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Reference

KONČAR-KET - Upgrade of MEPSO High Voltage Substation in Macedonia

RUGGEDCOM-based networks from Siemens address the challenges of the Macedonian transmission operator while strengthening a decade-long partnership with the local solution provider.

KONČAR-Electrical Industries Inc. (KONČAR-Group) is one of the biggest industrial companies in Croatia. Their main focus is in providing solutions for power generation, transmission and distribution as well electric traction and industry.

KONČAR-Group's Plant and Electric Traction Engineering division (KONČAR-KET), designs and builds complex electric plants and turn-key installations for power generation, transmission and distribution, renewable energy, transportation, oil and gas, water, chemical and other industries. The list of references includes hundreds of greenfield and refurbishment substation projects, power plants and industrial plants in more than 80 countries across Europe, Africa and Asia. KONČAR-KET manufactures its own protection, control and automation solutions as well as integrates equipment from third-party vendors.

When MEPSO – the state-owned Electricity Transmission System Operator of Macedonia – needed assistance in redesigning and upgrading nine of its high-voltage (110 kV) substations to meet global standards and integrate its substation automation, communication, protection and SCADA systems, it relied on KONČAR–KET for solutions.

Upgrading transmission substations was critical to MEPSO's goal to reliably deliver power to large industrial enterprises in mining, oil refining, steel and cement, as well as to residential customers. Remote monitoring, control and automation of nine MEPSO transmission substations, situated from 40 to 175 km (25 to 110 miles) away from its control center in Skopje, Macedonia, presented myriad challenges to the Macedonian transmission operator.

Macedonia's rugged terrain – its central valley, carved by the Vardar River - is ringed by mountains reaching over 2,700 meters (nearly 10,000 feet). It meant that a solution would have to withstand rugged environmental factors as well as combine new and legacy communications technologies over long distances.

For KONČAR–KET, however, the challenge was a familiar one.

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The challenge

KONČAR–KET needed reliable, high-performance switches, routers and servers to enable a communication network in support of substation protection and automation and SCADA monitoring and control for a Macedonian transmission operator.

KONČAR–KET's client, MEPSO, on the other hand needed a flexible, scalable network architecture, the integration of legacy and new devices and protocols and the foundation for future applications such as video surveillance and advanced cybersecurity – all tied together with highly reliable switches, routers and servers.

KONČAR–KET also had to meet its client's specific requirements. MEPSO considered it essential that a solution increase the network's reliability in terms of mean time between failures (MTBF) and mean time to repairs (MTTR). Thus, MEPSO highly preferred a solution that relied on equipment with dual power supplies, self-monitoring capabilities and extended warranty.

From a performance perspective, the communication network supporting KONČAR–KET's solution was expected to meet, if not exceed, the performance of a conventional, hard-wired system. High-speed generic object-oriented substation event (GOOSE) messaging, as defined in the IEC 61850-1 standard, needed to be available under all operating conditions. The architecture of the network had to provide for flexibility, availability and scalability to enable future functionalities and growth without impacting system operations. For example, the substation communications network would have to support multiple, always-on services such as substation automation, video surveillance, SCADA, access control and cybersecurity.

Remote monitoring, control and automation of nine transmission substations posed some challenges to the Macedonian transmission operator.

KONČAR–KET turned to a longtime partner, Siemens, and its broad RUGGEDCOM portfolio in order to select the switches, routers and servers that would support a communication network solution that met MEPSO's requirements.

"We at KONČAR–KET always implement the best-in-class equipment in our systems," Miksa said. "Normally in our contracts we have a multi-year guarantee of support, so if equipment doesn't work, it means we have to travel to replace it, and that costs time and money. We've had

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problems with other vendors in other projects. When I discuss projects with my team, the RUGGEDCOM line from Siemens is 'No. 1.'"

"KONČAR–KET has used RUGGEDCOM for a decade," Miksa continued. "In the past, I have installed RUGGEDCOM gear in transmission substations in Macedonia. In Croatia, we have had older RUGGEDCOM switches in operation now for a decade without a problem. I can say that RUGGEDCOM is reliable. When you put it into operation, you can trust it, especially in remote locations. In my experience, RUGGEDCOM switches are tough and easy to configure, operate and maintain."

The solution

KONČAR–KET designed two independent, switched Ethernet networks, based on Siemens portfolio of RUGGEDCOM switches, routers and servers, to provide substation automation and SCADA monitoring and control to MEPSO's central control room, as well as visibility for the utility's corporate network.

The KONČAR–KET solution for MEPSO included a substation automation design capable of integrating protection, measurement, local and remote SCADA monitoring and control, automation functions, alarms and event logging in one system, according to Miksa.

The network architecture had to be flexible and scalable, to adopt future applications such as surveillance, access control and advanced cybersecurity. The solution included a wide area network (WAN) connecting all nine substations to MEPSO's central control room, up to 175 km (110 miles) away.

The control network solution involved linking each substation's protective relays to a RUGGEDCOM RSG2488 Ethernet switch with 28 ports via an Ethernet link. The RUGGEDCOM RSG2488 then linked to a RUGGEDCOM RX1500 switch/router for local area network (LAN) control. Each RX1500 switch/router connected to MEPSO's WAN for remote monitoring and control by operators.

"The RSG2488 is the best choice in this solution," said Miksa. "It is easy to service and it is tough. The RSG2488's high port count allows the integration of more intelligent electronic devices (IEDs) while its ability to accommodate both optical fiber and copper Ethernet connections provides the flexibility to mix legacy and new IEDs."

RUGGEDCOM RSG2488

The RSG2488 – similar to all relays, switches and routers in this configuration – has a dual, hot-swappable power supply with automatic failover. If one power source fails, the other instantly kicks in to seamlessly maintain power to the switch and ensure that operators have an uninterrupted view of substation network operations. Should a fault trigger a relay or any device fails, operators reliably receive an alarm notifying them of the event.

A parallel monitoring network connecting the substation network to MEPSO's corporate network relied on serial links between the protective relays and a RUGGEDCOM RS416 serial device server with 16 ports linked by Ethernet cable

to the RX1500s. The RS416 runs on KONČAR–KET's own Proza-Net SCADA software and a GPS clock for synchronization of all signals.

"Normally, we use the RS416 to connect serial-based equipment in substations," Miksa said. "In MEPSO's case we're using it to ensure that the system operator has a service [maintenance monitoring] connection to every protective relay."

RUGGEDCOM products used by KONČAR–KET

RUGGEDCOM RSG2488: The RUGGEDCOM RSG2488 is the first utility-grade, field upgradable, non-blocking 28 Gigabit port layer 2 switch with hot-swappable dual redundant power supplies. The RSG2488 is designed to reduce rack space needs, cut sparing costs and minimize time-to-repair while eliminating routine maintenance and separate timing cabling, delivering increased network availability and lowest total cost of ownership. The RSG2488's modular flexibility provides up to 28 non-blocking ports that can be configured as 10/100/1000TX copper, 100FX or 1000SX fiber. With its 1U form factor and vertical loading design, the RSG2488 provides users with the flexibility and field maintenance simplicity needed to efficiently implement, maintain and evolve a broadband local area network.

RUGGEDCOM RS416: The RUGGEDCOM RS416 is a utility-grade serial device server with an integrated, fully managed Ethernet switch, designed to operate reliably in electrically harsh and climatically demanding environments. Featuring a modular design that can support IEEE 1588 and IRIG-B time synchronization, up to 16 serial ports, and up to 4 Ethernet ports, the RS416 is able to interconnect and synchronize multiple types of intelligent electronic devices (IEDs).

RUGGEDCOM RX1500 Multi-Service Platform: The RX1500 series is a cost efficient utility grade layer 2 and layer 3 switch and router. The RX1500's modular and field replaceable platform allows customers to select amongst WAN, serial and Ethernet options making it ideally suited for electric power utilities, the industrial plant floor, rail and traffic control systems.

RUGGEDCOM NMS: A fully-featured enterprise-grade network management software based on the OpenNMS platform, this solution is specifically designed for the rugged communications industry, providing a comprehensive platform for monitoring, configuring and maintaining mission-critical IP-based communications networks.

The RUGGEDCOM RSG2488 – a reliable, 28-port high-performance switch is used in a communications network for substation protection and automation and SCADA monitoring and control.

The RUGGEDCOM RSG2488 switch, the RX1500 switch/router and the RS416 serial server all meet MEPSO's – and, thus, KONČAR–KET's – requirements for operating under the environmental stresses common in transmission substations and specified by the IEC 61850-3 standard. RUGGEDCOM components meets those specifications by operating in a temperature range of -40 degrees Centigrade (-40° F) to +85 degrees Centigrade (185° F), as well as being rated for error-free operation in environments with high electromagnetic interference (EMI).

Siemens' best-in-class, five-year warranty on RUGGEDCOM products was another decisive factor in KONČAR–KET's decision to implement this particular solution.

The results

KONČAR–KET's Siemens solution for MEPSO delivered highly reliable remote access for monitoring and control of transmission substations for the utility.

KONČAR–KET measures the results and benefits of its project for MEPSO in several ways. KONČAR–KET's client, MEPSO, now has a more reliable approach to substation automation and remote SCADA monitoring and control than in the past. KONČAR–KET also installed the RUGGEDCOM Network Management Software (RUGGEDCOM NMS), which aids in efficient troubleshooting of communication networks.

KONČAR–KET's work for MEPSO is complete for now. Apart from ongoing maintenance work, it is possible that additional security features will be implemented at MEPSO's transmission substations, including video surveillance and additional, advanced cybersecurity functions.

Case study at-a-glance

Customer: KONČAR–KET, based in Zagreb, Croatia, has 300 employees based in four countries and focuses on power engineering and SCADA monitoring and control solutions for electric utility clients worldwide.

Challenge: KONČAR–KET, the solution provider, needed reliable, high-performance switches, routers and servers to enable a communication network in support of substation protection and automation and SCADA monitoring and control for a Macedonian transmission operator.

Solution: KONČAR–KET designed two independent, switched Ethernet networks, based on Siemens portfolio of RUGGEDCOM switches, routers and servers, to provide substation automation and SCADA monitoring and control to MEPSO's central control room as well as visibility for the utility's corporate network.

Results: Siemens solution for MEPSO provided highly reliable remote access for monitoring and control of transmission substations for the utility.

Security information

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial security concept. Siemens' products and solutions only form one element of such a concept. For more information about industrial security, please visit **www.siemens.com/industrialsecurity**