

Cisco Enables Automated Design and Development for the Substation



In today's global energy industry, utilities increasingly require cost-effective, time-efficient rollout of communications networks into the substation. With investment growing in remote monitoring and management of substations, engineers require new tools to help them rapidly implement this new capability.

Cisco® Services has developed a Connected Grid Visualization and Design Tool designed to help electrical and operational engineers more quickly design, model, and test the distributed communications network. Available as part of a Cisco Services engagement, the tool enables utilities to both implement new automated substations and maintain and retrofit existing facilities.

The Challenge of Automating Substation Communications

In large-scale automation implementation projects, it can be difficult for engineers to visualize the communications network in relation to the automated substation and to assure that intelligent electronic devices (IEDs) are connected to the right networks and with each other. As a result, implementations might become extremely complex, leading to higher costs and time-consuming deployments. Engineers also struggle with lack of information-sharing between IT, operations, and protection teams, with many processes still being almost entirely paper-based.

The Cisco Connected Grid Visualization Tool

Cisco addressed these challenges by developing a visual design software capability specifically for utility substation and telecommunications engineers. The Connected Grid Visualization and Design Tool supports multiple levels of the automation architecture, providing an interface that allows engineers to dynamically design, model, and test the local area network (LAN) both before and after deployment. This enables utilities to create a standard deployment plan, debug installations, and efficiently test and monitor each system upon activation. With complete information about the energy delivery network configurations and the 61850 protection schema, the tool can significantly automate much of the design of the communications network.

Rapid, Accurate Communications Network Design

Using this standards-based, user-friendly tool, engineers easily create models for substation designs that utilize original or imported common information models (CIMs) and IEC 61850 IED substation configuration language (SCL) files. Based on this information, the tool visually demonstrates the exact relationships between substation electrical equipment and IP-based network devices, enabling a faster communications design process.

Powerful Auto-Discovery Capability

This further allows engineers to take advantage of auto-discovery of IEDs, which allows them to visualize the relationship between the energy delivery network and its protection schema inside each substation, rendering them as an easy-to-use, one-line diagram overlaid by the communications network. The tool is also able to track series of changes to the network configuration; identify gaps between the design and the actual configuration; and communicate with and store information from routers, switches, and IEDs in a central data repository.

Modeling to Create Standardized Implementations

As routers, switches, and other systems are built into the design, the Connected Grid Visualization and Design Tool identifies security requirements that are then imposed 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 Commission and Operations

After the substation solution is activated, the tool can also be used to test and simulate the communications network in real time, reducing repeated travel to remote locations. It also features complete logs to support real-time monitoring and audit trail and follows the utility's physical and logical security access model.

This stand-alone tool may reside on the substation host processor, in a control center, or in a design lab for predeployment simulation. The interface may also be utilized in a field-portable version.

Connected Grid Visualization Tool: Benefits

Critical productivity gains can be achieved by utilizing the Cisco design visualization tool in the development process for both new and retrofitted substations, ranging from 50 to 70 percent through the various process phases. The tool also provides utilities with the ability to:

- Visualize the communications network in the context of the completed CIM energy delivery network design and IEC 61850 protection schema design
- Lay out and simulate the communications network as part of the design phase and calibrate the communications network during construction and testing
- Seamlessly share design files among multiple engineering teams
- Monitor the network on site once the substation is energized
- Maintain a record and audit trail of changes and produce communications network test reports

Table 1. Capabilities

Process Phase	Function	Capability
Design energy network	<ul style="list-style-type: none"> • Upload/create CIM energy network layout 	<ul style="list-style-type: none"> • Visualize and select equipment for energy network, resulting in schematic “one-line diagram” • Dynamically design network within software • Simulate CIM model changes
Design protection schema	<ul style="list-style-type: none"> • Upload/create IEC 61850 protective scheme layout 	<ul style="list-style-type: none"> • Define protection layout design on top of CIM power network • Define business rules, controls, and device specifications to detect and react to abnormal conditions
Design communications network	<ul style="list-style-type: none"> • Create communications design model based on uploaded/created CIM energy and IEC 61850 protective scheme design • Simulate network design model 	<ul style="list-style-type: none"> • Define protection layout design on top of CIM power network • Define business rules, controls, and device specifications to detect and react to abnormal conditions
Construct and detect communications network	<ul style="list-style-type: none"> • Auto-detect IP devices within minutes 	<ul style="list-style-type: none"> • Construct substation according to plan and design models and specifications • Create multiple design printouts • Track changes to configuration of communications network • Test field equipment, protective relay, and communications network according to manufacturer’s specifications and within controlled environment
Commission communications network	<ul style="list-style-type: none"> • Support validation process by capturing test results and so on 	<ul style="list-style-type: none"> • Create multiple design printouts • Track changes to configuration of communications network • Identify gaps between design and actual communication configuration • Validate that equipment is assembled and connected correctly and has proper ratings • Assure that devices are properly calibrated • Assure that overall system will perform as designed • Capture test results and any design modifications • Create baseline for substation

Cisco Services for Substation Architecture Designs

The Connected Grid Visualization and Design Tool is available as part of a services engagement that supports the Cisco Lifecycle approach for utilities, which defines the requisite activities at each phase of the utility lifecycle to help ensure a continuous high standard of performance. Offerings include defining requirements, developing forward-looking architectures and tools, coordinating the deployment and integration of solutions, and delivering ongoing optimization and managed capabilities. The tool is utilized as part of the service by both Cisco and utility engineers as defined in the service contract.

Why Cisco?

Cisco IP-based substation architectures are a primary component of the communication network that connects transmission and distribution substations to headquarters and the data center. Cisco Services provides a team of experts and partners focused on helping utilities to plan, build, and run these grid architectures. Our teams work closely with utility operations teams to design a robust network of substation systems that enable detailed monitoring, management, and visibility into critical equipment both today and into the future.

For More Information

For more information about Cisco Services and the Connected Grid Visualization and Design Tool, contact your Cisco Connected Grid Services account representative.



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