

Virtual Router Redundancy Protocol (VRRP)

Ethernet Switch

Support Notes

Version 3.70

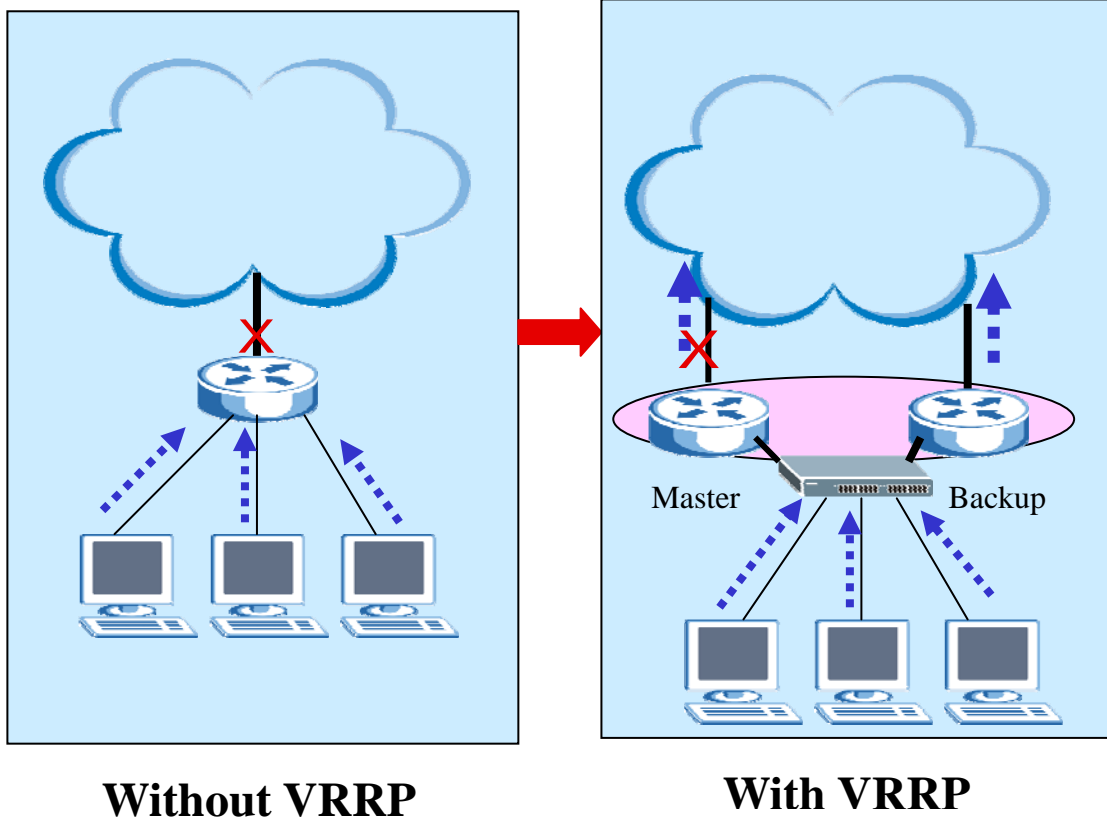
March 2007



Fault Free Protection

Overview of VRRP

Traditional network has one and only one gateway to put between internal network and external network. When the link of router has some trouble, the user can't access to internet anymore. But when we enable VRRP, if MASTER router fails, and the BACKUP router will take over, and ensure the traffic still go through.



VRRP (Virtual Redundancy Routing Protocol) provides a fail-over solution to increase network high availability and prevent single point of failure. Basically, VRRP utilizes two or more switches to work together. The master switch

handles all packets while the others are backup devices. When the master one fails, the backup device with highest priority will take over the packet handling.

Terminology:

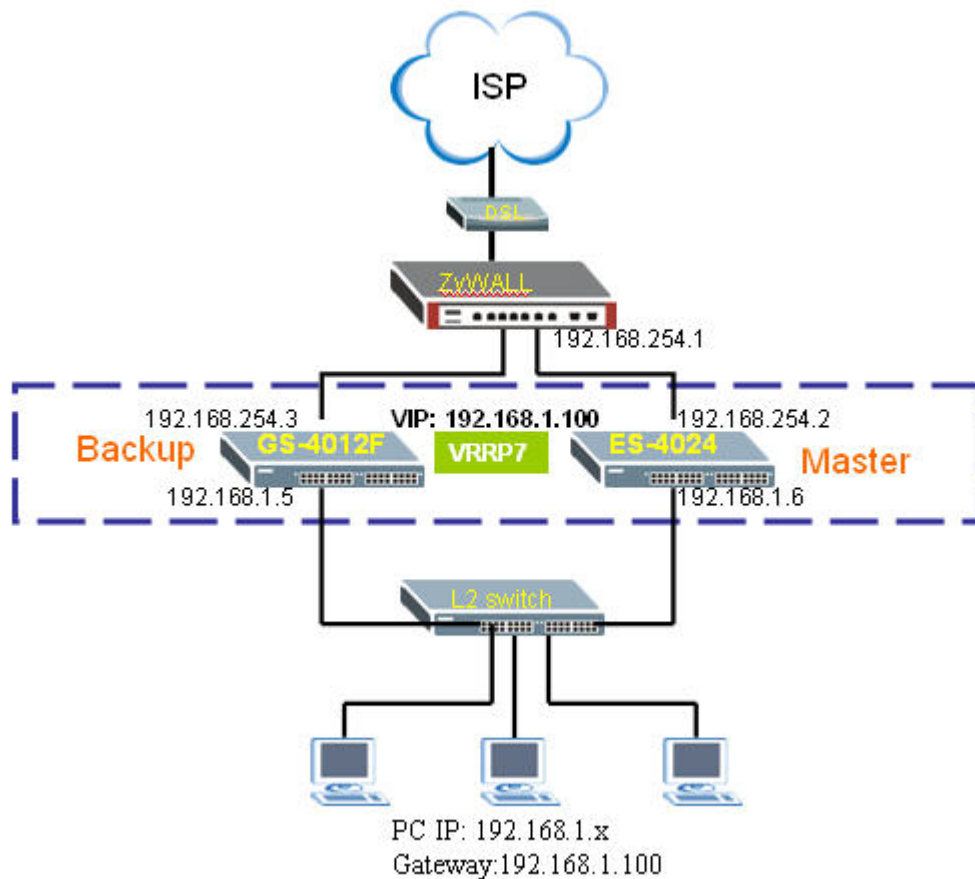
- VRRP Router: A router running the Virtual Router Redundancy Protocol.
- Virtual Router: An abstract object managed by VRRP that acts as a default router for hosts on a shared LAN.
- Virtual Router Master: VRRP Router with forwarding responsibility of a VR.
- Virtual Router Backup: Set of VRRP Routers available to assume forwarding responsibility when VR Master fails.

When do you need it?

VRRP is a L3 virtual routing protocol. For a network administrator, to ensure service/network always available without down time at gateway, VRRP can benefit this and further provide load sharing if more than one uplink is applied.

Scenario 1 -- Redundancy

The network administrator Peter of ZyCompany wants to ensure the high availability of their server farm from LAN users. According to vendor's recommendation, they buy one ZyXEL GS-4012F and one ZyXEL ES-4024 switch and have the configuration step by step as following.

**PC**

IP:192.168.1.x

Gateway:192.168.1.100

Switch A – ES-4024

downlink network:192.168.1.6

uplink IP:192.168.254.2

uplink gateway:192.168.254.1

virtual IP:192.168.1.100

Switch B – GS-4012F

downlink network:192.168.1.5

uplink IP:192.168.254.3

uplink gateway:192.168.254.1

virtual IP:192.168.1.100

Note1. Please notice that two IPs in switch A and switch B should be in different vlan groups. For example:

Switch A: 192.168.1.6 in vlan 1; 192.168.254.2 in vlan 2

Switch B: 192.168.1.5 in vlan 1; 192.168.254.3 in vlan 2

Note2. For VRRP application, you must configure two different VLAN groups for downlink network and uplink network. Otherwise, it's not secure that the authentication will be forwarded under same VLAN group.

Step 1. Configure a PC's IP as same subnet of switchA (by default, it's 192.168.1.1). Login switch's GUI by <http://switch's IP>. Please refer to quick start quick if you got problem at this step.

Step 2. Setup the switch A's VLAN info to apply the environment.

By default, ZyXEL switch has all ports with VLAN=1 setting already. We need to create another VLAN2 for uplink interface. In addition, please notice the "Tx tagging" setting to be unchecked if uplink device might be VLAN-unaware.

In this example, we assume

1. the ZyWALL which is VLAN-unaware is the uplink gateway, so here we configure VLAN1 and VLAN2 groups are with Tx tagging "untagged".
2. the network is very simple and we configure all ports are the member of both VLAN1 & VLAN2 groups

- a. Go to GUI menu **Advanced Application >> VLAN >> Static VLAN >>** choose **VLAN1** to show the detail. Modify VLAN1 with all ports with “Fixed” and uncheck “Tx Tagging”. Press **Add** button then.
- b. Create the VLAN2 via GUI menu **Advanced Application >> VLAN >> Static VLAN**, and configure all ports with “Fixed” and uncheck “Tx Tagging”. Press **Add** button then. See the figure below.
- c. Configure uplink port in GUI menu. Set the PVID to the same ID with uplink is 20.

ZyXEL Status

MENU

- Basic Setting
- Advanced Application
- Routing Protocol
- Management

VLAN

- Static MAC Forwarding
- Filtering
- Spanning Tree Protocol
- Bandwidth Control
- Broadcast Storm Control
- Mirroring
- Link Aggregation
- Port Authentication
- Port Security
- DHCP
- Access Control
- DiffServ
- Queuing Method
- VRRP

Static VLAN VLAN Status

ACTIVE ☒

Name

VLAN Group ID

Port	Control	Tagging
1	<input type="radio"/> Normal <input checked="" type="radio"/> Fixed <input type="radio"/> Forbidden	<input type="checkbox"/> Tx Tagging
2	<input type="radio"/> Normal <input checked="" type="radio"/> Fixed <input type="radio"/> Forbidden	<input type="checkbox"/> Tx Tagging
3	<input type="radio"/> Normal <input checked="" type="radio"/> Fixed <input type="radio"/> Forbidden	<input type="checkbox"/> Tx Tagging
4	<input type="radio"/> Normal <input checked="" type="radio"/> Fixed <input type="radio"/> Forbidden	<input type="checkbox"/> Tx Tagging
5	<input type="radio"/> Normal <input checked="" type="radio"/> Fixed <input type="radio"/> Forbidden	<input type="checkbox"/> Tx Tagging
6	<input type="radio"/> Normal <input checked="" type="radio"/> Fixed <input type="radio"/> Forbidden	<input type="checkbox"/> Tx Tagging
7	<input type="radio"/> Normal <input checked="" type="radio"/> Fixed <input type="radio"/> Forbidden	<input type="checkbox"/> Tx Tagging
8	<input type="radio"/> Normal <input checked="" type="radio"/> Fixed <input type="radio"/> Forbidden	<input type="checkbox"/> Tx Tagging
9	<input type="radio"/> Normal <input checked="" type="radio"/> Fixed <input type="radio"/> Forbidden	<input type="checkbox"/> Tx Tagging
10	<input type="radio"/> Normal <input checked="" type="radio"/> Fixed <input type="radio"/> Forbidden	<input type="checkbox"/> Tx Tagging
11	<input type="radio"/> Normal <input checked="" type="radio"/> Fixed <input type="radio"/> Forbidden	<input type="checkbox"/> Tx Tagging
12	<input type="radio"/> Normal <input checked="" type="radio"/> Fixed <input type="radio"/> Forbidden	<input type="checkbox"/> Tx Tagging

Add **Cancel** **Clear**

VID	Active	Name	Delete
1	Yes	1	<input type="checkbox"/>
2	Yes	VLAN2	<input type="checkbox"/>

Delete **Cancel**

Step 3. Setup the switch A's IP address of two interfaces for layer 3 routing and its uplink gateway. Take ES-4024 for example.

Configure Switch A's IP setting via GUI menu **Basic Setting >> IP Setup**.

- Default Gateway: 192.168.254.1
- 1st IP address: 192.168.1.6/24 with VID=1, see figure example as below.
- 2nd IP address: 192.168.254.2/24 with VID=2

ZyXEL Status

MENU

- Basic Setting
- Advanced Application
- Routing Protocol
- Management
- System Info
- General Setup
- Switch Setup
- IP Setup**
- Port Setup

IP Setup

Default Gateway: 192.168.254.1

Domain Name Server: 0.0.0.0

Apply Cancel

IP Address: 192.168.1.6

IP Subnet Mask: 255.255.255.0

VID: 1

Add Cancel

Index	IP Address	IP Subnet Mask	VID	Delete
1	192.168.1.1	255.255.255.0	1	<input type="checkbox"/>

Delete Cancel

After add the change, it will become as following setting.

ZyXEL Status

MENU

- Basic Setting
- Advanced Application
- Routing Protocol
- Management
- System Info
- General Setup
- Switch Setup
- IP Setup
- Port Setup

IP Setup

Default Gateway: 192.168.254.1

Domain Name Server: 0.0.0.0

Apply Cancel

IP Address: 0.0.0.0

IP Subnet Mask: 0.0.0.0

VID:

Add Cancel

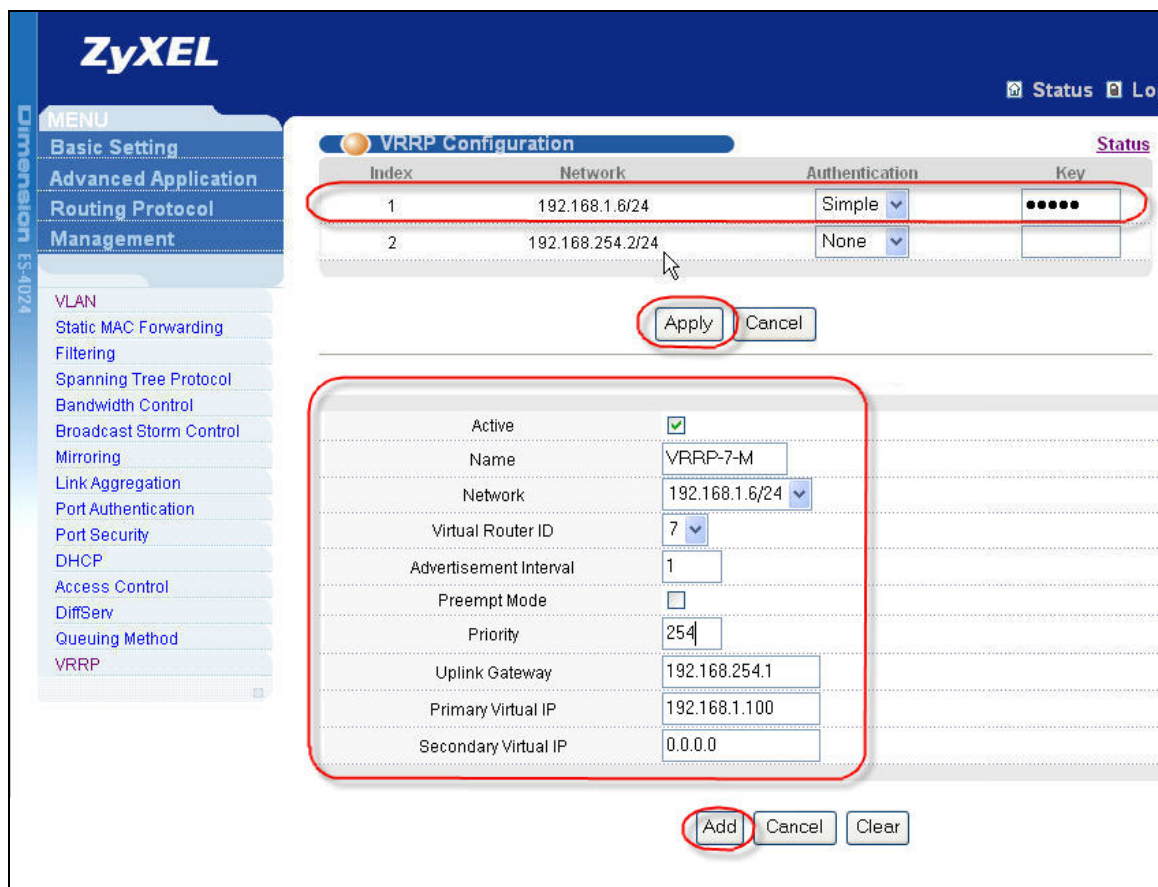
Index	IP Address	IP Subnet Mask	VID	Delete
1	192.168.1.6	255.255.255.0	1	<input type="checkbox"/>
2	192.168.254.2	255.255.255.0	2	<input type="checkbox"/>

Delete Cancel

Step 4. Setup the switch A's VRRP as the Master of group 1.

In the GUI menu **Advanced Application >> VRRP**, enter the **"Configuration"** link.

1. choose 'Simple' for authentication
2. Enter type '12345' for the key.
3. Press **'add'** button.
4. Then input the VRRP information as following figure. Here we use VRRP=7 and use priority=254 to indicate it is the Master role.



Step 5. Setup the switch B's VLAN to apply the environment. Refer to Step2 for the same setting.

Step 6. Setup the switch B's IP address of two interfaces and uplink gateway. Similar as switch A's setting at Step3, but different IP address as following.

Configure Switch B's IP setting via GUI menu **Basic Setting >> IP Setup**.

- Default Gateway: 192.168.254.1
- 1st IP address for **user subnet interface**: 192.168.1.5/24 with VID=1, see figure example as below.
- 2nd IP address for **uplink interface**: 192.168.254.3/24 with VID=2

Step 7. Setup the switch B's VRRP as the Backup of group 1. Please refer to Step6. Please note to use

1. choose 'Simple' for authentication
2. type '12345' for the key and press 'Apply' button
3. same 'Virtual Router ID' (=7 in this example)
4. lower priority (=100 in this example) to be a backup role
5. same uplink gateway in this scenario example (192.168.254.1)
6. same primary virtual IP (192.168.1.100 in this example)

Note: The design of authentication and key is for the authentication between Master and Backup. It only takes effect to configure for downlink network.

Step 8. Make sure uplink is ok to be ping. (Otherwise, the uplink status will stay at 'Init'.

Note: The redundancy works when it detect uplink gateway can be ping and other VRRP group members are not available or the switch is with the highest priority among alive VRRP switches.

Step 9. Check the VRRP status via GUI. Both Master and Backup switches should be alive as following.

For Master,

VRRP Status				Configuration
Index	Network	VRID	VR Status	Uplink Status
1	192.168.1.6/24	7	Master	Alive

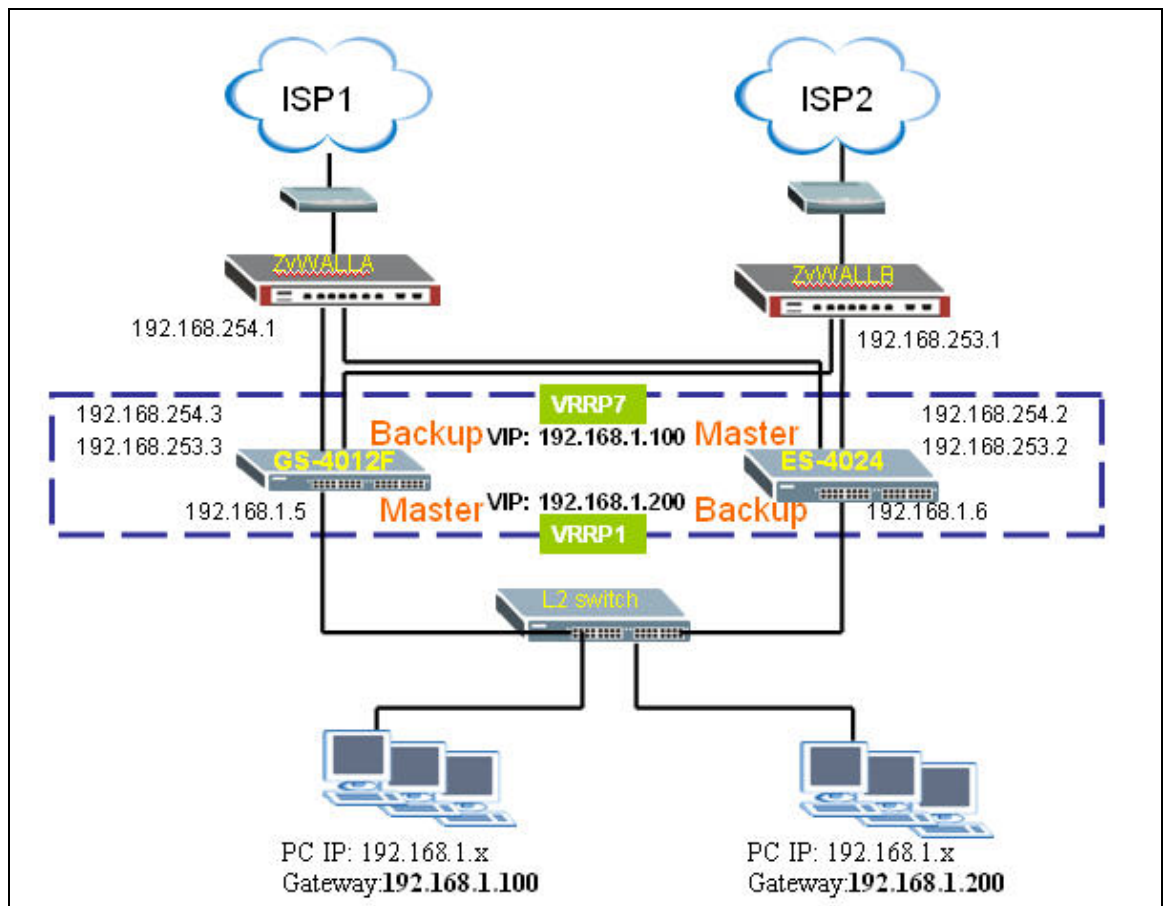
For Backup,

VRRP Status				Configuration
Index	Network	VRID	VR Status	Uplink Status
1	192.168.1.5/24	7	Backup	Alive

Scenario 2 – Load Sharing

Furthermore, ZyCompany wants to achieve load sharing based on the high availability application. To reach this target, two VRRP groups would be recommended. Each switch is a Master of one VRRP group and also acts a Backup of another VRRP group.

Network Admin will need to separate LAN users to two groups, each one use one virtual IP to share LAN traffic loading. So if the both Master are alive, PC group1's traffic will mainly go via SwitchA while PC group2's will mainly go via SwitchB. See following topology and configuration step by step.



PCs in group1

IP:192.168.1.x

Gateway:192.168.1.100

PCs in group2

IP:192.168.1.x

Gateway:192.168.1.200

Switch A – ES-4024

downlink network:192.168.1.5

downlink VLAN ID=1

VLAN ID	Uplink Interface IP	Uplink gateway	Virtual IP	VRRP ID	VRRP Role
2	192.168.254.2	192.168.254.1	192.168.1.100	7	Master
3	192.168.253.2	192.168.253.1	192.168.1.200	1	Backup

Switch B – GS-4012F

downlink network:192.168.1.6

downlink VLAN ID=1

VLAN ID	Uplink Interface IP	Uplink gateway	Virtual IP	VRRP ID	VRRP Role
2	192.168.254.3	192.168.254.1	192.168.1.100	7	Backup
3	192.168.253.3	192.168.253.1	192.168.1.200	1	Master

Note1. Two IPs in switch A and switch B should be in different vlan groups.
For example:

Switch A: 192.168.1.6 in vlan 1; 192.168.253.2 in vlan 2

Switch B: 192.168.1.5 in vlan 1; 192.168.254.3 in vlan 2

Note2. In this example, we connect to two ISPs to simulate the real world. It's in order to prevent the single point of failure additionally.

Step 1. Here we assume that all setting are based on Scenario1's configuration. Therefore, we will skip the basic setting in this Scenario.

Step 2. Add one more VLAN ID on SwitchA for another subnet connecting to ISP2.

Same as Scenario1, in this example, we assume

1. The uplink gateway, ZyWALL, which is VLAN-unaware
 2. The network is very simple and we configure all ports are the member of both VLAN1, VLAN2, and VLAN3 groups
- a. Create the VLAN3 via GUI menu **Advanced Application >> VLAN >> Static VLAN**, and configure all ports with "Fixed" and uncheck "Tx Tagging". Press **Add** button then. See the figure below.

VID	Active	Name	Delete
1	Yes	1	<input type="checkbox"/>
2	Yes	VLAN2	<input type="checkbox"/>
3	Yes	VLAN3	<input type="checkbox"/>

Step 3. Add one more Switch A's IP setting via GUI menu **Basic Setting >> IP Setup**.

- Default Gateway: **no change**
- Add 3rd IP address: 192.168.253.2/24 with VID=3, see following figure after the change.

Index	IP Address	IP Subnet Mask	VID	Delete
1	192.168.1.6	255.255.255.0	1	<input type="checkbox"/>
2	192.168.253.2	255.255.255.0	3	<input type="checkbox"/>
3	192.168.254.2	255.255.255.0	2	<input type="checkbox"/>

Step 4. Setup the switch A's VRRP as the Backup of VRRP group 1.

In the GUI menu **Advanced Application >> VRRP**, enter the **"Configuration"** link.

1. authentication: **no change**
2. key: **no change**
3. Then input the VRRP information as following figure. Here we use VRRP=1 and use priority=100 to indicate it is the Backup role.

Index	Network	Authentication	Key
1	192.168.1.6/24	Simple	•••••
2	192.168.253.2/24	None	
3	192.168.254.2/24	None	

Apply Cancel

Active	<input checked="" type="checkbox"/>
Name	VRRP-1-B
Network	192.168.1.6/24
Virtual Router ID	1
Advertisement Interval	1
Preempt Mode	<input type="checkbox"/>
Priority	100
Uplink Gateway	192.168.253.1
Primary Virtual IP	192.168.1.200
Secondary Virtual IP	0.0.0.0

Step 5. Setup the switchB's VLAN to apply the environment. Refer to Step2 for the same setting.

Step 6. Add one more interface info for the switch B's IP. Similar as switch A's setting at Step3, but different IP address as following.

Configure Switch B's IP setting via GUI menu **Basic Setting >> IP Setup**.

- Default Gateway: **no change**
- Add 3rd IP address for **another uplink interface**: 192.168.253.3/24 with VID=3

Step 7. Setup the switch B as the Master role of VRRP group 1. Please note to use

1. authentication: **no change**
2. key: **no change**
3. same 'Virtual Router ID' (=1 in this example)
4. lower priority (=254 in this example) to be a Master role
5. uplink gateway: 192.168.253.1
6. primary virtual IP: 192.168.1.200

Note: The design of authentication and key is for the authentication between Master and Backup. It only takes effect to configure for downlink network.

Step 8. Make sure uplink is ok to be ping. (Otherwise, the uplink status will stay at 'Init'.

Note: The redundancy works when it detects uplink gateway can be ping and other VRRP group members are not available or the switch is with the highest priority among VRRP switches alive.

Step 9. Check the VRRP status via GUI. Both Master and Backup switches should be alive as following.

For Master,

VRRP Status			Configuration	
Index	Network	VRID	VR Status	Uplink Status
1	192.168.1.6/24	7	Master	Alive
2	192.168.1.6/24	1	Backup	Alive

For Backup,

VRRP Status			Configuration	
Index	Network	VRID	VR Status	Uplink Status
1	192.168.1.5/24	1	Master	Alive
2	192.168.1.5/24	7	Backup	Alive

CLI for VRRP

no ip vrrp authentication-key

- Description: Resets the VRRP authentication settings

ip vrrp authentication-key <k>

- Description: Sets the VRRP authentication key in the routing domain.
- Ex: ip vrrp authentication-key 12345

router vrrp network <ip>/<mask-bits> vr-id <1-7> uplink-gateway <ip>

- Description: Set VRRP detail information.
- Ex: router vrrp network 192.168.1.5/24 vr-id 7 uplink-gateway 192.168.254.1

name VRRP-7-B

primary-virtual-ip 192.168.1.100

no inactive

no preempt