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GSMA 5G TRANSFORMATION HUB
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New Services Enabled by 5G Low Power Wide Area (LPWA) technologies NB-IoT and LTE-M for Manufacturing Equipment

Challenges and opportunities for connecting manufacturing equipment

ALMiG (or Automatic Air Pumps, Automatische Luftpumpen) Group, an industrial air compressor manufacturer located in Germany is using 5G Low Power Wide Area (LPWA) technologies NB-IoT and LTE-M to connect both new and legacy machines with minimal investment. The aim is to connect machines to cloud analytic platforms in the simplest way possible using a low-cost connectivity solution that can support all devices. By integrating Modbus Cloud Connect into their products, ALMiG has been able to enrich their COMPASS (Compressed Air Service Solution) digital services with real IoT-data.

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MANUFACTURING

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CASE STUDY LEAD: ALMIG KOMPRESSOREN GMBH

⊕ CHALLENGE

The main challenge was to develop new capabilities and business models for equipment that was already in service, and in a short timeframe without lengthy custom hardware development. The IoT solution adopted needed to be flexible enough to be both retrofitted to existing machines and also fitted to new machines. Meanwhile, ALMiG had to work with a lack of real data about the usage of their machines in the field. An additional challenge was the complexity of the IoT ecosystem, with different partners and suppliers potentially providing different components and a potential dependence on end-user customers for data communications infrastructure.

⊕ SOLUTION

ALMiG selected the Modbus Cloud Connect product offered by grandcentrix (a Vodafone company) to connect both new and already deployed ('brownfield') air compressors. Modbus Cloud Connect builds the digital bridge and connection between the sensing and actuating Modbus RTU (remote terminal unit) devices inside the air compressors and the cloud infrastructure of ALMiG.

⊕ IMPACT & STATISTICS

The new solution allows ALMiG to offer new business models, including 'as-a-service' propositions using real time IoT data. Customers benefit from daily updates, instant notification of critical status updates, and improved uptime through preventive maintenance. Another key benefit lies in ALMiG's potential to use IoT data from real world deployments to enhance future product development.

⊕ WIDER IMPLICATIONS

Wide area 5G LPWA (NB-IoT and LTE-M) connected productised solutions are well-suited to IoT enabling industrial equipment in a cost-effective way and in particular can play a significant role in the context of brownfield equipment. Such solutions can be easy to implement, efficient, sustainable, and affordable for both the manufacturer and its customers. Retrofit IoT solutions can enable manufacturers to offer new services associated with existing machines that are already deployed at client sites, and also to make these machines far more efficient. As with many IoT solutions, retrofitting equipment helps to optimise operational processes through remote monitoring and reduces the risk of equipment failure using predictive maintenance to unlock further cost savings.

⊕ STAKEHOLDERS

ALMiG Kompressoren GmbH, grandcentrix, Vodafone.

SOURCES & FURTHER INFORMATION

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In an intensely competitive environment, equipment vendors must adopt the latest technologies to enable leading edge services and remain competitive. Ideally such services would encompass all equipment that is used by their customers including both new equipment sold and also equipment that has been in service at client locations potentially for many years. But the users of such equipment generally can't afford any downtime and replacing legacy machines and equipment with new smart devices and tools is expensive. Accordingly, vendors of manufacturing equipment will place a premium on 'smart' solutions that can be integrated into both new and legacy ('brownfield') assets.

ALMiG Group is a supplier of air compressors that are used as part of many different manufacturing processes. The company has found an innovative way to connect both new air compressors and their existing devices estate with a single solution by using 5G Low Power Wide Area (LPWA) technologies NB-IoT and LTE-M to connect existing Modbus control and actuation capabilities. In collaboration with grandcentrix (a Vodafone company) ALMiG was able to rapidly develop a connected solution by making use of grandcentrix's Modbus Cloud Connect product.

By integrating Modbus Cloud Connect into their equipment, ALMiG digitised their products and better enabled their new COMPASS (Compressed Air Service Solution) service using real-time IoT-data. The central cloud software associated with the COMPASS service will maintain a digital twin of any connected machine and enables the processing, evaluation, and storage of information. Available data can be used to enhance existing processes and also to support new propositions such as, for example, enhanced servitised models. Using grandcentrix hardware and running on Vodafone's cellular communications

platform both existing and legacy devices can be connected using standardised hardware and pre-configured cloud adaptors.

grandcentrix' Modbus Cloud Connect product has four key aspects:

➔ **Hardware:** Modbus Cloud Connect Gateway is CE certified hardware with onboard firmware developed by grandcentrix, a form factor for DIN rail mounting and including terminal connections. The device has metallic and non-metallic surface antennas to aid connectivity.

➔ **Connectivity:** Includes a pre-installed SIM chipset that enables connection to 5G LPWA (NB-IoT and LTE-M) networks supported with a simple mobile connectivity tariff.

➔ **Self-Service-Portal:** A portal for device management and pre-configured data-integration via cloud-adap.

➔ **Support:** Initial support for device onboarding, as well as continuous support for ongoing operations including a service desk and trouble ticket system.

> We aimed for a self-sufficient connectivity solution based on Narrowband-IoT and LTE-M for our compressors. It seems natural to go directly to the source of this latest cellular IoT technology. So we have approached one of the world leaders when it comes to IoT, Vodafone.

Ralph Jeschabek - Head of Marketing at ALMiG

The benefits of connected manufacturing equipment

In the case of ALMiG, the Modbus Cloud Connect product was particularly beneficial since the company already operated a cloud platform and was able to relatively easily add new services based on the new IoT data. Since the adoption of Modbus Cloud Connect, ALMiG has launched a second cloud platform to enable a next generation of digital services.

The new IoT data supports key aspects of ALMiG's newly launched COMPASS proposition, including supporting customers with daily updates, instant notification of critical status updates, and improved uptime through preventive maintenance. Overall, the inclusion of IoT data has enabled ALMiG to migrate from providing reactive support to providing proactive support.

This approach includes aspects such as data management where clients often lack data science capabilities and can benefit from

support to define required data structures, frequencies of update, and which data feeds and correlations should be tracked to gain the most insight. Additionally, ALMiG has been able to simplify service activities and provide new services that extend to cover all plant-related activities.

Macro level information provided to clients includes a dashboard including both individual device data and also data about a clients' worldwide ALMiG device estate.

Another key benefit lies in ALMiG's potential to use IoT data from real world deployments to enhance future product development. Historically, ALMiG has supplied compressors to multiple industries, but with little data or feedback concerning exactly how the devices were being used by different customer segments. In the medium term, the company expects to be able to optimise product specifications for different customer types so that features that are not required can be omitted and compressor capabilities can be better matched to customer needs. Such an approach will enable ALMiG to make their

overall compressor portfolio more competitive in an evolving marketplace.

From an operational perspective, ALMiG benefits from the ability to undertake pre-emptive maintenance and upgrade their overall approach to field servicing. Currently, when large compressors break down, field engineers must often fly to a

customer location to undertake the necessary repairs. Accordingly, where repairs can be undertaken pre-emptively as a part of routine service maintenance there are significant benefits in terms of travel time and expense. Additionally, there are significant sustainability benefits associated with reducing air travel.

> Everything that is needed for the IoT capabilities of our products we are getting out of one hand from Vodafone & grandcentrix: Hardware, connectivity, data service (data integration in existing cloud) and technical support. We really appreciate the close and trustful collaboration as well as the high expertise in IoT. This in turn enables us to increase our customers' satisfaction by new digital services through connected products.

Ralph Jeschabek - Head of Marketing at ALMiG

Potential to **reduce cost and involvement** of multiple third-party resources

One of the challenges faced by ALMiG is that its clients typically acquire machines for large factories and industrial plants involving significant investments and corresponding depreciation periods of many years.

Accordingly, it is important for ALMiG to cater to customer demand for transparent and prompt access to usage data sourced from smart and connected machines, whilst also enabling those customers to maximise their return on previous investments by enabling similar services on already deployed machines.

For ALMiG, the deployment of Modbus Cloud Connect was an effective way to connect both new and existing machines and to optimise services associated with

both. Using Modbus Cloud Connect, compressors can be remotely monitored and controlled to reduce on-site operational effort using existing sensors and actuators. The solution can be easily retrofitted into existing machines and legacy systems and can be connected through pre-configured cloud adapters and use of the 5G mobile communications.

Digitization of our products has been a high priority for ALMiG for a long period. However, we had a hard time in getting together a solution with different partners for different services. Modbus Cloud Connect was the perfect answer to those challenges of the past, because all relevant building blocks are already harmonized and integrated as one product out of one hand. Based on this IoT-upgrade of our products, many opportunities and values for our customers will arise.

Ralph Jeschabek - Head of Marketing at ALMiG

Modbus
Product
Modbus RTU device

Infrastructure
Cloud-service
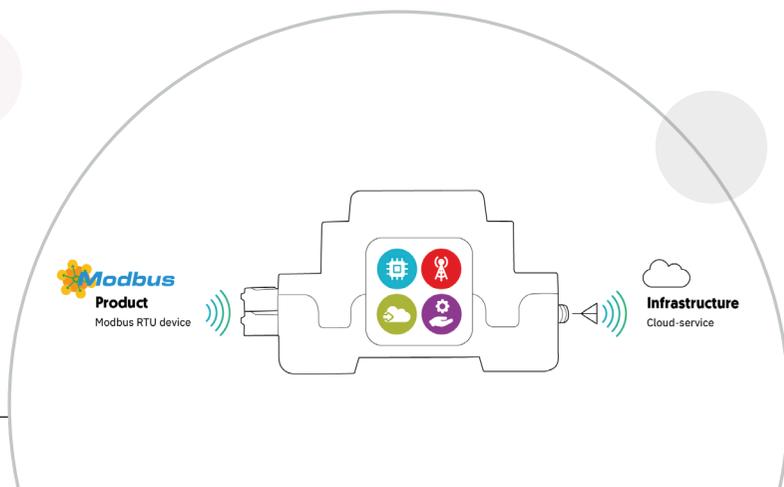
5G LPWA technologies NB-IoT and LTE-M combined with established Modbus protocols enables flexibility, simplicity and ease in deployment

5G LPWA technologies NB-IoT and LTE-M were particularly important for ALMiG since compressors are generally located indoors and often in areas that are difficult to reach with wide area cellular connectivity technologies other than NB-IoT and LTE-M. Meanwhile, the benefits of providing direct connections to compressors are manifold, since such connections do not rely on any third-party infrastructure other than a cellular network (which is in turn contracted to, and under the control of, ALMiG). In contrast, if ALMiG had adopted a short-range connectivity solution then connectivity for each compressor would have relied on a customer's local network and also ALMiG gaining access to that network so that compressors could be remotely controlled. Accordingly, the use of 5G technologies enables ALMiG to control direct connections to end devices, whereas a solution based on short-range technologies would have to rely on an extremely fragmented estate of local client networks. In turn, the use of 5G allows ALMiG to commit to deliver certain service levels, since the company controls all relevant infrastructure end-to-end.

Benefits of the Modbus Cloud Connect solution adopted by ALMiG include:

➜ **Flexibility:** Including the potential to support both the retrofit of existing units in the field and the equipping of new units with existing electronics, regardless of unit types or series. This allows ALMiG to turn a customer's entire estate of compressors into smart products.

➜ **Simplicity:** By using 5G LPWA technologies NB-IoT and LTE-M, data communication becomes independent of third-party infrastructure and there are clearly defined interfaces. This enables easy connection into existing Modbus-enabled capabilities of devices and supports collection of real time data such as operating hours and conditions and enables devices to be controlled remotely (for instance by adjusting air pressure settings). Connection to cloud infrastructure allows projects to be scaled quickly.

➜ **Ease in deployment:** Another key feature is that since the Modbus Cloud Connect solution is productised it can be deployed without any requirement for or dependence on any external third party vendor apart from grandcentrix. Effort, risk and costs that might result from the coordination and integration of external parties are thus significantly reduced.

Extending the rollout and **enabling a new commercial proposition**

Modbus Cloud Connect by Vodafone/grandcentrix **makes IoT simply easy.**

The partnership between ALMiG and grandcentrix will be continued and even expanded. Currently there are discussions about the development of an additional cloud-platform to complement the existing cloud platform. In the mid and long-term the target is to develop new applications and new services for customers.

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Using the large number of data points that are now sourced from compressors, ALMiG is working with data science experts from grandcentrix to get new insights

into customer usage of the equipment, resulting in the development of new applications or features. For example, customised and usage-based notifications can be provided to customers. Moreover, these insights will be reflected in AMiG's product portfolio development and R&D.

Modbus Cloud Connect is the "all-in-one" IoT product for direct connection of Modbus RTU devices via LPWA (Narrowband-IoT & LTE-M) to the cloud. For more information, please visit: **https://grandcentrix.net/ en/products/modbus/**

grandcentrix is a 100%-subsidiary of Vodafone Germany, supporting enterprises with the successful implementation of IoT projects. This includes custom bespoke IoT solutions (professional services) as well as IoT plug&play products such as Modbus Cloud Connect. In both business pillars the focus

is on the connection of devices to the internet of things with expertise along all IoT disciplines, from embedded engineering, production and certification, cloud backend and frontend, app, security and data science.

About the GSMA

The GSMA is a global organisation unifying the mobile ecosystem to discover, develop and deliver innovation foundational to positive business environments and societal change. Our vision is to unlock the full power of connectivity so that people, industry, and society thrive. Representing mobile operators and organisations across the mobile ecosystem and adjacent industries, the GSMA delivers for its members across three broad pillars: Connectivity for Good, Industry Services and Solutions, and Outreach. This activity includes advancing policy, tackling today's biggest societal challenges, underpinning the technology and interoperability that make mobile work, and providing the world's largest platform to convene the mobile ecosystem at the MWC and M360 series of events.

For more information, please visit the GSMA corporate website at **www.gsma.com.**

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GSMA 5G Transformation Hub

The GSMA 5G Transformation Hub is a source of information on some of the most innovative 5G solutions in the world. This portal contains case studies detailing design, benefits, key players, measured value and the future impact of scaling up these 5G solutions worldwide. The 5G Era is now firmly established and this family of standardised GSM technologies, including mmWave, are being rolled out successfully across the globe. The GSMA 5G Transformation Hub, launched at MWC Barcelona in 2022, provides details of how 5G is best placed to deliver real value for a range of key sectors including manufacturing, energy, transportation, media and live entertainment, smart cities and construction. Many more case studies will be added, in the coming months, covering even more industries and the GSMA is asking Members to nominate innovative 5G case studies to add to this global digital showcase. The 5G Transformation Hub and this particular Case Study are both sponsored by Qualcomm.

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