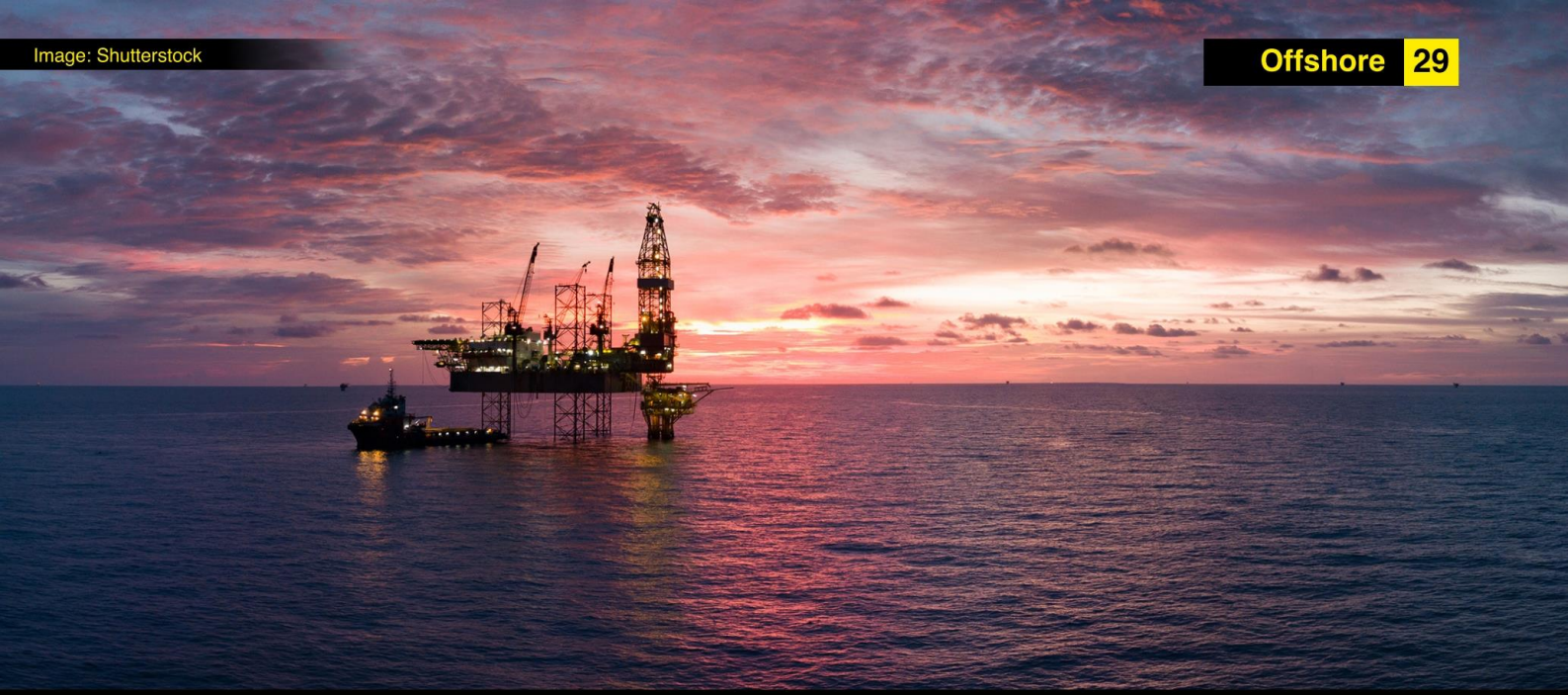

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Fuelling offshore oil and gas operations with a reliable wireless network

Offshore oil and gas operations are notoriously dangerous, with explosions, heavy machinery, and moving objects all posing considerable risks to those within the industry. In 2021, the rate of job-related injuries and illnesses in the oil and gas industry in the United States was 1.6 per 100 workers. However, this figure has consistently decreased over the last few decades. This is thanks to the introduction of newer and safer technology into the oilfield. Not only is this helping to keep workers away from dangerous environments, but it also improves operational efficiency.

During the COVID-19 pandemic, oil and gas operations became more challenging as many operators had reduced staff. This was due to the requirement to maintain social distancing from other colleagues or staff not being able to travel to the site. The pandemic highlighted how essential it is for industries to have the ability to perform and support tasks remotely – a particularly daunting task for traditionally "hands-on" industries.

As with unconventional resources, the major constraints for offshore production concern cost and the environment. This has been intensified further by the world's increasing energy consumption, projected to grow by 56% between 2010 and 2040, according to the International Energy Outlook 2013. New machinery and hardware alone do very little to ease the burden on operators in this hazardous and competitive industry.

A key component to achieving operational gains and safety is the ability to access real-time data and analytics as part of a fully integrated picture of the oilfield. This will provide oil and gas operators with a clear view of the assets and personnel operating within it. However, this places a considerable amount of pressure on the communications network.

An explosion of new technologies in oil and gas

Oil and gas companies increasingly adopt sophisticated applications to support equipment and personnel operating in remote, geographically dispersed areas. More apps, services, and assets are connected to oil and gas projects than ever before, with augmented reality, drones, and robotics playing increasingly more prominent roles. At the same time, offshore companies are transitioning from manned to unmanned assets operated from command centres onshore. In conditions like these, reliability and resilience are even more critical.

Complex technologies, also known as the Industrial Internet of Things (IIoT), and capabilities such as mobile M2M communications, real-time field intelligence, and predictive analytics have all been introduced into the oil and gas industry. Ultimately, this has increased productivity and ensured that sites are safer for personnel operating in oil rig and gas production environments. Operators have also opted to utilise robotics in these challenging conditions to combat the potential efficiency issues that human error can cause, such as downtime. Most importantly, deploying robotics to monitor and inspect hazardous industrial equipment removes worker safety risks by completely removing them from the situation.

To interact with and manage the growing number of IIoT technologies, companies need a network infrastructure that is fully mobile and provides optimal broadband connectivity organisation-wide. Reliance on the IIoT and M2M connectivity to improve productivity, streamline operations, and control costs have created a demand for a more reliable wireless network.

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Increasing interconnectivity requires a network to ensure the security and authenticity of the communications traffic moving in, out, and across it. Mission-critical applications must run on a communications network that offers reliable, agile, and adaptable connectivity that can thrive in diverse, mobility-driven environments.

For companies that work in explosive environments, connectivity is even more critical. A viable solution is a “living” mesh network that moves with and adapts to changes in connectivity demands.

Connectivity that prevents operational blowouts

Companies face daunting challenges when planning and implementing a communication network that provides site-wide mobile access to vital data, voice, and video. Oil and gas complexes typically span large geographic areas that are subject to noise, dirt, and weather extremes. And conditions are continually changing. To maintain continuous operations, companies seek to increase productivity and cut operating costs without compromising safety standards. However, the demands of managing operations and crews across vast areas are time-consuming and expensive. At the same time, production optimisation is becoming more sophisticated and more reliant on the interconnectivity of the IIoT to enable predictive data analytics.

A high-capacity wireless network that supports reliable, real-time data delivery to and from the array of onboard sensors within these autonomous systems is paramount. It can aid in the precise diagnosis of equipment problems and provide efficient fixes. Advanced wireless mesh networks are unique in delivering consistent, reliable coverage across any space, regardless of the environment’s size, topography, physical obstacles, radio frequency traffic, and weather conditions.

With a mesh network that is comprised of several communication nodes, data can automatically be identified and transmitted between radio nodes. These nodes can adjust to find the fastest and most stable connections. Mesh networks can easily scale up and down quickly by adding or removing nodes. The data

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traveling across the network can be seamlessly rerouted depending on the bandwidth needs, signal strength, or competing traffic. Having a network with M2M connectivity is a huge bonus. With each mobile asset equipped with a node, the mobile robots remain connected to the network with no dropouts experienced.

After a reliable network is ensured, the subsequent action is to capitalise on the advantages of remote collaboration. It can bring significant societal, economic, environmental, and climate benefits. Real-time support provided by remote collaboration enhances operator efficiency and safety, offering specialised knowledge and skills to remote or underserved workers while reducing workplace accidents and fatalities without compromising performance.

Shortfalls of wireless networking

A remote and rugged terrain needs constant observation. This can cause issues when achieving a consistent network connection, as the core environment of an oil or gas production site can be unpredictable and often isolated. As a result of implementing more technology on-site, an enormous volume of data is produced by devices that enhance oil recovery and improve production. Effectively managing this data will become even more critical as the industry moves towards unmanned facilities.

Operators often experience difficulties securing a reliable connection by conventional means, such as deploying Long-Term Evolution (LTE) or 5G technology. Public cellular networks often need more reliability, availability, latency, and security than mission-critical services in oil and gas require. As some mobile devices lack infrastructure capabilities, they can only connect to one access point at a time. This means that if an access point fails, all nodes connected to that access point are disconnected from the network. So, all access points are potential areas of failure. In the case of root controller nodes, one device manages the routing for the entire wireless network. If the root node fails, the whole network subsequently goes offline.

Keeping operations afloat

An oil and gas company, on average, faces nearly 27 days of unplanned downtime annually, amounting to losses of between $39 million (£29.9m) and $88 million (£69.2m).

Wireless mesh networks can empower companies to achieve efficiencies through equipment health monitoring. Using equipment performance data and a predictive maintenance model, companies can keep equipment operating at peak efficiency, extend the service life of offshore assets, and keep operations moving. Many companies have harnessed new technologies to enable up to a 30% decrease in maintenance costs, amounting to 60% of overall operational expenditure. ■

About the author

As the Vice President of Global Energy at Rajant, **Al Rivero** is responsible for working and engaging with clients who seek to implement a secure, reliable IIoT and mobility strategy for their Oil & Gas operations. He works closely with the clients to develop a strategic technology transition plan that ensures a reliable and secure migration of technologies. Fluent in English and Spanish, Al received a B.S. degree in Computational Mathematics from the University of California and a B.S. in Electrical Engineering from California State University. He has over 30 years of experience in various roles, ranging from staff engineer and project manager to operations management and technology management within the Chevron companies. He also has extensive IT/OT integration project experience, having worked with SAP, JDE, ESRI, and various automation and SCADA/DCS solutions for upstream, midstream refining, and petrochemical.