



Ruijie Networks – Innovation Beyond Networks

Ruijie Cloud High-density Wi-Fi Network Implementation Guide

Ruijie Networks Co., Ltd.

All rights reserved.

Author: LeVine Lin

Email: linxihao@ruijie.com.cn

Contents

1	Overview	2
2	Basic Requirements	2
2.1	Internet gateway Requirements	2
2.2	Wireless and Authentication Requirements	2
2.3	Access Control Related Requirements	2
2.4	Security Requirements	3
3	Implementation Solutions	3
3.1	Topology	3
3.2	Recommended Devices	4
3.3	AP Position Planning	5
3.4	VLAN/IP Planning	6
3.5	Authentication Schemes	6
3.6	Egress Bandwidth	6
3.7	Load Balancing	7
4	Reference Configurations	7
4.1	Ruijie Cloud Configuration	7
4.1.1	Creating an SSID	8
4.1.2	Configuring a Voucher	8
4.2	EG Reference Configuration	8
4.2.1	Creating a VLAN and a Corresponding Sub Interface	9
4.2.2	Creating a DHCP Address Pool	9
4.2.3	Configuring Local Authentication and Setting the Policy Type to Voucher	10
4.2.4	Checking Connection Statuses on Dual WAN Interfaces	10
4.2.5	Enabling Flow Control, Selecting a Flow Control Template, and Setting Bandwidth of WAN Interfaces	11
4.2.6	Configuring Load Balancing for WAN Interfaces	11
4.3	Switch Reference Configuration	13
4.4	Wireless Optimization Configuration	14
5	Management and Maintenance	15
5.1	Ruijie Cloud APP	15
5.2	Instructions for Use	15
6	Conclusion	17
7	References	18

1 Overview

With popularity of intelligent STAs and socialization of the Internet, network experience at large conferences (such as large exhibitions, expositions, seminars, and enterprise annual meetings) gains increasing focus from managers and affects the reputation of the whole conferences. Deployment of high-density Wi-Fi networks at venues and stadiums usually encounters the following challenges:

- A large number of APs need to be deployed to meet Internet access requirements of tens of thousands of users.
- It needs to be ensured that the large number of densely deployed APs do not interfere with each other.
- The egress bandwidth is limited and needs to be properly allocated, to ensure normal use of key applications.
- The authentication service needs to be provided for access users to ensure network security.
- The authentication server needs to meet authentication requirements of a large number of users and ensure a smooth authentication process.

2 Basic Requirements

This chapter describes basic requirements and solutions for high-density Wi-Fi networks by using an example of an actual scenario.

2.1 Internet Gateway Requirements

- Two network lines of operators need to be deployed at the Internet gateway for redundancy, to balance load on the Internet gateway.

2.2 Wireless and Authentication Requirements

- The wireless network needs to meet connection and smoothness requirements of 10,000 to 20,000 users.
- Three SSIDs are enabled at a conference site, which respectively correspond to voucher-based authentication, one-click authentication, and WPA2 authentication. The voucher-based authentication is available to paid users, the one-click authentication is available to free users, and the WPA2 authentication is available to staff. The authentication needs to be perception-free to avoid repeated authentication caused by roaming of users' STAs.
- At the conference site, no-traffic go-offline is needed so that STAs automatically go offline when they generate no traffic in 30 minutes.
- All deployed APs need to be capable of automatically adjusting channels and power as required.

2.3 Access Control Related Requirements

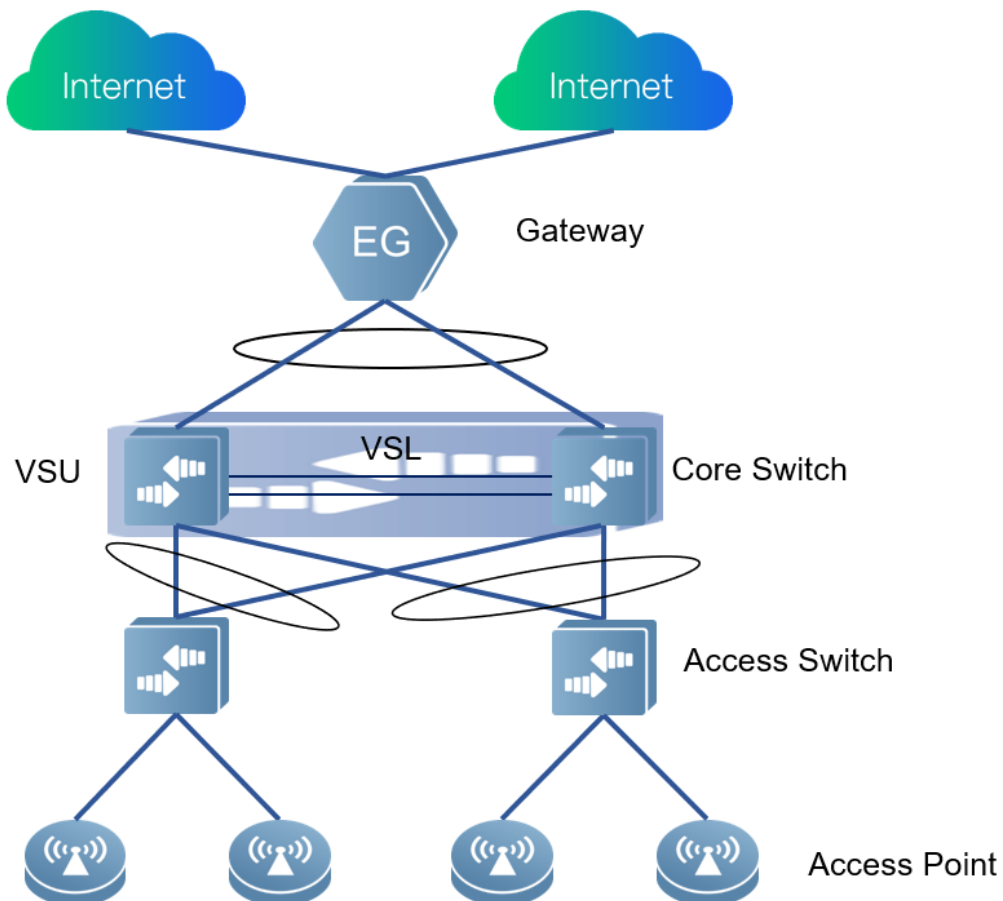
- A rate of the voucher-based authentication needs to be limited to 5 MB/s, and a rate of the one-click authentication needs to be limited to 1 MB/s.

2.4 Security Requirements

- Different VLANs are configured to isolate APs, switches, and users.
- Port isolation is needed on access switches to prevent certain STAs from affecting stability of the entire network.
- DHCP snooping is needed on the access switches to prevent private IP addresses and interference from other invalid DHCP servers.

3 Implementation Solutions

3.1 Topology



3.2 Recommended Devices

Recommended models:

- RG-EG3000XE: Allows up to 20,000 concurrent users; supports 2x40G SFP ports and 8x10G SFP ports, to ensure sufficient bandwidth; supports high-speed data forwarding and diversified types of load balancing; and provides guaranteed bandwidth for key applications, which is the key of the high-density Wi-Fi network project.
- RG-8605E: Provides a switching capacity of 22.25 Tbps and a packet forwarding rate up to 2880 Mpps, and supports VSU and 40G SFP ports, to ensure a sufficient switching capacity and SFP port-based access for project success.
- RG-S2910-10GT2SFP-UP-H: 12-port full gigabit PoE switch that can ensure line-rate forwarding on all interfaces.
- RG-S2910-24GT4XS-UP-H: 28-port full gigabit PoE switch that can ensure line-rate forwarding on all interfaces.
- RG-AP740-I: Indoor AP that supports an ultra-high wireless network rate up to 2533 Mbps, ensuring wireless Internet access experience in high-density scenarios.
- RG-AP720-I: Indoor AP that supports a wireless network rate of 1267 Mbps, achieving a great leap in AP coverage performance in combination with the X-sense antennas.
- RG-AP720-L: Indoor AP that supports a wireless network rate of 1167 Mbps and the 802.11ac dual-band dual-radio function.
- RG-AP630(IODA): Outdoor omnidirectional AP that supports a wireless network rate of 1.75 Gbps, and provides an ultra-large coverage area to ensure quick access of wireless users in open areas.
- RG-AP630(IDA2): Outdoor directional AP that supports a wireless network rate of 2.533 Gbps, and adopts a housing design of an IP68 protection grade, to prevent impact of harsh weather and environments.

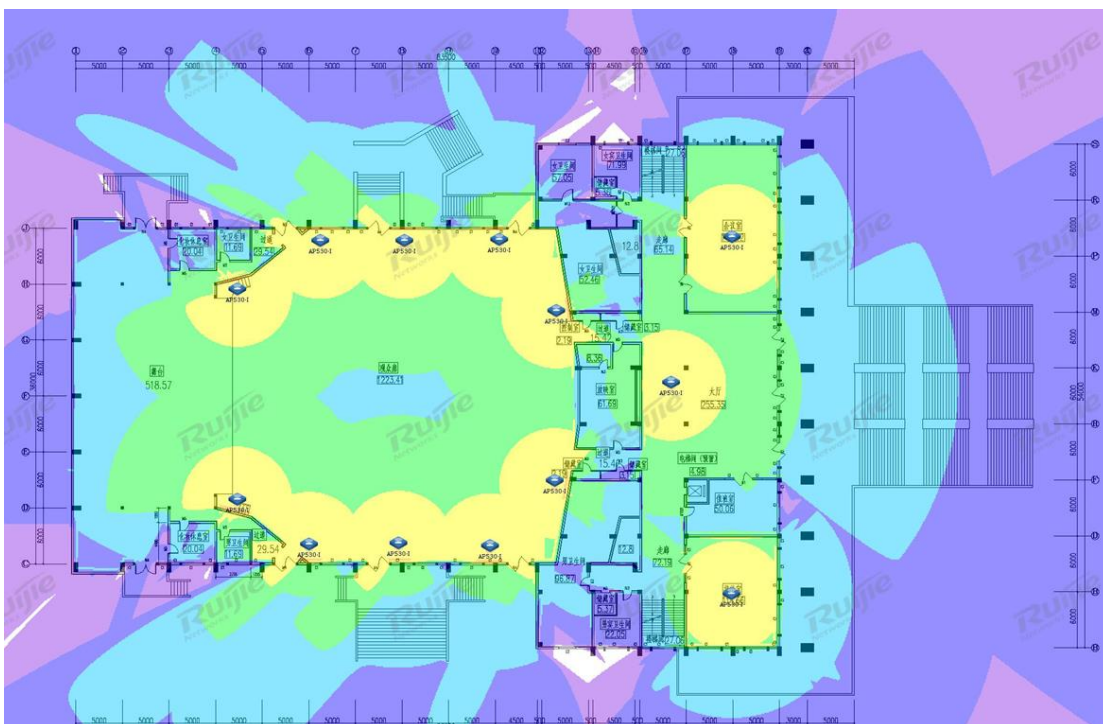


3.3 AP Position Planning

With Ruijie Site Survey Planner (<https://survey.ruijienetworks.com>), customers can plan AP positions based on the floor plan, simulate AP signal coverage, and generate a site survey report.

For operation details, see the *Site Survey User Guide*:

<http://ruijienetworks.com/service/document/read/58323>



3.4 VLAN/IP Planning

For higher security and ease of management, AP management addresses, switch management addresses, and user addresses are isolated at layer 2 by using different VLANs. Network segments are assigned based on user quantities allowed for different user access modes. It is suggested that the quantity of addresses be twice of the estimated quantity of users and discontinuous address segments be used, for better extensibility. Network segment examples:

- Switch management address segment: VLAN 10: 192.168.0.0/24; gateway address:192.168.0.1
- AP management address segment: VLAN 11: 192.168.8.0/20; gateway address: 192.168.8.1
- Address segment for users applying the voucher-based authentication: VLAN 100: 10.0.0.0/17; gateway address: 10.0.0.1
- Address segment for users applying the one-click authentication: VLAN 101: 10.1.0.0/17; gateway address: 10.1.0.1
- Address segment for users applying the WPA2 authentication: VLAN 102: 10.2.0.0/17; gateway address: 10.2.0.1

3.5 Authentication Schemes

The voucher-based authentication, one-click authentication, and WPA2 authentication are adopted, to ensure access speeds of tens of thousands of wireless users at a conference site and provide superb wireless network experience. When there are more than 50 web-authenticated users in the network, it is recommended that the EG device and the voucher function be used to configure local voucher-based authentication, and the one-click authentication and the WPA2 authentication be configured on the cloud. The voucher-based authentication and the one-click authentication are used for user access, and the WPA2 authentication is used for access to special devices. The voucher-based authentication is available to paid users, with a rate limited to 5 MB/s, and the one-click authentication is available to free users, with a rate limited to 1 MB/s.

3.6 Egress Bandwidth

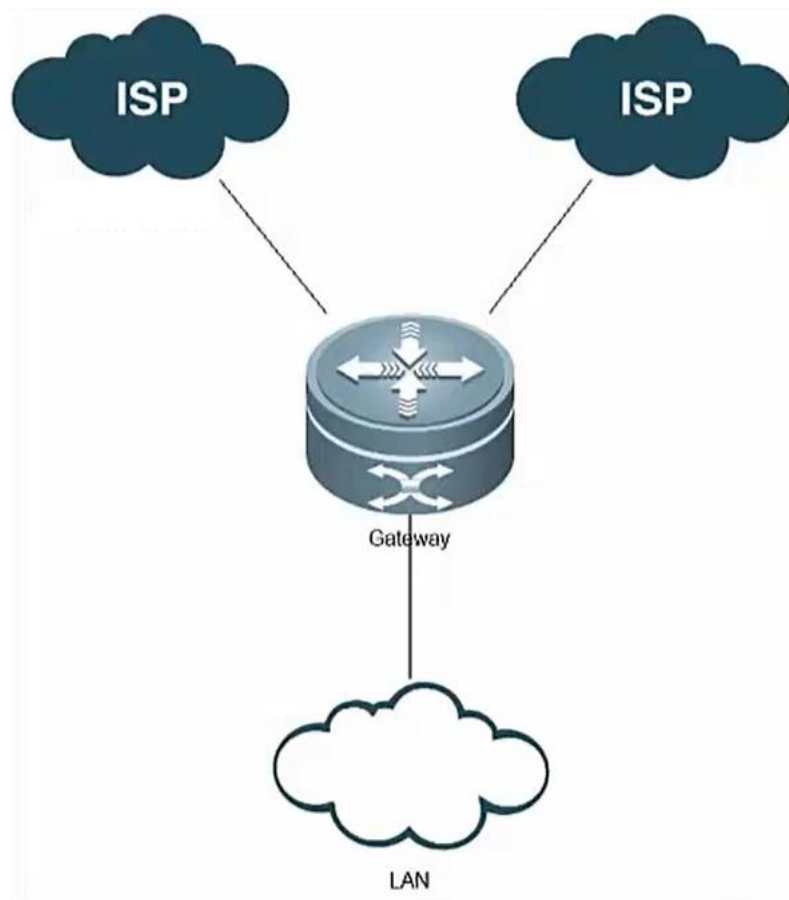
Two WAN lines of different operators are deployed at the Internet gateway. One of the WAN lines has a fixed address and is used to guarantee the Internet access bandwidth of key applications at the conference site. The other WAN line is an ADSL line and is used by applications with a high downlink rate, for example, a download application and a video application. The total egress bandwidth can be configured by referring to the following figure and the total user quantity in the conference site, to ensure the wireless Internet access experience.

Application Name	Bandwidth for Single User
Webpage traffic (HTTP, HTTPS)	80 KB/s
Browser game (Web game)	60 KB/s
Online game (Steam, LOL, DOTA2)	80–150 KB/s
Mobile game (Mobile game)	80–150 KB/s
Online music (Google Play)	300 KB/s
P2P download (P2P HTTP download)	100–300 KB/s

Video service (YouTube)	300–500 KB/s
Social media (Facebook, Instagram, Twitter)	200–400 KB/s

3.7 Load Balancing

Load balancing based on application-based routing and load balancing based on floating routing are adopted on the egress device. The former guarantees Internet access performance of key applications with priority at the conference site, and the latter ensures a timely switch to a redundant line in case of an external network line exception, to ensure normal use of a wireless network line at the conference site.



4 Reference Configurations

4.1 Ruijie Cloud Configuration

For basic provisioning configurations, see the *Ruijie Cloud Cookbook*.

https://www.ruijienetworks.com/support/documents/slide_75464

This document describes some key configurations only.

4.1.1 Creating an SSID

Parintins Save More

Wireless Configuration

SSID

WLAN ID	SSID	Encryption Mode	Hidden	Forward Mode	Radio	Auth Mode	Action
1	Startcom Ilha Conectada	Open	No	bridge	1,2	Auth Disabled	
2	Startcom	Open	No	bridge	1,2	Inner Portal	
3	Startcom PDV	wpa2-psk	No	nat	1,2	Auth Disabled	

Page 1 of 1 10 3 in total

4.1.2 Configuring a Voucher

Voucher > Manage Package Refresh Grid Full Screen

Add Package Package Name

Package Name	Description	Price	Max Concurrent Devices	Bind MAC	Period	Data Quota	Max Download Rate	Max Upload Rate	Action
1 dia	1 dia	70.00	1	Yes	1 Day	Unlimited	1 Mbps	1 Mbps	
3 dias	3 dias	70.00	1	Yes	3 Days	Unlimited	1 Mbps	1 Mbps	
4 dias	4 dias	70.00	1	Yes	4 Days	Unlimited	1 Mbps	1 Mbps	
Emergência	Voucher de emergência	0.00	1	Yes	2 Weeks	Unlimited	5 Mbps	5 Mbps	
Interno	Voucher interno	0.00	1	Yes	2 Weeks	Unlimited	10 Mbps	10 Mbps	
teste	teste	0.00	1	Yes	30 Minutes	Unlimited	Unlimited	Unlimited	
VIP	VIP	70.00	1	Yes	2 Weeks	Unlimited	10 Mbps	10 Mbps	

Page 1 of 1 10 7 in total

Voucher Refresh Copy Full Screen

Print Voucher Manage Package More ● Total Vouchers: 25436 ● Activated Vouchers: 0 ● Depleted Vouchers: 1588 Advanced Search

Voucher Code, Name/Ref, I

<input type="checkbox"/>	Voucher Code	Name/Ref	Package Name	Price	Period	Created at	Expired at	Devices	Bind MAC	Data Usage	Max Download Rate	Max
<input type="checkbox"/>	zvgtea	FarTest7	teste	0.00	30 Minutes	2019-06-26 14:06:57	2019-06-26 14:47:07	0/1	Yes	0 MB/Unlimited	Unlimited	
<input type="checkbox"/>	6cozg8	FarTest6	1 dia	70.00	1 Day	2019-06-26 13:45:14	2019-06-27 15:51:29	0/1	Yes	0 MB/Unlimited	1 Mbps	
<input type="checkbox"/>	d52oh7	test11	1 dia	70.00	1 Day	2019-06-26 12:27:37	2019-06-27 15:51:27	0/1	Yes	0 MB/Unlimited	1 Mbps	
<input type="checkbox"/>	zfmri7	FarTEST	teste	0.00	30 Minutes	2019-06-26 09:25:49	-	0/1	Yes	0 MB/Unlimited	Unlimited	
<input type="checkbox"/>	qj6tg3	1	1 dia	70.00	1 Day	2019-06-26 07:47:19	-	0/1	Yes	0 MB/Unlimited	1 Mbps	
<input type="checkbox"/>	vnlvvv	2	1 dia	70.00	1 Day	2019-06-26 04:05:26	-	0/1	Yes	0 MB/Unlimited	1 Mbps	
<input type="checkbox"/>	262rg7	-	Interno	0.00	2 Weeks	2019-06-25 20:25:59	2019-07-09 20:56:03	1/1	Yes	325 MB/Unlimited	10 Mbps	
<input type="checkbox"/>	14i2li	-	Interno	0.00	2 Weeks	2019-06-25 20:25:59	2019-07-09 21:26:10	1/1	Yes	64 MB/Unlimited	10 Mbps	
<input type="checkbox"/>	d5ybtF	-	Interno	0.00	2 Weeks	2019-06-25 20:25:59	2019-07-10 12:03:43	0/1	Yes	0 MB/Unlimited	10 Mbps	
<input type="checkbox"/>	2aw2j4	-	Interno	0.00	2 Weeks	2019-06-25 20:25:59	2019-07-13 21:38:30	0/1	Yes	0 MB/Unlimited	10 Mbps	

4.2 Ruijie EG Internet Gateway Reference Configuration

For basic provisioning configurations, see the *RG-EG Implementation Cookbook*.

https://www.ruijienetworks.com/support/documents/slide_75371

This document describes some key configurations only.

4.2.1 Creating a VLAN and a Corresponding Sub Interface

VLAN ID: * (Range: 1-4087)

IP Address: *

Submask: *

AnyIP: Enable

Reverse Path: Enable

Add

Sub Interface List

Sub Interface	VLAN ID	Interface Info	Bandwidth	ISP	Action
GigabitEthernet 0/2.102	102	IP Address: 10.2.0.1 Submask: 255.255.255.0	-	-	Edit Delete
GigabitEthernet 0/2.101	101	IP Address: 10.1.0.1 Submask: 255.255.128.0	-	-	Edit Delete
GigabitEthernet 0/2.100	100	IP Address: 10.0.0.1 Submask: 255.255.128.0	-	-	Edit Delete
GigabitEthernet 0/2.11	11	IP Address: 192.168.8.1 Submask: 255.255.248.0	-	-	Edit Delete
GigabitEthernet 0/2.10	10	IP Address: 192.168.0.1 Submask: 255.255.255.0	-	-	Edit Delete

Show No.: Total Count: 5 First Previous 1 Next Last GO

4.2.2 Creating a DHCP Address Pool

Interface

Route/Load

DNS Settings

VPN

NAT/Port Mapping

DHCP

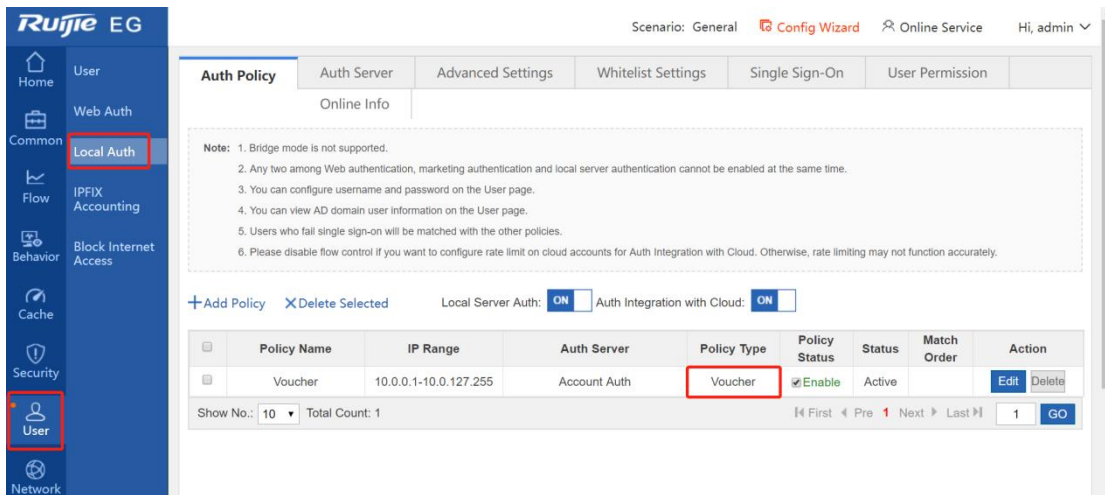
Settings Static IP Address User List

+ Add DHCP X Delete Selected DHCP O Excluded Address Range DHCP: ON

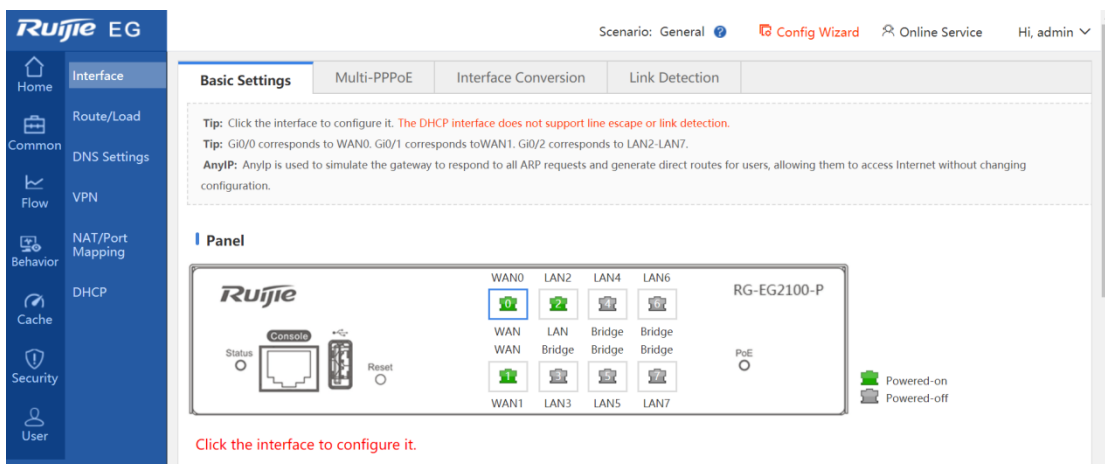
Name	IP Address Range	Default Gateway	Lease Time	DNS	Action
WPA2	10.2.0.1-10.2.127.254	10.2.0.1	Permanent	114.114.114.114	Edit Delete
One-click	10.1.0.1-10.1.127.254	10.1.0.1	Permanent	114.114.114.114	Edit Delete
Voucher	10.0.0.1-10.0.127.254	10.0.0.1	Permanent	114.114.114.114	Edit Delete
AP_management	192.168.8.1-192.168.15.254	192.168.8.1	Permanent	114.114.114.114	Edit Delete

Show No.: Total Count: 4 First Pre 1 Next Last GO

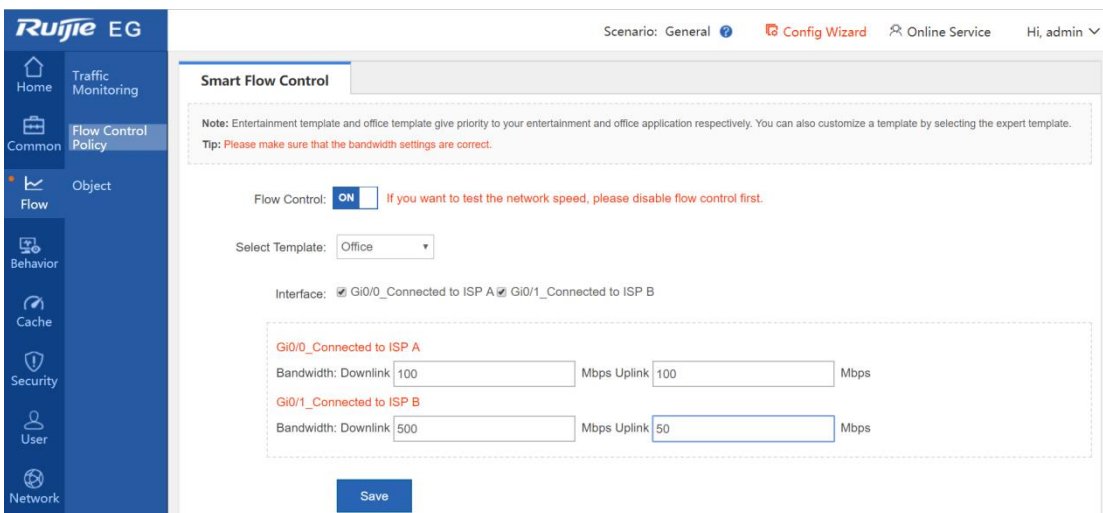
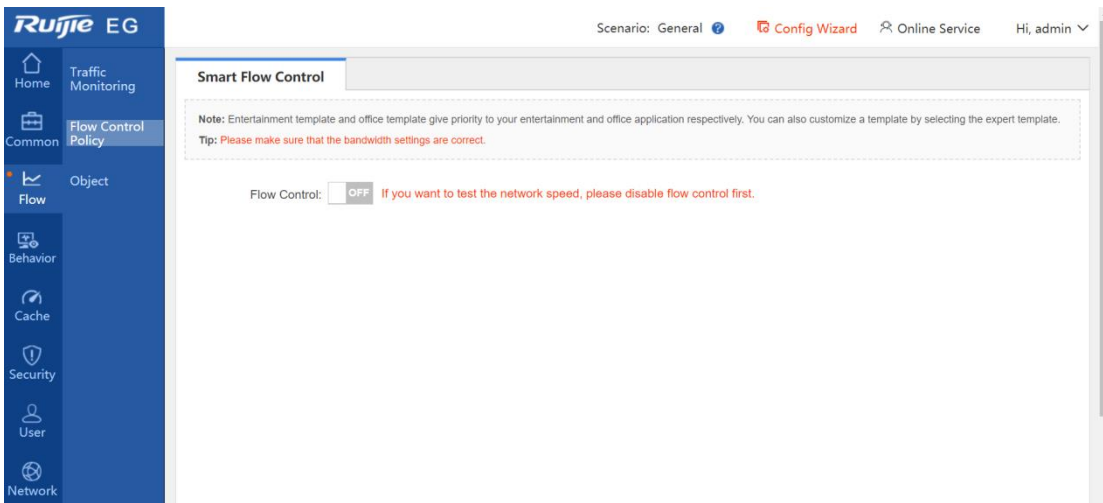
4.2.3 Configuring Local Authentication and Setting the Policy Type to Voucher



4.2.4 Checking Connection Statuses on Dual WAN Interfaces

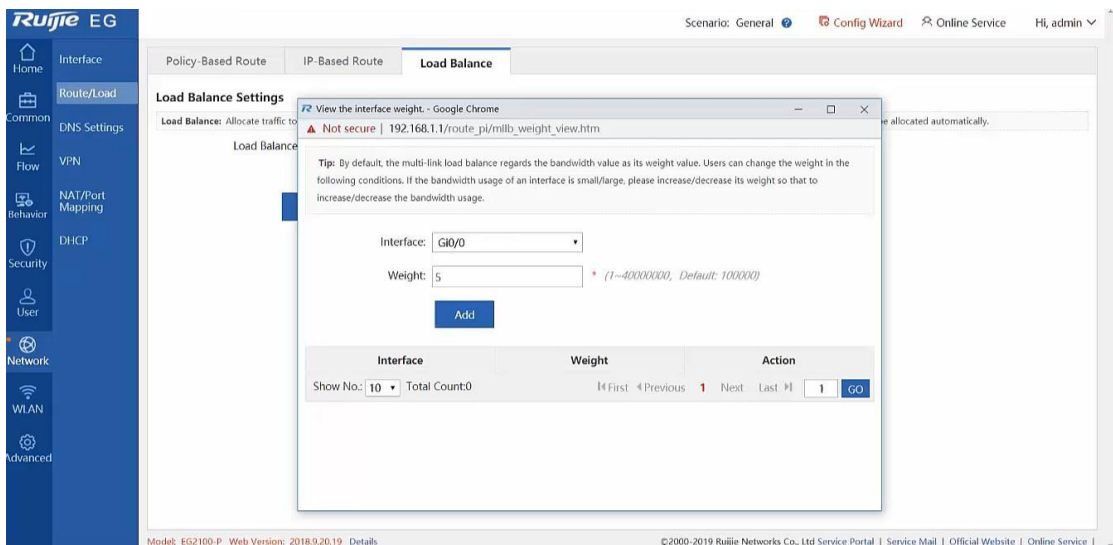
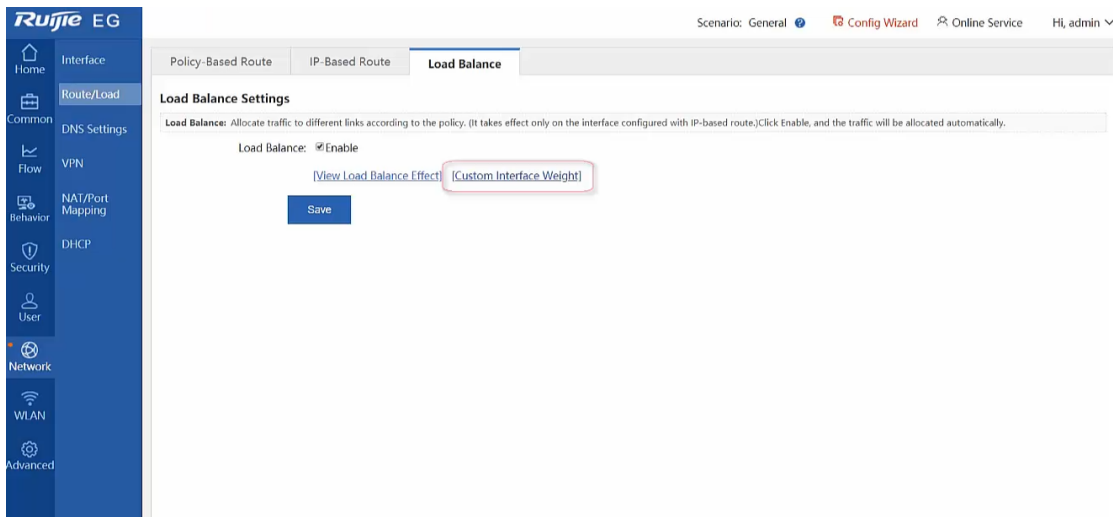
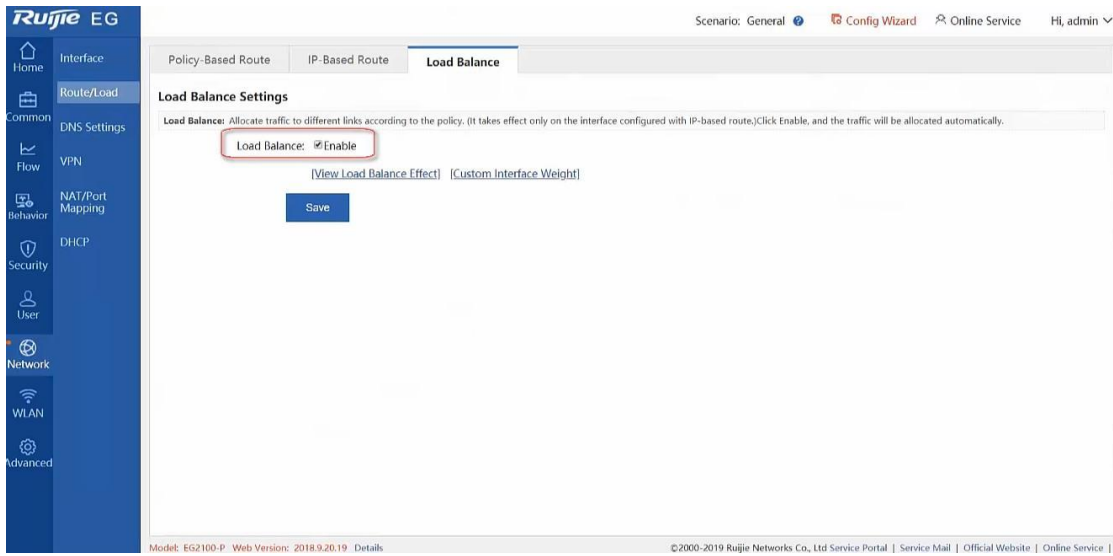


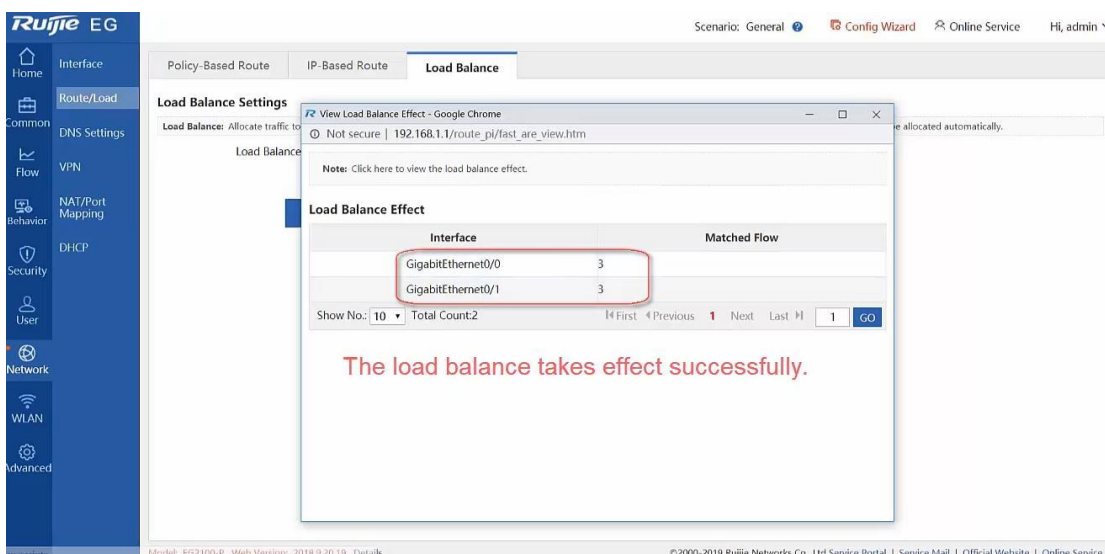
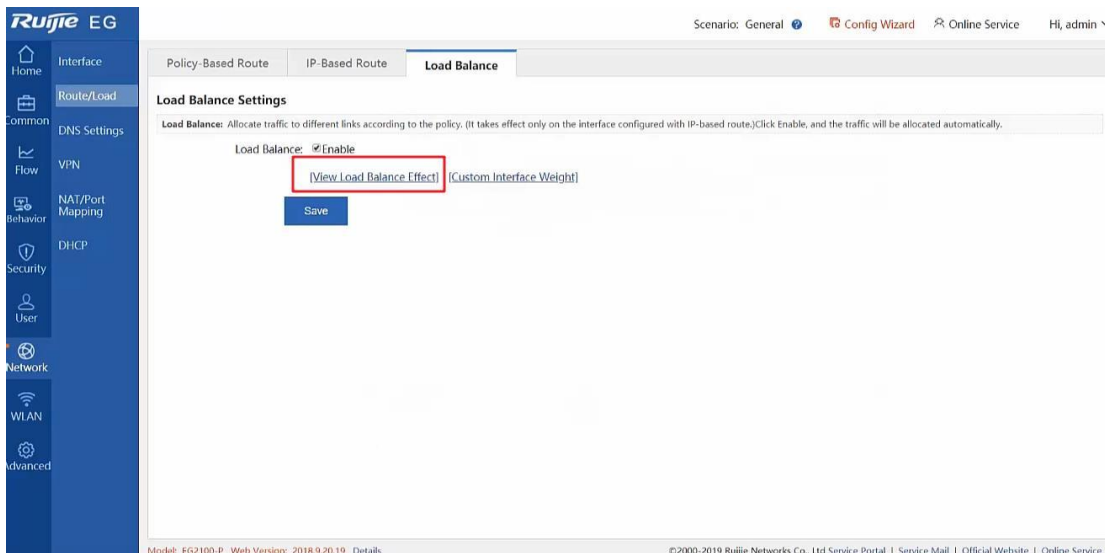
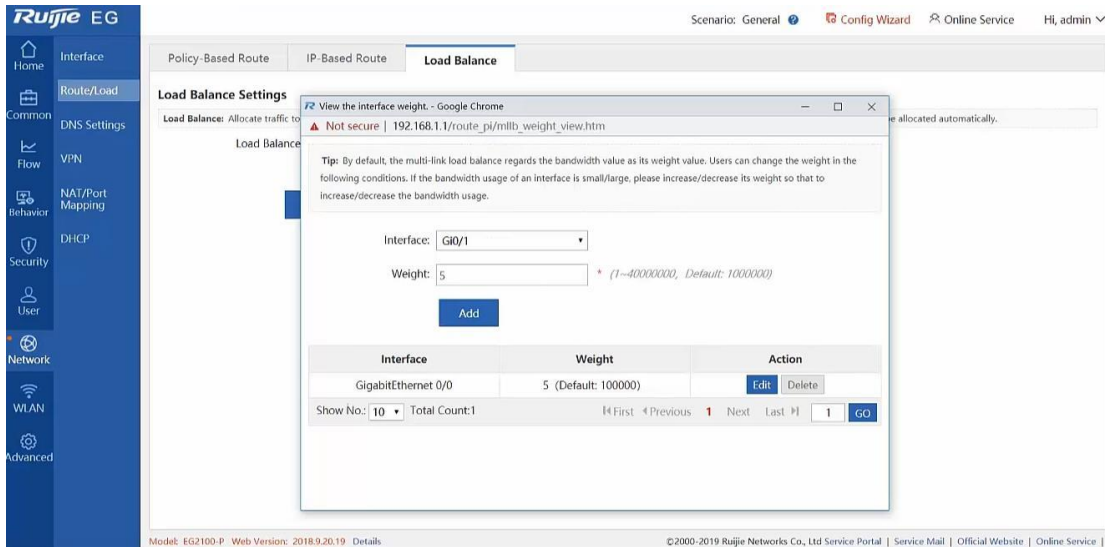
4.2.5 Enabling Flow Control, Selecting a Flow Control Template, and Setting Bandwidth of WAN Interfaces



4.2.6 Configuring Load Balancing for WAN Interfaces

For load balancing configuration, visit <https://www.ruijienetworks.com/support/video-1720>





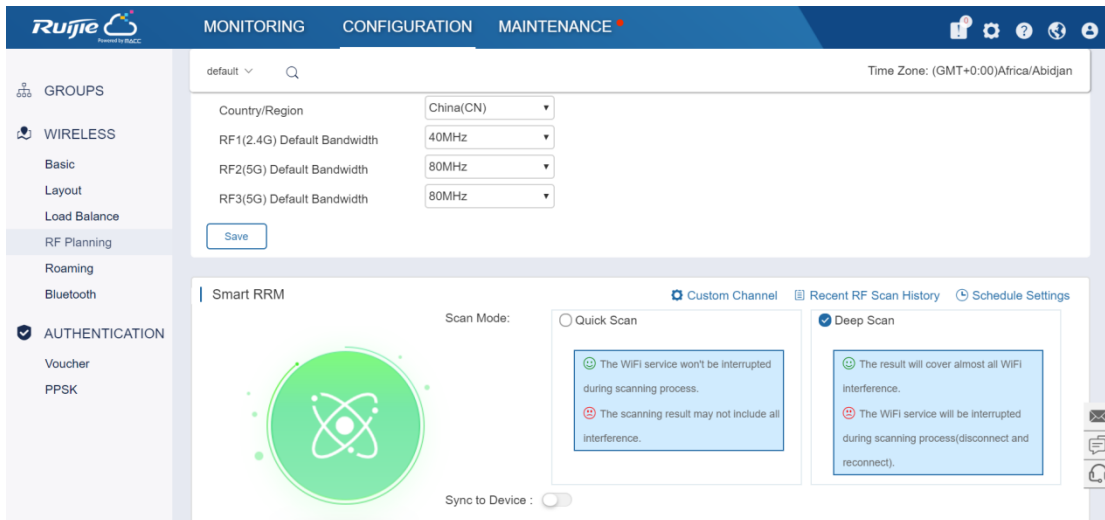
4.3 Switch Reference Configuration

(Note: the following vlan configuration is just for reference, please adjust accordingly in project.)

```
S2910-24GT4XS-UP-H#config
S2910-24GT4XS-UP-H(config)#vlan 10
S2910-24GT4XS-UP-H(config-vlan)#vlan 11
S2910-24GT4XS-UP-H(config-vlan)#vlan 100
S2910-24GT4XS-UP-H(config-vlan)#vlan 101
S2910-24GT4XS-UP-H(config-vlan)#vlan 102
S2910-24GT4XS-UP-H(config)#int gi 0/24
S2910-24GT4XS-UP-H(config-if-GigabitEthernet 0/24)#ip dhcp snooping trust
S2910-24GT4XS-UP-H(config-if-GigabitEthernet 0/24)#switchport mode trunk
S2910-24GT4XS-UP-H(config-if-GigabitEthernet 0/24)#switchport trunk allowed vlan only 10-11,100-102
S2910-24GT4XS-UP-H(config-if-GigabitEthernet 0/24)#exit
S2910-24GT4XS-UP-H(config)#ip dhcp snooping
S2910-24GT4XS-UP-H(config)#int ran gi 0/1-23
S2910-24GT4XS-UP-H(config-if-range)#sw
S2910-24GT4XS-UP-H(config-if-range)#switchport pro
S2910-24GT4XS-UP-H(config-if-range)#switchport protected
S2910-24GT4XS-UP-H(config-if-range)# switchport trunk native vlan 11
S2910-24GT4XS-UP-H(config-if-range)# switchport trunk allowed vlan only 10-11,100-102
S2910-24GT4XS-UP-H(config-if-range)#end
S2910-24GT4XS-UP-H#
S2910-24GT4XS-UP-H#wr
```

4.4 Wireless Optimization Configuration

Targeted wireless optimization is required after deployment to improve wireless Internet access experience of users in high-density scenarios. The automatic RF planning function of Ruijie Cloud can be used to automatically optimize APs on the entire network.



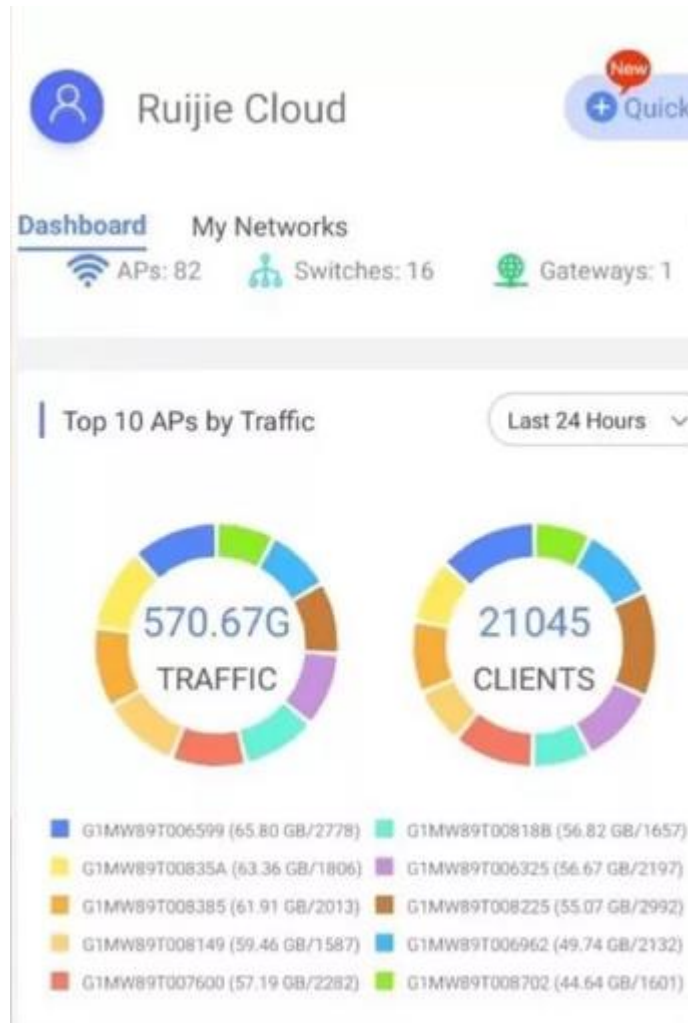
5 Management and Maintenance

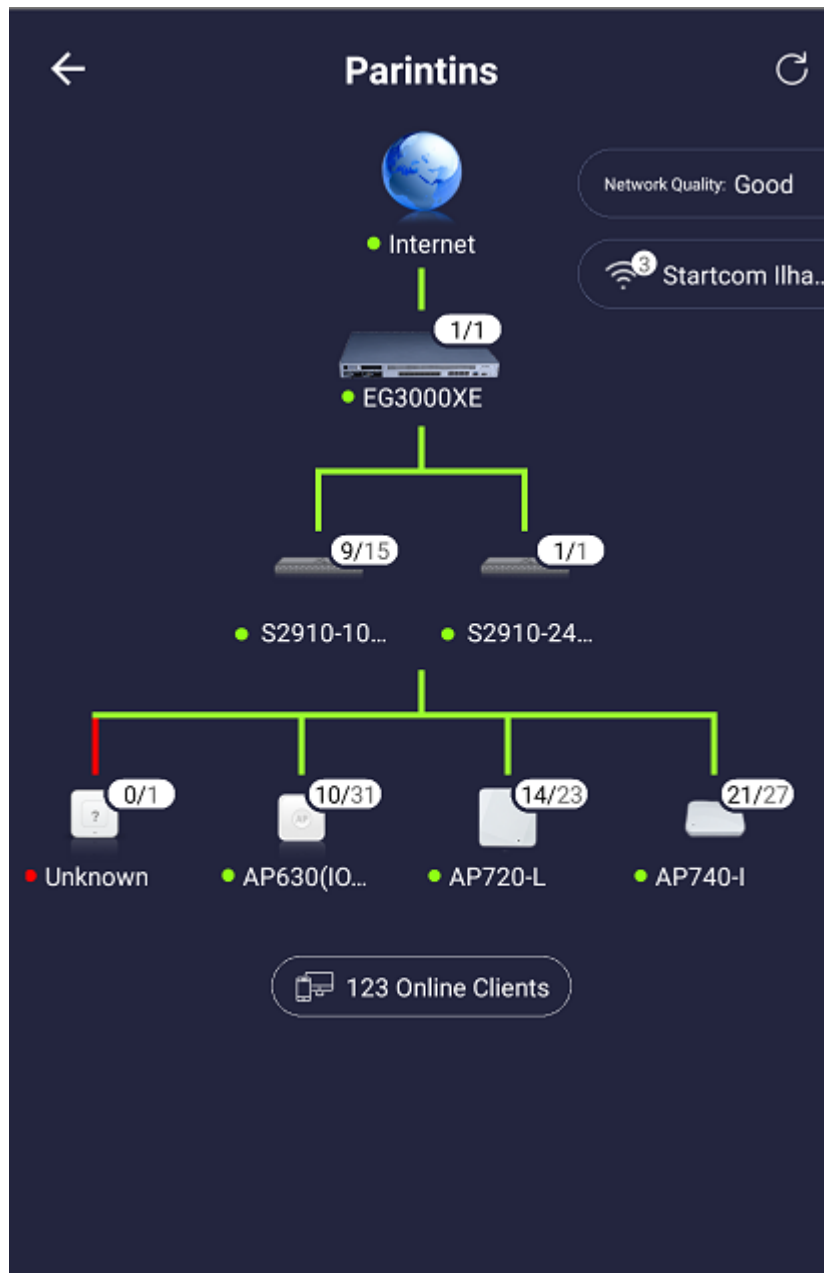
5.1 Ruijie Cloud APP

The Ruijie Cloud APP (downloaded from Google's or Apple's APP store) can be installed on mobile phones of administrators, so that the administrators can perform basic maintenance anytime anywhere, for example, view, optimize, modify configuration of, and add devices to the current network, and can upgrade network devices anytime anywhere. In this way, management and maintenance efficiency can be significantly improved, thereby ensuring Internet access experience of users.

5.2 Instructions for Use

For instructions for use, visit <https://www.ruijienetworks.com/support/video-1713>





6 Conclusion

For high-density wireless network projects, the Ruijie Cloud high-density Wi-Fi network solution provides access control for all devices on the cloud and can speed up portal display by using EG Internet Gateway local authentication, thereby increasing the user access speed and ensuring superb Internet access experience for users. In addition, Ruijie Cloud APP is used by O&M personnel to detect an existing network, upgrade devices, and optimize configurations anytime anywhere, thereby achieving optimal wireless network experience. Moreover, dual WAN interfaces are used to secure stable running of the wireless network at the conference site in case of a network line exception, thereby ensuring Internet access performance of wireless STAs at the entire conference site and guaranteeing a good reputation of the

whole project.

7 References

- Ruijie Cloud Cookbook V1.4
https://www.ruijienetworks.com/support/documents/slide_75464
- Ruijie Cloud Product Videos
<https://www.ruijienetworks.com/product/Video-1638/>
- RG-AP630 Series Access Point Hardware Installation and Reference Guide V2.0
<https://www.ruijienetworks.com/resources/preview/75447>
- RG-Switch Implementation Cookbook V1.1
https://www.ruijienetworks.com/support/documents/slide_75280
- RG-EG Implementation Cookbook (V1.0)
https://www.ruijienetworks.com/support/documents/slide_75371
- EG-EG Product Videos
<https://www.ruijienetworks.com/product/Video-1690>
- Ruijie EG Security Gateway datasheet_EG2100P EG3250
<https://www.ruijienetworks.com/resources/preview/75394>
- RG-EG2100-P V2 Hardware Installation and Reference Guide
<https://www.ruijienetworks.com/resources/preview/75320>
- Site Survey User Guide:
<http://ruijienetworks.com/service/document/read/58323>