Managing a MPLS based Process Network

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The business in figures

- 32 own hydroelectric power plants
- 2 combined heat and power plants
- 150 km of district heating pipes
- 200,000 end customers
- 16,500 km overhead lines and cables
- 3,500 km of fiber optic cables
  - 4,100 IP nodes
  - 150 MPLS nodes
- 1,100 employees
Smartgrid Core – transition from legacy PDH/SDH network to standardized IP/MPLS network

**Proprietary PDH/SDH Network**

- Existing legacy network
- SDH/PDH
- Line switched
- Security by obscurity

**IP Network**

- New standardized network
- IP/MPLS WAN Core
- Packet switched
- Security by design and standardization
One infrastructure for all services

Advantages

• One Infrastructure
• Similar to commercial Service Provider networks. Use of network «Best Practice» principles
• Lower operational cost
• Security
• Flexible
• Future needs
• Support long life cycle for grid equipment
• Easy to scale and extend
Phase Two Test Design 1+1 system (18 month)
Actual Design

MPLS-TE
IGP:ISIS
MP-BGP
SyncE
1588v2
Clock Source
Gastroplastic Simulating
Lumen
Circuit Emulation Pseudowire
C37.94
Transmit/Receive (110VDC/220VDC)
Clock Source
Gastroplastic Simulating
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Circuit Emulation Pseudowire
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Transmit/Receive (110VDC/220VDC)
GPS
132kV
Management Architecture

- Security Management
- Performance Management
- Fault Management (MOM)
- Configuration Management
- Report Management
Management Architecture

Security Management

Performance Management

Fault Management (MOM)

Configuration Management

Report Management
Network Monitoring

- **Passive Monitoring**
  - Netflow
  - SNMP
  - Syslog

- **Active Monitoring**
  - IP SLA
    - UDP Jitter in the MPLS Core
    - IP SLA Probes (Shadow Routers)
    - Watchdog for Crypto Routers (ICMP)
  - Ethernet OAM
    - Circuit Emulation tunnels. Teleprotection
IP SLA UDP Jitter Monitoring

IP SLA Source (Shadow Router) → MPLS Cloud → IP SLA Responder

UDP Stream
IP-SLA UDP Jitter Monitoring

- GPS
- Clock Source
- MPLS-TE
- IGP: ISIS
- MP-BGP
- SyncE
- 1588v2
- Circuit Emulation
- Pseudowire
- Transmit/Receive (110VDC/220VDC)
- SNMP Poll

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MPLS-TE

NOC

GPS

C37.94
IP-SLA ICMP for Crypto Routers

- **IP SLA as Connectivity Test**
  - Used for Self Recovery
  - ICMP packets are sent every 5 min
  - If test fail, Recovery will start
    - 10 min: Restart Cell Interface
    - 60 min: Restart Cell Module
    - 8h: Restart Router

IPSLA operation id: 1
Latest RTT: 72 milliseconds
Latest operation start time: 16:35:18 CET Tue Mar 14 2017
Latest operation return code: **OK**
Number of successes: 4
Number of failures: 0
Operation time to live: Forever

If not **OK** recovery will start
Ethernet OAM

- MPLS-TE
- IGP: ISIS
- MP-BGP
- SyncE
- 1588v2
- Circuit Emulation
- Pseudowire
- Transmit/Receive (110VDC/220VDC)
- GPS
- Clock Source
Thank you for your attention