Ruijie Networks – Innovation Beyond Networks

SCN Solution Cookbook (V1.0)

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Preface

Audience

- Network Engineers
- Network Administrator

Obtain Technical Assistance

- Ruijie Networks Websites: http://www.ruijienetworks.com
- Ruijie Service Portal: http://caseportal.ruijienetworks.com

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Revision History

Date	Change contents	Reviser
2018.7	Initial publication V1.0	Ruijie GTAC
2018.7	Adjust the overall structure of the cookbook Delete some content that doesn't fit with the overseas scenerio	Ruijie GTAC

Content

1 Solution Implementation Procedure

1.1 Preparation Before Implementation

1.1.1 Customer Information Collection

1.1.1.1 Confirmation of Project Progress

1. **Project handover:** Obtain the pre-sales solution information of the project from the pre-sales personnel, to understand the main planning of the customer network. Consider the available project implementation solution based on the equipment list and equipment delivery status.
2. **Confirmation of implementation environment:** Ensure that preparation of the peripheral environment for project implementation is completed, including equipment room construction, power supply (UPS or mains), and cabling of optical fibers/network cables, to guarantee the implementation progress.

1.1.1.2 Survey and Collection of Customer Requirement Information

Before the implementation, it is necessary to fully understand the customer's onsite service application requirements and network construction/reconstruction requirements. Collect information based on the customer's routine service usage and fully understand the customer's basic and special service requirements, to identify risks and make plans in advance based on the demarcation and limitation of the solution. A full understanding of information can provide necessary basis for the development of the implementation solution.

The information to be collected falls into the following categories:

1. Network status:

- Network topology information: includes the actual topology of the live network, locations of network equipment and servers, configurations of live network equipment (for in-depth analysis of the live network), and IP address and route planning information of live network equipment (route planning and routing table details).

2. Service application status:

- The following table describes the current service application, user scale, and network system operation & maintenance (O&M).

Level-1 Directory	Level-2 Directory	Refined Service	Information to Be Collected
Service application status	Office service	OA, mail, FTP, DNS, and DHCP	Information about whether the OA, mail, and FTP applications have extranet access requirements, have traffic guarantee, and allow access to the intranet or VPN environment
	Scientific research	Scientific research	Routing mode of scientific research websites or resource

	& teaching	websites	queries
		Multimedia teaching and office	Information about whether the conventional client or virtual space system based on the cloud host is used in the multimedia classroom
		Online education	Information about whether the campus network provides online education resources, whether the traffic is transmitted over the CERNET or the networks of the three major operators, and whether the bandwidth is largely consumed
	Entertainment	Browser-based entertainment, WeChat, QQ, Taobao, games, and videos	Major online behavior of students, whether rate limiting is performed on students, and whether content-accelerated devices are deployed for high-bandwidth applications
	Campus multicast	720p/1080p	Number of video program sources in campus network multicast applications, whether the definition standard is HD or ultra HD, and whether video freezing exists at peak hours
	IPv6	Resource requirements for accessing CERNETII	Information about whether the campus network provides IPv6 resource services, whether an egress exists on CERNET II, which IPv6 resource services are available, and whether a network node exists for IPv6-based independent interworking with other campus networks.
User scale	User type	Leader, teaching staff and relative, student, and visitor	Information about whether the campus network user types are missing, how to assign IP addresses for these users, access mode, and accounting mode
	User count	Scale	Number of users in the campus network and number of online users on the authentication server at peak hours
	Client type	Smart clients, such as the computer, mobile phone, and tablet	With more access clients and more diversified client types, the number of online users at peak hours poses higher pressure on the core and egress devices. Customers are concerned about security control, authorization, authentication, IP address assignment, behavior auditing, and location of clients.
		All-in-one cards and dumb clients, such as the printer, water meter, and environment monitoring instrument	

		Video monitoring and multimedia experiment equipment	
Network system O&M status	Information center	Information system and network sources	Information about whether the school has an independent information center, how responsibilities are divided between the information center and network center, and major concerns of the information center and network center
	Network center	O&M system integration	Information about whether a unified network management platform is configured for routine O&M and device management, and whether there are secondary development requirements for working with other application systems in the school
	Establishment and maintenance status	Self-establishment & self-maintenance, external establishment & external maintenance, and co-establishment & co-maintenance	Campus network types and information about how to maintain campus networks

3. **Basic configuration of the server:** includes the server's CPU, memory, disks, network (check the provided server hardware based on the SAM+ system environment preparations to determine whether the SAM+ and ePortal requirements are met), operating system and database versions (check the operating system and database versions based on the SAM+ system environment preparations to check whether the operating system and database meet the installation requirements), and SAM+ software version purchased by the customer (check whether the software version matches with the dongle and meets the project application requirements).
4. **Earlier requirements from the customer:** Find out the requirements (check the function support status in the scenario based on the higher education industry solution), evaluate whether the requirements can be met ahead of time, and check whether the requirements are within the scope of the solution.
5. **Requirements for interconnecting with live network equipment:** Consider compatibility for interconnecting with the equipment of other vendors, such as the STP, AP aggregation, and SAM+ system.
6. **User scale in the campus network:** includes the number of areas, teaching buildings, dormitory buildings, Web authenticated users, 802.1x authenticated users, and MAB authenticated users.
7. **User groups of the customer:** includes the access authentication and accounting requirements for different types of user groups (mainly access control and accounting policies, preparing for the subsequent access control and associated accounting policies of user groups).
8. **Operation mode of the customer:** includes the user registration/deregistration process, payment mode, and reconciliation mode, which affect the whole network operation.

9. Special service application

- Confirm the processing requirements for the all-in-one card clients, monitoring clients, and dumb clients with the customer by checking:
- Whether the all-in-one cards are deployed in a private network, which requirements are imposed on solution deployment, whether IP addresses are fixed or automatically obtained, and whether IP address segments or VLANs are consistent or randomly set.
- Whether the door status control system is deployed in a private network and which deployment requirements are posed in the solution scenario.
- Whether the printer application is shared at layer 2 or layer 3.
- Whether a MAC forgery scenario occurs.

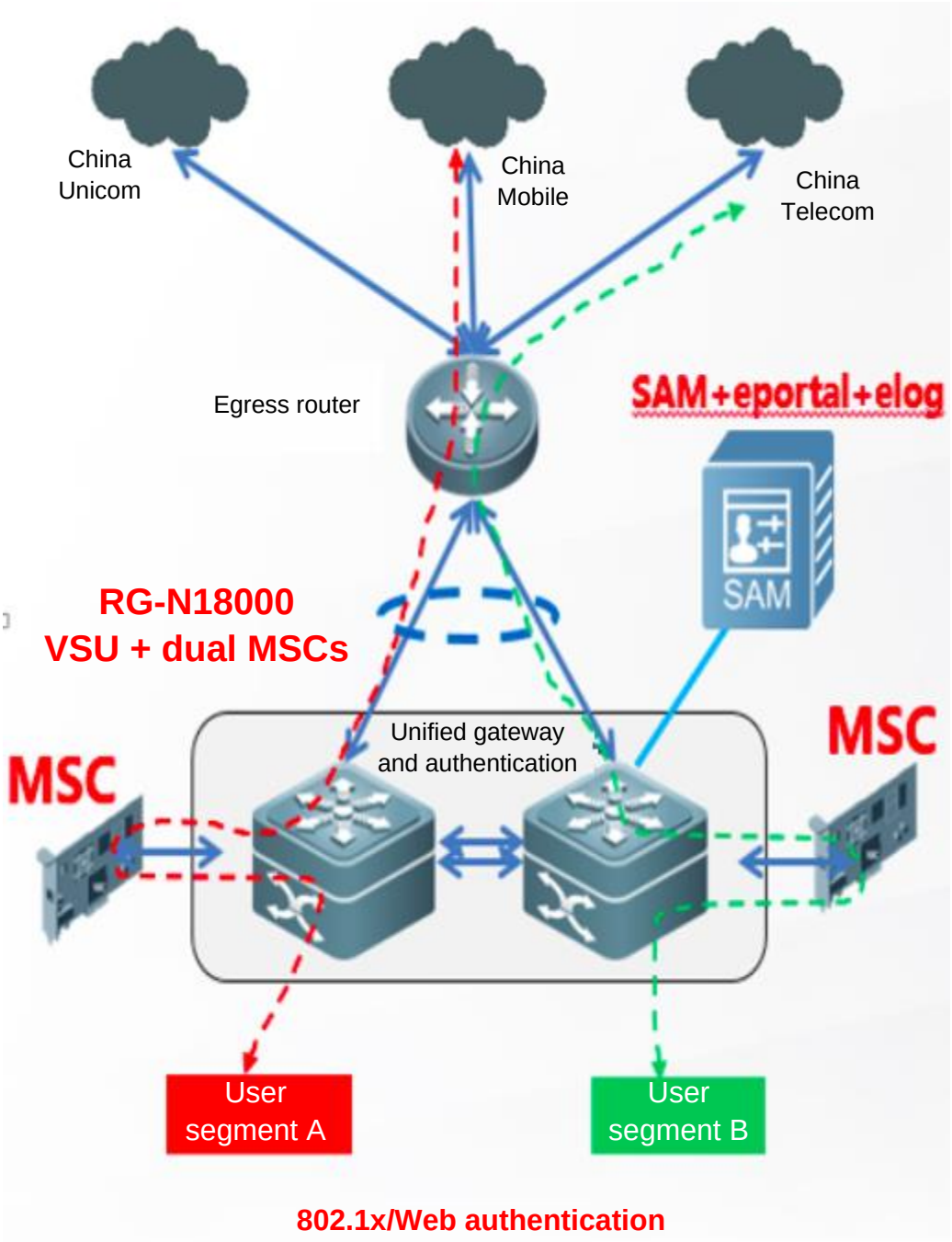
1.2 Deployment Model Selection

1.2.1 Layer 2 Access Isolation

1.2.1.1 Scenario Description

Area	Deployment and Feature Description
Core area	Two RG-N18000 switches form a VSU, both connecting to the egress area in the upstream direction. One MSC-ED card is inserted into each RG-N18000 to implement user traffic accounting and control. As the user gateway and authentication NAS device on the whole network, the RG-N18000 simultaneously supports Web authentication, wired 802.1x authentication, and MAB authentication.
Server area	A SAM+ server and an ePortal server are configured. The SAM+ server collects statistics on the user traffic from the MSC based on the accounting policy.
Aggregation area	A layer-2 transparent transmission device is connected to the upstream core devices in master/slave VSU mode via dual links. A trunk interface is configured in the aggregation area, but it is only used for layer-2 transparent transmission.
Access area	A protection port is configured to implement layer-2 isolation. VLAN segments need to be independently planned for special services (such as door status control, all-in-on card, and video monitoring) to distinguish from user service VLANs.

1.2.1.2 Scenario Topology



1.3 Check After Implementation

1.3.1 Software Information Check on the RG-N18000

1.3.1.1 Checking the CPU Usage

1. Method

```
Run the show cpu command in privileged EXEC mode to check the running status of the CPU:
HXJF-N18K#show cpu
==============================================
[Slot 1: M18000-24GT20SFP4XS-ED, Cpu 0]
CPU Using Rate Information
CPU utilization in five seconds:9.3%
CPU utilization in one minute:9.3%
CPU utilization in five minutes:9.3%
```

2. Criteria

(1) In the healthy state, the value of **CPU utilization in five minutes** should be less than 30%. Pay attention to risks if the CPU usage exceeds 60%.

(2) If a great number of configurations are made, a great deal of information is displayed, or the debugging command is configured on the device, the CPU usage may soar instantaneously (normal symptom). Stop the related operation or run the **undebug all** command.

1.3.1.2 Checking the Memory Usage

1. Method

```
HXJF-N18K#show memory
```

2. Criteria

```
p.p1 {margin: 0.0px 0.0px 0.0px 0.0px; text-align: justify; font: 10.5px Helvetica} span.s1
{font-kerning: none}
```

The memory usage should be less than 60%. Bearing more services may increase the memory usage. Pay attention to risks if the memory usage exceeds 80% and tends to continuously rise.

1.3.1.3 Checking Logs

1. Method

```
HXJF-N18K#show log
```

2. Criteria

```
p.p1 {margin: 0.0px 0.0px 0.0px 0.0px; text-align: justify; font: 10.5px Helvetica} span.s1
{font-kerning: none}
```

Check whether exceptions exist in logs, such as frequent up/down state switches of the interface, down state of the dynamic protocol, and alarms of higher severity.

1.3.1.4 Checking Configuration Information

1. Method

Run the **show run** command in privilege EXEC mode to check the switch configurations:

```
HXJF-N18K#show run
```

Pay attention to the following mandatory commands:

```
auth-mode gateway  //Enable the gateway mode.
ip radius source-interface (radius interface)  //Configure an interconnection interface for
communication between the RG-N18000 and server.
ip portal source-interface (portal interface)
offline-detect interval 15 threshold 0 //Configure no-traffic go-offline.
aaa authorization ip-auth-mode mixed   //Configure IP-based AAA authorization.
radius-server attribute nas-port-id format qinq   //Mandatory for the QinQ scenario
qinq termination pe-vlan 100-101   // Configure QinQ VLAN tag termination.
qinq termination ce-vlan 200 to 300
```

2. Criteria

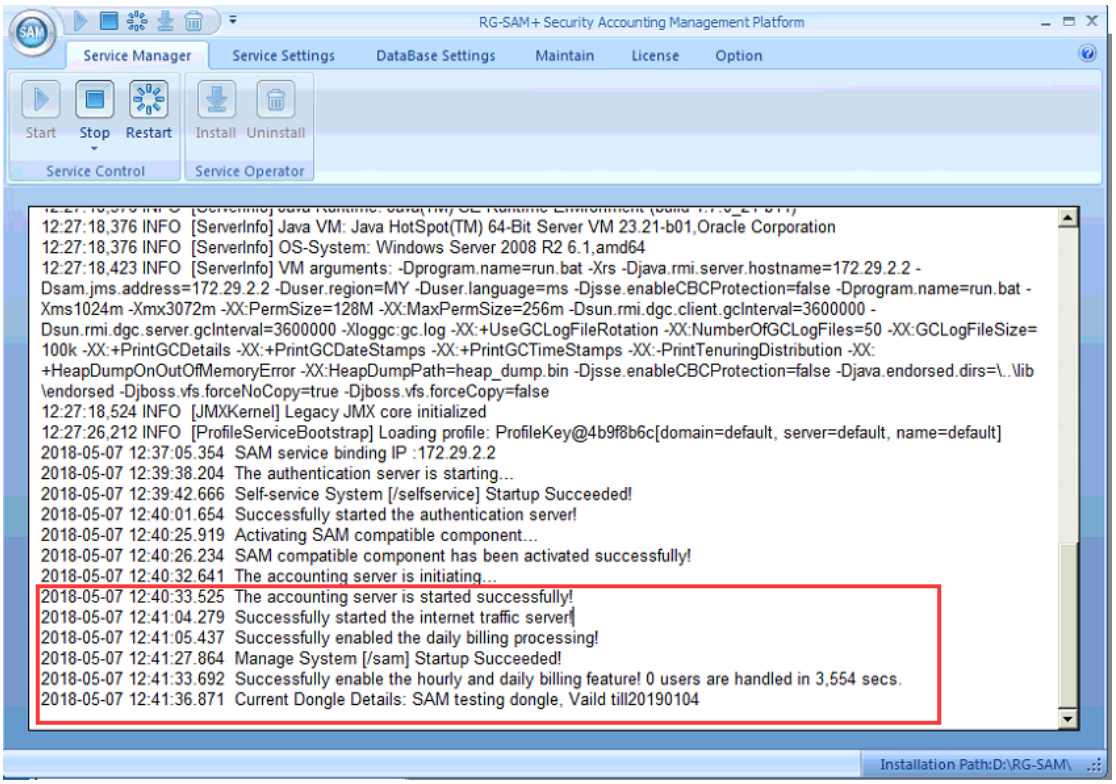
Check whether the deployed functions are consistent with the implementation solution, and whether the functions can be optimized.

1.3.2 Software Information Check on the SAM+ Server

1.3.2.1 Monitoring the Management Status

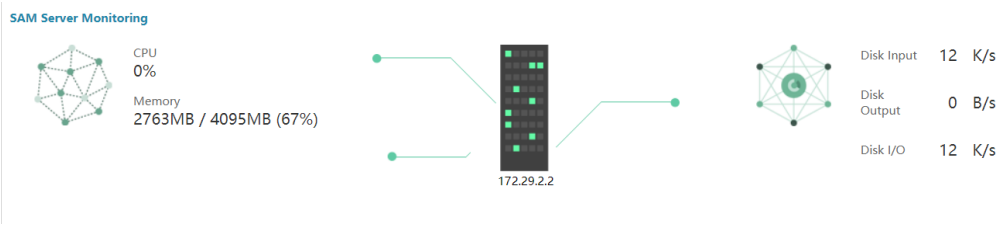
1. Method

Enable the service manager on the SAM+ server to check the running status:

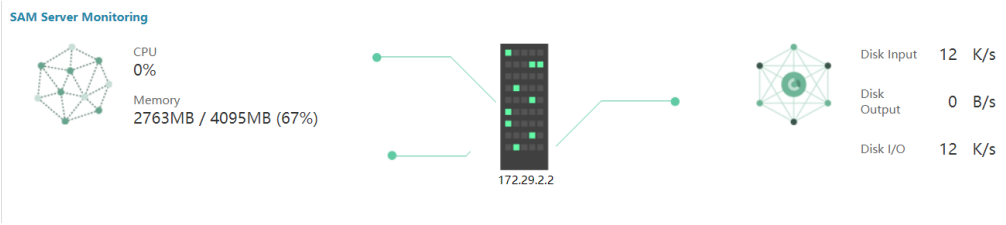


2. Criteria

For a standalone server, no error is prompted in the service manager. As shown in the preceding figure, normal prompt information includes: the system is started successfully, the SAM+ softdog type and validity period are checked, journals are recorded successfully, and a total of xxx users are processed.



1.3.2.2 Checking the CPU and Memory Usage

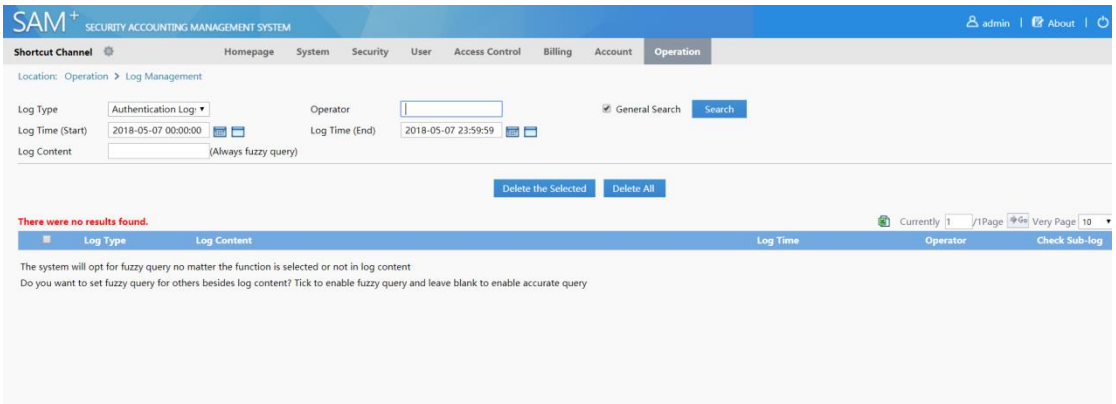


In the healthy state, the CPU usage should be less than 30%, and the memory usage less than 60%.

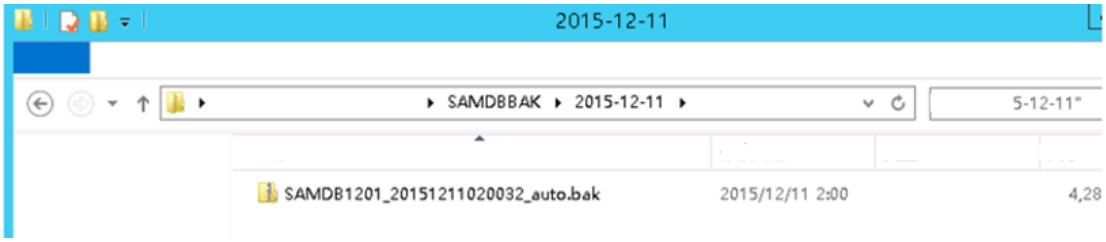
1.3.2.3 Checking O&M Logs

1. Method

(1) Enter the SAM+ management page and choose **Operation** > **Log** to check O&M logs.



(2) Enter the database backup directory to check sizes of backup files and disk space.



2. Criteria

(1) Ensure that the database shrinks properly.

(2) Ensure that database index fragments are organized properly.

(3) Ensure that the database is integral.

(4) Ensure that database parameters are normal.

(5) Ensure that the automatic database backup is normal.

(6) Ensure that database files are properly backed up. Ensure sufficient backup disk space to avoid backup failures.

1.3.2.4 Checking Solution Functions

Check whether the deployed functions are consistent with the implementation solution, and whether the functions can be implemented and optimized. For example:

1. Check whether the number of online authenticated users meets the expectation.
2. Check whether accuracy of traffic control meets the expectation.
3. Check whether the accounting policies are correct for different user types (such as the school director, teaching staff and their relatives, and student).
4. Check whether an account can log in on multiple clients.

5. Check whether different access modes match with different accounting policies.
6. Check whether the DHCP check in Web authentication succeeds.
7. Check whether users can log in via MAB authentication after the first Web authentication login.

1.3.3 Overall Network Running Check

1.3.3.1 Checking the Network Running Status

Perform a thorough check on the network running status, including the equipment check performed in the normal network running state and the function verification after network implementation:

1. Run the **show** command to check the running status of core device functions. For the regular operation commands, refer to the basic information check and spot check of access devices.
2. Run the **traceroute** command to check the network connectivity and whether data forwarding paths are correct. This check aims to test the consistency between the forward and return paths in the route design.

According to the configured function verification solution, perform link connection/disconnection and switch restart to test the application services, such as the connectivity test and download speed test, so as to verify the network reliability design.

3. Run the **ping** command to test the network delay and processing of large packets.
4. Check functions one by one according to the solution scenarios.
5. Check the actual service running status of users at peak hours.

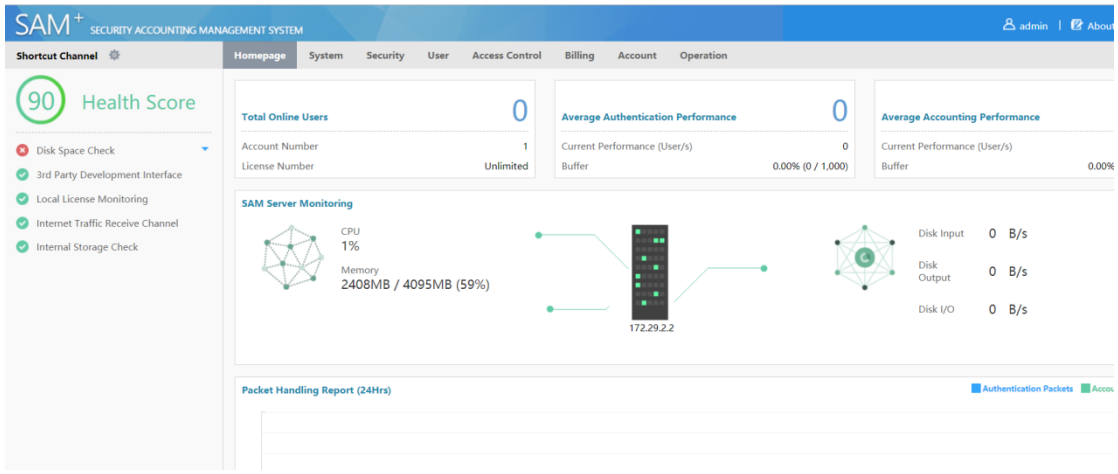
1.3.3.2 Checking the Device and System Running Statuses at Peak Hours

1. Check the running status of the RG-N18000 at peak hours.

```
Ruijie#show cpu      //The average CPU usage of the switch should be less than 30% in normal
cases.
Ruijie#show cpu-protect mboard
Ruijie#show cpu-protect           //Check whether the protocol rate exceeds the expectation and
protocol packets are dropped, to assist in locating the cause for high CPU usage.
Ruijie#show memory               //The memory usage of the switch should be less than 60% in
normal cases.
Ruijie#show arp counter         //Check the ARP aging time and whether the number of ARP entries
is normal.
Ruijie#show mac-address-table count //Check the number of MAC address tables on the network.
Ruijie#show ip route               //Check the routing table scale on the live network.
Ruijie#show web-auth user all     //Display Web authenticated users.
Ruijie#show dot1x sum              //Display 802.1x authenticated users.
```

2. Check the running status of the SAM+ server at peak hours.

Check the number of authenticated users on the SAM+ server, and whether the CPU usage and memory usage are normal.



1.3.4 Check Points for Important Time Guarantee

Guide for Checking Important Functional Indicators of the RG-N18000 on Simplistic Network for the Back-to-School Season

1.3.4.1 Regular Information Check

1.3.4.1.1 CPU

1.3.4.1.1.1 Command

show cpu

show cpu | inc postgres

1.3.4.1.1.2 Check Point

Check the CPU usage of the management module and line card, which should not be greater than 50%.

Check whether the CPU usage of an independent process approaches 12.5%. If yes, risks may exist and independent analysis and evaluation are required.

```
N18014#show cpu
==============================================
[Slot 1/1: M18000-24GT20SFP4XS-ED, Cpu 0]
CPU Using Rate Information
CPU utilization in five seconds:45.8%
CPU utilization in one minute:41.7%
CPU utilization in five minutes:47.8%
```

```
NO        5Sec     1Min     5Min Process
   1    0.00%    0.00%    0.00% init
   2    0.00%    0.00%    0.00% kthreadd
   3    0.00%    0.00%    0.00% migration/0
   4    0.00%    0.00%    0.00% ksoftirqd/0
```

Check the CPU usage of the postgres process, which should not stay high.

```
N18014#sho
N18014#show cpu | inc postgres
 5920    0.00%    0.00%    0.00% postgres
 5945    0.00%    0.00%    0.00% postgres
 5947    0.00%    0.00%    0.00% postgres
 5948    0.00%    0.00%    0.00% postgres
 5949    0.00%    0.00%    0.00% postgres
 5953    0.00%    0.00%    0.00% postgres
 5954    0.00%    0.00%    0.00% postgres
 5955    0.00%    0.00%    0.00% postgres
 8101    0.00%    0.00%    0.00% postgres
 8103    0.00%    0.00%    0.00% postgres
N18014#
```

1.3.4.1.2 Memory

1.3.4.1.2.1 Command

show memory

1.3.4.1.2.2 Check Point

Check the memory usage, which should not be greater than 50%.

```
N18014#show mem
N18014#show memory
System Memory: 16777216KB total, 6370892KB used, 10406324KB free, 37.9% used rate
Used detail:   1849716KB active, 326060KB inactive, 146552KB mapped, 3885088KB slab, 390980KB core, 244292KB others

PID     Vsd     Text    Rss     Data    Stack   Total   Process
27065   0       928     584     656     84      4508    sleep
25272   0       104     1976    17856   84      22736   rl-cop/0
```

1.3.4.1.3 Interface Traffic

1.3.4.1.3.1 Command

show int counters rate up

show int usage up

1.3.4.1.3.2 Check Point

Check the port utilization, which should not be greater than 80%.

```
N18014#show int usage up
Interface                                Bandwidth   Average Usage    Output Usage     Input Usage
---------------------------------------- ----------- ---------------- ---------------- ----------------
GigabitEthernet 1/1/1                    100    Mbit 0.00028200%      0.00035400%      0.00021000%
GigabitEthernet 1/1/2                    1000   Mbit 0.139269600%     0.114220000%     0.164319200%
GigabitEthernet 1/1/12                   1000   Mbit 0.209825700%     0.192302800%     0.227348600%
GigabitEthernet 1/1/13                   1000   Mbit 0.430890150%     0.861780300%     0.000000000%
GigabitEthernet 1/1/15                   1000   Mbit 0.529817550%     0.044433600%     1.015201500%
GigabitEthernet 1/1/16                   1000   Mbit 0.017101449%     0.034164400%     0.000038500%
GigabitEthernet 1/1/17                   1000   Mbit 0.017012000%     0.034024000%     0.000000000%
GigabitEthernet 1/1/22                   1000   Mbit 0.000031099%     0.000031099%     0.000031099%
TenGigabitEthernet 1/1/47                10000  Mbit 0.0184451450%    0.0301233200%    0.0067669700%
TenGigabitEthernet 1/1/48                10000  Mbit 0.0000515800%    0.0000661100%    0.0000370500%
TenGigabitEthernet 1/7/3                 10000  Mbit 0.0000086200%    0.0000156200%    0.0000016200%
TenGigabitEthernet 1/7/4                 10000  Mbit 0.0000086200%    0.0000156200%    0.0000016200%
TenGigabitEthernet 1/7/5                 10000  Mbit 0.0000088150%    0.0000160100%    0.0000016200%
```

1.3.4.1.4 Error Frame

1.3.4.1.4.1 Command

show interface counters errors

1.3.4.1.4.2 Check Point

Check for the types of error frames.

```
N18014#show interface counters errors  | ex  0                    0                    0
Interface    UnderSize            OverSize             Collisions           Fragments
------------ -------------------- -------------------- -------------------- --------------------
Gi1/1/12     0                    3518181              0                    0
Interface    Jabbers              CRC-Align-Err        Align-Err            FCS-Err
------------ -------------------- -------------------- -------------------- --------------------
Gi1/1/1_     0                    1                    0                    1
```

1.3.4.1.5 Port Up/Down

1.3.4.1.5.1 Command

show interface link-state-change statistics

1.3.4.1.5.2 Check Point

Check whether a port becomes up and down repeatedly for more than 100 times.

```
N18014#show interface link-state-change statistics
Interface     Link state  Link state change times   Last change time
------------- ----------- ------------------------- -------------------
Gi1/1/1       up          1                         2017-08-08 12:31:26
Gi1/1/2       up          1                         2017-08-08 12:31:27
Gi1/1/3       down        2                         2017-08-10 17:44:05
Gi1/1/4       down        2                         2017-08-10 17:44:05
Gi1/1/5       down        2                         2017-08-10 17:44:05
Gi1/1/6       down        2                         2017-08-10 17:44:05
```

1.3.4.1.6 Loop

1.3.4.1.6.1 Command

show rldp loop-detect-log

1.3.4.1.6.2 Check Point

Check for loop logs.

```
N18014#show rldp loop-detect-log
rldp vlan loop log
-----------------------------------
 Tue Aug  8 12:47:02 2017
    VLAN 2222 is detected loop on interface GigabitEthernet 1/1/24.
 Tue Aug  8 12:49:03 2017
    VLAN 2222 is detected loop on interface GigabitEthernet 1/1/23.
 Tue Aug  8 12:50:59 2017
    VLAN 2222 is detected loop on interface GigabitEthernet 1/1/24.
```

1.3.4.1.7 Line Card

1.3.4.1.7.1 Command

show version slots

1.3.4.1.7.2 Check Point

Check whether the line card is normal.

```
N18014#
N18014#show version slots
  Dev Slot Port Configured Module            Online Module              Software Status
  --- ---- ---- --------------------------- --------------------------- ---------------
  1   1    48   M18000-24GT20SFP4XS-ED      M18000-24GT20SFP4XS-ED      ok
  1   2    0    none                        none                        none
  1   3    0    none                        none                        none
  1   4    0    none                        none                        none
  1   5    0    none                        none                        none
  1   6    0    none                        none                        none
  1   7    7    M18000-MSC-ED               M18000-MSC-ED               ok
  1   8    0    none                        none                        none
```

1.3.4.1.8 Temperature

1.3.4.1.8.1 Command

show temperature

1.3.4.1.8.2 Check Point

Check whether the temperature is normal.

```
N18014#show temperature
Switch 1: RG-N18014
Switch 2: RG-N18014
slot    card_type                          warning(C)  shutdown(C)      current(C)
------- ---------------------------------- ----------  -------------- ---------------------------
1/1     M18000-24GT20SFP4XS-ED             56          80  |100 |100   39|44|45|44|(68)|(55)
1/2     N/A                                N/A         N/A              N/A
1/3     N/A                                N/A         N/A              N/A
1/4     N/A                                N/A         N/A              N/A
1/5     N/A                                N/A         N/A              N/A
1/6     N/A                                N/A         N/A              N/A
1/7     M18000-MSC-ED                      56          80  |100 |100   45|40|38|47|(-64)|(55)
1/8     N/A                                N/A         N/A              N/A
```

1.3.4.1.9 Fan

1.3.4.1.9.1 Command

show fan

1.3.4.1.9.2 Check Point

```
fan-id  status      mode      speed-level
------  ----------  --------  -----------
1/1     fail        normal    N/A
1/2     ok          normal    N/A
1/3     fail        normal    N/A
1/4     ok          normal    N/A
1/5     ok          normal    N/A
2/1     ok          normal    N/A
2/2     ok          normal    N/A
2/3     ok          normal    N/A
2/4     ok          normal    N/A
2/5     ok          normal    N/A
```

1.3.4.1.10 VSU

1.3.4.1.10.1 Command

show switch virtual topology

show switch virtual link port

1.3.4.1.10.2 Check Point

Check whether the VSU topology and port traffic are normal.

```
N18014#show switch virtual topology
Introduction: '[num]' means switch num, '(num/num)' means vsl-aggregateport num.

Chain topology:
[1](1/1)---(2/1)[2]

Switch[1]: master, MAC: 1414.babe.f012, Description:
Switch[2]: standby, MAC: 00d0.f810.1010, Description:
N18014#

N18014#show switch virtual link port
switch 1:
Port                          AP    State Peer-port                  Rx                  Tx                  Upt
ime
-----------------------------------------------------------------------------------------------------------------
-----
TenGigabitEthernet 1/1/47     1     OK    TenGigabitEthernet 2/4/3   53889149            2029005154531       3d,
2h,8m
TenGigabitEthernet 1/1/48     1     OK    TenGigabitEthernet 2/4/4   533083              849009              3d,
2h,8m

switch 2:
Port                          AP    State Peer-port                  Rx                  Tx                  Upt
ime
-----------------------------------------------------------------------------------------------------------------
-----
TenGigabitEthernet 2/4/3      1     OK    TenGigabitEthernet 1/1/47  2029005154743       53889239            3d,
2h,8m
TenGigabitEthernet 2/4/4      1     OK    TenGigabitEthernet 1/1/48  849009              533083              3d,
2h,8m
```

1.3.4.1.11 Packets Destined for the CPU

1.3.4.1.11.1 Command

show cpu-protect

1.3.4.1.11.2 Check Point

Check whether the number of packets destined for the CPU is normal, whether the rate of important packets is normal, and whether packet loss occurs.

Pay attention to the following packet types: arp, dhcp, dot1x, web-auth, web-auths, and rldp.

```
N18014#show cpu-p
N18014#show cpu-protect
%cpu port bandwidth: 200000(pps)
Traffic-class   Bandwidth(pps)  Rate(pps)  Drop(pps)
--------------  --------------  ---------  ---------
 0              40000           10         0
 1              40000           2          0
 2              150000          0          0
 3              40000           171        0
 4              40000           0          0
 5              40000           0          0
 6              40000           0          0
 7              40000           0          0
Packet Type         Traffic-class  Bandwidth(pps)  Rate(pps)  Drop(pps)  Total      Total  Drop
------------------  -------------  --------------  ---------  ---------  ---------  -----------
bpdu                6              256             0          0          0          0
arp                 1              36000           2          0          2265576    0
tpp                 6              256             0          0          0          0
dot1x               2              0               0          0          0          0
gvrp                5              256             0          0          0          0
rldp                5              2560            0          0          145192     0
lacp                5              512             0          0          0          0
rerp                5              256             0          0          0          0
reup                5              256             0          0          0          0
lldp                5              1536            0          0          36062      0
cdp                 5              1536            0          0          0          0
dhcps               2              20000           0          0          9746962    0
dhcps6              2              20000           0          0          0          0
dhcp6-client        2              20000           0          0          0          0
dhcp6-server        2              20000           0          0          3345       0
dhcp-relay-c        2              20000           0          0          0          0
```

1.3.4.1.12 Log

1.3.4.1.12.1 Command

show logging

1.3.4.1.12.2 Check Point

Check whether logs are abnormal.

1.3.4.2 Information Check Specific to Simplistic Network

1.3.4.2.1 DHCP Allocation and Conflict-incurred Failure

1.3.4.2.1.1 Command

show ip dhcp binding

show ip dhcp pool

show ip dhcp conflict

1.3.4.2.1.2 Check Point

Check the total number of IP addresses allocated via DHCP and the number allocated IP addresses in each address pool.

```
N18014#show ip dhcp binding

Total number of clients    : 0
Expired clients            : 0
Running clients            : 0

IP address        Hardware address       Lease expiration          Type
N18014#
```

```
N18014#show ip dhcp pool
Pool  name        Total      Distributed  Remained   Percentage
------------  -----------  -----------  --------   ----------
mypool0       0            0            0          0.00000
N18014#
```

Check the status of conflict-incurred failures.

```
N18014#show ip dhcp conflict
IP address      Detection Method
N18014#
N18014#
```

1.3.4.2.2 Number of ARP/MAC Addresses

1.3.4.2.2.1 Command

show arp count

debug bridge mac

show mac count

undebug all

1.3.4.2.2.2 Check Point

Check the number of static ARP/MAC addresses, which should be equal to the total number of authenticated users.

Check the number of ARP addresses, which should be equal to that of IP addresses allocated via DHCP (in the case without static IP addresses).

```
N18014#show arp counter
ARP Limit:                    170000
Count of static entries:      30001
Count of dynamic entries:     21008 (complete: 21007  incomplete: 1)
Total:                        51009
```

```
N18014#debug bridge mac
N18014#show mac count
051038: *Aug 11 14:54:27: N18014 %MAC-7-SERVER_DEBUG: Remain(97989): Total(128000), SS-origin-count(10), BRI-origin-count(30001)
051039: *Aug 11 14:54:27: N18014 %MAC-7-SERVER_DEBUG: Local   Address Count  : 64
Dynamic Address Count  : 10
Static  Address Count  : 0
Filtering Address Count: 0
Total Mac Addresses    : 10
Total Mac Address Space Available: 97989
N18014#und all
All possible debugging has been turned off
```

Quantity of static MAC addresses

1.3.4.2.3 ND Entry

1.3.4.2.3.1 Command

show ipv6 neighbors statistics

1.3.4.2.3.2 Check Point

Check the number of ND entries:

Entries: not greater than three times the number of ARP entries.

Probe: not greater than 1000.

Incomplete: not greater than 1000.

```
N18014#show ipv6 neighbors statistics

Memory: 11648 bytes
Entries: 16
  Static: 0,Dynamic: 6,Local: 10
  Incomplete:0, Reachable:11, Stale:5, Delay:0, Probe:0
N18014#
```

1.3.4.2.4 Status of RADIUS Server and Portal Server

1.3.4.2.4.1 Command

show web-auth portal

show radius server

1.3.4.2.4.2 Check Point

Check whether the status of the portal server is **Enable**.

```
N18014#show web-auth portal
Portal Servers Settings:
-------------------------------
  Ip:          192.168.1.7
  Key:         ruijie
  ref:         1

 portalv2 list show
-------------------------------
  Ip:            192.168.1.7
  port:          50100
  ref:           1
  URL format:    ruijie
  Status:        Enable
N18014#
```

Check whether the status of the RADIUS server is **Active**.

If the **timeouts** values of **Authen/Author** are high, the authentication may take a long time or the authentication fails.

If the **timeouts** value of **Account** is high, check whether abnormal logs exist on the SAM+ server.

```
N18014#show radius server

Server IP:     192.168.1.13
Accounting Port:  1813
Authen  Port:     1812
Test Username:    <Not Configured>
Test Idle Time:   60 Minutes
Test Ports:       Authen and Accounting
Server State:     Active
    Current duration 4650s, previous duration 0s
    Dead: total time 0s, count 0
    Statistics:
        Authen: request 11, timeouts 0
        Author: request 11, timeouts 0
        Account: request 114, timeouts 100
```

1.3.4.2.5 Number of 802.1x Authenticated Users and Failure Events

1.3.4.2.5.1 Command

show dot1x

show dot1x authmng abnormal

1.3.4.2.5.2 Check Point

Check the number of 802.1x users.

```
N18014#show dot1x

802.1X Status:                  enabled
Authentication Mode:            eap
Total User Number:              3(exclude dynamic user)
Authed User Number:             3(exclude dynamic user)
Dynamic User Number:            0
Pending User Number:            0
Re-authen Enabled:              disabled
Re-authen Period:               3600 sec
Quiet Timer Period:             10 sec
Tx Timer Period:                3 sec
Supplicant Timeout:             10 sec
Server Timeout:                 5 sec
Re-authen Max:                  3 times
Maximum Request:                3 times
Private supplicant only:        disabled
Client Online Probe:            disabled
Eapol Tag Enable:               disabled
Authorization Mode:             mixed
Hello Interval:                 20 Seconds (default 20s)
Hello Alive:                    250 Seconds (default 250s)
```

Check for abnormal events in 802.1x authentication.

```
N18014#show dot1x authmng abnormal
Time            Mac             AuthTime   AaaTout ReqIdTout ReqTout RsnaNtfy StrNtfy Type        Reason             Rs
   User
--------------- --------------- ---------- ------- --------- ------- -------- ------- ----------- ------------------ --
-- ----------
3 .11 15:20:59 0040.6400.0044 24         0       0         0       0        0       D1X_AUTH    aaa reject         0
3m 004064000044
3 .11 15:20:59 1414.4b3c.7702 0          0       0         0       0        0       D1X_AUTH    valid ip mab       0
3m
3 .11 15:23:56 0040.6400.0044 60         0       0         0       0        0       D1X_AUTH    aaa reject         0
3m 004064000044
3 .11 15:26:45 0040.6400.0004 0          0       0         0       0        0       D1X_OFFLINE no flow            0
3m 004064000004
3 .11 15:38:16 0020.6402.0001 0          0       0         0       0        0       D1X_OFFLINE no flow            0
3m 002064020001
3 .11 15:38:16 0020.6402.0002 0          0       0         0       0        0       D1X_OFFLINE no flow            0
3m 002064020002
3 .11 15:38:16 0020.6402.0000 0          0       0         0       0        0       D1X_OFFLINE no flow            0
```

1.3.4.2.6 Number of Web Authenticated Users and Failure Events

1.3.4.2.6.1 Command

show web-auth user all

show web-auth authmng abnormal

1.3.4.2.6.2 Check Point

Check the number of Web authenticated users.

```
N18014#show web-auth user all
Current user num: 1, online 1
Address         Online  Time Limit     Time Used      Status  Name               Terminal-type
--------------- ------- -------------- -------------- ------- ------------------ ----------------
100.0.46.166    On      240d 00:01:37  0d 00:17:26    Active  ceshi3             PC Windows 7
```

Check for abnormal events in Web authentication.

```
N18014#show web-auth authmng abnormal

record num:0, value:3000, max-num:1000, clock:1
N18014#
```

1.3.4.2.7 No-traffic Go-offline

1.3.4.2.7.1 Command

show run | in off

1.3.4.2.7.2 Check Point

Check whether only the VLAN-based no-traffic go-offline period is configured.

```
N18014#show run | in off
offline-detect interval 6 threshold 0
offline-detect interval 6 threshold 0 vlan 2001
N18014#
```

1.3.4.2.8 Number of Authentication-free VLANs

1.3.4.2.8.1 Command

show direct-vlan

1.3.4.2.8.2 Check Point

Check whether the number of authentication-free VLANs exceeds 50.

```
N18014#show direct-vlan
direct-vlan 192,1600-1601,2006-2007,2101-2102

Port        direct-vlan
--------    ----------------
Ag57        direct-vlan 333
N18014#
```

1.3.4.2.9 One-to-Many Mirroring

1.3.4.2.9.1 Command

show run | inc remote-span

show run | inc mac-loopback

show monitor

show switch virtual link port

show int usage up

1.3.4.2.9.2 Check Point

Check whether one-to-many mirroring is configured and whether a VSL has approximately full bandwidth.

If yes, it is necessary to take countermeasures, for example, change the mirroring mode (one-to-one mirroring to the layer-2 switch and flooding to multiple egresses), and change the VSL to 40 Gbps.

If no countermeasure is available, contact the TAC and R&D engineers.

1.3.4.2.10 AP Across Line Cards and Chassis

1.3.4.2.10.1 Command

show version slot

show agg sum

1.3.4.2.10.2 Check Point

Check whether an AP across line cards and chassis exists, and whether a VAC solution is used. If a VAC solution is used and the CPU usage of a line card exceeds 70%, contact the TAC and R&D engineers.

1.3.5 Network Authentication Health Check After Project Cutover

1.3.5.1 802.1x Authentication

```
DLUT-CORE-N18014#show dot1x authmng statistic
```

show 802.1x authentication information:

```
DOT1X current online number:..................18446744073709551615.
DOT1X historical max online number:...........0.
DOT1X aggregate online number:................0.
```

802.1x authentication statistics:

```
authentication number:.......................2322.
authentication success:......................0.
authentication success rate:.................0%.
  aaa reject                            : 49
  user logoff                            : 0
  conflict account                      : 0
  valid ip mab                          : 0
adjust authentication success rate:...........0%.
  request id timeout                     : 2258-------------->
  request timeout                         : 14--------------->
  aaa timeout                            : 1------------------>
  other timeout                          : 0-----------------> The network or server is unstable
according to the preceding four timeout items.
  ipam not allowed                       : 0---------------> AM rules are not met.
  ip band width fall                    : 0-----------------> IP/bandwidth authorization fails.
  set scc fall                          : 0------------------> SCC setting fails due to bottom
layer errors.
  author vlan fail                       : 0
  vid modify                            : 0
  prot user limit                        : 0--------------------> The number of users is limited
due to configuration errors.
  total user limit                       : 0------------------> The total number of users is
limited due to configuration errors.
  acct cache deny                        : 0--------------------> Accounting results are cached
slowly due to the unstable server or network.
  other security type                     : 0--------------------> Other security functions are
configured generally.
  close auth switch                       : 0-------------------> 802.1x authentication is
disabled globally.
  deny non-rg client                     : 0---------------------> Non-Ruijie clients are
filtered out.
```

```
  mab vlan deny                          : 0---------------------> The VLAN does not comply with
MAB VLAN configurations.
  valid ip                               : 0--------------------> No IP address is obtained.
  set acl fail                           : 0
  port down                               : 0
  not allow user                         : 0
authentication success rssi avgvalue:.........0dBm.
authentication fail rssi avgvalue:............0dBm.
```

802.1x offline statistics:

```
offline_total:...............................295.
  user logoff                             : 0
  server kickout user                      : 0
  no flow                                : 0-------------------> The user goes offline due to
no traffic.
  no ip                                  : 0-------------------> The user is forced to go offline
because it fails to obtain an IP address.
  session timeout                         : 0-------------------> The available online period
times out.
  flux out                               : 0-------------------> The traffic is used up.
  svr kickout user                       : 0
  hello timeout                           : 0-------------------> The client detection times
out.
  scc rollback                           : 0-------------------> SCC setting fails due to bottom
layer errors.
  mac rollback                           : 0-------------------> MAC setting fails due to bottom
layer errors.
  ip bandwith fail                        : 0-------------------> Authorization fails. Check
whether any configuration error exists.
  mng no port control                     : 0------------------->
  mng author change                       : 0
  mng allow user change                   : 0
  mng direct vlan change                  : 0
  mng clear cli                           : 0
  mng ipam change                         : 0
  mng staitc mac                         : 0
  mng filter mac                         : 0
  mng set mumab                           : 0
  mng mab vlan change                     : 0
  mng ip acct change                     : 0
  mng ctrl mode                           : 0
```

```
  mng vlan change                        : 0-------------------> The preceding items indicate
that configurations are changed.
  port move                              : 295
  vlan move                              : 0
  port-vlan move                         : 0------------------> The preceding items indicate
that migration occurs.
  invalid ip                             : 0
  port down                              : 0
  gsn fail                               : 0
  mab to 1x                              : 0-------------------> MAB authentication is replaced
by 802.1x authentication. Check whether 802.1x authentication is used by the user.
  mab to guest vlan                      : 0
  dhcp author fail                       : 0
  db recover fail                        : 0
  adb author fail                        : 0--------------------> The preceding VLAN
authorization items are generally not configured in the simplistic network environment.
  recover to scc fail                    : 0----------------------> SCC setting fails possibly
due to bottom layer errors.
  ha recover fail                        : 0----------------------> Hot backup recovery fails
possibly due to processing logic errors in 802.1x authentication.
  ip mab unset ip                        : 0
  s mab change                           : 0
  offline_by_auth:.............................0.
    request id timeout                   : 0
    request timeout                      : 0
    aaa timeout                          : 0
    other timeout                        : 0
    aaa reject                           : 0
    ipam not allowed                     : 0
    ip band width fall                   : 0
    set scc fall                         : 0
    user logoff                          : 0
    author vlan fail                     : 0
    vid modify                           : 0
    prot user limit                      : 0
    total user limit                     : 0
    acct cache deny                      : 0
    other security type                  : 0
    close auth switch                    : 0
    deny non-rg client                   : 0
    mab vlan deny                        : 0
```

```
    valid ip                            : 0
    set acl fail                        : 0
    port down                            : 0
    not allow user                      : 0
    conflict account                    : 0
    valid ip mab                        : 0-----------------> The preceding items indicate
failure statistics collected during the authentication.
```

1.3.5.2 MAB Authentication (Same as 802.1x Authentication)

1.3.5.3 Web Authentication

DLUT-CORE-N18014#show web-auth authmng statistics

Show web authentication information:

```
current online number:.................................3087.  --- Number of current online
users
historical max online number:...........................5071.  --- Historical maximum number
of online users
aggregate online number:................................344156.  --- Total number of
accumulative online users
```

Web authentication redirect statistics:

HTTP packet processing:

```
  number of users:.....................................12973993     --- Number of users
whose HTTP packets are processed
  number of HTTP packets received:.......................1543216156    ---  Number of HTTP
packets received
redirection time consumption for successful users:                  --- Time consumption for
redirection
  average time consumption:..............................58ms.
  aggregate time consumption:............................39285499875ms.
  number of less than half one second:...................663809946(98.738%).
  number of between half and one second:.................2082988(0.310%).
  number of more than one second:........................6402954.
Web authentication statistic:                                        -- Statistics related to
Web authentication
authentication processing:
  number of authentication requests received:............784127.
  number of reauthentication requests received:..........225537.
  number of error password:..............................391339.
  number of authentication failures:.....................48632(6.202%).
```

```
  AAA timeout:.........................................46736(96.101%).  ---  AAA
authentication times out due to the unstable network or server.
  authentication status timeout:.......................1(0.002%).       ---  Authentication
device timeout
  fail to set SCC:....................................0(0.000%).       ---  SCC setting
fails due to bottom layer errors.
  accounting reject:..................................0(0.000%).       ---  Rejection from
the accounting server
  accounting dev timeout:.............................0(0.000%).       ---  Accounting
device timeout
  user unexist:........................................1154(2.373%).    ---  The user does
not exist.
  portal timeout:.....................................0(0.000%).       ---  Portal server
timeout
  DHCPrelease pkt:....................................0(0.000%).       ---  No statistics
are collected for the following four items. Neglect them.
  sta move:...........................................0(0.000%).
  clear user:.........................................0(0.000%).
  config change:......................................0(0.000%).
  other:..............................................741.
```

Authentication time consumption for successful users:

```
  average time consumption:............................94ms.    ----  Time consumption for
authentication
  aggregate time consumption:..........................32609811ms.
  number of less than one second:......................341995(99.372%).
  number of between one and three second:..............667(0.194%).
  number of more than three second:....................1494(0.434%).
  number of less than one second(exclude server):........344121(99.990%).
  number of between one and three second(exclude server):6(0.002%).
  number of more than three second(exclude server):......29(0.008%).

Web authentication offline information:                          ---- Statistics related to Web
user go-offline
number of offline count:.............................341069.
  number of abnormal offline(rate):....................408(0.119%).
  number of portal timeout:............................408(100.000%).  --- The user goes
offline because the portal server does not respond, which is possibly resulted from an unstable
network or server.
  number of set fail:..................................0(0.000%).     --- SCC setting fails
due to bottom layer errors.
```

```
  number of link change:.............................0.             --- No statistics are
collected.
  no flow:...............................................277797.         --- The user goes
offline due to no traffic.
  kick off:..............................................23745.         --- The user is forced
to go offline by the server.
  dhcp release:..........................................8971.           --- The user goes
offline due to DHCP release.
  STA delete:............................................0.             --- The user is forced
to go offline.
  STA move:..............................................0.             --- The user goes
offline due to client migration.
  active offline:........................................15817.          --- The user goes
offline actively.
  session timeout:.......................................9975.           --- The user goes
offline because the available online period times out.
  cli clear:.............................................0.             --- The user goes
offline because the CLI command is cleared.
  no control:............................................0.             --- The user goes
offline because control is disabled.
  interface default:.....................................0.             --- The interface is
the default one.
  interface destroy:.....................................0.             --- The interface is
destroyed.
  interface add ap:......................................0.             --- The interface is
added to an AP.
  del ap:................................................0.             --- The interface is
deleted from an AP.
  dhcp ip check:.........................................0.             --- The user goes
offline due to DHCP IP check.
  vlan change:...........................................0.             --- The user goes
offline due to VLAN changes.
  intfvlan change:.......................................0.             --- The user goes
offline due to layer-3 VLAN configuration changes.
  other:................................................4356.
aggregate online time:................................444256014min
average online time of user:...........................1304min         --- Average online
duration of the user
```

Station-move:

```
move count:...............................................969637.         --- Number of
migrations
```

```
move fail:.............................................3550.           --- Number of
migration failures

Other important process statistics:                                    --- Time consumption
statistics of all modules are listed below.
Auth:                                                                --- Time consumption for
Web authentication
average time consumption:..............................71ms.
aggregate time consumption:............................24669338ms.
number of less than one second:........................342103(99.403%).
number of more than one second:........................2053.

AAA authentication:                                                  --- Time consumption for
AAA authentication
average time consumption:..............................2ms.
aggregate time consumption:............................1013078ms.
number of less than one second:........................344154(99.999%).
number of more than one second:........................2.

Radius authentication:                                                --- Time consumption for
RADIUS authentication
average time consumption:..............................0ms.
aggregate time consumption:............................78760ms.
number of less than one second:........................344156(100.000%).
number of more than one second:........................0.

Radius server authentication:                                        --- Time consumption for
RADIUS server authentication
average time consumption:..............................55ms.
aggregate time consumption:............................19158014ms.
number of less than one second:........................342113(99.406%).
number of more than one second:........................2043.

SCC:                                                                 --- Time consumption for
SCC setting
average time consumption:..............................0ms.
aggregate time consumption:............................9349ms.
number of less than one second:........................344156(100.000%).
number of more than one second:........................0.
```

```
Accounting:                                                    --- Time consumption for
accounting
average time consumption:.............................23ms.
aggregate time consumption:...........................7930055ms.
number of less than one second:.......................344050(99.969%).
number of more than one second:.......................106.

AAA accounting:                                                --- Time consumption for
AAA accounting
average time consumption:.............................3ms.
aggregate time consumption:...........................1081861ms.
number of less than one second:.......................344154(99.999%).
number of more than one second:.......................2.

Radius accounting:                                              --- Time consumption for
RADIUS accounting
average time consumption:.............................1ms.
aggregate time consumption:...........................630452ms.
number of less than one second:.......................344127(99.992%).
number of more than one second:.......................29.

Radius server accounting:                                       --- Time consumption for
RADIUS server accounting
average time consumption:.............................2ms.
aggregate time consumption:...........................828579ms.
number of less than one second:.......................344081(99.978%).
number of more than one second:.......................75.

Portal:                                                        --- Time consumption of the
portal server
average time consumption:.............................0ms.
aggregate time consumption:...........................0ms.
number of less than one second:.......................344156(100.000%).
number of more than one second:.......................0.
```

2 Solution Components and Parameters

2.1 Parameters of Switch Products

2.1.1 Specifications of Core Devices

Device Type	Product Type	Product Model	Quantity of Clients Supported in Authentication
RG-N18000	Supervisor module	CM	600 for Web authentication; 3000 for 802.1x authentication
RG-N18000	Supervisor module	CM II	60000
N18007	Supervisor module	CM	600 for Web authentication; 3000 for 802.1x authentication
N18007	Supervisor module	CM II	60000
N18007	Supervisor module	CM II-LITE	15000
Device Type	**Product Type**	**Product Model**	**Quantity of Supported Online Dual-stack Clients (ARP)**
RG-N18000/N18007	Line card	ED card	60000
RG-N18000/N18007	Line card	DB card	30000
Device Type	**Product Type**	**Product Model**	**Quantity of Inner VLANs Supported in QinQ Scenarios**
RG-N18000/N18007	Line card	ED card	511
RG-N18000/N18007	Line card	DB card	61
Device Type	**Product Type**	**Product Model**	**Quantity of Supported MAC Tables**
RG-N18000/N18007	Line card	ED card	128000
RG-N18000/N18007	Line card	DB card	96000
Device Type	**Product Type**	**Product Model**	**Supported DHCPv4 Capacity**
RG-N18000	Supervisor module	CM	8000
RG-N18000	Supervisor module	CM II	90000
N18007	Supervisor module	CM	8000
N18007	Supervisor module	CM II	90000
N18007	Supervisor module	CM II-LITE	90000

Device Type	Product Type	Product Model	Supported DHCP Snooping Capacity
RG-N18000	Supervisor module	CM	8000
RG-N18000	Supervisor module	CM II	90000
N18007	Supervisor module	CM	8000
N18007	Supervisor module	CM II	90000
N18007	Supervisor module	CM II-LITE	90000
Device Type	**Product Type**	**Product Model**	**Supported DHCPv6 Capacity**
RG-N18000	Supervisor module	CM	8000
RG-N18000	Supervisor module	CM II	90000
N18007	Supervisor module	CM	8000
N18007	Supervisor module	CM II	90000
N18007	Supervisor module	CM II-LITE	90000

2.1.2 Specifications of Aggregation Devices

Device Type	Product Model	Whether Flexible QinQ Supported	Recommended Version	Description
Aggregation	S5750 series (hardware V1.0)	Yes	10.4(3)p4 release(161753)	Only 768 outer VIDs are supported for inner/outer VID mapping.
Aggregation	S5750 series (hardware V2.0)	Yes	10.4(3)p4 release(161753)	N/A
Aggregation	S5750E series	Yes	10.4(3b18)p2,Release(207466)	N/A
Aggregation	S29E	Yes	10.4(2b12)p2 release(180357)	N/A
Aggregation	S2910XS-E series	Yes	S2910_RGOS 11.4(1)B1	N/A
Aggregation	S6200	Yes	10.4(5b1) release(150539)	N/A
Aggregation	S5760 series	No	N/A	The device needs to be replaced.
Aggregation	S26 series	No	N/A	The device needs to be

				replaced.
Aggregation	S7610	No	N/A	The device needs to be replaced.
Aggregation	S7604	No	N/A	The device needs to be replaced.
Aggregation	S35	No	N/A	The device needs to be replaced.
Aggregation	NBS5526XG	No	N/A	The device needs to be replaced.

2.1.3 Capacity Specifications

Level-1 Specifications	Level-2 Specifications	Level-3 Specifications	RG-N18000 (ED)	RG-N18000 (DB)
Authentication capacity	Web authentication	Web user capacity	60,000 for dual-stack	30,000 for dual-stack
	802.1x authentication	802.1x user capacity	60,000 for dual-stack	30,000 for dual-stack
	Web MAB authentication	Web MAB authentication capacity	60,000 for dual-stack	30,000 for dual-stack
IPv4 application protocol features	DHCP server	Quantity of users supported by the DHCP server	256K	256K
	DHCP relay	Quantity of supported servers	N/A	N/A
	DHCP snooping	Capacity of software-bound database	256K	256K
Layer-2 features	MAC address	Quantity of global MAC addresses (the maximum quantity of MAC addresses supported by the MAC address table need to be learned in full mesh mode)		
		Quantity of static MAC addresses	10000	10000
		Quantity of filtered MAC	10000	10000

		addresses		
		MAC address learning rate	2000/S	2000/S
	Quantity of clients	Quantity of clients (for IPv4/IPv6 dual-stack, each client is assigned with an IPv6 address and an IPv4 address)	CM: 5000 for the case with only 802.1x authentication 1000 for the case with only Web authentication CM II: 60,000 (recommended) in default mode	CM: 5000 for the case with only 802.1x authentication 1000 for the case with only Web authentication CM II: 45,000 (recommended) in default mode.
Layer 3 Features	ARP	ARP entry capacity (the maximum quantity of ARP entries supported by the ARP table need to be learned in full mesh mode)	Default mode: 170,000 (sharing resources with ND)	Default mode: 85000 (sharing resources with ND)
		ARP learning rate	CM I: 3000/s; CM II: 10,000/s	CM I: 3000/s; CM II: 10,000/s
	ND	ND entry capacity (the maximum quantity of ND entries supported by the ND table need to be learned in full mesh mode)	CM: 5000 CM II: 75,000 in default mode (sharing resources with ARP).	CM: 5000 CM II: 60000 in default mode (sharing resources with ARP).
		ND learning rate	CM I: 1500/s; CM II: 5000/s	CM I: 1500/s; CM II: 5000/s
	IPv4	Quantity of IP addresses set on each layer-3 interface	4000	4000
		Capacity of IPv4 hardware routing table (the maximum quantity of routing entries supported by the routing table need to be learned in full mesh mode)	Default mode: 12,000	Default mode: 384000
		Capacity of static routing table	The default value is 1024. A command can be used to configure a maximum of 10,000	The default value is 1024. A command can be used to configure a maximum of 10,000

			routes.	routes.
		Quantity of equal-cost routes supported by each route	32	32
		Quantity of routes supporting equal-cost routing	64	64
		Quantity of weighted next-hop routes supported by each route	8 (Weight = 4) 4 (Weight = 8) Weight x Route count ≤ 32	8 (Weight = 4) 4 (Weight = 8) Weight x Route count ≤ 32
		Multicast routing table	16000	16000
	IPv6	Quantity of IPv6 addresses set on each layer-3 interface	1000 at most	1000 at most
		Capacity of IPV6 hardware routing table (network routes) (the maximum quantity of routing entries supported by the routing table need to be learned in full mesh mode)	Default mode: 6000	Default mode: 1000
		Capacity of routing table supporting the subnet mask length of 65–128 (If no description is made, the capacity is not limited by the subnet mask length and the hardware routing table capacity prevails.)	Default mode: 1000	Default mode: 4000
		Capacity of static IPv6 routing table	1000	1000
		Quantity of IPv6 tunnel interfaces	127	127
		Multicast routing table	8000	8000
	PBRv4	Quantity of supported policy-based routes	1500–7000	1500–7000

		Quantity of equal-cost routes supported by each policy-based route	32	32
	PBR v6	Quantity of supported policy-based routes	1500–3000	1500–3000
		Quantity of equal-cost routes supported by each policy-based route	32	32
ACL	ACE capacity	Maximum number of inbound ACE entries associated with the SVI	7000	7000
		Maximum number of inbound ACE entries associated with the physical port/AP	7000	7000
		Maximum number of outbound ACE entries associated with the SVI (simulated based on inbound ACE entries, limited, and with inbound entries occupied)	N/A	N/A
		Maximum number of outbound ACE entries associated with the SVI (actual outbound ACE entries)	1000	1000
		Maximum number of outbound ACE entries associated with the physical port/AP (simulated based on inbound ACE entries)	N/A	N/A
		Maximum number of outbound ACE entries associated with the physical port/AP (actual outbound ACE entries)	1000	1000

3 Typical Scenarios

3.1 Access Isolation Scenario

3.1.1 Overall Solution

3.1.1.1 Solution Description

The simplistic network access isolation solution employs one VLAN for each access switch, and allows locating the specific access switch according to the VLAN ID. In addition, this solution provides layer-2 isolation for all users, effectively preventing layer-2 broadcast packet attacks and ARP and DHCP spoofing attacks.

1. The core RG-N18000 serves as the gateway and authentication NAS device on the whole network:

- A maximum of 60,000 online dual-stack clients are supported in coordination with ED cards, and a maximum of 30,000 online clients are supported in coordination with DB cards or both of ED and DB cards.
- Web authentication, wired 802.1x authentication, and MAB authentication are simultaneously supported. Wireless 802.1x authentication is not supported currently, because it needs to be deployed on the AC.
- Wireless 802.1x VLANs, AP management VLANs, and other special service VLANs requiring no authentication (such as door status control, all-in-one card, and video monitoring) are configured as authentication-free VLANs.
- As the core layer-2 gateway, the RG-N18000 can support the super VLAN function to perform aggregation gateway configurations for sub VLANs. One super VLAN can be deployed for each area, for example, one super VLAN for the office area of the xx campus and one super VLAN for the student dormitory area of the xx campus.
- The ARP proxy function is enabled on the super VLAN gateway of the core device by default, to guarantee layer-3 communication between sub VLANs and decrease ARP flooding traffic.
- The port protection function needs to be configured on the downlink interface of the core device (by running the **switchport protected** command), to prevent layer-2 broadcast between the same VLANs in different areas. In addition, unused VLANs need to be pruned to minimize the broadcast domain.
- The SVI of the super VLAN gateway needs to be set to OSPF passive if OSPF is configured.

2. The aggregation device serves as layer-2 transparent transmission device:

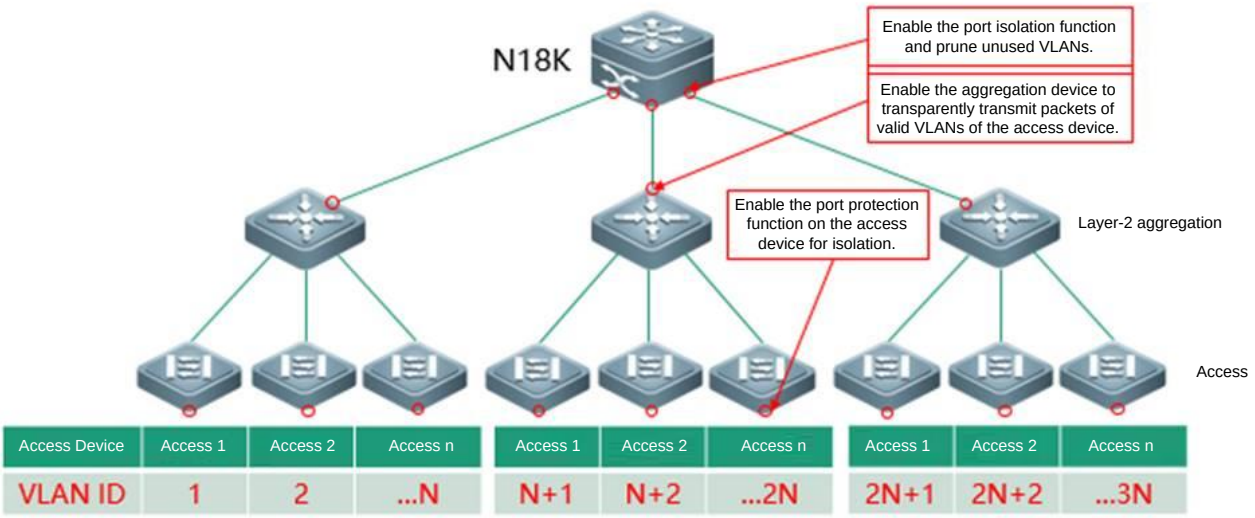
- The VLAN and trunk interfaces are configured for layer-2 transparent transmission only.
- The SVI of the user gateway needs to be set to OSPF passive if the conventional 3-layer network is deployed and OSPF is configured on the aggregation device.
- The port protection function needs to be configured on the downlink interface of the aggregation device (by running the **switchport protected** command), to prevent layer-2 broadcast between the same VLANs in different areas. In addition, unused VLANs need to be pruned to minimize the broadcast domain.
- The storm suppression function is configured to suppress broadcast packets at 1000 pps and multicast packets at 1000 pps. In addition, this function needs to be adjusted according to the live network applications. For example, if multicast

services exist on the live network, do not configure multicast packet suppression and suppress broadcast packets at 1000 pps.

3. The access device provides user-based layer-2 isolation:

- The same VLAN is configured on all interfaces of each access switch, and different VLANs are configured for different access switches.
- The port protection function needs to be configured on the interfaces of each switch (by running the **switchport protected** command), to implement layer-2 VLAN isolation.
- Different VLANs need to be configured for different access switches, with incremental VLAN IDs.
- VLAN segments need to be independently planned for special services (such as door status control, all-in-on card, and video monitoring) to distinguish from user service VLANs, to facilitate authentication-free VLAN configuration on the core device for special services.
- RDLP is enabled on the interface of the access device connected to the clients, and an anti-loop policy is configured to shut down a port upon a loop.
- The storm suppression function is enabled on the interfaces of the access device connected to the clients, to suppress broadcast packets at 300 pps and multicast packets at 300 pps. In addition, this function needs to be adjusted according to the live network applications. For example, if multicast services exist on the live network, do not configure multicast packet suppression and suppress broadcast packets at 1000 pps.

3.1.1.2 Solution Topology



3.1.1.3 Recommended Scenario

1. In the case of network construction, an access cascading scenario exists in the live network and flexible QinQ is not supported on the aggregation device.

Suggestion for the wired network scenario: It is recommended to deploy access isolation, configure one VLAN for each switch, and configure one super VLAN for each area (such as the office area of the xx campus, library of the xx campus, and student dormitory area of the xx campus).

2. In the case of network reconstruction, it is unclear whether devices are interconnected and whether flexible QinQ is supported.

Suggestion for the wired network scenario: It is recommended to deploy access isolation, configure one VLAN for each switch, and configure one super VLAN for each area (such as the office area of the xx campus, library of the xx campus, and student dormitory area of the xx campus).

3.1.2 VLAN/IP Planning

3.1.2.1 Planning Idea

Configure one VLAN (sub VLAN) for the access switch of each floor, and one super VLAN for each area (such as the student dormitory area of the xx campus).

Reserve VLANs (30% or more) for each area for further network change or expansion.

Reference templates:

Wired network VLAN/IP planning for the student dormitory area:

Device Model	Device Type	Location	Management Address	Sub VLAN	Super VLAN	Network Segment (planned according to rules, with the actual subnet mask length being /16)	Gateway	Network Management VLAN	Video Monitoring VLAN	All-in-one Card VLAN	Door Status Control VLAN
S2928G	Floor access switch	1/F, building 1, student dormitory area	192.168.132.1	1001	4000	172.16.0.0/24	172.16.15.254/16	100	101	102	103
S2928G	Floor access switch	2/F, building 1, student dormitory area	192.168.132.2	1002							
S2928G	Floor access	1/F, building 2, student	192.168.132.3	1003		172.16.1.0/24	172.16.15.254/16				

	switch	dormitory area									
S2928G	Floor access switch	2/F, building 2, student dormitory area	192.168.132.4	1004							
S2928G	Floor access switch	1/F, building 3, student dormitory area	192.168.132.5	1005		172.16.2.0/24	172.16.15.254/16				
S2928G	Floor access switch	2/F, building 3, student dormitory area	192.168.132.6	1006							
S2928G	Floor access switch	1/F, building 4, student dormitory area	192.168.132.7	1007		172.16.3.0/24	172.16.15.254/16				
S2928G	Floor access switch	2/F, building 4, student dormitory area	192.168.132.8	1008							
S2928G	Floor access switch	1/F, building 5, student dormitory area	192.168.132.9	1009		172.16.4.0/24	172.16.15.254/16				
S2928G	Floor access switch	2/F, building 5, student dormitory area	192.168.132.10	1010							
S2928G	Floor access switch	1/F, building 6, student dormitory area	192.168.132.11	1011		172.16.5.0/24	172.16.15.254/16				
S2928G	Floor access switch	2/F, building 6, student dormitory area	192.168.132.12	1012							
S2928G	Floor access switch	1/F, building 7, student dormitory area	192.168.132.13	1013		172.16.6.0/24	172.16.15.254/16				
S2928G	Floor access switch	2/F, building 7, student dormitory area	192.168.132.14	1014							

S2928G	Floor access switch	1/F, building 8, student dormitory area	192.168.132.15	1015		172.16.7.0/24	172.16.15.254/16				
S2928G	Floor access switch	2/F, building 8, student dormitory area	192.168.132.16	1016							
S2928G	Floor access switch	1/F, building 9, student dormitory area	192.168.132.17	1017		172.16.8.0/24	172.16.15.254/16				
S2928G	Floor access switch	2/F, building 9, student dormitory area	192.168.132.18	1018							
S2928G	Floor access switch	1/F, building 10, student dormitory area	192.168.132.19	1019		172.16.9.0/24	172.16.15.254/16				
S2928G	Floor access switch	2/F, building 10, student dormitory area	192.168.132.20	1020							
S2928G	Floor access switch	1/F, building 11, student dormitory area	192.168.132.21	1021		172.16.10.0/24	172.16.15.254/16				
S2928G	Floor access switch	2/F, building 11, student dormitory area	192.168.132.22	1022							

3.2 Wireless Isolation Scenario

3.2.1 Overall Solution

3.2.1.1 Solution Description

1. The simplistic network wireless isolation solution employs one super VLAN for each area (for example, a super VLAN for the office area of the xx campus), and two sub VLANs for each building in the area (one for wireless Web authentication and the other for wireless 802.1x authentication). This solution helps you locate wireless users to a specific building based on the VLAN, and enables wireless user isolation to prevent layer-2 broadcast packet attacks and ARP and DHCP spoofing attacks.

2. This solution also supports super VLANs based on the SSID, for example, one super VLAN separately for 802.1x authenticated student users, 802.1x authenticated teacher users, Web authenticated student users, and Web authenticated teacher users. This solution employs sub VLANs based on the area, building, and floor to control the scope of the broadcast domain.

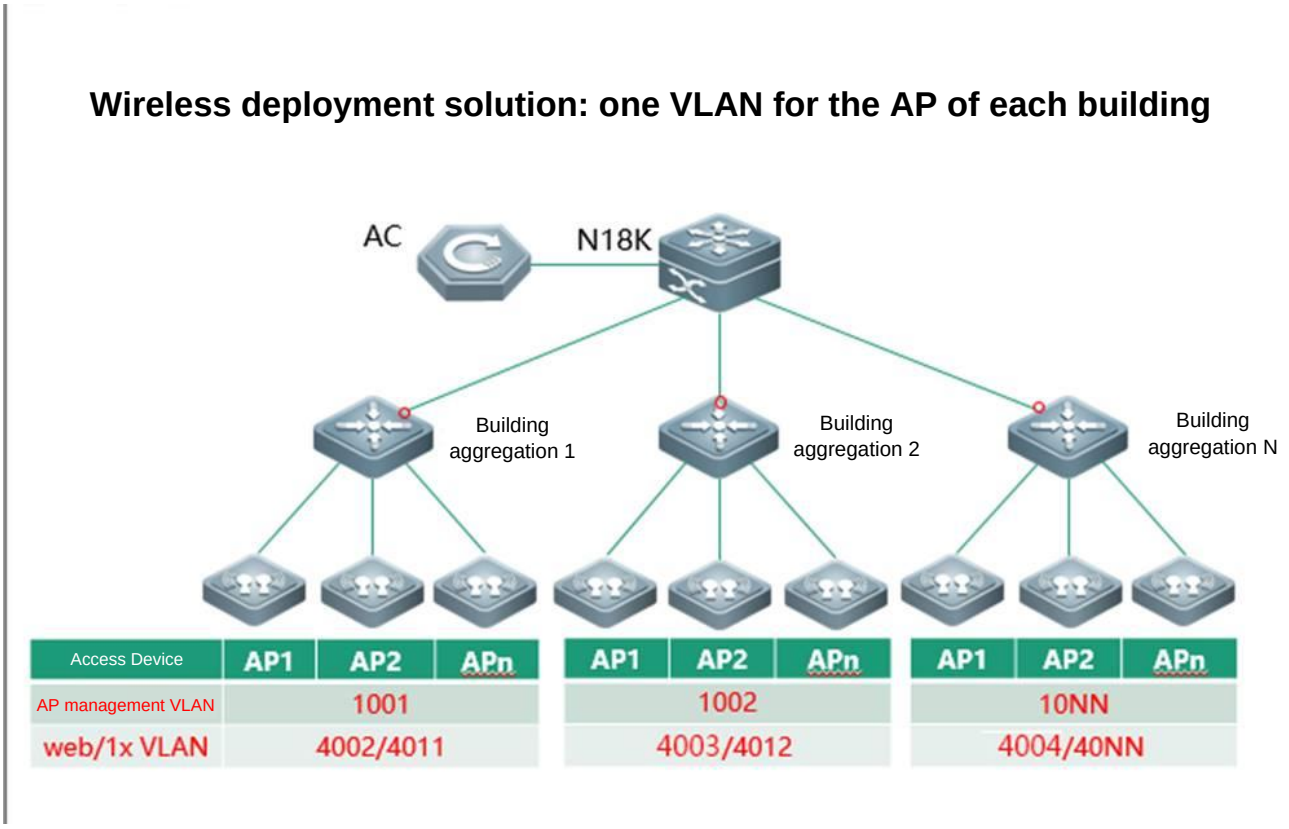
1. The core RG-N18000 serves as the gateway and authentication NAS device on the whole network:

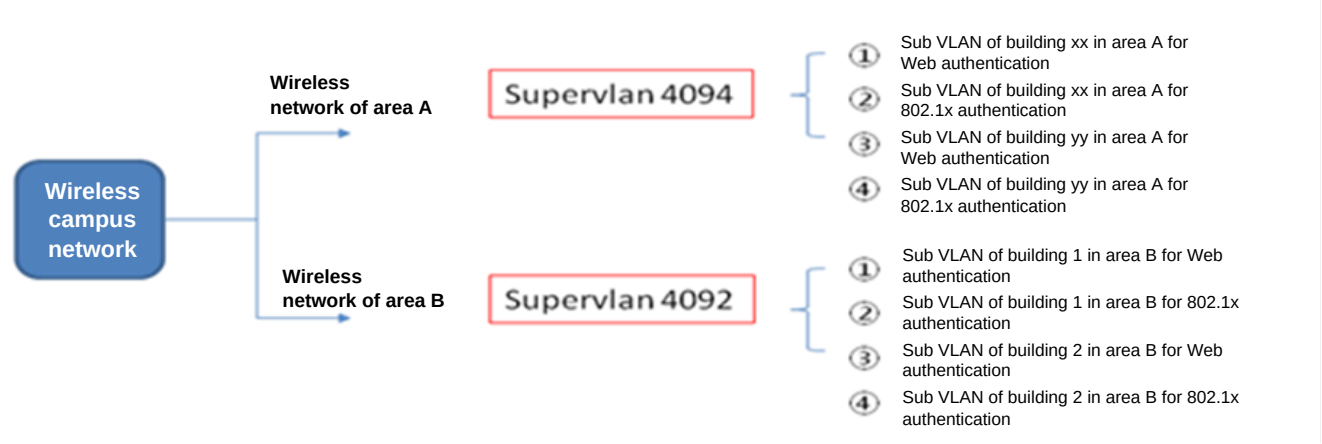
- A maximum of 60,000 online dual-stack clients (a maximum of 90,000 online clients in theory) are supported in coordination with ED cards, and a maximum of 30,000 online clients are supported in coordination with DB cards or both of ED and DB cards.
- Web authentication, wired 802.1x authentication, and MAB authentication are simultaneously supported. Wireless 802.1x authentication is not supported currently, because it needs to be deployed on the AC.
- Wireless 802.1x VLANs and AP management VLANs are configured as authentication-free VLANs.
- As the core layer-2 gateway, the RG-N18000 can support the super VLAN function to perform aggregation gateway configurations for sub VLANs. One super VLAN can be deployed for each area, for example, one super VLAN for the office area of the xx campus and one super VLAN for the student dormitory area of the xx campus.
- The ARP proxy function is enabled on the super VLAN gateway of the core device by default, to guarantee layer-3 communication between sub VLANs and decrease ARP flooding traffic.
- The port isolation function needs to be configured on the downlink interface of the core device, to prevent layer-2 broadcast between the same VLANs in different areas. In addition, unused VLANs need to be pruned to minimize the broadcast domain.

2. The AC serves as wireless controller in fit mode to perform the basic wireless configurations and simplistic network planning configurations:

- The basic wireless configuration mode is set to support centralized forwarding or local forwarding.
- Wireless user isolation is configured to prevent an overlarge wireless user broadcast domain in a VLAN.
- The ARP proxy function is disabled on the AC, so that the RG-N18000 serves as the ARP proxy, to prevent failures in migration of wireless authenticated users.
- One super VLAN is configured for each area, for example, one super VLAN for the office area of the xx campus.
- Two sub VLANs are configured for the AP of each building, one for wireless Web authentication and the other for wireless 802.1x authentication.
- SSIDs are set based on the operator and authentication mode, for example, SSID 1 for operator A - Web authentication, SSID 2 for operator A - 802.1x authentication, SSID 3 for operator B - Web authentication, and SSID 4 for operator B - 802.1x authentication.

3.2.1.2 Solution Topology





3.2.1.3 Recommended Scenario

The wireless simplistic network uses the wireless isolation solution.

3.2.2 VLAN/IP Planning

3.2.2.1 Planning Idea

- Configure one super VLAN for each area, for example, one super VLAN for the office area of the xx campus.
- Configure two sub VLANs for the AP of each building, one for wireless Web authentication and the other for wireless 802.1x authentication.
- Set SSIDs based on the operator and authentication mode, for example, SSID 1 for operator A - Web authentication, SSID 2 for operator A - 802.1x authentication, SSID 3 for operator B - Web authentication, and SSID 4 for operator B - 802.1x authentication.
- Reserve VLANs (30% or more) for each area for further network change or expansion.

Reference templates:

Wired network VLAN/IP planning for the student dormitory area:

Location	AP Management VLAN	AP Management Segment	Gateway	Web Authentication Sub VLAN	802.1x Authentication Sub VALN	Super VLAN	Network Segment	Gateway	Web Authentication SSID	802.1x Authentication SSID
Building 1, student dormitory area	900	192.168.16.0/20	192.168.31.254	3001	3501	4201	172.16.64.0/20	172.16.79.254/20	web-auth	802.1x-auth
Building 2, student dormitory area	900	192.168.16.0/20	192.168.31.254	3002	3502	4201	172.16.64.0/20	172.16.79.254/20	web-auth	802.1x-auth
Building 3, student dormitory area	900	192.168.16.0/20	192.168.31.254	3003	3503	4201	172.16.64.0/20	172.16.79.254/20	web-auth	802.1x-auth
Building 4, student dormitory area	900	192.168.16.0/20	192.168.31.254	3004	3504	4201	172.16.64.0/20	172.16.79.254/20	web-auth	802.1x-auth
Building 5, student dormitory	900	192.168.16.0/20	192.168.31.254	3005	3505	4201	172.16.64.0/20	172.16.79.254/20	web-auth	802.1x-auth

area										
Building 6, student dormitory area	900	192.168.16.0/20	192.168.31.254	3006	3506	4201	172.16.64.0/20	172.16.79.254/20	web-auth	802.1x-auth
Building 7, student dormitory area	900	192.168.16.0/20	192.168.31.254	3007	3507	4201	172.16.64.0/20	172.16.79.254/20	web-auth	802.1x-auth
Building 8, student dormitory area	900	192.168.16.0/20	192.168.31.254	3008	3508	4201	172.16.64.0/20	172.16.79.254/20	web-auth	802.1x-auth
Building 9, student dormitory area	900	192.168.16.0/20	192.168.31.254	3009	3509	4201	172.16.64.0/20	172.16.79.254/20	web-auth	802.1x-auth
Building 10, student dormitory area	900	192.168.16.0/20	192.168.31.254	3010	3510	4201	172.16.64.0/20	172.16.79.254/20	web-auth	802.1x-auth
Building 10, student dormitory area	900	192.168.16.0/20	192.168.31.254	3011	3511	4201	172.16.64.0/20	172.16.79.254/20	web-auth	802.1x-auth

4 Configuration of Important Functions

4.1 RG-N18000 Configuration

4.1.1 Common Scenario — Gateway

4.1.1.1 [Mandatory] Gateway Mode

Principles:

In the simplistic network solution, the core device acts as the gateway of the entire network, and controls access authentication. Users can be normally authenticated and go online only after the authentication mode is set to gateway authentication mode and dot1x or Web authentication is enabled.

Otherwise, when the number of 802.1x/Web authenticated users reach about 2000, the system prompts that the TCAM table is full and 802.1x/Web authentication is abnormal.

In comparison to the conventional network, the simplistic network in gateway mode has the following features:

1. An authenticated client is automatically bound with a static ARP address on the RG-N18000.
2. The RG-N18000 automatically enables the ARP proxy function on the SVI interface of a super VLAN. The ARP proxy can be disabled on a sub VLAN. (Valid to authenticated users)
3. The RG-N18000 does not actively send ARP requests to a sub VLAN of a super VLAN configured on an interface with authentication under control. Instead, the RG-N18000 actively sends ARP requests to authentication-free VLANs and common VLANs.
4. In gateway mode of the simplistic network, the **ip source-guard** command does not take effect.

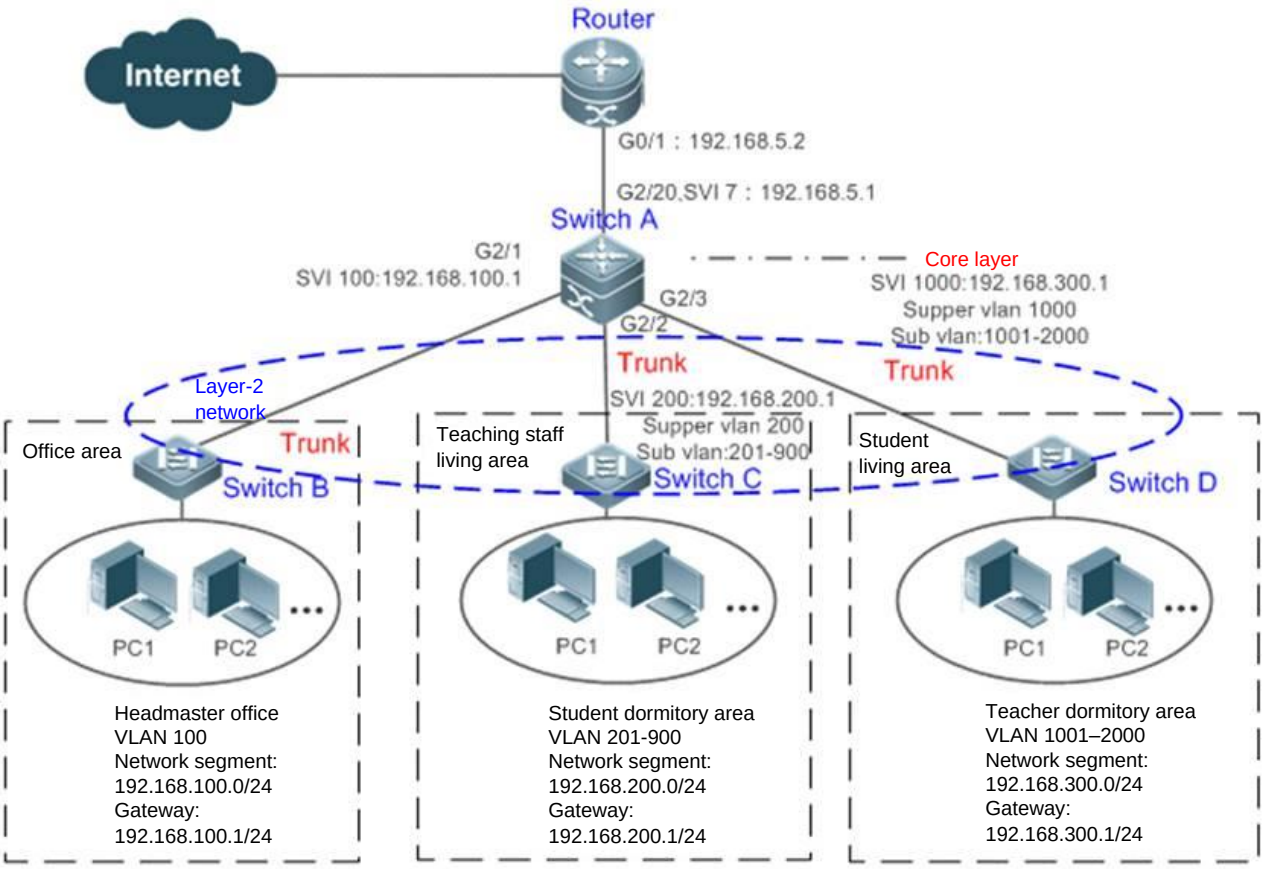
Configuration commands:

```
auth-mode gateway    //Configured in global configuration mode.
```

Precautions:

This command takes effect only after it is configured and saved and the device is restarted. After the device is restarted, run the **show run** command to check whether the configuration takes effect.

Configuration example



Configuration Steps	Set the authentication mode to the gateway authentication mode on the core gateway Switch A.

Switch A	`SwitchA(config)#auth-mode gateway`
	`Please save config and reload system.`
	`SwitchA(config)#exit`
	`*Nov  7 10:13:27: %SYS-5-CONFIG_I: Configured from console by console`
	`SwitchA#reload`
	`Reload system?(Y/N)y`
	`SwitchA#`

Verification	Run the **show running** command to check whether the configuration takes effect.

Switch A	`SwitchA(config)#show running-config | include auth-mode`
	`auth-mode gateway`
	`SwitchA#debug scc st`
	`================== sccd server info =================`
	`rdnd role  : 2/2.`
	`ready notify  : CLI LSM BRIDGE SS ACLK BRIDGE-READY TCPIP VFW`
	`aclk-socket info: async - 8, sync - 9, alive - 7. snd_cnt:692. rcv_cnt:692`

	data sync info : depend/ready(0x201e/0x201e) aclk(req:0) ss(req:0) mac(req:0) current scc mode: GATE MODE, new mode(GATE MODE). ability: 0x3f. offline-status : open, interval:6 min, threshold:0 bytes. station move : close. dot1x cpp : set. author mode:D1xAuthorMixed. proc status : svrid:75 todo-cnt:0 ret-cnt:0. max wait : client:9, cost:16(ms) max proc : client:11, svrid:72, tlvtype:105, ss-cnt:0, aclk-cnt:0 rv:0. cost:748(ms). cnt-stat : web-query-add-arp:[0], web-query-del-arp:[0]. : add-arp:[2], del-arp:[1]. : add-mac:[2], del-mac:[1].

4.1.1.2 [Mandatory] super VLAN

Principles:

The super VLAN technology is used to implement flat layer 2 networks for gateways. Super VLAN is also called VLAN aggregation. The aggregated VLAN range is called sub VLAN of the super VLAN. A super VLAN has the following features:

Each sub VLAN has the same functions as common VLANs. Different sub VLANs belong to different broadcast domains, and cannot access each other due to layer-2 isolation.

The SVI address of a super VLAN serves as the gateway address of the sub VLAN of the super VLAN.

When a sub VLAN requires layer-3 communication, the IP address of the virtual interface of the super VLAN is used as the gateway address for addressing and forwarding.

When sub VLANs need to access each other, the ARP proxy and ND proxy of the super VLAN need to be configured.

Note: When super VLANs and sub VLANs are configured in the simplistic network solution, super VLAN IDs are used only on SVIs, while sub VLAN IDs are used for AM rules, QinQ VLAN tag termination, and direct VLANs that need the VLAN ID range.

Configuration commands:

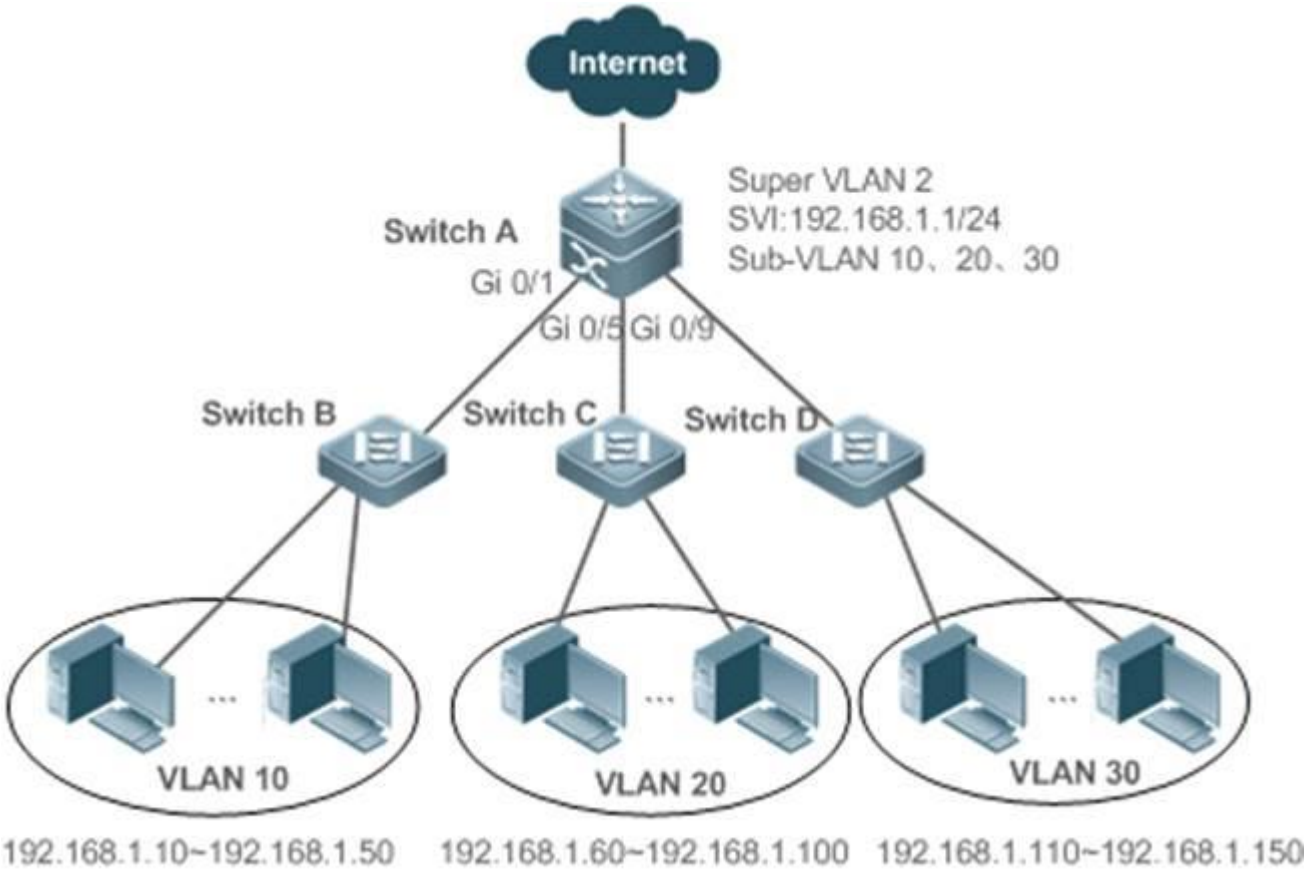
```
vlan (supervlan)              //Create a VLAN.
 supervlan              //Define the VLAN as a super VLAN.
 subvlan (subvlan-list)              //Define the sub VLAN range for the super VLAN.
 name (supervlan-name)              //Name the super VLAN.

int vlan  (supervlan)              //Create the gateway SVI for the super VLAN.
ip address (ip/netmask)              //Define the gateway address and mask.
```

Precautions:

An SVI and an IP gateway need to be configured for a super VLAN. Otherwise, communication is not supported between sub VLANs or between sub VLANs and other VLANs.

The ARP proxy is enabled by default. If the ARP proxy is disabled on a super VLAN or sub VLAN, users of sub VLANs cannot perform inter-VLAN communication.

Configuration example



Configuration Steps	Configure a super VLAN on the core switch. (Omitted) On the access switch, configure common VLANs corresponding to sub VLANs of the core switch.

A	`SwitchA#configure terminal`
	`Enter configuration commands, one per line.  End with CNTL/Z.`
	`SwitchA(config)#vlan 2`
	`SwitchA(config-vlan)#exit`
	`SwitchA(config)#vlan 10`
	`SwitchA(config-vlan)#exit`
	`SwitchA(config)#vlan 20`
	`SwitchA(config-vlan)#exit`
	`SwitchA(config)#vlan 30`

	SwitchA(config-vlan)#exit SwitchA(config)#vlan 2 SwitchA(config-vlan)#supervlan SwitchA(config-vlan)#subvlan 10,20,30 SwitchA(config-vlan)#exit SwitchA(config)#interface vlan 2 SwitchA(config-if-VLAN 2)#ip address 192.168.1.1 255.255.255.0 SwitchA(config)#interface range gigabitEthernet 0/1,0/5,0/9 SwitchA(config-if-range)#switchport mode trunk
Verification	Check whether the source device (192.168.1.10) and the destination device (192.168.1.60) can ping each other successfully.
A	SwitchA(config-if-range)# show supervlan supervlan id supervlan arp-proxy subvlan id subvlan arp-proxy subvlan ip range ---------- ---------- ---------- ---------- --------- 2 ON 10 ON 192.168.1.10 - 192.168.1.50 20 ON 192.168.1.60 - 192.168.1.100 30 ON 192.168.1.110 - 192.168.1.150

4.1.1.3 [Mandatory] Protected Port Isolation

Principles:

The simplistic network solution implements layer-2 user isolation by using protected ports. A protected port can prevent layer-2 forwarding within one VLAN of the same switch. When ports are configured as protected ports, protected ports of the same VLAN cannot communicate with each other but a protected port can normally communicate with a non-protected port.

Configuration commands:

```
switchport protected    //Configured in interface configuration mode.
```

Precautions:

N/A

Configuration example

```
Ruijie(config)#interface GigabitEthernet 0/1
Ruijie(config-if-GigabitEthernet 0/1)# switchport protected
```

4.1.1.4 [Mandatory] Interface Index Uniqueness

Principles:

The interface index of each port is unique. You can run the **show interface** command to display the **Index** field. After the device restarts, the interface index of the device may change. As a result, the area division function of SAM+ will fail. It is recommended to enable the interface index uniqueness function. After this function is configured, interface indexes are permanently recorded by the device. They do not change even if the device is restarted or a line card is removed and then inserted.

Configuration commands:

```
Ruijie(config)#snmp-server if-index persist          //Enable interface index uniqueness.
```

Precautions:

N/A

Configuration example

N/A

4.1.1.5 [Mandatory] Regular User Synchronization

Principles:

Some users on SAM+ may fail to go offline normally due to exceptions. For this, SAM+ automatically checks online users with the NAS at 02:00 A.M. every day, to delete information about fake online users.

Configuration commands:

```
snmp-server host (radius ip) informs version 2c (key)       //Configure SNMP for communicating
with SAM+.
```

Precautions:

Configure related information on SAM+.

Configuration example

N/A

4.1.2 Common Scenario — Address Management

4.1.2.1 [Mandatory] DHCP Snooping

Principles:

The DHCP snooping feature provides the following functions in simplistic networks:

1. A simplistic network adopts the flat layer-2 gateway architecture. DHCP snooping can prevent DHCP spoofing within the same VLAN of the DHCP downlink interface. (In theory, DHCP spoofing does not exist in the simplistic network solution and DHCP snooping mainly provides layer-2 protection. In simplistic networks, port protection needs to be enabled on interfaces of the same VLAN on core devices and access devices, to isolate layer-2 broadcast domains and prevent DHCP spoofing.)
2. DHCP snooping provides IP address authorization for 802.1x authentication or MAC Address Bypass (MAB) Authentication by using a DHCP snooping table, provided that the AAA IP authorization function is enabled, the **dot1x valid-ip-acct enable** and **dot1x mac-auth-bypass valid-ip-auth** commands are executed, and DHCP is configured to dynamically assign IP addresses to authenticated users.

Configuration commands:

```
ip dhcp snooping              //Mandatory. The command is used for DHCP snooping and IP
authorization for 802.1x authentication.
ip dhcp snooping check-giaddr     //Mandatory. It is configured to prevent the RG-N18000 with
DHCP snooping enabled from discarding DHCP relay packets from aggregation devices.
ip dhcp snooping arp-detect     //Optional. Enable fast ARP address reclaiming of DHCP snooping.
The ARP address reclaiming is performed once per second during ARP aging and can be performed
five times at most.

interface gi2/3/8                    //Optional. It is configured in scenarios in which the DHCP
server is not deployed on the RG-N18000 and the DHCP server communicates with the RG-N18000 at
layer 2.
 description link-to-dhcpserver
 ip dhcp snooping trust       //Configure a DHCP trusted port on the layer-2 port of the
interconnected DHCP server.
```

Precautions:

When the IP DHCP snooping feature is configured, the **ip dhcp snooping check-giaddr** command must be executed, so that the RG-N18000 with DHCP snooping enabled can process DHCP relay packets from aggregation devices. The **ip dhcp snooping check-giaddr** command has no drawbacks. Therefore, it is recommended to enable the command by default.

Configuration example

N/A

4.1.2.2 [Mandatory] Fast Address Reclaiming of DHCP Snooping

Principles:

Fast address reclaiming reclaims addresses of DHCP snooping entries rapidly, to prevent an overlarge DHCP snooping binding table caused by generation of multiple address entries by the same client during wireless user migration.

This function can be associated with the ARP module. When an ARP entry corresponding to an IP address in the DHCP snooping table is about to age, ARP detection is started. If no response is received within the detection count, the DHCP snooping entry of the IP address is deleted.

Configuration commands:

```
ip dhcp snooing arp-detect          //Optional. Enable fast ARP address reclaiming of DHCP snooping.
The ARP address reclaiming is performed once per second during ARP aging and can be performed
five times at most.
```

Precautions:

N/A

Configuration example

N/A

4.1.2.3 [Optional] DHCP Server

Principles:

Principles of a DHCP server in a simplistic network scenario are similar to those in a universal scenario. Identical parts of the principles are not described here.

Differences are as follows:

1. The recommended DHCP lease time is 2 hours. The purpose is to rapidly reclaim DHCP address resources that are not in use, to prevent IP address resources of the gateway from being fully occupied in areas with heavy traffic.
2. When the DHCP lease period of the client expires or the RG-N18000 receives a DHCP release packet, the RG-N18000 kicks the client offline during authentication.

This prevents a problem that, when the DHCP server assigns the IP address originally obtained by the client to a new client, the IP address is still corresponding to the original client in the authentication entry and stays in the online state, and the new client cannot be authenticated.

Configuration commands:

```
DSW-18KX_LX(config)#ip dhcp pool 4000              //Set the DHCP address pool for the wired
network in the dormitory area.
DSW-18KX_LX(dhcp-config)#lease 0 2 0               //Mandatory. Set the lease time to 2 hours.
DSW-18KX_LX(dhcp-config)#network 172.16.0.0 255.255.240.0
DSW-18KX_LX(dhcp-config)#dns-server 202.115.32.39 202.115.32.36
```

```
DSW-18KX_LX(dhcp-config)#default-router 172.16.15.254
```

Precautions:

It is recommended to set the DHCP server lease period to 2 hours.

When the DHCP lease period of the client expires or the RG-N18000 receives a DHCP release packet, the RG-N18000 kicks the client offline during authentication.

It is recommended to set the period for no-traffic go-offline detection to be shorter than the lease period of DHCP server.

Configuration example

N/A

4.1.2.4 [Optional] Fast Address Reclaiming of DHCP Server

Principles:

Fast address reclaiming is configured to enable the DHCP server to detect whether a user is offline. If a user goes offline and does not go online again within a period of time, the DHCP server reclaims the IP address assigned to the user.

The principles are described as follows: The DHCP server, based on IP addresses in the DHCP server table, conducts keepalive detection via the ARP module. If identifying that a user goes offline and does not go online again within a period of time (5 minutes by default), the DHCP server reclaims the IP address assigned to the user.

If the DHCP server function is configured on the RG-N18000, the fast address reclaiming function is mandatory.

Configuration commands:

```
ip dhcp server arp-detect        //Enable fast address reclaiming of the DHCP server. If identifying
that a user goes offline and does not go online again within a period of time (5 minutes by default),
the DHCP server reclaims the IP address assigned to the user.
```

Precautions:

N/A

Configuration example

N/A

4.1.2.5 [Optional] AM Rules

Principles:

AM rules can be used to divide the DHCP address segment based on the VLAN+port of the RG-N18000, but the DHCP address segment must exist in the DHCP address pool. The address segment assigned by using AM rules must be smaller than or equal to the DHCP address pool. Example:

DHCP address pool: network 192.168.0.0 255.255.0.0

AM rule: match ip 192.168.1.0 255.255.255.0 Gi5/3 vlan 1005

In the simplistic network environment, the gateway is deployed via super VLAN. Generally, the gateway is deployed in the following manners:

Scenario 1 (AM rules not required): Sub VLAN of each dormitory building or sub VLANs of some dormitory buildings form one super VLAN. The network segment corresponding to the gateway of the super VLAN is small (for example, several type C addresses). Each super VLAN is corresponding to one DHCP address pool. The network segments corresponding to the IP addresses obtained by students are refined and easily managed.

Scenario 2 (AM rules not required): Sub VLANs of the entire campus network form one super VLAN. The network segment corresponding to the gateway of the super VLAN is relatively large (for example, several type B addresses). Each super VLAN is corresponding to one DHCP address pool. The network segments corresponding to the IP addresses obtained by students are scattered and disordered and hard to manage. The school does not raise a requirement on provision of different policies on SAM+ or egress based on source IP addresses, for example, Internet access area control and PBR.

Scenario 3 (AM rules required): Sub VLANs of the entire campus network form one super VLAN. The network segment corresponding to the gateway of the super VLAN is relatively large (for example, several type B addresses). Each super VLAN is corresponding to one DHCP address pool. The network segments corresponding to the IP addresses obtained by students are scattered and disordered and hard to manage. The school requires refined management, and requires precise identification on user areas based on IP addresses, to implement requirements, for example, Internet access area control and PBR.

Scenario 4 (AM rules required): sub VLANs of the entire campus network form one super VLAN, and multiple secondary addresses are configured for the gateway of the super VLAN. In this scenario, AM rules must be configured. Otherwise, DHCP addresses cannot be assigned according to secondary addresses. (By default, the DHCP software assigns only the network segment to which the main gateway address belongs.)

Note 1: AM rules support the DHCP server and DHCP relay modes. In DHCP relay mode, the AM rules can be used only in scenario 4. The gateway has multiple secondary addresses. The AM rules are used to notify the DHCP server of the address segment to be used. In this scenario, the DHCP server must configure an address pool for each secondary address of the RG-N18000. Otherwise, the AM rules do not take effect. Example:

```
Configuration of the RG-N18000: ip helper-address 1.1.1.1 (Configure the DHCP relay on the
RG-N18000.)
int vlan 4000
ip add 192.168.1.1 255.255.255.0
ip add 192.168.2.1 255.255.255.0 secondary
ip add 192.168.3.1 255.255.255.0 secondary
```

AM rules: address-manage

```
match ip 192.168.1.0 255.255.255.0 Gi5/3 vlan 1005
match ip 192.168.2.0 255.255.255.0 Gi5/3 vlan 1006
match ip 192.168.3.0 255.255.255.0 Gi5/3 vlan 1007
```

```
DHCP server: network 192.168.1.0 255.255.255.0      //Multiple small address pools are configured. The network segment of each address pool is corresponding to the gateway address of one super VLAN.
network 192.168.2.0 255.255.255.0
network 192.168.3.0 255.255.255.0
```

Note 2:

1. AM rules are in strict mode by default when enabled. AM rules are described as follows:

After an AM rule is created, when a client requests an IP address via the RG-N18000, the client whose DHCP packets do not match the AM rule will not be assigned an IP address. Pay attention to this case during network reconstruction.

When Internet access packets from a client having a static IP address pass through the RG-N18000, if the static IP address does not match the created AM rule, the packets are allowed to pass. When the static IP address matches the AM rule but does not match the specified network segment, the client will fail the authentication and the Internet access will be rejected.

If a network segment is divided into excessively small network segments according to the created AM rule in wireless scenarios, IP addresses may not match the AM rule after wireless migration, and packets are discarded, causing migration failures. For example, the IP address segment for wireless super VLAN 3000 is 172.18.0.0/16. Two AM rules are configured: 172.18.1.0/24 for sub VLAN 2001, and 172.18.2.0/24 for sub VLAN 2002. When a client obtains an IP address in sub VLAN 2001 and then is migrated to sub VLAN 2002, because the original IP address does not match the AM rule of sub VLAN 2002, the client needs to obtain a new IP address and be authenticated before it can access the network.

2. (Optional) AM rules can be configured in loose mode, and are described as follows (recommended):

For DHCP packets matching an AM rule, IP addresses in an address segment configured in the AM rule are assigned to clients. DHCP packets that match no AM rule can apply for addresses according to the conventional logic of the DHCP address pool. The DHCP packets are not discarded.

Packets from static IP addresses are not discarded.

Packets from user IP addresses that do not match the AM rules are not discarded during wireless migration.

Note 3: The AM rule matching sequence is as follows:

More detailed AM rules are preferential for matching. In code implementation, AM rules containing the port parameters are matched with a higher priority. For example:

```
address-manage
match ip 192.168.1.0 255.255.255.0 vlan 400
match ip 192.168.2.0 255.255.255.0 Gi1/3 vlan 400(preferential for matching)
```

Configuration commands:

AM rules support VLAN-based and VLAN+port-based IP address assignment.

```
address-manage//Enable the address management function.
match ip 10.1.5.0 255.255.255.0 gi5/3 vlan 1005//Configure VLAN+port-based IP address assignment.
match ip 10.1.6.0 255.255.255.0 vlan 1006//Configure VLAN-based IP address assignment.
```

```
match ip default 172.16.128.0 255.255.128.0//Assign IP addresses from the default address segment
to clients that do not match the AM rule.
match ip loose//Configure the loose mode for the AM rule (recommended). For details, see the
above-mentioned   Note 2  .

address-manage       //Enable address management.
clear match ip//Access the address management configuration mode to disable AM rules globally.
```

Precautions:

When both the DHCP relay and AM rules are enabled, multiple small address pools must be configured on the DHCP server.

The strict mode is adopted by default after AM rules are enabled on the RG-N18000. In this mode, no IP address is assigned to areas that do not match AM rules in the live network. Pay attention to this case during network reconstruction. It is recommended to configure the loose mode for AM rules.

VLANs configured in AM rules map to outer sub VLANs in QinQ solutions and map to sub VLANs in access isolation solutions.

Configuration example

N/A

4.1.2.6 [Optional] Stateless IPv6 Address Acquisition

Scenario

The stateless IPv6 address acquisition is mainly applied on the layer-3 switch serving as the LAN user gateway. It is used when the IPv4/IPv6 dual-stack service needs to be enabled and users of downlink hosts need to access IPv6 resources. An IPv6 address contains up to 128 bits, and therefore the configuration is complex, and errors are prone to occur. It is expected that hosts can obtain IPv6 prefixes and gateway information without configuration, and IPv6 plug-and-play can be implemented. In this case, the stateless IPv6 address assignment function can be enabled on the user gateway, to assign IPv6 address prefixes and gateway information to downlink hosts.

In another case, a DHCPv6 server is deployed in a network, and IPv6 addresses and parameter information are assigned to downlink hosts in stateful mode. However, DHCPv6 is incapable of assigning gateway address information, lifetime, and other parameters. Therefore, the stateless IPv6 address assignment function needs to be enabled on the switch.

Currently, IPv6 addresses are mainly applied to campus networks on a large scale, and are seldom used in other sectors.

Description

An IPv6 address consists of a prefix and a 64-bit interface ID that is automatically generated from a 48-bit MAC address and is usually called EUI-64 address.

The prefix of an IPv6 address identifies the network between a host and a router. The prefix required by a host is actually the gateway prefix. A protocol can be run between the gateway switch and a host to automatically obtain the prefix. The Router

Solicitation and Router Advertisement (RA) of the Neighbor Discovery Protocol (NDP) can be used, where the former is used to discover a gateway and urge the gateway to send the RA containing the prefix to the host.

The RA contains the prefix, lifetime, default gateway, and other information. It cannot deliver the IPv6 address of the DNS server.

The RA function is disabled by default. You can run the **no ipv6 nd suppress-ra** command in interface configuration mode to enable it.

Network requirements

A customer requests that IPv6 prefixes be obtained in stateless mode and interface addresses be obtained according to the EUI-64, to form IPv6 addresses.

Obtaining IPv6 addresses in stateless mode can be easily configured.

The IPv6 protocol stack is enabled on Windows 7 clients by default. For Windows XP clients, run the **IPv6 install** command in the **Run** window to enable the IPv6 protocol and restart the clients.

Network topology

Configuration key points

1. Configure an IPv6 address on the core switch.
2. Enable the RA and O-bit flag on the user gateway.
3. Configure a DHCPv6 server and call it in interface configuration mode.

Configuration steps

1. Configure an IPv6 address for an interface and enable IPv6 on the interface.

```
Ruijie#conf t
Ruijie(config)#interface gigabitEthernet 1/1
Ruijie(config-if-GigabitEthernet 1/1)#no switchport
Ruijie(config-if-GigabitEthernet 1/1)#ipv6 enable
Ruijie(config-if-GigabitEthernet 1/1)#ipv6 address
2001:250:2003:2000::1/64   ------>Configure an IPv6 address for the interface.
```

2. Enable the RA function on the interface, set the O-bit flag to enable the host to obtain DNS, domain name, and other information, and call the address pool.

```
Ruijie(config-if-GigabitEthernet 1/1)#no ipv6 nd suppress-ra      ------>Enable the RA function.
```

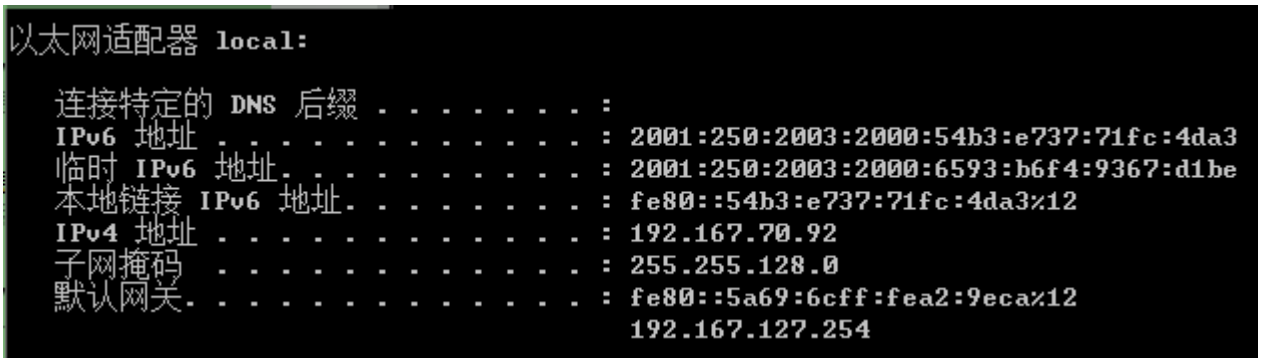
```
Ruijie(config-if-GigabitEthernet 1/1)#ipv6 nd other-config-flag ----->Set the O-bit flag to enable the host to obtain other information.
Ruijie(config-if-GigabitEthernet 1/1)# ipv6 dhcp pool ruijie ----->Call the address pool in interface configuration mode.
```

3. Configure an IPv6 server, including the domain name, prefix, and DNS server.

```
Ruijie(config)#ipv6 dhcp pool ruijie     ----->Create an IPv6 address pool.
Ruijie(dhcp-config)#domain-name www.example.com.cn   ----->Configure the domain name to be assigned to the client.
Ruijie(dhcp-config)#dns-server 2003::1              ----->Configure the DNS server to be assigned to the client.
Ruijie(dhcp-config)#exit
```

Verification

Check the IPv6 address obtained by a client.



Note: In the figure above, another IPv6 address is a temporary address automatically generated by the system. The interface address of the temporary address is randomly generated.

The probability of reconnecting to the local address by using the randomly derivative interface ID is very low. Therefore, clients running Windows Vista or Windows Server 2008 can send router requests by using the derivative local address, without waiting for completion of the Duplicate Address Detection (DAD). This is called optimistic DAD. The router discovery and DAD are performed simultaneously, which reduces time required for the interface initialization process. In the generation of this temporary address, however, data packets are sent to the network, which occupies network resources, affects the network health, and hinders IPv6 user uniqueness control. Therefore, it is recommended to disable this function. To do so, click **Start** > **Run**. In the **Run** window, enter **netsh**, **int ipv6** and **set privacy state=disable** in sequence, as shown in the figure below.

```
C:\Users\Administrator>netsh
netsh>int ipv6
netsh interface ipv6>set privacy state=disable
确定。

netsh interface ipv6>exit


C:\Users\Administrator>
```

For more information about temporary addresses, see http://technet.microsoft.com/zh-cn/magazine/2007.08.cableguy.aspx.

4.1.2.7 [Optional] Stateful IPv6 Address Automatic Acquisition

Network requirements

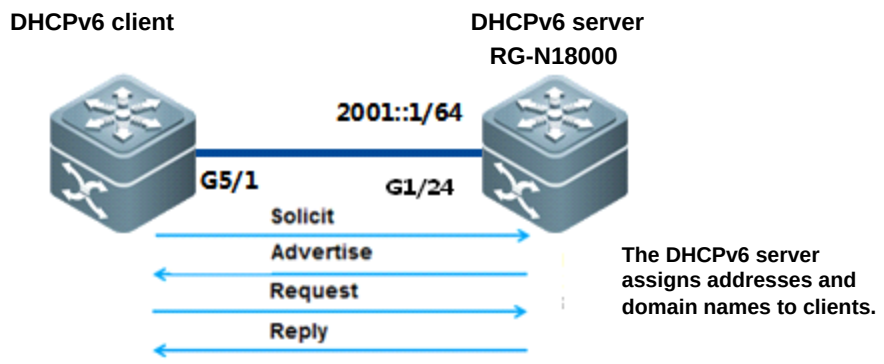
A switch is used as a DHCPv6 client, to obtain an IPv6 address from the DHCPv6 server, as well as the DNS server address, domain name, and other network parameters.

Note: If a PC expects to obtain a dynamic IPv6 address, the host must has a DHCPv6 client.

Windows 7, Windows Vista, and Windows Server 2008 each have a built-in DHCPv6 client.

Windows XP and Windows Server 2003 have no built-in DHCPv6 client. Users need to install the DHCPv6 client or enable the IPv6 protocol stack.

Network topology



Configuration key points

1. Configure the RG-N18000 switch as the DHCPv6 server and set its address to 2001::1/64.
2. Enable the DHCPv6 server to assign 2001::X/64 to the DHCPv6 client.
3. Set the address of the DNS server to 2003::1/64.
4. The domain name of the DHCPv6 client is www.example.com.cn.

Configuration steps

DHCPv6 server configuration:

1. Enable the IPv6 routing function.

```
Ruijie>enable
Ruijie#configure terminal
Ruijie(config)#ipv6 unicast-routing----->Enable the IPv6 routing function.
Ruijie(config)#end
```

2. Configure an IPv6 address for an interface and enable the IPv6 function on the interface.

```
Ruijie#conf t
Ruijie(config)#
Ruijie(config)#interface gigabitEthernet 1/24
Ruijie(config-if-GigabitEthernet 1/24)#no switchport
Ruijie(config-if-GigabitEthernet 1/24)#ipv6 address 2001::1/64   ----->Configure an IPv6
address for the interface.
Ruijie(config-if-GigabitEthernet 1/24)#ipv6 enable             ----->Enable the IPv6 function
on the interface.
Ruijie(config-if-GigabitEthernet 1/24)#end
```

3. Enable the RA function and set the M-bit flag and O-bit flag.

a. The DHCPv6 server does not assign a gateway address to the client. The RA function needs to be enabled on the device.

b. Set the **managed address configuration** flag bit in the RA packet to 1. This flag bit determines whether the host receiving the RA packet uses the stateful automatic configuration to obtain an IP address. By default, the flag bit is not set to 1 in the RA packet.

c. Set the **other stateful configuration** flag bit in the RA packet. This flag bit determines whether the host receiving the RA packet uses the stateful automatic configuration to obtain information other than addresses. By default, the flag bit is not set to 1 in the RA packet.

```
Ruijie>enable
Ruijie#configure terminal
Ruijie(config)#interface gigabitEthernet 1/24
Ruijie(config-if-GigabitEthernet 1/24)#no ipv6 nd suppress-ra     ----->Enable the RA function.
Ruijie(config-if-GigabitEthernet 1/24)#ipv6 nd managed-config-flag----->Set the M-bit flag of
the RA.
Ruijie(config-if-GigabitEthernet 1/24)#ipv6 nd other-config-flag----->Set the O-bit flag of the
RA.
Ruijie(config-if-GigabitEthernet 1/24)#ipv6 nd prefix 2001::/64 no-autoconfig  ----->Specify
that the RA prefix cannot be used for stateless automatic configuration.
Ruijie(config-if-GigabitEthernet 1/24)#end
```

4. Configure an IPv6 server, including the domain name, prefix, and DNS server.

```
Ruijie(config)#ipv6 dhcp pool ruijie     ----->Create an IPv6 address pool.
Ruijie(dhcp-config)#domain-namewww.example.com.cn   ----->Configure the domain name to be
assigned to the client.
Ruijie(dhcp-config)#dns-server 2003::1              ----->Configure the DNS server to be
assigned to the client.
Ruijie(dhcp-config)#iana-address prefix 2001::/64      ----->Apply the IPv6 prefix pool.
Ruijie(dhcp-config)#exit
```

5. Enable the DHCPv6 server function on the interface.

```
Ruijie(config)#interface gigabitEthernet 1/24
Ruijie(config-if-GigabitEthernet 1/24)#ipv6 dhcp server ruijie  ----->Enable the IPv6 function
on the interface.
Ruijie(config-if-GigabitEthernet 1/24)#end
```

Verification

1. Check information about the address pool of the DHCPv6 server.

```
Ruijie #show ipv6 dhcp pool
DHCPv6 pool: ruijie
     IANA address range: 2001::1/64 -> 2001::FFFF:FFFF:FFFF:FFFF/64
     preferred lifetime 3600, valid lifetime 3600
     DNS server: 2003::1
     Domain name: www.example.com.cn
```

Information about the address pool of the DHCPv6 server shows the name of the DHCPv6 address pool, name of the prefix pool, DNS, and domain name.

2. Check the binding table on the DHCPv6 server.

```
Ruijie #sho ipv6 dhcp binding
Client  DUID: 00:03:00:01:00:1a:a9:15:46:e2
     IANA: iaid 100001, T1 1800, T2 2880
     Address: 2001::2
     preferred lifetime 3600, valid lifetime 3600
     expires at Aug 25 2014 16:35 (3571 seconds)
The binding table shows the client DUID and prefix.
```

3. Check information obtained from the DHCPv6 server.

```
Ruijie #show ipv6 dhcp interface gigabitEthernet 5/1
            GigabitEthernet 5/1 is in client mode
            State is IDLE
            next packet will be send in : 1744 seconds
            List of known servers:
            DUID: 00:03:00:01:14:14:4b:1b:54:6c
            Reachable via address: FE80::1614:4BFF:FE1B:546D
```

```
            Preference: 0
            Configuration parameters:
            IA NA: IA ID 0x186a1, T1 1800, T2 2880
            Address: 2001::2
            preferred lifetime 3600, valid lifetime 3600
            expires at Jan 1 1970 7:38 (3544 seconds)
            DNS server: 2003::1
            Domain name: www.example.com.cn
  Rapid-Commit: disable
```

4. Check the status of the IP address obtained by the interface.

```
Ruijie #show ipv6 int g5/1
interface GigabitEthernet 5/1 is Up, ifindex: 1
  address(es):
    Mac Address: 00:1a:a9:15:46:e3
    INET6: FE80::21A:A9FF:FE15:46E3, subnet is FE80::/64
    INET6: 2001::2 [ DEPRECATED ], subnet is 2001::/64
      valid lifetime 3526 sec
  Joined group address(es):
    FF01::1
    FF02::1
    FF02::2
    FF02::1:FF00:2
    FF02::1:FF15:46E3
  MTU is 1500 bytes
  ICMP error messages limited to one every 100 milliseconds
  ICMP redirects are enabled
  ND DAD is enabled, number of DAD attempts: 1
  ND reachable time is 30000 milliseconds
  ND advertised reachable time is 0 milliseconds
  ND retransmit interval is 1000 milliseconds
  ND advertised retransmit interval is 0 milliseconds
  ND router advertisements are sent every 200 seconds<160--240>
  ND router advertisements live for 1800 seconds
```

4.1.2.8 [Optional] DHCPv6 Relay

Scenario

A dedicated DHCPv6 server running Windows 2003 or 2008 is deployed in the network center to assign IPv6 address prefixes and network parameters to hosts in the campus network, to implement centralized management and maintenance. The DHCP relay function needs to be enabled on all IPv4/v6 dual-stack layer-3 switches, to forward packets between

DHCPv6 clients and the DHCPv6 server. In this way, DHCPv6 clients can obtain IPv6 addresses and configuration parameters even if the DHCPv6 clients and the DHCPv6 server are not connected through local links.

In another case, a DHCPv6 server is deployed in the network, and IPv6 addresses and parameter information are assigned to clients in stateful mode. However, DHCPv6 is incapable of assigning gateway information, lifetime, and other parameters. Therefore, the stateless IPv6 address assignment function needs to be enabled on the switch, so that hosts can obtain gateway information.

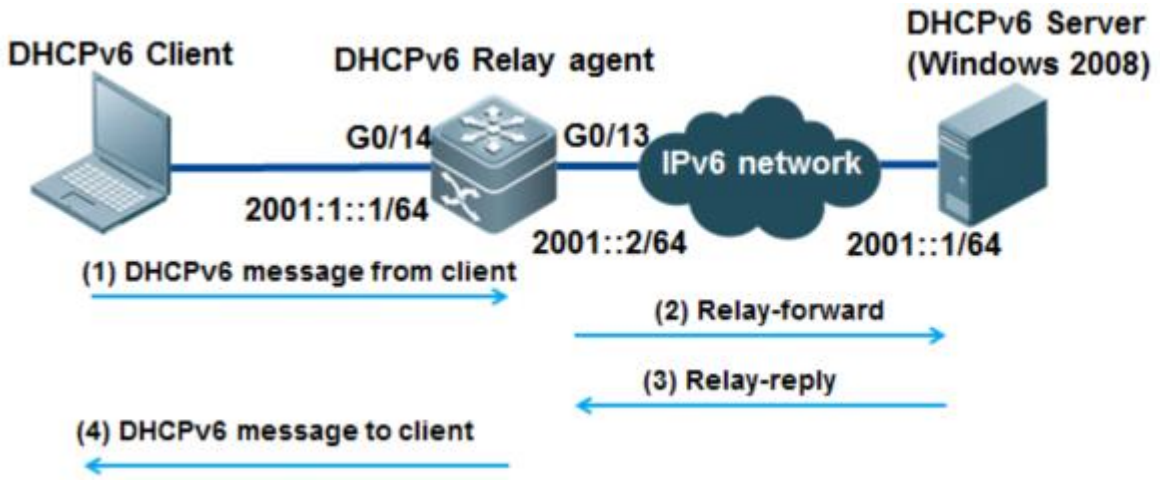
Description

The DHCPv6 application model consists of the server, client, and relay. The client and server obtain configuration parameters in request-response mode. The relay can transparently bridge clients and the server that are not connected through local links. The packet interaction and parameter maintenance of DHCPv6 are basically the same as those of DHCPv4, but DHCPv6 adjusts the packet structure and processing based on new networks.

Network requirements

User PCs are used as DHCPv6 clients to obtain IPv6 addresses from the DHCPv6 server running Windows 2008. After IPv6 addresses are obtained, the PCs can ping the DHCPv6 server successfully. The RG-N18000 serves as the DHCPv6 relay.

Network topology



Configuration key points

Complete the following configuration on the DHCPv6 server:

1. Configure an IPv6 address and gateway for the DHCPv6 server.
2. Configure scope information.
3. Configure log information.
4. Enable the IPv6 routing function on the DHCPv6 relay, create an IPv6 address, and configure the DHCPv6 relay.

Configuration steps

DHCP agent configuration:

1. **Enable the IPv6 routing function.**

```
Ruijie>enable
Ruijie#configure terminal
Ruijie(config)#ipv6 unicast-routing   ----->Enable the IPv6 routing function.
Ruijie(config)#end
```

2. **Configure an IPv6 address for an interface of the DHCPv6 server and enable the IPv6 function on the interface.**

```
Ruijie(config)#int g0/13
Ruijie(config-if-GigabitEthernet 0/13)#no switchport
Ruijie(config-if-GigabitEthernet 0/13)#ipv6 enable             ----->Enable the IPv6 function
on the interface.
Ruijie(config-if-GigabitEthernet 0/13)#ipv6 address 2001::2/64    ----->Configure an IPv6
address for the interface.
Ruijie(config-if-GigabitEthernet 0/13)#end
```

3. **Create a VLAN for the DHCPv6 client and configure the VLAN on an interface.**

```
Ruijie(config)#vlan 2
Ruijie(config-vlan)#exit
Ruijie(config)#int g0/14
Ruijie(config-if-GigabitEthernet 0/14)#switchport mode access
Ruijie(config-if-GigabitEthernet 0/14)#switchport access vlan 2
Ruijie(config-if-GigabitEthernet 0/14)#end
Ruijie#
```

4. **Configure the gateway IPv6 address for the DHCPv6 client and enable the DHCPv6 relay function.**

```
Ruijie#conf t
Ruijie(config)#interface vlan 2
Ruijie(config-if-VLAN 2)# ipv6 address 2001:1::1/64
Ruijie(config-if-VLAN 2)# ipv6 enable
Ruijie(config-if-VLAN 2)#ipv6 nd prefix 2001:1::/64  no-autoconfig  ----->Specify that the RA
prefix cannot be used for stateless automatic configuration.

Ruijie(config-if-VLAN 2)# ipv6 dhcp relay destination 2001::1 ----->Configure the DHCPv6 relay
and set its next hop to the interface of the server that is connected to the RG-N18000.
Ruijie(config-if-VLAN 2)# no ipv6 nd suppress-ra       ----->Enable the RA function.
Ruijie(config-if-VLAN 2)# ipv6 nd managed-config-flag  ----->Set the M-bit flag of the RA.
Ruijie(config-if-VLAN 2)# ipv6 nd other-config-flag      ----->Set the O-bit flag of the RA.
Ruijie(config-if-VLAN 2)# end
```

Enabling the RA function and setting the M-bit flag and O-bit flag:

a. The DHCPv6 server does not assign a gateway address to the client. The RA function needs to be enabled on the device.

b. Set the **managed address configuration** flag bit in the RA packet to 1. This flag bit determines whether the host receiving the RA packet uses the stateful automatic configuration to obtain an IP address. By default, the flag bit is not set to 1 in the RA packet.

c. Set the **other stateful configuration** flag bit in the RA packet. This flag bit determines whether the host receiving the RA packet uses the stateful automatic configuration to obtain information other than addresses. By default, the flag bit is not set to 1 in the RA packet.

4.1.3 Common Scenario — Authentication-free Access

4.1.3.1 [Optional] Authentication-free VLAN

Principles:

Authentication-free VLANs enable users in the specified VLANs to access the Internet without authentication.

The number of authentication-free VLANs is limited. Pay attention to the limit.

The number of authentication-free VLANs cannot exceed 100 in consideration that performance resources are greatly exhausted due to broadcast packet duplication in sub VLANs or in PE-CE VLANs. Countermeasures need to be taken to prevent the RG-N18000 from sending excessive ARP requests, which affects the CPU usage of the device and causes protocol flapping (such as OSPF flapping), packet loss, and network interruption at a high probability. When the number of authentication-free VLANs cannot meet service requirements, security channels are recommended. In a simplistic network, the ARP proxy function is enabled on the RG-N18000 serving as the network-wide gateway by default. Once ARP request scanning attacks occur, the RG-N18000 acts a proxy to flood ARP packets to authentication-free VLANs, resulting in great overhead in the CPU of the RG-N18000.

In a simplistic network, the following VLANs are usually configured as authentication-free VLANs (for reference only):

1. Special service VLANs (such as VLANs for all-in-one cards, video monitoring, and door status control systems, server VLANs, and other non-user VLANs)
2. NMS VLANs (switch NMS VLANs and wireless NMS VLANs)
3. VLANs corresponding to AC 802.1x authentication. Wireless 802.1x authentication must be carried out on the AC, and authentication exemption is required to avoid re-authentication.
4. Privilege user VLANs (such as VLANs for school principals and other directors).

If dumb clients (which do not actively send ARP packets) exist on the network, such as printers of some types and door status control systems, only authentication-free VLANs can be used to exempt authentication. This is because the RG-N18000 does not actively send ARP request packets to sub VLANs and therefore cannot learn the ARP information of the dumb clients.

Configuration commands:

```
direct-vlan 400, 600, 800-820        //Configure VLANs 400, 600, and 800-820 as
authentication-free VLANs. Users in these VLANs can access the network without authentication.
```

Note: The VLAN IDs used in the **direct-vlan** command are IDs of sub VLANs.

Precautions:

Authentication-free VLANs are exempted only from checks related to access authentication, but still need to undergo checks specified in security ACLs. If a specific user or VLAN is disallowed in a security ACL, the specific user or users in the specific VLAN cannot access the network. For users in authentication-free VLANs to access the network without authentication, ensure that the VLANs or users in the VLANs are not blocked by ACLs.

The number of authentication-free VLANs cannot exceed 100. Otherwise, the ARP proxy function may enable the RG-N18000 to send excessive ARP packets, resulting in CPU overload of the RG-N18000.

Configuration example

N/A

4.1.3.2 [Optional] Authentication-free sites

Principles:

Before users are authenticated, provide some site resources for users to log in or download data. This is called destination IP-based authentication exemption. In the simplistic network solution, this feature can be usually applied to:

1. Download the SU client and exempt the download server from authentication.
2. Provide public authentication-free resources in a campus network.
3. Allow unauthenticated users to access the portal server and enable the portal server to direct to the authentication page. (In the current version, users can directly access the portal server without authentication after the Web authentication template is configured.)

Configuration commands:

```
http redirect direct-site  x.x.x.x [Mask is optionally configured.]        //Configured in global
configuration mode. The server with the address x.x.x.x. is configured as an authentication-free
site.
```

Precautions:

A maximum of 50 authentication-free site entries can be configured.

Configuration example

N/A

4.1.3.3 [Optional] Source IP-based authentication exemption

Principles:

Authentication-free source IP addresses can be configured, so that users with the specified source IP addresses can access the Internet without authentication.

The application scenario is similar to that of authentication-free VLANs. The difference lies in that authentication is exempted based on different dimensions, and can be performed as required.

Configuration commands:

```
web-auth direct-host  x.x.x.x [The mask is optional.]        //Configured in global configuration
mode. The source IP address of x.x.x.x. is used as an authentication-free site.
```

Precautions:

A maximum of 1000 authentication-free entries can be configured (the total maximum number of entries that can be configured for both authentication-free source addresses and security channels is 1000).

Configuration example

N/A

4.1.3.4 [Optional] Security channels

Principles:

1. The security channel can invoke ACLs and is configured globally or based on ports, enabling ACL-based authentication exemption. ACLs support flexible ACEs. Therefore, the security channel can be used to accurately control authentication-free user groups by allowing packets with the specified source/destination MAC address, source/destination IP address, or the protocol ID above layer 4 without authentication. The security channel further avoids excessive CPU usage caused by ARP packets as in the authentication-free VLAN feature, and therefore is recommended.
2. The security channel must be configured on an interface or globally. If it is configured on both the interface and globally, the priority sequence is as follows: interface > global.
3. An excluded interface of the security channel is optional. After an excluded interface is configured, the global security channel is invalid to this excluded interface.
5. **The maximum number of entries that can be configured is 1000 for ED and EF cards and 100 for DB cards (the total maximum number of entries that can be configured for both authentication-free source addresses and security channels is 1000). If the ED and DB cards are both used, the entry capacity may be reduced to 100.**

Configuration commands:

ACL-related configuration is omitted here.

```
security global access-group {acl-id | acl-name }          //Apply a security channel in global
configuration mode.
```

```
security access-group {acl-id | acl-name }                    //Apply a security channel in
interface configuration mode.
security uplink enable//Configure a security channel excluded port in interface configuration
mode. The global security channel does not take effect on this interface.
```

Precautions:

An ACL uses the permit statement to set the authentication-free entry, and uses the deny statement to block an entry.

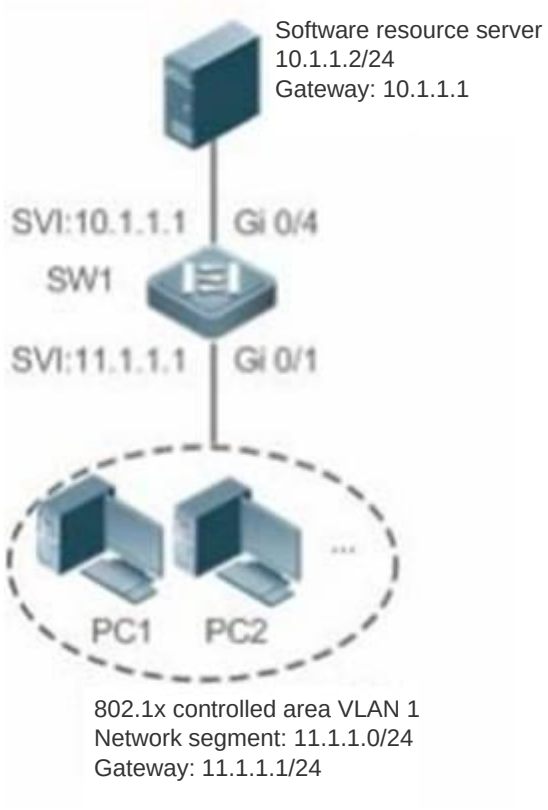
If the security channel is configured on both an interface and globally, the priority sequence is as follows: interface > global.

In an environment with only 802.1x authentication, this command is required to allow critical protocol packets such as ARP and DHCP packets.

```
Ruijie(config)# expert access-list extended 2700
Ruijie(config-exp-nacl)#10 permit arp any any any any any
Ruijie(config-exp-nacl)#20 permit udp any any any any eq bootpc
Ruijie(config-exp-nacl)#30 permit udp any any any any eq bootps
Ruijie(config)# security global access-group 2700
```

Configuration example

Scenario



Configuration Steps:

Configure an Expert extended ACL named exp_ext_esc.

Add an ACE to the ACL to allow the destination host 10.1.1.2.

Add an ACE to the ACL to allow DHCP packets.

Add an ACE to the ACL to allow ARP packets.

On the interface of the 802.1x authentication controlled area, configure the ACL exp_ext_esc as a security channel.

Run the following commands on SW1:

```
sw1(config)#expert access-list extended exp_ext_esc
sw1(config-exp-nacl)# permit ip any any host 10.1.1.2 any
sw1(config-exp-nacl)# permit 0x0806 any any any any any
sw1(config-exp-nacl)# permit udp any any any any eq 67
sw1(config-exp-nacl)# permit udp any any any any eq 68
sw1(config)#int gigabitEthernet 0/1
sw1(config-if-GigabitEthernet 0/1)# security access-group exp_ext_esc
```

Verification:

On a client of the Sales Department, ping the server of the Sales Department and check whether the ping operation is successful.

On clients of R&D Department 1 and R&D Department 2, ping the server of the Sales Department and check whether the ping operations are successful.

```
sw1#show access-lists
expert access-list extended exp_ext_esc
10 permit ip any any host 10.1.1.2 any
20 permit arp any any any any any
30 permit tcp any any any any eq 67
40 permit tcp any any any any eq 68……
sw1#show running-config interface gigabitEthernet 0/1
Building configuration...
Current configuration : 59 bytes
interface GigabitEthernet 0/1
security access-group exp_ext_esc
```

4.1.3.5 [Optional] Free-DNS (Fee Evasion Prevention)

Principles:

After control of Web authentication and 802.1x authentication is enabled on interfaces of the RG-N18000, all DNS packets are allowed to pass before user authentication by default (Web authentication allows DNS packets as specified in the protocol while 802.1x authentication allows DNS packets by using secure channels). Based on the vulnerability of allowing DNS packets prior to authentication, the fee evasion software in the market encapsulates all packets into DNS packets, to

implement Internet access without paying fees. The free-DNS mode can be configured to select DNS packets that are allowed to pass prior to authentication, so as to prevent user fee evasion.

Configuration commands:

1. Configure the free-DNS mode.

```
free-dns ip-address ip-mask
```

2. Delete the free-DNS mode.

```
no free-dns ip-address ip-mask
```

3. Precautions:

Free-DNS is valid only before user authentication. All DNS packets are allowed to pass after user authentication.

4. Configuration example

N/A

4.1.4 Common Scenario — Authentication

4.1.4.1 [Optional] 802.1x Authentication

Principles:

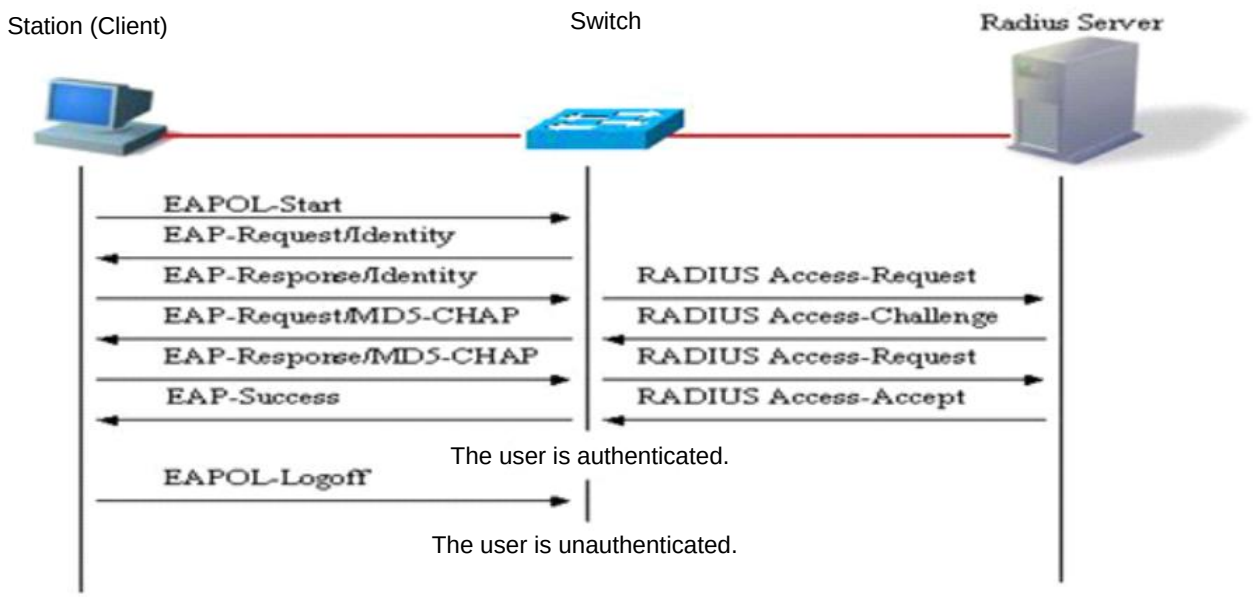
Authentication roles are described as follows:

Client: Ruijie SU client or an open-source client.

NAS: controls the network connection status of a client based on its current authentication status. The device serves as an agent between clients and the sever. It request usernames from clients, checks the authentication information from the server, and forwards the information to the clients.

RADIUS server: corresponding to Ruijie SAM+ system, which provides the authentication service for users.

The figure below shows the authentication flow.



Configuration commands:

```
aaa new-model//Enable the AAA function.
aaa accounting network (list name) start-stop group(group name)      //AAA reference
configuration. The actual service deployment prevails.
aaa authentication dot1x (list name) group (group name)//802.1x template reference
configuration for AAA. The actual service deployment prevails.
aaa authentication login default local      //Use the local username/password to log in to the
AAA device.
aaa group server radius (group name)           //Configure an AAA server group, which is
applicable to multi-RADIUS scenarios.
  server (radius ip)//Configure an AAA server group, which is applicable to multi-RADIUS
scenarios.
radius-server host (radius ip) key 7 (radius key) //Configure the IP address and key for the
AAA server, which are applicable to single-RADIUS scenarios.
aaa accounting update periodic 30         //Set the interval for AAA accounting update to 30s.
aaa accounting update //Configure AAA accounting update.
aaa authorization ip-auth-mode mixed     //Set the IP address authorization mode of 802.1x clients
to the mixed mode. The IP addresses can be obtained via polling in multiple ways (DHCP/RADIUS).
no aaa log enable   //Disable the AAA log function.

dot1x valid-ip-acct enable//Mandatory. The accounting update packets are used to upload the user
IP address to SAM+. If the 802.1x authentication module does not have IP entries of the user,
the user is forced to go offline 5 minutes later,  to prevent users at the IP address 0.0.0.0
```

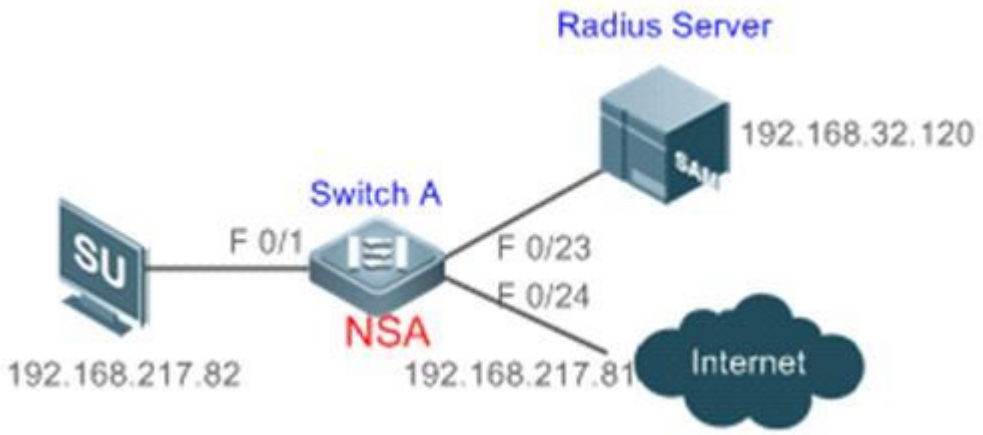
```
on SAM+. The configuration of this command will drop users out of the network. It is not recommended
to run this command in service peak hours.
dot1x accounting (list name)     //Optional. This command is required when the 802.1x accounting
list name for AAA is not set to default.
dot1x authentication (list name)     //Optional. This command is required when the 802.1x
authentication list name for AAA is not set to default.
interface range GigabitEthernet 0/2-3  //Configure the interface for enabling 802.1x
authentication.
    dot1x port-control auto//Enable 802.1x authentication on the interface.
snmp-server host x.x.x.x(server IP address) informs version 2c xx(community name)
snmp-server community xx(community name) rw
```

Precautions:

The list name configured in **aaa authentication dot1x** *(list name)* **group** *(group name)* should be consistent with that in **dot1x authentication** *(list name)*.

When only 802.1x authentication is enabled on an interface, security channels must be configured to allow DHCP packets to pass. Otherwise, users cannot obtain IP addresses. For specific configuration, see the security channel configuration.

Configuration example

Scenario	
Configuration Steps	Register the IP address of the device with the RADIUS server and configure the key for the device to communicate with the server. Create an account on the RADIUS server. Enable AAA on the device. Configure RADIUS parameters on the device. Enable 802.1x authentication on interfaces of the device. The following shows relevant configurations on the device. For the configurations of the server, see the server configuration guide.
	`ruijie# configure terminal` `ruijie (config)# aaa new-model`

	```ruijie (config)# aaa accounting network radius start-stop group default ruijie (config)# aaa authentication dot1x radius group default ruijie (config)# aaa authentication login default local ruijie (config)# aaa accounting update periodic 30 ruijie (config)# aaa accounting update ruijie (config)# aaa authorization ip-auth-mode mixed ruijie (config)# no aaa log enable ruijie (config)# radius-server host 192.168.32.120 key 7 ruijie ruijie (config)# interface FastEthernet 0/1 ruijie (config-if)# dot1x port-control auto```
Verification	Test whether authentication can be performed normally and whether network access behavior changes after authentication. Create an account on the server, for example, username:test,password:test. An unauthenticated client fails to ping 192.168.32.120. Start Supplicant on the client and enter the username for authentication. After the client is authenticated, it can ping 192.168.32.120 successfully.

4.1.4.2 [Mandatory] Web Authentication

Principles:

A user opens the Internet Explorer (IE) and accesses a website to initiate an HTTP request.

The NAS intercepts the HTTP request from the client, and forcibly forwards the HTTP request to the portal server. It also adds some relevant parameters to the portal URL. For the parameters, see CHAP authentication.

The portal server pushes the Web authentication page to the client.

The user enters the username and password on the authentication page and submits them to the portal server.

The portal server sends the username and password to the NAS to initiate authentication.

The NAS sends the username and password to the RADIUS server, which checks whether the user is valid and returns the Radius access-accept/reject message to the NAS.

The NAS returns the authentication result to the portal server.

The portal server pushes the authentication result page to the user based on the authentication result.

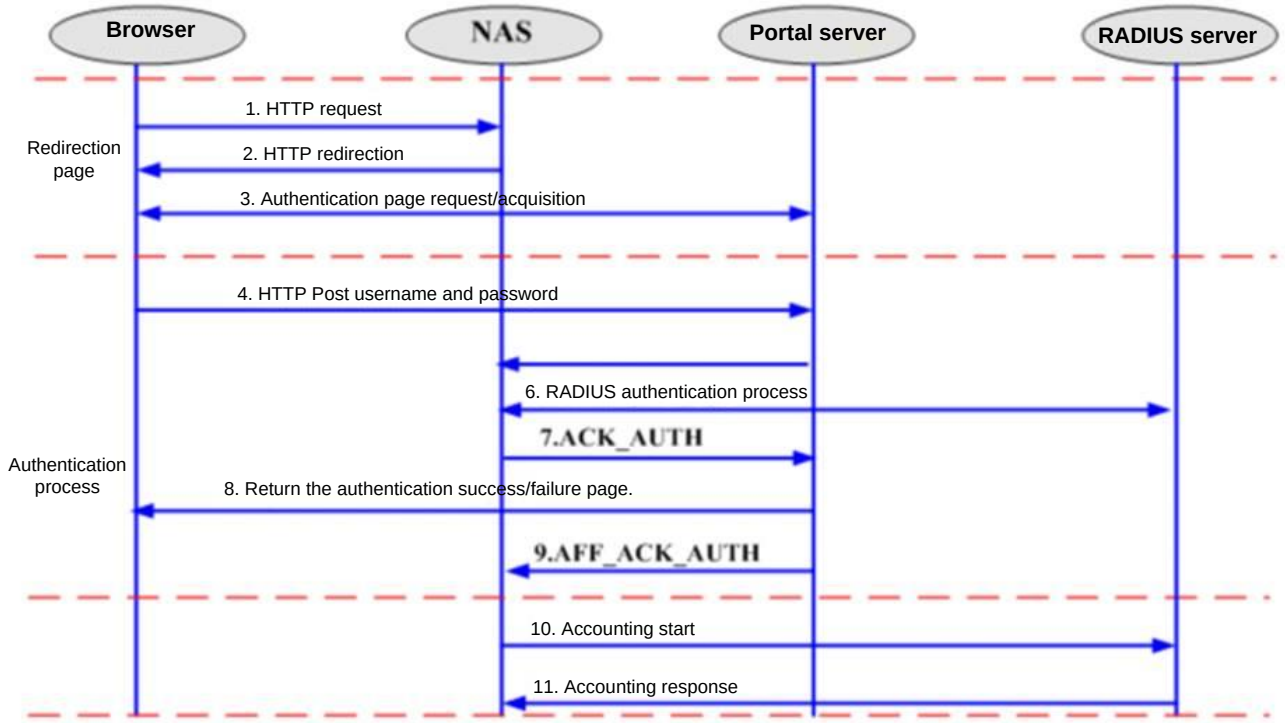
The portal server notifies the NAS that the authentication result packet has been received.

The NAS sends the accounting start packet.

Note: Web authentication acceleration supports direct access to the portal page for authentication, without redirection.

Difference from the 1st-generation portal: The authentication is completed by the NAS and RADIUS server, which greatly reduces the load of the portal server.

In simplistic network environments, static ARP addresses are automatically bound after Web authentication succeeds, which is different from that in conventional solutions.



Configuration commands:

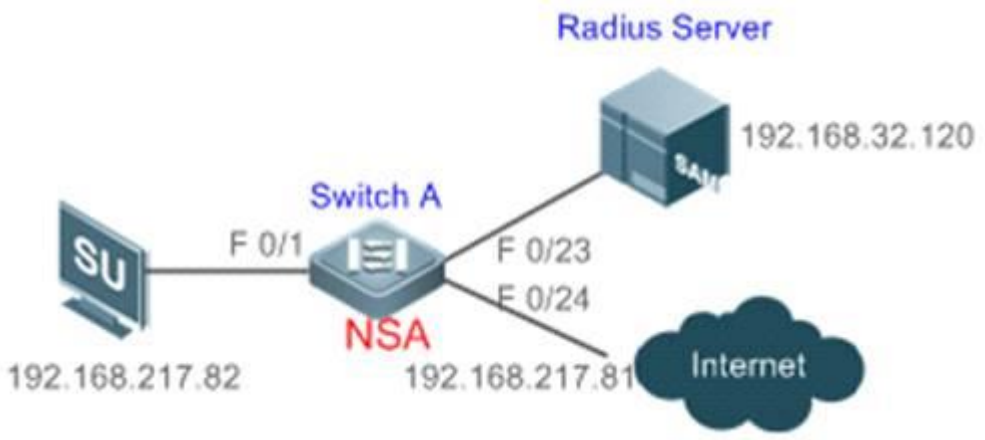
```
aaa new-model      //Enable the AAA function.
aaa accounting network (list name) start-stop group(group name)      //AAA reference
configuration. The actual service deployment prevails.
aaa authentication web-auth (list name) group(group name)          //Web authentication
template reference configuration for AAA. The actual service deployment prevails.
aaa authentication login default local      //Use the local username/password to log in to the
AAA device.
aaa group server radius (group name)           //Configure an AAA server group, which is
applicable to multi-RADIUS scenarios.
  server (radius ip)                                //Configure an AAA server group, which is
applicable to multi-RADIUS scenarios.
radius-server host (radius ip) key 7 (radius key)       //Configure the IP address and key for
the AAA server, which are applicable to single-RADIUS scenarios.
aaa accounting update periodic 30         //Set the interval for AAA accounting update to 30s.
aaa accounting update               //Configure AAA accounting update.
aaa authorization ip-auth-mode mixed     //Set the IP address authorization mode of 802.1x clients
to the mixed mode. The IP addresses can be obtained via polling in multiple ways (DHCP/RADIUS).
no aaa log enable   //Disable the AAA log function.
```

```
web-auth template eportalv2       //Create a Web authentication template.
ip 202.204.193.32                 //Set the IP address of the portal server.
url http://202.204.193.32/eportal/index.jsp   //Set the URL of the portal server.
authentication  (list name)     //Optional. This command is required when the authentication
list name for AAA is not set to default.
accounting  (list name)       //Optional. This command is required when the accounting list name
for AAA is not set to default.
web-auth portal key university     //Optional. Configure the key.
interface range GigabitEthernet 0/2-3  //Configure the interface for enabling Web
authentication.
    web-auth enable eportalv2              //Enable Web authentication on the interface.
    web-auth vlan-control 2000-3000     //Enable VLAN-based Web authentication control. This
command is used in a scenario in which both 802.1x authentication and Web authentication are
enabled on the same port of the RG-N18000, and some VLANs need to support only 802.1x authentication
control. Such VLANs can be excluded from the Web authentication VLAN range.
snmp-server host x.x.x.x(server IP address) informs version 2c xx(community name)
snmp-server community xx(community name) rw
```

Precautions:

The AAA method list must be consistent with the Web authentication method list.

Configuration example

Scenario	
Configuration Steps	Register the IP address of the device with the RADIUS server and configure the key for the device to communicate with the server. Create an account on the RADIUS server. Enable AAA on the device. Configure RADIUS parameters on the device. Enable Web authentication on interfaces of the device. The following shows relevant configurations on the device. For the configurations of the server, see the

	server configuration guide.

	``ruijie# configure terminal
	ruijie (config)# aaa new-model
	ruijie (config)# aaa accounting network radius start-stop group default
	ruijie (config)# aaa authentication web-auth radius group default
	ruijie (config)# aaa authentication login default local
	ruijie (config)# aaa accounting update periodic 30
	ruijie (config)# aaa accounting update
	ruijie (config)# no aaa log enable
	ruijie (config)# radius-server host 192.168.32.120 key 7 ruijie
	ruijie (config)# web-auth template eportalv2
	ruijie (config)# ip 202.204.193.32
	ruijie (config)# urlhttp://202.204.193.32/eportal/index.jsp
	ruijie (config)# interface FastEthernet 0/1
	ruijie (config-if)# web-auth enable eportalv2
	snmp-server host 192.168.21.120 informs version 2c xx (community name)
	snmp-server community XX(community name) rw
	``

Verification	Test whether authentication can be performed normally and whether network access behavior changes after authentication. Create an account on the server, for example, username:test,password:test. An unauthenticated client fails to ping 192.168.32.120. The client browser automatically redirects to the Web authentication page. Enter the username for authentication. After the client is authenticated, it can ping 192.168.32.120successfully.

4.1.4.3 [Mandatory] AAA IP Authorization

Principles:

802.1x authentication and MAB authentication do not support IP address identification. Ruijie extends the authentication application, which supports MAC+IP binding. This function is called IP authorization. There are four IP authorization modes:

SU authorization: IP addresses are provided by the Supplicant. This mode needs to be used in combination with Ruijie Supplicant.

RADIUS authorization: IP addresses are delivered to the device by the RADIUS server after clients are authenticated.

DHCP-server authorization: An authenticated client initiates a DHCP request to obtain an IP address. After an IP address is obtained, the system binds the IP address with the MAC address of the client. This mode is applicable to dynamic IP environments.

Mixed authorization: The system performs MAC+IP binding for authenticated clients in the sequence of Supplicant authorization, RADIUS authorization, and DHCP-server authorization. If the Supplicant provides an IP address, the authenticated client uses it preferentially; if the Supplicant does not provide an IP address, the IP address provided by the

RADIUS server is used; if the RADIUS server does not provide an IP address, the IP address provided by the DHCP server is used.

Note: Mixed authorization is recommended to all scenarios.

Configuration commands:

```
aaa authorization ip-auth-mode mixed//Configured in global configuration mode.
```

Precautions:

The configuration of this command is irrelevant to whether IP addresses can be uploaded to SAM+. The functions of this command are as follows: If no IP address is authorized to a user, there is no entry of the IP address and the user cannot be charged or brought offline upon no traffic. This command can be used in combination with **valid ip acct** to bring users who do not meet authorization configuration requirements offline.

Configuration example

N/A

4.1.4.4 [Optional] MAB Authentication

Principles:

MAB authentication, one of the main authentication modes in the simplistic network solution, is applicable to wireless users in office areas of campus networks. With the MAB authentication model and high-performance authentication processing capacity of the RG-N18000, MAB authentication enables the RG-N18000 to learn the MAC address of a client when the client accesses the network, so that teachers do not need to repeatedly entering their usernames and passwords when using wireless clients for Web authentication, to prevent deteriorating user experience. The RG-N18000 uses the MAC address of the client as the username and password to send an authentication request to SAM+ to complete the authentication as a proxy. The user cannot perceive the authentication in this process.

The following is the MAB authentication process:

Enable the client MAB authentication on SAM+ by accessing the access control directory.

After Web authentication succeeds for the first time, a user can select MAB authentication on the authentication success page.

When the user chooses to enable MAB authentication, the MAC address of the user client is registered with SAM+.

After the client connects to the network, the RG-N18000 serving as a NAS, identifies the MAC address of the client, and uses the MAC address as the username and password to initiate authentication to SAM+.

SAM+ determines validity of the MAC address and returns the authentication success/failure message to the NAS.

If the authentication is successful, the NAS sends the accounting start packet.

Configuration commands:

Note: MAB authentication takes effect only after each user is WEB authenticated for the first time. In addition, MAB authentication belongs to the 802.1x authentication system. Therefore, both Web authentication and 802.1x authentication need to be configured for MAB authentication.

Configuring global AAA parameters

```
aaa new-model      //Enable the AAA function.
aaa accounting network (list name) start-stop group(group name)      //AAA reference
configuration. The actual service deployment prevails.
aaa authentication dot1x (list name) group (group name)          //802.1x template reference
configuration for AAA. The actual service deployment prevails.
aaa authentication web-auth (list name) group(group name)          //Web authentication
template reference configuration for AAA. The actual service deployment prevails.
aaa authentication login default local      //Use the local username/password to log in to the
AAA device.
aaa group server radius (group name)           //Configure an AAA server group, which is
applicable to multi-RADIUS scenarios.
server (radius ip)                                //Configure an AAA server group, which is
applicable to multi-RADIUS scenarios.
radius-server host (radius ip) key 7 (radius key)       //Configure the IP address and key for
the AAA server, which are applicable to single-RADIUS scenarios.
aaa accounting update periodic 30         //Set the interval for AAA accounting update to 30s.
aaa accounting update               //Configure AAA accounting update.
no aaa log enable      //Disable the AAA log function.
```

Configuring 802.1x parameters and enabling 802.1x authentication on the interface

```
dot1x accounting (list name)     //Optional. This command is required when the 802.1x accounting
list name for AAA is not set to default.
dot1x authentication (list name)     //Optional. This command is required when the 802.1x
authentication list name for AAA is not set to default.
interface range GigabitEthernet 0/2-3  //Configure the interface for enabling 802.1x
authentication.
dot1x port-control auto//Enable 802.1x authentication on the interface.
```

Configuring Web authentication parameters and enabling Web authentication on the interface

```
web-auth template eportalv2
ip 202.204.193.32                 //Set the IP address of the portal server.
url http://202.204.193.32/eportal/index.jsp   //Set the URL of the portal server.
authentication  (list name)     //Optional. This command is required when the authentication
list name for AAA is not set to default.
accounting  (list name)       //Optional. This command is required when the accounting list name
for AAA is not set to default.
```

```
web-auth portal key university     //Optional. Configure the key.
interface range GigabitEthernet 0/2-3  //Configure the interface for enabling Web
authentication.
web-auth enable eportalv2////Enable Web authentication on the interface.
```

Configuring MAB authentication parameters and enabling MAB authentication on the interface

```
aaa authorization ip-auth-mode mixed    //Mandatory. Set the IP address authorization mode of
802.1x clients to the mixed mode. The IP addresses can be obtained via polling in multiple ways
(DHCP/RADIUS).
ip dhcp snooping              //Mandatory. An IP address needs to be obtained via the DHCP
snooping module for MAB authentication. Otherwise, a user with the IP address of 0.0.0.0 appears
on SAM.
dot1x mac-auth-bypass valid-ip-auth          //Mandatory. The DHCP module instructs the MAB
module to start authentication. Clients must obtain IP addresses before starting MAB
authentication. Otherwise, the MAB authentication is blocked to prevent clients with the IP
address of 0.0.0.0 on SAM+. The configuration of this command will drop users out of the network.
It is not recommended to run this command in service peak hours.
dot1x valid-ip-acct enable           //Mandatory. The accounting update packets are used to
upload the user IP address to SAM+. If the 802.1x authentication module does not have an IP entry
of the user, the user is kicked offline 5 minutes later,  to prevent users at the IP address
0.0.0.0 on SAM+. The configuration of this command will drop users out of the network. It is
not recommended to run this command in service peak hours.
dot1x mac-auth-bypass multi-user                   //Mandatory. Enable MAB authentication on
the interface.
dot1x mac-auth-bypass vlan (vlan-list)              //Optional. Configure this command in
interface configuration mode to enable VLAN-based MAB authentication.
dot1x multi-mab quiet-period 0             //Optional. Configure the quiet period for MAB
authentication. In this period, after a client fails the authentication, MAB authentication cannot
be restarted before the MAC entry of the client ages on the RG-N18000. In this way, SAM+ does
not generate logs of users who are not registered with SAM+. However, after failing the MAB
authentication at the first time, the client needs to wait for its MAC entry on the RG-N18000
to age before it can trigger MAB authentication again. Configure this function as required.
```

Precautions:

MAB authentication takes effect only after relevant configurations are completed on SAM+. For details, see MAB authentication configuration in "SAM+ Configuration".

MAB authentication takes effect only after it is selected on the authentication page.

MAB authentication takes effect after a client is MAB authenticated for the first time.

MAB authentication supports only dynamic DHCP users. It does not support static IP users. The RG-N18000 transfers IP addresses from the DHCP snooping module to SAM+, and therefore information about static IP users does not exist in the DHCP snooping module.

802.1x authentication has a higher priority than MAB authentication. Therefore, if a client is MAB authenticated and then uses the client software to perform 802.1x authentication, the MAB authentication entry will be deleted.

After MAB authentication is enabled, avoid configuring **User Preemption** or setting **Concurrent Logins Limit** to **1** . Otherwise, two clients using the same username will preempt a MAB authentication resource and be dropped out of the network.

Configuration example

See description about the configuration commands.

4.1.4.5 [Optional] MAB Authentication

Principles:

MAB authentication, one of the main authentication modes in the simplistic network solution, is applicable to wireless users in office areas of campus networks. With the MAB authentication model and high-performance authentication processing capacity of the RG-N18000, MAB authentication enables the RG-N18000 to learn the MAC address of a client when the client accesses the network, so that teachers do not need to repeatedly entering their usernames and passwords when using wireless clients for Web authentication, to prevent deteriorating user experience. The RG-N18000 uses the MAC address of the client as the username and password to send an authentication request to SAM+ to complete the authentication as a proxy. The user cannot perceive the authentication in this process.

The following is the MAB authentication process:

Enable the client MAB authentication on SAM+ by accessing the access control directory.

After Web authentication succeeds for the first time, a user can select MAB authentication on the authentication success page.

When the user chooses to enable MAB authentication, the MAC address of the user client is registered with SAM+.

After the client connects to the network, the RG-N18000 serving as a NAS, identifies the MAC address of the client, and uses the MAC address as the username and password to initiate authentication to SAM+.

SAM+ determines validity of the MAC address and returns the authentication success/failure message to the NAS.

If the authentication is successful, the NAS sends the accounting start packet.

Configuration commands:

Note: MAB authentication takes effect only after each user is WEB authenticated for the first time. In addition, MAB authentication belongs to the 802.1x authentication system. Therefore, both Web authentication and 802.1x authentication need to be configured for MAB authentication.

↘ Configuring global AAA parameters

```
aaa new-model      //Enable the AAA function.
aaa accounting network (list name) start-stop group(group name)      //AAA reference
configuration. The actual service deployment prevails.
aaa authentication dot1x (list name) group (group name)          //802.1x template reference
configuration for AAA. The actual service deployment prevails.
aaa authentication web-auth (list name) group(group name)          //Web authentication
template reference configuration for AAA. The actual service deployment prevails.
aaa authentication login default local      //Use the local username/password to log in to the
AAA device.
aaa group server radius (group name)           //Configure an AAA server group, which is
applicable to multi-RADIUS scenarios.
server (radius ip)                                //Configure an AAA server group, which is
applicable to multi-RADIUS scenarios.
radius-server host (radius ip) key 7 (radius key)       //Configure the IP address and key for
the AAA server, which are applicable to single-RADIUS scenarios.
aaa accounting update periodic 30         //Set the interval for AAA accounting update to 30s.
aaa accounting update               //Configure AAA accounting update.
no aaa log enable      //Disable the AAA log function.
```

Configuring 802.1x parameters and enabling 802.1x authentication on the interface

```
dot1x accounting (list name)     //Optional. This command is required when the 802.1x accounting
list name for AAA is not set to default.
dot1x authentication (list name)     //Optional. This command is required when the 802.1x
authentication list name for AAA is not set to default.
interface range GigabitEthernet 0/2-3  //Configure the interface for enabling 802.1x
authentication.
dot1x port-control auto//Enable 802.1x authentication on the interface.
```

Configuring Web authentication parameters and enabling Web authentication on the interface

```
web-auth template eportalv2
ip 202.204.193.32                 //Set the IP address of the portal server.
url http://202.204.193.32/eportal/index.jsp   //Set the URL of the portal server.
authentication  (list name)     //Optional. This command is required when the authentication
list name for AAA is not set to default.
accounting  (list name)       //Optional. This command is required when the accounting list name
for AAA is not set to default.
web-auth portal key university     //Optional. Configure the key.
interface range GigabitEthernet 0/2-3  //Configure the interface for enabling Web
authentication.
web-auth enable eportalv2////Enable Web authentication on the interface.
```

Configuring MAB authentication parameters and enabling MAB authentication on the interface

```
aaa authorization ip-auth-mode mixed    //Mandatory. Set the IP address authorization mode of 802.1x clients to the mixed mode. The IP addresses can be obtained via polling in multiple ways (DHCP/RADIUS).
ip dhcp snooping              //Mandatory. An IP address needs to be obtained via the DHCP snooping module for MAB authentication. Otherwise, a user with the IP address of 0.0.0.0 appears on SAM.
dot1x mac-auth-bypass valid-ip-auth          //Mandatory. The DHCP module instructs the MAB module to start authentication. Clients must obtain IP addresses before starting MAB authentication. Otherwise, the MAB authentication is blocked to prevent clients with the IP address of 0.0.0.0 on SAM+. The configuration of this command will drop users out of the network. It is not recommended to run this command in service peak hours.
dot1x valid-ip-acct enable           //Mandatory. The accounting update packets are used to upload the user IP address to SAM+. If the 802.1x authentication module does not have an IP entry of the user, the user is kicked offline 5 minutes later,  to prevent users at the IP address 0.0.0.0 on SAM+. The configuration of this command will drop users out of the network. It is not recommended to run this command in service peak hours.
dot1x mac-auth-bypass multi-user                   //Mandatory. Enable MAB authentication on the interface.
dot1x mac-auth-bypass vlan (vlan-list)              //Optional. Configure this command in interface configuration mode to enable VLAN-based MAB authentication.
dot1x multi-mab quiet-period 0             //Optional. Configure the quiet period for MAB authentication. In this period, after a client fails the authentication, MAB authentication cannot be restarted before the MAC entry of the client ages on the RG-N18000. In this way, SAM+ does not generate logs of users who are not registered with SAM+. However, after failing the MAB authentication at the first time, the client needs to wait for its MAC entry on the RG-N18000 to age before it can trigger MAB authentication again. Configure this function as required.
```

Precautions:

MAB authentication takes effect only after relevant configurations are completed on SAM+. For details, see MAB authentication configuration in "SAM+ Configuration".

MAB authentication takes effect only after it is selected on the authentication page.

MAB authentication takes effect after a client is MAB authenticated for the first time.

MAB authentication supports only dynamic DHCP users. It does not support static IP users. The RG-N18000 transfers IP addresses from the DHCP snooping module to SAM+, and therefore information about static IP users does not exist in the DHCP snooping module.

802.1x authentication has a higher priority than MAB authentication. Therefore, if a client is MAB authenticated and then uses the client software to perform 802.1x authentication, the MAB authentication entry will be deleted.

After MAB authentication is enabled, avoid configuring **User Preemption** or setting **Concurrent Logins Limit** to **1** . Otherwise, two clients using the same username will preempt a MAB authentication resource and be dropped out of the network.

Configuration example

See description about the configuration commands.

4.1.4.6 [Mandatory] No-traffic Go-offline

Principles:

When detecting that a client generates no traffic in a period of time, the core device RG-N18000 used in simplistic networks actively forces the client to go offline, thereby preventing invalid charging.

No-traffic go-offline can be enabled based on VLANs. In simplistic networks, VLANs represent different planned areas, and areas can be selected to enable/disable this function.

The family area of a campus network uses a router as a proxy to complete authentication for Internet access. After the traffic keepalive function is globally enabled on the RG-N18000, if a client in the family area does not access the Internet within a period of time, the client is forced to go offline and needs to be re-authenticated. Therefore, the traffic keepalive function is not recommended for this area. The

VLAN-based no-traffic go-offline can be configured for control.

Implementation principles:

To implement no-traffic go-offline, the system traverses the MAC address table of the device and compares the MAC address table with MAC addresses in the entries of authenticated users. If the MAC address of an authenticated user in the MAC address table has aged, the system determines that the user has no traffic and kicks the user offline. Note: The time consumed for traversing the MAC address table causes an error of 3–5 minutes to the original period for no-traffic go-offline detection. If the original period for no-traffic go-offline detection is set to 15 minutes, it actually takes 18 to 20 minutes to kick clients offline.

Configuration commands:

```
offline-detect interval 15 threshold 0        //If no traffic from a user is detected within 15 minutes, the user is kicked offline. The RG-N18000 checks whether there is user traffic matching the MAC address table for judgment.
offline-detect interval infinity threshold 0 vlan 300  //Set the no-traffic go-offline detection period to an infinite large value for VLAN 300. If the no-traffic go-offline function is globally enabled, run this command to disable this function for some VLANs.
VLAN-based no-traffic go-offline is applicable only to router dialup scenarios, in which routers are online for long. It cannot be applied to common client scenarios. Otherwise, the online duration on SAM+ will be inaccurate and affects the charging results.
```

Precautions:

Only no-traffic go-offline is supported currently, and low-traffic go-offline is not supported.

When the DHCP lease period of the client expires or the RG-N18000 receives a DHCP release packet, the RG-N18000 kicks the client offline during authentication.

It is recommended to set the period for no-traffic go-offline detection to be shorter than the lease period of DHCP server.

The function involves the traversal of the MAC address table, which increases the detection period by 3–5 minutes based on original parameter configuration. If the original period for no-traffic go-offline detection is set to 15 minutes, it actually takes 18 to 20 minutes to kick clients offline.

Configuration example

N/A

4.1.4.7 [Mandatory] IPv6 Authentication Mode

Principles:

Note that independent IPv6 authentication is not supported in simplistic networks. The IPv6 authentication mode is determined according to the IPv4 authentication result. Three modes are available:

Compatible: If IPv4 authentication fails, IPv6 packets cannot be forwarded; if IPv4 authentication succeeds, IPv6 packets can be forwarded.

Strict: IPv6 packets cannot be forwarded regardless of whether IPv4 authentication succeeds.

Loose: IPv6 packets can be forwarded regardless of whether IPv4 authentication succeeds.

Note: In simplistic networks, the RG-N18000 uses the strict mode by default, which will result in the failure to forward IPv6 packets. Change the mode to the compatible mode.

Configuration commands:

```
Ruijie(config)#address-bind ipv6-mode compatible     //Compatible mode
Ruijie(config)#address-bind ipv6-mode strict        //Strict mode
Ruijie(config)#address-bind ipv6-mode loose      //Loose mode
```

Precautions:

Note: In simplistic networks, the RG-N18000 uses the strict mode by default, which will result in the failure to forward IPv6 packets. Change the mode to the compatible mode.

Configuration example

N/A

4.1.4.8 [Mandatory] Source Port for Communicating with the RADIUS/Portal Server

Principles:

After configuration, the source port of the device for communicating with the RADIUS server is any specified port.

After configuration, the source port of the device for communicating with the portal server is any specified port.

Configuration commands:

```
ip portal source-interface loopback 0
ip radius source-interface lookback 0
```

Precautions:

Only one source port of the RADIUS server can be configured.

Only one source port of the portal server can be configured.

Configuration example

N/A

4.1.4.9 [Mandatory] Migration of Authenticated Users

Principles:

Scenario 1: When an online authenticated client migrates across super VLANs, migration of authenticated users must be enabled. Otherwise, the original authentication entry still exists and the client cannot be authenticated after moving to another VLAN/port.

Scenario 2: An online client migrates across different sub VLANs of the same super VLAN and the IP address keeps unchanged before and after migration. After migration of authenticated users is configured, the user is exempted from authentication before and after migration (the portal page does not pop up). It prevents user experience deterioration caused by frequent re-authentication.

Scenario 3: An online client migrates across super VLANs, and even if migration of authenticated users is configured, the client needs to be re-authenticated before accessing the network (the portal page pops up).

Scenario 4 (spoofing scenario): User A is authenticated in VLAN A. User B uses the same MAC address as User A and logs in by using the same username/password or MAC address to simulate migration. In such spoofing scenarios, the RG-N18000 sends an ARP detection packet to User A in VLAN A. If the RG-N18000 receives an ARP response from User A, it determines that spoofing occurs and rejects migration.

Note: VLANs here refer to sub VLANs.

Configuration commands:

station-move permit**//Mandatory. The overall switch for migration of authenticated users must be enabled, so that migration of Web and 802.1x authenticated users becomes available.** When an authenticated user triggers migration, the pre-migration authentication entry is automatically deleted and the post-migration authentication entry is automatically added.

web-auth station-move auto//Mandatory. After migration of Web authenticated users is enabled, when an authenticated user triggers migration, the Web authentication module automatically deletes the pre-migration authentication entry and automatically adds the post-migration authentication entry.

```
web-auth station-move info-update       //Mandatory. When migration of Web authenticated users is enabled, the accounting update packet is used to notify the RADIUS server of the latest value of the user VID/port.
```

Precautions:

VLAN changes after user migration refer to sub VLAN changes.

If a user migrates across super VLANs, that is, the IP address changes after migration, the migration cannot be completed.

Configuration example

N/A

4.1.5 Common Scenario — Authentication Optimization Configuration

4.1.5.1 [Optional] Portal Escape

Principles:

The portal escape mechanism exempts new users from authentication when the portal server on the live network becomes unavailable.

Configuration commands:

```
web-auth portal-check interval 3 timeout 3 retransmit 10    //Set the detection interval to 3s, timeout duration to 3s, and retransmission count to 10.
web-auth portal-escape [nokick]          //When portal escape takes effect and the nokick attribute is set, an online user will not be kicked offline. If the nokick attribute is deleted, an online user will be kicked offline.
```

Precautions:

The portal detection needs to be configured.

If multiple Portal servers are configured, the escape function takes effect only when all the Portal servers are unavailable.

This function is valid only to Portal servers.

Configuration example

N/A

4.1.5.2 [Optional] RADIUS Escape

Principles:

After the RADIUS escape function is configured, users can still be authenticated and access the Internet even if the RADIUS server malfunctions.

Configuration commands:

radius-server host (radius ip) test username ruijieidle-time 2 key (radius key) //Mandatory. Use this command to keep the detection between the device and the RADIUS server alive. The RG-N18000 sends a detection packet with the username/password being ruijie/ruijie (the username can be user-defined, but the password is always ruijie) to the RADIUS server for authentication. If the authentication succeeds, it indicates that the RADIUS is still alive. **radius key** here is not the user password. Instead, it is the key set by SAM+ server for interaction with the RG-N18000.

radius-server dead-criteria time 120 tries 12//Mandatory. The timeout duration is 120s. If the RG-N18000 does not receive a response after an authentication request is retransmitted for 12 times, the RG-N18000 determines to escape. This function prevents authentication jitter caused by oversensitivity of escape detection.

The account (user name: ruijie; password: ruijie) needs to be configured and activated on SAM+. This is mandatory.

```
web-auth radius-escape//Globally configured to enable RADIUS escape for Web authentication.
dot1x critical//Configured on the interface to enable RADIUS escape for dot1x authentication.
dot1x critical recovery action reinitialize       //Configured on the interface, so that after
the RADIUS server is recovered, the user that uses dot1x escape is kicked offline for
re-authentication.
```

Precautions:

The account needs to be configured and activated on the SAM server. For example, the username and password are both ruijie. Otherwise, a great number of spam logs from inexistent accounts are generated.

To cancel the escape detection command **no radius-server host** *(radius ip)* **test username ruijie idle-time 2 key** *(radius key)*, delete it, and then configure the **radius-server host** (*radius ip*) **key 7** *(radius key)* command. Otherwise, the RADIUS server is unreachable.

Configuration example

N/A

4.1.5.3 [Optional] Web Authentication — IP/VLAN-based SSID Mapping

Principles:

In conventional network solutions, an AC serving as the NAS for wireless user authentication obtains SSIDs of wireless users via the association module between the AC and APs and uploads the SSIDs to SAM+ server. In addition, policies are configured on SAM+ server/portal server to implement the mapping between SSIDs and authentication pages pushed by the portal server, so that different authentication pages are displayed for different ISPs or users.

In simplistic networks, the core device RG-N18000 cannot associate with APs to obtain SSIDs of wireless users. To address this defect, you can manually configure the VLAN-based SSID mapping function on the RG-N18000, so that SSIDs are uploaded to SAM+ server via authentication packets, thereby meeting the requirements of different ISPs or user groups for different authentication pages.

Configuration commands:

```
Ruijie(config)#web-auth mapping map-ssid vlan100 ssid ChinaNet        //Define the mapping
template name, mapped VLAN ID, and mapped SSID name.
Ruijie(config-if-GigabitEthernet 0/1)# web-auth apply-mapping map-ssid     //Apply the
mapping template to the interface.
```

Precautions:

Multiple mappings can be configured. If a user is out of the mapping range, the portal server is used for authentication by default.

VLANs cannot overlap with each other.

Configuration example

See description about the configuration commands.

4.1.5.4 [Optional]Static IP Address MAB Authentication

Note: This function is supported only in N18000_RGOS 11.0(1)B3P3 and later versions.

Principles:

Static IP address MAB authentication is MAB authentication triggered by using ARP packets. It needs to be used in combination with the quiet function as well as fast MAC binding entries of SAM+ server.

1. The fast MAC binding information of users need to be added to SAM+ server.
2. This function needs to be used in combination with the quiet function.

Configuration commands:

dot1x mac-auth-bypass static-ip-segment 1.1.1.0 255.255.255.0 unforced //Send ARP packets from the static IP address segment to trigger MAB authentication. MAB authentication can be initiated based on only IP address segments.

dot1x multi-mab quiet-period 300 //Enable 802.1x quiet function and set the quiet period to 300s. In this period, MAB authentication cannot be performed, but Web authentication and 802.1x authentication are available.

dot1x pending-user authen-num 24 //Optional. Set the default rate of MAB authentication triggered by ARP packets to 24 users/second. It is not recommended to change the default value.

Precautions:

1. The static IP address MAP authentication needs to be used together with the quiet function. Otherwise, users who fail the authentication performs authentication repeatedly, imposing great pressure on SAM+ and incurring exceptions. The recommended quiet period is 5 minutes.

2. Static IP address MAB authentication takes effect only when fast MAC binding entries are configured on SAM+. If no fast MAC binding entry is available on SAM+, manually bind MAC addresses. MAC addresses cannot be configured in Web authentication mode (if a static IP address is within the IP address segment range configured by using the **dot1x mac-auth-bypass static-ip-segment** command, the Web authentication page does not pop up and redirection cannot be performed).

Configuration example

interface GigabitEthernet 1/1 //Enable MAB authentication on the interface.

switchport protected

switchport mode trunk

switchport trunk allowed vlan only 2-50,3000-3001

dot1x port-control auto

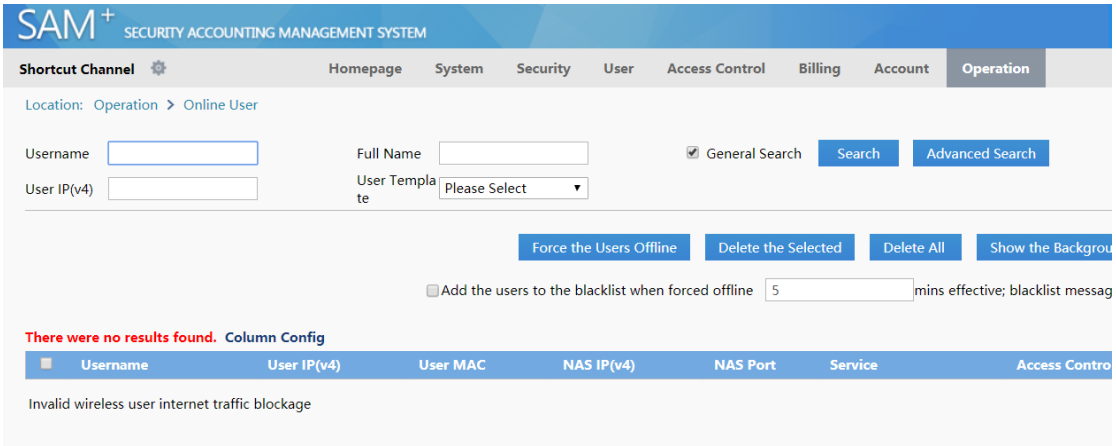
dot1x mac-auth-bypass multi-user

web-auth enable eportalv2

dot1x mac-auth-bypass static-ip-segment 10.20.50.0 255.255.255.0 //Configured globally send ARP packets from the static IP address segment to trigger MAB authentication.

dot1x multi-mab quiet-period 300 //Enable the 802.1x quiet function and set the quiet period to 300s.

After a user is authenticated, SAM+ automatically binds the MAC address of the user and enables static IP address MAB authentication upon next user login.



4.1.5.5 [Optional] 802.1x Authentication Quiet Function

Note: This function is supported only in N18000_RGOS 11.0(1)B3P3 and later versions.

Principles:

After the quiet function is configured, users who fail the authentication are added to the quiet queue and do not initiate authentication. They can initiate authentication after the quiet period expires.

Configuration commands:

```
dot1x multi-mab quiet-period 300  //Enable the 802.1x quiet function and set the quiet period to 300s.
```

Precautions:

The quiet function does not need to be configured if static IP address MAB authentication is not required. Otherwise, the function may affect authentication performance and cause high CPU usage of line cards.

Configuration example

N/A

4.1.5.6 [Mandatory] Preventing 802.1x Authentication from Preempting MAB Authentication Resources

Note: This function is supported only in N18000_RGOS 11.0(1)B3P3 and later versions.

Principles:

By default, 802.1x authentication has a higher priority than MAB authentication, and 802.1x authentication preempts resources of MAB authentication. If it is required that 802.1x authentication not preempt resources of MAB authentication and they have the same priority, configure this command on an interface. After configuration, 802.1x authentication does not preempt resources of MAB authentication and 802.1x authentication will fail if a MAB authenticated user is online.

Configuration commands:

```
DLUT-CORE-N18014(config-if-GigabitEthernet 1/3/34)#dot1x mac-auth-bypass precedence ?
  <cr>
```

Precautions:

Before the function is configured, do not enable Windows-embedded 802.1x authentication when MAB authentication is used. By default, 802.1x authentication preempts MAB authentication resources. As a result, a MAB authenticated user is kicked offline.

Configuration example

N/A

4.1.6 QinQ Isolation Scenarios

4.1.6.1 [Mandatory] QinQ VLAN Tag Termination

Principles:

The QinQ VLAN tag termination enables the routing forwarding module to receive and send packets with dual VLAN tags.

CE-vlan//QinQ inner VLAN tag. VLANs must be consecutive, for example, 101–150.

PE-vlan//QinQ outer VLAN tag (sub VLAN).

Note: The modified CE-VLAN configuration will overwrite original configuration. Improper configuration will cause network interruption.

Example: Original configuration: qinq termination ce-vlan 200 to 300

New configuration: qinq termination ce-vlan 301 to 310

The original configuration will be overwritten as follows: qinq termination ce-vlan 301 to 310

Configuration commands:

Configuring CE-VLANs

Command

qinq termination ce-vlan start-vid to end-vid

Parameter Description

start-vid indicates the minimum CE-VLAN ID.

end-vid indicates the maximum CE-VLAN ID.

Defaults

By default, user VLANs have no QinQ VLAN tag termination.

Command Mode

Global configuration mode

Usage Guide

There is no CE-VLAN by default.

Configuring PE-VLANs

Command

qinq termination pe-vlan [add | remove] vlan-list

Parameter Description

vlan-list: Indicates the VLAN list in the range of 1 to 4094.

Defaults

By default, ISP VLANs have no QinQ VLAN tag termination.

Command Mode

Global configuration mode

Usage Guide

ISP VLANs with QinQ VLAN tag termination can be configured in incremental mode.

Precautions:

QinQ VLAN tag termination is performed only in the case of routing and forwarding, and layer-2 forwarding enables only transparent transmission through tunnels.

If users of different CE-VLANs need to communicate with each other, the local ARP proxy (enabled by default) needs to be enabled on the SVI corresponding to the PE-VLAN.

ED cards support 511 CE-VLANs by default.

DB cards support 61 CE-VLANs by default.

It is recommended to reduce the number of CE-VLANs to be created during deployment, for example, if only 50 CE-VLANs are used on the live network, run the **qinq termination ce-vlan 101 to 151** command to create required VLANs. Avoid creating 511 CE-VLANs at a time. More CE-VLANs will result in high CPU usage of the RG-N18000.

Determine whether a client with a single VLAN tag exists on the RG-N18000. If yes, the VLAN ID of the client cannot be the same as that of the PE-VLAN (outer VLAN) configured in QinQ VLAN tag termination command.

Case:

The following command is executed to configure the outer VLAN range for QinQ VLAN tag termination on the RG-N18000: qinq termination pe-vlan 100-101.

After packets from a client with a single VLAN tag reach the RG-N18000, the RG-N18000 performs the following processing:

1. Determine whether the VLAN ID is 100, and if yes, enter the QinQ processing logic.
2. Check whether there is no inner VLAN ID from parsed packets, and if yes, discard the packets.

As a result, packets from the client with a single VLAN tag (VLAN ID = 100) cannot be forwarded. After the VLAN ID is changed to a value other than **100** and **101**, packets from the client can be forwarded normally.

Configuration example

Configuration Steps

Enable QinQ VLAN tag termination on the core switch and configure the PE-VLAN/CE-VLAN.

```
SwitchA#configure terminal
Enter one configuration command in each line, ended with CNTL/Z.
Ruijie(config)#qinq termination pe-vlan 100-101
Ruijie(config)#qinq termination ce-vlan 200 to 300
```

Verification

```
Ruijie(config)#show qinq termination
CE-VLAN:     200-300
PE-VLAN:     100 and 101
```

4.1.6.2 [Mandatory] Transparent Transmission of RADIUS Packets in QinQ Format

Principles:

The configuration of NAS-port-ID encapsulation format for RADIUS packets is mandatory in QinQ isolation scenarios in simplistic networks. RADIUS packets are encapsulated in a format that combines the interface name of the client and the inner and outer VIDs in a specified manner. SAM+ reads dual VLAN IDs based on the **nas-port-id** field.

Configuration commands:

```
radius-server attribute nas-port-id format qinq    //Configured in global configuration mode.
```

Precautions:

This function is mandatory in QinQ isolation scenarios.

Configuration example

```
Ruijie(config)# radius-server attribute nas-port-id format qinq
```

4.1.7 Anti-Loop Configuration for Simplistic Networks

4.1.7.1 [Mandatory] Anti-Loop Configuration on the Core Device

1. **By default, the Rapid Link Detection Protocol (RLDP) is enabled on the core device RG-N18000 of N18000_RGOS 11.0(1)B3P1 and later versions, to generate alarms for VLAN loops and make records. Therefore, do not disable RLDP.**
2. **Pay attention to RLDP loop logs.**
3. **Run the show rldp log command to display relevant logs.**

4.1.7.2 [Mandatory] Anti-loop Configuration on Access Devices

1. **Configure the Spanning Tree Protocol (STP) on the access device to assist RLDP loop prevention. Enable the Rapid Spanning Tree Protocol (RSTP) globally, and enable BPDU filter on the uplink interface of the access device, and BPDU guard on the downlink interface. Example:**

```
S2928-student(config)#spanning-tree              //Enable STP.
S2928-student(config)#spanning-tree mode rstp     //Enable RSTP, to prevent low convergence
speed of interfaces.
```

```
S2928-student(config)#spanning-tree portfast bpduguard default    //BPDU guard is enabled on PortFast interfaces by default.
S2928-student(config)#int ran gi 0/1-23
S2928-student(config-if-range)#spanning-tree portfast     //PortFast is enabled on the downlink interface and BPDU guard takes effect on the downlink interface. Once BPDU packets are received, the system considers that a loop occurs. Therefore, disable the downlink interface.
 S2928-student(config-if-range)#interface gi0/24
 S2928-student(config-if- GigabitEthernet 0/24)#spanning-tree bpdufilter enable     //Enable BPDU filter on the uplink interface, which does not send BPDU packets to external devices, so that no topology is established and no root bridge is elected, and loops are prevented on a single device.
S2928-student(config-if-AggregatePort 1))#exit
```

4.1.8 RG-N18000 Optimization Functions

4.1.8.1 [Optional] Fast Packet Capture

Note: This function is supported only in N18000_RGOS 11.0(1)B3P3.

Principles:

If the packet sending/receiving fails or an exception occurs during routine maintenance, you can specify the packet capture point, direction, as well as packet characteristics. Then, start packet capture and check whether packets are transmitted to/from the device to pinpoint the cause for the failure.

Configuration commands:

1. Create a packet capture rule.

```
packet capture rule rule-name  [src-macsmac] [dst-mac dmac]  [etype type | ip |arp ]
[src-ip sip sip-mask] [dst-ip dip dip-mask] [src-ipv6 sipv6 sipv6-prefix] [dst-ipv6 dipv6
dipv6-prefix][protocol protocol |tcp | udp] [src-port sport ] [dst-port dport]
```

2. Specify the packet capture point.

```
packet capture point capture-point-namerule rule-name location {interfaceinterface-name
| vlan vlan-id | control-plane} {in | out | both}
```

3. Enable/Disable the packet capture rule.

```
packet capture {start | stop}
```

Precautions:

1. This function is not risky theoretically. Nevertheless, it is not recommended to use it in service peak hours and non-fault cases. If the packet capture period is set to XX minutes in the software, the software stops packet capture after the period expires.
2. If the packet capture rate is higher than the data write speed of the device, packets cannot be completely written into the device. It is recommended to configure more accurate packet capture matching rules. The system CPU supports a packet capture rate up to 1000 pps in idle hours and 600 pps when the CPU usage is 65%. If the system CPU usage exceeds 70% (including 70%), packet capture is not started even if it is configured.

Configuration example

1. The following example captures the RADIUS authentication packets exchanged between a client (100.0.30.77) and SAM+ and those exchanged between the RG-N18000 (192.168.3.1) and SAM+.

Captured RADIUS packets need to be saved in the **tmp** directory (or the **usb0** directory in actual application). This directory does not need to be copied.

```
packet capture rule testdown filter ipv4_sip 100.0.30.77 0.0.0.0
packet capture rule testup filter ipv4_sip 192.168.3.1 0.0.0.0 v4_protocol udp ipv4_dport eq
1812
packet capture point testup rule testup location interface gigabitEthernet 1/1/2 both
packet capture point testdown rule testdown location interface gigabitEthernet 1/1/15 both
packet capture file tmp://test.pcap
packet capture file usb0://test.pacp ?
buffer-size  Buffer size of packet info   //Define the size of the file for storing captured
packets. The default size is 2 MB.
packet-num   Number of packets      //Define the number of packets to be captured. The default
value is 1024.
timeout      Timeout of minutes       //Define the packet capture duration. The default value
is 10 min.
packet capture start
show packet capture status
packet capture stop
```

```
N18014#show packet capture status

Capture rules:
  Capture rules testdown:
    Etype: 0x0800
    Source IP: 100.0.30.77
  Capture rules testup:
    Etype: 0x0800
    Protocol: 0x11
    Source IP: 192.168.3.1
    Destination  port: 1812

Capture points:
  Capture point testdown:
    Capture rules: testdown
    Location: Gi1/1/15
    Direction: all
    Packets captured(all): 28
  Capture point testup:
    Capture rules: testup
    Location: Gi1/1/2
    Direction: all
    Packets captured(all): 2

Capture file:
  Filename: /tmp///test.pcap
  Buffer size: 2(MB)

Capture Statistic:
  Status: running
  Start time: 2017-6-28 7:4:14
  Timeout: 10(minutes)
  Packets limit: 1024
  Write file packet count: 30
```

2. The screenshot below shows the ping packets sent by the client (100.0.30.77) and RADIUS packets sent by the device.

```
192.168.3.1     192.168.1.13    RADIUS   267 Access-Request(1) (id=1, l=225)
100.0.30.77     100.0.0.1       ICMP      74 Echo (ping) request  id=0x0001, seq=245/62720, ttl=6
192.168.3.1     192.168.1.13    RADIUS   267 Access-Request(1) (id=1, l=225)
100.0.30.77     100.0.0.1       ICMP      74 Echo (ping) request  id=0x0001, seq=246/62976, ttl=6
100.0.0.1       100.0.30.77     ICMP      74 Echo (ping) reply    id=0x0001, seq=246/62976, ttl=6
100.0.30.77     100.0.0.1       ICMP      74 Echo (ping) request  id=0x0001, seq=247/63232, ttl=6
100.0.0.1       100.0.30.77     ICMP      74 Echo (ping) reply    id=0x0001, seq=247/63232, ttl=6
```

3. If the captured packets are stored in the **TMP** directory, you can run the following commands to copy them to another directory:

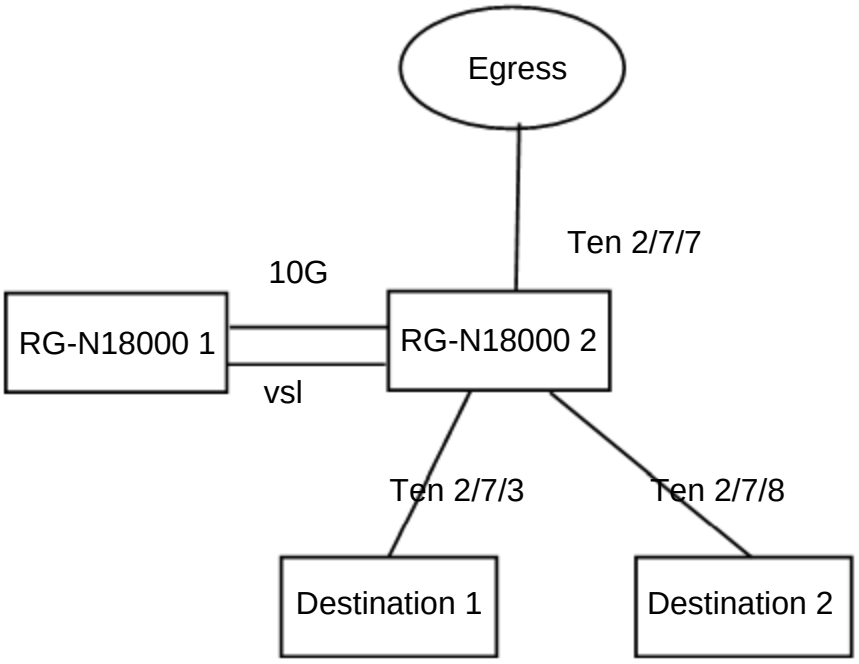
```
Ruijie#run-system-shell
   cd /tmp
   /tmp # mv xxx.pacp /tmp/vsd/0/ xxx.pacp
   Start the TFTP software on the client and run the commands to copy information about captured packets to the client.
copy tmp:/xxx.pacp tftp://xxx.xxx.xxx.xxx/xxx.pacp   //Select oob_tftp for the MGMT port.
```

4.1.8.2 Analysis of VSL Traffic Faults in the Case of One-to-Many Mirroring

Basic information

Fault symptom

On-site topology:



A customer mirrors the egress traffic to multiple servers in one-to-many mode. Two 10 Gbps VSLs are configured but the interface traffic of one VSL is about to reach the limit.

Fault analysis

1. Possible causes

With one-to-many mirroring, the traffic of the MAC self-loop port is flooded to a VSL via remote VLAN. There is no measure for balancing the layer-2 traffic flooded to the VSLs.

2. Cause locating

The traffic of one VSL is about to reach the limit, that is, 10 Gbps. Data is transmitted from RG-N18000 2 to RG-N18000 1.

It is found that the traffic in the inbound direction of RG-N18000 2 is not heavy but the traffic of the mirroring self-loop port is about 10 Gbps.

The self-loop port belongs to VLAN 1581.

3. Detailed analysis

a. Related configuration

```
vlan 1581
 name_VLAN student egress remote mirroring
 remote-span
!
interface TenGigabitEthernet 2/7/3
 description to- mirroring port
```

```
 switchport access vlan 1581
 spanning-tree bpdufilter enable
 ip dhcp snooping trust
 nfpp arp-guard enable
 nfpp icmp-guard enable
!
interface TenGigabitEthernet 2/7/4
 description to- destination mirroring port- source ten2/7/7&2/7/1
 no mac-address-learning
 switchport access vlan 1581
 ip dhcp snooping trust
 mac-loopback
!
interface TenGigabitEthernet 2/7/8
 description link_to_ASME1000_moniter
 no mac-address-learning
 switchport mode trunk
 switchport trunk native vlan 1581
 switchport trunk allowed vlan only 1581
!
monitor session 4 remote-source
monitor session 4 destination remote vlan 1581 interface TenGigabitEthernet 2/7/4 switch
monitor session 4 source interface TenGigabitEthernet 2/7/7 both
```

b. Principle analysis

One-to-many mirroring is configured on the RG-N18000, to mirror the traffic of the outbound port Te2/7/7 to port Te2/7/3 and port Te2/7/8.

- λCreate remote VLAN 1581 on the device.
- λSpecify the device as the RSPAN source device, configure the outbound port Te2/7/7 as the mirroring source port. Select a down port (port Te2/7/4) as the mirroring output port, add the port to the remote VLAN, and configure MAC self-loop by running the **mac-loopback** command in interface configuration mode.
- λAdd port Te2/7/3 and port Te2/7/8 to the remote VLAN.

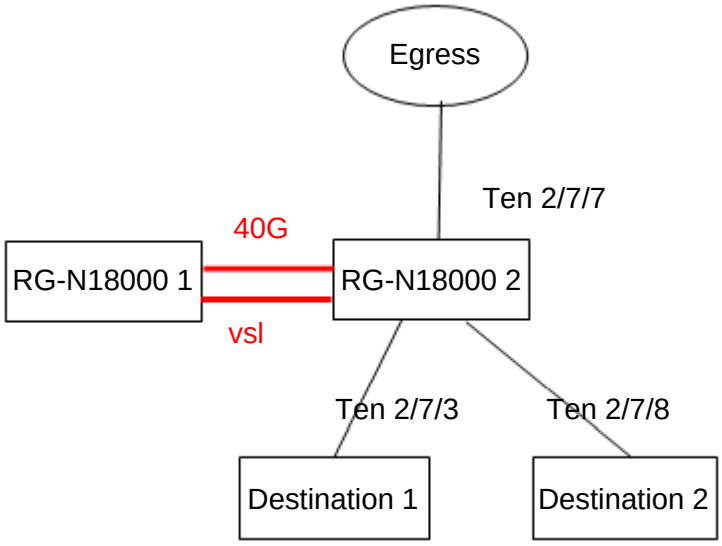
In this scenario, the traffic of the VLAN is flooded to all chips. The traffic of the MAC self-loop port is flooded to the VSL port regardless of whether RG-N18000 1 has a port included in VLAN 1581.

Solution

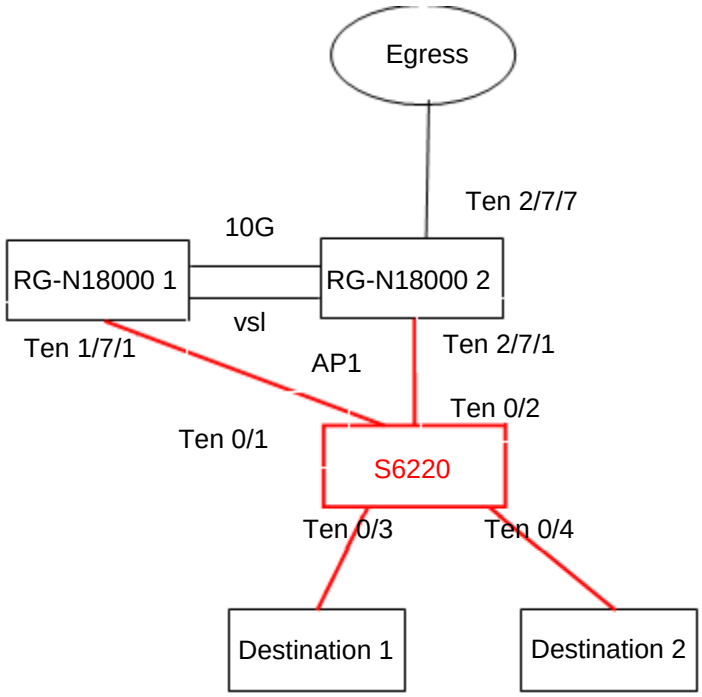
1. Optimization solution

a. Increase the VSL bandwidth.

Change the VSL port to 40G port. Line cards with 40G ports include 16XS2QXS-BD.



For one-to-many mirroring requirement, a layer-2 switch can be added to mirror the traffic of the mirroring source port to the layer-2 switch in one-to-one mode, and then the layer-2 switch floods the traffic to multiple destination ports over the same VLAN on the layer-2 switch.



Note: In the topology above, the source ports are Ten 2/7/7 and Ten 1/7/1, and the destination port is AP 1.

Configuration steps:

- = Add port Ten 1/7/1 and port Ten 2/7/1 of RG-N18000 1 to AP 1.
- = Configure local mirroring on the RG-N18000, and specify port Ten 2/7/7 and AP1 as the source port and destination port of mirroring respectively.
- = Add port Ten 0/1 and port Ten 0/2 of the S6220 to AP 1.

Add AP1, port Ten0/3, and port Ten0/4 of the S6220 to VLAN 100.

RG-N18000:

```
Ruijie# configure
Ruijie(config)#interface aggregatePort 1
Ruijie(config-if-AggregatePort 1)#exit
Ruijie(config)#interface tenGigabitEthernet 1/7/1
Ruijie(config-if-TenGigabitEthernet 1/7/1)#port-group 1
Ruijie(config)#interface tenGigabitEthernet 2/7/1
Ruijie(config-if-TenGigabitEthernet 2/7/1)#port-group 1
Ruijie(config)# monitor session 1 source interface tenGigabitEthernet 2/7/7
Ruijie(config)# monitor session 1 destination interface aggregatePort 1
S6220:
Ruijie(config)#interface aggregatePort 1
Ruijie(config-if-AggregatePort 1)#switchport access vlan 100
Ruijie(config-if-AggregatePort 1)#exit
```

```
Ruijie(config)#interface tenGigabitEthernet 0/1
Ruijie(config-if-TenGigabitEthernet0/1)#port-group 1
Ruijie(config)#interface tenGigabitEthernet 0/2
Ruijie(config-if-TenGigabitEthernet 0/2)#port-group 1
Ruijie(config)#interface tenGigabitEthernet 0/3
Ruijie(config-if-TenGigabitEthernet 0/3)# switchport access vlan 100
Ruijie(config)#interface tenGigabitEthernet 0/4
Ruijie(config-if-TenGigabitEthernet 0/4)# switchport access vlan 100
```

Thorough solution

N/A

4.2 SAM+ and ePortal Configuration

4.2.1 [Optional] Wired RG-N18000—802.1X Authentication

4.2.1.1 Adding the RG-N18000 on SAM

4.2.1.1.1 Function requirements

Add the NAS (RG-N18000) on SAM+.

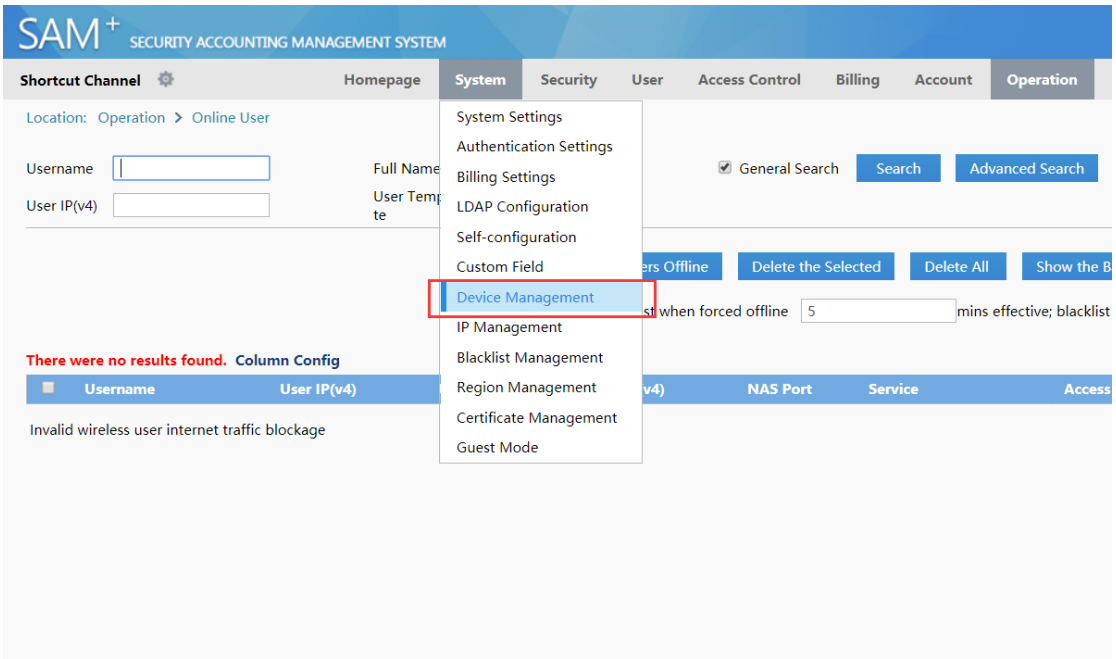
4.2.1.1.2 Configuration key points

The NAS-relevant parameters added on SAM+ must be consistent with the actual settings of the NAS. Otherwise, an authentication exception occurs.

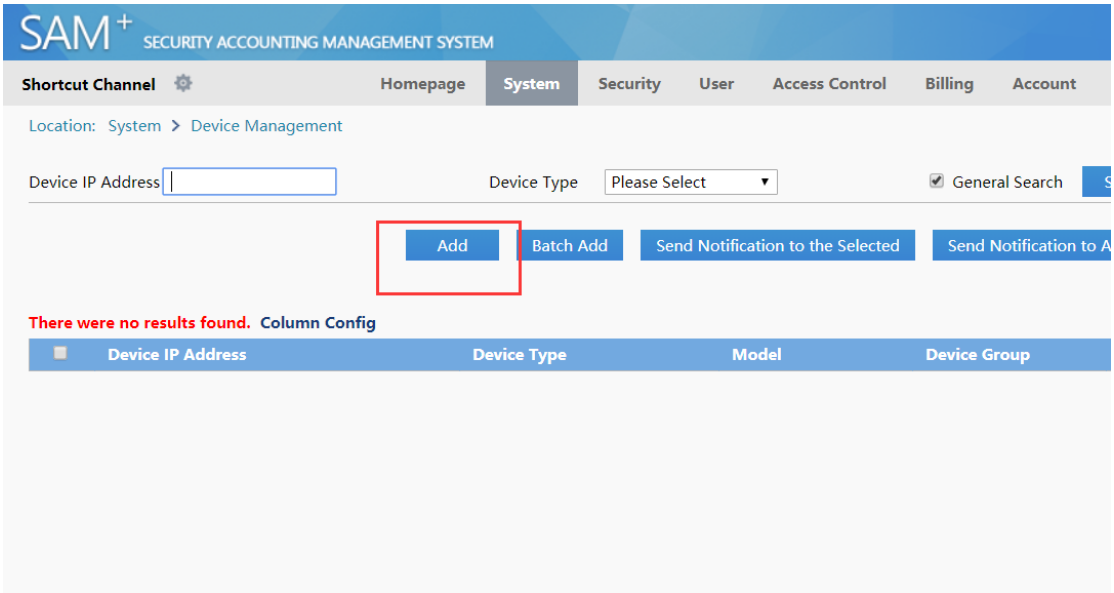
- The address for the RG-N18000 to interwork with SAM+ must be correct on SAM+. For example, if the source port for communicating with SAM+ is configured on the RG-N18000 by running the **ip radius source-interface loopback 0** command, the IP address of the loopback0 interface of the RG-N18000 needs to be entered in the **Device IP Address** column of SAM+.
- The key for interworking with the RG-N18000 needs to be consistent.
- The SNMP community for interworking with the RG-N18000 needs to be consistent.

4.2.1.1.3 Configuration steps

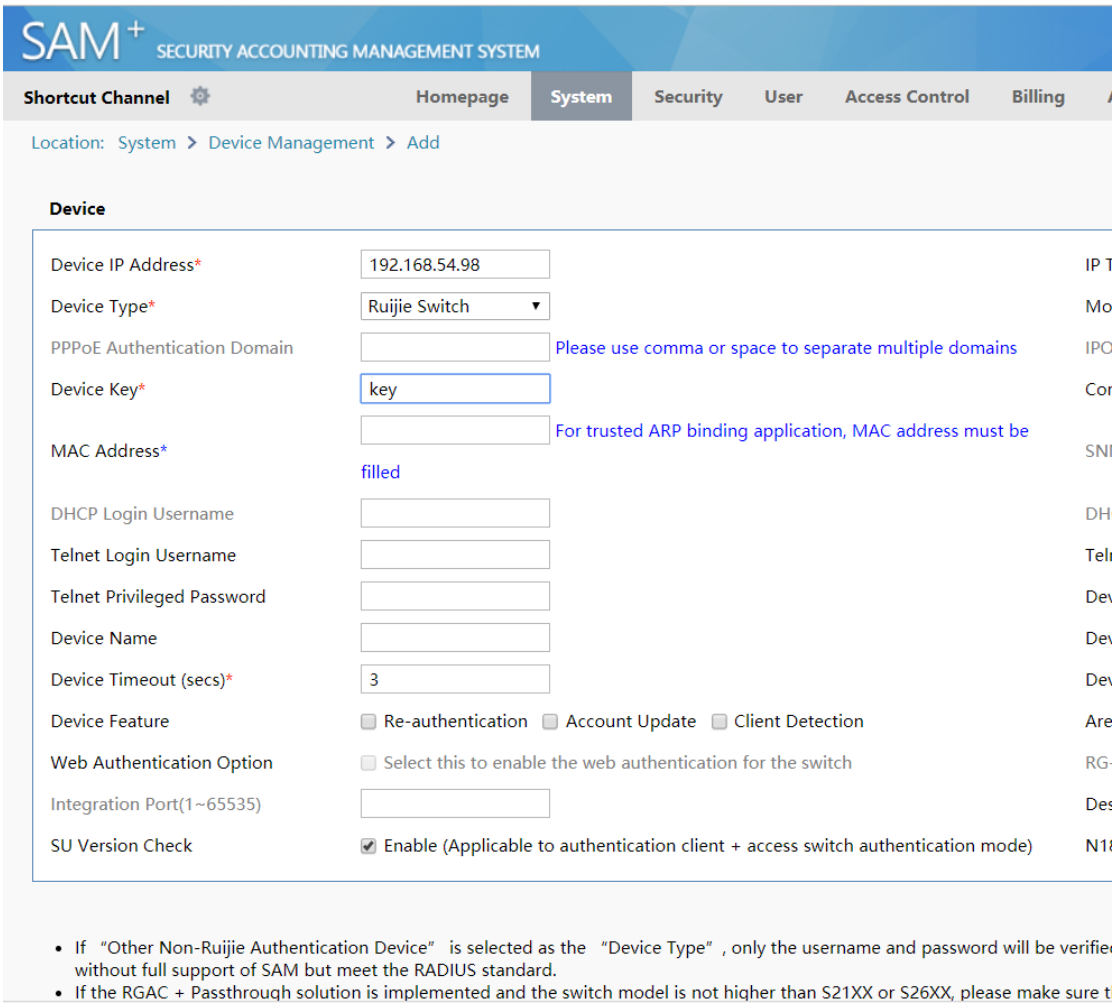
1. Log in to the SAM+ management page.
2. Choose **System** > **Device Management**.



3. Click **Add** to add a device.



4. Set NAS-relevant parameters and ensure that the key parameters are consistent with the actual settings of the NAS. Then, click **Save**.



4.2.1.1.4 Verification

1. Check whether the SAM+ server can ping the device successfully. If yes, it indicates that their communication is normal (ensure that ping packets are not intercepted by the firewall).

4.2.1.2 Access Control Configuration

4.2.1.2.1 Function requirements

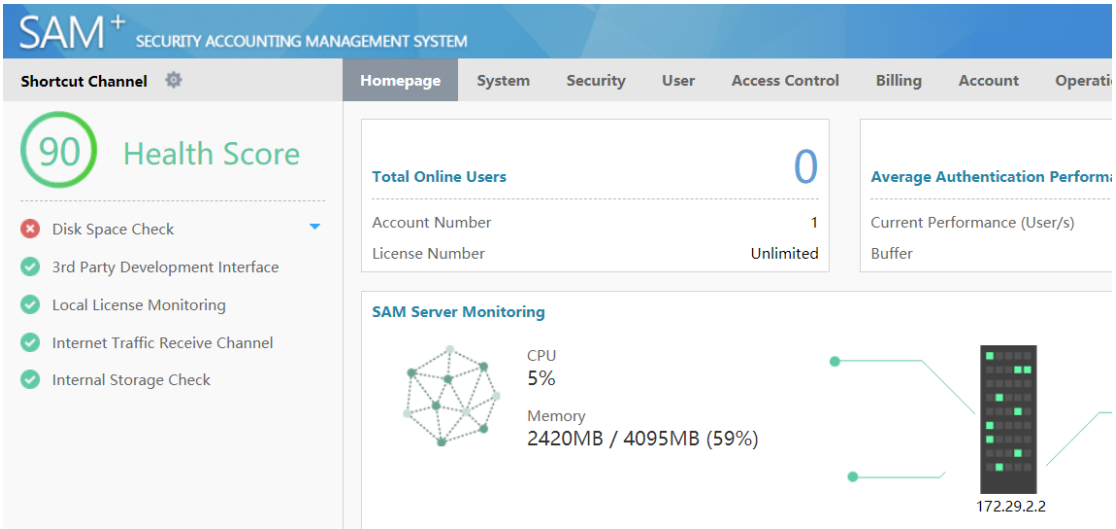
Configure access control to restrict Internet access behavior of users.

4.2.1.2.2 Configuration key points

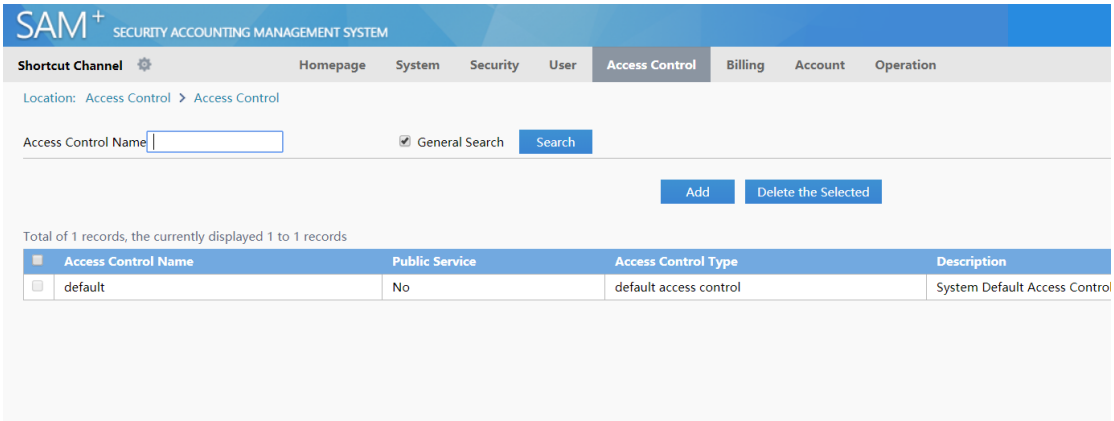
The Internet access behavior of access users needs to be confirmed with customers and access control needs to be configured based on actual conditions.

4.2.1.2.3 Configuration steps

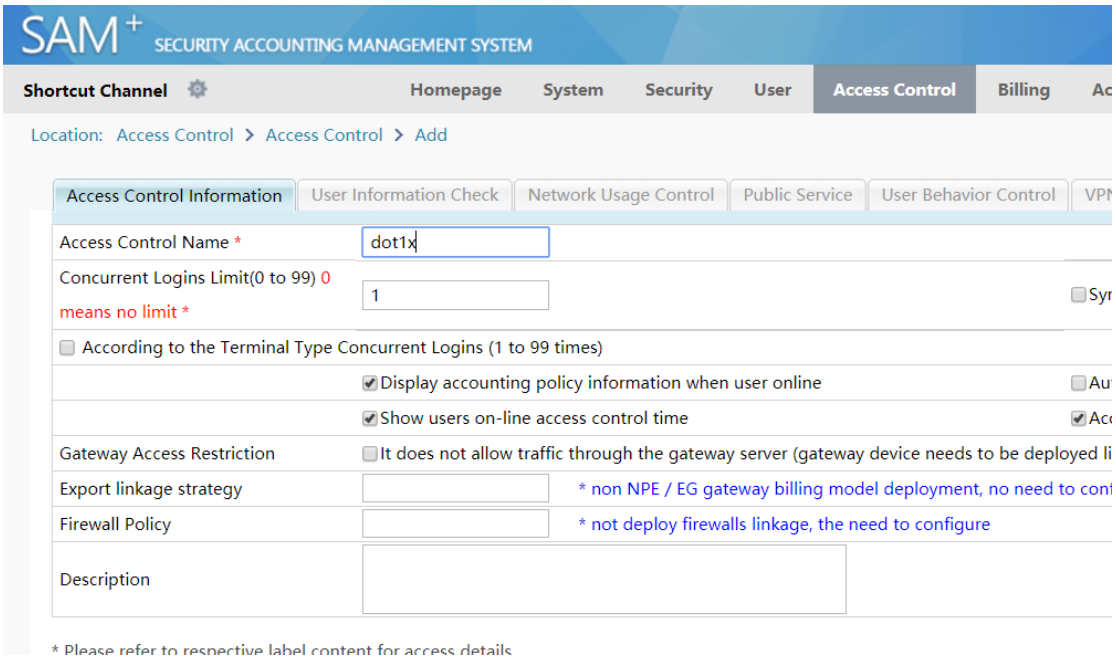
1. Log in to the SAM+ management page.
2. Choose **Access Control** > **Access Control**.



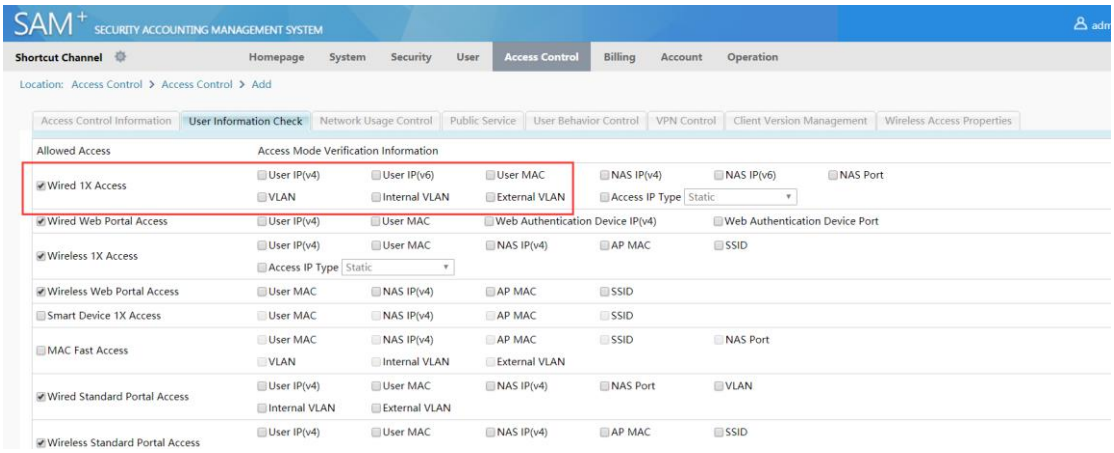
3. Click **Add** to add access control.



4. On the **Access Control Information** tab page, enter the access control name, for example, "dot1x", and set other parameters based on actual conditions.

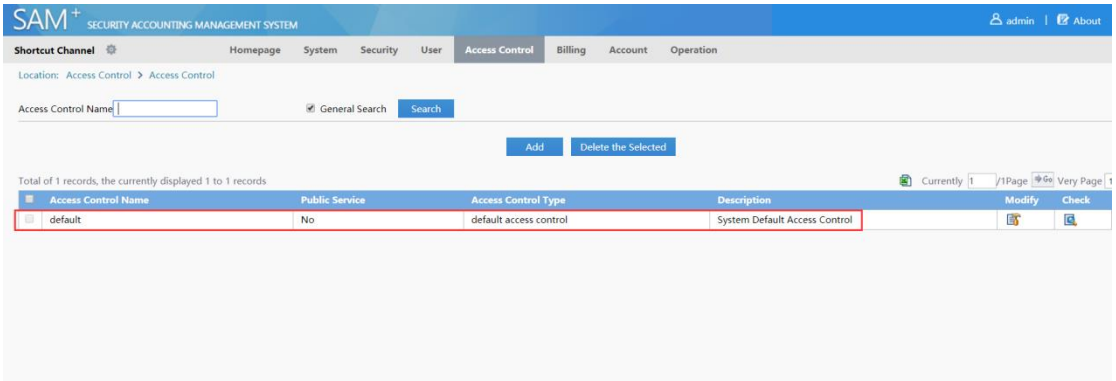


5. On the **User Information Check** tab page, select **Wired 1X Access** and configure whether to bind accounts with IP/MAC addresses based on actual conditions. Then, click **Save**.



4.2.1.2.4 Verification

Verify that access control is added successfully.



4.2.1.3 Billing Policy Configuration

4.2.1.3.1 Function requirements

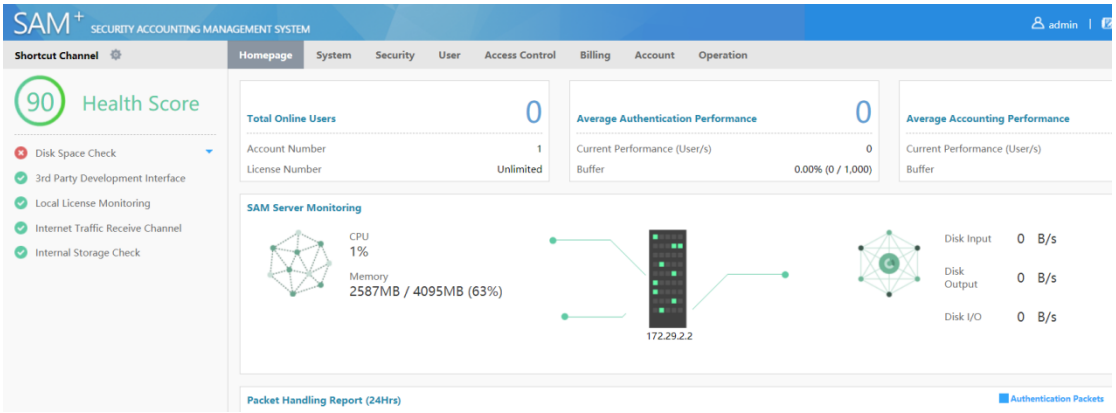
Configure billing policies based on billing requirements of access users, to pay for Internet access.

4.2.1.3.2 Configuration key points

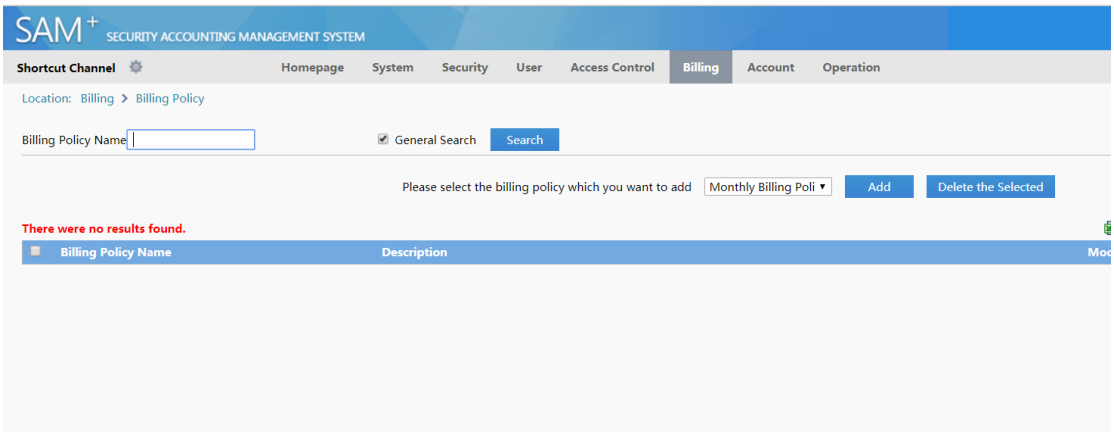
Billing requirements of access users need to be confirmed with customers and billing policies need to be configured based on actual conditions.

4.2.1.3.3 Configuration steps (monthly milling)

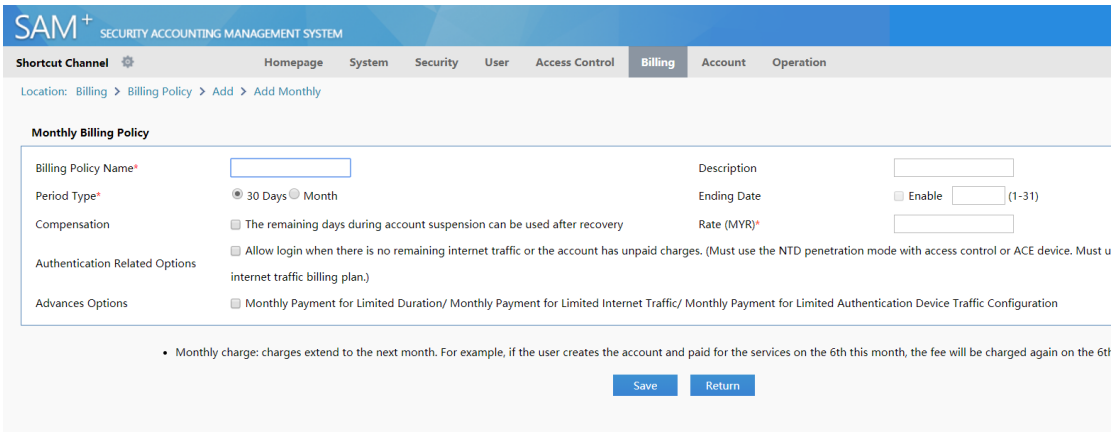
1. Log in to the SAM+ management page.
2. Choose **Billing** > **Billing Policy**.



3. Select **Monthly Billing Policy** and click **Add**.

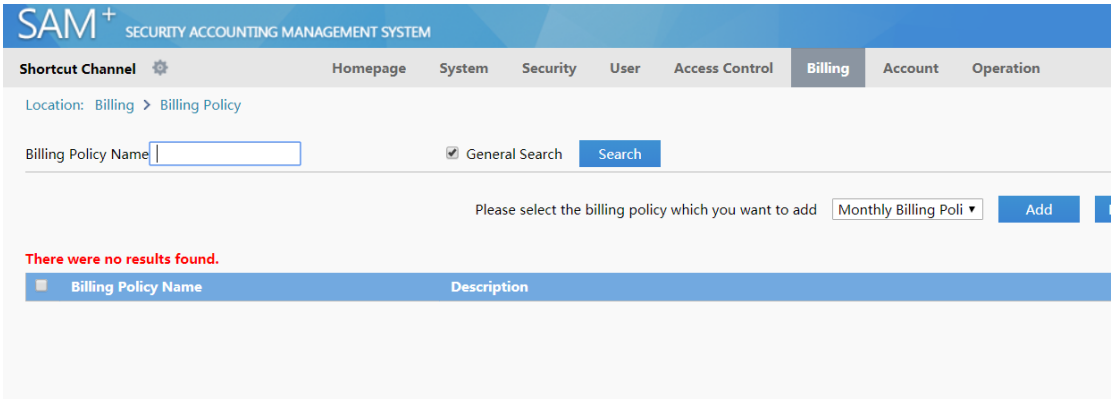


4. Enter the billing policy name, for example, "dot1x", set **Period Type** to **30 Days** or **Month**, and set **Rate (MYR)**, for example, 30 Yuan/month. Then, click **Save**.



4.2.1.3.4 Verification

Verify that the billing policy is added successfully.



4.2.1.4 User Template Configuration

4.2.1.4.1 Function requirements

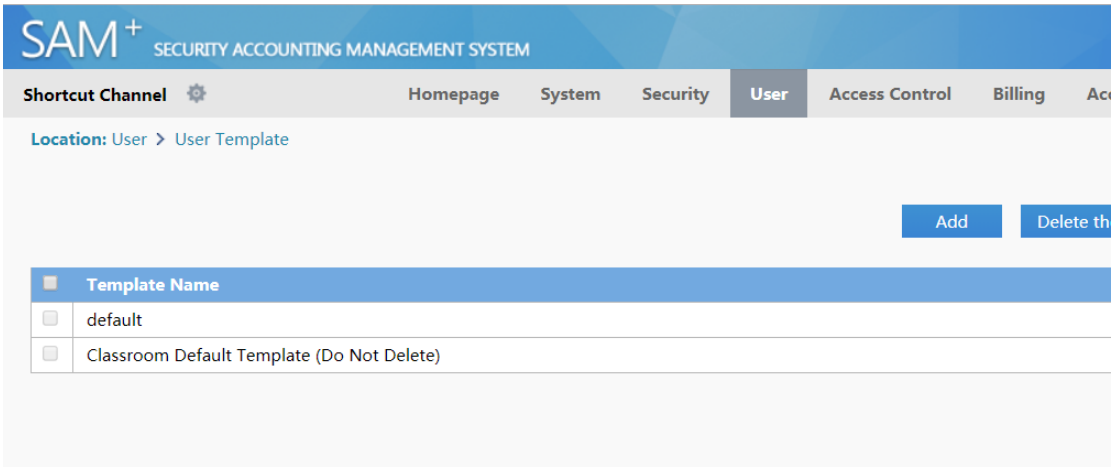
Configure user templates based on user attributes for later account creation.

4.2.1.4.2 Configuration key points

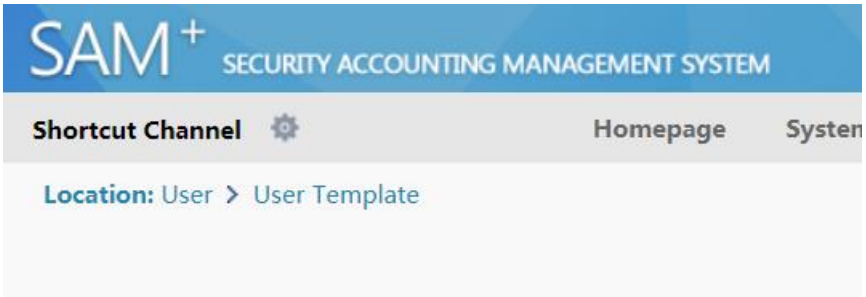
It is recommended to classify user templates with the same attribute into a group and give concise and intuitive names to the templates, for example, student monthly billing template or teacher monthly billing template.

4.2.1.4.3 Configuration steps

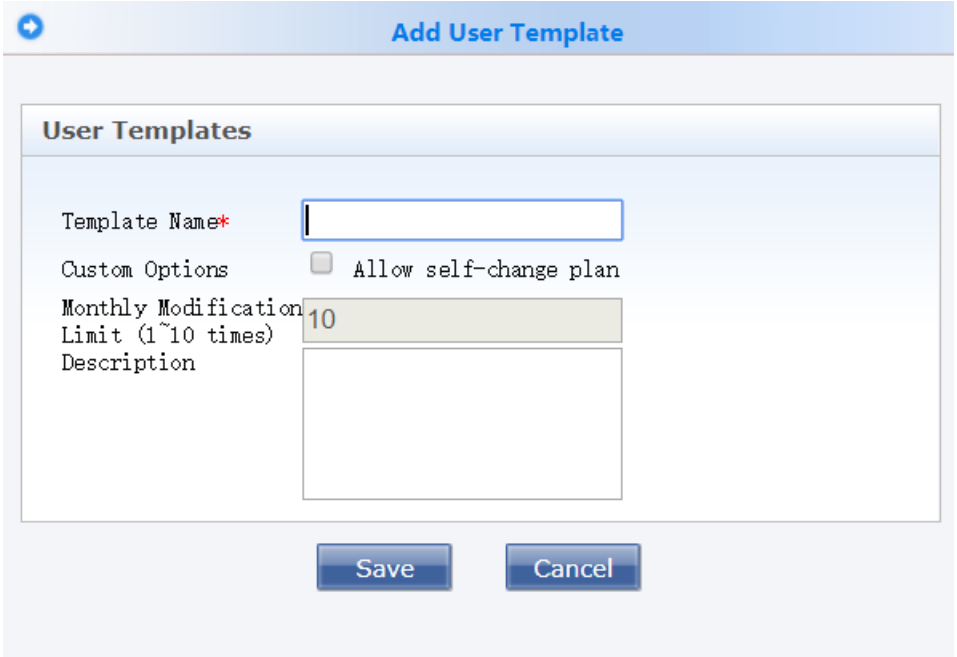
1. Log in to the SAM+ management page.
2. Choose **User** > **User Template**.



3. Click **Add**.

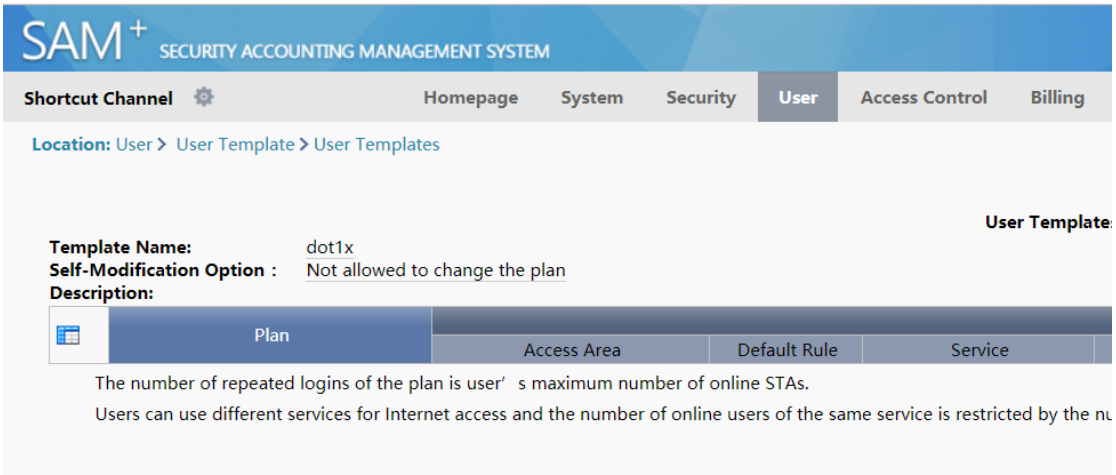


4. In the **Add User Template** dialog box, enter the template name, for example, "dot1x", and click **Save**.



4.2.1.4.4 Verification

Verify that the user template is added successfully.



4.2.1.5 User Plan Configuration

4.2.1.5.1 Function requirements

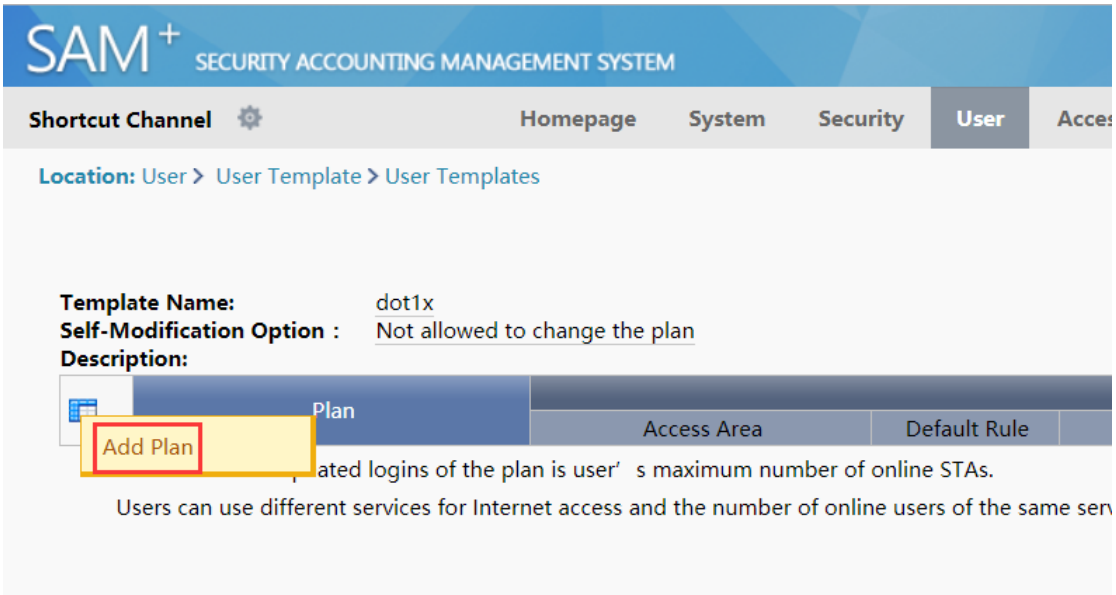
Configure a user plan to cover access limits of authenticated users, including the area, time range, access control, and billing policy. A user plan is akin to a phone service package.

4.2.1.5.2 Configuration key points

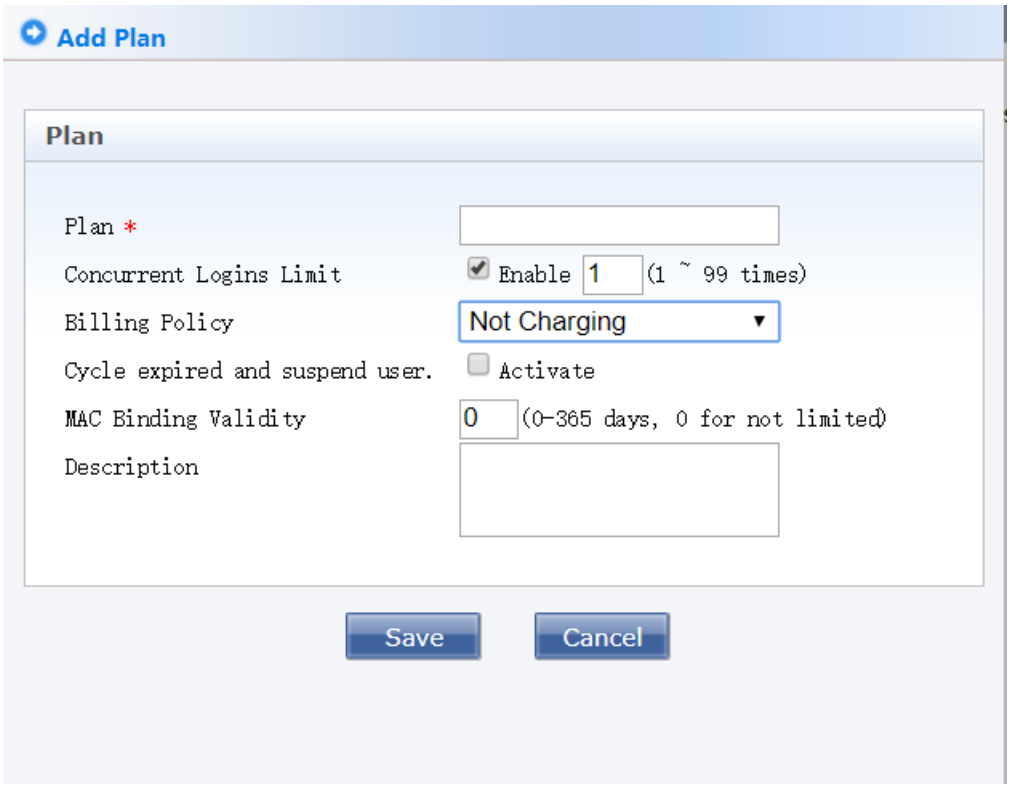
A plan covers all control options and fees for access users. Be sure to clearly confirm plans with customers before configuration.

4.2.1.5.3 Configuration steps

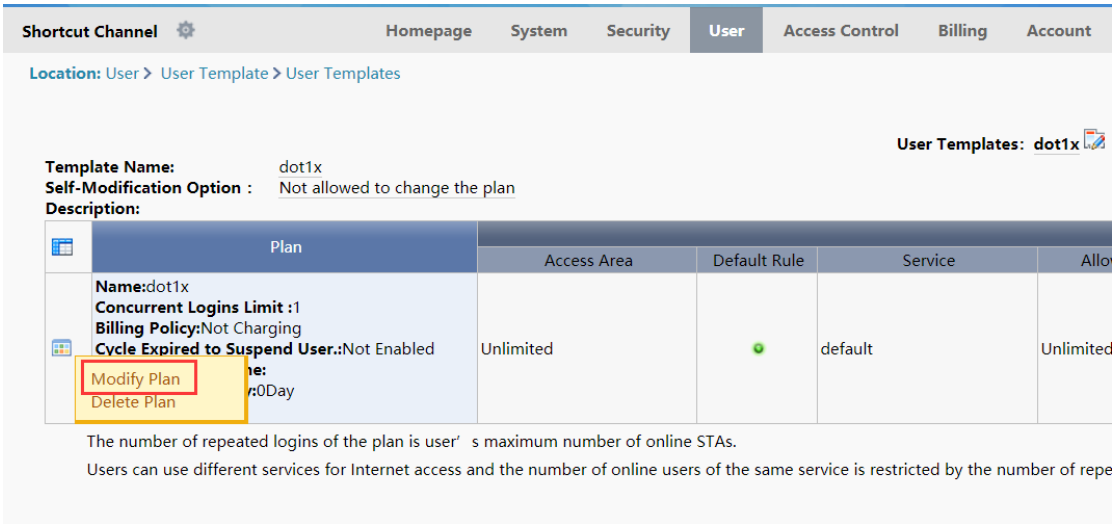
1. In the configured user template "dot1x", click **Add Plan**.



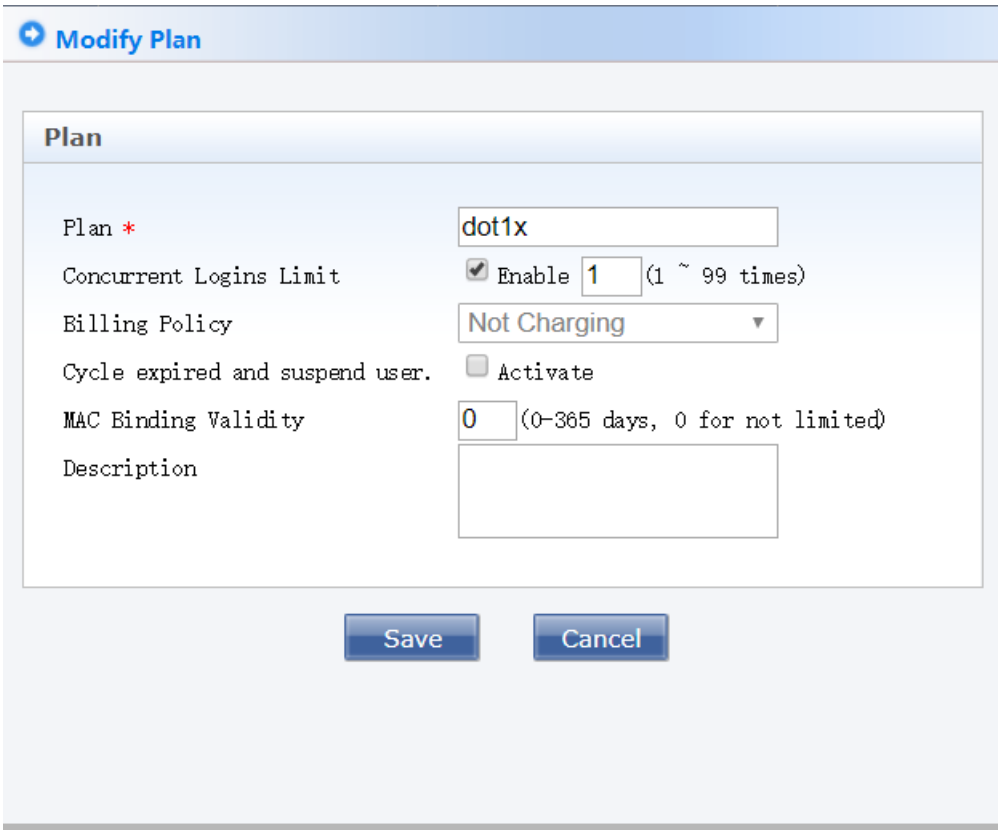
2. Enter the plan name, for example, "dot1x", select a configured billing policy or **Not Charging** based on actual requirements, and then click **Save**.



3. Click **Modify Plan** and modify the access area, access time range, access control, and billing mode.

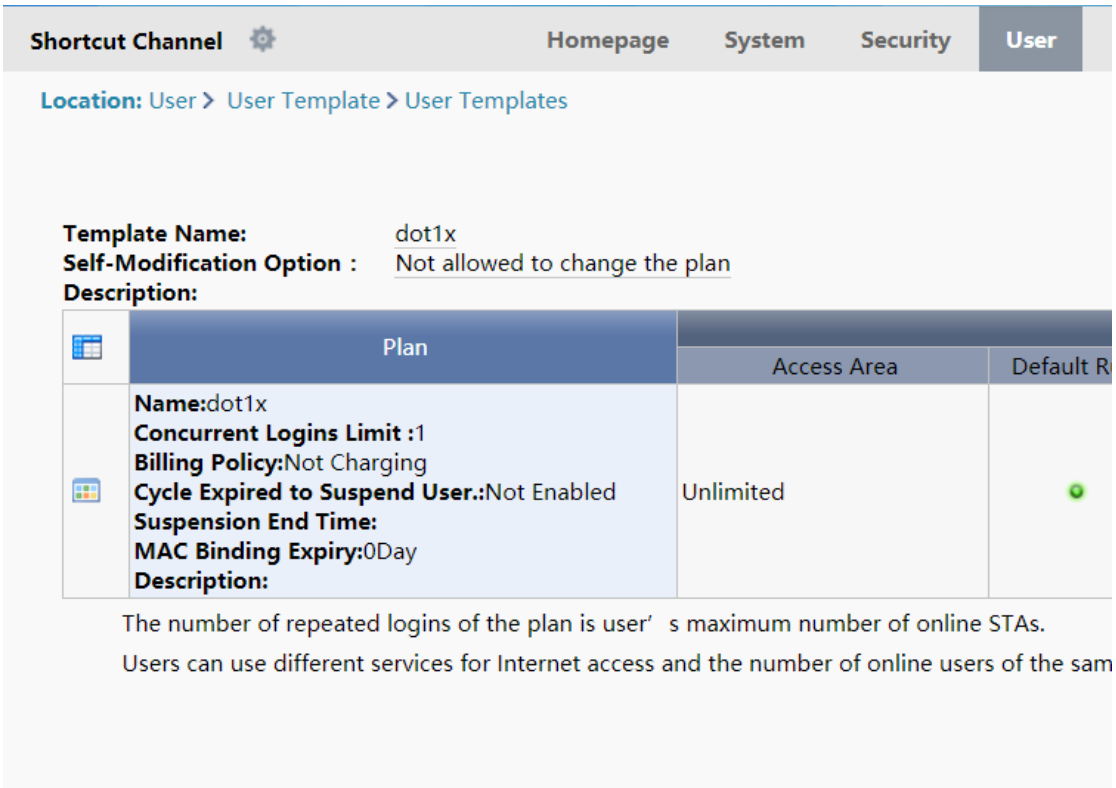


4. Modify the rule based on actual conditions. The figure below shows that the access area of authenticated users is unlimited, access control is set to "dot1x", the access time range is unlimited, and billing is performed based on the plan "dot1x".



4.2.1.5.4 Verification

Verify that the plan meets customer requirements.



4.2.1.6 User Group Configuration

4.2.1.6.1 Function requirements

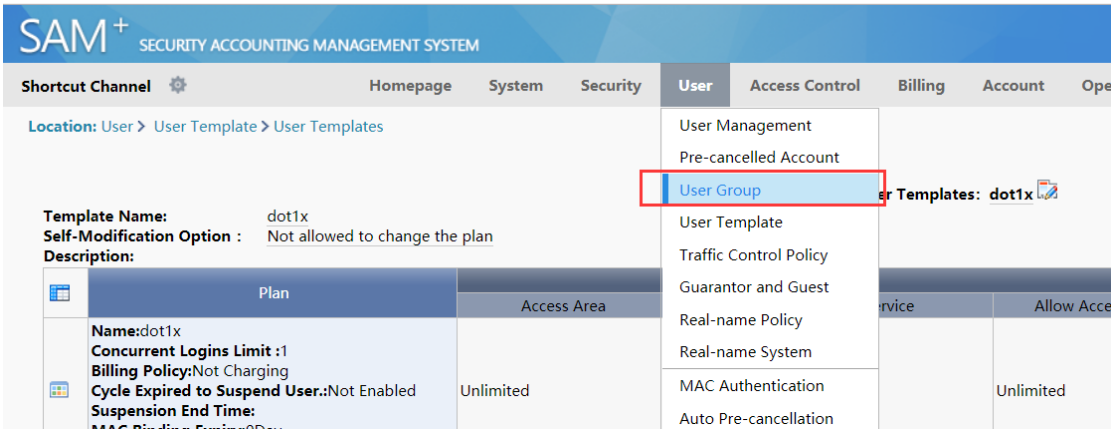
Add authenticated users with the same attribute to the same group, and define a response user template and plan for the user group to prepare for later account creation.

4.2.1.6.2 Configuration key points

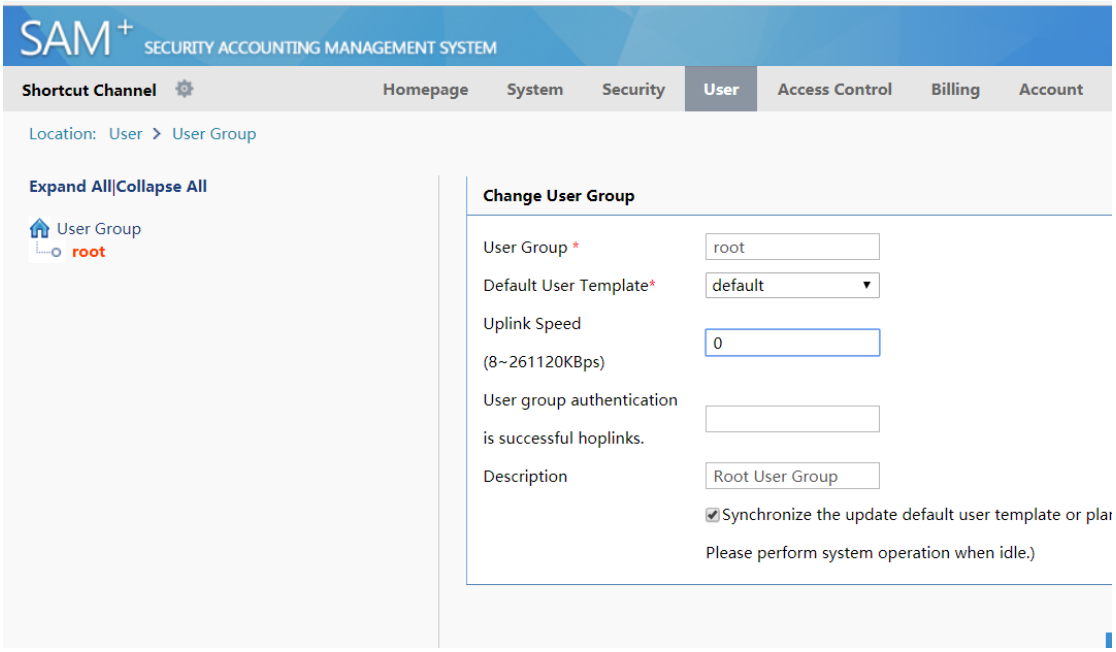
It is recommended to group access users by attribute, for example, group users on campus networks into "student user group" or "teacher user group".

4.2.1.6.3 Configuration steps

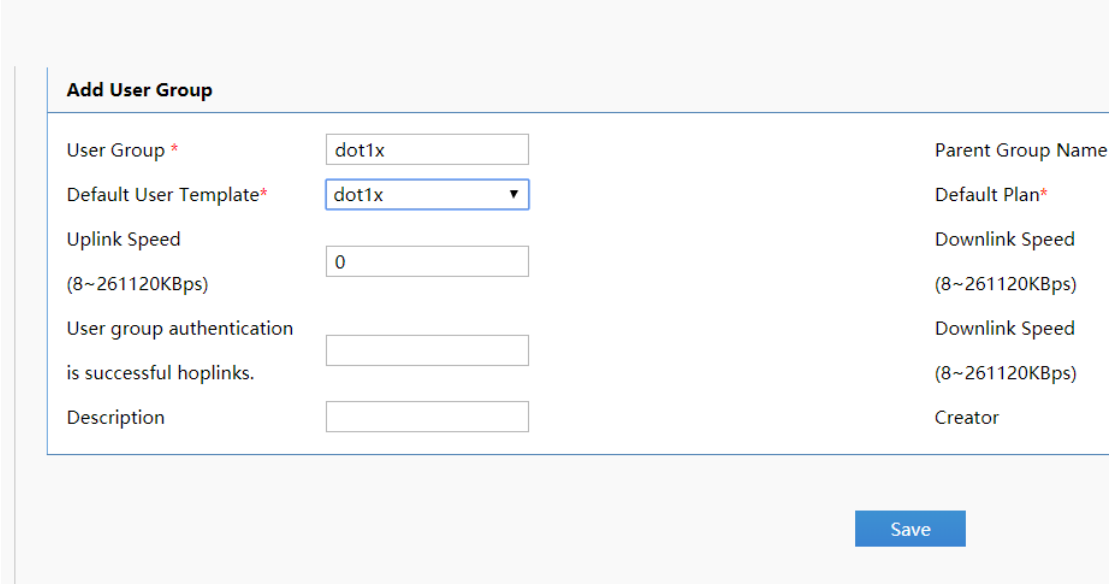
1. Log in to the SAM+ management page.
2. Choose **User** > **User Group**.



3. Click **Add**.

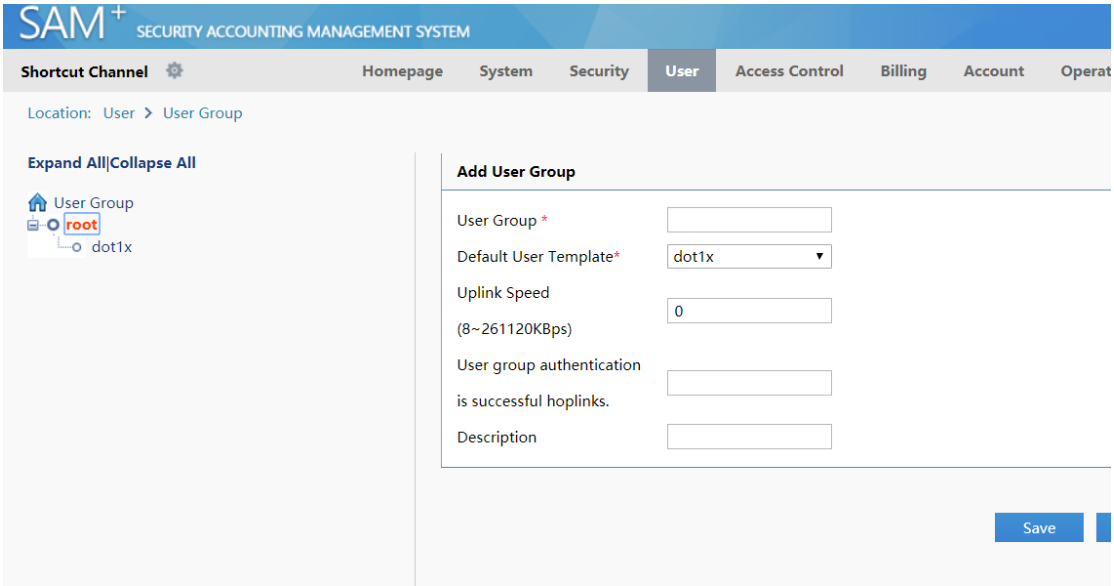


4. Enter the user group name, for example, "dot1x", and select the default user template and default plan. Then, click **Save**.



4.2.1.6.4 Verification

Verify that the user group is added successfully.



4.2.1.7 Account Creation

4.2.1.7.1 Function requirements

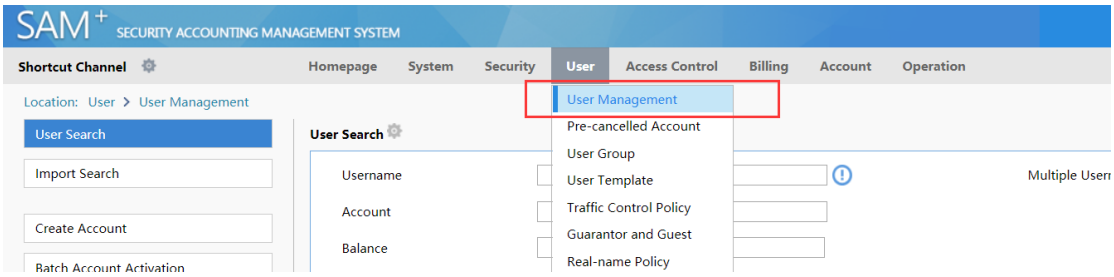
Create accounts in the SAM+ system.

4.2.1.7.2 Configuration key points

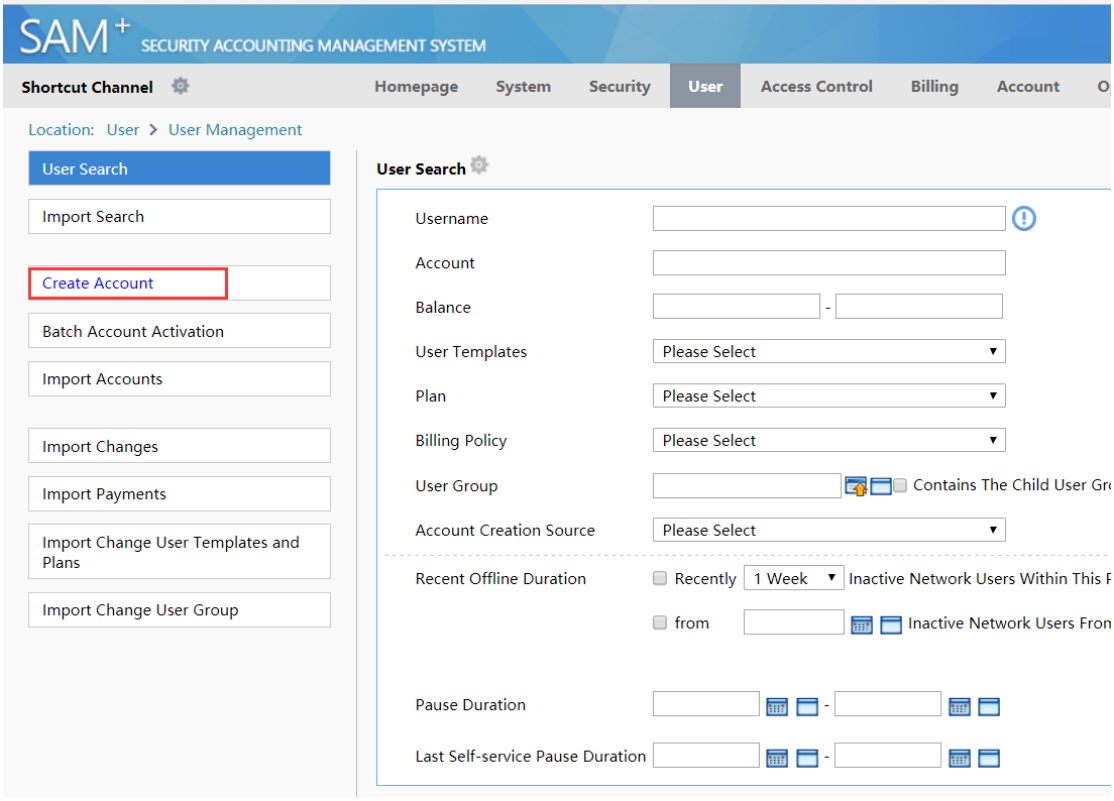
1. The account creation process generally requires users to go to business halls and apply for accounts by using their ID cards.
2. Accounts with the names same as those on their ID cards are registered during account creation.
3. A user group and a user template need to be selected during account creation as planned.

4.2.1.7.3 Configuration steps

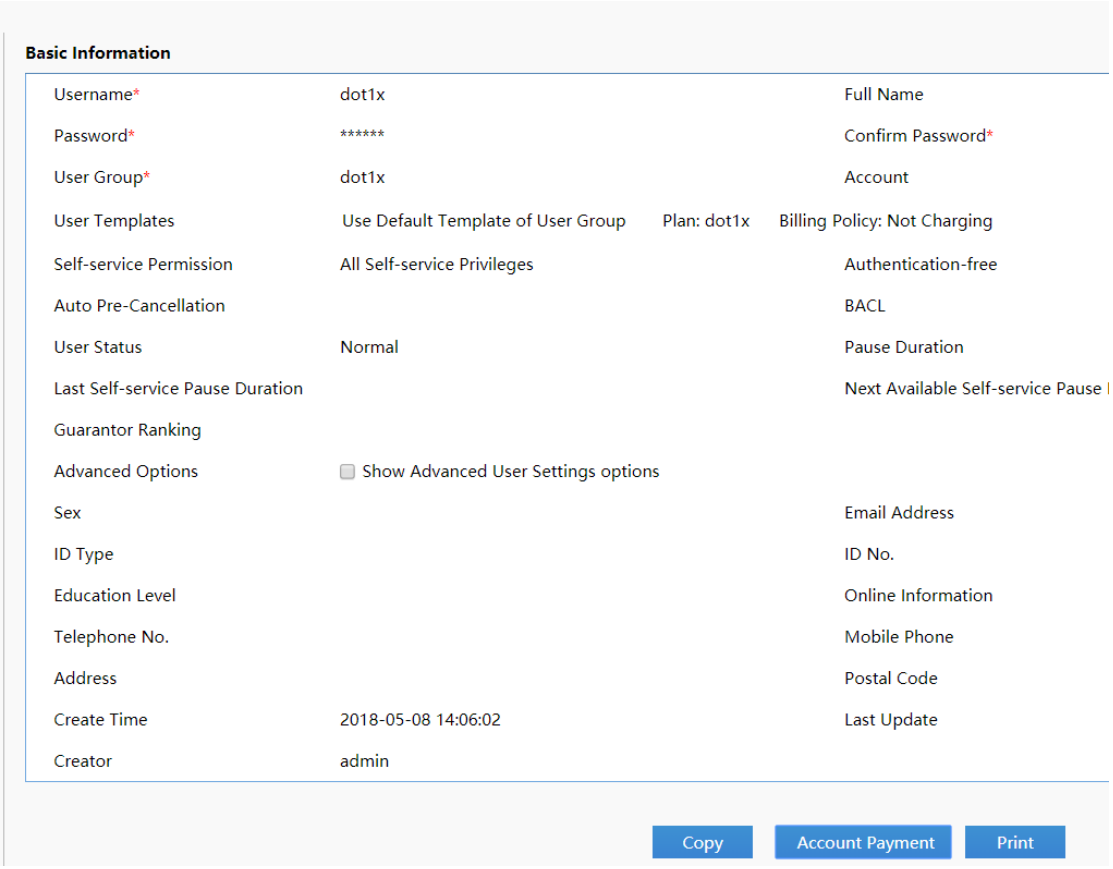
1. Log in to the SAM+ management page.
2. Choose **User** > **User Management**.



3. Click **Create Account** in the left pane.

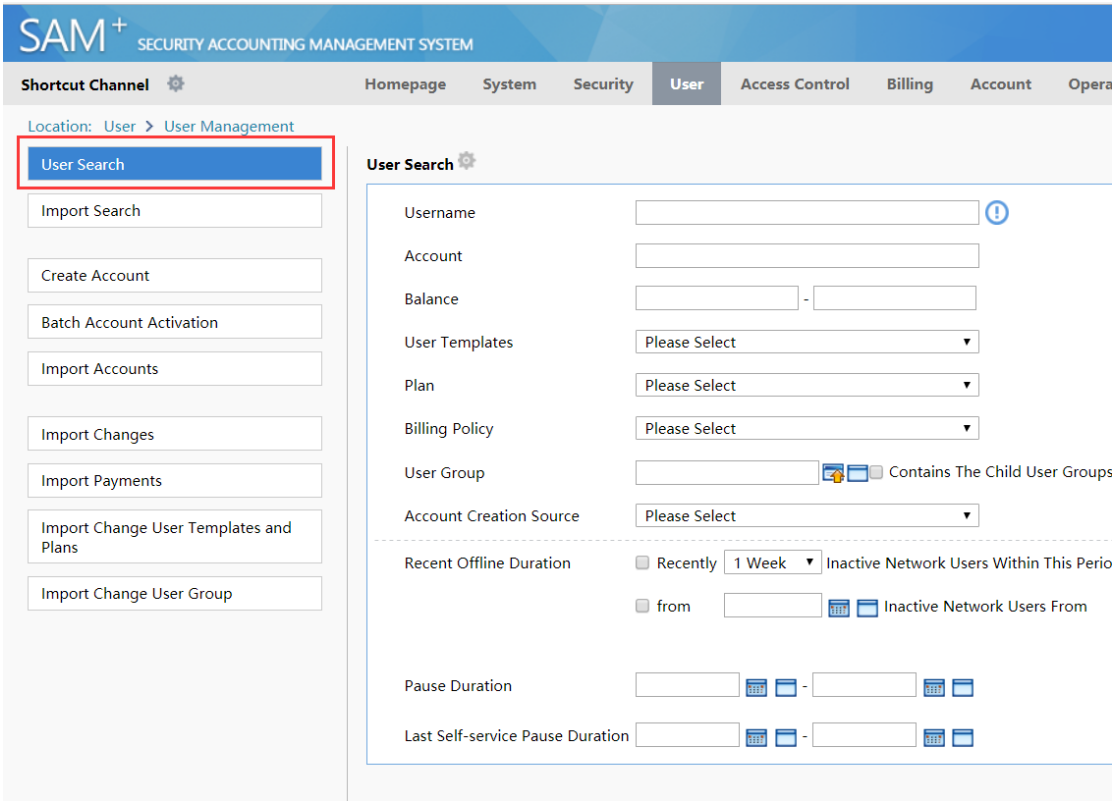


4. Enter the username and password, select a user group, user template, and plan. Then, click **Save**.



4.2.1.7.4 Verification

1. In the left pane of the **User Management** page, click **User Search**. In the displayed right pane, click **Search**. The added user is displayed.



4.2.1.8 Payment

4.2.1.8.1 Function requirements

Collect fees from newly created users, so that they can be authenticated, be charged, and access the Internet.

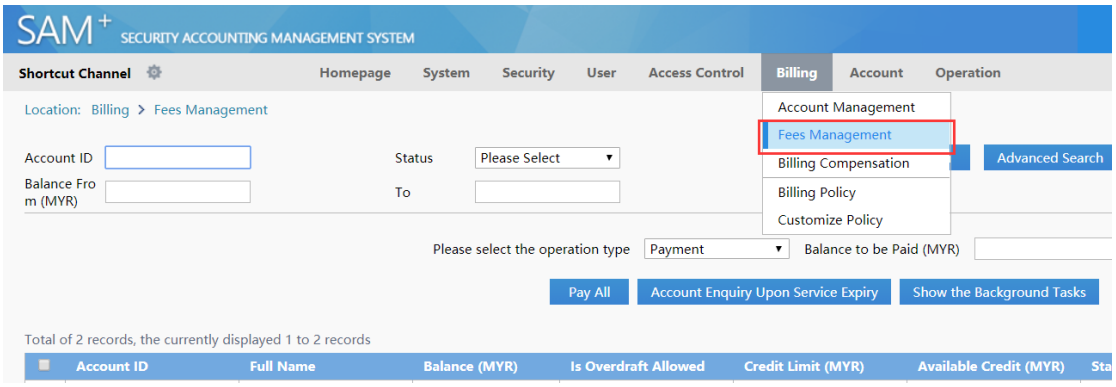
4.2.1.8.2 Configuration key points

The payment operation involves fees. Ensure that paid fees are consistent with the fees recorded in the system.

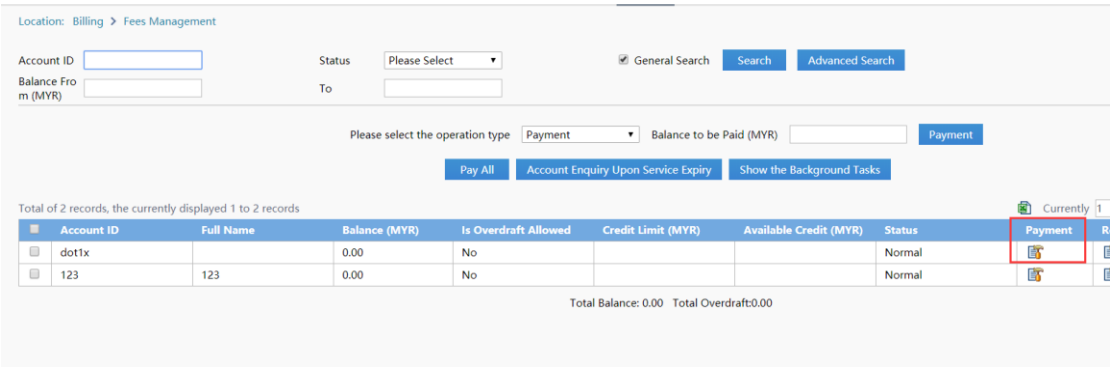
4.2.1.8.3 Configuration steps

1. Log in to the SAM+ management page.

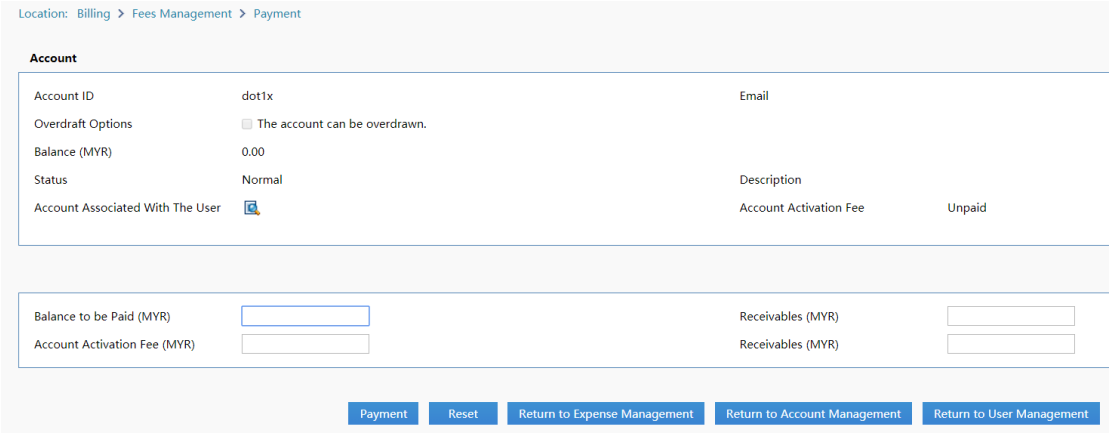
2. Choose **Billing** > **Fees Management**.



3. The newly created user has insufficient balance. Click the icon in the **Payment** column.

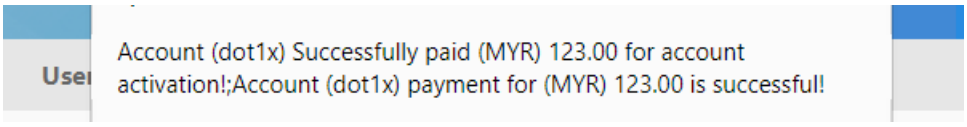


4. Collect the fees, record the fees actually paid by the user in the system, and click **Payment**.

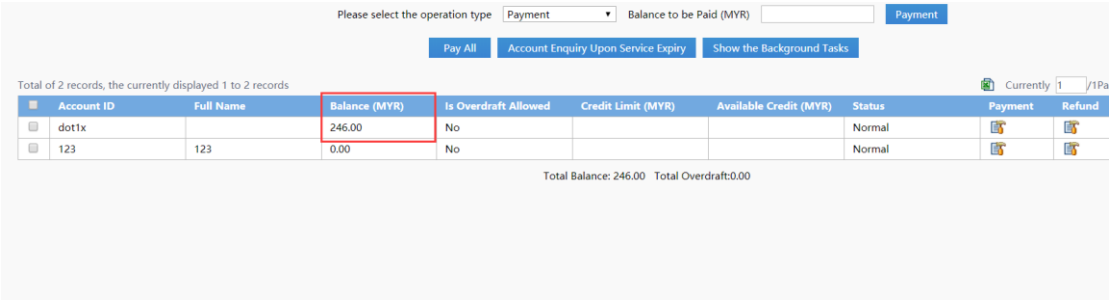


4.2.1.8.4 Verification

1. Verify that the fees are paid successfully.



2. Verify that the fees are corrected and the account is in the normal state. As shown in the figure below, 123 Yuan is deducted from the user account "dot1x" for the current month, and the account has 246 Yuan balance, and is in the normal state.



4.2.2 [Optional] Wireless AC — 802.1x Authentication

4.2.2.1 Adding an AC on SAM+

4.2.2.1.1 Function requirements

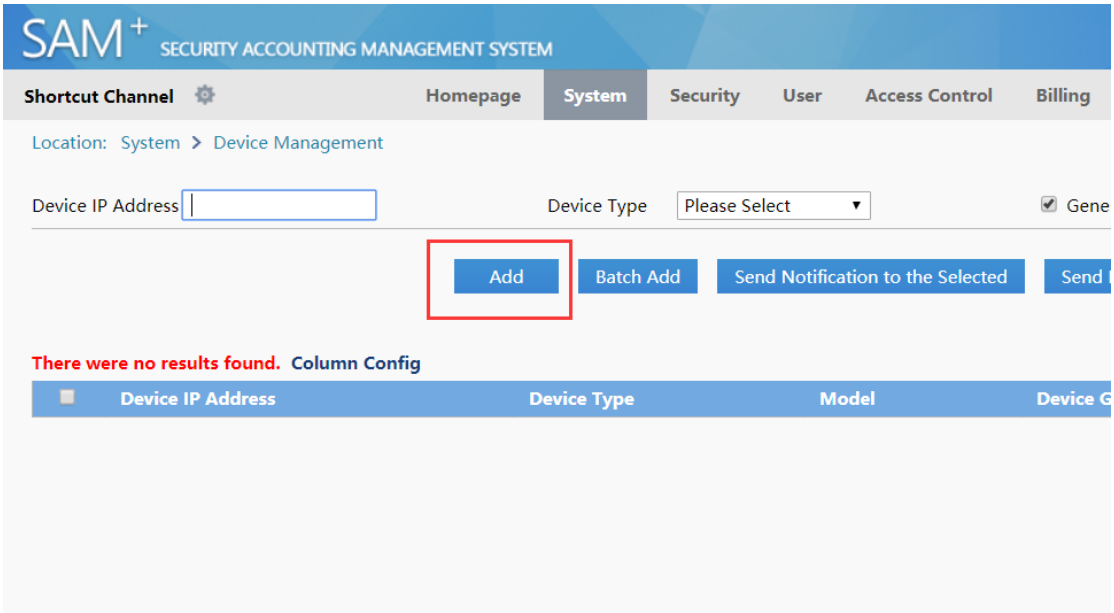
Add ACs on SAM+.

4.2.2.1.2 Configuration key points

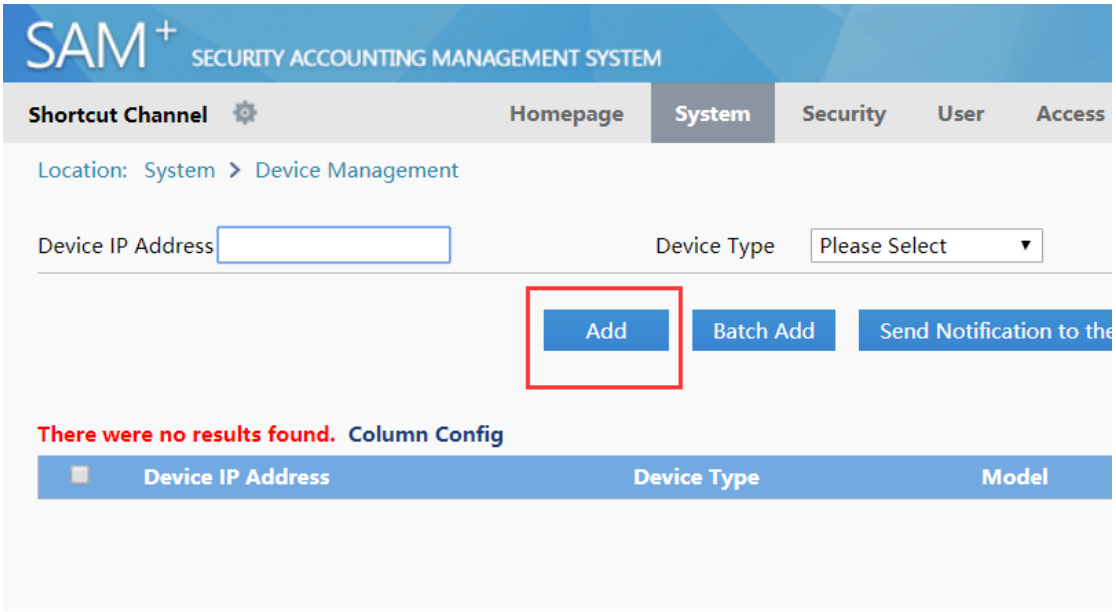
The AC parameters added on SAM+ must be consistent with the actual settings of the AC. Otherwise, an authentication exception will occur.

4.2.2.1.3 Configuration steps

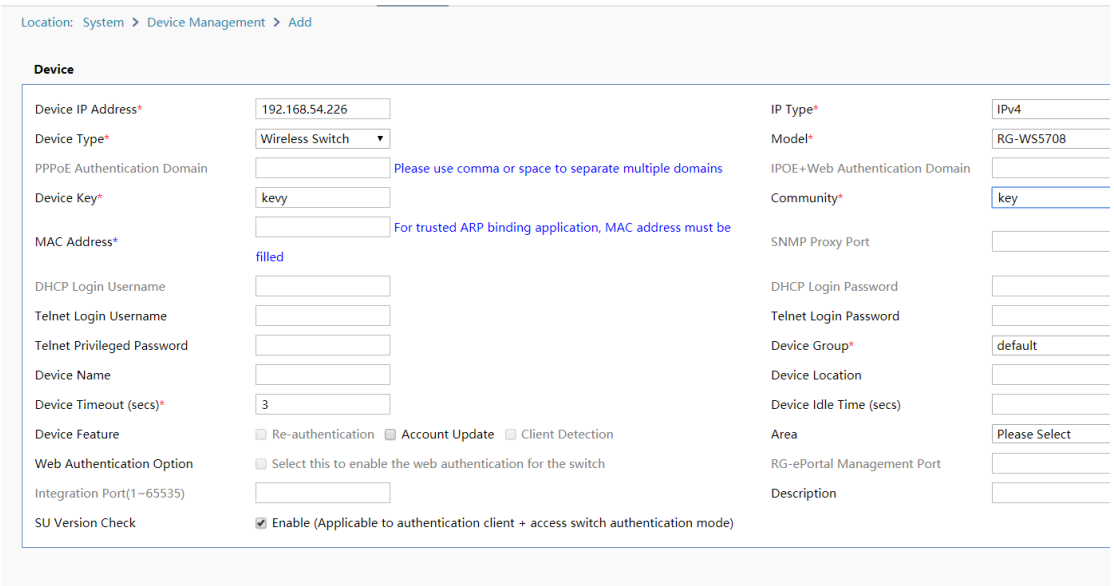
1. Log in to the SAM+ management page.
2. Choose **System** > **Device Management**.



3. Click **Add** to add a device.



4. Set AC parameters and ensure that the key parameters are consistent with the actual settings of the AC. Then, click **Save**.



4.2.2.1.4 Verification

1. Check whether the SAM+ server can ping the device successfully. If yes, it indicates that their communication is normal (ensure that ping packets are not intercepted by the firewall).

4.2.2.2 Access Control Configuration

4.2.2.2.1 Function requirements

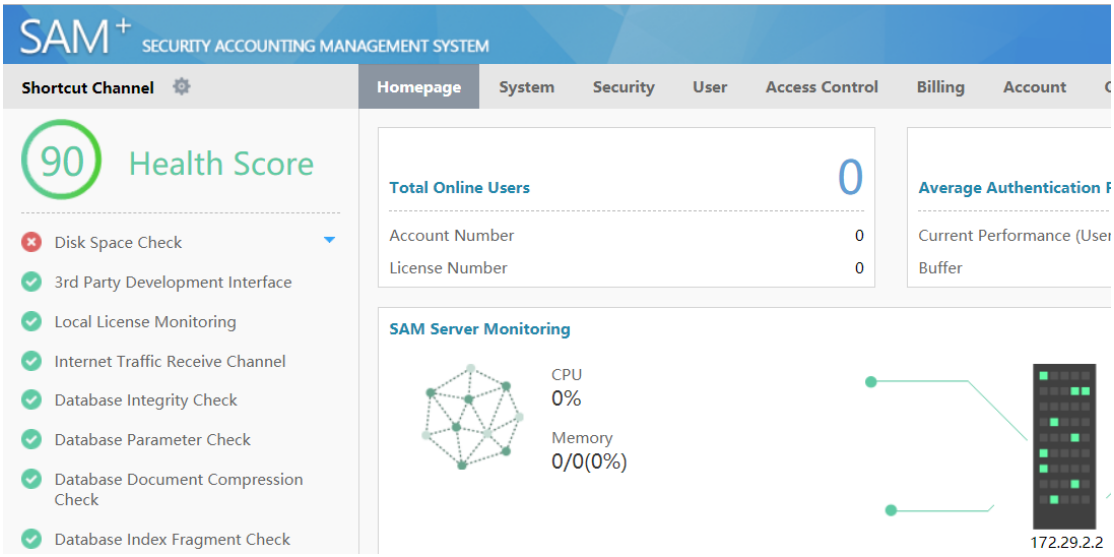
Configure access control to restrict Internet access behavior of users.

4.2.2.2.2 Configuration key points

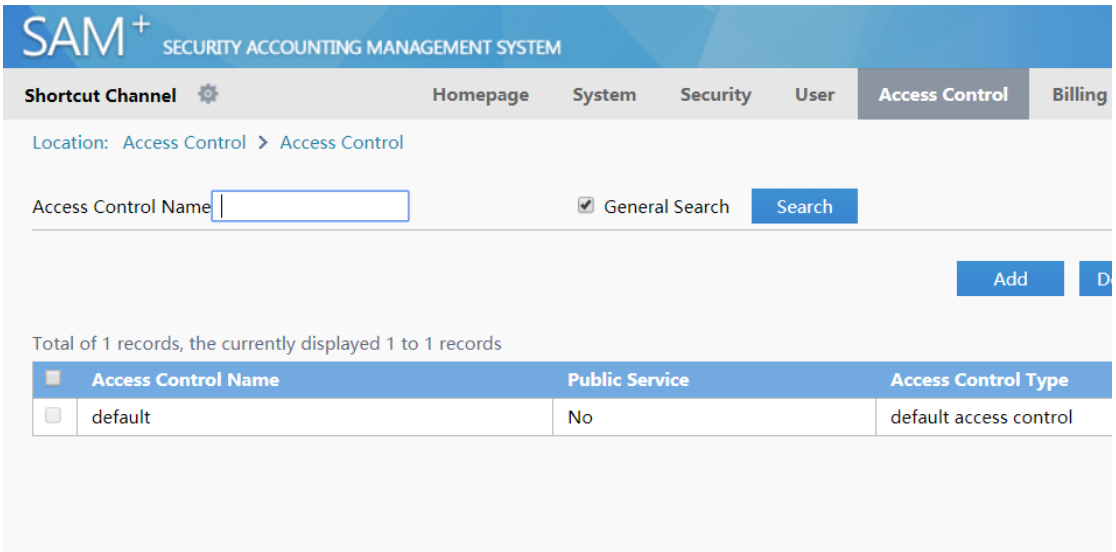
The Internet access behavior of access users needs to be confirmed with customers and access control needs to be configured based on actual conditions.

4.2.2.2.3 Configuration steps

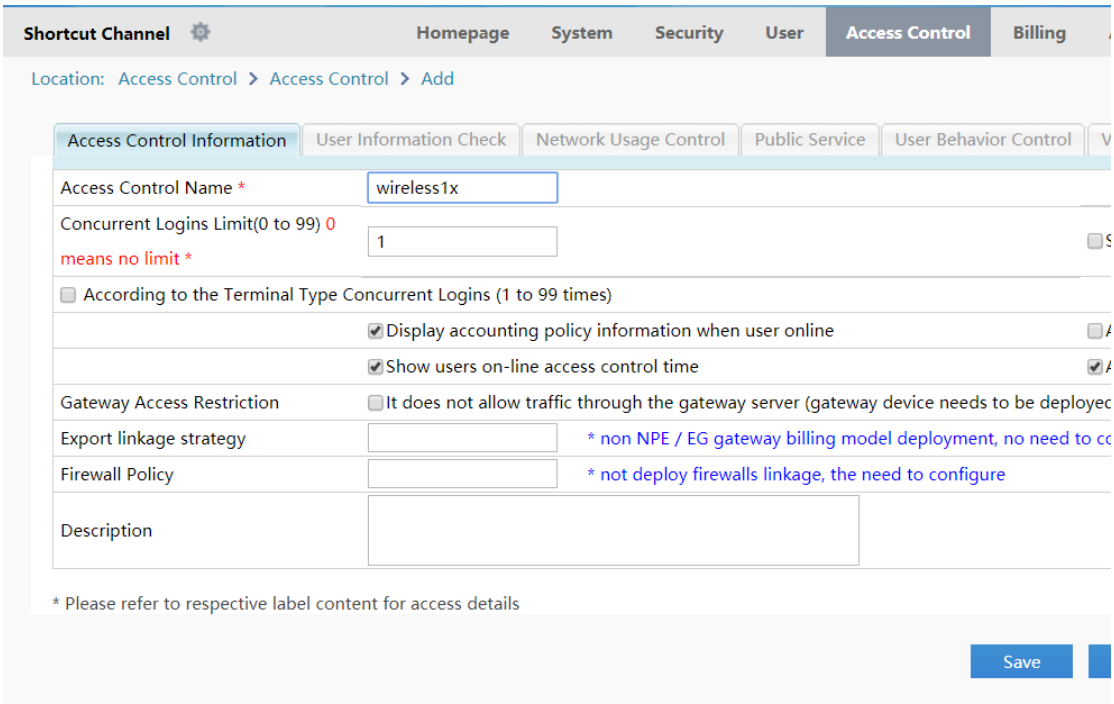
1. Log in to the SAM+ management page.
2. Choose **Access Control** > **Access Control**.



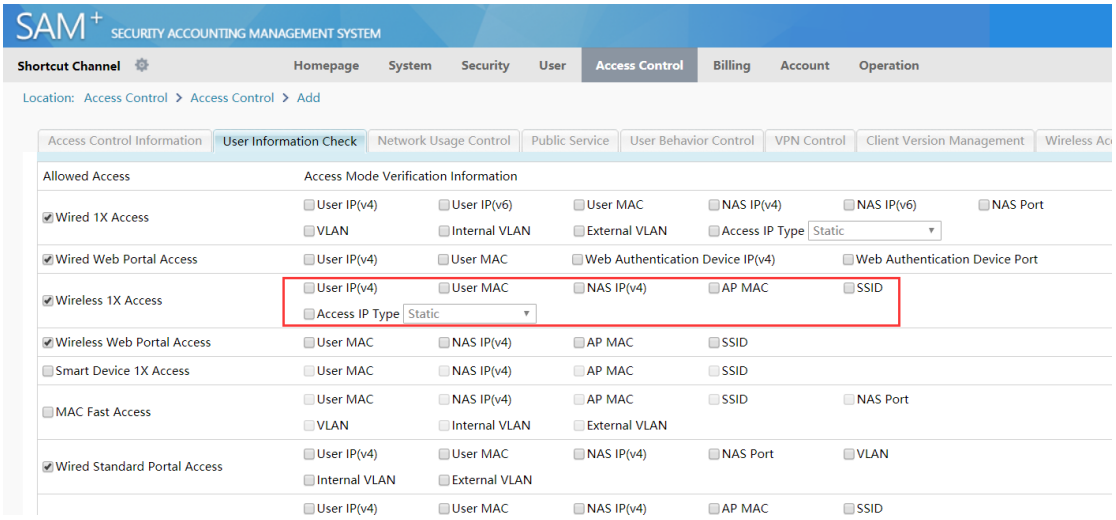
3. Click **Add** to add access control.



4. On the **Access Control Information** tab page, enter the access control name, for example, "wireless1x", and set other parameters based on actual conditions.

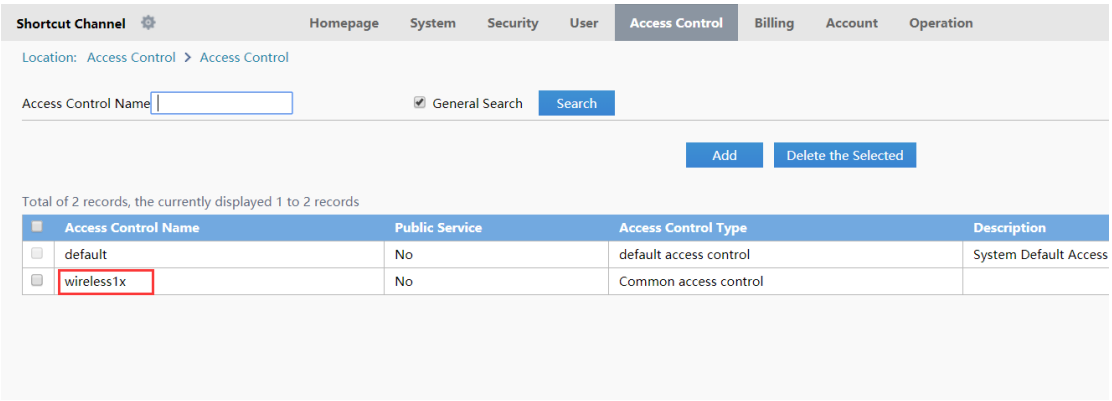


5. On the **User Information Check** tab page, select **Wireless 1X Access** and configure whether to bind accounts with IP/MAC addresses based on actual conditions. Then, click **Save**.



4.2.2.2.4 Verification

Verify that access control is added successfully.



4.2.2.3 Billing Policy Configuration

4.2.2.3.1 Function requirements

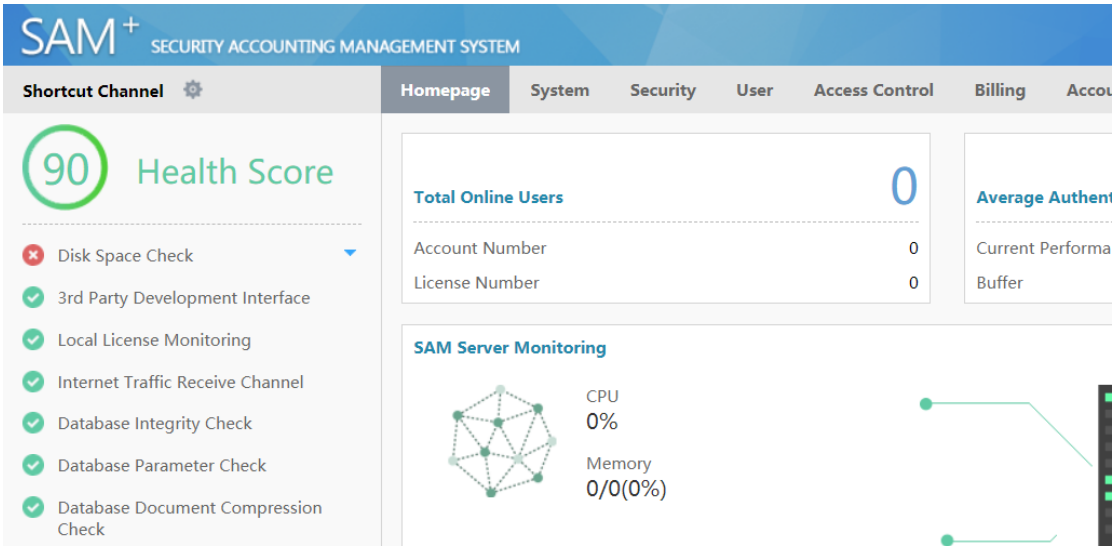
Configure billing policies based on billing requirements of access users, to pay for Internet access.

4.2.2.3.2 Configuration key points

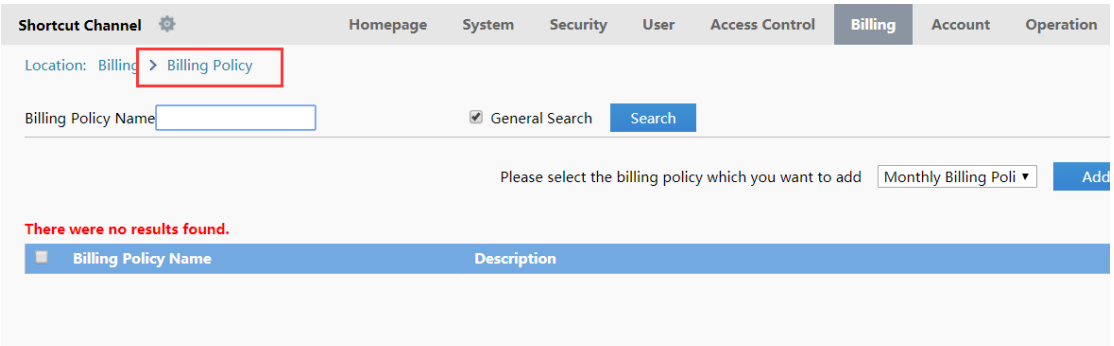
Billing requirements of access users need to be confirmed with customers and billing policies need to be configured based on actual conditions.

4.2.2.3.3 Configuration steps (monthly milling)

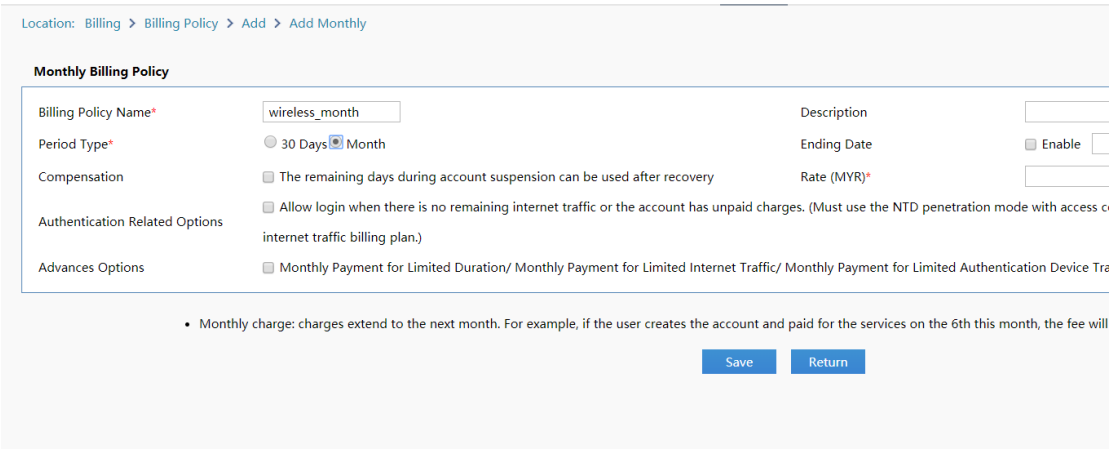
1. Log in to the SAM+ management page.
2. Choose **Billing** > **Billing Policy**.



3. Select **Monthly Billing Policy** and click **Add**.

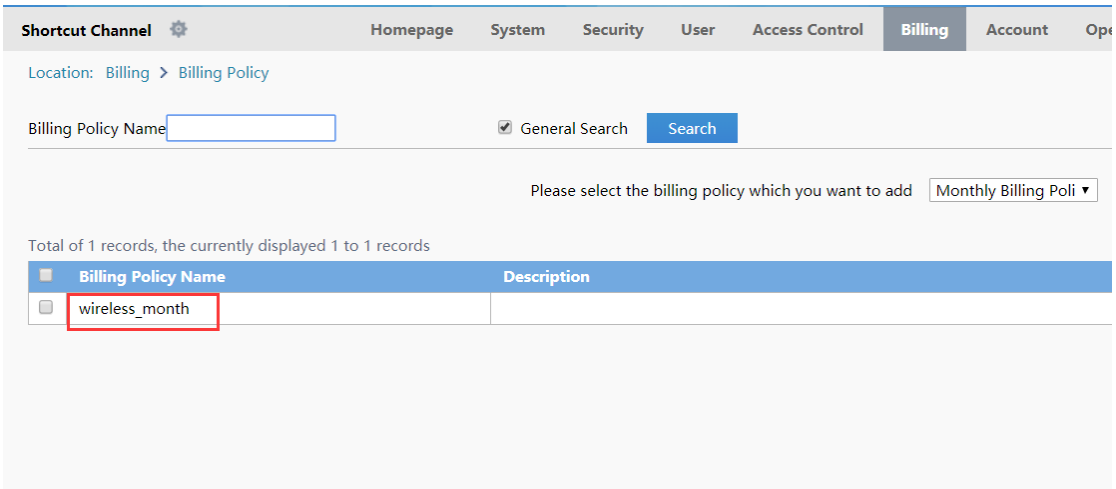


4. Enter the billing policy name, for example, "wireless_month", set **Period Type** to **30 Days** or **Month**, and set **Rate (MYR)**, for example, 30 Yuan/month. Then, click **Save**.



4.2.2.3.4 Verification

Verify that the billing policy is added successfully.



4.2.2.4 User Template Configuration

4.2.2.4.1 Function requirements

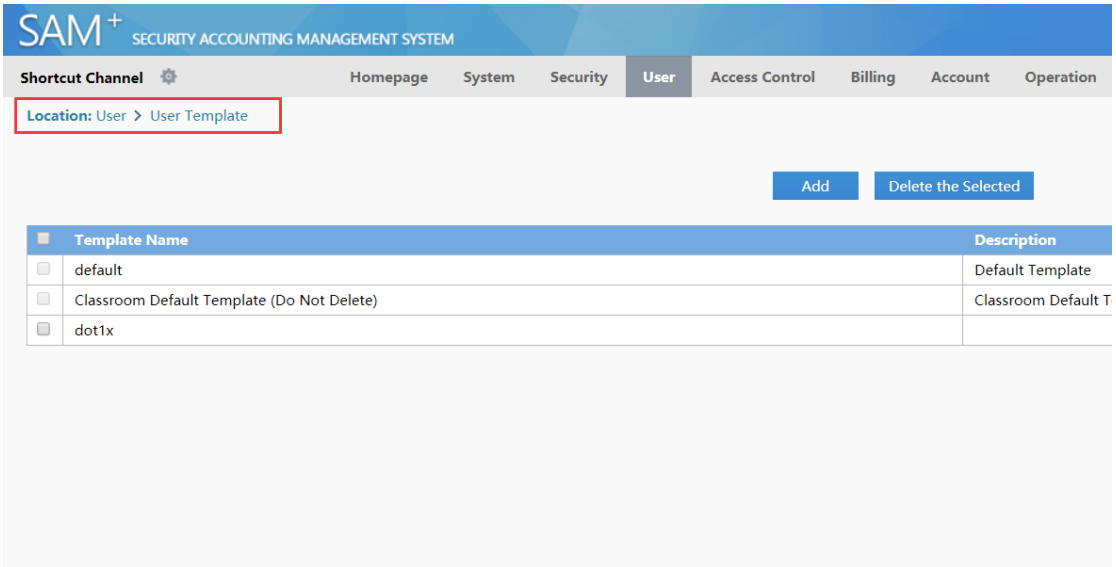
Configure user templates based on user attributes for later account creation.

4.2.2.4.2 Configuration key points

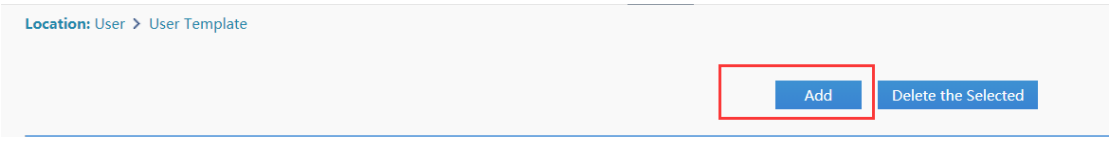
It is recommended to classify user templates with the same attribute into a group and give concise and intuitive names to the templates, for example, student monthly billing template or teacher monthly billing template.

4.2.2.4.3 Configuration steps

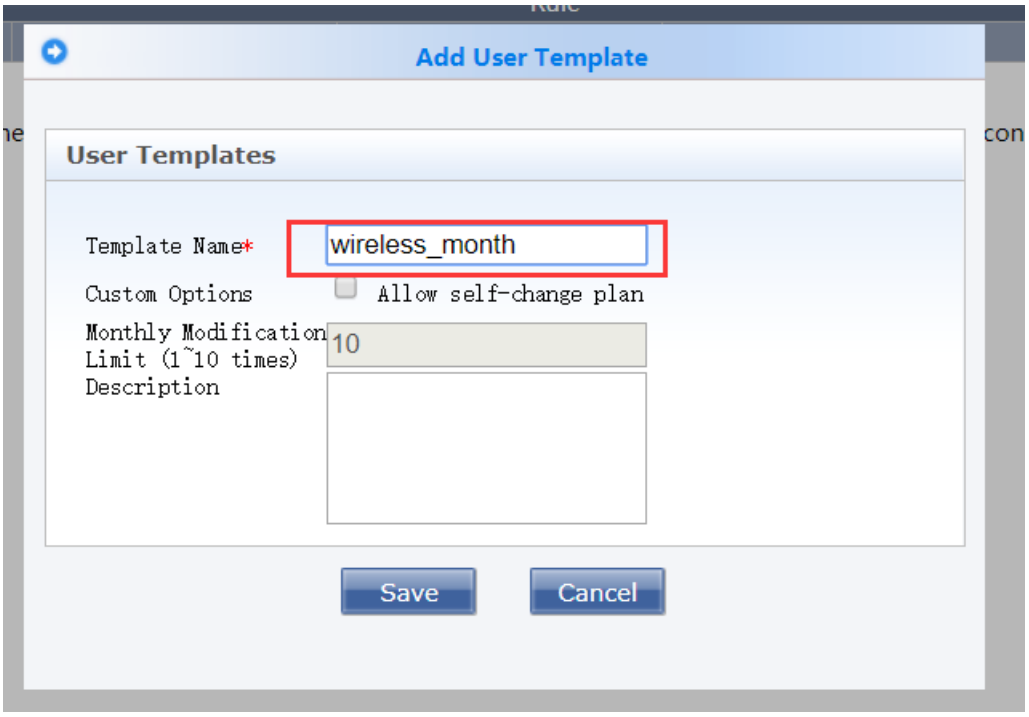
1. Log in to the SAM+ management page.
2. Choose **User** > **User Template**.



3. Click **Add**.

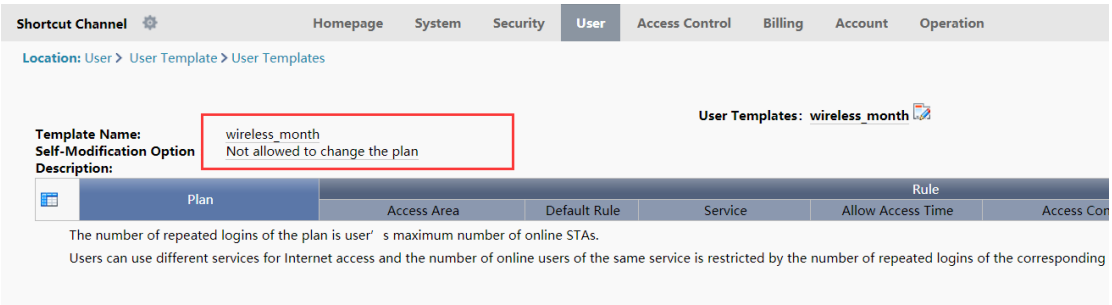


4. Enter the template name, for example, "wireles_month", and click **Save**.



4.2.2.4.4 Verification

Verify that the user template is added successfully.



4.2.2.5 User Plan Configuration

4.2.2.5.1 Function requirements

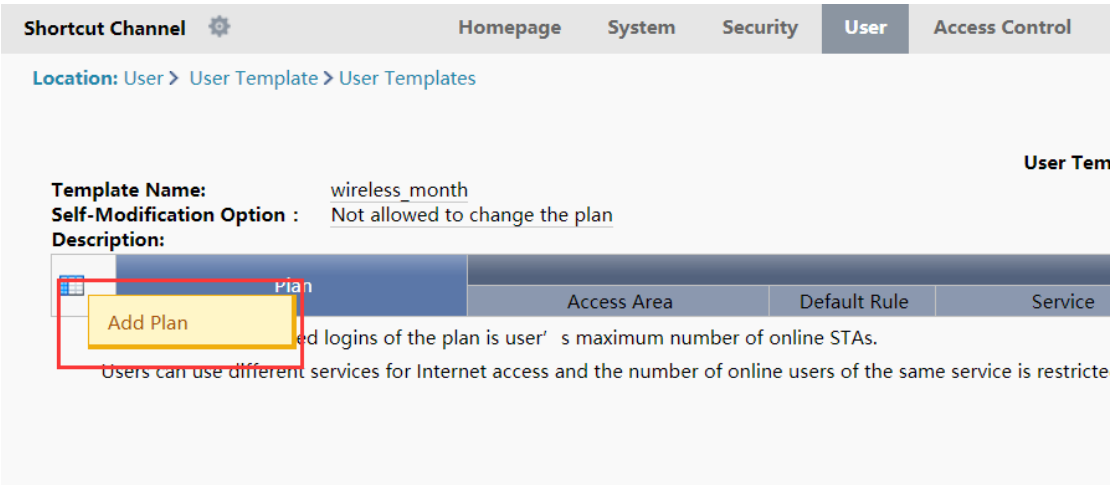
Configure a user plan to cover access limits of authenticated users, including the area, time range, access control, and billing policy. A user plan is akin to a phone service package.

4.2.2.5.2 Configuration key points

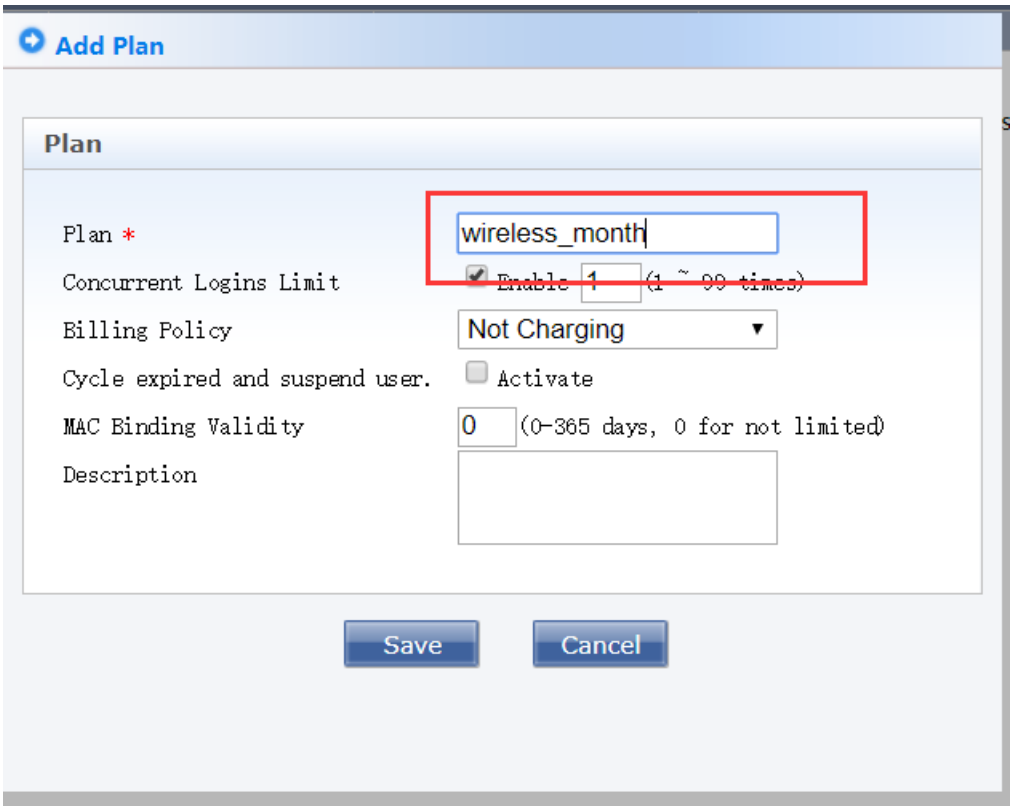
A plan covers all control options and fees for access users. Be sure to clearly confirm plans with customers before configuration.

4.2.2.5.3 Configuration steps

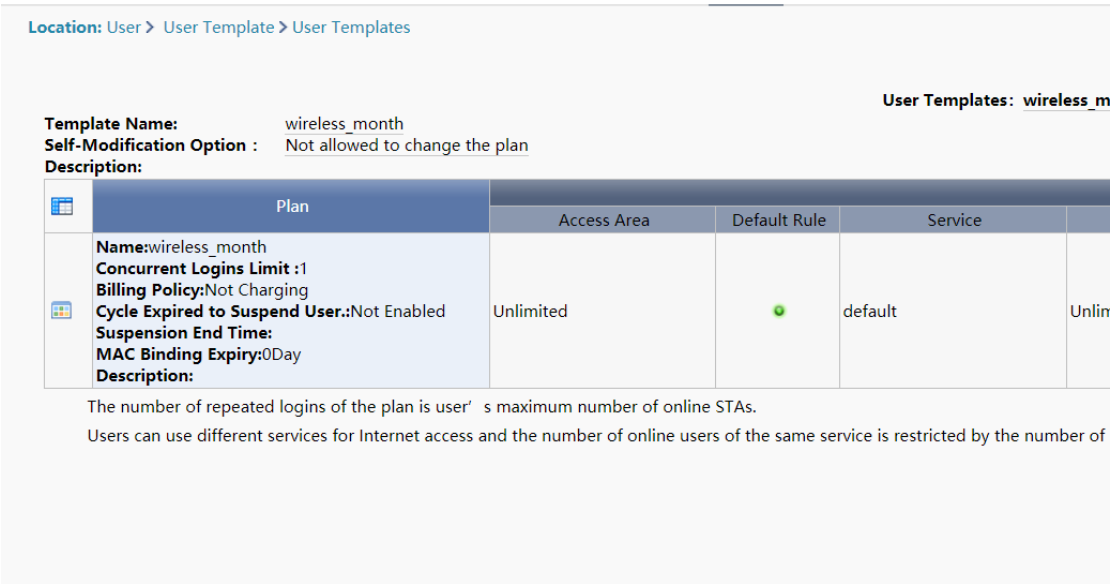
1. In the configured user template "wireless_month", click **Add Plan**.



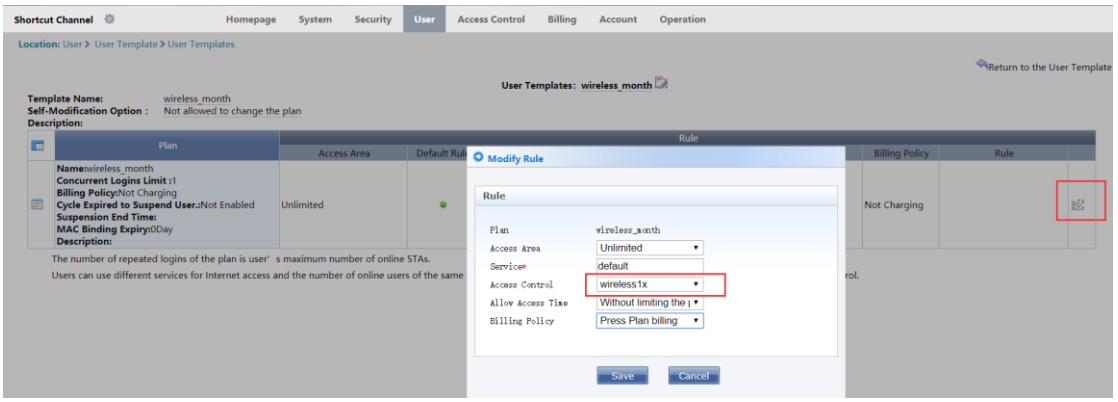
2. Enter the plan name, for example, "wireless_month", select a configured billing policy or **Not Charging** based on actual requirements, and then click **Save**.



3. Click **Modify Plan** and modify the access area, access time range, access control, and billing mode.

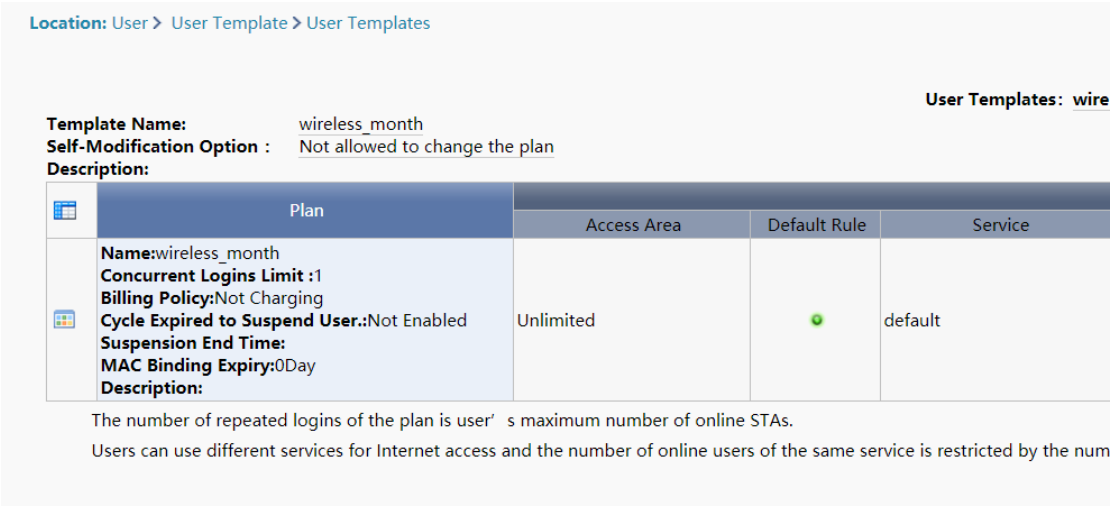


4. Modify the rule based on actual conditions. The figure below shows that the access area of authenticated users is unlimited, access control is set to "wireless1x", the access time range is unlimited, and billing is performed based on the plan "wireless_month".



4.2.2.5.4 Verification

Verify that the plan meets customer requirements.



4.2.2.6 User Group Configuration

4.2.2.6.1 Function requirements

Add authenticated users with the same attribute to the same group, and define a response user template and plan for the user group to prepare for later account creation.

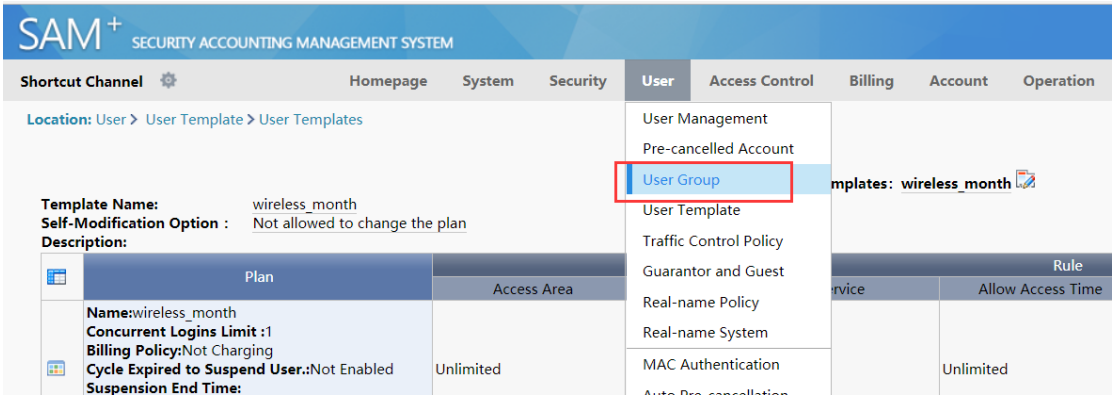
4.2.2.6.2 Configuration key points

It is recommended to group access users by attribute, for example, group users on campus networks into "student user group" or "teacher user group".

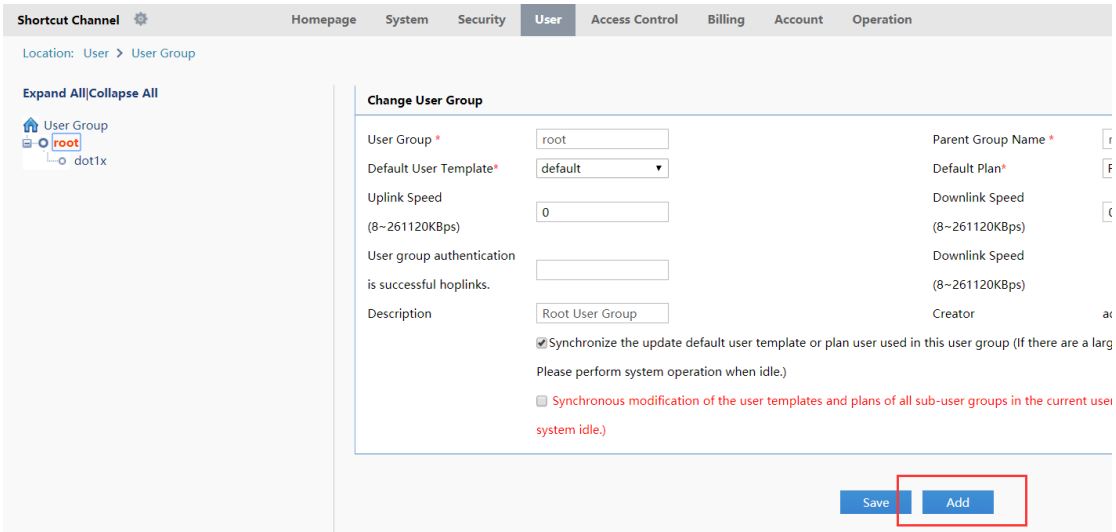
4.2.2.6.3 Configuration steps

1. Log in to the SAM+ management page.

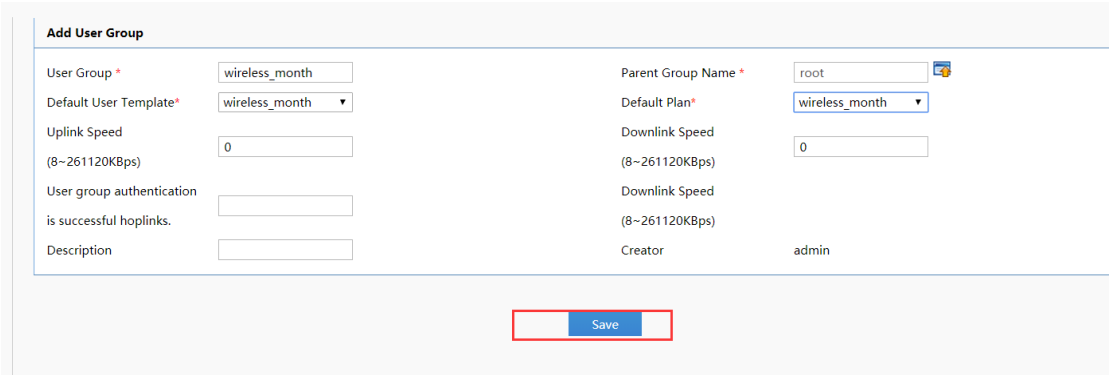
2. Choose **User** > **User Group**.



3. Click **Add**.

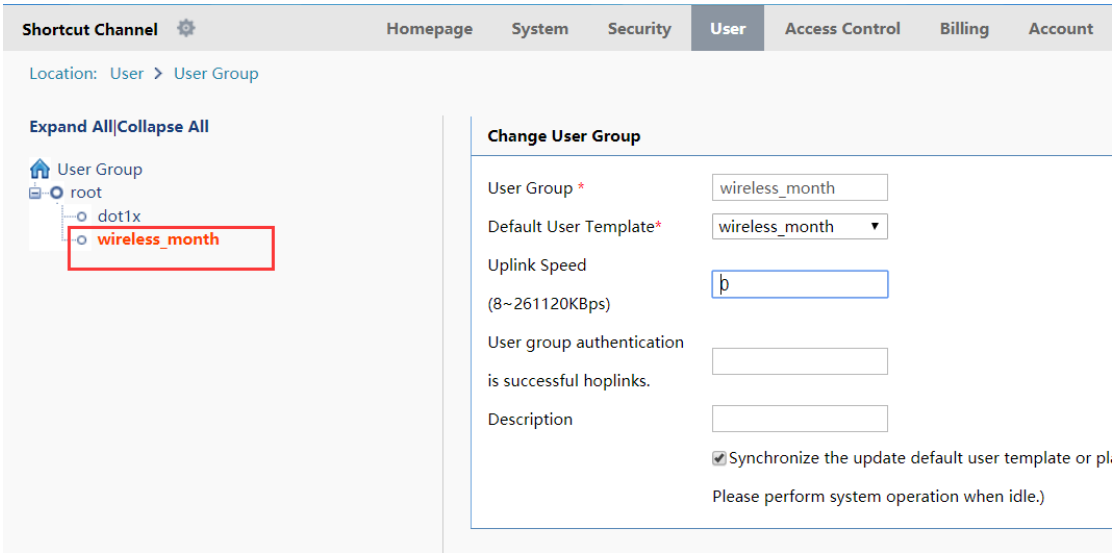


4. Enter the user group name, for example, "wireless_month", and select the default user template and default plan. Then, click **Save**.



4.2.2.6.4 Verification

Verify that the user group is added successfully.



4.2.2.7 Account Creation

4.2.2.7.1 Function requirements

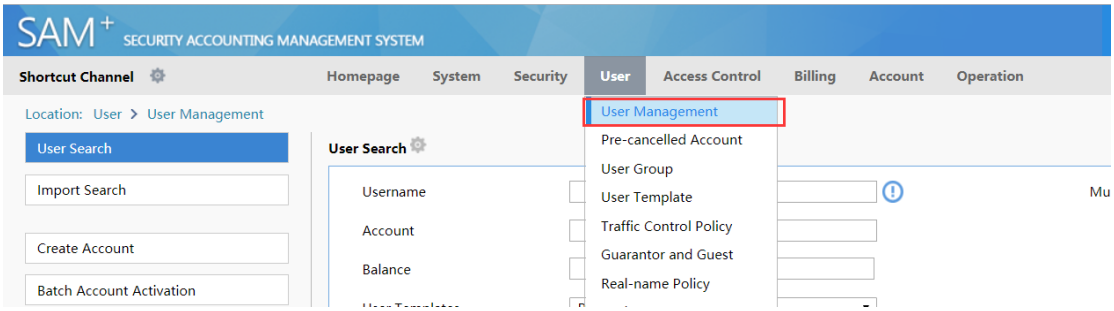
Create accounts for users in the SAM+ system.

4.2.2.7.2 Configuration key points

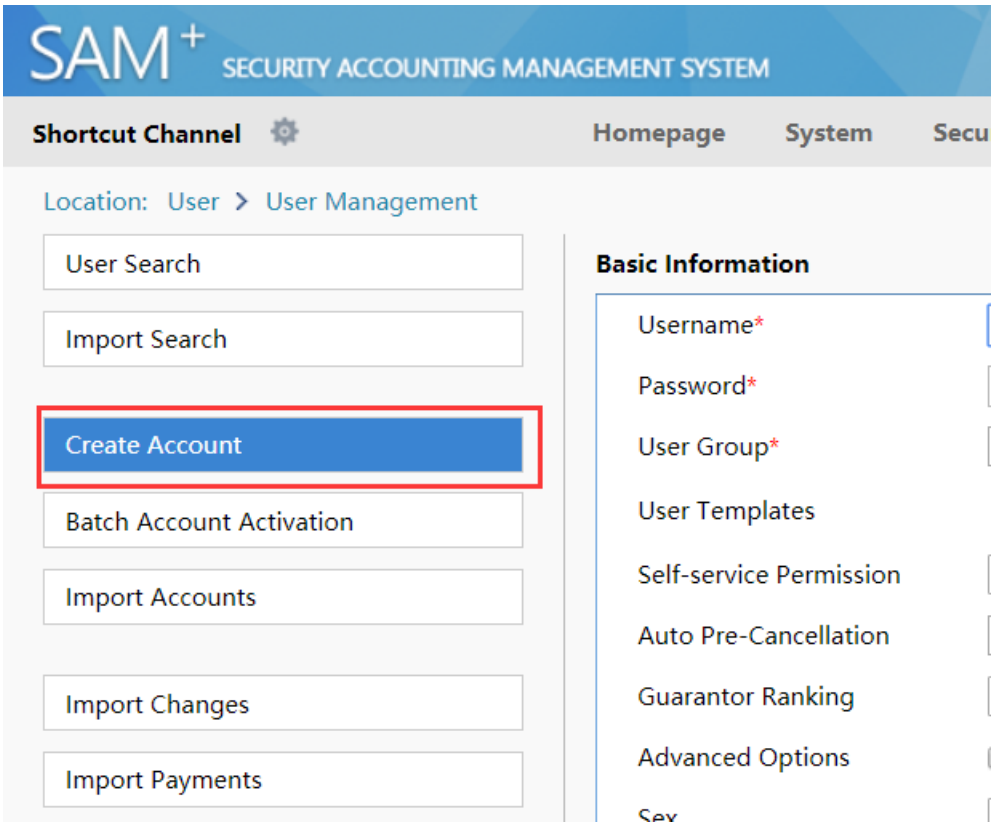
1. The account creation process generally requires users to go to business halls and apply for accounts by using their ID cards.
2. Accounts with the names same as those on their ID cards are registered during account creation.
3. A user group and a user template need to be selected during account creation as planned.

4.2.2.7.3 Configuration steps

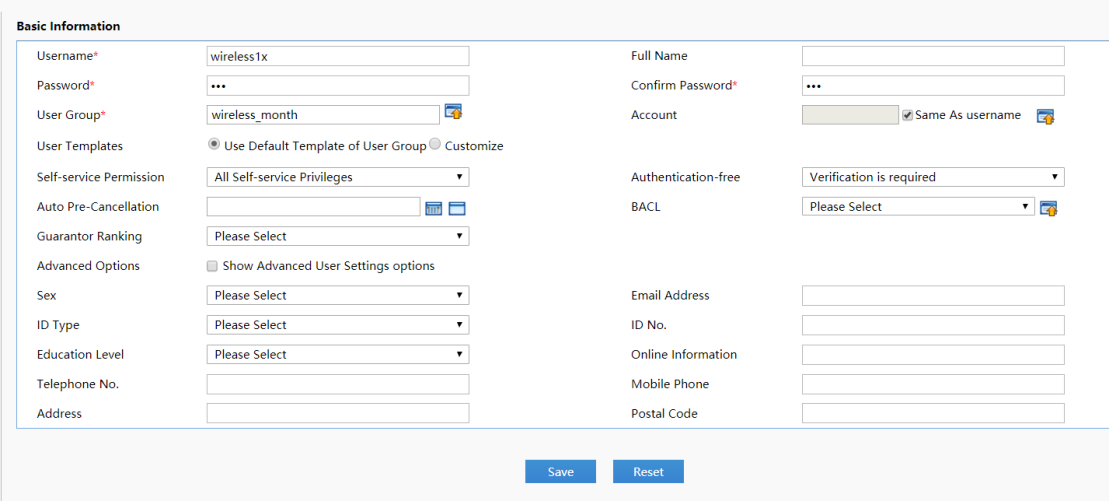
1. Log in to the SAM+ management page.
2. Choose **User** > **User Management**.



3. Click **Create Account** in the left pane.

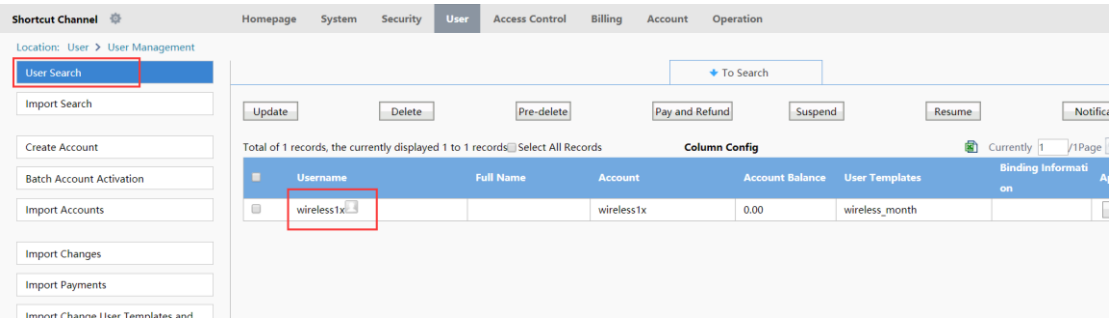


4. Enter the username and password, select a user group, user template, and plan. Then, click **Save**.



4.2.2.7.4 Verification

1. In the left pane of the **User Management** page, click **User Search**. In the displayed right pane, click **Search**. The added user is displayed.



4.2.2.8 Payment

4.2.2.8.1 Function requirements

Collect fees from newly created users, so that they can be authenticated, be charged, and access the Internet.

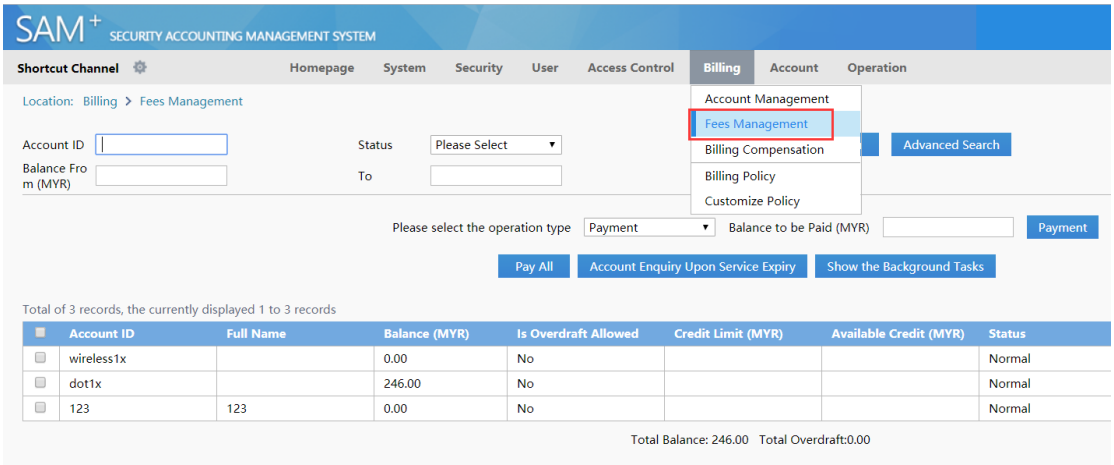
4.2.2.8.2 Configuration key points

The payment operation involves fees. Ensure that paid fees are consistent with the fees recorded in the system.

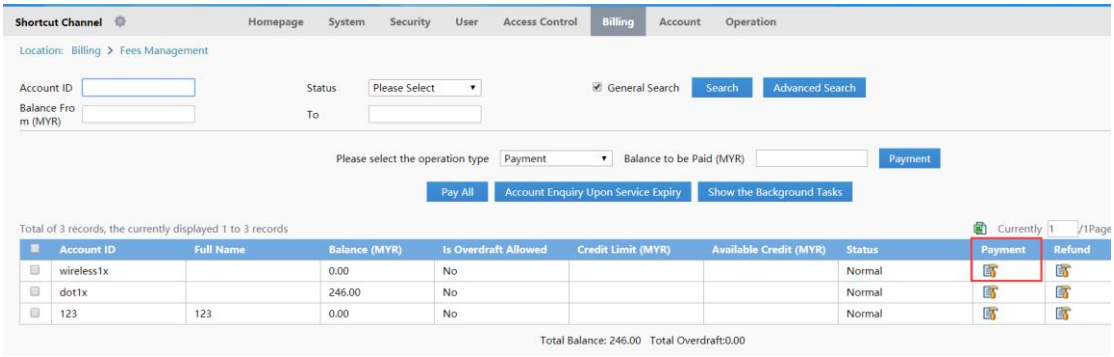
4.2.2.8.3 Configuration steps

1. Log in to the SAM+ management page.

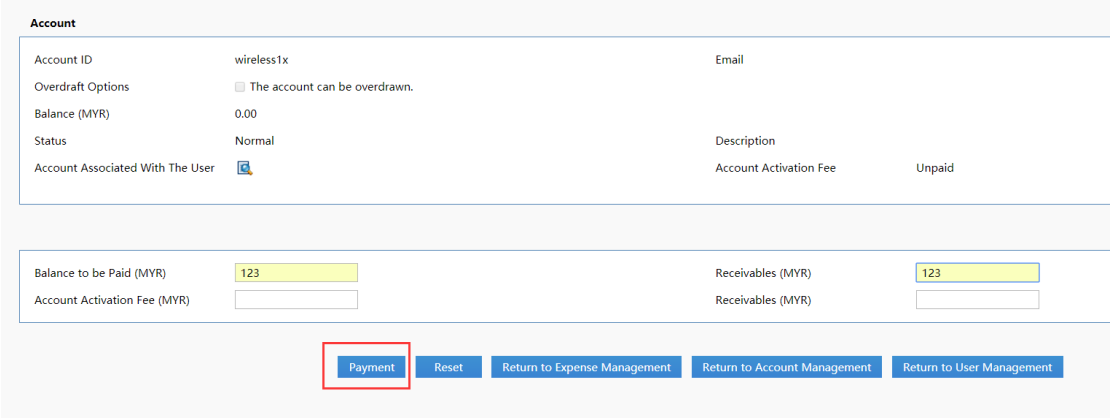
2. Choose **Billing** > **Fees Management**.



3. The newly created user has insufficient balance. Click the icon in the **Payment** column.



4. Collect the fees, record the fees actually paid by the user in the system, and click **Payment**.

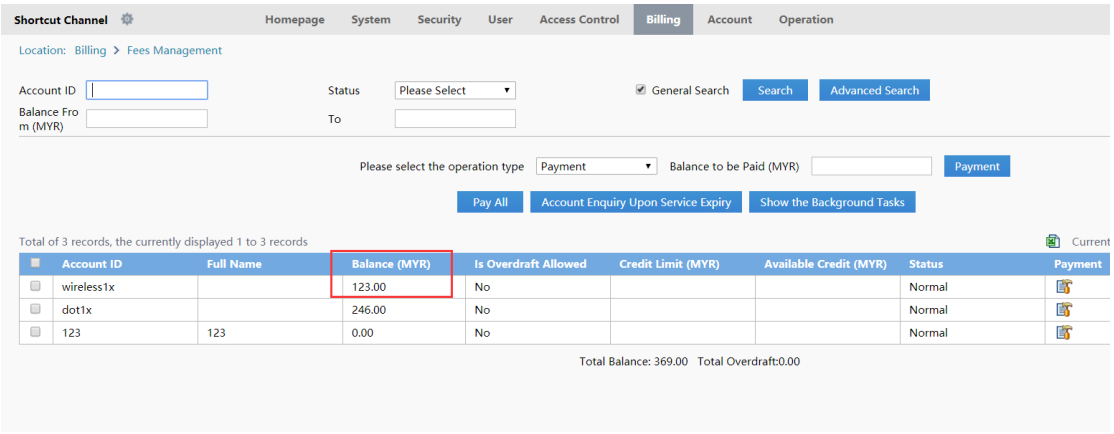


4.2.2.8.4 Verification

1. Verify that the fees are paid successfully.

Account (wireless1x) payment for (MYR) 123.00 is successful!

2. Verify that the fees are corrected and the account is in the normal state. As shown in the figure below, 123 Yuan is deducted from the user account "wireless1x" for the current month, and the account has 123 Yuan balance, and is in the normal state.



4.2.3 [Optional] RG-N18000 — Web Authentication (Wired & Wireless)

4.2.3.1 Adding the RG-N18000 on SAM+ (2)

4.2.3.1.1 Function requirements

Add the NAS (RG-N18000) on SAM+.

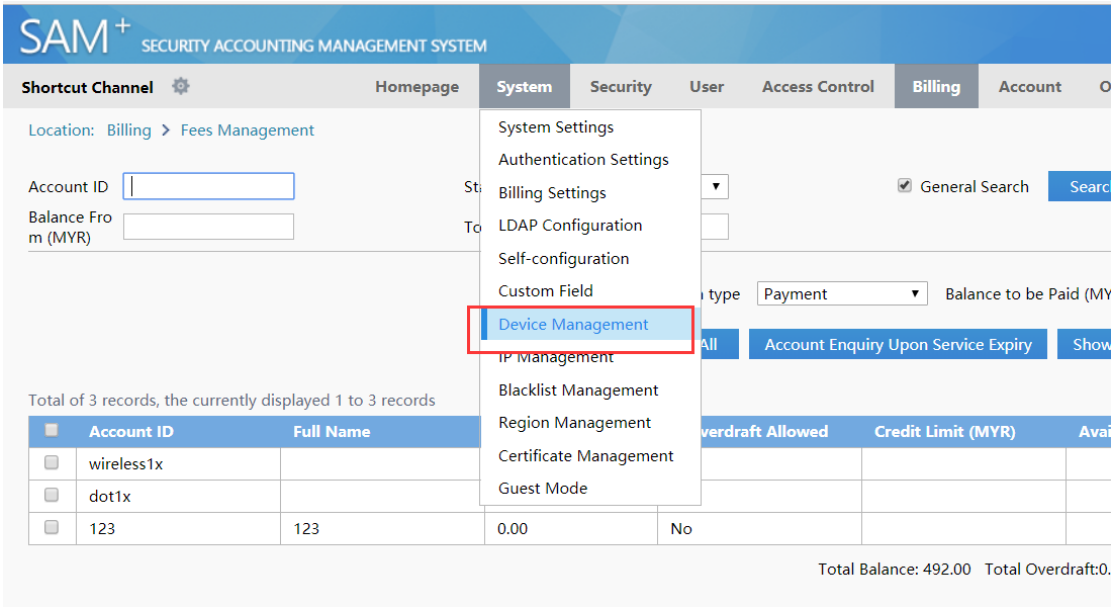
4.2.3.1.2 Configuration key points

The NAS-relevant parameters added on SAM+ must be consistent with the actual settings of the NAS. Otherwise, an authentication exception occurs.

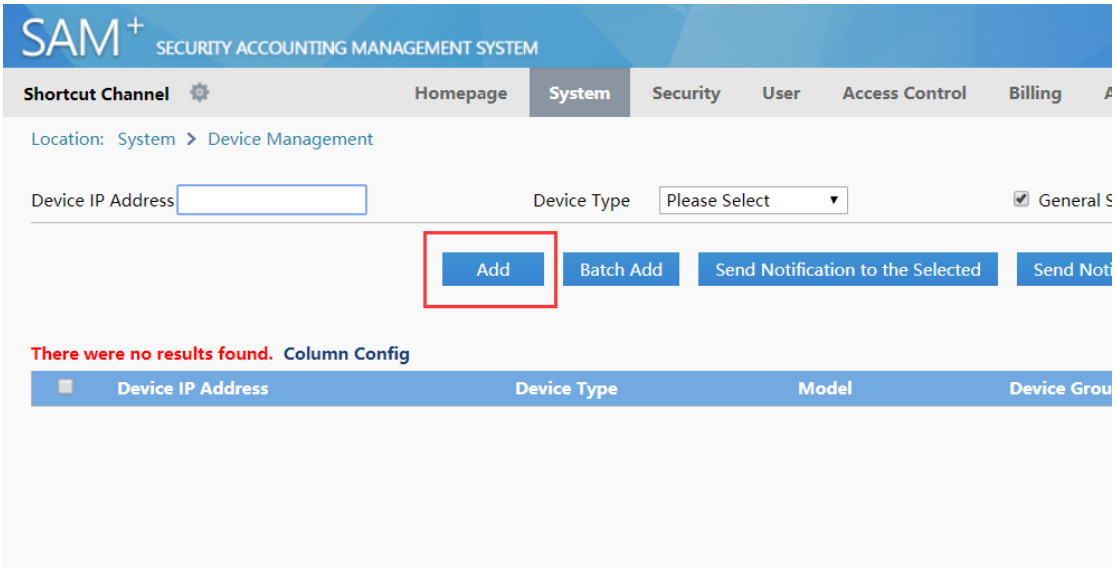
- The address for the RG-N18000 to interwork with SAM+ must be correct on SAM+. For example, if the source port for communicating with SAM+ is configured on the RG-N18000 by running the **ip radius source-interface loopback 0** command, the IP address of the loopback0 interface of the RG-N18000 needs to be entered in the **Device IP Address** column of SAM+.
- The key for interworking with the RG-N18000 needs to be consistent.
- The SNMP community for interworking with the RG-N18000 needs to be consistent.

4.2.3.1.3 Configuration steps

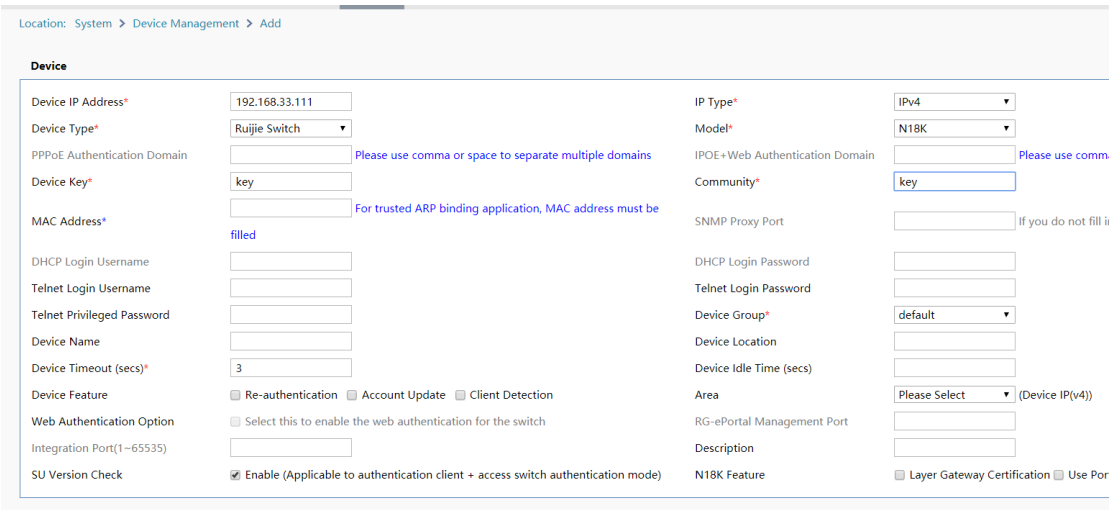
1. Log in to the SAM+ management page.
2. Choose **System** > **Device Management**.



3. Click **Add** to add a device.



4. Set NAS-relevant parameters and ensure that the key parameters are consistent with the actual settings of the NAS. Then, click **Save**.



4.2.3.1.4 Verification

1. Check whether the SAM+ server can ping the device successfully. If yes, it indicates that their communication is normal (ensure that ping packets are not intercepted by the firewall).

4.2.3.2 Adding the ePortal Server on SAM+

4.2.3.2.1 Function requirements

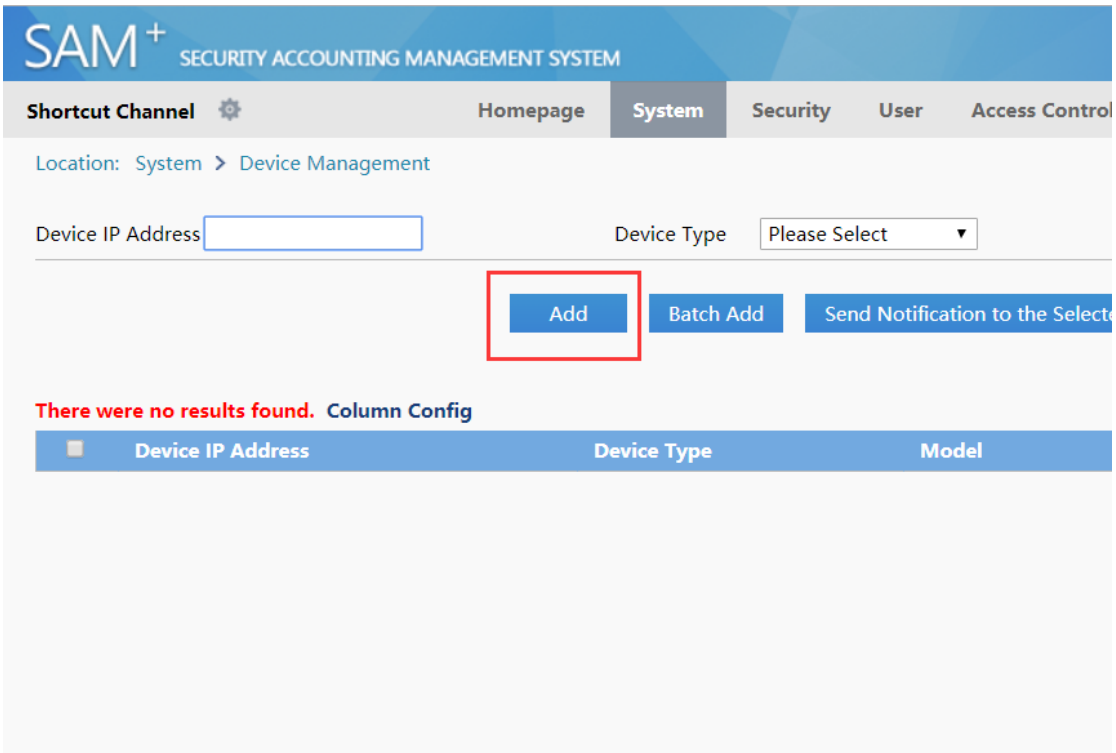
Add information about the ePortal Server on SAM+.

4.2.3.2.2 Configuration key points

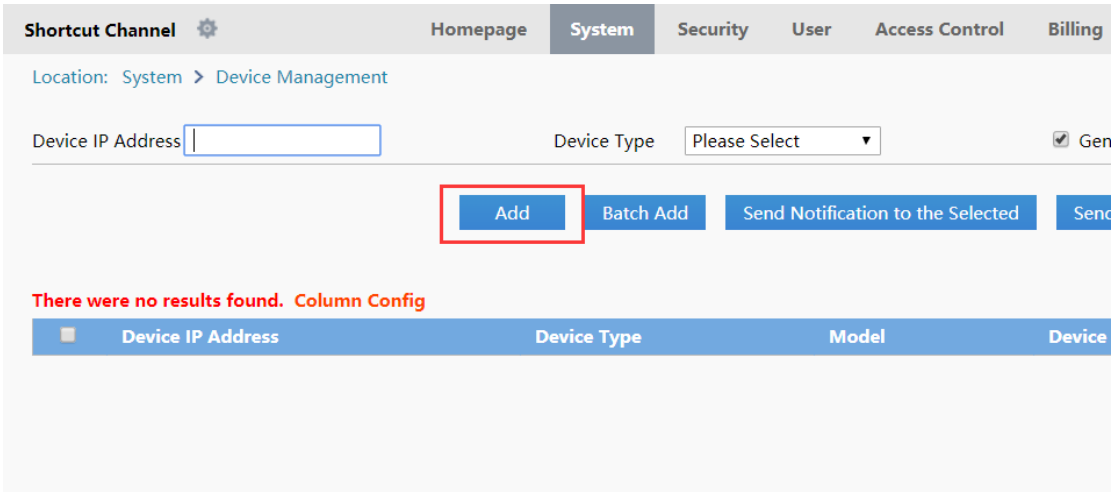
The ePortal parameters added on SAM+ must be consistent with the actual settings of the ePortal server. Otherwise, an authentication exception occurs.

4.2.3.2.3 Configuration steps

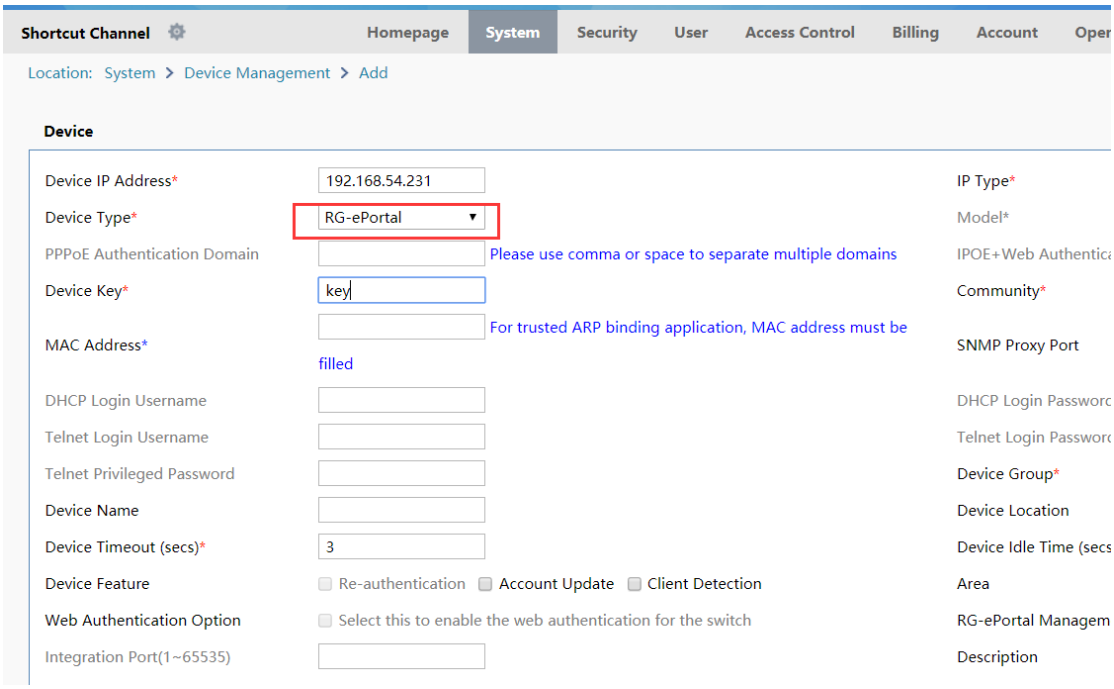
1. Log in to the SAM+ management page.
2. Choose **System** > **Device Management**.



3. Click **Add** to add a device.



4. Add the ePortal server and ensure that the key parameters are consistent with the actual settings of the ePortal server. Then, click **Save**.



4.2.3.2.4 Verification

1. Check whether the SAM+ server can ping ePortal successfully. If yes, it indicates that their communication is normal (ensure that ping packets are not intercepted by the firewall).
2. On the SAM+ server, log in to the ePortal system in HTTP mode and check whether you can log in successfully. If yes, it indicates that their communication is normal.

4.2.3.3 Adding SAM+ on the ePortal Server

4.2.3.3.1 Function requirements

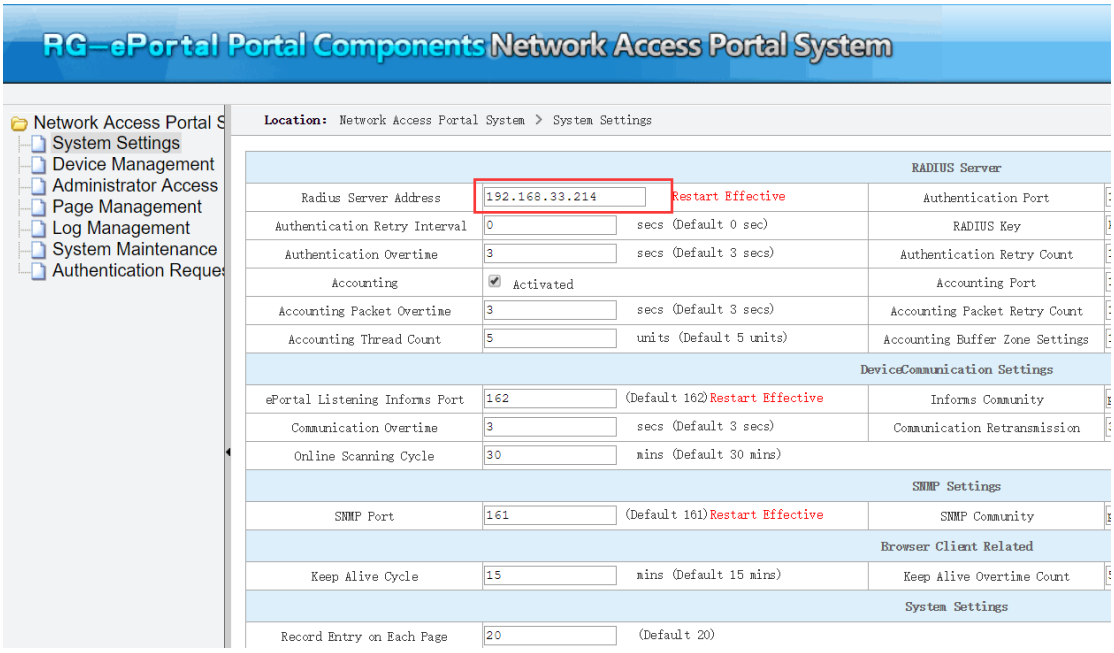
Set parameters of the ePortal server so that it can communicate with the SAM+ and NAS normally.

4.2.3.3.2 Configuration key points

The parameters on the ePortal server must be consistent with those on the SAM+ and NAS.

4.2.3.3.3 Configuration steps

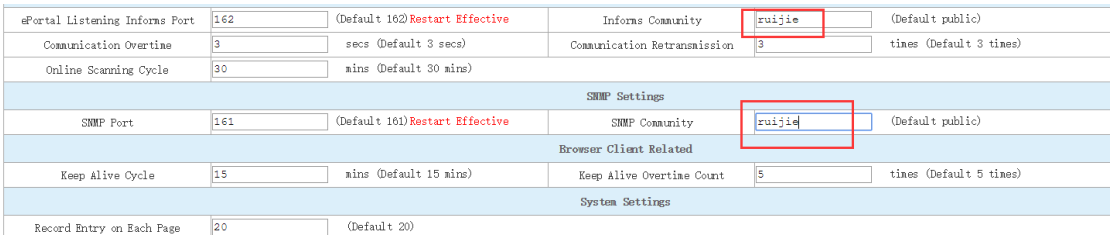
1. Log in to the ePortal management page, click **System Settings**, and enter the SAM+ address, RADIUS key, and authentication and accounting ports in the **RADIUS Server** area. Ensure that the parameters are consistent with those on the SAM+ server.



2. Set SNMP parameters in **Device Communication Settings**.

Informs Community: SNMP community name used for receiving traps from the device. It must be consistent with the community name configured on the device.

SNMP Community: community name of the virtual SNMP agent maintained on the ePortal system. It is used to process SNMP packets between the ePortal system and the RADIUS server.



4.2.3.3.4 Verification

Check parameters and verify that relevant parameters are consistent with those on SAM+ and the NAS.

4.2.3.4 Adding the RG-N18000 on the ePortal Server

4.2.3.4.1 Function requirements

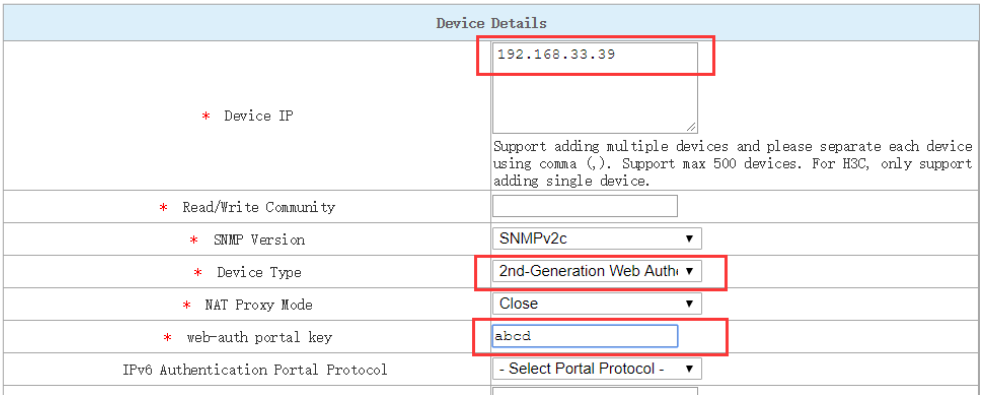
Add the NAS on the ePortal server.

4.2.3.4.2 Configuration key points

The NAS parameters added on the ePortal server must be consistent with those on the NAS.

4.2.3.4.3 Configuration steps

1. Log in to the ePortal management page, click **Device Management**, select **2nd-Generation Web Authentication Access Device** from the **Device Type** drop-down list, and enter the IP address and relevant parameters of the Web authentication access device. Keep these parameters consistent with those on the NAS. Then, click **Save**.



4.2.3.4.4 Verification

1. Check whether the ePortal server can ping the device successfully. If yes, their communication is normal (ensure that ping packets are not intercepted by the firewall).

4.2.3.5 Access Control Configuration

4.2.3.5.1 Function requirements

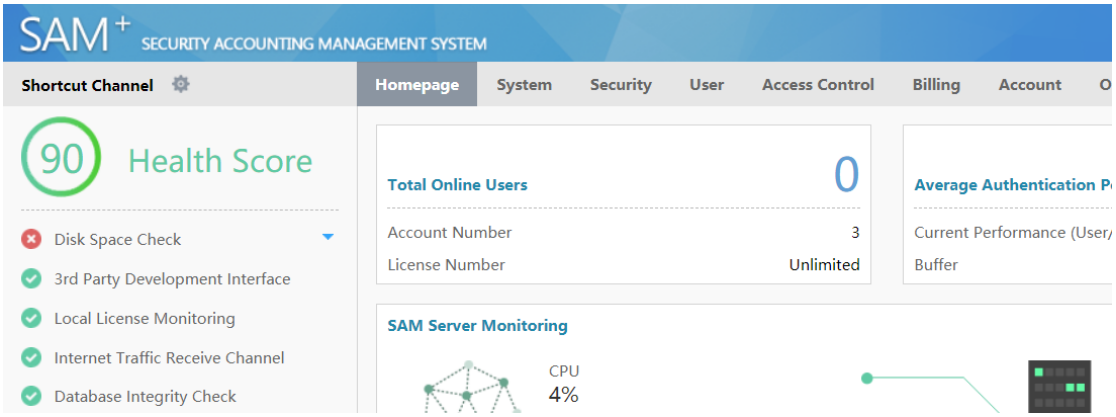
Configure access control to restrict Internet access behavior of users.

4.2.3.5.2 Configuration key points

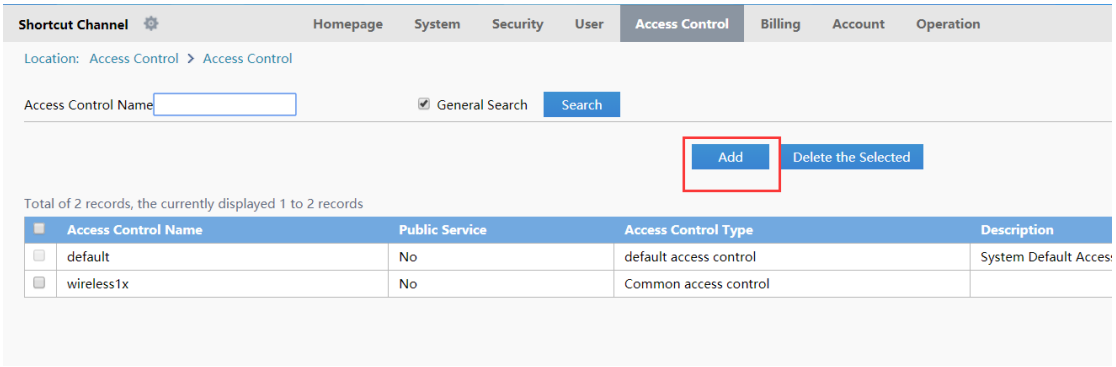
The Internet access behavior of access users needs to be confirmed with customers and access control needs to be configured based on actual conditions.

4.2.3.5.3 Configuration steps

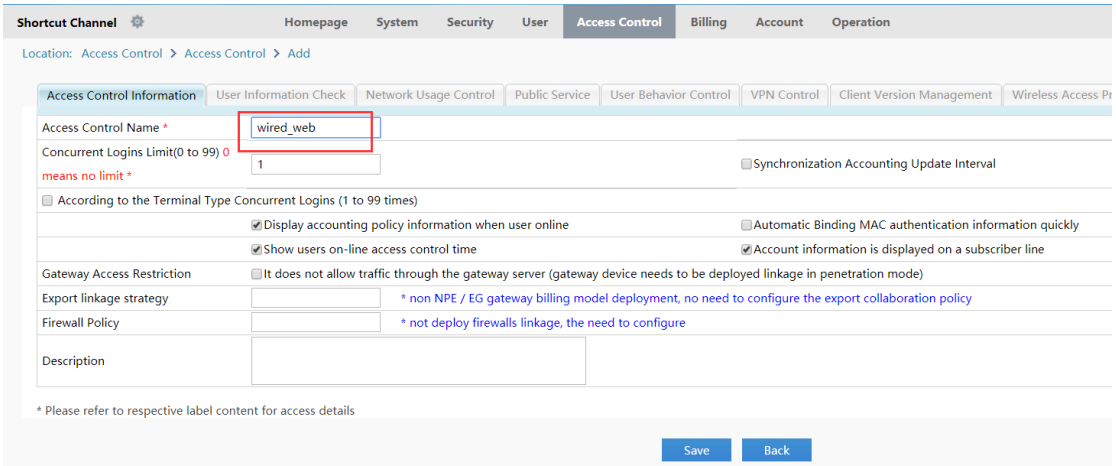
1. Log in to the SAM+ management page.
2. Choose **Access Control** > **Access Control**.



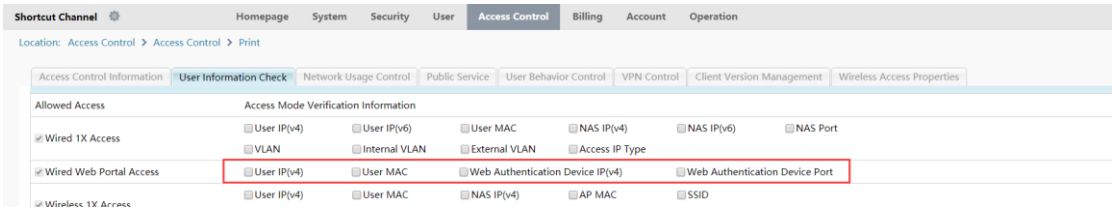
3. Click **Add** to add access control.



4. On the **Access Control Information** tab page, enter the access control name, for example, "wired_web", and set other parameters based on actual conditions.

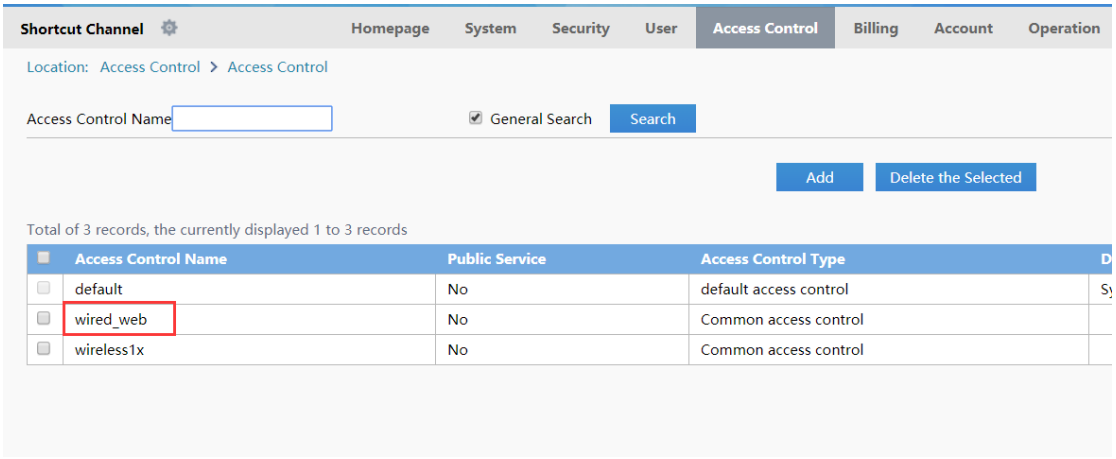


5. On the **User Information Check** tab page, select **Wired Web Portal Access** and configure whether to bind accounts with IP/MAC addresses based on actual conditions. Then, click **Save**.



4.2.3.5.4 Verification

Verify that access control is added successfully.



4.2.3.6 Billing Policy Configuration

4.2.3.6.1 Function requirements

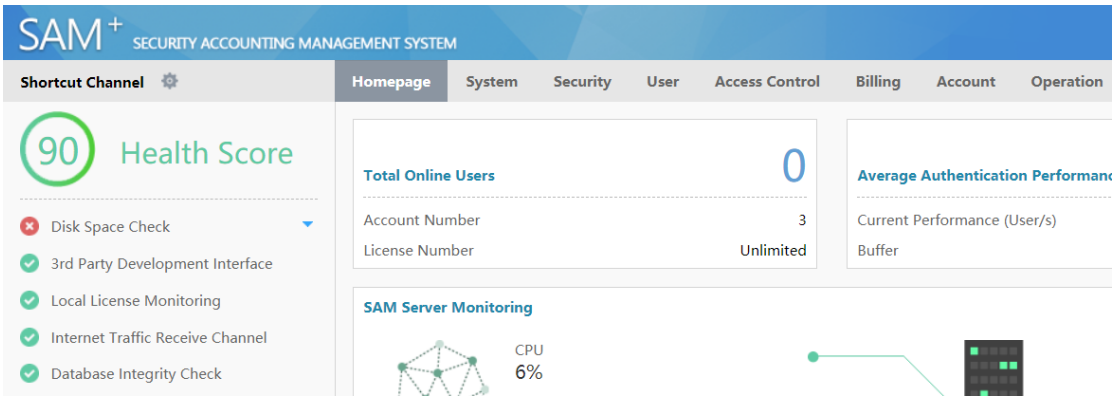
Configure billing policies based on billing requirements of access users, to pay for Internet access.

4.2.3.6.2 Configuration key points

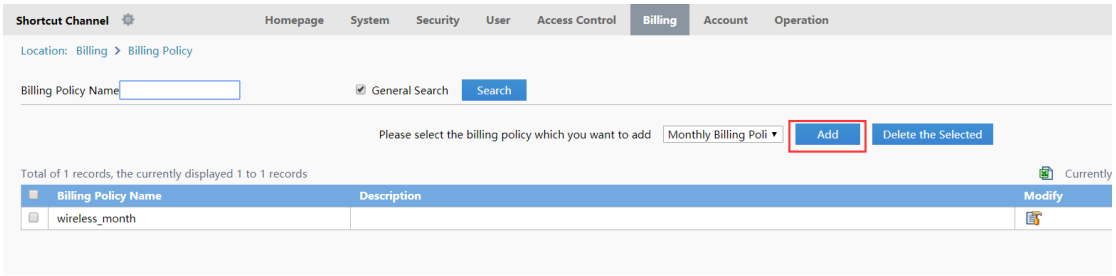
Billing requirements of access users need to be confirmed with customers and billing policies need to be configured based on actual conditions.

4.2.3.6.3 Configuration steps (monthly milling)

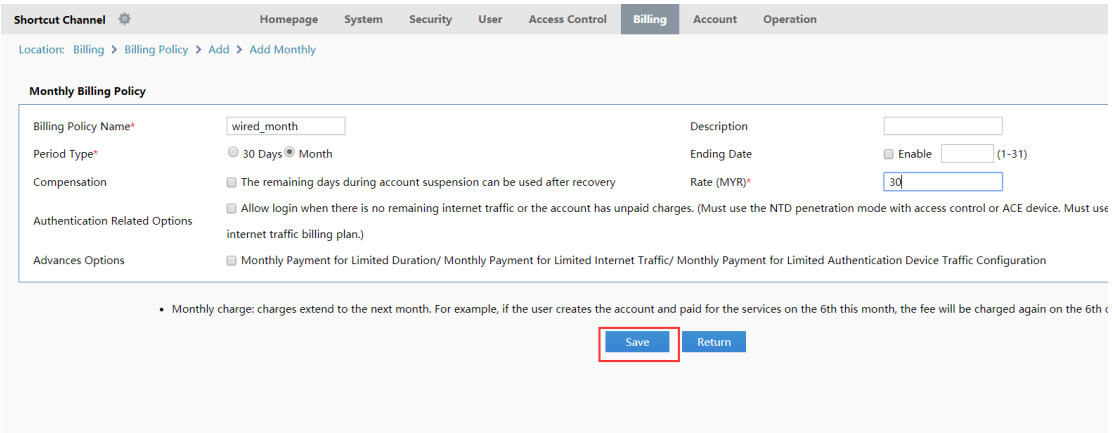
1. Log in to the SAM+ management page.
2. Choose **Billing** > **Billing Policy**.



3. Select **Monthly Billing Policy** and click **Add**.

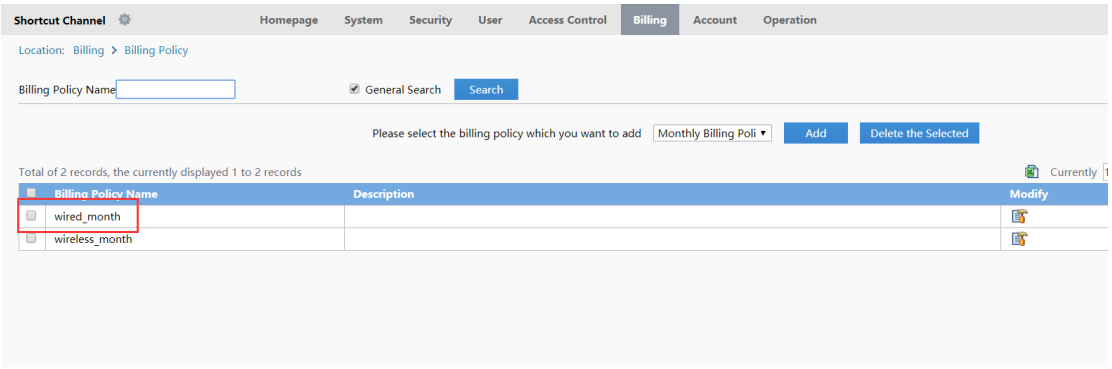


4. Enter the billing policy name, for example, "wired_month", set **Period Type** to **30 Days** or **Month**, and set **Rate (MYR)**, for example, 30 Yuan/month. Then, click **Save**.



4.2.3.6.4 Verification

Verify that the billing policy is added successfully.



4.2.3.7 User Template Configuration

4.2.3.7.1 Function requirements

Configure user templates based on user attributes for later account creation.

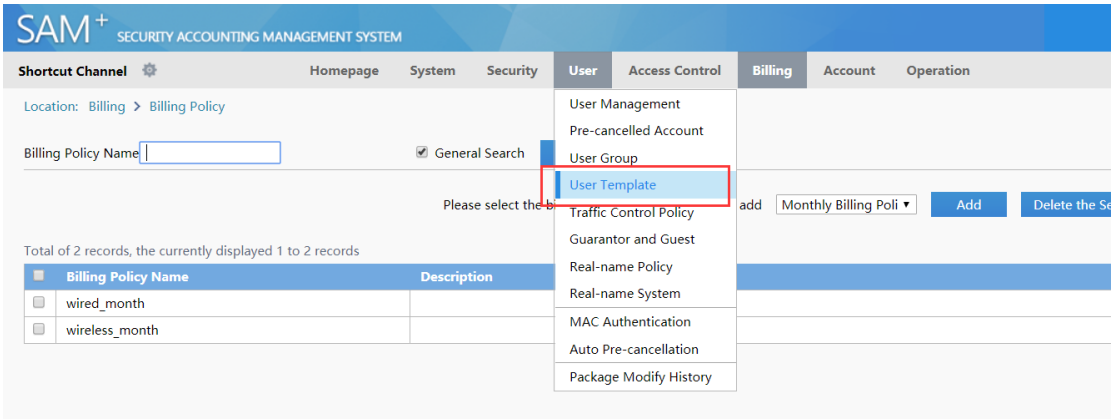
4.2.3.7.2 Configuration key points

It is recommended to classify user templates with the same attribute into a group and give concise and intuitive names to the templates, for example, student monthly billing template or teacher monthly billing template.

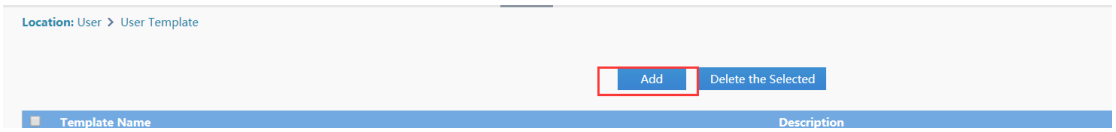
4.2.3.7.3 Configuration steps

1. Log in to the SAM+ management page.

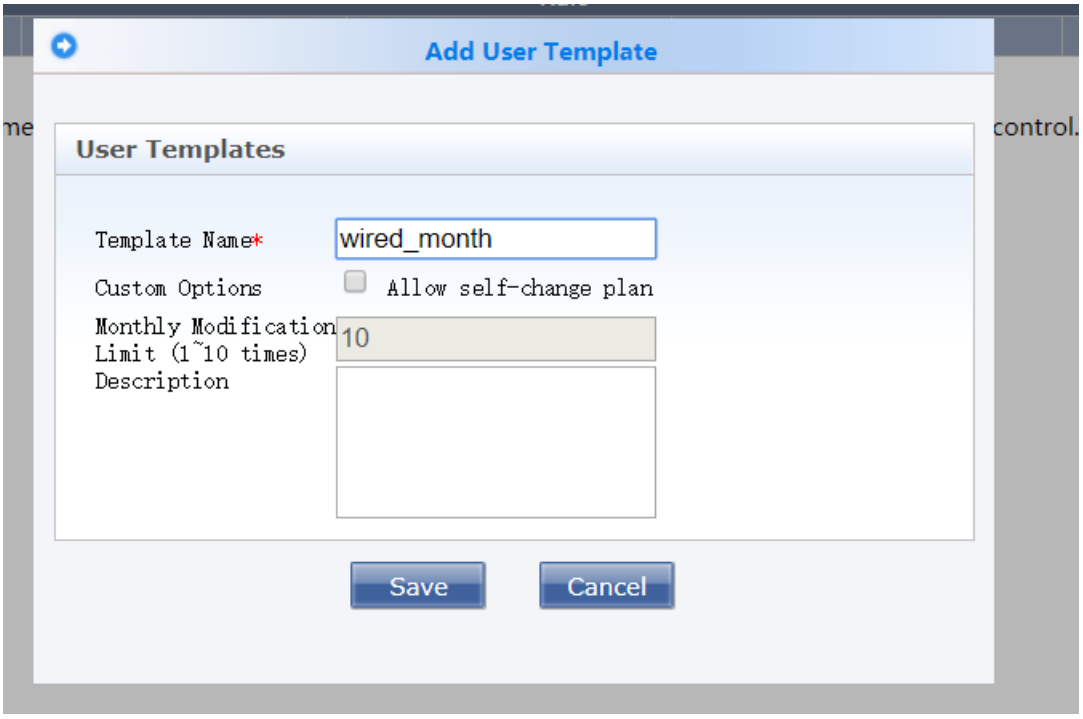
2. Choose **User** > **User Template**.



3. Click **Add**.

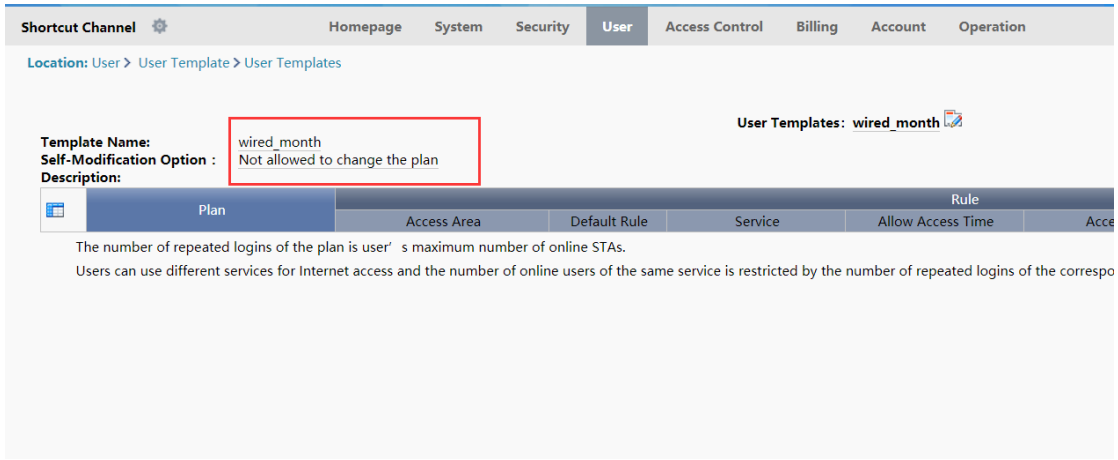


4. Enter the template name, for example, "wired_month", and click **Save**.



4.2.3.7.4 Verification

Verify that the user template is added successfully.



4.2.3.8 User Plan Configuration

4.2.3.8.1 Function requirements

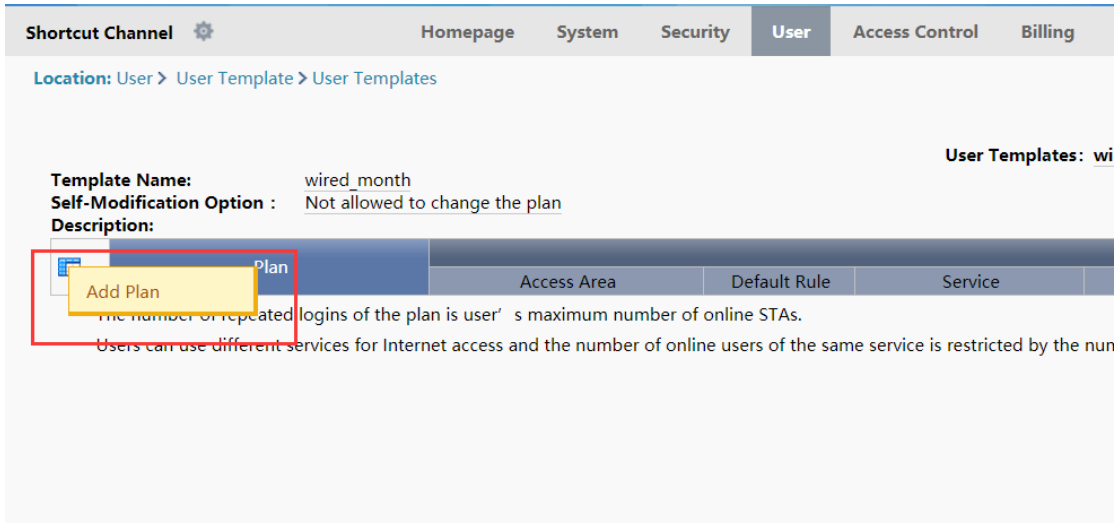
Configure a user plan to cover access limits of authenticated users, including the area, time range, access control, and billing policy. A user plan is akin to a phone service package.

4.2.3.8.2 Configuration key points

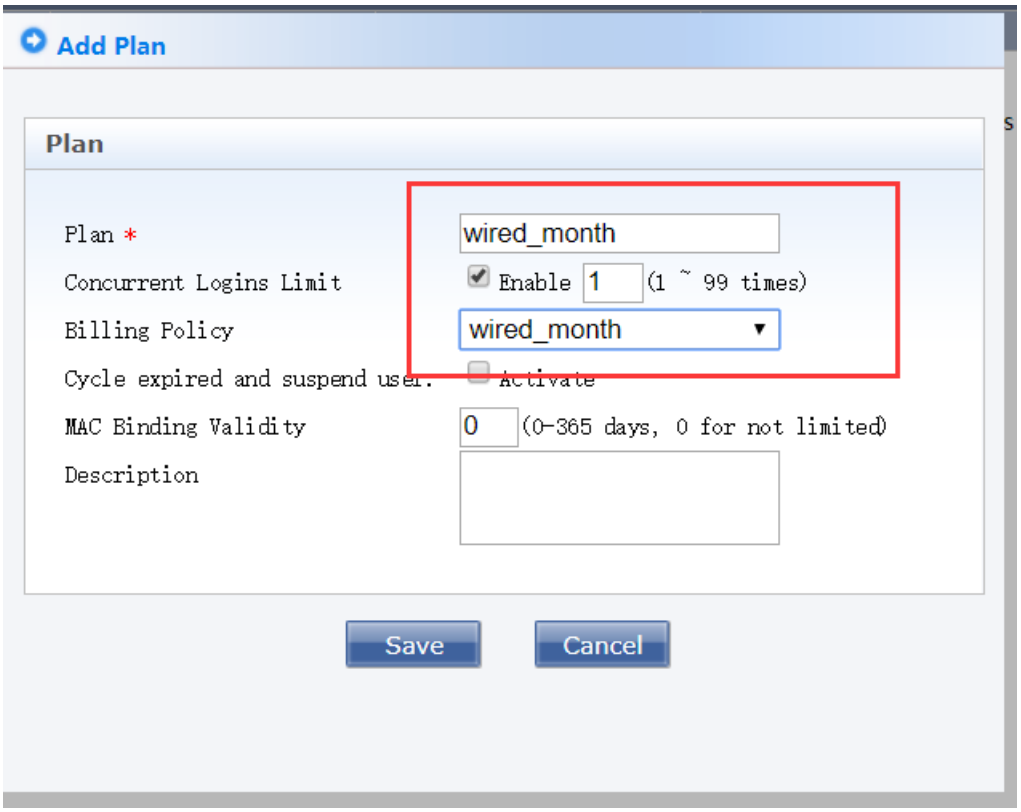
A plan covers all control options and fees for access users. Be sure to clearly confirm plans with customers before configuration.

4.2.3.8.3 Configuration steps

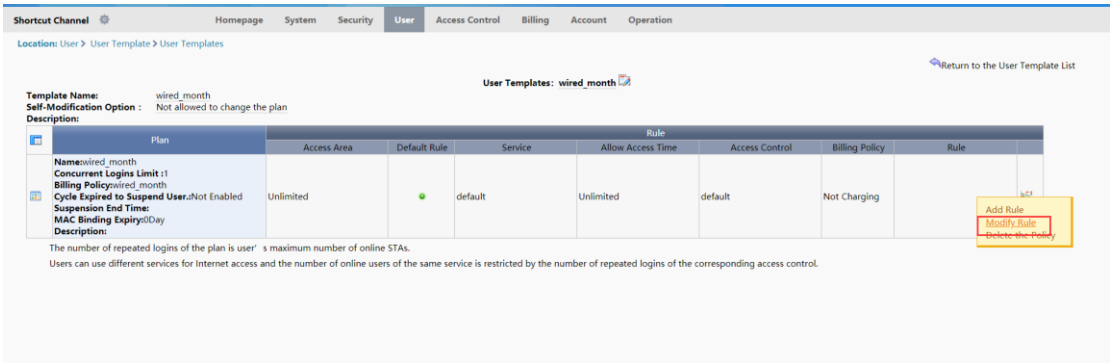
1. In the configured user template "wired_month", click **Add Plan**.



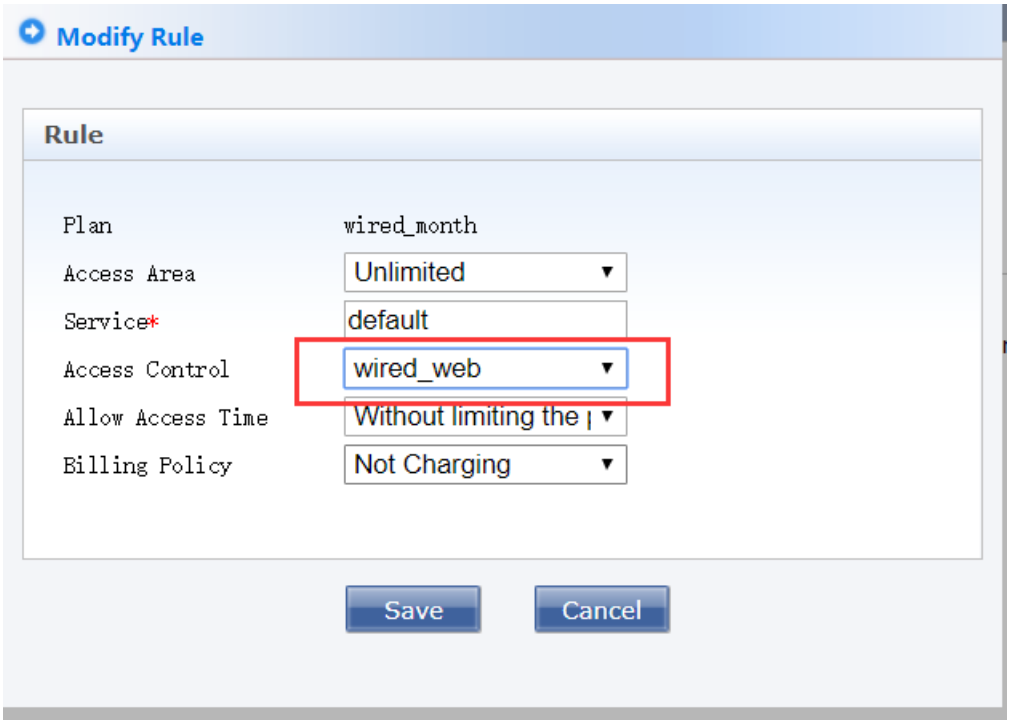
2. Enter the plan name, for example, "wired_month", select a configured billing policy or **Not Charging** based on actual requirements, and then click **Save**.



3. Click **Modify Plan** and modify the access area, access time range, access control, and billing mode.

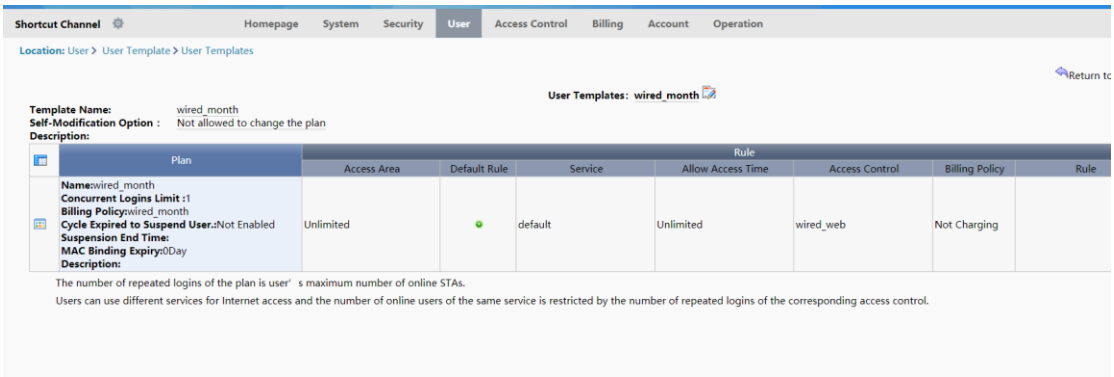


4. Modify the rule based on actual conditions. The figure below shows that the access area of authenticated users is unlimited, access control is set to "wired_web", the access time range is unlimited, and billing is performed based on the plan"wired_month".



4.2.3.8.4 Verification

Verify that the plan meets customer requirements.



4.2.3.9 User Group Configuration

4.2.3.9.1 Function requirements

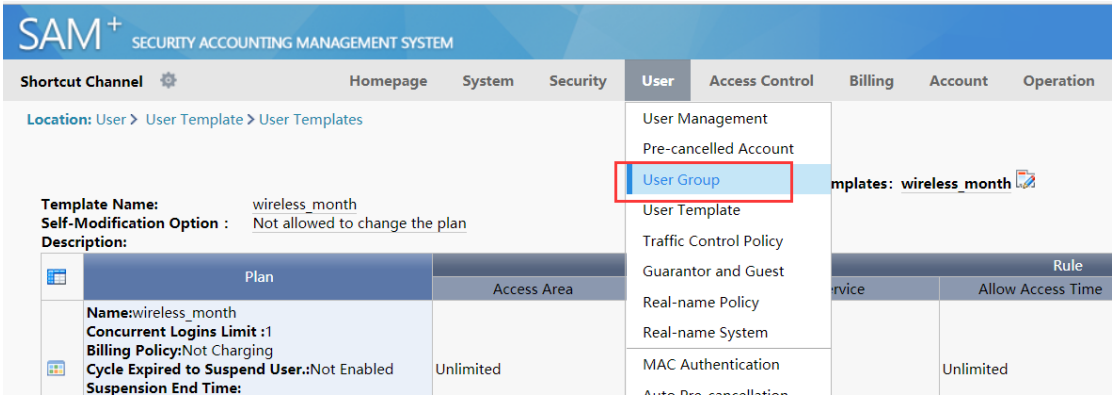
Add authenticated users with the same attribute to the same group, and define a response user template and plan for the user group to prepare for later account creation.

4.2.3.9.2 Configuration key points

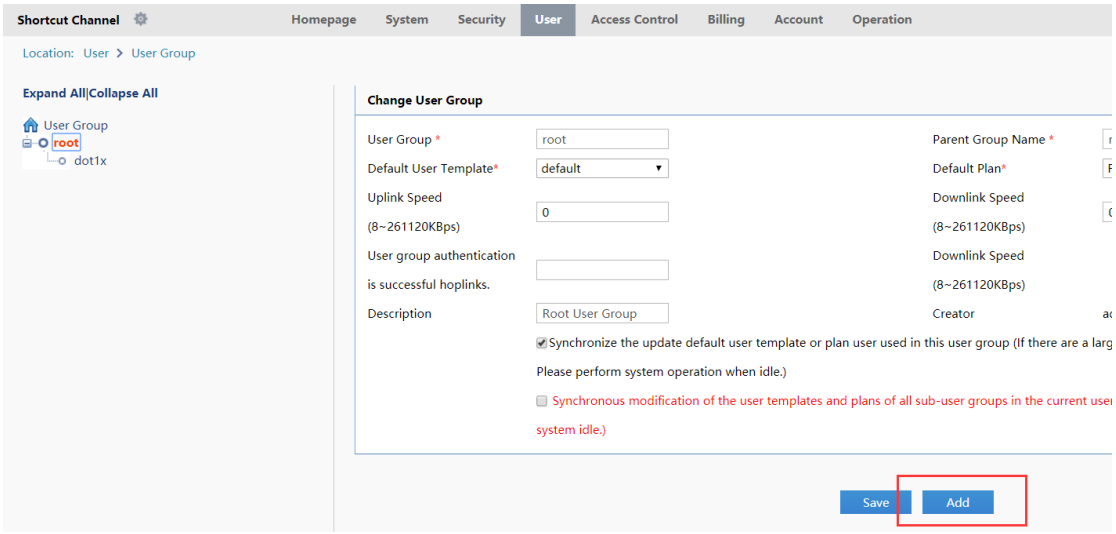
It is recommended to group access users by attribute, for example, group users on campus networks into "student user group" or "teacher user group".

4.2.3.9.3 Configuration steps

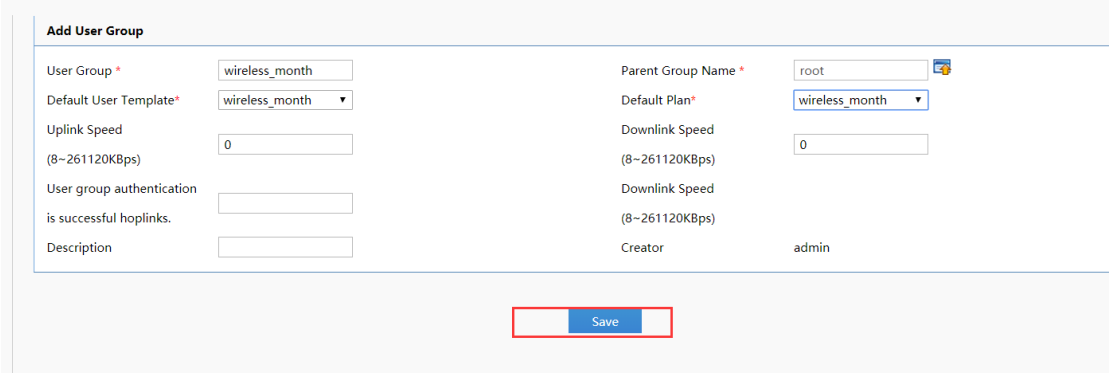
1. Log in to the SAM+ management page.
2. Choose **User** > **User Group**.



3. Click **Add**.

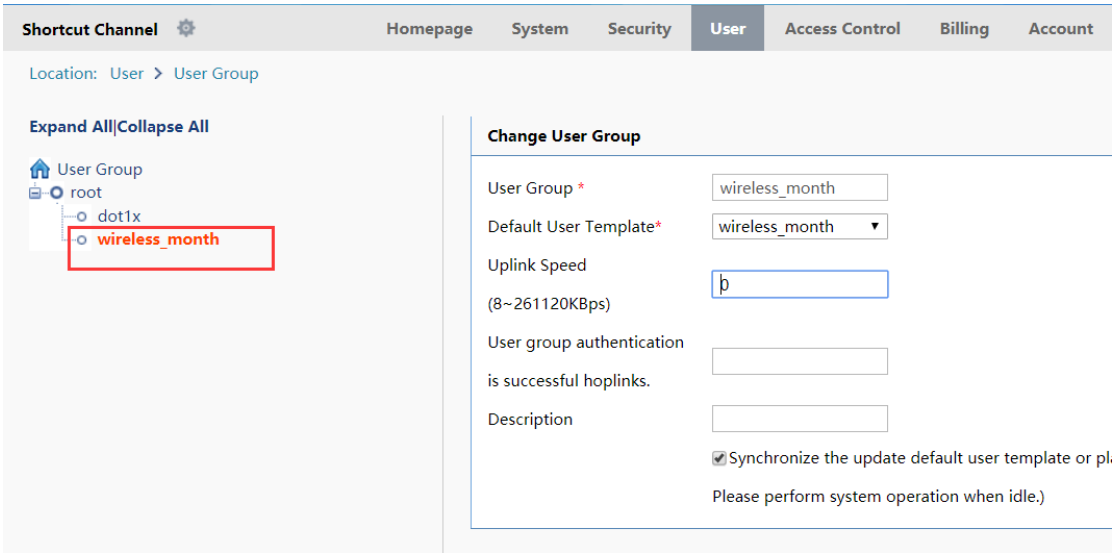


4. Enter the user group name, for example, "wireless_month", and select the default user template and default plan. Then, click **Save**.



4.2.3.9.4 Verification

Verify that the user group is added successfully.



4.2.3.10 Account Creation

4.2.3.10.1 Function requirements

Create accounts for users in the SAM+ system.

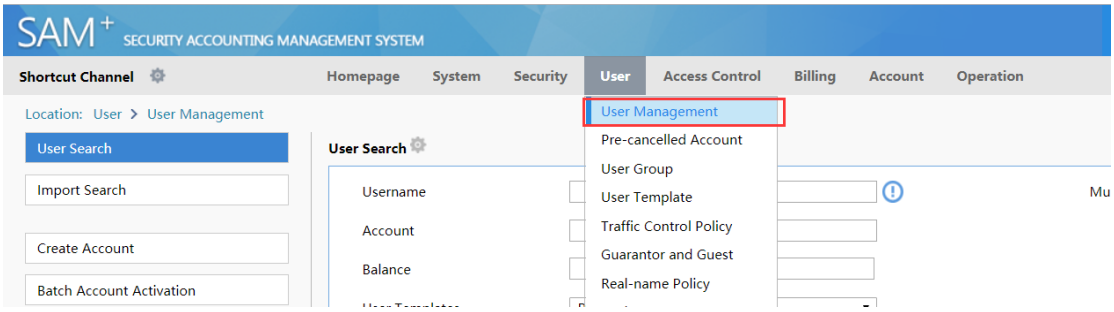
4.2.3.10.2 Configuration key points

1. The account creation process generally requires users to go to business halls and apply for accounts by using their ID cards.
2. Accounts with the names same as those on their ID cards are registered during account creation.

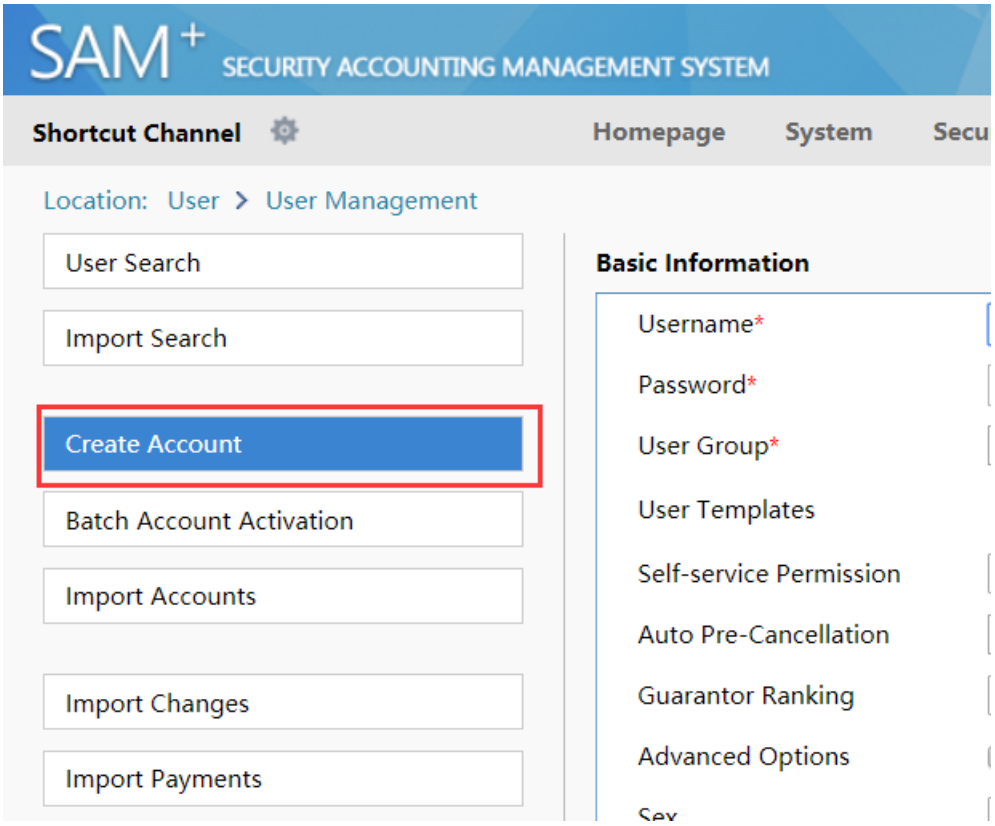
3. A user group and a user template need to be selected during account creation as planned.

4.2.3.10.3 Configuration steps

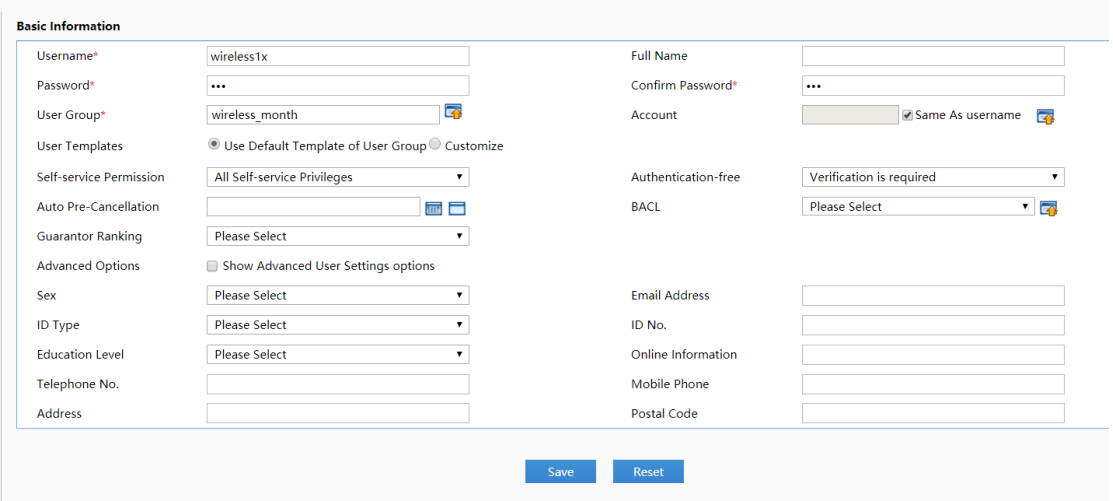
1. Log in to the SAM+ management page.
2. Choose **User** > **User Management**.



3. Click **Create Account** in the left pane.

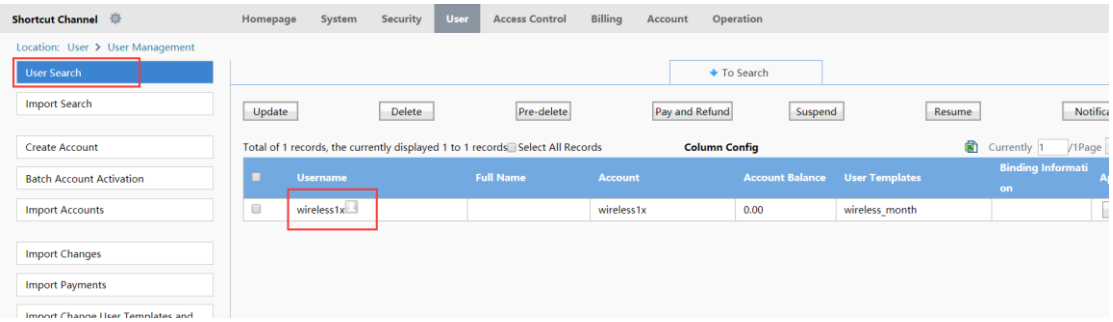


4. Enter the username and password, select a user group, user template, and plan. Then, click **Save**.



4.2.3.10.4 Verification

1. In the left pane of the **User Management** page, click **User Search**. In the displayed right pane, click **Search**. The added user is displayed.



4.2.3.11 Payment

4.2.3.11.1 Function requirements

Collect fees from newly created users, so that they can be authenticated, be charged, and access the Internet.

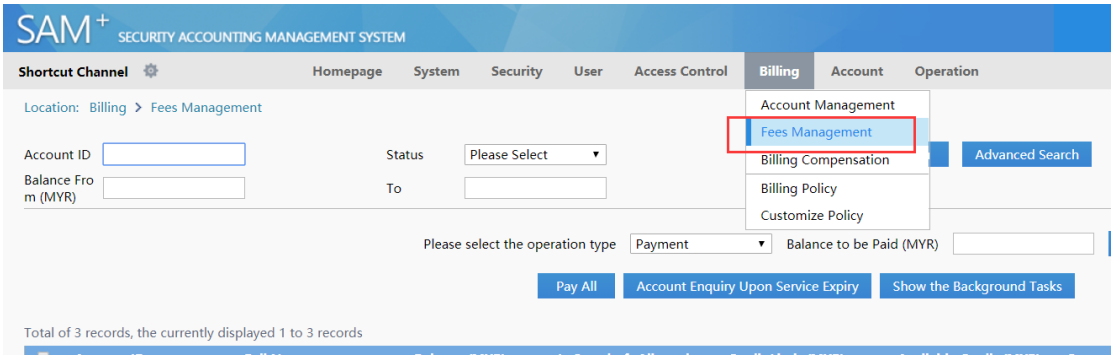
4.2.3.11.2 Configuration key points

The payment operation involves fees. Ensure that paid fees are consistent with the fees recorded in the system.

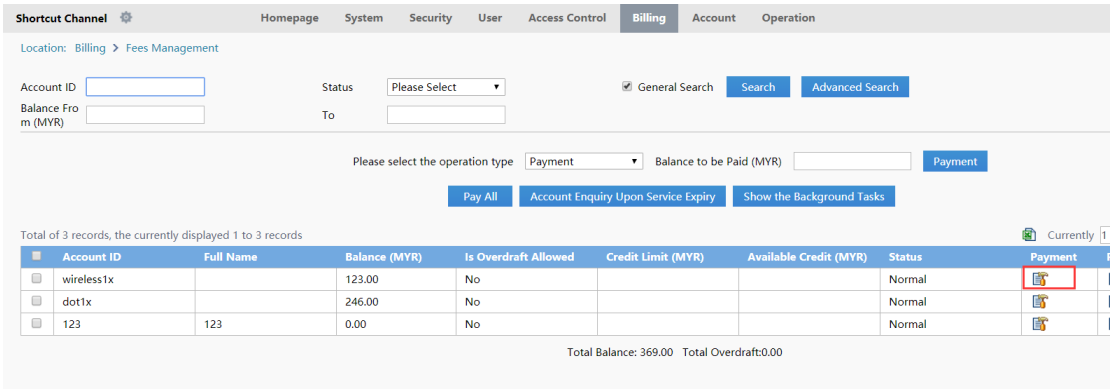
4.2.3.11.3 Configuration steps

1. Log in to the SAM+ management page.

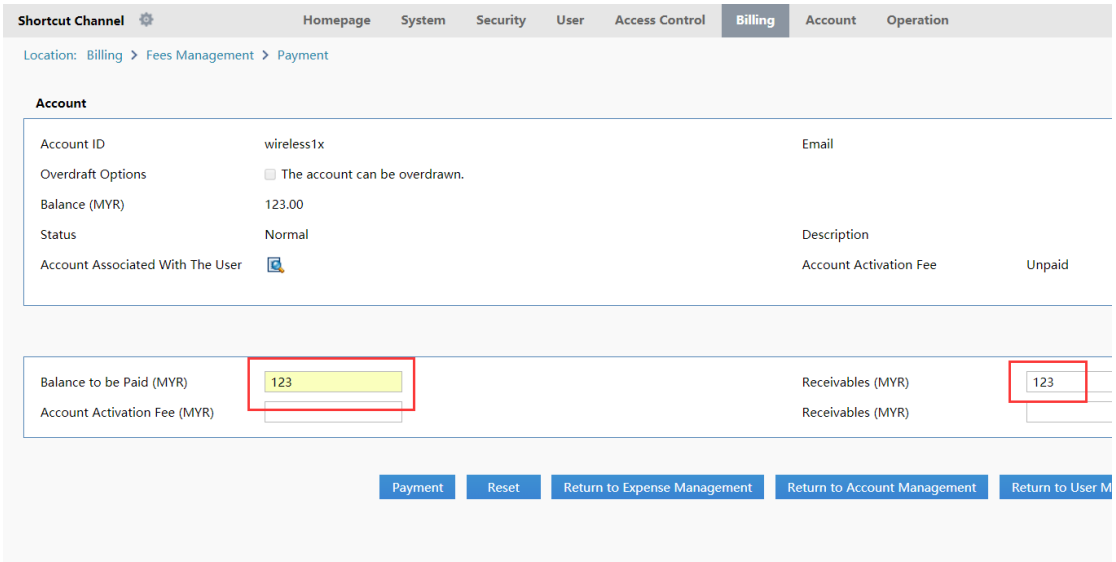
2. Choose **Billing** > **Fees Management**.



3. The newly created user has insufficient balance. Click the icon in the **Payment** column.



4. Collect the fees, record the fees actually paid by the user in the system, and click **Payment**.

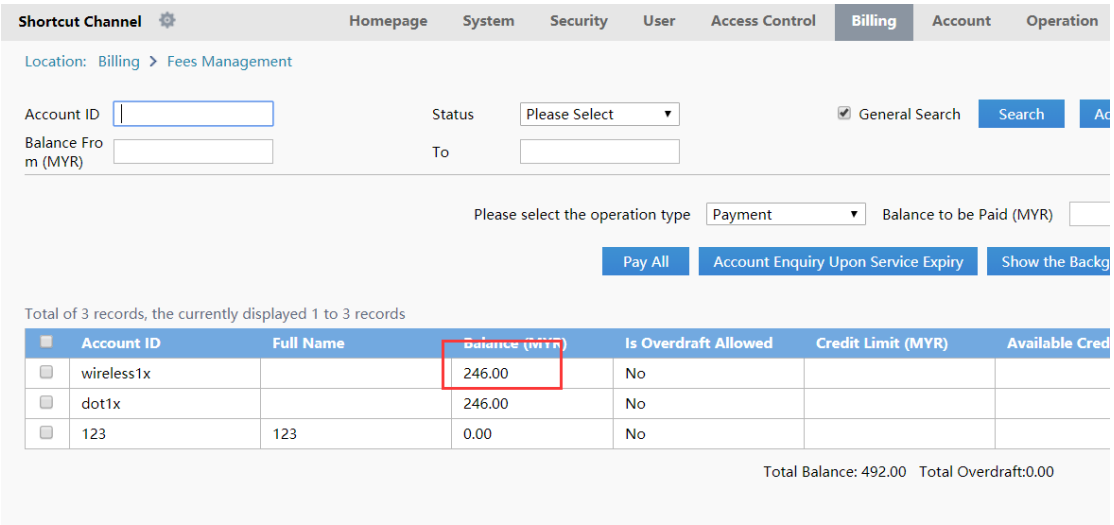


4.2.3.11.4 Verification

1. Verify that the fees are paid successfully.

Account (wireless1x) payment for (MYR) 123.00 is successful!

2. Verify that the fees are corrected and the account is in the normal state. As shown in the figure below, 123 Yuan is deducted from the user account "wireless1x" for the current month, and the account has 246 Yuan balance, and is in the normal state.



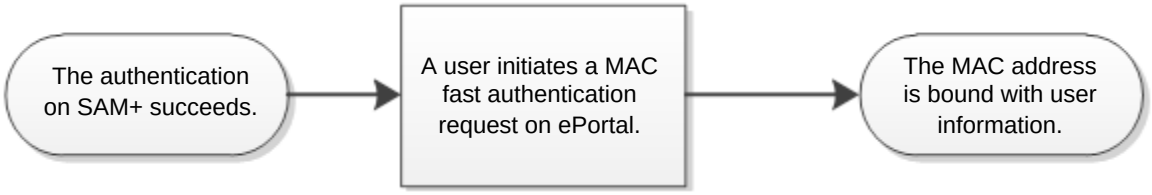
4.2.4 [Optional] MAB Authentication

4.2.4.1 [Optional] MAB Authentication in Automatic Mode

4.2.4.1.1 Function requirements

Enable MAB authentication in automatic mode on SAM+.

The process of MAC binding in automatic mode is as follows (Web authentication is required for initial access):



In automatic mode, users do not need to select **Smart Login** on the authentication page, which is different from the operation in manual mode.

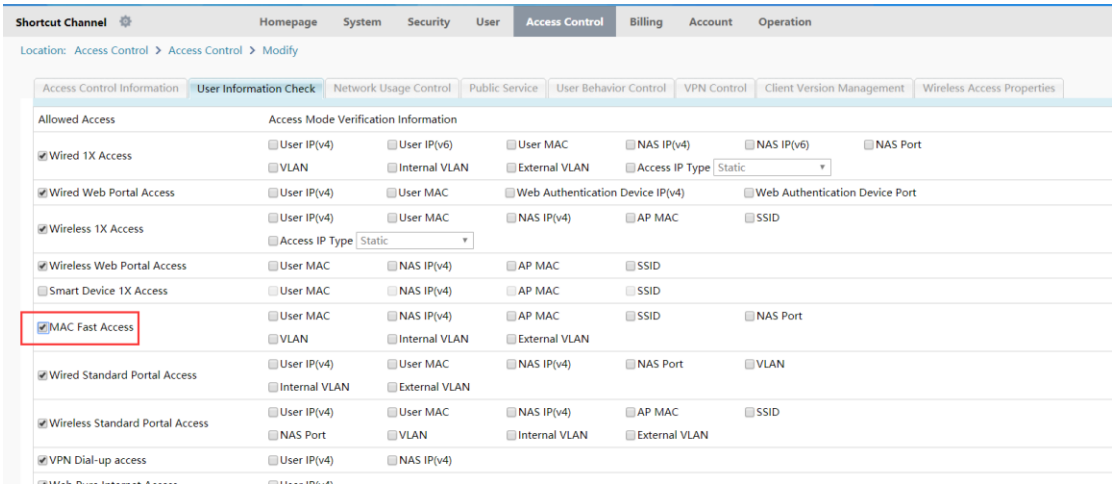
4.2.4.1.2 Configuration key points

Basic settings of Web authentication need to be completed to implement MAB authentication, and details are not described here.

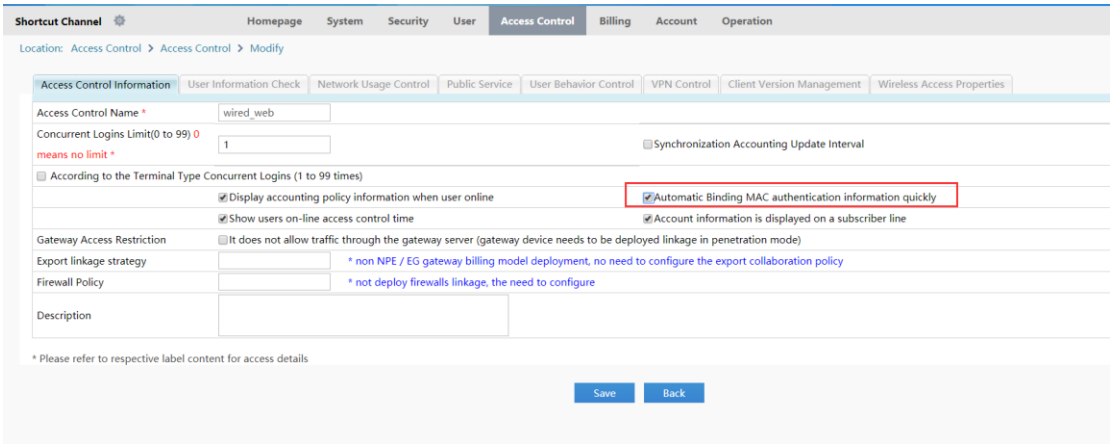
For basic settings of Web authentication on SAM+, see "RG-N18000 — Web Authentication (Wired & Wireless)" in "Common Scenario — Authentication" in "SAM+ and ePortal Configuration."

4.2.4.1.3 Configuration steps

1. Choose **Access Control** > **Access Control** > **Modify** > **User Information Check**, and select **MAC Fast Access**.

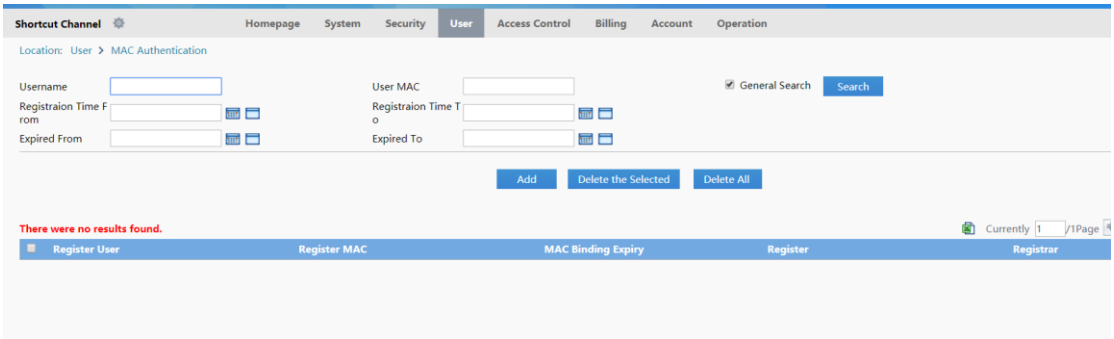


2. Choose **Access Control** > **Access Control** > **Modify** > **Access Control Information**, and select **Automatic Binding MAC authentication information quickly**.

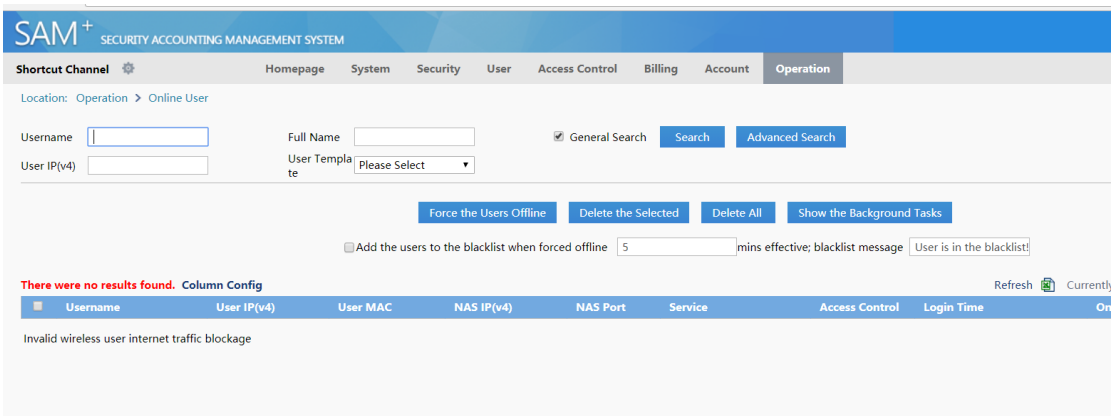


4.2.4.1.4 Verification

1. When a user uses a mobile phone to connect to an SSID with MAC authentication enabled, Web authentication needs to be completed for initial access.
2. On SAM+, choose **User** > **MAC Authentication** and check whether information about the MAB authenticated user has been learned.



3. After the user goes offline, enable the user to connect to the SSID with MAC authentication enabled, and check online user records on SAM+.

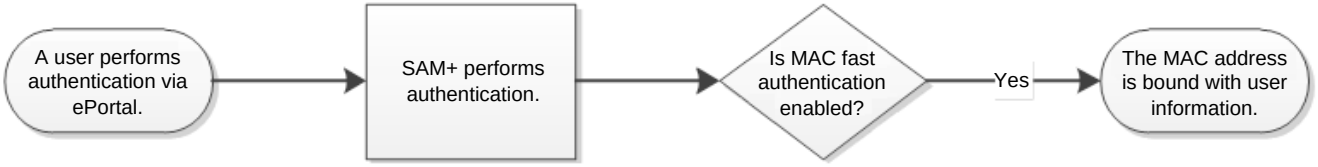


4.2.4.2 [Optional] MAB Authentication in Manual Mode

4.2.4.2.1 Function requirements

Enable MAB authentication in manual mode on SAM+.

The process of MAC binding in manual mode is as follows (Web authentication is required for initial access):



In manual mode, users need to select **Smart Login** on the authentication page, which is different from the operation in automatic mode.

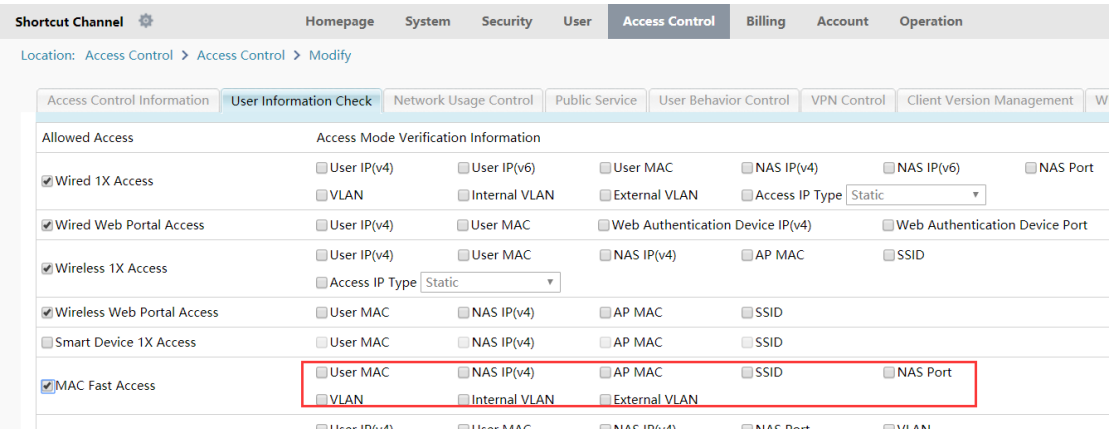
4.2.4.2.2 Configuration key points

Basic settings of Web authentication need to be completed to implement MAB authentication, and details are not described here.

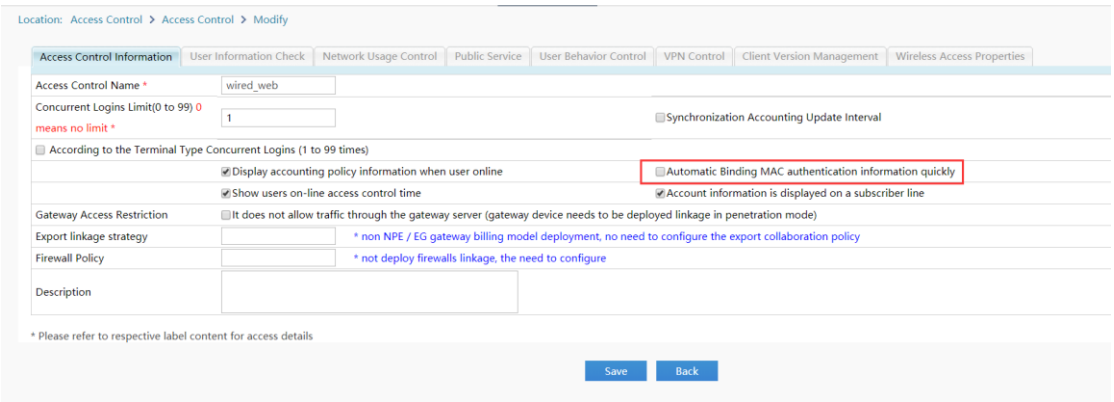
For basic settings of Web authentication on SAM+, see "RG-N18000 — Web Authentication (Wired & Wireless)" in "Common Scenario — Authentication" in "SAM+ and ePortal Configuration."

4.2.4.2.3 Configuration steps

1. Choose **Access Control** > **Access Control** > **Modify** > **User Information Check**, and select **MAC Fast Access**.



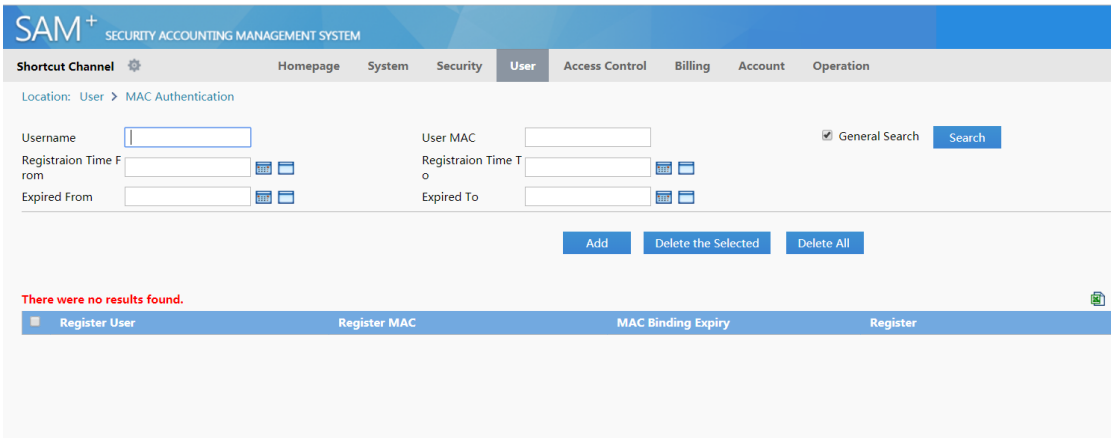
2. Choose **Access Control** > **Access Control** > **Modify** > **Access Control Information**, ensure that **Automatic Binding MAC authentication information quickly** is deselected.



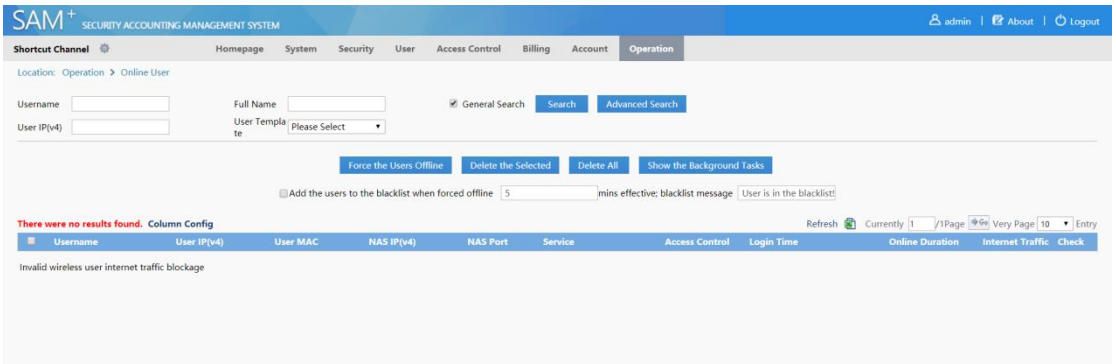
4.2.4.2.4 4. Verification

1. When a user uses a mobile phone to connect to a SSID with MAC authentication enabled, Web authentication needs to be completed for initial access, and **Enable MAB Authentication** needs to be checked.

2. On SAM+, choose **User** > **MAC Authentication** and check whether information about the MAB authenticated user has been learned.



3. After the user goes offline, enable the user to connect to the SSID with MAC authentication enabled, and check online user records on SAM+.



4.2.4.3 [Optional] Binding Validity Setting of MAB Authentication

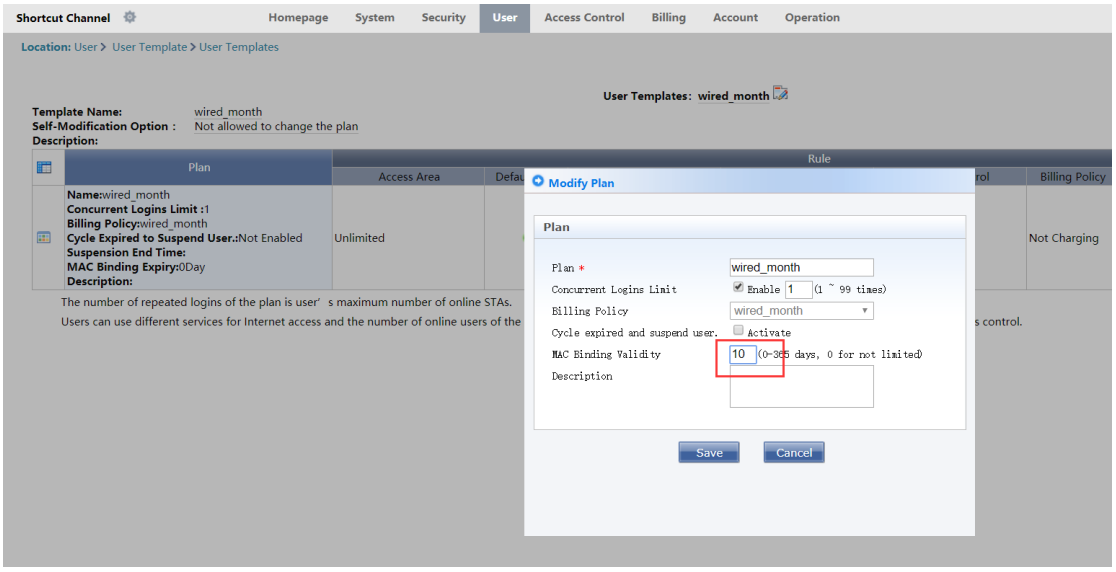
4.2.4.3.1 Function requirements

The MAC binding validity period (0–365 days) can be configured for a plan. After the validity period expires, MAC addresses are automatically unbound and the MAB authentication permission for the user is canceled.

4.2.4.3.2 Configuration key points

N/A

4.2.4.3.3 Configuration steps



4.2.4.3.4 Verification

N/A

4.2.5 [Optional] SSID-based Authentication Page Pushing

4.2.5.1 Function requirements

In some projects involving the networks of multiple ISPs, schools may request different Web authentication pages be pushed based on the SSIDs of the ISP networks.

The ePortal system allows displaying different authentication pages based on SSIDs or user groups.

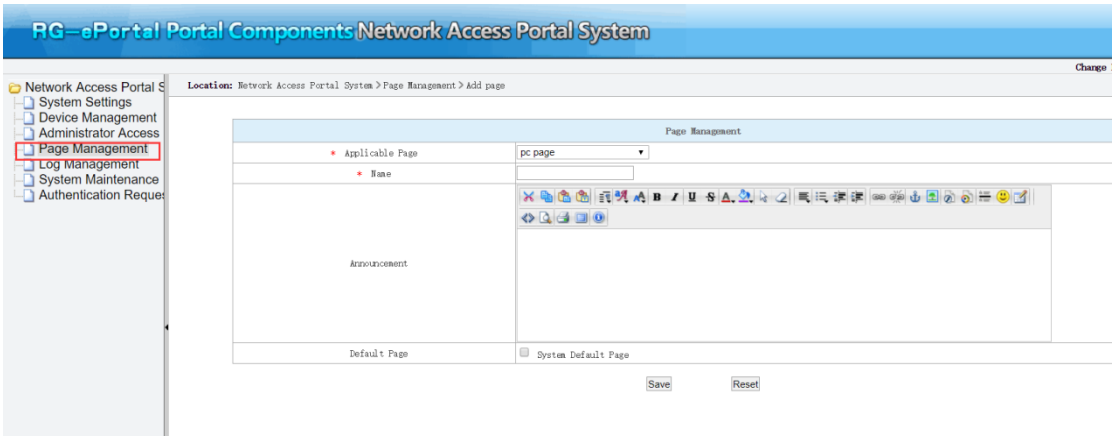
4.2.5.2 Configuration key points

In the simplistic network solution, the core device RG-N18000 cannot associate with APs to obtain SSIDs of users who adopt wireless authentication and the VLAN-based SSID mapping function is required.

For the configuration of the VLAN-based SSID mapping on the RG-N18000, see "Web Authentication — IP/VLAN-based SSID Mapping" in "Common Scenario — Authentication" in "RG-N18000 Configuration."

4.2.5.3 Configuration steps

1. In **Page Management**, customize authentication pages for user PCs and mobile phones based on customer requirements (one authentication page for the SSID of each ISP).



2. Complete the mapping between different SSIDs and customization pages.

4.2.5.4 Verification

Verify that the different customized authentication pages are displayed when users connect to different SSIDs.

5 Simplistic Network Configuration Examples (Important)

5.1 Configuration Examples of Access Isolation Solution + Wireless Isolation Solution

5.1.1 Customer Requirements

1. Layer-2 network requirements

- Deploy the access isolation solution to implement layer-2 isolation of users on the whole network.
- Deploy centralized forwarding on the wireless network.
- Enable IPv6 on the whole network, so that IPv6 users can access the network only after IPv4 authentication succeeds.
- Use the core device as the wired/wireless gateway and authentication NAS on the whole network, to provide unified management, and support a maximum of 20,000 online clients.

2. Requirements related to authentication types

- In the office area, deploy wired and wireless Web authentication and MAB authentication.
- In the student dormitory area, deploy wired 802.1x authentication, wireless 802.1x authentication, and wireless Web authentication.
- In the visitor area, deploy QR code authentication.
- In the headmaster office and other school director offices, deploy authentication exemption.
- Exempt re-authentication for users who move in the same area.

- In the dormitory area and office area, deploy no-traffic go-offline so that clients automatically go offline when the clients generate no traffic in 15 minutes.

3. Requirements related to authentication access control (Note: Access time control is only used for testing, and the actual deployment is subject to the onsite situation.)

- In the student dormitory area, network access is allowed only at 10:30–10:32.
- In the teaching area, network access is prohibited for student users at 9:00–12:00 and 14:00–16:00.
- In the office area, student users cannot be authenticated.

4. Address management requirements (Note: Address segment assignment is only used for case demonstration, and the actual deployment is subject to the onsite situation.)

- For the wired network, configure a private address with a 20-bit subnet mask for each area, and a private address with a 24-bit subnet mask for each building:

Office area: 10.1.16.0/20 (building 1: 10.1.16.0/24, building 2: 10.1.17.0/24 ... building 5: 10.1.20.0/24)

Student dormitory area: 10.1.32.0/20 (building 1: 10.1.32.0/20, building 2: 10.1.33.0/20 ... building 5: 10.1.36.0/20)

- For the wireless network:

Office area: 10.1.16.0/20 (building 1 for 802.1x authentication: 10.1.21.0/24, building 1 for Web authentication: 10.1.22.0/24, building 2 for 802.1x authentication: 10.1.23.0/24, and building 2 for Web authentication: 10.1.24.0/24)

Student dormitory area: 10.1.32.0/20 (building 1 for 802.1x authentication: 10.1.37.0/24, building 1 for Web authentication: 10.1.38.0/24, building 2 for 802.1x authentication: 10.1.39.0/24, and building 2 for Web authentication: 10.1.40.0/24)

(Note: One super VLAN is set in each area for both wired and wireless networks. You can also set one super VLAN in each area for the wireless network according to actual situations.)

- Special services need independent network segments:

Door status control service: 10.0.10.0/24

All-in-one card service: 10.0.11.0/24

Video monitoring service: 10.0.12.0/24

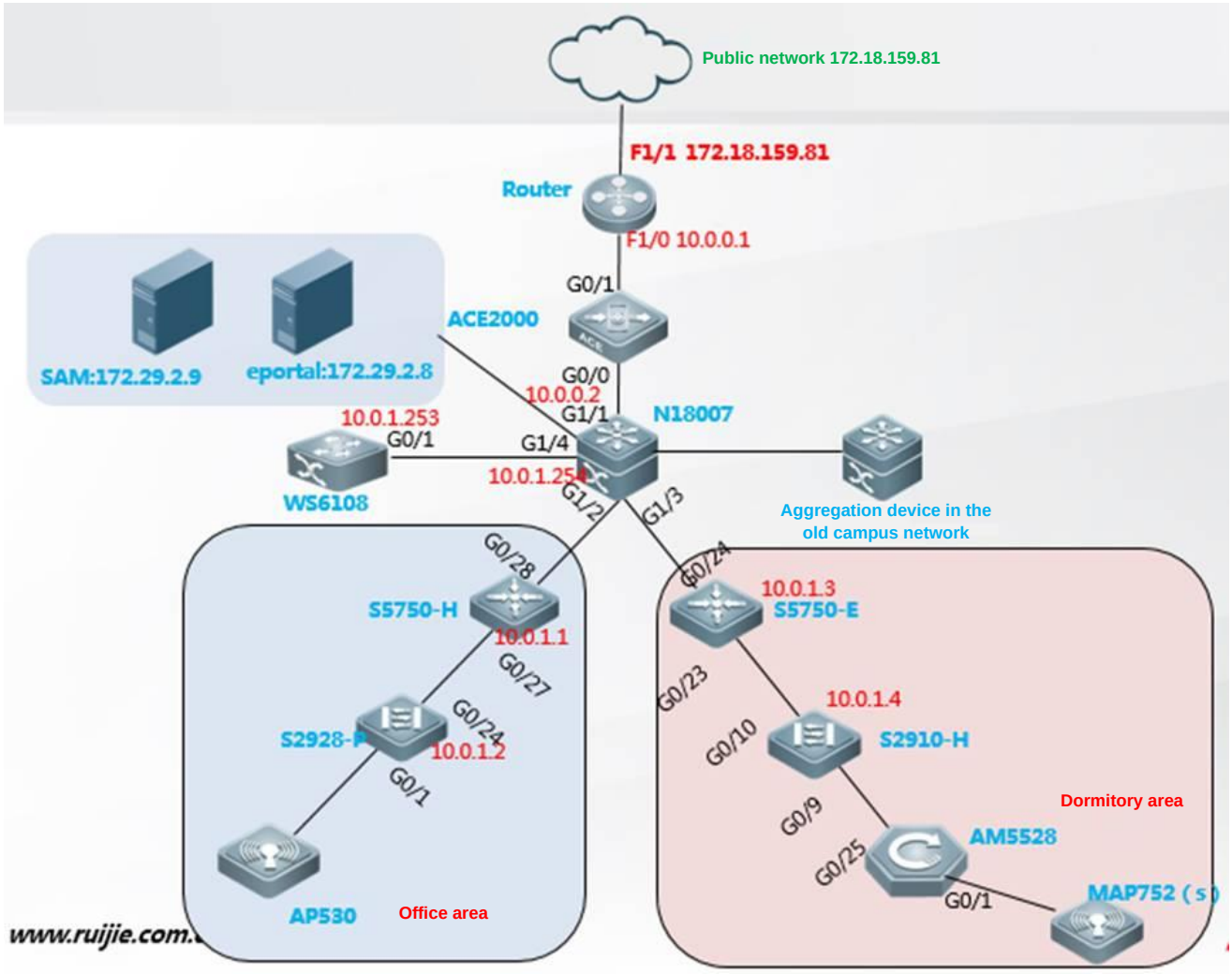
Wired device NMS: 10.0.1.0/24

AP management address: 10.0.2.0/24

5. Other requirements

- Only the network in the new campus is reconstructed. In the network in the old campus, layer-3 protocols are still used to connect to the RG-N18000, and the aggregation device serves as the user gateway and DHCP relay, and is interconnected with the RG-N18000 via OSPF.
- Configure the escape function on the RADIUS server and ePortal server, to avoid affecting the users' online services if either server is down.
- Configure VLAN pruning to avoid broadcast floods.
- Configure passive ports for routing optimization to avoid unnecessary protocol overheads of the CPU.

5.1.2 Topology



5.1.3 Configuration Precautions

1. The RG-N18000 does not support 802.1x authentication. Therefore, configure the wireless 802.1x NAS function on the AC.
2. IPv6 does not support direct authentication. Therefore, configure IPv6 authentication to compatible mode, so that IPv6 users can access the network after successful IPv4 authentication.
3. To avoid re-authentication for users who move in the same area, configure the migration function for authenticated users on the RG-N18000.
4. Enable AM rules to plan IP addresses for buildings in each area.
5. DHCP relay is enabled on the aggregation device of the original network. To prevent DHCP packets from being dropped by the DHCP snooping module on the RG-N18000, run the **ip dhcp snooping check-giaddr** command on the RG-N18000.

6. Configure the escape function on the RG-N18000 for the RADIUS server and portal server.

7. Configure VLAN pruning for the downlink trunk port of the RG-N18000.

5.1.4 VLAN/IP Planning on the Live Network

The following tables list VLAN/IP plans for the wired and wireless networks in the student dormitory area (plans for other areas are the same).

Wired network VLAN/IP planning for the student dormitory area:

Device Model	Device type	Position	Management Address	Sub VLAN	Super VLAN	IP Address Segment	Gateway	Network Management VLAN	Door Status Control VLAN	All-in-One Card VLAN	Video Monitoring VLAN
S2928G	Floor access switch	1F, building 1, student dormitory area	10.0.1.10	200	2001	10.1.32.0	10.1.32.254	3000	3010	3011	3012
S2928G	Floor access switch	2F, building 1, student dormitory area	10.0.1.11	201	2001	10.1.33.0	10.1.32.254	3000	3010	3011	3012
S2928G	Floor access switch	1F, building 2, student dormitory area	10.0.1.12	202	2001	10.1.34.0	10.1.32.254	3000	3010	3011	3012
S2928G	Floor access switch	2F, building 2, student dormitory area	10.0.1.13	203	2001	10.1.35.0	10.1.32.254	3000	3010	3011	3012
S2928G	Floor access switch	1F, building 3, student dormitory area	10.0.1.14	204	2001	10.1.36.0	10.1.32.254	3000	3010	3011	3012

Wireless network VLAN/IP planning for the student dormitory area:

Location	AP Management VLAN	AP Management Network Segment	Gateway	Sub VLAN of Web Authentication	IP Address Segment of Web Authentication	Sub VLAN of 802.1x Authentication	IP Address Segment of 802.1x Authentication	Super VLAN	Gateway	SSID of Web Authentication	SSID of 802.1x Authentication
Building 1, student dormitory area	3001	10.0.2.0/24	10.0.2.254	301	10.1.37.0/24	351	10.1.38.0/24	2001	10.1.32.254	su-web	su-1x
Building 2, student dormitory area	3001	10.0.2.0/24	10.0.2.254	302	10.1.39.0/24	352	10.1.40.0/24	2001	10.1.32.254	su-web	su-1x
Building 3, student	3001	10.0.2.0/24	10.0.2.254	303	10.1.41.0/24	353	10.1.42.0/24	2001	10.1.32.254	su-web	su-1x

dormitory area											
Building 4, student dormitory area	3001	10.0.2.0/24	10.0.2.254	304	10.1.43.0/24	355	10.1.44.0/24	2001	10.1.32.254	su-web	su-1x
Building 5, student dormitory area	3001	10.0.2.0/24	10.0.2.254	305	10.1.45.0/24	356	10.1.46.0/24	2001	10.1.32.254	su-web	su-1x

Overall VLAN/IP planning

Area	Service	Common VLAN	Super VLAN	Sub VLAN	IP	Gateway
Egress	Device interconnection	N/A			10.0.0.0/24	10.0.0.1
Server area	VM	N/A			172.29.2.0/24	172.29.2.253
Wired NMS	Device NMS	3000			10.0.1.0/24	10.0.1.254
Wireless AP	AP management	3001			10.0.2.0/24	10.0.2.254
Authentication-free area	Door Status Control VLAN	3010			10.0.10.0/24	10.0.10.254
	All-in-one card	3011			10.0.11.0	10.0.11.254
	Monitoring	3012			10.0.12.0/24	10.0.12.254
Office area	Wired 802.1x authentication and Web authentication		2000	1–99	10.1.16.0/24	10.1.16.254/20
	Wireless 802.1x authentication			100–149	10.1.18.0/24	
	Wireless Web authentication			150–199	10.1.19.0/24	
Dormitory area	Wired 802.1x authentication and Web authentication		2001	200–299	10.1.32.0/24	10.1.32.254/20
	Wireless 802.1x authentication			300–349	10.1.34.0/24	
	Wireless Web authentication			350–399	10.1.35.0/24	

5.1.5 Configuration Reference Commands on the Core RG-N18000

1. Configuring network communication in the egress area

Configure an uplink port on the RG-N18000, perform layer-3 configuration for the uplink port, configure routes, and check whether the external network communication is normal on the RG-N18000. The configuration commands are omitted.

2. Completing basic settings on the RG-N18000

```
DSW-18KX_LX(config)#auth-mode gateway//Configure the gateway mode and restart the device.
DSW-18KX_LX(config)#snmp-server host 172.29.2.9 informs version 2c ruijie  //Configure SNMP interaction between the RG-N18000 and SAM+.
DSW-18KX_LX(config)#snmp-server if-index persist//Set the port index to be permanently unique.
DSW-18KX_LX(config)#service dhcp//Enable the DHCP service on the core device.
DSW-18KX_LX(config)#ip dhcp snooping//Mandatory. This command is required for IP authorization for 802.1X authentication and MAB authentication.
DSW-18KX_LX(config)#ip dhcp snooping check-giaddr//Configure a compatible command for DHCP snooping and relay, to prevent DHCP packets from being dropped by the DHCP snooping module on the RG-N18000.
DSW-18KX_LX(config)#aaa group server radius SAM
DSW-18KX_LX(config-gs-radius)# server 172.29.2.9
DSW-18KX_LX(config)#aaa new-model
DSW-18KX_LX(config)#aaa accounting update periodic 30
DSW-18KX_LX(config)#aaa accounting update
DSW-18KX_LX(config)#aaa accounting network default start-stop group SAM
DSW-18KX_LX(config)#aaa authentication login default none
DSW-18KX_LX(config)#aaa authentication dot1x default group SAM
DSW-18KX_LX(config)#aaa authentication web-auth default group SAM
DSW-18KX_LX(config)#aaa authorization ip-auth-mode mixed        //Configure IP authorization to the mixed mode.
DSW-18KX_LX(config)#dot1x accounting default//Enable the 802.1x accounting list.
DSW-18KX_LX(config)#dot1x authentication default        //Enable the 802.1x authentication list.
DSW-18KX_LX(config)#ip radius source-interface GigabitEthernet 1/24  //Configure the source interface for the device to communicate with the RADIUS server. The device address added to SAM+ should be the address of this interface.
DSW-18KX_LX(config)#ip portal source-interface GigabitEthernet 1/24  //Configure the source interface for the device to communicate with the ePortal server. The device address added to the ePortal server should be the address of this interface.
DSW-18KX_LX(config)#ip dhcp snooping arp-detect     //Enable fast ARP address reclaiming of DHCP snooping. The ARP address reclaiming is performed once per second during ARP aging and can be performed five times at most.
DSW-18KX_LX(config)#ip dhcp server arp-detect//Enable fast address reclaiming of the DHCP server. If identifying that a user goes offline and does not go online again within a period of time (5 minutes by default), the DHCP server reclaims the IP address assigned to the user.
DSW-18KX_LX(config)#no aaa log enable
DSW-18KX_LX(config)#web-auth template eportalv2
DSW-18KX_LX(config.tmplt.eportalv2)#ip 172.29.2.8
DSW-18KX_LX(config.tmplt.eportalv2)#url http://172.29.2.8/eportal/index.jsp
```

```
DSW-18KX_LX(config.tmplt.eportalv2)# exit
DSW-18KX_LX(config)#web-auth portal key su
DSW-18KX_LX(config)#http redirect direct-site 192.168.9.12     //Configure the address of the RG-SU server as an authentication-free address.
DSW-18KX_LX(config)#web-auth direct-host 10.1.16.200        //Configure the client of a school director as an authentication-free client.
DSW-18KX_LX(config)#dot1x mac-auth-bypass valid-ip-auth //Mandatory. The DHCP module instructs the MAB module to start authentication. Clients must obtain IP addresses before starting MAB authentication.
DSW-18KX_LX(config)#dot1x valid-ip-acct enable   //Mandatory. The accounting update packets are used to upload the user IP address to SAM+. If the 802.1x authentication module does not have an IP entry of the user, the user is kicked offline 5 minutes later.
DSW-18KX_LX(config)#direct-vlan 100-149,300-349,3000-3001,3010-3012      //Configure VLANs for wireless 802.1x authentication, monitoring, device management, and wireless AP management as authentication-free VLANs.
DSW-18KX_LX(config)#web-auth portal-check interval 3 timeout 3 retransmit 10    //Configure portal escape.
DSW-18KX_LX(config)#web-auth portal-escape nokick
DSW-18KX_LX(config)#radius-server host 172.29.2.9 test username ruijie idle-time 2 key ruijie
DSW-18KX_LX(config)#radius-server dead-criteria time 120 tries 12     //Configure an IP address for the RADIUS server and enable the RADIUS escape test function.
DSW-18KX_LX(config)#web-auth radius-escape    //Globally enable RADIUS escape in Web authentication mode.
DSW-18KX_LX(config)#address-bind ipv6-mode compatible//Set IPv6 authentication to the compatible mode.
DSW-18KX_LX(config)#station-move permit    //Enable migration of 802.1x authenticated clients.
DSW-18KX_LX(config)#web-auth station-move auto    //Enable migration of Web authenticated clients.
DSW-18KX_LX(config)#web-auth station-move info-update
DSW-18KX_LX(config)#no dot1x station-move arp-detect   //It is recommended to disable ARP detection after migration of 802.1x authenticated clients, because the ARP detection will cause broadcast packet floods.
DSW-18KX_LX(config)#http redirect port 443     //Because this configuration consumes device resources, it is recommended to discuss with the customer about whether to enable the configuration if a great number of users need authentication.
DSW-18KX_LX(config)#cpu-protect type web-auths bandwidth 2000 //Configure the HTTPS optimization command. HTTPS involves socket encryption and decryption, consuming a great deal of processing resources. 11.0(1)B2T11 and later versions separate HTTPS from HTTP for the use of CPU resources. If HTTPS redirection is enabled, configure CPP rate limiting for HTTPS.
DSW-18KX_LX(config)#offline-detect interval 15 threshold 0      //Set the no-traffic go-offline detection period to 15 minutes.
```

```
DSW-18KX_LX(config)#snmp-server host 172.29.2.9 informs version 2c ruijie  //Configure SNMP.
DSW-18KX_LX(config)#snmp-server host 172.29.2.9 traps su
DSW-18KX_LX(config)#snmp-server community su rw
```

3. Configuring VLANs on the RG-N18000

```
DSW-18KX_LX(config)#vlan range 1-399
DSW-18KX_LX(config-vlan-range)#exit
DSW-18KX_LX(config)#vlan 2000
DSW-18KX_LX(config-vlan-range)#supervlan//Configure a super VLAN in the office area.
DSW-18KX_LX(config-vlan-range)#subvlan 1-199     //Associate sub VLANs with the super VLAN.
DSW-18KX_LX(config-vlan-range)#exit
DSW-18KX_LX(config)#vlan 2001
DSW-18KX_LX(config-vlan-range)#supervlan//Configure a super VLAN in the dormitory area.
DSW-18KX_LX(config-vlan-range)#subvlan 200-399     //Associate sub VLANs with the super VLAN.
DSW-18KX_LX(config-vlan-range)#exit
DSW-18KX_LX(config)#vlan 3000
DSW-18KX_LX(config-vlan)# name DeManagement
DSW-18KX_LX(config)#vlan 3001
DSW-18KX_LX(config-vlan)#name APManagement
DSW-18KX_LX(config)#vlan 3010
DSW-18KX_LX(config-vlan)# name MenJin
DSW-18KX_LX(config)#vlan 3011
DSW-18KX_LX(config-vlan)#name YiKaTong
DSW-18KX_LX(config)#vlan 3012
DSW-18KX_LX(config-vlan)#name JianKong
```

4. Configuring the IPv4/IPv6 gateway and DHCPv4/DHCPv6

```
DSW-18KX_LX(config)#ipv6 dhcp pool DHCPv6        //Create a DHCPv6 address pool for the DNS
server.
DSW-18KX_LX(dhcp-config)# domain-name scu6.edu.cn
DSW-18KX_LX(dhcp-config)# dns-server 2001:250:2003::8
DSW-18KX_LX(dhcp-config)# dns-server 2001:250:2003::9
DSW-18KX_LX(config)#ip dhcp pool sushe-pool//Configure a DHCP address pool in the dormitory area.
DSW-18KX_LX(dhcp-config)#lease 0 2 0//Mandatory. Set the lease period to 2 hours.
DSW-18KX_LX(dhcp-config)#network 10.1.32.0 255.255.240.0
DSW-18KX_LX(dhcp-config)#dns-server 202.115.32.39 202.115.32.36
DSW-18KX_LX(dhcp-config)#default-router 10.1.32.254
DSW-18KX_LX(config)#ip dhcp pool bangong-pool//Configure a DHCP address pool in the office area.
DSW-18KX_LX(dhcp-config)#lease 0 2 0//Mandatory. Set the lease period to 2 hours.
DSW-18KX_LX(dhcp-config)#network 10.1.16.0 255.255.240.0
DSW-18KX_LX(dhcp-config)#dns-server 10.1.16.0 255.255.240.0
DSW-18KX_LX(dhcp-config)#default-router 10.1.16.254
```

```
DSW-18KX_LX(config)#ip dhcp pool ap-pool//Configure a DHCP address pool for wireless AP
management.
DSW-18KX_LX(dhcp-config)#option 138 ip 10.10.1.1
DSW-18KX_LX(dhcp-config)#network 10.0.2.0 255.255.255.0
DSW-18KX_LX(dhcp-config)#default-router 10.0.2.254
DSW-18KX_LX(config)#int vlan 2000//Configure the gateway address for the super VLAN in the office
area.
DSW-18KX_LX(config-if-VLAN 2000)#ip address 10.1.16.254/20
DSW-18KX_LX(config-if-VLAN 2000)#ipv6 enable
DSW-18KX_LX(config-if-VLAN 2000)#ipv6 address 2001:250:2003:2000::1/64
DSW-18KX_LX(config-if-VLAN 2000)#no ipv6 nd suppress-ra
DSW-18KX_LX(config-if-VLAN 2000)#ipv6 nd other-config-flag
DSW-18KX_LX(config-if-VLAN 2000)#ipv6 dhcp server DHCPv6
DSW-18KX_LX(config)#int vlan 2001//Configure the gateway address for the super VLAN in the
dormitory area.
DSW-18KX_LX(config-if-VLAN 2001)#ip address 172.16.32.254/20
DSW-18KX_LX(config-if-VLAN 2001)#ipv6 enable
DSW-18KX_LX(config-if-VLAN 2001)#ipv6 address 2001:250:2003:2001::1/64
DSW-18KX_LX(config-if-VLAN 2001)#no ipv6 nd suppress-ra
DSW-18KX_LX(config-if-VLAN 2001)#ipv6 nd other-config-flag
DSW-18KX_LX(config-if-VLAN 2001)#ipv6 dhcp server DHCPv6
DSW-18KX_LX(config)#interface GigabitEthernet 1/1//Configure the port of the core RG-N18000 for
connecting to the egress device.
DSW-18KX_LX(config-if-GigabitEthernet 1/1)# no switchport
DSW-18KX_LX(config-if-GigabitEthernet 1/1)#ip address 10.0.0.2 255.255.255.0
DSW-18KX_LX(config)#int vlan 3000//Configure the gateway address for device management.
DSW-18KX_LX(config-if-VLAN 3000)#ip address 10.0.1.254/24
DSW-18KX_LX(config)#int vlan 3001//Configure the gateway address for the wireless AP device.
DSW-18KX_LX(config-if-VLAN 3001)#ip address 10.0.2.254/24
DSW-18KX_LX(config)#int vlan 3010//Configure the gateway address for door status control.
DSW-18KX_LX(config-if-VLAN 3010)#ip address 11.0.10.254/24
DSW-18KX_LX(config)#int vlan 3011//Configure the gateway address for the all-in-one card service.
DSW-18KX_LX(config-if-VLAN 3011)#ip address 10.0.11.254/24
DSW-18KX_LX(config)#int vlan 3012//Configure the gateway address for the monitoring service.
DSW-18KX_LX(config-if-VLAN 3012)#ip address 10.0.12.254/24
DSW-18KX_LX(config)#address-manage      //Enable AM rules to perform refined matching of address
segments.
DSW-18KX_LX(config-address-manage)#match ip 10.1.16.0 255.255.255.0 Gi1/2 vlan 2
DSW-18KX_LX(config-address-manage)#match ip 10.1.17.0 255.255.255.0 Gi1/2 vlan 3
DSW-18KX_LX(config-address-manage)#match ip 10.1.32.0 255.255.255.0 Gi1/3 vlan 200
DSW-18KX_LX(config-address-manage)#match ip 10.1.33.0 255.255.255.0 Gi1/3 vlan 201
```

```
DSW-18KX_LX(config-address-manage)#match ip 10.0.2.0 255.255.255.0 vlan 3001
DSW-18KX_LX(config-address-manage)#match ip 10.1.18.0 255.255.255.0 Gi1/4 vlan 100
DSW-18KX_LX(config-address-manage)#match ip 10.1.19.0 255.255.255.0 Gi1/4 vlan 150
DSW-18KX_LX(config-address-manage)#match ip 10.1.34.0 255.255.255.0 Gi1/4 vlan 300
DSW-18KX_LX(config-address-manage)#match ip 10.1.35.0 255.255.255.0 Gi1/4 vlan 350
DSW-18KX_LX(config-address-manage)#match ip loose      //It is recommended to configure the
loose mode.
... AM rules can be created one by one based on the preceding VLAN/IP planning tables. Note:
Once AM rules are enabled, port/VLAN mapping needs to be performed for the network segments to
be assigned on the whole network, including the network in the old campus that is not reconstructed
(the corresponding port is the port of the RG-N18000 for connecting to the aggregation device
of the old campus network; the corresponding VLAN is the VLAN of the SVI on the RG-N18000 for
connecting to the aggregation device of the old campus network).
```

5. Enabling authentication on the port of the RG-N18000

```
DSW-18KX_LX(config)#int GigabitEthernet 1/2//Configure the interface for connecting to the
aggregation device in the office area.
DSW-18KX_LX(config-if-GigabitEthernet 1/2)#switchport mode trunk
DSW-18KX_LX(config-if-GigabitEthernet 1/2)#dot1x port-control auto       //Enable 802.1x
authentication control on an interface.
DSW-18KX_LX(config-if-GigabitEthernet 1/2)#web-auth enable eportalv2//Enable Web
authentication on an interface.
DSW-18KX_LX(config-if-GigabitEthernet 1/2)#dot1x mac-auth-bypass multi-user //Enable
multi-user MAB authentication on an interface.
DSW-18KX_LX(config-if-GigabitEthernet 1/2)#dot1x mac-auth-bypass vlan 1-99  //Enable MAB
authentication for VLANs 1-99.
DSW-18KX_LX(config-if-GigabitEthernet 1/2)#switchport trunk allowed vlan only
1-199,3000-3001,3010-3012
DSW-18KX_LX(config-if-GigabitEthernet 1/2)#dot1x critical//Configure RADIUS escape in 802.1x
authentication mode on an interface.
DSW-18KX_LX(config-if-GigabitEthernet 1/2)#dot1x critical recovery action
reinitialize      //Enable an escaped user to perform re-authentication after RADIUS escape is
recovered.
DSW-18KX_LX(config-if-GigabitEthernet 1/2)#switchport protected     //Configure port
protection on an interface.
DSW-18KX_LX(config)#int GigabitEthernet 1/3//Configure the interface for connecting to the
aggregation device in the dormitory area.
DSW-18KX_LX(config-if-GigabitEthernet 1/3)#switchport mode trunk
DSW-18KX_LX(config-if-GigabitEthernet 1/3)#dot1x port-control auto       //Enable 802.1x
authentication control on an interface.
DSW-18KX_LX(config-if-GigabitEthernet 1/3)#web-auth enable eportalv2//Enable Web
authentication on an interface.
```

```
DSW-18KX_LX(config-if-GigabitEthernet 1/3)#switchport trunk allowed vlan only
200-399,3000-3001,3010-3012
DSW-18KX_LX(config-if-GigabitEthernet 1/3)#dot1x critical//Configure RADIUS escape in 802.1x
authentication mode on an interface.
DSW-18KX_LX(config-if-GigabitEthernet 1/3)#dot1x critical recovery action
reinitialize      //Enable an escaped user to perform re-authentication after RADIUS escape is
recovered.
DSW-18KX_LX(config-if-GigabitEthernet 1/3)#switchport protected     //Configure port
protection on an interface.
DSW-18KX_LX(config)#int GigabitEthernet 1/4//Configure the interface for connecting to the
wireless controller.
DSW-18KX_LX(config-if-GigabitEthernet 1/4)#switchport mode trunk
DSW-18KX_LX(config-if-GigabitEthernet 1/4)#dot1x port-control auto       //Enable 802.1x
authentication control on an interface.
DSW-18KX_LX(config-if-GigabitEthernet 1/4)#dot1x mac-auth-bypass multi-user //Enable
multi-user MAB authentication on an interface.
DSW-18KX_LX(config-if-GigabitEthernet 1/4)#dot1x mac-auth-bypass vlan 150-199//Enable MAB
authentication for VLANs 150-199 (wireless Web authentication in the office area).
DSW-18KX_LX(config-if-GigabitEthernet 1/4)#web-auth enable eportalv2//Enable Web
authentication on an interface.
DSW-18KX_LX(config-if-GigabitEthernet 1/4)#switchport trunk allowed vlan only
100-199,300-399,3000
DSW-18KX_LX(config)#int GigabitEthernet 1/44//Configure the port for connecting to the server
area.
DSW-18KX_LX(config-if-GigabitEthernet 1/44)#no switchport
DSW-18KX_LX(config-if-GigabitEthernet 1/44)#description linkto-SAM&eportalSERVER
DSW-18KX_LX(config-if-GigabitEthernet 1/44)#ip address 172.29.2.253 255.255.255.0
```

6. Optimizing VLAN pruning on the downlink port of the RG-N18000

7. Performing routing related configurations

```
DSW-18KX_LX(config)#router ospf 1
DSW-18KX_LX(config-router)#redistribute connected
DSW-18KX_LX(config-router)#passive-interfac  vlan 2000   //Mandatory. Configure a passive port
to to reduce CPU overheads.
DSW-18KX_LX(config-router)#passive-interfac  vlan 2001   //Mandatory. Configure a passive port
to to reduce CPU overheads.
DSW-18KX_LX(config-router)#passive-interfac  vlan 3000   //Mandatory. Configure a passive port
to to reduce CPU overheads.
DSW-18KX_LX(config-router)#passive-interfac  vlan 3001   //Mandatory. Configure a passive port
to to reduce CPU overheads.
```

```
DSW-18KX_LX(config-router)#passive-interfac  vlan 3010   //Mandatory. Configure a passive port
to to reduce CPU overheads.
DSW-18KX_LX(config-router)#passive-interfac  vlan 3011   //Mandatory. Configure a passive port
to to reduce CPU overheads.
DSW-18KX_LX(config-router)#passive-interfac  vlan 3012   //Mandatory. Configure a passive port
to to reduce CPU overheads.
```

5.1.6 Aggregation Configuration Reference Commands for the Dormitory Area

```
S5750-student(config)#vlan range 200-399,3000-3001,3010-3012      //Configure the VLAN range
for the access device in the student dormitory area, as well as the monitoring and management
VLANs.
S5750-student(config)#int GigabitEthernet 0/24 //Configure the uplink port of the aggregation
device as a trunk port for transparent transmission.
S5750-student(config-if-GigabitEthernet 0/24)#switchport mode trunk
S5750-student(config-if-GigabitEthernet 0/24)#switchport trunk allowed vlan remove
1-199,400-2999,3002-3009,3013-4094
S5750-student(config)#int GigabitEthernet 0/23//Configure the downlink port of the aggregation
device as a trunk port for transparent transmission.
S5750-student(config-if-GigabitEthernet 0/23)#switchport mode trunk
S5750-student(config-if-GigabitEthernet 0/23)#switchport trunk allowed vlan remove
1-199,400-2999,3002-3009,3013-4094
```

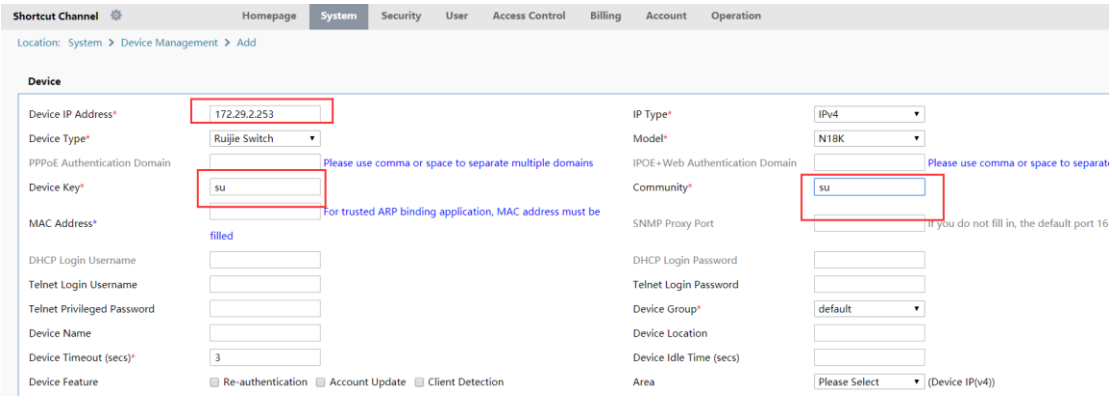
5.1.7 Access Configuration Reference Commands for the Dormitory Area

```
S2928G-student1-1(config)#vlan range 200-399,3000-3001,3010-3012     //Configure the VLAN
range for the access device in the student dormitory area, as well as the monitoring and management
VLANs.
S2928G-student1-1(config)#spanning-tree//Enable STP.
S2928G-student1-1(config)#spanning-tree mode rstp     //Enable RSTP to avoid overlow port
convergence speed.
S2928G-student1-1(config)#spanning-tree portfast bpduguard default    //Enable BPDU guard for
all PortFast ports by default.
S2928G-student1-1(config)#errdisable recovery interval 300//Configure the recovery interval
after a port is disabled by RLDP.
S2928G-student1-1(config)#int range gi0/1-22
S2928G-student1-1(config-if-range)#switchport access vlan 200    //Create an access port and
assign it to the corresponding VLAN.
S2928G-student1-1(config-if-range)#switchport protected//Mandatory. Configure port
protection.
```

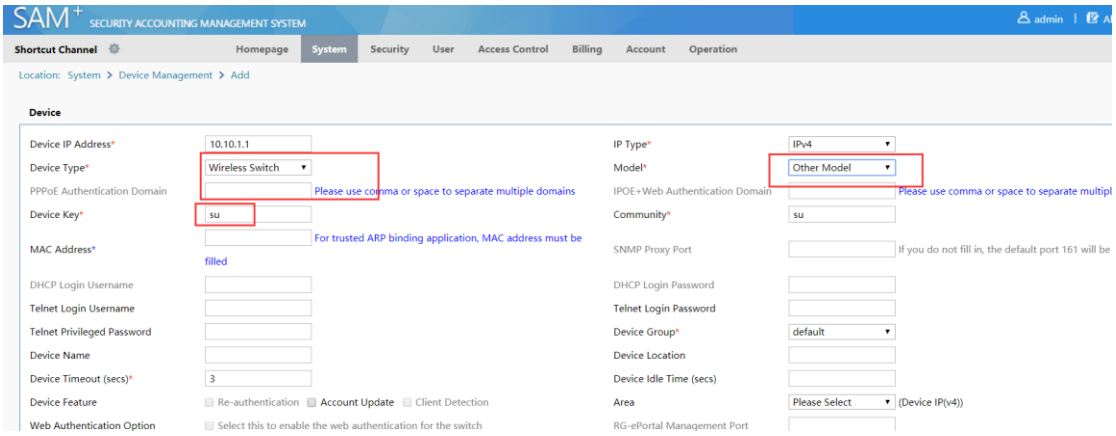
```
S2928G-student1-1(config-if-range)#spanning-tree portfast     //Enable PortFast on all
downlink interfaces, which validates BPDU guard at the same time. Once a BPDU packet is received,
the access switch regards that a loop occurs and shuts down the interfaces.
S2928G-student1-1(config-if-range)#rldp port loop-detect shutdown-port    //Mandatory.
Configure RLDP to prevent loops.
S2928G-student1-1(config)#int gi0/23//Configure the port for connecting to the AP.
S2928G-student1-1(config-if-GigabitEthernet 0/23)# switchport access vlan 3001
S2928G-student1-1(config-if-GigabitEthernet 0/23)#rldp port loop-detect shutdown-port
S2928G-student1-1(config)#int gi0/24//Configure the uplink port of the access device as a trunk
port for transparent transmission.
S2928G-student1-1(config-if-GigabitEthernet 0/24)#switchport mode trunk
S2928G-student1-1(config-if-GigabitEthernet 0/24)#spanning-tree bpdufilter enable//Enable a
BPDU filter for the uplink port, so that loop protection is provided only on single devices,
and BDPU packets are not transmitted externally, no topology is created, and no root bridge is
elected.
S2928G-student1-1(config-if-GigabitEthernet 0/24)# switchport trunk allowed vlan only
200-399,3000-3001,3010-3012
```

5.1.8 SAM + and ePortal Related Configurations

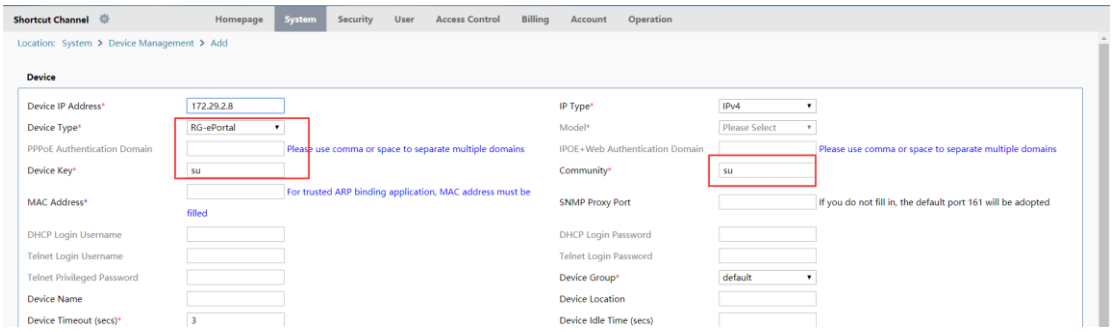
1. Adding an RG-N18000 on SAM+



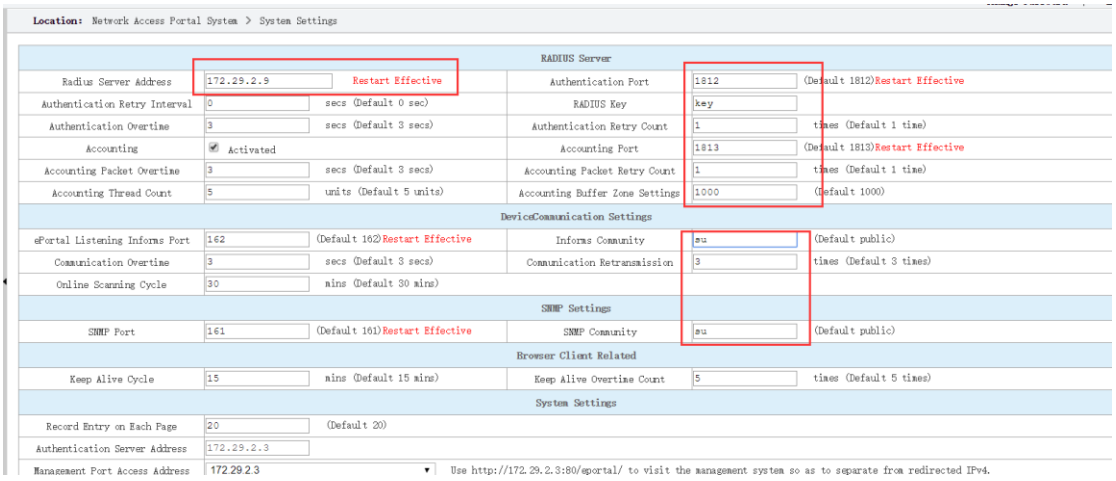
2. Adding an AC on SAM+



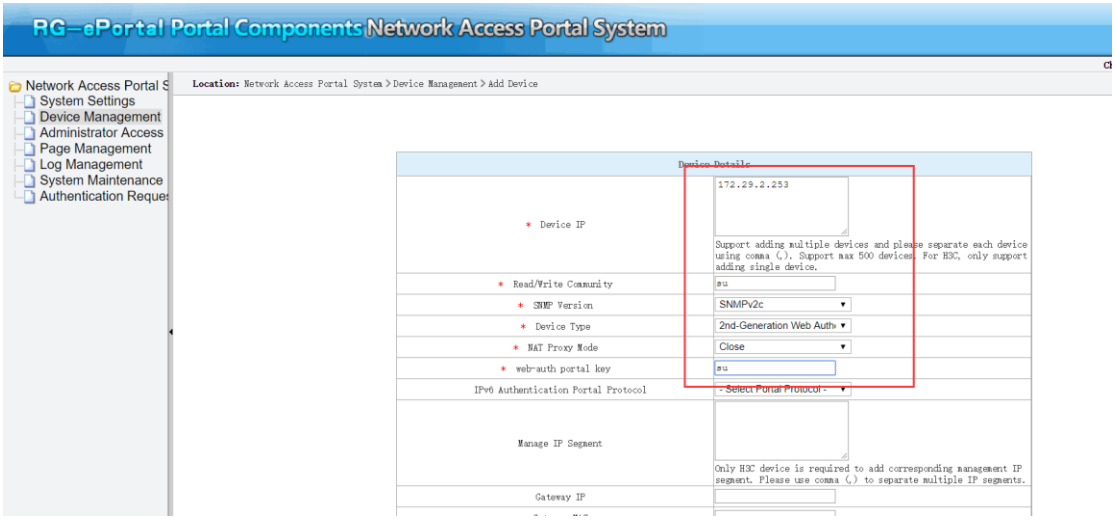
3. Adding ePortal on SAM+



4. Adding SAM+ on ePortal

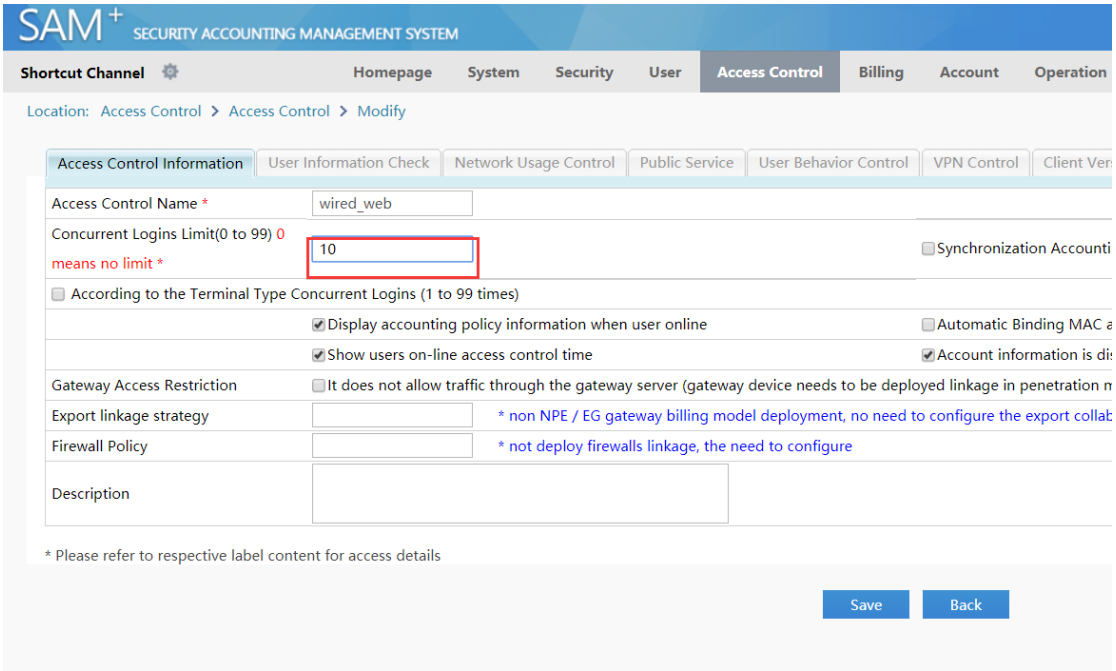


5. Adding an RG-N18000 on ePortal

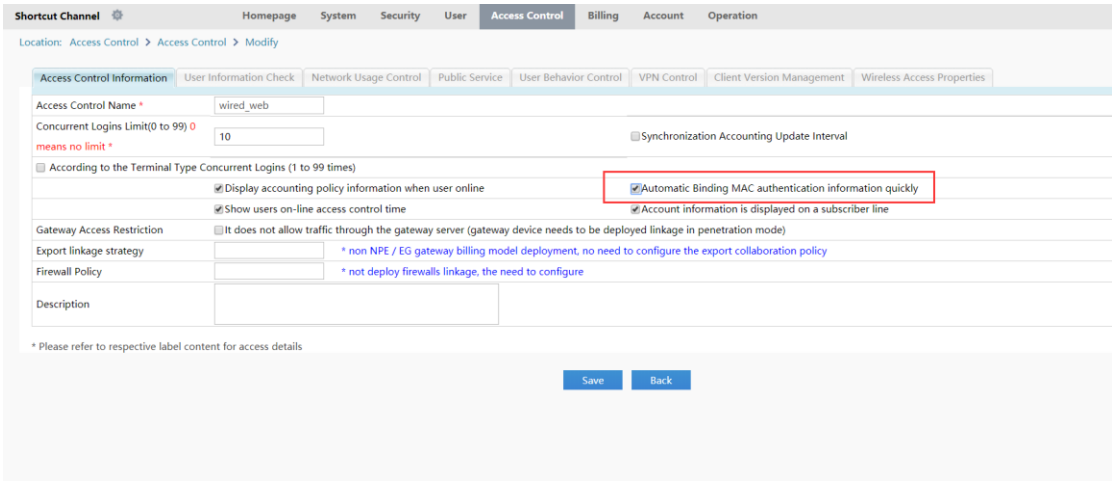


6. Configuring access control

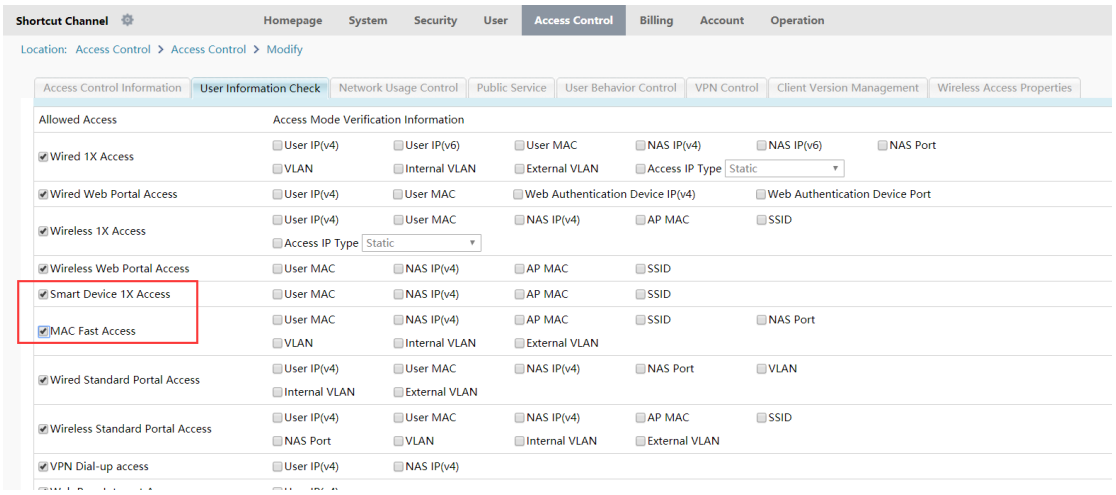
(1) It is not necessary to enable MAB authentication for access control in the dormitory area.



(2) It is necessary to enable MAB authentication for access control in the office area.

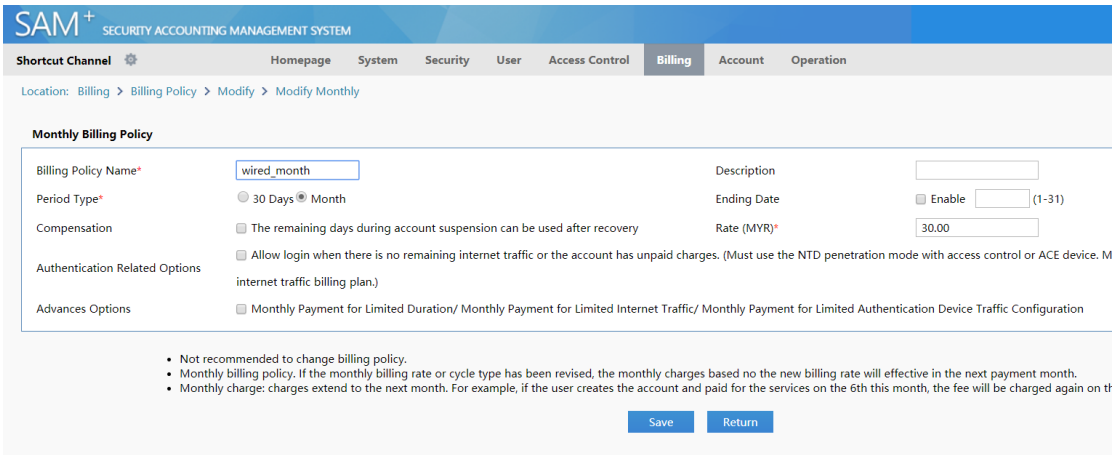


(3) The office area allows MAC fast access. To allow login using the native 802.1x authenticated client, select **Smart Device 1X Access**.

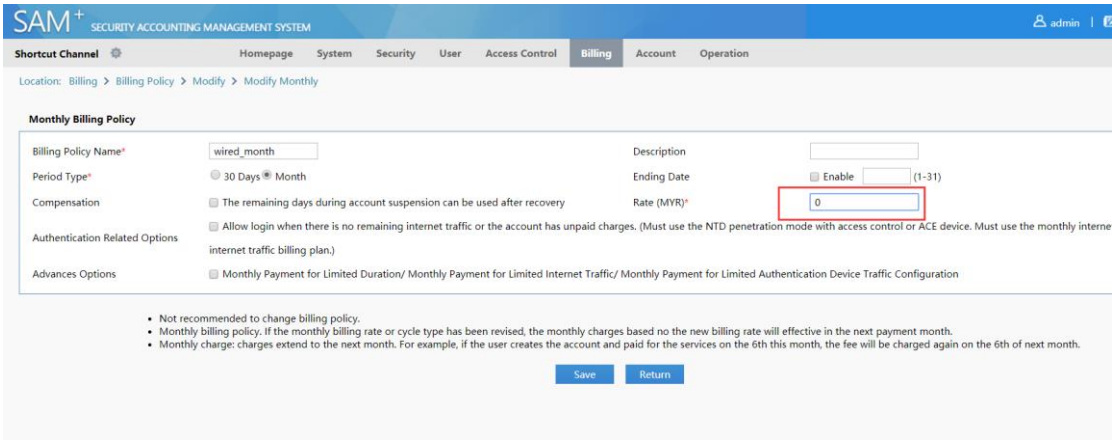


7. Configuring accounting policies

(1) Monthly accounting policy in the dormitory area

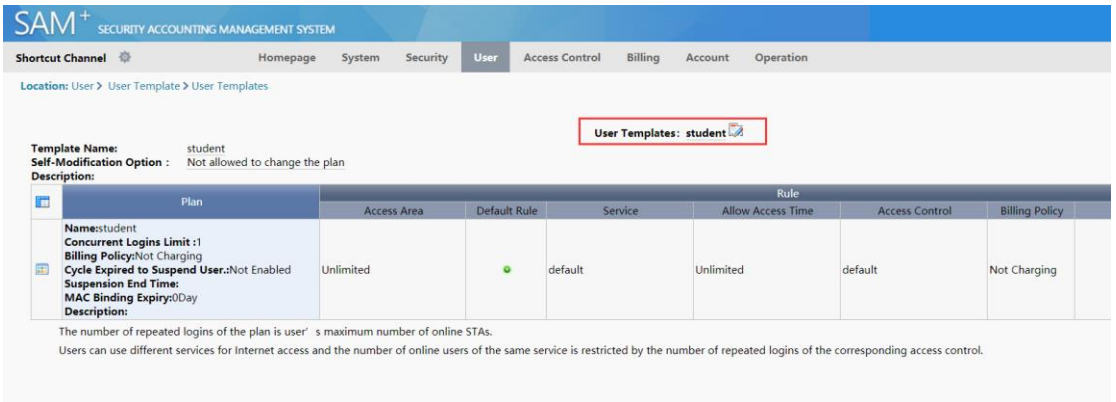


(2) Monthly accounting policy in the office area

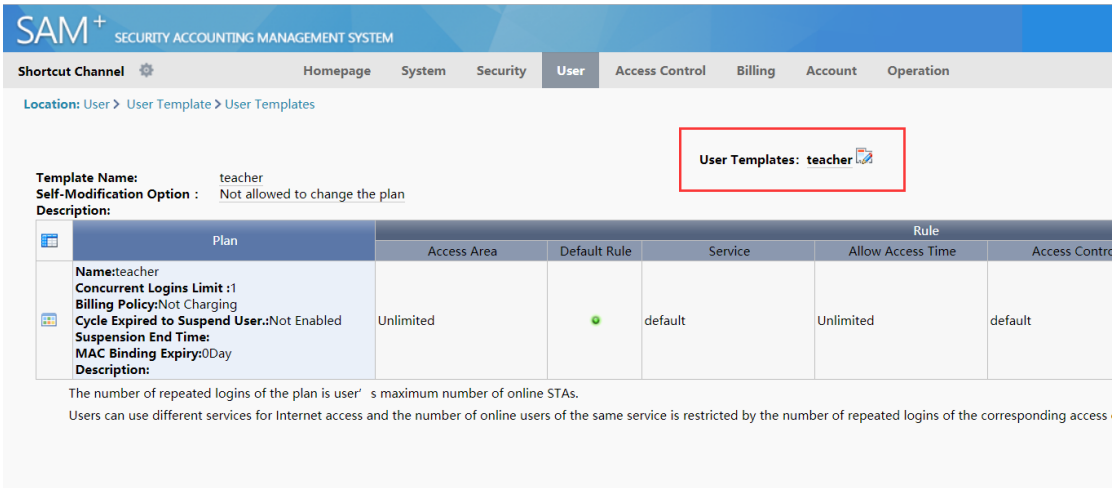


8. Configuring user templates

(1) User template in the dormitory area

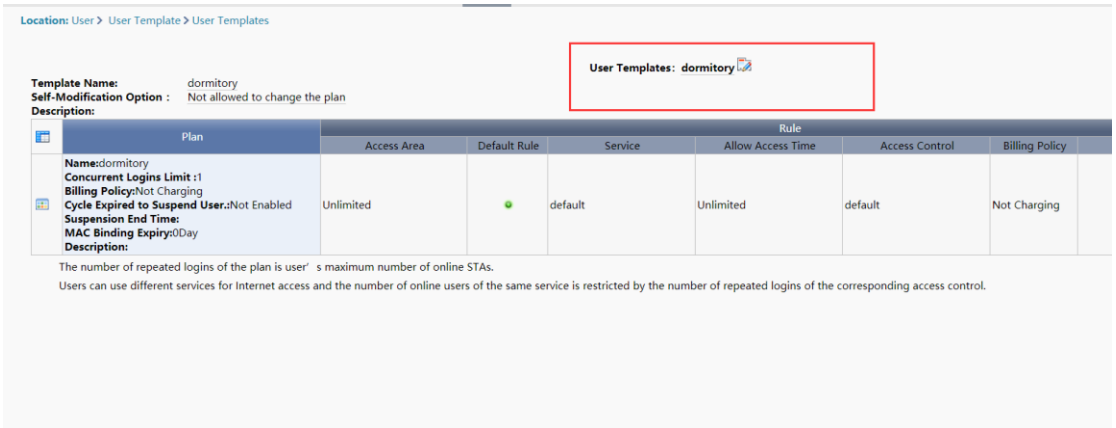


(2) User template in the office area

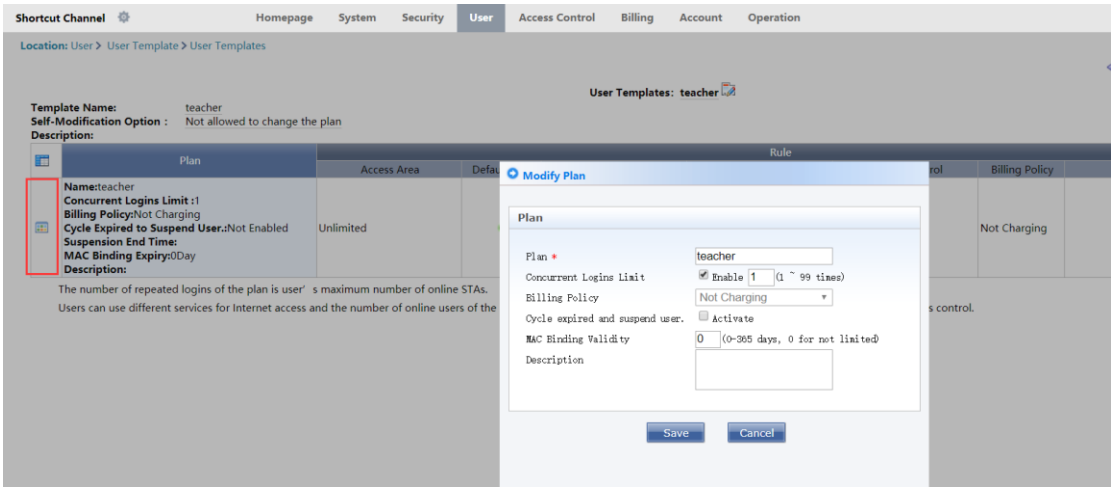


9. Configuring user plans

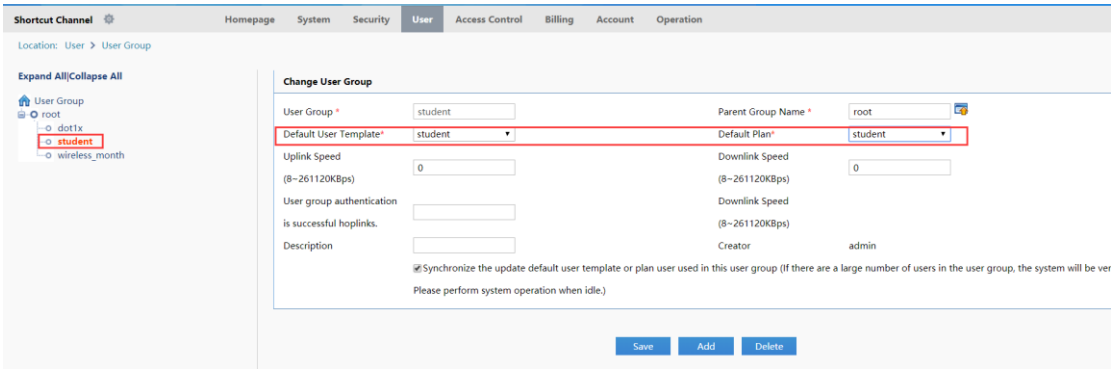
(1) User plan in the dormitory area

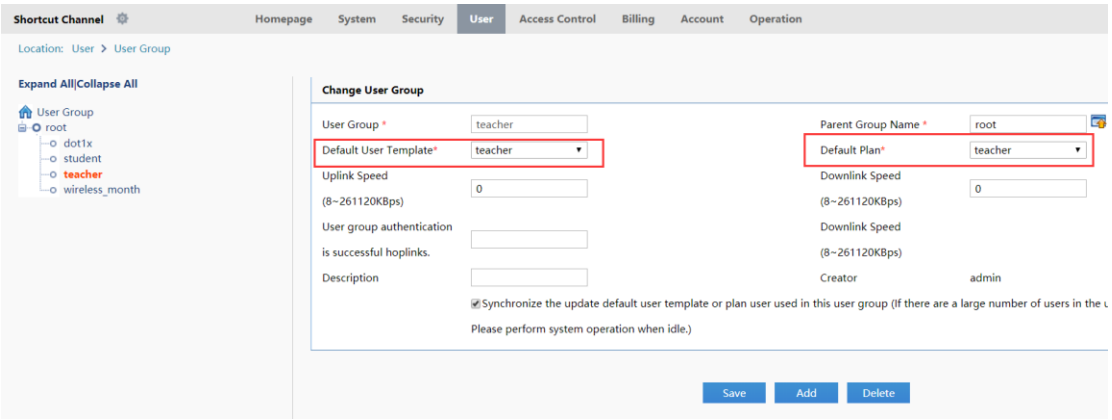


(2) User plan in the office area

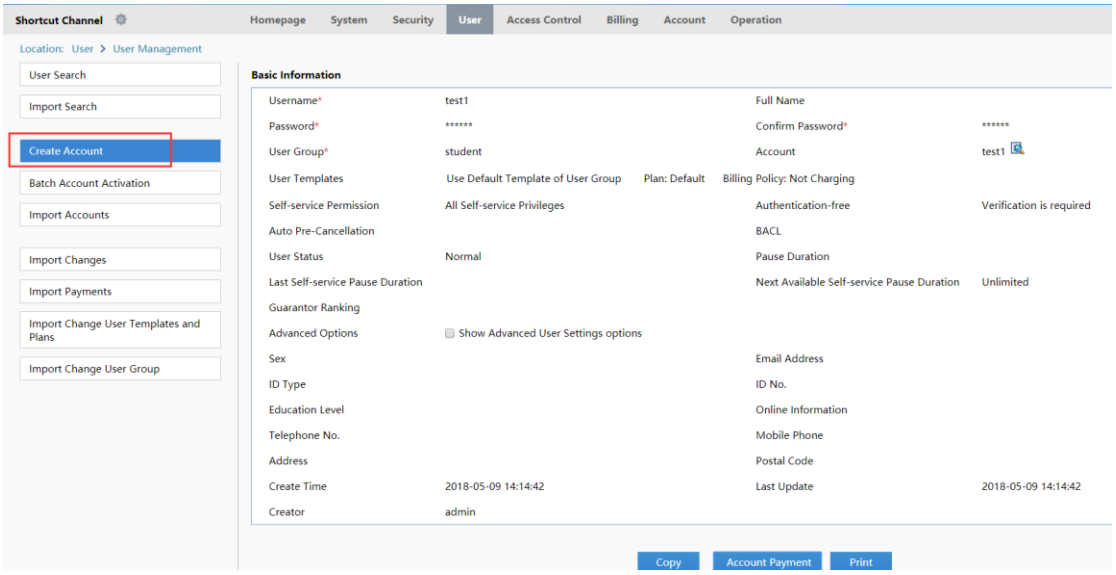


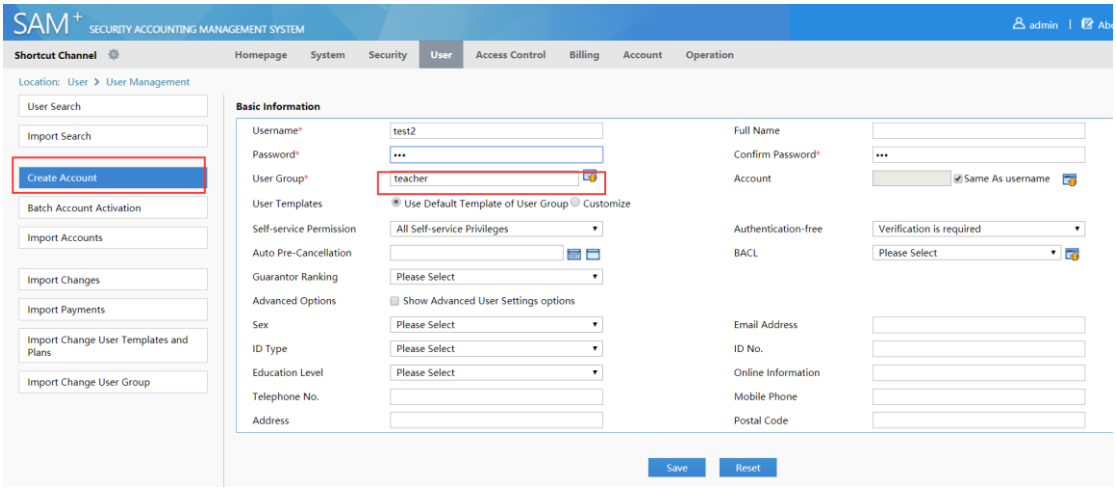
10. Configuring user groups



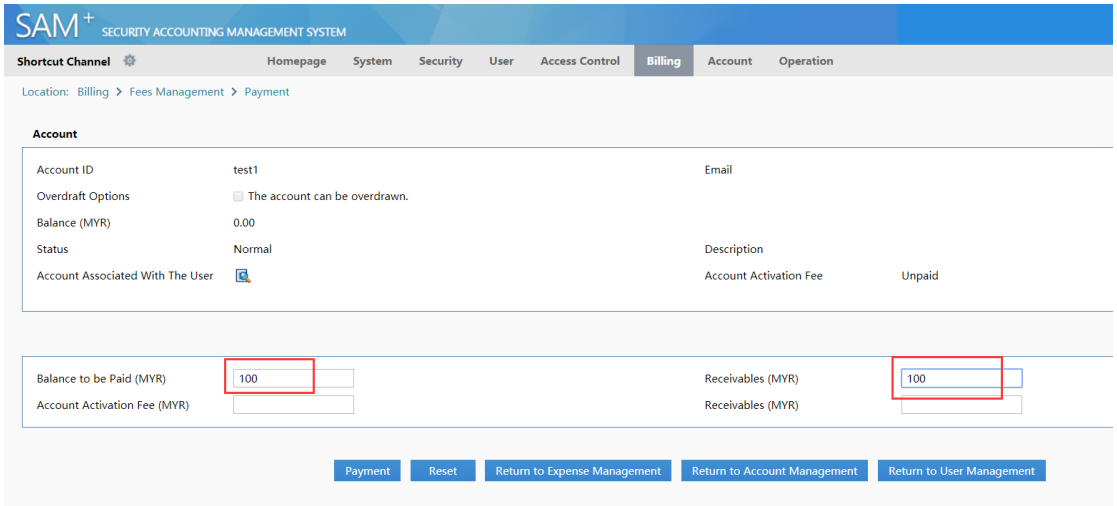


11. Registering users

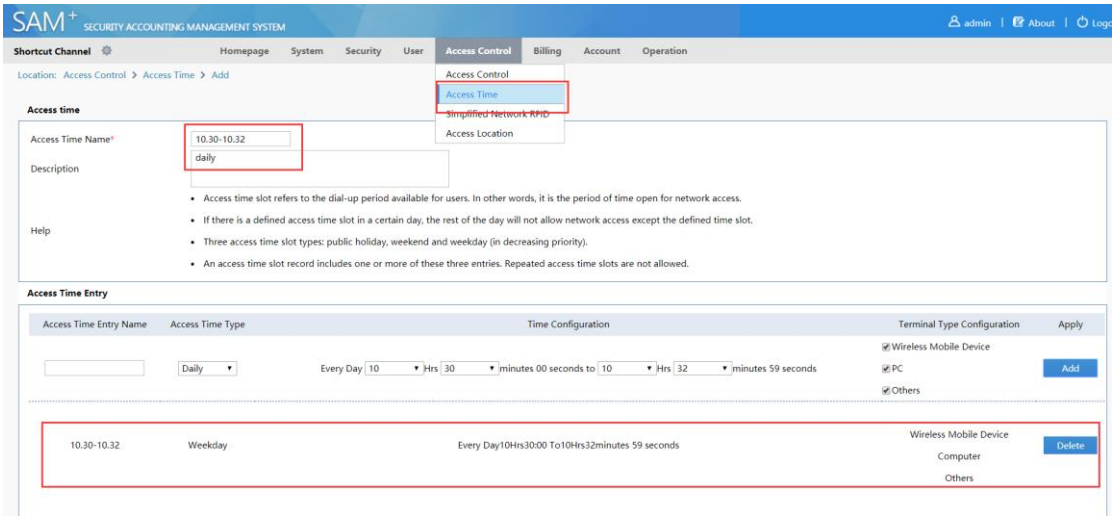




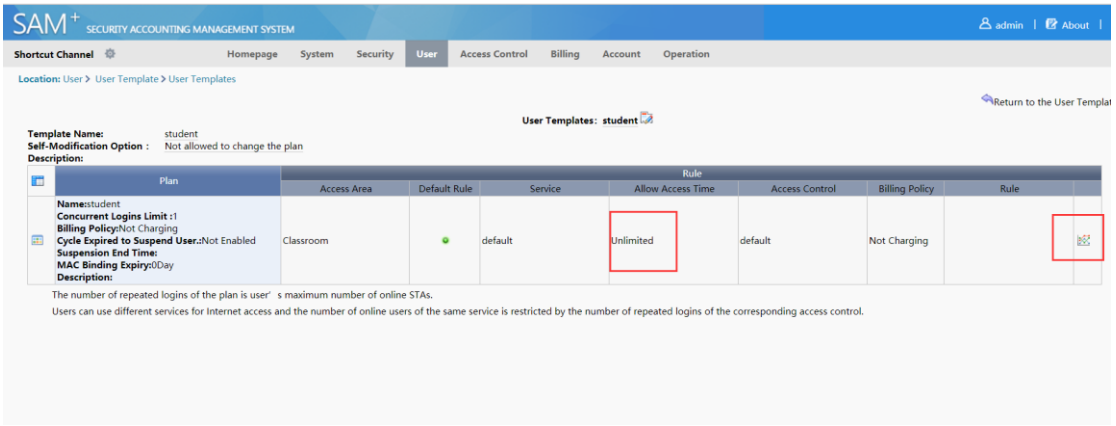
12. Payment



13. Controlling the access period



14. Associating the access period with the user template



15. Verifying login failure of student users beyond the access period (10:34)

6 Optimization and Precautions for Simplistic Network Configuration

6.1 Optimization and Precautions for the RG-N18000 Configuration

6.1.1 Disabling authentication accounting update

The 2nd-generation portal accounting update needs accounting update responses. If no response is received within a period of time, the RG-N18000 deems that the server is unreachable, resulting in intermittent network connection during authentication.

Configuration command: Ruijie(config)# no radius-server account update retransmit

Note: The RG-N18000 has resolved this issue in 11.0(1)B2 Build(10) released in October 2015. This command does not need to be configured on the RG-N18000 of 11.0(1)B2 Build(10) and later versions.

6.1.2 Optimizing HTTPS redirection on the RG-N18000

1. It is recommended to disable HTTPS redirection for 11.0(1)B2 build(10), 11.0(1)B2 build(11), and earlier versions.

HTTPS redirection involves socket encryption and decryption, which consume considerable resources, greatly lower the performance, and affect HTTP redirection. Therefore, the HTTPS redirection port needs to be disabled.

Configuration command: Ruijie(config)#no http redirect port 443

For example, some famous Websites such as Baidu use HTTPS and the configuration of this command will incur a redirection failure. In this case, enter a non-HTTPS URL to trigger redirection, for example, http://www.baidu.com.

2. For 11.0(1)B2T11 and later versions, enable HTTPS redirection as required and configure the CPP rate limit.

The HTTPS performance is optimized in the latest version, and CPU resources used by HTTPS and HTTP are separated and optimized to avoid mutual impact. HTTPS redirection can be enabled as needed. The HTTPS CPP rate limit must be configured (2 kbps for 11.0(1)B2T11 and 5 kbps for 11.0(1)B3P1).

```
Ruijie(config)#http redirect port 443
```

6.1.3 Enabling interface index uniqueness

The interface index of each physical port is unique on the RG-N18000. You can run the **show interface** command to display the **Index** field. When there are multiple line cards and an Aggregate Port (AP) is configured (one line card is inserted, the AP is configured, and then another line card is inserted), after the device is restarted, the interface indexes of the device may change. As a result, the area division function of SAM+ will fail. The interface index uniqueness function must be enabled.

Configuration command: Ruijie(config)#snmp-server if-index persist

6.1.4 Enabling migration of authenticated users on the RG-N18000 as user re-authentication is required after AC hot backup switchover

After wireless Web authentication is enabled on the RG-N18000, when hot backup switchover is performed on master and slave ACs, the port+VID information of Web authenticated clients changes on the RG-N18000 and such clients need to be re-authenticated, which is against the purpose of wireless AC hot backup. Migration of Web authenticated clients can be enabled on the RG-N18000 to resolve this issue. After the migration is enabled, if the user port or VLAN changes in the same super VLAN, the RG-N18000 processes authentication information internally and user re-authentication is not required.

```
Ruijie (config)# station-move permit
Ruijie (config)# web-auth station-move auto
Ruijie (config)# web-auth station-move info-update
```

6.1.5 Preventing users with all-zero IP addresses on SAM+

IP addresses of users to be authenticated need to be obtained through the SU client or the DHCP snooping table of the RG-N18000 for both 802.1x authentication and MAB authentication. When the following configurations are lost, the RG-N18000 fails to obtain IP addresses of to-be-authenticated users and sends all-zero IP addresses to the SAM+ server. If the preemption policy for users with the same IP addresses is configured on the SAM+ server, users are forced to go offline. To resolve this problem, configure the following commands:

```
Ruijie (config)# ip dhcp snooping                          //Enable IP DHCP snooping.
Ruijie (config)# aaa authorization ip-auth-mode mixed      //Set the IP authorization mode of
to-be-authenticated users to the mixed mode.
Ruijie (config)# dot1x mac-auth-bypass valid-ip-auth       //Apply MAB authentication only after
IP addresses are obtained. The configuration of this command will force online users to go offline.
It is not recommended to run this command in service peak hours.
Ruijie (config)# dot1x valid-ip-acct enable                //802.1x authenticated users
and MAB authenticated users are forced to go offline 5 minutes later if they fail to obtain IP
addresses. The configuration of this command will force online users to go offline. It is not
recommended to run this command in service peak hours.
```

6.1.6 Ensuring accuracy of online user information on SAM+ and the RG-N18000

To prevent exceptions caused by online user information inconsistency between SAM+ and the RG-N18000, SAM+ is configured to automatically check online user information with the RG-N18000 at 02:00 A.M. every day and delete information about fake online users.

```
Run the snmp-server command on the RG-N18000 to synchronize information with SAM+:
snmp-server host 172.18.18.18 informs version 2c ruijie    //The IP address of SAM+ is used in
the command.
snmp-server community ruijie rw
```

6.1.7 Restricting the number of authentication-free VLANs

When excessive authentication-free VLANs (more than 50) are configured, the duplication of broadcast or multicast packets will cause high CPU usage of line cards and incur failures. It is recommended that no more than 50 authentication-free VLANs be configured. If more than 50 authentication-free VLANs are required, use security channels or authentication-free sites instead.

Configuration command in global/interface configuration mode: direct-vlan xxx,xxx-xxx (run the **show direct-vlan** command for judgment)

6.1.8 Pruning VLANs configured on downlink interfaces of the RG-N18000

There is a risk on the RG-N18000 on a large Layer-2 network that protocol packets sent from a sub VLAN of the RG-N18000 are flooded to all sub VLANs. Especially in QinQ scenarios, a large number (PE-VLAN quantity x CE-VLAN quantity) of protocol packets will be flooded, which greatly increases the CPU usage of the RG-N18000 and consumes the link bandwidth of the downlink aggregation and access devices. Therefore, it is required to prune unnecessary VLANs on the downlink interfaces of the RG-N18000, to prevent unnecessary resource consumption.

```
DSW-18KX_LX(config-if-AggregatePort 103)#switchport trunk allowed vlan only
100-103,900,3501-3550,4201-4204
```

6.1.9 Configuring the downlink interfaces of the RG-N18000 as routing protocol passive interfaces to prevent resource waste

As described above, it is recommended to reduce CPU resources and link bandwidth of the RG-N18000 consumed by unnecessary protocol packets.

```
DSW-18KX_LX(config-router)#passive-interfac aggregatePort 100
```

6.1.10 Enabling the RG-N18000 to process DHCP relay packets in a case with DHCP snooping enabled

If DHCP snooping is enabled, the RG-N18000 discards DHCP relay packets for address application from the aggregation device. Run the following command to ensure protocol compatibility:

```
DSW-18KX_LX(config)#ip dhcp snooping check-giaddr          //DHCP snooping and DHCP relay
compatibility command. It is used to prevent the DHCP snooping module of the RG-N18000 from
discarding DHCP relay packets.
```

6.1.11 Reducing the number of CE-VLANs created during deployment

If only 50 CE-VLANs are required on the live network, run the **qinq termination ce-vlan 101 to 151** command to create required VLANs. Avoid creating 511 CE-VLANs at a time. More CE-VLANs will result in high CPU usage of the RG-N18000.

6.1.12 Disabling the DHCP guard function via NFPP

Disable the DHCP guard function of NFPP when the device serves as a DHCP relay. Otherwise, some users may fail to obtain IP addresses. NFPP has restrictions on the number of packets transmitted from MAC addresses.

```
Ruijie(config)#nfpp
Ruijie(config-nfpp)# no dhcp-guard enable      //The DHCP guard function can be enabled in interface configuration mode, to control the DHCP relay function on some interfaces.
```

6.1.13 Configuring alarms for easily-missed or error-prone configurations

1. If a message indicating that the entry quantity reaches the limit is displayed when there are only thousands of 802.1x authenticated users and Web authenticated users, check whether the gateway mode is configured (save the configuration and restart the device for the configuration to take effect).

```
Configuration command: auth-mode gateway
Check command: show run | include gateway
```

6.2 Configuration Optimization and Precautions for Aggregation Devices and Access Devices

6.2.1 Configuration Optimization of Aggregation Devices and Access Devices

6.2.1.1 Disabling security functions on the access and aggregation devices in simplistic network scenarios

NAS authentication-related functions (including AAA, Web authentication, and 802.1x authentication) as well as interface security and anti-spoofing security functions (DHCP snooping, ARP check, IP source guard) need to be disabled on the access and aggregation devices in simplistic networks. If such functions are not disabled, they may conflict with the simplistic network solution or unknown bugs may arise, affecting services on the live network.

For example, if 802.1x authentication is enabled on the RG-S21 series devices, 802.1x packets cannot be transparently transmitted to the RG-N18000.

6.2.1.2 Enabling functions on access devices

1. Enable the RLDP function:

```
Ruijie(config-if- FasterEthernet 0/1)#rldp port loop-detect shutdown-port
```

2. Enable the port protection function if there are interfaces belonging to the same VLAN:

```
Ruijie(config-if-FasterEthernet 0/1)# switchport protected
```

3. Enable the storm suppression function. It is recommended that the rate of multicast and broadcast access packets be limited to 30 PPS, which can be adjusted based on actual conditions.

```
Ruijie(config-if-FasterEthernet 0/1)# storm-control multicast pps 30
Ruijie(config-if-FasterEthernet 0/1)# storm-control broadcast pps 30
```

6.2.1.3 Enabling functions on the aggregation device

1. Enable VLAN pruning.
2. Enable the port protection function if there are interfaces belonging to the same VLAN:
3. Enable the storm suppression function. It is recommended that the rate of multicast and broadcast access packets be limited to 1000 PPS, which can be adjusted based on actual conditions.

Note: The aggregation device serves users in a building. Only VLAN pruning and port protection are required if the aggregation device serves users in an area.

6.2.1.4 Enabling port protection on access devices in the access isolation solution, to prevent DHCP spoofing

In the access isolation solution, all interfaces on the access device share the same VLAN and port protection must be enabled. Otherwise, when a private downlink router connected to the access device serves as a DHCP server, DHCP packets are flooded in the above-mentioned VLAN, resulting in DHCP spoofing. It is recommended to replace an access switch that does not support port protection in a project if any.

6.2.1.5 Enabling RLDP on access devices

Loops may occur due to private hub connections. RLDP must be enabled at the access device to. Otherwise, Web authentication or 802.1x authentication packets may be flooded after loops occur, and the CPP of the RG-N18000 reaches the limit. As a result, users throughout the network cannot perform 802.1x authentication or Web authentication. It is recommended to replace an access switch that does not support RLDP in a project if any.

6.2.1.6 Configuring STP and RLDP on access devices to prevent loops in QinQ isolation scenarios

Globally enable STP on each access device, enable BPDU filter on the uplink interface as well as BPDU guard and RLDP on downlink interfaces. The BPDU filter configured on the uplink interface of an access device ensures that STP takes effect only on a single device and topology learning and root bridge election are not performed. When receiving of BPDU packets, the BPDU guard configured on a downlink interface shuts down the downlink interface to prevent loops.

Note: STP does not need to be enabled in the access isolation solution whereas it is mandatory in the QinQ isolation solution, because RLDP may fail to detect loops when one VLAN is configured on each port of the access device in the QinQ scenario.

6.2.2 Precautions for Wireless Device Configuration

6.2.2.1 Disabling the ARP proxy function of the AC globally

The ARP proxy function of the AC is not globally disabled. As a result, the ARP keepalive packets sent by the RG-N18000 are responded to by the AC during migration of authenticated users. The ARP proxy function is enabled by default and needs to be disabled on the AC, so that the gateway ARP proxy function is carried out by the RG-N18000.

```
AC(config)#no proxy_arp enable
```

6.2.2.2 Enabling the layer-2 isolation function for wireless users on the AC to prevent an overlarge broadcast domain

```
AC(config-wids)#user-isolation ac enable
```

6.2.2.3 Creating NFPP trust lists on the AC and adding the gateway MAC address of the RG-N18000 to the trust lists of ARP-guard and DHCP-guard

The user gateway is deployed on the RG-N18000 on simplistic networks. The AC interacts with the RG-N18000 very frequently. As a result, the gateway MAC address of the RG-N18000 is added to the isolation lists by ARP-guard and DHCP-guard of NFPP. Create NFPP trust lists on the AC and add the gateway MAC address of the RG-N18000 to the trust lists of ARP-guard and DHCP-guard.

```
nfpp
arp-guard trusted-host 10.51.0.1 5869.6ca2.9ec
dhcp-guard trusted-host 10.51.0.1 5869.6ca2.9ec
```

6.2.2.4 Ensuring NAS consistency for Web authenticated wireless users

If the NAS of some wireless users is the RG-N18000 while the NAS of other wireless users is the AC, MAB authentication will fail during inter-area roaming and users need to be re-authenticated. In severe cases, information about the same user exists on two NASs, resulting in a charging error.

6.2.2.5 Configuring DHCP snooping + IP source guard + ARP check to prevent ARP spoofing and private IP address configuration of wireless users

802.1x authentication is configured on the AC and the following functions need to be enabled on the AC: DHCP snooping + IP verify source port-security + ARP-check.

Web authentication is configured on the RG-N18000, and static ARP addresses are bound after successful authentication by default, to prevent ARP spoofing. To prevent private IP address configuration, enable the **web-auth dhcp-check** command on the device.

6.3 Scenario Restrictions and Suggestions

6.3.1 Scenario Restrictions

6.3.1.1 MAB authentication does not support static IP addresses by default, but supports manually-added IP addresses.

IP addresses need to be authorized for MAB authenticated users by using the DHCP snooping table, source binding table, or 802.1x binding table of the RG-N18000. Static IP addresses are not contained in the DHCP snooping entries of the RG-N18000 because users of static IP addresses do not exchange DHCP packets. Therefore, no IP addresses can be authorized for MAB authenticated users. As a result, entries with all-zero addresses exist on SAM+. If the **dot1x mac-auth-bypass valid-ip-auth** command is configured, MAB authentication is not initiated.

MAB authentication is normal for manually added static IP addresses, and information about users who use MAC fast authentication needs to be manually added on SAM+. The configuration is as follows:

dot1x address-binding mac 9048.9a8e.a033 ip 10.0.100.188

ip source binding 5656.5656.6654 vlan 10 192.168.1.1 interface gi1/3

6.3.1.2 The aggregation device needs to support selective QinQ in the QinQ isolation solution. Otherwise, the QinQ isolation solution cannot be deployed.

In the QinQ isolation solution, the aggregation device needs to add an outer VLAN to packets with an inner VLAN from access devices. This requires the selective QinQ function. It is necessary to replace aggregation devices that do not support selective QinQ in a project if any.

6.3.1.3 After the AM rule function is enabled, AM rules need to be configured for assigned DHCP network segments throughout the network. Otherwise, the DHCP server cannot assign addresses.

The AM rule function is configured globally. After it is enabled, all DHCP packets sent to the RG-N18000 must match AM rules configured on the RG-N18000. DHCP packets that do not match the AM rules will be discarded.

This problem does not exist if the AM loose mode is enabled using the **match ip loose** command.

6.3.1.4 After the AM rule function is enabled, if the same network segment is configured in two AM rules, address preemption occurs and users who match the AM rule of a smaller address pool may fail to obtain IP addresses.

```
AM rule 1: match ip 192.168.0.0 255.255.0.0 Gi5/3 vlan 1005
AM rule 2: match ip 192.168.6.0 255.255.255.0 Gi5/4 vlan 1006
```

The same IP address segment is configured in AM rule 1 and AM rule 2 and users who match AM rule 1 may preempt IP addresses in the address pool of AM rule 2. As a result, users who match AM rule 2 fail to obtain IP addresses.

It is recommended to avoid overlapped IP address segments in entries of AM rules.

6.3.1.5 If the loose mode of the AM rule function is not configured, some users who do not match AM rules in strict mode cannot be pinged or fail to obtain IP addresses.

```
Ruijie(config)#address-manage
Ruijie (config-address-manage)#match ip loose
```

6.3.1.6 When the AM rule function is enabled on the RG-N18000 serving as a DHCP relay, multiple secondary addresses must be configured for the RG-N18000 and multiple small DHCP address pools must be configured for the DHCP server.

A non-Ruijie device may be used as the DHCP server. The processing logic of the DHCP server is implemented according to RFC standards, and the DHCP server cannot perform refined address assignment according to Ruijie AM rules after only one large address pool is configured. Therefore, multiple small DHCP address pools must be created for the DHCP server based on the gateway address of the RG-N18000, so that the DHCP server is compatible with the AM rules configured on the RG-N18000 serving as a DHCP relay.

For example, if the DHCP relay is enabled on the RG-N18000 and the AM rules need to be used to achieve refined assignment of the DHCP address pool, multiple secondary addresses must be configured for the gateway of the super VLAN on the RG-N18000. If the AM rules are disabled, users can only request IP addresses in the network segment of the primary IP address of the gateway.

```
interface VLAN 4000
ip address 10.168.1.1 255.255.255.0
ip address 172.168.1.1 255.255.255.0 secondary     //If no AM rule is configured, client in the
VLANs corresponding to the network segments of secondary addresses cannot obtain IP addresses.
```

Two address pools need to be created on the DHCP server: 10.168.1.0 255.255.255.0; 172.168.1.0 255.255.255.0.

6.3.1.7 DB cards support 51 CE-VLANs at most, and do not support excessive cascaded access devices in QinQ isolation scenarios.

Incremental IDs need to be assigned to CE-VLANs when access devices are cascaded in QinQ isolation scenarios. DB cards cannot support a number of cascaded switch interfaces greater than 51.

It is recommended to modify the cascading topology, and replace DB cards with ED cards when modifying the cascading topology cannot resolve the problem.

6.3.1.8 The FP entry capacity is limited.

ED cards support up to 7,000 ACLs while DB cards support a maximum of 2,000 ACLs only. All security functions share a fixed total quantity of FP table entries. Therefore, when ACL/PBR-related ACEs are configured, applications of the same category needs to be configured in the same super VLAN rather than on different SVIs. Otherwise, the FP entry capacity may be insufficient. The algorithm is described as follows:

For limitations and calculation methods of the FP entry capacity, see the *TCAM Hardware Resource Calculation Method of Security Functions*. Function groups occupy entries differently. It is required to calculate whether the number of entries reach the limit and how many entries are available in strict accordance with the preceding attachment. Both the configuration and

card type affect the calculations. The following uses the FE entry capacity of the devices used by Xuzhou Medical College as an example to describe the TCAM occupancy.

1. Slice occupancy: Normally, the following five function groups occupy seven slices.

Function Group 3 (802.1x authentication, Web authentication, authentication-free VLANs, extended ACL-based security channels, and authentication-free sites): Occupies two slices and supports a maximum of 256 entries. Available space of this function group = 256 – Occupied space. The available space indicates how many entries can be configured in this function group and only applications in the same category as the function group can be configured.

Function Group 4 (authentication-free sites with ARP): Occupies one slice, and supports a total of 256 entries for DB cards and 512 entries for ED cards.

Function Group 5 (PBR and default route): Occupies two slices, and supports a total of 256 entries for DB cards and 512 entries for ED cards.

Function Group 7 (QinQ VLAN tag termination): Occupies one slice, and supports a total of 256 entries for DB cards and 512 entries for ED cards.

Function Group 8 (QinQ migration): Occupies one slice, and supports a total of 256 entries for DB cards and 512 entries for ED cards.

2. If the DB card is used, only eight slices are available, with each supporting 256 entries. After the five function groups above are configured, there is only one slice available, with the available space of 256 entries.

When there are more than 256 authentication-free VLANs in Function Group 3, this group occupies another two slices.

When the number of authenticated-free VLANs is smaller than 256, they occupy two slices; when the number is greater than 256, they occupy four slices.

For example, if 370 authentication-free VLANs are configured, they occupy four slices. Though five function groups are configured, nine slices are actually required. Therefore, the capacity is insufficient. If entries need to be configured for other function groups in single mode, the available slice can be used for entry delivery.

3. If the ED card is used, 14 slices are available, with each supporting 512 entries. After the five function groups above are configured, there are seven slices available, with each supporting 512 entries. There are two types of available space: one is the available space of the seven occupied slices and such available space supports the configuration delivery of the same function group; the other is the idle seven slices, which can be requested by other function groups.

6.3.1.9 Inter-VSL mirroring in VSU scenarios is limited.

1. The traffic mirrored across chassis cannot be balanced among VSL ports. As a result, all bandwidth of one VSL may be occupied and packets of other service may be discarded.
2. One-to-many mirroring floods the traffic to the mirrored VLAN through the loopback interface. Even if the peer chassis has no member port of the VLAN, mirrored traffic is also flooded to the peer chassis and the traffic cannot be balanced among VSLs. Consequently, all bandwidth of one VSL may be occupied and packets of other services are discarded.

Mitigation measures:

1. Limit the rate of inter-chassis traffic floods, to avoid affecting packets of other services.

2. As far as mirroring is concerned, it is recommended that the mirroring destination port be configured as the inter-chassis AP, which can balance traffic among ports. By default, local forwarding is preferred and traffic is not transmitted through VSLs.

6.3.1.10 In global ACLs, the permit entry does not take effect but the deny entry does.

6.3.1.11 In security channels, the permit entry takes effect but the deny entry does not.

6.3.1.12 The number of management VLANs in an AP cannot be too large in wireless scenarios. It is not recommended that the quantity exceed 512.

6.3.1.13 Wireless 802.1x authentication can be enabled only on the AC and the RG-N18000 does not support wireless 802.1x authentication.

6.3.1.14 It is not recommended to configure the IP source guard and ARP check functions in simplistic network scenarios.

By default, static ARP addresses are bound with authenticated users in simplistic networks, to prevent ARP spoofing. In addition, the IP source guard function occupies FP entries, resulting in entry insufficiency.

6.3.1.15 Restrictions on dumb clients that do not initiate network access actively

In the simplistic network solution, authentication-free VLANs, authentication-free sources, and security channels are configured on the RG-N18000, only clients in authentication-free VLANs can actively access dumb clients that do not actively send packets.

6.3.1.16 Restrictions on adding authentication-free devices to authentication-free VLANs

When excessive authentication-free VLANs (more than 50) are configured, the duplication of broadcast and multicast packets will cause high CPU usage of line cards and incur failures.

7 Common Troubleshooting for Simplistic Networks

7.1 Authentication Page Display Failure During Web Authentication

7.1.1 Symptom

A blank page is displayed, or a prompt indicating that no device is registered is displayed during Web authentication.

7.1.2 Possible Causes

1. The client cannot obtain an IP address, and fails to send HTTP packets.

2. The client obtains an unavailable DNS server, and the domain name fails to be parsed.
3. The redirection parameter, portal key, and source interface configured on the RG-N18000 are inconsistent with those on ePortal.
4. The DHCP check in Web authentication is enabled on an interface and a static IP address is used, resulting in redirection failures.
5. HTTP packets are lost and cannot reach the RG-N18000, and the RG-N18000 fails to perform redirection.
6. Packets cannot reach the Web process, and the RG-N18000 fails to perform redirection.
7. The client cannot communicate with the portal server via packets because of channel exceptions, such as unreachable routes and security device filtering.
8. The ePortal server works abnormally, sending no response packets.
9. If a non-SAM+ server is adopted, the possible cause is that the URL does not meet server requirements and therefore, the Web authentication page does not pop up.
10. The user uses a static IP address, but has the DHCP check in Web authentication configured: **web-auth dhcp-check** or **web-auth dhcp-check vlan xxx**.
11. In version 11.0(1)B3P3, the Web authentication page cannot be displayed and redirection cannot be performed if a static IP address is within the MAB authentication address range.

7.1.3 Handling Steps

1. Check whether the client obtains a correct IP address.
2. Open the browser, enter http://www.ruijie.com.cn and http://183.1.1.1 (the IP address must not exist in the intranet) separately, and observe whether the browser redirects to the URL.

If the browser fails to redirect to the entered website but redirects to the entered IP address, check whether the DNS resolution is normal.

If the redirection fails after the website and IP address are entered or no page pops up after redirection, proceed to the following step.

3. Check whether the configurations on the RG-N18000 and ePortal are correct.

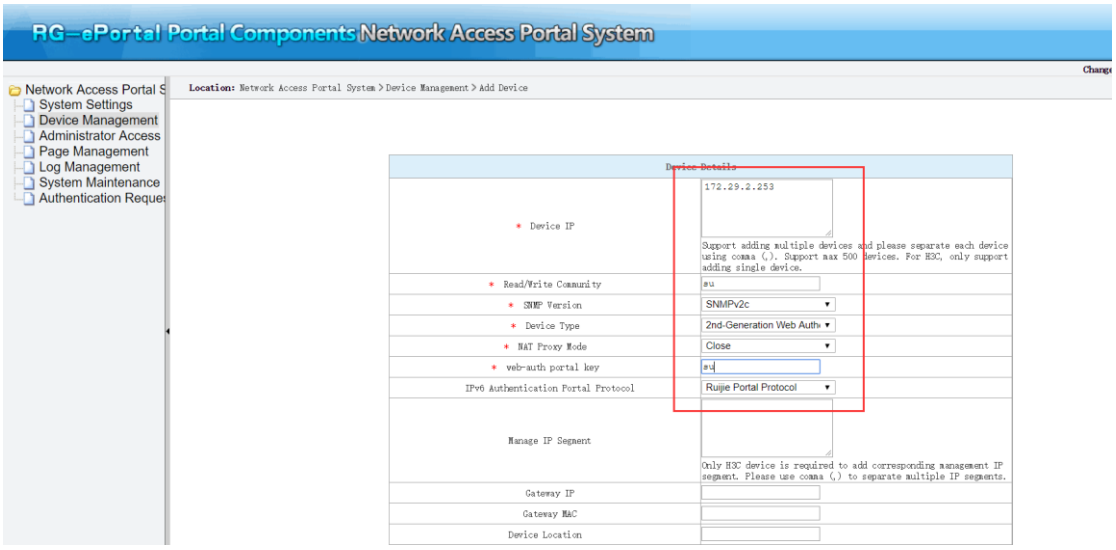
Check whether the redirection configuration is correct on the RG-N18000, and whether the **web-auth portal key** and **IP portal source interface** commands on the RG-N18000 are consistent with those on the ePortal.

```
web-auth template eportalv2      //Create a Web authentication template.
ip 202.204.193.32               //IP address of the ePortal server
url http://202.204.193.32/eportal/index.jsp    //URL of the ePortal server.
web-auth portal key ruijie    //Encrypt the URL. There must be no space at the end of the command.
ip portal source-interface GigabitEthernet 1/24  //The IP address of the interface is 35.0.0.1
configured on the ePortal. Ensure that the route is reachable.
```

Check whether Web authentication is correctly configured on the interface. Ensure that both 802.1x authentication and Web authentication are enabled on a VLAN.

```
interface range GigabitEthernet 0/1  //Configure the interface for enabling Web
authentication.
web-auth enable eportalv2             //Enable Web authentication on the interface.
web-auth vlan-control 2000-3000     //Enable VLAN-based Web authentication.
```

Check whether the configuration on ePortal is consistent with that on the RG-N18000. See the figure below.



4. Check whether DHCP check in Web authentication is enabled on the interface, whether IP DHCP snooping is enabled, and whether the IP address is obtained dynamically. The DHCP check in Web authentication needs to be associated with DHCP snooping entries. If no DHCP snooping binding table is available, the Web authentication redirection will fail.

Command for DHCP check in Web authentication: **web-auth dhcp-check** or **web-auth dhcp-check vlan** *xxx*

5. Run the **show version** command to check whether the RG-N18000 is of version 11.0(1)B3P3. If yes, check whether static IP address MAB authentication is enabled. If a static IP address is within the IP segment range configured by using the **dot1x mac-auth-bypass static-ip-segment** command, the Web authentication page does not pop up and redirection cannot be performed.

6. If the system still fails to redirect to the URL after the steps above are performed, check whether the RG-N18000 receives the packets.

```
show mac-address-table | include ***(MAC address of the user)
show arp | include ****(MAC address of the user)
If no output of the preceding commands is displayed, it indicates that the RG-N18000 does not
receive the packets. If relevant entries are displayed, perform ACL counting or packet capture
for confirmation.
ip access-list extended YYY
10 permit ip host 192.168.1.1 any    //192.168.1.1 is the user IP address.
20 permit ip any any
interface gigabitEthernet    1/1
ip access-group YYY in  //Apply the ACL to the faulty port.
ip access-list counter YYY    //Display the packet count.
```

```
show access-list     //Check whether relevant packet statistics are collected.
```

Example:

```
core(config)#expert access-list extended exp1
core(config-exp-nacl)#20 permit ip host 1.1.1.1 any any any
core(config-exp-nacl)#100 permit ip any any any any
core(config-exp-nacl)#100 permit ip any any any any
core(config-exp-nacl)#exit
core(config)#int te1/1
core(config-if-TenGigabitEthernet 1/1)#expert access-group exp1 in
core(config-if-TenGigabitEthernet 1/1)#exit
core(config)#expert access-list counter exp1
core(config)#show access-lists

expert access-list extended exp1
 20 permit ip host 1.1.1.1 any any any (20)
 100 permit ip any any any any (1000)
core(config)#
```

Packet count

7. Normally, if the system still fails to redirect to the URL after the steps above are performed, collect debugging information on the RG-N18000 based on fault information, and contact the TAC for handling.
8. If the system successfully redirects to the URL but the authentication page does not pop up, check the connectivity between the client and ePortal.

For example, to run the ping command, disable the firewall on the ePortal server and ensure that the firewall on the intermediate link allows access.

9. If the connectivity between the client and ePortal is normal, enable packet capture on both the client and ePortal, record the URL to which the client redirects as well as the logs on the ePortal server, and contact the ePortal R&D engineers for handling.

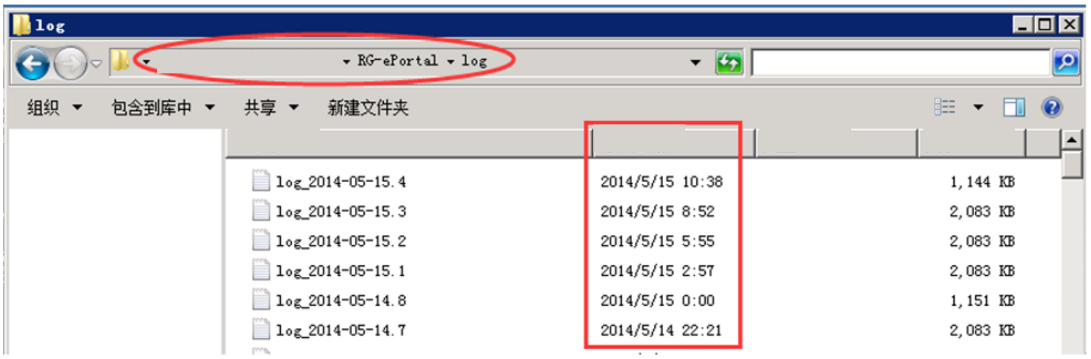
7.1.4 Fault Information Collection

Run the following commands to collect information on the RG-N18000:

```
terminal length 0
show ver detail
show run
show mac-address-table | include ***(MAC address of the user)
show arp | include ****(MAC address of the user)
show ip dhcp snooping
show ip dhcp snooping binding | in H.H.H
debug web-auth cli
show web-auth user name ***
debug web show
```

```
debug web stat
debug scc stat
undebug all
show log
terminal no length
```

The figure below shows the information collected on the ePortal server.



7.1.5 Fault Summary and Notes

The Web authentication page can be popped up in the following steps:

Step 1: The client exchanges HTTP packets with the RG-N18000, which pushes the redirection URL to the client. The client browser redirects to the redirection URL.

Step 2: The client accesses the redirection URL and exchanges packets with the ePortal server.

Therefore, if the client fails to redirect to the URL, the failure occurs between the client and the RG-N18000; if the client redirects to the URL but no page pops up, the failure occurs between the client and the ePortal.

7.2 Web Authentication Failure

7.2.1 Symptom

A Web authentication prompt shows that the authentication fails or the connection to the authentication server times out.

7.2.2 Possible Causes

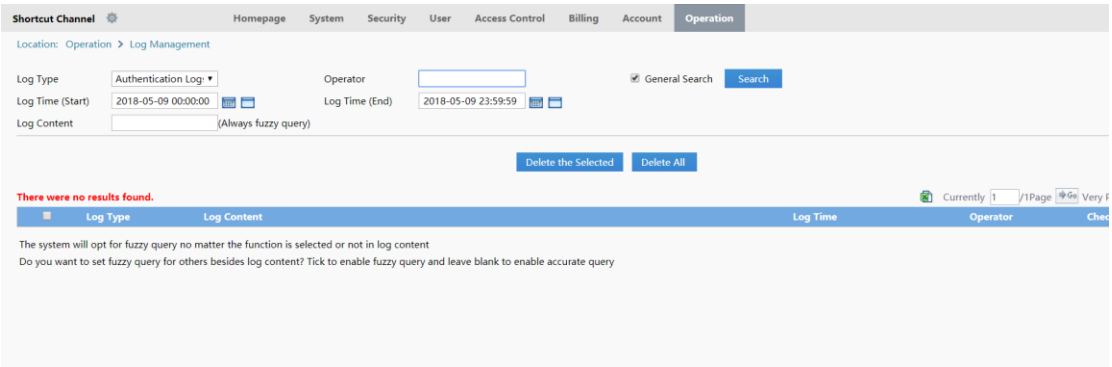
1. The verification conditions of SAM+ are not met.
2. The interconnection configurations between the RG-N18000, ePortal, and SAM+ are inconsistent.
3. The connectivity between the RG-N18000 and ePortal or between the RG-N18000 and SAM+ is abnormal. As a result, packets cannot be exchanged normally.
4. Portal or RADIUS packets cannot be properly processed due to internal errors of the RG-N18000.
5. The ePortal server or SAM+ server malfunctions, causing failures in processing or responding to packets.

6. The RADIUS server is faulty, and both the escape function and the none mode of AAA are configured on the RG-N18000.

7.2.3 Handling Steps

1. Pay attention to the authentication failure prompt on the client page and that on the SAM+ server. Perform basic fault locating based on the prompts and check whether the verification conditions of SAM+ are met.

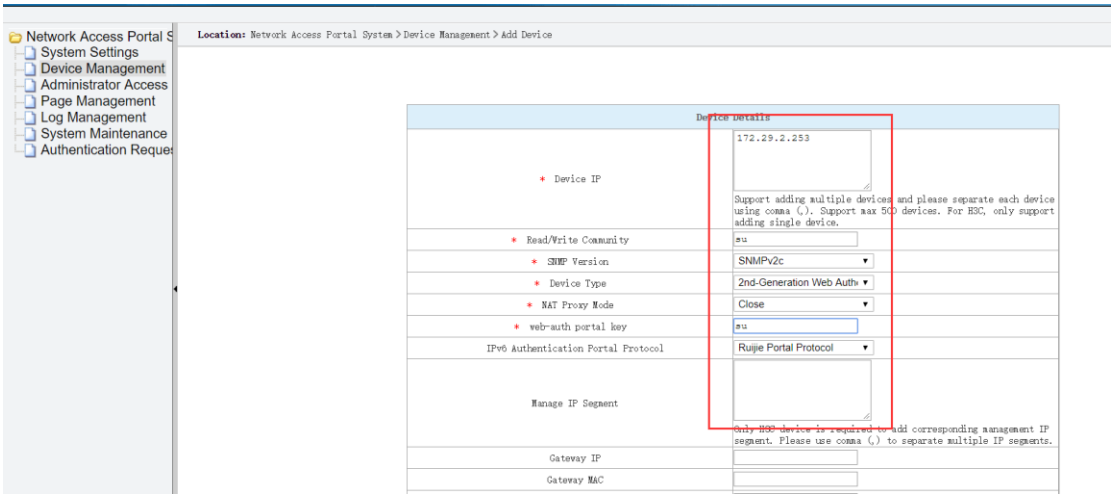
For example, if prompts on the client and SAM+ clearly show that the Web authentication service is not allowed in this area or information verification fails, check the area, service, and access control and make adjustments accordingly on SAM+.

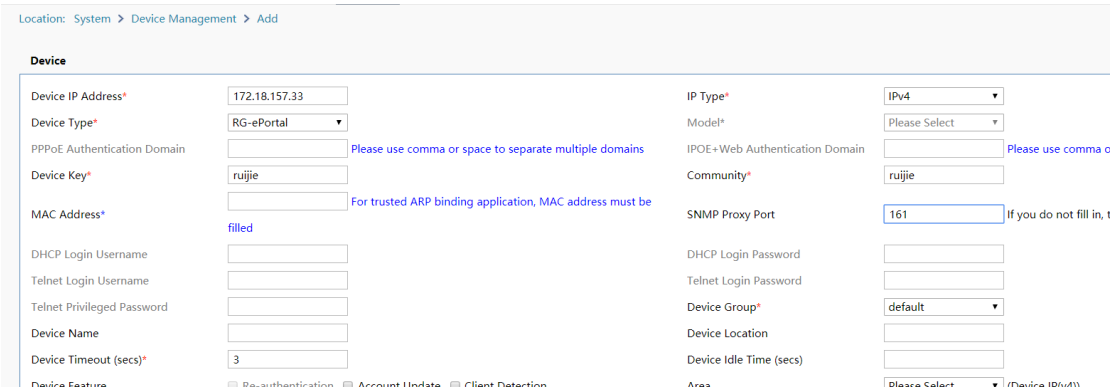


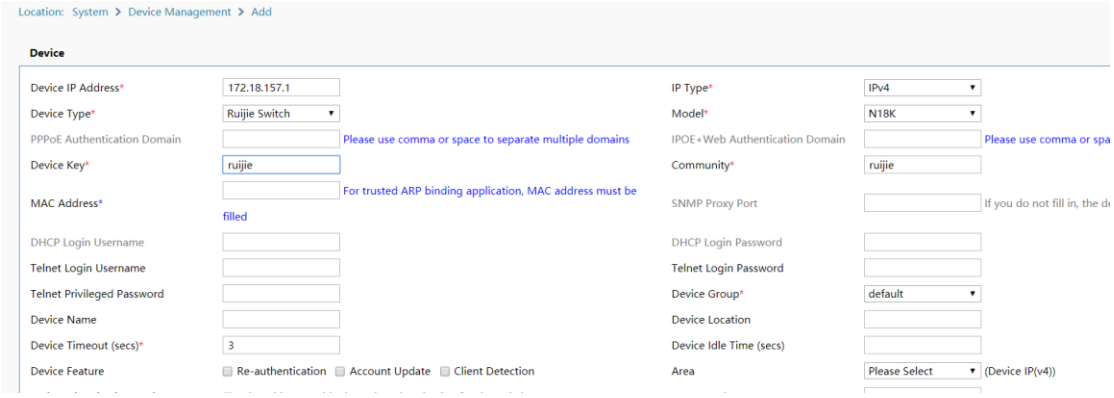
2. Check the device configurations, mainly the RADIUS server configuration, RADIUS key, configurations on SAM+ and ePortal, and IP RADIUS source interface.

```
aaa new-model       //Enable the AAA function.
aaa authentication login default local      //Use the local username/password for login to the AAA device.
radius-server host 172.18.157.32 key  ruijie        //Configure the IP address and key for the AAA server, which are applicable to the scenarios with a single RADIUS server.
aaa accounting network default start-stop group radius      //AAA reference configuration. The actual service deployment prevails.
aaa authentication web-auth default group radius          //Reference configuration for AAA Web template. The actual service deployment prevails.
aaa accounting update                //Configure AAA accounting update.
aaa accounting update periodic 15         //Set the interval for AAA accounting update to 15 min.
aaa authorization ip-auth-mode mixed     //Set the IP address authorization mode of 802.1x clients to the mixed mode. The IP addresses can be obtained via polling in multiple ways (DHCP/RADIUS).
no aaa log enable   //Disable the AAA log function.
web-auth template eportalv2       //Create a Web authentication template.
   ip 172.18.157.33              //IP address of the ePortal server.
   url http://172.18.157.33/eportal/index.jsp    //URL of the ePortal server.
   authentication  default     //Optional. This command is required when the authentication list name for AAA is not set to default.
   accounting  default       //Optional. This command is required when the accounting list name for AAA is not set to default.
```

```
web-auth portal key ruijie     //Mandatory. Configure the Web portal key.
ip radius source-interface GigabitEthernet 1/24   //Configure the source interface for the device to communicate with the RADIUS server. The device address added to SAM+ should be the address of this interface.
ip portal source-interface GigabitEthernet 1/24   //Configure the source interface for the device to communicate with the ePortal server. The device address added to the ePortal server should be the address of this interface.
interface range GigabitEthernet 0/2-3  //Configure the interface for enabling Web authentication.
    web-auth enable eportalv2              //Enable Web authentication on the interface.
    web-auth vlan-control 2000-3000     //Enable VLAN-based Web authentication.
snmp-server host 172.18.157.32 informs version 2c ruijie
snmp-server community ruijie rw
```







3. Ping the server from the RG-N18000 (the ping operation is forbidden if the firewall is enabled on the server). The operation aims to check the connectivity between the IP address of the source interface and the server. If the connectivity test fails, check the network status.

4. If the RG-N18000 is unreachable to the server, check whether the network is normal and then check whether SAM+ is faulty. If SAM+ is faulty, check whether the escape function is configured on the RG-N18000.

Check whether the none mode of AAA is configured in the following case: The SAM+ server is faulty, and the escape function is configured, but the escape function does not take effect and a message is displayed during authentication, indicating that the authentication times out and the device does not respond.

```
SDYY-N18007-Center#sh run | inc radius
web-auth radius-escape
aaa accounting network default start-stop group radius none
aaa authentication dot1x default group radius none
aaa authentication web-auth default group radius none
ip radius source-interface Loopback 0
```

The none mode of AAA enables users to access the Internet without authentication when the RADIUS server is unreachable, provided that "radius-server timeout xxx" is displayed. RADIUS packets are sent at an interval of 5s by default and the default retransmission count is 3. The none mode of AAA is applied 20 seconds later. By default, the packet from ePortal times out when ePortal fails to receive a response within 9 seconds. As a result, the none mode of AAA is not applied when the packet from ePortal times out. The user escape function also fails.

Handling suggestions: 1. Delete the none mode of AAA.

2. Run the following command to set the RADIUS detection duration to a value smaller than the timeout duration (9s) of packets of ePortal: radius-server timeout 2

5. If the configuration is correct and the association is normal, run the following commands on the RG-N18000 to collect information:

```
debug scc stat
debug web-auth cli
sh web user ip ***(ip)  -- Check whether a user using this IP address is online.
sh web syslog ip ***(ip)    --Display the historical Internet access records of the IP address.
show web-auth authmng abnormal
show radius timeout record - Display RADIUS server timeout records.
```

```
show radius auth stat    -- Display statistics relevant to RADIUS authentication. When a fault occurs, run this command several times to check statistical changes.
show radius acct stat  --- Display RADIUS accounting statistics. When a fault occurs, run this command several times to check statistical changes.
```

Capture user authentication packets on the client, ePortal, and SAM+, and submit them to the TAC for handling.

7.2.4 Fault Information Collection

```
terminal length 0
show ver detail
show run
debug scc stat
debug web cli
show mac-address-table | include ***(MAC address of the user)
show arp | include ****(MAC address of the user)
show ip dhcp snooping
show ip dhcp snooping binding | in ****(user MAC address)
sh web user ip ******* (user IP address)
sh web syslog ip ******* (user IP address)
show web-auth authmng abnormal
show radius timeout record
show radius auth stat
show radius acct stat
show log
terminal no length
```

7.2.5 Fault Summary and Notes

7.3 Network Dropout During Web Authentication

7.3.1 Symptom

Web authenticated users are dropped out of the network, cannot access the network, or are prompted for re-authentication.

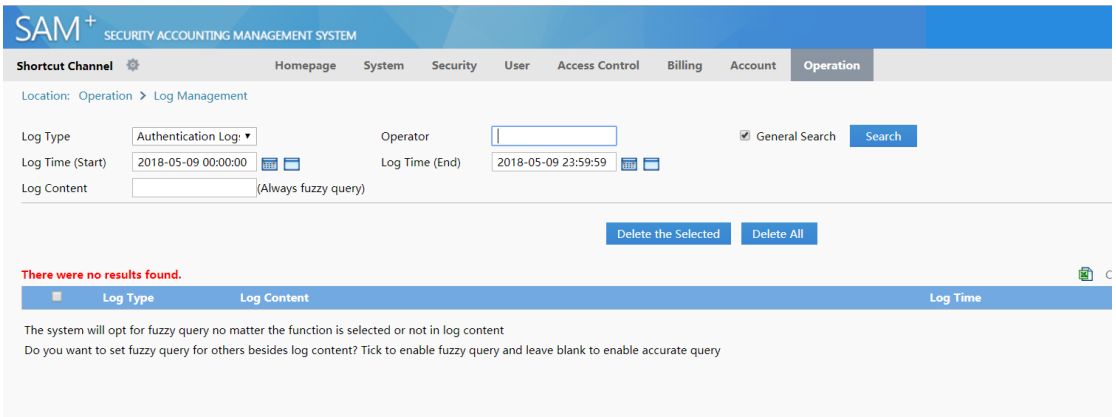
7.3.2 Possible Causes

1. The SAM+ server forces users to go offline, or users go offline due to the change in RG-N18000 configurations.
2. Users go offline due to user preemption behavior.
3. Users go offline because the accounting updates on the RG-N18000 do not match configurations on the SAM+ server.
4. Users generate no traffic within a period of time (code 4, idle timeout).

5. Users go offline for data migration because the environment is abnormal (such as a loop).

7.3.3 Handling Steps

1. Go to the SAM+ system and access **Operation** > **Online User** on the Web management page, locate the user, view the go-offline cause prompt, and find out the possible go-offline causes preliminarily.



Note: The user go-offline prompts provided on SAM+ are accurate, but there may be some errors due to complex network environments.

2. If the device prompts that the user go-offline is caused by no traffic detected, as shown in the figure below, it indicates that SAM+ receives the TCP2009 no traffic notification from the traffic audit device (such as the RSR77, ACE, or EG) and forces the RG-N18000 to bring the user offline.

```
N18K#show web-auth syslog ip 10.1.32.8
Address: 10.1.32.8  Core-index 1 Current index 65
 Index:             57
 Time:              2017-5-31 14:13:57
 Behavior:          ONLINE
 Mac:               c0f2.fb8c.ae8f
 Vid:               350
 Port:              Gi1/4
 Timeused:          0d 00:00:00
 Flow_up:           0
 Flow_down:         0
[usr_syslog_show_byip]  Timestart:        1970-1-1 08:00:00
[usr_syslog_show_byip]  Utype:            3
[usr_syslog_show_byip]  Status:           WBA_USTATE_WAIT_AFF_ACK
[usr_syslog_show_byip]  Event:            WBA_EVENT_AFF_ACK
[usr_syslog_show_byip]  Escape:           0
[usr_syslog_show_byip]  Ipfix_Flow_up:    0
[usr_syslog_show_byip]  Ipfix_Flow_down:  0
[usr_syslog_show_byip]  Costime:          0

 Index:             62
 Time:              2017-5-31 15:05:44
 Behavior:          OFFLINE
 Mac:               c0f2.fb8c.ae8f
 Vid:               350
 Port:              Gi1/4
 Timeused:          0d 00:51:48
 Flow_up:           0
 Flow_down:         0
[usr_syslog_show_byip]  Timestart:        2017-5-31 14:13:57
[usr_syslog_show_byip]  Utype:            3
[usr_syslog_show_byip]  Status:           WBA_USTATE_ONLINE
[usr_syslog_show_byip]  Event:            WBA_EVENT_DHCP_UNBINDING_USER
[usr_syslog_show_byip]  Escape:           0
[usr_syslog_show_byip]  Ipfix_Flow_up:    0
[usr_syslog_show_byip]  Ipfix_Flow_down:  0
[usr_syslog_show_byip]  Costime:          3108
[usr_syslog_show_byip]  acct_upd_cnt:     3
[usr_syslog_show_byip]  time_last_upd:    2017-5-31 14:58:56
[usr_syslog_show_byip]  time_acct_stop:   1970-1-1 08:00:00
[usr_syslog_show_byip]  cause:            Administrator reset the port or session
```

Note: As shown in the figure, the prompt displayed on the RG-N18000 shows that the user is forced to go offline.

If the device prompts that the go-offline cause is code4 (idle value timeout), as shown in the figure below, it indicates that the code value in the accounting stop packet of the RG-N18000 is 4, representing that the RG-N18000 forces the user to go offline because no user traffic is detected.

```
 Index:              20
 Time:               2017-5-9 19:42:02
 Behavior:           ONLINE
 Mac:                c0f2.fb8c.ae8f
 Vid:                100
 Port:               Gi1/3
 Timeused:           0d 00:00:00
 Flow_up:            0
 Flow_down:          0
[usr_syslog_show_byip]  Timestart:        1970-1-1 00:00:00
[usr_syslog_show_byip]  Utype:            3
[usr_syslog_show_byip]  Status:           WBA_USTATE_WAIT_AFF_ACK
[usr_syslog_show_byip]  Event:            WBA_EVENT_AFF_ACK
[usr_syslog_show_byip]  Escape:           0
[usr_syslog_show_byip]  Ipfix_Flow_up:    0
[usr_syslog_show_byip]  Ipfix_Flow_down:  0
[usr_syslog_show_byip]  Costime:          0

 Index:              21
 Time:               2017-5-9 20:07:11
 Behavior:           OFFLINE
 Mac:                c0f2.fb8c.ae8f
 Vid:                100
 Port:               Gi1/3
 Timeused:           0d 00:25:09
 Flow_up:            0
 Flow_down:          0
[usr_syslog_show_byip]  Timestart:        2017-5-9 19:42:02
[usr_syslog_show_byip]  Utype:            3
[usr_syslog_show_byip]  Status:           WBA_USTATE_ONLINE
[usr_syslog_show_byip]  Event:            WBA_EVENT_LOW_FLOW_OFFLINE
[usr_syslog_show_byip]  Escape:           0
[usr_syslog_show_byip]  Ipfix_Flow_up:    0
[usr_syslog_show_byip]  Ipfix_Flow_down:  0
[usr_syslog_show_byip]  Costime:          1509
[usr_syslog_show_byip]  acct_upd_cnt:     1
[usr_syslog_show_byip]  time_last_upd:    2017-5-9 19:57:02
[usr_syslog_show_byip]  time_acct_stop:   2017-5-9 19:40:58
[usr_syslog_show_byip]  cause:            Low flow detected
```

Check the go-offline time and the RG-N18000 configuration based on relevant prompts.

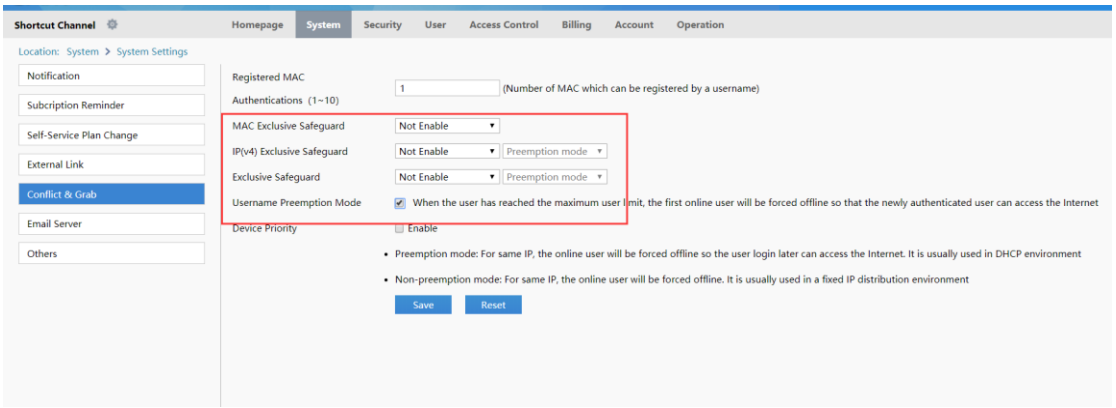
```
offline-detect interval 15 threshold 0        //If no traffic from a user is detected within 15 minutes, the user is brought offline. The RG-N18000 performs judgment by checking whether there is user traffic matching entries in the MAC address table.
offline-detect interval 15 threshold 0 vlan 1000-1500      //Optional. Enable the no-traffic go-offline function for VLANs 1000 to 1500.
```

If the user is brought offline before the go-offline detection interval set on the RG-N18000 expires, the no-traffic go-offline function is initiated by another device. In this case, check the traffic detection function on other associated devices.

For example, the configurations on the RSR77 are as follows:

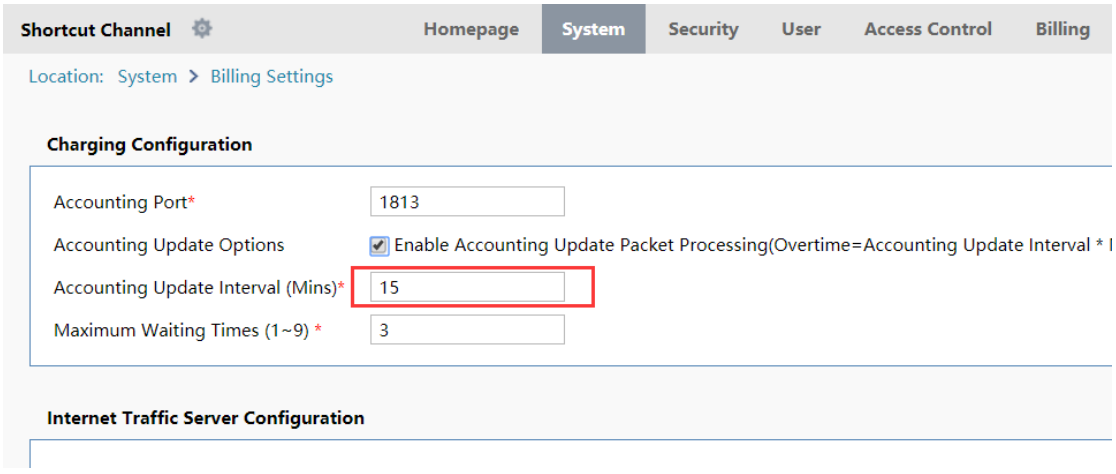
```
sam-acct user keepalive-detect enable      //Enable the keepalive detection function (enabled by default).
sam-acct user keepalive-detect 900        //Force a user to go offline if no traffic from the user is detected within 900 seconds (900 seconds by default).
```

3. If the server prompts that the user is brought offline due to preemption, check the system settings and attributes of accounts, whether the MAC address uniqueness limit is configured, and whether the number of clients is limited.



4. Check whether the accounting update configuration on the RG-N18000 is consistent with that on SAM+.

```
aaa accounting update                //Configure AAA accounting update.
aaa accounting update periodic 15         //Set the interval for AAA accounting update to 15 min.
aaa accounting network default start-stop group radius     //AAA reference configuration. The
actual service deployment prevails.
web-auth template eportalv2
ip 172.18.157.33
url http://172.18.157.33/eportal/index.jsp
authentication default
accounting default    //Enable the accounting update function.
```



5. If the server prompts that the user is brought offline due to migration (VLAN migration, port migration, or VLAN & port migration), check the user go-offline cause on the device. If the device also prompts that the user is brought offline due to migration, as shown in the figure below, check the MAC address of the user.

```
YCXY-LC-N18010#show web syslog ip 10.102.92.163
Address: 10.102.92.163  Core-index 3 Current index 10592
 Index:            11172
 Time:             2017-3-28 20:19:31
 Behavior:         ONLINE
 Mac:              40c6.2a6f.288b
 Vid:              1204
 Port:             Te2/4
 Timeused:         0d 00:00:00
 Flow_up:          0
 Flow_down:        0
[usr_syslog_show_byip]  Timestart:        1970-1-1 08:00:00
[usr_syslog_show_byip]  Utype:            3
[usr_syslog_show_byip]  Status:           WBA_USTATE_ESCAPE_PENDING
[usr_syslog_show_byip]  Event:            WBA_EVENT_NEW_SOCK
[usr_syslog_show_byip]  Escape:           2
[usr_syslog_show_byip]  Ipfix_Flow_up:    0
[usr_syslog_show_byip]  Ipfix_Flow_down:  0
[usr_syslog_show_byip]  Costime:          0

 Index:            11271
 Time:             2017-3-28 20:24:13
 Behavior:         STATION-MOVE
 Mac:              40c6.2a6f.288b
 Vid:              2400
 Port:             Ag20
 Timeused:         0d 00:00:00
 Flow_up:          0
 Flow_down:        0
[usr_syslog_show_byip]  Timestart:        2017-3-28 20:19:31
[usr_syslog_show_byip]  Utype:            3
[usr_syslog_show_byip]  Status:           WBA_USTATE_ONLINE
[usr_syslog_show_byip]  Event:            WBA_EVENT_STATION_MOVE_OFFLINE
[usr_syslog_show_byip]  Escape:           2
[usr_syslog_show_byip]  Ipfix_Flow_up:    0
[usr_syslog_show_byip]  Ipfix_Flow_down:  0
[usr_syslog_show_byip]  Costime:          282
```

Run the **show mac-address-table address ***** and **show arp ***** commands on the device to check whether the VID or port associated with the MAC address changes. If yes, proceed to the following step.

Based on the new VID or port, locate the earliest device that learns the MAC address and pinpoint the cause for MAC address drift.

A loop or IP address spoofing occurs on the downlink device.

7.3.4 Fault Information Collection

Run the following commands to collect information on the RG-N18000:

```
terminal length 0
show ver detail
show run
show mac-address-table | include ***(MAC address of the user)
```

```
show arp | include ****(MAC address of the user)
show ip dhcp snooping
show ip dhcp snooping binding | in ****(user MAC address)
debug scc stat
debug web cli
sh web user ip ***(ip)
sh web syslog ip ***(ip) ---
show web-auth authmng abnormal
debug scc pgsql st  --- Display relevant statistics of the database.
undebug all
show log
terminal no length
```

7.3.5 Fault Summary and Notes

7.4 802.1x Authentication Failure

7.4.1 Symptom

802.1x authentication fails or 802.1x authenticated users are dropped out of the network.

7.4.2 Possible Causes

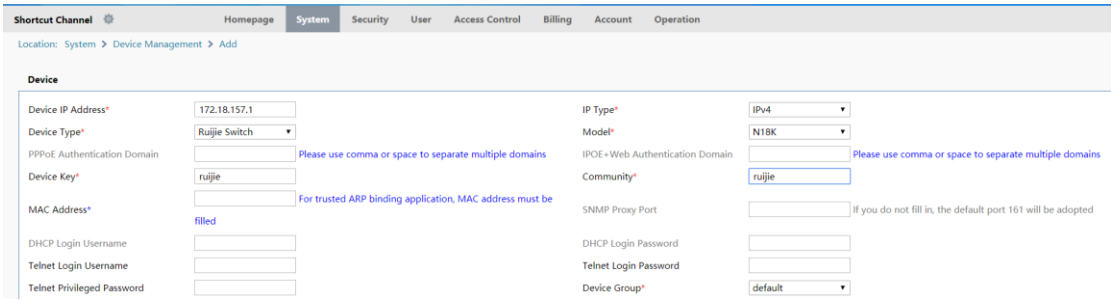
1. The configurations for interconnection between the RG-N18000 and SAM+ server are incorrect. As a result, the RG-N18000 fails to send packets to the SAM+ server, or the SAM+ server fails to process received packets.
2. The channel between the RG-N18000 and SAM+ server is abnormal, and RADIUS packets cannot be sent to the SAM+ server.
3. The channel between the client and the RG-N18000 is abnormal, and EAP packets cannot be sent to the RG-N18000.
4. The configurations are incorrect on the RG-N18000, and the RG-N18000 fails to process or respond to packets.
5. Users fail to obtain correct IP addresses.
6. Software failures occur on the RG-N18000 or SAM+ server, and authentication packets cannot be properly sent or processed.
7. VLAN ports are migrated, and a prompt about active user go-offline is displayed even if the user does not go offline actively (11.0(1)B3P2 and earlier versions).

7.4.3 Handling Steps

1. On the client and SAM+, access **Operation** > **Log**, collect relevant authentication failure prompts, and make basic judgment based on the prompts.

2. If the system is stuck in the connection to the authentication server or a prompt about an authentication server connection failure is displayed during client authentication, check whether 802.1x authentication configurations on the RG-N18000 and SAM+ are correct. If a prompt is provided on SAM+, follow the prompt to complete the configuration. If no prompt is provided on SAM+, check whether the RADIUS server is configured correctly.

```
aaa new-model
radius-server host 192.168.32.120 key 7 ruijie
ip radius source-interface gigabitEthernet 1/24

aaa accounting network default start-stop group radius
aaa authentication dot1x default group radius
aaa accounting update periodic15
aaa accounting update
dot1x accounting default
dot1x authentication default
aaa authorization ip-auth-mode mixed
no aaa log enable
interface FastEthernet 0/1
   dot1x port-control auto
expert access-list extended 2700
  10 permit arp any any
  20 permit udp any any any any eq bootpc
  30 permit udp any any any any eq bootps
security global access-group 2700
```



3. Check whether the connectivity between the IP address of the source interface of the RG-N18000 and SAM+ is normal.

4. If the authentication is stuck in the phase of authentication server searching or a prompt is displayed, indicating that searching for an authentication server fails, check whether the link between the client and the RG-N18000 is normal and whether the 802.1x authentication function is configured on a downlink port connected to the RG-N18000.

Check whether EAP packets are filtered out because 802.1x authentication is enabled on the access-layer S21 series switch, or whether EAP packets are not forwarded because the switch connects to a TP-LINK device.

5. If the fault persists after the steps above are performed, run the following command to collect go-online/offline records, and capture packets on the client and the SAM+ server.

Show dot1x user diag mac xxx

```
VSU-N18K-CORE#show dot1x user diag mac 78e3.b5a5.9cc2
USER-RECORD: 78e3.b5a5.9cc2
Time           ifx    vid  authstate      backstate  paestate   authT    ipT      event           detail
-------------- ------ ---- -------------- ---------- ---------- -------- -------- --------------- ---------
04.26 08:40:43 133    1511 Disconnected   Idle       0x800000   0     ms 0     ms create pae      none
04.26 08:40:44 133    1511 Authenticated  Idle       0x10a39020 643   ms 0     ms pkt start       none
04.26 08:40:44 133    1511 Authenticated  Idle       0x10a39021 643   ms 0     ms acct start      none
04.26 08:41:01 133    1511 Disconnected   Idle       0x13a39021 92    ms 0     ms acct stop       none
VSU-N18K-CORE#
```

```
        As shown in the figure above:
        create pae: Indicates that a user is created.
        pkt start: Indicates authentication initiated by the start packet from the client.
        acct start: Indicates that the authentication is successful and accounting starts.
        acct stop: Indicates that the user goes offline and the accounting stop packet is sent.
    Show dot1x authmng statistics
    Show dot1x authmng mab statistics
    sh ip dhcp snooping binding
```

6. Check whether an IP address can be obtained normally.

```
expert access-list extended 2700
  10 permit arp any any
  20 permit udp any any any any eq bootpc
  30 permit udp any any any any eq bootps
security global access-group 2700
```

After verifying that the configuration above is normal, if an IP address still fails to be obtained, check possible causes and rectify the fault by following the handling procedure of a DHCP fault.

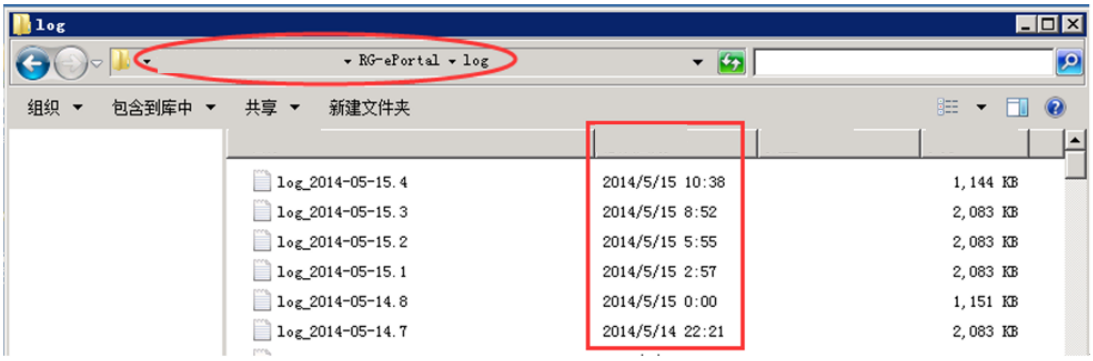
7. If the authentication still fails after the configuration above is adopted, collect information on the RG-N18000, enable packet capture on both the client and SAM+, and send the information and captured packets to the TAC for handling.

7.4.4 Fault Information Collection

```
Run the following commands to collect information on the RG-N18000:
terminal length 0
show ver detail
show run
show mac-address-table | include ***(MAC address of the user)
show arp | include ****(MAC address of the user)
show ip dhcp snooping
show ip dhcp snooping binding | in ****(user MAC address)
show dot1x user diag mac xxx
show dot1x authmng abnormal | in xxx
show dot1x authmng statistic
```

```
show dot1x authmng mab statistic
show dot1x user mac xxx
show dot1x
deb dot1x dump gl
show log
terminal no length
```

The directory for storing logs to be collected on SAM+ is as follows:



7.4.5 Fault Summary and Notes

7.5 Network Dropout During 802.1x Authentication

7.5.1 Symptom

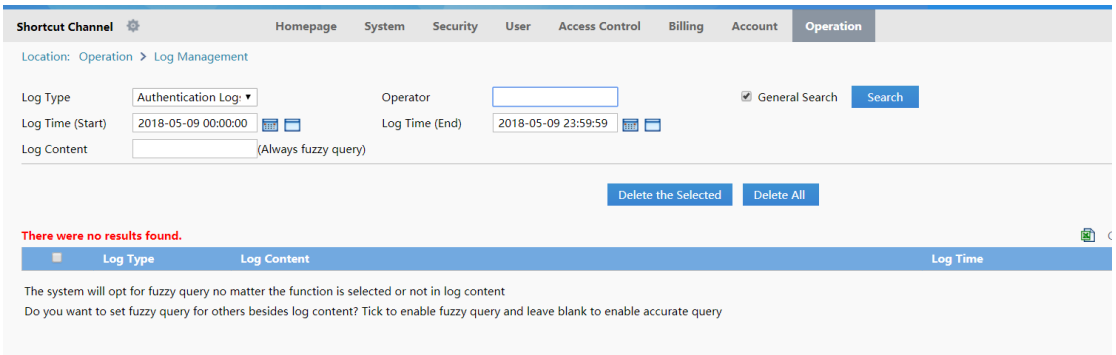
Network Dropout During 802.1x Authentication

7.5.2 Possible Causes

1. Users generate no traffic within a period of time.
2. The client version is not compatible with the SAM+ server version.
3. VLAN ports are migrated, and a prompt about active user go-offline is displayed even if the user does not go offline actively (11.0(1)B3P2 and earlier versions).

7.5.3 Handling Steps

1. Go to the SAM+ system and access Operation > Online User on the Web management page, locate the user, view the go-offline cause prompt, and find out the possible go-offline causes preliminarily.



Note: The user go-offline prompts provided on SAM+ are accurate, but there may be some errors due to complex network environments.

2. If the device prompts that the user go-offline is caused by no traffic detected, as shown in the figure below, it indicates that SAM+ receives the TCP2009 no traffic notification from the traffic audit device (such as the RSR77 or ACE).

If the device prompts that the go-offline cause is code4 (idle value timeout), as shown in the figure below, it indicates that the code value in the accounting stop packet of the RG-N18000 is 4, representing that the RG-N18000 forces the user to go offline because no user traffic is detected.

Check the go-offline time and the RG-N18000 configuration based on relevant prompts.

```
offline-detect interval 15 threshold 0        //If no traffic from a user is detected within 15 minutes, the user is brought offline. The RG-N18000 performs judgment by checking whether there is user traffic matching entries in the MAC address table.
offline-detect interval 15 threshold 0 vlan 1000-1500      //Optional. Enable the no-traffic go-offline function for VLANs 1000 to 1500.
```

If the user is brought offline before the go-offline detection interval set on the RG-N18000 expires, the no-traffic go-offline function is initiated by another device. In this case, check the traffic detection function on other associated devices.

For example, the configurations on the RSR77 are as follows:

```
sam-acct user keepalive-detect enable      //Enable the keepalive detection function (enabled by default).
sam-acct user keepalive-detect 900        //Force a user to go offline if no traffic from the user is detected within 900 seconds (900 seconds by default).
```

3. The RG-N18000 sends the EAP failure packet to the client during user VLAN or port migration. After receiving the packet, the client actively initiates a go-offline request.

Run the **show dot1x authmng abnormal** command to display the user go-offline cause. If it is determined that the fault is caused by port or VLAN migration, run the **show mac-address-table** and **show arp** commands to display the migration information and find out the cause for migration (loop or other causes) to rectify the fault.

```
N18K#show dot1x authmng abnormal
Time           Mac            AuthTime   AaaTout ReqIdTout ReqTout RsnaNtfy StrNtfy Type        Reason             Rssi   User
-------------- -------------- ---------- ------- --------- ------- -------- ------- ----------- ------------------ ------ ----------
5 .10 17:29:36 9048.9a8e.a033 9317       0       1         3       0        0       D1X_AUTH    user logoff        0  dBm ruijie001
5 .10 17:31:55 9048.9a8e.a033 6858       0       1         2       0        0       D1X_AUTH    auth success       0  dBm ruijie001
5 .10 17:32:13 9048.9a8e.a033 2531       0       1         0       0        0       D1X_AUTH    auth success       0  dBm ruijie001
5 .10 17:33:6  9048.9a8e.a033 0          0       2         0       0        0       D1X_AUTH    request id timeout 0  dBm
5 .10 17:39:7  9048.9a8e.a033 0          0       2         0       0        0       D1X_AUTH    request id timeout 0  dBm
5 .10 17:39:9  9048.9a8e.a033 1213       0       0         0       0        0       D1X_AUTH    auth success       0  dBm ruijie001
5 .10 17:39:12 9048.9a8e.a033 2870       0       1         0       0        0       D1X_REAUTH  auth success       0  dBm ruijie001
5 .10 17:41:6  9048.9a8e.a033 2603       0       1         1       0        0       D1X_REAUTH  auth success       0  dBm ruijie001
5 .10 17:42:0  9048.9a8e.a033 2886       0       1         0       0        0       D1X_AUTH    auth success       0  dBm ruijie001
5 .10 17:42:20 9048.9a8e.a033 2498       0       1         1       0        0       D1X_AUTH    auth success       0  dBm ruijie001
5 .10 17:42:32 9048.9a8e.a033 0          0       1         1       0        0       D1X_OFFLINE svr kickout user   0  dBm ruijie001
5 .10 9 :58:45 9048.9a8e.a033 2837       0       1         1       0        0       D1X_AUTH    auth success       0  dBm ruijie001
5 .10 9 :58:51 9048.9a8e.a033 5677       0       3         2       0        0       D1X_REAUTH  auth success       0  dBm ruijie001
5 .10 10:4 :55 9048.9a8e.a033 5752       0       2         1       0        0       D1X_AUTH    auth success       0  dBm ruijie001
5 .10 10:6 :53 9048.9a8e.a033 0          0       2         1       0        0       D1X_OFFLINE svr kickout user   0  dBm ruijie001
N18K#
```

Common causes:

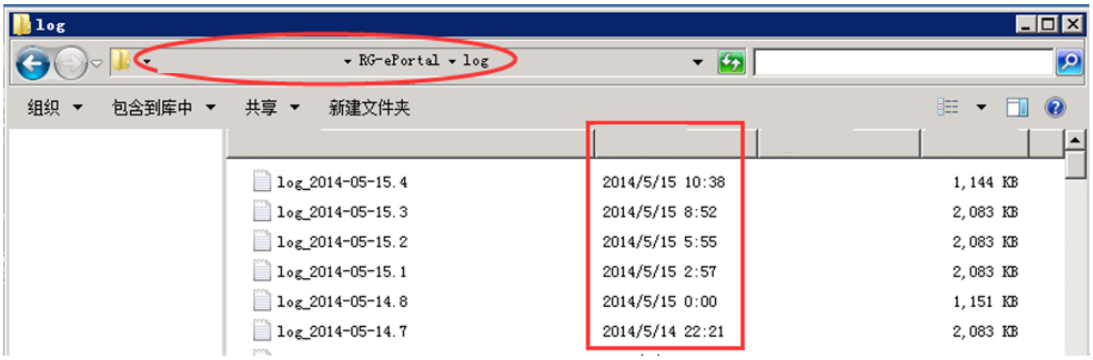
```
"user logoff" : \--->>The client logs out.
"server kickout user" : \--->>The server kicks the user off the network.
"no flow" : \---.>>No traffic is detected.
"port move" : \--->>Port migration occurs.
"vlan move" : \--->>VLAN migration occurs.
"port-vlan move" : \--->>Both port migration and VLAN migration occur.
"invalid ip" : \--->>No valid IP address is available.
```

7.5.4 Fault Information Collection

Run the following commands to collect information on the RG-N18000:

```
terminal length 0
show ver detail
show run
show mac-address-table | include ***(MAC address of the user)
show arp | include ****(MAC address of the user)
show ip dhcp snooping
show ip dhcp snooping binding | in ****(user MAC address)
show dot1x user diag mac xxx
show dot1x authmng abnormal | in xxx
show dot1x authmng statistic
show dot1x authmng mab statistic
show dot1x user mac xxx
show dot1x
deb dot1x dump gl
show log
terminal no length
```

The directory for storing logs to be collected on SAM+ is as follows:



7.5.5 Fault Summary and Notes

7.6 MAB Authentication Failure

7.6.1 Symptom

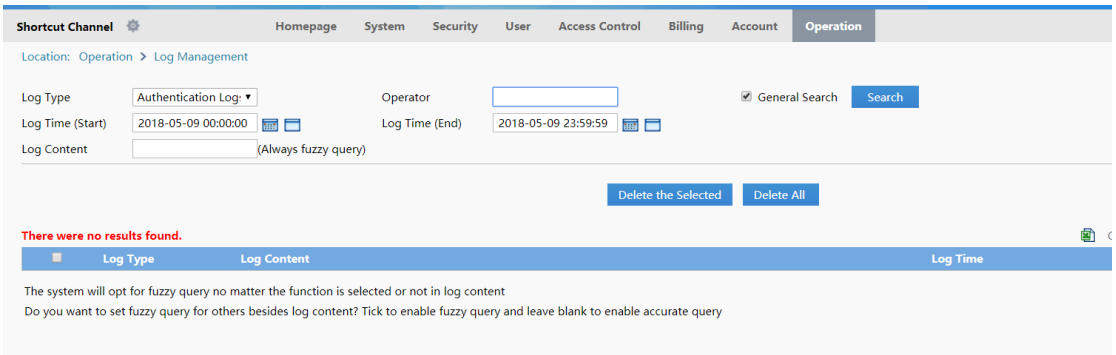
MAB perception-free authentication fails.

7.6.2 Possible Causes

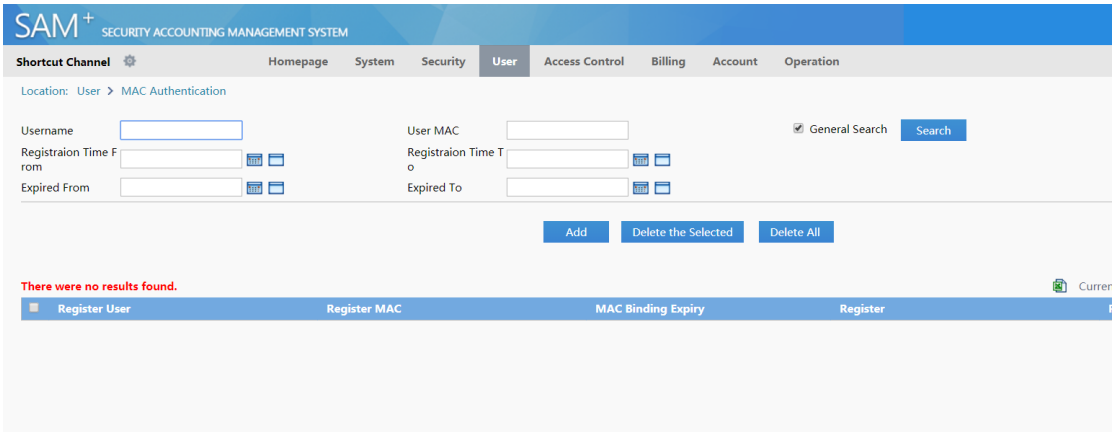
1. MAB perception-free authentication is not enabled on the SAM+ server, and the SAM+ server fails to learn MAC addresses of clients.
2. The RG-N18000 is incorrectly configured, and fails to initiate MAB perception-free authentication.
3. Users fail to obtain correct IP addresses, not meeting the mechanism of **dot1x mac-auth-bypass valid-ip-auth**.
4. The device fails to learn the corresponding MAC address, and does not initiate MAB authentication.
5. Software failures occur on the RG-N18000 or SAM+ server, and MAB perception-free authentication is not initiated or processed properly.

7.6.3 Handling Steps

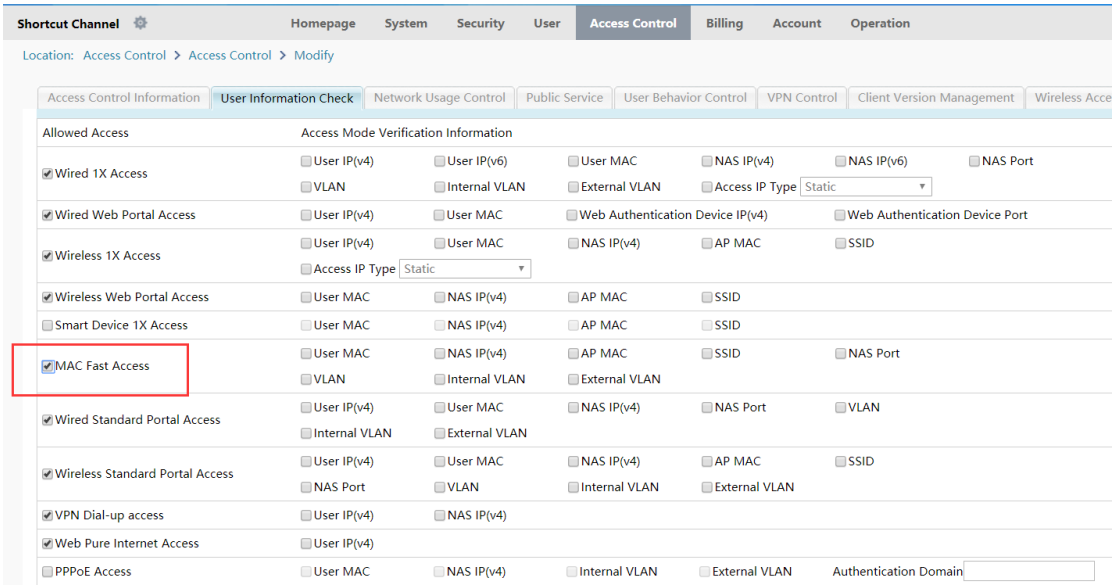
1. On the client and SAM+, access **Operation** > **Log**, collect relevant authentication failure prompts, and make basic judgment based on the prompts. As shown in the figure below, the RG-N18000 initiates MAB authentication but there is no MAB authentication entry on the SAM+ server. As a result, the MAB authentication fails.



As shown in the figure below, access **User** > **MAC Authentication** and check whether binding entries of the username corresponding to the MAC address exist.



Check whether MAC fast authentication is checked for access control.



2. If SAM+ has no authentication failure entry of the MAC address, MAB authentication interaction exceptions may be caused by improper configuration on the RG-N18000.

```
aaa new-model       //Enable the AAA function.
```

```
aaa accounting network default start-stop group radius      //AAA reference configuration. The actual service deployment prevails.
aaa authentication dot1x default group radius        //Reference configuration for AAA 802.1x authentication template. The actual service deployment prevails.
aaa authentication web-auth default group  radius         //Reference configuration for AAA Web authentication template. The actual service deployment prevails.
aaa authentication login default local      //Use the local username/password for login to the AAA device.
radius-server host 172.18.157.32 key ruijie        //Configure the IP address and key for the AAA server, which are applicable to the scenarios with a single RADIUS server.
aaa accounting update periodic 15         //Set the internal for AAA accounting update to 15 min.
aaa accounting update               //Configure AAA accounting update.
no aaa log enable      //Disable the AAA log function.
dot1x accounting default     //Optional. This command is required when the accounting list name for AAA is not set to default.
dot1x authentication default     //Optional. This command is required when the 802.1x authentication list name for AAA is not set to default.
 web-auth template eportalv2
    ip 172.18.157.33               //IP address of the ePortal server
    url http://172.18.157.33/eportal/index.jsp    //URL of the ePortal server.
    authentication  default     //Optional. This command is required when the authentication list name for AAA is not set to default.
    accounting  default      //Optional. This command is required when the accounting list name for AAA is not set to default.
web-auth portal key ruijie    //Mandatory. Configure the key for encrypting the URL for interconnection with ePortal.
aaa authorization ip-auth-mode mixed    //Mandatory. Set the IP address authorization mode of 802.1x clients to the mixed mode. The IP addresses can be obtained via polling in multiple ways (DHCP/RADIUS).
ip dhcp snooping               //Mandatory. An IP address needs to be obtained via the DHCP snooping module for MAB authentication. Otherwise, a user with the IP address of 0.0.0.0 appears on SAM+.
dot1x mac-auth-bypass valid-ip-auth          //The DHCP module instructs the MAB module to start authentication. The configuration of this command will drop users out of the network. It is not recommended to run this command in service peak hours.
dot1x valid-ip-acct enable           //Mandatory. The accounting update packets are used to upload the user IP address to SAM+. If the 802.1x authentication module does not have an IP entry of the user, the user is kicked offline 5 minutes later.
interface range GigabitEthernet 0/2-3  //Enable 802.1x authentication on the interface.
    web-auth enable eportalv2    //Enable Web authentication on the interface.
    dot1x port-control auto      //Enable 802.1x authentication on the interface.
```

```
    dot1x mac-auth-bypass multi-user                    //Mandatory. Enable MAB authentication on the interface.
    dot1x mac-auth-bypass vlan (vlan-list)              //Optional. Configure this command in interface configuration mode to enable VLAN-based MAB authentication.
```

3. After the **dot1x mac-auth-bypass valid-ip-auth** command is configured, dynamic users must obtain IP addresses and relevant entries exist in the DHCP snooping binding table before MAB authentication can be initiated for them.

Run the **show ip dhcp snooping binding** or **show ip dhcp snooping binding | include 192.168.1.1** command to check whether relevant entries are displayed.

If no, check whether the IP address is proper and whether the DHCP process is normal.

If the user IP address is static and there is no DHCP interaction, statically bind entries on the RG-N18000 to trigger MAB authentication. See the following command.

dot1x address-binding mac 9048.9a8e.a033 ip 10.0.100.188

4. If the configuration is correct, run the **show mac-address-table** command to check whether the MAC address is learned successfully. If yes but MAB authentication is not initiated, contact the TAC for handling. If no, enable packet capture to check whether the RG-N18000 receives packets. If yes, contact the TAC for handling.
5. If the cause cannot be pinpointed after the operations above are performed, the software of the RG-N18000 may be faulty, which result in the failure to initiate MAB authentication, or the software of SAM+ may be faulty, which result in the failure in processing of MAB authentication. Collect information on the RG-N18000, enable packet capture on both the client and SAM+, and send the information and captured packets to the TAC for handling.

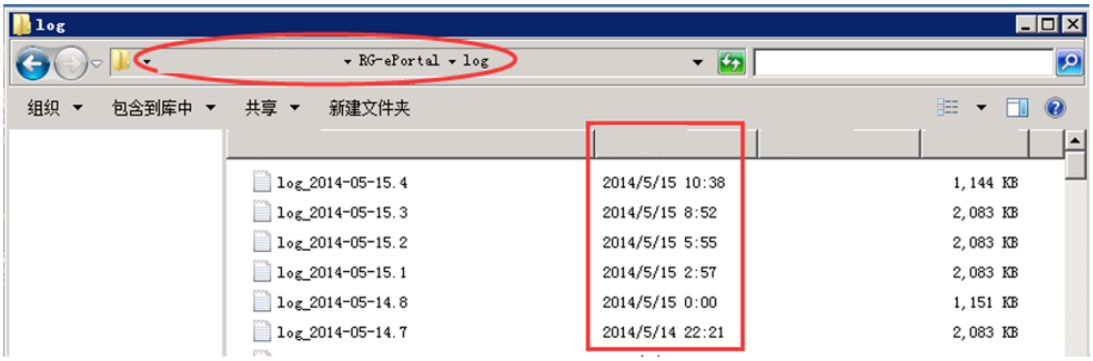
7.6.4 Fault Information Collection

Run the following commands to collect information on the RG-N18000:

```
terminal length 0
show ver detail
show run
show mac-address-table | include ***(MAC address of the user)
show arp | include ****(MAC address of the user)
show ip dhcp snooping
show ip dhcp snooping binding | in ****(MAC address of the user)
show dot1x user diag mac xxx
show dot1x authmng abnormal | in xxx
show dot1x authmng statistic
show dot1x authmng mab statistic
show dot1x user mac xxx
deb web-auth mab user-show
show dot1x
deb dot1x dump gl
show log
```

```
terminal no length
```

The directory for storing logs to be collected on SAM+ is as follows:



7.6.5 Fault Summary and Notes

7.7 Exception/Failure in Dynamic Acquisition of IP Addresses

7.7.1 Symptom

The device fails to dynamically obtain IP addresses or the dynamically obtained IP addresses are abnormal.

7.7.2 Possible Causes

1. The DHCP address pool and sub VLANs are not associated with a super VLAN, and AM rules are incomplete, resulting in IP address allocation failures.
2. Addresses in the address pool are exhausted, and no IP address can be allocated.
3. Only 802.1x authentication is configured on interfaces and no security channel is configured.
4. The intermediate channel fails or ACL configurations are incorrect, and DHCP packets cannot reach the RG-N18000.
5. DHCP snooping is enabled on the downstream switch and the upstream port is not added to the list of trusted ports, and therefore DHCP response packets are dropped.
6. The client is faulty, and DHCP packets cannot be sent or received DHCP packets cannot be processed.
7. The DHCP relay is incorrectly configured on the RG-N18000, or the channel between the gateway and DHCP server is abnormal.
8. The RG-N18000 serves as a DHCP relay, packets between the RG-N18000 and the server are transmitted at layer 2, and the client is not in the same VLAN as the server. As a result, the RG-N18000 does not send packets to the client according to the DHCP snooping binding table.
9. The DHCP server performance is abnormal, resulting in packet processing or response failures.
10. DHCP packets are dropped at the IP layer (founded by displaying the TCP/IP CPU usage).

7.7.3 Handling Steps

1. Check whether the DHCP, super VLAN, gateway interface, and AM rules are correctly configured.

The main DHCP configuration is as follows:

```
ip dhcp pool bangong
lease 0 2 0
network 10.1.32.0 255.255.240.0   //The mask here contains 20 bits.
dns-server 192.168.58.110
default-router 10.1.32.254
```

Note: If the subnet mask of an address in the DHCP address pool contains 20 bits but that of the IP address configured for the gateway interface does not, DHCP needs to be configured based on the network segment to which the subnet mask of the gateway IP address belongs.

The main super VLAN configuration is as follows:

```
vlan 2001
Super VLAN
subvlan 200-399         //Associate the sub VLANs with the super VLAN.
name susheZONE
```

Note: The VLAN of each interface on the client connected to the access switch is a sub VLAN, which needs to be associated with the super VLAN.

The main AM rule configuration is as follows:

```
address-manage                                                    //Enable the address
management function.
     match ip 10.1.5.0 255.255.255.0 gi5/3 vlan 1005         //Configure VLAN+port-based
matching mode.
     match ip 192.168.2.0 255.255.255.0 Gi5/3 vlan 1006
     match ip 192.168.3.0 255.255.255.0 Gi5/3 vlan 1007
     match ip loose                                                    //Set the AM rule to
loose mode. If the loose mode is not configured, clients that do not match the AM rules cannot
obtain IP addresses.
```

Note: The matching of AM rules is matching the interface and VLAN configured in the AM rules, for example, the Gi5/3 interface and VLAN 1005 above. If it is confirmed that DHCP packets are from the Gi5/3 interface and VLAN 1005, the DHCP packets match the AM rules. In this case, the IP address obtained by the user must be in the range of 10.1.5.0 to 10.1.5.255 regardless of whether in loose or strict mode. If no AM rule is matched or IP addresses in the range of 10.1.5.0 to 10.1.5.255 are all assigned, no IP address can be obtained regardless of whether in loose mode or strict mode. If no AM rule is matched, it indicates that neither the interface (for example, Gi5/3) nor VLAN (for example, VLAN 1005) is matched. If no AM rule is matched in loose mode, an IP address outside the DHCP address pool is assigned.

2. Run the **show** command to check whether IP addresses in the DHCP address pool are used up.

Collect basic DHCP information and check whether IP addresses in the DHCP address pool are used up.

show ip dhcp pool

```
86-WS#
86-WS#
86-WS#show ip dhcp pool
Pool  name        Total      Distributed  Remained   Percentage
------------  -----------  -----------  --------   -----------
vlan-71       65533        175          65358      0.26704
vlan-72       65533        0            65533      0.00000
vlan-73       65533        0            65533      0.00000
vlan-74       65533        0            65533      0.00000
```

Number of assigned addresses

Number of available addresses

Address pool usage

Note: If the value in the **Percentage** column is greater than 80%, addresses in the DHCP address pool are to be used up.

show ip dhcp server statistics

```
86-WS#show ip dhcp server statistics
Address pools              7
Lease counter              2958
Dynamic address pools      7
Active  Lease Counter      1625
Expired Lease Counter      1333
Malformed messages         0
Dropped messages           0

Message                    Received
BOOTREQUEST                385431
DHCPDISCOVER               203124
DHCPREQUEST                182307
DHCPDECLINE                0
DHCPRELEASE                0
DHCPINFORM                 0

Message                    Sent
BOOTREPLY                  203124
DHCPOFFER                  203124
DHCPACK                    0
DHCPNAK                    0
```

IP address conflict exists.

Note: Focus on the value of the **DHCPDELINE** field. A larger value indicates more IP address conflicts in the network. This field shows the total number of IP address conflicts since startup. It is recommended to refresh the field every 10 minutes to check whether the value increases greatly. If yes, an IP address conflict occurs.

```
show ip dhcp snooping binding | in H.H.H
```

```
86-WS#show ip dhcp snooping binding
Total number of bindings: 1272
NO.   MACADDRESS         IPADDRESS       LEASE(SEC)   TYPE           VLAN  INTERFACE
----- ---------------- --------------- ------------ ------------- ----- --------------------
1     520c.345c.0529     90.70.3.197     787667       DHCP-Snooping 70    Wlan 1001
2     520c.123a.0191     90.70.0.81      786627       DHCP-Snooping 70    Wlan 1000
3     520c.356a.03df     90.70.4.225     787890       DHCP-Snooping 70    Wlan 1001
4     520c.123a.037b     90.70.0.179     786628       DHCP-Snooping 70    Wlan 1000
5     520c.356a.023b     90.70.4.141     787890       DHCP-Snooping 70    Wlan 1001
6     520c.345c.051f     90.70.3.195     787667       DHCP-Snooping 70    Wlan 1001
7     520c.345c.06af     90.70.4.19      787676       DHCP-Snooping 70    Wlan 1001
8     520c.345c.03b7     90.70.3.123     787668       DHCP-Snooping 70    Wlan 1001
9     520c.123a.053d     90.70.1.13      786628       DHCP-Snooping 70    Wlan 1000
10    520c.123a.0385     90.70.0.181     786628       DHCP-Snooping 70    Wlan 1000
11    520c.345c.0100     90.70.2.240     787665       DHCP-Snooping 70    Wlan 1001
12    520c.134a.028b     90.70.1.225     786893       DHCP-Snooping 70    Wlan 1000
13    520c.345c.03f8     90.70.3.136     787667       DHCP-Snooping 70    Wlan 1001
14    520c.123a.01b9     90.70.0.89      786626       DHCP-Snooping 70    Wlan 1000
15    520c.356a.03f8     90.70.4.230     787890       DHCP-Snooping 70    Wlan 1001
16    520c.345c.026d     90.70.3.57      787666       DHCP-Snooping 70    Wlan 1001
17    520c.345c.0146     90.70.2.254     787665       DHCP-Snooping 70    Wlan 1001
18    520c.356a.0092     90.70.4.56      787888       DHCP-Snooping 70    Wlan 1001
19    520c.134a.00c4     90.70.1.134     786885       DHCP-Snooping 70    Wlan 1000

86-WS#show ip dhcp snooping binding | in
86-WS#show ip dhcp snooping binding | in 520c.345c.0529
1     520c.345c.0529     90.70.3.197     787654       DHCP-Snooping 70    Wlan 1001
86-WS#
```

Total number of DHCP snooping binding entries

DHCP snooping binding entry of a specific MAC address

Note: Pay attention to the value of DHCP snooping binding entries. If DHCP snooping is enabled and the number of entries exceeds the specified limit (256,000), no new DHCP snooping binding entry can be generated. If an entry is displayed, it indicates the MAC address is associated with an IP address.

3. Run the **show ip dhcp server agent mac** *xx.xx.xx* command to display the packet exchange for a client to acquire an IP address.

```
HXJF-N18K#show ip dhcp server agent mac 0010.9400.0061
Hardware address     : 0010.9400.0061
Client status        : running
Discover received    : 10
Request received     : 5
Ack sent             : 5
Decline received     : 0
Release received     : 4
Offer sent           : 10

Events status        : Discover, Offer, Request, Ack
0010.9400.0061 syslog index 6:
IP              State                  Event              Time
10.20.1.55      Idle     --->Checking  Recv_Discover      Mon Jul 10 15:52:19 2017
10.20.1.55      Checking--->Offer      PING_PASS          Mon Jul 10 15:52:20 2017
10.20.1.55      Offer    --->Bind      Recv_Request       Mon Jul 10 15:53:19 2017
10.20.1.55      Bind     --->Idle      Recv_Release       Mon Jul 10 15:58:09 2017
10.20.1.55      Idle     --->Checking  Recv_Discover      Mon Jul 10 15:58:15 2017
10.20.1.55      Checking--->Offer      PING_PASS          Mon Jul 10 15:58:16 2017
10.20.1.55      Offer    --->Bind      Recv_Request       Mon Jul 10 15:59:15 2017
10.20.1.55      Bind     --->Bind      Recv_Request       Mon Jul 10 16:59:15 2017
```

4. Check whether only 802.1x authentication is configured on interfaces, and no security channel is configured. Configure a security channel if none is configured.

expert access-list extended 2700

10 permit arp any any

20 permit udp any any any any eq bootpc

30 permit udp any any any any eq bootps

security global access-group 2700

5. Check whether DHCP packets sent by the client normally reach the RG-N18000.

Manually configure an IP address to ping the gateway to check the connectivity (the ping operation fails if authentication is enabled). Alternatively, run the **debug** command to check whether the RG-N18000 receives the packets, and if no, check the intermediate network.

debug ip dhcp filter mac H.H.H //Run this command so that only packets of a specific MAC address are displayed.

debug ip dhcp server all

Search logs by keywords:

%DHCPD-7-DEBUG: recv dhcp packet from 10.8.8.1 mac 0010.184a.ae10 ifx(4296), l2_port(50), vlan(200), vrf(3) inner_vid (0) vni(0), len=300

--->>This log shows that the DHCP request from the user is received.

%DHCPD-7-DEBUG: send dhcp packet to 10.8.8.1, len=324, ret =324, success!

%DHCPD-7-DEBUG: make ack success, send packet

--->>This log shows that the ACK packet is sent to the user.

6. Check whether the DHCP snooping trust port is correctly configured on the downlink switch.

```
switch#show ip dhcp snooping    //Display the DHCP snooping configuration.
Switch DHCP snooping status                    :   ENABLE
DHCP snooping Verification of hwaddr status     :   DISABLE
DHCP snooping database write-delay time         :   0 seconds
DHCP snooping option 82 status                 :   DISABLE
DHCP snooping Support bootp bind status         :   DISABLE
Interface                      Trusted         Rate limit (pps)
------------------------        -------         ----------------
GigabitEthernet 1/2             YES             unlimited
Default                                No              unlimited
```

Note: Check whether relevant uplink ports are configured as trusted ports and whether a rate limit is configured on downlink ports.

7. Enable the debug function on the RG-N18000, and check the packet interaction based on ACL counting (capture packets on the downlink port of the RG-N18000 if condition permit) and packet capture on the client.

expert access-list extended exp1

20 permit udp any host 1111.1111.1111 any any range bootps bootpc (Replace "1111.1111.1111" with the user MAC address.)

90 permit etype-any any any

100 permit ip any any any any

int te1/1 (faulty port)

expert access-group exp1 in

exit

expert access-list counter exp1

show access-list --(Check whether packet statistics are collected.)

The digit enclosed in the red rectangle indicates that 10 DHCP packets are received.

```
core(config)#expert access-list extended exp1
core(config-exp-nacl)#$ost 1111.1111.1111 any any range bootps bootpc
core(config-exp-nacl)#90 permit etype-any any any
core(config-exp-nacl)#100 permit ip any any any any
core(config-exp-nacl)#exit
core(config)#int te1/2/1
core(config-if-TenGigabitEthernet 1/2/1)#expert access-group exp1 in
core(config-if-TenGigabitEthernet 1/2/1)#exit
core(config)#expert access-list counter exp1
core(config)#show access-lists

mac access-list extended 700
 10 permit any any etype-any

expert access-list extended exp1
 20 permit udp any host 1111.1111.1111 any any range bootps bootpc  (10)
 90 permit etype-any any any  (3)
 100 permit ip any any any any  (40)
core(config)#
```

If the client sends out packets but the RG-N18000 does not receive the packets, check whether the intermediate network is reachable.

If the RG-N18000 receives the packets but no relevant log output or response log is generated for the **debug** command, contact the TAC for handling.

If the RG-N18000 returns a response but the client does not receive it, check whether the intermediate network is reachable (check whether ACL or DHCP snooping is configured).

8. If DHCP relay is configured on the RG-N18000, packet interaction between the gateway IP address of the access client and the DHCP server is abnormal due to unreachable route or firewall errors.

On the RG-N18000, ping the DHCP server from the source IP address, to check whether the DHCP server is reachable.

9. The RG-N18000 serves as a DHCP relay, packets between the RG-N18000 and the server are transmitted at layer 2, and the client is not in the same VLAN as the server. As a result, the RG-N18000 does not send packets to the client according to the DHCP snooping binding table.

The principles are described as follows:

1. The client is configured on VLAN 60 and the WDS server is configured on VLAN 2.
2. The client with the IP address of 192.168.60.2 from VLAN 60 sends the DHCP-Request packet to the WDS server with the IP address of 192.168.0.65. When the packet passes through the DHCP snooping module of the core device, a temporary entry containing the MAC address + VLAN 60 is recorded.
3. When the WDS server from VLAN 2 responds to the client with the DHCP-ACK packet, the core device uses MAC address + VLAN 2 for matching in the DHCP snooping table but fails to find the temporary entry. As a result, the packet is directly sent to SVI2 and the client fails to receive the DHCP-ACK packet.

Solution: Run the **no ip dhcp snooping vlan 2** (server VLAN) command on the core device.

10. Capture packets for interaction between the client and the RG-N18000. Capture packets of the RG-N18000 and the DHCP server.

7.7.4 Fault Information Collection

Run the following commands to collect information on the RG-N18000:

```
debug ip dhcp filter mac H.H.H   //Run this command so that only packets of a specific MAC address
are displayed.
debug ip dhcp server all
terminal length 0
show ver detail
show run
show ip dhcp pool
show ip dhcp server statistics
show arp | include ***
sho mac-address-table | include ***
show ip dhcp snooping binding

show ip dhcp snooping binding | in H.H.H
show ip dhcp server agent mac xx.xx.xx   (supported in version 11.0(1)B3P3)
show nfpp dhcp-guard host
show ip dhcp relay-statistics
show ip dhcp conflict
show log
show interface counters rate
show interface counters summary
terminal no length
```

7.7.5 Fault Summary and Notes

7.8 Failure to Access the Internet or Internet Access Stalling After Authentication

7.8.1 Symptom

A user fails to access the Internet or the Internet access is stalling after authentication.

7.8.2 Possible Causes

1. The authentication fails or the user goes offline immediately after successful authentication.

2. A loop in the downlink device causes random packet loss between the client and the gateway.
3. A static IP address is configured for the client and AM rules are configured. Packets are discarded when no AM rule is met.
4. Packets are discarded due to improper routing of the RG-N18000 or intermediate device.
5. Some packets are discarded due to very high CPU usage of the device, and incorrect VLAN tags are added to packets due to software bugs.

7.8.3 Handling Steps

1. On the RG-N18000, run the **show web-auth user name ***** and **show dot1x user name*** ** commands to check whether the user is online. In addition, access **Operation** > **Online User** on SAM+ to check whether there are online users.

If the user is offline, rectify the fault based on authentication symptoms by referring to authentication failure troubleshooting procedures. If the user is online, proceed to the following step.

2. Check the port rate or logs and check whether there are loops. If a loop exists, rectify the fault by referring to the loop locating manual.

See the *Procedure for Layer-2 Loop Problem Locating in Simplistic Networks*.

3. If the IP address is manually configured, check the AM configuration.

In loose mode, data forwarding is allowed for manually configured normal IP addresses regardless of whether the IP addresses are within the AM range.

In strict mode, data forwarding is allowed for manually configured IP addresses that are within the AM range.

4. Check relevant routing entries on the RG-N18000 to check whether more detailed routes are learned from other devices.
5. Locate the packet loss point based on ACL-based packet counting or packet capture.

Enable ACL-based packet counting on the RG-N18000 (enable packet capture for troubleshooting if conditions permits).

expert access-list extended exp1

20 permit arp host 1111.1111.1111 any //Check whether ARP packets are received. Replace "1111.1111.1111" with the user MAC address.

40 permit icmp host 1.1.1.1 any any any //Check whether the ICMP packets are received. Replace "1.1.1.1" with the user IP address.

90 permit etype-any any any

100 permit ip any any any any

int te1/2/1 //te1/2/1 is the ingress of the RG-N18000.

expert access-group exp1 in

expert access-list counter exp1 //Enable packet counting for an ACL named exp1.

```
core(config)#show access-lists

expert access-list extended exp1
 20 permit arp host 1111.1111.1111 any  (4)
 40 permit icmp host 1.1.1.1 any any any  (15)
 90 permit etype-any any any  (3)
 100 permit ip any any any any  (40)
core(config)#
```

The ACL-based packet count above shows whether ARP packets or ICMP packets are lost.

If the RG-N18000 does not receive the ARP packets or ICMP packets, check whether the access and aggregation links of the downlink port are faulty.

If the RG-N18000 receives the ARP packets or ICMP packets, check whether ACLs or AM rules for filtering out ARP or ICMP packets are configured.

If no filtering is configured, run the **debug arp ip +** *user IP address* command to check whether ARP packets are sent to the IP layer. Run the **un al** command to disable the debug function, as shown in the figure below.

```
core#debug arp ip 1.1.1.1
*May 16 16:48:24: %SYS-5-CONFIG_I: Configured from console by console
core#*May 16 16:48:28: %P1143-7-DEBUG: ARP:recv request src 1.1.1.1 00d0.f822.33d3; dst 1.1.1.2
0000.0000.0000; TenGigabitEthernet 1/2/5, subvlan 0, inner_vid 0
*May 16 16:48:28: %P1143-7-DEBUG: ARP:send reply src 1.1.1.2 00d0.f822.33bb; dst 1.1.1.1 00d0.f822.33d3;
TenGigabitEthernet 1/2/5, subvlan 0, inner_vid 0
*May 16 16:48:28: %P1143-7-DEBUG: ARP:send request src 1.1.1.2 00d0.f822.33bb; dst 1.1.1.1 00d0.f822.33d3;
TenGigabitEthernet 1/2/5, subvlan 0, inner_vid 0
*May 16 16:48:28: %P1143-7-DEBUG: ARP:recv reply src 1.1.1.1 00d0.f822.33d3; dst 1.1.1.2 00d0.f822.33bb;
TenGigabitEthernet 1/2/5, subvlan 0, inner_vid 0
core#un al
```

If ARP packets are not sent to the IP layer or the RG-N18000 does not send out the response from the IP layer, contact the TAC to rectify the fault by using the frame path method.

6. If the ping result shows that no packet loss occurs but it is slow in opening websites and some websites even cannot be opened, check whether only some websites or all websites have the same problem. If only some websites encounter this problem, such websites may be faulty.

If most websites and even some famous websites have this problem, connect the client to the uplink device of the RG-N18000 for testing. If the fault persists, check the uplink device or enable packet capture on the border router to check whether packets are sent out and whether responses are received.

If the Internet access is normal, check whether the RG-N18000 receives and forwards packets normally based on the ACL-based packet counting or packet capture in the inbound direction of the uplink interface or outbound direction of the downlink interface of the RG-N18000.

```
expert access-list extended exp1
20 permit ip host 1.1.1.1 any any any    (Replace "1.1.1.1" with the actual website IP address.)
90 permit etype-any any any
100 permit ip any any any any
```

```
int te1/2/1              //Uplink interface of the RG-N18000
expert access-group exp1 in
int te1/2/1              //Downlink interface of the RG-N18000
expert access-group exp1 out
expert access-list counter exp1
show access-lists
```

Note: Compare the inbound packets and outbound packets counted based on ACLs to check whether the RG-N18000 forwards packets normally.

7. If packet exchange is normal and an MSC card is configured, check whether PBR is configured and whether the configured uplink and downlink paths are consistent. See the figure below.

```
route-map pbr-upload permit 10
 match ip address upload
 set ip policy load-balance src-ip
 set ip policy no-ttl-decrease
 set ip next-hop 10.10.10.2
!
route-map pbr-download permit 10
 match ip address download
 set ip policy load-balance dst-ip
 set ip policy no-ttl-decrease
 set ip next-hop 10.10.20.2
!
```

For specific configuration, see the *Typical Configuration Cases of MSC Cards in Simplistic Networks*.

If the configured paths are inconsistent, the MSC card discards packets because the packets fail the TCP connection validity check.

If the configuration is free of errors, compare whether the number of packets received by the downlink interface of the RG-N8000 is consistent with that sent by the uplink interface of the RG-N18000 by using the ACL-based packet counting method.

7.8.4 Fault Information Collection

1. Record fault symptoms clearly, including the fault scope, packet loss frequency, fault pattern, and whether the network is changed before the fault.
2. Clarify the network topology so that the TAC learns about the environment, which is conducive to troubleshooting.

7.8.5 Fault Summary and Notes

1. Record fault symptoms clearly, including the fault scope, packet loss frequency, fault pattern, and whether the network is changed before the fault.
2. Clarify the network topology so that the TAC learns about the environment, which is conducive to troubleshooting.
3. Locate the packet loss point based on ACL-based packet counting or packet capture.
4. Check the configuration or work with the TAC to pinpoint the packet loss cause.

7.9 ACL Statistics Scripts of the Troubleshooting Tool

ACL statistics scripts for:

1. ARP-based packet statistics
2. ICMP-based packet statistics
3. IP-based packet statistics
4. TCP-based packet statistics
5. UDP-based packet statistics
6. MAC-based packet statistics

1. ARP-based packet statistics

expert access-list extended exp1

```
   20 permit arp host 1111.1111.1111 any   (Check whether ARP packets are received. Replace
"1111.1111.1111" with the actual user MAC address.)
   90 permit etype-any any any
   100 permit ip any any any any
   exit
int te1/2/1           (te1/2/1 is the ingress of the RG-N18000.)
   expert access-group exp1 in
   exit
expert access-list counter exp1
show access-lists
```

```
expert access-list extended exp1
    20 permit arp host 1111.1111.1111 any
    90 permit etype-any any any
    100 permit ip any any any any
    exit
int te1/2/1
    expert access-group exp1 in
    exit
expert access-list counter exp1
show access-lists

expert access-list extended exp1
 20 permit arp host 1111.1111.1111 any (4)
 90 permit etype-any any any (3)
 100 permit ip any any any any (40)
core(config)#
```

2. ICMP-based packet statistics

expert access-list extended exp1

```
   40 permit icmp host 1.1.1.1 any any any  (Check whether ICMP packets are received. Replace
"1.1.1.1" with the actual user IP address.)
   90 permit etype-any any any
   100 permit ip any any any any
   exit
int te1/2/1           (te1/2/1 is the ingress of the RG-N18000.)
   expert access-group exp1 in
   exit
expert access-list counter exp1
show access-lists
```

```
expert access-list extended exp1
    40 permit icmp host 1.1.1.1 any any any
    90 permit etype-any any any
    100 permit ip any any any any
    exit
int te1/2/1
    expert access-group exp1 in
    exit
expert access-list counter exp1
show access-lists

expert access-list extended exp1
 40 permit icmp host 1.1.1.1 any any any (4)
 90 permit etype-any any any (3)
 100 permit ip any any any any (40)
core(config)#
```

3. IP-based packet statistics

```
expert access-list extended exp1
     20 permit ip host 1.1.1.1 any any any  (Replace "1.1.1.1" with the actual user IP address.)
     90 permit etype-any any any
100 permit ip any any any any
        exit
        int te1/2/1 (faulty port)
            expert access-group exp1 in
         exit
           expert access-list counter exp1
           show access-list  --(Check whether packet statistics are collected.)
```

```
core(config)#expert access-list extended exp1
core(config-exp-nacl)#20 permit ip host 1.1.1.1 any any any
core(config-exp-nacl)#100 permit ip any any any any
core(config-exp-nacl)#100 permit ip any any any any
core(config-exp-nacl)#exit
core(config)#int te1/1
core(config-if-TenGigabitEthernet 1/1)#expert access-group exp1 in
core(config-if-TenGigabitEthernet 1/1)#exit
core(config)#expert access-list counter exp1
core(config)#show access-lists

expert access-list extended exp1
 20 permit ip host 1.1.1.1 any any any (20)
 100 permit ip any any any any (1000)
core(config)#
```

Packet count

4. TCP-based packet statistics

```
expert access-list extended exp1
        20 permit tcp host 1.1.1.1 any any any  (Replace "1.1.1.1" with the actual user IP
address.)
      90 permit etype-any any any
100 permit ip any any any any
         exit
         int te1/2/1 (faulty port)
             expert access-group exp1 in
          exit
            expert access-list counter exp1
            show access-list  --(Check whether packet statistics are collected.)
```

```
expert access-list extended exp1
    20 permit tcp host 1.1.1.1 any any any
    90 permit etype-any any any
    100 permit ip any any any any
    exit
int te1/2/1
    expert access-group exp1 in
    exit
expert access-list counter exp1
show access-lists

expert access-list extended exp1
 20 permit tcp host 1.1.1.1 any any any (4)
 90 permit etype-any any any (3)
 100 permit ip any any any any (40)
core(config)#
```

5. UDP-based packet statistics

```
expert access-list extended exp1
        20 permit udp host 1.1.1.1 any any any  (Replace "1.1.1.1" with the actual user IP
address.)
      90 permit etype-any any any
100 permit ip any any any any
         exit
         int te1/2/1 (faulty port)
             expert access-group exp1 in
          exit
            expert access-list counter exp1
            show access-list  --(Check whether packet statistics are collected.)
```

```
expert access-list extended exp1
    20 permit tcp host 1.1.1.1 any any any
    90 permit etype-any any any
    100 permit ip any any any any
    exit
int te1/2/1
    expert access-group exp1 in
    exit
expert access-list counter exp1
show access-lists

expert access-list extended exp1
 20 permit udp host 1.1.1.1 any any any (4)
 90 permit etype-any any any (3)
 100 permit ip any any any any (40)
core(config)#
```

6. MAC-based packet statistics

```
mac access-list extended mac1
      20 permit host 1111.1111.1111 any
      100 permit any any
      exit
int te1/2/1
      expert access-group mac1 in
      exit
mac access-list counter mac1
show access-lists            show access-list  --(Check whether packet statistics are
collected.)
```

```
expert access-list extended exp1
    20 permit host 1111.1111.1111 any
    100 permit any any
    exit
int te1/2/1
    expert access-group mac1 in
    exit
mac access-list counter mac1
show access-lists

mac access-list extended mac1
 30 permit host 1111.1111.1111 any etype-any (10)
 100 permit any any etype-any (50)
core(config)#
```

7.10 Layer-2 Loop Problem Locating in Simplistic Networks

7.10.1 Check RLDP logs.

Run the following command to check RLDP logs to preliminarily locate the ports and VLANs experiencing the loop: show rldp loop-detect-log,

```
Ruijie#sh rldp loop-detect-log
rldp vlan loop log
-----------------------------------
 Fri Mar 31 06:06:28 2017
    VLAN 1 is detected loop on interface TenGigabitEthernet 3/6.
 Fri Mar 31 06:08:04 2017
    VLAN 1 is detected loop on interface TenGigabitEthernet 3/14.
 Fri Mar 31 06:08:07 2017
    VLAN 1 is detected loop on interface TenGigabitEthernet 3/14.
```

7.10.2 Find out the ports and VLANs that encounter the loop.

Run the **rldp reset** and **show rldp** commands several times and check the **neighbor** field. Check whether the VLANs and ports change each time after the **rldp reset** command is executed, in an effort to determine the loop type (see the figure below).

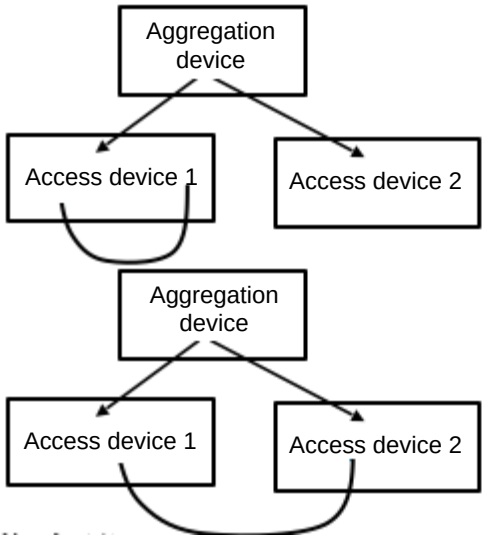
```
Ruijie#rldp reset
*Mar 31 06:23:16: %RLDP-3-LINK_DETECT_RECOVER: Interface TenGigabitEthernet 3/14 reco
vered from loop error.
Ruijie#*Mar 31 06:23:19: %RLDP-3-LINK_DETECT_ERROR: VLAN 1 is detected loop on interf
ace TenGigabitEthernet 3/14.
*Mar 31 06:23:19: %RLDP-3-LINK_DETECT_ERROR: Detected loop error on interface TenGiga
bitEthernet 3/14.isolate-vlan.
```

```
Ruijie#sh rldp interface te3/14
port state       : error
local bridge     : 00d0.f822.33e4
neighbor bridge  : 00d0.f822.33e4
neighbor port    : TenGigabitEthernet 3/6
vlan-loop detect information:
     error  vlan: 1
     action: isolate-vlan
     state : error
```

7.10.3 Take measures based on the following cases:

7.10.3.1 Same VLAN and same port

The VLANs and ports causing the loop can be determined after the operations above are performed. If the VLANs and ports keep unchanged after the **rldp reset** command is executed several times, the possible topology is as follows:



Operation steps

1. Find out the aggregation switch experiencing the loop based on the ports and find out the access switch based on the VLANs.
2. Run the following command to check whether port traffic statistics is abnormal on the aggregation switch and access switch. If yes, rectify the fault step by step based on the abnormal traffic. show interface counters rate [up]

```
Ruijie#show interfaces counters rate | ex 0                    0              $
Interface     Sampling Time          Input Rate            Input Rate            Output R
ate           Output Rate
                                     (bits/sec)            (packets/sec)         (bits/se
c)            (packets/sec)
------------ --------------------- -------------------- -------------------- --------
------------ --------------------
Gi0/11        5 seconds              849671428             940095                84967524
1             940099
Gi0/23        5 seconds              0                     0                     85704022
7             894072
Gi0/29        5 seconds              849675580             940100                84967178
6             940096
```

3. If the condition permits, enable the RLDP function on the aggregation switch and access switch (the enabling of RLDP will shut down the loop ports) to check whether a loop is detected.

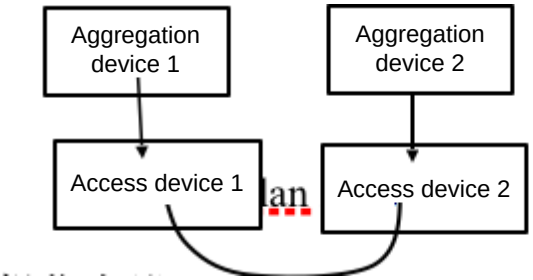
```
Ruijie(config)#rldp enable
Ruijie(config)#int
Ruijie(config)#interface gi
Ruijie(config)#interface gigabitEthernet 0/11
Ruijie(config-if-GigabitEthernet 0/11)#rldp port loop-detect shutdown-po
Ruijie(config-if-GigabitEthernet 0/11)#rldp port loop-detect shutdown-port
Ruijie(config-if-GigabitEthernet 0/11)#*Mar 31 14:58:16: %RLDP-3-LINK_DETECT_RECOVER
 rldp recover interface GigabitEthernet 0/11 from loop error
```

```
Ruijie#show rldp
rldp state          : enable
rldp hello interval: 3
rldp max hello      : 2
rldp local bridge   : 001a.a9c3.ceac
-----------------------------------
GigabitEthernet 0/11
port state       : normal
neighbor bridge : 0000.0000.0000
neighbor port    :
loop detect information          :
     action: shutdown-port
     state : normal
```

4. Run the **show mac-address-table vlan** *xx* command multiple times to check whether MAC addresses in the MAC address table have drifted. If MAC addresses have drifted, a loop occurs on the drift source and destination ports. If no MAC address drift exists on the access switch, check whether it occurs on the aggregation switch.

7.10.3.2 Same VLAN but different ports

The VLANs and ports causing the loop can be determined after the operations above are performed. If the VLANs keep unchanged but the ports change after the **rldp reset** command is executed several times, the possible topology is as follows:



Operation steps

1. Run the **rldp reset** and **show rldp** commands several times and check the **neighbor** field to find out the ports and VLANs of all loops.
2. Run the **show mac | in vlan** command on the aggregation switches at both ends and check whether entries of the same MAC address exist.
3. If yes, the interface corresponding to the MAC address is a loop interface.

7.10.3.3 Different VLANs but same port

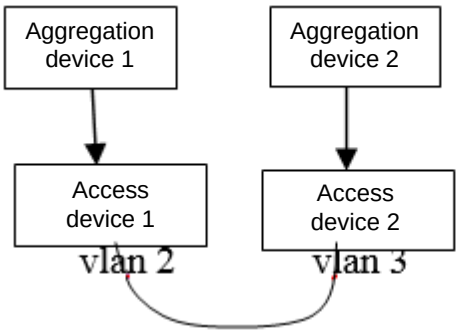
The VLANs and ports causing the loop can be determined after the operations above are performed. If VLANs are different but ports are the same after the **rldp reset** command is executed several times, the possible topology is as follows:

Operation steps

1. Find out the aggregation switch experiencing the loop based on the ports and find out the access switch based on the VLANs.
2. Run the **show mac | in vlan** command to display the MAC address tables of VLANs on the two access switches and check whether entries of the same MAC address exist.

7.10.3.4 Different VLANs and different ports

Possible topology:



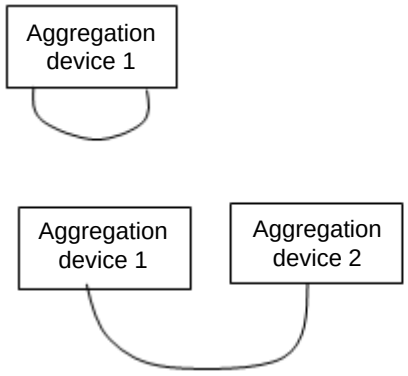
Operation steps

1. Run the **rldp reset** and **show rldp** commands several times and check the **neighbor** field to find out all ports and VLANs experiencing the loop.

2. Run the **show rldp** command and check the **neighbor** field. Check whether the neighbor ports are on the same downlink port of the core switch. 3. Run the **show mac | in vlan** command on the aggregation switches at both ends and check whether entries of the same MAC address exist.

7.10.3.5 Trunk port loop

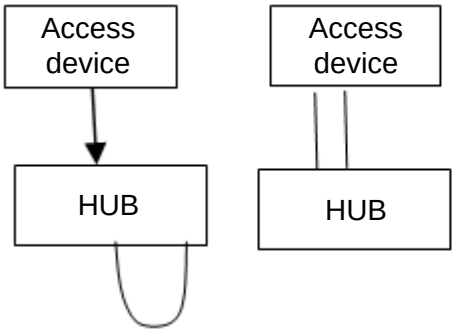
Possible topology:



Operation steps

1. Run the **show rldp** command and check the **neighbor** field. Check whether the neighbor ports are on the same downlink port of the core switch.
2. Check whether MAC address drift occurs on the aggregation switch or check the port traffic statistics.

7.10.3.6 Hub loop



Run the show interface counters summary up command to check traffic statistics of access ports.

7.11 Failure to Query Real-time Traffic of the User Gateway on SAM+ in MSC Card Scenarios

7.11.1 Symptom

No user traffic information is found when the real-time traffic of the gateway is queried on SAM+.

7.11.2 Possible Causes

1. Configurations for interconnecting with SAM+ are improper on the RG-N18000. As a result, IPFIX packets are exchanged abnormally.
2. The gateway policy name added to SAM+ is inconsistent with that added to the RG-N18000. As a result, the user group synchronization between the SAM+ and the RG0N18000 fails.
3. The PBR is configured incorrectly on the RG-N18000 and MSC, and therefore, traffic is not diverted to the MSC.

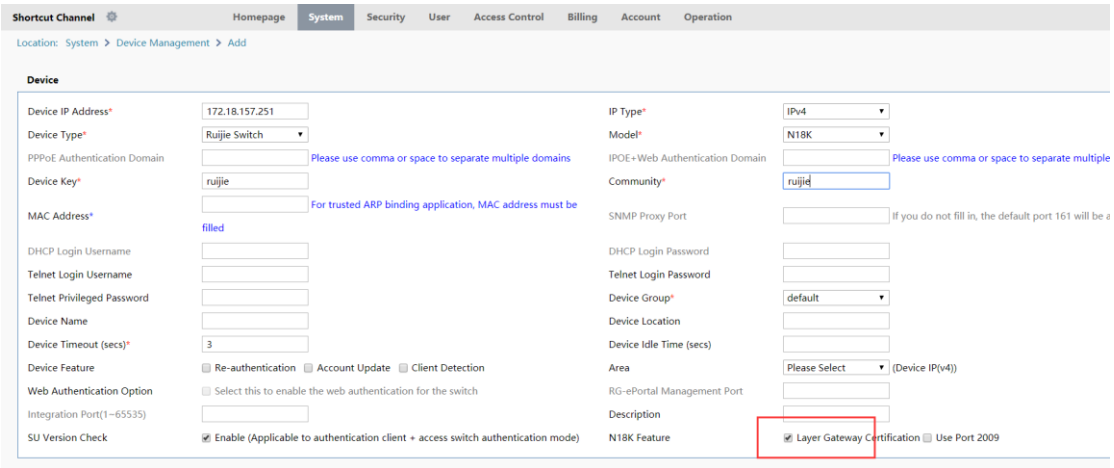
7.11.3 Handling Steps

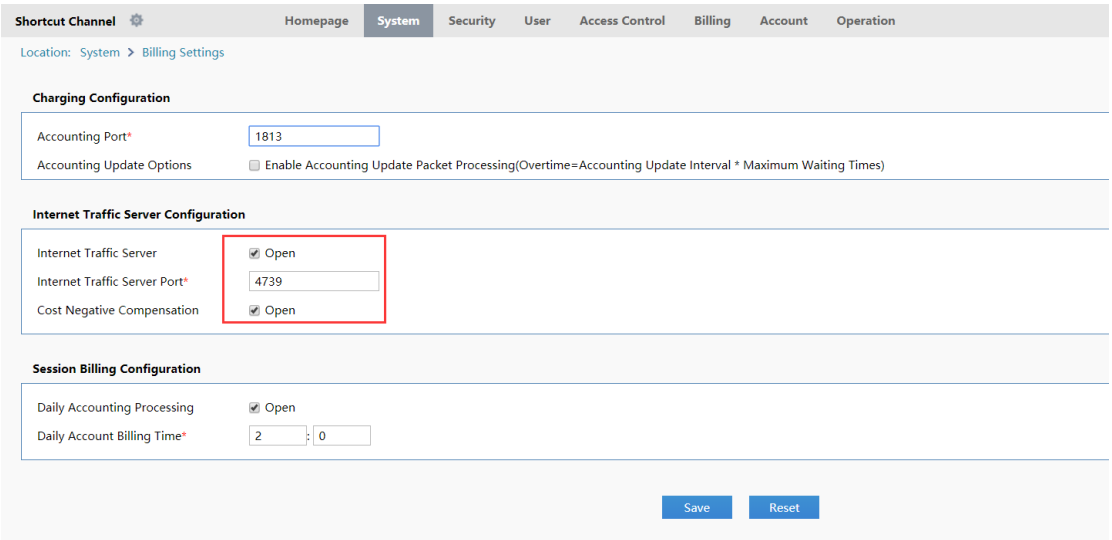
1. Check whether the interconnection configurations of the RG-N18000 and SAM+ are correct.

RG-N18000 configuration: The authentication and accounting mode is set to IPFIX.

dot1x acct-method ipfix //Set the 802.1x authentication and accounting mode to IPFIX, to upload traffic information to the SAM+ server (192.168.1.6 indicates the source interface, which can be a layer-3 interface or VLAN, or configured as required.)

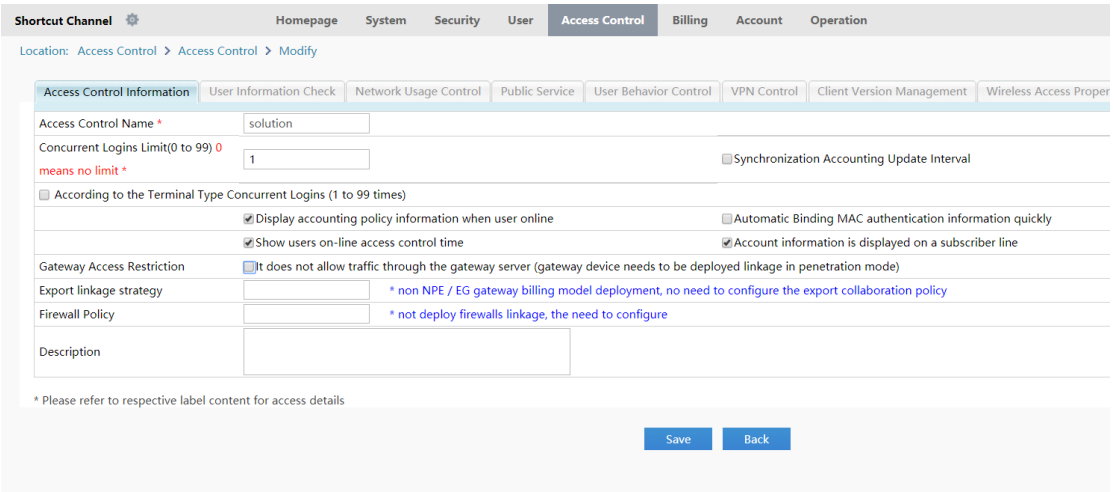
Check whether the SAM+ configuration is correct.





The gateway policy name is mandatory, so that the gateway policy can be delivered to the RG-N18000 and the RG-N18000 can synchronize user information to the MSC. Pay attention to the following items when configuring the gateway policy:

The gateway policy name should be consistent with that configured on the MSC card, for example, **default**.



2. Check the PBR configuration.

Use the client to access an extranet and run the **show ip fpm flows | include (IP)** command on the MSC card to check the values of **SendBytes** and **RecvBytes** and whether traffic is increasing. If the values are **0** or the traffic is not increasing, check the PBR configuration.

```
MSC#show ip fpm flows
Pr  SrcAddr                    DstAddr                    SrcPort     DstPort     Vrf     SendBytes  RecvBytes  St   srcif
f                   ctrl_flag  delay
6   10.0.3.2       (0.0.0.0)    10.0.3.254     (0.0.0.0)  55332(0)    3333 (0)    0       60         0          2    fff
ffff                c0000
6   10.0.5.2                     10.0.5.1                  42091       3333        0       204678876  204590106  1    fff
                    0           10
6   10.0.5.2                     10.0.5.1                  42092       3333        0       204485958  204502204  1    fff
                    0           0
6   10.0.5.2                     10.0.5.1                  42093       3333        0       204532961  204511386  1    fff
                    0           0
6   10.0.5.2                     10.0.5.1                  42094       3333        0       204485916  204486051  1    fff
                    0           0
17  172.18.159.172               239.192.152.143           6771        6771        511     984        0          1    2001
        (ffffffff)  40000
6   10.0.5.2                     10.0.5.1                  42097       3333        0       204488420  204489255  1    fff
                    0           0
6   10.0.5.2                     10.0.5.1                  42098       3333        0       204488334  204488445  1    fff
                    0           0
17  10.0.5.2                     172.18.157.32             1230        123         0       2302116    2676904    3    fff
                    0
17  10.0.5.2                     10.0.5.1                  1230        123         0       2302116    2302116    3    fff
```

```
RG-N18000
ip access-list extended pbr-download
 10 permit ip any 10.20.0.0 0.0.255.255//The network segment is a network segment whose traffic
needs to be diverted to the MSC.
ip access-list extended pbr-upload
 10 permit ip 10.20.0.0 0.0.255.255 any//The network segment is a network segment whose traffic
needs to be diverted to the MSC.

route-map pbr-upload permit 10
 match ip address pbr-upload
 set ip policy load-balance src-ip
 set ip policy no-ttl-decrease
 set ip next-hop 10.0.3.2 //LAN address of the MSC card.
!
route-map pbr-download permit 10
 match ip address pbr-download
 set ip policy load-balance dst-ip
 set ip policy no-ttl-decrease
 set ip next-hop 10.0.4.2 //WAN address of the MSC card.

HXJH-18K(config)#int vlan 2001 //Invoke PBR-upload on the downlink interface.
HXJH-18K(config-if-VLAN 2001)#ip policy route-map pbr-upload

HXJH-18K(config)#int gi1/23 //Invoke PBR-download on the uplink interface.
HXJH-18K(config-if-GigabitEthernet 1/23)# ip policy route-map pbr-download

MSC configuration:
ip access-list standard PBR-ACL //Matching needs to be performed on all user traffic.
 10 permit any

route-map port2-WAN permit 10
 match ip address user-data
 set ip next-hop 10.0.3.1 //Set the next hop of data flows of the WAN port to the IP address
of the WAN port on the RG-N18000.

route-map port1-LAN permit 10
 match ip address user-data
 set ip next-hop 10.0.4.1 //Set the next hop of the data flows from the LAN port to the IP address
of the WAN port on the RG-N18000.

MSC(config)#int tenGigabitEthernet 0/1
```

```
MSC(config-if-TenGigabitEthernet 0/1)# ip policy route-map port1-LAN


MSC(config)#int tenGigabitEthernet 0/2
MSC(config-if-TenGigabitEthernet 0/2)# ip policy route-map port2-WAN
```

7.12 Network Access Exception After Traffic Goes Through the MSC Card

7.12.1 Symptom

A network access exception occurs after traffic goes through the MSC card.

7.12.2 Possible Causes

1. Check whether the PBR is configured correctly. Incorrect PBR configuration may result in incorrect traffic diversion.
2. The number of ACEs on the RG-N18000 exceeds the limit. As a result, a PBR diversion exception occurs.
3. The IP connection count exceeds the upper limit, causing failures in opening some websites.
4. Packets cannot be processed and are discarded due to poor MSC performance.

7.12.3 Handling Steps

1. Check whether the PBR is configured correctly. Incorrect PBR configuration may result in incorrect traffic diversion.

Use the client to access an extranet and run the **show ip fpm flows | include (IP)** command on the MSC card to check the values of **SendBytes** and **RecvBytes** and whether the traffic is increasing. If the values are **0** or the traffic is not increasing, check the PBR configuration.

```
MSC#show ip fpm flows
Pr  SrcAddr                     DstAddr                     SrcPort     DstPort     Vrf         SendBytes   RecvBytes   St   srcif
f                ctrl_flag   delay
6   10.0.3.2       (0.0.0.0)    10.0.3.254     (0.0.0.0)    55332(0)    3333 (0)    0           60          0           2    fff
ffff             c0000
6   10.0.5.2                     10.0.5.1                    42091       3333        0           204678876   204590106   1    fff
                 0           10
6   10.0.5.2                     10.0.5.1                    42092       3333        0           204485958   204502204   1    fff
                 0           0
6   10.0.5.2                     10.0.5.1                    42093       3333        0           204532961   204511386   1    fff
                 0           0
6   10.0.5.2                     10.0.5.1                    42094       3333        0           204485916   204486051   1    fff
                 0           0
17  172.18.159.172               239.192.152.143             6771        6771        511         984         0           1    2001
       (ffffffff)    40000
6   10.0.5.2                     10.0.5.1                    42097       3333        0           204488420   204489255   1    fff
                 0           0
6   10.0.5.2                     10.0.5.1                    42098       3333        0           204488334   204488445   1    fff
                 0           0
17  10.0.5.2                     172.18.157.32               1230        123         0           2302116     2676904     3    fff
                 0
17  10.0.5.2                     10.0.5.1                    1230        123         0           2302116     2302116     3    fff
```

2. The number of ACEs exceeds the limit. As a result, a PBR diversion exception occurs.

Delete PBR configuration from the interface and reconfigure the PBR (exercise caution when performing this operation), or configure an ACL that can be invoked by any interface, and check whether the number of ACEs exceeds the limit. If relevant logs are produced, it indicates that the number of ACEs exceeds the limit.

```
QJNU-CORE(config)#web-auth direct-host 003681: Sep 28 11:35:17 QJNU-CORE: %AAA-6-USER_AUTH_PASSED: User authenticated
003682: Sep 28 11:35:18 QJNU-CORE: %AAA-6-USER_AUTH_PASSED: User authenticated. Username: 2016112150.
003683: Sep 28 11:35:20 QJNU-CORE: %AAA-6-USER_AUTH_PASSED: User authenticated. Username: 2015113224.
 2.2.2.2
003684: Sep 28 11:35:24 QJNU-CORE: %CLI-5-EXEC_CMD: Configured from vty0(10.19.9.104) by rgs command: web-auth direct
QJNU-CORE(config)#003685: Sep 28 11:35:24 QJNU-CORE: %SS_FP_CORE-4-ACE_CAP_SHORTAGE: TCAM's hardware resources is sho
```

3. The IP connection count exceeds the upper limit, causing failures in opening some websites.

If several people in a dormitory share one IP address for Internet access, the IP quantity upper limit is small and some connections will be blocked. If a PC, mobile phone, or server has multiple external connections, the Internet access will be affected.

Locate the MSC card connected to the faulty client and run the **show flow-pre-mgr ip-info** *[ip-address]* command on the MSC card to check the IP connection quantity. In the figure below, the IP connection quantities of the first two IP addresses reach the upper limit and the corresponding clients may experience similar access exceptions. See the figure below.

```
M18000-MSC-EDA#show flow-pre-mgr ip-info
IP-ADDRESS          flow-cnt            flow-limit
=============================================================
172.24.29.14        2000                2000
172.24.8.87         2000                2000
172.24.38.234       1997                2000
172.24.21.24        1975                2000
172.24.21.119       1806                2000
59.73.166.65        1780                2000
172.26.129.59       1722                2000
172.24.19.137       1692                2000
172.24.10.54        1649                2000
172.24.22.172       1643                2000
172.24.4.194        1587                2000
172.24.12.205       1479                2000
172.26.138.86       1389                2000
172.26.35.33        1353                2000
172.26.11.88        1198                2000
172.26.4.236        1169                2000
172.24.34.147       1101                2000
172.26.130.12       1090                2000
172.24.4.199        1019                2000
59.73.160.143       959                 2000
172.24.34.6         944                 2000
59.73.145.76        937                 2000
```

4. Packets cannot be processed and are discarded due to poor MSC performance.

Run the **show interface** command to check the value of **no buffer**. If the value increases rapidly, it indicates that the performance is poor. If the value is not zero but increases occasionally, the performance is acceptable.

```
MSC#show interface
========================== TenGigabitEthernet 0/1 ========================
Index(dec):1 (hex):1
TenGigabitEthernet 0/1 is UP  , line protocol is UP
  Hardware is CN6880 TenGigabitEthernet, address is 5869.6c60.aaef (bia 5869.6c60.aaef)
  Interface address is: 10.0.3.2/24
  ARP type: ARPA, ARP Timeout: 3600 seconds
  Interface IPv6 address is:
    No IPv6 address
  MTU 1500 bytes, BW 10000000 Kbit
  Encapsulation protocol is Ethernet-II, loopback not set
  Keepalive interval is 10 sec , set
  Carrier delay is 2 sec
  Ethernet attributes:
    Last link state change time: 1970-01-01 08:03:13
    Time duration since last link state change: 2 days, 16 hours, 34 minutes,  8 seconds
    Priority is 0
    Medium-type is Fiber
    Admin duplex mode is AUTO, oper duplex is Full
    Admin speed is AUTO, oper speed is 10G
  Rxload is 1/255, Txload is 1/255
   10 seconds input rate 719 bits/sec, 0 packets/sec
   10 seconds output rate 1058 bits/sec, 1 packets/sec
    273907 packets input, 24239943 bytes, 0 no buffer, 0 dropped
    Received 4 broadcasts, 0 runts, 0 giants
    0 input errors, 0 CRC, 0 frame, 0 overrun, 0 abort
    465828 packets output, 60305081 bytes, 0 underruns , 0 dropped
    0 output errors, 0 collisions, 0 interface resets
```