Security Guide
Oracle Banking Corporate Lending Process Management
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ORACLE
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1. About this Manual

1.1 Purpose

This guide provides security-related usage and configuration recommendations for *Oracle Banking Microservices Architecture* products. This guide may outline procedures required to implement or secure certain features, but it is also not a general-purpose configuration manual.

1.2 Audience

This guide is primarily intended for IT department or administrators deploying *Oracle Banking Microservices Architecture product* and third party or vendor software's. Some information may be relevant to IT decision makers and users of the application are also included. Readers are assumed to possess basic operating system, network, and system administration skills with awareness of vendor/third-party software's and knowledge of *Oracle Banking Microservices Architecture* products.

1.3 Scope

1.3.1 Read Sections Completely

Each section should be read and understood completely. Instructions should never be blindly applied. Relevant discussion may occur immediately after instructions for an action, so be sure to read whole sections before beginning implementation.

1.3.2 Understand the Purpose of this Guidance

The purpose of the guidance is to provide security-relevant configuration recommendations. It does not imply the suitability or unsuitability of any product for any particular situation, which entails a risk decision.

1.3.3 Limitations

This guide is limited in its scope to security-related issues. This guide does not claim to offer comprehensive configuration guidance. For general configuration and implementation guidance refer to other sources such as Vendor specific sites.

1.3.4 Test in Non-Production Environment

To the extent possible, guidance should be tested in a non-production environment before deployment.

Ensure that any test environment simulates the configuration in which the application will be deployed as closely as possible.

2. Prerequisite

2.1 Operating Environment Security

Please refer the vendor specific documentation for making the environment more safe and secured.

2.2 Network Security

Please refer the vendor specific documentation for making the environment more safe and secured.

2.3 Oracle Database Security

Please refer the Oracle Database Security specification document for making the environment more safe and secured.

2.3.1 Product Recommended configuration

This section contains security recommendations for the Database used for Oracle Banking Microservices Architecture products.

File Name	Property	Feature
Init.ora	REMOTE_OS_AUTHENT=FALSE	Authentication
Init.ora	TRACE_FILES_PUBLIC=FALSE	Authorization
Init.ora	REMOTE_OS_ROLES=FALSE	Authorization
Init.ora	O7_DICTIONARY_ACCESSIBILITY = FALSE	Authorization
Init.ora	AUDIT_TRAIL = OS	Audit
Init.ora	AUDIT_FILE_DEST = E:\logs\db\audit	Audit
To audit sessions	SQL> audit session;	Audit
To audit schema changes	SQL> audit user;	Audit

File Name	Property	Feature
To audit other events	SQL> AUDIT DATABASE LINK; -- Audit create or drop database links SQL> AUDIT PUBLIC DATABASE LINK; -- Audit create or drop public database links SQL> AUDIT SYSTEM AUDIT; -- Audit statements themselves SQL> AUDIT ALTER ANY ROLE by ACCESS; -- Audit alter any role statements SQL> AUDIT ALTER DATABASE by ACCESS; -- Audit alter database statements SQL> AUDIT ALTER SYSTEM by ACCESS; -- Audit alter system statements SQL> AUDIT CREATE ROLE by ACCESS; -- Audit create role statements SQL> AUDIT DROP ANY ROLE by ACCESS; -- Audit drop any role statements SQL> AUDIT PROFILE by ACCESS; -- Audit changes to profiles SQL> AUDIT PUBLIC SYNONYM by ACCESS; -- Audit public synonyms statements SQL> AUDIT SYSDBA by ACCESS; -- Audit SYSDBA privileges SQL> AUDIT SYSOPER by ACCESS; -- Audit SYSOPER privileges SQL> AUDIT SYSTEM GRANT by ACCESS; -- Audit System grant privileges	Audit

To audit the events, login through sqlplus as SYSTEM and issue the commands.

2.4 Application Server Security

Please refer the Oracle Web Logic Security specification document for making the environment safer and more secured.

Oracle Banking Microservices Architecture products supports the following authentication schemes for the online web application

- Standard LDAP Directory (e.g., OUD/AD/Embedded Weblogic)
- SSO with OAM (Oracle Access Manager – Part of the Oracle Identity Management Suite)
- SAML assertions with a Service Provider protecting the resource and an Identity Provider.

Oracle Banking Microservices Architecture products Solution supports the following authentication scheme for the API layer

- OAuth (CLIENT CREDENTIALS) with OAM
- OAuth (CLIENT CREDENTIALS) without OAM

In case the customer does not have OAM, they can use OAUTH without OAM or it is expected that the customer has an enterprise API Management Layer that protects *Oracle Banking Microservices Architecture product*'s API layer with the same controls (i.e., OAuth)

Support for SSL (Secure Transformation of Data)

Oracle Banking Microservices Architecture products to be configured that all HTTP connections to the application are over SSL/TLS. In other words, all HTTP traffic in the clear will be prohibited; only HTTPS traffic will be allowed. It is highly recommended to enable this option in a production environment, especially when WebLogic Server acts as the SSL terminator.

2.5 SSL Support

2.5.1 SSL Setup

Refer to **SSL Setup Guide** in WebLogic and otherwise is provided in the document available in the below link.

2.5.2 Choice of the SSL cipher suite

Oracle WebLogic Server allows for SSL clients to initiate a SSL connection with a null cipher suite. The null cipher suite does not employ any bulk encryption algorithm thus resulting in transmission of all data in clear text, over the wire.

The default configuration of Oracle WebLogic Server is to disable the null cipher suite. Ensure that the usage of the null cipher suite is disabled, preventing any client from negotiating an insecure SSL connection.

Furthermore, for installations having regulatory requirements requiring the use of only 'high' cipher suites, Oracle WebLogic Server can be configured to support only certain cipher suites. The restriction can be done in config.xml of the WebLogic domain. Provided below is an example config.xml restricting the cipher suites to those supporting 128-bit symmetric keys or higher and using RSA for key exchange.

```
....
<ssl>
       <enabled>true</enabled>
       <ciphersuite>TLS_RSA_WITH_AES_256_CBC_SHA</ciphersuite>
</ssl>
....
```

- Configuration of WebLogic Server to support the above defined cipher suites might also require an additional command line argument to be passed to WebLogic Server, so that a FIPS 140-2 compliant crypto module is utilized. This is done by adding **-Dweblogic.security.SSL.nojce=true** as a JVM argument.
- The restriction on cipher suites needs to be performed for every managed server.
- The order of cipher suites is important – Oracle WebLogic Server chooses the first available cipher suite in the list, that is also supported by the client.
- Cipher suites with RC4 are enabled despite it being second best to AES. This is primarily for older clients that do not support AES (for instance, Microsoft Internet Explorer 6, 7 and 8 on Windows XP).

2.5.3 Product configurations for SSL

Refer to **Section 12.4** in **Oracle Banking Microservices Platform Foundation Installation Guide**.

2.6 Securing the Oracle Banking Microservices Architecture products

Securing the *Oracle Banking Microservices Architecture products* includes securing

A) The Online Web Application and
B) The API Layer exposed to external consumers

2.6.1 Online Web Application

Authentication and authorization to requests to access the Online Web Application(*appshell*) are controlled using the below industry standard approaches:

- Standard LDAP Directory authentication
- SSO with OAM
- SSO with other External SSO Agents
- SAML with the *Oracle Banking Microservices Architecture* products acting as the service provider
- SAML SSO Integration

2.6.1.1 JWT (JSON Web Tokens)

In addition to the authentication, the *Oracle Banking Microservices Architecture* products online web application uses JWT (JSON Web Tokens) to maintain the state for authenticated users.

JSON Web Tokens are an open, industry standard RFC 7519 method for representing claims securely between two parties. JSON Web Token (JWT) is a compact, URL-safe means of representing claims to be transferred between two parties. The claims in a JWT are encoded as a JSON object that is used as the payload of a JSON Web Signature (JWS) structure or as the plaintext of a JSON Web Encryption (JWE) structure, enabling the claims to be digitally signed.

- No Session to Manage (stateless): The JWT is a self-contained token which has authentication information, expire time information, and other user defined claims digitally signed.
- Portable: A single token can be used with multiple backend.
- No Cookies Required, So It's Very Mobile Friendly
- Good Performance: It reduces the network round trip time.
- Decoupled/Decentralized: The token can be generated anywhere. Authentication can happen on the resource server, or easily separated into its own server.

In addition, the following policies are followed for JWT,

- **Token Store:** To increase the security and better usability, every authentication/refresh request is secured by random unique key. The generated token and the secure key are persisted in the table, so that during the horizontal scaling of the servers, any API gateway instance can serve for the request.

- **Cipher strength:** Platform security module hashes the JWT footer with HS512 algorithm.

- **Refresh Token:** Users are allowed to get the new token any time before expiring the existing token.

- **Claims:** The JWT Claims Set represents a JSON object whose members are the claims conveyed by the JWT. Platform security module validates below claims during the process.

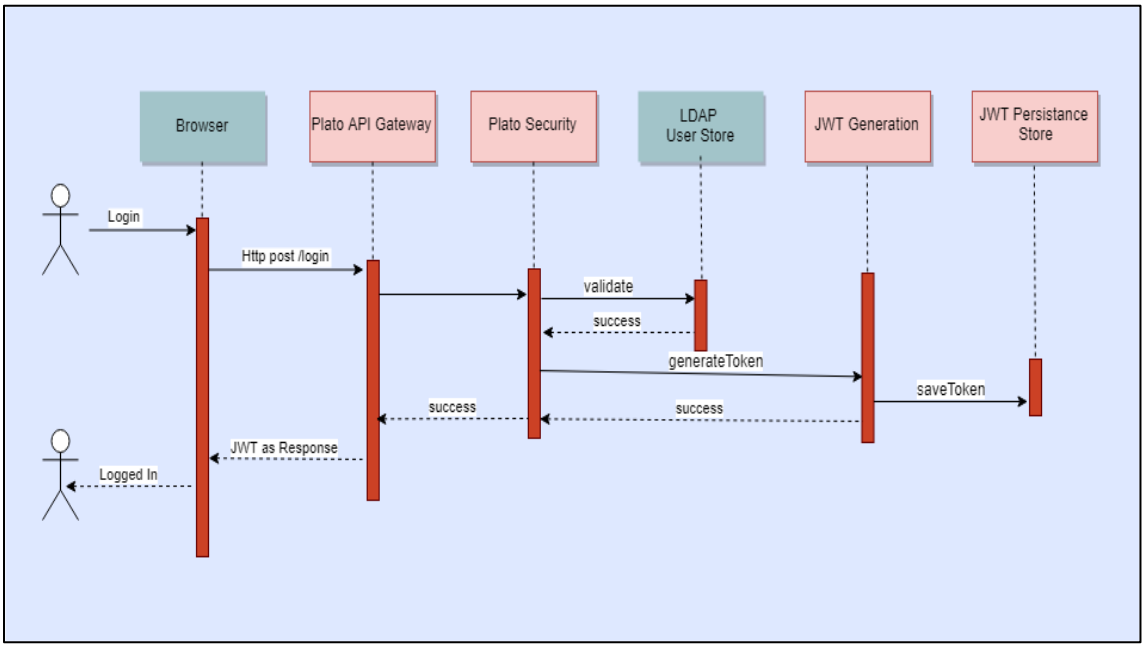
Claim Name	Description	Mandatory	Type
Iss	Issuer	Yes	Registered
Sub	Subject	Yes	Registered
Aud	Audience	No	Registered
Exp	Expiration Time	Yes	Registered
Nbf	Not Before	No	Registered
Iat	Issued At	Yes	Registered
Jti	JWT Id	Yes	Registered
Tid	Tenant Id	Yes	Private

- **Token Expiry:** Platform security module invalidates the token, if the client submits after the Expiration time.

- **Logout:**
  While user calls the logout operation, platform security module clears the issued token and deletes the record from the table as well. The old token no longer will be used for any purpose.

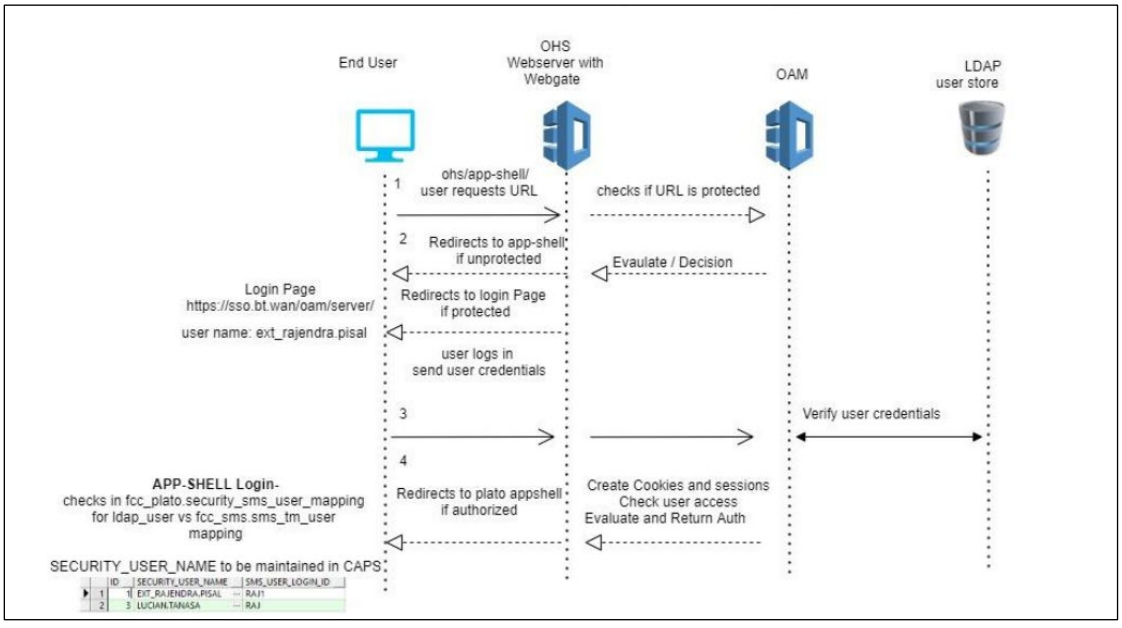
The various security flows for the **online web application** are depicted below.

2.6.1.2 LDAP Authentication



- The user is presented the standard login page for the Oracle Banking Microservices Architecture products
- The user enters a user id and password. The credentials are validated against a standard LDAP store.
- If successful, the API Gateway generates a JWT token (Utilizing Oracle's Security Developer Toolkit part of Oracle's Platform Security Services), persists it in the Database and returns the same.

2.6.1.3 OAM Based SSO



- The online UI is protected on OAM.

- Client requests protected resource. OAM presents SSO Login screen
- Client enters a user id and password. In case of success, OAM sets the corresponding user profile details in the security context
- The request is routed to the Gateway which extracts the profile details from the security context
- The API Gateway creates a JWT token (Utilizing Oracle's Security Developer Toolkit part of Oracle's Platform Security Services), persists it in the Database and returns the same.
- The UI layer uses this token to maintain state and conduct subsequent invocations

Product configuration:

The following parameters need to be set to enable a successful integration with OAM as SSO in Oracle Banking Microservices Architecture products:

PLATO.SECURITY_CONFIG table
o USER_HEADER_ATTRIBUTE_KEY,IS_SSO_CONFIGURED,USER_MAPPING_REQUIRED to be set as true

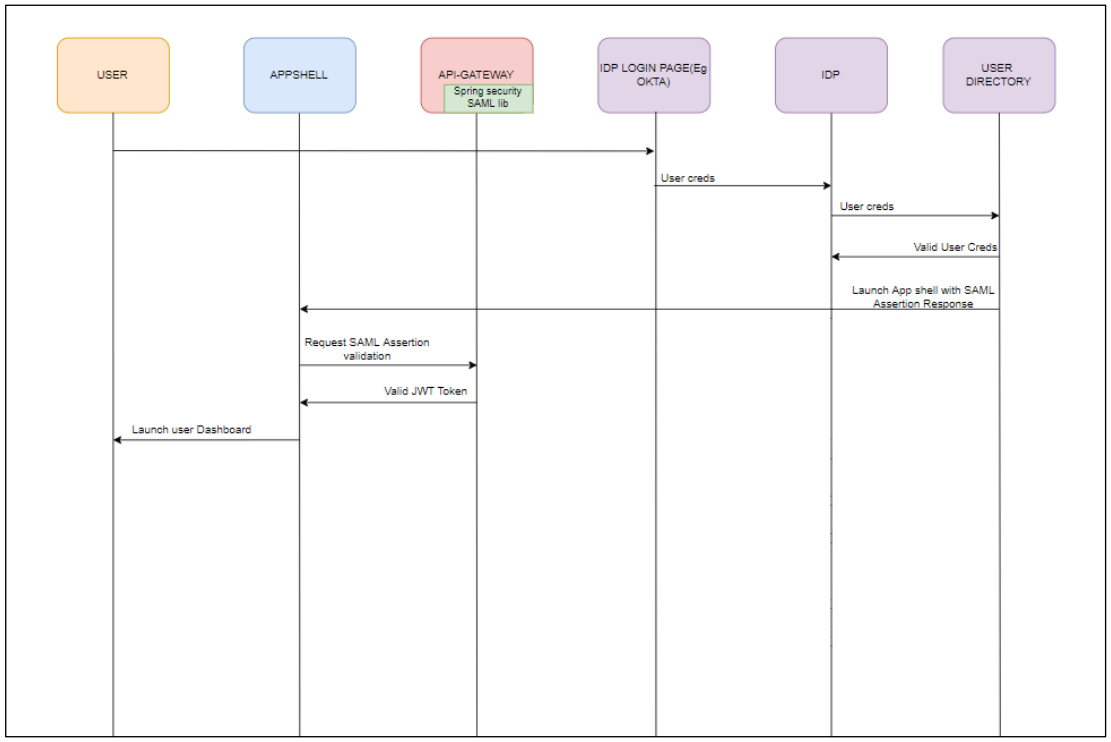
ID	KEY	VALUE
1	USER_HEADER_ATTRIBUTE_KEY	**userId**
2	USER_HEADER_ATTRIBUTE_REQUIRED	**Y**
3	IS_SSO_CONFIGURED	**true**
4	USER_MAPPING_REQUIRED	**true**

PLATO.SECURITY_SMS_USER_MAPPING table - maintain DN vs SMS user_ID mapping in

	ID	SECURITY_USER_NAME	SMS_USER_LOGIN_ID
1	1	EXT_RAJENDRA.PISAL	RAJ1
2	3	LUCIAN.TANASA	RAJ

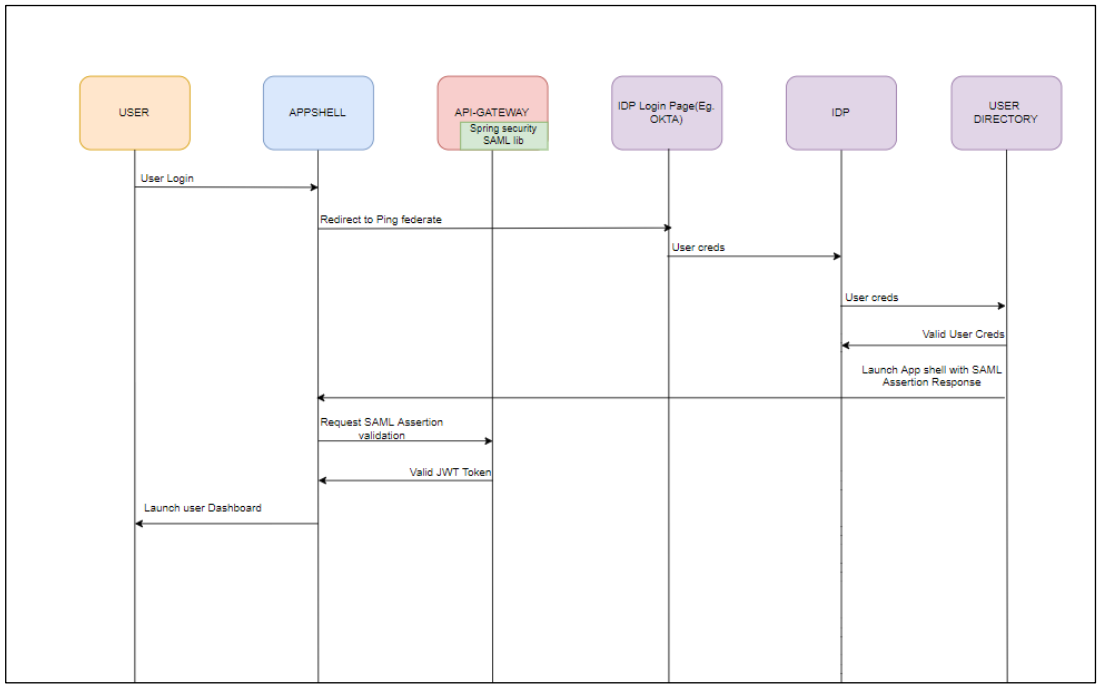
2.6.1.4 SAML Authentication

2.6.1.4.1 IDP Initiated SAML Authentication



- The Identity Provider is external to the *Oracle Banking Microservices Architecture* products (e.g. OKTA) with the Oracle Banking Microservices Architecture products acting as the Service Provider
- Client requests protected resource from Oracle Banking Microservices Architecture products. The Idp presents a configured login screen to the user
- Client enters a user id and password. In case of success, the Idp sets the corresponding user profile details in the security context
- The request is routed to the Gateway which extracts the profile details by decoding the SAML response
- The API Gateway creates a JWT token (Utilizing Oracle's Security Developer Toolkit part of Oracle's Platform Security Services), persists it in the Database and returns the same.
- It is possible to configure an external service to do the SAML Verification instead of the API Gateway using the EXTERNAL_SSO_VALIDATION_URL parameter in the SECURITY_CONFIG table in PLATO-SECURITY schema

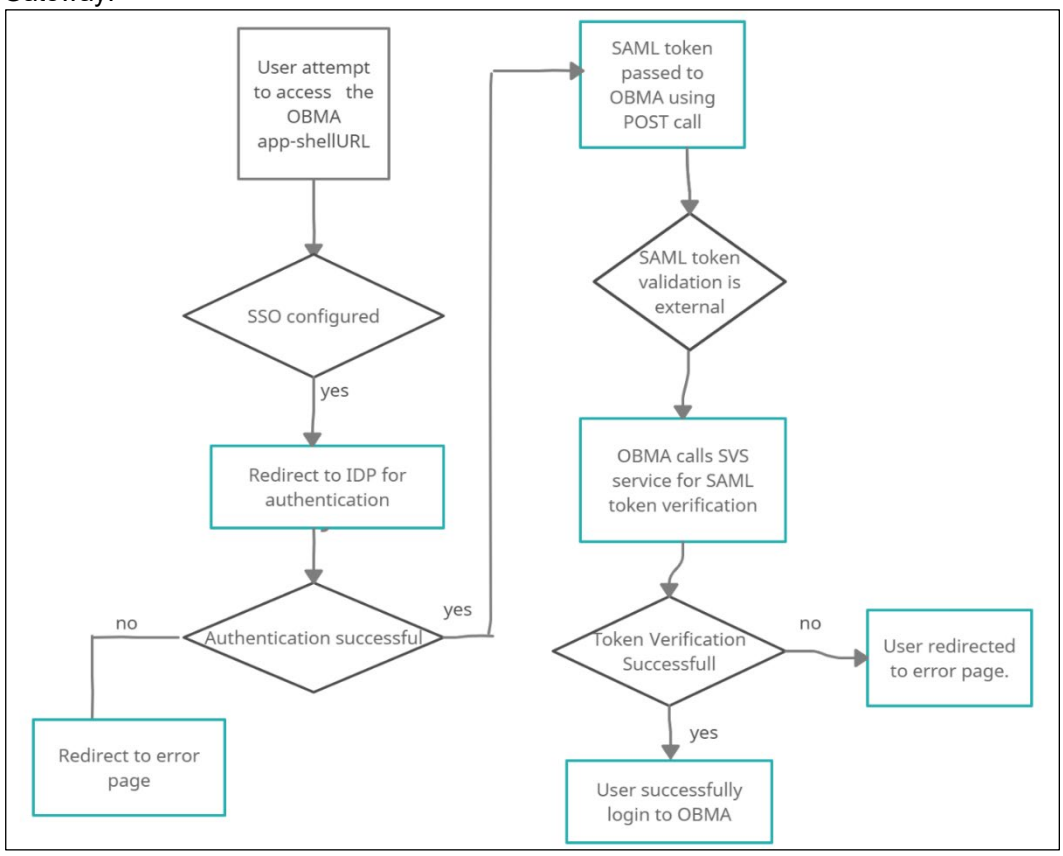
2.6.1.4.2 SP Initiated SAML Authentication



- The user initiates a call to the Oracle Banking Microservices Architecture application and is redirected to the federate login page of the bank.
- The Identity Provider is external to the *Oracle Banking Microservices Architecture* products (e.g. OKTA) with the Oracle Banking Microservices Architecture products acting as the Service Provider
- The Idp presents a configured login screen to the user
- Client enters a user id and password. In case of success, the Idp sets the corresponding user profile details in the security context
- The request is routed to the Gateway which extracts the profile details by decoding the SAML response
- The API Gateway creates a JWT token (Utilizing Oracle's Security Developer Toolkit part of Oracle's Platform Security Services), persists it in the Database and returns the same.

2.6.1.4.3 SAML SSO Implementation:

It is possible to configure an external service to do the SAML Verification instead of the API Gateway.



Steps to achieve SSO-SAML Authentication.

- Bank user will try to access the Oracle Banking Microservices Architecture app-shell URL.
- Oracle Banking Microservices Architecture will check if the IS_SSO_CONFIGURED parameter is set to true in the SECURITY_CONFIG table.
- If the IS_SSO_CONFIGURED parameter is true the user will be redirected to the IDP for authentication.
- On successful authentication IDP will generate the SAML token and pass the token to the Oracle Banking Microservices Architecture assertion consumer service URL in the body of POST method through EXTERNAL_SSO_KEY parameter.
- Oracle Banking Microservices Architecture will receive the token and check if the SSO_SERVICE_PROVIDER is set to EXTERNAL in the SECURITY_CONFIG table.
- If SSO_SERVICE_PROVIDER is EXTERNAL, Oracle Banking Microservices Architecture would make a HTTP Post call to SVS using the EXTERNAL_SSO_VALIDATION_URL configured in the SECURITY_CONFIG table for SAML token validation. Oracle Banking Microservices Architecture will pass the SAML token through EXTERNAL_SSO_TOKEN_KEY parameter in the body of the POST to SVS.
- SVS will return a XML response with IsValid tag as TRUE or FALSE. If the tag value is TRUE, Oracle Banking Microservices Architecture would generate JWT token using the user id from the <subject> </subject> tag of SVS response and allow the user to login.
- In case of failure, Oracle Banking Microservices Architecture would give login error to the user.

Product Configurations required:

The following parameters needs to be configured in the SECURITY_CONFIG table in the PLATO-SECURITY schema to enable SAML SSO.

KEY	VALUE
IS_SSO_CONFIGURED	True
JWT_EXP_SECONDS	JWT expiry time
JWT_ALGORITHM	HS512
EXTERNAL_SSO_VALIDATION_URL	SVS URL
EXTERNAL_SSO_KEY	Parameter in which the SAML token will be passed to Oracle Banking Microservices Architecture from IDP after user authentication.
SSO_SERVICE_PROVIDER	EXTERNAL
EXTERNAL_SSO_TOKEN_KEY	Parameter in which the SAML token will be passed to SVS URL for token validation.
HEADERS	Request headers for making HTTP call to SVS URL

2.6.1.5 FCUBS integration with Oracle Banking Microservices Architecture as SSO Provider

Refer to **Launching <Product Name> from UBS** section in the product Installation Guide.

2.6.2 API Security

Refer to <Product Name> **API Security Guide** for the detailed explanation.

2.6.3 Two-way SSL Connection

A two-way SSL is used when the server needs to authenticate the client. In a two-way SSL connection, the client verifies the identity of the server and then passes its identity certificate to the server. The server then validates the identity certificate of the client before completing the SSL handshake.

In order to establish a two-way SSL connection, must have two certificates, one for the server and the other for client.

Below configuration has to be ensured in weblogic.xml within the deployed application ear.

- Cookies are set with Http only as true
- Cookie secure flag set to true
- Cookie path to refer to deployed application

<wls: session-descriptor>
<wls: cookie-http-only>true</wls: cookie-http-only>
</wls: session-descriptor>

<wls: session-descriptor>
<wls: cookie-secure>true</wls: cookie-secure>
<wls: url-rewriting-enabled>false</wls: url-rewriting-enabled>
</wls: session-descriptor>
Always make sure Cookies are set with always Auth Flag enabled by default for WebLogic server.

3. Securing *Oracle Banking Microservices Architecture Products*

3.1 Desktop Security

Please refer the vendor specific relevant sections for securing the Desktops Operating system. Also do refer the Browser specific security settings mentioned in the vendor specific docs.

Refer the client browser setting required for Oracle Banking Microservices Architecture products.

3.2 Oracle Banking Microservices Architecture products Controls

3.2.1 Overview

This chapter describes the various programs available within *Oracle Banking Microservices Architecture products*, to help in the maintenance of security.

Access to the system is possible only if the user logs in with a valid ID and the correct password. The activities of the users can be reviewed by the Security Officer in the Event Log and the Violation Log reports.

3.2.2 Disable Logging

It is recommended that the debug logging facility of the application be turned off, once the system is in production. This is achieved by updating the logback.xml file of the application.

The above-described practice does not disable logging performed by the application in the database tier. This can be disabled by running the lockdown scripts provided. The lockdown scripts will disable logging across all modules and across all users in the system.

3.2.3 Sign-on Messages

Message	Explanation
User Authentication Failed/Invalid Login	An incorrect user ID or password was entered.
User Status is Locked. Please contact your System Administrator	The user profile has been disabled due to an excessive number of attempts to login, using an incorrect user ID or password. The number of attempts could have matched either the successive number of login failures (configured for the system).

3.2.4 Authentication & Authorization

Only authenticated users can access the system. Secondly, a user should have access rights to execute a function. The user profile of a user contains the User ID and the functions to which the user has access. *Oracle Banking Microservices Architecture* product operation such as new, copy, query, unlock and so on will be enabled based on function rights available for the user. The function rights will be checked for each operation performed by the user, in Security Management Service module of *Oracle Banking Microservices Architecture* products.

3.2.5 Role Based Access Controls

- Application-level access has implemented via the Security Management System (SMS) module.
- SMS supports “ROLE BASED” access of Screens and different types of operations.
- *Oracle Banking Microservices Architecture* products supports dual control methodology, wherein every operation performed has to be authorized by another user with the requisite rights.
- SMS provides an option to map multiple roles for a user in a given branch. Allowed operations are mapped to the roles and SMS authorizes the user based on it.

3.2.6 Access Controls - Branch Level

- SMS provides the branch level access through the roles provided for the user at a particular branch

3.2.7 Maker – Checker

Application supports dual control methodology, wherein every operation performed has to be authorized by another user with the requisite rights.

3.2.8 Access Enforcement

Access management in *Oracle Banking Microservices Architecture* products can be done in two steps.

- **Branch level:** In such a case the user cannot view even the menu list of the *Oracle Banking Microservices Architecture* products when he tries to login into the restricted branch. Thus, no transactions could be performed.
- **Roles wise:** As described above based on the user-roles mapping, the user can access different functions of *Oracle Banking Microservices Architecture* products. For an example, a bank clerk will have access to customer creation, account opening, term-deposits opening and liquidation screens, but he will not have access to User Creation function activity.

3.2.9 Password Management

The Oracle Banking Microservices Architecture products relies on external password management and does not store any credentials. If an external LDAP is used, password management and policy rules can be set on that (For ex. For Weblogic Embedded-LDAP, the user and password rules can be configured via the admin console of the weblogic). If OIM/OAM is configured, password management and policy rules can be set on OIM. The IdP (Identity Provider) in case of SAML takes care of the password policies.

Certain user password related parameters should be defined at the system level. These parameters will apply to all the users of the system. Examples of such parameters are the number of invalid login attempts after which a user-id should be disabled, the maximum and minimum length for a password.

3.2.9.1 Password Policies

To enable password validation, there is a flag given in SECURITY_CONFIG table called:

PASSWORD_VALIDATION_FLAG – It has to be set as Y to enable

Password validation criteria are configurable through the table created called SECURITY_PASSWORD_VAL_CONFIG. Each property in that is being explained through the following table:

Property	Value	Description
MIN_PSWD_LEN	Any integer	Minimum password length required
MAX_PSWD_LEN	Any integer	Maximum password length allowed
MIN_PSWD_AGE	Any integer	Not used currently
MAX_PSWD_AGE	Any integer	Not used currently
FLAG_UPPER_CHAR	Y/N	Y- UpperCase characters required
NUM_MAND_UPPER	Integer	Minimum uppercase characters required Checked only if FLAG_UPPER_CHAR is set to Y
FLAG_LOWER_CHAR	Y/N	Y- LowerCase characters required
NUM_MAND_LOWER	Integer	Minimum lowercase characters required Checked only if FLAG_LOWER_CHAR is set to Y
FLAG_SPECIAL_CHAR	Y/N	Y- Special characters required
NUM_MAND_SPECIAL	Integer	Minimum special characters required Checked only if FLAG_SPECIAL_CHAR is set to Y
FLAG_NUMERIC_CHAR	Y/N	Y- Numeric characters required
NUM_MAND_NUMERIC	Integer	Minimum numeric characters required Checked only if FLAG_ NUMERIC_CHAR is set to Y

4. General Information

4.1 Cryptography

Oracle Banking Microservices Architecture products uses cryptography to protect the sensitive data.

For encryption, AES, which is considered to be of gold standard, is used. It produces a key size of 256 bits when it comes to symmetric key encryption.

4.2 Security patch

Security patches needs to be applied whenever it's available for the applicable product version.

4.3 Oracle Database Security Suggestions

4.3.1 Access Control

Database Vault (DV) Provides enterprises with protection from the insider threats and in advantage leakage of sensitive application data. Access to application data by users and administrators is controlled using DV realms, command rules and multi factor authorization. DV also address Access privilege by separating responsibilities.

4.3.2 Data Protection

Advance Security provides the most advance encryption capabilities for protecting sensitive information without requiring any change to the application. TDE is native database solution that is completely transparent to the existing applications.

Advance Security also provides strong protection for data in transit by using network encryption capabilities. Features like Easy to deploy, ensure secure by default to accept communication from client using encryption, Network encryption using SSL/TLS.

4.3.3 Monitoring and Compliance

Audit Vault (AV) transparently collects and consolidate audit data from multiple databases across the enterprise, does provide valuable insight into who did what with which data & when including privilege users. The integrity of the audit data is ensured using controls including DV, Advance Security. Access to AV data is strictly controlled. It also does provide graphical summaries of activity causing alerts, in addition database audit setting are centrally managed and monitored.

4.4 Oracle Software Security Assurance - Standards

Every acquired organization must complete the Mergers and Acquisitions (M&A) Security Integration process. The issues identified during this review must be addressed according to the agreed upon M&A remediation plan. The acquired organization must complete SPOC assignments and plan integration of OSSA methodologies and processes into its SDLC.

4.5 References

4.5.1 Datacenter Security Considerations

Please refer to the following links to understand Datacenter Security considerations

https://docs.oracle.com/en/middleware/fusion-middleware/weblogic-server/12.2.1.4/depgd/understanding.html#GUID-F6E8BF0B-FBCF-44D2-A33F-13C4EF2E0031

4.5.2 Database Security Considerations

Please refer the below links to understand more on Database Security considerations recommended to be followed

https://www.oracle.com/security/database-security/

https://docs.oracle.com/en/database/oracle/oracle-database/19/dbseg/database-security-guide.pdf

4.5.3 Security Recommendations / Practices followed for Database Environment

Please refer the below mentioned links to understand more on Security recommendations / practices followed for Database Environment

https://docs.oracle.com/en/database/oracle/oracle-database/19/security.html

https://docs.oracle.com/en/database/oracle/oracle-database/19/dbseg/index.html

4.5.4 Common Security Considerations

Please refer below links to understand some of the common security considerations to be followed.

https://www.oracle.com/database/technologies/high-availability/fusion-middleware-maa.html

https://www.oracle.com/a/tech/docs/tip4847-maa-best-practices-for-database.pdf

https://docs.oracle.com/en/middleware/fusion-middleware/weblogic-server/12.2.1.4/perfm/basics.html#GUID-178B107B-10E9-4563-BCA4-E06E14F5D3FF

https://docs.oracle.com/en/middleware/fusion-middleware/weblogic-server/12.2.1.4/lockd/securing-production-environment-oracle-weblogic-server.pdf

https://docs.oracle.com/en/middleware/fusion-middleware/weblogic-server/12.2.1.4/secmg/index.html

https://docs.oracle.com/en/middleware/fusion-middleware/weblogic-server/12.2.1.4/index.html

Security Guide

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https://www.oracle.com/industries/financial-services/index.html