

# CS 305 Lab Tutorial

## Lecture 15 Router

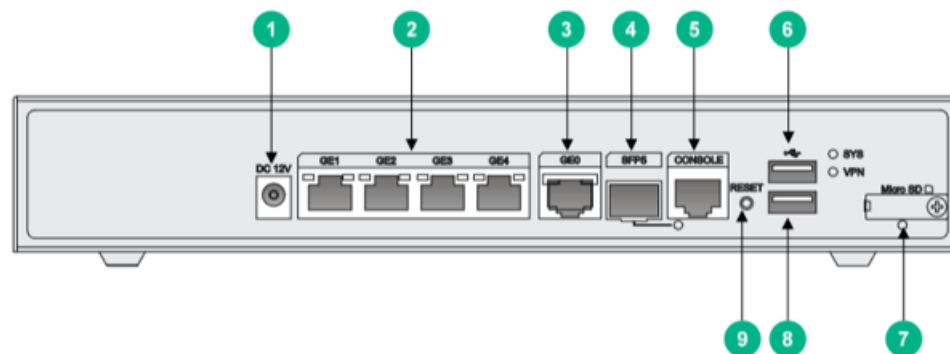
### (H3C MSR810/830/360-4)

Dept. Computer Science and Engineering  
Southern University of Science and Technology

# Router(MSR810)



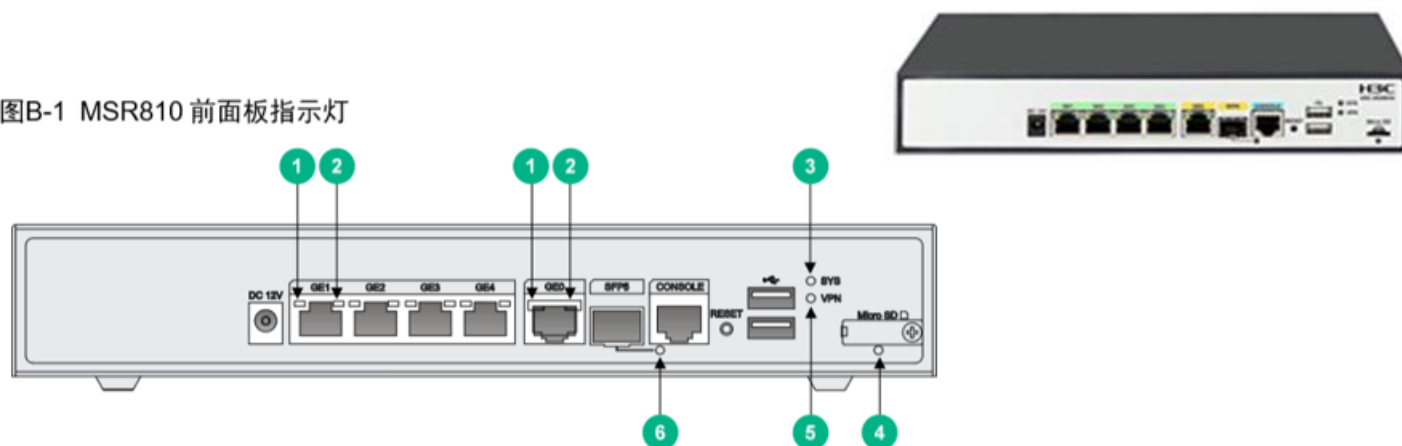
图A-1 MSR810 前视图



1.AC adapter socket	2.Gigabit Ethernet LAN interface GE1~GE4	3.Gigabit Ethernet wAN interface GE0
4.Gigabit Optical fiber interface	5. Configuration port CONSOLE	6. USB interface
7. Micro SD card slot	8. USB interface	9. RESET button

# Router(MSR810)

图B-1 MSR810 前面板指示灯



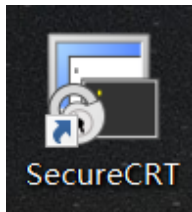
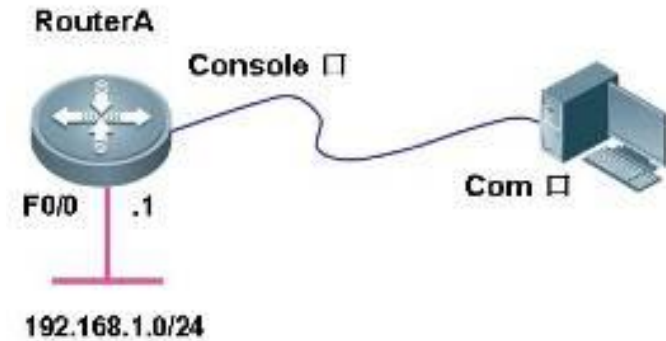
1. GE port yellow Indicator light	2. GE port green Indicator light
3. SYS Indicator light	4. Micro SD card Indicator light
5. VPN Indicator light	6. SFP Optical fiber interface Indicator light

Indicator light	status	indicate
SYS Indicator light	green always on	SDRAM checking (bootrom phase)
	yellow Twinkle @1HZ	SDRAM checking failed(bootrom phase)
	off	No power input, or working failure status
GE green/yellow	green always on	Links are connected and work in Gigabit mode
	green twinkle	data sending and receiving ,work in Gigabit mode
	yellow always on	Links are connected and work in 10/100 Migabit mode
	yellow twinkle	data sending and receiving ,work in 10/100 Migabit mode
	off	Links are disconnected

# Connect with router by console

To configure the router by PC

1. Connect the “console” port of Router with “com” port of PC
2. Invoke the SecureCRT on PC to communicate with CLI of Router



**Serial Options**

The port may be manually entered or selected from the list.

Port:

Baud rate:

Data bits:

Parity:

Stop bits:

Flow control

☐ DTR/DSR

☒ RTS/CTS

☐ XON/XOFF

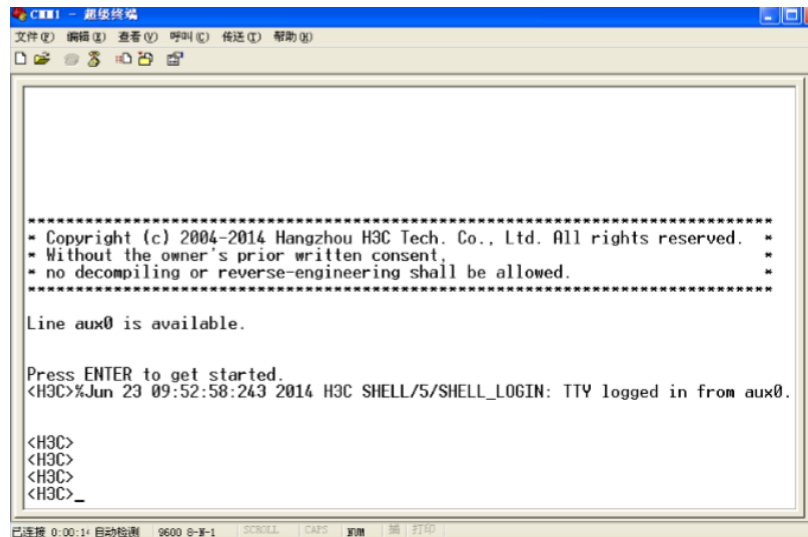
Name of pipe:

Serial break length:  milliseconds

# CLI (Command Line Interface)

TEXT style instruction interaction interface between user and device.

- Users input text commands, submit devices by inputting return key to execute corresponding commands for configure and manage the devices.
- confirm the configuration results by viewing the output information.



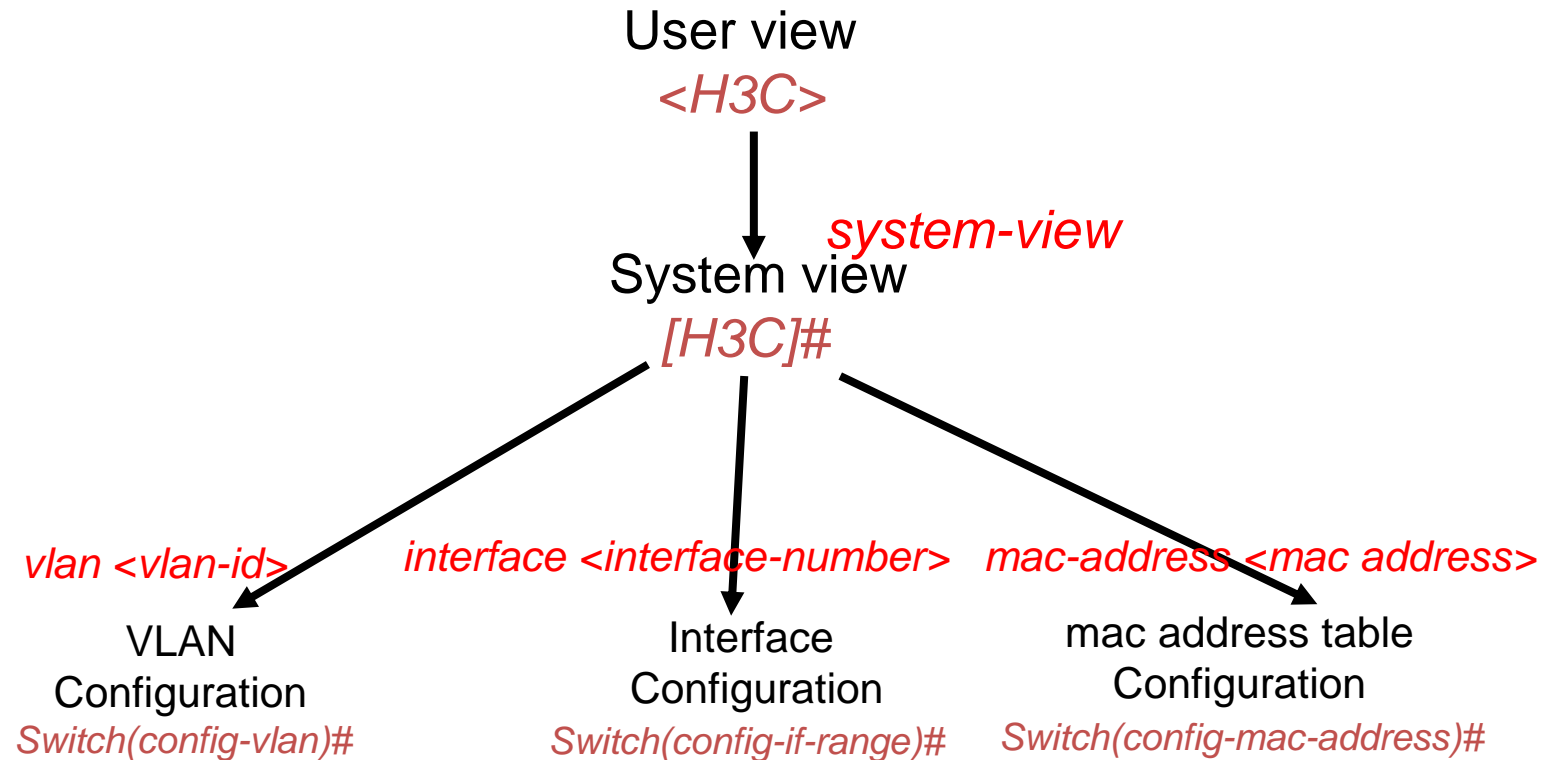
```
*****
* Copyright (c) 2004-2014 Hangzhou H3C Tech. Co., Ltd. All rights reserved. *
* Without the owner's prior written consent,                               *
* no decompiling or reverse-engineering shall be allowed.                  *
*****

Line aux0 is available.

Press ENTER to get started.
<H3C>%Jun 23 09:52:58:243 2014 H3C SHELL/5/SHELL_LOGIN: TTY logged in from aux0.

<H3C>
<H3C>
<H3C>
<H3C>_
```

# Views and Command



*Tips: return /ctrl+c could be used to return to exit current view*

# Commands and Keys

- Setting
  - Restore factory default, reboot
  - In different views (system, interface, sub-functions)
  - To set device, interface, ip address, service, AAA etc.
- display
  - Device, interface, dhcp, ip routing-table etc.
  - The keys usefull for displaying the output in pages

keys	function
space key	continue to display the message of next screen
enter key	continue to display the message of next line
<Ctrl + C>	stop display,return to the command line state
<PageUp>	display last page
<PageDown>	display next page

# Reminds on error inputs

表1-11 命令行常见错误信息表

英文错误信息	错误原因
% Unrecognized command found at '^' position.	命令无法解析，符号“^”指示位置出错
% Incomplete command found at '^' position.	符号“^”指示位置的参数输入不完整
% Ambiguous command found at '^' position.	符号“^”指示位置的关键字不明确，存在二义性
% Too many parameters.	输入参数太多
% Wrong parameter found at '^' position.	在符号“^”指示位置的参数错误

Tips: “ display history-command “ to display 10 history commands by default



# Ethernet Interface

There are several Ethernet interfaces supported on the device:

- **Layer 2 Ethernet interface:**
  - a physical interface working in the data link layer, which can exchange and forward received messages in layer 2
- **Layer 3 Ethernet Interface:**
  - It is a physical interface working in the network layer. It can configure IP address and route the received message in three layers.
- Layer 2 and 3 switchable Ethernet interface:
  - It is a physical interface that can work in Layer2 mode or Layer3 mode and be used as a Layer2 Ethernet interface or Layer3 Ethernet interface.
  - Using “**display ... brief**” to find the brief description on interface
  - Using “**port-link mode ...**” to change the mode of interface, bridge or route
  - Using “**ip address ...**” to configure the IP address of Ethernet interface

# Show the link-mode of interface

```
<H3C>display interface brief
The brief information of interface(s) under route mode:
Link: ADM - administratively down; Stby - standby
Protocol: (s) - spoofing
Interface      Link Protocol Main IP      Description
Cellular0/0    DOWN DOWN      --
GE0/0          DOWN DOWN      --
GE0/1          DOWN DOWN      --
GE0/8          DOWN DOWN      --
GE0/9          DOWN DOWN      --
NULL0         UP   UP(s)       --
Vlan1          DOWN DOWN      192.168.1.1
```

```
The brief information of interface(s) under bridge mode:
Link: ADM - administratively down; Stby - standby
Speed or Duplex: (a)/A - auto; H - half; F - full
Type: A - access; T - trunk; H - hybrid
Interface      Link Speed Duplex Type PVID Description
GE0/2          DOWN auto  A     A    1
GE0/3          DOWN auto  A     A    1
GE0/4          DOWN auto  A     A    1
GE0/5          DOWN auto  A     A    1
GE0/6          DOWN auto  A     A    1
GE0/7          DOWN auto  A     A    1
```

The link-mode of Router's interfaces could be set.

```
[H3C-GigabitEthernet0/2]display this
#
interface GigabitEthernet0/2
 port link-mode bridge
#
return
[H3C-GigabitEthernet0/2]port link
[H3C-GigabitEthernet0/2]port link-mo
[H3C-GigabitEthernet0/2]port link-mode rout
[H3C-GigabitEthernet0/2]port link-mode route
[H3C-GigabitEthernet0/2]display this
#
interface GigabitEthernet0/2
 port link-mode route
#
return
[H3C-GigabitEthernet0/2]
```

tips: using “port link-mode xxx” to set the interface work on bridge or route mode.

# Set IP address of Interface

An interface whose link-mode is route could be set IP address.

using “ip address x.x.x.x y.y.y.y” to set IP address (here “x.x.x.x” is the IP address while “y.y.y.y” is the related subnet mask).

Q: why “192.168.1.2 255.255.255.0” is an error setting while “192.168.2.1 255.255.255.0” is ok

```
[H3C-GigabitEthernet0/2]ip addr
[H3C-GigabitEthernet0/2]ip address 192.168.1.2 255.255.255.0
Error: The IP address you entered overlaps with another interface!
[H3C-GigabitEthernet0/2]ip address 192.168.2.1 255.255.255.0
[H3C-GigabitEthernet0/2]exit
```

```
<H3C>display interface brief
The brief information of interface(s) under route mode:
Link: ADM - administratively down; Stby - standby
Protocol: (s) - spoofing
Interface      Link Protocol Main IP      Description
Cellular0/0    DOWN  DOWN  --
GE0/0          DOWN  DOWN  --
GE0/1          DOWN  DOWN  --
GE0/8          DOWN  DOWN  --
GE0/9          DOWN  DOWN  --
NULL0         UP    UP(s)  --
Vlan1         DOWN  DOWN  192.168.1.1

The brief information of interface(s) under bridge mode:
Link: ADM - administratively down; Stby - standby
Speed or Duplex: (a)/A - auto; H - half; F - full
Type: A - access; T - trunk; H - hybrid
Interface      Link Speed  Duplex Type PVID Description
GE0/2          DOWN  auto   A     A    1
GE0/3          DOWN  auto   A     A    1
GE0/4          DOWN  auto   A     A    1
GE0/5          DOWN  auto   A     A    1
GE0/6          DOWN  auto   A     A    1
GE0/7          DOWN  auto   A     A    1
```

# Routing table

Routing tables contain routes discovered by various routing protocols, which are usually classified into three categories according to their sources:

- **Direct Routing:** Routing discovered by link layer protocols, also known as interface routing.
- **Static routing:** The routing that the network administrator configures manually. The disadvantage is that whenever the network topology changes, it needs to be reconfigured manually and can not be automatically adapted.
- **Dynamic routing:** Routing discovered by routing protocols.

```
[H3C]display ip routing-table
Routing Tables: Public
Destinations : 6          Routes : 6
```

Destination/Mask	Proto	Pre	Cost	NextHop	Interface
10.10.1.0/24	Direct	0	0	10.10.1.1	GE0/2
10.10.1.1/32	Direct	0	0	127.0.0.1	InLoop0
10.10.7.0/24	Direct	0	0	10.10.7.73	GE0/7
10.10.7.73/32	Direct	0	0	127.0.0.1	InLoop0
127.0.0.0/8	Direct	0	0	127.0.0.1	InLoop0
127.0.0.1/32	Direct	0	0	127.0.0.1	InLoop0

```
[H3C]ip rou
[H3C]ip route-static 10.10.2.0 24 10.10.7.71
[H3C]display ip routing-table
Routing Tables: Public
Destinations : 7          Routes : 7
```

Destination/Mask	Proto	Pre	Cost	NextHop	Interface
10.10.1.0/24	Direct	0	0	10.10.1.1	GE0/2
10.10.1.1/32	Direct	0	0	127.0.0.1	InLoop0
10.10.2.0/24	Static	60	0	10.10.7.71	GE0/7
10.10.7.0/24	Direct	0	0	10.10.7.73	GE0/7
10.10.7.73/32	Direct	0	0	127.0.0.1	InLoop0
127.0.0.0/8	Direct	0	0	127.0.0.1	InLoop0
127.0.0.1/32	Direct	0	0	127.0.0.1	InLoop0

# Routing

In the network, the **Router** chooses an appropriate path **according to the destination address** of the received message and forwards the message **to the next router**. The last router in the path is responsible for forwarding the message to the destination host.

**Routing is the path information of the message in the process of forwarding, which is used to guide the message forwarding.**

According to different routing destinations, routing can be divided into:

- **Network Routing:** Destination is network segment, subnet mask length is less than 32 bits
- **Host routing:** destination is host, subnet mask length is 32 bits

According to whether the destination is directly connected to the router, the routing is divided into:

- **Direct Routing:** The destination network is directly connected to the router
- **Indirect routing:** the destination network is not directly connected to the router

# FIB(Forwarding Item Base)

- Each forwarding item in the FIB table indicates which physical interface of the router should be used to send messages to a subnet or a host to reach the next router in the path, or to the destination host in the directly connected network without passing through another router.

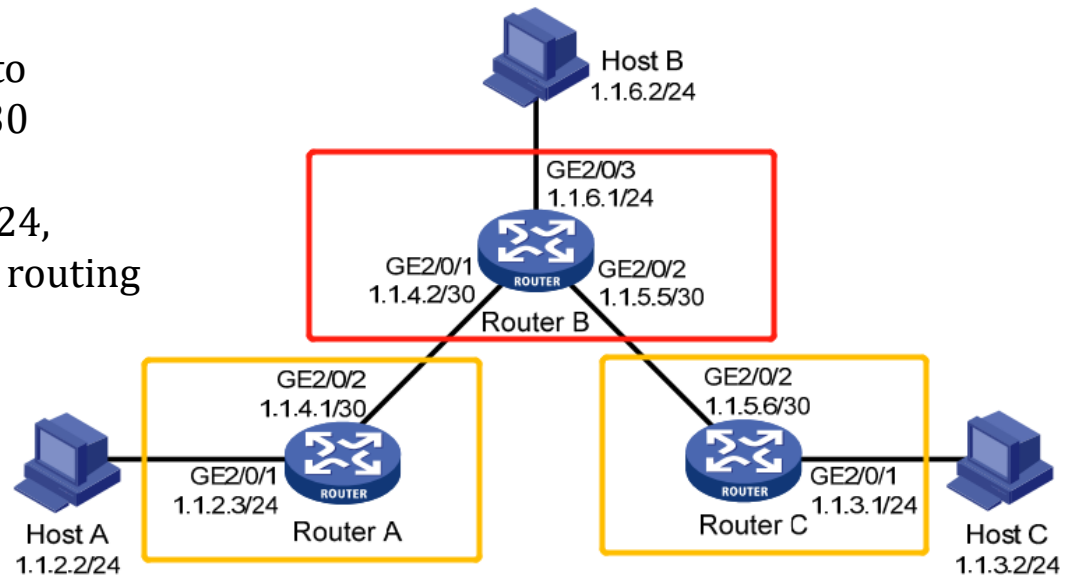
```
<H3C>display fib
Destination count: 8    FIB entry count: 8
Flag:
  U:Useable    G:Gateway    H:Host    B:Blackhole    D:Dynamic    S:Static
  R:Relay

Destination/Mask  Nexthop      Flag      OutInterface  InnerLabel  Token
10.10.4.0/24      10.10.7.71   USG       GE0/7         Null        Invalid
10.10.2.0/24      10.10.7.71   USG       GE0/7         Null        Invalid
10.10.7.0/24      0.0.0.0      U         GE0/7         Null        Invalid
10.10.7.73/32     127.0.0.1    UH        InLoop0       Null        Invalid
10.10.1.0/24      0.0.0.0      U         GE0/2         Null        Invalid
10.10.1.1/32      127.0.0.1    UH        InLoop0       Null        Invalid
127.0.0.1/32      127.0.0.1    UH        InLoop0       Null        Invalid
127.0.0.0/8       127.0.0.1    U         InLoop0       Null        Invalid
<H3C>
```

# Add Static Routing

Router B got the direct routing to  
1.1.6.1/24, 1.1.4.2/30, 1.1.5.5/30

If B wants to routing to 1.1.2.0/24,  
1.1.3.0/24, Route B need to add routing  
info as follow:



```
<RouterB> system-view
[RouterB] ip route-static 1.1.2.0 255.255.255.0 1.1.4.1
[RouterB] ip route-static 1.1.3.0 255.255.255.0 1.1.5.6
```

tips: "1.1.2.0 255.255.255.0" is the NetID and Subnet Mask of the destination, 1.1.4.1 is the IP address of next-hop

# Practice(1)

while use “MSG 360-4”, its 'login name' and 'password' are both: admin.

- Connect the router by console, answer the following questions:
  - find the “hardware address”, “bandwidth”, “pvid” of an interface, check if it has ever received or sent packets
  - how many types of link-mode on interfaces of router, could the link-mode be changed for an interface? how to change it?
  - could it be possible to set an IP address on an interface which work on bridge mode? if yes, try it
  - could it be possible to set port link-type on an interface which work on route mode? if yes, try it

tips: use “dis int gig xxx” could find more details about the interface



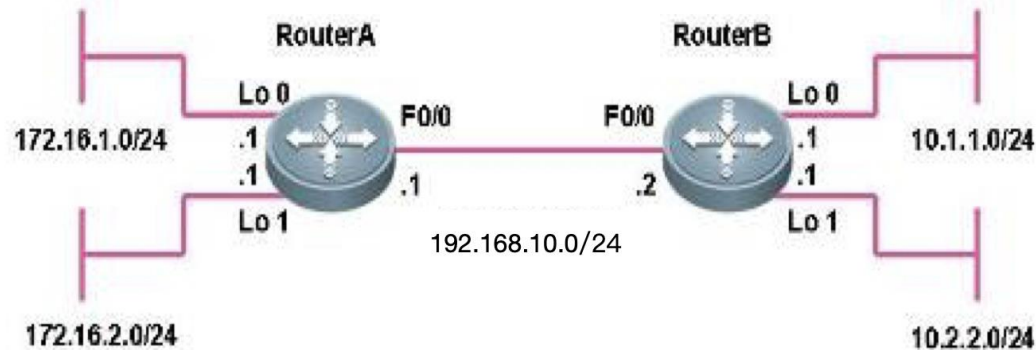
# Practice(2)

- Build a network with two PCs (PCa and PCb) and a Router
- Configure the network according to the following requirements:
  - PCa belongs to subnet1, PCb belongs to subnet2, Router connect subnet1 and subnet2
    - The network ID of Subnet1 and subnet2 are both B type address with 24bits network ID length
  - PCa and PCb work as DHCP client, Router work as DHCP server
  - On the Router, there are at least 2 dhcp ip-pools with different network and different gateway-list
- Test
  - Show the IP addresses of PCa and PCb
  - Use command “ping” to test the connection between PCs, are they reachable or not? Why? show ip routing-table on the Router.
  - Set MTU on the interface which connects PCa. Set MTU as 46.
    - invoke “Wireshark” on PCa to capture the ICMP packets
    - use “ping *destination -l 90*” on PCa (destination here is the IP address of the interface which connects PCa)
    - Does the IP fragment happen on the ICMP request or ICMP reply or both?

tips: use “mtu xxx” to set the MTU value of the interface.

# Optional Practice (use two Routers)

1. Implement cross-router communication
2. Show the rout-table and fib info on Router A and Router B
3. Save the configuration as setup configuration



# Tips : reboot

```
<ns> reboot
Start to check configuration with next startup configuration file, please wait.....DONE!
This command will reboot the device. Current configuration will be lost, save current configuration
? [Y/N]:y
Please input the file name(*.cfg)[flash:/startup.cfg]
(To leave the existing filename unchanged, press the enter key):
Validating file. Please wait....
Configuration is saved to device successfully.
This command will reboot the device. Continue? [Y/N]:y
#Jan 1 00:23:47:779 2013 H3C DEVM/1/REBOOT:
Reboot device by command.

%Jan 1 00:23:47:779 2013 H3C DEVM/5/SYSTEM_REBOOT: System is rebooting now. 系统正在重启。
System is starting.

..
Press Ctrl+D to access BASIC-BOOTWARE MENU
Booting Normal Extend BootWare

*****
*
*                      H3C MSR830 BootWare, Version 5.10
*
*****
copyright (c) 2004-2017 New H3C Technologies Co., Ltd.

Compiled Date       : Apr 25 2017
CPU ID              : 0xa
CPU L1 Cache        : 32KB
CPU L2 Cache        : 256KB
Memory Type         : DDR3 SDRAM
Memory Size         : 256MB
Memory Speed        : 533MHz
Flash Size          : 128MB
PCB Version         : 2.0
```

In user view “reboot” will reminds to save the current configuration as startup cfg, if you choose yes , the configuration will work on the coming reboot stage.