Scenario-based Enterprise WLAN Design

Backhaul

Foreword

- Backhaul in scenario-based enterprise WLAN design refers to wireless bridging between APs. In the WLAN field, wireless backhaul is mainly applied based on mesh networks. Mesh technology facilitates WLAN construction in complex environments, such as metros, tunnels, docks, and emergency communication.

- In countries where infrastructure is under-developed, wireless backhaul becomes the optimal choice for customers who requires fast deployment and installation. In wireless solutions, Wi-Fi has proper bandwidth, long backhaul distance, high pertinence, and low costs. These advantages make Wi-Fi the best way to carry the last mile of the video surveillance network.

- This design guide describes the methods, principles, and precautions for backhaul solution design.

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Objectives

- Upon completion of this course, you will be able to:

  - Understand common services and application scenarios of wireless backhaul.

  - Understand AP and antenna selection policies.

  - Understand bandwidth calculation methods in backhaul scenarios.

  - Describe the requirements and precautions for implementing backhaul.

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1. **Backhaul Scenario Overview**

2. WLAN Planning and Design for Backhaul Scenarios

3. Huawei's WLAN Construction Standards for Backhaul Scenarios

4. Typical WLAN Design Case in Backhaul Scenarios

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Backhaul Scenario Overview

- Wireless backhaul refers to wireless bridging between APs. On a WLAN, wireless backhaul is applied in the mesh networking. Mesh technology facilitates WLAN construction in complex environments, such as metros, tunnels, docks, and emergency communication.

Rural area

Oil field or mine

Scenic spot

Road intersection

- Remote areas, large coverage, low bandwidth
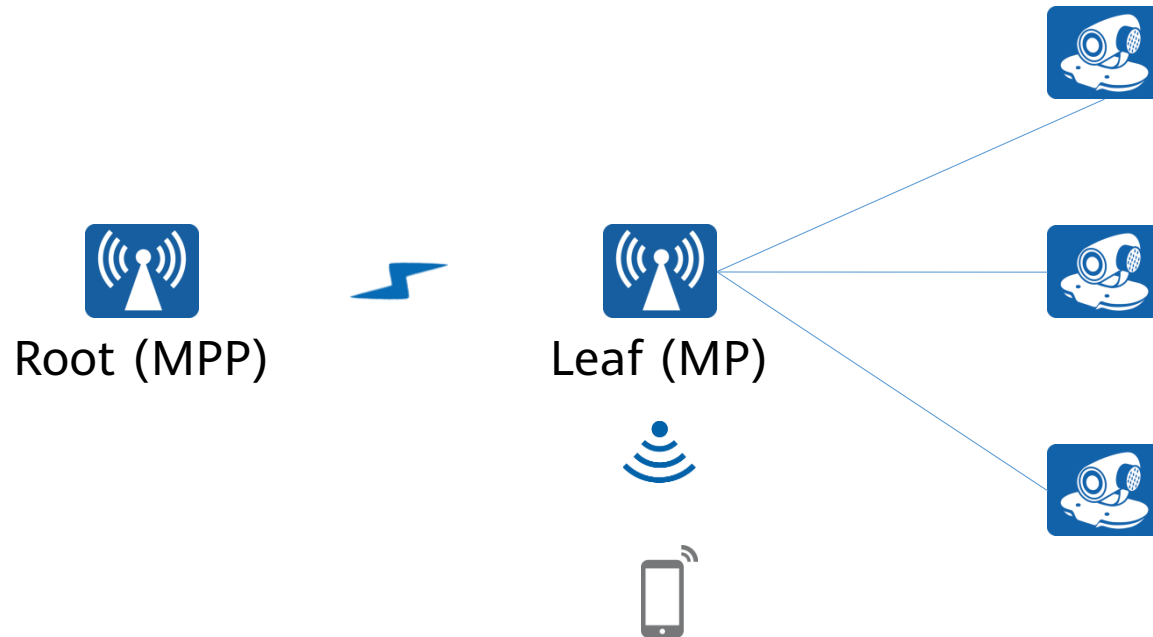- Harsh outdoor environment

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Mesh Network Overview

- A Wireless Mesh Network (WMN) is a communications network that consists of multiple wirelessly connected APs in a Mesh topology. Points on a WMN can automatically establish a topology and maintain mesh connectivity. Mesh links between MPPs and MPs are used for wireless backhaul.
  - Mesh Point (MP): a mesh-capable node that uses IEEE 802.11 MAC and physical layer protocols for wireless communication. This node supports automatic topology discovery, automatic route discovery, and data packet forwarding. An MP can provide both mesh service and user access service.
  - Mesh Portal Point (MPP): an MP that connects the mesh network to other types of networks. The MPP provides the Portal function to allow MPs to communicate with external networks.

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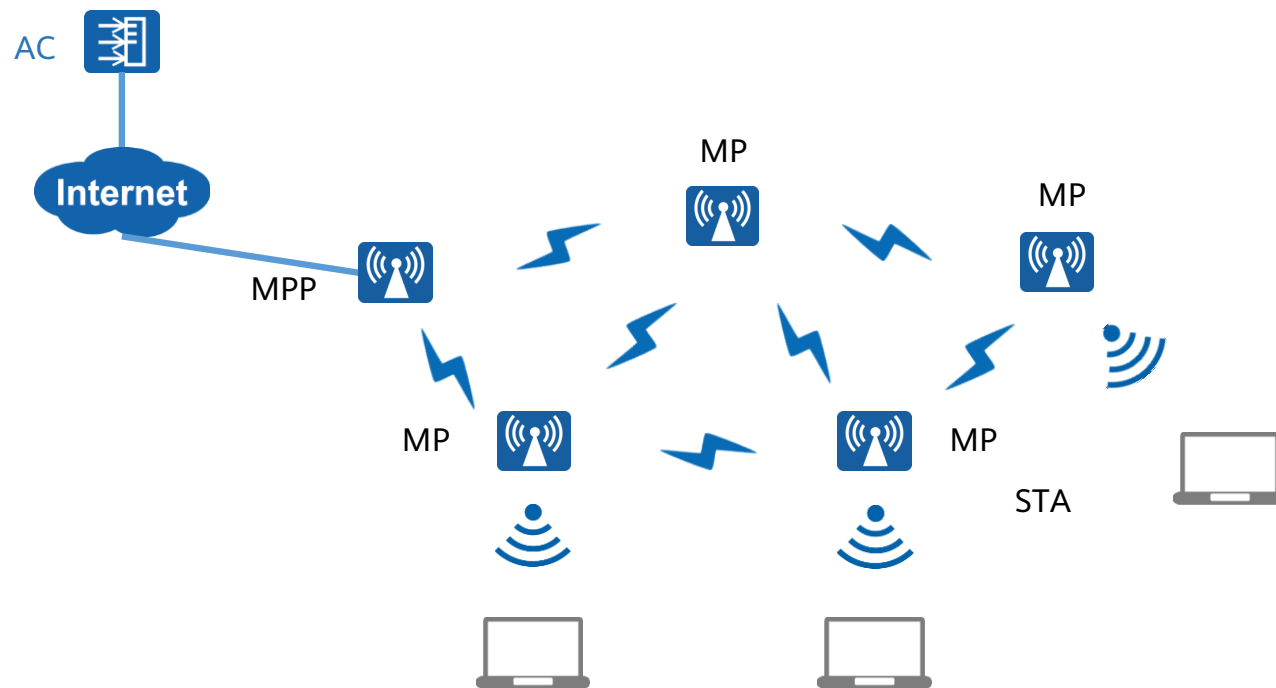
Major Services in Backhaul Scenarios

Root (MPP)   Leaf (MP)

Video backhaul is the major service in backhaul scenarios. In some cases, wireless coverage is required. This design guide focuses on video backhaul and elevator coverage.

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Challenges in Backhaul Scenarios

Complex environment

- **Backhaul scenarios are complex. Obstacles affect the backhaul function.**

High bandwidth requirement

- **Requirements for bandwidth are increasing. The increase in the number and definition of cameras imposes stricter requirements on the network.**
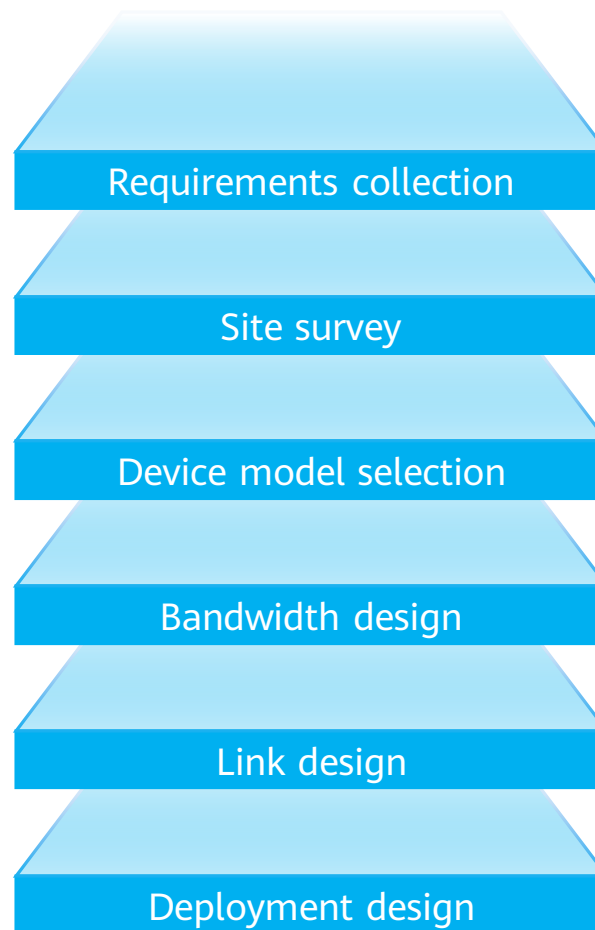
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Network Planning and Design Process for Backhaul Scenarios

Requirements collection

Site survey

Device model selection

Bandwidth design

Link design

Deployment design

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Requirements Collection in Backhaul Scenarios

Requirement Type	Description
STA distribution	Learn about the size of the area where STAs are located and the distribution of STAs.
Wired aggregation position	Obtain the position of the wired side (access switch or optical fiber). The root (MPP) needs to be connected to the wired access network.
Signal propagation environment	Record the main obstacles (such as high-rise buildings, mountains, and trees) in the area. Avoid obvious obstacles at both ends of a link.
Bandwidth	Per-STA bandwidth
STA type	Record the types of STAs, especially whether the STAs support the Wi-Fi function.
Power supply	Power supply equipment and areas on site, and whether they are available should be checked and selected according to customers' requirements.
Available frequency	Learn about the available 5 GHz channels in the local area.
Site construction	Check whether there are specific requirements for outdoor site construction, for example, whether the customer does not allow the site deployment on the rooftop of a building, or whether specified sites can be used.

Site Survey Content in Backhaul Scenarios

- Site survey table

Survey Item	Remarks
Buildings that can be used as sites and their heights	Select some typical positions for installing STAs, check whether there are tall buildings or trees around the STAs, and take photos clockwise around the STAs at an interval of 60° for archiving.
Signal propagation environment in the coverage area	Check whether there are obstacles such as tall buildings and trees around the aggregation point. If so, take photos clockwise around the aggregation point at an interval of 60° for archiving.

Device Model Selection Factors

MIMO	The number of spatial streams ranges from 4 to 16. An AP with more spatial streams supports higher throughput and larger access capacity. Therefore, select APs with a proper number of spatial streams based on the application scenario and access density.
Antenna	Indoor APs support omnidirectional, directional, and smart antennas. Outdoor APs support omnidirectional and directional antennas. Indoor scenario: Smart antennas provide the best coverage effect. Therefore, APs with smart antennas are recommended. Directional antennas are suitable for high installation scenarios. Omnidirectional antennas are suitable for scenarios where the coverage area is small and the deployment is not dense.
Maximum transmit power (combined power)	The Wi-Fi transmit power is controlled by the country code and varies depending on the local regulations. When the transmit power gets closer to the specified upper limit, the transmitted signal is stronger and the coverage distance is longer. For details, see the *Country Codes and Channels Compliance* in the product documentation.
Antenna gain	A higher antenna gain indicates a stronger signal strength and longer coverage distance. Select APs with proper antenna gains based on site requirements.
Power supply	The power supply mode is related to the deployment scenario. Currently, PoE power supply is used in most scenarios. You can also use a power supply or use dual power supplies for backup. Pay attention to the AP's power consumption and the power supply capability of PoE switches.
Wi-Fi standard	The Wi-Fi standard has evolved to the sixth generation, and each generation of the standard is compatible with earlier ones. The latest Wi-Fi 6 standard greatly improves the Wi-Fi speed and capacity, and achieves a four-fold increase in the throughput and capacity. Therefore, Wi-Fi 6 APs are recommended.
Other features	As the Internet of Things (IoT) comes into widespread use, deploying an IoT network independently will cause repeated cabling, separate management and O&M, and high hardware and O&M investment. Therefore, it is recommended that IoT scalability be considered when you select Wi-Fi APs.
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Common APs in Backhaul Scenarios

AP	AirEngine 8760R-X1/8760R-X1E		AirEngine 6760R-51/6760R-51E	
Image				
MIMO	8+8, 4+12, or 4+8+independent scanning	8+8, 4+4+4, 4+4+independent scanning	4+4	4+4
Antenna and gain	Built-in dual-band directional antennas; 10/11 dBi	External antennas	Built-in dual-band directional antennas; 10/11 dBi	External antennas
Maximum transmit power (combined power)	33 dBm/33 dBm	33 dBm/33 dBm	24 dBm/24 dBm	24 dBm/24 dBm
Maximum power consumption	53.2 W (excluding PoE OUT)	53.2 W (excluding PoE OUT)	35.3 W	35.3 W
Power supply	PoE (802.3bt)	PoE (802.3bt)	PoE (802.3bt)	PoE (802.3bt)
Operating temperature	–40°C to +65°C	–40°C to +65°C	–40°C to +65°C	–40°C to +65°C
Other features	Wi-Fi 6, IoT, BLE 5.0, built-in surge protection, smart antenna, IP68	Wi-Fi 6, IoT, BLE 5.0, built-in surge protection, IP68	Wi-Fi 6, IoT, BLE 5.0, built-in surge protection, IP68	Wi-Fi 6, IoT, BLE 5.0, built-in surge protection, IP68

More WLAN products

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Common Antennas in Backhaul Scenarios

Antenna Part Number	27013721	27013720	27013719	27013718
External Model	ANTDG0407A1NS	ANTDG0808D4NR	ANTDG1313D4NR	ANTDG1316D4NR
Antenna Type	Omnidirectional	Directional	Directional	Directional
Radios	2.4 GHz and 5 GHz	2.4 GHz and 5 GHz	2.4 GHz and 5 GHz	2.4 GHz and 5 GHz
Gain (dBi)	4/7	8/8	13/13	13/16
Beamwidth Horizontal (Degree)	360/360	70/70	33/30	33/18
Beamwidth Vertical (Degree)	30/15	70/70	33/30	33/18
Dimensions (H x W x D)	235 mm x 23.8 mm (length x diameter)	40 mm x 220 mm x 220 mm	33 mm x 380 mm x 380 mm	33 mm x 380 mm x 380 mm
Connector Type	1 x Type N male connector (single-polarized)	4 x Type N female connector (dual-polarized)	4 x Type N female connector (dual-polarized)	4 x Type N female connector (dual-polarized)

- Auxiliary materials

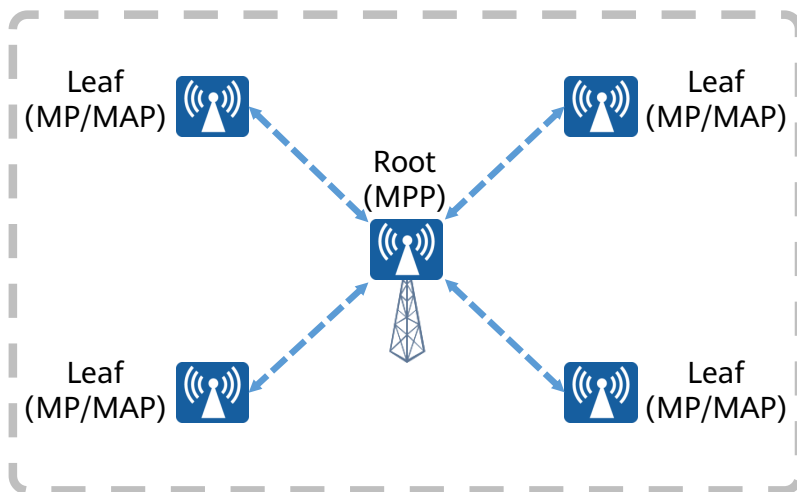| Part Number	Material	Remarks
04130032	Feeder	2 m, 3 m, or 5 m; connector type: Type N male connector
27110001	Load	

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AP Selection in Backhaul Scenarios

- AirEngine 8760R-X1E/ AirEngine 6760R-51E

  - It is recommended that APs with external antennas be used in backhaul scenarios. Different antennas can be flexibly configured to support backhaul at different distances. The AirEngine 8760R-X1E can be switched to work in dual-5G mode, while the AirEngine 6760R-51E has only one 5G radio. In the current version, only two AirEngine 6760R-51E APs can be connected to 5 GHz antennas to function as relay nodes.

- AirEngine 8760R-X1/ AirEngine 6760R-51

  - Both the AirEngine 8760R-X1 (100° x 20°) and AirEngine 6760R-51 (60° x 20°) have only one 5 GHz radio with a gain of 11 dBi. They are applicable to backhaul scenarios with short distances.
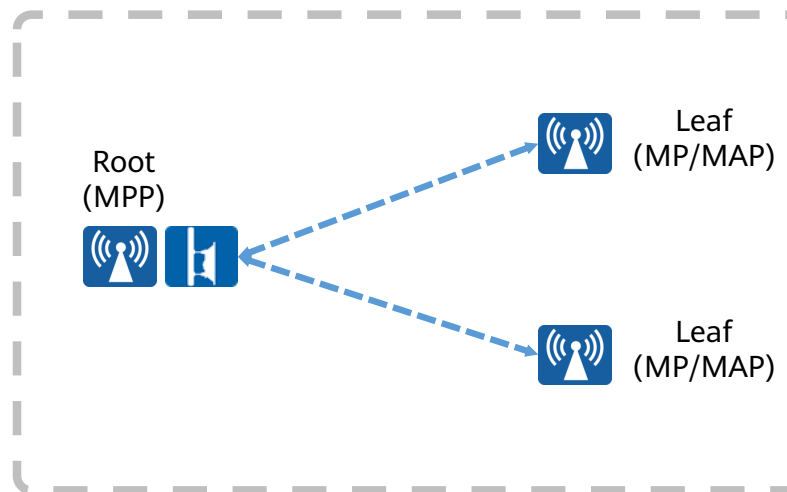
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Backhaul Antenna

Omnidirectional antenna:

Leaf (MP/MAP)
Root (MPP)
Leaf (MP/MAP)
Leaf (MP/MAP)
Leaf (MP/MAP)

Directional antenna:

Root (MPP)
Leaf (MP/MAP)
Leaf (MP/MAP)

1. Omnidirectional antennas are used when the distance between the root and leaf nodes is within 500 m, the distribution angle is large, and the number of leaf nodes is large.
2. Directional antennas are used when the distance between the root and leaf nodes is greater than 500 m, the number of leaf nodes is small, and the azimuths are centralized.
3. The preceding two points are only for rough antenna selection. If the link rate needs to be considered, take the antenna gain and antenna angle also into account when selecting antennas. For details, see the bandwidth design.

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Common Services and Average Bandwidth in Backhaul Scenarios

- Elevator scenario

  Elevators are usually small in area, mainly requiring wireless coverage.

- Video backhaul scenario

Item	Service Characteristics	Latency	Jitter	Packet Loss Rate	Bandwidth (HD)
Video surveillance	Storage traffic is sensitive to packet loss and requires data integrity. Real-time surveillance streams require a low latency. Playback traffic requires good stability.	≤ 400 ms	≤ 50 ms	≤ 0.1%	On demand

Video surveillance codec formats include H.264 and H.265, which require different streams:
H.264 720P: bit stream of 2 Mbps; H.264 1080P: bit stream of 4 Mbps
H.265 720P: bit stream of 1 Mbps; H.265 1080P: bit stream of 2 Mbps
In video surveillance, there is a burst video stream at a fixed interval, that is, a key frame: I frame.
Therefore, the Wi-Fi backhaul channel must reserve 130% to 170% of bit-stream bandwidth for each camera. Around 7 Mbps bandwidth is reserved for H.264 1080P video streams.

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Bandwidth Design — Mesh P2P Transmission

| Wi-Fi 6 P2P Bridge Throughput Reference (5G)																	
Device Model	Environment	Antenna Gain		HE20 RSSI & Throughput (Mbps)							HE40 RSSI & Throughput (Mbps)						
		Root AP	Leaf AP	100 m	200 m	500 m	1 km	2 km	3 km	5 km	100 m	200 m	500 m	1 km	2 km	3 km	5 km
AirEngine 8760R-X1E /AirEngine 6760R-51E Power: 21 dBm	Urban area	7dBi-360deg	16dBi-18deg	−38 dBm	−46 dBm	−56 dBm	−64 dBm	−72 dBm	−76 dBm	−84 dBm	−38 dBm	−46 dBm	−56 dBm	−64 dBm	−72 dBm	−76 dBm	−84 dBm
				130	130	120	80	30	20	N/A	270	240	200	120	60	N/A	N/A
		11dBi-60deg	16dBi-18deg	−34 dBm	−42 dBm	−52 dBm	−60 dBm	−68 dBm	−72 dBm	−80 dBm	−34 dBm	−42 dBm	−52 dBm	−60 dBm	−68 dBm	−72 dBm	−80 dBm
				130	130	120	100	60	30	N/A	270	270	240	160	80	60	N/A
		16dBi-18deg	16dBi-18deg	−29 dBm	−37 dBm	−47 dBm	−55 dBm	−63 dBm	−67 dBm	−75 dBm	−29 dBm	−37 dBm	−47 dBm	−55 dBm	−63 dBm	−67 dBm	−75 dBm
				130	130	120	120	95	60	30	270	270	240	200	160	100	45
	Suburban or rural area	7dBi-360deg	16dBi-18deg	−38 dBm	−46 dBm	−56 dBm	−64 dBm	−72 dBm	−76 dBm	−84 dBm	−38 dBm	−46 dBm	−56 dBm	−64 dBm	−72 dBm	−76 dBm	−84 dBm
				130	130	120	80	45	30	N/A	270	240	200	160	80	45	N/A
		11dBi-60deg	16dBi-18deg	−34 dBm	−42 dBm	−52 dBm	−60 dBm	−68 dBm	−72 dBm	−80 dBm	−34 dBm	−42 dBm	−52 dBm	−60 dBm	−68 dBm	−72 dBm	−80 dBm
				130	130	130	120	80	45	20	270	250	240	180	120	80	N/A
		16dBi-18deg	16dBi-18deg	−29 dBm	−37 dBm	−47 dBm	−55 dBm	−63 dBm	−67 dBm	−75 dBm	−29 dBm	−37 dBm	−47 dBm	−55 dBm	−63 dBm	−67 dBm	−75 dBm
				130	130	130	120	100	80	45	270	270	240	240	160	160	45
		23dBi-9deg	23dBi-9deg	−15 dBm	−23 dBm	−33 dBm	−41 dBm	−49 dBm	−53 dBm	−61 dBm	−15 dBm	−23 dBm	−33 dBm	−41 dBm	−49 dBm	−53 dBm	−61 dBm
				130	130	130	130	130	120	100	270	270	270	250	240	200	160

1. To estimate bandwidth at a transmission distance between two distance values listed in the table, refer to the bandwidth value of the larger distance. For example, to estimate bandwidth value at a distance of 4 km, refer to the bandwidth value at a transmission distance of 5 km.
2. The preceding data does not take EIRP into consideration and is calculated based on the maximum transmit power of the AP.

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Bandwidth Design — Mesh P2MP Transmission

- Check whether the actual throughput of STAs meet requirements using the throughput calculation method for P2MP transmission.

  - When calculating the throughput in P2MP transmission mode, multiply the P2P transmission performance by the throughput impact factor. The value of the throughput impact factor corresponds to the value of M in P2MP transmission mode. The following table lists the mapping.

Root-Leaf Ratio	Throughput Impact Factor	
	Root	Leaf
1:1	1	1
1:2	0.8	0.40
1:3	0.75	0.25
1:4	0.7	0.18
1:5	0.65	0.13
1:6	0.6	0.10

25 Mbps

75 Mbps

Root AP

Leaf AP

Leaf AP

Distance: 1 km
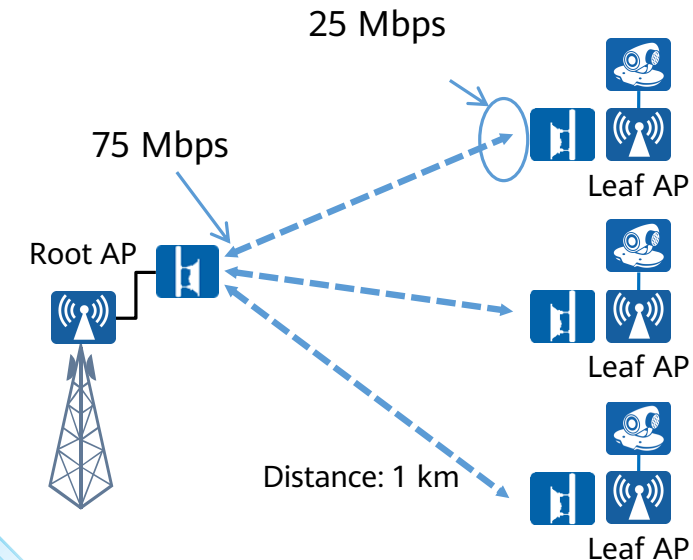
Leaf AP

In urban areas, 11dBi-60deg (Root) & 16dBi-18deg (Leaf) antennas are deployed at spacing of 1 km and the frequency bandwidth of HE20. The P2P throughput is 100 Mbps. When the root-leaf ratio is 1:3, the throughput is calculated as follows:
Total root bandwidth: 100 x 0.75 = 75 Mbps; leaf bandwidth: 100 x 0.25 = 25 Mbps

The bandwidth loss is 10% for each relay node.

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Bandwidth Design — Mesh

AC ————— MPP ⇠⇢ MP1 ⇠⇢ MP2

AC   MPP   MP1   MP2

- Conditions:

  - All MPs use the same 5 GHz channel, with no other channel around, and all MPs are in the same collision area.

  - Assume that the backhaul bandwidth of one hop is C Mbps and the number of hops is N.

  - The MPP uses the HE40 mode and provides 270 Mbps bandwidth.

  - Bandwidth estimation formula: The peak throughput of each node is C/N, and the average throughput of each MP is 2 x C/(N x (N + 1)). (N indicates the total number of hops)

  - In chain networking, there can be a maximum of eight hops between the MAP and the MPP. A maximum of four hops is recommended.

- Bandwidth estimation:

  - Currently, there is no universal method for calculating link bandwidth in mesh networking.

  - MP1 uses the 5 GHz channel once to send traffic to the AC. Therefore, the peak bandwidth is 270 Mbps (270/1).

  - MP2 uses the 5 GHz channel twice to send traffic to the AC. Therefore, the peak bandwidth is 135 Mbps (270/2 = 135 Mbps).

  - Average bandwidth of MP1 and MP2 = (2 x 270)/(2 x (2 + 1)) = 90 Mbps.

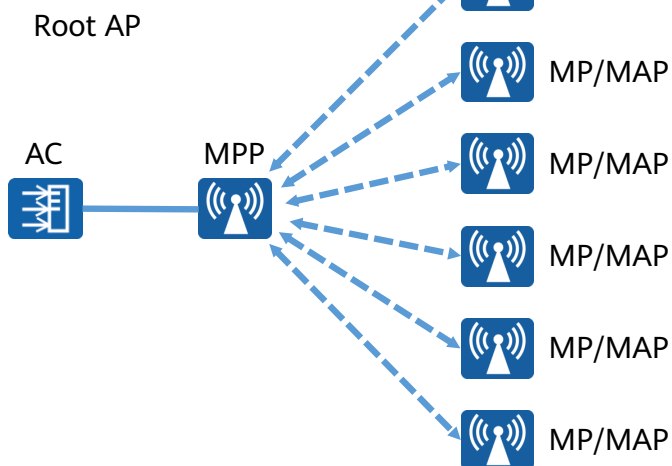Note: The bandwidth of multiple MPPs can be calculated based on the bandwidth calculation for a single MPP.
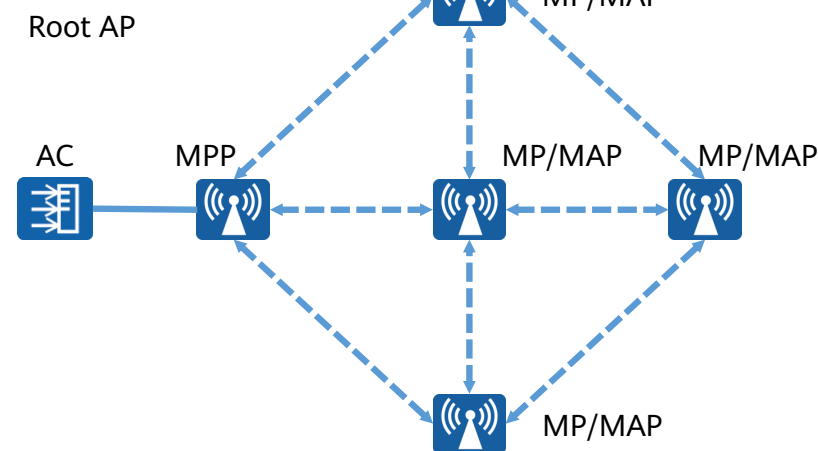
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Backhaul Link (1/2)

Chain networking:

AC — MPP — MP/MAP — MP/MAP — MP/MAP

Star networking:

Root AP

AC — MPP

MP/MAP
MP/MAP
MP/MAP
MP/MAP
MP/MAP
MP/MAP

Mesh networking:

Root AP

AC — MPP

MP/MAP
MP/MAP — MP/MAP
MP/MAP

1. The chain topology is not recommended unless in special scenarios.
2. An MPP supports a maximum of 20 mesh nodes.
3. The number of hops on the entire network greatly affect the network throughput. A maximum of eight hops can be configured between the MAP and the MPP. It is recommended that no more than four hops be configured between the MAP and the MPP.
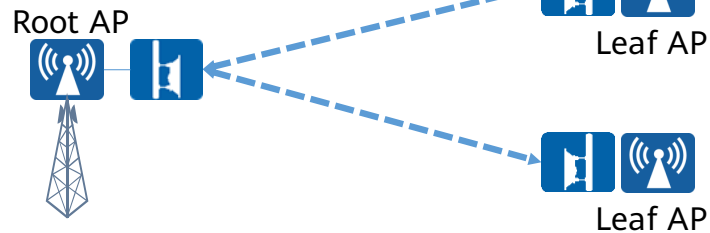
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Backhaul Link (2/2)

P2P

Root AP

Leaf AP

Scenario
- There is only one leaf AP.
- If the distance between the root and leaf APs is greater than 3 km, P2P transmission is recommended.
- The P2P transmission distance should not exceed 5 km.

P2MP

Root AP

Leaf AP

Leaf AP

Scenario
- The number of leaf APs ranges from 2 to 6.
- Backhaul distance ≤1 km: One root AP can connect to a maximum of six leaf APs.
- Backhaul distance (1 km, 3 km]: It is recommended that one root AP connect to a maximum of three leaf APs.
- Backhaul distance > 3 km: P2MP transmission is not recommended.

Relay

Root AP
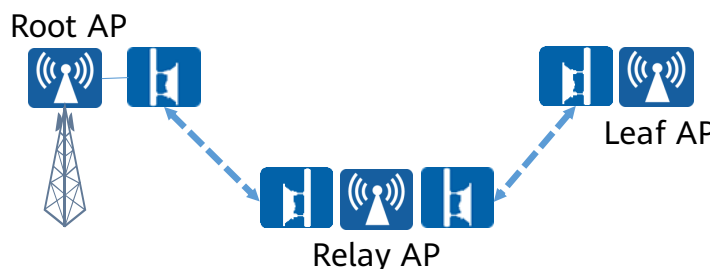
Leaf AP

Relay AP

Scenario
- If the distance between the leaf AP and root AP exceeds 5 km, you are advised to deploy relay nodes as required.
- When the number of leaf APs is greater than six, deploy a relay AP to increase the number of leaf APs that can be connected to each root AP.
- If obstacles exist between the leaf AP and root AP, the obstacles can be bypassed.
- To ensure data transmission quality, it is recommended that signals be relayed for no more than one time.

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Site Design Principles

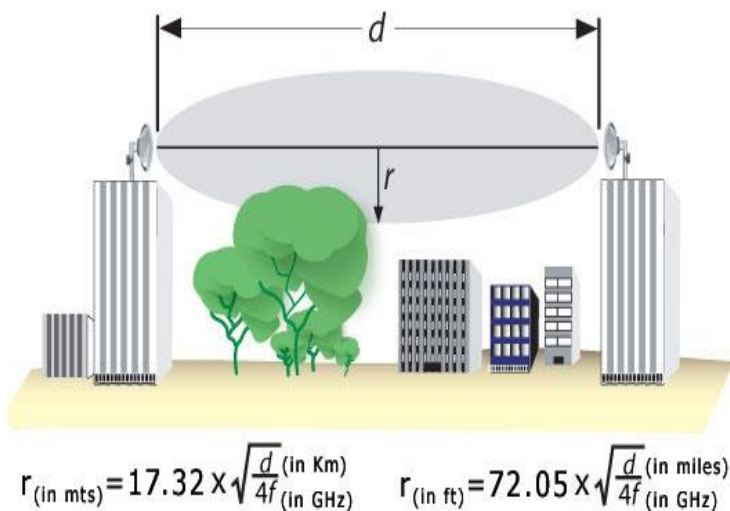Radar stations, radio transmitters, and television transmitters

Rogue AP
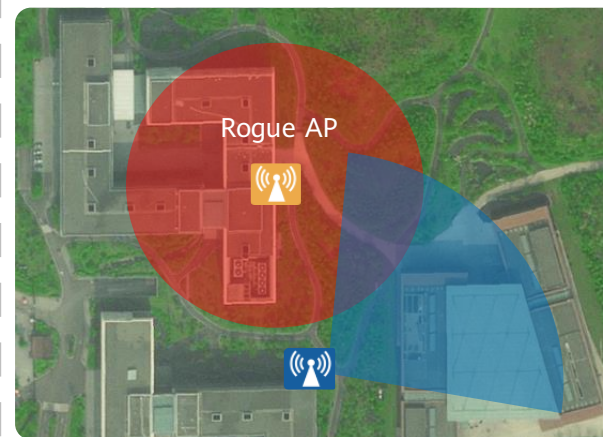
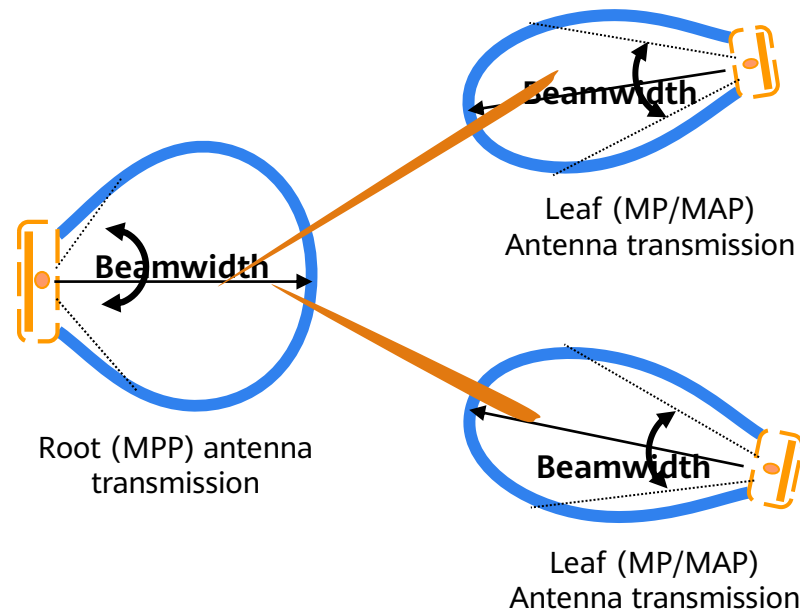Channel interference of APs in other systems needs to be avoided.

1. Avoid strong electromagnetic interference or other signal interference near a site.
2. Reliable power sources must be available for a site.

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AP Deployment Rules

$$r_{(in\ mts)} = 17.32 \times \sqrt{\frac{d\ \text{(in Km)}}{4f\ \text{(in GHz)}}} \qquad r_{(in\ ft)} = 72.05 \times \sqrt{\frac{d\ \text{(in miles)}}{4f\ \text{(in GHz)}}}$$

Backhaul Distance d (km)	1	2	3	4	5
Round-Up Fresnel Radius (m)	4	6	7	8	9

Beamwidth

Root (MPP) antenna transmission

Beamwidth

Leaf (MP/MAP) Antenna transmission

Beamwidth

Leaf (MP/MAP) Antenna transmission

1. Install antennas in appropriate positions to ensure that both ends of the link are visible and no obstacle exists in the Fresnel zone.
2. Adjust the antenna azimuth of the leaf node (MP/MAP) to ensure that the main lobe faces the antenna of the root node (MPP).
3. Adjust the azimuth of the root node (MPP) antenna so that its main lobe covers antennas of all leaf nodes (MP/MAP).

* Fresnel zone: The Fresnel zone of radio beams is an ellipsoid area around a transmission path within a line of sight. The thickness of the zone varies with the length of the signal path and the frequency of the signal.

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Sub-scenarios Involved in WLAN Construction Standards

Elevator

Video backhaul

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Network Planning Solution 1 for Elevators
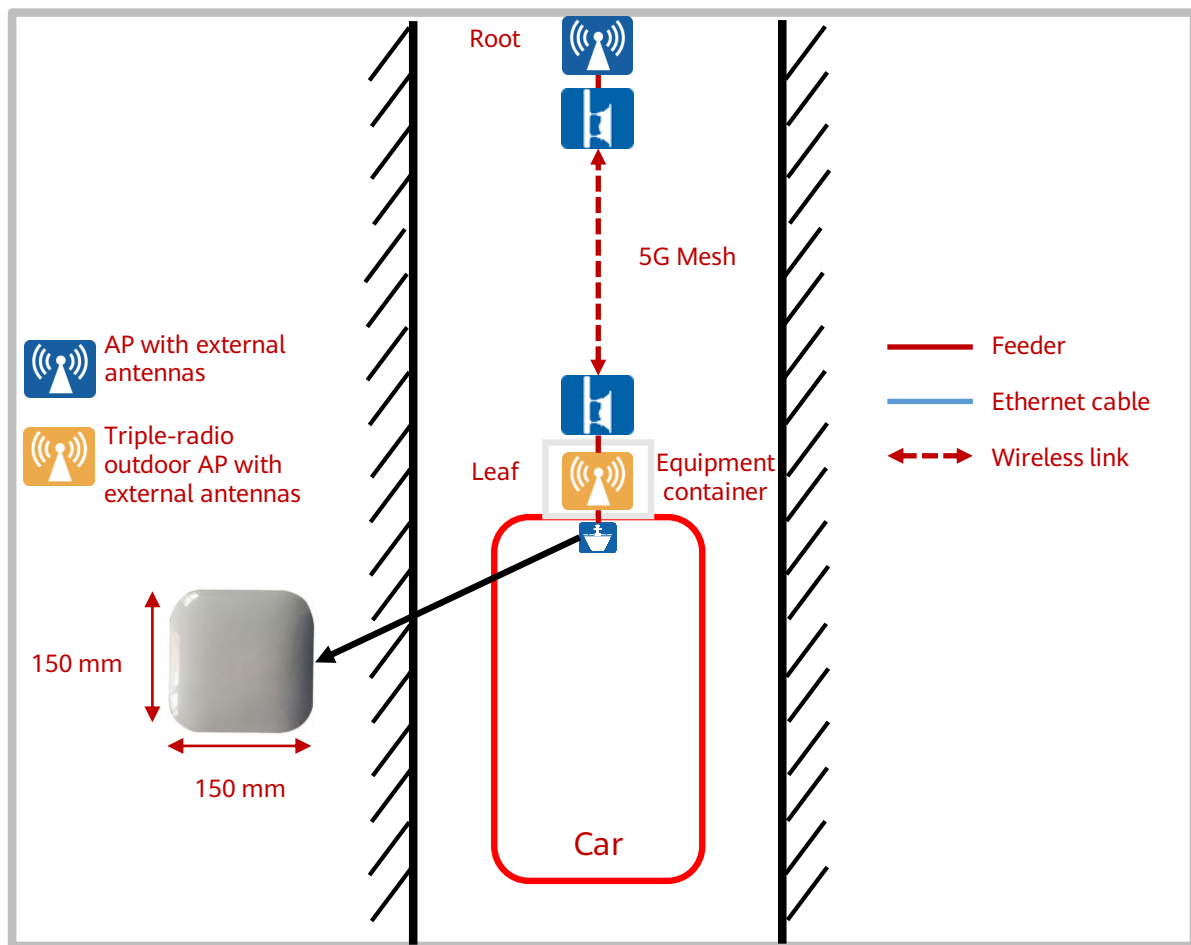
Root

5G Mesh

Leaf

Equipment container

Car

150 mm

150 mm

AP with external antennas

Triple-radio outdoor AP with external antennas

Feeder

Ethernet cable

Wireless link

Device Model Selection

- Root AP and antenna
  - Use outdoor APs with external antennas.
  - The 27013718 directional antenna is used for data backhaul between two APs.
- Leaf AP and antenna
  - Use outdoor triple-radio APs with external antennas.
  - The 27013718 directional antenna is used for data backhaul between two APs.
  - The 27012545 omnidirectional antenna (with a 1 m pigtail) is used to cover the elevator car.
- Precautions
  - The root AP, leaf ap, and backhaul antenna are large in size. Confirm the installation space in advance.
  - The leaf AP is are located in the equipment container above the car, moving together with the car.
  - The feeder between the antenna in the car and the AP needs to be customized. One end of the feeder is an RP-SMA-K female connector, and the other end is a Type N male connector. It is recommended that the RG8 jumper be purchased. The length of the RG8 jumper should not be too long.

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Product List for Solution 1

No.	Product	Function	Product Model	Selection
1 (Root)	WLAN AP	Root	(Outdoor AP with external antennas)	Mandatory
	Antenna	Root backhaul antenna	27013718	Mandatory
	RF cable	Connecting the AP and antenna	04130032 (2 m) x 4 04130033 (3 m) x 4 04130034 (5 m) x 4	Mandatory (with several lengths to select)
	PoE power adapter	Power supply	02220154	Optional
2 (Leaf)	WLAN AP	Leaf and car coverage	(Outdoor triple-radio AP with external antennas)	Mandatory
	Antenna	Leaf backhaul antenna	27013718	Mandatory
	RF cable	Connecting the AP and antenna	04130032 (2 m) x 4 04130033 (3 m) x 4 04130034 (5 m) x 4	Mandatory (with several lengths to select)
	Antenna	Car coverage antenna	27012545	Mandatory
	PoE power adapter	Power supply	02220154	Mandatory
	RF load	Blocking unused RF ports on the AP	27110001	Optional

Note: 1. The AC and switch are the same as those in common projects. 2. Installation auxiliary materials, such as the equipment container and RF cable length, are configured based on site requirements.

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Network Planning Solution 2 for Elevators
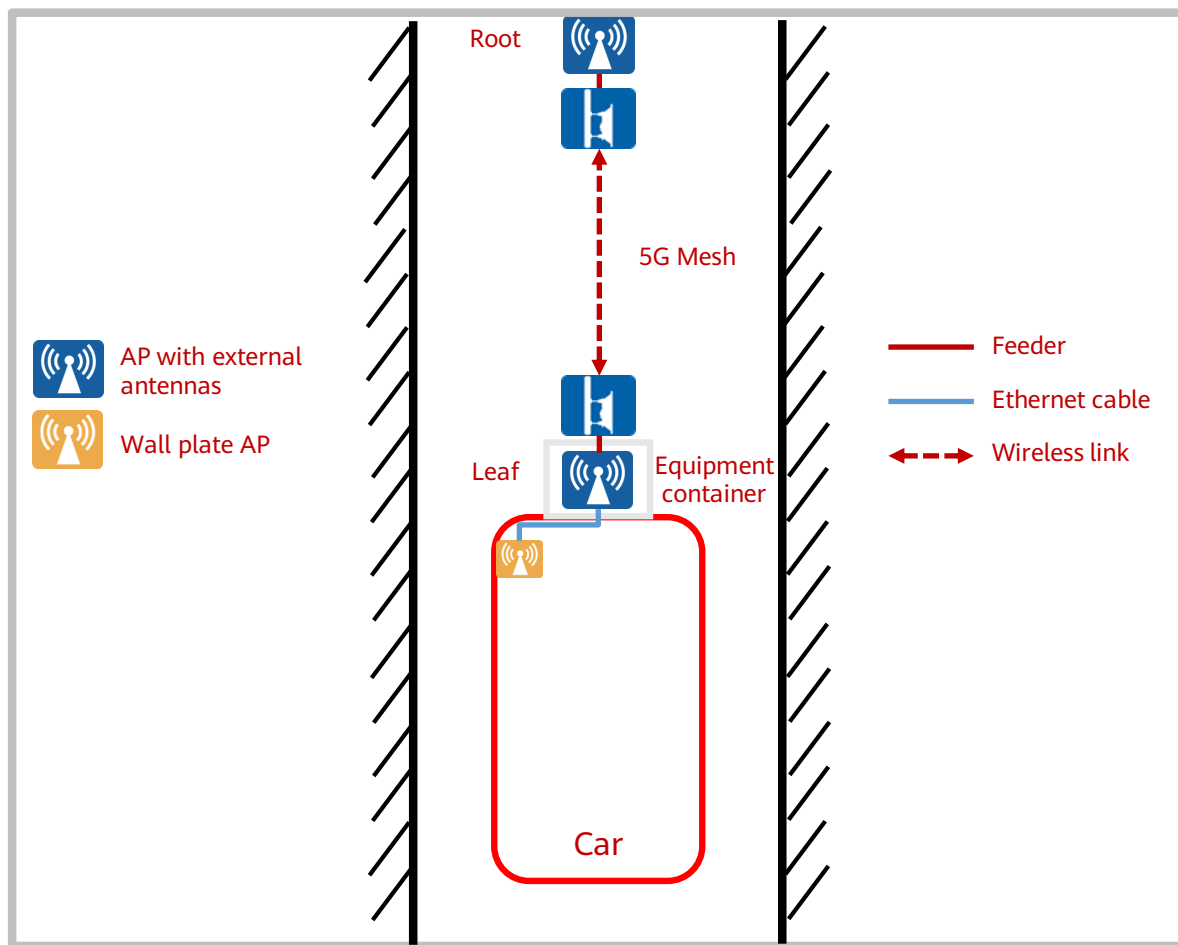
Root

5G Mesh

AP with external antennas

Wall plate AP

Leaf

Equipment container

Feeder

Ethernet cable

Wireless link

Car

Device Model Selection

- Root AP and antenna
  - Use outdoor APs with external antennas.
  - The 27013718 directional antenna is used for data backhaul between two APs.
- Leaf AP and antenna
  - Use outdoor APs with external antennas.
  - The 27013718 directional antenna is used for data backhaul between two APs.
- Car coverage AP
  - The wall plate AP is connected to the leaf AP through an Ethernet cable to provide signal coverage for elevator cars.
- Precautions
  - The root AP, leaf AP, and backhaul antenna are large in size. Confirm the installation space in advance.
  - The leaf AP is are located in the equipment container above the car, moving together with the car.
 - It is recommended that the wall plate AP be installed inside the car.

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Product List of Solution 2

No.	Product	Function	Product Model	Selection
1 (Root)	WLAN AP	Root	(Outdoor AP with external antennas)	Mandatory
	Antenna	Root backhaul antenna	27013718	Mandatory
	RF cable	Connecting the AP and antenna	04130032 (2 m) x 4 04130033 (3 m) x 4 04130034 (5 m) x 4	Mandatory (with several lengths to select)
	PoE power adapter	Power supply	02220154	Optional
2 (Leaf)	WLAN AP	Leaf	(Outdoor AP with external antennas)	Mandatory
	Antenna	Leaf backhaul antenna	27013718	Mandatory
	RF cable	Connecting the AP and antenna	04130032 (2 m) x 4 04130033 (3 m) x 4 04130034 (5 m) x 4	Mandatory (with several lengths to select)
	WLAN AP	Car coverage antenna	(Wall plate AP)	Mandatory
	PoE power adapter	Power supply	02220154 x 2	Mandatory

Note: 1. The AC and switch are the same as those in common projects. 2. Installation auxiliary materials, such as the equipment container and RF cable length, are configured based on site requirements.

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Network Planning Solution 3 for Elevators — Trailing Optical Fiber (Non-Backhaul)
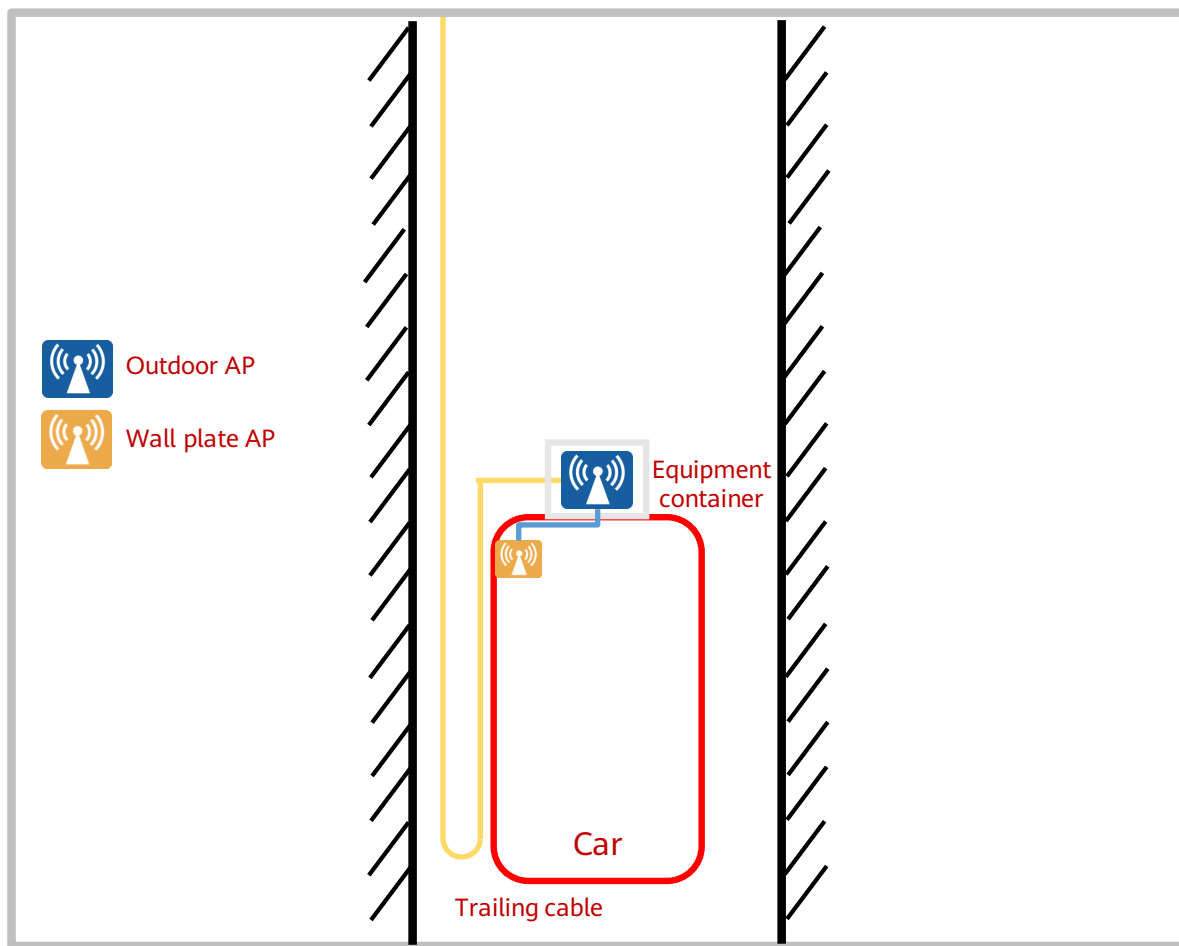

- Material list:

Equipment	Model	Description
AP	(Outdoor AP)	Optical ports available, allowing for optical modules to be directly inserted
PoE power adapter	02220154	2
Optical module	Purchased	If network cables are used, optical modules are not required.
Equipment container	Purchased	Auxiliary materials such as APs, power adapters, and switches (possibly) should be considered in the dimensions of the equipment container.
Cable	Purchased	
AP	(Indoor AP)	Dual-band Wi-Fi coverage in a car

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Network Planning Solution for Video Backhaul Scenarios

P2P
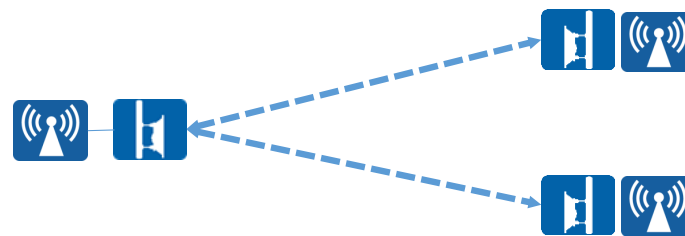
P2MP

Suggestions for Network Planning and Deployment

- Backhaul distance ≤1 km: One root AP can connect to a maximum of six leaf APs.
- Backhaul distance (1 km, 3 km]: It is recommended that one root AP connect to a maximum of three leaf APs.
- Backhaul distance > 3 km: P2P backhaul is recommended, with the maximum distance of a single hop of 5 km.

- If the distance between the leaf AP and root AP exceeds 5 km, you are advised to deploy relay nodes as required.
- To ensure data transmission quality, it is recommended that the number of relay times be less than or equal to 1.
- The backhaul distances on this page are not subject to the EIRP limit.
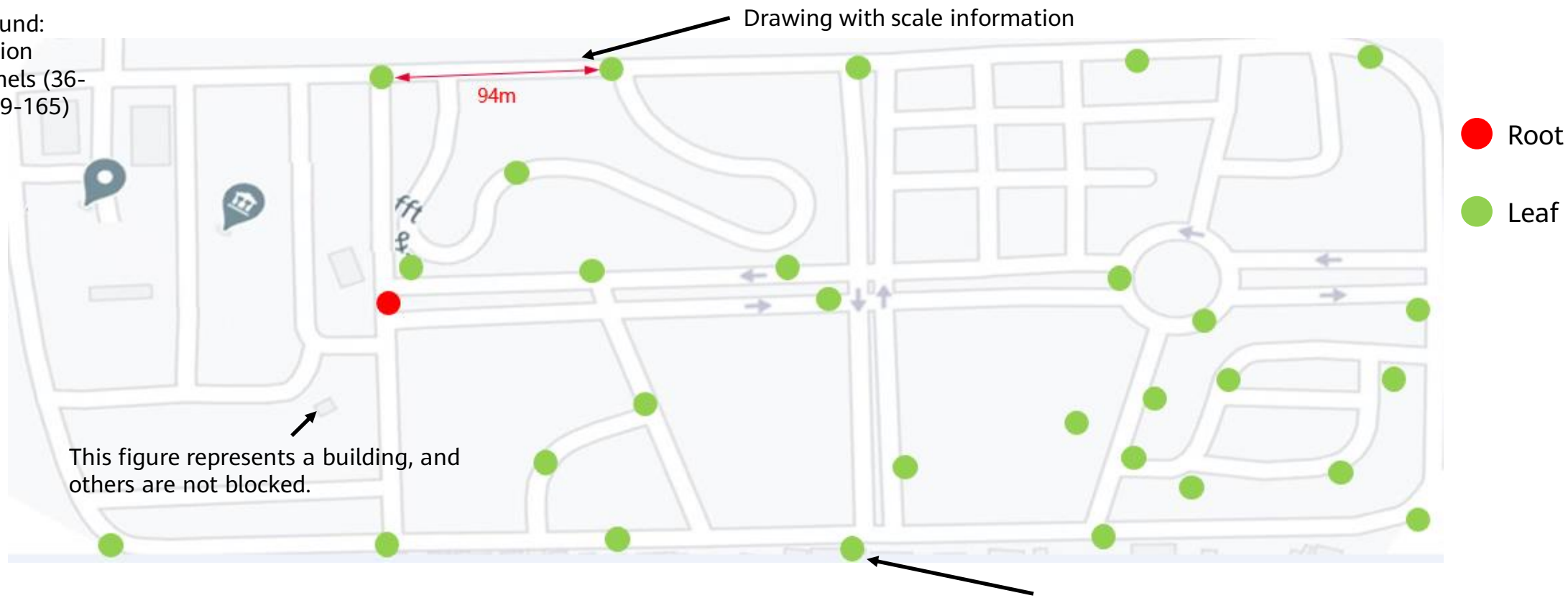
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Contents

Video Backhaul Project Case

- Collect the floor plan and requirement information.

Project background:
No EIRP restriction
All 5 GHz channels (36-64, 100-144, 149-165) are available.

Drawing with scale information

94m

This figure represents a building, and others are not blocked.

Each leaf node has two cameras. The cameras support 1080p and the codec format is H.264.

● Root

● Leaf

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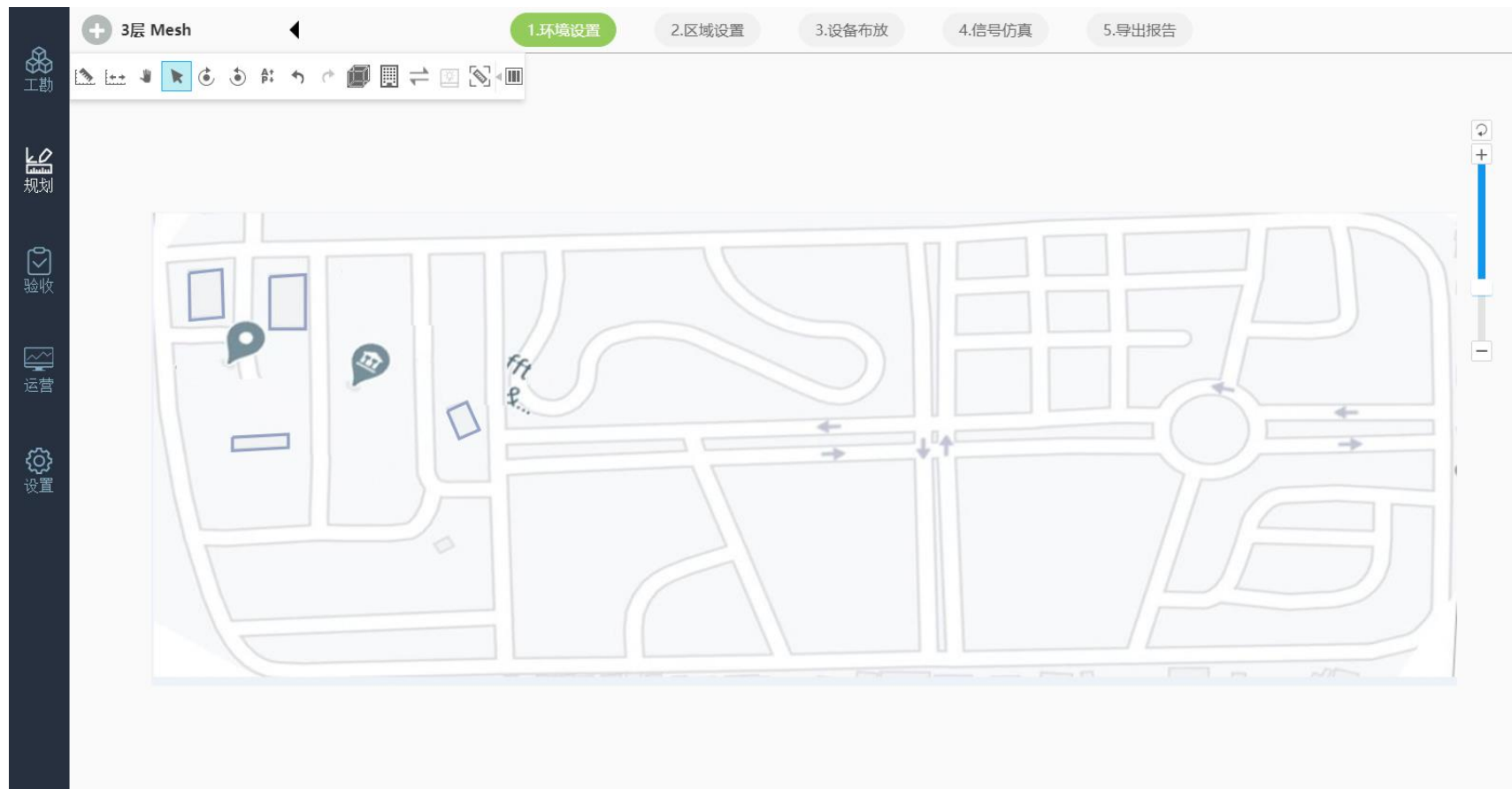
Obstacle Drawing

After you create a project on the WLAN Planner (https://serviceturbo-cloud.huawei.com), import a drawing, and set the scale, draw obstacles based on the building distribution.

Backhaul Link Planning

There are a large number of leaf nodes. The root node uses three AirEngine 8760R-X1E APs, each of which has two 30° external antennas connected. The APs are enabled to work in dual-5G mode. The distance between every two antennas is greater than 4 m.

All 5 GHz channels are available. After the HE40 frequency bandwidth is used, there are 11 channels. In the figure, lines in different colors indicate different channels.

In the current project, the maximum backhaul distance is 500 m, and the maximum backhaul distance supported is 5 km (P2P).

In all P2MP scenarios, leaf nodes must be located in the antenna coverage angle of the root node.

Use two AirEngine 6760R-51E APs, each of which has one directional antenna connected, as a relay node. Each link supports only one relay node.

In the current project, the maximum backhaul distance is 500 m, the maximum root-leaf ratio is 1:6, and one relay is included. The minimum bandwidth of each leaf node can be calculated as follows: 500 m in the urban area, HE40, P2P bandwidth of 240 Mbps. After passing through a relay mode, the bandwidth is about 240 x 0.9 = 216 Mbps. The bandwidth of a leaf node is 216 x 0.1 = 21.6 Mbps, which meets the requirements.

A maximum of six leaf nodes can be connected in P2MP mode.

- General principle: Use HE40 frequency bandwidth. There is no obstacle between backhaul APs, and the requirements of the Fresnel zone are met.

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Quiz

1. In video backhaul scenarios, what is the recommended maximum number of relays on a single link?

   A. 1   B. 2

   C. 3   D. 4

2. What is the maximum number of hops between an MAP and an MPP in mesh networking? How many hops is recommended at most? (Select two answers respectively.)

   A. 2   B. 4

   C. 6   D. 8

Summary

- 1. Typical service types and challenges in backhaul scenarios

- 2. WLAN planning process for backhaul scenarios

- 3. Huawei's WLAN construction standards and planning rules for backhaul scenarios

- 4. Video backhaul project case

Thank You

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