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CSCI 312 – Schnepf

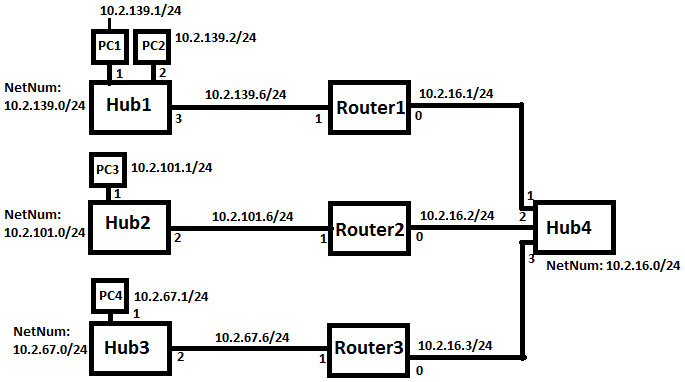
Lab 3 Report

4/16/2013

**Lab 3 – Configuring a Router**

**Introduction:**

In this lab, some of the skills and practices that were covered in class are put to the test, as some more advanced network equipment, such as the Cisco Router, is used in building a basic packet-forwarding network. Also, some of the configuration principles that were discussed are also used, such as setting up default gateways for TCP/IP transport. A combination of separated networks, with a range of varying network numbers and hosts, connected to three different routers, of which are then connected to a hub, is the basic model for the network used in this lab (a diagram can be viewed on the attached sheet). The network is then setup to forward our packets on through a default router and onto the next router where their final destination should be located. The ultimate goal to be achieved by the end of the lab is that all hosts should be able to send packets onto every other host that is on our internetwork.



**Lab:**

First the machines are set up to model the network above; all of the ports and hosts were configured with the correct IP addresses, and the default routes of each PC were established. Below you will find the output of some of the display setting of the routers, with a small explanation of the essential parts of the material. The routers were set up by using the global configuration mode (using the *configure terminal* command in the privileged mode on the cisco router), then accessing each interface (using the *interface InterfaceName*), and finally configuring the address of that interface (by using the *ip address IpAddress SubnetMask* command).

**Router1:**

-The output on this page was generated using the “show interfaces” command on the cisco router.

-In the highlighted parts of these texts, you will see both the name of the interface (the port being worked on), and the IP address associated with that port. There is also a range of other information available on this page, but in our lab, all that should be worried about is the IP addresses and masks of each port on the router.

-The first port (FastEthernet0/0) has an IP address of 10.2.16.1 with a subnet mask of 255.255.255.0.

-The second port (FastEthernet0/1), its setting information displayed below, has an IP address of 10.2.139.6 with a subnet mask of 255.255.255.0.

FastEthernet0/0 is up, line protocol is up

Hardware is AmdFE, address is 0007.8518.8260 (bia 0007.8518.8260)

Internet address is 10.2.16.1/24

MTU 1500 bytes, BW 10000 Kbit, DLY 1000 usec,

reliability 255/255, txload 1/255, rxload 1/255

Encapsulation ARPA, loopback not set

Keepalive set (10 sec)

Half-duplex, 10Mb/s, 100BaseTX/FX

ARP type: ARPA, ARP Timeout 04:00:00

Last input never, output 00:00:08, 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

0 packets input, 0 bytes

Received 0 broadcasts, 0 runts, 0 giants, 0 throttles

0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored

0 watchdog

0 input packets with dribble condition detected

112 packets output, 12102 bytes, 0 underruns

0 output errors, 0 collisions, 1 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 is administratively down, line protocol is down

Hardware is PowerQUICC Serial

MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec,

reliability 255/255, txload 1/255, rxload 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: 0/75/0/0 (size/max/drops/flushes); 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)

Available Bandwidth 1158 kilobits/sec

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, 0 interface resets

0 output buffer failures, 0 output buffers swapped out

0 carrier transitions

DCD=down DSR=down DTR=down RTS=down CTS=down

FastEthernet0/1 is up, line protocol is up

Hardware is AmdFE, address is 0007.8518.8261 (bia 0007.8518.8261)

Internet address is 10.2.139.6/24

MTU 1500 bytes, BW 10000 Kbit, DLY 1000 usec,

reliability 255/255, txload 1/255, rxload 1/255

Encapsulation ARPA, loopback not set

Keepalive set (10 sec)

Half-duplex, 10Mb/s, 100BaseTX/FX

ARP type: ARPA, ARP Timeout 04:00:00

Last input 00:00:04, output 00:00:04, 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

5 packets input, 376 bytes

Received 1 broadcasts, 0 runts, 0 giants, 0 throttles

0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored

0 watchdog

0 input packets with dribble condition detected

20 packets output, 2463 bytes, 0 underruns

0 output errors, 0 collisions, 1 interface resets

0 babbles, 0 late collision, 0 deferred

0 lost carrier, 0 no carrier

0 output buffer failures, 0 output buffers swapped out

Router1#show running-config

-The output on this page was generated using the “show running-config” command on the cisco router.

-In the highlighted parts of these texts, you will see both the name of the interface (the port being worked on), and the IP address associated with that port.

-Between the areas “ip classless,” and “ip http server” one would actually find any routes that have been established for this router.

Building configuration...

Current configuration : 612 bytes

!

version 12.2

service timestamps debug uptime

service timestamps log uptime

no service password-encryption

!

hostname Router1

!

enable secret 5 $1$zkX4$FLviLvtl2RKLW8nBoGkYH/

enable password netlab

!

ip subnet-zero

!

!

!

!

!

!

interface FastEthernet0/0

ip address 10.2.16.1 255.255.255.0

no ip mroute-cache

speed auto

half-duplex

!

interface Serial0/0

no ip address

no ip mroute-cache

shutdown

!

interface FastEthernet0/1

ip address 10.2.139.6 255.255.255.0

no ip mroute-cache

duplex auto

speed auto

!

ip classless

ip http server

!

!

line con 0

line aux 0

line vty 0 4

password netlab

login

!

end

The next step was to test the connectivity of the machines by sending a ping from PC1 to every other PC, and the various ports on the routers. Then this would be done again from PC3, and finally then done again from Router1. The output results, and then a summary of those results can be found below.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **From -> To** | **Result** | **From -> To** | **Result** | **From -> To** | **Result** |
| PC1 -> PC2 | Y | PC3 -> PC2 | N | R1 -> PC1 | Y |
| PC1 -> PC3 | N | PC3 -> PC1 | N | R1 -> PC2 | Y |
| PC1 -> PC4 | N | PC3 -> PC4 | N | R1 -> PC3 | N |
| PC1 -> R1(Port0) | Y | PC3 -> R1(Port0) | N | R1 -> PC4 | N |
| PC1 -> R1(Port1) | N | PC3 -> R1(Port1) | N | R1 -> R2(Port0) | Y |
| PC1 -> R2(Port0) | N | PC3 -> R2(Port0) | N | R1 -> R2(Port1) | N |
| PC1 -> R2(Port1) | N | PC3 -> R2(Port1) | Y | R1 -> R3(Port0) | Y |
| PC1 -> R3(Port0) | N | PC3 -> R3(Port0) | N | R1 -> R3(Port1) | N |
| PC1 -> R3(Port1) | N | PC3 -> R3(Port1) | N |  |  |
| \*R# = Router# |  |  |  |  |  |

The next part of the lab was chiefly concerned with establishing connectivity between these separated networks, and making an actual internetwork among these machines. We do this by establishing basic routing tables on each router, which will forward packets onto other networks through the network established between the routers (our network with the network number 10.2.16.0/24 is the network where these packets will be forwarded onto to their proper router, which will then send them onto their final destination). Below are the initial routing tables for each router (which were obtained by using the *show ip route* on the cisco router).

-Router1-

Router1>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, su - IS-IS summary, 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 **(This section is not displayed onward)**

Gateway of last resort is not set

10.0.0.0/24 is subnetted, 4 subnets

C 10.2.16.0 is directly connected, FastEthernet0/0

C 10.2.139.0 is directly connected, FastEthernet0/1

-Router2-

router2#show ip route

Gateway of last resort is not set

10.0.0.0/24 is subnetted, 4 subnets

C 10.2.16.0 is directly connected, FastEthernet0/0

C 10.2.101.0 is directly connected, FastEthernet0/1

-Router3-

router#show ip route

Gateway of last resort is not set

10.0.0.0/24 is subnetted, 4 subnets

C 10.2.16.0 is directly connected, FastEthernet0/0

C 10.2.101.0 is directly connected, FastEthernet0/1

The major parts of these outputs are highlighted. What is seen are the networks that are directly connected to the router, which should be the side where the PCs are located (network numbers 10.2.139.0, 10.2.101.0, 10.2.67.0), and the network that connects the three routers (network number 10.2.16.0).

Now we create the static routes that will forward our packets on from each host to their proper destinations. The routes were established by using the *ip route IpAddress SubnetMask NextHopRouterAddress* command. The new routing tables are displayed below.

-Router1-

Router1>show ip route

Gateway of last resort is not set

10.0.0.0/24 is subnetted, 4 subnets

C 10.2.16.0 is directly connected, FastEthernet0/0

S 10.2.67.0 [1/0] via 10.2.16.3

S 10.2.101.0 [1/0] via 10.2.16.2

C 10.2.139.0 is directly connected, FastEthernet0/1

-Router2-

router2#show ip route

Gateway of last resort is not set

10.0.0.0/24 is subnetted, 4 subnets

C 10.2.16.0 is directly connected, FastEthernet0/0

S 10.2.67.0 [1/0] via 10.2.16.3

C 10.2.101.0 is directly connected, FastEthernet0/1

S 10.2.139.0 [1/0] via 10.2.16.1

-Router3-

Router#show ip route

Gateway of last resort is not set

10.0.0.0/24 is subnetted, 4 subnets

C 10.2.16.0 is directly connected, FastEthernet0/0

C 10.2.67.0 is directly connected, FastEthernet0/1

S 10.2.101.0 [1/0] via 10.2.16.2

S 10.2.139.0 [1/0] via 10.2.16.1

Now you will see the address of each subnetwork within our internetwork, and where each packet should be forwarded onto when they are sent from a host on that network. Each router has a next hop address for each of the other routers and the hosts on the other side of that router. (Again, the relevant information is highlighted in each routing table.)

At this point, each host on each network can now send and receive packets from each of the other hosts (and each of the ports on every router). The output from PC1 to each router and each host on the internetwork, and also a revised table is displayed below.

PC1 -> PC2

[root@PC1 ~]# ping -c 2 10.2.139.2

PING 10.2.139.2 (10.2.139.2) 56(84) bytes of data.

64 bytes from 10.2.139.2: icmp\_req=1 ttl=64 time=1.00 ms

64 bytes from 10.2.139.2: icmp\_req=2 ttl=64 time=0.480 ms

--- 10.2.139.2 ping statistics ---

2 packets transmitted, 2 received, 0% packet loss, time 1001ms

rtt min/avg/max/mdev = 0.480/0.742/1.005/0.263 ms

PC1 -> PC3

[root@PC1 ~]# ping -c 2 10.2.101.1

PING 10.2.101.1 (10.2.101.1) 56(84) bytes of data.

64 bytes from 10.2.101.1: icmp\_req=1 ttl=62 time=6.52 ms

64 bytes from 10.2.101.1: icmp\_req=2 ttl=62 time=1.57 ms

--- 10.2.101.1 ping statistics ---

2 packets transmitted, 2 received, 0% packet loss, time 1001ms

rtt min/avg/max/mdev = 1.579/4.053/6.527/2.474 ms

PC1 -> PC4

PING 10.2.67.1 (10.2.67.1) 56(84) bytes of data.

64 bytes from 10.2.67.1: icmp\_req=1 ttl=62 time=3.58 ms

64 bytes from 10.2.67.1: icmp\_req=2 ttl=62 time=1.53 ms

--- 10.2.67.1 ping statistics ---

2 packets transmitted, 2 received, 0% packet loss, time 1001ms

rtt min/avg/max/mdev = 1.537/2.560/3.583/1.023 ms

PC1 -> Router 1(0/0)

[root@PC1 ~]# ping -c 2 10.2.16.1

PING 10.2.16.1 (10.2.16.1) 56(84) bytes of data.

64 bytes from 10.2.16.1: icmp\_req=1 ttl=255 time=1.31 ms

64 bytes from 10.2.16.1: icmp\_req=2 ttl=255 time=1.25 ms

--- 10.2.16.1 ping statistics ---

2 packets transmitted, 2 received, 0% packet loss, time 1001ms

rtt min/avg/max/mdev = 1.257/1.284/1.311/0.027 ms

PC1 -> Router 1(0/1)

[root@PC1 ~]# ping -c 2 10.2.139.6

PING 10.2.139.6 (10.2.139.6) 56(84) bytes of data.

64 bytes from 10.2.139.6: icmp\_req=1 ttl=255 time=2.30 ms

64 bytes from 10.2.139.6: icmp\_req=2 ttl=255 time=1.28 ms

--- 10.2.139.6 ping statistics ---

2 packets transmitted, 2 received, 0% packet loss, time 1001ms

rtt min/avg/max/mdev = 1.285/1.794/2.303/0.509 ms

PC1 -> Router 2(0/0)

[root@PC1 ~]# ping -c 2 10.2.16.2

PING 10.2.16.2 (10.2.16.2) 56(84) bytes of data.

64 bytes from 10.2.16.2: icmp\_req=1 ttl=254 time=3.44 ms

64 bytes from 10.2.16.2: icmp\_req=2 ttl=254 time=1.69 ms

--- 10.2.16.2 ping statistics ---

2 packets transmitted, 2 received, 0% packet loss, time 1001ms

rtt min/avg/max/mdev = 1.693/2.571/3.449/0.878 ms

PC1 -> Router 2(0/1)

[root@PC1 ~]# ping -c 2 10.2.101.6

PING 10.2.101.6 (10.2.101.6) 56(84) bytes of data.

64 bytes from 10.2.101.6: icmp\_req=1 ttl=254 time=1.81 ms

64 bytes from 10.2.101.6: icmp\_req=2 ttl=254 time=1.73 ms

--- 10.2.101.6 ping statistics ---

2 packets transmitted, 2 received, 0% packet loss, time 1001ms

rtt min/avg/max/mdev = 1.732/1.771/1.811/0.057 ms

PC1 -> Router 3(0/0)

[root@PC1 ~]# ping -c 2 10.2.16.3

PING 10.2.16.3 (10.2.16.3) 56(84) bytes of data.

64 bytes from 10.2.16.3: icmp\_req=1 ttl=254 time=1.77 ms

64 bytes from 10.2.16.3: icmp\_req=2 ttl=254 time=1.80 ms

--- 10.2.16.3 ping statistics ---

2 packets transmitted, 2 received, 0% packet loss, time 1000ms

rtt min/avg/max/mdev = 1.776/1.791/1.806/0.015 ms

PC1 -> Router 3(0/1)

[root@PC1 ~]# ping -c 2 10.2.67.6

PING 10.2.67.6 (10.2.67.6) 56(84) bytes of data.

64 bytes from 10.2.67.6: icmp\_req=1 ttl=254 time=2.03 ms

64 bytes from 10.2.67.6: icmp\_req=2 ttl=254 time=1.85 ms

--- 10.2.67.6 ping statistics ---

2 packets transmitted, 2 received, 0% packet loss, time 1001ms

rtt min/avg/max/mdev = 1.855/1.942/2.030/0.097 ms

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **From -> To** | **Result** | **From -> To** | **Result** | **From -> To** | **Result** |
| PC1 -> PC2 | Y | PC3 -> PC2 | Y | R1 -> PC1 | Y |
| PC1 -> PC3 | Y | PC3 -> PC1 | Y | R1 -> PC2 | Y |
| PC1 -> PC4 | Y | PC3 -> PC4 | Y | R1 -> PC3 | Y |
| PC1 -> R1(Port0) | Y | PC3 -> R1(Port0) | Y | R1 -> PC4 | Y |
| PC1 -> R1(Port1) | Y | PC3 -> R1(Port1) | Y | R1 -> R2(Port0) | Y |
| PC1 -> R2(Port0) | Y | PC3 -> R2(Port0) | Y | R1 -> R2(Port1) | Y |
| PC1 -> R2(Port1) | Y | PC3 -> R2(Port1) | Y | R1 -> R3(Port0) | Y |
| PC1 -> R3(Port0) | Y | PC3 -> R3(Port0) | Y | R1 -> R3(Port1) | Y |
| PC1 -> R3(Port1) | Y | PC3 -> R3(Port1) | Y |  |  |
| \*R# = Router# |  |  |  |  |  |

The final part of this lab entails moving PC4 onto the network that attaches all of our routers (10.2.16.0/24), and running wireshark to capture traffic generated from a ping from PC3 to PC1. Below is most of the relevant data in that output, and a brief summary there afterward.

No. Time Source Destination Protocol Length Info

4 7.401201 Cisco\_02:1e:a0 CDP/VTP/DTP/PAgP/UDLD CDP 371 Device ID: Router Port ID: FastEthernet0/0

Frame 4: 371 bytes on wire (2968 bits), 371 bytes captured (2968 bits)

IEEE 802.3 Ethernet

Logical-Link Control

Cisco Discovery Protocol

No. Time Source Destination Protocol Length Info

13 32.646143 10.2.101.1 10.2.139.1 ICMP 98 Echo (ping) request id=0x064e, seq=1/256, ttl=63

Frame 13: 98 bytes on wire (784 bits), 98 bytes captured (784 bits)

Ethernet II, Src: Cisco\_87:29:20 (00:04:dd:87:29:20), Dst: Cisco\_18:82:60 (00:07:85:18:82:60)

Internet Protocol Version 4, Src: 10.2.101.1 (10.2.101.1), Dst: 10.2.139.1 (10.2.139.1)

Internet Control Message Protocol

No. Time Source Destination Protocol Length Info

14 32.647586 10.2.139.1 10.2.101.1 ICMP 98 Echo (ping) reply id=0x064e, seq=1/256, ttl=63

Frame 14: 98 bytes on wire (784 bits), 98 bytes captured (784 bits)

Ethernet II, Src: Cisco\_18:82:60 (00:07:85:18:82:60), Dst: Cisco\_87:29:20 (00:04:dd:87:29:20)

Internet Protocol Version 4, Src: 10.2.139.1 (10.2.139.1), Dst: 10.2.101.1 (10.2.101.1)

Internet Control Message Protocol

The relevant data above displays a view of a few different things. One of the first important packets that is seen picked up by wireshark shows the protocol *CDP*, which is actually the Cisco Detection Protocol that is used for forwarding among the physical layers of the routers (it technically operates on the Data Link layer of the OSI model[[1]](#footnote-1)). Next, ping from PC3 to PC1 is sent, which also shows us the MAC addresses of the two routers being used. Finally, the reply is sent back from PC1 to PC3. From these pings, the MAC addresses of the routers can be found, which are displayed below. (Note: The MAC addresses of the two PC’s cannot be found because wireshark can only see the physical layer communications of the network that the routers are on, and not the physical layer connections of the two separate subnets. These addresses were found from the previous lab report.)

**MAC Addresses**

PC1 – 00:24:81:11:30:e9

PC3 – 00:25:b3:ca:2b:e8

Router1 (FastEthernet 0/0) – 00:07:85:18:82:60

Router2 (FastEthernet 0/0) – 00:04:dd:87:29:20

**Conclusion:**

In this lab, the material that we covered in class really started to be used, like new equipment, such as routers, and new internal configurations explored and used, like routing tables, default gateways, subnets, and TCP/IP configurations. A diagram of our network was made, the physical connections were then established, the internal configurations were adjusted, and finally, the internetwork of these subnetworks was created. By the end of this lab, every host was able to connect to every other host, which was the main objective of this lab.

1. ”Cisco discovery and cdp how cdp works example and guide.” ComputerNetworkingNotes.com <http://computernetworkingnotes.com/cisco-devices-administration-and-configuration/cisco-discovery-protocol.html> [↑](#footnote-ref-1)