CO223 – SETTING UP A NETWORK

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GROUP 03
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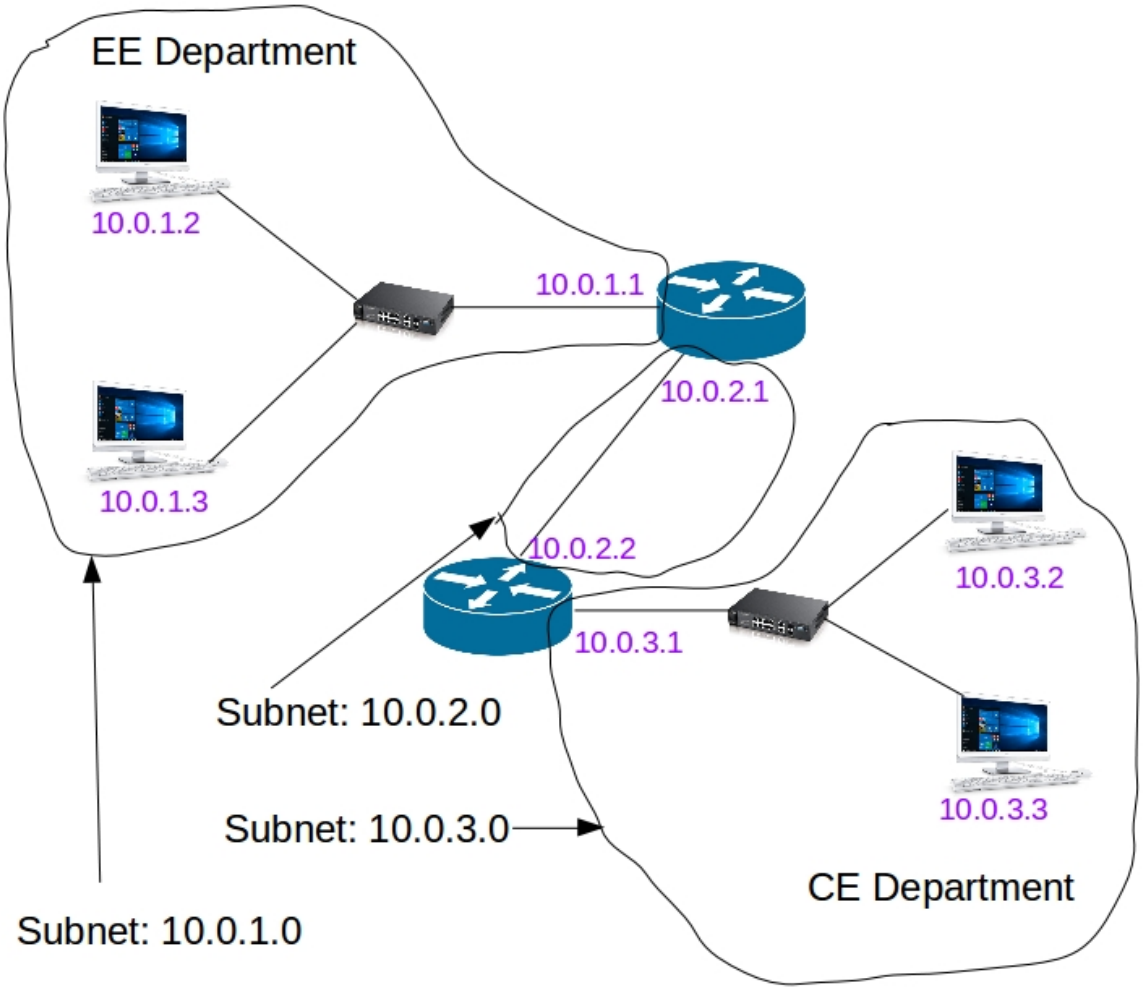
05/05/2017

Planing the IP assignemts



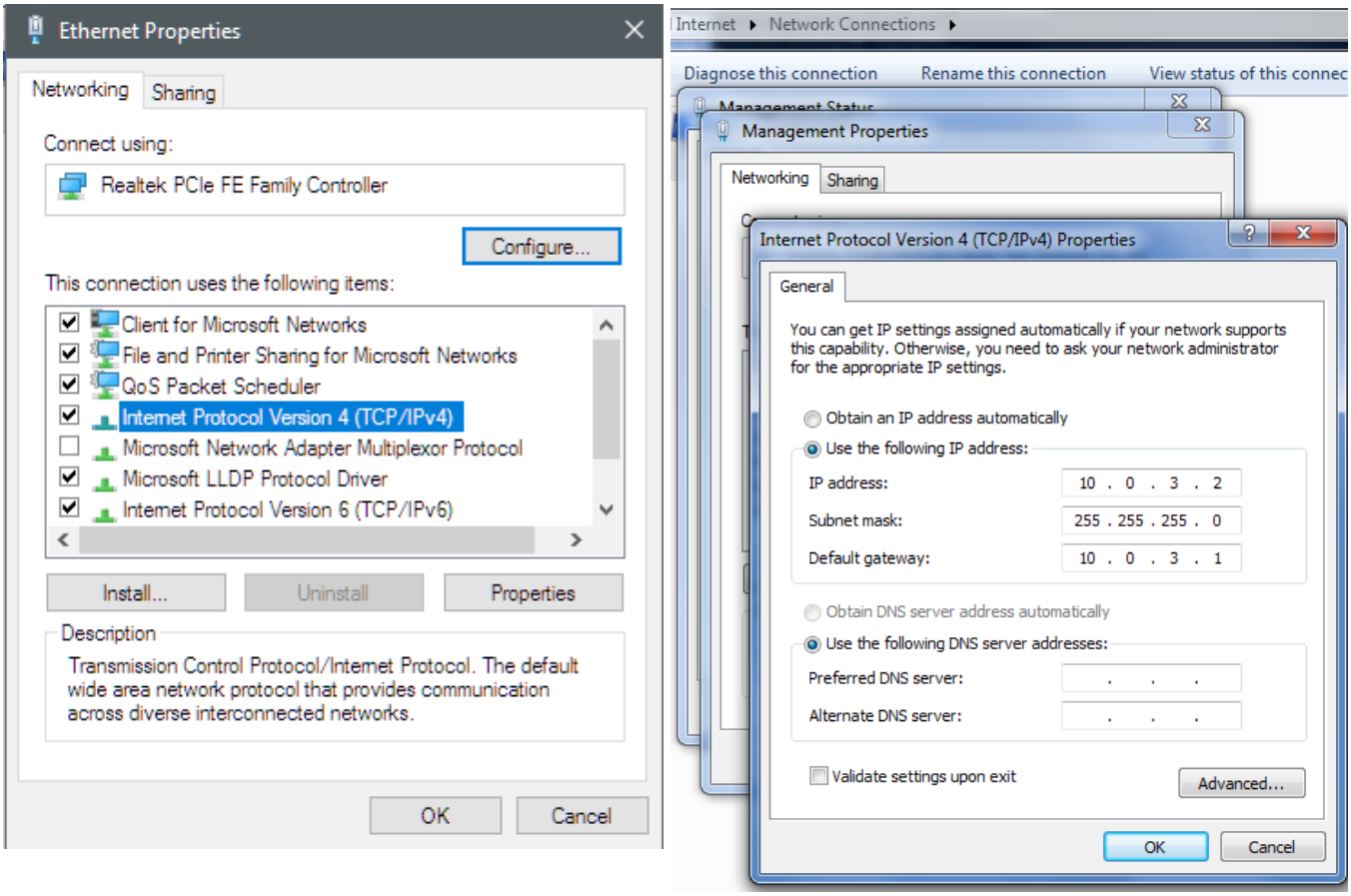
IP addresses assignment to different subnets and to interfaces in each of them

Manual address assignment and static routing

Setting the PC IP Address

Since the PCs connected to the network had windows as the operating system, setting up ip addresses was done by the following steps

Start > Control Panel > Network and Internet > Network and Sharing Center > Change adapter Settings > Ethernet > Properties



The ip address 10.0.3.2 was given to this PC.
The subnet mask was 255.255.255.0.
The default gateway is the ip address of the router which is directly connected to this PC.

Setting the router IP address

The router was accessed by using PUTTY and on the serial data. Following is the commands used on the router.

```
Router(config-if)#no shutdown
Router(config-if)#ex
Router(config-if)#exit
*Nov 25 18:30:20.511: %LINK-3-UPDOWN: Interface GigabitEthernet0/0, changed stat
e to up
Router(config)#
*Nov 25 18:30:22.575: %LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEth
ernet0/0, changed state to up
Router(config)#interface gigabitEthernet 0/1
Router(config-if)#ip address 10.0.2.2 255.255.255.0
```

This was to configure the ip address of the interface connecting the middle subnet to the router. Similar commands were used to set the ip address 10.0.3.1 to GigabitEthernet0/1 interface. Finally the interfaces had the ip addresses as

```
Router#show ip interface b
Interface                  IP-Address      OK? Method Status                Prot
ocol
GigabitEthernet0/0         10.0.3.1        YES manual up                    up

GigabitEthernet0/1         10.0.2.2        YES manual up                    up

Serial0/0/0                unassigned      YES unset  administratively down down

Serial0/0/1                unassigned      YES unset  administratively down down
```

Note: Hereafter the “Router” will be named R1 by the following command,

```
Router(config)#hostname R1
```

<u>Setting static routes</u>

The router had automatically identified the subnets directly connected to its interfaces.

```
Router#show ip route
Codes: C - connected, S - static, 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
       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

Gateway of last resort is not set

     10.0.0.0/24 is subnetted, 2 subnets
C       10.0.2.0 is directly connected, GigabitEthernet0/1
C       10.0.3.0 is directly connected, GigabitEthernet0/0
```

In static routing, entires should be added for the subnets which are NOT directly connected to the router interfaces (the EE department subnet in this case)

```
R1(config)#ip route 10.0.1.0 255.255.255.0 10.0.2.1
R1(config)#
```

and it resulted in the following routing table,

```
*Nov 25 18:55:30.375: %SYS-5-CONFIG_I: Configured from console by consoleshow ip
 route
Codes: C - connected, S - static, 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
       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

Gateway of last resort is not set

     10.0.0.0/24 is subnetted, 3 subnets
C       10.0.2.0 is directly connected, GigabitEthernet0/1
C       10.0.3.0 is directly connected, GigabitEthernet0/0
S       10.0.1.0 [1/0] via 10.0.2.1
```

Testing the network using ping

```
R1#ping 10.0.1.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.0.1.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
```

R1 to R2 ping

```
C:\Users\Administrator>ping 10.0.3.2

Pinging 10.0.3.2 with 32 bytes of data:
PING: transmit failed. General failure.
PING: transmit failed. General failure.
PING: transmit failed. General failure.
PING: transmit failed. General failure.

Ping statistics for 10.0.3.2:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
```

Ping to PC

```
C:\Users\Administrator>ping 10.0.3.3

Pinging 10.0.3.3 with 32 bytes of data:
Reply from 10.0.3.3: bytes=32 time=1ms TTL=128
Reply from 10.0.3.3: bytes=32 time<1ms TTL=128
Reply from 10.0.3.3: bytes=32 time<1ms TTL=128
Reply from 10.0.3.3: bytes=32 time<1ms TTL=128

Ping statistics for 10.0.3.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 1ms, Average = 0ms
```

Ping to PC

When R3 is connected to R1 for external communication

R2’s default gateway will stay the same.
R1’s default gateway would be R3’s interface connected to R1.

Automatic Address Assignment : DHCP

The following commands were used to start a DHCP server on the router.

```
ip cef
no ip dhcp use vrf connected
!
ip dhcp pool co223_S4pool
   network 10.0.3.0 255.255.255.0
   default-router 10.0.3.1
   domain-name co223S4.ce.pdn.ac.lk
   dns-server 10.0.3.10
   lease 0 4
```

co223_s4pool was the name given for the pool of ip addresses to be assigned for the devices requesting ip addresses from the server.

10.0.3.0 is the subnet of the ip addresses being assigned and 255.255.255.0=11111111.11111111.11111111.00000000 means that only the number where 0’s are present could be changed when assigning ip addresses. Therefore, it means that the range of ip addresses that could be assigned are from 10.0.3.1 to 10.0.3.255

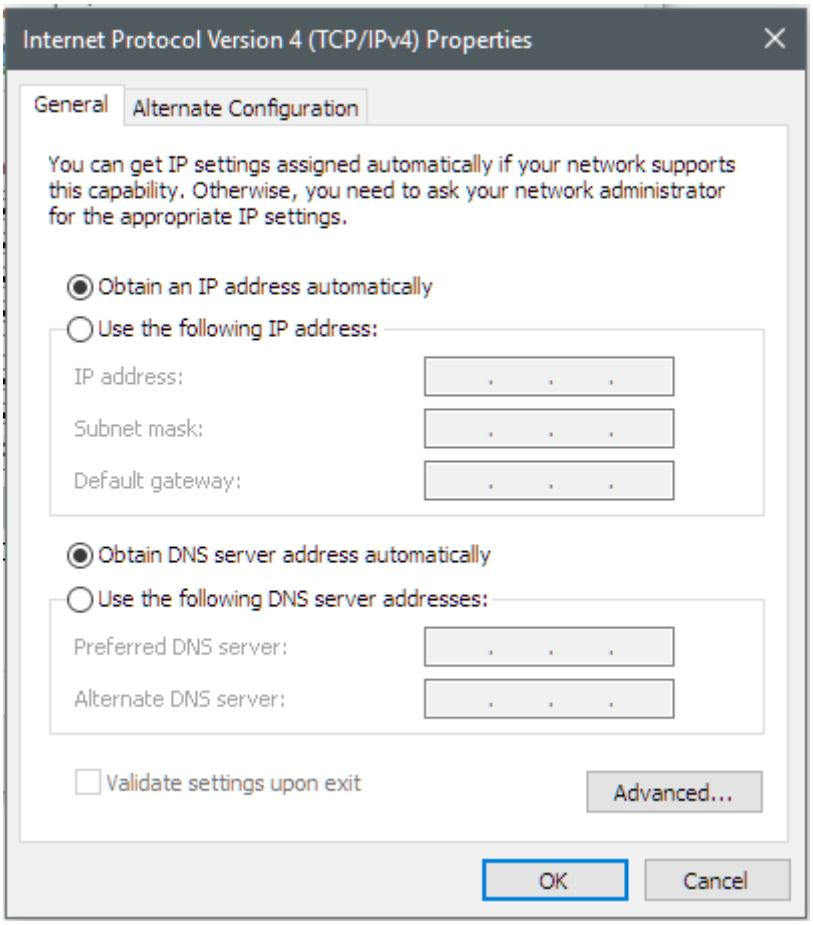
deafult-router 10.0.3.1 is the address of the default gateway for any device getting the ip address from the DHCP server and the dns-server 10.0.3.10 is the DNS server for any device obtaining an ip address from the DHCP server. (These information are sent in addition to an ip address for a DHCP request)

lease 0 4 means that an ip address given by the DHCP server expires within 0 days and 4 hours.

“Domain-name” command was not useful in this lab.

<u>Configuring the network that the same DHCP server could be used to give dynamic ip addresses for EE department as well.</u>

First the TCP/IPv4 setting should be set as following to obtain IP addresses dynamically for all the computers in EE department subnet.



Then R3 should start acting as a “DHCP Relay”

Then the following commands should be run on the R3 terminal.

```
ip dhcp relay enable
ip dhcp relay server 10.0.3.1
```

Here what happens is that the computers in EE subnet broadcasts the DHCP requests but they are routed from R3 to R1 and then the responds are sent from R1 to R3 and then again broadcasted.

(Reference: http://www.cisco.com/)

Dynamic Routing RIP

First the static routes were removed from the routing table

```
R1(config)#no ip route 10.0.1.0 255.255.255.0 10.0.2.1
```

Then, the router was set to use RIP

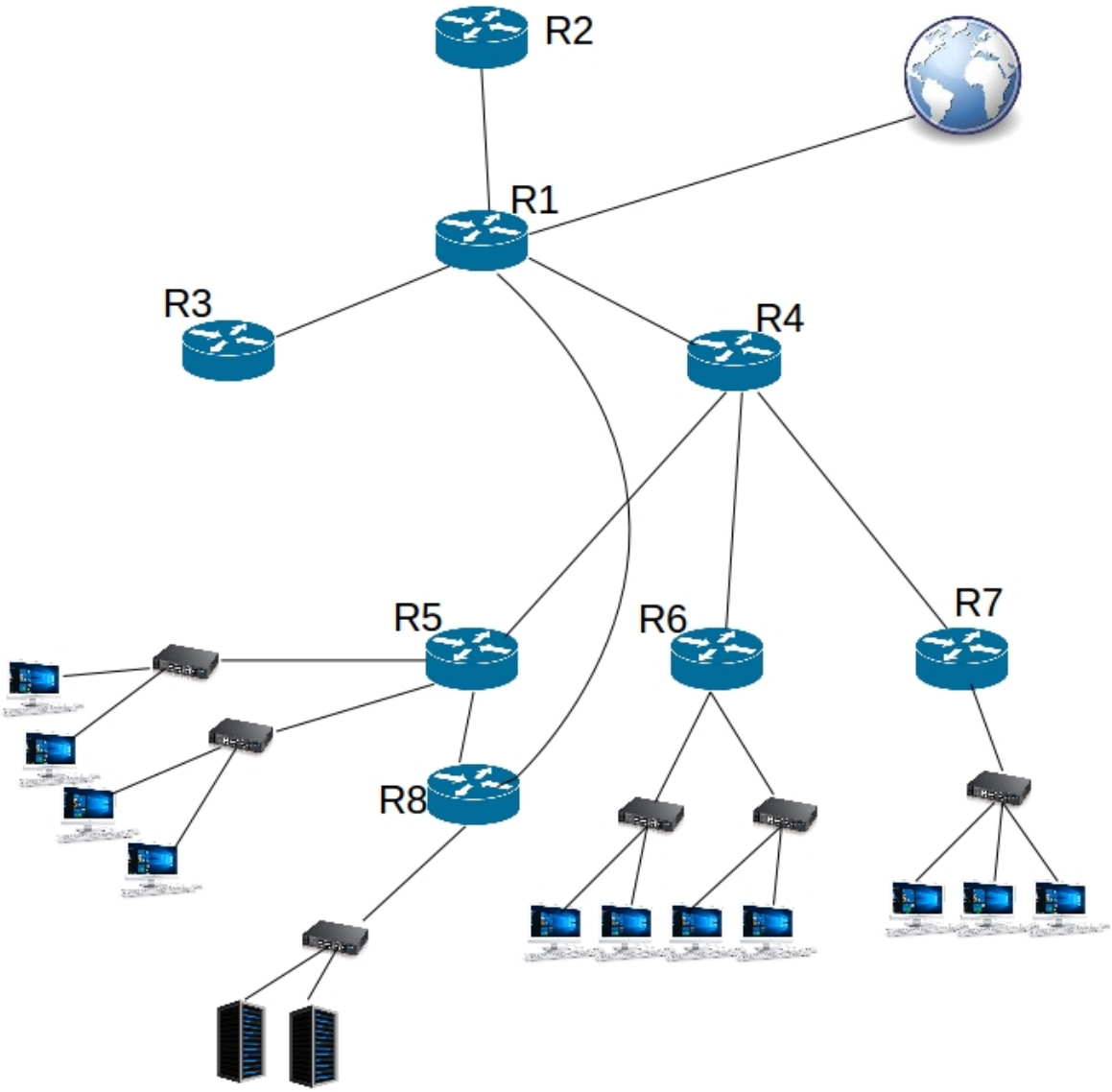
```
R1#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#router rip
```

Then the subnets connected to the router were added.

```
R1(config-router)#net
R1(config-router)#network 10.0.3.0
R1(config-router)#new
R1(config-router)#ne
R1(config-router)#net
R1(config-router)#network 10.0.2.0
R1(config-router)#exit
R1(config)#exit
```

Other Issues

Setting up a network for the university



R1 connects the university to the Internet.
R2,R3,R4 are the main routers of the faculties.
R4, the router for engineering faculty is connected to routers of different departments R5,R6,R7.
Every department router is connected to the switches which connect them to the individual computers.

R5 the computer engineering department router is connected to R8 which is connected to a switch connecting all the servers in the university network (DHCP server, DNS server, web cache, etc). R8 is directly connected to R1 as well.

Traffic isolation for students and staff

The traffic isolation could be attained by configuring the DHCP server to give IP addresses from two separate blocks for students and staff and then configuring the routers to route the packets from different blocks in different paths.

Cisco IOS Command Modes

The command modes used in this lab exercise are as following,

- config
- config-if
- config-router
- dhcp-config

The cisco IOS (Internetwork Operating System) runs on Cisco routers. They too have a set of commands like windows command prompt or linux shell has. These commands are categorized into different sets as IOS command modes according to the purpose of the commands.

config: This mode is for configuring the common aspects of the router (the aspects that are not limited to a single function of the router)

config-if: Configuring interfaces mode was used to configure the ethernet interfaces in this session.

config-router: This mode is to configure the network layer functionality of the router such as assigning ip addresses and managing routing protocols/tables.

dhcp-config: This mode is used to configure a dhcp server.

Router Ports

CON: CON stands for the console port which could be used to connect the router to a PC using a RJ45 cable and be accessed by a terminal interface. When using this port, the transmission speed should be taken into account. This port was used for configuration in the lab exercise.

AUX: The auxiliary port is used to connect the router to a modem using an RJ45 cable so that the router could be accessed in remote.

MGMT: The management port allows the administrator to access the router from a torally different ip address (through a different subnet). This is useful when the subnet the router is usually connected is down.

USB: Universal serial bus port of the router is used to share a USB device over the network. This is mostly used for devices like printers or scanners but could be used even for memory devices.

Communicating With A Router Using SSH

A router could be accessed by the ip address a username.

```
ssh userName@ip.ip.ip.ip
```

In the first time it will be prompted whether the key is trusted. Even though normally we just accept the key, for higher security it could be accepted after checking.

Then enter the password at prompt and the router could be controlled using ssh.