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Unlocking the smart factory:

How private 5G networks
power next-gen Industrial IoT

IndustryWeek.

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Introduction

In the constantly evolving Industry 4.0 landscape, Industrial IoT (IIoT) is now a driving force for manufacturers. IIoT allows manufacturers to connect machines, sensors, and other devices, enabling real-time data collection. This connectivity optimizes processes, significantly boosting efficiency, productivity and cost savings.

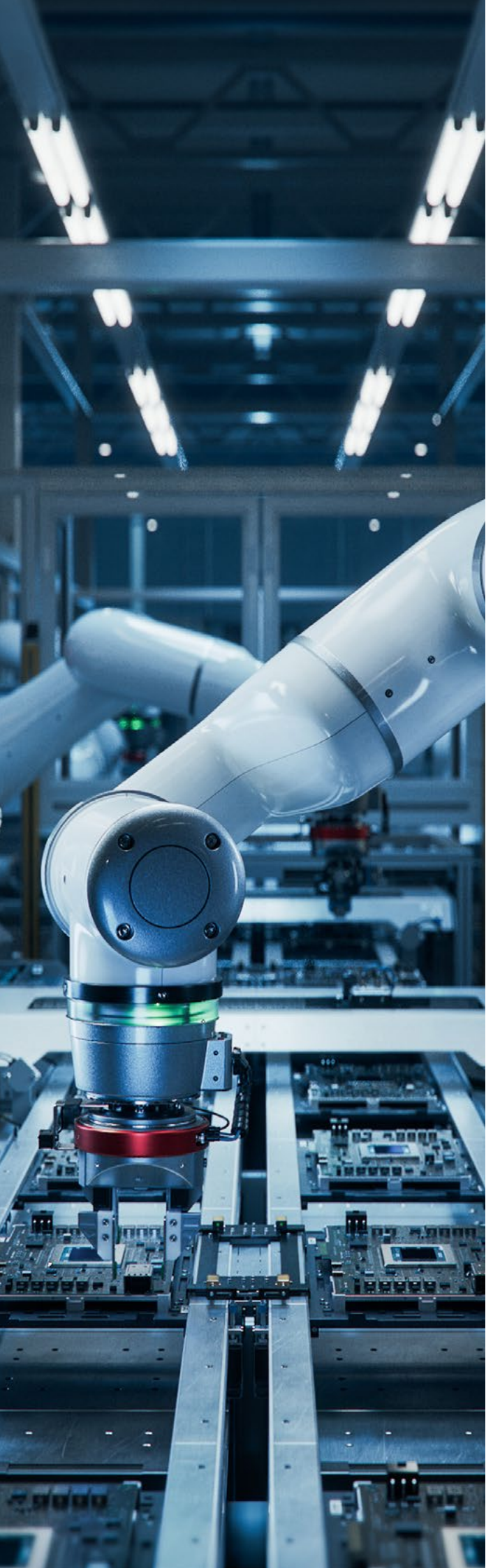
Yet many manufacturers struggle to fully leverage IIoT due to outdated data infrastructure with unreliable and unsecure connectivity. Traditional networks typically lack the flexibility to onboard additional devices, and conventional wireless solutions lack the necessary bandwidth, speed and reliability needed for the high data demands of IIoT devices.

This paper explores how private 5G networks can overcome these hurdles and unlock the transformative power of IIoT.

In this paper, we cover:

- The limitations of legacy data—How it is often insufficient for IIoT applications as it can be outdated, incomplete and unreliable.
- The role of private 5G networks—How they are essential for collecting accurate, high-quality, real-time data from an expanded range of devices.
- The benefits of IIoT for manufacturers—
 - Increased data collection from more places
 - Enhanced data reliability and robustness
 - Accelerated decision-making with real-time data insights

Ultimately, this paper aims to equip manufacturers to lead their IIoT data network investments with more confidence, clarity and success.



The rise of Industrial IoT



Today, IIoT is reshaping the manufacturing landscape by connecting machines, sensors and other industrial devices to gather and analyze real-time data. These smart devices, embedded throughout factories and production lines, provide information around machine health, performance, environmental conditions and inventory levels. By leveraging this data, manufacturers can unlock efficiency, make more informed decision-making and enhance overall competitiveness.

So, how is IIoT transforming the industry?

Enhanced operational visibility

Traditionally, manufacturing relies heavily on manual inspections and siloed, historical data to understand production processes. IIoT, with its network of sensors and connected devices, offers a continuous window into factory operations and insights. This allows:

- Real-time machine monitoring—Sensors detect early signs of equipment wear and tear, enabling proactive maintenance and avoiding costly downtime.
- Optimized production tracking—Live data highlights production bottlenecks and allows for dynamic adjustments to optimize resource allocation.
- Environmental insights—Sensors track factors such as temperature, humidity and air quality, ensuring optimal production conditions and product quality.

Data-driven decision-making

IIoT generates an immense amount of data that enhances decision-making across all levels of manufacturing operations. Advanced analytics enable manufacturers to:

- Spot trends—Allows for proactive optimization of processes and resources by identifying production patterns.
- Predict equipment failures—Use predictive maintenance to prevent downtime and ensure smooth production flow.
- Refine product design and development—Leverage real-world data to enhance and improve product design, performance, and user experience across the entire product design life cycle or PLM.

More automation and efficiency

IIoT paves the way for increased precision and automation in manufacturing processes. Connected machines and robots can perform tasks with greater precision and speed in manufacturing.

This leads to:

- Lower labor costs—Automation handles repetitive tasks, freeing workers to focus on higher-value activities.
- Better product quality—Automation reduces human error and ensures consistent product quality.
- Higher production throughput—Streamlined processes increase production volumes and accelerate time-to-market.



The rise of a data-driven manufacturing landscape

The growth of IIoT is fueled by several key factors. The decreasing cost of sensors, as well as advances in analytics, industrial AI and machine learning, provide powerful algorithms to unlock the true value of data—such as computer vision, enabling machines to "see" and interpret visual information from the world around them.

According to [Statista](#), the global market for IIoT is expected to grow to some 3.3 trillion USD by 2030, underscoring its rapid industry adoption.

"IIoT is not just about connecting machines; it's about unlocking the potential of new, revolutionary technologies that require high-quality data and will transform the way we manufacture."

• • •

- Jan Diekmann, Technical Account Manager, Ericsson

The data challenge: Why legacy infrastructure falls short

While IIoT offers immense potential, its success relies on its ability to seamlessly collect, analyze and utilize vast amounts of data in real time. However, this presents a significant challenge, as traditional wired and wireless networks, along with existing data infrastructure, often fall short of meeting the demands of IIoT deployments. Here's why:

The pitfalls of outdated data

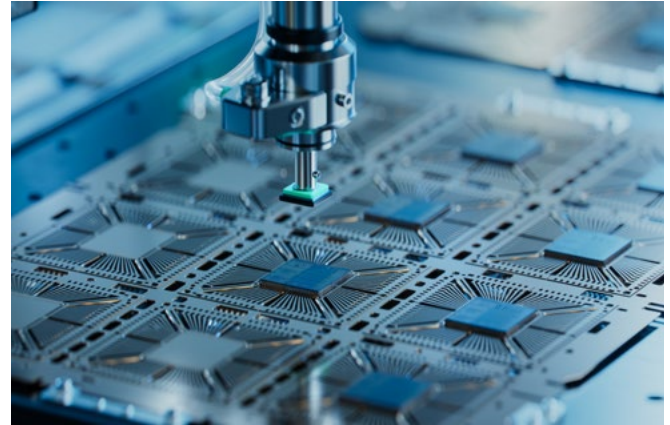
IIoT applications thrive on high-quality, real-time data to function effectively. However, many manufacturers struggle with the limitations of their existing data systems due to:

- **Outdated and incomplete information**—Legacy data collection methods, whether wired or wireless, often rely on manual processes. As a result, even small process changes can render data outdated, making it irrelevant to current and future predictions.
- **Lack of context and real-time insights**—Traditional data may lack the context and timeliness needed for actionable insights, crucial for IIoT applications such as predictive maintenance.

Limitations of traditional networks

Successful IIoT deployments hinge on the ability to collect, analyze and handle massive amounts of data in real time. However, traditional networks often fall short of meeting the demands of these complex applications.

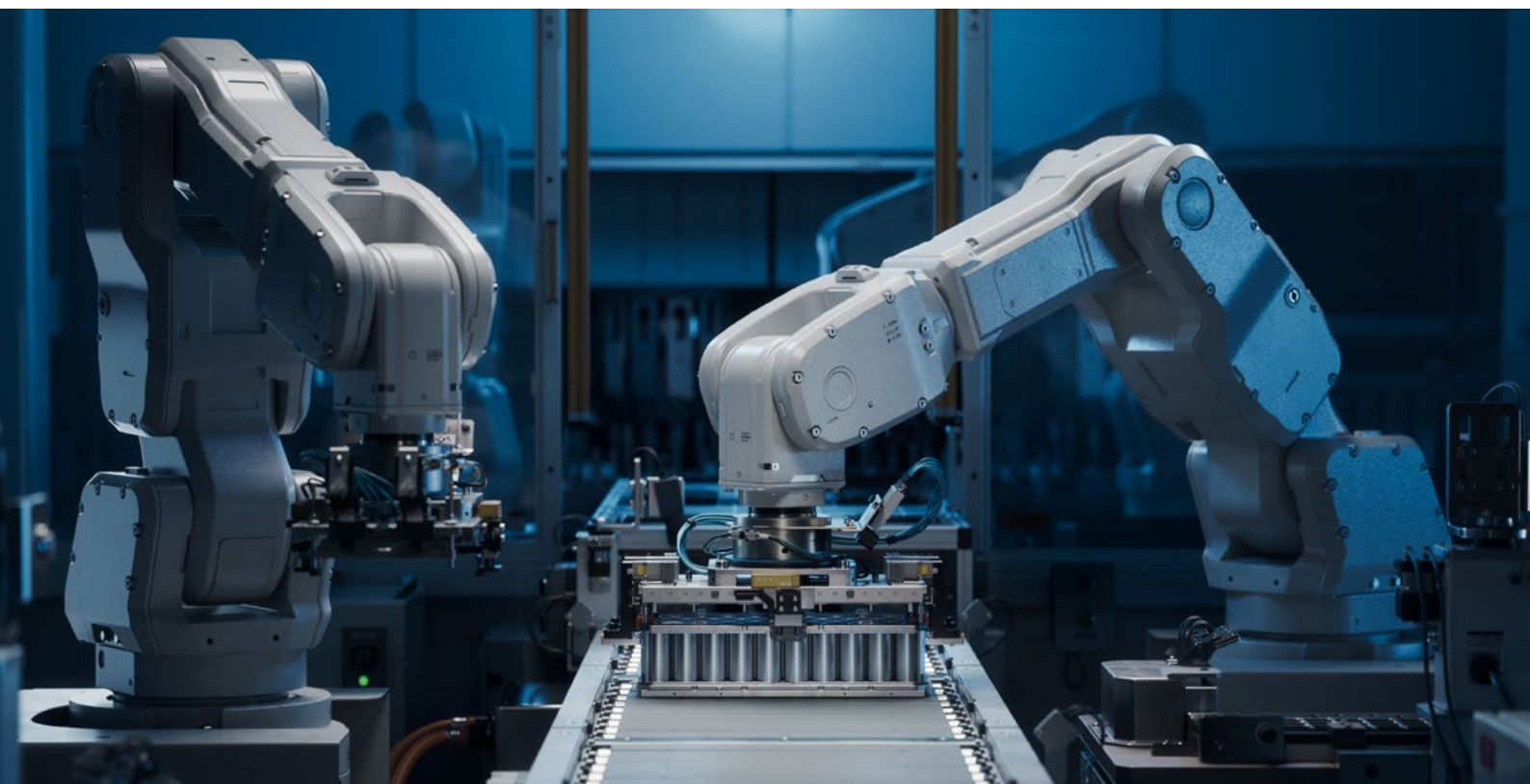
- **Wired network limitations**—While wired networks are reliable, they lack the ability to accommodate the growing number of devices, leading to bottlenecks. Plus, adding cabling to expand wired networks is time-consuming and costly.
- **Wireless network limitations**—While offering flexibility, Wi-Fi networks often struggle with capacity, coverage and security issues, impacting performance and reliability.



SCADA constraints

In the industrial realm, SCADA (Supervisory Control and Data Acquisition) refers to a system of software and hardware components that enable organizations to monitor and control industrial processes. While SCADA systems have been a cornerstone of industrial automation, they face limitations in the context of modern IIoT deployments.

- **Scalability**—SCADA systems often struggle with scalability as the number of connected devices increases, leading to performance degradation. IIoT platforms are designed to handle larger volumes of data and accommodate a growing number of devices without compromising performance.
- **Data analytics**—SCADA systems are primarily focused on real-time monitoring and control, with limited capabilities for advanced analytics. IIoT platforms, on the other hand, are built to support sophisticated analytics, enabling predictive maintenance, optimization and other value-added applications.



How private 5G networks enable Industrial IoT

To fully harness the potential of IIoT, a robust and reliable network infrastructure is crucial. While traditional wired and wireless networks can fall short in supporting the demands of IIoT applications, private 5G networks offer a game-changing solution.

Because private 5G networks are dedicated cellular networks tailored to the specific needs of an organization, they provide greater control, security and customization, making them ideal for business-critical industrial applications. Offering a unique set of advantages, private networks overcome the challenges posed by legacy systems and unlock the full potential of IIoT by delivering:

- **High bandwidth and low latency**—Private 5G networks offer much higher bandwidth and ultra-low latency compared to traditional wireless networks. This allows for large real-time data transfers and immediate responses for critical applications, especially vital for predictive maintenance and remote control of robots. They also support multiple QoS classes for prioritizing essential tasks.
- **Enhanced security and reliability**—Security is paramount when dealing with sensitive industrial data. Private 5G networks offer robust security features like network isolation, traffic separation and restricted access control, minimizing the risk of cyberattacks and unauthorized data breaches. Additionally, their dedicated nature ensures consistent, reliable data transmission, a critical factor for business-critical manufacturing operations.
- **Scalability and flexibility for future growth**—Unlike wired networks that require complex and expensive cabling expansions, private 5G networks easily scale and adapt to growing device density. Based on an accepted security framework, adding new devices to the network is a simple process, allowing manufacturers to easily accommodate future IIoT growth. Additionally, the wireless nature of private 5G networks provides greater flexibility for changing factory layouts or new sensor installations, fostering continuous innovation and process optimization.
- **Integration with advanced technologies**—Private 5G enables seamless integration of advanced technologies, such as edge computing, industrial generative AI and machine learning (ML) into IIoT applications. Its high bandwidth and low latency allow real-time data processing at the network edge, closer to where the data is generated. This allows for faster data analysis and facilitates the implementation of AI and ML algorithms for predictive maintenance, anomaly detection and process optimization. Additionally, decisions based on this analysis can be implemented in the production process in real time.



Unleashing the power of IIoT with private 5G: Real-world use cases

Manufacturers are leveraging private 5G networks with IIoT to drive significant improvements across various use cases

Predictive maintenance with real-time sensor data

Traditional maintenance often relies on more reactive approaches, leading to significant downtime and potential production losses. Private 5G networks enable:

- Continuous sensor monitoring—A network of sensors can collect real-time data on equipment health and performance.
- Predictive maintenance—Advanced analytics powered by AI and machine learning can identify early signs of equipment failure, enabling proactive maintenance and preventing costly downtime.
- Optimized repair schedules—Real-time data insights help schedule maintenance during downtime periods, minimizing production disruptions.

Read case: [Toyota material handling transforms production operations with Ericsson Private 5G](#)

Inventory optimization with real-time tracking

Managing inventory levels and ensuring timely reordering of materials can be challenging in large-scale manufacturing. Private 5G networks and IIoT simplify this by:

- Real-time asset tracking—Sensors provide up-to-the-minute location and usage data.
- Automatic reordering—Inventory levels can be monitored in real time while also triggering automatic reorders to prevent stockouts and production delays.
- Improved space utilization—Real-time data on inventory location and usage helps optimize storage space and streamline logistics.

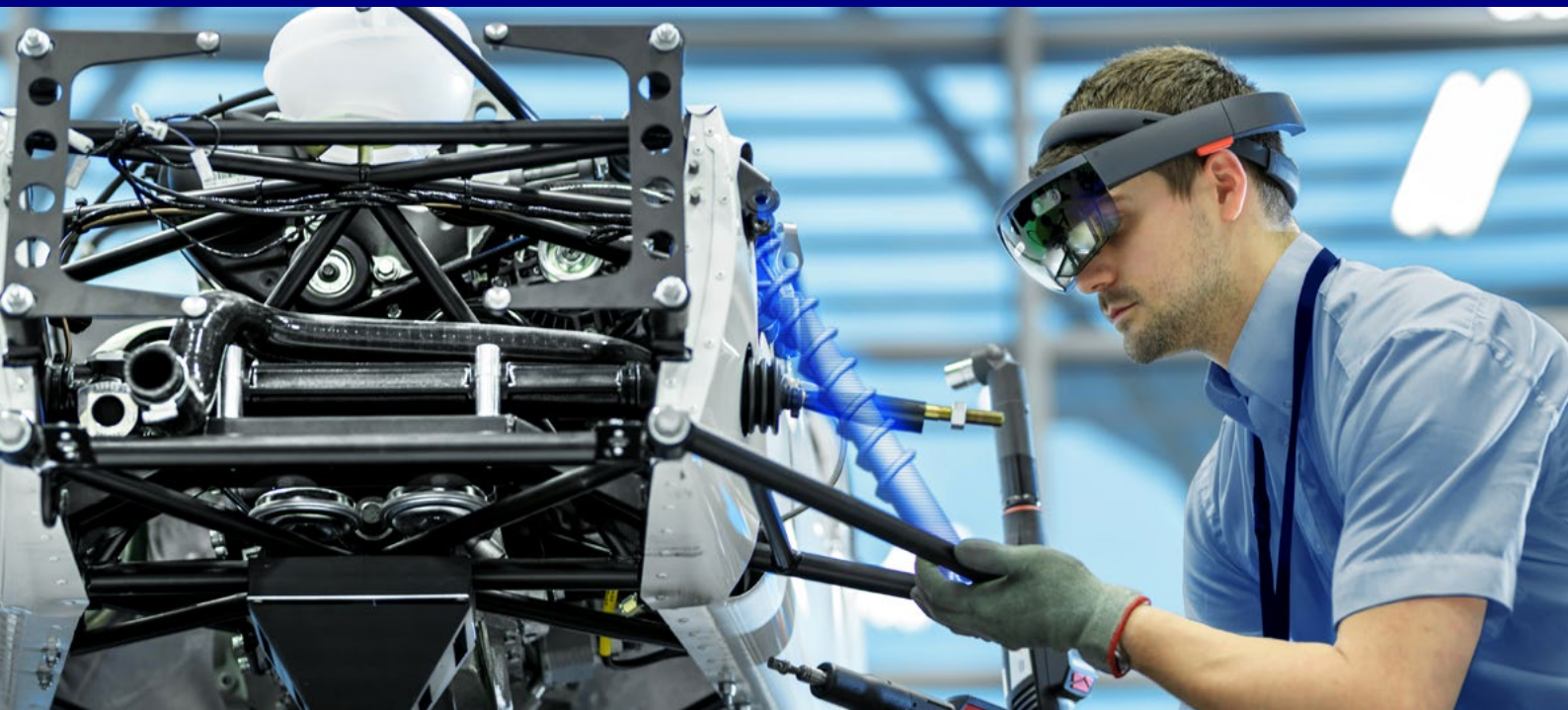
Read case: [Transforming warehouse operations with Ericsson Private 5G](#)

Connected worker with augmented reality (AR)

Imagine a factory worker equipped with AR glasses that overlay real-time data and instructions onto their field of view. This is the reality with private 5G-enabled AR glasses.

- Enhanced training efficiency—AR guides new workers through complex tasks, reducing training time and errors.
- Improved maintenance and repair—AR offers real-time instructions to technicians as well as remote expert assistance for faster and more accurate repairs.
- Increased worker safety—AR highlights potential hazards and safety protocols, creating a safer work environment.

Read case: [5G and virtual reality accelerate vehicle battery design - hyperbat case study](#)



Embarking on your IIoT journey: Key considerations and getting started

The path to a successful IIoT implementation requires careful planning and understanding of its challenges and benefits. Following are key considerations for enhancing your IIoT implementation:

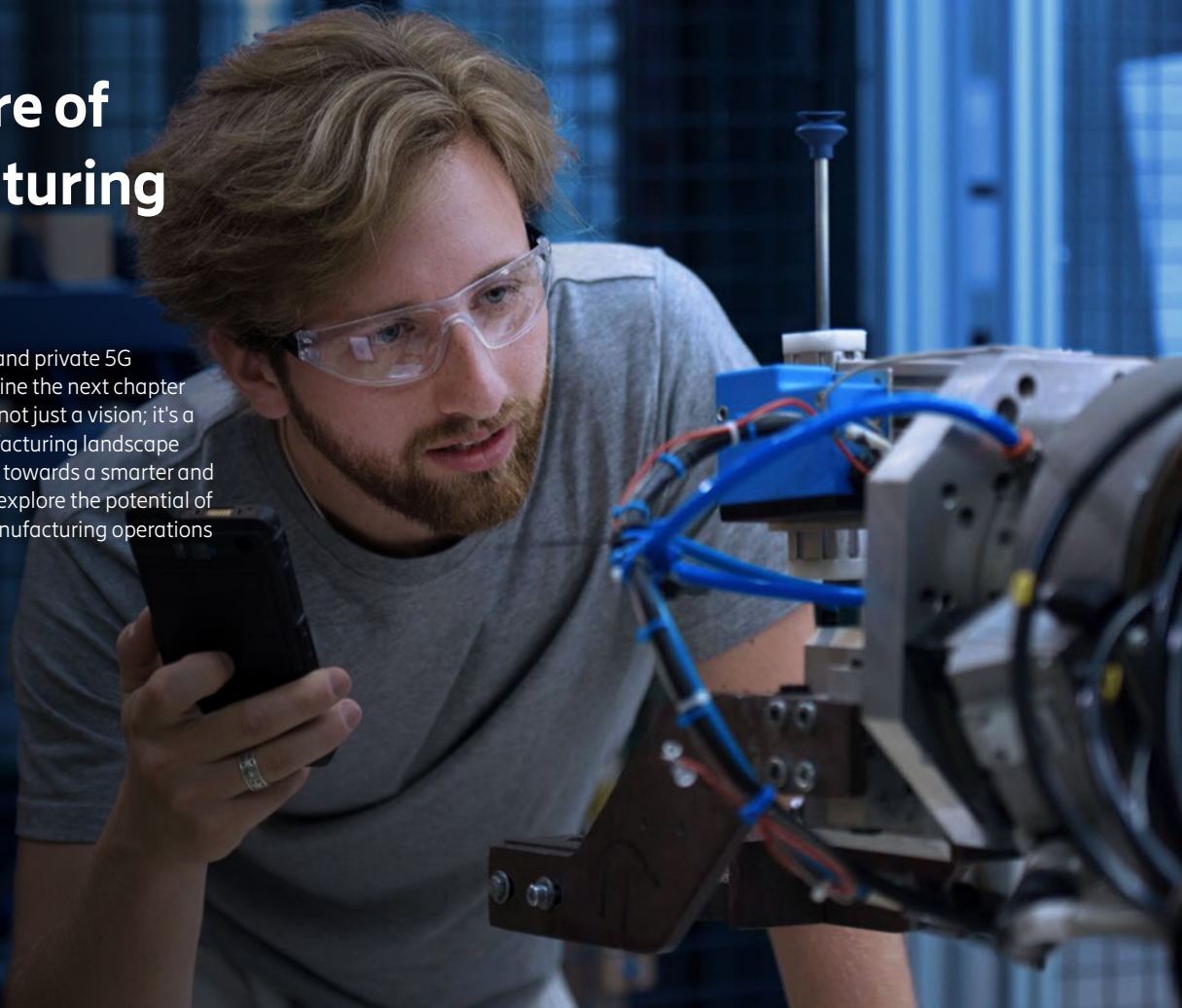
- **Assess infrastructure**—Before embarking on an IIoT journey, it's crucial to assess your existing machinery to determine if upgrades or sensor retrofits are needed for data collection and real-time communication.
- **Explore network considerations**—Traditional networks may struggle with the demands of IIoT deployments. Exploring robust connectivity solutions, like private 5G networks, can provide high bandwidth, low latency and reliability essential for seamless factory data transmission.
- **Develop a data analytics strategy**—Investing in advanced data analytics is essential to unlock insights and transform raw data into actionable intelligence for optimizing operations. If insights need to be in real time to take corrective actions, consider running certain applications at the network edge.
- **Prioritize security**—As data is central to manufacturing operations, robust security measures, including strong data encryption and access controls, are essential to safeguarding sensitive information and ensuring data privacy throughout your IIoT ecosystem.
- **Foster collaboration**—A successful IIoT implementation requires collaboration across various departments within your organization. Establishing a well-defined exchange of data, communication and teamwork between engineering, IT, operations and leadership will ensure a smooth transition and successful integration of IIoT technologies.

Industry leaders like Ericsson offer expertise and guidance through every stage of IIoT implementations, from network design and sensor selection to data analytics and ongoing support. For more resources, visit www.ericsson.com/manufacturing.

To gauge your progress in your smart manufacturing journey, take our free smart manufacturing maturity assessment at www.ericsson.com/smart-manufacturing-assessment.

The future of manufacturing is smart

The convergence of IIoT and private 5G networks is helping to define the next chapter of smart factories. IIoT is not just a vision; it's a reality shaping the manufacturing landscape today. Begin your journey towards a smarter and more efficient future and explore the potential of IIoT to empower your manufacturing operations for a new era of success.



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