Ethernet and IEC 61850

The Communication Standard for Power Distribution and Transmission
Let’s Begin with a Question:

Which benefits do you expect from the use of the IEC 61850 standard?
Surely These Benefits:

- Reduced engineering costs
- Reliable operation
- High investment security
- Established technology

= Reduced total cost of ownership
Agenda

- Change in Communication
- Plus Points
- Solutions and Visions
“Take part in the change in communication.”
### The Initial Situation

- Devices communicate with one another through wiring.
- Slow serial communications protocols are used (master-slave technique).
- Within a switchgear system, diverse, in part proprietary communications protocols are used.
- Frequently, a cost-intensive data conversion is necessary.
- Redundancy can only be achieved by doubling the communication (two busses).

#### Network Control Level
- IEC 60870-5-101, DNP, ...

#### Station Level
- IEC 60870-5-101 / 103, DNP, ...

#### Field Level
- Hardwired binary inputs and outputs

#### Process Level
- 100V..120V, 1A/5A
- Hardwired

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Sector Infrastructure & Cities
Ethernet and IEC 61850
The User’s Needs

- Integration in engineering, communication and documentation
- Support of modern service concepts
- Long-term expandability
- Flexibility in the selection of components
- Cost optimization
The Solution

- Currently, an integrated communication without protocol conversion is possible up to the Station Level.
- Siemens masters and implements communication up to the Network Control Level and brings this experience into the continuous standardization.
- IEC 61850 uses the standard Ethernet.
- The standard supplies thought-out migration concepts, even for heterogeneous systems.
- The data model is future-oriented, independent of innovation advancements.
Solvay Group: International Chemical and Pharmaceutical Company

- Operation of high, medium and low voltage systems

- Worldwide systems in use with IEC 61850 up to the network control level, others being planned
Motivation to Use IEC 61850

- Worldwide accepted, manufacturer-neutral standard
- Object-oriented, self-describing data model
- Future-oriented data model
- High performance
- Great flexibility in case of changes and expansions
Customer’s Experiences

- “The export of IED configuration data (SCL) and the subsequent import in a data management tool simplifies the engineering considerably and reduces the testing effort significantly.”

- “IEC 61850 enables easy remote maintenance and support of service locally.”
Customer’s Experiences

- “A central and extremely exact time synchronization is ensured through GPS/SNTP.“

- “With slight changes to an IED, you have to pay attention to the consistency of the configuration data.“
“Collect the plus points with IEC 61850 and Ethernet.“
Ethernet and IEC 61850
The Plus Points at a Glance

- Modular hardware
- Variable system topologies
- Parallel processing of services
- High interoperability
- Standardized engineering
- Efficient service concepts

Ethernet + IEC 61850

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Select the Ethernet interface that fits your application!
Ethernet and IEC 61850
SIPROTEC 5 Ethernet Ports

The Ethernet system interfaces for SIPROTEC 5 enable a retroaction-free communication, independent of protective functions and control functions.

You choose between optical and electrical versions.
Ethernet and IEC 61850
Ethernet Module

Essential Properties of the Ethernet Modules:

- **Line** operating mode:
  Only one of the two interfaces is active, the other is passively monitored.

- **Switch** operating mode:
  You implement connections between SIPROTEC devices without additional external switches.
Design topologies to fit the local requirements and the desired redundancy!
Ethernet and IEC 61850
Ring Structure with External Switches
Ethernet and IEC 61850
Ring Structure with Integrated Switches
Ethernet and IEC 61850
Ring Structure with multiple Rings
Ethernet and IEC 61850

Plus Point: **Redundancy Configurations**

Seamless redundancy solutions with PRP and HSR!
 Principle of PRP - IEC 62439-3.4

- Two parallel networks
- Device are connected to network PRP-A and PRP-B
- Devices send via both active links
- RedBox for connection of non PRP devices
- Seamless

→ Interoperability tests done
Principle of HSR-Configuration – IEC 62439-3.5

- 2 Redboxes
- SIPROTEC devices with integrated HSR switch
- Rings with up to 50 devices
- Redboxes distributed in the ring
- Seamless
  → Interoperability tests done
Ethernet and IEC 61850
Plus Point: **Parallel Processing of Services**

Use one and the same bus connection for different communication services!
Ethernet and IEC 61850 Parallel Running Communications Services

- IEC 61850 Info Report
  Connection to SICAM PAS
- IEC 61850 GOOSE
  Generic Object Oriented Substation Event
- IEC 61850 SNTP
  Simple Network Time Protocol
- DIGSI - IP
  Operator control / monitoring with DIGSI 4
- Web – Services / SNMP
  Monitoring with Browser

Ethernet Port on the SIPROTEC device

Data Highway with 100 MBit/s
Ethernet and IEC 61850
Plus Point: High Interoperability

Combine different standard-conforming components in a system and let them communicate with each other!
Ethernet and IEC 61850
Interoperability

Wide Area Network

Remote and
Browser Access

Corporate Network

SCADA
Maintenance

Router

Intranet
Web Server

Home Office

Router

Web Server

SCADA

Intranet
Ethernet and IEC 61850
Plus Point: Standardized Engineering

Replace wiring through data telegrams!
Ethernet and IEC 61850

Simple Wiring saves Costs

Conventional Wiring

Wiring with IEC 61850
Collaborative Engineering saves Time

1. Design
2. Drawings
3. Wiring
4. Switchgear manufacturing
5. Test
6. Commissioning

Time saving

Traditional  With IEC 61850
Use service resources exactly where you need them!
Ethernet and IEC 61850
Fewer Resources, Faster Task Solutions

- The control centre detects an error from the remote location and evaluates it.
- The control centre decides which employee must go to the disturbance location and with what material.
- The employee goes to the location and completes his task.
“Profit from our solutions and our competence.”
Ethernet and IEC 61850
Switchgear Interlocking with IEC 61850-GOOSE

IEC 61850 - GOOSE

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Ethernet and IEC 61850

We Think Beyond

**Network Control Centre**

- Device
- Device

**Harmonization with CIM**

- IEC 61970*

**IEC 61850 Station Bus**

- Firewall
- Router

**IEC 61850 and Ethernet**

- Protection & Control

**IEC 61850 Process Bus**

- Merging Unit
- CB Control Unit

**Digital Converter**

- Data Transmission according to IEC 61850-9-2

**Communication with other Switchgear Systems**

*Standardization in work
Ethernet and IEC 61850
Our Solutions in Use Worldwide

Up to now more than 250,000 SIPROTEC devices with IEC 61850 Interface were delivered!
Reasons for IEC 61850-Technology from Siemens

- **Years of experience**
  - More than 250,000 SIPROTEC devices speak for themselves

- **The full range of solutions**
  - Full line provider of IEC 61850 server and client solutions since 2004
  - All SIPROTEC protection and control devices support IEC 61850

- **The better engineering tool - DIGSI**
  - Simple and comfortable IEC 61850 system configuration tool
  - Support of IEC 61850 Edition 1 and 2
  - Flexible Engineering of IEC 61850 structures
**Reasons for IEC 61850-Technology from Siemens**

- **Compatibility**
  - IEC 61850 technology that has consistently been given the KEMA ‘s A Level certificate
  - Support of Edition 1 and Edition 2

- **Availability**
  - Support of redundant protocols
  - Support of redundancy protocols RSTP, PRP and HSR

- **Guaranteed future**
  - All SIPROTEC IEC 61850 protection devices that have been produced since 1998 can be easily upgraded for the IEC 61850 technology