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Cisco Connected Grid Design Suite (CGDS) - Substation Workbench Installation and Configuration Guide

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Preface

This preface describes the purpose, audience, organization, and conventions used in the *Cisco Connected Grid Design Suite (CGDS) - Substation Workbench Installation and Configuration Guide*. It also provides information on the related documentation.

Audience

This guide is for experienced system administrators who install and configure the Cisco Connected Grid Design Suite (CGDS) application in an Electrical Substation. This document contains instructions for installing and configuring the Cisco Connected Grid Design Suite - Substation Workbench product on servers and client computers.

The skill set and information required for the installation of the CGDS Designer and CGDS Monitor are specified as prerequisites in the respective chapters.

Organization

Chapter Number	Chapter Title	Description
Chapter 1	Getting Started	Provides an overview of the Cisco Connected Grid Design Suite (CGDS) application.
Chapter 2	Installing and Configuring the CGDS Monitor	Provides information on how to install and configure the CGDS Monitor.
Chapter 3	Installing and Configuring the CGDS Designer	Provides information on how to install and configure the CGDS Designer.

Document Conventions

Convention	Indication
bold font	Commands and keywords and user-entered text appear in **bold** font.
italic font	Document titles, new or emphasized terms, and arguments for which you supply values are in *italic* font.
[ ]	Elements in square brackets are optional.
{x | y | z }	Required alternative keywords are grouped in braces and separated by vertical bars.
[x | y | z]	Optional alternative keywords are grouped in brackets and separated by vertical bars.
string	A nonquoted set of characters. Do not use quotation marks around the string or the string will include the quotation marks.
`courier` font	Terminal sessions and information the system displays appear in `courier` font.
Bold courier font	Information you enter appears in bold courier font.
Italic courier font	Variables for which you must supply a value are shown in italic courier font.
Option > Option	Used to describe a series of menu options.
< >	Nonprinting characters such as passwords are in angle brackets.
[ ]	Default responses to system prompts are in square brackets.
!, #	An exclamation point (!) or a pound sign (#) at the beginning of a line of code indicates a comment line.

Note Means *reader take note*. Notes contain helpful suggestions or references to material not covered in the manual.

Caution Means *reader be careful*. In this situation, you might perform an action that could result in equipment damage or loss of data.

Related Documentation

- *Cisco Connected Grid Design Suite (CGDS) - Substation Workbench Release 1.5 Release Notes*
- *Cisco Connected Grid Design Suite (CGDS) - Substation Workbench Quick Start Guide*
- *Cisco Connected Grid Design Suite (CGDS) - Substation Workbench Designer User Guide*
- *Cisco Connected Grid Design Suite (CGDS) - Substation Workbench Monitor User Guide*
- *Cisco Connected Grid Design Suite (CGDS) - Substation Workbench Troubleshooting Guide*

Obtaining Documentation and Submitting a Service Request

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Getting Started

About the Cisco Connected Grid Design Suite

The Cisco Connected Grid Design Suite (CGDS) supports electrical and operational engineers as they design, configure, and monitor distributed communications networks that are capable of enabling next-generation use cases today. The CGDS helps utilities to both implement new, automated substations, and maintain and retrofit existing substations.

The CGDS provides the CGDS Substation Workbench that allows substation engineers to dynamically develop, model, and test the substation local area network (LAN) both before and after installation. It provides real-time visualization and monitoring of the integrated substation LAN from Intelligent Electronic Devices (IEDs) and switches to authorized and unauthorized IP-enabled devices.

The CGDS offers two installers to install the following CGDS components:

- CGDS Monitor—Run an ISO image on a bare UCS or Advantech box base RHEL 5.8 OS to install the CGDS Monitor. For more information, see the Chapter 2, “Installing and Configuring the CGDS Monitor”.
- CGDS Designer —The InstallAnywhere installer installs the CGDS Designer on a Windows 7 based system. For more information, see the Chapter 3, “Installing and Configuring the CGDS Designer”.

Collecting Required Information

You will need the following information during installation:

For the CGDS Monitor

- An IP address for the CGDS server and Monitoring layer respectively, and the following details:
  - Netmask
  - Gateway IP address
  - One or more name server IP addresses (DNS)
- Ensure that the CGDS server is connected to the SPAN/RSPAN/ERSPAN switch ports to monitor the network traffic.

- Must be aware of the network traffic redirection configuration in switch for redirecting all of the traffic in the substation to the CGDS Monitor.

For the CGDS Designer

- The Oracle database must be installed.
- Must have the following information:
  - Oracle Instance IP address.
  - Credentials to access the Oracle database and permissions to create and access the tables.
  - SID and port number of Oracle.
- The IP address of the CGDS Monitor to validate the substation configuration.
- Web Services Management Agent (WSMA) service must be installed on the CGDS server.

Verifying the Network Configurations

Verify the following network configurations:

- All of the machines are configured to be on the same locale.
- The system time is synchoronized on all of the machines.

Installing and Configuring the CGDS Monitor

This chapter provides instructions on how to install and configure the CGDS Monitor on a server platform that is validated or certified by Cisco.

About the Server and CGDS Monitor

The CGDS application is tested and validated to work on either of the following servers:

- UCS C220 Non-Hardened Substation Server
- Advantech UNO-4683 Hardened Substation Server

The construction of the hardened server is optimized for harsh operating environments that are likely to exist within an electrical substation. The server is certified to be both IEEE 1613 and IEC 61850 compliant.

Run an ISO image taken from the CGDS CD on a bare UCS or Advantech box to configure the server for the CGDS Substation Workbench and install the CGDS Monitor.

The key features of the CGDS Monitor include:

- Discovery of switches and routers (including non-Cisco devices) and IEDs using the DNP, GOOSE, and SNMP protocols.
- Performance monitoring includes traffic Analysis and latency.
- Generic Object Oriented Substation Events (GOOSE) event analysis for the IED messages.
- Events and alarms.

The Substation Workbench provides the ability to monitor the GOOSE capture, performance monitoring, and sending alerts to the CGDS Monitor when abnormalities occur.

Installing and Configuring the CGDS Monitor

Install the CGDS Monitor on the UCS C220 M3 server from the CGDS Linux CD.

Verifying the Installation Media

The hash code is used to validate the CGDS CD. The hash code is published with the CD. Verify whether the actual hash code matches with the hash code in the CD by entering the following command in the boot prompt:

```
linux mediacheck
```

If the hash code does not match, contact the Cisco representative for replacing the CD.

Prerequisites

Gather the information as specified in the "Collecting Required Information" section on page 1-1 before you start your installation.

The prerequisites for installing the CGDS Monitor are as follows:

1. Ensure that a virtual drive is created. For more information on how to create a virtual drive, see the "Creating a Virtual Drive" section on page 2-2.
2. Ensure that a copy of the CGDS ISO image is taken from the CGDS CD to the local machine.
3. Ensure that the Cisco Integrated Management Controller (CIMC) is upgraded to the latest version.

Creating a Virtual Drive

To create a virtual drive, perform the following steps:

Step 1 If the hard drive is a SATA, it is directly connected to the BIOS and can be configured using the booting menu.

Step 2 If the hard drive is a SAS, it needs to be configured through RAID.

To configure the hard drive through RAID, do the following:

a. Create an array.
b. Create a disk.
c. Select the disk as a bootable device.
d. Activate the disk.

Installing the CGDS Monitor

To install the CGDS Monitor, perform the following steps:

Step 1 Log in to the CIMC.

Step 2 Insert the CGDS CD in your computer.

Step 3 Change the boot order to boot the system from the CDROM.

To change the boot order, do the following:

a. In the Server pane, click **BIOS**.
b. In the Actions area, click **Configure Boot Order**.
c. Click **OK**.
d. The Configure Boot Order page appears.
e. Click **CDROM**.
f. Click **Up**.
g. Click **Apply**.

Step 4 In the Actions area, click the **Launch KVM Console** link.

Step 5 In the KVM Console, click **Virtual Media**.

The Initializing connection dialog box appears.

Step 6 Click **Cancel**.

Step 7 Click **Add Image**.

Step 8 Navigate to the location where you have saved the copy of the CGDS ISO image on your local machine, and select the ISO image.

Step 9 Select the **Mapped** check box.

The ISO image is loaded on to the virtual media.

Step 10 From the Macros menu, choose **Ctrl-Alt-Del**.

The system restarts and boots from the CGDS installation CD.

Step 11 In the boot prompt, enter **Install** and press **Enter**.

The installation process is started. The KVM tab displays the progress of the installation process. Once the installation is done, the system automatically reboots.

Step 12 When rebooting, in the CIMC, change the boot order to boot the system from the HDD.

To change the boot order, do the following:

a. In the Server pane, click **BIOS**.
b. In the Actions area, click **Configure Boot Order**.
c. Click **OK**.
d. The Configure Boot Order page appears.
e. Click **HDD**.
f. Click **Up**.
g. Click **Apply**.

Once the installation is done, the system prompts to enter the CGDS credentials.

Step 13 Enter the CGDS credentials that are provided with the ISO image.

The system prompts you to change the default password.

Step 14 Enter the current password.

```
Enter current password:
```

Step 15 Enter the new password and re-enter the password in the appropriate prompts.

```
Enter new password:
Re-type new password:
```

The Main menu appears.

Step 16 Enter one of the following alphabets and press **Enter** to choose a menu option for configuration:

- a—System Settings
- b—System Accounts
- c—Services Control
- d—Troubleshooting
- e—CGDS Administration
- X—Exit

Step 17 Enter X and press **Enter** to exit the Main menu.

Configuring the Network in the CGDS Server

To configure the network or application after installation, perform the following steps:

Step 1 Log in to the CIMC.

Step 2 In the Actions area, click the **Launch KVM Console** link.

The KVM Console appears.

Step 3 Enter the user name and password in the following prompts:

```
cgds login:
Password:
```

The Main menu appears with the following menu options:

  - a—System Settings
  - b—System Accounts
  - c—Services Control
  - d—Troubleshooting
  - e—CGDS Administration
  - X—Exit

Step 4 Enter **e** and press **Enter**.

The CGDS Administration page appears with the following menu options:

  - a—Configure Bridge Network

- b—Show Bridge
- c—Install NAM
- d—NAM Console
- e—Show VMs
- R or < or ,—Return to prior menu

Step 5 Enter **a** and press **Enter**.

The content of the ifcfg-bridge0 file is displayed.

Step 6 Enter the following details:

- IPADDR=<*IP_address*>
- NETMASK=<*Netmask*>
- GATEWAY=<*Gateway_address*>
- DELAY=<*Delay*>

Step 7 Enter **:wq** and press **Enter** to save the file.

The system displays the following message after saving the file:

```
Press any key to return to the main menu.
```

When you press any key, the system displays the CGDS Administration menu.

Step 8 Enter **R** or **<** or **,** and press **Enter** to return to the prior menu.

The main menu appears.

After configuring the network address, restart the system by executing Step 9 through Step 13.

Step 9 Enter **c** and press **Enter**.

Step 10 The Service Control page appears with the following menu options:

- a—Networking
- R or < or ,—Return to prior menu

Step 11 Enter **a** and press **Enter**.

Step 12 The Networking page appears with the following menu options:

- a—Restart Networking
- R or < or ,—Return to prior menu

Step 13 Enter **a** and press **Enter** to restart the system.

Once the system is restarted, the system displays the following message:

```
Press any key to return to the main menu.
```

The set network configuration is applied to the system.

Step 14 In the main menu, enter **e** and press **Enter**.

The CGDS Administration page appears with the following menu options:

- a—Configure Bridge Network
- b—Show Bridge
- c—Install NAM
- d—NAM Console

- e—Show VMs
- R or < or ,—Return to prior menu

Step 15 Enter **d** and press **Enter**.

The NAM console appears.

Step 16 To set the IP address for the NAM console, enter the following commands:

```
#ip address <ip_address> <subnet_mask>
#ip gateway <gateway_address>
#ip http server enable
```

The system prompts you to enter the NAM credentials.

Step 17 Enter the username as **admin** and the password as **ciscocisco**.

Note If the credentials of the NAM are changed, update the credentials in the discovery.config file that is available in the webwsma_2.war file.

Step 18 Enter **Exit** and press **Enter**.

The system logs out of the NAM console.

Step 19 Press **Ctrl+]**.

The system displays the following message:

```
Press any key to return to the main menu.
```

When you press any key, the system displays the main menu.

Configuring the Property File

You can configure the property file in one of the following situations:

- During a fresh installation of the CGDS.
- Whenever the CGDS server IP address or the NAM IP address is updated.
- After applying patches to the CGDS.

The prerequisites for configuring the property file are as follows:

1. Ensure that the network configuration is completed in the CGDS server. For more information on the network configuration, see the "Configuring the Network in the CGDS Server" section on page 2-4.
2. Ensure that the following details are updated in the config.sh file:
   - The IP address of the NAM console.
   - The port number of the Tomcat server.

To configure the property file, perform the following steps:

Step 1 Log in to the Putty tool.

Step 2 Navigate to the config.sh file that is located in the following path:

/opt/cisco/cgds/bin

Step 3 Run the following command:

```
./config.sh
```

Step 4 Navigate to the ssl.conf file that is located in the following path:

/etc/httpd/conf.d

Step 5 Replace the port numbers from 8085 to 8080.

Step 6 Restart the httpd service.

Step 7 Stop the Tomcat service.

Step 8 Navigate to the following path:

/opt/cisco/apache/tomcat/webapps/CGDS/WEB-INF/classes

Step 9 Open the Config.properties file in edit mode.

Step 10 Update the lines as follows:

- iepLoginService = http://{CGDS_SERVER_IP}:8283/services/iep/logout—Replace this line with the following line:**iepLogoutService = http://{CGDS_SERVER_IP}:8283/services/iep/logout**
- identityService = https://{CGDS_SERVER_IP}:9449/carbon/userstore/index.jsp?region=region1&item=userstores_menu

Step 11 Start the Tomcat service.

Step 12 Untar the CGDS.war file, and copy the axis2.xml file from CGDSWAR_Exploded locations/esb to /opt/cisco/wso2/wso2esb/repository/conf/axis2/.

Step 13 Open the carbon.xml file that is located in the /opt/cisco/wso2/wso2esb/repository/conf/ path in edit mode.

Step 14 Update the lines as follows:

- <!--HostName>www.wso2.org</HostName-->—Replace this line with the following line: **<HostName>CGDS_SERVER_IP</HostName>**
- <ServerURL>local:/${carbon.context}/services/</ServerURL>—Comment the line as follows: **<!--<ServerURL>local:/${carbon.context}/services/</ServerURL-->**
- <!--<ServerURL>https://${carbon.local.ip}:${carbon.management.port}${carbon.context}/services/</ServerURL> -->—Replace this line with the following line: **<ServerURL>https://CGDS_SERVER_IP:${carbon.management.port}${carbon.context}/services/</ServerURL>**

Step 15 Open the carbon.xml file that is located in the /opt/cisco/wso2/wso2is/repository/conf/ path in edit mode

- <HostName>localhost</HostName>—Replace this line with the following line: **<HostName> CGDS_SERVER_IP </HostName>**
- <ServerURL>local:/${carbon.context}/services/</ServerURL>—Comment the line as follows: **<!--<ServerURL>local:/${carbon.context}/services/</ServerURL -->**
- <!--<ServerURL>https://${carbon.local.ip}:${carbon.management.port}${carbon.context}/services/</ServerURL> -->—Replace this line with the following line: **<ServerURL>https://CGDS_SERVER_IP:${carbon.management.port}${carbon.context}/services/</ServerURL>**

Step 16 Restart the wso2esb and wso2is services.

The properties that are required for the CGDS server are configured.

Accessing the CGDS Monitor

Once the installation is complete, you can use the CGDS Monitor to perform network analysis on the substation data.

You can access the CGDS Monitor from any system in the substation network. The URL format to access the CGDS Monitor is as follows:

https://<*CGDS_Server_IP_Address*>/CGDS

Installing and Configuring the CGDS Designer

This chapter provides instructions on how to install the CGDS Designer.

About the CGDS Designer

The CGDS Designer enables utilities to create a standard deployment plan, design, and simulate the network for detailed reviews; calibrate and debug it during construction and testing; and efficiently test and monitor each system upon activation. It also supports the seamless sharing of design files among multiple engineering teams. With complete information about the energy delivery network configurations and the IEC 61850 protection schemas, the tool automates much of the communications network design process.

The engineers access the CGDS Designer to create models for substation designs that utilize original or imported common information models (CIMs) and IEC 61850 IED substation configuration language (SCL) files. The tool visually demonstrates the exact relationship between substation electrical equipment and IP-based network devices enabling a more reliable design process.

Prerequisites

- Oracle 11g server.
- Gather the information as specified in the "Collecting Required Information" section on page 1-1 before you start your installation.

Installing the CGDS Designer

The InstallAnywhere installer is used to install the CGDS Designer on a Windows 7 based system.

To install the CGDS Designer, perform the following steps:

Step 1 Insert the CGDS CD in to the computer.

Tip You will need to have the following information available before you start the installation process - the CGDS server IP address, and a valid user name and password.

Step 2 Copy the installer executable file from the CGDS CD to the local machine.

Step 3 Double click the installer executable file.

The InstallAnywhere installer begins the installation of the CGDS.

Step 4 Click **Next**.

The CGDS License page appears.

Step 5 Select the **I accept the terms of the License Agreement** radio button.

Step 6 Click **Next**.

The default destination folder for the CGDS Designer installation appears.

Step 7 (Optional) Choose a destination folder for the installation.

Step 8 Click **Next**.

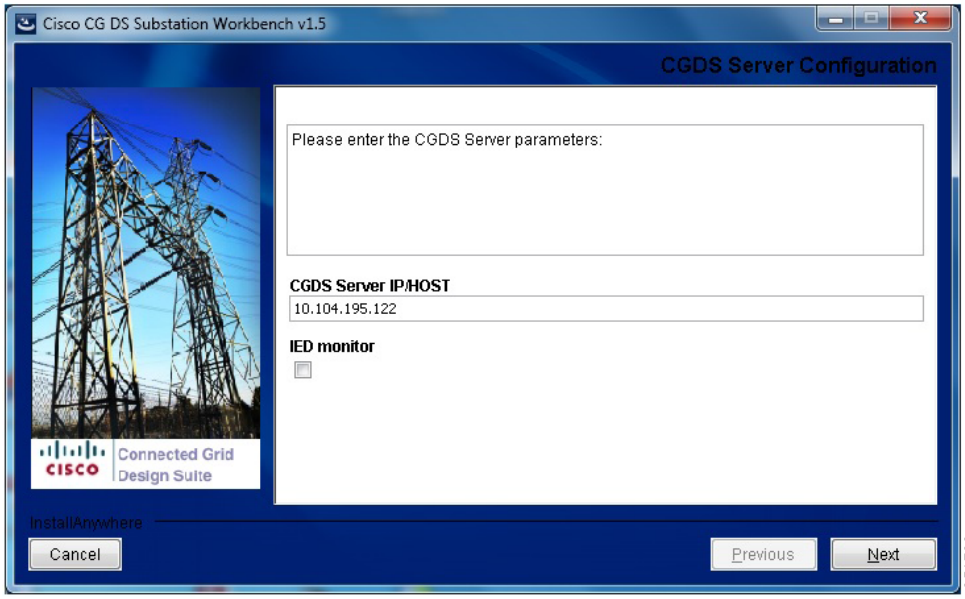
The Pre-Installation Summary page appears with the following details:

- Product name
- Installation folder path
- Shortcut folder path
- Available and required disk space for installation

Step 9 Click **Install** to launch the installation of JRE, the CGDS Designer Client package, and the other required software.

Once the installation begins, the progress is displayed on the installation page.When the installation is completed, the CGDS Server Configuration page appears.

Figure 3-1 CGDS Designer — CGDS Server Configuration Page



Step 10 Enter the CDGS server IP address in the CGDS Server IP/HOST text box.

Note You can leave the IED monitor check box unselected.

The CGDS Designer is installed on a client computer that connects to the CGDS Server using Ethernet. This requires an IP address, which is configured using the CGDS Server Configuration page. Even if the client exists within the server (for instance, by running on a virtual machine), it is still necessary to provide an IP address.

In addition to client-to-server communications, the CGDS Designer communicates with network devices using the Web Services Management Agent (WSMA). WSMA is a function of the Cisco IOS through which network devices can be fully managed. WSMA operates in both listener mode (connections are initiated by external applications.) and initiator mode (WSMA initiates the connections).

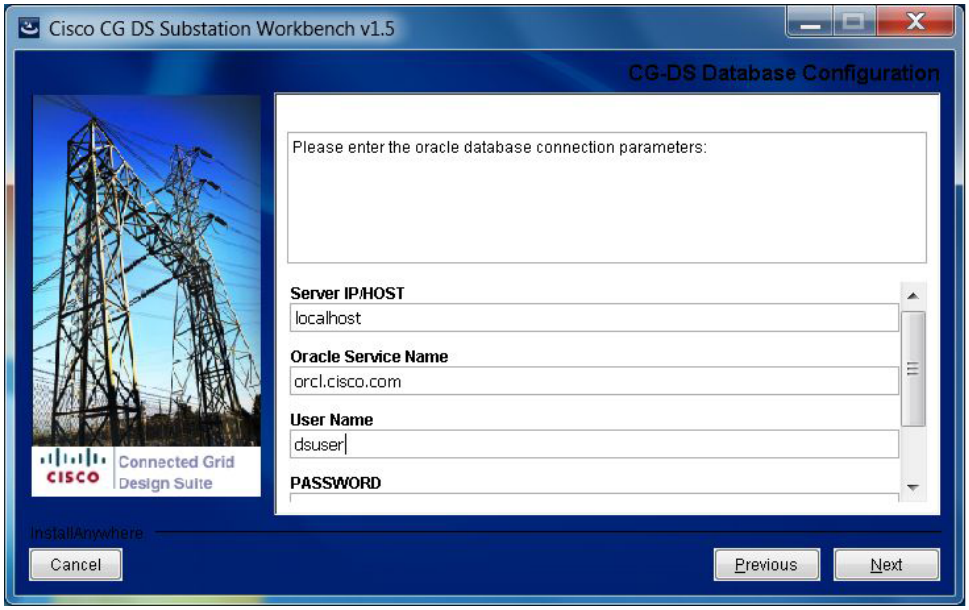
WSMA performs the following functions:

- Supports HTTP, HTTPS, Secure Shell Version 2 (SSHv2), and TLS transports.
- Provides an XML-encoded model for configuration and operational data.
- Publishes schemas for the web services.
- Avoids screen scraping.
- Allows faster NMS application development.
- Provides faster response times compared to traditional telnet-based access mechanisms. WSMA also requires IP addresses.

Step 11 Click **Next**.

The CGDS Database Configuration page appears.

Figure 3-2 CGDS Designer — CGDS Database Configuration Page



Step 12 Enter the following Oracle database connection parameters:

- Server IP address or host name

- Oracle service name
- Credentials to access the Oracle database.
- Port number of the Oracle database.

Step 13 Click **Next**.

The installer removes the backup files.

Once the installation is completed, the Install Complete screen appears.

Step 14 Select the **Yes, restart my system** radio button.

Step 15 Click **Done**.

The system restarts and completes the installation of the CGDS Designer.

Updating the Server, WSMA, and Database Details

If you have provided incorrect details for the CGDS Monitor server, WSMA, or the Oracle database in the installer, you can update these details after the installation.

1. To update the CGDS Monitor server and WSMA details, open the CG-DS.exe file with the notepad. Navigate to the client tag and update the WSMA details.
2. To update the Monitor server details, navigate to the appSettings tag and update the details, such as the IP address, user name, and password.
3. To update the database details, open the LocalConfig.xml file with the notepad and update the database details, such as the hostname, port, user name, and password. You can control the monitoring function and IED monitor function by setting one of the following values in the MonitorFuncs and IEDMonitor tags:

– 0—To disable the monitoring function.

– 1—To enable the monitoring function.

Note Ensure that the CGDS Designer is closed when you are updating the server, WSMA, and database details.