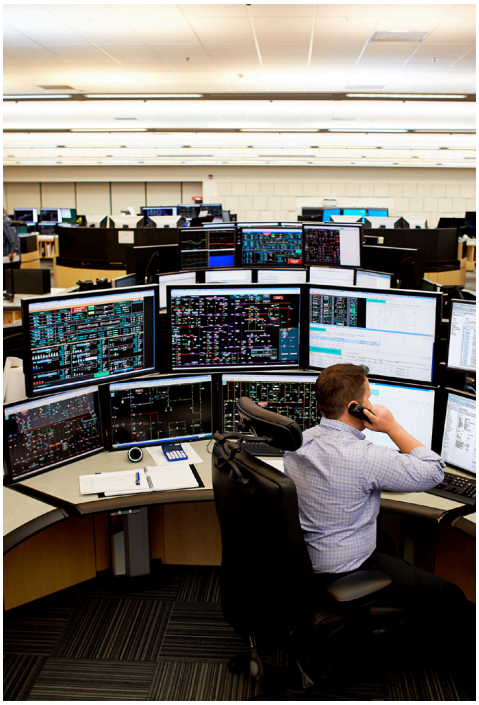


"SCANA is continually modernizing our systems and our grid for increased reliability and to better protect against cyber threats. We look to our technology partners, such as Cisco, for digital technology to help comply with those regulations, stay safe, and effectively enable operational technology."

Randy Senn
CIO at SCANA

Substation Communication Network

Moving From Legacy substation protocols to IEC-61850

In order to integrate substation protection, control, measurement and monitoring applications into one common protocol, a new communication protocol has been developed and standardized as IEC 61850 – Communication Networks and Systems in Substations. IEDs and associated applications communicate with each other and have different requirements on the underlying network.

In this paper we explain why Cisco Industrial Ethernet switches are suitable for the utility environment and different applications, and how we use cisco IE switches and related technologies to build an Ethernet based network to provide highly reliable and scalable connectivity for substation.

Robust Industrial Design for Substation Compliance

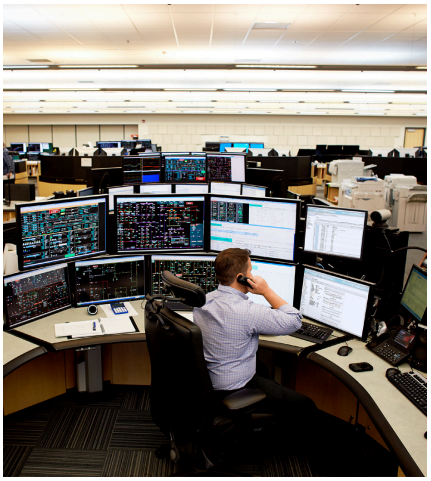
Cisco's full range of product IE switches, including IE 5000, IE 4000, IE 2000U, are rugged hardware design compliant with IEEE 1613 and IEC 61850-3 substation standards. These are fan-less (no moving parts), convection cooled switches, built for extended durability and ensures error-free operation in a wide temperature range and high Electromagnetic Interference (EMI) environments.

High Availability and Redundancy in LAN

High availability is a critical requirement for utility networks that transport mission-critical data. As shown in figure-1, Cisco IE switches running in ring topology and tree topology provide redundancy for higher network availability, by implementing industrial-leading rapid convergence Cisco Resilient Ethernet Protocol (REP), zero-convergence Parallel Redundancy Protocol (PRP/IEC 62439-3), High Available Seamless Ring (HSR), IEEE 802.1w Rapid Spanning Tree Protocol (RSTP) and per-VLAN Rapid Spanning Tree Plus (PVRST).

IEEE 1588 Precision Time Synchronization

Precision timing is required for IEDs performing fault recording, sequence of events recording and any application that require data to be accurately time-stamped within substation. Precision Time Protocol (IEEE 1588 v2) is deployed on all IE switches in the diagram shown in figure-1 to meet the time synchronization requirement in utility substation.



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Mission Critical Applications in Substation

Communication plays a critical role in real-time operations of a power system. Different applications have different requirement on the underlying network performance, such as low-latency, low loss probability. For example, Generic Object Oriented Substation Event (GOOSE) embeds data into Ethernet data packets and use Publisher-Subscriber mechanism to send time sensitive and critical communications. The feature-rich QoS on Cisco IE switches helps classify and prioritize this mission critical traffic.

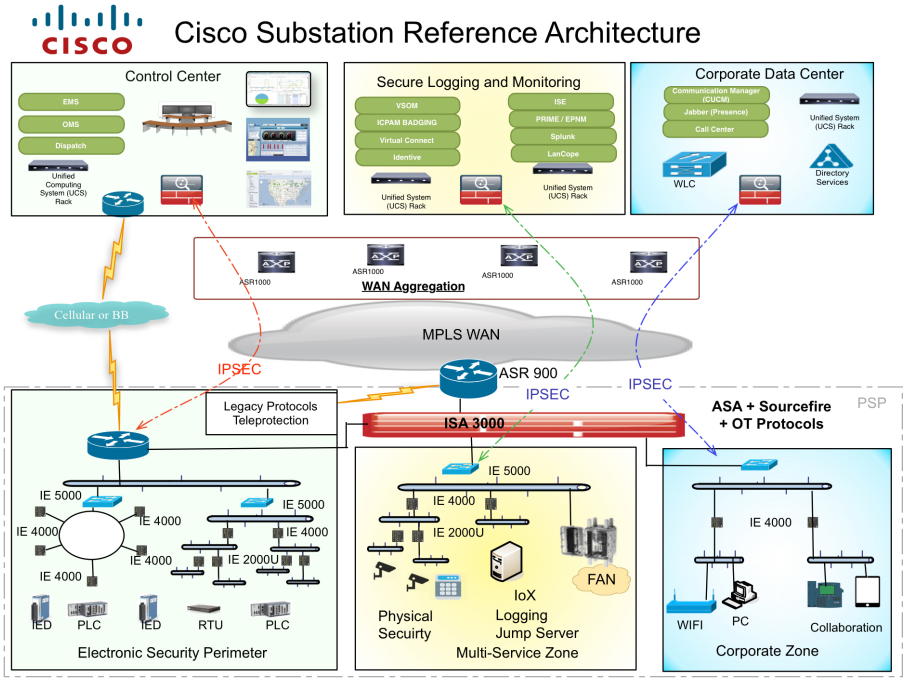

Figure 1. Substation LAN Solution

Next Steps

To learn more about the Cisco Substation LAN Solution, contact your local Cisco representative, email us at ask-utility-experts@cisco.com, or visit www.cisco.com/go/smartgrid.