Integration Objects'
MQTT IoT Connector for OPC DA

OPC Client for MQTT
Version 1.0 Rev.0

USER GUIDE

OPC Compatibility
OPC Data Access 1.0A
OPC Data Access 2.00
OPC Data Access 2.05a
OPC Data Access 3.00

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OPC Client for MQTT User Guide Version 1.0 Rev0
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PREFACE

ABOUT THIS USER GUIDE

This guide:

- Describes the main features offered by Integration Objects' OPC Client for MQTT,
- Lists the system requirements for installing and running OPC Client for MQTT,
- Explains how to configure OPC Client for MQTT,
- And details how to use and run this OPC Client.

TARGET AUDIENCE

This user guide is intended for users who are looking for applications that can collect real-time data and publish those data into MQTT Brokers.
Knowledge of the basics of OPC Data Access (OPC DA) specification is a prerequisite. It also assumed minimum knowledge of the MQTT protocol.

DOCUMENT CONVENTIONS

Convention	Description
`Monospaced type`	Indicates a file reference
Bold	Click/selection action required
	Information to be noted

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INTRODUCTION

1. Overview

The Internet of Things (IoT) is a network of computing devices, intelligent systems, advanced analytics, mechanical and digital machines and/or objects that collect, share and transfer data without requiring human-to-human or human-to-computer interaction. The collected data can be, for example, sent to Cloud-based services for further analysis and reporting purposes.

The application of IoT to the manufacturing industry is called Industrial Internet of Things (IIoT). IIoT can improve connectivity, efficiency, scalability, time savings, and cost savings for manufacturing organizations. IIoT empower industrial organizations to connect data silos with all of their people, and processes from the plant floor to the executive offices.

The Message Queueing Telemetry Transport (MQTT) protocol is quickly emerging as the standard for IIoT, due to its lightweight overhead, publish/subscribe model, and bidirectional capabilities.
As OPC is a powerful solution for communication in the industrial field, nowadays, the link between OPC and IoT protocols seems necessary to enhance performance, security, and operations automation and ensure high availability.

Integration Objects' OPC Client for MQTT leverages both MQTT protocol and OPC standard in order to allow you to collect real-time data from one or more OPC Data Access (OPC DA) servers and transfer those data to any MQTT Broker accessible through the network. This OPC client provides multithreading capabilities using MQTT Agents.

2. Architecture

The following diagram illustrates the OPC Client for MQTT typical system architecture.

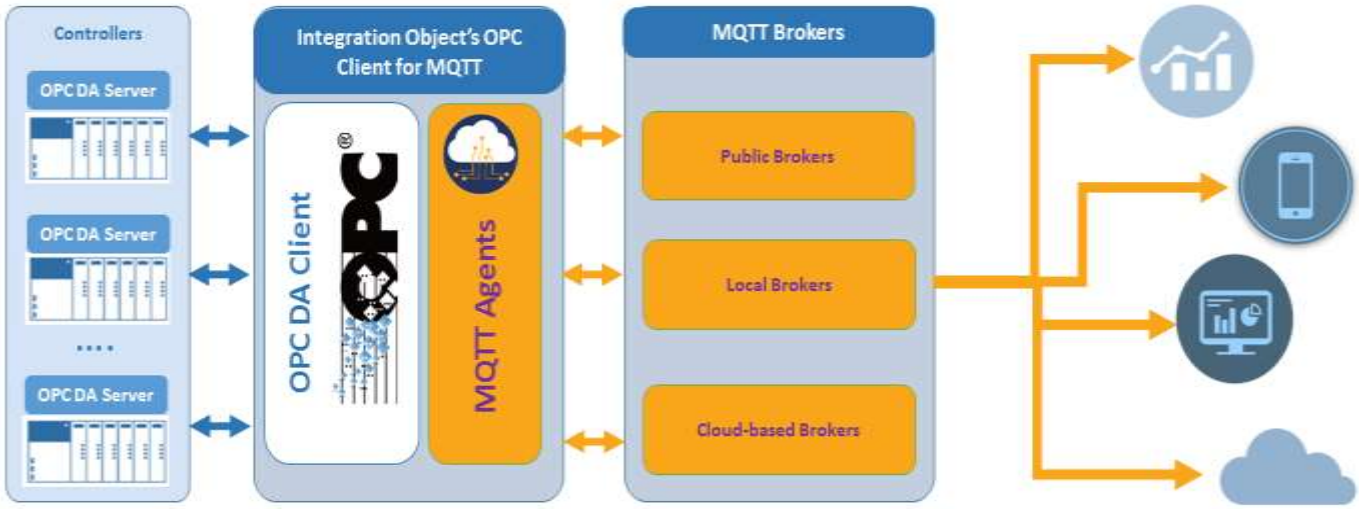

Figure 1: OPC Client for MQTT Architecture

3. Features

The OPC Client for MQTT offers the following features:

- A fully compliant OPC DA Client
- An intuitive Graphical User Interface allowing users to easily and quickly configure multiple MQTT agents
- Automatic discovery of all OPC Servers available on the network
- Managing multiple local and remote connections to OPC Servers simultaneously
- Monitoring data changes in real-time
- Collecting and publishing real-time data into MQTT Brokers securely
- Support of the following OPC Data Access functionalities:
  - Items browsing
  - Managing OPC DA groups (Add, Remove)
  - Performing synchronous and asynchronous read and write operations of item data values, their timestamps, and their qualities
- Automatic reconnection to MQTT Brokers when the connection is lost
- Support of MQTT protocol versions 3.1 and 3.1.1
- Management of dynamic XML files to save the configuration settings for a user session
- Data recovery options to resend data when the connection with the MQTT Broker is lost
- Automatic reconnection to the OPC Server when the connection is lost
- Windows Service Publisher: The publishing operations are managed by a Windows service working in the background, guaranteeing a continuous process and automatic restart when the host machine is restarted.
- Tracing of all OPC calls and data requests.

4. Operating Systems Compatibility

OPC Client for MQTT supports the following operating systems:

- Windows 7
- Windows 8
- Windows 8.1
- Windows 10
- Windows Server 2008
- Windows Server 2008 R2
- Windows Server 2012
- Windows Server 2012 R2
- Windows Server 2016

5. OPC Compatibility

- OPC Data Access 1.0a
- OPC Data Access 2.00
- OPC Data Access 2.05a
- OPC Data Access 3.00

6. Minimum Hardware Requirements

The following are the minimum hardware requirements to run the OPC Client for MQTT:

	Description
Processor	1 GHz (higher recommended)
RAM	1 GB (higher recommended)
Disk Space	200 MB hard disk space for full installation

Table 1: Minimum Hardware Requirements

GETTING STARTED

1. Pre-Installation Considerations

In order to properly run the OPC Client for MQTT, the following software components need to be installed on the target system:

- The OPC core components 3.00, which consist of all shared OPC modules including the DCOM proxy/stub libraries, the OPC Server Enumerator, .NET wrappers, etc.
- .NET framework 4.5 or higher.

Also, make sure there is no firewall or antivirus blocking the application.

2. Installing and Running

To install the OPC Client for MQTT:

1. Run the **Integration Objects' OPC Client for MQTT** installation package using an administrator account. The installation welcome dialog will appear.

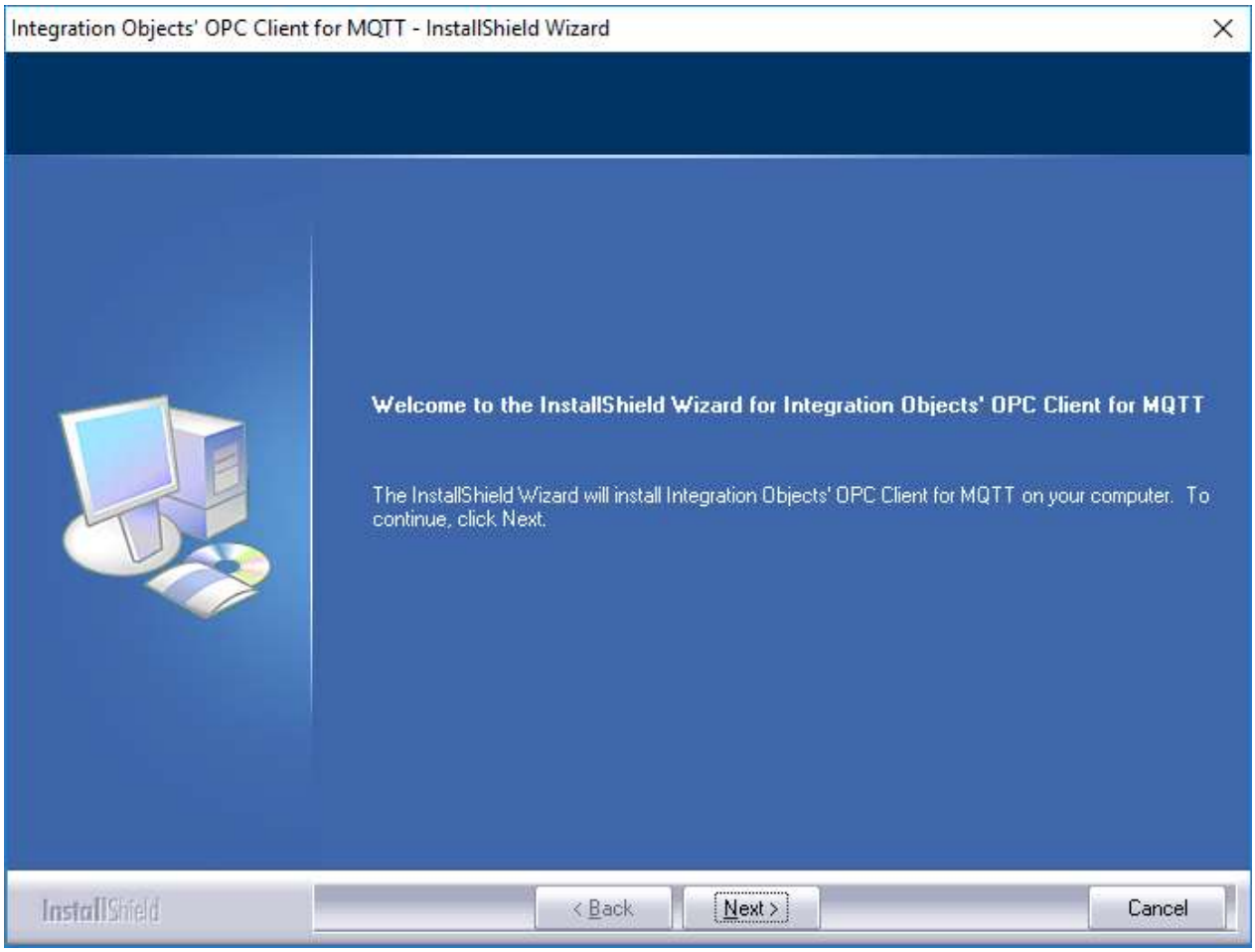

Figure 2 : Installation Welcome Dialog

2. Click the **Next** button. The license agreement will be displayed.

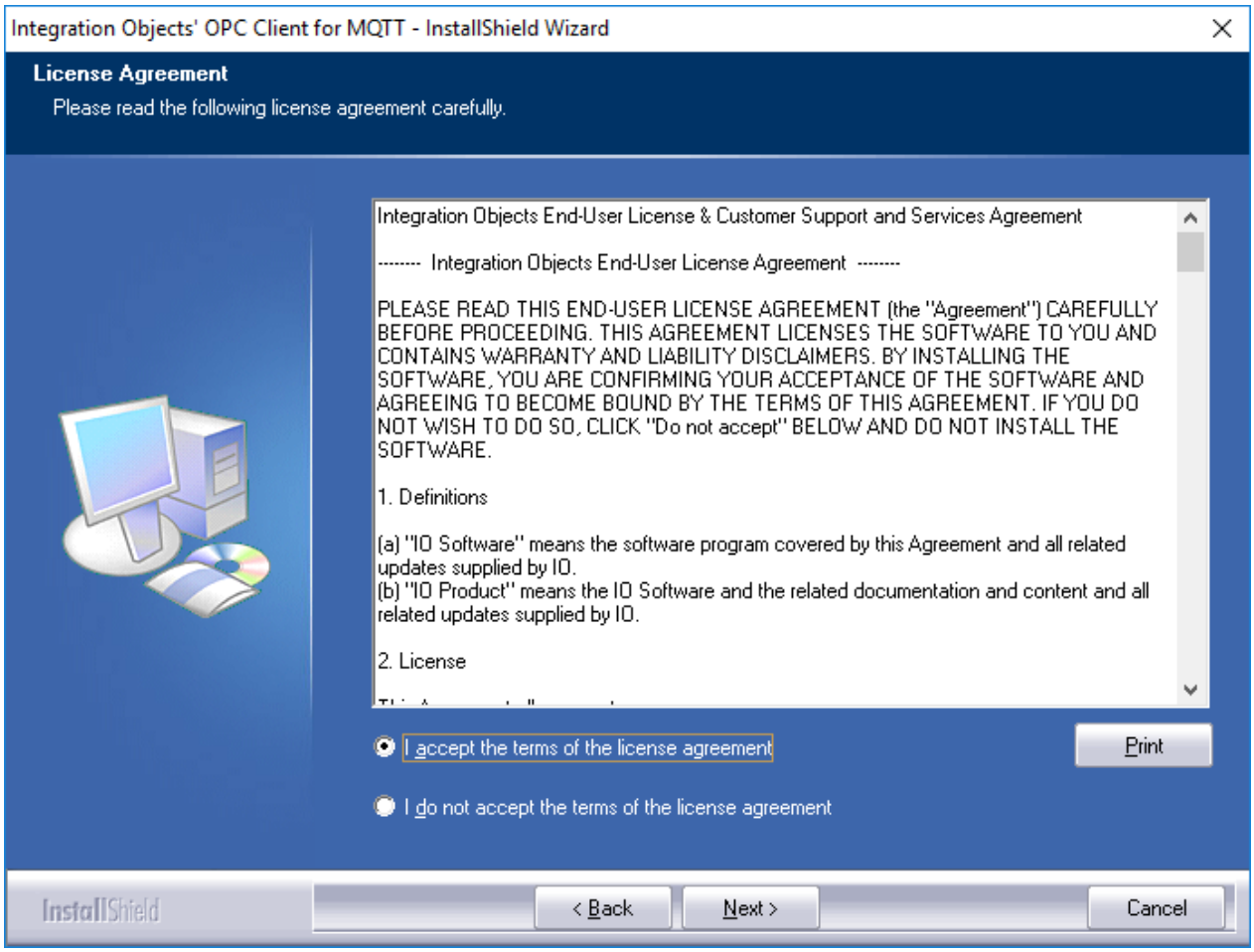

Figure 3: License Agreement Dialog

3. After reading the license agreement, select the first option and click the **Next** button. By proceeding, you are accepting all of the license agreement terms. Otherwise, you can cancel the installation.
   The customer information dialog will appear.

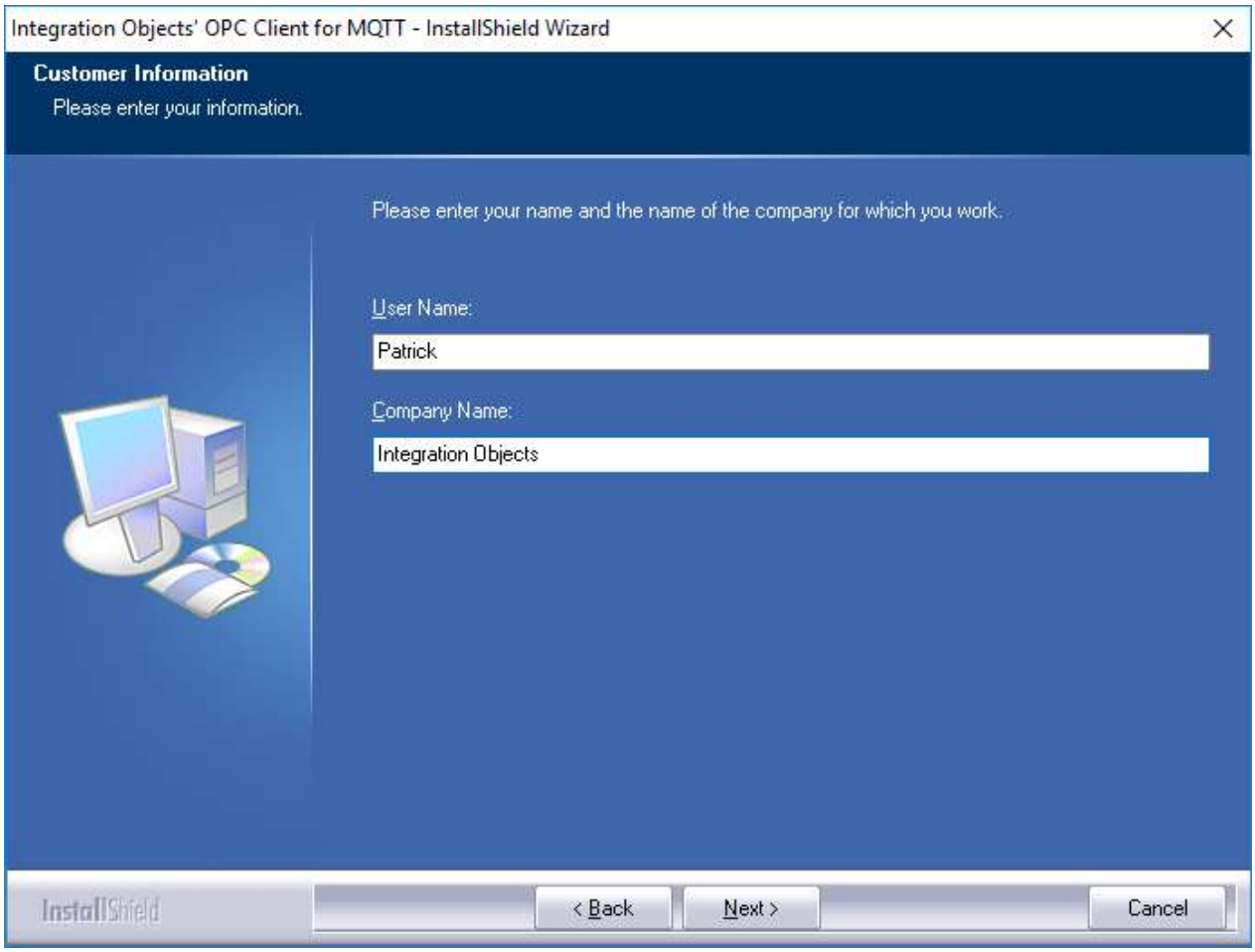

Figure 4: Customer Information Dialog

4. Add the user name and the company name and then click the **Next** button. The dialog for choosing the destination folder will be displayed.

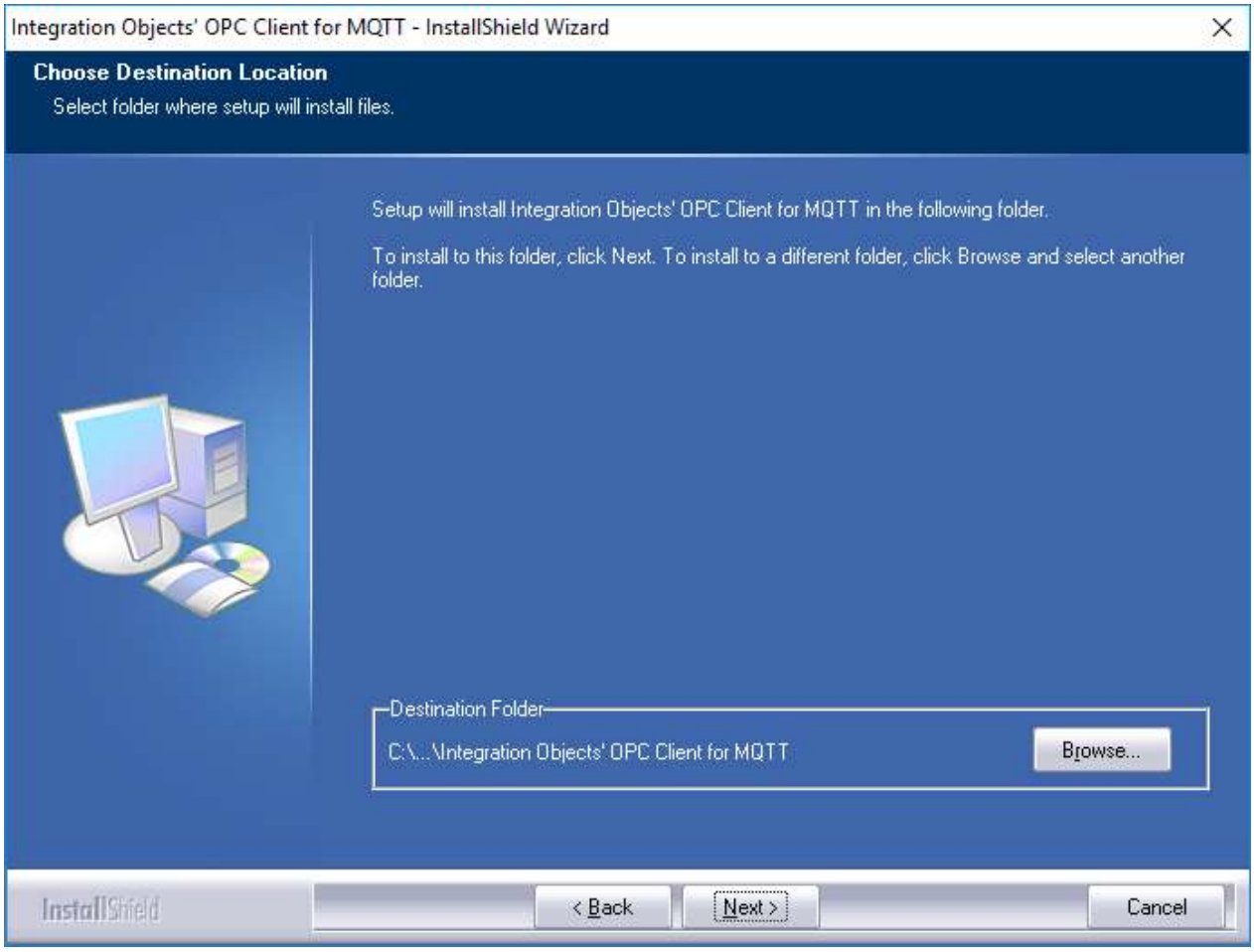

Figure 5: Choose Destination Folder Dialog

5. Click the **Next** button to use the default destination folder and continue the installation, or the **Browse** button to select a different destination folder. The installation dialog will then appear.

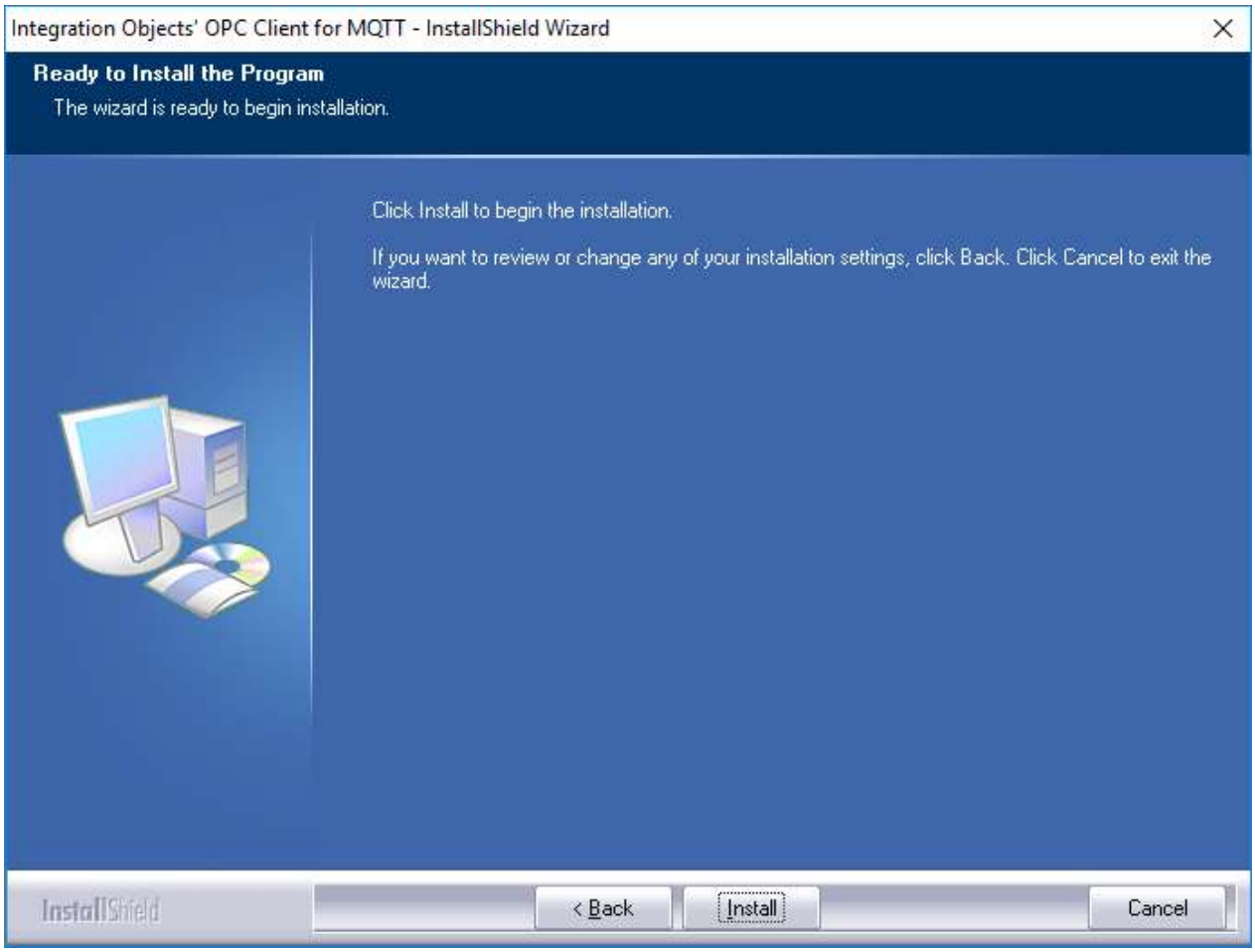

Figure 6: Installation Dialog

6. Click the **Install** button to start installation.

   The setup will then copy the necessary files to the selected destination folder, create shortcut icons to launch the OPC Client for MQTT and authorization license program from the start menu and make an un-installation entry in the **Control Panel → Programs → Uninstall a program.**

7. Before the completion of the installation, the following dialog will be displayed in order to configure the user account that will be used to run the services:

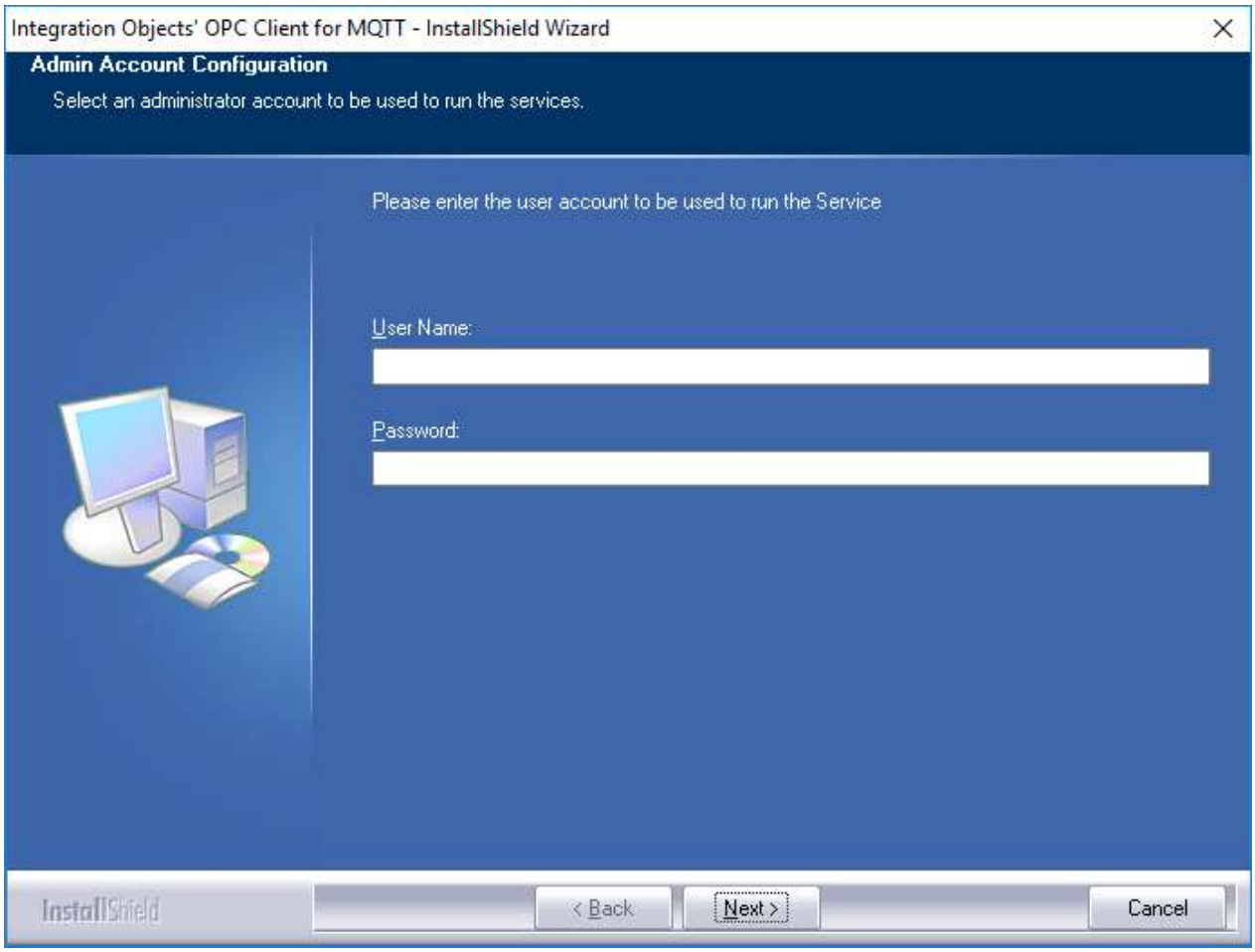

Figure 7: Configure Service Account

The selected user account must have the "Log on as a service" right granted and the account information must be correct for the service to run properly.
If you do not enter a valid account, the Local System account will be used to run the services. You can still modify this configuration after the installation using the Windows services manager.

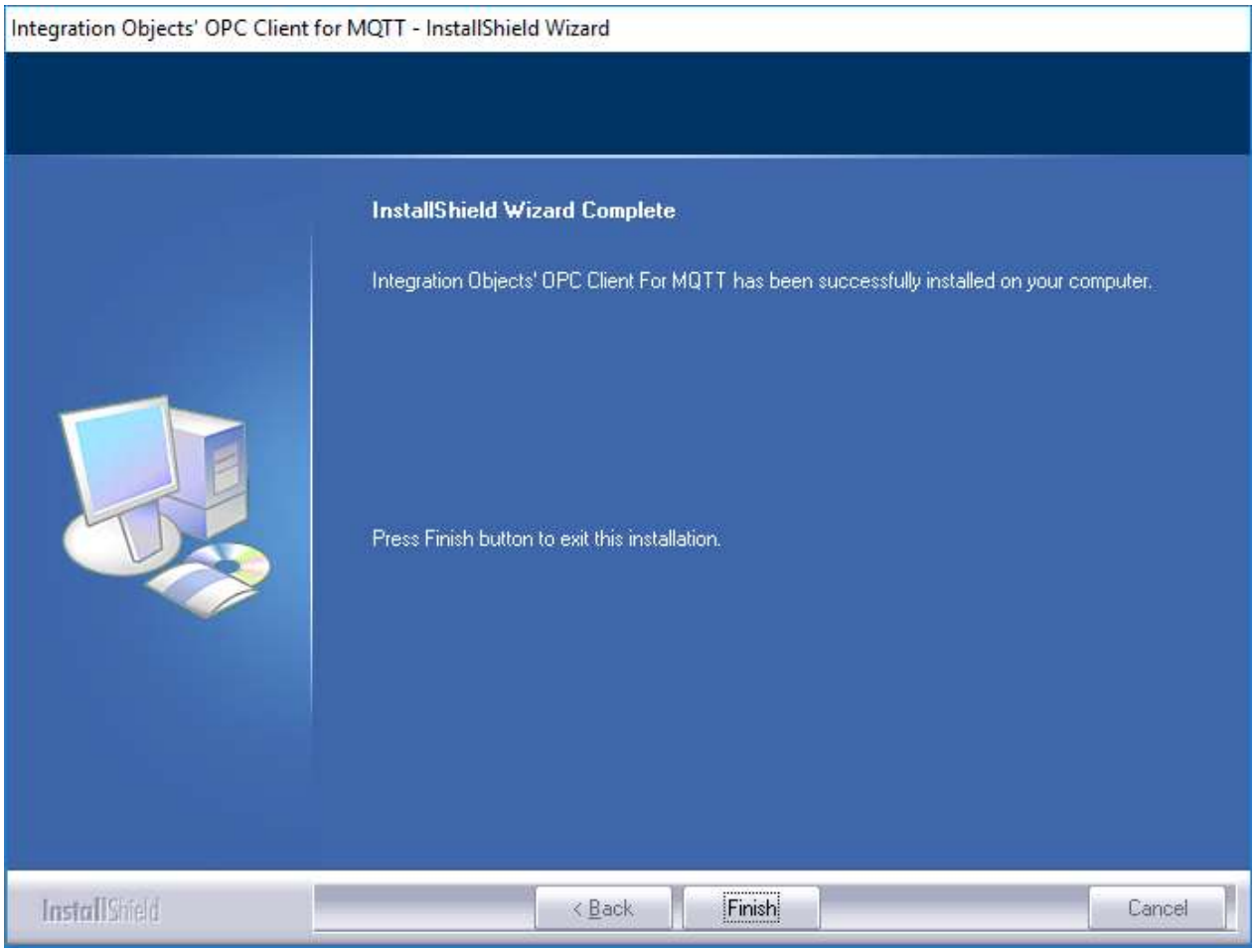

Figure 8: Installation Completed Dialog

3. Files Included in the Distribution

After running the setup, you will get the following main files on your system under the target installation folder:

File Names	Description
`OPCClientForMQTT.exe`	The graphical user interface
`OPCDAClientForMQTTService.exe`	OPC Client for MQTT service
`LicenseAuthorization.exe`	The license authorization tool allowing you to activate your licenses
`OPC Client MQTT Uninstaller.exe`	The Uninstaller

IntegrationObjects.OPCDAClientMQTTService.dll IntegrationObjects.OPCDAClientMQTT.Common.dll IntegrationObjects.OPCDACLientMQTTDLL.dll IntegrationObjects.OPCNetClientSDK.dll IntegrationObjects.Logger.SDK.dll IntegrationObjects.KNet.Forms.dll IntegrationObjects.KNet.Common.dll IntegrationObjects.KNet.Browser.dll IntegrationObjects.Logger.SDK.dll IntegrationObjects.Logger.SDK.UserControl.dll DevComponents.DotNetBar2.dll IntegrationObjects.Networking.M2Mqtt.dll Newtonsoft.Json.DLL License.dll LaunchSetup.dll	Core assembly files
ConfigOPCClientSDK.ini OPCMQTTClientConfig.ini OPCDAClientMQTTServiceConfig.ini	Configuration files
OPC Client for MQTT User Guide.pdf	This user guide
OPC Client for MQTT Quick User Guide.pdf	The quick user guide

Table 2: Files in the Distribution

4. Starting-up

The OPC Client for MQTT user interface can be launched from the start menu shortcut.
To do so, click on **Start ➔ Programs ➔ Integration Objects ➔ OPC Client for MQTT➔ OPC Client for MQTT**

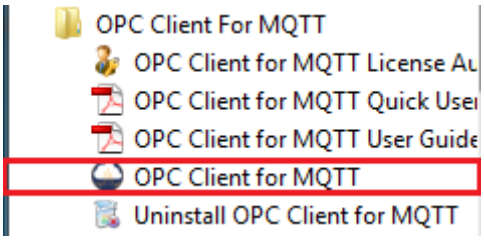

Figure 9: OPC Client for MQTT Start Menu

The OPC Client for MQTT service is started automatically with the host machine restart. It can be started and stopped manually from the Windows services manager.

5. Removing the OPC Client for MQTT

To uninstall the OPC Client for MQTT, follow the steps below:

1. Click the **Uninstall OPC Client for MQTT** shortcut available in the start menu, as shown in the figure below:

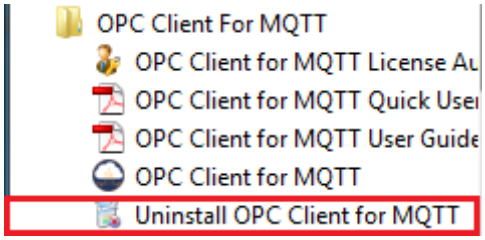

Figure 10: Uninstall Shortcut in the Start Menu

The following dialog box will appear:

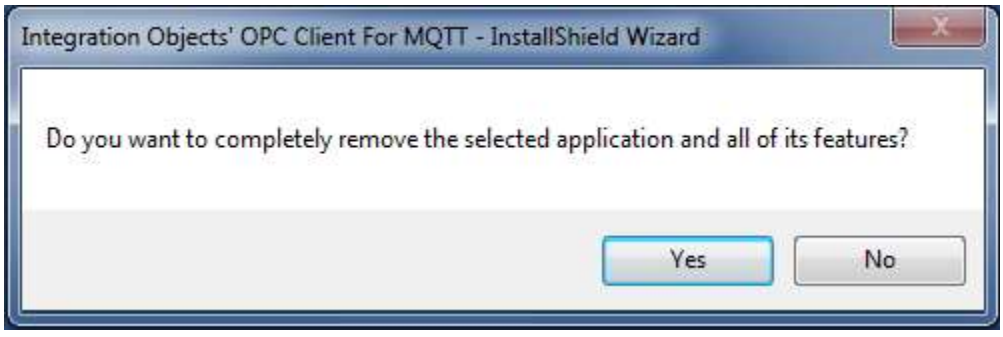

Figure 11: Uninstall the OPC Client for MQTT

2. Click the **Yes** button to start uninstalling.

3. The wizard will then take you through the removal steps. At the end, click **Finish** when the un-installation is complete.

The uninstaller program requires administrator right for the software removal to be completed correctly.

The OPC Client for MQTT can also be manually removed as follows:

1. Go to the **Control Panel**.
2. Click **Programs and Features**
3. In the **Programs and Features** dialog screen, select **Integration Objects' OPC Client for MQTT**.
4. Click **Uninstall** then **OK**.

USING OPC CLIENT FOR MQTT

In this section, you will find an overview of the OPC Client for MQTT user interface as well as the steps required to configure and use this software.

1. User Interface Overview

The OPC Client for MQTT user interface, illustrated in the figure below, allows you to connect to multiple OPC Servers and configure different MQTT agents.

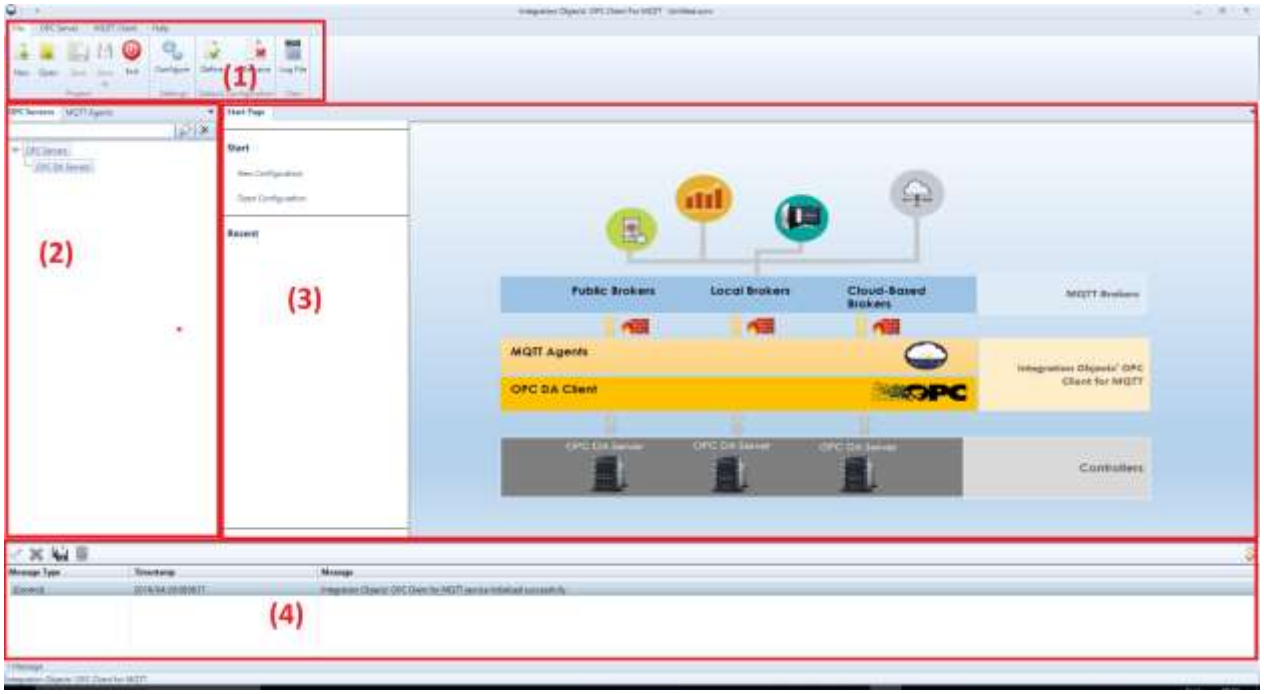

Figure 12: OPC Client for MQTT Main View

There are four parts in the main user interface, as highlighted above:

- Menu bar (1): It contains the File menu, the OPC Server menu, the MQTT Client menu and the Help menu. These menus provide access to the functions that help the user interact with the application.
- Configuration tabs (2): This control contains 2 tabs, which are:
  - OPC Servers: Contains the list of connected OPC DA servers.
  - MQTT Clients: Contains the list of configured MQTT Agents.
- Start page (3): This is the main welcome page. It allows users to quickly access the recently opened configuration files from the available, as illustrated below:

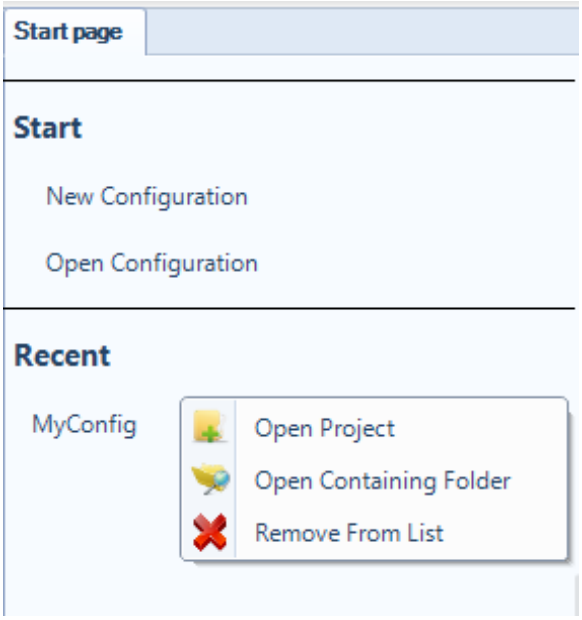

Figure 13: Start Page Menu

From the same view, the user can also:

- Create a new configuration by clicking on **New Configuration** button
- Open saved configuration by clicking on **Open Configuration** button.

- Log messages browser (4): This part displays log messages. The most recent messages are displayed at the top of the list.

When launching the OPC Client for MQTT, a new empty configuration will be automatically created**.**

2. File Menu

Figure 14: File Menu

2.1. Project

Using the Project section in the File menu, you can**:**

- **New** - Create a new configuration by hitting the **New** button.

- **Open** - Open an existing configuration by clicking **Open** and selecting the appropriate ".ocm" configuration file,
- **Save** - Save your current configuration by clicking **Save** or **Save As**,
- **Exit** - Close the application by clicking the **Exit** button.

2.2. Settings

Using the Settings section in the File menu, you can configure the OPC Client for MQTT settings. Click the **Configure** button to view and modify the OPC Client for MQTT settings.
In the general settings tab, the user can:

- Change the user interface theme.
- Enable user authentication to access the configuration interface.
- Choose to include the advanced settings into the MQTT Agents wizards.
- Choose to automatically deny the stop services messages boxes when closing the user interface.
- Configure the reconnection period to OPC DA Servers when the connection is lost.

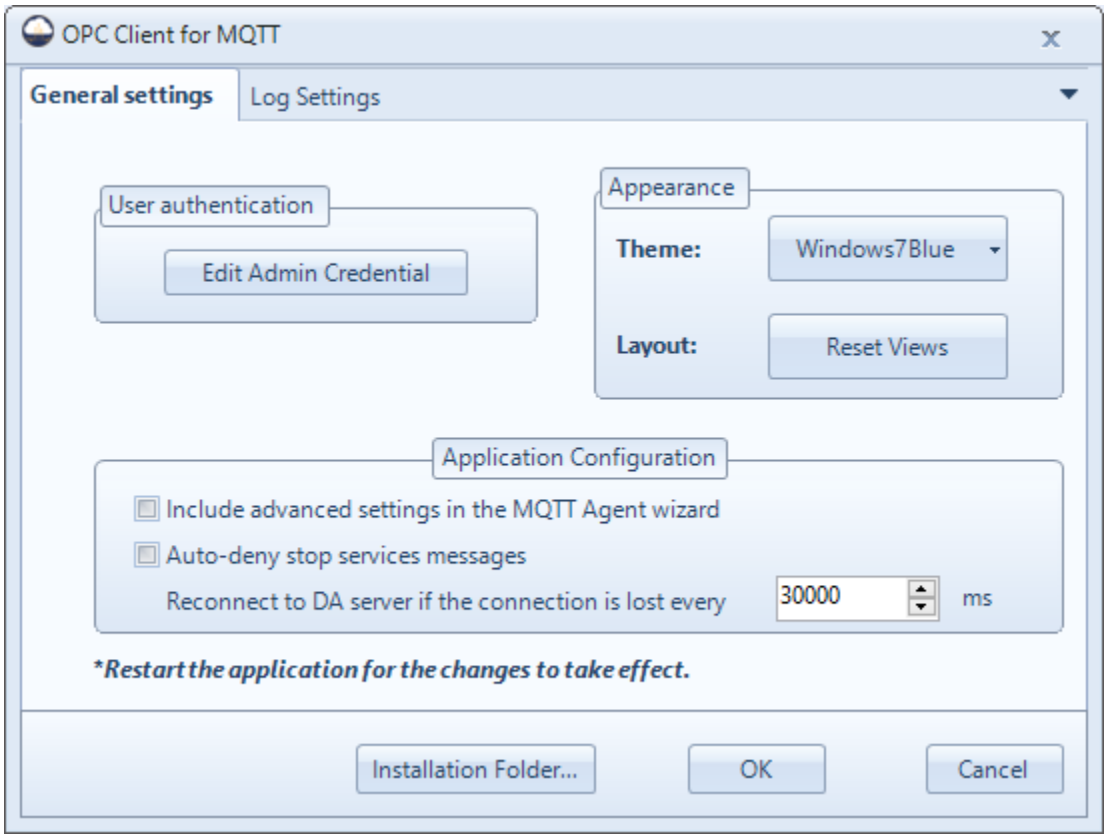

Figure 15: OPC Client for MQTT Settings

You can configure the log parameters as illustrated in the following figure:

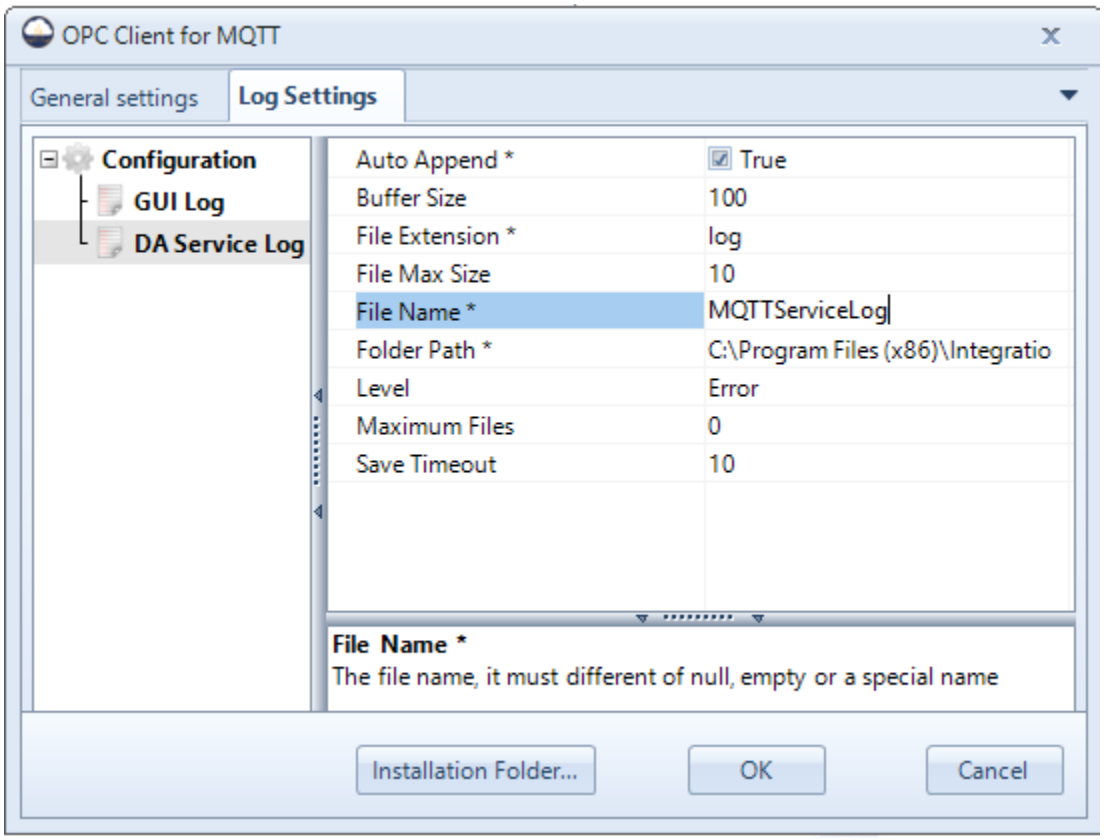

Figure 16: Log Settings

For more information about the above parameters, please see Table 7 Log Settings.

2.3. Default Configuration

The OPC Client for MQTT provides the possibility to set a saved configuration as a startup configuration. It means that the configuration will be loaded automatically at the application start-up. To add a default configuration:

- Save your configuration by clicking the **Save** button available in the File menu. Your configuration will be saved into a folder that contains the following files:
  - A file with the extension ".ocm" that contains the names of the DA configuration file.
  - Files with the extension ".xml" that contain the DA configuration
- Then, click the **Define** button in the file menu.

Figure 17: Define/Remove a Default Configuration

- The open file dialog screen will be displayed. Select your saved OCM configuration and then click the OK button.
- When you restart the OPC Client for MQTT, the default configuration will be automatically loaded.

To remove the default configuration, click the **Remove** button.

2.4. View

Using the View Section in the file menu, you can check the OPC Client for MQTT Configuration tool activities by clicking on **Log File** button.

Figure 18: View Log File

3. Administrator Account

3.1. Login into OPC Client for MQTT

When starting the application, if the user had enabled the user authentication feature, the OPC Client for MQTT will ask the user for his login credentials.

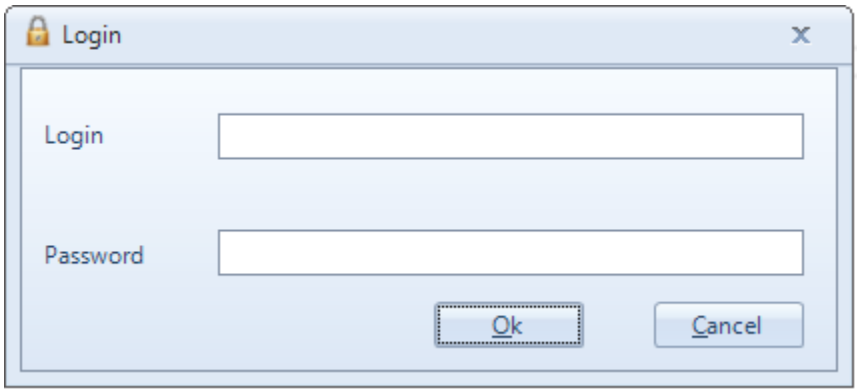

Figure 19: Login Window

The default admin credentials are:

- Login: OCMAdmin
- Password: OCM@2dmin

3.2. Edit Administrator Credentials

To edit your login credentials (user name and password), click on the OPC Client for MQTT **Configure** button, click **Edit Admin Credentials** on the displayed window and the following window will be displayed:

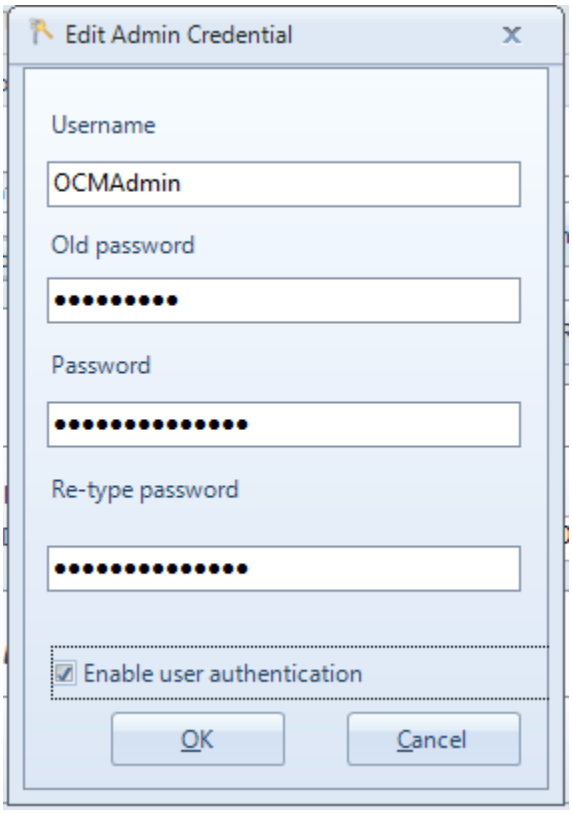

Figure 20: Edit Admin Credentials

It is highly recommended that users change the default password once they enable the user authentication.

4. OPC Server Menu

In the menu bar of the OPC Client for MQTT, you can access the different OPC functionalities using the OPC Server menu:

Figure 21: OPC Server Menu Bar

4.1. OPC Servers Management

Click the **Connect** button in the OPC Server menu to connect to local and remote OPC DA servers. The connection dialog is shown in the figure below:

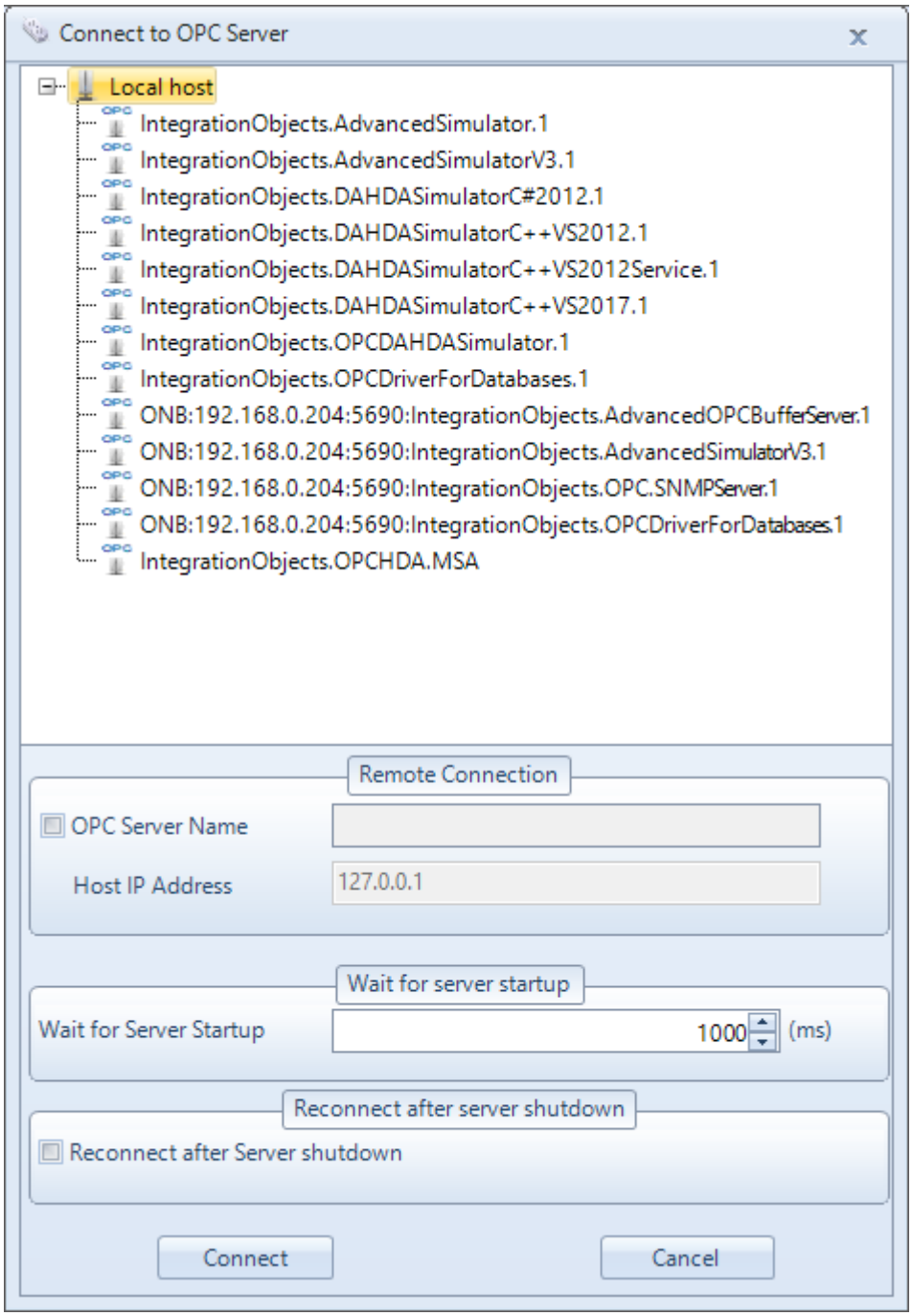

Figure 22: OPC Server Connection Dialog

You can either browse the list of the OPC DA Servers available in your local machine or manually enter:

- The Server name (ProgID) of your OPC DA Server,
- The IP address or the host name of the machine that hosts this OPC Server.

You can also refresh the list of available OPC Servers by clicking on the **Refresh** action available in the right click menu on the Local Host node.

The **Wait for server startup** defines the time for which the OPC Client for MQTT will wait for the OPC Server to report that it is in the RUNNING state before declaring a connection error. By default, this field is set to 1 second (1000 milliseconds).

The **Reconnect after server shutdown** option defines whether the OPC Client for MQTT should reconnect to the OPC Server after the shutdown request or not.

After the OPC connection operation succeeds, a new node representing the new connection will be added to the OPC Servers tree view of the main user interface.

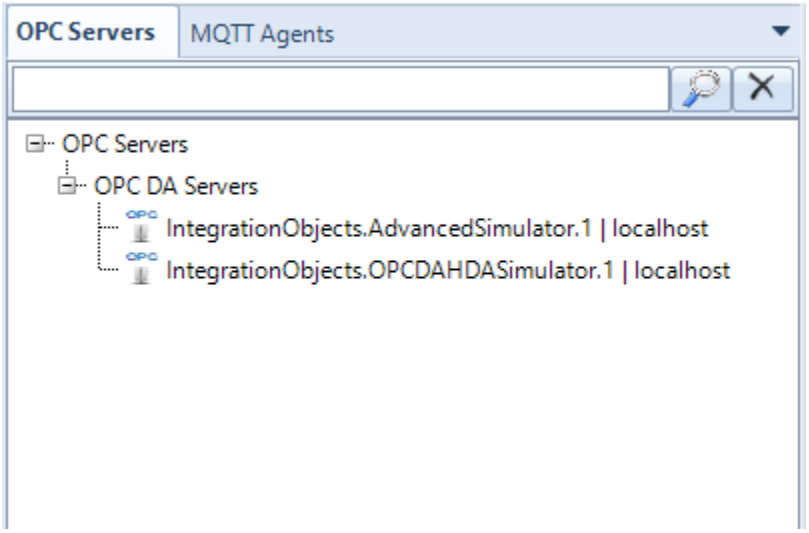

Figure 23: OPC Servers Tree

4.2. OPC Automatic Reconnection

The OPC Client for MQTT monitors the status of the connected OPC Servers periodically. Whenever a communication problem occurs with any connected OPC Server, the OPC Client for MQTT automatically starts the OPC reconnection procedure.
During the time interval in which the connection to the requested OPC Server is lost, the corresponding OPC items will be frozen in their latest status and the server node will be highlighted by a red icon and disabled.

Once the communication is reestablished and reconnection is successful, the OPC Server node will be enabled and you can resume using the OPC functionalities of the server.

5. MQTT Client Menu

In the menu bar of the OPC Client for MQTT, you can access the different MQTT functionalities using the MQTT Client menu:

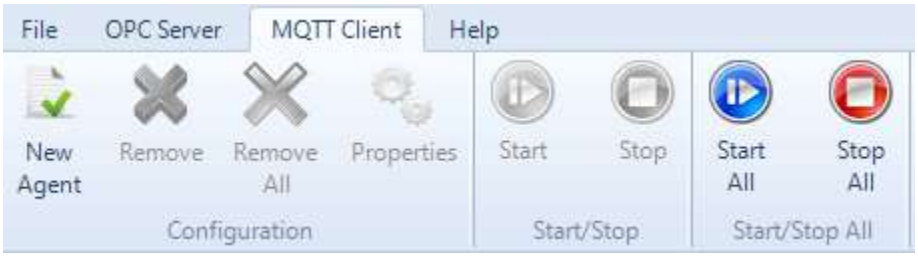

Figure 24: MQTT Client Menu Bar

Using this menu, you can manage your MQTT Agents by adding a new one, remove a specific agent, remove all agents, view an MQTT agent properties, start or stop an agent and start or stop all agents.

6. Help Menu

You can access to the OPC Client for MQTT user guide or get information about the product version or build date using the Help menu.

Figure 25: Help Menu Bar

OPC DA FUNCTIONALITIES

When the user successfully connects to an OPC DA Server, a node will be created under the OPC DA Servers. We will explain in this section the main OPC DA functionalities available in the OPC Client for MQTT.

1. OPC DA Server

Right click on any added OPC DA Server node in the OPC DA Servers tree and the following menu will be displayed.

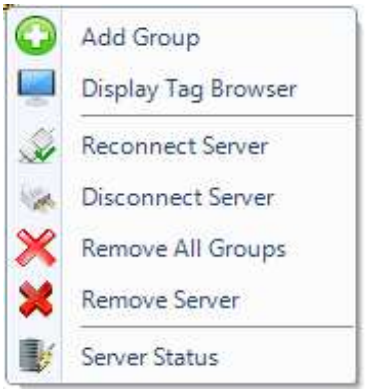

Figure 26: The OPC DA Server Menu

1.1. Add an OPC Group

To add a new group to a connected OPC Server, right click on the server node and select **Add Group** from the displayed menu. The following dialog will appear:

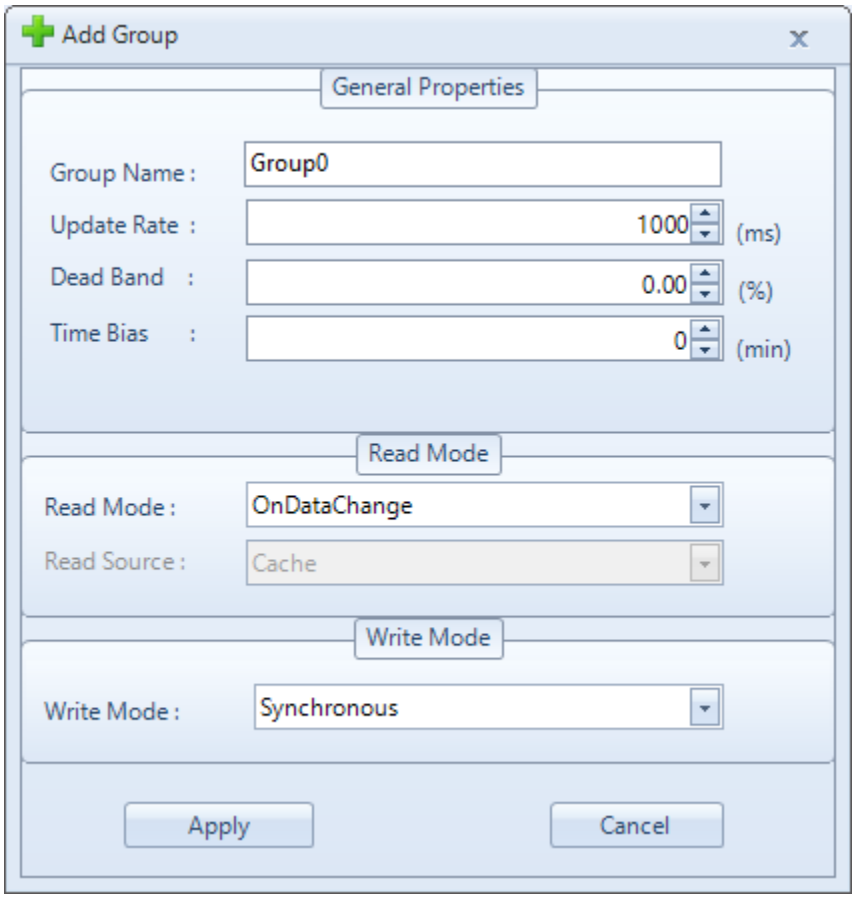

Figure 27: Add Group Dialog

General Properties

- **Group Name**: The name must be unique among the other groups already created in the OPC Server.
- **Update Rate**: specifies the fastest rate at which data changes for this group may be sent by the server. Passing 0 indicates that the server should use its fastest available update rate. The update rate is specified in milliseconds.
- **Dead Band**: is the range through which the input may be varied without initiating a response. It specifies the change percentage in an item value that will cause a notification of this value to the OPC client. A 0.0 value indicates all changes to be received.
- **Time Bias**: The purpose of the TimeBias is to indicate the time zone in which the data was collected. Enter 0 to use the default system TimeBias.

Read Mode: indicates the read mode to be used for the group. There are three read modes:

- **OnDataChange** (for OPC DA version 2.05 and higher): the data will be collected asynchronously on report by exception basis.
- **Synchronous:** the data will be collected by performing periodic synchronous read operations to a server. There are two types of read source:
  - DEVICE: Reading data from device.
  - CACHE: Reading data from cache.
- **Asynchronous (I/O 2.0):** the data will be collected by performing periodic asynchronous read operations to an OPC DA version 2.0 or higher compliant server.

Write Mode: indicates the write mode to be used for the group. There are 4 write modes:

- **Synchronous:** allows the OPC client to send synchronous write requests to the OPC Server.
- **Asynchronous:** allows the OPC client to send asynchronous write requests to the OPC Server (for OPC DA version 2.0 or higher).
- **Synchronous IO2:** allows the OPC client to send synchronous write requests to the OPC Server (for OPC DA version 3.0).
- **Asynchronous IO3:** allows the OPC client to send asynchronous write requests to the OPC Server (for OPC DA version 3.0).
- **Synchronous IO2 (WriteVQT):** allows the OPC client to send synchronous write VQT requests to the OPC Server (for OPC DA version 3.0).
- **Asynchronous IO3 (WriteVQT):** allows the OPC client to send asynchronous write VQT requests to the OPC Server (for OPC DA version 3.0).

1.2. Browse an OPC Server

You can browse the address space including all the branches and items for any OPC DA Server that supports OPC DA browsing. To browse your OPC Server, right click on your OPC Server node and choose **Display Tag Browser** from the displayed menu.

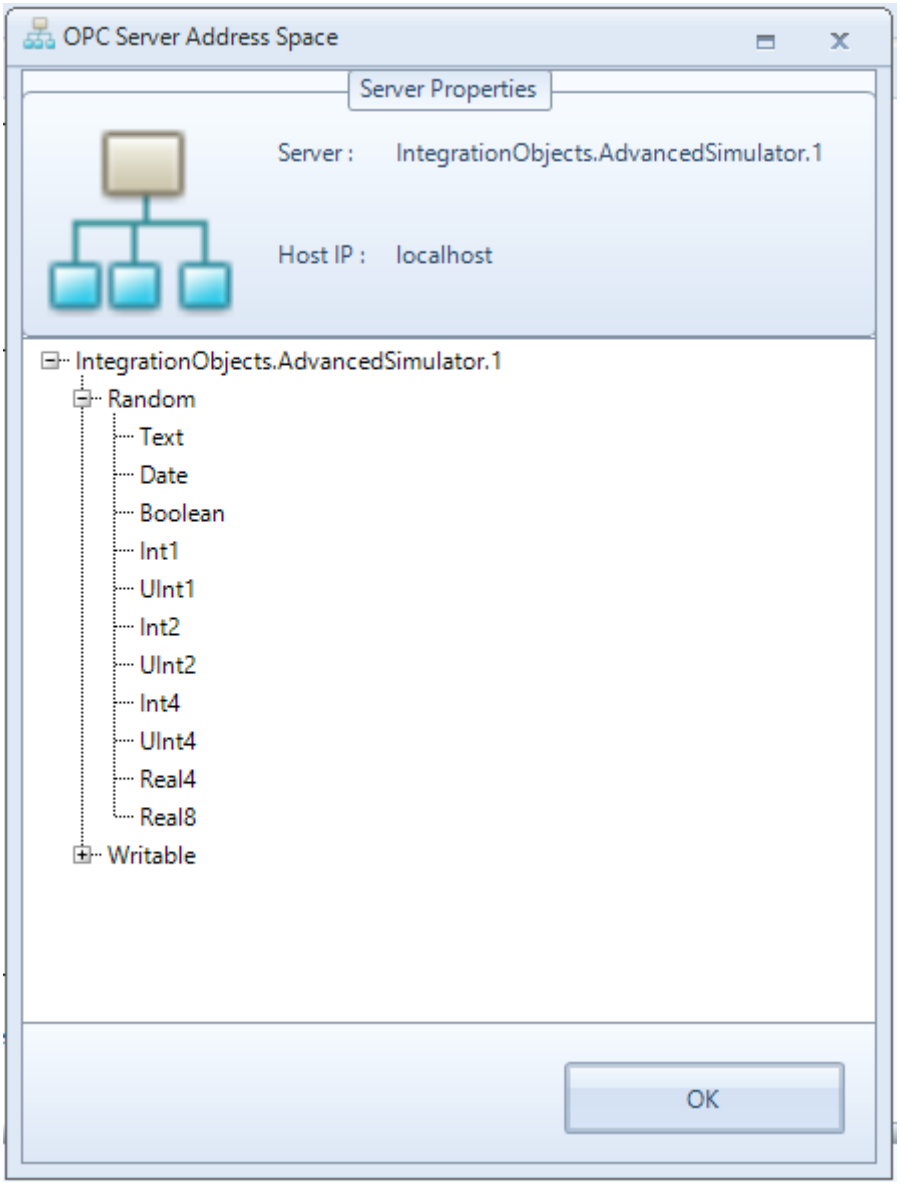

Figure 28: OPC Server Address Space Browser

1.3. Remove an OPC Server

To remove an OPC Server, click the **Remove Server** button available in the server right click menu. The OPC connection will be then released and the selected server node and its children nodes will be consequently removed from the tree view.

1.4. Remove All OPC Servers

To remove all added OPC Servers, click the **Remove All Servers** button available in the OPC Server menu in the menu bar. All servers' nodes will be deleted from the tree view and all OPC connections will be released.

Figure 29: Remove All Button

1.5. View OPC Server Status

Select your OPC Server node and click on the **Server Status** button available in the server right click menu item. The following dialog will appear:

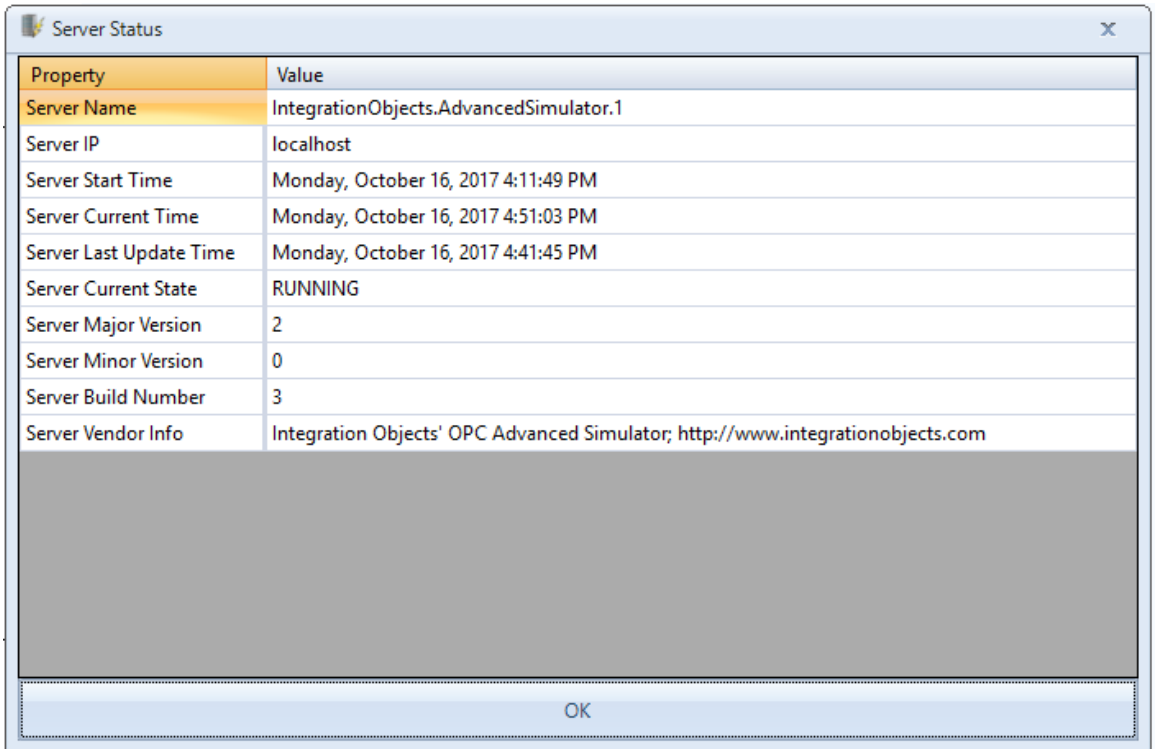

Figure 30: Server Status Dialog

This screen provides you with the current status and detailed information about the selected OPC Server.

2. OPC Group Management

Right click on the selected OPC Group node and the following context menu will be displayed.

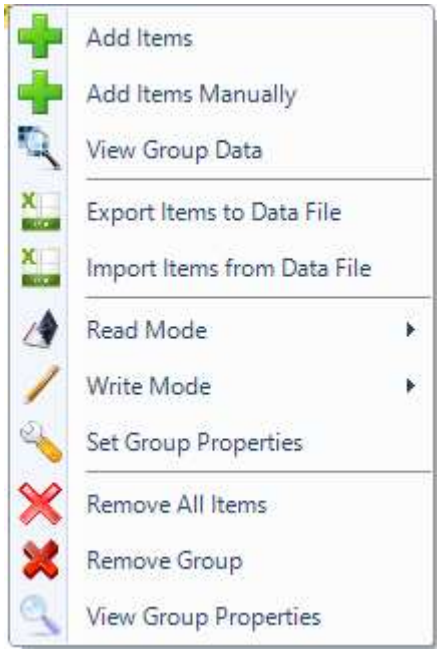

Figure 31: OPC Group Menu

2.1. Add OPC Items

To add OPC items, click the **Add Items** context menu item. The Add Items window will be displayed as illustrated in the figure below. Then, drag and drop items from the items tree in the left side to the grid in the right side and click **Apply**.

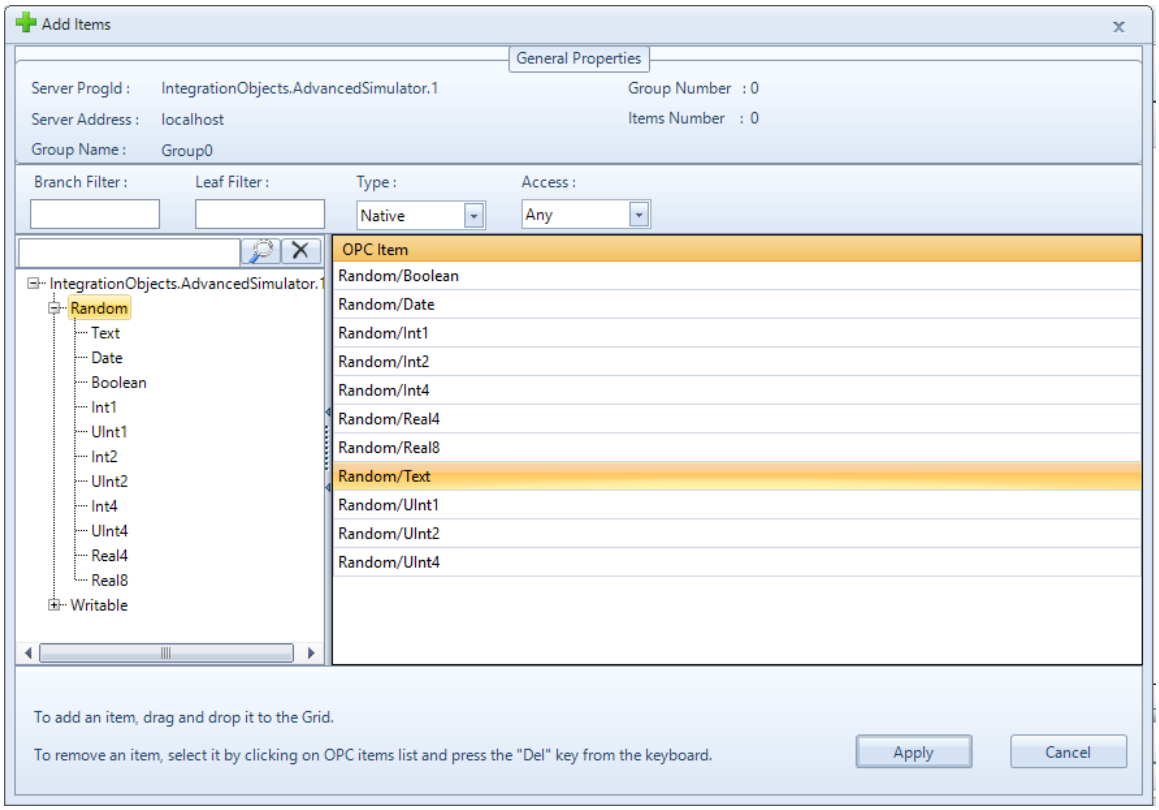

Figure 32: Add Items Dialog

To add all items, you can right click on the root node and press **Add** in the displayed menu, drag-and-drop the root node to the grid view or select multiple tags using the mouse and the Shift key in your keyboard.
To remove items from the selected list, you can select multiple items using the shift key in your keyboard and delete them using the **Del** button.

2.2. Add Items Manually

You can add OPC items manually by selecting **Add Items Manually** context menu item. The following window will be displayed.

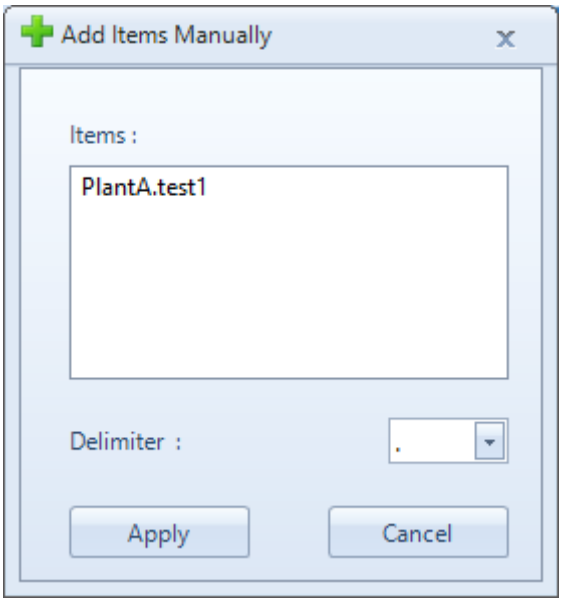

Figure 33: Add Items Manually

In the **Items** section, enter the list of ItemID of the items to be added separated by the delimiter that you can select from the **Delimiter** drop down list then click the **Apply** button.

2.3. Monitor OPC Items

You can monitor OPC DA items values by selecting **View Group Data** context menu item.

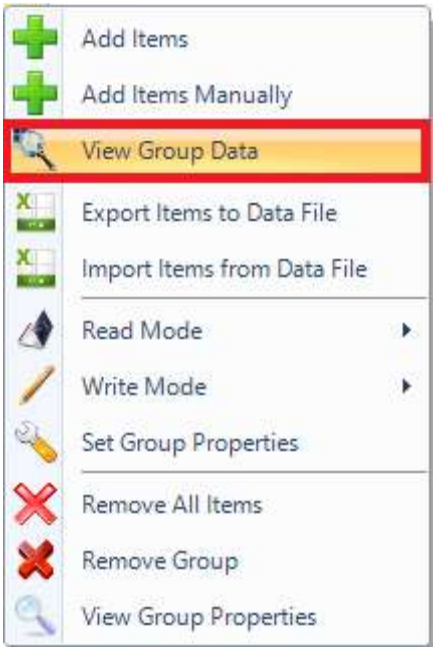

Figure 34: View Group Data

A new tab containing data changes grid view will be displayed in the main user interface, as illustrated in the figure below.

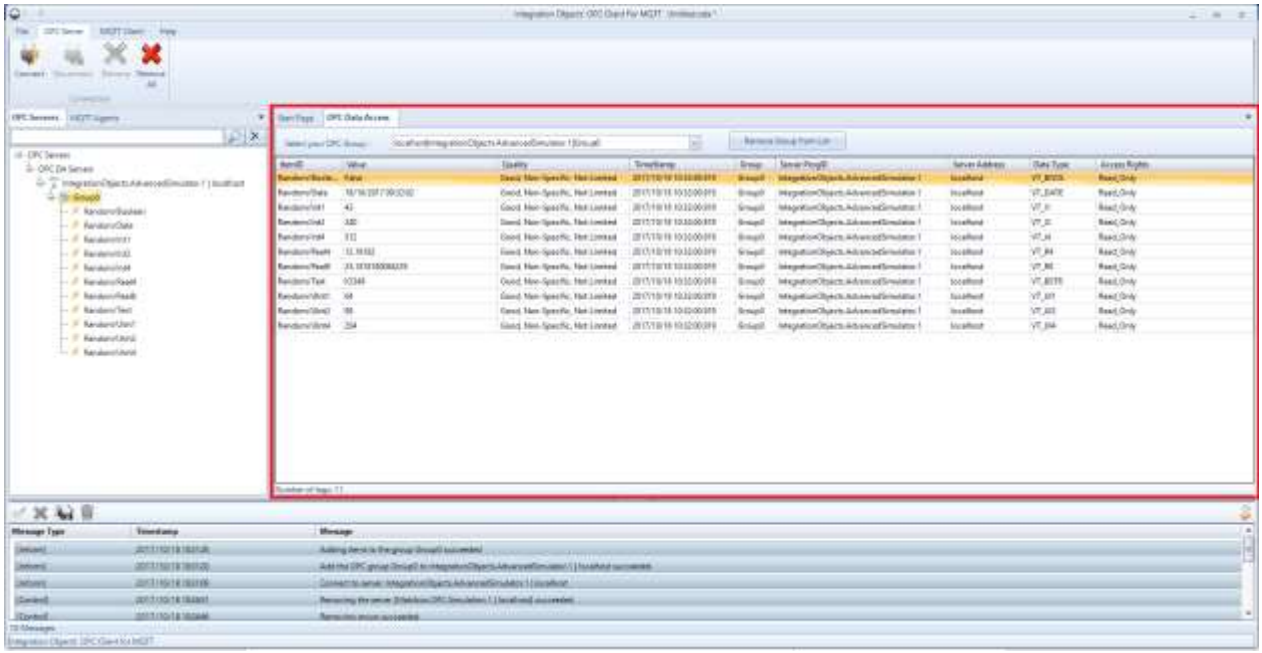

Figure 35: OPC Data Changes Display

2.4. Export Items to Data File

You can export added tags into a csv file using the **Export Items to Data File** option. The file will contain all OPC tags with the following properties:
Item ID, Item State and Item Data Type

2.5. Import Items to Data File

You can import a tags configuration file using the **Import Items from Data File** button available in the group right click context menu. The CSV file should have the following format:
Item ID, Item State and Item Data Type.

```
Item ID,Item State,Item Data Type
Random/Boolean,1,VT_BOOL
Random/Date,1,VT_DATE
Random/Int1,1,VT_I1
Random/Int2,1,VT_I2
Random/Int4,1,VT_I4
Random/Real4,1,VT_R4
Random/Real8,1,VT_R8
Random/Text,1,VT_BSTR
Random/UInt1,1,VT_UI1
Random/UInt2,1,VT_UI2
Random/UInt4,1,VT_UI4
```

Figure 36: Example of CSV File

2.6. Change the Read Mode

To change the read mode of the OPC group, click the **Read Mode** context menu item, you will have the list of available read mode as shown in the figure below.

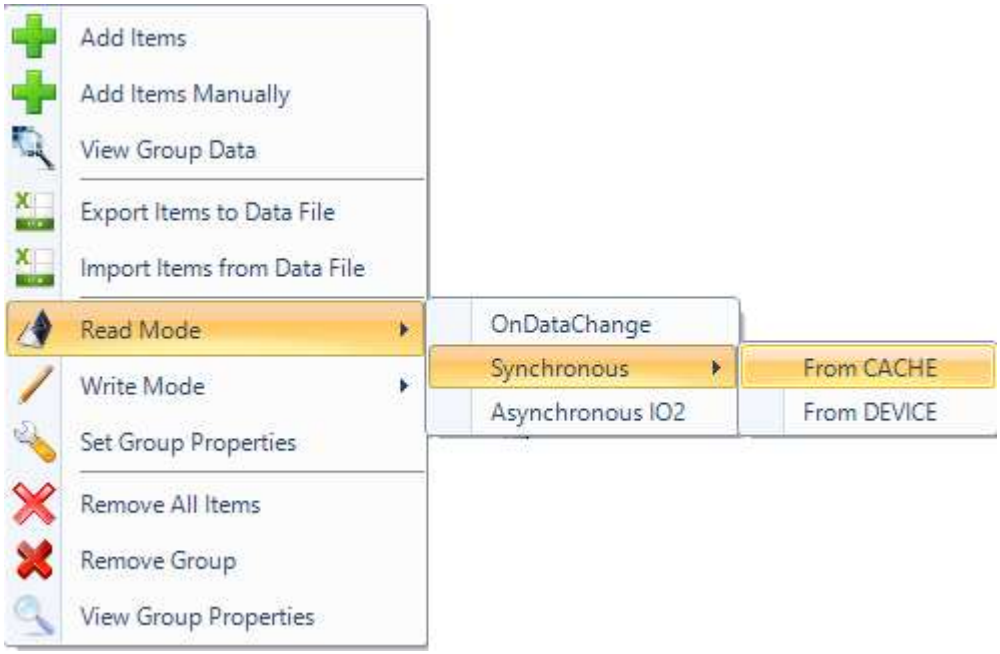

Figure 37: Change the OPC Group Read Mode

For more information about the read modes, please refer to section "1.1 Add an OPC Group".

2.7. Change the Write Mode

To change the current group write mode, click the **Write Mode** context menu item and select the new mode as shown below.

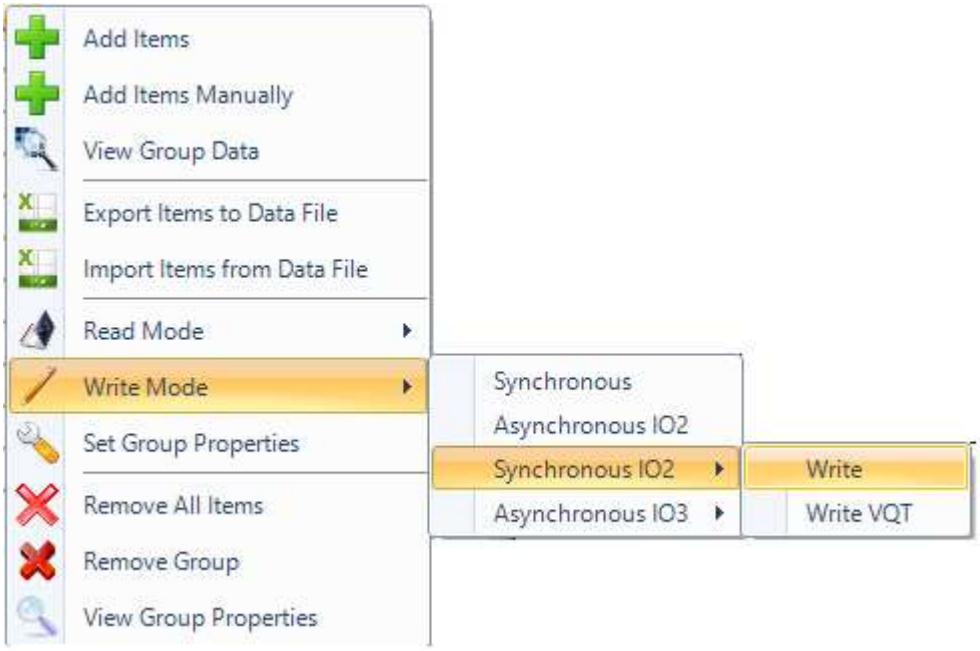

Figure 38: Change the OPC Group Write Mode

For more information about the write modes, please refer to section "1.1 Add an OPC Group".

2.8. Set Group Properties

To edit the properties of an OPC group, click the **Group Properties** context menu item. The following dialog screen will appear:

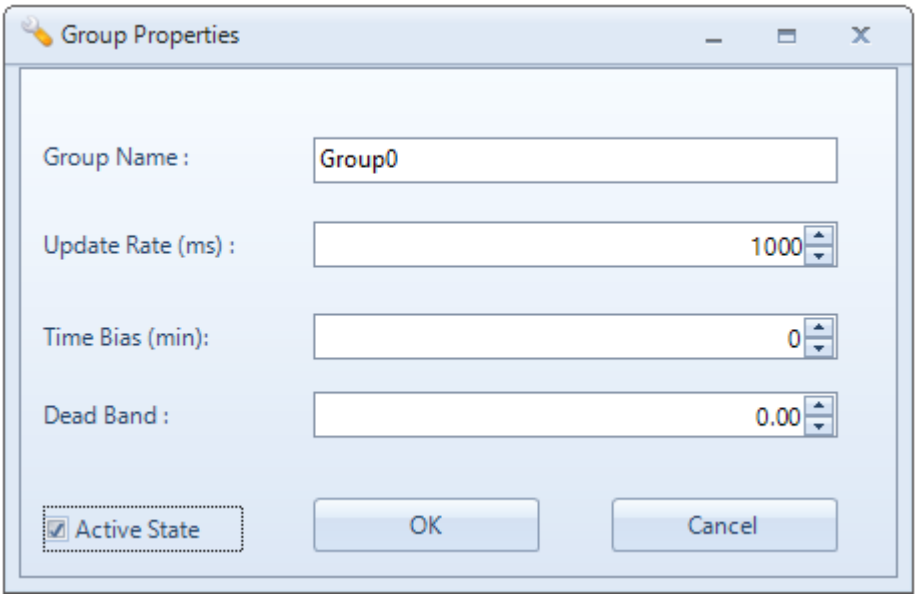

Figure 39: Set Group Properties Dialog

Using this dialog, you can:

- Change the name of the OPC Group. Note that the group name must be unique for each OPC Server.
- Update the other group properties such as the update rate, the time bias and the dead band),
- Activate/Deactivate the group state by checking/un-checking the **Active State** option.

You can also use this screen dialog to view the current information related to the selected group.

2.9. Remove All Items

To delete all items of the group, select the related group node and click the **Remove All Items** context menu item. All added items will be removed from the tree view.

2.10. Remove OPC Group

You can delete an OPC group by clicking the **Remove Group** context menu item. The group node and all of its OPC items will be deleted from the tree view.

2.11. View Group Properties

In order to check the OPC DA Group properties, click on **View Group Properties** context menu item. The following dialog will appear:

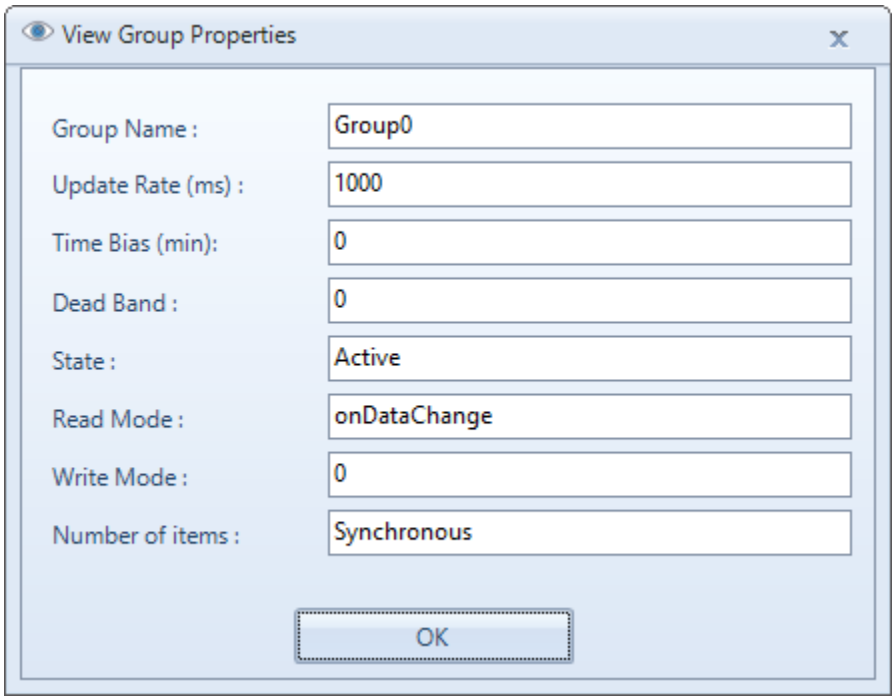

Figure 40: View Group Properties Dialog

3. OPC Item Management

This section describes how to manage OPC items. It is assumed that at least one OPC item is added to an OPC group.
Right click on the OPC item node and the following context menu will be displayed:

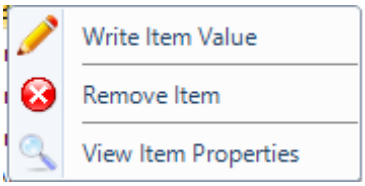

Figure 41: OPC Item Context Menu

3.1. Write Item Value

To write a value to an OPC item, right click on the item and select the **Write Item Value** context menu item.

- If the group write mode is **Synchronous** or **Asynchronous**, the following dialog screen will appear:

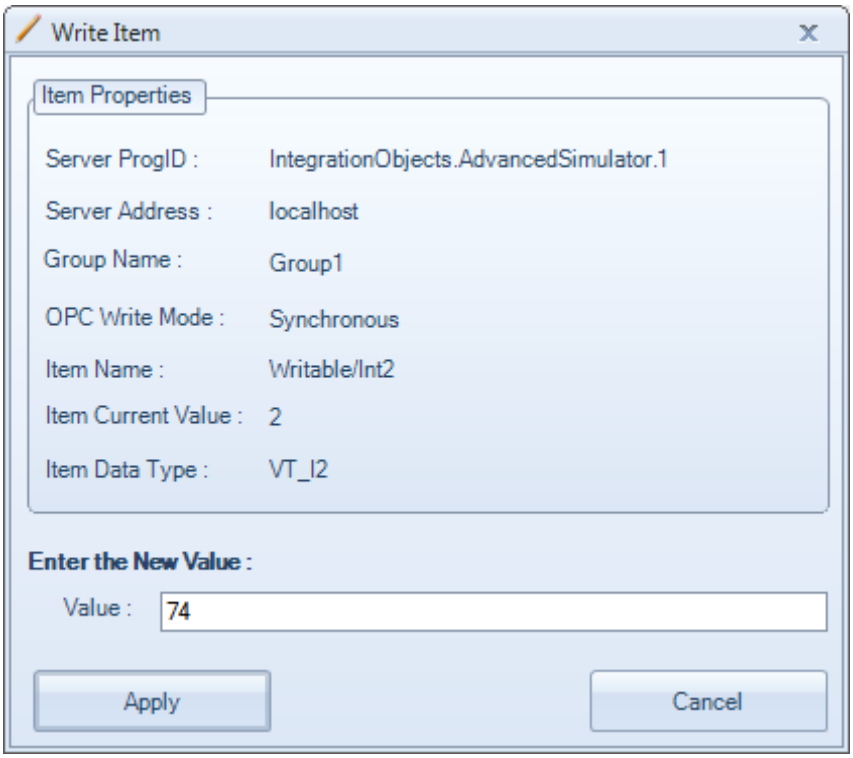

Figure 42: Write Item Dialog (1)

This dialog displays the following information:

- The OPC Server ProgID
- The OPC Server Address
- The OPC Group Name
- The current Write mode set for the OPC Group.
- The Item ID
- The Item Data Type
- The Item Current Value

To complete the write operation, enter the new value to be written to the item and click the **Apply** button to confirm.

- If the group write mode is **SynchronousIO2 (WriteVQT)** or **Asynchronous IO3 (WriteVQT)**, the following dialog screen will appear:

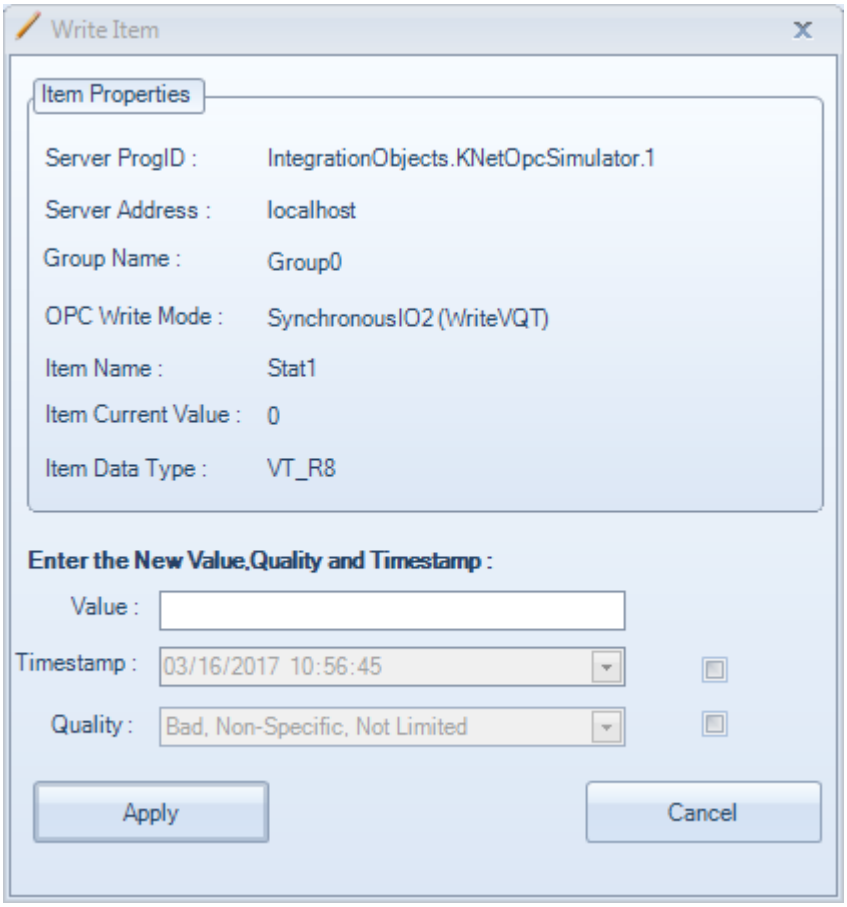

Figure 43: Write Item Dialog (2)

To complete the write operation, enter the new value to be written to the item, optionally the new timestamp and quality. Then, click the **Apply** button to confirm.

3.2. Remove an OPC Item

You can remove an OPC Item by clicking on the **Remove Item** context menu item. The OPC Item will be removed from the tree view and from the data changes grid view.

3.3. View Item Properties

You can view the item properties by right clicking on the OPC Item and selecting **View Item Properties**

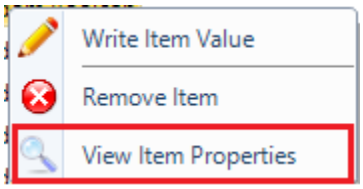

Figure 44: View Item Properties

The following dialog will be prompted:

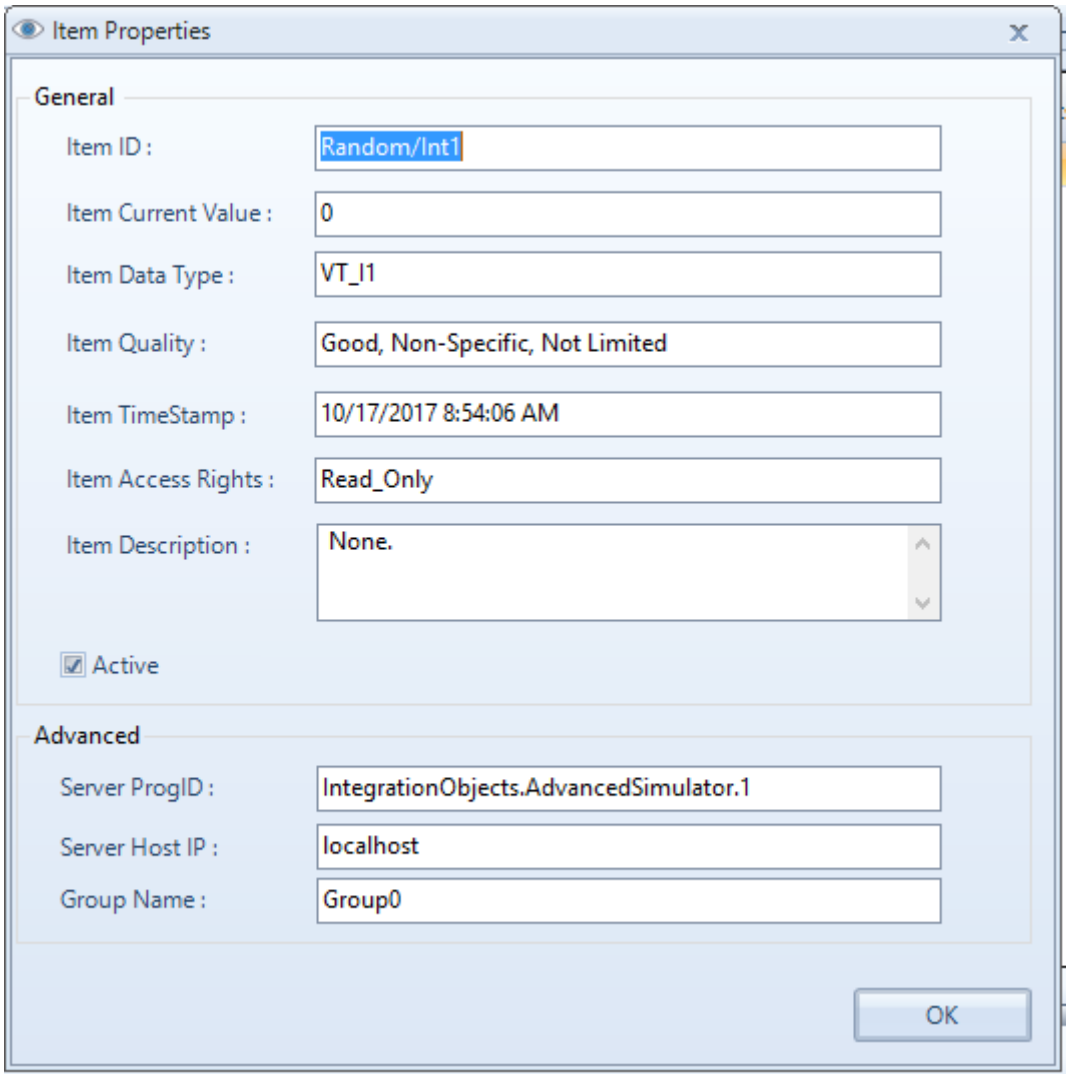

Figure 45: Item Properties Dialog

This dialog displays all of the tags information:

- Item ID
- Item Current Value

- Item Data Type
- Item Quality
- Item Time Stamp
- Item Access Rights
- Item Description
- The OPC Server ProgID
- The OPC Server Host IP
- The OPC Group Name
- The Item Active State

You can update the Item Active State by checking or unchecking the **Active** checkbox and clicking the **OK** button.

MQTT FUNCTIONALITIES

The MQTT Agent publishes data collected from any OPC DA server into MQTT brokers. In this chapter, we will describe the necessary steps to configure one or more MQTT agents.

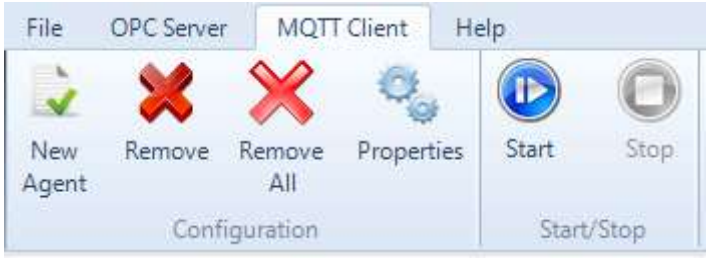

Figure 46: MQTT Client Menu

1. Add New MQTT Agent

To add a new MQTT agent, click the **New Agent** button located in the MQTT Client menu. The following wizard will be prompted:

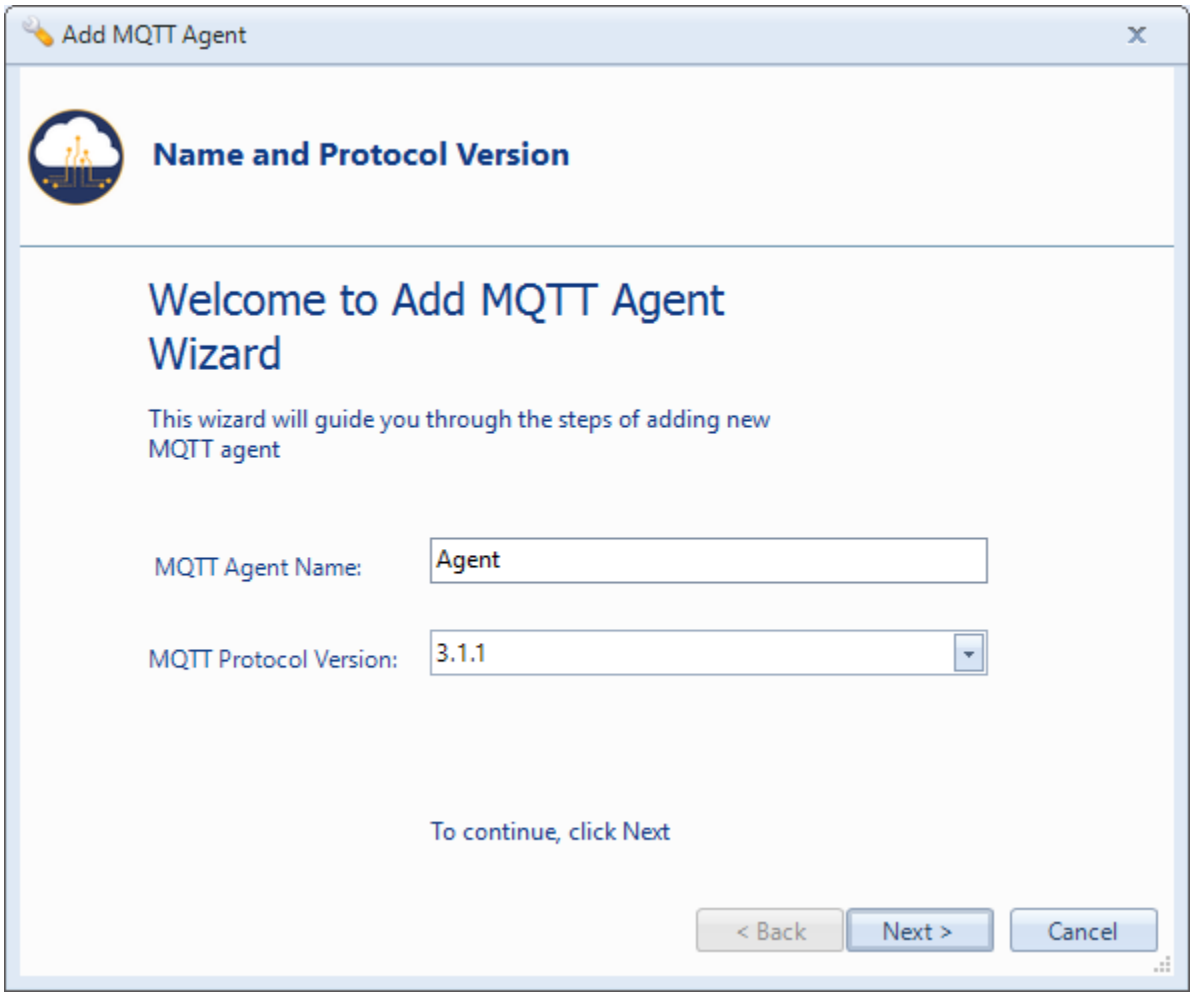

Figure 47: Name and Protocol Version Configuration

Step 1: Type the name of your MQTT Agent and choose the MQTT protocol version. Click the **Next** button. You will then be prompted to configure the Broker and connection parameters.

The difference between the versions depends on the MQTT Broker and how it is implemented .

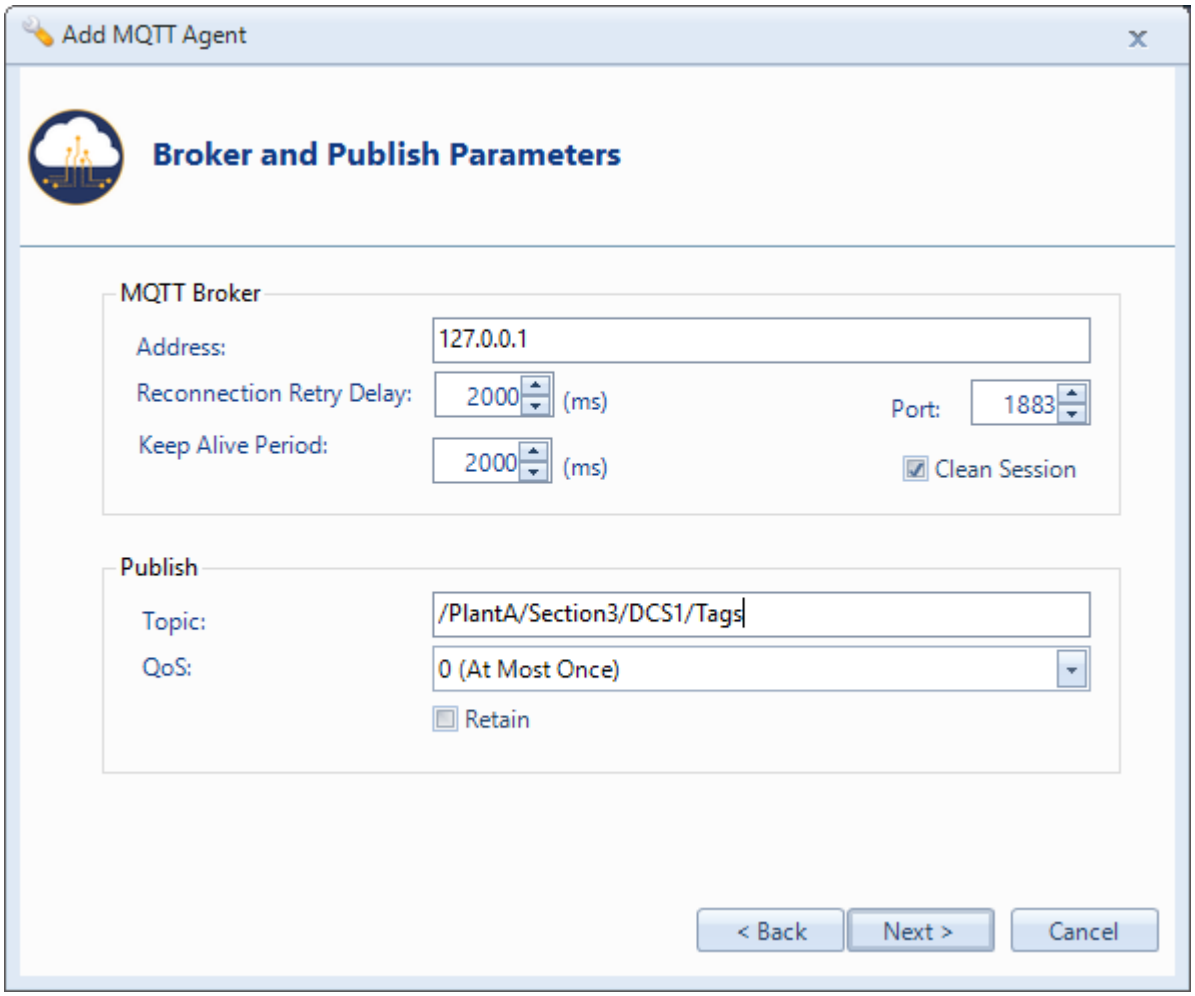

Figure 48: Broker and Publish Parameters Configuration

The configuration parameters to be entered are detailed in the table below:

Parameter	Description
Address	The URL or the IP address of the MQTT Broker.
Port	MQTT Broker port
Reconnection retry delay	If the connection with the MQTT Broker goes down, the agent will try to reconnect to that broker every “reconnection retry delay” period.
Keep Alive Period	The longest possible period of time, which the Broker and the client can endure without sending a message.

Clean Session	Check if the MQTT Broker should not store the session for the client ID.
Topic	Messages will be published to that Topic
QoS	The Quality of Service that will be used to publish data
Retain	If this option is checked, the last published message will be buffered in the Broker.

Table 3: Broker and Publish Parameters

Step 2: Type the MQTT Broker parameters. Click the **Next** button. You will then be prompted to assign OPC Groups to the MQTT Agent.

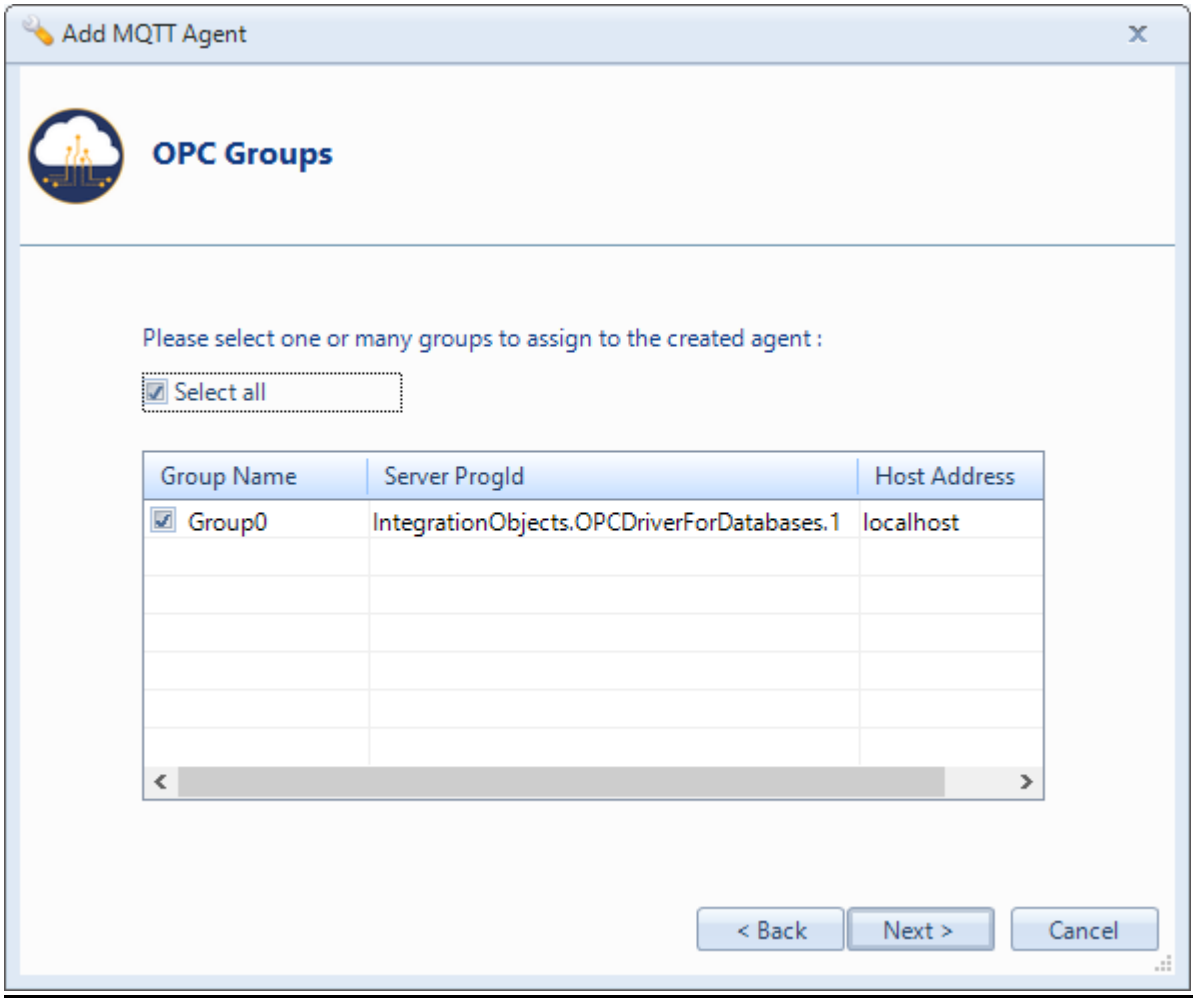

Figure 49: Assign OPC Groups

Step 3: Click the **Next** button to display all new agent parameters as shown below:

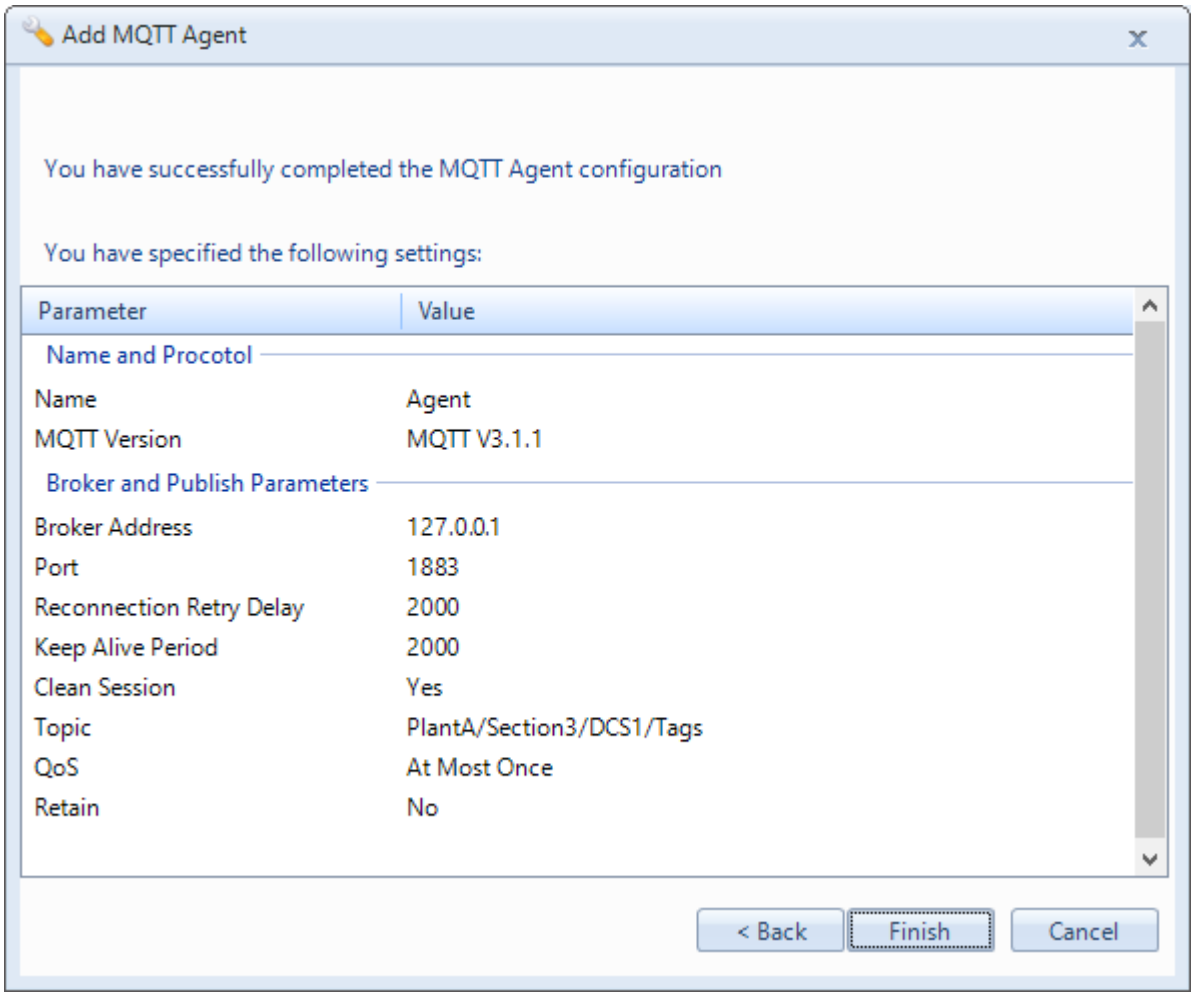

Figure 50: MQTT Agent Parameters Verification

Click **Finish** to confirm the new MQTT agent configuration, **Back** to edit your configuration or **Cancel** to exit the wizard.
Once confirmed, the MQTT agent will be added to agents' tree.

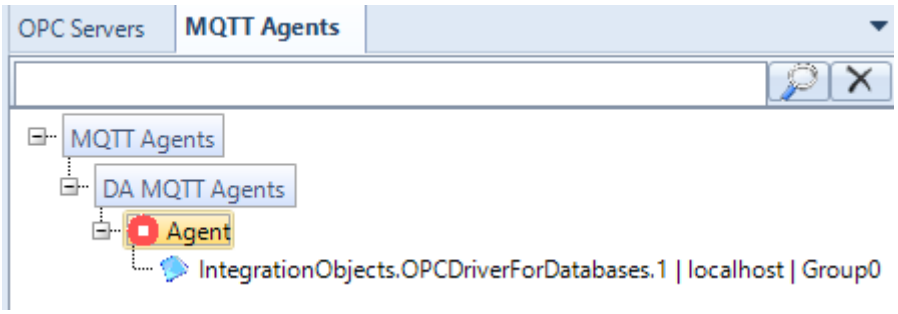

Figure 51: Agents Tree

2. Start Agent

To start the MQTT agent, select the related node in the agents' tree and click the **Start** button from the MQTT Client menu bar or right click on the agent node and select **Start** from the displayed menu.

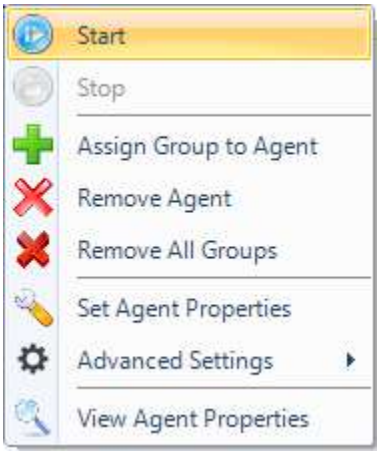

Figure 52: Start Agent

3. Stop Agent

To stop the Agent, click the **Stop** button in the MQTT Client menu bar or right click on the agent and select **Stop** from the displayed menu.

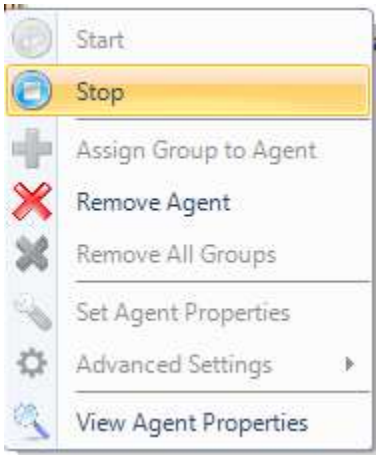

Figure 53: Stop Agent

4. Remove Agent

To remove an agent, select the agent node from the tree view of MQTT Agents and click the **Remove** button in the ribbon bar.

You can also use the **Remove Agent** context menu item as illustrated in the figure below.

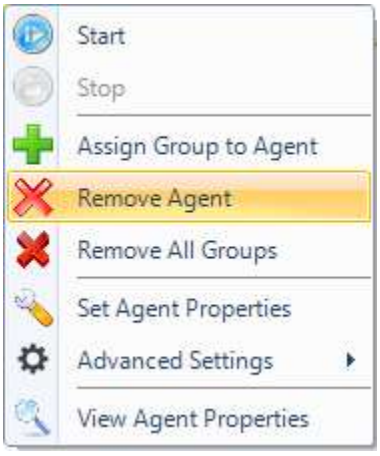

Figure 54: Remove Agent

Note that the MQTT agent should be stopped before being removed.

5. Remove All Groups

To remove all groups that were assigned to the MQTT Agent, click the **Remove All Groups** button in the context menu bar.

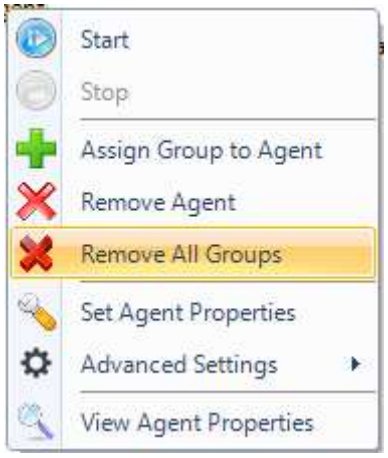

Figure 55: Remove All Groups

Note that an MQTT agent should be stopped before deleting any group assigned to that MQTT agent.

6. View Agent Properties

To view the agent properties, click the **View Agent Properties** context menu item and the following window will appear:

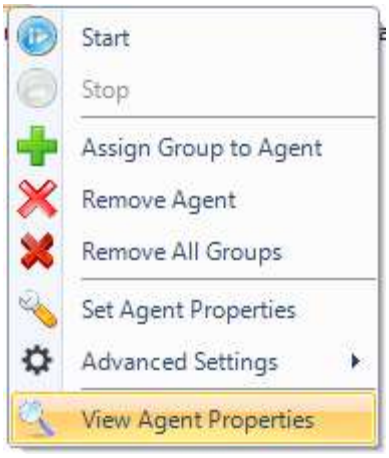

Figure 56: View Agent Properties

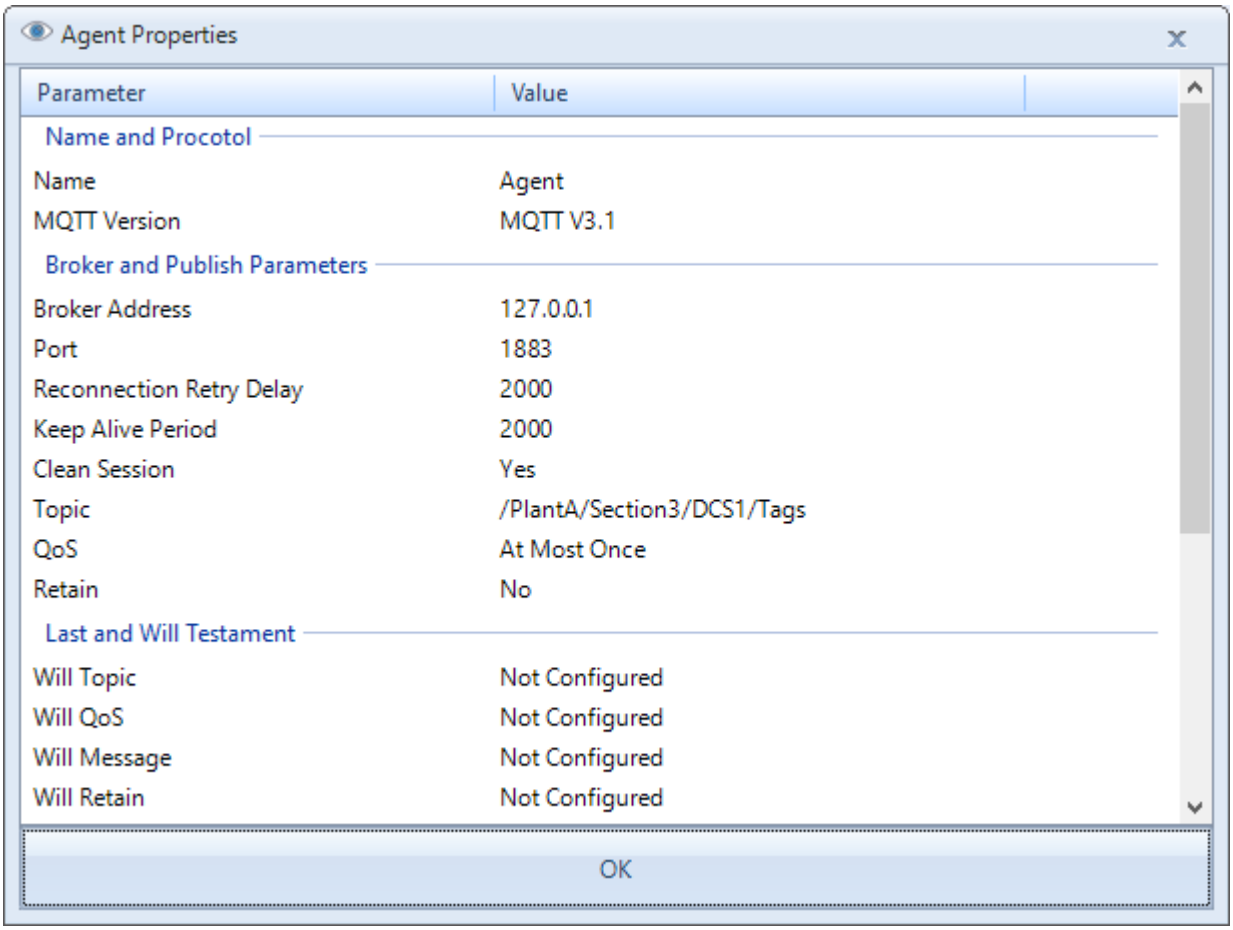

Figure 56: Agent Properties Window

7. Set Agent Properties

To modify the MQTT Agent properties, click on **Set Agent Properties** context menu item:

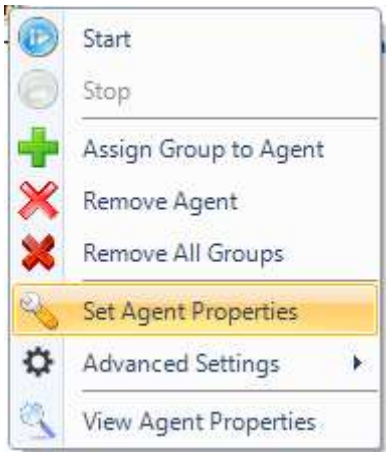

Figure 57: Set Agent Properties

8. Assign Group to Agent

To assign one or more groups to an agent, click the **Assign Group to Agent** context menu item and the following window will appear:

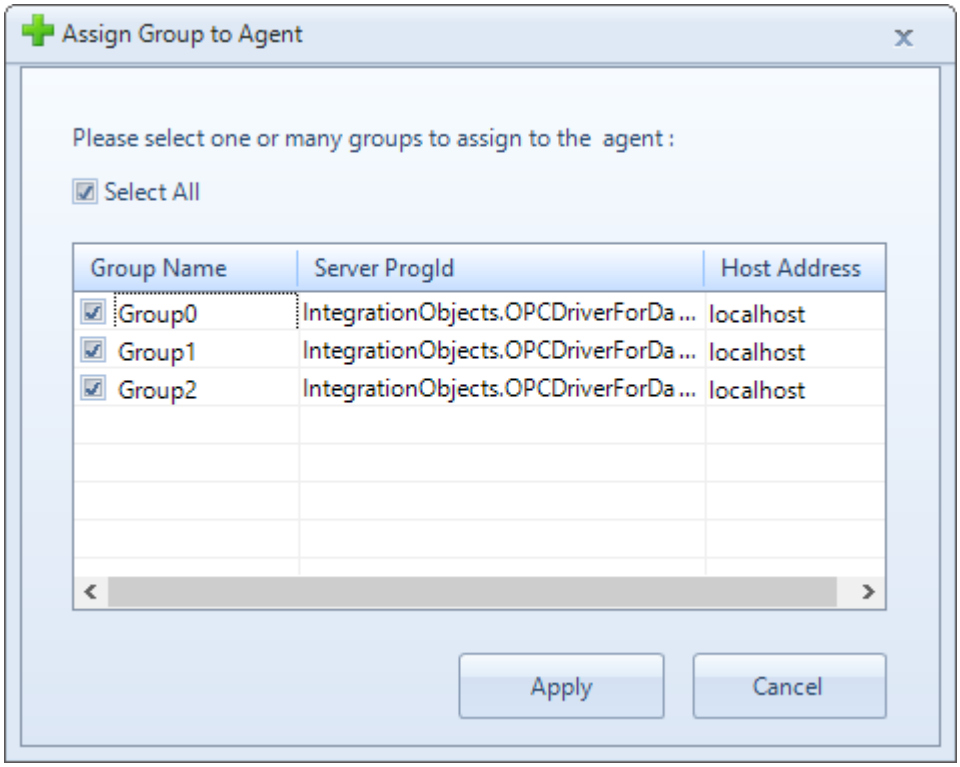

Figure 57: Assign Groups to Agent

Select the groups that will be added to the MQTT agent and then click **Apply**.

9. Advanced Settings

9.1. Authentication and TLS

To configure the agent authentication and TLS, click the **Advanced Settings → Authentication and TLS** context menu button.

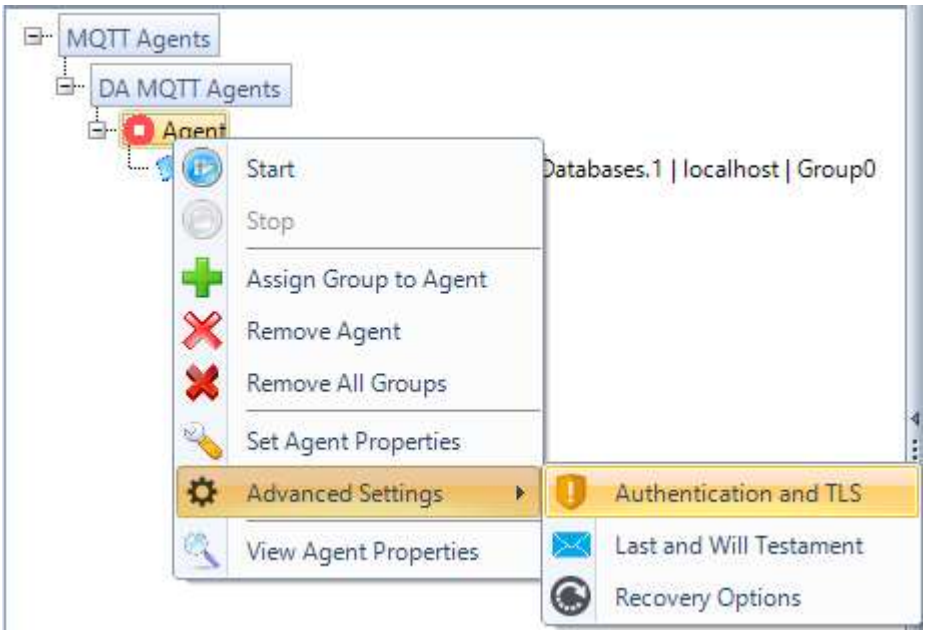

Figure 58: Authentication and TLS

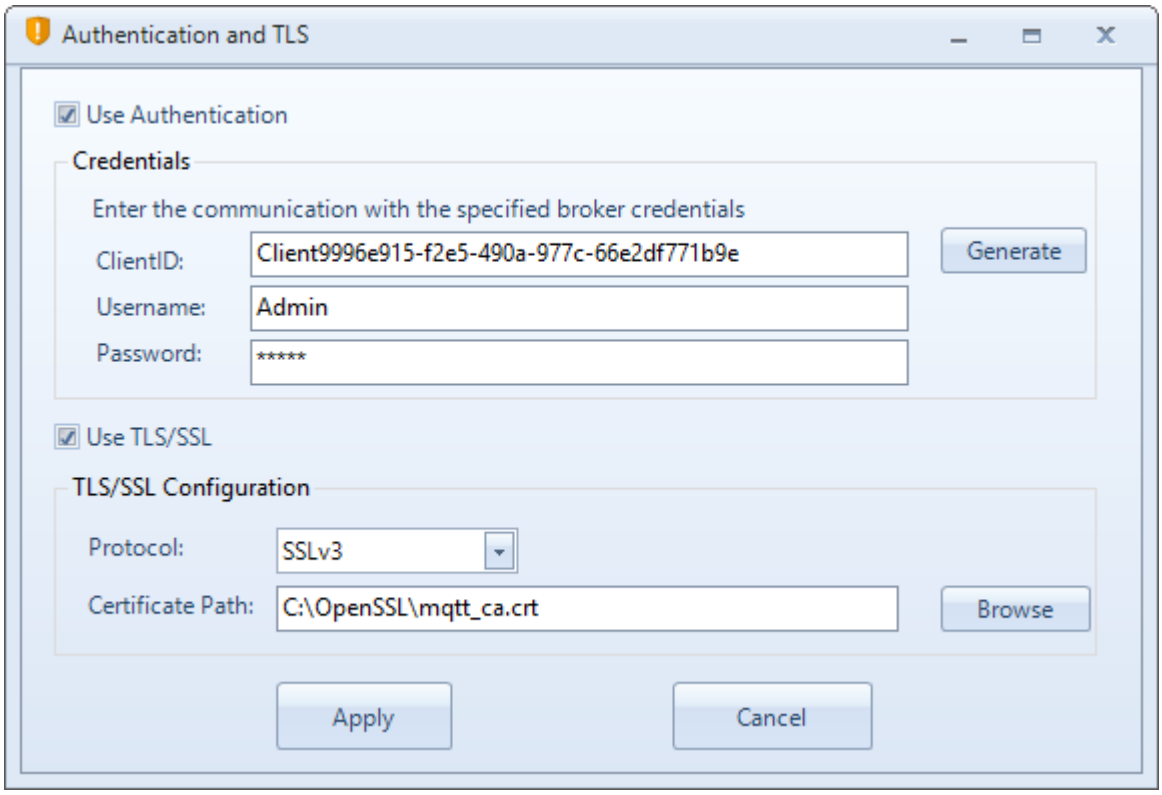

Figure 59: Authentication and TLS Configuration

Parameter	Description
Use Authentication	Check this option if you want to use authentication.
Client ID	The MQTT agent ID in the broker. Click “Generate” to generate a unique ID.
Username	Username to connect to the MQTT broker.
Password	Password to connect to the MQTT broker.
Use TLS/SSL	Check this option if you want to use a certificate for the communication with the MQTT broker.
Protocol	The protocol that will be used to secure the channel between MQTT Agent and MQTT Broker. It can be SSLv3, TLSv1.0, TLSv1.1 or TLSv1.2.
Certificate Path	The certificate file path. Click Browse button to choose the file location.

Table 4: Authentication and TLS Configuration Parameters

Username and password are optional as the connection to some MQTT brokers does not require any username or password.

9.2. Last and Will Testament

To configure the agent Last and Will Testament Message, click the **Advanced Settings → Last and Will Testament** context menu button.

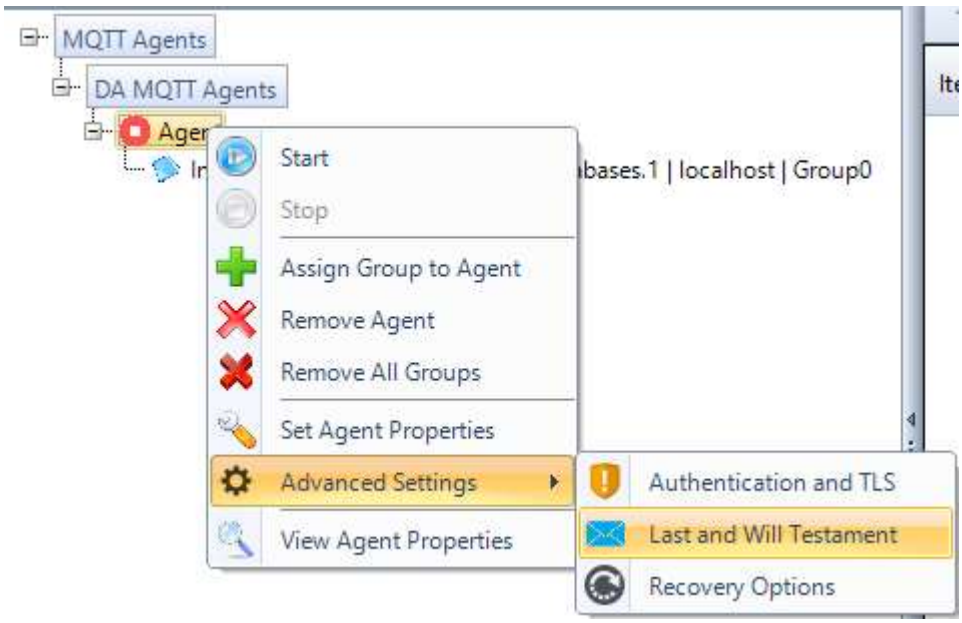

Figure 60: Last and Will Testament

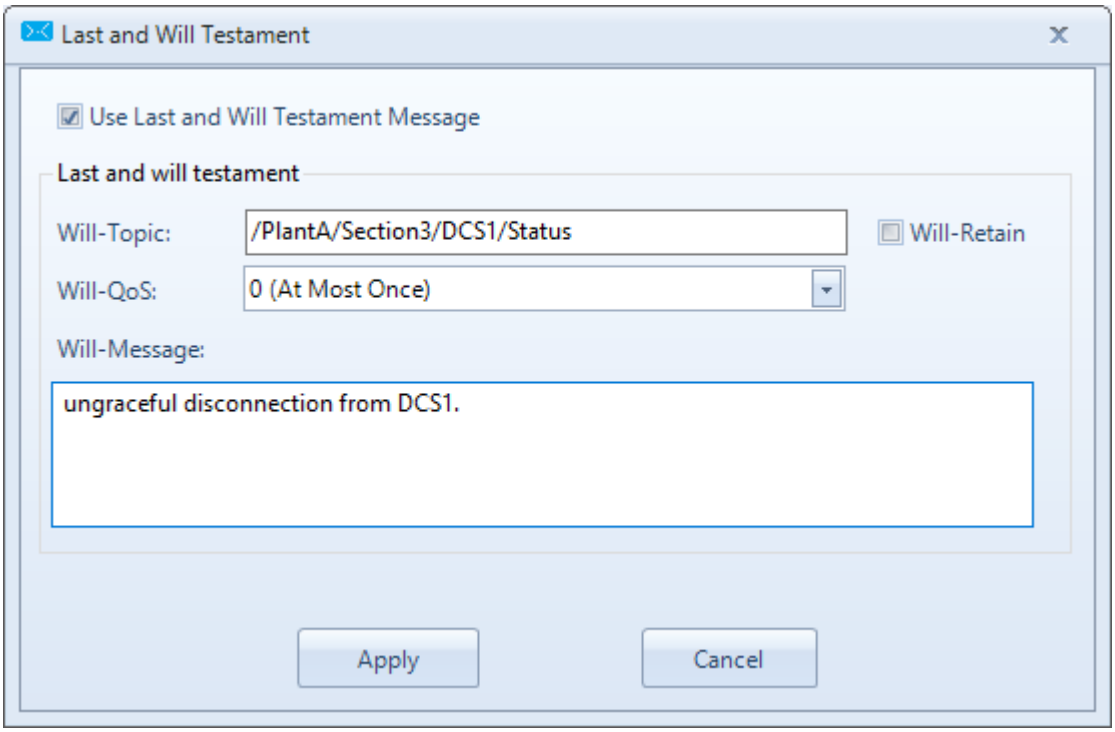

Figure 61: Last and Will Testament Configuration

The Last and will testament feature is used for notifying MQTT clients subscribed to the Will-Topic that the publisher client is disconnected abnormally (e.g. network communication problems).

Parameter	Description
Use Last and Will Testament	Check this option if you want to use Last and Will Testament message.
Will-Topic	The topic of the last and will testament publication.
Will-Retain	Check if the will-message should be retained.
Will-QoS	Sending will-message Quality of Service level.
Will-Message	The payload to be send to other clients in case of ungraceful disconnection.

Table 5: Last and Will Testament Parameters

9.3. Recovery Options

To configure the agent recovery options, click the **Advanced Settings → Recovery Options** context menu button. These options allow to store the data to be sent to the agent locally during

communications disruptions and to be resent to the agent when communications are reestablished.

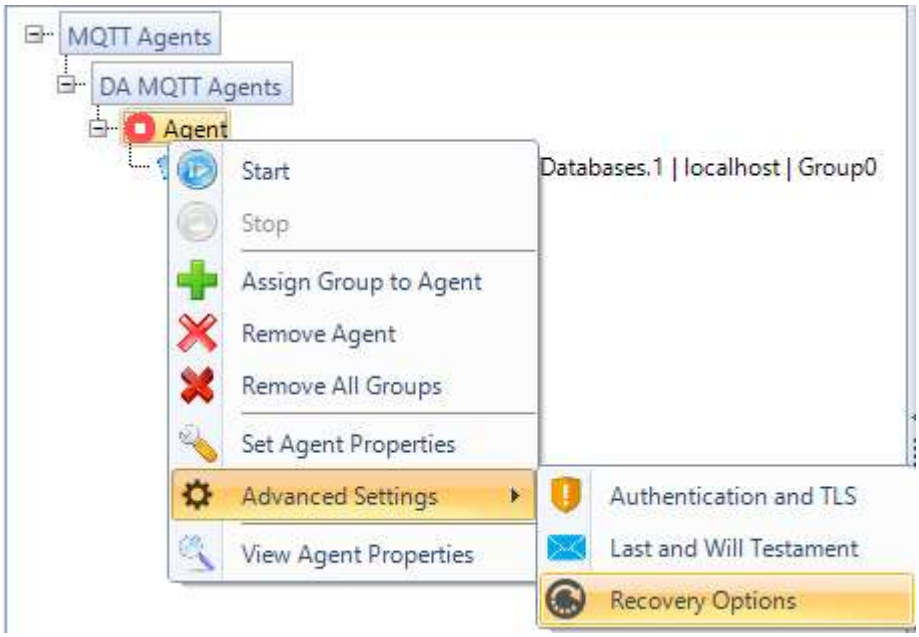

Figure 62: Recovery Options

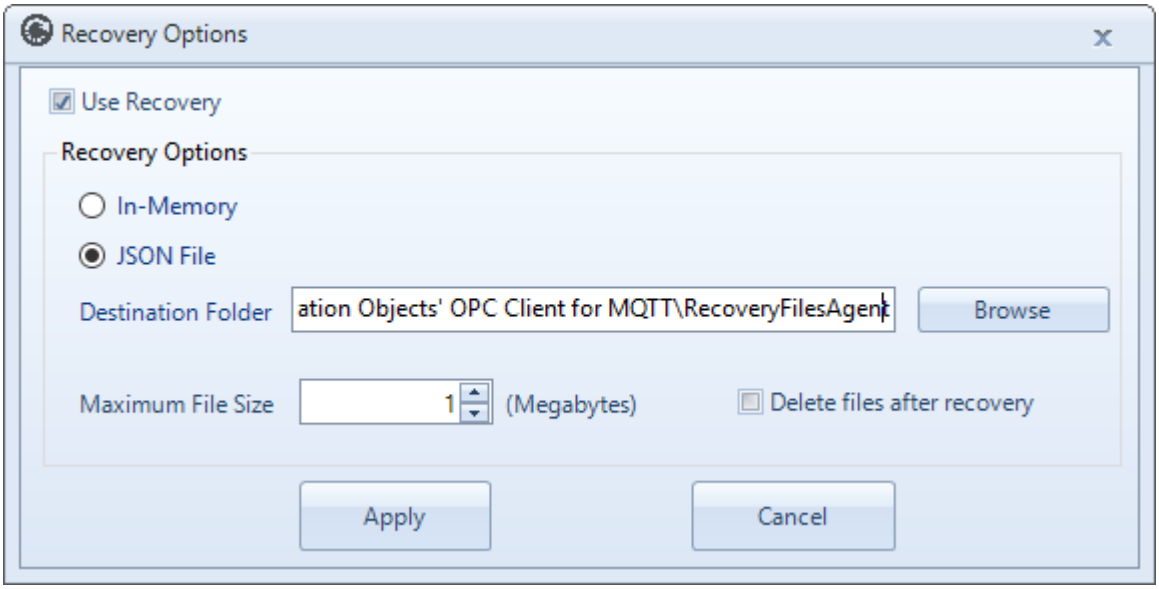

Figure 63: Recovery Options Configuration

Parameter	Description
Use Recovery	Check this option if you want to use data recovery operation when the connection with the broker is lost.

In-Memory	Check if you want to store data in-memory.
JSON File	Check this option if you want to store data in JSON files.
Maximum File size	The maximum JSON backup file size. If this limit is exceeded, a new file will be created.
Delete files after recovery	Check this option if you want to delete JSON backup files when the recovery procedure is completed.

Table 6: Recovery Options Parameters

10. Message Format

The OPC Client for MQTT uses a JSON format to send data to the MQTT broker. This format has the following structure.


```
{
   "Timestamp":"2018/03/22 11:54:14.266",
   "ListofValues":[
      {
         "ID":"Random/Boolean",
         "value":"False",
         "timestamp":"2018/03/22 11:50:59.706",
         "quality":"Good, Non-Specific, Not Limited"
      },
      {
         "ID":"Random/Date",
         "value":"30/12/1899 00:00:00",
         "timestamp":"2018/03/22 11:50:59.706",
         "quality":"Good, Non-Specific, Not Limited"
      },
      {
         "ID":"Random/Int1",
         "value":"0",
         "timestamp":"2018/03/22 11:50:59.706",
         "quality":"Good, Non-Specific, Not Limited"
      },
      {
         "ID":"Random/Int2",
         "value":"0",
         "timestamp":"2018/03/22 11:50:59.706",
         "quality":"Good, Non-Specific, Not Limited"
      }
   ]
}
```


Figure 64: JSON Message Format

TRACING CAPABILITIES

The OPC Client for MQTT has event tracing capabilities and produces 2 log files named as follows:

- The `LogEvent.log` that records errors and debugging information generated by the user interface,
- The `MQTTServiceLog.log` that records errors and debugging information generated by the OPC DA Client for MQTT service.

If difficulties occur with the OPC Client for MQTT, the log files can be extremely valuable for troubleshooting. Under normal operation, the client logs contain very little information.
These log files are generated at start-up under the installation folder.

The OPC Client for MQTT incorporates 2 configuration files: `OPCMQTTClientConfig.ini` and `OPCDAClientMQTTServiceConfig.ini`. These files include several logging parameters. All these parameters have default settings and can be changed by editing the configuration files.

To change one of the configuration files (in this example we use the `OPCDAClientMQTTServiceConfig.ini` file), you can proceed as follows:

1. Open `OPCDAClientMQTTServiceConfig.ini` in a text editor.
2. Edit any of the parameters listed in the following tables:

Log Setting	Description	Default Value
AutoAppend	Set to true to continue writing log messages in the existed log file or to false to create a new file.	True
BufferSize	The maximum number of messages to be stored in the runtime memory before launching a write action in the hard disk. The specified value must be greater than 100.	100 messages
FileName	The OPC Client for MQTT Service log file name	MQTTServiceLog
MaximumFiles	Set to 0 means that log files will be created in an unlimited way.	0
Level	There are five log levels: 1. Control: Logs only control messages generated by OPC Client for MQTT Service. 2. Error: Logs error and control messages generated by the OPC Client for MQTT Service.	Control

	3. Warning: Logs warning, error and control messages generated by OPC Client for MQTT Service. 4. Inform: Logs information, warning, error and control messages generated by the OPC Client for MQTT Service. 5. Debug: Logs all messages generated by the Client for MQTT Service. The higher the log level, the more information is recorded. We recommend using level "Control" for a better performance of the service. The other levels are dedicated for troubleshooting purposes.	
AutoSaveTimeOut	The time to wait to read all messages from the buffer and write it on hard disk, the minimum value is 10s.	10 seconds

Table 7: Log Settings

3. Save the file for the log settings and restart your application for changes to take effect.
   Sample Configuration File:

```
[FileLogConfiguration]
AutoAppend=True
BufferSize=100
FileName=MQTTServiceLog
MaximumFiles=0
Level=Error
AutoSaveTimeOut=10
```

TROUBLESHOOTING

Case 1: Cannot launch the OPC Client for MQTT

If you are using an evaluation license, you should first check the license validity by launching the License Authorization tool. You can start it directly from the startup menu:

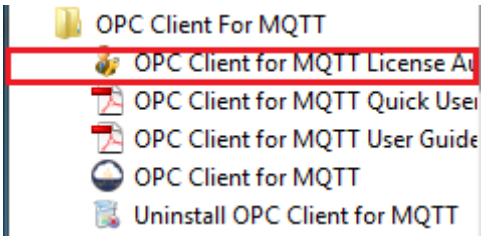

Figure 65: Open License Authorization Tool

If the License Authorization tool shows that the demo has expired and you want to activate it using your full activation license, you should in this case follow the steps below:

1. Run the License Authorization tool using an administrator account

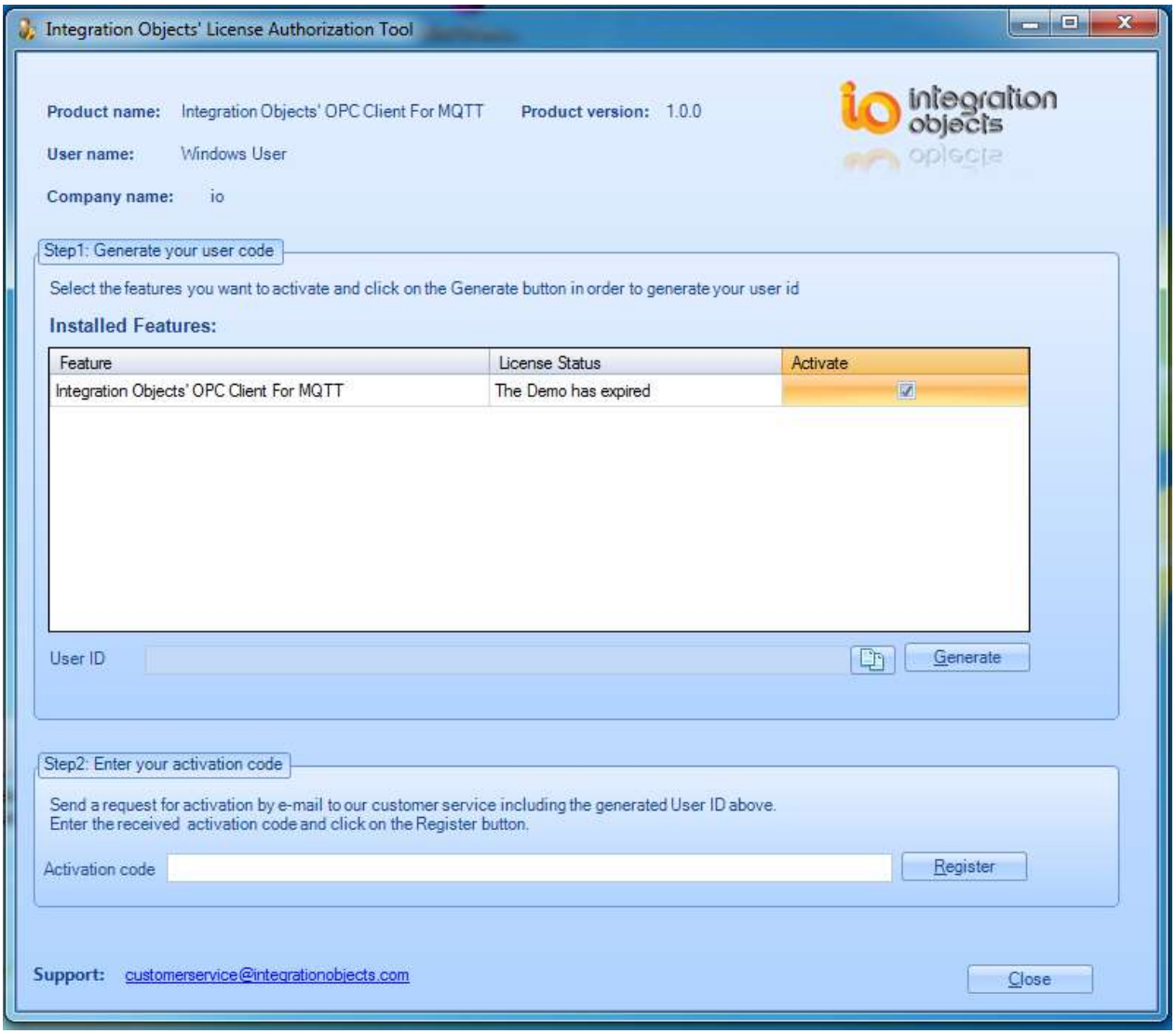

Figure 66: Demo License Expired

2. Click the **Generate** button
3. Copy and send the **User ID** to the sales team {sales@integrationobjects.com} so they can generate your activation code.
4. Enter the given **Activation code**

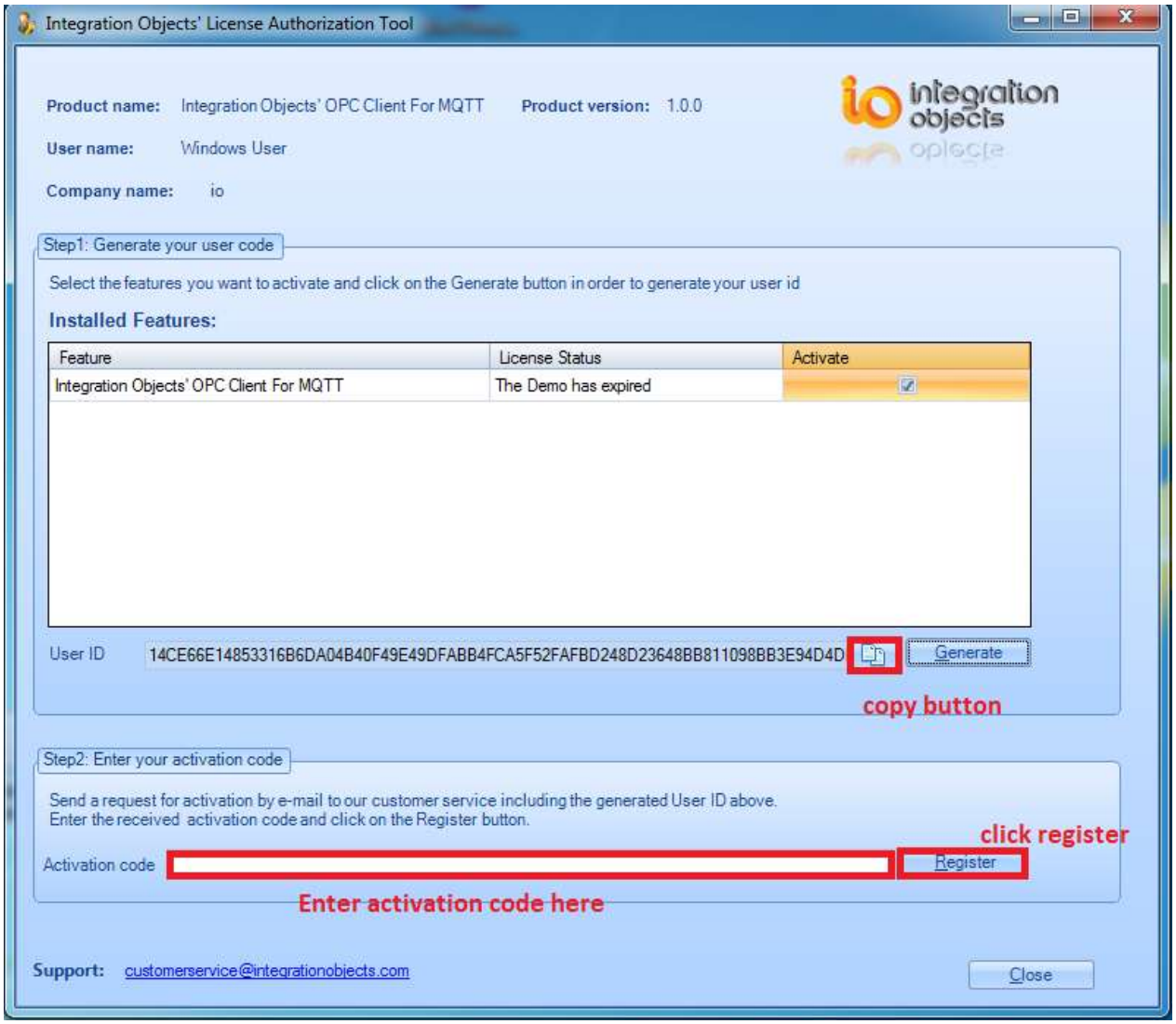

Figure 67: Activate License

5. Click the **Register** button

Case 2: Cannot start the OPC Client for MQTT service

In case the OPC Client for MQTT DA service could not be started, check if:

1. The license is still valid (see the first case above)
2. The user has the privileges to run the service.

In order to change the user account running the OPC Client for MQTT service, please proceed as follows:

1. Open the windows service manager
2. Right click on **Integration Objects' OPC DA Client for MQTT service** and select **Properties**

3. Go to the **Log on** tab.
4. Check **This account** and enter the user credentials for the service as illustrated in the figure below:

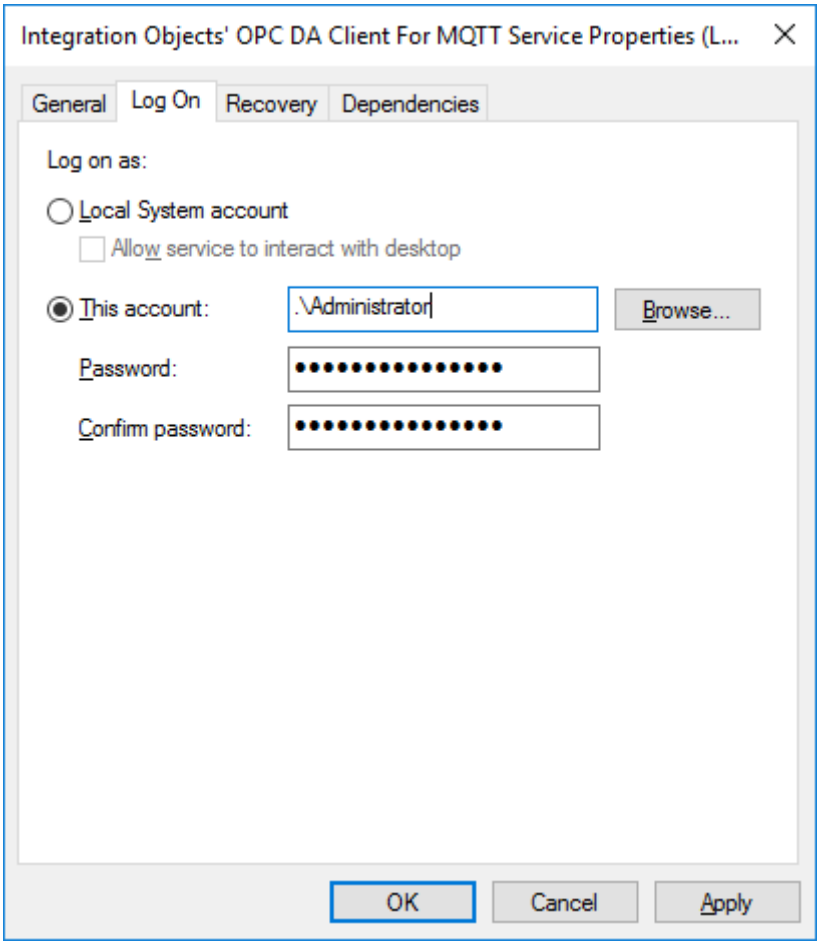

Figure 68: OPC DA Client for MQTT Service Log on

5. Click the **OK** button.

To add the "Log on as a service" right to an account on your local computer

1. Open the Local Security Policy
2. In the console tree, double-click Local Policies, and then click User Rights Assignment.
3. In the details panel, double-click Log on as a service.

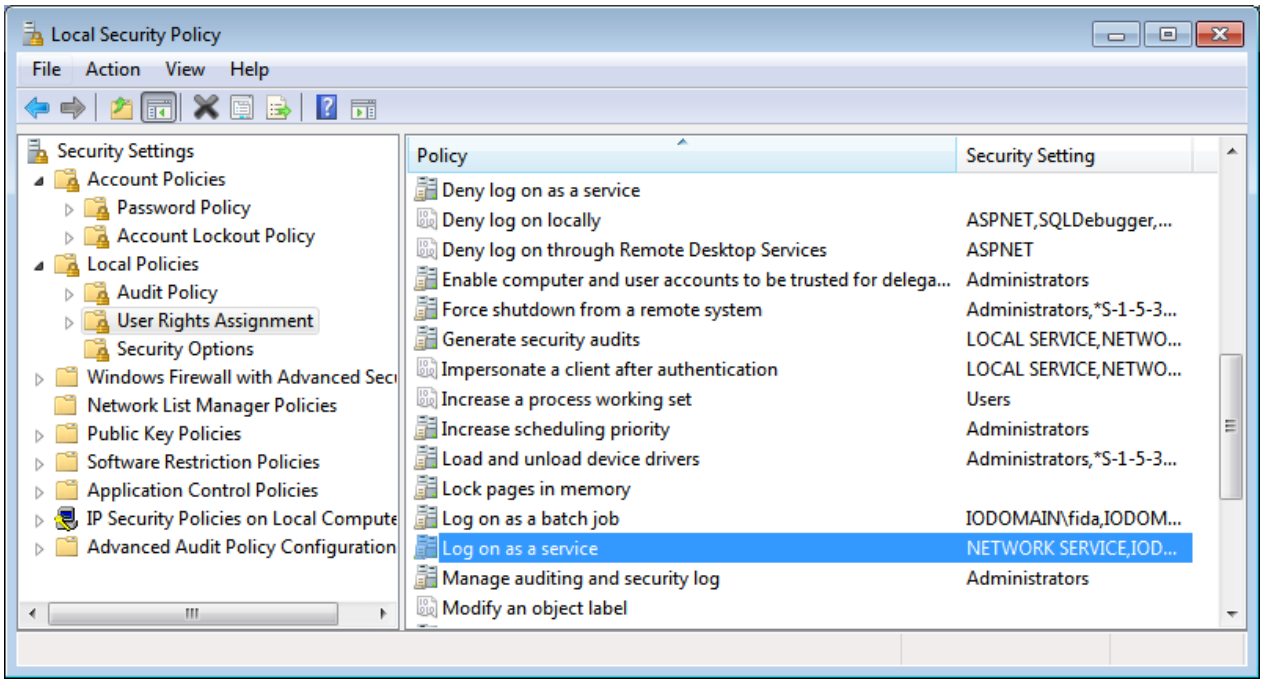

Figure 69: Log on as a Service Policy

4. Click Add User or Group, and then add the appropriate account to the list of accounts that possess the Log on as a service right.

Case 3: Cannot connect to a local OPC Server

You should check if the OPC Core Components are installed in your machine. You can find the OPC Core components under the following path:
.:\Integration Objects\Integration Objects' OPC Client for MQTT\Components

If they are already installed, you should use the regsvr32 command as shown below to register them again:

1. Example (Windows 7, 64 bit, System Drive "C:"):

    regsvr32 C:\Windows\SysWOW64\opcproxy.dll
    regsvr32 C:\Windows\ SysWOW64\opccomn_ps.dll

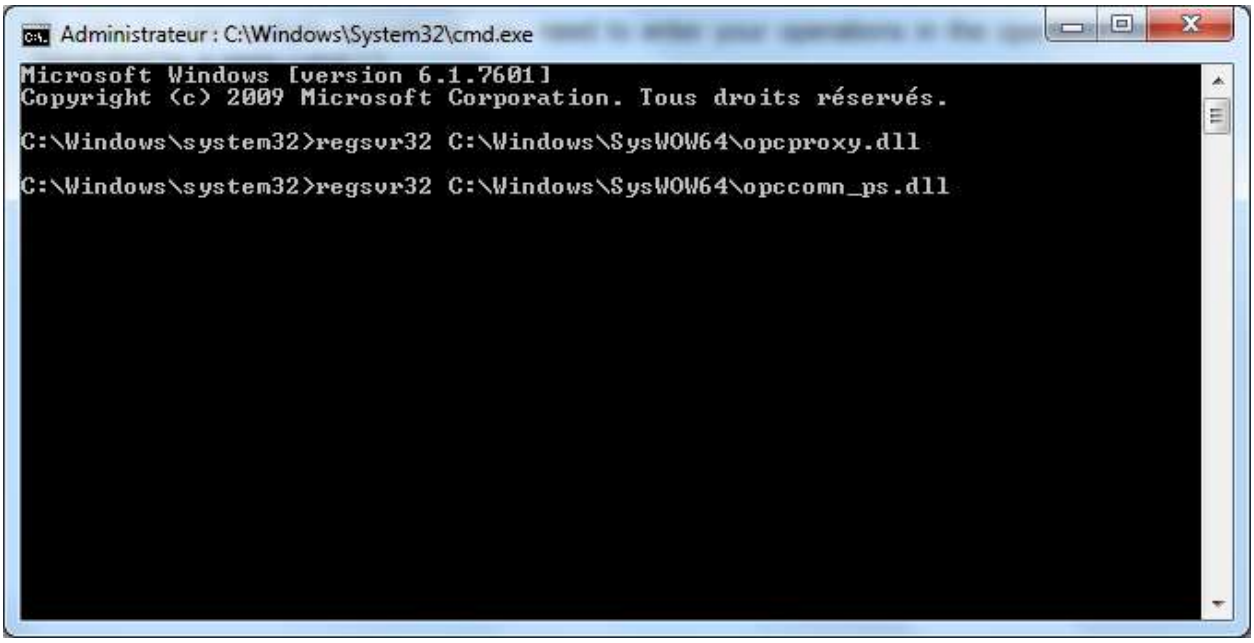

Figure 70: Register OPC Core Components on Windows 7 64 bit

2. Example (Windows 7, 32 bit, System Drive "C:"):

regsvr32 "C:\WINDOWS\system32\opcproxy.dll"
regsvr32 "C:\WINDOWS\system32\opccomn_ps.dll"

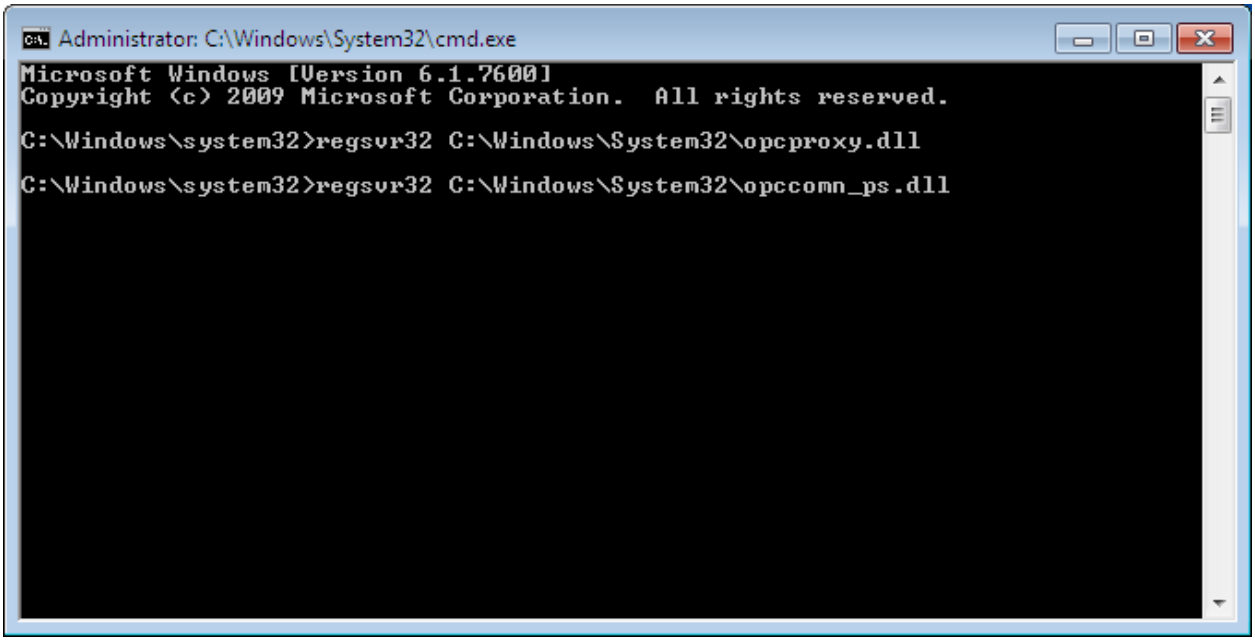

Figure 71: Register OPC Core Components on Windows 7 32 bit

You can also repair the installation OPC Core Components using the installation wizard.

In case the problem persists, you need to change the user account of the service to use an account that has access rights to connect your OPC Server and read data. Check **Case 2**.

Case 4: I need to access the OPC Client for MQTT files. Where can I find the installation folder for OPC Client for MQTT?

Follow these steps:

1. Select the OPC Client for MQTT shortcut (from your Desktop or the Start Menu),
2. Right-click on it and choose properties,
3. A properties window appears containing the shortcut information,
4. Click the **Find Target …** button.

OR

1. Open the OPC Client for MQTT
2. Go to the File menu bar and click on **Configure** button
3. Click the **Installation Folder** button as illustrated in the figure below:

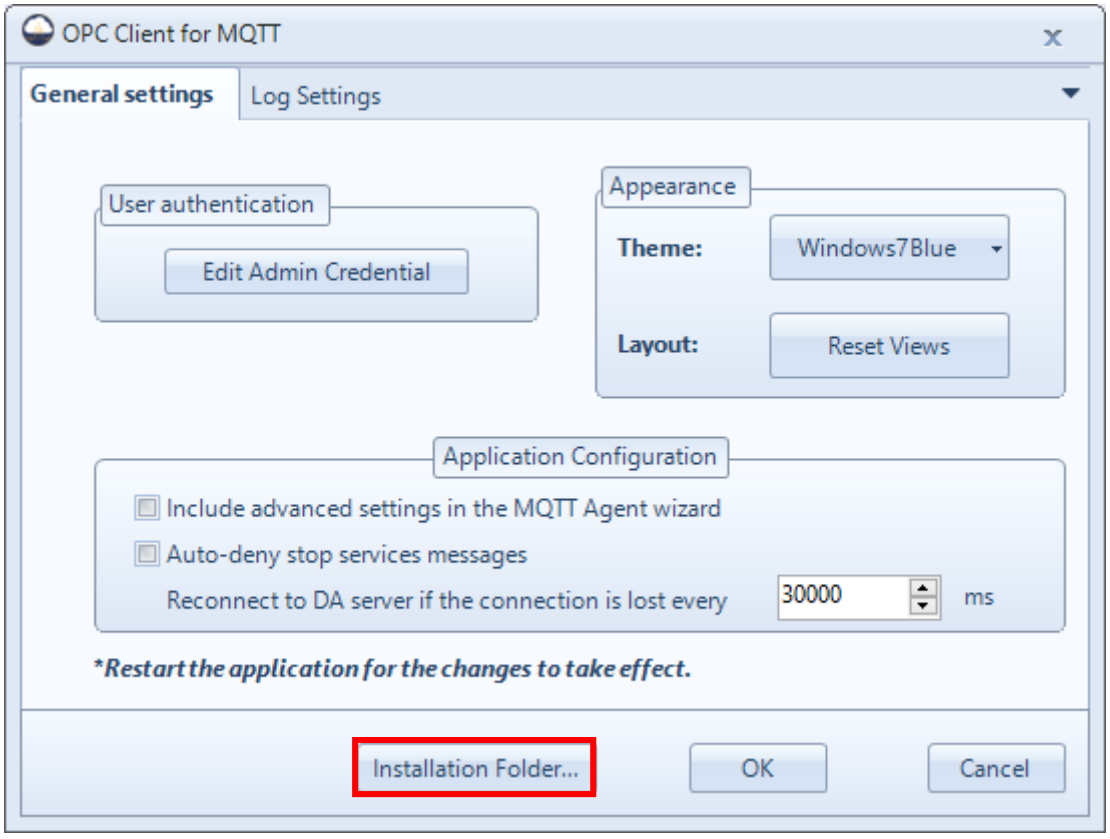

Figure 72: Open Installation Folder

Case 5: Cannot connect to MQTT Broker

If you configured a connection to an MQTT Broker and it does not work, check the following items:

- The configured MQTT Broker address and port are correct,

- There is no proxy filtering or a firewall that blocks the communication with the MQTT Broker. You can check your connection with telnet:

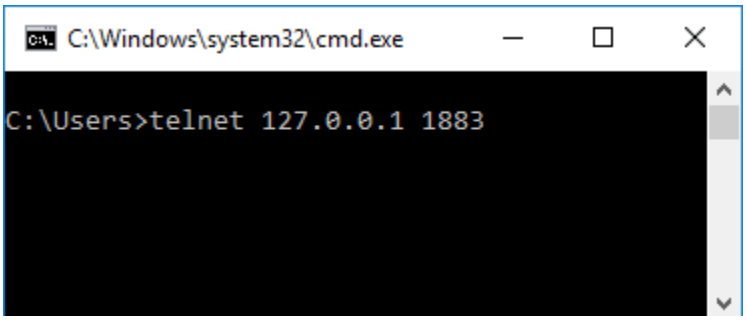

Figure 73: Check Port Availability using Telnet

- The configured authentication parameters (Username, password) are correct.

Case 6: Messages are lost

We recommend you to configure Quality of Service parameters. More information are presented below:

- Why is Quality of Service important?
  - QoS is a major feature of MQTT, it makes communication in unreliable networks a lot easier because the protocol handles retransmission and guarantees the delivery of the message, regardless how unreliable the underlying transport is. Whenever a packet gets lost on the way, the sender is responsible for resending the last message.
- When using QoS 0?
  - You have a complete or almost stable connection between sender and receiver
  - You do not care if one or more messages are lost once in a while
- When using QoS 1?
  - You need to get every message and your use case can handle duplicates.
  - You cannot bear the overhead of QoS 2. Because QoS 1 is a lot faster in delivering messages without the guarantee of level 2.
- When using QoS 2?
  - It is critical to your application to receive all messages exactly once.

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