

IEC 61850

eNode Configuration

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- [IEC 61850 Configuration Guide](#)
 - [IEC 61850 Interoperability](#)
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Documentation Control

Author:	Daniel Jones
Revision:	1.01
Revision History:	1.00 – Initial Release 1.01 – Update for eNode Designer 1.01
Creation Date:	9 December 2015
Last Revision Date:	29 October 2018
Product Reference:	197-0600 User Manual
Document Status:	Release

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1 Introduction

This document describes how to use the **IEC 61850 eNode Designer Module** to configure SystemCORP's *IEC 61850 ADH Application* within the eNode Designer.

The ADH Application is able communicate according to the IEC 61850 standard, using and exchanging data and commands to other ADH Applications.

1.1 Scope

This document is divided into 3 major sections:

- **Overview** with **General Description**; and a
- **IEC 61850 ADH Application Configuration Guide**
- **IEC 61850 ADH Application Interoperability**

IEC61850 Standard related information and the IEC 61850 Standard itself is not part of the scope of this document. For more detailed information on the SystemCORP's PIS-10 IEC61850 Software Stack see the appropriate SystemCORP documents or visit our website.

<http://www.systemcorp.com.au/support/iec61850-api-manual/>

1.2 Overview

1.2.1 Document Reference

- [1] Document Title: 197-0100 eNode Designer User Manual
Revision: Version 1.00

1.2.2 List of Abbreviations

ADH	= Application Data Hub
DA	= Data Attribute
IEC	= International Electrotechnical Commission
IED	= Intelligent Electronic Device
SCL	= Substation Configuration Language

2 General Description

The IEC 61850 eNode Designer Module uses a pre-existing SCL file for configuration; the configuration tool's primary action is to select which data points should be added to or mapped from the ADH database.

When an SCL file is loaded into eNode Designer, a *copy* is saved in the eNode Designer project file. This allows the project file to be sent (e.g. email) and opened elsewhere without needing to also send the SCL file.

2.1 General Screen Description

Once an SCL file has been imported, a view similar to the following will be shown. The tabs section allows the user to browse the local IED versus the connected remote IEDs.

In the **client**, there are no configuration options for the local IED so that tab is not shown. It just has a tab of remote IEDs showing all the servers connected.

In the **server**, the local IED is configurable so that tab is shown. In 61850 servers, the only data points it has access to from remote IEDs are those published on GOOSE, so the remote IEDs tabbed is named "GOOSE subscription".

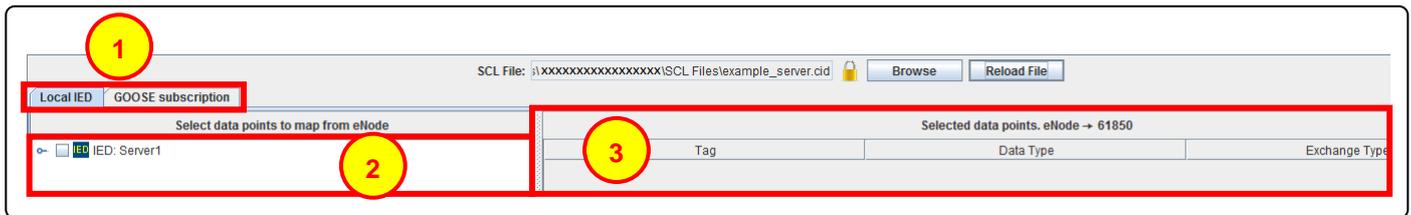


Figure 2-1 – View of a newly loaded server SCL file.

- 1 **Tabs** – Local IEDs will be separate from Remote IEDs. See details above.
- 2 **SCL Tree Windowpane** – This shows the Project Tree of the currently selected IED. The tick-boxes allow for selection of data points for mapping. Expand the branches to view further down the project tree.
- 3 **Mapped Points** – This is where the points that have been mapped will appear. Each row in this table corresponds to a single "ticked" leaf DA node in the tree.

2.2 SCL Tree Explanation

The SCL file given is expanded into a tree-view showing different levels of IED, Logical Devices, Logical Nodes, then into Data Objects and Data Attributes. The “final” nodes are mappable data points. A screen shot is shown below.

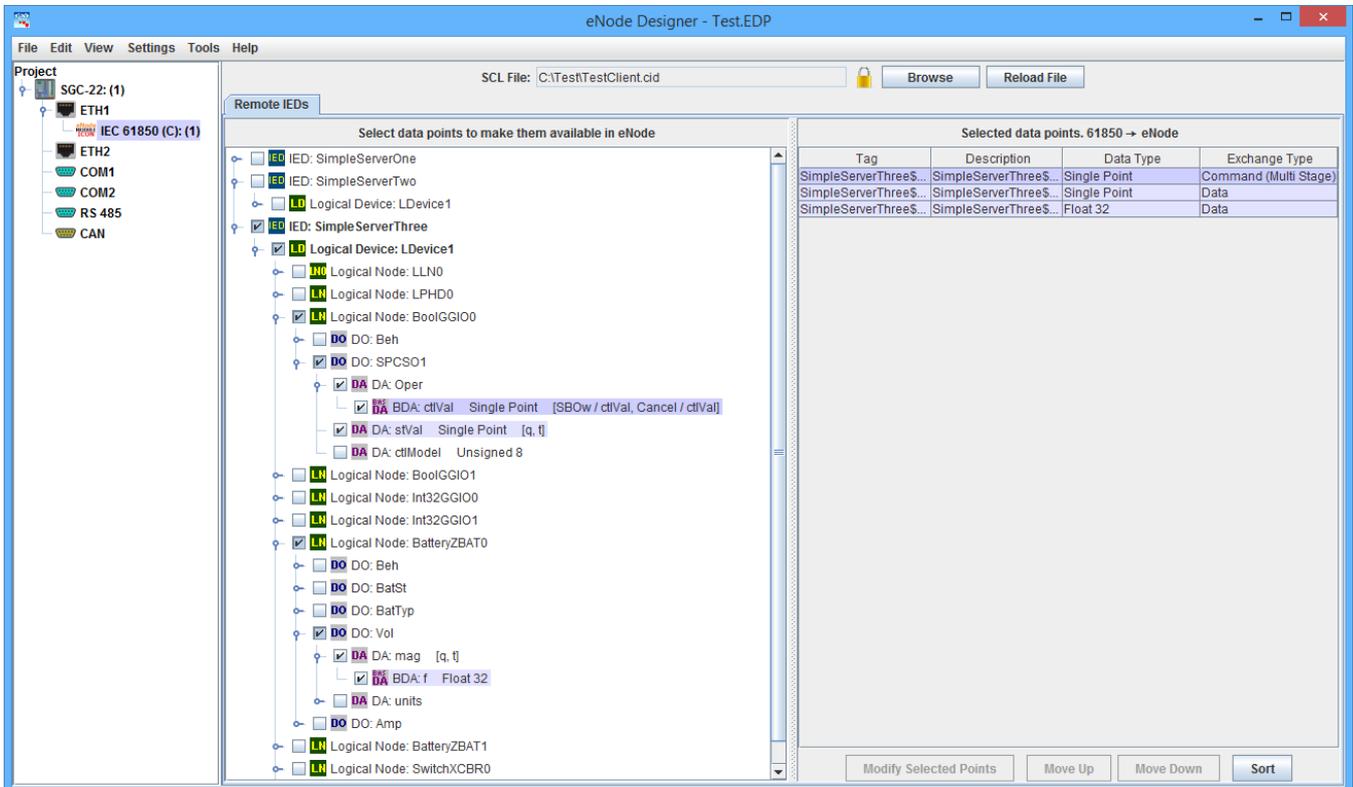


Figure 2-2 - Main screen.

Each mappable point has a description of its data type, which is extracted from the SCL file. A zoomed in portion of the tree is shown below along with a more detailed description of the components.

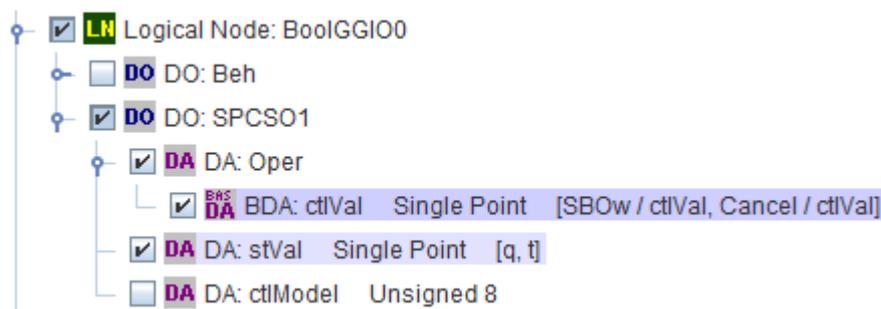


Figure 2-3 - Main screen of a single logical node.

For example with this BoolGGIO0/SPCS01/stVal, the tree node text contains information about its node type (DA), node name (stVal), ADH Data Type (Single Point), and in this case also some square bracket notation. The square bracket notation shows that the q and t DAs are bound with the $stVal$ data point. This is explained further in section 2.3.

The data type of the point is extracted from the IEC 61850 data type (e.g. “BOOLEAN” becomes “Single Point”). A special case is 61850 enumerated types, which are placed in the eNode Database as “Integer 32”. Unsupported IEC 61850 data types including string types are not shown in the SCL tree at all.

2.3 Associated DAs are Combined into a Single Data Point

Every eNode Designer data point has an associated timestamp (when the data value changed) and quality flags. This is similar to how IEC 61850 works with q (quality) and t (timestamp) DAs being updated together with DAs such as $stVal$. Thus eNode Designer groups the q and t with the appropriate values according to the 61850 specification to the single eNode (or ADH) data point. Mapping the $stVal$ eNode data point also automatically maps the associated quality and time with IEC 61850 data attributes q and t .

Multi-stage commands (such as Select Before Operates) are represented as a single data point for mapping in eNode Designer. Thus, the 61850 Operate structures are combined to a single structure: the “Oper”.

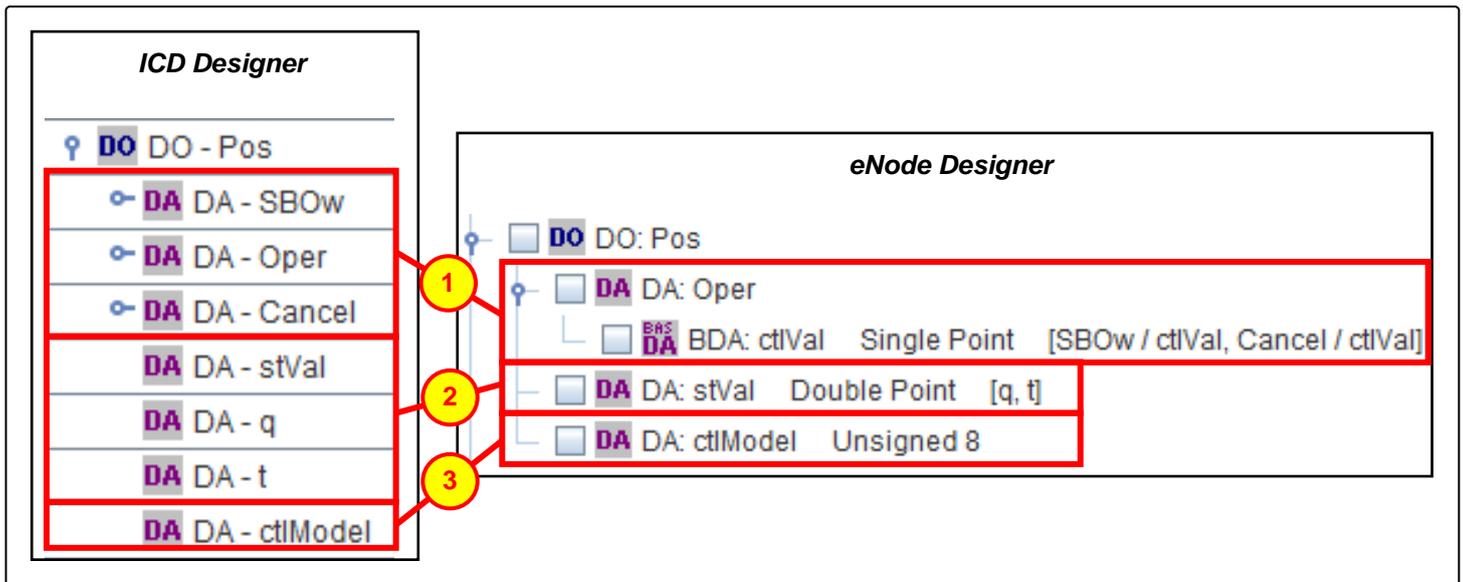


Figure 2-4 – Combined DAs, example one.

This figure contains a screenshot from *ICD Designer* and a screenshot from *eNode Designer* to illustrate how data points are grouped together within *eNode Designer*. **Both images show the same *Pos Data Object* in a XCBR Logical Node.**

- 1 **DA: Oper** – Shown in the *ICD designer* image as *DA - SBOw*, *DA - Oper* and *DA - Cancel*, these data attributes are all grouped as *DA: Oper* within *eNode Designer*. This point contains the *ctIVal* data points of *DA - SBOw*, *DA - Oper* and *DA - Cancel*. This is shown using the square brackets notation.
- 2 **DA: stVal** – According to IEC 61850 specification, q and t apply to $stVal$. They are separate DAs but they are grouped together in *eNode Designer*. This is shown using the square bracket notation after the “stVal”: [q, t].
- 3 **DA: ctIModel** – This is only a single Data Point in both *ICD designer* and *eNode Designer*.

Another example is shown below. In this example, the q and t apply to the mag according to the IEC 61850 specification. Any selected point "inside" this mag will have the q and t values associated with the mag combined into one data point.

For example, in this case, the $magSi$ has its quality and time mapped with the 61850 q and t DAs adjacent to the mag .

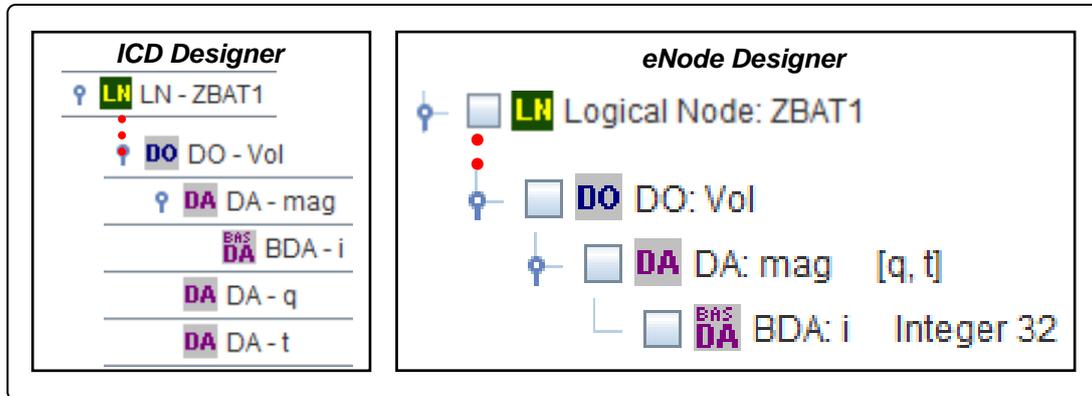


Figure 2-5 – Combined DAs, example two.

2.4 Replaces Ethernet Properties

When generating and sending the configuration to the target platform, the SCL's local IED Ethernet properties are modified to match those specified in eNode Designer.

That is, the following attributes are changed in the Access Point associated with the first IED in the SCL file that is sent to the target device.

Attribute	Modification
<code><P type="IP">...</P></code>	Replaced by Ethernet's property in eNode Designer
<code><P type="IP-SUBNET">...</P></code>	Replaced by Ethernet's property in eNode Designer
<code><P type="IP-GATEWAY">...</P></code>	Replaced by Ethernet's property in eNode Designer
<code><P type="MAC-Address">...</P></code>	Removed. Obtained automatically.

Table 2-1 – Automatic IP Setting Modifications.

3 IEC 61850 ADH Application Configuration Guide

3.1 Adding the Module in eNode Designer

The IEC 61850 module can only be added to *Ethernet* ports. An IEC 61850 ADH Application can be set up as a Client or a Server. The choice will be presented when adding it to the project.

To add the module to the project, follow the steps explained below.

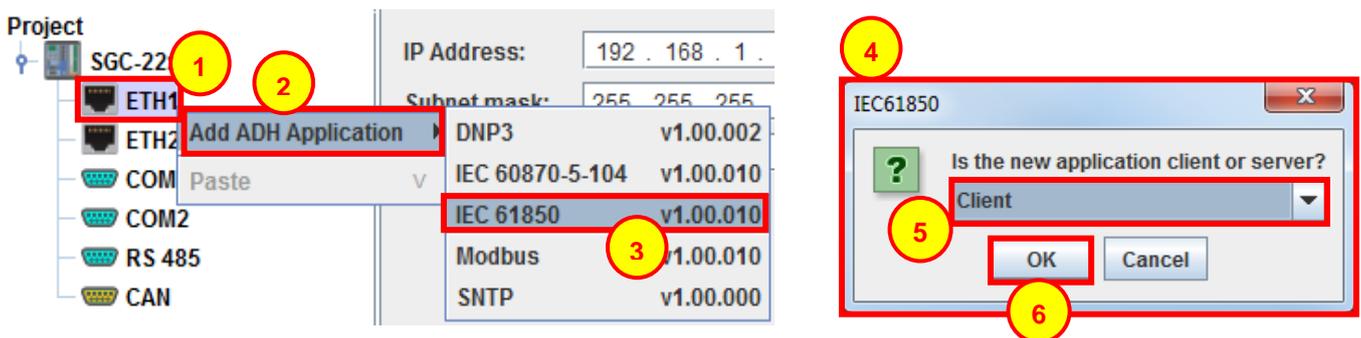


Figure 3-1 - Adding an IEC 61850 module to the project.

- 1 Right click the intended port for the *IEC 61850* ADH Application.
- 2 Click **Add ADH Application**.
- 3 Click **IEC61850**.
- 4 A dialogue box will appear asking whether the new application is a *Client* or a *Server*.
- 5 Select either *Client* or *Server* from the drop down menu.
- 6 Click **OK** to add the application.

3.2 Common Configuration Details

After a new *IEC61850 Server* or *Client* is added, an *SCL file* needs to be selected. The following pane will appear at the top centre of the screen for both *IEC61850 Servers* and *Clients*.



Figure 3-2 – SCL file selection.

- 1** **SCL file** – Shows location and name of the SCL file once it has been added to eNode Designer.
- 2** **Browse** – This button will bring up an *Open File* dialogue box to select the SCL file to be loaded for the ADH Application, see: [Open SCL File Dialogue Box](#).
- 3** **Reload File** – This option is only available once a file has been loaded. Reload file is explained further in [Changing and Reloading SCL Files](#).

3.2.1 Open SCL File Dialogue Box

The open file dialogue box is used to find an SCL file to load into *eNode Designer*.

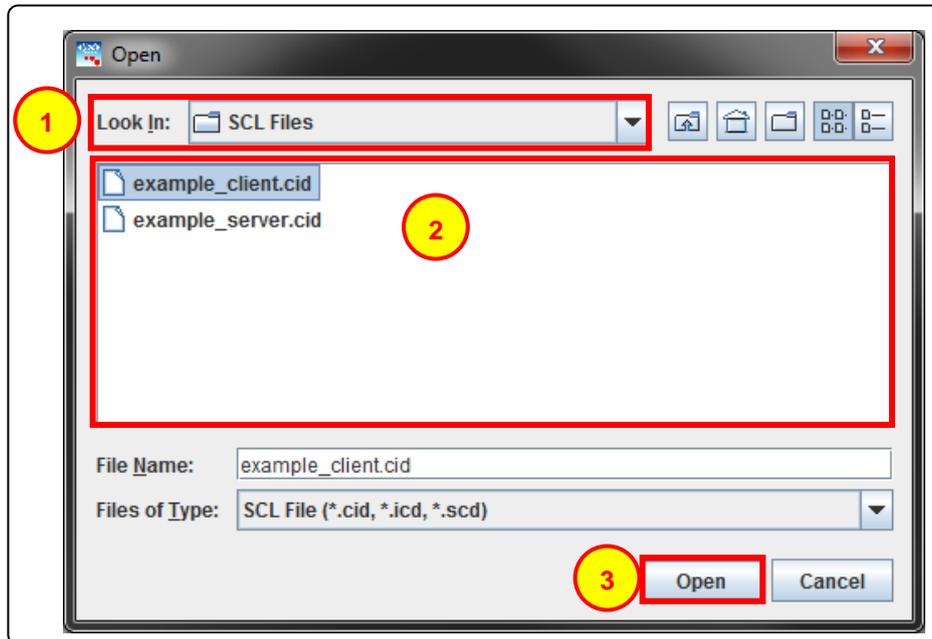


Figure 3-3 – Open file dialogue box.

- 1 **Look In** – This drop-down menu can be used to choose a folder location where the desired SCL file will be found.
- 2 **Contents window** – The desired *SCL* file can be selected from the list of files within the folder. Make sure to load a *Client* file if configuring a *Client* or a *Server* file if configuring a *Server*. If the incorrect kind is selected, it will not load and an error message will be displayed.
- 3 **Open** – Once the desired file is selected. Click **Open** to import the *SCL* file.

3.2.2 Changing and Reloading SCL Files

When an SCL file is loaded into eNode Designer, a copy is saved in the eNode Designer project. If the SCL file has changed, a warning will appear next to Reload File, Left clicking the reload file button will load the changes into eNode Designer.



Figure 3-4 – Altered file warning.

- 1 Browse** – This button can be used to change the current SCL file, however this will require confirming login details. This will bring up the *Open File* dialogue box to select the SCL file to be loaded for the ADH Application, see: [Open SCL File Dialogue Box](#).
- 2 Altered File Warning** – The exclamation mark within the yellow triangle will be shown when the currently loaded SCL file has been changed externally. This indicates that it will need to be reloaded to reflect those changes within eNode Designer.

3.3 Client Configuration

3.3.1 IEC 61850 Client – Select which data points to use in eNode Designer.

Once a Client SCL file has been imported, the following view will be shown. In this example, some of the *SCL Tree* has been expanded and some data points selected.

Selecting data attributes in the tree assigns adds ADH data points into the system, whose value (and where relevant, timestamp and quality) will be taken from that IEC 61850 point. Each eNode data point is shown in the table on the right. All the data points in the table are those available in eNode Designer for mapping. All data point values have default values automatically assigned based on the SCL file. The *Tag* and *Description* are changeable by the user.

Checking (or unchecking) a tree node will check (or uncheck) all tree nodes “inside” it.

The screenshot displays the eNode Designer interface. At the top, the SCL File is set to 'C:\Test\TestClient.cid'. The interface is divided into two main panes. The left pane, titled 'Remote IEDs', shows a tree view of the SCL file structure. The right pane, titled 'Selected data points, 61850 → eNode', contains a table of the selected data points.

Tag	Description	Data Type	Exchange Type
SimpleServerOne\$LDDevice1\$BoolGGIO0\$SPCSO1\$stVal	SimpleServer...	Single Point	Data
SimpleServerOne\$LDDevice1\$BoolGGIO0\$Alm1\$stVal	SimpleServer...	Single Point	Data
SimpleServerOne\$LDDevice1\$BoolGGIO1\$SPCSO1\$stVal	SimpleServer...	Single Point	Data
SimpleServerOne\$LDDevice1\$Int32GGIO0\$ISCSO1\$stVal	SimpleServer...	Integer 32	Data
SimpleServerOne\$LDDevice1\$SwitchXCBR0\$Pos\$Oper\$ctlVal	SimpleServer...	Single Point	Command (Multi...
SimpleServerOne\$LDDevice1\$SwitchXCBR0\$Pos\$stVal	SimpleServer...	Double Point	Data
SimpleServerOne\$LDDevice1\$SwitchXCBR0\$Pos\$ctlModel	SimpleServer...	Unsigned 8	Data

Figure 3-5 - Mapped client example.

- 1 **Remote IEDs** – This shows the Remote IED's connected to the client, all Remote IED's will show in this area under their respective IED tree nodes within the *Project Tree Windowpane*.
- 2 **Project Tree Windowpane** – This shows the a tree view of all remote IEDs. The tick-boxes allow for selection of data points to be made available for mapping in the database. Expand the branches to view further down the project tree.
- 3 **Selected Data Points** – This is where the points selected for inclusion in the database will appear. Points that show in this area have been made available to the database and can be utilised by other applications.

3.4 Server Configuration

If the server SCL file has more than one IED in the file, the first one is the Local IED, and the rest are remote IEDs. The GOOSE subscription tab shows all remote IEDs which publish GOOSE messages. The way 61850 works, the only data points accessible in a server from remote IEDs are those which are published on GOOSE.

The IEC 61850 server application in some way acts like a server *and* a client. It is able to reference “client” points to and from the local IED, but also “produces” points it puts in to the eNode Database from the remote IEDs.

3.4.1 IEC 61850 Server – Mapping Data Points to the Local IED

To select a DA to map, expand the tree down to the final level (the final DA) and tick the checkbox.

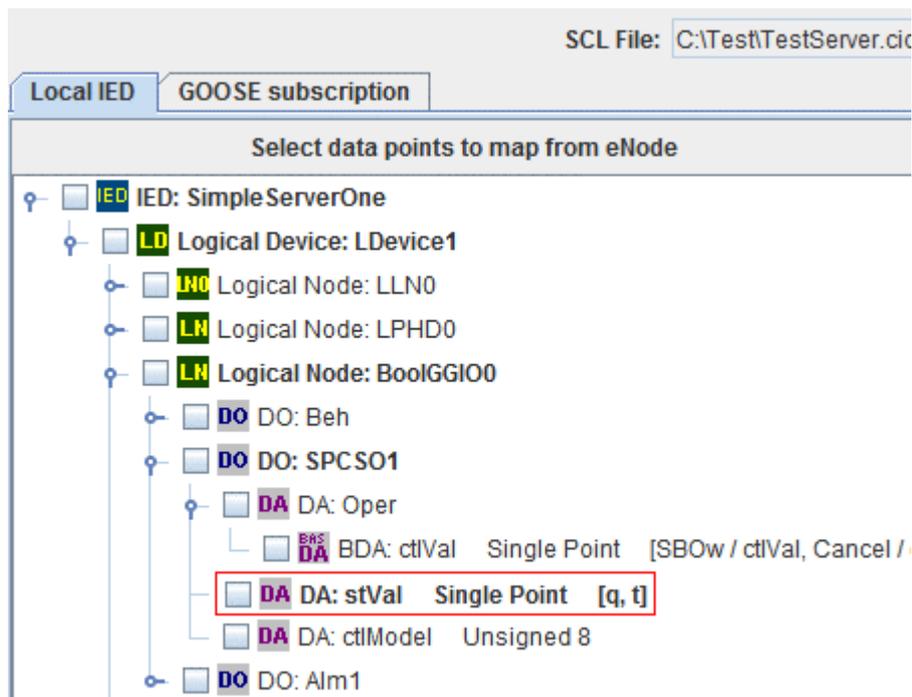


Figure 3-6 - To map, first browse to the desired point.

Selecting a point for mapping from eNode will bring up the following window. This window allows you to select which data point value to map to. Points are **live mapped** within the dialogue: as soon as a mapping is changed in this window, it is changed within eNode Designer.

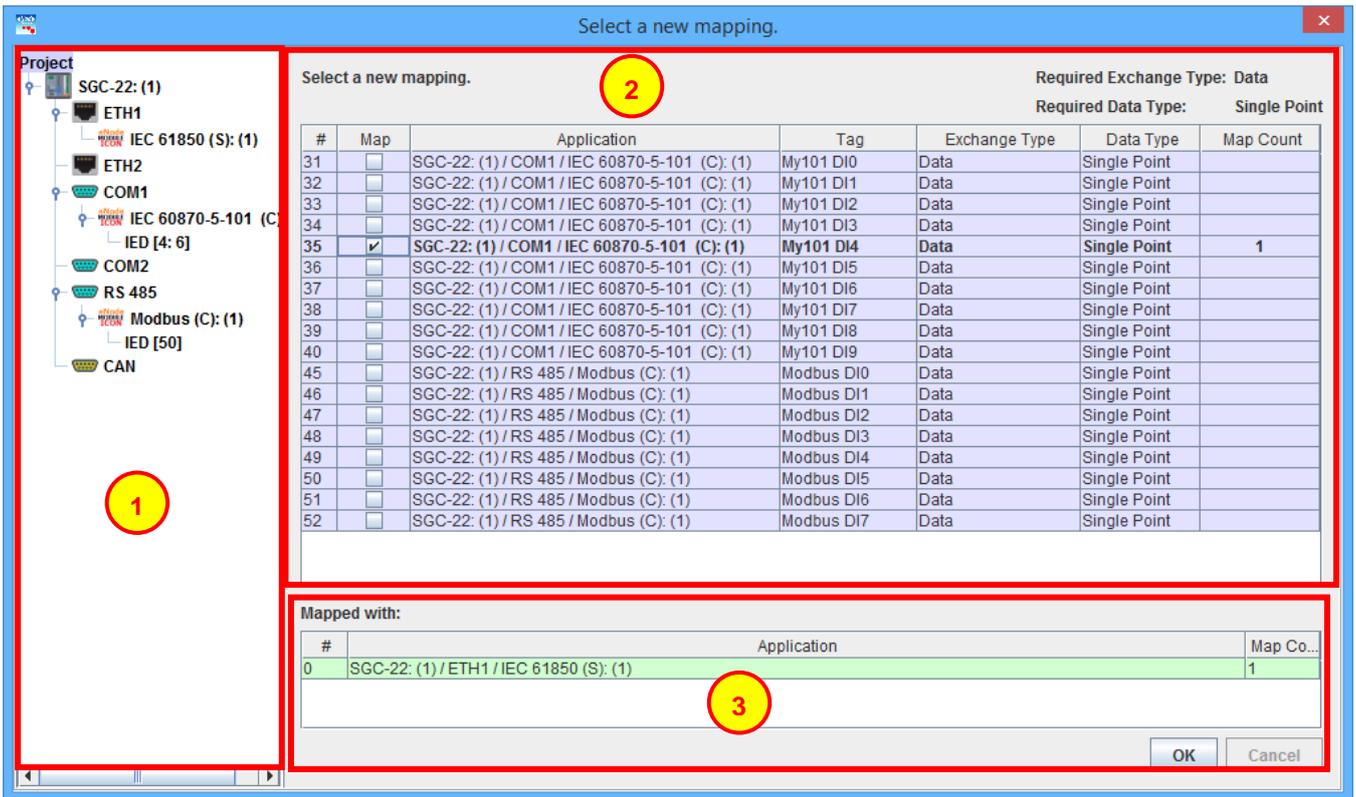


Figure 3-7 - Mapping a server point.

- 1 **Project Tree Windowpane** – This shows the eNode Designer project view. Use this to filter the list of available data points.
- 2 **Available Points** – This shows the list of possible points which can map to the given point.
- 3 **Mapped Points** – Shows the applications the selected point in (2) is currently mapped to.

Once points have been mapped they are added to the table.

SCL File: C:\Test\TestServer.cid

Local IED GOOSE subscription

Select data points to map from eNode

- IED: SimpleServerOne
 - LD Logical Device: LDevice1
 - LN Logical Node: LLN0
 - LN Logical Node: LPHD0
 - LN Logical Node: BoolGGIO0
 - DO DO: Beh
 - DO DO: SPCS01
 - DA DA: Oper
 - DA BDA: ctIVal Single Point [SBOW / ctIVal, Cancel /
 - DA DA: stVal Single Point [q, t]
 - DA DA: ctIModel Unsigned 8
 - DO DO: Alm1
 - LN Logical Node: BoolGGIO1

Selected data points. eNode → 61850

Tag	Description	Data Type	Exchange Type
My101 DI4	My101 DI4	Single Point	Data

Figure 3-8 - Point has been mapped.

3.4.2 IEC 61850 Server - Altering Existing Mappings

The eNode Module only allows a data point to be mapped to *one* server DA. So if a client point is already mapped to another DA in this server, it will be shown in grey and be unmappable. To map it to the other point, it must first be unmapped from its original location.

3.4.3 IEC 61850 Server - GOOSE Subscription

This tab works the same as the client tab except the **only points displayed are those available on GOOSE**. That is, only points in a data set which are in a GOOSE control group are shown. In addition, all GOOSE information comes through as “Data”. This means that commands cannot be handled server to server.

Clicking the GOOSE subscription tab in the Server view will show the following view. The project tree has been expanded and some data points selected for this example.

Tag	Description	Data Type	Exchange Type
SimpleServerTwo\$LDdevice1\$BoolGGIO0\$SPCSO1\$Oper\$ctlVal	SimpleServerTw...	Single Point	Data
SimpleServerTwo\$LDdevice1\$BoolGGIO0\$SPCSO1\$stVal	SimpleServerTw...	Single Point	Data
SimpleServerTwo\$LDdevice1\$BatteryZBAT0\$Vol\$mag\$f	SimpleServerTw...	Float 32	Data
SimpleServerTwo\$LDdevice1\$BatteryZBAT0\$Vol\$units\$SIUnit	SimpleServerTw...	Unsigned 8	Data
SimpleServerTwo\$LDdevice1\$BatteryZBAT1\$Vol\$mag\$f	SimpleServerTw...	Float 32	Data
SimpleServerTwo\$LDdevice1\$BatteryZBAT1\$Vol\$units\$SIUnit	SimpleServerTw...	Unsigned 8	Data
SimpleServerTwo\$LDdevice1\$SwitchXCBR0\$Pos\$Oper\$ctlVal	SimpleServerTw...	Single Point	Data
SimpleServerTwo\$LDdevice1\$SwitchXCBR0\$Pos\$stVal	SimpleServerTw...	Double Point	Data

Figure 3-9 – GOOSE subscription: data point selection.

- 1 **Project Tree Windowpane** – This shows the project tree of the GOOSE subscription IED in order to select data points. The entire IED’s data points are selected in this figure.
- 2 **Points Available For Mapping** – This shows the selected data points for mapping to eNode. The points shown in this location are currently available to other applications within eNode. Tags can be edited by double clicking them, or copied and pasted by right clicking.

4 Reference Guide

4.1 Mass Tree Expanding and Collapsing

There are several options for expanding and collapsing many tree nodes at once.

Right click a tree node:

<i>Expand All</i>	Expands all tree nodes inside the tree node.
<i>Collapse All</i>	Collapses the tree nodes inside it and the tree node itself.
<i>Collapse Below</i>	Collapses the tree nodes inside it

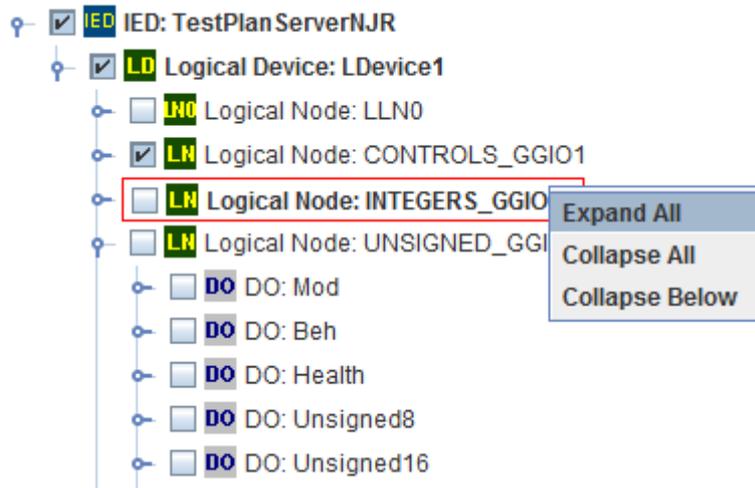


Figure 4-1 - SCL tree node context menu

Right click empty space in the SCL tree pane:

<i>Expand Entire Tree</i>	Expands the entire SCL tree. For very large files, it enforces a limit as a maximum number of nodes it will expand.
<i>Collapse Entire Tree</i>	Collapses the entire SCL tree.

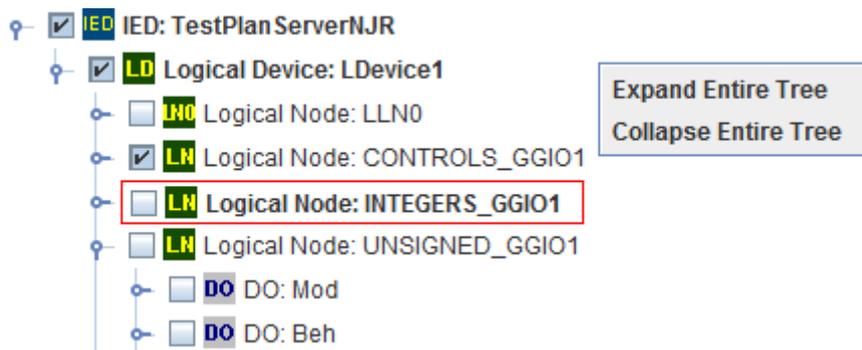


Figure 4-2 - SCL tree pane context menu

4.2 Table Buttons

At the bottom of the data point table, there are several buttons to modify and organise the table.

Selected data points. 61850 → eNode			
Tag	Description	Data Type	Exchange Type
SimpleServerOne\$LDevice1\$BoolGGIO0\$SPCSO1\$Oper\$ctlVal	SimpleServerOne...	Single Point	Command (Multi S...
SimpleServerOne\$LDevice1\$BoolGGIO0\$SPCSO1\$stVal	SimpleServerOne...	Single Point	Data
SimpleServerOne\$LDevice1\$BoolGGIO0\$SPCSO1\$ctlModel	SimpleServerOne...	Unsigned 8	Data
SimpleServerOne\$LDevice1\$BoolGGIO0\$Alm1\$stVal	SimpleServerOne...	Single Point	Data
SimpleServerOne\$LDevice1\$BatteryZBAT0\$Vol\$mag\$f	SimpleServerOne...	Float 32	Data
SimpleServerOne\$LDevice1\$BatteryZBAT0\$Vol\$units\$SIUnit	SimpleServerOne...	Unsigned 8	Data
SimpleServerOne\$LDevice1\$BatteryZBAT0\$Amp\$mag\$f	SimpleServerOne...	Float 32	Data
SimpleServerOne\$LDevice1\$BatteryZBAT1\$Vol\$mag\$f	SimpleServerOne...	Float 32	Data
SimpleServerOne\$LDevice1\$BatteryZBAT2\$Vol\$mag\$i	SimpleServerOne...	Integer 32	Data
SimpleServerThree\$LDevice1\$BoolGGIO0\$SPCSO1\$Oper\$ctlVal	SimpleServerThr...	Single Point	Command (Multi S...
SimpleServerThree\$LDevice1\$BoolGGIO0\$SPCSO1\$stVal	SimpleServerThr...	Single Point	Data
SimpleServerThree\$LDevice1\$BatteryZBAT0\$Vol\$mag\$f	SimpleServerThr...	Float 32	Data

Figure 4-3 - Table buttons.

Modify Selected Points Brings up a window to allow changing the Tag and Description of all the selected points at once. See section 4.3 for details.

Move Up Moves the selected rows one row upward.

Move Down Moves the selected rows one row downward.

Sort Sorts the table to be in the same order as it appears in the SCL tree.

4.3 Modify Selected Points Window

The tags and descriptions of multiple points can be changed at once using this window. The data type and exchange type are fixed, since they are taken from the SCL file.

Select the desired points, then left click "Modify Selected Points". Note that the selection does not have to contain contiguous rows – for example you can select row 1,3 and 10 (select row 1, hold the CTRL key on the keyboard, then click row 3 and row 10).

Selected data points. 61850 → eNode

Tag	Description	Data Type	Exchange Type
SimpleServerOne\$LDevice1\$BoolGGIO0\$SPCSO1\$Oper\$ctlVal	SimpleServerOne...	Single Point	Command (Multi S...
SimpleServerOne\$LDevice1\$BoolGGIO0\$SPCSO1\$stVal	SimpleServerOne...	Single Point	Data
SimpleServerOne\$LDevice1\$BoolGGIO0\$SPCSO1\$ctlModel	SimpleServerOne...	Unsigned 8	Data
SimpleServerOne\$LDevice1\$BoolGGIO0\$Alm1\$stVal	SimpleServerOne...	Single Point	Data
SimpleServerOne\$LDevice1\$BatteryZBAT0\$Vol\$mag\$f	SimpleServerOn...	Float 32	Data
SimpleServerOne\$LDevice1\$BatteryZBAT0\$Vol\$units\$SIUnit	SimpleServerOne...	Unsigned 8	Data
SimpleServerOne\$LDevice1\$BatteryZBAT0\$Amp\$mag\$f	SimpleServerOne...	Float 32	Data
SimpleServerOne\$LDevice1\$BatteryZBAT1\$Vol\$mag\$f	SimpleServerOn...	Float 32	Data
SimpleServerOne\$LDevice1\$BatteryZBAT2\$Vol\$mag\$si	SimpleServerOn...	Integer 32	Data
SimpleServerThree\$LDevice1\$BoolGGIO0\$SPCSO1\$Oper\$ctlVal	SimpleServerThr...	Single Point	Command (Multi S...
SimpleServerThree\$LDevice1\$BoolGGIO0\$SPCSO1\$stVal	SimpleServerThr...	Single Point	Data
SimpleServerThree\$LDevice1\$BatteryZBAT0\$Vol\$mag\$f	SimpleServerThr...	Float 32	Data

2
1

Modify Selected Points
Move Up
Move Down
Sort

Figure 4-4 - Opening the Modify Selected Points window.

- 1 Select Desired Points
- 2 Left click the **Modify Selected Points** Button

This will bring up the following window.

Modify Data Points ✕

Original:

Tag	Description	Data Type	Exchange Type
SimpleServerOne\$LDevice1\$BatteryZBAT0\$Vol\$mag\$f	SimpleServerOne\$LDevice1\$Batt...	Float 32	Data
SimpleServerOne\$LDevice1\$BatteryZBAT1\$Vol\$mag\$f	SimpleServerOne\$LDevice1\$Batt...	Float 32	Data
SimpleServerOne\$LDevice1\$BatteryZBAT2\$Vol\$mag\$si	SimpleServerOne\$LDevice1\$Batt...	Integer 32	Data

Preview:

Tag	Description	Data Type	Exchange Type
Battery Voltage 00	SimpleServerOne\$LDevice1\$Batt...	Float 32	Data
Battery Voltage 01	SimpleServerOne\$LDevice1\$Batt...	Float 32	Data
Battery Voltage 02	SimpleServerOne\$LDevice1\$Batt...	Integer 32	Data

New values:

Tag	Description	Data Type	Exchange Type
Battery Voltage [2X]	[N]	[N]	Data

You can use "[N]" as the original text of the cell.

You can use "[X]" as an auto increment counter. [Y] and [Z] work similarly. Use [3X] to produce values like "001".

Define counter [X]

Start At: Step by:

Define counter [Y]

Start At: Step by:

Define counter [Z]

Start At: Step by:

OK
Cancel

Figure 4-5 - Modify Selected Points window.

In this window, modify the contents in the (1) "New values" area to see the (2) "Preview" area update accordingly. You can use the counters [X], [Y] and [Z] to substitute auto-incrementing integer values. You can specify the initial values and step values using the "Start At" and "Step by" fields at the bottom of the window.