Digital Substation
A Substation – Why Should We Make It Digital?

- Business agility
  - Adopt new business models
  - Time to operation

- Standardization
  - Regulatory compliance
  - Environmental impact

- Quality assurance
  - Avoid outages

- Avoid human errors

- Managing of investments
  - Investment security
  - Reduced space
  - Reduced maintenance expenses
  - Reduced outage times

- Ensuring grid availability and reliability
  - Asset productivity and lifecycle

- Operational efficiency
  - Reduce total cost of ownership
  - Privacy and security of data

- Reduce investments costs

- Reduce investments costs

- Regulate compliance

- Reduced space
A Digital Substation – What is it about?

1. Digitalization of Station Level
   - Digitalization of Process Level
2. Cyber Security
3. Asset Mgt. Support
4. Grid Operation Support
5. Integrated Engineering

- **Non-conventional Instrument transformers (NCITs)**
  - Provide primary values to the merging units based on new principles
- **Merging Units (MU)**
  - Converts analog primary values of the NCITs in digital information (Sampled Measured Values)
- **Process Bus**
  - Communicates field data to protection and control system based on IEC 61850-9-2
- **Sensors**
  - Provide more information on current status of the electrical equipment
- **IoT**
  - Value-adding central applications
  - Big data analytics
  - IT/OT integration
- **Digital Control Room**
  - More data acquisition, intelligent decentral applications, cyber security
- **Digital Control Room**
  - Digital protection and automation with station bus based on IEC 61850
Digitalization of Station Level

Previously

Serial communication on station level

Substation controller

HMI

Ethernet communication on station level

Switch

Substation controller

Station Bus Bay

IEC 61850

Hardware and functionality as one fix unit

Flexibility throughout the life time – Functions and apps are independent from a modular hardware

Benefits

- Agility regarding future requirements
- Investment security

Digital

SICAM A8000

SIPROTEC 5
Digitalization of Process Level

Previously
- Copper cabling
- Analog values
- e.g. 3.2 m
- e.g. 5 m
- 50 – 250 m

Digital
- Fibre optic cabling
- Ethernet
- IEC 61850-9-2
- Merging Unit
- e.g. 3.5 m
- e.g. 2.9 m

BenEFits
- Reduced space and weight
- Higher performance in measurement
- Cost savings by reduced wiring
- Improved safety
- Interoperability
- Flexible assignment of functions
3 Cyber Security

Secure Substation

Benefits
• Preventing downtimes by minimizing cyber risks
• Compliant with regulations & laws
• Retention of good reputation
• Comprehensive coverage of all security aspects from a single, trusted partner
Asset Management Support for Primary and Secondary Equipment

Enterprise Resource Planning

- Commercial
- Purchasing
- Human Resources
- etc.

Asset Performance Mgt.

Substation Device Mgt.

Benefits of ProductCERT

- Lower investment and operational costs
- Higher performance by improved reliability, availability and updated security
- Efficient processes by conscious decisions and action

Health Index

Importance Index

Health Index

Department

- IT
- Security
- Contractors

BSI

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Siemens ProductCERT

Central Database

Security

Research

CERT

3rd Party

Vendors

Pentesters

Free-time Hackers

Monitoring and Information

US ICS-CERT

BSI

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**Grid Operation Support**

**Power Transmission: PMUs enable WAMS, Fault Recording**

**Benefits**

**Wide Area Monitoring System (WAMS)**
- Real-time detection of instabilities, e.g. Power Swing, Islanding, Overload – blackout prevention
- Increased operational awareness – early reaction, better grid utilization

**Fault Record Analysis**
- Faster and accurate fault location analysis for better action planning (i.e. restoration)
- Recommendation for operation
Grid Operation Support
Power Distribution: Self-optimizing Applications

Regional Controller in Digital Primary Substation
• Self-healing application
• Load Management application
• Area Voltage Control application

Benefits
• Avoidance of outages
• Reduction of outage times
• Protection of primary equipment
6 Integrated Engineering

Grid Operator

- Data to supplier
- Data from supplier

Single line diagram
- Primary (basic) engineering
- Secondary engineering

Secondary drawings
- Protection devices configuration
- Test engineering

Device Configuration
- RTU configuration
- HMI configuration

Test Cases
- Asset management

SITIPE Platform

Supplier Process

Benefits
- Reduced time to operation
- Data consistency
- Optimized refurbishment process: easier updating of documentation and testing

Quality

Project timeline
Thank You for Your Attention!

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