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Wireless automation solutions

Are your fields connected, automated and ready for the market rebound?

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During the downturn, many operations teams got smaller, but the size of the fields they manage have not. Great uncertainty in the market is forcing oil and gas companies to adjust spending to meet only the most critical business demands. Corporate leadership has sent a clear message to the field: optimize daily operations and get it done with less.

Through mergers and acquisitions, some companies have inherited additional assets and are faced with the challenge of integrating disparate SCADA and communication systems into their current environment. They must now contend with larger territories and far more inputs and outputs. The “great crew change” has added to the problem, as increasing numbers of experienced technicians are retiring and leaving younger workers with fewer mentors in the field. Technology is one very effective way to bridge the knowledge gap created by the great crew change, and communications technologies provide mobile access to all the critical information that operators need.

With modern network connectivity throughout the field, teams can use data to make better, more timely decisions about the health of remote assets, potentially delaying an emergency site visit to a future scheduled trip. Real time SCADA and software dashboards give operators the power to operate by exception, focusing their resources on higher producing assets. Field networks with intelligent routing technology and self-organizing architectures can automatically recover in the event of failure, preventing prolonged gaps in data and unnecessary site visits. With less time spent behind the windshield, operators are safer, more productive and better able to meet production demands. In turn, the company benefits from higher production rates, reduced downtime and lower exposure to fines and reclamation costs from safety and environmental incidents. The question is no longer whether a company should invest in modern communications networks, because the savings are real. The question these days is which cost model and architecture provide the most flexible, secure, high performance solution?

Modern field network architecture should be able to incorporate multiple wired and wireless technologies, all based on open networking standards. Radio networks create links from remote well pads to larger facilities that have more robust wired or wireless connectivity, like field offices and operations centers. But not all radio networks were engineered to perform at today’s standards. Variance in distance, terrain, RF noise floor and power budgets for remote sites make it very difficult to build a modern wireless network that operates in a single frequency band. True, the higher frequency bands are capable of extending broadband speeds at impressive distances, but there are power limitations imposed by regulatory bodies like the Federal Communications Commission (FCC), and these limits shorten link distances. By diversifying the use of unlicensed spectrum, a single wireless network can deliver increased bandwidth while avoiding the interference that has plagued traditional narrowband radio systems.

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To overcome distance and obstacles in the wireless signal path, combining different radio technologies to build a robust field network is often the best approach. When companies have tower infrastructure located near their field assets, fixed broadband wireless systems, such as point-to-multipoint and microwave point-to-point, generally provide the highest throughput to the field. However, PTP systems have limited flexibility in terms of data paths, and they are relatively expensive to design and install. When used in conjunction, PTP/PTMP systems and broadband wireless mesh provide very high performance and reliability by maximizing each other's strengths. PTP systems provide the backbone, and broadband mesh can extend that capacity to the edge with the flexibility to route around potential points of failure. Additionally, field personnel can roam throughout the field with laptops and handheld devices for access to the data that they need, when and where they need it. Mobile mesh routers extend access even further by providing high powered mesh connectivity to vehicles.

Broadband mesh is an excellent choice for covering the core of the oil field where its capability to automatically select the best route through the network from multiple radio frequency (RF) paths, channels and bands provides superior reliability and throughput. Broadband mesh routers also provide enterprise-class security capabilities such as firewalls and IPsec virtual private networks (VPNs).

Oil and gas fields may be located many miles from the nearest field operations center. As a result, long distance, broadband PTMP links are often used to provide backhaul between the wireless mesh field network and the operations center.

Out in the field, there may be remote well pads or wells that are not economically feasible to connect with broadband mesh technology. There may also be off-grid pads and wells that cannot supply enough electrical power to support broadband mesh routers. In both cases, power efficient, sub-1 GHz PTMP radios can provide a solution. These devices have traditionally been narrowband radios that supported proprietary communication protocols and provided little or no software functionality. However, a new generation of sub-1 GHz PTMP radios is emerging that supports higher data rates, IP networking and enterprise-class security capabilities. These products complement broadband mesh routers and PTMP radios, filling a lower performance and power consumption niche while providing reliability and security consistent with the technologies used elsewhere in the network.

By pushing the 900 MHz frequency band farther out toward the edge of the field, the noise floor in this crowded band is reduced and the network has more entrance ramps to the broadband highway. A distributed, self-healing broadband mesh diversifies the frequencies in use while providing path redundancy and minimizing the need for more towers. The broadband mesh hands off the data to a PTP radio system or to fiber, where it is available. This optimized mix of technologies allows a company to boost performance and develop a migration path over time, as budgets allow. Finally, the major difference between a subscription-based model (cellular, satellite) and modern private wireless is clear: control. The company or an industry-specific field service provider can control all aspects of the network without relying on a public carrier. In some instances, the answer is to combine both approaches as part of a plan to gradually migrate to a fully private solution. Either way, oil and gas companies begin to realize that ultimately, relying upon consumer-grade cellular networks to support their mission critical production data is not the answer.

Implementing a private modern wireless communications network in the field does present some challenges, of course. However, these challenges are also the answer to some clear vulnerabilities with legacy protocols and technologies. The use of Internet Protocol and Ethernet-based technologies means that Operations teams must collaborate with IT organizations to put in place the security controls necessary to eliminate vulnerabilities, both externally and internally. A leading producer in California recently expressed concerns over potential exposure to attack with serial-based SCADA radio communication devices that would impact many of their Programmable Logic Controllers in the field. Without encryption and the ability to block certain types of data traffic over the communications system, this company is exposing its equipment to cyberattacks. Decades-old serial protocols are the main culprit here, as they were not designed with cyber security in mind.

To address the vulnerabilities found in legacy SCADA radio systems, companies should consult with networking experts to design and implement a multi-layer, defense-in-depth security architecture using open security standards. Open standard, enterprise security tools and techniques have been honed for years, and are constantly being updated. Security solution vendors, government-funded organizations (agencies such as CNSS, outside bodies such as CERT) and security researchers constitute a large and active security community

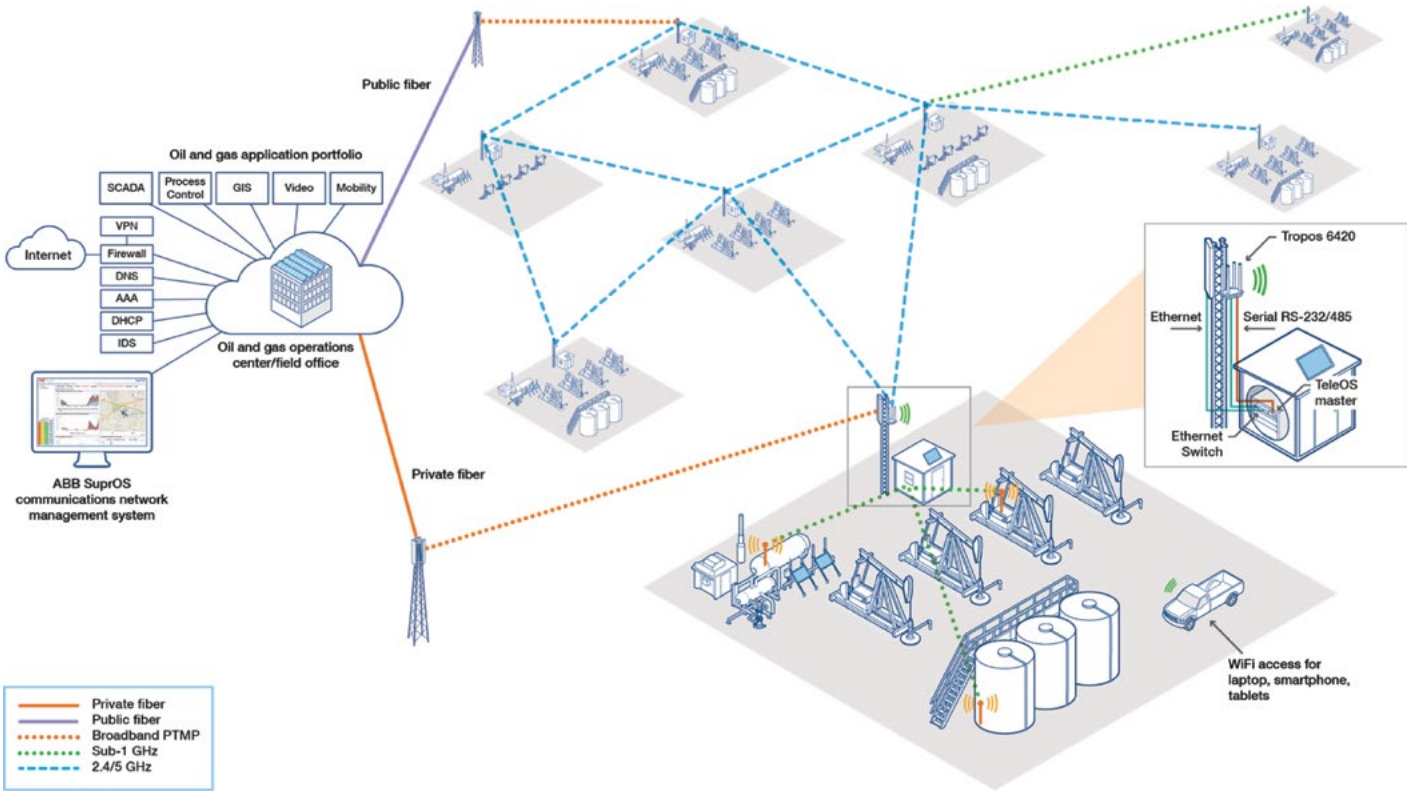
around the globe. These groups and individuals discover and publish vulnerabilities and ensure that vendors maintain transparency about the security of their products, and correct any weaknesses. As a result, oil and gas companies can leverage the past and ongoing work of the enterprise and Internet security community.

At ABB, we understand that modern wireless communication networks are the fabric that connects field assets to the business. We have built networks for some of the largest shale players throughout North America, enabling them to reduce costs, optimize production and lead the market through the downturn and beyond. Our field engineers are ready to assist with evaluation of your existing infrastructure, then help design a modern network that leverages past investments wherever possible while laying the foundation for higher performance. Training and ongoing maintenance services can be part of a commissioning and handover plan, or it can be part of a complete turnkey solution.

With business demands increasing as the workforce struggles to keep up, technology should be the enabler. Oil and gas companies must now realize that robust, powerful, economical technologies are available. Improving operation efficiency in the upstream oil field depends not only on new technologies, but also on the operating models in place. IT and Operations teams must work together to meet the business demands of the digital oilfield in these uncertain times. With the right field communications plan in place, real-time production data, secure mobile access and cost-saving collaboration across departments becomes critical for leaner, meaner upstream operations.

Modern wireless network architecture for upstream

Mesh core, broadband PTP/PMP backhaul, narrowband PTP/PMP on the edge



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