
COMMUNICATION NETWORKS

Ready for the challenges of tomorrow.

FOX615 Multiservice Platform



Today's challenges.

Utilities today face a variety of challenges.

The growing trend towards the Internet of Things (IoT) has further reinforced the requirement for robust and reliable telecommunications in today's digitalized world. Public telecommunications have adapted to new applications and migrated to packet switched technologies, whilst the operational networks of critical infrastructure, such as electrical power utilities, have remained bound by stringent requirements that guarantee reliability of service.

As more utilities are privatized and strive to minimize CAPEX and OPEX and the steep increases in power consumption continue, without the

corresponding expansion of transmission and generation capacity, pressure on power grids around the world increases. This, together with the introduction of distributed renewable power generation and the evolution of smarter grids increase the importance of intelligent communication networks. Utilities require a communication network that can deliver outstanding performance more than ever in order to guarantee the delivery of power, enable new applications and more significantly the protection of your assets and the limiting of failures across the grid.



Teleprotection functionality Safeguarding the electrical grid

Critical to grid operations is the protection of powerlines, through teleprotection. Teleprotection systems were developed alongside the electrical grids themselves, and the operational communication networks used are mainly driven by those applications. In 1940, the average telephone user was just getting to grips with the rotary-dial telephone, while ABB was deploying power-line communications: utilizing the electrical transmission infrastructure to carry teleprotection data and avoiding the need for a separate Pilot Line.

Public telecom networks have evolved at an amazing speed, this has been primarily driven by new applications (e.g. smartphones, YouTube, email) which results in a growing demand for increased bandwidth. Subsequently this has resulted in network solutions with a higher capacity for data transmission with a lower focus upon the quality of service. Teleprotection systems, in contrast, have always operated under the pressure of protecting critical infrastructure. Reliability and quality of service is paramount, resilience is required, while new technologies and techniques must prove themselves robust enough to match, or exceed, the existing equipment before they can safely be used in the electrical network.

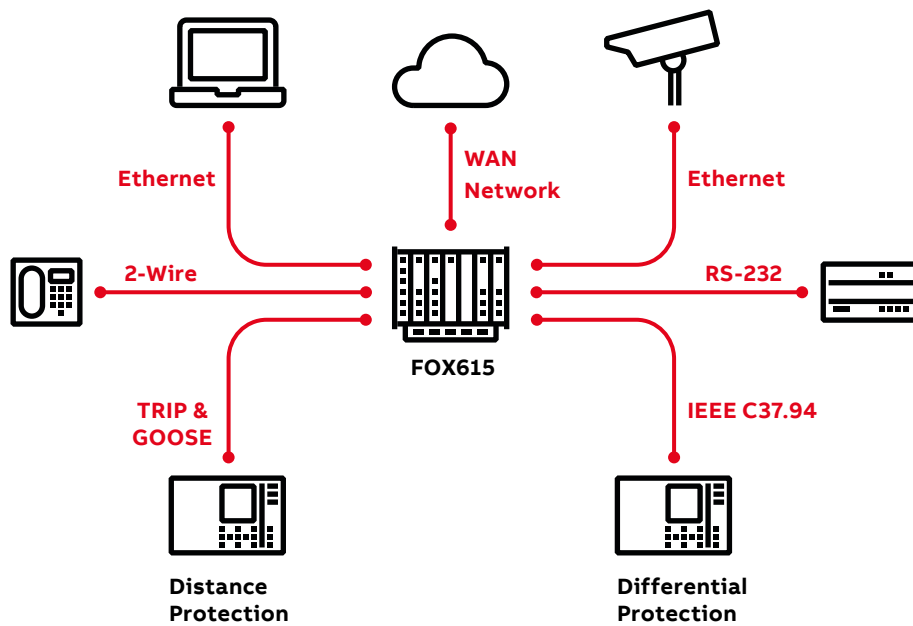


Integration of existing infrastructure

Investment cycles in utilities are much longer than those in the public telecom sector. Protection and control equipment in electrical substations, which is ultimately connected to utility communication equipment, is particularly long-lived. The ultimate goal of commissioning an all-Ethernet/IP network is still far away, particularly for power grids, which link hundreds or even thousands of established substations.

A basic requirement of such a system would be longevity, with guaranteed performance as per established technologies. Unlike the full network refurbishments often seen in public telecommunications networks, utility networks evolve slowly, increasing in size and slowly migrating to new technologies in a step-by-step approach. This evolution means that high interoperability between existing and new installations as well as parallel operation of both is a must.

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01 FOX615 Multiservice Platform Guaranteed communication performance for critical applications

Utility environment, a challenge in itself

These days most offices grind to a halt in the face of a failed internet connection, but no industry compares to electrical transmission in being dependent on robust, resilient, and predictable communications. Only suppliers with an intimate knowledge of the industry can supply, and maintain, equipment capable of meeting that unique set of demands.

In addition to extremes of temperature, utility communications equipment is also exposed to magnetic and electrical fields, which are particularly severe during short-circuit events. In order to maintain the high levels of availability required, especially in emergency situations, utility communications equipment must offer a robust and reliable design that has proven capabilities for providing accurate functionality under extreme conditions. In dusty and remote environments, where regular maintenance cannot be guaranteed, fan-less designs are preferable.



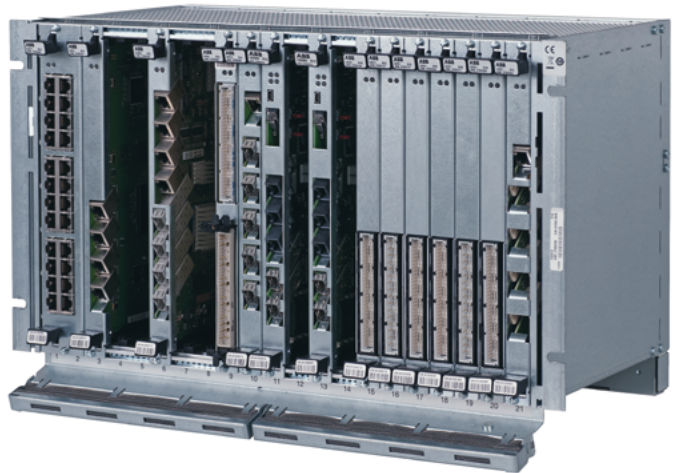
Cyber Security- Layered communication architectures ensure improved network security

Packet-based networks use publicly documented protocols, and utilities are potential targets, so a comprehensive (and co-ordinated) security policy is essential across the entire network.

Depending on the application requirements, different measures need to be taken, starting from denial of service protection, protection against data modification using authentication, up to encryption of confidential data and centralized user account management. This ensures a 'defense in depth' approach and is supported with the FOX615 platform. Additionally the static approach of MPLS-TP, with much less protocols being potential targets for attacks, and the natively integrated SDH technology reduce potential attack surfaces.

FOX615

Enabling seamless migration and extension of existing communication infrastructures.



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01 FOX615 unit

02 FOX615 - allowing stepwise migration from SDH to MPLS-TP with guaranteed performance

An outstanding multiservice platform for real-time utility communication.

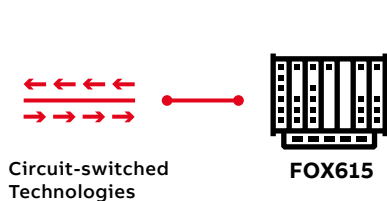
ABB's FOX615 is a hybrid solution supporting traditional TDM (PDH / SDH) and Multi-Protocol Label Switching - Transport Profile (MPLS-TP) – the latest standard designed to address the new applications using packet switched technology natively. The majority of existing communication networks of power utilities are based on Time

Division Multiplexing, TDM, which allocates dedicated circuits to specific communications and thus guaranteeing the required communication performance parameters such as bandwidth, latency and symmetry. New standards today are based on packet switched technologies (e.g. IEC 60870-5-104 or IEC 61850) and therefore integrate natively into a packet switched MPLS backbone network.

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SDH

Supported network.



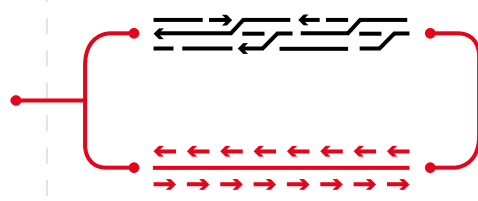
Phase 1

NG SDH
Ethernet over SDH

- IEC 104 RTU
- Voice over IP (VoIP)
- Video over IP

Hybrid

Combined networks.



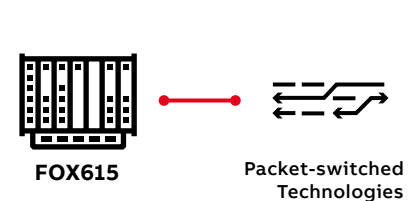
Phase 2

Hybrid Platforms
SDH/ MPLS-TP

- Non-critical applications on PSN
- Critical applications remain on TDM

MPLS-TP

Future network.

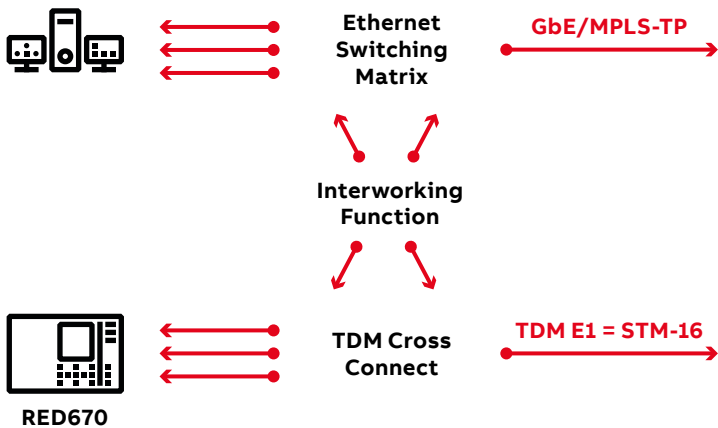


Phase 3

MPLS-TP

- IEC 61850 over IP
- Traditional over IP
- Critical application on PSN

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03 Universal Equipment
providing SDH and
enhanced Packet
Switched Network
(PSN) Services

Well known features of SDH networks were left behind when MPLS was originally created for dynamic public telecommunication networks and implemented as IP/MPLS. That’s why an enhancement of the standard was required, leading to MPLS-TP bringing back those missing features from SDH to the MPLS world such as bidirectional and static channel routing or end to end channel supervision using Operational Administration Maintenance (OAM). FOX615 provides native MPLS-TP and SDH functionality as part of the hybrid approach implemented.

FOX615 today offers much more to a utility than any other multiservice platform for real-time utility communications.

The combination of state of the art SDH technology and future MPLS-TP technology provides an easy and flexible way to migrate technology in a utility network. All FOX615’s which are deployed in the field today can easily be upgraded to MPLS-TP. It also allows the parallel

implementation of SDH and MPLS-TP in one node, separating traffic according to their performance requirements. One further option is to just implement a pure MPLS-TP node. FOX615 today offers much more to a utility than any other multiservice platform for real-time utility communications.

FOX615 the utility communication solution
FOX615 is designed to be deployed in harsh environments ranging from extreme temperatures to magnetic and electrical fields, which can be particularly severe during short-circuit events. Furthermore it includes integrated teleprotection interfaces for distance as well as for differential protection. These interfaces are designed to work in TDM as well as in MPLS-TP networks. Especially the implementation of differential protection over PSN networks imposes huge challenges, as the PSN inherent jitter has to be compensated to guarantee a reliable functionality. FOX615 can guarantee the communication channel performance required of those critical application. Additionally FOX615 provides the possibility to distribute exact Time of Day information, pass it on to end devices and can help to become more independent of any 3rd party clock source e.g. GPS.

Communication Networks functionality explained	SDH	IP-MPLS	MPLS-TP
Static channel routing	✓		✓
End to end channel supervision	✓		✓
Deterministic data channels	✓		✓ ¹
Bidirectional channels	✓	*	✓
Switchover < 50ms	✓	*	✓
OAM based switchover	✓		✓
Sophisticated GUI for channel configuration	✓		✓
Easy configuration	✓		✓
Network Management System	✓	✓	✓

* Supported with additional protocols
1 Deterministic network performance not as good as with SDH technology

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FOXMAN-UN

ABB's powerful network management system.

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01 FOXMAN-UN Network
Management system

All ABB Communication Network Products are fully integrated into FOXMAN-UN, including FOX615 and its utility specific interfaces for distance and differential protection. FOXMAN-UN provides sophisticated supervision features, such as a graphical representation of the communication network, a view of the synchronization status of FOX615 network elements and performance monitoring of links. In addition, FOXMAN-UN allows certain tasks, such as firmware distribution and activation, to be automated and scheduled.

Minimizing maintenance

FOX615 is configured using the FOXCST graphical configuration software. Intuitive user dialogs, equipment views and the ability to configure offline. It helps users to reduce down time of network elements and to speed up troubleshooting. The full integration of FOX615 into FOXMAN-UN ensures easy configuration of multiple network elements, especially the Networking Package option which allows efficient and failure-save automatic configuration of MPLS-TP communication links in a network. This also allows the operation of larger networks with reasonable efforts. FOXMAN-UN's unique ability to integrate a range of ABB Utility Communication devices helps operators to enhance the overall performance of utilities' operational networks.

IP/MPLS with its dynamic protocols is well adapted to the requirements of the volatile public telecom networks, which are very different to those of stable operational networks; where knowledge of channel routing is more important than load dependent network reconfigurations.

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Since MPLS-TP is a technology that uses network management systems for channel configuration instead of running many dynamic protocols on the node, the operation of the network and the general parameters of performance become significantly easier. This is an important aspect in the power utility environment. Releasing the network elements from all these dynamic protocols has many advantages. For example, it makes the setup, configuration and troubleshooting of the nodes much easier, it also reduces the complexity of the node itself with corresponding cost savings on hardware and the power consumption of the node.



Utility dedicated know-how.

We are over 75 years of utility communications experience.

At ABB we'd like to take you into the next generation of teleprotection technology, and we have the experience and equipment to do so. We've been protecting critical infrastructure for more than a century, but our history is one of constant innovation – taking the best new technologies and developing them for challenges unique to the industry, and unique to you.

Long product life cycle measured in decades not years

Just as important as the specifications and integrations is the commitment and experience that ABB brings with its product range. The telecommunications industry is highly volatile, with fast changing technologies, short product life cycles and different business models. Customers can find themselves with limited support and limited options, which is less of a problem when communication bandwidth requirements are growing rapidly, leading to complete replacement of installed base in short cycles. This is not an option for critical infrastructure, where replacement is complex and availability and safety is at stake.

ABB Communication Networks - We are here for the lifetime of your network

ABB is a long-standing and experienced supplier of solutions for power utilities. These include network supervision, protection systems and communication solutions for operational networks. ABB also actively participates in organizations like CIGRE, IEC and IEEE, contributing recommendations and standards for future developments in the electric power industry. As one of only a few companies that provides both communications and protection and control solutions for the operation of power grids, ABB can deliver outstanding solutions for the demanding applications of power utilities.

ABB Communication Networks has a huge global installed base of communication devices within operational networks, including teleprotection devices, Power Line Carrier equipment and fiber optic communication. We are your utility communications partner, ready for the challenges of tomorrow.



ABB Switzerland Ltd.

Power Grids

Grid Automation
Bruggerstrasse 72
CH-5400 Baden
Switzerland

abb.com/communicationnetworks