

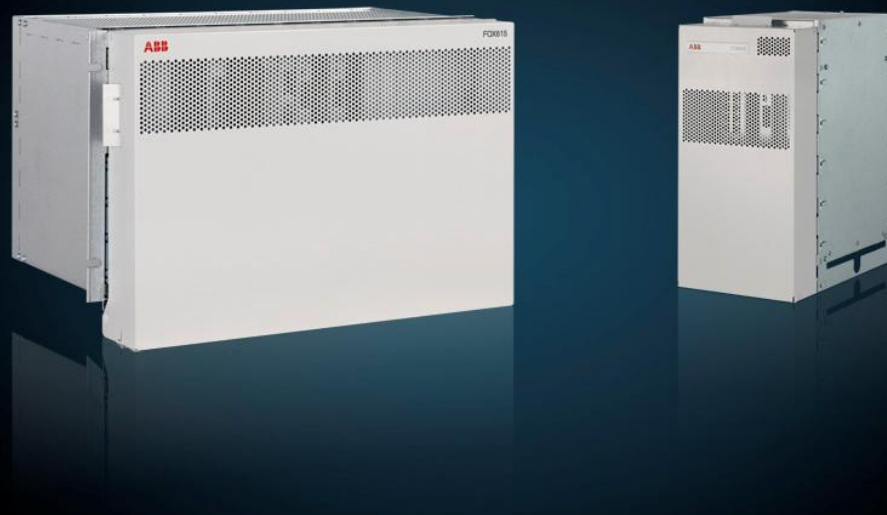
Ramon Bächli, PSNM, 27.01.2014

# ABB communication networks

## FOX615 universal multiplexer for utility networks

# Agenda

- Requirements for utility communication
- The FOX615 Platform
  - FOX615 concept
  - FOX615 – made for utilities requirements
  - FOX615 – interoperability with FOX515
  - FOX615 – technical information
  - FOXCST – intuitive configuration tool
- Network Management System FOXMAN-UN
- Summary



# ABB Utility Communication Requirements

# Requirements for utility communication EMC/ EMI



Substation environment faces:

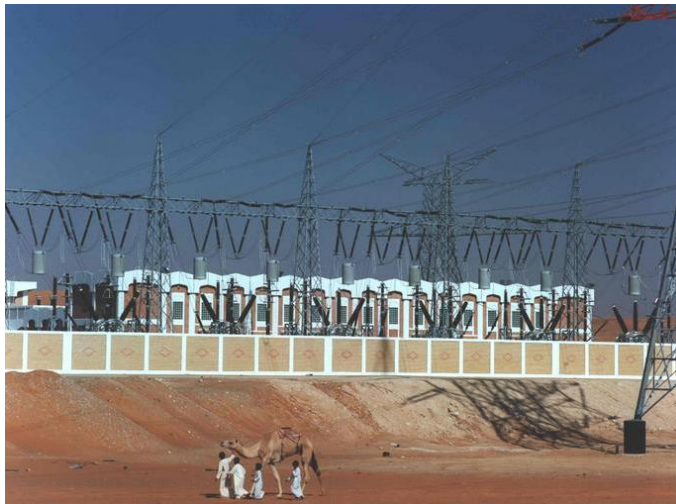
- Very high voltage levels
- Very high current levels (specially in case of short circuit)

→ Strong electrical- & magnetic fields

- Utility communication equipment must withstand this stress without any influence on communication
- IEEE 1613 defines EMC/ EMI requirements for substation environment

# Requirements for utility communication

## Ambient conditions



- Utility communication equipment will be installed in locations with enhanced environmental requirements
- Proper air conditioning might not always be the case
- Utility Communication equipment must be designed for enhanced temperature range and provide reliable communication services even under very high or low temperatures



# Requirements for utility communication

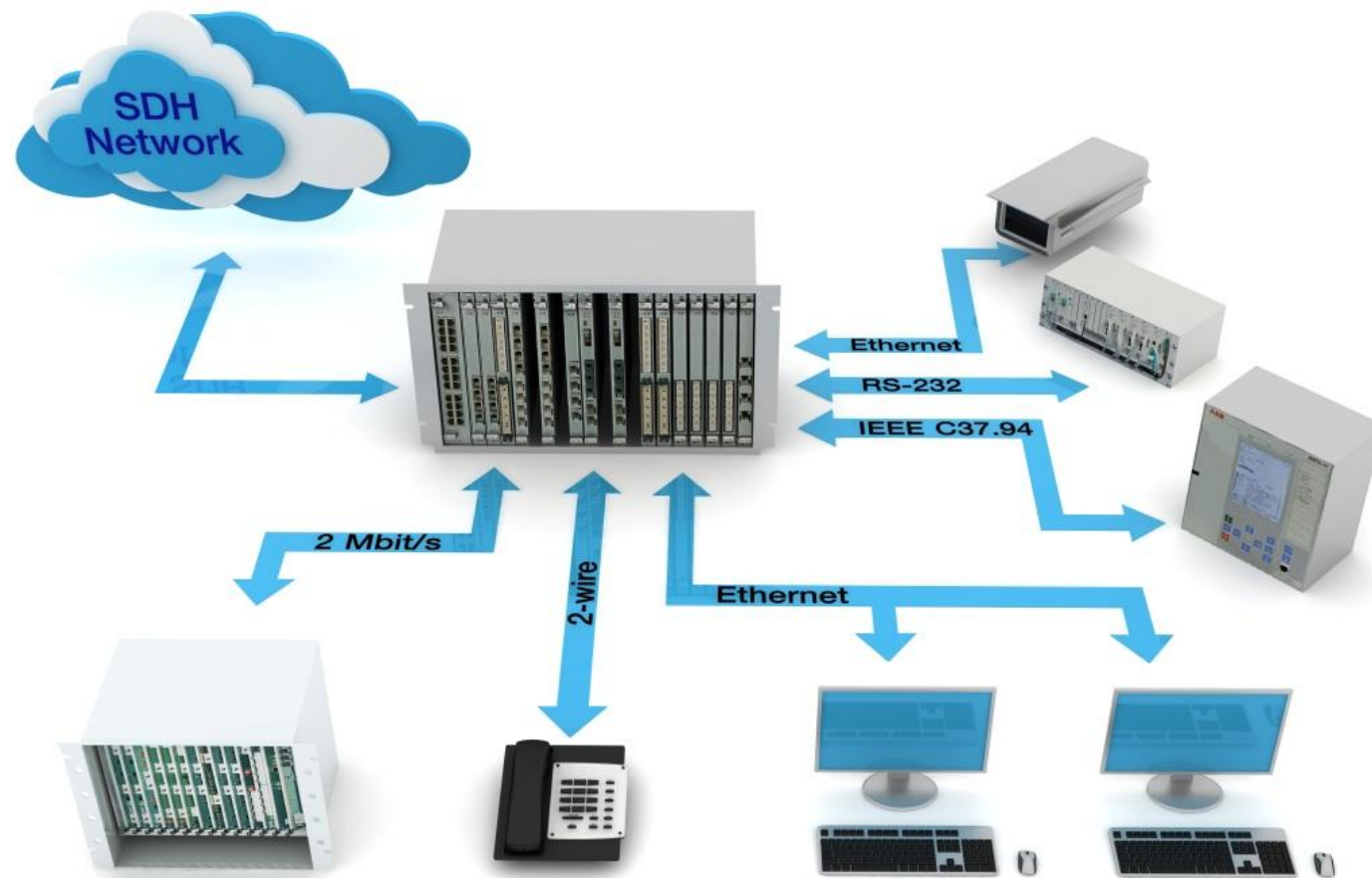
## Life time cycle



- Equipment in substation/ utility environment will be operating much longer in comparison to public telecom operators network
- Very high MTBF of the equipment required to guarantee correct operations over total life cycle
- Long time availability of spare parts & extension material required

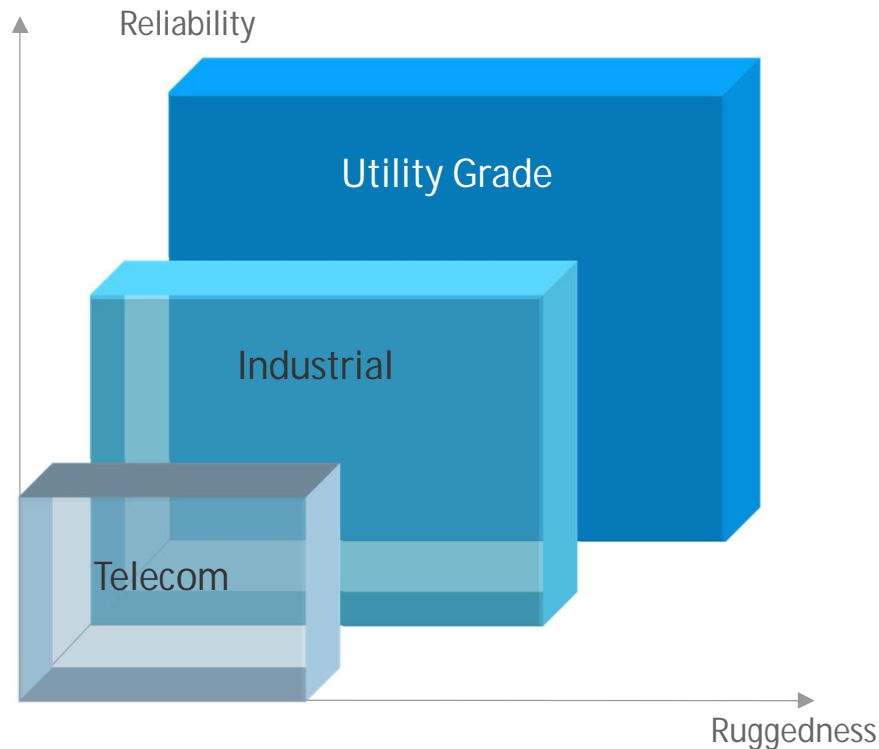
# FOX615 multiservice platform

## Requirements



# FOX615 multiservice platform

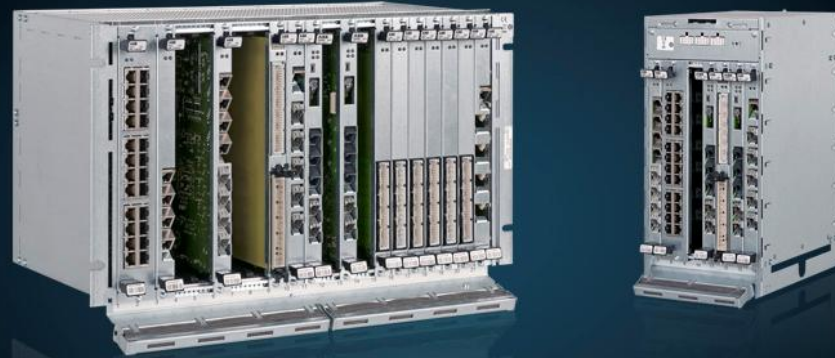
## Utility Grade Products Requirements



Utility Grade means...

- High levels of Electromagnetic Immunity
- Wide variation in environmental influences (temperature, vibration, shock etc.)
- Sustainable product lifecycle strategy
- External Type Testing and intensive application testing
- Allowing redundant network structures in terms of media, path diversity, network resilience and hardware duplication
- Built in Security and Network Management

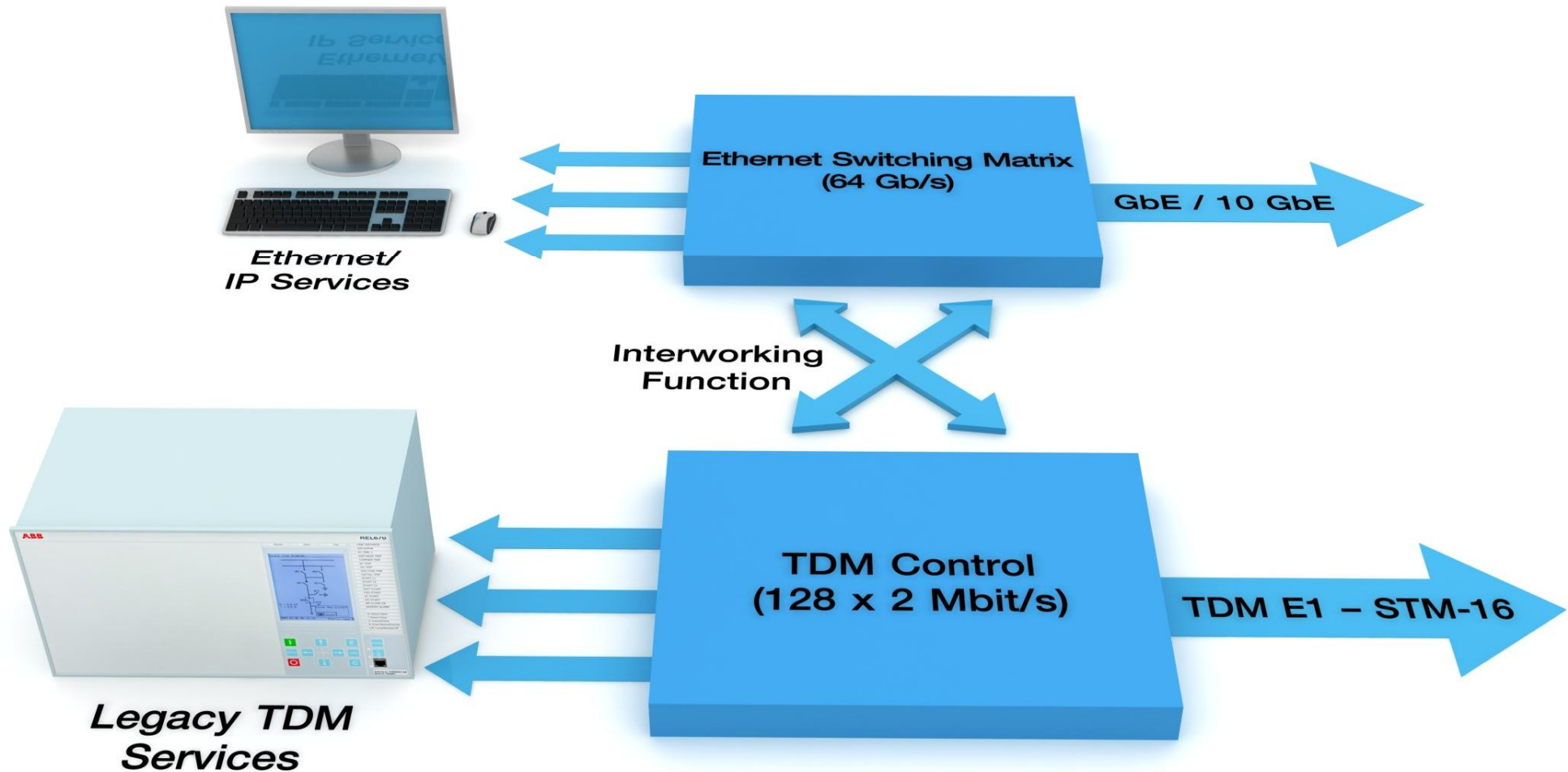




# FOX615 Concept

# FOX615 Concept

## Universal Equipment providing SDH and GbE Services



# FOX615 Concept Overview



FOX615...

- Is a universal communication platform providing:
  - Traditional TDM aggregate interfaces up to STM-16
  - GbE, 10 GbE aggregate interfaces and L2 Switching
- Has 19' subrack providing 21 (8) slots for plug-in modules
  - Providing Ethernet star connection to central cross connect (GbE & 10 GbE)
  - Providing TDM bus similar to FOX515 PBUS
- Provides Ethernet over SDH features
- Provides Circuit Emulation for TDM over Packet Switch Networks features

# FOX615 Concept

## FOX615 – Utility Grade Multiplexer



### Mechanical Layout

- FOX615
  - 21 slots for modules, including Central Unit
  - 19"- or ETSI-version available.
- FOX612
  - 8 slots for modules, incl. CPU
  - Vertical or horizontal mounting
- High MTBF figures, enhanced redundancy features
- Based on international standards (ITU-T, IEC, IEEE, EN, ETS)
- Redundant power feeding, distribute power supply

# FOX615 Concept

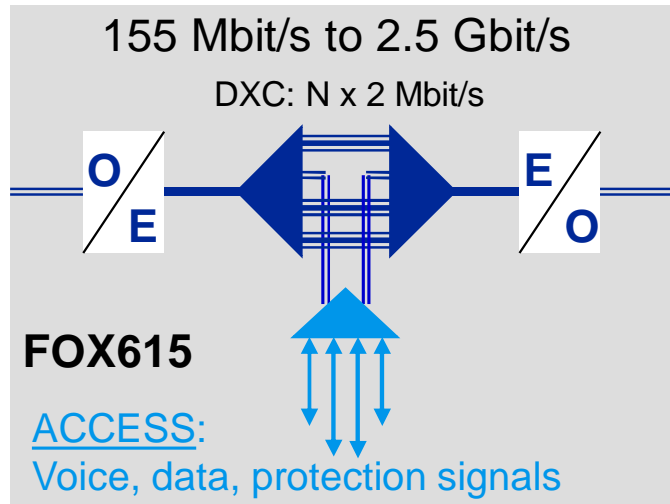
## Outstanding Multiservice Platform for power utilities





# FOX615 Concept

## Combined access – transport multiplexer



### Transport Level: Interfaces

- 10 GbE, optical
- 2.5 Gbit/s (SDH: STM-16), optical
- 622 Mbit/s (SDH: STM-4), optical
- 155 Mbit/s (SDH: STM-1), optical
- N x 2 Mbit/s, SHDSL, electrical

### With interfaces to all applications:

- Voice: Subscribers, PAX, PABX
- E1 (2 Mbit/s)
- Teleprotection/ Differential Protection
- Legacy data applications:  
600 bit/s ... N x 64 kbit/s, V.24/28, V.11/X.21,  
V.35, RS-485
- Ethernet/IP



# FOX615 Concept

## “Legacy” access interfaces



- “Legacy” data interfaces for connecting various existing equipment such as RTUs or energy meters
  - V.24/28, V.35, V.11, X.24, RS-485, G.703 64 kbit/s, E1 2 Mbit/s
  - Data rate from subrate 64 kbit/s up to  $n \times 64$  kbit/s ( $n = 31$ )
  - Asynchronous or synchronous data transmission



- Traditional voice interfaces for connecting to existing PABX or Telephone sets
  - 2 wire FXS
  - 2 wire FXO
  - 2/4 wire E&M

# FOX615 Concept

## Ethernet/ IP interfaces



- Ethernet/IP interfaces for connecting various IP applications such as energy meters, VoIP phones or cameras
  - Ethernet over SDH or PDH services
  - 4 to 24 physical ports
  - 10/100BaseT, 100Base/FX, 1000BaseSX/LX ports
  - Point – point Ethernet tunnel
  - L2 Switching (RSTP)
  - L3 routing (OSPF)
  - Power over Ethernet
- Strong redundant switching fabric of 64 Gbit/s capacity
- Distributed Switching Architecture
- 1 GbE and 10 GbE uplink ports



# FOX615 Concept

## Aggregate Interfaces



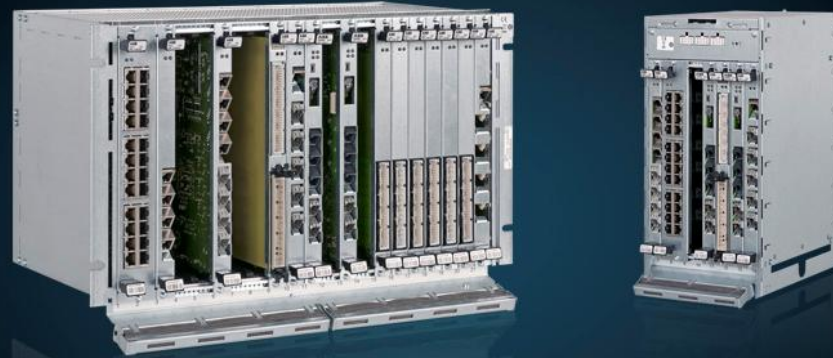
- SDH Aggregate interfaces providing 4 SFP cages per module
  - 2 x optical STM-4/16 ports
  - 2 x optical STM-1/4 ports
  - Hardware protection possible
  - Supporting protection mechanism: MSP 1+1, LTP (SNCP)
  - Linear, ring & meshed networks
- All modules are SFP based. Various types of SFPs supported
  - STM-1: S-1.1, L-1.1, L-1.2, X.1.2, U-1.2, also CWDM SFP available
  - STM-4: S-4.1, L-4.1, L-4.2, X.4.2, also CWDM available
  - STM-16: S-16.1, L-16.1, L-16.2, LR-16.2



# FOX615 Concept

## Reliability – Fanless design



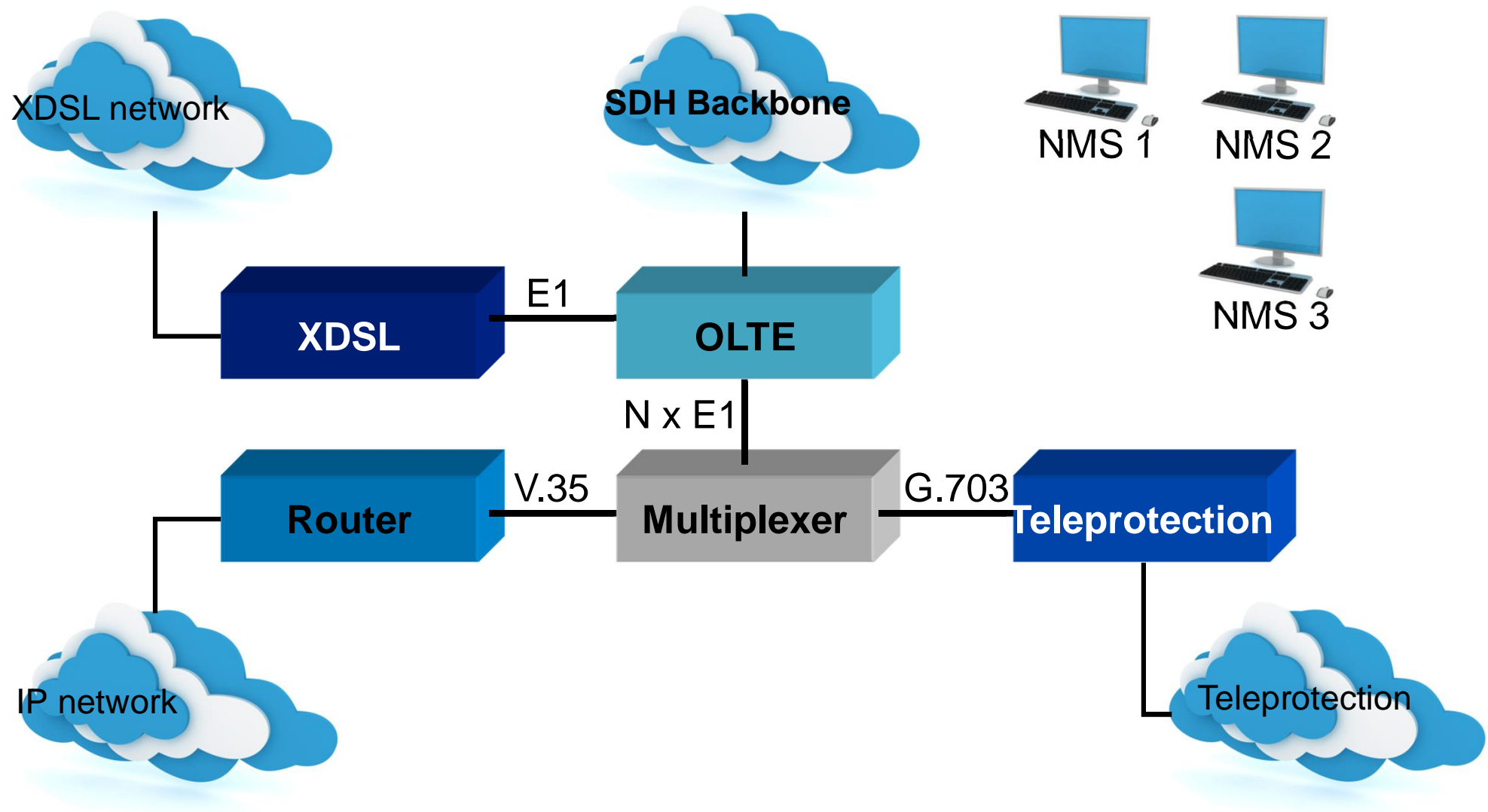


# FOX615

## Made to cover utilities requirements

# FOX615 - made for utilities requirements

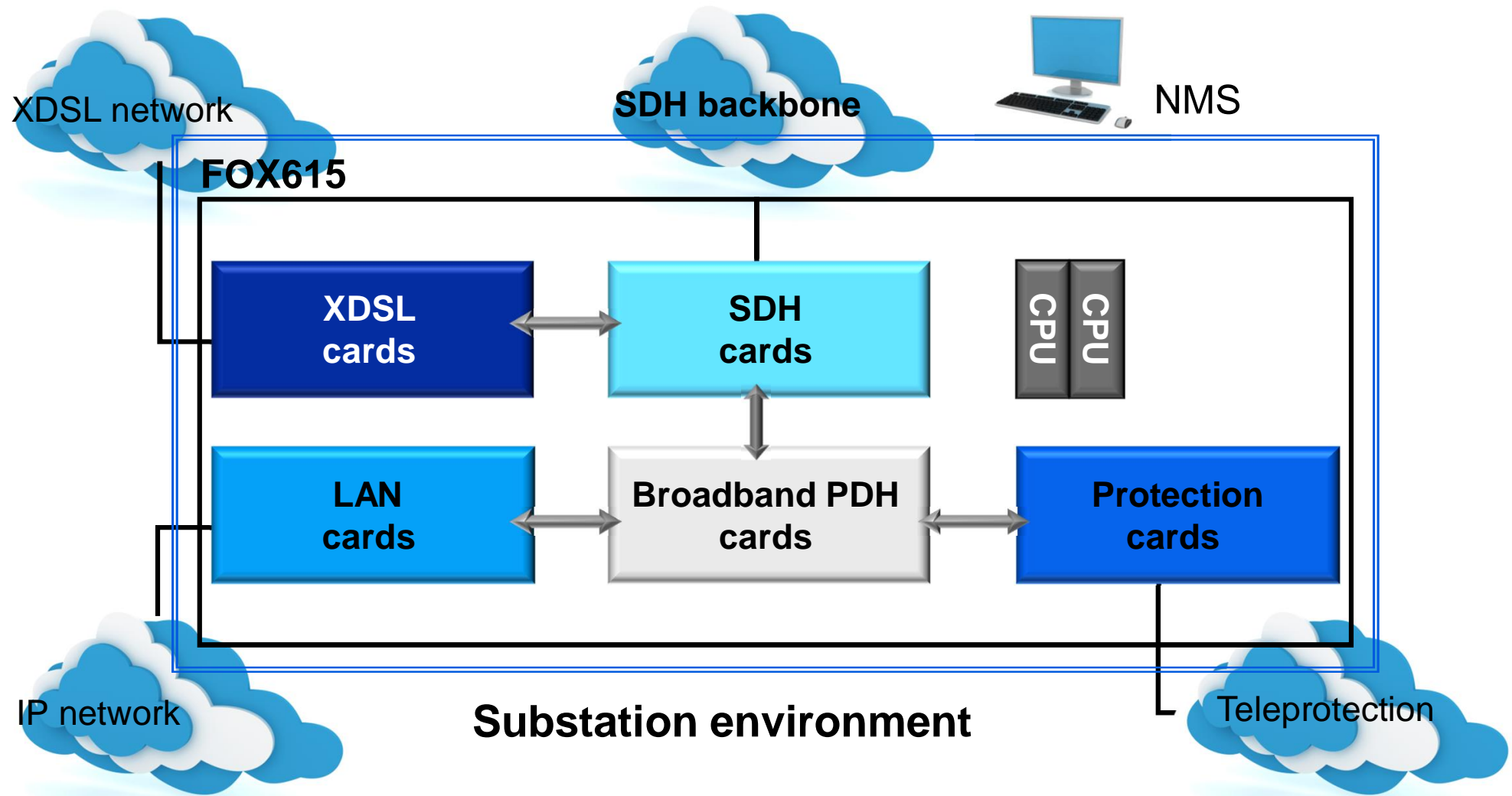
## Box concept





# FOX615 - made for utilities requirements

## FOX615 concept



# FOX615 - made for utilities requirements

## Advantages of FOX615 Concept

### Box Solutions

- Various configuration tools for different services
- Various Management Systems or complicated overall NMS integration
- Many external interfaces
- Low flexibility due to hardwiring of interconnections between individual boxes
- Different power supplies (might with different voltage levels), no redundancy
- Space consuming
- Maintenance intensive
- Various suppliers, different life cycles of each product

### FOX615 Solutions

- One configuration tool for all services including Teleprotection
- One Management Systems including Teleprotection application
- All interfaces are part of the FOX615
- High flexibility due to software cross connection functionality between interfaces
- One power supply with the possibility for redundant configuration
- Space saving, one 19' rack
- Easy to maintain and configure
- One single supplier with one life cycle concept for the whole equipment

# FOX615 - made for utilities requirements

## Teleprotection interfaces

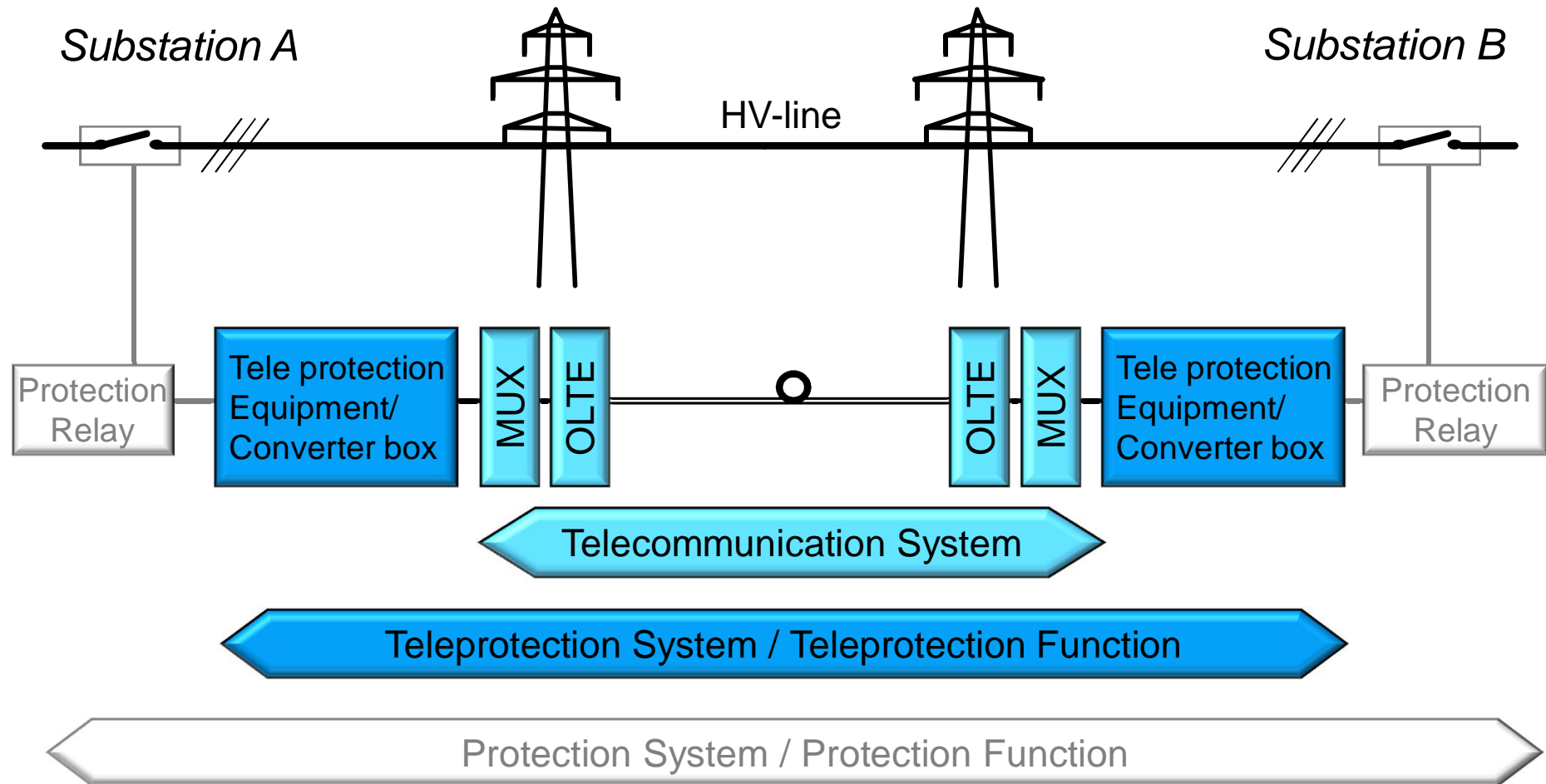


- FOX615 offers integrated interfaces for Protection applications
  - Integrated Teleprotection Interfaces for Distance Protection
    - 4 x Teleprotection Command Input/ Output
    - Additional binary Inputs/ Outputs, as well as relays available
    - Integrated Teleprotection equipment functionality
  - Integrated Teleprotection Interface for Differential Protection
    - 4 x SFP cage for:
      - IEEE C37.94 port for interconnection to Differential Protection relays
      - ABB optical ports for interconnection with REL316, REL551, REL561, NSD570 or FOX6+



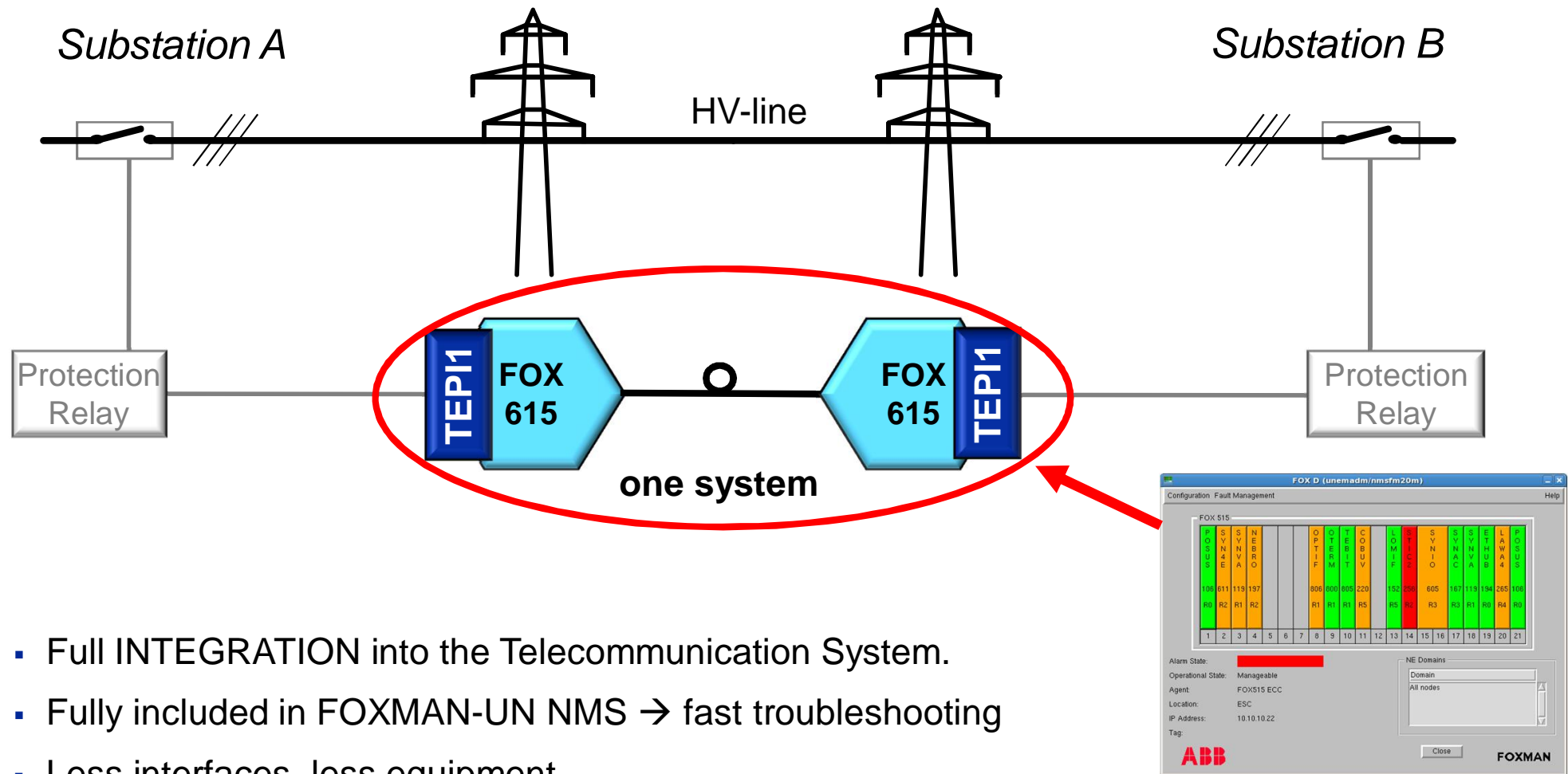
# FOX615 - made for utilities requirements

## Protection application - Traditional BOX-Solution



# FOX615 - made for utilities requirements

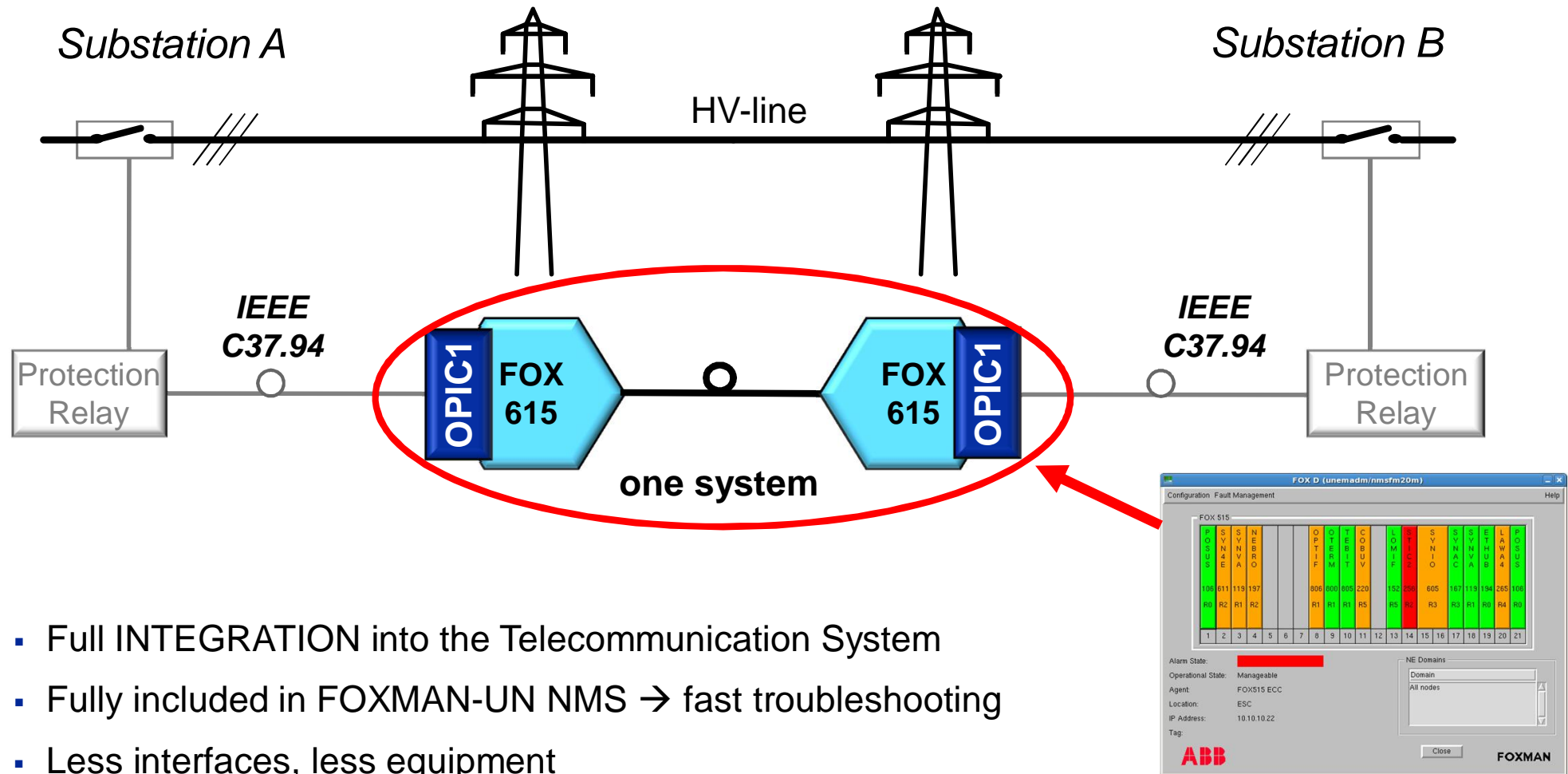
## Distance Protection - FOX615 Teleprotection Solutions



NMS: Network Management

# FOX615 - made for utilities requirements

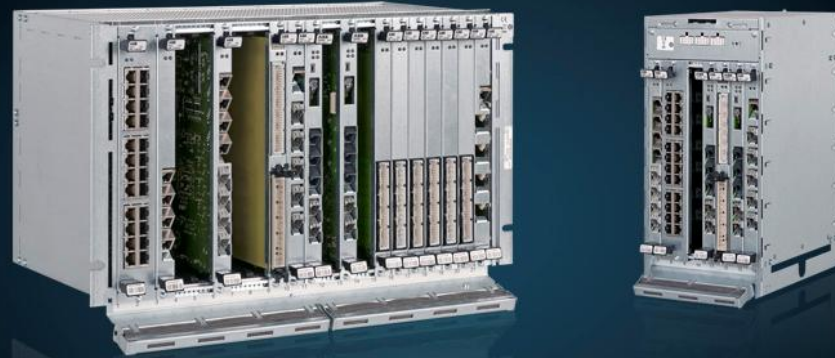
## Differential Protection - FOX615 Protection Solutions



- Full INTEGRATION into the Telecommunication System
- Fully included in FOXMAN-UN NMS → fast troubleshooting
- Less interfaces, less equipment  
→ Highly INCREASED AVAILABILITY!

NMS: Network Management



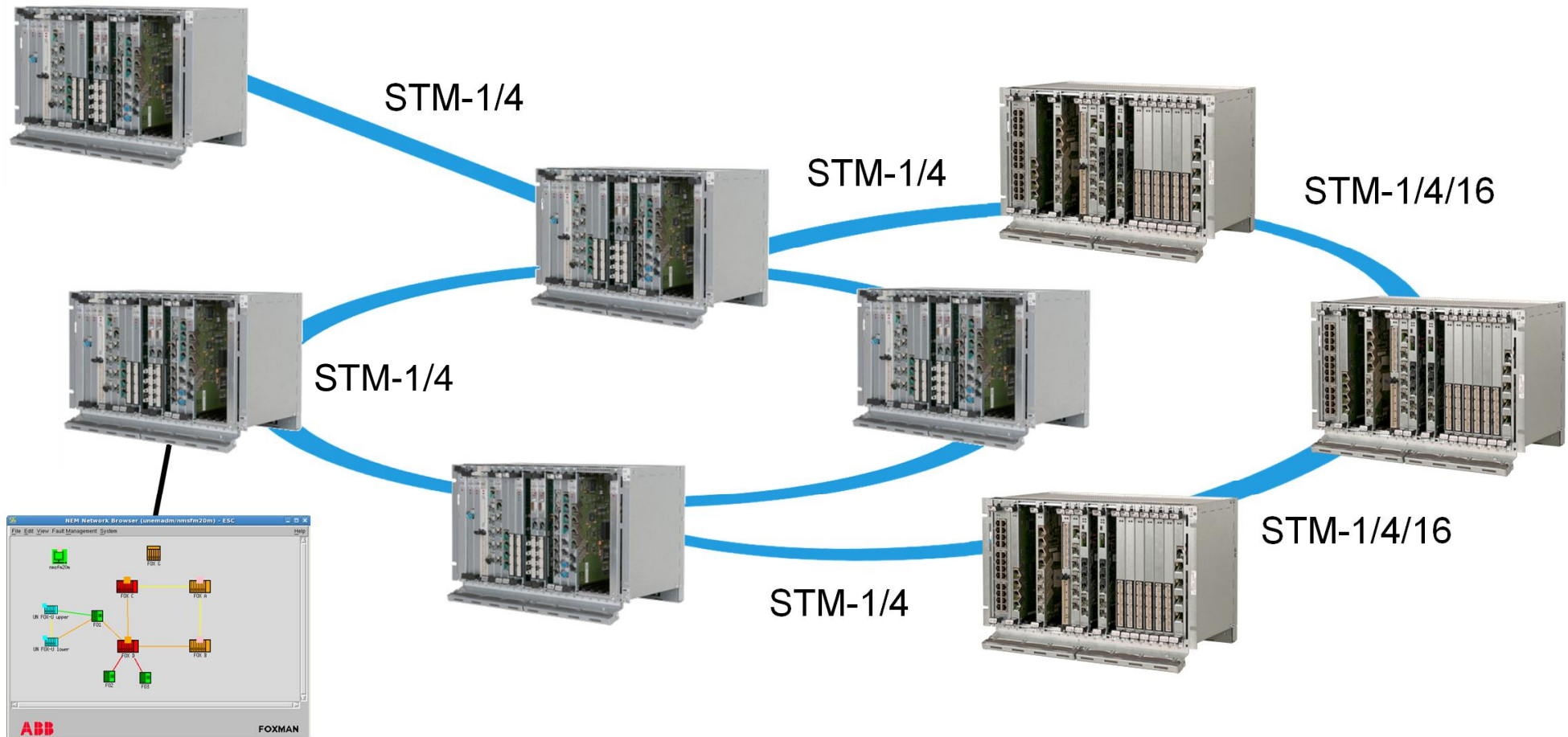


# FOX615

## Interoperability with existing FOX515 networks

# Interoperability with existing FOX515 networks

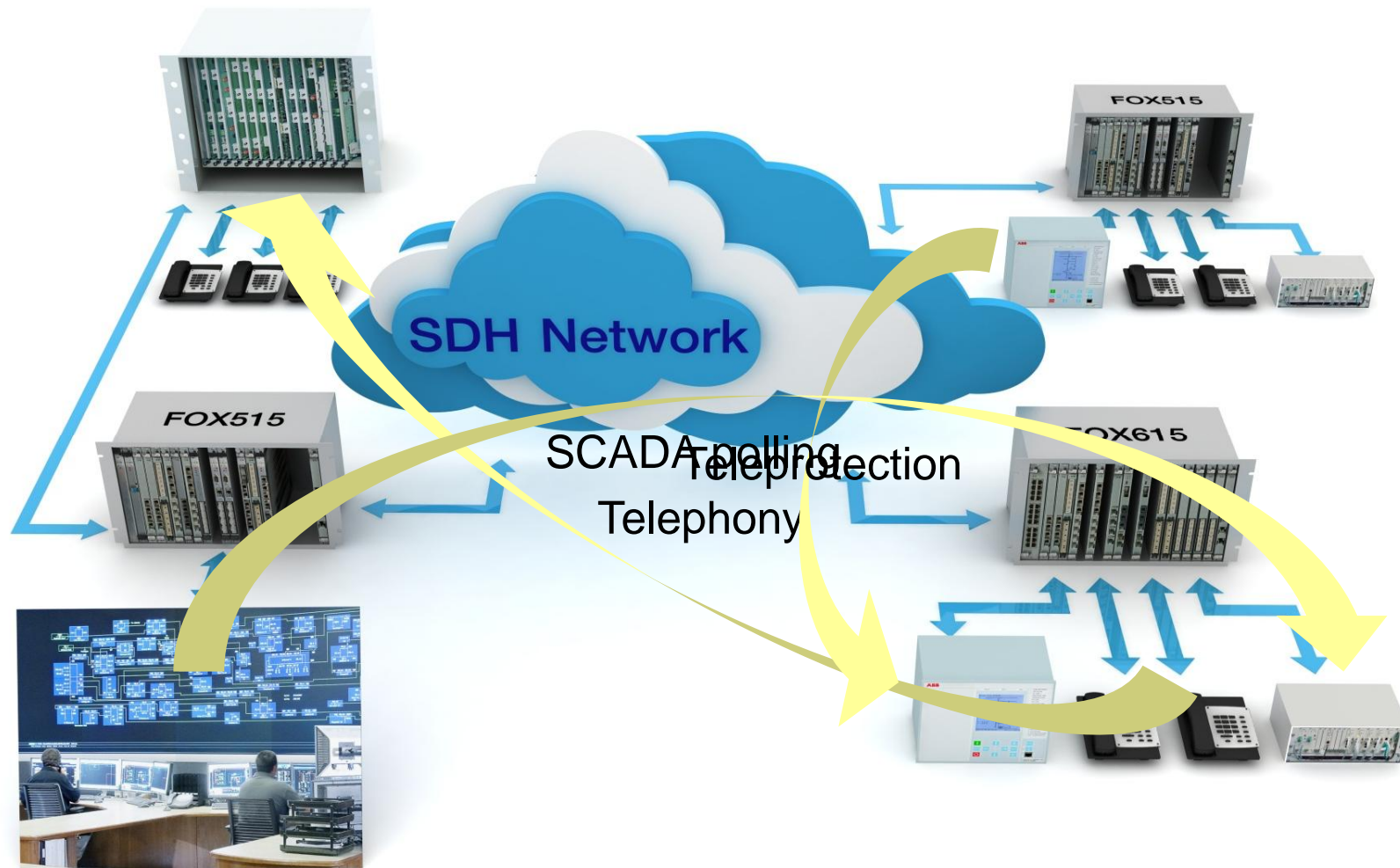
## Extension of existing FOX515 networks



Network Management  
System

# Interoperability with existing FOX515 networks

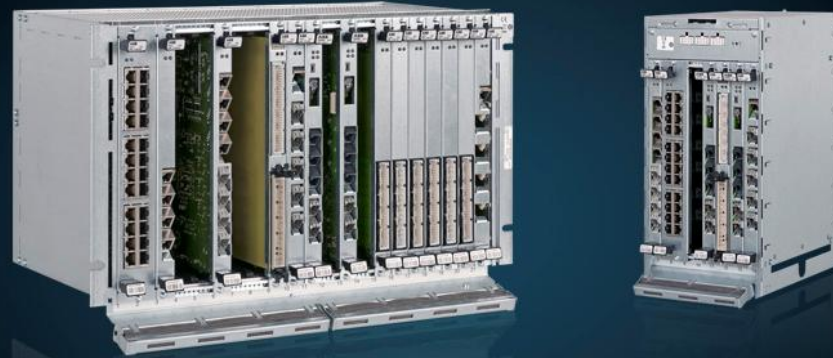
## FOX515/ FOX615 full interoperability



# Interoperability with existing FOX515 networks

## FOX515/ FOX615 module comparison

FOX51x Platform	FOX61x Platform	Description
FOX512	FOX612	Fiber Optic Multiplexer platform 612
FOX515	FOX615	Fiber Optic Multiplexer platform 615
COBUx	CESM1	Central Ethernet Switch Module
STICx	DATI1	SHDSL aggregate TDM module
SUBHx	LESU1	Legacy Subscriber interface module
EXLAN	LEXI1	Legacy Exchange interface module
NEMSG	LEDA1	2/4 wire analogue E&M module
GECOD	LECO1	G.703 64kbit/s codirectional interface module
SYN4E / SYNAC	SAMO1	SDH aggregate STM-1/4 module
SYN4E / SYNAC	SAMO2	SDH aggregate STM-1/4/16 module
LOMIF	LEDE1	(LEgacy Data) 8 x E1 port data module
DATAx	LEDS1	(LEgacy Data) Multiprotocol serial data module
SWITE	EPOI1	Power over Ethernet module
NEBRx	ELET1	Electrical 24 port Ethernet module
NEBRx	ETOP1	Optical 12 port Ethernet module
ETER1	EPSI1	Ethernet over PDH module
TEBIT / ALCAR	TEPI1	Teleprotection interface module
OPTIF	OPIC1	Optical protection interface module



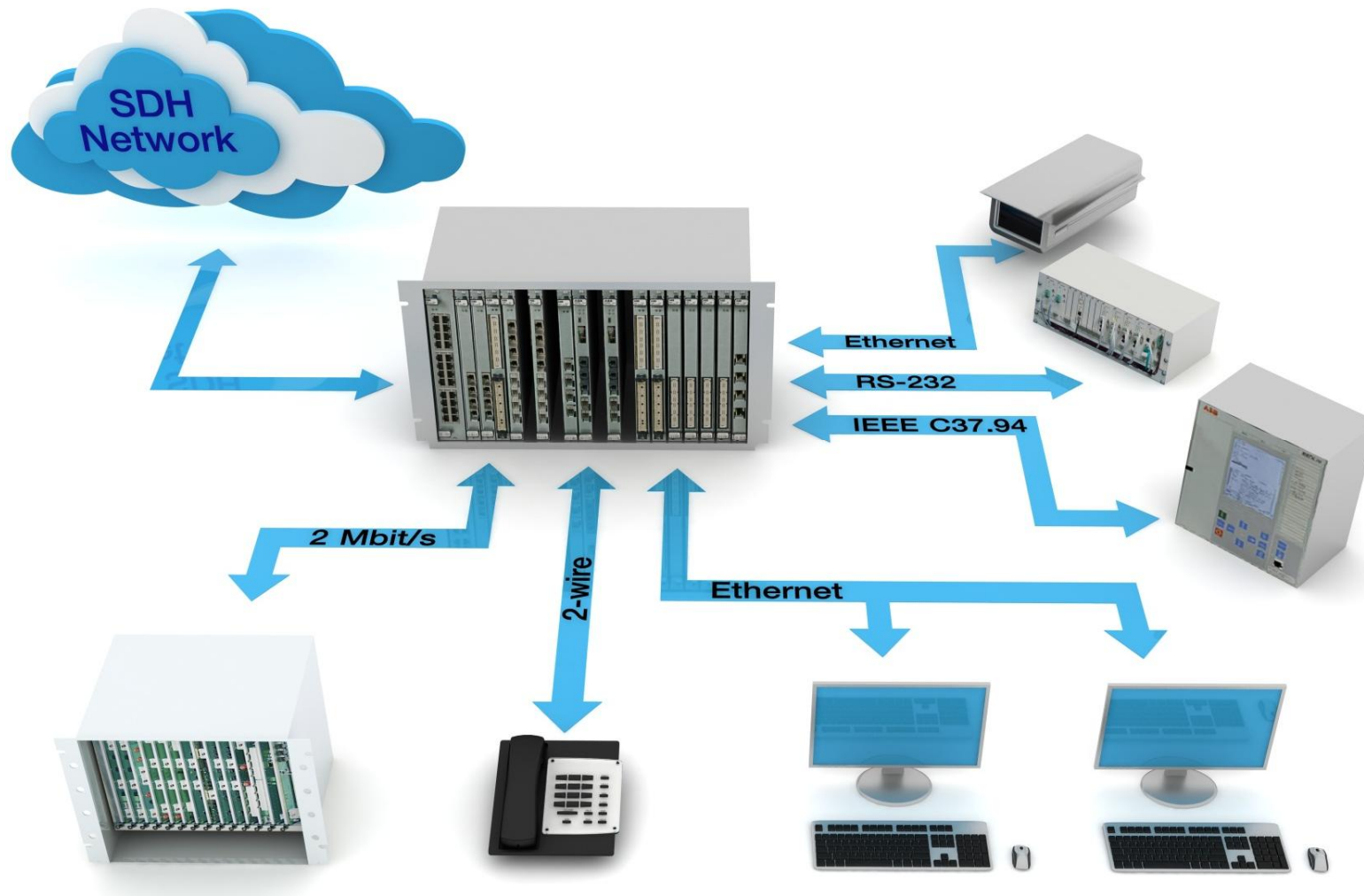
# FOX615

## Technical information



# FOX615: Technical information

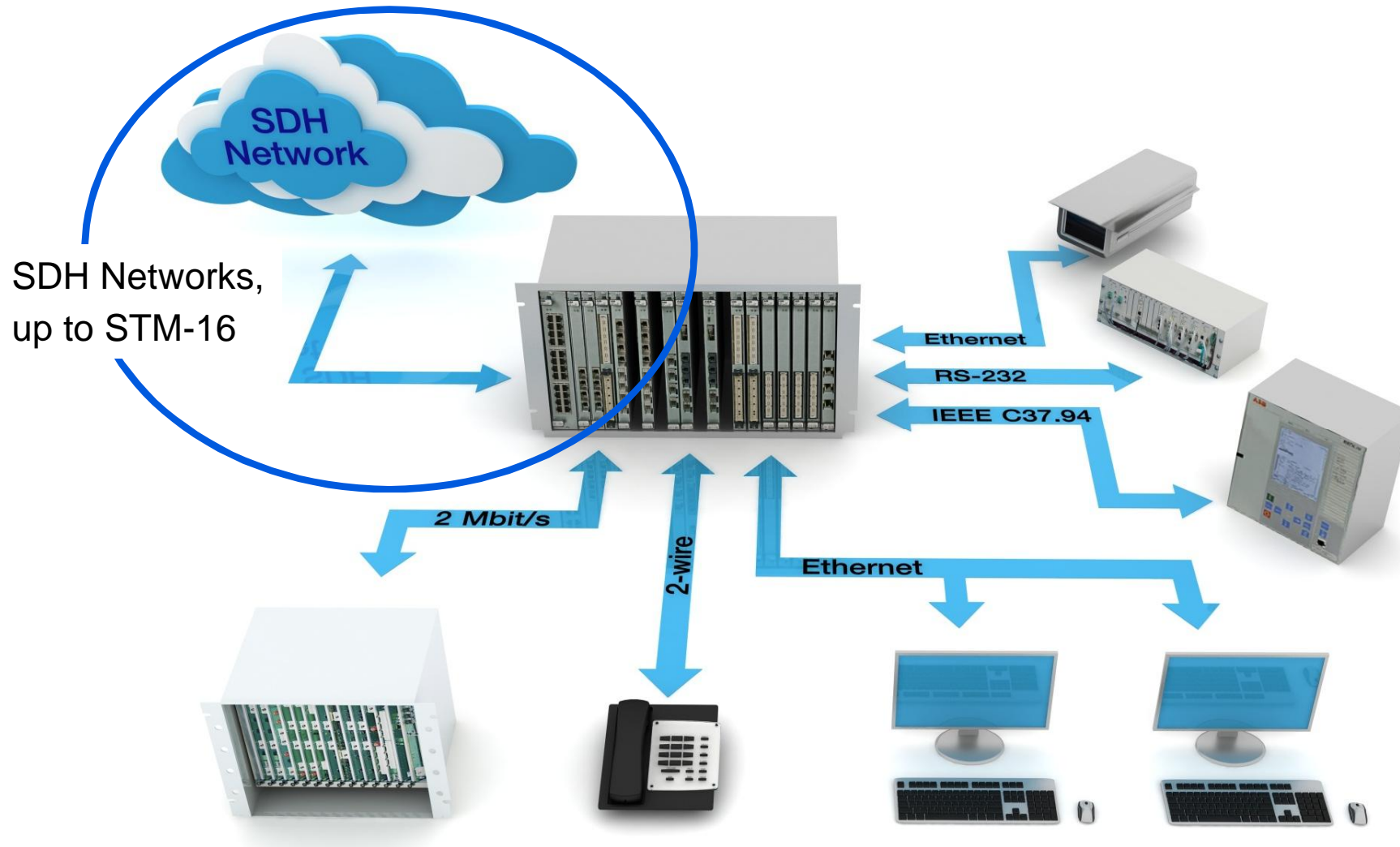
## Applications





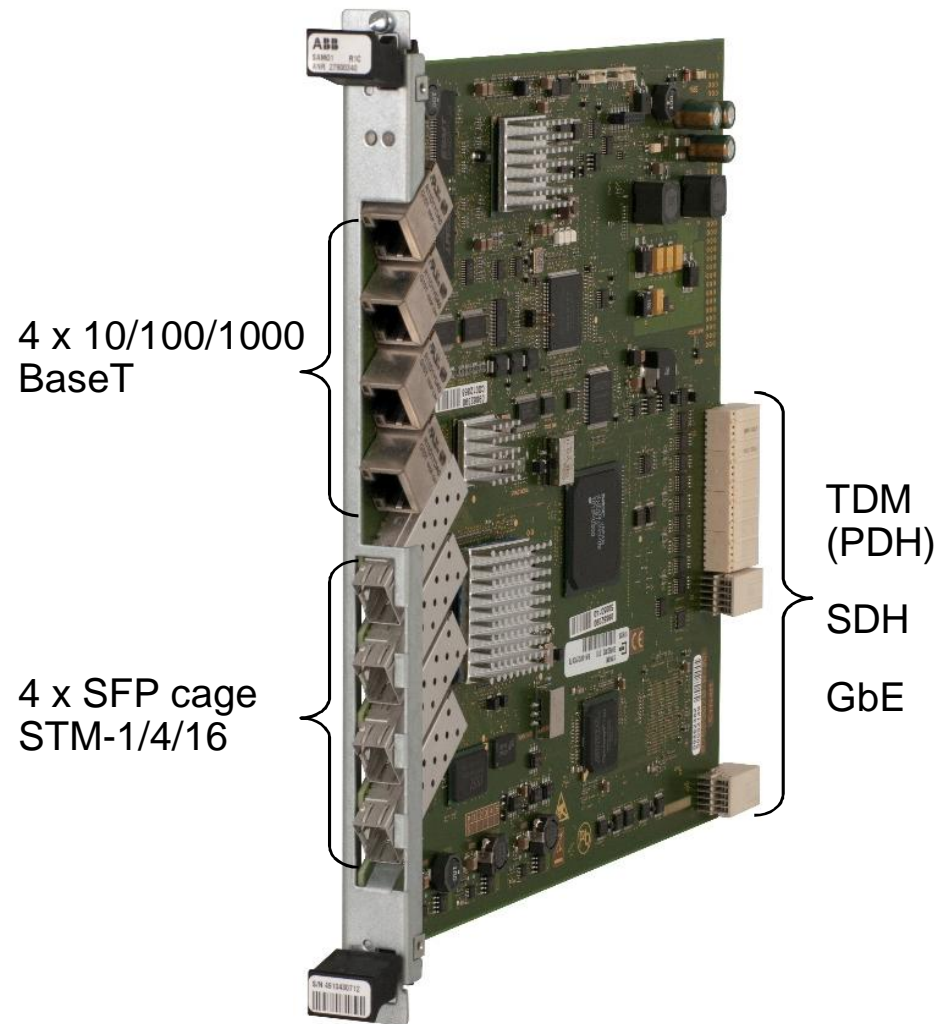
# FOX615: Technical information

## Applications - SDH backbone



# FOX615: Technical information

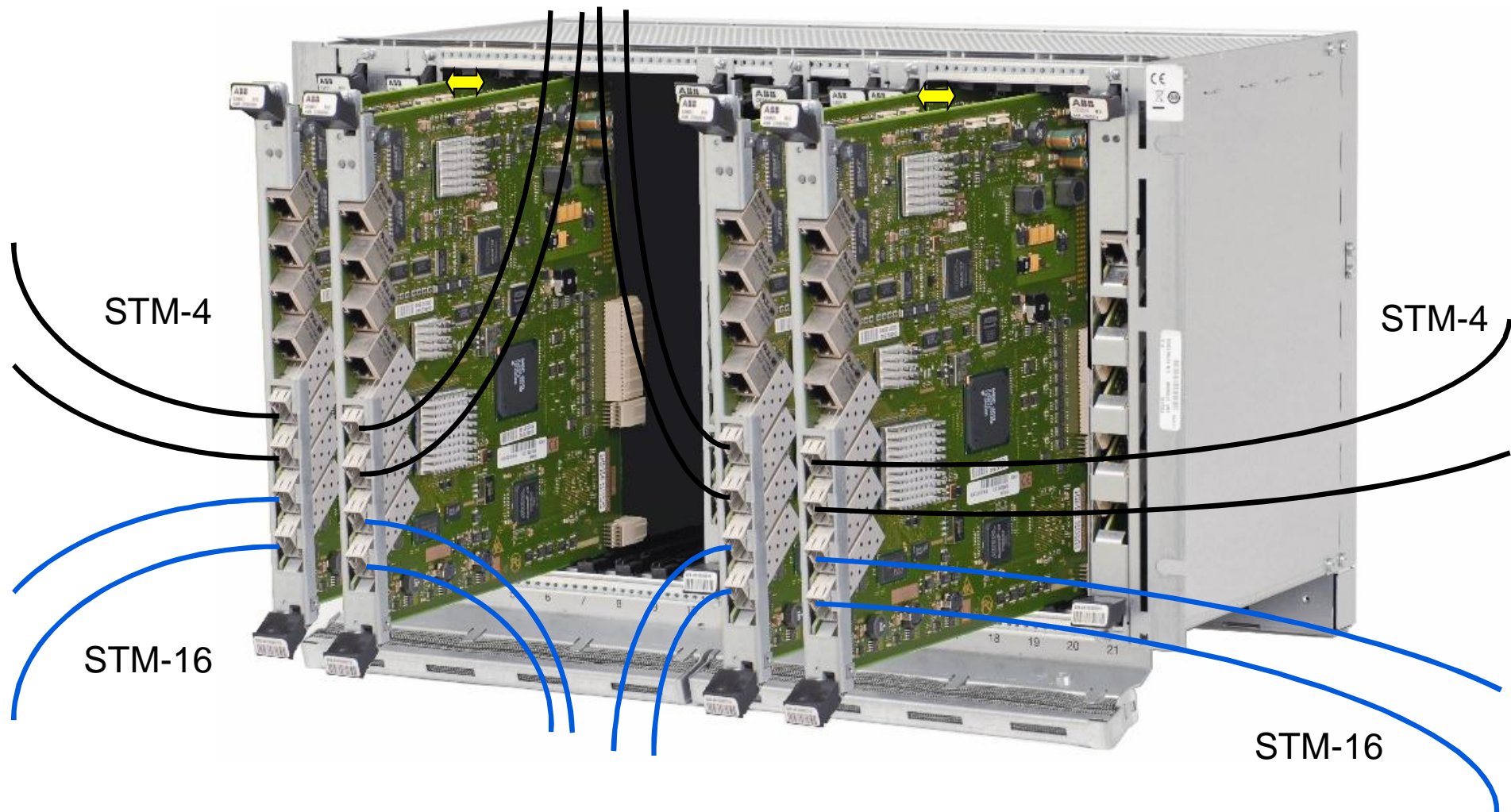
## SAMO2: Enhanced SDH Functionality



- Interface module available with 4 x SFP cage providing STM-1 to STM-16 capacity
- Redundant configuration of SDH modules supported
- Traffic protection supported
  - SNCP
  - MSP
- Up to 4 x SDH modules per FOX615 Rack
- Including Ethernet over SDH functionality

# FOX615: Technical information

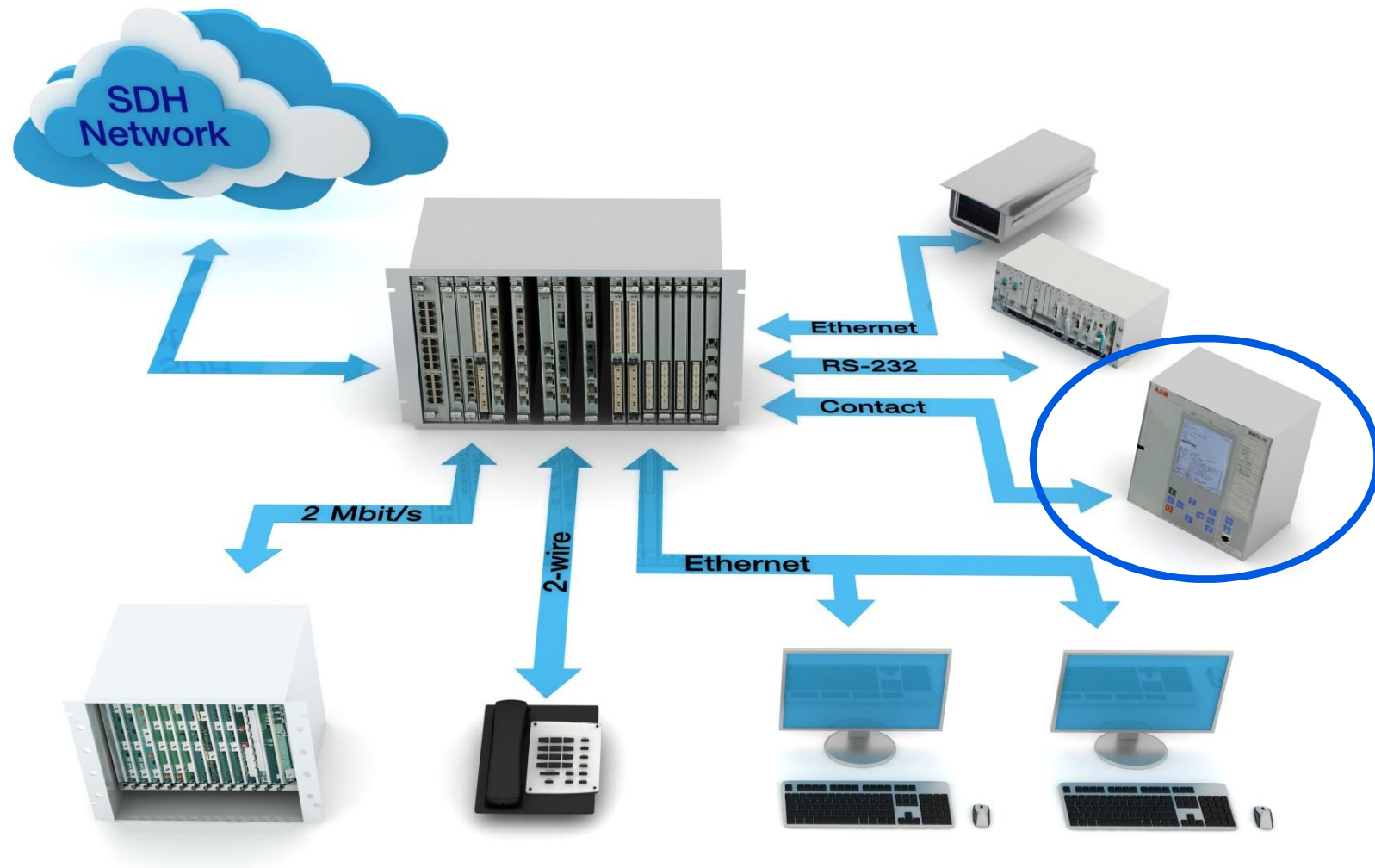
## SAMO2: Enhanced SDH Functionality





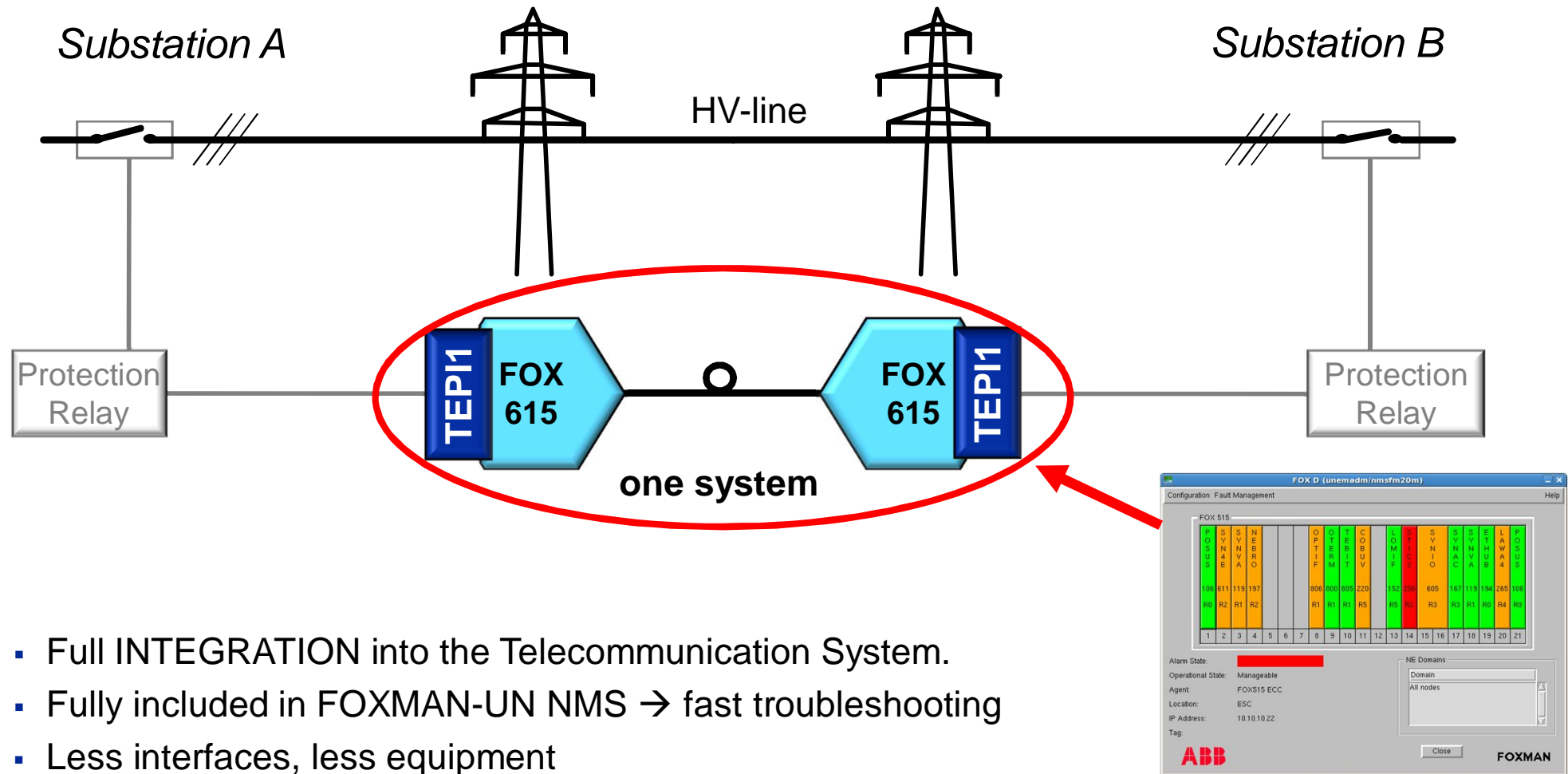
# FOX615: Technical information

## Applications - Protection of Powerline



# Teleprotection & binary module

## TEPI1 - Teleprotection application



NMS: Network Management

# FOX615: Technical information

## Teleprotection interfaces



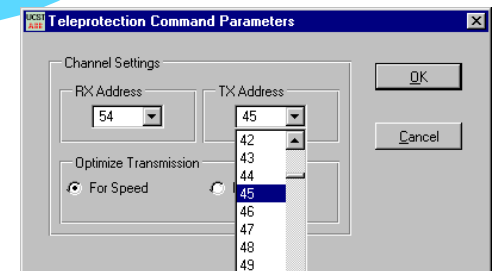
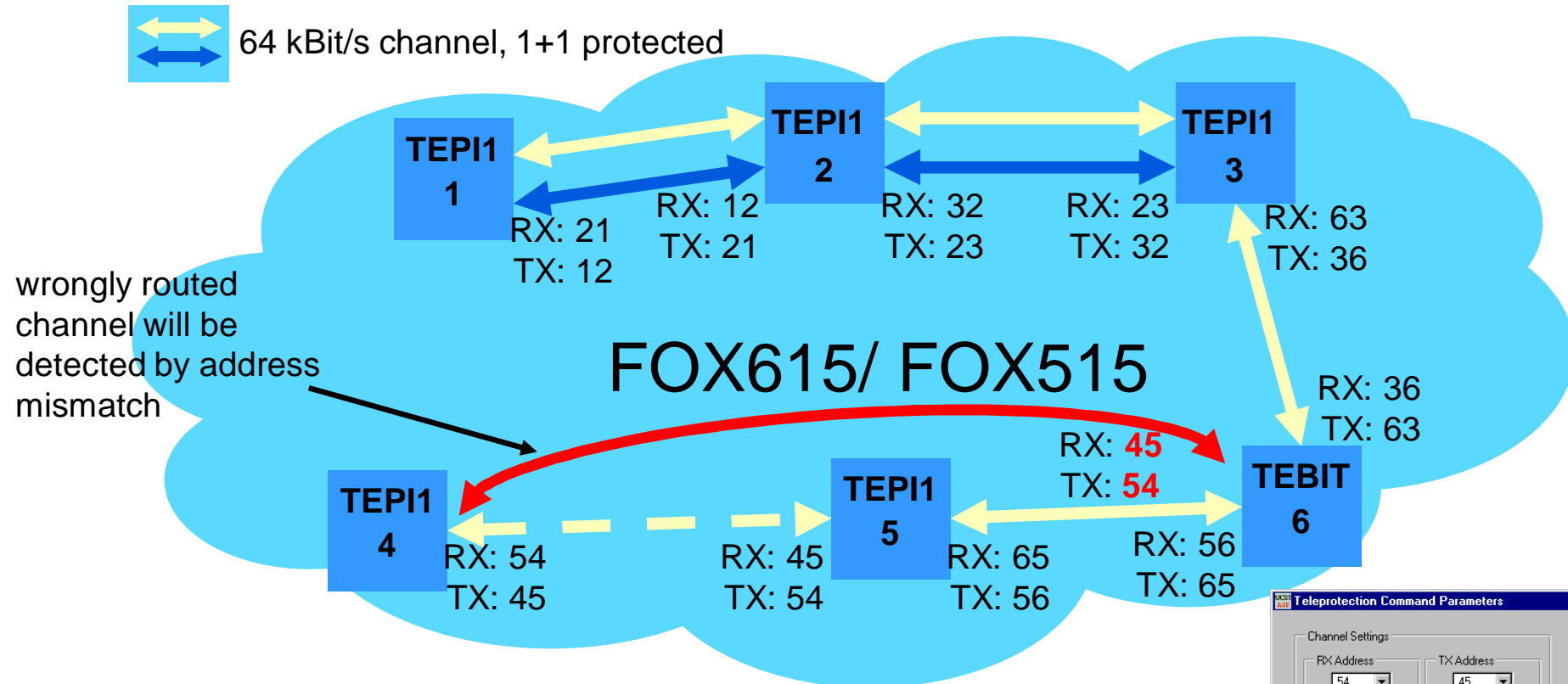
- Integrated Teleprotection Interfaces for Distance Protection
  - 4 x Teleprotection Command Input/ Output
  - 16 x Binary contact Input
  - 8 x Binary contact Output
  - 6 x Auxiliary Relay
  - Integrated Event Recorder



- Integrated Teleprotection Interface for Differential Protection
  - 4 x SFP cage for:
    - IEEE C37.94 port for interconnection to Differential Protection relays
    - ABB optical ports for interconnection with REL316, REL551, REL561, NSD570 or FOX6+

# FOX615: Technical information

## Teleprotection Command Addressing

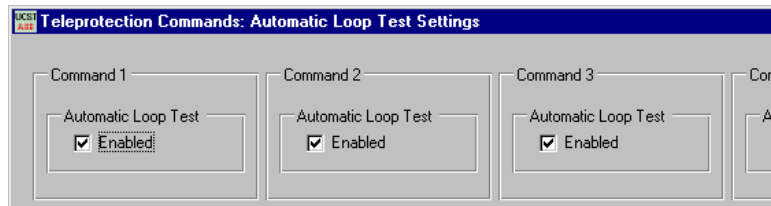
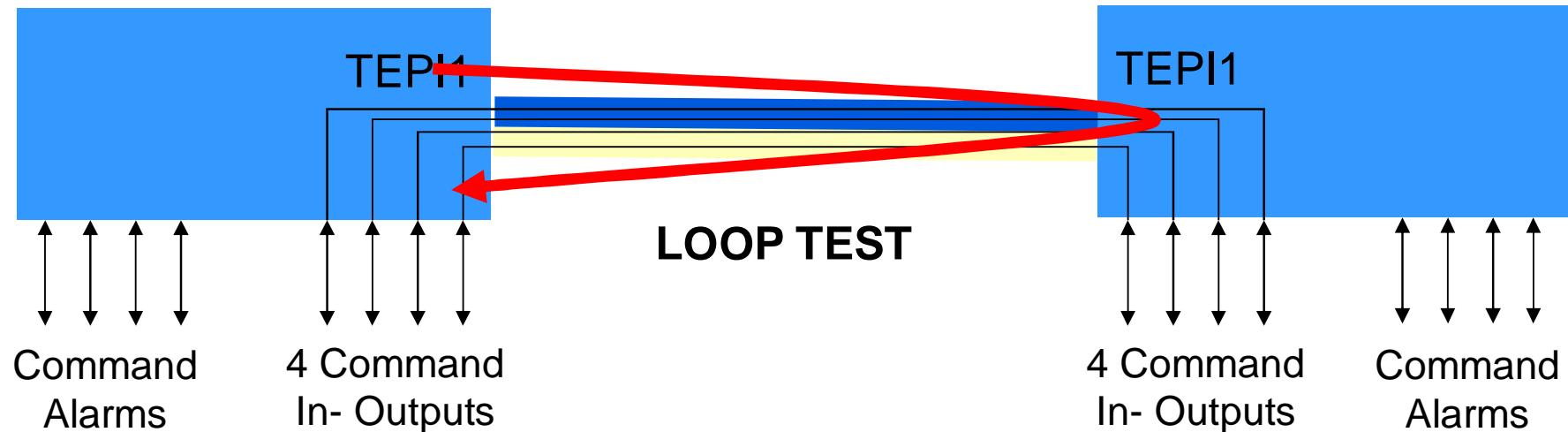


- Teleprotection Command Addressing scheme prevents wrong Trips because of routing failures in the network
- FOXMAN-UN NMS will get TEPI1 address mismatch which allows an operator to take immediate actions



# FOX615: Technical information

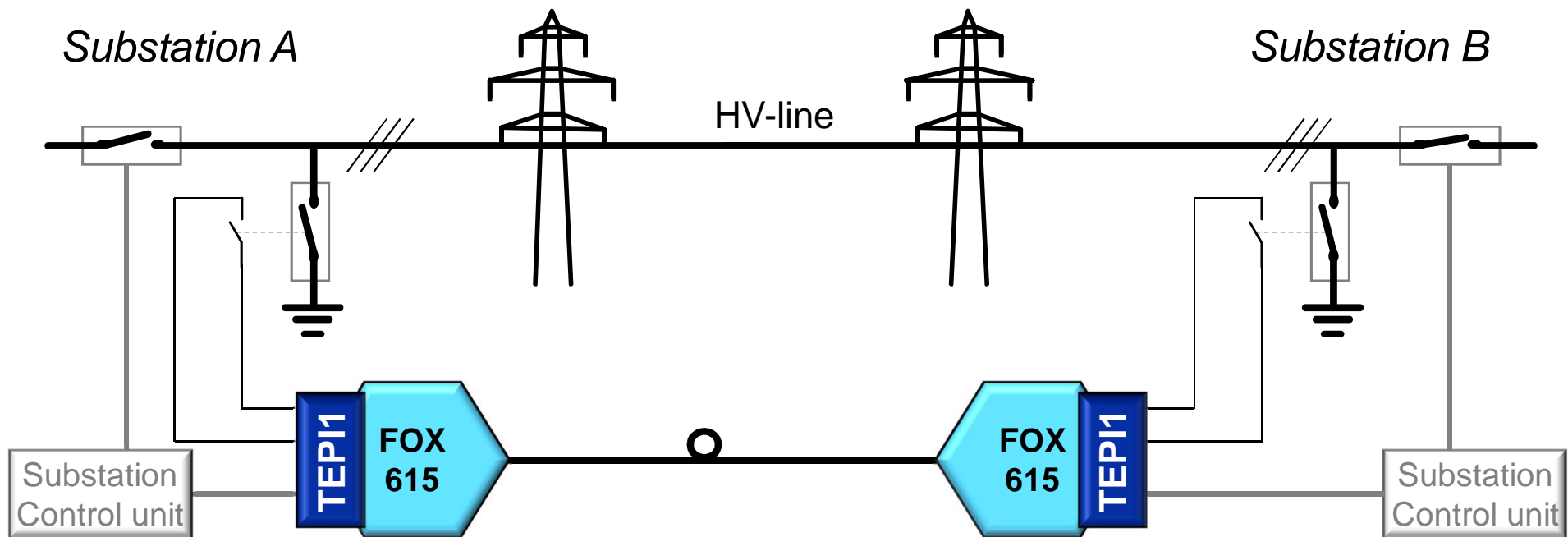
## Loop Test and Propagation Delay



- Loop tests to verify communication channel availability
- Test interval programmable, per default repeated every minute
- Independent test for each command
- Measurement of propagation delay with each loop test

# Teleprotection & binary module

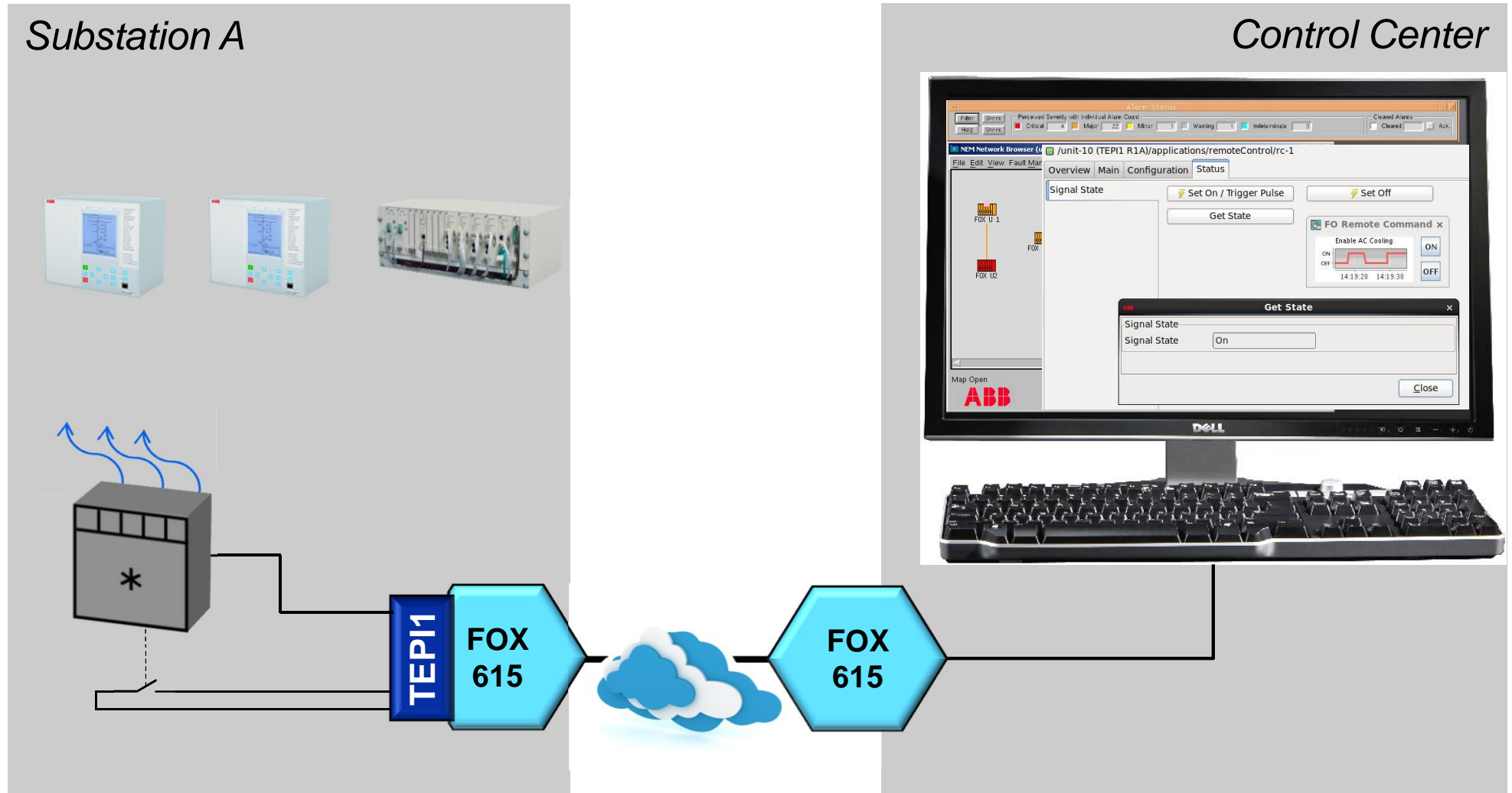
## TEPI1 - Binary signal transmission



- 8 x voltage & 2 x 4 current loop inputs
- 8 x voltage and 4 x relay outputs

# Teleprotection & binary module

## TEPI1 – Remote control and alarm acquisition



# FOX615: Technical information

## OPIC1: Differential Protection Interface



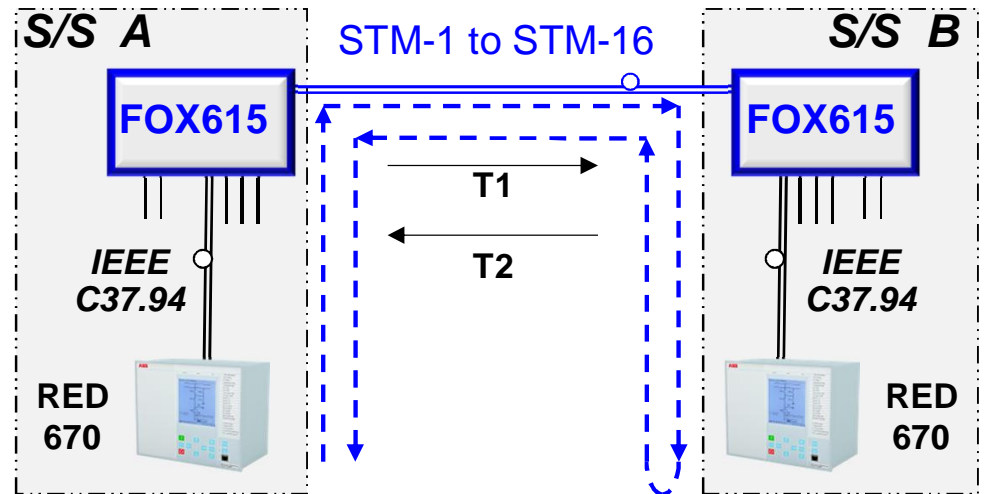
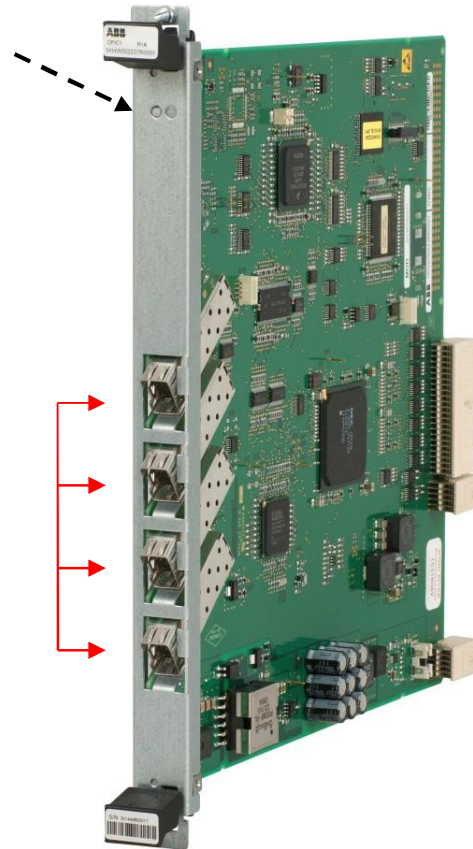
- 4 x IEEE C37.94 ports ANSI/IEEE C37.94
  - ABB Protection Relay RED670
  - 3rd party relays with C37.94 interface
  - Teleprotection NSD570 with G1LOa module
- 4 x optical ABB ports 64 kbit/s on 1310 nm single mode to connect to
  - ABB Relay REL316, REL551, REL561
  - NSD570 with G1LO
  - FOX6Plus
- 1+1 path protection on N x 64 kbit/s for SYMMETRICAL Switching of Tx- & Rx-path

# FOX615: Technical information

## OPIC1: Differential Protection Interface

LED indication:  
Status, alarms

4 x IEEE C37.94  
with SFP cages



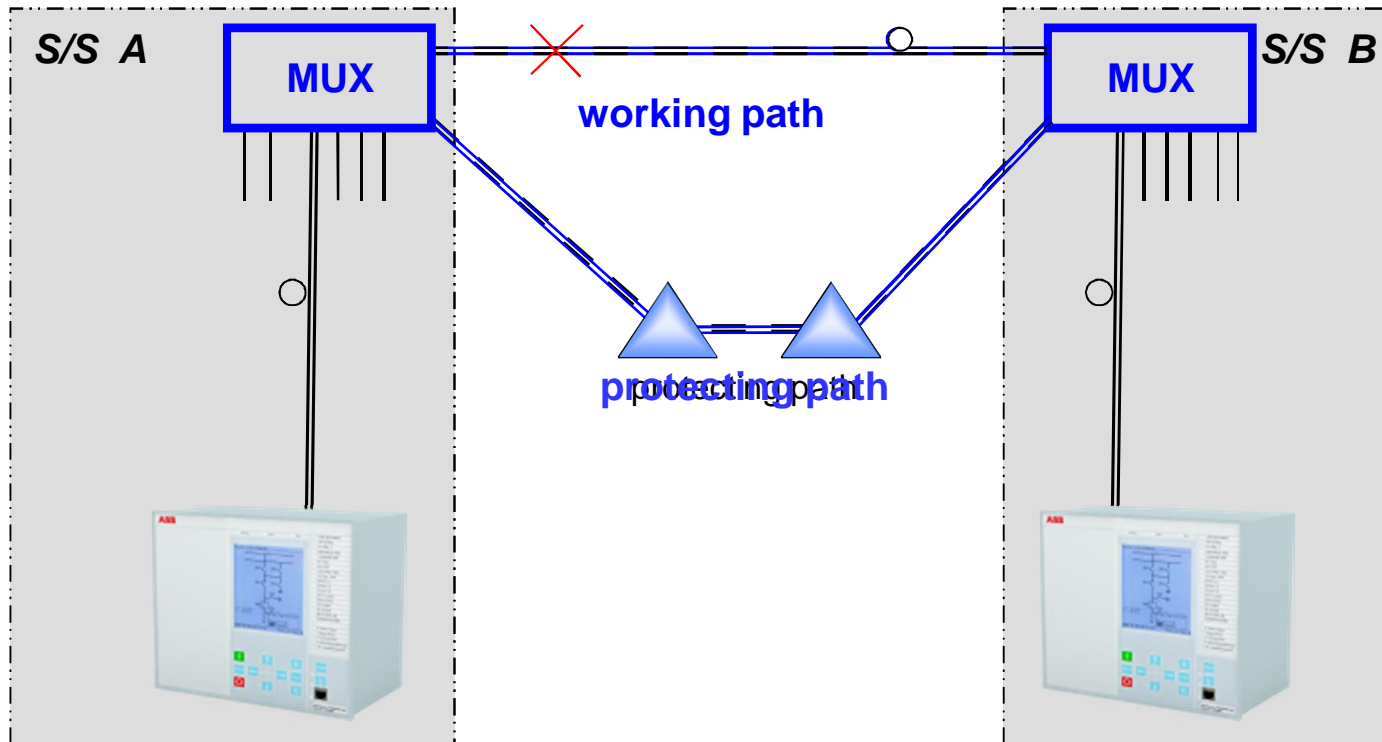
**RED670 with Echo Timing:**

$$\text{Transmission Delay } T_d = \frac{(T1 + T2)}{2}$$

- Time compensation for  $T_d$ : Up to 20 ms
- Delay measurement (loop): Every 5 ms

# FOX615: Technical information

## OPIC1: Differential Protection Interface

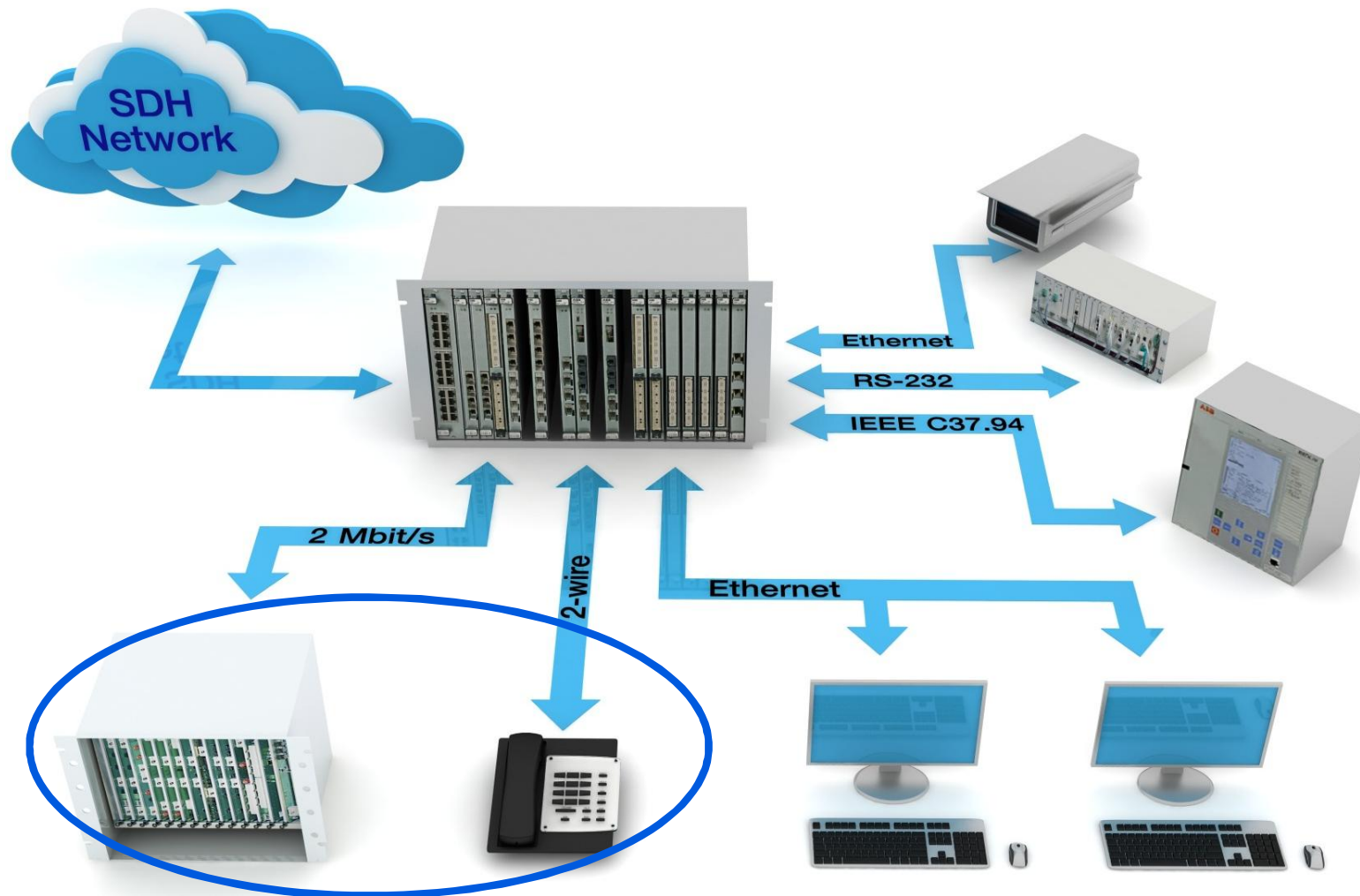


To avoid false tripping after switchover from working to protecting path protection services require:

- Bi-Directional (symmetrical) switching of receive and transmit path

# FOX615: Technical information

## Applications – operational telephony





# FOX615: Technical information

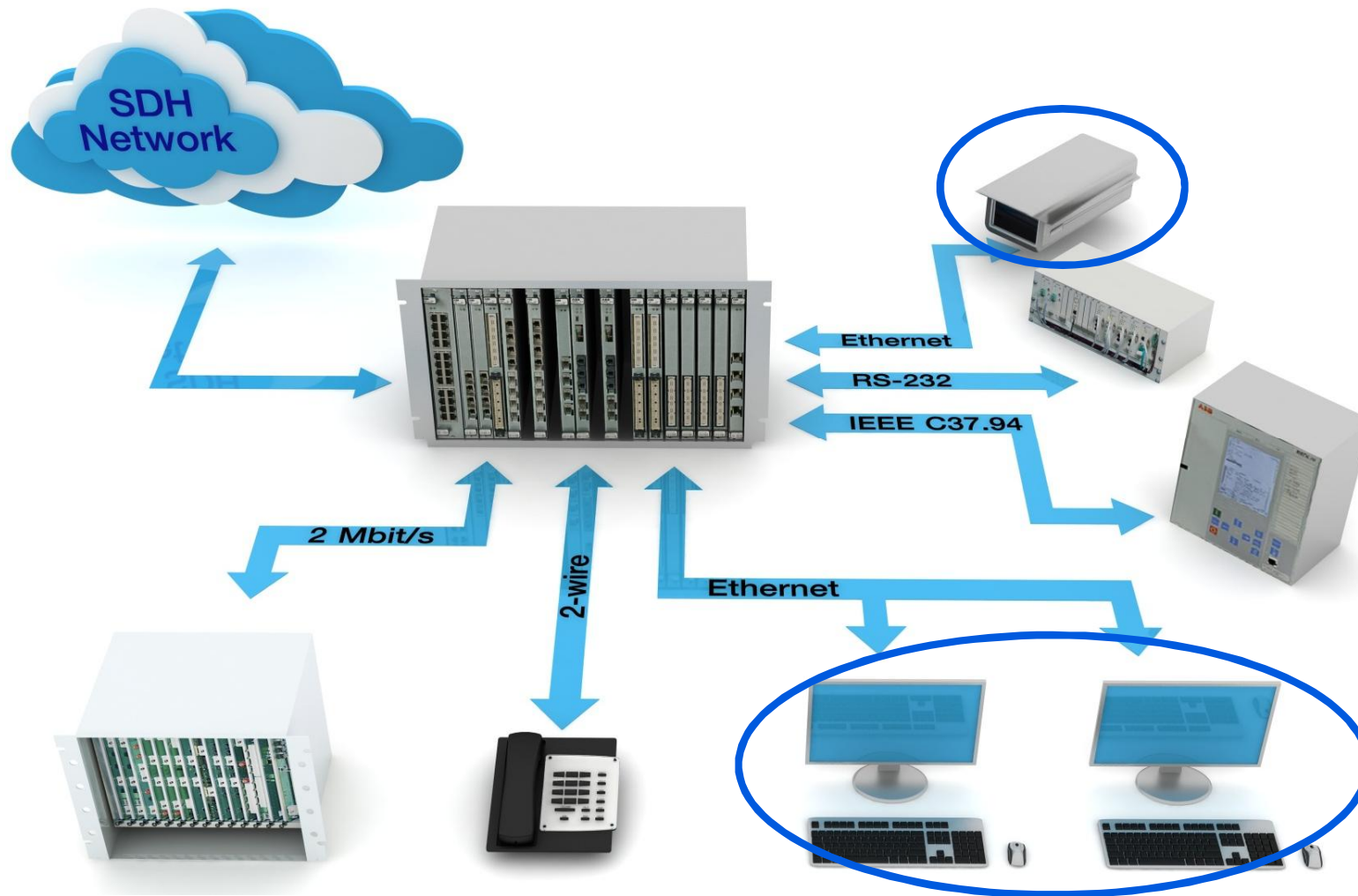
## Telephony Modules - overview



- 2 wire Subscriber interface (LESU1)
  - 16 x 2 wire FXS ports
  - 2 wire a/b interface
- 2 wire FXO interface (LEXI1)
  - 12 x 2 wire FXO ports
  - 1+1 protection
  - Simulates telephone sets towards the exchange
- 2/4 wire E&M interface (LEDA1)
  - 8 x 2/4 wire interfaces (AF) 300 Hz – 3.4 kHz
  - Including conferencing functionality (32 participants)
  - Equipment protection for conferencing functionality
  - 1+1 protection
  - Provides tests loops and test signal insertion

# FOX615: Technical information

## Applications - LAN



# Enhanced Ethernet/ IP functionality

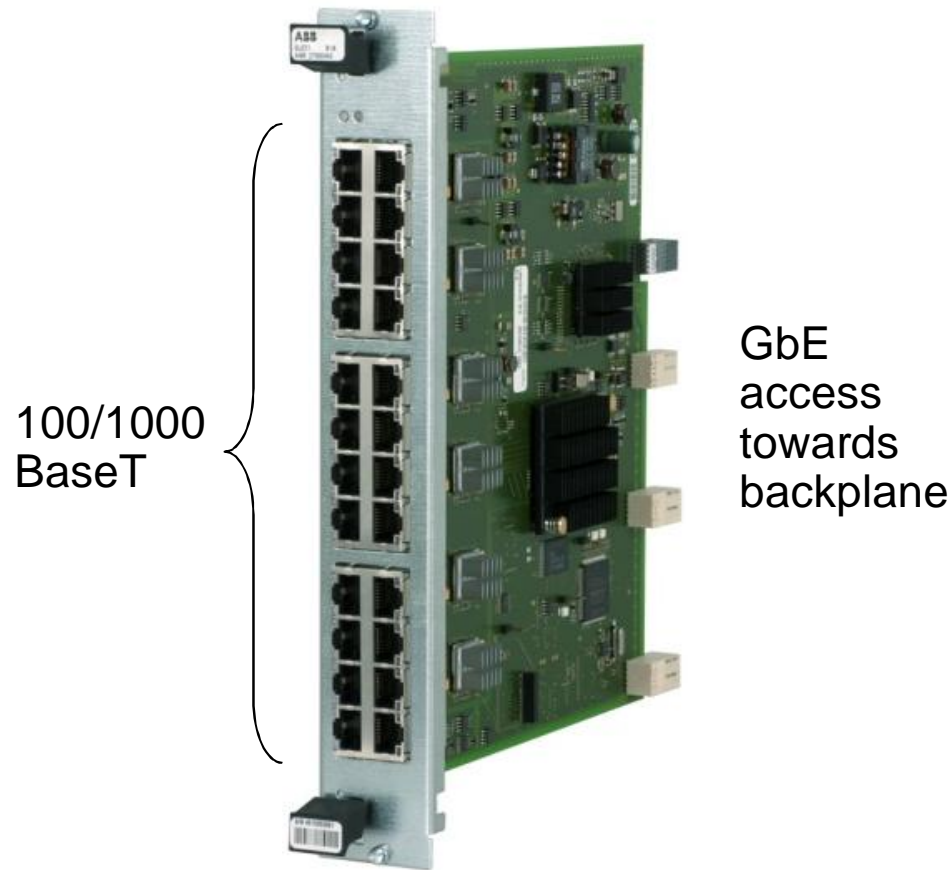
## Ethernet access/uplink interfaces



- Different amount of Ports
  - 12 x SFP cage for 100/1000 Base-FX
  - 24 x 10/100/1000 Base-T
  - 2 x GbE/ 10 GbE SFP(+) & 3 x 10/100/1000 Base-T
  - 4 x 10/100 Base-T with L2 switching or L3 routing
- VLAN and VLAN Tag stacking
- Traffic prioritization
- Can be used for interconnection with remote sites (aggregation switches)

# FOX615: Technical information

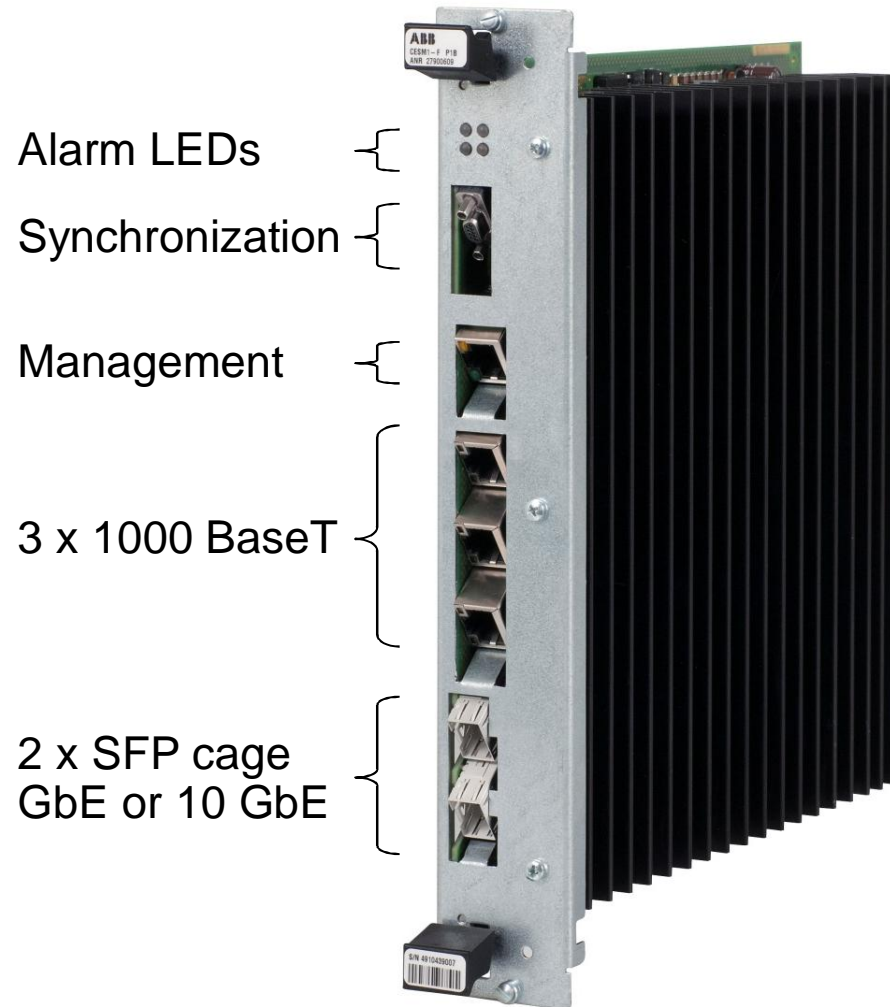
## ELET1: Electrical Ethernet access interface



- 24 x 100/1000 BaseT port
- VLAN and VLAN Tag stacking
- Traffic prioritization
- 2 Slot module
- Up to 10 can be plugged into 1 FOX615  
→ 240 ports

# FOX615: Technical information

## CESM1: Ethernet Core Interface



- Ethernet Switch functionality with 64 Gbit/s capacity
  - Access to GbE star
  - VLAN and VLAN Tag stacking as per IEEE 802.1ad
  - Link aggregation protocol support as per IEEE802.3ad
- Management interface
- Synchronization interface
- Redundant configuration possible
- Synchronous Ethernet

# FOX615: Technical information

## EPOI1: Power over Ethernet interface

- 12 Port 10/100/1000 Base-T providing Power over Ethernet functionality
- Support of PoE or PoE1 (up to 34 W per Port)
- Total PoE capacity of max. 84 W
- Part of distributed switching architecture
- Fanless operation possible
- VLAN and VLAN Tag stacking
- Traffic prioritization
- Can be used for connecting and powering VoIP phones, IP cameras or WIFI routers

# FOX615: Technical information FOXCST, intuitive configuration tool

Chassis view for quick status information

Different for different configuration views

ID	Layer	Dir	N	Label 1	Z-End	A-End Working	A-End Protecting
1	P0_nc	↔	1	/Unit-21/port-1: PSTN	/Unit-9/port-7/chan-1: P0_nc (n=1)	/Unit-9/port-8/chan-1	/Unit-9/port-8/chan-2
2	P0_nc	↔	1	/Unit-17/port-1: PSTN	/Unit-9/port-7/chan-2: P0_nc (n=1)	/Unit-9/port-8/chan-1	/Unit-9/port-8/chan-2
3	P0_nc	↔	1	/Unit-21/port-2: PSTN	/Unit-18/pdhy/vc12-1/p12/chan-1: P0_nc (n=1)	/Unit-18/pdhy/vc12-1/p12/chan-2: P0_nc (n=1)	/Unit-18/pdhy/vc12-1/p12/chan-3: P0_nc (n=1)
4	P0_nc	↔	1	/Unit-21/port-3: PSTN	/Unit-18/pdhy/vc12-1/p12/chan-4: P0_nc (n=1)	/Unit-18/pdhy/vc12-1/p12/chan-5: P0_nc (n=1)	/Unit-18/pdhy/vc12-1/p12/chan-6: P0_nc (n=1)
5	P0_nc	↔	1	/Unit-19/port-1: V.35 (64 Kbit/s)	/Unit-17/port-2: PSTN	/Unit-18/pdhy/vc12-1/p12/chan-7: P0_nc (n=1)	/Unit-18/pdhy/vc12-1/p12/chan-8: P0_nc (n=1)
6	P0_nc	↔	1	/Unit-19/port-2: V.35 (64 Kbit/s)	/Unit-17/port-3: PSTN	/Unit-18/pdhy/vc12-1/p12/chan-9: P0_nc (n=1)	/Unit-18/pdhy/vc12-1/p12/chan-10: P0_nc (n=1)
7	P0_nc	↔	1	/Unit-17/port-2: PSTN	/Unit-9/port-7/chan-3: P0_nc (n=1)	/Unit-18/pdhy/vc12-1/p12/chan-11: P0_nc (n=1)	/Unit-18/pdhy/vc12-1/p12/chan-12: P0_nc (n=1)
8	P0_nc	↔	1	/Unit-17/port-3: PSTN	/Unit-9/port-7/chan-4: P0_nc (n=1)	/Unit-18/pdhy/vc12-1/p12/chan-13: P0_nc (n=1)	/Unit-18/pdhy/vc12-1/p12/chan-14: P0_nc (n=1)
9	P0_nc	↔	1	/Unit-9/port-7/chan-3: P0_nc (n=1)	/Unit-9/port-7/chan-5: P0_nc (n=1)	/Unit-18/pdhy/vc12-1/p12/chan-15: P0_nc (n=1)	/Unit-18/pdhy/vc12-1/p12/chan-16: P0_nc (n=1)
10	P0_nc	↔	1	/Unit-9/port-7/chan-4: P0_nc (n=1)	/Unit-9/port-7/chan-6: P0_nc (n=1)	/Unit-18/pdhy/vc12-1/p12/chan-17: P0_nc (n=1)	/Unit-18/pdhy/vc12-1/p12/chan-18: P0_nc (n=1)
11	P0_nc	↔	1	/Unit-9/port-7/chan-5: P0_nc (n=1)	/Unit-14/port-1: E0 (codirectional)	/Unit-18/pdhy/vc12-1/p12/chan-19: P0_nc (n=1)	/Unit-18/pdhy/vc12-1/p12/chan-20: P0_nc (n=1)
12	P0_nc	↔	1	/Unit-9/port-7/chan-6: P0_nc (n=1)	/Unit-14/port-2: E0 (codirectional)	/Unit-18/pdhy/vc12-1/p12/chan-21: P0_nc (n=1)	/Unit-18/pdhy/vc12-1/p12/chan-22: P0_nc (n=1)
13	P0_nc	↔	1	/Unit-14/port-1: E0 (codirectional)	/Unit-14/port-3: E0 (codirectional)	/Unit-18/pdhy/vc12-1/p12/chan-23: P0_nc (n=1)	/Unit-18/pdhy/vc12-1/p12/chan-24: P0_nc (n=1)
14	P0_nc	↔	1	/Unit-14/port-3: E0 (codirectional)	/Unit-18/vc4/vc4-1/km-111: VC12	/Unit-18/pdhy/vc12-1: VC12 (Unequipped)	/Unit-18/pdhy/vc12-2: VC12 (Unequipped)
15	VC12	↔		/Unit-18/vc4/vc4-1/km-112: VC12	/Unit-18/vc4/vc4-1/km-113: VC12	/Unit-18/pdhy/vc12-3: VC12 (Unequipped)	/Unit-18/pdhy/vc12-4: VC12 (Unequipped)
16	VC12	↔		/Unit-18/vc4/vc4-1/km-121: VC12	/Unit-18/vc4/vc4-1/km-122: VC12	/Unit-18/pdhy/vc12-5: VC12 (Unequipped)	/Unit-18/pdhy/vc12-6: VC12 (Unequipped)
17	VC12	↔		/Unit-18/vc4/vc4-1/km-123: VC12	/Unit-18/vc4/vc4-1/km-124: VC12	/Unit-18/pdhy/vc12-7: VC12 (Unequipped)	/Unit-18/pdhy/vc12-8: VC12 (Unequipped)
18	VC12	↔		/Unit-18/vc4/vc4-1/km-125: VC12	/Unit-18/vc4/vc4-1/km-126: VC12	/Unit-18/pdhy/vc12-9: VC12 (Unequipped)	/Unit-18/pdhy/vc12-10: VC12 (Unequipped)
19	VC12	↔		/Unit-18/vc4/vc4-1/km-127: VC12	/Unit-18/vc4/vc4-1/km-128: VC12	/Unit-18/pdhy/vc12-11: VC12 (Unequipped)	/Unit-18/pdhy/vc12-12: VC12 (Unequipped)
20	VC12	↔		/Unit-18/vc4/vc4-1/km-129: VC12	/Unit-18/vc4/vc4-1/km-130: VC12	/Unit-18/pdhy/vc12-13: VC12 (Unequipped)	/Unit-18/pdhy/vc12-14: VC12 (Unequipped)
21	VC4	↔		/Unit-18/vc4/vc4-1: VC4 (VC12 - VC12)	/Unit-18/sch/sch-1: VC4 (Unequipped)	/Unit-18/sch/sch-2: VC4 (Unequipped)	/Unit-18/sch/sch-3: VC4 (Unequipped)

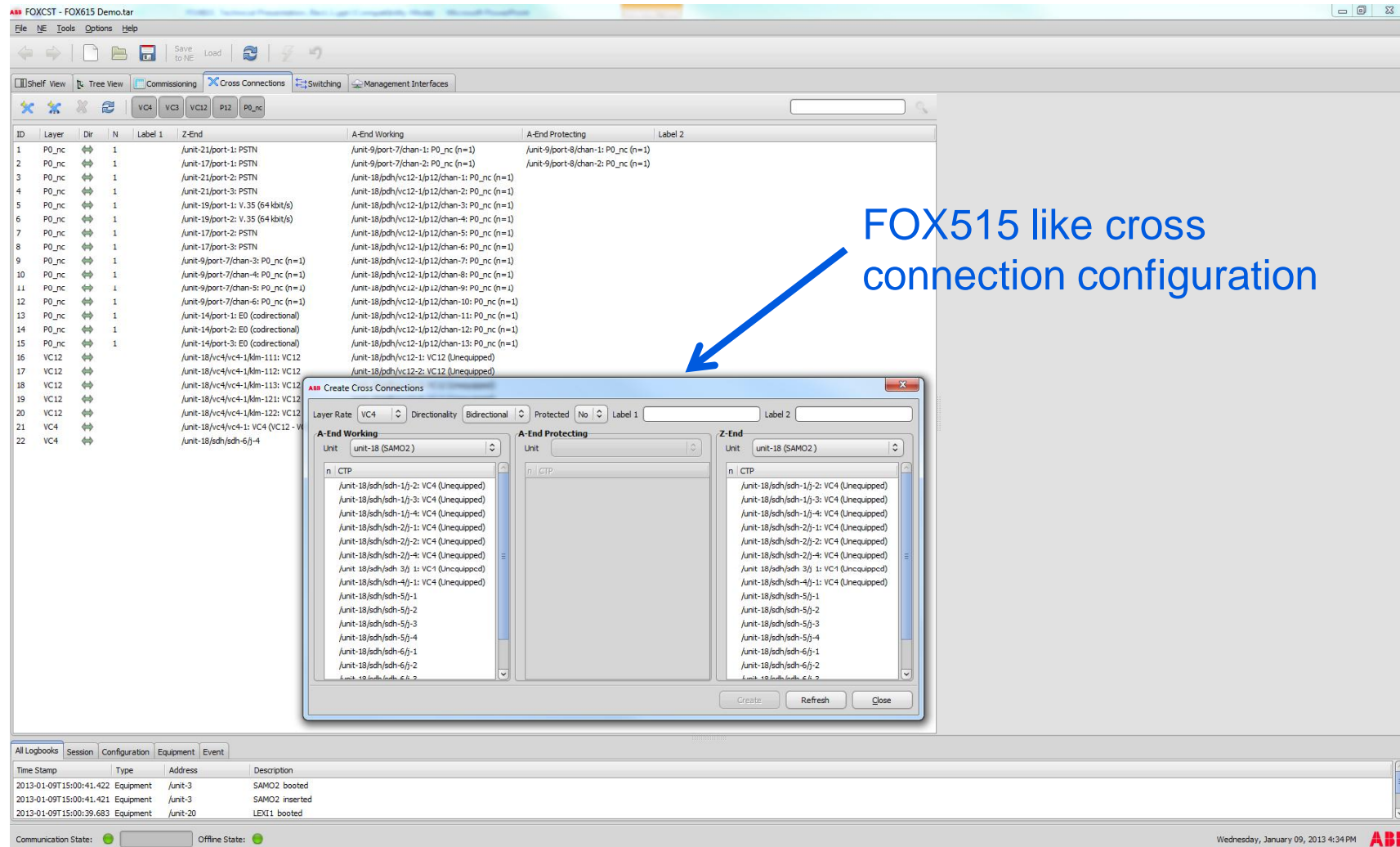
Time Stamp	Type	Address	Description
2013-01-09T15:00:41.422	Equipment	/unit-3	SAMO2 booted
2013-01-09T15:00:41.421	Equipment	/unit-3	SAMO2 inserted
2013-01-09T15:00:39.683	Equipment	/unit-20	LEX11 booted

Communication State: ● Offline State: ●

Wednesday, January 09, 2013 4:06 PM **ABB**



# FOX615: Technical information FOXCST, intuitive configuration tool



# FOX615: Technical information

## FOXCST, intuitive configuration tool

FOX615 - FOX615 Demo.tar

File NE Tools Options Help

Save to NE Load

Shelf View Tree View Commissioning Cross Connections Switching Management Interfaces

Unit-18: SAMO2 (samo2\_1b09) : Ok (Active)

Overview Main Configuration Fault Management

General

SETS

ESO

EQP

PDH Clock Sources

PDH Clock Source 1 /unit-9/port-7

PDH Clock Source 2 /unit-9/port-8

PDH Clock Source 3

PDH Clock Source 4

SETS Clock Selection

Source	Priority	QL	Holdoff Time	Wait-To-Restore Time
sdh-1	1	Received	0	30
wll-2	2	Received	0	30
sdh-3	Disabled	Received	0	30
sdh-4	Disabled	Received	0	30
sdh-5	3	Received	0	30
sdh-6	4	Received	0	30
sdh-7	Disabled	Received	0	30
sdh-8	Disabled	Received	0	30
PDH Clock Source 1	Disabled	14	0	30
PDH Clock Source 2	Disabled	14	0	30
PDH Clock Source 3	Disabled	14	0	30
PDH Clock Source 4	Disabled	14	0	30
ESI	Disabled	14	0	30
Internal	14	11	0	30

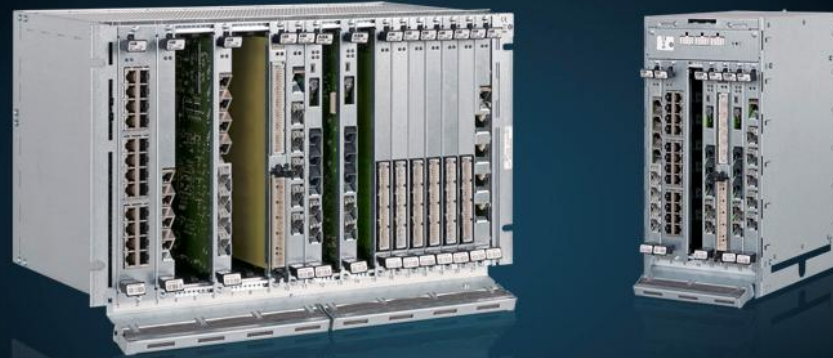
Selection Algorithm QL

All Logbooks Session Configuration Equipment Event

Time Stamp	Type	Address	Description
2013-01-09T15:00:41.422	Equipment	/unit-3	SAMO2 booted
2013-01-09T15:00:41.421	Equipment	/unit-3	SAMO2 inserted
2013-01-09T15:00:39.683	Equipment	/unit-20	LEX1 booted

Communication State: Offline State:

Wednesday, January 09, 2013 4:37 PM ABB

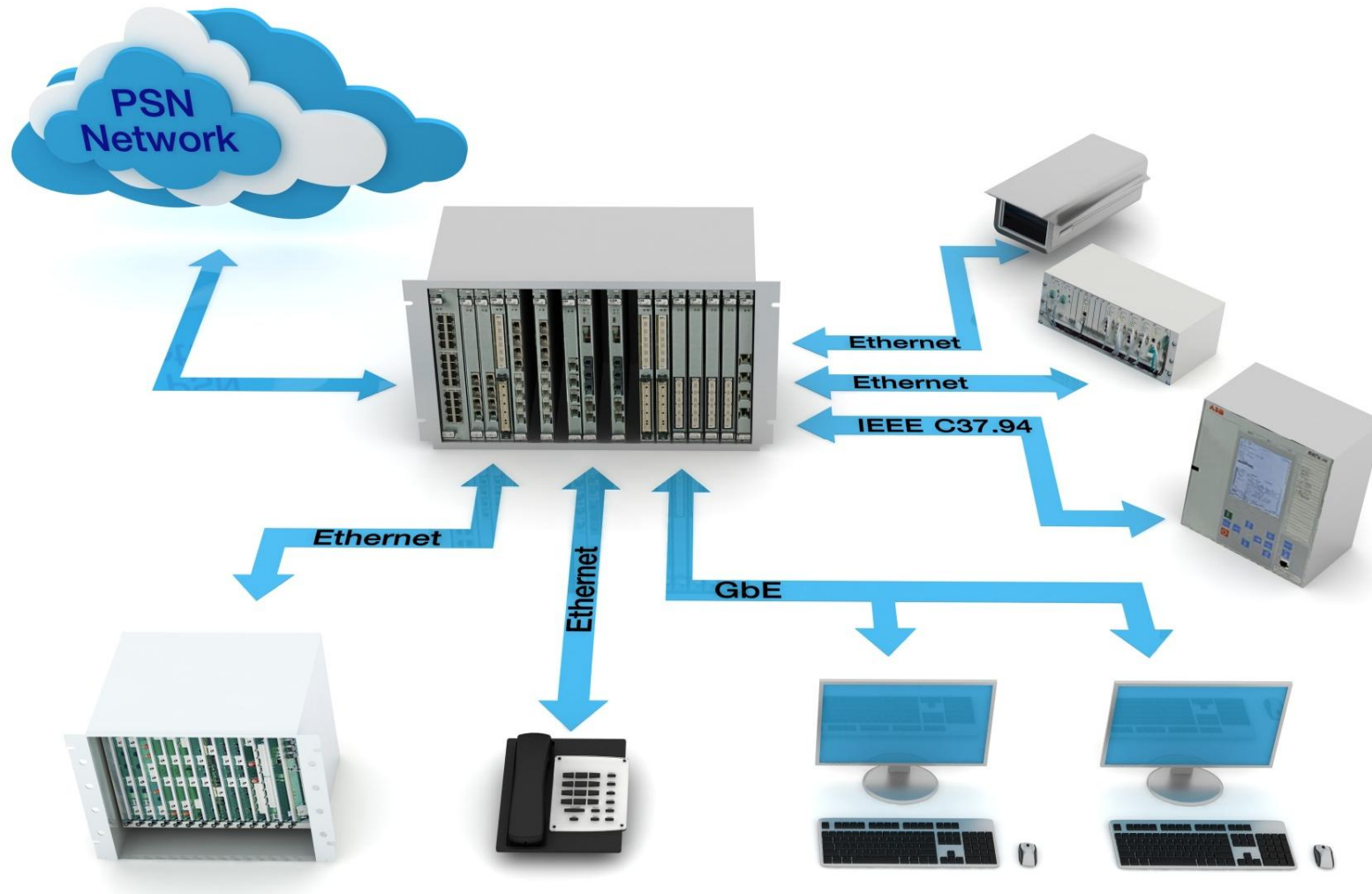


# FOX615

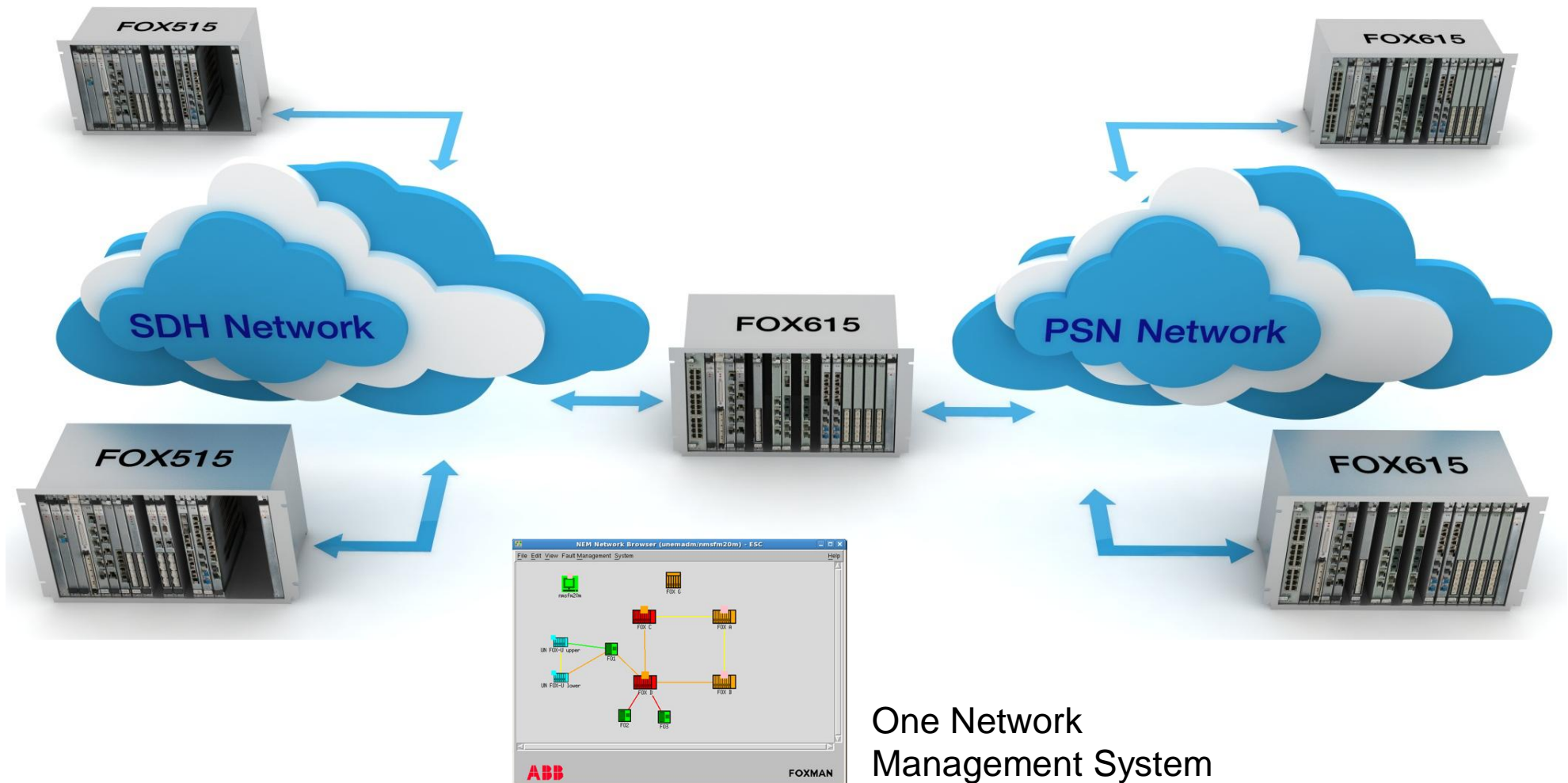
## Packet Switched Networks

# FOX615 packet switched backbone

## Applications



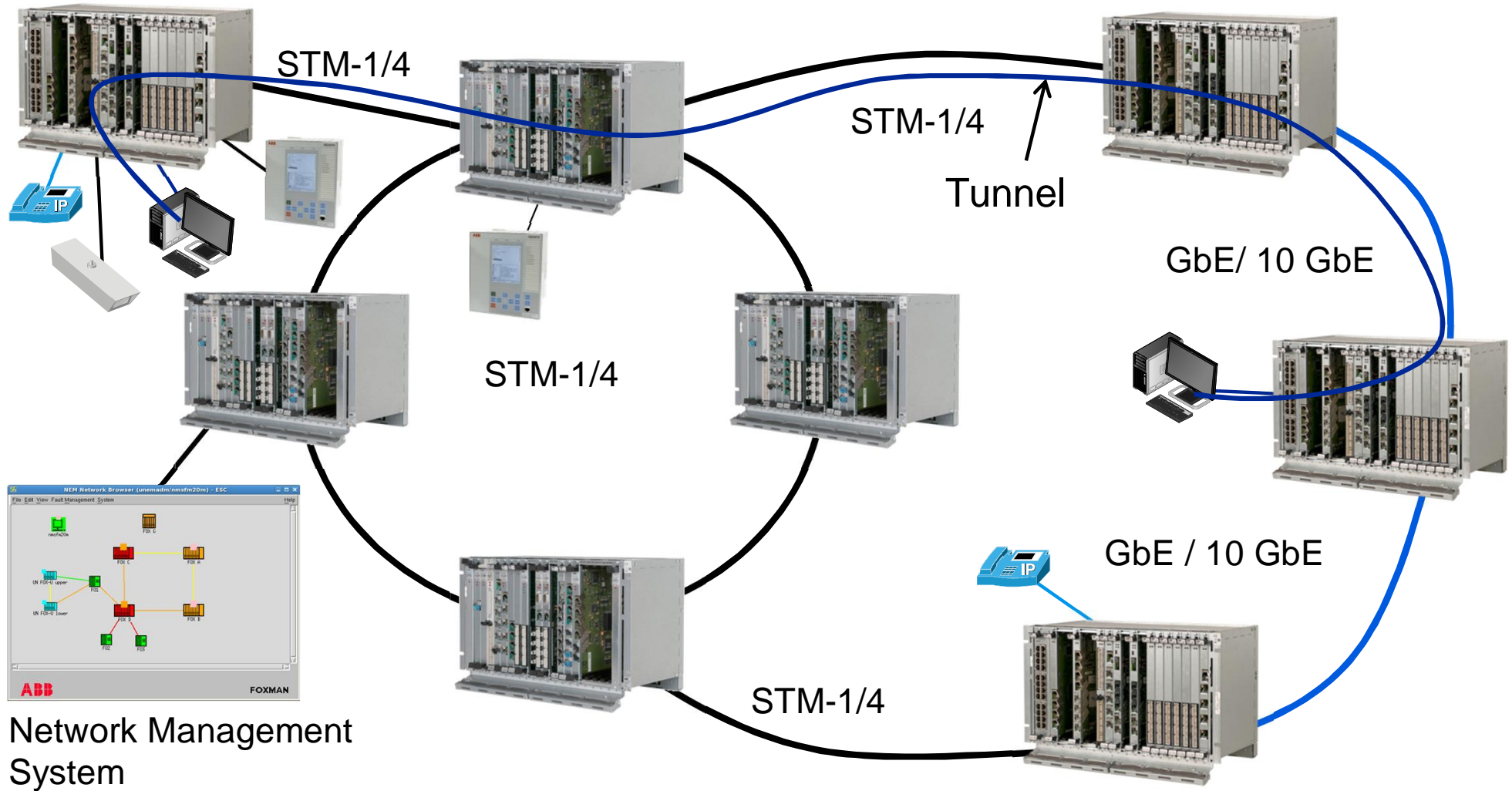
FOX615 packet switched backbone  
FOX515/ FOX615 upgradability to GbE





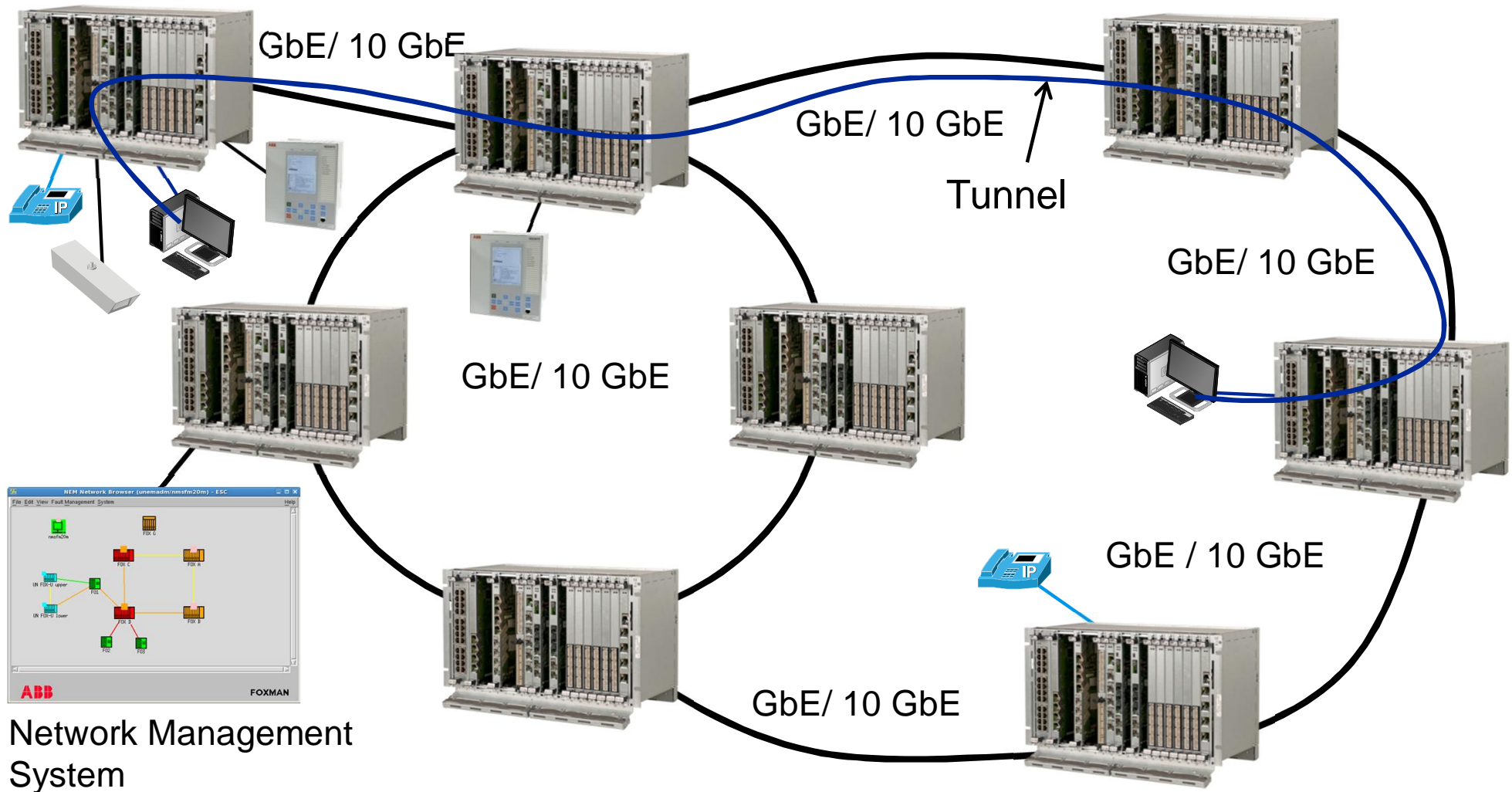
# Migration strategy of existing networks

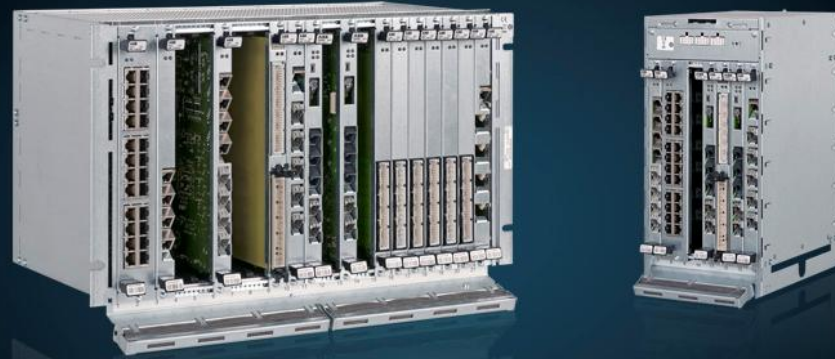
## FOX615 PSN tunnelling through of existing network





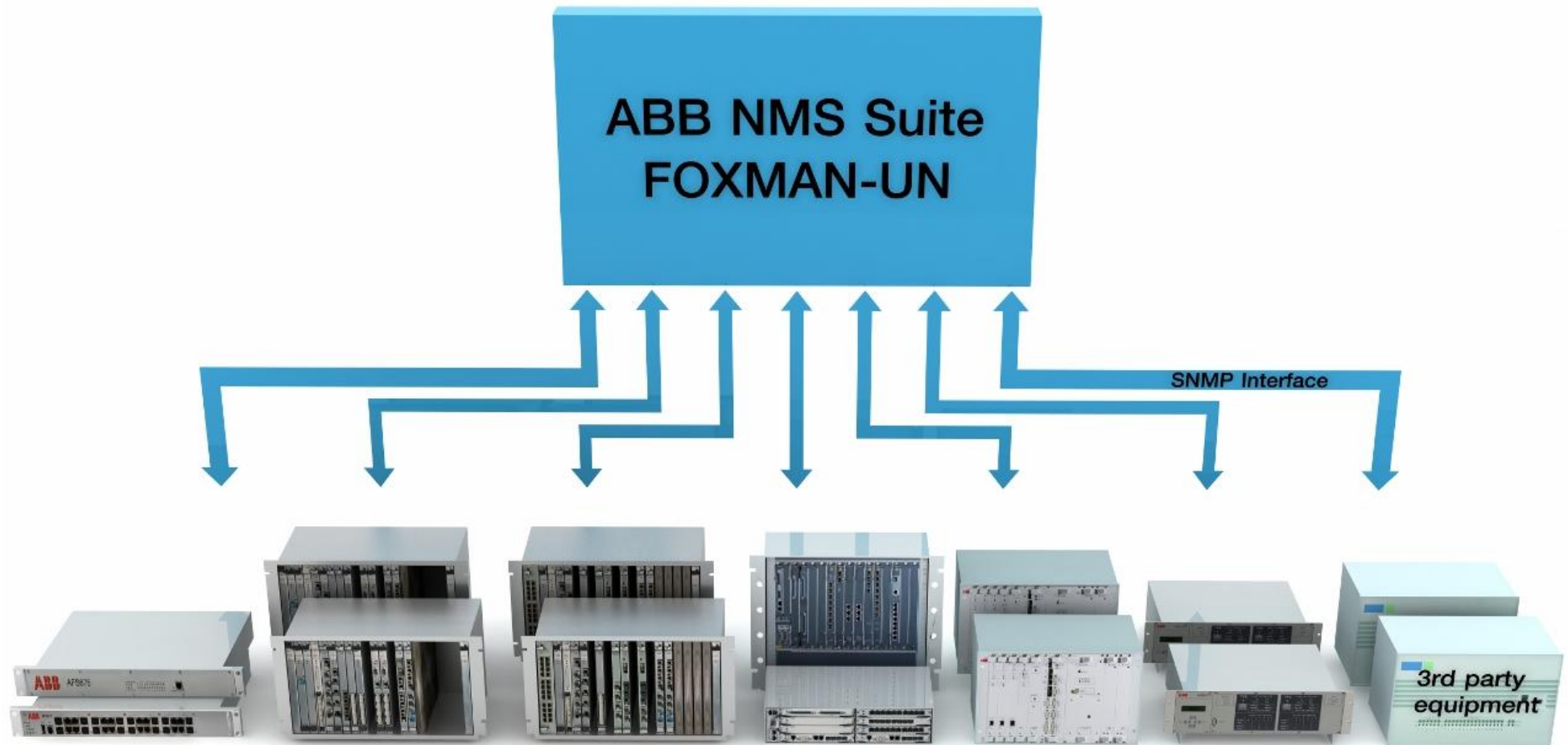
# Migration strategy of existing networks FOX615 all PSN network



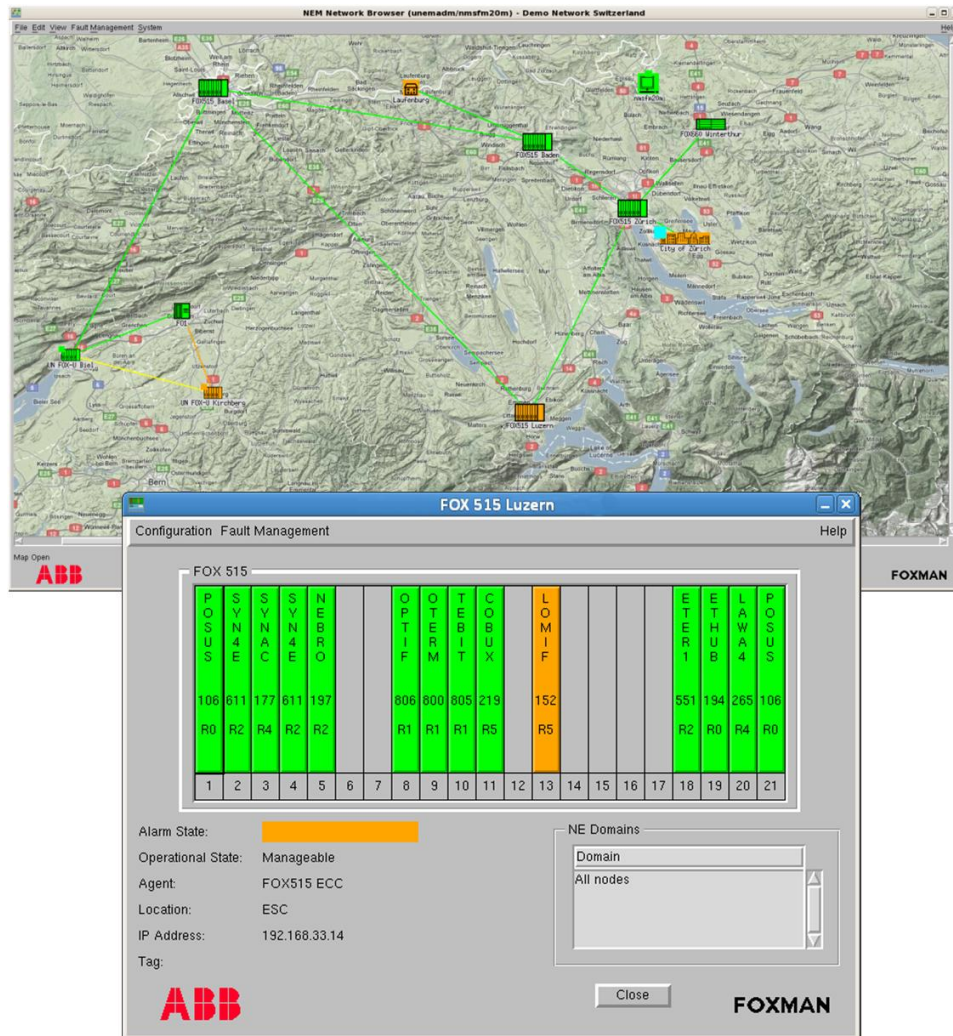


# FOX615 Network Management System

# FOXMAN-UN: ONE Management System



# FOXMAN-UN Functionality



## Fault Management

- Status supervision
- Alarm documentation

## Configuration Management

- Equipment configuration
- Network configuration

## Account management

- Providing information for accounting

## Performance Management

- According to ITU-T G.826

## Safety Management

- Access / Intrusion Control
  - Software
  - Physical intrusion



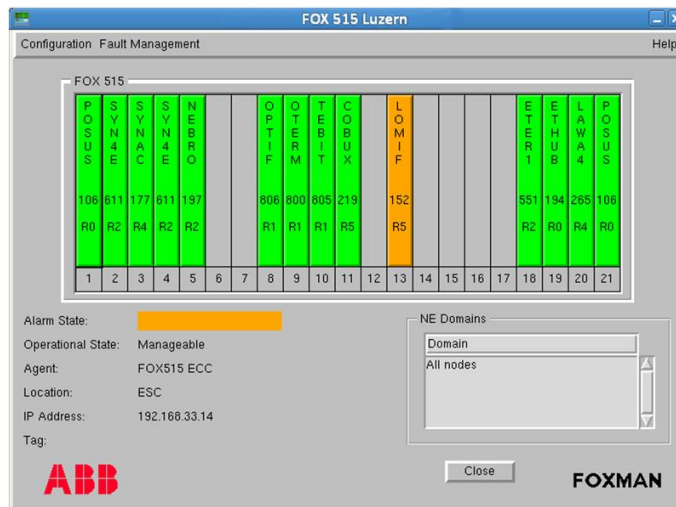
# FOXMAN-UN

## Hierarchical structure



### Display of Network

- Different levels of communication network:
  - Global
  - Per region
  - Detailed - down to the communication room
- Color code for condition of equipment



### Display of Equipment

- Different types of information:
  - Shelf with status of modules
  - Alarm lists (through specific filters)
  - History of alarms
  - Many others
- Color code on module level for condition of equipment

# ABB FOX515/ FOX615 solutions

## Summary

- FOX615 is...
  - prepared for future packet switched backbone networks
  - fully integrated into the FOXMAN-UN
- 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



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