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How IoT Can Ensure Mission Critical Operations

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When you're close to a city, with developed road and telecommunication systems, a vehicle breakdown is often little more than a minor inconvenience. Imagine, however, that same scenario somewhere out in the plains of Africa or the Australian outback, where cellular coverage is patchy and it is a several- hour drive to the nearest town. For organizations operating in these areas, the priority is ensuring the safety of personnel, especially in extreme climates. But there could also be serious commercial and reputational consequences if connectivity failures make it impossible to access the network and the data and applications that run on it.

In such cases, having satellite connectivity on the roofs of vehicles as a backup provides a safety net for teams out on the road by enabling them to communicate with colleagues back at head office. It also means that vehicles can be tracked in close to real-time, even in remote locations, so any issues can be identified and addressed quickly.

Reliable connectivity is similarly vital in other hard-to-reach and potentially dangerous environments, such as gas and oil pipeline networks.

For a long time, pipelines have been monitored using SCADA (Supervisory Control and Data Acquisition), and they remain a useful way of detecting leaks and prioritizing actions. But, as we'll observe later in this article, we're now seeing SCADA being superseded by IoT solutions, which allow users to connect their assets and manage their data in a single location in the cloud. Whereas SCADA networks rely on highly specialized hardware and sensors, IoT supports a wider range of sensors and data and can therefore vastly improve monitoring capabilities.

We can also see the value of IoT in disaster preparedness, including wildfire and flood monitoring. A monitoring network rolled out in an area with a history of forest fires, for instance, could provide early warnings based on changes in the temperature, wind, and humidity, all picked up by sensors, without humans having to be physically present. The sensor data would enable one to determine which way the fire is blowing and where it's likely to go next so teams can mobilize on the ground and prepare any warranted emergency services.

Minimum Bandwidth, Superior Coverage

Another advantage of an IoT solution is that it can function with minimal bandwidth to carry the minimum amount of data required. That means you don't need to have broadband systems installed in areas where you have high satellite capacity requirements. Also, one can align satellite capacity (say, one megahertz) with the amount of sensor data needed. Doing so can bring down the total cost of ownership, compared with relying on broadband satellite services.

Satellite IoT provides reliable connectivity in areas where coverage has traditionally been limited, such as remote and vast farmlands and vessels at sea. Being able to maintain connectivity is essential for communication, particularly in seagoing vessels that don't require or otherwise don't have a GMDSS (Global Maritime Distress and Safety System) but still need connectivity to make voice calls.

The installation process is also much simpler than it would be for a VSAT (very small aperture terminal). A dynamic IoT satellite terminal requires no pointing. With a fixed terminal, pointing can be done easily via a mobile phone app.

Saving Time and Reducing Error

Satellite IoT can also significantly speed up response times to sensor alerts by enabling cloud-based automation in otherwise unconnected areas. You could, for instance, program the system to turn off applications if the temperature increases and turn them back on again when the temperature goes down. This reduces the burden on human operatives who don't have to be watching the screen all the time, at the risk of delay or error.

Because IoT solutions connect to the cloud, users can capture an ever-increasing amount of sensor data. As a result, machine learning and AI capabilities will be necessary to determine what is unusual and where action should be taken, otherwise users will be left with reams of dashboard stats.

If you had a network of 1,000 sensors all reporting temperature, you don't need or want to know what that temperature is every five seconds. You only want to know – probably within five seconds – whether the temperature has risen or fallen below the minimum or maximum average for the past week. This is where AI and machine learning are tremendously helpful because they can process vast amounts of data accurately and at speed.

SCADA vs. IoT

SCADA has been around for some 30 years and has been highly valuable in monitoring industrial processes and critical infrastructure over a large and/or disparate area. However, its limitations stem from the fact that systems are normally built using specialist hardware and priority protocols like Modbus, so they're not interoperable, nor are they industry-standard.

IoT, on the other hand, has become the industry standard because it uses communication protocols like lightweight messaging MQTT (Message Queue Telemetry Transport). We can also carry IP data for IoT. The sensors connect to it using established low power wide area networks (LPWAN), such as LoRaWAN and Sigfox, along with other industry-standard providers. In fact, there are hundreds of different gateway vendors out there that convert from these LPWAN standards to IP so that they can be transmitted across satellite or any network.

Flexibility and Scalability

Satellite IoT is becoming increasingly accessible to organizations, including those who test its capabilities and dip their toes in the water without committing to CapEx costs.

Scalability at speed is also possible because the cost of sensors has dropped dramatically in recent years, while the variety of LPWAN sensor technologies has grown. Furthermore, you no longer need a stand-alone IoT satellite system because you can leverage existing hub equipment and fire up a satellite IoT system on it.

IoT has vastly improved over the past 15 years and it's getting better all the time. Users can therefore do much more than before. Now it's possible to pull in data sources and use machine learning at a higher level because you're interoperating with different services rather than relying on the closed network that SCADA offers.

IoT in Action

Going back to our example at the start, better cellular coverage could alert teams to a broken-down vehicle in a remote location. What's preferable, of course, is being able to prevent the breakdown from happening in the first place. This is where IoT really comes into its own.

In this scenario, you could use the Sigfox network to connect to the vehicle's diagnostics to see whether there has been a change in tire pressure and engine temperature. There might be other sensors running on LoRaWAN, and additional sensors elsewhere.

The data from all these sources, all with different gateway protocols, can be converted into IP and sent over the satellite network. Greater collaboration between IoT vendors is also making it possible to pull in more data sources. All this makes it easier for companies to deliver a service without having multiple gateways or multiple conversion points to address, making deployment faster and more cost- effective.

Flexibility is Key

More and more, we're seeing the barriers to satellite IoT adoption being broken down as the number of options available to organizations grows. Open networks, for one, help to bring down the cost of ownership, giving users the freedom to choose precisely which capacity will suit their needs. Technology has also developed at such a rate as to enable dual capabilities, meaning users have the option to run in an IoT mode network sharing capacity with all their other IoT terminals and switch to a dedicated channel SCPC mode for a short period when greater throughput and less latency are needed.

Safety being the main priority, on-the-ground teams can also switch to a dedicated channel if required and make important calls using a mobile IP app over the satellite. The flexibility of this dedicated channel SCPC mode is key because customers like the idea of being able to log into systems when they need to. Otherwise, they end up paying a premium for their terminal and airtime even if they're only using the broadband capability for 1 percent of the time.

Crucially, it also allows them to prioritize mission-critical data by managing it on a terminal-by- terminal basis, helping them achieve a higher level of accuracy and due diligence before making a decision.