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Reliable connectivity, crucial for multisite manufacturing efficiency

How to successfully deploy private 5G networks across geographically dispersed manufacturing sites

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Introduction

As manufacturers adopt more data capabilities across their operations, the need for reliable and scalable connectivity is greater than ever. At the same time, many are expanding to connect multiple plants and sites, further increasing network demands.

To stay competitive in today's rapidly evolving digital landscape, manufacturers need consistent, scalable, and flexible connectivity. For those operating across multiple factories, warehouses and remote sites, ensuring streamlined network performance reliability can be both a challenge and a necessity.

As digital transformation accelerates, manufacturers are increasingly deploying advanced software, connecting workers, and tools that require uniform network performance across multiple sites. But scaling these technologies across dispersed locations requires more than just robust sometimes intermittent bandwidth—it calls for consistency and repeatability.

Traditional networks like Wi-Fi can't keep up with the demands of Industry 4.0 technologies—especially at scale. Private 5G networks offer the speed, security and adaptability, enabling manufacturers to deploy complex applications like autonomous mobile robots (AMRs), edge compute, and artificial intelligence (AI). By unifying IT (information technology) and OT (operational technology) under a single scalable network platform, manufacturers can drive new levels of efficiency, enhance security, and gain a lasting competitive advantage.

To expand seamlessly without reinventing the wheel at every location, enterprises need a network foundation that delivers reliable connectivity. That's where private 5G with multisite capabilities offer compelling solutions addressing both centralized and decentralized network assets, aligning with enterprise needs.

Designed for environments small and large, private 5G offers the flexibility, security and reliability to support a wide range of industrial applications. The key? Understanding the situation and establishing a clear blueprint to match the right network design to each site's specific needs.

Multisite environments: One challenge, many shapes

A multisite environment can take many forms—from a large, centralized facility with multiple buildings and connectivity needs, to a global operation spanning different countries (Figure 1). This complexity means there's no one-size-fits-all solution. Some enterprises may need broad, consistent coverage across the facility; others may benefit from targeted deployments that bring compute and connectivity exactly where they're needed.

Adding to that complexity, not all organizations are at the same stage of digital maturity. Legacy IT systems, siloed networks and varied infrastructure can create friction when rolling out new processes, methods, and tools. And with growing customer demands, mobility and flexibility are no longer optional—they're crucial. Traditional, wired networks often can't keep up with the pace of change.

No matter what the specific site needs are, manufacturers face a range of challenges, including:

- **Fractured operations and lack of standardization:** Varying network solutions at different sites make it difficult to manage and scale operations effectively, driving up costs and complexity.
- **High latency and unreliable real-time data access:** Critical applications like automation and robotics require ultra-reliable, low-latency connectivity.
- **Increased security risks:** Disparate systems lead to inconsistent security policies and greater exposure to cyber threats.
- **Complicated and costly network management:** Managing separate IT/OT networks across multiple locations increases complexity and operational costs.
- **Limited scalability:** As manufacturers expand or add new facilities, outdated network infrastructure can't keep up.
- **Reduced innovation and competitive disadvantage:** Lack of seamless connectivity limits the adoption of Industry 4.0 technologies such as AI, automation, and robotics.

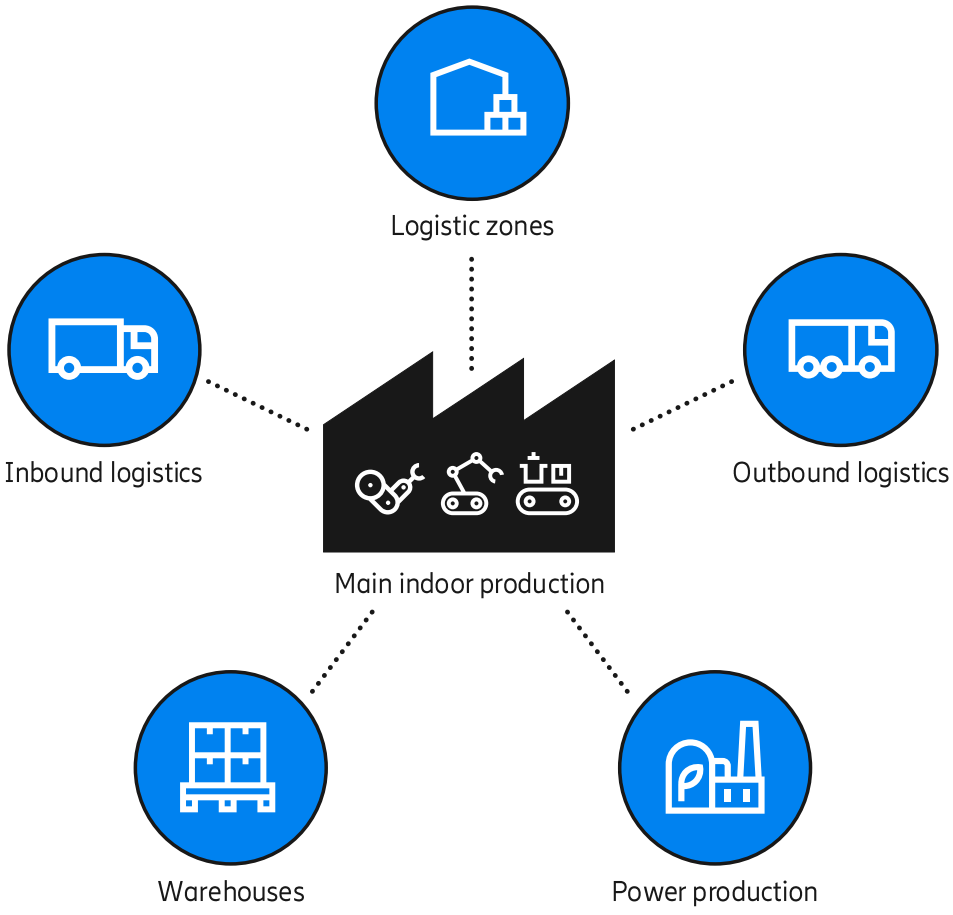


Figure 1: Illustrative manufacturing multisite environment

Why manufacturers need a unified approach to IT and OT

As the race toward smart factories continues, manufacturers must bridge the gap between IT (informational technology) and OT (operational technology)—especially across geographically dispersed sites. When these functions remain siloed, it can add complexity to things like network security, workload distribution, and automation.

Take security and access control, for example. These are typically IT concerns. Meanwhile, automation and robotics fall under OT. However, in a real-world scenario, a manufacturer using AMRs for inventory management across multiple sites would need the devices to function seamlessly, without manually swapping SIMs at every location Add, when using a cellular network. This requires IT and OT working together on a network that's unified, secure and flexible.

That's where network architecture becomes critical. Depending on a site's requirements, with multisite manufacturers can choose:

- All-remote radio setups
- Hybrid models with local breakouts and centralized control planes
- Fully localized control planes for maximum responsiveness

Each option ensures compute and connectivity are tailored to the site's needs—without compromising on consistency.

Unlocking unified connectivity with private 5G

A scalable private 5G network provides the backbone for manufacturers to seamlessly connect multiple sites, from high-tech production plants to remote warehouses . With a standardized network architecture across all locations, companies can reduce complexity and unlock the benefits of unified connectivity. And the improved radio capabilities of 5G makes it all possible.

With a unified platform, manufacturers can centralize control where possible, deploying decentralized solutions only where necessary to ensure connectivity is tailored to each site's specific needs. Some locations may require ultra-low latency for precision robotics and automation, while others may need broad, reliable coverage for asset tracking and logistics. Private 5G supports both scenarios, delivering a consistent, flexible solution that keeps operations running smoothly.

Ericsson Private 5G offers this flexibility, along with built-in security, robust radio capabilities, and the ability to operate across different regulatory environments, making it ideal for global manufacturers. With private 5G as the foundation, manufacturers can ensure that their entire operation is connected, secure, and ready for the future.

Finding the right network architecture for the job

Many manufacturers are already leveraging private 5G to enhance operations across multiple, geographically dispersed sites—but adapting the network to the environment is key to a successful deployment. For example, a factory might require a robust, self-sufficient private 5G network to support real-time industrial automation and low-latency IT/OT applications. At the same time, a warehouse in another city may only need private cellular coverage to enable connected devices, asset tracking, and mobile workforce management.

Effective customization starts with network architecture. Most of the deployments we've seen fall into three categories, which are then further adapted for each specific enterprise's specific needs (Figure 2).

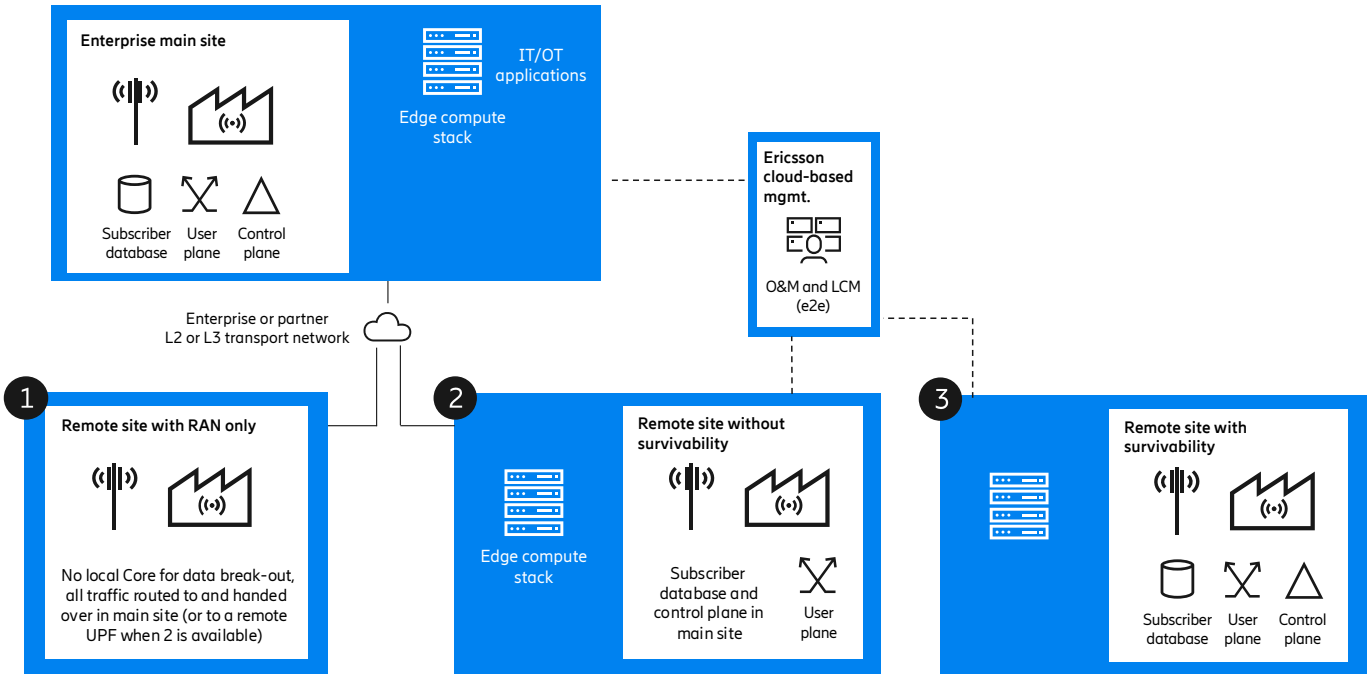


Figure 2: Multisite network deployment options

Remote site with RAN only

In some deployment scenarios, remote industrial sites only require private cellular coverage. These sites are equipped with RAN (Radio Access Network) components, while all data traffic is routed to and managed by the central core network hosted at the main location. This centralized approach simplifies infrastructure at the edge, as there's no need for a local core or compute resources. IT/OT applications are also hosted in the main site, ensuring centralized control and reducing maintenance overhead in remote areas. This model is ideal for locations such as warehouses or vehicle yards where basic reliable connectivity beyond Wi-Fi is sufficient to support operations .

Key features of this approach:

- No local core; all traffic is backhauled to the central core network
- IT/OT workloads are processed at the main location, ensuring consistency and control
- Suitable for sites that only need private cellular connectivity without complex local infrastructure
- Most cost-effective option
- No need to deploy a full private 5G system in all locations, only RAN deployed in remote locations
- No need to run several long fibers between basebands and radio units

Remote site without survivability

Some remote sites are deployed without survivability features, meaning they rely on centralized network components for critical functions and don't have the redundancies of other architectures. While IT/OT applications are hosted locally at the site using an edge compute stack, the subscriber database and control plane remain centralized at the main site. In this setup, there's no need for a full core-based private 5G deployment at each location, striking a balance between local application performance and overall network cost efficiency.

Key features of this approach:

- Critical control functions like the subscriber database and control plane are centralized
- IT/OT workloads run on an edge compute stack at the remote location
- Avoids deploying a full private 5G core at the edge, reducing overall infrastructure costs
- Relatively cost-effective offering compared to a standard Network Controller for locations that need local breakout
- Remote location system stops working if transport network between sites fails (hence the lack of survivability)

Remote site with survivability

In mission-critical locations, remote sites may be designed with full survivability to ensure continuous operations even if connectivity to the main site is lost. These sites host both IT/OT applications and the necessary network functions locally, enabling complete self-sufficiency. This includes deploying a local control plane and subscriber database, often as part of a compact private 5G core and edge compute stack . With this setup, the site can manage devices, process data, and maintain services independently, making it ideal for production facilities or remote operations where downtime is not an option.

Key features of this approach:

- IT/OT applications and critical network functions are hosted on site
- Premium offering for locations that need self-sufficiency
- Local breakout plus local control and authentication
- Remote location system continues working even if transport network between sites fails

Table 1 summarizes these multisite deployment options and illustrates their distinct value and examples of what hardware configurations could look like using Ericsson's technology.

Option	Value	Ericsson Hardware Example
Remote site with RAN only	**Option 1** Most cost-effective solution. In this case there is no need to deploy a full private 5G system in all locations, only RAN is deployed in remote locations. In addition, there is no need to run multiple long fibers between Basebands and Radio Units.	**Main location:** • Network Controller pair • Single or Redundant Router 6675 • Single or redundant GNSS kit **Main or additional locations:** • Baseband • Radio • Dot/Antenna
	Option 2 Same as Option 1, except organizations can use their own transport network. They save on fiber cost between private 5G Router and Basebands.	**Main location:** • Network Controller pair **Main or additional locations:** • Baseband • Radio • Dot/Antenna • GNSS kit per location (plans to support PTP to remove GNSS kit)
Remote site without survivability	Relatively cost-effective solution than a standard Network Controller for locations that need local breakout. Remote location system stops working if transport network between sites fails.	**Main location:** • Network Controller appliance pair • Single or Redundant Router **Main or additional locations:** • Remote UPF appliance pair
Remote site with survivability	Premium solution for locations that need self-sufficiency—local breakout plus local control and authentication. Remote location system continues working even if transport network between sites fails.	**Main location:** • Network Controller pair or NC as SW redundant instances (single instance late) • Baseband • Radio • Dot/Antenna • GNSS kit **Additional locations:** • Same as main location

Table 1: Multisite network deployment options

Returning to our illustrative manufacturing multisite environment, Figure 3 illustrates how each remote site can deploy their respective linked network based on their individual needs.

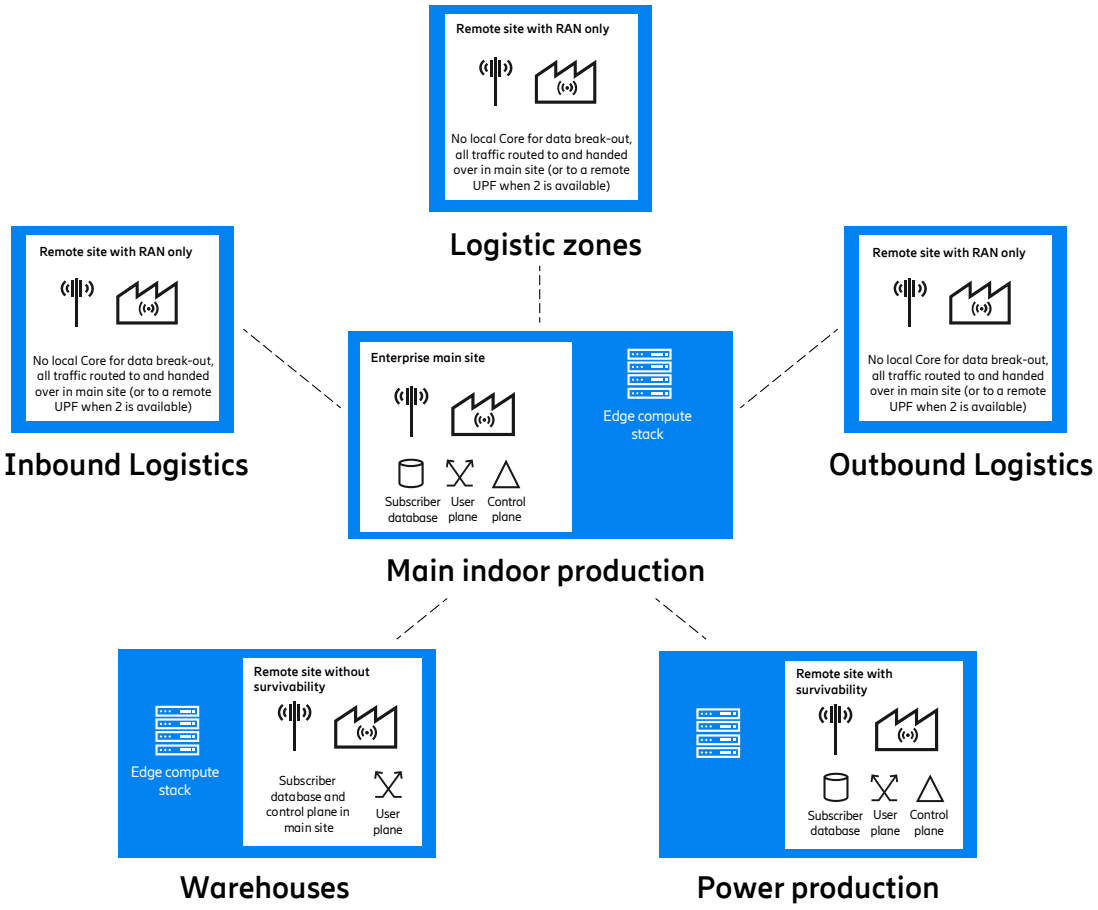


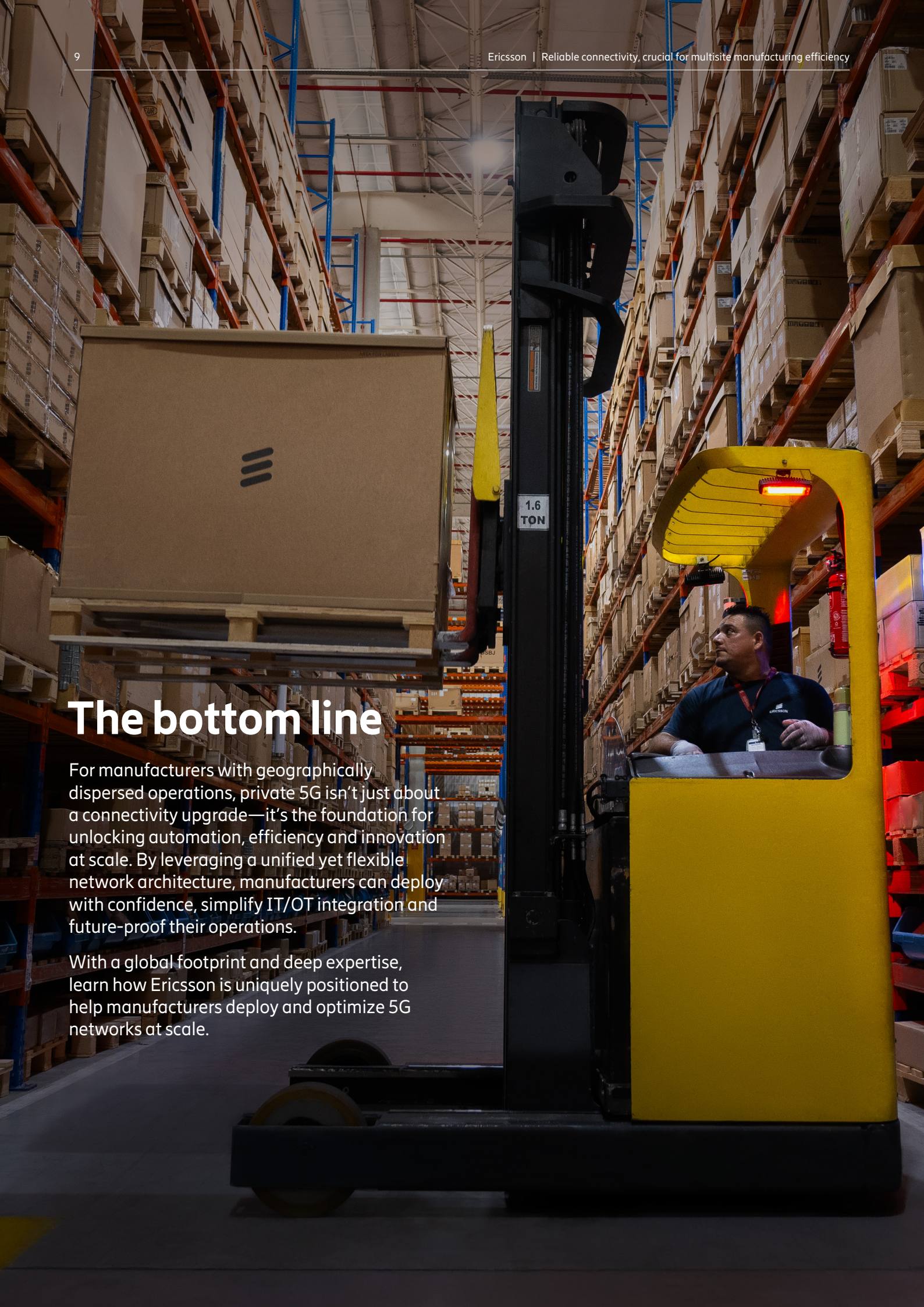
Figure 3: Illustrative multisite manufacturing environment with multisite network deployment

Real-world examples of private 5G in action

Critical manufacturing use cases including autonomous things, industrial IoT and advanced analytics are driving digital transformation. A few real-world examples where this is happening in a multisite environment:

- Across sectors , private 5G enables the reliable connectivity needed for automated material handling, AMRs, and logistics tracking. In a recent deployment, private 5G allowed an automotive manufacturer to integrate large-scale production sites with warehouses and outdoor vehicle staging areas. Using centralized core with remote radio solutions, the company could extend and optimize coverage across different environments without excessive infrastructure costs.
- Company expansions often pose challenges when it comes to expanding connectivity—even when new sites are nearby. When a steel manufacturing company acquired a new production facility across the street, they needed to connect it to existing IT infrastructure. In this case, private 5G allowed them to extend secure, high-speed connectivity to the new site while maintaining centralized management.
- On a larger scale, global companies are often faced with challenges as they work to meet various compliance and regulatory standards. For example, a multinational aviation manufacturer operates facilities in several countries, so they need seamless connectivity across borders. With its global regulatory approvals, private 5G enabled uniform network deployment without complex workarounds.

Flexibility is the watchword here. With private 5G deployed across all these locations, devices can move or be redeployed between sites without reconfiguration issues, ensuring business continuity and operational agility.



The bottom line

For manufacturers with geographically dispersed operations, private 5G isn't just about a connectivity upgrade—it's the foundation for unlocking automation, efficiency and innovation at scale. By leveraging a unified yet flexible network architecture, manufacturers can deploy with confidence, simplify IT/OT integration and future-proof their operations.

With a global footprint and deep expertise, learn how Ericsson is uniquely positioned to help manufacturers deploy and optimize 5G networks at scale.

About Ericsson

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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