Application Brief

Remote Asset Monitoring and Secure IoT SCADA Communications for Oil and Gas

Oil & Gas' Digital Transformation: The Challenges

The oil and gas industry is undergoing digital transformation to improve efficiency and turnaround time, among others. This process, however, presents several challenges to the oil & gas companies. Specifically, the challenges revolve around security, as new and evolving threats throughout the supply chain posing a severe risk for devices and installations that are now connected to the internet. In addition, there's a need for a seamless integration of new technologies to enhance legacy SCADA systems, due to the need to decentralize remote operations for cost reduction and automation support. Lastly, the increased amount of data being collected, mostly in real time, from sensors, video cameras, workforce ERP systems and the internet, requires efficient data analytics.

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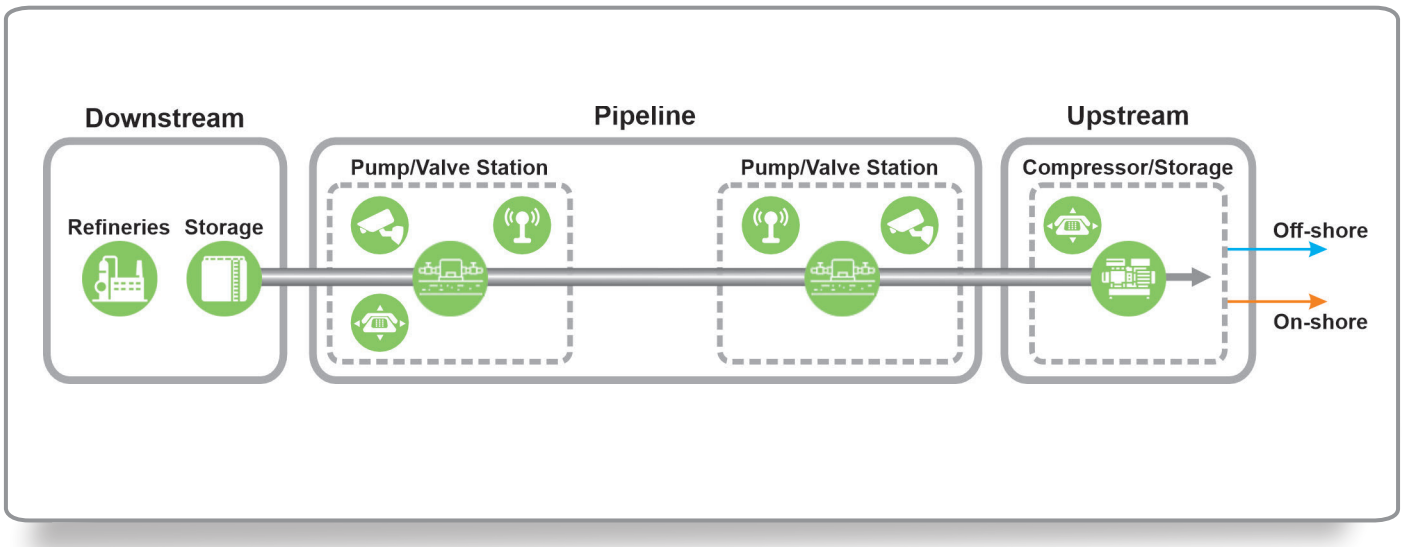
The above challenges are common to companies operating in all segments of the industry – upstream pipeline and downstream, even though these might be completely different companies. Across the different segments the need to manage and monitor all assets, to improve production and operations, and to lower CapEx and OpEx are paramount.



Another requirement is that appropriate solutions would support long-distance operations. Oil and gas fields are often remote, covering areas ranging from hundreds of square feet up to thousands of square feet. To ensure extraction feasibility and proper operations, many devices are needed, including pumps, compressors, generators, pipelines, wellheads, drilling equipment, and many others, often incorporating low-speed telemetry.

Secure Connectivity for IoT SCADA and Asset Monitoring

RAD offers comprehensive solutions to provide efficient and secure remote asset monitoring and IIoT sensor connectivity. It addresses the need for real-time data collection, as well as integrating legacy SCADA systems into modern IIoT platforms.

Monitoring remote assets: A typical site includes many assets, as described above. All these assets must be controlled and monitored. The data generated by the sensors is collected, processed, and analyzed via gateways. This allows oil and gas field operators to improve efficiency, fix errors in real-time, and dynamically apply maintenance procedures according to data trends.

Application Brief

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Collecting data in real-time: When decisions are made based on available data, such as for safety monitoring equipment and control systems, the ability to collect it in real time is key. This data can then be analyzed along with trend algorithms as well as AI and machine learning models. The growing amount of data is processed in central control centers as well as in edge sites.

The main advantage of processing the data locally is that edge devices can prioritize and filter data before transmitting it to central servers or the cloud. This also minimizes latency (delay) and improves reaction time and overall security. In addition, by utilizing edge devices, local processing can reduce the volume of traffic that needs to be sent over networks, thereby saving bandwidth and reducing costs.

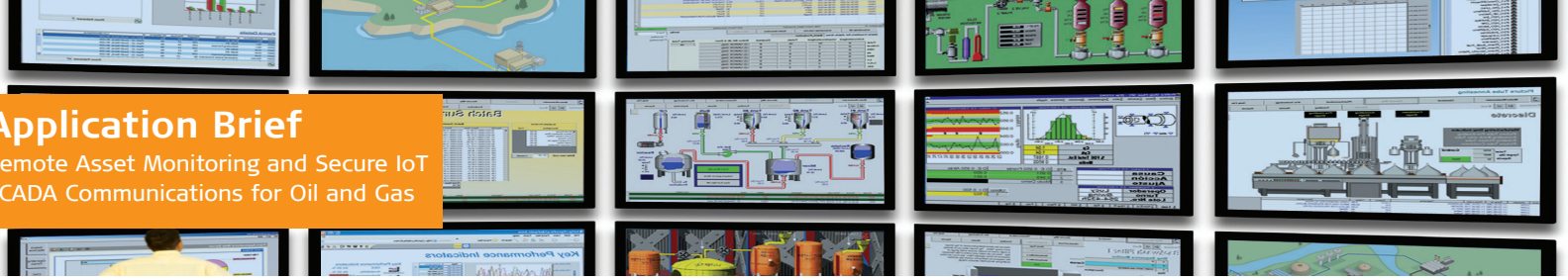
Connecting IIoT sensors and devices: IoT and IIoT sensors are critical for data collection and monitoring devices. They are small, ruggedized and their battery – which is connected and controlled – has long life. They collect temperature, pressure, flow rates, equipment status, and other data from the remote infrastructure, and are complemented by existing SCADA RTUs and PLCs.

The seamless connection of sensors is facilitated through a combination of traditional copper and Ethernet wires, along with VHF/UHF legacy systems and cutting-edge wireless technologies like LoRaWAN and Wi-Fi-Halow. This expanding network of sensors and IoT devices, spanning from the field to dedicated data centers and platforms, relies on IIoT gateways and an Operational Technology (OT) wide area network (WAN) for robust connectivity.

Such IIoT gateways play a pivotal role in aggregating data from multiple sensors and devices at specific locations, whether it's an oil field, a pipeline segment, or refinery machinery. They streamline communications, monitoring, and management of these devices, enhancing overall operational efficiency.

Gateways also provide data security elements, such as Firewall and data encryption, to protect this environment from external and internal threats.

Operational Technology WAN, or OWAN, utilizes mostly fiber infrastructure to transport and connect data from remote sites and alongside pipelines. However, where fiber is not available, it utilizes wireless technologies: 4G/LTE and 5G mobile technology, licensed and unlicensed radio systems, CBRS and Anterix in North America, are examples of OWAN wireless options. Connectivity must be always-on, highly resilient and protected, to enable uninterrupted operations.



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The Value of Edge Computing for Oil and Gas

Edge computing capabilities are supported by IoT gateways, dedicated servers, and other telecommunications devices. This means that they have real-time processing and storage capacity to handle several functionalities at or near the remote sites. Such functionalities include data analytics, algorithm application, and immediate decision making based on the incoming data.

By processing data locally at the edge, latency (delay) is minimized because data doesn't travel to a centralized data center for analysis. This is crucial for applications where real-time response is essential, such as safety and control systems. Edge devices can prioritize and filter data before transmitting it to central servers or the cloud, hence reducing the volume of data that needs to be sent over the network to save bandwidth and reduce costs.

Edge computing can enhance cybersecurity by limiting the exposure of critical infrastructure to external networks. In addition, it adds and hosts additional cybersecurity functionalities such as anomaly detection systems, deep packet inspection for IIoT and SCADA protocols, Distributed DoS protection and much more.

IIoT and SCADA Co-Existence

Oil and gas fields are monitored and controlled using legacy SCADA PLCs and RTUs, and employing protocols like Modbus, DNP3, IEC 101, and 104. In parallel, there is an increasing presence of new-generation IIoT sensors and devices. Many of these devices support the Message Queuing Telemetry Transport (MQTT) communication protocol, which has become the de-facto standard across various industries.

MQTT is known for its lightweight and efficient design, making it well-suited for applications in the oil and gas sector. It can handle many sensors and devices, while minimizing bandwidth and resource usage. MQTT supports TLS/SSL encryption and authentication, enhancing data integrity and confidentiality. Similar to edge computing, data can be prioritized with QoS (Quality of Service) levels, and pre-processed at remote sites to improve decision-making, efficiency, and security. To support all generations of devices, controllers and protocols, multi-protocol capacity is essential in IoT gateways.

Application Brief

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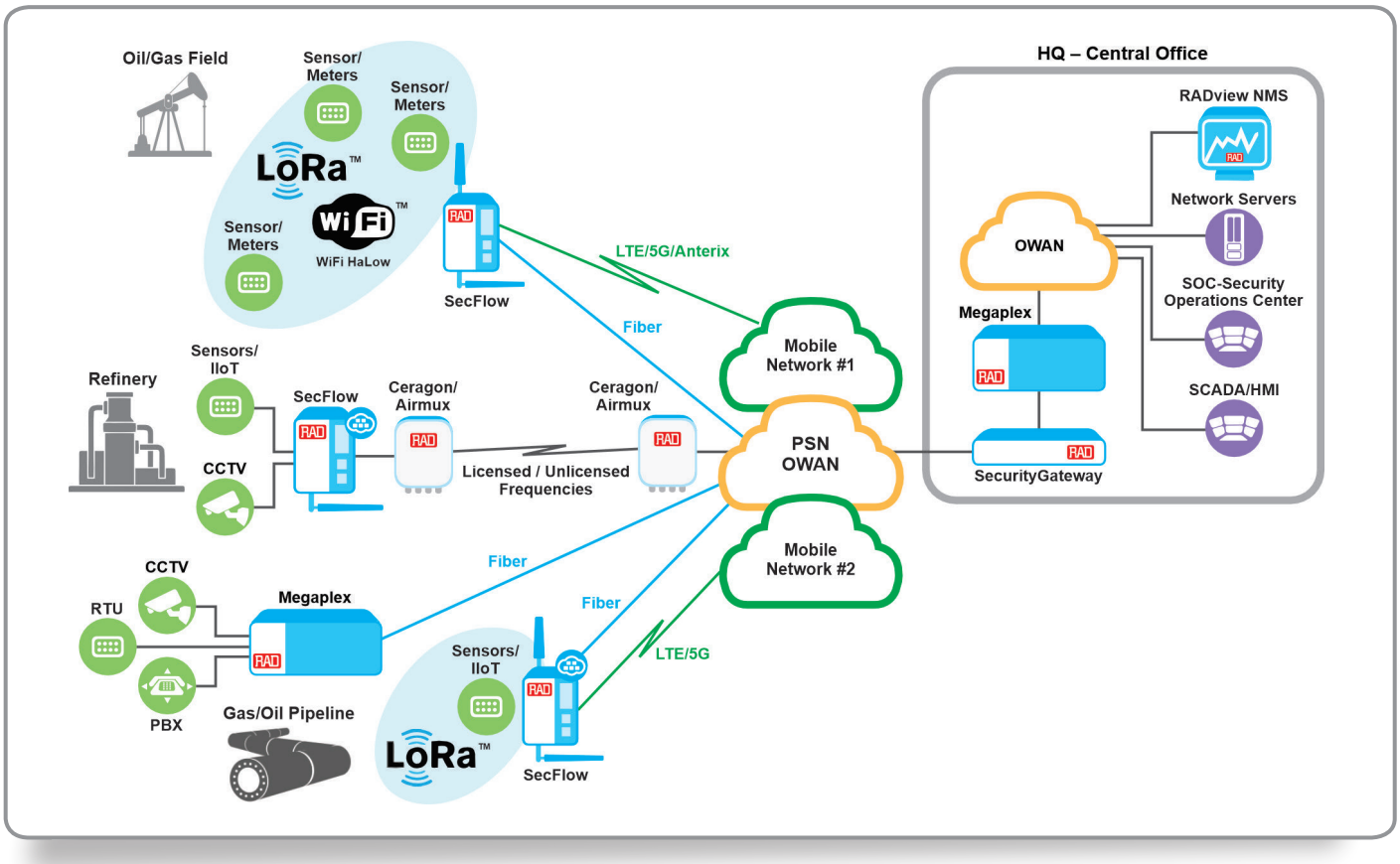
RAD offers a comprehensive range of solutions tailored for contemporary oil and gas fields, including:

- Cutting-edge, robust IIoT gateways equipped with edge computing capabilities
- Operational WAN solutions facilitating TDM to Packet migration
- Secure data transport via fiber or licensed and unlicensed wireless links
- Ruggedized Ethernet switches designed to withstand extreme conditions in remote sites
- Intelligent SFPs enabling the use of cost-effective XGS-PON fiber infrastructure while offering straightforward encryption for legacy IP systems

Combining innovation with operational excellence, RAD portfolio revolutionizes oil and gas operations, enhancing efficiency, safety, and reliability in remote and challenging environments. RAD's tailored offerings support end-to-end network management, reliable and secure oil and gas fields connectivity.



Learn more about RAD's SecFlow and Megaplex

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