



Computer Networks 1

Lab 8

Introduction to DHCP and VLSM subnets calculation

Names:
Student No.:

I. Objectives

1. Introduction to Basic DHCP configuration on Cisco Packet Tracer
2. Practice on VLSM subnets calculation

II. Content and Practice

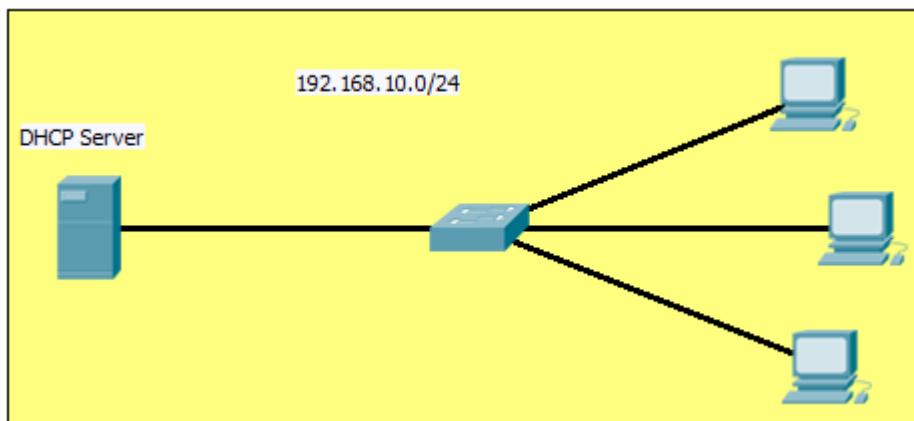
1. Introduction to DHCP

Each computer that uses the TCP/IP protocol suite needs four pieces of information:

1. The IP address of the computer
2. The subnet mask of the computer
3. The IP address of a router
4. The IP address of a name server

The Dynamic Host Configuration Protocol (DHCP) is a client/server protocol designed to provide the four pieces of information for a diskless computer or a computer that is booted for the first time.

Practice 1:





Requirement: Configure DHCP server for 3 PCs on Cisco Packet Tracer.

2. Calculating variable-length subnet mask (VLSM) subnets

The subnetworks in a network should be carefully designed to enable the routing of packets. We assume the total number of addresses granted to the organization is N, the prefix length is n, the assigned number of addresses to each subnetwork is N_{sub}, the prefix length for each subnetwork is n_{sub}, and the total number of subnetworks is s. Then, the following steps need to be carefully followed to guarantee the proper operation of the subnetworks.

1. The number of addresses in each subnetwork should be a power of 2.
2. The prefix length for each subnetwork should be found using the following formula:

$$n_{\text{sub}} = n + \log_2 (N/N_{\text{sub}})$$

where:

the total number of addresses granted to the organization is N, the prefix length is n

the assigned number of addresses to each subnetwork is N_{sub}, the prefix length for each subnetwork is n_{sub}

3. The starting address in each subnetwork should be divisible by the number of addresses in that subnetwork. This can be achieved if we first assign addresses to larger networks.

Scenario:

A transnational company is allocated a class C address of 192.168.10.0/24 for its branches in Perth, Sydney, Singapore and Kuala Lumpur. Kuala Lumpur has WAN connections to all other branches.

- Perth requires 60 hosts.
- Kuala Lumpur requires 28 hosts.
- Sydney and Singapore each require 12 hosts.

Calculate VLSM subnets and the respective hosts allocate the largest requirements first from the address range.

Instructions: We will carry out some steps to fulfill this mission:

Requirements levels should be listed from the largest to the smallest.

In this example Perth requires 60 hosts. Use 6 bits since $2^6 - 2 = 62$ usable host addresses. Thus 2 bits will be used from the 4th Octet to represent the extended-network-prefix of /26 and the remaining 6 bits will be used for host addresses.

$$2^m - 2 \geq 60$$

$$m = 6$$

$$n = 2.$$

Step 1



The first step in the subnetting process is to divide the allocated address of 192.168.10.0/24 into four equal size address blocks. Since $4 = 2^2$, 2 bits are required to identify each of the 4 subnets. Next, take subnet #0 (192.168.10.0/26) and identify each of its hosts.

Allocated Address	Sub-networks	62 usable hosts/ sub-network (subnet #0)
192.168.10.0/24	192.168.10.0/26	192.168.10.0/26 (Network Address)
	192.168.10.64/26	192.168.10.1/26
	192.168.10.128/26	192.168.10.2/26
	192.168.10.192/26	192.168.10.3/26
		thru
		192.168.10.61/26
		192.168.10.62/26
		192.168.10.63/26 (Broadcast Address)

Here is the range for the /26 mask.

Perth	Range of addresses in the last octet
192.168.10.0/26	From 0 to 63, 60 hosts required. Hosts 0 and 63 cannot be used because they are the network and broadcast addresses for their subnet

Step 2

Allocate the next level after all the requirements are met for the higher level or levels.

Kuala Lumpur requires 28 hosts. The next available address after 192.168.10.63/26 is 192.168.10.64/26. Note from the above table that this is subnet number 1. Since 28 hosts are required, 5 bits will be needed for the host addresses, $2^5 - 2 = 30$ usable host addresses. Thus 5 bits

will be required to represent the hosts and 3 bits will be used to represent the extended-network prefix
of /27. Applying VLSM on address 192.168.10.64/27 gives:

Sub-network #1	Sub-sub-networks	30 usable hosts
		192.168.10.64/27 (Network Address)
192.168.10.64/26	192.168.10.64/27	192.168.10.65/27
	192.168.10.96/27	192.168.10.66/27
	192.168.10.128/27	192.168.10.67/26
	192.168.10.192/27	thru
		192.168.10.93/27
		192.168.10.94/27
		192.168.10.95/27 (Broadcast Address)

Here is the range for the /27 mask.

$$\begin{aligned}2^m - 2 &\geq 12 \\m &= 4 \\n &= 1.\end{aligned}$$



Kuala Lumpur	Range of addresses in the last octet
192.168.10.64/27	From 64 to 95, 28 hosts required. Hosts 64 and 95 cannot be used because they are the network and broadcast addresses for their subnet. Thirty usable addresses are available in this range for the hosts.

nhu cầu sử dụng nhỏ mà IP lớn
-> đè nặng lên chi phí router.

Practice 2:

Keep identifying the subnets and hosts' IP addresses for Sydney, Singapore and WAN links.

Build the network topology on Cisco Packet Tracer for the whole company, each branch has its own DHCP Server.

III. Submission

Complete practice 1 and 2, compress all files into lab8.zip and submit this file to your instructor.

References

1. Cisco Networking Academy Program
2. TCP/IP Protocol Suite – Fourth Edition, Behrouz A. Forouzan