ABB Communication Networks

Latest News FOX615 / References with TROPOS Mesh
Why ABB for Utility Communication solutions
Benefit from integrated know how
Focus standards for the Utility market
Active participation in defining future solutions

[Logos of IEC, CIGRE, and IEEE]
Utility Communication
An integrated network
Utility Communication
An highly Integrated Network
FOX Family
MPLS-TP on the Road-Map

FOX515H
Transport Multiplexer providing up to SDH STM-64 interfaces

FOX660
Hybrid optical transport multiplexer providing SDH interfaces up to STM-16 & 10GbE inclusive MPLS-TP in one device

FOX515 / 615
Combined access and transport multiplexer providing up to SDH STM-16 & 10GbE capacity and many legacy data access interfaces

FOX505
Access multiplexer providing legacy data access interfaces and traffic capacity up to STM-1

Legacy data ( < n x 64kbps)
Teleprotection / Voice

© ABB Network Management Forum
October 14, 2013 | Slide 6
Interoperability with existing FOX515 networks
FOX515/FOX615 full interoperability
Power utilities applications

Utilities mission in the focus

- Power utility need to reliably transmit and distribute electrical energy
- Various applications help the utility to ensure the reliable energy transmission and distribution
- Some of them are mission critical
  - Requiring real time communication
  - Requiring predictable and constant communication channels

- The Utility Communication-Network helps to achieve reliable energy transmission and distribution and accordingly it needs to fulfil the requirements defined by the applications without compromise
Teleprotection functionality – safeguarding the electrical grid (distance and differential protection is a must!)

- In case of malfunction the potential implications are tremendous
  - Blackouts
  - Destroyed primary equipment such as transformers or switchgears

- Requirements on communication performance are very high
  - Hard real-time communication
  - Very deterministic data channels
  - Very high network availability
  - Very high dependability and security
## Application requirements

### Overview about various applications

<table>
<thead>
<tr>
<th>Service</th>
<th>Data rate</th>
<th>Acceptable latency [ms]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voice</td>
<td>2.4 – 100 kbit/s per channel</td>
<td>&lt; 100</td>
</tr>
<tr>
<td>Telecontrol</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SCADA</td>
<td>0.05 – 64 kbit/s</td>
<td>&lt; 1000</td>
</tr>
<tr>
<td>ICCP</td>
<td>2 Mbit/s – 100 Mbit/s</td>
<td>&lt; 1000</td>
</tr>
<tr>
<td><strong>Distance Protection</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blocking</td>
<td>&lt; 64 kbit/s</td>
<td>&lt; 4 - 8</td>
</tr>
<tr>
<td>Permissive</td>
<td>&lt; 64 kbit/s</td>
<td>&lt; 5 - 10</td>
</tr>
<tr>
<td>Intertrip</td>
<td>&lt; 64 kbit/s</td>
<td>&lt; 8 - 16</td>
</tr>
<tr>
<td><strong>Line Differential Protection</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EHV (Extreme High Voltage)</td>
<td>64 kbit/s – 2 Mbit/s</td>
<td>&lt; 5</td>
</tr>
<tr>
<td>HV (High Voltage)</td>
<td>64 kbit/s – 2 Mbit/s</td>
<td>&lt; 10</td>
</tr>
<tr>
<td>MV (Medium Voltage)</td>
<td>64 kbit/s – 2 Mbit/s</td>
<td>&lt; 40</td>
</tr>
<tr>
<td>Video Surveillance</td>
<td>256 kbit/s – 10 Mbit/s</td>
<td>&lt; 1000</td>
</tr>
<tr>
<td>Other operational data</td>
<td>64 kbit/s – 100 Mbit/s</td>
<td>&lt; 1000</td>
</tr>
</tbody>
</table>

1) Line Differential Protection is very sensitive to Jitter/ Wander and asymmetrical delay (movie)
Operational excellence
The need for multiservice networks

- Requirement for huge variety of different interfaces
- Requirement for utility specific interfaces such as Teleprotection
- Requirement for real time data channels for mission critical applications
- Requirement for channel supervision for mission critical services (e.g. Teleprotection)
- Requirement for support of various protocols and topologies
- Requirement for highest communication channel availability
References FOX networks world wide
Technology trends
FOX615
Technology trends
Packet switched backbone networks

- Presently the public telecom sector is strongly going for IP/MPLS solutions
  - Driven by high data volume traffic in their networks (smartphones, tablets, etc.)
  - Good and cost effective solution for low to medium performance demanding applications such as data or voice
  - Bandwidth optimization (overbooking) is key for increased revenues
- Utility’s operational networks require to transmit real time data
  - Control and availability of utilities assets is core business and depends on communication network reliability and performance
  - Selected utility applications (e.g. differential protection) require high performance data channels
    - Very low and deterministic delay times
    - Symmetrical delay times for send and receive directions
    - Highest availability figures of the communication channels
**Technology trends**

**Why not IP/MPLS for utilities?**

- IP/MPLS is a technology designed for public telecom applications
  - Problems with applications requiring deterministic communication
  - Problems with symmetry requirements of utilities applications
  - Problems with predefined (fixed) channel routing
  - Lack of channel supervision and fast protection schemes
  - Very complex in terms of configuration & maintenance (based on experience of pilot installations and first projects)

- Cost advantage for power utility presently seen in IP/MPLS solutions/equipment's might not be materialized due to:
  - Significantly increased complexity and effort on configuration and maintenance side (high OPEX)
  - Requirement for highly specialized (expensive) staff for operation and maintenance of the communication network

- **IP/MPLS might not be the best technology for a utility**
Technology trends
ABB’s outlook with FOX615

- ABB is carefully investigating possible solutions for future packet switched backbone networks considering:
  - The application and availability requirements of utilities
  - The configuration effort required for such solutions
  - The supervision and management possibilities
  - The right point of time for PDH/SDH - packet switched technology migration

- ABB product family however already supports sophisticated packet switched functionality

- ABB continues introducing solutions designed for utility applications via packet switched networks
  - FOX615 e.g. is fully prepared for future migration from SDH to packet switched networks
  - ABB sees MPLS-TP as the most promising technology for future utilities operational networks
Technology trends
SDH & Ethernet are complementary

- Understand SDH & Ethernet as complementary technologies
  - SDH provides QoS for real-time applications
  - Ethernet access interfaces allow efficient integration of data applications
  - Next Generation SDH (GFP, VCAT, LCAS) enables standardized transport of Ethernet applications in SDH WAN networks
  - Enhanced Ethernet functionality makes the equipment future prove
    - Strong Ethernet switching matrix must be available
    - High performance access interfaces must be available
    - Future migration Packet Switched Technologies with traffic engineering and QoS must be possible
Future communication networks for power utilities
Optimized approach – hybrid solution
ABB FOX515/ FOX615 solutions
Summary

- FOX615 provides…
  - full interoperability to FOX515
  - similar TDM access interfaces as FOX515 including utility specific interfaces such as Teleprotection
  - support of SDH technology until 2020 and beyond
  - significantly enhanced Ethernet/ IP interfaces & services

- FOX615 is a utility grade equipment (enhanced temperature range, EMC/ EMI) based on well proven FOX515 experience

- FOX615 provides investment protection because of:
  - Full interoperability with huge installed FOX515 base
  - Future upgradability to Packet Switched Networks
  - Full integration into the FOXMAN-UN NMS
Tropos
WLAN-Mesh
Wireless Technologies Overview

Wireless Networks

- Private Networks (investment based)
  - V/UHF Modem (Low speed data)
  - V/UHF PMR (Low speed data, voice)
  - MW PtMP (High speed data)
  - MW Mesh (High speed data)

- Public Networks (fee based)
  - Satellite (Low speed data)
  - Cellular Nets (data and voice)
  - MW PtMP (High speed data)

- + Security
- + Reliability/Performance
- - Longer deployment
- - Capital investment
- + Low investment
- + Immediate deployment
- - Operation fees
- - Security/reliability/Perf.

TETRA
MPT1327 - DMR
WiMAX
HyperLAN
WiFi

© ABB Network Management Forum
October 14, 2013 | Slide 21
eMobility Germany
Wolfsburg AG, Wolfsburg

- Tropos WLAN-Mesh running since 2008
- Over 70 Dual-Band 6320 Routers installed
- Next extension +70 Dual-Band Routers
- Tropos-Network covers over 20 km²
- Applications in use over the network:
  - SCADA
  - Free parking space
  - eCharging Stations
  - Public WLAN
Abu Dhabi Electric & Water Authority (ADWEA)
Efficient resource management, emirate-wide

- Over 1 million smart power and water meters in urban, suburban and rural areas connected by Tropos network
- Tropos network spans >3,000 square miles
- Built to support multiple Smart Grid applications simultaneously
  - Advanced Metering Infrastructure (AMI)
  - Real-time SCADA substation control
  - Distribution automation (DA)
  - Mobile workforce connectivity
  - Substation video security
  - Street light control
Avista, USA
Two smart grid projects – both using Tropos GridCom

- Spokane Smart Circuits Project
  - Goal: reduce outage times through faster detection and isolation of faults
  - 14 substations and 59 distribution feeders serving >110,000 customers
  - Network connects >200 DA devices

- Pullman Smart Grid Demonstration Project
  - AMI: 13,000 power and 5,000 gas meters
  - DA: 13 feeders and >60 DA devices (reclosers, cap banks, transformers)
  - Part of the Pacific Northwest smart grid demonstration project
  - Opportunity to extend use of networks for additional applications