**ZEBRA**

Is Your Wireless Network Industrial Strength?

FIVE CRUCIAL QUESTIONS TO ASK AND ANSWER AS YOU PREPARE YOUR INDUSTRIAL ENVIRONMENTS TO TAKE FULL ADVANTAGE OF TODAY'S RAPIDLY EXPANDING WIRELESS COMMUNICATIONS OPPORTUNITIES

It's Time to Call the Wireless Communications Systems in Use in Your Industrial Facilities on the Carpet.

Here's why: When it comes to wireless communications, most industrial environments are three to five years behind the carpeted space. After years of focusing heavily on corporate office and branch WLANs, many organizations are surprised at what they're finding when they look to leverage today's advanced mobility tools beyond the carpeted space. They're discovering that while they've been concentrating elsewhere, their industrial wireless communications needs have both substantially grown and radically changed, to the point where existing networks and traditional approaches will no longer support the operational performance that is required to thrive in a changing market.

The Difference Maker

Although it began as a trickle, the movement toward re-shoring or expanding domestic industrial capacity is quickly becoming a trend. To make the most of the myriad opportunities this accelerating trend offers, manufacturers, distributors, wholesalers, retailers, logistics providers — and virtually every other link in the supply chain — are evolving their communications networks to meet the numerous challenges posed by today's industrial spaces. As these environments become larger, more complex and more reliant on operations-critical real-time communications technology, organizations are beginning to recognize that industrial strength wireless technology can be a differentiator. They understand that a high-performance, purpose-built industrial WLAN is a critical success factor in maximizing the benefits of mobility in their manufacturing, distribution and storage facilities.

All WLANs Are Not the Same

Organizations that operate both industrial and non-industrial facilities have quickly learned that their wireless needs are not the same. Especially those who attempt to use office- and consumer-grade technology from the civilized, climate-controlled carpeted space to support their complex, fast-paced, RF-challenged industrial environments. You don't simply need a WLAN; you need the right WLAN. Planning and implementation are no longer as simple as asking how many square feet you have, the type of materials used in constructing your building and calculating how many access points you'll need. Today you need to know much, much more. How many users will be on the network? How many and what kinds of devices will they be using? Which applications will your network have to support today and in the future? How will the equipment, assets, and materials that move within and throughout your industrial environments affect your network?

Industrial Strength Wireless Networks

Industrial wireless network operations and IT managers face a host of difficult challenges that are unique to industrial environments. Overcoming these challenges is what an industrial strength wireless network is all about. You need a system that's tough, intelligent and reliable enough to meet and master a host of major communications challenges you don't find in carpeted spaces.

As you examine your current industrial wireless system, or plan a new or upgraded network, it's crucial to understand the specific challenges you will face and the capabilities your network will need to provide to overcome them. Thoughtful and thorough answers to these five questions will help you ensure that your wireless network is truly industrial strength.

33%

33% of manufacturing companies are considering re-shoring their production operations, with 14% definitely planning to do so.

MIT/WSJ, July 2012

74.8%

When asked if they were confident in the capabilities of their current industrial communications wireless network infrastructure, 74.8% of respondents said, "not without modifications or investment."

AutomationWorld.com Survey, July 2012

1 Can Your WLAN Support Reliable Mobile Connectivity in a Complex and Dynamic Environment?

The nature of industrial environments is a constant state of flux, requiring the wireless network to quickly adapt to changing dynamics. Inventory and equipment are continuously being shipped and moved, changing the physical state of the space virtually minute-to-minute. There's also their sheer size, with structures getting bigger, taller and more dense, and often encompassing both indoor and outdoor facilities and hundreds of thousands of square feet that challenge coverage and connectivity. Equally important is the need for mobility. Industrial environments have never been more on the move — in terms of people, equipment, materials and merchandise — than they are today. The need for nomadic communications solutions — including seamless roaming for a wide variety of users and devices — has never been more critical.

Your optimum solution is a high-performance voice and data mobile network that empowers your employees to conduct business efficiently and productively while moving on foot or in vehicles ranging from forklifts in a warehouse to tugs and yard trucks in a port facility. The network must also provide the reliable machine-to-machine (M2M) connections that empower productivity-enhancing automation. Operationally, you need a self-healing network that assures continuous uptime for business-critical industrial equipment and applications.

| THROUGH 2015, MOBILITY IS THE | #1 | TECHNOLOGY PRIORITY FOR WHOLESALERS |
| | #2 | TECHNOLOGY PRIORITY FOR MANUFACTURERS |

GARTNER, September 2012

2 Can Your Network Support a Plethora of Consumer and Industrial Strength Devices?

Dynamic industrial wireless environments don't just have to deal with a wide variety of mobile workers; they also have to accommodate an equally wide variety of wireless devices with varying antenna strengths and receiver sensitivities, which can affect connectivity. Different workers need different devices for different tasks. Some have powerful laptop computers, others reliable ruggedized handheld and wearable computers, bar code scanners, RFID readers and other technologies that can withstand the rigors of the industrial space and provide hands-free data collection and communications.

Further complicating the issue is the growing use of employees' personal smartphones or tablets. Your network must account for the performance limitations of these various devices, and have the power and inherent intelligence to compensate for these issues to ensure reliable connectivity under even the most challenging RF conditions.
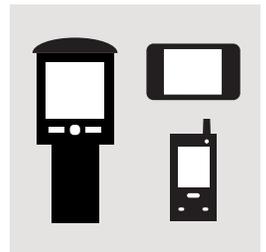
| 21% | OF MANUFACTURERS SURVEYED ARE DEPLOYING RUGGED HANDHELD COMPUTERS FOR WAREHOUSE MANAGEMENT |
| 15% | OF MANUFACTURERS ARE NOW SUPPORTING ENTERPRISE SMARTPHONES FOR ASSET AND FACILITIES MANAGEMENT |

Zebra Manufacturing Barometer, 2013

3 Can Your Industrial Network Deliver the Optimum Amount of Bandwidth for Each Voice, Data and Video Application?

There's no question about the proliferation of powerful applications designed for industrial environments. The only question is which specific applications you anticipate utilizing in your operations, and how much bandwidth each requires; for example, telnet sessions and native apps require less bandwidth than browser-based applications and video. The bandwidth discussion begins with the need for reliable range and coverage that make bandwidth accessible throughout your operation. The next step is providing the optimum amount of throughput.

One thing you can be certain of is that the growth of browser-based network access and cloud-based applications will drive more traffic over the network. You can also be sure that many of today's lower-bandwidth systems will be unable to handle it effectively. Although the 802.11n standard provides significant bandwidth capabilities, bandwidth is nevertheless always finite. The reality is, optimization of 802.11n benefits depends largely on how you architect your network and segment and route your traffic. That makes how you manage your bandwidth key to optimizing operations. Your industrial network must enable you to avoid congestion and bottlenecks by efficiently controlling your bandwidth, allowing you to deliver the right amount of throughput for the right application on the right device at the right time.
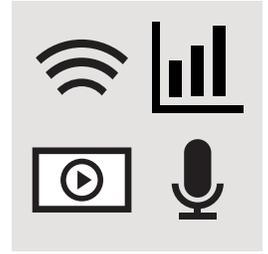
4 Do You Have the Tools and/or Resources to Monitor and Manage Your Industrial Wireless Network and Devices in Real Time?

Industrial wireless networks are becoming more and more complex. To reap maximum value from highly complex systems like these it's imperative to have real-time management of your network components, your devices and your applications. Whether you're in a production, warehouse or other supply chain environment, downtime is always the enemy. Your network must enable proactive rather than reactive troubleshooting and provide systemwide security that guards against intrusion and the growing risk of cyber attacks.

Ultimately, effective management demands centralized visibility and control of your entire system — including WiFi infrastructure, mobile devices, scanners, readers, sensors and applications — that provide the reliability and redundancy you need indoors and out. A critical question is: Do you have the technical expertise and resources to manage your industrial networks internally? For many organizations, that's simply not the case, at least not without some help.

What kind of help? It can come in the form of integrated security, management and troubleshooting tools that can decrease the complexity and risks of building and maintaining an industrial network. It can also come from forming a partnership with an expert in mission- and business-critical wireless communications. In this model, you can concentrate your efforts on your core business while your managed services partner concentrates on planning, provisioning, monitoring, troubleshooting and optimizing your network and devices.
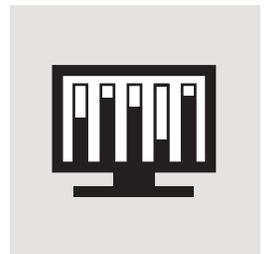
# 5 Can You Deploy a Unified Corporate-Wide WLAN Optimized for Both Carpeted and Industrial Environments?

The reality is, virtually all corporate-wide wireless networks are going to have something of a split personality. What's optimal for the relative calm of the carpet is simply not going to be ideal for the rough-and-tumble atmosphere of the plant floor, distribution center or yard. Yet the right solution is hardly ever the added complexity and expense of a bifurcated network. In the best of all possible worlds, you need a powerful single network that can be optimized for both environments. This optimization may require a relatively simple hardening of the hardware supporting your network, either inherently in the equipment or by adding additional components such as aftermarket NEMA enclosures. It might also require more specialized support for faster roaming and more cost-effective redundancy features to ensure connection reliability and availability.

The carpeted space solution will maximize indoor office voice and data communications, while the industrial network is ruggedized for indoor/outdoor coverage, mobile connectivity, complex RF challenges and extreme conditions and temperature ranges. Although performance and reliability are paramount, the ultimate key to enhanced productivity and ROI is having powerful unified network management capabilities. Your optimum corporate network will provide an integrated management and control platform that enables you to monitor and maximize performance of both network environments in real-time from a single centralized command center.

Prepare to Reap the Benefits

As you answer the five fundamental questions posed in this paper, it's important to understand that the answers are anything but theoretical. They reflect the fact that in the real world industrial environments are a far cry from the climate-controlled calm of the carpeted space. They're hectic, intense, demanding and complex, and they come in a wide variety of sizes and shapes. But they all have one thing in common. Virtually every industrial environment demands a high-speed communications network that is more robust, more efficient and more reliable than any standard system deployed in an office building or corporate headquarters.

That's why for a growing number of organizations it has become business critical to make sure the wireless systems in these facilities can deliver the performance that these unique and specialized environments require. For a peek at how rugged, operations-critical wireless networks can empower different types of industrial environments, we've divided them into four broad categories.

MANUFACTURING PLANTS

PORT ENVIRONMENTS

CORPORATE OFFICES

WAREHOUSES AND DISTRIBUTION CENTERS
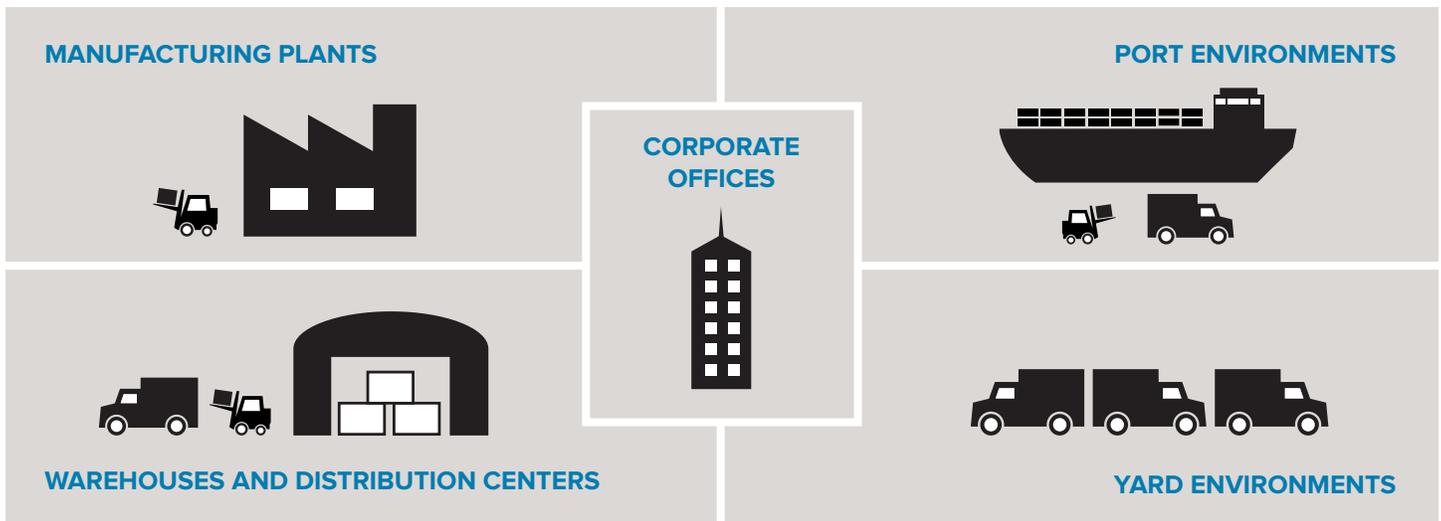
YARD ENVIRONMENTS

Industrial Strength Manufacturing Plants

Today, forward-looking manufacturers are managing and shaping their new realities through the use of ruggedized, high-speed wireless networks developed for complex industrial environments. High-performance wireless communications networks can enable both process and discrete manufacturers to access, move and manage voice, video and data on a single converged network. Because in a production environment uptime is essential, wireless systems must be able to support productivity-enhancing automation, streamline processes and be highly reliable, self-healing and redundant. They also help manage and mitigate risk, and provide real-time actionable intelligence that helps improve quality and control.

Modern manufacturing operations utilize a wide range of communications applications. Mobile operators are leveraging wireless to create mobile extensions to the Human Machine Interface (HMI) using remote access and virtualization. The right wireless networks can push alerts and work orders for both preventative and reactive maintenance for production equipment using HMI. They can extend alarm and alert integration from Programmable Logic Controllers (PLC) to devices on the plant floor, and support real-time video monitoring and surveillance. In addition, they help streamline plant communications by bridging Push-to-Talk (PTT) across two-way radios and wireless VoIP devices.

Effective industrial wireless networks can also help ensure compliance with production specifications and regulatory controls. They can support real-time testing of finished goods, monitor status and performance in real time against key performance indicators (KPI) and ensure lot and batch traceability. By validating locations and machinery where readings are recorded, they can also ensure that operator rounds have been performed on schedule and at the appropriate locations across the plant.

Industrial Strength Warehouses and Distribution Centers

As companies strive to respond more quickly and accurately to customer demands, the value of efficient inventory storage, movement and control is hard to overestimate. Today's warehouses have become bigger, taller and more densely packed than ever. There are more SKUs, shorter cycles and a premium on fast, accurate fulfillment, as well as high worker turnover and escalating labor costs. More manufacturers, wholesalers, logistics companies and retailers are turning to wireless networks— and the rugged mobile devices they support — to help them automate and streamline operations, enhance flexibility to respond to consumer demand and better manage risk.
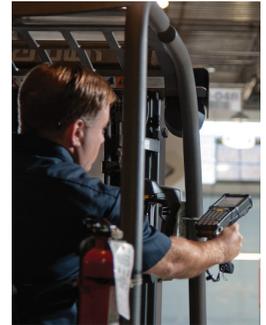
Industrial strength wireless networks can enable automation and mechanization of labor-intensive processes such as receiving, put-away, storage, cycle counting, picking and packing, loading and shipping. They can also deliver high performance in difficult cold storage environments such as refrigerators, freezers and chillers. Industrial wireless systems deliver mobile, telnet or browser-based access to the Warehouse Management System (WMS), providing a robust and reliable user interface to enhance worker productivity. They can provide persistent connections and roaming on fast moving warehouse equipment such as forklifts and crawlers, as well as connectivity for all handheld scanners and mobile computers in use across the space. The networks can also help assure efficiency with locationing capabilities that identify the presence of workers, assets and vehicles for optimal task management. The result is streamlined end-to-end operations in warehouses and distribution centers, as well as throughout the entire supply chain.

20%	MATERIAL AND PRODUCT HANDLERS
24%	PRODUCTION WORKERS
30%	INSPECTORS AND QUALITY CONTROL PERSONNEL

Today, 20% of material and product handlers, 24% of production workers and 30% of inspectors and quality control personnel are equipped with handheld mobile computers, more than double since 2010.

Zebra Manufacturing Barometer, 2013
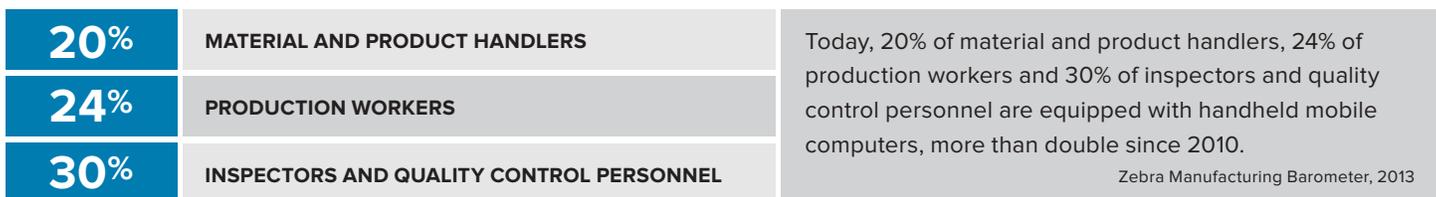
Industrial Strength Yard Environments

A typical storage and staging yard is a fast-paced outdoor environment in constant motion over long distances, which can grow to become miles long and miles wide. These spaces rely heavily on real-time wireless communications that allow cadres of workers on foot to coexist with many different types of intelligent vehicles, both manned and unmanned. WiFi-enabled semi trailer-trucks, cranes, yard trucks and more can help keep operations flowing smoothly and safely in environments such as rail yards, container terminals, intermodal facilities and cross-docking hubs. They can help ensure that containers are loaded and off-loaded to and from the right delivery vehicles and that dropped trailers (and the goods and materials within them) are not misplaced or lost. And they do it all quickly, efficiently and, above all, accurately. Utilizing high-speed voice, data and video wireless communications to and from a wide range of mobile and fixed devices, today's industrial wireless networks also enable real-time management of the entire indoor-outdoor network from a single screen.
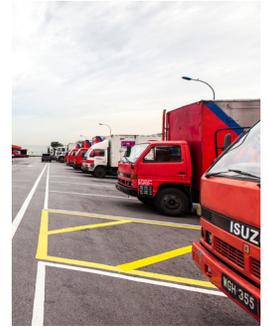
Industrial strength wireless networks deliver crucial mobility across the outdoor space and allow real-time access to the Yard Management System (YMS). They support sophisticated, bandwidth-intensive applications such as remote video surveillance and mobile voice, video and data connectivity, while increasing efficiency by simplifying the monitoring and tracking of shipments, containers and contents in real time. Wireless networks also help minimize losses by keeping track of all your assets, from reusable pallets to forklifts to 20-ton tanker trucks. In addition, overlay wireless narrowbanding solutions can offer cost-efficient text-based messaging across long distances and in especially challenging RF environments.

Your industrial wireless networks also help streamline delivery and shipment by instantly directing drivers to the correct dock, improving turnaround times, reducing idling and saving fuel. You can direct workers to precise locations, maximize receiving and cross-docking operations, monitor vehicles and drivers to improve safety and productivity and set up automated gate-in, gate-out operations.

Industrial Strength Port Environments

The growing globalization of commerce has increased the importance of highly efficient port operations as part of the supply chain. Like everything else in the global economy, port operations have become an extremely competitive marketplace. All over the world, ports are vying to differentiate themselves through streamlined processes, utilizing industrial wireless networks that help optimize receiving, storage and delivery, in most cases under extremely chaotic and challenging RF conditions.

Port operations present a formidable test for the coverage, connectivity and performance of wireless communications technology. A snapshot of a typical port environment shows a 24-hour hive of activity made up of people, containerized cargo, ships and multiple transport modes that are increasingly reliant on industrial wireless communications to help things run smoothly, efficiently and cost-effectively. High-quality, real-time wireless voice, video and data communications can help ensure that this complex mix of semi-trailer trucks, rail cars, mobile cranes, forklifts, hostlers and turtles, terminal operators, ships and longshoremen keeps manifest integrity and meets rigid time schedules. Port environments are also rife with RF challenges — 40-ft. steel containers stacked five-high, for example — making interference-mitigating wireless technology essential. The critical importance of security demands a number of wireless-enabled applications, including landside and waterside perimeter video surveillance, automated license plate recognition for identifying and verifying vehicles, fixed and mobile TWIC readers to verify identity of personnel requiring unescorted access to various areas of the port, and sensors for detection of pre-determined thresholds related to theft or terrorism.

20% to 39% Forklifts equipped with vehicle mounted mobile computers have increased from 20% to 39% since 2010.

Zebra Manufacturing Barometer, 2013

The Industrial Wireless Opportunity

Today's industrial spaces — from the plant floor to the warehouse and out to yards and ports — present significant challenges not normally encountered in the carpeted space. It's readily apparent that the typical use cases for industrial wireless networks and mobile devices are more stringent and demanding than most wireless equipment has been designed and built to support. As many organizations are discovering, many WLANs from the carpeted space are generally unsuited for these harsher, more mobile, more complex industrial environments.

To help you answer these five critical questions, examine the use cases outlined throughout this paper, and analyze the specific challenges of expanding and hardening your own industrial wireless networks. The time is now to make sure your industrial environments are empowered and protected by wireless networks that are truly industrial strength.

Zebra Leadership Series
This paper is one of a series examining the challenges, the opportunities and the realities of how wireless communications innovation is transforming the enterprise.

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