MOBILE IoT CASE STUDY -

ATLAS COPCO HARNESSING CONNECTIVITY FOR INDUSTRIAL IoT

EXECUTIVE SUMMARY

Atlas Copco, one of the world's leading suppliers of industrial equipment, has been at the forefront of offering ground-breaking services for several years now with remotely managed air compressors that use 2G and 3G cellular communications. It is now preparing to leverage the newest Mobile IoT networks being rolled out by mobile operators. The low cost connectivity will help the Stockholm-based company enrich its industrial products and related services. With access to up-to-date information on the usage and condition of a customer's compressor, Atlas Copco can provide timely maintenance services and minimise the costs associated with breakdowns and production loss. The data collected from air compressors also enables customers to manage their energy usage efficiently.

Having initially connected its industrial air compressors using 2G / 3G modules supplied by Sierra Wireless, Atlas Copco plans to start using Mobile IoT solutions from mid-2019. Its air compressors are equipped with Sierra Wireless' FX30 programmable IoT gateway, which is about the size of a cigarette box and can now support 2G, 3G, 4G, LTE-M and NB-IoT connectivity.

For Atlas Copco, part of the appeal of Mobile IoT technologies is longevity. "We have an installed base of hundreds of thousands of machines," notes Damien Hoyen, Project leader IOT at Atlas Copco. "Compressors are investment products and usually tend to be in operation for more than 10 years, so we need connectivity that is future-proof." Although they can run on 4G networks, both LTE-M and NB-IoT are already considered to be part of 5G networks and are set to be an integral part of mobile operators' IoT portfolios for the foreseeable future.

Importantly for Atlas Copco, Mobile IoT networks can provide coverage in basements or rooms where there is a lot of metal, which can be difficult for conventional wireless networks to penetrate. "From what we have measured, we know the coverage is working a lot better," says Nicolas Damour, Director of Technology Partnership Development at Sierra Wireless. "With conventional 2G or 4G cellular, you would be able to cover about 70% of your fleet of industrial machines, whereas with low power wide area connectivity it is something like 96%."

Another advantage of moving to Mobile IoT connectivity is the potential to use a single global SKU (stock keeping unit) product that can change its frequency to adapt to all cellular networks across the world. Atlas Copco anticipates being able to deploy the same connectivity module in all the markets where it operates.

Mobile IoT networks could make the economics even more favourable by enabling the cost of connectivity to be bundled with the cost of the device in a single offering, adds Nicolas Damour. "Sierra Wireless already delivers such integrated Ready-to-Connect solutions to its customers, allowing them to focus on their core business with a hardware that comes together with an embedded SIM, pre-connected to the global mobile networks," he says.

INTRODUCTION

Digital technologies are driving an industrial revolution. By capturing information in real-time and enabling remote control of machinery, the Internet of Things (IoT) can increase efficiency and enhance the value manufacturers can provide to customers. In fact, the IoT, along with artificial intelligence and cloud computing, is one of the key enablers of Industry 4.0, in which self-optimising production facilities process a continuous flow of information to automatically adapt to events, such as a supply shortage or a new customer requirement.

Advances in cellular technologies are now enabling the industrial IoT to expand rapidly. In particular, new Mobile IoT technologies are well placed to serve businesses' connectivity needs – they can support a large number of connections in a small area, while also providing excellent indoor coverage.

Delivered through a straightforward upgrade to a 4G (LTE) network, the primary Mobile IoT technologies - NB-IoT and LTE-M – can provide low-power wide area coverage across industrial plants. As the number of deployments rises, economies of scale are kicking in, cutting the cost of high-volume chipsets. This virtuous circle is further accelerating the growth in Mobile IoT connections. GSMA Intelligence estimates the number of Mobile IoT connections worldwide will rise from 127 million in Q4 2018 to 1.9 billion in 2025.

Industry will fuel much of this growth. As the NB-IoT and LTE-M module cost falls, it is becoming feasible to connect almost every asset in an industrial plant, allowing production managers and their suppliers to perform proactive maintenance, maximise uptime and optimise energy usage.

This paper outlines how Atlas Copco, a leading supplier of industrial equipment, is harnessing Mobile IoT technologies to enhance its product line and customer proposition.
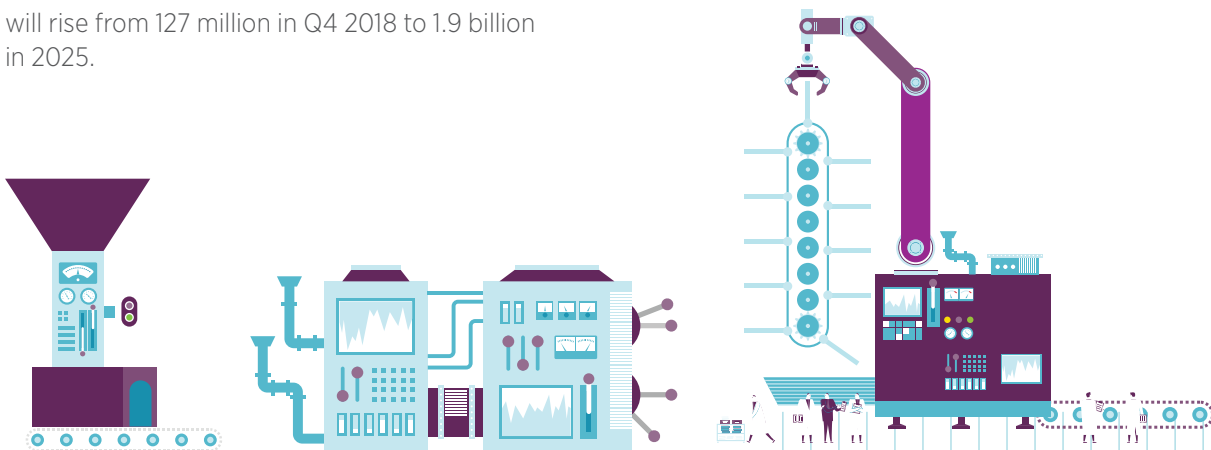
HOW ATLAS COPCO IS HARNESSING CONNECTIVITY

With 34,000 employees and annual revenues of about US$9.5 billion, Atlas Copco is one of the world's leading suppliers of air compressors, vacuum solutions, generators, pumps, power tools, assembly systems and other industrial equipment.

The Stockholm-based company, which has customers in more than 180 countries, is exploring how the low cost connectivity offered by Mobile IoT technologies can enhance its products and services. In its industrial compressor business, for example, Atlas Copco is beginning to use NB-IoT and LTE-M to collect data that can be used to provide preventive maintenance. With access to up-to-date information on the usage and condition of a customer's compressor, local service teams can deliver the right service visit at the right time for faster fault resolution, saving costs associated with breakdowns and production loss. The data collected from air compressors also enables customers to manage their energy usage efficiently and further increases product reliability.

Atlas Copco has developed its own back-end system for collecting and analysing the data generated by the compressors. "With connectivity, we can remotely see the data, which can be extracted for data mining," says Damien Hoyen, Project leader IOT at Atlas Copco. "With the industrial air compressors, we are interested to know when a service is due for a unit. It is a bit like a gauge on your car. With the connectivity, we can initiate the service at the moment when we need to do the service. We can prepare in advance and optimise the availability of people and parts. We could even bundle this service visit with another planned service visit in a single visit."

The overall objective is to help customers avoid downtime, which could cost millions of euros in the case of a large chemical plant or another major industrial operation. Prior to the introduction of connectivity, Atlas Copco would call customers regularly to find out how much they had used their industrial air compressors: an inefficient process for both parties.

At the beginning of this decade, Atlas Copco began to add connectivity modules to its compressors, paving the way for the launch of its SMARTLINK remote monitoring service in 2013. It says that thousands of customers globally have since benefited from SMARTLINK. Three tiers of service are available – the basic tier flags to customers when their compressors will need servicing, while the second tier also allows for the remote monitoring of faults and subsequent interventions. The top tier supplements these services with continuous energy monitoring, enabling customers to analyse how to increase efficiency of their compressed air installation.

MOVING ON TO MOBILE IOT NETWORKS

Having initially connected its industrial air compressors using 2G modules supplied by Sierra Wireless, Atlas Copco plans to start using Mobile IoT solutions from mid-2019. Its air compressors are equipped with Sierra Wireless' FX30 programmable IoT gateway - a small, flexible and rugged programmable cellular gateway, which can be configured to support 2G, 3G, 4G, LTE-M and NB-IoT connectivity. About the size of a cigarette box, the gateway has both a serial port and an Ethernet port, as both interfaces are widely used in industrial machinery. It also has an IoT connector expansion slot, which can be used to integrate sensors and other hardware into the gateway.

"The FX30 IoT gateway has evolved from 2G to support 3G and 4G and now 4G Low Power Wide Area technologies," says Nicolas Damour, Director of Technology Partnership Development at Sierra Wireless. "It supports both NB-IoT and LTE-M but also 2G as a fall-back, which is very important, as it gives you versatility from the get-go. For a worldwide deployment, you are far better off with both LPWA technologies, as many operators are deploying one or the other. And have 2G as a fall-back." The gateway is part of Sierra Wireless' "device-to-cloud IoT solution", which also comprises the Legato open source Linux platform integrated with Sierra's own AirVantage IoT platform for connectivity and device management. "Our strategy is to do one simple product that can go everywhere," adds Damien Hoyen of Atlas Copco. "As the gateway is part of Legato common platform, we don't have to re-write 6,000 lines of code to go from 3G to 4G."

Another key consideration for Atlas Copco is longevity. "We have an installed base of hundreds of thousands of machines," notes Damien Hoyen. "Compressors can run for many years, so we need connectivity that is future-proof. Most of the compressors today are connected over 2G, but some operators will switch off their 2G networks in the next few years. 4G will be around for 20 years, which makes it future-proof." Although they can run on 4G networks, both LTE-M and NB-IoT are already considered to be part of 5G networks and are set to be an integral part of mobile operators' IoT portfolios for the foreseeable future.

Indeed, one of the advantages of using a cellular-based IoT platform is the certainty that mobile operators will continue to be in business in 10 or 20 years. By contrast, start-ups using wireless technologies in unlicensed spectrum have yet to prove their staying power.

"The FX30 gateway and its predecessors have been around for 15 years," says Nicolas Damour of Sierra Wireless. "I wouldn't be surprised if it is being used in hundreds of thousands, if not millions, of machines, ranging from air compressors to coffee makers." The gateway is also versatile in that it can be retrofitted to existing machines in the field, he adds.

At the same time, Mobile IoT networks can provide coverage in basements or rooms where there is a lot of metal, which can be difficult for conventional wireless networks to penetrate. "From what we have measured, we know the coverage is working a lot better," adds Nicolas Damour. "With conventional 2G or 4G cellular, you would be able to cover about 70% of your fleet of industrial machines, whereas with low power wide area connectivity it is something like 96%. You still have the odd area where you have some issues."

Another advantage of moving to Mobile IoT connectivity is the potential to use a single global SKU (stock keeping unit) product that can change its frequency to adapt to all cellular networks across the world. Atlas Copco anticipates being able to deploy the same connectivity module in all the markets where it operates as the chosen IoT gateway supports multiple frequency bands. "Being able to deploy a single

product worldwide is important," says Nicolas Damour. "A traditional 4G product is tailored for a particular region in terms of frequency bands, but low power wide area connectivity is much simpler. With a software-defined radio, you can support all the bands used worldwide in one product. LTE-M also supports roaming out of the box, which is a big plus."

Indeed, Damien Hoyen stresses that Atlas Copco's rollout of the Mobile IoT-enabled air compressors will be governed in part by the availability of international roaming services. "It is very complex for us, as our machines are deployed in over 100 countries," he explains. "We deploy our machines globally and we don't want have to do different SKUs for different countries. We are working through a global agreement with a major Mobile Network Operator at the moment as our compressor business is global and will need to be deployed in all markets."

> " *With conventional 2G or 4G cellular, you would be able to cover about 70% of your fleet of industrial machines, whereas with low power wide area connectivity it is something like 96%.* "

Nicolas Damour, Director of Technology Partnership Development at Sierra Wireless.

In time, Atlas Copco is also considering employing eSIMs, which can be remotely configured to connect to different operators' networks, removing the need to physically change the SIM card if a machine needs to switch networks. Sierra plans for future iterations of the gateway to support the GSMA eUICC specification for remote provisioning, allowing subscriptions to be remotely updated over-the-air.

Cost is also a key consideration at the lower end of the market. Sierra Wireless is aiming to ensure the cost of a Mobile IoT module is comparable with that of a 2G module. "But I would argue the main driver of adoption would be a new cost model" in which the cost of connectivity is bundled in with the cost of the device in a single offering, explains Nicolas Damour. "Sierra Wireless already delivers such integrated Ready-to-Connect solutions to its customers, allowing them to focus on their core business with a hardware that comes together with an embedded SIM, pre-connected to the global mobile networks," he says.

This kind of commercial clarity and certainty is an important factor for industrial companies making long-term investments in equipment and plant. notes Damien Hoyen. "many of our machines go to semi-professional shops where the operating cost of a connectivity solution must meet the business case." so the cost of connectivity is an important factor.
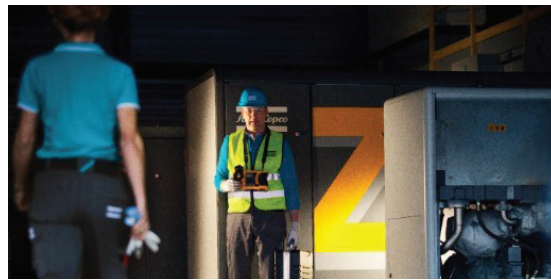
> **❝** *Our strategy is to do one simple product that can go everywhere. As the gateway is part of Legato common platform, we don't have to rewrite 6,000 lines of code to go from 3G to 4G.* **❞**
>
> **Damien Hoyen,** Project Leader IOT at Atlas Copco

CONCLUSIONS AND NEXT STEPS

For Atlas Copco, the indoor coverage, the global reach and the longevity of Mobile IoT technologies are key attributes: air compressors with NB-IoT and LTE-M modules can remain connected for decades to come.

Having completed the required engineering, Atlas Copco and Sierra Wireless are embarking on field tests of LTE-M and NB-IoT. Assuming those tests are successful, commercial air compressors should begin connecting to Mobile IoT networks in the second quarter of 2019.

While most air compressors are plugged into a mains electricity supply, battery-powered industrial equipment could benefit from the low power consumption of Mobile IoT technologies. Sierra Wireless says the FX30 gateway consumes less than 1W in idle mode and 2mW in ultra-low power mode, making it ideal for solar and battery powered applications.