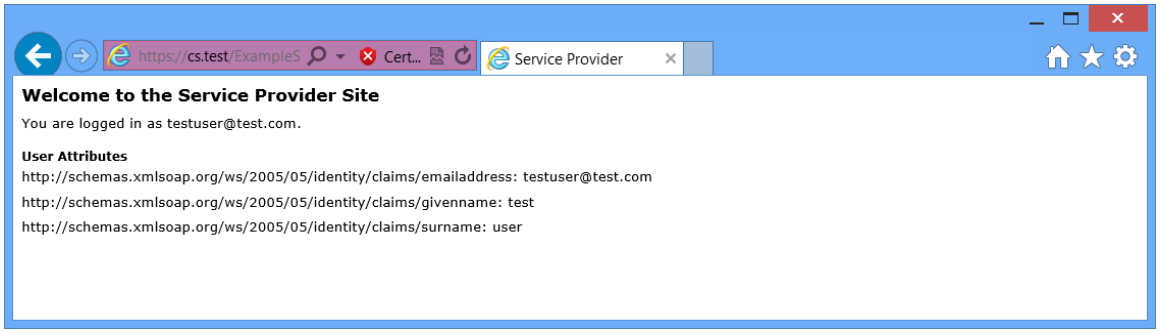


4. Login using the user name and password of a user defined in Active Directory.
5. Select the service provider and click Go to initiate SSO.



6. You should then be presented with the service provider's default page.

   This means you've successfully completed a SAML v2.0 SSO and are logged in at the service provider with your identity provider user name.



10.3.6 Configuring the Identity Provider

The following sections describe interoperability between the example identity provider and ADFS acting as the relying party (i.e. service provider).

The saml.config file includes the following entry for the ADFS partner service provider.

```
<PartnerServiceProvider Name="http://adfs.test/adfs/services/trust"
                        WantAuthnRequestSigned="false"
                        SignResponse="false"
                        SignAssertion="true"
                        EncryptAssertion="false"
                        AssertionConsumerServiceUrl=
                            "https://adfs.test/adfs/ls/"/>
```

The name must match with the issuer name ADFS uses in the authn request. For example, if ADFS is deployed to the myadfs server then the name must be http://myadfs/adfs/services/trust.

The web.config's *PartnerSP* setting specifies the partner service provider for IdP-initiated SSO and should be set to http://adfs.test/adfs/services/trust.

```
<add key="PartnerSP" value="http://adfs.test/adfs/services/trust"/>
```

The web.config's *TargetUrl* setting specifies, for IdP-initiated SSO, the relying party configured in ADFS and should be set to RPID=ExampleServiceProvider.

The RPID syntax is specific to ADFS. If not specified then ADFS will convert the IdP-initiated SSO into SP-initiated SSO.

```
<add key="TargetUrl" value="RPID=ExampleServiceProvider"/>
```

10.3.7 Configuring ADFS – Adding a Claims Provider

To support IdP-initiated SSO, edit the ADFS web.config at C:\inetpub\adfs\ls. In the microsoft.identityServer.web, add the following entry:

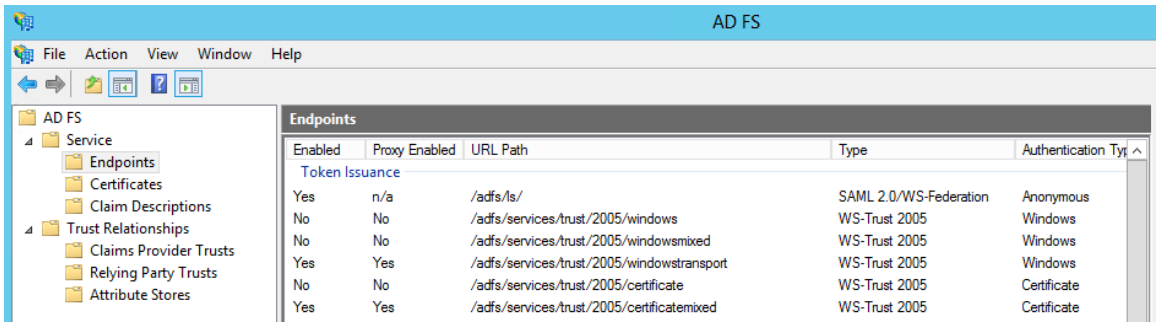
```
<useRelayStateForIdpInitiatedSignOn enabled="true" />
```

If not enabled, ADFS will convert IdP-initiated SSO into SP-initiated SSO.

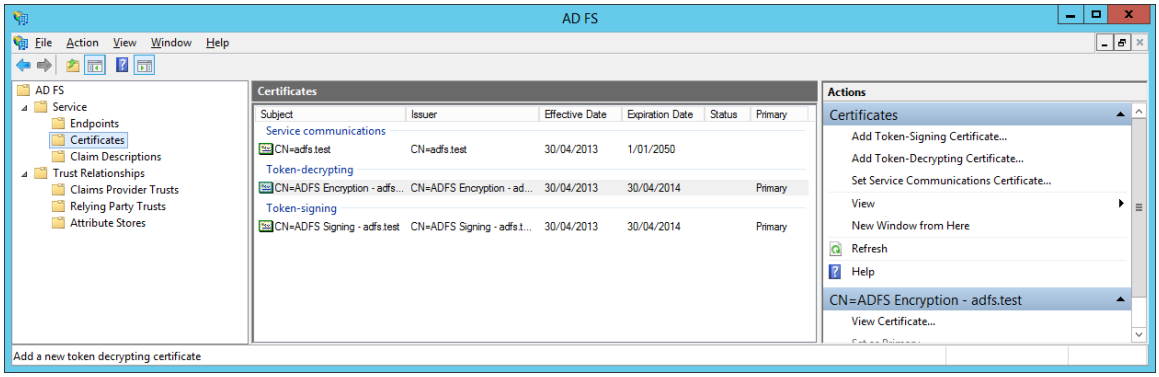
In the ADFS terminology, the identity provider is a claims provider. Using the ADFS management console, add a claims provider trust for the identity provider.

Note that strings in ADFS, including URLs, are case sensitive.

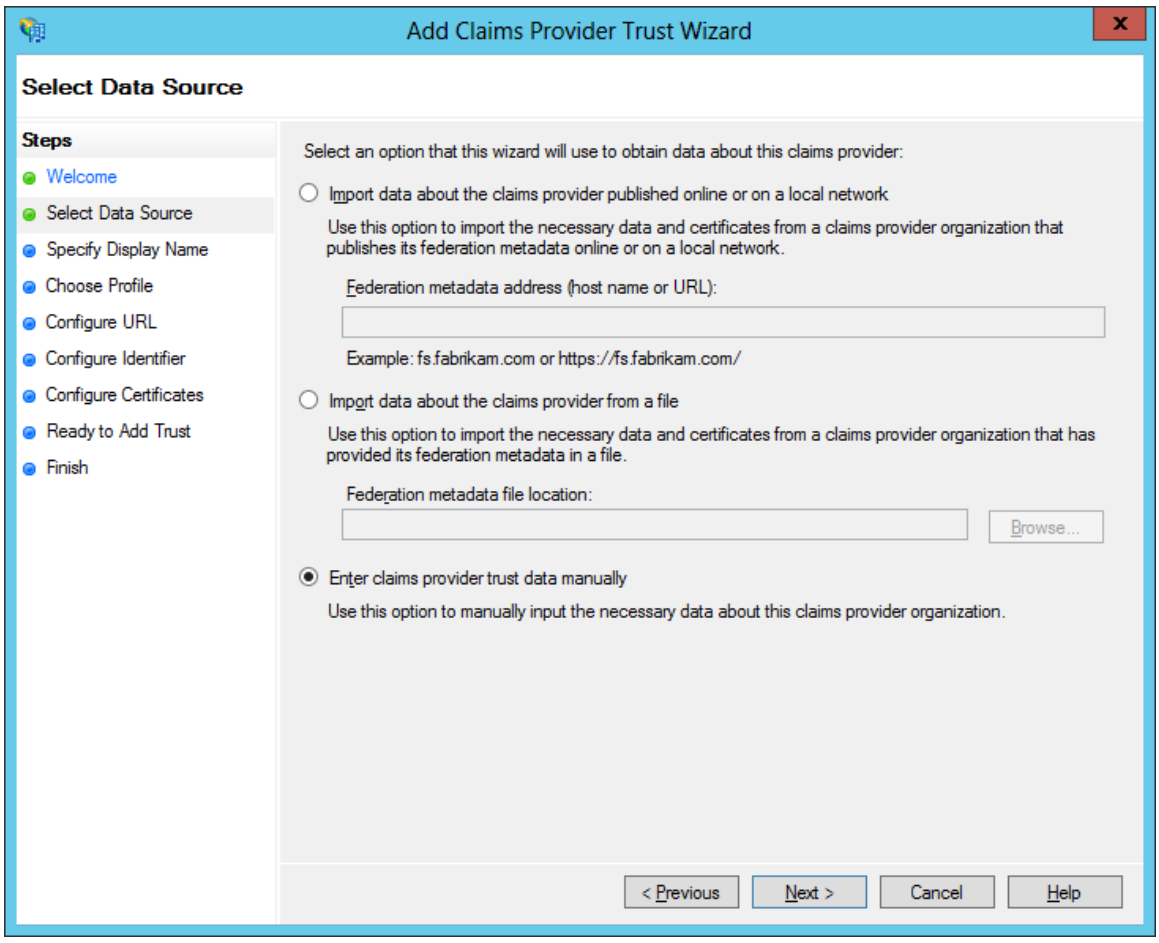
Confirm that the /adfs/ls endpoint for SAML v2.0 exists. If it doesn't, refer to the ADFS documentation.



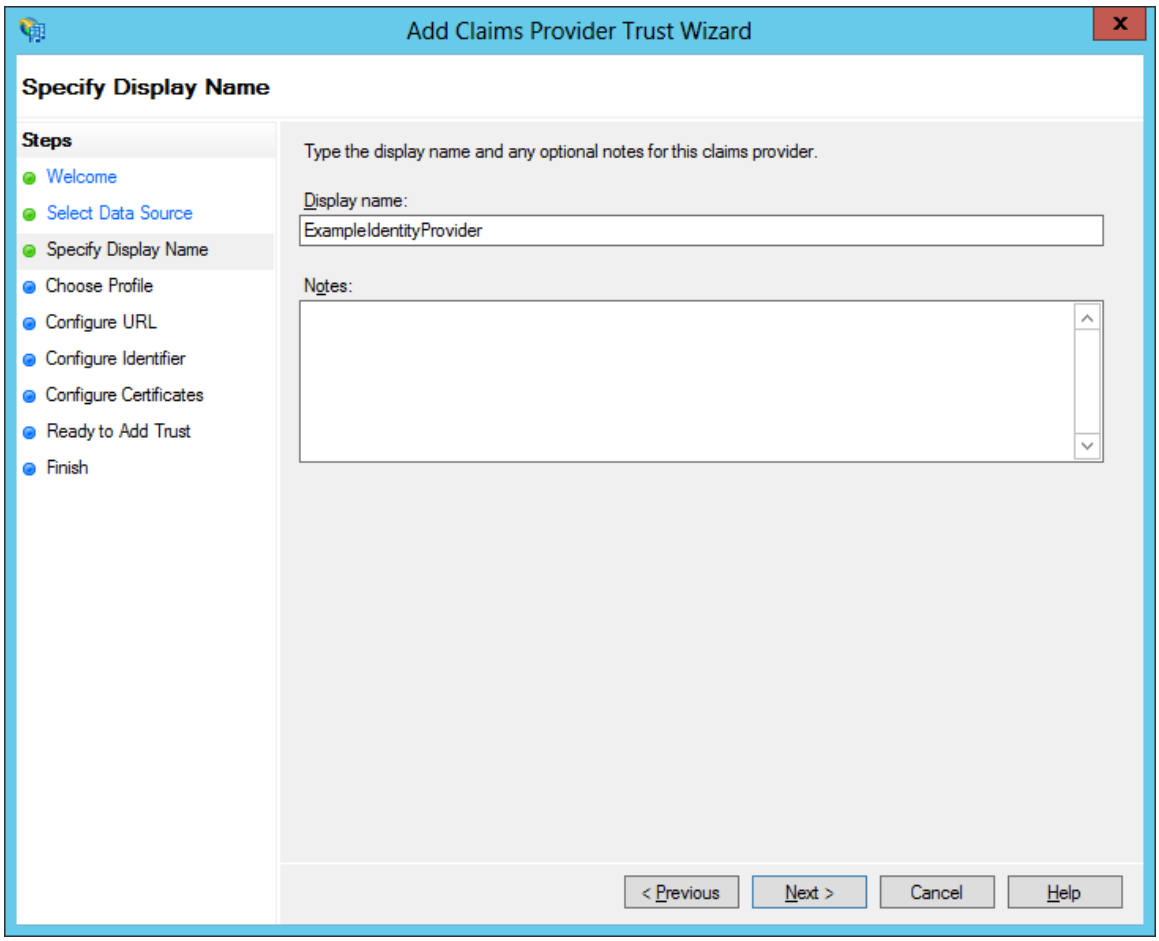
Confirm that the service communications, token decrypting and token encrypting certificates exist. If they don't, refer to the ADFS documentation.



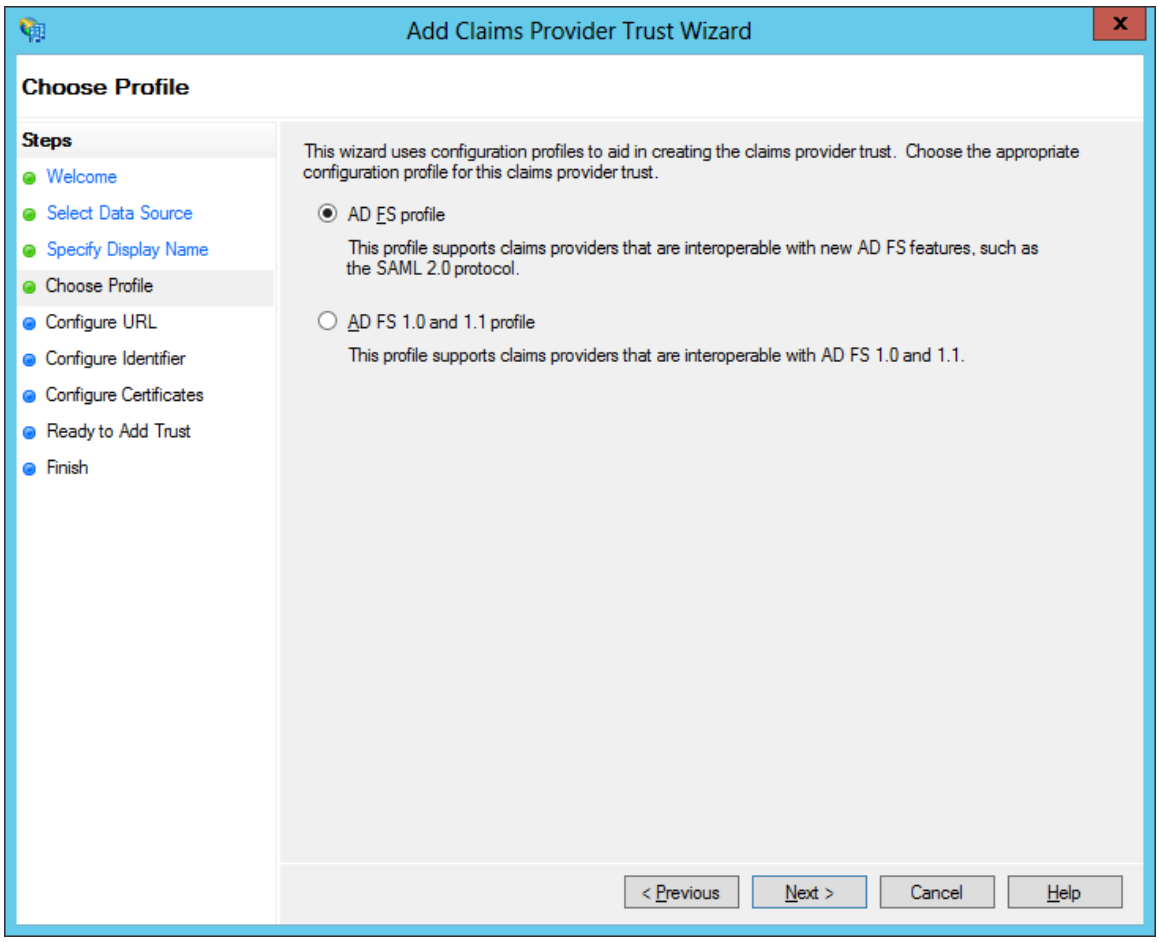
Add a claims provider trust and select the option to enter the claims provider information manually.



Specify a display name. The display name does not have to match with any other configuration.

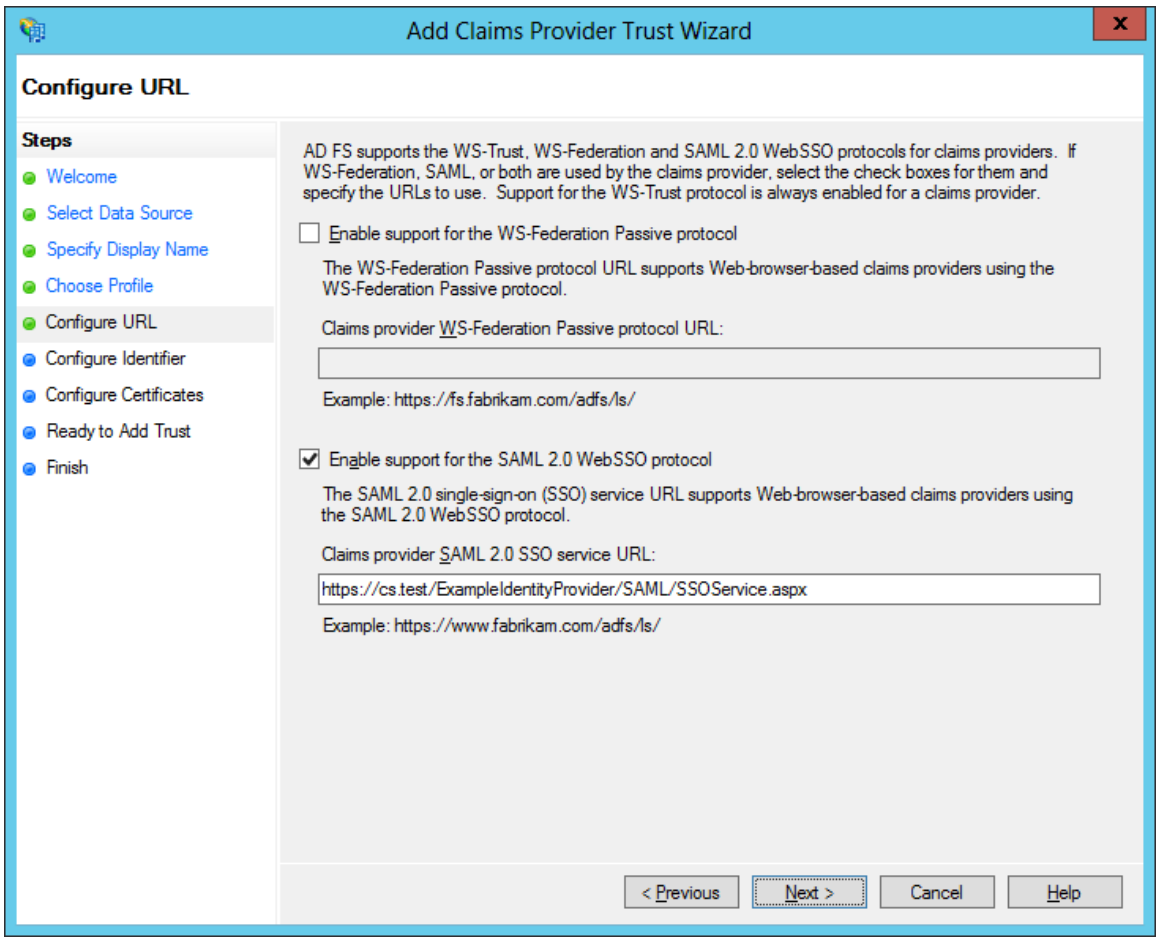


Choose the ADFS profile.



Enable support for SAML v2.0 and specify the identity provider's SSO service URL. ADFS sends the authn request to this URL. For example:

https://cs.test/ExampleIdentityProvider/SAML/SSOService.aspx



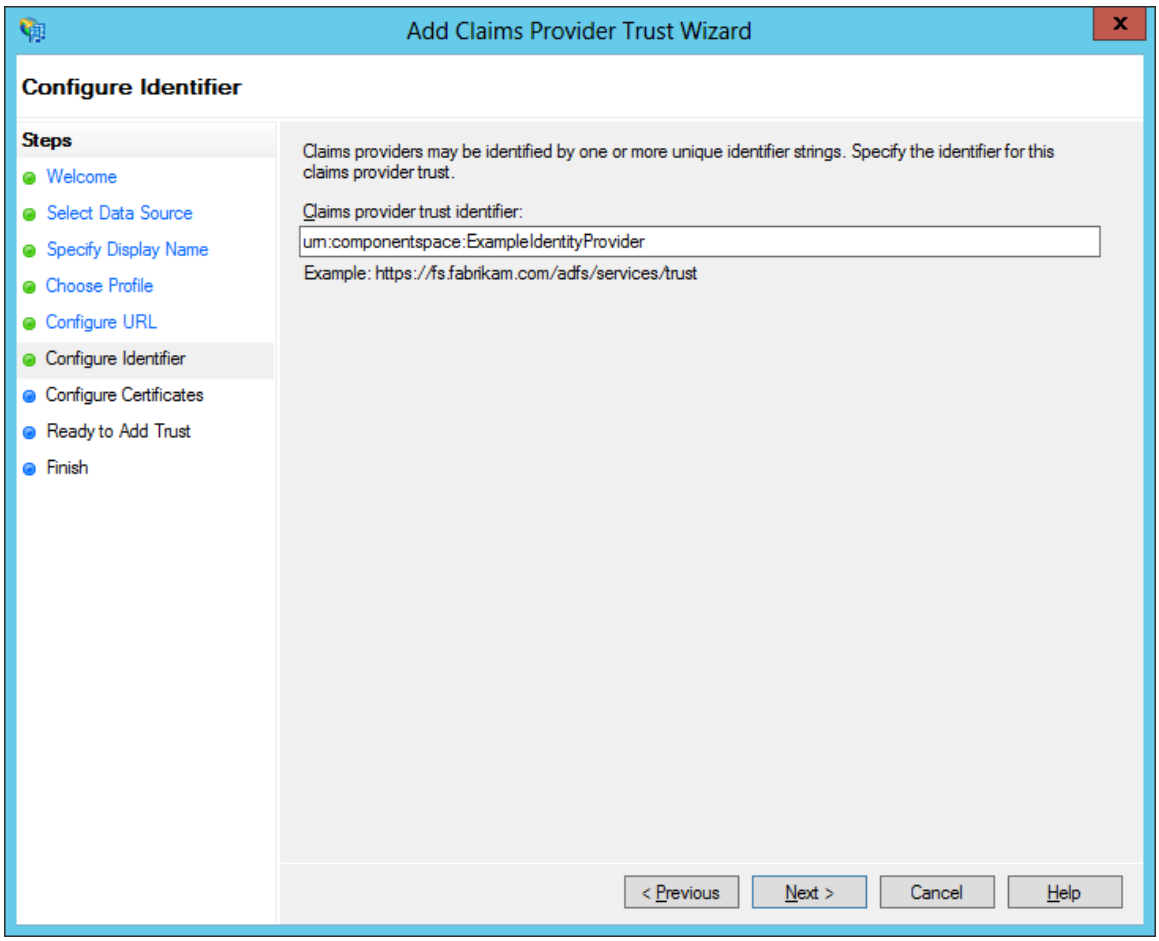
Specify the claims provider trust identifier. This identifier must match the issuer field in the authn request sent by the service provider. The IdentityProvider name attribute in the saml.config configuration file is used as the issuer and so this name and the claims provider trust identifier must match.

For example, if the saml.config includes:

<IdentityProvider Name="urn:componentspace:ExampleIdentityProvider"/>

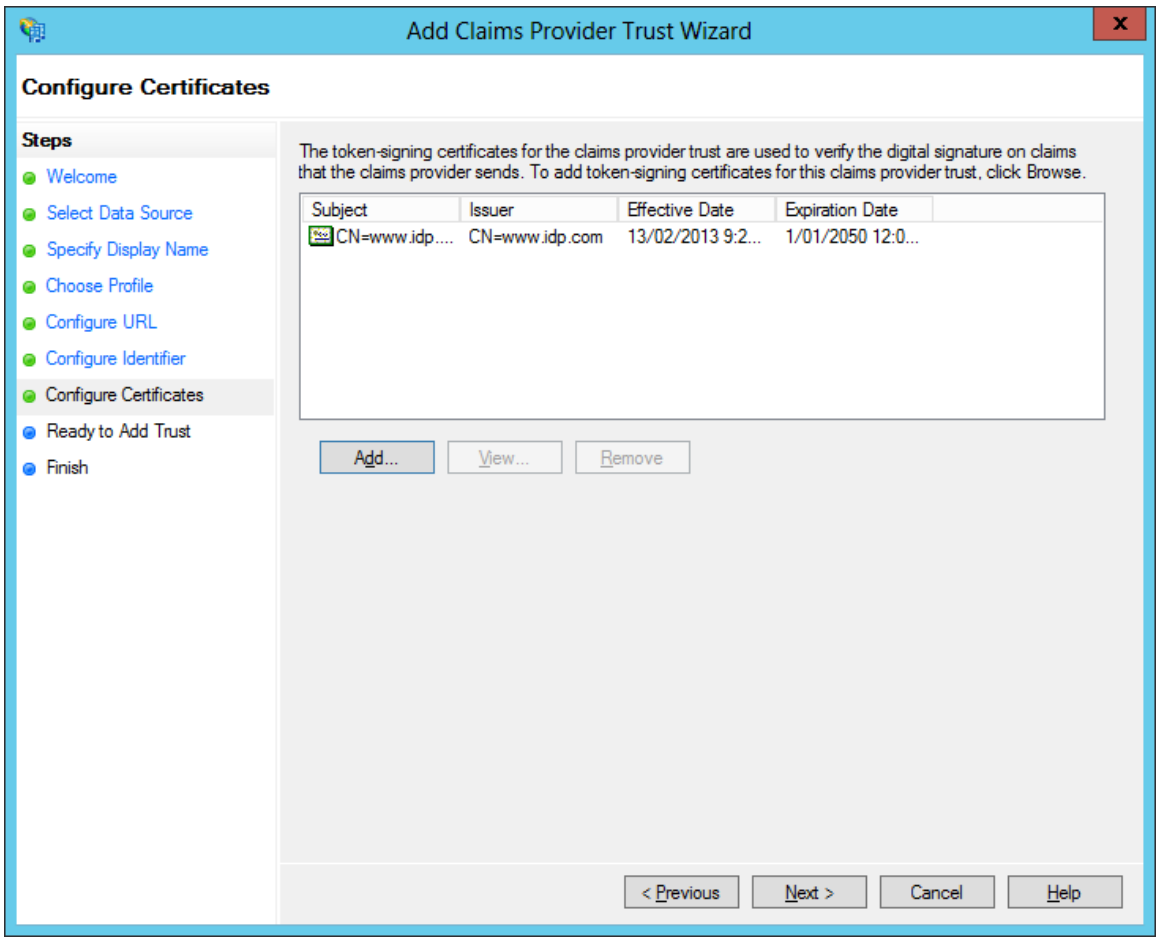
Then the claims provider trust identifier must be:

urn:componentspace:ExampleIdentityProvider.

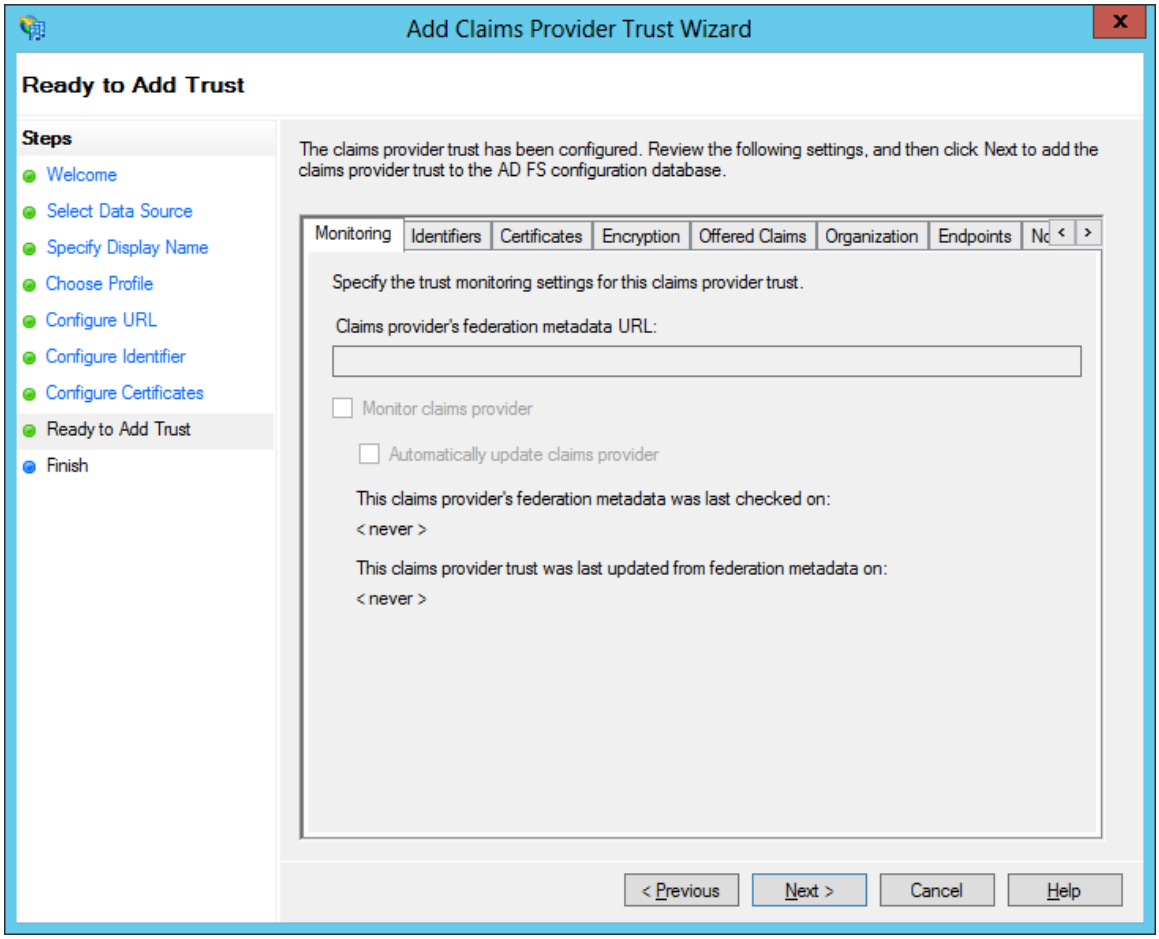


Browse to idp.cer to specify it as the token signing certificate. Ignore any warnings about the key length.

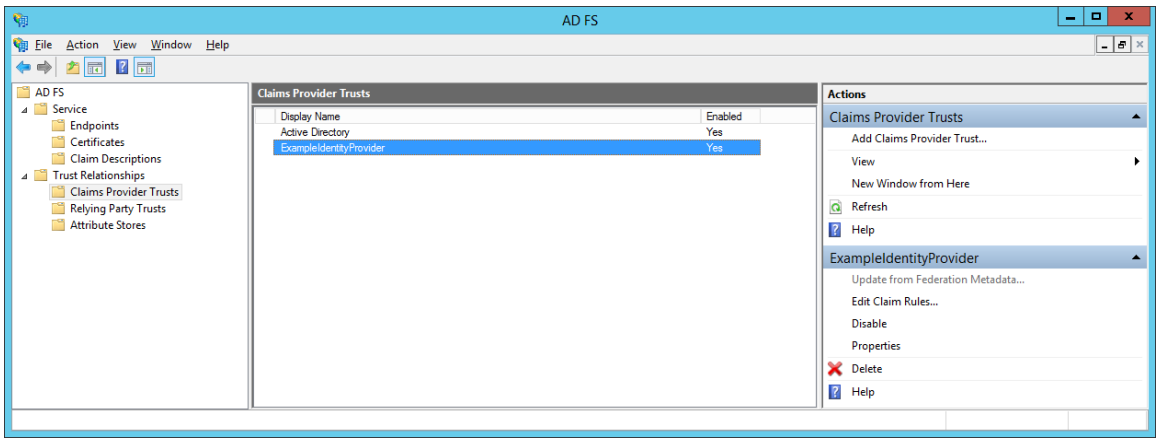
ADFS uses the token signing certificate to verify the SAML assertion signature.



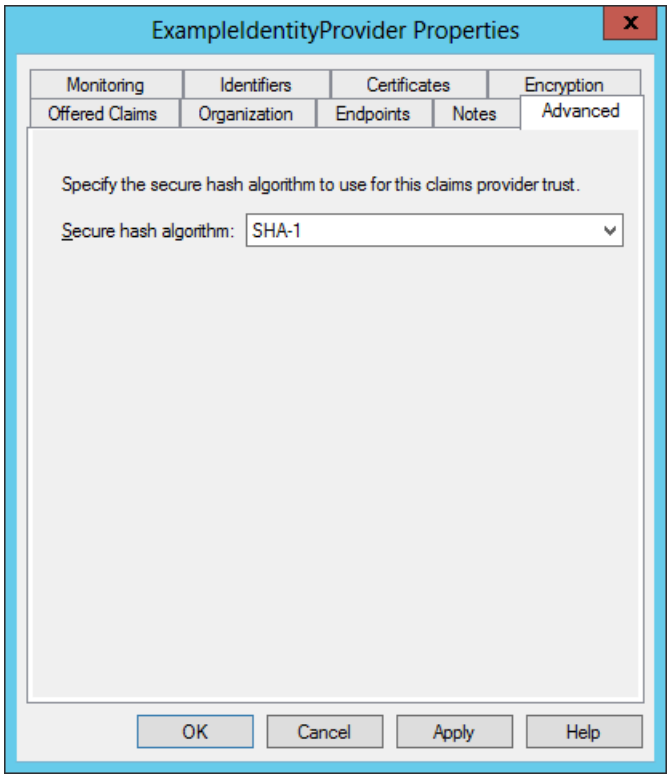
Review the configuration and close the wizard.



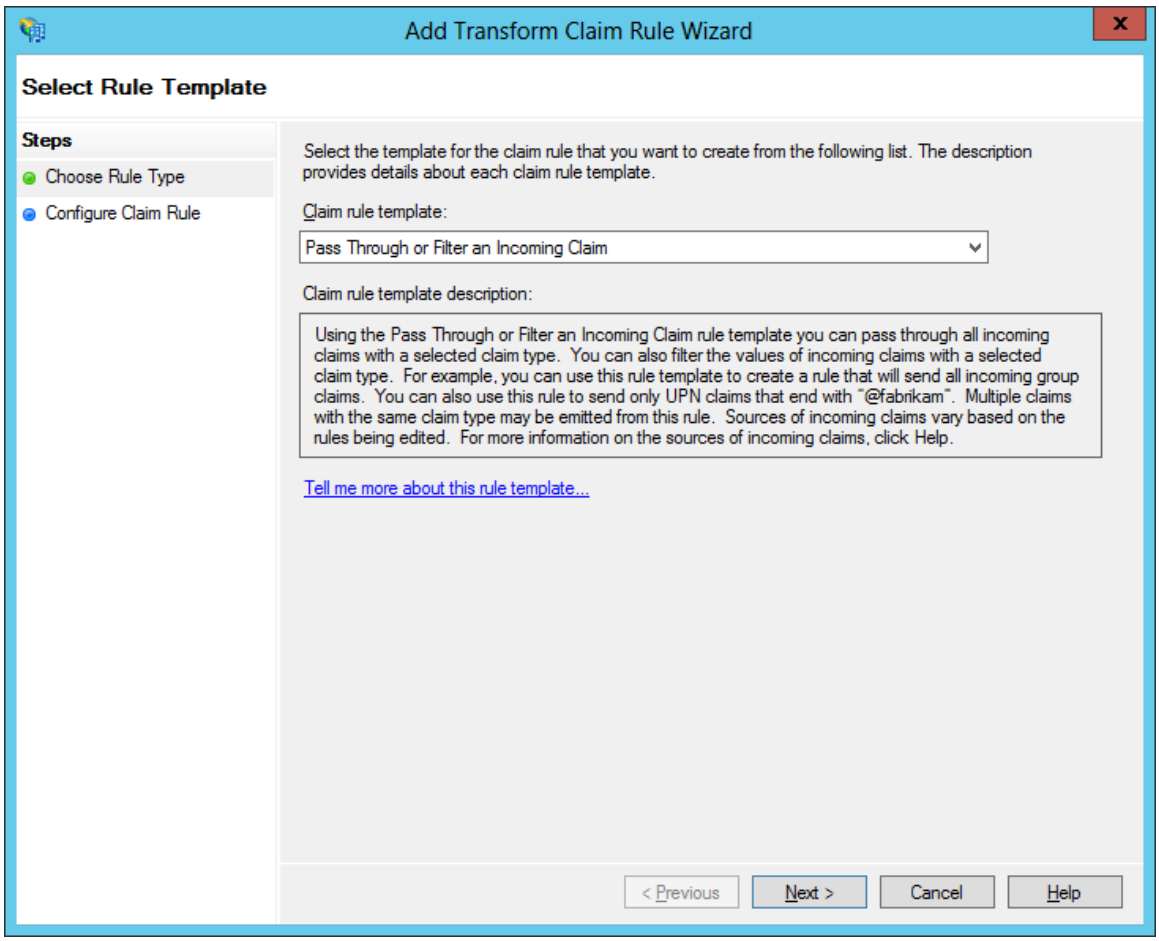
The identity provider should be included in the list of claims provider trusts.



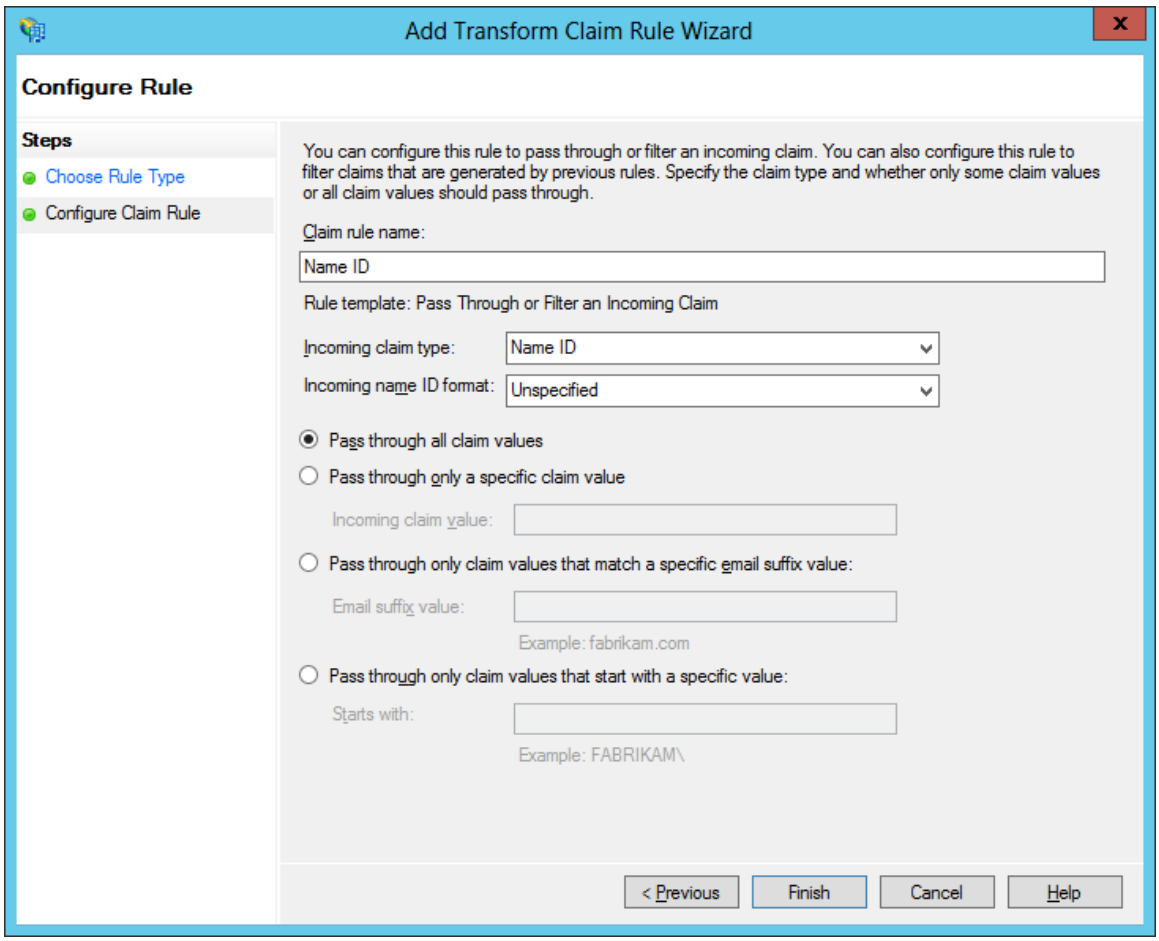
Although the SAML v2.0 component supports SHA-256 signatures, for this example SHA-1 is used. To specify this, open the claims provider trusts' properties and, under the Advanced tab, select SHA-1.



Edit the claim rules and add a rule. Use the pass through template.



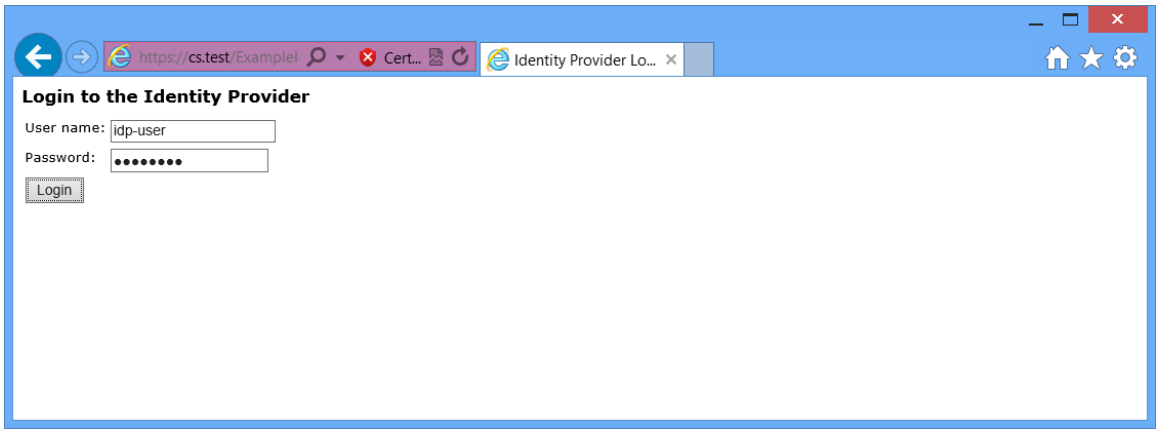
Add a rule to pass through the Name ID. Ignore any warning.



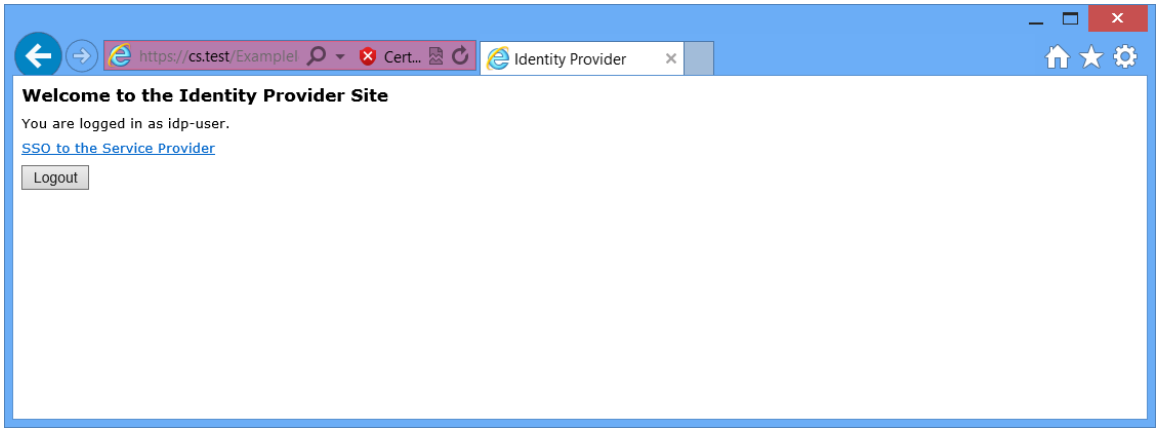
10.3.8 Running the Identity Provider with IdP-Initiated SSO

In this example, the user logs in at the identity provider and initiates SSO to ADFS. ADFS forwards this to the specified service provider. The asserted identity, passed to the service provider in a SAML assertion, is used to perform an automatic login at the service provider.

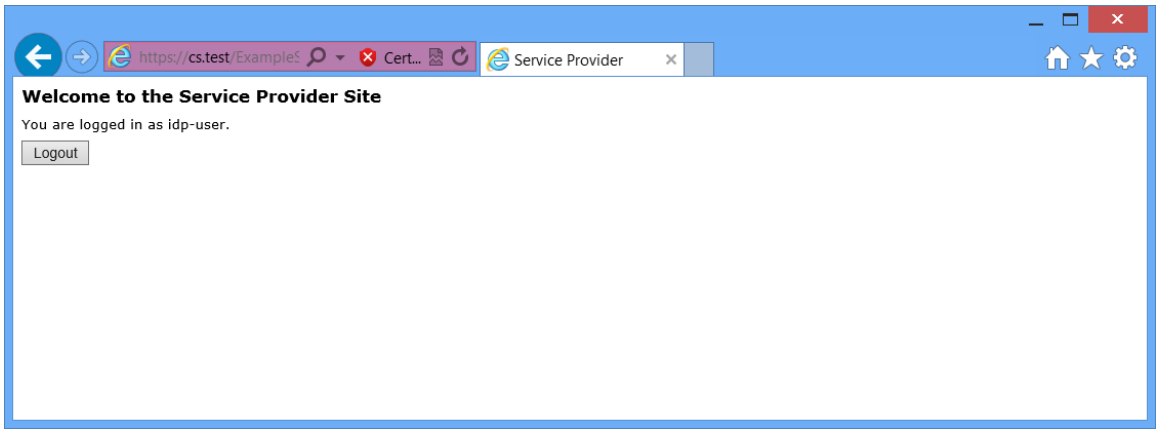
1. Browse to https://cs.test/ExampleIdentityProvider, ignoring any browser certificate warnings.



2. Click the link to single sign-on to the service provider.

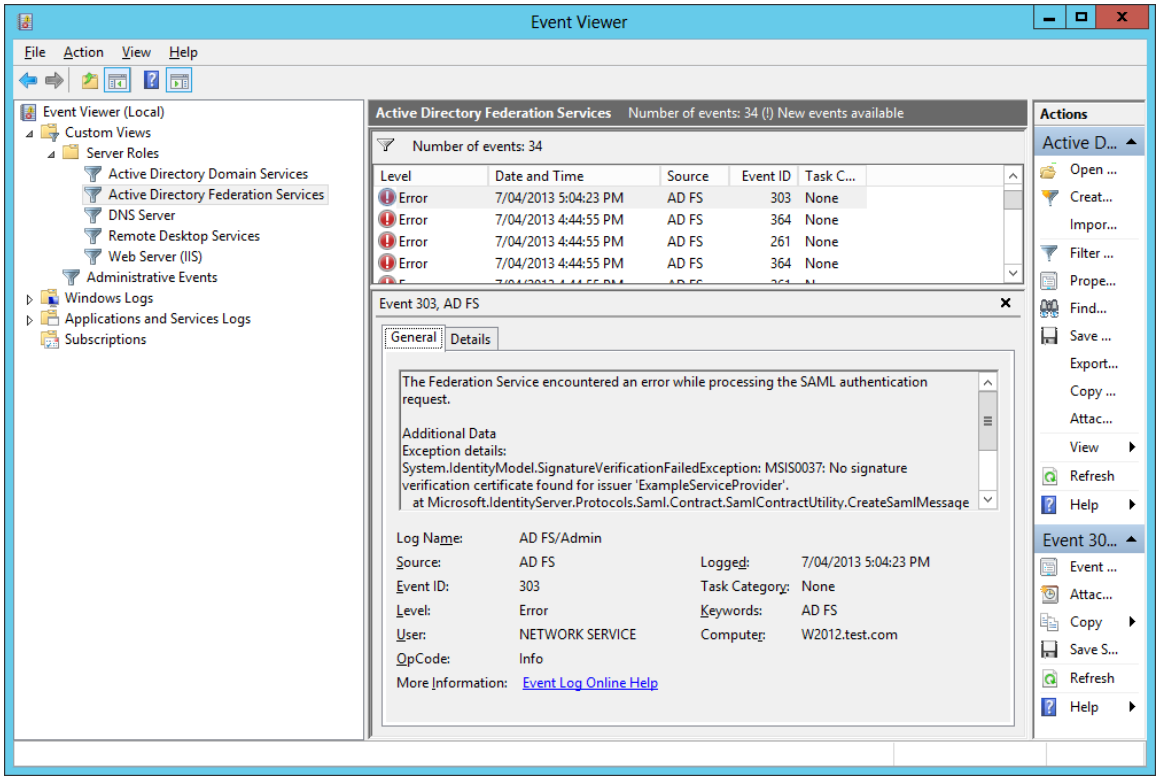


3. You should then be presented with the service provider's default page.



10.3.9 Troubleshooting ADFS SSO

Configuration errors will result in a cryptic message displayed in the browser by ADFS. To troubleshoot configuration and other problems, refer to the ADFS event log.



ADFS metadata may be viewed at the FederationMetadata/2007-06/FederationMetadata.xml endpoint. For example:

https://adfs.test/FederationMetadata/2007-06/FederationMetadata.xml

10.4 Office 365 Interoperability

The Web Forms and MVC example identity providers demonstrate single sign-on with Office 365.

The following sections describe the configuration for the Web Forms example identity provider but, with the appropriate changes, apply equally to the MVC examples.

Refer to sections 10.1 and 10.2 for instructions on installing and configuring the Web Forms and MVC example identity providers.

10.4.1 Configuring the Identity Provider

The saml.config file includes the following entry for the Office 365 partner service provider.

```
<PartnerServiceProvider Name="urn:federation:MicrosoftOnline"
                        WantAuthnRequestSigned="false"
                        SignSAMLResponse="false"
                        SignAssertion="true"
                        EncryptAssertion="false"
                        NameIDFormat=
    "urn:oasis:names:tc:SAML:2.0:nameid-format:persistent"
                        AuthnContext=
    "urn:oasis:names:tc:SAML:2.0:ac:classes:Password"
                        AssertionConsumerServiceUrl=
    "https://login.microsoftonline.com/login.srf"
                        SingleLogoutServiceUrl=
    "https://login.microsoftonline.com/login.srf"/>
```

The web.config's *PartnerSP* setting specifies the partner service provider for IdP-initiated SSO and should be set to urn:federation:MicrosoftOnline.

```
<add key="PartnerSP" value="urn:federation:MicrosoftOnline"/>
```

The web.config's *SubjectName* setting specifies the subject's name identifier. This must match with the user's immutable identifier configured in Office 365. In this example, a fixed immutable identifier is used. Refer to section 10.4.3.1.

```
<add key="SubjectName" value="12345678"/>
```

The web.config specifies the SAML attributes. The IDPEmail attribute must match with the user's principal name configured in Office 365. In this example, a fixed principal name is used.

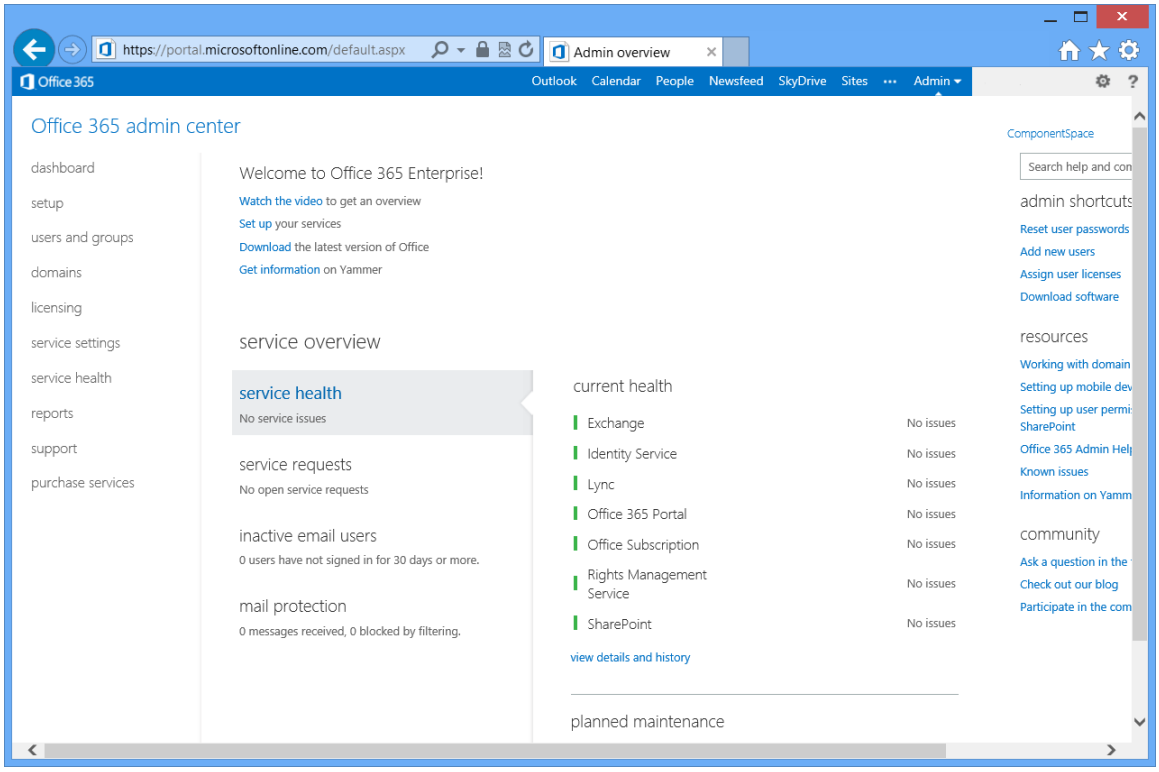
```
<add key="Attribute_IDPEmail" value="test@componentspace.com"/>
```

To keep the example identity provider simple, fixed values are used for the user's immutable identifier and principal name. In a production application, these values would be retrieved from the user store (e.g. Active Directory or a user database).

10.4.2 Configuring Office 365

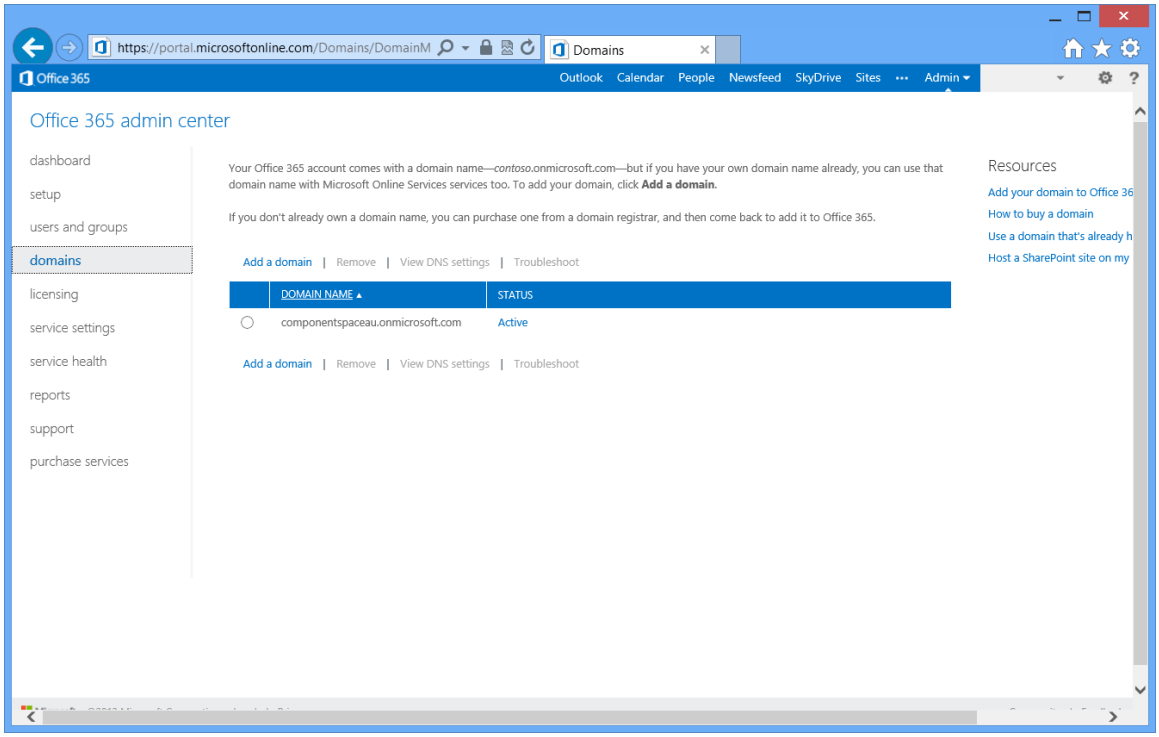
Login, as an administrator, to the Office 365 administration center at:

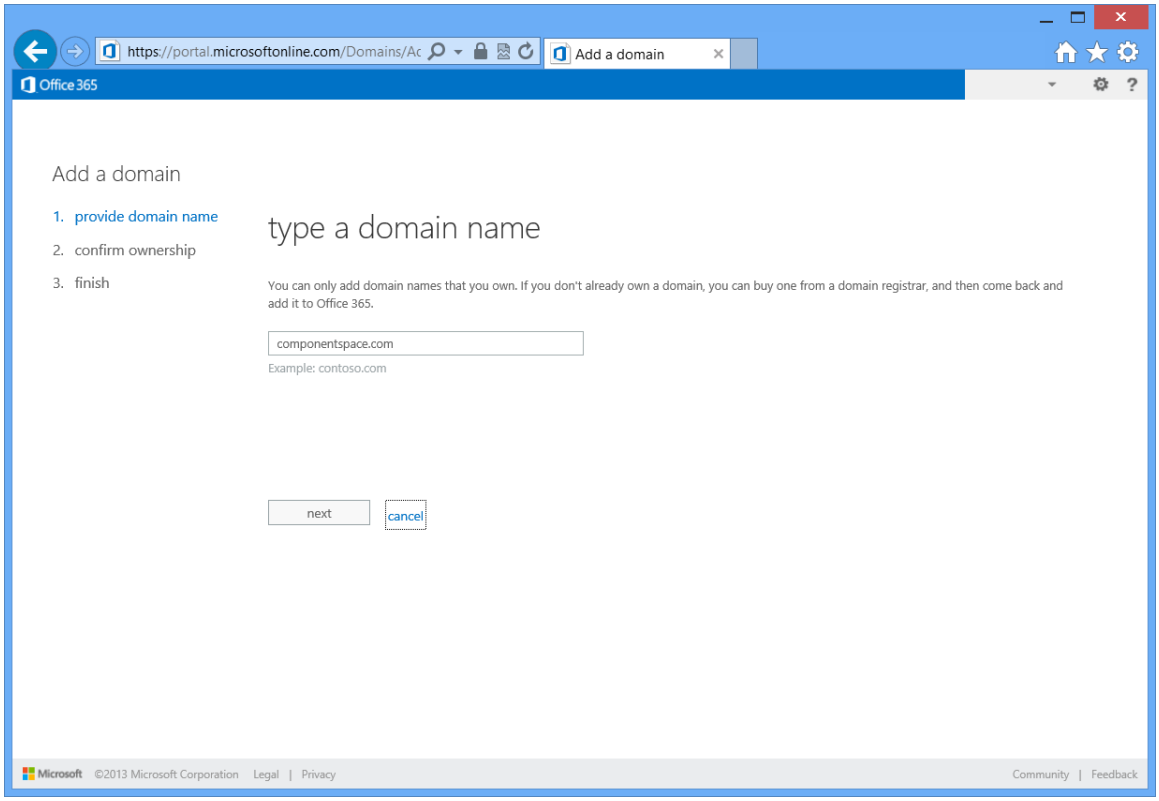
https://portal.microsoftonline.com/

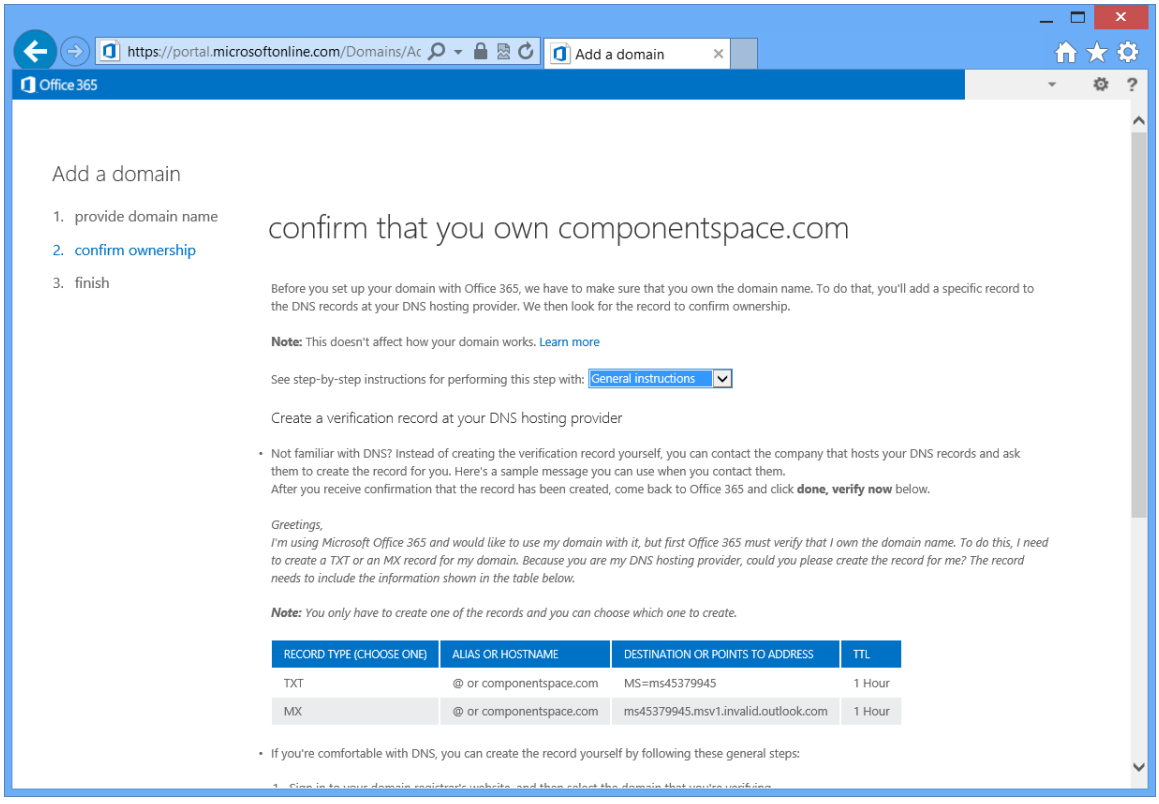


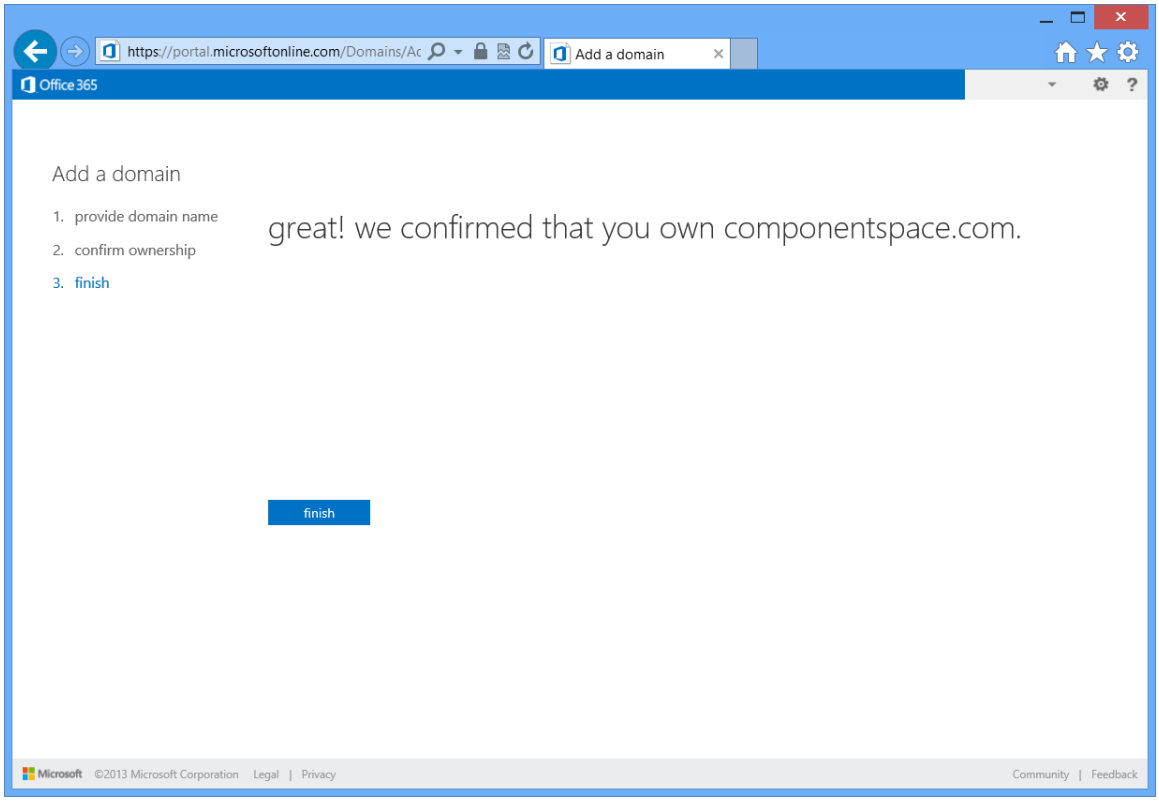
10.4.2.1 Add a Domain

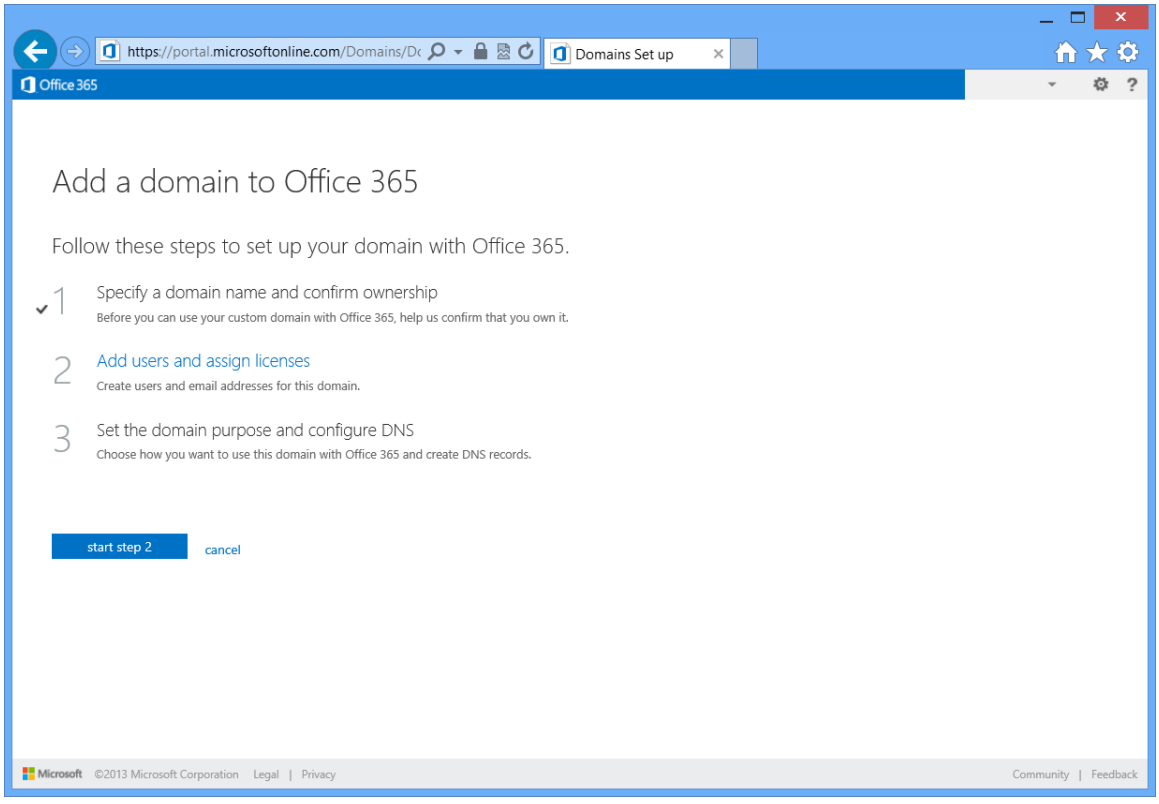
Add a domain that will be used for single sign on.



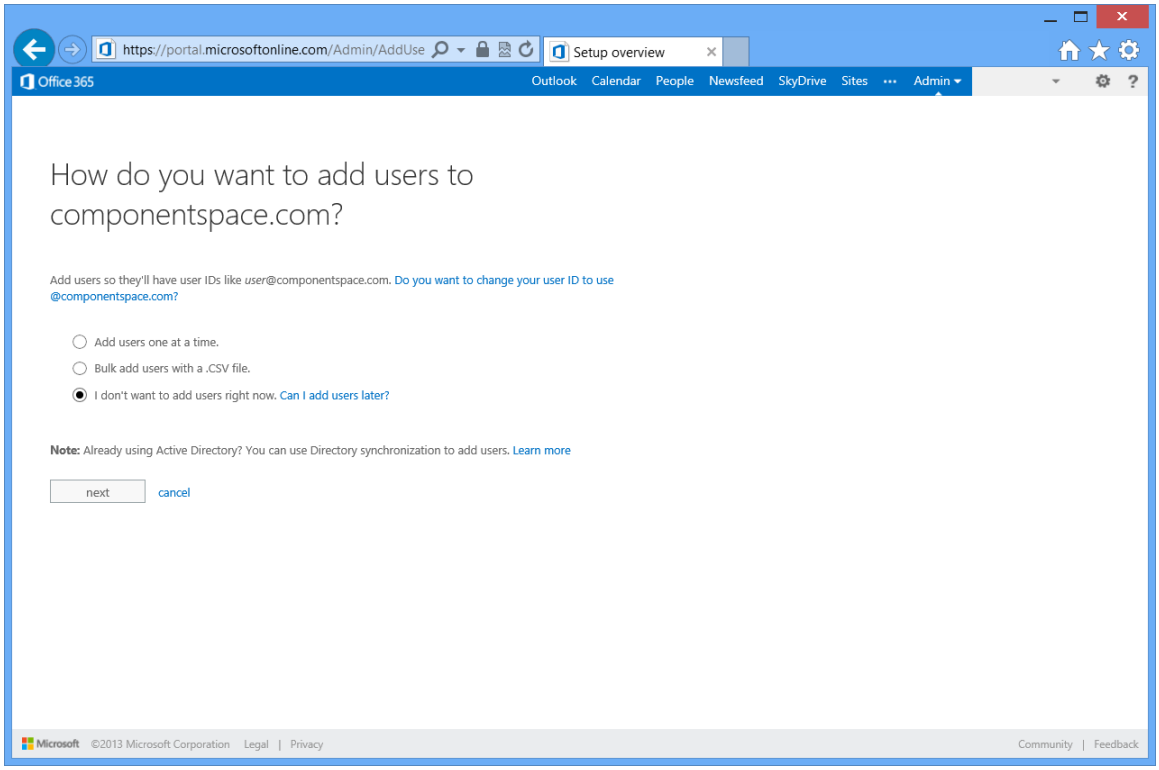

https://portal.microsoftonline.com/Domains/Ac
Add a domain
Office 365
Add a domain
1. provide domain name
2. confirm ownership
3. finish
type a domain name
You can only add domain names that you own. If you don't already own a domain, you can buy one from a domain registrar, and then come back and add it to Office 365.
componentspace.com
Example: contoso.com
next
cancel
Microsoft ©2013 Microsoft Corporation Legal | Privacy
Community | Feedback

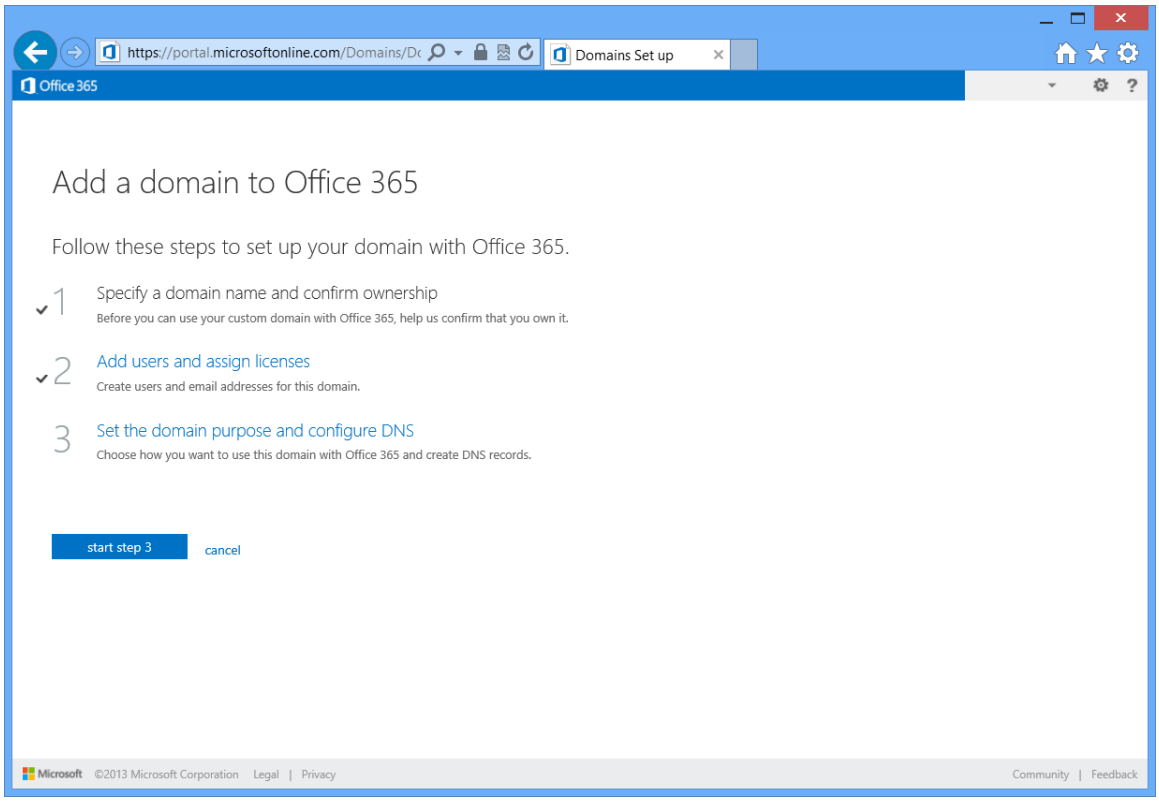

https://portal.microsoftonline.com/Domains/Ac
Add a domain
Office 365
Add a domain
1. provide domain name
2. confirm ownership
3. finish
confirm that you own componentspace.com
Before you set up your domain with Office 365, we have to make sure that you own the domain name. To do that, you'll add a specific record to the DNS records at your DNS hosting provider. We then look for the record to confirm ownership.
Note: This doesn't affect how your domain works. Learn more
See step-by-step instructions for performing this step with: General instructions
Create a verification record at your DNS hosting provider
Not familiar with DNS? Instead of creating the verification record yourself, you can contact the company that hosts your DNS records and ask them to create the record for you. Here's a sample message you can use when you contact them.
After you receive confirmation that the record has been created, come back to Office 365 and click done, verify now below.
Greetings,
I'm using Microsoft Office 365 and would like to use my domain with it, but first Office 365 must verify that I own the domain name. To do this, I need to create a TXT or an MX record for my domain. Because you are my DNS hosting provider, could you please create the record for me? The record needs to include the information shown in the table below.
Note: You only have to create one of the records and you can choose which one to create.
RECORD TYPE (CHOOSE ONE) | ALIAS OR HOSTNAME | DESTINATION OR POINTS TO ADDRESS | TTL
TXT | @ or componentspace.com | MS=ms45379945 | 1 Hour
MX | @ or componentspace.com | ms45379945.msv1.invalid.outlook.com | 1 Hour
If you're comfortable with DNS, you can create the record yourself by following these general steps:


https://portal.microsoftonline.com/Domains/Ac
Add a domain
Office 365
Add a domain
1. provide domain name
2. confirm ownership
3. finish
great! we confirmed that you own componentspace.com.
finish
Microsoft ©2013 Microsoft Corporation Legal | Privacy
Community | Feedback

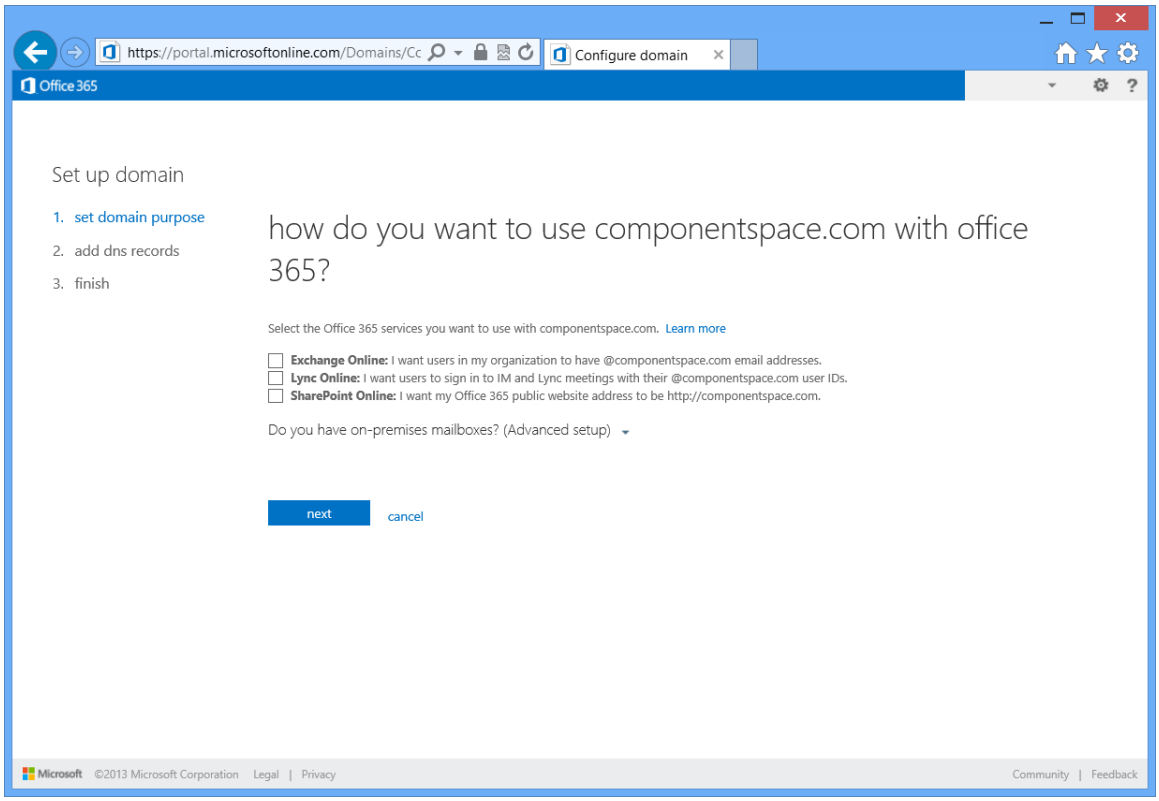

https://portal.microsoftonline.com/Domains/Dc
Domains Set up
Office 365
Add a domain to Office 365
Follow these steps to set up your domain with Office 365.
1 Specify a domain name and confirm ownership
Before you can use your custom domain with Office 365, help us confirm that you own it.
2 Add users and assign licenses
Create users and email addresses for this domain.
3 Set the domain purpose and configure DNS
Choose how you want to use this domain with Office 365 and create DNS records.
start step 2
cancel
Microsoft ©2013 Microsoft Corporation Legal | Privacy
Community | Feedback

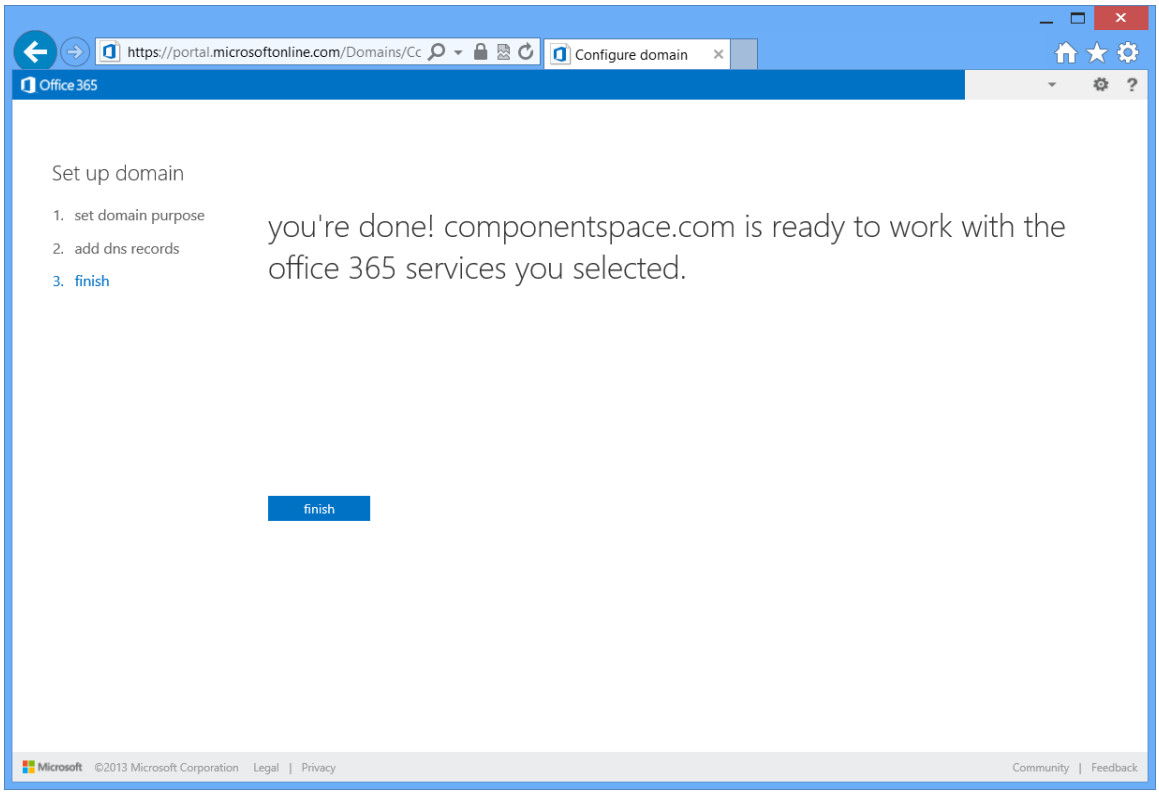
Don’t add any users at this stage.

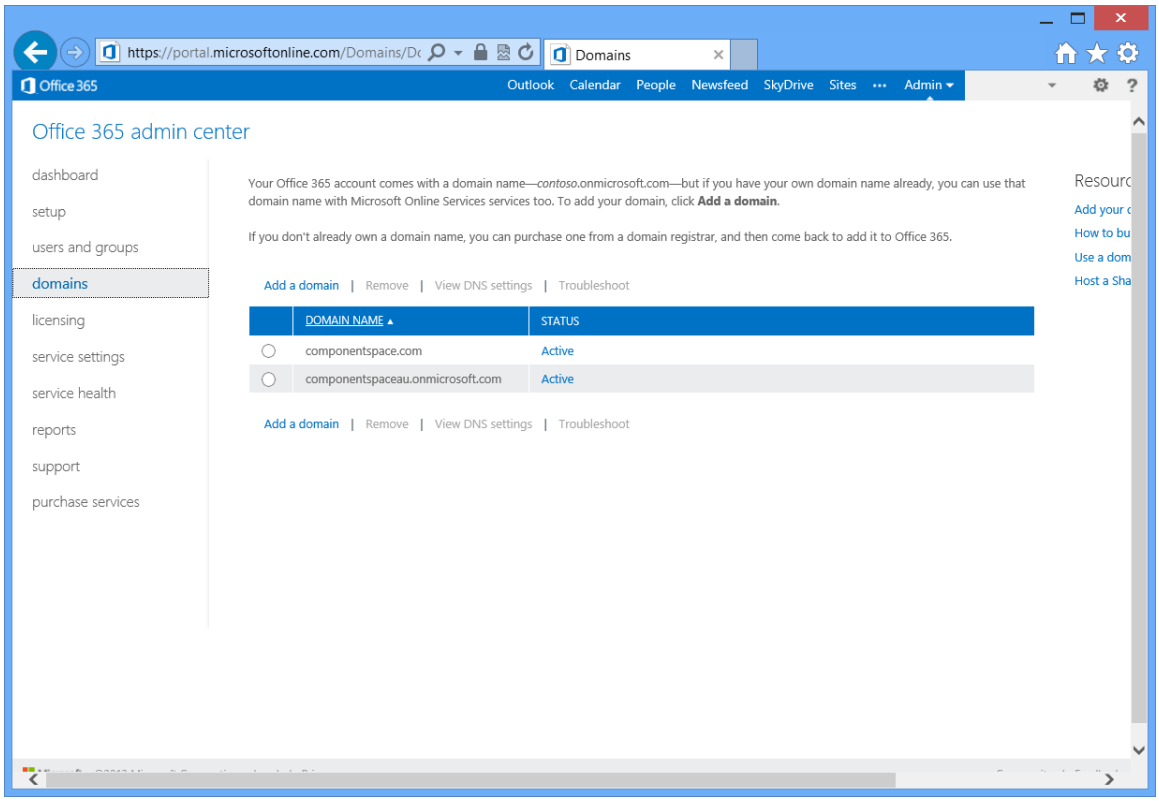




Unless DNS entries are to be updated, uncheck the Exchange Online and Lync Online check boxes.


https://portal.microsoftonline.com/Domains/Cc
Configure domain
Office 365
Set up domain
1. set domain purpose
2. add dns records
3. finish
how do you want to use componentspace.com with office 365?
Select the Office 365 services you want to use with componentspace.com. Learn more
Exchange Online: I want users in my organization to have @componentspace.com email addresses.
Lync Online: I want users to sign in to IM and Lync meetings with their @componentspace.com user IDs.
SharePoint Online: I want my Office 365 public website address to be http://componentspace.com.
Do you have on-premises mailboxes? (Advanced setup)
next
cancel
Microsoft ©2013 Microsoft Corporation Legal | Privacy
Community | Feedback


https://portal.microsoftonline.com/Domains/Cc
Configure domain
Office 365
Set up domain
1. set domain purpose
2. add dns records
3. finish
you're done! componentspace.com is ready to work with the office 365 services you selected.
finish
Microsoft ©2013 Microsoft Corporation Legal | Privacy
Community | Feedback



10.4.2.2 Set the Default Domain

Ensure the newly added domain is not the default domain.

Click the organization's name in the top right corner.

Change the default domain to the onmicrosoft.com domain (e.g. componentspaceau.onmicrosoft.com instead of componentspace.com).

10.4.2.3 Install the Azure PowerShell Cmdlets

Single sign on cannot be configured using the Office 365 administration center. Instead, the Windows Azure Active Directory Module for Windows PowerShell cmdlets are used to configure Office 365 for single sign on.

Download and install the cmdlets from:

http://technet.microsoft.com/en-us/library/jj151815.aspx

More information about these cmdlets and using them to configure single sign on may be found at:

http://technet.microsoft.com/en-us/library/jj151815.aspx

and

http://technet.microsoft.com/en-us/library/hh967628.aspx

10.4.2.4 Configuring the Domain for Single Sign On

Run the Set-MsolDomainAuthentication cmdlet to configure single sign on.

The following PowerShell script configures the componentspace.com domain.

For convenience, it's recommended this is included in a PowerShell .ps1 script file.

```
# Configure Office 365 SSO

# Prompt for the administrator's credentials
$cred=Get-Credential
Connect-MsolService -Credential $cred

$domain = "componentspace.com"
$issuer = "urn:componentspace:ExampleIdentityProvider"
$ssoUrl =
"https://test.componentspace.com/ExampleIdentityProvider/SAML/SSOServic
e.aspx"
$ecpUrl =
"https://test.componentspace.com/ExampleIdentityProvider/SAML/ECP.aspx"
$logoffUrl =
"https://test.componentspace.com/ExampleIdentityProvider/SAML/SLOServic
e.aspx"
$cert =
"MIIBrzCCARigAwIBAgIQWJaxa3/MnJ1O88oamyZTuzANBgkqhkiG9w0BAQUFADAWMRQwEg
YDVQQDEwt3d3cuaWRwLmNvbTAeFw0xMzAyMTIyMzIyNDRaFw00OTEyMzExNDAwMDBaMBYxF
DASBgNVBAMTC3d3dy5pZHAuY29tMIGfMA0GCSqGSIb3DQEBAQUAA4GNADCBiQKBgQDEruhL
B9LyKJsuuXTl39vEYMYUg+/o+SoOLfuRH7g/o/FJV6QT0gFDL70uN/YDdDnC8zDza8WZbDl
eA0W7ot76Uq71vFwf69fV4VnhxsQOmDAGlmQDeZtbWWbJEmnX9oAwkqQEOd8sBZnyYrbwPy
zgnWM3HLOu2vVvNtXUmWJ6owIDAQABMA0GCSqGSIb3DQEBBQUAA4GBAKN1MWb8ug6TLiqDw
XcYqfbsFDfPoI04pH2Pzu19NBs6v9P0G+SF2tRlZ4NVQ/ADQkUPuWM0GKiluJwS898R+RF6
znCvW93rl4FdQli66OJO2PnDlSViBfc07hj0atOYo1weFFtBLinAYIZL6P/S1IcHTYpo3Mg
oQGVInCMMyTUW"

Set-MsolDomainAuthentication -FederationBrandName $domain -DomainName
$domain -Authentication federated -PreferredAuthenticationProtocol
SAMLP -IssuerUri $issuer -SigningCertificate $cert -PassiveLogOnUri
$ssoUrl -ActiveLogOnUri $ecpUrl -LogOffUri $logoffUrl –Verbose
```

The following is a template for configuring a domain.

```
# Configure Office 365 SSO

# Prompt for the administrator's credentials
$cred=Get-Credential
Connect-MsolService -Credential $cred

$domain = "TODO: specify domain name"
$issuer = "TODO: specify issuer"
$ssoUrl = "TODO: specify SSO service URL"
$ecpUrl = "TODO: specify ECP service URL"
$logoffUrl = "TODO: specify the SLO service URL"
$cert = "TODO: specify the identity provider's certificate"
```

```
Set-MsolDomainAuthentication -FederationBrandName $domain -DomainName
$domain -Authentication federated -PreferredAuthenticationProtocol
SAMLP -IssuerUri $issuer -SigningCertificate $cert -PassiveLogOnUri
$ssoUrl -ActiveLogOnUri $ecpUrl -LogOffUri $logoffUrl –Verbose
```

The $domain is the domain name previously configured in Office 365 for single sign on.

The $issuer is the identity provider name. This name must match with the IdentityProvider name configured in the identity provider's saml.config. For example, if the identity provider name is urn:componentspace:ExampleIdentityProvider then the $issuer must be set to the same value.

The $ssoUrl is the identity provider's SSO service URL. In browser-based SP-initiated SSO, Office 365 will send an authentication request to this endpoint.

The $ecpUrl is the identity provider's Enhanced Client or Proxy URL. In non-browser-based SP-initiated SSO, Office 365 will send an authentication request to this endpoint.

The $logoffUrl is the identity provider's SLO service URL.

The $cert is the identity provider's certificate. Office 365 will use this certificate to verify signed SAML assertions from the identity provider.

The Set-MsolDomainAuthentication cmdlet configures authentication for the domain.

The "-Authentication federated" parameter specifies to use single sign on. The "-PreferredAuthenticationProtocol SAMLP" parameter specifies to use the SAML protocol rather than WS-Federation.

10.4.2.5 Confirming the Domain's SSO Settings

Run the Get-MsolDomainFederationSettings cmdlet to confirm the single sign on settings. For example:

```
$domain = "componentspace.com"
Get-MsolDomainFederationSettings -DomainName $domain
```

10.4.3 Adding a User

Run the New-MsolUser cmdlet to add a user to the domain. For example:

```
New-MsolUser -UserPrincipalName test@componentspace.com -ImmutableId
12345678 -FirstName Test -LastName User -DisplayName "Test User" -
LicenseAssignment "componentspaceau:ENTERPRISEPACK" -usageLocation US
```

The UserPrincipalName is the user ID.

The ImmutableId is a unique ID that identifies the user. See section 10.4.3.1.

The LicenseAssignment assigns licenses to the user. Use the Get-MsolAccountSku cmdlet to get the value for the license assignment.

10.4.3.1 User Immutable Identifier

The immutable identifier uniquely and permanently identifies the user.

The SAML response sent by the identity provider includes the immutable identifier as the subject name identifier in the SAML assertion. The user principal name is included as the IDPEmail SAML attribute. Both these values must match with the Office 365 configuration for single sign on to be successful.

For user information stored in Active Directory, the user's object GUID (objectGUID attribute) may be used as the immutable identifier.

For user information stored in a database or some other user registry, some other unique identifier must be assigned as the immutable identifier.

In the example identity provider, a fixed immutable identifier is used.

10.4.4 Deleting a User

During testing, it may be necessary to delete and reconfigure users in Office 365.

Users may be deleted using the Office 365 administration center or by using the PowerShell Remove-MsolUser cmdlet. For example:

```
Remove-MsolUser -UserPrincipalName test@componentspace.com
```

Deleting the user moves the user to the Office 365 recycle bin. To create a user with the same name, the user first must be removed from the recycle bin. This requires the object identifier associated with the user.

The Get-MsolUser cmdlet is used to retrieve the object identifier. For example:

```
Get-MsolUser -ReturnDeletedUsers -SearchString test@componentspace.com
| select UserPrincipalName, ObjectId
```

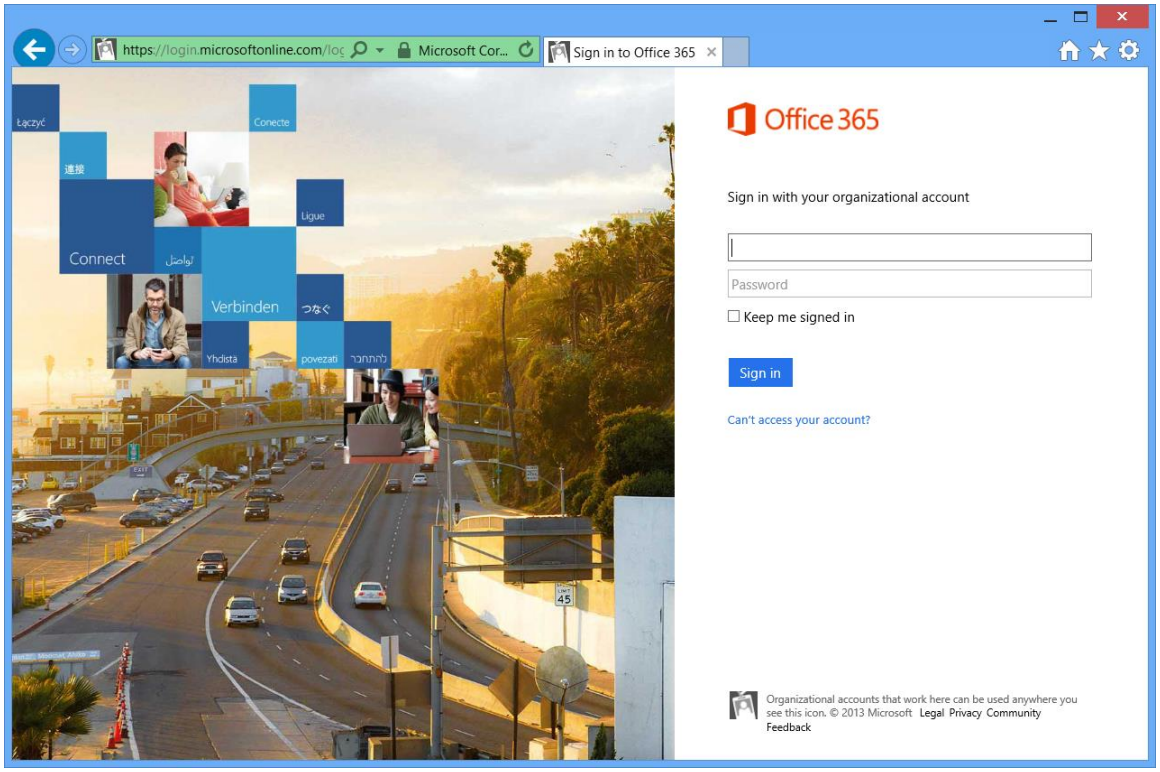
The Remove-MsolUser cmdlet is used to delete the user from the recycle bin. For example:

```
Remove-MsolUser -RemoveFromRecycleBin –ObjectId [objectID value]
```

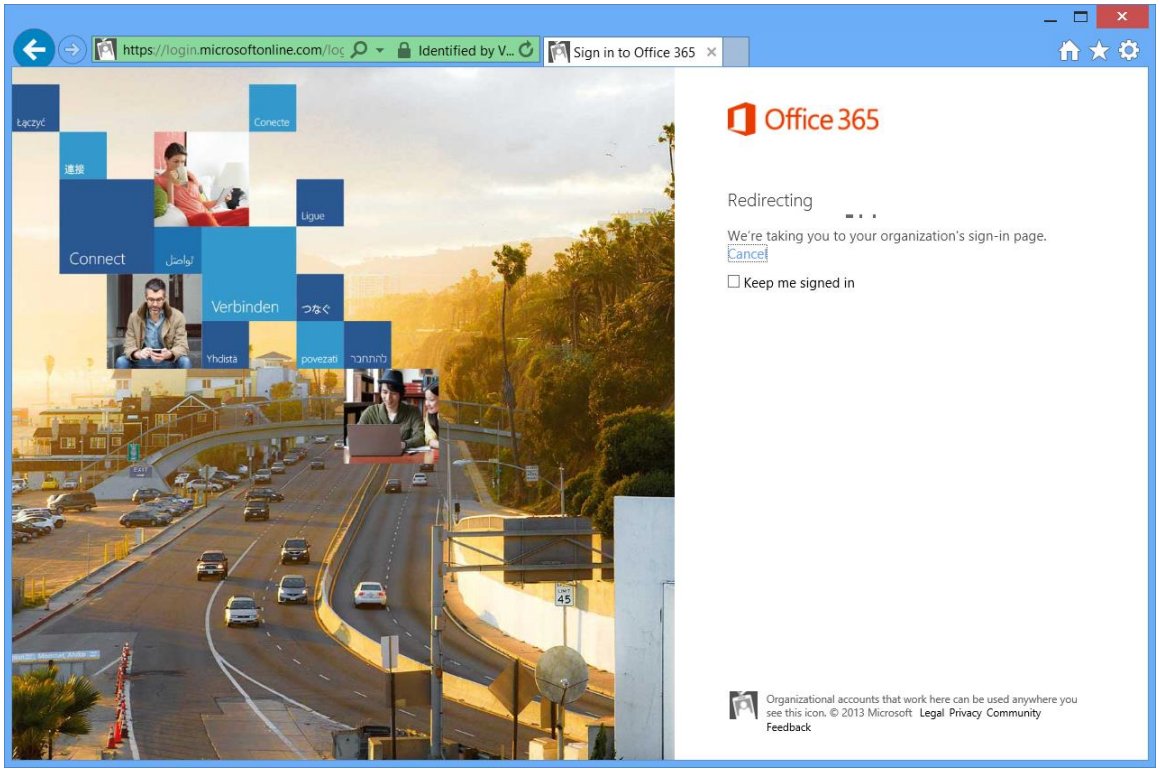
10.4.5 Running the Identity Provider with SP-Initiated SSO

In this example, the user is attempting to login at Office 365 and, rather than performing a local login at Office 365, SSO is initiated with a local login occurring at the example identity provider and the asserted identity, passed to the service provider in a SAML assertion, is used to perform an automatic login at the Office 365.

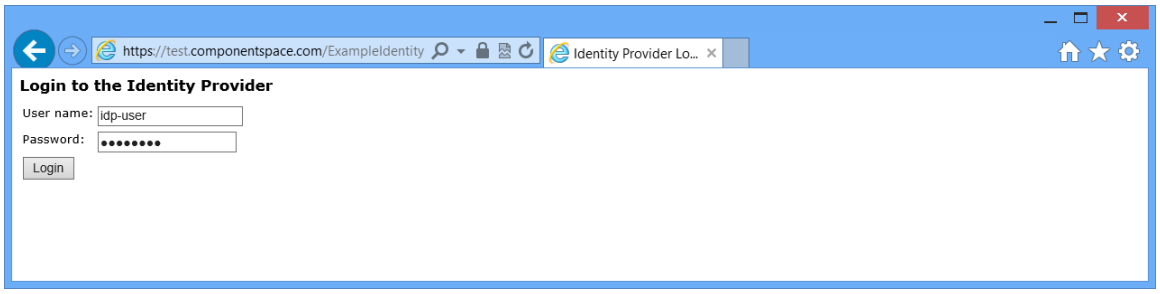
1. Browse to https://portal.microsoftonline.com/.



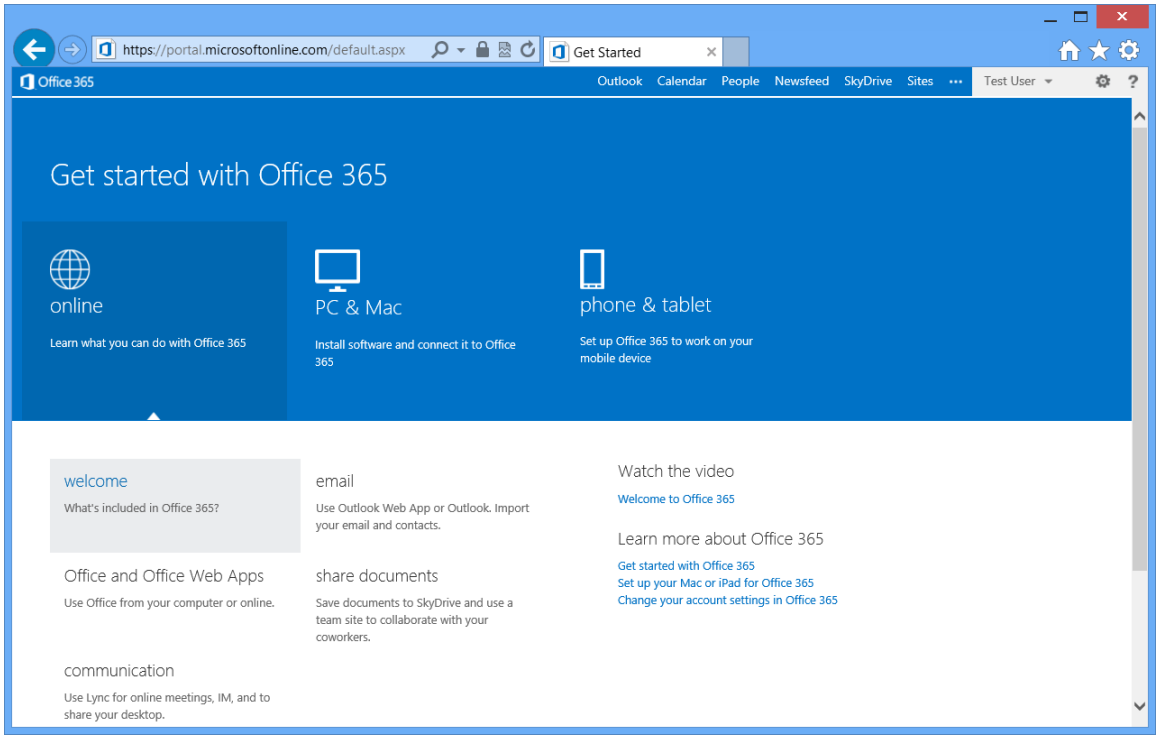
2. Specify the user e.g. test@componentspace.com. Although a prompt for a password is initially displayed, Office 365 determines the domain is federated and automatically redirects to the identity provider for login.



3. Login at the example identity provider.



4. You should now be logged in at Office 365.



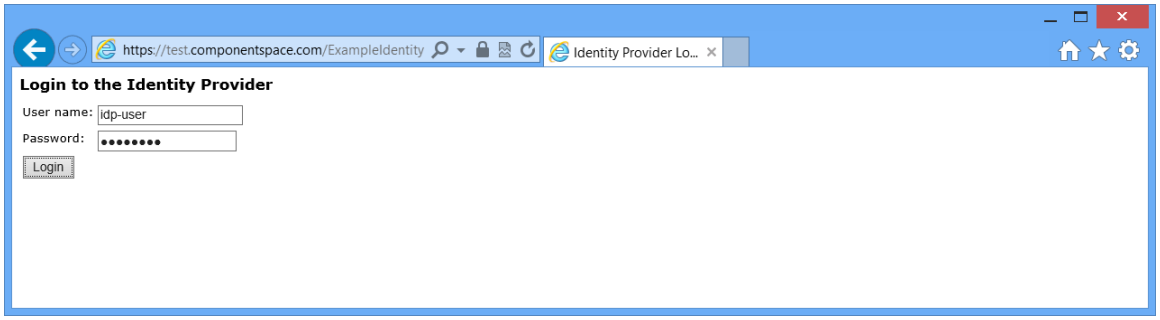
10.4.6 Running the Identity Provider with IdP-Initiated SSO

In this example, the user is logged in at the identity provider and clicks a link to SSO to Office 365.

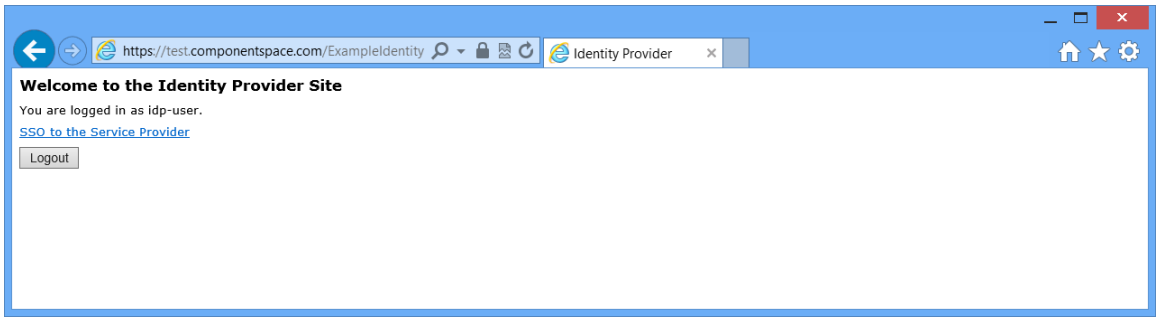
1. Browse to the example identity provider.

   For example: https://test.componentspace.com/ExampleIdentityProvider.

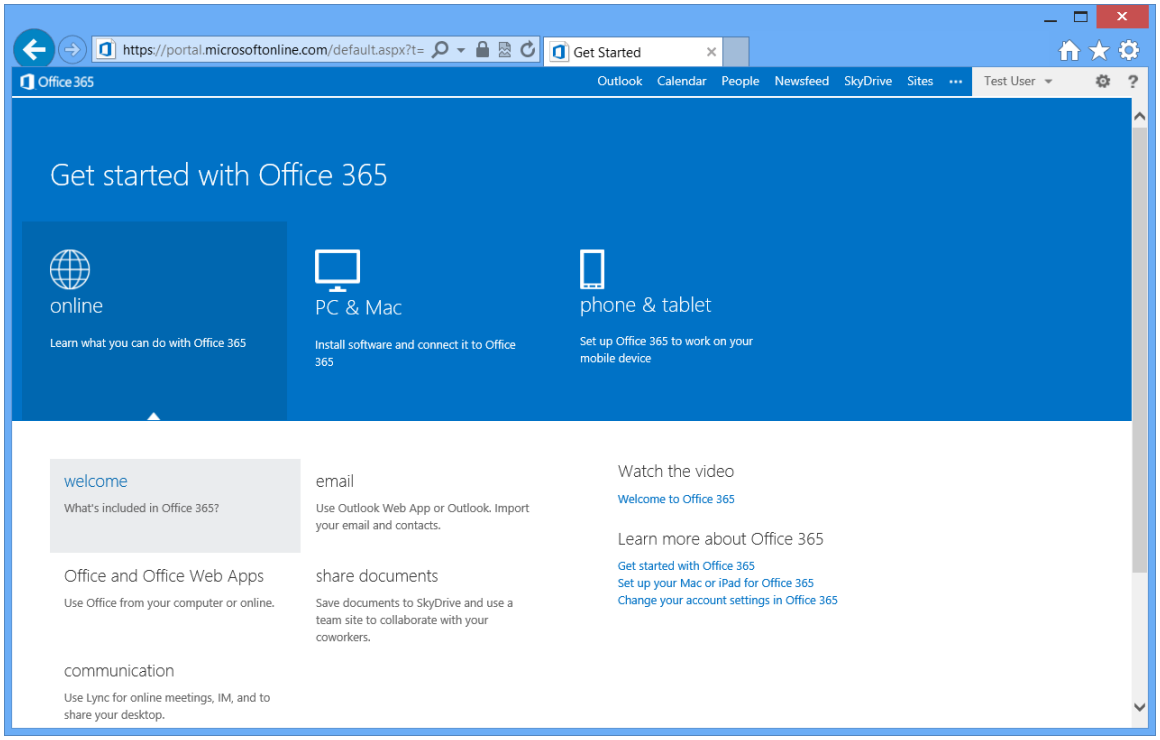
2. Login at the example identity provider.



3. Click the link to SSO to Office 365.



4. You should now be logged in at Office 365.



10.4.7 Email Client Support

Office 365 supports users of email clients, such as Microsoft Outlook, logging in through an identity provider.

The user's name and password are sent by the email client to Office 365 which delegates user authentication to the identity provider.

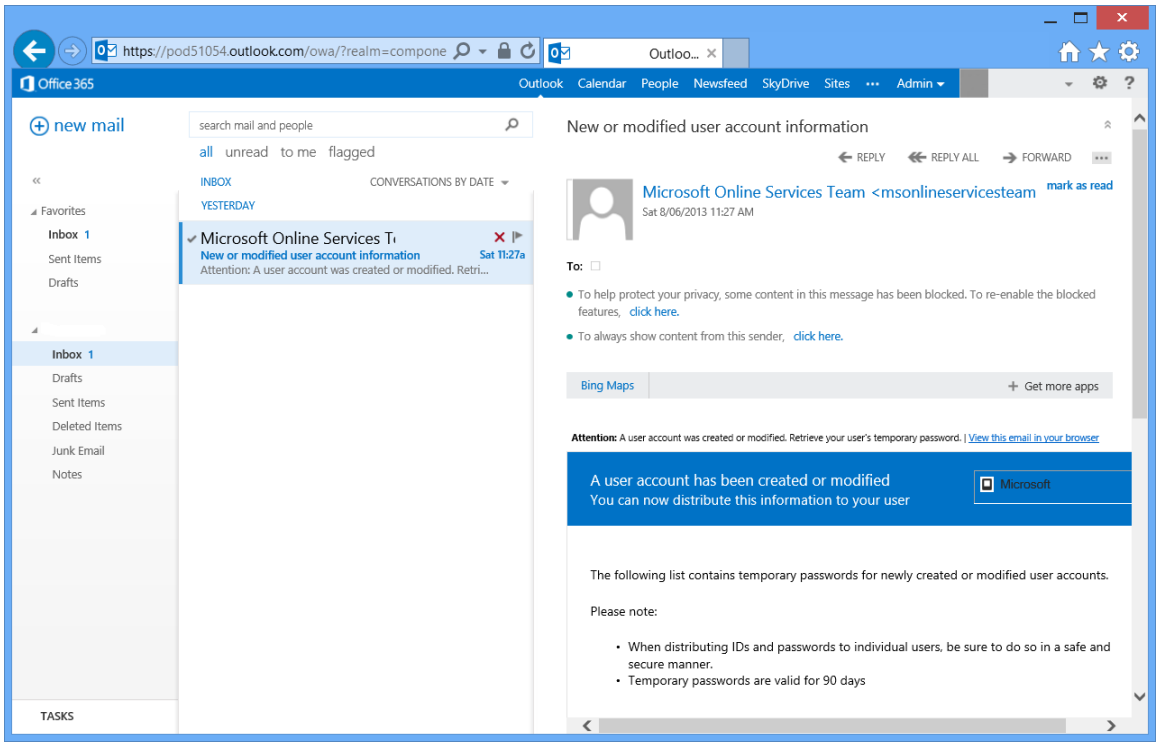
The SAML Enhanced Client or Proxy (ECP) profile is used for the exchange of SAML messages between Office 365 and the identity provider.

Along with the SAML authentication request sent to the identity provider, Office 365 includes the user's name and password in the HTTP authorization header.

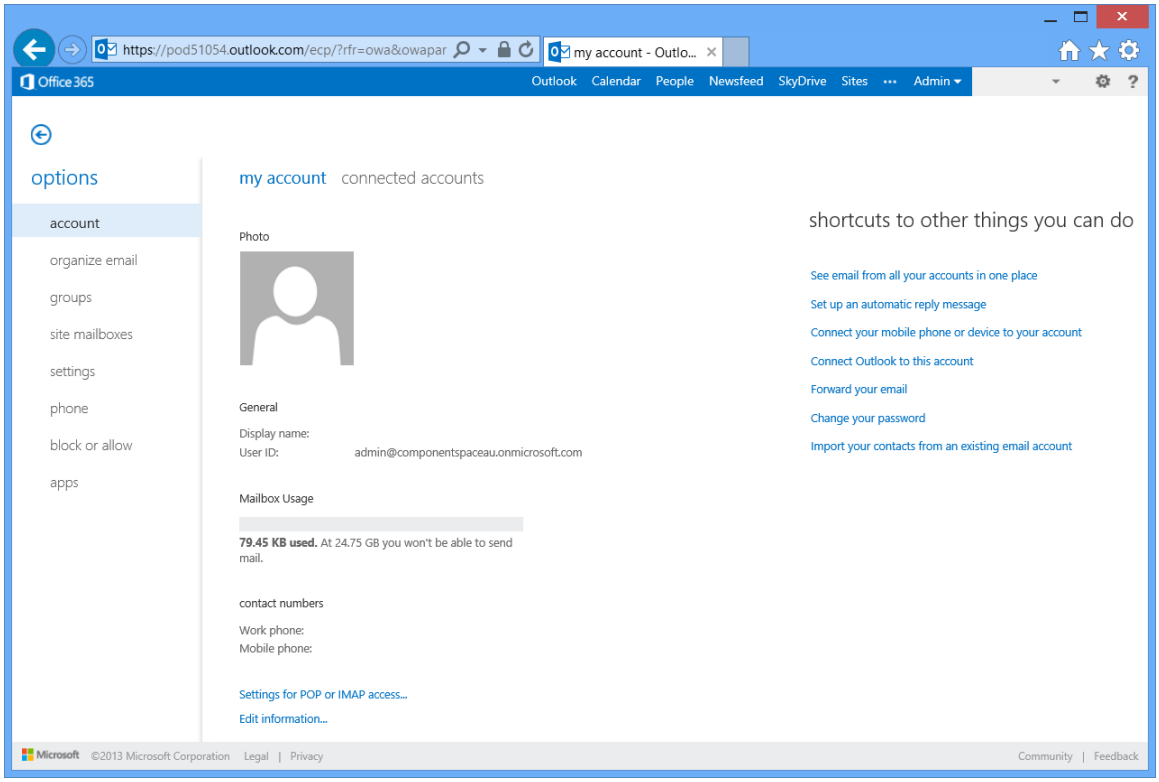
The identity provider uses these credentials to authenticate the user. If authenticated, the identity provider returns a SAML response to Office 365.

10.4.8 Configuring an Email Client

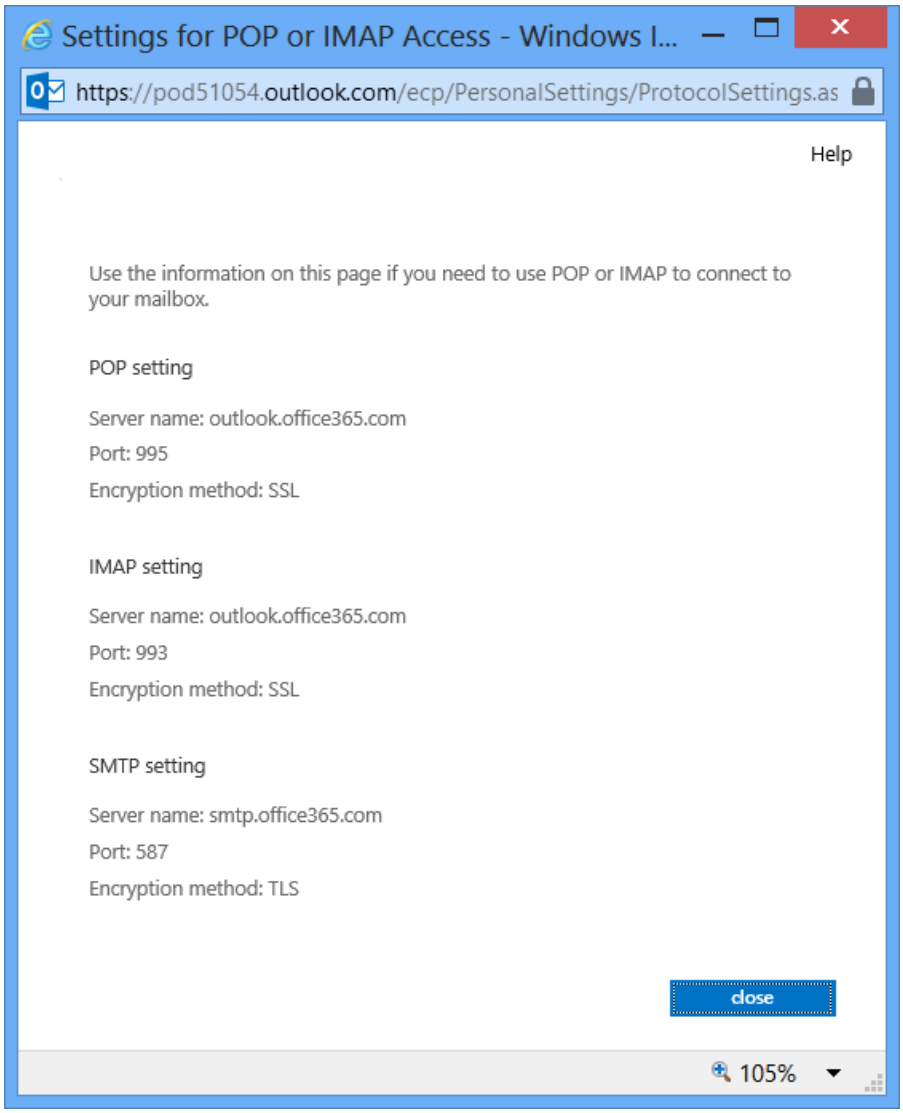
Login as the Office 365 administrator and click the Outlook link at the top of the page. This applies regardless of whether Outlook or some other email client is used.



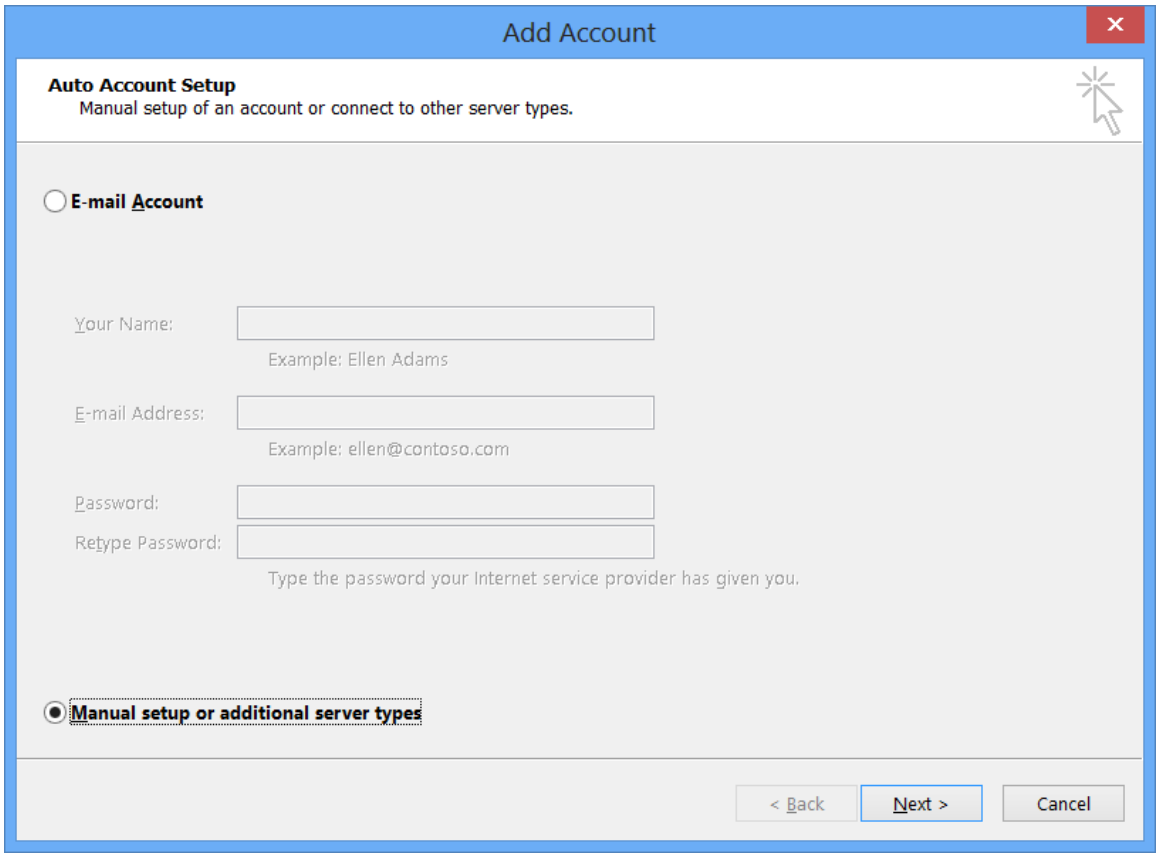
Click the settings cog at the top right and select Options.

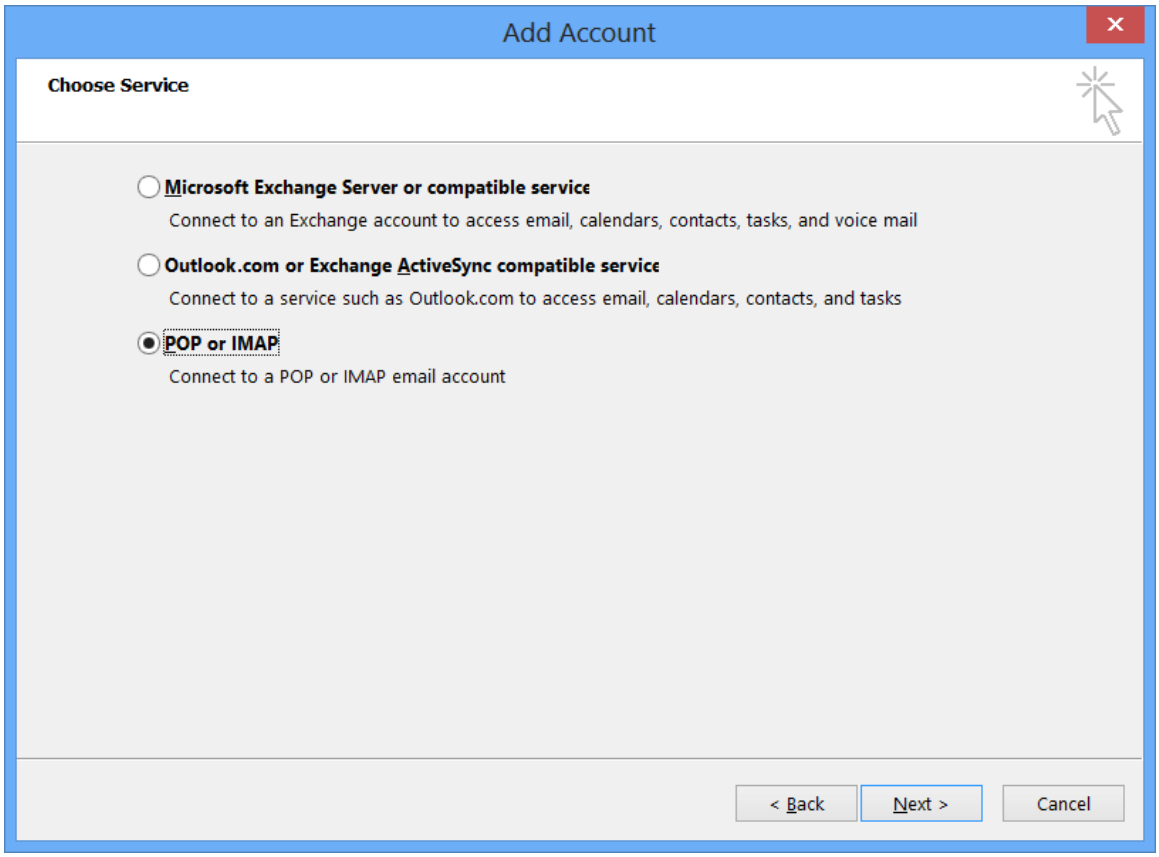


Click Settings for POP or IMAP access and take note of these settings.

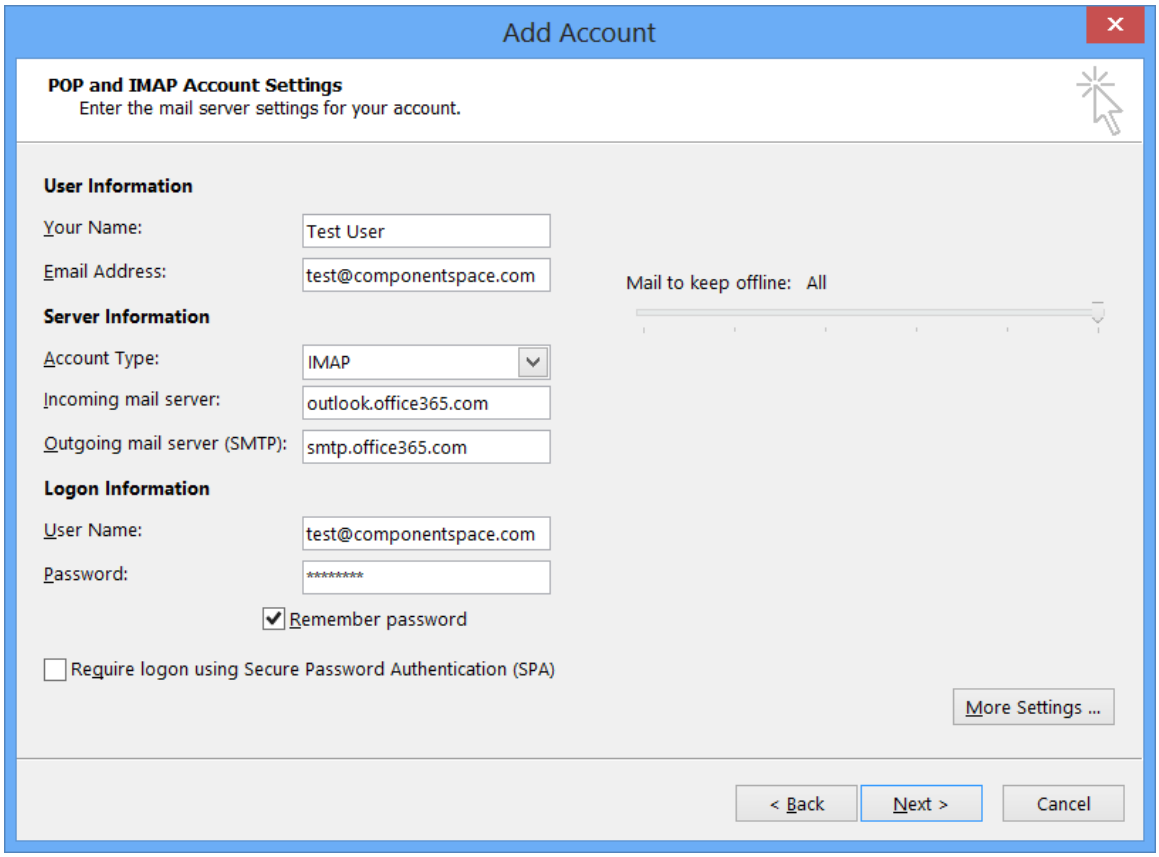


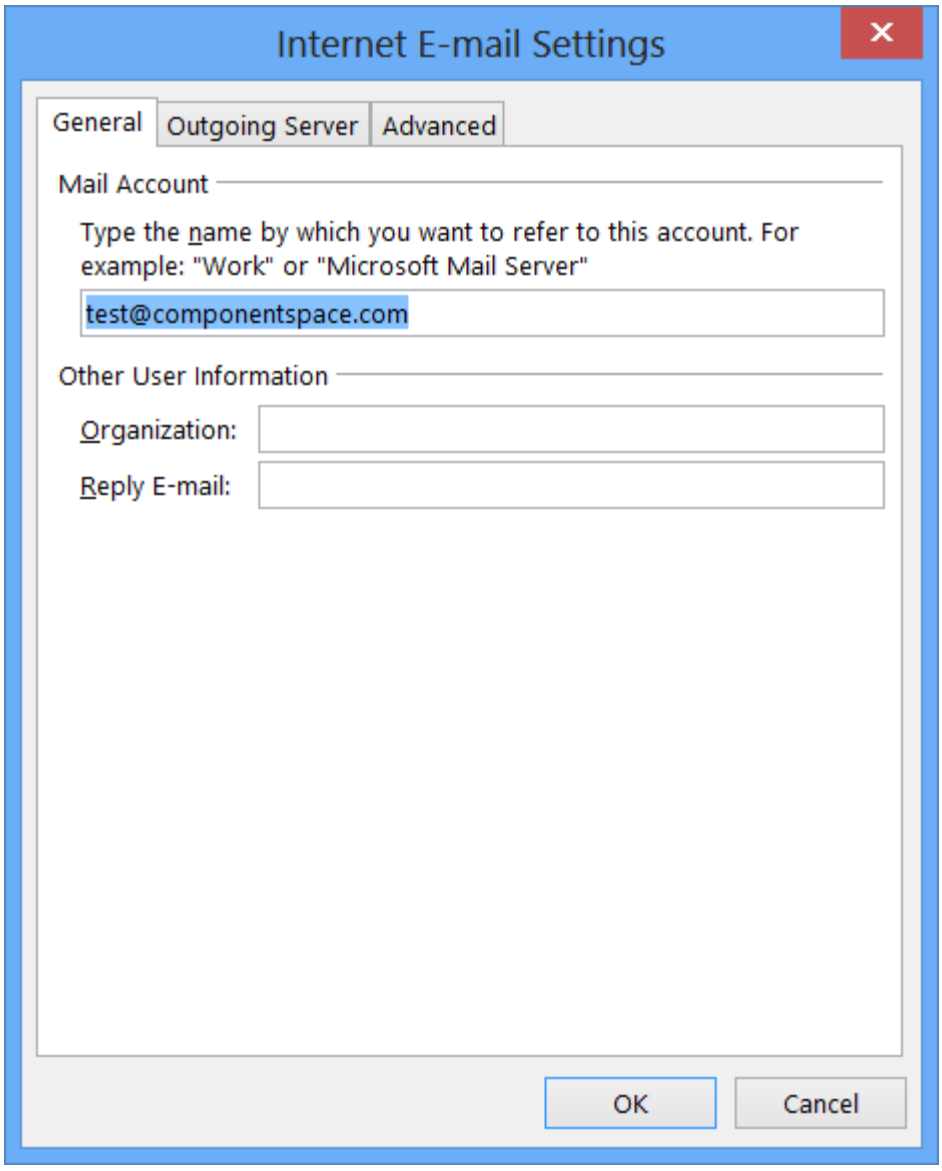
Open the Microsoft Outlook client and configure a new account.

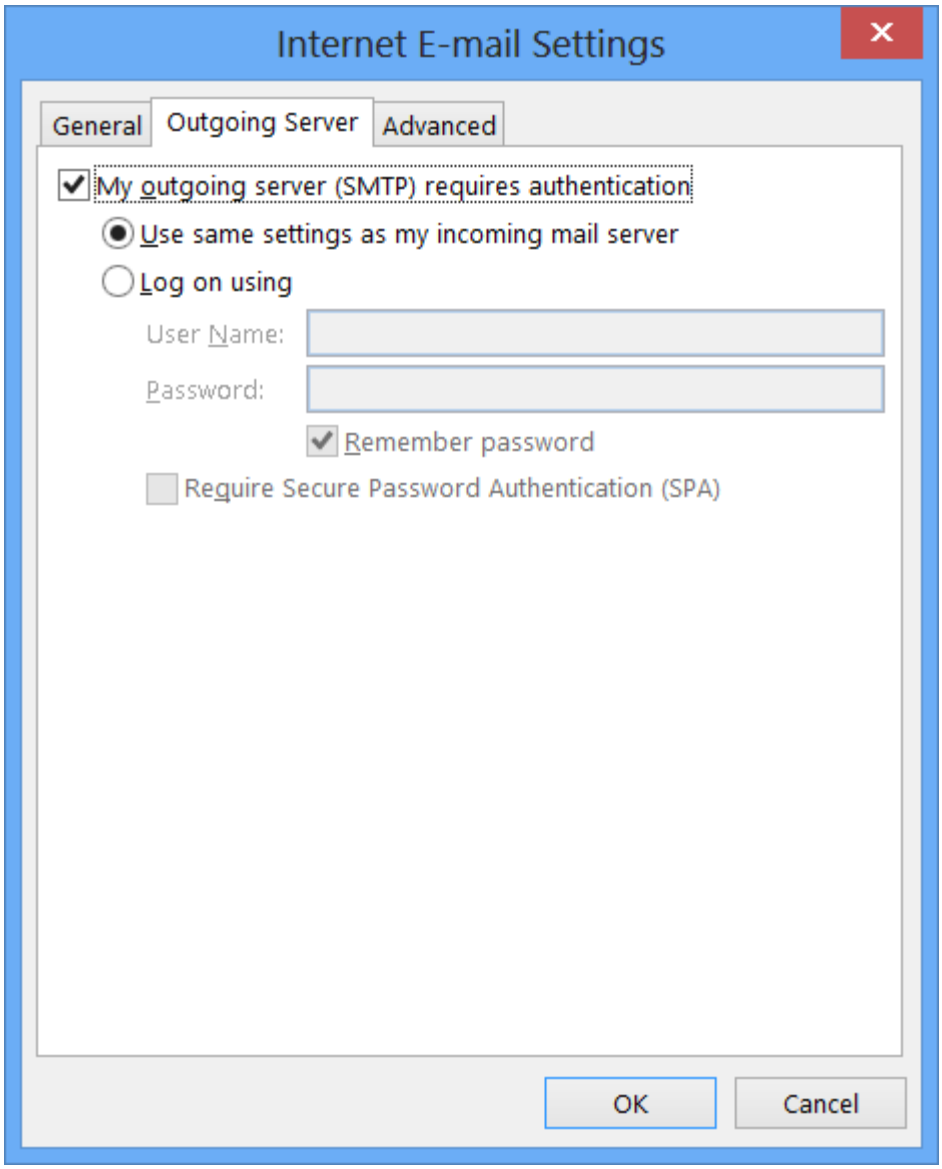

Add Account
Auto Account Setup
Manual setup of an account or connect to other server types.
E-mail Account
Your Name:
Example: Ellen Adams
E-mail Address:
Example: ellen@contoso.com
Password:
Retype Password:
Type the password your Internet service provider has given you.
Manual setup or additional server types
< Back
Next >
Cancel

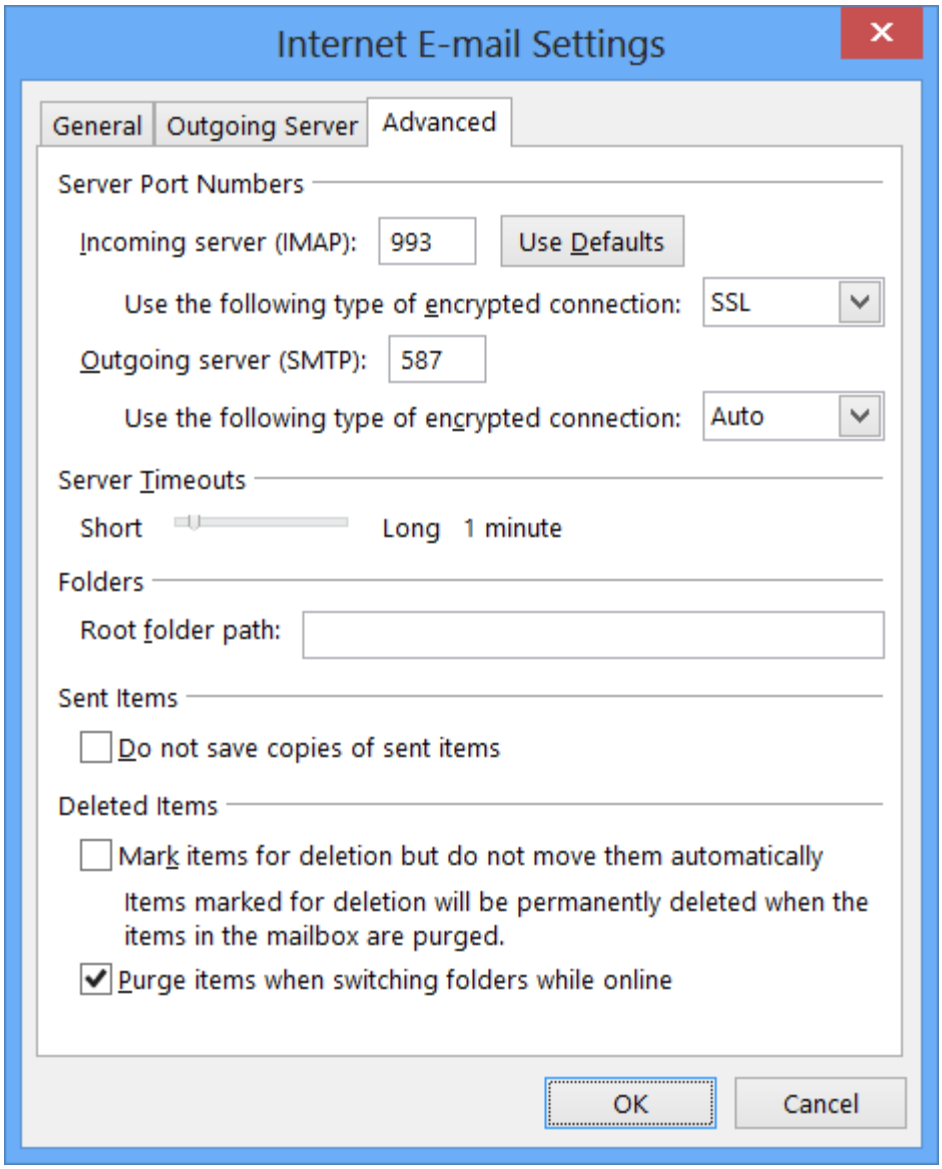


Specify the settings from Office 365.


Add Account
POP and IMAP Account Settings
Enter the mail server settings for your account.
User Information
Your Name:
Test User
Email Address:
test@componentspace.com
Mail to keep offline: All
Server Information
Account Type:
IMAP
Incoming mail server:
outlook.office365.com
Outgoing mail server (SMTP):
smtp.office365.com
Logon Information
User Name:
test@componentspace.com
Password:
****
Remember password
Require logon using Secure Password Authentication (SPA)
More Settings ...
< Back
Next >
Cancel

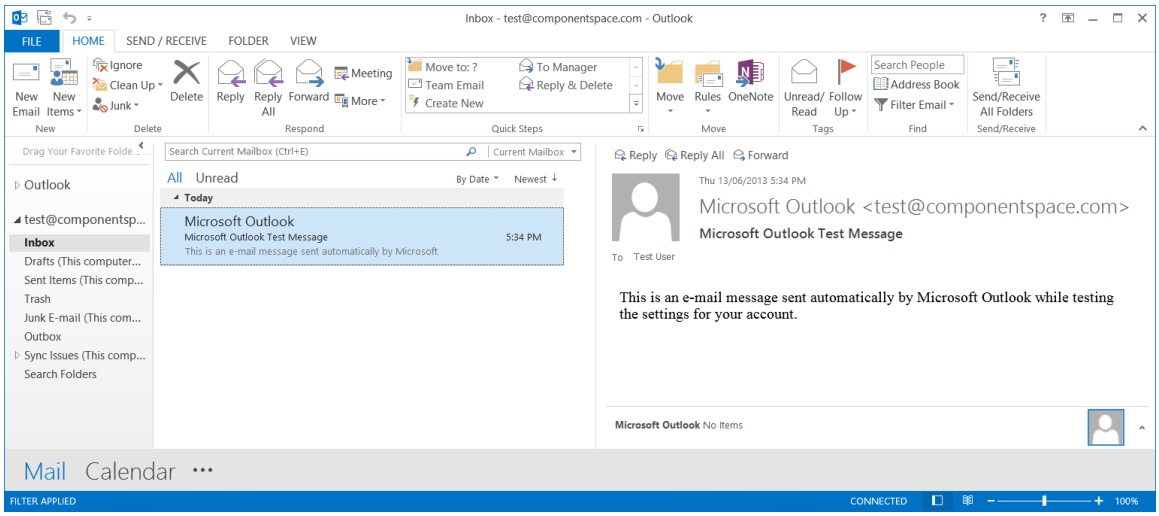

Internet E-mail Settings
General
Outgoing Server
Advanced
Mail Account
Type the name by which you want to refer to this account. For example: "Work" or "Microsoft Mail Server"
test@componentspace.com
Other User Information
Organization:
Reply E-mail:
OK
Cancel


Internet E-mail Settings
General
Outgoing Server
Advanced
My outgoing server (SMTP) requires authentication
Use same settings as my incoming mail server
Log on using
User Name:
Password:
Remember password
Require Secure Password Authentication (SPA)
OK
Cancel



10.4.9 Running the Email Client

Running the email client will cause user authentication to occur at the identity provider.



10.4.10 Troubleshooting Office 365 SSO

Refer to the Office 365 documentation pages. The following article lists error codes and recommended actions.

http://support.microsoft.com/kb/2615736

Office 365 SAML metadata may be retrieved from:

https://nexus.microsoftonline-p.com/federationmetadata/saml20/federationmetadata.xml

10.5 Google Apps Interoperability

The Web Forms and MVC example identity providers demonstrate SP initiated single sign-on with Google Apps.

The following sections describe the configuration for the Web Forms identity service provider but, with the appropriate changes, apply equally to the MVC example identity provider.

Refer to sections 10.1 and 10.1.7 for installing and configuring the Web Forms and MVC example identity providers.

10.5.1 Configuring the Identity Provider

The saml.config file includes the following entry for the Google Apps partner service provider.

```
<PartnerServiceProvider Name="google.com"
                        WantAuthnRequestSigned="false"
                        SignResponse="true"
                        SignAssertion="false"
                        EncryptAssertion="false"/>
```

The name matches with the issuer name Google Apps uses in the authn request.

The assertion consumer service URL specified in the authn request is used rather than configuring this URL. Alternatively, the assertion consumer service URL may be configured (e.g. https://www.google.com/a/<domain-name>/acs).

10.5.2 Configuring Google Apps

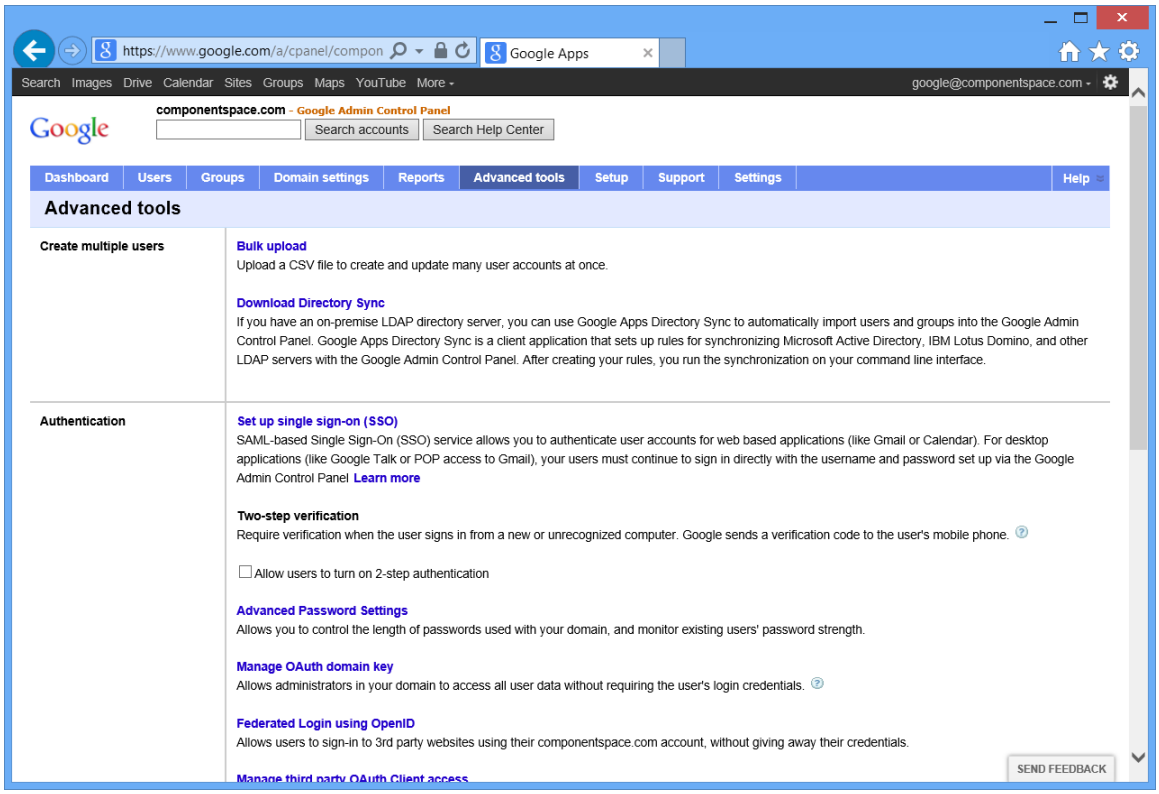
Login as an administrator to the Google Admin Control Panel at:

https://www.google.com/a/<domain-name>

For example:

https://www.google.com/a/componentspace.com

Select the Advanced tools tab and under the Authentication section, click the Set up single sign-on (SSO) link.



Specify the sign-in page URL. This is the identity provider's single sign-on service where the authn request is sent.

For example:

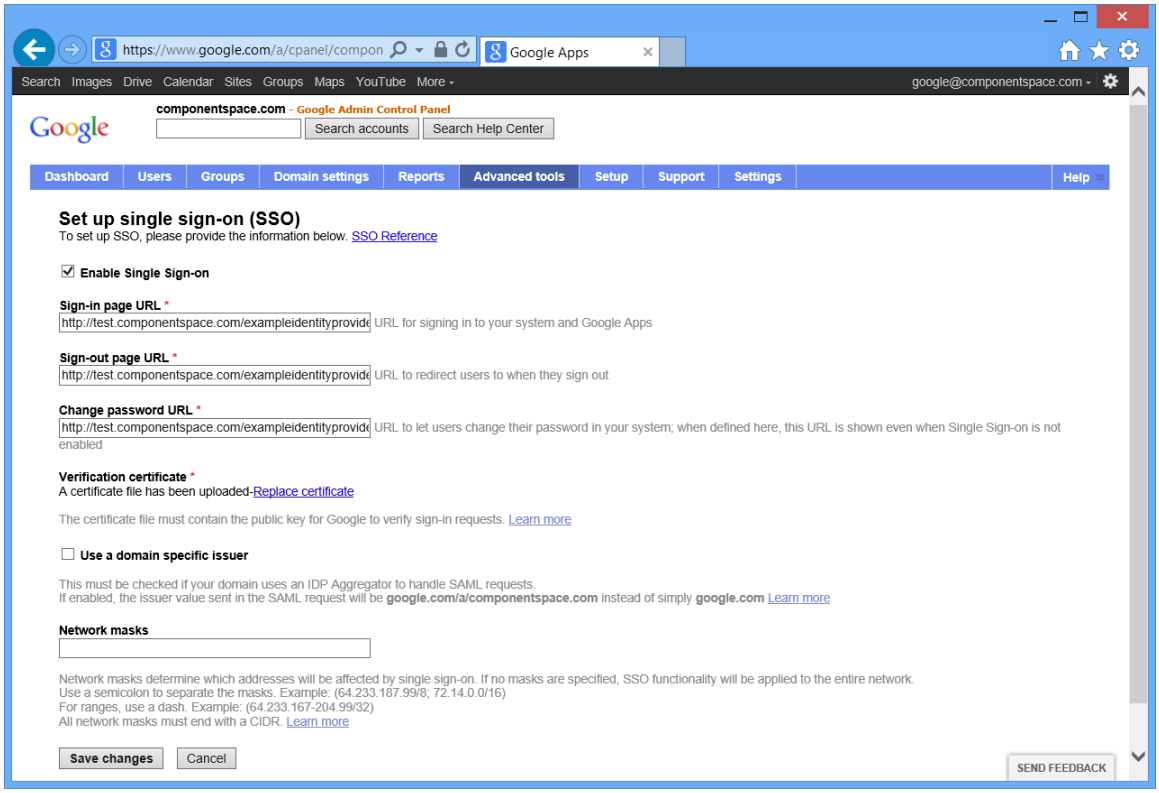
https://test.componentspace.com/ExampleIdentityProvider/SAML/SSOService.aspx

Specify the sign-out page URL. When the user signs out of Google Apps they are redirected to the sign-out page. Google Apps does not send a SAML logout request.

Specify the change password URL. The user is redirected to this page when they wish to change their password. This does not involve SAML.

Upload the identity provider's certificate.

For example: idp.cer.



10.5.3 Running Google Apps with SSO

In this example, the user is attempting to access a protected resource on the service provider and, rather than performing a local login at the service provider, SSO is initiated with a local login occurring at the identity provider and the asserted identity, passed to the service provider in a SAML assertion, is used to perform an automatic login at the service provider.

1. Browse to:

   https://mail.google.com/a/<domain-name>

   For example:

   https://mail.google.com/a/componentspace

2. You should then be presented with the identity provider login prompt.
3. Login using the user name and password of a user known to the identity provider. The user account should also exist in Google Apps.

4. You should then be presented with the Google Mail default page.

   This means you've successfully completed a SAML v2.0 SSO and are logged in at Google Apps with your identity provider user name.

10.5.4 Troubleshooting Google Apps SSO

Refer to the Troubleshooting Single Sign-On (SSO) article in the Google Apps documentation.

10.6 Salesforce Interoperability

The Web Forms and MVC example identity providers demonstrate both IdP and SP initiated single sign-on with Salesforce.

The following sections describe the configuration for the Web Forms identity and service providers but, with the appropriate changes, apply equally to the MVC example identity and service providers.

Refer to sections 10.1 and 10.1.7 for installing and configuring the Web Forms and MVC example identity providers.

10.6.1 Configuring the Identity Provider

The saml.config file includes the following entry for the Salesforce partner service provider.

```
<PartnerServiceProvider Name="https://saml.salesforce.com"
                        WantAuthnRequestSigned="false"
                        SignResponse="true"
                        SignAssertion="false"
                        EncryptAssertion="false"
                        AssertionConsumerServiceURL=
                            "https://login.salesforce.com"/>
```

The web.config file identifies the partner service provider. This must specify the Saleforce service provider.

```
<add key="PartnerSP" value="https://saml.salesforce.com"/>
```

10.6.2 Configuring Salesforce as a Service Provider

Login as an administrator to Salesforce at:

https://login.salesforce.com

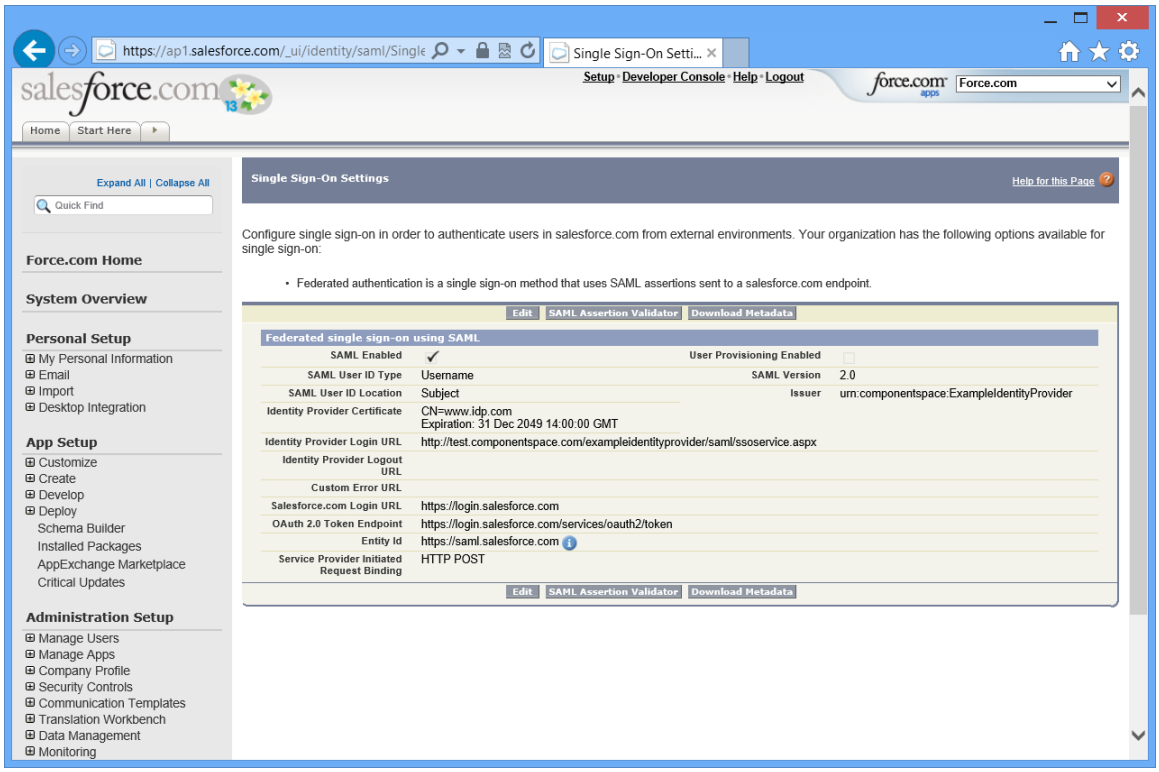
Select Setup > Security Controls > Single Sign-On Settings.

Enable SAML.

Specify the issuer, upload the identity provider's certificate and specify the login URL.

For example, the issuer is urn:componentspace:ExampleIdentityProvider, upload the idp.cer file, and specify

http://test.componentspace.com/ExampleIdentityProvider/SAML/SSOService.aspx as the login URL.



10.6.3 Running the Example Identity Provider – IdP-Initiated SSO

1. Browse to:

   http://localhost/ExampleIdentityProvider

   You should then be presented with the identity provider login prompt.

2. Login using the user name and password of a user known to the identity provider.

   The user account must also exist in Salesforce.

   You may have to update the credentials section of the example identity provider's web.config to include the user name.

3. Click the link to SSO to Salesforce.

   The Saleforce main page should be displayed.

   This means you've successfully completed a SAML v2.0 SSO and are logged in at Salesforce with your identity provider user name.

10.6.4 Configuring the Service Provider

The saml.config file includes the following entry for the Salesforce partner identity provider.

```
  <PartnerIdentityProvider
              Name="https://componentspace-dev-ed.my.salesforce.com"
              SignAuthnRequest="false"
              WantSAMLResponseSigned="true"
              WantAssertionSigned="false"
              WantAssertionEncrypted="false"
              UseEmbeddedCertificate="true"
              SingleSignOnServiceUrl=
"https://componentspace-dev-
ed.my.salesforce.com/idp/endpoint/HttpRedirect"/>
```

The partner identity provider name must match with the issuer name generated by Salesforce. See section 10.6.5.

The web.config file identifies the partner identity provider. This must specify the Saleforce identity provider.

```
<add key="PartnerIdP"
     value=" https://componentspace-dev-ed.my.salesforce.com "/>
```

10.6.5 Configuring Salesforce as an Identity Provider

Login as an administrator to Salesforce at:

https://login.salesforce.com

Select Setup > Security Controls > Identity Provider.

Enable the Identity Provider. The generated self-signed certificate is okay to use.

Add a service provider.

Specify the name as ExampleServiceProvider and the entity ID as urn:componentspace:ExampleServiceProvider.

Specify the ACS URL. For example:

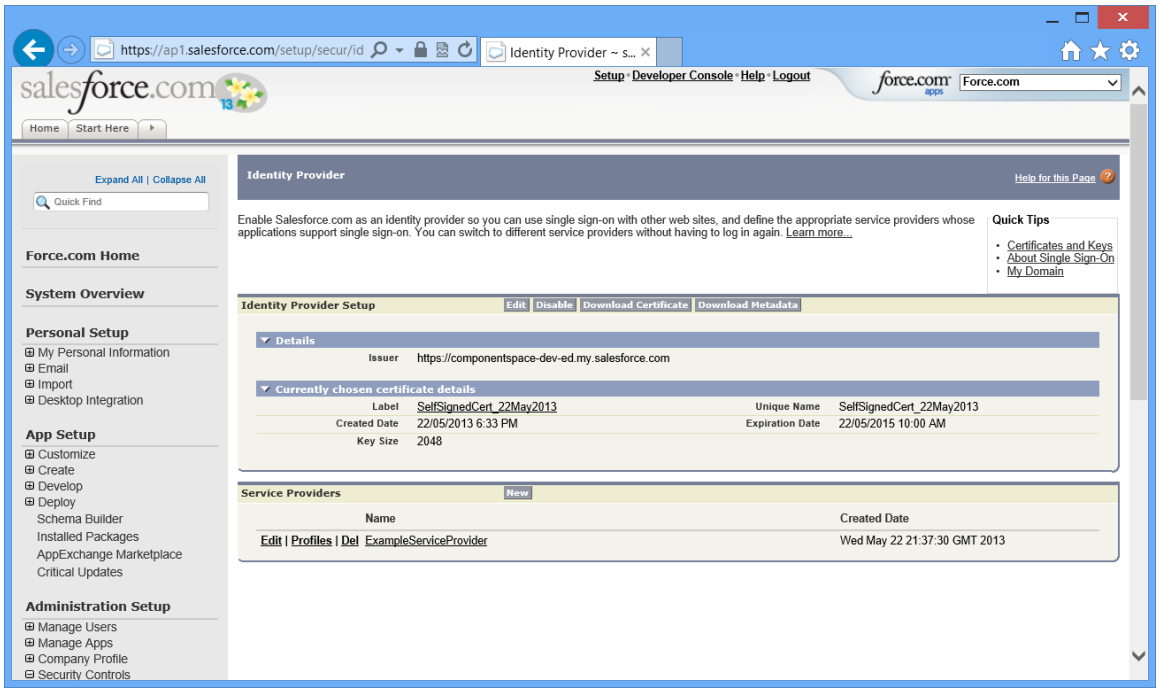
http://test.componentspace.com/ExampleServiceProvider/SAML/AssertionConsumerService.aspx

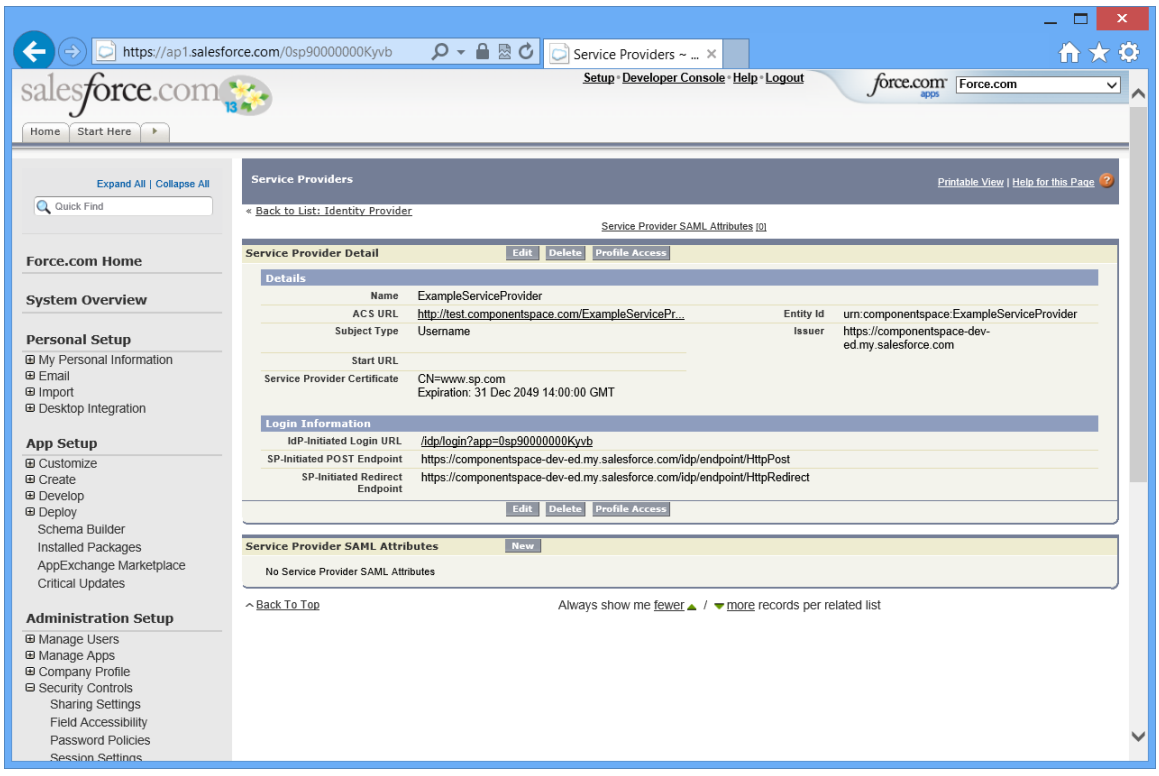
A start URL is not required.

Select user name as the subject type.

Select the user profiles which will have access to the service provider.

Note that if SAML is enabled as described in section 10.6.2, the identity provider role is delegated to the configured identity provider. To have Salesforce act as the identity provider, disable SAML.





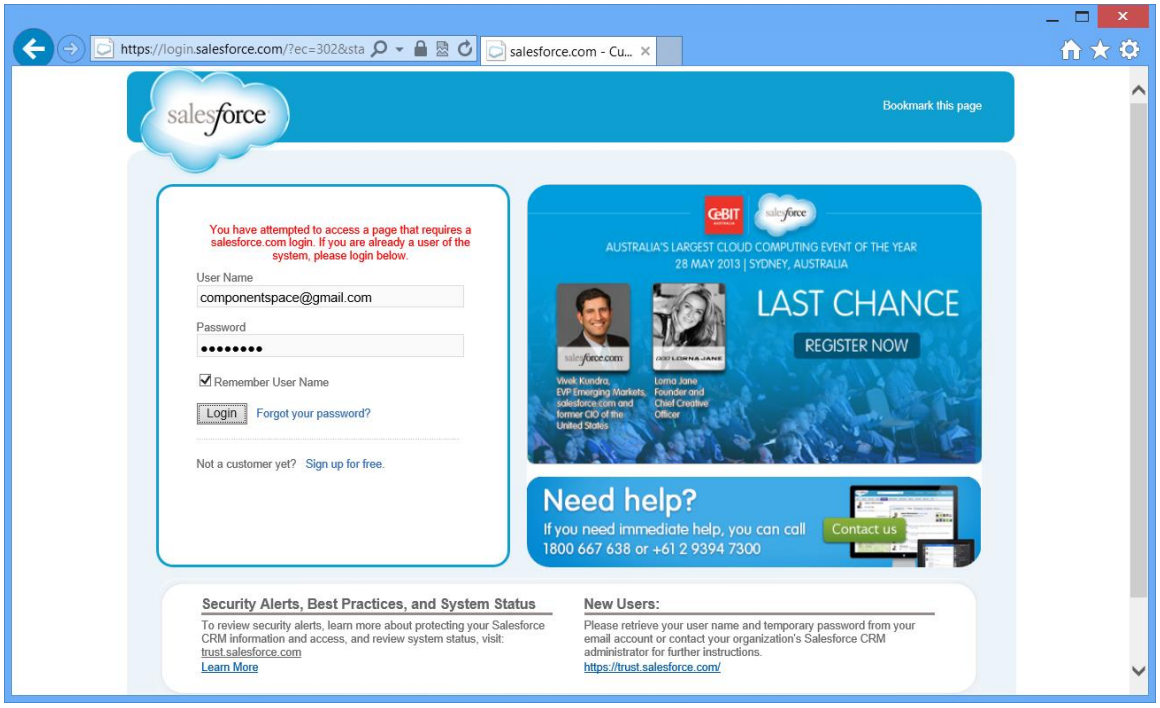
10.6.6 Running the Example Service Provider – IdP-Initiated SSO

1. Browse to the IdP-Initiated login URL specified under the login information for the service provider in the Salesforce configuration. For example:

https://ap1.salesforce.com/idp/login?app=0sp90000000Kyvb

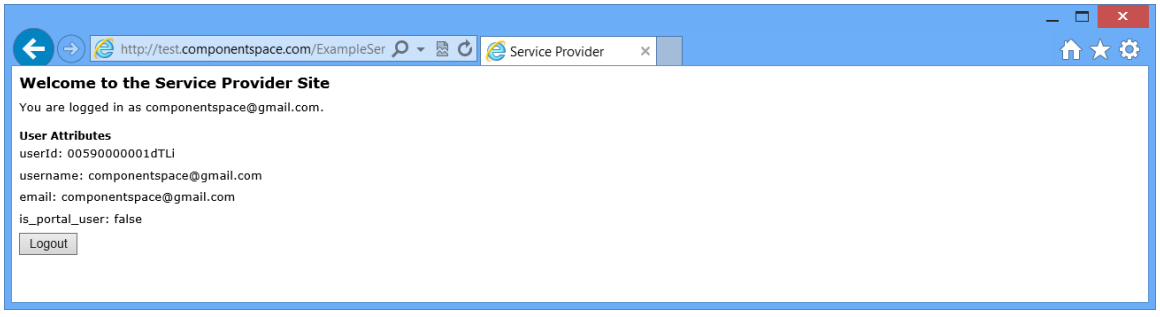
You should then be presented with the Salesforce login prompt.

2. Login using the user name and password of a user known to Salesforce.



3. The example service provider page should be displayed.

This means you've successfully completed a SAML v2.0 SSO and are logged in at the example service provider with your Salesforce user name.



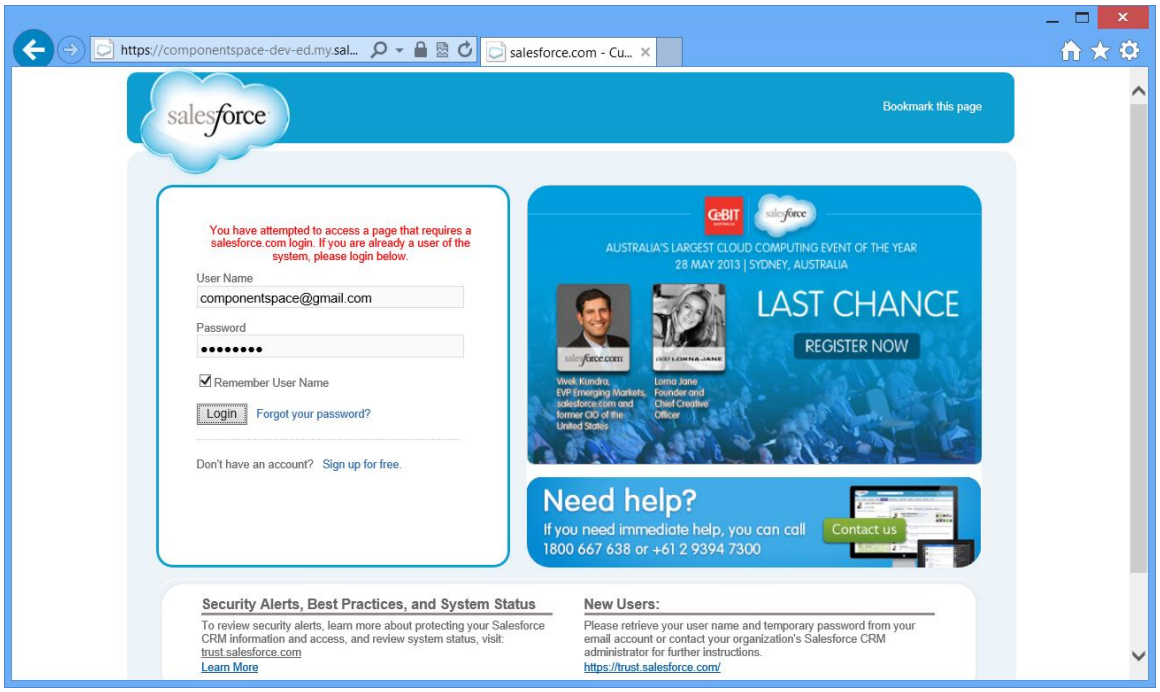
10.6.7 Running the Example Service Provider – SP-Initiated SSO

1. Browse to the example service provider. For example:

http://test.componentspace.com/ExampleServiceProvider

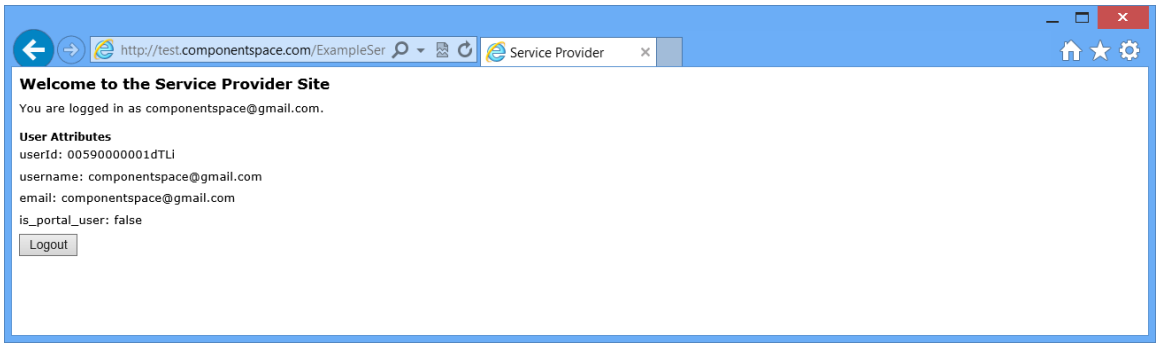
You should then be presented with the Salesforce login prompt.

2. Login using the user name and password of a user known to Salesforce.



3. The example service provider page should be displayed.

   This means you've successfully completed a SAML v2.0 SSO and are logged in at the example service provider with your Salesforce user name.



10.6.8 Troubleshooting Salesforce SSO

Use Setup > Security Controls > Single Sign-On Settings > SAML Assertion Validator to debug problems with the SAML response.

View the Login History under Setup > Manage Users > Login History.

10.7 Shibboleth Interoperability

The Web Forms and MVC example identity providers demonstrate SP initiated single sign-on with Shibboleth.

The following sections describe the configuration for the Web Forms identity service provider but, with the appropriate changes, apply equally to the MVC example identity provider.

Refer to sections 10.1 and 10.1.7 for installing and configuring the Web Forms and MVC example identity providers.

10.7.1 Configuring the Identity Provider

The saml.config file identifies the local identity provider. This must match with the entity ID specified in the metadata uploaded to Shibboleth.

```
<IdentityProvider Name="https://test.componentspace.com"/>
```

The saml.config file includes the following entry for the Shibboleth partner service provider.

```
<PartnerServiceProvider Name="https://sp.testshib.org/shibboleth-sp"
                        WantAuthnRequestSigned="false"
                        SignResponse="true"
                        SignAssertion="false"
                        EncryptAssertion="false"
                        AssertionConsumerServiceURL=
                "https://sp.testshib.org/Shibboleth.sso/SAML2/POST"/>
```

10.7.2 Configuring the Service Provider

The saml.config file identifies the local service provider. This must match with the entity ID specified in the metadata uploaded to Shibboleth.

```
<ServiceProvider Name="https://test.componentspace.com"/>
```

The saml.config file includes the following entry for the Shibboleth partner service provider.

```
<PartnerIdentityProvider Name="https://idp.testshib.org/idp/shibboleth"
                         SignAuthnRequest="true"
                         WantResponseSigned="true"
                         WantAssertionSigned="false"
                         WantAssertionEncrypted="false"
                         UseEmbeddedCertificate="true"
                         SingleSignOnServiceUrl=
        "https://idp.testshib.org/idp/profile/SAML2/Redirect/SSO"/>
```

The web.config file identifies the partner identity provider. This must specify the Shibboleth identity provider.

```
<add key="PartnerIdP" value="https://idp.testshib.org/idp/shibboleth"/>
```

10.7.3 Configuring Shibboleth

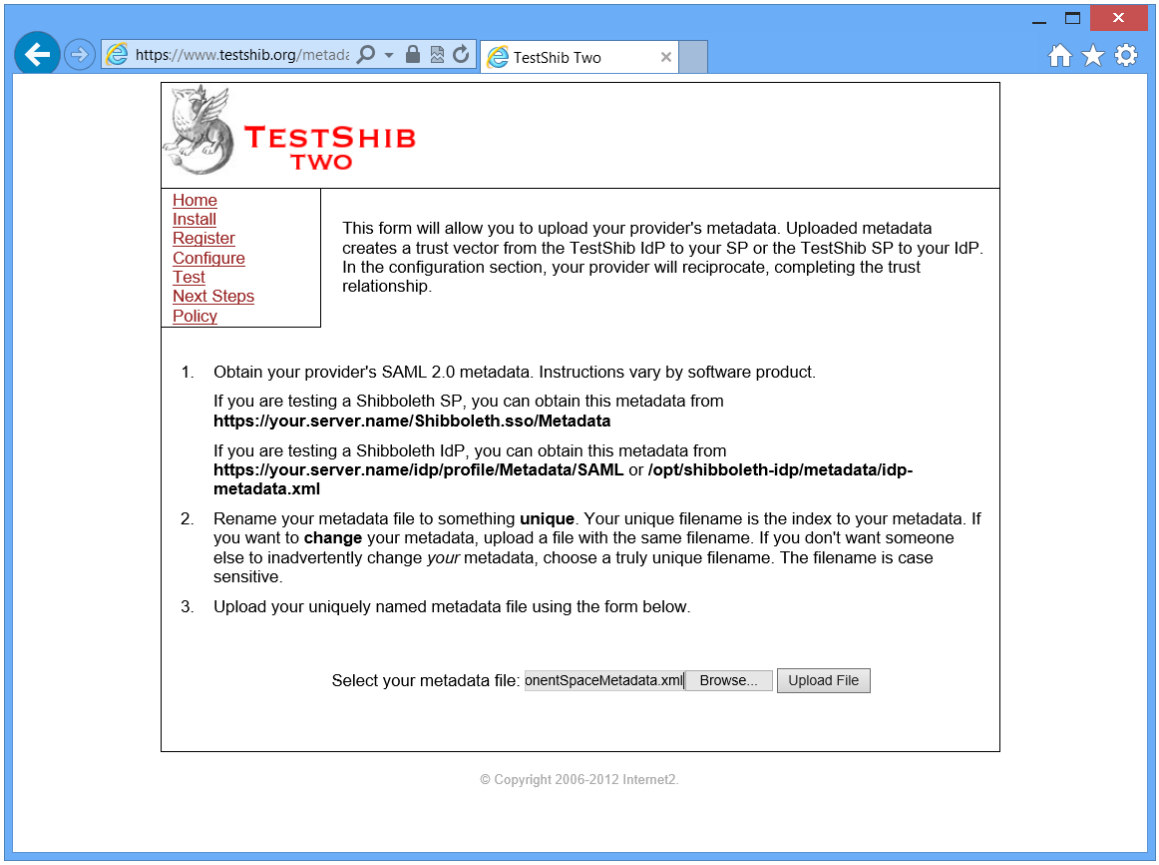
The supplied ComponentSpaceMetadata.xml includes metadata for the example identity provider and the example service provider. The entity ID must uniquely identify your organization. The URLs must be modified to match your configuration.

The metadata to modify may be found at C:\Program Files (x86)\ComponentSpace SAML v2.0 for .NET\Examples\Metadata\Template.

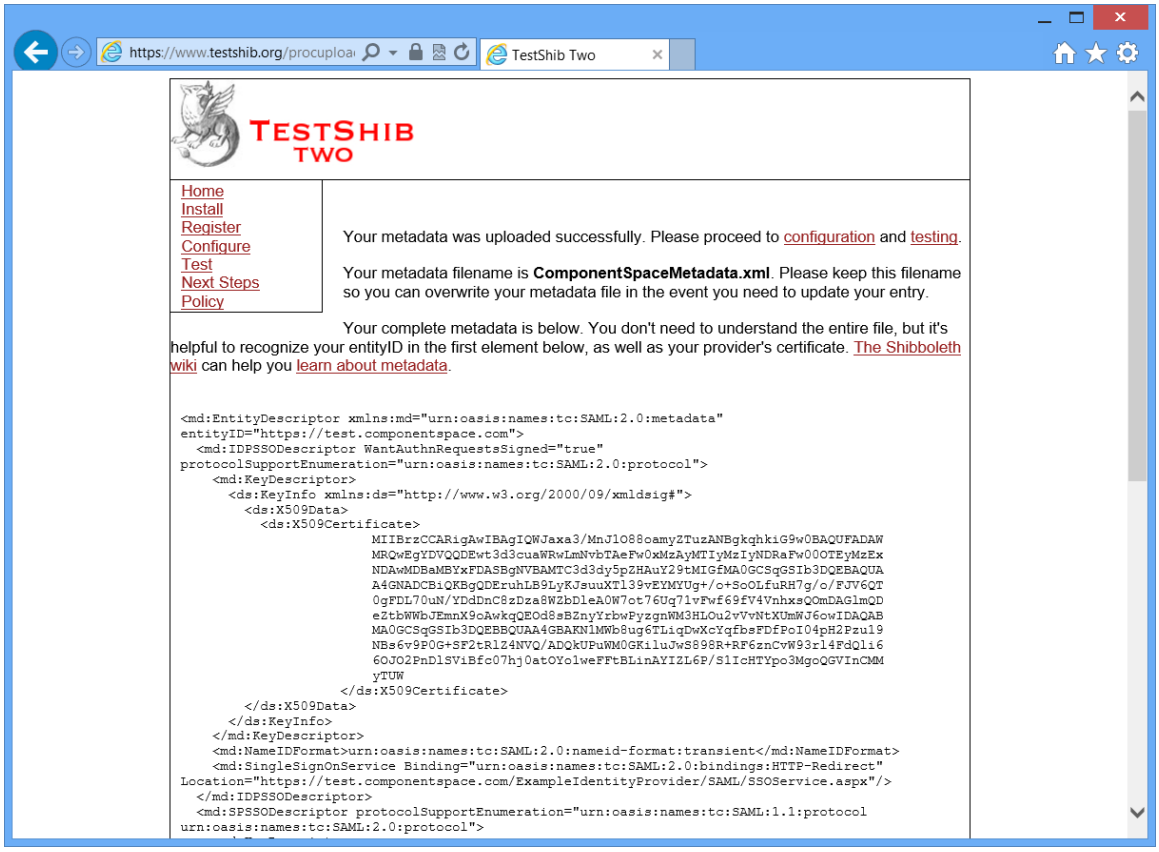
Once the metadata has been updated, navigate to:

https://www.testshib.org/testshib-two/index.jsp

Click the Register button and upload your SAML metadata.



Confirm that the metadata has been uploaded successfully.



Metadata for Shibboleth and other entities may be found at:

http://www.testshib.org/metadata/testshib-two-metadata.xml

10.7.4 Running Shibboleth with SSO – Example Identity Provider

1. Browse to:

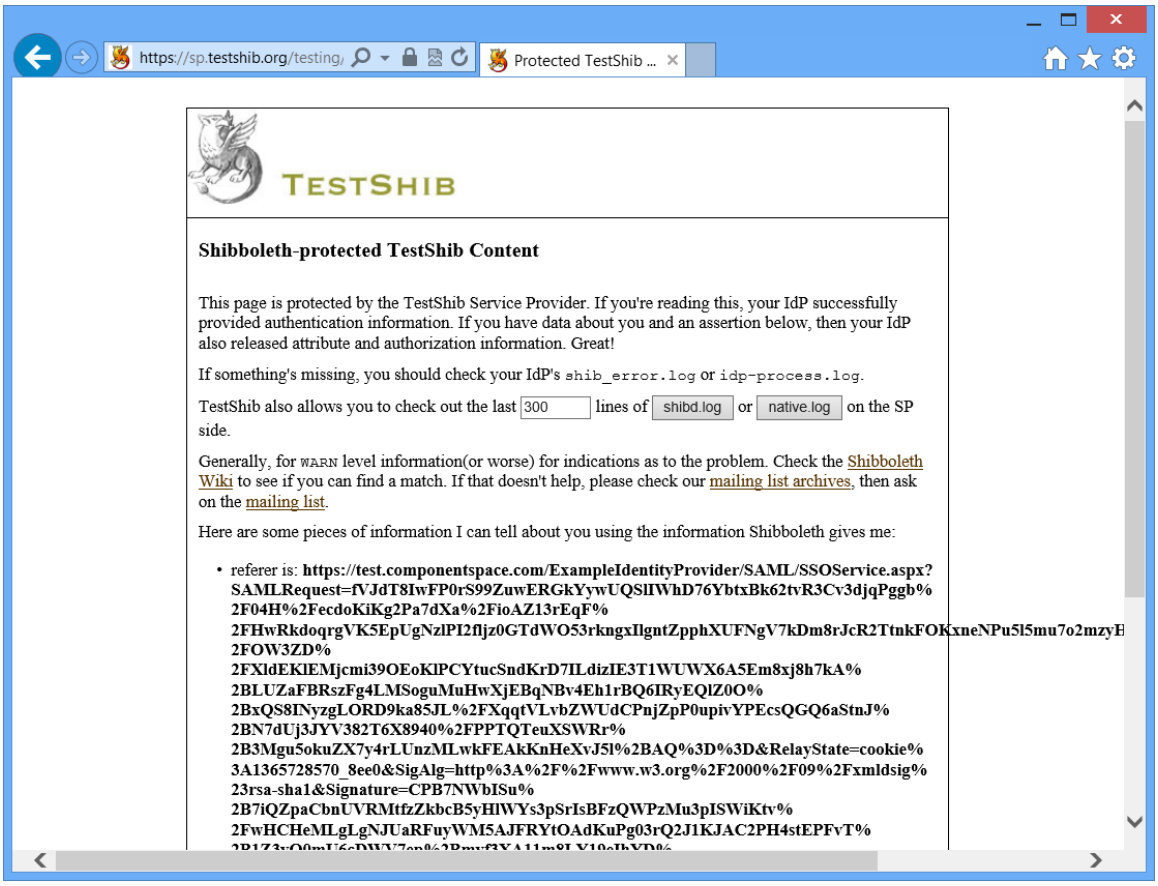
   https://sp.testshib.org/

   Specify the entity ID you defined in your metadata. This entity ID is used as a key by Shibboleth to retrieve the correct metadata.

2. You should then be presented with the identity provider login prompt.
3. Login and you should be returned to Shibboleth.

   https://sp.testshib.org/testing/sample.jsp

   This means you've successfully completed a SAML v2.0 SSO and are logged in at Shibboleth with your identity provider user name.



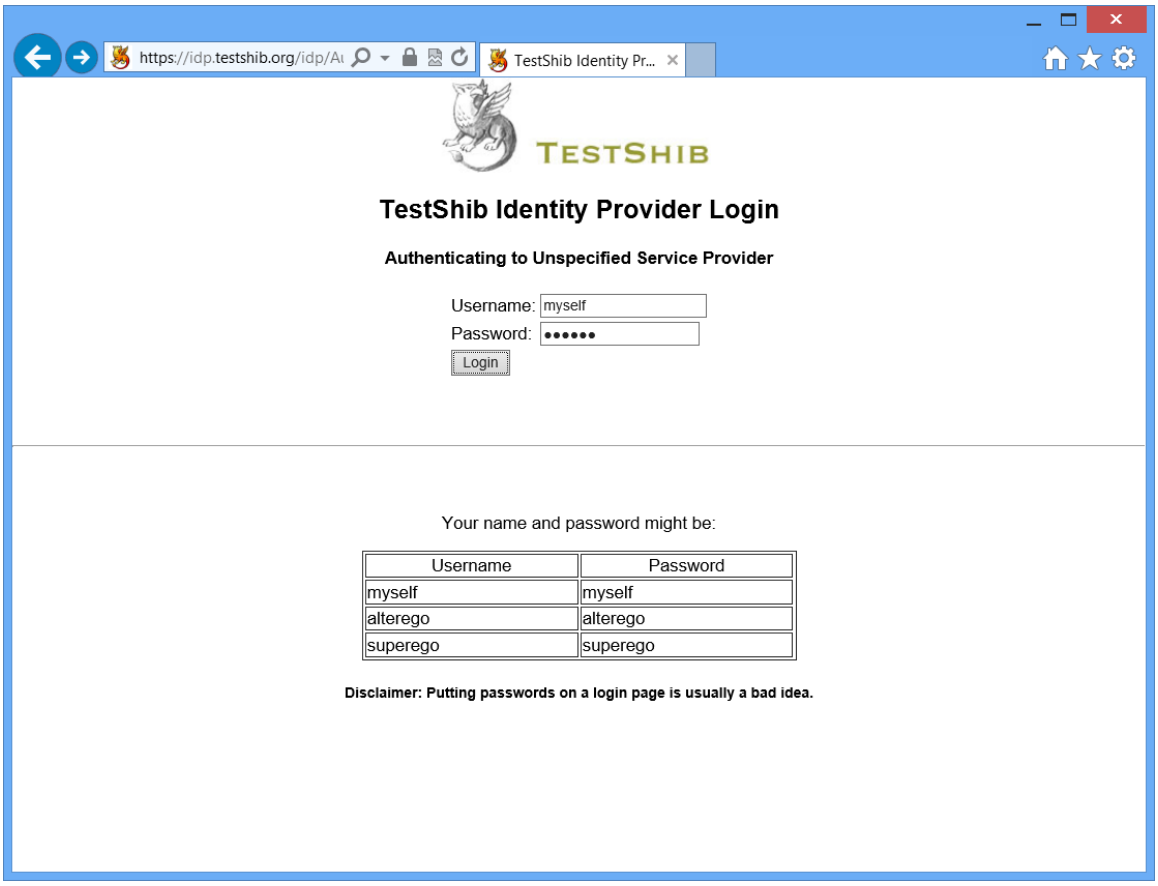
10.7.5 Running Shibboleth with SSO – Example Service Provider

1. Browse to the example service provider URL:

   For example:

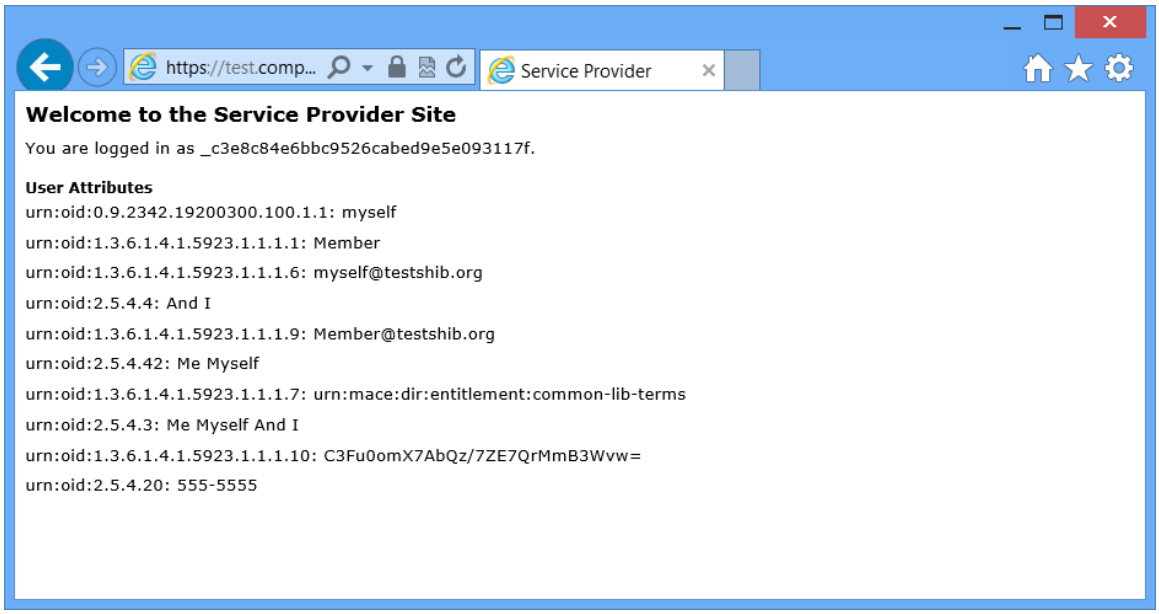
   https://test.componentspace.com/ExampleServiceProvider

2. You should then be presented with the identity provider login prompt.



3. Login using one of the listed user names and passwords.
4. The example service provider main page should be displayed.

   This means you've successfully completed a SAML v2.0 SSO and are logged in at the example service provider with your Shibboleth user name.



10.7.6 Troubleshooting Shibboleth SSO

The Shibboleth identity provider logs may be viewed at:

https://idp.testshib.org/cgi-bin/idplog.cgi?lines=300&logname=shibd.log.

The Shibboleth service provider logs may be viewed at:

https://sp.testshib.org/cgi-bin/splog.cgi?lines=300&logname=shibd.log.

11 Example Applications - Low Level APIs

The example applications must be built and published prior to their use.

The following sections describe the installation and execution of these example applications.

The example applications described in sections 10.1 and 11.2 demonstrate SP initiated SSO and logout using a number of different bindings. These applications are written in VB.NET.

The example applications described in sections 11.3 and 11.4 demonstrate IdP initiated SSO and logout using a number of different bindings. These applications are written in C#.

The example application described in section 11.5 and 11.5 demonstrates interoperability with Active Directory Federation Services (ADFS). This application is written in C#.

The example application described in section 11.6 demonstrates interoperability with Google Apps. This application is written in C#.

The example application described in section 11.7 demonstrates interoperability with Salesforce. This application is written in C#.

The example applications in sections 11.8 and 11.9 demonstrate interoperability with the Shibboleth open source SSO software package. These applications are written in C#.

The example application in section 11.10 demonstrates creating and manipulating SAML assertions. This application is written in VB.NET.

The example applications in section 11.11 demonstrate creating and manipulating SAML metadata. These applications are written in C#.

The example applications in section 11.12 demonstrate generating and verifying XML signatures. These applications are written in C#.

Section 11.13 includes various utility applications.

11.1 SP-Initiated SSO – Identity Provider

The SAML2IdentityProvider web application, in conjunction with the SAML2ServiceProvider web application, demonstrates SP initiated single sign-on and logout.

11.1.1 Installing the Identity Provider

6. Using Visual Studio, build and publish the web application.
7. Open the Internet Information Services management console.
8. Under the default web site for the local computer, create an application with an alias of SAML2IdentityProvider.
9. For the physical path, browse to the directory where SAML2IdentityProvider was built and published.
10. Ensure the web application has been successfully installed and configured by browsing to http://localhost/SAML2IdentityProvider.

11.1.2 Configuring the Identity Provider

The identity provider configuration is contained within its web.config file's <appSettings> section and contains the *spArtifactResponderURL* and *spLogoutURL*.

The *spArtifactResponderURL* specifies the URL of the service provider's artifact responder. Its default value is http://localhost/SAML2ServiceProvider/SAML/ArtifactResponder.aspx.

The *spLogoutURL* specifies the URL of the service provider's logout service. Its default value is http://localhost/SAML2ServiceProvider/SAML/SingleLogoutService.aspx.

Modifying web.config does not require an application restart.

If you use the default installation you won't need to modify this configuration.

11.1.3 Running the Identity Provider

As this is SP initiated SSO, you need to run the service provider application rather than the identity provider to initiate SSO.

In this example SSO is not being used. Instead, you should simply perform a local login at the identity provider to ensure it is functioning correctly.

1. Browse to http://localhost/SAML2IdentityProvider.
2. Login using the user name *idp-user* and a password of *password* (see Figure 24).
3. Verify that you've been redirected to the identity provider's default page (see Figure 25).

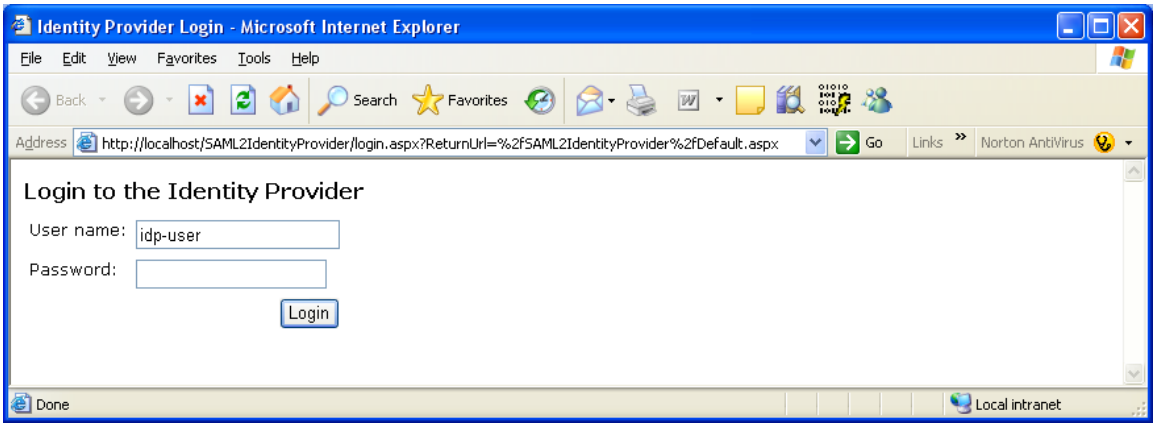


Figure 24 Identity Provider Login Page

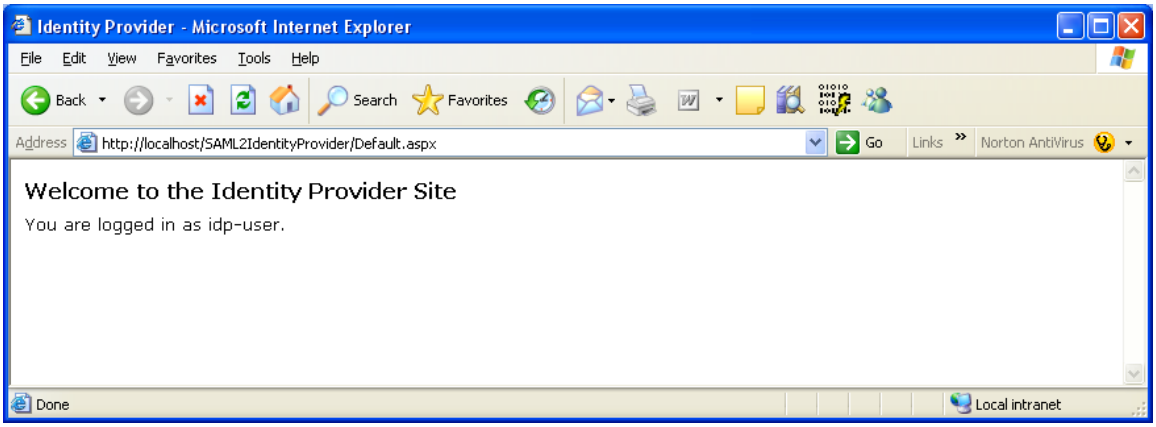


Figure 25 Identity Provider Default Page

11.1.4 Running the Identity Provider in Visual Studio

You may run the identity provider in Visual Studio. The one additional step is to note the port number being used by Visual Studio to run the application. You then need to update the service provider's configuration as described in section 11.2.2 to account for the different port number being used by Visual Studio.

11.2 SP-Initiated SSO – Service Provider

The SAML2ServiceProvider web application, in conjunction with the SAML2IdentityProvider web application, demonstrates SP initiated single sign-on and logout.

11.2.1 Installing the Service Provider

1. Using Visual Studio, build and publish the web application.
2. Open the Internet Information Services management console.
3. Under the default web site for the local computer, create an application with an alias of SAML2ServiceProvider.
4. For the physical path, browse to the directory where SAML2ServiceProvider was built and published.
5. Ensure the web application has been successfully installed and configured by browsing to http://localhost/SAML2ServiceProvider.

11.2.2 Configuring the Service Provider

The service provider configuration is contained within its web.config file's <appSettings> section and contains the *idpssoURL*, *idpArtifactResponderURL* and *idpLogoutURL*.

The *idpssoURL* specifies the URL of the identity provider's SSO service. Its default value is http://localhost/SAML2IdentityProvider/SAML/SSOService.aspx.

The *idpArtifactResponderURL* specifies the URL of the identity provider's artifact responder. Its default value is http://localhost/SAML2IdentityProvider/SAML/ArtifactResponder.aspx.

The *idpLogoutURL* specifies the URL of the identity provider's logout service. Its default value is http://localhost/SAML2IdentityProvider/SAML/SingleLogoutService.aspx.

Modifying web.config does not require an application restart.

If you use the default installation you won't need to modify this configuration.

11.2.3 Running the Service Provider without SSO

In this example SSO is not being used. Instead, you should simply perform a local login at the service provider to ensure it is functioning correctly.

1. Browse to http://localhost/SAML2ServiceProvider.
2. You should be presented with the form shown in Figure 28.
3. Select the service provider as the location where login will occur.
4. Login using the user name *sp-user* and a password of *password* (see Figure 26).
5. Verify that you've been redirected to the service provider's default page (see Figure 27).

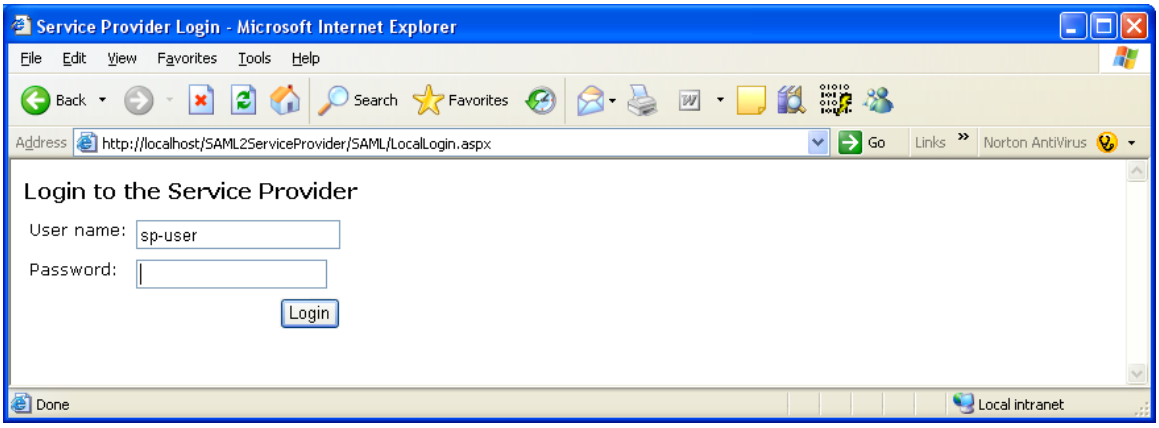


Figure 26 Service Provider Login Page

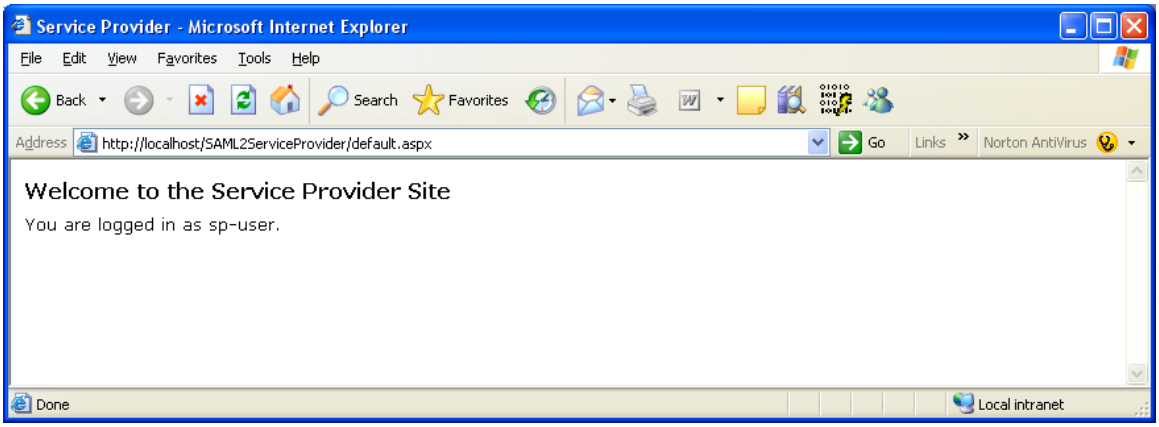


Figure 27 Service Provider Default Page – Logged in as sp-user

11.2.4 Running the Service Provider with SSO

In this example, the user is attempting to access a protected resource on the service provider and, rather than performing a local login at the service provider, SSO is initiated with a local login occurring at the identity provider and the asserted identity, passed to the service provider in a SAML assertion, is used to perform an automatic login at the service provider.

7. Browse to http://localhost/SAML2ServiceProvider.
8. You should be presented with the form shown in Figure 28.
9. Select the identity provider as the location where login will occur.

   Selecting the identity provider will initiate a SAML v2.0 SSO. Selecting the service provider will initiate a local login at the service provider.
10. Select the binding to use when communicating between the service provider and identity provider.

    The user experience should be the same regardless of the binding selected. The

only time when this isn't the case is if the HTTP POST binding is selected and Javascript is disabled in which case the user will be presented with an intermediate form and a button they need to click.

11. Select the binding to use when communicating between the identity provider and service provider.

    The user experience should be the same regardless of the binding selected. The only time when this isn't the case is if the HTTP POST binding is selected and Javascript is disabled in which case the user will be presented with an intermediate form and a button they need to click.

12. Click the Continue button.
13. You should then be presented with the identity provider login page (see Figure 24) as you will be logging in at the identity provider, not the service provider.

    If you are not then you must already have logged in at the identity provider. To force a login, close the browser and start again.

14. Login using the user name *idp-user* and a password of *password*.
15. You should then be presented with the service provider's default page (see Figure 29).

    This means you've successfully completed a SAML v2.0 SSO and are logged in at the service provider with your identity provider user name.

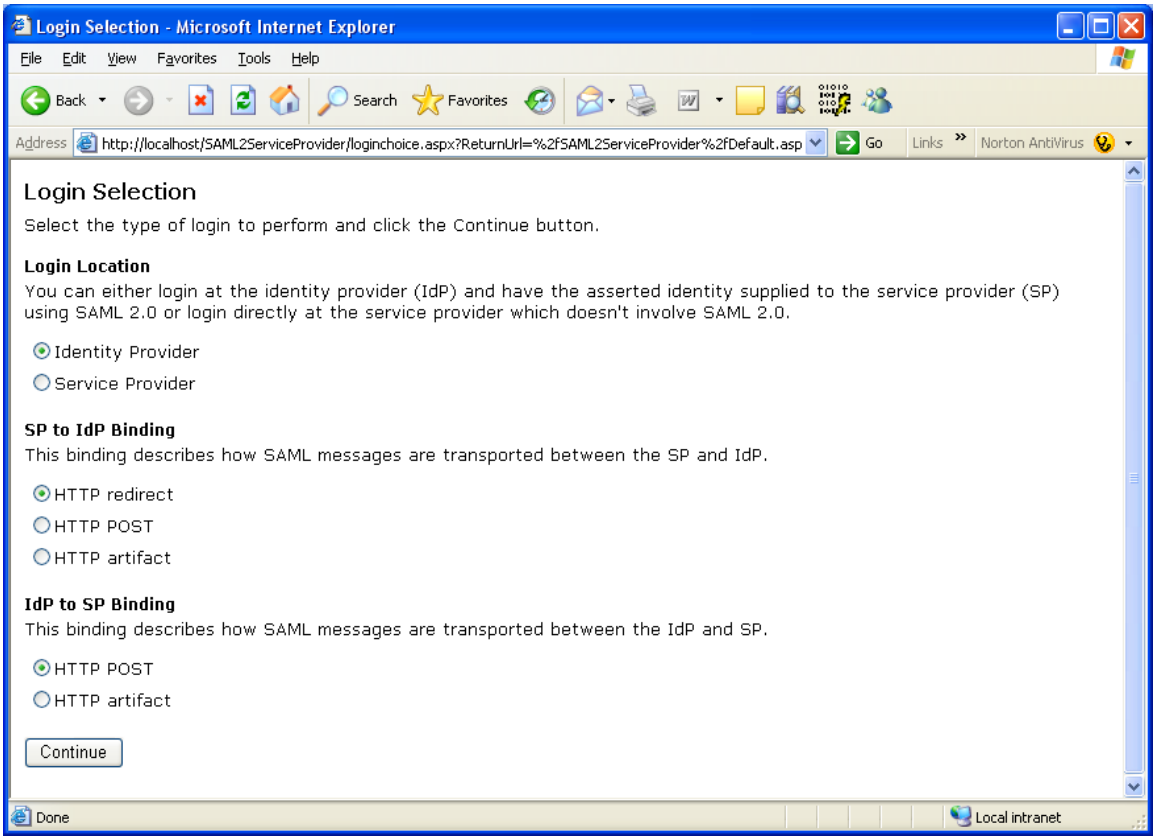


Figure 28 Service Provider Login Selection Page

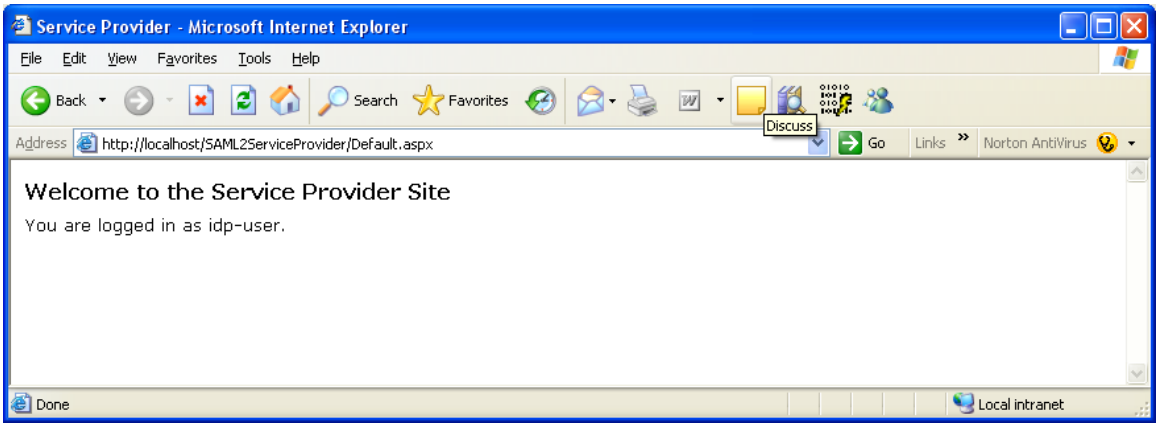


Figure 29 Service Provider Default Page – Logged in as idp-user

The service provider is coded so as not to force authentication at the identity provider. To demonstrate this login at the identity provider and, using the same browser session, browse to the service provider and select the login location as the identity provider. No login at the identity provider will be required as you have already logged in.

1. Login at the identity provider by following the steps described in section 11.1.3.

2. Using the same browser session, follow the steps described in section 11.2.4.

   You should not have to login again at the identity provider.

11.2.5 Running the Service Provider in Visual Studio

You may run the service provider in Visual Studio. The one additional step is to note the port number being used by Visual Studio to run the application. You then need to update the identity provider's configuration as described in section 11.1.2 to account for the different port number being used by Visual Studio.

11.2.6 Service Provider SSO Execution Flow

Figure 30 illustrates the execution flow between the example service provider and identity provider.

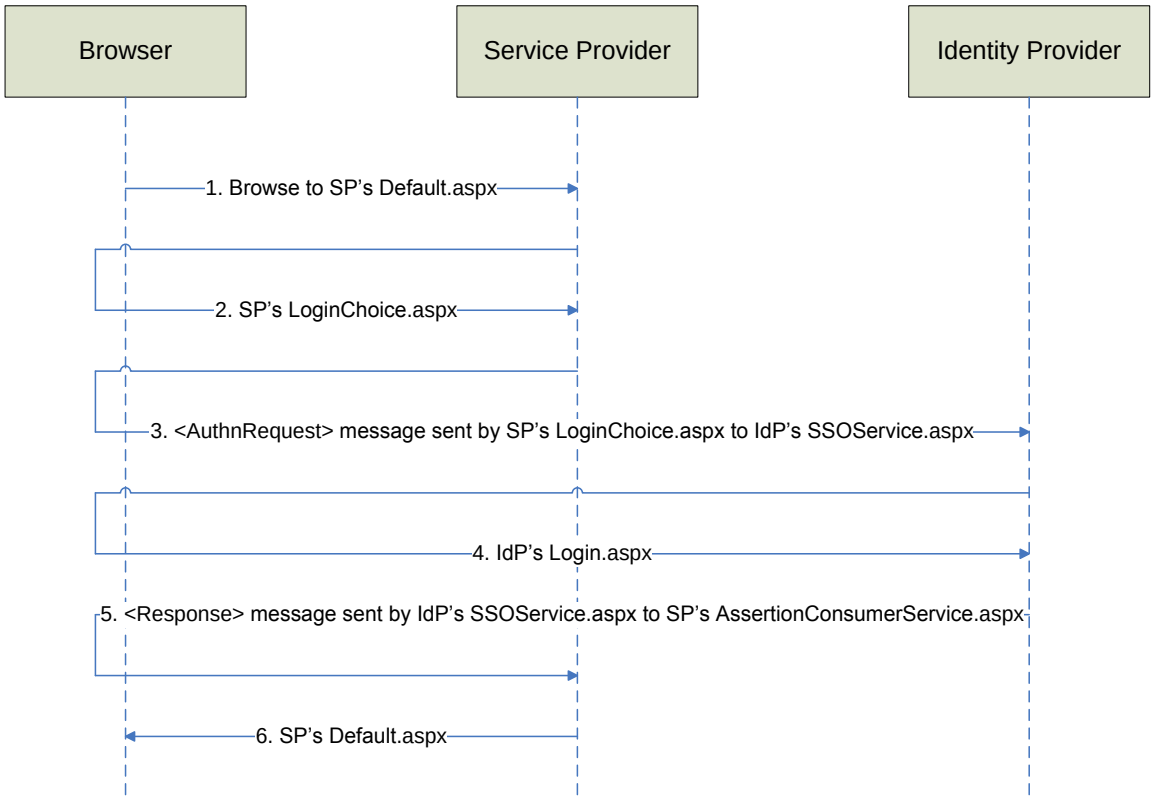


Figure 30 SSO Execution Flow

1. The user browses to http://localhost/SAML2ServiceProvider.aspx.
2. As this is configured in web.config as a protected page, the user is redirected by ASP.NET to the configured login page, LoginChoice.aspx.
3. The user selects from the LoginChoice.aspx to login at the identity provider.

The LoginChoice.aspx page sends a SAML v2.0 AuthnRequest protocol message to the identity provider's SSOService.aspx using the selected SP to IdP binding.

4. If the user isn't logged in at the identity provider, the identity provider redirects the user to the identity provider's Login.aspx page.

   Once logged in, ASP.NET redirects the user back to the SSOService.aspx page.

5. The SSOService.aspx page returns the asserted identity in a SAML assertion contained in a SAML v2.0 Request protocol message that's sent to the service provider's AssertionConsumerService.aspx page using the specified IdP to SP binding.
6. The service provider performs an automatic login using the asserted identity and redirects the user to the original service provider page (Default.aspx).

11.3 IdP-Initiated SSO – Service Provider

The SAML2SP web application, in conjunction with the SAML2IdP web application, demonstrates IdP initiated single sign-on.

11.3.1 Installing the Service Provider

1. Using Visual Studio, build and publish the web application.
2. Open the Internet Information Services management console.
3. Under the default web site for the local computer, create an application with an alias of SAML2SP.
4. For the physical path, browse to the directory where SAML2SP was built and published.
5. Ensure the web application has been successfully installed and configured by browsing to http://localhost/SAML2SP.

11.3.2 Configuring the Service Provider

There is no service provider configuration.

11.3.3 Running the Service Provider

As this is IdP initiated SSO, you need to run the identity provider application rather than the service provider to initiate SSO.

In this example SSO is not being used. Instead, you should simply perform a local login at the service provider to ensure it is functioning correctly.

1. Browse to http://localhost/SAML2SP.
2. Login using the user name *sp-user* and a password of *password*.
3. Verify that you've been redirected to the service provider's default page.

11.3.4 Running the Service Provider in Visual Studio

You may run the identity provider in Visual Studio. No configuration changes are required.

11.4 IdP-Initiated SSO – Identity Provider

The SAML2IdP web application, in conjunction with the SAML2SP web application, demonstrates IdP initiated single sign-on.

11.4.1 Installing the Identity Provider

1. Using Visual Studio, build and publish the web application.
2. Open the Internet Information Services management console.
3. Under the default web site for the local computer, create an application with an alias of SAML2IdP.
4. For the physical path, browse to the directory where SAML2IdP was built and published.
5. Ensure the web application has been successfully installed and configured by browsing to http://localhost/SAML2IdP.

11.4.2 Configuring the Identity Provider

The identity provider configuration is contained within its web.config file's <appSettings> section.

The *AssertionConsumerServiceURL* specifies the URL of the service provider's assertion consumer service.

The *SPTargetURL* specifies the target URL of the service provider.

Modifying web.config does not require an application restart.

If you use the default installation you won't need to modify this configuration.

11.4.3 Running the Identity Provider

In this example, the user is attempting to access a protected resource on the service provider and, rather than performing a local login at the service provider, SSO is initiated with a local login occurring at the identity provider and the asserted identity, passed to the service provider in a SAML assertion, is used to perform an automatic login at the service provider.

1. Browse to http://localhost/SAML2IdP.
2. You should be presented with the identity provider login page as you will be logging in at the identity provider, not the service provider.

   If you are not then you must already have logged in at the identity provider. To force a login, close the browser and start again.
3. Login using the user name *idp-user* and a password of *password*.

4. You should then be presented with the identity provider's default page.
5. Click the link to access the service provider.
6. You should then be presented with the service provider's default page.

   This means you've successfully completed a SAML v2.0 SSO and are logged in at the service provider with your identity provider user name.

11.4.4 Running the Identity Provider in Visual Studio

You may run the service provider in Visual Studio. The one additional step is to note the port number being used by Visual Studio to run the application. You then need to update the identity provider's configuration as described in section 11.4.2 to account for the different port number being used by Visual Studio.

11.5 ADFS Interoperability – Service Provider

The ADFSSP web application demonstrates SP initiated single sign-on with Windows Active Directory Federation Services (ADFS).

11.5.1 Installing the Service Provider

1. Using Visual Studio, build and publish the web application.
2. Open the Internet Information Services management console.
3. Under the default web site for the local computer, create an application with an alias of ADFSSP.
4. For the physical path, browse to the directory where ADFSSP was built and published.
5. Ensure the web application has been successfully installed and configured by browsing to http://localhost/ADFSSP.

11.5.2 Configuring the Service Provider

The service provider configuration is contained within its web.config file's <appSettings> section.

The *SingleSignOnServiceBinding* specifies the binding to use when communicating to the identity provider. The options are:

- urn:oasis:names:tc:SAML:2.0:bindings:HTTP-POST
- urn:oasis:names:tc:SAML:2.0:bindings:HTTP-Redirect

The *HttpPostSingleSignOnServiceURL* specifies the URL of the identity provider's single sign-on service when using the HTTP POST binding.

The *HttpRedirectSingleSignOnServiceURL* specifies the URL of the identity provider's single sign-on service when using the HTTP Redirect binding.

Modifying web.config does not require an application restart.

If you use the default installation you won't need to modify this configuration.

11.5.3 Miscellaneous Configuration

For the purposes of this example, the host name of the service provider is www.sp.com and the host name of the ADFS identity provider is www.idp.com.

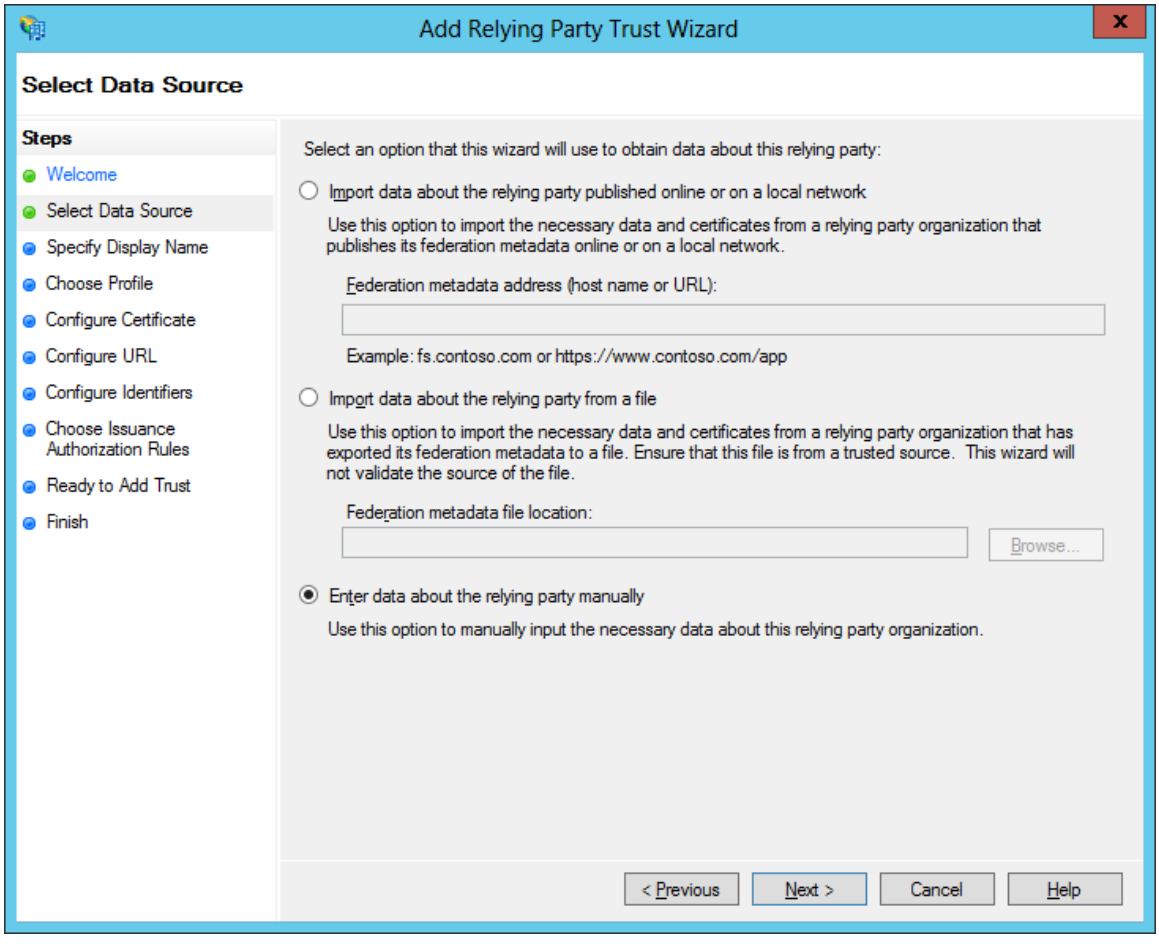
Update the Windows\System32\drivers\etc\hosts file on the identity provider and server provider to include entries for www.idp.com and www.sp.com. For example:

192.168.1.20 www.idp.com
192.168.1.21 www.sp.com

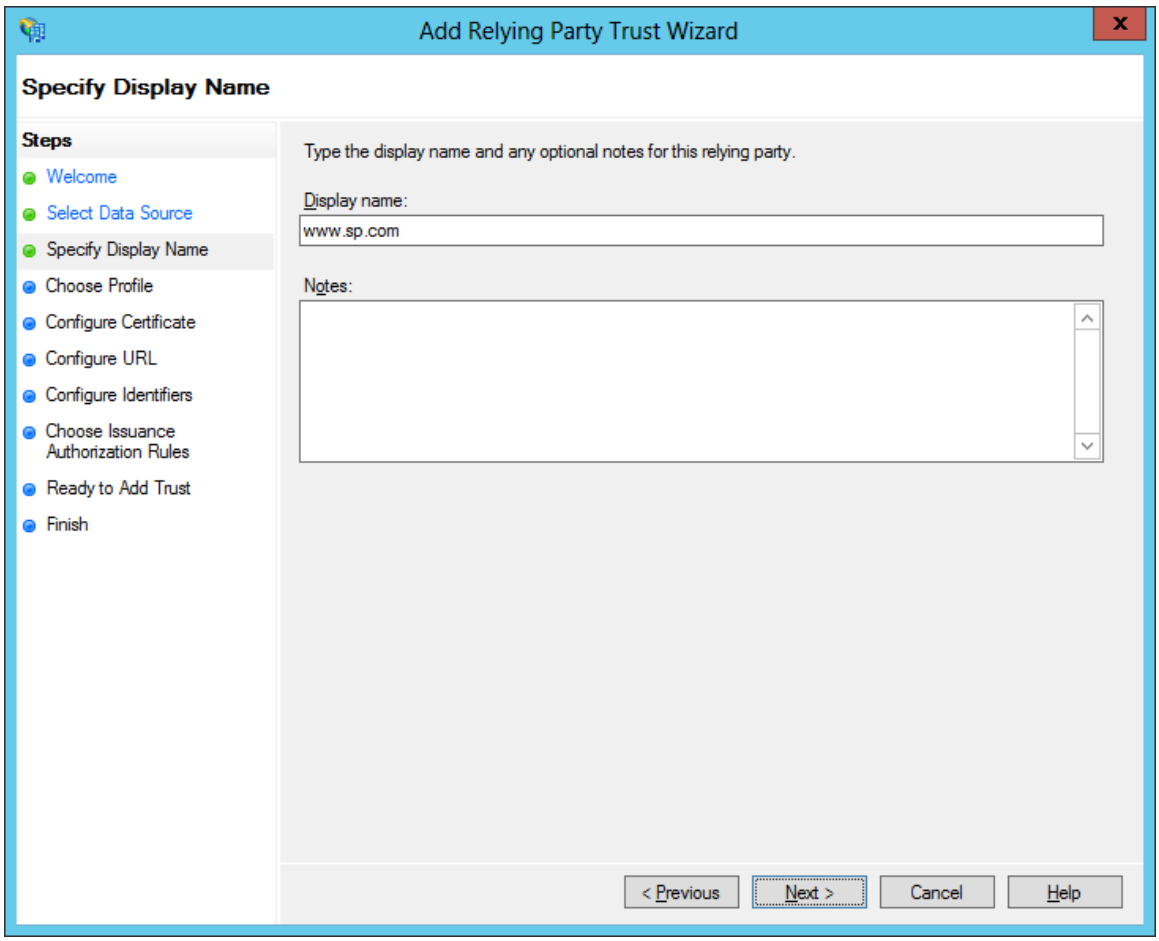
11.5.4 Configuring ADFS

In the ADFS terminology, the service provider is a relying party. Using the ADFS management console, add a relying party trust for the service provider.

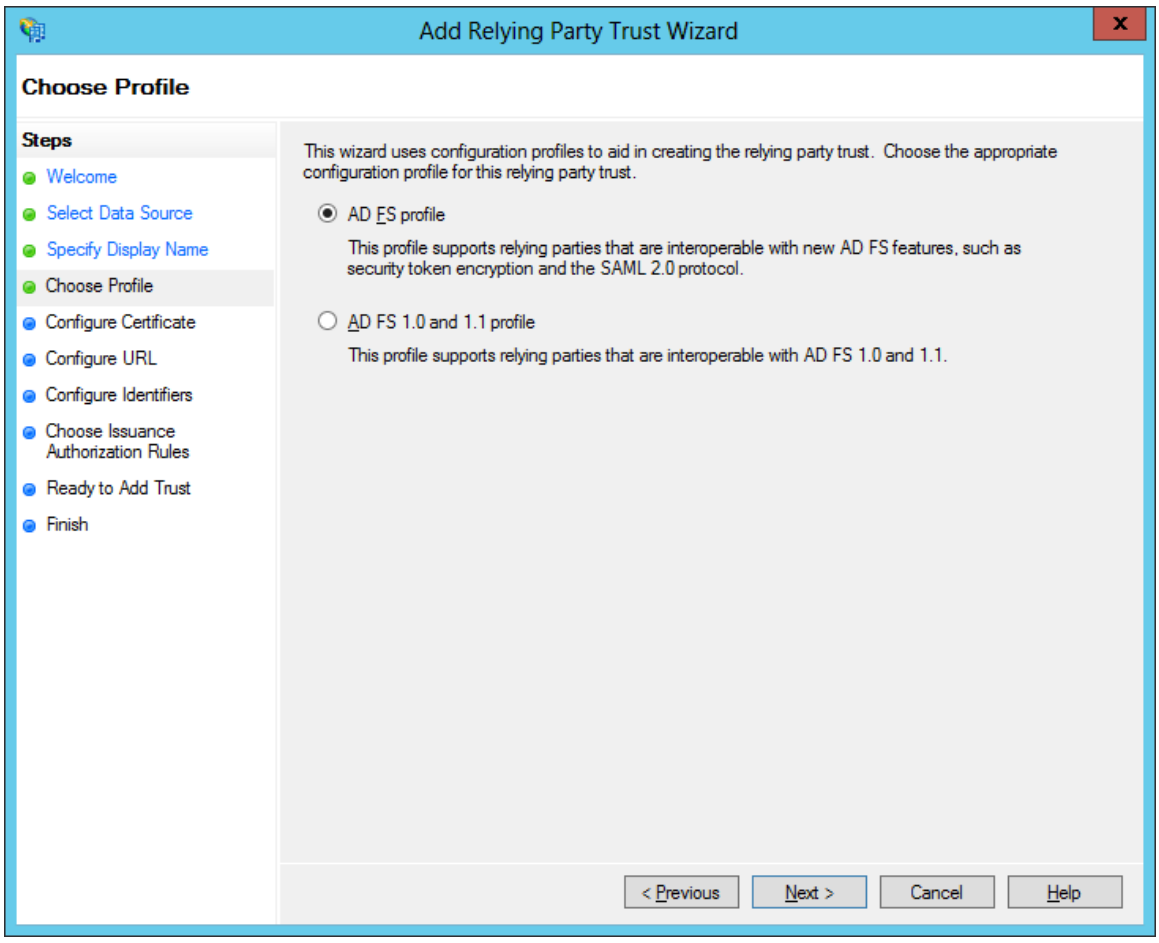
Select the option to enter the relying party information manually.



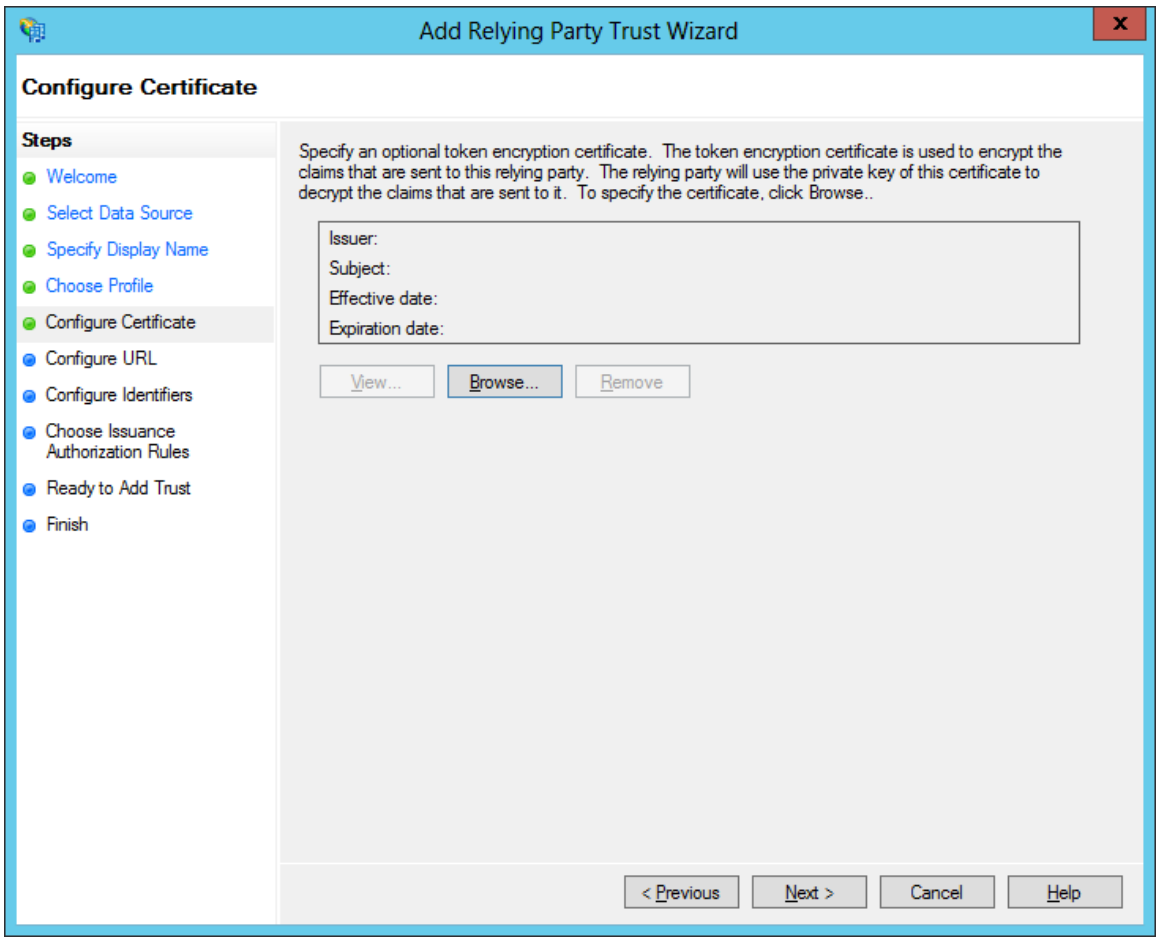
Specify a display name.



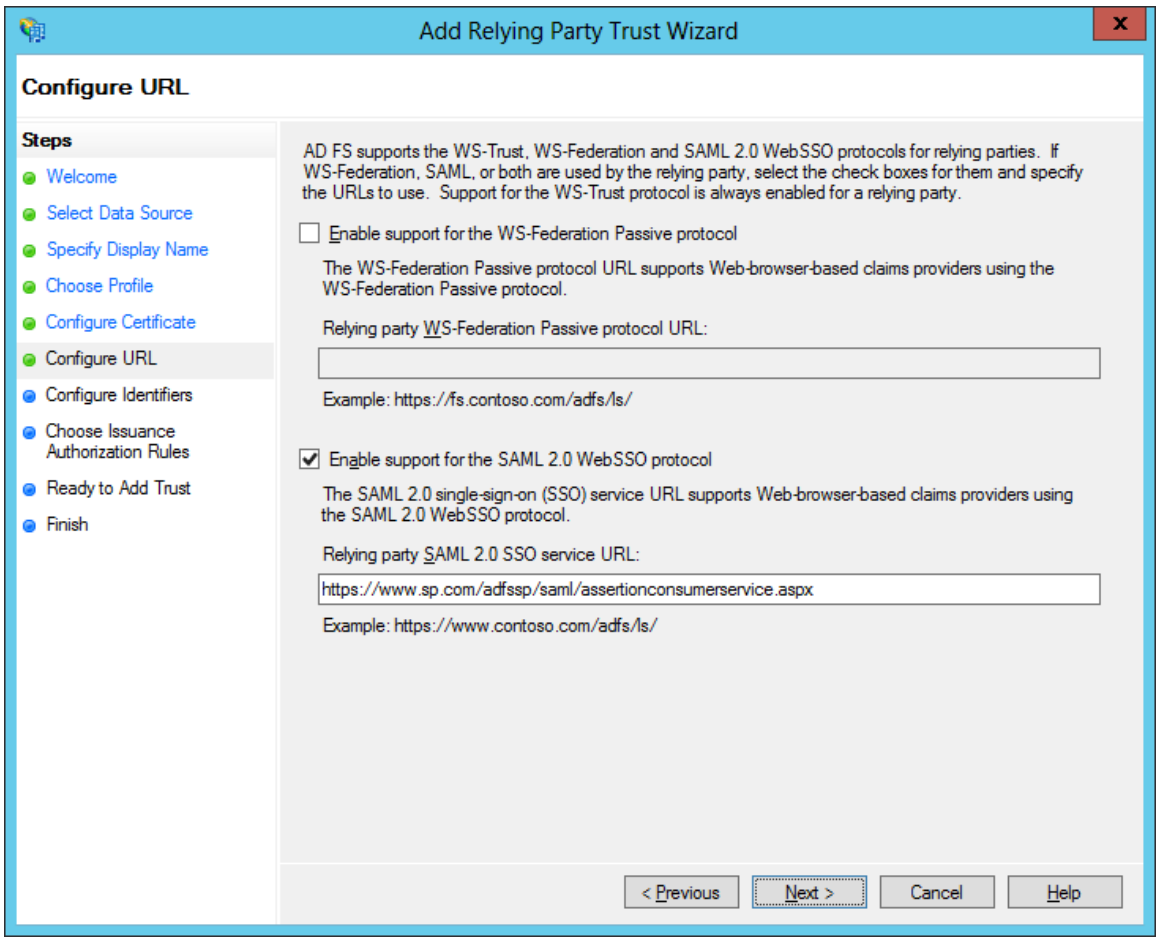
Choose the ADFS profile.



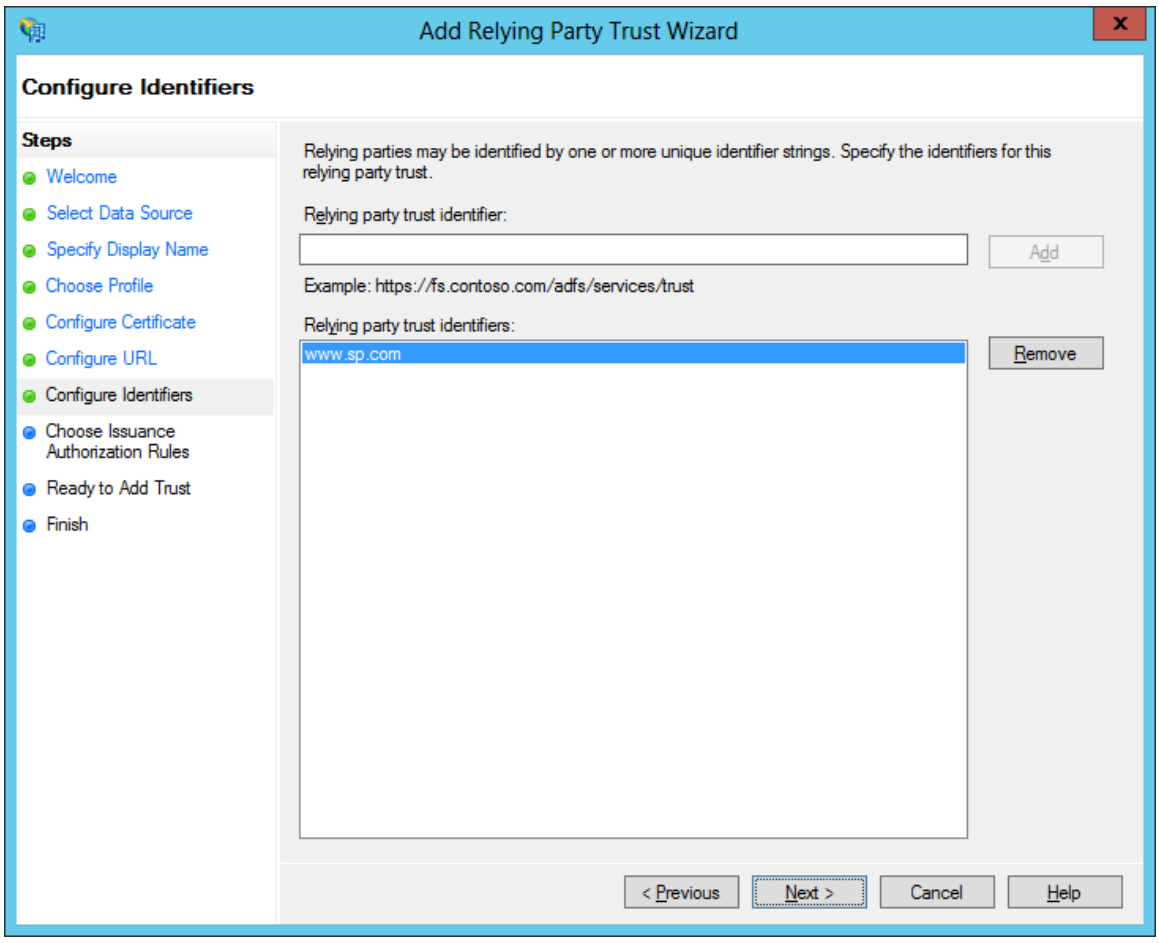
If you wish to have the SAML assertion returned by ADFS encrypted, browse to sp.cer to specify it as the token encryption certificate.



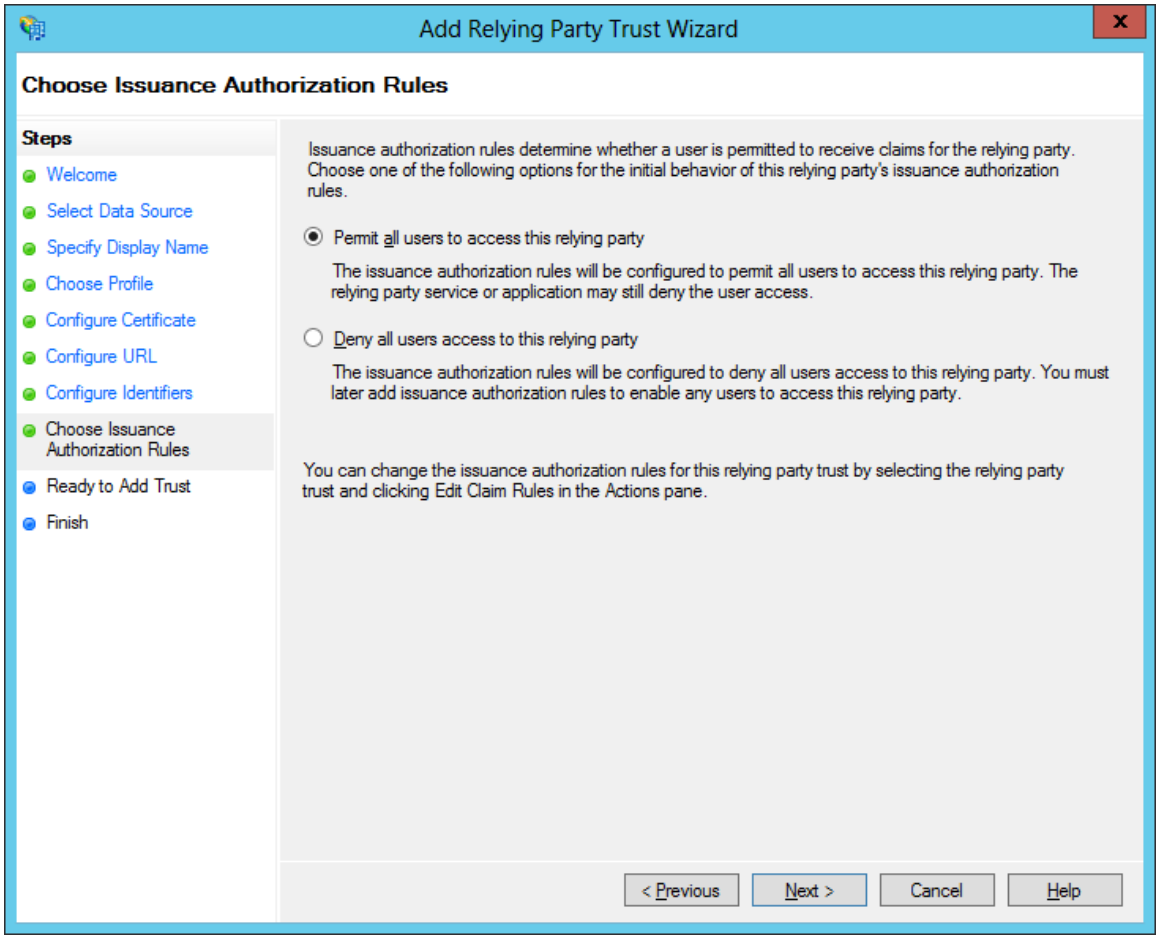
Enable support for SAML v2.0 and specify the service provider's assertion consumer service URL.



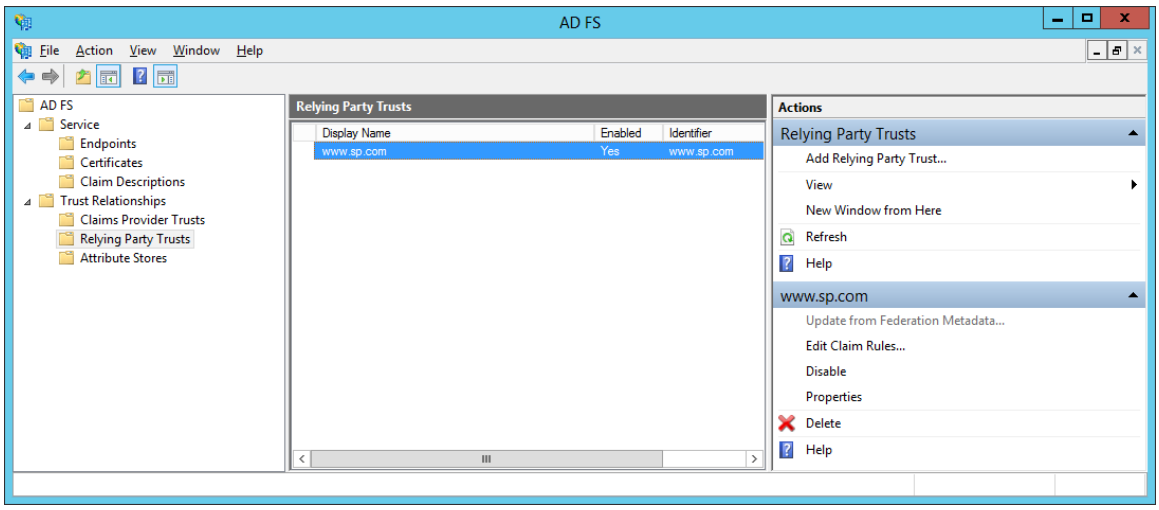
Specify the relying party trust identifier.



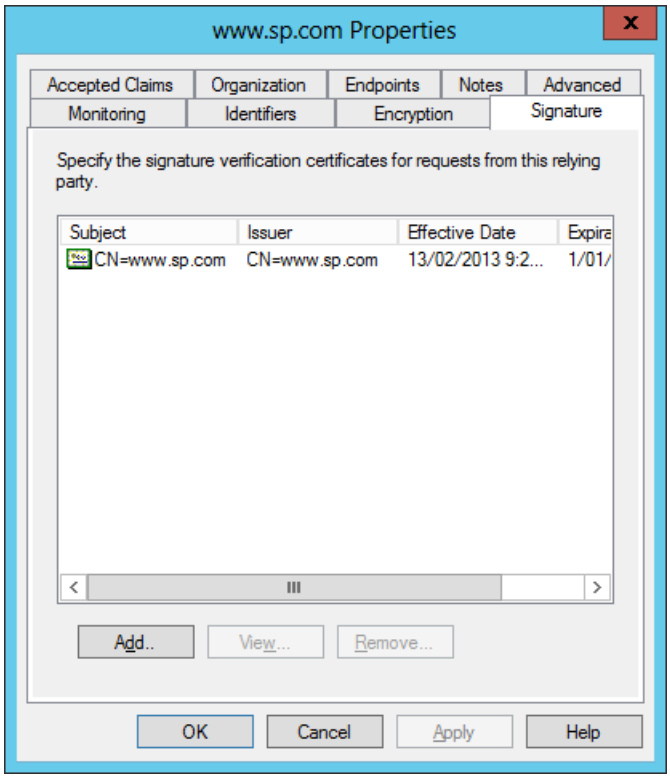
Permit all users access to this relying party.



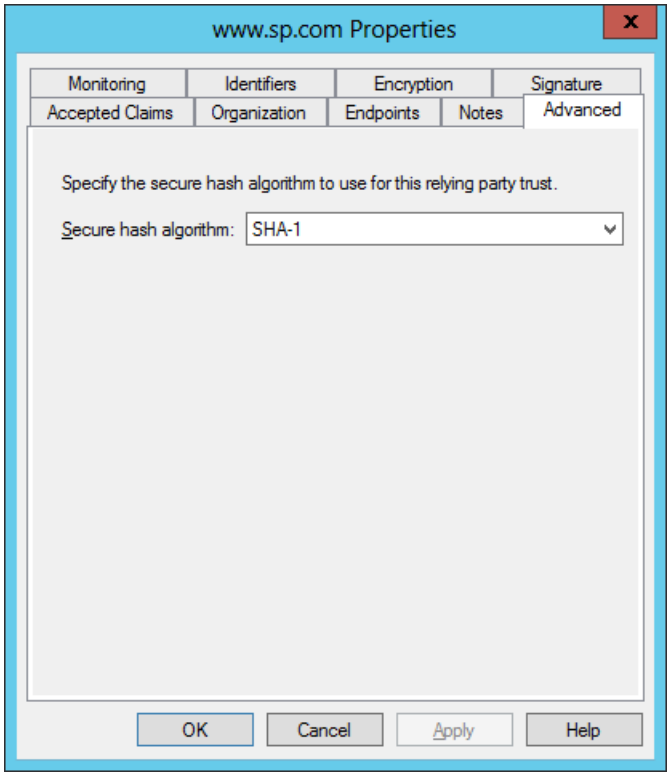
Review the configuration and click Finish. The service provider should be included in the list of relying party trusts.



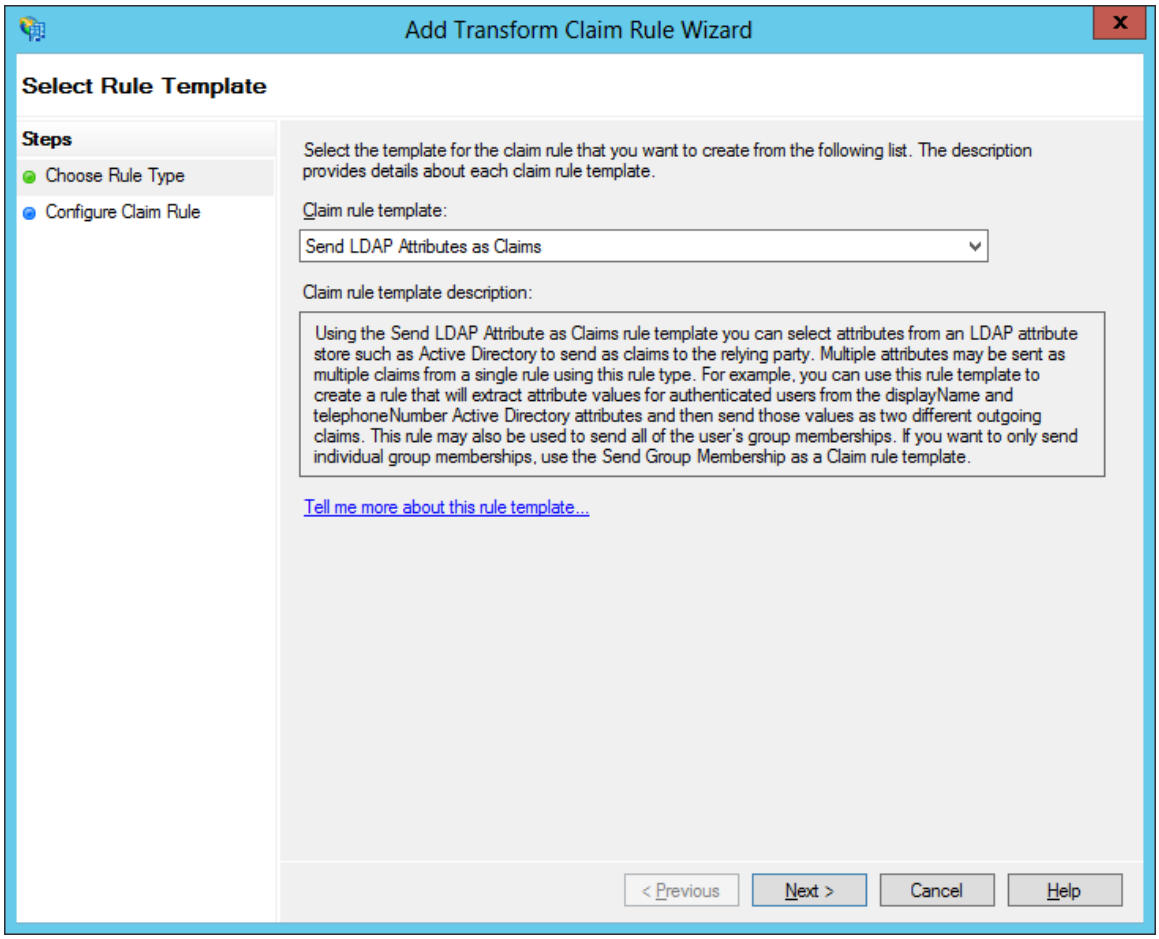
The authn request sent by the service provider is signed. To specify the certificate to use to verify the signature, bring up the reply party trusts properties and under the Signature tab add the service provider certificate.



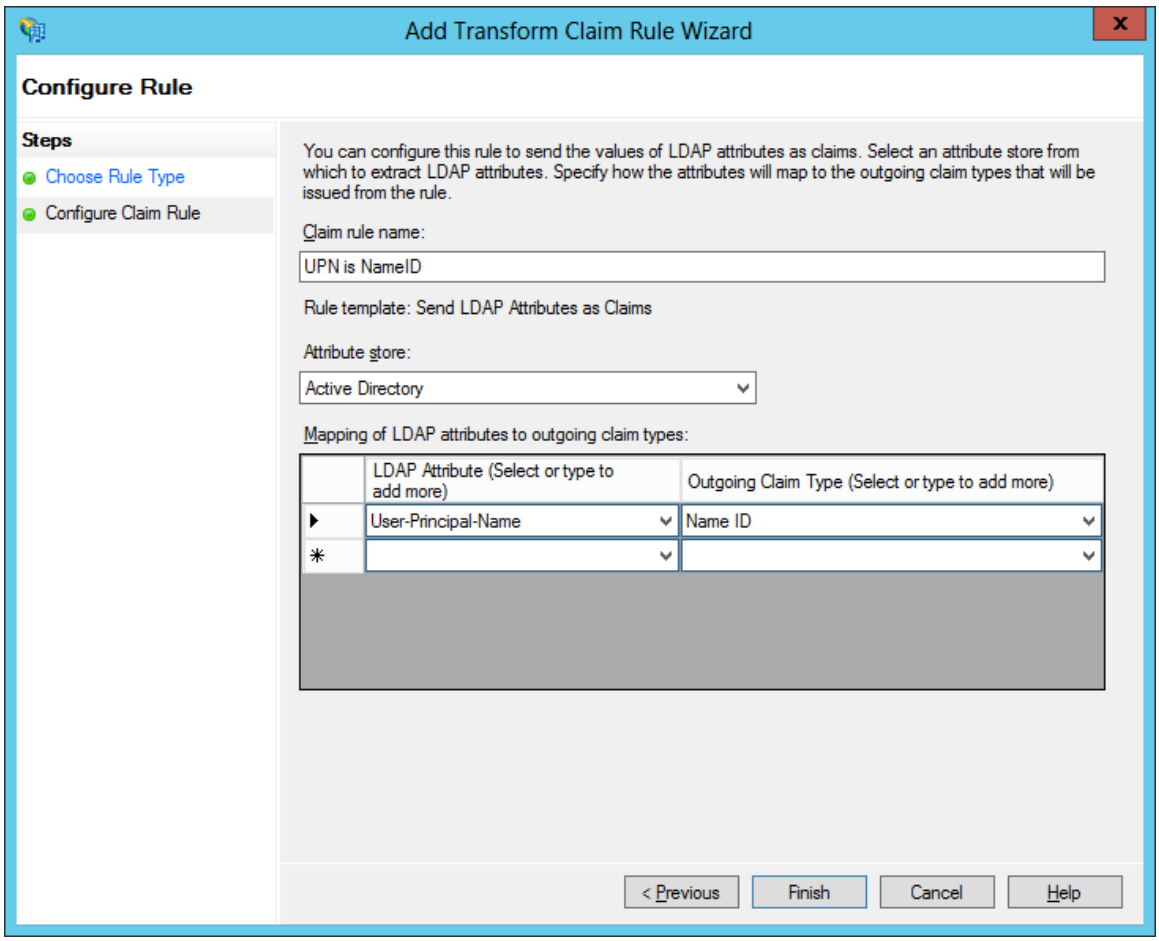
Although the SAML v2.0 component supports SHA-256 signatures, for this example SHA-1 is used. To specify this, under the Advanced tab select SHA-1.

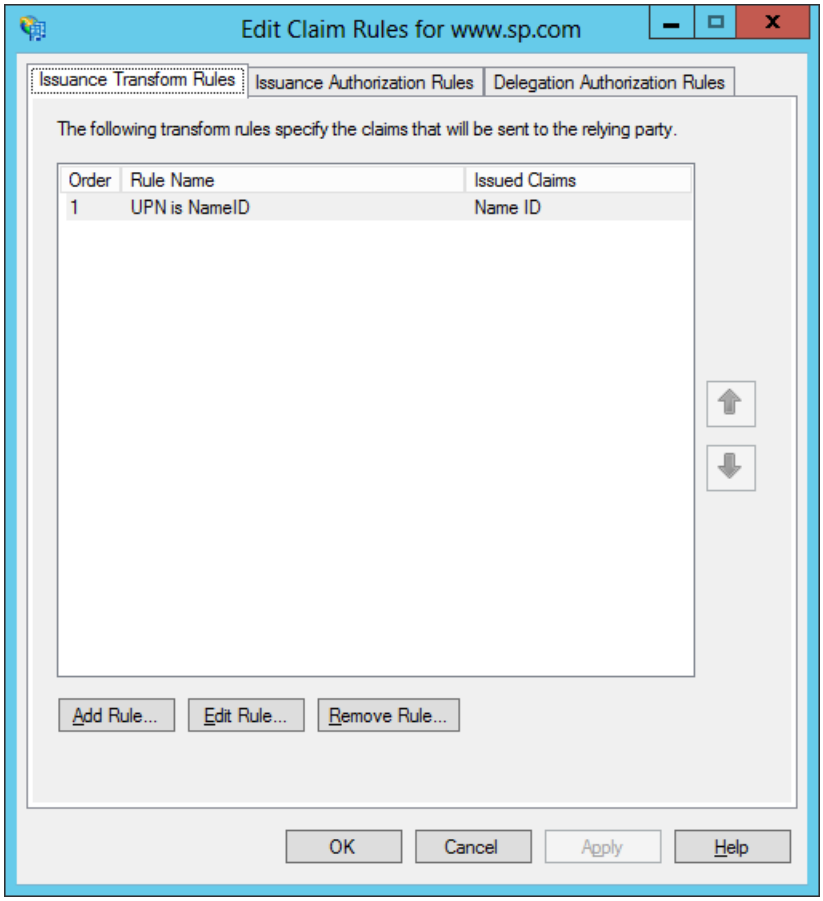


Edit the claim rules and add a rule.



Map the Active Directory user principal name to the outgoing Name ID.


Add Transform Claim Rule Wizard
Configure Rule
Steps
Choose Rule Type
Configure Claim Rule
You can configure this rule to send the values of LDAP attributes as claims. Select an attribute store from which to extract LDAP attributes. Specify how the attributes will map to the outgoing claim types that will be issued from the rule.
Claim rule name:
UPN is NameID
Rule template: Send LDAP Attributes as Claims
Attribute store:
Active Directory
Mapping of LDAP attributes to outgoing claim types:
LDAP Attribute (Select or type to add more)
Outgoing Claim Type (Select or type to add more)
User-Principal-Name
Name ID
< Previous
Finish
Cancel
Help



ADFS should now be ready to communicate with the example service provider.

To review the metadata published by ADFS browse to:

https://www.idp.com/FederationMetadata/2007-06/FederationMetadata.xml

11.5.5 Running the Service Provider without SSO

In this example SSO is not being used. Instead, you should simply perform a local login at the service provider to ensure it is functioning correctly.

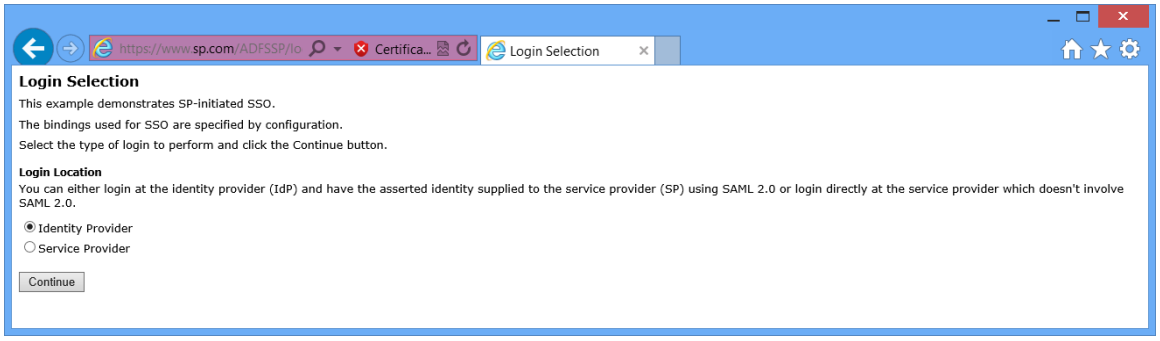
1. Browse to https://www.sp.com/ADFSSP, ignoring any browser certificate warnings.
2. Select the service provider as the location where login will occur.
3. Login using the user name *sp-user* and a password of *password*.
4. Verify that you've been redirected to the service provider's default page.

11.5.6 Running the Service Provider with SSO

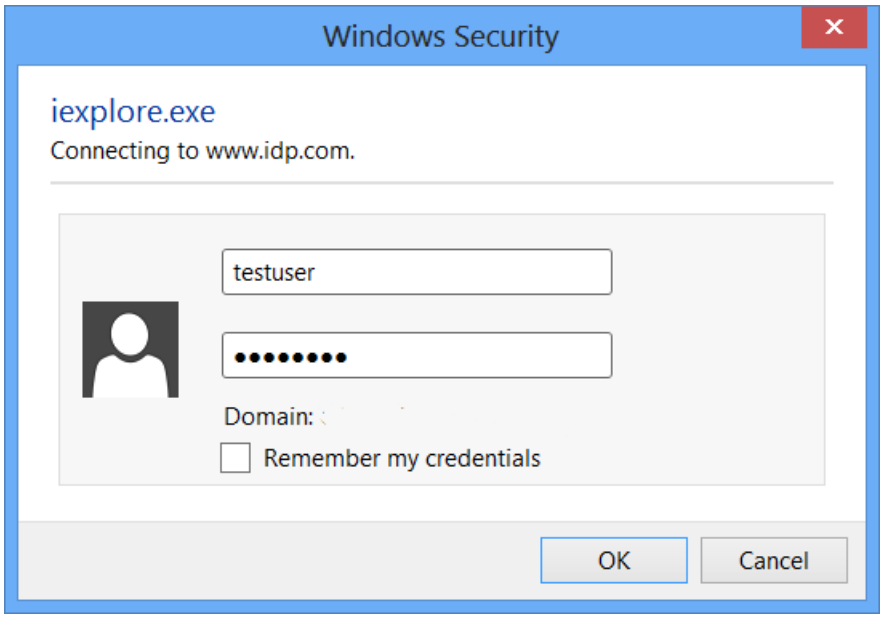
In this example, the user is attempting to access a protected resource on the service provider and, rather than performing a local login at the service provider, SSO is initiated with a local login occurring at the ADFS identity provider and the asserted identity, passed to the service provider in a SAML assertion, is used to perform an automatic login at the service provider.

1. Browse to http://www.sp.com/ADFSSP, ignoring any browser certificate warnings.
2. Select the identity provider as the location where login will occur.

   Selecting the identity provider will initiate a SAML v2.0 SSO to ADFS. Selecting the service provider will initiate a local login at the service provider.



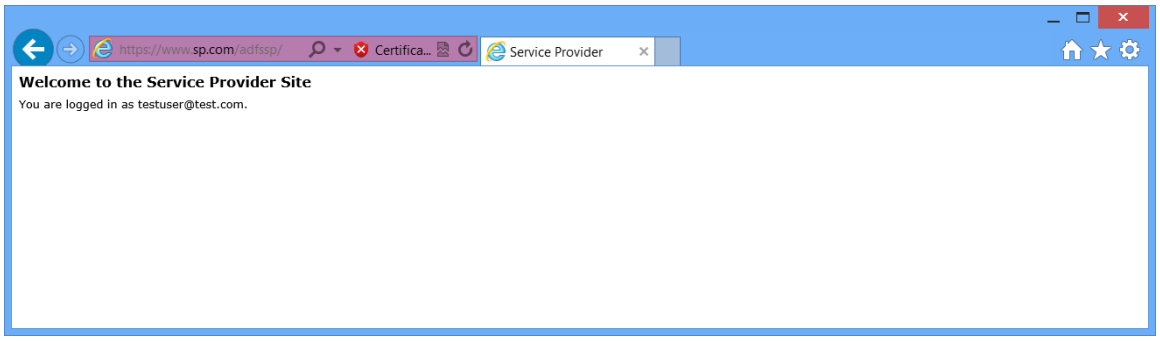
3. You should then be presented with the identity provider login prompt as you will be logging in at the identity provider, not the service provider.



4. Login using the user name and password of a user defined in Active Directory.

5. You should then be presented with the service provider's default page.

   This means you've successfully completed a SAML v2.0 SSO and are logged in at the service provider with your identity provider user name.



11.6 Google Apps Interoperability – Identity Provider

The GoogleIdP web application demonstrates single sign-on with Google Apps. Google Apps is the service provider and GoogleIdP acts as the identity provider in an SP-initiated single sign-on. This allows single sign-on to Google web applications such as Gmail.

11.6.1 Installing the Identity Provider

1. Using Visual Studio, build and publish the web application.
2. Open the Internet Information Services management console.
3. Under the default web site for the local computer, create an application with an alias of GoogleIdP.
4. For the physical path, browse to the directory where GoogleIdP was built and published.
5. Ensure the web application has been successfully installed and configured by browsing to http://localhost/GoogleIdP.

11.6.2 Configuring the Identity Provider

The only identity provider configuration you may need to change is the list of user credentials specified in web.config. The user name that you log into at the identity provider must match with an account name in Google Apps.

Modifying web.config does not require an application restart.

11.6.3 Configuring Google Apps

Refer to the Google Apps documentation for instructions on enabling and configuring single sign-on.

When using the GoogleIdP application, the following URLs should be specified. Replace the example host name with the appropriate host name or IP address.

The sign-in page is: http://www.yourdomain.com/GoogleIdP/SAML/SSOService.aspx.

The sign-out page is: http://www.yourdomain.com/GoogleIdP/SAML/Logout.aspx.

The change password page is:
http://www.yourdomain.com/GoogleIdP/ChangePassword.aspx.

Upload the certificate contained in the idp.cer file in the project's directory.

11.6.4 Running Google Apps

1. Browse to a Google application (e.g. http://mail.google.com/a/yourdomain.com).
2. Login using the user name *google* and a password of *password*. This assumes there's a Google App user called *google*. You may have to modify the user credentials in the GoogleIdP web.config to include a Google App user name.
3. Verify that you've been redirected and signed into the Google app.
4. Sign out from the Google App.
5. Verify that you've been redirected to the GoogleIdP logout page.

11.7 Salesforce Interoperability – Identity Provider

The SalesforceIdP web application demonstrates single sign-on with Salesforce. Salesforce is the service provider and SalesforceIdP acts as the identity provider in an IdP-initiated single sign-on. This allows single sign-on to Salesforce.

11.7.1 Installing the Identity Provider

1. Using Visual Studio, build and publish the web application.
2. Open the Internet Information Services management console.
3. Under the default web site for the local computer, create an application with an alias of SalesforceIdP.
4. For the physical path, browse to the directory where SalesforceIdP was built and published.
5. Ensure the web application has been successfully installed and configured by browsing to http://localhost/SalesforceIdP.

11.7.2 Configuring the Identity Provider

The only identity provider configuration you may need to change is specified in web.config. The Issuer setting must match with the issuer specified in the Salesforce SSO configuration. The SalesforceLoginID is the Salesforce user name used to single sign-on to Salesforce.

Modifying web.config does not require an application restart.

11.7.3 Configuring Salesforce

Refer to the Salesforce documentation for instructions on enabling and configuring single sign-on.

The SAML version is 2.0. The issuer is www.idp.com. This must match the Issuer setting specified in web.config. Upload the certificate contained in the idp.cer file in the project's directory.

The user ID type should be set to specify that the assertion contains the user's Salesforce user name and the user ID is in the subject's name identifier. The Salesforce user name is configured with the SalesforceLoginID setting in web.config.

The Salesforce Login History under Manage Users provides a useful log for debugging single sign-on problems.

11.7.4 Running Salesforce

1. Browse to SalesforceIdP (e.g. http://localhost/SalesforceIdP).
2. Login using the user name *idp-user* and a password of *password*.
3. Click the link to navigate to Salesforce.

11.7.5 Validating SAML Responses in Salesforce

The Salesforce SAML Assertion Validator may be used to track down SAML assertion validation errors.

1. Capture and copy the SAML response XML making sure not to modify it in any way. For example, turn on trace within web.config and copy the SAML response XML from the generated log file.
2. Paste the SAML response XML into the Salesforce SAML Assertion Validator screen and click Validate.
3. Review the validation check list.

11.8 Shibboleth Interoperability – Identity Provider

The ShibbolethIdP web application, in conjunction with the ShibbolethSP web application, demonstrates SP initiated single sign-on.

These applications may also be used to demonstrate interoperability with Shibboleth. Shibboleth (shibboleth.internet2.edu) is an open source SSO software package using Java and C++ technologies. Installation and configuration of the Shibboleth software is beyond the scope of this document and is not required for this demonstration.

11.8.1 Installing the Identity Provider

1. Using Visual Studio, build and publish the web application.
2. Open the Internet Information Services management console.
3. Under the default web site for the local computer, create an application with an alias of ShibbolethIdP.
4. For the physical path, browse to the directory where ShibbolethIdP was built and published.

5. Ensure the web application has been successfully installed and configured by browsing to http://localhost/ShibbolethIdP.

11.8.2 Configuring the Identity Provider

The identity provider configuration is contained within its web.config file's <appSettings> section.

The *AssertionConsumerServiceBinding* specifies the binding to use when communicating to the service provider. The options are:

- urn:oasis:names:tc:SAML:2.0:bindings:HTTP-POST
- urn:oasis:names:tc:SAML:2.0:bindings:HTTP-Artifact.

The *HttpPostAssertionConsumerServiceURL* specifies the URL of the service provider's assertion consumer service when using the HTTP POST binding.

The *HttpArtifactAssertionConsumerServiceURL* specifies the URL of the service provider's assertion consumer service when using the HTTP Artifact binding.

The *ArtifactResolutionServiceURL* specifies the URL of the service provider's artifact resolution service.

Modifying web.config does not require an application restart.

If you use the default installation you won't need to modify this configuration.

11.8.3 Running the Identity Provider

As this is SP initiated SSO, you need to run the service provider application rather than the identity provider to initiate SSO.

In this example SSO is not being used. Instead, you should simply perform a local login at the identity provider to ensure it is functioning correctly.

1. Browse to http://localhost/ShibbolethIdP.
2. Login using the user name *idp-user* and a password of *password*.
3. Verify that you've been redirected to the identity provider's default page.

11.8.4 Running the Identity Provider in Visual Studio

You may run the identity provider in Visual Studio. The one additional step is to note the port number being used by Visual Studio to run the application. You then need to update the service provider's configuration as described in section 11.8.2 to account for the different port number being used by Visual Studio.

11.9 Shibboleth Interoperability – Service Provider

The ShibbolethSP web application, in conjunction with the ShibbolethIdP web application, demonstrates SP initiated single sign-on.

These applications may also be used to demonstrate interoperability with Shibboleth. Shibboleth (shibboleth.internet2.edu) is an open source SSO software package using Java

and C++ technologies. Installation and configuration of the Shibboleth software is beyond the scope of this document and is not required for this demonstration.

11.9.1 Installing the Service Provider

6. Using Visual Studio, build and publish the web application.
7. Open the Internet Information Services management console.
8. Under the default web site for the local computer, create an application with an alias of ShibbolethSP.
9. For the physical path, browse to the directory where ShibbolethSP was built and published.
10. Ensure the web application has been successfully installed and configured by browsing to http://localhost/ShibbolethSP.

11.9.2 Configuring the Service Provider

The service provider configuration is contained within its web.config file's <appSettings> section.

The *SingleSignOnServiceBinding* specifies the binding to use when communicating to the identity provider. The options are:

- urn:oasis:names:tc:SAML:2.0:bindings:HTTP-POST
- urn:oasis:names:tc:SAML:2.0:bindings:HTTP-Redirect
- urn:oasis:names:tc:SAML:2.0:bindings:HTTP-Artifact.

The *HttpPostSingleSignOnServiceURL* specifies the URL of the identity provider's single sign-on service when using the HTTP POST binding.

The *HttpRedirectSingleSignOnServiceURL* specifies the URL of the identity provider's single sign-on service when using the HTTP Redirect binding.

The *HttpArtifactSingleSignOnServiceURL* specifies the URL of the identity provider's single sign-on service when using the HTTP Artifact binding.

The *ArtifactResolutionServiceURL* specifies the URL of the identity provider's artifact resolution service.

Modifying web.config does not require an application restart.

If you use the default installation you won't need to modify this configuration.

11.9.3 Running the Service Provider without SSO

In this example SSO is not being used. Instead, you should simply perform a local login at the service provider to ensure it is functioning correctly.

5. Browse to http://localhost/ShibbolethSP
6. Select the service provider as the location where login will occur.
7. Login using the user name *sp-user* and a password of *password*.

8. Verify that you've been redirected to the service provider's default page.

11.9.4 Running the Service Provider with SSO

In this example, the user is attempting to access a protected resource on the service provider and, rather than performing a local login at the service provider, SSO is initiated with a local login occurring at the identity provider and the asserted identity, passed to the service provider in a SAML assertion, is used to perform an automatic login at the service provider.

6. Browse to http://localhost/ShibbolethSP.
7. Select the identity provider as the location where login will occur.

   Selecting the identity provider will initiate a SAML v2.0 SSO. Selecting the service provider will initiate a local login at the service provider.
8. You should then be presented with the identity provider login page as you will be logging in at the identity provider, not the service provider.

   If you are not then you must already have logged in at the identity provider. To force a login, close the browser and start again.
9. Login using the user name *idp-user* and a password of *password*.
10. You should then be presented with the service provider's default page.

    This means you've successfully completed a SAML v2.0 SSO and are logged in at the service provider with your identity provider user name.

11.9.5 Running the Service Provider in Visual Studio

You may run the service provider in Visual Studio. The one additional step is to note the port number being used by Visual Studio to run the application. You then need to update the identity provider's configuration as described in section 11.9.2 to account for the different port number being used by Visual Studio.

11.10 Assertion Examples

Assertion examples may be found under the examples directory (e.g. C:\Program Files (x86)\ComponentSpace\SAML2\Examples\Assertion).

11.10.1 SAML Assertion Example Application

The AssertionExample application demonstrates:

- Creating a SAML response message and accessing its contents
- Converting a SAML response message to and from XML
- Signing a SAML response message and verifying the signature
- Creating a SAML assertion and accessing its contents
- Converting a SAML assertion to and from XML
- Signing a SAML assertion and verifying the signature

- Encrypting and decrypting a SAML assertion
- Encrypting and decrypting a SAML attribute

11.11 Metadata Examples

Metadata examples may be found under the examples directory (e.g. C:\Program Files (x86)\ComponentSpace\SAML2\Examples\Metadata).

See section 14 for SAML metadata templates and examples.

11.11.1 Import Metadata Example Application

The ImportMetadata application imports a SAML metadata file into the high-level API SAML configuration (saml.config).

Usage:

ImportMetadata.exe <metadata-filename>

where the file contains the SAML entities descriptor or entity descriptor metadata to be imported into saml.config.

For example, the following imports IdP metadata into saml.config:

ImportMetadata.exe idp-metadata.xml

The saml.config file, if any, is assumed to be in the current directory.

If it doesn't exist, a saml.config file is created. Otherwise, metadata is merged into the existing saml.config.

A saml.config partner provider entry is created for each entity descriptor in the metadata.

The updated saml.config includes "TODO" instructions where additional information is required or needs review.

11.11.2 Export Metadata Example Application

The ExportMetadata application exports the high-level API SAML configuration (saml.config) to SAML metadata.

Usage:

ExportMetadata.exe <partner-name> [<certificate-filename>] <metadata-filename>

where the partner name specifies the partner provider in the SAML configuration, the certificate file contains the local provider's X.509 certificate, and a metadata file containing the SAML entity descriptor metadata is created.

For example, the following exports saml.config to a metadata file:

ExportMetadata.exe urn:componentspace:ExampleIdentityProvider sp.cer sp-metadata.xml

The saml.config file is assumed to be in the current directory.

A single metadata entity descriptor is created for the local provider configured in saml.config.

The generated metadata includes “TODO” instructions where additional information is required or needs review.

11.11.3 SAML Metadata Example Application

The MetadataExample application demonstrates creating and manipulating SAML metadata including:

- Creating and reading an IdP entity descriptor
- Creating and reading an SP entity descriptor

11.11.4 ReadMetadata

ReadMetadata reads SAML metadata. It is a useful utility for confirming the metadata syntax is valid.

Usage:

ReadMetadata.exe <filename>

where the file contains the SAML entities descriptor or entity descriptor metadata.

For example, the following parses IdP metadata:

ReadMetadata.exe idp-metadata.xml

11.12 Signature Examples

XML signature examples may be found under the examples directory (e.g. C:\Program Files (x86)\ComponentSpace\SAML2\Examples\Signature).

11.12.1 SHA-256 Signature Example Application

The SHA256Signature application demonstrates generating and verifying XML signatures using the SHA-256 digest and signature algorithms.

SHA-256 XML signature support requires a .NET CLR security update. Refer to section 16.3 for more details.

11.12.2 SignSAML

SignSAML demonstrates signing SAML assertions and protocol messages. It is also a useful utility for debugging signature verification errors.

Usage:

SignSaml.exe –k <keystore> -p <password> <filename>

where the keystore is a PFX file containing a key, the password is the password to the keystore, and the file contains the XML to be signed.

For example, the following signs a SAML response:

SignSaml.exe –k test.pfx –p password SAMLResponse.xml

11.12.3 VerifySAML

VerifySAML demonstrates verifying signatures on SAML assertions and protocol messages. It is also a useful utility for debugging signature verification errors.

Usage:

VerifySaml.exe [–c <certificateFileName>] <filename>

where the certificateFileName is a CER file containing the certificate to use to verify the signature, and the file contains the signed XML to be verified.

If no certificateFileName is specified then the certificate contained in the signed XML is used.

For example, the following verifies a SAML response:

VerifySaml.exe –c test.cer SAMLResponse.xml

11.13 Utility Applications

Utility applications may be found under the examples directory (e.g. C:\Program Files (x86)\ComponentSpace\SAML2\Examples\Utility).

11.13.1 ValidateConfig

ValidateConfig validates the SAML configuration file against its schema. See section 6 for a description of the SAML configuration schema.

ValidateConfig is a useful utility for debugging SAML configuration file errors.

Usage:

ValidateConfig.exe <filename >

where the file contains the SAML configuration.

For example, the following validates a SAML response:

ValidateConfig.exe saml.config

11.13.2 ValidateXML

ValidateXML demonstrates validating SAML assertions, protocol messages and metadata against the SAML, XML signature and XML encryption schemas. It is also a useful utility for debugging invalid SAML XML errors.

Usage:

ValidateXml.exe <filename>

where the file contains the SAML assertion, protocol or metadata XML to be validated.

For example, the following validates a SAML response:

ValidateXml.exe SAMLResponse.xml

11.13.3 EncryptSAML

EncryptSAML demonstrates encrypting SAML assertions. It is also a useful utility for debugging encryption errors.

Usage:

EncryptSaml.exe –c < certificateFileName> <filename>

where the certificateFileName is a CER file containing the certificate to use to encrypt the assertion, and the file contains the SAML assertion XML to be encrypted.

For example, the following encrypts a SAML assertion:

EncryptSaml.exe –c test.cer SAMLAssertion.xml

11.13.4 DecryptSAML

DecryptSAML demonstrates decrypting encrypted SAML assertions. It is also a useful utility for debugging decryption errors.

Usage:

DecryptSaml.exe –k <keystore> -p <password> <filename>

where the keystore is a PFX file containing a key, the password is the password to the keystore, and the file contains the encrypted SAML assertion XML to decrypt.

For example, the following decrypts an encrypted SAML assertion:

DecryptSaml.exe –k test.pfx –p password EncryptedAssertion.xml

11.13.5 ParseHttpRedirectUrl

ParseHttpRedirectUrl decodes the query string parameters in an HTTP redirect URL and verifies their signature. It is a useful utility for debugging signature errors.

Usage:

ParseHttpRedirectUrl.exe –c < certificateFileName> <filename>

where the certificateFileName is a CER file containing the certificate to use to verify the signature, and the file contains the redirect URL including query string.

For example, the following parses a redirect URL:

ParseHttpRedirectUrl.exe –c test.cer RedirectURL.txt

11.13.6 Java Utilities

A Java application may be found under the examples directory (e.g. C:\Program Files (x86)\ComponentSpace\SAML2\Examples\Java).

This application may be used to independently generate and verify signatures.

Refer to the readme.txt in the Examples\Java directory for instructions on running this application.

12 Creating your own SSO Application

The following steps describe the process for enabling SAML single sign-on in your application. Refer to section 3 if you are not familiar with SAML single sign-on.

1. Determine whether your application will be an identity provider (IdP) or service provider (SP).
2. Determine whether your application will support IdP-initiated SSO and/or SP-initiated SSO.
3. Exchange SAML configuration information (e.g. X.509 certificates, URLs) with the partner organization or site (see section 14).
4. Add a reference to the SAML class library in your application (see section 4.1).
5. Add endpoint pages to your application to receive SAML protocols messages, if required.
6. Call into the SAML class library API to enable SAML single sign-on.

   The example applications described in section 5 are a good starting point for understanding the SAML class library API.

   Refer to the class library reference for help using the API (see section 21).
7. Once completed, distribute the SAML class library DLL with your application (see section 4.2).

12.1 Considerations

The example applications described in section 5 are a good starting point for adding SSO support to your application.

However, these are only example applications and have been kept as simple as possible to assist you in understanding them.

For production applications you will need to consider a number of requirements not covered by the example applications.

12.1.1 Error Handling

The example applications include minimal error handling.

The example applications display the specific error on the browser.

In a production environment you should not display specific error information but instead should log this information and display a generic error message or error page.

12.1.2 Configuration

Some of the example applications allow the user to select the SAML bindings.

The bindings to use should be negotiated between the identity provider and service provider and not exposed to the user.

12.1.3 Key Management

SAML assertions and protocol message may be signed to ensure their integrity and origin.

Also, SAML assertions may be encrypted to ensure the privacy of their data.

The example applications sign messages using private keys stored in PFX files and verify signatures using public keys stored in CER files.

You may wish to store keys and certificates in one of the Windows certificate stores and access them using the .NET framework's X509Store class.

12.1.4 Security

Some of the example applications do not use HTTPS.

You should follow the security recommendations described in the SAML specification.

Typically this means using HTTPS.

13 Test Certificates and Keys

Test certificate and key files are supplied that may also be used during the development of your identity provider or service provider applications.

For example, the SP initiated identity provider includes an idp.pfx and sp.cer in its root directory. The SP initiated service provider includes an sp.pfx and idp.cer in its root directory. The password for these PFX files is *password*.

The identity provider uses the secret key stored in idp.pfx to sign messages. The service provider uses the public key contained in idp.cer to verify signatures in messages received from the identity provider.

Similarly, the service provider uses the secret key stored in sp.pfx to sign messages. The identity provider uses the public key contained in sp.cer to verify signatures in messages received from the service provider.

Certificates may also be embedded in the XML signature that's included with the signed message. These certificates may be used rather than separately stored certificates although you need to consider any security ramifications.

The following sections outline a number of alternatives for generating your own test certificates and keys.

Test certificate and keys should not be used in a production environment. You should purchase these from a certificate issuing service. Standard SSL certificates may be used.

13.1 Makecert

Use the makecert and pvk2pfx tools that ships with Visual Studio (e.g. C:\Program Files\Microsoft Visual Studio 8\Common7\Tools\Bin\makecert.exe) to create certificate files and private key files.

makecert -r -pe -sky exchange -n "cn=www.idp.com" -sv idp.pvk idp.cer

You then need to convert the PVK file to a PFX file so it can be loaded with the .NET framework classes.

pvk2pfx -pvk idp.pvk -spc idp.cer -pfx idp.pfx -po password -f

Refer to the Microsoft help for additional options.

13.1.1 Makecert and SHA-256 XML Signatures

When using makecert to create a self-signed certificate to generate SHA-256 XML signatures (see section 16.3), the correct cryptographic provider type must be specified.

The Microsoft Enhanced RSA and AES Cryptographic Provider is required to support SHA-256 signatures. This provider's type is twenty-four.

For example:

makecert -r -pe -sky exchange -n "cn=www.idp.com" -ss My -sy 24

Rather than saving the certificate and private key to files, they're saved to the Windows certificate store. This is required to work around an issue in makecert or pvk2pfx where the provider type information is lost if the certificate and private key are directly saved to files.

The Microsoft Management Console's Windows Certificate snap-in should be used to export the certificate and private key to a PFX file.

The default 1024 bit key length may be used for SHA-256 XML signature generation.

If you wish to create a 2048 bit key, specify the length parameter.

For example:

makecert -r -pe -sky exchange -n "cn=www.idp.com" -ss My -sy 24 -len 2048

The default signature algorithm used to sign the certificate using the issuer's private key is SHA-1. This is independent of the certificate's support for SHA-256 XML signatures. For example, a SHA-1 signed certificate may be used to generate SHA-256 XML signatures.

If you wish to sign the certificate using SHA-256, specify the algorithm parameter.

For example:

makecert -r -pe -sky exchange -n "cn=www.idp.com" -ss My -sy 24 -len 2048 -a sha256

13.2 Microsoft Certificate Server

1. If not already done, install the Windows 2003 Certificate Services Windows component. This installs a certification authority (CA) to issue certificates.
2. Navigate to the certificate service (e.g. http://localhost/certsrv) and request a certificate. Select the "advanced certificate request" and then "Create and submit a request to this CA". Fill in the certificate request details, specifying the certificate type as server authentication certificate and make sure "Mark keys as exportable" is checked.

3. Using the Certification Authority MMC snap-in, view the pending requests and issue a certificate.
4. Back at the certificate service click, view the status of the pending certificate request and click the link to install the certificate.
5. Using the Certificates MMC snap-in, view the certificate to confirm that it has been installed. If required you can export the certificate and private key to a PFX file but make sure to check "Include all certificates in the certification path if possible". You can also export the certificate only if required.

13.3 Keytool

Use the Java keytool that comes with the JDK to create certificate files and private key files.

keytool -genkey -dname "cn=www.idp.com" -alias idp -keypass password -keyalg RSA -validity 3650 -keystore idp.pfx -storepass password -storetype pkcs12

You then need to generate a certificate file.

keytool.exe -export -alias idp -keystore idp.pfx -storepass password -storetype pkcs12 -rfc -file idp.cer

14 SAML Metadata

The “Metadata for the OASIS Security Assertion Markup Language (SAML) V2.0” specification defines a format for exchanging SAML configuration information. This exchange occurs out-of-band (e.g. by downloading from web sites or by email) between partner organizations as part of establishing a single sign-on environment.

The use of SAML metadata is entirely optional. Information, including endpoint URLs etc, may be exchanged in any manner convenient to the partner organizations.

14.1 Metadata Production

The SAML library supports the generation of SAML metadata programmatically. Section 11.11 outlines example projects demonstrating how to generate identity provider and service provider metadata.

Alternatively, metadata may be created using your preferred XML editor and some knowledge of the SAML metadata XML schema. Templates and examples are included in C:\Program Files (x86)\ComponentSpace SAML v2.0 for .NET\Examples\Metadata\Templates.

The IdP-template.xml is a suitable starting point for creating identity provider metadata and includes comments outlining what has to be edited. The IdP-example.xml is an example of identity provider metadata.

The SP-template.xml is a suitable starting point for creating service provider metadata and includes comments outlining what has to be edited. The SP-example.xml is an example of identity provider metadata.

14.2 Metadata Consumption

The SAML library supports the consumption of SAML metadata programmatically. Section 11.11 outlines example projects demonstrating how to read identity provider and service provider metadata.

Alternatively, metadata may be read using your preferred XML editor and with some knowledge of the SAML metadata XML schema. Information including URLs etc may then be extracted and included with your application's configuration.

14.3 Importing and Exporting Metadata

Section 11.11 describes example applications for importing and exporting SAML metadata to and from SAML configuration (saml.config).

15 Troubleshooting

15.1 Tracing

To help resolve problems, tracing internal to the product may be enabled. If you are experiencing a problem you may be asked to enable tracing.

15.1.1 Diagnostic Tracing in Web Applications

To enable diagnostic tracing, update your application's web.config to include a `<system.diagnostics>` section as shown in the example configuration below.

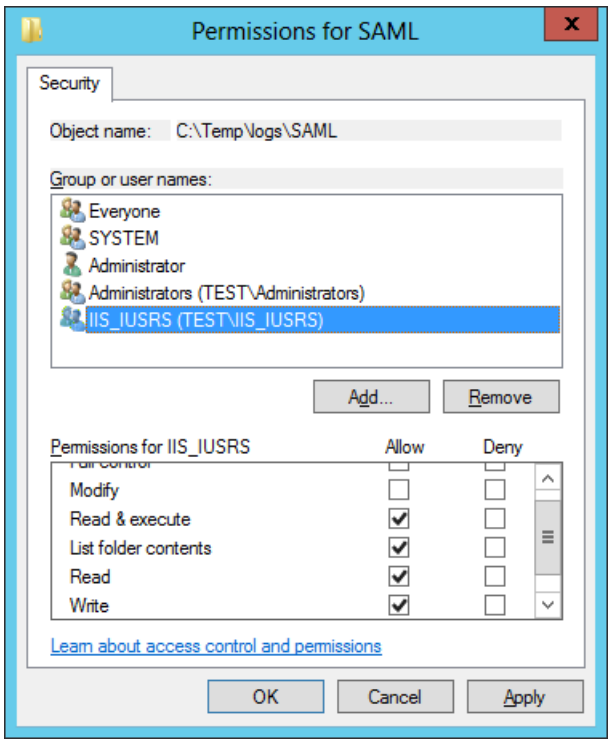
```
<system.diagnostics>
  <trace autoflush="true">
    <listeners>
      <add name="TextWriter"/>
    </listeners>
  </trace>
  <sources>
    <source name="ComponentSpace.SAML2" switchValue="Verbose">
      <listeners>
        <add name="TextWriter"/>
      </listeners>
    </source>
  </sources>
  <sharedListeners>
    <add name="TextWriter"
         type="System.Diagnostics.TextWriterTraceListener"
         initializeData="c:\temp\logs\saml\idp.log"/>
  </sharedListeners>
</system.diagnostics>
```

Most of the example applications include a diagnostic tracing section in their web.config files.

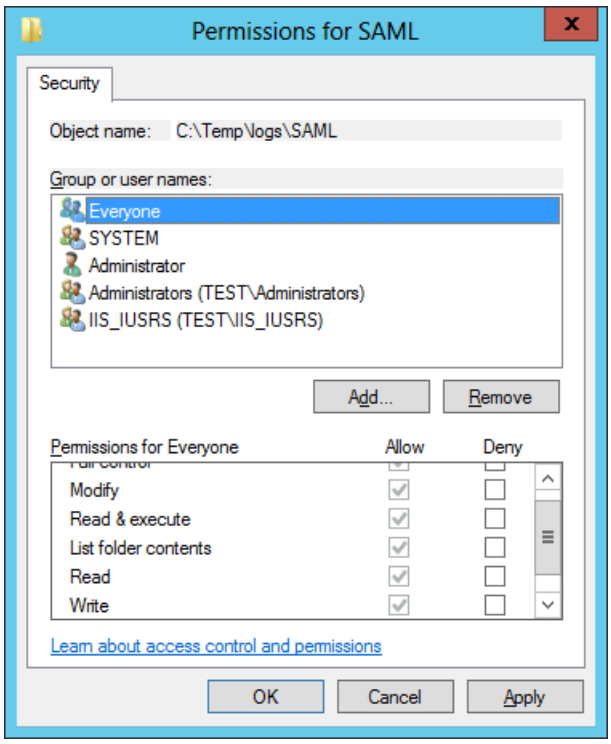
15.1.1.1 Setting Log File Permissions

You must ensure the directory where the log file will be written exists. In this example, the directory c:\temp must exist in order for the SAML2.log file to be created.

The user account running the web application must have write permission to this directory. For example, give the IIS_USERS group write permission to the directory.



Alternatively, in a development environment you may give the Everyone group write permission to the directory. This should not be done in a production environment.



15.1.2 Diagnostic Tracing in Non-Web Applications

Create a standard .NET configuration file for your application, if one doesn't already exist. The configuration file name consists of your application file name and `.config`. For example, if your application is called *myapplication.exe* then its configuration file should be named *myapplication.exe.config*. The configuration file must be located in the same directory as the application executable.

Include in the `<system.diagnostics>` section a switch and listeners as shown in the example configuration below.

```
<system.diagnostics>
  <trace autoflush="true">
    <listeners>
      <add name="TextWriter"/>
    </listeners>
  </trace>
  <sources>
    <source name="ComponentSpace.SAML2" switchValue="Verbose">
      <listeners>
        <add name="TextWriter"/>
      </listeners>
    </source>
  </sources>
  <sharedListeners>
    <add name="TextWriter"
         type="System.Diagnostics.TextWriterTraceListener"
         initializeData="c:\temp\logs\idp.log"/>
```

```
    </sharedListeners>
  </system.diagnostics>
```

15.2 Troubleshooting XML Signatures

SAML assertions and protocol messages may include an XML signature. If a signature fails to verify then either the signed XML has been altered in some way or the wrong certificate has been used to perform the verification.

One common problem when manipulating signed XML is to be careful to preserve white-space characters as these characters are significant when generating signatures. Internally, the SAML v2.0 class library ensures white-space is preserved. If you load or manipulate the signed XML ensure the XML is not modified prior to verifying its signature and specifically ensure white-spaces are preserved.

If signature verification is failing ensure the correct certificate is being used. The certificate is either contained in the XML signature or is loaded from a certificate file or store. If you are using a separately loaded certificate rather than a certificate contained within the XML signature, ensure the certificate is the correct one.

15.2.1 VerifySAML

If you believe the correct certificate is being used you can run a supplied utility, VerifySAML, to see whether the signature can be verified (see section 11.11.4).

For example, to verify the signature on a SAML protocol response you would capture the response to file, ensuring the XML is not altered in any way, and run:

VerifySaml.exe [–c <certificateFileName>] <filename>

The certificateFileName is a CER file containing the certificate to use to verify the signature. Only specify this parameter if the certificate is being loaded from a certificate file or store. If the certificate is included in the XML signature, then do not specify this parameter.

The filename is the file containing the SAML protocol response as XML.

This utility may be used to verify signatures on SAML requests, responses and assertions.

15.2.2 VerifySAML Log File

The VerifySAML utility generates a VerifySAML.log0020file in the working directory. This includes log entries generated by the .NET framework during signature verification.

If signature verification is successful, the log will include entries like:

System.Security.Cryptography.Xml.SignedXml Verbose: 13 : [SignedMessage#00245fb7, VerifyReference] Reference Reference#003917f2 hashed with "http://www.w3.org/2000/09/xmldsig#sha1" (SHA1CryptoServiceProvider) has hash value a3503180ce819de2efc3a66f9b29b7d2687033ec, expected hash value a3503180ce819de2efc3a66f9b29b7d2687033ec.

System.Security.Cryptography.Xml.SignedXml Information: 9 : [SignedMessage#00245fb7, SignatureVerificationResult] Verification with key RSACryptoServiceProvider#039490e2 was successful

This shows that the calculated hash of the canonicalized XML matches the hash or digest value contained in the XML signature. This confirms that the XML has not been modified.

It also shows that the calculated signature value matches the signature value in the XML signature. This confirms that the XML was signed by the owner or subject of the certificate.

If the XML has been modified after signing, the log will include entries like:

System.Security.Cryptography.Xml.SignedXml Verbose: 13 : [SignedMessage#00245fb7, VerifyReference] Reference Reference#003917f2 hashed with "http://www.w3.org/2000/09/xmldsig#sha1" (SHA1CryptoServiceProvider) has hash value 604bfa74922eb89c25d061a0e9eda3d3f1967d9c, expected hash value a3503180ce819de2efc3a66f9b29b7d2687033ec.
System.Security.Cryptography.Xml.SignedXml Information: 12 : [SignedMessage#00245fb7, VerificationFailure] Verification failed checking references.

This shows that the calculated hash of the canonicalized XML does not match the hash or digest value contained in the XML signature. This means that the XML has been modified.

If the wrong certificate is used to verify the signature, the log will include entries like:

System.Security.Cryptography.Xml.SignedXml Information: 12 : [SignedMessage#00245fb7, VerificationFailure] Verification failed checking SignedInfo.

15.2.3 Java VerifyXMLSignature

A Java application is supplied for independently checking XML signatures. This application may be run using the provided VerifyXMLSignature.bat script file.

The VerifyXMLSignature.bat uses Java 1.6 or better to verify XML signatures.

15.2.4 XML Signatures and Prefixes

Consider the following section of XML:

```
<samlp:Response xmlns:samlp="urn:oasis:names:tc:SAML:2.0:protocol/>
```

The element name is Response; it’s prefixed with samlp; and it’s declared in the urn:oasis:names:tc:SAML:2.0:protocol namespace.

What uniquely identifies this element is its name and namespace. The prefix is a mechanism for linking an element with its namespace declaration.

By conventions samlp is used for the urn:oasis:names:tc:SAML:2.0:protocol namespace although any other prefix would be equally valid.

Java and some other implementations often use the ds prefix for the XML signature namespace. For example:

```
<ds:Signature xmlns="http://www.w3.org/2000/09/xmldsig#/">
```

The .NET framework treats the XML signature namespace as the default namespace and consequently doesn't use a prefix. For example:

```
<Signature xmlns="http://www.w3.org/2000/09/xmldsig#">
```

Both forms, with and without a prefix, are equally valid.

The class library supports verifying XML signatures that use no prefix, the ds prefix or some other prefix.

XML signatures generated by the class library will no include a prefix.

When confronted with XML signature verification issues, some third parties who are familiar with the use of the ds prefix will assume that the missing prefix is the issue. This is not the case and, if it ever were the case, this would indicate poorly implemented XML signature verification at the third party.

15.3 Troubleshooting Loading Certificates

When loading X.509 certificates using the .NET X509Certificate2 class, always specify the X509KeyStorageFlags.MachineKeySet flag. This ensures the certificate may be accessed from within IIS. For example:

```
X509Certificate2 x509Certificate = new X509Certificate2("idp.pfx", "password",
                                                         X509KeyStorageFlags.MachineKeySet);
```

15.3.1 Certificates Stored in Files

When loading a certificate from file, if an access denied exception occurs, this generally indicates a file permissions error.

Firstly, make sure the process the application is running under has permission to read the certificate file. For example, ensure the IIS_USERS group has read permission to the idp.pfx file.

If the permissions are correct for the pfx file, then the issue lies with the private key.

Private keys are stored in containers on the file system. The location of the private key container on Windows 7/Windows 8/Windows 2008 and Windows 2012 is:

C:\ProgramData\Microsoft\Crypto\RSA\MachineKeys

The FindPrivateKey.exe Windows SDK utility may be run to locate the private key container.

http://msdn.microsoft.com/en-us/library/aa717039.aspx

The application process must have permission to create a file in the private key container folder.

The following code dumps out a certificate:

```
X509Certificate2 x509Certificate = new X509Certificate2("idp.pfx", "password",
                                                         X509KeyStorageFlags.MachineKeySet);

Trace.Write(x509Certificate.ToString(true));
```

Its output is:

```
[Version]
V1

[Subject]
CN=www.idp.com
Simple Name: www.idp.com
DNS Name: www.idp.com

[Issuer]
CN=www.idp.com
Simple Name: www.idp.com
DNS Name: www.idp.com

[Serial Number]
46D399D0

[Not Before]
8/28/2007 1:43:12 PM

[Not After]
8/25/2017 1:43:12 PM

[Thumbprint]
4E387A0C0B695DB05F5DFD70D2572BB0FEBB98BA

[Signature Algorithm]
```

md5RSA(1.2.840.113549.1.1.4)

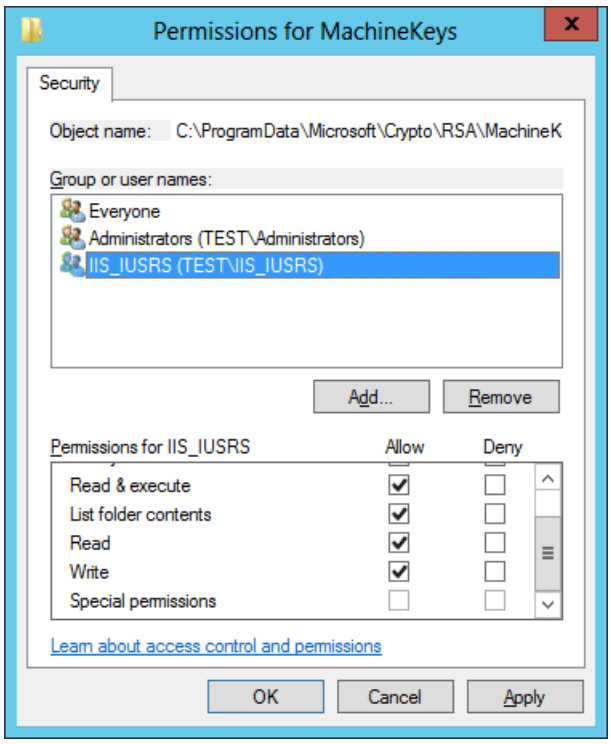
[Public Key]
Algorithm: RSA
Length: 1024
Key Blob: 30 81 89 02 81 81 00 a3 7d 6a de 62 59 6b 25 df 66 42 c3 b8 b7 27 6a 77 3f 28 6f 91 0c 55 be 3a 56 03 3f e4 6e 6e f5 a7 b7 c5 f9 8e d8 94 4d ca 7c 21 0e 3a 4c d1 14 16 c9 26 b2 89 d4 6f 90 27 1b ec ce 09 c6 b0 6f 67 49 af c9 01 b4 23 61 7e 2f d3 b9 f6 46 05 03 63 b8 0c 4d 32 2d f8 c8 88 11 74 68 a7 6b 39 c7 81 c9 6b 00 82 19 4f 22 9e ad 0a 98 8c f2 f5 c5 10 ec 14 6a 73 a8 61 a2 ff 6a 29 cc df 27 57 99 02 03 01 00 01
Parameters: 05 00

[Private Key]
Key Store: Machine
Provider Name: Microsoft Base Cryptographic Provider v1.0
Provider type: 1
Key Spec: Exchange
Key Container Name: {7D7021F3-C4E9-44C2-BB68-ECD0517EF5FE}
Unique Key Container Name: 1cff1ca21ad134bb7e6e87ee27ff71d3_cddd8d16-473b-40eb-8c9f-9cb4b8d44d33
Hardware Device: False
Removable: False
Protected: False

Note the unique key container name. This name is different each time the certificate is loaded.

At the time the certificate is loaded, a file with the private key container name is created in the private key container (e.g. C:\ProgramData\Microsoft\Crypto\RSA\MachineKeys\7D7021F3-C4E9-44C2-BB68-ECD0517EF5FE).

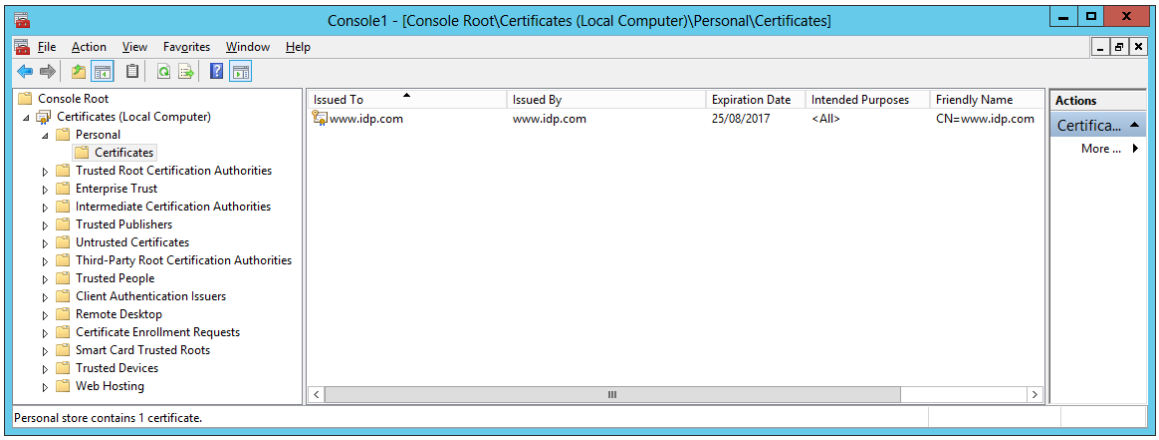
The application process must have permission to create files in this container.



15.3.2 Certificates Stored in the Windows Certificate Store

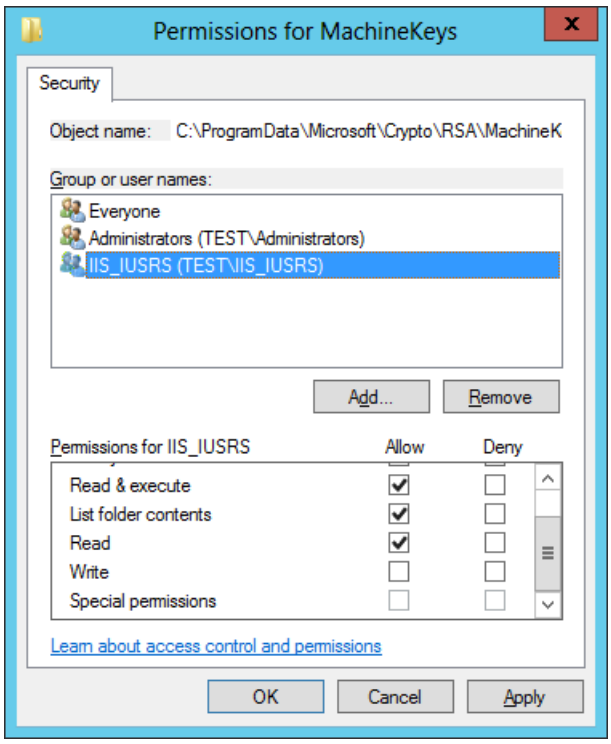
When loading a certificate from the Windows Certificate Store, if an access denied exception occurs, this generally indicates a permissions error.

Firstly, make sure the certificate is stored in the local computer store rather than the current user's store. This ensures the certificate may be accessed from within IIS.



Select the certificate, and click the menu Action > All Tasks > Manage Private Keys.

Make sure the application process (e.g the IIS_IUSRS group) has read access.



16 Generating and Verifying Signatures

The following data types may be signed:

- SAML request and response messages
- SAML assertions
- SAML metadata

To generate or verify signatures on SAML request or response messages use the methods contained in the ComponentSpace.SAML2.Protocols.SAMLMessageSignature class.

To generate or verify signatures on SAML assertions use the methods contained in the ComponentSpace.SAML2.Assertions.SAMLAssertionSignature class.

To generate or verify signatures on SAML metadata use the methods contained in the ComponentSpace.SAML2.Metadata.SAMLMetadataSignature class.

Supplying the wrong data type to a signature class will result in errors. For example, trying to verify the signature on a SAML assertion using the SAMLMessageSignature class is an error.

Refer to the class library documentation described in section 21 for details regarding these classes and their methods. Also, review the example code which demonstrates signing and verifying SAML messages, assertions and metadata.

16.1 Signature Generation

To generate a signature on an object it must first be converted to XML. For example, to sign a SAMLResponse object it must first be converted to XML by calling its ToXml

method. Similarly, to sign a SAMLAssertion object it must first be converted to XML by calling its ToXml method. The returned XmlElement may then be passed into SAMLMessageSignature.Generate, in the case of a SAML response, or SAMLAssertionSignature.Generate, in the case of a SAML assertion, to generate the signature and store it in the XML.

The sequence for constructing and signing a SAML response is:

1. Construct the SAMLResponse object and use its properties and methods to create the SAML response.
2. Call SAMLResponse.ToXml to convert the SAML response to an XmlElement.
3. Call SAMLMessageSignature.Generate, passing in the SAML response XmlElement, to generate a signature.

The sequence for constructing and signing a SAML assertion is:

1. Construct the SAMLAssertion object and use its properties and methods to create the SAML assertion.
2. Call SAMLAssertion.ToXml to convert the SAML assertion to an XmlElement.
3. Call SAMLAssertionSignature.Generate, passing in the SAML assertion XmlElement, to generate a signature.

16.2 Signature Verification

Signature verification must occur on the XML prior to converting it to a SAML object. For example, given a SAML response as an XmlElement, call SAMLMessageSignature.Verify to verify the signature. Once verified, construct as SAMLResponse object using the XmlElement. Similarly, given a SAML assertion as an XmlElement object, call SAMLAssertionSignature.Verify to verify the signature. Once verified, construct a SAMLAssertion object using the XmlElement.

Constructing a SAML object from an XmlElement and then converting it back to XML using the ToXml method will cause the signature verification to fail.

The sequence for constructing and verifying a SAML response is:

1. Call SAMLMessageSignature.Verify, passing in the SAML response XmlElement, to verify the signature.
2. Construct the SAMLResponse object from the SAML response XmlElement.
3. Call the SAMLResponse properties and methods to access the contents of the SAML response.

The sequence for constructing and verifying a SAML assertion is:

1. Call SAMLAssertionSignature.Verify, passing in the SAML assertion XmlElement, to verify the signature.
2. Construct the SAMLAssertion object from the SAML assertion XmlElement.
3. Call the SAMLAssertion properties and methods to access the contents of the SAML assertion.

16.3 SHA-256 Support

By default, SHA-1 signatures are supported and are perfectly suitable for the majority of use cases. However, SHA-256 (also referred to as SHA-2) signatures are also supported for those use cases requiring additional security.

The SHA256Signature example project demonstrates SHA-256 signature generation and verification. Successfully running this example project confirms that SHA-256 support is enabled.

There are a number of options for supporting SHA-256 XML signatures depending on the target .NET framework level.

16.3.1 .NET 4.5 Framework Support

For .NET 4.5 and above, SHA-256 support is, for the most part, built into the .NET framework. The only requirement is to register the cryptographic algorithm.

The RSAPKCS1SHA256SignatureDescription class in the System.Deployment.Internal.CodeSigning namespace is contained in the System.Deployment assembly.

To enable SHA-256 support:

1. Add a reference to the System.Deployment assembly.

2. In your application, add the following section of code to enable SHA-256 XML signatures. A suitable location might be your application's Application_Start method in Global.asax.

```
using System.Security.Cryptography;
using System.Deployment.Internal.CodeSigning;

protected void Application_Start(object sender, EventArgs e) {
    // Enable SHA-256 XML signature support.
    CryptoConfig.AddAlgorithm(
            typeof(RSAPKCS1SHA256SignatureDescription),
            "http://www.w3.org/2001/04/xmldsig-more#rsa-sha256");
}
```

16.3.2 CLR Security Update

For .NET 3.5 and above, SHA-256 support in XML signatures requires the use of the CLR security update.

Download the CLR security update from:

http://clrsecurity.codeplex.com/

Installation instructions may be found at:

http://clrsecurity.codeplex.com/wikipage?title=Security.Cryptography.RSAPKCS1SHA256SignatureDescription&referringTitle=Home&ProjectName=clrsecurity

1. Extract the Security.Cryptography DLL from the CLR security zip.

2. Run gacutil.exe /i Security.Cryptography.dll to add the assembly to the GAC.

3. View the assembly (e.g. C:\Windows\assembly) and note the version number (e.g 1.6.0.0). Alternatively, the version number may be found by running:

   gacutil.exe /l Security.Cryptography

4. Update machine.config (e.g. in C:\Windows\Microsoft.NET\Framework\v4.0.30319\Config and C:\Windows\Microsoft.NET\Framework64\v4.0.30319\Config) ensuring the version number of the assembly is correct. The <mscorlib> should be inserted after the <system.web> section in <configuration>. See below for an example configuration.

5. Certificates and keys should be generated using the "Microsoft Enhanced RSA and AES Cryptographic Provider".

The following is an example configuration for insertion into machine.config.

```
<mscorlib>
  <!-- ... -->
  <cryptographySettings>
    <cryptoNameMapping>
      <cryptoClasses>
        <cryptoClass
RSASHA256SignatureDescription="Security.Cryptography.RSAPKCS1SHA256Sign
atureDescription, Security.Cryptography, Version=1.6.0.0,
Culture=neutral, PublicKeyToken=31bf3856ad364e35" />
      </cryptoClasses>
      <nameEntry name="http://www.w3.org/2001/04/xmldsig-more#rsa-
sha256" class="RSASHA256SignatureDescription" />
    </cryptoNameMapping>
  </cryptographySettings>
</mscorlib>
```

To generate SHA-256 signatures, use one of the overloaded signature Generate methods that take as parameters the digest and signature methods.

The default digest method is http://www.w3.org/2000/09/xmldsig#sha1.

The default signature method is http://www.w3.org/2000/09/xmldsig#rsa-sha1.

Instead of the defaults, specify http://www.w3.org/2001/04/xmlenc#sha256 as the digest method and http://www.w3.org/2001/04/xmldsig-more#rsa-sha256 as the signature method.

For example:

```
SAMLMessageSignature.Generate(
    samlResponseElement,
    x509Certificate.PrivateKey,
    x509Certificate,
    null,
    "http://www.w3.org/2001/04/xmlenc#sha256",
    "http://www.w3.org/2001/04/xmldsig-more#rsa-sha256");
```

No code changes are required to verify SHA-256 signatures.

17 Extracting SAML Assertions from SAML Responses

SAML responses may contain one or more of the following:

- Encrypted SAML assertions
- Signed SAML assertions
- SAML assertions that are neither encrypted nor signed

The ComponentSpace.SAML2.Protocols.SAMLResponse class encapsulates a SAML response message. To access the various types of SAML assertions contained within it use of the following properties or methods from this class:

- Assertions
- GetEncryptedAssertion
- GetSignedAssertion
- GetAssertion
- GetEncryptedAssertions
- GetSignedAssertions
- GetAssertions

The Assertions property returns all assertions including encrypted and signed assertions. Encrypted assertions are returned as EncryptedAssertion objects. Signed assertions are returned as XmlElement objects. Unencrypted, unsigned assertions are returned as SAMLAssertion objects.

The GetEncryptedAssertion method returns the encrypted assertion as an EncryptedAssertion object. Section 18 describes how to process encrypted assertions.

The GetSignedAssertion method returns the signed assertion as a SAMLAssertion object after verifying the signature.

The GetAssertion method returns the unencrypted and unsigned assertion as a SAMLAssertion object.

Typically a SAML response contains one SAML assertion. The following methods support retrieving multiple SAML assertions.

The GetEncryptedAssertions method only returns the encrypted assertions as EncryptedAssertion objects. Section 18 describes how to process encrypted assertions.

The GetSignedAssertions method only returns the signed assertions as XmlElement objects. Signed assertions are returned as XmlElement objects as this is the format required for signature verification. Section 15.3.2 describes how to verify a signature. Once the signature is verified a SAMLAssertion object may be constructed from the XmlElement.

The GetAssertions method only returns the unencrypted and unsigned assertions as SAMLAssertion objects.

The list of objects returned by the Assertions property is equivalent to combining the three lists returned by the GetEncryptedAssertions, GetSignedAssertions and GetAssertions methods.

17.1 Extracting a SAML Assertion

The following section of code returns the unsigned and unencrypted SAML assertion from the SAML response.

```
SAMLAssertion samlAssertion = samlResponse.GetAssertion();
```

17.2 Extracting a Signed SAML Assertion

The following section of code returns the signed SAML assertion from the SAML response after having verified its signature. The supplied X.509 certificate is used to perform the signature verification.

```
SAMLAssertion samlAssertion =
    samlResponse.GetSignedAssertion(x509Certificate);
```

17.3 Extracting an Encrypted Assertion

The following section of code extracts encrypted SAML assertion from the SAML response. The supplied X.509 certificate is used to perform the decryption.

```
EncryptedAssertion encryptedAssertion =
    samlResponse.GetEncryptedAssertion();

SAMLAssertion samlAssertion =
    encryptedAssertion.Decrypt(x509Certificate);
```

18 Encrypted Assertions

For additional security, SAML assertions may be encrypted.

To encrypt a SAML assertion construct an EncryptedAssertion object supplying the SAMLAssertion to be encrypted, an X.509 certificate, and specifying the type of encryption to perform.

A random symmetric session key is generated from the public key contained within the X.509 certificate. The symmetric key is used to encrypt the data. The encryption method for the encrypted symmetric key is http://www.w3.org/2001/04/xmlenc#rsa-1_5. The encryption method for the data is that specified in the EncryptedAssertion constructor (e.g. http://www.w3.org/2001/04/xmlenc#aes256-cbc).

To decrypt an EncryptedAssertion call either the Decrypt or DecryptToXml method. The decrypt method returns a SAMLAssertion object. The DecryptToXml method returns an XmlElement and should be used if the encrypted assertion is also signed. Both methods accept an asymmetric key decrypting key and an optional data encryption method.

The asymmetric key is used to decrypt the symmetric key contained within the encrypted data. The symmetric key is used to decrypt the data.

The encryption method for the encrypted symmetric key is expected to be http://www.w3.org/2001/04/xmlenc#rsa-1_5 or http://www.w3.org/2001/04/xmlenc#rsa-oaep-mgf1p.

If the optional data encryption method is not specified then the encryption method for the data supplied in the encrypted data is used.

The example project described in section 11.10 demonstrates encrypting and decrypting SAML assertions.

19 Extracting Statements from SAML Assertions

SAML assertions may contain one or more of the following:

- Authentication statements
- Authorization decision statements
- Attribute statements

The ComponentSpace.SAML2.Assertions.SAMLAssertion class encapsulates a SAML assertion. To access the various types of statements contained within it use of the following properties or methods from this class:

- Statements
- GetAuthenticationStatements
- GetAuthorizationDecisionStatements
- GetAttributeStatements

The Statements property returns all statements including authentication, authorization decision and attribute statements. Authentication statements are returned as AuthnStatement objects. Authorization decision statements are returned as AuthzDecisionStatement objects. Attribute statements are returned as AttributeStatement objects.

The GetAuthenticationStatements method only returns the AuthnStatement objects. The GetAuthorizationDecisionStatements method only returns the AuthzDecisionStatement objects. The GetAttributeStatements method only returns the AttributeStatement objects.

The list of objects returned by the Statements property is equivalent to combining the three lists returned by the GetAuthenticationStatements, GetAuthorizationDecisionStatements and GetAttributeStatements methods.

20 Extracting SAML Attributes

As well as the methods described in section 19 for accessing attribute statements contained in SAML assertions, the ComponentSpace.SAML2.Assertions.SAMLAssertion class includes the following convenience methods to access SAML attributes:

- GetAttributes
- GetAttributeValue

The GetAttributes method returns the list of all unencrypted SAML attributes with the specified name.

The GetAttributeValue method returns the value of the SAML attribute with the specified name. This method assumes that only one attribute exists with the specified name, the attribute only has one value, and the value is a string. If this isn't the case then use one of the other attribute related methods.

21 Class Library Reference

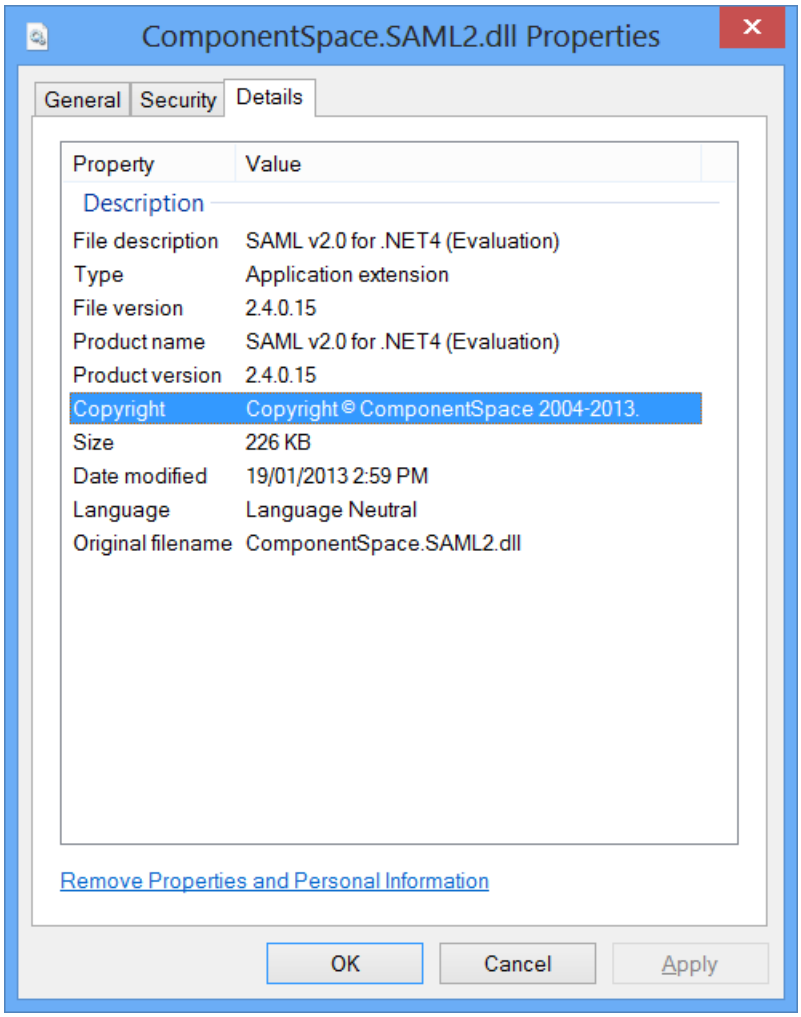
The reference section is contained within a separate help file. You can find the reference help file in the documentation directory or navigate to it using the Start menu.

22 Class Library Version

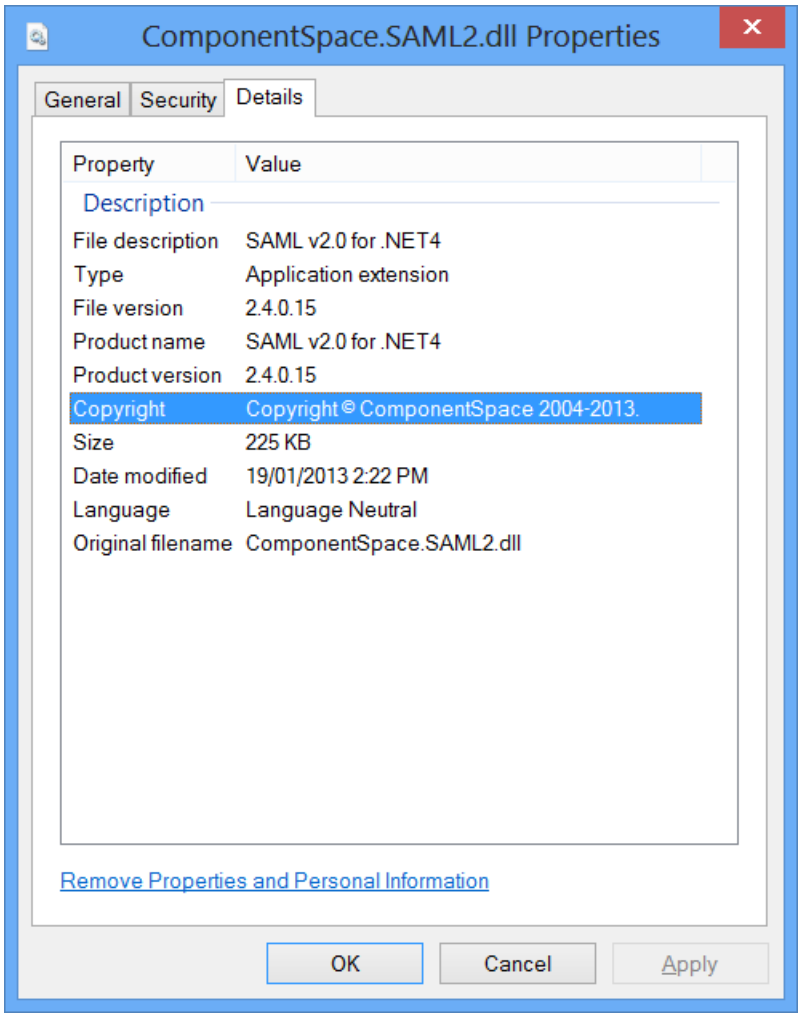
The License.IsLicensed method may be used to determine whether the class library is a licensed or evaluation version. The version information may be retrieved by calling the License.GetVersion method.

Alternatively, using Windows Explorer, select the class library DLL and bring up its file properties. Under the Details tab the version number may be found. If the DLL is an evaluation version then this also will be indicated.

The following properties are for the evaluation version of the DLL.



The following properties are for the licensed version of the DLL.



23 Frequently Asked Questions

1. *What is SAML?*

   The Security Assertion Markup Language (SAML) consists of a set of standards published by the OASIS organization (www.oasis-open.org). Refer to their web site for more details.

2. *What version of SAML is supported?*

   We support SAML v1.1 and v2.0. Please note that these are packaged as separate products.

3. *I can't build the examples. Why can't the ComponentSpace namespace be found?*

   The assembly containing the namespace or the project referencing it has been moved. The simplest way to fix this is to re-add the reference to the project by browsing to where the DLL is located (typically the installation directory).

4. *I keep receiving an error message saying the trial period has expired. What does this mean?*

   You are using an evaluation version of the component and the trial period has ended. If you need to extend the evaluation period, please contact us.

5. *How do I tell if I'm using an evaluation version?*

   Navigate to the component DLL and right click it to bring up the file properties. Under the Version tab, the description will specify whether or not it's an evaluation version.

6. *I'm not sure how to use the product. What can I do?*

   Whether you're evaluating the product or are an existing customer, please feel free to contact us with any questions you might have.

7. *The product is missing a feature I really need. What can I do?*

   Please contact us if there's additional functionality you would like to see. Your feedback is most welcome and will be given careful consideration.

8. *Does the product support SAML single sign-on?*

   Yes. The product includes the necessary functionality for enabling SAML single sign-on at either the identity provider or service provider web site. You need to integrate this functionality with your existing web applications.

9. *Can I generate and verify XML digital signatures on SAML assertions and protocol messages?*

   Yes. Refer to the Reference section and the Examples for more information.

10. *Is the product compatible with Product X?*

    It should be but if you have any questions please contact us. A simple test is to integrate the example identity provider or service provider application with the product in question.

11. *How do I create a SAML assertion?*

    Use the ComponentSpace.SAML2.Assertions.SAMLAssertion class to create a SAML assertion.

    The example applications demonstrate creating and manipulating SAML assertions.

12. *How do I convert a SAML assertion to and from XML?*

    The ComponentSpace.SAML2.Assertions.SAMLAssertion class includes a

constructor that creates a SAML assertion from an XML element. This class also includes a ToXml method that converts the SAML assertion object to XML.

13. *How do I sign a SAML assertion?*

    The ComponentSpace.SAML2.Assertions.SAMLAssertionSignature class has methods for generating and verifying signatures on SAML assertions that are serialized to XML.

    Typically you create a SAML assertion using the ComponentSpace.SAML2.Assertions.SAMLAssertion class. Once complete, you convert it to XML using the ToXml method of this class. Then you pass this XML to the Generate method of the SAMLAssertionSignature class.

14. *How do I verify a signed SAML assertion?*

    The ComponentSpace.SAML2.Assertions.AssertionSignature class has methods for generating and verifying signatures on SAML assertions that are serialized to XML.

    Typically you verify the signature by passing the XML to the Verify method of the SAMLAssertionSignature class. Once verified, you create a SAML assertion from the XML using the ComponentSpace.SAML2.Assertions.Assertion class.

15. *How do I create a SAML protocol message?*

    Use the classes under the ComponentSpace.SAML2.Protocols namespace for creating protocol messages. For example, to create an authentication request you would use the AuthnRequest class.

16. *How do I convert a SAML protocol message to and from XML?*

    The protocol message classes include a constructor that creates a SAML protocol message from an XML element. These classes also include a ToXml method that converts the SAML protocol message to XML.

17. *How do I sign a SAML protocol message?*

    The ComponentSpace.SAML2.Protocols.SAMLMessageSignature class has methods for generating and verifying signatures on SAML protocol messages that are serialized to XML.

    Typically you create a SAML message using the corresponding class in the ComponentSpace.SAML2.Protocols namespace. Once complete, you convert it to XML using the ToXml method of this class. Then you pass this XML to the Generate method of the SAMLMessageSignature class.

18. *How do I verify a signed SAML protocol message?*

    The ComponentSpace.SAML2.Protocols. SAMLMessageSignature class has

methods for generating and verifying signatures on SAML protocol messages that are serialized to XML.

Typically you verify the signature by passing the XML to the Verify method of the SAMLMessageSignature class. Once verified, you create a SAML protocol message from the XML using the appropriate constructor for the protocol message's corresponding class in the ComponentSpace.SAML2.Protocol namespace.

19. *What's the difference between CurrentUser and LocalMachine when referring to certificate store locations?*

    Please refer to the Microsoft knowledge base article Q322371. If running in an ASP.NET application then keys may need to be loaded from LocalMachine key stores.

20. *How do I use HTTPS to secure the connection between identity provider and the service provider?*

    The MSDN has numerous articles on configuring HTTPS within an ASP.NET environment. A good starting point is the article *Building Secure ASP.NET Applications: Authentication, Authorization, and Secure*.

24 Support

For further information, visit us at www.componentspace.com or send email to info@componentspace.com.

If you need assistance, have a bug to report, or a product enhancement request, send email to support@componentspace.com.