

Auranet EAP Solution 4

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

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Background

For businesses spread out across multiple locations, such as supermarket or hotel chains, efficient network management can prove challenging. In traditional wireless networking solutions, the wireless network of each branch is separate from the others. There are two major disadvantages to this:

1. The first is that it's not possible to centrally manage the network. The wireless network of each site will require independent management and maintenance. Not only will this increase the cost of the management equipment, but the cost and efficiency of network management will also be affected.
2. The second is that LAN resources cannot be shared between the sites. This increases the operating cost because such networks cannot provide a unified business platform, leading some businesses to utilize different servers at different sites.

For these types of businesses, it is essential to provide a multi-site wireless networking solution which is economical, reliable, and centrally managed.

TP-Link's Auranet EAP Series products provide a range of cost-effective indoor solutions engineered to meet the networking needs of today's indoor business environments. With over 20 years of networking experience behind us, 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 here applies to the following customers and application scenarios:

1. Hotel chains, supermarket chains, chain stores and any other businesses with branches in multiple locations, and with a total wireless client number of 500 -1000 or more.
2. Sites that require business-class, high-speed and stable wireless access services.

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 to suit your business
5. Outstanding technical support with both pre-sales and post-sales support
6. Free and professional global hotline support and warranty service available 24/7

Solutions

This document will introduce two solutions based the management of EAPs across multiple sites using the EAP Controller. One is achieved through the use of VPN tunneling, and the other is achieved using NAT port forwarding. To build a site-to-site VPN between your headquarters and branches using the gateway routers, "Multi-Site Management

via VPN Tunnel” is recommended. If it is impossible to build a site-to-site VPN tunnel between your headquarters and branches, please use the second solution “Multi-Site Management via NAT Port Forwarding”. The solutions include the following three parts:

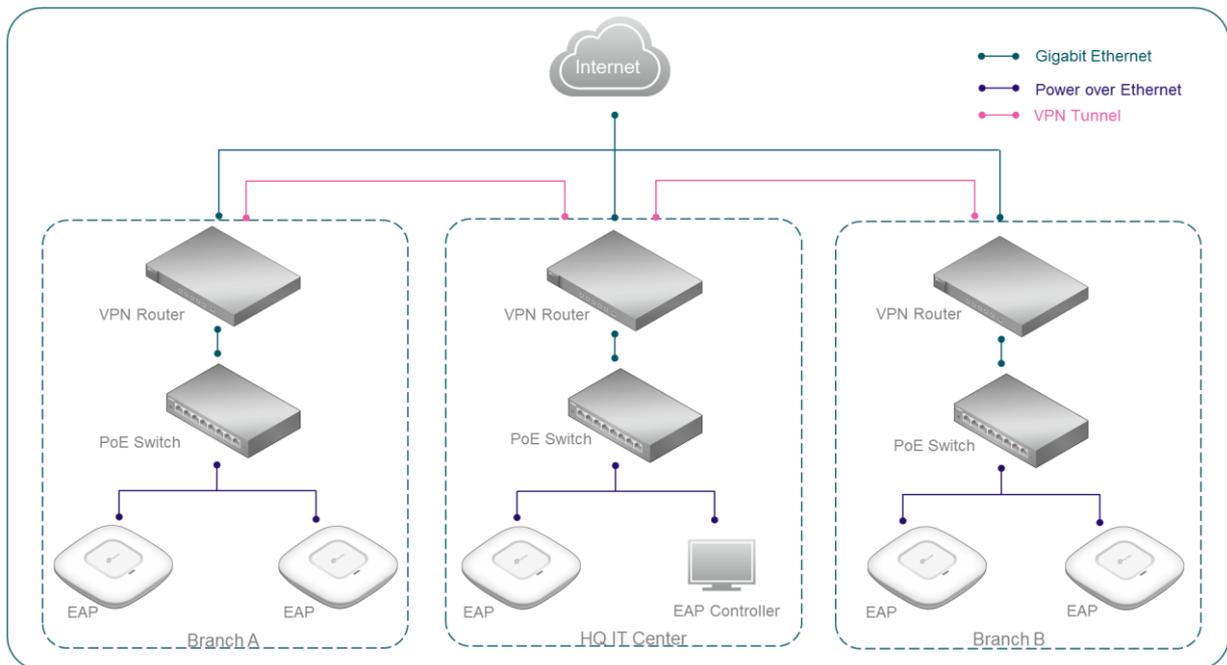
A. Solution Features and Topology Description

B. Wired Network Deployment and Configuration Guide

C. Wireless Network Deployment and Configuration Guide

A. Solution Overview and Network Topology Description

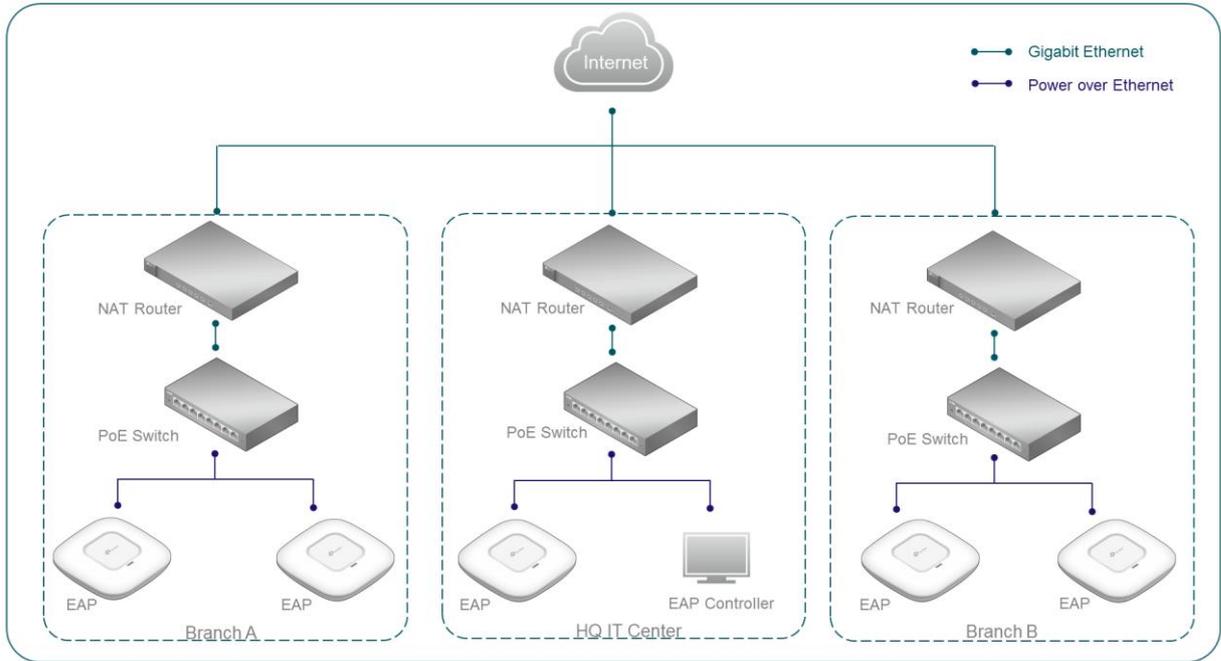
Solution 1 --- Multi-Site Management and Deployment of EAP Wireless Network via VPN Tunnel



As shown above:

- 1) The LAN of the headquarters and branches are connected via VPN tunnels.
- 2) EAP products are used to extend the wireless network based on the existing wired network in headquarters and branches.
- 3) EAPs from all branches are centrally managed with an EAP Controller located at headquarters.

Solution 2 --- Multi-Site Management and Deployment of EAP Wireless Network via NAT Port Forwarding



As shown above:

- 1) The relevant ports on the gateway router at the headquarters are opened to allow the wireless controller to manage EAPs in all branches.
- 2) EAP products are used to extend the wireless network based on the existing wired network in headquarters and branches.
- 3) EAPs from all branches are centrally managed with an EAP Controller located at headquarters.

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

- 1) **Solution 1: Building a site-to-site VPN tunnel between the gateway routers of the headquarters and branches**

Different manufacturers have different methods for building site-to-site VPN tunnels. Please consult the manufacturer of your gateway router for information. Here we recommend the TP-Link SafeStream VPN Router, and IPsec site-to-site VPN. For detailed configuration steps for this product, please refer to FAQ-380. For questions regarding the configuration of VPN tunnels with TP-Link routers, please contact TP-Link Technical Support.

- 2) **Solution 2: Opening the relevant ports on the gateway router of the headquarters**

In this solution, you don't need to set a site-to-site VPN on the gateway routers. However, the gateway router must support NAT Port Forwarding features such as Virtual Server. Please be aware different manufacturers have different configuration methods. For detailed configuration instructions, please consult the support team of your gateway router manufacturer. In order for the EAP Controller in headquarters to discover and manage EAPs from all branches, we need to open UDP port 5246 and 5247 on the gateway router at headquarters. Here, we take the TP-Link SafeStream Load Balance Router as an example. For the detailed configuration instructions of this product, please refer to FAQ-1347.

Please note that opening ports only achieves cross-NAT data communication between the EAP Controller and EAPs. It cannot achieve site-to-site LAN information and resource sharing. In addition, multi-site management via port forwarding is insecure since the data exchange between different sites is not encrypted. It will also increase the risk that your local network gets attacked from external networks when you open ports on your NAT device. Solution 1 is recommended if you require a high level of network security.

TP-Link provides various SMB routers. In this solution, we recommend the following TP-Link SafeStream routers when selecting a gateway router:

Type	SafeStream VPN Router		SafeStream Load Balance Router
Model	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: EAP Power Supply Selection (Access Layer Switch Must Support 802.3af/at Standard 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

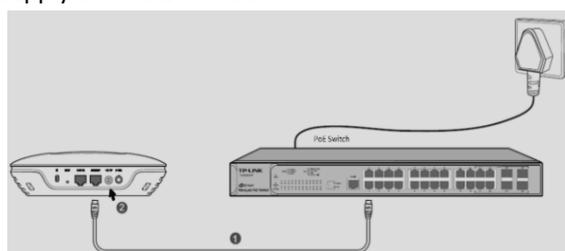
In addition, different TP-Link EAP products support different PoE standards. PoE technologies adopted on the TP-Link Auranet series EAP are listed in the following table:

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

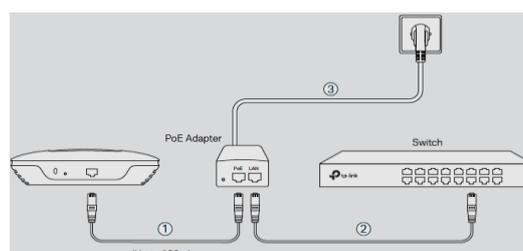
Find out more about [TP-Link PoE switches](#) by visiting our official website.

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, an 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 an 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:

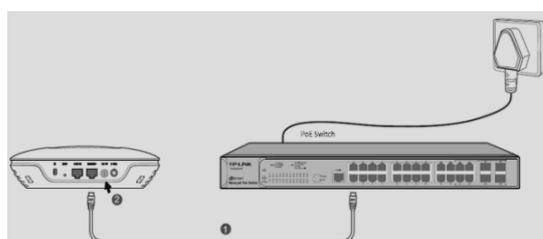


Standard PoE Power Supply

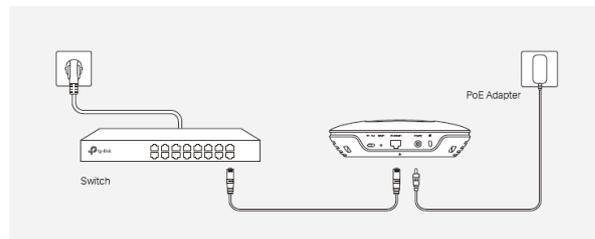


External Adapter Power Supply

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 product. 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 types 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 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?
 - It's a heavy task to configure, upgrade and maintain so many EAPs if all working at Standalone mode
 - In Standalone mode, it's difficult to monitor the EAPs and know the real-time network status
 - The hardware resource of a single AP is limited, so advanced functions are not supported and function upgrade is impossible either.

2) The advantages of centralized management with the EAP Controller:

- 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.

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

Solution 1: Multi-site Management and Deployment of EAP Wireless Network via VPN Tunnel

Continuing from Section B, “Wired Network Deployment and Configuration Guide”, the headquarters and branches can have cross-NAT data exchange after a VPN tunnel is built successfully between the headquarters and branches. The EAPs and EAP Controller are now in the same LAN. For the EAP Controller to automatically discover EAP products, however, you still need to inform the EAPs of the EAP Controller’s IP address.

- **Installing EAP Discover Utility in Each Site**
All subnets must [download](#) and install EAP Discover. By adding the IP address of the EAP Controller to the EAP Discover Utility, the Discover Utility will inform EAPs in all subnets of the IP address of the EAP Controller and build a 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 management using the EAP Controller with VPN tunneling and Option 138, please refer to [FAQ-1362](#).

Solution 2: Multi-Site Management and Deployment of EAP Wireless Network via NAT Port Forwarding

Continuing from Section B, "Wired Network Deployment and Configuration Guide", the headquarters and branches have been connected over the internet, and the relevant ports on the gateway router have already been opened for the EAP Controller. For the EAP Controller to automatically discover EAP products, you still need to inform EAPs of the EAP Controller's IP address. (In this case, the IP address required is the WAN IP of the gateway router at headquarters.) There are two methods for this:

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

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-1363](#). 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, please refer to [FAQ-1364](#).

4) Wireless Network Optimization

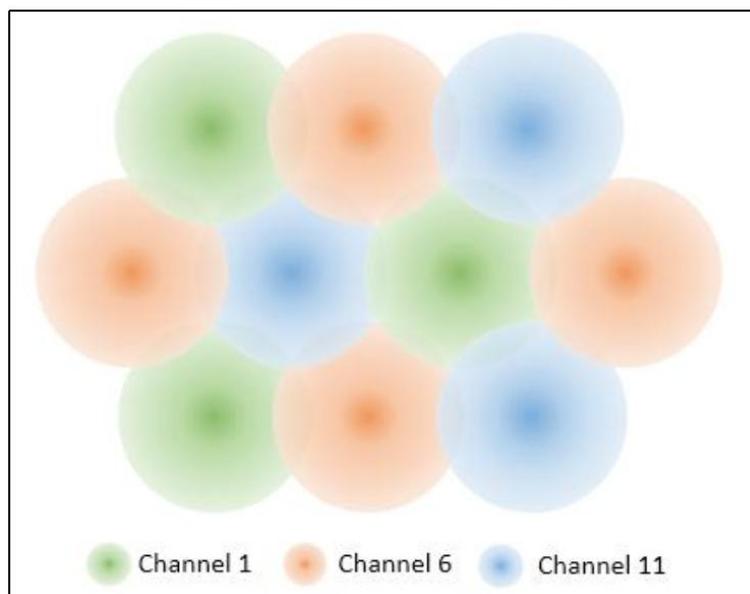
After the EAP Controller has discovered your EAPs, the status of the EAPs will change to “Pending”. After you adopt these EAPs, the EAP Controller will synchronize the wireless settings such as SSID and password to each EAP. For detailed configuration steps, please refer to [User Guide for EAP Controller](#).

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:

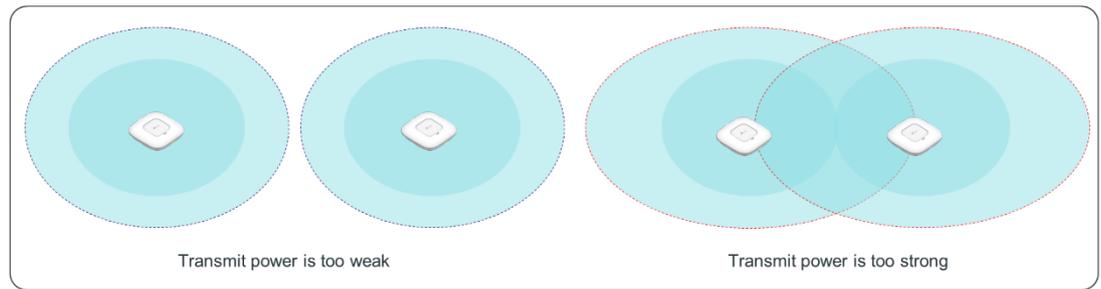
- **Wireless Channel Assignment**

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.