



GE VERNOVA

INTEGRATED SUBSTATION CONTROL SYSTEM (iSCS)

IEC® 61850-based Substation
Automation Solutions



Grid Solutions

The Business Case

The next generation substation control and automation systems will be linked to the rapid globalization of customer markets and the need to provide class-leading performance, at the lowest total cost of ownership, while also providing both communications network integration and data security.

iSCS (Integrated Substation Control System)

This new business paradigm is based around the implementation of the IEC61850 technologies as the defacto standard for future generations of substation automation systems, including interfacing to primary plant and equipment. An IEC 61850 implementation can eliminate much of the substation copper wiring, replacing it with digital communications—and helping to reduce associated capital and operating costs.

Customers are using the engineering tools encompassing SCL and data modeling promoted by IEC 61850 as a means to drive down system engineering, design, configuration and installation/commissioning costs—and to enable open, competitive and non-proprietary solutions. Further, device-functional convergence and integration is creating opportunities for the elimination of redundant equipment, thereby reducing the number of interfaces leading to potential improvements in system reliability.

Total life cycle cost reduction demands system conception and the design of each element for integration, installation and operation/maintenance from the outset. This includes effective and efficient configuration tools and testing systems.

Network operators/owners are seeing more opportunities for monitoring and management of substation asset data as part of their overall asset management and optimization strategies. Where implemented, new training regimes are leading to a significant reduction in user costs.

iSCS (Integrated Substation Control System)

iSCS is a modular and scalable solution, enabling the specific targeting of the main customer market segments from a single portfolio:

- Transmission utilities
- Distribution utilities and major private networks
- Industrial network applications
- Power generation exit substations

iSCS takes full advantage of new and emerging technologies and IEC 61850 concepts in order to drive material and labor cost benefits for users.

Core to the value proposition is class-leading cyber-security performance, backed up by GE Vernova's Six-Sigma* quality, providing utility executives with ongoing peace of mind during the life-cycle of the installation.

Transmission Applications

Issue: Leading-edge technical performance and reliability.

Response: iSCS provides IEC 61850 compliance with third party certification, making it Interoperable, fit-for-purpose and compatible with other solutions (giving Defined, Tested and Declared performance parameters). It addresses some of the initial teething problems of IEC 61850 solutions promoted, in that care has been taken to specify and implement precise conformance blocks. iSCS provides a totally flexible solution for transmission utilities for large substation applications—e.g., 250-300 Intelligent Electronic Devices (IEDs)—and alternative substation topologies and system architectures.

Distribution Applications

Issue: Minimized total life-cycle cost.

Response: iSCS is designed for scalability, allowing the widest range of network topologies and integration (at bay-level: single IED solution; substation level: single data manager, HMI, configuration platform).

Industrial Applications

Issue: Specialized automation applications and architectures; minimized downtime and maintenance.

Response: iSCS provides totally flexible system configuration, able to simply support an extensive range of IEDs. Each offering comes with a portfolio of services and support (e.g., extended Warranty) that will adapt the specific business requirements of Industrial clients.

Power Generation Exit Substation Applications

Issue: Integration of exit substation control system with power plant DCS systems.

Response: GE Vernova's vast experience of power generation control provides easy integration of substation and power plant DCS systems.

Refurbishment Applications

Issue: Risk management and cost control in the integration of new iSCS to legacy systems.

Response: iSCS provides access to GE Vernova's vast library of legacy protocols, to help provide better risk management and execution of retrofit and refurbishment works.

IEC 61850 Solution

Features and Benefits

Core functionality across the complete range of iSCS solutions (see Fig. 1):

- IEC 61850 architecture with Station Bus (100 MB/s, optionally to support 1GB/s); Industry standard LAN equipment hardened for S/S use; range of legacy protocols (with ZERO cost overhead to the iSCS hardware, software or configuration; millisecond time synchronisation).
- Scalable station-level computer, optionally redundant (combining functions of HMI; substation gateway, data concentrator and automation functions) range of SCADA protocols
- Scalable bay-level IED range covering Controller, Protection, Metering, Power Quality and Asset monitoring functions; communications features to support dual LAN and varied architectures. Able to accommodate one IED per bay, as and where acceptable.
- Bay-level Communications: integration of alternative protocols (such as IEC 60870-5-101/103, Modbus®, DNP 3.0, etc.) directly on to the LAN.
- Extensive use of IEC 61850 for cost optimization (configuration, testing, installation)
- Key iSCS performance parameters DEFINED, TESTED and DECLARED, based on Reference Systems.
- Comprehensive system automation capability (voltage control, sequential automation, synchronizing, interlocking etc.), IEC 61131-3-compliant configuration, high performance.
- GE Vernova system configuration using a single tool or a single suite of integrated tools.

Features/Benefits

- Scalable solution for substations world-wide; flexible and cost-effective for transmission, sub-transmission, distribution and industry applications.
- Reduced total cost of ownership.

- Standard bay solutions. Simple, rapid configuration, even for retrofit/extension applications. Reduced project cycle time.
- Class-leading cyber-security.
- Homogeneous, scalable HMI for the complete GE Vernova substation portfolio (IEDs, iSCS, substation security systems, etc.)
- Optional range Monitoring and Diagnostics IEDs, with asset modeling capabilities.
- Optional Simulation HMI to be used for operator training.
- Upward compatibility and value proposition of the iSCS into GE Vernova's DMS/EMS and those systems of the competition (e.g., for substation database management and upgrades)
- Integration of the iSCS into the EMS to look at outage management and data transfer (e.g., for substation database upgrades).
- Integration with OSIsoft PI, eDNA, and Cascade through enterprise gateway.
- Secure remote access to IED databases to overcome lack of local, qualified staff
- Local in-country services positioning and support.

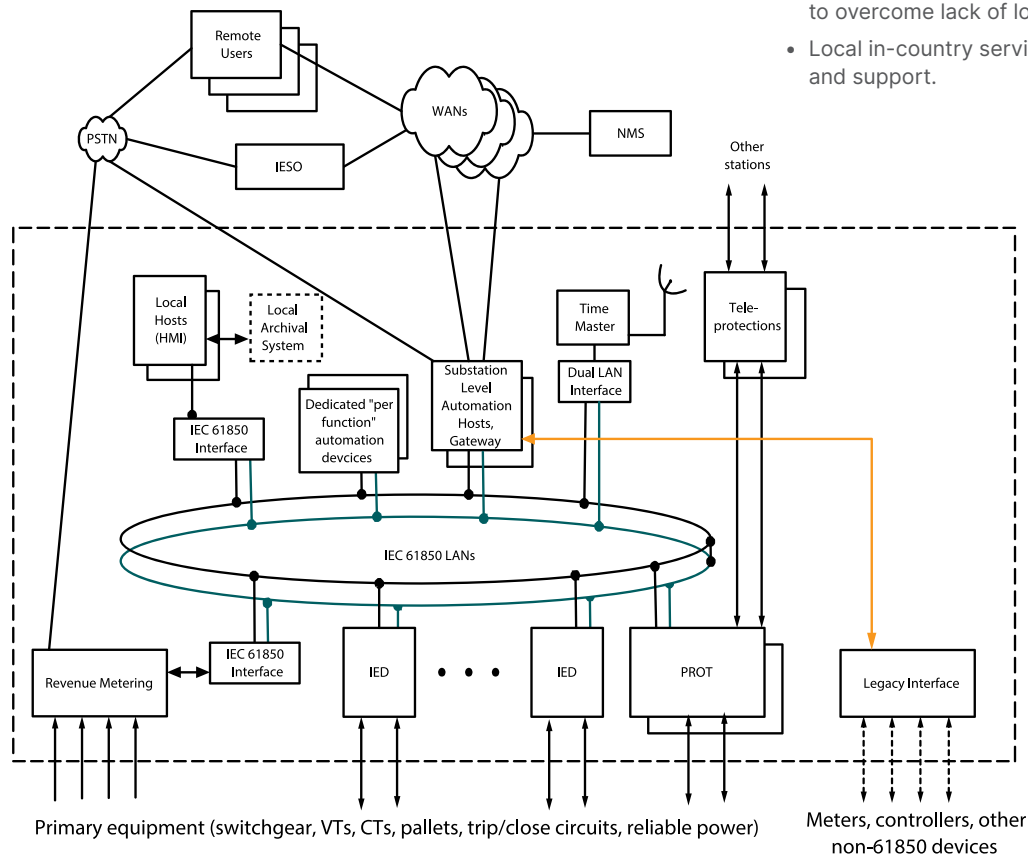


Figure 1 - [GE Vernova] Conceptual Functional Architecture

Typical Customer Scenarios

Scenario 1

I have a series of fully automated substations, but protocols are non-IEC 61850. Multiple supplier equipment was used to reach the automation level required, but now there is a 61850 mandate and very little capital for spending on these substations.

- Fully automated with non-61850 Protocols may have multiple propriety protocols per device
- DFR and other bay-level units may not be integrated due to protocol limitations
- Metering is not included in the automation system due to protocol limitations

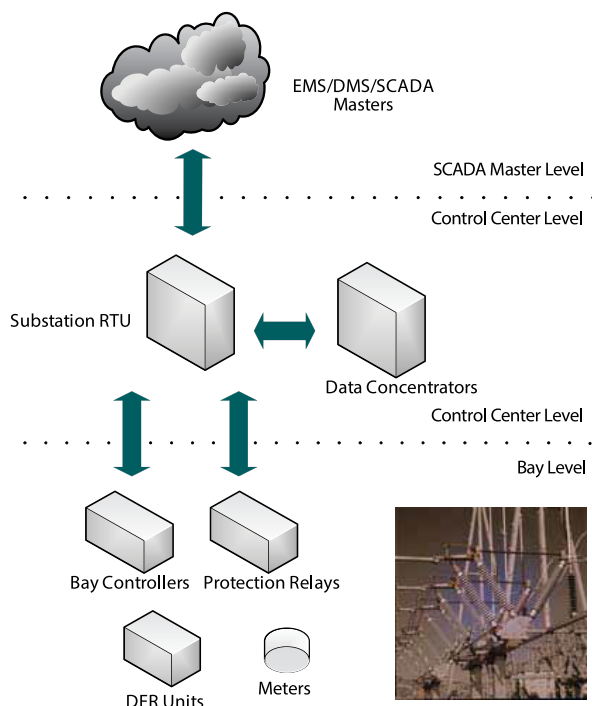


Figure 2 - Existing architecture

GE Vernova Solution:

No need to replace what has been installed in the past, as GE Vernova will provide solutions tailored to meet each substation's needs. Products have a large protocol suite to communicate with many different devices.

- Replacement of older and existing equipment is not required
- Fully integrated system with D25's 140+ suite of protocols and D400* protocol conversion capability
- Fully automated and 61850 compliant
- Security features in D400 are added to comply with security requirements such as NERC® requirements
- Cost-effective hybrid solutions
- Migration strategies adapted to each customer's technical and investment plans

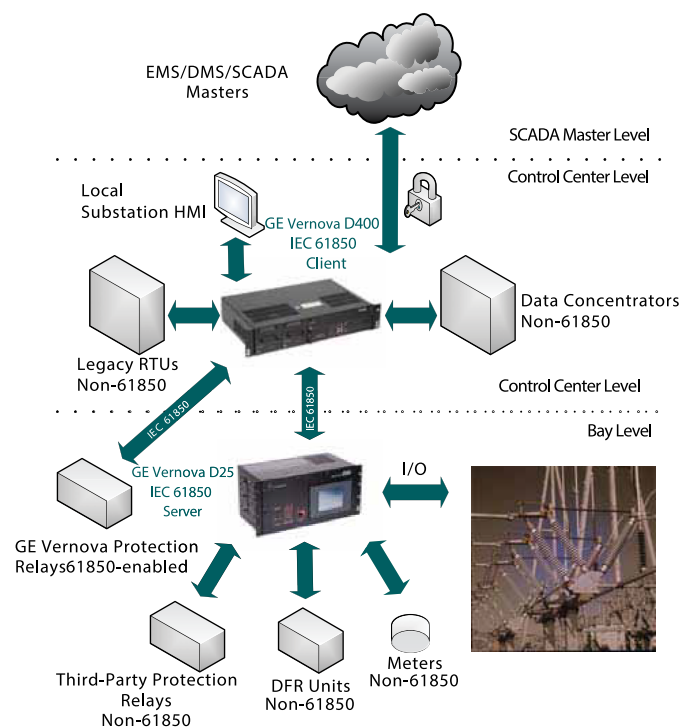


Figure 3 - GE Vernova Solution

IEC 61850 Solution

Scenario 2

I have a series of substations which have been automated in the past using expensive stand-alone hardware. It is now required to have a system in place to provide system-wide automation taking into account security as well as IEC 61850.

- Single devices per function have been implemented
- Most devices do not have connection ports for SCADA and automation; some have contact inputs and outputs for monitoring and control
- Limited or no automation function capability available
- Limited visibility from the Master SCADA level down to the substation

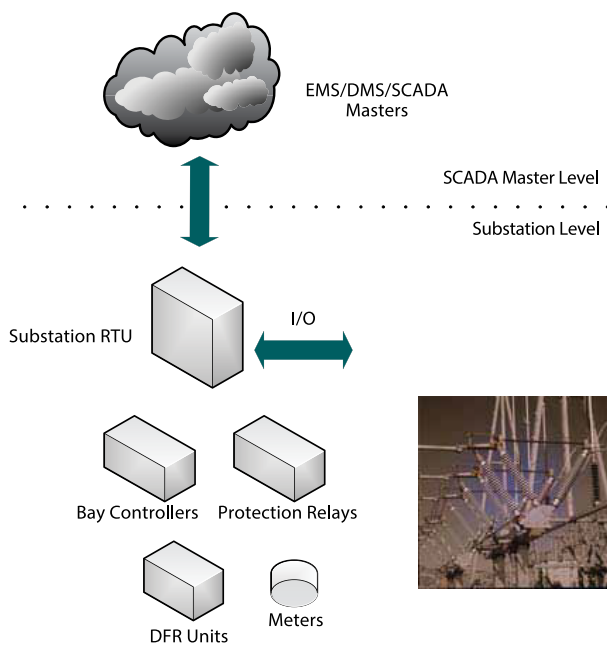


Figure 4 - Existing architecture

GE Vernova Solution:

GE Vernova's product offering allows for full integration of those older-generation IEDs by first providing a system solution, and second, converting all data to IEC 61850 protocol.

- Full automation at bay-level achieved with One Box: D25*
- Fully automated and IEC 61850 Compliant
- Security compliance with D400 Data Manager
- Existing or installed devices can be used as backup
- Local HMI functionality
- Full visibility at the SCADA Master Level, from alarms and status to analog values and fault records

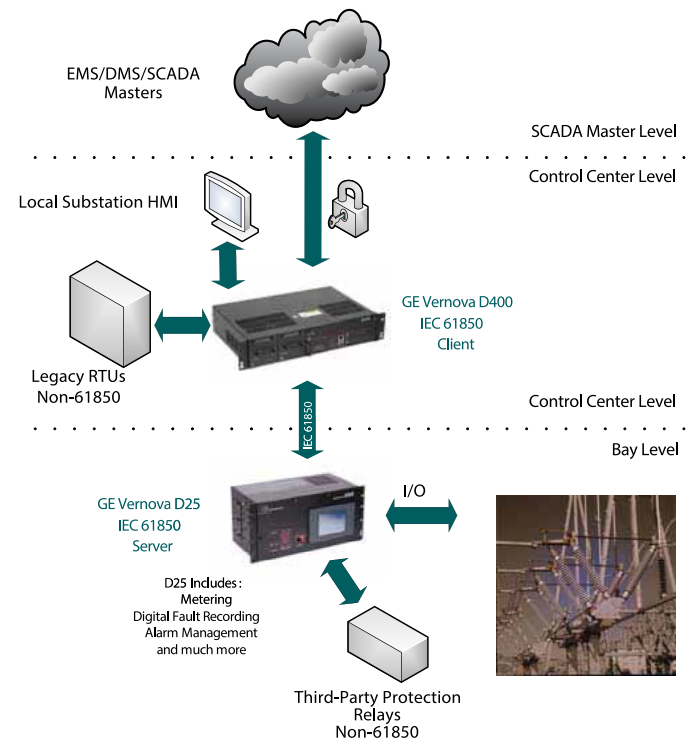


Figure 5 - GE Vernova Solution

Core Modules

An iSCS system is constructed using a variety of industry-proven products.

EnterpriseSERVER.NET

EnterpriseSERVER.NET, a product of SubNet Solutions, is a non-operational “DataMart” that brings focused substation data to protection relay engineers, asset managers, O&M engineers, etc., and meets NERC CIP security requirements. Some of the benefits of this module are secure NERC CIP communication with IEDs, fault record collection and processing, graphical displays for asset management, collection and processing of events, and gateway for business intelligence applications (PI, eDNA, Cascade, etc.).

GE Vernova's D400 Substation Data Manager

D400 substation data manager is a secure, substation-hardened gateway that collects metering, status, event, and fault report data from serial or LAN-based IEDs. The D400 summarizes data from the IEDs and makes it available locally through a Keyboard-Video-Mouse (KVM) port to support a local HMI or locally/remotely through a standard secure web browser (HTTPS). It supports serial and/or LAN connections to SCADA masters. TCP/IP network connections are supported over the built-in Ethernet and the modem interface. It also has MMS client in IEC 61850 client or server connections.



- **GE Vernova's D400 61850 Configuration Tool**

The IED Loader configuration software leverages IEC 61850 self-description capabilities and configuration techniques to quickly and easily set up the D400 for communications with IEC 61850 compliant devices. Drag-and-drop capabilities enable quick and easy addition of devices from any vendor. Devices can be added to the system in minutes.

- **GE Vernova's D400 Cyber Security**

D400 as a gateway of information provides security as per NERC requirements over the data which passes through to the different devices and IEDs in the substation. Secure web server (128 bit encryption), secure access using SSH (Secure Shell)/SCP (Secure Copy)/HTTPS, Cisco TACACS+ support and support for remote user authentication are just some of the security measures included in D400.

GE Vernova's D25 Bay Controller

The D25 is ideal for new additions and retrofits to existing facilities. It is upgradeable, and supports over 110 communication protocols including IEC 61850. It also has the flexibility that allows it to be used in a variety of applications. The D25 can replace multiple devices with a single unit. It functions as a IEC 61131-3 capable programmable logic controller, a remote terminal unit, a local area network node, an IED gateway, a bay level controller, revenue class meter (non-certified), a power quality monitor, and a fault/event (waveform) recorder. The D25 has been enhanced with a variety of new features for those customers looking for a flexible full-range substation IED.

Some of the features include

- SNTP
- Does not require extran transducers for most signals
- Supports 61850 GSSE



IEC 61850 Solution

GE Vernova's HMI

PowerLink Advantage* is a powerful and agile HMI which benefits from the scalability and capabilities of a PC-based solution. It communicates with IEC 61850 devices as well as a device that may not be IEC 61850-ready yet over DNP3 or a protocol converter or substation server as it is capable of communicating over multiple channels through multiple communication protocols.



GE Vernova's Universal Relay* Protection Relays

The Universal Relay (UR) is a family of leading-edge protection and control products built on a common modular platform. All UR products feature high performance protection, expandable I/O options, integrated monitoring and metering, high-speed communications, and extensive programming and configuration capabilities. The UR forms the basis of simplified power management for the protection of critical assets, either as a stand-alone device or within an overall power automation system. UR relays perform the most advanced protection schemes and algorithms covering generation, transmission, distribution, and motor protection along with monitoring and metering functions within a power system.



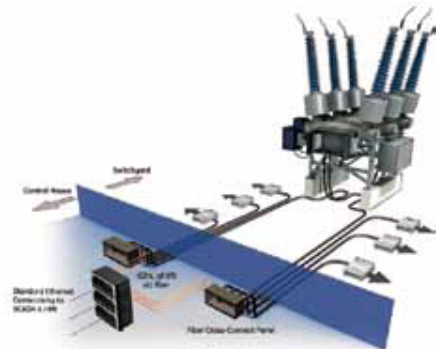
GE Vernova's Multilink* Switches

The MultiLink family is a line of industrial and substation-hardened Ethernet switches that will provide you with secure, reliable communications with all of your critical infrastructure devices. Designed to meet the unique requirements of the Protection and Control industry the MultiLink Ethernet switches will ensure your communications network is always available, even under the worst environmental and transient conditions. Some of the features include IEC 61850-3 compliant for harsh substation environments, -40°C to +85°C operating temperature without fans, Radius and TACACS+ for secure password authentication, copper and fiber optic gigabit ports, and network ring-recovery of less than 5 ms per switch.



GE Vernova's Multilin* HardFiber System IEC 61850 Process Bus Solution

This is a true breakthrough in the installation and ownership of protection and control systems. The Multilin HardFiber System saves utilities up to 50% in total P&C labor costs by replacing thousands of copper wires with IEC 61850 digital communications over a few fiber optic cables. GE Vernova Digital Energy makes IEC 61850 Process Bus a reality, delivering significant life-cycle cost savings with the next-generation in protection and control. Some of the applications include retrofit and greenfield installations for power generation, transmission and distribution systems, transformer protection, transmission line protection and much more.



iSCS Values and Benefits

Customer Typical Concerns

Experienced partner is required. It should not be required to train the partner or even explain the current problems in detail. The proposed partner must also have completed successful projects through partnerships with other utilities and clients.

Need solutions and not just products. The partnership should not be a “sales” opportunity for a large corporation to modify utility specification and processes in order to sell more products. A solution is needed.

Safety is very important. The utility has a specific safety protocol and portrays safety as the number one issue to its customers. The partner must adhere to the same principle.

Quality is crucial. The utility has a mandate to adhere to quality procedures and any solution implemented must be of high-quality.

Need to integrate the already-installed base. Utility has spent millions of dollars and many man-years of effort has been put towards the infrastructure. A solution cannot be a replacement and in other words, erasing the original challenges.

A lot of protocols within the existing fleet. There are a lot of ‘mini’ systems within the fleet of equipment which operate exclusive of the entire system, because its manufacturer would not with the other suppliers.

Local contact with service and support is important.

Why GE Vernova?

GE Vernova Energy T&D with over 30 years of experience since the inception of initial ideas of “data management” within power systems, has well over a thousand years of experience within its staff. It has accomplished numerous projects around the globe in more than 80 countries, surpassing any of its competitors in performance, consistency, and experience.

GE Vernova Energy T&D can derive solutions based on each utility’s specific requirement and in most cases that involves working with other vendors and suppliers and third-party products. Keeping the customer’s issues as the main objective, GE Vernova Energy T&D can find the optimal solution by tapping into solutions from around the globe and its experience with other utilities.

GE Vernova Energy T&D, with a long track record in safe workplace, has a large department with just one thing in mind: Safety. With safety as the number one issue, all of its employees follow the safety procedures within the entire process. As a global company GE Vernova prides itself on its safety track record.

GE Vernova T&D is a leader in Quality in the marketplace as the only major company with Six Sigma quality plans and spends millions of dollars every year improving quality in every step of the manufacturing, all the way to engineering and IT. GE Vernova T&D will meet any quality standards with an open arm and will in fact promote high standards within each utility it works with.

GE Vernova T&D, with the goal of finding the optimal solution while keeping the costs as low as possible, will integrate already-installed equipment. With products that support up to 140 communication protocols and deep system integration and engineering knowledge within the company, GE Vernova T&D can provide a world-class solution.

GE Vernova T&D promotes the Open Systems concept and follows international standards and protocols. In addition, it is able to integrate those “mini” systems and the chances are it has done so already in another part of the world and a different utility.

GE Vernova Energy T&D has offices all around the world.

For more information, visit
gevernova.com/grid-solutions

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