

# Course "Netzwerke"

## LAB 2 Basic Router Configuration

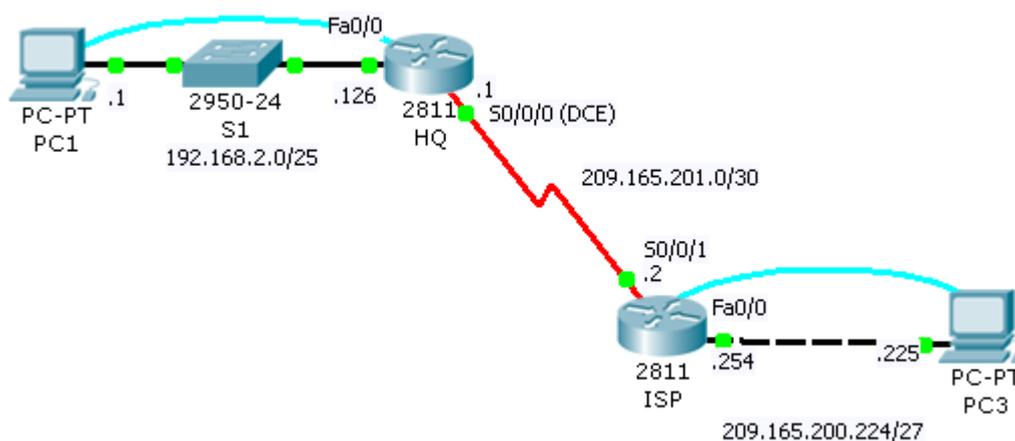
### Learning Objectives

- Review of previously learned skills.
- Basic IOS Command Line Interface operation.
- Basic Router configuration.
- Verification and testing of configurations.
- Management of configuration files

### Scenario

In this lab activity, you will review previously learned skills, including basic IOS command line interface operation and configuration commands. You will also learn to save configuration files to a text file and to a TFTP server. The skills presented in this lab are essential to completing the rest of the labs in this course. The instructions here presume that you start with opening file "*Netzwerke-P2-BasicRouterConfig\_E2\_1\_5\_2.pkt*" in PacketTracer but it's not an absolute need to have this file.

### Topology Diagram



Device		Interface	IP Address	Subnet Mask	Default Gateway
HQ	HQ-LAN	Fa0/0	192.168.2.126	255.255.255.128	N/A
	HQ-ISP-LAN	So/o/o(DCE)	209.165.201.1	255.255.255.252	N/A
PC2	HQ-LAN	N/A	192.168.2.1	255.255.255.128	192.168.2.126
ISP	ISP-LAN	Fa0/0	209.165.200.254	255.255.255.224	N/A
	HQ-ISP-LAN	So/o/1	209.165.201.2	255.255.255.252	N/A
PC3	ISP-LAN	N/A	209.165.200.253	255.255.255.224	209.165.200.254

N/A: Not available

## Task 1: Cable the Links of the Network.

Steps 1 to 7 help you creating the network topology shown in the drawing above.

**Step 1** Open File "**Netzwerke-P2-BasicRouterConfig\_E2\_1\_5\_2-Student.pkt**" with PacketTracer. Cable the network devices using the appropriate cable types.

**Step 2** Connect the HQ Router to the S1 Switch.

**Step 3** Connect PC2 to the S1 Switch.

**Step 4** Connect PC3 to the ISP Router.

**Step 5** Connect Router HQ with Router ISP via a serial WAN Link

Use a serial cable to connect the serial interfaces HQ-S0/0/0(DCE) and ISP-S0/0/1(DTE)

**Step 6** Connect PC2 with HQ-Console Port and PC3 with ISP-Console Port

Use a console (rollover) cable to connect PC2-RS232 with HQ-Console and PC3-RS232 with ISP-Console.

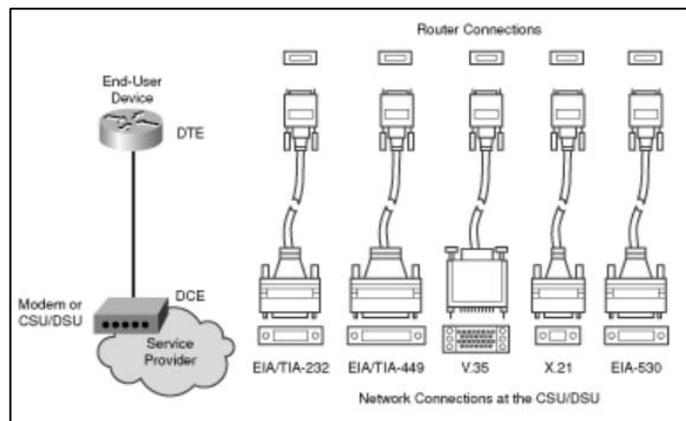
### What are serial interfaces and what are they good for?

For long-distance communication, Wide Area Networks (WAN) use serial transmission. **Serial router interfaces** connect routers to those WAN via **serial cables** (see **figure** to the right). **Serial transmission** is a method of data transmission in which bits of data are transmitted sequentially over a single channel. This one-at-a-time transmission contrasts with **parallel data transmission**, which transmits several bits at a time.

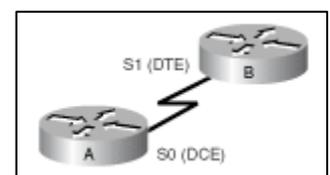
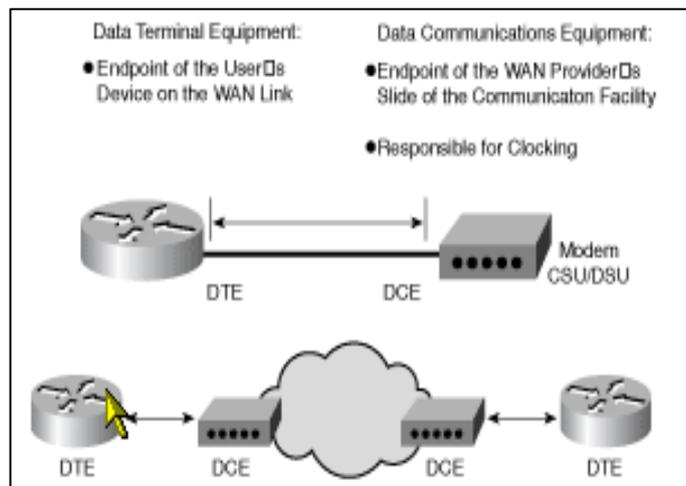
In real life networks serial cables are equipped with connectors connecting to the data terminal equipment (**DTE**) at one end and connecting to the data circuit Equipment (**DCE**) at the other side (see **figure** to the right). The DTE interface is the endpoint of the user's device on the WAN link. The DCE interface is typically the point where responsibility for delivering data passes into the hands of the WAN service provider.

Real life DCE is a modem or a **channel/data service unit [CSU/DSU]**. In contrast to DTE interfaces DCE interfaces additionally provides the WAN providers **clocking signal** for bit synchronization purposes. Routers are DTE that need this clocking signal to extract the bits from the received WAN signals.

**In laboratory testbeds** which do not use real life WAN connections but connect 2 routers back-to-back the clocking signal is missing. In such cases, one of the two routers terminating a WAN link needs to



### Serial cables with different connector types



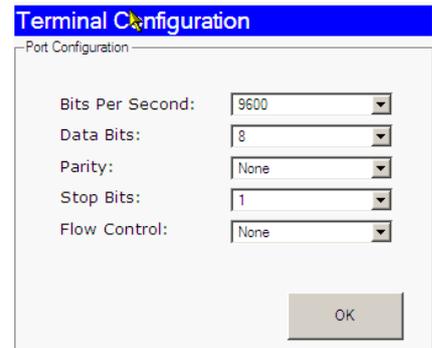
alternatively produce the clocking signal. Clocking signal delivering interfaces at routers are labeled as DCE interfaces (see **figure** to the right). To implement this, you need a DTE serial cable for the DTE router, and a special DCE serial cable to connect to the serial interface of the DCE router.

[<http://www.ciscopress.com/articles/article.asp?p=169686&seqNum=5&rl=1>]

**Step 7:** Now connect the serial interfaces of HQ and ISP with a DCE cable connected to HQ.

## Task 2: Login to the Routers

- Open HyperTerminal via PC2 desktop (here abbreviated with 'Terminal')
- Login to the HQ router. Use the following parameters (same as in Lab 1) when configuring the connection.
- Press the **Enter** key when the HyperTerminal session window comes up,. You should see the router prompt.



## Task 3: Erase and Reload the Router HQ.

**Step 1** Using the HyperTerminal session established in the previous Task, enter privileged EXEC mode on HQ.

```
HQ>enable
```

**Step 2** To clear the configuration, issue the erase startup-config command. Confirm the objective when prompted, and answer 'no' if asked to save changes.

```
HQ#erase startup-config
Erasing the nvram filesystem will remove all configuration
files! Continue? [confirm]
[OK]
Erase of nvram: complete
%SYS-7-NV_BLOCK_INIT: Initialized the geometry of nvram
Router#
```

**Note:** The prompt has changed to the default router name "Router".

**Step 3** When the prompt returns, issue the reload command. Confirm the objective when prompted. **After the router finishes the boot process, choose not to use the AutoInstall facility.**

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

%SYS-5-RELOAD: Reload requested by console. Reload Reason: Reload Command.
System Bootstrap, Version 12.1(3r)T2, RELEASE SOFTWARE (fcl)
Copyright (c) 2000 by cisco Systems, Inc.
cisco 2811 (MPC860) processor (revision 0x200) with 60416K/5120K bytes of
memory

Self decompressing the image :
##### [OK]
Restricted Rights Legend
```

Rest is omitted

**Step 4** Establish a HyperTerminal Session from PC3 to ISP. Repeat steps 1 through 3 to remove any startup configuration file that may be present.

## Task 4: Command Line Basics.

**Step 1** Establish a HyperTerminal session to router HQ.

**Step 2** Enter privileged EXEC mode.

```
Router>enable
Router#
```

**Step 3:** Enter an incorrect command (e.g. configure terminal) and observe the router response.

```
Router#configure terminal
      ^
% Invalid input detected at '^' marker.
Router#
```

**Command line errors** occur primarily from typing mistakes. If a command keyword is **incorrectly typed**, the user interface uses the caret symbol (^) to identify and isolate the error. The ^ appears at or near the point in the command string where an incorrect command, keyword, or argument was entered.

To correct an incorrectly entered command after the **Enter** key is pressed, use the **Up Arrow** key on the keyboard can be pressed to recall the command. Then use the **Right Arrow** and **Left Arrow** keys to move the cursor to the location where the mistake was made and make the correction. If something needs to be deleted, use the **Backspace** key.

**Step 4** Correct the previous command.

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

**Step 5** Return to Privileged EXEC mode with the exit command.

```
Router(config)#exit
Router#
```

**Step 6** Examine the commands that are available for Privileged EXEC mode. A question mark, ?, can be entered at the prompt to display a list of available commands.

```
Router#?
Exec commands:
<1-99>      Session number to resume
clear       Reset functions
clock       Manage the system clock
configure   Enter configuration mode
connect     Open a terminal connection
copy        Copy from one file to another
debug       Debugging functions (see also 'undebug')
delete      Delete a file
dir         List files on a filesystem
disable     Turn off privileged commands
disconnect  Disconnect an existing network connection
enable      Turn on privileged commands
erase       Erase a filesystem
exit        Exit from the EXEC
logout      Exit from the EXEC
more        Display the contents of a file
no          Disable debugging informations
ping        Send echo messages
reload      Halt and perform a cold restart
resume      Resume an active network connection
setup       Run the SETUP command facility
--More--
```

**Step 7** View the rest of the command output by pressing the spacebar. The remainder of the output will appear where the --More-- prompt appeared previously.

```

show          Show running system information
ssh          Open a secure shell client connection
telnet       Open a telnet connection
terminal     Set terminal line parameters
traceroute   Trace route to destination
undebg       Disable debugging functions (see also 'debug')
vlan         Configure VLAN parameters
write        Write running configuration to memory, network, or terminal
Router#

```

**Step 8** Exit from Privileged EXEC mode with the exit command.

```

Router#exit
Router con0 is now available
Press RETURN to get started. [Enter]
Router>

```

**Step 9** Press the Enter key to enter User EXEC mode. The Router> prompt should be visible.

**Step 10** **IOS commands** can be **abbreviated**, as long as enough characters are typed for the IOS to recognize the unique command. Enter only the character e at the command prompt and observe the results.

```

Router>e
% Ambiguous command: "e"
Router>

```

Enter en at the command prompt and observe the results.

```

Router>en
Router#

```

The abbreviated command **en** contains enough characters for the IOS to distinguish the enable command from the exit command.

**Step 11** Type the abbreviated command conf, press the Tab key, and observe the results.

```

Router#conf
Router#configure

```

This functionality of the IOS is called **auto-complete**.

**Step 12** IOS commands must be entered in the correct mode. For example, configuration changes cannot be made while in privileged EXEC mode. Attempt to configure a new Routername. Enter the command hostname HQ at the privileged EXEC prompt to do this and observe the results.

```

Router#hostname HQ
          ^
% Invalid input detected at '^' marker.

Router#

```

## Task 5: Basic Configuration of Router HQ.

**Step 1** Establish a HyperTerminal session to router HQ.

**Step 2** Enter privileged EXEC mode.

**Step 3** Enter global configuration mode.

```

Router#configure terminal
Router(config)#

```

Note that router IOS has switched to configuration mode. This is indicated by new router prompt.

**Step 4** Configure the router name as HQ.

```
Router(config)#hostname HQ
HQ(config)#
```

Note that router prompt changed again indicating the new router name.

**Step 5** Disable DNS lookup with the `no ip domain-lookup` command.

```
HQ(config)#no ip domain-lookup
HQ(config)#
```

Whenever you enter commands unknown to IOS command interpreter (e.g. in case of syntax errors) this command is interpreted as your try to telnet to a resource with the given URL by default. The following DNS lookup of the associated IP address fails after a long timeout period. This very annoying behavior is stopped with this command.

**Step 6** Configure an EXEC mode password using the `enable password password` command. Use `cisco` for the *password*.

```
Router(config)#enable password cisco
HQ(config)#
```

**Step 7** Configure an EXEC mode password using the `enable secret password` command. Use `class` for the *password*.

```
HQ(config)#enable secret class
HQ(config)#
```

**Note:** The `enable password` is less secure than the `enable secret` password. The `enable secret` command encrypts the password using a non-reversible cryptographic function. The encrypted password is useful in environments where the password crosses the network or is stored on a TFTP server. Therefore don't use the `enable password` if possible. Older IOS versions do not provide the `enable secret` password command.

Since the `enable secret` is configured, the `enable password` is no longer necessary. All IOS commands can be removed from the configuration using the `no` form of the command.

**Step 8** Remove the enable password.

```
Router(config)#no enable password cisco
HQ(config)#
```

**Step 9 (deleted)**

**Step 10** Configure the console password on the router. Use `cisco` as the password. Note how router prompt changes to indicate that you are in line configuration mode.

```
HQ(config)#line console 0
HQ(config-line)#password cisco
HQ(config-line)#login
HQ(config-line)#exit
HQ(config)#
```

With the `exit` command you leaved line configuration mode.

**Step 11** Configure the password for telnet access (5 virtual terminal lines vty numbered 0 to 4). Use `cisco` as the password.

```
HQ(config)#line vty 0 4
HQ(config-line)#password cisco
HQ(config-line)#login
```

Now exit from line configuration mode.

**Step 12** Configure the **FastEthernet0/0** interface with the IP address **192.168.2.126/25**. Note how the prompt indicates interface configuration mode.

```
HQ(config)#interface fastethernet 0/0
HQ(config-if)#ip address 192.168.1.1 255.255.255.0
```

**Step 13:** Router interfaces are deactivated by default. Now activate it by typing

```
HQ(config-if)#no shutdown

%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface
FastEthernet0/0, changed state to up
HQ(config-if)#
```

**Step 14:** Configure the **Serial0/0/0** interface with the IP address **209.165.201.1/30**. Set the **clock rate to 64000**.

```
HQ(config-if)#interface serial 0/0/0
HQ(config-if)#ip address ...
HQ(config-if)#clock rate 64000
```

**Note:** At the serial 0/0/0 interface the clocking signal of this DCE interface is activated by applying the clock rate 64000 command.

**Step 15** Now activate s0/0/0 interface by typing

```
HQ(config-if)#no shutdown
```

**Step 16** Use the **end** command to return to privileged EXEC mode.

```
HQ(config-if)#end
HQ#%SYS-5-CONFIG_I: Configured from console by console
HQ#
```

**Step 17** Enter the **show running-config** command to display the contents of the currently running configuration file.

```
HQ#show running-config
output omitted ...
```

The output must reflect your configuration activities! **Check it!**

**Step 18** Save the HQ configuration using the **copy running-config startup-config** command.

```
HQ#copy running-config startup-config
Building configuration...
[OK]
HQ#
```

**Explanation:** All commands input via command line interface are immediately saved in RAM memory. You can display it by typing **show running-config** at the command line. In case of electrical power outage the current configuration would be lost. Each router has a non-volatile memory called NVRAM to store a copy of the current or running configuration. This copy is called **startup configuration**. Type **show startup-config** to display it. It should match the running-config.

The router admin is responsible for copying the running-config to the startup-config in NVRAM.

## Task 6: Basic Configuration of Router ISP.

**Step 1** Erase and Reload the Router ISP

**Step 2** Configure **hostname**, **passwords** on console and telnet ports and **disable DNS lookup**.

**Step 3** Configure the **Serial 0/0/1** interface with the IP address **209.165.201.2/30** and **activate** the interface.

**Step 4** Configure the **FastEthernet0/0** interface with the IP address **209.165.200.254/27** and **activate** the interface.

**Step 5** Return to privileged EXEC mode and **save** the ISP **configuration** using the copy running-config startup-config command

## Task 7: Configure IP Addressing on the Host PCs.

**Step 1** Configure the host **PC2** that is attached to HQ with an IP address of **192.168.2.1/24** and a **default gateway** of **192.168.2.126**.

**Step 2** Configure the Host PC3 that is attached to ISP with an IP address of **209.165.200.253/27** and a **default gateway** of **209.165.200.254**.

## Task 8: Router show Commands.

**Step 1** Enter the show running-config command to display the contents of the currently running configuration file.

```
HQ#show running-config
Building configuration...

... remaining lines omitted ...
```

```
-----
ISP#show running-config
Building configuration...

Remaining lines are omitted ...
```

**Step 2** Enter the show startup-config command to display the startup configuration.

The **show startup-config** command displays the startup configuration file contained in NVRAM. From privileged EXEC mode on the HQ router, examine the output of the show startup-config command. If the --More-- prompt appears, press the Spacebar to view the remainder of the command output.

**Step 3** Enter the show interfaces command to display the statistics for all interfaces.

The **show interfaces command displays statistics** for all interfaces configured on the router. A specific interface can be added to the end of this command to display the statistics for only that interface. If the --More-- prompt appears, press the Spacebar to view the remainder of the command output.

```
HQ#show interfaces
FastEthernet0/0 is up, line protocol is up (connected)
  Hardware is Lance, address is 0090.0c0b.9101 (bia 0090.0c0b.9101)
  Internet address is 192.168.2.126/25
  MTU 1500 bytes, BW 100000 Kbit, DLY 100 usec, rely 255/255, load 1/255
  Encapsulation ARPA, loopback not set
  ARP type: ARPA, ARP Timeout 04:00:00,
  Last input 00:00:08, output 00:00:05, output hang never
  Last clearing of "show interface" counters never
  Queueing strategy: fifo
  Output queue :0/40 (size/max)
```

```
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
  0 packets input, 0 bytes, 0 no buffer
  Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
  0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
  0 input packets with dribble condition detected
  0 packets output, 0 bytes, 0 underruns
  0 output errors, 0 collisions, 2 interface resets
  0 babbles, 0 late collision, 0 deferred
  0 lost carrier, 0 no carrier
  0 output buffer failures, 0 output buffers swapped out
```

```
FastEthernet0/1 is administratively down, line protocol is down (disabled)
Hardware is Lance, address is 0090.0c0b.9102 (bia 0090.0c0b.9102)
MTU 1500 bytes, BW 100000 Kbit, DLY 100 usec, rely 255/255, load 1/255
Encapsulation ARPA, loopback not set
ARP type: ARPA, ARP Timeout 04:00:00,
Last input 00:00:08, output 00:00:05, output hang never
Last clearing of "show interface" counters never
Queueing strategy: fifo
Output queue :0/40 (size/max)
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
  0 packets input, 0 bytes, 0 no buffer
  Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
  0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
  0 input packets with dribble condition detected
  0 packets output, 0 bytes, 0 underruns
  0 output errors, 0 collisions, 2 interface resets
  0 babbles, 0 late collision, 0 deferred
  0 lost carrier, 0 no carrier
  0 output buffer failures, 0 output buffers swapped out
```

```
Serial0/0/0 is up, line protocol is up (connected)
Hardware is HD64570
Internet address is 209.165.201.1/30
MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load 1/255
Encapsulation HDLC, loopback not set, keepalive set (10 sec)
Last input never, output never, output hang never
Last clearing of "show interface" counters never
Input queue: 0/75/0 (size/max/drops); Total output drops: 0
Queueing strategy: weighted fair
Output queue: 0/1000/64/0 (size/max total/threshold/drops)
  Conversations 0/0/256 (active/max active/max total)
  Reserved Conversations 0/0 (allocated/max allocated)
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
  0 packets input, 0 bytes, 0 no buffer
  Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
  0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
  0 packets output, 0 bytes, 0 underruns
  0 output errors, 0 collisions, 2 interface resets
  0 output buffer failures, 0 output buffers swapped out
  0 carrier transitions
DCD=up DSR=up DTR=up RTS=up CTS=up
```

```
Serial0/0/1 is administratively down, line protocol is down (disabled)
Hardware is HD64570
MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load 1/255
Encapsulation HDLC, loopback not set, keepalive set (10 sec)
Last input never, output never, output hang never
Last clearing of "show interface" counters never
Input queue: 0/75/0 (size/max/drops); Total output drops: 0
Queueing strategy: weighted fair
Output queue: 0/1000/64/0 (size/max total/threshold/drops)
  Conversations 0/0/256 (active/max active/max total)
  Reserved Conversations 0/0 (allocated/max allocated)
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
  0 packets input, 0 bytes, 0 no buffer
  Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
  0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
  0 packets output, 0 bytes, 0 underruns
  0 output errors, 0 collisions, 2 interface resets
  0 output buffer failures, 0 output buffers swapped out
  0 carrier transitions
DCD=down DSR=down DTR=down RTS=down CTS=down
Vlan1 is administratively down, line protocol is down
```

```

Hardware is CPU Interface, address is 0090.0cae.117a (bia 0090.0cae.117a)
MTU 1500 bytes, BW 100000 Kbit, DLY 1000000 usec,
    reliability 255/255, txload 1/255, rxload 1/255
Encapsulation ARPA, loopback not set
ARP type: ARPA, ARP Timeout 04:00:00
Last input 21:40:21, output never, output hang never
Last clearing of "show interface" counters never
Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
Queueing strategy: fifo
Output queue: 0/40 (size/max)
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
 1682 packets input, 530955 bytes, 0 no buffer
  Received 0 broadcasts (0 IP multicast)
   0 runts, 0 giants, 0 throttles
   0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
 563859 packets output, 0 bytes, 0 underruns
   0 output errors, 23 interface resets
   0 output buffer failures, 0 output buffers swapped out
HQ#

```

Similar output for ISP.

**Step 4** Enter the **show version** command to display the information about the currently loaded software version along with hardware and device information.

The show version command displays information about

- ROM Bootstrap Program (important in case of IOS failures)
- Location of IOS
- CPU and amount of RAM
- Physical Interfaces on the router
- Amount of NVRAM ( used to store the startup-config file)
- Amount of flash memory (used to permanently store the Cisco IOS)
- Configuration register setting

The **configuration register** has several uses, including password recovery. The **factory default setting** for the configuration register is **0x2102**. This value indicates that the router will attempt to load a Cisco IOS software image from flash memory and load the startup configuration file from NVRAM.

```

HQ#show version
Cisco IOS Software, 1841 Software (C1841-IPBASE-M), Version 12.3(14)T7, RELEASE
SOFTWARE (fc2)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2006 by Cisco Systems, Inc.
Compiled Mon 15-May-06 14:54 by pt_team

ROM: System Bootstrap, Version 12.3(8r)T8, RELEASE SOFTWARE (fc1)

System returned to ROM by power-on
System image file is "flash:c1841-ipbase-mz.123-14.T7.bin"

```

This product contains cryptographic features and is subject to United States and local country laws governing import, export, transfer and use. Delivery of Cisco cryptographic products does not imply third-party authority to import, export, distribute or use encryption. Importers, exporters, distributors and users are responsible for compliance with U.S. and local country laws. By using this product you agree to comply with applicable laws and regulations. If you are unable to comply with U.S. and local laws, return this product immediately.

A summary of U.S. laws governing Cisco cryptographic products may be found at: <http://www.cisco.com/wwl/export/crypto/tool/stqrg.html>

If you require further assistance please contact us by sending email to [export@cisco.com](mailto:export@cisco.com).

```

Cisco 1841 (revision 5.0) with 114688K/16384K bytes of memory.
Processor board ID FTX0947Z18E

```

```
M860 processor: part number 0, mask 49
2 FastEthernet/IEEE 802.3 interface(s)
2 Low-speed serial(sync/async) network interface(s)
191K bytes of NVRAM.
31360K bytes of ATA CompactFlash (Read/Write)
```

```
Configuration register is 0x2102
HQ#
```

**Step 5: Verify** that **routing tables** contain the following routes using the **show ip route** command.

The **show ip route** command and output will be thoroughly explored in upcoming exercises. For now, you are interested in seeing that both HQ and ISP have two routes. Both routes are designated with a **C**. These are the directly connected networks that were activated when you configured the interfaces on each router. If you do not see two routes for each router as shown in the following output, proceed to Step 6.

```
HQ#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route
```

```
Gateway of last resort is not set
```

```
192.168.2.0/25 is subnetted, 1 subnets
C    192.168.2.0 is directly connected, FastEthernet0/0
209.165.201.0/30 is subnetted, 1 subnets
C    209.165.201.0 is directly connected, Serial0/0/0
```

```
ISP#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route
```

```
Gateway of last resort is not set
```

```
209.165.200.0/27 is subnetted, 1 subnets
C    209.165.200.224 is directly connected, FastEthernet0/0
209.165.201.0/30 is subnetted, 1 subnets
C    209.165.201.0 is directly connected, Serial0/0/1
```

```
ISP#
```

**Step 6** A common problem are router interfaces that are not configured correctly or not activated. Use the **show ip interface brief** command to quickly verify the configuration of each router's interfaces. Your output should look similar to the following:

```
HQ#show ip interface brief
Interface IP-AddressOK? Method Status Protocol
FastEthernet0/0 192.168.2.126 YES manual up up
FastEthernet0/1 unassignedYES unset administratively down down
Serial0/0/0 209.165.201.1 YES manual up up
Serial0/0/1 unassignedYES unset administratively down down
Vlan1 unassignedYES manual administratively down down
HQ#
```

```
ISP#show ip interface brief
Interface IP-AddressOK? Method Status Protocol
FastEthernet0/0 209.165.200.254 YES manual up up
FastEthernet0/1 unassignedYES unset administratively down down
Serial0/0/0 209.165.201.2 YES manual up up
Serial0/0/1 unassignedYES unset administratively down down
Vlan1 unassignedYES manual administratively down down
```

If the *--More--* prompt appears, press the Spacebar to view the remainder of the command output.

If both interfaces are **up** and **up**, then both routes will be in the routing table. Verify this again by using the **show ip route** command.

## Task 9: Test Connectivity Using Ping.

**Step 1:** Use the ping command to test connectivity between the HQ router and PC2.

The possible output characters from the ping facility:

- ! indicates receipt of a reply.
- . indicates the network server timed out while waiting for a reply.
- U a destination unreachable error PDU was received.
- ? Unknown packet type.
- & Packet lifetime exceeded.

**Step 2:** Repeat the ping from PC2 to HQ.

**Step 3:** Send an extended ping from HQ to PC2. To accomplish this, type ping at the privileged EXEC prompt and press Enter.

**Step 4: Send a ping from PC2 to HQ. From PC2's desktop open Command Window. Now ping to HQ.**

**Step 5:** Use the ping command to test connectivity between the ISP router and PC3.

**Step 6:** Test connectivity between router HQ and ISP.

From the router HQ, is it possible to ping ISP using the command **ping 209.165.201.2**?

From the router ISP, is it possible to ping HQ using the command **ping 209.165.201.1**?

If the answer is NO for the questions above, **troubleshoot the configurations** to find the error using the following systematic process:

1. Check the cabling. Are the routers physically connected?
2. Check the router configurations.
  - Do they match the Topology Diagram?
  - Check the IP address configuration.
  - Did you configure the clock rate command on the DCE side of the link?
3. Check the router interfaces using the `show ip interface brief` command.

Are the interfaces "up" and "up"?

If your answer to all three questions is YES, then you should be able to successfully ping from HQ to ISP and from ISP to HQ.

### Step 7: Reflection

Attempt to ping from the host connected to HQ to the host connected to ISP. This ping should be unsuccessful.

Attempt to ping from the host connected to HQ to router ISP. This ping should be unsuccessful.

Attempt to ping from the host connected to ISP to router HQ. This ping should be unsuccessful.

What is missing from the network that is preventing communication between these devices? If you are in doubt have a look at the routing tables.

## Task 10: Using Traceroute.

**Step 1** Use the **traceroute** command at the HQ privileged EXEC prompt to discover the path that a packet will take from the HQ router to PC2.

**Step 2** Use the **tracert** command at the Windows command prompt to discover the path that a packet will take from the HQ router to PC2.

## Task 11: Create a start.txt File.

Router configurations can be saved to a text (.txt) file for later use. The configuration can be copied back to the router so that the commands do not have to be entered one at a time.

**Step 1:** View the running configuration of router HQ using the show running-config command.

**Step 2:** Select the command line output to be copied, press right mouse button and choose the copy command from HyperTerminal context menu.

**Step 3:** Open Notepad. Notepad is typically found on the Start menu under Programs, Accessories, Editor. After Notepad opens, select Paste from the Notepad Edit menu.

**Step 4:** Some commands will have to be edited or added before the startup script can be applied to a router. Some of these changes are:

- Remove the first lines containing

```
Building configuration...
Current configuration : 681 bytes
version 12.3
```
- Adding a **no shutdown** command to FastEthernet and serial interfaces that are being used.
- The **ip classless** command should be removed.
- Unused interfaces can be removed.

Edit the text in the notepad file.

**By the way:** IOS interprets all command **lines** beginning with '!'-character as comments

**Step 5:** Save the open file in Notepad to **start-HQ-yourName.txt**.

**Step 6:** Repeat steps 1 to 5 for router ISP. Save the open file in Notepad to **start-ISP-yourName.txt**.

These files are part of your successful preparation. Show it to your instructor before you start with lab 2.

## Task 12: Load the start.txt File onto the HQ Router.

- Step 1:** Erase the current **startup configuration** of HQ. Confirm the objective when prompted, and answer 'no' if asked to save changes.
- Step 2:** When the prompt returns, issue the **reload** command. Confirm the objective when prompted. After the router finishes the boot process, choose **not to use** the **AutoInstall** facility.
- Step 3:** Enter global configuration mode and **open start.txt** file in a text editor.
- Step 4:** Select all the lines in the start.txt file that was created in Notepad and choose Edit > **Copy**.
- Step 5:** From the HyperTerminal Edit menu, choose **Paste** to Host.
- Step 6:** After all of the pasted commands have been applied, use the show running-config command to verify that the running configuration appears as expected.
- Step 7:** **Save** the **running configuration** to NVRAM using the copy running-config startup-config command.

Congratulation! Now you are a Basic Router Expert.