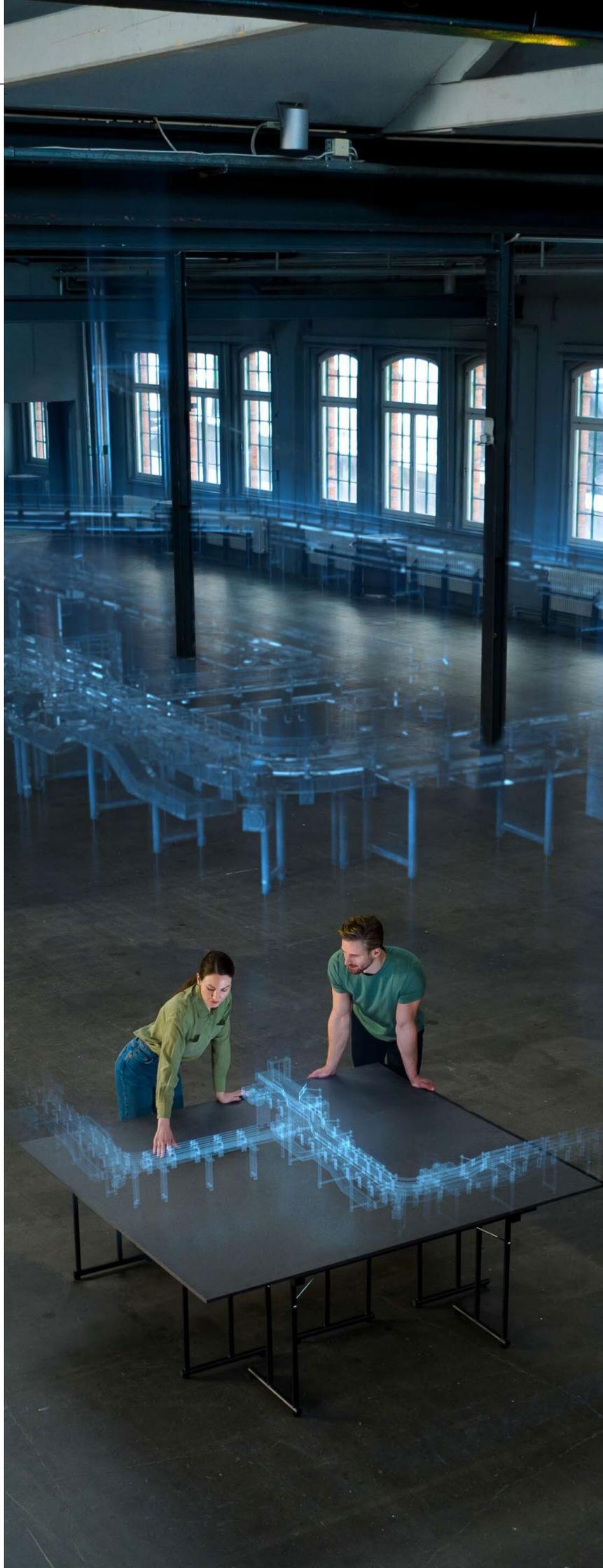ERICSSON

Private 5G: The secret to building a successful digital transformation

IndustryWeek

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Executive summary

Many manufacturers are embarking on or accelerating their digital transformation journeys, investing heavily in technologies like automation, AI and the Industrial Internet of Things (IIoT). But one critical factor is often overlooked—the underlying network infrastructure. Without the right foundation, even the most advanced initiatives risk falling short.

This paper challenges the common assumption that existing connectivity is sufficient, revealing how many organizations may be further behind than they realize when it comes to a network capable of truly supporting Industry 4.0.

Private 5G networks are not just another technology layer—they are a foundational enabler of digital transformation in manufacturing. Unlike traditional Wi-Fi or fragmented legacy systems, private 5G delivers the unparalleled reliability, security, low latency and scale required to support the next wave of innovation. It removes structural and hidden barriers that can stall progress.

"With a projected compound annual growth rate (CAGR) of 42% over the next five years, **private 5G is positioned to become a foundational enabler for enterprise innovation**—especially in environments where reliability, performance and network independence are critical."[1]

This paper demonstrates how private 5G accelerates key investments to enable flexible capacity, increased automation and resilient operations. These capabilities not only strengthen competitiveness but also help address broader challenges, such as rising labor costs and workforce shortages. By understanding the pivotal role of a purpose-built network, manufacturers can unlock new possibilities, maximize returns on their digital initiatives, and secure long-term operational advantage.

[1] Infosys Knowledge Institute, "Private 5G – Trends and outlook"

The unseen foundation of digital transformation

Manufacturers are in a relentless pursuit of efficiency, agility and competitive advantage, driving widespread adoption of digital transformation. This new era, often termed Industry 4.0, promises unprecedented levels of automation, data-driven decision-making and interconnected operations. The manufacturing sector is investing significantly in advanced technologies—from sophisticated robotics and artificial intelligence to vast Industrial Internet of Things (IIoT) deployments. Indeed, the global IoT in the manufacturing market is projected to grow from USD 116.52 billion in 2024 to USD 673.95 billion by 2032,[2] and 95% of manufacturers have invested in, or plan to invest in, AI/ML over the next five years.[3]

Yet, amid this surge of innovation, one crucial component is often underestimated—the network infrastructure that underpins every digital initiative.

Many manufacturers assume that their existing Wi-Fi or wired networks are sufficient for the journey towards a more software defined factory. In reality, these legacy systems often become hidden bottlenecks, slowing progress and preventing organizations from realizing the full potential of their digital investments. This can lead to a sobering realization for some—"We're further behind than we thought"—when it comes to the network's readiness for true digital scale.

The digital transformation journey— Overcoming the hidden network bottleneck

Manufacturing's digital transformation is a multi-faceted journey, encompassing the integration of information technology (IT), operational technology (OT), an increasingly vital, yet often less-understood, network and understanding the need for these to communicate with each other in a new way. However their underlying connectivity infrastructure often remains a weak link, preventing seamless data flow and real-time control.

This hidden bottleneck can manifest as:

- **Data latency**—Delays in data transmission from sensors to analytical platforms hinder real-time decision-making. For critical industrial applications, even milliseconds of delay can impact control, safety and efficiency.

- **Limited capacity**—Traditional networks often struggle to support the massive number of devices and data streams required by modern IIoT deployments. As factories become more instrumented with sensors and connected machines, the sheer volume of data can overwhelm existing infrastructure, leading to performance degradation.

- **Reliability issues**—Harsh industrial environments, filled with heavy machinery, electromagnetic interference and moving obstacles, can significantly disrupt conventional wireless signals like Wi-Fi. This leads to unpredictable performance, dropped connections and costly downtime.

- **Security risks**—Connecting critical OT systems beyond the known and established structures, which often control sensitive production processes, to less secure, shared networks introduces significant cybersecurity risks. Breaches can lead to production halts, intellectual property theft and safety hazards.

- **Lack of flexibility**—Traditional wired networks, while reliable for static connections, inherently limit the flexibility of factory layouts. Reconfiguring production lines or introducing mobile machinery becomes a complex, time-consuming and expensive endeavor, impeding rapid adaptation to new product variants or market demands.

These constraints explain why many manufacturers find their digital transformation efforts are falling short, which leads to the realization that their network is not just a utility—it is a make-or-break accelerator of progress.

Why private 5G is foundational for Industry 4.0

Private 5G networks are purpose-built to address the specific, stringent requirements of industrial environments, making them uniquely foundational for manufacturing digital transformation. Their core capabilities directly overcome the limitations of conventional networks:

- **Ultra-Reliable Low Latency Communication (URLLC)**— Private 5G delivers predictable, extremely low latency (down to milliseconds) and high reliability (up to "four nines" or 99.9999%). This is crucial for real-time control of machinery, robotics and safety-critical applications, enabling immediate responses and precise synchronization. This level of responsiveness is vital for closed-loop control systems, collaborative robots and automated processes where instantaneous communication prevents errors and ensures operational fluidity.

- **Massive Machine-Type Communication (mMTC)**—Designed to connect up to a million devices per square kilometer, private 5G can effortlessly support the burgeoning number of sensors, actuators and IIoT devices in a smart factory, providing the scale needed for comprehensive data collection. This capability is essential as manufacturers deploy thousands of sensors for condition monitoring, environmental tracking and quality control, creating a dense network of interconnected devices without performance degradation.

- **Enhanced Mobile Broadband (eMBB)**—With high bandwidth and throughput, private 5G can handle large data volumes, including high-definition video streams for quality inspection or remote assistance, without compromising performance. This enables applications like real-time video analytics for defect detection, remote expert guidance using augmented reality and large-scale data offloading from connected machinery.

- **Dedicated and secure spectrum**—Operating on dedicated or licensed spectrum, private 5G minimizes interference from other

wireless systems, ensuring consistent performance. Its inherent network isolation and robust security features (e.g., SIM-based authentication, network slicing) protect sensitive operational data from cyber threats, a critical concern for IT and OT convergence. This dedicated nature provides a predictable and secure environment, free from the congestion and vulnerabilities of public or shared wireless networks.

- **Mobility and seamless handover**—Unlike Wi-Fi, private 5G supports seamless mobility across large areas, ensuring devices remain connected without interruption as they move, vital for autonomous things like AGVs, AMRs and mobile workers. This enables continuous connectivity for critical applications, preventing costly downtime or safety risks associated with dropped connections as assets move between different coverage zones.

> "Private 5G networks are not just another technology, but a foundational catalyst for realizing comprehensive manufacturing digital transformation."

With these capabilities, private 5G collectively provides a unified, resilient and highly available network technology platform. This means the inherent uptime and robustness of the 5G technology and its components, coupled with its extensive network reach and capacity to connect a diverse array of sensors and devices, ensure seamless integration and operation of advanced digital technologies across the factory floor.

Accelerating key manufacturing investments with private 5G

Private 5G acts as a powerful accelerator for a manufacturer's most critical digital investments, making complex initiatives easier, more reliable and more impactful. This is where 5G is a catalyst for digital transformation.
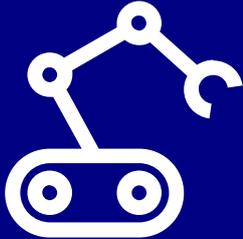
Autonomous things (AGVs, AMRs, robots) investments

Private 5G's ultra-low latency and seamless mobility are crucial for the real-time control and coordination of autonomous devices, such as vehicles and robots. This enables dynamic routing, collision avoidance and precise task execution, significantly improving material handling, logistics and assembly processes. The reliable, consistent connectivity ensures that these systems operate without interruption, a critical factor for safety and efficiency in dynamic factory environments. While it's still in the early days for the application of autonomous technologies, private 5G provides the necessary foundation for wider adoption.
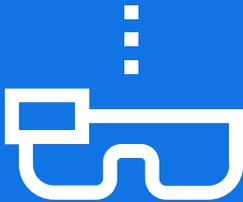
IIoT investments

The ability to connect a massive number of sensors and devices reliably and securely transforms IIoT investments from a data collection exercise into a real-time intelligence engine. Private 5G ensures that high-volume sensor data (e.g., vibration, temperature, pressure) is transmitted instantly, enabling granular monitoring and unlocking the full value of data analytics. This real-time data flow is essential for applications like predictive maintenance, quality control and resource optimization, directly impacting operational efficiency and cost savings..
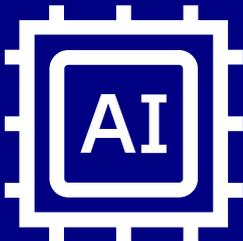
AI investments

AI models thrive on access to real-time, high-quality data. Private 5G provides the high-bandwidth, low-latency communication pathways essential to feed these AI applications, such as machine vision for quality control, predictive analytics and adaptive process optimization. This moves AI from theoretical potential to practical, real-time impact on the factory floor, enabling faster decision-making and more intelligent automation.

Innovation enabler

Beyond existing applications, private 5G serves as an innovation enabler, making new possibilities easier to achieve. It provides the reliable, high-performance foundation required for emerging technologies—like augmented reality (AR) for remote assistance and virtual reality (VR) for training and highly distributed edge computing—fostering a culture of continuous improvement and unlocking next-generation operational models.

Enabling flexible capacity and agile operations

The demands of modern manufacturing necessitate unprecedented flexibility and agility. Private 5G directly addresses these needs, promoting resilience and adapting to dynamic market conditions.

- **Flexible production and assembly workplaces**—Machines, tools and workstations can easily be reconfigured without the limits of wiring or the unreliability of Wi-Fi. This enables rapid adjustments to product variants, mass customization, and smaller batch production, cutting retooling costs and reducing time-to-market.

- **Increased automation**—The reliable, low-latency connectivity of private 5G is fundamental to scaling automation. It allows for more sophisticated coordination between robots, machines and control systems, pushing the potential of lights-out manufacturing and reducing reliance on manual labor for repetitive or hazardous tasks.

- **Promoting resilience and addressing labor challenges**—By enabling higher levels of automation and remote operation, private 5G can help mitigate the impact of labor shortages and rising labor costs. It allows for more efficient utilization of human capital, focusing skilled workers on higher-value tasks and ensuring operational continuity even with reduced on-site personnel. This resilience extends to faster recovery from disruptions, as the robust network supports remote diagnostics and rapid reconfigurations.
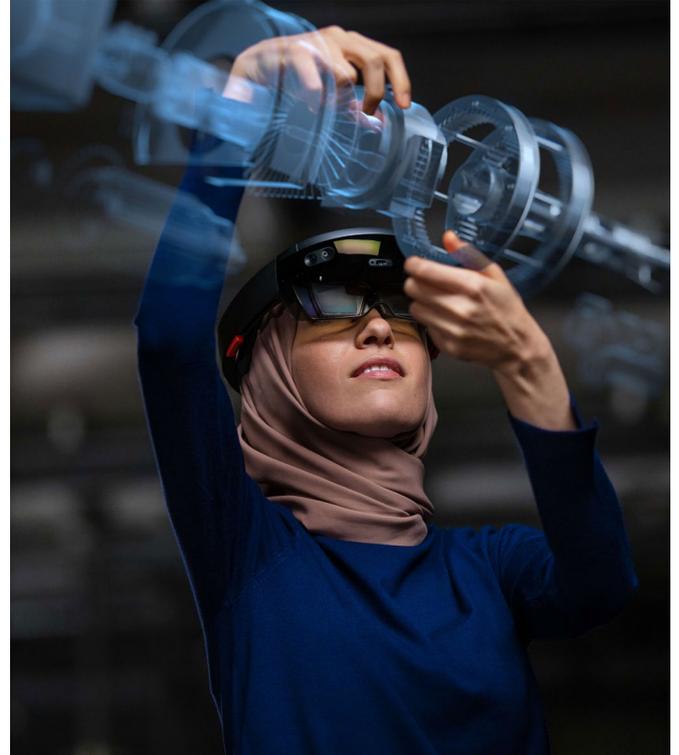
Realizing digital scale, integration and investment benefits

The true value of manufacturing digital transformation lies in its ability to scale and integrate across the entire manufacturing ecosystem.

- **Overcoming barriers to scale**—Private 5G's wireless nature and inherent scalability simplify the process of extending coverage and capacity. Unlike traditional networks that often require significant

re-cabling or complex upgrades for expansion, private 5G allows manufacturers to deploy new IIoT devices, introduce more autonomous systems or expand digital initiatives across multiple facilities with greater speed and cost-effectiveness. This means digital transformation efforts can grow organically with business needs, avoiding costly infrastructure overhauls.

- **Seamless integration**—Private 5G provides a unified, secure and high-performance communication fabric that simplifies the integration of disparate IT and OT systems. By offering a common, reliable backbone for data exchange, it reduces the complexity and cost associated with connecting various applications and devices, enabling a holistic view of operations. This streamlined integration is vital for breaking down data silos and enabling an end-to-end process and its visibility.

- **Maximizing investment ROI**—Without a robust and reliable network technology, even the most advanced digital technologies can underperform. Private 5G ensures that AI, IIoT and automation investments are fully leveraged, delivering promised productivity gains, efficiency improvements and agility. It transforms potential into realized value, ensuring a strong return on digital transformation expenditures.

The essential core of smart manufacturing

Digital transformation in manufacturing is only as strong as its foundation. While many manufacturers are investing in Industry 4.0 applications, network infrastructure is often the hidden barrier limiting success. Private 5G removes that barrier. With the unique combination of unmatched reliability, security, low latency and scalability, it establishes the indispensable backbone for smart manufacturing.

While enabling and accelerating the adoption and impact of autonomous things, IIoT, and AI, it also provides the flexibility,

resilience, and capacity for innovation needed to stay competitive. Adopting private 5G is not simply a connectivity upgrade— it's a strategic investment in the future of manufacturing. It lays the groundwork for continuous innovation, sustainable competitiveness, and the realization of the factory of the future.

To explore how private 5G can transform your operations and initiate your journey towards a truly smart factory, please visit www.ericsson.com/manufacturing for further resources on private networks, IIoT and autonomous systems.
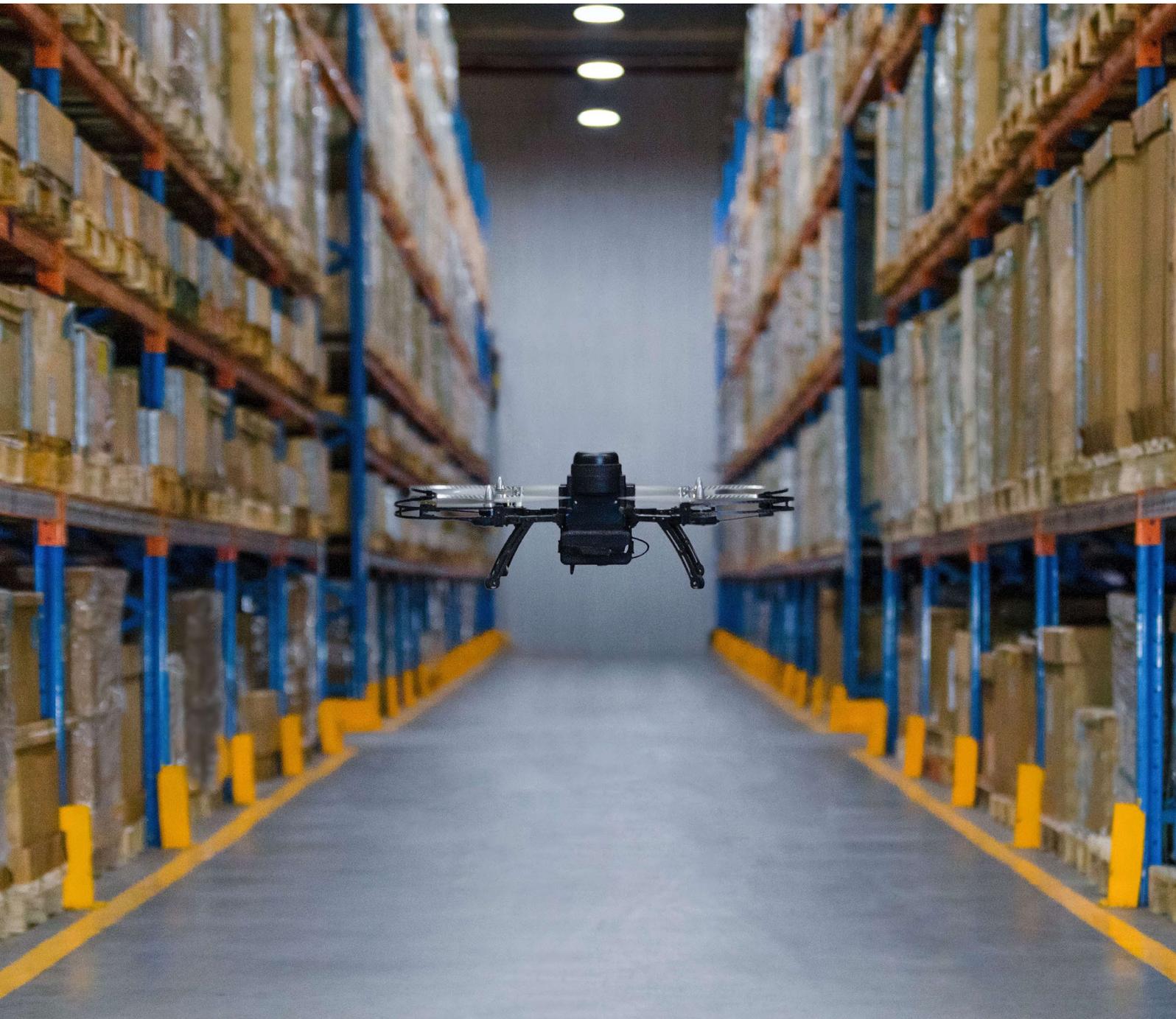
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