Private 5G Ushers in a New Era for Vertical Industries

Understanding clients' and partners' needs to deploy private 5G

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The role and relevance of private 5G

Public versus private 5G

Why 5G is a different cellular technology

The transformational potential of 5G arises because, unlike previous technologies, it was built to address a wide array of use cases including smartphones, data, and the ultrareliable and low-latency communication needed for automated guided vehicles (AGVs) or augmented reality / virtual reality (AR/VR). It can effectively bring cellular connectivity into enterprise and vertical markets and is meant to deliver

- eMBB (enhanced mobile broadband): up to 20Gbps

- mMTC (massive machine type communication): up to 1 million devices per square kilometer

- cMTC (critical machine type communication): as little as 1ms of latency

The ways in which 5G is different from previous generations include its flexibility, its approach to edge computing, new mmWave spectrum to support more data-intensive use cases, and a software-defined architecture enabling additional flexibility and configurability in the network.

Significantly, 5G is here, and according to Omdia's *5G Service Provider Tracker – 2Q21*, there have been more than 150 commercial 5G launches across all regions. This means that the 5G ecosystem is well underway in developing new devices, use cases, and solutions.

Beyond supply one of the most important aspects of the 5G opportunity is the demand coming from enterprises and vertical industries. Enterprises see 5G as a key enabler of their digital strategy: according to Omdia's 2020 IT Insight survey, 5G and edge outpaced other technologies such as artificial intelligence (AI) and machine learning (ML), blockchain, and big data platforms, being selected by 32% of enterprises as very important for their digital strategy in the coming 18 months.

> " *5G and edge outpaced other technologies such as AI and ML, blockchain, and big data platforms, being selected by 32% of enterprises as very important.* "

There are also several ways of delivering 5G, and the question of whether to opt for a public 5G or a private 5G network or something in between is one dependent on an enterprise's needs. Among the most important factors favoring the deployment of a private network the security, control (of network and data), performance, and vendor selection elements stand out. This is because, being purpose built for the enterprise's needs, a private 5G network will be tailored to the specific requirements of the enterprise. This also means that the enterprise will be able to choose its preferred partners across all the layers of the end-to-end solution.

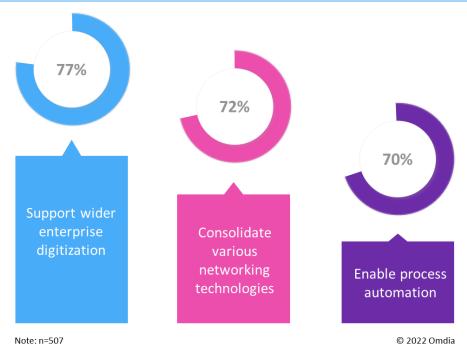**Figure 1: Assessing public and private 5G**

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Source: Omdia

Adoption and momentum of private 5G

One of the strengths of private 5G is that the flexibility of the technology and of its ecosystem means that it can support multiple goals of the enterprise. According to Omdia's *Private LTE and 5G Network Enterprise Survey Insight – 2020*, the top three drivers for enterprises to deploy private networks are "support wider enterprise digitization," "consolidate various networking technologies," and "enable process automation." This shows that private 5G is a framework underpinning an enterprise digital transformation: it is a means to replace and consolidate existing technologies that might struggle to serve the evolving needs of the enterprise and is a lever to improve processes via increased automation.

Figure 2: Top three drivers for enterprises to deploy private 5G

77% — Support wider enterprise digitization

72% — Consolidate various networking technologies

70% — Enable process automation

Note: n=507

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Source: Omdia, Private LTE and 5G Network Enterprise Survey Insight – 2020

Private 5G will be delivered on the promise of enterprise 5G and the wider idea of 5G to support industries and mission- and business-critical applications. In the first half of 2021, private network rollouts for the first time outpaced trials and test announcements, a sign that the market is maturing and moving from early-stage understanding of the technology to actual deployment. According to Omdia's *LTE and 5G Private Networks Tracker –2Q21*

- In the first half of 2021, private network rollouts represented 24% of all announcements, while trials and tests represented 20%.

- In 1H21 73% of all announcements were centered on 5G, another sign that the technology is rapidly gaining traction in the products, deployments, and strategies of market players.

- From 1H21, 35% of all publicly announced private network rollouts depend on 5G technology.

> " *In 1H21 private network rollouts represented 24% of all announcements, while trials and test represented 20%.* "

Figure 3: Proportion of 5G-centered private network announcements

■ 5G-centered announcements ■ Other announcements

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Source: Omdia LTE and 5G Private Networks Tracker – 2Q21

Private 5G is also gaining momentum with an increasing amount of spectrum being made available from regulators to the enterprise (e.g., Germany), new features being introduced (release 16), and more vertical activity and engagement taking place (e.g., 5G Alliance for Connected Industries and Automation, 5G-ACIA).

Figure 4: Why is private 5G gaining momentum?

■ **Industry engagement**
Vertical industries and ecosystems have been increasingly active in 5G with recent examples including a utilities alliance and the 5G-ACIA.

■ **Release 16**
Release 16 was concluded in 2020 and is bringing significant new features including 5G NR-U, Industrial IoT, and 5G positioning to private networks.

■ **Spectrum**
Spectrum liberalization continues to be a key market trend with recent examples including Finland (4Q20), Brazil (currently setting vertical spectrum), and Norway and Sweden (currently considering it). These are some of the latest countries to join the likes of the US, Germany, the UK, Taiwan, Australia, Japan, and many more.

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Source: Omdia

Opportunities for enterprises and the benefits of private 5G

Private 5G drivers and the impact of COVID-19

One of the key assets of 5G is its ability to meet various needs of the enterprise. Whether the enterprise wants to increase data security or to better control its data, private 5G networks are delivering on those goals thus helping the enterprise's digital transformation.
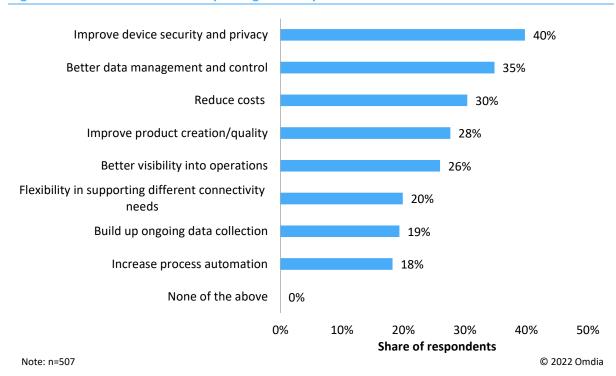
Figure 5: What benefits can enterprises gain with private 5G?

Note: n=507

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Source: Omdia, Private LTE and 5G Network Enterprise Survey Insight – 2020

The pandemic has accelerated enterprises' understanding of the benefits brought by digitization: those enterprises that were more advanced in their digitization journey and were more flexible in adapting to the new environment were better able to thrive in difficult circumstances. The pandemic reinforced the enterprise's need to incorporate new technologies such as private networks and Internet of Things (IoT) to enable better collection, handling, and analysis of data. It also highlighted the importance of automation and automated processes as countries placed restrictions on workforce movement.

Unique use cases also stemmed from private networks to tackle the new challenges presented by the pandemic. For instance, with the need for social distancing still relevant in many countries,

private networks can be used to support cameras with machine vision to ensure that employees maintain the required distance or the mandated face covering if applicable.

"

The pandemic reinforced the enterprise need to incorporate new technologies such as private networks and IoT to enable better collection, handling, and analysis of data.

"

Vertical uptake and deployment options

Top three industries for private networks

Industrial vertical markets lead the private 5G market

While there are private network deployments across all industries, including retail, sport, and entertainment, the three leading industries are manufacturing, transport and logistics, and energy and mining.

Figure 6: Top three private networks industries by activity

Manufacturing – 29%   Transport & logistics – 16%   Energy & mining – 14 %

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Source: Omdia LTE and 5G Private Networks Tracker – 2Q21

Manufacturing

Why is it a leading industry?

Manufacturing is undergoing a perfect storm brought about by Industry 4.0 and the increasing need to generate, connect, and act on data, enabling the entrance of new technologies such as AI and 5G. Particularly in regard to 5G, the potential of a wireless technology that can deliver similarly to wired ones means doors are opening for a more reconfigurable factory, less reliant on legacy cables.

Selected drivers

- IT-OT convergence

- Wired connectivity replacement for additional flexibility

- From linear to modular production line

What are the key use cases?

Key use cases include using video cameras for quality control, AGVs, mobile workforce, machine monitoring, and AR/VR.

Transport and logistics

Why is it a leading industry?

This industry often offers a microcosmos where the increasing need for automation and optimization is driving the use of new technologies as current wireless options (i.e., Wi-Fi or land mobile radio [LMR]) struggle to meet the evolving needs of the customer. A port is the classic example of this type of industry with its need for remote-control, high-density sensor support and mission-critical communication.

Selected drivers

- Increased traffic volumes require more efficiency for operations.

- Global competition means ports and airports need to implement new technologies to stay ahead of competitors.

- There is a need to improve operations and safe working environments in light of environmental and sustainability agendas.

What are the key use cases?

Key use cases include remote control of cranes (port side and quay), autonomous vehicles, mobile workforce, security, and drones.

Energy and mining

Why is it a leading industry?

Automation in difficult and challenging environments is the name of the game for this industry. Sites are also often located in isolated areas where there is no other option but to deploy a private network able to deliver on stringent requirements and service level agreements (SLAs) given the hazardous environment and high safety needs.

Selected drivers

- Worker safety

- Automation of use cases and processes

- Optimization of machinery and equipment

What are the key use cases?

Key use cases include AGVs for autonomous haulage, autonomous mining operations, environmental sensing, safety monitoring, safe worker, drones, and remote maintenance with AR/VR.

Challenges for private networks and the role of your provider

While the opportunity for private 5G is clear, it should also be noted that private 5G is a complex solution that requires multiple technologies, partners, and services to be aligned for the solution to work for the enterprise. Variables include the type of radio access and spectrum supported; existing enterprise systems, core configurations, and locations; network design; integration with IT systems and applications; network deployment, maintenance, and monitoring; security; variable number of sites; and different geographies. This creates an opportunity for providers to hide the complexity behind the scenes leveraging a complex partner ecosystem spanning infrastructure vendors, communication service providers, cloud providers, and application to deliver an easy-to-use private 5G solution for the enterprise.

It is therefore important for an enterprise to rely on a partner that can help it navigate the complexity of private 5G without limitation in its geographical or spectrum scope. An ideal partner should also leverage hands-on experience on core and radio access network (RAN) and on the complexity of integrating various networks' architecture with the enterprise's existing systems.

Complete end-to-end deployment, monitoring, and support and best-of-breed partner products are essential for a successful deployment.

Every use case requires multiple components to be fine-tuned and orchestrated for successful delivery to the enterprise. As with the use of an AGV on the factory floor, considerations for successful deployment include handover scenarios, local core for ensured connectivity, and local data breakouts.

The complexity does not just exist on the technical side of the project: the continuous running of the network and the financing of the network are also key challenges. A private 5G network must be sold in alignment with how an enterprise wants to purchase it. According to Omdia's Private LTE and 5G Networks Enterprise survey, 78% of enterprises deploying or looking to deploy a private 5G network prefer OpenX to be the main source for the project financing.

> *Complete end-to-end deployment, monitoring, and support and best-of-breed partner products are essential for a successful deployment.*

Case study: Infosys private 5G solution for a leading automobile manufacturer

Context

A leading automobile manufacturing company in Germany (referred to here as the customer) wants to leverage private 5G to transform the manufacturing processes in all its manufacturing plants.

The customer is a market leader in passenger cars and trucks and has multiple manufacturing plants across multiple countries. The customer selected Infosys as a partner to deliver private 5G as a service with the following requirements:

- Deploy and operate private 5G as a service to all manufacturing plants around the globe.

- Leverage enterprise spectrum in countries where it is available and leverage local service providers in countries where enterprise spectrum is not available.

- Take over existing 5G nonstandalone (NSA) deployment and upgrade the same to 5G standalone (SA).

- Provide a 5G stack compliant with 3GPP R16 so that the latest features of low latency and reliability of 5G networks can be leveraged for advanced use cases.

- Comply to a common 5G standard across all deployments such that a use case developed and deployed in one plant can be reused and repeated across all plants.

- Provide network upgrades and support new use-case onboarding as technology evolves and OEM solutions are available for deployment.

- Comply with stringent network availability and support SLAs for the delivered network:

    - Initial set of use cases to be supported

    - AGV and monorail controls over 5G that require very high reliability and low latency

    - PLC communication over 5G (Profinet on 5G) that requires very low latency and reliability

    - Handheld tools localization and location-based configurations

–　AR/VR-based remote worker assistance

To meet these requirements and standardize the way the 5G network is deployed and exploited by the use cases, an expert integrator is required. The solution provider should be able to build networks adapting to local differences while unifying them with a common global standard. The customer chose Infosys to deliver such a network.
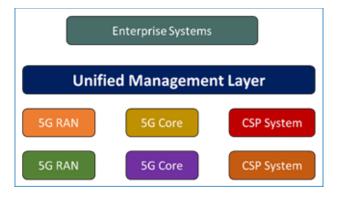
Infosys approach

Solution stack

Deployment of this nature requires multiple variations of the solution to be built to cater to geo-specific differences, deployment models, spectrum bands, and so on. In addition, because the technology is in its early stages and continually evolving, there is a need to build an ecosystem of partners to leverage a best-of-breed network for the customer. Therefore, Infosys selected a multi-vendor integration approach to build the solution with a primary and a secondary solution stack.

Such a stack is integrated, tested, and deployed in countries where the customer can procure an enterprise spectrum. For other countries where there is no enterprise spectrum available, Infosys is working with local service providers to deliver private 5G services.

Figure 7: Representation of multi-vendor stack and unified management layer

Source: Infosys

Unified management layer

Building a multi-vendor stack comes with a complexity of operating the network via the management plane interfaces provided by the respective OEMs. The need to use service provider solutions in the mix because of spectrum dependencies adds to this complexity. To mitigate the complexity, a unified management layer is built in-house using open source software components. This layer provides a common interface for the enterprise across all its 5G deployments. It also reduces the complexity of operations and monitoring of many deployments.
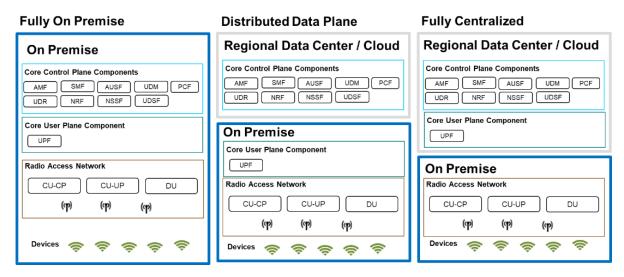
Deployment models

The use cases onboarded to the 5G network have very different characteristics and hence place varied requirements on the network. There are three different deployment models supported to

meet the needs of the use cases. The deployment model is chosen based on the latency needs and proximity to a regional data center.

Figure 8: Private 5G deployment models

Source: Infosys

Staging lab for preproduction testing

Because the technology is in its early stages of development, OEMs are expected to provide frequent upgrades to their software. These may be patch upgrades with bug fixes or major release upgrades with new features. In either case, it is essential to keep upgrading the deployed base so that the customer can exploit the latest developments from the OEMs. Upgrades are required to ensure minimal service downtime and zero impact on existing functionality.

To ensure that the delivered software meets the quality requirements, Infosys has built a preproduction staging lab equipped with test tools, simulators, spectrum, and end devices. The OEM software is thoroughly tested in the staging lab before being deployed in the field.

Trial kit for initial validation

The end users of the private 5G networks are the factory managers of each plant. Because this is a new technology, they often look for clear return on investment before venturing into a production deployment across the plant. They need to see a fully functional 5G network with use cases demonstrated to understand the power of private 5G. To cater to this requirement, Infosys delivers a low-cost trial kit, which is a scaled-down version of the 5G network that can be deployed in a smaller area for trials.
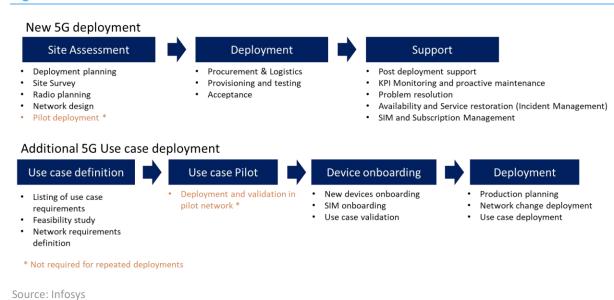
End-to-end services

Finally, the private 5G solution is delivered as an end-to-end service from site survey to postdeployment operations. The services are simplified to the extent that the factory managers who

intend to use private 5G in their factories can just order a network from a catalog, and the rest is taken care of by Infosys.
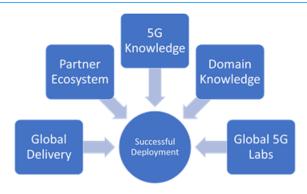
Figure 9: End-to-end services

New 5G deployment

Site Assessment
- Deployment planning
- Site Survey
- Radio planning
- Network design
- Pilot deployment *

Deployment
- Procurement & Logistics
- Provisioning and testing
- Acceptance

Support
- Post deployment support
- KPI Monitoring and proactive maintenance
- Problem resolution
- Availability and Service restoration (Incident Management)
- SIM and Subscription Management

Additional 5G Use case deployment

Use case definition
- Listing of use case requirements
- Feasibility study
- Network requirements definition

Use case Pilot
- Deployment and validation in pilot network *

Device onboarding
- New devices onboarding
- SIM onboarding
- Use case validation

Deployment
- Production planning
- Network change deployment
- Use case deployment

* Not required for repeated deployments

Source: Infosys

Infosys value proposition

Infosys has a rich knowledge base in the cellular wireless technologies required to deploy and operate a fully fledged private 5G network. This knowledge along with industry vertical domain knowledge and a rich global partner ecosystem helps Infosys to deliver a comprehensive 5G service globally for enterprises. The 5G labs run by Infosys help in delivering tested solutions and incubate new use cases as the technology evolves.

Figure 10: Infosys key assets and expertise

Source: Infosys

Key takeaways

- Private 5G is rapidly becoming a key pillar enabling enterprise digitization and supporting new and existing use cases including AGVs and worker safety. Private 5G is a complex solution that requires many technologies, partners, and services to be aligned for the solution to work for the enterprise. Therefore enterprises must look for a partner that is able to deal with this complexity and to orchestrate all these different elements to deliver a solution for the enterprise.

- Industrial enterprises have been leading the expansion of private 5G because this solution is delivering benefits beyond other existing competing options. For instance, 5G brings the potential of a wireless technology that can deliver a similar level of service as wired ones in terms of reliability and latency while opening the door to a more reconfigurable factory less reliant on legacy cables.

Appendix

Methodology

This report was produced in collaboration with Infosys leveraging Omdia's internal expertise, assets, and deliverables in private networks and the wider enterprise 5G market.

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