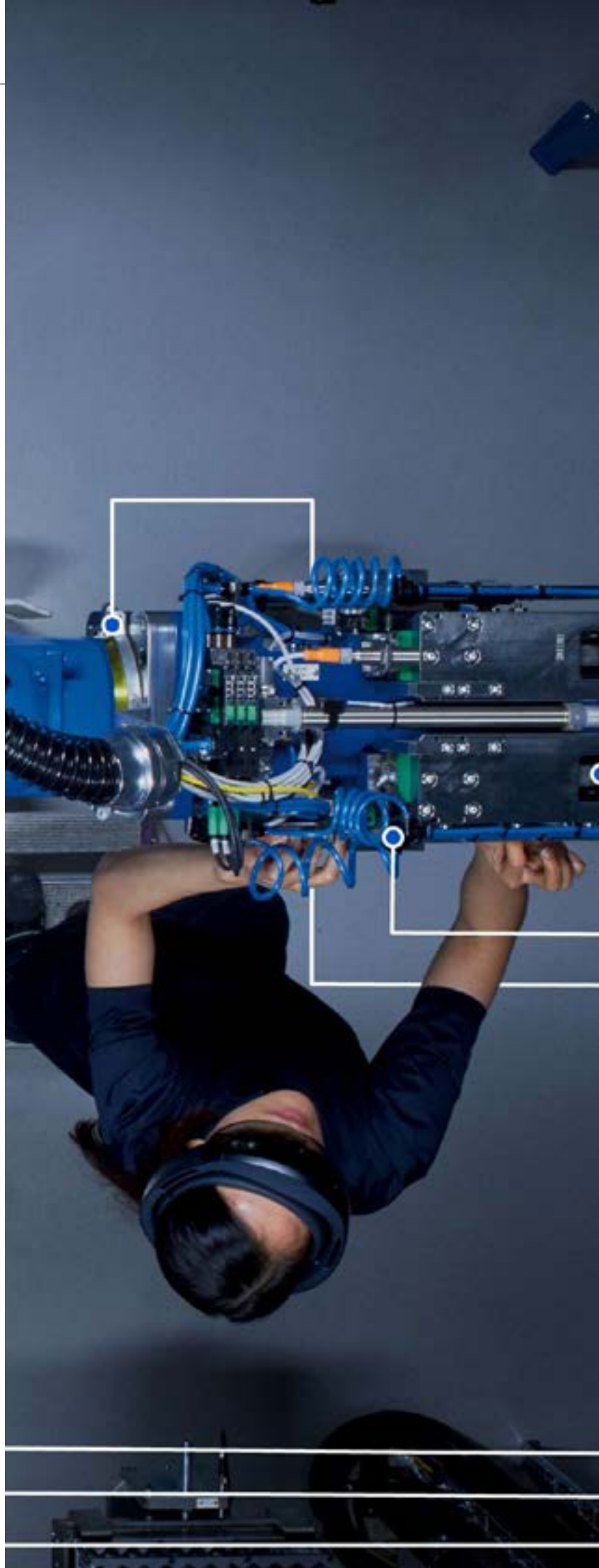# Gain a competitive edge with real-world lessons on private 5G networks

The use of private networks in manufacturing applications is rapidly growing. In this paper, we present valuable insights and lessons learned from the field with the goal of enhancing productivity and ensuring a more productive outcome within the adoption process.

ERICSSON

IndustryWeek.

Contents

Introduction

For years, traditional wired and wireless networks have served as indispensable tools for manufacturers. However, in the face of escalating technological complexity and the proliferation of data, relying solely on these conventional networks can impede digital transformation efforts. As a result, a fresh approach to data networks is imperative, with research suggesting private 5G cellular networks as a promising solution.

While the adoption of private networks in manufacturing is still in its early stages, it is undergoing prompt expansion. A recent Gartner report[1] predicts a minimum of 40% of full-production private network deployments in industrial manufacturing will be 5G-based by 2025, indicating a significant shift toward advanced and transformative technology.

In this paper, Ericsson leverages its extensive experience to understand the advantages of private networks for manufacturing. Drawing on real-world deployments, Ericsson also discusses the practical benefits these networks offer, the challenges of deploying wireless communications, and valuable recommendations for achieving successful outcomes.

[1] How to Prepare for 5G Private Mobile Network Adoption," Gartner, August 29, 2023

What are private networks and why do they matter?

A private network is a localized area network using licensed, shared, or unlicensed wireless spectrum, coupled with LTE or 5G technology, designed to be configured to support an enterprise's specific requirements within a specific geographic area. Compared to traditional and Wi-Fi networks, private networks offer manufacturers several distinct advantages:

- Speed and flexibility — Delivers rapid data transmission, facilitating informed decision-making processes

- Lower and predictable latency — Minimizes signal delay between devices, particularly critical to robotics and autonomous vehicles

- Expanded device connectivity — Facilitates numerous connections to a broader array of machines and sensors, vital for seamless digital transformation

- Enhanced security — Ensures significantly more secure data transfer through dedicated frequencies and end-to-end encryption

- Superior, seamless coverage — Enables access in various environments, including both indoors and outdoors, facilitating connectivity for machines and workers alike

- Better governance — Allows meticulous control over permitted devices on the network

- Built-in mobility — Designed for superior mobility, ensuring seamless handovers as devices move within the network

Some manufacturers have been hesitant, waiting for the elusive "killer use case" before investing in a private network. However, this approach overlooks the fundamental nature of private networks. Instead of viewing them as a single revolutionary application, it's more accurate to think of private networks as a foundational technology, enabling numerous use cases to evolve over time. The return on investment (ROI) for a private network stems from the cumulative impact of these diverse use cases, rather than relying on any one specific application.
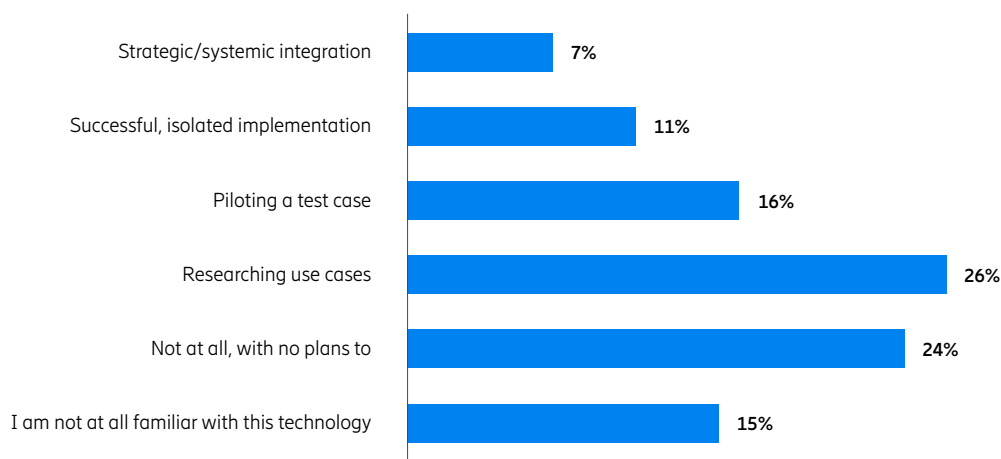
Bottom line — manufacturers who embrace this technology now will position themselves at the forefront of their digital transformation journey, gaining a strategic advantage over competitors who are waiting for the "perfect" use case. In fact, a recent IndustryWeek study supports this trend, finding of all industrial manufacturers who responded, 18% have implemented the technology, 16% are piloting a test case, and 26% are researching use cases. Even in these early stages, a substantial number of manufacturers are recognizing the value and are actively integrating private networks in their operations today.

Use of private cellular networks

When given the definition of a private cellular network, respondents are receptive to the idea. Eighteen percent have implemented the technology, 16% are piloting a test case, and 26% are researching use cases.

A private cellular network is a local area network that uses licensed, shared, or unlicensed wireless spectrum and LTE or 5G technology to create a dedicated network configured to support an enterprise's specific requirements within a specific geographic area.

To what degree are you leveraging private cellular networks within your organization?

Category	Percentage
Strategic/systemic integration	7%
Successful, isolated implementation	11%
Piloting a test case	16%
Researching use cases	26%
Not at all, with no plans to	24%
I am not at all familiar with this technology	15%

Base: All respondents (n=107).

Real world examples

As private networks become more widespread, the range of their applications continues to expand. Presented below are three compelling case studies that not only demonstrate the current advantages of these networks, but also exemplify the immense potential they hold for future automation, innovation, and productivity.

Atlas Copco Airpower

Atlas Copco Airpower, a world-leading manufacturer of compressors, vacuum solutions, generators, and pumps, embraced 4G and 5G networks to enhance their intelligent manufacturing process. Dedicated networks provide stable connectivity, enabling autonomous guided vehicles equipped with cameras to optimize their paths in combination with the detection of unlabeled pallets. Portable tools, fixed tools, and machinery were seamlessly integrated into the network, showcasing a smart and streamlined factory floor and contributing to improved production performance.

Wouter Ceulemans, president of the Airtec division at Atlas Copco, notes, "This technology gives us the possibility to connect our machines wirelessly instead of the traditional way with cables. The exciting use cases will come when we can make use of low latency. The case that wraps it all together for us is, of course, security. We can all do this in a secure environment. I think that the factory of the future will be a lot more autonomous, automated, and intelligent."

Hitachi Astemo

In collaboration with Ericsson and AWS, Hitachi America R&D is leading the manufacturing industry by innovating a groundbreaking computer vision solution. Leveraging private 5G wireless, cloud, and AI/ML models, this trial included Ericsson 5G radios, AWS edge-to-cloud technologies, and Hitachi's video analytics suite, demonstrating the stability and reliability of 5G connectivity for manufacturing use cases, notably in defect detection using AI and ML models. Unlike traditional methods with one-by-one inspections, the trial showcased the capability of 5G computer vision to inspect 24 assembly components simultaneously. Moreover, it paved the way for further innovations, enabling smart factory capabilities and seamless automation across manufacturing sites around the world.

Ericsson USA 5G Smart Factory

Recognized as a "global lighthouse" by the World Economic Forum, Ericsson USA 5G Smart Factory stands as a beacon as a Fourth Industrial Revolution (4IR) pioneer. This highly automated factory, powered entirely by renewable electricity, outperformed similar non-automated sites. With 5G-connected robots and advanced 4IR technologies, the factory achieved significant improvement in output per employee and a substantial reduction in manual material handling. Fredrik Jejdling, Ericsson's executive vice president and head of networks, emphasized, "Running fully automated factories using the latest technologies is part of our strategy for a more resilient and sustainable global supply chain. This World Economic Forum designation highlights the transformative impact of 5G technology in general — and on our factories in particular — to benefit business and society at large."

Tips for planning a private network

Effective planning is the cornerstone of successful private network implementation. By starting with a smaller, simpler application, manufacturers can gradually progress towards larger deployments and more intricate use cases.

The following are key considerations to guide manufacturers in planning their private network:

- **Define specific applications.** Determine precisely where and how the private network will be applied. Identify practical and cost-effective deployment areas that promote automation and digitalization. For example, initiate deployment in specific zones of a warehouse where robots operate efficiently.

- **Start with simplicity.** Begin with uncomplicated use cases before advancing to more intricate applications. This incremental approach facilitates learning and prevents costly mistakes. For example, start by connecting sensors to collect data on equipment performance. Once mastered, progress to controlling autonomous vehicles via the private network.

- **Establish a clear data architecture plan.** Develop a comprehensive data plan prior to network deployment. Understand the implementation locations of use cases and how they drive the usage in the network. Plan for the overall solution, including integration, and how to collect, store, and analyze the data generated.

- **Create an operational plan.** Devise an operational strategy outlining network maintenance procedures and protocols for seamless addition of new devices. Clearly define roles and responsibilities within the organization and identify network overseers. Implement training programs for existing IT staff to effectively manage the network.

- **View the private network as an innovation platform.** Consider the private network as an innovation hub supporting a wide range of applications. Avoid fixating on a single "killer" use case; instead, focus on its potential to enable a multitude of applications. Future capabilities may unveil unforeseen use cases not even imagined today.

- **Secure stakeholders' buy-in at all levels of the organization.** Recognize that a private network is a strategic investment with organization-wide implications. Obtain commitment and support from stakeholders at all levels before deploying the network. Collaboration and alignment are crucial for a successful private network implementation.

Foundational private network deployment examples:

Connect the hard-to-reach

A private network serves to connect equipment, locations, and traditionally wired devices wirelessly. This is particularly valuable for devices situated in remote or hazardous areas, or those challenging to cable. For instance, in a manufacturing setting, a private network can connect sensors on robots or cameras on forklifts, enhancing operational efficiency.

Connect data islands

Private networks bridge historically isolated data islands, creating a single source of truth. This consolidation facilitates streamlined access and data analysis from various sources, enhancing efficiency and productivity. For example, in manufacturing, connecting disparate pieces of equipment through a private network provides a comprehensive view of the entire production process as a whole.

The connected worker

A private network can be used to replace push-to-talk radios, offering workers access to real-time information and communication tools. This advancement significantly improves safety and productivity, enabling seamless communication and coordination among workers. In industrial settings, private networks can connect workers with devices such as tablets, hard hats equipped with cameras, and augmented reality headsets. This technology enhances efficiency in highly complex environments, allowing workers to interact more effectively with a wide array of technologies.

Video surveillance and smart video analytics

A private network extends video surveillance coverage across larger campuses or manufacturing sites, bolstering safety and security measures. By integrating security cameras in various areas — such as buildings, parking lots, warehouses, and vehicles — private networks enable efficient monitoring, analysis, and responses to incidents, ultimately ensuring a safer environment.

Mobility

Designed to support mobility, private networks offer significant advantages for moving vehicles such as autonomous mobile robots (AMRs.) These networks facilitate live map updates and inter-communication between AMRs for obstacle avoidance and utilization of additional video and sensor capabilities. This reduces risk and increases vehicle speed while ensuring seamless and safe mobility within industrial environments.
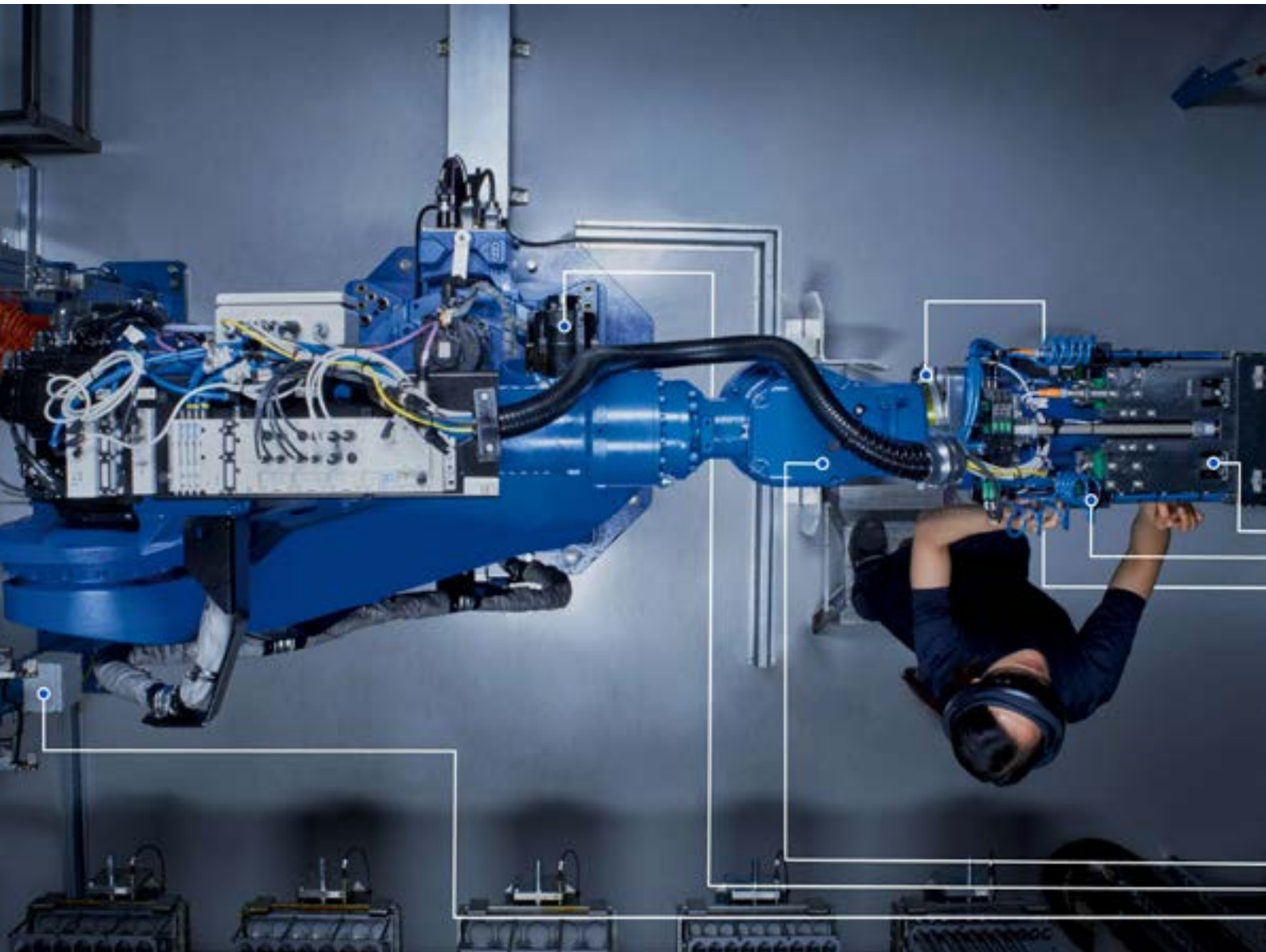
Tips for successful deployment

Deploying a private network in a manufacturing environment demands careful planning and attention to detail to ensure optimal results. The following are key insights to guide a successful deployment:

- **Pay attention to the specifications.** Thoroughly assess specifications, such as the types of cables needed, the proximity to power lines, and the environmental conditions. It is crucial to ensure the compatibility of private network equipment with existing infrastructure and its ability to withstand the operating environment.

- **Choose between internal or external design.** Decide whether the network design will be handled internally or with the assistance of vendors/partners. Internal design provides local control and implementation but can be more costly and time-consuming. Collaborating with vendors/partners can expedite the private network deployment, but it may involve relinquishing some control over the design and implementation.

- **Consider multi-mode equipment operating 4G and 5G simultaneously.** Opt for multi-mode equipment capable of operating on both 4G and 5G. This approach leverages cost-effective LTE devices currently available today while accommodating more demanding 5G devices in the future.

- **Plan for long-term scalability.** As organizational requirements evolve, the network infrastructure must adapt and scale accordingly. Emphasize a modular design to allow for growth and expansion, addressing future needs early in the network design process.

- **Conduct comprehensive testing and validation.** Prioritize thorough testing and validation processes. Assess whether the network supports targeted use cases and meets mobility, throughput, and latency requirements. Ensure proper execution of network handovers and verify compliance with quality-of-service standards for each access point. Validate radio locations, channels, site names, and parameters in alignment with the planned design and documentation.

The right partnership is critical to success

In the realm of a successful deployment of a private network, selecting the right partner is paramount. A reliable partner not only ensures the successful implementation of the network but anticipates subsequent needs based on the desired future state. Considering the likelihood of a long-term collaboration, it is essential to choose a partner that aligns with the internal culture and can be trusted implicitly.

Key factors to consider when choosing a partner:

Spectrum

Numerous countries offer unlicensed spectrum for enterprises (e.g., CBRS in the U.S.). If an unlicensed spectrum is unavailable or desired for the specific installation, a partner can help secure licensed spectrum. A proficient partner will possess experience in securing 5G spectrum for private networks, providing guidance through the application process and ensuring the acquisition of needed spectrum for network deployment.

Scalability

A partner's capacity to scale the network over time, either within a single environment or globally, is key to a successful deployment. Because global deployments often involve regulatory complexities, this skill becomes especially valuable and pertinent.

Commitment to the project

Make sure that the partner chosen is deeply committed to the project's success. They must be willing to be involved throughout the entire process, from initial planning and deployment to ongoing management and support.

Real-world industrial manufacturing experience

A partner with real-world manufacturing experience understands the industry's unique needs and challenges. Such a partner will be able to help design a private network tailored to the specific requirements of the environment, aligning seamlessly with the manufacturers' goals.

Conclusion

While early adoption of emerging technology presents challenges, the potential benefits of private networks as a foundation for future innovation and accelerated digital transformation far outweigh the risks. Manufacturers are rapidly embracing private networks due to their capacity to enable agile, data-centric business operations surpassing the capabilities of conventional wired and Wi-Fi networks.

Whether assessing data network investments or striving for a competitive edge in the future, the time to explore and deploy a private network is now. Technology, equipment, sensors, and even spectrum allocation are advancing swiftly. Today, manufacturers can begin with targeted solutions and subsequently scale capacity and use cases as needed. Establishing a foundational private network deployment paves the way for leveraging these advancements as they emerge, ensuring a strategic position in the evolving landscape of industrial connectivity.

To learn more about Ericsson's experience with private networks, visit https://www.ericsson.com/en/private-networks.

To read the IndustryWeek research report about private network adoption in manufacturing, visit https://www.ericsson.com/en/industries/manufacturing/industry-report-form.

Ericsson enables communications service providers and enterprises to capture the full value of connectivity. The company's portfolio spans the following business areas: Networks, Cloud Software and Services, Enterprise Wireless Solutions, Global Communications Platform, and Technologies and New Businesses. It is designed to help our customers go digital, increase efficiency and find new revenue streams. Ericsson's innovation investments have delivered the benefits of mobility and mobile broadband to billions of people globally. Ericsson stock is listed on Nasdaq Stockholm and on Nasdaq New York.

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