ZyMesh

ZyMesh Introduction

- **What is ZyMesh?**
  Wireless Mesh is a group of access points forming wireless links automatically and dynamically via truly wireless.

On the basis of mesh networking, ZyMesh is the ZyXEL proprietary protocol that creates wireless mesh links with easy configuration, better management, and enhanced reliability.

- **This technology helps:**
  - Extend Wi-Fi coverage to places difficult for cabling
  - Build Wi-Fi service when a temporary network is required
  - Maintain the mesh APs under the management of controller
  - Improved reliability

Before mesh networking, WDS (Wireless Distribution System) was the commonly adopted solution to extend Wi-Fi coverage. However, the limitations of using WDS still trouble the deployment due to redundant efforts:
- It requires the advance assignment of the channel and MAC addresses in each WDS AP.
- The WDS link **cannot** be managed under a controller-managed WLAN network.

**Terminologies of ZyMesh**

- **Root AP**
  - The AP in the ZyMesh group that connects to controller and infrastructure via its Ethernet port (mesh portal point).

- **Repeater AP**
  - The AP in the ZyMesh group that connects to the Root AP or another
Repeater AP (mesh access point).

- **ZyMesh ID**
  - The SSID that ZyMesh APs use to form a group.

- **Wireless Hop**
  - The link between 2 nodes of ZyMesh AP nodes.

**How Does It Work?**

- Among a group of APs, which are to form the mesh connectivity, a **ZyMesh ID** will be assigned and applied to APs for auto-association and connectivity without the inconvenience of cabling.

- Each Repeater AP will dynamically select the BEST path to transfer data.

**Before The Deployment**

- Connect all the mesh APs to NXC WLAN controller using Ethernet for initial provisioning.
  - Create the **ZyMesh profile** including ZyMesh ID & pre-shared key.
  - Assign ZyMesh AP types (Root AP or Repeater AP) and AP service profile in the Managed AP List and AP Group.
  - ZyMesh APs can work as mesh node and provide AP service at the same time.
Deployment Considerations

The following factors should be considered when planning for a ZyMesh network.

- **VLAN**
  - ZyMesh AP can act as ZyMesh node and provide AP service at the same time. Decide whether VLAN is required in the AP service of ZyMesh APs.

- **Signal quality**
  - Create quality links for each wireless hop via a site survey and RSSI value.

- **Performance requirement**
  - All the ZyMesh APs use the same channel, so they share the bandwidth. Too many wireless hops or repeater APs mean that the throughput will decrease dramatically.
  - Consider the minimum required throughput from the needs of Wi-Fi clients.

- **2.4 GHz or 5 GHz?**
  - When the 2.4 GHz frequency range is overwhelmed in the space, use the 5 GHz frequency range to establish a mesh network for stable connection. But be aware that the distance between APs is shorter
than that of the 2.4 GHz frequency band.

- If the distance between Root & Repeater AP is long, or with lots of obstacles in-between; consider using the 2.4 GHz frequency for mesh connection

- **Wireless hops**
  - Maximum wireless hops suggested are 2.

- **Repeater AP & Root AP**
  - No more than 6 Repeater APs under 1 Root AP is suggested.
  - More than 1 Root AP is suggested to prevent single point of failure.
Initial Provision & Deployment Scenarios

Initial Provisioning without VLAN

- Connect all the ZyMesh APs to the NXC controller via a wired line.
- Apply both ZyMesh profile and AP profiles to the ZyMesh APs.

Deployment Scenario – without VLAN required

- After initial provisioning, place the access points in proper positions for the network to be established and function automatically.
Initial Provisioning – with VLAN required scenario 1

- When using the AP series which supports data tunneling that includes NWA3000-N, NWA5000-N and WAC6500 series, in VLAN required scenario the fastest way is to make sure that the VLAN tags will be carried all the way through in the SSID profile settings.

Deployment Scenario – with VLAN required scenario 1

- After initial provisioning, place the access points in proper positions to establish the network and function automatically.
**Initial Provisioning – with VLAN required scenario 2**

- If you are using the AP series in mixed combination of supporting data tunneling, then separate the AP profiles of both data tunneling and local bridge with correct VLAN numbers.
- Apply different AP profiles to different AP series accordingly.

![Diagram showing VLAN profiles and network topology]

**Deployment Scenario – with VLAN required scenario 2**

- In this case, the local bridge AP can only be used as Root APs, which connect to the network via a wired line. Repeater APs need to be with data tunneling capability support.

![Diagram showing deployment scenario with VLAN enabled]
Link Quality Check

- After the initial setup is complete and the AP is installed, use the web GUI of the NXC controller in "ZyMesh link info" to check the link quality.

  - **RSSI threshold**
    - I. RSSI signal threshold is configurable to ensure the connection quality between ZyMesh nodes.
    - II. -65dBm is suggested (same for 2.4 & 5 GHz)
    - III. If RSSI signal strength is worse than the required level, the following actions can be taken for improvement:
      1) Change the AP positions for better signal.
      2) Add a high-gain antenna to enhance the sensitivity.
      3) Add one more Repeater AP in between 2 long-range nodes.

- The other way is to conduct a WLAN client performance check.
  - If performance is not good enough, please also try the above methods or adjust the channel in use.

- Troubleshooting index: use the following:
  - ZyMesh log
  - ZyMesh link info

Route Selection

- Each Repeater AP can be regarded as a wireless client and it will select the best route depending on the signal strength it senses from ZyMesh AP nearby.

- When the signal quality changes, the Repeater AP will re-choose another ZyMesh AP, which has a better signal quality.
Benefits of ZyMesh

- **Easiest Wi-Fi extension method with minimal efforts**
  - Provides intuitive Wi-Fi extension for cabling difficult areas.
  - Centralized configuration from controller and distributed to mesh APs.
  - All connected mesh APs stay configurable and manageable from NXC controller.

- **Wi-Fi extension with the best reliability**
  - Each Repeater AP has multiple route selections. When one route fails, other routes can be the backup & fail-over to maintain the wireless service.
  - A mechanism to choose best route via signal strength is included, as it highly improves the link quality.
Technical Details

Time required for Route Setup

- Root AP: same load-time as an AP boot-up process
- Repeater AP deployed to its site:
  - After its system boots-up, it takes around 120 ~ 180 seconds (by different models & the example for 1 wireless hop)
  - The short deployment time is due to event-driven method.

More Information

- When mesh links are formed and any Repeater AP is accidentally connected with an Ethernet cable, the Ethernet port will **NOT** be functional until the wireless link is lost.
- Before the AP needed to be setup with the ZyMesh (Root/Repeater AP), it must be reset to default, and then connect with the controller to setup the ZyMesh connection.
- **Load Balancing**
  - Load balancing will be **disabled** by default when ZyMesh is working. This is to ensure a stable Mesh connection.
- It does not support DCS and DFS on Repeater AP (DCS and DFS can work on Root AP).
- It does not support VLAN on local-bridging mode.
- **Limitation:** The Root AP and Repeater AP **MUST** run in the same country code and channel when initializing the mesh link.
Supported Models

<table>
<thead>
<tr>
<th>WLAN Controller</th>
<th>WLAN Access Point</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NXC5500</strong></td>
<td><strong>WLAN Controller</strong></td>
</tr>
<tr>
<td><strong>NXC2500</strong></td>
<td><strong>WLAN Access Point</strong></td>
</tr>
<tr>
<td><strong>With FW V4.10 or above</strong></td>
<td><strong>Series</strong></td>
</tr>
<tr>
<td><strong>Models</strong></td>
<td><strong>NWA3000-N Series</strong></td>
</tr>
<tr>
<td><strong>NWA3560-N</strong></td>
<td><strong>NWA5000-N Series</strong></td>
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<tr>
<td><strong>NWA5550-N</strong></td>
<td><strong>NWA5120 Series</strong></td>
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<td><strong>NWA5121-N</strong></td>
<td><strong>WAC6500 Series</strong></td>
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<tr>
<td><strong>NWA5123-NI</strong></td>
<td><strong>(Future Support)</strong></td>
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<tr>
<td><strong>Series</strong></td>
<td><strong>WAC6502D-S</strong></td>
</tr>
<tr>
<td><strong>WAC6503D-S</strong></td>
<td><strong>WAC6502D-E</strong></td>
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<td><strong>WAC6553D-E</strong></td>
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<td><strong>Tunnel</strong></td>
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**Note:** ZyMesh on FW 4.20 for WAC6500 Series is Beta function; the official release will be available at next major release.

**ZyMesh Enhancement in FW V4.20**

The GUI Changes are listed as following.

Renamed “All ZyMesh AP” to “ZyMesh”.

<table>
<thead>
<tr>
<th>Before V4.20</th>
<th>After V4.20</th>
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<tbody>
<tr>
<td><img src="image1" alt="Before V4.20" /></td>
<td><img src="image2" alt="After V4.20" /></td>
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Removed ZyMesh SSID Grouping.

### Before V4.20

<table>
<thead>
<tr>
<th>#</th>
<th>Description</th>
<th>IP Address</th>
<th>MAC Address</th>
<th>Age of Info</th>
<th>Upload Signal</th>
<th>Down Signal</th>
<th>SSID Name</th>
<th>Signal Strength</th>
<th>TX Rate</th>
<th>RX Rate</th>
<th>Link Up Time</th>
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<tbody>
<tr>
<td>1</td>
<td>ZyMesh AP</td>
<td>192.168.1.4</td>
<td>00:17:56:02:08:03</td>
<td>417912</td>
<td>58</td>
<td>1</td>
<td>ZyMesh AP</td>
<td>1000</td>
<td>5000</td>
<td>2016/09/01 07:57:16</td>
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New field description for indicating ZyMesh AP and New field “Hop” to indicate ZyMesh AP hop count.

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ZyMesh Configuration

ZyMesh repeater AP can select best available path to transfer traffic

Scenario:
The ZyMesh function enables the ZyXEL WLAN AP to transfer network traffic over a wireless link. It provides a reliable network. The Repeater AP can select the best available path to transfer traffic. For example, if traffic is transferred by “A” path, then “B” path will be the backup.

Topology:

Example

Step 1: If your WTP’s firmware version does not support ZyMesh, you must first perform a firmware upgrade on NXC 4.10.
Step 2: Create the ZyMesh profile, Radio, security and SSID profile for MBSSID use.

Step 3: Before deploying the AP, each AP must be connected to the NXC controller via Ethernet directly and automatically provisioned.

Step 4: On NXC GUI, please determine the ZyMesh AP's OP mode (root/repeater AP) and assign ZyMesh and radio profile to each Root and Repeater AP. The Repeater AP can also be configured via AP Group.
Step 5: Deploy APs into your place.

Step 6: Verify the WDS link:

- Before losing the uplink repeater AP in ‘A site’, you can see two Repeater APs in ‘A site’ (one hop) are connected to Root AP. One Repeater AP in ‘B site’ (2 hops) is connected to one of them.

- If you have lost the uplink Repeater AP in ‘A site’, you will see the 2 hops Repeater change to another or original path to the uplink Repeater or Root AP.
**Setup SSID with VLAN via ZyMesh (Tunnel mode)**

**Scenario:**
SSID needed to use the VLAN via ZyMesh topology.

**Topology:**

Example

![Topology Diagram](image)

**Step 1:** Configure the ZyMesh Profile.
Step 2: On the AP profile > SSID add a new SSID for the ZyMesh radio profile use.

Step 3: On the AP profile > SSID add a SSID and setup with tunnel mode.
Step 4: Add a new radio profile with the ZyMesh (suggested to be used in 5 GHz band).

Step 5: Add a new radio profile for the MBSSID use (suggested to be used in 2.4 GHz band).

Step 6: On the AP Management, configure the Root AP profile.
Step 7: On the AP Management, configure the hop1_Repeater AP profile.
Step 8: On the AP Management, configure the hop2_Repeater AP profile.

Step 9: After completing the configuration of the AP profile, double confirm the setting.
Step 10: Verify the ZyMesh link status.