GE
Grid Solutions

DS Agile 7.0

Redefining Substation Automation

As power networks become more efficient and intelligent, substation automation systems need to provide new and smarter solutions. GE's DS Agile 7.0 is a digitized control system that is compatible with traditional copper wired systems and interoperable with IEC 61850 compliant third-party devices.

The DS Agile 7.0 digitized control system incorporates a new, state-of-the-art user interface that provides holistic and accurate monitoring of the substation for optimal control, operation and maintenance, maximizing asset usage while preserving health.

Electrical and non-electrical data is acquired by sensors and condition monitoring units across the substation, integrated into the DS Agile database and displayed through a customizable graphical interface, enabling greater substation situational awareness.

Key Benefits

- Reduce substation footprint and save up to 80% of copper wiring with digitization
- Extend primary device life with substation situational awareness
- Interoperability with IEC 61850 Ed2 compliance certificate
- User friendly with powerful and customizable HMI
- Flexible hardware and software configuration and network topology for integration with legacy technologies
- High availability with IED and network seamless redundancy
- Save onsite trips with secure remote access
- Customer proximity with local teams supported by the Center of Excellence for project delivery and support
- Wide range of applications with scalable solution

Applications

- Transmission, distribution
- Utilities, industry
- Green field, brown field substations

Substation Digitization

- Merging units
- Switchgear control units
- Non-conventional optical CT
- Gigabit process bus
- IEC 61850 Ed2

Situational Awareness

- Primary equipment condition data
- Indoor and outdoor environmental conditions
- Auxiliary services state
- Substation infrastructure information

Universal Graphical Interface

- Customizable views
- Zooming, panning, decluttering
- Vectorial
- Flexible widget integration

Flexible Network Topology

- 0 ms network redundancy
- IEC 62439-3 PRP and HSR
- 1 Gbps bandwidth
- Network segregation

Imagination at work

Data Concentration and Processing

One of DS Agile's essential functions is to concentrate and process data. The information can come from a variety of sources, both analog and digital. For example, when integrating legacy equipment, analog inputs are acquired directly from current and voltage transformers while digital inputs are acquired over serial communication or hardwired links.

DS Agile manages many types of data from the substation's primary and secondary equipment, such as transformer tap changer and switchgear positions, control signals, measurement values, disturbance records, settings, and others. Each item of qualified data is uniquely referenced in the system configuration tool to ensure full consistency of the information, as well as allowing it to be re-used in other parts of the system.

Automation

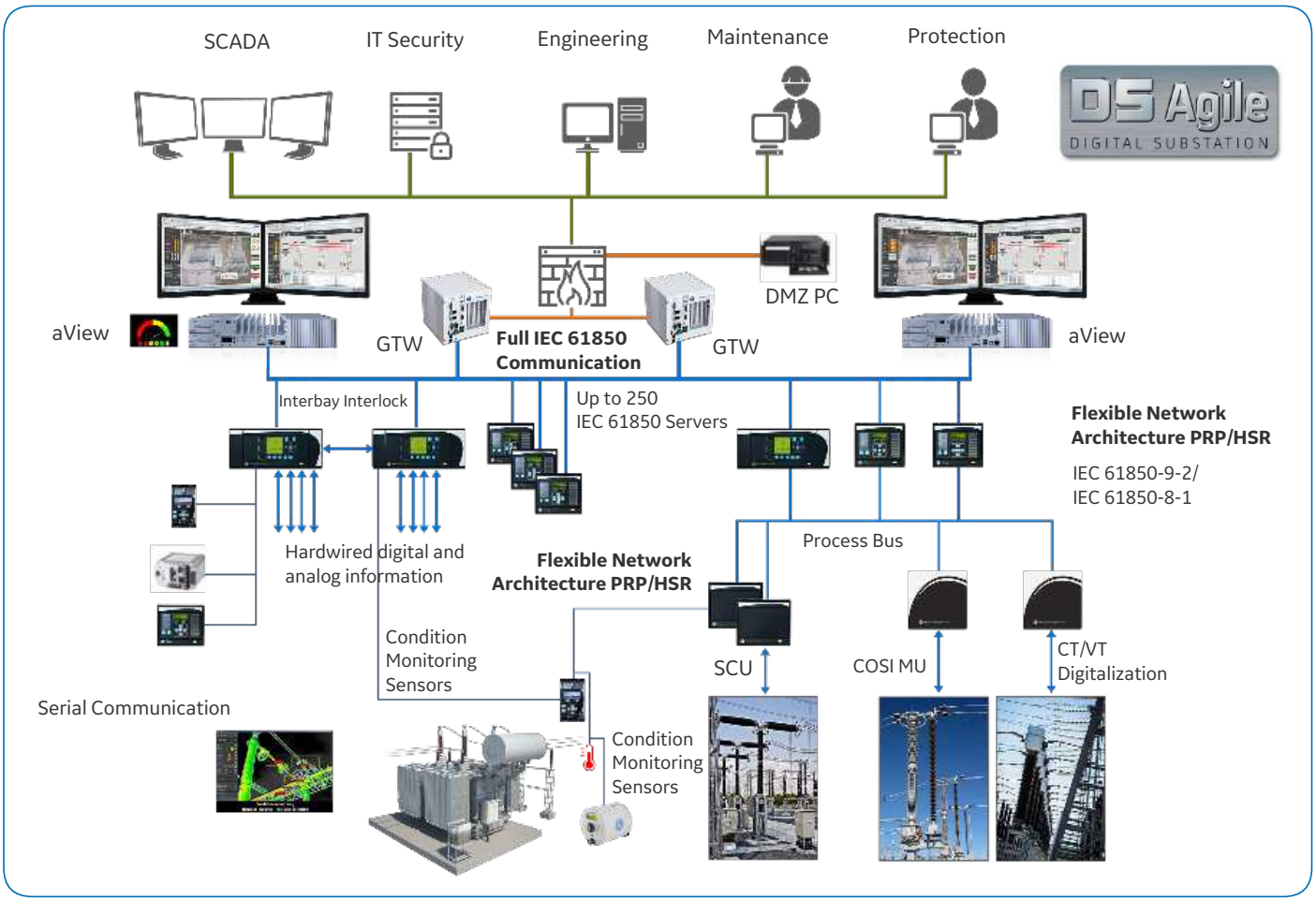
The operator can configure specific control sequences or automation schemes across one or more sites (e.g. automatic re-closing, System Integrity Protection Schemes (SIPS), synchro-check, feeder protection, automatic reclosing and voltage regulation of parallel transformers). Such applications work based on local or remote data. Similarly, the outputs perform local or remote actions.

Programmable logics are implemented using either Programmable-Scheme Logic (PSL) or Programmable-Logic Controller (PLC) methods. PSL is used for fast automation applications and is available within the C264 bay controller.

Since PSL is event-driven, there is no cycle time. The optional PLC tool is fully compliant with IEC 61131-3 and it is used for complex or sequential automation applications.

Control

Once a control operation is initiated by an operator, locally or remotely, multiple checks are performed by the system before the effective issue of the control order or signal, in order to make it fully secure. For instance, interlocks are ensured by logical equations or as the result of a dynamic topological analysis coupled with expert rules. Interlocks are managed as close to the process as possible to provide the best security of operation. Interlocking conditions are graphically displayed on the operator's screen in order to immediately identify the locking conditions, if any, allowing the operator to make the appropriate changes before issuing the order.



DS Agile System capabilities

Monitoring and Diagnostics

DS Agile features diverse functions for local or remote monitoring and data analysis. Key situational information is obtained either from the embedded LCD screens of the C264 bay controller and other monitoring devices, or through the powerful graphical user interface DS Agile aView, which provides more sophisticated and clear monitoring views. The user benefits from customized displays for easier awareness and maintenance, comprehensive alarm annunciator screens, accurate fault location, etc. Other typical features include advanced reporting, dual-language display and disturbance record analysis.

System Components

A typical DS Agile solution integrates many Intelligent Electronic Devices (IEDs) such as protection relays, measurement centers, bay controllers, etc. In addition to those supplied by GE, DS Agile is fully open to the integration of third-party devices so that existing devices in the field and user preferences can be accommodated.

DS Agile C264 substation / bay controller

When third-party devices are integrated, strict tests are realized in order to validate functional interoperability limits, data retrieval, control capabilities and remote settings.

IEC 61850 Process Bus Devices

GE provides a flexible range of IEDs allowing data (i.e. measurements, control signals and condition monitoring parameters) acquisition and conversion into IEC 61850 sample values and GOOSE messages. The SCU (Switchgear Control Unit), in particular, also permits monitoring and control commands for operating switchgear devices.

Merging units are the smart IEDs that enable measurement acquisition and conversion into IEC 61850-9-2LE, sending them through the Ethernet process bus network. These are:

- Reason MU320 analog merging units, which interface with conventional instrument transformers or any other IEC 61850-9-2LE device
- Numerical Merging Units and COSI MU, dedicated to the COSI range of digital instrument transformers that use smart optical measurement technology

DS Agile SCU switchgear control & monitoring unit

Switchgear control units, like the DS Agile SCU and also the versatile MU320, are designed for interfacing with and controlling circuit breakers, disconnectors and any other primary switchgear equipment, processing the I/O signals as IEC 61850-8-1 GOOSE messages at process bus level.

DS Agile C264 Bay Control Unit (BCU)

The C264 bay controller is a sophisticated modular computer that supports many applications and functions for substation control, communications, monitoring, protection and automation.

Typical C264 applications include:

- Bay control
- Remote Terminal Unit (RTU)
- IED gateway / Data concentrator
- Automation - PLC & PSL
- Sequence-of-events recorder (SOE)
- Measurement center
- Power quality monitoring
- Integrated feeder protection
- Automatic voltage regulation
- Synchro-check

DS Agile A-Series Gateway

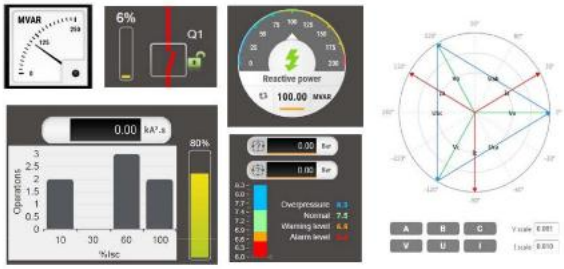
Combining full compliance with IEC 61850 Ed2, hot-standby redundancy and ease of commissioning, the DS Agile Gateway offers a powerful solution for interfacing bay level devices to SCADA/EMS systems with a variety of standard communication protocols.

DS Agile A-series gateway

DS Agile aView: Universal Graphical Interface

Aimed at releasing the potential of digital technologies while facilitating adequate situational awareness of the substation, today's Digital Control Systems (DCS) are required to integrate all kinds of digitized data acquired across the whole substation. More importantly, they can display the huge amounts of information in a clear, smart manner through customized views, dashboards and applications specific to the different users.

DS Agile aView is the ultimate universal Human-Machine Interface (HMI) that enables the management of the multiple control, measuring and monitoring information from the substation, making the DS Agile the ideal solution for responding to the most demanding challenges of substation owners and operators.



Main Substation HMI Functions

- Single-line dynamic diagram viewer: voltage & bay level
- Operation and monitoring of switchgears and transformers
- Alarm & event list viewing and reporting
- Substation troubleshooting, disturbance analysis
- Data monitoring, logging, archiving and trend viewer
- Monitoring of primary and secondary devices
- Integrated online condition monitoring dashboards
- Handle full substation perimeter data not only primary devices

Enhanced Graphics Capabilities

- Zooming
- Panning
- Decluttering
- Vectorial objects
- Advanced curve drawing
- Flexible integration of widgets

Smart Engineering Functionalities

- Large library of electrical symbols and components
- The mimic behaviour can be configured and tested offline, independent of the field devices
- Multi-language HMI with online switching capability
- Easy and fast installation saving man hours

Operation Improvement

Advanced Alarm and Event Management

- Alarm lists accessible from any substation level
- Real-time and historic alarms / event lists available
- Alarm management: inhibition, on/off monitoring
- Synthesis of alarm groups

Full Substation Situational Awareness

- Holistic view: monitoring of the complete substation through one common, universal interface
- Synthetic, visual information of substation state and health
- Intuitive and fast data access in the system database

Easy and Secure Operation Tasks

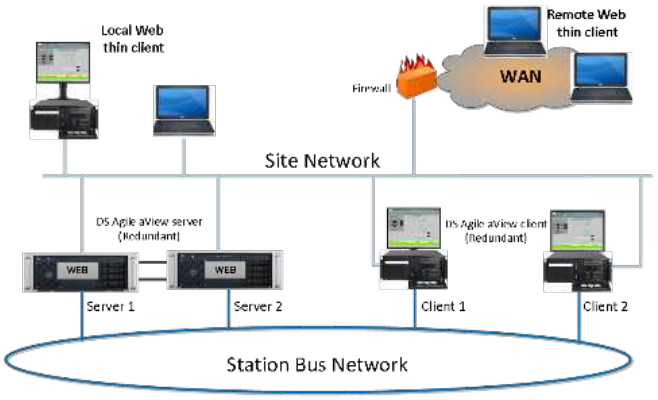
- Improved control pop-ups (e.g., Select-Before-Operate)
- Intervention tags (normal / test / locked) can be placed at any level: substation, voltage level or bay
- HMI desktop environment and filters saved per user

Full Remote Access and Control

- Remote access to substation with maintenance / operation interface
- Web browser access secured through substation's firewall
- Up to 5 Web clients
- Different user access rights depending on local or remote connection

High-Performance Workstation Hardware

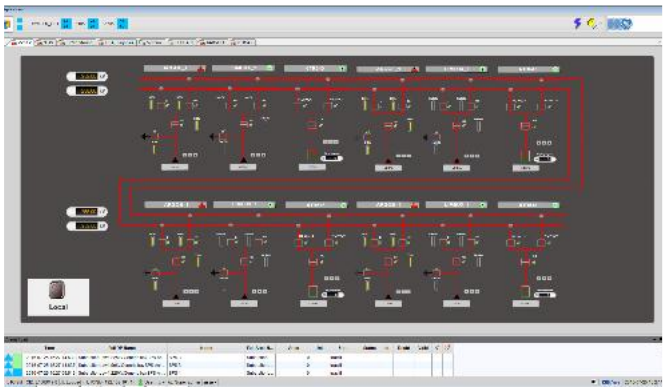
- Powerful graphics capabilities for high resolution screens
- Able to manage up to 100,000 data points
- Supports up to 4 high resolution screens
- High storage capacity embedded for mid & long term archiving
- Can be supplied with IEC 62439-3 PRP / HSR interface
- Optional solutions with separate client and server PCs or "all-in-one", cost-effective integration
- Hot stand-by redundancy



DS Agile aView redundant server and client HMI workstations in a network providing local and remote web access

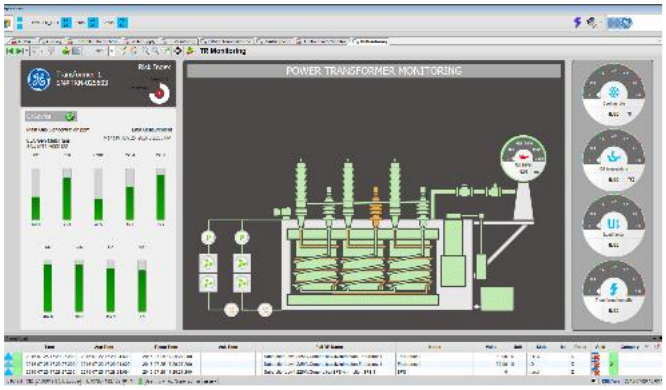
HMI Views and Application Examples

Single-line Diagram Example

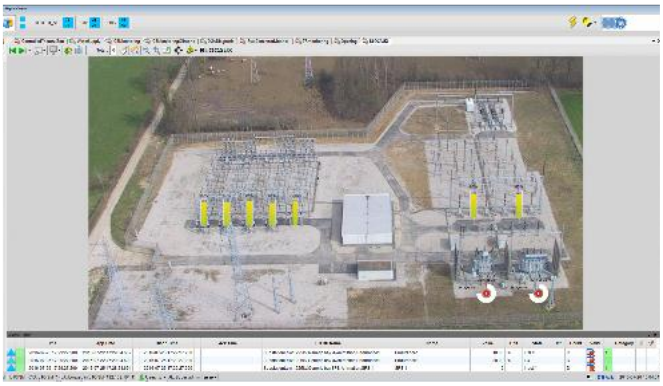


Detailed Bay Representation

Condition Monitoring of Transformer



"Bird's Eye View" Substation Situational Awareness



Condition Monitoring

Online condition monitoring functions are essential for the optimum life cycle management of the substation's primary devices.

A wide range of state-of-the-art sensors and IEDs for online data acquisition can be integrated within the DS Agile system through IEC 61850 or other standard communications protocols to provide valuable, real-time condition data for failure prevention and optimal asset management, such as:

- Electrical measurements
- Primary equipment condition data
- Indoor & outdoor environmental conditions
- Auxiliary services state
- Substation infrastructure

GE's expert solutions for online condition monitoring of primary equipment, such as the MS3000 power transformer monitoring and GISWatch for gas insulated switchgear are tightly integrated with DS Agile.

Ethernet Switches

GE's Reason H-series Ethernet switches use a combination of Parallel Redundancy Protocol (PRP) and High-availability Seamless Redundancy (HSR) protocols and fiber-optic connections to ensure reliability and availability of substation communications networks. All these, while maintaining the flexibility of being able to connect to standard Ethernet networks are ideal for substation refurbishment or upgrades.

All H-series switches are available as standalone, embedded or PCI card (for integration into a PC) versions.

Reason H49, GE's all in one gigabit redundancy solution, has been especially designed for the digital substation, for use on the substation bus and process bus, in a mix of PRP dual star and HSR rings. The 1000 Mbps HSR ring allows to transport multiple Sampled Value streams on the same ring, simplifying network topology. In addition, IEEE 1588 v2 and Power Profile compliance allow for high precision timing application such as Sampled Value timestamping.

Reason H49 All in one gigabit redundancy solution

Protection and Control Relays

Based on field proven results, GE provides a comprehensive range of protection and control relays for transmission, sub-transmission, generation and industrial substations.

Typical protection applications include:

- Busbar
- Transformer differential
- Line differential
- Distance
- Generator
- Motor
- Feeder
- Phasor measurement
- System integrity protection schemes

MiCOM P40 Protection Relay

Multilin UR protection and control family

Measuring and Recording

GE's Reason IEDs are integrated in DS Agile for fast, highly accurate, real-time fault recording and analysis, power quality measurements and trend recording - ideal for analyzing network faults, reactions of protection IEDs, dynamic network stability and long-term trends.

Reason RPV311 digital fault recorder

Redundant Network Architectures

Network Redundancy

The DS Agile system architecture is built around an Ethernet network. The Ethernet network may be local to a substation -typically for a transmission application- or it can interconnect dispersed sites commonly found in industrial or infrastructure applications.

Communication availability is of paramount importance as the network carries the tripping signals. All DS Agile components support the Parallel Redundancy Protocol or High-availability Seamless Redundancy protocols to achieve 0 ms recovery in case of a single failure. This means that no tripping signals are lost in case of a single failure.

DS Agile network topology is flexible and can mix RSTP, PRP and HSR, to achieve the right level of redundancy and performance. Network performance is further tuned with traffic segregation and priorization using VLAN and PCP priority codes.

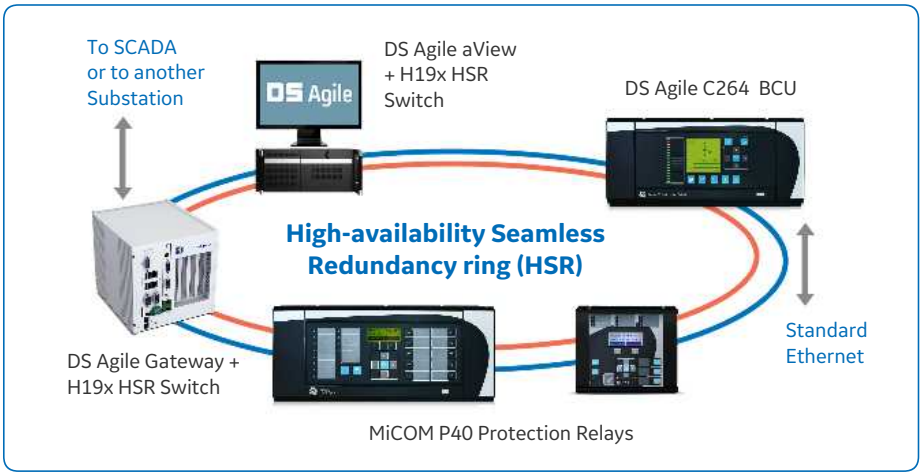
Communications Protocols

IEC 61850 Ed2 is the standard communication protocol of DS Agile within the substation.

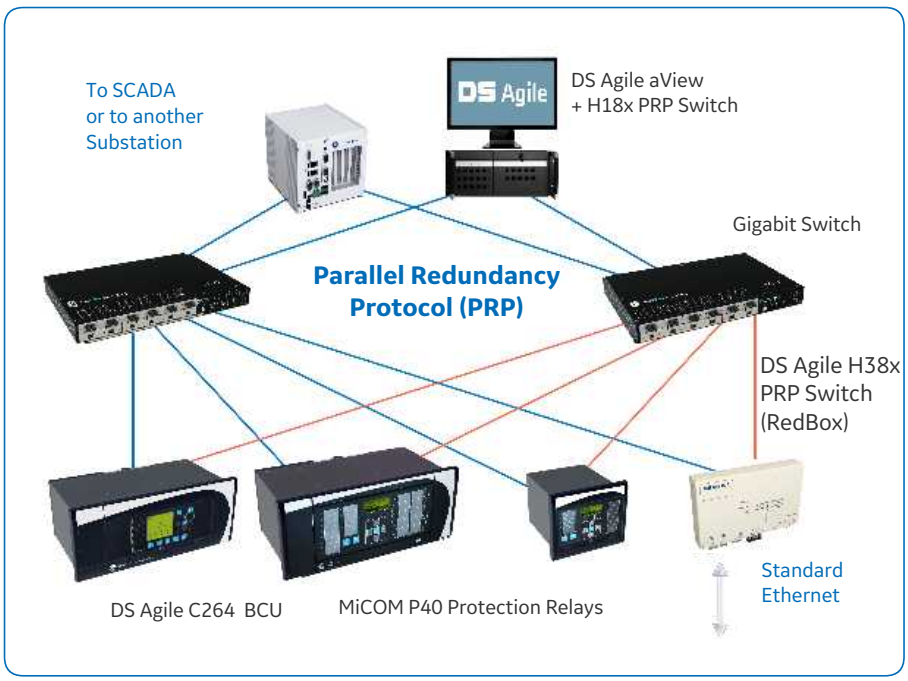
Communications with remote grid control centers are achieved through
IEC 60870-5-101, IEC 60870-5-104, DNP3, OPC or other older protocols on demand.

DS Agile provides protocols conversion from most standard serial protocols
(EC 60870-5-104/103/T101, DNP3, and MODBUS) in order to interface with a variety of devices, allowing seamless substation extensions with integration of existing technologies.

The same link is used to retrieve settings or disturbance records from MiCOM and Agile devices.

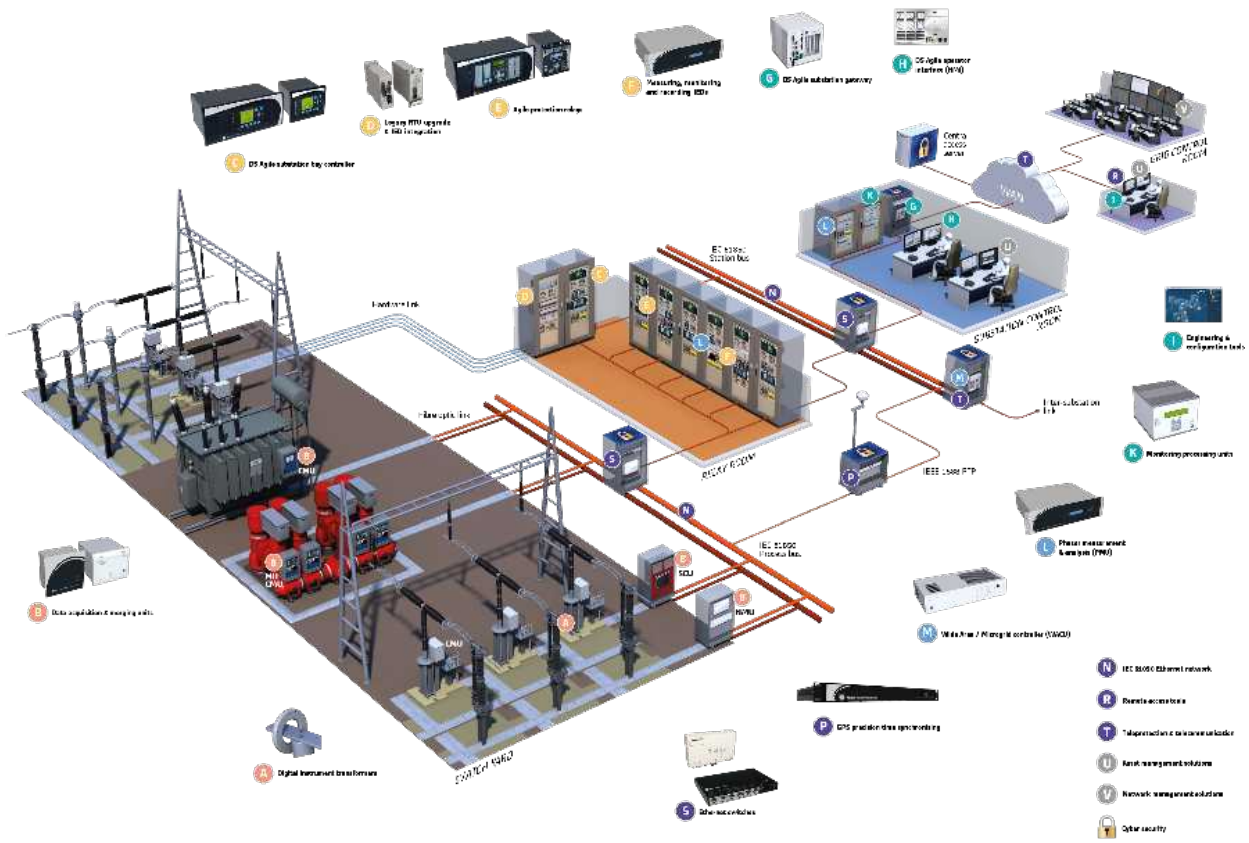


IEC 62439-3-5 HSR ring, Ethernet-based architecture



IEC 62439-3-4 PRP dual star, Ethernet-based architecture

Agile Digital Substation by GE



When it comes to protecting and controlling your critical assets, good products are not enough. In addition to our excellent state-of-the-art products, GE can also provide you with:

- Strong system design and manufacturing capabilities
- Highly experienced project execution teams located worldwide
- Support and advice to make existing installations evolve
- Long-term maintenance, refurbishment and asset life extension
- Technical training programs
- After-sales services with worldwide regional coverage

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Imagination at work