

Auranet EAP Solution 3

EAP Indoor Wi-Fi Solutions for Large-Sized and
Multi-Subnet Network

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Background

Free Wi-Fi can increasingly be found in shopping malls, hotels, dormitories, factories, airports and other large indoor spaces. The scale of such locations, with hundreds or even thousands of access points, brings its own logistical challenges for wireless network deployment, configuration and maintenance. Another consideration is that complex environments such as these, with heavy visitor traffic and a large number of connected clients, can be susceptible to wireless interference. A solution is required that can be deployed rapidly and managed centrally while also providing fast, stable Wi-Fi.

TP-Link's Auranet EAP Series products provide a range of cost-effective indoor solutions carefully engineered to meet the networking needs of indoor business environments. With over 20 years of networking experience, TP-Link has an outstanding track record as a commercial wireless network solutions provider, owing to our dedicated technical support team and trusted partners.

Application Scenarios

The solution provided in this document applies to the following customer groups and scenarios:

1. Large indoor wireless networks including shopping malls, airports, canteens, hotels, factories, and dormitories with 500 to 1000+ wireless clients
2. Sites that require business-class, high-speed and stable wireless access services
3. Sites that require centralized configuration and management of access points.
4. Customers that require portal authentication service, where products and services are advertised to guests when they connect

For enquiries about the selection or implementation of these solutions, please contact TP-Link Technical Support.

Why TP-Link?

1. 20 years of experience delivering quality products at an affordable price
2. Over 1000 global professional and reliable partners
3. Effective, economical and reliable wireless solutions
4. Diverse range of products available for your business
5. Outstanding technical support with both pre-sales and post-sales support
6. Free and dependable global hotline support and warranty service available 24/7

Solutions

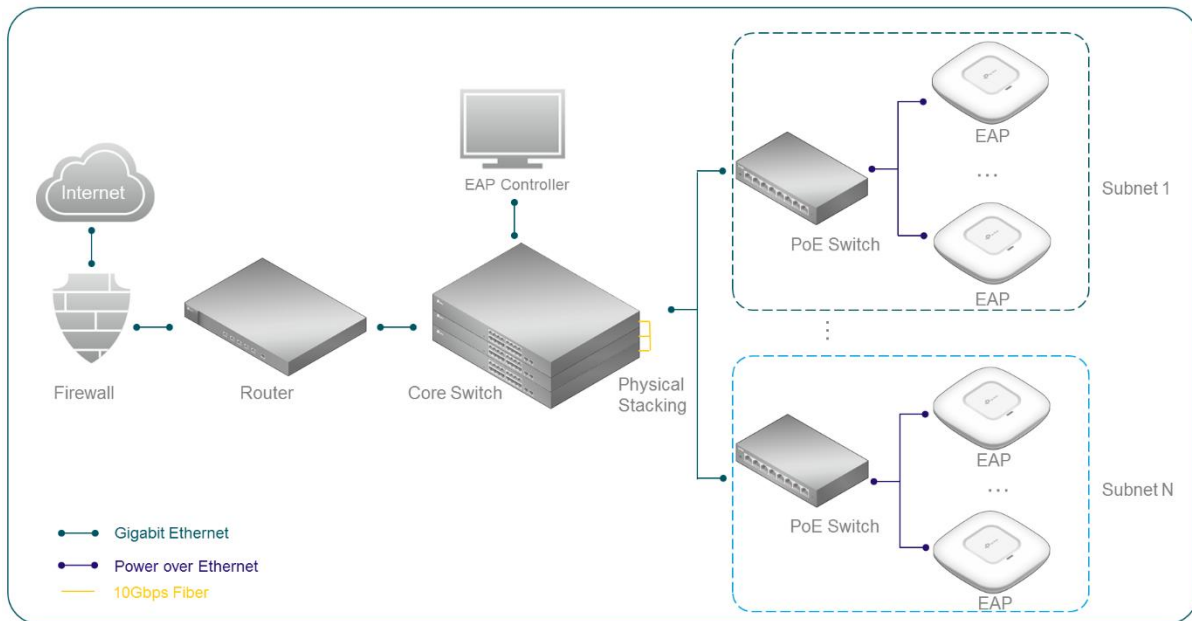
This document will demonstrate a solution suitable for large-sized wireless networks with 500-1000+ wireless clients and dozens or even hundreds of access points. If you just want to extend a wireless network with our EAP products based on your existing wired network, you need to make sure that your existing wired network meets the basic network requirements detailed in this document. If you need to build a brand new wired and wireless network, we will also recommend a set of indoor wired & wireless solutions based on TP-Link products for your reference.

This solution includes the following three parts:

- A. Solution Features and Topology Description
- B. Wired Network Deployment and Configuration Guidance
- C. Wireless Network Deployment and Configuration Guidance

A. Solution Overview and Network Topology Description

Solution --- Indoor Wi-Fi Networking Solutions for Large-sized Multiple Subnet Networks Based on EAP Products



As shown above:

- 1) In the wired network, different departments or areas are divided into subnets. Dividing subnets can isolate broadcast domains and reduce broadcast traffic in the network. It can also improve network security and simplify management.
- 2) EAP products support layer 3 cross-subnet management (L3 Management), and a single EAP Controller can manage EAPs from different subnets. There is no need to change the existing wired network when extending wireless network using EAP products.
- 3) An L3 stackable switch is used as the core layer switch to divide subnets, and multiple core layer switches stack to improve the stability of the network. The EAP Controller is deployed at the core layer and centrally manages all EAPs from different subnets. PoE switches are used to supply power for EAPs on the access layer. SMB router and Firewall equipment can provide the gateway and network security service.

You can deploy an appropriate number of EAPs for your indoor wireless network by considering the area where wireless coverage is needed and the number of clients during peak usage. The recommended number of wireless clients for each EAP is 25. (For dual-band EAPs the number is 50, or 25 for each band.) A single EAP has a range of 15 meters. For guidelines on the number of EAPs needed in an ideal environment, you can refer to the test report in Part C of this document, entitled "Wireless Network Deployment and Configuration Guide 3: EAP Product Deployment". However, please note that the actual number of required EAPs will depend on the environment they are deployed in, since wireless signal is affected by obstacles, RF interference and other factors.

B. Wired Network Deployment and Configuration Guide

1. Wired Network Deployment and Configuration Guide 1: Gateway Selection

There are multiple subnets in this solution, so the gateway router must support Multi-Nets NAT (Multiple Subnet NAT) and Static Routing. Different router manufacturers require different configuration steps to set up Multi-Nets NAT. For TP-Link routers, refer to [FAQ-887](#) for detailed instructions.

TP-Link provides a variety of SMB routers (Gateway Router Equipment). For this solution, we recommend the following TP-Link SafeStream routers as the gateway router:

| Model | SafeStream VPN Router | | SafeStream Load Balance Router |
|------------------------------|-----------------------|-----------|--------------------------------|
| | TL-ER6120 | TL-ER6020 | TL-ER5120 |
| Concurrent Session | 60000 | 30000 | 120000 |
| Recommended Client Number | 300 | 150 | 600 |
| NAT Throughput | 350Mbps | 180Mbps | 350Mbps |
| Multi-nets NAT Subnet Number | 16 | 8 | 16 |
| Maximum Number of WAN Port | 2 | 2 | 4 |

To learn more about our [SafeStream VPN Routers](#) and [SafeStream Load Balance Routers](#), please visit our official website.

2. Wired Network Deployment and Configuration Guide 2: Core/Convergence Layer Switch Selection

The core/convergence layer switch must have sufficient data forwarding and processing capabilities. Since we are dealing with an L3 multi-subnet network, stackable L2+/L3 switches are recommended as the core switch as these support subnetting and routing. Stacking switches can produce higher network stability and achieve equipment redundancy. In this solution, we recommend the following TP-Link switches. Further information about [TP-Link Switches](#) can be found on our official website.

| Model | T1700G-28TQ | T2700G-28TQ | T3700G-28TQ | T2600G-28TS | T2600G-52TS |
|-------------------------|---------------|-------------|-------------|-------------|-------------|
| DHCP Relay | Supported | Supported | Supported | Supported | Supported |
| DHCP Server | Not Supported | Supported | Supported | Supported | Supported |
| Number of IP interfaces | 16 | 128 | 128 | 16 | 16 |
| Number of static routes | 32 | 256 | 256 | 48 | 48 |
| No. of Units Per Stack | 6 | 8 | 8 | No | No |
| Static/Dynamic LAG | Supported | Supported | Supported | Supported | Supported |
| Switching Capacity | 128Gbps | 128Gbps | 128Gbps | 56Gbps | 104Gbps |
| Packet Forwarding Rate | 95.2Mpps | 95.2Mpps | 95.2Mpps | 41.67Mpps | 77.4Mpps |

Why do we choose L2+/L3 switches as the core Layer switches?

Most L2 switches support 802.1q VLAN, which divides the network into different VLANs. However, after VLAN division not only are the broadcast and multicast traffic isolated, but the unicast communication between VLANs is also blocked. This is inconvenient for the network communication.

If L2+/L3 switches are used, it can not only reduce network load by isolating broadcast domains but can also achieve unicast communication between VLANs through data routing. At the same time, the high data forwarding capability can ensure your network runs smoothly. For this reason, it is recommended to use L2+/L3 switches to divide VLAN and subnets for stability.

3. Wired Network Deployment and Configuration Guide 3: EAP Power Supply Selection--Access Layer

Switches Need to Support Standard 802.3af/at PoE

PoE (Power over Ethernet) allows a single cable to provide both data connection and electric power. Using PoE switches can simplify network deployment and save costs since there's no need to install additional power cabling. TP-Link provides different levels of PoE switches with a variety of port numbers, which can meet the requirements of PoE power supply and network access in various scenarios. In this solution, we recommend using the following PoE switches:

| Model | T1500-28PCT | T1500G-10MPS | T1600G-28PS | T1600G-52PS | T2600G-28MPS |
|----------------|---|---|--|--|---|
| Standard | 802.3at | 802.3at | 802.3at | 802.3at | 802.3at |
| PoE+ Ports | 24 | 8 | 24 | 48 | 24 |
| Power Supply | 180W | 116W | 192W | 384W | 384W |
| Ethernet Ports | 24 Fast RJ45 Ports 4 Gigabit RJ45 Ports 2 Combo Gigabit SFP Slots | 8 Gigabit RJ45 Ports 2 Gigabit SFP Slots | 24 Gigabit RJ45 Ports 4 Gigabit SFP Slots | 48 Gigabit RJ45 Ports 4 Gigabit SFP Slots | 24 Gigabit RJ45 Ports 4 Gigabits SFP Slots |

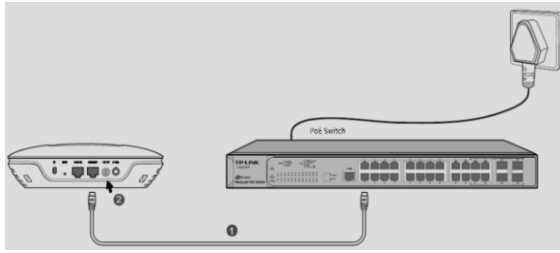
In addition, different TP-Link EAP products support different PoE standards. PoE technologies adopted on the TP-Link Auranet series EAP are listed in the following table:

| Model | EAP320 | EAP330 | EAP245 | EAP225 | EAP115 | EAP115-wall | EAP110 |
|--------------|---------|--------|--------|---------|--------|-------------|-------------|
| PoE Standard | 802.3at | | | 802.3af | | | Passive PoE |

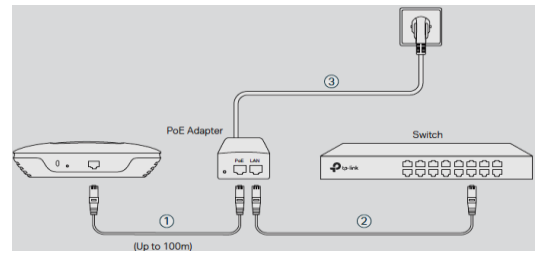
Find out more about [TP-Link PoE switches](#) by visiting our official website.

Note 1: The maximum output power per PoE port in IEEE 802.3af is 15.40W. A more recently developed standard, IEEE 802.3at, offers up to 30W on each port. 802.3at PSE (power source equipment) is backward-compatible with 802.3af PD (powered device). The IEEE 802.3af PoE switch cannot provide power to the 802.3at devices such as EAP320, EAP330, and EAP245. However, a 802.3at standard PoE switch can power either 802.3af or 802.3at standard EAPs.

Note 2: EAP110 and EAP110-Outdoor support passive PoE, which requires an out-of-box passive PoE adapter or injector for power supply, but can't be powered by a 802.3af/ 802.3at PoE switch. EAP110 and EAP110-Outdoor cannot be powered by an external power adapter either. With Passive PoE, it's important to note that the adapter requires a power socket. Sketches of standard PoE power supply and passive PoE power supply are shown below:

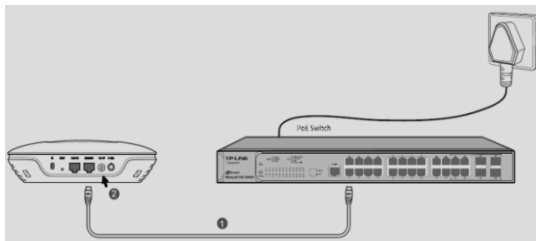


Standard PoE Power Supply

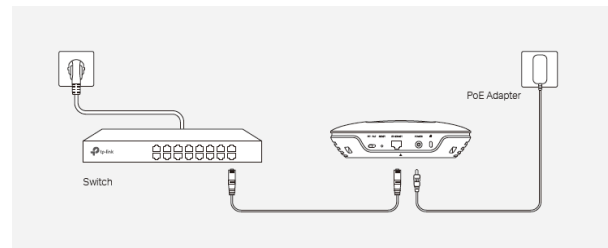


Passive PoE Power Supply

If you do not have a standard PoE switch or Passive PoE Adapter, you can also use the DC Power Adapter that comes with the EAP. However, when using a power adapter for power supply, the location of your EAP may be limited by the location of power sockets.



Standard PoE Power Supply



External Adapter Power Supply

C. Wireless Network Deployment and Configuration Guide

1. Wireless Network Deployment and Configuration Guide 1: Solution Selection

Here we choose the TP-Link EAP Controller & EAP wireless access points to extend the wireless network based on the preexisting or newly built wired network and manage all the EAPs centrally by using an EAP Controller. The main advantages of this solution are:

- Deployment is convenient. There's no need to change the existing wired network.
- The EAP Controller can discover and manage the EAPs automatically, and provide real-time monitoring of the EAPs' working status.
- EAP Controller software is totally free and can be installed on any Windows PC.

2. Wireless Network Deployment and Configuration Guide 2: EAP Product Selection

TP-Link provides different levels of 11n/11ac EAP products to meet different requirements. See the table below for details.

| Model | EAP330 | EAP245 | EAP320 | EAP225 | EAP115 | EAP115-Wall | EAP110 |
|---------------------|---------------------------------|---------------------------------|--------------------------------|------------------------------|-------------------|---------------------|-------------------|
| Wireless Throughput | 2.4GHz:600Mbps 5GHz:1300Mbps | 2.4GHz:450Mbps 5GHz:1300Mbps | 2.4GHz:300Mbps 5GHz:867Mbps | | 2.4GHz: 300Mbps | | |
| Internal Antennas | 2.4GHz:3*6dBi 5GHz:3*7dBi | 2.4GHz:3*4dBi 5GHz:3*4dBi | 2.4GHz:2*6dBi 5GHz:2*7dBi | 2.4GHz:2*4dBi 5GHz:2*4dBi | 2.4GHz: 2*3dBi | 2.4GHz: 2*1.8dBi | 2.4GHz: 2*3dBi |
| Captive Portal | √ | √ | √ | √ | √ | √ | √ |
| Airtime Fairness | √ | × | √ | × | × | × | × |
| Beam forming | √ | × | √ | × | × | × | × |

| | | | | | | | |
|-----------------|----------------------------|---|---|---|-------------------------------------|----------------------------|---|
| Band Steering | √ | √ | √ | √ | × | × | × |
| Load Balance | √ | √ | √ | √ | √ | √ | √ |
| Management Mode | EAP Controller, Standalone | | | | EAP Controller, Standalone, Cluster | EAP Controller, Standalone | |

Why do we choose 5GHz EAP products?

- 1) The 2.4GHz band only has three available non-overlapping channels for transmission: 1, 6, and 11. The 5GHz band can provide a much larger number of channels.

Please note that due to different local regulations, available 5GHz channels differ between countries and regions. For example, in the United States twenty-two 5GHz channels are supported, while in Europe nineteen 5GHz channels are supported.

- 2) The 5GHz channel is much cleaner, with less interference. The 2.4GHz wireless band uses the same channel signals as other devices such as Bluetooth and microwave ovens, so it is more likely to experience interference in a noisy environment. Compatibility with 5GHz band Wi-Fi is becoming widespread, with greater and greater numbers of devices now supporting it. Furthermore, it allows dual-band EAP products to handle larger numbers of simultaneous connections.

3. Wireless Network Deployment and Configuration Guide 3: EAP Controller Introduction

- 1) **Why is centralized management necessary?**

- Medium or large-scale networks can contain many EAPs. Hence, configuration and management is much more convenient if all EAPs can be managed at the same time using the EAP controller. Managing each EAP individually in Standalone mode would be time consuming and inefficient.
- It is difficult to monitor all EAPs and keep track of their working status in real time if they are in Standalone mode.
- A single EAP in Standalone mode has limited hardware capabilities. Certain advanced functions are not supported and some functions cannot be upgraded in Standalone mode.

- 2) **The advantages of centralized management with an EAP Controller:**

- Configure and manage all access points simultaneously through an intuitive interface. Keep every access point up to date with unified software updates.
- Easily monitor the working status, network traffic statistics and user information of all EAPs.
- Portal Authentication, Load Balance and many other advanced wireless functions are supported.

EAP Controller Info:

| EAP Controller (ver. 2.4.7 or above) | | |
|--------------------------------------|------------------|---|
| Operation System | | Windows OS |
| Configuration Requirement | | Recommend Intel I3 CPU, 2GB RAM, 10G HDD or above |
| L3 Management | | Support |
| L3 Discovery Methods | | Discovery Utility、DHCP Option 82 |
| Main Software Function | Captive Portal | No Authentication、Simple Password、Hotspot、External Radius Server、External Portal Server |
| | WLAN Group | Support |
| | Management Sites | Support |
| | Load Balance | Support |
| | Rate Limit | Support |
| | Management VLAN | Support |
| | Mail Log | Support |
| | Map | Support |

Functions listed here are the main functions of the EAP Controller. For more information about the [EAP Controller](#), please visit our official website. After configuration is complete, you may need to keep the EAP controller software open depending on the features you are using. Captive Portal, for example, requires the EAP Controller to be constantly running. For more details, please read [FAQ 1024](#) on our website.

4. Wireless Network Deployment and Configuration Guide 4: EAP Product Deployment

1) EAP Product Installation

TP-Link EAP products can be ceiling-mounted, wall-mounted and ceiling-rail mounted. Installation methods are simple and fast. The installation procedure differs between EAP products.

- For the installation of EAP330/EAP320, please refer to the [EAP320 Installation Guide](#).
- For the installation method of EAP225 and other EAP products, please refer to the [EAP225 Installation Guide](#).
- For the installation of EAP115-Wall, please refer to the [EAP115-Wall Installation Guide](#).

2) EAP Product Cabling

If you are using EAP245 and other Standard PoE EAPs, you can simply use Ethernet cables to connect the EAPs to your network. To ensure normal communication and power transmission, we recommend that you use Ethernet cables that are Cat. 5E or above, with a maximum length of 100 meters.

If you are using EAP110 (This does not support Standard PoE, but does support Passive PoE.), you may use any standard of Ethernet cable. However, you need to consider the position of the power socket which supplies power to the Passive PoE Adapter. Considering the simplicity and flexibility of wiring/cabling, if you have a Standard PoE switch, and your network scale is large, we recommend that you use the Standard PoE switch.

For every EAP product, you will need to decide the number of EAPs and where to install them based on your indoor environment. You should consider the following factors:

- Carpet Area: In theory, the wireless coverage of an access point can reach up to 500 square meters. However, the actual coverage may be less than that value, due to the effects of signal interference and obstacles.
- Number of Connections and Internet Behaviors: A single band (2.4GHz or 5GHz) of an access point has a recommended number of connected devices of 30, and the connected capacity of the 5GHz band is slightly more than that of the 2.4GHz band. A series of tests carried out with a selection of EAP products produced the following results when users streamed 720P HD videos:

| | 2.4 GHz | | | 5 GHz | |
|--------------------|---------|--------|--------|--------|--------|
| | EAP330 | EAP320 | EAP110 | EAP330 | EAP320 |
| Smooth Play* | 28 | 26 | 25 | 40 | 38 |
| Occasional Error** | 30 | 30 | 30 | 42 | 42 |

*Smooth Play indicates the maximum number of connected devices when all clients are able to smoothly stream 720P HD videos.

**Occasional Error indicates the maximum number of connected devices when clients experience occasional buffering or pausing when streaming 720P HD videos.

- Obstacles: Obstacles cause varying degrees of wireless signal attenuation. To ensure complete coverage, try to install the EAPs in the center of an open room, which reduces the interference between the EAPs and their surroundings. It is recommended to test the signal reception in the corner of the room.

3) Discover and Manage EAPs

In a Layer 3 network with multiple subnets, the EAP Controller cannot discover EAPs in different subnets automatically. Instead, the EAPs must be informed of the EAP Controller's IP address. The EAPs from different subnets then communicate with the EAP Controller to achieve cross-subnet management (L3 management). There are two options for EAP Controller cross-subnet management (L3 management) which are as follows:

- **Installing EAP Discover Utility in Each Subnet**

Excluding the subnet that the EAP Controller is located in, all other subnets must [download](#) and install the EAP Discover Utility. By adding the IP address of EAP Controller to the EAP Discover Utility, the Discover Utility will inform EAPs in different subnets of the EAP Controller's IP address, and build the connection between EAPs and EAP Controller. For detailed configuration steps please refer to [FAQ-1359](#). After the EAP Controller has discovered all EAPs, you can close the Discover Utility until the IP address of EAP Controller is changed or an EAP is forgotten or reset. In these cases, the EAP Discover Utility should be run again to enable the EAP Controller to discover EAPs.

Note: EAP Discover Utility is currently only supported on Windows and MAC OS.

- **Using DHCP Option 138**

If you use EAP Discover Utility to find EAPs, you need to install EAP Discover Utility in every subnet, which can be inconvenient. If your DHCP Server supports DHCP Option 138, we can inform EAPs of the EAP Controller's IP address when the DHCP server is assigning IP addresses to EAPs with Option 138. Different manufacturers require different configuration steps for DHCP Servers regarding

Option 138. If you are unsure, please contact the manufacturer of your DHCP Server. Here we take the TP-Link JetStream T2600 switch as an example. For detailed configuration steps regarding Option 138 on TP-link switches, please refer to [FAQ-1360](#).

4) Wireless Network Optimization

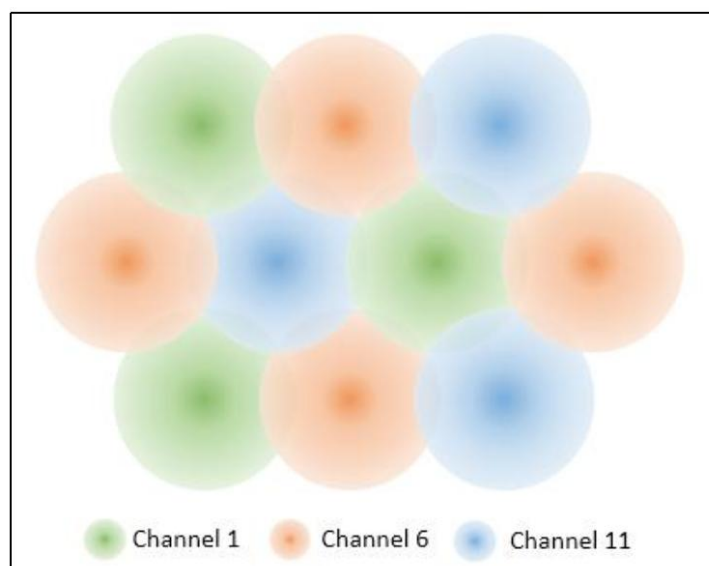
After the EAP Controller has discovered your EAPs, the status of the EAPs will change to “Pending”. After you adopt these EAPs, the EAP Controller will synchronize the wireless settings such as SSID and password to each EAP. For detailed configuration steps, please refer to [User Guide for EAP Controller](#).

Once the status of all EAPs change to “Connected”, the basic wireless network is built. You can access the internet and configure Wireless Authentication, VoIP and other value-added functions by connecting to the wireless network of the EAPs.

The following features can help to create a more stable network:

- Channel Optimization

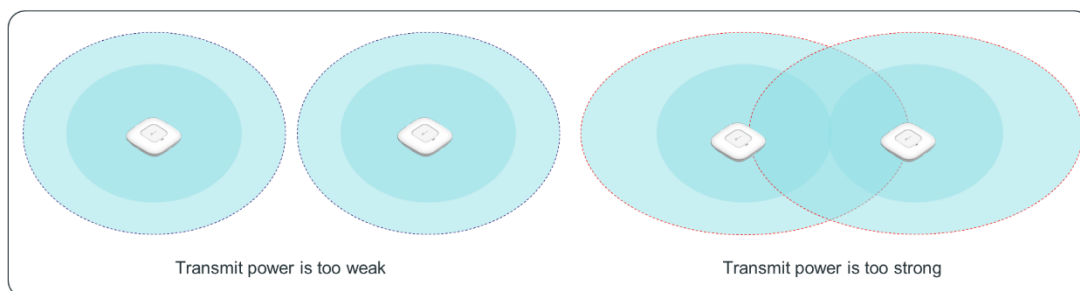
No matter whether you select the 2.4GHz or 5GHz band when deploying your wireless network, it is important to ensure that wireless signals of adjacent EAPs do not interfere with each other. To achieve this, we can manually assign and fix channels for each access point. The following figure shows a possible channel assignment layout based on the three non-overlapping 2.4GHz wireless channels (1, 6 and 11).



- Transmission Power Adjustment

Generally, the higher the transmission power is, the larger the area that the wireless signal can cover. In places with a high density of clients, however, access points tend to be placed very close together, which may result in their wireless signals interfering. High transmission power is another factor that can result in interference between adjacent access points. Analyzing transmission

power requires professional wireless signal analysis tools such as inSSIDer. When two access points are close together and there is no obstacle between them, it is recommended to reduce the transmission power. If there are many obstacles and access points are spread far apart from one another, the transmission power may be increased.



- **Load Balance**
Load Balance attempts to distribute wireless clients evenly between access points. Clients with a weak wireless signal can also be removed from the network, creating a smoother connection for users. To learn more about how Load Balance works, and how to configure it, please refer to the [EAP Controller's User Guide \(Page 61\)](#).
- **Band Steering**
This feature is supported by 2.4GHz/5GHz dual band products. When possible, dual-band clients will be connected to the cleaner and faster 5GHz network instead of the 2.4GHz band. This provides a better online experience for users on both bands since network traffic on the 2.4GHz band will also be reduced. To learn more about how Load Balance works, and how to configure it, please refer to the [EAP Controller's User Guide \(Page 31\)](#).

5. Wireless Network Deployment and Configuration Guide 5: Improve Wi-Fi Access Experience

TP-Link Auranet EAPs provide more than just basic Wi-Fi. They also provide a wealth of software features and value-added services, such as Captive Portal, SSID Isolation and Rate Limit.

- 1) By using Captive Portal Authentication, you can advertise your business while providing authentication for the users. TP-Link Auranet EAPs support a variety of Captive Portal authentication modes. Users can select Captive Portal authentication modes according to their network size, application scenario and customers.
- 2) SSID Isolation can ensure the customers' network security. By setting up SSID Isolation, you can isolate communication between all wireless clients. This not only reduces broadcast traffic, but also enhances network security.
- 3) Rate Limit works by limiting P2P download speeds and other bandwidth intensive applications to ensure that all users have a good internet experience. With the Rate Limit function enabled, we can set up the maximum allowed upload and download rate for each client. This avoids situations where individual clients are taking up a large proportion of the bandwidth and slowing down the internet connection of other users.