WHY PRIVATE, INDUSTRIAL *5G NETWORKS* WILL DRIVE BUSINESS DIGITALIZATION AND GROWTH

While a lot of the talk about **5G cellular** focuses on higher performance and new use cases, there's an important feature of 5G that can be easy to overlook: the fact that 5G specifications include features that are tailored for support of private networks: cellular networks used by just one business, one application, or one site.

Private cellular networks aren't a new idea in and of themselves. Railways have operated on private networks for a very long time, and portions of the 2G mobile spectrum were made available for local, private use more than a decade ago. What's new with 5G is the extent to which the 3GPP, the organization that defines cellular standards, tailored 5G for use in private networks that support vertical business requirements.

The emphasis on private networks is partly a response to the industrial sector, where there's a push to replace private wired Ethernet networks with wireless ones, but it's also a way to bring new capabilities to a wide range of business processes. By broadening the appeal of private cellular networks, the 3GPP has designed 5G to be a standard that will improve operations, drive digitalization, and generate growth for years to come.

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WHY GO PRIVATE?

Let's say you're a business and you want to tap into the higher speed, higher capacity, and lower latency 5G can provide. Maybe you want 5G so you can have self-guided robots move goods between warehouses, or so you can boost efficiency with predictive maintenance capabilities across your manufacturing facilities. You might want 5G so the thousands of medical devices in your hospital can securely connect to the cloud, or you might be building a stadium and will use 5G to let 50,000 fans stream video to their smartphones on game day.

Whatever your reason for wanting 5G, you basically have two options for accessing 5G service. You can use a public 5G network, shared by many thousands of other users and devices, and hope that you get the next-generation experience you want using advanced "Network Slicing" methods that 3GPP prescribes in the 5G standards, or you can use a private 5G network, optimized for your particular situation and dedicated to your use alone.

For a growing number of businesses worldwide – from manufacturing facilities, warehouses, seaports, and mining operations to hospitals, utilities, sporting venues, and even music festivals – the choice is clear. To take full advantage of what 5G has to offer, it makes sense to go private.

Configurability and control are the two biggest benefits of using a private network. You determine the coverage, the quality of service, the security layers, and whether you maintain the operation onsite or remotely. You decide who has access, what data's stored onsite, and what gets sent to the cloud. You even have the option of running on dedicated spectrum, for greater stability, since you're not having to share spectrum with anyone else. You can bring coverage to places where public service is limited or unavailable, and you can tailor operation to support any number of site-specific use cases and events.

WIRED PERFORMANCE, WITHOUT THE WIRES

Many of today's industrial operations use wired networks based on Ethernet using quasi-proprietary or standard Time Sensitive Networking (TSN) features to guarantee throughput and latency. These wired connections may deliver the necessary latency or bandwidth for advanced use cases, such as robotic control, but they're expensive to maintain, need replacement when they wear out, and are difficult to reconfigure if changes in demand call for a new

setup. The latest generation of wireless Ethernet, Wi-Fi 6, is a cost-effective way to transition to wireless operation, especially indoors. When wireless coverage needs to be extended to outdoors or reliability needs are very high, Wi-Fi 6 may not be suitable. With 3GPP support for integration with Wi-Fi and hand-offs to Wi-Fi networks, benefits from both standards can be combined when needed.

A NEW WORLD OF POSSIBILITIES

Support for industrial-grade performance in private 5G networks makes it easier to transition away from cables, while also making it possible to do things we haven't done before.

With 5G, wireless connections for controllers, switches, sensors, and actuators can offer latency and reliability that rivals those of wired connections, up to 99.9999% availability and sub millisecond latency. 5G can connect higher device density, offering a path to connect "everything" in the factory floor. Data transmission speeds of up to tens of Gbps support new use cases that depend on Ultra High Definition (UHD). Interference from metal objects is less of an issue, too, since multiple 5G transmitters create redundant paths to the receiver. If a metal object, such as a forklift or a piece of equipment blocks the path, the packet can use an alternate route.

WORKING IN COMBINATION WITH WI-FI

For many companies, though, it makes sense to combine 5G with the latest versions of Wi-Fi, namely Wi-Fi 6 or the recently announced Wi-Fi 6E, which operates in the unlicensed 6 GHz spectrum. Wi-Fi 6/6E offers many of the same benefits as 5G and is fast, easy, and inexpensive to deploy, so it's a good choice for a number of use cases, especially indoors. The combination of Wi-Fi 6/6E and 5G is particularly compelling for large-scale sites that need broadband operation over a wide area. The two technologies can work together to support things like high-definition video surveillance throughout the site, Automated Guided Vehicles (AGVs) that move between buildings and outdoor areas, automated traffic control to manage the flow of delivery vehicles, and autonomous delivery drones that traverse the entire site.

TAILORED OPERATION

The high degree of flexibility offered by 5G means private 5G networks are being used to service all kinds of use cases. Here are just a few.

A busy shipping port, for example, can use a private 5G network to track tens of thousands of shipping containers, while controlling cranes, forklifts, and Automated Guided Vehicles (AGVs) and at the same time communicating with hundreds or even thousands of employees. As people and machinery move from place to place within the port, 5G ensures smooth handoffs from the Wi-Fi 6 networks used indoors, so there's continuous connectivity throughout the site.

A utility company, on the other hand, can use a private 5G network for their energy-distribution grid, so as to connect windmills in geographically dispersed, hard-to-reach locations to the rest of their infrastructure, which includes smart meters, transformers, battery-based energy storage systems, and vehicles used by their mobile workforce.

On the factory floor, a private 5G network can be used to manage complexity, so IoT devices don't interfere with one another. Using 5G network slicing, which manages performance by assigning priority, items like UHD cameras and extended reality headsets get the guaranteed latency rates they need, while other devices, such as sensors and trackers, make do with lower-speed connections. At the same time, every single tool and piece of equipment used at the site can be monitored, for location and time in service, to increase productivity and automate predictive maintenance.

When it comes to new construction or temporary installations, companies can use a private 5G network to skip the wires and go straight to wireless. Not having to deal with copper wires and Ethernet cables saves resources and lowers costs, while making the configuration that much more flexible. In the unique case of music festivals, for example, a private 5G network can support everything associated with a large-scale, multi-day event – speaker connections, TV broadcast, attendee smartphones, emergency services – while making the entire setup easy to build, take down, and re-erect somewhere else.

Investing in a private 5G network gives businesses a way to accelerate digitalization while creating a competitive advantage, since connectivity is so much easier to customize, integrate, and scale when processes need to change or new operating models are called for.

FINDING SPECTRUM

You can establish a private 5G network by partnering with a mobile operator who manages it on your behalf using network slicing, or you can go it alone, by building, maintaining, and operating in your own spectrum.

When partnering with a mobile operator, you're likely to be using spectrum that they own and dedicate to your use. In some countries, including parts of Europe, you have the option to use a portion of the spectrum that has been set aside for industrial use. And in other places, including the U.S., newly opened portions of the unlicensed spectrum are an attractive option for many types of private 5G networks. In private networks that operate in shared-spectrum bands, 5G offers dedicated features, such as Coordinated MultiPoint (CoMP) and synchronized sharing, that make it easier to achieve consistent, highly reliable performance.

BUILDING MOMENTUM

5G is compelling technology for business and industry, and private 5G networks offer companies a way to make the most of their 5G investment. As more companies transition their legacy wired and wireless networks to 5G, and the attraction of new use cases leads to broader industrial use of 5G, private 5G networks can be expected to grow quickly.

In 2020, the market analysts at Deloitte estimated that hundreds of thousands of companies are likely to deploy private cellular networks over the next decade. Some of

these companies will do so out of a desire to upgrade from cables to wireless, but many others will go private as a way to support process change and business redesign, so they can reshape the way they do business.

In response to the growing popularity of private 5G networks, the resources for building and operating such networks starting to grow, too, with system integrators and Mobile Network Operators (MNOs) offering a range of options for companies to consider.

THE NXP PERSPECTIVE

For our part, as a leading developer of 5G capable devices, we're enabling private 5G networks with our Layerscape and Layerscape Access family, a line of fully programmable baseband products for 5G Access Edge systems. We combine these basebands with a highly flexible, software base, supported by an ecosystem of software vendors who help deliver a complete solution.

To learn more about private 5G networks and how NXP is accelerating infrastructure deployments, visit us **www.nxp.com/5g**.

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Wim is a Distinguished Member of Technical Staff at NXP Semiconductors. Focused on 3GPP LTE and 5G as well as 802.11 processing stacks and their implementation, Wim is responsible for 4G and 5G stack development, small cells, and CRAN implementations associated with many wireless infrastructure projects.