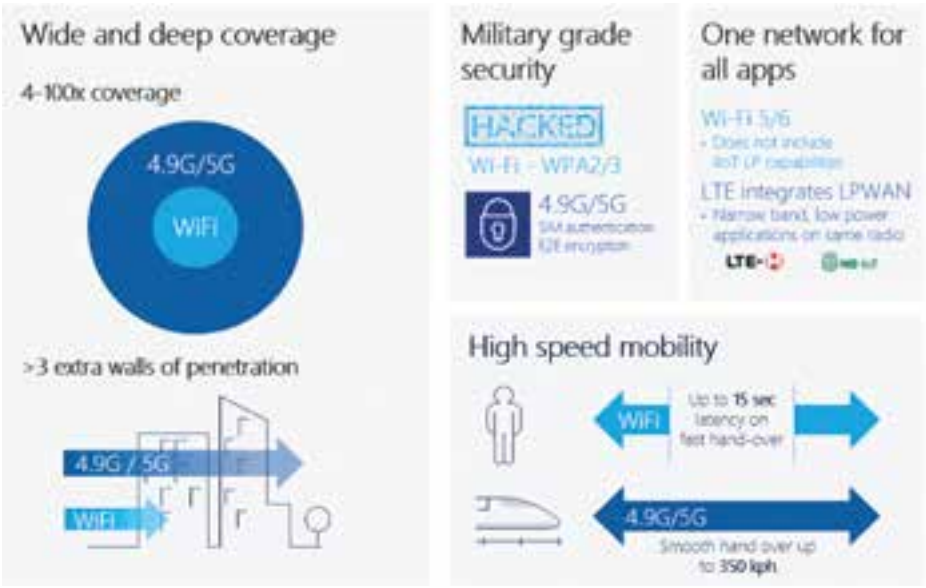
The intelligent factory:

THE WAY TOWARDS OPTIMISING PRODUCTION PROCESSES

Figure 1 (Source: Nokia)



These days everyone is talking about making better use of the condition data and process data from plant and machinery present (but not always evaluable) in every business – not least because it appears to be very promising in terms of increased productivity and cost reduction. From the operators' perspective this provides a wide range of possible applications and opportunities. For example, a lot of waste can be avoided if a faulty batch is detected and eliminated immediately before or, at the latest, during processing. Predictive maintenance also gives financial benefits. It builds on the automatic monitoring of wearing parts, analyses appropriate signals from the component and schedules a maintenance slot at a point in the production process where it will do the least harm – for instance the next weekend, and definitely before it comes to a stop or even fails altogether. At the same time this means avoiding superfluous "standard

How can plant and machinery parameters be effectively recorded and evaluated? What demands do these tasks place on the IT infrastructure? This use case provides answers.

maintenance intervals", which in turn cuts operating costs.

This and other use cases have one thing in common: they posit the reliable and often very rapid provision and evaluation of machine data. Unlike the data traffic produced by office applications or the mobile applications of employees, these are business-critical applications with a serious impact on company success or even the company itself – take, for example, the prevention of malfunctions in a power station.

It is easy to see the benefit to those operating a pool of machinery or equipment. But what are the "sticking points" in implementation? What key aspects are there to consider?

The following four aspects can be mentioned here: connecting the machines to a data network; designing the company's in-house network and data centre infrastructure for these business or company-critical applications; deciding on Edge or Cloud-based data processing; and finally, analysing and interpreting the data to give the desired process improvement.

Connecting the machines properly

First the good news: today the purely technical connection of machinery and equipment to the IT world has largely been solved. For this you need gateways which either connect the PLC of the machine or individual sensors or measuring instruments, and transmit the data to the company network.

Relatively new machines often have standard interfaces such as OPC-UA for this. Older ones can be incorporated by a roundabout route. Neither is a trivial matter, but experts like those at Datwyler IT Infra have various ways of solving any problems which might arise. In so doing they have recourse to gateways of market-leading partners.

Optimising the IT infrastructure

Once connected up, the machines transmit a large amount of additional condition and process data to the company network. This can pose major challenges for the IT infrastructure, depending on the available bandwidth and processing rate. No interruptions in data transfer should occur if the machinery is constantly monitored, the processes analysed, and fast intervention in process control can take place if necessary.

That is why it is worth having a specialist like Datwyler audit the existing company network and the existing data centre infrastructure. As part of such an audit Datwyler prepares a weak point analysis, suggests improvements or a new network structure, and finally implements these – at the operator's request.

For the most part it is advisable to separate the IT infrastructure for the machine data from the existing office and staff level data. This increases data security in the machine network and creates the necessary free space for redesigning and optimising it to suit the application, and for employing the most suitable technology – wired, WiFi or even 5G. A wired network, whether copper or fibre optic cabling, performs very well in terms of data transmission, but on the other hand is confined to a particular location and is relatively inflexible if additional sensors or devices are to be incorporated. WiFi is relatively prone to disruption, has limited coverage, and is adversely affected by walls or objects in the transmission/reception area. In addition, the WiFi-typical latency times of up to 15 milliseconds are unacceptable for many control applications (see Figure 1).

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5G wireless technology opens up exciting new opportunities with high transmission rates, a low latency of under three milliseconds, and the best possible flexibility without the use of cabling. With the Nokia Digital Automation Cloud (NDAC), for example, Datwyler can offer customers a package which is perfectly matched to the requirements of a 5G enterprise network (see Figure 2). Set against this are the investment costs for the antennae in the company grounds and (moderate) licence fees for a frequency band on the company site.

Companies in Germany and a few other European countries can already purchase such a frequency band for their sites. No doubt other countries will follow before long. Businesses are showing an extraordinary amount of interest.

Combining edge and cloud

In any case, when designing the optimum IT infrastructure Datwyler will bear in mind the pros and cons of a wired, WiFi or 5G connection and will match the solution to each individual customer's application. This includes advice on whether data analysis should take place as near as possible to the machine or via Cloud-based software.

Very economical Cloud-based applications, often as SaaS, are used for many applications such as reports, benchmarks, alarms, communications or notifications. On the other hand, it is not always appropriate to send all the machine data to the Cloud and only analyse them there. The data volume, the traffic this would produce would be uneconomical. It often makes much more sense to process the bulk of the data on the spot, near the machine, "at the edge", so to speak. That way a business avoids network overload, long response times, disruptions due to possible faults in the outside Internet connection and the high cost of Cloud Computing. The company also keeps often sensitive production data close to home. This requires an Edge Computing infrastructure, i.e. a local computing and storage capacity which Datwyler will design and implement jointly with the customer.

The skill lies in deciding which applications best suit a Cloud-based solution and which analytical processes are best dealt with on an Edge infrastructure. And because Edge and Cloud are not separate worlds but ought to be combined in the best possible way, Datwyler brings in expert partners in Cloud consulting and Cloud integration. For users this means a one stop "Edge *and* Cloud solution".

Interpreting data correctly

Finally, back to the use cases for such an all-round IT infrastructure solution. The fact is that a business extracts and analyses its machine data with a specific intention. It can happen that the use case itself is clear – for example to avoid the repeated nonconformity of a manufactured product – but not the data which can provide information on the cause of the fault.

When hypotheses fail it is advisable first to read out the data from the machines, perhaps adding environmental data like workshop temperature and atmospheric humidity and, with the help of experts and possibly also AI, to analyse same in order to identify possible patterns and connections.

Not only does this give a much better understanding of connections previously unknown or merely suspected, but it also provides new use cases for boosting efficiency and cutting costs – i.e. even greater benefit. In cases like these Datwyler also has software and service partners on board for data analysis. *(kal)*

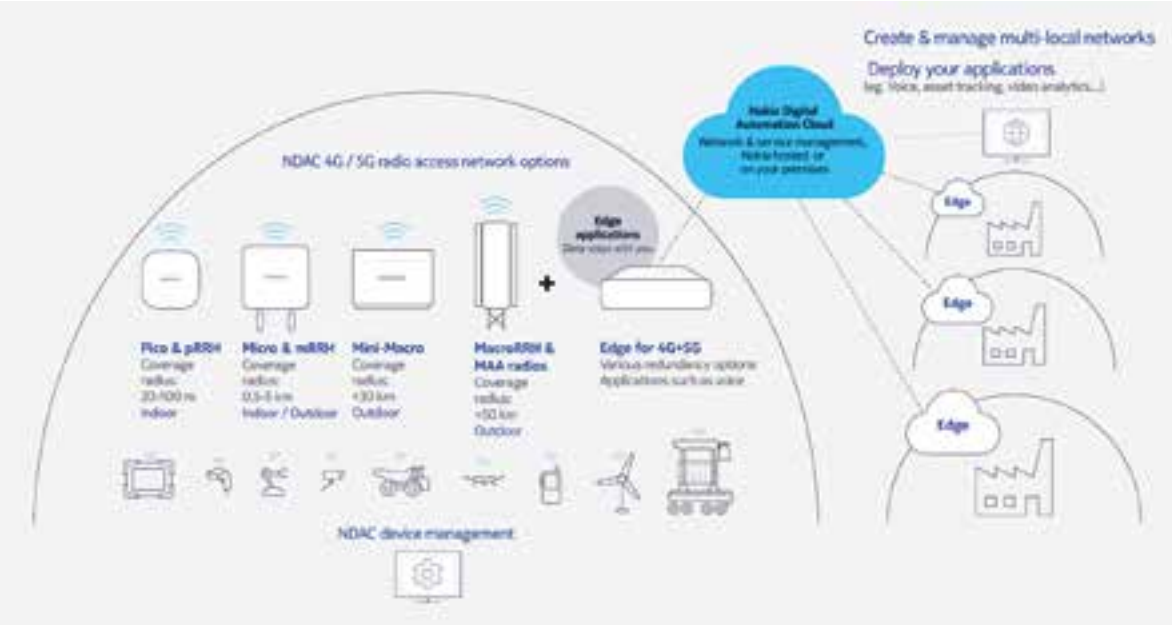

Figure 2
(Source: Nokia)

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