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Implementing SAML Service Provider (SP) in a Java Web Application

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Contents

Overview

This document describes a simple SAML authentication implementation in a Java Web Application. This example uses a Java maven build and uses the com.coveo.saml.SamlClient library to perform the SAML communications. The com.coveo.saml.SamlClient is available on github at https://github.com/coveooss/saml-client.git and can be pulled in via maven by adding the following depedency:

```
<dependency>
    <groupId>com.coveo</groupId>
    <artifactId>saml-client</artifactId>
    <version>4.0.0</version>
 </dependency>
```

From the github readme:

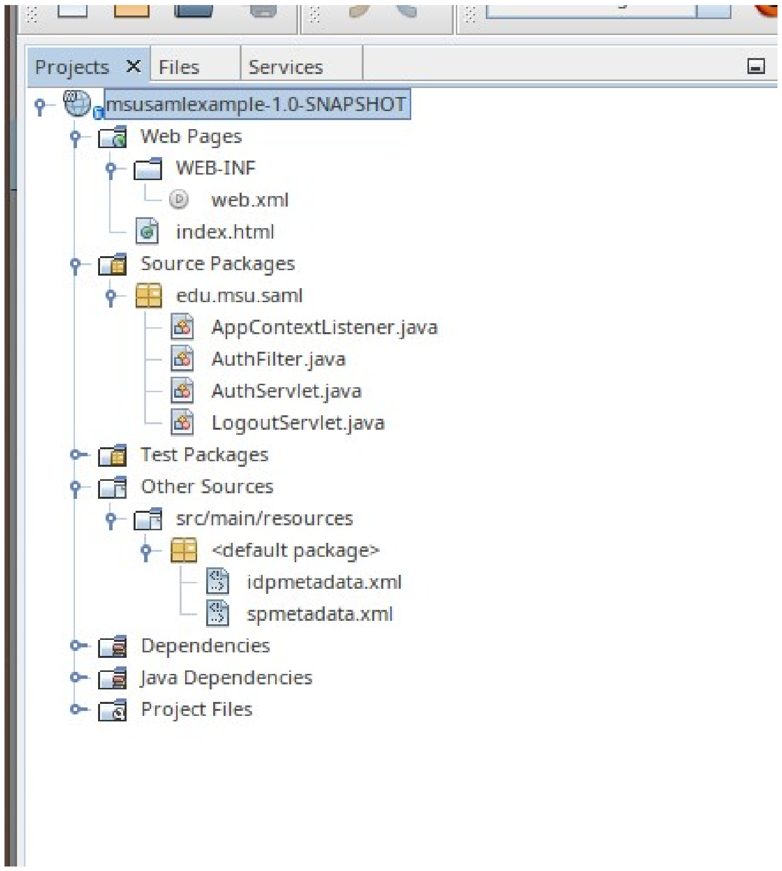
This library implements a very simple SAML 2.0 client that allows retrieving an authenticated identity from a compliant identity provider, using the HTTP POST binding.

It is based on the OpenSAML library, and only provides the necessary glue code to make it work in a basic scenario. This is by no means a complete implementation supporting all the nitty gritty SAML details, but it does perform the basic task of generating requests and validating responses. It's useful if you need to authenticate with SAML but don't want to bring in an uber large framework such as Spring Security.

In order to work, the library must be provided with the xml metadata information that can be obtained from the identity provider. It is also possible to initialize it by directly providing the required values.

As of now, I've tested the library with ADFS and Okta as identity providers.

This maven project layout is shown below:



```
msusamlexample-1.0-SNAPSHOT
    Web Pages
        WEB-INF
            web.xml
        index.html
    Source Packages
        edu.msu.saml
            AppContextListener.java
            AuthFilter.java
            AuthServlet.java
            LogoutServlet.java
    Test Packages
    Other Sources
        src/main/resources
            <default package>
                idpmetadata.xml
                spmetadata.xml
    Dependencies
    Java Dependencies
    Project Files
```

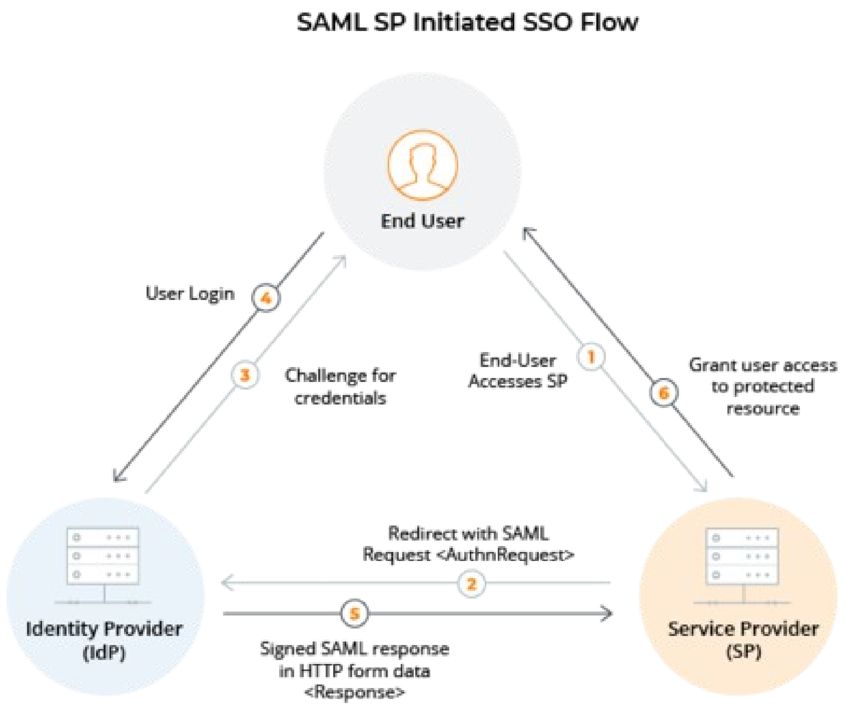
PREREQUISITES

The perquisites listed below were used in the sample application described in this document. The java web application logic can be built with earlier versions if required.

- Java 8
- Java EE 8
- Maven 3 - sample app used a maven build

SAML COMMUNICATION FLOW

In this example the msusamlexample Service Provider (SP) communicates to the SAML Identity Provider (IDP) for SSO authentication. If the SP has not previously authenticated the IDP will display a login. If login credentials are verified the IDP will callback to the configured AssertionConsumerService on the SP with with any configured attributes.


SAML SP Initiated SSO Flow
End User
User Login
4
3
Challenge for credentials
End-User Accesses SP
1
6
Grant user access to protected resource
Redirect with SAML Request <AuthnRequest>
2
5
Signed SAML response in HTTP form data <Response>
Identity Provider (IdP)
Service Provider (SP)

SAML IDP/SP Metadata

As SAML technology has matured, the importance of SAML metadata has steadily increased. Today an implementation that supports SAML web browser requires a schema-valid SAML metadata file for each SAML partner. In this example we have idpmetadata.xml and spmetadata.xml. The IDP metadata can be pulled from the IDP server you are using. The SP metadata is used to define communication parameters for the IDP to SP callbacks. Examples are shown below:

IDP Metadata

```
 ?xml version="1.0" encoding="UTF-8"?>
<EntityDescriptor xmlns="urn:oasis:names:tc:SAML:2.0:metadata"
                  xmlns:ds="http://www.w3.org/2000/09/xmldsig#"
                  xmlns:shibmd="urn:mace:shibboleth:metadata:1.0"
                  xmlns:xml="http://www.w3.org/XML/1998/namespace"
                  entityID="https://rbtdev/idp/shibboleth">
    <IDPSSODescriptor errorURL="https://rbtdev/identity/feedback.htm"
         protocolSupportEnumeration="urn:oasis:names:tc:SAML:2.0:protocol">
        <Extensions>
            <shibmd:Scope regexp="false">rbtdev</shibmd:Scope>
        </Extensions>
        <KeyDescriptor use="signing">
            <ds:KeyInfo>
                <ds:X509Data>
                    <ds:X509Certificate>{cert info}
                    </ds:X509Certificate>
                </ds:X509Data>
            </ds:KeyInfo>
        </KeyDescriptor>
        <KeyDescriptor use="encryption">
            <ds:KeyInfo>
                <ds:X509Data>
                    <ds:X509Certificate>{cert info}
                    </ds:X509Certificate>
                </ds:X509Data>
            </ds:KeyInfo>
        </KeyDescriptor>
        <ArtifactResolutionService
          Binding="urn:oasis:names:tc:SAML:2.0:bindings:SOAP"
          Location="https://rbtdev/idp/profile/SAML2/SOAP/ArtifactResolution"
          index="1"/>
        <SingleLogoutService
            Binding="urn:oasis:names:tc:SAML:2.0:bindings:HTTP-Redirect"
            Location="https://rbtdev/idp/profile/SAML2/Redirect/SLO"/>
          .
          .
          .

    <Organization>
        <OrganizationName xml:lang="en">MSU</OrganizationName>
        <OrganizationDisplayName xml:lang="en">MSU</OrganizationDisplayName>
        <OrganizationURL xml:lang="en">https://rbtdev</OrganizationURL>
    </Organization>
</EntityDescriptor>
```

In the XML above rbtdev is the IDP server. The {cert info} sections would contain the certificate. This XML will passed to the SamlClient to initiate the SP to IDP communications.

SP Metadata

SP metadata is used when registering a Service Provider with an Identity Provider and defines the callback parameters used during the authentication process. An example XML is shown below:

```
<?xml version="1.0"?>
<md:EntityDescriptor xmlns:md="urn:oasis:names:tc:SAML:2.0:metadata"
    entityID="https://rbtdev:8443/msusaml">
    <md:SPSSODescriptor AuthnRequestsSigned="false"
        WantAssertionsSigned="false"
        protocolSupportEnumeration="urn:oasis:names:tc:SAML:2.0:protocol">
        <md:SingleLogoutService
            Binding="urn:oasis:names:tc:SAML:2.0:bindings:HTTP-Redirect"
            Location="https://rbtdev:8443/msusaml/redirect" />
        <md:NameIDFormat>urn:oasis:names:tc:SAML:1.1:nameid-
```

```
            format:unspecified</md:NameIDFormat>
        <md:AssertionConsumerService
            Binding="urn:oasis:names:tc:SAML:2.0:bindings:HTTP-POST"
            Location="https://rbtdev:8443/msusaml/auth"  index="1" />
    </md:SPSSODescriptor>
</md:EntityDescriptor>
```

This simple SP metadata definition does not define any certificates for signing and encryption. These can be added if desired. The areas highlighted in yellow are the SP application defined callback URLs.

JAVA IMPLEMENTATION

The java implementation consists of 4 java files and the web.xml configuration for the web application.

- ApplicationContextListener – Creates the SamlClient at context startup and stores the client as a context attribute for use by other classes
- AuthFilter – Checks to see if user is authenticated, if not, redirects to the IDP for authentication
- AuthServlet – This contains the callback defined for the IDP authentication. This gets called if user is authenticated. Any defined attributes can be loaded here and stored in the current session for later use.
- LogoutServet – handles logout redirect from IDP.

WEB.XML

The java classes described above are configured here. Context parameters (highlighted in yellow) contain application-specific initialization parameters:

```
<web-app version="4.0" xmlns="http://xmlns.jcp.org/xml/ns/javaee"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xsi:schemaLocation="http://xmlns.jcp.org/xml/ns/javaee
    http://xmlns.jcp.org/xml/ns/javaee/web-app_4_0.xsd">
    <session-config>
        <session-timeout>
            30
        </session-timeout>
    </session-config>
    <!-- IDP interface information -->
    <context-param>
        <param-name>relaying.party.identifier</param-name>
        <param-value>https://rbtdev:8443/msusaml</param-value>
    </context-param>
    <context-param>
        <param-name>saml.assertion.handler.url</param-name>
        <param-value>https://rbtdev:8443/msusaml/auth</param-value>
    </context-param>

    <listener>
        <listener-class>edu.msu.saml.AppContextListener</listener-class>
    </listener>
    <filter>
        <filter-name>AuthFilter</filter-name>
        <filter-class>edu.msu.saml.AuthFilter</filter-class>
    </filter>
    <filter-mapping>
        <filter-name>AuthFilter</filter-name>
        <url-pattern>/*</url-pattern>
    </filter-mapping>
    <servlet>
        <servlet-name>AuthServlet</servlet-name>
        <servlet-class>edu.msu.saml.AuthServlet</servlet-class>
    </servlet>
    <servlet-mapping>
        <servlet-name>AuthServlet</servlet-name>
        <url-pattern>/auth</url-pattern>
    </servlet-mapping>
    <servlet>
        <servlet-name>LogoutServlet</servlet-name>
        <servlet-class>edu.msu.saml.LogoutServlet</servlet-class>
    </servlet>
    <servlet-mapping>
        <servlet-name>LogoutServlet</servlet-name>
        <url-pattern>/logout</url-pattern>
    </servlet-mapping>
</web-app>
```

ApplicationContextListener

```
public class AppContextListener implements ServletContextListener {
    public static final String AUTHENTICATED_SESSION_DATA_KEY =
"authenticated.session.data";

    @Override
    public void contextInitialized(ServletContextEvent e) {
        // create SamlClient and store for later use
        System.out.println("in AppContextListener.contextInitialized()");
        SamlClient samlClient;
        try {
            // create the SamlClient
            samlClient = SamlClient.fromMetadata(
                e.getServletContext()
                  .getInitParameter("relaying.party.identifier"),
                e.getServletContext()
                 .getInitParameter("saml.assertion.handler.url"),
                getIDPMetaData(e.getServletContext()));
            // set the SamlClient a a context attribute for later use
            e.getServletContext().setAttribute("samlclient", samlClient);
            System.out.println("SamlClient created");
        } catch (SamlException ex) {
            throw new RuntimeException(ex.toString(), ex);
        }

    }


    @Override
    public void contextDestroyed(ServletContextEvent e) {
    }

    private Reader getIDPMetaData(ServletContext servletContext) {
        // load the IDP metadata file from idpmetadata.xml on the classpath
        return new InputStreamReader(servletContext
            .getResourceAsStream("/WEB-INF/classes/idpmetadata.xml"));
    }
}
```

AuthFilter

```
public class AuthFilter implements Filter {

    @Override
    public void init(FilterConfig filterConfig) throws ServletException {
    }

    @Override
    public void doFilter(ServletRequest request, ServletResponse response,
        FilterChain chain) throws IOException, ServletException {
        HttpServletRequest httpServletRequest = (HttpServletRequest) request;
        HttpServletResponse httpServletResponse
            = (HttpServletResponse) response;
        System.out.println("in AuthFilter.doFilter() - "
            + httpServletRequest.getRequestURL().toString());

        try {
            // if we have a SamlResponse in the request or authenticated
            // session data process normally, if not redirect to IDP for
            // authentication
            if ((httpServletRequest.getParameter("SAMLResponse") != null)
                || (httpServletRequest.getSession()
                    .getAttribute(
                    AppContextListener.AUTHENTICATED_SESSION_DATA_KEY)
                      != null)) {
               chain.doFilter(request, response);
            } else {
                System.out.println("redirect to IDP");
                // get the SamlClient from the context
                SamlClient samlClient =
                  (SamlClient)httpServletRequest.getServletContext()
                 .getAttribute("samlclient");
                samlClient.redirectToIdentityProvider(
                    httpServletResponse, null);
            }
        } catch (SamlException ex) {
            throw new ServletException(ex);
        }
    }

    @Override
    public void destroy() {
    }
}
```

AuthServlet

```
@WebServlet(name = "AuthServlet", urlPatterns = {"/auth"})
public class AuthServlet extends HttpServlet {

    @Override
    protected void doPost(HttpServletRequest request,
        HttpServletResponse response) throws ServletException, IOException {
        System.out.println("in AuthServlet.doPost()");
        SamlClient samlClient = (SamlClient)
            request.getServletContext().getAttribute("samlclient");
         try {
            SamlResponse samlResponse =
                samlClient.decodeAndValidateSamlResponse(
                    request.getParameter("SAMLResponse"), "POST");
            System.out.println("samlResponse - " + samlResponse);

            // pull attributes from response and store them in current session
            Map<String, String> attributes =
                SamlClient.getAttributes(samlResponse);
            System.out.println("saml attributes - " + attributes.toString());
                request.getSession().setAttribute(
            AppContextListener.AUTHENTICATED_SESSION_DATA_KEY, attributes);

            // forward to desired page
            request.getRequestDispatcher("index.html").forward(request,
                response);
        } catch (SamlException ex) {
            throw new ServletException(ex.toString(), ex);
        }
    }
}
```

LogoutServlet

```
@WebServlet(name = "LogoutServlet", urlPatterns = {"/logout"})
public class LogoutServlet extends HttpServlet {

    @Override
    protected void doGet(HttpServletRequest request,
       HttpServletResponse response) throws ServletException, IOException {
       System.out.println("in LogoutServlet.doGet()");

       // remove authentication session data and invalidate session
       request.removeAttribute(
           AppContextListener.AUTHENTICATED_SESSION_DATA_KEY);
       request.getSession().invalidate();
       request.getRequestDispatcher("index.html").forward(request, response);
    }
}
```