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Implementing claims authentication in AVEVA™ PI System™

Presented By: Ryan Biggins

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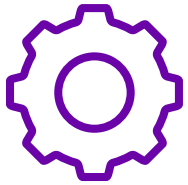
Improving security with OpenID Connect (OIDC)



Challenge

Security in my AVEVA PI System is unnecessarily complicated

- Servers distributed across workgroups, isolated domains, untrusted domains
- Heavy use of Windows Credential Manager
- Use of PI Trusts (Not recommended)

Solution

Use OpenID Connect (OIDC) authentication and other new features in AVEVA™ PI Server 2023

- New to AVEVA PI Server 2023
- A form of claims authentication
- Uses tokens for access

Benefits

- TLS/SSL to natively encrypt communication for all authentication methods
- Free from the boundaries of a Windows domain/Active Directory
- Can federate to your organization's existing identity provider (IdP)

AVEVA

Agenda

- New AVEVA PI Server features overview
- TLS/SSL certificates
- OpenID Connect
- Installation/upgrade considerations
- Managing security access
- Troubleshooting
- Questions

Relevant new AVEVA PI Server features

- Support for TLS/SSL certificates
  - Natively encrypts communication for all AVEVA PI System authentication methods (OIDC, Windows, PI Trust)
- OpenID Connect (OIDC) authentication
  - A form of claims authentication
  - Possible through the AVEVA Identity Manager (AIM) service and an identity provider (IdP) of choice

Note: AVEVA PI Server 2023 requires you to be on AVEVA™ Flex

TLS/SSL certificates

TLS/SSL certificates

- Transport Layer Security (TLS):
  - Cryptographic protocol that involves certificates
  - Previous iterations were known as Secure Sockets Layer (SSL)
- Natively encrypts communication in AVEVA PI System for all different authentication methods
- Same technology is used to secure communication with websites
  - HTTPS protocol requires a TLS/SSL certificate
- Issued by a certificate authority (CA)
- Need to be trusted by all clients that connect
- Applications (PI DA, asset framework, AVEVA Identity Manager (AIM)) that are installed on the same server can share the same certificate
- Optional feature for PI Server; Required if using OIDC authentication

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Certificates in AVEVA™ PI System™

Which AVEVA PI System components now support TLS/SSL?

Newly Supported:

- Data archive
- Asset framework
- AIM

Already Supported:

- AVEVA™ PI Vision™
- PI Web API
- AVEVA PI Integrator for Business Analytics
- Several others (mostly web-based)

Which certificate authority (CA) is best?

In order of preference/strength

1. Third-party CA (Issued by GlobalSign, DigiCert, GoDaddy, etc.)
   - Preferred if users and applications are spread across multiple untrusted domains
   - Preferred if accessing the application from outside the corporate network
   - Most servers/computers will trust these certs automatically
   - Incur a cost to obtain
2. Enterprise CA (Issued by your domain/IT)
   - Preferred if users and applications are mostly contained within the same domain forest
   - Servers/computers within the corporate domain forest will trust these certs automatically
3. Self-signed (Issued by your server)
   - Not recommended for corporate deployment
   - These certs are trusted only on the local server or to any server onto which it is imported

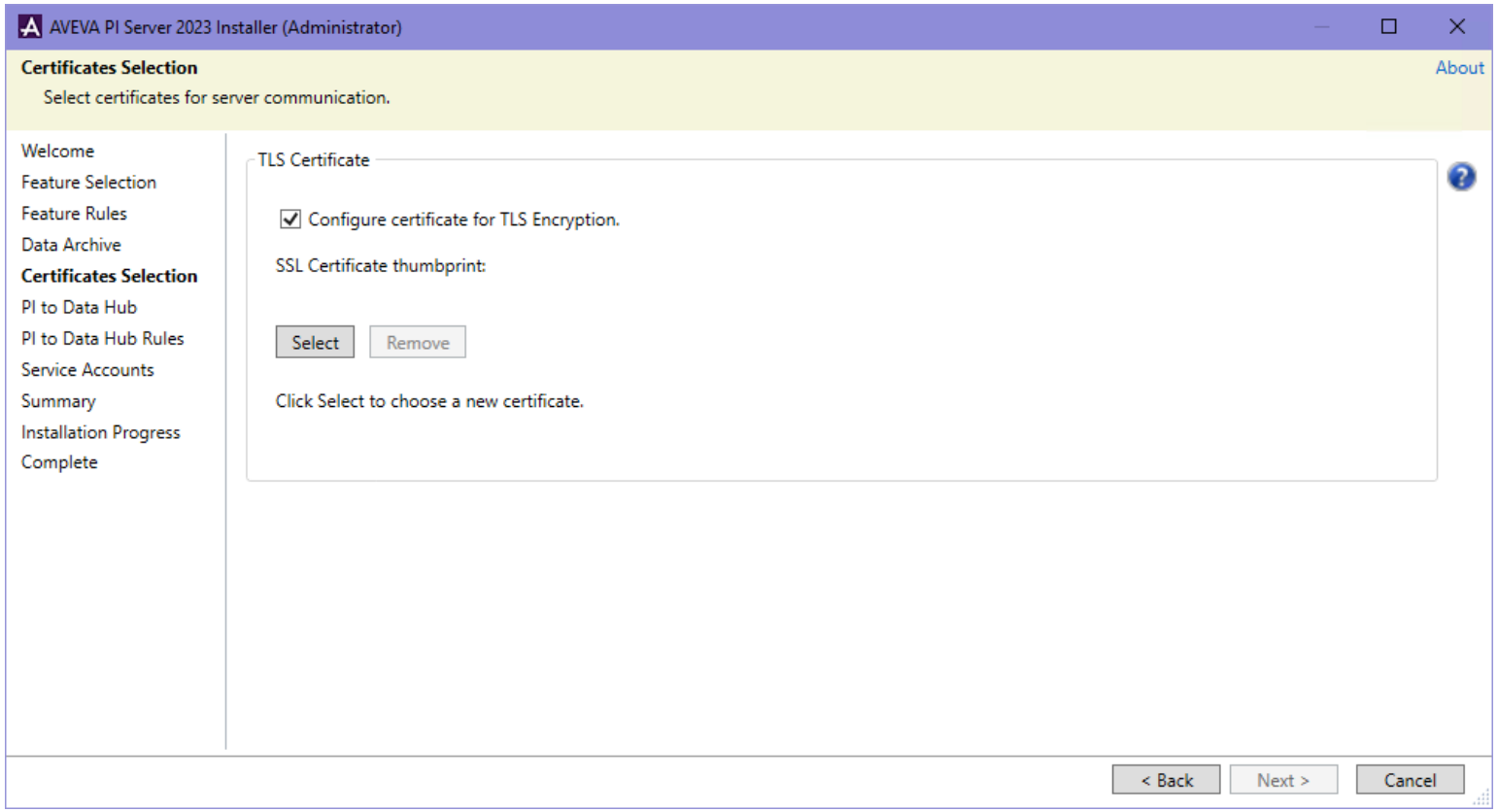
Choose the option that makes the most sense for your deployment

AVEVA

Applying and checking certificates

AVEVA PI System Data Archive or Asset Framework (AF)

Select certificate during installation

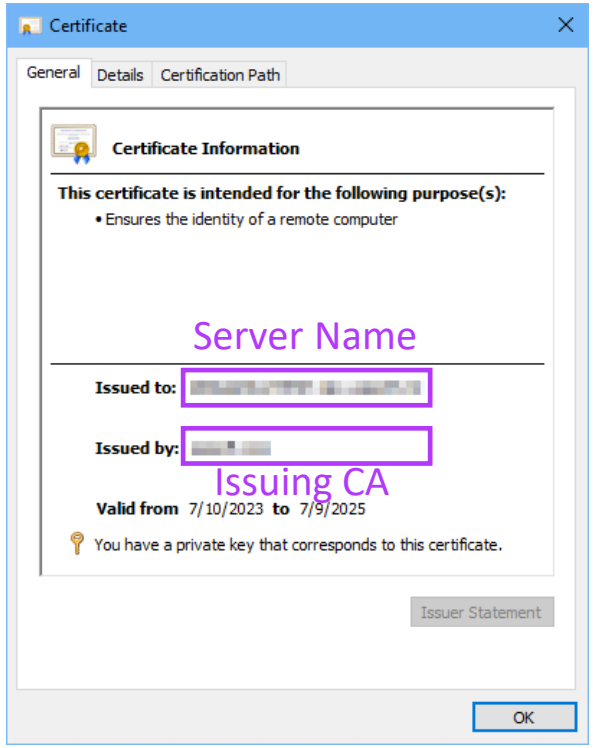


Applying and checking certificates

AVEVA PI System Data Archive

Change certificate at a later time (Using **pidiag**)

- **pidiag -tls -r <thumbprint>** (or **pidiag -tls --register <thumbprint>**)



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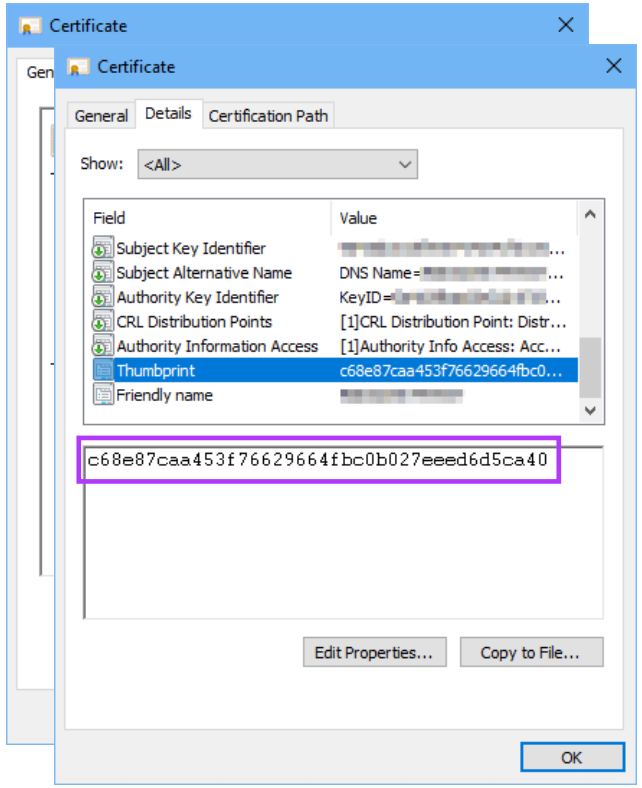
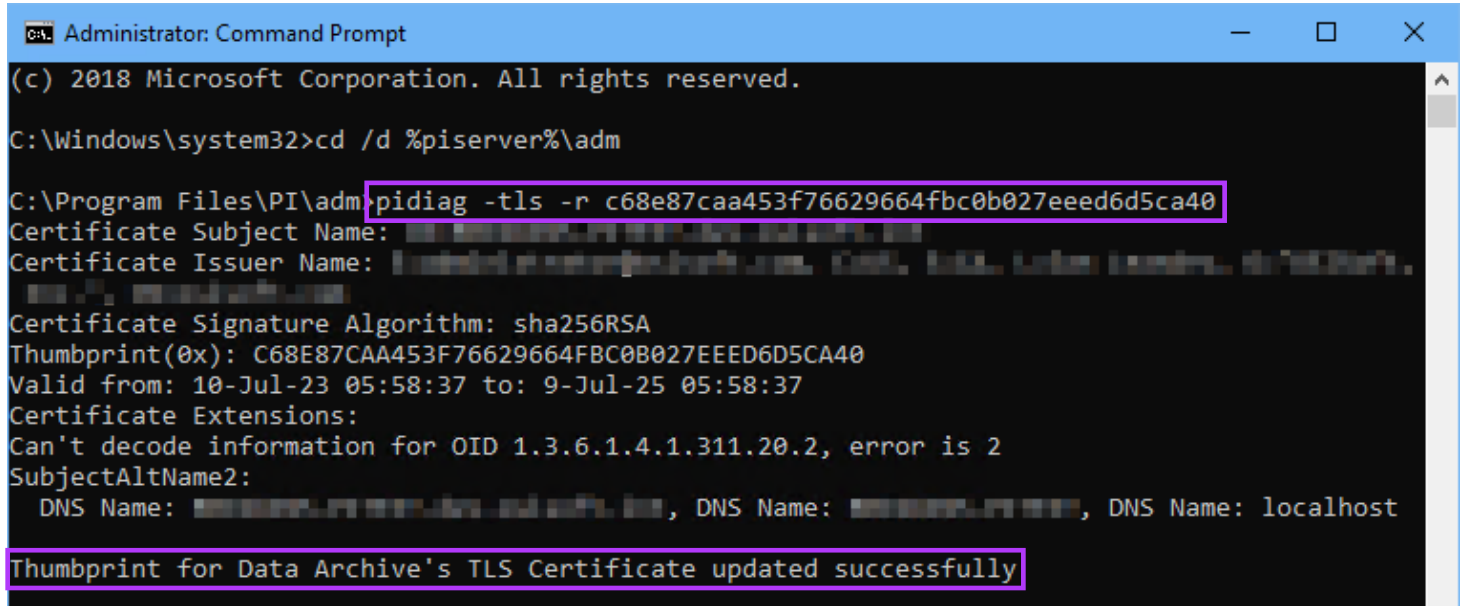


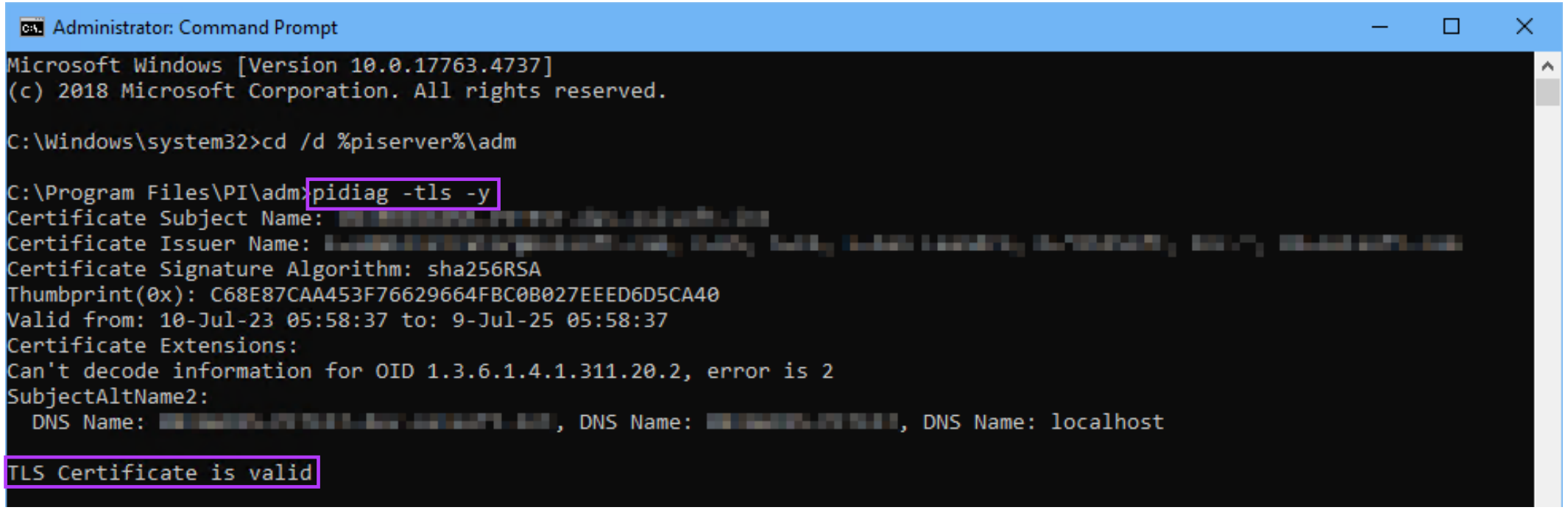


Applying and checking certificates

AVEVA PI System Data Archive

Verify current certificate (Using **pidiag**)

- **pidiag -tls -y** (or **pidiag -tls --verify**)

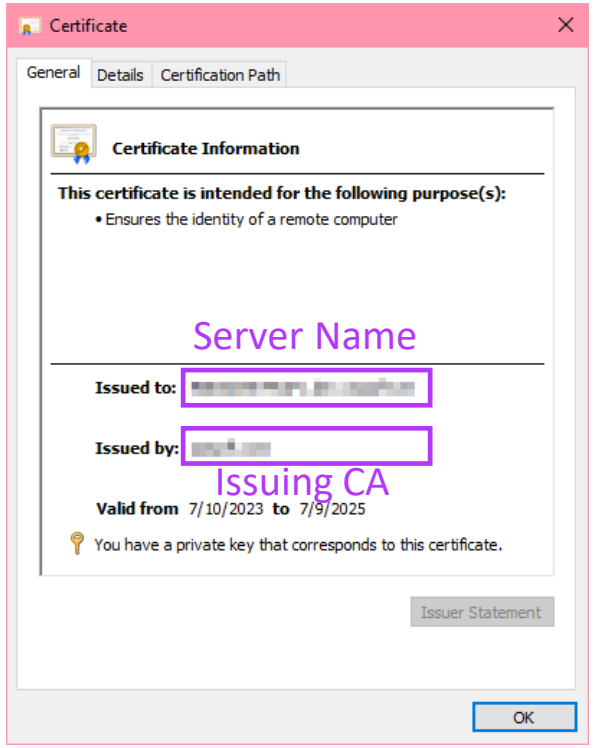


Applying and checking certificates

AVEVA PI System Asset Framework (AF)

Change certificate at a later time (Using **AFDiag**)

- **AFDiag /CT:<thumbprint>** (or **AFDiag /CertificateThumbprint:<thumbprint>**)



Applying and checking certificates

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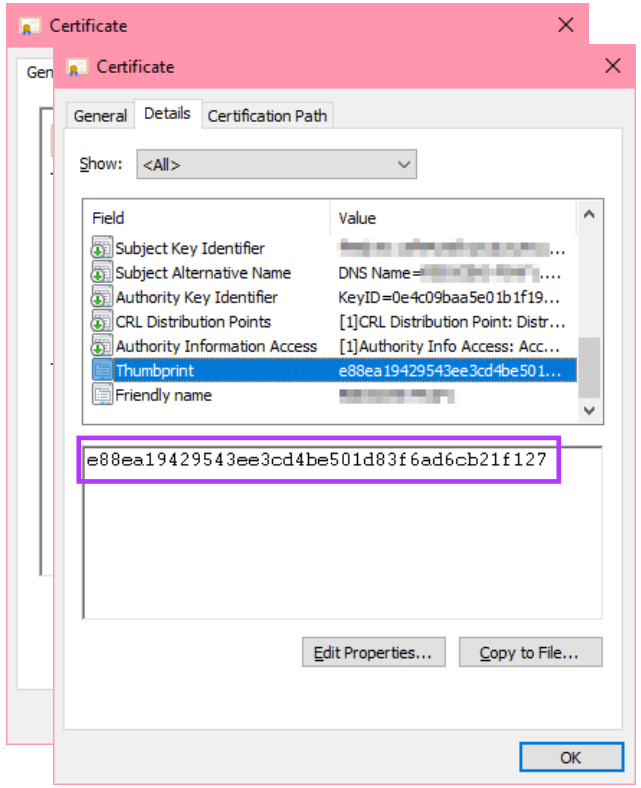
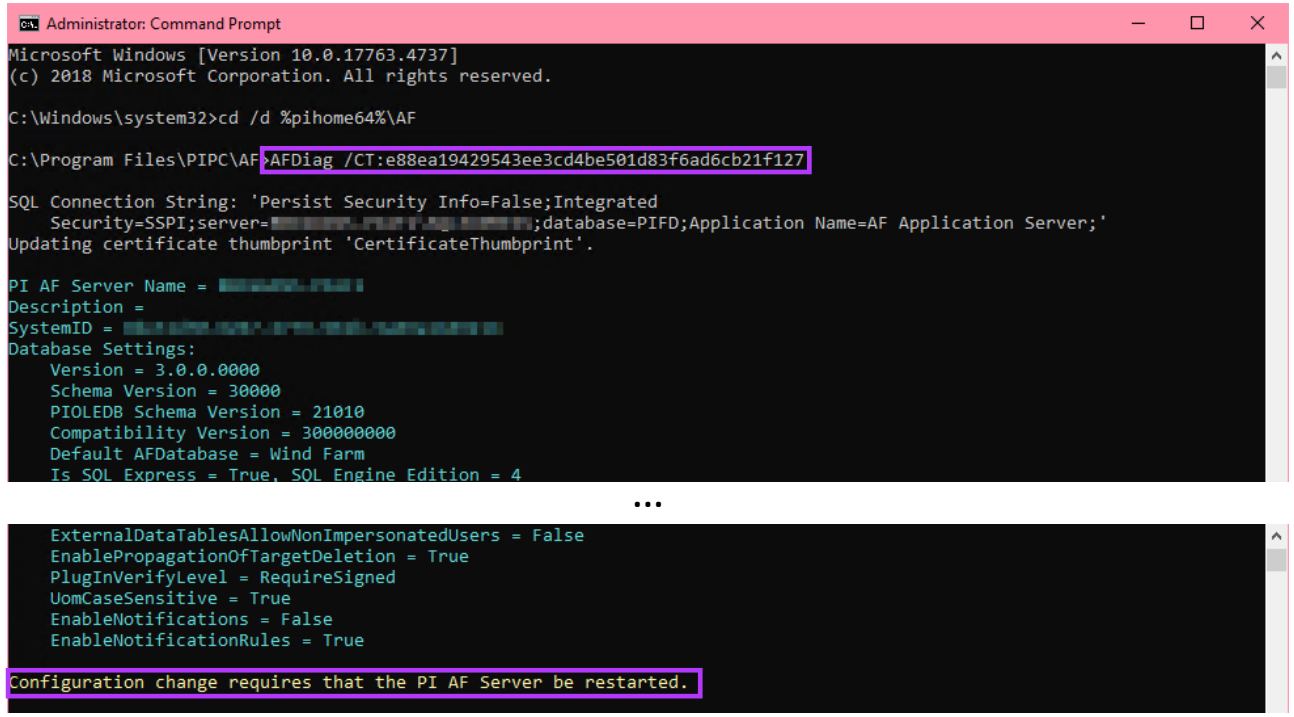


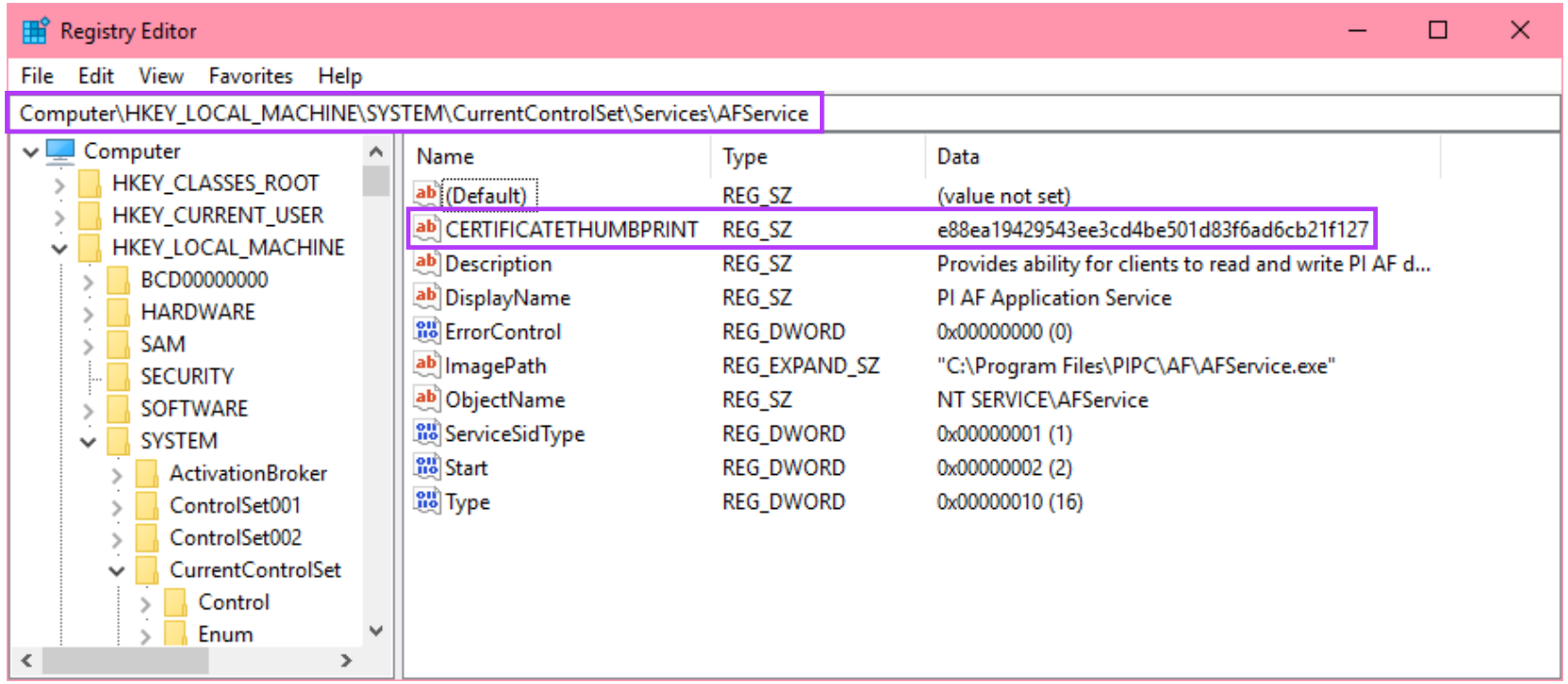


Applying and checking certificates

AVEVA PI System Asset Framework (AF)

Verify current certificate (Using registry)

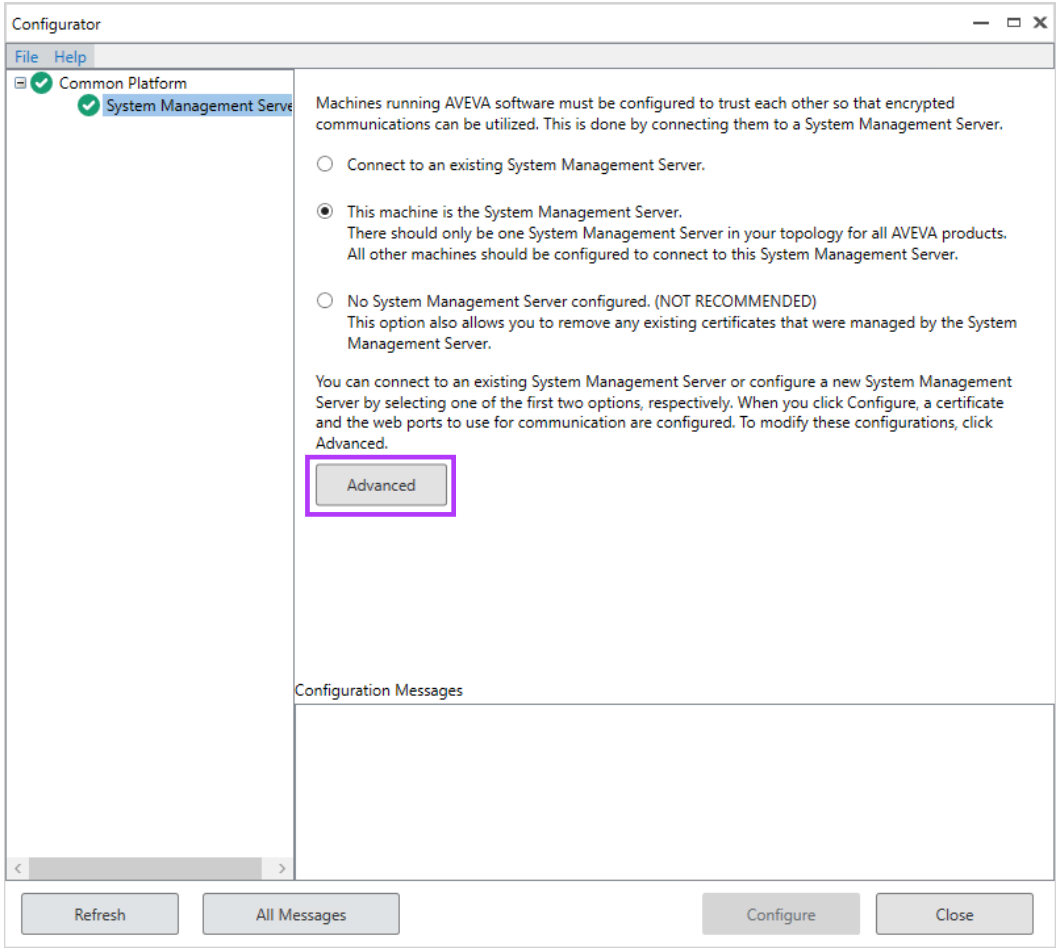
- Computer\HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\AFService
- CERTIFICATETHUMBPRINT



Applying and checking certificates

AVEVA Identity Manager (AIM)

Select certificate through configurator



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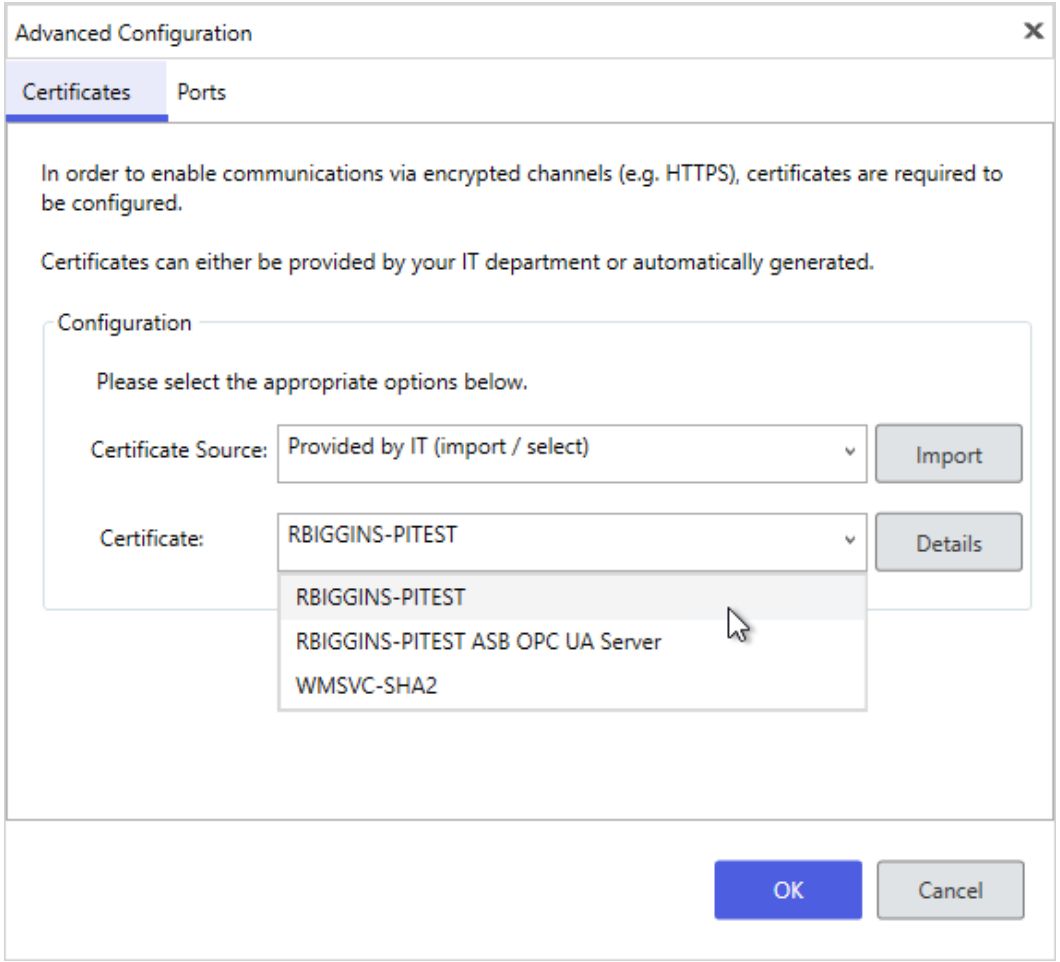


OpenID Connect (OIDC) authentication

Claims in AVEVA PI System

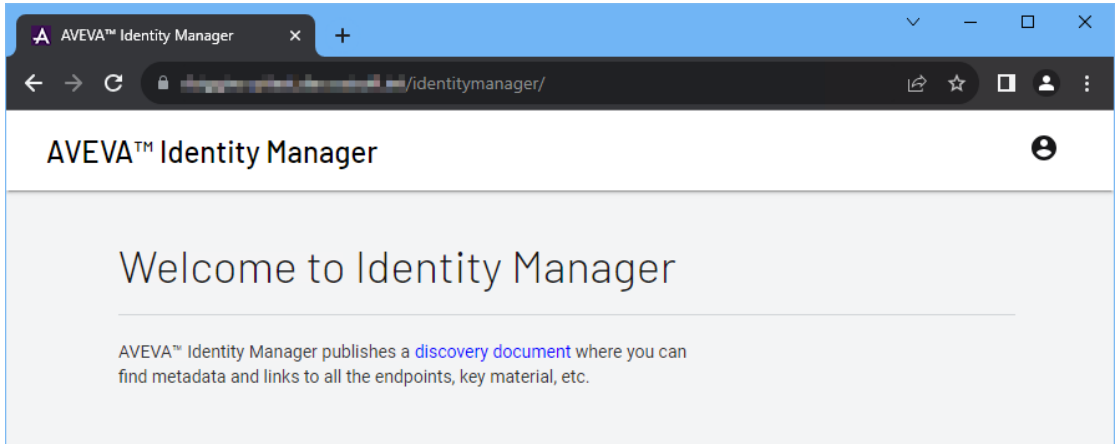
OpenID Connect (OIDC) authentication

- Authentication is the process by which a user or application proves its identity to a server and forms an initial connection
- Claims authentication is based on the premise that an external identity provider (IdP) is trusted to make claims about the identity of a user
- OpenID Connect (OIDC) is a form of claims authentication
  - Built on the OAuth 2.0 Framework
  - Makes Single Sign On (SSO) possible
  - Involves tokens (Access, Refresh, etc.)
- AVEVA Identity Manager (AIM) is the identity service that handles OIDC authentication in AVEVA PI System

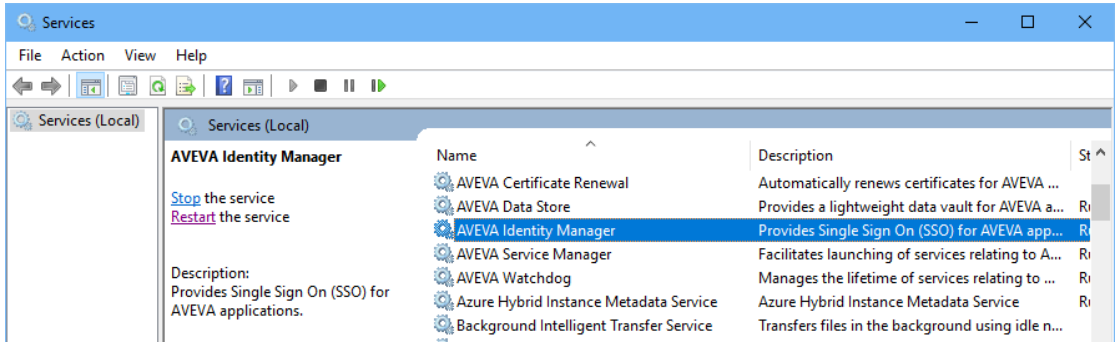
For a full discussion of technical details, benefits, and reasons behind the feature introduction, see the presentation **Introduction to claims authentication**

AVEVA™ Identity Manager (AIM)

- "Identity service;" runs as a Windows service
- Part of the AVEVA Platform Common Services (PCS)
  - Obtainable via Platform Common Services (PCS) for AVEVA PI System install kit
- Manage AIM using the Configurator application
- If available, AIM registers with default IdP:
  - Windows Active Directory (AD)
- Connect AIM to one additional IdP:
  - AVEVA Connect (recommended)
  - Azure Active Directory (AAD)
- Register individual AVEVA PI Server components with AIM



Accessing AIM endpoint via browser



Configurator application

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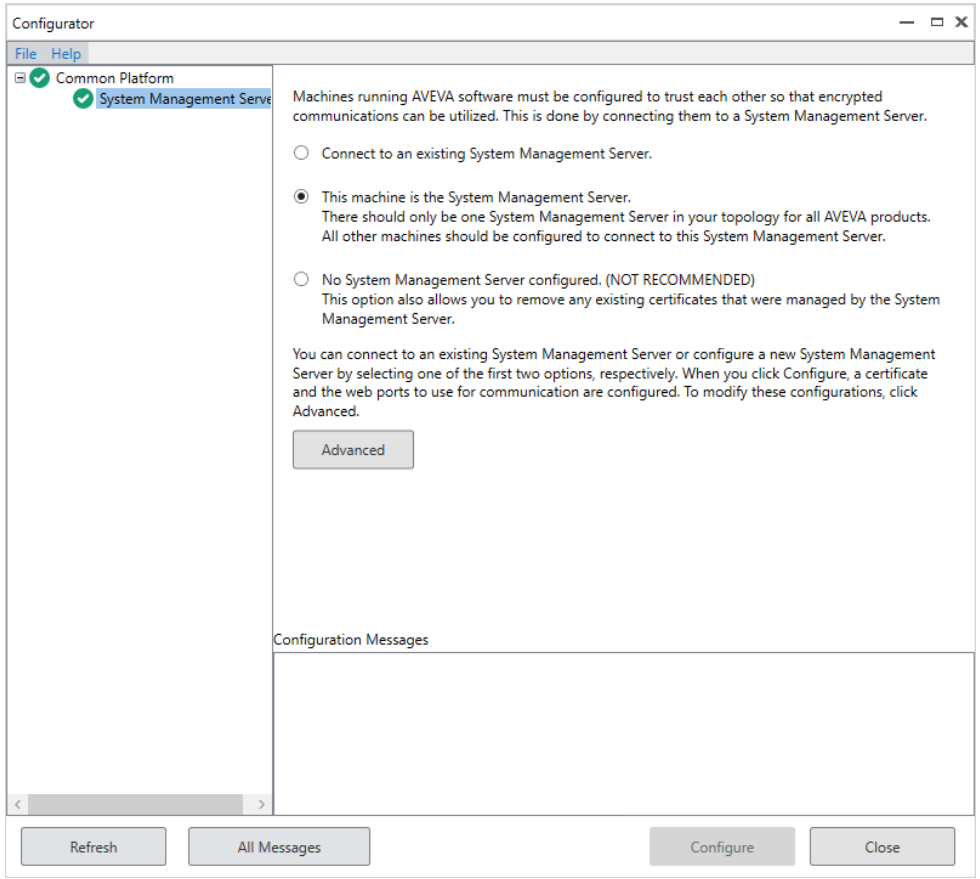
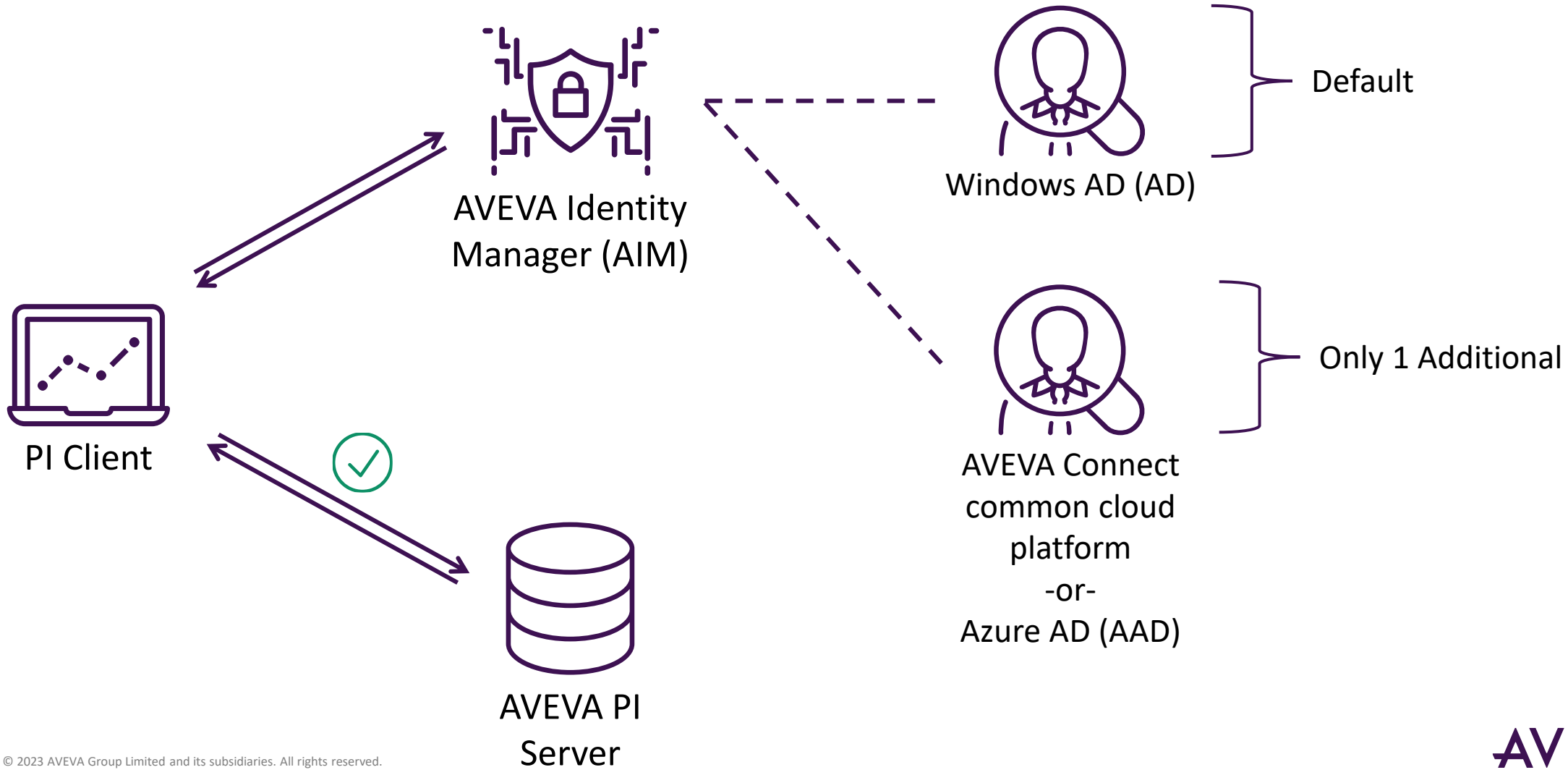
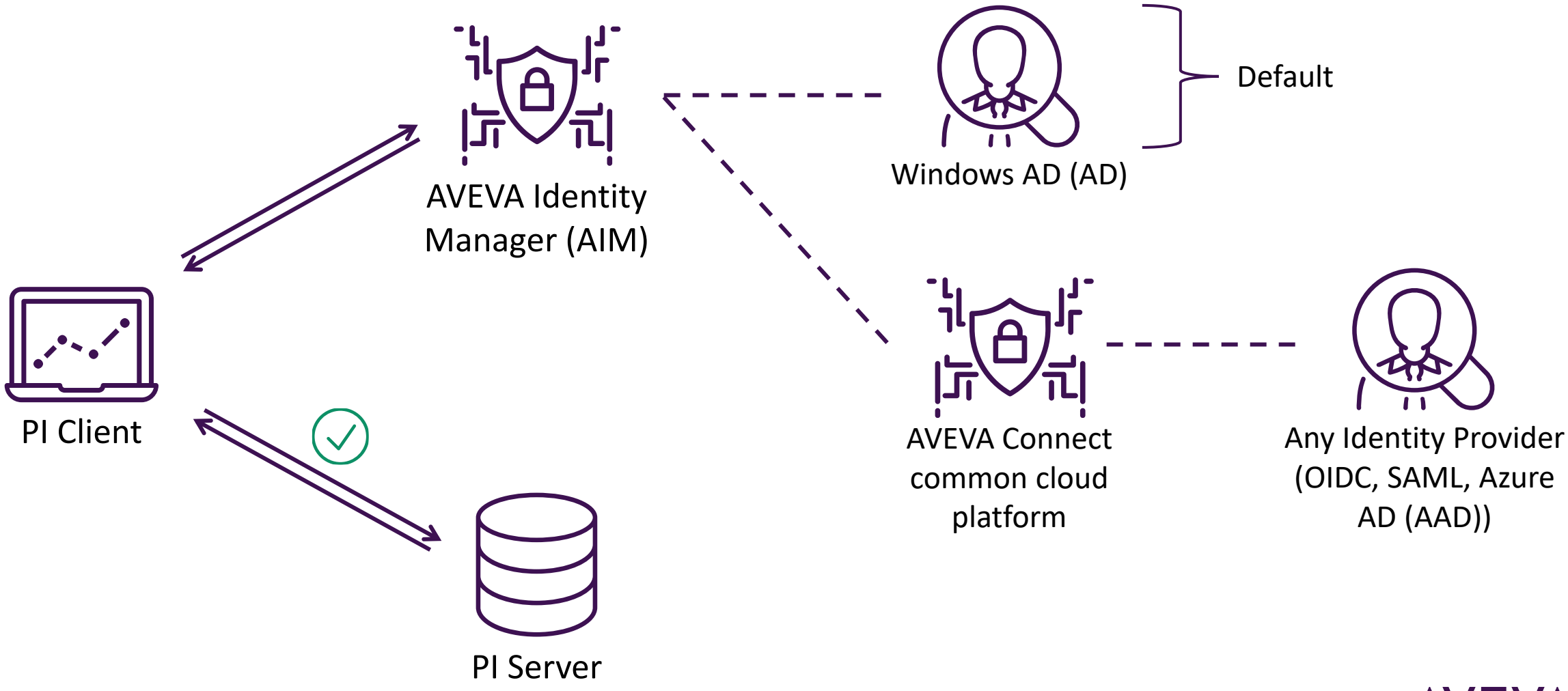


Configurator application

Authentication flow



Authentication flow (with federation)



Supported products

Where can I use OIDC in AVEVA PI System?

Supported:

- Data archive
- Asset framework
- PI Notifications
- AVEVA PI Vision
- PI Web API
- AVEVA Adapters*
- PI AF SDK-based PI Clients (PI System Explorer, AVEVA™ PI DataLink™)
- Custom PI AF SDK applications*

Not Supported:

- AVEVA PI Interfaces
- AVEVA PI Connectors
- PI Buffer Subsystem
- AVEVA PI System Management Tools (SMT)**

Installation/upgrade considerations

Installation/upgrade path

1. Decide upon AVEVA PI System architecture; Which server will host AIM service?
2. Prepare and import server certificates for AIM and AVEVA PI Server components
   - Third-party CA certs or Enterprise CA certs preferred
3. Prepare service accounts and administrative accounts (Windows)
4. Install Platform Common Services (PCS) for AVEVA PI System; Contains AIM service
5. Add administrative accounts to aaAdministrators local group (Windows)
6. Perform initial AIM setup in Configurator application; Change AIM certificate
7. Connect AIM to an (additional) identity provider (IdP)
   - Steps will differ depending on IdP (AVEVA Connect or Azure Active Directory (AAD))
   - If needed, federate to an IdP, using AVEVA Connect, common cloud platform, as an identity service
8. Install or upgrade AVEVA PI Server components
   - Check the option to enable TLS/SSL
9. Manage certificates for AVEVA PI Server components
10. Register AVEVA PI Server components with AIM using OIDC Configuration Tool

Federating to other Identity Providers (IdPs)

What if I have an existing IdP that I want to use?

- AVEVA Connect supports federation to your existing IdP
- Examples of other common IdPs:
  - OIDC-compliant IdPs
    - Google, PingID, ADFS, Okta, etc.
  - SAML-compliant IdPs
  - Azure AD (AAD)
    - While AIM can connect directly to AAD, it can also federate to AAD via AVEVA Connect
    - It is recommended to federate to AAD rather than connect directly to AAD
    - Federation to AAD allows you to take advantage of all the subscription services available on AVEVA Connect, common cloud platform

Federating to other Identity Providers (IdPs)

How do I federate to my existing IdP?

1. Determine the type of IdP that you have: (OIDC-compliant, SAML-compliant, Azure AD (AAD))
2. Set up AIM to connect to AVEVA Connect, common cloud platform as the IdP
3. Contact connect.support@aveva.com about federation
4. Support group will verify that requester has the right to set up federation for the respective domain
5. Support group will request for information related to your IdP
6. *(If federating to Azure AD (AAD))* Support group will provide required preparation tasks to complete and wait for confirmation
7. Support group will set up federation

Registering AVEVA™ PI Server components with AIM

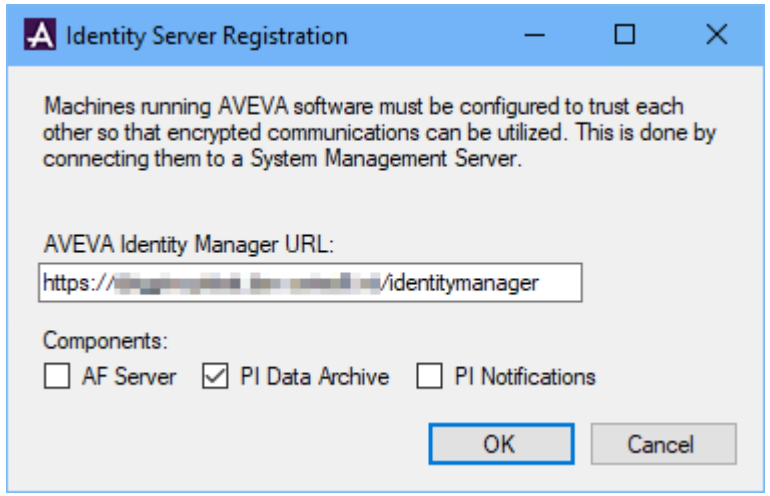
AVEVA.PI.OIDCConfigurationTool.exe

- Perform this task locally on each server where an AVEVA PI Server component resides
  - i.e. Register the asset framework server with AIM from the asset framework server; register the data archive server with AIM from the data archive server
- Use **AVEVA.PI.OIDCConfigurationTool.exe**
  - Can be run interactively or with supplied parameters
  - Supports registration and unregistration of components
  - Supports silent mode
  - Located in:
    - **%PISERVER%\ADM** on data archive servers
    - **%PIHOME64%\AF** on asset framework servers

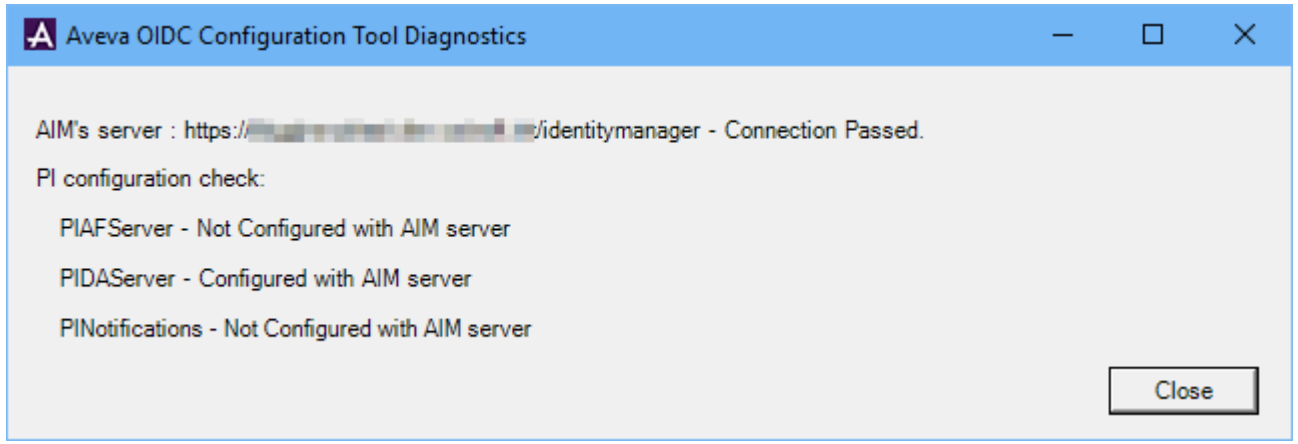
AVEVA

Registering AVEVA™ PI Server components with AIM

AVEVA.PI.OIDCConfigurationTool.exe



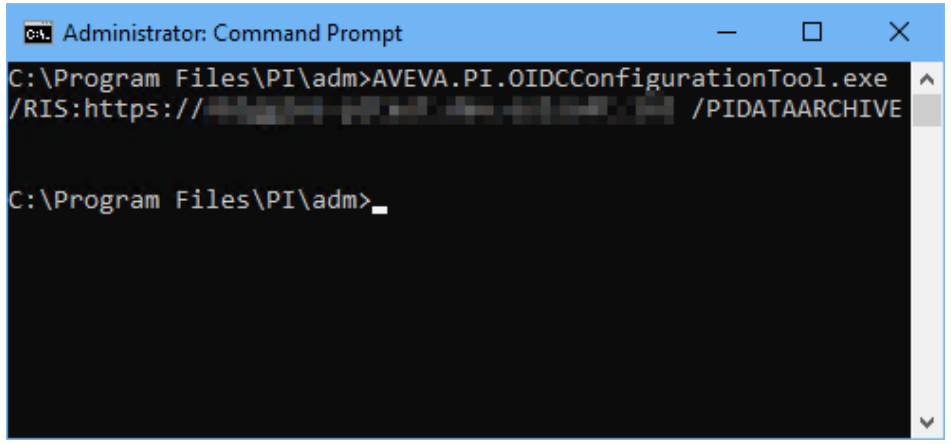
Interactive registration



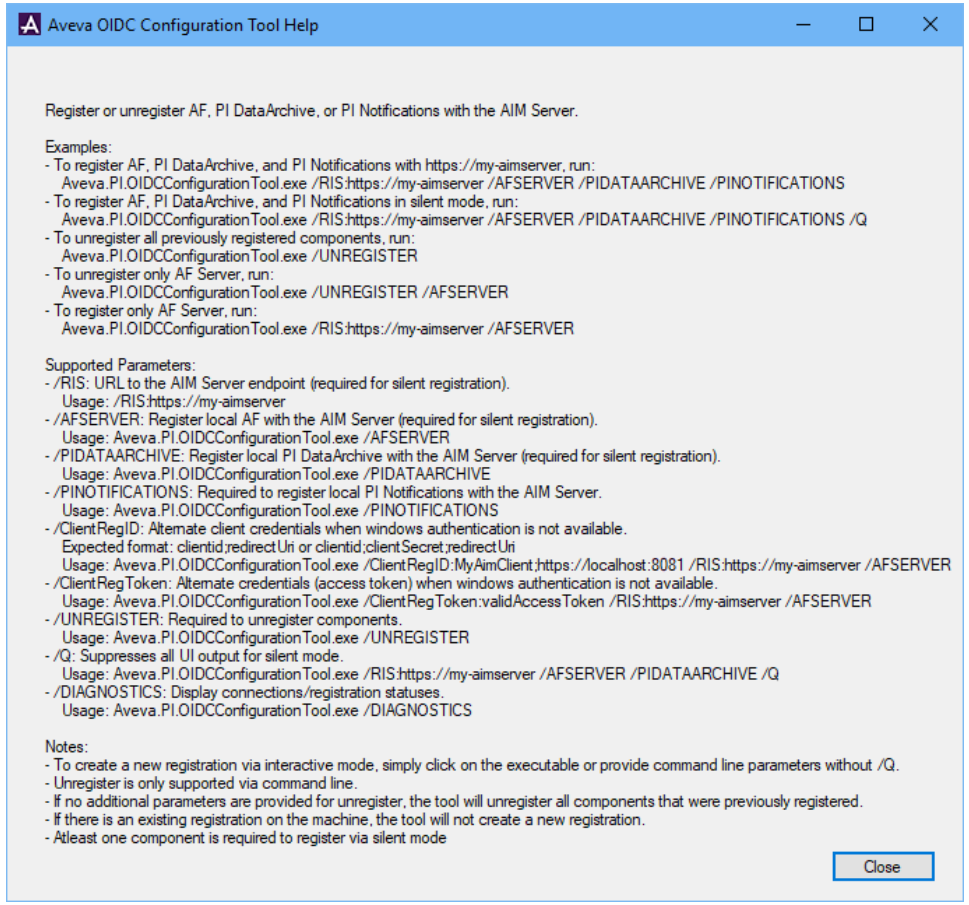
Check registration status
from Command Prompt with **/DIAGNOSTICS** parameter

Registering AVEVA™ PI Server components with AIM

AVEVA.PI.OIDCConfigurationTool.exe



Registration through Command Prompt
/RIS:<AIMServer> and **/PIDATAARCHIVE** parameters

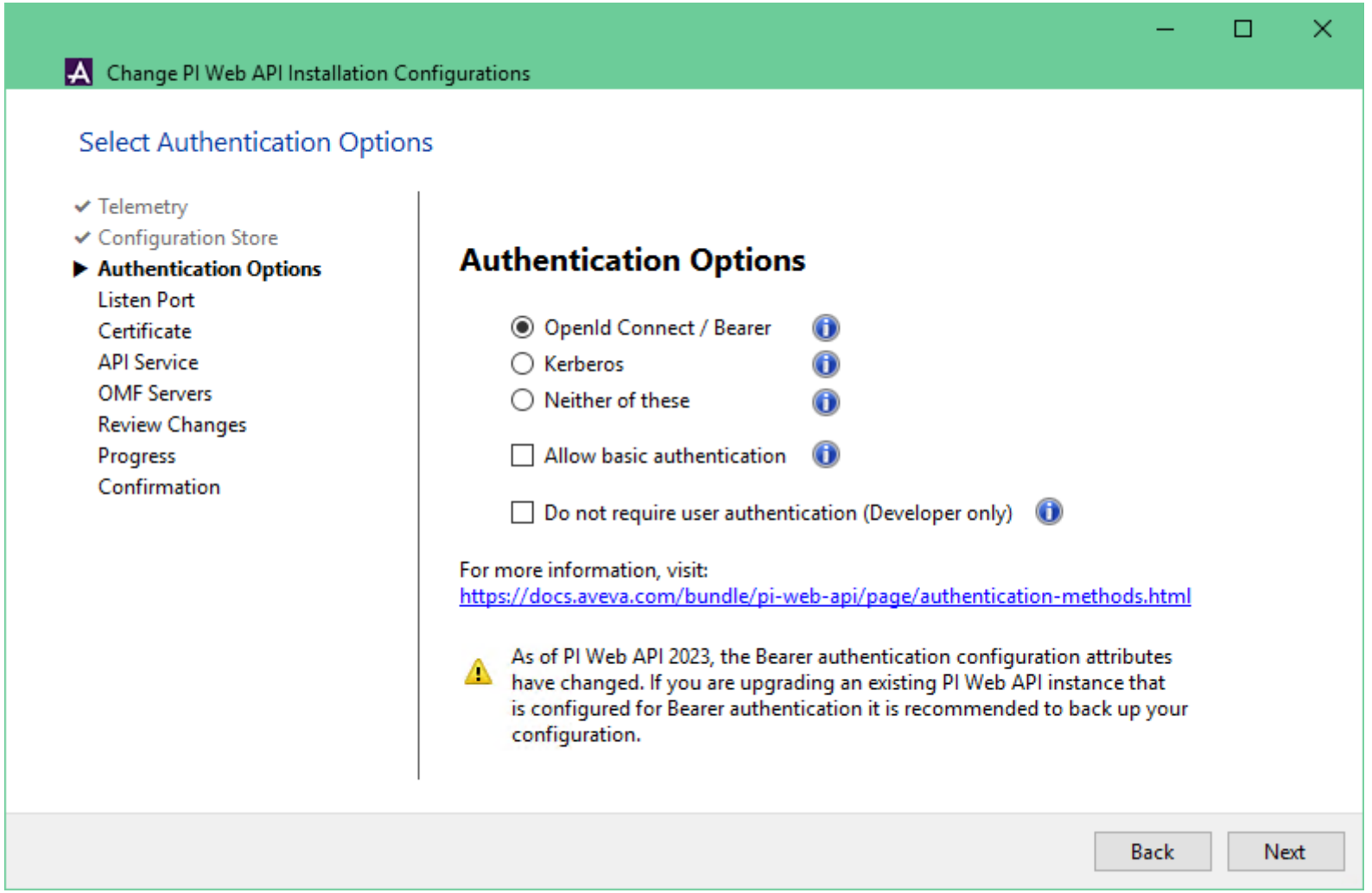


List options and examples
from Command Prompt with **/HELP** parameter

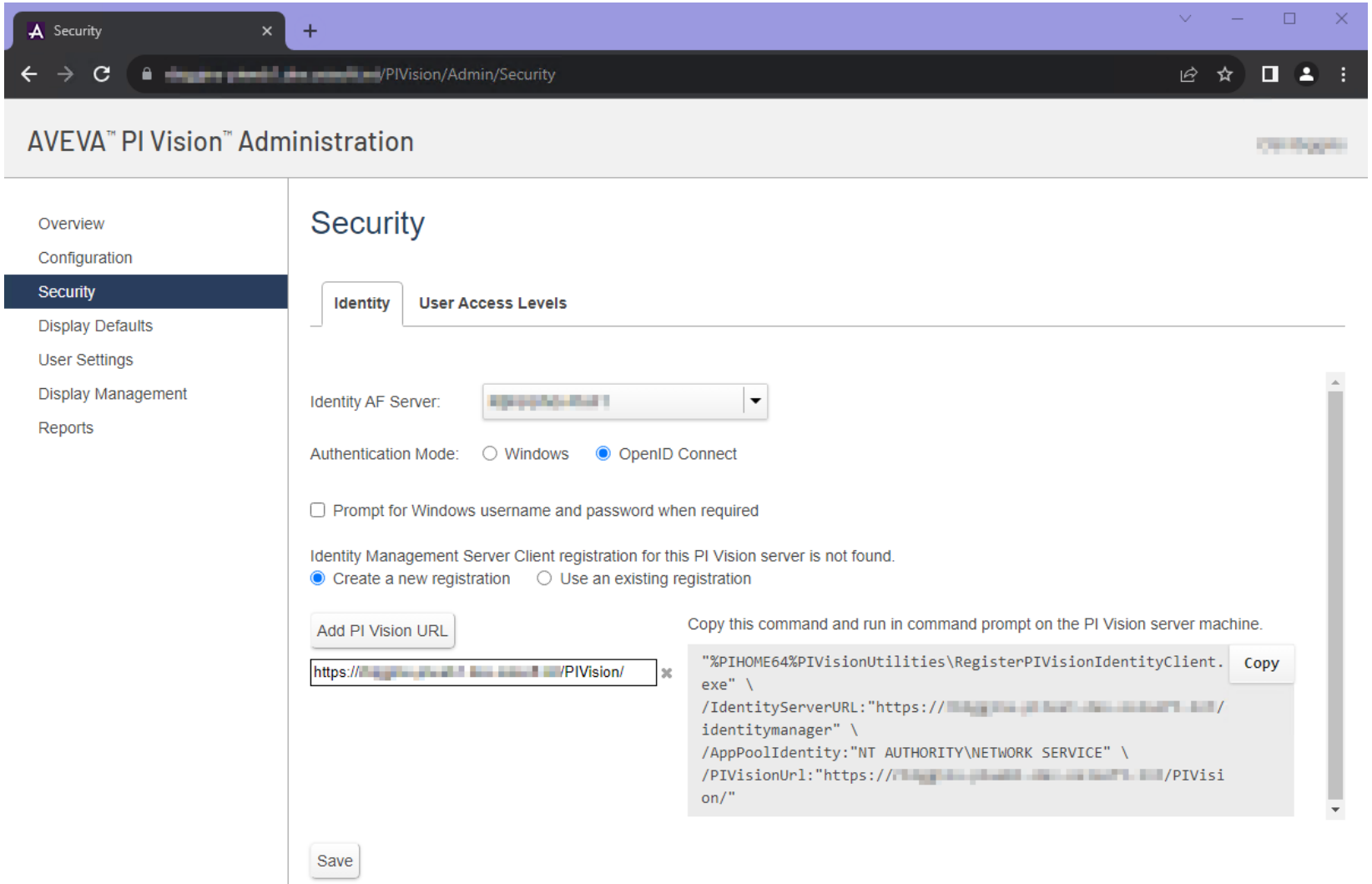
Registering PI Web API/AVEVA™ PI Vision™ with AIM

- Pre-requisite: Register the asset framework with AIM first
- PI Web API
  - Use PI Web API Admin Utility
- AVEVA PI Vision
  - Use AVEVA PI Vision admin site and registration utility

Registering PI Web API with AIM



Registering AVEVA™ PI Vision™ with AIM



Managing security access

OIDC mapping types

- AVEVA PI System and asset framework mapping via OIDC role
  - Appropriate for applications with a human user
  - OIDC roles are the user groups on the IdP
  - Will prompt for credentials upon initial connection
  - Session can persist as long as access token and refresh tokens allow (Single Sign On [SSO])
- AVEVA PI System and asset framework mapping via OIDC client ID
  - Appropriate for automated applications (PI Adapters, PI AF SDK applications, etc.)
  - Client ID and Secret (essentially the client password) are used to authenticate
    - Built into the automated application itself
    - Client ID and Secret need to be made known to AIM; Register the client details with AIM via PowerShell

Creating client IDs

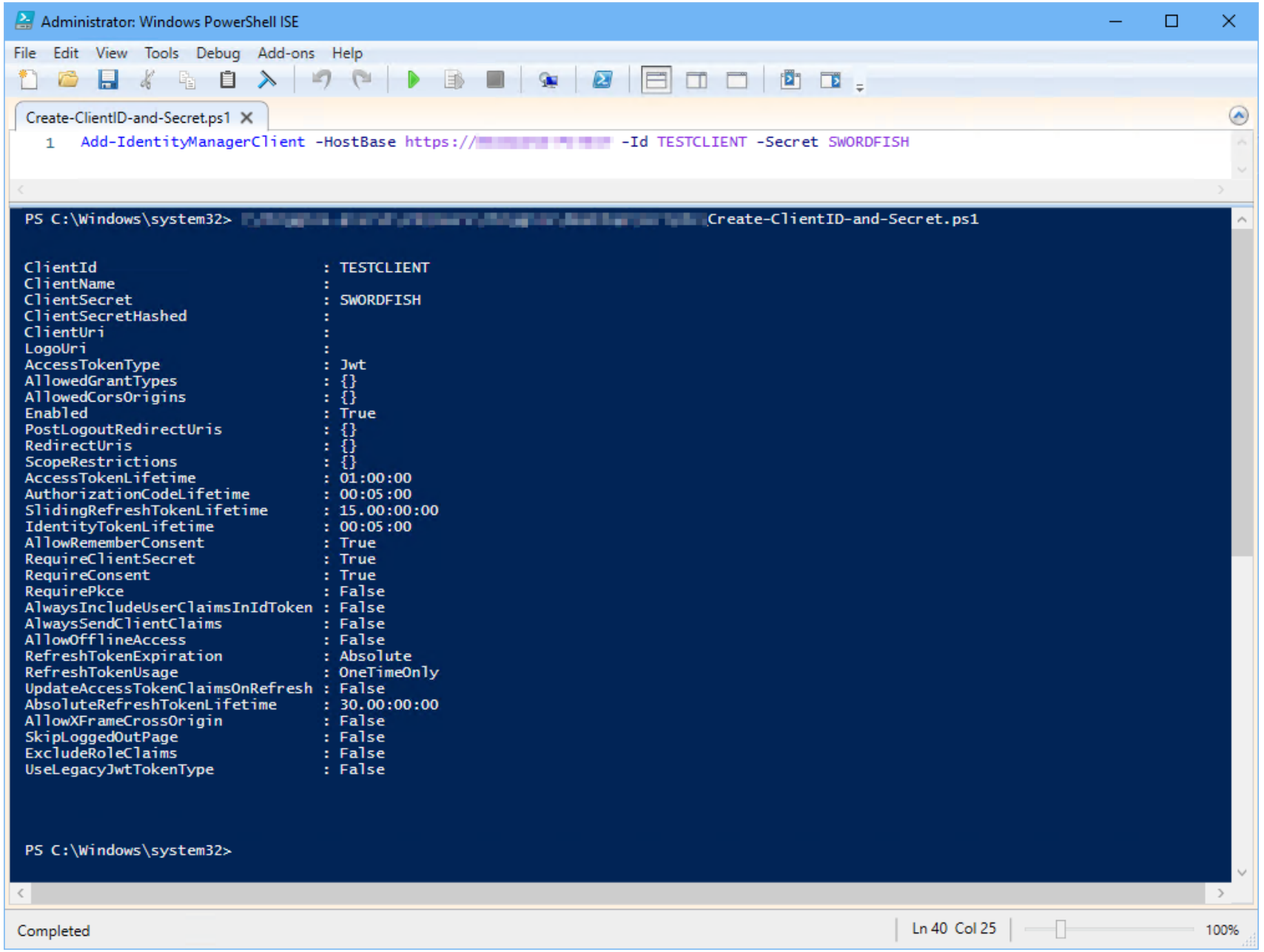
1. Open PowerShell ISE on the AIM server

2. Enter **Add-IdentityManagerClient**, then enter the required parameters for this command (the required parameters have a '*' next to them in the module window of PowerShell ISE)
    1. HostBase – The name of the AIM server; Formatted like "https://<AIMServerHostname>"
    2. Id – As in Client ID; The unique identifier of the client
    3. ***(Optional; Recommended)*** Secret – Essentially the password for the client; Known only to the client and the identity service

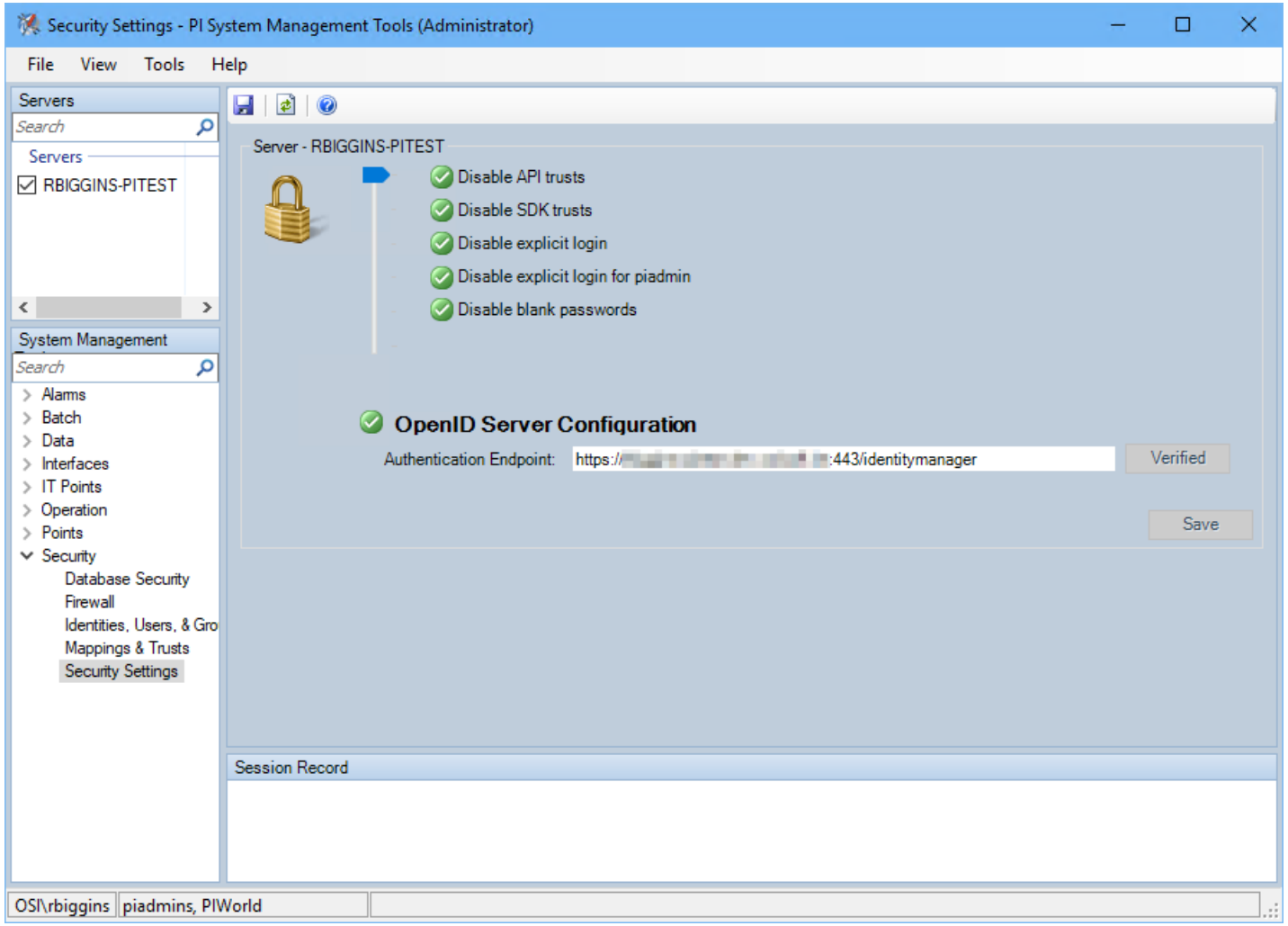
3. The client is registered with AIM and the supplied ID and secret can be used

PCS for AVEVA PI System comes packaged with a set of PowerShell commandlets that allow you to interact with PCS and make configuration changes programmatically. **Add-IdentityManagerClient** is one such example.

AVEVA

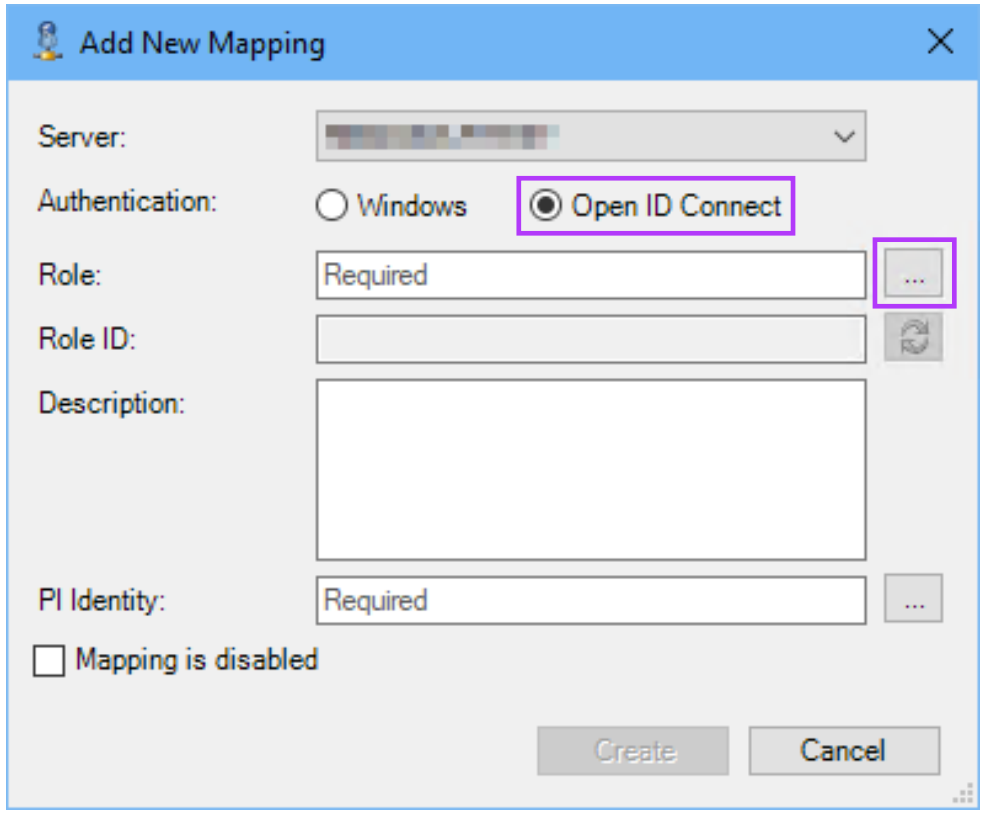


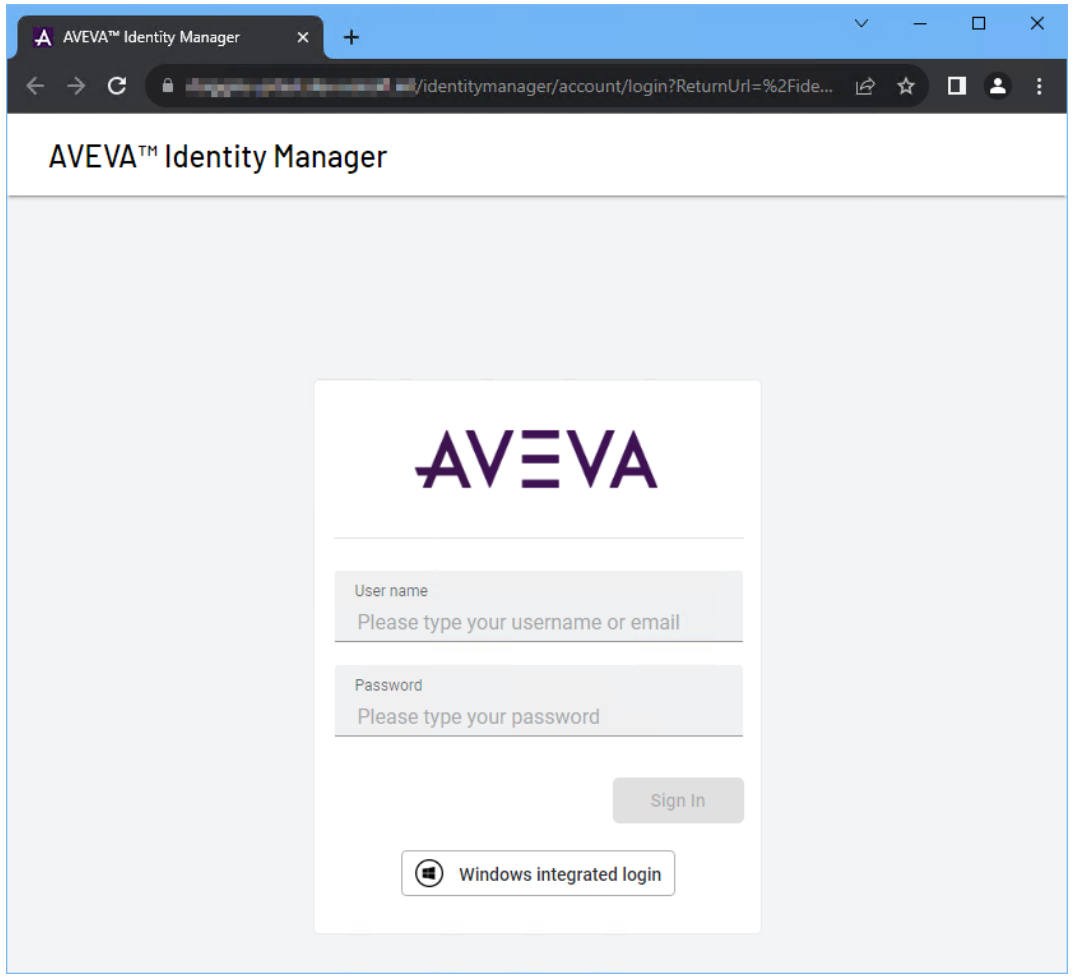
Changes to the security page in AVEVA™ PI System™ system management tools (SMT)



Creating AVEVA™ PI Data Archive mappings for OIDC

AVEVA PI System Management Tools (SMT)





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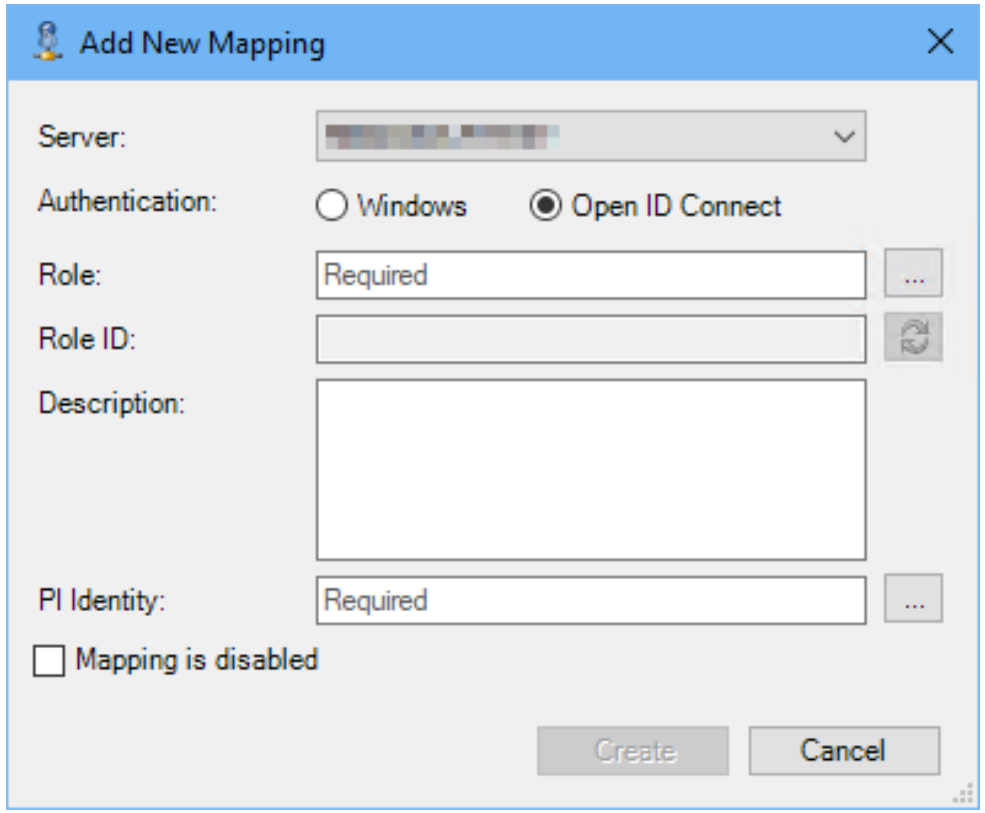

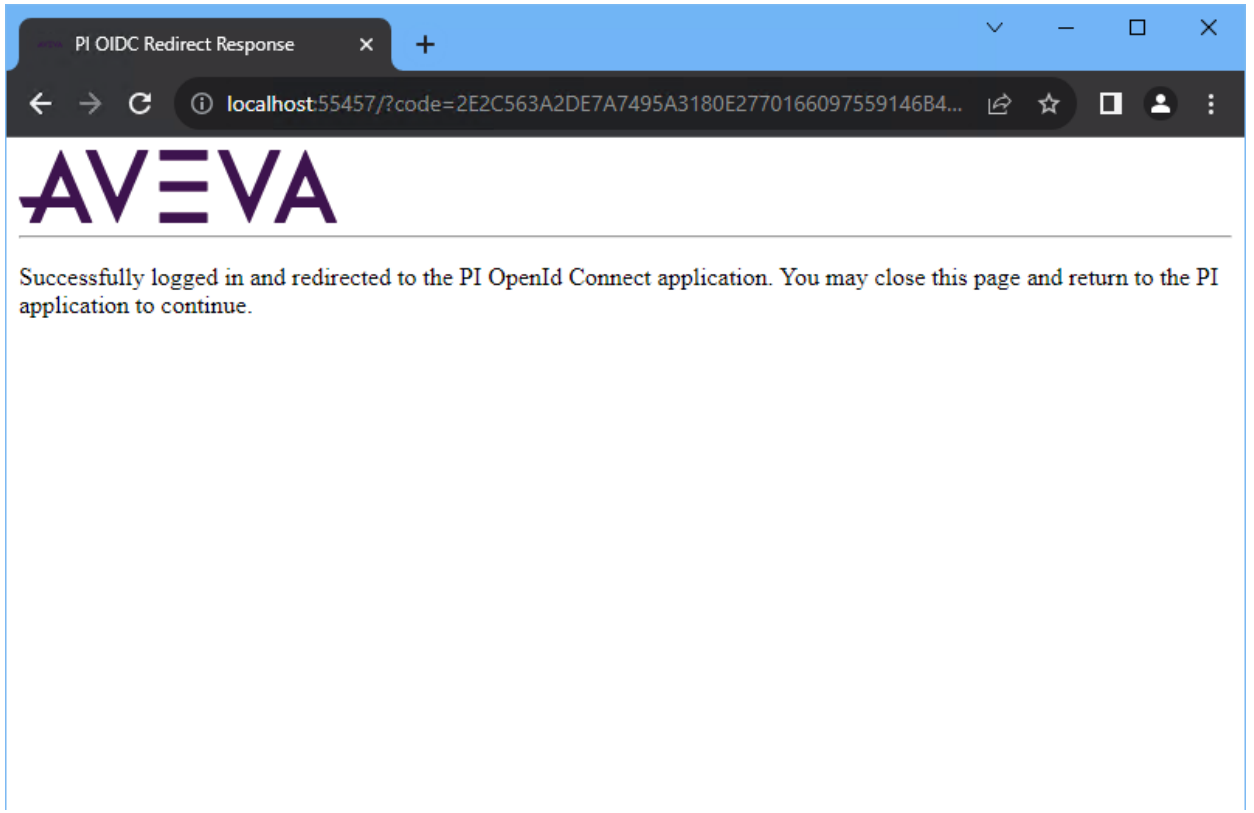

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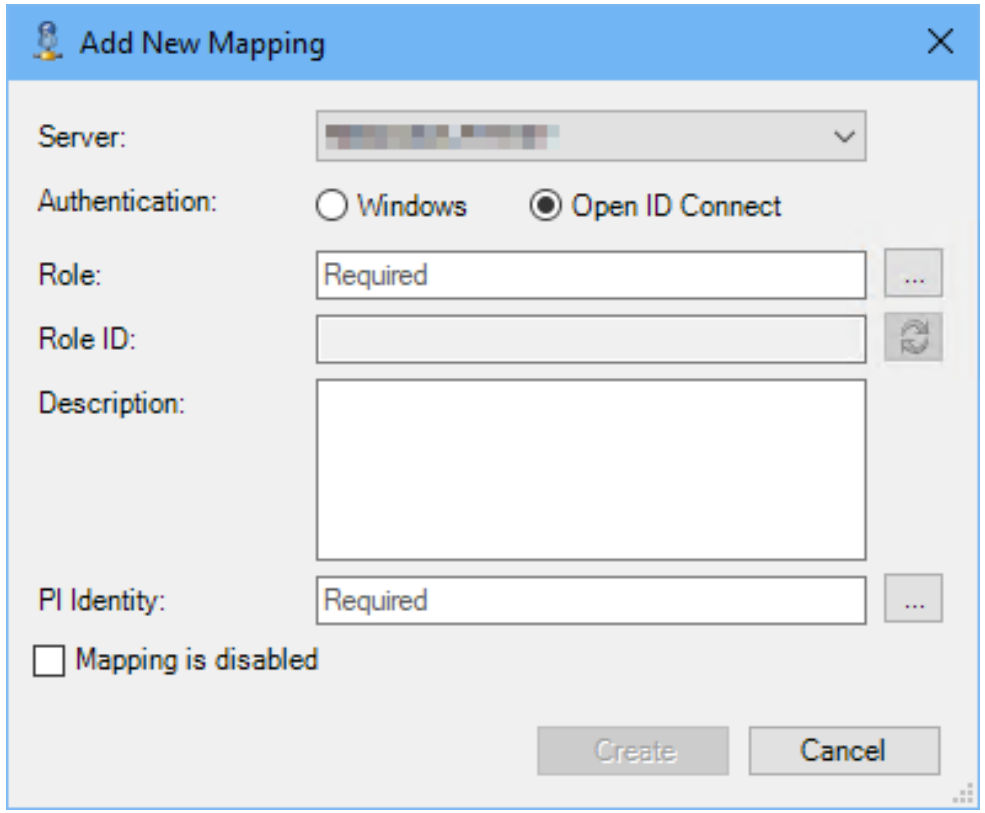

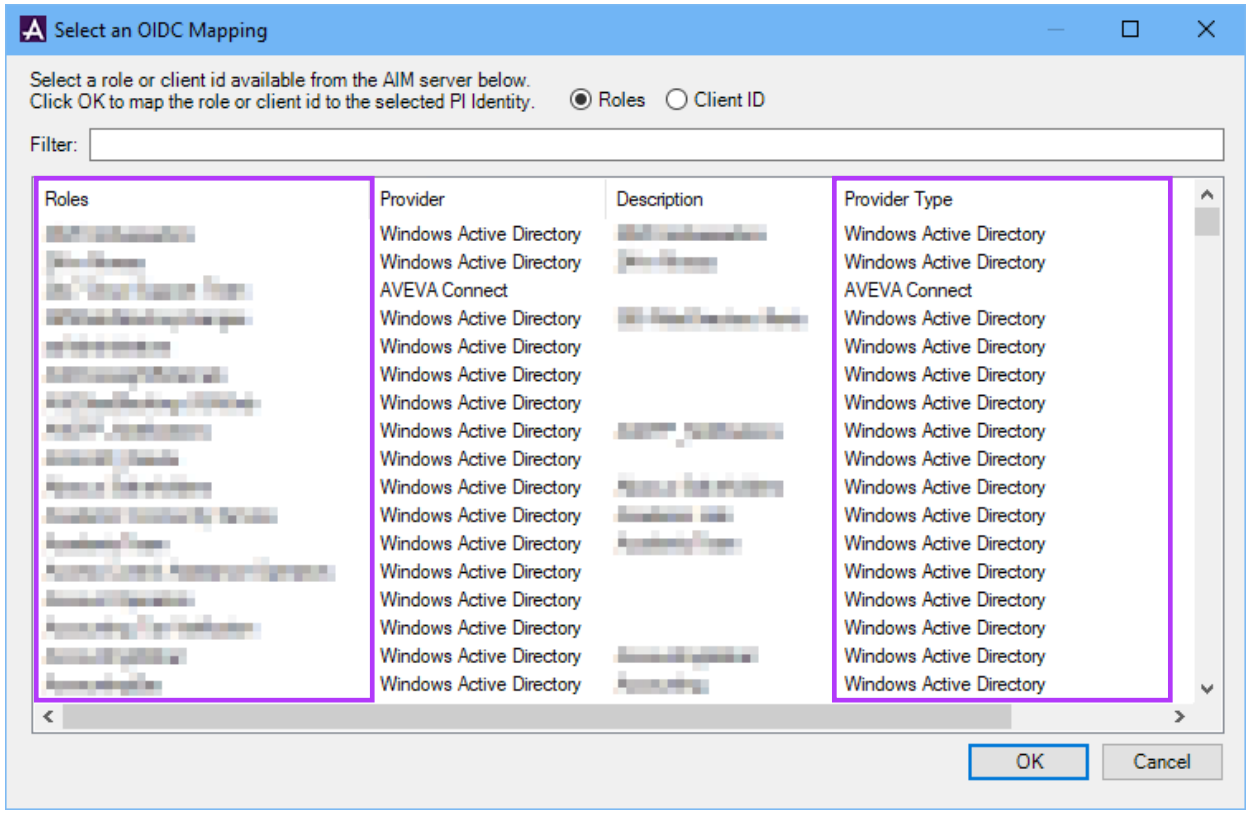

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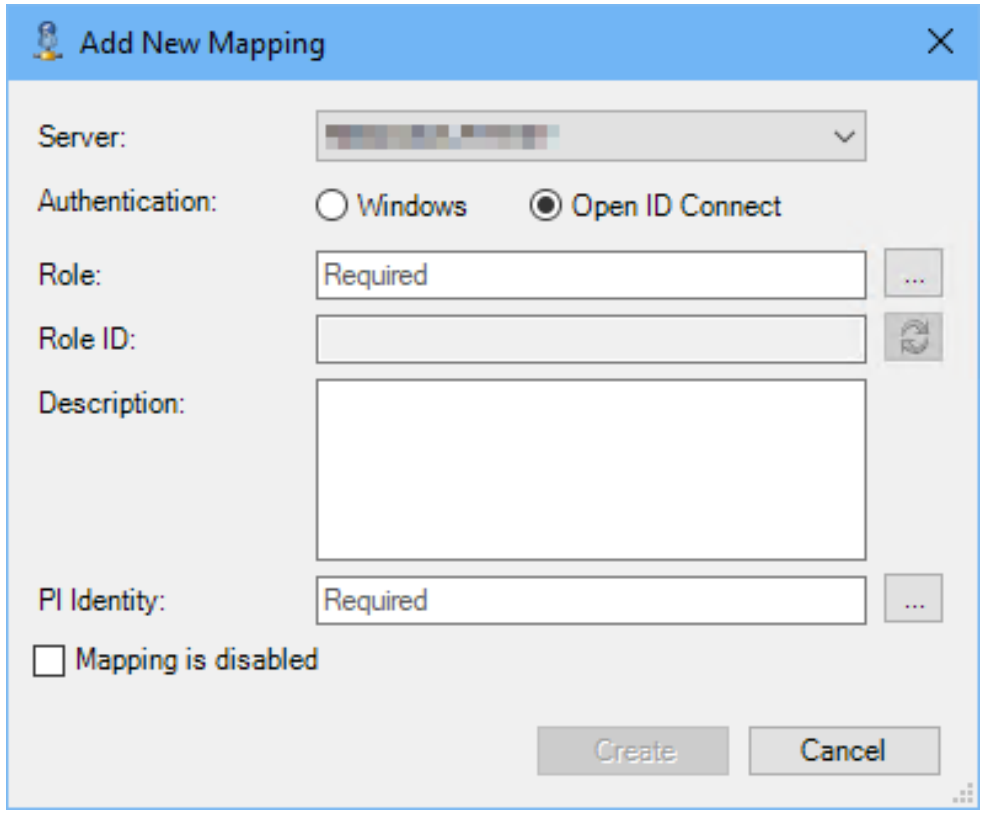

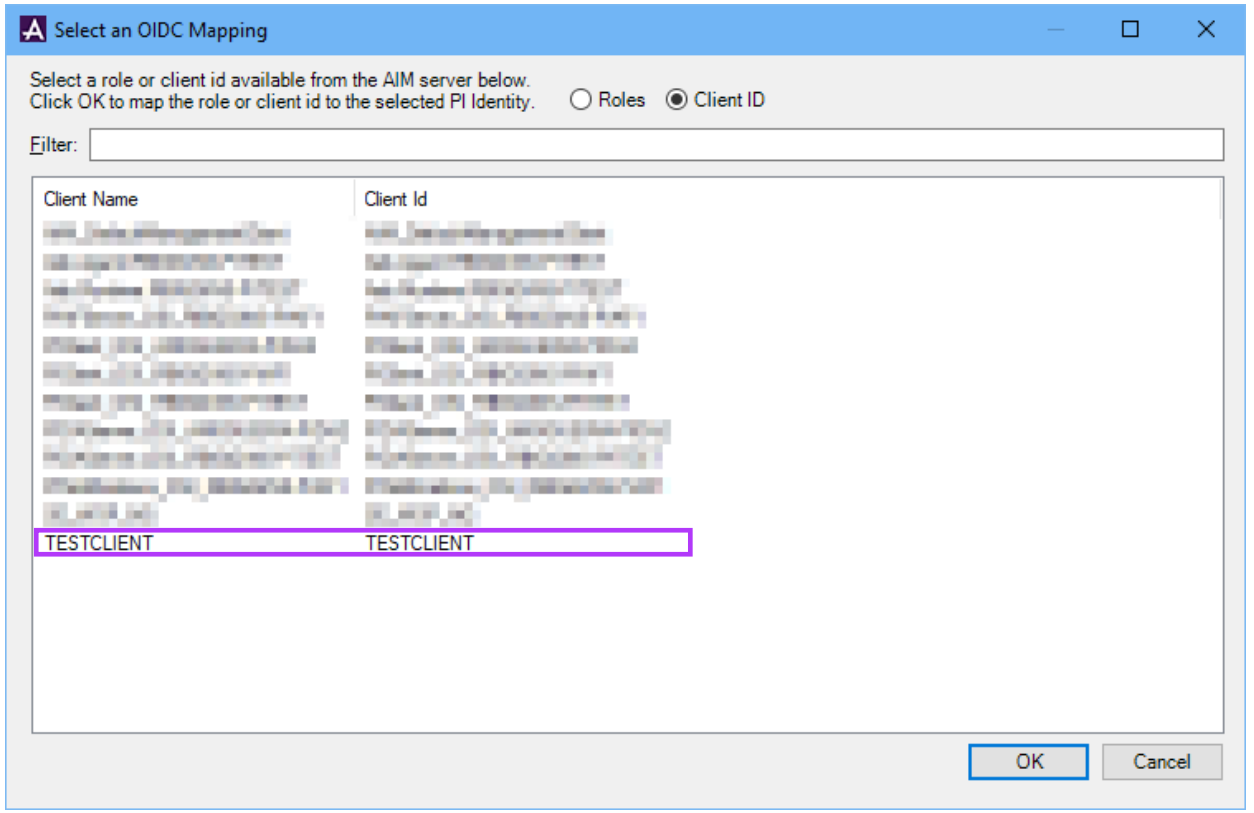

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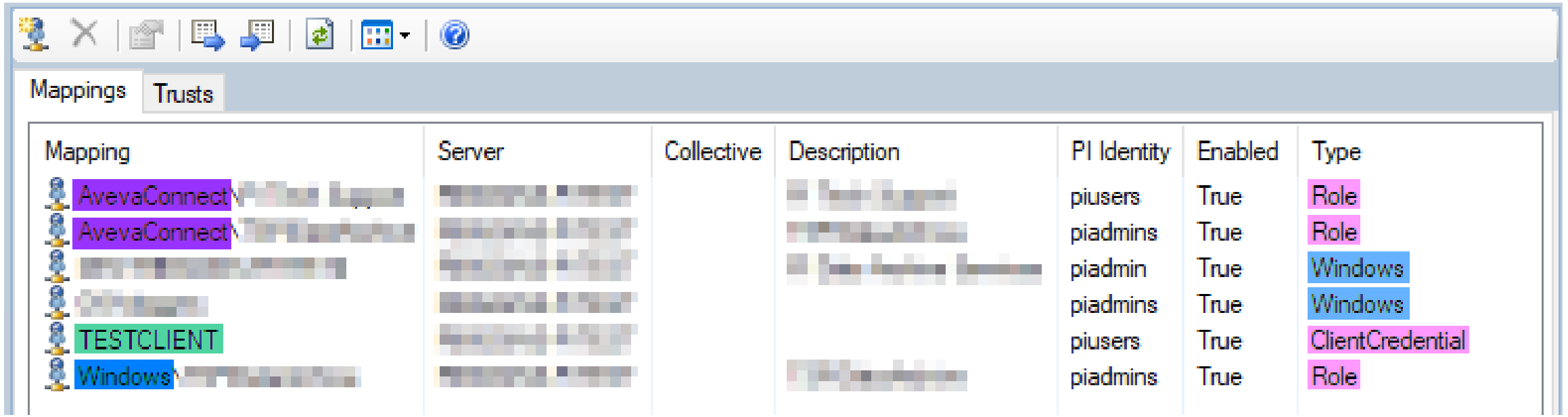
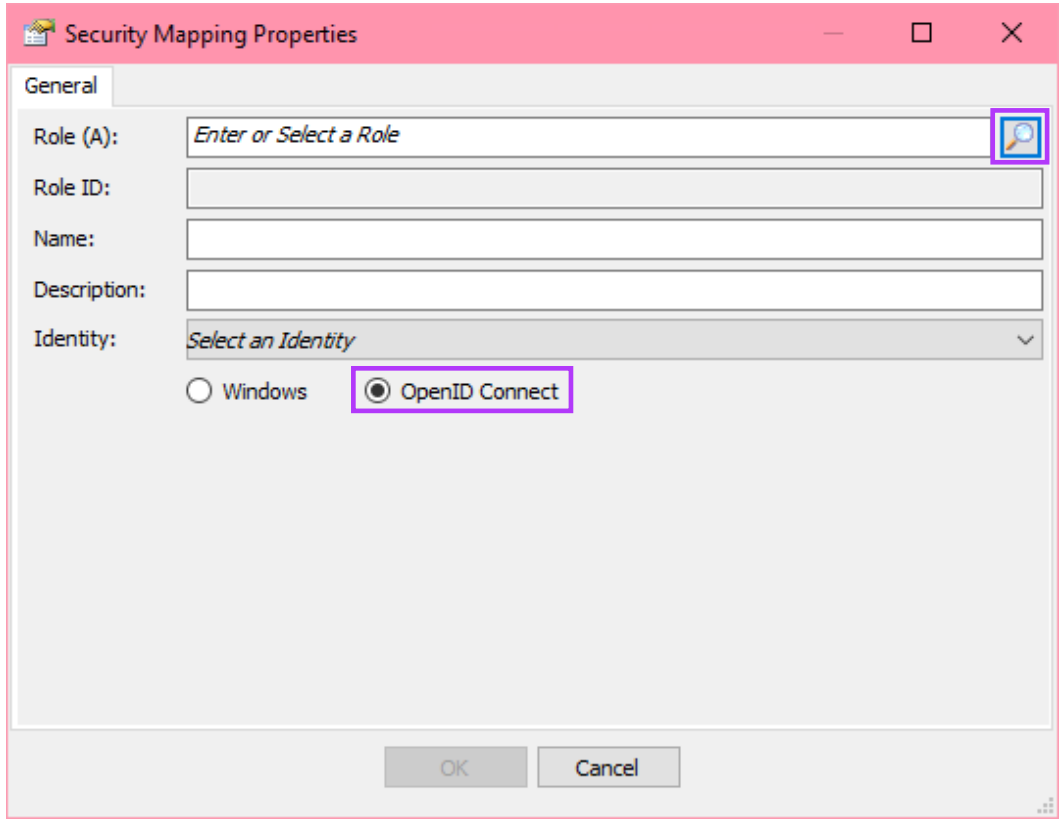
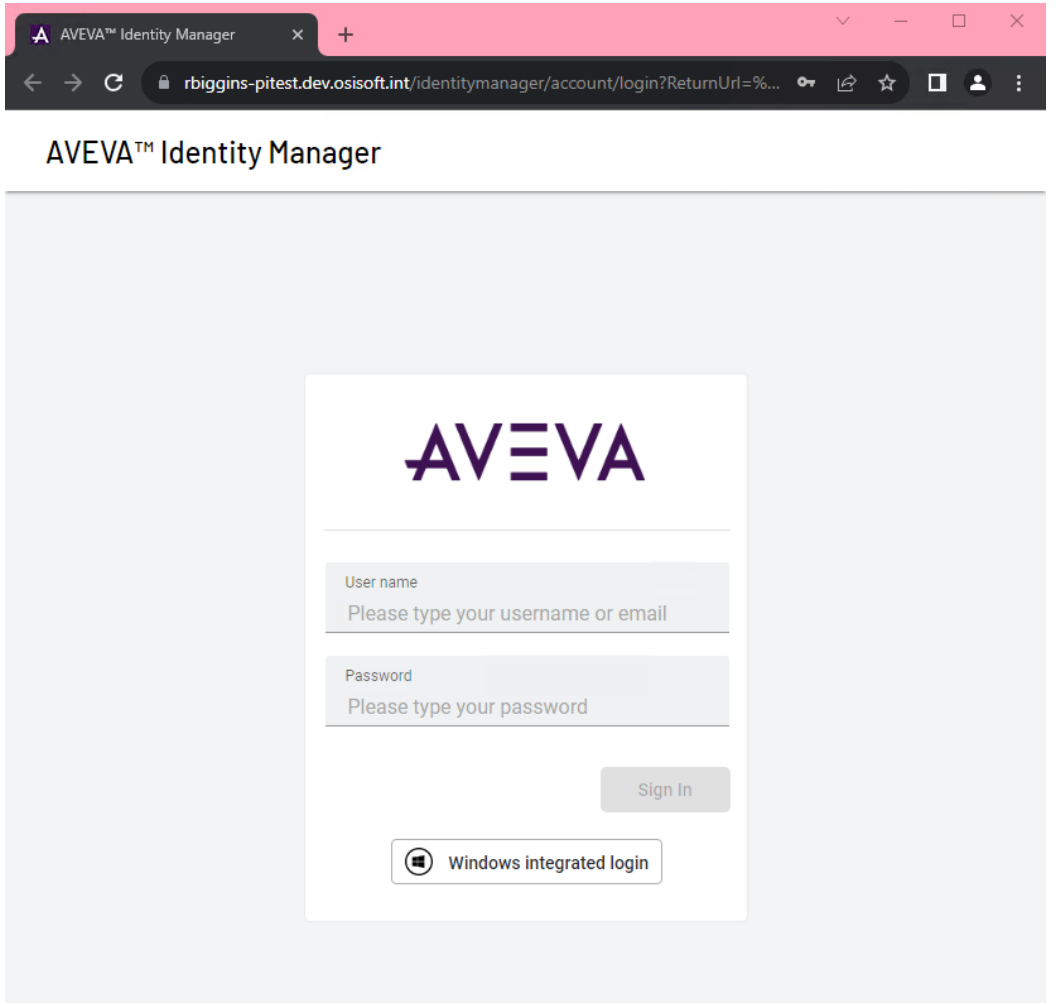


Creating asset framework mappings for OIDC

AVEVA PI System Explorer (PSE)





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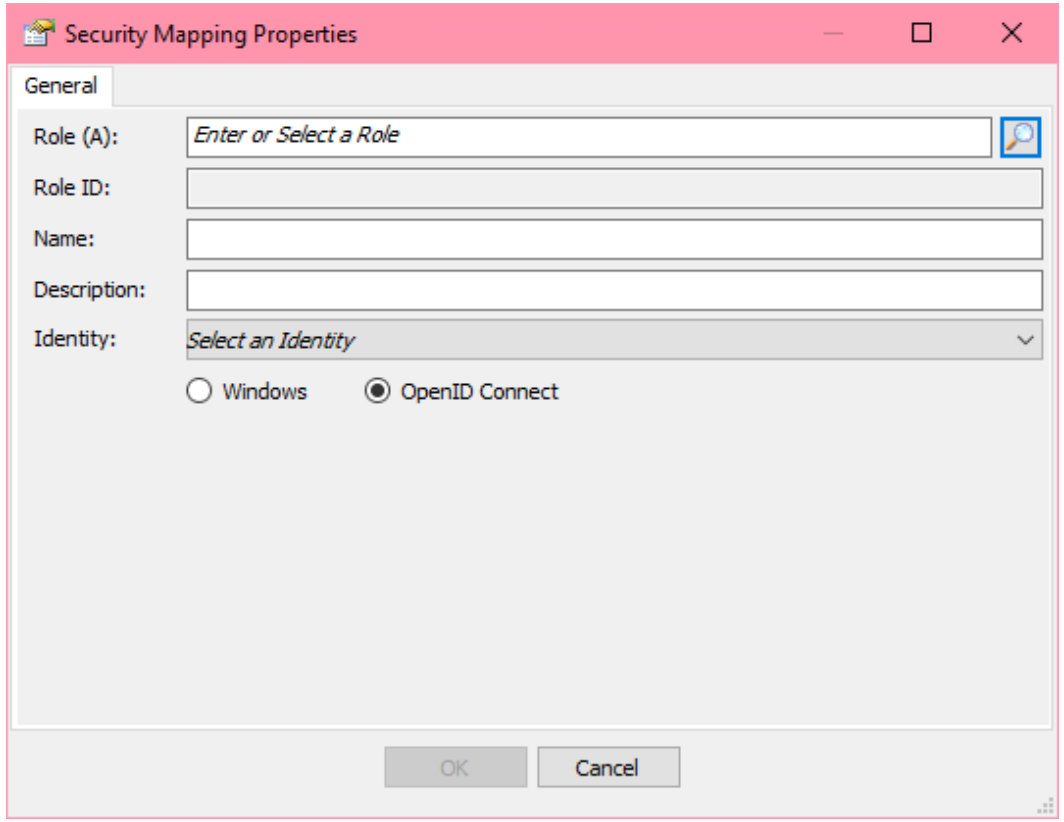
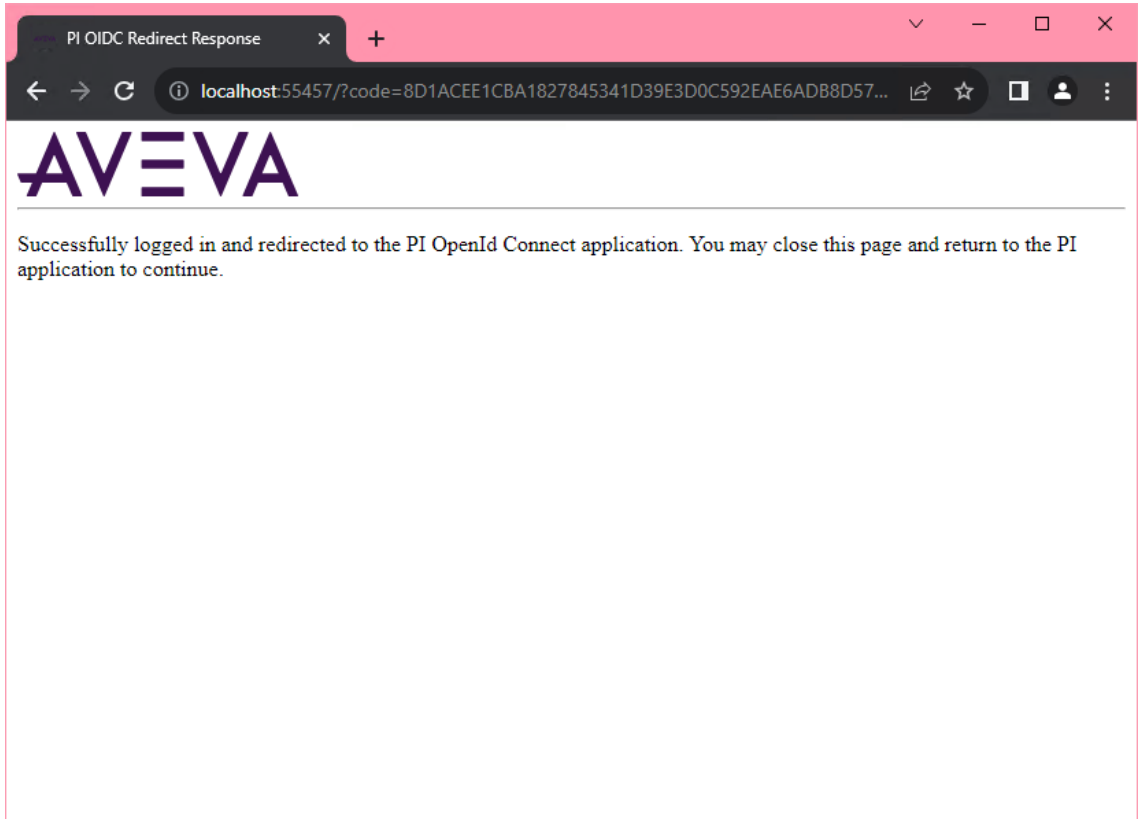
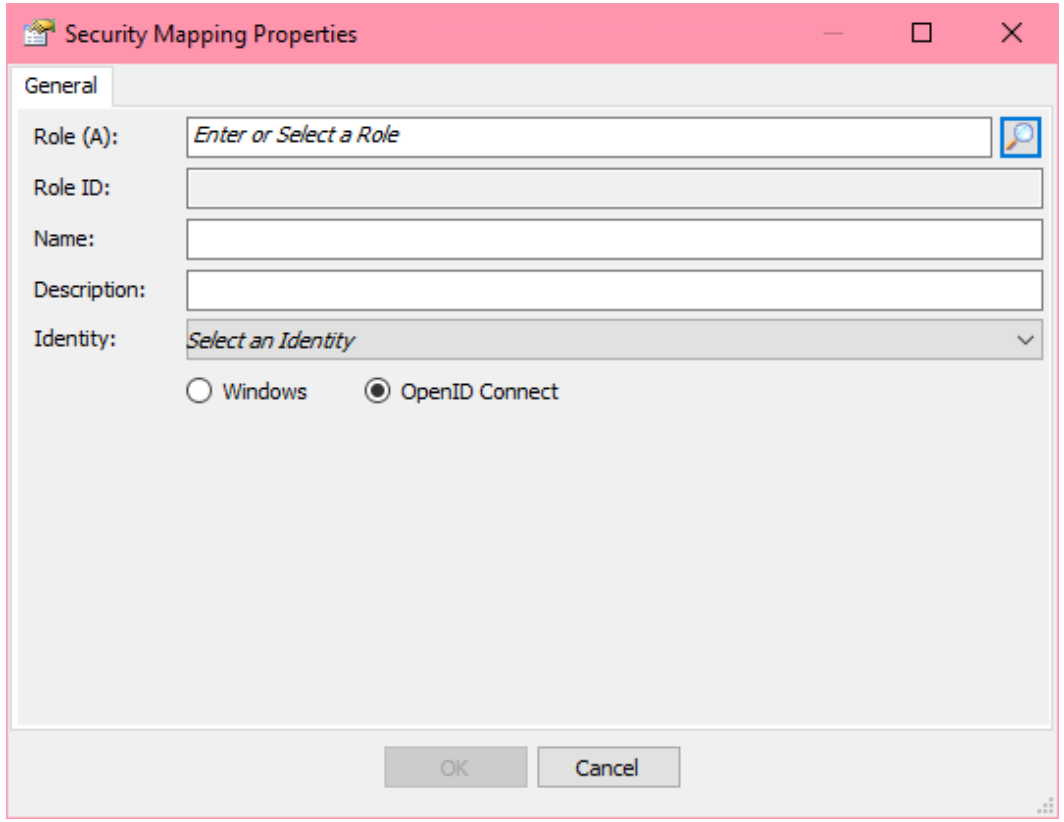
AVEVA PI System Explorer (PSE)

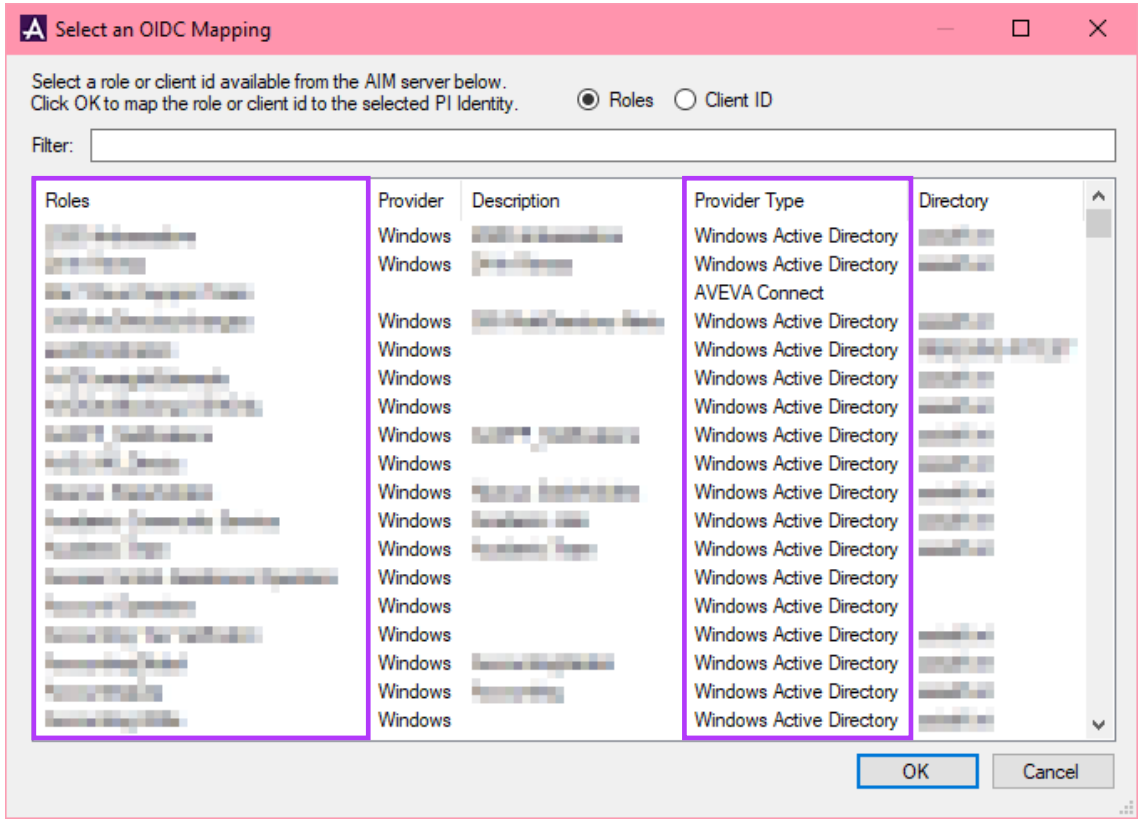




Creating asset framework mappings for OIDC

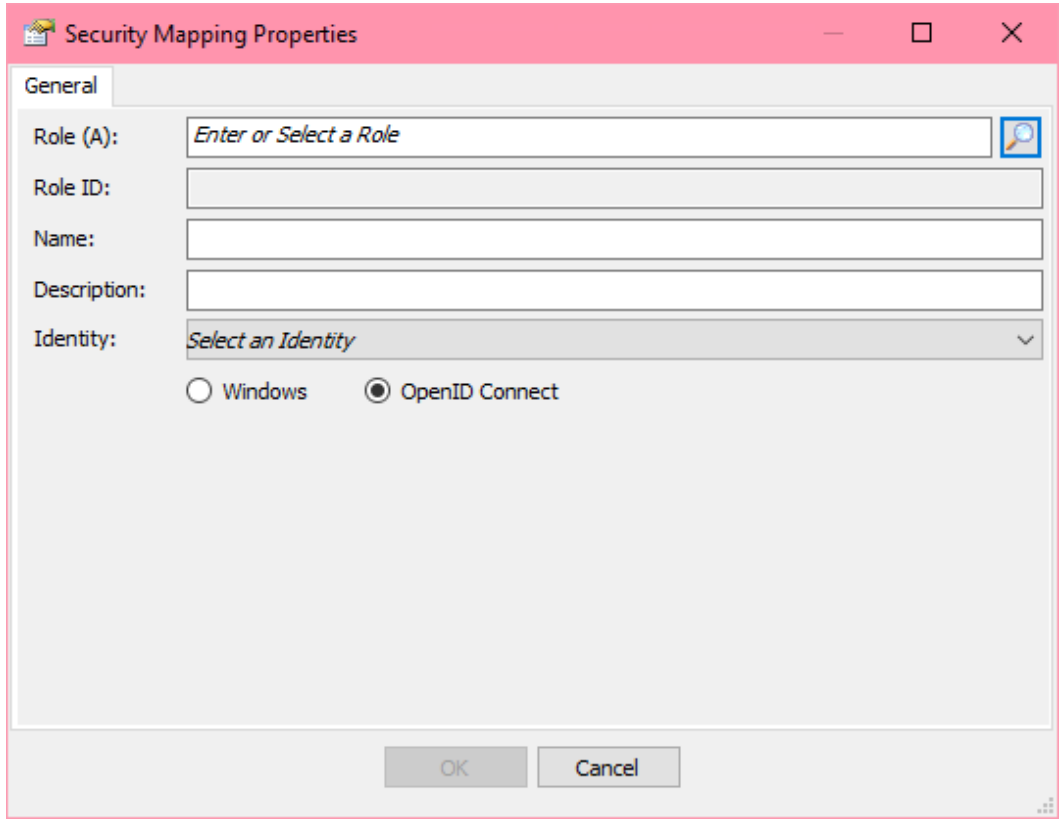
AVEVA PI System Explorer (PSE)

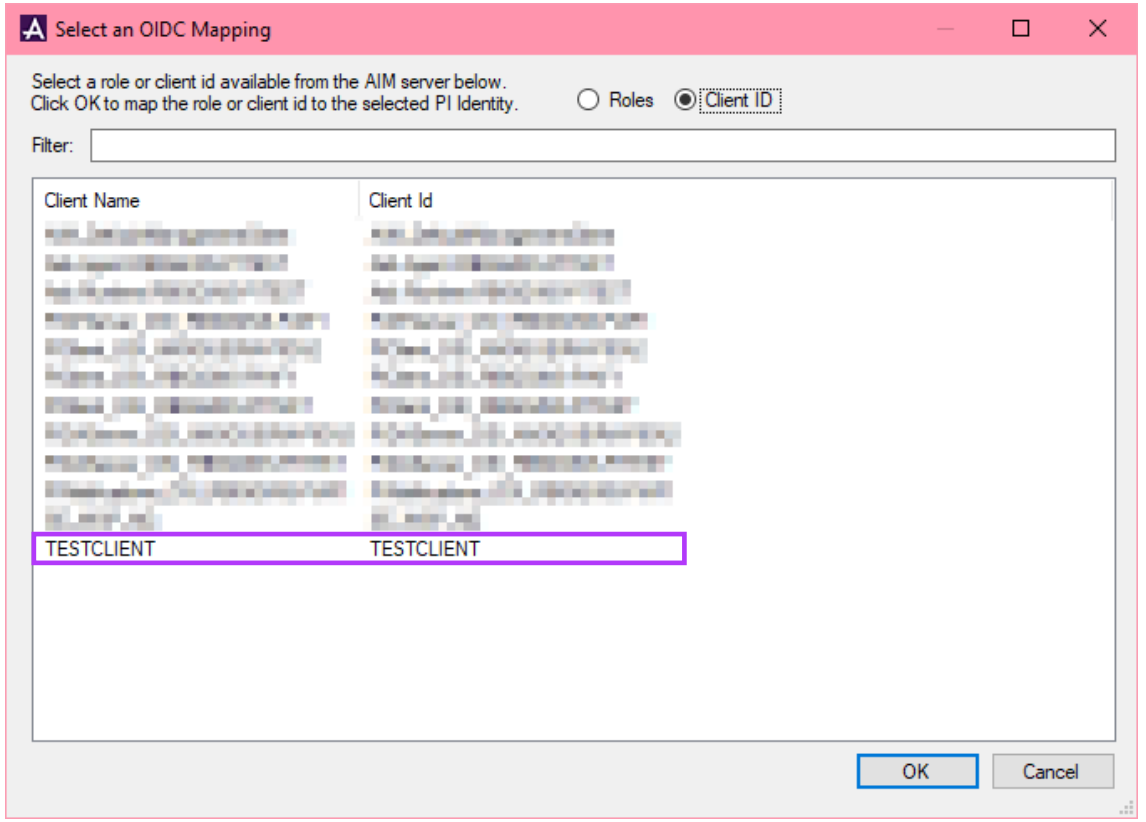




Creating asset framework mappings for OIDC

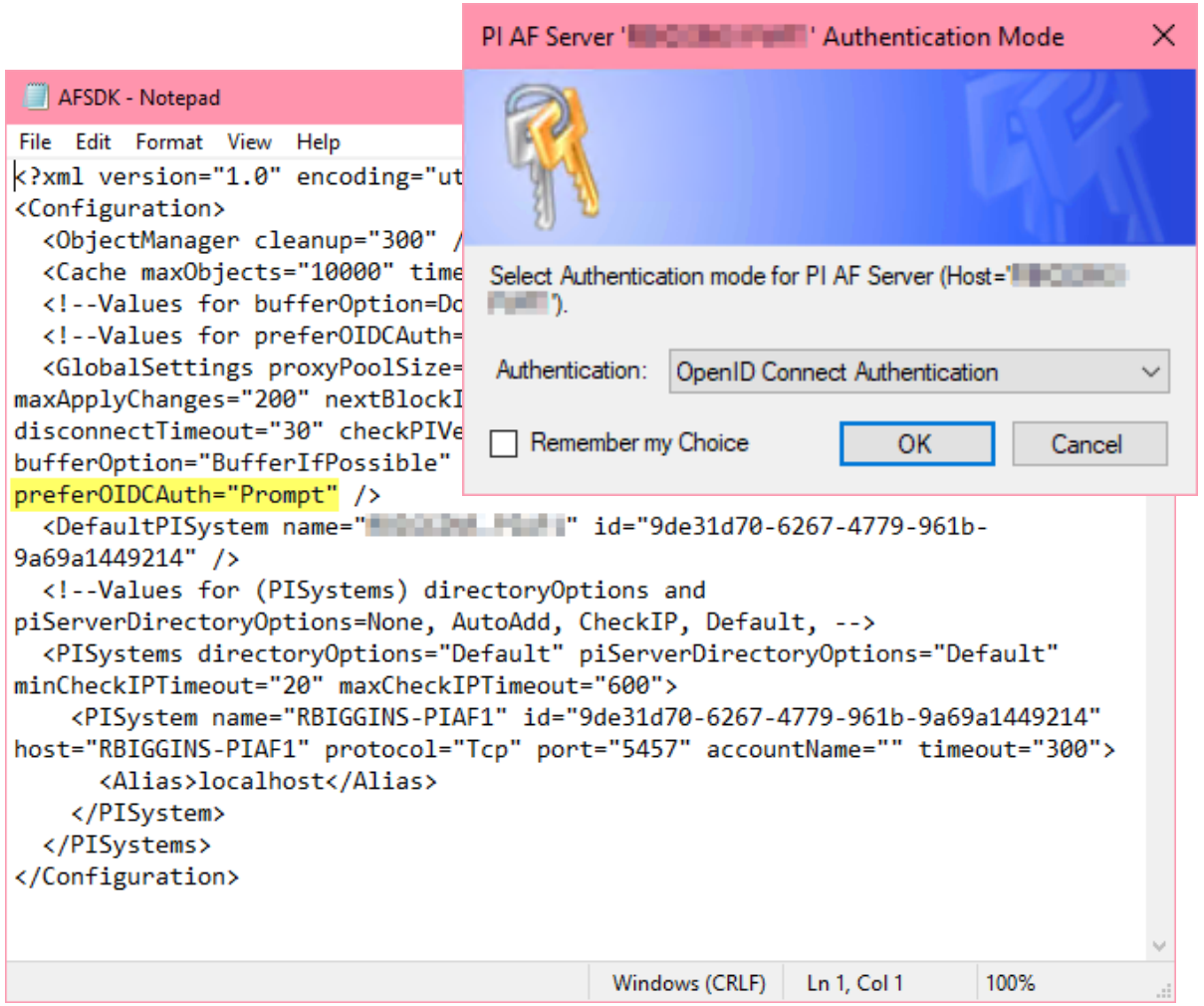
AVEVA PI System Explorer (PSE)





Set preference for PI AF SDK clients

- No popup if the certificate isn't present
- preferOIDCAuth setting in **%ProgramData%\OSIsoft\AF\AFSDK.config**
  - Client-wide setting
  - Valid settings:
    - Prompt
    - Never
    - Always



Troubleshooting

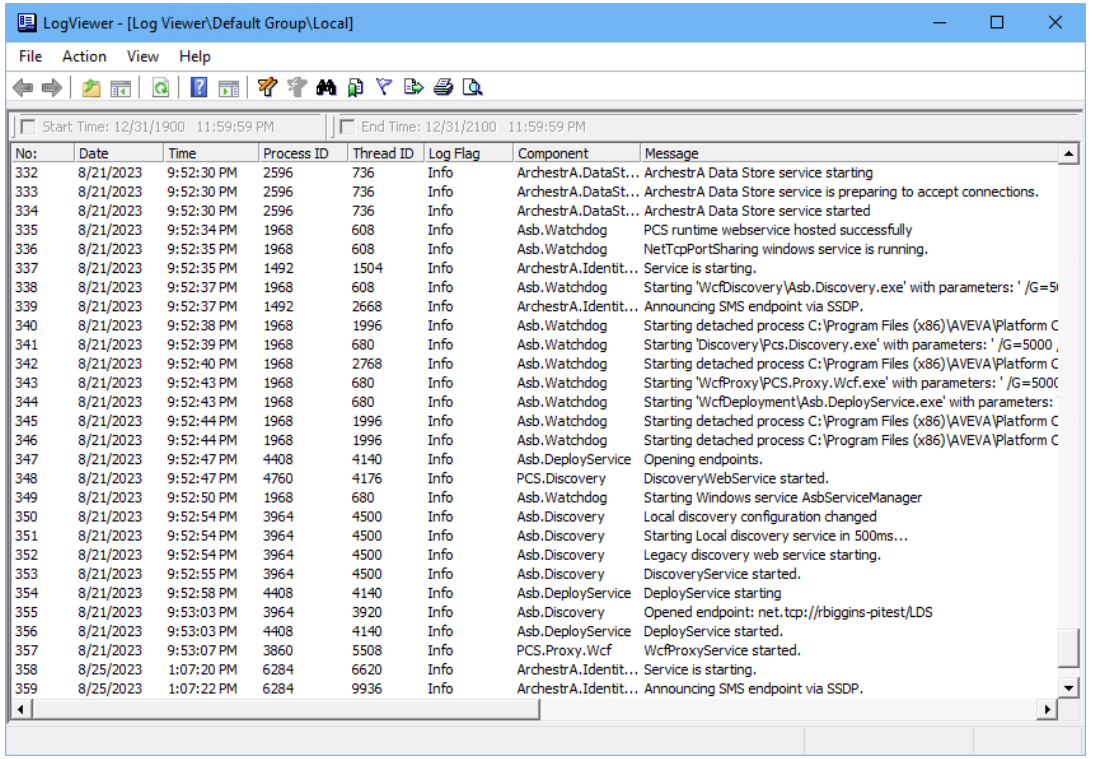
Troubleshooting tips

- Check that managing user is in the aaAdministrators group on AIM server
- Validate general network connectivity between PI Client & AIM and between PI Client & AVEVA PI Server component
- Review AVEVA PI Server component logs and AIM logs (PCS logs)
- Check that certificates are valid (for AIM and AVEVA PI Server components)
- Check that the PI Client trusts certificates (for AIM and AVEVA PI Server components)
- Check registration of AVEVA PI Server components with AIM (Locally, using **AVEVA.PI.OIDCConfigurationTool.exe**)
- Review configuration between AIM and IdP (Refer to relevant setup guide)

Logs

Authentication troubleshooting

- Check relevant AVEVA PI System application logs for OIDC authentication attempt messages
  - Asset framework (AF): Event viewer > Applications and services logs > AF
  - AVEVA PI System data archive: PIPC logs (PI SMT, PI AF SDK Utility, pigetmsg)
- Check AIM logs (PCS logs)
  - Use ArchestrA log viewer (aaLogViewer)
  - Local to AIM server
  - Can increase logging level to get more information



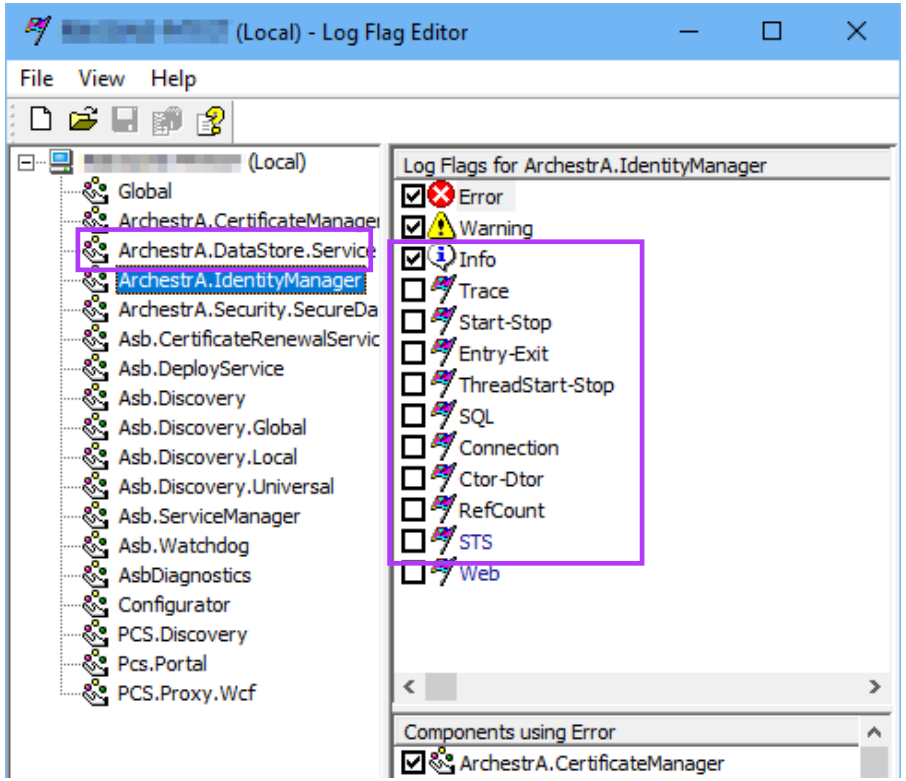
No:	Date	Time	Process ID	Thread ID	Log Flag	Component	Message
332	8/21/2023	9:52:30 PM	2596	736	Info	ArchestrA.DataSt...	ArchestrA Data Store service starting
333	8/21/2023	9:52:30 PM	2596	736	Info	ArchestrA.DataSt...	ArchestrA Data Store service is preparing to accept connections.
334	8/21/2023	9:52:30 PM	2596	736	Info	ArchestrA.DataSt...	ArchestrA Data Store service started
335	8/21/2023	9:52:34 PM	1968	608	Info	Asb.Watchdog	PCS runtime webservice hosted successfully
336	8/21/2023	9:52:35 PM	1968	608	Info	Asb.Watchdog	NetTcpPortSharing windows service is running.
337	8/21/2023	9:52:35 PM	1492	1504	Info	ArchestrA.Identit...	Service is starting.
338	8/21/2023	9:52:37 PM	1968	608	Info	Asb.Watchdog	Starting 'WcfDiscovery\Asb.Discovery.exe' with parameters: ' /G=5
339	8/21/2023	9:52:37 PM	1492	2668	Info	ArchestrA.Identit...	Announcing SMS endpoint via SSDP.
340	8/21/2023	9:52:38 PM	1968	1996	Info	Asb.Watchdog	Starting detached process C:\Program Files (x86)\AVEVA\Platform C
341	8/21/2023	9:52:39 PM	1968	680	Info	Asb.Watchdog	Starting 'Discovery\Pcs.Discovery.exe' with parameters: ' /G=5000 ,
342	8/21/2023	9:52:40 PM	1968	2768	Info	Asb.Watchdog	Starting detached process C:\Program Files (x86)\AVEVA\Platform C
343	8/21/2023	9:52:43 PM	1968	680	Info	Asb.Watchdog	Starting 'WcfProxy\PCS.Proxy.Wcf.exe' with parameters: ' /G=500(
344	8/21/2023	9:52:43 PM	1968	680	Info	Asb.Watchdog	Starting 'WcfDeployment\Asb.DeployService.exe' with parameters:
345	8/21/2023	9:52:44 PM	1968	1996	Info	Asb.Watchdog	Starting detached process C:\Program Files (x86)\AVEVA\Platform C
346	8/21/2023	9:52:44 PM	1968	1996	Info	Asb.Watchdog	Starting detached process C:\Program Files (x86)\AVEVA\Platform C
347	8/21/2023	9:52:47 PM	4408	4140	Info	Asb.DeployService	Opening endpoints.
348	8/21/2023	9:52:47 PM	4760	4176	Info	PCS.Discovery	DiscoveryWebService started.
349	8/21/2023	9:52:50 PM	1968	680	Info	Asb.Watchdog	Starting Windows service AsbServiceManager
350	8/21/2023	9:52:54 PM	3964	4500	Info	Asb.Discovery	Local discovery configuration changed
351	8/21/2023	9:52:54 PM	3964	4500	Info	Asb.Discovery	Starting Local discovery service in 500ms...
352	8/21/2023	9:52:54 PM	3964	4500	Info	Asb.Discovery	Legacy discovery web service starting.
353	8/21/2023	9:52:55 PM	3964	4500	Info	Asb.Discovery	DiscoveryService started.
354	8/21/2023	9:52:58 PM	4408	4140	Info	Asb.DeployService	DeployService starting
355	8/21/2023	9:53:03 PM	3964	3920	Info	Asb.Discovery	Opened endpoint: net.tcp://rbiggins-pitest/LDS
356	8/21/2023	9:53:03 PM	4408	4140	Info	Asb.DeployService	DeployService started.
357	8/21/2023	9:53:07 PM	3860	5508	Info	PCS.Proxy.Wcf	WcfProxyService started.
358	8/25/2023	1:07:20 PM	6284	6620	Info	ArchestrA.Identit...	Service is starting.
359	8/25/2023	1:07:22 PM	6284	9936	Info	ArchestrA.Identit...	Announcing SMS endpoint via SSDP.

aaLogViewer application

Increase logging level for PCS logs

AIM troubleshooting

1. Open the **appsettings.json** file
   - Located at **C:\Program Files (x86)\AVEVA\Platform Common Services\Management Server\appsettings.json**
2. Take a copy of the **appsettings.json** file
3. Locate and change the LogLevel of Logging section to ”Trace”
4. Open the ArchestrA Log Viewer
   - Located at **C:\Program Files (x86)\Common Files\ArchestrA\aaLogViewer.exe**
5. Go to **Actions > Log Flags** and enable all log flags for **ArchestrA.IdentityManager** component
6. Perform your test and export the log as an ***.aaLGX** file
7. Revert the logging level back to default settings when finished



aaLogViewer application

Full steps in [How to enable SMS tracing]

Questions?

Please wait for the microphone.

State your name and company.

Please remember to…

Navigate to this session in the mobile app to complete the survey.

Thank you!

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