• Increased productivity in the operation of the communication network by reducing manual tasks
• Increased service availability for critical communications by reducing service downtime
• Increased efficiency for network deployments by the reducing gap between as-planned vs as-built
Overlay Management System
Answering complex network challenges.

Utilities employ a wide variety of equipment and technologies in their communication networks. Their efficient management presents a challenge for utilities, as these networks are built to be in reliable operation for many years.

Network management systems are today essential for the provision, operation and extension of communication networks. Operational networks maintain a considerable installed base of equipment which have been deployed across several years, typically based on circuit-switched technologies PDH and SDH. Although investment in these technologies is declining, the majority of operational networks continue to rely on these technologies to transport their mission critical services (e.g. SCADA data, teleprotection data and rail signaling).

In many scenarios, communication networks are often poorly documented. In addition, utilities are facing challenges with an aging workforce and a lack of domain expertise for planning and operations. This can lead to problems when maintaining and operating their communication network and increasing risks due to the unavailability of the network as a result of deficient designs. In the severest of cases, this can lead to huge financial losses due to service unavailability caused by outages within their mission critical communication infrastructure.

Common outage scenarios in communication networks are caused by non-compliant designs including a lack of path redundancy, diversity on optical fiber cables or single points of failure of equipment installed in transit stations. If deficient designs could be automatically detected and traced in advance this would allow utilities to significantly reduce service downtime due to unexpected outages.

The communication channel unavailability resulting from a deficient design or misconfiguration on the communication network has a direct impact on monitoring and control of the critical infrastructure, ultimately leading to financial losses to customers.

FOXOLM offers an accurate, detailed and new perspective of your utility communication network
FOXOLM is a business intelligence platform which combines relevant network information from one or more network management systems to provide visualization, reporting and analysis of network asset utilization across multi-service technologies, including PDH, SDH, WDM and Ethernet.

FOXOLM plays a key role in providing accurate documentation of the communication network, detailed analysis of inventory & capacity usage in the field, increases communication channel availability for critical applications and provide efficient tools for planning & optimization in network extensions/retirements.

FOXOLM also allows operational staff to visualize As-Built diagrams for network exploration, as well as line managers to use built-in analysis and reporting tools to profile regions or identify areas that are the most exposed to risk. Furthermore, network planners can drill down to detailed inventory statistics to determine potential capacity bottlenecks as well as design new network diagrams for planned extensions and strategic migrations in the communication network.

It is far more time consuming to accurately plan & document a network over its life time, than the time required for its provisioning in field.
### ABB Communications Networks

Addressing utility communication needs.

ABB’s Network Management Suite answers the strong need for integrated software solutions capable of managing complex Mission Critical Communication Networks.

**Network Management Systems (NMS)**

Former ‘point to point’ communication based architectures could be easily managed with simple tools such as equipment craft-terminals and element managers. However, today’s networks form complex meshed structures comprising a wide range of technologies. These are based on various communication media, including fiber optics, wireless or Power Line Carrier. Moreover, Mission Critical communications need to ensure network performance and high-availability of service based on well known traffic protection schemes existing for PDH/SDH networks, as well as for MPLS-TP.

ABB Network management systems enable reduced operational costs for utility networks by reducing the complexity in network operations and planning, as well as enhancing the reliability and the availability of services.

FOXMAN-UN, FOXVIEW and UNEM provide a comprehensive range of tools, technologies and enable the integration of FOX, UMUX and XMC equipments through its corresponding network management systems. In addition they also allow real-time monitoring of the performance of the network, alarms surveillance, and configuration management. The Network management system is also supporting advanced configurations including protection mechanisms that allow full redundancy of the network.

FOXOLM provides an additional service management layer for mission critical networks thanks to the integration of the underlying ABB network management systems: FOXMAN-UN, UNEM, FOXVIEW and FOXMAN-EM. This integration brings maximum synergy through managing different services & technologies in a unique offering.

<table>
<thead>
<tr>
<th>Service Management</th>
<th>Element &amp; Network Management</th>
<th>Network Equipment</th>
<th>Segment Specific Focus</th>
</tr>
</thead>
<tbody>
<tr>
<td>MTOSI / TMF 814</td>
<td>MTOSI / TMF 814</td>
<td>SNMP, Proprietary</td>
<td>Power Grids</td>
</tr>
<tr>
<td>REST / SOAP / EXCEL</td>
<td></td>
<td>SNMP, Proprietary</td>
<td>Generation, Transmission and Distribution</td>
</tr>
<tr>
<td>FOXOLM</td>
<td>FOXMAN / FOXVIEW</td>
<td>FOX</td>
<td>Transportation, Oil &amp; Gas and Authorities</td>
</tr>
<tr>
<td></td>
<td>UNEM</td>
<td>UMUX / XMC</td>
<td></td>
</tr>
</tbody>
</table>

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**Abbreviations**

- **FOXOLM**: FOX Over Management
- **FOXMAN-UN**: FOX Management UNEM
- **FOXVIEW**: FOX Video
- **UNEM**: Universal Element Management
- **MTOSI / TMF 814**: Management Telecommunication Management Information Services/Telecommunication Management Forum 814
- **REST / SOAP / EXCEL**: Representational State Transfer / Simple Object Access Protocol / Excel
- **SNMP**: Simple Network Management Protocol
- **Proprietary**: Equipment-specific management protocol
- **FOX**: Fast Operation and Xchange
- **UMUX / XMC**: Universal Multiprotoco/Universal Multiprotocol Crossover
- **Power Grids**: Generation, Transmission and Distribution
- **Transportation, Oil & Gas and Authorities**: Industry-specific services
Maximize network lifetime
Unlock the value of network data.

Key applications:
- Network documentation
  - Discovery & automatic documentation of resources installed for access & transport networks
  - Asset and inventory management of physical and logical resources
- Analysis and simulation
  - Analysis & reporting of resource utilization for capacity planning and network extensions/migrations
  - Optimization of installed infrastructure and reduced maintenance cost with network inventory
  - Automation of reliability analysis by reporting of single-points-of-failures and service impact of the potential risks
  - Simulation of what-if scenarios for planned maintenance works to reduce service unavailability
- Network planning
  - Support in strategic planning for decision makers to smoothly and safely migrate end-of-life equipment
  - Automation tools for planning, operation and commissioning stages replacing manual tasks

Your benefits:
- Increase in operational productivity and user experience
- Comprehensive view of multi-layer networks
- Accurate network documentation through automated data upload
- Reduce operational workload with recurring reporting tasks
- Optimize network inventory and strategic plan capacity
  - Efficient and accurate inventory of physical & logic resources including statistical utilization reporting
  - Easy detection of capacity bottlenecks and optimize areas of overcapacity
  - Generate input for inventory and capacity utilization benchmarks
- Pro-active risk assessment against network misconfiguration
  - Ensure main & backup path diversity through route protection analysis
  - Eliminate service downtime in event of equipment unavailability and infrastructure
  - Eliminates financial loss due to planned outages
- Detail planning & traceability for network extensions and retirements
  - Optimize resource availability & capacity for network extensions
  - Document & plan new physical and logical resources, interconnections and services
  - Automatic reconciliation between planned resources versus discovered resources
Gain full visibility of your network
Uncovering hidden network patterns.

**Network Discovery & Documentation**
Network discovery is a process which periodically parses network data exported by underlying management systems or network equipments. The discovery process runs autonomously without user intervention and can be scheduled based on customer needs, ensuring that users have of up to date snapshot of the network. During discovery process network data is automatically stored in an SQL database.

Users can analyze detailed maps, explore network diagrams, search & visualize network resources including, sites, nodes. Connectivity diagrams are generated dynamically and allow users to navigate through configured services/circuits per station, equipment, card or port including its end-to-end routing information.

FOXOLM provides graphical representation of all logical layers which are configured in a PDH/SDH communication network. Its intuitive graphical user interface is an alternative for users who are not experienced with the network management systems or do not have deep knowledge in communication technologies.

**Logical Inventory**
Logical inventory provides traceability of resources that are interconnecting hardware and capacity installed in the different layers of a PDH/SDH communications network, including physical layer, link layer, trails or virtual containers, and circuits or services. In a communications network, traffic paths or trails represent capacity installed, which can be utilized to provide circuits or services.

FOXOLM provides end-to-end graphical representation of logical inventory it provides as well as the correlation between trails and circuits from various technologies like PDH, SDH and xWDM. FOXOLM also provides a hierarchal view of all network resources (showing how they relate each other) in a very intuitive and user-friendly manner. Users can generate circuit routing reports or “channel lists”, containing relevant information required for the generation of work orders for commissioning engineers.

**Physical Inventory**
An accurate and updated inventory system is a basic requirement for Utilities, as they need to manage a considerable amount of physical inventory in their communication networks. Often external inventory systems do not feature connectivity to the network management systems or network equipment, as network data needs to be entered and maintained manually by operators on a regular basis. In most of the cases these activities are very time consuming and very often human error prone (depending on the size and complexity of the communications network).

As a part of network planning and maintenance activities, operators/line mangers need to assess physical utilization in the network. FOXOLM offers predefined inventory analysis reports and charts, or by generating statistical information directly in the diagrams or networks maps. This is a particularly interesting feature for planning departments who regularly need to work on this basis in order to cope with network extensions or migrations.

FOXOLM uses open protocols and telecommunication management standard framework. It uses web technologies, providing a user friendly graphical interface avoiding the need to install additional software.
Seamless network operations
Prediction, planning and simulation.

Network Capacity Analysis
Available capacity and network resource usage are key constraints in network optimization and extension process in Mission critical networks. Therefore they need to be managed effectively. In a network with hundreds of interconnected resources it is essential to have timely and accurate access to information related to capacity installed versus capacity used, in order to make optimum usage of existing network resources and effectively plan new capacity in order to cope with demands of network growth without compromising existing services.

FOXOLM provides tools and dashboard views which assist in the detection of resource constraints across the complete network and verifies spare capacity required for the provisioning of service/circuits for a particular subset of the network. Statistics like link filling percentage are automatically calculated and represented graphically on colored maps or through the generation of reports. With a few clicks users are able to identify capacity bottlenecks in the complete network without the need to do deep investigations in the underlying network equipment.

Route Protection Analysis
Mission critical networks need to be reliable from day one and kept like that as they evolve over their lifetime. However, in practice these networks are often exposed to potential reliability risks, typically due to deficient network design carried out during planning or due to inaccurate configuration implemented in the field by commissioning engineers. Ultimately these could lead to a significant operational impact and financial losses for customers and service and end-users in case of outages, e.g. in case a teleprotection circuit/service is unavailable when it should be, leading to significant losses in the power grid.

FOXOLM has an routine that runs route protection analysis on all circuits/trails existing in a network. This pro-actively looks up redundancy problems and detects single point of failures, allowing reliability issues to be automatically identified. Users have a smooth and accurate way to identify, visualize and report non-compliant designs existing in the network. FOXOLM enables operation teams to reduce the number of reliability issues, allowing effective planning of network redesigns and therefore prevent outage events to happen. The overall reliability of the network is therefore significantly improved.

Incident Simulation
Very often users face huge challenges in planning of maintenance works or outages for their operational networks. The key point on the planning of an outage is the determination of the service impact caused when the outage is carried out on a particular station, equipment of link/interconnection.

FOXOLM provides a simulation of what-if scenarios, by combining one or more failures in the network and automatic calculation of the service impact. Users or planners are able to simulate what-if scenarios, e.g. equipment failures or link outage, providing reporting of the service impact of such operation based on service/circuit reliability analysis.

Although network data often exists in the Network Management Systems, it is scattered over a collection of network layers, often based on different technologies and sometimes maintained by different teams and therefore not easily accessible to users.
Maximize operational productivity
Integration into every environment.

Advanced statistical algorithms determine what are the top incidents in the network, allowing users to do a comprehensive risk assessment to identify areas most exposed to risks and take necessary measures to prevent outages. The ultimate goal of this feature is the reduction of service downtime and elimination of financial loss for the Utility.

FOXOLM planning features allow for the planning of new network resources both physical and logical. On top of this it can make the necessary reservations of existing resources for upcoming service activation needs. FOXOLM will not only provide the current state of the network (network snapshot) but also offer the view of the network as it is expected to be soon, consolidating the current state and plans for resources to be still deployed (or decommissioned).

FOXOLM plan & retirement features enable the following operations:
- **Extensions**: allow plan (design) of new equipment
- **Provisioning**: allow design of new client (routed) circuits and trails
- **Migration**: allow design of new client (routed) circuit and trails
- **Migration**: allow migration (modification) of existing circuit and trails
- **Retirement**: allow to decommission existing equipment, circuits and trails
- **Reservation**: allow to lock critical resources
- **Documentation**: allow to document passive (or non-managed) equipment

### Network Planning

Network planning requires skilled engineers and specific know-how in planning and operations which can be a challenge for Utilities. In addition, as the complexity of a network increases, it is essential to have planning tools which allow to save costs, automate tasks and increase network reliability of the network. Often it is not possible to easily verify what has been planned is corresponding with what is installed, without using specific engineering tools that allow design extensions and keeping track of commissioned activities as the on-site works go on.

### FOXOLM system requirements

<table>
<thead>
<tr>
<th>Server type</th>
<th>CPU</th>
<th>RAM</th>
<th>Disk Space</th>
<th>Network Interfaces</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical</td>
<td>Intel XEON equivalent</td>
<td>At least 32 GB</td>
<td>At least 250 GB</td>
<td>At least 2</td>
</tr>
<tr>
<td>Virtual</td>
<td>1</td>
<td>At least 32 GB</td>
<td>At least 250 GB</td>
<td>At least 2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Operating System</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microsoft Windows Server</td>
<td>2012 Standard</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Third Party Software - Server</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS Internet Information Services (IIS)</td>
<td>5.1 or higher</td>
</tr>
<tr>
<td>MySQL Server</td>
<td>5.7</td>
</tr>
<tr>
<td>MySQL Connector</td>
<td>6.4.6</td>
</tr>
<tr>
<td>VMware ESXi (virtualization)</td>
<td>6.0 U3</td>
</tr>
<tr>
<td>Tortoise SVN Server</td>
<td>Any</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Third Party Software - Client</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS Internet Explorer (IE)</td>
<td>6.0 or higher</td>
</tr>
<tr>
<td>JavaScript</td>
<td>1.3 or higher</td>
</tr>
<tr>
<td>Adobe SVG plug-in (IE 6,7,8)</td>
<td>3.01 build 81 or higher</td>
</tr>
<tr>
<td>Tortoise SVN Client</td>
<td>Any</td>
</tr>
</tbody>
</table>