CCNA Assignment

**Module – 2**

* Describe IPv4 address range and explain example of subnetting.

IPv4 Address Range:

Class A: 0.0.0.0 - 127.255.255.255 (128 networks)

Class B: 128.0.0.0 - 191.255.255.255 (16,384 networks)

Class C: 192.0.0.0 - 223.255.255.255 (2,097,152 networks)

Class D: 224.0.0.0 - 239.255.255.255 (multicast)

Class E: 240.0.0.0 - 254.255.255.255 (reserved)

255.255.255.255 (broadcast)

Here's a simple example:

Subnetting:

Network: 192.168.1.0/24

Goal: Divide the network into 4 subnets

Subnet Mask: 255.255.255.0 (28 bits)

Subnets:

1. 192.168.1.0/28 (14 hosts)

2. 192.168.1.1 (14 hosts)

3. 192.168.1.254 (14 hosts)

4. 192.168.1.255 (14 hosts)

Each subnet has its own range of IP addresses, allowing for more efficient use of the network.

* List of private address.

Class A : 10.0.0.0 – 10.255.255.255

Class B : 172.16.0.0 – 172.31.255.255

Class C : 192.168.0.0 – 192.68.255.255

* What is routing? Explain work of Router and protocol.

Routing is the process of forwarding packets of data between networks, using the best path possible, to ensure efficient and reliable communication.

Work of Router :

* Receives incoming packets from networks or devices.
* Examines packet headers for destination IP addresses.
* Uses routing tables to determine best path for packet forwarding.
* Forwards packets to next hop or final destination.
* Performs Network Address Translation (NAT) and packet filtering.

Routing protocols :

1. RIP (Routing Information Protocol) : Distance-vector protocol, uses hop count to determine best path.
2. OSPF (Open Shortest Path First) : Link-state protocol, uses Dijkstra’s algorithm to determine best path.
3. EIGRP (Enhanced Interior Gateway Routing Protocol) : Distance-vector protocol, uses composite metric to determine best path.
4. BGP (Border Gateway Protocol) : Path-vector protocol, used for inter-autonomous system routing.

* Which software we are use for routing and switching.

Cisco Packet Tracer

* Explain Basic command.

Basic networking commands:

Router Commands

1. enable - Enter privileged mode

2. configure terminal - Enter config mode

3. show running-config - Display current config

4. show IP interface brief - Display IP interface info

Switch Commands

1. show mac address-table - Display MAC address table

2. show VLAN- Display VLAN info

General Commands

1. ping - Test network connectivity

2. traceroute - Display path to destination

3. ipconfig (Windows) / ipconfig (Linux) - Display IP config

4. shutdown / reload - Restart or shut down device

* Types of Routing – example of Static routing.

There are three parts of routing :

1. Static routing
2. Dynamic routing
3. Default routing

Example of Static routing :

Network Diagram:

Router A (192.168.1.1)

|

|---> Router B (192.168.2.1)

|

|---> Network C (192.168.3.0/24)

Static Route Configuration:

Router A:

IP route 192.168.3.0 255.255.255.0 192.168.2.1

This static route tells Router A:

- Destination network: 192.168.3.0/24

- Next-hop address: 192.168.2.1 (Router B)

When Router A receives packets destined for Network C, it will forward them to Router B, which will then forward them to Network C.

* Explain Dynamic routing.

Automatically adjusts routing tables to network changes.

Uses routing protocols (RIP, OSPF, EIGRP, BGP) to discover new networks and adapt to changes.

* Deference btw RIP EIGRP and OSPF.

RIP (Routing Information Protocol): Distance Vector

- Uses hop count as metric

- Maximum hop count: 15

- Updates every 30 seconds

EIGRP (Enhanced Interior Gateway Routing Protocol): Hybrid (Distance Vector + Link State)

- Uses bandwidth, delay, load, and reliability as metrics

- Scalable and flexible

- Updates as needed

OSPF (Open Shortest Path First): Link State

- Uses cost (based on bandwidth) as metric

- Supports large networks and multiple areas

- Updates as needed

Key Differences

- Scalability: OSPF > EIGRP > RIP

- Convergence Speed: EIGRP > OSPF > RIP

- Complexity: OSPF > EIGRP > RIP

- Metric: RIP (hop count), EIGRP (composite), OSPF (cost)

Choosing a Protocol

- Small networks: RIP or EIGRP

- Large networks: OSPF or EIGRP

- Complex topologies: OSPF or EIGRP

* Perform Example of RIP EIGRP and OSPF with different area concept.

RIP Example

Network Diagram:

Router A (192.168.1.1) --- Router B (192.168.2.1) --- Router C (192.168.3.1)

RIP Configuration:

Router A: router rip, network 192.168.1.0

Router B: router rip, network 192.168.2.0

Router C: router rip, network 192.168.3.0

EIGRP Example

Network Diagram:

Router A (192.168.1.1) --- Router B (192.168.2.1) --- Router C (192.168.3.1)

EIGRP Configuration:

Router A: router eigrp 100, network 192.168.1.0

Router B: router eigrp 100, network 192.168.2.0

Router C: router eigrp 100, network 192.168.3.0

OSPF Example with Multiple Areas

Network Diagram:

Area 0 (Backbone):

Router A (192.168.1.1) --- Router B (192.168.2.1)

Area 1:

Router B (192.168.2.1) --- Router C (192.168.3.1)

Area 2:

Router B (192.168.2.1) --- Router D (192.168.4.1)

OSPF Configuration:

Router A: router ospf 100, network 192.168.1.0 area 0

Router B: router ospf 100, network 192.168.2.0 area 0, network 192.168.3.0 area 1, network 192.168.4.0 area 2

Router C: router ospf 100, network 192.168.3.0 area 1

Router D: router ospf 100, network 192.168.4.0 area 2

* Example of Default routing.

Network Diagram:

Router A (192.168.1.1) --- Router B (192.168.2.1)

Default Route Configuration:

Router A: ip route 0.0.0.0 0.0.0.0 192.168.2.1

This default route tells Router A:

- Destination: Any IP address (0.0.0.0/0)

- Next-hop: Router B (192.168.2.1)

When Router A receives packets for unknown destinations, it will forward them to Router B.

* Explain Autonomous system number.

Autonomous System Number (ASN):

- Unique number identifying a network on the internet

- Used for routing and identifying networks in BGP

- Assigned by Regional Internet Registries (RIRs)

- Format: 16-bit or 32-bit number

Ex.: ASN 64512 identifies a specific network on the internet.

* What is switching explain VLAN?

**Switching**

Switching is a process in networking that forwards packets between devices on a network. A switch examines the destination MAC address of a packet and forwards it to the corresponding port.

**VLAN (Virtual Local Area Network)**

A VLAN is a virtual network that groups devices together, regardless of their physical location. VLANs improve network security, scalability, and management.

* What is Access port and trunk port?

Access Port

- A port that carries traffic for only one VLAN

- Un-tagged packets (no VLAN ID)

- Used for end-devices (e.g., computers, printers)

- Example: Connecting a computer to a switch port

Trunk Port

- A port that carries traffic for multiple VLANs

- Tagged packets (with VLAN ID)

- Used for inter-switch connections or connecting to routers

- Example: Connecting two switches together to share VLANs

* List of basic SHOW command.

Basic SHOW commands:

Router Commands

1. show running-config - Displays current configuration

2. show startup-config - Displays saved configuration

3. show IP interface brief - Displays IP interface info

4. show IP route - Displays routing table

5. show protocols - Displays network protocols

Switch Commands

1. show mac address-table - Displays MAC address table

2. show VLAN - Displays VLAN info

3. show spanning-tree - Displays spanning tree info

Interface Commands

1. show interface - Displays interface info

2. show IP interface - Displays IP interface info

General Commands

1. show version - Displays device version

2. show clock - Displays device clock

3. show logging - Displays logging info

* Explain of Layer 2 and Layer 3 switch.

Layer 2 switch :

Operates at the Data Link Layer (Layer 2) of the OSI model

Forwards packets based on MAC addresses

Uses MAC address tables to learn and store device addresses

Provides basic switching functionality, such as : Frame forwarding

Error detection

Flow control

Layer 3 switch :

Operates at both the Data Link Layer (Layer 2) and Network Layer (Layer 3) of the OSI model

Forwards packets based on both MAC addresses and IP addresses

Uses routing tables to make forwarding decisions

Provides advanced switching functionality, such as : Routing

Packet filtering

Quality of Service

(QoS)

Network Address

Translation (NAT)

* Example – VLAN Access port and trunk port.

**Access Port:**

- Carries traffic for only one VLAN

- Example: Switch port connected to a computer (VLAN 10)

**Trunk Port:**

- Carries traffic for multiple VLANs

- Example: Switch port connected to another switch (VLANs 10, 20, 30)

* Example of inter VLAN routing.

Router Configuration:

interface FastEthernet 0/0

no shutdown

ip address 192.168.1.1 255.255.255.0

interface FastEthernet 0/1

no shutdown

ip address 192.168.2.1 255.255.255.0

Switch Configuration:

interface VLAN 10

ip address 192.168.1.2 255.255.255.0

interface VLAN 20

ip address 192.168.2.2 255.255.255.0

Router-on-a-stick configuration allows inter-VLAN routing between VLAN 10 and VLAN 20.

* Explain switching method and VTP.

Switching Methods :

1. Store-and-Forward: Reads the whole packet before sending.

2. Cut-Through: Sends packet as soon as it reads the address.

3. Fragment-Free: Reads a bit, checks for errors, then sends.

VTP (VLAN Trunking Protocol) :

1. VTP Server: Main manager that updates others.

2. VTP Client: Receives updates from the server.

3. VTP Transparent: Doesn't share VLAN info.

* What is spanning Tree – Mention spanning tree protocol and algorithm.

Spanning Tree Protocol (STP) is a network protocol that ensures a loop-free topology in Ethernet networks with redundant connections. It prevents network loops, which can cause broadcast storms, network congestion, and device failures.

Spanning Tree Algorithm :

* Elect Root Bridge
* Determine Root Port
* Designate Designated Port
* Block Redundant Ports
* Example of Per VLAN spanning tree.

Network Topology:

- 3 switches: SW1, SW2, and SW3

- 2 VLANs: VLAN 10 (Sales) and VLAN 20 (Marketing)

PVST Configuration:

- SW1 (Root Bridge for VLAN 10)

- VLAN 10: priority 4096

- VLAN 20: priority 8192

- SW2

- VLAN 10: priority 16384

- VLAN 20: priority 4096

- SW3

- VLAN 10: priority 32768

- VLAN 20: priority 16384

PVST Operation:

- VLAN 10: SW1 is the root bridge, SW2 is the designated bridge, and SW3 is the alternate bridge.

- VLAN 20: SW2 is the root bridge, SW1 is the designated bridge, and SW3 is the alternate bridge.

This configuration allows for separate spanning tree instances for each VLAN, improving network stability and reducing the risk of network loops.

* What is IPv6? Explain types and IP address range.

IPv6 is the latest internet protocol, providing :

* Larger 128-bit address space
* Improved security
* Better mobility support
* Simplified header format

Replacing IPv4, IPv6 offers virtually unlimited unique addresses.

Here are the IPv6 types and IP address ranges:

IPv6 Address Types

1. Unicast (one-to-one)

2. Multicast (one-to-many)

3. Anycast (one-to-nearest)

IPv6 Address Ranges

1. Global Unicast: 2000::/3

2. Unique Local: FC00::/7

3. Link Local: FE80::/10

4. Multicast: FF00::/8

5. Loopback: ::1/128

6. Unspecified: ::/128

* Example of Ipv6 – RIP

IPv6 RIP Example:

Router A:

ipv6 address 2001:db8:1::1/64

ipv6 rip enable

ipv6 rip default-information originate

Router B:

ipv6 address 2001:db8:2::1/64

ipv6 rip enable

Router C:

ipv6 address 2001:db8:3::1/64

ipv6 rip enable

This configures RIPng on Router A, B, and C, enabling IPv6 routing information exchange.