**CCNA - Network Access**

**Module – 2**

**• Describe IPv4 address range and explain example of subnetting.**

**Ans.** IPv4 (Internet Protocol version 4) address are 32-bit numerical labels that are used to uniquely identify device on a network. The IPv4 address space is divided into several classes, but most commonly used method is classful addressing and classless Inter-Domain Routing (CIDR).

**Example:**

* IPv4 Address Range: Class A (1.0.0.0 to 126.255.255.255), Class B (128.0.0.0 to 191.255.255.255), Class C (192.0.0.0 to 223.255.255.255).
* Subnetting Example: Subnetting 192.168.0.0/24 into /27 subnets results in subnets like 192.168.0.0/27, 192.168.0.32/27, each accommodating 32 hosts.

**• List of private address.**

**Ans.** Private IP address ranges are reserved for internal use within private networks and are not routable on the public internet. The three main private IP address ranges are:

1. 10.0.0.0 to 10.255.255.255 (Class A)

2. 172.16.0.0 to 172.31.255.255 (Class B)

3. 192.168.0.0 to 192.168.255.255 (Class C)

These private address ranges are commonly used for home and enterprise networks to allow multiple devices to share a common private network space.

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

**Ans.** Routing, in simple terms, is like finding the best way for information to reach its destination on the internet. It's comparable to a roadmap or GPS guiding data through various paths, ensuring it gets to the right place efficiently. Just as a mail carrier chooses the best route to deliver a letter, routers make decisions about the most effective paths for data packets to travel between different networks.

Router:

Connection Between Networks: Routers serve as the gateways between different networks, such as local area networks (LANs) and the internet.

Packet Forwarding: They examine the destination IP addresses of data packets and use a routing table to determine the best path for forwarding the packets to their intended destinations.

Network Address Translation (NAT): Routers can perform NAT, mapping private IP addresses in a local network to a single public IP address for communication on the internet.

Protocol:

Communication Rules: Protocols are sets of rules and conventions that devices follow to communicate with each other effectively.

Routing Protocols: Specifically in the context of routing, routing protocols are used by routers to exchange information about the networks they are aware of and the best paths to reach them.

Examples: Common routing protocols include RIP (Routing Information Protocol), OSPF (Open Shortest Path First), and BGP (Border Gateway Protocol).

**• Which software we are used for routing and switching.**

**Ans.** Routing and switching, various software solutions are used, depending on the hardware vendor and network requirements. Some commonly used software in the networking industry includes:

1. Cisco IOS (Internetwork Operating System)
2. Junos
3. NX-OS (Cisco Nexus Operating System)
4. Arista EOS (Extensible Operating System)
5. Cumulus Linux
6. HP Network OS(Comware)
7. ExtremeXOS

**• Explain Basic command.**

**Ans. 1.** Show Interfaces:

Show interfaces

* Show IP Router:

Show IP route

2. Configuration Commands:

- Configuration Terminal Mode:

Configure terminal

* Interface Configuration:

Interface <interface\_type><interface\_number>

3. Verification Commands:

- Ping:

Ping <destination\_IP\_address>

* Traceroute:

Traceroute <destination\_IP\_address>

4. Security Commands:

- Enable Password Encryption:

Service password -encryption

Set console Password:

Line console 0

Password <password>

Login

5. Routing Commands:

- Static Route:

Ip route <destination\_network> <subnet\_mask> <next\_hop>

Dynamic Routing Protocol (process\_ID)

Router ospf <process\_ID>

Network <network\_ID> <wildcard\_mask> area <area\_ID>

**• Types of Routing – example of Static routing.**

**Ans.** Routing can be classified into two main types: static routing and dynamic routing. Static routing involves manually configuring the routing table on a network device, specifying the paths that data packets should take. Here's an example of static routing:

**Static Routing Example:**

Consider a simple network with three routers (Router A, Router B, and Router C) connected in a linear topology. The IP addresses and routing tables are as follows:

Router A:

Interface Fa0/0: 192.168.1.1/24

Interface Fa0/1: 10.0.0.1/24

Routing Table:

**Destination Subnet Mask Next Hop**

**10.0.0.0 255.255.255.0 192.168.1.2**

**• Explain Dynamic routing.**

**Ans.** Dynamic routing is like using GPS for data on the internet. Routers talk to each other, sharing information about the best paths for data to travel. It's automatic and adapts to changes in the network, making it more flexible than manually setting routes. Examples include OSPF and EIGRP.

**• Deference btw RIP EIGRP and OSPF.**

**Ans.**

|  |  |  |
| --- | --- | --- |
| **RIP** | **EIGRP** | **OSPF** |
| RIP stand for Routing Information protocol. | EIGRP stands for Interior Gateway Routing Protocol. | OSPF stand for Open Shortest Path First. |
| It Is an Industry standard dynamic routing protocol. | It Is a Cisco standard routing protocol. | It Is an Industry standard routing protocol. |
| RIP is denoted by R in routing table. | EIGRP is denoted by D in routing table. | It Is denoted by O in routing table |
| Its Administrative Distance Is 120. | Its Administrative distance Is 90 | Its administrative distance is 110. |
| RIP works on Bellman Ford algorithm. | EIGRP works on DUAL (Diffusing Update Algorithm) Algorithm | OSPF works on DIJKSTRA Algorithm. |

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

**Ans. RIP Example:**

Network Topology:

[A]

|

[B]---[C]

Configuration:

Router A: router rip, version 2, network 192.168.1.0

Router B: router rip, version 2, network 192.168.1.0, network 192.168.2.0

Router C: router rip, version 2, network 192.168.2.0

**EIGRP Example:**

Network Topology:

[A]

|

[B]---[C]

Configuration:

Router A: router EIGRP 10, network 192.168.1.0

Router B: router EIGRP 10, network 192.168.1.0, network 192.168.2.0

Router C: router EIGRP 10, network 192.168.2.0

OSPF Example with Different Areas:

Network Topology:

[A]

|

[B]---[C]

Configuration:

Router A: router OSPF 1, network 192.168.1.0 0.0.0.255 area 0

Router B: router OSPF 1, network 192.168.1.0 0.0.0.255 area 0, network 192.168.2.0 0.0.0.255 area 1

Router C: router OSPF 1, network 192.168.2.0 0.0.0.255 area 1

**• Example of Default routing.**

**Ans.** Default routing involves forwarding all network traffic to a specific router, known as the default gateway, when the destination network is not found in the routing table. Here's a brief example:

Network Topology:

[A]

|

[B]---[C]

Configuration:

Router A

IP route 0.0.0.0 0.0.0.0 <IP\_Address\_of\_Default\_Gateway>

Router B

IP route 0.0.0.0 0.0.0.0 <IP\_Address\_of\_Default\_Gateway>

Router C

IP route 0.0.0.0 0.0.0.0 <IP\_Address\_of\_Default\_Gateway>

**• Explain Autonomous system number.**

**Ans.** An Autonomous System Number (ASN) is a unique numerical identifier assigned to an Autonomous System (AS), which is a collection of IP networks and routers under a single administrative control. ASNs are crucial for internet routing, particularly in the Border Gateway Protocol (BGP), enabling the exchange of routing information between different autonomous systems.

**• What is switching explain VLAN?**

**Ans.** Switching is a networking technology that connects devices within a local network, allowing them to communicate efficiently. Switches operate at Layer 2 (Data Link Layer) of the OSI model.

A VLAN (Virtual Local Area Network) is a logical segmentation of a network into distinct broadcast domains. VLANs allow devices in different physical locations to be grouped together as if they are on the same network, even if they are not physically connected to the same switch. VLANs are used to enhance network security, optimize bandwidth, and simplify network management.

**• What is Access port and trunk port?**

**Ans.** In networking, an access port is like a door to a specific room, allowing a device to connect to a single VLAN (Virtual Local Area Network). It's used for end devices like computers or printers.

On the other hand, a trunk port is like a highway, allowing multiple VLANs to pass through a single network link. Trunk ports are typically used to interconnect switches and carry traffic from multiple VLANs**.**

**• List of basic SHOW command.**

**Ans. Show Interfaces:**

Displays the status and statistics of interfaces.

**Show IP Interface Brief:**

Provides a brief overview of IP interfaces and their status.

**Show Running-Config:**

Shows the current configuration of the device.

**Show IP Route:**

Displays the routing table, showing the routes the device knows about.

**Show VLAN:**

Lists information about configured VLANs.

**Show CDP (Cisco Discovery Protocol) Neighbour:**

Shows information about directly connected Cisco devices.

**Show ARP (Address Resolution Protocol):**

Displays the ARP table, mapping IP addresses to MAC addresses.

**Show Version:**

Provides information about the device's hardware and software.

**Show Interfaces Status:**

Shows the status of all interfaces and their connectivity.

**Show Spanning-Tree:**

Displays information about the Spanning Tree Protocol (STP) status.

**• Explain of Layer 2 and Layer 3 switch.**

**Ans.** Layer 2 (L2) and Layer 3 (L3) switches are devices used in computer networks, and they operate at different layers of the OSI model.

Layer 2 Switch:

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

Operation: Performs switching based on MAC addresses.

Forwarding Decisions: Uses MAC address tables to forward frames within the same VLAN.

Key Features: VLAN support, MAC address learning, and frame forwarding.

Example Protocol: Ethernet.

Layer 3 Switch:

Functionality: Combines features of a switch and a router, operating at both Layer 2 and Layer 3.

Operation: Performs switching at Layer 2 and routing at Layer 3.

Forwarding Decisions: Uses both MAC addresses (Layer 2) and IP addresses (Layer 3) for forwarding decisions.

Key Features: VLAN support, routing between VLANs, and dynamic IP routing.

Example Protocols: Ethernet (Layer 2), IP (Layer 3).

**• Example – VLAN Access port and trunk port.**

**Ans. Switch A Configuration:**

Trunk port:

interface GigabitEthernet0/1

switchport mode trunk

Access Port for Computer A:

interface FastEthernet0/1

switchport mode access

switchport access VLAN 10

**Switch B configuration:**

**Trunk port:**

interface GigabitEthernet0/1

switchport mode trunk

Access port for computer B:

interface FastEthernet0/1

switchport mode access

switchport access VLAN 20

Example:

Switch A:

Port GigabitEthernet0/1 is configured as a trunk port.

Port FastEthernet0/1 is an access port assigned to VLAN 10 for Computer A.

Switch B:

Port GigabitEthernet0/1 is configured as a trunk port.

Port FastEthernet0/1 is an access port assigned to VLAN 20 for Computer B.

**• Example of inter VLAN routing.**

**Ans.** Imagine a scenario with a router connecting two VLANs, VLAN 10 and VLAN 20, each with its own set of computers**.**

**Router Configuration:**

interface GigabitEthernet0/0.10

encapsulation dot1Q 10

IP address 192.168.10.1 255.255.255.0

interface GigabitEthernet0/0.20

encapsulation dot1Q 20

IP address 192.168.20.1 255.255.255.0

**Switch Configuration:**

interface GigabitEthernet0/1

switchport trunk encapsulation dot1Q

switchport mode trunk

**Computer in VLAN 10 (connected to switch):**

interface FastEthernet0/1

switchport mode access

switchport access VLAN 10

IP address 192.168.10.2 255.255.255.0

**Computer in VLAN 20 (connected to switch):**

interface FastEthernet0/2

switchport mode access

switchport access VLAN 20

IP address 192.168.20.2 255.255.255.0

**Example:**

The router has sub interfaces on its GigabitEthernet0/0 interface, each corresponding to a different VLAN.

The switch is configured with a trunk link to the router, allowing VLAN information to pass.

Computers in VLAN 10 and VLAN 20 connect to the switch and have IP addresses within their respective subnets.

The router, with its sub interfaces, acts as the gateway for each VLAN, enabling inter-VLAN routing.

**• Explain switching method and VTP.**

**Ans. Switching Method:**

Switching is like directing traffic on a road. In networking, switches forward data frames within a local network. There are two main switching methods:

**Store-and-Forward:** The switch receives the entire frame, checks for errors, and then forwards it.

**Cut-Through:** The switch quickly forwards the frame as soon as it knows the destination, without waiting for the entire frame.

**VTP (VLAN Trunking Protocol):**

VTP is like a librarian managing book categories. In networking, VTP helps manage VLANs across switches. Key points:

**Purpose:** Propagates VLAN configurations across the network.

**Modes**: Server (configures VLANs), Client (accepts VLAN configurations), and Transparent (passes VLAN info but doesn't configure).

**Benefits:** Simplifies VLAN administration and ensures consistency in VLAN configurations across switches.

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

**Ans. Spanning Tree:**

Think of spanning tree like backup roads on a map. In networking, it's a protocol (STP) that prevents loops in Ethernet networks.

**Spanning Tree Protocol (STP):**

Purpose: Prevents network loops by blocking redundant paths in a network.

Algorithm: Uses the Distributed Algorithm (802.1D) or Rapid Spanning Tree Protocol (RSTP - 802.1w).

Operation: Elects a root bridge, determines the best paths to the root, and blocks redundant paths.

STP is crucial for network reliability by avoiding broadcast storms caused by loops in Ethernet networks.

**• Example of Per VLAN spanning tree.**

**Ans.** Imagine a network with multiple VLANs and switches. Per VLAN Spanning Tree (PVST) is an enhancement of the Spanning Tree Protocol (STP) that runs a separate instance of STP for each VLAN.

**Example configuration:**

**Switch A (Root for VLAN 10)**

spanning-tree VLAN 10 root primaries

**Switch B (Root for VLAN 20):**

spanning-tree VLAN 20 root primaries

**Switch C (Root for Configuration):**

spanning-tree VLAN 10,20 priority 16384

**Example:**

Switch A is configured as the root bridge for VLAN 10.

Switch B is configured as the root bridge for VLAN 20.

Switch C has no root configuration, so it will use default values.

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

**Ans. IPv6 (Internet Protocol version 6):**

Think of IPv6 as an expanded address book for the internet. It's the latest version of the Internet Protocol, designed to provide a larger address space.

**Types:**

Unicast: One-to-one communication. Example: 2001:db8::1.

Multicast: One-to-many communication. Example: ff02::1.

Anycast: One-to-nearest communication to the nearest of a group of addresses. Example: 2001:db8::2.

**IPv6 Address Range:**

**IPv6 addresses are 128 bits long.**

**Notable range: 2000: :/3, which encompasses various address types and allocations.**

IPv6 is crucial for the growing number of devices on the internet, providing a vast address space compared to its predecessor, IPv4.

**• Example of Ipv6 – RIP.**

**Ans.** Router(config)# ipv6 unicast-routing

Router(config)# interface GigabitEthernet0/0

Router(config-if)# ipv6 rip EXAMPLE-RIP enable

Router(config-if)# exit

Router(config)# router rip

Router(config-router)# version 2

Router(config-router)# network <IPv6\_network>

**Example:**

* ipv6 unicast-routing enables IPv6 routing on the router.
* interface GigabitEthernet0/0 enters the interface configuration mode.
* ipv6 rip EXAMPLE-RIP enable enables RIPng on the specified interface.
* router rip enters the RIP configuration mode.
* version 2 specifies the use of RIP version 2.
* network <IPv6\_network> configures the IPv6 network to participate in RIP