On the Way to the Smart Grid
Nord Energi, Denmark

A power distribution and transmission company in Denmark relies on Nexans managed industrial switches to ensure a smooth communication with SCADA and to improve its power station management.

Nord Energi is a Danish power company that specialises in electrical power distribution and transmission. It is one of the most efficient and safest electricity suppliers in Denmark with a very high quality of service. The company has 140 employees and supplies around 93,500 customers in the regions of Vendsyssel and Aalborg. It sold about 837,300 MWh in 2015 and scored over 99.99% for the reliability of its power supply. To pave the way for a smooth migration to Smart Grid the company opted for intelligent iSwitches already in 2008.

Nexans

Challenges

- Create an extremely reliable and flexible IT infrastructure for a power distribution grid
- One central point of management for the whole system
- Extended reliability, high availability and redundancy of the Grid
- Interoperability and easy integration with SCADA

Solution

- LANactive Industry Switches
- Industrially hardened design
- NexMan as a network management tool for network monitoring and control
- Extensive support from manufacturer

Benefits

- SD card to replace settings in case of a downtime in the field
- Very easy to manage and maintain, one person can do everything very quickly
- Reliable, redundant and scalable network
- Less time for configuration and troubleshooting

The Pilot Project

Back then the company launched a Pilot Project to gear up its 60/10 kV substations with intelligent switches that would be integral part of the existing grid infrastructure and ensure intelligent communication of all the elements of the system with SCADA.

Due to historical developments, the substations used to have their own networks and servers. There was no central management, so the intelligence and monitoring functions of the power supply and distribution infrastructure remained underutilised or accessible only via parallel applications or proprietary systems. A single management interface was needed. At the same time, it was crucially important to protect the system from unauthorised access and to ensure a safe and reliable operation of the stations.

After researching the market and testing solutions extensively, the team opted for Nexans managed industry switches. Three points were very important: smart integration into SCADA, advanced security features and user friendly interface. There were very few switches with this range of functionalities at that time, particularly in terms of security and network availability. Moreover, the switches were specially developed for applications in harsh environments and had a very high MTBF thanks to industry grade hardware design. Eventually Nexans LANactive Industry switches were found to be best suited to modernise the network of Nord Energi.

Smart Integration with SCADA

The company currently owns app. 40 60/10 kV and 2,626 10/0.4 kV substations and manages over 2,892 km of power lines.

"Over the years, we have been using several generations of Nexans systems", says Lone Fiil, Senior Electrical Engineer with Nord Energi. "The switches function as a key element in the services infrastructure of our 60/10 kV and a few 10/0.4 kV substations, which have been equipped with motor and remote terminal units – they can now be controlled and monitored from SCADA". The goal is to minimise downtime and at the same time make the first step towards the Smart Grid. Now the switches are mostly used for the interstation communication with SCADA, but can also communicate with the central station as part of a uniform platform for the exchange of IED (intelligent electronic devices) data, services and network information.

Extended Functionalities and Support

"We have made very good experience with Nexans iSwitches", says Michael Bartholomaeussen, IT Supporter with Nord Energi. "The switches ensure end to end live network monitoring and diagnostics of the copper and fibre links. They provide
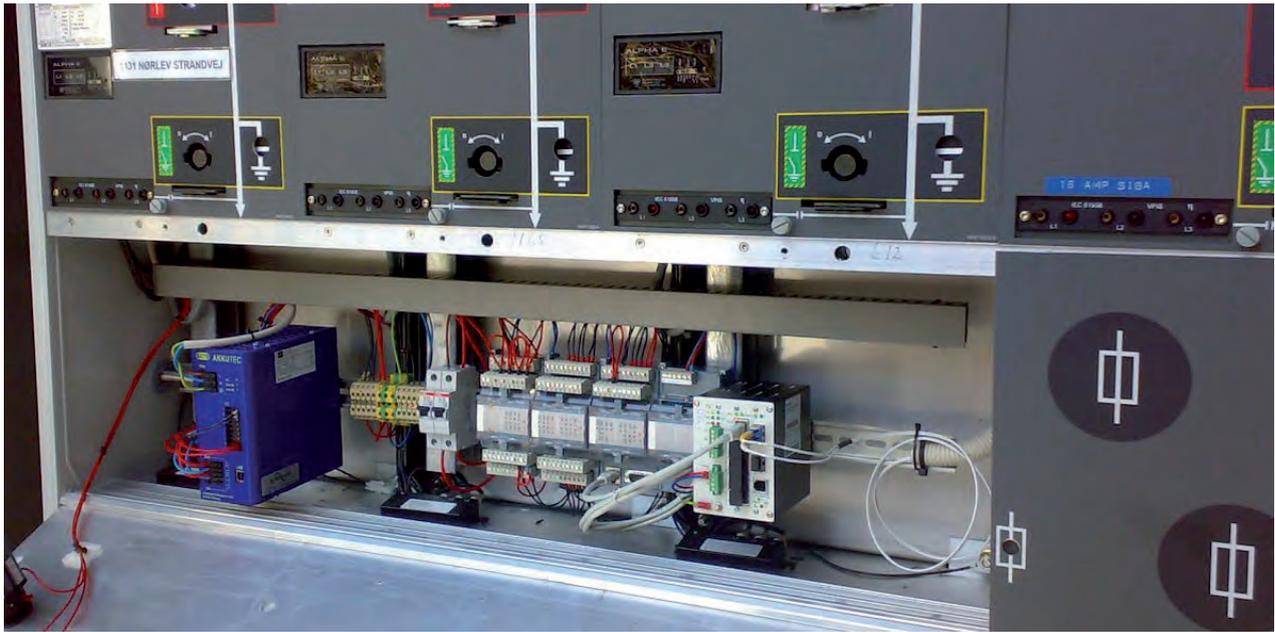
extended information about the network status in a very comfortable way and ensure a stable power supply. The switches help us to provide a secure, stable and fast communication, both for the management of our 60/10 kV stations and for the remote control of our 10/0.4 kV substations".

The central cockpit is NEXMAN, a software tool to manage the network. It offers a single user friendly interface for all network configuration and management settings, which is particularly important for managing substations scattered over large distances. Master configurations for hundreds of switches can be created and distributed very quickly and efficiently with NEXMAN.

"Moreover, the switches are very easy to maintain and to replace", adds Michael. "Both switch configuration and firmware settings can be backed up centrally in the management environment. Each switch has a Memory Card which stores its configurations and firmware. The card also stores an additional unique MAC address fixed in its memory. Remove the card and insert it into another switch. You´ll set it going without any need to change the access control tables as it will immediately get the MAC address which is preset on the card as well as the firmware and configu-

rations. The system will see the same switch all the time".

"For us as an energy distribution company the question of network reliability and security is of the uttermost importance", goes on Michael. "iSwitches support a special operating mode which deactivates insecure management protocols like Telnet and HTTP and activates the secure mode, for example for password administration. All management protocols can be activated or deactivated individually. Extra protection is granted by Access Control Lists (ACL). Moreover, the iSwitches support RADIUS authentication, certificate based IEEE 802.1x and SNMPv3 with two different encryptions, one for authentication and one for privacy.
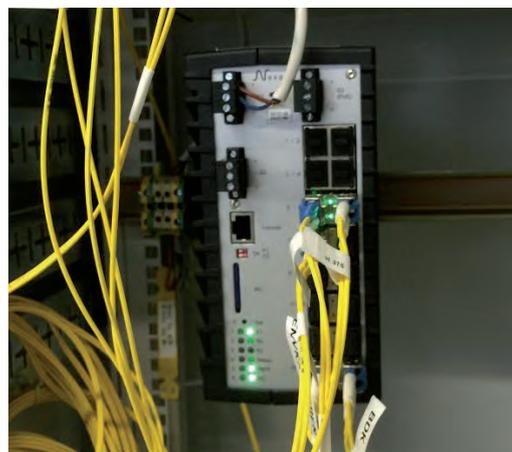
Alarms Traps can be also transmitted encrypted with SNMPv3, and password and other sensitive information is stored and transmitted via HTTPS (AES 128). Each port can be authenticated to prevent unauthorised access to the network and thus to the grid".

"The Switches are very reliable high tech systems", says Lone. "They are intelligent and robust. Many have been with us for years, since the very first day! However, things happen, and when you need support, you get it. We might have one incident per year, but we get very quick and timely help. We may also have special wishes regarding software features and have them implemented. Well, Nexans actually listens to what the customer wants and solves problems in a very easy and uncomplicated way".

The Road to the Smart Grid

The decision made in 2008 turned out right.

"All in all, Nexans switches have a wide range of functionalities and security features to make the Power Grid management much easier", sums up Lone. "For us it is very important to automate many processes on the Grid and reduce time for problem identification and fixing. The switches make the Grid smarter and bring us closer to our ultimate goal - a stable power supply with as few downtimes and outages as possible".

The new generation of Nexans iSwitches, iGigaSwitches 16xx with Gigabit speeds, already support IEC 61850 (6, 7-1, 7-2, 7-3, 7-4, 8-1, 9-1, 9-2, IEC 61850 Certificate Level A, IEC 61850 SERVER functionality - MMS and GOOSE). The standard was developed to enable a universal data model to incorporate network components into the electrical grid and ensure a single data model for the switch, its connections, IEDs, status and alarm messages in SCADA. The managed industrial switches from Nexans were the first on the market to pass KEMA certification tests to guarantee complete compliance with IEC 61850.

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APPENDIX

SCADA

SCADA (Supervisory Control and Data Acquisition) is an industrial automation control system. It operates coded signals over communication channels to provide control of remote equipment. Its architecture includes computers, networked data communications and graphical user interfaces for high level process supervisory management, but also relies on other peripheral devices such as PLC and RTU to interface to the process plant or machinery.

The real-time control logic is performed by networked modules which connect to the field sensors, actuators and control valves. These provide information to I/O modules and their associated electronic processors (PLCs and RTUs). Data acquisition begins at the RTU/PLC level and includes instrumentation readings and equipment status reports that are communicated to supervisory computers. The supervisory computers collate information from processor nodes on the system and feed operator control screens. The software presents the station information to the operating staff graphically in the form of diagrams, alarm displays, trend graphs and event logging pages. It accumulates time-stamped data, events, and alarms in a database which is queried and used to populate analytics reports. Based on this information the operator can make supervisory decisions to adjust or override normal RTU/PLC controls.

The new standard IEC 61850 (parts 6, 7-1, 7-2, 7-3, 7-4, 8-1, 9-1 and 9-2 of Communication Networks and systems for Power Utility automation) helps to bring various field devices, IEDs and network components into a single whole and thus significantly improve the efficiency of power generation, distribution and consumption infrastructures.
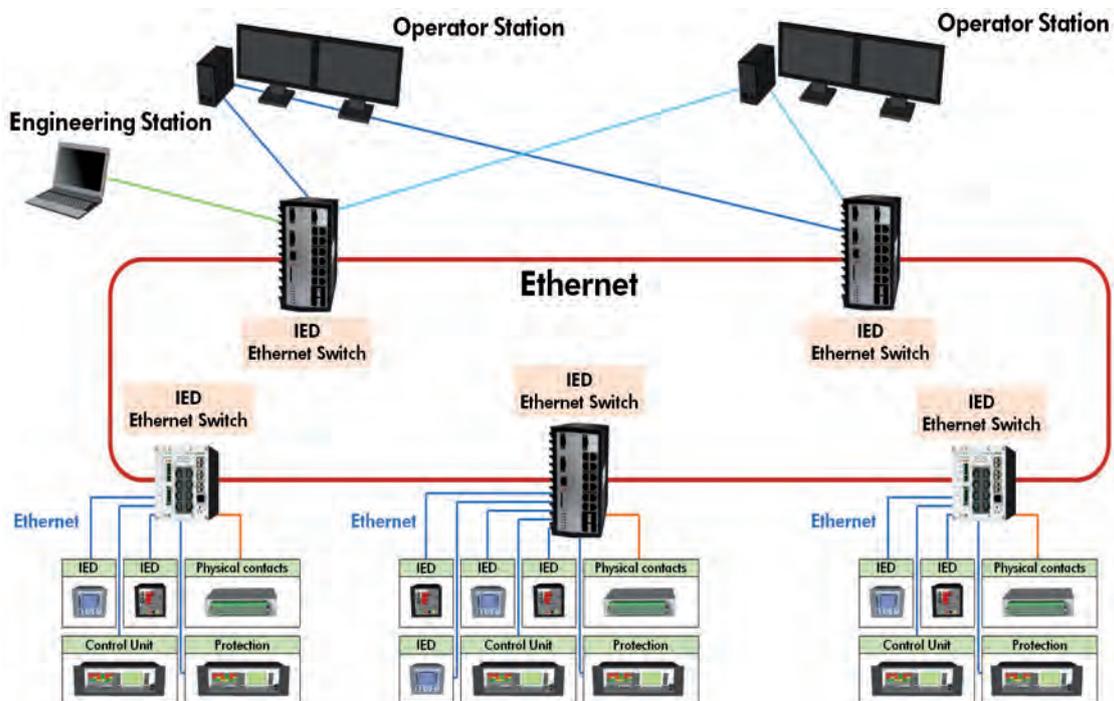
Graphical representation of SCADA

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