DATA-TRONIX®

VidcasterIP

Virtual Video Matrix

IPAV H.264 Networking Strategy Guide

V1.0.0

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1 Networking Principles

1.1 Networking Strategy

Please select an appropriate networking strategy based on the following table.

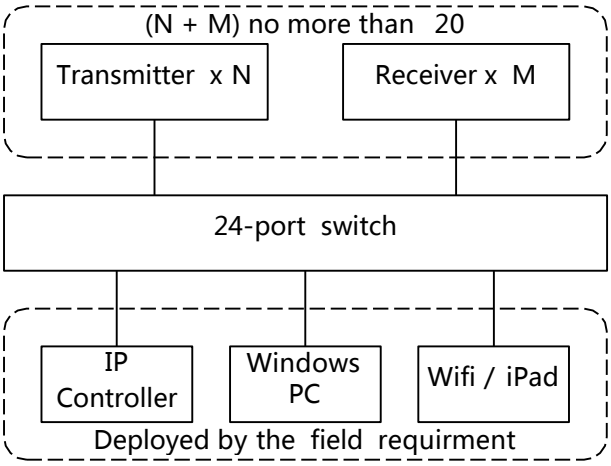
TX, RX Information		Networking Strategy	
Distribution Status	Total Quantity	Network Topology	Recommended Switches
Centralized	Less than or equal to 20 TX/RX	Single Switch Networking	Cisco or HUAWEI 24-port 100 Mbps Ethernet Switch Or Cisco or HUAWEI 24-port 1000 Mbps Ethernet Switch
	Less than or equal to 44 TX/RX		Cisco or HUAWEI 48-port 100 Mbps Ethernet Switch Or Cisco or HUAWEI 48-port 1000 Mbps Ethernet Switch
	More than 44 TX/RX	Cascading Switch Networking	Cisco switch: Core switches uses 1000 Mbps Ethernet switches. Extended switches use 100 Mbps Ethernet switches or 1000 Mbps Ethernet switches.
Distributed	No requirement		

Therefore, networking strategies are chosen based on the TX/RX's distribution positions and quantity. For more information, see the examples below.

1.1.1 Single Switch Networking

When TX/RX is in concentrated distribution and its number is less than or equal to 44, use a single switch for networking.

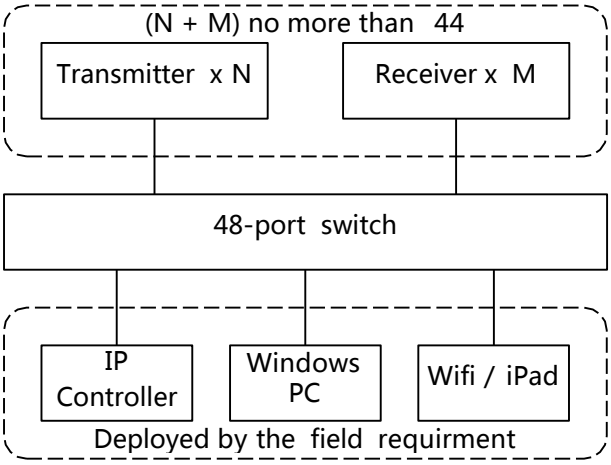
1.1.1.1 24-port Single Switch Networking



The illustration above is a topology of a single 24-port switch networking. You can choose a switch from the following.

1. Cisco Brand
   - ✧ 24-port 100Mbps Ethernet switch: WS-C2960-24TC-L
   - ✧ 24-port 1000Mbps Ethernet switch: SG300-28, SG500-28, WS-C2960X-24TS-L
   - ✧ 24-port 100Mbps PoE Ethernet switch: WS-C2960-24PC-L
   - ✧ 24-port 1000Mbps PoE Ethernet switch: SG300-28P, SG500-28P, WS-C2960S-24PS-L, WS-C2960X-24PS-L
2. HUAWEI Brand
   - ✧ 24-port 100Mbps Ethernet switch: S2700-26TP-EI-AC
   - ✧ 24-port 1000Mbps Ethernet switch: S5700-28P-LI-AC
   - ✧ 24-port 100Mbps PoE Ethernet switch: S2700-26TP-PWR-EI
   - ✧ 24-port 1000Mbps PoE Ethernet switch: S5700-28P-PWR-LI-AC

1.1.1.2 48-port Single Switch Networking



The illustration above is a topology of a single 48-port switch. You can choose a switch

brand from the following.

1. Cisco Brand
   - ✧ 48-port 100Mbps Ethernet switch: WS-C2960-48TC-L
   - ✧ 48-port 1000Mbps Ethernet switch: SG500-52, WS-C2960X-48TS-L
   - ✧ 48-port 100Mbps PoE Ethernet switch: WS-C2960-48PST-L
   - ✧ 48-port 1000Mbps PoE Ethernet switch: SG500-52MP, WS-C2960X-48FPS-L
2. HUAWEI Brand
   - ✧ 48-port 100Mbps Ethernet switch: S2700-26TP-EI-AC
   - ✧ 48-port 1000Mbps Ethernet switch: S5700-48TP-SI-AC
   - ✧ 48-port 1000Mbps PoE Ethernet switch: S5700-48TP-PWR-SI

1.1.1.3 Tips

When you use a single switch for networking,

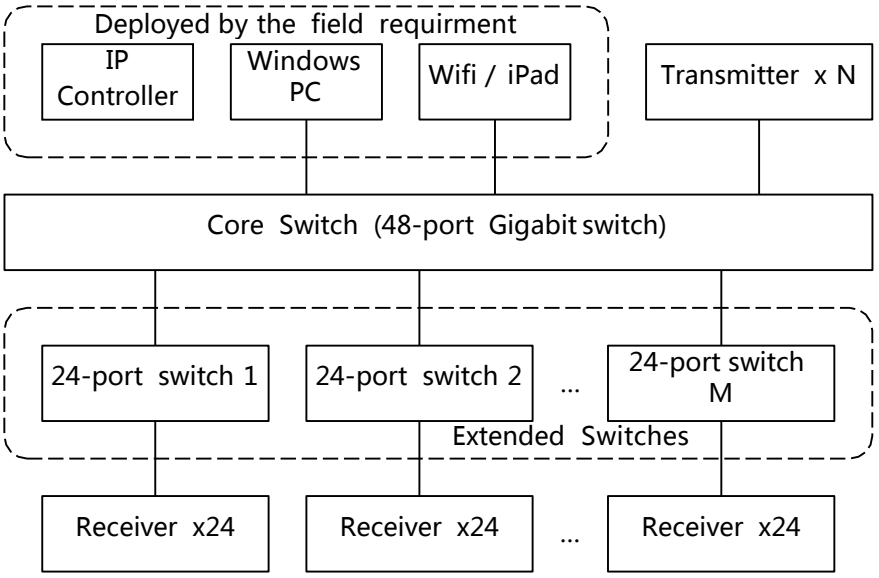
- ✧ If only one or two remote TX/RX need cables of more than 100 meters to connect to the switch, you can use Ethernet repeaters for network extension, or you can also directly use low-end unmanaged switches. So this will help simply network topology and reduce the workload.
- ✧ If more remote TX/RX exist, you have to use cascading switches for networking.

1.1.2 Cascading Switch Networking

You must follow the rules below.

- ✧ The core switch must be a 1000Mbps or faster Ethernet switch. Enough cascading bandwidth is required because the cascading cables are used to transmit multiple IP streams.
- ✧ Bidirectional data flow each must be not more than 1000Mbps between a core switch and extended switches and leave enough bandwidth unused for backup allowance. By taking a typical code rate of 20Mbps as an example, the number of TX connected to a single extended switch should be not more than 25 and so does RX, but the total number of TX and RX can be more than 25.
- ✧ If the distance between a core switch and extended switches is more than 100 meters, you should use fiber-optic cables for cascading networking.

1.1.2.1 Simple Cascading Switch Networking



In most cases, it will not require too many TX for networking and all TX can be centrally deployed. You can use them for networking based on the illustration above.

- ✧ Use a 48-port 1000Mbps switch as the core switch
- ✧ Use 24-port Ethernet switches as the extended switches
- ✧ Connect core switch to all TX, IP controllers, wireless access points and third party control devices such as PCs
- ✧ Connect all RX to extended switches
- ✧ The sum of TX and extended switches are less than or equal to 44

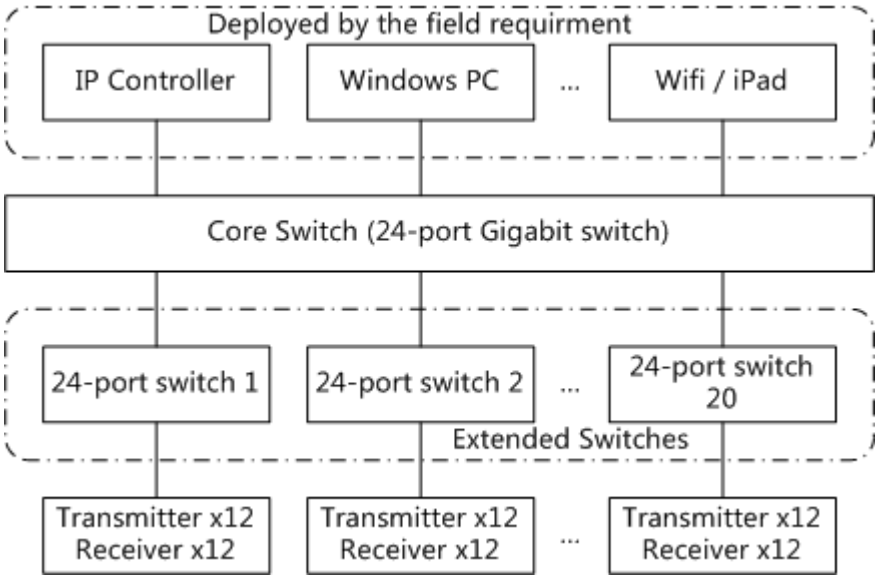
For example, TX's number is 40. Extended switches are 48-port switches. This networking can support 176 RX (4x44) to create 40 x 176 distributed matrix. We would recommend that you use Cisco 2960 series switches for cascading.

1. Core switches
   - ✧ 48-port 1000Mbps Ethernet switch: SG500-52, WS-C2960X-48TS-L
   - ✧ 48-port 1000Mbps PoE Ethernet switch: SG500-52MP, WS-C2960X-48FPS-L
2. Extended Switches
   - ✧ 24-port 100Mbps Ethernet switch: WS-C2960-24TC-L
   - ✧ 24-port 1000Mbps Ethernet switch: SG500-28, WS-C2960X-24TS-L
   - ✧ 24-port 100Mbps PoE Ethernet switch: WS-C2960-24PC-L
   - ✧ 24-port 1000Mbps PoE Ethernet switch: SG500-28P, WS-C2960S-24PS-L,

WS-C2960X-24PS-L

1.1.2.2 Complex Cascading Switch Networking

If TX cannot be centrally deployed for example due to long distance or its number exceeds 44, you need to consider many complex factors when cascading. For more information, consult installers, distributors or equipment manufacturers. See the example below.



The networking model above offers the following features.

- ✧ Use a 24-port 1000Mbps Ethernet switch as the core switch
- ✧ Use 24-port Ethernet switches as the extended switches
- ✧ Connect IP controller, wireless access point (AP) and PC to the core switch.
- ✧ Both TX and RX are connected to the extended switches. They each account for a half in a switch.

Note:

As shown in the figure above, the core switch offers 24 ports, among which three are connected to IP controller, PC, Wi-Fi/iPad and one reserved. The others can be connected to 20 extended switches, each of which is connected to 12 TX and 12 RX. Therefore, the number of TX is 240 (12 x 20) and so does RX, creating a 240 x 240 distributed matrix. If the core switch and extended switches are 48-port models, the number of each TX and RX is 1056 (24 x 44), creating a 1056 x 1056 distributed matrix.

In the actual scenarios, because of various factors it's difficult for TX/RX to be distributed

uniformly in all the extended switches. If you need the complex cascading networking, contact your installers, distributors or equipment manufacturers.

1.2 Choosing an Ethernet Switch

The Ethernet switches in IPAV networking must support the following functions.

- ✧ Multicast forwarding or filtering
- ✧ IGMP Snooping
- ✧ IGMP Querier
- ✧ IGMP snooping fast leave

If the Ethernet switches are used for cascading networking, they must also support the following functions.

- ✧ Dynamic multicast router port
- ✧ Forwarding unknown multicast to multicast router port only

The basic requirements above should be met with in the networking process. Based on the practical networking, we've found that various Ethernet switches work in different ways. Therefore, some switches meeting with the previous requirements only may not apply in the IPAV networking. The final conclusion can be made through practical function verification and pressure testing. "Introduction to Recommended Switches" section in this manual shows the tested brands or models of switches for your reference.

1.3 Configuring the Ethernet Switches

Configurations in Ethernet switches vary with networking strategies. For more information, see below.

Feature of Switch	Single Switch Networking	Cascading Networking	
		Core Switch	Extended Switch
Green or energy-saving feature	Disable	Disable	Disable
Multicast forwarding or filtering	Enable	Enable	Enable
IGMP Snooping	Enable	Enable	Enable
IP address of IGMP Querier	Must be assigned a valid value		Not be cared
IGMP Querier	Enable	Enable	Disable

Feature of Switch	Single Switch Networking	Cascading Networking	
		Core Switch	Extended Switch
IGMP snooping fast leave	Enable	Disable	Enable
Dynamic multicast router port	Disable	Disable	Enable
Forwarding unknown multicast	Disable	Disable	Router port only*

Note:

* indicates that extended Ethernet switches must forward unknown multicast messages to multicast router port only.

The requirements in the table above should be met with. Different brands or models of switches may have different names of the previous features. Besides, their configuration methods may vary greatly. Therefore, complete their configurations by referring to the Ethernet switches' user guides. Regarding our tested Ethernet switches, refer to "Configuring the Ethernet Switches" section.

1.4 PoE

1.4.1 Overview

Power over Ethernet (PoE) allows an Ethernet switch to provide both data connection and electrical power to a network device through a single cable. Doing so reduces the number of wires that must be strung in order to install the network. The result is lower cost, less downtime, easier maintenance, and greater installation flexibility than with traditional wiring. A PoE system consists of Power Source Equipment (PSE) and Powered Device (PD).

- ✧ PSE is a device such as a PoE Ethernet switch that provides PD with power on the Ethernet cable. Also, it's a manager in the power supply process.
- ✧ PD is a device powered by a PSE and thus consumes energy. Examples include wireless access points and TX/RX. The electric modules that receive power from PSE are called PD modules.

Now PoE standard has two versions.

- ✧ IEEE 802.3af: PoE standard provides up to 15.4 W of DC power at the PSE. Only 12.95 W is assured to be available at the PD.

- ✧ IEEE 802.3at : PoE standard, known as PoE+ or PoE plus, provides up to 32 W of DC power at the PSE. Only 25.5 W is assured to be available at the PD.

In general, PoE standard consists of the two versions above. When mentioning PoE in the following sections, we regard it as IEEE 802.3af version in order to develop this manual easily.

1.4.2 Choosing PoE Power Supply Schemes

We should focus on the power capacity of the PoE Ethernet switches. In the current market, many PoE Ethernet switches may be unable to provide enough power on all ports simultaneously. For example, many 48-port PoE Ethernet switches can provide up to 370W of DC power. If each port needs 15.4 W based on the PoE standard, these switches can only supply power up to 24 ports together.

For how to select an appropriate PoE switch and connect to PD correctly, see the two optional schemes below.

1.4.2.1 PoE Power Supply Scheme

All our IPAV products are Class 0 devices that comply with PoE standard, which provides up to 15.4 W of DC power at the PSE. We strongly recommend that calculate the total number of ports that PoE Ethernet switches are able to supply power to using 15.4 W on each port. See the formula below.

$$N = Pc / 15.4$$

Note:

"N" indicates the total number of ports that PoE Ethernet switches are able to supply power to. "Pc" is the power capacity of these switches.

According to the formula above, we recommend the using of 24-port PoE Ethernet switches with 370W power capacity and 48-port PoE Ethernet switches with 740W. If your switches cannot meet with this requirement, use the formula above to calculate the total number of PD that PoE Ethernet switches are able to supply power to.

This scheme is PoE standard compliant completely and suitable for all PoE Ethernet switches.

1.4.2.2 Expansion Scheme

The actual power consumption of TX/RX may be far less than 15.4W. In this case, more PD can be connected to the PoE Ethernet switches. When more PD are connected, if they consume more energy than usual at a moment, the overall consumption could exceed the switch's power capacity while each PD may consume less than 15.4W, and thus affect the system operation. To avoid this issue above, reserve the power capacity allowance of the PoE switch when choosing a switch.

According to the actual testing results of PoE consumption in each product, the following power consumptions can be used.

- IPE1000, IPD1000, IPE2000, IPD2000 and IPD3000: 10W
- N131, N141, IPE3000 and IPM3000: 15.4W

The power consumptions above include the appropriate allowance. So do not need to consider this allowance when using them.

In addition, whether a switch is able to power the PD according to their actual consumption depends on how the switch works. If your PoE Ethernet switch supports this feature, you can use this scheme for PoE power supply.

Note:

For exact PoE power consumption data of IPAV products, see their user guides.

1.4.3 Other Factors

We should consider other factors when using PoE power of Ethernet switches.

1. Non PoE Capable Ports

The number of PD that PoE Ethernet switches can supply power to may be less than the switches' ports. We should disable PoE function in ports that are not used to provide power so that system stability will not be affected by connecting too many PD by mistake. For more information, see the user guides of Ethernet switches.

2. Higher PoE Power Consumption

TX/RX's power consumption is usually measured when it's supplied power by a power adapter. At this moment, their PD modules do not work. When TX/RX are powered by a PoE Ethernet switch, their PD modules will consume energy. Therefore, power consumption measured when powered by PoE switches is more than that when using a power adapter.

3. Cables

Full consideration of cable power consumption is taken when making PoE standards. We do not need to care for it if qualified cables are used. If problems or exceptions occur during the installation only when powered by PoE switches, we should check the quality of the cables.

4. USB Devices

PoE power capacity of the switch is limited. If a PD connects to a USB device, we also need to consider the power consumption of this USB device. If USB devices like mouses or keyboards are used, we do not care for their consumption. But if a portable hard drive is connected or an electronics device is used for charging via the USB port, we recommend the using of their power adapters.

1.5 Wireless Access Devices

In order to use clients in portable devices such as iPads, it's necessary to deploy wireless access devices in IPAV system. See the following notes and advice.

1.5.1 Choosing a Wireless Access Device

At present, common wireless access devices contain Wi-Fi routers and Wi-Fi access points (AP). A Wi-Fi router, easy-to-use and comprehensive, is the combination of a Wi-Fi AP and a broadband router and is widely used in families and small and medium enterprises. In IPAV networking, we just need a wireless network for allowing portable devices like iPads to access the network. So both Wi-Fi routers and Wi-Fi APs are used for this purpose.

1. Wi-Fi Radio Bands

Wi-Fi mainly operates in the 2.4GHz and 5 GHz spectrums. The 2.4 GHz spectrum is getting pretty crowded now that a large number of Wi-Fi devices are operating on the same frequencies. It's hard to offer stable and high-speed channel for our visual application. But the 5 GHz spectrum will provide faster data rates, fewer disconnections, less interference and a more enjoyable experience. Besides, the new versions of iPads support 5 GHz wireless connection. Therefore, we recommend the using of 5 GHz wireless access devices and access to iPad via 5 GHz Wi-Fi.

2. Communication Channels

Wireless spectrum must be under government supervision. Countries and regions allow different communication channels to be used in Wi-Fi communication. If the portable devices and wireless access devices operate in the different spectrums, connection may fail. In this case, you need to set communication channels in wireless access devices. Countries and regions have different laws and regulations on wireless channel allocation. So your wireless access devices may still fail to connect to the portable devices after setting a wireless channel. Then contact your device manufacturer for further solution.

3. IGMP Querier

A great many of wireless access devices, especially wireless routers, offer IGMP Querier capacity. These devices will regularly send IGMP query messages in the network, affecting IGMP Snooping in the IPAV network and interfering with the system operation. Therefore, we would recommend that you use wireless access devices without IGMP

Querier capacity or disable IGMP Querier directly if existing.

Please note no introduction about IGMP Querier capacity is mentioned in the user guides of many wireless access devices. We would recommend that you consult your dealers or manufacturers before purchasing them.

4. Network Connection

Wi-Fi routers are usually equipped with multiple Ethernet ports. One of these ports is WAN port the others are LAN ports. If a Wi-Fi router is used, connect one of its LAN ports to the IPAV system, ensuring that wireless access devices and the IPAV system are on the same subnet.

For the IPAV system using cascading networking, connect a wireless access device to the core Ethernet switch, simplifying network topology and making networking easy.

2 Introduction to Recommended Switches

2.1 Cisco Brand

Purpose	Model	Port Configuration
24-port 100Mbps Ethernet switch	WS-C2960-24TC-L	24 10/100BASE-T Ethernet ports 2 Gigabit Combo ports(10/100/1000Base-T + 100/1000Base-X)
48-port 100Mbps Ethernet switch	WS-C2960-48TC-L	48 10/100BASE-T Ethernet ports 2 100/1000BASE-X Ethernet fiber ports 2 SFPs
24-port 1000Mbps Ethernet switch	SG300-28	26 10/100/1000BASE-T Ethernet ports 2 Combo ports(10/100/1000Base-T+GBIC/SFP)
24-port 1000Mbps Ethernet switch	SG500-28	24 10/100/1000BASE-T Ethernet PoE+ ports 2 Combo ports(10/100/1000Base-T + GBIC/SFP) 2 SFP(1G/5G)
24-port 1000Mbps Ethernet switch	WS-C2960X-24TS-L	24 10/100/1000BASE-T Ethernet ports 4 SFPs
48-port 1000Mbps Ethernet switch	SG500-52	48 10/100/1000BASE-T Ethernet PoE+ ports 2 Combo ports(10/100/1000Base-T + GBIC/SFP) 2 SFP(1G/5G)
48-port 1000Mbps Ethernet switch	WS-C2960X-48TS-L	48 10/100/1000BASE-T Ethernet ports 4 SFPs
24-port 100Mbps PoE Ethernet switch	WS-C2960-24PC-L	24 10/100BASE-T Ethernet PoE ports 2 Gigabit Combo ports(10/100/1000Base-T + 100/1000Base-X) Available PoE power: 370W
48-port 100Mbps PoE Ethernet switch	WS-C2960-48PST-L	48 10/100BASE-T Ethernet PoE ports 2 Gigabit Combo ports(10/100/1000Base-T + 100/1000Base-X) 2 SFPs Available PoE power: 370W
24-port 1000Mbps PoE Ethernet switch	SG300-28P	26 10/100/1000BASE-T Ethernet PoE+ ports 2 Combo ports(10/100/1000Base-T+GBIC/SFP) Available PoE power: 180W
24-port 1000Mbps PoE Ethernet switch	SG500-28P	24 10/100/1000BASE-T Ethernet PoE+ ports 2 Combo ports(10/100/1000Base-T + GBIC/SFP) 2 SFP(1G/5G) Available PoE power: 180W

Purpose	Model	Port Configuration
24-port 1000Mbps PoE Ethernet switch	WS-C2960S-24PS-L	24 10/100/1000BASE-T Ethernet PoE+ ports 4 SFPs Available PoE power: 370W
24-port 1000Mbps PoE Ethernet switch	WS-C2960X-24PS-L	24 10/100/1000BASE-T Ethernet PoE+ ports 4 SFPs Available PoE power: 370W
48-port 1000Mbps PoE Ethernet switch	SG500-52MP	48 10/100/1000BASE-T Ethernet PoE+ ports 2 Combo ports(10/100/1000Base-T + GBIC/SFP) 2 SFP(1G/5G) Available PoE power: 740W
48-port 1000Mbps PoE Ethernet switch	WS-C2960X-48FPS-L	48 10/100/1000BASE-T Ethernet PoE+ ports 4 SFPs Available PoE power: 740W

Please note that there are some performance problems with SG300 series switches based on our testing data.

1. The ability to handle multicast request is insufficient. It takes a long time for switches to start forwarding multicast packets to the corresponding ports after receiving IGMP Join messages. The switches that act as extended switches in a cascade network have more obvious problems. If they receive more multicast requests in a short period, some of the requests will be discarded because switches are unable to deal with them in time, resulting in Rx switch failure.
2. Multicast forwarding synchronization is poor. There is a big time difference when copying and forwarding the same multicast packet to the multiple host ports. The time for each port to receive multicast packets may have a difference of 20ms or more. As a result, the same source on different Rx may be out of sync.

In summary, SG300 can be used in single switch networking and locations where high multi-screen synchronization is not required. If you require a cascaded network, multi-view or video wall, we would recommend that you use C2960 or SG500 series switches for networking.

2.2 HUAWEI Brand

Purpose	Model	Port Configuration
24-port 100Mbps Ethernet switch	S2700-26TP-EI-AC	24 10/100BASE-T Ethernet ports 2 Gigabit Combo ports(10/100/1000Base-T + 100/1000Base-X)
48-port 100Mbps Ethernet switch	S2700-52P-EI-AC	48 10/100BASE-T Ethernet ports 2 100/1000BASE-X Ethernet fiber ports 2 Gigabit SFP uplink ports
24-port 1000Mbps Ethernet switch	S5700-28P-LI-AC	24 10/100/1000BASE-T Ethernet ports 4 1000BASE-X Ethernet fiber ports
48-port 1000Mbps Ethernet switch	S5700-48TP-SI-AC	44 10/100/1000BASE-T Ethernet ports 4 Gigabit Combo ports(10/100/1000Base-T + 100/1000Base-X)
24-port 100Mbps PoE Ethernet switch	S2700-26TP-PWR-EI	24 10/100BASE-T Ethernet PoE+ ports 2 Gigabit Combo ports(10/100/1000Base-T + 100/1000Base-X) Available PoE power: 740W
24-port 1000Mbps PoE Ethernet switch	S5700-28P-PWR-LI-AC	24 10/100/1000BASE-T Ethernet PoE+ ports 4 1000BASE-X Ethernet fiber ports Available PoE power: 370W
48-port 1000Mbps PoE Ethernet switch	S5700-48TP-PWR-SI	44 10/100/1000BASE-T Ethernet PoE+ ports 4 Gigabit Combo ports(10/100/1000Base-T + 100/1000Base-X) Available PoE power: 740W

2.3 Recommended Wireless AP

We would recommend the use of D-Link 5 GHz wireless AP model DAP-1665. Because it does not support IGMP Querier, passes the test and meets the requirements for IPAV networking.

3 Configuring Switches

Different brands or models of switches are configured in a different way. This section gives configuration methods related to IPAV networking for recommended switches. For more information about these switches, see their user guides.

For each switch, we provide both manual and import configuration. Manual configuration is a bit more complex but has wide application range. If you want to use import

configuration, a same switch model must first be prepared and configured properly. So you can select an appropriate configuration method according to the actual situation. Switches have a large number of configuration items. To avoid interfere from irrelevant items, we would strongly recommend that you restore your switches to their factory defaults before starting configuration.

3.1 Cisco SG300 Series Switches

For Cisco SG300 series switches, we would recommend that you use models SG300-28 and SG300-28P. They can only be used in single switch networking due to their multicast problems.

3.1.1 Basic Operations

3.1.1.1 Logging In to the Switches

If you want to configure switches, you need to use special cables and connect them to the switches' dedicated ports.

1. Connect your PC to a switch.

Use a matching serial cable to connect between switch's **Console** port and PC's serial port. If your PC has no serial ports, use a USB-to-serial converter and install correct drivers.

2. Configure serial communication parameters

Run terminal emulation software on your PC. Create a session and configure serial communication parameters according to the following table.

Parameters	Value
Communication Port	● If your PC is equipped with serial ports in factory defaults, usually choose COM1 port. ● If your PC's multiple serial ports are configured or PC is connected with a USB-to-serial converter, see the related user guides.
Baud Rate	115200 bps

Parameters	Value
Flow Control	None
Parity	None
Stop Bits	1
Data Bits	8 bits

3. Create communication connection

In terminal emulation software select the previous created session and start the connection. When connection is successful, switch will not give any prompt. At this moment, press **Enter**. Switch will give the following prompt.

```
Detected speed: 115200
```

Press **Enter** again. Switch will ask you to input user name.

```
User Name:
```

Input **cisco** (for example default user name **cisco** is used). Switch will ask you to input password.

```
Password:
```

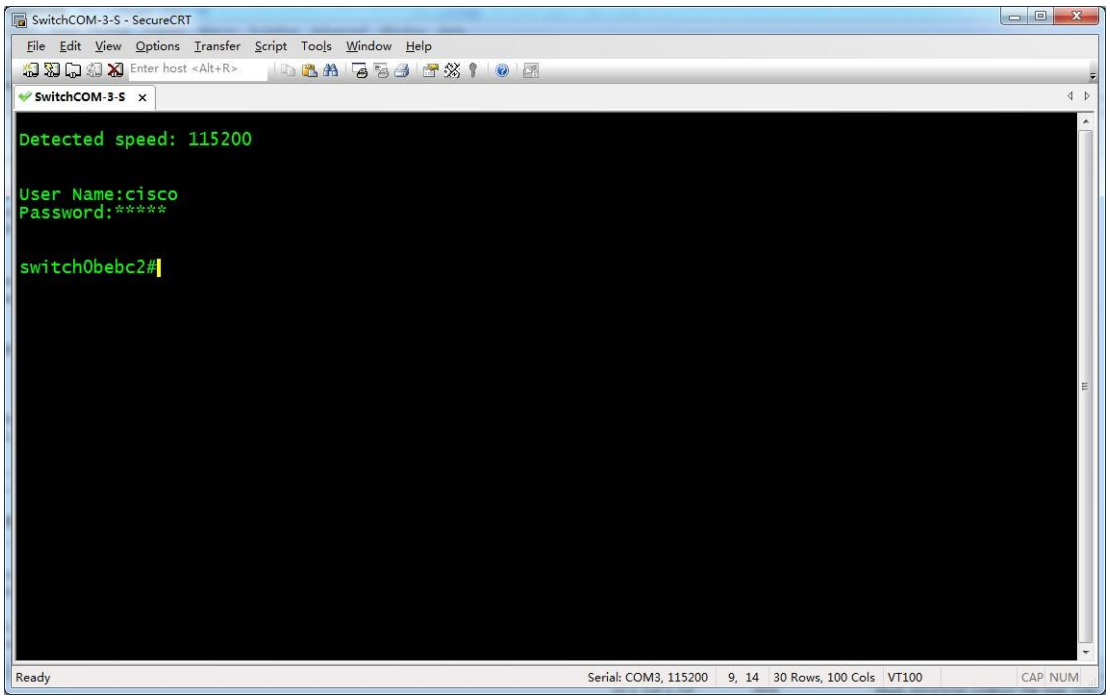
After inputting correct password, switch will display prompt in normal mode.

```
switch0bebc2#
```

Please note:

- ✧ In factory defaults of SG300 series switches, user mode and privileged mode have the same commend-line prompt and the highest privilege level. In this case, we call it "normal mode".
- ✧ SG300 series switches use the combination of "switch" and the last six characters of MAC address as the default names. In the prompt examples of this manual, "0bebc2" are the last six characters of MAC address of a SG300 series switch in our test. They may vary with actual switches.

The following screen capture describes the previous steps. It means that you have successfully logged in to the switch and entered normal mode.



3.1.1.2 Resetting to Factory Defaults

1. In user mode input **delete startup-config** to delete startup configuration. Switch will give the following prompt.

```
switch0bebc2#delete startup-config
Delete startup-config? (Y/N)[N]
```

Enter **Y** (not case sensitive) to confirm. Switch will give the following prompt which means that startup configuration is deleted.

Note:

In this manual, "Y", "Yes", "N" and "No" are not case sensitive.

```
switch0bebc2#02-May-2013 14:59:54 %FILE-I-DELETE: File Delete - file URL
flash://startup-config
```

2. Input **reload** to reboot switch. Switch will give the following prompt.

```
switch0bebc2#reload
You haven't saved your changes. Are you sure you want to continue ? (Y/N)[N]
```

Input **Y** to confirm. Switch will give the following prompt.

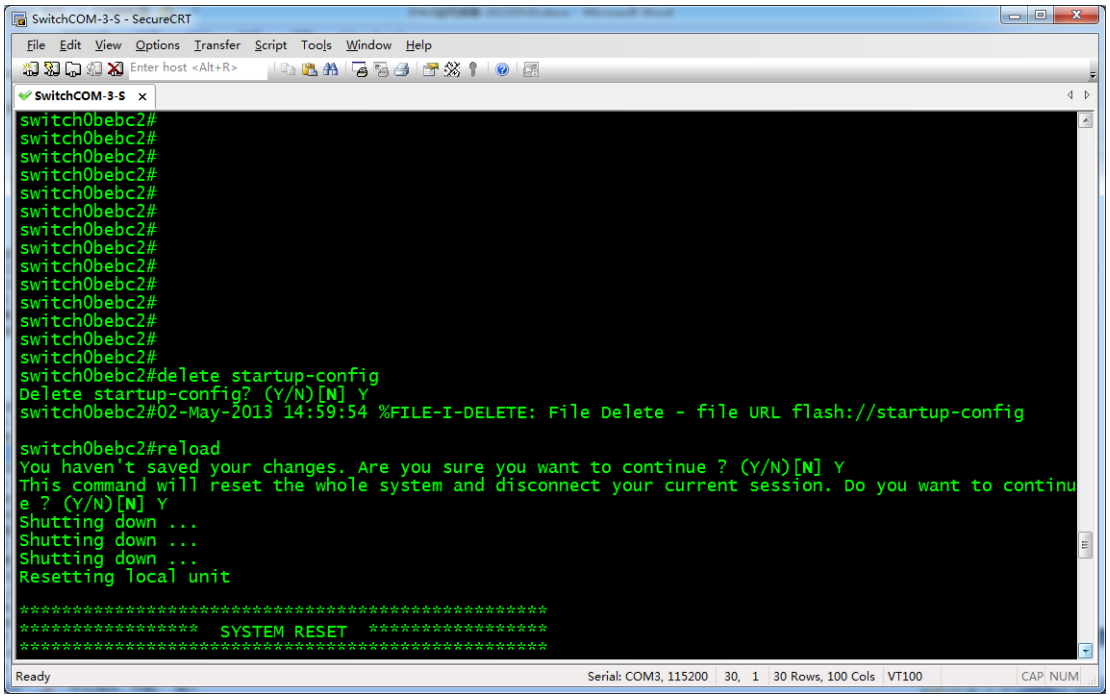
```
This command will reset the whole system and disconnect your current session.
Do you want to continue ? (Y/N)[N]
```

Input **Y** to confirm. Switch will give the following prompt.

```
Shutting down ...
Shutting down ...
Shutting down ...
Resetting local unit

************************************************
*****************  SYSTEM RESET *****************
************************************************
```

The following screen capture describes the previous steps.



3. Switch reboots. When the following prompt appears, quickly press **Enter** twice to complete the baud-rate detection process.

```
Console baud-rate auto detection is enabled, press Enter twice to complete the
detection process
```

If you do it slowly and exceed the time limit, switch will continue to ask you to input user name. Switch will give the following prompt.

```
Console baud-rate auto detection is enabled, press Enter twice to complete the
detection process

User Name:
```

In summary, press **Enter** twice before any effective input to work with switch for baud-rate auto detection. Switch will give the following prompt.

```
Detected speed: 115200


User Name:
```

Input default name **cisco**. Switch will ask you to input password.

```
Password:
```

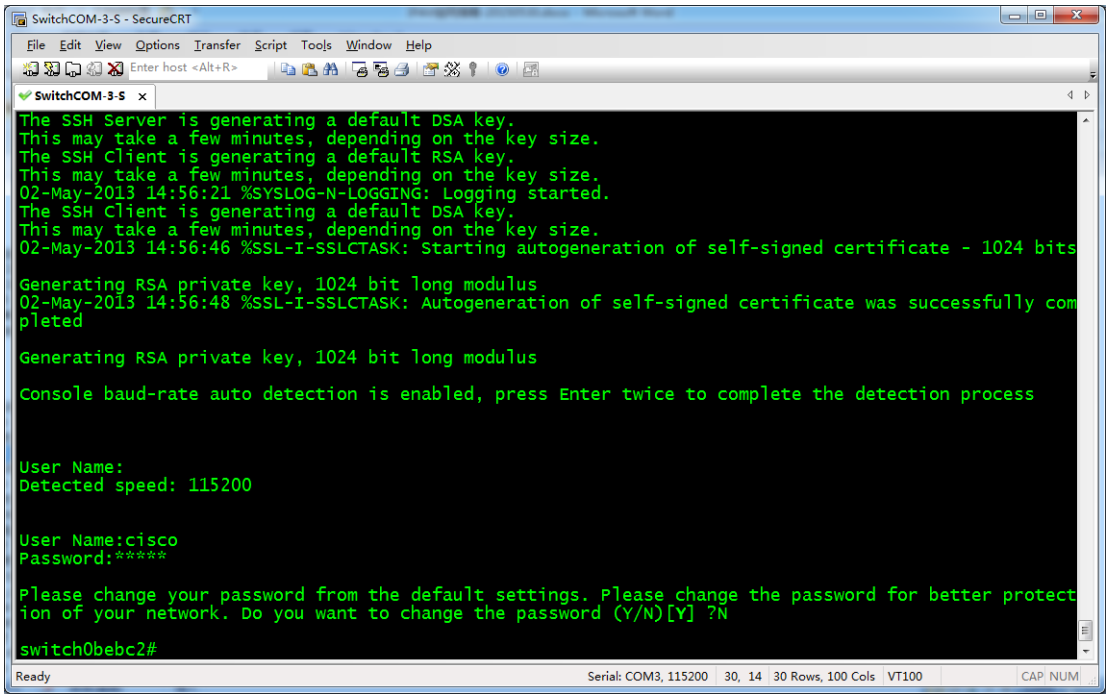
Input default password **cisco**. Switch will ask if you want to change your password.

```
Please change your password from the default settings. Please change the password
for better protection of your network. Do you want to change the password (Y/N) [Y] ?
```

Now, input **N** to skip the password change process. Switch will give the following prompt.

```
switch0bebc2#
```

The screen capture is as follows.



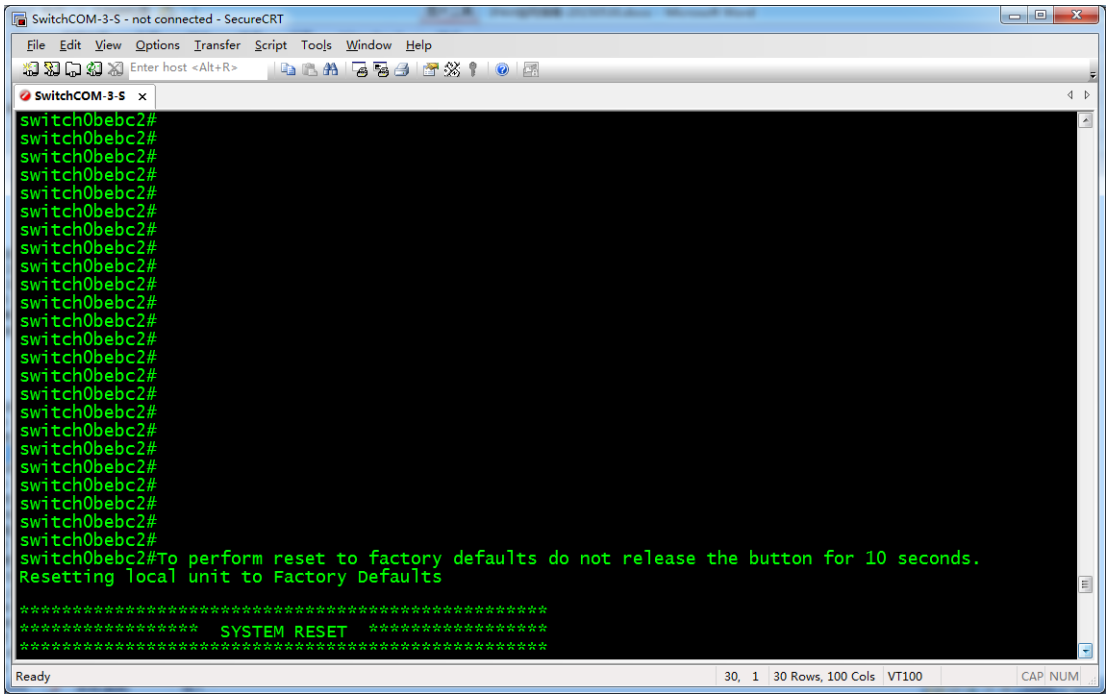
At this moment, you have successfully reset switch to factory defaults and entered normal mode.

If you forgot switch's password and cannot access its command-line interface, you can perform reset to factory defaults by using a stylus to press and hold Reset button until the following prompt appears.

```
switch0bebc2#To perform reset to factory defaults do not release the button for
10 seconds.
Resetting local unit to Factory Defaults

************************************************
*****************  SYSTEM RESET  *****************
************************************************
```

The screen capture is as follows.



The prompt above means that switch is reset to factory defaults and starts rebooting. Now you can release Reset button and wait until switch finishes rebooting and then operate based on step 3 above.

3.1.2 Manual Configuration

3.1.2.1 Global Configuration

1. In normal mode input **config** to enter global configuration mode. Switch will give the following prompt.

```
switch0bebc2#config
switch0bebc2(config)#
```

2. Input **no eee enable** to disable energy saving function. Switch will give the following prompt. (The following prompt is related to network devices connected to switch)

```
switch0bebc2(config)#no eee enable
switch0bebc2(config)#02-May-2013 15:02:16 %LINK-W-Down: gi1
02-May-2013 15:02:16 %LINK-W-Down:  gi9
02-May-2013 15:02:16 %LINK-W-Down:  gi11
02-May-2013 15:02:16 %LINK-W-Down:  Vlan 1
02-May-2013 15:02:18 %LINK-I-Up:  gi1
02-May-2013 15:02:18 %LINK-I-Up:  Vlan 1
02-May-2013 15:02:19 %LINK-I-Up:  gi9
02-May-2013 15:02:19 %LINK-I-Up:  gi11
02-May-2013 15:02:22 %STP-W-PORTSTATUS: gi1: STP status Forwarding
02-May-2013 15:02:23 %STP-W-PORTSTATUS: gi9: STP status Forwarding
02-May-2013 15:02:24 %STP-W-PORTSTATUS: gi11: STP status Forwarding
```

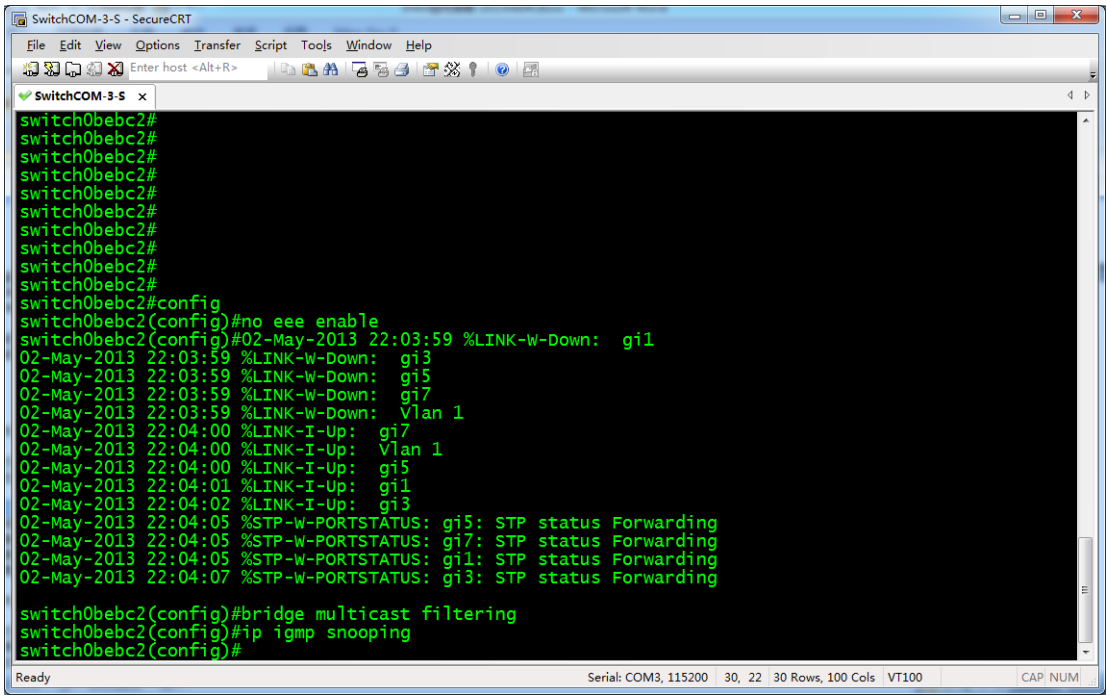
3. Input **bridge multicast filtering** to enable multicast filtering function.

```
switch0bebc2(config)#bridge multicast filtering
switch0bebc2(config)#
```

4. Input **ip igmp snooping** to enable global IGMP Snooping function.

```
switch0bebc2(config)#ip igmp snooping
switch0bebc2(config)#
```

The following screen capture describes the previous steps.



3.1.2.2 VLAN Configuration

1. In global configuration mode, input **ip igmp snooping vlan 1** to enable IGMP Snooping function for VLAN 1.

```
switch0bebc2(config)#ip igmp snooping vlan 1
switch0bebc2(config)#
```

2. Input **ip igmp snooping vlan 1 querier address 192.168.22.222** to assign IP address for IGMP Querier.

```
switch0bebc2(config)#ip igmp snooping vlan 1 querier address 192.168.22.222
switch0bebc2(config)#
```

3. Input **ip igmp snooping vlan 1 querier** to enable IGMP Querier function for VLAN 1.

```
switch0bebc2(config)#ip igmp snooping vlan 1 querier
switch0bebc2(config)#
```

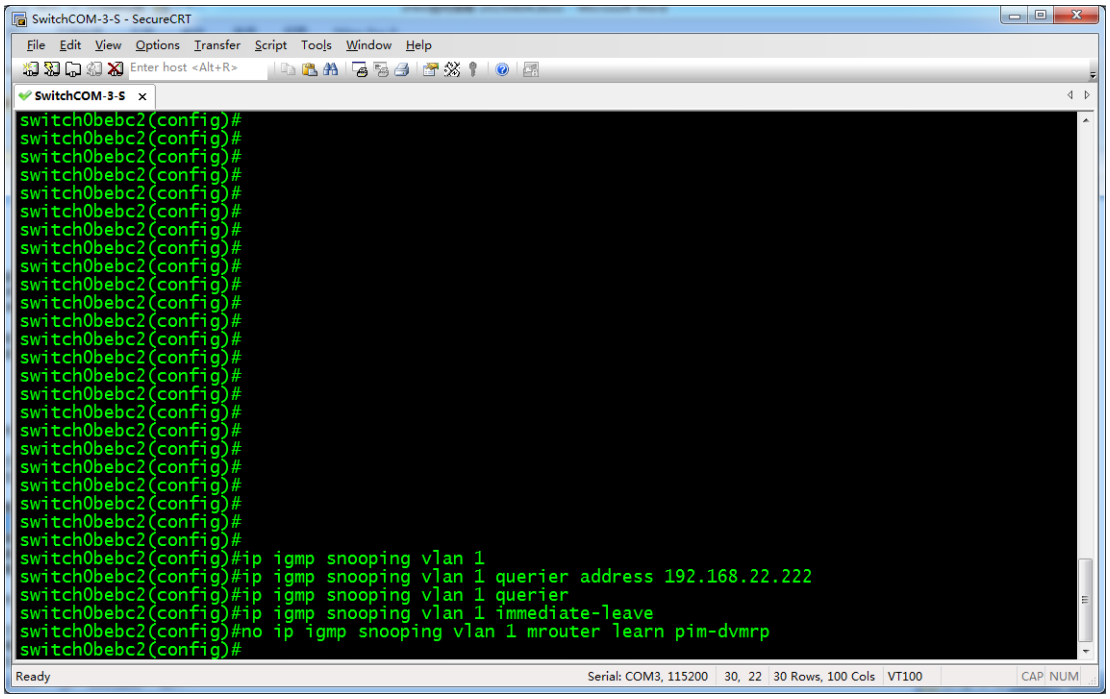
4. Input **ip igmp snooping vlan 1 immediate-leave** to enable multicast fast leave function for VLAN 1.

```
switch0bebc2(config)# ip igmp snooping vlan 1 immediate-leave
switch0bebc2(config)#
```

5. Input **no ip igmp snooping vlan 1 mrouter learn pim-dvmrp** to disable dynamic multicast router ports for VLAN 1.

```
switch0bebc2(config)#no ip igmp snooping vlan 1 mrouter learn pim-dvmrp
switch0bebc2(config)#
```

The following screen capture describes the previous steps.



3.1.2.3 Port Configuration

1. In global configuration mode input **interface range gi1-28** to enter all Gigabit Ethernet port bulk operation mode.

```
switch0bebc2(config)#interface range gi1-28
switch0bebc2(config-if-range)#
```

Note:

The Ethernet switches in the example are equipped with 28 Gigabit Ethernet ports. If your switches have different number of ports and various port types, set the parameters of **interface range** command based on their user guides.

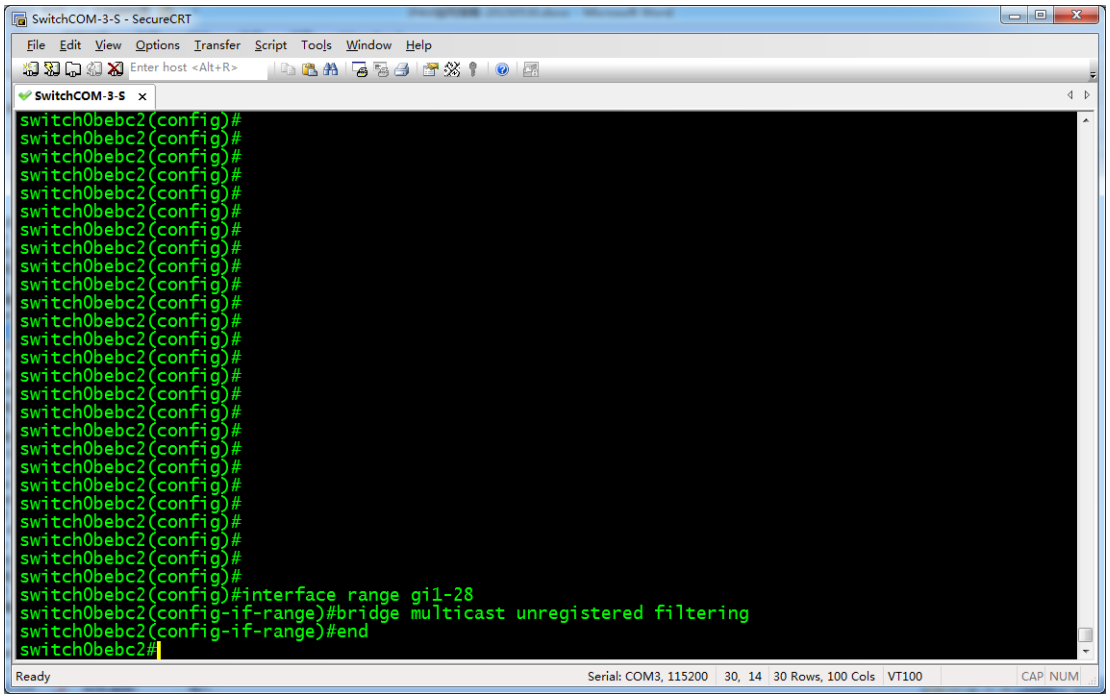
2. Input **bridge multicast unregistered filtering** to drop unknown multicast messages in all Gigabit Ethernet ports.

```
switch0bebc2(config-if-range)#bridge multicast unregistered filtering
switch0bebc2(config-if-range)#
```

3. Input **end** to return normal mode.

```
switch0bebc2(config-if-range)#end
switch0bebc2#
```

The following screen capture describes the previous steps.



Please note that you need to perform the operations above on all the Ethernet ports connected in the network. If other ports are used, configure them according to the example above.

3.1.2.4 Confirming Configuration

After configuration, input **show running-config** in normal mode. Switch will give feedback about the current detailed configuration.

```
switch0bebc2#show running-config
config-file-header
...
bridge multicast filtering
...
ip igmp snooping
ip igmp snooping vlan 1
no ip igmp snooping vlan 1 mrouter learn pim-dvmrp
ip igmp snooping vlan 1 immediate-leave
ip igmp snooping querier address 192.168.22.222
ip igmp snooping vlan 1 querier
no eee enablehostname switch0bebc2
!
interface gigabitethernet1
 bridge multicast unregistered filtering
!
interface gigabitethernet2
 bridge multicast unregistered filtering
...
!
interface gigabitethernet28
 bridge multicast unregistered filtering
!
exit
switch0bebc2#
```

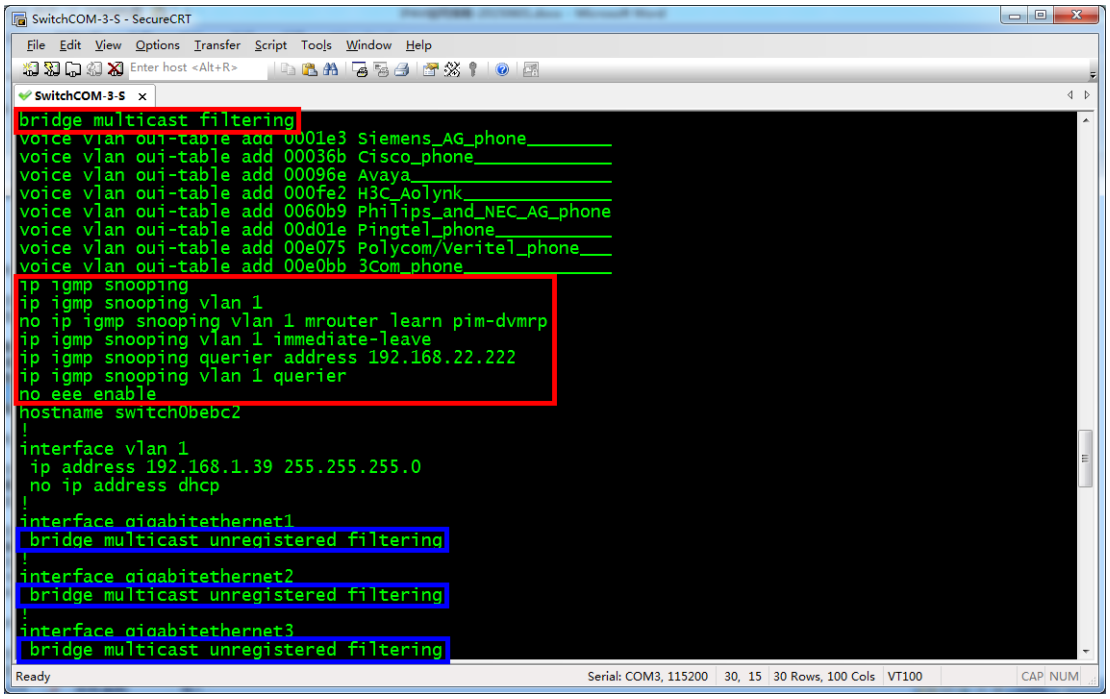
The information above includes the eight configuration commands we input.

```
bridge multicast filtering
...
ip igmp snooping
ip igmp snooping vlan 1
no ip igmp snooping vlan 1 mrouter learn pim-dvmrp
ip igmp snooping vlan 1 immediate-leave
ip igmp snooping querier address 192.168.22.222
ip igmp snooping vlan 1 querier
no eee enable
```

And the following configuration is set on each Ethernet port.

```
bridge multicast unregistered filtering
```

The screen capture is as follows.



Eight configuration commands are marked in red boxes. The commands marked in blue boxes are set on each port configuration. If your confirmation result is the same as above, it indicates that SG300 series switches are correctly configured.

3.1.2.5 Saving Configuration

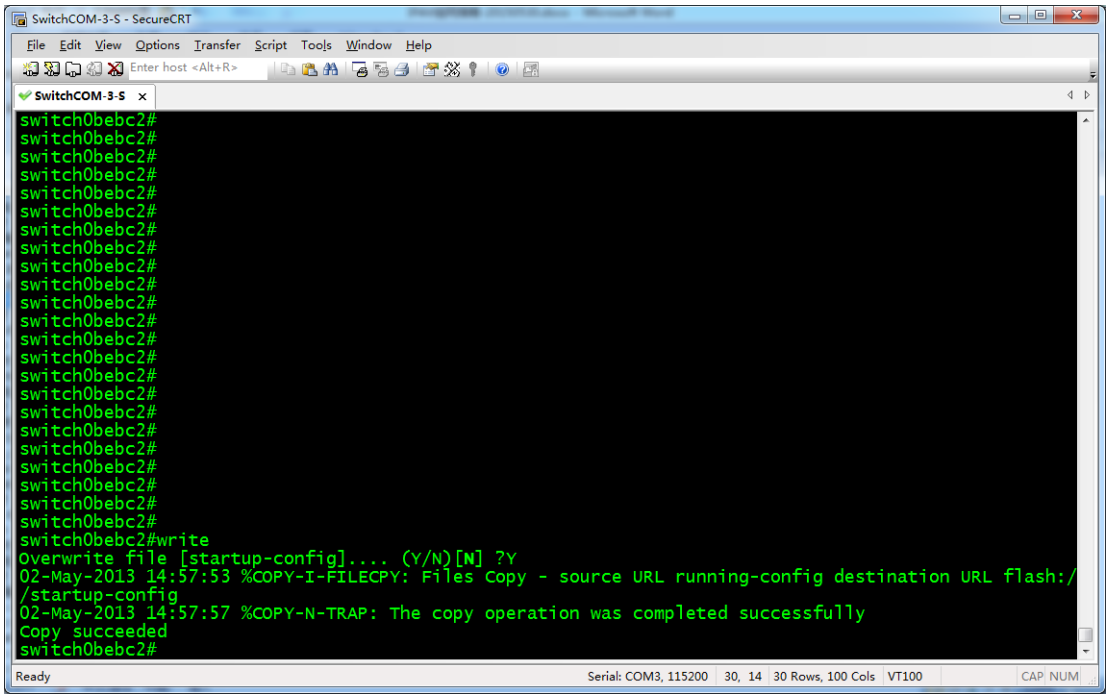
1. In normal mode, input **write** to save configuration. Switch will give the following prompt.

```
switch0bebc2#write
Overwrite file [startup-config].... (Y/N)[N] ?
```

Enter **Y** to confirm. Switch will give the following prompt.

```
02-May-2013 15:01:12 %COPY-I-FILECPY: Files Copy - source URL running-config
destination URL flash://startup-config
02-May-2013 15:01:16 %COPY-N-TRAP: The copy operation was completed successfully
Copy succeeded
switch0bebc2#
```

The screen capture is as follows.



Now, the confirmed configuration is saved. Switch will continue to run the configuration for the next startup.

3.1.3 Importing Configuration

Before importing configuration for switches, complete related preparations by referring to "Reference Information" section, and then operate based on the following steps.

1. After logging in to a switch, in normal mode input **config** to enter global configuration mode.

```
switch0bebc2#
switch0bebc2#configure
```

2. Input **interface vlan 1** to enter configuration view of VLAN 1.

```
switch0bebc2(config)#interface vlan 1
switch0bebc2(config-if)#
```

3. Input **ip address 192.168.1.39 255.255.255.0** to configure management IP address for VLAN 1. Switch will give the following prompt.

```
switch0bebc2(config-if)#ip address 192.168.1.39 255.255.255.0
Please ensure that the port through which the device is managed has the proper
settings and is a member of the new management interface.
Would you like to apply this new configuration? (Y/N)[N]
```

Input **Y** to confirm. After execution, switch will return command prompt.

```
switch0bebc2(config-if)#
```

4. Input **end** to return normal mode.

```
switch0bebc2(config-if)#end
switch0bebc2#
```

5. Input **copy tftp://192.168.1.73/SG300.CFG startup-config** to obtain configuration file **SG300.CFG** from a PC whose IP address is 192.168.1.73. (IP address and configuration file name are examples only. Please use actual information) Switch will give the following prompt.

```
switch0bebc2#copy tftp://192.168.1.73/SG300.CFG startup-config
Overwrite file [startup-config].... (Y/N)[N] ?
```

Input **Y** to confirm. Switch will give the following prompt.

```
02-May-2013 15:04:09 %COPY-I-FILECPY: Files Copy - source URL
tftp://192.168.1.73/SG300.CFG destination URL flash://startup-config
!!..02-May-2013 15:04:15 %COPY-N-TRAP: The copy operation was completed
successfully
!
Copy: 14103 bytes copied in 00:00:06 [hh:mm:ss]

switch0bebc2#
```

6. Input **reload**. Switch will give the following prompt.

```
switch0bebc2#reload
You haven't saved your changes. Are you sure you want to continue ? (Y/N)[N]
```

Input **Y** to confirm. Switch will give the following prompt.

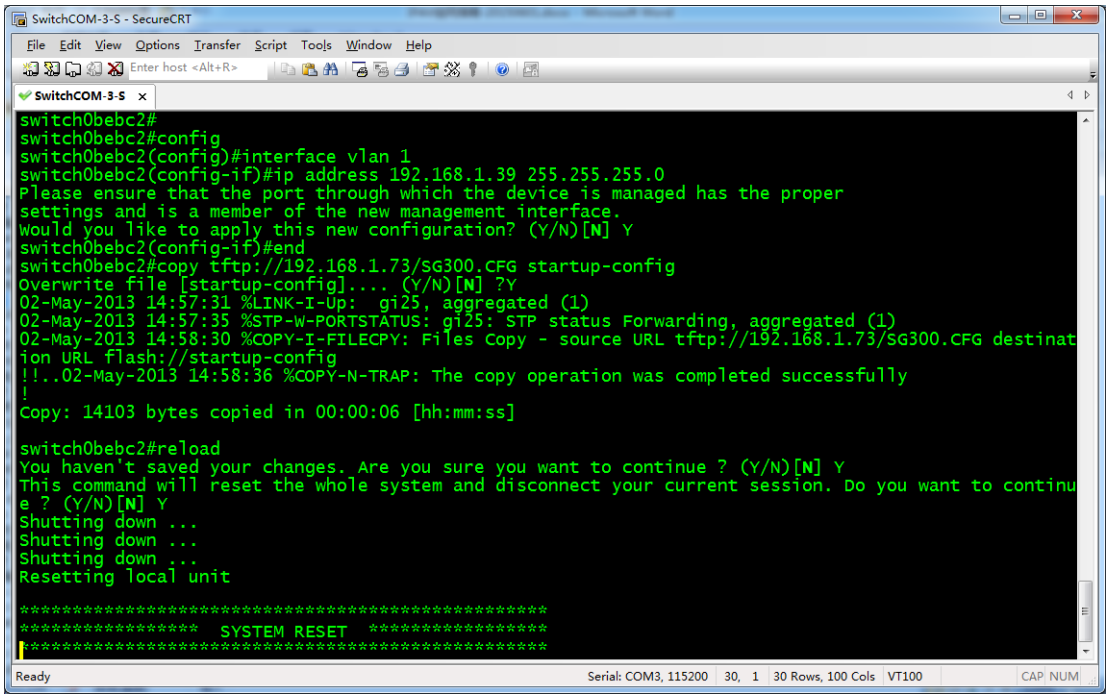
```
This command will reset the whole system and disconnect your current session.
Do you want to continue ? (Y/N)[N]
```

Input **Y** again to confirm. Switch will give the following prompt.

```
Shutting down ...
Shutting down ...
Shutting down ...
Resetting local unit

************************************************
*****************  SYSTEM RESET *****************
************************************************
```

The following screen capture describes the previous steps.



After rebooting, switch runs configuration file **SG300.CFG**.

3.2 Cisco SG500 Series Switches

For Cisco SG500 series switches, we would recommend that you use models SG500-28, SG500-28P, SG500-52 and SG500-52MP. Operations on them are almost the same as SG300 series switches. They can be used in both single switch networking and cascading networking.

3.2.1 Basic Operations

3.2.1.1 Logging In to the Switches

If you want to configure switches, you need to use special cables and connect them to the switches' dedicated ports.

1. Connect your PC to a switch.

Use a matching serial cable to connect between switch's Console port and PC's serial port. If your PC has no serial ports, use a USB-to-serial converter and install correct drivers.

2. Configure serial communication parameters

Run terminal emulation software on your PC. Create a session and configure serial communication parameters according to the following table.

Parameters	Value
Communication Port	● If your PC is equipped with serial ports in factory defaults, usually choose COM1 port. ● If your PC's multiple serial ports are configured or PC is connected to a USB-to-serial converter, see the related user guides.
Baud Rate	115200 bps
Flow Control	None
Parity	None
Stop Bits	1
Data Bits	8

3. Create communication connection

In terminal emulation software select the previously created session and start the connection. When connection is successful, switch will not give any prompt. At this moment, press **Enter**. Switch will give the following prompt.

```
Detected speed: 115200
```

Press **Enter** again. Switch will ask you to input user name.

```
User Name:
```

Input **cisco** (for example default user name **cisco** is used). Switch will ask you to input password.

```
Password:
```

After inputting correct password, switch will display prompt in normal mode.

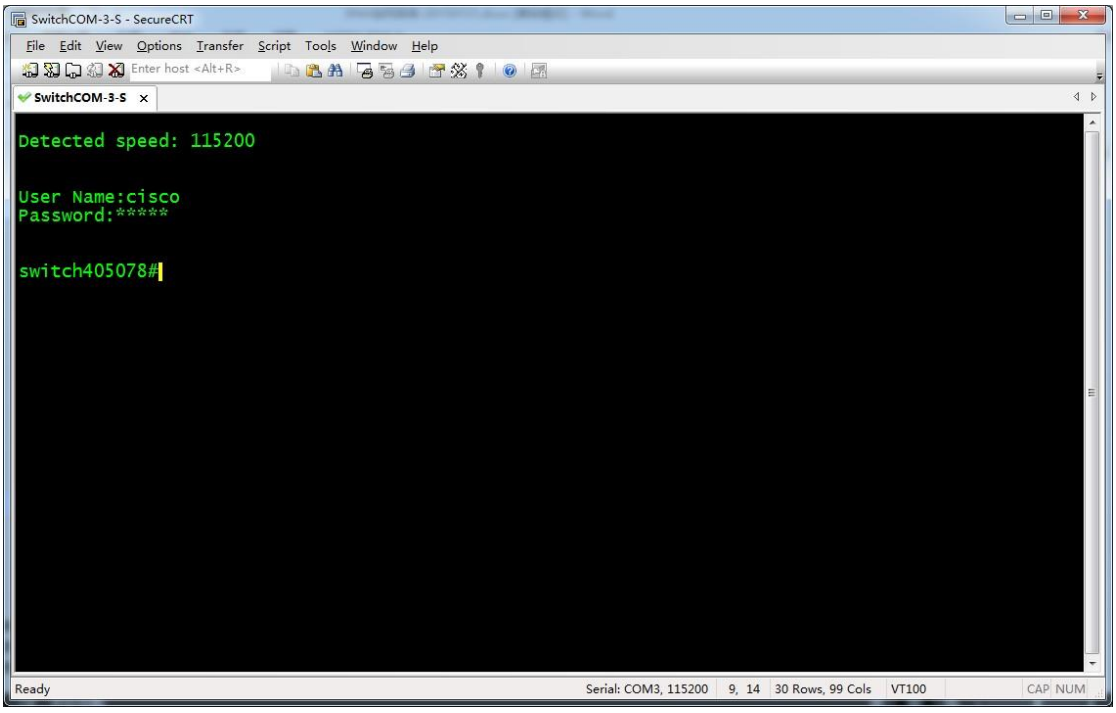
```
switch405078#
```

Please note:

✧ In factory defaults of SG500 series switches, user mode and privileged mode have the same commend-line prompt and the highest privilege level. In this case, we call it "normal mode".

✧ SG500 series switches use the combination of "switch" and the last six characters of MAC address as the default names. In the prompt examples of this manual, "405078" are the last six characters of MAC address of a SG500 series switch in our test. They may vary with actual switches.

The following screen capture describes the previous steps. It means that you have successfully logged in to the switch and entered normal mode.



3.2.1.2 Resetting to Factory Defaults

1. In user mode input **delete startup-config** to delete startup configuration. Switch will give the following prompt.

```
switch405078#delete startup-config
Delete startup-config? (Y/N)[N]
```

Enter **Y** (not case sensitive) to confirm. Switch will give the following prompt, which means that startup configuration is deleted.

```
switch405078#02-May-2013 17:03:05 %FILE-I-DELETE: File Delete - file URL flash://startup-config
```

2. Input **reload** to reboot switch. Switch will give the following prompt.

```
switch405078#reload
You haven't saved your changes. Are you sure you want to continue? (Y/N)[N]
```

Input **Y** to confirm. Switch will give the following prompt.

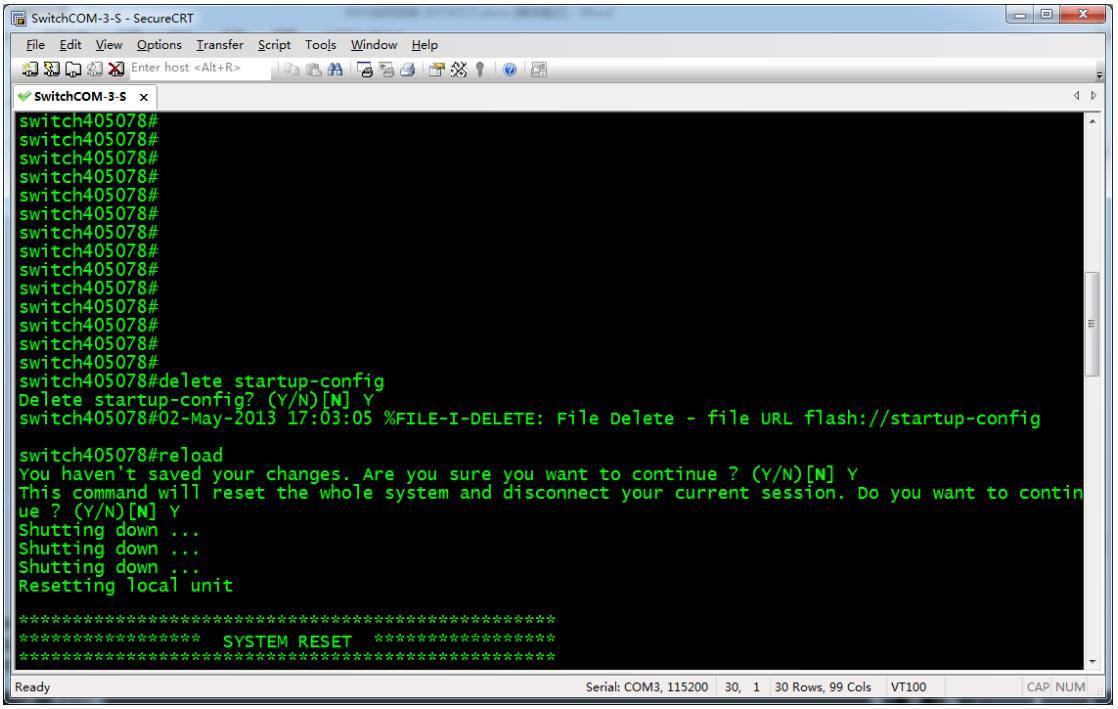
```
This command will reset the whole system and disconnect your current session. Do you want to continue ? (Y/N)[N]
```

Input **Y** to confirm. Switch will give the following prompt.

```
Shutting down ...
Shutting down ...
Shutting down ...
Resetting local unit

************************************************
*****************  SYSTEM RESET  *****************
************************************************
```

The following screen capture describes the previous steps.



3. Switch reboots. When the following prompt appears, quickly press **Enter** twice to complete the baud-rate detection process.

```
Console baud-rate auto detection is enabled, press Enter twice to complete the detection process
```

If you do it slowly and exceed the time limit, switch will continue to ask you to input user name. Switch will give the following prompt.

```
Console baud-rate auto detection is enabled, press Enter twice to complete the detection process

User Name:
```

In summary, press **Enter** twice before any effective input to work with switch for baud-rate auto detection. Switch will give the following prompt.

```
Detected speed: 115200


User Name:
```

Input default name **cisco**. Switch will ask you to input password.

```
Password:
```

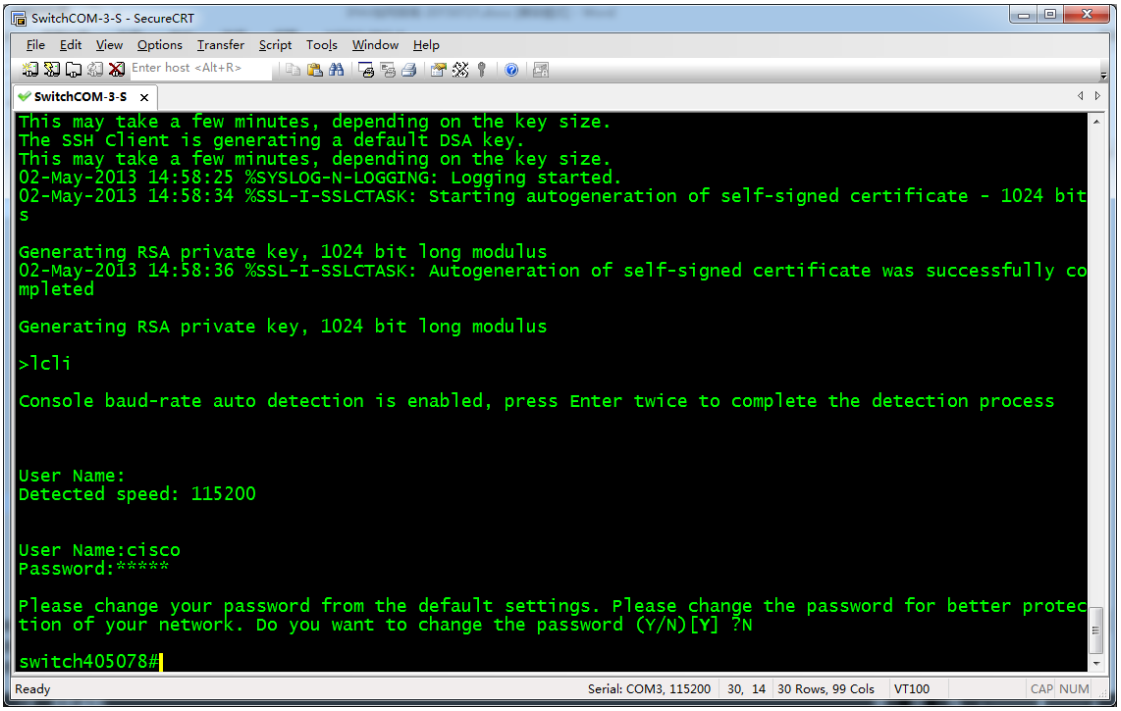
Input default password **cisco**. Switch will ask if you want to change your password.

```
Please change your password from the default settings. Please change the password for better
protection of your network. Do you want to change the password (Y/N)[Y]?
```

Now, input **N** to skip the password change process. Switch will give the following prompt.

```
switch0bebc2#
```

The screen capture is as follows.



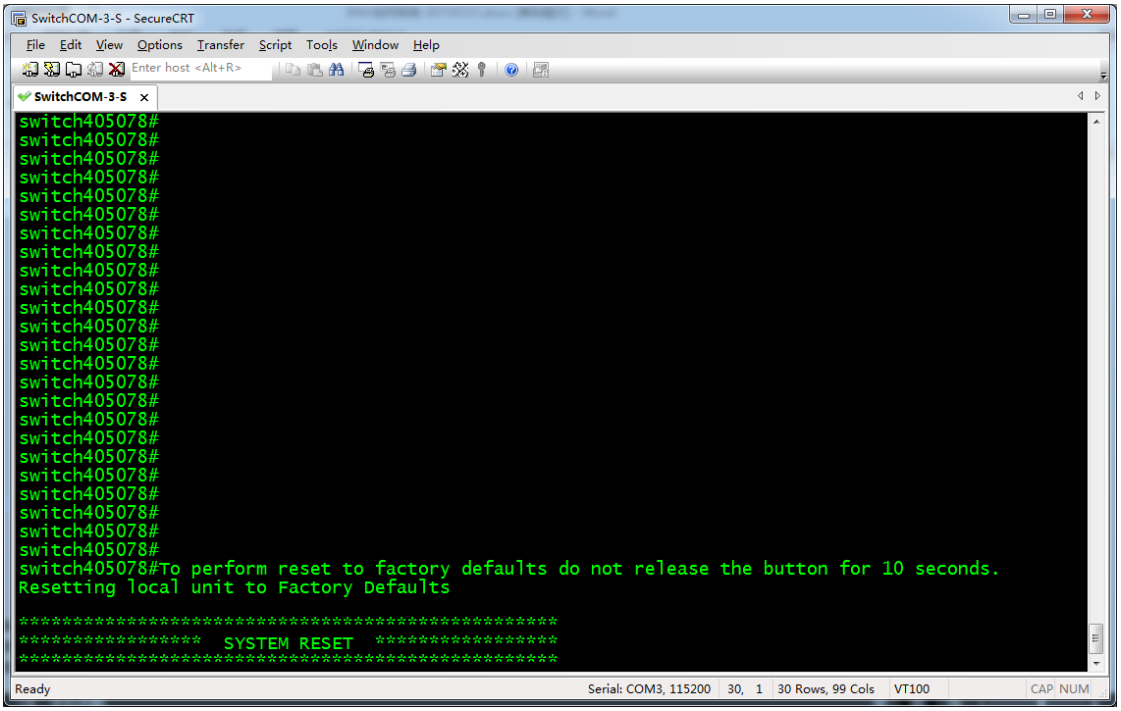
Now, you have successfully reset switch to factory defaults and entered normal mode.

If you forgot switch's password and cannot access its command-line interface, you can perform reset to factory defaults by using a stylus to press and hold Reset button until the following prompt appears.

```
switch405078#To perform reset to factory defaults do not release the button for 10 seconds.
Resetting local unit to Factory Defaults

**************************************************
**********  SYSTEM RESET  **********
**************************************************
```

The screen capture is as follows.



The prompt above means that switch is reset to factory defaults and starts rebooting. Now you can release Reset button and wait until switch finishes rebooting, and then operate based on the previous step 3.

3.2.2 Manual Configuration

3.2.2.1 Single Switch Networking Configuration

1. Global Configuration

In normal mode input **config** to enter global configuration mode. Switch will give the following prompt.

```
switch405078#config
switch405078(config)#
```

Input **no eee enable** to disable energy saving function. Switch will give the following prompt. (The following prompt is related to network devices connected to switch)

```
switch405078(config)#no eee enable
switch405078(config)#02-May-2013 14:59:25 %LINK-W-Down: gi1/1/6
02-May-2013 14:59:25 %LINK-W-Down:  gi1/1/8
02-May-2013 14:59:25 %LINK-W-Down:  Vlan 1
02-May-2013 14:59:28 %LINK-I-Up:  gi1/1/8, aggregated (1)
02-May-2013 14:59:28 %LINK-I-Up:  Vlan 1, aggregated (1)
02-May-2013 14:59:29 %LINK-I-Up:  gi1/1/6, aggregated (1)
02-May-2013 14:59:32 %STP-W-PORTSTATUS: gi1/1/8: STP status Forwarding, aggregated (1)
02-May-2013 14:59:34 %STP-W-PORTSTATUS: gi1/1/6: STP status Forwarding, aggregated (1)
02-May-2013 15:00:32 %INIT-I-Startup: Warm Startup
```

Input **bridge multicast filtering** to enable multicast filtering function.

```
switch405078(config)#bridge multicast filtering
switch405078(config)#
```

2. Configure **IGMP Snooping**.

Input **ip igmp snooping** to enable global IGMP Snooping function.

```
switch405078(config)#ip igmp snooping
switch405078(config)#
```

Input **ip igmp snooping vlan 1** to enable IGMP Snooping function for VLAN 1.

```
switch405078(config)#ip igmp snooping vlan 1
switch405078(config)#
```

Input **ip igmp snooping vlan 1 querier address 192.168.22.222** to assign IP address for IGMP Querier.

```
switch405078(config)#ip igmp snooping vlan 1 querier address 192.168.22.222
switch405078(config)#
```

Input **ip igmp snooping vlan 1 querier** to enable IGMP Querier function for VLAN 1.

```
switch405078(config)#ip igmp snooping vlan 1 querier
switch405078(config)#
```

Input **ip igmp snooping vlan 1 immediate-leave** to enable multicast fast leave function for VLAN 1.

```
switch405078(config)#ip igmp snooping vlan 1 immediate-leave
switch405078(config)#
```

Input **no ip igmp snooping vlan 1 mrouter learn pim-dvmrp** to disable dynamic multicast router ports for VLAN 1.

```
switch405078(config)#no ip igmp snooping vlan 1 mrouter learn pim-dvmrp
switch405078(config)#
```

3. Configure unknown multicast messages

In global configuration mode input **interface range gi1/1/1-28** to enter all Gigabit Ethernet port bulk operation mode.

```
switch405078(config)#interface range gi1/1/1-28
switch405078(config-if-range)#
```

Note:

The Ethernet switches in the example are equipped with 28 Gigabit Ethernet ports. If your switches have different number of ports and various port types, set the parameters of **interface range** command based on their user guides.

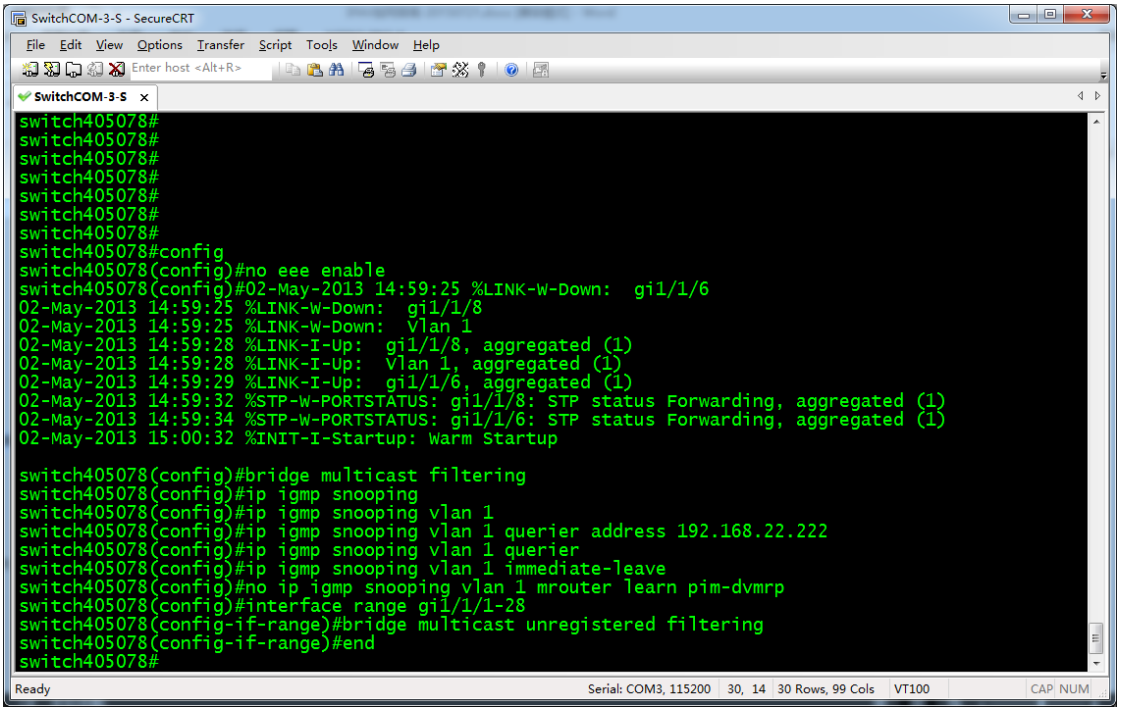
Input **bridge multicast unregistered filtering** to drop unknown multicast messages in all Gigabit Ethernet ports.

```
switch405078(config-if-range)#bridge multicast unregistered filtering
switch405078(config-if-range)#
```

Input **end** to return normal mode.

```
switch405078(config-if-range)#end
switch405078#
```

The following screen capture describes the previous steps.



4. Confirm and save configuration.

In normal mode input **show running-config**. Switch will give feedback about the current detailed configuration.

```
switch405078#show running-config
config-file-header
switch405078
...
bridge multicast filtering
...
ip igmp snooping
ip igmp snooping vlan 1
no ip igmp snooping vlan 1 mrouter learn pim-dvmrp
ip igmp snooping vlan 1 immediate-leave
ip igmp snooping vlan 1 querier
ip igmp snooping vlan 1 querier address 192.168.22.222
no eee enable
hostname switch405078
!
interface gigabitethernet1/1/1
  bridge multicast unregistered filtering
!
interface gigabitethernet1/1/2
  bridge multicast unregistered filtering
...
interface gigabitethernet1/1/28
  bridge multicast unregistered filtering
!
exit
switch405078#
```

The information above includes the eight configuration commands we input.

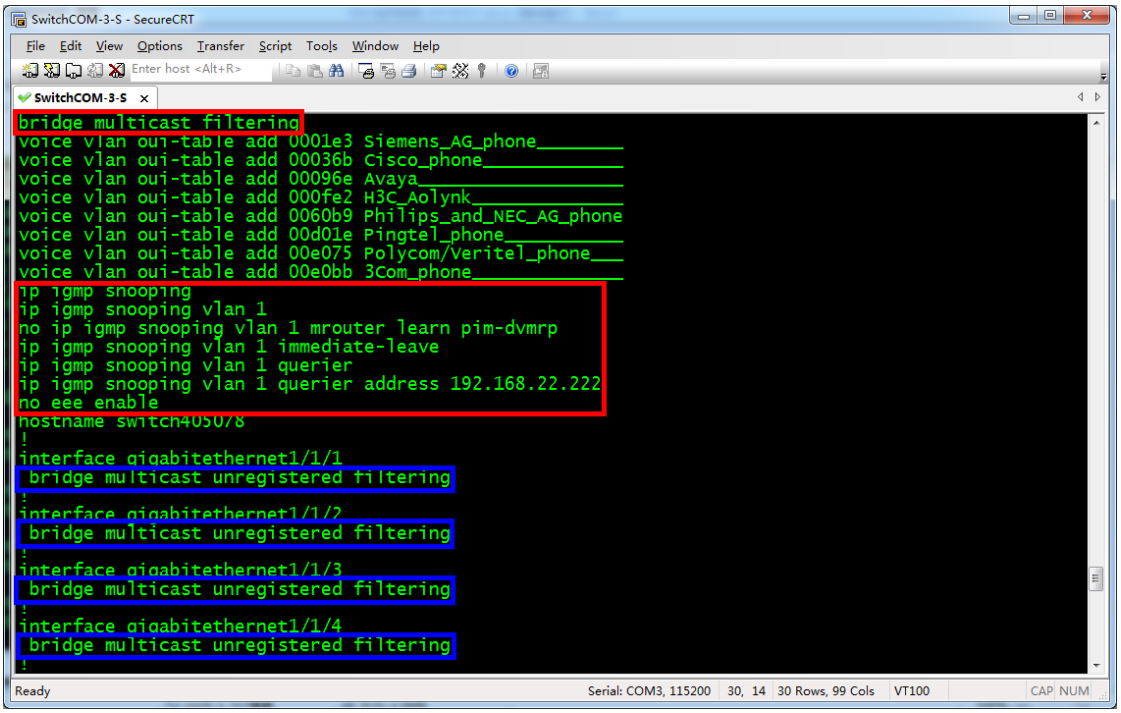
```
bridge multicast filtering
...
ip igmp snooping
ip igmp snooping vlan 1
```

```
no ip igmp snooping vlan 1 mrouter learn pim-dvmrp
ip igmp snooping vlan 1 immediate-leave
ip igmp snooping vlan 1 querier
ip igmp snooping querier address 192.168.22.222
no eee enable
```

And the following configuration is set on each Ethernet port.

```
bridge multicast unregistered filtering
```

The screen capture of confirmed configuration is as follows.



Eight configuration commands are marked in red boxes. The commands marked in blue boxes are set on each port configuration. If your confirmation result is the same as above, it indicates that SG500 series switches are correctly configured.

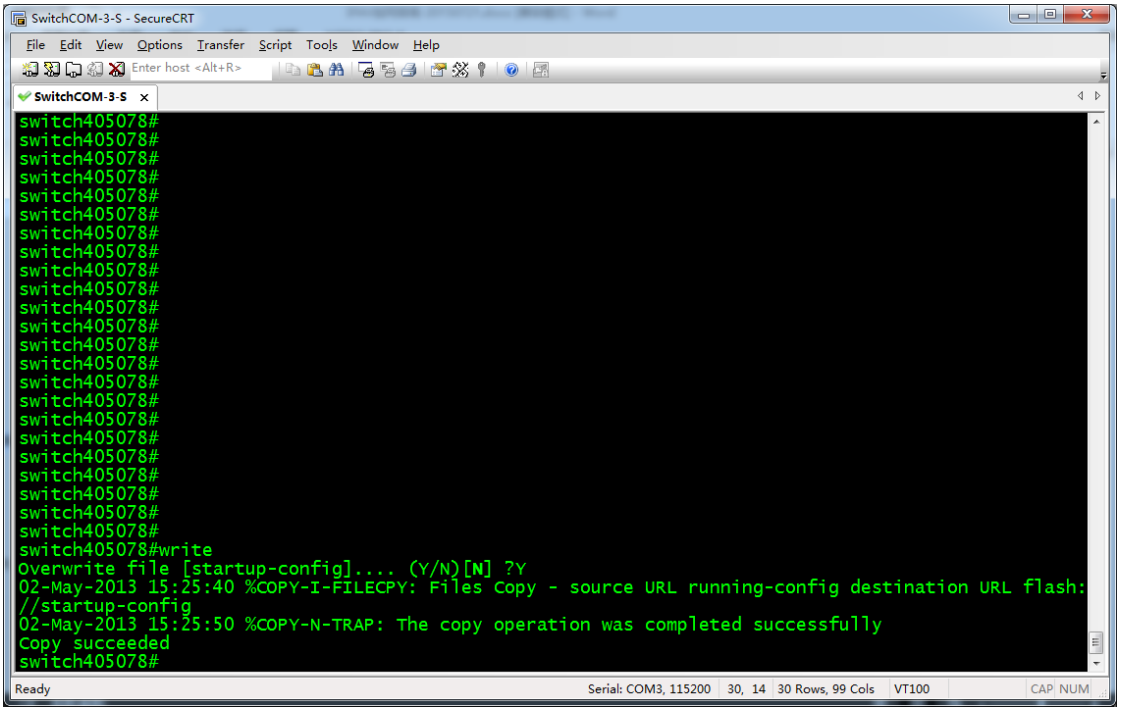
After confirming the configuration, input **write** to save configuration. Switch will give the following prompt.

```
switch405078#write
Overwrite file [startup-config].... (Y/N)[N] ?
```

Enter **Y** to confirm. Switch will give the following prompt.

```
02-May-2013 15:25:40 %COPY-I-FILECPY: Files Copy - source URL running-config destination URL
flash://startup-config
02-May-2013 15:25:50 %COPY-N-TRAP: The copy operation was completed successfully
Copy succeeded
switch405078#
```

The screen capture is as follows.



Now, the confirmed configuration is saved. Switch will continue to run the configuration for the next startup.

3.2.2.2 Core Switch Configuration

1. Global Configuration

In normal mode input **config** to enter global configuration mode. Switch will give the following prompt.

```
switch405078#config
switch405078(config)#
```

Input **no eee enable** to disable energy saving function. Switch will give the following prompt. (The following prompt is related to network devices connected to switch)

```
switch405078(config)#no eee enable
switch405078(config)#02-May-2013 14:59:13 %LINK-W-Down: gi1/1/6
02-May-2013 14:59:13 %LINK-W-Down:  gi1/1/8
02-May-2013 14:59:13 %LINK-W-Down:  Vlan 1

switch405078(config)#02-May-2013 14:59:16 %LINK-I-Up:  gi1/1/8, aggregated (1)
02-May-2013 14:59:16 %LINK-I-Up:  Vlan 1, aggregated (1)
02-May-2013 14:59:17 %LINK-I-Up:  gi1/1/6, aggregated (1)
02-May-2013 14:59:20 %STP-W-PORTSTATUS: gi1/1/8: STP status Forwarding, aggregated (1)
02-May-2013 14:59:21 %STP-W-PORTSTATUS: gi1/1/6: STP status Forwarding, aggregated (1)
02-May-2013 15:00:46 %INIT-I-Startup: Warm Startup

switch405078(config)#
```

Input **bridge multicast filtering** to enable multicast filtering function.

```
switch405078(config)#bridge multicast filtering
switch405078(config)#
```

2. Configure IGMP Snooping.

Input **ip igmp snooping** to enable global IGMP Snooping function.

```
switch405078(config)#ip igmp snooping
switch405078(config)#
```

Input **ip igmp snooping vlan 1** to enable IGMP Snooping function for VLAN 1.

```
switch405078(config)#ip igmp snooping vlan 1
switch405078(config)#
```

Input **ip igmp snooping vlan 1 querier address 192.168.22.222** to assign IP address for IGMP Querier.

```
switch405078(config)#ip igmp snooping vlan 1 querier address 192.168.22.222
switch405078(config)#
```

Input **ip igmp snooping vlan 1 querier** to enable IGMP Querier function for VLAN 1.

```
switch405078(config)#ip igmp snooping vlan 1 querier
switch405078(config)#
```

Input **no ip igmp snooping vlan 1 mrouter learn pim-dvmrp** to disable dynamic multicast router ports for VLAN 1.

```
switch405078(config)#no ip igmp snooping vlan 1 mrouter learn pim-dvmrp
switch405078(config)#
```

3. Configure unknown multicast messages

In global configuration mode input **interface range gi1/1/1-28** to enter all Gigabit Ethernet port bulk operation mode.

```
switch405078(config)#interface range gi1/1/1-28
switch405078(config-if-range)#
```

Note:

The Ethernet switches in the example are equipped with 28 Gigabit Ethernet ports. If your switches have different number of ports and various port types, set the parameters of **interface range** command based on their user guides.

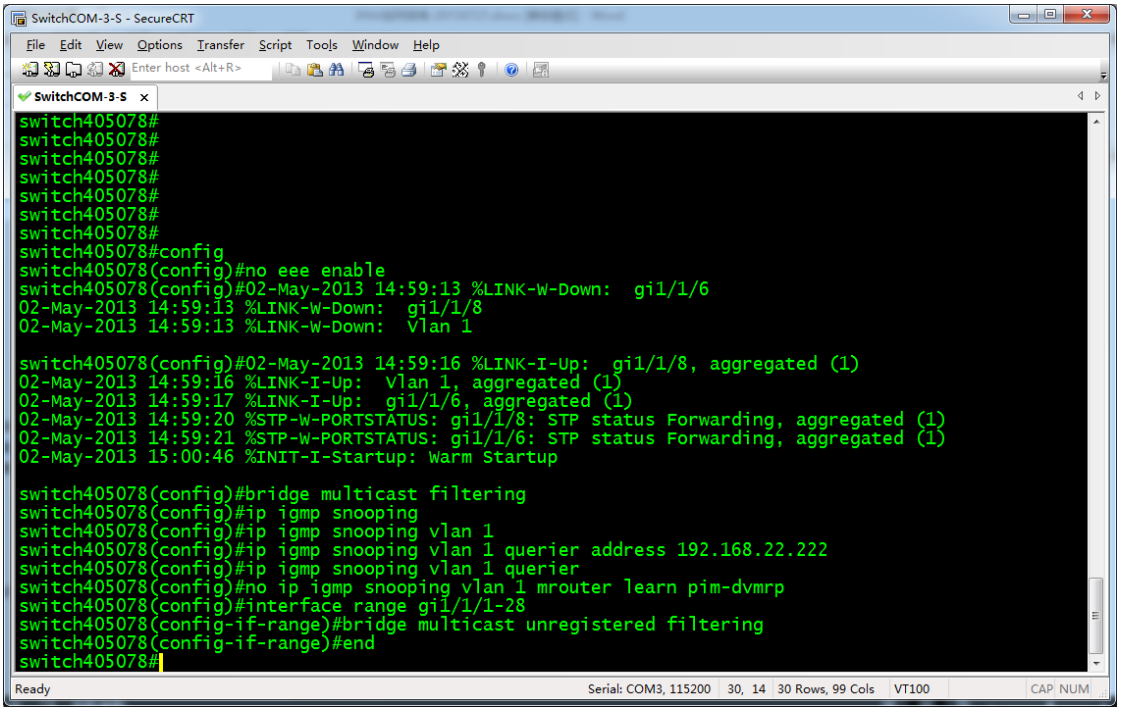
Input **bridge multicast unregistered filtering** to drop unknown multicast messages in all Gigabit Ethernet ports.

```
switch405078(config-if-range)#bridge multicast unregistered filtering
switch405078(config-if-range)#
```

Input **end** to return normal mode.

```
switch405078(config-if-range)#end
switch405078#
```

The following screen capture describes the previous steps.



4. Confirm and save configuration.

In normal mode input **show running-config**. Switch will give feedback about the current detailed configuration.

```
switch405078#show running-config
config-file-header
switch405078
...
bridge multicast filtering
...
ip igmp snooping
ip igmp snooping vlan 1
no ip igmp snooping vlan 1 mrouter learn pim-dvmrp
ip igmp snooping vlan 1 querier
ip igmp snooping vlan 1 querier address 192.168.22.222
no eee enable
hostname switch405078
!
interface gigabitethernet1/1/1
  bridge multicast unregistered filtering
!
interface gigabitethernet1/1/2
  bridge multicast unregistered filtering
...
interface gigabitethernet1/1/28
  bridge multicast unregistered filtering
!
exit
switch405078#
```

The information above includes the seven configuration commands we input.

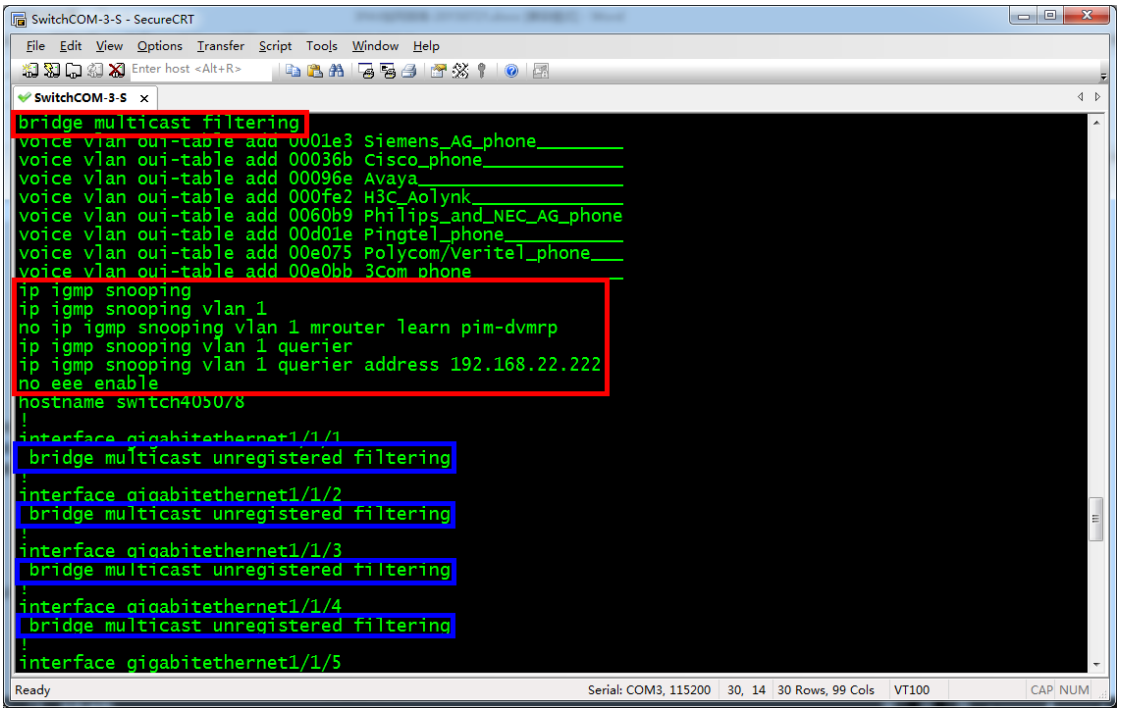
```
bridge multicast filtering
...
ip igmp snooping
ip igmp snooping vlan 1
no ip igmp snooping vlan 1 mrouter learn pim-dvmrp
```

```
ip igmp snooping vlan 1 querier
ip igmp snooping vlan 1 querier address 192.168.22.222
no eee enable
```

And the following configuration is set on each Ethernet port.

```
 bridge multicast unregistered filtering
```

The screen capture of confirmed configuration is as follows.



Seven configuration commands are marked in red boxes. The commands marked in blue boxes are set on each port configuration. If your confirmation result is the same as above, it indicates that SG500 series switches are correctly configured.

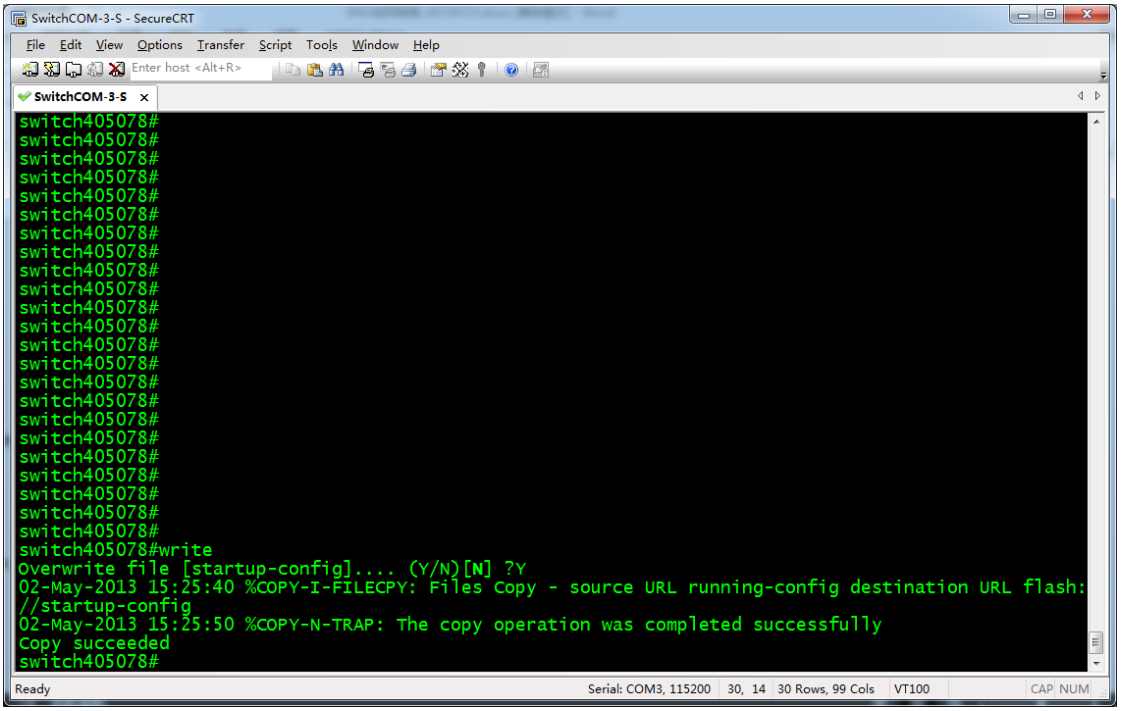
After confirming the configuration, input **write** to save configuration. Switch will give the following prompt.

```
switch405078#write
Overwrite file [startup-config].... (Y/N)[N] ?
```

Enter **Y** to confirm. Switch will give the following prompt.

```
02-May-2013 15:25:40 %COPY-I-FILECPY: Files Copy - source URL running-config destination URL
flash://startup-config
02-May-2013 15:25:50 %COPY-N-TRAP: The copy operation was completed successfully
Copy succeeded
switch405078#
```

The screen capture is as follows.



Now, the confirmed configuration is saved. Switch will continue to run this configuration for the next startup.

3.2.2.3 Extended Switches Configuration

1. Global Configuration

In normal mode input **config** to enter global configuration mode. Switch will give the following prompt.

```
switch405078#config
switch405078(config)#
```

Input **no eee enable** to disable energy saving function. Switch will give the following prompt. (The following prompt is related to network devices connected to switch)

```
switch405078(config)#no eee enable
switch405078(config)#02-May-2013 15:03:34 %LINK-W-Down: gi1/1/6
02-May-2013 15:03:34 %LINK-W-Down:  gi1/1/8
02-May-2013 15:03:34 %LINK-W-Down:  Vlan 1
02-May-2013 15:03:36 %LINK-I-Up:  gi1/1/8
02-May-2013 15:03:36 %LINK-I-Up:  Vlan 1
02-May-2013 15:03:37 %LINK-I-Up:  gi1/1/6
02-May-2013 15:03:41 %STP-W-PORTSTATUS: gi1/1/8: STP status Forwarding
02-May-2013 15:03:42 %STP-W-PORTSTATUS: gi1/1/6: STP status Forwarding

switch405078(config)#
```

Input **bridge multicast filtering** to enable multicast filtering function.

```
switch405078(config)#bridge multicast filtering
switch405078(config)#
```

2. Configure **IGMP Snooping**.

Input **ip igmp snooping** to enable global IGMP Snooping function.

```
switch405078(config)#ip igmp snooping
switch405078(config)#
```

Input **ip igmp snooping vlan 1** to enable IGMP Snooping function for VLAN 1.

```
switch405078(config)#ip igmp snooping vlan 1
switch405078(config)#
```

Input **ip igmp snooping vlan 1 immediate-leave** to enable multicast fast leave function for VLAN 1.

```
switch405078(config)#ip igmp snooping vlan 1 immediate-leave
switch405078(config)#
```

3. Configure unknown multicast messages

Unknown multicast messages must be forwarded to the cascading port connected to the core switch when using SG500 series Ethernet switches as extended switches. In fact, these switches will forward unknown multicast messages to all ports in default settings. Therefore, we only need to make configurations to drop unknown multicast messages on all non-cascading ports.

We assume that Ethernet port 21 is a cascading port. In this case, input **interface range gi1/1/1-20,gi1/1/22-28** to perform bulk operations on all the other ports except port 21. If another port is used as the cascading port, change the parameters of this command. For more information about this command, see the switches' user guides. When inputting this command, the switch will give the following prompt.

```
switch405078(config)#interface range gi1/1/1-20,gi1/1/22-28
switch405078(config-if-range)#
```

Note:

The Ethernet switches in the example are equipped with 28 Gigabit Ethernet ports. If your switches have different number of ports and various port types, set the parameters of **interface range** command based on their user guides.

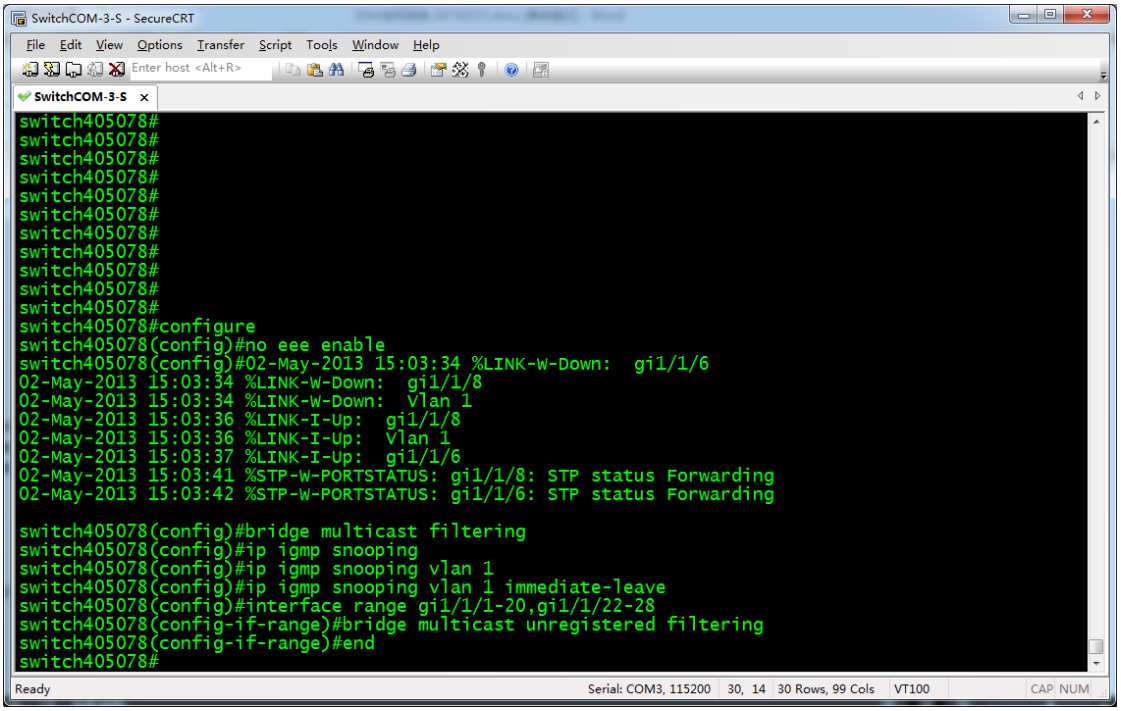
Input **bridge multicast unregistered filtering** to drop unknown multicast messages in the Gigabit Ethernet ports specified in the last step.

```
switch405078(config-if-range)#bridge multicast unregistered filtering
switch405078(config-if-range)#
```

Input **end** to return normal mode.

```
switch405078(config-if-range)#end
switch405078#
```

The following screen capture describes the previous steps.



4. Confirm and save configuration.

In normal mode input **show running-config**. Switch will give feedback about the current detailed configuration.

```
switch405078#show running-config
config-file-header
switch405078
...
bridge multicast filtering
...
ip igmp snooping
ip igmp snooping vlan 1
ip igmp snooping vlan 1 immediate-leave
no eee enable
hostname switch405078
!
interface gigabitethernet1/1/1
  bridge multicast unregistered filtering
!
interface gigabitethernet1/1/2
  bridge multicast unregistered filtering
...
interface gigabitethernet1/1/20
  bridge multicast unregistered filtering
!
interface gigabitethernet1/1/22
  bridge multicast unregistered filtering
...
interface gigabitethernet1/1/28
  bridge multicast unregistered filtering
!
exit
```

The information above includes the five configuration commands we input.

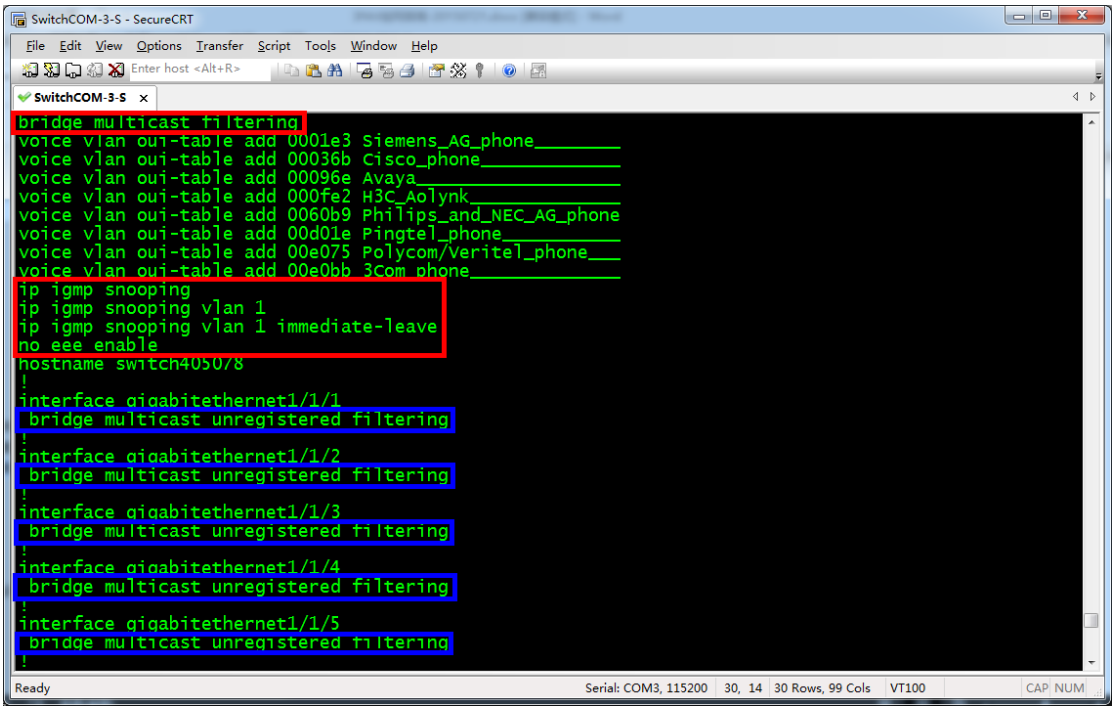
```
bridge multicast filtering
...
```

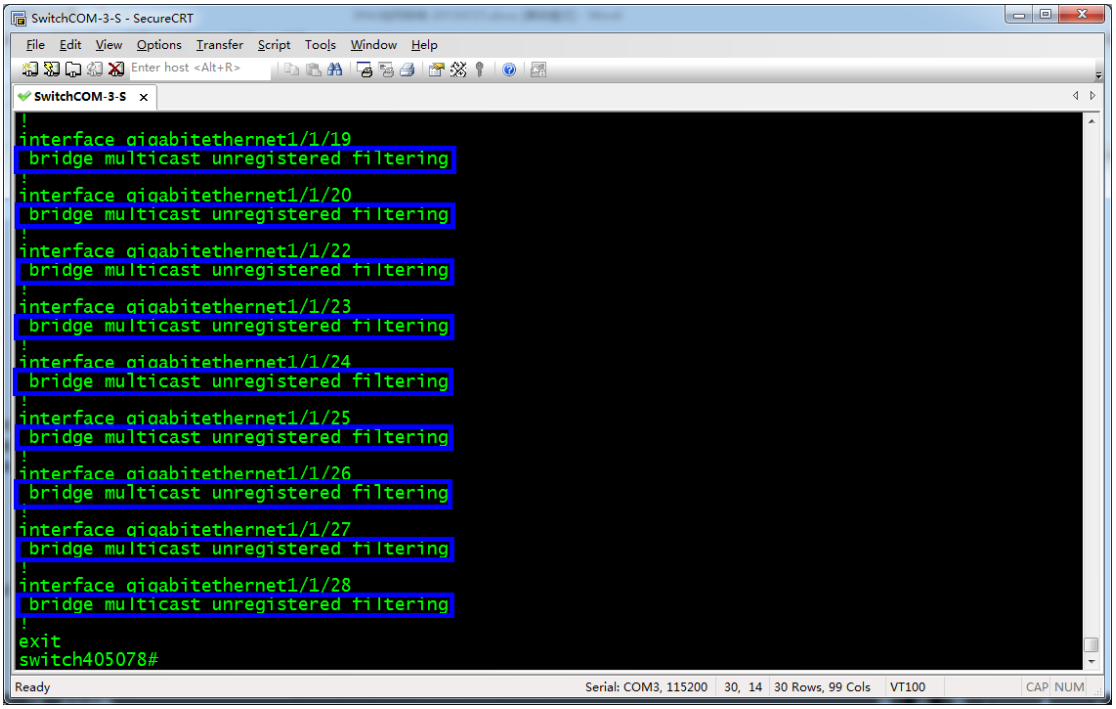
```
ip igmp snooping
ip igmp snooping vlan 1
ip igmp snooping vlan 1 immediate-leave
no eee enable
```

And the following configuration is set on each Ethernet port except port 21.

```
bridge multicast unregistered filtering
```

The screen capture of confirmed configuration is as follows.





Five configuration commands are marked in red boxes. The commands marked in blue boxes are set on each port configuration except on port 21. If your confirmation result is the same as above, it indicates that SG500 series switches are correctly configured.

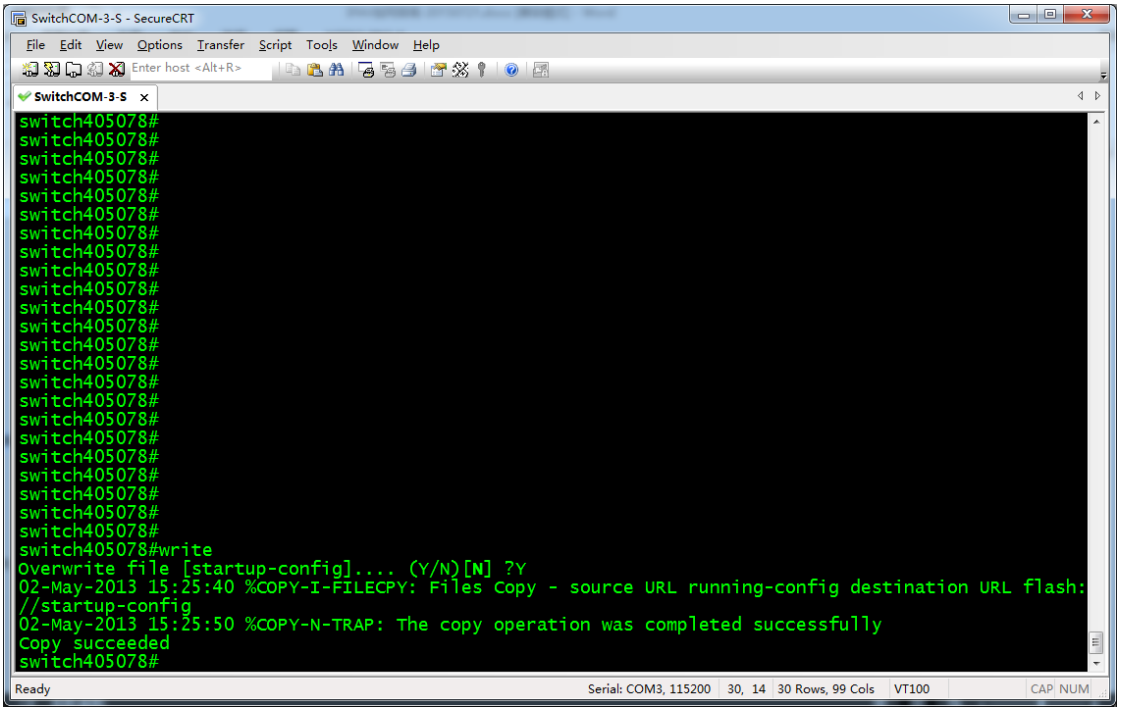
After confirming the configuration, input **write** to save configuration. Switch will give the following prompt.

```
switch405078#write
Overwrite file [startup-config].... (Y/N)[N] ?
```

Enter **Y** to confirm. Switch will give the following prompt.

```
02-May-2013 15:25:40 %COPY-I-FILECPY: Files Copy - source URL running-config destination URL
flash://startup-config
02-May-2013 15:25:50 %COPY-N-TRAP: The copy operation was completed successfully
Copy succeeded
switch405078#
```

The screen capture is as follows.



Now, the confirmed configuration is saved. Switch will continue to run the configuration for the next startup.

3.2.2.4 Limiting Gigabit Ethernet Ports' Speed

When using both 1000 Mbps Ethernet switches and 100 Mbps Ethernet switches for networking, if you connect RX to 100Mbps switches and TX to 1000Mbps switches, the quality of pictures will be affected due to different port speeds. To resolve this problem, we would recommend that you configure 1000Mbps switches' Ethernet ports connected to TX and limit their speed to 100Mbps.

1. View port speed.

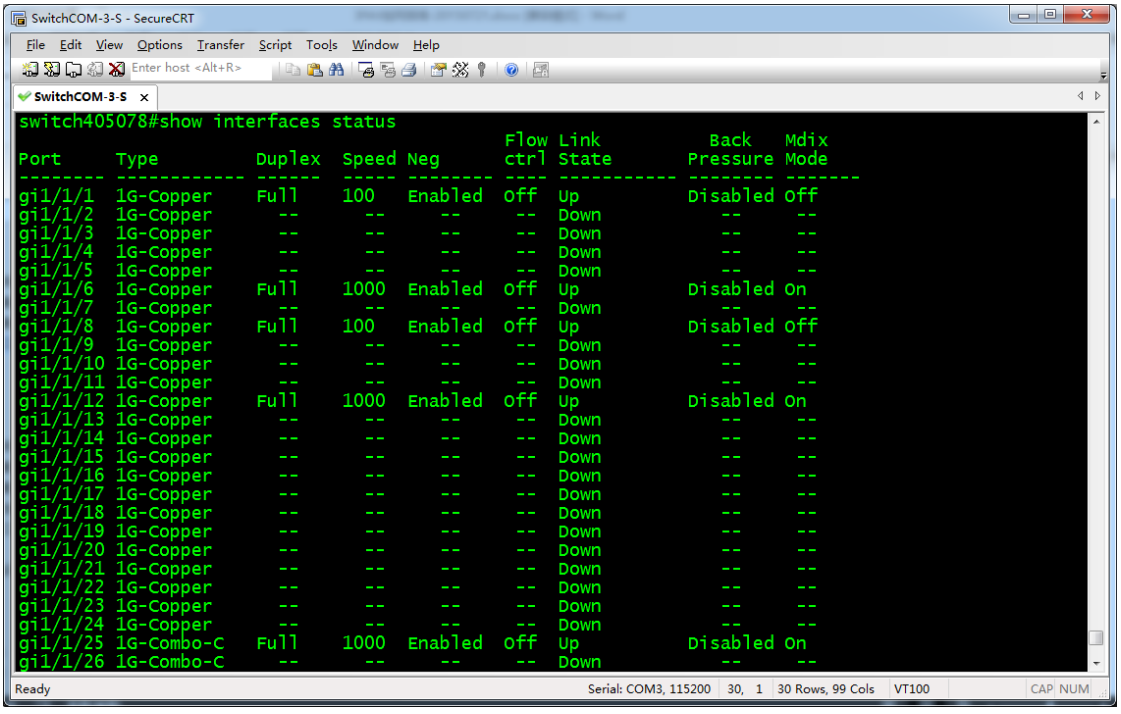
In normal mode input **show interface status** to view port speed information. Switch will give the following prompt.

```
switch405078#show interfaces status
                                                    Flow Link          Back     Mdix
Port       Type            Duplex  Speed Neg        ctrl State       Pressure Mode
-------- ------------ ------   ----- -------- ---- ----------- -------- -------
gi1/1/1   1G-Copper      Full     100    Enabled  Off   Up            Disabled Off
gi1/1/2   1G-Copper        --       --      --      --   Down            --       --
gi1/1/3   1G-Copper        --       --      --      --   Down            --       --
gi1/1/4   1G-Copper        --       --      --      --   Down            --       --
gi1/1/5   1G-Copper        --       --      --      --   Down            --       --
gi1/1/6    1G-Copper     Full     1000   Enabled  Off   Up            Disabled On
gi1/1/7   1G-Copper        --       --      --      --   Down            --       --
gi1/1/8   1G-Copper      Full     100    Enabled  Off   Up            Disabled Off

...
gi1/1/25 1G-Combo-C     Full     1000   Enabled  Off   Up            Disabled On
gi1/1/26 1G-Combo-C       --       --      --      --   Down            --       --

                                                    Flow      Link
Ch          Type      Duplex  Speed   Neg        control   State
-------- ------- ------   -----   -------- -------   -----------
Po1          --       --       --       --       --      Not Present
Po2          --       --       --       --       --      Not Present
...
Po32         --       --       --       --       --      Not Present
switch405078#
```

The screen capture is as follows.



Parameters in speed column are the port speeds. "100" means 100Mbps. "1000" means 1000Mbps.

2. Change port speed.

Input **config** to enter global configuration mode. Switch will give the following prompt.

```
switch405078#config
switch405078(config)#
```

Use **interface** command to select an Ethernet port connected to TX for entering port

configuration mode. Switch will give the following prompt.

```
switch405078(config)#interface gi1/1/6
switch405078(config-if)#
```

Input **no negotiation** to disable auto negotiation. Switch will give the following prompt.

```
switch405078(config-if)#no negotiation
switch405078(config-if)#
```

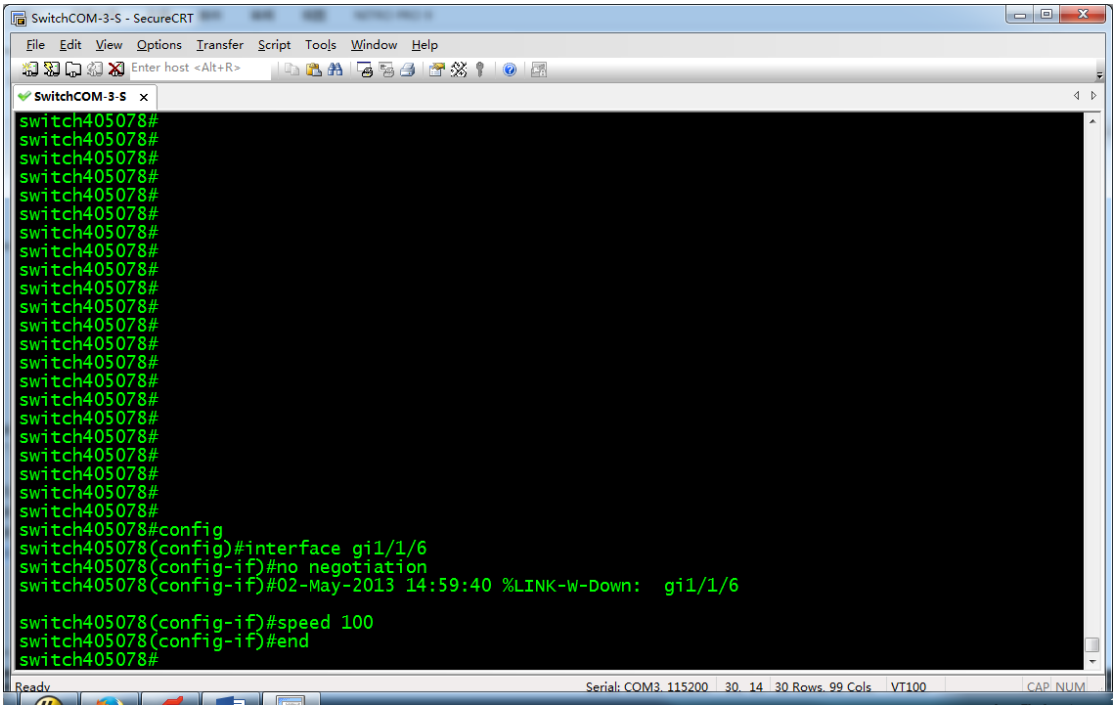
Input **speed 100** to set port's rate mode as 100Mbps. Switch will give the following prompt.

```
switch405078(config-if)#speed 100
switch405078(config-if)#
```

Input **end** to return normal mode. Switch will give the following prompt.

```
switch405078(config-if)#end
switch405078#
```

During the operation period above, messages of port disconnection or reconnection may appear. The following screen capture describes the previous steps.



You can also use **interface range** command to set multiple successive ports to perform bulk operations on their modes.

3. Confirm the configuration.

In normal mode input **show interface status** to show if the previous modification takes effect. Switch will give the following prompt.

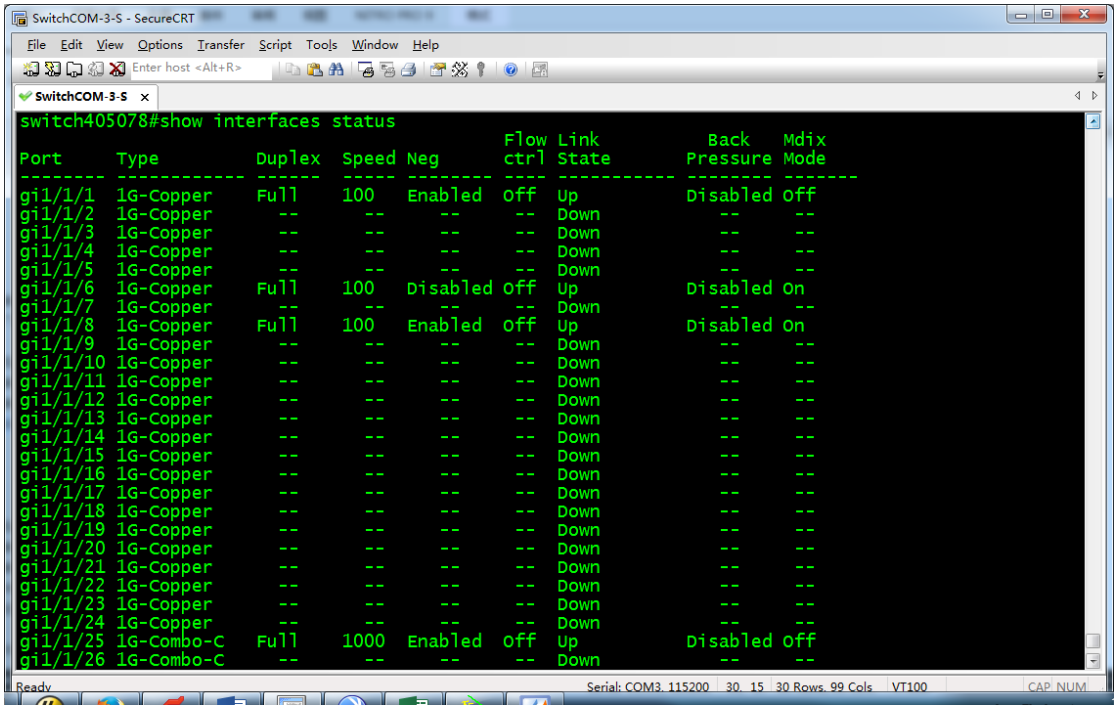
```
switch405078#show interfaces status
                                                                  Flow Link          Back     Mdix
Port        Type              Duplex  Speed Neg          ctrl State          Pressure Mode
-------- ------------ ------   ----- -------- ---- ----------- -------- -------
gi1/1/1 1G-Copper          Full      100     Enabled   Off    Up                Disabled Off
gi1/1/2   1G-Copper          --         --        --        --   Down                 --        --
```

```
gi1/1/3   1G-Copper        --        --        --        --   Down                 --        --
gi1/1/4   1G-Copper        --        --        --        --   Down                 --        --
gi1/1/5   1G-Copper        --        --        --        --   Down                 --        --
gi1/1/6    1G-Copper     Full      100     Disabled Off   Up                Disabled On
gi1/1/7   1G-Copper        --        --        --        --   Down                 --        --
gi1/1/8   1G-Copper     Full      100     Enabled   Off   Up                Disabled Off

...
gi1/1/25 1G-Combo-C     Full      1000    Enabled   Off   Up                Disabled On
gi1/1/26 1G-Combo-C       --        --        --        --   Down                 --        --

                                                          Flow       Link
Ch          Type      Duplex   Speed   Neg          control   State
-------- ------- ------   -----   -------- -------   -----------
Po1          --        --        --        --        --      Not Present
Po2          --        --        --        --        --      Not Present
...
Po32         --        --        --        --        --      Not Present
switch405078#
```

The screen capture is as follows. From the capture, we will see that the working rate in Gi1/1/6 port becomes 100Mbps.



4. Save the configuration

After confirming that configuration has taken effect, use **write** command to save configuration so that switch can run this configuration for the next startup. For more information, see the previous related sections in this manual.

Please note that all the Ethernet ports connected to TX should be configured as above. If other ports are also connected to TX, configure them according to the example above.

3.2.3 Importing Configuration

Please refer to "Reference Information" section to make preparations before importing configuration to Ethernet switches. Then do as follows.

1. After logging in to switches, in normal mode input **config** to enter global configuration mode.

```
switch405078#config
switch405078(config)#
```

2. Input **interface vlan 1** to enter the configuration view of VLAN 1.

```
switch405078(config)#interface vlan 1
switch405078(config-if)#
```

3. Input **ip address 192.168.1.39 255.255.255.0** to configure management IP address for VLAN 1. Switch will give the following feedback.

```
switch405078(config-if)#ip address 192.168.1.39 255.255.255.0
Please ensure that the port through which the device is managed has the proper
settings and is a member of the new management interface.
Would you like to apply this new configuration? (Y/N)[N]
```

Input **Y** to confirm. After execution, switch will give the following prompt.

```
switch405078(config-if)#
```

4. Input **end** to return normal mode.

```
switch405078(config-if)#end
switch405078#
```

5. Input **copy tftp://192.168.1.73/ SG500.CFG startup-config** to obtain configuration file **SG500.CFG** from a PC whose IP address is 192.168.1.73. The previous configuration file and PC IP address are examples only. The actual situations may vary. Switch will give the following prompt.

```
switch405078#copy tftp://192.168.1.73/SG500.CFG startup-config
Overwrite file [startup-config].... (Y/N)[N] ?
```

Input **Y** to confirm. Switch will give the following prompt.

```
02-May-2013 15:02:33 %COPY-I-FILECPY: Files Copy - source URL tftp://192.168.1.73/SG500.CFG
destination URL flash://startup-config
.........!
Copy: 3170 bytes copied in 00:00:11 [hh:mm:ss]

switch405078#
```

6. Input **reload**. Switch will give the following prompt.

```
switch405078#reload
You haven't saved your changes. Are you sure you want to continue ? (Y/N)[N]
```

Input **Y** to confirm. Switch will give the following prompt.

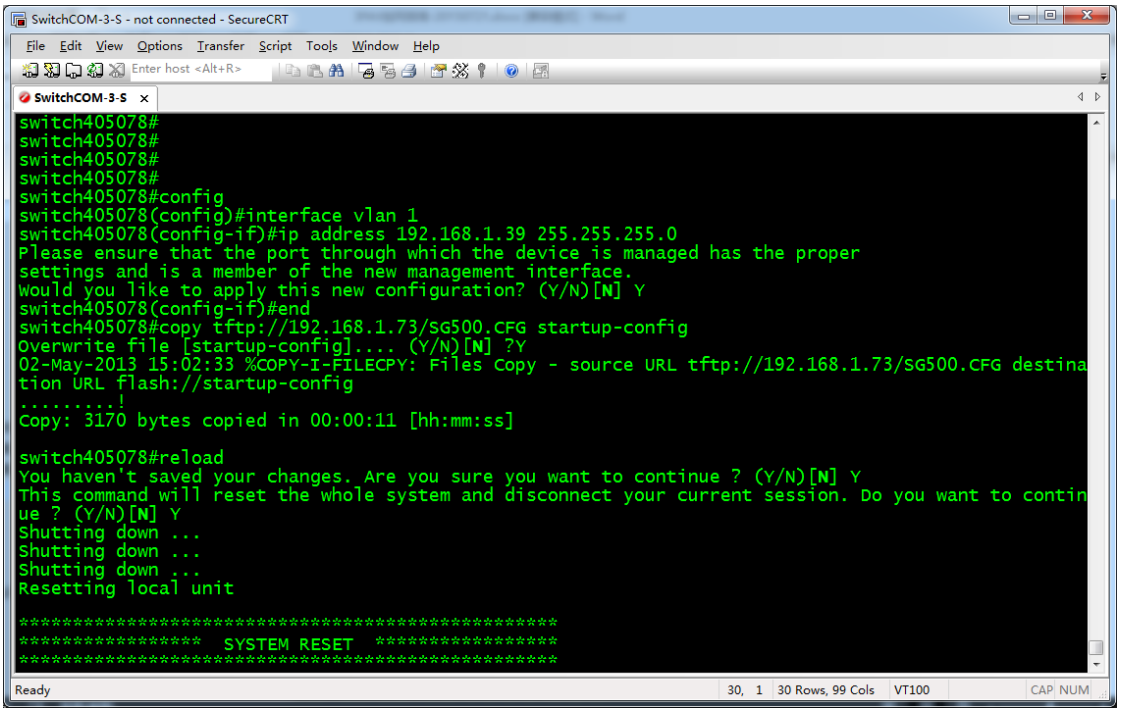
```
This command will reset the whole system and disconnect your current session. Do you want to continue ?
(Y/N)[N]
```

Input **Y** again to confirm. Switch will give the following prompt.

```
Shutting down ...
Shutting down ...
Shutting down ...
Resetting local unit

************************************************
****************  SYSTEM RESET  ****************
************************************************
```

The screen capture describes the previous steps.



After rebooting, Ethernet switches will run the configuration file SG500.CFG.

3.3 Cisco C2960 Series Switches

For Cisco C2960 series switches, we would recommend that you use models WS-C2960-24TC-L, WS-C2960-48TC-L, WS-C2960S-24PS-L, WS-C2960X-24PSQ-L and WS-C2960X-48FPS-L. They can be used for both single switch networking and cascading switch networking. But these two 100Mbps models WS-C2960-24TC-L and WS-C2960-48TC-L can only be used as extended switches in cascading switch networking.

3.3.1 Basic Operation

3.3.1.1 Logging In to the Switches

If you want to configure switches, you need to use special cables and connect them to the switches' dedicated ports.

1. Connect your PC to a switch

Use a matching Console cable to connect between switch's **Console** port and PC's serial port. If your PC has no serial ports, use a USB-to-serial converter and install correct drivers.

2. Configure serial communication parameters

Run terminal emulation software on your PC. Create a session and configure serial communication parameters according to the following table.

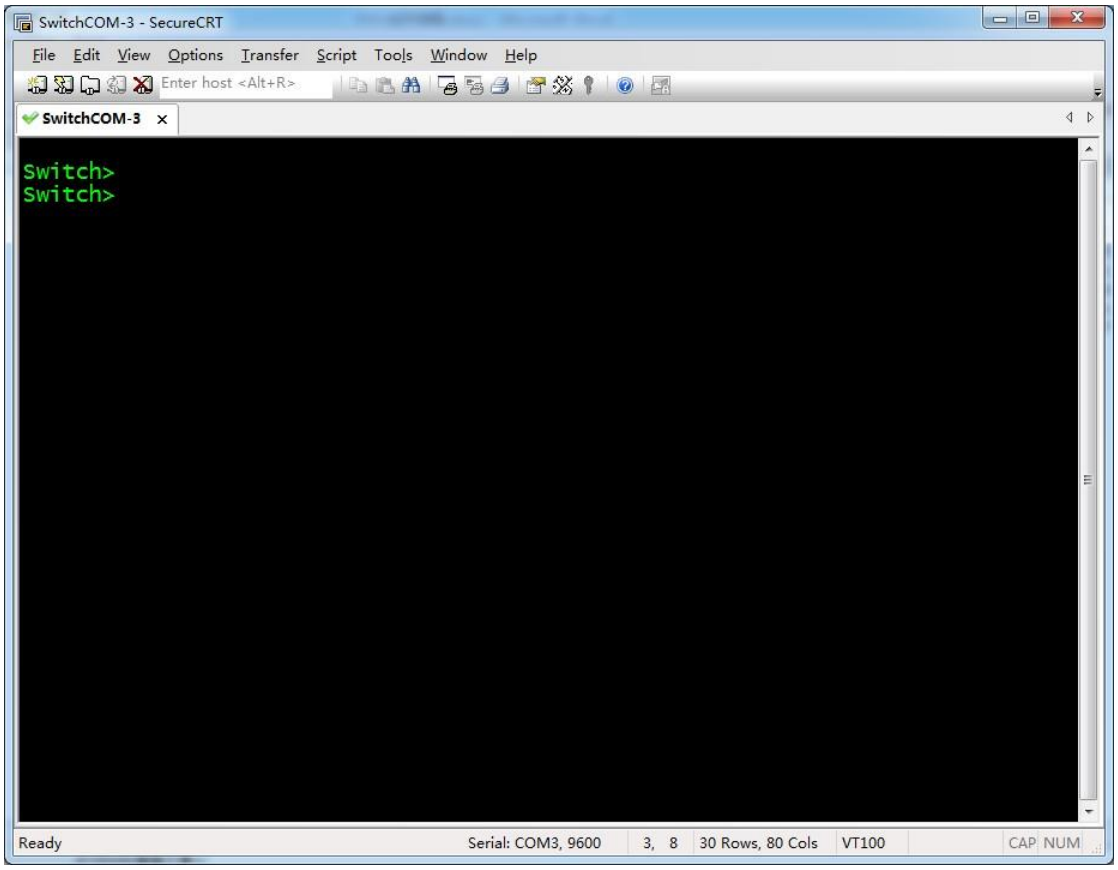
Parameters	Value
Communication Port	If your PC is equipped with serial ports in factory defaults, COM1 port is usually enabled. If your PC's multiple serial ports are configured or PC is connected with a USB-to-serial converter, see the related user guides.
Baud Rate	9600 bps
Flow Control	None
Parity	None
Stop Bits	1
Data Bits	8 bits

3. Create communication connection

In terminal emulation software select the previous created session and start the connection. When connection is successful, switch will not give any prompt. At this moment, press **Enter**. Switch will give the following prompt.

```
Switch>
Switch>
```

The screen capture is as follows. It means that you have successfully logged in to the switch and entered user mode.



3.3.1.2 Switching Operation Mode

The command-line interface of C2960 series switches has many different operation modes. This section describes several modes mentioned in this manual.

1. User mode is the default mode after logging in to the switch. In this mode, only some query operations can be performed. The prompt is as follows.

```
Switch>
```

Enter **enable** to enter privileged mode. Password may be needed.

2. Privileged mode allows you to perform some maintenance operations. The prompt is as follows.

```
Switch#
```

You can perform the following mode switching operations.

- ✧ Input **disable** to return user mode.
- ✧ Input **config terminal** to enter global configuration mode.

3. Global configuration mode allows you to change some global configuration. The prompt is as follows.

```
Switch(config)#
```

You can perform the following mode switching operations.

- ✧ Input **end** to return privileged mode
- ✧ Use **interface** command to enter port configuration mode
- ✧ Use **interface range** command to enter port bulk configuration mode

4. Port configuration mode allows you to change the settings of a single port. The prompt is as follows.

```
Switch(config-if)#
```

Input **end** to return global configuration mode.

5. Port bulk configuration mode allows bulk changes to multiple ports. The prompt is as follows.

```
Switch(config-if-range)#
```

Input **end** to return global configuration mode.

For more information about operation modes, see the user guides of switches.

3.3.1.3 Resetting to Factory Defaults

1. In user mode input **enable** to enter privileged mode.

```
Switch>enable
Switch#
```

2. Input **erase startup-config** to remove startup configuration. Switch will give the following prompt.

```
Switch#erase startup-config
Erasing the nvram filesystem will remove all configuration files! Continue?
[confirm]
```

Press **Enter** to confirm. Switch will give the following prompt.

```
[OK]
Erase of nvram: complete
Switch#
*Mar 1 02:02:50.549: %SYS-7-NV_BLOCK_INIT: Initialized the geometry of nvram
```

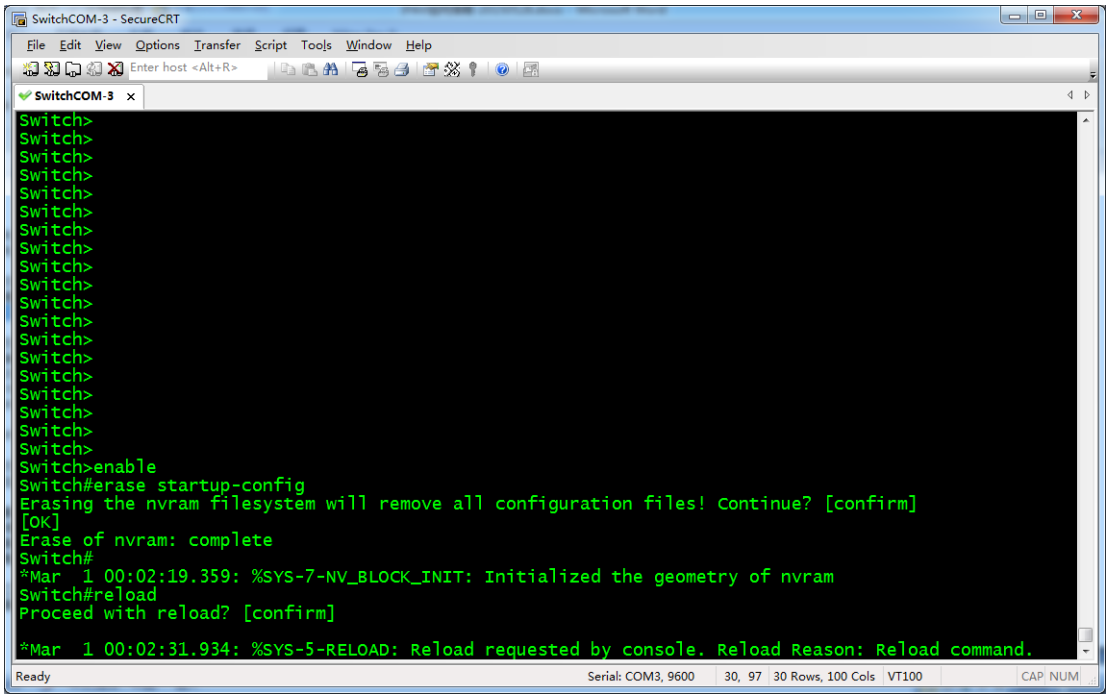
3. Input **reload** to reboot switch. Switch will give the following prompt.

```
Switch#reload
Proceed with reload? [confirm]
```

Press **Enter** to confirm. Switch will give the following prompt.

```
*Mar  1 02:05:18.700: %SYS-5-RELOAD: Reload requested by console. Reload Reason:
Reload command.
```

The following screen capture describes the previous steps.



4. Switch reboots. When the following prompt appears,

```
Press RETURN to get started!
```

Press **Enter**. Switch will give the following prompt.

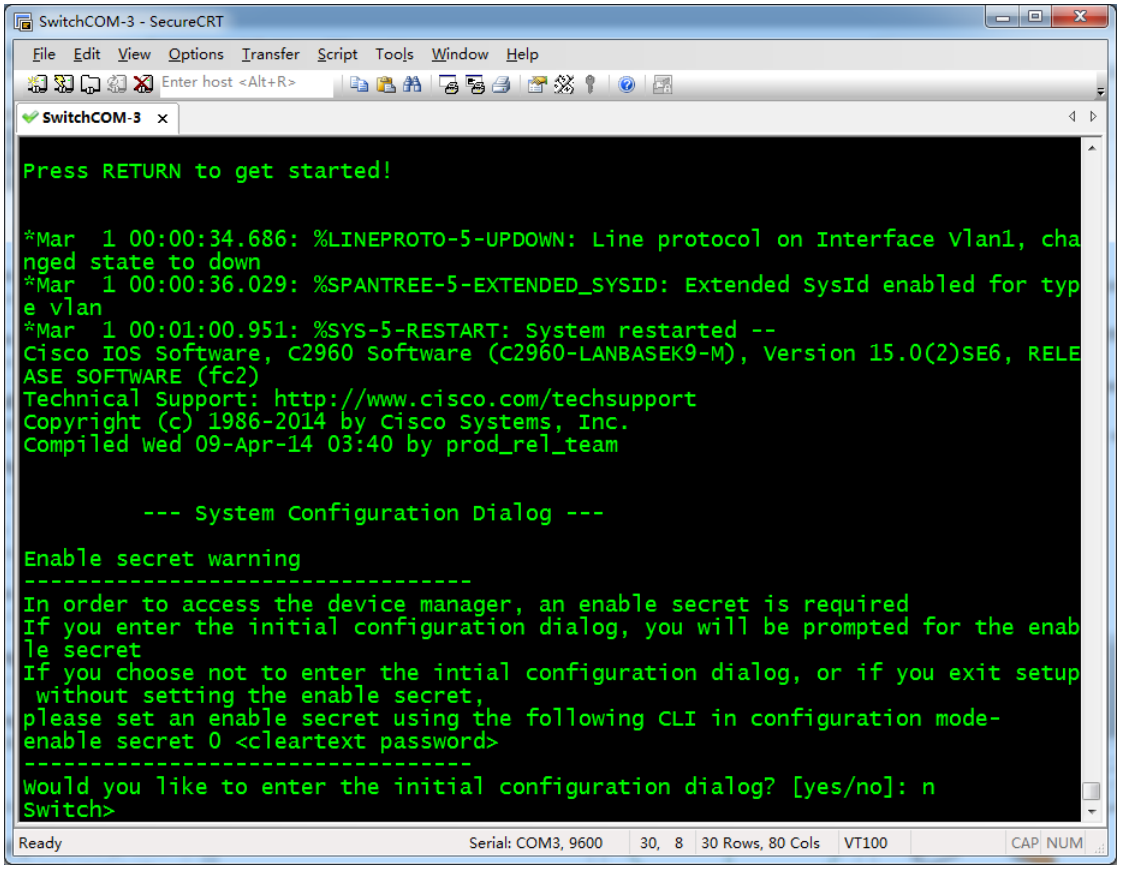
```
        --- System Configuration Dialog ---

Enable secret warning
----------------------------------
In order to access the device manager, an enable secret is required
If you enter the initial configuration dialog, you will be prompted for the enable
secret
If you choose not to enter the intial configuration dialog, or if you exit setup
without setting the enable secret,
please set an enable secret using the following CLI in configuration mode-
enable secret 0 <cleartext password>
----------------------------------
Would you like to enter the initial configuration dialog? [yes/no]:
```

If entering **Yes** or **Y**, switch will start an initial configuration process where you can manage some basic configuration such as password configuration. If entering **No** or **N**, switch will run in factory defaults. Now, we enter **N** to make switch run in factory defaults. Switch will give the following prompt.

```
Switch>
```

The screen capture is as follows.



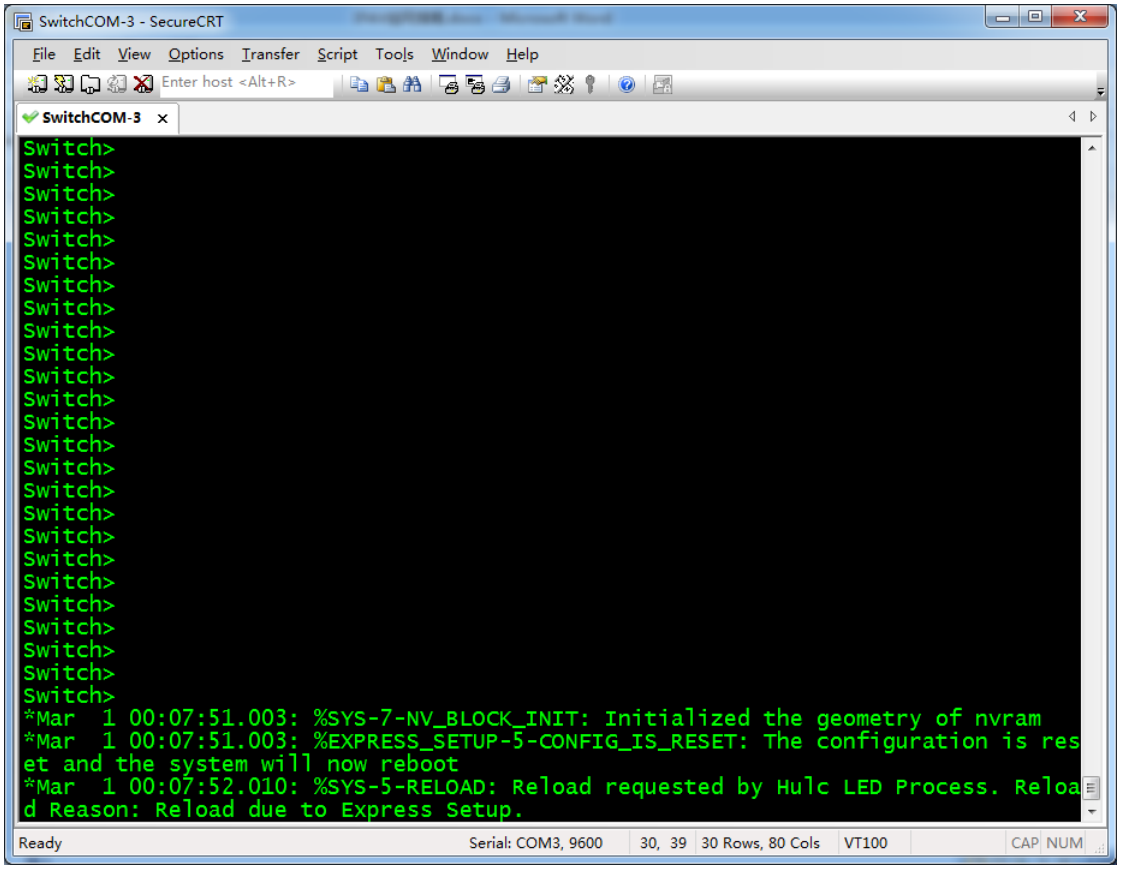
Now, we have successfully reset switch to factory defaults.

If some of switch's Ethernet ports are connected to devices using network cables, switch may display their status information during the previous process. You can ignore it.

If you forgot password and cannot access privileged mode, you can press and hold **MODE** button until screen displays the following prompt.

```
Switch>
*Mar 1 00:02:15.366: %SYS-7-NV_BLOCK_INIT: Initialized the geometry of nvram
*Mar 1 00:02:15.375: %EXPRESS_SETUP-5-CONFIG_IS_RESET: The configuration is
reset and the system will now reboot
*Mar 1 00:02:16.381: %SYS-5-RELOAD: Reload requested by Hulc LED Process. Reload
Reason: Reload due to Express Setup.
```

The screen capture is as follows.



The prompt above means that switch is reset and starts rebooting. Now, you can release **MODE** button. Wait until switch finishes rebooting and follow the instructions in step 4.

3.3.2 Manual Configuration

3.3.2.1 Configuring Single Switch Networking

Based on C2960 series switches' factory defaults, when they are used in single switch networking, IGMP Querier and multicast fast leave functions must be enabled. Perform the following operations after switches are reset.

1. Enter privileged mode

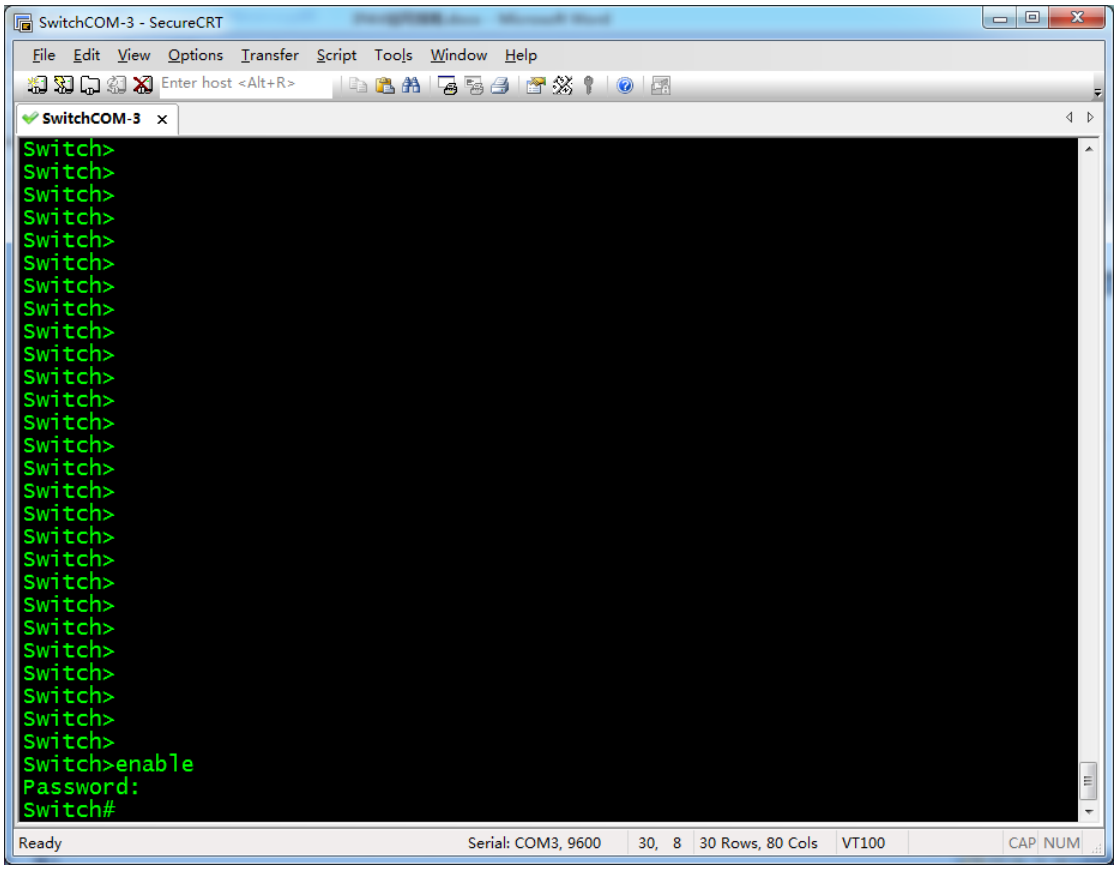
In user mode input **enable**. If password is required, switch will give the following prompt.

```
Switch>enable
Password:
```

After inputting the password, switch will give the following prompt.

```
Switch#
```

It means that you have successfully entered privileged mode. The screen capture is as follows.



If no password is required, switch will not ask you to enter password but will directly enter the privileged mode.

2. Enter global configuration mode

   Enter **config terminal**. Switch will give the following prompt.

```
Switch#config terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#
```

It means that you have successfully entered global configuration mode.

3. Input **ip igmp snooping vlan 1 immediate-leave** to enable multicast fast leave for VLAN 1.

```
Switch(config)#ip igmp snooping vlan 1 immediate-leave
Switch(config)#
```

4. Enable IGMP Querier

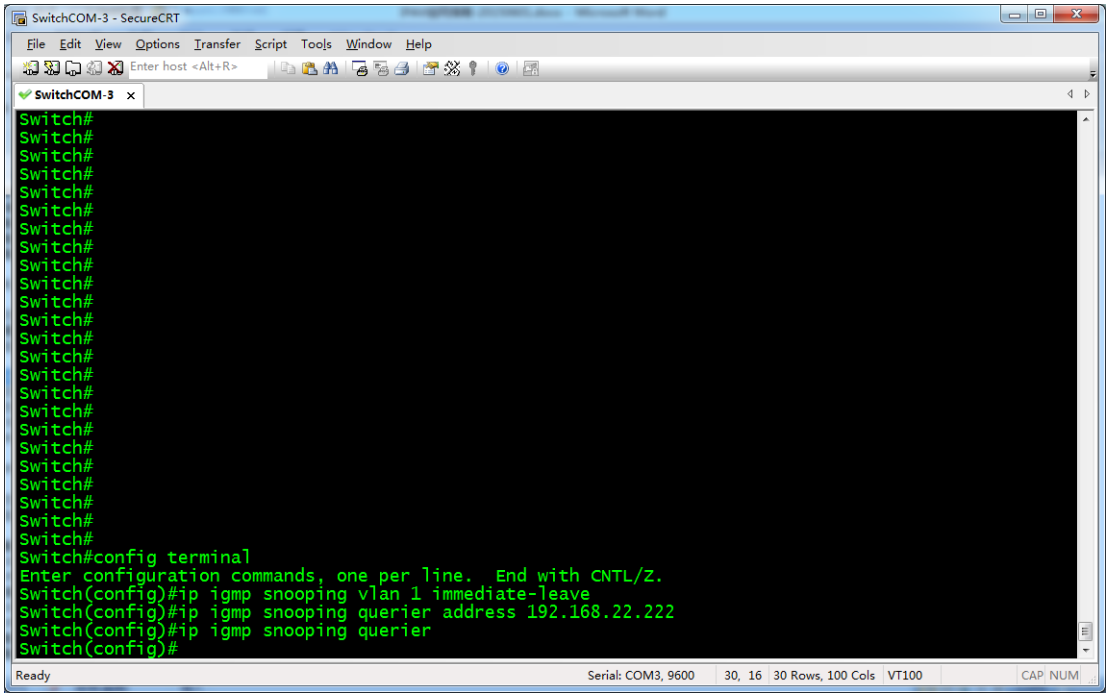
Input **ip igmp snooping querier address 192.168.22.222** to assign an IP address for IGMP Querier. Switch will give the following prompt.

```
Switch(config)#ip igmp snooping querier address 192.168.22.222
Switch(config)#
```

Enter **ip igmp snooping querier** to enable IGMP Querier. Switch will give the following prompt.

```
Switch(config)#ip igmp snooping querier
Switch(config)#
```

The following screen capture describes steps 2-4.



5. Confirm configuration

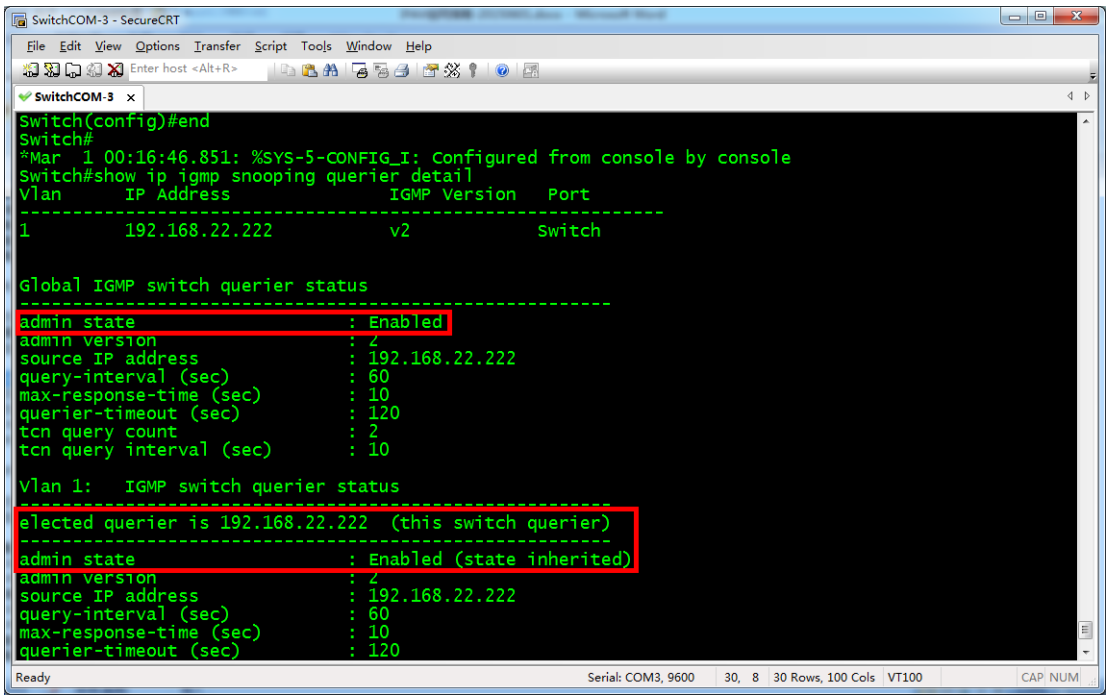
Enter **end** to return privileged mode. Switch will give the following prompt.

```
Switch(config)#end
Switch#
*Mar 1 00:39:20.646: %SYS-5-CONFIG_I: Configured from console by console
Switch#
```

Input **show ip igmp snooping querier detail**. Switch will give the following prompt.

```
Switch#show ip igmp snooping querier detail
...
Global IGMP switch querier status
------------------------------------------------------------
admin state                  : Enabled
...
Vlan 1:   IGMP switch querier status
------------------------------------------------------------
elected querier is 192.168.22.222   (this switch querier)
------------------------------------------------------------
admin state                  : Enabled (state inherited)
...
```

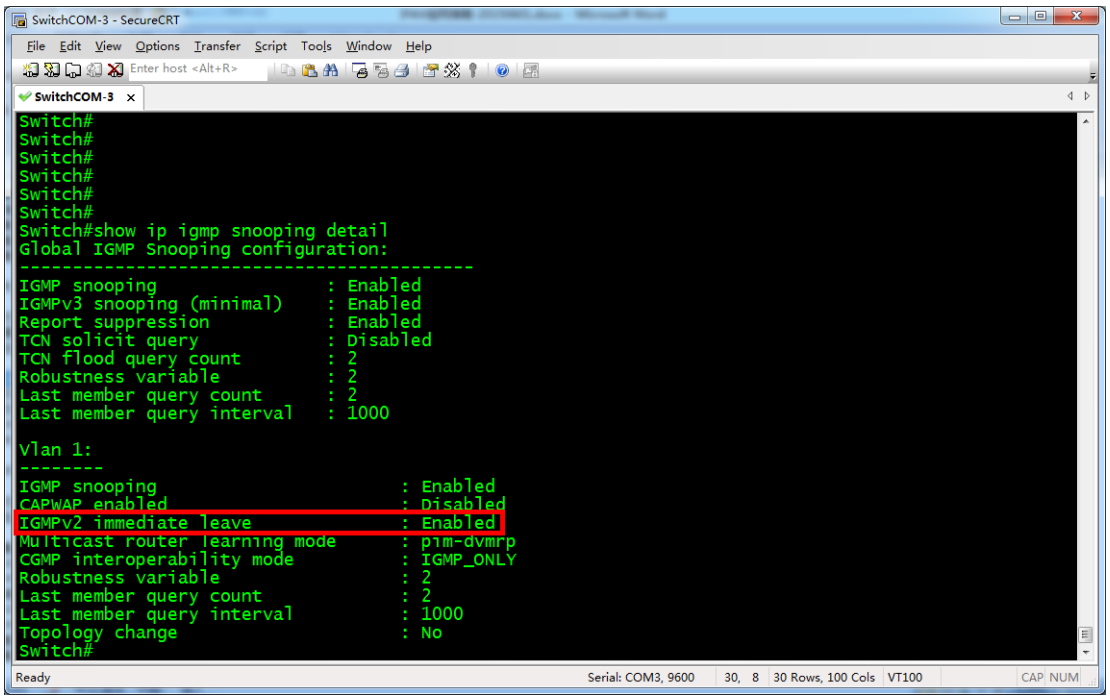
The related screen capture is as follows. The information in red boxes means that IGMP Querier is correctly enabled.



Continue to input **show ip igmp snooping detail** to view IGMP Snooping detail.

```
Switch#show ip igmp snooping detail
Global IGMP Snooping configuration:
-------------------------------------------
IGMP snooping              : Enabled
...
Vlan 1:
--------
IGMP snooping                    : Enabled
...
IGMPv2 immediate leave             : Enabled
...
```

The screen capture is as follows. The information in red box means that multicast fast leave is enabled for VLAN 1.

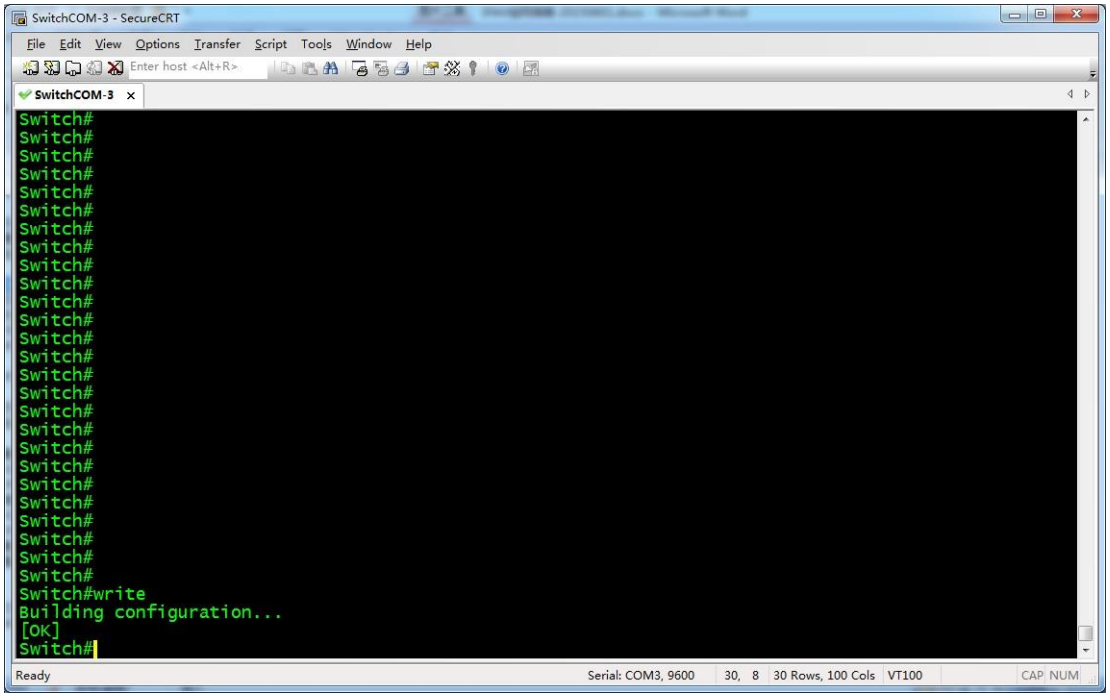


6. Save configuration

   After confirming correct configuration, input **write** to save the current configuration. Switch will display the following prompt.

```
Switch#write
Building configuration...
[OK]
```

The screen capture is as follows.



Now, it has successfully saved configuration used in single switch networking.

Switch will run this configuration for the next startup.

3.3.2.2 Configuring Core Switches

Based on C2960 series switches' factory defaults, when they are used as core switches, only IGMP Querier function needs to be enabled. Perform the following operations after they are reset.

1. Enter privileged mode

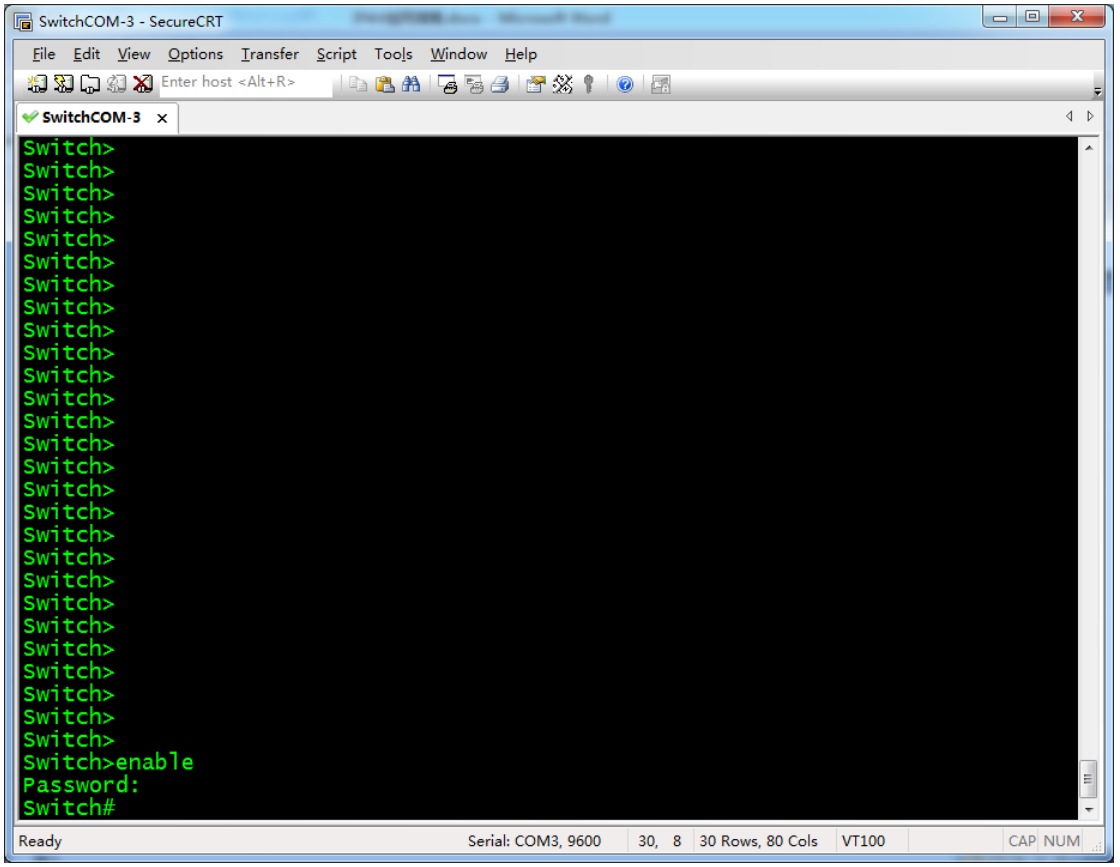
In user mode input **enable**. If password is required, switch will give the following prompt.

```
Switch>enable
Password:
```

After inputting the password, switch will give the following prompt.

```
Switch#
```

It means that you have successfully entered privileged mode. The screen capture is as follows.



If no password is required, switch will not ask you to input password but will directly enter privileged mode.

2. Enter global configuration mode

Input **config terminal**. Switch will give the following prompt.

```
Switch#config terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#
```

It means that you have successfully entered global configuration mode.

3. Enable IGMP Querier

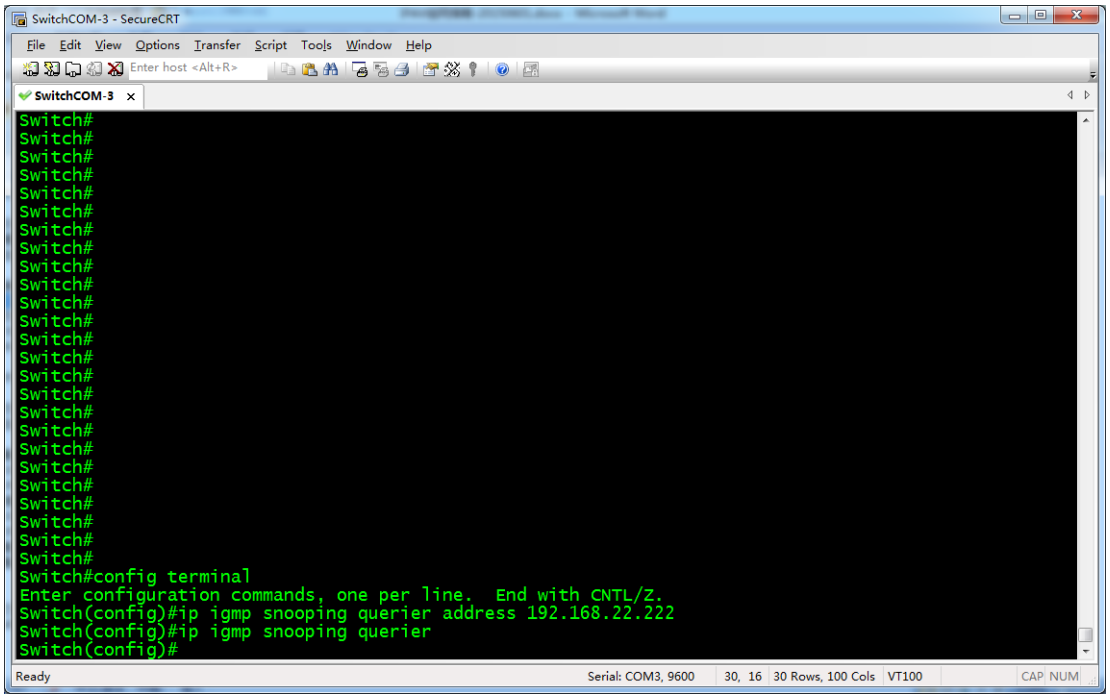
Input **ip igmp snooping querier address 192.168.22.222** to assign an IP address for IGMP Querier. Switch will give the following prompt.

```
Switch(config)#ip igmp snooping querier address 192.168.22.222
Switch(config)#
```

Input **ip igmp snooping querier** to enable IGMP Querier. Switch will give the following prompt.

```
Switch(config)#ip igmp snooping querier
Switch(config)#
```

The following screen capture describes steps 2-3.



4. Confirm configuration

Input **end** to return privileged mode. Switch will give the following prompt.

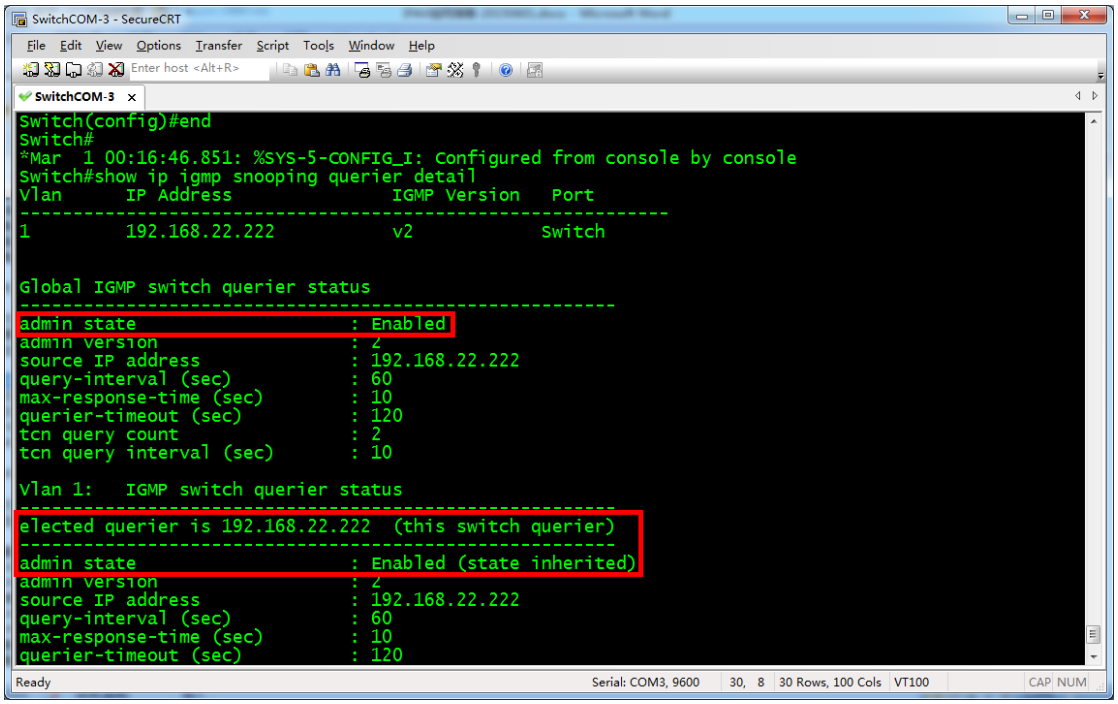
```
Switch(config)#end
Switch#
*Mar 1 00:39:20.646: %SYS-5-CONFIG_I: Configured from console by console
Switch#
```

Input **show ip igmp snooping querier detail**. Switch will give the following prompt.

```
Switch#show ip igmp snooping querier detail
```

```
...
Global IGMP switch querier status
-----------------------------------------------------------
admin state                  : Enabled
...
Vlan 1:   IGMP switch querier status
-----------------------------------------------------------
elected querier is 192.168.22.222   (this switch querier)
-----------------------------------------------------------
admin state                  : Enabled (state inherited)
...
```

The related screen capture is as follows. The information in red boxes means that IGMP Querier is enabled correctly.

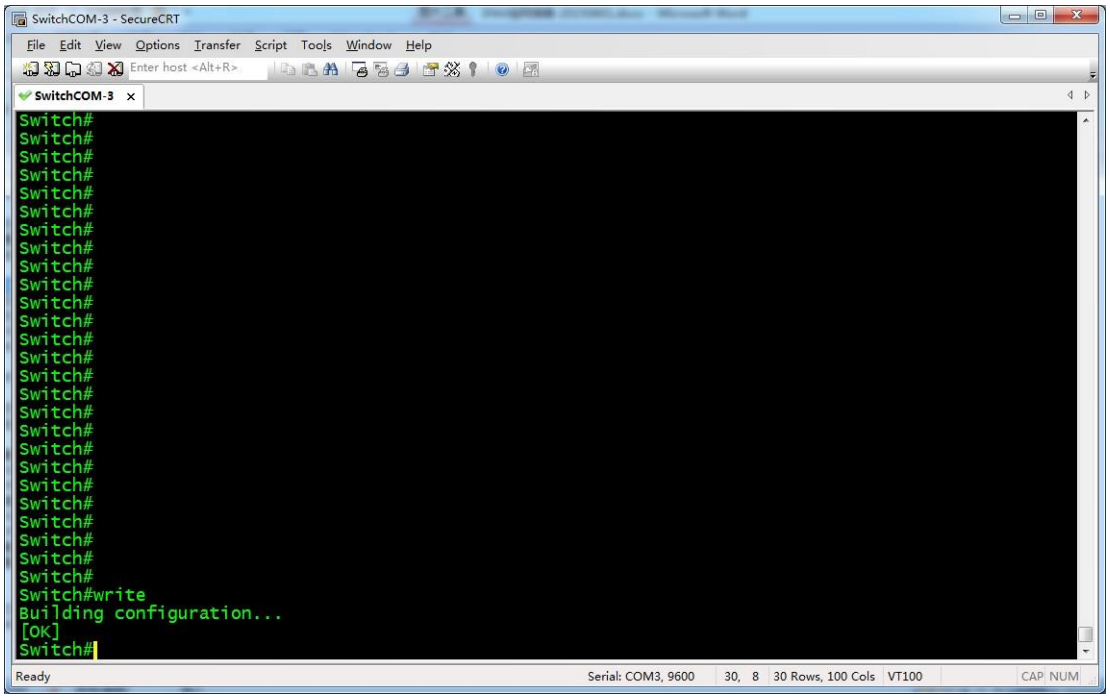


5. Save configuration

   After confirming correct configuration, input **write** to save the current configuration. Switch will display the following prompt.

```
Switch#write
Building configuration...
[OK]
```

The screen capture is as follows.



Now, it has successfully saved the current configuration. Core switch will run this configuration for the next startup.

3.3.2.3 Configuring Extended Switches

In factory defaults of C2960 series switches, IGMP Snooping is enabled but IGMP Querier is disabled. When they are used as extended switches, only multicast fast leave needs to be enabled.

1. In user mode input **enable** to enter privileged mode.

```
Switch>enable
Switch#
```

2. Input **config terminal** to enter global configuration mode.

```
Switch#config terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#
```

3. Input **ip igmp snooping vlan 1 immediate-leave** to enable multicast fast leave for VLAN 1.

```
Switch(config)#ip igmp snooping vlan 1 immediate-leave
Switch(config)#
```

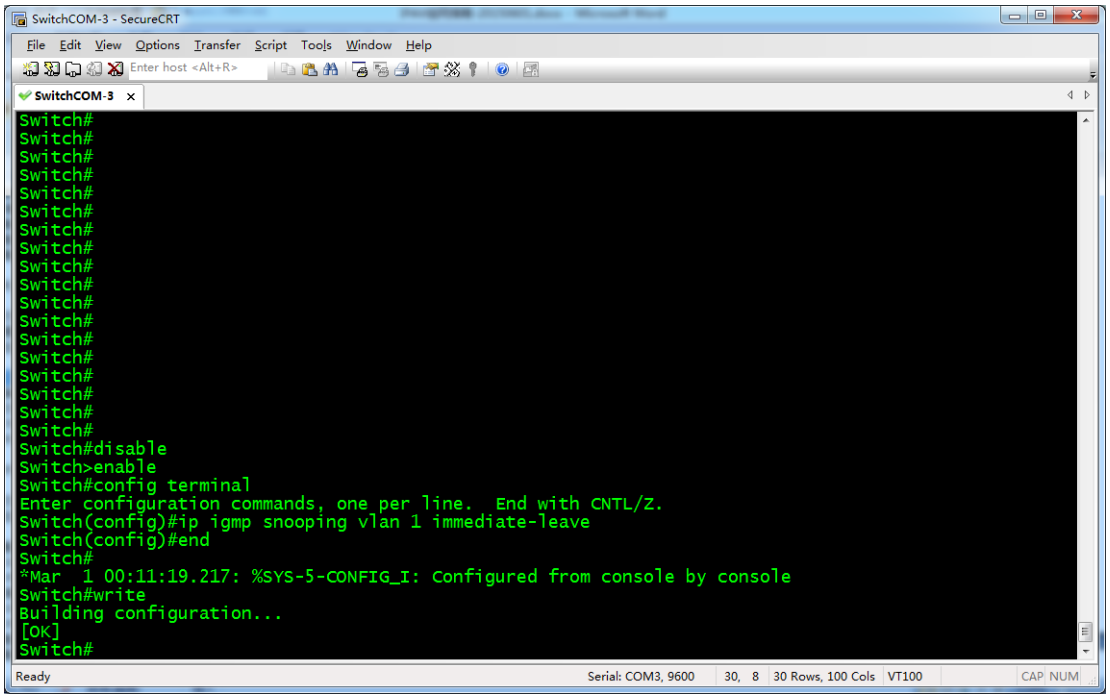
4. Input **end** to return privileged mode.

```
Switch(config)#end
Switch#
```

5. Input **write** to save the current configuration.

```
Switch#write
Building configuration...
[OK]
```

The following screen capture describes the previous steps.



Now, C2960 series switches have been successfully configured to be extended switches.

3.3.2.4 Preventing Multicast Flood Caused by TCN

C2960 series switches will forward multicast packets to all the ports when network topology changes. In Cisco's documentation, network topology change is abbreviated as TCN (Topology Change Notification). The most common TCN event is connection or disconnection of network cables. In a network environment with C2960 series switches for networking, if you plug or unplug a network device's network cable, multicast flood may happen. Although this situation rarely happens when the system works properly, we would recommend that you manually disable this function. To do this:

1. Obtain port configuration information

C2960 series switches' each Ethernet port can be set not to be affected by multicast flood caused by TCN. So first you need to obtain the switch's port configuration.

In user mode input **show interface description** to obtain the switch's port configuration.

WS-C2960-24TC-L will give the following prompt.

```
Switch>show interface description
Interface                   Status        Protocol Description
Vl1                        admin down    down
Fa0/1                      down          down
Fa0/2                      down          down
Fa0/3                      up            up
Fa0/4                      down          down
...
Fa0/23                     down          down
Fa0/24                     down          down
Gi0/1                      up            up
Gi0/2                      up            up
```

From the list above, we can see that this switch has 24 100Mbps Ethernet ports ranging from Fa0/1 to Fa0/24. Other models of switches will give different prompt due to different port configuration.

2. Assign host port range

After obtaining port configuration, it needs to assign related Ethernet ports as the next operated objects.

In user mode input **enable** to enter privileged mode. Switch will give the following prompt.

```
Switch>enable
Switch#
```

Input **config terminal** to enter global configuration mode. Switch will give the following prompt.

```
Switch#config terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#
```

Use **interface range** command to enter port bulk configuration mode. Switch will give the following prompt.

```
Switch(config)#interface range fa 0/1-24
Switch(config-if-range)#
```

Note:

The Ethernet switches in the example are equipped with 24 100Mbps Ethernet ports. If your switches have different number of ports and various port types, set the parameters of **interface range** command based on their user guides.

The prompt above is the operation result on WS-C2960-24TC-L. Its argument **Fa0/1-24** is port configuration information from the previous step. For different switches, arguments behind **interface range** may be different. For example port range of WS-C2960S-24PS-L should be assigned like this:

```
Switch(config)#interface range Gi 1/0/1-28
Switch(config-if-range)#
```

Subsequent operations will be performed on these ports.

3. Ban TCN Multicast Flood

Input **no ip igmp snooping tcn flood** to ban these ports from multicast flood due to TCN. Switch will give the following prompt.

```
Switch(config-if-range)#no ip igmp snooping tcn flood
Switch(config-if-range)#
```

4. Save the current configuration.

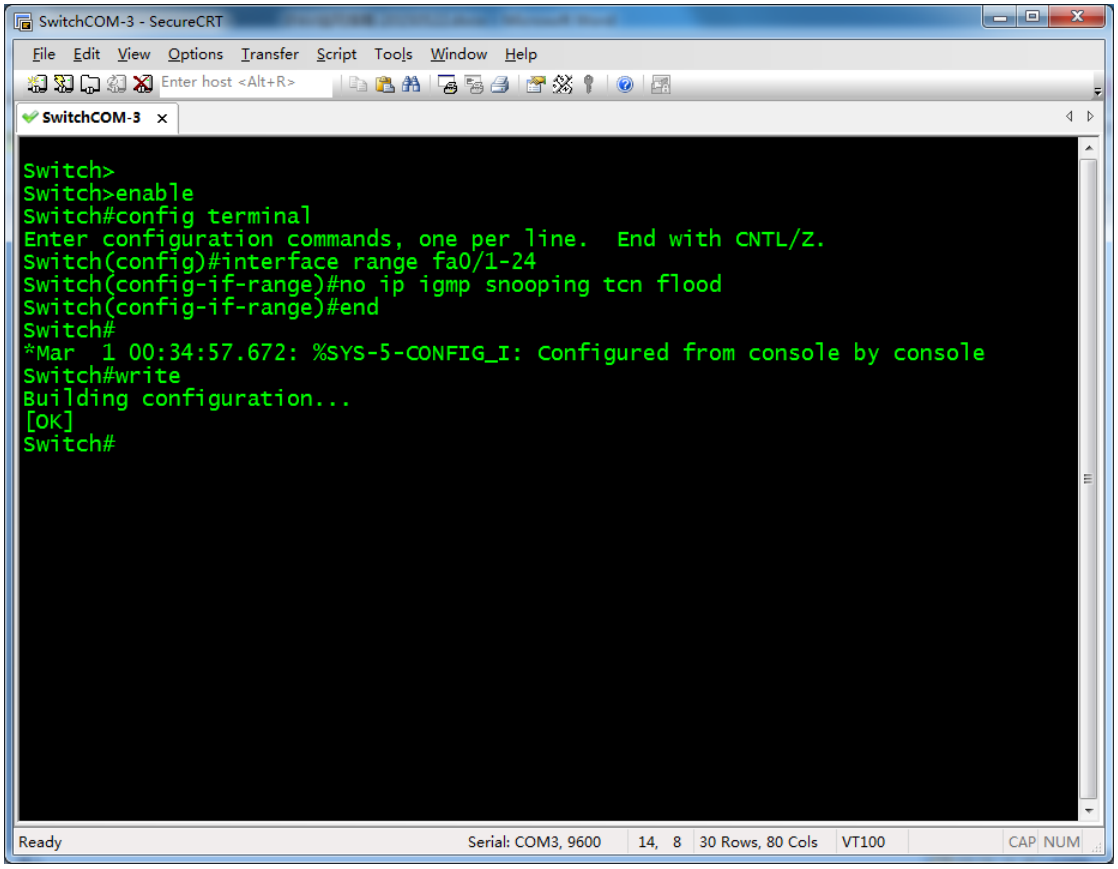
Input **end** to return privileged mode. Switch will give the following prompt.

```
Switch(config-if-range)#end
Switch#
*Mar 1 00:58:18.292: %SYS-5-CONFIG_I: Configured from console by console
Switch#
```

Input **write** to save the configuration so that the settings will take effect for the next startup. Switch will give the following prompt.

```
Switch#write
Building configuration...
[OK]
Switch#
```

The following screen capture describes the previous steps 2-4 operated on WS-C2960-24TC-L.



Now, multicast flooding caused by TCN has been successfully prevented from all host ports. Please note that in the previous example we only configure main ports of switches except a few ports such as WS-C2960-24TC-L's two Gi ports. You can configure these undone ports according to the example above.

3.3.2.5 Limiting Gigabit Ethernet Ports' Speed

When using both 1000 Mbps Ethernet switches and 100 Mbps Ethernet switches for networking, if you connect RX to 100Mbps switches and TX to 1000Mbps switches, the quality of pictures will be affected due to different port speeds. To resolve this problem, we would recommend that you configure 1000Mbps switches' Ethernet ports connected to TX and limit their speed to 100Mbps. Here takes WS-C2960S-24PS-L as an example to introduce how to configure the ports.

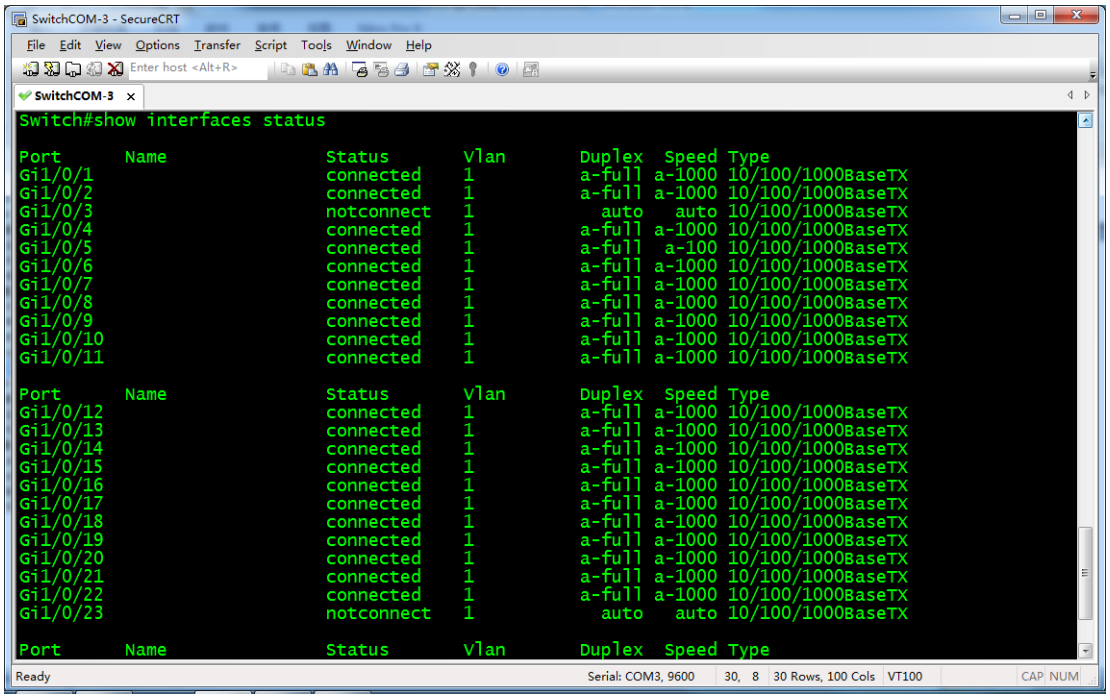
1. View port speed.

In privileged mode input **show interface status** to view port speed information. Switch will give the following prompt.

```
Switch#show interface status

Port      Name              Status      Vlan      Duplex  Speed Type
Gi1/0/1                     connected   1         a-full a-1000 10/100/1000BaseTX
Gi1/0/2                     connected   1         a-full a-1000 10/100/1000BaseTX
Gi1/0/3                     notconnect  1           auto   auto 10/100/1000BaseTX
Gi1/0/4                     connected   1         a-full a-1000 10/100/1000BaseTX
Gi1/0/5                     connected   1         a-full  a-100
10/100/1000BaseTX
Gi1/0/6                     connected   1         a-full a-1000 10/100/1000BaseTX
Gi1/0/7                     connected   1         a-full a-1000 10/100/1000BaseTX
...
Gi1/0/26                    notconnect  1           auto   auto Not Present
Gi1/0/27                    notconnect  1           auto   auto Not Present
Gi1/0/28                    notconnect  1           auto   auto Not Present
Fa0                        notconnect  routed      auto   auto 10/100BaseTX
Switch#
```

The screen capture is as follows.



Parameters in speed column are the port speeds. "100" means 100Mbps. "1000" means 1000Mbps.

2. Change port speed.

Input **config terminal** to enter global configuration mode. Switch will give the following prompt.

```
Switch#config terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#
```

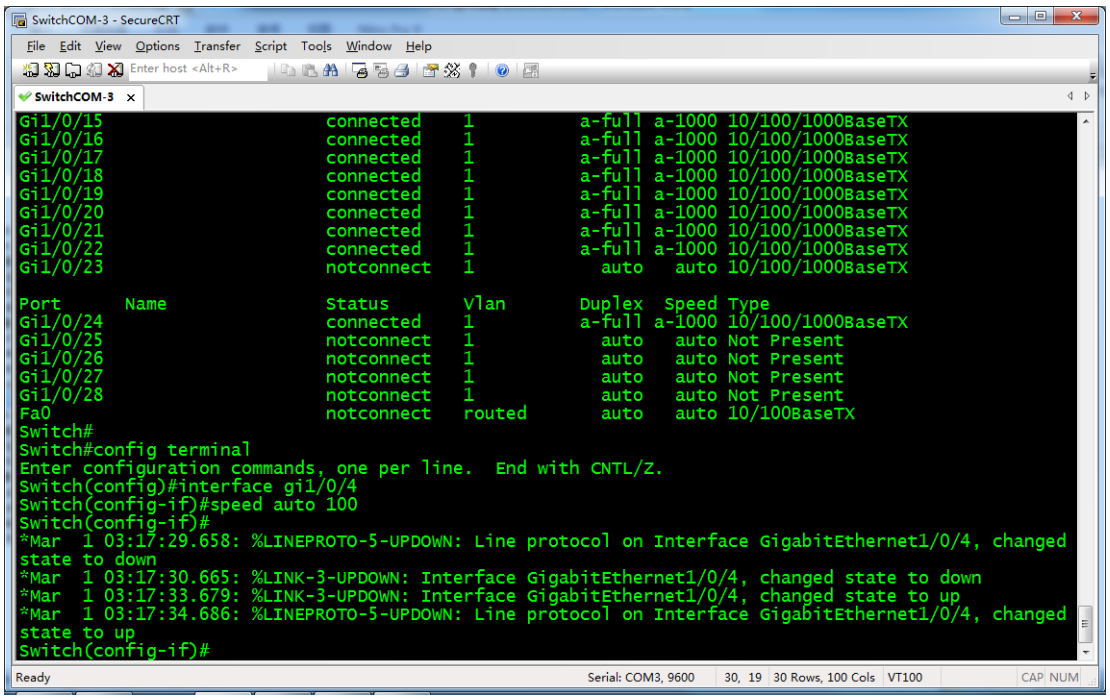
Use **interface** command to select a Ethernet port connected to TX for entering port configuration mode. Switch will give the following prompt.

```
Switch(config)#interface gi1/0/4
Switch(config-if)#
```

Input **speed auto 100** to set port's rate mode as 100Mbps auto negotiation. Switch will give the following prompt.

```
Switch(config-if)#speed auto 100
Switch(config-if)#
```

Then switch may disconnect from this port and reconnect to it. The screen capture is as follows.



You can also use **interface range** command to assign multiple successive ports for bulk mode change.

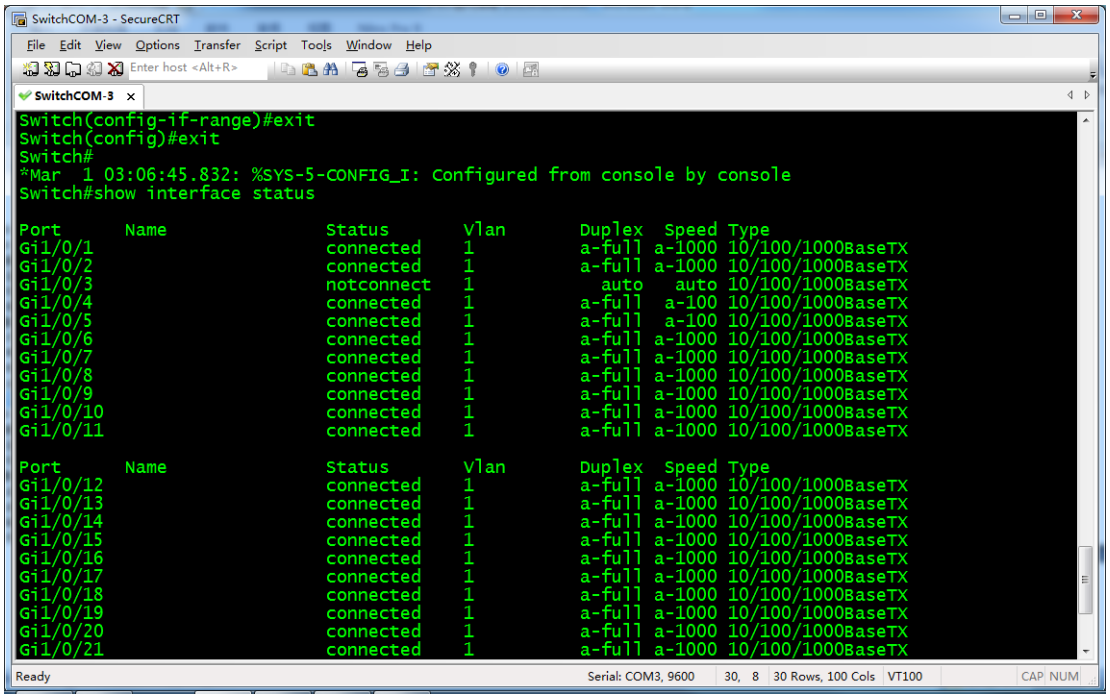
3. Confirm the configuration

Input **exit** twice to return privileged mode, and then input **show interface status** to see if the previous changes take effect. Switch will give the following prompt.

```
Switch(config-if-range)#exit
Switch(config)#exit
Switch#
*Mar 1 03:06:45.832: %SYS-5-CONFIG_I: Configured from console by console
Switch#show interface status

Port      Name              Status      Vlan      Duplex  Speed Type
Gi1/0/1                     connected    1         a-full a-1000 10/100/1000BaseTX
Gi1/0/2                     connected    1         a-full a-1000 10/100/1000BaseTX
Gi1/0/3                     notconnect   1           auto   auto 10/100/1000BaseTX
Gi1/0/4                     connected    1         a-full  a-100
10/100/1000BaseTX
Gi1/0/5                     connected    1         a-full  a-100
10/100/1000BaseTX
Gi1/0/6                     connected    1         a-full a-1000 10/100/1000BaseTX
Gi1/0/7                     connected    1         a-full a-1000 10/100/1000BaseTX
...
Gi1/0/26                    notconnect   1           auto   auto Not Present
Gi1/0/27                    notconnect   1           auto   auto Not Present
Gi1/0/28                    notconnect   1           auto   auto Not Present
Fa0                        notconnect   routed      auto   auto 10/100BaseTX
Switch#
```

The screen capture is as follows.



From the figure above, Gi1/0/4 port speed is changed to 100Mbps.

4. Save the configuration

After confirming that configuration has taken effect, use **write** command to save configuration so that switch can run this configuration for the next startup. For more information, see the previous related sections in this manual.

Please note that all the Ethernet ports connected to TX should be configured as above. If other ports are also connected to TX, configure them according to the example above.

3.3.3 Importing Configuration

Before importing configuration for switches, complete related preparations by referring to "Reference Information" section, and then operate based on the following steps.

1. In user mode input **enable** to enter privileged mode. Switch will give the following prompt.

```
Switch>enable
Switch#
```

2. Input **config terminal** to enter global configuration mode. Switch will give

the following prompt.

```
Switch#config terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#
```

3. Input **interface vlan 1** to enter port configuration mode.

```
Switch(config)#interface vlan 1
Switch(config-if)#
```

4. Input **ip address 192.168.1.39 255.255.255.0** to configure management IP address for VLAN 1.

```
Switch(config-if)#ip address 192.168.1.39 255.255.255.0
Switch(config-if)#
```

5. Input **no shutdown** to ensure that ports are always open. Switches may give some additional prompt.

```
Switch(config-if)#no shutdown
Switch(config-if)#
*Mar 1 00:06:06.506: %LINK-3-UPDOWN: Interface Vlan1, changed state to up
*Mar 1 00:06:06.515: %LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan1,
changed state to up
Switch(config-if)#
```

6. Input **end** to return privileged mode.

```
Switch(config-if)#end
Switch#
*Mar 1 00:06:19.022: %SYS-5-CONFIG_I: Configured from console by console

Switch#
```

7. Input **copy tftp: startup-config** to download configuration file from PC. Switch will give the following prompt.

```
Switch#copy tftp: startup-config
Address or name of remote host []?
```

Enter PC's IP address such as **192.168.1.73**. Switch will continue to prompt configuration file name.

```
Source filename []?
```

Input configuration file name in TFTP directory such as **C2960-IPAV.cfg**. Switch will continue to give prompt.

```
Destination filename [startup-config]?
```

Press **Enter** to confirm. Switch will download configuration data from PC via TFTP.

```
Accessing tftp://192.168.1.73/C2960-IPAV.cfg...
Loading C2960-IPAV.cfg from 192.168.1.73 (via Vlan1): !
[OK - 2365 bytes]
2365 bytes copied in 17.138 secs (138 bytes/sec)
Switch#
*Mar 1 00:08:41.989: %SYS-5-CONFIG_NV_I: Nonvolatile storage configured from
tftp://192.168.1.73/C2960-IPAV.cfg by console
Switch#
```

8. Input **reload** to reboot switch. Switch will give the following prompt.

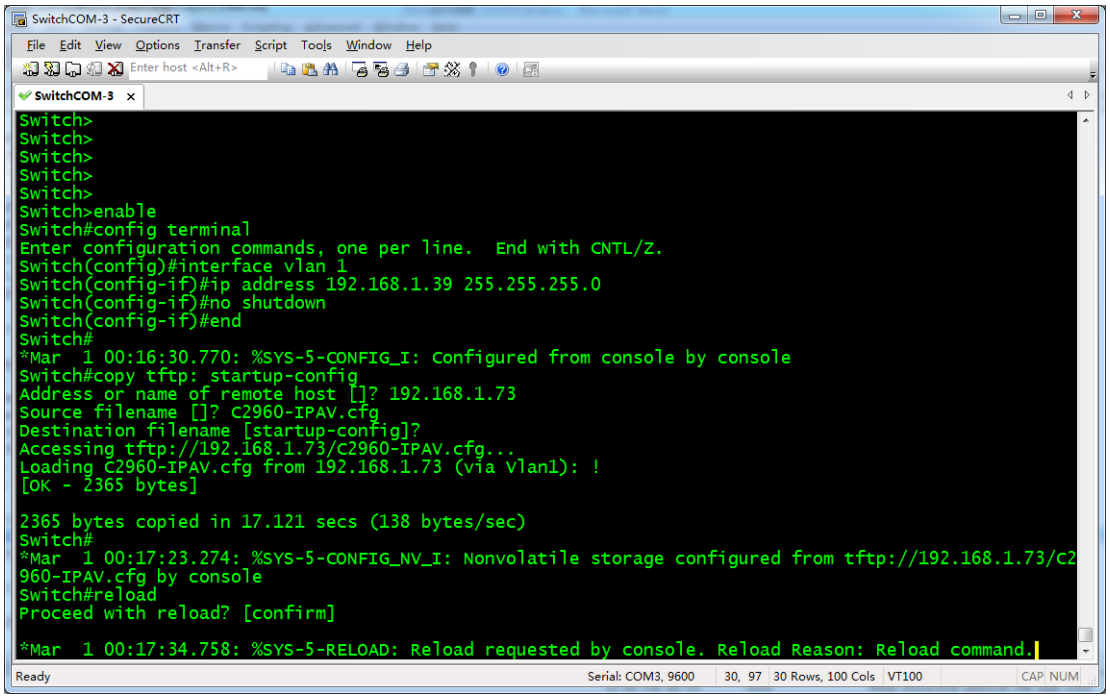
```
Switch#reload
```

```
Proceed with reload? [confirm]
```

Press **Enter** to confirm. Switch will give the following prompt.

```
*Mar  1 02:05:18.700: %SYS-5-RELOAD: Reload requested by console. Reload Reason:
Reload command.
```

The following screen capture describes the previous steps.



After rebooting, switch will run configuration file **C2960-IPAV.cfg**.

3.4 HUAWEI S2700, S5700 Series Switches

For HUAWEI S2700, S5700 series switches, we would recommend that you use models S2700-26TP-EI-AC, S2700-52P-EI-AC, S5700-28P-PWR-LI-AC and S5700-48TP-PWR-SI. They can be used in single switch networking and have similar configuration methods.

3.4.1 Basic Operations

3.4.1.1 Logging In to the Switches

If you want to configure switches, you need to use special cables and connect them to the switches' dedicated ports.

1. Connect your PC to a switch

Use a matching Console cable to connect between switch's **Console** port and PC's serial port. If your PC has no serial ports, use a USB-to-serial converter and

install correct drivers.

2. Configure serial communication parameters

Run terminal emulation software on your PC. Create a session and configure serial communication parameters based on the following table.

Parameters	Value
Communication Port	If your PC is equipped with serial ports in factory defaults, COM1 port is usually enabled. If your PC's multiple serial ports are configured or PC is connected with a USB-to-serial converter, see the related user guides.
Baud Rate	9600 bps
Flow Control	None
Parity	None
Stop Bits	1
Data Bits	8 bits

3. Build communication connection

In terminal emulation software select the previous created session and start the connection. Switch will give the following prompt.

```
User interface con0 is available
Please Press ENTER.
```

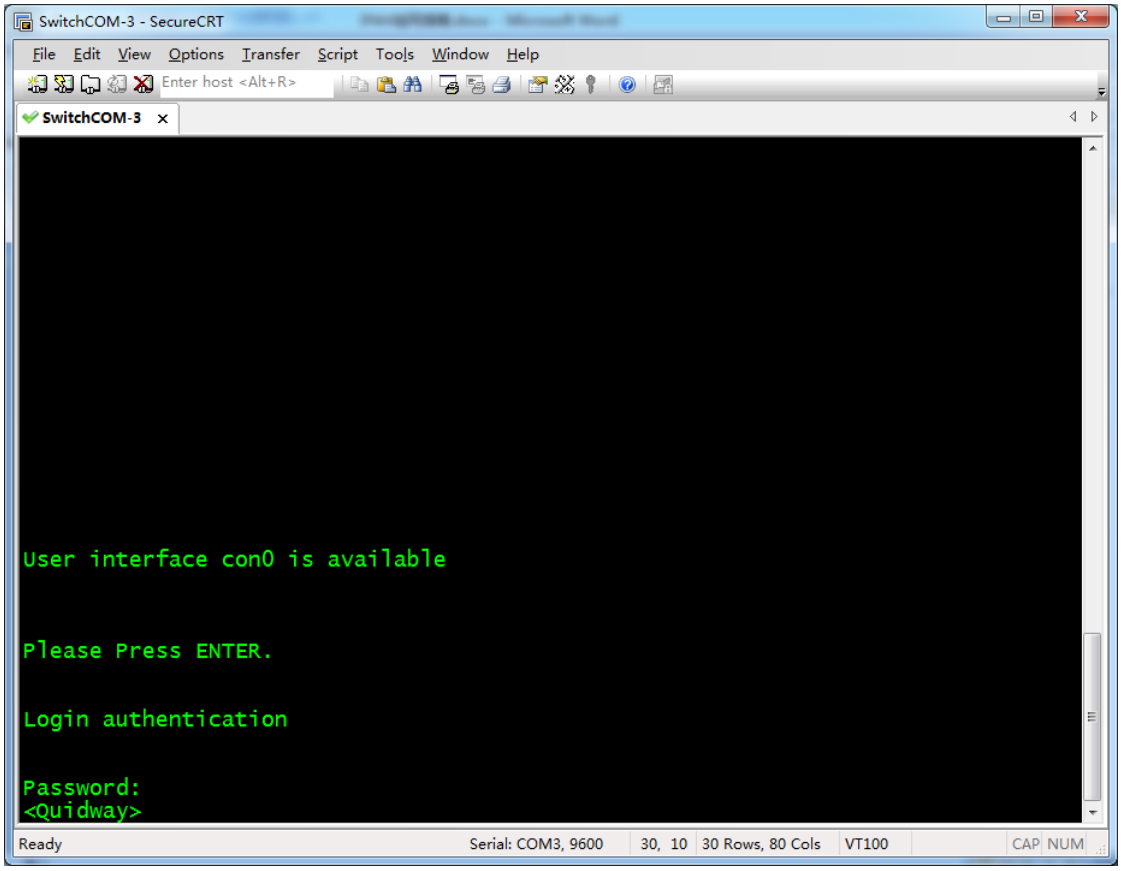
Press **Enter** (If switch does not give any prompt directly press **Enter**). Switch will give the following feedback.

```
Login authentication
Password:
```

After password is input, screen will display the following prompt, indicating that user is in default view.

```
<Quidway>
```

The following screen capture describes the previous steps.



Now, you have successfully logged in to the switches and can perform further operations.

3.4.1.2 Resetting to Factory Defaults

To avoid interface with IPAV networking from other settings, we would recommend that you reset switches to factory defaults before starting configuring switches.

1. Log in to switch using terminal emulation software. Input **reset save**.

   Switch will give the following prompt.

```
<Quidway>reset save
The action will delete the saved configuration in the device.
The configuration will be erased to reconfigure. Continue? [Y/N]:
```

Input **Y**. Switch will give the following prompt.

```
Warning: Now clearing the configuration in the device.
Info: Succeeded in clearing the configuration in the device.
```

2. Continue to input **reboot** to make switches stay in factory defaults status.

   Switch will give the following prompt.

```
<Quidway>reboot
Info: The system is now comparing the configuration, please wait.
Warning: All the configuration will be saved to the configuration file for the
```

```
next startup:, Continue?[Y/N]:
```

Input **N**. Switch will give the following prompt.

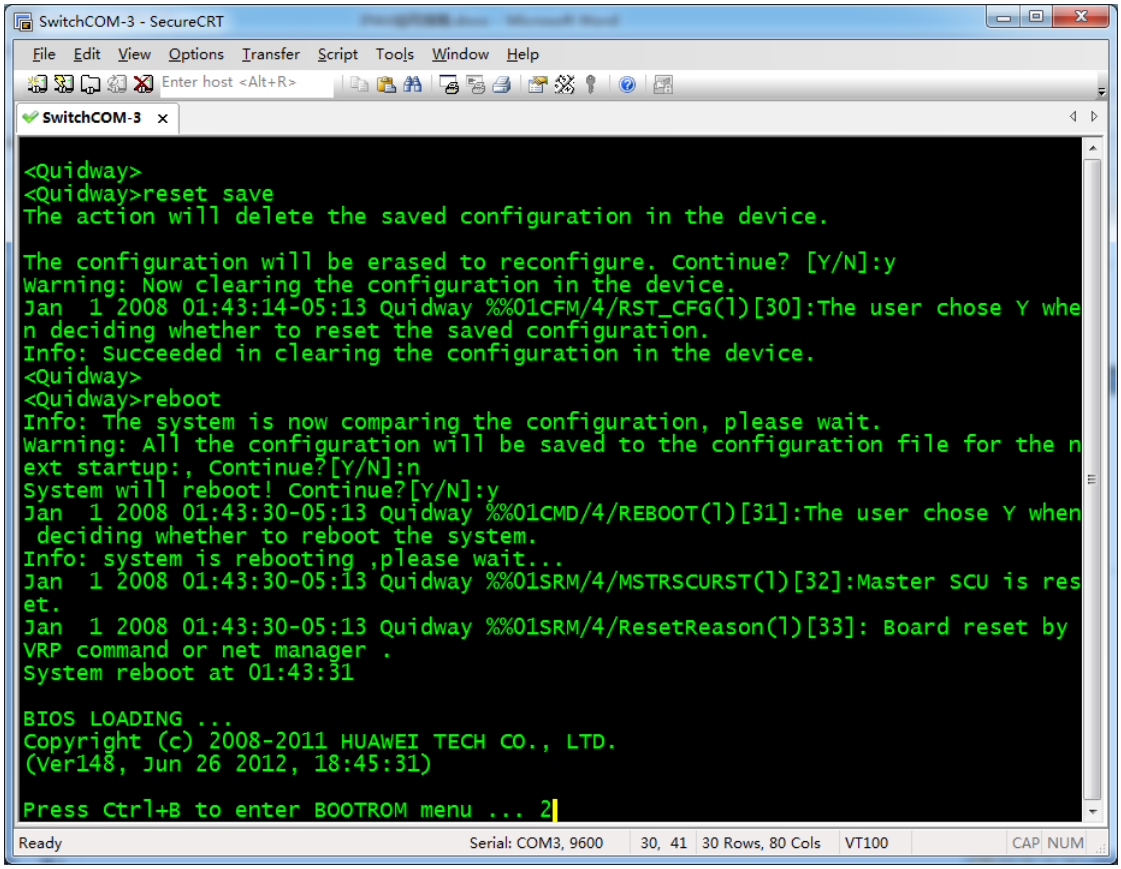
```
System will reboot! Continue?[Y/N]:
```

Input **Y**. Switch will give the following prompt after printing some information.

```
System reboot at 01:37:56

BIOS LOADING ...
```

The following screen capture describes the previous steps 1-2.



3. After switch is reset to factory defaults and reboots, it will give the following prompt.

```
Recover configuration...OK!
Press ENTER to get started.
done
```

After pressing **Enter**, switch will ask you to configure the login password.

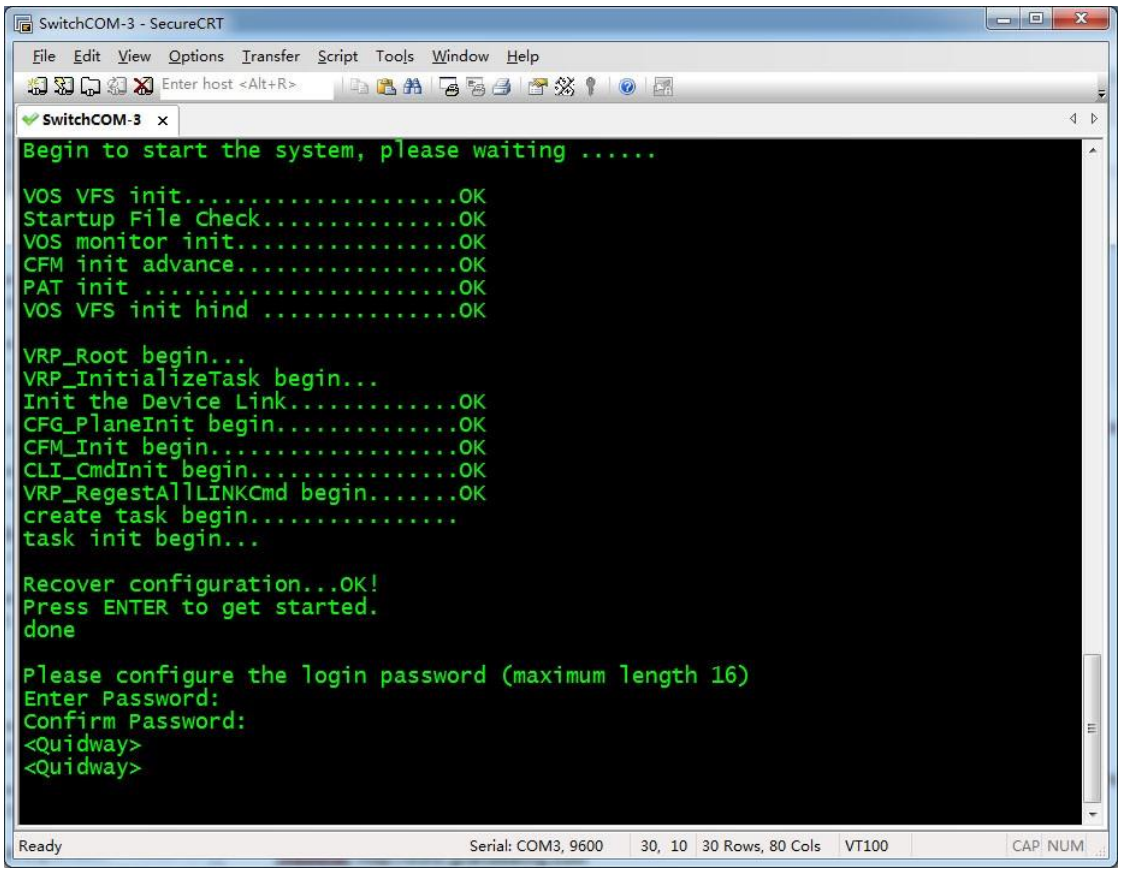
```
Please configure the login password (maximum length 16)
Enter Password:
```

After inputting the password, switch will ask you to input password again for confirmation.

```
Confirm Password:
```

After inputting the same password twice, you can now configure switches.

The following screen capture describes this step.



3.4.2 Manual Configuration

The following introduces operation process of manual configuration via commands. During the process, switch will give the similar prompt like below now and then.

```
Jan 5 2008 01:41:40-05:13 Quidway DS/4/DATASYNC_CFGCHANGE:OID
1.3.6.1.4.1.2011.5.25.191.3.1 configurations have been changed. The current
change number is 1, the change loop count is 5, and the maximum number of records
is 1.
```

You can directly press **Enter** to ignore it.

3.4.2.1 Changing the Configuration

A little difference exists in configuration process of S2700 and S5700 series switches. Configuration methods of dropping unknown multicast messages are the main difference. They will be described separately.

3.4.2.1.1 S2700 Series Switches

1. After logging in to the switches input **system-view** in default view to enter system view.

```
<Quidway>system-view
Enter system view, return user view with Ctrl+Z.
[Quidway]
```

2. Input **igmp-snooping enable** to enable global IGMP Snooping.

```
[Quidway]igmp-snooping enable
[Quidway]
```

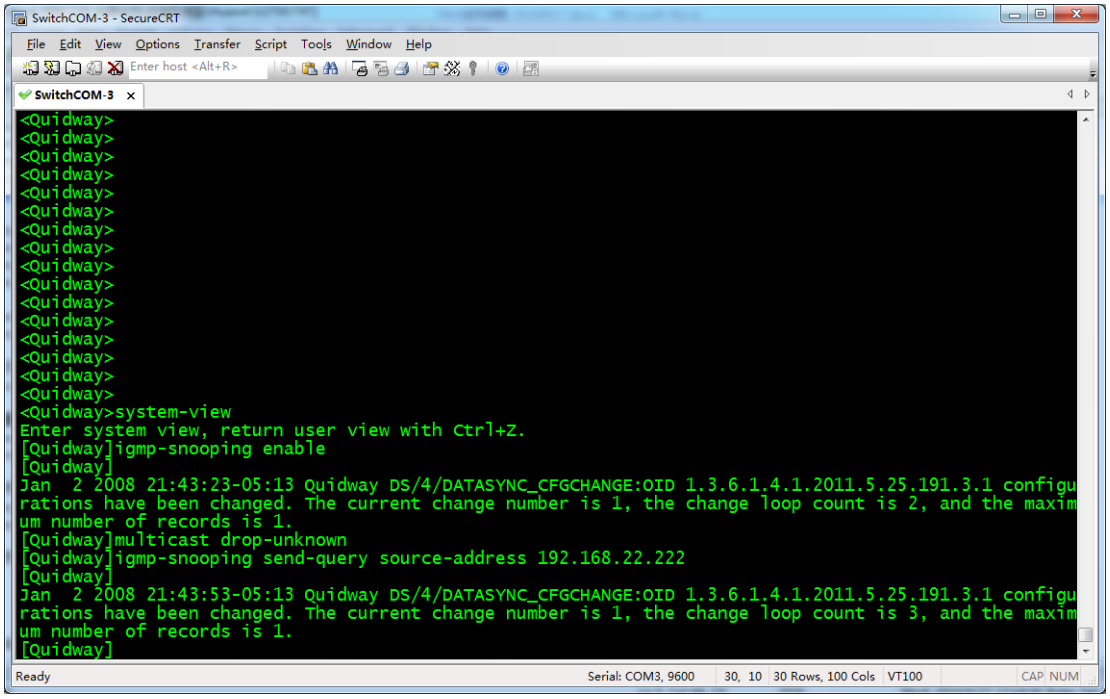
3. Input **multicast drop-unknown** to control switches to drop unknown multicast messages.

```
[Quidway]multicast drop-unknown
[Quidway]
```

4. Input **igmp-snooping send-query source-address 192.168.22.222** to assign IP address for IGMP Querier.

```
[Quidway]igmp-snooping send-query source-address 192.168.22.222
[Quidway]
```

The following screen capture describes the previous steps 1-4.



5. In system view input **vlan 1** to enter the view of VLAN 1.

```
[Quidway]vlan 1
[Quidway-vlan1]
```

6. Input **igmp-snooping enable** to enable IGMP Snooping for VLAN 1.

```
[Quidway-vlan1]igmp-snooping enable
[Quidway-vlan1]
```

7. Input **igmp-snooping querier enable** to enable IGMP Querier for VLAN 1.

```
[Quidway-vlan1]igmp-snooping querier enable
[Quidway-vlan1]
```

8. Input **igmp-snooping prompt-leave** to enable multicast fast leave for VLAN 1.

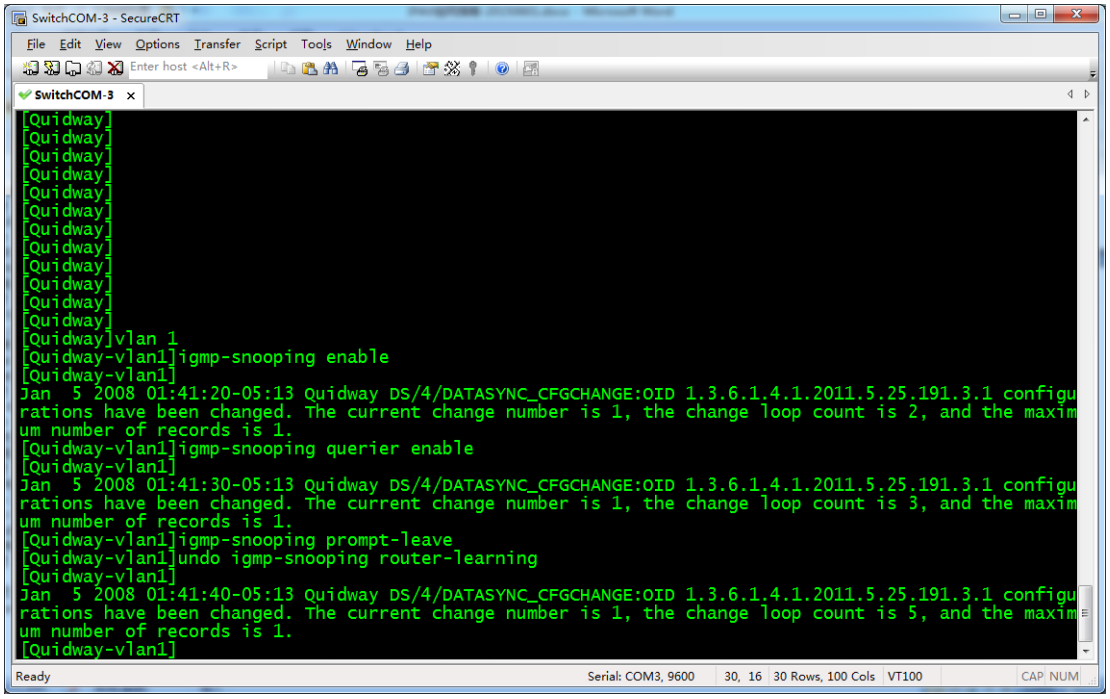
```
[Quidway-vlan1]igmp-snooping prompt-leave
```

```
[Quidway-vlan1]
```

9. Input **undo igmp-snooping router-learning** to disable dynamic multicast router port for VLAN 1.

```
[Quidway-vlan1]undo igmp-snooping router-learning
[Quidway-vlan1]
```

The following screen capture describes the previous steps 5-9.



3.4.2.1.2 S5700 Series Switches

1. After logging in to the switches input **system-view** in default view to enter system view.

```
<Quidway>system-view
Enter system view, return user view with Ctrl+Z.
[Quidway]
```

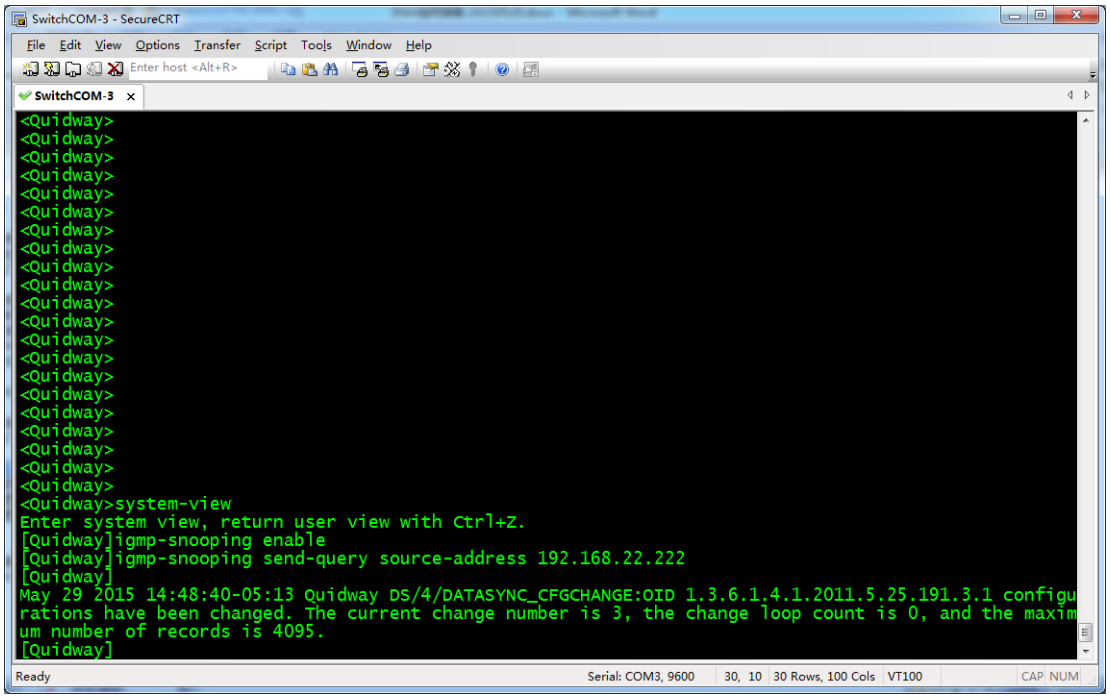
2. Input **igmp-snooping enable** to enable global IGMP Snooping.

```
[Quidway]igmp-snooping enable
[Quidway]
```

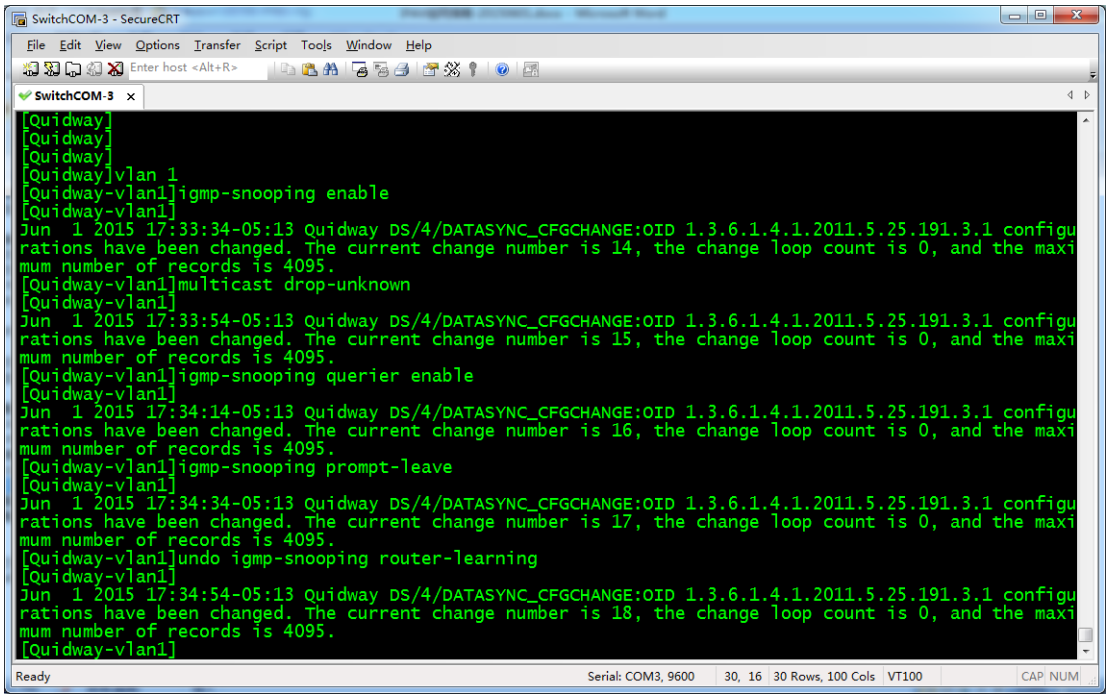
3. Input **igmp-snooping send-query source-address 192.168.22.222** to assign IP address for IGMP Querier.

```
[Quidway]igmp-snooping send-query source-address 192.168.22.222
[Quidway]
```

The following screen capture describes the previous steps 1-3.


SwitchCOM-3 - SecureCRT
File Edit View Options Transfer Script Tools Window Help
Enter host <Alt+R>
SwitchCOM-3
<Quidway>
<Quidway>
<Quidway>

The following screen capture describes the previous steps 4-9.



3.4.2.2 Confirming Configuration

1. In the view of VLAN 1 input **quit** to return system view.

```
[Quidway-vlan1]quit
[Quidway]
```

2. Input **quit** to return default view.

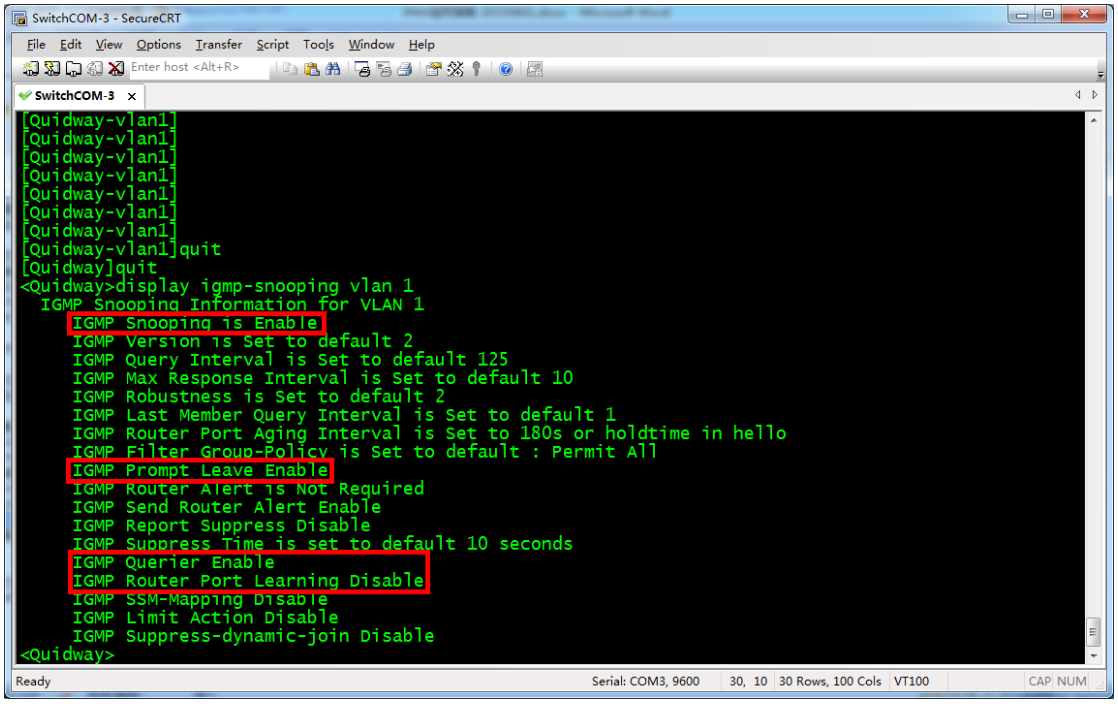
```
[Quidway]quit
<Quidway>
```

3. Input **display igmp-snooping vlan 1** to view the configuration of VLAN 1.

   Switch will give the following prompt.

```
<Quidway>display igmp-snooping vlan 1
 IGMP Snooping Information for VLAN 1
    IGMP Snooping is Enable
    ...
    IGMP Prompt Leave Enable
    ...
    IGMP Querier Enable
    IGMP Router Port Learning Disable
    ...
```

The following screen capture describes the steps above. The information in red boxes means that switches have been configured correctly.



3.4.2.3 Saving Configuration

After confirming correct configuration, save the configuration to make switches run the specific configuration after rebooting.

1. In default view input **save**. Switch will give the following feedback.

```
<Quidway>save
The current configuration will be written to the device.
Are you sure to continue?[Y/N]
```

2. Input **Y**. Switch will ask you to confirm configuration file name.

```
Info: Please input the file name(*.cfg,*.zip)[vrpcfg.zip]:
Jan 1 2008 03:05:30-05:13 Quidway %%01CFM/4/SAVE(l)[30]:The user chose Y when deciding whether to save the configuration to the device.
```

Press **Enter**. Switch will ask if you want to overwrite the original configuration file.

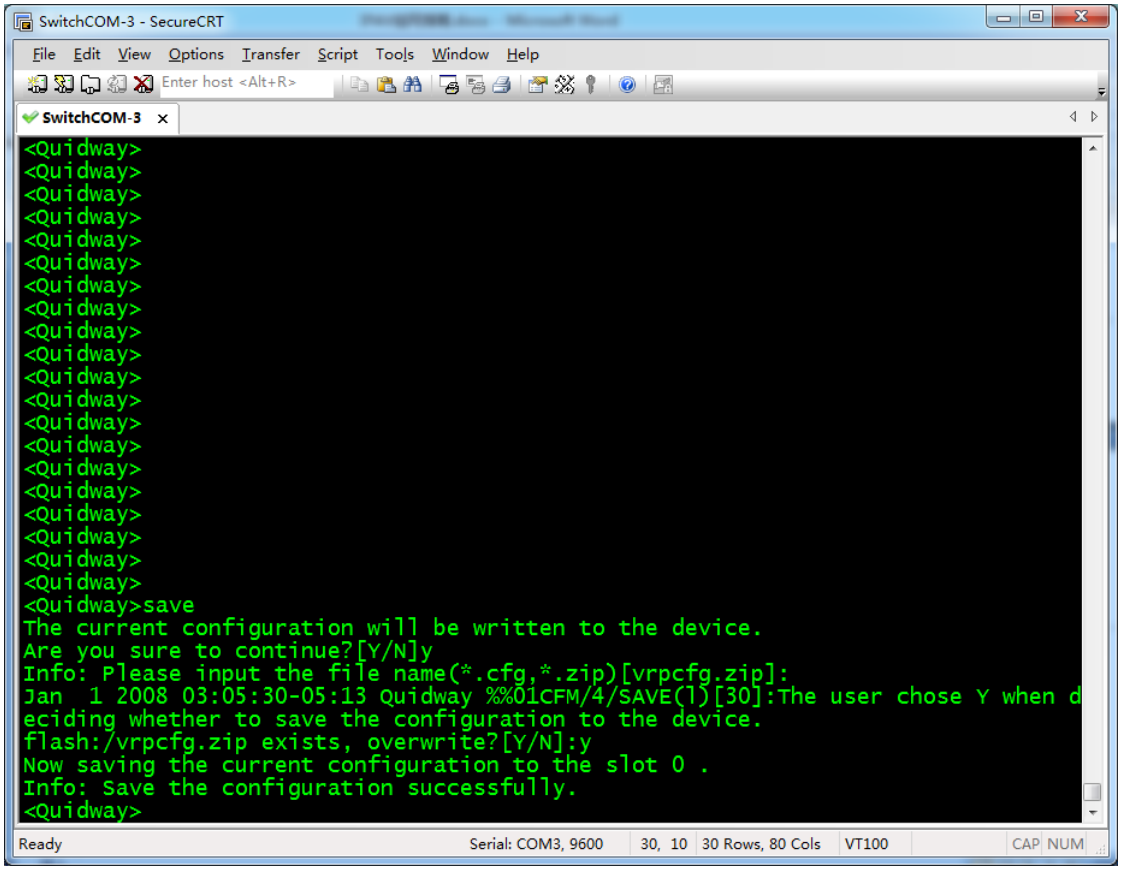
```
flash:/vrpcfg.zip exists, overwrite?[Y/N]:
```

3. Input **Y**. Switch will start saving the configuration. Switch will give the following feedback.

```
Now saving the current configuration to the slot 0.
Info: Save the configuration successfully.
<Quidway>
```

The following screen capture describes the previous steps. According to the different time of saving configuration, switches may not give prompt of confirming configuration file name and overwriting original configuration file in

step 3. It's fine only if switches give prompt of saving configuration successfully.



3.4.3 Importing Configuration

Before importing configuration for switches, complete related preparations by referring to "Reference Information" section, and then operate based on the following steps.

1. After logging in to switches, input **system-view** in default view to enter system view.

```
<Quidway>system-view
Enter system view, return user view with Ctrl+Z.
[Quidway]
```

2. Input **interface vlan 1** to enter the interface view of VLAN 1.

```
[Quidway]interface vlan 1
[Quidway-Vlanif1]
```

3. Input **ip address 192.168.1.39 255.255.255.0** to configure management IP address for VLAN 1.

```
[Quidway-Vlanif1]ip address 192.168.1.39 255.255.255.0
[Quidway-Vlanif1]
```

4. Input **quit** twice to return default mode.

```
[Quidway-Vlanif1]quit
```

```
[Quidway]quit
<Quidway>
```

5. Input **tftp 192.168.1.73 get S2700-IPAV.cfg** to obtain configuration file **S2700-IPAV.cfg** from a PC whose IP address is 192.168.1.73. Switch will give the following prompt.

```
<Quidway>tftp 192.168.1.73 get S2700-IPAV.cfg
Info: Transfer file in binary mode.
Downloading the file from the remote TFTP server. Please wait.../
TFTP: Downloading the file successfully.
    1482 bytes received in 1 second.
<Quidway>
```

6. Input **startup saved-configuration S2700-IPAV.cfg** to for switches to run using the downloaded configuration file for the next start-up.

```
<Quidway>startup saved-configuration S2700-IPAV.cfg
Info: Succeeded in setting the configuration for booting system.
<Quidway>
```

7. Enter **reboot** to reboot switch.

```
<Quidway>reboot
Info: The system is now comparing the configuration, please wait.
Warning: All the configuration will be saved to the configuration file for the
next startup:, Continue?[Y/N]:
```

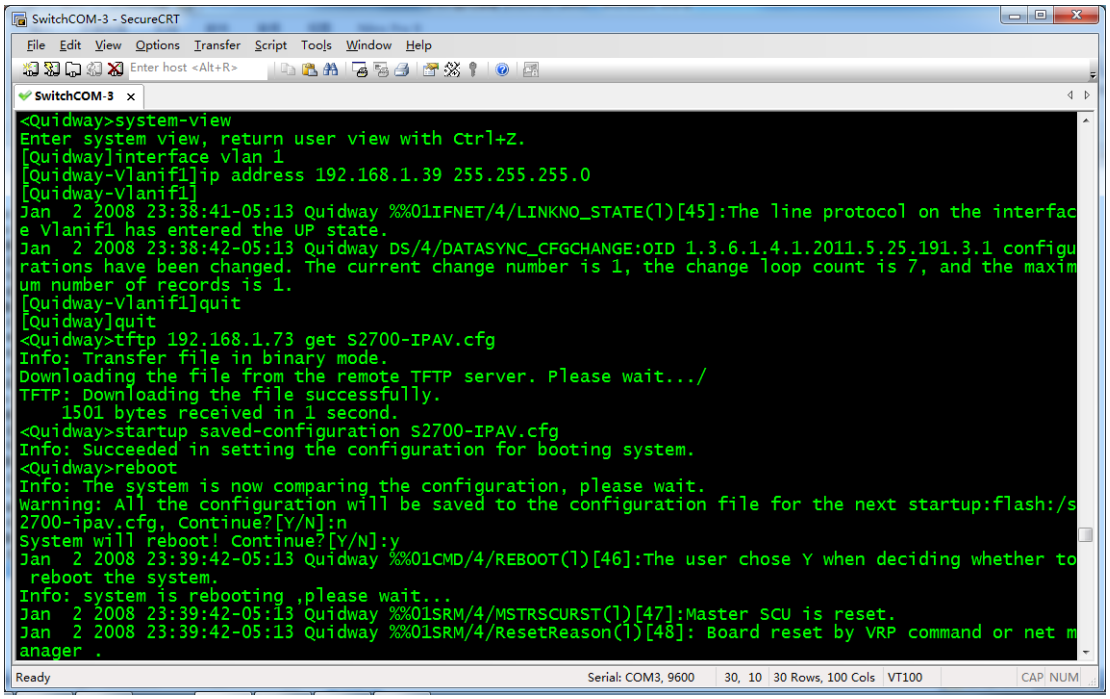
Input **N**. Switch will give the following prompt.

```
System will reboot! Continue?[Y/N]:
```

Now input **Y**. Switch starts rebooting.

```
Jan  2 2008 22:32:39-05:13 Quidway %%01CMD/4/REBOOT(l)[2]:The user chose Y when
deciding whether to reboot the system.
Info: system is rebooting ,please wait...
```

The following screen capture describes the steps above.



After rebooting, switch will run the configuration of S2700-IPAV.cfg.

3.5 Reference Information

3.5.1 Preparations before Importing Configuration

Before importing configuration for switches, the following preparations are required.

1. Contact your supplier or installer to obtain switch's configuration files. A switch is configured to be a core switch and an extended switch using different configuration files. Please ensure to obtain appropriate configuration files to meet your actual needs.
2. Configuration file includes password information as well as the configuration information of IPAV networking. Please ask configuration file provider for password lest no password is available after importing configuration.
3. Use a network cable to connect between PC and switch. Disconnect all the other network cables from the switch expect the one connected to your PC, preventing switch broadcasting TX's multicast messages to PC's Ethernet port to affect the transmission of configuration data.
4. Set a static IP for PC. For example, set PC's IP address as 192.168.1.73 with a subnet mask of 255.255.255.0. Different operating systems have different methods of setting a static IP. For more information, see their user guides.
5. Start TFTP server software on your PC and store the prepared configuration file in the directory of TFTP server. This operation is performed in a different way in different TFTP server software. The latter sections in this manual will offer an example of using tftpd32 for your reference.

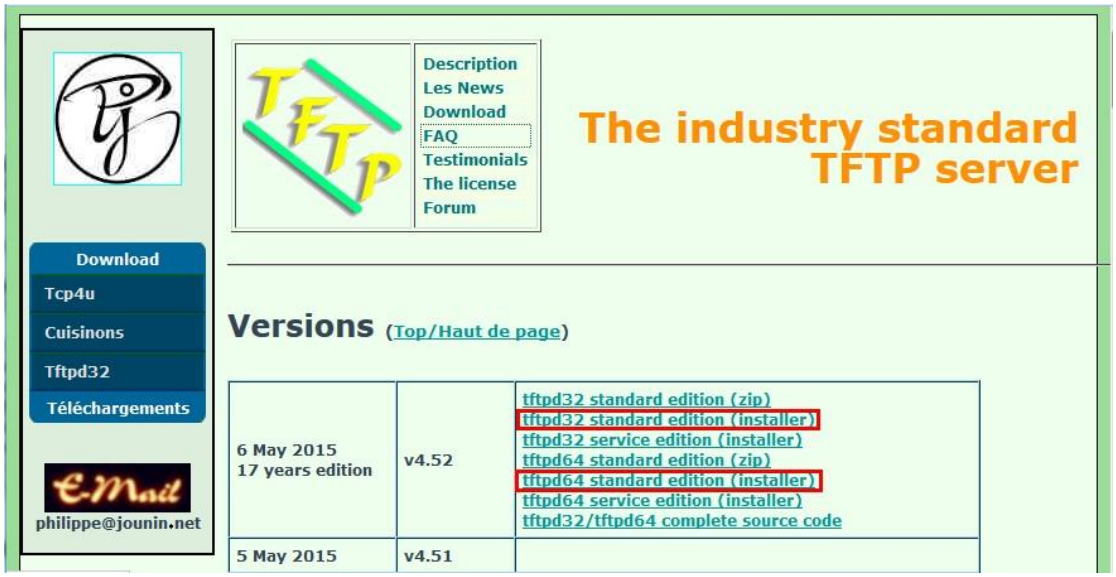
3.5.2 Using Tftpd32

Tftpd32 is free open-source software, which can be used to set up a TFTP server on a Windows PC. Here we simply introduce how to use it.

1. Online download

Various versions of Tftpd32 are available on

http://tftpd32.jounin.net/tftpd32_download.html



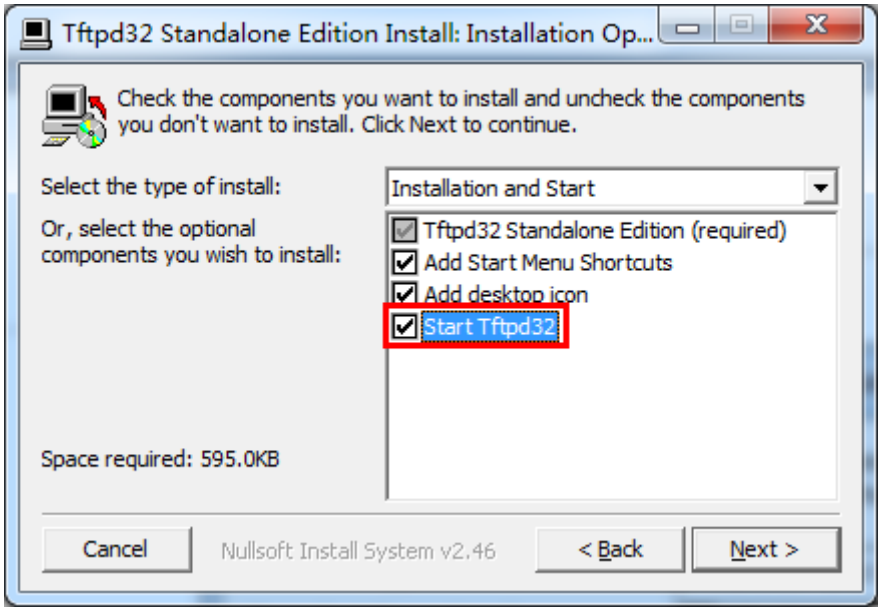
Note:

- ✧ Please download standard edition (installer) versions which are marked in red boxes in the screen capture above.
- ✧ Two versions are marked in red boxes, respectively corresponding to 32-bit and 64-bit Windows. Select an appropriate one that suits your needs.
- ✧ **tftpd32 standard edition (installer)** will be taken as an example latter in this chapter.

2. Installation

Click the downloaded installation package **Tftpd32-4.52-setup.exe**.

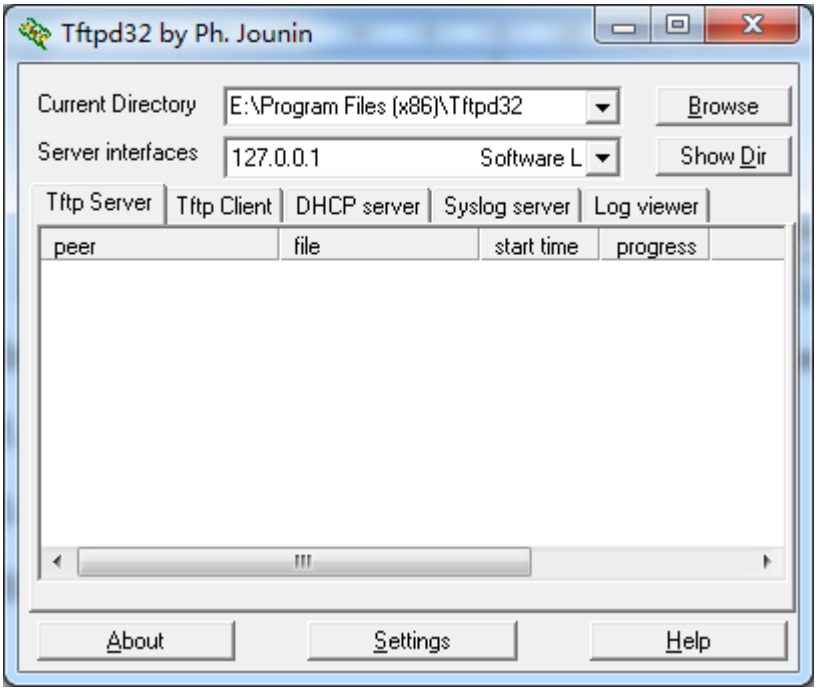
Click the **I Agree** button.



Select **Start Tftpd32** (marked in red box in the screen capture above), and then click the **Next** button and follow the on-screen instructions to complete the installation.

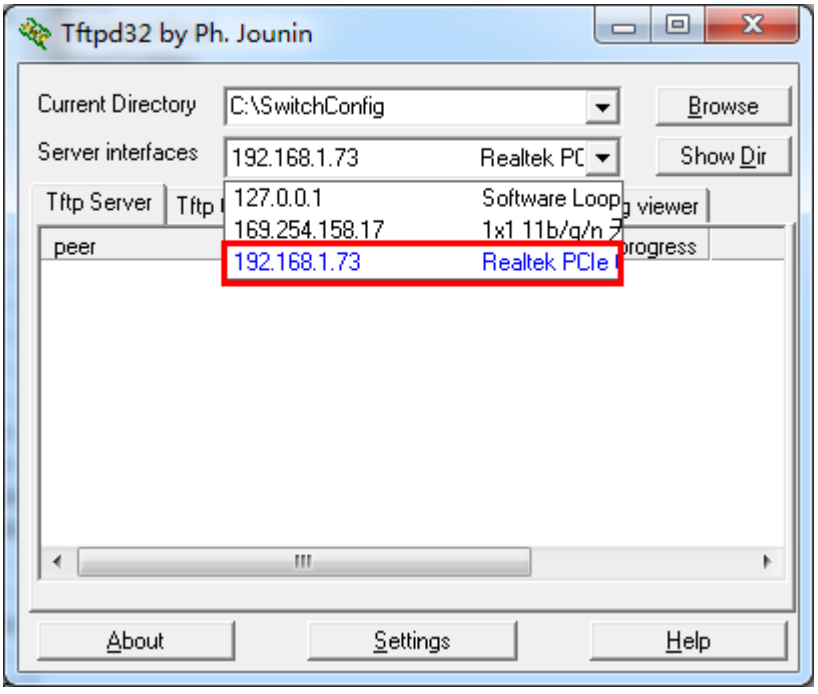
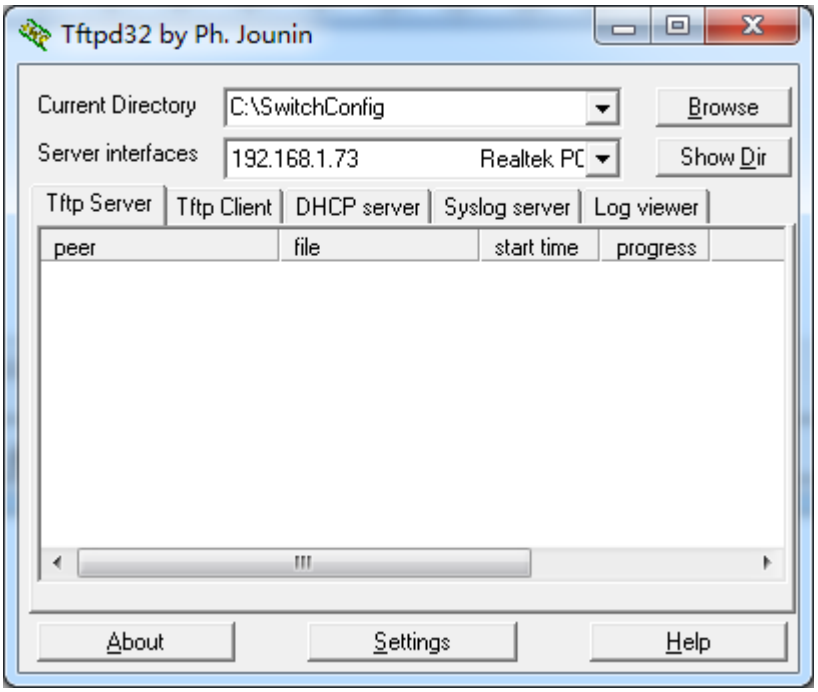
3. Getting started

After installation, Tftpd32 will start automatically.



You need to configure **Current Directory** and **Server interfaces** before using **tftpd32** to perform import and export configuration for switches.

- ✧ Click the **Browse** button, and then select the directory which stores switch configuration file as the current working directory, for example **C:\SwitchConfig**.
- ✧ Select the network interface that offers TFTP service for **Server interfaces**, for example select 192.168.1.73.



Now, tftpd32 has been configured successfully. The screen capture is as follows.