Economic Benefits and Global Rollout of Wi-Fi 6E in 6 GHz: Connecting to the Future

Wi-Fi Alliance

Wi-Fi Alliance® vision:

connecting everyone and everything, everywhere

Wi-Fi Alliance: 900+ companies comprising a who's who in technology and beyond

Focus areas to support our vision

Drive next generation technology

Improve quality of service for enhanced user experiences

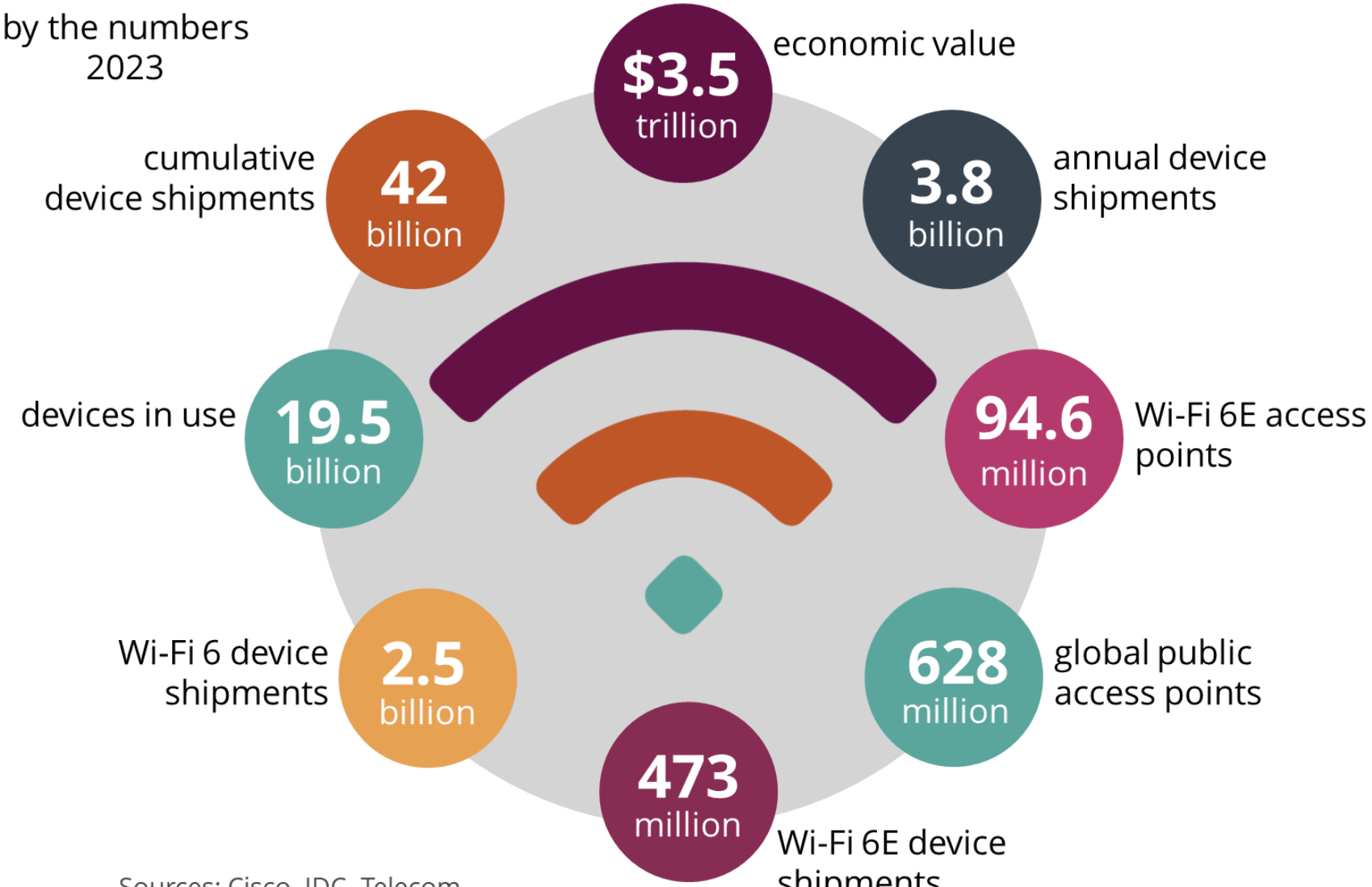
Ensure consistency, interoperability across devices

Integrate with complementary technologies for seamless connectivity

Ensure global spectrum availability, harmonization

Wi-Fi®

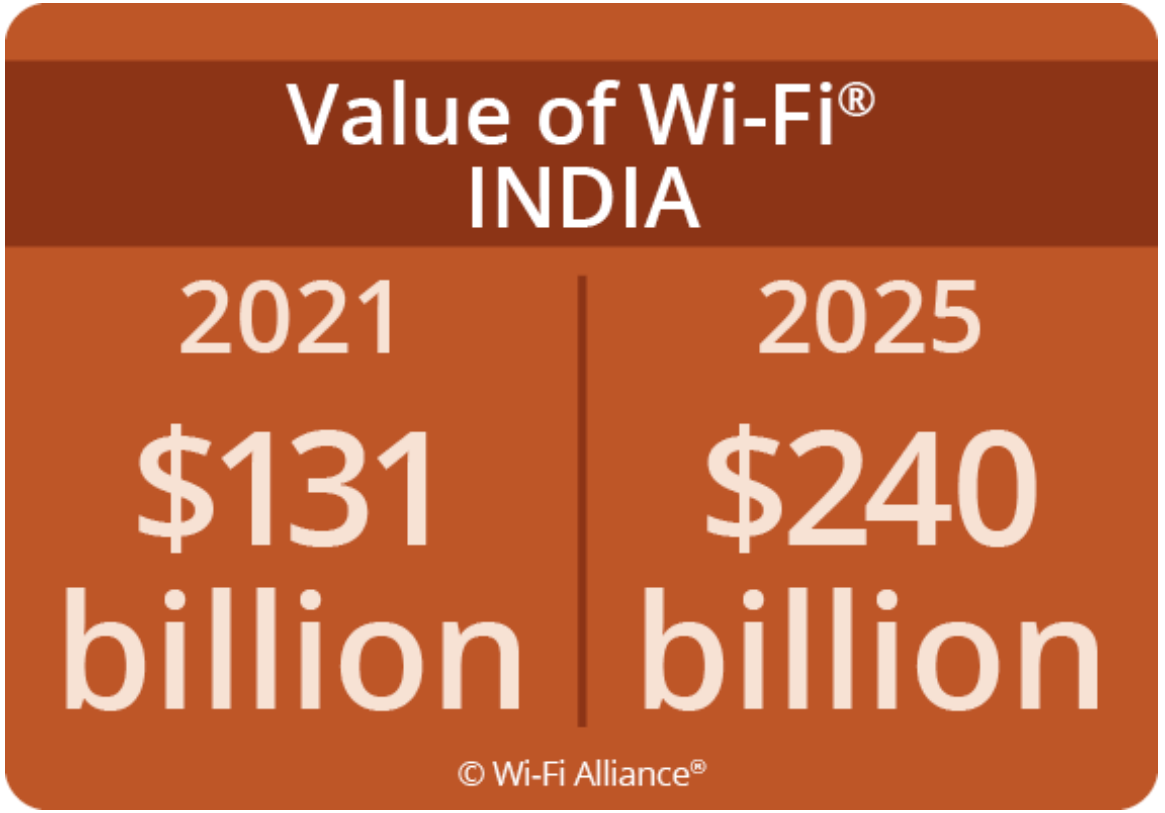
by the numbers
2023



Sources: Cisco, IDC, Telecom Advisory Services, Wi-Fi Alliance®

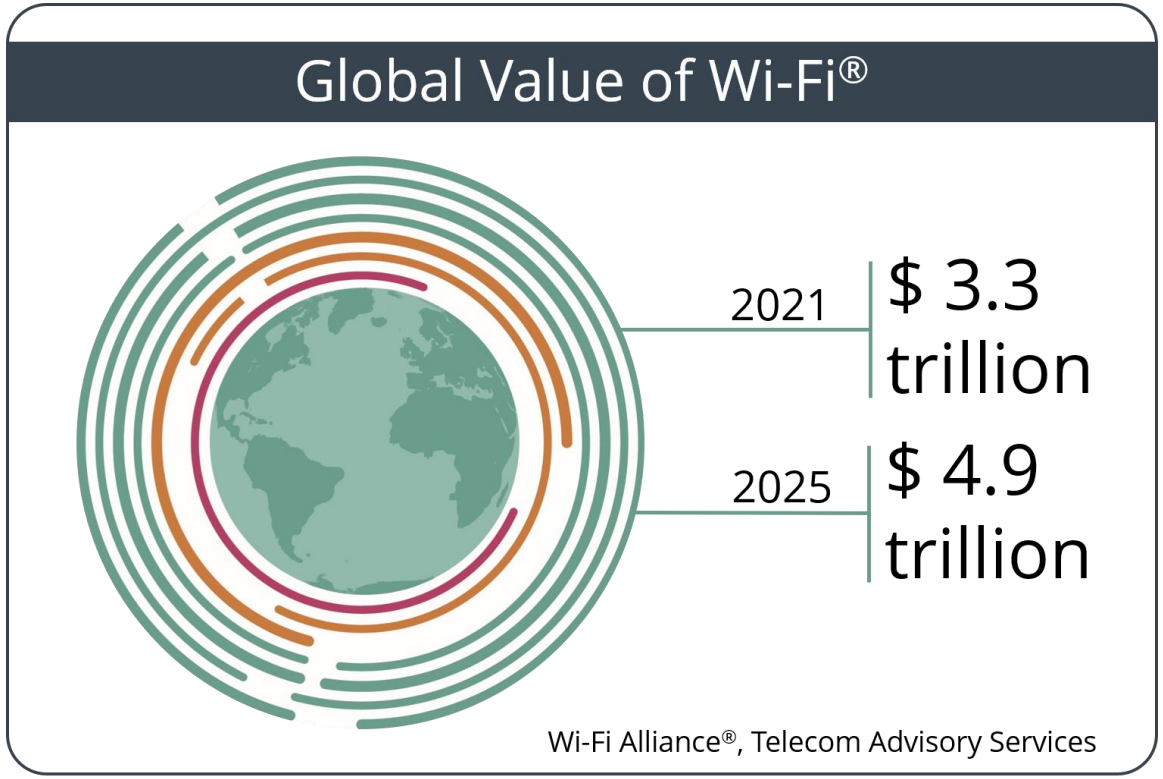
Economic value of Wi-Fi in India: $240B by 2025

- In recent years, Wi Fi has become a pervasive feature in the Indian telecommunications landscape
- Forty percent of Wi-Fi traffic is expected to rely on 6 GHz channels in 2025
- Accelerated effect derived from new spectrum allocation and latest Wi-Fi technologies will continue to grow and still be far from reaching its maximum potential
- After free Wi-Fi, enterprise Wi-Fi will become the second most important factor for driving the value of Wi-Fi



Economic value delivered by Wi-Fi to reach $5 Trillion by 2025

- Study released February 2021 solidifies Wi-Fi as critical to economic resilience
- Value grows, even in times of crisis
- Ensuring spectrum access to enable innovation, advanced applications paramount to continuing benefits
- Developing economies demonstrate strong Wi-Fi value growth



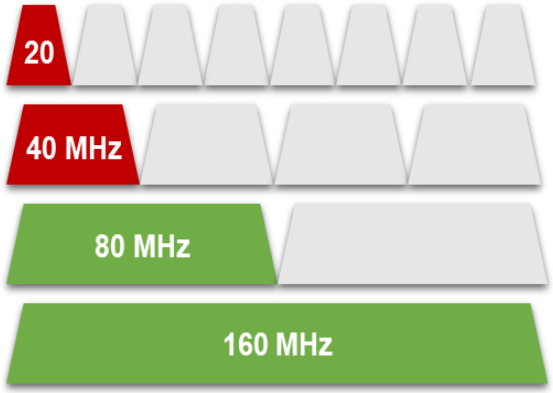
www.valueofwifi.com

Global Economic Value of Wi-Fi (2021-2025)

Delivering Gigabit Connectivity with Wi-Fi

- Gigabit connectivity is a policy priority – but connectivity is only as good as the narrowest bottleneck
- Governments and wireline providers invest considerable resources to provide Gigabit infrastructure – but over 50% of data traffic is delivered by Wi-Fi
- Wireline consumers pay for Gigabit connectivity – but most connect via Wi-Fi

Gigabit Requires 80 / 160-MHz Channels



	1SS	2SS
20 MHz	143Mbps	286 Mbps
40 MHz	286 Mbps	573 Mbps
80 MHz	600 Mbps	1.2 Gbps
160 MHz	1.2 Gbps	2.4 Gbps

Sources: Aruba Networks Hewlett Packard Enterprise

Upcoming Wi-Fi advancements

Enterprises transformed by Wi-Fi 6E and Wi-Fi 7

- The release of 6 GHz spectrum for Wi-Fi three years ago was a landmark decision in the history of technology. Since then, the Wi-Fi industry has been working overtime to deliver 6 GHz Wi-Fi services everywhere
- We believe we've only scratched the surface on capitalizing on 6 GHz Wi-Fi. Enterprise Wi-Fi is growing at an unprecedented rate – companies and industries are back with a vengeance following disruptions and lockdowns – and the need for device connectivity, connected vehicles, automation, sensors, control, monitoring, connected robotics, etc. is bigger than ever
- There's also a difference: New Wi-Fi standards deliver predictable and SLA-compliant performance. This expands the addressable market for Wi-Fi solutions enormously. most of the value of the band will be extracted in the coming 5-10 years

Major opportunities in smart home Wi-Fi continue

- Smart home technology and services are one of the biggest opportunities in tech overall – and Wi-Fi is the cornerstone of the smart home
- Only a small percentage of homes around the globe are served by managed Wi-Fi and the need for smart home Wi-Fi solutions will keep rising
- Meanwhile multi-gigabit fiber to the home is driving up the need for gigabit whole-home Wi-Fi

Will there be a Wi-Fi AR/VR/XR device revolution?

- Industry says yes – and certainly the Wi-Fi standards are ready to deliver gigabit speeds and extreme low latency to make it all come alive
- And with rumored glasses and headsets from Meta, Apple, Google, and others – could AR/VR/XR become available to the mass market, or will these types of applications find their customers in industry – or both?
- Time to dive into the debate

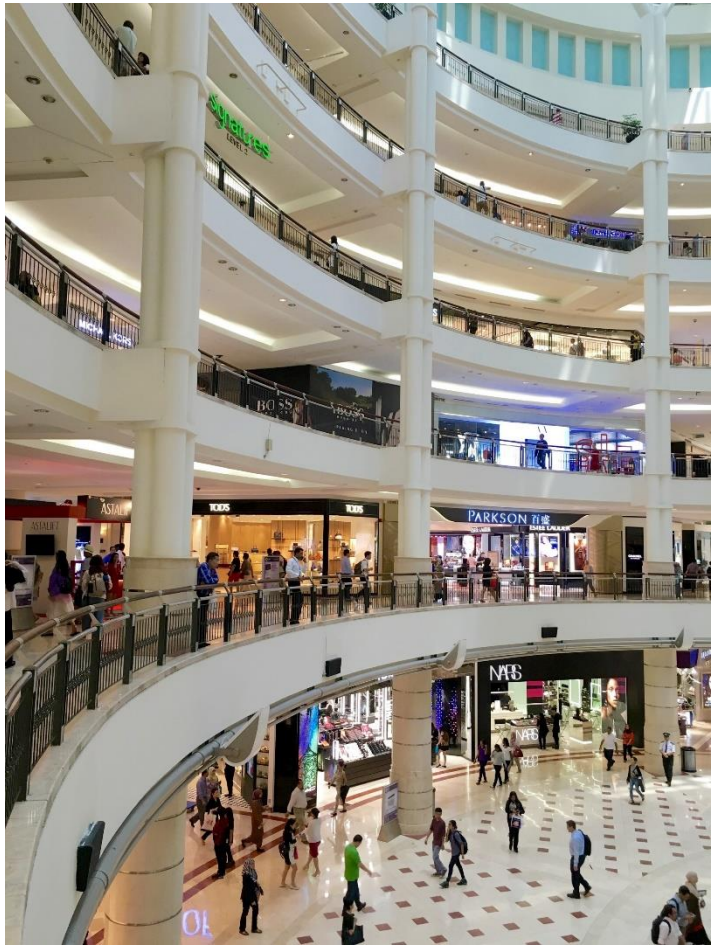
New and vastly improved: Wi-Fi Location-based services

- Wi-Fi-based location services are experiencing a rebirth – and it is ready for the mass market
- The Wi-Fi Location standard implemented by leading vendors allows sub-1 meter indoor location accuracy
- This is a new paradigm in LBS and will fuel myriads of use cases for consumers and industry. Watch this space carefully – opportunities abound

Wi-Fi CERTIFIED Location™

Accurate indoor location determination through Wi-Fi

- Enables location-based applications and services to deliver the same great experience indoors as they do outdoors
  - Uses the Fine Timing Measurement (FTM) protocol from IEEE 802.11-2016
  - Leverages existing infrastructure in Wi-Fi Location-enabled networks
  - Delivers better performance in multi-path environments than existing angle-based and RSSI methods
- Provides user control of when to share location
- Allows self-locating APs to support 6 GHz standard power requirements.



The Wi-Fi IoT explosion – with Matter, and more

- IoT is headed towards 27 billion devices in 2025 – and we contend Wi-Fi will be the winning means of connectivity
- The Wi-Fi standards – including Wi-Fi HaLow™ – are perfectly suited to deliver the full range of IoT applications for industry and consumers

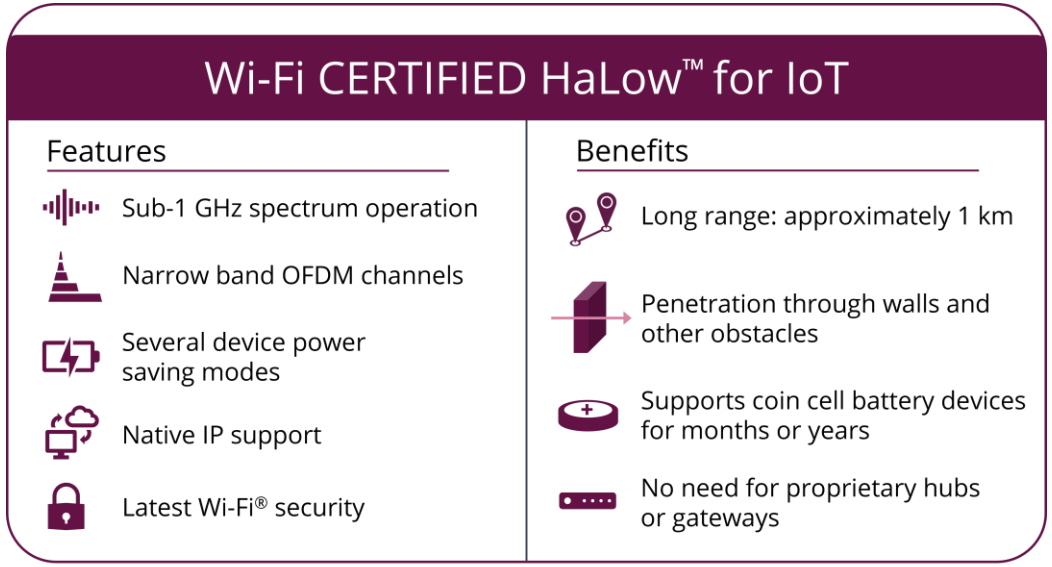
Wi-Fi CERTIFIED™ and Matter deliver an exceptional IoT experience

- Wi-Fi CERTIFIED is an essential ingredient in Matter certification
- Wi-Fi and Matter use a common application layer and data model, allowing devices to communicate across multiple IP network technologies
- When paired together, Wi-Fi CERTIFIED and Matter allow users to choose from a wide range of brands that bring simplicity, interoperability, reliability, and security to the IoT market
- Wi-Fi CERTIFIED and Matter impart confidence in consumers because their devices are based on proven technologies
- Backward compatibility means Wi-Fi 4 or later will work with the Matter ecosystem
- Wi-Fi does not need to add any new functionality to support Matter

Wi-Fi CERTIFIED HaLow™

Long range, low power Wi-Fi® for IoT

- Addresses Internet of Things (IoT) use cases requiring minimal power consumption, longer range (1 km), and many devices per node
- Based on IEEE standard 802.11ah, operates in sub-1 GHz frequency band
- Leverages the latest Wi-Fi security, Wi-Fi CERTIFIED WPA3™
- Native IP support provides a scalable platform for IoT applications with no need for proprietary hubs or gateways
- Use cases: sensor networks, smart building products and systems, industrial and home automation, extended-range WLAN



Source: Wi-Fi Alliance®

Industry 4.0 presents a significant opportunity for Wi-Fi

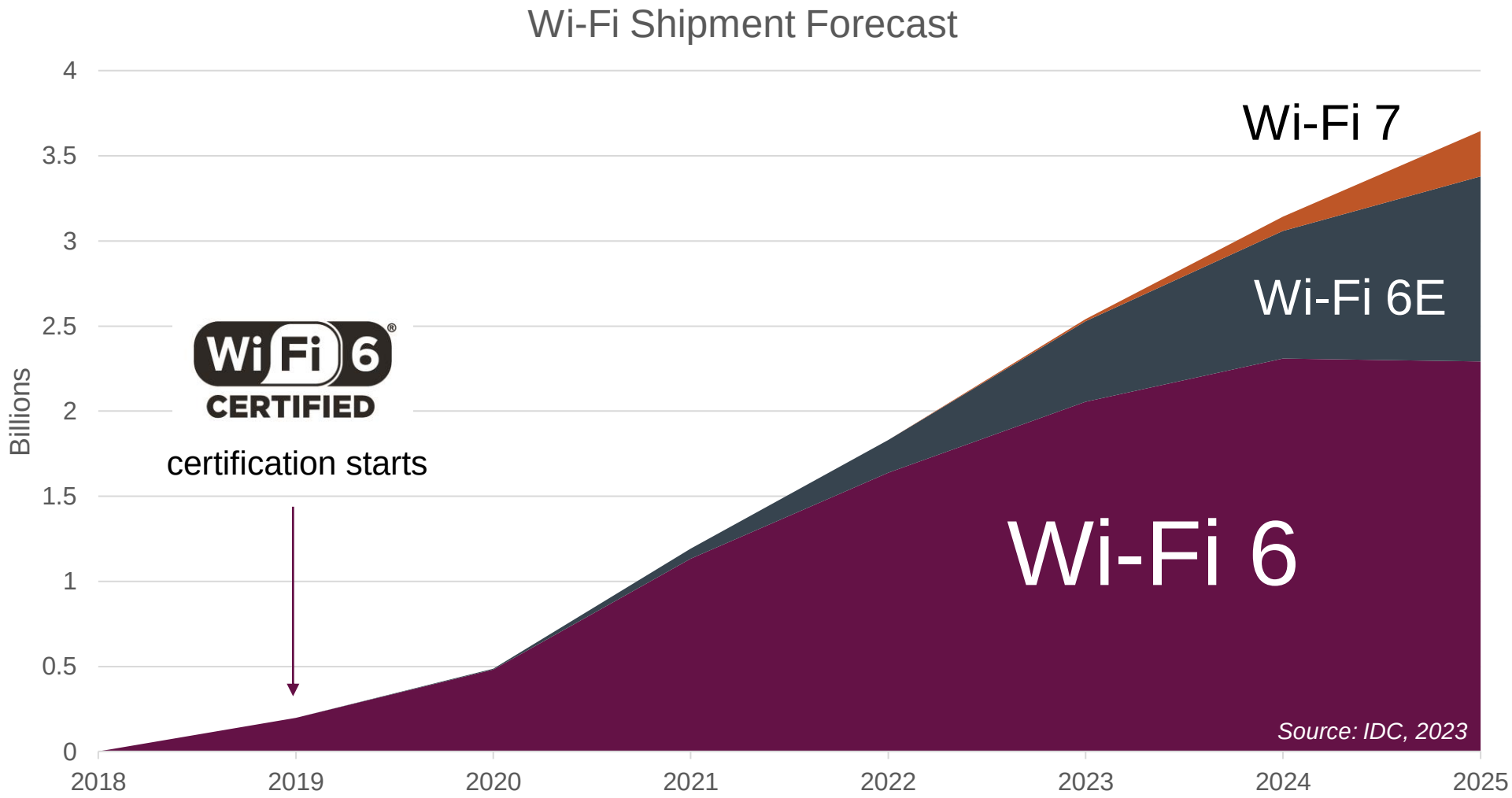
- Wi-Fi supports a variety of Industry 4.0 use cases:
  - **Internet of Things**: Fast, reliable Wi-Fi connectivity accommodates a large number of IoT devices
  - **Artificial intelligence**: Rapid data transfers over Wi-Fi allow for faster decision making
  - **Big data analytics**: Collection of large volumes of data via Wi-Fi from various sources for processing

*PwC, 2022

Wi-Fi improves productivity and reduces risks

- **Factory automation**: Using Wi-Fi for real-time monitoring and control of automated machinery from a central location
- **Asset tracking:** Wi-Fi can be used to track the location of equipment, improving efficiency
- **Autonomous robots (AR):** Wi-Fi is being used to control robots that work alongside humans, improving productivity and reducing the risk of accidents

Expansion of the latest Wi-Fi technologies will provide the necessary connectivity to support Industry 4.0

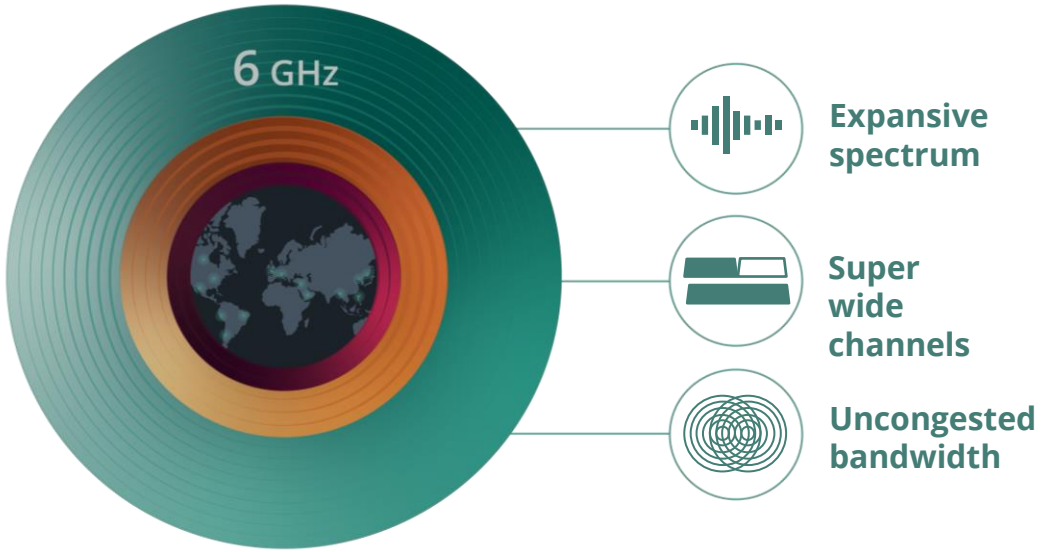


Wi-Fi 6 supports Industry 4.0 with lower costs and cutting-edge technology

- Wi-Fi 6 is less expensive to deploy and operate indoors than other technologies
  - **No license fees:** Wi-Fi operates in unlicensed bands without spectrum fees or access charges
  - **Lower-cost infrastructure:** A full Wi-Fi 6 deployment can be created using only access points, a controller for management, and software
  - **Cost-effective expansion:** New spectrum in 6 GHz can be used for large-scale deployments
- Wi-Fi 6 features deliver dramatic performance increases for Industry 4.0
  - **Target Wake Time:** Extends battery life by scheduling wake times for each client device
  - **Orthogonal frequency-division multiple access (OFDMA):** Allows multiple users to use a channel simultaneously, more efficiently managing resources and ensuring reliable performance
  - **Beamforming:** Wi-Fi 6 increases the number of beamforming streams from four to eight, increasing data rates and accommodating more devices on a network at once

Consideration #1: 6 GHz is transforming Wi-Fi technology**

- Wi-Fi 6E: capabilities required for advanced use cases: faster speed, lower latency, higher efficiency, higher density
  - In 2023, more than 473 million Wi-Fi 6E devices and 94.6 million Wi-Fi 6E access points will ship
  - In 2025, 32% of all Wi-Fi 6 device shipments will be Wi-Fi 6E and there will be over 1 billion Wi-Fi 6E devices
- Wi-Fi 7: enhanced AR/VR/XR, industrial IoT, automotive, telepresence, immersive 3-D support with higher data rates, stringent latency, reliability, and QoS
  - Data transfers rates up to 30 Gbps
  - 84 million units expected to ship in 2024



Wi-Fi Alliance®

Wi-Fi 6E video

*Source: IDC Research, Jan 2023
**In a recent survey, 58% of companies said 6 GHz is critical or very important to their strategy
Intel predicts in 2022 around 30 percent of their product mix will be Wi-Fi 6E

Wi-Fi technology provides the necessary connectivity for Industry 4.0

- **Wi-Fi 6E** extends Wi-Fi into the 6 GHz frequency band, which offers numerous benefits, including:
  - The ability to support more devices simultaneously in a dense environment
  - Improved and faster remote machine control
  - Lower power consumption with target WPA3 security can protect sensitive business data from cyber threats
- **Wi-Fi 7** offers the same benefits of the 6 GHz band plus many new features, including:
  - Multi-Link Operation, allowing devices to send or receive data across different frequency bands, increasing data rates and lowering latencies
  - 4K QAM, for a boost in peak performance
  - 320 MHz channels for massive throughput gains

6 GHz Wi-Fi is powering Industry 4.0 and the Internet of Things

- Industrial IoT plays a strong role in Industry 4.0 by allowing devices and humans to work together to maximize efficiency
- The improved performance of 6 GHz Wi-Fi allows employees and connected devices to access and share large data loads more quickly and efficiently, increasing productivity and collaboration
- Industrial IoT devices connected over 6 GHz Wi-Fi can communicate with low latency to control manufacturing operations in real-time
- Global IoT-connected devices are set to reach 30 billion by 2030*
- Dozens or hundreds of industrial IoT devices can be on a single 6 GHz Wi-Fi network without straining capacity

*Transforma insights

Wi-Fi 6E deployments increase worldwide

- Saudi Arabia's Communications and Information Technology Comission (CITC) has performed the first global live demo of an end-to-end automatic frequency coordination system to enable outdoor Wi-Fi 6E usage
- European home broadband operators currently supporting Wi-Fi 6E now include Orange (France), Bouygues (France), Free (France), Deutsche Glasfaser (Germany), and Swisscom (Switzerland).
- Singapore's Infocomm Media Development Authority announced the release of the lower 6 GHz band for unlicensed use and expects Wi-Fi 6E-enabled equipment and devices to be commercially available by 3Q 2023
- Chase Center, home of the Golden State Warriors, installed more than 250 Wi-Fi 6E access points

Bringing world-class connectivity to India with 6 GHz Wi-Fi

- Wi-Fi delivers significant social and economic value
  - Wi-Fi is used more than ever: Wi-Fi is integral to telecom infrastructure, and essential through crises such as the COVID-19 pandemic
- Wi-Fi spectrum needs require access to 5925-7125 MHz
  - 5925-7125 MHz band is uniquely suited to meet growing demand for Wi-Fi connectivity – no alternative spectrum now or in the future
  - Next generation of Wi-Fi (Wi-Fi 7) depends on access to multiple wider (320 MHz) channels
- Wi-Fi 6E deployment in 5925-7125 MHz already underway in countries around the world – over 473 million Wi-Fi 6E devices in 2023
  - Extensive studies confirmed that Wi-Fi deployments in 5925-7125 MHz protect existing satellite and terrestrial operations
- Forty percent of Indian Wi-Fi traffic is expected to rely on 6 GHz channels in 2025*
- 6 GHz allocation in India will represent a $63.4 billion increase in economic value in 2025*

Conclusion - Wi-Fi 6E is ready to deliver connectivity benefits now

- Wi-Fi is optimized for high performance indoor connectivity and therefore delivers the bulk of the world's data traffic, including most data traffic on mobile devices. Demand for Wi-Fi will continue to grow with increased fiber deployments and cellular generations
- Opening the entire 6 GHz band for unlicensed use offers more benefits than licensed IMT networks, including:

- Exceptional performance for next-generation use cases, such as XR, HD video streaming, industry 4.0 and telehealth

- Lower congestion in densely populated areas, such as factories, large venues, and shopping malls

- Harmonious coexistence with incumbent operations

- Wi-Fi 6E is a resounding success and by 2024 there will be billions of devices installed globally able to operate from 5.925 to 7.125 GHz. Only countries that allow Wi-Fi access to the entire 6 GHz spectrum range will get the most benefits
- Wi-Fi 7 and Wi-Fi 8 will depend on 6 GHz access, and 320 MHz channels will be optimized for demanding emerging use cases
- 6 GHz is perfectly suited for Wi-Fi to continue to deliver the connectivity users need, there is no alternative spectrum for Wi-Fi, and 6 GHz is unsuitable for IMT

Thank you

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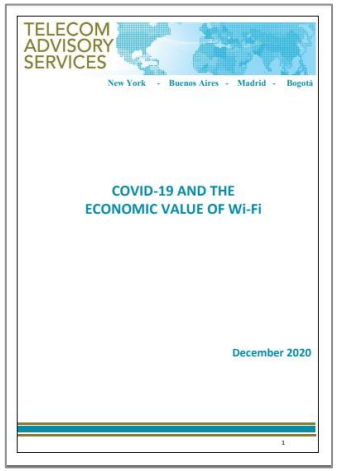
References

Highlights sheet

Study summary

Study details



COVID-19 and Wi-Fi