CCNA 200-301

CISCO™

Lesson_14

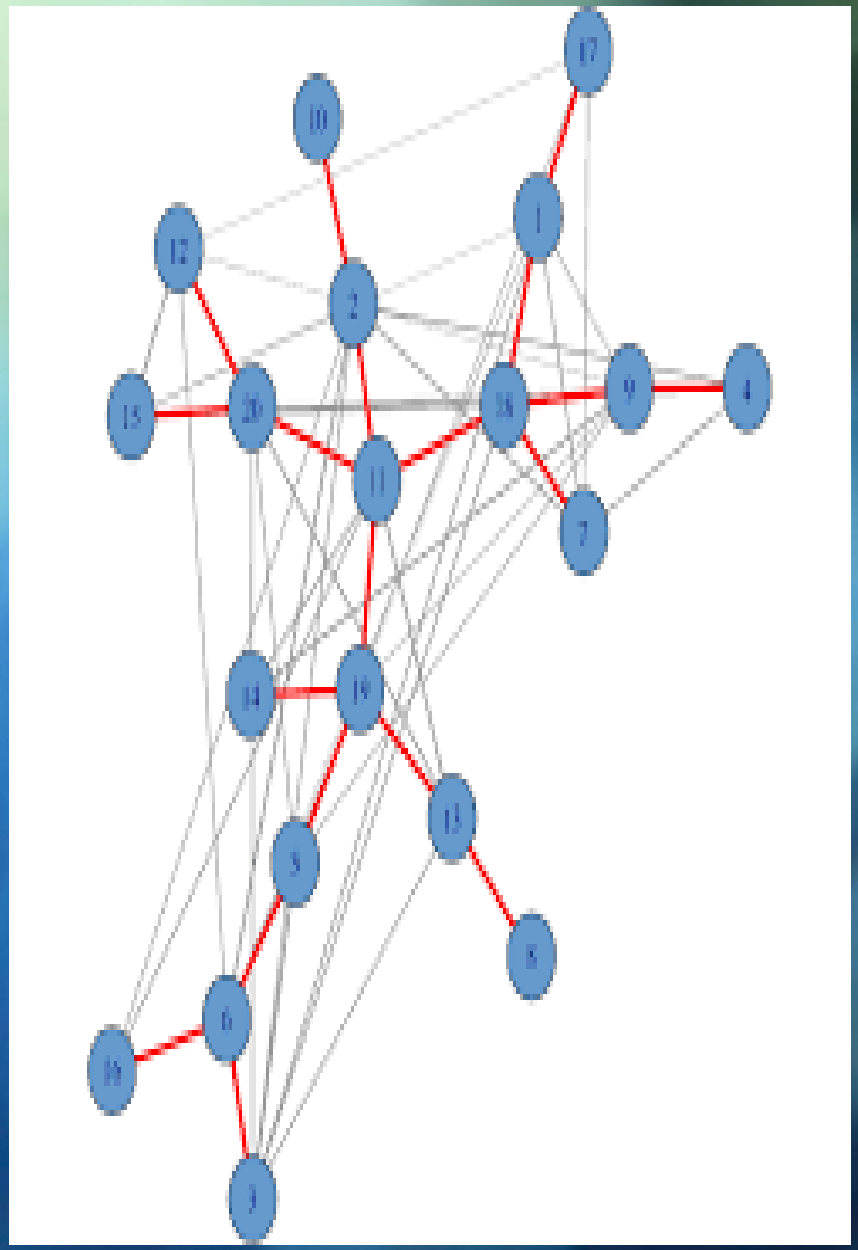
STP Standards

IPv4 addressing

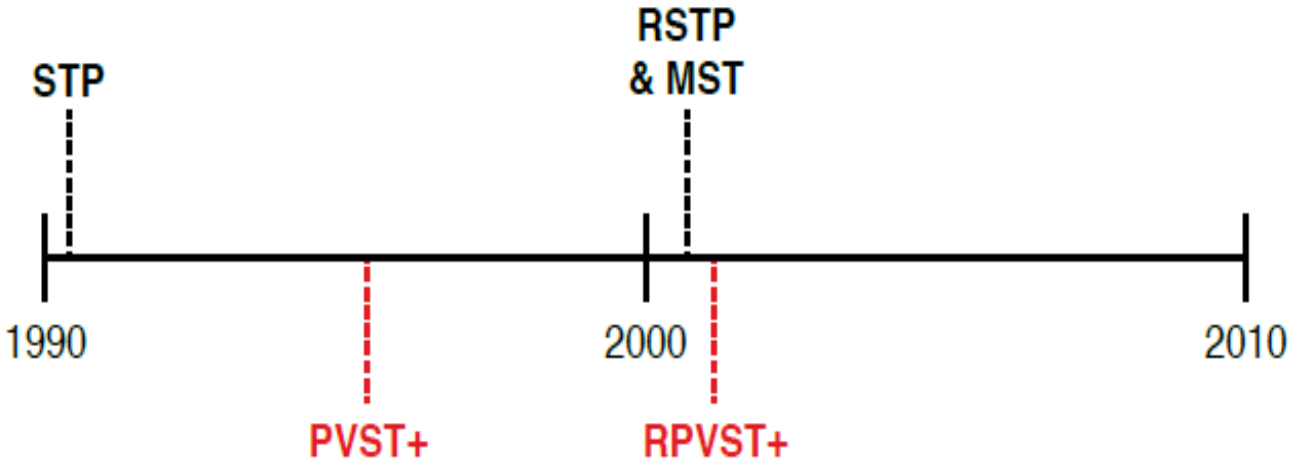
STP Standards

According to STP open standards Cisco needed to create it own proprietary versions.

- When STP was the only STP standard back in the 1990s with 802.1D, Cisco created the STP-based Per VLAN Spanning Tree Plus (PVST+) protocol, which creates one spanning tree instance per VLAN.
- When the IEEE introduced RSTP (in 802.1D amendment 802.1w, in the year 2001), Cisco also created the Rapid PVST+ (RPVST+) protocol. RPVST+ provided more features than standardized RSTP, including one tree per VLAN.
- The IEEE did not adopt Cisco's PVST+ or RPVST+ into their standards to create multiple spanning trees. Instead, the IEEE created a different method: Multiple Spanning Tree Protocol (MSTP), originally defined in 802.1Q amendment 802.1s.



STP Standards



Packet tracer example…

```
SW1(config)# spanning-tree mode ?
  mst         Multiple spanning tree mode
  pvst        Per-Vlan spanning tree mode
  rapid-pvst  Per-Vlan rapid spanning tree mode
SW1(config)#
```

IPv4 address range

In the next table we can see IPv4 address range:

Historical classful network architecture

Class	Leading bits	Size of *network number* bit field	Size of *rest* bit field	Number of networks	Number of addresses per network	Start address	End address
A	0	8	24	128 (2^7)	16 777 216 (2^{24})	0.0.0.0	127.255.255.255
B	10	16	16	16 384 (2^{14})	65 536 (2^{16})	128.0.0.0	191.255.255.255
C	110	24	8	2 097 152 (2^{21})	256 (2^8)	192.0.0.0	223.255.255.255

IPv4 address range

Generally, IPv4 address range is divided into 2 parts:

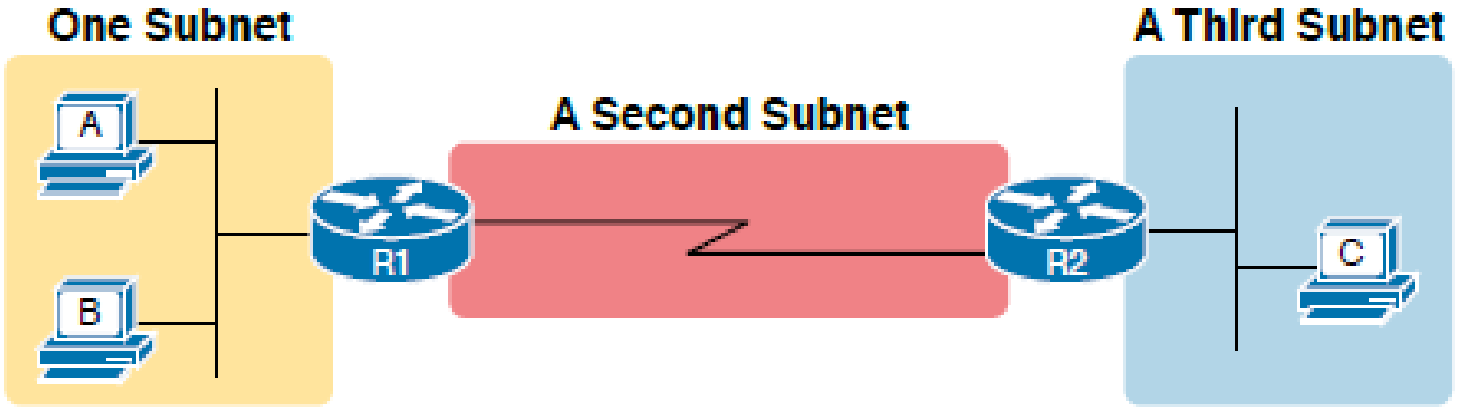
Public IP addresses and **Private IP addresses**.

In local networks we use Private IP addresses which are shown in the next table.

These IP address range is based on Clasfull address range.

Name	CIDR block	Address range	Number of addresses	*Classful* description
24-bit block	10.0.0.0/8	10.0.0.0 – 10.255.255.255	16 777 216	Single Class A.
20-bit block	172.16.0.0/12	172.16.0.0 – 172.31.255.255	1 048 576	Contiguous range of 16 Class B blocks.
16-bit block	192.168.0.0/16	192.168.0.0 – 192.168.255.255	65 536	Contiguous range of 256 Class C blocks.

IPv4 addressing cont.



Suppose that we have network that is shown in the image. According to Clasfull IP address range we need to give one full class for each subnet.

According to the C class IP address range:

For the "**One Subnet"**: 192.168.1.0/24

For the **"A Second Subnet"** : 192.168.2.0/24

For the **"A Third Subnet":** 192.168.3.0/24

Each subnet has $2^8 - 2 = 254$ hosts. According to the topology for **"One Subnet"** we need 2 IP addresses, for **"A Second Subnet"** we need also 2 Ip addresses, and for "**A third subnet"** we need just 1 IP address.

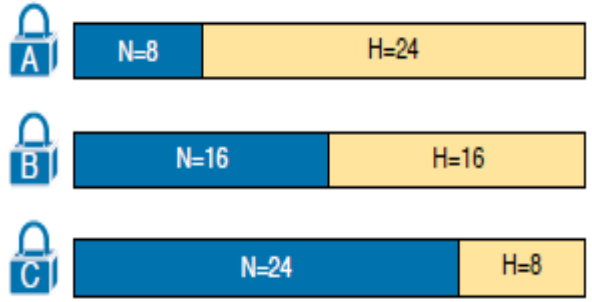
This is not good IPv4 design, because all unused IPv4 addresses are used in vain.

The solution is **VLSM.**

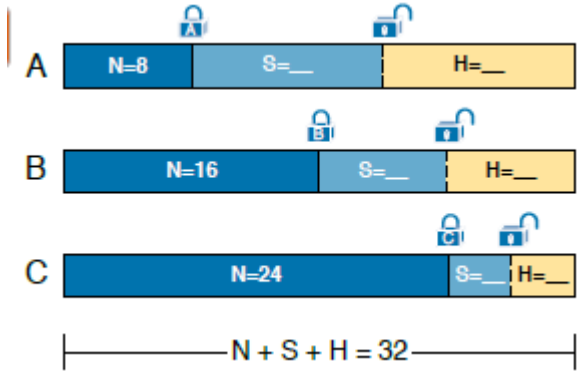
VLSM (Variable-Length Subnet Mask)

To create multiple sizes of subnets in one Class A, B, or C network, the engineer must create some subnets using one mask, some with another, and so on. Different masks mean different numbers of host bits, and a different number of hosts in some subnets based on the **$2^H - 2$** formula.

This is the unsubnetted Class A, B, C address range:



This is the subnetted,using borrowing host bits:



VLSM example

In IPv4 addressing design we have two formulas:

For the number of hosts: **2^H-2.**

For the number of subnets: **2^S**

Task: **172.16.0.0, 200 Subnets, 200 Hosts**

- Use a single mask for all subnets.
- Plan for 200 subnets.
- Plan for 200 host IP addresses per subnet.
- Use private Class B network 172.16.0.0.

Original Class B subnets: 172.16.0.0/16

16 bits for network portion, 16 bits for host portion.

According to our example: $200 < 2^S$

$200 < 2^H$-2

For the **$200 < 2^S$**，S=8.

Fort the **$200 < 2^H$-2, H=8.**

As a result:

172.16.0.0/24

VLSM example

We have Ip address 192.168.1.0/24. we divide it according to the number of subnets:

Sales: 14 hosts,

Marketing: 50 hosts,

IT Department: 60 hosts:

In this case we need three subnets for each sector: According to 2^S formula $3<2^2$. we will borrow three bits from host bits.

11111111.11111111.11111111.00000000 = /24

11111111.11111111.11111111.11000000 = /26 new subnet mask: **255.255.255.192.**

we have 6 host bits.

VLSM example

According to the host 6 bits the IPv4 address blocks are formed.

2^6-2 = 62 (block size 64).

192.168.1.0/26

192.168.1.64/26

192.168.1.128/26

192.168.1.192/26

192.168.1.256/26

Sales: 14 hosts,

Marketing: 50 hosts,

IT Department: 60 hosts:

192.168.1.0/26 – Sales.

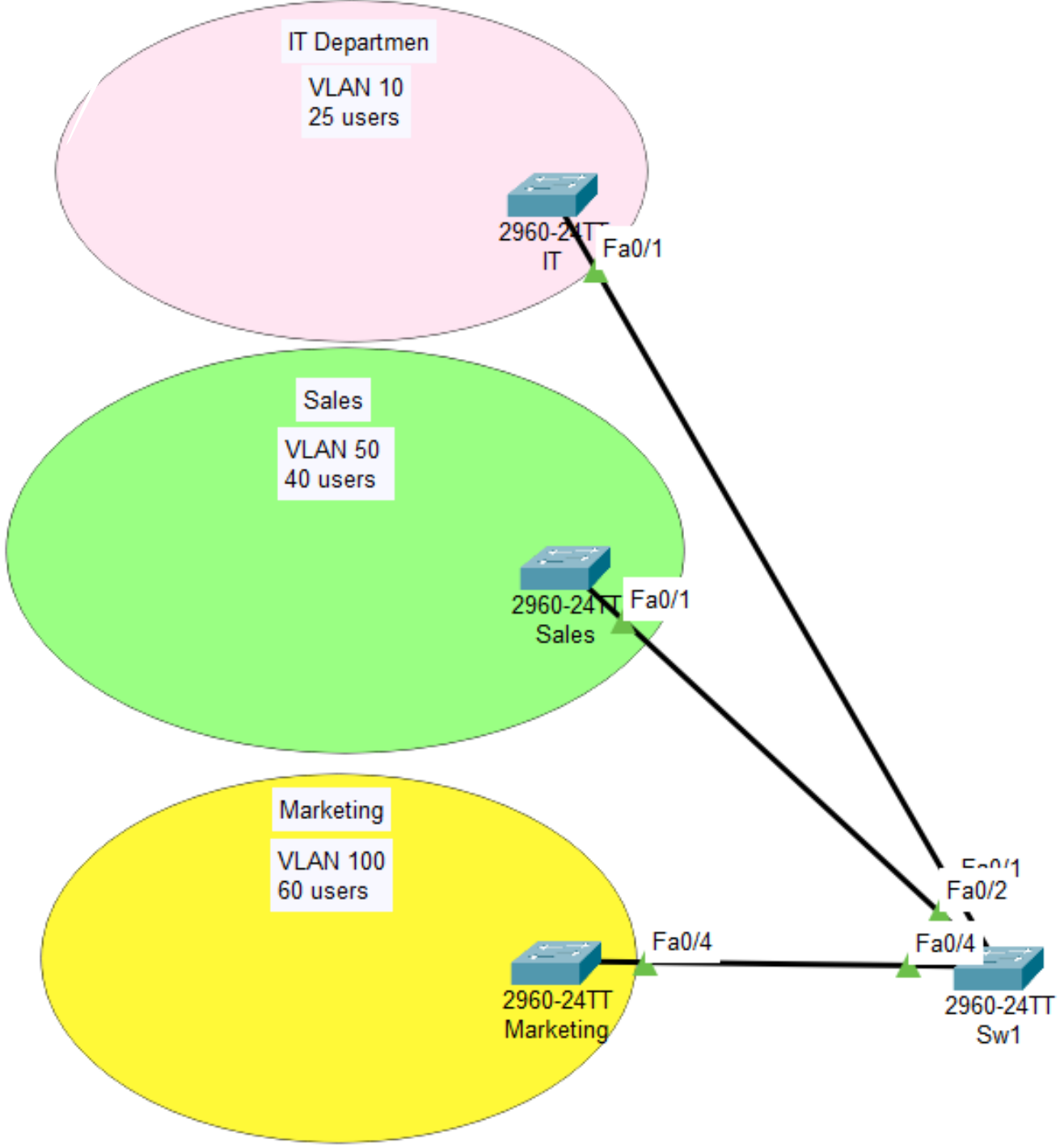
192.168.1.64/26 – Marketing.

192.168.1.128/26 – IT Department.

Task for home

Given range 192.168.0.0/24

Design IPv4 assignment according to the number of users.



Tasks for home

Problem	IP Address	Mask	Subnet ID
1	10.77.55.3	255.248.0.0	
2	172.30.99.4	255.255.192.0	
3	192.168.6.54	255.255.255.252	
4	10.77.3.14	255.255.128.0	
5	172.22.55.77	255.255.254.0	
6	1.99.53.76	255.255.255.248	

Prefix	Binary Mask	Decimal
	11111111 11111111 11000000 00000000	
		255.255.255.252
/25		
/16		
		255.0.0.0
	11111111 11111111 11111100 00000000	
		255.254.0.0
/27		

	IP Address	Mask	Subnet ID	Broadcast Address
1	10.77.55.3	255.255.255.0		
2	172.30.99.4	255.255.255.0		
3	192.168.6.54	255.255.255.0		
4	10.77.3.14	255.255.0.0		
5	172.22.55.77	255.255.0.0		
6	1.99.53.76	255.0.0.0		

That is all for Lesson 14

The key is :

Learn

Repeat

Practice

You will be able to reach your goals.

GOOD LUCK !!!!!...