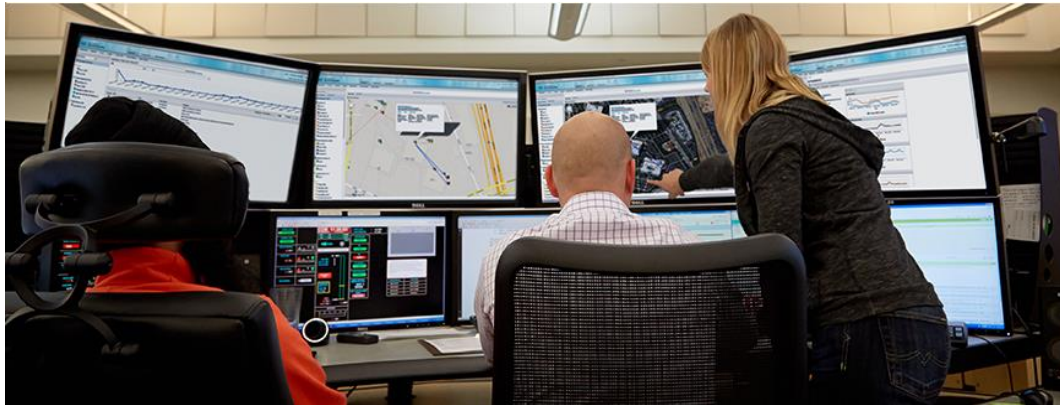# Connected Grid Design Suite (CGDS) – Substation Workbench, Release 1.0

The Cisco Connected Grid Design Suite (CGDS) is a portfolio of software modules, hardware appliances, and services developed to support operational engineers throughout the grid modernization lifecycle. The first software module released within the suite is the Substation Workbench. The Substation Workbench provides a single pane-of-glass visualization capability for protection and telecommunications networks, and enables vendor-agnostic substation configuration via standards-based templates. Using the Substation Workbench, engineers are able to design, deploy, and monitor distributed automated substation communications networks supporting next generation grid applications.

Americas Headquarters

Cisco Systems, Inc.

170 West Tasman Drive

San Jose, CA 95134-1706

USA

http://www.cisco.com

Tel: 408 526-4000

         800 553-NETS (6387)

Fax: 408 527-0883

Revised April 8, 2013
Text Part Number: 78-21159-01

Introduction

The Cisco Connected Grid Design Suite (CGDS) – Substation Workbench helps utilities to design and implement new automated substations and monitor or retrofit existing facilities.

The Substation Workbench enables:

- Proven budget and time savings during design, deployment, and operations
- Maintained or improved reliability, security, and regulatory compliance
- Faster project execution
- Quick and efficient configuration and visualization of telecom equipment in support of T&D grid applications

The following data about performance improvements are derived from a study by the accounting firm Ernst & Young:

Process Phase	Substation Level of Complexity					
	Low Complexity		Medium Complexity		High Complexity	
	Current Process Time	Time Savings with CGDS	Current Process Time	Time Savings with CGDS	Current Process Time	Time Savings with CGDS
Design Communication Network	4 weeks	25%	12 weeks	30%	24 weeks	50%
Configure Communication Network	1-2 weeks 1 person	90%	4 weeks 1 person	90%	8-12 weeks 1 person	90%
Construct & Test Communication Network	1 week 1 person	50%	3-4 weeks 1 person	70%	8 weeks 1 person	70%
Commission Communication Network	2 weeks 1 person	50%	3-4 weeks 1 person	70%	8 weeks 2 people	70%
Operate & Maintain (Diagnose Communication Issues Inside Substation)	15 minutes 1 person	50%	30 minutes 1 person	50%	1 hour 1 person	50%
Operate & Maintain (6-month service check)	2 hours 1 person	50%	1 day 1 person	70%	3 days 1-2 people	80%

With a focus on the intra-substation local area network (LAN), the Substation Workbench enables vendor-agnostic substation configuration via standards-based configuration templates. Engineers gain real-time visualization and monitoring of integrated LAN devices such as Intelligent Electronic Devices (IEDs), routers, and switches. This visualization includes elements of the operations and telecommunications network superimposed into a familiar one-line diagram format.

Engineers can dynamically develop, model, and test the LAN both before and after installation. Once a utility has created an optimized substation model, it can be efficiently and effectively deployed across a service territory. This allows utilities to monitor system performance and identify abnormalities enabling greater system reliability and security.

Product Configurations

The Substation Workbench Release 1.0 is available in two configurations shown in the table below:

Table 1.   CGDS Substation Workbench Release 1.0 Available Configurations

Configuration	Capabilities	Optimized for:
Substation Workbench (Engineering & Design configuration)	• Design and Modeling • Visualization • Configuration Assistance • Simulation and Testing	• Utility engineering teams • Cisco, its partners, and system integrators working with utilities on grid modernization projects.
Substation Workbench (Monitoring configuration)	• Discovery • Visualization • Configuration Assistance • Simulation and Testing • Monitoring	• Utilities having an integrated substation model that are interested in monitoring the actual versus the intended configuration, network latencies in support of grid applications, and more. • Utilities interested in having Cisco and its partners develop the integrated substation model as part of a services engagement.

Benefits

Some of the benefits of the Substation Workbench Release 1.0 include:

- Superior visualization of energy, protection, and communications networks based on easy access to information, helping engineers to make smarter decisions

- Streamlined network design processes based on the solutions' recommendations for the telecommunications network and security design

- Improved bottom-line based on the Substation Workbench's easy-to-use, standards-based approach; speeding up automation deployment, reducing the utility risk profile, and cutting costs

Table 2.   Functions and Capabilites

Process Phase	Function	Capability
Designing the energy network	• Upload or create CIM energy network layout	• Visualize and select equipment for energy network, resulting in schematic "one-line diagram" • Dynamically design network within software • Simulate CIM model changes
Designing the protection scheme	• Upload or create IEC 61850 based protection scheme layout	• Define protection layout design on top of CIM power network • Define business rules, controls, and device specifications to detect and react to abnormal conditions
Designing the communications network	• Create communications design model based on uploaded or created CIM energy and IEC 61850 protection scheme design • Simulate a network design model	• Define protection layout design on top of CIM power network • Define business rules, controls, and device specifications to detect and react to abnormal conditions

Constructing and detecting the communications network	• Auto-detect IP devices within minutes	• Construct substation according to plan and design models and specifications • Create multiple design reports • Track changes to configuration of communications network • Test field equipment, protective relay, and communications network according to manufacturer's specifications and within controlled environment
Commissioning the communications network	• Support the validation process by capturing test results	• Create multiple design reports • Track changes to configuration of IEDs and communications network devices • Identify gaps between design and actual communication configuration • Validate that equipment is installed and connected correctly and has proper ratings • Assure that devices are properly calibrated • Assure that the overall system will perform as designed • Capture test results and design modifications • Create a baseline for the substation • GOOSE/MMS recording and analysis

Features

Table 3.   Features

Features	Description
Rapid and Accurate Communications Network Design	• Users can create models for substation designs that utilize original or imported common information models (CIMs) and IEC 61850 IED substation configuration language (SCL) files. • CGDS - Substation Workbench visually demonstrates the exact relationships between substation electrical equipment and IP-based network devices enabling a more reliable design process.
Automated Discovery of IP-Enabled Devices	• Engineers may leverage auto-discovery of IP-enabled devices within the substation (routers, switches, IEDs, laptops, etc.) to visualize the relationship between the energy delivery network, its protection scheme, and the telecommunications network inside each substation. • These are rendered as a familiar one-line diagram, overlaid by the communications network. • The Substation Workbench tracks the series of changes to the network configuration and identifies gaps between the design and the actual configuration. • The Substation Workbench communicates with and stores information from routers, switches, and IEDs in a decentralized repository within the substation as well as a centralized data repository housed in the control center.
Modeling to Create Standardized Implementations	• As routers, switches, and other systems are built into the design, the Substation Workbench identifies security requirements as part of the dynamic modeling process. • This supports a secure, standardized deployment plan that reduces complexity and speeds implementation of multiple substations creating significant savings for large-scale implementations.
Optimize Substation Commissioning and Operations Monitoring	• The Substation Workbench can simulate and test the substation communications network in real time. • Provides information and notification of other events available to the Operations Edition, reducing the need for travel to remote locations for engineers. • The Workbench features complete logs to support real-time monitoring and audit trail in accordance with the utility's physical and logical security access model. • Workbench network capture engine provides critical GOOSE/MMS message recording and protocol analysis as well as critical network path latency statistics to help identify system problems and alerts of any network performance degradation.

Standards and Protocols Supported

The CGDS Substation Workbench Release 1.0 was developed to accommodate the needs of utilities as they exist today and helps them to easily adapt for the future. As such, the product accommodates current industry standards and is compliant with the following future-looking standards:

- IEC 61850
- IPv6
- IEEE 1613

Figure 1. Key Capabilities Viewed by Process Phase

Product Specifications

Hardware Requirements (Server)

The CGDS Substation Workbench Release 1.0 server software resides on one of two types of approved servers. Other hardware may be substituted if it is validated by Cisco (see Service Offerings section below).

The specifications of the approved servers follow:

Table 4.   Server Hardware/Software Requirements

Attribute	Cisco Connected Grid Appliance 220NH (Cisco UCS C220 M3 SFF Rack Server, Non-hardened substation appliance)	Advantech UNO 4863 (Hardened substation server appliance)
Memory	4GB	4GB
Processor	One or two Intel® Intel® Xeon® E5-2600 series processor family CPUs / Intel® C600 series chipset	Intel Core i7 2.0 GHz processor
Disk Size	At least 300 GB	At least 300 GB
Operating System / Hypervisor /bus width	Red Hat Enterprise 6.3 / KVM / 64-bit	Red Hat Enterprise 6.3 / KVM / 64-bit
Environmental Certifications	Has not been tested/certified for – • IEEE 1613 • IEC 61850	Has been tested/certified for - • IEEE 1613 • IEC 61850-3
Network Ports / USB	• 1 Gigabit Ethernet management port, and dual 1 Gigabit Ethernet ports • 3 x USB 2.0 (1 x internal), used for external DVD during installation	• 2 x 10/100/1000Base-T (supports teaming function) and 4 x 10/100Base-T • 6 x USB 2.0 (1 x internal), used for external DVD during installation
Product URL	http://www.cisco.com/en/US/products/ps12369/index.html	http://www.advantech.com/products/UNO-4683/mod_C563A97C-44A3-4BD5-979A-7F98C061D6E2.aspx

Hardware Requirements (Client computer)

The Substation Workbench Release 1.0 client software resides on a laptop or desktop computer and communicates with the server application over a network connection. Specifications for an acceptable client computer follow:

Table 5.   Client Hardware/Software Requirements

Attribute	Client Computer
Memory	At least 2 GB
Processor	2 GHz or greater
Disk Size	At least 100 MB available for CGDS - Substation Workbench Release 1.0, and associated components
Operating System / Other requirements	• Windows 7 • Microsoft .NET Framework 4

Detailed instructions for installing the Substation Workbench Release 1.0 Server and Client software are available in the Substation Workbench Release 1.0 Installation Guide (78-21154-01).

Service Offerings

Cisco and our partners have experts ready to help utilities plan, design, and implement the CGDS Substation Workbench solution, as well as train utilities on its use. Customers can select any combination of these services, ensuring that customers can select the precise level of interaction that will meet their needs and help make their implementation a success.

Customer Requirements Definition

The Customer Requirements Definition phase includes a review of key technology and standards based on interviews to gather and document requirements, including policy, functional, technical, security, and compliance. Surveys are used to document the current operational network and substation communication architectures including a review of the existing network documentation. This phase results in functional specifications and a detailed work plan.

Solution Design & Implementation

In the Solution Design & Implementation phase, Cisco or our partners use the customer requirements to create an architecture including CGDS that will scale to meet future needs. The design is thoroughly reviewed prior to completion and release. Following formal sign-off, the required materials are obtained and a pilot project launched. All attributes of integrating CGDS into the customer environment are documented and archived.

Substation Model Design & Testing

In the Substation Model Design & Testing phase, Cisco helps create and test a substation model based on the latest IEC standards, taking into account specific grid application requirements. The resulting model considers customer specific current substation designs and modeling technology and helps to identify any gaps between IEC standards and current customer practices. Following development of the model, Cisco develops the metadata that describes the model and confirms that the network visualization performs properly and aligns with customer expectations.

Knowledge Transfer

Once the Substation Workbench is deployed, the model is built, and system testing is completed, Cisco or Cisco partners work with the utility to provide user documentation and training so that the utility can maintain and operate the solution.

Platform Validation Services

The Substation Workbench has been certified on the aforementioned server platforms. Utilities may also want to explore deployment of the Substation Workbench software on existing hardware. If a utility customer has previously invested in a substation compute platform, Cisco will work with the utility to test and certify their existing platform for use with the CGDS solution.

For More Information

For more information about Cisco Connected Grid and the Connected Grid Design Suite, please contact your Cisco Connected Grid Services account representative or visit the Smart Grid website:
http://www.cisco.com/web/strategy/energy/substation_automation.html