PRIVATE CELLULAR NETWORKS: UNLOCKING VALUE IN WAREHOUSING AND LOGISTICS

EXECUTIVE SUMMARY

Private cellular networking (PCN) is poised to disrupt applications and use cases across many industries. While Wi-Fi and PCN both operate in similar frequency ranges for propagation, Wi-Fi tends to serve connectivity needs on a best-effort basis. On the other hand, cellular infrastructure delivers many unique advantages, especially to operational technology (OT) and RF-challenged environments, given its deterministic capabilities.

PCN provides superior coverage and enables seamless client indoor and outdoor mobility, eliminating network overlays and simplifying management. Furthermore, lower latency will unlock tactile control of machines, machine-to-machine communications, and the ability to manage things in motion. Massive device support will also allow IT and OT administrators to provision and manage thousands of networked devices and sensors quickly and easily. Enhanced encryption, unified policy management, and segmentation will ensure the highest levels of security. These cellular “superpowers” will vary in importance based on specific applications and the use of 4G versus 5G modalities. However, at a high level, PCN delivers the coverage, security, mobility, and reliability required by all enterprises.

Traditionally, enterprise cellular connectivity is used for business redundancy and failover needs. However, organizations such as the OnGo Alliance are democratizing access to licensed spectrum in the United States that is needed for PCN through its general authorized access (GAA) and priority access licensing (PAL) of citizens broadband radio service (CBRS) spectrum. As a result, PCN is gaining momentum as a primary connectivity solution for retail warehousing, inventory management, transportation, and broader supply chain use cases. To this point, it is estimated that there are ¾ million outdoor storage yards in the United States alone, with a majority integrating a warehousing component designed to manage and store raw materials, components, and finished goods. Additionally, some of the largest distribution centers operated by Amazon, Walmart, Target, and others exceed two million square feet – coverage areas that stretch the economics of utilizing Wi-Fi as a cost-effective connectivity solution. Consequently, there is a need for PCN solutions that provide

reliable, secure, and scalable connectivity to support the demands of warehousing and logistics.

PCN adoption is gaining momentum, but enterprises that vertically integrate warehousing and logistical operations require guidance, given the abundance of solutions offered today. Furthermore, significant market attention is directed towards 5G in public mobile network deployments and PCN. However, private 4G LTE is a viable consideration for warehousing and logistics use cases given the requirements of most common use cases, its relatively lower cost than 5G, and its mature client device ecosystem.

Warehousing and Logistics Challenges

Warehousing and logistics operations present unique challenges. Today, asset management in warehouses and outdoor storage lots is predominantly accomplished with limited network connectivity. This leads to inefficient, error-prone, and less-secure workflows. These applications tax the use of Wi-Fi connectivity inherently designed to support fewer devices and concurrent sessions. Furthermore, the typical construction of factories, warehouses, and outdoor storage yards introduces Wi-Fi radio frequency noise and propagation challenges, especially outdoors.

These dynamic industrial environments often include indoor facilities and outdoor depots, creating multiple network overlays that are difficult to manage. Security is also problematic, given the significant number of devices that must be supported and the historic mix of OT connectivity modalities that introduce risk and are difficult to manage within a single management console. As a result, legacy infrastructure tends to create blind spots that can be compromised by bad actors that conduct denial-of-service attacks and extort ransomware.

Finally, and likely the single biggest challenge in warehousing and logistics, is the need to track the movement and location of assets and inventory. These use cases typically involve the utilization of handheld scanners and mobile devices that require consistent and reliable connectivity. However, Wi-Fi handoffs between access points (APs) do not deliver the resiliency and dependability required to support these high-mobility workflows. Beyond PCN's ability to facilitate improved coverage, its underlying architecture is deterministic. This allows a cellular network to serve a client device more efficiently and provide it the strongest connection relative to Wi-Fi.

WHY PRIVATE CELLULAR NETWORKING VERSUS WI-FI

For enterprises engaged in warehousing and logistics operations, four significant advantages are associated with deploying PCN versus Wi-Fi – coverage, security, mobility and reliability.

- PCN provides an extremely broad coverage area and the ability to propagate both indoors and outdoors within a single network overlay. This is ideal for warehousing operations that utilize outdoor storage yards and indoor pick-and-pack facilities. On average, three to five times more Wi-Fi APs than PCN APs are required to cover the same indoor space largely due to the lower noise floor.
- Warehouses utilize a wide array of connected devices and sensors, from scanners to RFID tags and beacons. These OT environments are inherently more vulnerable, given the scale of industrial IoT deployments and the nature of headless devices that are difficult to manage. PCN delivers enhanced encryption based on larger public mobile network operation standards to ensure the highest levels of security. This is anchored by its roots in managing massive device connectivity through a subscriber identity module (SIM) platform.
- PCN delivers mobility capabilities that are not bound by the handoff challenges associated with Wi-Fi. PCN is deterministic, facilitating connectivity that is governed by central network control to optimize signal strength consistently. This is powerful, especially when tracking things in motion, including the inbound receipt of raw materials and components and the outbound flow of finished goods within warehouses.
- At the confluence of better coverage, mobility, and security, PCN delivers rock-solid reliability for industrial applications based on cellular infrastructure that is supported with lightly licensed CBRS and unlicensed spectrum. The advantages to warehousing and logistics operations are less downtime, improved productivity, and, ultimately, higher business profitability.

Beyond these four considerations, PCN provides robust support for industrial applications. It can fine-tune latency, throughput, and other elements to tailor connectivity needs to specific application and device requirements. This is achieved through traffic prioritization and network slicing schemes that deliver SLA-like predictability to ensure mission critical operations have unparalleled connectivity uptime.

PRIVATE CELLULAR NETWORKING INVESTMENT PROTECTION

Significant cost and investment protection considerations make deploying PCN an optimal choice. From an initial cost standpoint, cellular APs are generally more expensive than Wi-Fi APs, but the savings realized in avoiding the densification of Wi-Fi APs over expansive distances in warehouses, distribution centers, and storage yards is substantial. In a typical outdoor storage yard, more than ten times as many Wi-Fi APs as cellular APs are required to provide equivalent coverage. There is also additional cost avoidance with PCN, given its lower deployment expense relative to Wi-Fi AP cabling, mounting, and other associated capital and operational expense outlays. Finally, PCN can mitigate the opportunity costs associated with potential downtime, given Wi-Fi's best-effort capabilities. A major logistics company deploying an Ericsson PCN solution realized a 20% improvement in productivity and a 15% capital investment savings through eliminating Wi-Fi access points and the corresponding connectivity blackouts and dead zones.

Beyond the initial deployment expense, PCN's long-term investment protection makes it shine as an alternative to Wi-Fi. Enterprises can start with 4G and, as use cases necessitate, add 5G APs to a dual mode 4G/5G PCN, often avoiding an extensive rip and replacement of existing infrastructure. Furthermore, PCN provides the flexibility of adding cellular backhaul network elements as needed for point-to-point broadband connectivity when fiber is cost prohibitive or not available. The latter is an important consideration in rural warehousing and logistics deployments or environments where connectivity options are often limited.

STRATEGIC PARTNERSHIP VALUE

Zebra Technologies is one of the most recognized names in industrial automation. The company manufactures connected autonomous robots, barcode scanners, RFID readers, industrial tablets and mobile computers, printers, cloud-based workflow solutions, and more. Over the past two years, Zebra and Cradlepoint, part of Ericsson, have collaborated on several fronts, marrying edge-enabled devices with highly performant PCN infrastructure in warehousing and logistics use cases. To this end, Zebra devices support 4G and 5G connectivity, given cellular's ability to facilitate coverage, security, mobility, and reliability.

From a coverage standpoint, Zebra confirms the 10:1 ratio of Wi-Fi AP to a single outdoor cellular access point with PCN. The company also finds mitigation of data leakage with PCN deployments compared to public mobile network access, given the

ability for its customers to define and implement precise security policy control for devices and IoT sensors. From a mobility perspective, PCN often dramatically improves process automation, reduces operational costs, and speeds digital transformation within Zebra deployments over Wi-Fi. Finally, the higher reliability of PCN unlocks new use cases for Zebra customers tied to remote subject matter expert assistance, improved safety and compliance, and predictive and ongoing maintenance with computer vision applications. Future collaboration plans with Cradlepoint include the ability to pull key statistics from Zebra-connected devices in real time to provide PCN-powered digital experience monitoring (DEM). The resulting data-driven insights could improve future operational performance, return on investment and investment protection in industrial use cases within Zebra and Cradlepoint installations.

Call to Action

PCN is well suited for deployment across a wide range of use cases and applications. Wi-Fi will continue to serve the best-effort connectivity needs of enterprises, but cellular infrastructure delivers many unique advantages, especially in OT and RF-challenged environments. PCN provides broad indoor and outdoor coverage, enhanced security based on public mobile network operation standards, mobility not bound by fixed access points, and reliability based on cellular core and radio architecture, supported with lightly licensed CBRS.

Moor Insights & Strategy believes that Cradlepoint NetCloud Private Networks is a compelling platform unlocking value in warehousing and logistics. It delivers unified cloud management and orchestration in a single pane of glass for management simplicity that spans multi-cloud, network edge to core. Plug-and-play cellular APs and zero-touch provisioning of routers also ease deployment and ongoing management with a Wi-Fi-like user interface that is familiar to enterprise IT professionals. Furthermore, Cradlepoint's use of CBRS GAA 4G mid-band spectrum delivers an optimal balance of price, propagation, and performance, offering a path to 5G as enterprise demands grow. Last but not least, strategic partnerships and co-development efforts with companies such as Zebra Technologies and channel partners also demonstrate Cradlepoint's understanding of the unique needs of warehousing and logistics.

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