Distribution system operator using Ethernet extenders

Managed Ethernet extenders enabled Netz Lübeck GmbH to meet ISMS requirements for increased diagnostics and alerting in its distribution system. Unmanaged and managed Ethernet extenders are operated together in one network with only one extender being required for each SHDSL segment group.

IN ADDITION TO ACTUAL ENERGY SUPPLY, cities and municipalities need to meet legal requirements and specifications more and more. Years ago already, they were assigned responsibility for municipal IT security and network stability according to EnWG (German law on energy management) Part 3 §§ 13 and 14 as well as DIN ISO/IEC 27001.

Information security management

Like many municipal companies, Netz Lübeck GmbH is responsible for energy and water supply in the relevant catchment area. Therefore, the municipal supplier must know and meet the deadlines and framework conditions of the corresponding safety standards.

The German association for gas and water technology reminded its members that energy supply companies (gas and electricity) have to prove certification according to DIN ISO/IEC 27001 in conjunction with the IT safety catalog of the Federal Network Agency until January 31st, 2018. In addition, the deadline for water supply and wastewater disposal companies which are subject to the KritisV and which are to implement a safety standard on the basis of the regulation or a safety standard developed by the industry is May 2018.

In addition to the installation of an EEG supply management system (EEG = German Renewable Energy Sources Act) for energy data acquisition and regulation required by the German Energy Act (EnWG) as of 2015, the employees of Netz Lübeck GmbH are currently implementing an information security management system (ISMS). The ISMS is the basis for certification according to DIN ISO/IEC 27001 which means that the Lübeck supplier achieves the specifications of the Federal Ministry of the Interior derived from the national plan for information infrastructures (NPSI) on time.

"We are fully aware of our responsibility," explained Rainer Zug, Automation/Infrastructure Technology Manager at Netz Lübeck GmbH. He also assumes regulations to be tightened by the European Union with regard to Network and Information Security (NIS) and the BSI KritisV to be expanded in order to ensure reliable networks and to minimize risks of an attack to the IT systems.
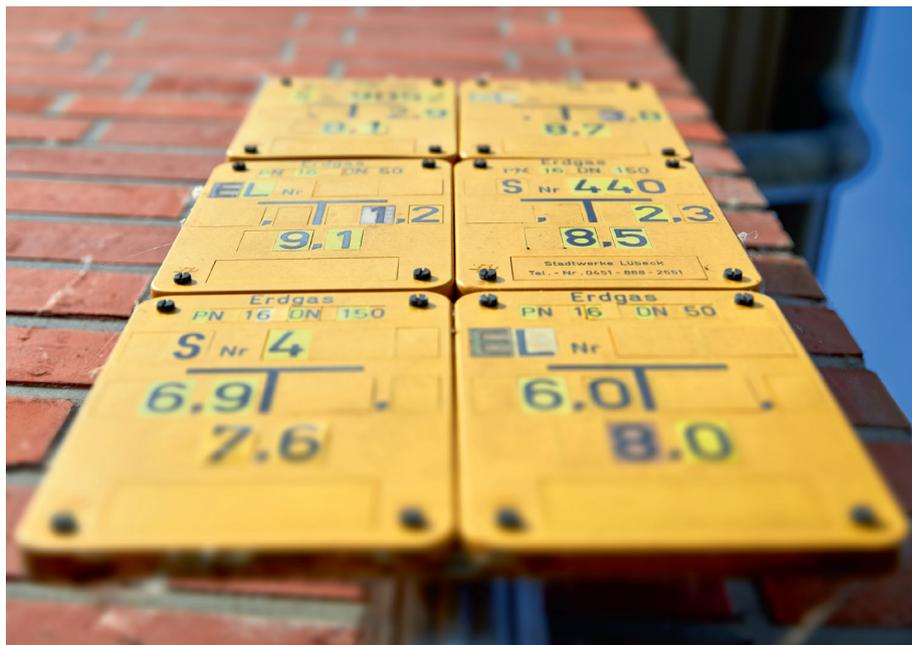
Application example of train-to-trackside communication.

SOURCE: PHOENIX CONTACT

Digital distribution networks

The Association of Municipal Companies (VKU = Verband kommunaler Unternehmen) thinks that the risk of failure or disturbance of the supply network in Germany currently is low. This results from a survey which records only a few significant attacks per month on the relevant IT systems. These attacks do not cause any damage.

They are mainly targeted on individual employees and on access to the systems or the administration network. According to VKU this high level of security results from the fact that about twelve percent of the municipal companies have already implemented an ISMS, and more than 60 percent of the suppliers are planning to use an ISMS. In addition, the employees are given specific instructions on how to use the information technology systems. Approximately 60 percent of the companies also have their employees trained regularly. Regardless of the legal obligations, more than 90 percent of the municipal suppliers intend to take security measures in the future.

To enhance protection against manipulation and a potentially associated blackout, creation and expansion of modern digital distribution networks according to VKU is of fundamental significance. In a press meeting on this topic, Katherina Reiche, VKU Managing Director, and Josef Hasler, Chairman of N-ERGIE, again underlined the importance of the power distribution networks. Katherina Reiche refers to the distribution networks as the local system managers that will be the key to success for the energy turnaround. Katherina Reiche also explains that intelligent distribution network clusters for regional balance as well as powerful transmission paths for long-range transport of energy will be required in order for the energy turnaround to succeed.

Acquisition of all relevant data

This situation poses some challenges to small and medium-sized municipal companies in particular. In addition to the approaches of the German government, VKU, the Federal Association of the German Energy and Water Industries and Germany's digital association have published supporting guidelines on system responsibility and IT security:

- Practical Guide to Supporting Measures by Grid Operators - Communication / Application Guide to Implementing System Responsibility, §§ 13 Sec. 2, 14 Sec. 1 and 14 Sec. 1c of EnWG.

- Guide for IT security catalog including requirements on information security for operators of electricity and gas networks.

To ensure supply reliability, all the relevant data must be acquired in the entire distribution network. In this way, the municipal companies can respond to fluctuations in the network before they occur. This requirement involves new tasks for Netz Lübeck GmbH as the supplier operates a network of 4151 kilometers, one of Germany's largest distribution networks, extending from the Schleswig-Holstein border to Mecklenburg-Western Pomerania.

The required remote stations are stand-alone stations. Until now, they were controlled and regulated in a distributed way using a serial protocol based on IEC standard 60870-5-101. In the last years, however, a trend towards IP/Ethernet communication became apparent. Therefore, newer controllers use modern and powerful TCP/IP protocols, such as IEC standard 60870-5-104, and capabilities with regard to data acquisition and monitoring.

Ethernet via SHDSL technology

Because of the new IP transmission and the large distribution network Rainer Zug and his team were faced with additional challenges. These include that data exchange via Ethernet is considerably faster on the one hand but requires specifically shielded cables which are only able to cover a distance of 100 meters, maximum, on the other hand.

Because of their large coverage and high data rate, fiberglass cables have proven to be the optimum solution and are already used as an FO backbone network. For communication with most of the remote stations the fiberglass cables would have needed to be re-installed, a fact that would have turned out to be too expensive because of the network size and the distances to be covered.

For this reason, Netz Lübeck GmbH uses the modern SHDSL technology for new and replacement installations. Since 2014, unmanaged Ethernet extenders from Phoenix Contact are used for this. In the meantime more than 50 devices have been installed. Currently, these devices allow for remote control and monitoring of almost 120 remote systems of the different supply segments. The SHDSL communication network follows the supply topology: from the network control center to the next water treatment plant, to the next cogeneration unit, to the next gas pressure regulating station, and so on.

The team of Rainer Zug also uses the telecommunication lines of the 1960s. It is therefore not necessary to install a new transmission medium. In addition, each remote station only requires one Ethernet extender. The SHDSL technology enables Ethernet communication up to 20 kilometers via any two-wire cables. It also became evident that less than one third of the maximum data rate

In addition to monitoring the gas pressure control (8 bar to 50 mbar low pressure) the supply quantity, for example, is now detected via the Ethernet extenders.

of the SHDSL cable of 15 Mbps was required for data acquisition.

Diagnostics and transmission paths

"Thanks to using the Ethernet extenders and, as a result, remote monitoring of the remote stations we save a lot of driving," said Rainer Zug. In addition, the object protecting barrier of one gas pressure regulating station can now be controlled from the network control center. The protecting barrier is part of the ISMS implemented by Netz Lübeck GmbH and which aims at comprehensive risk assessment. The automation/information technology team was particularly convinced by the easy startup and handling of the Ethernet extenders. "The devices can be installed by means of Plug and Play without any configuration," explains Rainer Zug. "Impact-free extension of the SHDSL network is also possible."

The Lübeck team is looking forward to the next projects using Ethernet extenders. Ring redundancy and diagnostics of all the extenders and paths via IP are planned for these projects. In the developed concept, the SHDSL connections that are currently ending in the network control center are supposed to be connected to the FO backbone network and the remote stations that are not yet detected via the 104 protocol are supposed to be equipped with SHDSL technology. Furthermore, the responsible persons think about using the redundant ring function of the Ethernet extenders which has not been used so far. In combination with the central FO backbone ring the availability of the transmission network would be further increased thus contributing to the fulfillment of the requirements from EEG supply management.

Connections up to 20 kilometers

Using Ethernet extender technology, managed and unmanaged extenders are now able to be connected to the control center across distances of 20 kilometers. Thanks to the combination of unmanaged and managed Ethernet extenders in one network, IP networking is robust and cost-effective.

The unmanaged Ethernet extenders allow for IP communication in large Ethernet systems. Automatic topology and data rate detection saves money and time during commissioning. The existing two-wire copper wires can be used for networking. The system can be extended during operation without causing any adverse impact. In addition to point-to-point and line topologies, a redundant ring function can be used. In this way, error-free operation of IP transmission is ensured for large applications that require high failsafe performance.

When using managed Ethernet extenders even unmanaged devices can be diagnosed centrally via IP. The system therefore not only responds to changed basic conditions, but also issues a warning in the event of unexpected events such as path weakening. Status, warning, and error messages are forwarded automatically to the control center via SNMP.

Summary

Using managed Ethernet extenders, Netz Lübeck GmbH was able to meet the ISMS requirement for increased diagnostics and alerting in the event of an error. Unmanaged and managed Ethernet extenders can be operated together in one network with only one managed Ethernet extender being required for each SHDSL segment group. Status, warning, and error messages can be sent automatically via SNMP (Simple Network Management Protocol) to the control center. Interaction of devices in combination with the existing cables make using the system easy and economical, but also satisfies the demand for intelligent and powerful networks.

Modernization of the distribution network needs to be driven forward. This is an requirement for integrating the growing proportion of renewable energy systems in the network structures, and VKU noted that energy turnaround will not be successful without using intelligent and powerful networks.

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SOURCE: PHOENIX CONTACT