How Private Networks are Accelerating Oil & Gas Efficiency

Remote site connectivity supports condition monitoring, predictive analytics and other emergent applications
In the past, connecting to oil & gas industry remote field assets was either slow, uncertain or expensive — or even some combination of the three.

Upstream, midstream and downstream oil & gas today look to private 4G and 5G networks as the standard for advanced wireless data transmission. What’s called last-mile connectivity is key to the industry’s journey to digital transformation.

A recent *Oil & Gas Engineering* webcast looked at current issues being addressed by private cellular networks in the oil & gas industry. The webcast was sponsored by telecommunications provider Ericsson. The presenters were Viren Parikh, a director of business development, Ericsson, and Frode Støldal, chief digital officer, Tampnet.

Parikh showed how telecommunications and the oil & gas industries intersect across the upstream, midstream and downstream industry sectors. The upstream and midstream, characterized by remote operations, gain from telecommunications advances. Sprawling downstream facilities, such as refineries and petro-chemical plants, also benefit.

Støldal addressed specifics of the high-tech offshore oil & gas industry, particularly the communications infrastructure that Ericsson partner Tampnet makes available in the Gulf of Mexico, the North Sea and elsewhere around the world.

Emerging technologies increase the need for last-mile connectivity. For example, the Industrial Internet of Things (IIoT) and edge computing make condition monitoring and predictive maintenance an affordable possibility. Computer analytics, machine learning and artificial intelligence are quickly becoming mainstream technologies. All add to the demand for secure data connectivity.

“We’ll look at the opportunity private networks offer the oil & gas industry, exemplified in the idea of ‘one network to rule them all’,” Parikh began.
Long-term commitment
As a market leader in global 4G and 5G network infrastructure, Ericsson supplies the means to unlock connectivity’s value.

Headquartered in Stockholm, Ericsson has presence in 180 different countries and annual revenue in recent years of anywhere from $23 billion to $26 billion. It employs about 95,000 worldwide with more than 45,000 patents in communications, wireless communications and wireline communications-related intellectual property.

“We’re the leader in LTE and 5G technologies. At this moment, 97 of 180 globally deployed live 5G networks are based on Ericsson technology,” Parikh said.

For those not among the cognoscenti, LTE stands for Long Term Evolution and is the 4th generation (4G) wireless broadband standard. LTE offers higher bandwidth, meaning faster connection speeds, and better underlying technology for voice calls (VoIP) and multimedia streaming.

5G is the fifth-generation technology standard for broadband cellular networks, which communications service providers began deploying worldwide in 2019 and is the planned successor for today’s cellular networks.

The advantages of private LTE or 5G networks include:

- High bandwidth, low latency
- Support for important use cases—voice, mission-critical push-to-talk (MC-PTT), autonomous machines, remote control, predictive maintenance, environmental sensing
- Reliable and predictable performance
- Cost-efficient — compared to Wi-Fi
• Rich device ecosystem gives companies more choices for communications

• End-to-end security, using SIMs, on both network and device levels. Wi-Fi standards only cover L1-L2 security.

Regarding private networks, Ericsson has more than 50 5G industry-collaboration programs going on across the globe and in multiple industries. To accomplish this, an entire ecosystem of operators, industry partners and device makers is needed.

Tampnet operates the largest offshore high-capacity communications networks in the world.

“Tampnet is focused on the oil & gas sector. It’s a strong partner because of the expertise it brings to bear and the level of engagement it has in the industry,” Parikh said. “At the center of it all is the connected worker. Companies want to connect personnel wherever they are, without congestion, without interruption and with minimal delay.”

Partnership programs allow Ericsson to better understand how connectivity demand is evolving. Partners include hardware, software and application providers. The Ericsson ecosystem includes the independent software providers, OEMs and system integrators to furnish the glue that melds the different pieces.
Cross-industry applications
Private cellular network solutions for the oil & gas industry are enabling major safety and efficiency improvements and uncovering business value for the oil and gas sector.

Site inspections: Use of drones for site inspections has application across industry sectors. Conducting site inspections can be hazardous. It’s time consuming, ridden with incidents and burdened with an abundance of must-comply security regulations and measures.

“Remote site inspections are increasingly carried out with drones. 5G enables drones to do a number of things simultaneously. It’s controlled wirelessly and it’s equipped with a camera. The drone captures images to stream to backend systems, perhaps analyzing the data. 5G low latency and peak throughput speeds make a difference,” Parikh said.

Drone-based inspections eliminate the risk associated with manual inspections and the plethora of equipment otherwise needed. That translates into worker safety. Moreover, any production downtime associated with manual inspections can be dramatically minimized.

“Based on studies from Ericsson and industry consultants, it’s been estimated approximately three out of every four manual inspections can be eliminated. Further, it’s been estimated that up to 90% of the time spent on manual inspections can be eliminated,” Parikh said.

“Push to X”: Push-to-x is a service that gives professionals using smartphones reliable access
Push-to-X: Data & Voice Combined

- Driver: Replacing LMR (Land mobile radio)
- Walkie Talkies fundamental on remote sites
- Connected worker critical use case
- Need to enrich comms. with high turnover of field technicians, complex equipment, industry jargon

Mission Critical Push-to-Talk:
- 1-1, Group calls, pre-established groups, auto-join, late call entry, auto-answer, Secure communication
- Push-to-X (text and multimedia)
- Video
- PMR professional features
- Scanning, Priority, Distress, Recording, Location

to voice, video, multimedia and location information and instant sharing with a defined group of people, all at the push of a button.

IT managers often speak to Ericsson about renewing their DMR and LMR systems, Parikh said.

- Digital mobile radio (DMR) is a limited open digital mobile radio standard defined by the European Telecommunications Standards Institute and used in commercial products around the world.

- Land mobile radio (LMR) allows push-to-talk two-way communications between radio transceivers. LMR is used in mission-critical communications in public safety and industrial environments.

Industrial users are looking to move beyond the limitations of their DMR and LMR systems.

Typically, these systems are bandwidth limited. With an LTE or 5G integrated push-to-talk system, all the traditional functionality is there along with the additional capability to use video and other applications.

In addition, users have options for transitioning legacy systems. Legacy equipment running on LMR or DMR can integrate into LTE. Alternatively, two systems can run in parallel until the time comes to sunset the LMR system. This allows for a more graceful transition when
introducing new technologies, whether it’s in a refinery or remote facility.

Ericsson has been implementing push-to-talk systems on LTE for quite some time. A primary reason users choose LTE is to replace their DMR system. They can do more with a DMR system embedded as an application on the LTE network.

**Network consolidation and advancement**

“Before turning to the specifics of the offshore oil & gas industry, I want to leave you with the idea of the one network to rule them all,” Parikh said. “Network consolidation is a worthy goal for IT managers. It represents a simpler operations model.”

If you’re an IT manager, imagine the simplicity of running one network versus running two, three or four parallel networks, one for Wi-Fi, one for Bluetooth, one for LMR. Imagine one network with all the different end devices needed for network availability, security hardening and coverage capacity.

Coverage capacity is the biggest issue for oil & gas companies looking at private networks. It’s no small matter, however, that LTE and 5G are based on strict 3GPP standards and have hardened built-in security with encryption and layers of security protocols.

Ericsson believes the 3GPP-based technologies, which include 5G, can best achieve the goals of the oil & gas industry. 3GPP standards guarantee the level of performance required for the industry’s demanding applications. 3GPP-based...
technologies such as LTE and 5G are part of the large ecosystem shared by almost all the world’s mobile providers. The 3GPP ecosystem can accommodate different localized technologies such as LoRa, Wi-Fi and Bluetooth.

In typical deployments, LTE and 5G can act as both middle and last mile and can be the base underlying wireless technology for a typical oil & gas plant. Because of these benefits, 3GPP has been increasingly adopted by industrial sectors that have very similar use cases and requirements to oil & gas.

The innovation made possible by availability of high-capacity, low-latency networks is increasingly clear. “Data traffic in the last year increased somewhere between 1,500% to 2,000%. Digital transformation is changing communication patterns and best-practice operations,” Støldal said.

**Cellular infrastructure available**

Tampnet provides offshore assets with high-speed Internet connection through a subsea fiber-optic broadband network. It also installs and operates an offshore 4G LTE network.

High-capacity Internet access enables digitalization.

“Tampnet’s expertise lies in high-capacity, low-latency infrastructure for the offshore oil & gas, renewable energy and mission-critical industries. We operate on more than 350 offshore oil & gas platforms, floating production storage and offloading units, exploration rigs and vessels in the Gulf of Mexico and North Sea and own more than 4,500 kilometers of fiber as infrastructure,” Støldal said.
Acquired from BP in 2020, the fiber-optic network in the Gulf of Mexico encompasses about 100,000 square miles and is based on 4G technology, soon to be enhanced to 5G. The network adheres to the same standards as onshore networks. The cell phone, for example, of an AT&T subscriber works at sea just as it does on land.

The preexisting 2G cellular network was upgraded with an Ericsson redundant Core LTE/GSM RAN network, while the Tetra micro network on each rig was replaced with an Ericsson microwave solution designed for high humidity. This upgrade solution ensured that high-capacity, low-latency data and voice services were now available and providing benefits to more than 50 oil rig platforms.

The North Sea network is about the same size as that in the Gulf of Mexico and encompasses an area a bit larger than the United Kingdom itself. “Global operations in the Gulf of Mexico
and the North Sea transpire based on identical protocols, standards and interfaces,” said Støldal. “We recently launched a similar network in Canada. Within weeks, we’ll be launching in Trinidad and Tobago.”

Connectivity enables digitalization, “which is the road we’re traveling on together,” said Støldal. “We’re in the early days of this transformation, but users are executing use cases by connecting to our network.”

**Private cellular networks**

Private cellular networks provide the coverage and redundancy essential for remote and autonomous operations.
“Offshore platforms are massive steel constructions. Traditionally, complete coverage would face multiple obstructions,” said Støldal. “We have about 40 assets where every inch of an oil platform or rig is connected. Benchmarks show this end-to-end capability is delivered with a private network at 20% of the cost of using Wi-Fi.”

Benefits include as follows:
- 80% lower cost than Wi-Fi
- 100% coverage possible
- Ex and ATEX approved solution
- meets requirements of IIOT technology
- Compatible with legacy PLC and operational systems.

For the offshore oil & gas industry, the result is an integrated system with the connected worker and the connected platform solutions, with the connected worker accessing a wide range of services on the network, supported by digital workflows.

The connected platform encompasses a wide range of IoT-connected devices supporting asset integrity, measurement, safety and operational applications, as well as additional services.

Implementing these solutions allows remote assets to benefit from the latest industrial computing technology and supports operator safety, environmental and cost-reduction goals.
The Industrial Internet of Things (IIoT) combines advances in sensors, connectivity and analytics to accomplish remote process and equipment monitoring. Low-cost vibration, temperature and pressure sensors allow comprehensive installations on motors, pumps and all types of rotating equipment.

Further advances in asset integrity monitoring for fixed and structural systems, such as pipe-wall thickness and corrosion/erosion monitoring, and process monitoring may also be connected. Even legacy systems can be retrofitted with modules to allow 4G communication.

Industry 4.0 culminates in mass implementation of digital twins, robotics, and augmented reality, as well as private networks.

**Public/private hybrids**

If complete individual public and private networks are required, the two must work together whilst maintaining security, flexibility and reliability.

The architecture of a private network setup, seen as a rig or platform asset service, allows a complete local breakout at the asset level, including data and communication authentication, but also full-access control of the public network. An asset service manager enables third parties to access networks hassle free, which otherwise can involve complicated authorization and security. The private network can be sliced in different
dimensions, helping users to digitalize workflows. “It helps users do more, optimizing resources such as remote workers carrying out remote inspections,” Støldal said.

Ongoing convergence of information technologies and operations technologies (IT/OT) heightens security concerns and the need to align with appropriate protocols and standards. One such standard is IEC 62443, for the secure development of industrial automation and control systems, including a thorough and systematic set of cybersecurity recommendations.

The 3GPP telecom security standards were developed by the 3rd Generation Partnership Project with the initial goal of developing globally applicable specifications for 3G mobile systems. The flexibility of its authentication method is a key enabler of 5G for industrial use cases.

LTE specifies two user equipment states, idle and connected, so as to avoid unnecessary signaling. Tampnet’s private networks ensure operations continue even if the connection is lost or the fiber goes down. Users remain in control during idle mode. This is very important.

Gartner has predicted that in future 75% of all industrial data will be processed at the edge.
“Using a private network can be seen as having a data center on an oil rig that enables processing data locally, at high speeds and with low latency. It will be interesting to see further advances and opportunities for this domain,” Støldal said.

**Devices and applications**

Tampnet’s sensor and device catalog program includes more than 150 different sensors targeting the oil & gas industry. The sensors may support corrosion, vibration or valve monitoring. It could be a connected service. The sensor and device catalog documents many of the solutions deployed and running on the Tampnet infrastructure today.

Users like to put many different device versions on the network. Flexibility allows full control of data flows on reception, for storage and analytics use. The solution is scalable in terms of the number of devices installed on it.

“We continue to develop this ecosystem and are still in the early days,” Støldal said. “An increasing number of sensors are ATEX certified and that number will continue to increase.”

ATEX certification ensures the safety of equipment intended for use in potentially explosive atmospheres in the European Union. While many requirements for ATEX certification overlap with NFPA vacuum design requirements often relied upon during an OSHA inspection, the ATEX directive isn’t relevant in the United States.

**Application use cases**

To wrap up his presentation, Støldal outlined several deployed application solutions supported by the Tampnet technology, include the following:

- Remote inspections, including with StreamSolutions, a platform of audio and video streaming services, active in the North Sea.
- Autonomous inspections, involving robotics designer Boston Dynamics and BP.
- Drone/emissions monitoring with Flylogix, the unmanned aircraft developer, and in use
by Maersk, the integrated logistics and supply chain services provider.

• Vibration monitoring, with technology from SKF, the global supplier of bearings, seals and lubricants and used by Total. Monitored data is transmitted to an insurance company, for “insurance as a service capability,” of which we’ll surely see more, Støldal said.

• Corrosion under insulation, using CorrosionRADAR technology for early corrosion detection, and live with Total.

“We have many different solutions live as we speak,” Støldal said. “We’re seeing more and more users willing to try things that offer good business cases. We’re going to see more of these advanced use cases going forward."

Proof of concepts currently being tested include the following.

• Corrosion under insulation, with TRISENSE from Trinity Touch, the provider of wireless IoT sensors; Indusenz, the provider of real-time sensors and data solutions; and CorrosionRADAR.

• Vibration monitoring with Nanoprecise, provider of predictive management solutions combining AI, IoT and LTE.

• Tank monitoring with Suretank, an offshore logistics provider for the oil & gas industry.

• Asset tracking with Envio, the energy equipment and solutions provider.

• Miniature multi-sensor with Extech Instruments, the supplier of handheld electronic test equipment and measuring instruments, and Disruptive Technologies, provider of sensors and IoT infrastructure.
Would you like to learn more about oil & gas solutions from Ericsson?

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