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Trends in Enterprise-class Wireless LAN *Explosive Growth and Real Innovation*

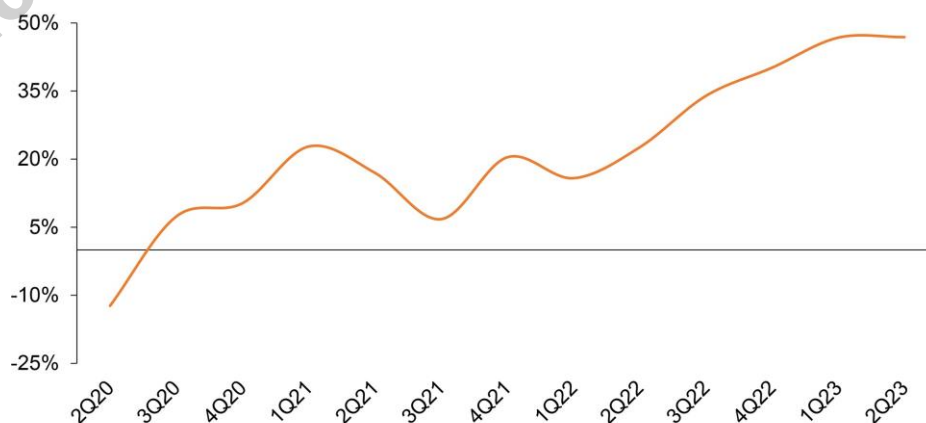
By: [Sian Morgan](#)

Sales of Wireless LAN (WLAN) equipment to enterprises have exploded (See Figure 1, below). Since the pandemic, amidst difficult supply conditions, manufacturers' enterprise-class WLAN revenues grew to dizzying heights in the first half of 2023. The industry has not experienced this level of expansion in over fifteen years.

The boom is due to a mixed bag of drivers. Certainly, long lead times and advanced ordering have resulted in a compressed spike in deliveries. But hidden among the pandemic knock-on effects is a real demand for new solutions. Universities are replacing Ethernet ports with WLAN APs in dorm rooms. Retail operations are converting to "scan as you go" operations. In their new office configurations optimized for hybrid work, enterprises are blanketing patios and parking lots with Wi-Fi coverage.



Enterprise-Class WLAN Revenues Y/Y Growth



Source: Dell'Oro Group 2023 WLAN Quarterly Report



Many different types of businesses are benefiting from new Wi-Fi use cases, but the following four trends cut across all enterprise verticals and may benefit any organization looking to refresh its LAN.

1. 6 GHz is the new fast lane – if you’re lucky.

For over two decades, the IEEE has worked to evolve WLAN specifications, releasing new versions of the 802.11 standard every three to five years. The most recent standards are shown in the (see table below). In May 2020, the FCC approved the 6 GHz frequency band for unlicensed use, and Wi-Fi users in the U.S. began salivating at the thought of bypassing congestion in the 2.5 and 5 GHz bands. Approval of the full 6 GHz band increased the available spectrum by nearly five times.

The Wi-Fi Alliance reports that more than 70 countries have approved or are considering allocating at least a portion of the 6 GHz for Wi-Fi. Europe has approved half the band for unlicensed use while other countries, such as China and India, are not allowing Wi-Fi traffic to access any of the band. More clarity around the worldwide acceptance of Wi-Fi’s use of the 6 GHz frequency band should come at the end of the year, at the World Radiocommunication Conference in Dubai.

IEEE Protocol	Wi-Fi Alliance Brand	Commercial Availability†
802.11ac	Wi-Fi 5 wave 1	2Q13
	Wi-Fi 5 wave 2	2Q15
802.11ax	Wi-Fi 6	3Q18
	Wi-Fi 6E (using 6 GHz band)	3Q21
802.11be	Wi-Fi 7*	2Q23

*Wi-Fi Alliance certification program not yet available
 † Quarter of first enterprise-class Access Point sales

Source: Dell’Oro Group

Access Points (AP) supporting Wi-Fi 6E, and by definition the new 6 GHz spectrum, appeared on the market just as the supply chain ground to a near halt, and Wi-Fi 6E AP production was slowed by the additional components required to manufacture the technology. While many of the high-end smartphones and laptops adopted the 6E standard, the iPhone was a notable holdout, and there was weaker 6E support in mid-to-low-range devices. (In September, Apple announced support on the iPhone 15 Pro, but not the iPhone 15). These complications led to a slower adoption of Wi-Fi 6E APs. Now, we are on the cusp of the next wave of Wi-Fi technology. A handful of vendors have already announced Wi-Fi 7 APs which will make use of the 6 GHz band. Nearly all the major vendors are expected to begin selling Wi-Fi 7 APs next year. 802.11be involves a higher-order modulation scheme, the ability to operate on multiple links simultaneously (MLO), and other innovations designed to boost speeds, lower latency, and improve power efficiency. However, the killer feature for some enterprises will be access to a pristine, new 6 GHz spectrum. We can thank Wi-Fi 6E for having laid the ecosystem groundwork.

2. Campus network backbones get fatter.

Five years ago, over 90% of WLAN APs shipped were interconnected to the LAN with a 1 Gbps port. In five years, we expect that to drop below 40%. The Wi-Fi 7 APs being announced so far all have at least one 10 Gbps port to connect to the enterprise LAN. We expect that the mid-to-low-range APs to be announced next year will have 5 Gbps or 2.5 Gbps connections.

More bandwidth is required to support all of that videoconferencing traffic, but there are also other factors putting LAN connectivity under stress. The plethora of IoT devices has driven up the number of connections and has increased demand for switch ports supporting Power over Ethernet.

These shifts will incite IT leaders to reconsider their campus switch architecture and cabling infrastructure. Transmissions at 10 Gbps require CAT6A cables and are subject to distance limitations. Some of the Wi-Fi 7 APs have optical connectors as well, and enterprises may consider laying fiber cables in new buildings or high-traffic areas.

3. AI learns network management.

We are in the midst of an AI (Artificial Intelligence) revolution. IT leaders are under pressure to demonstrate how AI will propel their business forward -and a mere chatbot won't suffice. Leaders may find the AI revolution they seek in the form of AIOps (Artificial Intelligence for IT operations) that promises to relieve the burden of enterprise network management-a burden that has grown with the proliferation of Wi-Fi.

AIOps management applications collect and analyze billions of data points, both from end clients and the network equipment. Then, advanced analytics and machine learning (ML) algorithms are used to create a baseline image of user behavior and network performance.

Most of the major brands of enterprise-class WLAN equipment on the market tout AI-driven management, and businesses that have installed these systems are providing compelling feedback. One organization we spoke with told us they had reduced their trouble tickets by over 90%.

The most desirable AIOps features will depend on the specific vertical and configuration of the enterprise, but here are a few that stand to benefit organizations the most:

- With a detailed knowledge of user patterns, AIOps applications can intelligently and dynamically adjust alarm thresholds. Without the benefit of AI, many alarms raised are unnecessary, drowning out real problems. For instance, a false alarm may be raised at noon every day when a large batch of phones disconnect from the network - only because employees are leaving to grab lunch.
- Network problems can be automatically detected. For example, if a cleaning crew accidentally disconnects the AP in a conference room, the IT team can be alerted that the radio propagation patterns have changed, even before Wi-Fi users try and connect. We have heard from enterprises that installed AIOps for their Wi-Fi APs and discovered existing configuration problems in connected application platforms that had been affecting end-user performance for years.
- AIOps can go as far as suggesting solutions to problems that were detected, prompting the network operator to implement the fix. Large Language Models can also summarize technical documentation, making it easier to understand issues and modify network configurations.
- The networks in venues such as stadiums or auditoriums handle a huge variability in traffic load. With analysis of network activity and performance data, a network management tool can proactively identify bottlenecks in specific areas. For example, AIOps could identify that wait times are too long at a particular concession stand, or that a specific exit towards the parking lot is always congested.
- In an office scenario, integration of data from videoconferencing platforms can help AIOps applications uncover the root cause of bad video quality. Over time, an AI operations application could begin to predict the conditions for optimal video quality, helping to reduce employee frustration.

With the potential for measurable results in the form of cost savings, efficiency improvement, and a solution to skilled labor shortage, the vision of AIOps will be compelling to executives and their shareholders.

Looking further ahead, we may start to see AI and ML integrated into the WLAN standards. The IEEE has formed a topic interest group, called 802.11 AIML, which has been considering use cases and features that could be included in future generations of WLAN specifications. If work continues in this area, AI could eventually become baked into the standards, forcing manufacturers to be even more creative in differentiating their solutions.

4. An innovative business model fosters new competitors.

The term “Network as a Service” appeared quite frequently in the context of Campus IT services in 2022. Campus NaaS offers vary from vendor to vendor, but the service has the potential to fundamentally alter the way enterprises consume IT.

The industry is familiar with services based on a cloud-consumption model, such as Infrastructure and Platform as a Service (IaaS and PaaS), which reflect the characteristics listed in the table below.

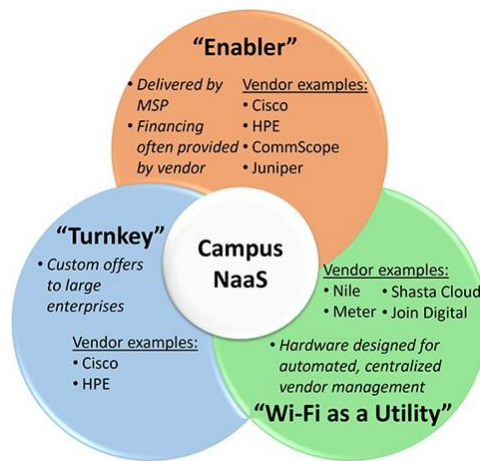
Cloud Consumption Service Description	Cloud Consumption Implementation Characteristic
<p>Outcome-Oriented</p> <ul style="list-style-type: none"> • Technology is abstracted • Service is purchased based on SLA or SLO <p>Elastic</p> <ul style="list-style-type: none"> • Expands capacity automatically, as required • Easy to change service level or reduce consumption and costs <p>Recurring Price structure</p> <ul style="list-style-type: none"> • Subscription or consumption fees • Generally considered an operational expense <p>Maintenance-Free</p> <ul style="list-style-type: none"> • No maintenance or software upgrades • No technology obsolescence 	<p>Shared</p> <ul style="list-style-type: none"> • Sharing of computing resources enables elasticity due to the consolidation of demand <p>Centralized</p> <ul style="list-style-type: none"> • Economies of scale possible due to shared infrastructure costs (e.g., real-estate, HVAC) <p>Automated</p> <ul style="list-style-type: none"> • Includes tools for self-service onboarding, service modification and expansion

Source: Dell’Oro Group Campus NaaS and Public Cloud-Managed LAN Report

However, it is not always clear how these characteristics should apply to campus networks, in which WLAN APs and switches are dedicated and physically installed on-site. Campus NaaS vendors have chosen to adopt the cloud consumption characteristics to differing degrees, and available offers vary in terms of the following factors:

- Whether the Campus NaaS offer requires an upfront purchase commitment or whether it has a fully recurring price structure.
- Whether the campus NaaS offer is outcome-based. For instance, the price is based on floor area or number of employees, instead of being based on the sum of the underlying technology components. An outcome-based structure transfers responsibility for the network design and performance to the service provider.
- Whether the offer is inclusive of all life-cycle services, and whether these services are provided by an MSP, directly from the vendor, or some combination of the two.

All the Campus NaaS offers available today have one thing in common: they aim to simplify IT for enterprises and reduce upfront capital expenditures in exchange for a contractual commitment. The available offers can be loosely grouped into three overlapping categories.



Source: Dell’Oro Group

Most of the incumbent WLAN vendors offer the “Enabler” variant of Campus NaaS. The vendors deliver hardware and software to MSPs, who wrap the technology in professional services for enterprises. Vendors such as HPE and Cisco also provide “turnkey” Campus NaaS offers for large enterprises. These offers include custom designs and direct delivery of complete “day-2 operations” by the vendor, in addition to hardware financing.

Startups have also identified an opportunity to carve out some of the revenues in the expanding WLAN market by offering the “Wi-Fi as a Utility” variant of Campus NaaS. The new entrants have developed specialized technology to automate and centralize network management. These companies generally deliver their own life cycle services to enterprises, although also work with MSPs for some facets. “Wi-Fi as a Utility” offers can be coupled with vertical-specific applications (for example, asset tracking or office utilization monitoring), letting enterprises benefit from value-added applications while taking their Wi-Fi network for granted.

We do not expect that enterprise-class WLAN revenues will continue to expand at the current pace for many more quarters. Once vendors have worked through their backlogged orders the industry should experience a pause, or digestion period, as excess inventory is absorbed.

However, the reader should not be fooled into thinking that a slowdown in revenues reflects the diminishing importance of LAN connectivity solutions. Enterprise demand for high-performance Wi-Fi is very real and continues to grow. The allocation of more spectrum, technological breakthroughs, and new commercial structures are combining to uncover opportunities for enterprises to increase their efficiency - and these advancements are still in their infancy. The WLAN market is evolving rapidly, and the future looks bright for enterprises able to capitalize on these innovations.