GLOBAL COM

The Value of a Blended Next-Gen Wireless Approach for Today's Digital World

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INTRODUCTION

Fueled by the proliferation of mobile devices, advancements in cellular and Wi-Fi transmission, and innovative mobile platforms in conjunction with being an attractive fiscal alternative to physical wired connections, wireless technology has evolved to become an integral part of the digital world we live in—enabling everything from broadband access, mobile commerce and communication, to smart building and smart city IoT/IIoT device connectivity, and location and asset tracking.

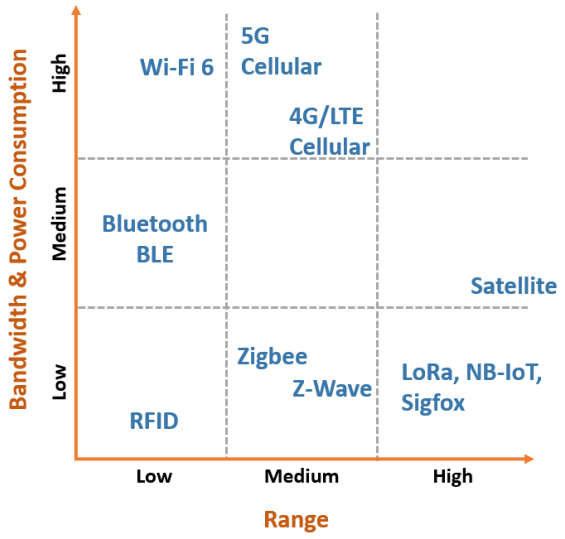
With flexible, low-cost deployments, higher bandwidth capacity, and the ability to reach more places, wireless technology is rapidly becoming ubiquitous as the de facto media for connecting people and things in the enterprise business and beyond. But leveraging wireless communications doesn't involve a single technology. Truly achieving digital transformation and gaining a competitive advantage today through wireless technology demands a blended next-generation approach that brings together multiple wireless technologies—all working together to effectively and efficiently support a wide range of applications.

A MYRIAD OF OPTIONS

There are several different wireless technologies available today that leverage various licensed and unlicensed frequency bands across the electromagnetic spectrum to transmit and send information wirelessly via antennas, including:

- Cellular communications like 3G, 4G LTE or 5G that operates within in licensed bands
- Citizens Broadband Radio Service (CBRS) that operates within unlicensed bands
- High-efficiency IEEE 802.11 Wi-Fi for high-bandwidth LAN/Internet connectivity
- Global satellites that provide communication links between various points on Earth
- Short-range, low-power applications between devices or between devices and a control system
- Long-range, low-power WAN technology for periodic communications between IoT devices and gateways
- Radio-frequency identification (RFID) via digital data encoded in RFID tags

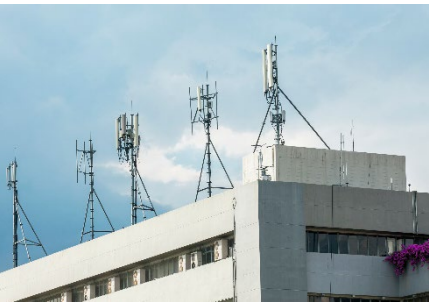
Each wireless technology has its own advantages and disadvantages in terms of bandwidth, power consumption, range, and cost. While there is some overlap, each wireless technology is suited to support certain application needs and environments.



Cellular Communications

Cellular communications have advanced from 3G with an average speed of 8 Mb/s, to 4G LTE with an average speed of 12 to 60 Mb/s, to now 5G operating at much higher frequencies and even higher-speed, lower-latency transmission to support emerging IoT/IIoT applications.

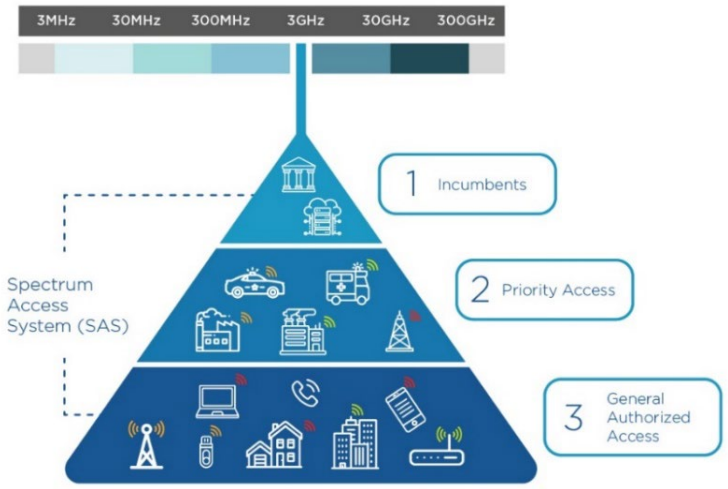
Enterprise businesses can deliver cellular communications for their facilities and campuses via distributed antenna systems (DAS) with multiple nodes functioning as a single cell to boost cellular coverage in heavy-traffic areas. They can also deploy more cost-effective small-cell technology that uses individual cell sites to create a cellular network for a given area.



5G small cells can be millimeter wave (mmWave) or Sub-6GHz. mmWave uses high-frequency bands that offers faster speeds but at a much shorter range and with limited propagation—high-frequency signals are easily blocked by doors, windows, trees, and walls. In contrast, Sub-6 uses mid-to-low frequencies bands at reduced speeds but with far better coverage and penetration. mmWave requires many smaller, lower-range nodes, which makes it more expensive to deploy and better suited for crowded indoor targeted locations. Sub-6 is better suited for outdoor venue and campus deployments.

CBRS

Citizen's Broadband Radio Service (CBRS), also known as private LTE, is a cellular-based technology that operates in an unlicensed band of frequency established by the Federal Communications Commission (FCC), allowing private organizations to gain the advantage of today's carrier-grade 4G LTE and emerging 5G cellular connectivity. CBRS licenses include incumbent protection, priority access, or general availability, each of which requires central management via a cloud-based spectrum access system (SAS) that assigns spectrum channels and their associated transmit power.



CBRS is ideal for locally-controlled applications like secure voice, push-to-talk, and unique business applications for campus environments, industrial sites, and distribution hubs. It's also ideal for schools and municipalities to deliver broadband service to a specific area or community.

High-efficiency Wi-Fi

Like cellular technology, Wi-Fi has also advanced with high-efficiency Wi-Fi 5 offering with a maximum speed of about 3.5 Gb/s and now Wi-Fi 6 and 6E with a theoretical maximum speed of 10 Gb/s. Wi-Fi is designed to provide wireless connectivity to a corporate LAN through the use of wireless access points connected to the network.

While Wi-Fi offers faster speeds, it is ideally suited for smaller-scale coverage for specific users on a native network for internal business applications. Public Wi-Fi is also often offered by hospitality venues, retail establishments, airports, and other public-facing facilities to provide Internet access to users.

Satellite Communications

Orbiting satellites provide communications by receiving signals from the Earth, amplifying the incoming signal, and transmitting the signal back to Earth. They can be fixed with equipment in set locations for specific applications and users like the military or mobile for various land, maritime and aeronautical applications, including voice, data, and GPS navigation. Satellite communications is also used for TV and radio broadcasting.

Short-Range Wireless

There are a variety of short-range wireless applications like high-bandwidth Bluetooth for continuous device-to-device communications like headsets, hands-free calling, and wireless file transfer. Unlike Bluetooth that consumes batter life quickly, Bluetooth Low-Energy (BLE) is used for exchanging small amounts of data periodically for location tracking, proximity marketing, wayfinding, industrial monitoring, and a variety of other applications where devices can run on battery power for years.

Other short-range wireless applications include Zigbee where signals transmit on the 2.4 GHz frequency from one device to another up to about 20 meters and speeds of 250 Kb/s using a central hub, with the ability to support unlimited hops between thousands of devices. Zigbee is ideal for smart metering, building automation, and retail services in smaller facilities. Z-Wave also uses a central hub but operates in the 800 to 900 MHz for less interference with speeds up to 100 Kb/s. Z-Wave offers better battery life and a range of about 100 meters but is limited to four hops and 232 devices. It's ideal for energy management, climate control, smoke detectors, smart sensors, and security. The two technologies target similar applications, but Zigbee is more versatile and readily available across a wide range of devices, while Z-Wave is limited in availability but offers a simpler protocol with easier deployment.

Long-Range, Low-Power Wireless

Referred to as low-power WAN (LPWAN), longer-range, low-power applications like Sigfox, LoRa, and NB-IoT are ideal for collecting data from very low-rate IoT/IIoT devices and sensors over much greater distances, making them ideal for large-scale deployments. NB-IoT is a cellular-based technology requiring licensed frequency bands, but offering reduced latency, data rates of 200 Kb/s, and distances of up to 10 km. Sigfox and LoRa are non-cellular based technologies that use networked gateways to collect information from devices. They offer better battery life than NB-IoT with data rates of 100 and 50 Kb/s, respectively. Sigfox is used primarily for uplinks and supports distances up to 40 km in rural areas, while LoRa supports bidirectional communication with distances of 5 km in urban areas and 20 km in rural areas. These applications also have excellent penetration to reach underground areas like parking garages. They are ideal for collecting data from smart sensors and meters spread across large campuses and communities.

RFID

RFID readers capture data encoded in RFID tags via radio waves. RFID tags contain an integrated circuit and antenna to transmit information wirelessly to readers. For enterprise business, RFID is ideal for asset and personnel tracking for applications like inventory, logistics, and supply chain management. It is also often used for patient monitoring in healthcare, access control, attendance tracking, anti-theft in retail, commercial fleet and refueling management, and more. Every-day consumer examples include key fobs, contactless payment, electronic toll collection, and e-passports.

IT'S NOT ONE OR THE OTHER

For many years, networks were traditionally built with wired connections to connect people, place, and things, but as bandwidth and mobility needs have increased, replacing cabling is a costly, disruptive approach. With the myriad of wireless technologies available, enterprise businesses of all types and sizes have the ability to support virtually all of their communications needs wirelessly. But more importantly, it's not about using one wireless technology over another, but rather taking a blended wireless approach where multiple technologies co-exist to deliver communications for a variety of applications.

Application	Cellular/ Small Cell	CBRS	Enterprise Wi-Fi	Global Satellite	Zigbee	Z-Wave	Bluetooth	BLE	LPWAN	RFID
Access Control			○		●	●		●		●
Asset & Personnel Tracking					○	○		●		●
Broadband Access	●	●								
Building Automation			○		●	●			○	
Business Communication / Collaboration (Internet, email, BYOD, LAN)	○	●	●							
Campus Communication	●	●	●							
Earth Observation / Weather Monitoring				●					○	
Fleet Management	●	●		●					○	○
Global Navigation	○	○		●						
Hands-free Communication							●			
Indoor Navigation / Wayfinding	○	○	○				●	●		
Logistics / Inventory Management						○		●		●
Military / Maritime		●		●						
Mobile Payment			○		○		●	○		●
Public Safety	●	●	○							
Push-to-Talk	○	●	○	○						
Radio & TV Broadcast			○	●						
Smart Agriculture	○								●	
Waste Management, Smart Metering, Environmental Monitoring	○	○							●	
Wireless peripherals (printers, keyboards)						○	●			

● Highly Applicable ○ Moderately Applicable

SUMMARY

Wireless technologies have advanced to support virtually every business need regardless of application and environment. With support for everything from broadband access, high-bandwidth low-latency networking and advanced mobile communications, to short- and long-range low-power device connectivity, public and private entities can leverage wireless technologies to enable digital transformation for facilities, campuses, and larger geographic regions. While many wireless technologies support multiple application needs, the key to implementing a blended wireless approach is to work with your integration partner to determine the range of applications for a given business and environment, evaluate the distance and bandwidth requirements for each, and effectively leverage multiple wireless technologies. As a premier global systems integrator with experience in deploying a wide range of wireless technologies in both the public and private sectors, Global Com can help you cost-effectively adopt a blended wireless approach for all your business needs.