Distribution Automation / Self-Healing Competence Center

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Selfhealing Grid - HEP ODS Elektra Koprivnica

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Challenges

- Reduce outages, 50 km of overhead line with plenty of faults
- Terrainn configuration – communication solution
- First self-healing grid pilot project, based on decentralized system architecture and wireless communication – limited experience

Solution

- 4 reclosers with controllers
- Wireless communication
- Advanced automation system based on IEC 61850 protocol
- Advanced adaptive protection scheme

Benefits

- Increased system reliability
- Better SAIFI and SAIDI factor
- High-speed reconfiguration < 300ms
- Integration in existing system

Self-healing Grid
Koprivnica Solution

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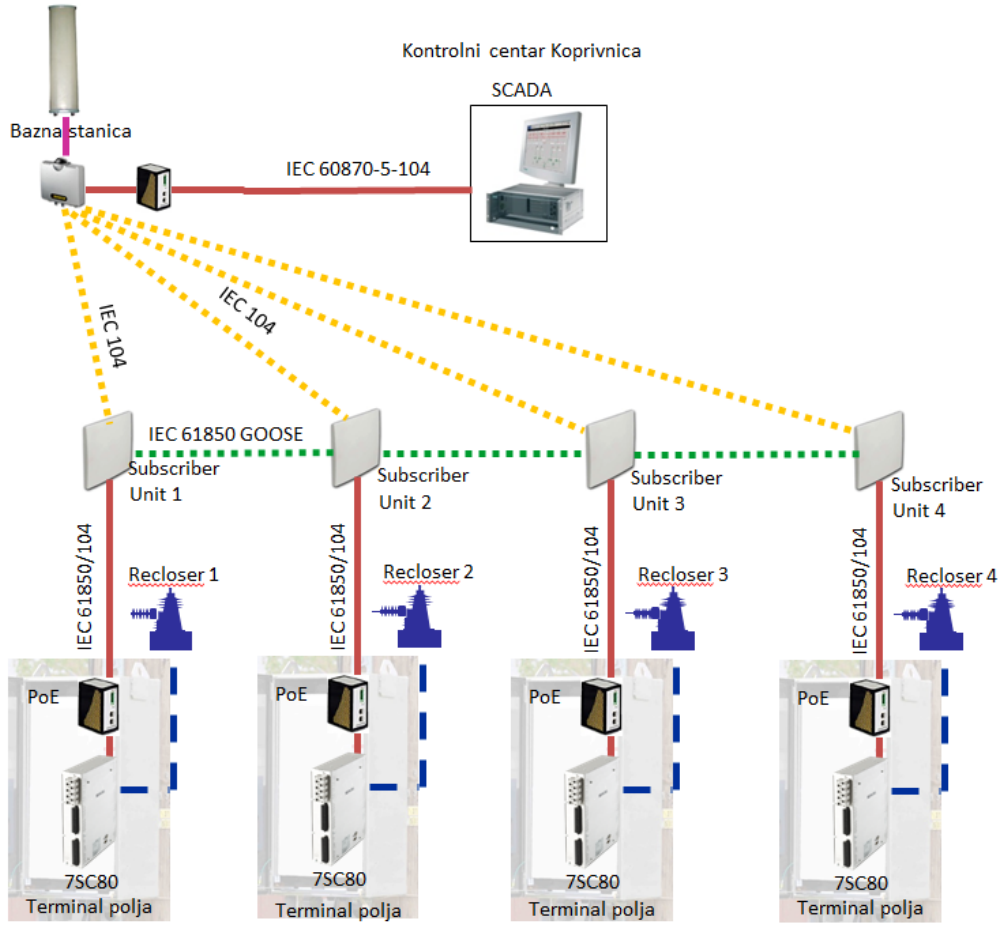
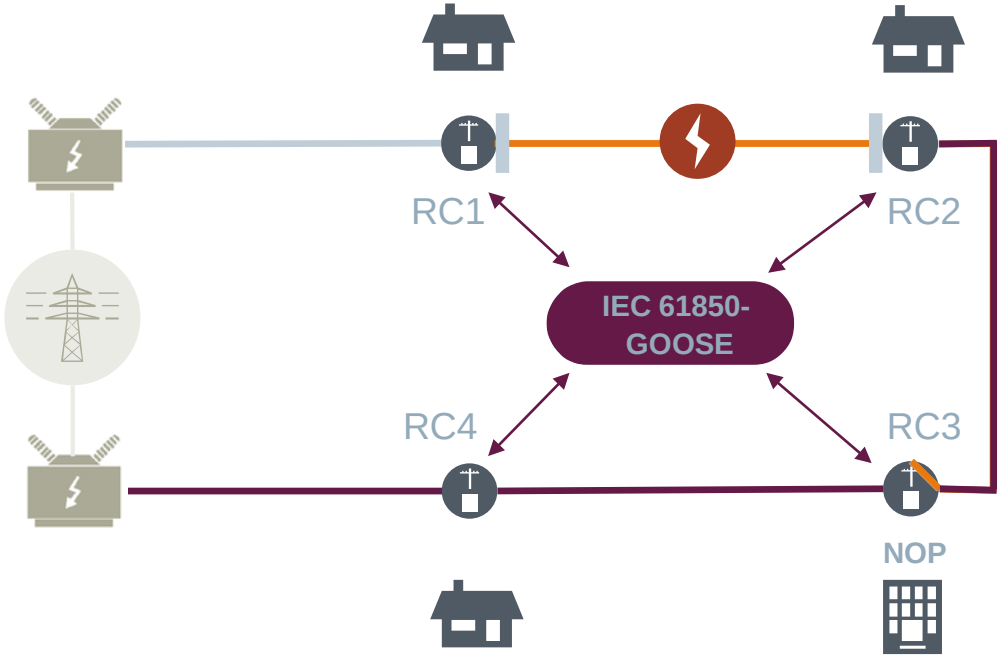
- Siemens 3AD Recloser + 7SC80 controller
- Decentralized architecture
- 2 communication protocols in same time (7SC80):
  - IEC 61850 GOOSE - Fault detection, isolation and power restoration < 300ms
  - IEC60870-5-104 - vertical communication to control center
- Advanced protection functions (jDiff, adaptive protection)
- Local engineering and local partners

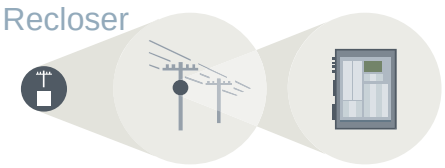


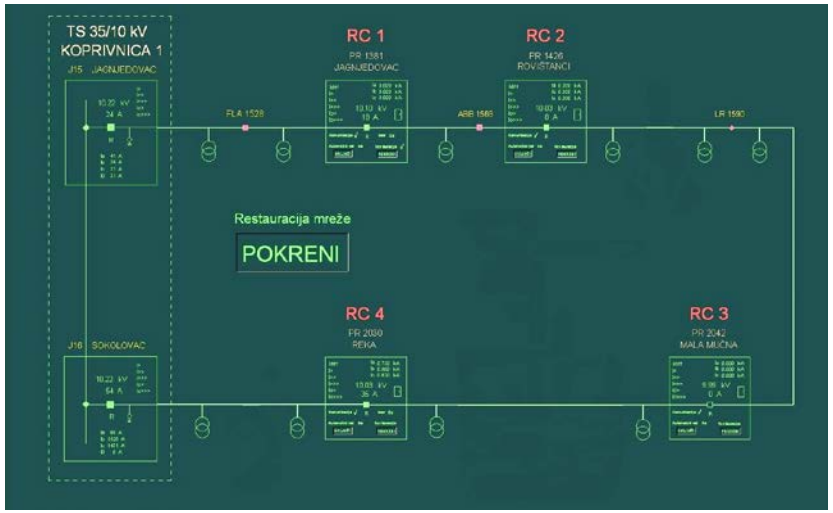
Self-healing grid Koprivnica - solution

- FLISR - Fault location, isolation and service restoration
- ATS - Automatic transfer source



Recloser





Adaptive protection 1

- **Jump differential (jDiff)**
- Selectivity and protection coordination – predefined scenarios

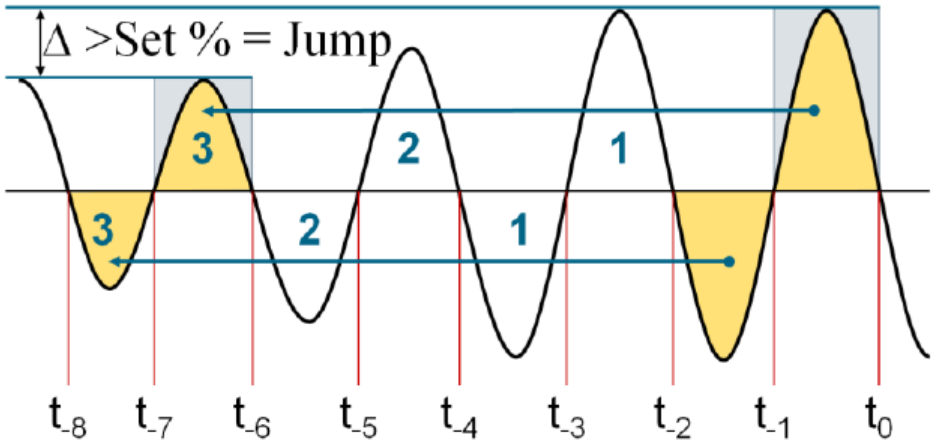


Figure 5 - Jump Differential detector

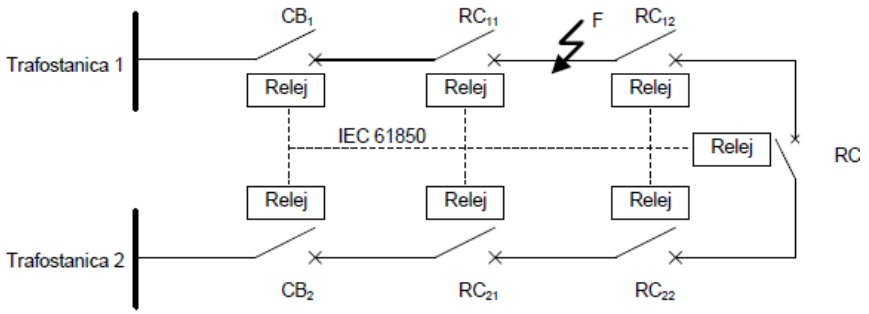
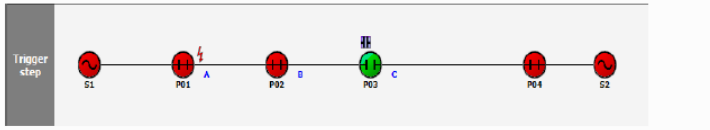


Figure 1 - OHL with communication

Adaptive protection 2

- Jump differential (jDiff)
- **Selectivity and protection coordination – pre-defined scenarios**



Step	P01	P02	P03	P04
Isolation during transient fault (first cycle of Auto Reclose successful)				
1	Open	Open	Close	-
2	Close	Open	Close	-
Isolation during permanent fault (first and second cycle of Auto Reclose unsuccessful)				
1	Open	Open	Close	-
2	Close	Open	Close	-
3	Open	Open	Close	-
4	Close	Open	Close	-
5	Open	Open	Close	-
Restauration after transient fault (return to initial state)				
1	-	Close	Open	-
Restauration after permanent fault (return to initial state)				
1	Close	Close	Open	-

Figure 4 - Switching sequence matrix for fault on section A

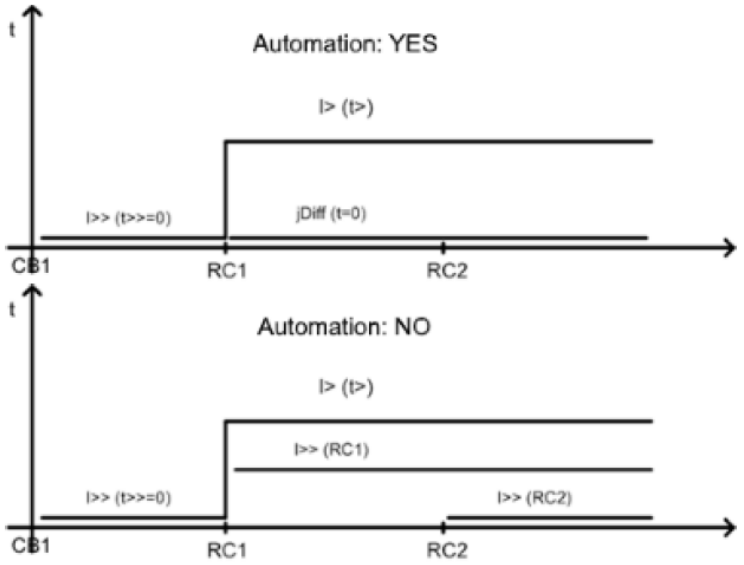


Figure 7. Protection coordination in zone 1 with and without communication (automation)

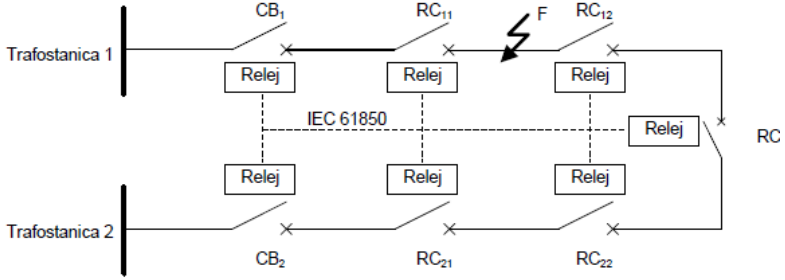


Figure 1 - OHL with communication

Communication solution

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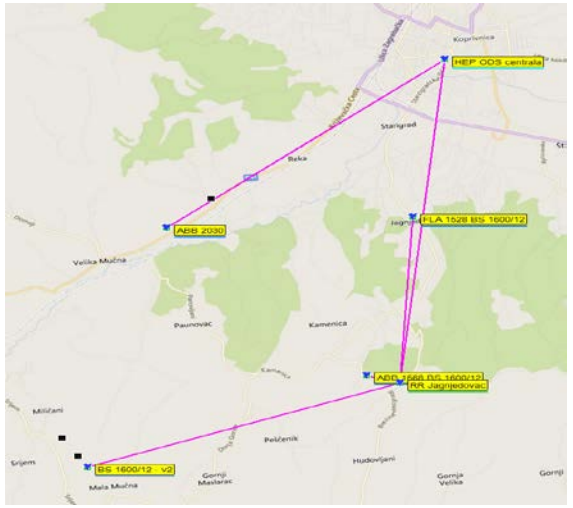
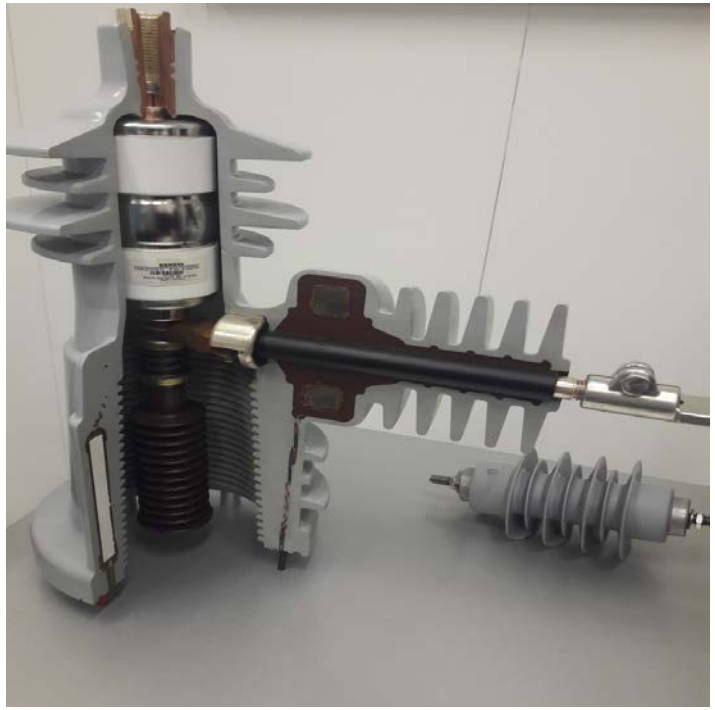
- Preliminary planning was needed due to difficult terrain
- Telecommunication pole 70m height –
  to achieve direct optical visibility
- Microwave radio equipment, frequency range 5.4 GHz
- Point-to-point and point-to-multipoint links
- Testing on all locations to ensure that links have enough:
  - Throughput 25 Mbit/s
  - High reliability (≥99.99%)
  - Low latency
- Antennas are located at 8m height on poles



Pre-commissioning period



Factory visit, Berlin

Vacuum recloser cut-out

Simulation in test lab,
Nurnberg and Zagreb

Factory test of complete solution,
Zagreb

Commissioning period

Instalation period of 3AD recloser RC2

3AD Recloser and Communication antena

Signal testing and energizing of 3AD recloser 1 (Master)

Secondary Distribution Automation
Intelligent Ring Main Unit

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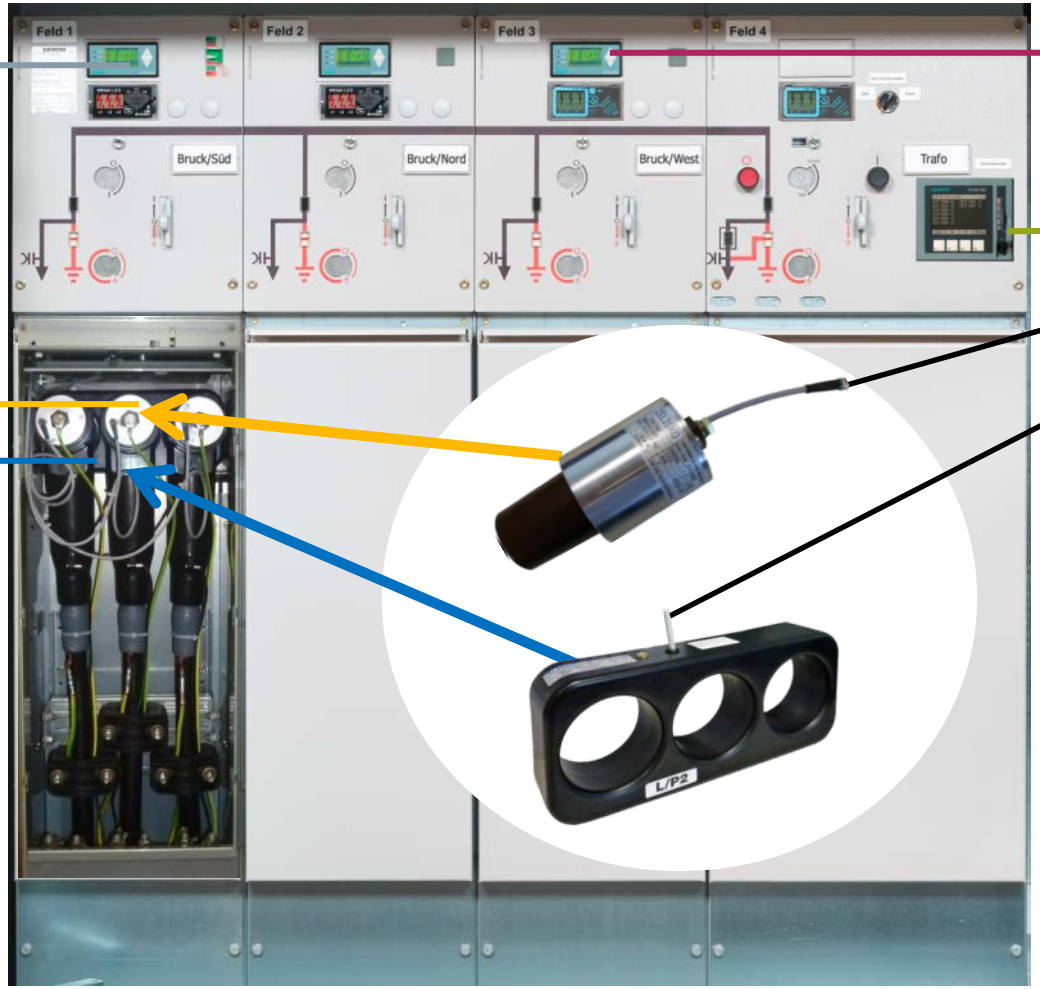
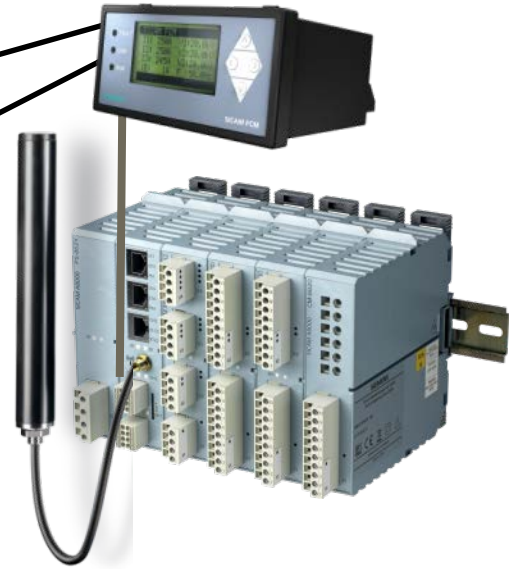
Motor Control Unit,
electronic control for
switching devices in 8DJH

Low-power voltage transformer for
SICAM FCM acc. to IEC 61869-7,
3.25V/√3 @ Ur max. 24kV

Low-power current transformer
for SICAM FCM acc. to
IEC 61869-8, 225mV @ 300A



Monitor for supervision of the
distribution grid
SICAM FCM (Feeder Condition Monitor)



Smart Grid RTU SICAM A8000
for automation of distribution grids

RC-HR Siemens d.d.
Center of Competence

Self Optimizing Grid
Sales and engineering competencies

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- Siemens RC-HR regional competence center for consulting on delivering SDA projects, namely the decentralized solution
- Local engineering know-how and SDA expertise
    - o We know the tools
    - o We can test the solution – with IEC61850 and GOOSE communication
    - o We can test the application
- Training and engineering support for the opportunities from Siemens local organization and their VAR partners
- Fully equipped lab/test facilities
- And proven experience (SDA project references) from the bidding phase to the delivery

Self Optimizing Grid - CoC
Regional and customer support

- SDA RC-HR Lab for testing and engineering
- Training on SW tools (e.g. FASE, DIGSI, DM, etc.)
- Pre-engineering and FAT support
- Simulation tools / demos

Thank you for attention!
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