Successful implementation of Digital Substation

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SGTech- Europe
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Content

• Pilot installation- Design
• Testing Experiences
• Operational Experiences
• Further activities in Project
• Further plans- Statnett
Smart, Effective and Secure

Digital Substation - Challenges today's philosophy?

- Safety
- Time
- Cost
- Functionality
Goals for the R&D project

- Develop next generation control systems
- Digital substations including PB, GOOSE, SV and LPIT.
- Build Competance.
- Gain experience and verify maturity of technology
- Interoperability
Pilot installation – compact design

Multivendor
Ring topologi
PRP-REDBOX
VLAN
FAST GOOSE
Priority
PTP
Time Synchronisation

- Importance
- Cooperation with COSEC Time project
IT Security

• Firewall on gateway- only IP traffic from trusted IP and MAC adress on SB and PB.
• RBAC- Role Based Access Control
• Sticky MAC address
• Unused ports are closed by the firewall
• TAP-Terminal Access Point- V Broker 110-NettScout
Testing Experiences

Test and simulation functionalities
  • Logical device approach
  • Different implementation of test and simulation mode.

Planning for GOOSE
  • Test terminals
  • Predefining of the test GOOSE

Workshops!
Testing Experiences (cont......)

Monitoring and fault finding
- Alarms not affecting the grid operation
- Response matrix
- Close cooperation of control system with the network design

Documentation
- Need of documenting logics, function and the flow of GOOSE

Testing and commissioning of the network component
- Communication network as the central part of design
- Firmware upgrade and security patches
Testing with Omicron- DANE0

- System verification
- Fault finding and analysing
- Timesync. and BMCA

Fremtiden er elektrisk
Heat issue
- No effect on the performance
- Affects the lifetime of the components

Continual Comparison of current and Voltage
- MU and SAMU outputs
- MU and Conv. Analog
- SAMU and Conv. Analog
Operation Experiences (cont…….)

• Start of Distance protection

• Transformer fault in the neighbouring station:
• Current L3 and V3 (SAMU, MU og "normal" overlapping):
Operation Experiences (cont.....)

MU internal failure- alarm and the quality bit.

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# Operation Experiences (cont....)

**Energy meter**
- Comparison of values
- Good quality of the measurements
- Accreditation - Primary control in the factory together with the better balance control?

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Fremtiden er elektrisk
Co-operation with Synaptec

Efficient busbar protection & asset monitoring

Objectives
1. Test the busbar protection scheme with more number of SV streams.
2. Verify interoperability
3. Confirm no temperature effects
4. Automate asset monitoring in 1 system

Methodology
1. Install shadow protection scheme
2. Compare results
3. Monitor 21 electrical & mechanical sensors simultaneously in one system
4. Analyse the results by implementing them in the digital twin for transformer

Fremtiden er elektrisk
Design of bay cabinet - Challenges

- EMP protection
- Climatic condition
- Optimal Maintenance
- Cyber security

Cyber Security and Network
Statnett digitalisations plan

One green field substation in Oslo area for 420KV GIS and one brownfield refurbishment AIS substation…timeline 2021-22
Specification Phase

- Co-operation with other TSO
- Co-operation with DSO
- Co-operation with vendors
- Co-operation with Universities and research institute
- Architecture: protocols, level of redundancy, control functionality

- Qualification of LPIT together with MU
- Qualification of protection and Control IEDs
Publications

Publication 2018
• DPSP- Testing
• PAC World- Operational experience
• Cigre- Experience med multivendor digital stasjon

Publications planned for 2019
• Busbar protection scheme with sensor data- PAC world- Synaptec
• Time synchronisation- Cigre B5 Colloquium-Norway
Digitalisation progressing in full speed!

Cooperation!