

Cisco Services for Transmission and Distribution Substation Networks



Today's electric utilities face the demands of a rapidly transforming industry, with increasing regulatory compliance requirements, demands for network security, renewable resource integration initiatives, and grid operations transparency. Identified as critical national infrastructure by most nations, companies are under pressure to assure 24x7 reliability, security, and availability of the power grid. To meet these needs, utilities are turning to smart grid architectures enabled by a communications network that extends from headquarters to transmission and distribution substations. This comprehensive architecture provides the situational awareness needed to control, automate, and integrate grid assets and systems.

The Challenges of Traditional Substation Design

Traditionally, substation communications operate based on a patchwork of limited local area networks (LANs) pieced together over several years. Today, however, the substation network must support a much more comprehensive set of services, including remote engineering and vendor access, larger numbers of onsite applications, and more stringent cyber and physical security in compliance with regulations such as the U.S. NERC CIP standard. At the same time, the substation network also needs to encompass functionality and scalability to meet industry best practices and recommendations, such as industry standards such as NIST interoperability and IEEE P2030. Operators therefore need to focus on:

- Establishing a comprehensive wide area network (WAN), control center, and substation network strategy to simplify, standardize, and consolidate existing network systems
- Adoption of an architecture designed to address cybersecurity concerns
- Connecting the substation's mix of IP-enabled and legacy network devices such as intelligent electronic devices (IEDs), relays, and synchrophasors, based on the DNP3, serial, 61850, C37.118, and IP protocols
- Achieving optimal response times, reliability, and scalability for future expansion

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The Cisco GridBlocks™ architecture provides a reference design for the communication network that connects transmission and distribution substations to headquarters and the data center. This network enables a series of automated services that allow



utilities to monitor IEDs, gather sensor readings, manage assets, and provision devices and software for operational and nonoperational SCADA, synchrophasors, teleprotection, and physical security.

Cisco Connected Grid Services teams work closely with utility operations teams to design and support robust substation network systems that enable detailed monitoring, management, and visibility to critical equipment. Cisco Service offerings include:

Business Priorities Assessment and Use Case Development

Working with utility leadership and management, Cisco experts conduct a detailed analysis of business priorities and objectives and examine the development and assessment of options to address these needs. Objectives are then mapped to current and future use cases, and these use cases are further developed. The team identifies business architectural options that can implement the use cases and establishes an operational and management framework. Finally, the team provides a qualitative financial and ROI analysis to determine the architecture that best helps to cut costs and promote new sources of revenue.

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Current Network Architecture Assessment and Gap Analysis

With a focus on delivering greater security control, efficiency, and savings, Cisco assesses the readiness of the utility to transition the substation network. The Cisco Services team evaluates the functional strengths of existing networks to accelerate architectural planning and design. It also examines critical readiness factors such as infrastructure design, environmental issues, and security, making recommendations to proactively resolve gaps.

Architecture and Design

Cisco Services teams review the current state of each substation network and areas for improvement to align the utility to the needs of its business, unify network-based services, and ascertain the most effective architecture for the organization. Networks being transitioned can be assessed based on a number of models, including:

- Multiservice IP core
- Multiservice with Multiprotocol Label Switching (MPLS)
- MPLS networks with regionalized model
- WAN core (IP) nodes options for all three models

The characteristics of each model are assessed to meet the needs of the operator, including:

- Network stability
- Required level of availability
- Capital and operating expenses
- Design and configuration simplicity
- Determinism
- Operational simplicity

- Unicast/multicast failover convergence
- Agility for new services

Implementation

For the substation network architecture to work effectively, it needs to be implemented without compromising availability or performance. Cisco works with utilities directly to transparently transition systems within the substation, assuring little disruption to the business, energy service, or customers. When the entire energy chain is automated, grid reliability and responsiveness improve, and operating costs are lowered.

Optimization

Cisco Services support the utility over time to evolve the substation to help the company expand, meet new security challenges, and evolve to meet new demands such as the addition of renewable resources to the grid. Cisco works with the utility to initiate and maintain operational documentation, engage in ongoing knowledge transfer, and conduct design reviews to make sure that the architecture keeps pace with changing requirements.

Benefits

Cisco Connected Grid Services deliver clear and immediate benefits to the utility, enabling better visibility across the grid, greater reliability, and significant cost savings. Our open standards-based infrastructures enable a more scalable and secure substation network design. Benefits include:

- Reliable communications using interoperable devices on a common network
- Remote monitoring of station equipment and sensors for better visibility in the station

- Improved load balancing based on more accurate information on grid assets
- Reduced service disruption due to proactive equipment maintenance
- Lower operational costs, reduced lease line charges, and improved worker productivity
- Demonstrated compliance with NERC CIP and other regulatory requirements
- Improved incident response, better worker safety, and stronger loss prevention

Why Cisco?

Cisco brings more than 30 years of industry networking experience to each utility project. The Cisco Connected Grid Services team has the experience, expertise, and portfolio of technology solutions to improve how the energy industry serves its customers and manages its day-to-day business. By uniting disparate networks through the substation, Cisco enables utilities to manage assets more efficiently and secure information across the grid, optimizing business functions, and simplifying grid operations for the future.