Wi-Fi 6 ACCELERATES ADOPTION OF INDUSTRY 4.0

While automation is one of the most prominent trends associated with **Industry 4.0**, the latest phase of the **Industrial Revolution**, another key element of Industry 4.0 is **wireless data**, and the ways that real-time information, made available over wireless connections, enhances industrial operations.

From production to warehousing and delivery, a wide variety of Industry 4.0 use cases build on the new ways we can wirelessly gather, analyze, interact with, and use real-time information. Whether it's smart sensors wirelessly transmitting status at key points of the production line, wireless Augmented Reality (AR) headsets helping maintenance personnel analyze and repair equipment, or Autonomous Guided Vehicles (AGVs) wirelessly navigating a warehouse to restock inventory – Industry 4.0 relies heavily on the latest capabilities of wireless connectivity.

5G IS PART OF THE PICTURE

When wireless coverage needs to service a large outdoor area, such as a shipping port or an industrial park, 5G cellular is a logical choice for deploying Industry 4.0 use cases. In some instances, especially at large-scale production sites, manufacturers are even deploying and operating their own private 5G networks as part of their Industry 4.0 strategies.

This makes sense, since 5G offers high-density, low-latency, broadband operation over a wide area, so it's a good option for Industry 4.0 use cases like high-definition video surveillance covering a large outdoor area, automated traffic control to manage the flow of delivery vehicles, and autonomous delivery drones that service outdoor locations.

WI-FI 6 TAKES INDUSTRY 4.0 INSIDE

When operations move indoors, though, and wireless signals don't have to travel over such long distances, the latest generation of Wi-Fi technology, Wi-Fi 6, is often a more cost-effective approach for deploying Industry 4.0 use cases, because Wi-Fi 6 is less expensive to deploy and operate compared to cellular:

- **No License Fees**

   Wi-Fi 6 operates in unlicensed bands
   (2.4 GHz, 5 GHz, and now 6 GHz, with Wi-Fi 6E),
   so there are no spectrum fees or access charges to pay.

- **Lower-Cost Infrastructure**

   Wi-Fi 6 access points are typically less expensive than their cellular counterparts, and a full Wi-Fi 6 deployment can be created using only access points and a controller for management. 5G typically requires additional hardware, including Multi-access Edge Computing (MEC) servers and small-cell gateways, on top of access points.

- **Cost-Effective Expansion**
   The introduction of 6 GHz spectrum, with Wi-Fi 6E, opens up new spectrum space and enables low-cost expansion. The 6 GHz bands can be used for large-scale deployments of smart sensors that connect to the Internet of Things (IoT), as well as high-bandwidth applications such as Augmented and Virtual Reality (AR/VR).

WI-FI 6 DELIVERS WHAT INDUSTRY 4.0 NEEDS

Simply put, what 5G cellular does for wide-area access, Wi-FI 6 does for local access. Each Wi-Fi 6 access point reaches farther and covers a greater area, and can support many more devices at once. Wi-Fi 6 also delivers a dramatic boost in speed, plus a 50% improvement in battery life, a 4x increase in network capacity, and a 2x increase in bandwidth over previous generations of Wi-Fi. When it comes to Industry 4.0 use cases, there are four Wi-Fi 6 features that are particularly relevant:

1. TWT for Low-Power IoT Sensors and Longer Battery Life with TWT

A power-efficient scheduling scheme, called Target Wake Time (TWT), lets a Wi-FI 6 access oint schedule the wake time for each client, based on individual device requirements and expected traffic activity. That helps extend battery life in a variety of IoT sensors, and enables more flexible placement of condition-monitoring devices. The result is more reliable inputs, the ability to connect previously unconnected machinery, and better energy management in power-sensitive applications.

2. Low Latency for Improved AR

AR applications, headsets, and smart glasses enable a variety of new ways to get information and interact with data. Developers can explore 3D designs before they're built, maintenance crews have hands-free access to more advanced diagnostics and repair instructions, warehouse workers can locate items faster, and training sessions can provide real-world experience while keeping people safe. Wi-Fi 6 delivers the necessary latency, as well as the robustness and reliability, needed to supply AR use cases with video, voice, and real-time data visualizations.

3. OFDMA for Network Efficiency and Determinism

Wi-Fi 6 provides network access using Orthogonal Frequency-Division Multiple Access (OFDMA), which lets multiple users, with varying bandwidth needs, use the channel simultaneously. OFDMA means Wi-FI 6 supports more deterministic industrial networking performance than ever before, ensuring much higher Quality of Service (QoS) than with previous Wi-FI standards. More efficient resource management also leads to more reliable performance at all times, particularly as more devices are connected, so every device, be it a tiny sensor or a fully automated robot, benefits from faster, more efficient service.

4. Beamforming for Higher Network Capacity

Wi-Fi 6 uses a transmission technique, called beamforming, to create a faster, more reliable connection. Transmit beamforming enables higher data rates at a given range, making it possible to accommodate more devices on the network at once. Transmit beamforming is already part of Wi-Fi, but Wi-FI 6 increases the number of beamforming streams from four to eight, and as a result substantially increases network range, throughput, and capacity. An industrial deployment can expand to accommodate more devices while maintaining reliable connectivity.

A VALUABLE UPGRADE

As in the home and the enterprise, industrial environments need to expand their support for traditional Wi-Fi applications, especially internet access for mobile and computing devices. Across the board, more people are using more devices to access more data, and industrial applications need to address this. The added capacity and bandwidth of Wi-FI 6 makes it a compelling upgrade on these grounds alone.

At the same time, though, Wi-FI 6 can bring the added benefit of enabling Industry 4.0 use cases that need a robust, reliable, secure, and flexible Wi-Fi infrastructure. That includes things like production lines that are more automated and flexible, Real-Time Location Services (RTLS), condition monitoring, robotics, wearables, AR, and safety applications.

Ultimately, Wi-Fi 6 and the opening of the 6-GHz band for Wi-Fi 6E presents an enormous opportunity for Wi-Fi to provide low-latency, high-performance indoor connectivity in dense industrial environments. Combine this with lower infrastructure costs, as well as near universal coverage, and Wi-Fi 6

becomes an even more compelling option Industry 4.0 use cases. What's more, Wi-Fi 6 is a cost-effective complement and support technology for services running over 5G, so industrial applications can extend in-place 5G services by adding Wi-Fi 6 for indoor operation.

OPTIMIZING FOR INDUSTRY 4.0

At NXP, our engineering teams are optimizing Wi-FI 6 to ensure robust, high-QoS, industrial-grade network performance for a variety of mission-critical applications. We offer high-performance solutions alongside out IoT chipsets, to provide connectivity on both the access and client side.

We've also optimized Wi-Fi 6 for battery-powered operation, with solutions that enable a more than 50% reduction in standby power compared to previous generations of Wi-Fi. We increase flexibility by adding Bluetooth 5.1 functionality to Wi-Fi 6 operation. Careful integration saves on power here, too, since the onboard Bluetooth radios use ultra-low-power communication for their interactions.

CONNECT WITH NXP TO DISCOVER THE POSSIBILITIES

NXP offers one of the broadest wireless portfolios in the industry, and our early success with Wi-Fi 6 shows just how committed we are to creating a connected world that anticipates and automates. To learn more about our Wi-Fi 6 solutions, visit **www.nxp.com/wifi6**.

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