SIEMENS

A major oil & gas player in the Middle East deploys a rugged network from Siemens

Siemens network design and integrated solutions enables reliable, resilient communications for monitoring, control and surveillance of oil and gas fields

Located on the southeast tip of the Arabian Peninsula, the Sultanate of Oman covers nearly 316,000 square kilometers (122,000 square miles) of desert terrain, except for a coastal range in the northeast where the capital port of Muscat is located. Oman is bordered on land by the United Arab Emirates, Saudi Arabia and Yemen, and by sea by the Gulf of Oman and the Arabian Sea.

Oman's diverse economy relies on its oil and gas exports. The sultanate possesses the 25th largest known oil and gas reserves in the world. Petroleum Development Oman (PDO) has 70 percent of the sultanate under oil and gas production and/or exploration. Thus oil and gas extraction, at massive scale, and transport from the sultanate's far-flung deserts to its ports is critical to this Middle Eastern nation's economic health.

The sultanate's geography and climate present a challenge to safe, secure and efficient oil and gas production. The northeast coastal range reaches 2,000 meters and the southern coast can experience 90 percent humidity and monsoon-like rains. The vast interior desert is also a land of extremes with temperatures that typically exceed 50° degrees Celsius (120° degrees Fahrenheit), and sometimes reach as high as 60° degrees Celsius (140° degrees Fahrenheit).

Thus extreme temperatures, moisture and blowing sand and dust can wreak havoc on wellhead-related communications networks and security equipment. These environmental conditions had in the past revealed reliability issues with a former vendor's equipment and PDO found that maintaining air-conditioned shelters for fragile communications equipment was impractical and expensive.

Scale and changing circumstances presented a challenge as well. PDO seeks best-in-class, flexible solutions that can be expanded as new fields and wells are brought online and older equipment at existing wellheads is augmented or replaced. The complexity and scale of the resulting networks and the need for manageability, flexibility and future functionalities underscores PDO's need for robust network design and field solutions.

siemens.com/ruggedcom

The challenge

Petroleum Development Oman sought a long-established vendor to provide network design and a suite of solutions to enable reliable, resilient and efficient monitoring and control of remote, automated oil and gas wellheads in a harsh desert environment.

PDO favors long-term relationships with market-leading vendors with an established track record of reliable performance, a broad product portfolio, outstanding customer service support and future innovation. PDO's due diligence led it to Siemens and its best-in-class network design skills and reliable field solutions.

"At PDO, we tend to go with the preeminent equipment on the market," said Issam Al Kharusi, an IMT (information management and technology) project engineer with PDO. "If it fulfills our requirements, we standardize on it. We don't change it unless a new requirement is created. That's when Siemens entered the picture [in 2008]."

"The relationship we enjoy is a strong one," Al Kharusi said. "The support we receive is excellent. Our operations team, which manages these networks, becomes familiar with the equipment we choose. Their training enables them to deal with any switch configuration that's needed. In turn, Siemens becomes familiar with what we're doing. Their people are aware of the requirements at each of our locations. In fact, Siemens once notified us of a firmware upgrade needed in all the switches at one of our locations. They were proactive and took care of it within a short period of time."

Siemens met PDO's need for three basic applications: wellhead monitoring to support safe, efficient operations, improved SCADA connectivity that allows the integration of legacy and new sensors and enhanced surveillance capabilities to enable intrusion detection, real-time alarms and timely responses.

Wellhead monitoring and SCADA connectivity feed a data network that informs operators of conditions and events in the field. Due to the network's complexity and scale, a brief explanation is in order.

Envision a cluster of wellheads spread over, say, 30 square kilometers. Each wellhead has an array of I/O sensors connected to a RUGGEDCOM RS900 compact Ethernet switch. A couple dozen wellheads are connected via fiber optic cable over distances from three to 30 kilometers away to a Remote Gathering Manifold Station (RGMS), which employs a RUGGEDCOM RSG2100 19" rack switch. Multiple RGMSs feed the accumulated data, via fiber optic cable, to a local control room, which relies on an RUGGEDCOM RSG2100 or RSG2200 19" rack switch. The RSG2100s/RSG2200s, in turn, to feed visualization tools that allow operators to monitor conditions at dozens of wellheads in the area in a safe and timely manner. Ultimately, local control rooms send the accumulated data (except live video surveillance feeds, which are an eventual goal) to PDO's central office in Muscat.

Networks akin to this description are spread out over thousands of square kilometers across Oman's interior desert. A discussion of specific solutions is necessarily general, as Siemens solutions are applied differently in different circumstances. But the themes of manageability, flexibility and intelligence apply to the entire solution.

"These switches are inter-connected and smart enough to identify alternative routes [for data] in case a fiber optic line fails," Al Kharusi noted. "If one route fails, these switches know how to stay connected via another route."

"Our main concerns focus on temperature, blowing dust and compact size,"Al Kharusi said. "Actually, if you look at the performance history since we first installed the first RUGGEDCOM switch seven years ago, we haven't had a single failure."

The solution

Siemens network design and solution suite supports automated, manageable communications networks for safe, reliable and resilient oil-and-gas operations in the harsh deserts of the Middle East.

RUGGEDCOM RS900 Ethernet switches inside PDO's oil and gas wellheads reliably provide sensor data for monitoring and control in harsh desert environments. The RUGGEDCOM RS900 9-port, fully managed Ethernet switch has no fans or other moving parts, it is sealed against dust and sand and it withstands temperature swings from -40° C (-40° F) to 85° C (185° F) – all with a modest footprint.

"Our main concerns focus on temperature, blowing dust and compact size,"Al Kharusi said. "Actually, if you look at the performance history since we first installed the first RUGGEDCOM switch seven years ago, we haven't had a single failure."

This reliability is critical to safe, efficient operation of oil and gas wells.

"Should outflow [from a wellhead] exceed normal limits and something needs to be shut down, that's where our alarm system comes in," Al Kharusi pointed out.

Should a switch eventually fail, RUGGEDCOM switches ensure high availability and fast network recovery times through the implementation of, eRSTP (enhanced rapid spanning tree protocol), which offers resilience and a swift return to service for the network.

"In some cases, the [RUGGEDCOM] RS900 switch also allows PDO to combine legacy and newer technologies such as IEDs [intelligent electronic devices], which prevents stranded costs, yet enables upgrades," Al Kharusi added.

RUGGEDCOM RS400 serial servers at the wellhead translate legacy RTU (remote terminal units) serial communications data to fiber-based Ethernet for integration into the SCADA network. The 4-port serial device server has an integrated, fully managed switch, and this configuration allows PDO to maintain past investments, integrate legacy and new sensors and upgrade its system as needed. It also makes SCADA more reliable. Prior to the use of RUGGEDCOM serial servers, SCADA connectivity was accomplished through wireless VHF communications.

"We had issues with that connectivity," Al Kharusi said. "Especially early in the morning, we had fog and sandstorms, so communication was always an issue between the RTUs and the remote gathering manifold stations. But later on we replaced that equipment with the RS400 serial servers, which provided reliable serial-to-fiber connectivity."

RUGGEDCOM RSG2100 modular Ethernet switches are employed at two different points in the field networks – some units are integrated at the remote manifold gathering stations, others at the local control room – and each switch is configured, sometimes remotely, according to its specific role in the overall network.

"The flexibility of optimizing the switch, based on any specific project, is important," Al Kharusi said. "We have many different requirements, and how we optimize the switch depends on what type of connectivity and distances are involved."

"We wanted a product that could be configured remotely and monitored should it go down," he added.

RUGGEDCOM RMC40 4-port Ethernet switch converts copper-based serial communications from digital video cameras for surveillance to fiber-based Ethernet signals sent to a RUGGEDCOM RSG2100 switch at the local control room. Video cameras provide automated alarms to operators if they detect inappropriate movement or images, such as an intruder attempting to penetrate perimeter fencing at the wellhead or outside of local control rooms.

PDO's security requirements mean it maintains two separate networks for SCADA and surveillance from each wellhead, through a single RUGGEDCOM RS900 switch, to the Remote Gathering Manifold Stations and to the local control room (see accompanying diagram). The RUGGEDCOM RS900 switch enables separate virtual local area networks (VLANs) to segregate the SCADA and surveillance networks.

The results

Siemens network design and integrated solutions provide robust monitoring and control of oil and gas wellheads, as well as surveillance, in a harsh desert environment. Siemens solution increases the safety and efficiency of operations and supports future functionalities.

The integrated Siemens solution thus provides a robust, reliable means to monitor wellhead sensors, enables enhanced SCADA functionalities for monitoring and control, preserves legacy investments and supports surveillance systems that can alert operators with real-time alarms. The Siemens solution offers additional benefits in terms of operational efficiency and safety.

The unmanned wellhead sites are time-consuming and expensive to service with field crews and thus PDO sought the automated communications solutions offered by RUGGEDCOM equipment. Remote monitoring and management of the switches themselves provides operational efficiencies, cost savings, as well as safety for the personnel and environmental protection.

"In south Oman we have some of the deepest and most 'sour' fields in the world," Al Kharusi noted. "The amount of H2S – hydrogen sulfide [a poisonous, flammable, explosive gas] – is great and under very high pressure. So PDO is trying to minimize the number of people doing routine field work by having them work centrally and remotely. We needed smart connectivity to do that and the Siemens solution provides it."

The implementation of the integrated Siemens solution is considered a continuous effort across PDO's oil and gas fields, including new initiatives.
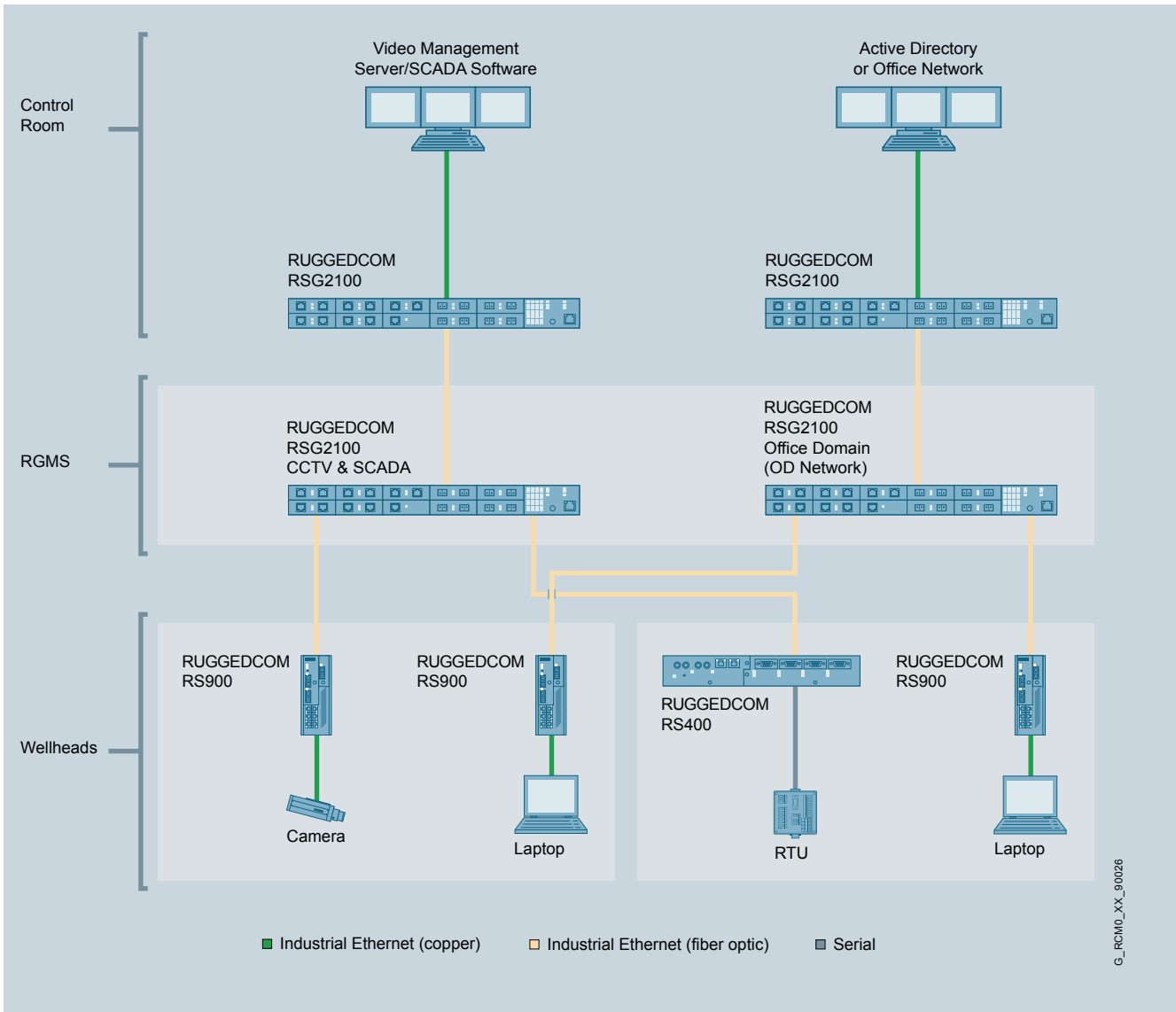
"We have a new project coming up in south Oman, one of PDO's biggest projects," he continued. "In this case we'll use the RUGGEDCOM RS900 because of its ability to handle multiple connectivities. We need wellhead monitoring, but also surveillance, intrusion detection and remote access control. The RUGGEDCOM RS900 switch can enable all of these functionalities."

"We also plan to deploy the RUGGEDCOM RSG2488 switch, which offers 'field replaceable' communications modules [with improved eRSTP] that speeds reconfiguration time," Al Kharusi said. "This will make things easier because we won't have to order products already configured. We can add on new modules for new connectivity as we go along – whether that's serial, fiber or Ethernet, it's up to us. This is will improve the scalability and flexibility [of the Siemens solution]."

In another application being planned, PDO will add resilience to a wellhead site by adding RUGGEDCOM switches in parallel with legacy equipment, in case the latter fails.

RUGGEDCOM RS900

RUGGEDCOM RS400

RUGGEDCOM RSG2100

RUGGEDCOM RMC40

RUGGEDCOM products used by PDO

Control Room

Video Management Server/SCADA Software

Active Directory or Office Network

RUGGEDCOM RSG2100

RUGGEDCOM RSG2100

RGMS

RUGGEDCOM RSG2100 CCTV & SCADA

RUGGEDCOM RSG2100 Office Domain (OD Network)

Wellheads

RUGGEDCOM RS900

RUGGEDCOM RS900

RUGGEDCOM RS400

RUGGEDCOM RS900

Camera

Laptop

RTU

Laptop

■ Industrial Ethernet (copper)   □ Industrial Ethernet (fiber optic)   ■ Serial

G_RCM0_XX_90026

Siemens network design and solution suite

"Siemens is assisting us in the network design to minimize downtime as we add the RUGGEDCOM switches for resilience," Al Kharusi said. "So we're working together to find the optimal way to design and implement these changes."

In the future, PDO also plans to provide mobile worker communications and enable the massive bandwidth needed to bring real-time surveillance video back to the central office in Muscat.

"The quality of the equipment is excellent, the support we've received is excellent, so I'm looking at expanding Siemens solution for future requirements," Al Kharusi said.

Case study at-a-glance

Customer: Petroleum Development Oman (PDO) has 70 percent of the sultanate under oil and gas production and/or exploration, with a mandate to ensure reliable, efficient, secure and safe operations.

Challenge: PDO sought a long-established vendor to provide network design and a suite of solutions to enable reliable monitoring, control and surveillance of remote, automated oil and gas wellheads in a harsh desert environment.

Solution: Siemens network design and solution suite supports automated, manageable communications networks for reliable, efficient and secure oil-and-gas operations in the harsh deserts of the Middle East.

Results: Siemens network design and integrated solution provide robust monitoring and control of oil and gas wellheads, as well as surveillance, in a harsh desert environment. Siemens solution increases the safety and efficiency of operations and supports future functionalities, while enabling time and cost savings.

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

siemens.com/ruggedcom