Globalstar™

EBOOK

Next Generation Warehousing and Logistics: Robotics Enablement via Resilient Networks

The Rise of Robotics in Warehousing and Logistics

Warehousing and logistics operations are under unprecedented pressure. The explosive growth of e-commerce, accelerated delivery expectations, and increasingly complex omnichannel fulfillment models have forced operators to rethink how goods are stored, moved, and tracked. Labor shortages, rising wage pressures, and the need for greater efficiency mean that traditional processes are no longer enough to keep pace with demand.

Against this backdrop, robotics has emerged as a critical tool in transforming warehouses and distribution networks. Autonomous mobile robots (AMRs), automated guided vehicles (AGVs), robotic picking systems, and automated sortation lines are no longer futuristic concepts; they are becoming mainstream solutions. These systems deliver faster order turnaround, improved accuracy, and optimized inventory management while allowing human workers to focus on higher-value tasks.

What is making this shift viable now is the convergence of powerful enabling technologies. Advances in machine vision, artificial intelligence, and edge computing have unlocked new levels of robotic intelligence, allowing machines to navigate dynamic environments, adapt in real time, and work safely alongside people. At the same time, the network infrastructure that underpins these systems is evolving. Traditional Wi-Fi, often plagued by interference and handoff issues, cannot support dense fleets of connected devices with low latency requirements. Instead, organizations are turning to next-generation private networking solutions designed for high reliability, seamless coverage, and real-time performance.

In short, the warehousing and logistics market is reaching a tipping point where robotics is not only practical but essential. The key to unlocking its full value lies in pairing these technologies with resilient, future-ready connectivity.

Common Use Cases for Robotics in Warehousing and Logistics

Robotics is no longer a futuristic concept on the warehouse floor, it's an operational necessity for organizations striving to meet rising demand and tighter delivery windows.

Here are some of the most common ways robotics is transforming warehousing and logistics operations today.

Automated Guided Vehicles (AGVs) and Autonomous Mobile Robots (AMRs)

These robots move goods seamlessly across large warehouse footprints, transporting pallets, totes, and individual items. They reduce labor strain while increasing throughput and reducing time-to-pick.

Automated Storage and Retrieval Systems (AS/RS)

High-density storage environments leverage robotic arms and shuttles to store and retrieve goods with precision. This reduces errors, minimizes wasted space, and speeds up order fulfillment.

Robotic Picking and Packing

AI-enabled robotic arms can identify, pick, sort, and pack items at high speeds, improving accuracy and freeing human workers for higher-value tasks.

Fleet and Inventory Visibility

Robots equipped with sensors provide constant feedback on inventory levels and asset positions, ensuring real-time data for decision-making and reducing lost or misallocated items.

Loading and Unloading Automation

Robotics streamlines container loading/unloading operations, improving efficiency at inbound docks and reducing truck turnaround times.

In warehousing and logistics, these robotics use cases are only as powerful as the network that supports them. High data volumes from fleets of robots demand resilient, low-latency connectivity that keeps pace with modern supply chain speed.

Why Robotics Needs Resilient Networks

Modern robotics has transformed warehouses, logistics hubs, industrial plants, and factory floors into highly automated ecosystems. But these machines, whether they are autonomous mobile robots (AMRs), automated guided vehicles (AGVs), robotic arms, or inspection drones, are only as effective as the networks that drive them. A resilient network isn't just a convenience; it's the backbone that keeps automation running with precision.

Robotics thrives on data. Every movement, sensor reading, and command is transmitted in real time to ensure that robots avoid collisions, stay on schedule, and adapt dynamically to changes in their environment. For example, an AGV in a warehouse may need to reroute instantly if a pallet blocks its path, while a robotic arm in a manufacturing plant may require split-second updates to keep pace with conveyor lines. If a network drops or slows down, operations grind to a halt, creating bottlenecks and costly downtime.

Resilient networks also enable scalability. As organizations deploy more robots across larger or more complex facilities, their communication needs increase exponentially. A network must maintain low latency, high throughput, and interference resistance, even when supporting hundreds, or thousands, of devices simultaneously. This level of robustness allows organizations to deploy robotics confidently, knowing that performance will not degrade as demand grows.

Security is another critical layer. Robotics often handles sensitive operational data – blueprints, production schedules, inventory records – so the network must safeguard this information from unauthorized access or interference. A resilient network is built with strong encryption, precise segmentation, and the ability to isolate traffic for specific use cases, preventing disruption and ensuring compliance.

Ultimately, robotics delivers on its promise of speed, precision, and cost savings only when its wireless connectivity network infrastructure matches that same standard of reliability and intelligence. A resilient network becomes the invisible engine behind higher productivity, improved safety, and optimized workflows.

What Stands in the Way: Warehousing and Logistics Environments

Warehousing and logistics environments present unique wireless connectivity challenges that can limit the effectiveness of robotics if not addressed. These facilities are often sprawling, with high ceilings, metal racks, dense shelving, constantly changing layouts, and often dry or cold storage. Every obstacle, whether a stack of pallets or a moving forklift, can cause interference or block signals. Wi-Fi networks, in particular, struggle in this setting, as they rely on listen-before-talk access points that require extensive planning and frequent adjustments.

Another challenge is the sheer density of devices. Warehouses now host fleets of AMRs, handheld scanners, RFID readers, and sensors, all competing for bandwidth. Legacy networks weren't designed to handle this level of traffic, resulting in unpredictable latency and dropped connections. For robotics, even a split-second delay can lead to errors (missed scans, routing conflicts, or unnecessary stops) that slow down fulfillment.

Mobility adds another layer of complexity. Robots and vehicles traverse long distances at varying speeds, moving between indoor and outdoor areas, and across loading docks where coverage zones overlap. Traditional Wi-Fi often forces connected devices to attach to nearest access point resulting in multiple hand-offs, causing interruptions that degrade performance. For time-critical operations like order fulfillment or last-mile staging, those interruptions add up to real costs.

Finally, logistics facilities must constantly evolve to keep pace with customer demands. Seasonal spikes or new product lines often require rapid reconfiguration of floor plans and workflows. Networks that demand intensive re-planning and manual tuning can't keep up, leaving robotics unable to operate at their full potential.

The Rising Demand for Private Networking

Across industries, a silent transformation is underway: the migration from public, best-effort connectivity to dedicated private networking. Organizations in warehousing, logistics, manufacturing, and beyond are asking more of their wireless networks than ever before. Automation, AI-driven analytics, and real-time visibility into assets and workflows have become cornerstones of operational efficiency. But these technologies only deliver when the underlying network can meet strict performance, security, and scalability requirements.

This is why private networks, wireless systems that an enterprise owns or controls within its own footprint, are seeing explosive growth. Unlike public cellular networks, which are built for mass consumer use, private networks are tuned specifically for the needs of a facility, an enterprise campus, or even an entire supply chain. They provide predictable performance, tight security, and the ability to scale without competing with outside users.

Meeting New Needs

Private networks are gaining traction because they address key pain points that traditional public cellular networks or legacy Wi-Fi systems simply can't:

Low Latency and High Reliability

Automation systems and robotics need instant, uninterrupted communications. A private network removes the variability that comes with using unlicensed spectrum and public infrastructure with others.

Dedicated Capacity

When a facility runs on its own network, bandwidth can be allocated based on operational priorities. High-throughput video streams, edge AI applications, and massive device fleets no longer fight for airtime.

Security and Control

With sensitive operational data flowing constantly, organizations need airtight control over who accesses their network and how. A private network enables segmentation, encryption, and strict governance.

These needs are not niche. From warehouses fulfilling orders in minutes to industrial floors with robots welding alongside humans, reliable connectivity is becoming mission-critical.

Wi-Fi vs. Cellular Private Networking

In most facilities today, Wi-Fi is the default wireless technology. It is inexpensive, widely available, and well understood. But as operations scale and automation increases, Wi-Fi starts to show its limits:

Coverage Gaps

Wi-Fi access points have relatively short range, so large sites require dense deployments. Every access point adds cost, complexity, and potential points of failure.

Interference and Handoffs

In environments with moving robots, high shelving, or dense machinery, Wi-Fi signals can scatter, creating dead zones and forcing constant handoffs between access points. These micro-interruptions may go unnoticed for casual use but are catastrophic for automation.

Lack of Quality of Service (QoS)

Wi-Fi is a shared medium with no guaranteed performance. When multiple devices compete, latency spikes and throughput drops.

Cellular private networks, especially 5G, were designed from the ground up to overcome these issues. A single private cellular radio can cover a much larger area than Wi-Fi, reducing deployment costs and complexity. Handoff issues are eliminated or minimized, as the network can be architected as a “Supercell” with seamless roaming across the site. And because private cellular networks can operate on dedicated or shared-licensed spectrum vs Wi-Fi which operates in unlicensed spectrum, they offer interference-free performance and guaranteed QoS, even under heavy load.

Scalability is another differentiator. Private 5G networks are built to support dense device ecosystems with low latency, ideal for environments where automation is growing year over year. Unlike Wi-Fi, which often requires “forklift” upgrades (ripping and replacing hardware) to scale, cellular private networks can grow through software updates and modular expansion.

Use Case Highlight

In a modern distribution center, hundreds of autonomous mobile robots (AMRs) and automated guided vehicles (AGVs) crisscross the floor, moving inventory from receiving to storage to packing stations. Workers with handheld scanners update stock levels in real time, while managers monitor throughput from dashboards fed by live data.

On a Wi-Fi network, this environment quickly reaches a tipping point. Each robot and handheld device competes for airtime with the same access points that support office staff and guest devices. Interference from high shelving and dense product loads forces constant tuning, and even a brief handoff delay can cause a robot to pause or misroute — slowing fulfillment and increasing costs.

With a private cellular network, those limitations disappear. A few strategically placed radios provide consistent coverage across the facility. Robots move freely without dropped signals or latency spikes. Video analytics can run in parallel with control signals, providing richer insights without clogging the network. The result is a fulfillment operation that scales smoothly as demand grows, with fewer outages and faster throughput translating directly into financial gains.

Why Traditional Wi-Fi-Based Private Networks Fall Short – And Why a New Approach Is Needed

For years, Wi-Fi has been the default choice for private networks inside warehouses, factories, and logistics hubs. It is familiar, relatively inexpensive, and easy to deploy on a small scale. Yet, as automation accelerates and mission-critical processes move from human control to interconnected systems, these legacy (Wi-Fi-based) private networks are increasingly showing their limitations.

Coverage and Scalability Challenges

Traditional private networks built on Wi-Fi often struggle in large or complex environments. Their limited range means a dense mesh of access points is required to cover even a moderately sized facility, driving up both initial costs and ongoing maintenance. Every new robot, camera, or sensor adds additional load. When sites expand or workflows shift, the network must often be redesigned or “retuned,” consuming engineering resources and increasing downtime.

Performance Bottlenecks

Wi-Fi was never designed for latency-sensitive applications.
In environments where machines communicate hundreds of times per second, even momentary drops or handoff delays can have a significant impact. Robots pause mid-route, video feeds buffer, and time-sensitive control commands are delayed, all of which are small inefficiencies that compound into measurable operational costs.

Interference and RF Noise

Warehouses, industrial floors, and ports are filled with physical barriers and sources of RF noise, metal shelving, heavy equipment, dense fleets of devices, that degrade Wi-Fi signals. The result is unpredictable performance and dead zones that require constant troubleshooting. While public cellular offers broader coverage, it lacks the control, security, and guaranteed capacity that many industries require.

Security and Control Gaps

Traditional private networks can also struggle to meet today’s cybersecurity demands. Unlicensed spectrum environments are more susceptible to interference and eavesdropping, and legacy network designs were not built with granular segmentation and zero-trust principles in mind.

Why a New Approach Is Needed

As industries demand real-time data, automation, and advanced analytics, a more resilient and scalable network foundation is critical. Private 5G and other next-generation architectures are purpose-built to address these gaps, offering licensed or interference-free spectrum, ultra-low latency, broader coverage with fewer radios, and software-defined flexibility to evolve as operations grow.

In short, traditional private networks were never engineered for the scale and intensity of today's industrial applications. To unlock the full potential of robotics, AI, and IoT, organizations need a new approach: one that treats connectivity not as an afterthought, but as the backbone of their operational future.

XCOM RAN: Driving Resilient Networks for Warehousing and Logistics

As warehouses and logistics hubs evolve into hyper-automated, data-driven environments, the foundation that keeps everything moving isn't forklifts or conveyors; it's wireless connectivity. Autonomous guided vehicles (AGVs), robotic picking arms, AI-enabled cameras, and advanced tracking systems all depend on constant, reliable communication. Yet traditional private networking approaches like dense Wi-Fi grids or reliance on public cellular networks often struggle to meet these demands.

This is where XCOM RAN, a software-defined radio access network built for private 5G, is a gamechanger. Unlike legacy networks, XCOM RAN is engineered from the ground up to deliver resilient, high-performance connectivity in RF-dense environments like massive distribution centers or sprawling logistics yards. It integrates seamlessly into your private network and elevates it with features purpose-built for critical operations.

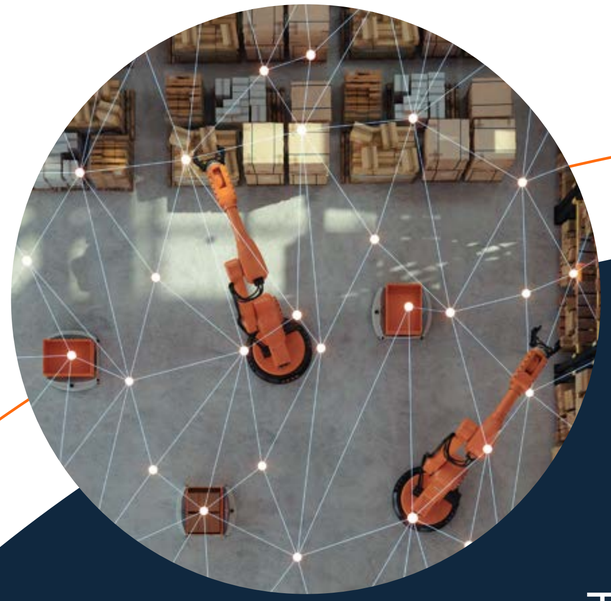
In warehousing and logistics, efficiency depends on timing. An autonomous mobile robot (AMR) must receive route updates without delay; an inventory management system must sync its data in real time; a yard management system needs constant visibility into assets and inbound/outbound schedules. Interruptions, whether from handoff issues, interference, or overloaded access points, cascade into missed service levels, operational downtime, and higher costs.

XCOM RAN addresses these challenges by creating a single "Supercell" environment. Multiple radios work together as one cohesive cell, eliminating mobility handoffs and maintaining uninterrupted connections as equipment and people move through large or segmented facilities. Its software-defined architecture means network behavior can evolve at the speed of software updates, not forklift hardware upgrades.

When applied to warehousing and logistics, this translates to optimized workflows, better asset visibility, and a wireless network that scales as you scale. Whether deploying dozens of AMRs in a single warehouse or connecting a fleet of robotic forklifts across multiple fulfillment sites, XCOM RAN provides the bandwidth, latency, and resilience needed to supercharge operations.

Topline Benefits of XCOM RAN in Warehousing and Logistics

- **Seamless coverage** with no mobility handoffs, even in massive facilities
- **Ultra-low latency and high throughput** for real-time robot control and analytics
- **Software-defined updates** for future-proof scalability and features
- **Reduced infrastructure overhead** with fewer radios needed for full coverage
- **Enhanced interference mitigation** to maintain performance in RF-dense areas
- **Flexible integration** with private 5G cores and existing automation platforms



Tap Into the Full Potential of Your Network

Robotics, automation, and mission-critical applications demand more than a basic private network. To truly scale, streamline operations, and stay competitive, you need a solution designed to handle high-density environments, heavy data loads, and zero-downtime expectations. XCOM RAN delivers that edge as a software-defined, future-proof platform that turns your private 5G network into a supercharged foundation for growth.

Take the next step toward seamless connectivity and operational excellence.

Globalstar™

Ready to transform your network?

Contact our team of experts to learn how XCOM RAN can support your automation journey.