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The MSPs guide to **Wi-Fi 6**

A spotlight on the latest Wi-Fi standard, what it offers users and the benefits of upgrading

A sky-level view of next generation Wi-Fi

Take a bow 802.11ax, the latest incarnation of wireless LAN (WLAN) technology.

Bestowed the moniker 'Wi-Fi 6' by our friends at the Wi-Fi Alliance, the next generation Wi-Fi is the all-new standard from the Institute of Electrical and Electronics Engineers (IEEE), the association responsible for Wi-Fi development.

With each new Wi-Fi standard, we have seen notable performance improvements.

When Wi-Fi 5 (802.11ac) superseded Wi-Fi 4 (802.11n) in 2014, for example, the door was opened for working in either the 2.4GHz or 5GHz spectra. We benefited from higher bandwidths of up to 80 MHz and enjoyed speeds of up to several gigabit per second (Gbps).

The new kid on the block now offers even more, promising further improvements in efficiency and performance.

Wi-Fi 6 has been designed with high-density, public network environments, such as trains, stadiums, schools and airports, very much in mind. With the proliferation of Internet of Things (IoT) devices, it can also be expected to bring wider benefits for heavy-usage homes and businesses.

Although Wi-Fi 6E can now be spotted on some devices – the 'E' standing for 'extended' – this is identical to Wi-Fi 6 save for its additional support for hardware that taps into the 6GHz frequencies.

The new 6GHz spectrum offers higher throughputs and lower latency.

The US Federal Communications Commission (FCC) released 1.2GHz of radio spectrum in the new 6GHz band to unlicensed users in May of this year. By July, the UK telecoms regulator Ofcom had followed suit, making 500MHz available for indoor Wi-Fi use.

As with previous standards, Wi-Fi 6 is backwards compatible, but users should be aware that older devices won't be able to benefit from the newer features.

Why is Wi-Fi 6 better than Wi-Fi 5?

The relentless rise of connected devices and services, and the accompanying expectations of users, is testing the limits of Wi-Fi network capabilities.

In crowded end-user environments, in particular, Wi-Fi networks using Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA) – the technology ensuring that only one radio can transmit on the same channel at any given time – can markedly lose efficiency.

Key new benefits

- **Orthogonal Frequency Division Multiple Access (OFDMA)** may not roll off the tongue, but it is arguably the most important new feature of Wi-Fi 6.

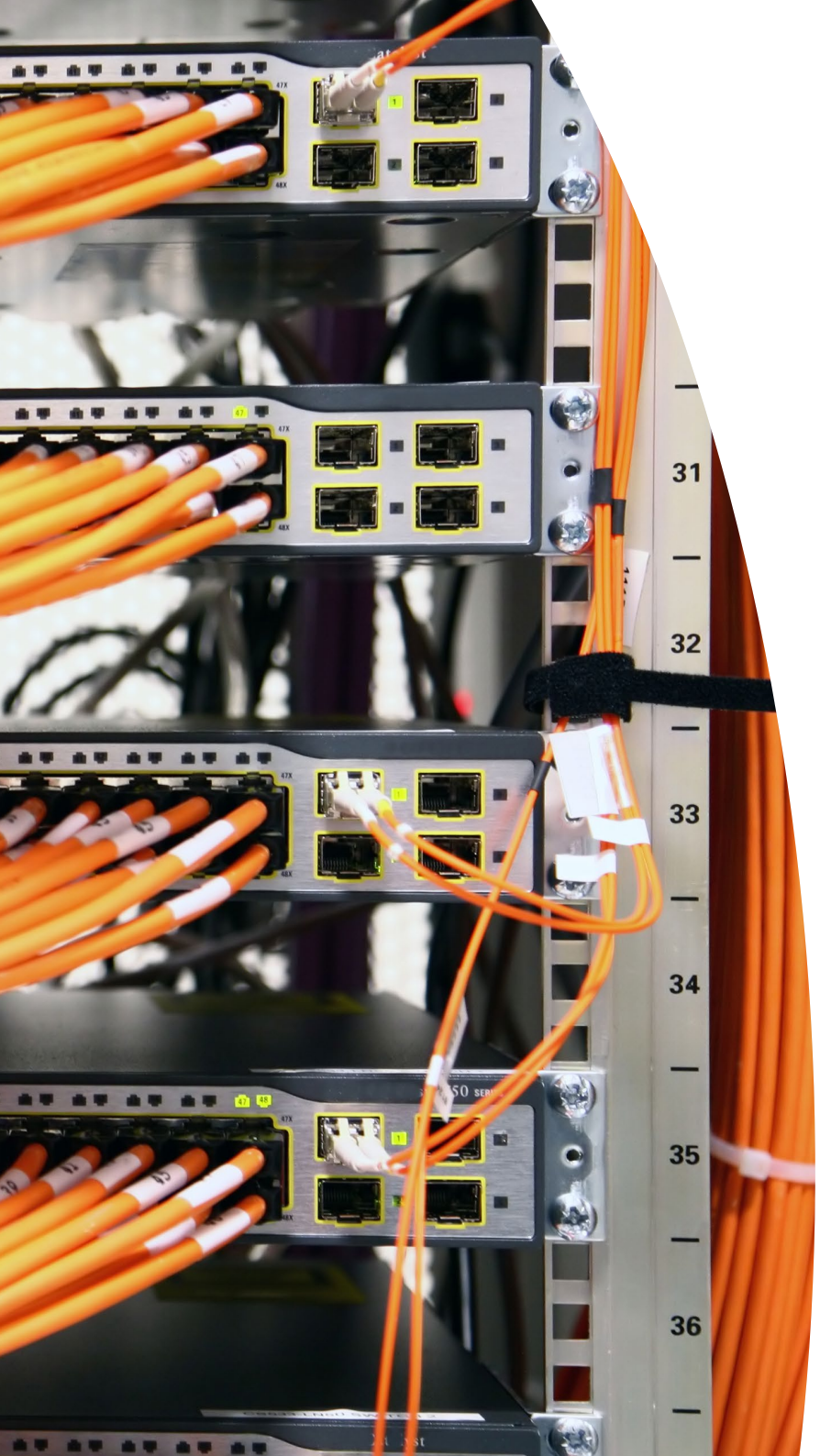
  An upgrade on Orthogonal Frequency Division Multiplexing (OFDM) used by Wi-Fi 5, OFDMA enables routers to subdivide channels into smaller resource unit (RU) radio bands. This means that multiple clients, with different bandwidth requirements, can share the same channel and connect simultaneous to a single access point.
  OFDMA consequently offers better support for crowded device environments and helps reduce latency.

- Another multi-user technology employed by Wi-Fi 6 – and yet another longwinded acronym – **Multi-user, multiple input, multiple output (MU-MIMO)** was actually introduced with the previous standard.

  As with OFDMA, MU-MIMO also supports simultaneous multiple-user access to wireless networks, this time by enabling multi-antenna access points to simultaneously transmit data streams. By doing so, it improves performance for data-intense activities such as video streaming and video conferencing.

  W-Fi 6 has extended the capabilities of MU-MIMO by increasing the number of potential simultaneous users. With eight antennas, eight spatial streams are now offered in the 5 GHz band (and four spatial streams in the 2.4 GHz band), instead of four. Furthermore, these are available for both upstream and downstream connections. MU-MIMO had only previously been available for downstream.

- Denser **1024 quadrature amplitude modulation (QAM)** allows for more data to be transmitted per packet, delivering a 25% increase in throughput over the 256 QAM used by Wi-Fi 5.



- The introduction of new power-saving feature **Target Wake Time (TWT)** enhances the battery life of W-Fi 6 client devices, reduces contention between devices and increases network throughput.

  TWT achieves this by improving on previous power-saving mechanisms and allowing sleep time to be increased. By delivering traffic at specific intervals and negotiating with each device when they sleep, based on the when they need to send and receive data, the feature helps access points to manage Wi-Fi network activity.

- **Basic Service Set (BSS) colouring** also helps increase throughput and improve network performance by 'marking' shared frequencies. This enables access points to determine if channels are too busy, or if they can transmit simultaneously and avoid co-channel interference (CCI).

- Although speed, in itself, has not been the principal focus of Wi-Fi 6, a combination of the eight spatial streams and 1024 QAM modulation means that, for a single user, **the maximum data rate has increased to around 9.6Gbps** in a 160MHz channel. This makes Wi-Fi 6 37% faster than its predecessor.

  Furthermore, the combined technological advancements for the new standard enables multiple users to connect to the same network with limited impact on connection speeds.

- **WPA3 (Wi-Fi Protected Access) security** was optional with Wi-Fi 5, with Wi-Fi 6 however, it is a prerequisite. No Wi-Fi 6 device will receive certification from the Wi-Fi Alliance without it.

  The enforcement of the latest WPA3 standard, with improved encryption, means enhanced network security and greater protection from hackers.

The ingredients for good Wi-Fi

When defining a 'good' Wi-Fi network, speed – or more specifically maximum throughput – invariably becomes the focus.

This can be influenced by a number of factors including channel bandwidth, the number of devices sharing a channel, bandwidth utilization and modulation.

Wi-Fi 6 offers clear advancements in all of these areas.

In isolation, however, speed is an inadequate Wi-Fi benchmark. From an end-user perspective, availability, accessibility, reliability and wider performance considerations must also be taken into account.

The higher number of streams introduced with Wi-Fi 6 helps increase network range and accessibility. Furthermore, the combination of new and improved technologies, such as OFDMA, is expected to improve availability, accessibility and reliability, with a more predictable performance, particularly in congested environments.

It must be remembered, however, that Wi-Fi 6 is not the panacea of all network ills.

A range of other factors will continue to influence network performance, from the physical environment to issues within the network infrastructure, such as the deployment of antennas or the distance between networked devices.

Signal strength (dBm) is of course crucial, but here the upgrade to Wi-Fi 6 is of little significance, albeit more channels should help reduce the impact of noise from other devices.

Responsibility for service availability, reliability and performance will also fall at the feet of the ISPs and digital network providers that sit behind the radio connections.

Should your customers upgrade to Wi-Fi 6?

Wi-Fi 6 could signal an important step change for businesses, helping to reduce connectivity frustrations and improving productivity for those relying on Wi-Fi to perform critical tasks across multiple devices.

The denser the network, the greater the potential for clients to see performance improvements.

Cost, however, must be factored into any business decision.

As things stand, hardware devices supporting W-Fi 6 remain relatively expensive, although their increasing availability is slowly helping to drive prices down.

A decision to upgrade now, rather than to wait, should ultimately depend upon the nature and requirements of the business in question.

The steeper cost of upgrading now should be balanced against the business case.

Now may indeed be the time to act if a business operates in an Industrial Internet of Things (IIOT) environment, for example, if Wi-Fi performance is a current client concern, if the business provides public Wi-Fi in a busy environment and is striving for best-in-class service, or if the highest standards of security are business critical.

For other organisations, a cost-benefit analysis may call for a more gradual transition. All new hardware will include the new Wi-Fi 6 protocols as standard over the course of the next three to five years – by which time we will all be reaping the benefits.

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