



# Wi-Fi 6

## This is The End of Slow Business

Next-Gen Connectivity for Next-Gen Businesses

### Wi-Fi 6 Whitepaper

**D-Link<sup>®</sup>**

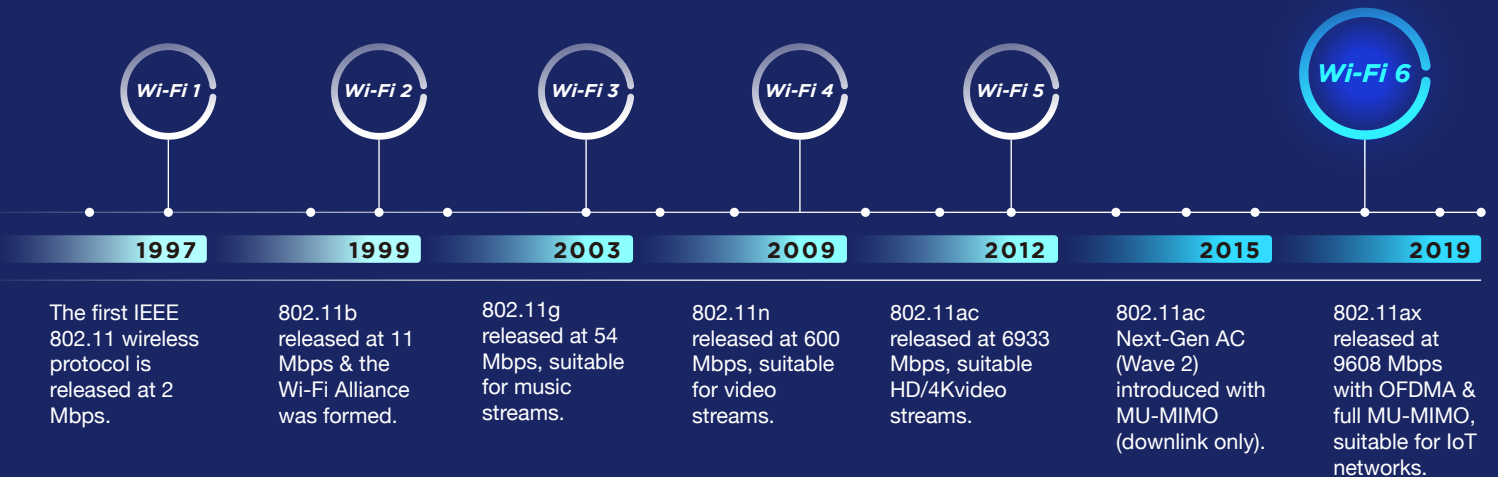
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# Introduction

Wi-Fi 6, also referred to as the 802.11ax protocol, promises to bring blazing wireless connectivity for enhanced user experiences like never before. But aside from the obvious consumer benefits, Wi-Fi 6 is also generating a lot of excitement for IoT environments in many vertical industrial applications. In this paper, we will take a look at 5 key features that enable Wi-Fi 6 to achieve high data rate and low-latency performance in challenging high-density scenarios.

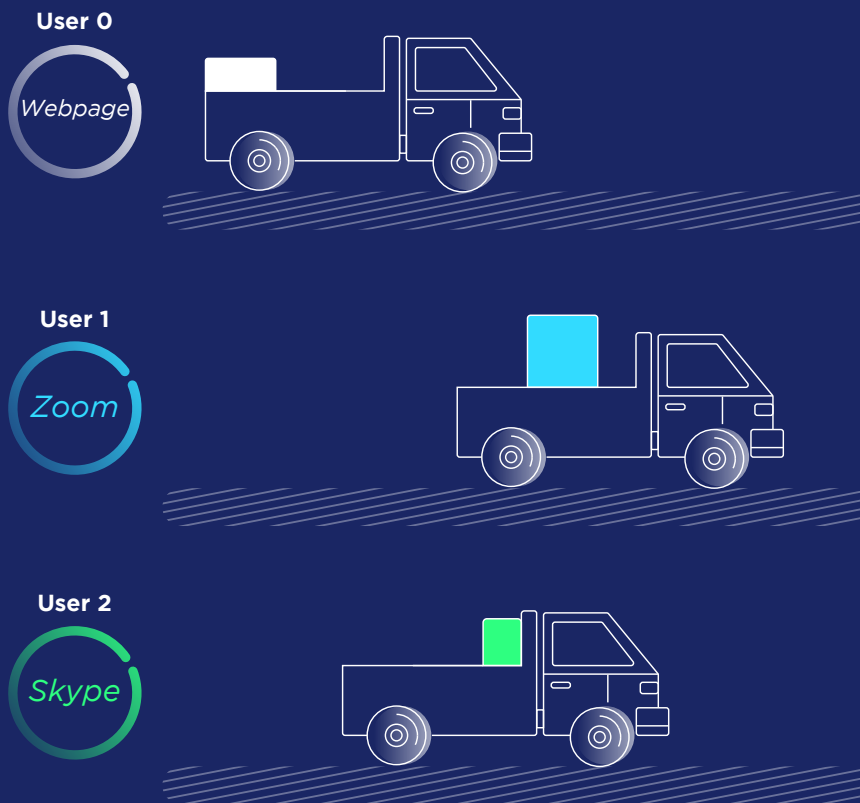
The first IEEE 802.11 protocol was adopted in 1997 and has since made giant leaps in data throughput at every new release to significantly enhance user experience. The latest release, Wi-Fi 6 (802.11ax), brings a slew of new features to open new wireless possibilities across a range of IoT application environments. To get an idea of how far Wi-Fi has come in terms of technological advancement, below is a historical timeline of important milestones in wireless communication development.



## Wi-Fi 5 - Orthogonal Frequency Division Multiplexing (OFDM)

In the previous generation of Wi-Fi (also known as the 802.11ac protocol), wireless data packets are separated into specific timeframes and transmitted using OFDM for data transfer to different network devices. An OFDM data packet contains data

for different devices but delivers data to only one specific device per timeframe regardless of data type and size, which can have a negative impact on other wireless devices communicating on the network.



**OFDM**

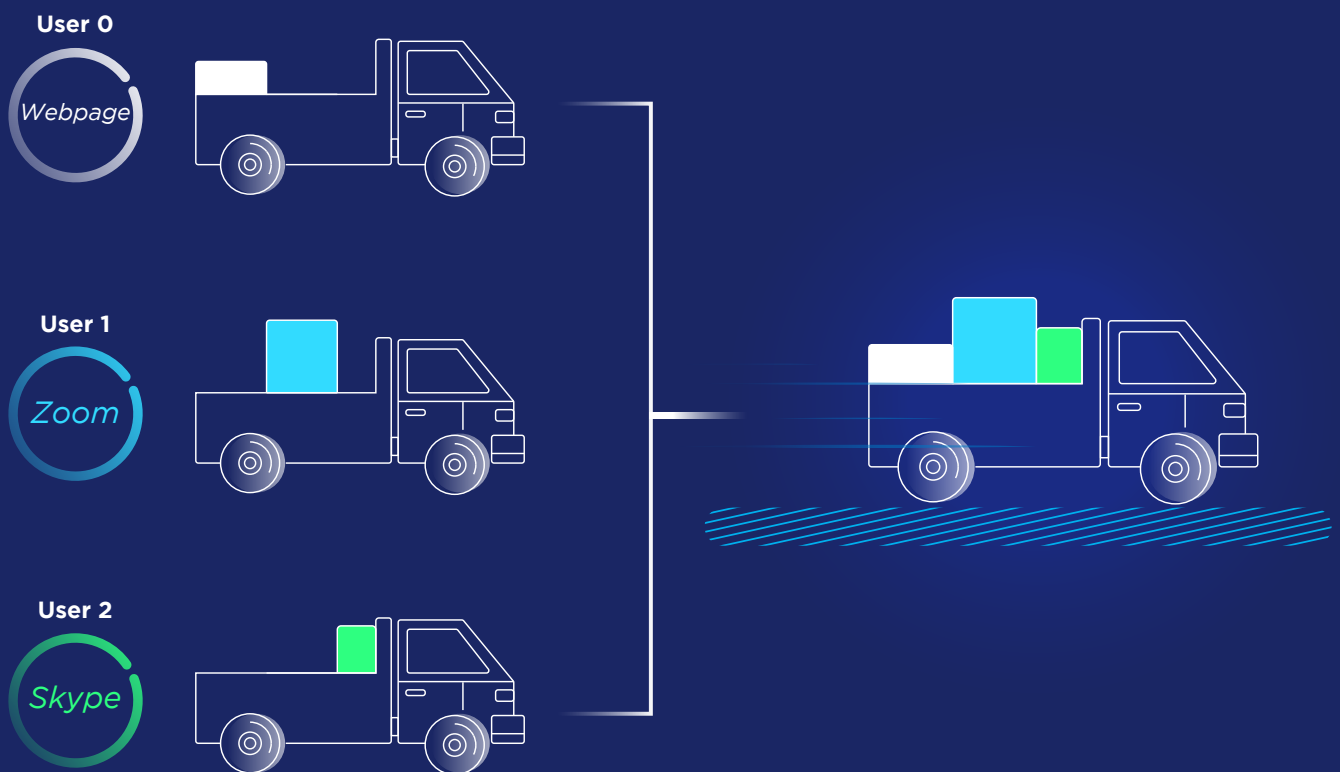
Wi-Fi 5

# Orthogonal Frequency Division Multiple Access (OFDMA)

## Why You Want Wi-Fi 6

Previous Wi-Fi 5 technology with OFDM was inadequate for device-heavy scenarios. Wi-Fi 6 uses OFDMA, an extension of the OFDM architecture, to improve data-rate efficiency and reduce latency for densely-connected wireless networks, such as IoT environments for Smart industrial applications. OFDMA can significantly boost data throughput and reduce wireless latency by achieving highly-efficient spectral usage across the wireless signal.

OFDMA enables data for different users to be placed in the same packet, effectively utilising available space to reduce latency for users on the network. Furthermore, Wi-Fi 6 with OFDMA can simultaneously deliver more data to more users than ever before.



# OFDMA

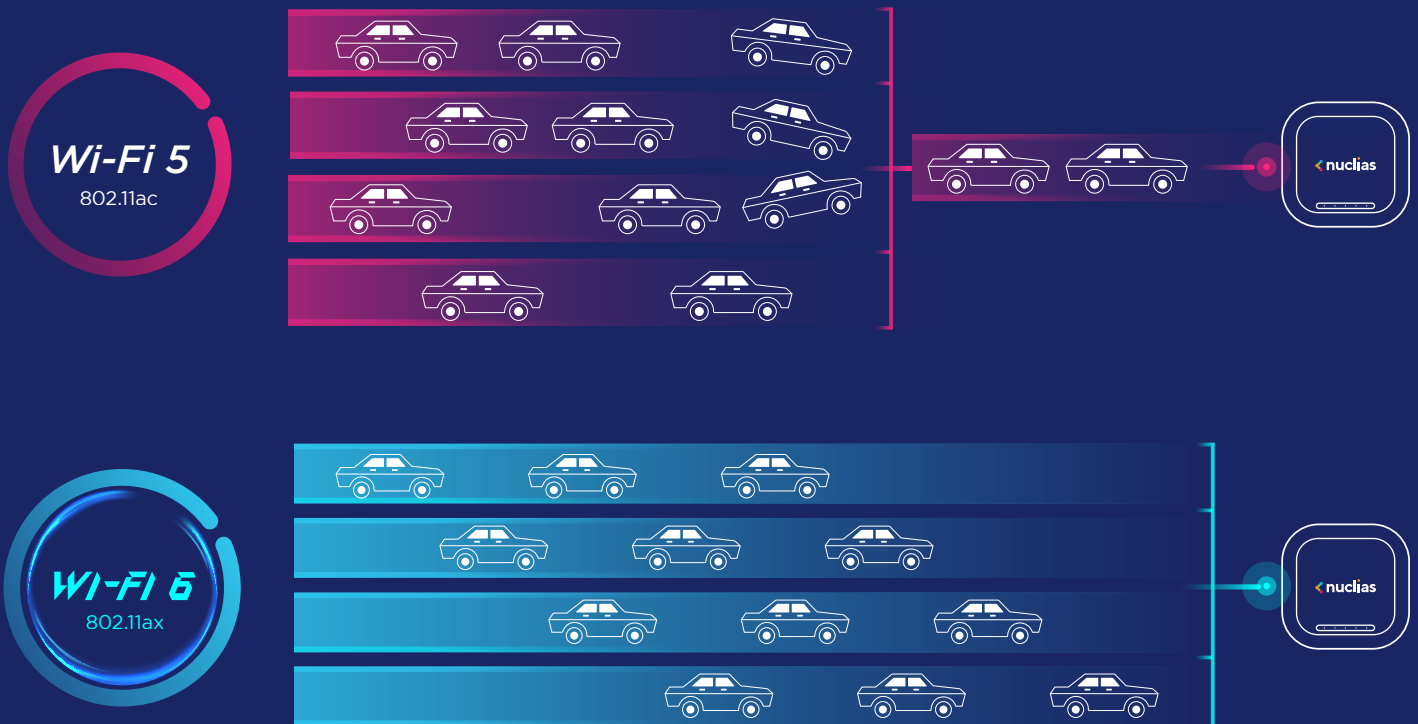
Wi-Fi 6

# Multi-User Multiple Input Multiple Output (MU-MIMO)

Along with OFDMA, Wi-Fi 6 has another very significant technological enhancement, known as MU-MIMO, to further reduce network latency and significantly increase wireless network bandwidth. Earlier versions of Wi-Fi 5 used SU-MIMO\* (Single User Multiple Input Multiple Output), which only

allowed communication with multiple devices in consecutive order, or one at a time. Wi-Fi 6 with MU-MIMO uses multiple spatial streams for simultaneous communication with multiple devices (or groups of devices).

\*Later versions of Wi-Fi 5 (802.11ac Wave 2) adopted MU-MIMO (downlink only).



Though both are very similar in concept, do not confuse MU-MIMO with OFDMA. OFDMA enables multi-user access by subdividing a data packet, while MU-MIMO transmits to multiple devices (or

groups of devices) simultaneously via multiple antennas using different wireless signals (2.4 GHz & 5 GHz spatial streams) .

# 1024 Quadrature Amplitude Modulation (1024 QAM)

To further facilitate massive amounts of data transfer on the wireless network, Wi-Fi 6 uses 1024 quadrature amplitude modulation (1024 QAM), an improvement from the previous Wi-Fi 5 modulation scheme (256 QAM), to add another 2 bits of data per symbol transmitted (total of 10 bits),

enabling Wi-Fi 6 to ensure high quality of service (QoS) for high-traffic venues such as sport arenas, train stations, and convention centers. That's an impressive 25% increase in data rate throughput.



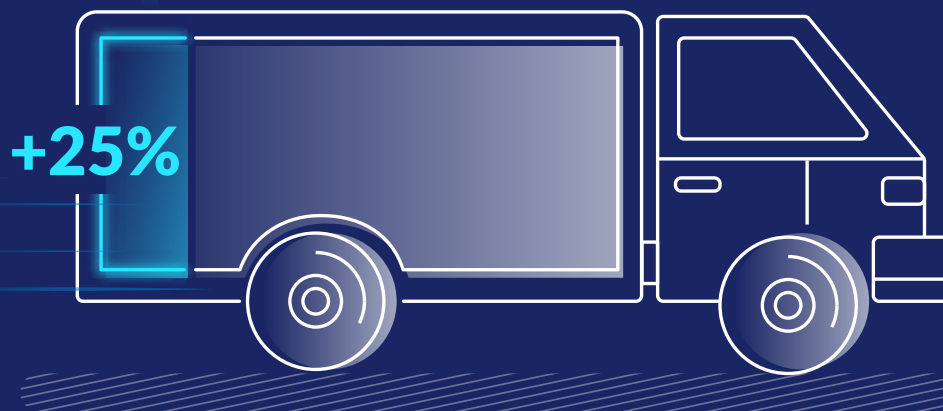
Sport Arenas



Train Stations



Convention Centers



**1024 QAM**

Higher capacity up to 25%

# Target Wake Time (TWT)

Instead of using contention-based network access, where every device has to wait for permission to transmit data to the access point, Wi-Fi 6 uses TWT to establish a schedule-based communication environment between the access point and devices to reduce network congestion and power consumption.

This feature may not sound very impressive for conserving the battery life of your phone, tablet, or laptop at home, but for densely-connected IoT

environments, such as wireless sensor networks (WSN) in factory automation, battery conservation is a huge benefit.

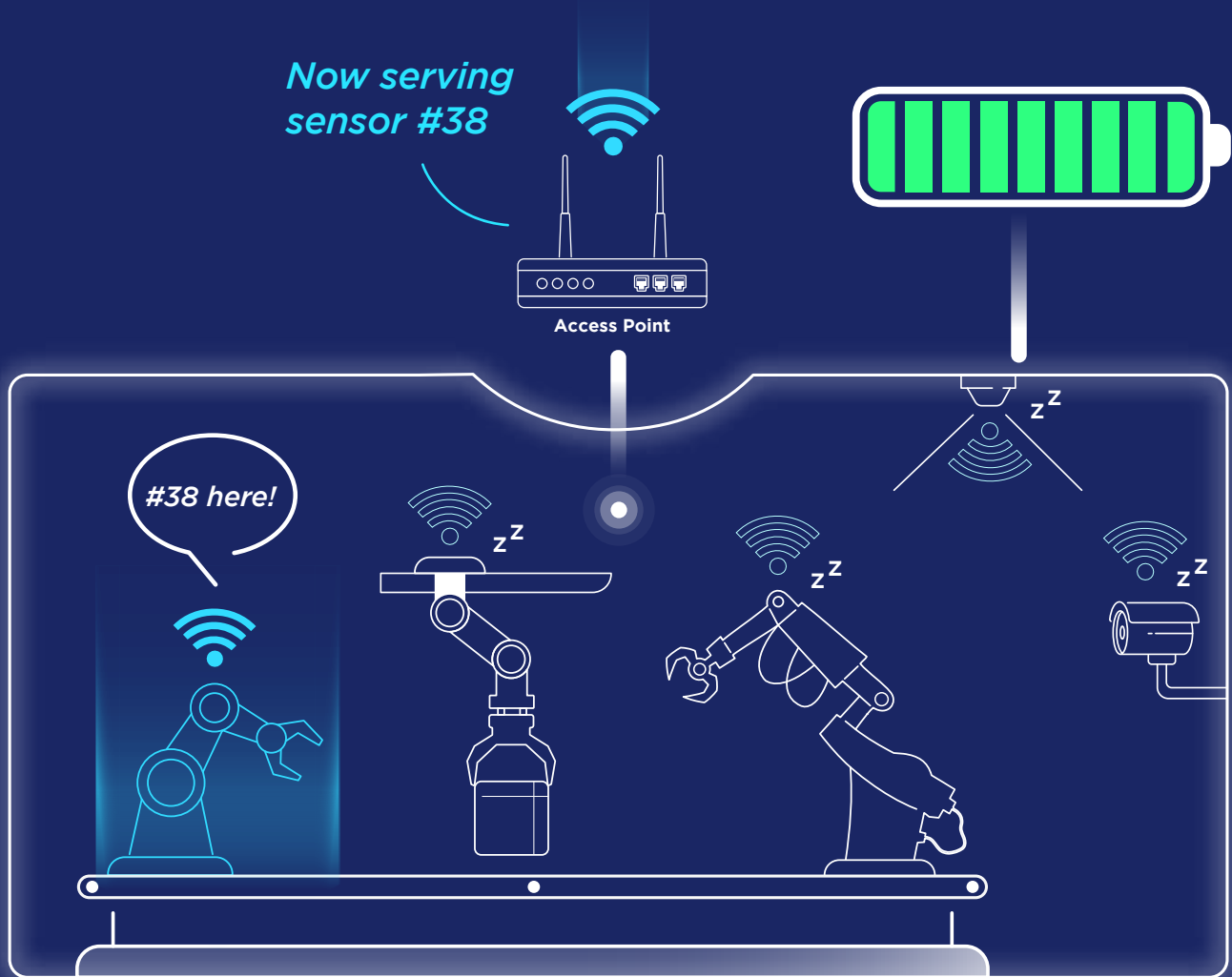
Imagine hundreds of sensor devices in a factory competing for data transmission by repeatedly sending requests to the access point, causing countless collisions on the wireless channel and quickly depleting battery life.



**Contention**-Based Access



To reduce network congestion and optimise spectral efficiency, TWT enables the access point to schedule communication timeslots for every device on the network, placing all devices in sleep mode except the one device being served during the scheduled time period, significantly reducing network congestion and effectively conserving device battery life.

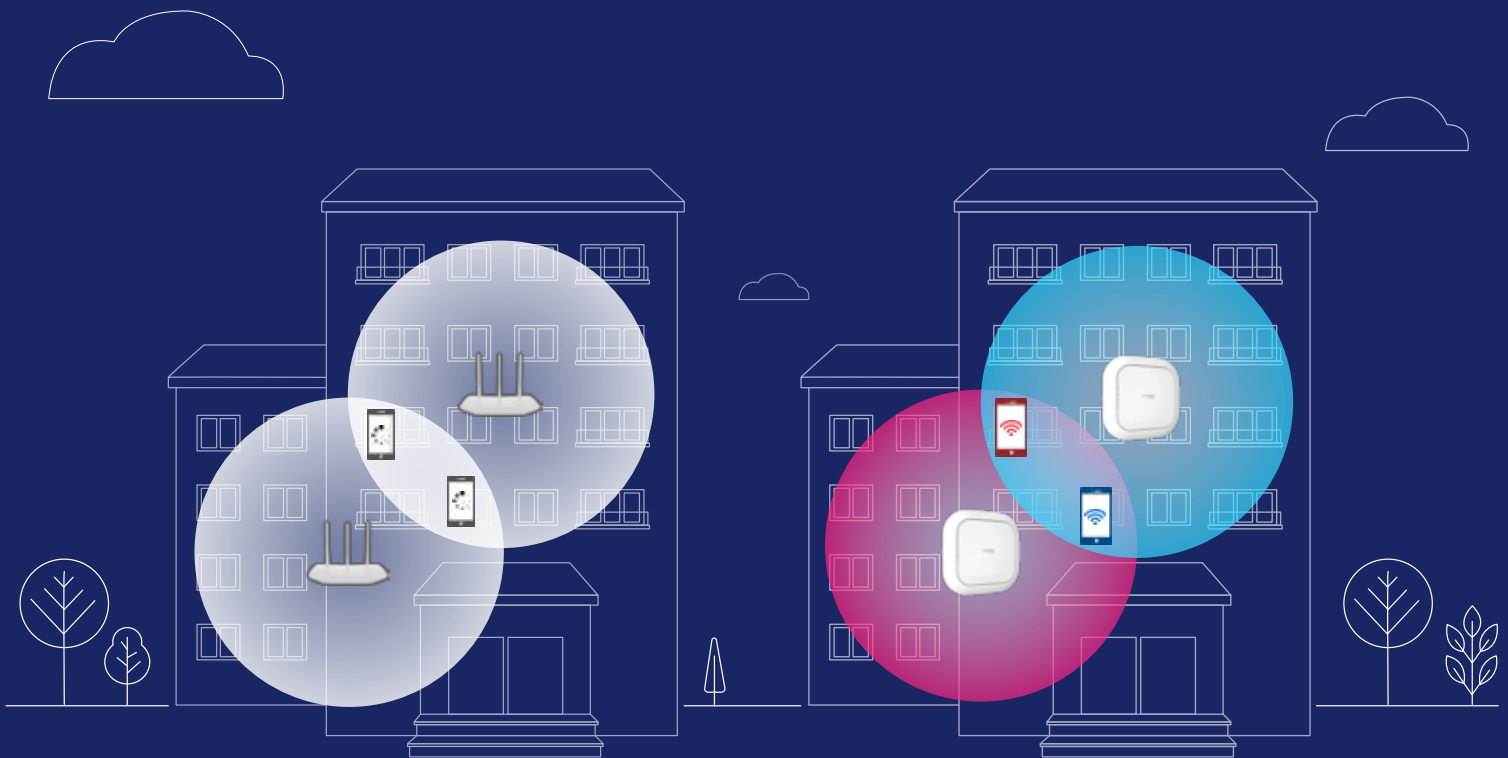


**TWT**  
**Schedule**-Based Access

## BSS (Basic Service Set) Coloring

To minimise wireless interference, the Wi-Fi 6 protocol enables access points to inject 'coloring' information into the data packet when coverage overlap with another BSS is detected, enabling devices to effectively identify and ignore signals from another wireless network. The access point

can also change its color if a neighboring BSS access point is using the same color (known as color collision). The access point embeds a blue color element into the data packet, allowing the device to ignore all signals from the overlapping network, effectively eliminating interference.



More Wi-Fi congestion



*Reduced Wi-Fi congestion*

# Wi-Fi 6 for Business Applications

Managing wireless networks for high-traffic locations such as corporate offices, schools, hotels, and shopping centers can be very challenging, even for experienced IT managers and MSPs (Managed Service Providers). In this section, we'll briefly discuss network management concerns for these key business sectors.

1

## Enterprise



In fast-paced corporate offices where agile working environments have been adopted, access to high-bandwidth services such as high-definition video streaming and cloud-based applications can happen anytime, anywhere. While Wi-Fi 6 can alleviate many traffic-related network bottlenecks, an agile working environment will still need an agile form of network management to effectively minimize network congestion. Most enterprise networks will also require ample network security measures to protect sensitive company data from unauthorized access.

2

## Education



Wi-Fi connectivity is a must-have for classrooms, and so are access permissions for the various types of users, curriculum, and locations across the campus. In addition to blocking access to unauthorized websites, network administrators should also have the ability to control every aspect of the network, such as activating specific network segments for targeted class sessions and disabling network access for empty classrooms to preserve network bandwidth and prevent unauthorized access.

In addition to smart phones, laptops, and tablets, Wi-Fi 6 will connect more devices in the classroom, including smart watches, gaming consoles, Kindle, Echo, scan markers, and even bandwidth-intensive interactive learning experiences such as AR/VR headsets.

For campus operations, Wi-Fi 6 can link IoT sensors to fully automate Smart systems such as HVAC, lighting, security, surveillance, and emergency response to significantly improve energy efficiency and enhance student safety.

### 3 Hospitality



When arriving at a hotel, one of the first things a guest is likely to ask for is the Wi-Fi password. With so many guest devices accessing the wireless network relentlessly looking for the best local attractions, user account management is just as important as bandwidth allocation to keep them reliably connected with seamless handoffs when moving from their room to the downstairs bar, or even to the outdoor pool. For temporary restricted network access, front desk attendants can print vouchers for non-resident guests, granting network access only within a limited time and usage speed to preserve bandwidth, ensuring high quality of service for paying resident guests.

In addition to connecting IoT sensors to enable Smart systems such as for security, premise lighting, surveillance, POS, and customer service kiosks, Wi-Fi 6 can enable hyper-personalised guest services through voice-activated virtual assistants to effortlessly set the alarm for the morning flight, order tickets for the opera, and even draw bath water at the specified temperature right before bath time. Beacon technology can also be implemented to provide proximity marketing. For example, guests passing by the hotel spa may receive text messages about facial discounts.

### 4 Retail/SMBs



Retail businesses often have multiple locations and individual network maintenance across remote sites will be very time consuming and costly. Businesses should have an efficient centralised platform for remote network management to ensure services such as POS (Point of Sale) terminals, customer service kiosks, and captive portals remain operational to enhance shopper experience. Network downtime can incur significant losses as well as have a negative impact on customer loyalty.

Along with the arrival of Wi-Fi 6, user experience will be considerably improved across most business scenarios and each will have varying network infrastructures with different application needs. But one common requirement for business networks of any size is the need for an effective management solution to achieve optimised network performance and reliability, which can only be accomplished through real-time monitoring and efficient maintenance with a centralised management platform. And D-Link has a range of network management solutions to help you do just that.

# D-Link Wi-Fi 6 Solutions

A centralised network management platform is an essential part of optimising business operations and D-Link has the right solution for any organisation. From simple Wi-Fi setups in local coffee shops to complex enterprise-class multi-site deployments, D-Link solutions deliver enhanced software tools for efficient cost-saving network manageability to streamline business operations, minimise network downtime, and improve overall business productivity.



## *Nuclias Cloud*

Designed for smaller organisations with limited IT knowledge/budget, Nuclias Cloud is a 100% cloud-based network management platform to allow SMBs, MSPs, and VARs quick and easy access to centrally manage multiple remote networks with 99.9% SLA (Service-Level Agreement) reliability via a web browser or app. Nuclias Cloud features around-the-clock automated failure detection with rapid escalation across multiple time zones to help quickly identify and resolve network concerns before they spiral into serious problems. Network expansions are also fast and effortless with Zero-Touch deployment for device installations with virtually unlimited scalability.



## *Nuclias Connect*

Designed for organisations needing more network customisation and control, Nuclias Connect is a software-based platform (with optional hardware controller) for on-premise network management (license-free management of up to 1,000 APs) or hosted on a public cloud service as a cloud-based solution. With on-premise network management, sensitive company data and user information stays secure on the local network, allowing administrators the option of adding more security measures locally.

## *Unified Wireless*

Designed for demanding enterprise wireless network environments, the Unified Wireless LAN solution is built around a dedicated hardware controller to deliver advanced automation, security, stability, and control to the wireless network infrastructure. With centralised control policies, the network administrator has precise

## *Unified*

control over network access for users, including which network resources they can access, when they can access, and their connection speeds.

# See All Wi-Fi 6 Devices

High-powered APs that are ready to bring the power of Wi-Fi 6 straight to your business.

## | *Cloud Managed APs for SMBs*



DBA-X2830P

DBA-X1230P

## | *On-Premise Managed APs for SMBs*



DAP-X2810

DAP-X2850

## *Unified* | *On-Premise Managed APs for Enterprises*



DWL-X8630AP

# Conclusion

## Limitations of Wi-Fi 6

Theoretically, the base speed of Wi-Fi 6 is 1.2 Gbps per stream, with most consumer units using dual streams for a total ceiling speed of 2.4 Gbps. For most home users, Wi-Fi 6 multi-Gigabit speeds will be bottlenecked at the ISP (Internet Service Provider) router because ISP connection bandwidth generally does not exceed 1 Gbps (unless fiber connectivity is available).

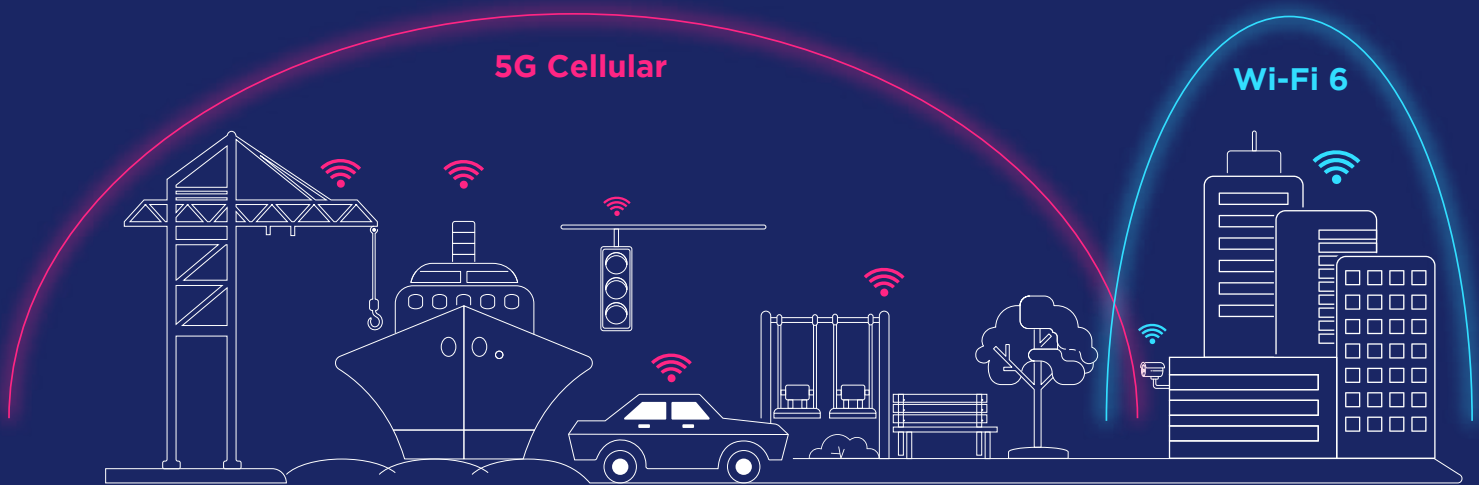
For many wireless indoor business applications, Wi-Fi 6 delivers reliable mission-critical M2M

communication for highly-populated industrial sensor/device networks and lightning-fast connectivity for enterprise data network accessibility. Multi-Gigabit ports (2.5 Gbps) will need to be available to allow unrestricted throughput for Wi-Fi 6 access points. Because Wi-Fi access points must be tethered by cable to a switch, use of Wi-Fi connectivity is usually very limited for outdoor IoT applications.

## Wi-Fi 6 & 5G

The world of IoT and digital transformation will certainly require another wireless technology to compensate for the limitations of Wi-Fi 6, and 5G cellular connectivity can provide the missing link.

D-Link is a global provider for affordable high-performance wired and wireless solutions. For the latest Wi-Fi 6 and 5G solutions to enable your digital transformation, please contact your local D-Link representative or visit our website.



**IoT**  
Digital Transformation