DIFFERENT BY DESIGN™

INDUSTRY BRIEF: CBRS PRIVATE WIRELESS

The Fundamental Glue for Industry 4.0 Realization

OVERVIEW

The Premise of the Fourth Industrial Revolution, Industry 4.0

The move toward the fourth industrial revolution is one where factories have machines that are augmented with wireless connectivity for sensors, control, visual inspection, and more, which in turn are connected to a system that can visualize the entire production line and make decisions on its own. In essence, Industry 4.0 is the trend toward communications, automation, and data exchange in manufacturing technologies and processes that include cyber-physical systems (CPS), the internet of things (IoT), industrial internet of things (IIOT), cognitive computing, and artificial intelligence.

WHAT IS CBRS?

CBRS is a band of radio-frequency spectrum from 3.5GHz to 3.7GHz that the Federal Communications Commission has designated for use by the private sector to enable new forms of mobilized enterprises and enable new solutions across multiple industries.

A fundamental element of this revolution is the mobilization of the factory, with communications for both machines and humans as a pervasive and guaranteed element to ensure the symbiotic interactions to operate the Industry 4.0 factory smoothly.

The National Academy of Science and Engineering's Industry 4.0 Maturity Study illustrates this as the cross-section of Structured Communications with Digital Capability (Figure 1). This model accurately highlights key areas of communications and considers the following important connectivity elements within a realized Industry 4.0 factory:

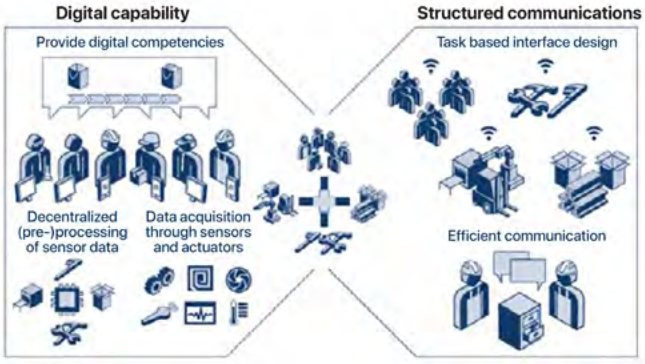

Figure 1 - Source: Industry 4.0 Maturity Index Study, National Academy of Science and Engineering

Important connectivity elements within a realized Industry 4.0 factory

- Sensors and controls, which must be increasingly more mobile and agile within the factory, must have connectivity to maintain accuracy of the factory workstreams.
- Operations and planning of the factory demand mobile communications tools, from tablets and hand-held computers to audible and visual tools that are with them at all times and have persistent access to the digital knowledge base.
- Floor-level machines and tools, from full-size robotics to cobots, palletizers, and hand-held tools, will be connected for traceability, communications, safety methods, and access to data that is crucial to achieve Industry 4.0.
- Operators must have the ability to quickly and efficiently communicate with each other, or among groups. Hands-free communications tools that can enable immediate workgroup or specialist connectivity to resolve floor issues, and communications apparatus that are smart enough to use proximity sensing for safety, will be critical to empowering Industry 4.0.

SITUATION

Building an Industry 4.0 Connectivity Framework

To envision the details of providing Industry 4.0 connectivity, one must examine specific use cases within a factory and then identify the efficiencies that can be achieved and mobilization methods that are available. It is well known that adoption of new spectrum support, and even wireless in general, is not common on all machines and that adaptors and methods to mobilize such equipment can be cost-effective and reasonable. At the same time, the rate of adoption for new private wireless as an embedded capability is growing at a tremendous rate. This will be an area of leverage for those that have invested in flexible and scalable private wireless infrastructure.

The following chart examines 18 different edge devices and connectivity requirements that can mobilize workstreams, operations, security, and communications that achieve the Industry 4.0 Structured Communications and Digital Capability model.

This Connectivity Framework serves as a guide and an approach to examine any given factory's devices and workstreams. It also focuses purely on the connectivity use cases, means to connect, and related efficiencies. In practice, it is important to consider that a private wireless connectivity system must also provide for mapping to internal and external data sources and allow for grouping of various systems into such secure and prioritized network topologies as virtualized local area networks (VLANs) and to both private cloud and public cloud data sources. To consider this, we take a look at means of scalable systems that can slice spectrum and map it into various networks and systems.

	Connectivity Use Cases	Business Efficiencies Objective	Mobilization Methodologies
IT System Workflow Mobilization	· Automated Guided Vehicles (AGVs) · Mobile Cobots · SCADA Controllers/Sensors · Palletization Controllers · Video Quality Inspection · Product WIP SW Image Load · Proximity/Location Sensors	Ensure pervasive data connectivity throughout the factory or warehouse regardless of changeover states, wireless impeding equipment, flows, or active movements during workflows. Provide connectivity assurances and reliability with mapping to related networks (VLANs) and services with service quality metrics and enterprise security practices.	Small form factor Ethernet bridges, USB dongles, or localized gateways provide flexible and reusable connectivity methods that can align with overall IP networking topology.
Maintenance & Operations	· Mixed Reality Headsets · Audible Interactive	Provide visual and/or audible access to maintenance databases and support technicians to optimize repairs or changeovers. Provide safety geofences and workflow guides.	On-body secure mobile connectivity with wireless headset and ear-worn devices that may include remote vision (cameras) for enabling hands-free remote assistance.
Facility Security	·Video Surveillance · PTT Radios	Ensure real-time and persistent communications and monitoring of the facility with a move toward object and POI visual identity and alert systems.	Hardened PTT radios and video cameras using small form factor Ethernet connectivity to wireless infrastucture.
Factory & Warehouse Communications and Data Access	· Hardened Tablets · LED Display Systems · Hands-free Intercom · PTT Radios · Mobile Phone Private Data · Mobile Phone – PBX Extension · Hand-held Code Scanners	Utilize a common wireless infrastructure to enable multiple methods of human communications and data access throughout the facility. Include operator hands-free intercom layers, tools for access to internal databases, and workflow management systems for a common yet flexible mobile communications infrastructure.	Mobile devices, belt pack intercom systems, and hand-held computers and scanners available for direct connectivity to private wireless infrastructure are emerging or exist today. Mobile smartphones with DSDS (Dual SIM) and private band support can be connected into the private network.

Figure 2 - Industry 4.0 Connectivity Framework. Source: JMA Wireless

Industry 4.0 Grade Private Wireless Connectivity Slicing and Mapping

Infrastructure selection for private wireless should consider flexibility to leverage all available spectrum, the ability to group or combine spectrum into slices of capacity, and to map these slices into different network systems. Modern wireless systems have moved to virtualized software that has the flexibility to change as the factory changes and as the technology changes. Moreover, these systems and their radio counterparts to distribute radio waves throughout the factory are architectured as factory-grade systems that can withstand harsh environments and distribute waves (RF energy) into complex areas of factory floors, often with a host of fixed and moving metal objects.

Modern private wireless technologies will have core capabilities that operate on factory compute infrastructure (data center and cloud-oriented) and use hardened and The above diagram illustrates the Industry 4.0-ready private wireless system from JMA. At the core of this system is its XRAN virtualized software, which has realized flexible radio functionality in software, providing extreme scalability that allows factories to realize the full potential of available spectrum. The XRAN software then uses JMA's industrial-grade radios connected over a fiber infrastructure so that factories can depend on connectivity and realize flexibility to scale into the future using software programmability. Moreover, JMA has built the ability to slice the spectrum throughout the factory and map those slices into key layers of the factory networking system.

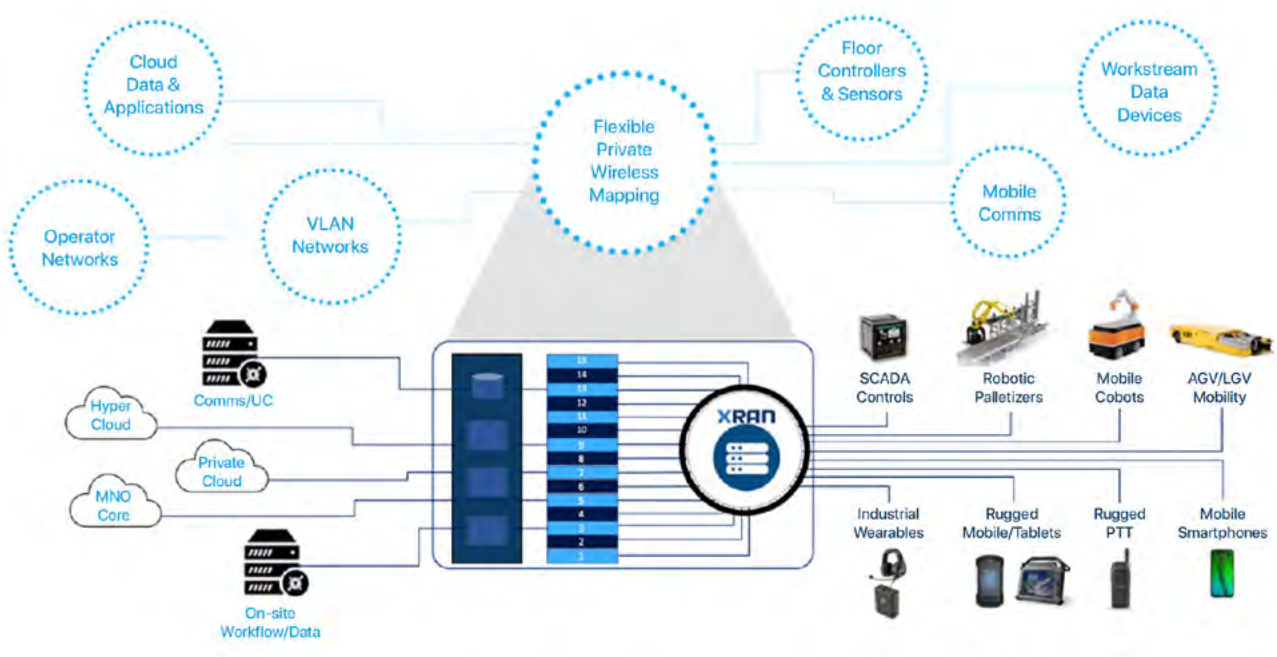

Figure 2 - Industry 4.0 Connectivity Framework. Source: JMA Wireless

Conclusion

For executives and IT management considering their connectivity infrastructure and ways to leverage the new private wireless spectrum called CBRS (Citizens Broadband Radio Service), it is crucial to consider the reliability, scalability, and flexibility of these systems. New technology innovations have taken these systems far beyond basic access point hardware designs and will provide you with an ability to maximize your use of the available spectrum. In 2020, no industrial advanced technology planning should go forward with Industry 4.0 planning without an exhaustive examination of this new technology.

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About JMA Wireless

JMA Wireless is the leading global innovator in mobile wireless connectivity solutions that ensure infrastructure reliability, streamline service operations, and maximize wireless performance. Employing powerful, patented innovations, their solutions portfolio is proven to lower the cost of operations while ensuring lifetime quality levels in equipment and unrivaled performance for coverage and high-speed mobile data.

JMA Wireless solutions cover macro infrastructure, outdoor and indoor distributed antenna systems, small cell solutions, and virtualized RAN software. JMA Wireless corporate headquarters are located in Liverpool, NY, with manufacturing, R&D, and sales operations in over 20 locations worldwide.

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