

Wi-Fi 7 WHITE PAPER

# HFCL EMPOWERS CONNECTIVITY BEYOND IMAGINATION





# INTRODUCTION

The demand for high-speed Wi-Fi continues to grow in line with the growing number of connected devices and evolving applications arising from not just businesses and homes but also from schools and universities.

As a result of these advancements, contemporary life is becoming increasingly reliant on secure, dependable, high-speed wireless access. To accommodate the evergrowing demand of high bandwidth applications, such as 4K/8K streaming, anticipated AR/VR and Metaverse developments, remote collaboration, Cloud gaming, and many more, Wi-Fi Technology must evolve continuously.

The modern-day applications and the ever-emerging use cases necessitate networks to be intelligent and efficient apart from being high-speed and ultra-secure, and the legacy Wi-Fi systems are inadequate to handle these requirements.

The latest Wi-Fi standard- IEEE 802.11be or Wi-Fi 7, is the next generation of Wi-Fi technology and the most advanced form of Wi-Fi that overcomes these challenges. Wi-Fi 7 promises significant improvements over the current Wi-Fi standards in terms of high speed, low latency, extremely high throughput, and intelligent and self-optimizing networks.

Wi-Fi 7 will be faster and more efficient, with improved mesh networking capabilities and better interference mitigation techniques. This will result in a better wireless experience for all users, even in densely populated and far-fetched areas.



## What is the hype about Wi-Fi 7?

Wi-Fi 7 is all set to create a stir and take the rein from Wi-Fi 6 and Wi-Fi 6E. The newest Wi-Fi standard is poised to be launched in 2024 and will push the boundaries of what Wi-Fi can achieve through its advanced set of features ensuring great user experience. With Wi-Fi 7, Wireless Technology will finally be able to compete with Ethernet networks in terms of speed, reliability, and latency. Wi-Fi 7 brings in more flexibility and capabilities and will work in close coordination with 3GPP-based 5G to deliver seamless indoor networks, introduce edge computing, distributed and cloud architectures, virtualization, and digitalization in the emerging private wireless networks (PWN). Moreover, Wi-Fi 7 will play a key role in supporting applications that require deterministic latency, high reliability, and quality of service (QoS).

# What Makes Wi-Fi 7 The Most Advanced Form Of Wi-Fi?

Wi-Fi 7 enhances the wireless experience and fosters the development of emerging use cases, thanks to extremely high throughput, consistently low latency, and high speed, plus support for advanced features like 320 MHz channels, 4K QAM, preamble puncturing and advanced multi-link operations.

## **Additional Spectrum & Wider 320 MHz Channels:**

Doubling the max Channel size from 160 MHz to 320 MHz doubles the throughput. Wi-Fi 7 can deliver massive throughput gains by packing more data into each transmission, thanks to a wider channel and capacity gains from the 6 GHz spectrum. Wi-Fi 7 supports 160 + 160 MHz, 240 + 180 MHz, and 160 + 80 MHz channels to combine non-adjacent spectrum blocks and enhance data transfer rates.

## **4096 QAM:**

Wi-Fi 7 adopts a higher-order modulation scheme: 4096 QAM as compared to 1024 QAM supported by Wi-Fi 6 & 6E standards. This means that more data can be packed and transmitted into a given time slice, leading to higher transmission rates and in turn higher transmission efficiency and reduced lag.

## **16 Spatial Streams, Double the Capacity:**

Wi-Fi 7 doubles the number of Spatial streams from 8 to 16 on all three frequencies. This theoretically corresponds to double the physical transmission rates as compared to Wi-Fi 6. Each stream is essentially a multiplier when combined with channel width and type of modulation in use. This helps meet growing traffic demands caused by an increasing number of connected devices in homes and enterprises.

## **Multi-Link Operation:**

Wi-Fi 7 enables devices to simultaneously send and receive data across different frequency bands and channels or, both bands can be used concurrently to share redundant/unique data to deliver optimum performance, increase throughput, reduce latency, and improve reliability for emerging applications like VR/AR, online gaming, remote offices, and cloud computing.

### **Multi AP operation & Coordinated MU-MIMO:**

To foster efficient usage and balanced allocation of radio resources, multi-AP coordination strives to optimise channel selection and manage loads amongst APs. Coordinated scheduling between multiple APs in Wi-Fi 7 involves inter-cell coordinated planning in the time and frequency domains, inter-cell interference coordination, and coordinated MU-MIMO. As a result, there is less interference between APs, and the air interface resources are used much more effectively.

### **Multi Resource Unit & Preamble Puncturing:**

With Wi-Fi 6, each user can only send or receive frames on an assigned Resource Unit (RU), which significantly limits the flexibility of the spectrum resource scheduling. Moreover, when another device uses any part of a large high-speed channel, the entire channel becomes unavailable—and a different channel must be used. OFDMA enhancements with Wi-Fi 7 increase spectral efficiency & flexibility, reduce latency and enhance the user experience by assigning punctured Resource Units (RU) per STA.

Moreover, Wi-Fi 7 can use puncturing to eliminate transmission in parts of the channel (up to 20 MHz) to accommodate spectrum restrictions that may prohibit the use of part of the band. Puncturing also makes it possible to use wide channels in environments where there is insufficient contiguous spectrum available.

### **Deterministic Low Latency & High Reliability:**

With Wi-Fi 7, users will not only experience less latency, but that latency will be deterministic – latency over Wi-Fi link will be less variable and more predictable. Features like MLO, Multi-AP, Preamble Puncturing and availability of wider channels help in reducing latency, especially in congested environments, to support real-time applications such as online gaming, IIoT applications and AR/VR. Deterministic latency will improve support for applications that cannot tolerate variable latency, like industrial automation, Healthcare and other applications that can tolerate consistent latency. Moreover, packet duplication over multiple links significantly reduces the chance of data loss, thus offering a highly reliable Wi-Fi connection.

## Enhanced Security with WPA3 & OWE:

Wi-Fi 7 will come with the latest cutting-edge Wi-Fi-certified WPA3 security protocols. The WPA3 security protocols enable more robust authentication, deliver increased cryptographic strength for highly sensitive data markets, and maintain the resiliency of mission-critical networks.

The 192-bit security mode offered by WPA3-Enterprise ensures the right combination of cryptographic tools is used and sets a consistent baseline of security within a WPA3 network. Moreover, with Opportunistic Wireless Encryption (OWE), the WPA3 standard preserves the convenience that Open Wi-Fi Networks offer while reducing some of the risks associated with accessing an unsecured network.

## Use Cases

Wi-Fi delivers a vast range of opportunities across a variety of sectors, including smart homes, smart cities, automotive, healthcare, enterprise, government, and industrial IoT environments.

It enables users to automate their smart homes and connect a wide variety of connected household objects, carry out tasks in Virtual and Mixed reality, monitor supply chains and other critical functions in real-time in industrial facilities, and unlock business value by increasing productivity and efficiencies for both enterprises and hybrid-work scenarios.





## Internet of Things & XR/ VR/ MR applications

As the Internet of Things (IoT) gathers pace, there is far greater demand for machine-to-machine (M2M) connections, many of them wireless. Wi-Fi with its wide-ranging technology portfolio, integration with existing networks and a strong legacy of interoperability make it the obvious choice to unlock greatest value from IoT. The economic potential of IoT is boundless and Wi-Fi 7 will play a pivotal role in delivering IoT innovation, providing pervasive connectivity to connect a wide variety of “things” to each other, to the internet, and to 18 billion Wi-Fi devices in use around the world. Enabled by advanced Wi-Fi 7 features like low latency (less than 2ms), Extremely High Throughput (greater than 40 Gbps), possibility of connecting large number of simultaneous users, and Multi AP coordination, the Internet of Things (IoT) can be used to enable and even enhance Virtual Reality (VR) and Augmented Reality (AR) experiences. These applications include

- Use of IoT and Augmented Reality (AR) to improve security and law enforcement agencies; (Defence)
- Use of AR for predictive maintenance of facilities and equipment; (Industrial IoT)
- Use of VR with different types of sensors (IoT) to enhance the immersive experience for Guests in hotels, Online Gaming, Malls and Stadiums, Smart Homes (Hospitality)
- Use of different types of sensors (IoT) in autonomous and connected cars for seamless connectivity and enhanced user experience

We believe that Wi-Fi 7 will augment 3GPP based 5G networks to promote innovation in the Internet of Things and interconnect millions of devices, intelligently and efficiently, thereby creating exciting new use-cases.



## Healthcare

Reliable and high-speed internet is critical to the functioning of the Healthcare system. The pandemic has further made it imperative to have an unfailing network so that people in the far-fetched areas can be taken care of using Telemedicine or for (delete)Timely Remote Diagnosis.

Wi-Fi 7, the latest and the most advanced form of Wi-Fi, is well suited to cater to such dynamic environments because Wi-Fi is one of the most trusted, ubiquitous wireless technologies offering high-performance connectivity, WPA3 security, and support for legacy devices.

The availability of a wider 320 MHz Channel, additional 6GHz spectrum, and 16 spatial streams means that Wi-Fi 7 can deliver massive throughput gains of up to 40 Gbps by packing more data into each transmission.

This enables Wi-Fi networks to efficiently handle dense environments with hundreds or thousands of devices and medical equipment requiring simultaneous connectivity and ensuring smooth transfer of heavy medical files and patient reports without any delay.

Moreover, with features such as multi-AP coordination, Multi Resource Unit allocation and Preamble Puncturing, users can experience seamless connectivity with latency that is not only less but also deterministic in nature. Wi-Fi 7 can also be used to enable IoT healthcare applications by using VR, for example, to test the optimal surgical plan to reduce the risk of surgical failures.

We believe that advancements in spectrum and network intelligence that come with Wi-Fi 7 will truly transform the way Wi-Fi is being used in the Healthcare industry.



## Public Wi-Fi Networks

Wi-Fi 7 will play a key role in delivering secure and high-speed public Wi-Fi networks, especially in extremely high-density areas requiring high bandwidth like indoor and outdoor stadiums, concert halls and public parks. It offers unprecedented capacity, allowing users in crowded environments to perform demanding tasks while receiving flawless Wi-Fi. Wi-Fi 7 delivers Extremely High Throughput and low latency while enabling a large number of simultaneous users to experience high-speed internet connectivity.

Moreover, the newest Wi-Fi standard brings in intelligent and self-optimizing networks in terms of channel & band selection and coordination amongst APs to enhance spectral efficiency and minimize latency for improving overall user experience.

WPA3 Security Standard and Wi-Fi-certified Passpoint 3.0 streamline access to Wi-Fi hotspots in public places by allowing users to securely connect to the public hotspots and eliminate the need for users to find and authenticate a network each time they connect. We feel that Public Networks will truly benefit from the advanced features that come with Wi-Fi 7. Combining the power of Wi-Fi 7 with the advantages offered by Open-Source Networks will truly change the landscape of Public Wi-Fi Networks.

Through network disaggregation at both the Hardware and Software levels, Open-Source Network architecture promotes innovation amongst the participating community members and encourages other players to join the community. This promotes flexibility, improves scalability & performance and brings down the total cost of ownership, thereby benefitting the customers as well as the end consumers.

# Experience World's First Open-Source Wi-Fi 7 Access Points With HFCL

We at HFCL are extremely excited to announce the latest addition to our advanced range of Wi-Fi Products under the io brand: Wi-Fi 7 Indoor and Outdoor Access Points.

## Indoor Access Points



**ion8bi**

10 Wi-Fi 7 Dual Radio 4x4:4 Indoor Access Point  
with Integrated Antenna (5 dBi)



**ion12bi**

10 Wi-Fi 7 Tri Radio 4x4:4 Indoor Access Point  
with Integrated Antenna (5 dBi)

## Outdoor Access Points



**ion8b/ion8be**

10 Wi-Fi 7 Dual Radio 4x4:4 Outdoor Access Point



**ion12b/ion12be**

10 Wi-Fi 7 Tri Radio 4x4:4 Outdoor Access Point

With this launch, io by HFCL has become the first OEM in the world to launch Open-Source Wi-Fi 7 Access Points. Based on the IEEE 802.11be standard, this revolutionary Wi-Fi technology is designed to deliver extremely high throughput (EHT), higher spectral efficiency, better interference mitigation, and Real-Time Applications (RTA) support. The first generation of Wi-Fi 7 products will offer up to 10 Gbps data rate, support up to 1536 simultaneous users and offer latency under 2 ms.

This is a huge upgrade from the existing Wi-Fi 6 Access Points that offer peak data rates of 5 Gbps and latency of 10 ms, making Wi-Fi 7 APs ideal for high-density environments such as stadiums, airports, and convention centers. The Access Points are built on the Open-Source Network architecture, making the entire solution highly flexible, scalable, vendor-agnostic, and robust.

This new wireless connectivity standard is set to revolutionize wireless connectivity and will fuel the development of new and emerging use cases, especially for AI and IoT applications. With faster speeds and enhanced security, Wi-Fi 7 will significantly impact the market, and we are proud to be leading the charge.

HFCL- a leading global technology company & a leading Telecom Equipment manufacturer leveraging technology leadership, is ready to enable a world where everyone and everything can be intelligently connected. HFCL's comprehensive product suite is purpose-built to cater to the evolving network ecosystems and meet ever-growing connectivity demands for higher bandwidth, high throughput, and low latency.

HFCL has an end-to-end stack of Networking products in its portfolio ranging from different types of Optical Fiber cables, Wi-Fi Access Points, Fully Managed Network Switches, Unlicensed Band Radios, mmWAVE, GPON, and a recently launched range of 5G products. Backed by a strong R&D focus, HFCL's product portfolio will enable technology providers such as Telecom operators, Internet service providers, System Integrators, and Network Administrators to offer mission-critical and real-time application services and deliver a better user experience than ever before.

HFCL will continue contributing to its vision of becoming a technology leader in this space by tailoring connectivity solutions and products that meet the specific needs of its customers, outpacing the immediate business demands, and positioning them as future-ready.



# Conclusion

The white paper briefs out the features and the use cases of the recent and the most advanced standard of Wi-Fi: Wi-Fi 7. However, it is not an exhaustive list of all its unique features. Wi-Fi 7 promises to be a game changer for wireless networking, offering faster speeds and better range than ever. With its latest features, such as Multi-Link Operation, multi-AP coordination, Preamble Puncturing and deterministic latency, the new standard is poised to take over the market.

“We take great pride in being the first OEM in India to launch a Wi-Fi 7 product line and the first in the world to offer Wi-Fi 7 Access Points that are Open Wi-Fi ready. This means all our clients will benefit from the cost and operational benefits of the open-source community. Our Wi-Fi 7 portfolio, which is based on the Wi-Fi 7 Qualcomm® Networking Pro Series Platforms and complies with the most recent IEEE 802.11be standard is created to address the growing demands of global enterprises and industries for a wide range of emerging use cases-Internet of Things (IoT) and IIoT applications, supporting advancements in Cloud/Edge Computing, Cloud gaming, and other xR-based applications.

Wi-Fi 7 uses faster connections with 320 MHz and 4k QAM, multiple connections with multi-link operation and ‘adaptive connections’ for adaptive interference puncturing to deliver an enhanced user experience while offering better power efficiency”, Mr. Mahendra Nahata, MD, HFCL Limited.





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