Huawei High-Quality Campus 10G & Wi-Fi 7

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Contents

More Enterprise Campuses Go Digital

Driven by policies and new technologies, the digital transformation of enterprise campuses is in full swing. Networks are the cornerstone for enterprise digital transformation. That's why more and more enterprises attach importance to network construction and constantly optimize network architecture.

Driving force 1: new technologies

- Cloud-based campus applications and unified data convergence become a new norm.
- Intelligent technologies, such as AR/VR, IoT, big data, and digital twins, are gradually mature.
- The rise of Wi-Fi 7 and IPv6 Enhanced technologies accelerates campus network convergence.
- Terminals are gradually evolving into digital, IP-based, and intelligent ones.

Driving force 2: policies

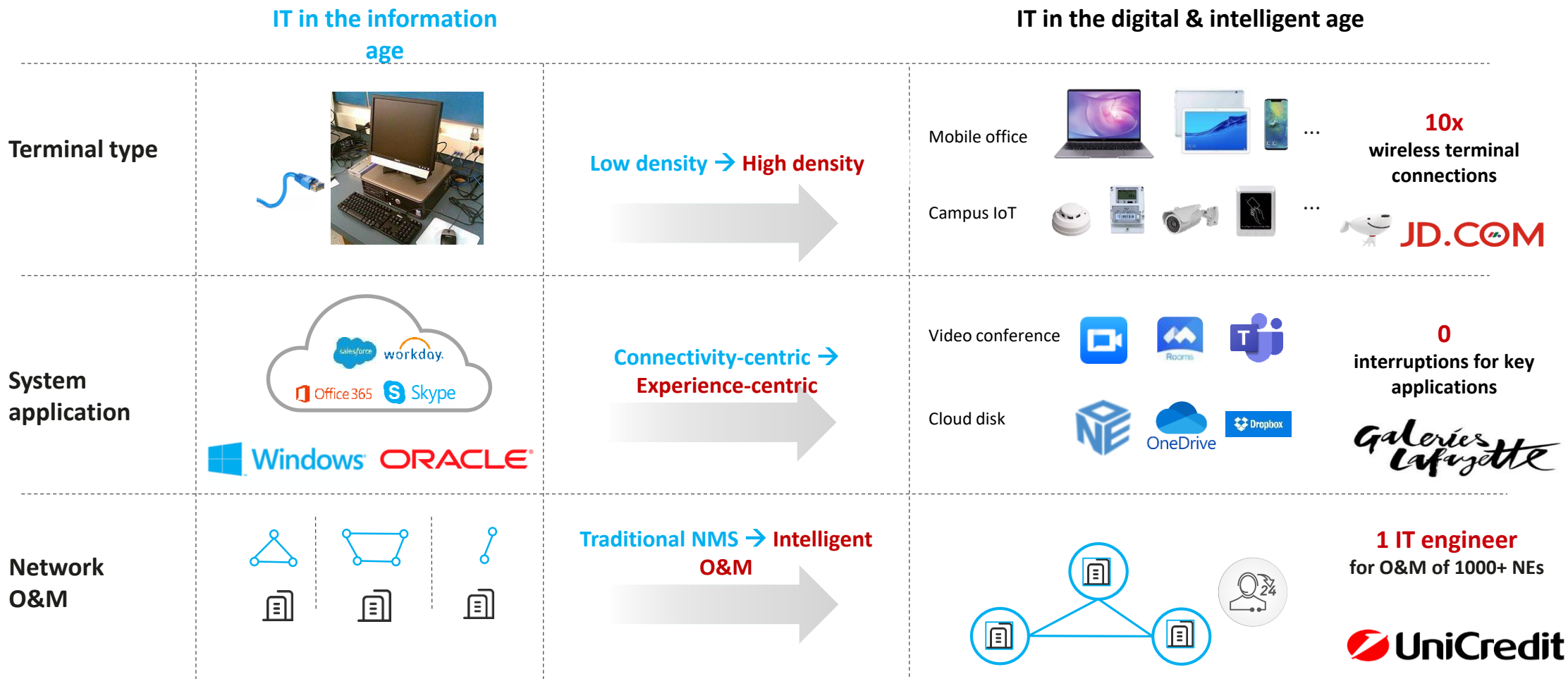**170+** countries have released their digital strategies.

- UK: Digital Strategy, Digital Charter
- Germany: Industry 4.0, High-Tech Strategy 2025
- France: Digital France
- Saudi Arabia: Saudi Vision 2030
- UAE: UAE Centennial 2071
- Brazil: Brazilian Digital Transformation Strategy (E-Digital)
- China: Digital Strategy for China
- ….

Network — the cornerstone for enterprise digital transformation

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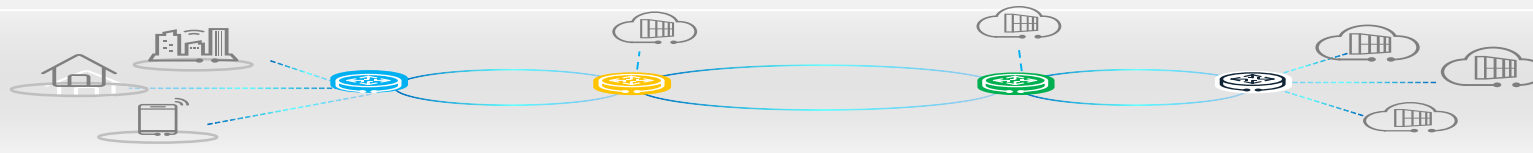
Digital and Intelligent Transformation Trends at Enterprises:

## High-Density Terminals, Always-Assured Applications, and Intelligent O&M

	IT in the information age		IT in the digital & intelligent age	
Terminal type		**Low density → High density**	Mobile office ... Campus IoT ...	**10x** wireless terminal connections JD.COM
System application	salesforce workday Office 365 Skype Windows ORACLE	**Connectivity-centric → Experience-centric**	Video conference Cloud disk OneDrive Dropbox	**0** interruptions for key applications Galeries Lafayette
Network O&M		**Traditional NMS → Intelligent O&M**		**1 IT engineer** for O&M of 1000+ NEs UniCredit

Gartner's findings: **70%** of enterprises still operate with IT in the information age.

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Campus Network Construction Trends: Connectivity-Centric → Experience-Centric

Connectivity-centric era

1. **Connects servers and PCs**; mainly wired, with wireless as a supplement
2. **On-premises deployment** of enterprise applications, and access in client/server mode
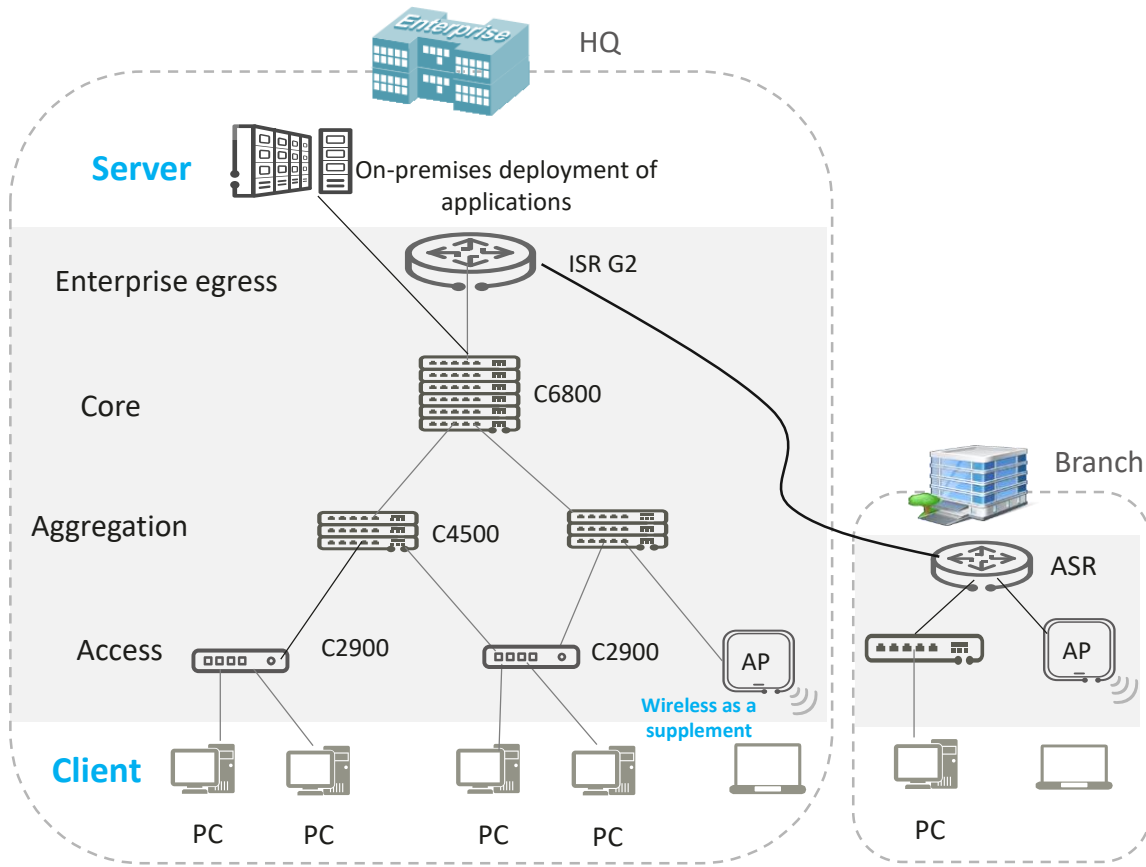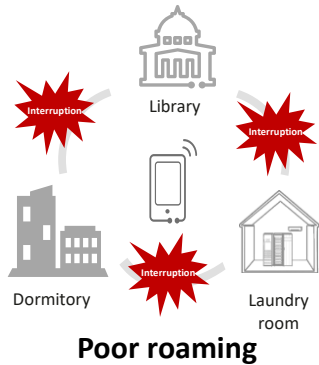

Experience-centric era

1. **Connects cloud applications and global branches;** mainly fully wireless, with wired as a supplement
2. Cloud-based **deployment of enterprise applications; experience-centric,** with OA, production, and IoT network convergence
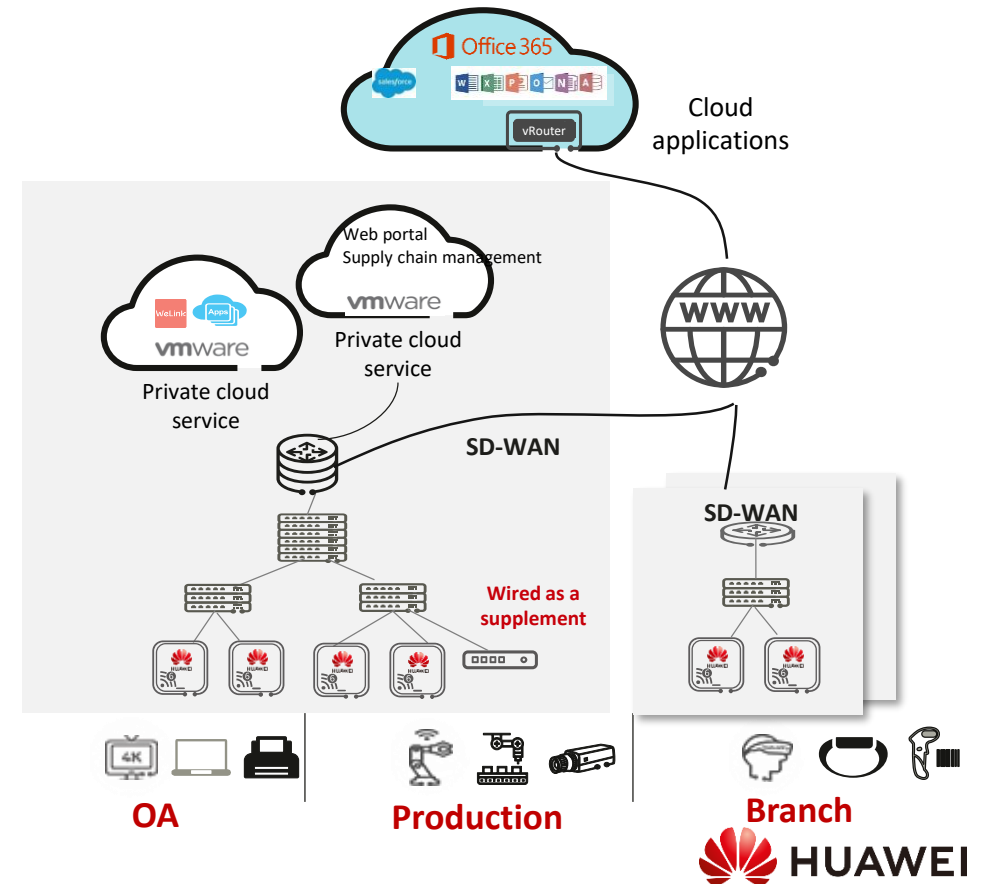
3 Challenges for Campus Network Upgrade in the Experience-Centric Era

Poor wireless experience

Poor roaming

New York University: interrupted WhatsApp video calls when users move from dormitories, to laundry rooms, and to the library

No application assurance

200 terminals per AP

37 Interactive Entertainment:
A single AP serves 60 employees and 200 terminals.
Typical issues: video conference interruptions, slow download from the cloud disk (taking dozens of minutes)

Labor-intensive O&M

100-150 NEs managed by 1 engineer

Swiss Post: poor wireless experience, frequent network disconnections
Upon a network fault, the network administrator drove 500 km in a round trip, but still failed to solve it.
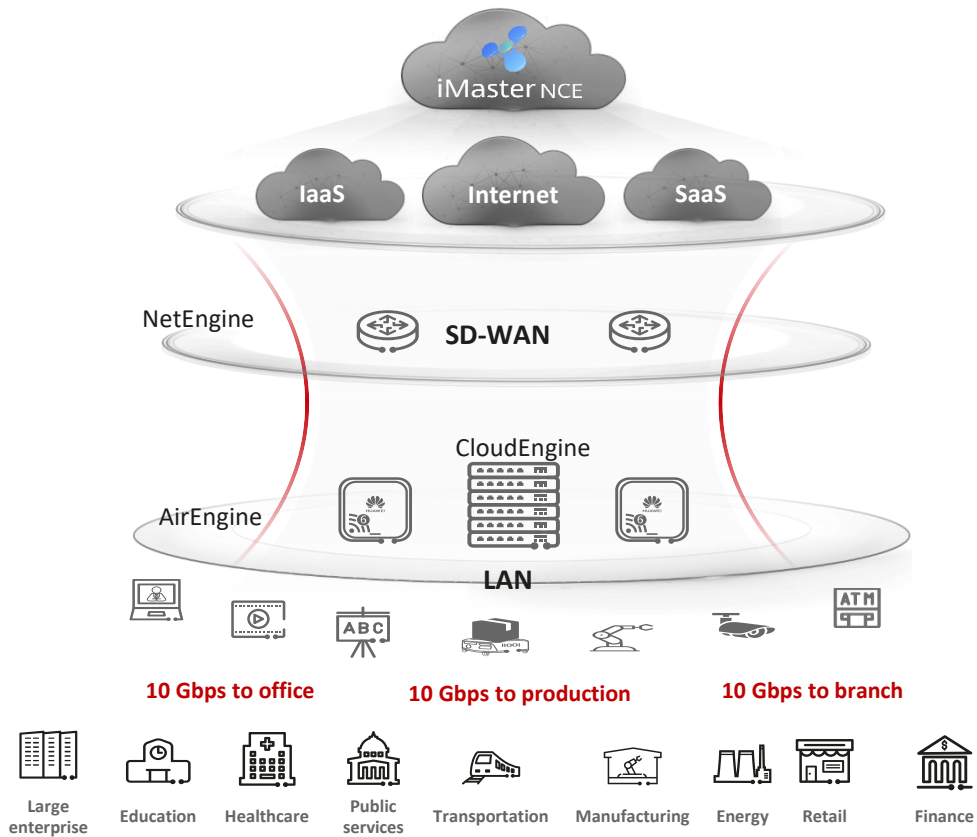
Contents

1. Campus Network Trends and Challenges

2. **Huawei High-Quality 10 Gbps CloudCampus Solution**

   - Solution Architecture

   - Wireless Experience Upgrade

   - Application Experience Upgrade

   - O&M Experience Upgrade

3. Success Stories

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Huawei High-Quality 10 Gbps CloudCampus:

The Preferred Choice for Your Digital and Intelligent Journey

iMaster NCE

IaaS   Internet   SaaS

NetEngine

SD-WAN

CloudEngine

AirEngine

LAN

10 Gbps to office   **10 Gbps to production**   **10 Gbps to branch**

Large enterprise   Education   Healthcare   Public services   Transportation   Manufacturing   Energy   Retail   Finance

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O&M experience upgrade »»»

Intelligent O&M with a digital map

Four-level visibility: users, networks, devices, and applications

Fast fault locating in minutes

10x ↑

O&M efficiency

Application experience upgrade »»»

Audio & video and VIP user experience assurance

1 solution for experience assurance of 10,000 users

E2E experience assurance: users, networks, terminals, and applications

0

video conference interruptions

Wireless experience upgrade »»»

10 Gbps to a room, 10 Gbps to an AP

Wi-Fi 7: 120-channel smooth HD video
Multi-GE access, high-density 100GE core

4x ↑

terminal speed

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New Scenarios & New Applications, Calling for a New WLAN

Metaverse

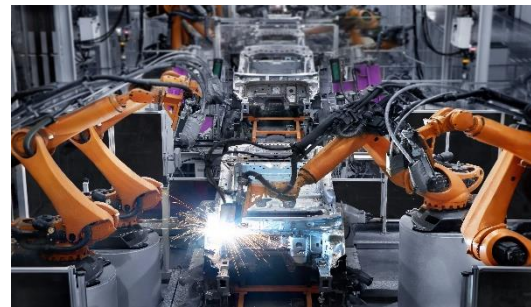**High bandwidth and low latency**

10 Gbps+, millisecond-level

AR/VR education

High bandwidth and low latency

1 Gbps+, < 5 ms

Manufacturing AOI

High bandwidth

7–8 Gbps (site)

Industrial control

Low latency

5 ms

Telemedicine

Low latency and high reliability

5 ms, multi-link

Warehouse

High reliability

Multi-link, zero interruption

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Illustration personnelle Cas personnel IRM

Healthcare

The Wi-Fi 7 Era Is Coming: Accelerated Standards, Ecosystems, and Markets

Ever-maturing **standardization**

- ■ Adopted 5925-6425 MHz
- ■ Adopted 5925-7125 MHz
- ▥ Adopted 5925-6425 MHz, Considering 6425-7125 MHz
- ■ Considering 5925-6425 MHz
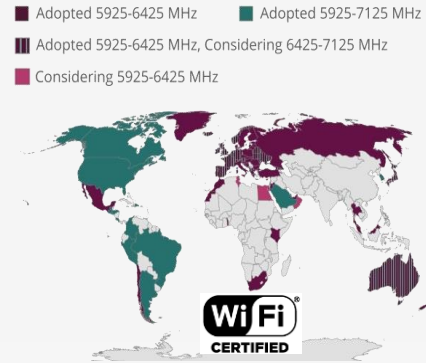
The Wi-Fi 7 standard is ready.
70% countries have granted the 6 GHz spectrum.

22.9%
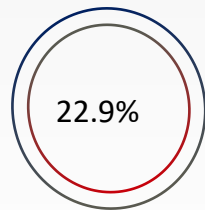
No. 1

Huawei's contributions to
the Wi-Fi 7 standard

Ever-growing **ecosystem**

Honor Magic 5 Android 13 (T)
Google Pixel 8 Android 14
MSI Pioneer 17 laptop

Oppo Find X6 Pro 16 GB / 512 GB
Xiaomi 14 Pro
Lenovo Legion laptop
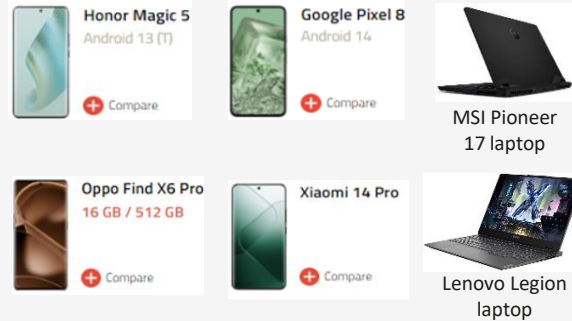
Honor, Samsung, Xiaomi, Lenovo, ASUS, etc.

40+ phone/laptop models already support Wi-Fi 7.
Huawei and Apple products will support Wi-Fi 7 in 2024.

intel | MEDIATEK
BROADCOM | Qualcomm
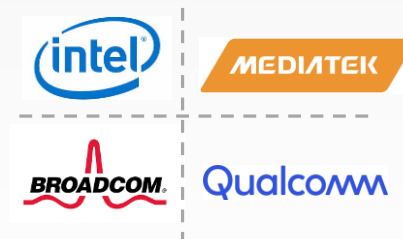
- Current: **20+** types of chips already support Wi-Fi 7.
- WFA forecast: 233 million terminals will support Wi-Fi 7 in 2024.

Ever-expanding **market**

Unit: %

Wi-Fi 7

Wi-Fi 6
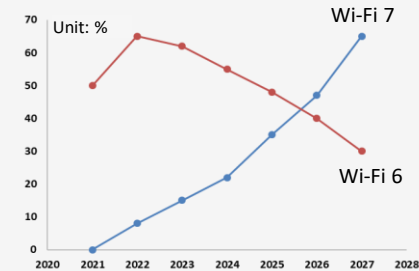
IDC: Wi-Fi 7 will account for **65%** in 2027.

$Millions

Multi-GE

GE
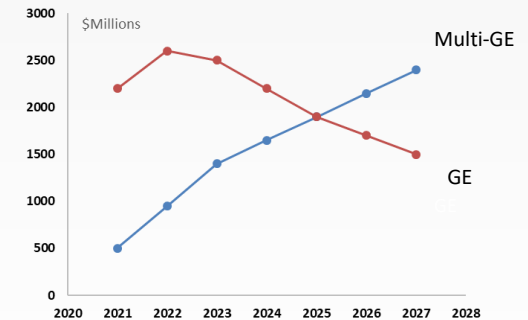
IDC: Multi-GE will account for **70%** in 2026.

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Key Contributor to Wi-Fi Standards: Leading Commercial Use of New Products

In terms of Wi-Fi 7 standardization, Huawei is more than a leading WLAN vendor; it is also a leading Wi-Fi chip vendor.

Source: NGB Corporation

Wi-Fi 4&5 (802.11n/11ac) — No. 5

Vendor	Share
Intel	17.7%
Qualcomm	10.5%
Broadcom	9.3%
Marvell/NXP	7.2%
Huawei	6.2%
Cisco Systems	4.6%
Samsung	3.5%
ETRI	3.0%
Conexant	2.7%
Nokia	2.4%
LG Electronics	1.9%
NTT	1.8%
STMicroelectronics	1.7%
Sony	1.7%
Motorola	1.6%
CSR	1.4%
Toshiba	1.1%
Mitsubishi Electric	1.1%
MediaTek	1.0%
Nortel Networks	1.0%

Wi-Fi 6 (802.11ax) — No. 2

Vendor	Share
Qualcomm	16.0%
Huawei	12.0%
Intel	10.0%
Marvell/NXP	7.3%
MediaTek	6.3%
Newracom	6.2%
Broadcom	5.1%
NTT	4.3%
LG Electronics	4.2%
ZTE	2.8%
Apple	2.7%
Ericsson	1.8%
Samsung	1.8%
WILUS	1.5%
Quantenna	1.4%
InterDigital	1.4%
Sony	1.1%
Toshiba	1.1%
ETRI	1.1%
Yonsei Univ.	1.0%

Wi-Fi 7 (802.11be) — No. 1

Vendor	Share
Huawei	22.9%
Qualcomm	15.2%
Intel	9.5%
LG Electronics	9.4%
Marvell/NXP	4.8%
Samsung	4.6%
MediaTek	4.4%
Broadcom	3.5%
Ericsson	2.8%
ZTE	2.1%
InterDigital	1.9%
Panasonic	1.8%
Apple	1.7%
Meta	1.6%
Quantenna	1.5%
Sony	1.2%
Cisco Systems	1.1%
OPPO	1.0%
Nokia	0.9%
MaxLinear	0.8%

IEEE 802.11ax (Wi-Fi 6)

Chair

Osama Aboul-Magd

IEEE 802.11be (Wi-Fi 7)

Technical Editor

Edward Au

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More Innovations @ Wi-Fi 7: Better Wi-Fi Connectivity for More Use Cases

	Maximum rate/radio	Frequency band	Channel width	MCS	Multi-RU	Multi-link
Wi-Fi 6	9.6 Gbps (5 GHz radio)	2.4 GHz 5 GHz	160 MHz	1024-QAM	S-RU per user	Single-link
Wi-Fi 6E	9.6 Gbps (5/6 GHz radio)	2.4 GHz 5 GHz **6 GHz**	160 MHz	1024-QAM	S-RU per user	Single-link
Wi-Fi 7	**23 Gbps*** (6 GHz radio)	2.4 GHz 5 GHz **6 GHz**	320 MHz **2x**	**4096-QAM** **20%+ ↑ bandwidth**	**Multi-RU per user**	**Multi-link**

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New 6 GHz Frequency Band @ Wi-Fi 7: Clean (Lower-Interference) and Abundant Spectrum Resources

Wi-Fi 6E/Wi-Fi 7 spectrum

Wi-Fi 6 spectrum

| | 2400 MHz | 2500 MHz | 5170 MHz | 5330 MHz | 5490 MHz | 5730 MHz | 5735 MHz | 5835 MHz | 5925 MHz | 6425 MHz | 7125 MHz |

500 MHz (6 GHz, low-frequency)

20 MHz	3	25	59
40 MHz		12	29
80 MHz		6	14
160 MHz		2	7

2.4 GHz
70 MHz

5 GHz
500 MHz
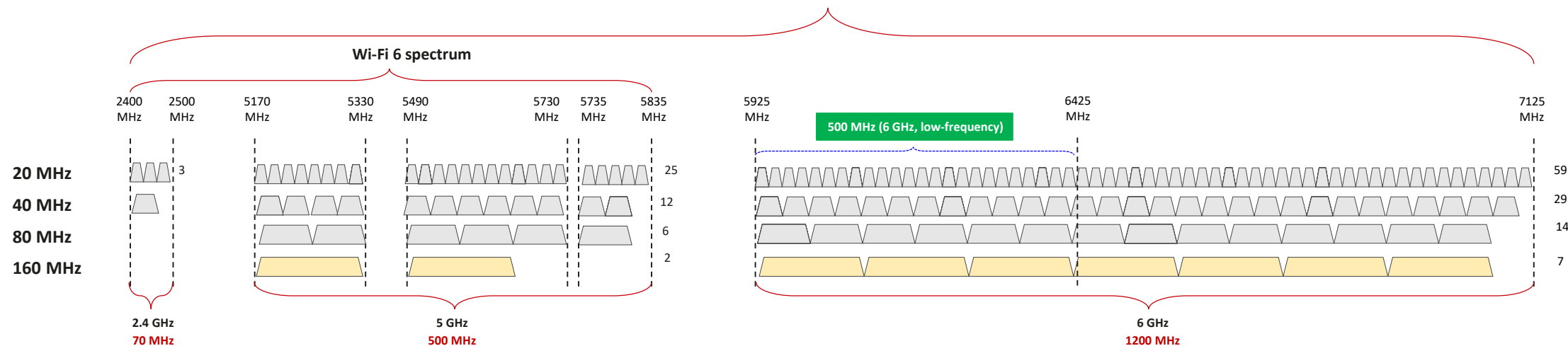
6 GHz
1200 MHz

Global adoption of the 6 GHz frequency band

6GHz Frequency Status	Region & Country
Full 6 GHz, adopted	Argentina, Brazil, Canada, Colombia, Costa Rica, Dominica, Salvador, Guatemala, Honduras, Peru, Saudi Arabia, South Korea, USA
6 GHz low-frequency, adopted	Bahrain, Chile, EU, Jordan, Kenya, Malaysia, Mauritius, Mexico, New Zealand, Russia, Singapore, South Africa, Thailand, Togo, Türkiye, UAE
6 GHz low-frequency, adopted; 6 GHz high-frequency, considering	Australia, Austria, Belgium, CEPT, Faroe Islands, France, Germany, Gibraltar, Hong Kong (China), Iceland, Ireland, Isle of Man, Japan, Liechtenstein, Luxembourg, Monaco, Netherlands, Norway, Qatar, Spain, Switzerland, United Kingdom
6 GHz low-frequency, considering	Egypt, Oman, Tunisia

Source: https://www.wi-fi.org/countries-enabling-wi-fi-in-6-ghz-wi-fi-6e

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EHT320 + 4096-QAM: 2.4x Maximum Transmission Rate (vs. Wi-Fi 6)

Frequency bandwidth: 160 MHz → 320 MHz

160 (Wi-Fi 6)   100%↑   320 (Wi-Fi 7)

QAM: 1024 → 4096

2^{10} (Wi-Fi 6)   20%↑ 2^{12} (Wi-Fi 7)
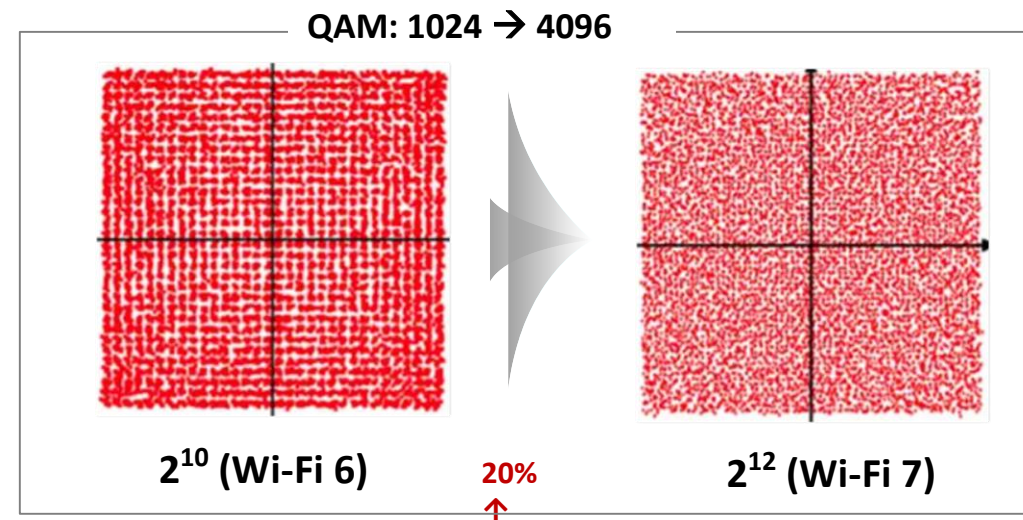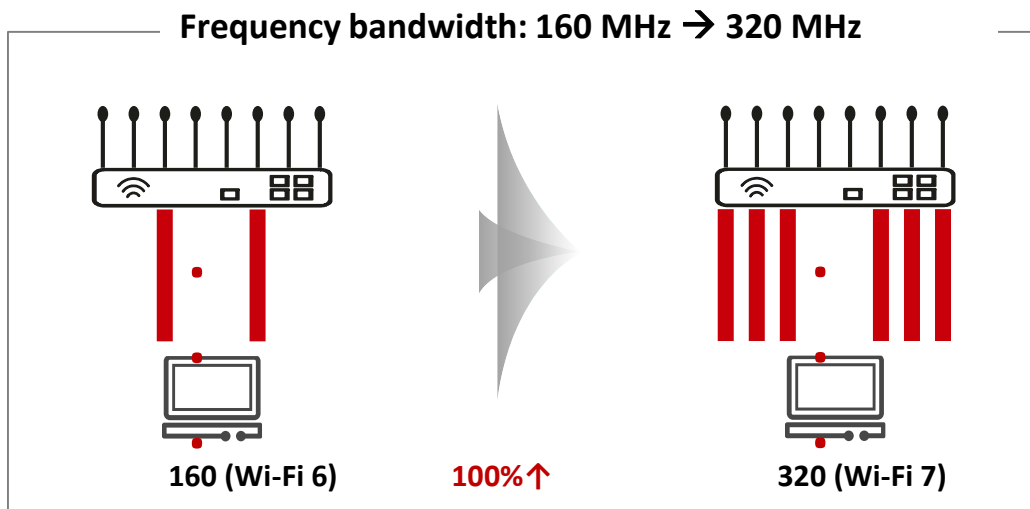
**Maximum air interface rate in Wi-Fi 7 @ 6 GHz powered by EHT320 and 4096-QAM:**

✓ Maximum rate with eight spatial streams = $8 \times 2 \times 2 \times 980 \times 1/13.6 \times 12 \times 5/6 = 23.058$ Gbps

Wi-Fi	Protocol	Frequency Band	Bandwidth	Subcarrier Bandwidth	Total Number of Subcarriers	Number of Valid Subcarriers	Number of Symbols [1/(Symbol + GI)]	QAM Mode	Bits/ Symbol	Coding Rate	Rate/Spatial Stream	Calculation Method
Wi-Fi 7	802.11be	2.4 GHz 5 GHz 6 GHz	EHT20	78.125 kHz	256	234	1/(12.8 us + 0.8 us)	4096-QAM	12	5/6	172 Mbps	$234 \times 1/13.6 \times 12 \times 5/6$
			EHT40		512	468				5/6	345 Mbps	$468 \times 1/13.6 \times 12 \times 5/6$
			EHT80		1024	980				5/6	722 Mbps	$980 \times 1/13.6 \times 12 \times 5/6$
			EHT160		2048	2 x 980				5/6	1441 Mbps	$2 \times 980 \times 1/13.6 \times 12 \times 5/6$
			EHT320		4096	2 x 2 x 980				5/6	2882 Mbps	$2 \times 2 \times 980 \times 1/13.6 \times 12 \times 5/6$

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Innovative **Multi-RU:** Much Better Utilization of Wireless Resources

RU Type	20 MHz	40 MHz	80 MHz	160 MHz/(80+80) MHz	320 MHz/(160+160) MHz
RU-26	9	18	37	74	148
RU-52	4	8	16	32	74
RU-106	2	4	8	16	32
RU-242	1	2	4	8	16
RU-484	-	1	2	4	8
RU-966	-	-	1	2	4
2xRU-966	-	-	-	1	2
4xRU-966	-	-	-	-	1
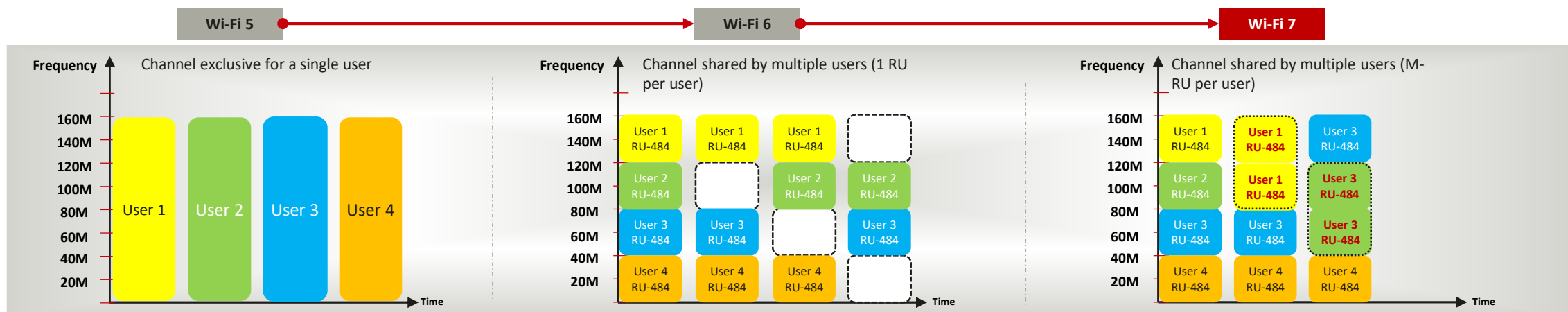
Wi-Fi 7 Perfectly Replaces Wired Networks, and Unlocks More Innovative Use Cases

4K conference
70 Mbps bandwidth, < 100 ms latency

Immersive education
AR/VR, < 10 ms latency

Production automation
AGV: zero packet loss during roaming, < 10 ms latency

Extending from workplaces to production spaces, unlocking more innovative use cases

Scenario	Application	Bandwidth	Latency	Number of Terminals	Wired	Wi-Fi 5	Wi-Fi 6/6E	Industry Wi-Fi 7	Huawei Wi-Fi 7
Office applications	4K conference	70 Mbps	100 ms	30-50	✔	✘	✘	✘	✔
	Immersive education	100 Mbps	10-20 ms	30-50	✘	✘	✘	✘	✔
	Multi-application hybrid work	30-channel 1080p video conference + 500 Mbps download from the cloud disk + 1 GB code upload			✔	✘	✘	✘	✔

	UDP Downstream Throughput (Gbps)	UDP Upstream Throughput (Gbps)	Average Round-trip Latency (WAC Ping Endpoint)	AP Performance with All Three Radios (UDP Downstream)
AirEngine 8771-X1T Wi-Fi 7 AP	4.33	4.20	2 ms	13.25 Gbps

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User Concurrency Upgrade:

120-Channel 1080p Video with Wi-Fi 7 vs. 30-Channel 1080p Video with Wi-Fi 6

Application scenario

High-density office

1000-people auditorium/gymnasium

3 terminals   **120 terminals** per

per person   AP

80% video conferencing + **20%** data download

Ultra-high-density access   **High-density AP deployment**

50 persons/100 m^2 1 AP every 10 m

Great signal attenuation due to AP co-channel interference

Signal attenuation by 40% every 30 m

Unique benefits of Huawei Wi-Fi 7

Intelligent joint scheduling

MU-MIMO	+	**OFDMA**	+	**MRU-MIMO**	=	**Joint scheduling**
Overpass		Multi-lane road		Multi-user carpooling		User concurrency: **30%** ↑

1080p HD video   30-channel with Wi-Fi 6   **120-channel with Huawei Wi-Fi 7**
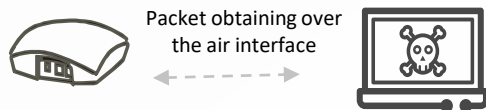
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Wi-Fi Security Upgrade: Huawei-Only Wi-Fi Guard, Allowing Only Authorized Users to Parse Signals

Application scenario

Public services (governments)

Wi-Fi signals are not searched or eavesdropped by other devices in the office campus.

Packet obtaining over the air interface

Banking/Securities

Financial service hall: Wireless signals must be free from eavesdropping, preventing user information from being stolen.

Data eavesdropping

Huawei-only: Wi-Fi Guard

Wi-Fi Guard

Invalid data

010101010

010101101
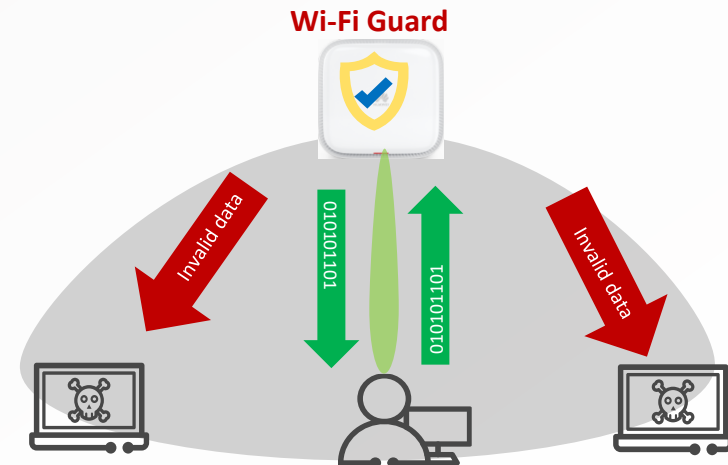
Invalid data

Unauthorized terminals can only receive invalid data.

Authorized terminals can receive valid data.

Unauthorized terminals can only receive invalid data.

The in-house chip performs PHY scrambling. In this way, only authorized terminals can correctly parse data.

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CoSR Multi-AP Coordination: 20% ↑ User Concurrency Performance

Challenges: severe co-channel interference in high-density office scenarios

Scenario: In high-density office scenarios, APs are deployed close to each other, among which many non-adjacent APs have weak mutual perception but can still detect each other at the same frequency. This causes the air interfaces to fail to transmit data at the same time, affecting the total system throughput.
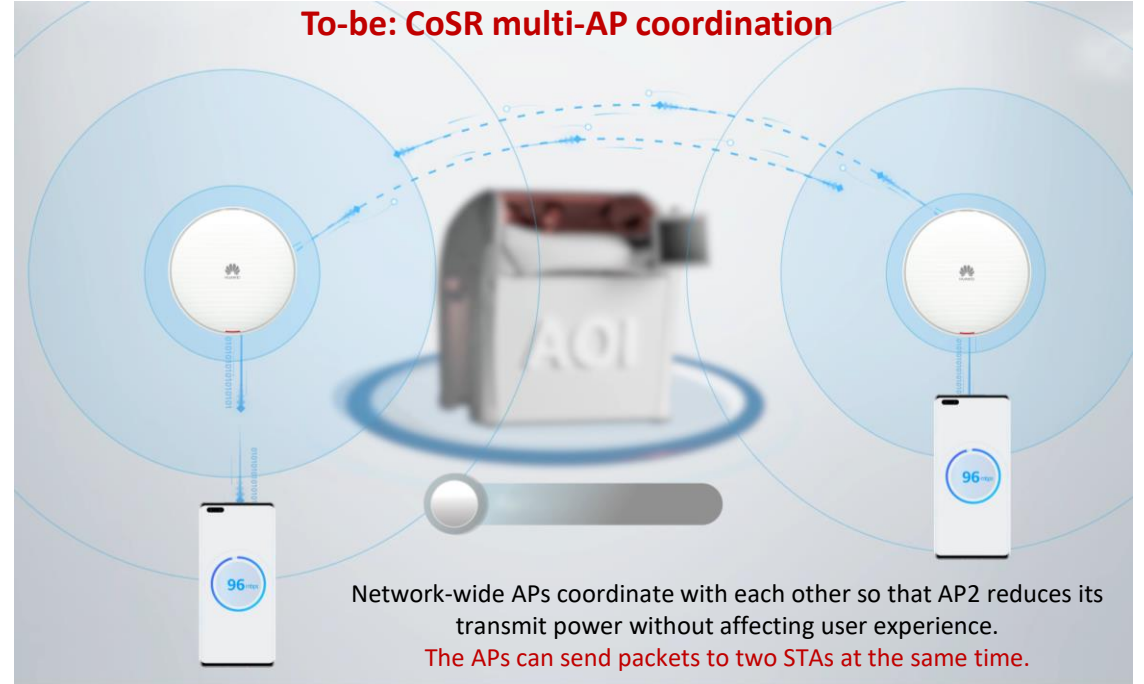
As-is: traditional solution

When AP1 sends packets to the STA, AP2 works in the carrier sense phase.
After AP1 finishes sending packets, AP2 needs to preempt the air interface to send packets.

To-be: CoSR multi-AP coordination

Network-wide APs coordinate with each other so that AP2 reduces its transmit power without affecting user experience.
The APs can send packets to two STAs at the same time.

Competitiveness

Maximized air interface resources

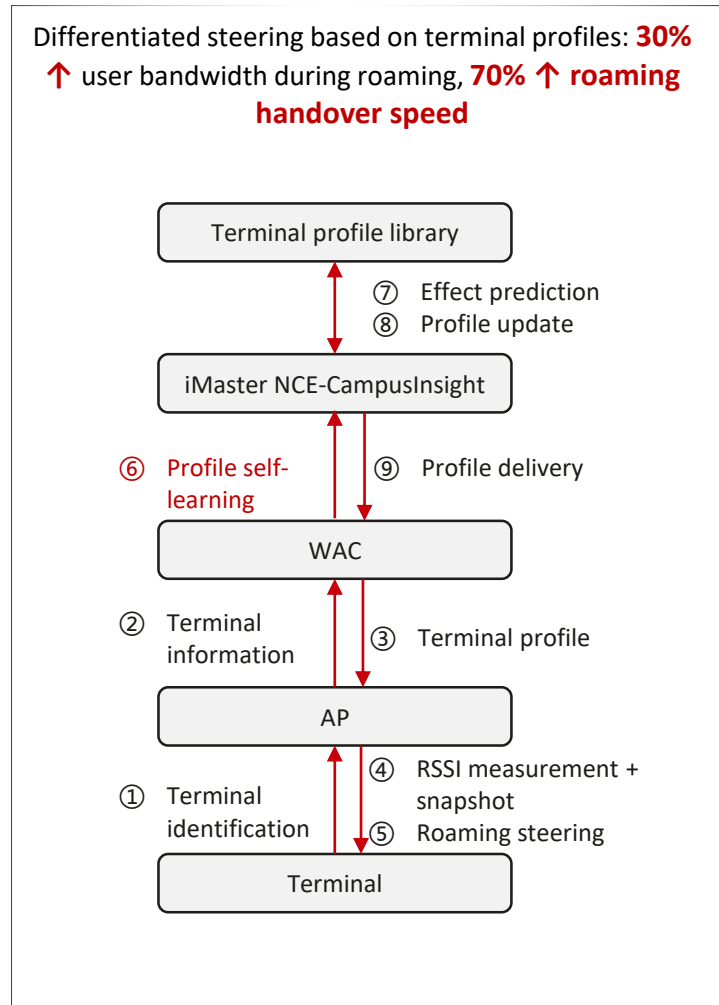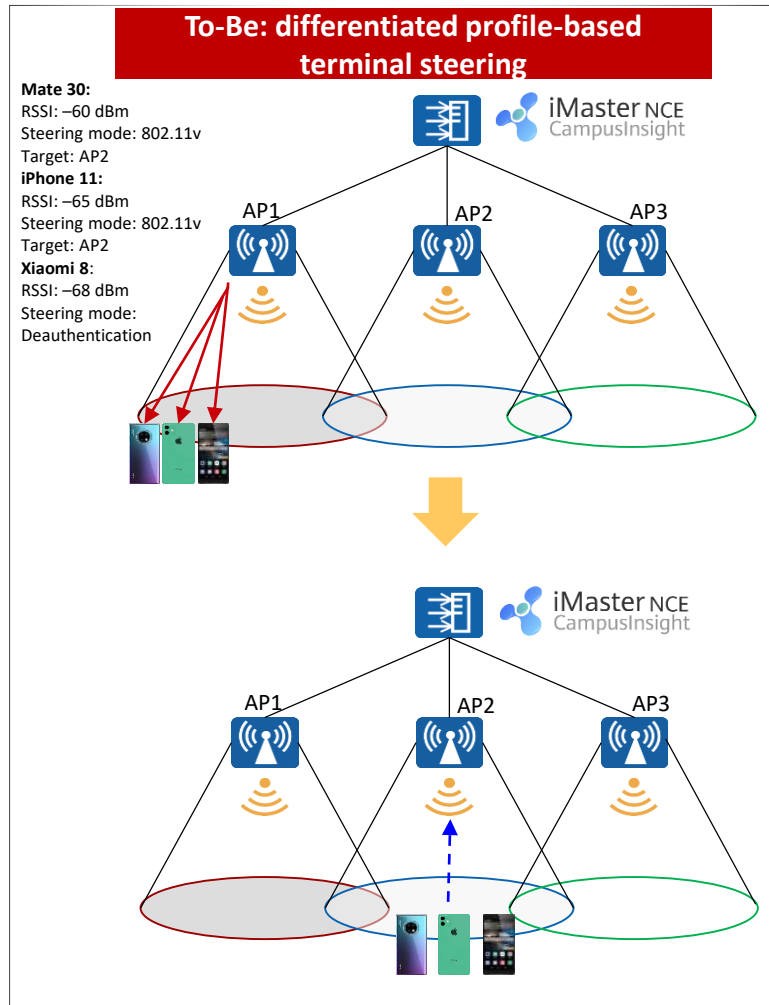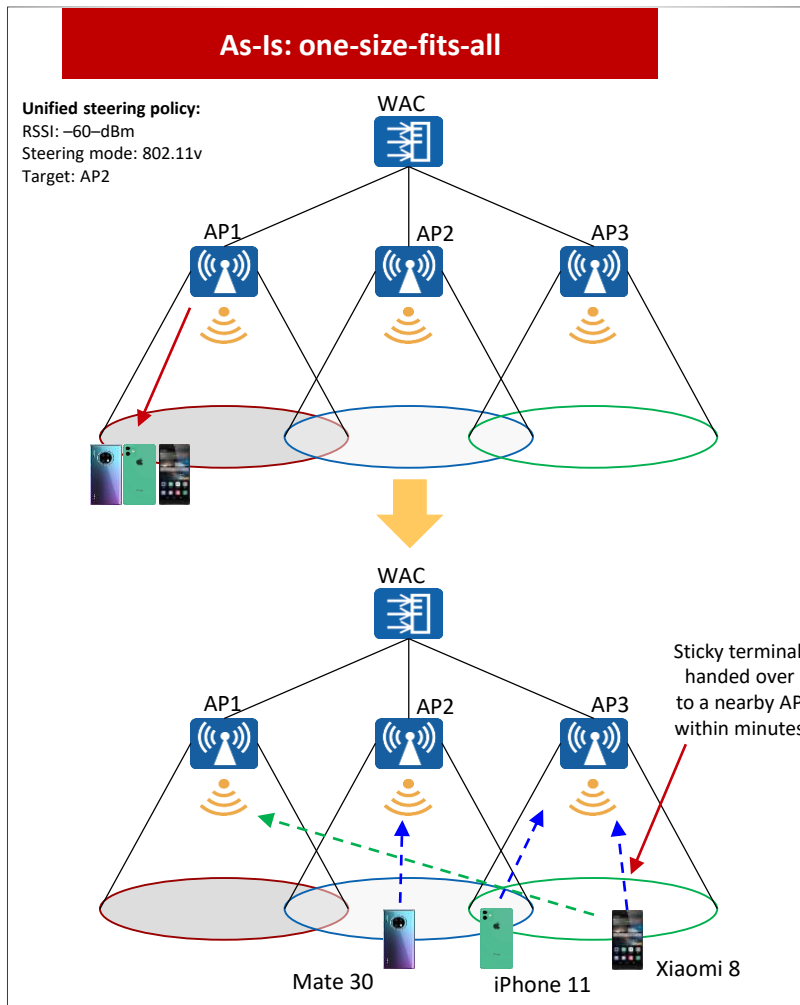**20%** higher user concurrency performance and downlink bandwidth of the entire network

Network-wide intelligent coordination

Network-wide coordinated calculation of APs and intelligent selection of concurrent STAs reduce co-channel interference in dense environments.

Per-packet customized transmit power

The optimal transmit power is customized for each packet destined for each STA.

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AI Roaming: Differentiated Terminal Roaming Steering, 30% ↑ User Roaming Speeds

As-Is: one-size-fits-all

Unified steering policy:
RSSI: −60−dBm
Steering mode: 802.11v
Target: AP2

WAC
AP1 AP2 AP3

Sticky terminal, handed over to a nearby AP within minutes

Mate 30   iPhone 11   Xiaomi 8

To-Be: differentiated profile-based terminal steering

Mate 30:
RSSI: −60 dBm
Steering mode: 802.11v
Target: AP2
iPhone 11:
RSSI: −65 dBm
Steering mode: 802.11v
Target: AP2
Xiaomi 8:
RSSI: −68 dBm
Steering mode: Deauthentication

iMaster NCE CampusInsight

WAC
AP1 AP2 AP3

Differentiated steering based on terminal profiles: **30% ↑** user bandwidth during roaming, **70% ↑ roaming handover speed**

Terminal profile library

⑦ Effect prediction
⑧ Profile update

iMaster NCE-CampusInsight

⑥ Profile self-learning   ⑨ Profile delivery

WAC

② Terminal information   ③ Terminal profile

AP

① Terminal identification   ④ RSSI measurement + snapshot
⑤ Roaming steering

Terminal

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Innovative Antenna Hardware Architecture Design: More Compact, More Energy-Efficient, and More Aesthetic

Plastic front cover

Antenna

Die-casting shielding cover

PCB

Die-casting rear cover

5 layers → 3 layers

Die-casting rear cover

PCB + antenna

Plastic front cover
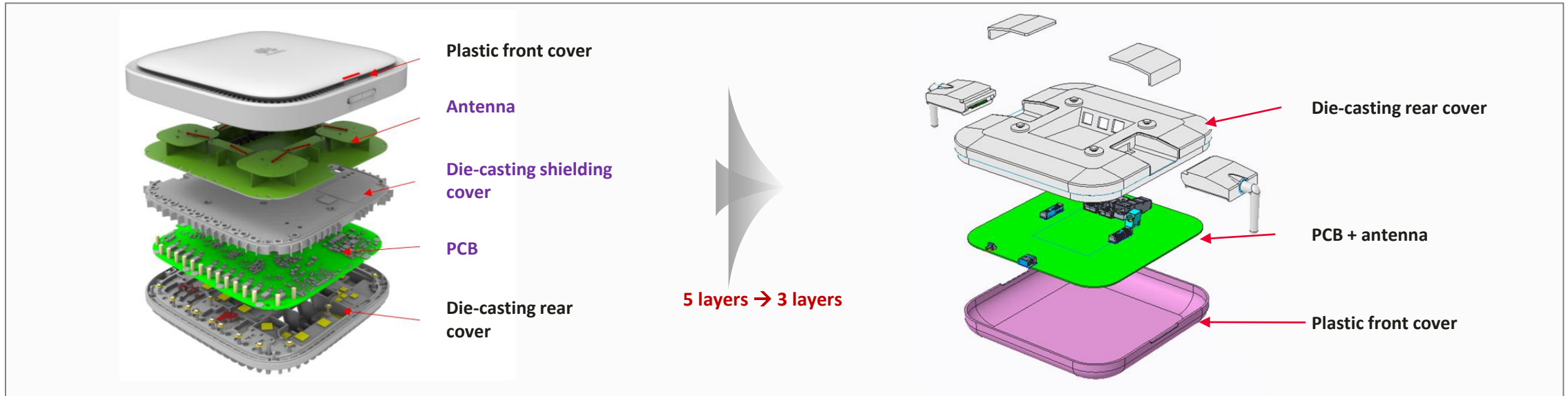
Thickness	**Power consumption** (Max.)	**Weight**
61 mm Wi-Fi 6 AP **20%↓** < 50 mm	55.0 W Wi-Fi 6 AP **19%↓** 44.4 W	1.86 kg Wi-Fi 6 AP **24%↓** 1.4 kg
Smaller size, lower logistics & warehousing costs	Lower power consumption, significant energy savings	Lightweight, easy to install, saving transportation costs

Wi-Fi 6 (AirEngine 8760-X1-PRO) vs. Wi-Fi 7 (AirEngine 8771-X1T)

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Wi-Fi 7 AP — AirEngine 8771-X1T

AirEngine 8771-X1T

Triple radios

Radio 1 Radio 2

2.4 GHz 5 GHz

6 GHz

Radio 3

Flexible switching between 5 GHz and 6 GHz on the local licensed spectrum

Dynamic-zoom smart antennas

High-density mode

Omnidirectional mode

Omnidirectional and high-density coverage modes used on demand; 10% to 20% higher performance
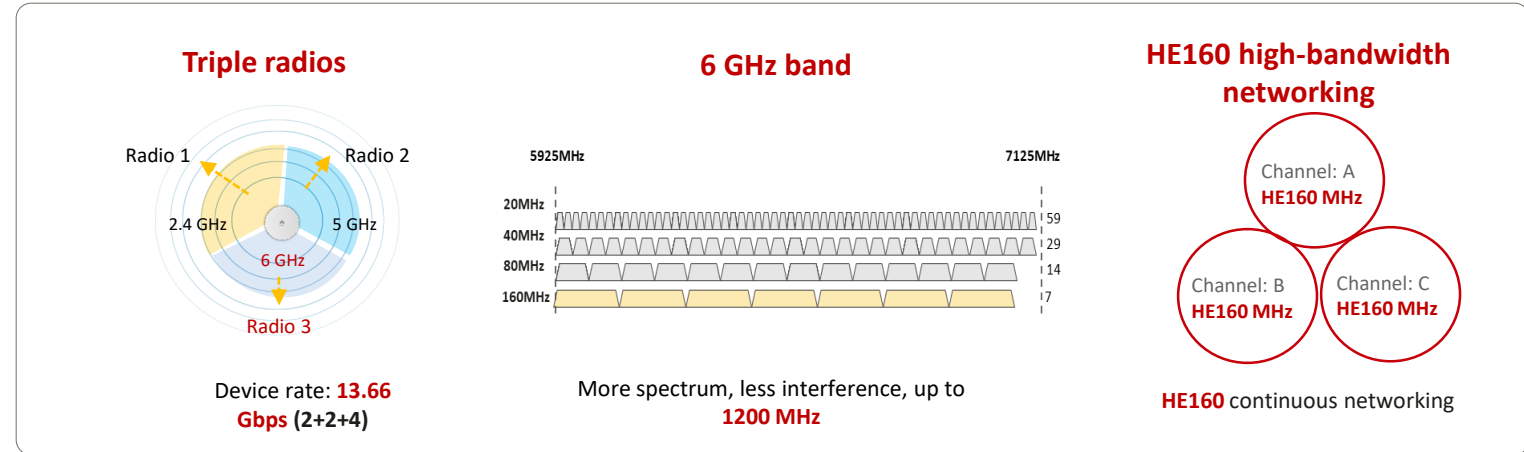
HE160 high-bandwidth networking

Channel: A
HE160 MHz

Channel: B
HE160 MHz

Channel: C
HE160 MHz

HE160 continuous networking, up to 320 MHz available

Parameter	Specifications
Max. device rate	**18.67 Gbps (1.376 Gbps + 5.765 Gbps + 11.53 Gbps)**
Spatial stream	4x4 @ 2.4 GHz (40 MHz) + 4x4 @ 5 GHz (160 MHz) + 4x4 @ 6 GHz (320 MHz)
Port	2 x 10GE Base-T + 1 x 10GE SFP+
Power supply	1) DC: 48 V ± 10% 2) PoE: 802.3bt (dual PoE-In) 3) Hybrid PoE (60 W PoE++ @ 300 m via hybrid cable)
IoT expansion	Built-in BLE 5.2 + external USB

Indoor Settled High-Density Wi-Fi 7 AP — AirEngine 6776-57T

AirEngine 6776-57T

Triple radios

Radio 1   Radio 2
2.4 GHz   5 GHz
6 GHz
Radio 3

Device rate: **13.66 Gbps** (2+2+4)

6 GHz band

5925MHz   7125MHz

20MHz   59
40MHz   29
80MHz   14
160MHz   7

More spectrum, less interference, up to **1200 MHz**

HE160 high-bandwidth networking

Channel: A
HE160 MHz

Channel: B
HE160 MHz

Channel: C
HE160 MHz

HE160 continuous networking

Parameter	Specifications	Parameter	Specifications
Device rate	13.66 Gbps (0.69 Gbps + 1.44 Gbps + 11.53 Gbps)	Antenna	Built-in smart antenna
Radio	2x2 @ 2.4 GHz (40 MHz) 2x2 @ 5 GHz (160 MHz) 4x4 @ 6 GHz (320 MHz)	Port	1 x 5GE electrical port + 1 x GE electrical port (The 5GE port supports PoE-In.)
Power supply	DC: 12 V ± 10% PoE: 802.3at/af	IoT expansion	Built-in BLE 5.2 + external USB

Indoor Settled High-Density Wi-Fi 7 AP — AirEngine 6776-56TP

AirEngine 6776-56TP

Triple radios

Radio 1   Radio 2
2.4 GHz   5 GHz
5 GHz
Radio 3

Device rate: **7.89 Gbps**
(2+2+4)

Smart antenna

Beamforming, **2x** stronger signal strength at the same location

Intelligent converged scheduling

Multi-dimensional converged scheduling, **50%** higher concurrency than the industry average

Parameter	Specifications	Parameter	Specifications
Device rate	7.89 Gbps (0.69 Gbps + 1.44 Gbps + 5.76 Gbps)	Antenna	Built-in smart antenna
Radio	2x2 @ 2.4 GHz (40 MHz) 2x2 @ 5 GHz (160 MHz) 4x4 @ 5 GHz (160 MHz)	Port	1 x 5GE electrical port + 1 x GE electrical port (The 5GE port supports PoE-In, while the GE port supports PoE-Out.)
Power supply	DC: 48 V ± 10% PoE: 802.3bt/at	IoT expansion	Built-in BLE 5.2 + external USB

HUAWEI

Indoor Settled Wi-Fi 7 AP — AirEngine 5776-26

AirEngine 5776-26

6 spatial streams

5 GHz — Radio 1
2.4 GHz — Radio 2

Device rate: **6.45 Gbps**
(2+4)

Smart antenna

Beamforming, **2x** stronger signal strength at the same location

NearLink support

NearLink

NearLink (a new short-range wireless connection technology), unlocking new use cases

Parameter	Specifications	Parameter	Specifications
Device rate	6.45 Gbps (0.69 Gbps + 5.76 Gbps)	Antenna	Built-in smart antenna
Radio	2x2 @ 2.4 GHz (40 MHz) 4x4 @ 5 GHz (160 MHz)	Port	1 x 2.5GE electrical port + 1 x GE electrical port (The 2.5GE port supports PoE-In.)
Power supply	DC: 12 V ± 10% PoE: 802.3at/af	IoT expansion	BLE 5.4 + external USB + NearLink SLE1.0

HUAWEI

Indoor Optical-Electrical Settled Wi-Fi 7 AP — AirEngine 5773-23H

AirEngine 5773-23H

4 spatial streams

5 GHz   2.4 GHz

Radio 1   Radio 2

Device rate: **3.57 Gbps**
(2+2)

Smart antenna

Beamforming, **2x** stronger signal strength at the same location

Hybrid cable

Built-in optical module, supporting plug-and-play optical fibers
Easy deployment due to 2000 m PoE via **hybrid cable**

Parameter	Specifications	Parameter	Specifications
Device rate	3.57 Gbps (0.69 Gbps + 2.88 Gbps)	Antenna	Built-in smart antenna
Radio	2x2 @ 2.4 GHz (40 MHz) 2x2 @ 5 GHz (160 MHz)	Port	1 x 2.5GE optical port + 1 x GE electrical port (The 2.5GE port supports the hybrid cable and PoE-In.)
Power supply	DC: 12 V ± 10% PoE: 802.3at/af	IoT expansion	BLE 5.2 + external USB

HUAWEI

Indoor Settled Wi-Fi 7 AP — AirEngine 5773-22P

AirEngine 5773-22P

4 spatial streams

5 GHz / 2.4 GHz
Radio 1 / Radio 2

Device rate: **3.57 Gbps**
(2+2)

Smart antenna

Beamforming, **2x** stronger signal strength at the same location

PoE-Out

Power supply to low-power PoE terminals, eliminating the need of local **power supply or cabling**
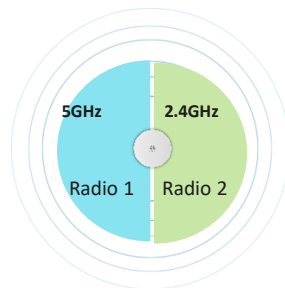
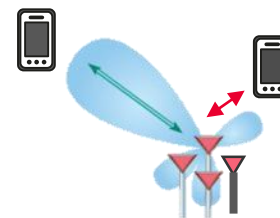| Parameter	Specifications	Parameter	Specifications
Device rate	3.57 Gbps (0.69 Gbps + 2.88 Gbps)	Antenna	Built-in smart antenna
Radio	2x2 @ 2.4 GHz (40 MHz) 2x2 @ 5 GHz (160 MHz)	Port	1 x 2.5GE electrical port + 1 x GE electrical port (The 2.5GE port supports PoE-In, while the GE port supports PoE-Out.)
Power supply	DC: 12 V ± 10% PoE: 802.3at/af	IoT expansion	BLE 5.2 + external USB

Indoor Settled Wi-Fi 7 AP — AirEngine 5773-21

AirEngine 5773-21

4 spatial streams

5GHz — 2.4GHz

Radio 1 — Radio 2

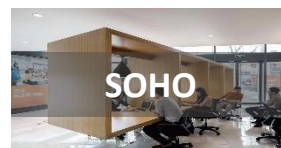Device rate: **3.57 Gbps**
(2+2)

Smart antenna

Beamforming, **2x** stronger signal strength at the same location

NearLink support

NearLink

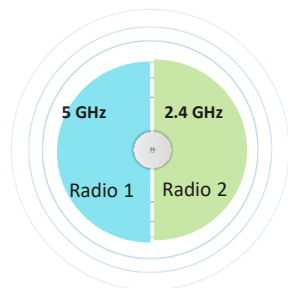**NearLink** (a new short-range wireless connection technology), unlocking new use cases

Key use cases

Store

SOHO

Café

Supermarket

Parameter	Specifications
Device rate	3.57 Gbps (0.69 Gbps + 2.88 Gbps)
Radio	2x2 @ 2.4 GHz + 2x2 @ 5GHz
Antenna	Built-in smart antenna
Power supply	PoE: 802.3at/af
Port	1 x 100M/1000M/2.5GE electrical port 1 x USB port

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Optical-Electrical Wall Plate Wi-Fi 7 AP — AirEngine 5773-23HW

4 spatial streams

5 GHz 2.4 GHz

Radio 1 Radio 2
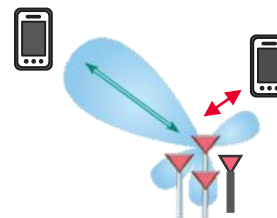
Device rate: **3.57 Gbps**
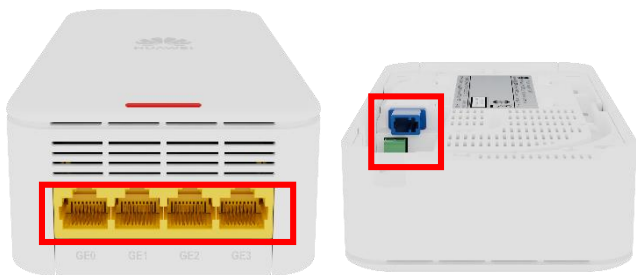**(2+2)**

Smart antenna

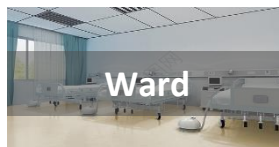Beamforming, **2x** stronger signal strength at the same location

Hybrid cable

Built-in optical module, supporting plug-and-play optical fibers
Easy deployment due to 2000 m PoE via **hybrid cable**

GE0 GE1 GE2 GE3

Key use cases

Dormitory

Ward

Parameter	Specifications
Device rate	3.57 Gbps (0.69 Gbps + 2.88 Gbps)
Radio	2x2 @ 2.4 GHz + 2x2 @ 5 GHz
Antenna	Built-in smart antenna
Power supply	PoE: 802.3at/af
Port	1 x 1000M/2.5GE optical port (supporting hybrid cables) 4 x 10M/100M/1000M electrical port 1 x USB port

HUAWEI

Backhaul Upgrade: Digital and Intelligent Transformation Drive Campus Network Upgrade to 10 Gbps

Application scenario

Mobile office

Upgrade to Wi-Fi 7, with uplink bandwidth exceeding 1 Gbps

Holographic medical image reading

PET-CT: 2.5 GB/time
3D image reading: 2.5 GB/time

AR/VR

High bandwidth and low latency
1 Gbps+, < 5 ms

Manufacturing AOI

High bandwidth
7-8 Gbps (10-channel per site)

Huawei-only solution and benefits

Bandwidth upgrade: GE → 2.5GE
Smooth upgrade, industry-leading

Energy saving + upgrade without replacing legacy cables

Industry   Huawei

FD-MIMO algorithm: same performance with 50% fewer transistors and 45% lower power consumption

Bandwidth upgrade: GE → 10GE
On-demand upgrade, unique in the industry

Pay-as-you-grow   +   Remote one-click upgrade

Base models + RTU licenses

Model L
Model S
Model E
Model X
Model Y

10G
5G
2.5G
1G

Base device models + RTU licenses: flexible port rate options

No repeated network planning, no site visit for onsite operations
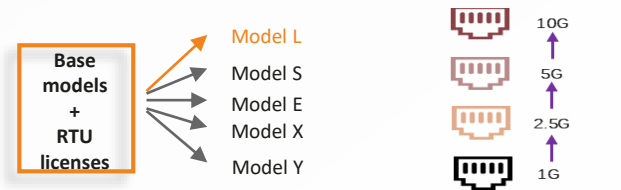
Money saving: cable reuse

0-cost upgrade

Power saving:

30% ↓ electricity fees

50,000 kWh electricity saved on a 1000-user campus each year

Labor saving:

smooth upgrade with **RTU licenses**

0 repeated site visits

Deterministic Experience Upgrade: 1588v2 + TSN, Enabling Real-Time Deterministic Forwarding of Industrial Control Traffic

Application scenario

Production & manufacturing

Instruction delivery and data collection in milliseconds

Industrial control

Industrial control service intervals of 8 ms; if signaling is lost for three such intervals, the production line is suspended.

Huawei-only solution and benefits

1588v2 — 30 ns precise clock synchronization

Watch A

Watch B

Frequency synchronization

Phase synchronization
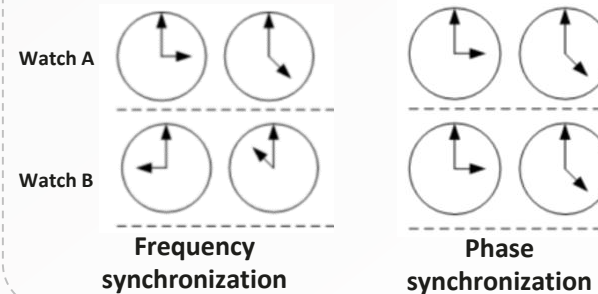
TSN: < 5 μs forwarding of service flows in real time

Past

Now
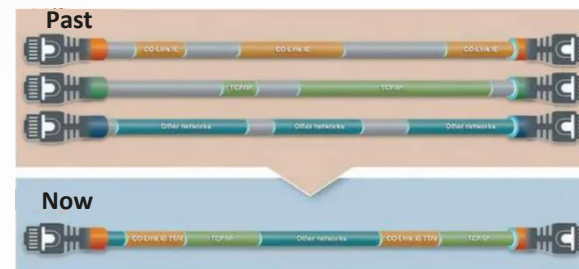
0 interruption for industrial production networks, due to deterministic assurance

HUAWEI

VIP User Experience Upgrade: VIP Services for VIP Users, Uncompromised Experience Even Upon Network Congestion

Application scenario

Joining a conference via IdeaHub

Projection from a computer

VIP assurance for executives

More than 30 participants access the conference room network, causing interruptions on IdeaHub.

Projection from a computer is delayed in the conference room while employees are downloading large files.

VIP users do not receive VIP network services that are different from common users.

Huawei-only solution and benefits

Dedicated time slices, < 50 ms latency for VIP users, even upon network congestion

Industry

VIP
VIP

When congestion occurs, all users contend for resources, increasing the latency.

Huawei

VIP
VIP

Common users wait, while VIP users go first.

> 150 ms

< 50 ms

Industry   Huawei

Average air interface latency for VIP users
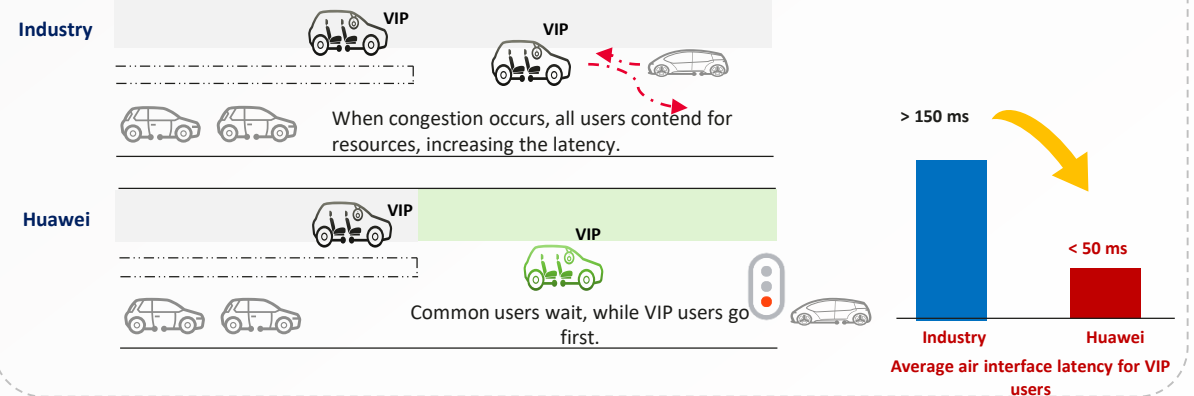
Targeted signal enhancement for VIP users, 20% higher bandwidth anytime, anywhere

20 m   20 m

Aluminum Alloy Body

VIP users   Common users

Bandwidth

A   1.2 x A

Common users   VIP users

HUAWEI
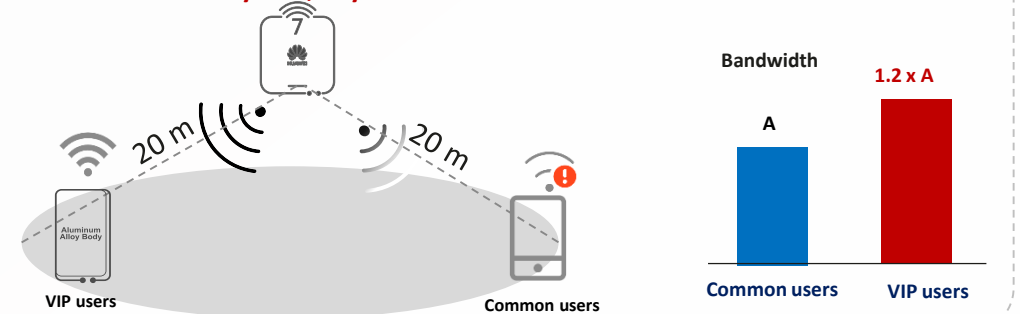
One-Map Visibility: Network-Wide Four-Dimensional Information Visibility, Intuitive Service Experience Awareness

Enterprise networks are becoming increasingly large and complex, and the number of devices and terminals surge, making routine network maintenance more difficult. The workload of O&M personnel increases sharply, and the pressure doubles.

As-Is: scattered network information

Inspection guide

Routine inspection

Device list

Switch A	Online
AP1	Online
AP2	Offline
…	…

User list

TOM	1 Mbps
LUCY	2 Mbps
Zhang	10 kbps
…	…

Alarm list

| Disk space shortage	Major
Port fault	Urgent
Low temperature	Warning
…	…

…

Long inspection period

- Scattered network information such as network and device status. There are hundreds of inspection steps, and each inspection takes over 1 hour.

Invisible service experience

- Inspection can only detect device faults, but cannot detect the actual network experience of users and applications.

To-Be: one-map visibility

The digital map of Huawei iMaster NCE
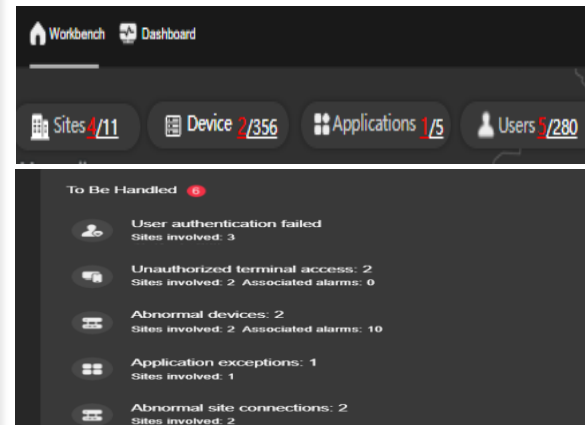
Four-dimensional information visibility

- Network status: device status, link status, topology, etc.
- Terminal visibility: terminal type, status, location on the topology, etc.
- User experience visibility: user experience scoring, access indicators and parameters, root cause analysis of user faults, etc.
- Application experience visibility: latency, traffic, jitter, abnormal flow, topology location of faults, root cause analysis, etc.

Proactive experience awareness

- One-map overview of device faults and poor application/user experience
- Intelligent to-do items, centralized display of exceptions, and a simple portal for O&M

HUAWEI

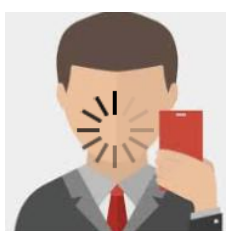# One-Second Demarcation: Fault Locating in Seconds, Clear Fault Demarcation

As wireless access scenarios keep growing, user experience cannot be guaranteed, access failures and network interruptions occur frequently, and complaints increase. As such, network experience faults of users and applications need to be quickly located.

As-Is: difficult to locate faults

Services

Conference lag — **Internet access freezing**
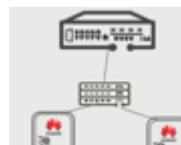
Network department

Where did the fault occur?

...

Unable to reproduce faults	Difficult to locate	High technical skill requirements
Difficult for key users to reproduce faults	Time-consuming to check a large number of devices one by one	Difficult to locate the root causes of faults; lack of rectification methods
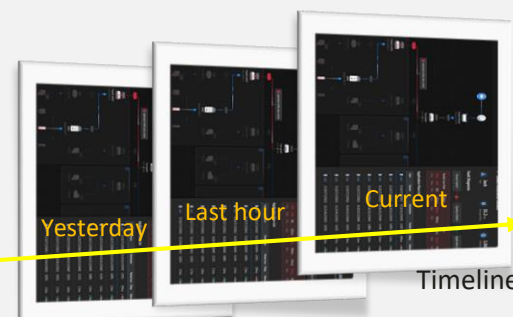
To-Be: fault locating in seconds

Traceable

Yesterday · Last hour · Current

Timeline

Massive indicator data is stored so that the digital map supports playback by time and the historical network status can be viewed.

A fault occurs.

Data reporting
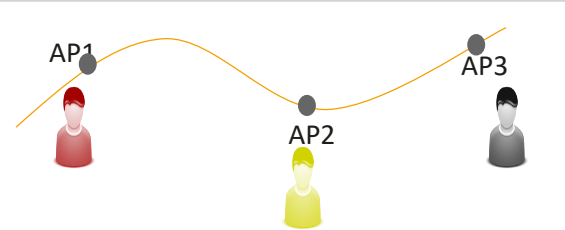
Fault inference

- Precise fault scenario matching
- Automatic identification of root causes of faults
- Providing the most reasonable suggestions
- 200+ fault inference rules

Huawei's long-term O&M expertise

Continuous learning from faults occurring at real sites
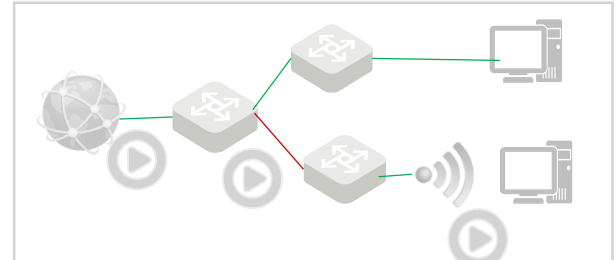
Fault knowledge base

User journey

AP1
AP2
AP3

Application analysis

HUAWEI

One-Click Optimization: One-Click Experience Assurance for Key Services

Key conferences and VIP users raise requirements for experience assurance. However, the assurance efficiency of network O&M personnel is low. With the sharp increase of audio and video traffic, rapid experience assurance gradually becomes a must.

As-Is: difficult experience assurance

Business department

Key service assurance requirements

Time-consuming and labor-consuming, impossible for timely experience assurance

Network department

Develop strategies (depending on experts).

Output configurations (complex configuration).

...

Deliver configurations (to a large number of devices).

Complex configuration

Traditional configuration procedures are complex and involve a large number of parameters. Devices are configured one by one, making it difficult to quickly respond to service requirements.

Expert-dependent

Network configuration depends on expert experience, resulting in high labor costs.

To-Be: one-click experience assurance

Easy to interact
One-click service assurance settings via the dashboard of the digital map, which is easy to interact

Configuration automation
iMaster NCE automatically generates and delivers configurations in batches based on service intents.

Service assurance → One-click assurance → Take effect in time

Automatically generated

Network configuration 1 ... Network configuration n → Bulk delivered to → Network device A ... Network device Z

VIP user assurance

Application assurance

HUAWEI

Contents

1. Campus Network Trends and Challenges

2. Huawei High-Quality 10 Gbps CloudCampus Solution

   - Solution Architecture

   - Wireless Experience Upgrade

   - Application Experience Upgrade

   - O&M Experience Upgrade

3. Success Stories

Winning Global Recognition Across Diverse Industries; a Leader in Gartner MQ

Europe (Unieuro, ETH Zürich):
- Transportation: ShoreLink (Sweden), BizkaiBus (Spain)
- Healthcare: Elisabeth Hospital, Contilia Group
- Education: ETH Zurich (Switzerland)
- Retail: Unieuro, Italy
- Finance: UniCredit, Italy

Europe (Enel, ikoula):
- Energy: Enel, Italy
- Manufacturing: SEAT, Spain
- Public services: ADA autonomous community, Spain

Middle East & Central Asia:
- Public services: Qatar 2022 World Cup stadiums
- Finance: Al Masraf, UAE
- Transportation: HQ campus of Kazakhstan Temir Zholy
- Healthcare: American Hospital Dubai

China:
- Public services: Beijing e-Government extranet
- Education: Southeast University, Macao University of Science and Technology (MUST), Wuhan University of Technology
- Manufacturing: Wanhua Chemical
- Finance: China Construction Bank
- Large enterprises: JD.com

Africa (Exxaro):
- Energy: Exxaro, South Africa
- Transportation: Transnet, South Africa
- Education: EA university, Egypt

Asia Pacific (UnionBank):
- Finance: UnionBank of the Philippines, Mandiri (Indonesia)
- Education: National University of Singapore, KMITL University (Thailand)
- Large enterprises: Square Enix, Japan
- Transportation: Hong Kong International Airport (China)

Latin America (ORIGINAL):
- Public services: CONAGUA (Mexico), IMSS (Mexico), TJSP (Brazil)
- Transportation: SEPOMEX, Mexico
- Finance: Bank of Brazil and CAIXA, Brazil
- Electric power: CFE, Mexico

1 million 10GE switches

8 million Wi-Fi 6/7 APs

5000+ sets of iMaster NCE

HUAWEI

Southeast University: Leveraging Wi-Fi 7 to Build the World's Fastest Stadium Network

- World-renowned university, located in the time-honored city Nanjing, China
- Also a key university directly subordinate to the Ministry of Education of China and included in the "Double First-Class", "Project 985" and "Project 211" initiatives
- This project is to transform the stadium of the university's Jiulonghu campus. This stadium has 4486 seats in total (namely, 2990 fixed seats, 1468 movable seats, and 28 seats in the rostrum).

Challenges

- Outdated wireless network built with Wi-Fi 4 APs: incomplete wireless coverage, frequent disconnections, and other issues
- Some APs are more than 100 m away from the ELV room. Traditional cabling solutions cannot meet this need.

Huawei solution

Core switch
CloudEngine
S8700-6
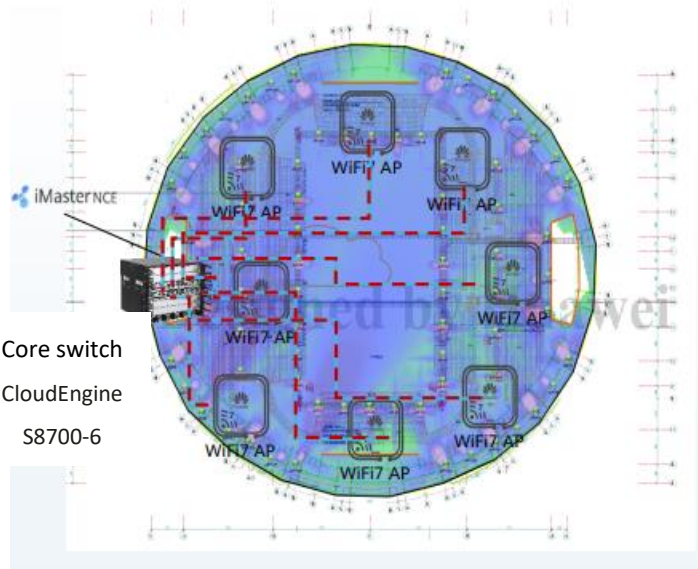
- **High-quality 10 Gbps campus**: **Wi-Fi 7 APs** are deployed in the stadium to ensure full wireless coverage in all scenarios and seamless roaming. The CloudEngine S8700-6 switch is also deployed to provide all-optical **2.5GE wired access**.

- **High-density hybrid optical-electrical modular device + hybrid cable**: One CloudEngine S8700-6 switch is enough to supply power and transmit data to all APs throughout the stadium. **One such device is for the entire stadium**. **Hybrid cables enable 2000 m ultra-long-distance PoE,** facilitating AP deployment and ensuring the aesthetics and security of cabling.

Benefits

Advanced stadium network
Built with the industry's first commercial Wi-Fi 7 AP, **leading the industry**

Simplified O&M and reduced investment
One device for the entire stadium, **80% ↓** managed nodes, **30% ↓** investments

HUAWEI

International School of Monaco: Drawing on Wi-Fi 7 to Build a Future-Proof School Campus Network with Record-High Speeds
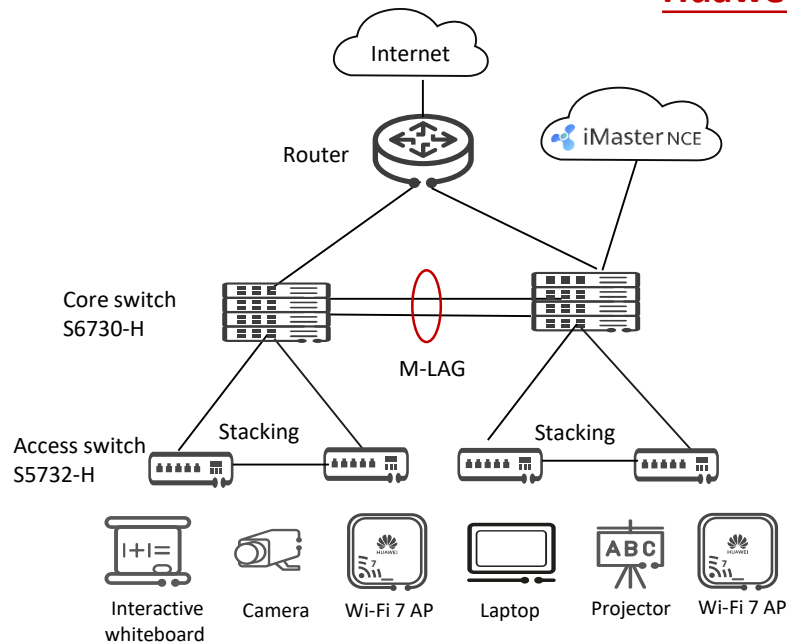
ISM
THE INTERNATIONAL
SCHOOL OF MONACO

- Founded in 1994
- Among top 15 schools in the European Union and top 125 private schools globally in 2023
- Approximately 800 students and 171 teachers now
- Complete infrastructures, diversified teaching modes, and focus on teaching experience upgrade

Challenges

- The new building introduces the latest teaching methods (e.g., AR/VR and multimedia). To support this, a highly reliable, high-bandwidth, fully-wireless network is required.
- An important national conference will be held in this building, and the network must be constructed within 2 months.
- Visualized network management is needed to eliminate manual troubleshooting and improve O&M efficiency.

Huawei solution

Internet
iMaster NCE
Router
Core switch S6730-H
M-LAG
Access switch S5732-H
Stacking
Stacking
Interactive whiteboard
Camera
Wi-Fi 7 AP
Laptop
Projector
Wi-Fi 7 AP

- **Reliable, ultra-broadband wireless network: Wi-Fi 7 AirEngine 8771-X1T** with unique dynamic-zoom smart antennas is deployed to ensure seamless roaming in all scenarios. CloudEngine S5732-H **10GE access** switches and CloudEngine S6730-H core switches (M-LAG capable **for always-on services during upgrade**) are also deployed.

- **Fast service provisioning:** iMaster NCE-Campus enables lego-like modular configuration and implements **service provisioning in minutes**.

- **Proactive and intelligent O&M:** Huawei-only digital map enables unified O&M and facilitates easy network **fault locating and backtracing**.

Benefits

Best-in-class school campus network, better teaching experience
Use of Wi-Fi 7 AP to **stay ahead,** ready for service needs over the next 5 years

Fast service provisioning, timely assurance for the planned key conference
3x configuration efficiency, half a month ahead of schedule

Intelligent O&M, higher O&M efficiency
Network-wide status visibility, fault locating in **minutes, 10x** higher efficiency

Huawei High-Quality Wi-Fi 7 Campus Network Solution: Building Innovative Digital Infrastructure with Ultra-High-Speed Access

S5732-H/S5755-H

Multi-GE

May 2024

Wi-Fi 7

AirEngine 8771-X1T   AirEngine 6776-57T/56TP

Premium Edition:
Multi-GE + Wi-Fi 7

S5735-S/S5735-L

May 2024

2.5GE

May 2024   May 2024

Wi-Fi 7

AirEngine 5776-26   AirEngine 5773-23H/22P/21

Standard Edition:
2.5GE + Wi-Fi 7

Large enterprises   Education   Healthcare   Public services   Finance
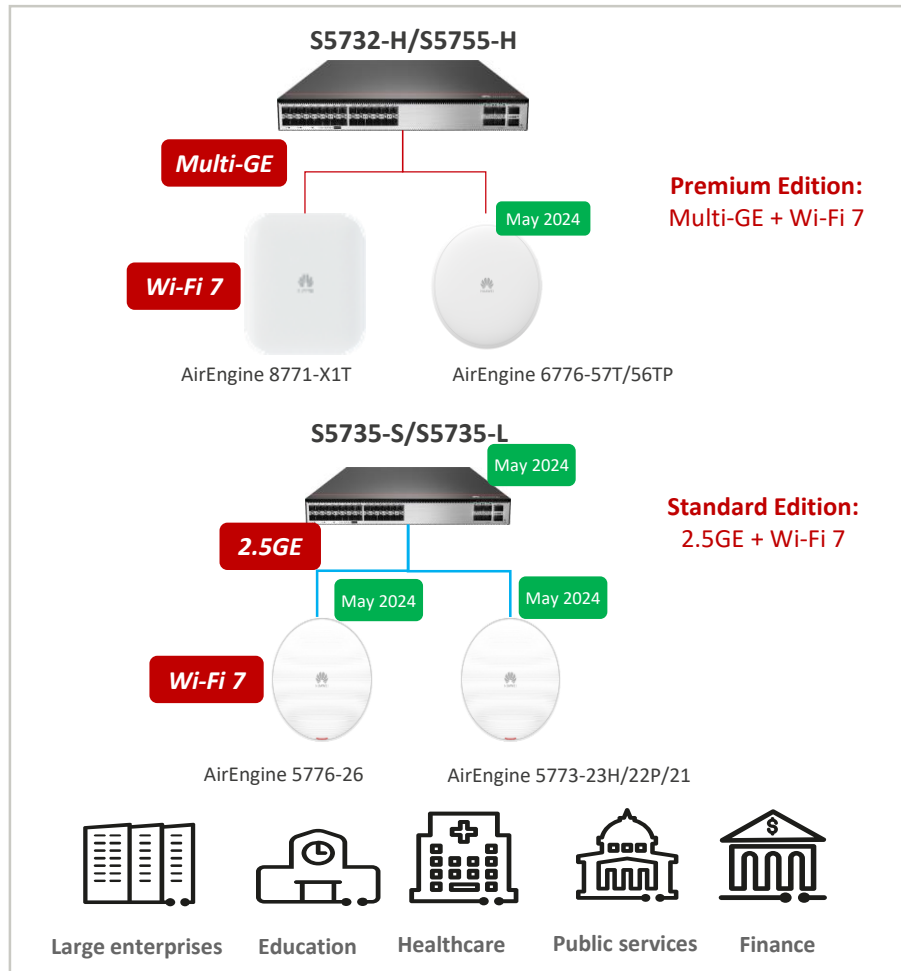
One Wi-Fi generation ahead ≫≫

Industry's first enterprise-class Wi-Fi 7 AP
Max. device rate: 18.67 Gbps

2x ↑
terminal speed

Upgrade without replacing cables ≫≫

Customer investment protection
GE-to-2.5GE upgrade, without replacing legacy Cat5e cables

0
cabling costs

Always-smooth experience ≫≫

Optimal experience for audio & video/VIP users
Smooth 120-channel 1080p video experience

0
interruption for ultimate experience

HUAWEI

Thank you.

$$\text{Data Rate} = \frac{N_{SD,U} * N_{BPSCS,U} * R * N_{SS}}{T_{DFT} + T_{GI}}$$

- Number of Data Subcarriers per Resource Unit
- Number of Coded Bits per Subcarrier per Stream for the Resource Unit
- Coding
- Number of Spatial Streams
- OFDM Symbol Duration
- Guard Interval Duration

把数字世界带入每个人、每个家庭、每个组织，构建万物互联的智能世界。

Bring digital to every person, home and organization for a fully connected, intelligent world.

HUAWEI

MERCI DE VOTRE ATTENTION !

Sondage de satisfaction
Merci de votre feedback

Scannez-moi

Cyberdefense

Bandwidth Reservation for VIP Users: Ultimate Experience for VIP Users

Requirements & Challenges
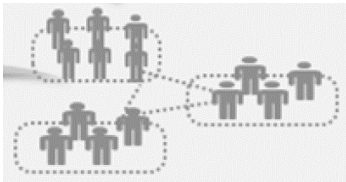
Randomly flowing swarm traffic

(Example) Conference room scenario:
A sharp increase in users → air interface resource preemption → degraded experience of wireless conference terminals

Conference terminals

Other office terminals

>>

iMaster NCE

Bandwidth reservation ratio for VIPs:

0%   20%   50%   100%

20
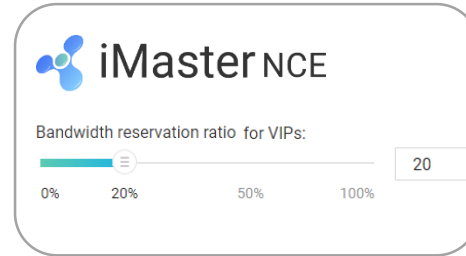
- Define VIP users.
- Define the percentage of bandwidth to be reserved for VIP users.

Wi-Fi 6 AP

20%

bandwidth reserved

VIP user: conference terminal

Common user

Reserve OFDMA spectrum resources for VIP users

Time

78.125KHz

Spectrum dedicated to VIP users (reserved subcarrier)

Spectrum

Spectrum shared by common users (shared subcarrier)

VIP users   Common users

On-demand bandwidth reservation:
- When no VIP user is connected to an AP, no bandwidth is reserved.
- Sufficient bandwidth resources are reserved only for VIP users.

HUAWEI

VIP User Assurance: One-Click Settings for VIP Users, Ensuring Experience

Requirements & Challenges
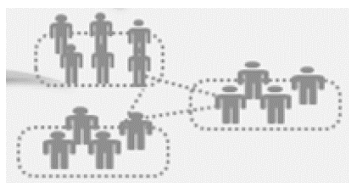
Randomly flowing swarm traffic

(Example) Conference room scenario:
A sharp increase in users → air interface resource preemption → degraded experience of wireless conference terminals
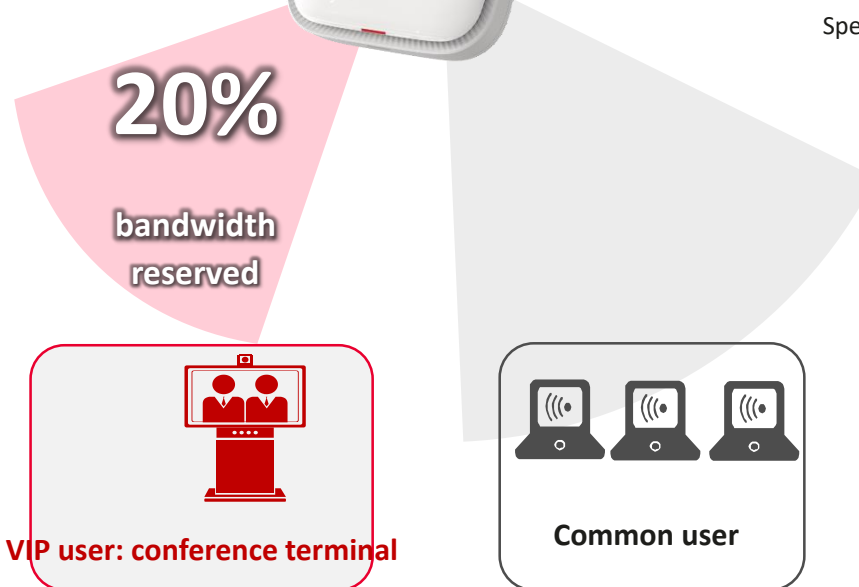
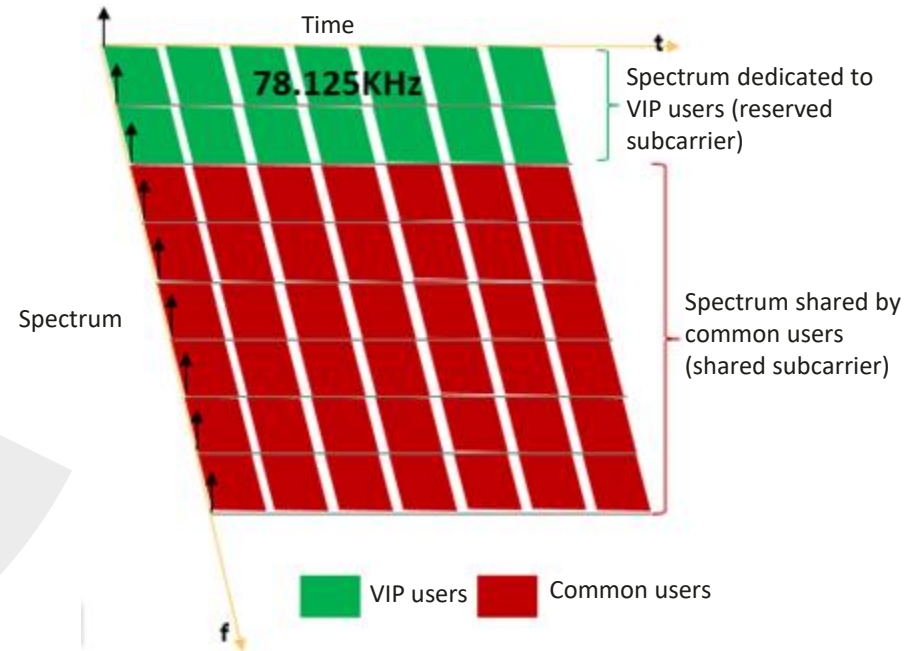**Conference terminal**   **Other office terminal**

One-click settings for VIP users

iMaster NCE
(Authentication server)

User Statistics   Manage Users>

Search   VIP Management

User name	User Type	Score ↑↓
TOM e4-46-da-4c-f0-e6	VIP用户	69

- When a user is set as a VIP user on iMaster NCE, the VIP role is bound to the user, and the authorization rule is bound to the VIP role. When the user is authenticated, the authorization rule takes effect.

User
→ Set as a VIP
Default VIP roles
↓
Preset high-priority authorization rules:
[The authorization result is VIP for any VIP user.]

Authentication   Authorization
          User experience parameters

- VIP users can preferentially access the network. When the number of users connected to an AP reaches the upper limit, VIP users preferentially connect to the AP.

- The AP reserves resources for VIP users. When no VIP user accesses the network, the resources are shared by all users.

AP

20% bandwidth reserved

VIP user   **Common User**

Proactive assurance for VIP users

- When the experience of VIP users deteriorates, the system generates an alarm to remind O&M personnel to locate and rectify the fault in a timely manner.

Notification of proactive O&M
↑
Alarm upon poor experience
↑
User experience scoring

The AP reserves OFDMA spectrum resources for VIP users.

Time
78.125KHz
Spectrum dedicated to VIP users

Spectrum

Spectrum shared by common users

■ VIP user   ■ Common User

f

- **Wireless bandwidth reservation for VIP users**

Network Reconstruction Scenarios: Upgrade to Multi-GE Switches, Without Replacing Legacy Cables; Cate5e Cables Can Adapt to Entry-Level Wi-Fi 7

2.5x user bandwidth

GE-to-2.5GE upgrade, enabling new use cases and meeting the bandwidth needs of Wi-Fi 7 APs

0 cabling costs

Cat5e or higher cables support 2.5 Gbps. During upgrade to 2.5GE, legacy cables can be reused.

Forward compatible

10/100/1000/2500 Mbps auto-adaptation; compatible with existing 10 Mbps terminals

Cat5e cables support GE/2.5GE/5GE transmissions.

Maximum transmission distances of different cables on multi-GE ports

Cable Type (6-a-1 Bundle)	Multi-GE Port (Different Rates)			
	100M/1000M	2.5GE	5GE	10GE
Category 5e unshielded twisted pair (Cat5e UTP)	100 m	100 m	• 55 m • 100 m (6-a-1 bundle only for the first 30 m) Not recommended due to high risk	Not supported
Category 5e shielded twisted pair (Cat5e STP)	100 m	100 m	100 m	Not supported

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New Network Scenarios: Hybrid Cable for Both Superfast Data Transmission and Long-Distance Power Supply

As Is: network cable

High costs: different generations of network cables, requiring re-cabling for each speed increase

Re-cabling → Cat6A
Re-cabling → Cat6
Re-cabling → Cat5e
Re-cabling → Cat5
Re-cabling → Cat3

Speed increase = Re-cabling

10M   100M   1/2.5GE   5GE   10GE   25GE

Transmission media revolution

Network cable → Hybrid cable

To Be: Hybrid cable

Investment protection: 15 patents, no need to replace and re-cable for 10-15 years

10GE upgrade   25GE PnP

Electrical signal

Optical signal

Optical-electrical module

Industry-leading PoE at 2000 m, thanks to the use of superconducting red copper material

6 mm hybrid cable, the industry's **thinnest**, featuring a thin-wall design

Electrical shock or short circuit prevention through intelligent sensing at the back end

Innovative RTU: Flexible Choices of Port Rates

2 base models + 6 RTU licenses = 45 models to choose from

CloudEngine S5732-H

48 x 10GE PoE++

Tolly.
Certified

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1 x RTU license#3

| 12 x GE + 12 x 10GE | 12 x 2.5GE + 12 x 10GE | 1 x RTU license#5 | 24 x 10GE |

1 x RTU license#6

1 x RTU license#6

1 x RTU license#6

| 12 x GE + 12 x 5GE | 12 x 2.5GE + 12 x 5GE | 12 x 5GE + 12 x 10GE |

1 x RTU license#4

1 x RTU license#4

1 x RTU license#6

| 12 x GE + 12 x 2.5GE | 24 x 2.5GE | 24 x 5GE |

1 x RTU license#1

2 x RTU license#1

2 x RTU license#2

24 x GE

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Pay-as-You-Grow, 30% ↓ Network Construction Costs

Future-proof network	+	Smooth evolution	=	Pay-as-you-grow
• **10GE-ready** access switches • Flexible upgrade to **Wi-Fi 7 APs**		• **Flexible bandwidth upgrade** via RTU licenses • One-click remote upgrade, **without on-site visits** • **Fast network upgrade**, without repeated planning or commissioning		• **On-demand network construction**, avoiding over-investment • **On-demand upgrade,** protecting investment and reducing CAPEX

Typical campus scenario: A fully-wireless office campus has **5000** employees and **10,000** terminals. It plans to deploy **1000** Wi-Fi 7 APs, **50** access switches, **4 to 8** aggregation switches (via stacking), and **2** core switches (via clustering).

GE campus network CAPEX — 11%

GE-to-10GE upgrade CAPEX — 62%

Total CAPEX — 38%

■ Vendor C   ■ Huawei

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