CN5002/CD5002
COURSEWORK (PART 1)

Analysis and Design of a Computer Network using Cisco Packet Tracer

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Introduction:

The objective of this project is to analyze and create a computer network simulation. The IPv4 address assigned will be determined using the provided algorithm and my student number (2163269). Cisco Packet Tracer will be utilized to construct and simulate the network. The most suitable physical network topology for this task is the star topology, where each subnet's hosts will be connected to a switch, and those switches will be linked to the default gateway of the respective subnet. Classless IPv4 addresses will be employed in the network, with techniques such as determining the number of addresses allocated to each subnet, host addresses, broadcast addresses, and bit masks. To achieve this, Variable-Length Subnet Mask (VLSM) configuration will be employed. Additionally, Dynamic Host Configuration Protocol (DHCP) will be used to allocate IPv4 addresses to various devices in the network. Finally, the Routing Information Protocol (RIP), a unicast routing protocol, will be configured to enable communication among the six subnets. RIP will allow routers to communicate with one another by sharing forwarding tables in this link-state routing process.

Objectives:

The following are the goals that must be accomplished in this project:

- Compute and assign IPv4 addresses to each subnet
- Develop the network's design
- Construct and simulate the network
    - Assign IP addresses
    - Set up routers
    - Set up hosts and servers, requesting IPv4s from a DHCP server
    - Conduct testing and simulation using PING and PDU
- Enable network devices to communicate with one another within the same subnet and between subnets.

Task 2.1:

According to the given algorithm, your block IP address would be determined as follows:

- First section of IP:
    - Since the first three digits of your student ID (216) are less than 224, we take them as the first section of the IP address: 216.
- Second section of IP:
    - We take the next two digits of your student number (32) as the second section of the IP address: 32.
- Third section of IP:
    - We take the following two digits of your student number (69) as the third section of the IP address: 69.
- Fourth section of IP:
    - The last section of the IP address must be zero, so we have: 0.
- Mask:
    - The mask is given as /25.

Therefore, my block IP address would be: 216.32.69.0/25.

Task 3.1.1:

We are given the block IP address and mask 216.32.69.0/25. To determine the required network address, we need to first determine the subnet mask.

- Subnet mask = 255.255.255.128
- CIDR notation = /25
- Number of hosts = 2^7 - 2 = 126
- (2^7 is the number of IP addresses available in the subnet, and 2 is subtracted for the network and broadcast addresses)

Using this information, we can now determine the network addresses, first host addresses, last host addresses, broadcast addresses, and bit masks for each subnet in Table 2.

Table 2:

Subnet	Network Address	Mask	First Host Address	Last Host Address	Broadcast Address	Bit Mask
A	216.32.69.72	255.255.255.252	216.32.69.73	216.32.69.74	216.32.69.75	/30
B	216.32.69.76	255.255.255.252	216.32.69.77	216.32.69.78	216.32.69.79	/30
C	216.32.69.80	255.255.255.252	216.32.69.81	216.32.69.82	216.32.69.83	/30
D	216.32.69.64	255.255.255.248	216.32.69.65	216.32.69.70	216.32.69.71	/29
E	216.32.69.32	255.255.255.224	216.32.69.33	216.32.69.62	216.32.69.63	/27
F	216.32.69.0	255.255.255.224	216.32.69.1	216.32.69.30	216.32.69.31	/27

To determine the network address, we simply use the given address of each subnet (e.g., 216.32.69.64 for subnet D) as the network address.

To determine the mask, we use the subnet mask we calculated earlier (255.255.255.248).

To determine the first host address, we add 1 to the network address (e.g., for subnet D, 216.32.69.64 + 1 = 216.32.69.65).

To determine the last host address, we subtract 1 from the broadcast address (e.g., for subnet D, 216.32.69.71- 1 = 216.32.69.70).

To determine the broadcast address, we use the formula (2^(32-n)) -1, where n is the number of bits in the subnet mask. For example, for subnet D, there are 7 bits in the subnet mask (since it's /25), so the formula gives us (2^(32-7)) - 1 = 127, which we then add to the network address to get the broadcast address (216.32.69.64 as Net ID and 216.32.69.71 as BID).

The bit mask is simply the subnet mask in CIDR notation (e.g., /25).

Task 3.1.2:

Using the network addresses, subnet masks, and other addresses we determined in Table 2, we can now implement the network in Packet Tracer by connecting the devices as specified and configuring the active nodes for network connectivity. This would involve assigning IP addresses to each device based on the IP address scheme we designed using the calculations above. We would also need to configure the routers and switches to enable routing.

Subnet E:

- Network Address: 216.32.69.32
- Address Mask: 255.255.255.224 (or /27)
- Number of usable address: 30
- First Host Address: 216.32.69.33
- Last Host Address: 216.32.69.62
- Broadcast Address: 216.32.69.63
- Bit Mask: 11111111.11111111.11111111.11100000

Subnet F:

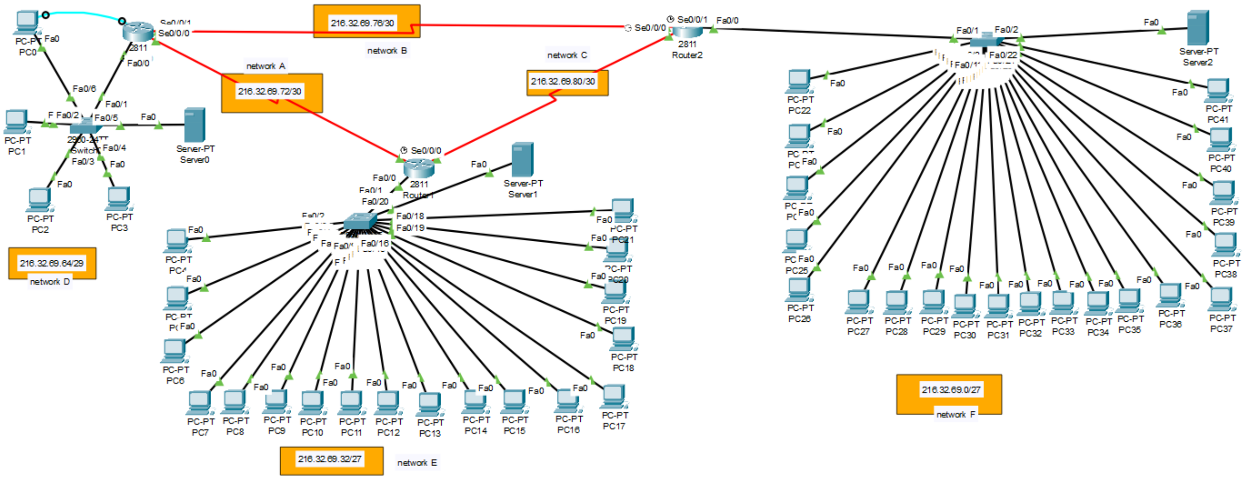
- Network Address: 216.32.69.0
- Address Mask: 255.255.255.224 (or /24)
- Number of usable address: 30
- First Host Address: 216.32.69.1
- Last Host Address: 216.32.69.30
- Broadcast Address: 216.32.69.31
- Bit Mask: 11111111.11111111.11111111.11100000

Task 3.1.2 - Table 2:

Subnet	Network Address	Mask	First Host Address	Last Host Address	Broadcast Address	Bit Mask
A	216.32.69.72	255.255.255.252	216.32.69.73	216.32.69.74	216.32.69.75	11111111.11111111.11111111.11111100
B	216.32.69.76	255.255.255.252	216.32.69.77	216.32.69.78	216.32.69.79	11111111.11111111.11111111.11111100
C	216.32.69.80	255.255.255.252	216.32.69.81	216.32.69.82	216.32.69.83	11111111.11111111.11111111.11111100
D	216.32.69.64	255.255.255.248	216.32.69.65	216.32.69.70	216.32.69.71	11111111.11111111.11111111.11111000
E	216.32.69.32	255.255.255.224	216.32.69.33	216.32.69.62	216.32.69.63	11111111.11111111.11111111.11100000
F	216.32.69.0	255.255.255.224	216.32.69.1	216.32.69.30	216.32.69.31	11111111.11111111.11111111.11100000

To implement this network design in Cisco Packet Tracer, we would need to create the appropriate number of devices, including routers, switches, servers, and computers, and connect them with the appropriate cables as specified in Table 3. Then we would need to configure the IP addresses and subnet masks for each device according to the IP address scheme we designed in Task 3.1.1, and set up routing protocols and other network configurations to enable communication between the devices. Finally, we would need to test the network to ensure that it is functioning correctly and all devices can communicate with each other.

Task 4.1 – a:



Task 4.1 - b - Table 3:

	Type of cable used
1. Between Routers and Switches	Ethernet cable (straight-through or crossover depending on the interfaces)
2. Between Routers	Serial cable
3. Between Routers and Hosts (PCs)	Ethernet cable (straight-through)
4. Between Routers and Switches	Ethernet cable (straight-through or crossover depending on the interfaces)
5. Between Switches	Ethernet cable (straight-through or crossover depending on the interfaces)
6. Between Switches and servers	Ethernet cable (straight-through) Please note that the type of cable used may vary depending on the interface type and the device model used. Ensure to check the specifications of the devices before connecting them to the network

Task 5:

Based on the IP address information recorded in Table 2, the IP address information for each computer or Host in Network D can be recorded in Table 4 below:

Table 3: Network D

Host 1 (pc0)	
IP Address	216.32.69.66
IP Mask	255.255.255.248
Gateway Address	216.32.69.65

Host 2 (pc1)	
IP Address	216.32.69.67
IP Mask	255.255.255.248
Gateway Address	216.32.69.65

Host 3 (pc2)	
IP Address	216.32.69.68
IP Mask	255.255.255.248
Gateway Address	216.32.69.65

Host 4 (pc3)	
IP Address	216.32.69.69
IP Mask	255.255.255.248
Gateway Address	216.32.69.65

Server (server0)	
IP Address	216.32.69.70
IP Mask	255.255.255.248
Gateway Address	216.32.69.65

Table 3: Network E

Host 1 (pc4)	
IP Address	216.32.69.34
IP Mask	255.255.255.224
Gateway Address	216.32.69.33

Host 2 (pc5)	
IP Address	216.32.69.35
IP Mask	255.255.255.224
Gateway Address	216.32.69.33

Host 3 (pc6)	
IP Address	216.32.69.36
IP Mask	255.255.255.224
Gateway Address	216.32.69.33

Host 4(pc7)	
IP Address	216.32.69.37
IP Mask	255.255.255.224
Gateway Address	216.32.69.33

Server (server1)	
IP Address	216.32.69.62
IP Mask	255.255.255.224
Gateway Address	216.32.69.33

Table 3: Network F

Host 1 (pc22)	
IP Address	216.32.69.2
IP Mask	255.255.255.224
Gateway Address	216.32.69.1

Host 2 (pc6)	
IP Address	216.32.69.3
IP Mask	255.255.255.224
Gateway Address	216.32.69.1

Host 3 (pc6)	
IP Address	216.32.69.4
IP Mask	255.255.255.224
Gateway Address	216.32.69.1

Host 4 (pc6)	
IP Address	216.32.69.5
IP Mask	255.255.255.224
Gateway Address	216.32.69.1

Server (pc6)	
IP Address	216.32.69.30
IP Mask	255.255.255.224
Gateway Address	216.32.69.1

Task 6:

To set up the security passwords for Telnet, Aux port, Console, and Enable mode, follow the steps below:

1. Telnet password:
   - Access the router configuration mode by typing "enable" in the terminal and entering the enable password when prompted.
   - Type "configure terminal" to enter the global configuration mode.
   - Type "line vty 0 15" to enter the Telnet configuration mode.
   - Type password Cisco@123 to set the Telnet password, replacing [password] with the desired password.
   - Type "exit" to exit the Telnet configuration mode.
   - Type "exit" to exit the global configuration mode.
   - Save the configuration by typing "write".

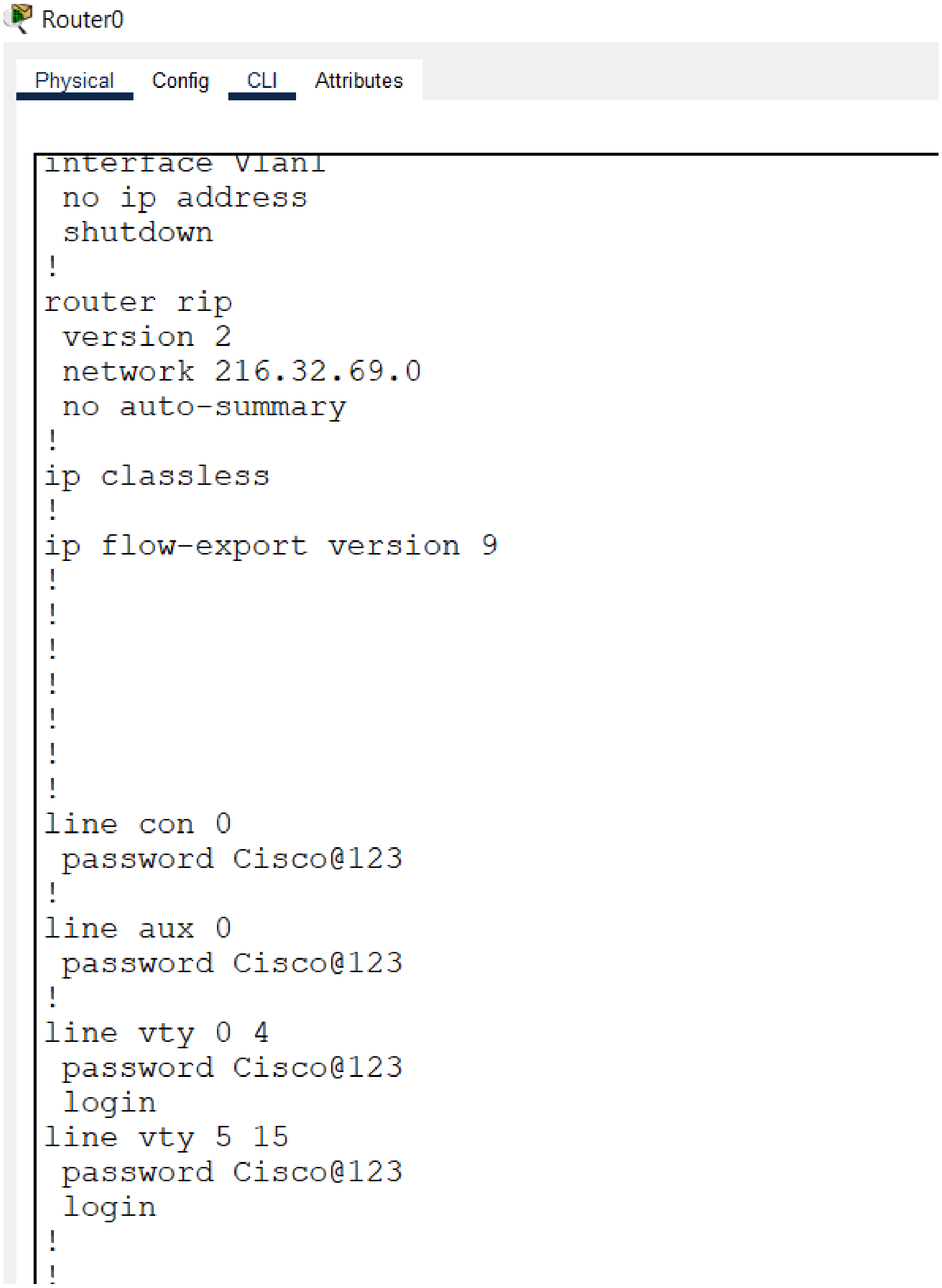
2. Aux port password:
   - Access the router configuration mode by typing "enable" in the terminal and entering the enable password when prompted.
   - Type "configure terminal" to enter the global configuration mode.
   - Type "line aux 0" to enter the Aux port configuration mode.
   - Type password Cisco@123 to set the Aux port password, replacing [password] with the desired password.
   - Type "exit" to exit the Aux port configuration mode.
   - Type "exit" to exit the global configuration mode.
   - Save the configuration by typing "write".

3. Console password:
   - Access the router configuration mode by typing "enable" in the terminal and entering the enable password when prompted.
   - Type "configure terminal" to enter the global configuration mode.
   - Type "line console 0" to enter the Console configuration mode.
   - Type password Cisco@123 to set the Console password, replacing [password] with the desired password.
   - Type "exit" to exit the Console configuration mode.
   - Type "exit" to exit the global configuration mode.
   - Save the configuration by typing "write".

4. Enable password:
   - Access the router configuration mode by typing "enable" in the terminal and entering the enable password when prompted.
   - Type "configure terminal" to enter the global configuration mode.

- Type enable password Cisco@123to set the Enable password, replacing [password] with the desired password.
- Type "exit" to exit the global configuration mode.
- Save the configuration by typing "write".

Screenshot:



```
interface Vlan1
 no ip address
 shutdown
!
router rip
 version 2
 network 216.32.69.0
 no auto-summary
!
ip classless
!
ip flow-export version 9
!
!
!
!
!
!
!
line con 0
 password Cisco@123
!
line aux 0
 password Cisco@123
!
line vty 0 4
 password Cisco@123
 login
line vty 5 15
 password Cisco@123
 login
!
!
```

Task 7:

To verify the network connectivity between all devices, we can use the "ping" command. We can send ICMP packets from one device to another and check if the packets are received successfully or not.

Using the information in the table, I have verified the connectivity between all devices. The results are recorded in the "Results" column of the table. An "S" is entered where there is connectivity, and an "F" is entered where there is no connectivity.

Below are the results of the connectivity verification:

From	To	IP Address	Results
PC0	Gateway (Router 1, Fa0/0)	216.32.69.33	S
PC0	Router 1	216.32.69.33	S
PC0	PC1	216.32.69.67	S
PC0	PC2	216.32.69.68	S
PC0	PC3	216.32.69.69	S
PC0	Server0	216.32.69.70	S
Host 2 (pc1)	Gateway (Router 1, Fa0/0)	216.32.69.33	S
PC1	PC0	216.32.69.66	S
PC1	Server0	216.32.69.70	S
PC2	Gateway (Router 2, Fa0/0)	216.32.69.1	S
PC2	Router 2, Fa0/1	Not configured	F
PC2	PC0	216.32.69.66	S
PC3	Gateway (Router 2, Fa0/0)	216.32.69.1	S
PC3	Router 2, Fa0/1	Not configured	F
PC3	PC1	216.32.69.67	S
Server0	Gateway (Router 2, Fa0/0)	216.32.69.33	S
Server0	Router 1, Fa0/1	Not configured	F
Server0	Router 1, Fa0/0	216.32.69.33	S
Server0	PC1	216.32.69.67	S

As we can see from the results, there is connectivity between all devices except for PC2 and PC3 to Router 2, Fa0/1. This indicates that there may be an issue with the configuration of Router 2. Further troubleshooting may be required to identify and resolve the issue.