Pioneering the Future with Wi-Fi 8

Part two: Reliable Communication

MediaTek Filogic White Paper

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Table of Contents

Key Insights

- Wi-Fi 8 is designed to seamlessly cooperate with cellular networks for internet access.
- Wi-Fi 8 increases opportunity of wireless data transmission and spectrum efficiency via Non-Primary Channel Access and In-Device Coexistence.
- Wi-Fi 8 improves long-tail latency via TXOP Preemption and High Priority EDCA.

Introduction

Since its standardization by IEEE 802.11 in 1997, Wi-Fi technology has become a cornerstone of global wireless network communication. By utilizing radio waves to transmit data between devices, Wi-Fi enables a wide range of devices—such as personal computers, smartphones, tablets, and other smart devices—to access the internet and communicate seamlessly without physical connections. Over the years, Wi-Fi has evolved through numerous iterations, starting with the initial 802.11b and advancing to the cutting-edge 802.11be (Wi-Fi 7), with each generation offering improvements in speed, coverage, and connection quality. This evolution has established Wi-Fi as one of the crowning technological achievements of the 21st century, transforming it from a basic, low-rate data wireless conduit into a robust, high-performance connectivity solution. These advancements have opened the door to innovative use cases and applications, revolutionizing the way we connect and interact with the digital world.

MediaTek Filogic - Pioneering Innovation

The forthcoming Wi-Fi 8 aims to prioritize a pivotal aspect of wireless communication that has become increasingly critical: reliability. Recognizing the ever-growing quest for reliable wireless connectivity, the IEEE 802.11 Working Group has designated Wi-Fi 8 for Ultra High Reliability (UHR) and has formed the Task Group bn to spearhead this development. Industry experts from around the globe are contributing a wealth of potential features to this endeavor. MediaTek Filogic, as an active specification contributor and leading product provider for Wi-Fi solutions, is excited to share its technological vision through a series of white papers. These documents will dissect the myriad features under consideration, organized into four key categories:

1. **Fast:** Strategies to enhance the data throughput between access points (APs) and stations (STAs).
2. **Reliable:** Methods to bolster the reliability of wireless services.
3. **Always-on Connected:** Techniques to minimize service interruptions and maintain constant connectivity.
4. **Beyond Wi-Fi 8:** A look at the ongoing efforts to improve Wi-Fi services that fall outside the scope of the 802.11bn standard. This includes, but is not limited to, topics such as Integrated Millimeter Wave (IMMW) and Artificial Intelligence and Machine Learning (AIML).

As we advance on this journey to the next frontier of Wi-Fi technology, MediaTek Filogic invites you to join in exploring the innovations that will define the future of wireless connectivity.

Wi-Fi 8 Overview and Trends

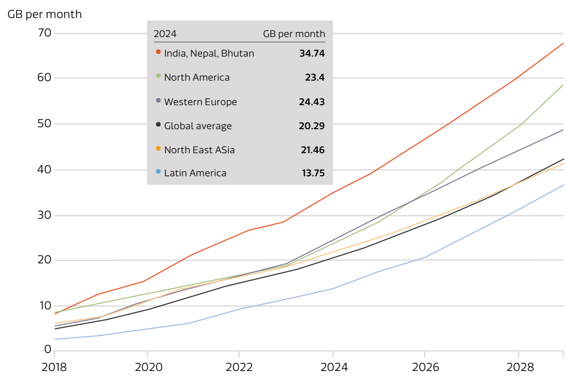
The parity of Wi-Fi and 5G

Wi-Fi has emerged as the most viable alternative to traditional wireline connectivity solutions such as Ethernet and coaxial cables. It offers users the convenience of cable-free flexibility for many devices like laptops and televisions, without the constraints of physical connections. While the peak throughput of Wi-Fi often exceeds the requirements of many applications, users may sometimes experience intermittent jitter during streaming or video conferencing. This is indicative of Wi-Fi's susceptibility to environmental factors impacting signal quality and consistency. In many residential environments, cable-equivalent reliability remains a significant challenge for Wi-Fi technology.

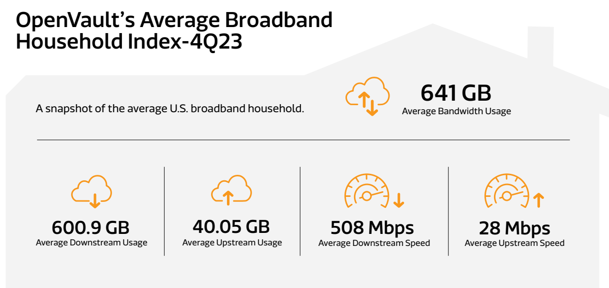
In the current landscape, two prominent wireless technologies dominate the market: cellular 5G and Wi-Fi. While there has been debates about the potential for one to replace the other, yet it is likely that both will coexist in the foreseeable future. Several factors contribute to this coexistence:

1. **Cost Considerations:** The cost of 5G services is generally higher than that of Wi-Fi, largely due to the expensive licensing fees associated with 5G spectrum allocation.
2. **Device Compatibility:** Most consumer electronics come equipped with Wi-Fi capabilities, whereas 5G or 4G connectivity is less common. For instance, Wi-Fi-only tablets continue to lead the tablet market.
3. **Data Offloading:** According to a study by Cisco, in 2022 over 50% of global mobile data traffic was offloaded to Wi-Fi networks, highlighting the significant role Wi-Fi plays in managing data traffic.
4. **Data Volume:** Data usage figures below illustrate the disparity in usage between the two technologies. In the United States, the average monthly data usage per person was approximately 23GB over 4G/5G and a substantial 650GB over broadband as shown in Figure 1. or 250GB per person. And most of the broadband data are carried by Wi-Fi. This indicates that Wi-Fi handles more data in magnitude than 4G/5G. Projections for 2030 suggest that while 4G/5G may carry around 60GB per month, it will still far below the data carried by Wi-Fi. Based on the study, it will surpass 1TB per broadband subscription in 2028 or around 400GB per person.

These points highlight the complementary nature of 5G and Wi-Fi, with each serving distinct roles in the wireless ecosystem. Wi-Fi's significant data handling capacity, along with cost-effectiveness and widespread device integration, ensures its continued relevance amidst the expanding 5G infrastructure.



(a) Mobile data traffic per active smartphone by Ericsson



(b) A snapshot of the average US broadband household by OpenValut & Fierce network

Figure 1. data consumption by mobile and broadband per month.

Evolution of Wi-Fi 8

As previously mentioned, Wi-Fi 8 is designated as UHR and aims to enhance effective and reliable communication. This generation of Wi-Fi standards shifts the focus on improving effective throughput, which refers to the actual data transfer rate experienced by users in real-world environments. For example, the flagship APs are equipped with three streams across each frequency band: 2.4GHz, 5GHz, and 6GHz. Most Wi-Fi clients support up to two streams and two bands. Typically, the channel bandwidth available to clients is less than the maximum defined by the standard. For instance, most iPhone models feature an 80MHz bandwidth, except for the iPhone 15 Pro. The capabilities of these smartphones are well-suited for streaming, requiring 25Mbps for 4K video on Netflix and 100Mbps for 8K video on YouTube.

The table below summarizes the key features and parameters from Wi-Fi 4 through Wi-Fi 8. The concept of multiple AP coordination, introduced in Wi-Fi 7, was deferred to Wi-Fi 8 due to its complexity. The popularity of mesh networks has made multiple APs more common in homes, enhancing the Wi-Fi coverage. However, without effective coordination, these APs may contend and share the common spectrum resources, resulting in often only one AP utilizing the spectrum at any given time. Thus, improving performance is a critical focus. To address these challenges, dynamic sub-channel operation and non-primary channel usage have been proposed. These features are designed to optimize performance when there is a disparity in the number of streams and channel bandwidths among devices. For example, a BW320 (320MHz bandwidth) AP, when communicating with a BW80 (80MHz bandwidth) client, must limit itself to BW80, thereby losing 75% of its transmission capability. Dynamic Sub-Channel Operation (DSO) addresses this issue effectively. Non-Primary Channel Access (NPCA) aims to resolve scenarios where the primary channel is unavailable, allowing communication between the AP and the client to occur via a non-primary channel.

Mitigating interference and minimizing latency present formidable challenges in the realm of Wi-Fi services, particularly due to the inherent uncertainties involved. Wi-Fi 8 introduces a robust suite of features designed to address these issues effectively. Key among these features are In-Device Coexistence (IDC) mechanisms, TXOP preemption and HIP EDCA. These advanced capabilities are pivotal in delivering a more reliable and responsive Wi-Fi experience.

Here is a comparative table highlighting the technology evolution from Wi-Fi 4 through Wi-Fi 8:

Feature	Wi-Fi 4	Wi-Fi 5	Wi-Fi 6	Wi-Fi 7	Wi-Fi 8
Maximum Channel Bandwidth (MHz)	40	160	160	320	320
Frequency Bands (GHz)	2.4 and 5	5	2,4,5 and 6	2,4,5 and 6	2,4,5 and 6
Max PHY rate	150Mbps * 4 600Mbps	866Mbps * 8 ~6.9Gbps	1200Mbps * 8 ~9.6Gbps	2880Mbps*8 ~23Gbps1	2880Mbps * 8 ~23Gbps
Modulation	64 QAM	256 QAM	1024 QAM	4096 QAM	4096 QAM
Spatial Streams	4	8	8	8	8
MU-MIMO		DL only	UL & DL	UL & DL	UL & DL
Target Wait Time			Individual, broadcast	Restricted	Coordinated
OFDMA (# RU per STA)			Yes (single)	Yes (multiple)	Yes (multiple)
Multi-Link Operation				Yes	Yes
Multi-AP Coordination					Yes
DSO/NPCA					Yes
IDC					Yes
TXOP Preemption/HIP EDCA					Yes
dRU					Yes
IEEE Standard	11n	11ac	11ax	11be	11bn

Table 1. The major features among Wi-Fi generations.

Wi-Fi service has become an integral part of daily life due to its convenience and flexibility. In the past, individuals commonly sought out Ethernet connections upon arriving at hotels; nowadays travelers check for Wi-Fi access upon arriving at venues. While cellular LTE & 5G provide long range mobile access, it cannot fully replace the utility of Wi-Fi for most users. As indicated in the preceding section, the final leg of Internet connectivity is increasingly transitioning to Wi-Fi and LTE, with Wi-Fi maintaining a dominant position in this space.

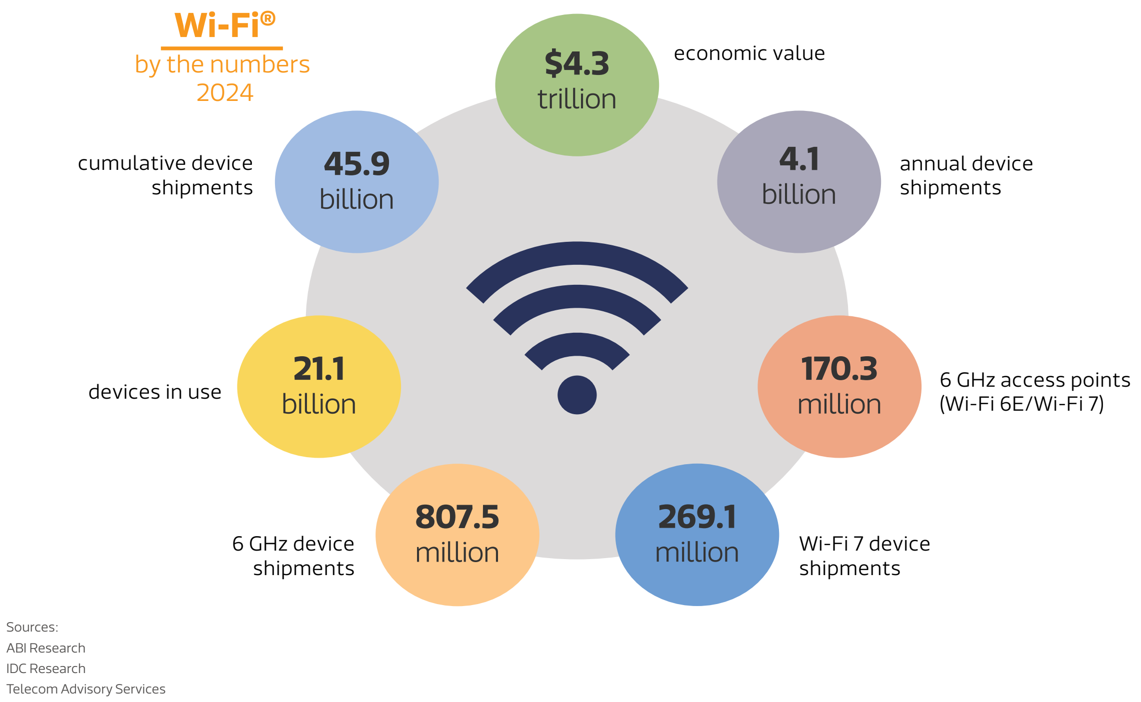


Figure 2. Value of Wi-Fi by the numbers.

Wi-Fi is also a key contributor to the global economy. The number of cumulative Wi-Fi devices shipped will be 45.9 billion by 2024 and around 46% are actively used based on the latest WFA study. In 2024, the annual devices shipped will be 4.1 billion which grows by about 7% YoY. In these devices, around 30% are smart phones and 6.5% are Wi-Fi 7 devices.

The global economic value provided by Wi-Fi reached $4.3 trillion USD in 2024 and will reach $4.9 trillion in 2025 based on the study conducted by WFA across 29 economies. United States and European Union lead the world with $1.6 trillion USD and $637 million USD, correspondingly.

Further analysis shows that growth in the EU region is primarily driven by the development of the Internet of Things (IoT), the use of Virtual Reality (VR), Augmented Reality (AR), Mixed Reality (MR), and eXtended Reality (XR), along with free wireless internet. Additionally, the EU's opening of 500 MHz of bandwidth in the 6 GHz band for wireless network use gives a significant boost.

The United States is the country with the most extensive use of wireless networks globally. Eighty-five percent of broadband households have wireless network services, and 55% of mobile users access the internet via Wi-Fi networks rather than cellular 4G/5G. With FCC opening the full 6 GHz band, providing 1200 MHz of bandwidth for Wi-Fi network use, the economic contribution of wireless networks will grow to $1.58 trillion in 2025.

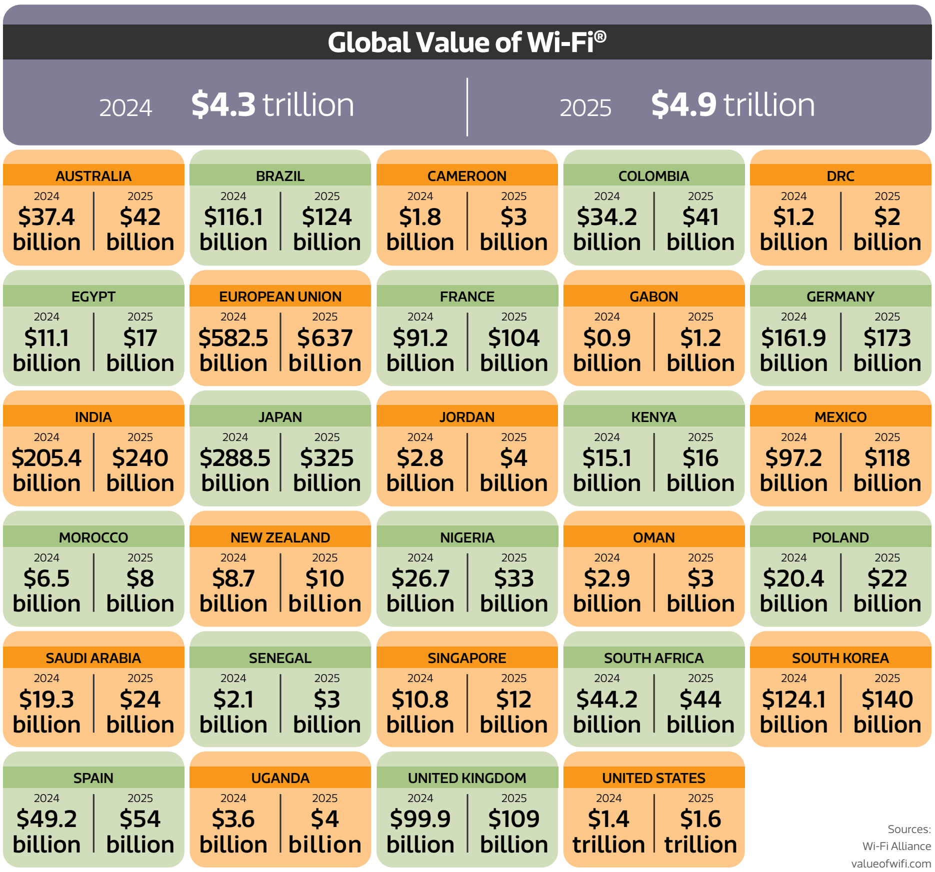


Figure 3. Global value of Wi-Fi.

Among the 27 main economies, China has the largest Passive Optical Network (PON) deployment. There are more than 650 million broadband subscribers and 28.6% have 1Gbps or above high-speed broadband access, during mid-2024. The average connection speed is 487.6Mbps which is 17.9% growth compared to 2023. Three major operators shipped most PON gateways with integrated Wi-Fi. while some PON gateways are without Wi-Fi for separate or existing Wi-Fi AP.

With increasing Wi-Fi devices in a household, the rising demand for better Wi-Fi is expected. The ever-growing demand for wireless applications ensures Wi-Fi will continue to play a leading role enabling next generation use cases and applications since there is no replaceable technology in the foreseeable future.

The Focus of Filogic Wi-Fi 8

Wi-Fi 8 prioritizes reliability as its main objective, aiming to provide deterministic wireless services for applications such as XR, industrial automation, e-Health, and more. This focus on reliability is a significant shift from previous Wi-Fi standards, which primarily concentrated on increasing speed and throughput.

According to the IEEE 802.11 timeline, the target final approval date of IEEE 802.11bn, which encompasses Wi-Fi 8, is set for September 2028. The certification process for related products generally launches a year before the standard ratification. For instance, the first Wi-Fi 7 products were shipped in late 2023, with Wi-Fi certified Wi-Fi 7 products launching in early 2024, while the Wi-Fi 7 standard, 11be, is expected to be approved in September 2024, that is a 4-month delay from the original schedule. Based on this 4-year cadence, Wi-Fi 8 products are anticipated to hit the market in late 2027. That said, an exception to this cadence was observed in Wi-Fi 4, where the standardization process was prolonged, resulting in the pre-N products introduced approximately 3 years before the standard was officially finalized.

The development cycle for a Wi-Fi standard at IEEE is approximately 6 years, as illustrated in the figure below. It is interesting to note that products often become available before the finalization of the standard. For example, even though Wi-Fi 7 is still in the final approval stage, Wi-Fi 7 devices have been in the market since the end of 2023. This early availability is due to manufacturers developing products based on draft versions of the standard rather than waiting for the final version. For Wi-Fi 8, the first products are expected to be available in early 2028, pacing for early adoption for latest Wi-Fi technologies before the standard is officially completed. Any subsequent specification updates before the final approval need to be accommodated by certification or product update to ensure interoperability.

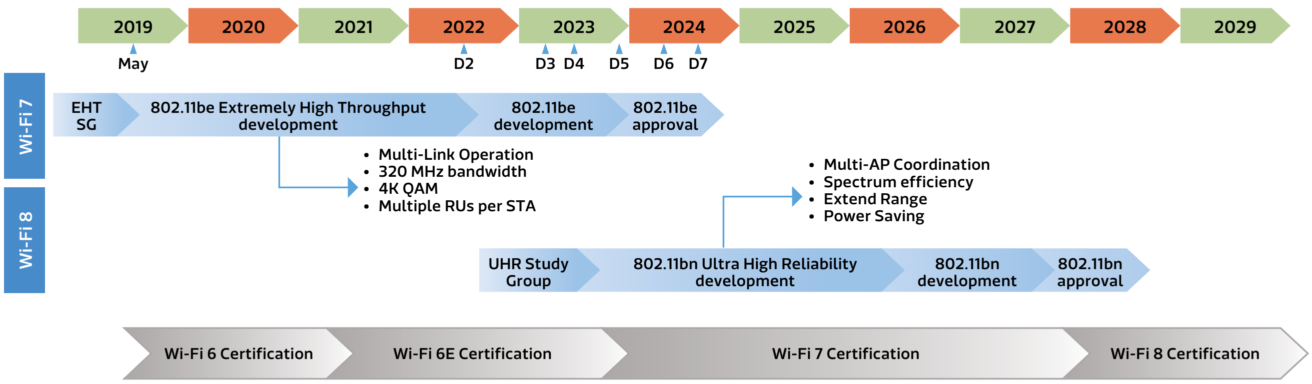


Figure 4. IEEE and WFA milestone about Wi-Fi 7 and Wi-Fi 8.

Each iteration of the IEEE 802.11 standards has progressively enhanced the Wi-Fi capabilities. As indicated in the previous figure, Wi-Fi 7 is focused on maximizing peak throughput with innovations such as Multi-Link Operation, 320MHz bandwidth and 4K-QAM technology. Theoretically, the maximum Physical Layer (PHY) rate for a tri-band 4x4 Wi-Fi AP could reach around 19Gbps. When accounting for overhead, the actual peak throughput in a clean environment is approximately 80% of the PHY rate. Such pristine conditions are typically found only in clean lab environment, rather than everyday usage scenarios.

The Wi-Fi 8 Advantage

With Wi-Fi access becoming a staple in every household, interference is an inevitable challenge. The situation is further complicated by the deployment of multiple APs or mesh networks to ensure comprehensive home coverage, often sharing the same channel to minimize channel switching latency. Consequently, the throughput experienced by a user at any given moment may be significantly lower than the peak throughput. For instance, streaming a 4K video from Netflix requires 25Mbps, which is a fraction (less than 2%) of the peak throughput of a tri-band 4x4 Wi-Fi 7 AP. Despite this, users may still encounter jitter due to protocol overhead and random interference. This real-world throughput is referred to as effective throughput, which is the actual speed users can expect from their Wi-Fi connection. When effective throughput falls below 25Mbps, users may experience noticeable disruptions in their streaming quality. Wi-Fi 8 highlights the cooperation of multiple APs to minimize the interference and maximize the effective throughput.

Enabling Reliable, Actual Performance in Everyday Wi-Fi Environments

In this white paper we have divided our vision into several categories, with each encompassing a set of features. It is important to note that this categorization is subjective, as each feature can contribute to multiple categories. In this chapter, we concentrate on the reliability aspect. Here, "Reliable" refers to enhancing the accessibility to the spectrum and reducing the long-tail latency. Our goal is to address the actual performance that users can reliably achieve in typical, everyday Wi-Fi environments. Key enablement technologies include NPCA, In-Device Coexistence (IDC), Latency and QoS Enhancement by Preemption, and High Priority (HIP) EDCA. Their key aspects for enhancing communication reliability are illustrated in the following real-life scenarios.

Non-Primary Channel Access (NPCA)

Scenario: Lila, Rose and Susie rented a three-bedroom apartment. Each one installed their own AP and connected to internet via Ethernet gateway. They each set up their own Wi-Fi BSSID for their personal devices, such as smartphone, notebook, tablet, gaming devices, smart TV, IoT devices, etc. The APs set their BSSID to channel 38, 42 and 50, respectively. Lila was downloading files from internet while also streaming 4K video. Rose and Susie were also watching internet streams, however their Wi-Fi access suffered intermittent connectivity issues, despite having a fast internet service suitable for three people.

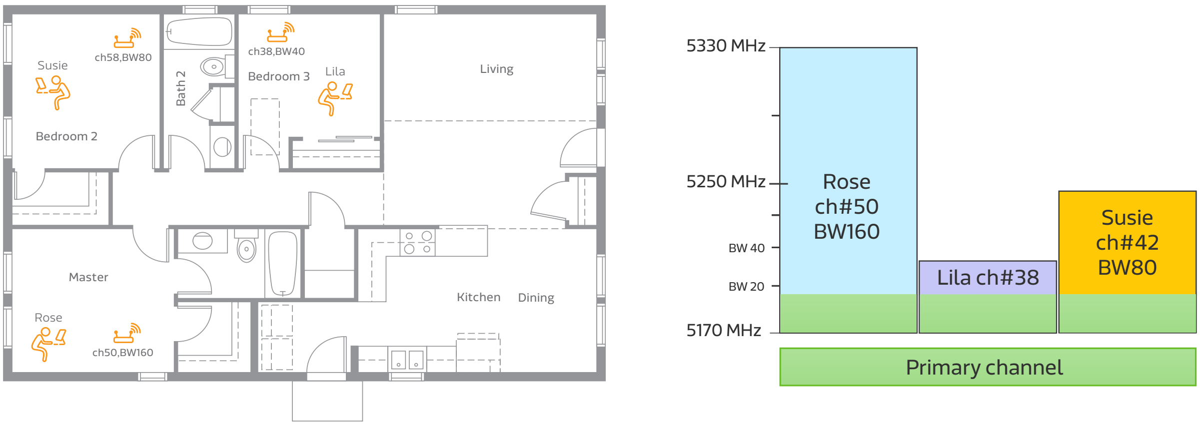


Figure 5. Multiple AP with overlapping channels.

Issue: As shown in the figure above, the three BSSIDs are assigned to the lower 5G band. Based on current Wi-Fi standards, all three APs compete for spectrum on the same primary channel. Since Lila's AP is set to channel 38 with a 40MHz bandwidth, the peak throughput Lila can achieve is only a quarter of Rose's. This configuration forces Lila's Wi-Fi access to take longer and reduces Wi-Fi access time for both Susie and Rose. As a result, the connectivity of Rose and Susie is adversely affected.

Challenge: The primary channel is mandatory for Wi-Fi access in all previous Wi-Fi standards. A Wi-Fi technology is needed to transmit data in other, available spectrum when the primary channel is occupied. For example, Rose is transmitting data in the upper 120MHz, while Lila is transmitting data on channel 38.

Technology: Most Co-Channel Interference (CCI) originates from legacy devices operating within narrow bandwidths. These older technologies, originally designed for less crowded frequency bands, are insufficient for modern network demands and inadvertently disrupt communication. As more users and devices connect to the same channels, interference from these legacy devices becomes increasingly problematic, even while non-primary channels remain underutilized, significantly reducing overall bandwidth efficiency.

To address narrow bandwidth CCI, NPCA has been introduced in Wi-Fi 8. To employ NPCA, the AP and the wireless device (Station/STA) must negotiate an NPCA primary channel. This negotiation can occur when the primary channel is changed or when additional CCI is detected.

Once narrow bandwidth CCI is detected, both the AP and the STA switch to the NPCA primary channel for packet detection. In the case of an 80 MHz CCI within a 160 MHz BSS, our study demonstrates a 37.5% increase in throughput. Beyond the throughput gains, NPCA also offers advantages in use cases where low latency is a critical experience factor.

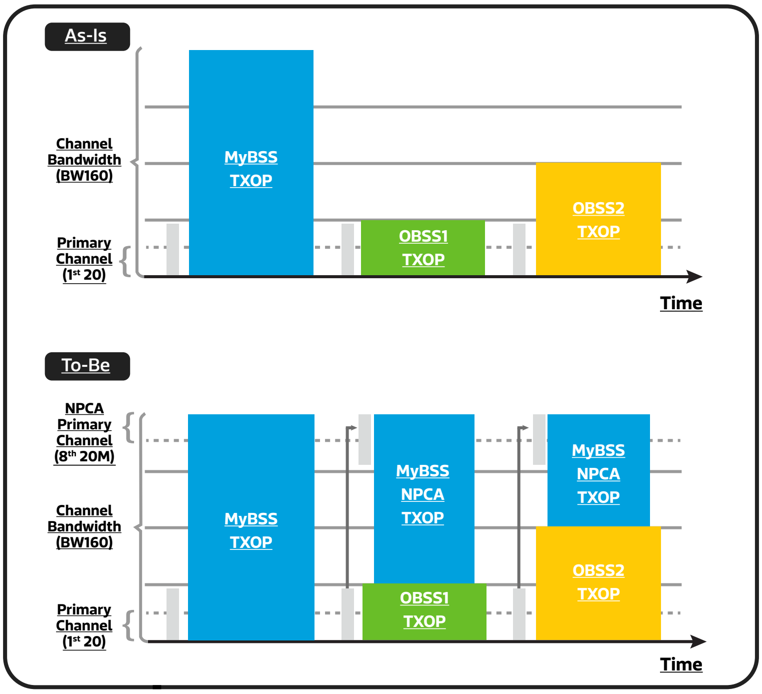


Figure 6. NPCA improves the bandwidth efficiency when narrow bandwidth CCI exists.

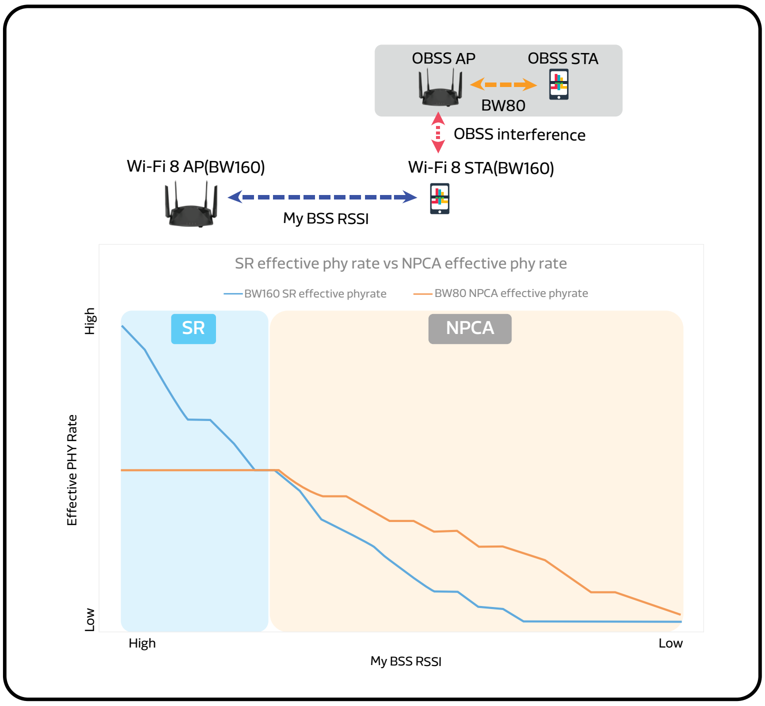


Figure 7.NPCA and SR provide complementary anti-noise solution.

In scenarios where the narrow bandwidth CCI is relatively strong, NPCA can provide a more effective data rate than tradition technology, like Spatial Reuse. NPCA is integrated with MediaTek Filogic's anti-noise solution, providing a more reliable user experience in device-dense environments.

In-Device Coexistence (IDC)

Scenario: Tim was on a conference call with a colleague in a conference room. He was using Wi-Fi to connect his laptop to the conference call service, where he has shared his screen with everyone. He used a Bluetooth headset for both his microphone and audio. During the conference, Tim and his colleagues were also sharing files – uploading and downloading them from shared intranet resources. He noticed that the audio quality suddenly became poor whenever files were being exchanged, causing disruption to the meeting's progress.

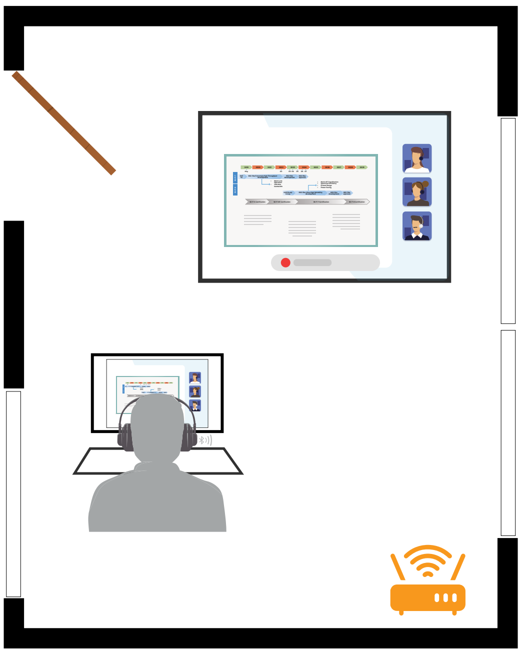


Figure 8. Tim is doing conference, but his Bluetooth audio is intermittent.

Issue: During the conference call, the video and audio streaming, and file transfers are competing for the available bandwidth. Even when the audio has highest priority for transmission, it may be blocked by long packets used in file transfers, causing the audio to become intermittent.

Challenge: There is interference between AP and STA, using Wi-Fi, and STA and headset, using Bluetooth. Since Bluetooth packets are sent in scheduled time slots, the AP should transmit data during Bluetooth packet inactivity.

Technology: The presence of multiple wireless radios within a single device has become a common technological advancement. These different radios often share resources, such as antennas, to reduce cost, size and power use, but which can also lead to resource unavailability or interference issues.

Numerous algorithms have been developed to address the coexistence problems of multiple internal radios in each device, aiming to minimize interference and maximize resource utilization. However, there remains a significant need for new communication protocols that enable APs to better understand and accommodate the coexistence needs of Non-AP STA devices.

The information for In-Device Coexistence (IDC) can be carried in the Initial Control Frame (ICF), the Initial Control Response Frame (ICR), and the Control Response Frame (CRF). This coexistence information can be extended to serve various purposes. Here are some examples:

1. The information may indicate one or more repeated periods, referred to as 'unavailable windows,' during which the device experiences IDC issues.
2. The information may specify the transmission and reception capabilities applied during the unavailable windowto ensure reliability despite interference. This includes details such as the maximum Modulation and Coding Scheme (MCS) and the maximum number of available spatial streams.
3. The information assists APs in better adapting to the situation through mechanisms like rate control.

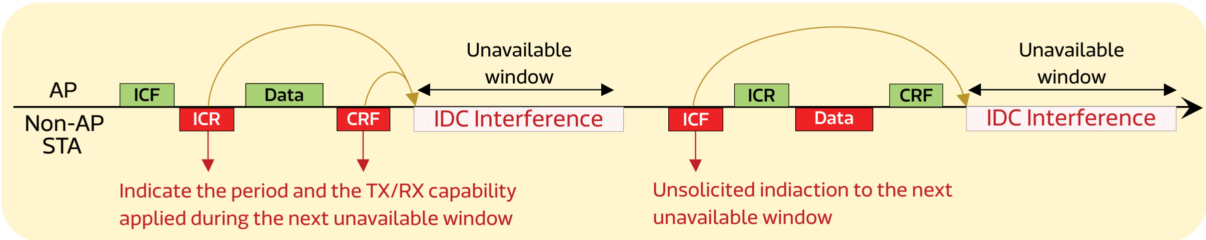


Figure 9. Example of Frame-Exchange-Sequence of IDC.

Wi-Fi 8, when powered by MediaTek Filogic, integrates the IDC protocol with in-house optimized algorithms, providing users with a better multi-radio coexistence experience.

TXOP Preemption

Scenario: Asher is playing an online game while his friend, Ellie, is doing a livestream of him playing. Ellie was using two smartphones, and streaming 4K video, with one watching Asher play while the other streamed Asher's gameplay. However, Asher's character controls sometimes experienced lag, causing him frustration. All the devices are connected using Wi-Fi.

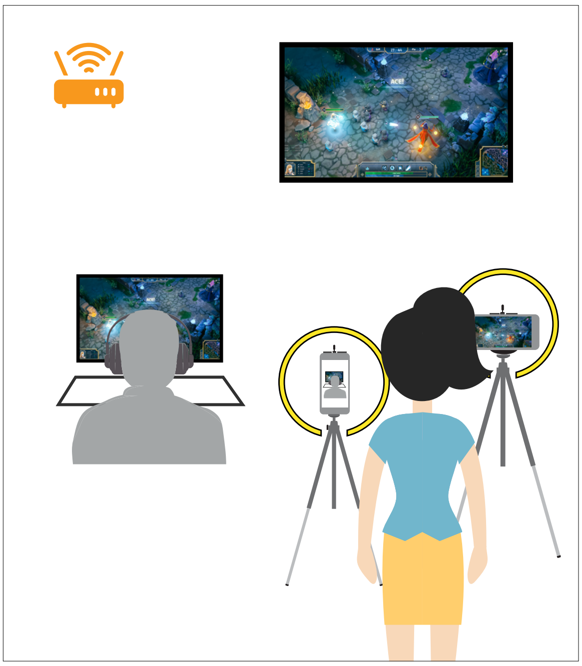


Figure 10. A gamer is playing, while also livestreaming on other devices.

Issue: When Asher plays alone, the Wi-Fi is almost entirely dedicated to his gaming machine. However, when livestreaming is active, multiple devices compete for Wi-Fi bandwidth. If a command is issued to control his character while a video data packet is being transmitted, the command packet must wait. Occasionally, this causes a delay in command packets, resulting in input lag, and a poor user experience.

Challenge: To achieve high throughput and spectrum efficiency, Wi-Fi usually aggregates data packets into a larger PPDU. This minimizes the overhead but extends the waiting time of packets in the queue. Can we adjust the size of the PPDU to minimize the waiting time?

Technology: In certain scenarios, non-TXOP holders may need to transmit urgent low-latency data or high-priority messages. These situations arise when immediate communication is essential, such as in real-time applications or emergency notifications.

While shortening the Transmission Opportunity (TXOP) duration can help ensure the timely delivery of low-latency data or high-priority messages, this approach may also negatively impact overall system efficiency. Frequent channel access increases contention and delays for other devices, ultimately reducing the network's effective throughput.

To address this challenge, TXOP-based preemption can be utilized. This mechanism allows non-TXOP holders to temporarily interrupt ongoing transmissions for urgent messages, ensuring that critical data is transmitted promptly without significantly disrupting network efficiency.

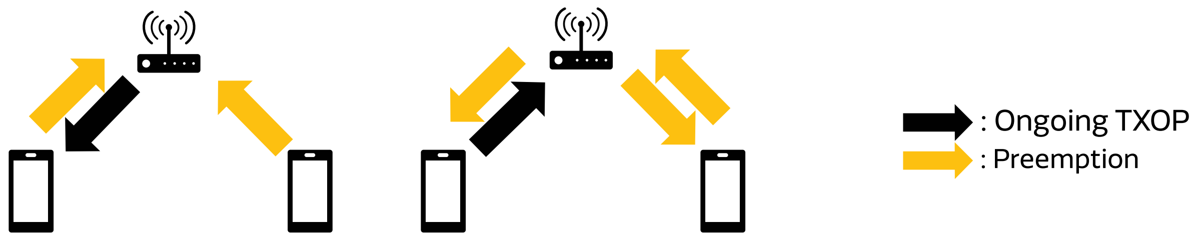


Figure 11. Preemption Use Cases.

There are two types of TXOP preemption in which we are interested:

1. During an ongoing DL TXOP, an UL preemption request from the responder or other intra-BSS STAs.

2. During an ongoing UL TXOP, a DL preemption request from the responder or an UL preemption request from other intra-BSS STAs.

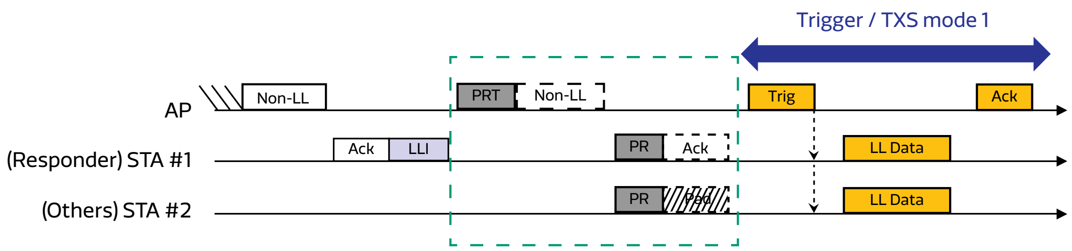


Figure 12. Example of the Trigger for Preemption in DL TXOP.

Here is an example of the trigger for preemption during an ongoing DL TXOP:

1. The AP sends a Preemption Request Trigger (PRT) to poll for a Preemption Request (PR) for pending UL low-latency (LL) transmissions.

2. The responder and/or other STAs respond with a PR to indicate pending LL transmissions.

3. The AP then sends a Trigger Frame (Trig) to initiate UL LL transmissions.

MediaTek Filogic's trigger for preemption simplifies the design with a unified mechanism for both DL and UL TXOP preemptions, enabling support for low-latency and high-priority transmissions. It also shifts complexity from the STA to the AP and leverages the existing trigger-based mechanism to handle PR transmissions from multiple STAs.

High Priority EDCA (HIP EDCA)

Scenario: Matt joined a study group. After a long discussion, they were taking a break. Most of his friends were using their smartphones or notebooks to make calls, playing online games, or watch videos; they are all using the school's Wi-Fi network. Matt called his girlfriend, but the audio was frequently intermittent.

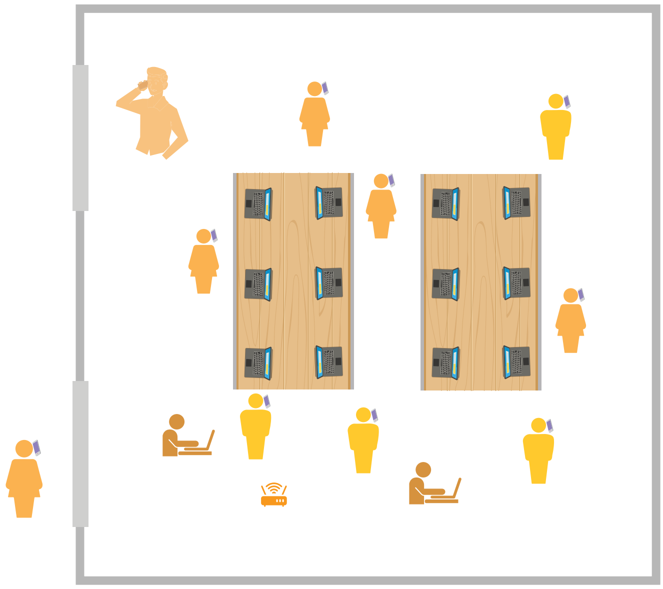


Figure 13. Students are enjoying phones, streaming, and playing games during a study break

Issue: Each device competes for the opportunity to transmit in Wi-Fi communication, and audio packets are usually assigned the highest priority for transmission. If two or more devices transmit audio packets in the same time slot, all transmissions will fail when using existing Wi-Fi technology. All devices will then pause packet transmission for a random period before attempting retransmission. Since several students are making audio calls, all devices compete for Wi-Fi packet priority, causing random latency spikes as packets fail and wait for an available slot for retransmission.

Challenge: When multiple devices are competing the Wi-Fi access, the packet failure, wait and retransmission attempt will cause a latency spike in the audio, and negative user experience. How can we better negotiate multiple devices with high priority packets, ensuring an acceptable latency and connection reliability?

Technology: The existing Enhanced Distributed Channel Access (EDCA) mechanism provides a smaller backoff contention window for STAs transmitting AC3 (or AC-VO) data traffic compared to other Access Categories (ACs). This design prioritizes time-sensitive multimedia transmissions, allowing them to access the channel more quickly. However, the reduced contention window significantly increases the likelihood of collisions in environments where multiple STAs simultaneously generate AC3 data traffic. When several devices compete for channel access with smaller backoff timers, the chances of overlapping transmissions rise dramatically, leading to a higher incidence of collisions. Even though retransmission mechanisms are in place to handle these collisions, their frequency remains high, making it challenging for the system to converge effectively.

To address this issue, MediaTek proposes a streamlined High Priority EDCA (HIP EDCA) mechanism, which reuses the RTS frame with a fixed data rate and reconfigures EDCA parameters as follows:

1. Reuse the non-HT format with a fixed data rate as a High Priority RTS.
2. Reconfigure the EDCA parameters to AIFSN = 2, CWmin = 0, and CWmax = 7 for transmitting the High Priority RTS.

With these settings, High Priority AC can consistently gain channel access when competing with other ACs. Meanwhile, STAs that send an RTS and experience a collision can retry the RTS within the EIFS period, as STAs with suspended backoff will not contend for the medium during this time.

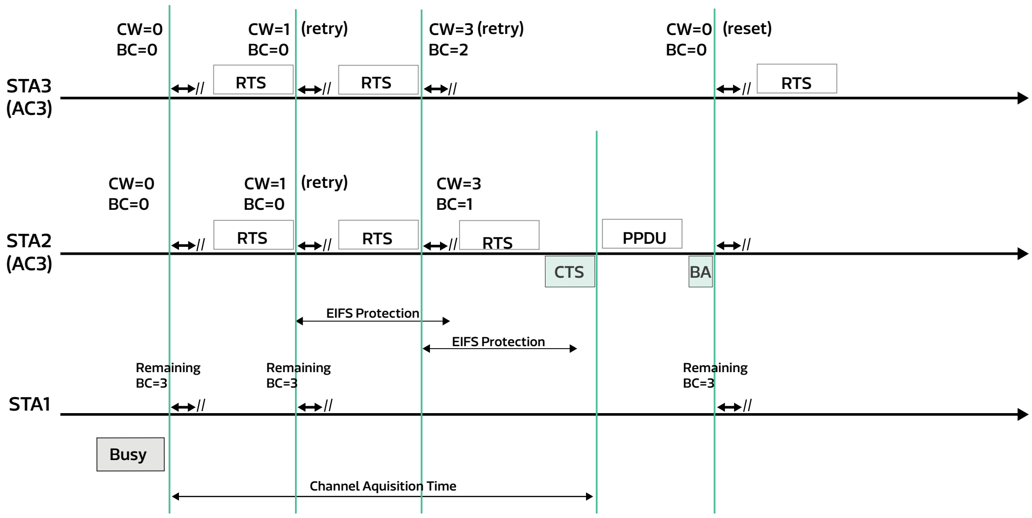


Figure 14. Illustration of HIP EDCA Frame Exchange Sequence

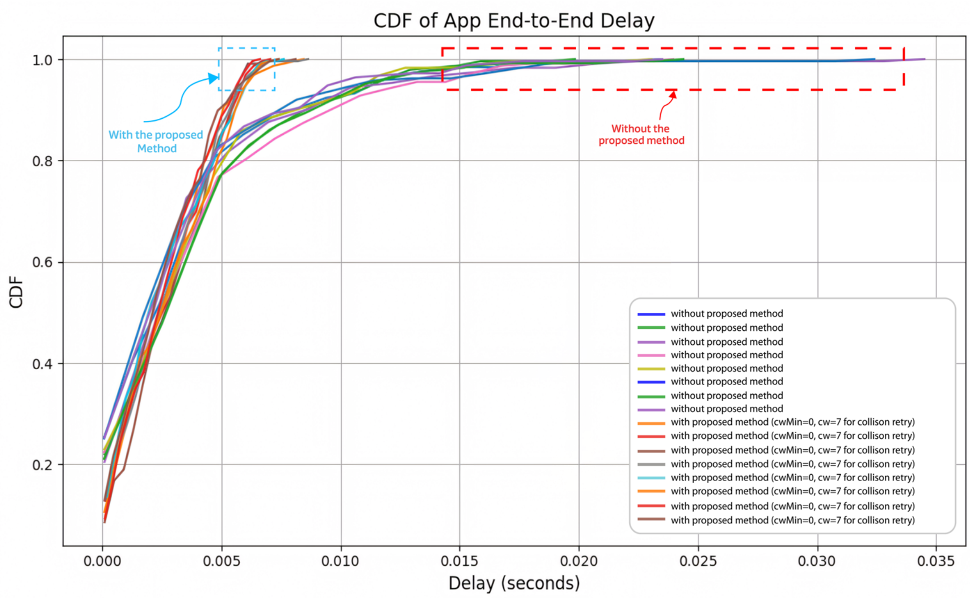


Figure 15. Long-tail Latency Reduced by HIP EDCA

In a setup with eight AC3 STAs and eight AC1 full-buffered STAs, our study shows that the long-tail latencies of AC3 STAs can be significantly reduced, from >30 ms to <10 ms. By integrating HIP EDCA into next-generation Wi-Fi, MediaTek Filogic provides a streamlined implementation that ensures a more reliable and low-latency user experience.

Conclusion

The evolution of Wi-Fi standards is being driven by the ever-increasing demand for faster, more reliable, and even more efficient wireless communications. Each new standard, from 802.11a to the latest 802.11be, has brought significant improvements in speed, capacity, and performance, enabling a wide range of applications and devices to connect seamlessly. As we continue to innovate and integrate more devices into our daily lives, the progression of Wi-Fi technology remains crucial, ensuring that our wireless networks can keep up with the growing needs of both consumers and businesses. The 802.11bn standard promises greater advancements, with the potential for higher effective speeds, lower latency, and more robust communications in increasingly crowded and diverse wireless environments.

Filogic has leveraged several advanced technologies as below for enhancing communication efficiency across the various user scenarios.

- The NPCA increases the opportunity for transmission and enhances spectrum efficiency in multiple AP environments.
- The IDC aims to arrange Wi-Fi and Bluetooth transmissions to minimize interference. It also addresses the coexistence of Zigbee, Matter, and UWB.
- TXOP Preemption and HIP EDCA are both used to reduce long-tail latency and improve QoS.

Further enhancements and features that build upon these foundational technologies will be explored in subsequent papers, continuing the discussion on advancing Wi-Fi communication capabilities.

MediaTek in the Wi-Fi Industry

MediaTek is the world's largest supplier of Wi-Fi solutions, including standalone networking products such as routers, repeaters, and mesh access points, and devices with embedded Wi-Fi connectivity such as smartphones, tablets, TVs, IoT, smart home devices, PCs and laptops, games consoles, and many others.

Besides delivering high performance and low power integrated solutions to these platforms, MediaTek is actively participating in IEEE and Wi-Fi Alliance certification development to ensure top performance and industry interoperability. Some recent examples include selection of MediaTek's Filogic platforms as Wi-Fi 6E and Wi-Fi 6 R2 test bed devices. With Wi-Fi 7 and more, MediaTek continues to contribute technical expertise and knowledge of diverse market segment standards for improved Wi-Fi performance in daily applications.

Get set for Wi-Fi 7 with the latest in MLO innovation from MediaTek

MediaTek's innovations and product platforms are equipped to support next-generation MLO reliability using our newly unveiled Filogic 880 and Filogic 380 high performance, power-efficient and reliable Wi-Fi solutions.

<Discover Filogic>

https://www.mediatek.com/products/networking-and-connectivity/filogic-wifi6-wifi7

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