Wi-Fi 6 and WiFi 6E Vs. WiFi 8 for IoT

Wi-Fi 6 and WiFi 6E provide stable connections and low interference, which are suitable for current IoT needs; WiFi 8 brings ultra-high speed and lower latency, opening a new chapter for the widespread application of IoT in the future.

Introduction

With the rapid development of IoT technology, wireless network technology plays a vital role in it. As one of the most commonly used wireless LAN technologies, Wi-Fi's evolving standards provide IoT with more efficient, stable and fast connections.

This article will delve into the application of Wi-Fi 6, WiFi 6E and the emerging WiFi 8 technologies in IoT, and compare their technical characteristics, performance advantages and applicable scenarios.

Wi-Fi 6 Technology Detailed Explanation

(I) Technical Features

1. Rate Improvement

- Wi-Fi 6 uses higher-order modulation methods (such as 1024-QAM), more subcarriers, and lower frame interval overhead, which increases its maximum connection rate to 9.6 Gbps, a significant improvement over Wi-Fi 5.

2. High-density access

- Through complete **MU-MIMO** (multi-user multiple-input multiple-output) and uplink and downlink OFDMA (orthogonal frequency division multiple access) technologies, Wi-Fi 6 can significantly improve concurrency and average terminal rate in high-density deployment scenarios. This means that in the IoT environment, more devices can access the network efficiently at the same time.

3. Anti-interference

- Wi-Fi 6 introduces 4G LTE's cell spatial reuse technology (SR), which greatly reduces mutual interference between APs and improves access capacity and stability. This means more reliable network connections for devices in the IoT.

4. Power saving management

- Wi-Fi 6 supports TWT (target wake-up time) technology, which can define different wake-up times for each terminal. The terminal device will only enter the working state after receiving its own "wake-up" information, and will be in sleep state for the rest of the time, thereby saving power consumption and extending battery life. This is especially important for low-power devices in the Internet of Things.

5. Support multiple frequency bands at the same time

- Wi-Fi 6 supports both 2.4G/5G frequency bands, and can select the appropriate frequency band for connection according to different usage scenarios and device requirements.

Wi-Fi 6, WiFi 6E and WiFi 8 in IoT

(II) Application in the Internet of Things

1. Smart home

- In the smart home scenario, the high speed and low latency characteristics of Wi-Fi 6 make communication between smart home devices smoother. For example, smart speakers, smart TVs, smart cameras and other devices can achieve fast connection and efficient collaboration through Wi-Fi 6 networks.

2. Smart Factory

- In smart factories, the high-density access and anti-interference characteristics of Wi-Fi 6 enable a large number of industrial devices to access the network at the same time and maintain a stable communication connection. This is of great significance for realizing functions such as industrial automation, intelligent monitoring and remote maintenance.

3. Smart City

- The number of IoT devices in smart cities is huge and diverse. The high speed, high-density access and anti-interference characteristics of Wi-Fi 6 enable these devices to access the

network more efficiently and realize intelligent management and services of urban infrastructure.

WiFi 6E Technology Detailed Explanation

Wi-Fi 6 and WiFi 6E for IoT

(I) Technical Features

1. Extended Spectrum Resources

- WiFi 6E is an extension of Wi-Fi 6, and the main change is the expansion of the spectrum. WiFi 6E supports operation on the 6 GHz band, which provides Wi-Fi devices with wider bandwidth

resources. Compared with the traditional 2.4 GHz and 5 GHz bands, the 6 GHz band has more channels and less interference.

2. Higher speed and low latency

- WiFi 6E inherits the advanced features of Wi-Fi 6, including OFDMA, MU-MIMO and other technologies, which enables multiple devices to use wireless resources efficiently in parallel, greatly improving speed and network responsiveness. Especially for high-bandwidth applications such as high-definition video, virtual reality (VR) and augmented reality (AR), WiFi 6E can provide higher transmission rates and lower latency.

3. Less interference and congestion

- Because the 6 GHz band is specifically divided for WiFi 6E, existing 2.4 GHz and 5 GHz band devices will not interfere with 6 GHz band devices. This means that WiFi 6E can avoid the congestion of traditional Wi-Fi bands and provide clearer and more stable wireless connections.

(II) Application in IoT

1. Support for high-bandwidth applications

- In IoT, high-bandwidth applications such as high-speed downloads, 4K/8K video streaming, virtual reality (VR) and augmented reality (AR) place higher demands on wireless networks. WiFi 6E provides sufficient transmission capacity for these bandwidth-intensive applications by broadening the spectrum, ensuring a smooth user experience.

2. Dense user environment

- In public places such as airports, shopping malls, and stadiums, dense user density is the norm. Traditional Wi-Fi networks often suffer from weak signals and slow speeds due to network congestion. The introduction of WiFi 6E can effectively disperse network pressure. Through larger bandwidth and more advanced technology, multiple users can use the network efficiently in parallel, reducing network interference in high-density environments and improving the overall user experience.

3. Future smart device support

- With the popularization of 5G networks and the surge in the number of smart devices, WiFi 6E provides good support for future Internet of Things (IoT) applications. Through wider spectrum bandwidth, WiFi 6E provides more efficient access

capabilities for a large number of IoT devices and supports a wider range of smart device application scenarios, such as autonomous driving and telemedicine.

WiFi 8 Technology Preliminary Exploration

WiFi 8 Features and Applications

(I) Technical Features

1. Double bandwidth

- Compared with WiFi 6 and WiFi 6E, WiFi 8 is expected to have a significant improvement in bandwidth. Although the specific value

has not yet been announced, it can be speculated that it will support wider channels and higher data transmission rates to meet the future IoT devices' demand for high-speed networks.

2. Throughput tripled

- WiFi 8 is also expected to achieve a significant improvement in throughput. This means that under the same network environment, WiFi 8 can support more devices to access the network at the same time and maintain high-speed data transmission.

3. More advanced modulation technology

- In order to achieve higher data transmission rates and lower bit error rates, WiFi 8 may adopt more advanced modulation technology. For example, higher-order modulation methods than 1024-QAM, such as 4096-QAM, may be introduced.

4. Multi-Link Operation (MLO)

- WiFi 8 may introduce multi-link operation (MLO) technology, allowing client devices to send and receive data across different frequency bands and channels. This will further improve the

flexibility and reliability of the network, especially in complex and changing IoT environments.

The Future of WiFi 8 Technology

(II) Potential applications in IoT

1. Ultra-high-speed IoT applications

- WiFi 8 will provide strong support for IoT applications that require ultra-high-speed data transmission, such as remote medical surgery and real-time data transmission in autonomous driving. Its high bandwidth and high throughput characteristics will ensure

that these applications can transmit large amounts of data in real time and stably.

2. Large-scale IoT deployment

- In large-scale IoT deployment scenarios, such as smart cities and smart factories, WiFi 8's high concurrency and low latency characteristics will enable more devices to access the network at the same time and maintain efficient communication connections. This will help realize the intelligent management and collaborative work of IoT devices.

3. Future smart life experience

- With the popularity of smart devices such as smart homes and wearable devices, people's demand for wireless networks is also increasing. WiFi 8 will provide these devices with more stable and fast network connections, further enhancing people's smart life experience.

Comparison of Wi-Fi 6, WiFi 6E and WiFi 8 in the Internet of Things

WiFi 8 for IoT

(I) Performance comparison

1. Speed and throughput

- In terms of speed and throughput, WiFi 8 is expected to be the highest among the three. WiFi 6E also has significant improvements in speed and throughput compared to Wi-Fi 6, mainly due to its support for a wider 6 GHz frequency band.

2. Concurrency

- Both Wi-Fi 6 and WiFi 6E support MU-MIMO and OFDMA technologies and have high concurrency capabilities. WiFi 8 is expected to further improve concurrency capabilities on this basis to meet the needs of future IoT devices for efficient network communication.

3. Anti-interference and stability

- All three use advanced anti-interference technologies, such as SR, BSS Coloring, etc., to improve network stability and reliability. However, since WiFi 6E supports wider frequency bands and fewer interference sources, its anti-interference ability may be relatively stronger. WiFi 8 is expected to introduce more advanced anti-interference technologies to further improve network stability.

4. Power management

- Both Wi-Fi 6 and WiFi 6E support **TWT technology** to achieve low power management. WiFi 8 is expected to further optimize power management technology on this basis to meet the low power consumption requirements of IoT devices.

(II) Comparison of applicable scenarios

1. Smart home

- In smart home scenarios, Wi-Fi 6 can already meet the network requirements of most devices. However, for applications that require higher bandwidth and lower latency (such as high-definition video streaming, VR/AR experience, etc.), WiFi 6E will provide better support. WiFi 8 is expected to provide a more ultra-fast and stable network connection for future smart home devices.

2. Smart Factory

- In smart factories, due to the presence of a large number of industrial equipment and complex network environments, the requirements for wireless networks are also higher. Both Wi-Fi 6 and WiFi 6E can provide high concurrency and anti-interference capabilities to meet the needs of smart factories. WiFi 8 is expected to further improve the performance and stability of the network to support more complex industrial automation and intelligent monitoring applications.

3. Smart City

- The number and variety of IoT devices in smart cities are huge, and the requirements for wireless networks are also very high.

Both Wi-Fi 6 and WiFi 6E can provide stable network connections and efficient data transmission for smart cities. WiFi 8 is expected to provide more powerful support for high-bandwidth applications in smart cities through its ultra-high bandwidth and throughput.

Wi-Fi 6 Vs. WiFi 6E Vs. WiFi 8

(III) Cost and compatibility comparison

1. Cost

- **Wi-Fi 6**: As a relatively mature technology, the cost of Wi-Fi 6 equipment has gradually decreased. There are a large number of

Wi-Fi 6 routers and terminal devices available on the market, and the price is relatively affordable.

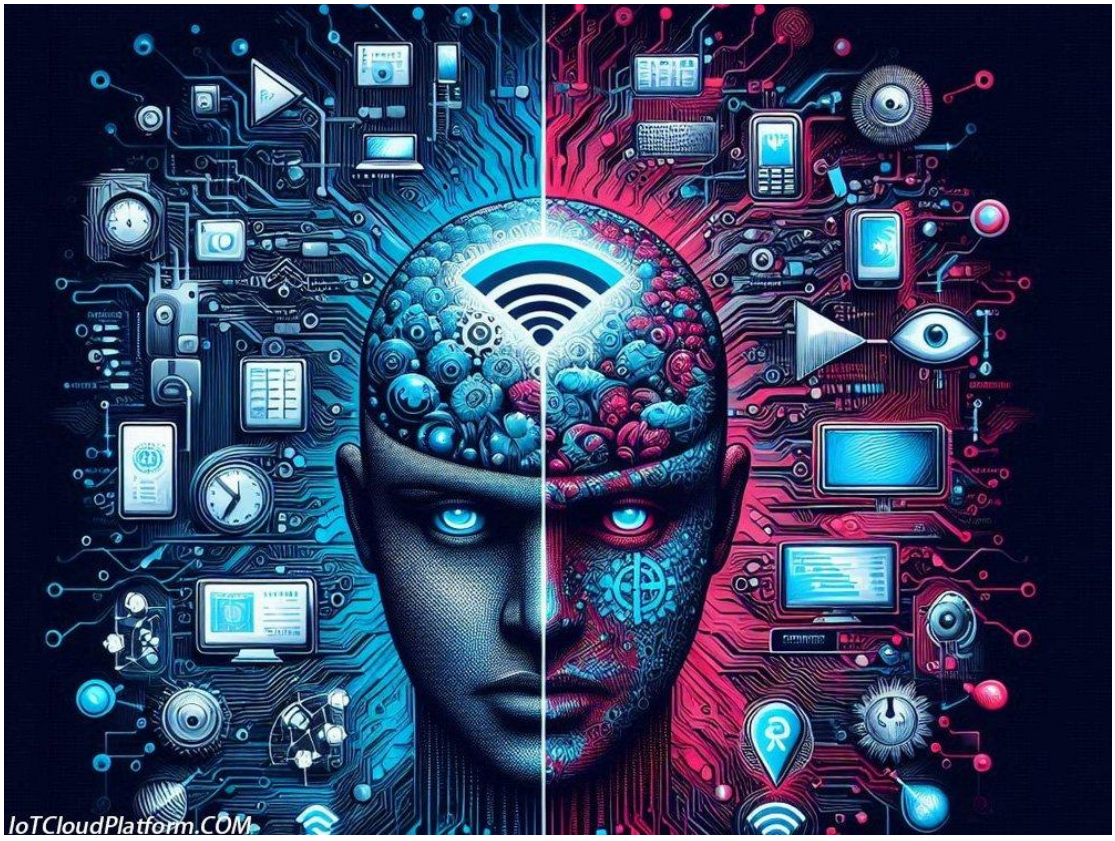
- **WiFi 6E**: Due to the opening of the 6 GHz frequency band and the upgrade of related technologies, the cost of WiFi 6E equipment may be slightly higher than Wi-Fi 6, but with the popularization of technology and the increase in production, the cost is expected to gradually decrease.
- **WiFi 8**: As the latest wireless network technology, the cost of WiFi 8 equipment may be higher in the early stage, especially for high-end routers and terminal devices. However, with the maturity of technology and market competition, the cost is expected to gradually decrease.

2. Compatibility

- **Wi-Fi 6**: Wi-Fi 6 has good compatibility with previous Wi-Fi standards (such as Wi-Fi 5 and Wi-Fi 4), which means that existing Wi-Fi devices can work normally under Wi-Fi 6 networks, although they may not enjoy the full advantages of Wi-Fi 6.
- **WiFi 6E**: WiFi 6E is also compatible with previous Wi-Fi standards, and because it supports the 6 GHz band, it can also coexist with devices that only support the 2.4 GHz and 5 GHz bands. However,

to fully enjoy the advantages of WiFi 6E, devices need to support the 6 GHz band.

- **WiFi 8**: As the latest technology, WiFi 8 may face some challenges in terms of compatibility. Although it may strive to maintain compatibility with previous Wi-Fi standards, some older devices may not be able to fully adapt to WiFi 8 networks due to significant differences in technology.



Wi-Fi 6, WiFi 6E and WiFi 8 combine with IoT and AI technologies to realize a smarter world

Special Considerations in the Internet of Things

In the Internet of Things environment, wireless network technology not only needs to meet basic requirements such as high speed, low latency, and high concurrency, but also needs to consider the following special factors:

1. Device Diversity

- There are many types of IoT devices, from sensors, actuators to smart devices, and their communication requirements, power consumption requirements, and processing capabilities vary. Therefore, wireless network technology needs to be flexible enough to adapt to the communication needs of different devices.

2. Network Scale and Topology

- IoT networks may cover a wide area and contain a large number of device nodes. Therefore, wireless network technology needs to support large-scale network deployment and have good network topology adaptability, such as star, mesh, etc.

3. Security and Privacy Protection

- IoT devices often involve user privacy data, such as home monitoring, health monitoring, etc. Therefore, wireless network

technology needs to provide a strong security mechanism to ensure the confidentiality and integrity of data transmission.

4. Power Management

- Many devices in the IoT are battery-powered and have strict requirements on power consumption. Therefore, wireless network technology needs to adopt low-power design to extend the battery life of devices.

Selection strategy of Wi-Fi 6, WiFi 6E and WiFi 8 in the Internet of Things

Applications of Wi-Fi 6, WiFi 6E, WiFi 8

1. Select according to application requirements

- For applications that require high speed and low latency, such as high-definition video surveillance, telemedicine, etc., you can choose WiFi 6E or WiFi 8 (when available).
- For scenarios with dense devices and high concurrency, such as smart factories and smart cities, Wi-Fi 6 and WiFi 6E are good choices, while WiFi 8 may provide better performance.
- For power-sensitive applications, such as wearable devices and sensor networks, wireless network technologies with low power consumption characteristics should be selected.

2. Consider device compatibility

- When choosing wireless network technology, you need to consider the compatibility of existing devices. If a large number of Wi-Fi 5 or Wi-Fi 4 devices have been deployed in the network, it may be more appropriate to choose Wi-Fi 6 or WiFi 6E.

3. Evaluate costs and benefits

- When choosing wireless network technology, you need to consider cost-effectiveness comprehensively. Although new technologies may provide higher performance, they may also bring higher costs.

Therefore, you need to make a choice based on actual needs and budget.

4. Pay attention to technology development trends

- Wireless network technology is constantly evolving, and new standards and technologies are constantly emerging. When choosing, you should pay attention to technology development trends and choose technologies with long-term development prospects.

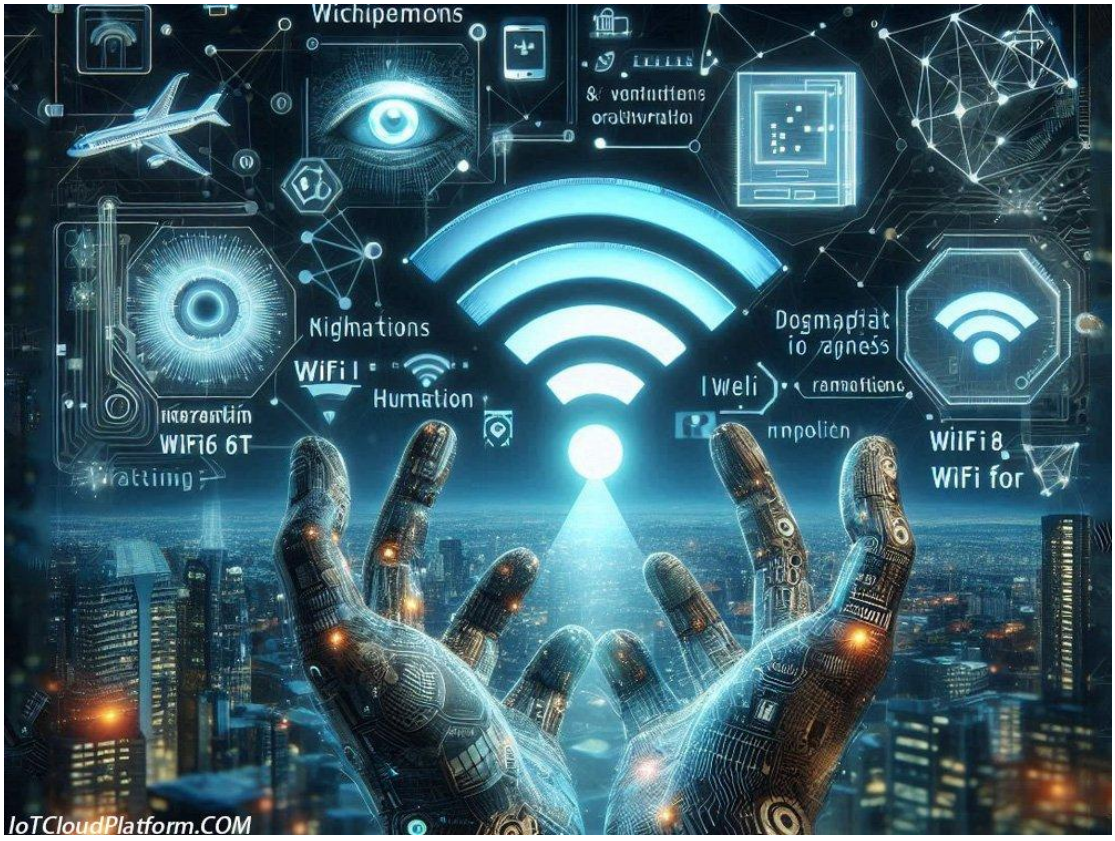
Wi-Fi 6, WiFi 6E, and WiFi 8 are used in smart city construction

Conclusion

Wi-Fi 6, WiFi 6E and WiFi 8 are all important wireless network technologies, and they have broad application prospects in the Internet of Things. Wi-Fi 6 is relatively mature and can meet the needs of most IoT applications; WiFi 6E provides higher performance and less interference by expanding spectrum resources; and WiFi 8 is expected to provide ultra-high-speed and stable network connections in the future to support a wider range of IoT applications.

When choosing, you need to consider factors such as actual application needs, device compatibility, cost-effectiveness and technology development trends.

With the continuous evolution and development of wireless network technology, we have reason to believe that the future Internet of Things will be more intelligent, efficient and convenient.



Wi-Fi 6, WiFi 6E and WiFi 8 for aviation IoT

About IoT Cloud Platform

IOT Cloud Platform (blog.iotcloudplatform.com) focuses on IOT solutions, sensors, smart homes, smart cities, IoT design, RFID, lora devices, IoT systems, IoT modules, new energy, WiFi IoT and other technological knowledge and products.

FAQs

The following are frequently asked questions and answers about Wi-Fi 6, WiFi 6E and WiFi 8 in IoT applications:

What are the advantages of Wi-Fi 6 in IoT applications compared to previous generations of Wi-Fi standards?

The advantages of Wi-Fi 6 in IoT applications are mainly reflected in higher transmission efficiency, lower latency, stronger connection stability and support for more device connections. These features enable Wi-Fi 6 to better meet the needs of dense IoT devices and frequent data transmission.

What additional improvements does WiFi 6E have for IoT applications compared to Wi-Fi 6?

WiFi 6E extends the 6GHz frequency band, provides greater bandwidth and more non-overlapping channels, and reduces interference with spectrum sharing with older devices. This enables WiFi 6E to support more devices to run efficiently at the same time in IoT applications, especially in high-density user environments.

What are the main technical upgrades of WiFi 8 compared to Wi-Fi 6 and WiFi 6E?

WiFi 8 (also known as 802.11be) mainly improves the speed and capacity of wireless networks, supports higher modulation methods and wider channel bandwidths. This will bring faster transmission speeds and lower

latency to IoT applications, especially in scenarios that require processing large amounts of data or real-time interaction.

For IoT device manufacturers, should they choose Wi-Fi 6, WiFi 6E or WiFi 8?

Which Wi-Fi standard to choose depends on the application scenario, cost budget and future development trend of IoT devices. For most current IoT applications, Wi-Fi 6 and WiFi 6E are sufficient to meet the needs. However, for applications that require higher speeds and lower latency, or manufacturers who have requirements for future technology upgrades, WiFi 8 can be considered.

What should users pay attention to when using IoT devices that support different Wi-Fi standards?

When using IoT devices that support different Wi-Fi standards, users need to ensure that the router in their home or office supports the corresponding Wi-Fi standard. For example, if the device supports WiFi 6E, the router also needs to support the 6GHz band to fully utilize the performance of the device. In addition, users also need to pay attention to the compatibility and interoperability of the devices to ensure that different devices can communicate normally.