

Matrikon® Data Broker Adapter for OPC to UA

Version 1.0.0

User Manual



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DOCUMENT VERSION - Version: 1.0

SOFTWARE VERSION - Version: 1.0

1.1 Document revision history

Table 1

Version	Supported Release	Date	Description	
1.0.0	1.0.0	2024-05	New Document	

1.2 Related documents and resources

This document contains information from the following resources

- www.opcfoundation.org
- www.matrikonopc.com

There are references found in these documents.

- Matrikon Data Broker User Manual
- Matrikon Data Broker Licensing Guide

1.3 Intended audience

This manual provides reference information and usage instructions for all users of the MDB Adapter for OPC to UA.

1.4 Document Scope

The User Manual for the MDB Adapter for OPC to UA serves as both a user guide and a reference manual for the Adapter.

The user guide contains detailed instructions for carrying out basic tasks for using the adapter, including:

- Installation
- Connection to MDB
- Managing users
- Configuring Adapter connections

For instructions on tasks related to data mapping and advanced features of the Adapter and MDB, refer to the MDB User Manual.

The reference section of this document contains information on all features of the Adapter, which include:

- Supported connection types
- Available options
- OPC UA compliance
- OPC to UA communication
- Server status, statistical, and control items

Wherever applicable, the descriptions of features contain links to the relevant user instructions in the Using the Adapter section.

1.5 Document Navigation

All entries in the Table of Contents, List of Figures, and List of Tables contain cross-references to relevant details.

You can find the TOC on the left to navigate through the document.

1.6 Document Conventions

1.6.1 Admonishments

	NOTE - This symbol indicates more information that you need to consider when using this product or a feature of the product.
	INFO - This symbol indicates additional information about the product or feature of the product.
	CAUTION - This symbol indicates that an incorrect action can result in an error or unintended or unwanted operation of the product or a product feature.



WARNING - This symbol indicates that care must be taken to avoid an incorrect action that can result in serious system errors, including catastrophic failure!

1.6.2 Terms and Abbreviations

Table 2 Terms and Abbreviations

Abbreviation	Description
COM	Component Object Model. A method to organize software and specify how to build the components that can dynamically interchange.
DA	OPC Data Access. It provides access to real-time process data.
DCOM	Distributed Component Object Model. It is an extension of COM that allows communication between COM components over a network.
DDE	Dynamic Data Exchange. It enables the transfer of data between two running applications.
HDA	OPC UA Historical Data Access.
HMI	Human Machine Interface. A device that allows interaction between you and the machine. It is typically used in process control applications.
OPC	It is a communication standard. Refer to the link for more information [http://www.opcfoundation.org/].

1.7 Privacy Statement

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Please see the following link for the complete [Privacy Statement](#) .

INTRODUCTION TO THE MDB ADAPTER FOR OPC TO UA

The MDB Adapter for OPC to UA provides access to field devices compatible with the OPC to UA protocol.

2.1 Adapter architecture

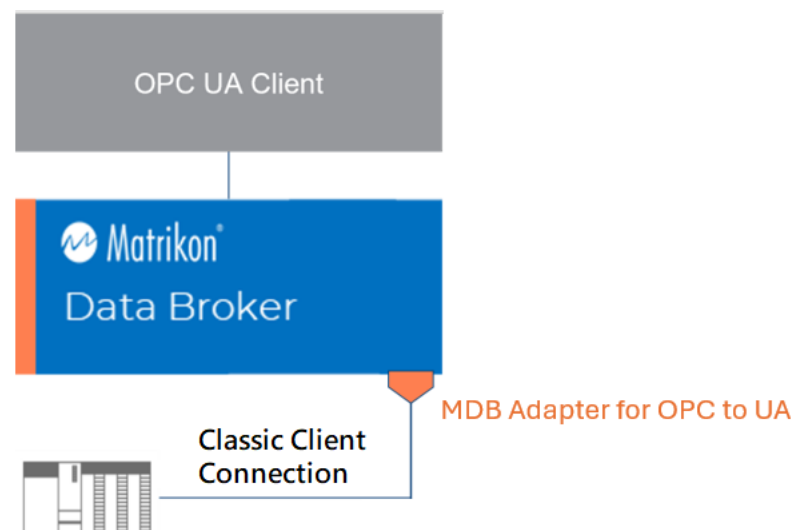
Figure below shows the system architecture for MDB with the Adapter for OPC to UA. The MDB Adapter for OPC to UA is an OPC UA server that connects to Classic OPC Servers and exposes it as OPC UA server to support a client connection from MDB using its Federator technology.

CAUTION

The Adapter restricts third-party OPC UA clients from connecting directly. OPC UA Clients connect to the Adapter through MDB.

MDB configures, reads, and monitors the data in the Classic OPC Servers through this Adapter. Refer to the MDB User Manual for a complete description of MDB features and functionality.

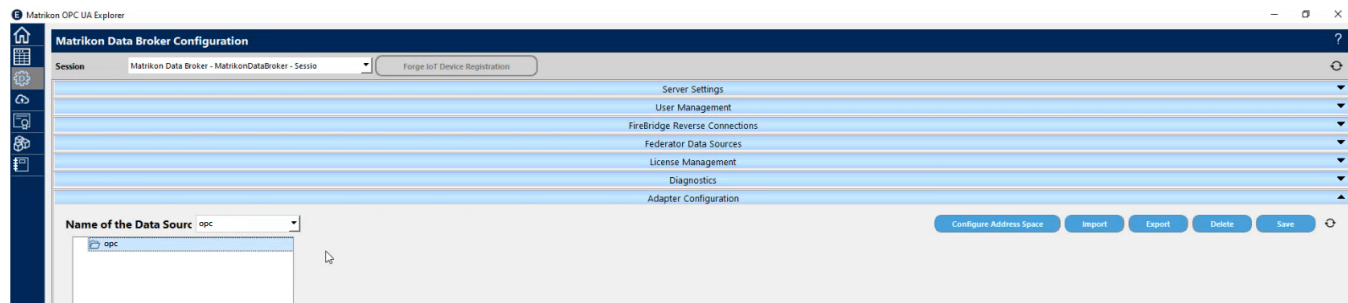
Figure 1 MDB with Adapter for OPC to UA



2.2 Adapter user interface

The MDB Configuration Page fully integrates the interface required to perform all the configuration for the OPC to UA Adapter. The MDB Adapter for OPC to UA appears as a selectable option within the MDB Adapter Configuration panel.

Figure 2 MDB OPC to UA Adapter Configuration



This adapter configuration panel provides management of the configuration of OPC to UA Adapter to connect to Classic OPC Servers according to the requirement. Refer to the chapter on Using the Adapter in this manual for instructions on managing and configuring these connections to Classic OPC Servers and options.

2.3 Supported Connections

The MDB Adapter for OPC to UA supports connection to Classic OPC Servers from MDB to OPC UA Clients via the following connection types.

- Classic Client Connection

This section describes the installation process for the MDB Adapter for OPC to UA.

3.1 System requirements

3.1.1 Hardware

Matrikon recommends the following hardware configuration for the installation of the Adapter.

Table 3 Hardware Requirements

RAM (system memory)	CPU	Storage (HDD)
8G	4 core i5 or later processor	minimum 1G free space

3.1.1.1 Security Settings on Windows

Security Settings on Windows

It is highly recommended that the following security measures be taken. For your corporate guidelines, consult your local security or IT team.

1. Enable Data Execution Prevention (DEP). To enable DEP, follow these instructions or consult the Windows help online instructions for your specific version of Windows.
 - a. Tap the Windows key or Start button.
 - b. Type “Windows Security” and select the Windows Security app at the top of the search results.
 - c. Select App & browser control and then Exploit protection.
 - d. Find Data Execution Prevention in the System settings tab and enable it.
2. Enable Address Space Layout Randomization (ASLR). To enable ASLR, follow these instructions or consult the Windows help online instructions for your specific version of Windows.
 - a. Tap the Windows key or Start button.
 - b. Type “Windows Security” and select the Windows Security app at the top of the search results.
 - c. Select Force randomization from images (Mandatory ASLR) and enable it by default (if not already on).

3.1.2 Software

The OPC to UA Adaptor for MDB is compatible with the following operating systems.

- Windows 10 (64-bit)
- Windows 11
- Windows Server 2016
- Windows Server 2019
- Windows Server 2022

The Adapter requires MDB 2.3.2 or later for proper operation and is incompatible with previous versions.

3.1.3 Installed Files

The installation program copies the following files to the installation directory at C:\Program Files\Matrikon\MDBAdapters\OPCtoUAAdapter.

Table 4 List of installed files

Files	Description
MatrikonDataBrokerOPCtoUAAdapter.exe	The OPC to UA adapter executable file
OPC to UA Adapter Root.qml	OPC to UA Adapter Root Configuration Panel
Classic Client Connection.qml	OPC to UA Adapter Configuration Panel
adapter_nodeset.xml	The OPC to UA adapter OPC UA node set file
adapter.options	The OPC to UA adapter options file
FlxComm64.dll	Third-party library file
FlxConnect64.dll	Third-party library file
FlxCore64.dll	Third-party library file
libcurl_x64.dll	Third-party library file
install.bat	Installation batch file
setup.bat	Installation auxiliary batch file
uninstall.bat	Uninstallation batch file
IsValidServiceAccount	Application file
MDBOPCtoUAAdapter	Application file
Matrikon Data Broker OPCtoUA Adapter User Manual.pdf	User Manual for MDB Adapter for OPC to UA

3.2 Install as a Windows service

The installation program installs the Adapter as a service in Windows by default. This installation does not support configuration as a console application.

3.2.1 Pre-installation

Before the installation, perform the below steps:

- You can select an unused port on the host machine for the OPC to UA Adapter OPC UA Server to use as its listening port.
- If it does not already exist, create a service account for use by the Adapter with these settings.
 - A local or domain account,
 - Not an administrator (Recommended), and
 - Log on as a service permission.

NOTE

For more information on the Logon as a Service permission, consult the [Matrikon OPC KB](#) or Microsoft articles.

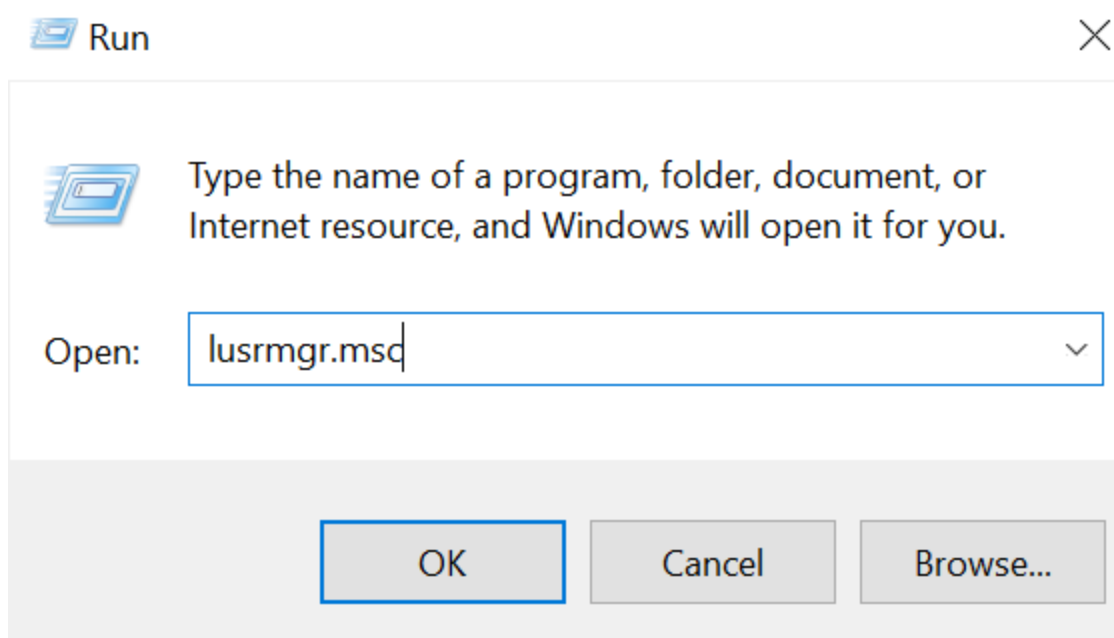
When installing the software

- Log on using an account with local administrative rights.

Steps to add a user with Log on as a service

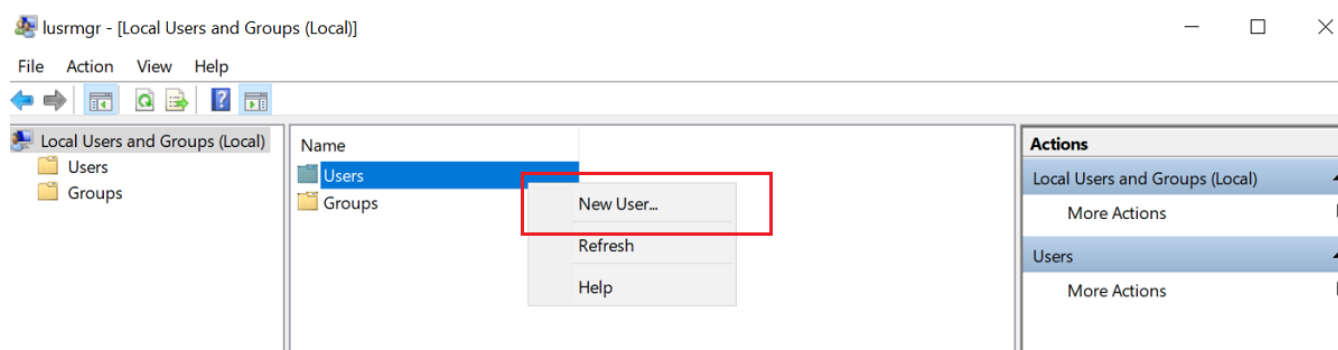
1. Open Run and type "lusrmgr.msc" to open Local users and groups.

Figure 3 Run Window



2. In Local Users and Groups window, right click Users and click New User.

Figure 4 Local Users and Groups window



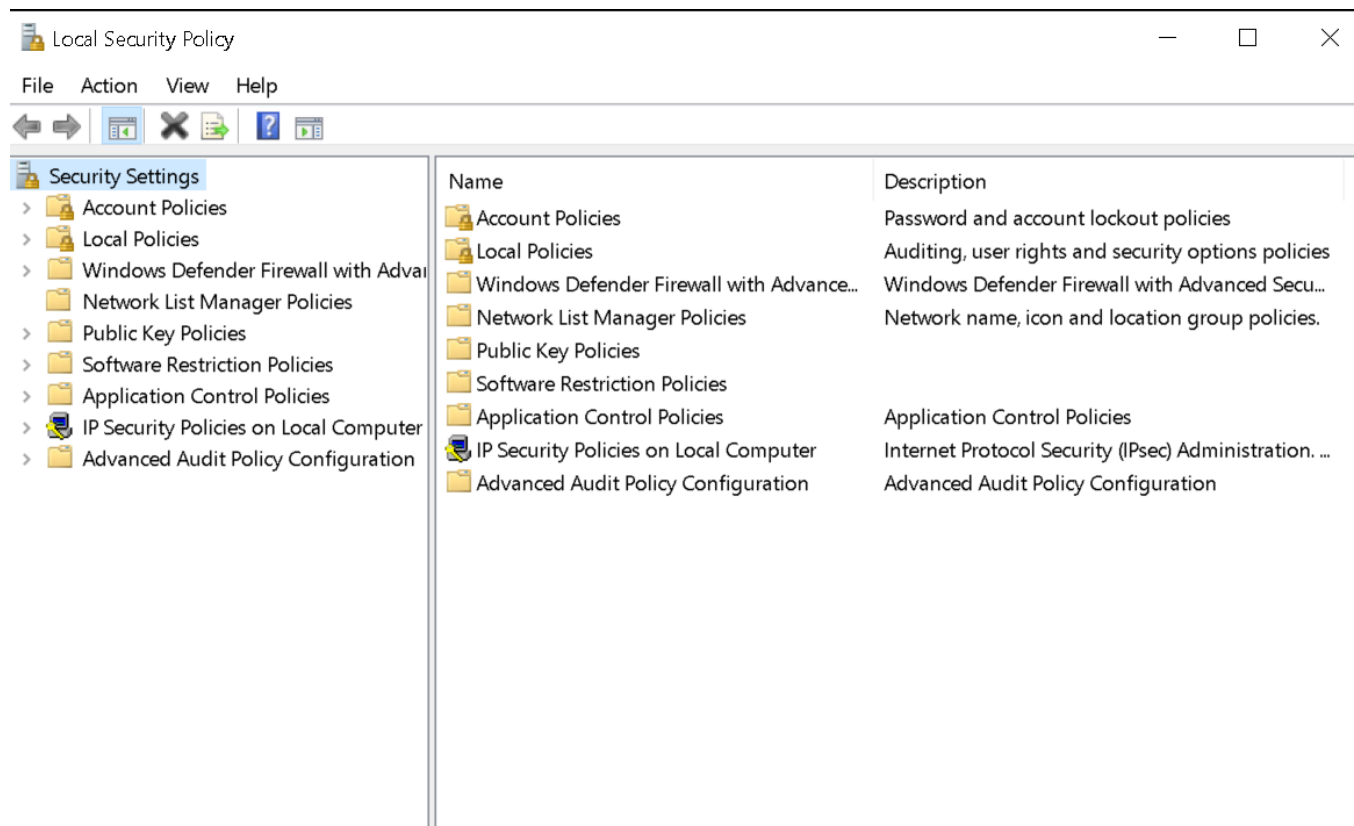
3. Enter your preferred User name, Password, check the two items shown in the below picture and click Create.

Figure 5 New User window

The 'New User' dialog box is shown. It has fields for 'User name:', 'Full name:', and 'Description:'. The 'User name' field contains 'matrikonopc'. Below these are 'Password:' and 'Confirm password:' fields, both filled with dots. At the bottom, there are four checkboxes: 'User must change password at next logon' (unchecked), 'User cannot change password' (checked), 'Password never expires' (checked), and 'Account is disabled' (unchecked). The 'Create' button is highlighted with a red rectangle. The 'Help' and 'Close' buttons are also visible.

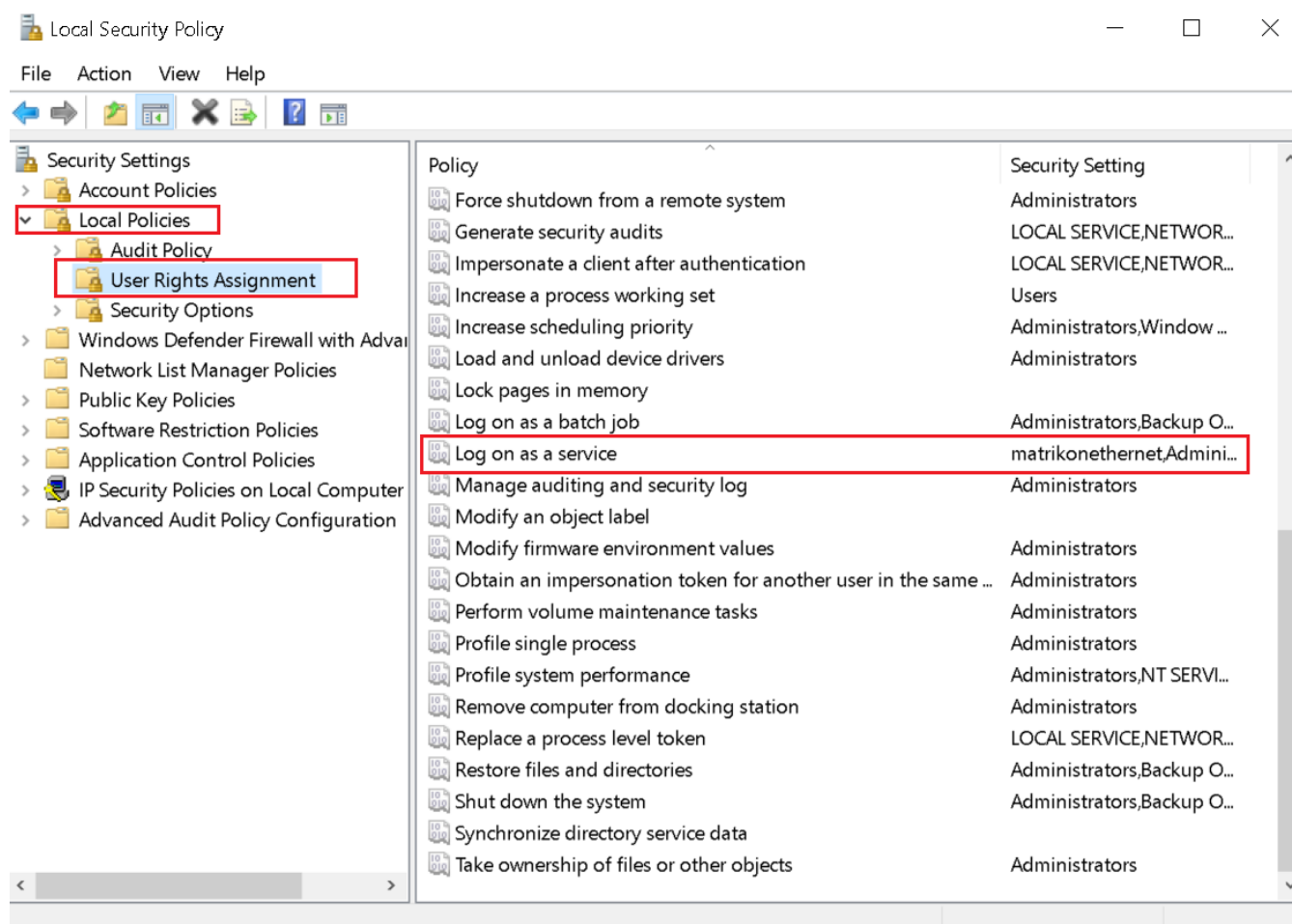
4. After the user is created, open Local Security Policy.

Figure 6 Local Security Policy window



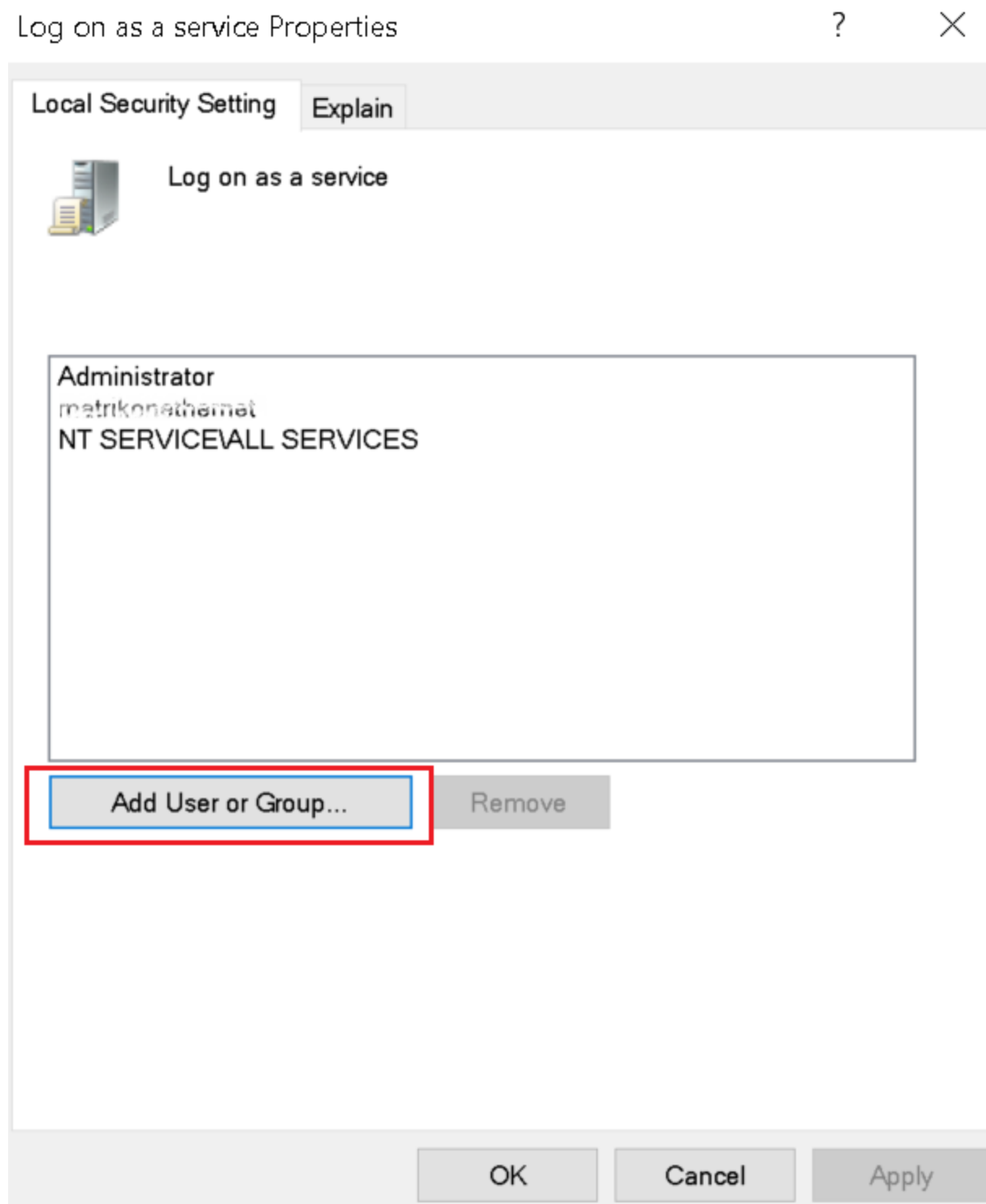
5. Click Local Policies, User Rights Assignment and then select Log on a Service from the policy list.

Figure 7 User Rights Assignment



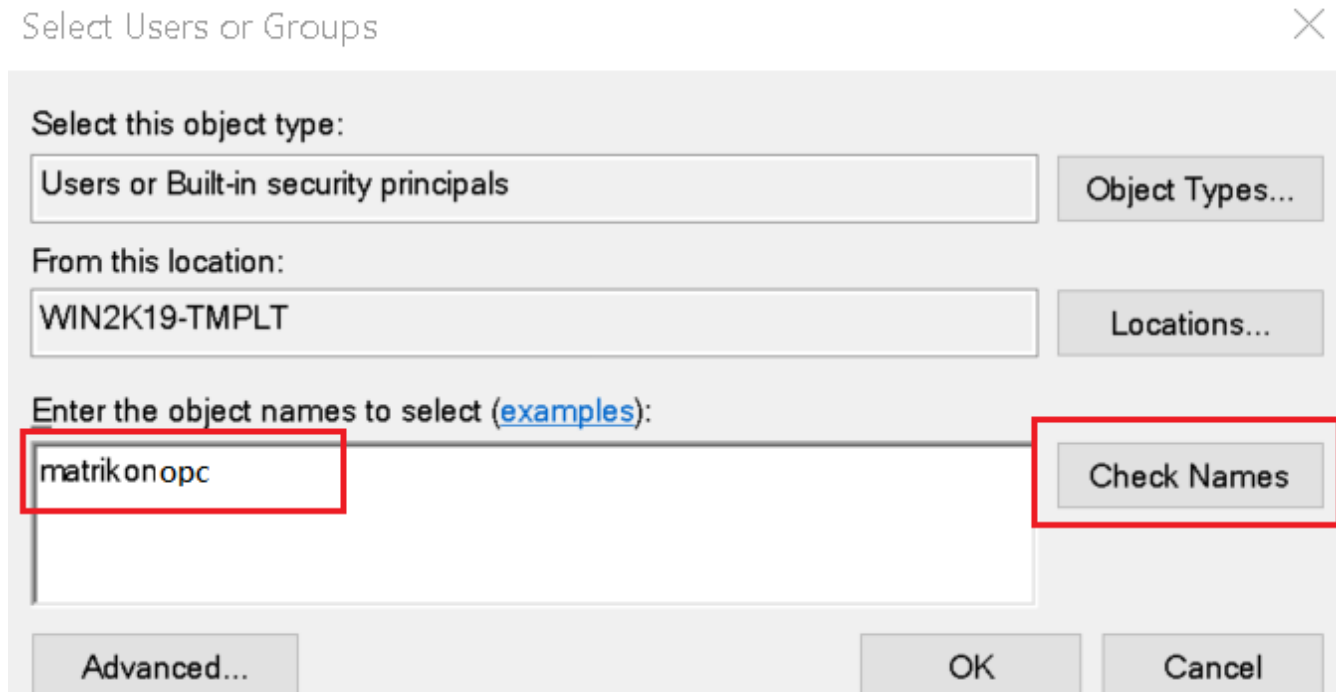
6. Click Add User or Groups in the Log on as a Service window

Figure 8 Add User or Groups



7. Enter the user name you created earlier (Step 3) and click Check Names.

Figure 9 Check Names



Select Users or Groups

Select this object type:
Users or Built-in security principals

From this location:
WIN2K19-TMPLT

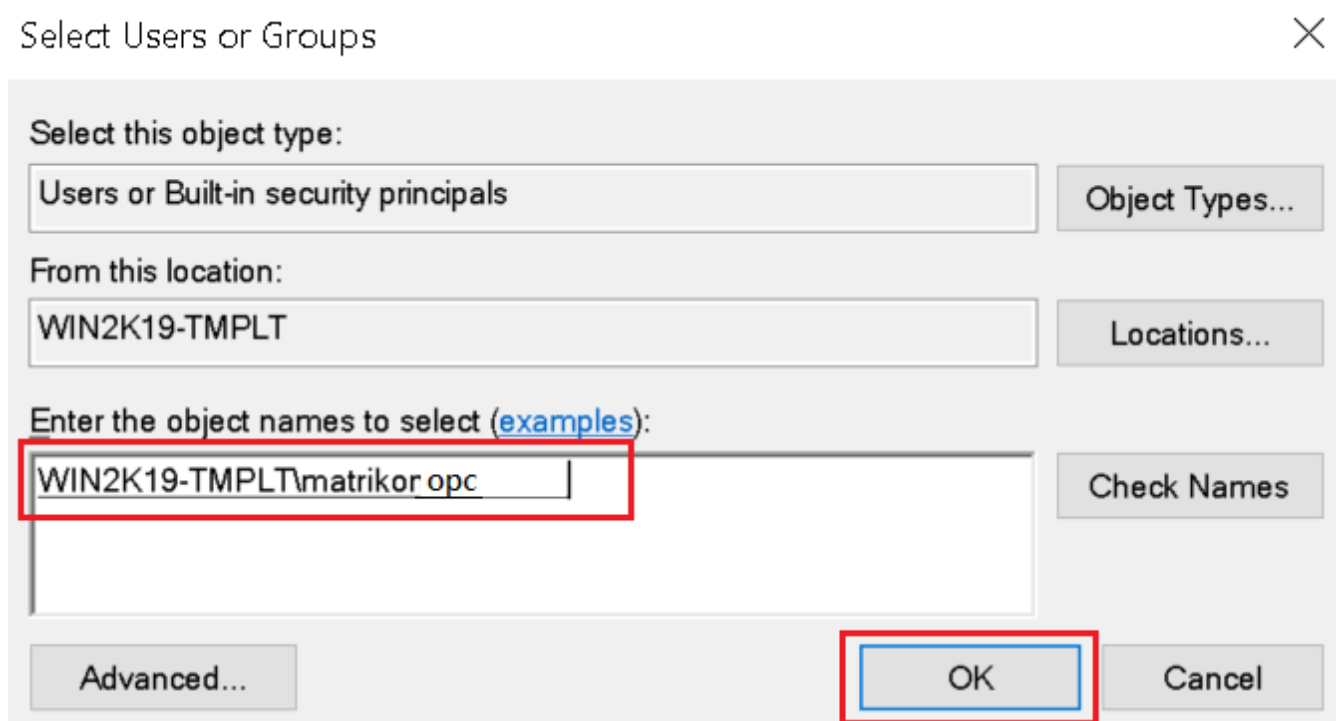
Enter the object names to select (examples):
matrikonopc

Check Names

Advanced... OK Cancel

8. After the user is added as shown below, click OK.

Figure 10 Select Users or Groups



Select Users or Groups

Select this object type:
Users or Built-in security principals

From this location:
WIN2K19-TMPLT

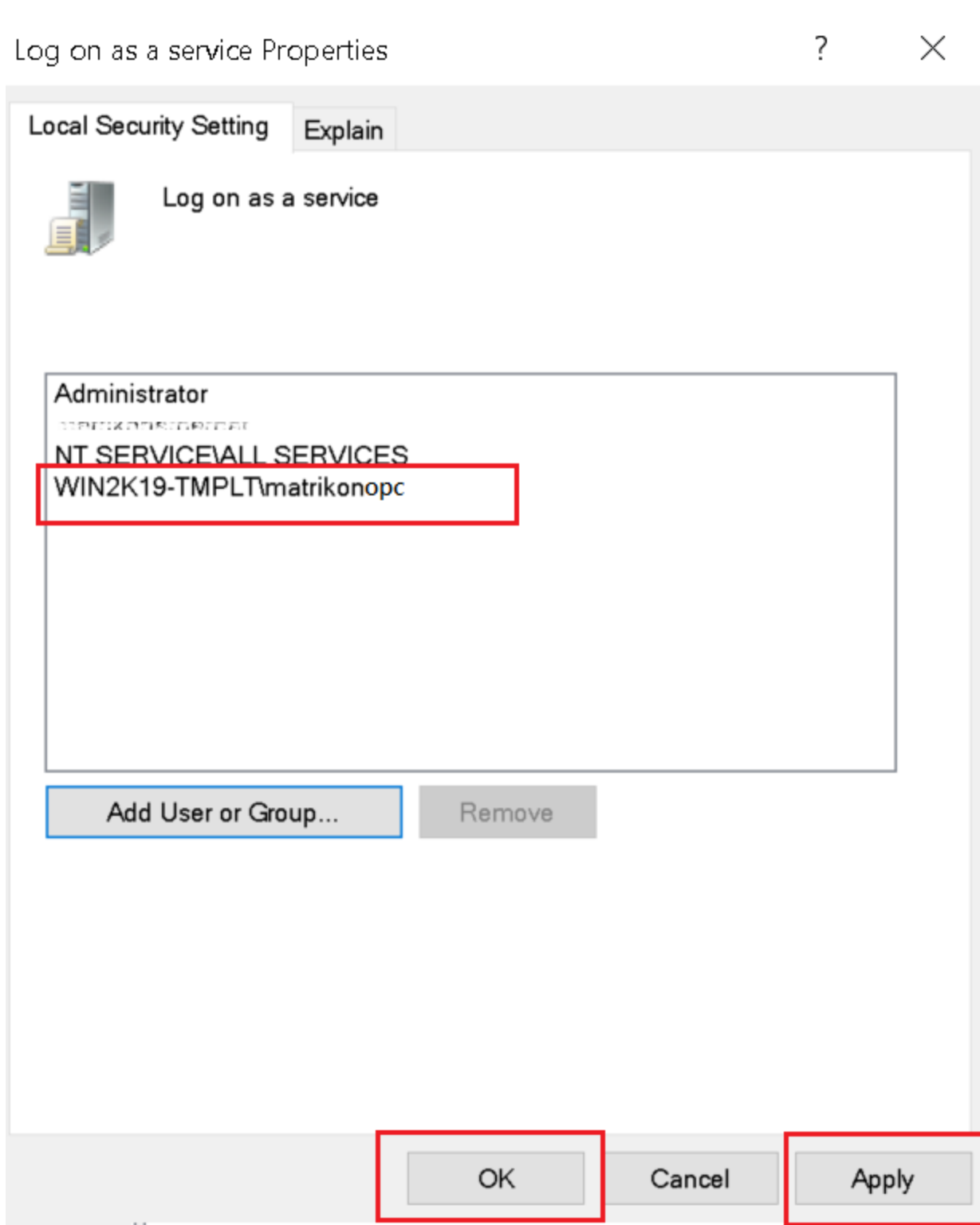
Enter the object names to select (examples):
WIN2K19-TMPLT\\matrikonopc

Check Names

Advanced... OK Cancel

9. Click Apply and OK

Figure 11 log on as a service properties

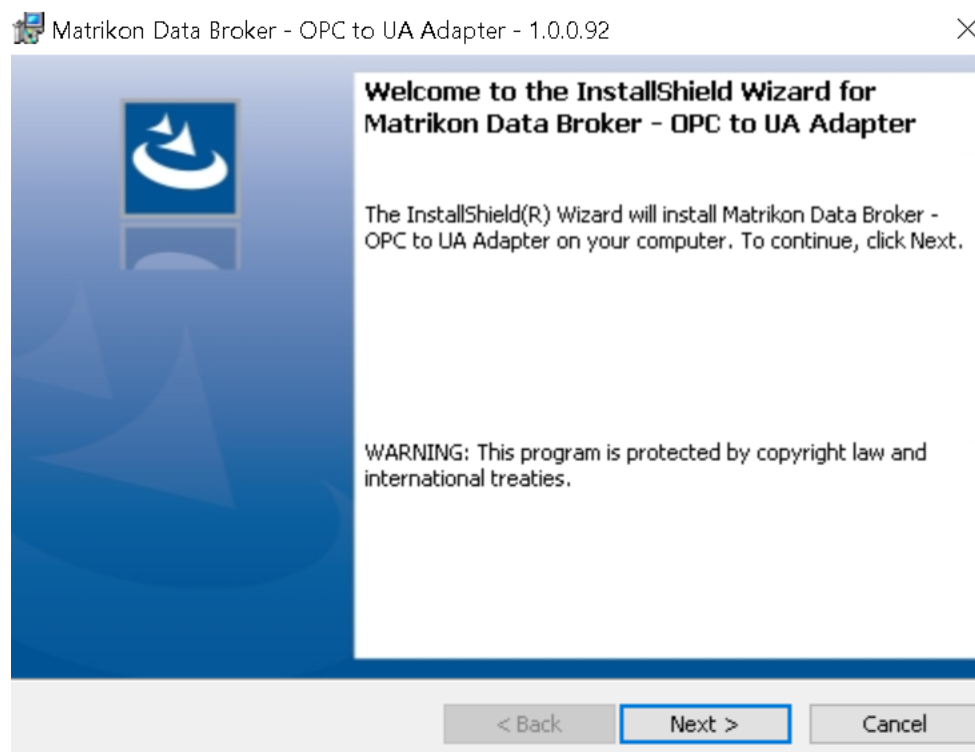


3.2.2 Installation

To install the MDB Adapter for OPC to UA, you can do the following steps:

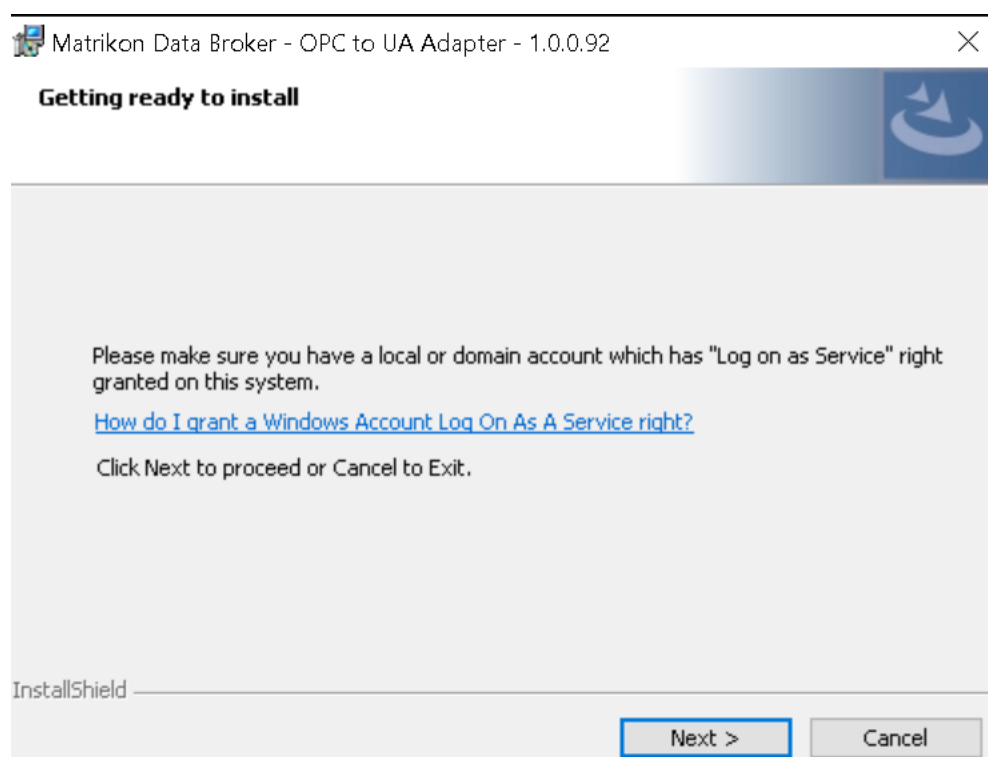
1. You can navigate to the installation media location.
2. Launch the installation file MatrikonDataBrokerOPCtoUAAdapter.exe. The MDB - OPC to UA Adapter installation Wizard appears.

Figure 12 Adapter Installation Wizard



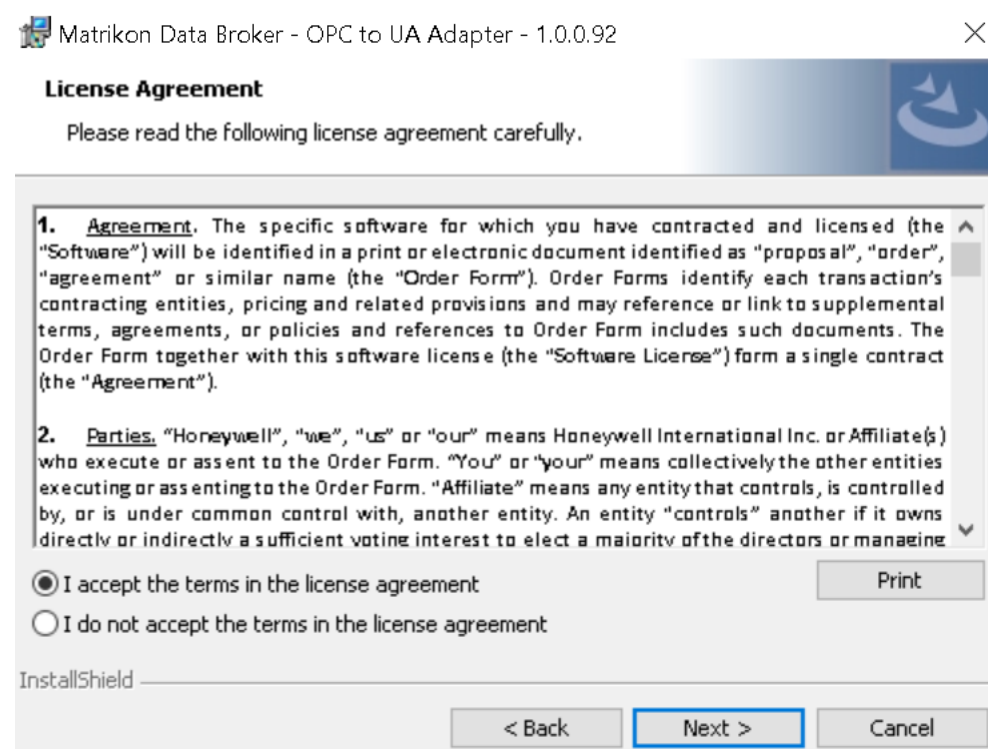
3. Click Next >. The Ready to Install window appears. This panel reminds you to create a non-administrator service account and ensure that it has the Log on as a Service permission enabled. For more information on granting this permission, refer to the Pre-Installation section of this chapter.

Figure 13 Getting Ready to Install



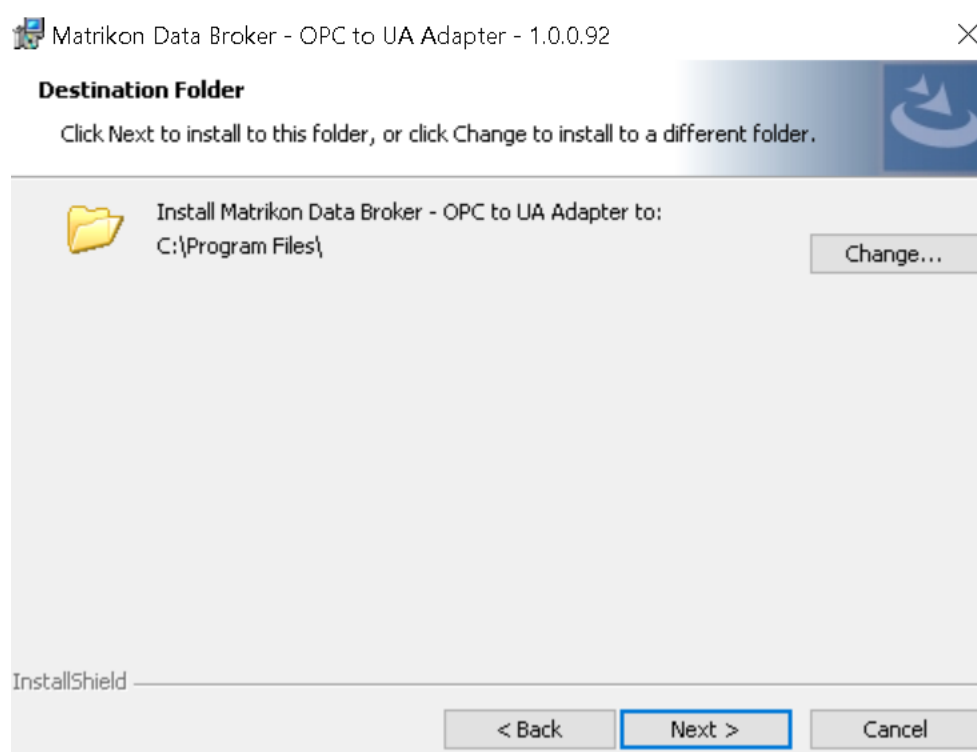
- Click Next. The License Agreement window appears.

Figure 14 License Agreement



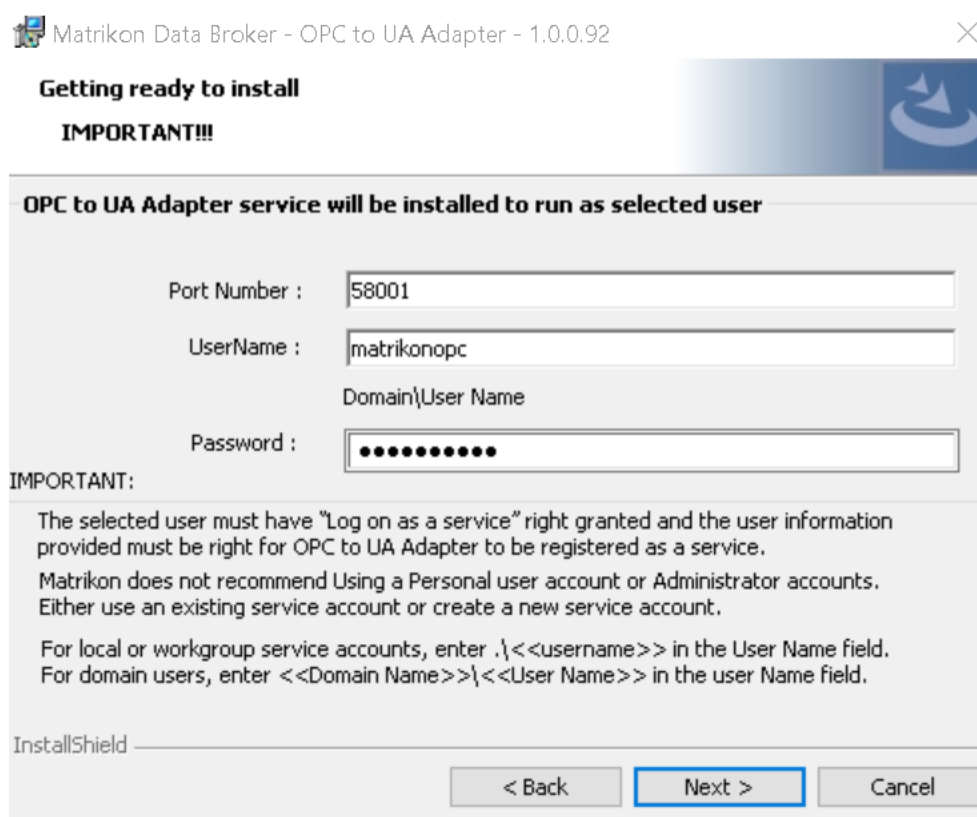
- Read the terms of the license agreement carefully. Select I accept the terms in the license agreement, then click Next. The Destination Folder selection window appears.

Figure 15 Select Destination Folder



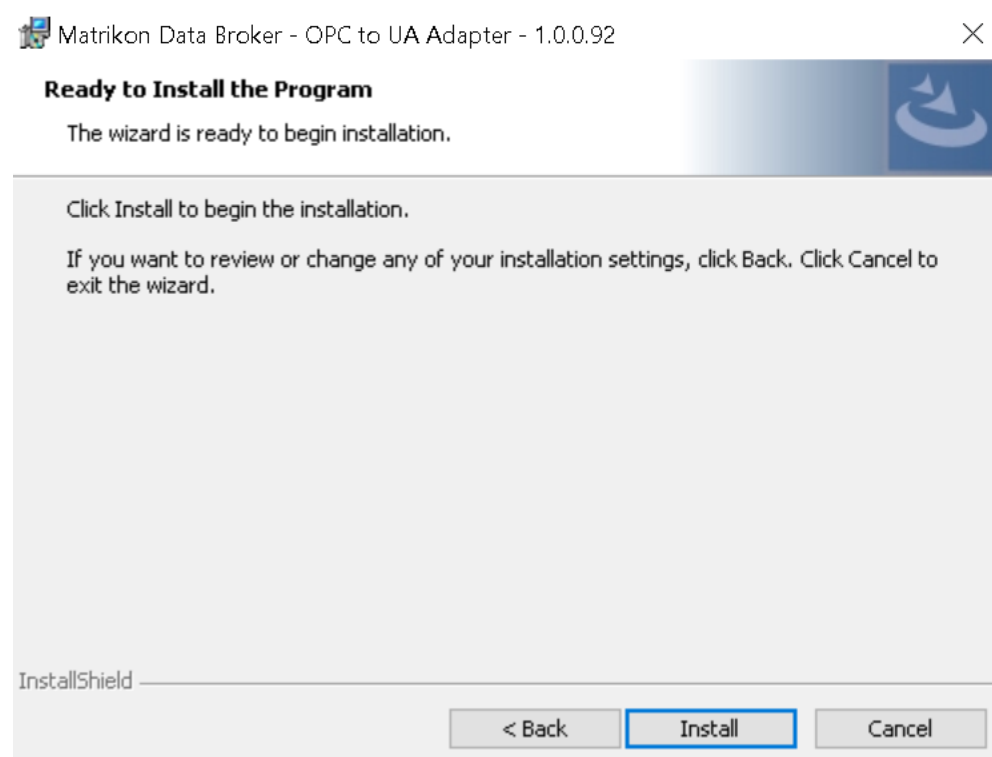
6. Click Next to select the default installation folder. To choose another file location, click Change to browse for a new folder location. Select the new location, then click the Next button. The OPCtoUA Adapter Service Details window appears.

Figure 16 Adapter Service Details



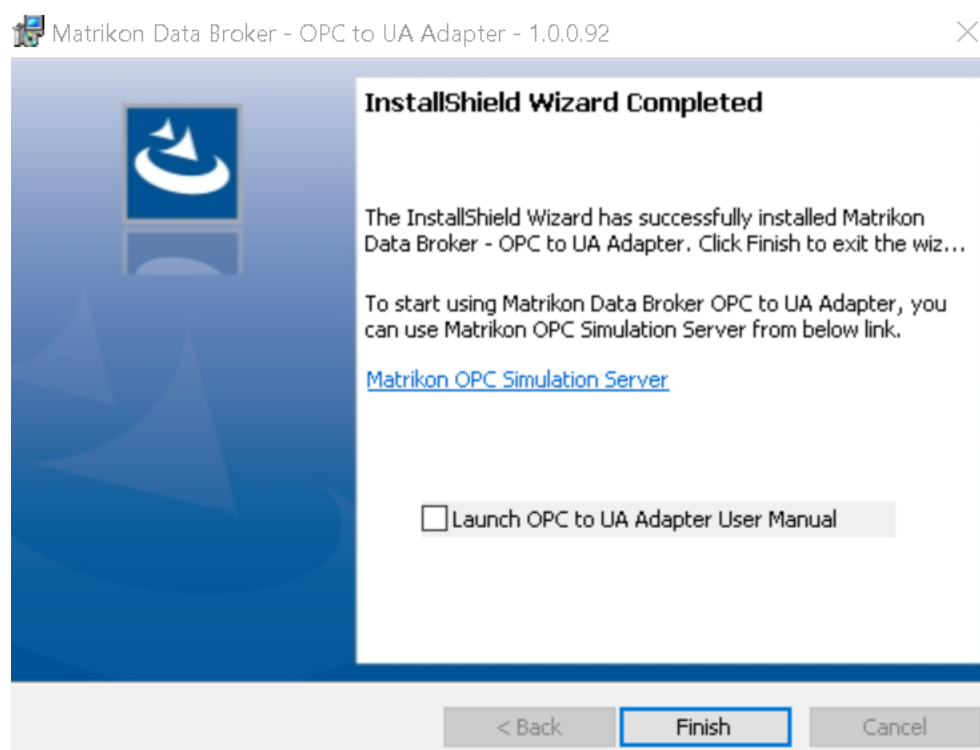
7. You can enter the required service details for the Adapter.
 - Port Number: Type the port number for the OPCtoUA Adapter OPC UA Server.
 - Username: Type a username in the following format:
 - For local accounts: .\<username>
 - For domain users: <Domain Name>\<username>
 - Password: Type the password for the account you specified.
8. Click Next. The Ready to Install the Program window appears.

Figure 17 Ready to Install



9. Click Install. The installation begins.
10. After completion, the InstallShield Wizard Completed dialog appears. Click Finish to complete the installation and exit the wizard.

Figure 18 Installation Complete



3.2.3 Service confirmation

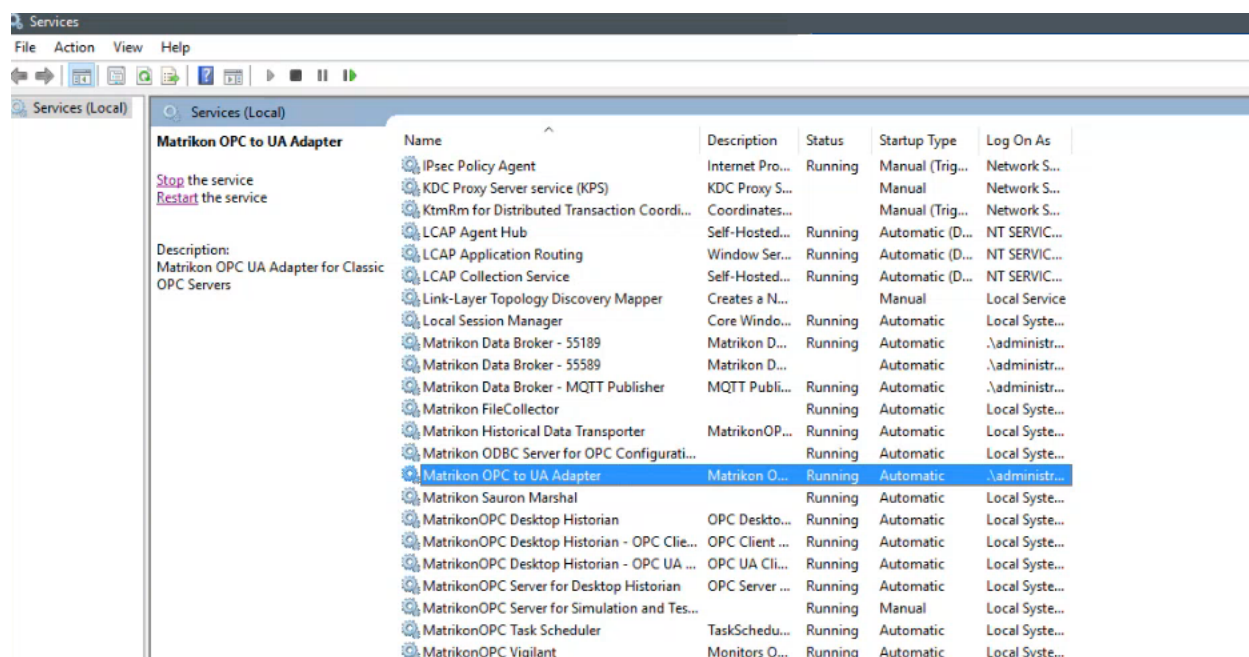
The MDB Adapter for OPC to UA service starts automatically after successful installation.

Perform the following steps to confirm the service registration and ensure that the service is running.

1. Go to Start > Run and type services.msc, press Enter. The Services window appears with the list of all services registered on your machine.
2. Verify the services panel lists the Matrikon for OPC to UA Adapter service and ensure the status is Running.
3. If the service is listed but not running, start the service. If the service fails to start, contact Matrikon Support for further

assistance.

Figure 19 Services Window



3.2.4 Post-installation

After the installation, check and make sure the environment variables below are created/available in the system where Matrikon OPC UA Explorer is running. These variables are used to configure the Adapter.

- QML_XHR_ALLOW_FILE_WRITE set to 1
- QML_XHR_ALLOW_FILE_READ set to 1

3.3 Certificate management

Starting the adapter service creates a PKI folder in the service volume path. The PKI folder stores all certificates relevant to this application.

In a system with a Certification Authority (CA), this entity manages the certificates and places them in the appropriate folder. With no CA available, a system administrator manages the certificates. Applications automatically place certificates for unknown or untrusted applications in the rejected folder. Administrators are responsible for inspecting the certificate and moving it to the trusted folder if it is valid.

For more information on security in OPC UA applications, refer to the section on [Security in OPC UA](#).

The MDB Adapter for OPC to UA is licensed as an MDB feature. Refer to the MDB Licensing Guide for specific details regarding the MDB licensing.

Without a license for OPC to UA features applied, the license status is the Grace Period MDB connects to the Adapter as a data source in MDB and gets disconnected after 120 minutes. Restarting the service resets this timer.

The table below lists the MDB licensing features that apply to the OPC to UA Adapter and OPC to UA Adapter Plus.

Table 5 MDB licensing features

MDB Feature	Description
Matrikon Data Broker OPC to UA Adapter	Must be enabled to use the MDB Adapter for OPC to UA
Matrikon Data Broker OPC to UA Plus Adapter	Must be enabled to use the MDB Adapter for OPC to UA Plus

Table 6 OPC to UA Adapter licenses to features mapping

Feature - License Mapping	Matrikon Data Broker OPC to UA Adapter	Matrikon Data Broker OPC to UA Plus Adapter
Connect to Classic OPC Server installed on the same system as the Adapter	Yes	Yes
Browse the entire address space of the Classic OPC Server as presented by the server	Yes	Yes
To use user rights on nodes as represented in Classic OPC Server into Adapter	Yes	Yes
Wild card-based filtering of the nodes to reduce #of nodes from the Classic OPC Server represented in the Adapter	Yes	Yes
Other general features available in the Adapter	Yes	Yes

Feature - License Mapping	Matrikon Data Broker OPC to UA Adapter	Matrikon Data Broker OPC to UA Plus Adapter
Connect to Classic OPC Servers, which are remote to the system where Adapter is installed	No	Yes
To build Static Address Space of Adapter from an exported list nodes of Classic OPC Server address space	No	Yes
To change one or more nodes of Classic OPC Servers user rights Read Write to Read Only	No	Yes

License Management

Activation ID: 6668 6666 6666 6666 6666 6666 6666 6666

Activation **Deactivation**

Activate License Offline Activate License Online

Generate Request File Process Response File

License Mode: Node Lock Product License Status: **Licensed**

	Feature	Product License Status	Capacity	Consumed	License Expiry Date
12	Matrikon Data Broker OPC to UA Adapter	Licensed	Enabled	NA	Permanent
13	Matrikon Data Broker OPC to UA Plus Adapter	Licensed	Enabled	NA	Permanent
14	Matrikon Data Broker Ethernet IP Adapter	Licensed	Enabled	NA	Permanent
15	Matrikon Data Broker Profinet Adapter	Licensed	Enabled	NA	Permanent
16	Matrikon Data Broker Siemens Adapter	Licensed	Enabled	NA	Permanent

Matrikon's OPC UA Explorer provides the primary tools to access and configure MDB and its component technologies. This includes the configuration of the MDB Adapter for OPC to UA, as this Adapter does not provide an independent GUI for this purpose.

The MDB Adapter for OPC to UA acts as a Federated Data Source for MDB. The Adapter accepts direct client connection only from MDB. The MDB Federated Data Sources panel in the MDB Configuration tool manages the MDB connection to the Adapter. The Adapter Configuration panel provides access to the configuration interface for the Adapter. This chapter contains all instructions for carrying out administrative, connection, and configuration tasks for the Adapter.

NOTE

Users must connect to MDB using the admin account to configure the Adapter.

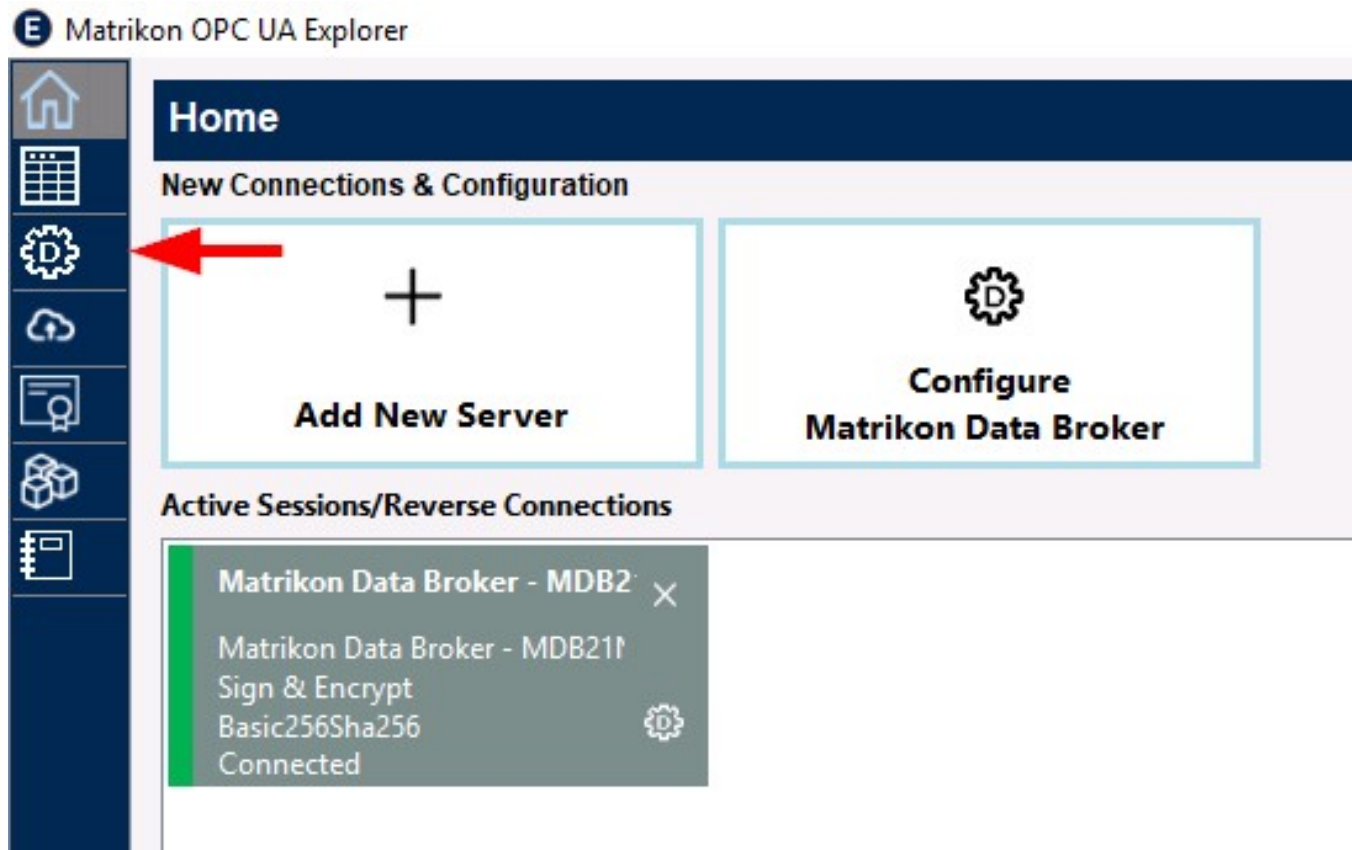
Third-party client applications can connect to the Adapter through MDB, accessing data and configuration items through the MDB address space.

5.1 Connecting the Adapter to MDB

This instruction describes the process for connecting MDB to the Adapter. The Adapter accepts a client connection exclusively from Matrikon's OPC UA Explorer and MDB using the Federator feature. Any other client must connect to MDB to access the Adapter and its configured items.

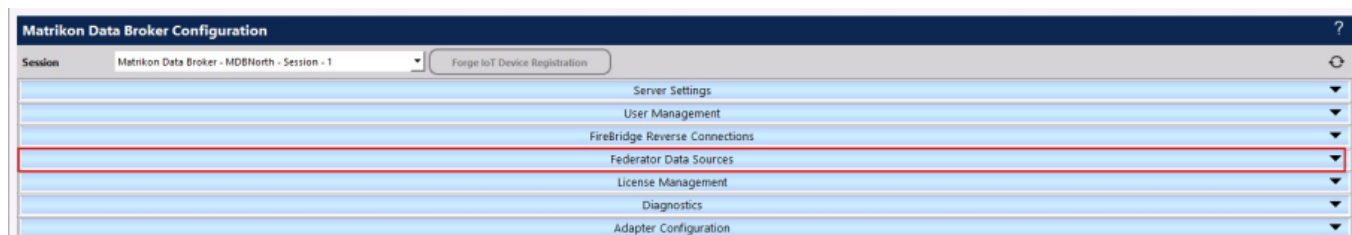
1. Launch Matrikon OPC UA Explorer and connect to the MDB instance.
2. Click the Configure MDB icon or the Configure Matrikon Data Broker tile in the left toolbar.

Figure 20 Select MDB Configuration Tool



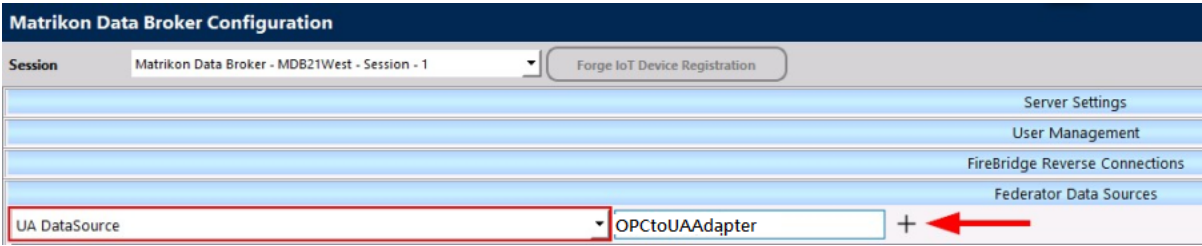
3. Expand the Federator Data Sources panel by clicking the panel header.

Figure 21 Federator Data Sources



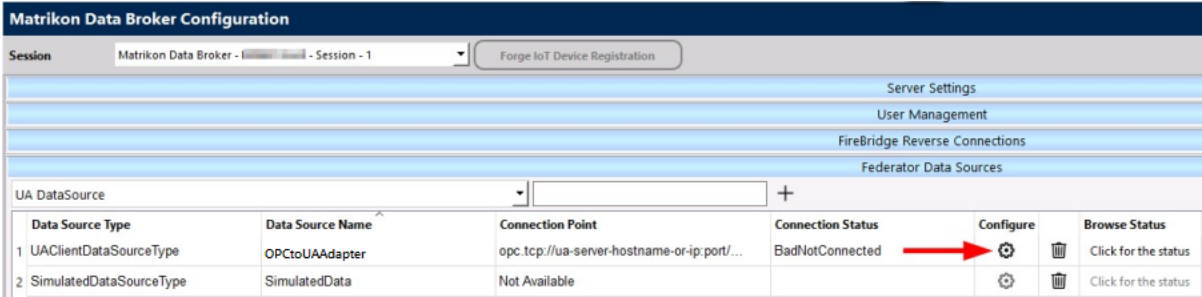
4. Select UA DataSource from the drop-down menu and enter a name for the connection. Click the + icon to the right of the name to add the connection. The new connection appears in the list of Data Sources.

Figure 22 Add Federated Data Source



5. Click the Configure button for the new connection to open the Data Source Configuration dialog.

Figure 23 Configure Federated Data Source



6. Click the Connections tab of the Data Source Configuration dialog:

Figure 24 Data Source Configuration - Connections

- a. With the Discovery radio button selected, enter the name or IP address of the MDB instance host machine and the port number assigned to the Adapter during installation. Click the Find Servers button.

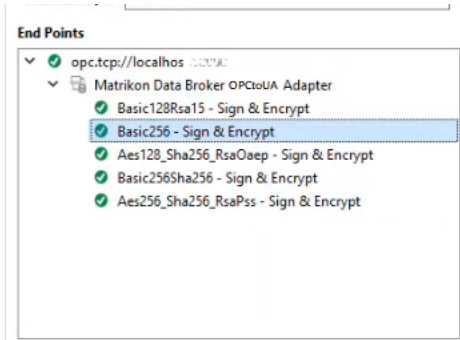
Figure 25 Data Source Connection using Discovery

- b. If the Local Discovery Server (LDS) is unavailable, select the Manual radio button and enter the Adapter URL.

Figure 26 Manual Data Source Connection

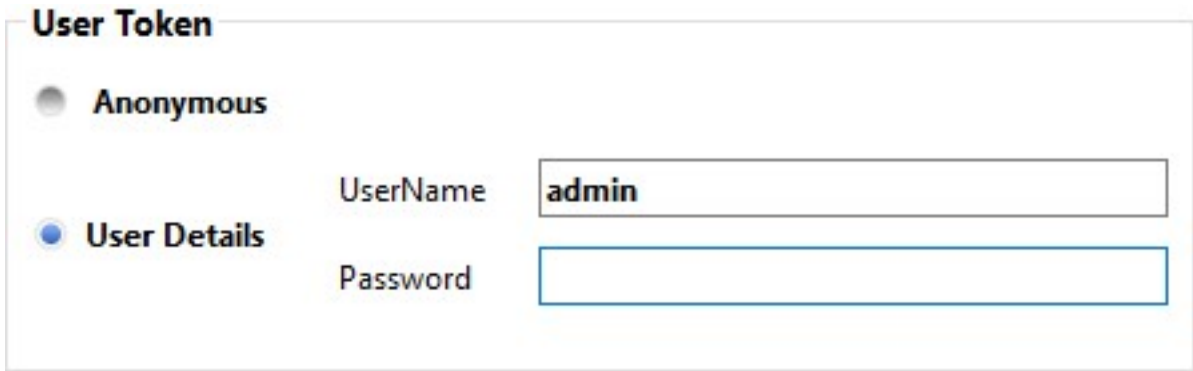
- c. You can expand the OPC Server and choose a connection method.

Figure 27 Adapter End Points



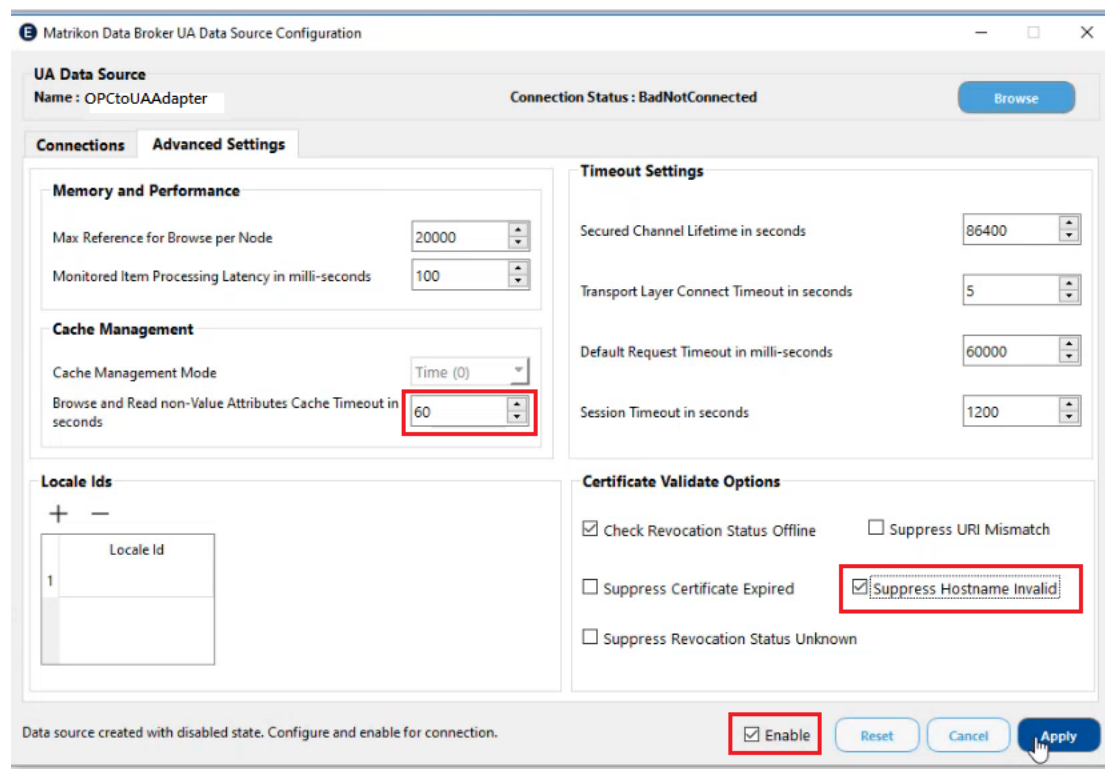
- d. Select User Details in the User Token area. The default accounts are
Username: admin
Password: none (blank)

Figure 28 User Details



- 7. Click the Advanced Settings tab of the Data Source Configuration dialog:

Figure 29 Data Source Configuration - Advanced Settings



a. Select the below Certificate Validate Options

- a. Suppress URI Mismatch
- b. Suppress Hostname Invalid

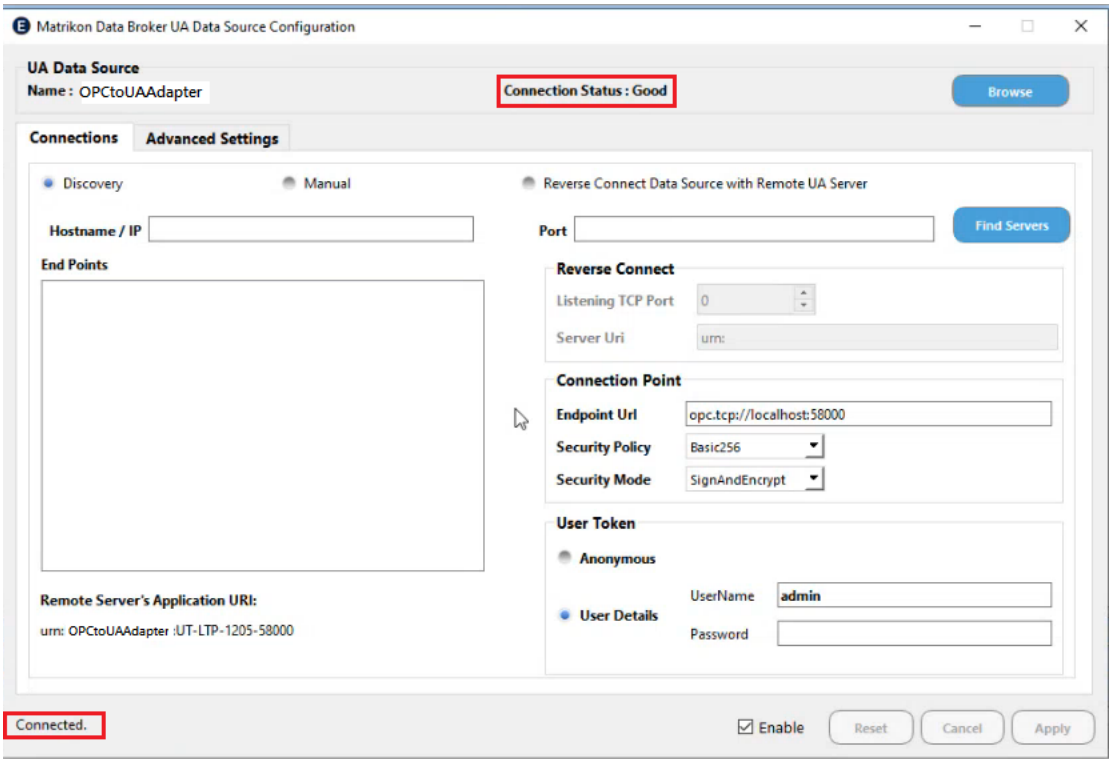
8. Please select the Enabled check box, then click the Apply button.

NOTE

At this point, MDB starts configuring the address space by aggregating the namespaces and types in the new data source. The time required for this varies depending on the extent of the address space of the data source. This can take several minutes.

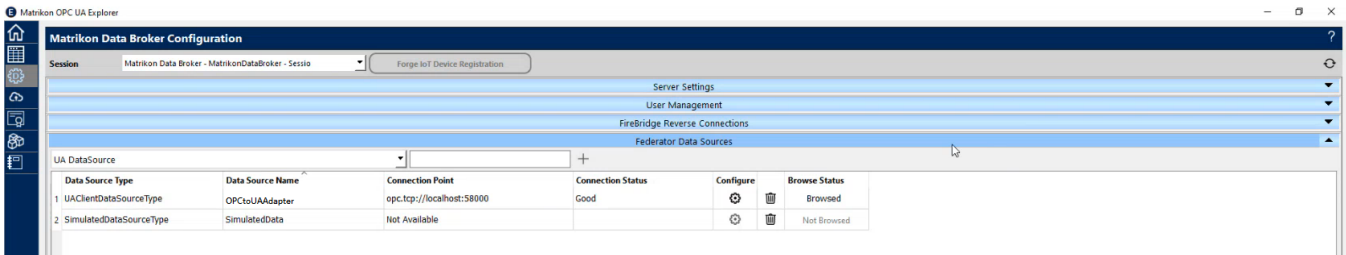
- 9. After adding the OPCtoUA Adapter data source, the Connection Status at the top right shows as Good. Click the BROWSE button to aggregate the OPCtoUA Adapter's address space into MDB.
- 10. Upon successful connection, the Connection Status indicates Good, and the message in the lower left-hand corner reads Connected.

Figure 30 Data Source Configuration - Connected



11. Close the Data Source Configuration dialog by clicking the X in the top right-hand corner.
- The Connection Status in the Federator Data Sources panel still indicates Bad. Click twice on the blue panel header to collapse, then expand the panel. This refreshes the display, and the Connection Status shows Good.

Figure 31 Federated Data Source Status



5.2 User management

The MDB Adapter for OPC to UA has two pre-configured users: admin and operator. Tables below shows the permissions associated with the admin account and permissions related to the operator account.

Table 7 Permissions for the admin account

	Configuration Methods	Logging Options	Operating Limits	Options	User Configuration	Adapter Data
Call	Yes					

	Configuration Methods	Logging Options	Operating Limits	Options	User Configuration	Adapter Data
Read		Yes	Yes	Yes	Yes	Yes
Write		Yes	Yes	Yes	Yes	Yes

Table 8 Permissions for the operator account

	Configuration Methods	Logging Options	Operating Limits	Options	User Configuration	Adapter Data
Call						
Read		Yes	Yes	Yes		Yes
Write		No	No	No		Yes

NOTE

Write permissions for all the items in the Adapter require enabling the write attribute of the physical object.

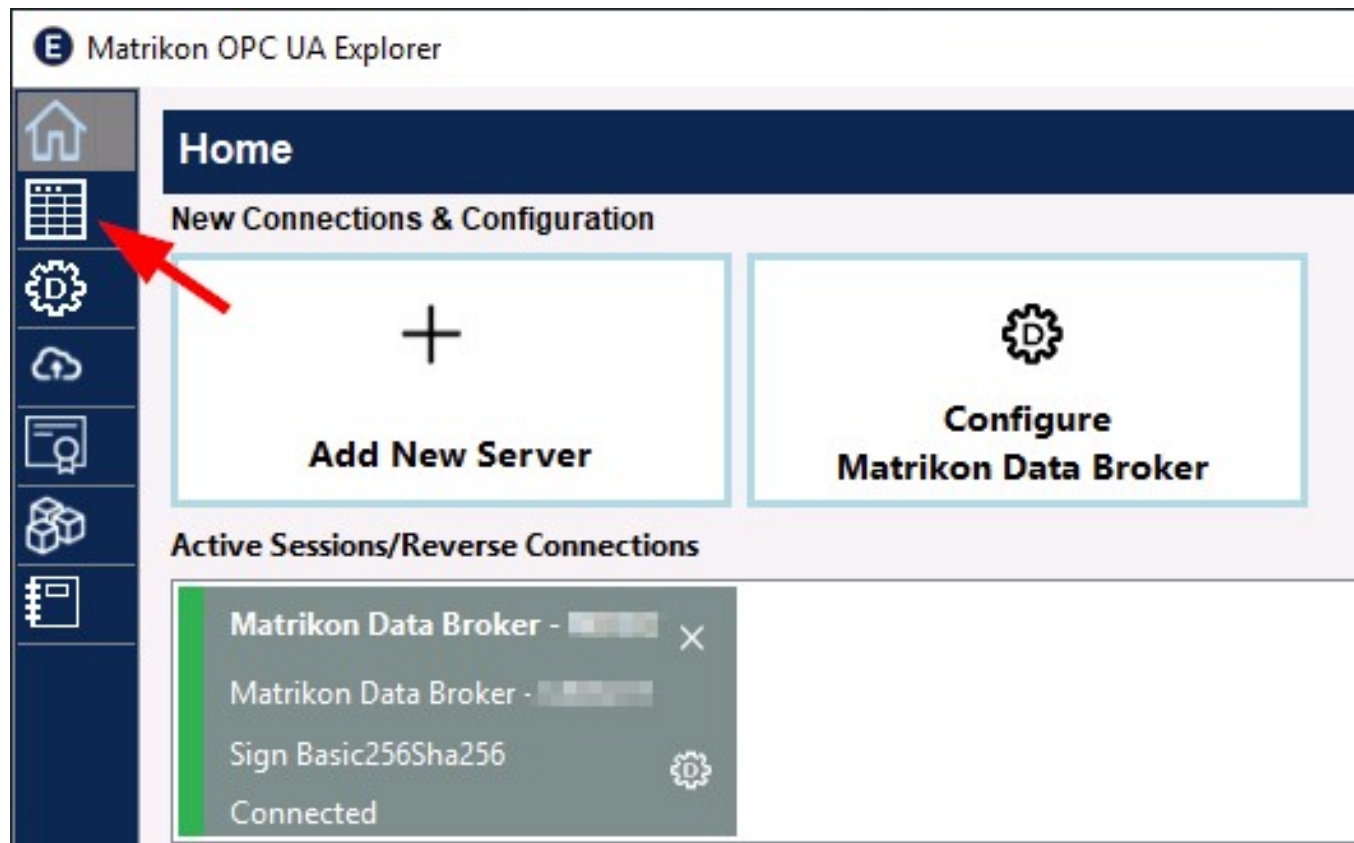
Methods are software components associated with or owned by an object. When invoked, methods run to completion and return the result to the client.

The Adapter does not provide a GUI for managing these users. Administrators can enable or disable these accounts and change their passwords in the MDB address space. This feature requires that users connect to MDB using the admin account.

This section provides instructions for managing the Adapter’s users.

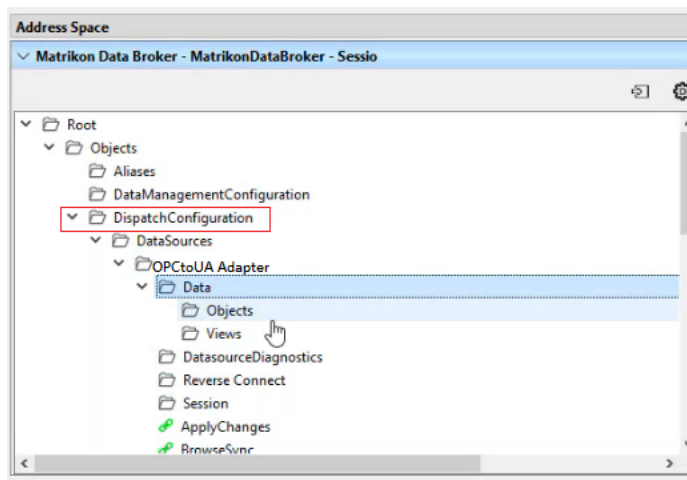
1. Connect to MDB using OPC UA Explorer. Log in to MDB using the admin account and password.
2. Access the MDB Address Space by clicking the Data View icon.

Figure 32 Access the MDB Data View



3. In the MDB Address Space, the OPC to UA Adapter appears under DispatchConfiguration (Figure 23).

Figure 33 OPCtoUA adapter in MDB address space



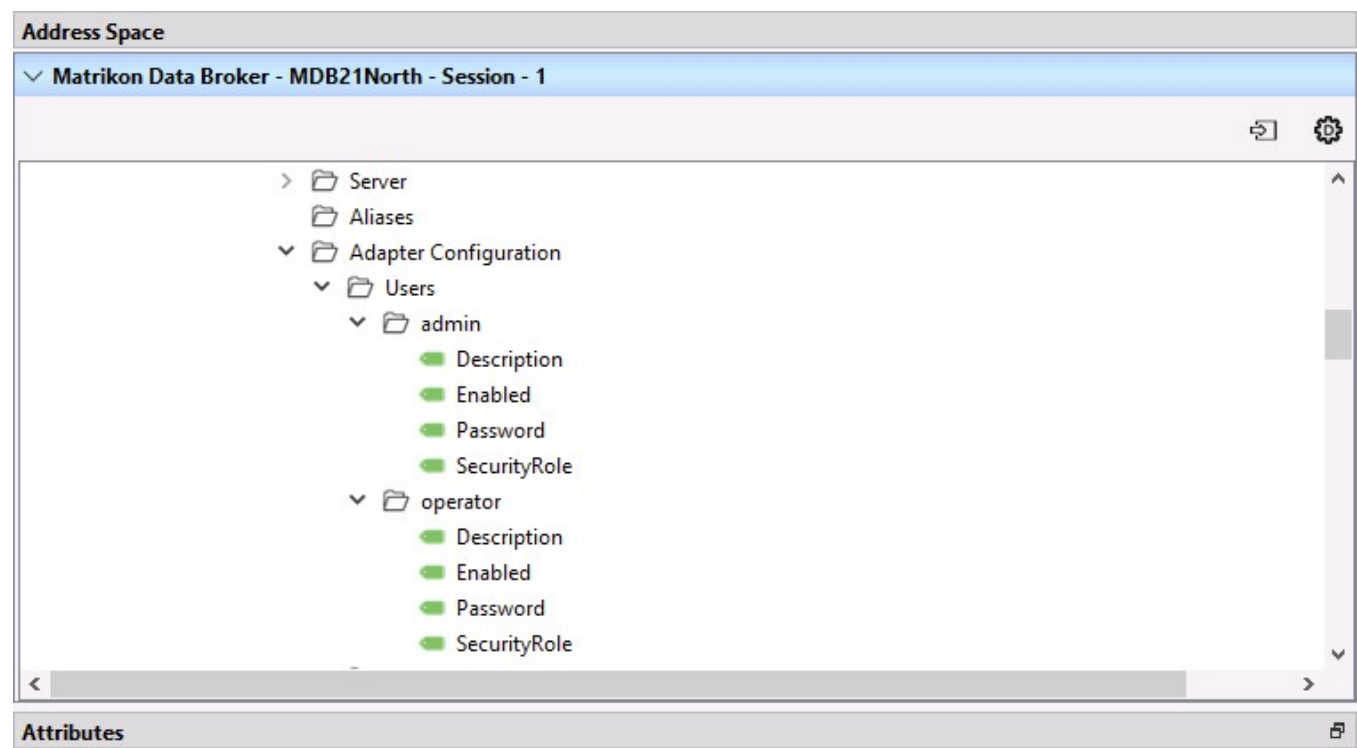
4. Expand the DispatchConfiguration node.
DispatchConfiguration > DataSources > OPC to UA > Data > Objects > Adapter Configuration

INFORMATION

This folder contains nodes used to configure many advanced features of this adapter. This instruction deals specifically with enabling or disabling the users and resetting the passwords. Modifying the other items in this folder can have unknown or unintended consequences.

5. You can expand the Adapter Configuration folder to the required user.

Figure 34 User Management



6. Please select the required object and drag it into the Data View window. The table below shows the options for editing User attributes.

Table 9 Editing User Attributes

	Description	Enabled	Password	Security Role
admin	Yes	No	Yes	No
operator	Yes	Yes	Yes	No

CAUTION

Client applications cannot display the Password attribute. Once the change is committed, clients always return a null string for this attribute. Please ensure you correctly enter and document the new password before committing the change. Failure to do so can render the adapter inaccessible, requiring a re-installation to restore connectivity.

7. To change the password, double-click the Password field and enter the new value.
8. To enable or disable the operator account, click the Enable checkbox to toggle the setting as required.

5.3 Adapter configuration

The MDB Federator Data Sources configuration panel provides initial connection and communication parameters configuration. MDB provides two additional configuration mechanisms for the Adapter.

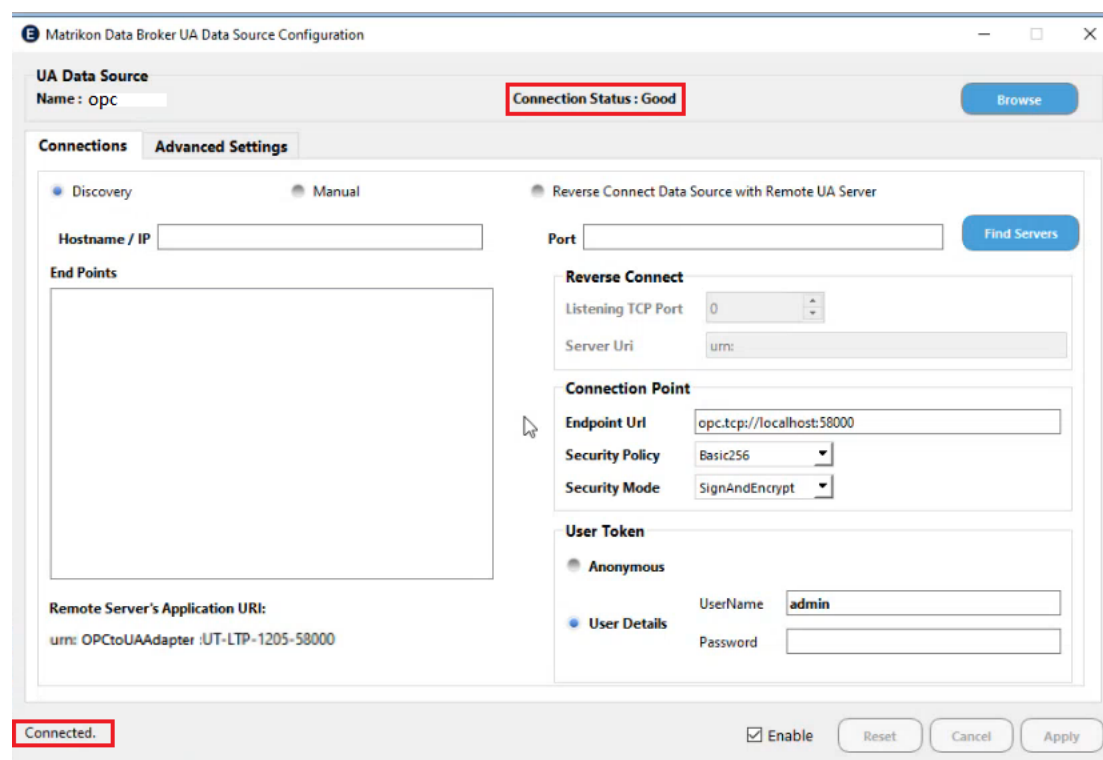
The Adapter Configuration panel provides:

1. Configuration of device connections
 - a. Logging options for the root adapter
 - b. Configuration of the adapter Address Space
2. The MDB Address Space provides user management.

5.3.1 Adding Classic Client Connection to Adapter

Once the Adapter is connected and the connection status is good, as shown below

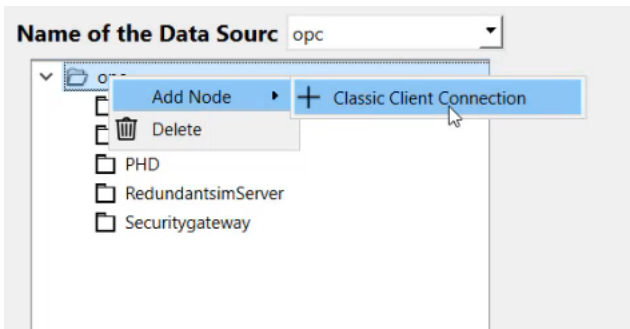
Figure 35 Adapter connection status



To configure the device details

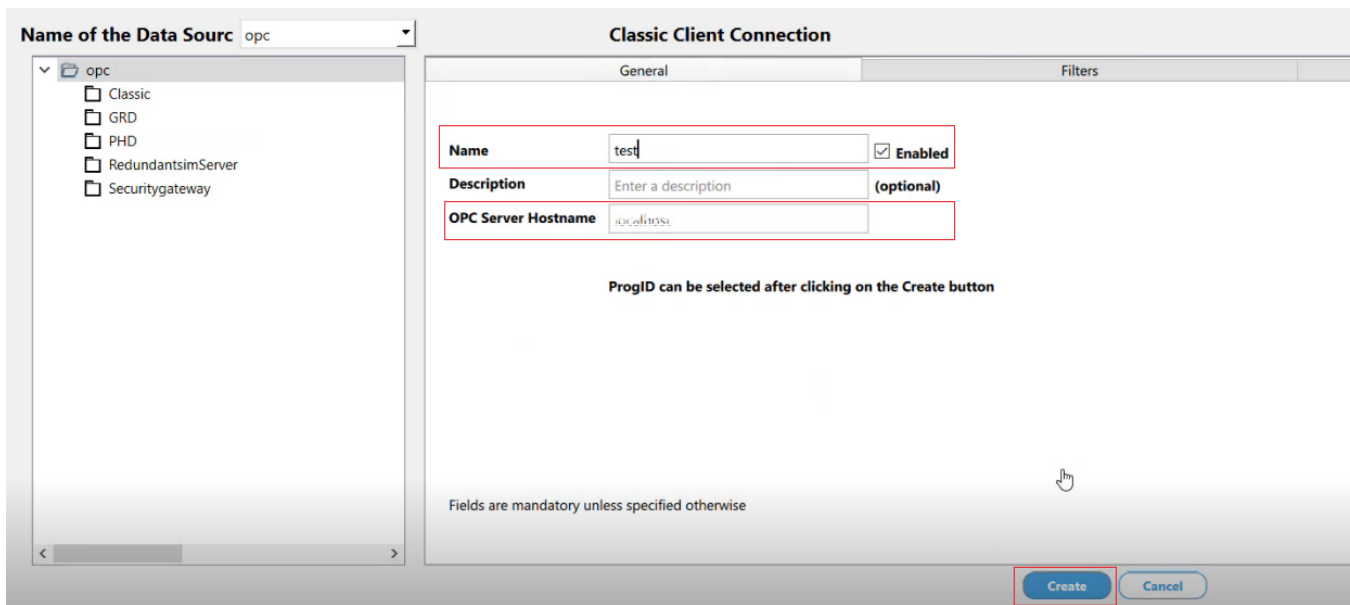
1. Click Adapter configuration and select the OPC to UA adapter

Figure 36 Adapter configuration



2. OPC to UA Classic Client server status windows appear. Enter the details, including the classic server connection, IP address of classic OPC server, and click Create to create the client connection.

Figure 37 OPC to UA device status windows



CAUTION

Client connection does not support names comprising dot(.) Symbol. For example, a name like "OPC.simulation" is not allowed.

NOTE

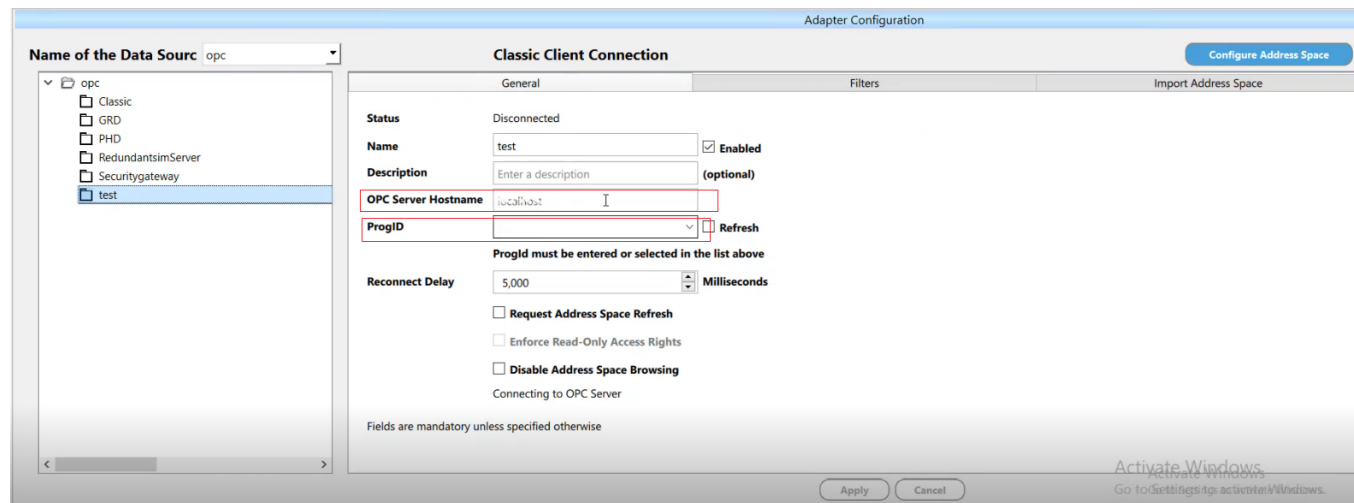
After clicking Create, wait for a few seconds for the newly created Classic OPC Server connection to appear in the left-hand tree.

NOTE

If it is a remote Connection, it must be verified in Classic Connection, i.e., OPC Explorer (DCOM Connection).

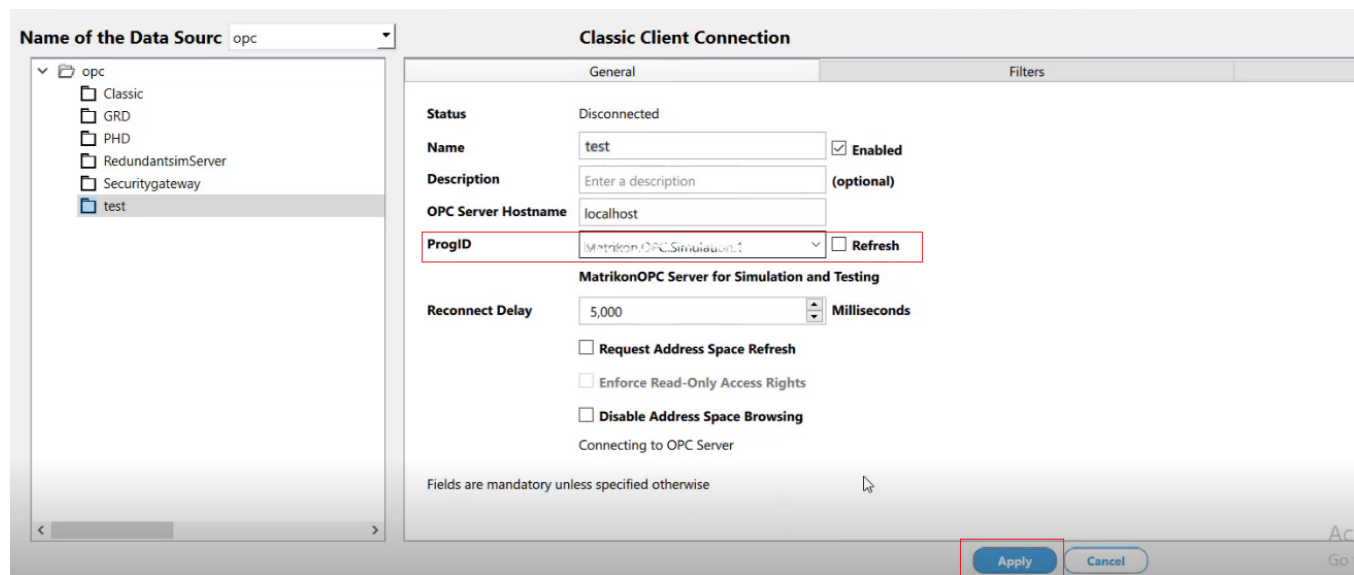
3. Select the created client connection. Select the ProgID related to the Classic OPC Server you are connecting to from this connection.

Figure 38 Select OPC ProgID



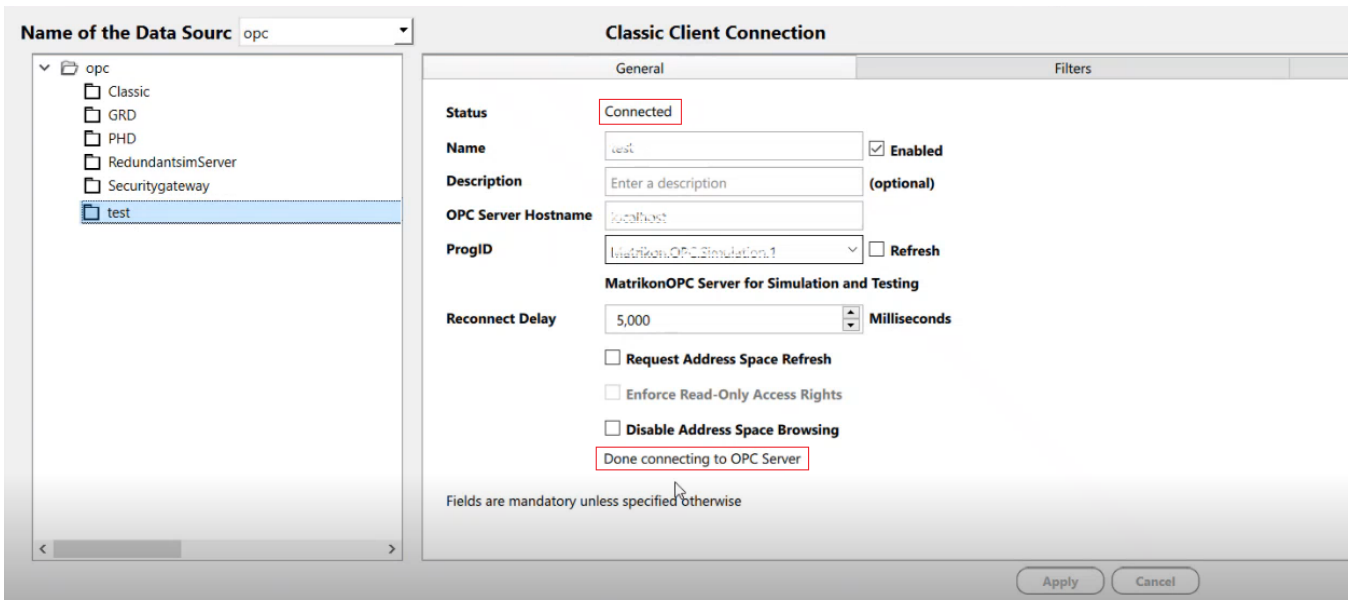
4. If you are connecting to a Classic OPC Server running on a remote system (a feature available only with the OPC to UA Plus Adapter license feature), enter that system's Host Name/IP Address and click the Apply button. After a few seconds to a minute, select the "Refresh" check box next to the "Prog ID" drop-down and click Apply. After a few seconds, the Prog ID drop-down gets refreshed with the Prog IDs of Classic OPC Servers from the remote system. Select the related Prog ID of the Classic OPC Server you want to connect to and proceed to the next steps.
5. Click Apply

Figure 39 Create Address space



6. OPC to UA adapter is successfully connected

Figure 40 OPC to UA adapter connected

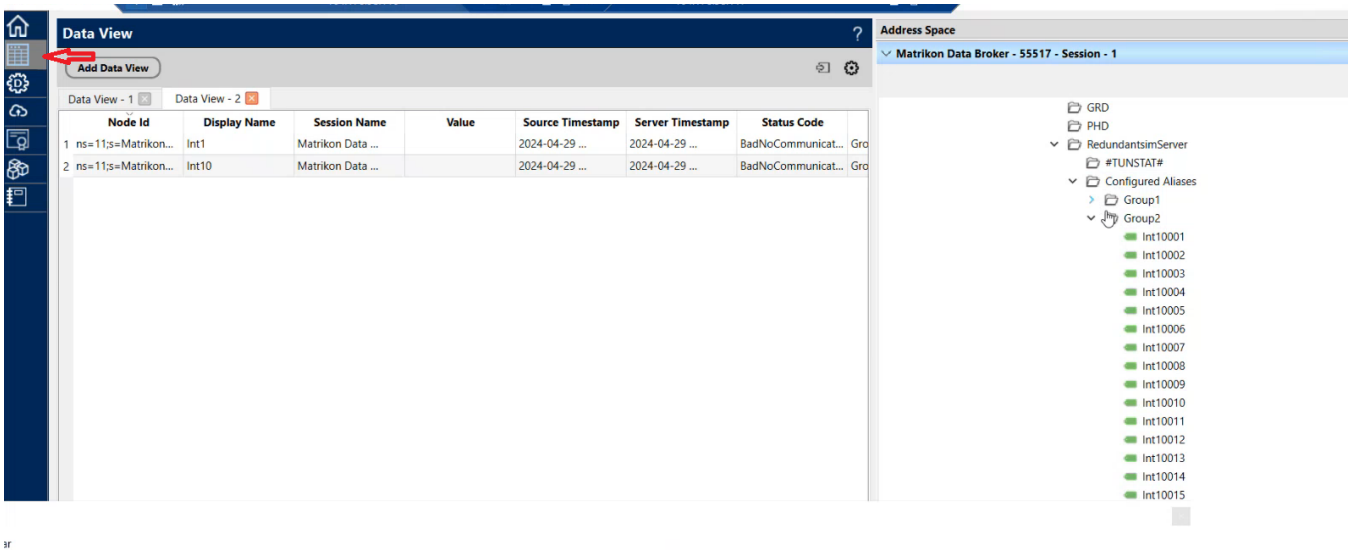


7. You can choose other options as described below.

- Request Address Space Refresh- To manually refresh the Address Space of the Classic OPC Server, select this Check Box and click Apply.
- Set access rights to read-only-To override the access rights of all nodes to read-only, select this check box and click Apply. Please note that this feature is only available with an OPC to UA Plus Adapter license.
- Disable Address Space Browsing- If you do not want the Adapter's Address space to dynamically change, select this option to disable it. This option is, by default, selected when you use the "Import Address Space" feature to build the adapter's static address space.

8. Validate the values in the Address Space.

Figure 41 Validate the values in the Address Space



There are some additional features for the OPC UA Adapter under the Adapter configuration's Filters screen.

- **Filters:** It filters the items in the Address Space. There are different types of filter options available:
 - **Item ID Filter:** You can filter the specific properties of items using its Item ID taken from the OPC Classic server. You can select one or more wild card character filters in this field.
 - **Access Rights Filter:** You can filter the nodes by selecting only those that are "Writeable" or "Readable." By default, both these options are checked, so all nodes are shown.
 - **Get all OPC Classic Properties:** If you keep it active, it shows all the OPC classic item properties in the address space.
 - **Create Analog Item Properties:** If you keep it active, analog item properties are also shown in Address Space.
 - **Only these properties:** You can make use of Only these properties by entering the required OPC classic property Identifiers from the OPC Classic Server in a numeric range.

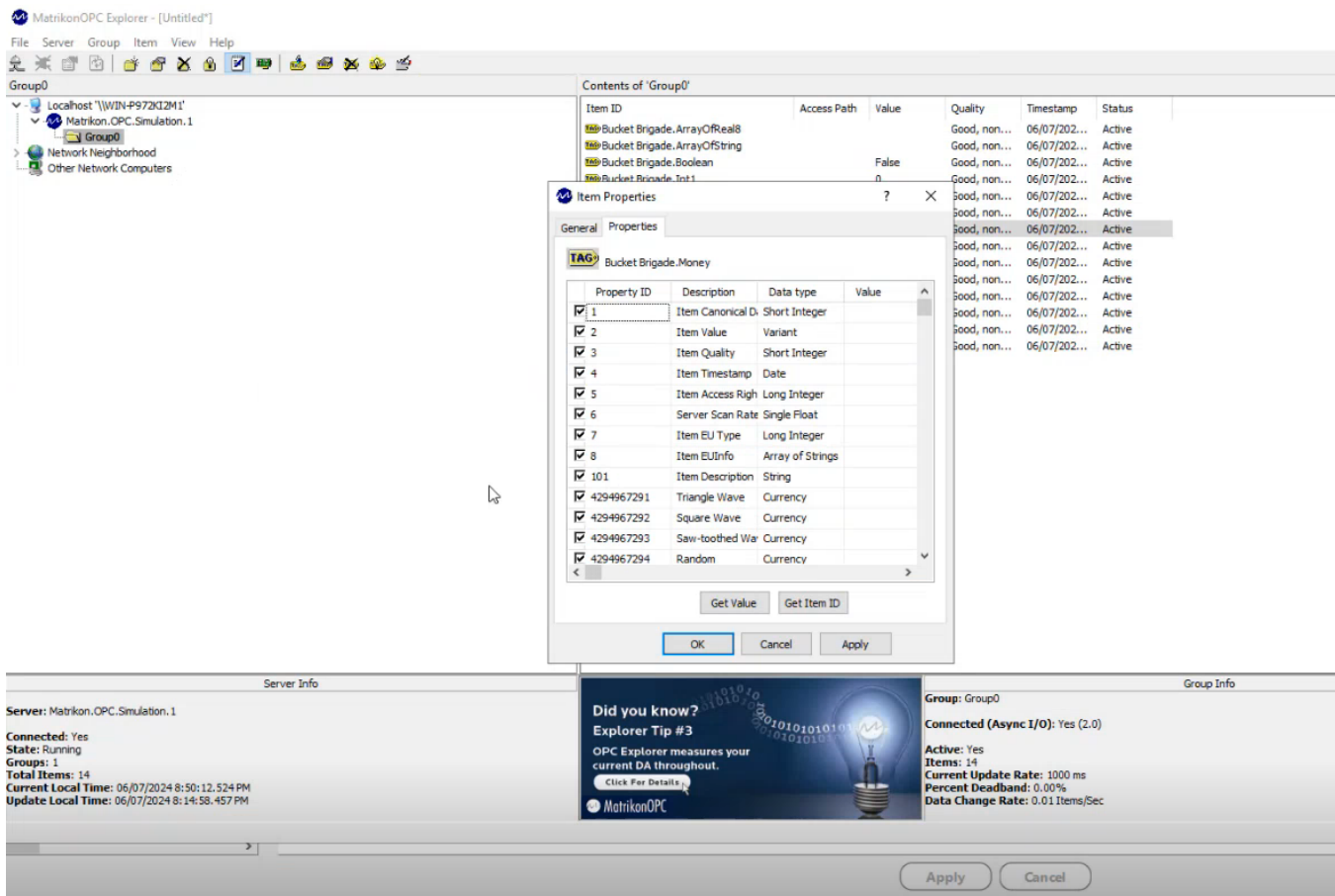
Figure 42 Filters

The screenshot shows the 'Adapter Configuration' window with the 'Classic Client Connection' tab selected. The 'Filters' sub-tab is active. On the left, a tree view shows the 'opc' data source expanded, with sub-items: Classic, GRD, PHD, RedundantsimServer, Securitygateway, and 'test' (selected). The main area contains the following settings:

- Item ID Filter:** A text input field with the placeholder 'Enter a valid item ID filter' and an example 'Example: Network1.PLC1*'. Below it is a list box and two buttons: 'Add' and 'Delete'.
- Access Rights Filter:** Two checked checkboxes for 'Writeable' and 'Readable'. Below them are two unchecked checkboxes: 'Get all OPC Classic Properties' and 'Create Analog Item Properties'.
- Only these properties:** A text input field with the placeholder 'Enter OPC Classic Property Identifiers' and an example 'Example: 1-10;1025-1030'.

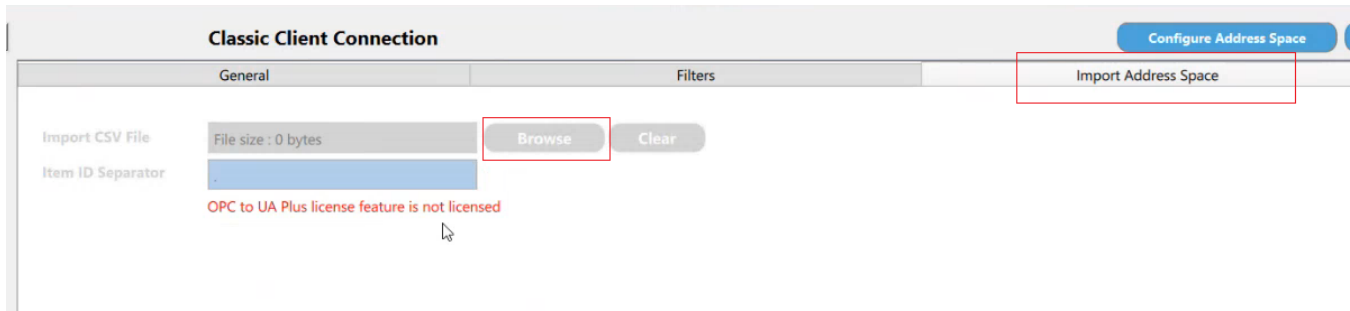
At the bottom, a note states: 'Fields are mandatory unless specified otherwise'.

Figure 43 OPC Classic Server - A sample window



- Import Address Space:
Import Address Space allows you to build a static address space for an OPC to UA Adapter from Classic OPC Servers. This is very useful when you have a large number of items/tags/nodes in Classic OPC Server but only need a few of those items to be available through OPC to UA Adapter.
This feature is available only with OPC to UA Plus Adapter license feature.
To make use of this functionality, First Disable Address Space Browsing under General, create a CSV file with only the required items of Classic OPC Server from Matrikon OPC Explorer and you can load the CSV file which browses only the items mentioned in the CSV file. It lists the items in the Address space and the folder for validation.

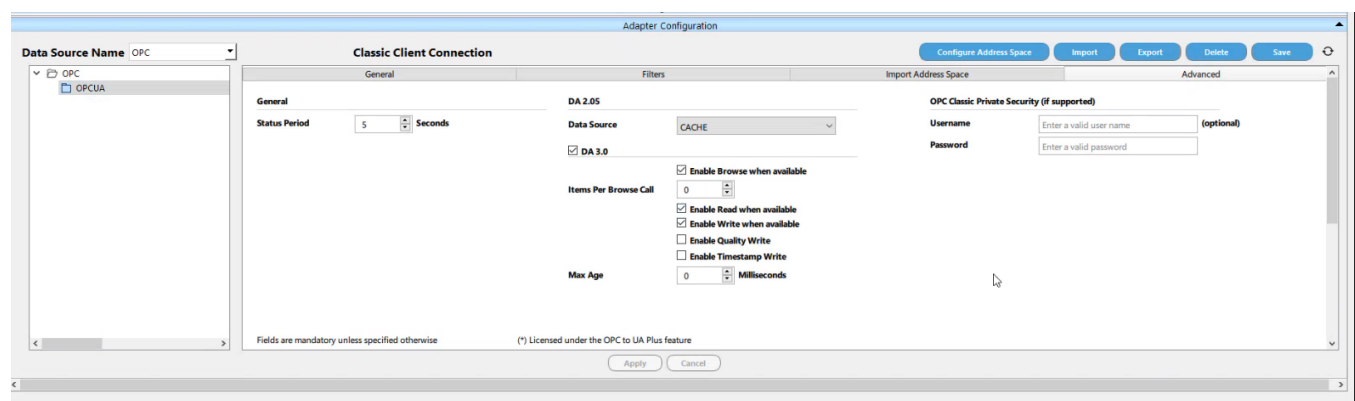
Figure 44 Import Address Space



- Advanced Settings/Options

Figure 45 Advanced Settings/Options

These additional options in Advanced Settings help improve the performance and functionality when connecting to Classic OPC Servers.



There are two versions of Data Access: DA 2.05 and DA 3.0.

DA 2.05

- The Data source has two options to select CACHE and DEVICE

CACHE	DEVICE
Returns the data that is available in the cache, i.e., memory	It sends the request to the device and retrieves the fresh data if it's available
Data is browsed as per the point memory	Browsing happens at the device level, and whenever the change occurs the read requests and response is sent

Figure 46 DA 2.05



DA 3.0

- There are two types of browsing methods DA 3.0 Items Per Browse Call and DA 3.0 Max Age

Items Per Browse Call	Max Age
Browsing as per the selection and to be validated in wire sharks and logs	Classic OPC server returns cache data if t-t1 < max age; otherwise it triggers another request to the device

Figure 47 DA 3.0

Items Per Browse Call: 0

Max Age: 0 Milliseconds

☒ Enable Browse when available
☒ Enable Read when available
☐ Enable Write when available
☐ Enable Quality Write
☐ Enable Timestamp Write

DA 3.0 Options

- Enable browse when available: If checked, the adapter uses the DA 3.0 browse call (if supported by the Classic OPC Server). If unchecked, it uses the DA 2.05 call.
- Items Per Browse Call: The maximum number of items per DA 3.0 browse call. Keeping the default (0) is recommended unless the OPC Server documentation suggests otherwise.
- Enable Read when available: If checked, the adapter uses the DA 3.0 read call (if supported by the Classic OPC Server). If unchecked, the adapter uses the DA 2.05 call.
- Enable Write when available: If checked, the adapter uses the DA 3.0 write call (if supported by the Classic OPC Server). If unchecked, it uses the DA 2.05 call.
- Enable Quality Write: The item's quality can be overridden if the following conditions are satisfied:
 - This option is checked.
 - The DA 3.0 write is enabled.
 - The classic OPC Server supports writing to the item's quality.
 - The data value sent by the OPC UA Client has its status code enabled.
- Enable Timestamp Write: The item's timestamp can be overridden if the following conditions are satisfied:
 - This option is checked.
 - The DA 3.0 write is enabled.
 - The classic OPC Server supports writing to the item's timestamp.
 - The data value sent by the OPC UA Client has its timestamp enabled.
- Max Age: The item's cached value is returned to the client if it is not older than the specified period (in milliseconds). Otherwise, a call is made to the device to retrieve a fresher value. When set to zero, the server will always retrieve the value from the device (the equivalent of the Device read in DA 2.05).

Enable Write when available: If checked, the adapter uses the DA 3.0 write call (if supported by the Classic OPC Server). If unchecked, it uses the DA 2.05 call.

NOTE

Un-checking the check box next to DA 3.0, you can force the use of only DA 2.05 browsing. By default, if both DA 2.05 and 3.0 are available, DA 3.0 is used explicitly.

OPC Classic Private Security

If supported, you can use the OPC Classic Private Security. You must set the User name and password in the Classic OPC Servers. This feature is generally available in some of the Matrikon Classic OPC Servers.

5.3.2 Creating the root object

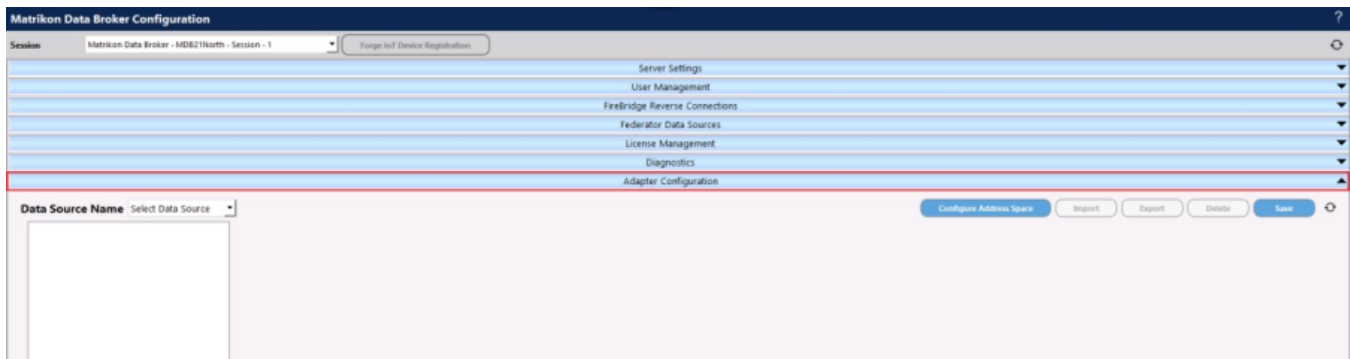
With MDB connected to the Adapter, access MDB Configuration to configure the Adapter. The default screen of OPCtoUA Adapter Data Source gives options to configure options at adapter level and also provides additional information about the OPCtoUA Adapter.

To configure the options for OPCtoUA Adapter, follow below steps:

- 1. Connect to MDB with OPC UA Explorer and open MDB Configuration by clicking the Configure MDB icon in the left-hand menu bar.

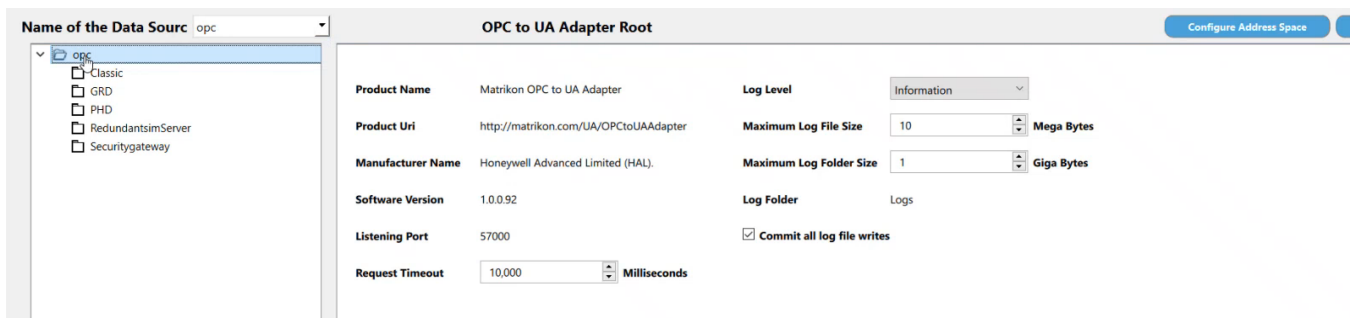
Expand the Adapter Configuration panel by clicking the panel header. By this time, you should have added OPCtoUA Adapter OPC UA Server as a Data Source to MDB.

Figure 48 Adapter Configuration



- 2.
- 3. For the OPC to UA Adapter, the root object provides server info and configurable logging options. The following sections in this chapter describe the configuration items for this adapter.

Figure 49 OPC to UA Adapter Root Object

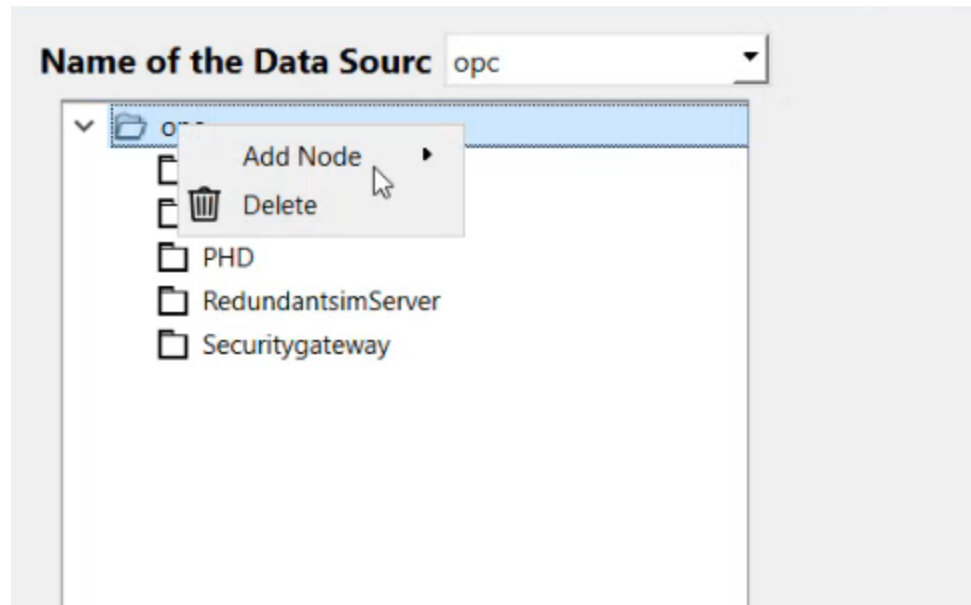


5.3.3 Creating or deleting a configuration object

The configuration object or node represents the mechanism required to connect to the OPC to UA device(s) in the process control system. To create a new node in the adapter:

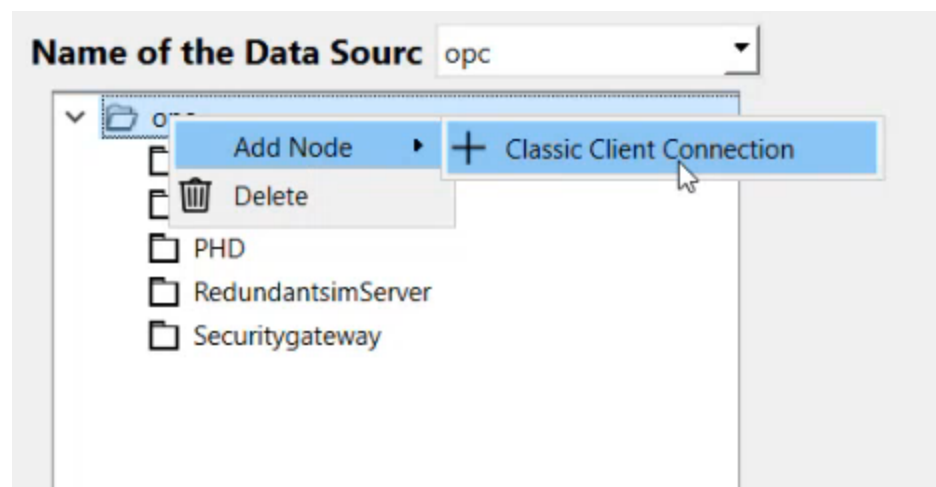
1. Access the OPC to UA Adapter configuration panel as described in [Updating the Adapter address space](#)
2. Right-click the parent object. The below figure shows the contextual menu displayed.

Figure 50 Add or Delete a Node



3. Select Add Node to create a new configuration object.

Figure 51 OPC to UA Objects Available from the Root Object



4. To delete an existing node, right-click the Classic Client Connection in the tree and click Delete.
5. Alternatively, clicking the Delete button deletes the selected Classic Client Connection.

NOTE

After clicking the Apply button in any of the operations, wait a few seconds to a minute for the screen to refresh or for the actions to complete before performing the following action.

INTRODUCTION TO OPC UA

The OPC Unified Architecture (OPC UA) specification is a platform-independent communications and data modeling standard for exchanging data and information between industrial control system (ICS) components. OPC UA supports

- A client-server model in which information is exchanged between applications in a series of request and response messages and
- A publish-subscribe model that defines the mechanisms for publishers to push data to subscribers through network messages.

For this manual, we discuss only the client-server architecture.

A.1 Design goals

The following characteristics of OPC UA enable integration into the modern industrial space, taking advantage of recent technological advances.

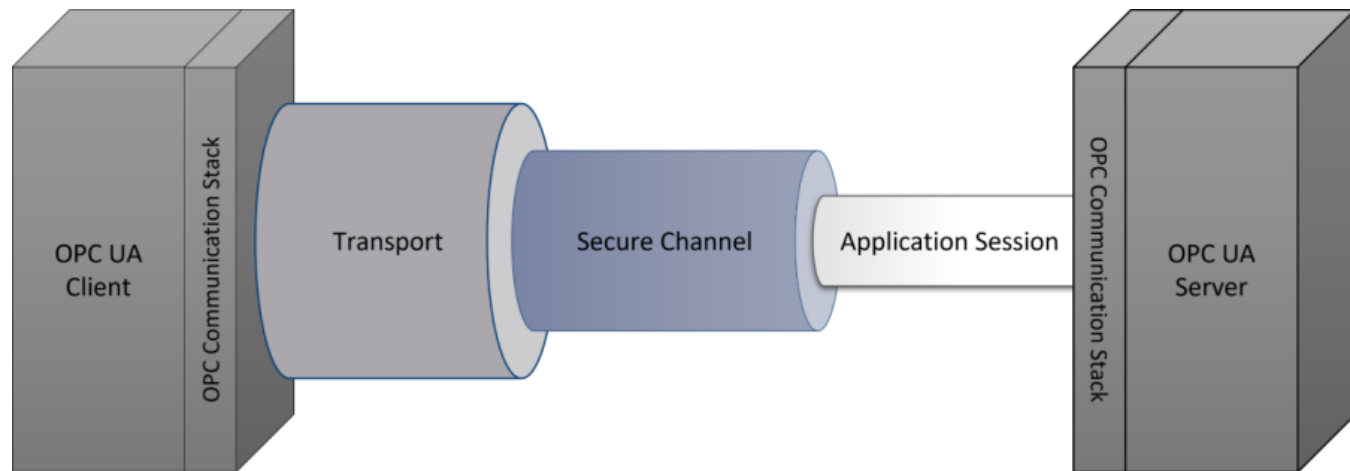
- **Functional Equivalence.** All functionality available to OPC Classic is likewise known to OPC UA, along with additional functionality unique to UA.
- **Platform Independence.** The specification is not based upon a single technology, as Classic is with COM. This means that applications are entirely agnostic concerning the platform.
- **Secure.** It is defined directly in the specification, with encryption, digital signing, authentication, authorization, and auditing mechanisms.
- **Extensible.** New and emerging technologies and methodologies, such as new transport protocols, security algorithms, encoding standards, or application services, can be incorporated into OPC UA while maintaining backward compatibility with existing products.
- **Comprehensive Information Modelling.** Complete object-oriented capabilities provide modeling for even the most complex systems.

The OPC UA specification describes

- The functionality required in the client and server applications
- The components and configuration of the address space that represent real-world objects to which the server application connects
- The services that define all interaction between applications
- The structure of the messages
- The security mechanisms used to protect these messages
- How OPC UA maps to accepted technologies

Figure 76 shows a typical client-server connection between OPC UA applications.

Figure 52 OPC UA Connection



The OPC UA Communication Stack is a collection of software libraries that implement the technology mappings supported by the application. Applications must support the same stack technologies to connect and communicate.

The Transport layer is the protocol for establishing communications between OPC UA applications.

The Secure Channel is a long-running logical connection between a client and a server. Security measures defined in the stack are used to create this secured connection.

The Application-layer session is a connection between the applications that are used for the exchange of messages. The session

- Provides state information related to the communication between the client and the server
- Is associated with a specific user
- Is independent of the underlying communication protocols

The security mechanisms applied to the Secure Channel handle encryption and digital signing of the messages exchanged through the session. The communication stack manages the sessions: this is transparent to the user.

A.2 OPC UA applications

The OPC UA specification defines the mechanisms for sharing and exchanging data between industrial applications. Applications developed from this specification are interoperable with any other OPC UA application, provided they implement the same defined functionality (see [Profiles](#)).

A.2.1 Client and server roles

Typically, in the client-server architecture, the client initiates connection and communication by sending the required service requests to the server. OPC UA also defines a reverse-connect function, which allows the server to begin the connection process. Clients and servers have the following primary roles regardless of which application initiated the connection.

- Request services from servers
- Receive data and notification messages from servers.
- Make the responses from the server available to the application that consumes them.

Servers

- Connect to devices (real objects)
- Expose the data associated with these objects.
- Respond to requests from clients.
- Send notifications to the client.

A.3 Service-oriented architecture

Unlike OPC Classic, which relies on COM function calls, OPC UA uses services to interact between applications. The services implement all functionality of the client and server applications.

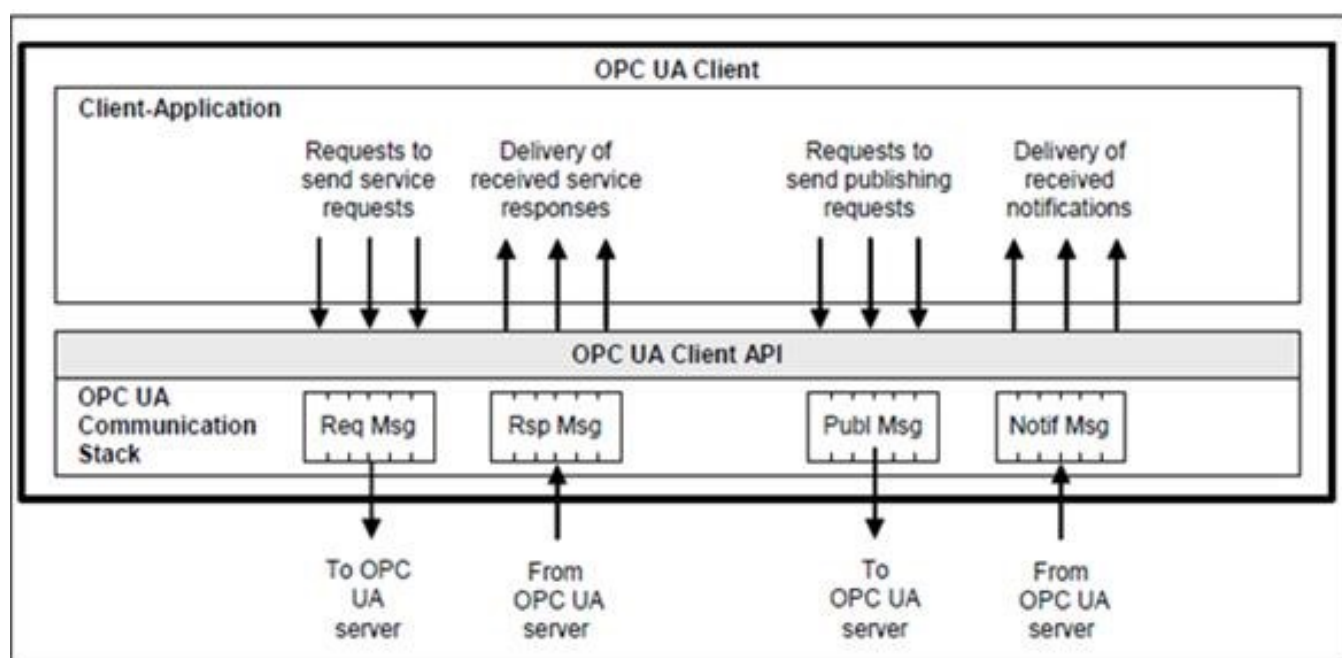
The OPC UA Specification Part 4 (OPC 10000-4) describes the Service Sets and individual services.

A.4 OPC UA client application

An OPC UA client is an application that sends messages that conform to the services defined in the specifications to the server.

Figure 77 shows the structure of a typical OPC UA client, including its major components and their relationships with each other.

Figure 53 OPC UA Client Structure



The Client-Application implements the functions of the client.

The OPC UA Client API is an internal interface the application uses to send and receive service requests and responses to and from the server.

The OPC UA Communication Stack converts client API calls into messages and sends them to the server through the underlying transport protocol. It also receives the response and notification messages from the underlying transport protocol and delivers them to the client application through the client API.

A.4.1 Subscriptions and Monitored Items

Clients establish a subscription to receive data change and event notifications from the server at a specified rate, known as the publishing interval. The client then adds monitored items to the subscription, each setting an attribute or event to be monitored by the server. The server samples each monitored item at a specified interval known as the sampling interval.

Servers only notify the client if a data value, status change, or an event has occurred.

A.4.2 Reading and writing

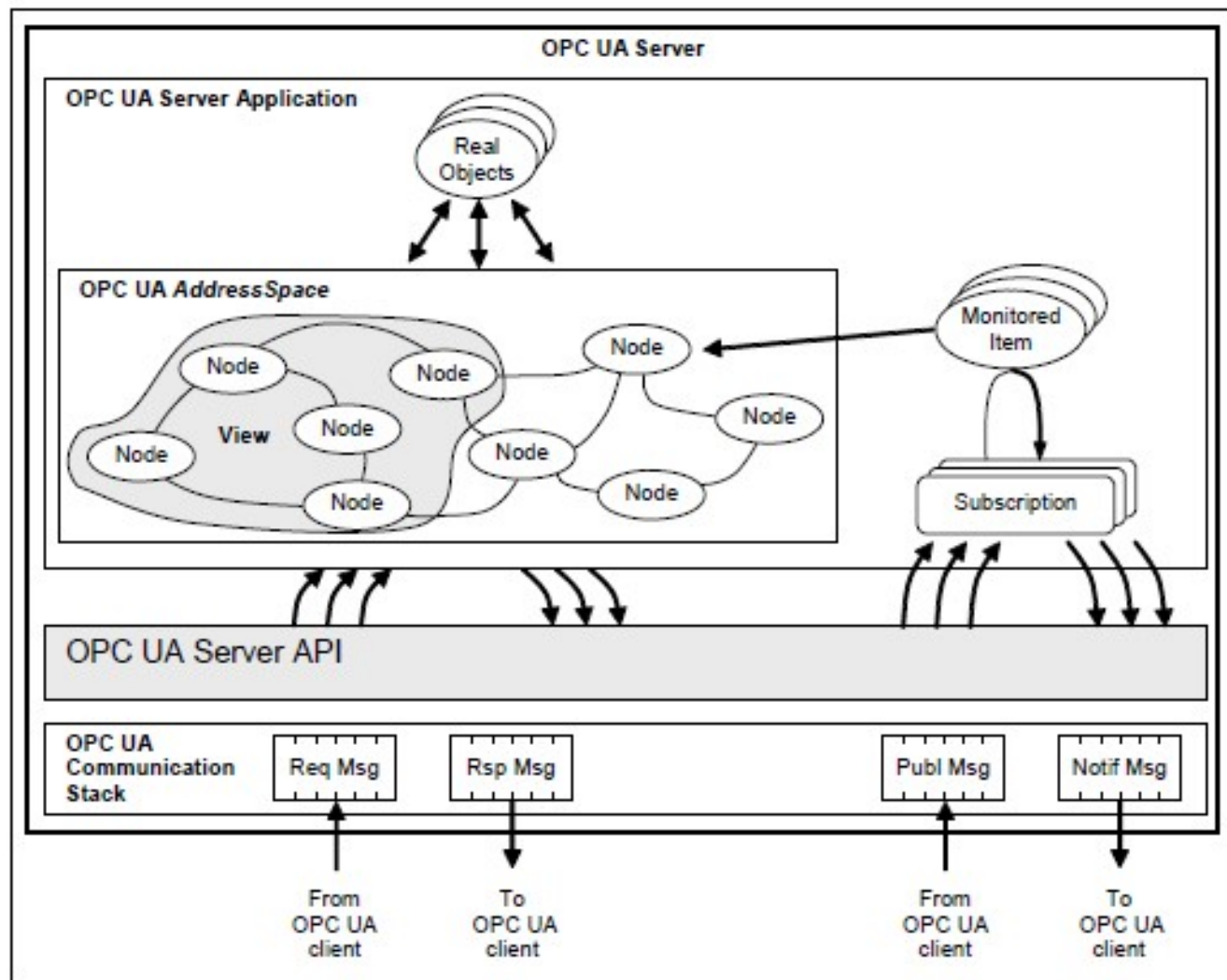
A client can also request a read or write of any node attribute by invoking one of the Attribute services.

A.5 OPC UA server application

An OPC UA server is an application that implements and exposes the Services specified in this set of specifications.

Figure 78 represents an OPC UA Server and shows its key components.

Figure 54 OPC UA Server Structure



Real objects are

- Physical objects such as industrial devices or diagnostic counters
- Software objects

These objects are mapped to nodes in the OPC UA Address Space, a digital representation of the real objects accessible to the server. Nodes are defined by their attributes, which contain information such as the node type and the value.

Clients browse the address space or a subset of the address space called a view. Clients then identify node attributes to read from or write to and send read and write request messages to the server. The communication stack handles these message requests and passes them to the underlying transport protocol.

A.5.1 Address Space

The address space is the core of the OPC UA Server. It is a digital representation of the server's information available to the client. The primary component of the *address space* is the *node*. Nodes are defined by their *attributes* and *properties* and are interconnected by *references*. The nodes contain all the information and data associated with the data and event sources and provide the context for these sources.

Attributes are the primitive characteristics of the node, such as the variable's value, the variable's read and write permissions, a textual description of the variable, and so forth. Properties are nodes that describe the characteristics of a node. For example, an *AnalogItem* node has a property *EURange*. The *EURange* property is a node that contains an upper and lower operating limit for the value exposed by the *AnalogItem* in the Engineering Units attribute of the *AnalogItem*.

References form the connection between nodes and define their relationship. There is great flexibility in how nodes can reference each other. Rather than a strict tree structure, OPC-UA also allows circular references.

A.5.1.1 Folders

A Folder is a type of node used to organize the address space. Folders have no other information associated with them than the nodes in the address space.

A.5.1.2 Views

A View is a Folder-type node that contains a subset of the address space, used by the server to restrict the nodes made visible to the client. The default view of an address space is the entire address space. The View can limit a particular client's access to nodes relevant to that user's requirement for data or information.

The set of nodes in different views can overlap, meaning that the different views can represent the same data in a different context, different data, or a combination of both.

A.6 Data Modelling

The OPC UA specification defines all components of the address space and the services that manage them. This allows OPC UA applications to manage the address space configuration, the data, and the information it represents.

A model is a digital representation of a real-world object, such as a device, a process, or a manufacturing facility. OPC UA allows models to be created and reused as needed. They can also be imported and wholly or partly reused from other sources. Data models defined in the OPC UA Companion Specifications include a nodeset file. These files contain the node types required to represent the objects defined in the model. OPC UA server applications import these files to define their address space. The server then maps these address space components to the real-world objects they represent, allowing data from the devices to be shared by the server.

A.7 Security in OPC UA

OPC UA provides security by authenticating clients and servers using symmetric public key algorithms and X.509v3 application instance certificates. Asymmetric public key algorithms are also used for symmetric key generation and are exchanged periodically. Client-server communication channels are secured with symmetric algorithms, which are faster and more resource-efficient than Asymmetric algorithms.

OPC UA applications must be provisioned with a certificate during commissioning. Most applications generate a self-signed certificate on installation. Application administrations can generate signed certificates based on their corporate policies and use them in place of the self-signed certificates. All certificates require management to ensure they meet certain conditions, including

- All information in the certificate is valid.
- The application is from a valid source.
- The certificate is not expired.
- The application URI is valid.
- The signature is valid.

All security profiles currently supported by the specification require the existence of a Public Key Infrastructure (PKI). An administrator in a system carries out the PKI functions using the appropriate application certificates. Certificates can also be managed by Certification Authority (CA), an application responsible for

- Verifying the information in a certificate request
- Issuing an Application Instance Certificate
- Signing an Application Instance Certificate
- Validating Application Instance Certificates as required by the supported security protocols

CAUTION

Matrikon recommends using a corporate CA to sign, issue, and manage certificates. The use of self-signed certificates is discouraged.

Once a secure channel is established and authentication has taken place, user authorization and permissions are handled at the session level using the security mechanisms implemented in the session. There can be multiple sessions in a channel, each with different authorization.

A.8 Profiles

A facet is a single piece of defined functionality. A profile represents the full-featured definition of functionality that the application must support. Profiles are collections of Facets and other Profiles. The OPC Foundation describes profiles online in this [link](#) and publishes them in the OPC UA specification Part 7 (OPC UA 10000-7).

A.9 OPC UA Resources

OPC UA is a multi-part specification comprised of the following

- UA Core
- UA Field Exchange
- UA Device Model
- Industry and technology-based Companion Specifications

Copies of the specifications can be downloaded from the OPC Foundation website at <https://opcfoundation.org/developer-tools/documents/>

Matrikon provides a series of Whitepapers and articles offering.

- Information on new products
- Topics of interest to users and those considering UA as a solution
- Industry-specific insights

Access these resources on the Matrikon website at <https://matrikonopc.com/downloads/types/whitepapers/index.aspx>.

OPC STATUS CODES

Table 10 Status Code Bit Assignments

Field	Bit Range	Description
Severity	30 : 31	Indicates whether the StatusCode represents a good, bad, or uncertain condition. These bits have the following meanings: • Good Success 00 Indicates that the operation is successful, and the associated results can be used. • Uncertain Warning 01 Indicates that the operation is partially successful and that associated results cannot be suitable for some purposes. • Bad Failure 10 Indicates that the operation failed, and any associated results cannot be used. • Reserved 11 Reserved for future use. All Clients should treat a StatusCode with this severity as “Bad”.
Reserved	29	Reserved for use in OPC UA application specific APIs. This bit can always be zero on the wire but can be used by OPC UA application specific APIs for API specific status codes.
Reserved	28	Reserved for future use. It can always be zero.
SubCode	16 : 27	The code is a numeric value assigned to represent different conditions. Each code has a symbolic name and a numeric value. All descriptions in the OPC UA specification refer to the symbolic name. OPC 10000-6 maps the symbolic names onto a numeric value.
StructureChanged	15	Indicates that the structure of the associated data value has changed since the last Notification. Clients cannot process the data value unless they re-read the metadata. Servers can set this bit if the DataTypeEncoding is used for Variable changes. 7.29 describes how the DataTypeEncoding is specified for a Variable. Servers can also set this bit if the Variable's EnumStrings Property of the DataType changes. This bit is provided to warn Clients that parse complex data values that their parsing routines can fail because the serialized form of the data value has changed. This bit only means StatusCodes returned as part of a data change Notification or the HistoryRead. StatusCodes used in other contexts are always set this bit to zero. The bit is set on one data change Notification per MonitoredItem that samples values when the structure change happens. If the data change notification with the bit set is deleted because of a

Field	Bit Range	Description
		queue overflow, the bit must be set on the following data change notification in the queue.
SemanticsChanged	14	Indicates that the semantics of the associated data value have changed. Clients cannot process the data value until they re-read the metadata associated with the Variable.
Reserved	12 : 13	Reserved for future use. It is always zero.
InfoType	10 : 11	The type of information contained in the info bits. These bits have the following meanings: • NotUsed 00 The info bits are unused and can be set to zero. • DataValue 01 The StatusCode and its info bits are associated with a data value returned from the Server. The info bits are defined in Table 181. • Reserved 1X Reserved for future use. The info bits can be ignored.
InfoBits	0 : 9	Additional information bits that qualify the StatusCode. The structure of these bits depends on the Info Type field.

This chapter describes the troubleshooting workarounds for the issues.

C.1 Adapter Configuration Screens show blank in OPC UA Explorer

C.1.1 Issue

The adapter configuration window shows blank when trying to configure an adapter in OPC UA Explorer when you are running OPC UA Explorer in a Virtual Machine (VM).

These are the messages you receive:

OPENGL32.dll DrvSwapMultipleBuffers

C:\Program Files\Matrikon\opcuaexplorer\QtQuick\Controls\Fusion\impl\qtquickcontrols2fusionstyleimplplugin.dll

QTQUICKCONTROLS2FUSIONSTYLEIMPLPLUGIN.DLL

VM3DUM64_10.DLL - OpenAdapterWrapper

Failed to create vertex shader: 0x80070057

Failed to build graphics pipeline state

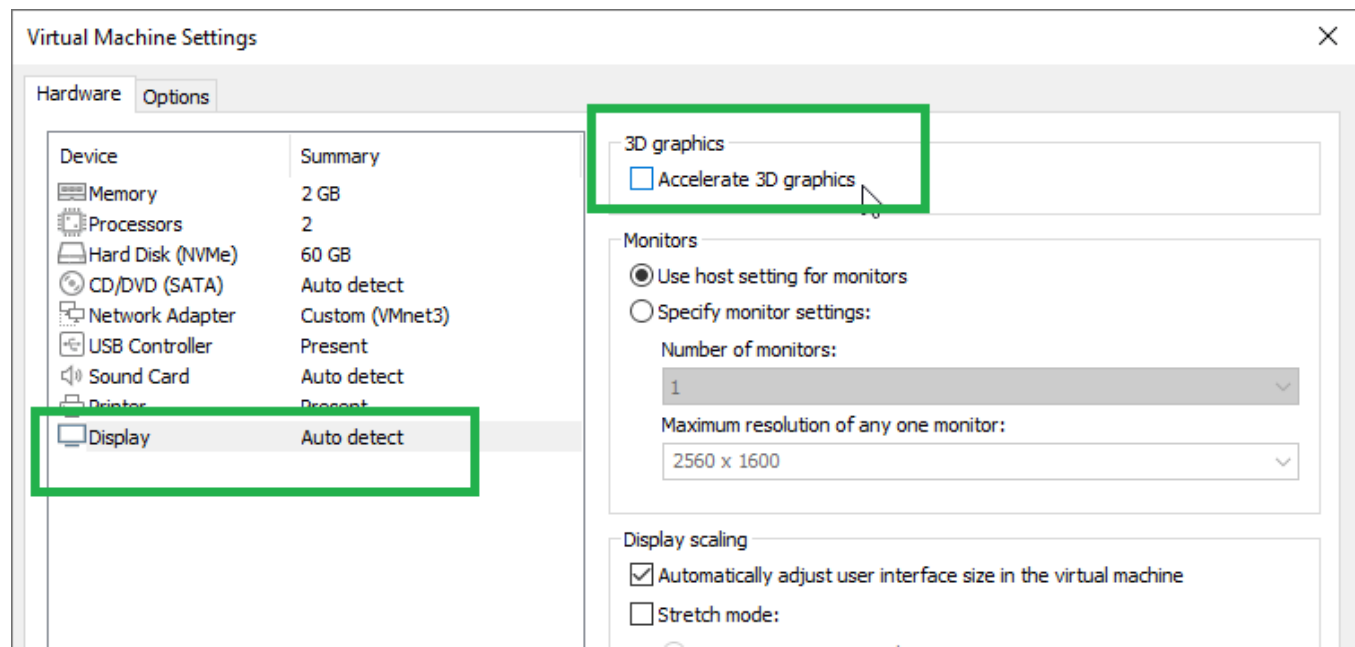
C.1.2 Reason

This issue is with the VM 3D Acceleration.

C.1.3 Workaround/Solution

- Stop the VM
- Launch the Virtual machine settings
- Select the Display adapter under Hardware
- Uncheck the Accelerate 3D graphics

Figure 55 Accelerate 3D graphics



- Restart the VM and repeat the steps to configure the adapter

CONTACTING SUPPORT

The Matrikon Customer Services department (www.opcsupport.com) is available 24 hours a day, seven days a week. Contact Matrikon Support using the information below, or email support@MatrikonOPC.com. For Monday to Friday daytime support requests, contact [Matrikon Support](#) using the regional phone numbers provided below:

Table 11 Contacting Support

Region	Office Hours	Contact Information
North America UTC/GMT -7 hours (MST)	8:00 am-5:00 pm	+1-877-OPC-4-ALL (672-4255) +1-780-945-4011
South America UTC/GMT -3 hours (BRT)	9:00 am-5:00 pm	+55 (11) 4380-8995
Europe /Africa/Middle East UTC/GMT +1 hours (CET)	9:00 am-5:00 pm	+49-699-675-8875 (Request OPC Support)
Australia/Asia UTC/GMT +10 hours (AEST)	9:00 am-5:00 pm	+61-3-7037-2768

Table 12 Contacting Support

Region	Contact Information
All*	+1-780-231-9480

For after-hours support in all regions, use the following number. There is no extra charge from Matrikon OPC for calling their after-hours support number.

*Available only to priority and premium support customers.