



Designing

The CGDS Designer allows you create a substation topology. The Cisco Connected Grid Design Suite (CGDS) application allows you to design the integrated substation LAN by analyzing configurations for the switches and intelligent electronic devices (IEDs). This enables you to visualize, design, and validate the LAN design before and after installing it in a substation.

You can create different network topologies such as star and ring topologies. A star topology consists of a central switch, which acts as a conduit to transmit messages. This consists of a central node to which all of the other nodes are connected; this central node provides a common connection point for all of the nodes through a hub. A ring topology is a network topology in which each node connects to exactly two other nodes, forming a single continuous pathway for signals through each node that forms a ring. The data travels from node to node, with each node along the way handling every packet.

The CGDS Designer supports the CISCO CGS2520 and RuggedCom RSG2200 switches, GOOSE and DNP IEDs. The supported functionalities for these switches and IEDs are as follows:

Table 4-1 **Supported Functionalities - Switches and IEDs**

Functionality	Switch	IED
Validate network	Both CISCO and RuggedCom	NA
Get IED connection	Only CISCO	Both GOOSE and DNP IEDs are connected to the CISCO switches
Get remote VLAN	Only CISCO switches display the VLAN ID and switch ports active to these VLAN ID	NA

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Designing the Substation Topology


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Creating a Model

To create a model, perform the following steps:

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- Step 1** Log in to the CGDS Designer.
- For more information on logging in to the CGDS Designer, see the [“Logging In” section on page 1-2 in Chapter 1, “Getting Started”](#). The home page appears.
- Step 2** Click the Cisco  icon, and click **New**.
- The Model dialog box appears.
- Step 3** Enter the following details:
- In the Name text box, enter the name of the model.
 - In the Description text box, enter an unique description.
 - From the Map drop-down list, choose the required criteria.
 - Click **Select Users**.
- The Select Users dialog box appears.
- Step 4** Select the users and click **OK**. The Creator and the Time fields are set by default.
- Step 5** Click **Create**.
- The model is created.
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Viewing an Existing Model



To view an existing model, perform the following steps:

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- Step 1** Log in to the CGDS Designer.
- For more information on logging in to the CGDS Designer, see the [“Logging In” section on page 1-2 in Chapter 1, “Getting Started”](#). The home page appears.
- Step 2** In the View Models pane, click one of the existing models to view it.
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Manually Designing the Substation Topology

To manually design the substation topology, perform the following steps:

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- Step 1** Log in to the CGDS Designer.
- For more information on logging in to the CGDS Designer, see the “[Logging In](#)” section on page 1-2 in [Chapter 1, “Getting Started](#)”. The home page appears.
- Step 2** Click the Cisco  icon and choose Network Design Wizard from the menu. The Network Design Wizard -- SCL File Setup dialog box appears.
- Step 3** Add a new SCL file. To add a new SCL file, perform the following steps:
- a. Click **Add new SCL file**.
The SCL Version Controller window appears. You can add, delete, and rename the version group.
 - b. Click **Add Group** to add a new group.
 - c. Click **Rename** to rename the version group.
 - d. Click **Delete** under the Version Group to delete the version group.
 - e. Click **Add Version** to create a new version of the SCL file and perform the following steps:
 1. In the SCL file text box, browse for and choose the SCL file that contains the details about the substation, IED (Intelligent Electronic Device), and so on.
 2. In the Description and Version Detail text box, enter the description and version details of the of the SCL file.
 3. Click **OK**. The Selected SCL file is imported into the CGDS Designer.
-  **Note** You must create different versions of the SCL file for different models. It is recommended to have one group for one SCL file. If you want to create new groups, you can add them.
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- f. (Optional) To find the difference between the versions of the SCL files, select the desired versions, and click **Difference**.
 - g. To delete the version, select the desired version and click **Delete**.
 - h. Click **Close** to close the SCL Version Controller window.
- Step 4** To select an existing SCL file, choose the desired group from the Group drop-down list and choose the version from the Version drop-down list.
- Step 5** Click **Next**. The Network Design Wizard -- Connection dialog box appears.
- Step 6** Choose the Auto generate connection radio button. Click **Next**. The Network Design Wizard -- Select Network Devices dialog box appears.
- Step 7** Click **Add**. To add the switch information, perform the following steps:
1. From the Voltage Level Type drop-down list, choose the desired voltage level.
 2. From the Vendor drop-down list, choose the desired vendor. The available options are Cisco and RuggedCom.
 3. From the Switch Type drop-down list, choose the desired switch type.
 - If you have chosen Cisco as the vendor, then the available options are CGS2520, CGS-1000-16TC, CGS-1000-8TC, and CGS-10004TC.

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- If you have chosen RuggedCom as the vendor, then the available option is RSG2200.
- 4. In the Name text box, enter the name of the switch.
- 5. From the Ports Connection drop-down list, choose the desired port connection.
- 6. Enter the relevant details in the following text boxes:
 - Description
 - Username
 - Password
 - IP Address
 - Subnet Mask
 - Gateway
- 7. (Optional) Click **Save As** to save the switch information. The information is stored in the XML format.
- 8. (Optional) To import the existing switch information, click **Load**. Browse for the XML file that contains the switch information.
- 9. Click **Add** to add the switch information.

Step 8 (Optional) For the star topology, choose one of the switches to be the main switch and click **Main Switch**.

Step 9 Click **Next**. The Network Design Wizard -- IED Association dialog box appears.

Step 10 From the IED Type drop-down list, choose the desired IED type. The available options are DNP, IEC61850, IEC60870.5-103, IEC60870.5-101.

Step 11 Click **Add** to add the IEDs. The IED Association dialog box appears.



Note You must enter the IP address of the switch for the DNP protocol and MAC address for the GOOSE protocol.

You can associate either a DNP or GOOSE IED. To associate the DNP IED, continue with [Step 12](#). To associate the GOOSE IED, continue with [Step 13](#).

Step 12 To associate the DNP IED, perform the following steps:

- a. From the IED Name drop-down list, choose the desired IED that is available in the SCL file.
- b. From the Switch drop-down list, choose the switch for which you want to associate the IED.
- c. From the Switch Port drop-down list, choose the desired switch port.
- d. From the Sub Network drop-down list, choose the sub network. The available option is SF-SubNectWork.
- e. In the VLAN ID text box, enter the VLAN ID.
- f. In the Subnet Mask text box, enter the subnet mask ID.
- g. In the Gateway text box, enter the gateway ID.
- h. Click **Add**. The IED association success message appears.
- i. Click **Close**.

Step 13 To associate the IEC61850 IED type, perform the following steps:


- a. From the IEDs drop-down list, choose the desired IED that is available in the SCL file.

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- b. From the IED port type drop-down list, choose the desired IED port type. The available options are RJ45 for electrical plug and ST for bajonet plug.
 - c. From the Sub Network drop-down list, choose the sub network. The available option is SF-SubNectWork.
 - d. From the Switch drop-down list, choose the switch for which you want to associate the IED.
 - e. From the Switch Port drop-down list, choose the desired switch port.
 - f. In the IED Port Description text box, enter a short description for the IED port.
 - g. Select the desired binding access point from the Bind Access Point check boxes.
 - h. From the Communication Interface drop-down list, choose the desired type of the interface.
 - i. Click **Add**. The IED association success message appears.
 - j. Click **Close**.
- Step 14** Click **Next**. The Network Design Wizard - - VLAN Information wizard dialog box appears.
- Step 15** Click **Next**. The Network Design Wizard - - Summary dialog box appears displaying the information about the SCL file, connection topology file, network device, and switch details.
- Step 16** Click **Finish**. The network topology is created.
-

Designing the Topology using a Template


To design the network topology using a template, perform the following steps:

- Step 1** Log in to the CGDS Designer.
- For more information on logging in to the CGDS Designer, see the [“Logging In” section on page 1-2 in Chapter 1, “Getting Started”](#). The home page appears.
- Step 2** Click the Cisco  icon and choose Network Design Wizard from the menu.
- The Network Design Wizard -- SCL File Setup dialog box appears.
- Step 3** Add a new SCL file. To add a new SCL file, perform [Step 3](#) of the [“Manually Designing the Substation Topology” section on page 4-3](#).
- Step 4** To select an existing SCL file, choose the desired group from the Group drop-down list, and choose the version from the Version drop-down list.
- Step 5** Click **Next**. The Network Design Wizard -- Connection dialog box appears.
- Step 6** Select the Use a connection template radio button. The existing template is loaded with the switch details.
- Step 7** You can choose to edit the switch details. Perform [Step 7](#) through [Step 16](#) in [Manually Designing the Substation Topology, page 4-3](#).
-

Designing the Topology using the Autodiscovery Result

To design the network using the autodiscovery result, perform the following steps:

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- Step 1** Log in to the CGDS Designer.
For more information on logging in to the CGDS Designer, see the “Logging In” section on page 1-2 in Chapter 1, “Getting Started”. The home page appears.
- Step 2** Click the Cisco  icon and choose Network Design Wizard from the menu.
The Network Design Wizard -- SCL File Setup dialog box appears.
- Step 3** Add a new SCL file. To add a new SCL file, perform Step 3 of the “Manually Designing the Substation Topology” section on page 4-3.
- Step 4** To select an existing SCL file, choose the desired group from the Group drop-down list, and choose the version from the Version drop-down list.
- Step 5** Click **Next**. The Network Design Wizard -- Connection dialog box appears.
- Step 6** Select the Import the AutoDiscovery Result radio button and browse for the autodiscovery result file. Click **Next**. The Network Design Wizard -- Select Network Devices dialog box appears.



Note When creating the network topology using the autodiscovery result, you cannot add or modify the switch and IED information.

-
- Step 7** Click **Next**. The Network Design Wizard -- IED Association dialog box appears.
- Step 8** Click **Next**. The Network Design Wizard -- VLAN Information dialog box appears.
- Step 9** Click **Next**. The Network Design Wizard -- Summary dialog box appears.
- Step 10** Click **Finish**. The network topology is created.
-

Binding an SCL Version to a Model

To bind the SCL version to a model, perform the following steps:

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- Step 1** Log in to the CGDS Designer.
For more information on logging in to the CGDS Designer, see the “Logging In” section on page 1-2 in Chapter 1, “Getting Started”. The home page appears.
- Step 2** Choose **Others > Bind**.
The Version Bind dialog box appears.
The Version Bind area displays the following details about the versions that are binded in the CGDS:
- Step 3** In the Bind Information area, perform the following steps:
- From the Group drop-down list, choose the group criteria.
 - From the Bind Version drop-down list, choose the version criteria.
 - Select the Always bind last version check box, if you want to bind the last version.
- Step 4** In the Version Information area, enter the following details:
- Version
 - Time
 - Description

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- Detail

Step 5 Click **Bind**.

Finding Differences between the SCL Files

To determine the differences between the SCL files, perform the following steps:

Step 1 Log in to the CGDS Designer.

For more information on logging in to the CGDS Designer, see the “[Logging In](#)” section on page 1-2 in [Chapter 1, “Getting Started](#)”. The home page appears.

Step 2 Choose **Others > File Diff**.

The SCL Version Difference dialog box appears.

Step 3 In the SCL File1 and SCL File2 text boxes, browse for and select the files for which you want to find the difference.

Step 4 Click **Difference**.

The differences between the two files are summarized in the SCL File difference table.

Generating an Auto Bay View

An auto bay view displays a pictorial view of grouping IEDs with different subnets under different voltage levels.

To generate an auto bay view, perform the following steps:

Step 1 Log in to the CGDS Designer.

For more information on logging in to the CGDS Designer, see the “[Logging In](#)” section on page 1-2 in [Chapter 1, “Getting Started](#)”. The home page appears.

Step 2 Choose **View > AutoBay**.

A confirmation dialog box appears.

Step 3 Click **OK**.

You can view the generated auto bay view.

Validating the Network Details

After designing the substation topology in the CGDS Designer, you must validate the IED connections, switch connections, and VLAN information.

- [Validating the Network Details, page 4-7](#)
- [Obtaining the IED Connection, page 4-8](#)

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- [Obtaining the VLAN Information, page 4-9](#)
- [Validating the SCL File, page 4-9](#)

Validating the Network

You must ensure that all of the switches are reachable in the network. A switch may be unreachable due to one of the following reasons:

- The IP address is not reachable.
- The login name or password for the switch is incorrect.
- There is a network issue.

To validate the network, perform the following steps:

-
- Step 1** Log in to the CGDS Designer.
- For more information on logging in to the CGDS Designer, see the [“Logging In” section on page 1-2 in Chapter 1, “Getting Started”](#). The home page appears.
- Step 2** In the My Models pane, click the model for which you want to validate the network.
- The selected model is loaded.
- Step 3** Click **Validate Network**. The log files display the information about whether the switch is valid or not reachable.
-

Obtaining the IED Connection

You must ensure that all of the IEDs are connected and securely communicating with each other. An IED that is physically connected to a switch appears with an IED media access control (MAC) address, whereas an IED that is logically connected appears with the unknown value.

The IED connection status appears as connected if the IED is securely connected, whereas the status appears as not connected if the IED is not connected. The IED may not be connected due to the following reasons:

- The IED is connected to an unreachable switch.
- The IED is connected to more than one switch due to which there is a configuration error.

This feature is used to validate the connection status of all of the IEDs with the switch in the substation topology.

To obtain the IED connection, perform the following steps:

-
- Step 1** Log in to the CGDS Designer.
- For more information on logging in to the CGDS Designer, see the [“Logging In” section on page 1-2 in Chapter 1, “Getting Started”](#). The home page appears.
- Step 2** In the My Models pane, click the model for which you want to obtain the IED connection.
- The selected model is loaded.
- Step 3** Click **Get IED Connection**.

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The Get IED Connection dialog box appears with the following detailed information about the IEDs:

- IED Name—Name of the IED.
 - IED Port No—Port number of the IED.
 - Mac Address/IP Address—MAC address or IP address of the IED. If the MAC address exists, it indicates that the IED is connected to the switch.
-

Obtaining the VLAN Information

The virtual local area network (VLAN) addresses and active ports are connected to the VLAN ID. To obtain the VLAN information, perform the following steps:

-
- Step 1** Log in to the CGDS Designer.
- For more information on logging in to the CGDS Designer, see the “[Logging In](#)” section on page 1-2 in [Chapter 1, “Getting Started](#)”. The home page appears.
- Step 2** In the My Models pane, click the model for which you want to obtain the VLAN information.
- The selected model is loaded.
- Step 3** Click **Get Remote VLAN**. This displays all of the available VLANs and the associated switches and the port details.
-

Validating the SCL File

The Validate SCL File command examines the syntax, tags, and the duplicate information that is present in the SCL file.

To obtain the VLAN information, perform the following steps:

-
- Step 1** Log in to the CGDS Designer.
- For more information on logging in to the CGDS Designer, see the “[Logging In](#)” section on page 1-2 in [Chapter 1, “Getting Started](#)”. The home page appears.
- Step 2** In the My Models pane, click the model for which you want to validate the SCL file.
- The selected model is loaded.
- Step 3** Click **Validate SCL**.
- The SCL file is validated. If there any errors in the file, then it is displayed.
-

Exporting the Substation Topology Details

- [Exporting a Network Configuration, page 4-10](#)
- [Exporting the Substation Topology, page 4-10](#)

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- [Exporting the IED Topology, page 4-10](#)
- [Exporting the Signal Matrix, page 4-11](#)

Exporting a Network Configuration

After the network engineer completes the designing and validation process, the existing topology can be exported and shared with other users, even for the users who are not in the same facility.


Exporting creates an XML version of the physical network topology and logical network topology, which can be imported into the Monitoring & Analysis configuration.

To export the network configuration in the XML format, perform the following steps:

-
- Step 1** Log in to the CGDS Designer.
- For more information on logging in to the CGDS Designer, see the [“Logging In” section on page 1-2 in Chapter 1, “Getting Started”](#). The home page appears.
- Step 2** Click the Cisco  icon. Choose **Export > Export Network Configuration** from the menu.
- Step 3** The Save As screen appears. Enter the file name and browse for the location where you would like to save the file.
- Step 4** Click **Save**. The file is saved in the XML format.
-


Exporting the Substation Topology

To export the substation topology, perform the following steps:

-
- Step 1** Log in to the CGDS Designer.
- For more information on logging in to the CGDS Designer, see the [“Logging In” section on page 1-2 in Chapter 1, “Getting Started”](#).
- Step 2** Click the Cisco  icon. Choose **Export > Export Substation Topology** from the menu.
- Step 3** The Save As screen appears. Enter the file name and browse for the location where you want to save the file.
- Step 4** Click **Save**. The file is saved in the XML format.
-

Exporting the IED Topology

To export the IED topology, perform the following steps:


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- Step 1** Log in to the CGDS Designer.
- For more information on logging in to the CGDS Designer, see the [“Logging In” section on page 1-2 in Chapter 1, “Getting Started”](#). The home page appears.
- Step 2** Click the Cisco  icon and choose **Export > Export IED Topology** from the menu.

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- Step 3** The Save As screen appears. Enter the file name and browse for the location where you want to save the file.
 - Step 4** Click **Save**. The file is saved in the XML format.
-

Exporting the Signal Matrix

To export the signal matrix, perform the following steps:

- Step 1** Log in to the CGDS Designer.
For more information on logging in to the CGDS Designer, see the [“Logging In” section on page 1-2 in Chapter 1, “Getting Started”](#). The home page appears.
 - Step 2** Click the Cisco  icon and choose **Export > Export Signal Matrix** from the menu.
 - Step 3** The Save As screen appears. Enter the file name and browse for the location where you want to save the file.
 - Step 4** Click **Save**. The file is saved in the XML format.
-

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