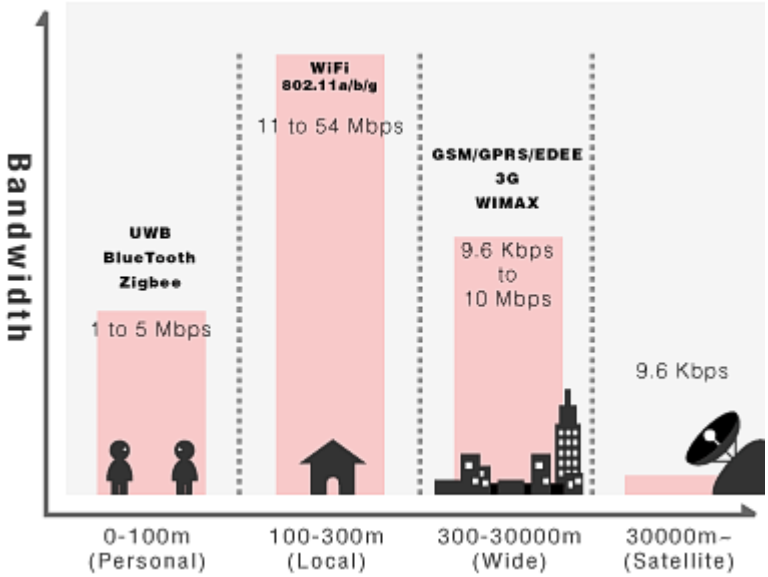
Choosing a Wireless Technology

If you have been considering going wireless for your industrial application, you're not alone. With the explosive growth of wireless adoption in consumer and commercial sectors, industrial system integrators are wondering what wireless can do for them. Recent marketing studies conclude that the market for industrial wireless networking products will grow 36% each year for at least the next 4 to 5 years. Flexibility with installation and lower costs are the most common motivations when system integrators decide to go wireless.



A dizzying number of wireless technologies and standards, such as Bluetooth, Wi-Fi, 3G, and more, are available for use with industrial applications. But with so many choices, how can an industrial system integrator know which industrial wireless solution is best for the application at hand?

The best starting point is to understand the intended application. For most industrial applications, system integrators need to connect remote devices to an existing network. What is it that you intend to accomplish?

- If you need to establish a wireless local network infrastructure, you need the wireless equivalent of a **switch**--a wireless access point.
- If you need to establish a wireless wide area network connection, you need the wireless equivalent of a **modem or router**.
- If you need to connect a remote serial device such as a PLC or RTU to an existing network, you need the wireless equivalent of a **serial device server** or **serial modem.**
- If you need advanced management, such as protocol conversion, of remote devices in a compact, flexible, easily-installed package, you need a **wireless embedded computer**.

Once you understand the needs of your application, you can determine whether an appropriate wireless solution exists for you.

Selecting the right technology
Finding the appropriate wireless solution for your industrial application depends on your specific needs, such as transmission range, data rate, reliability, and security. Cost and ease of setup and maintenance are also important factors. You must consider your existing network infrastructure and what it is equipped to handle. Of the different wireless technologies that are available, **WLAN** and **cellular** technologies are the most suitable for typical industrial applications.

	WLAN	Cellular
Range	100 to 300 m	Up to 30 km, depending on base station
Bandwidth	Up to 54 Mbps	Up to 160 Kbps (Edge)
Reliability	Depends on individual installation	Depends on cellular provider
Security	Essentially open standard with imperfect security measures means special precautions must be taken	Fewer security concerns due to strict licensing and bandwidth allocation for cellular providers
Standards	Open standards that are widely recognized and used	Depends on cellular provider, usually region-based
Setup, Maintenance	Private installations require investment in access points, transmitters, etc.	Cellular provider responsible for infrastructure

WLAN technology is based on well-established 802.11 standards that include the popular standard known as Wi-Fi. Since the 802.11 standards are open, any compliant device can connect to another compliant device, and anyone can generate and power their own wireless network by installing access points. WLAN is ideal for applications where a network infrastructure is already in place, and is typically used when wireless Ethernet/Internet access is required at high data transfer speeds. However, WLAN technology has well-known security issues, so encryption methods such as WEP, WPA, and WPA2 are required for critical data. Also, a new WLAN installation requires careful planning and tuning to achieve the most benefits.

With **cellular technology**, devices communicate over cellular networks that are managed by licensed cellular providers. Several cellular standards are in use worldwide, with GSM/SMS (2G) firmly established, and GPRS/Edge (2.5G/2.75G) and CDMA or 3G growing quickly. Network availability and reliability is also dependent on the specific cellular provider. Although cellular bandwidth is significantly lower than WLAN, its range is far greater. Since cellular providers use restricted, well-defined bands for their networks, cellular signals are considered very secure and not vulnerable to eavesdropping in the way that WLAN signals are.

"The maturity of the commercial cellular technology makes it an attractive option for industrial applications," according to Bee Lee, Business Manager at Moxa Technologies. Cellular technology is particularly suited for simple, periodic management of installations that are not

near a network infrastructure. Since a carrier is required for the cellular connection, additional monthly fees are typically required.

In general, use WLAN technology when you need higher bandwidth, when you have access to a nearby network infrastructure, and when you need a high degree of control and customization. Use cellular technology when you need superior range, security, and simplicity, or if you need to manage devices by cell phone.

High bandwidth with WLAN solutions

	Application	Equivalent To
Wireless access point	establish/extend network	Ethernet switch or router
Wireless serial device server	connect serial device to Wi-Fi network	serial device server
Wireless embedded computer	advanced remote management and data processing over Wi-Fi	embedded computer

Wireless access points, also known as APs, are the WLAN equivalent of Ethernet switches and routers. They are used to create a coverage area in which other wireless devices can connect to an Ethernet network. For all WLAN solutions, you will either be installing APs or connecting wirelessly to an AP. The AP itself must be physically connected to the network infrastructure. It typically serves a room of mobile workstations or sites where it would be difficult to lay down network cables. Since the AP is the point of entry to the main network, it is where security issues are the most critical.

Wireless serial device servers are the WLAN equivalent of serial device servers. They are used to connect serial devices such as PLCs or RTUs to an Ethernet network. As with all WLAN solutions, APs are required to establish the coverage area. Depending on the manufacturer and model, the wireless device server may also operate in Ad Hoc mode, meaning that it can connect to another Ad Hoc wireless client rather than to an AP. This would be suitable, for example, if you need to allow occasional wireless management from a laptop. Wireless device servers are generally used when the serial device is in a difficult location, or when a system integrator wishes to simplify network installation and reduce wire clutter.

Wireless embedded computers are embedded computers with WLAN capability either built-in or added on. Embedded computers are used when advanced management functions are required and space, power, or the budget is limited. Wireless embedded computers are used when a mobile connection to the network is also needed, or when wiring would be difficult or expensive. For example, a Modbus RTU slave in a difficult location could be connected to the Ethernet network using a wireless embedded computer. The embedded computer would handle the protocol conversion and would thus extend the useful life of the legacy device.

Superior mobility with cellular solutions

	Application	Equivalent To
Industrial cellular router	establish/ wide area network	broadband router
Industrial cellular modem	connect serial device to network	landline or broadband modem
Cellular-enabled embedded computer	advanced remote management and data processing	embedded computer

Industrial cellular modems provide serial connectivity over a cellular network. With GSM, you can connect to a device by dialing a cell phone number. By using GPRS, you can connect serial devices over carrier TCP/IP network. This makes cellular modems useful for periodic monitoring of a remote device's status, or for easy remote console management. Remote devices can also periodically report their own status by calling out from the cellular modem. Generally, cellular modems are designed to communicate with other modems, either cellular or landline. Enhanced performance and functions are possible depending on the cellular network that is supported. Advanced models also allow direct communication with cell phones using SMS text messaging. This makes other applications possible, such as device management by cell phone. Vending machines and LED message boards, for example, are well suited for management by cell phone.

Industrial cellular routers, which are the cellular equivalent of a broadband router or access point, provide multiple Ethernet devices with a cellular connection. This makes the cellular router useful for remote monitoring or telemetry since wiring problems are eliminated. Traditional broadband connections are dependent on the ISP infrastructure. If the area is very difficult to reach or not well-supported by an ISP, cellular can be an effective solution. It eliminates the cost of road construction, licensing, labor, and other factors that would normally be required to embed fiber or other cables at a specific location. Using industrial cellular routers can make difficult locations accessible to the network, and are ideal for applications such waste water pump controller monitoring, environmental monitoring, and more.

Cellular-enabled embedded computers are embedded computers with a cellular modem attached or built-in. Embedded computers provide advanced management or data processing for remote devices, in situations where space or cost prevents full-fledged PCs from being used. A cellular solution would be chosen instead of a WLAN solution when superior range is needed, or when there are no APs or other network infrastructure nearby. The range and mobility of cellular technology also makes it ideal for logistics, cargo, and intelligent transportation applications.

Things to remember

Regardless of the wireless technology used, there are some considerations common to almost all industrial applications. Specifications of industrial networking products are usually two to three times stronger than the rating found in comparable office grade equipment. Industrial equipment usually faces much harsher environments and usage, and may not enjoy the comfort of an air-conditioned server room. Industrial systems integrators often require the following:

- RS-485 support
- Signal surge & isolation protection
- Electrical field protection and isolation
- Wide DC power input range
- DIN-rail and flat panel mounting
- Compliance with GCF (Europe) and PTCRB (USA) for cellular
- Class 1, Div. 2/ATEX certification for hazardous locations
- -40° to 70°C operating temperature range
- Long-term support

Although wireless technology is advancing rapidly, industrial applications require a stable platform and proven solutions. Both WLAN and cellular technologies have enjoyed widespread adoption and long-term support that will likely continue far into the future. With a better understanding of your application requirements and the wireless options available, you no longer have to be afraid of cutting the cord.

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