

Module Practice and Quiz

11.10.1

Packet Tracer - Design and Implement a VLSM Addressing Scheme



In this lab you will design a VLSM addressing scheme given a network address and host requirements. You will configure addressing on routers, switches, and network hosts.

- Design a VLSM IP addressing scheme given requirements.
- Configure addressing on network devices and hosts.
- Verify IP connectivity.
- Troubleshoot connectivity issues as required.

[Design and Implement a VLSM Addressing Scheme](#)[Design and Implement a VLSM Addressing Scheme](#)

11.10.2

Lab - Design and Implement a VLSM Addressing Scheme



Skills Practice Opportunity

You have the opportunity to practice the following skills:

- Part 1: Examine Network Requirements
- Part 2: Design the VLSM Address Scheme
- Part 3: Cable and Configure the IPv4 Network

You can practice these skills using the Packet Tracer or lab equipment, if available.

Packet Tracer - Physical Mode (PTPM)

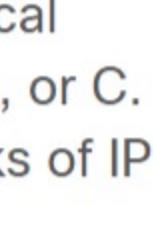
[Design and Implement a VLSM Addressing Scheme - Physical Mode](#)[Design and Implement a VLSM Addressing Scheme - Physical Mode](#)

Lab Equipment

[Design and Implement a VLSM Addressing Scheme](#)

11.10.3

What did I learn in this module?



IPv4 Addressing Structure

An IPv4 address is a 32-bit hierarchical address that is made up of a network portion and a host portion. The bits within the network portion of the address must be identical for all devices that reside in the same network. The bits within the host portion of the address must be unique to identify a specific host within a network. A host requires a unique IPv4 address and a subnet mask to show the network/host portions of the address. The prefix length is the number of bits set to 1 in the subnet mask. It is written in "slash notation", which is a "/" followed by the number of bits set to 1. Logical AND is the comparison of two bits. Only a 1 AND 1 produces a 1 and all other combination results in a 0. Any other combination results in a 0. Within each network there are network addresses, host addresses, and a broadcast address.

IPv4 Unicast, Broadcast, and Multicast

Unicast transmission refers to a device sending a message to one other device in one-to-one communications. A unicast packet is a packet with a destination IP address that is a unicast address which is the address of a single recipient. Broadcast transmission refers to a device sending a message to all the devices on a network in one-to-all communications. A broadcast packet has a destination IP address with all ones (1s) in the host portion, or 32 one (1) bits. Multicast transmission reduces traffic by allowing a host to send a single packet to a selected set of hosts that subscribe to a multicast group. A multicast packet is a packet with a destination IP address that is a multicast address. IPv4 has reserved the 224.0.0.0 to 239.255.255.255 addresses as a multicast range.

Types of IPv4 Addresses

Public IPv4 addresses are globally routable between ISP routers. Not all available IPv4 addresses can be used on the internet. There are blocks of addresses called private addresses that are used by most organizations to assign IPv4 addresses to internal hosts. Most internal networks use private IPv4 addresses for addressing all internal devices (intranet); however, these private addresses are not globally routable. Loopback addresses used by a host to direct traffic back to itself. Link-local addresses are more commonly known as APIPA addresses, or self-assigned addresses. In 1981, IPv4 addresses were assigned using classful addressing: A, B, or C. Public IPv4 addresses must be unique, and are globally routable over the internet. Both IPv4 and IPv6 addresses are managed by the IANA, which allocates blocks of IP addresses to the RIRs.

Network Segmentation

In an Ethernet LAN, devices broadcast to locate other devices using ARP. Switches propagate broadcasts out all interfaces except the interface on which it was received. Routers do not propagate broadcasts; instead each router interface connects a broadcast domain and broadcasts are only propagated within that specific domain. A large broadcast domain is a network that connects many hosts. A problem with a large broadcast domain is that these hosts can generate excessive broadcasts and negatively affect the network. The solution is to reduce the size of the network to create smaller broadcast domains in a process called subnetting. These smaller network spaces are called subnets. Subnetting reduces overall network traffic and improves network performance. An administrator may subnet by location, between networks, or by device type.

Subnet an IPv4 Network

IPv4 subnets are created by using one or more of the host bits as network bits. This is done by extending the subnet mask to borrow some of the bits from the host portion of the address to create additional network bits. The more host bits that are borrowed, the more subnets that can be defined. The more bits that are borrowed to increase the number of subnets also reduces the number of hosts per subnet. Networks are most easily subnetted at the octet boundary of /8, /16, and /24. Subnets can borrow bits from any host bit position to create other masks.

Subnet a /16 and a /8 Prefix

In a situation requiring a larger number of subnets, an IPv4 network is required that has more hosts bits available to borrow. To create subnets, you must borrow bits from the host portion of the address of the existing internetwork. Starting from the left to the right with the first available host bit, borrow a single bit at a time until you reach the number of bits necessary to create the number of subnets required. When borrowing bits from a /16 address, start borrowing bits in the third octet, going from left to right. The first address is reserved for the network address and the last address is reserved for the broadcast address.

Subnet to Meet Requirements

A typical enterprise network contains an intranet and a DMZ. Both have subnetting requirements and challenges. The intranet uses private IPv4 addressing space. The 10.0.0.0/8 can also be subnetted using any other number of prefix lengths, such as /12, /18, /20, etc., giving the network administrator many options. Because these devices need to be publicly accessible from the internet, the devices in the DMZ require public IPv4 addresses. Organizations must maximize their own limited number of public IPv4 addresses. To reduce the number of unused host addresses per subnet, the network administrator must subnet their public address space into subnets with different subnet masks. This is known as Variable Subnet Length Masking (VLSM). Administrators must consider how many host addresses are required for each network, and how many subnets are needed.

Variable Length Subnet Masking

Traditional subnetting might meet an organization's needs for its largest LAN and divide the address space into an adequate number of subnets. But it likely also results in significant waste of unused addresses. VLSM allows a network space to be divided into unequal parts. With VLSM, the subnet mask will vary depending on how many bits have been borrowed for a particular subnet (this is the "variable" part of the VLSM). VLSM is just subnetting a subnet. When using VLSM, always begin by satisfying the host requirements of the largest subnet. Continue subnetting until the host requirements of the smallest subnet are satisfied. Subnets always need to be started on an appropriate bit boundary.

Structured Design

A network administrator should study the network requirements to better plan how the IPv4 network subnets will be structured. This means looking at the entire network, both the intranet and the DMZ, and determining how each area will be segmented. The address plan includes determining where address conservation is needed (usually within the DMZ), and where there is more flexibility (usually within the intranet). Where address conservation is required the plan should determine how many subnets are needed and how many hosts per subnet. This is usually required for public IPv4 address space within the DMZ. This will most likely include using VLSM. The address plan includes how host addresses will be assigned, which hosts will require static IPv4 addresses, and which hosts can use DHCP for obtaining their addressing information. Within a network, there are different types of devices that require addresses: end user clients, servers and peripherals, servers that are accessible from the internet, intermediary devices, and gateways. When developing an IP addressing scheme, have a set pattern of how addresses are allocated to each type of device. This helps when adding and removing devices, filtering traffic based on IP, and well as simplifying documentation.

11.10.4

Module Quiz - IPv4 Addressing



1. What is the prefix length notation for the subnet mask 255.255.255.224?

- /28
- /26
- /27
- /25

2. How many valid host addresses are available on an IPv4 subnet that is configured with a /26 mask?

- 64
- 62
- 190
- 254
- 192

3. Which subnet mask would be used if 5 host bits are available?

- 255.255.255.224
- 255.255.255.128
- 255.255.255.0
- 255.255.255.240

4. A network administrator subnets the 192.168.10.0/24 network into subnets with /26 masks. How many equal-sized subnets are created?

- 4
- 2
- 8
- 64
- 1
- 16

5. What subnet mask is represented by the slash notation /20?

- 255.255.255.0
- 255.255.224.0
- 255.255.192.0
- 255.255.240.0
- 255.255.255.248

6. Which statement is true about variable-length subnet masking?

- Subnets may only be subnetted one additional time.
- Each subnet is the same size.
- Bits are returned, rather than borrowed, to create additional subnets.
- The size of each subnet may be different, depending on requirements.

7. Why does a Layer 3 device perform the ANDing process on a destination IP address and subnet mask?

- to identify the network address of the destination network
- to identify faulty frames
- to identify the host address of the destination host
- to identify the broadcast address of the destination network

8. How many usable IP addresses are available on the 192.168.1.0/27 network?

- 256
- 32
- 62
- 254
- 30
- 16

9. Which subnet mask would be used if exactly 4 host bits are available?

- 255.255.255.128
- 255.255.255.224
- 255.255.255.248
- 255.255.255.240

10. Which two parts are components of an IPv4 address? (Choose two.)

- network portion
- logical portion
- host portion
- subnet portion
- broadcast portion
- physical portion

11. If a network device has a mask of /26, how many IP addresses are available for hosts on this network?

- 64
- 62
- 30
- 14
- 16
- 32

12. What does the IP address 172.17.4.250/24 represent?

- network address
- multicast address
- host address
- broadcast address

13. If a network device has a mask of /28, how many IP addresses are available for hosts on this network?

- 16
- 254
- 62
- 14
- 256
- 32

14. What is the purpose of the subnet mask in conjunction with an IP address?

- to mask the IP address to outsiders
- to determine the subnet to which the host belongs
- to uniquely identify a host on a network
- to identify whether the address is public or private

15. A network administrator is variably subnetting a network. The smallest subnet has a mask of 255.255.255.224. How many usable host addresses will this subnet provide?

- 2
- 62
- 6
- 30
- 14
- 16

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