



CISCO™

CCNA 200-301

Lesson 5

1. WAN technologies

2. IP routing



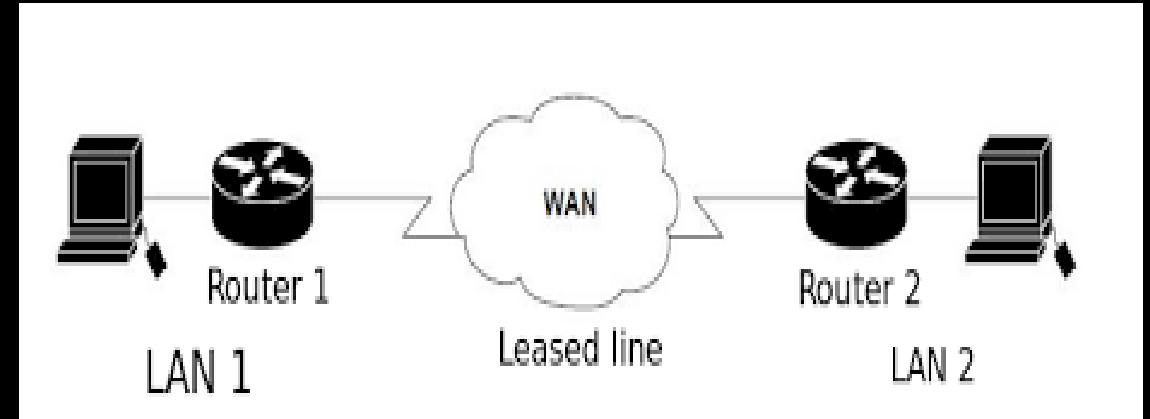
Leased Line WANs

To make connection between LANs two routers are used at each site and they are connected to WAN.

The term *leased line* refers to the fact that the company using the leased line does not own the line but instead pays a monthly lease fee to use it.

Leased Lines are provided by telco.

Telco – Telephone Company.

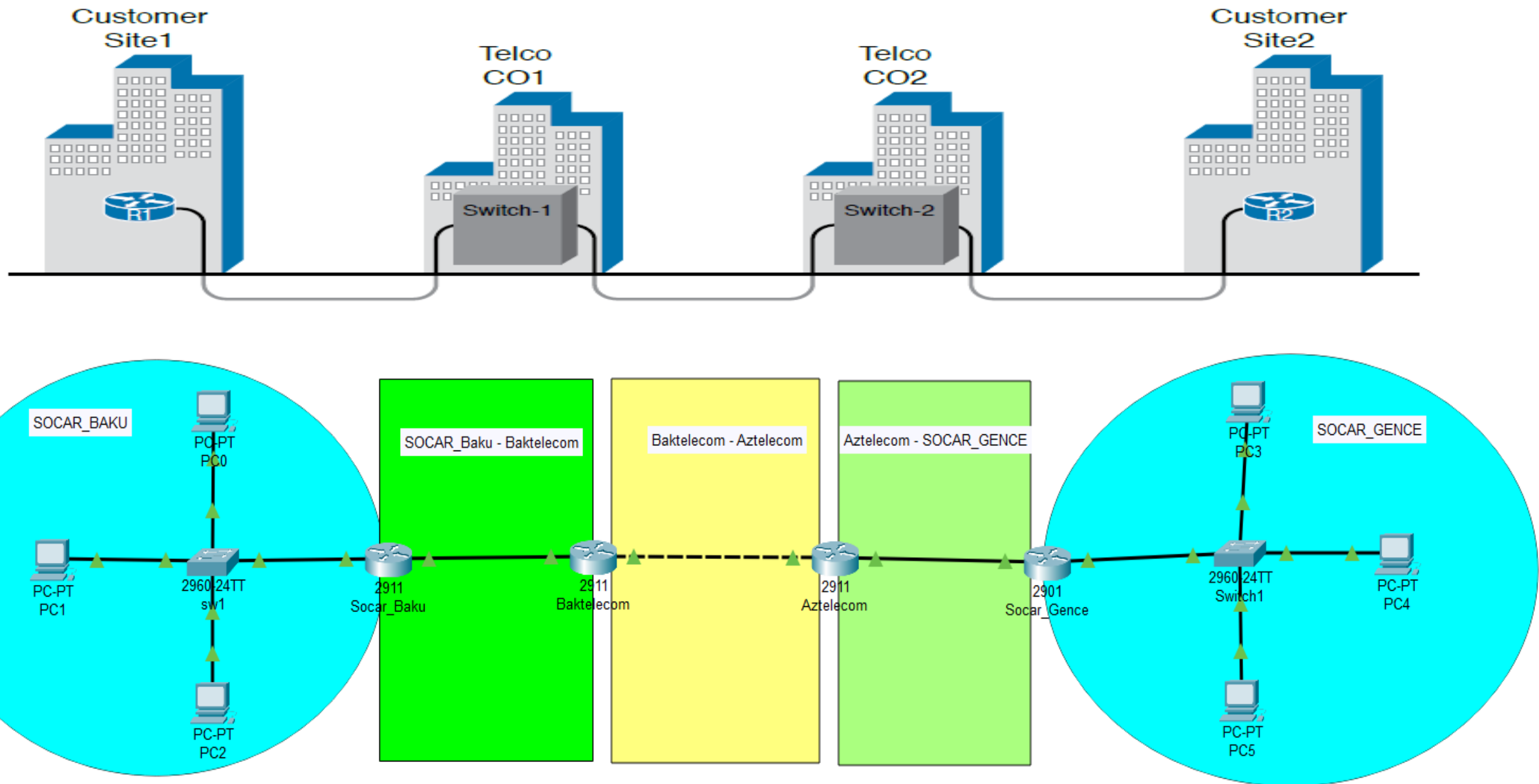


Leased Line WANs cont.

Terminology:

- ❖ Leased circuit (line) – there is electrical circuit between sites.
- ❖ Serial line (link) – bits flow serially and routers use serial interfaces.
- ❖ P2P – there are more than two devices between sites.
- ❖ T1 – 1.544 Mbps line between sites, this is specific type of leased line.
- ❖ Private – customer has its own physical line.

Example



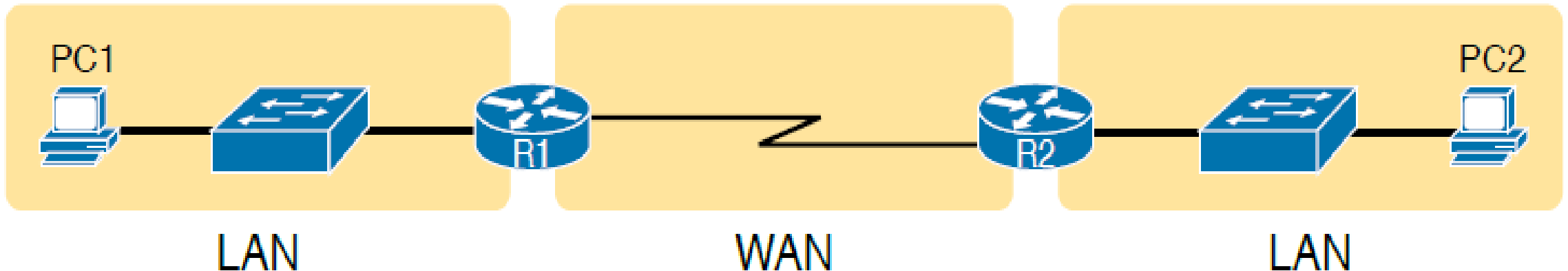
Leased Line WANs cont.

Generally Leased line defines Layer 1 services. In other words, it is responsible to deliver bits from one side to other. There are two Data-Link layer protocols that are used to control leased lines.

HDLC – High Level Data Link Control Protocol

PPP – Point to Point Protocol.

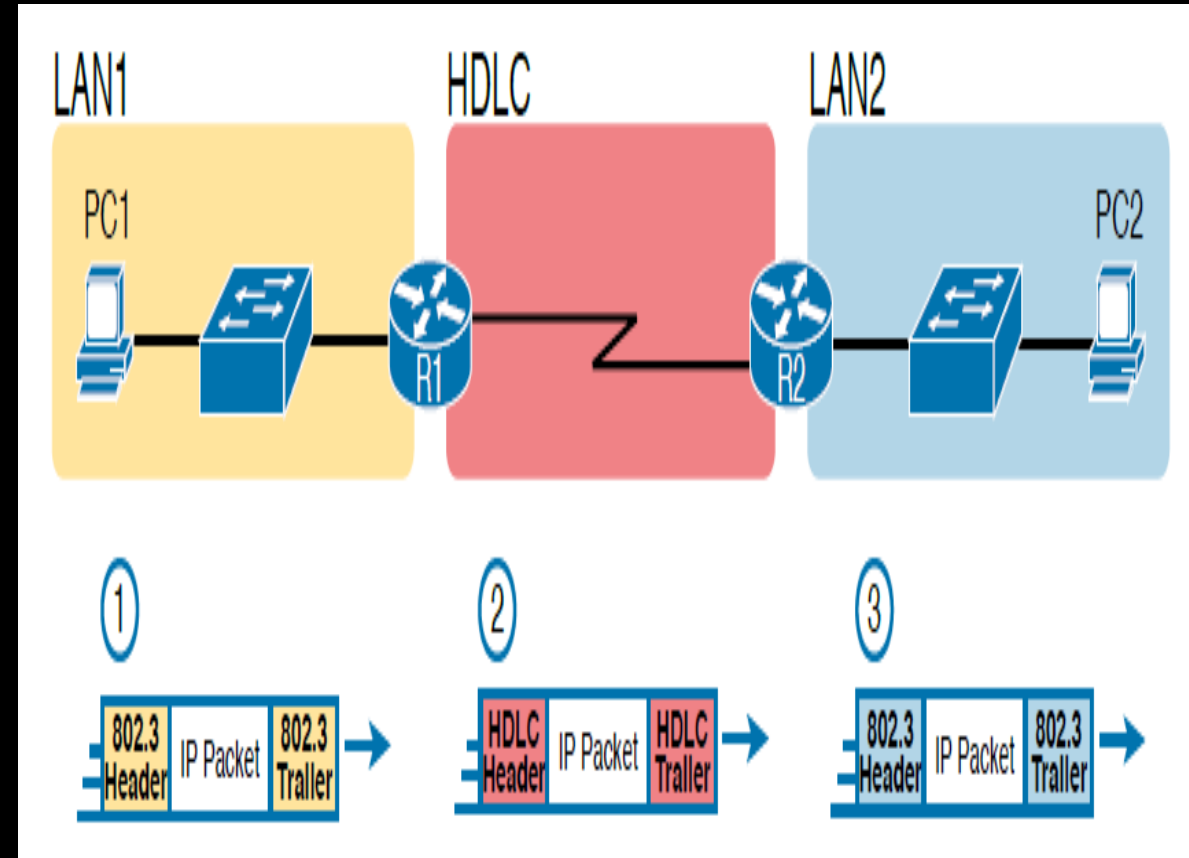
Let's continue with the next topology.



Leased Line WANs cont.

1. PC1 encapsulates IP packet with Ethernet header and trailer and sends to R1.
2. R1 decapsulates Ethernet header and encapsulates with HDLC header and trailer and sends to R2.
3. R2 decapsulates HDLC header and trailer and encapsulates with Ethernet header and trailer and sends to PC2.

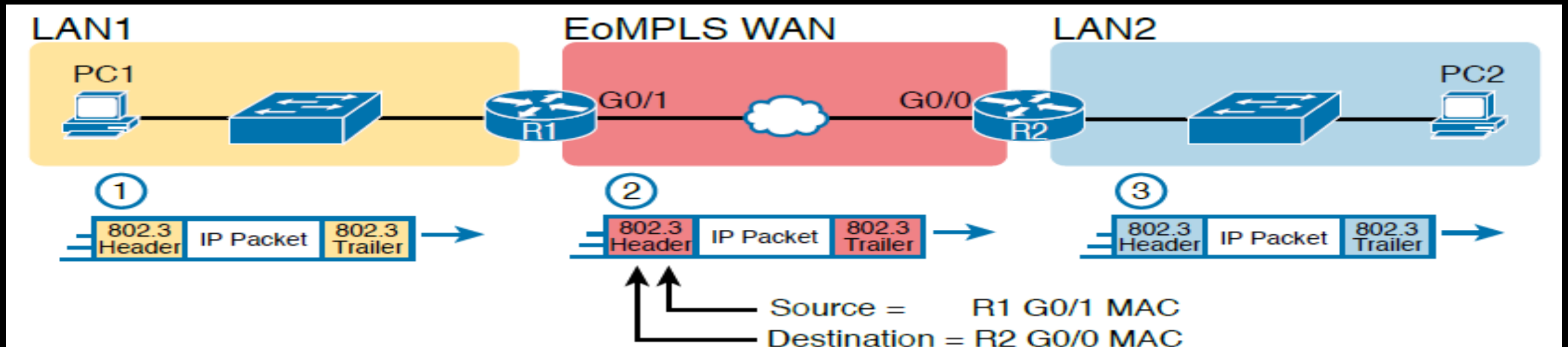
The HDLC frames provide the means to encapsulate the network layer packet correctly so that it crosses the link between routers



Ethernet WAN technology

Today, many WAN service providers (SP) offer WAN services that take advantage of Ethernet. SPs offer a wide variety of these Ethernet WAN services, with many different names. But all of them use a similar model, with Ethernet used between the customer site and the SP's network.

In this case, the IP packet is encapsulated with the ethernet header and trailer.



Ethernet vs HDLC header

HDLC Field	Ethernet Equivalent	Description
Flag	Preamble, SFD	Lists a recognizable bit pattern so that the receiving nodes realize that a new frame is arriving.
Address	Destination Address	Identifies the destination device.
Control	N/A	Mostly used for purposes no longer in use today for links between routers.
Type	Type	Identifies the type of Layer 3 packet encapsulated inside the frame.
FCS	FCS	Identifies a field used by the error detection process. (It is the only trailer field in this table.)

IP Routing

IP routing is network layer job and responsible of sending IP packet from one network to another.

IP routing is done on routers using Routing protocols. According to routing protocols algorithm routers form routing table to destination networks.

Router operates at Layer 3.

Each router has it routing table.

Cisco ASR920



IP routing cont.

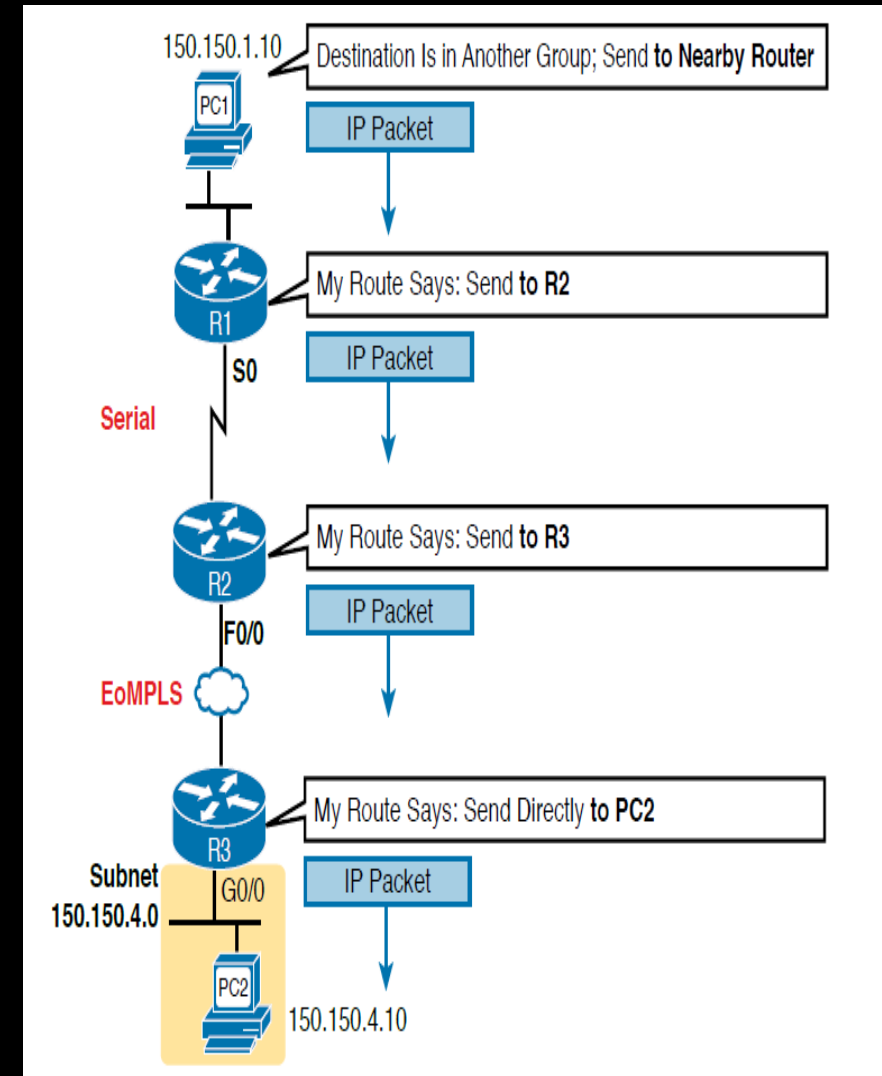
Routing Process.

PC1 analyzes that the destination network is outside and sends IP packet to nearby router (default gateway or default router).

According to R1 routing table R1 forward IP packet to R2.

According to R2's routing table R2 forward IP packet to R3.

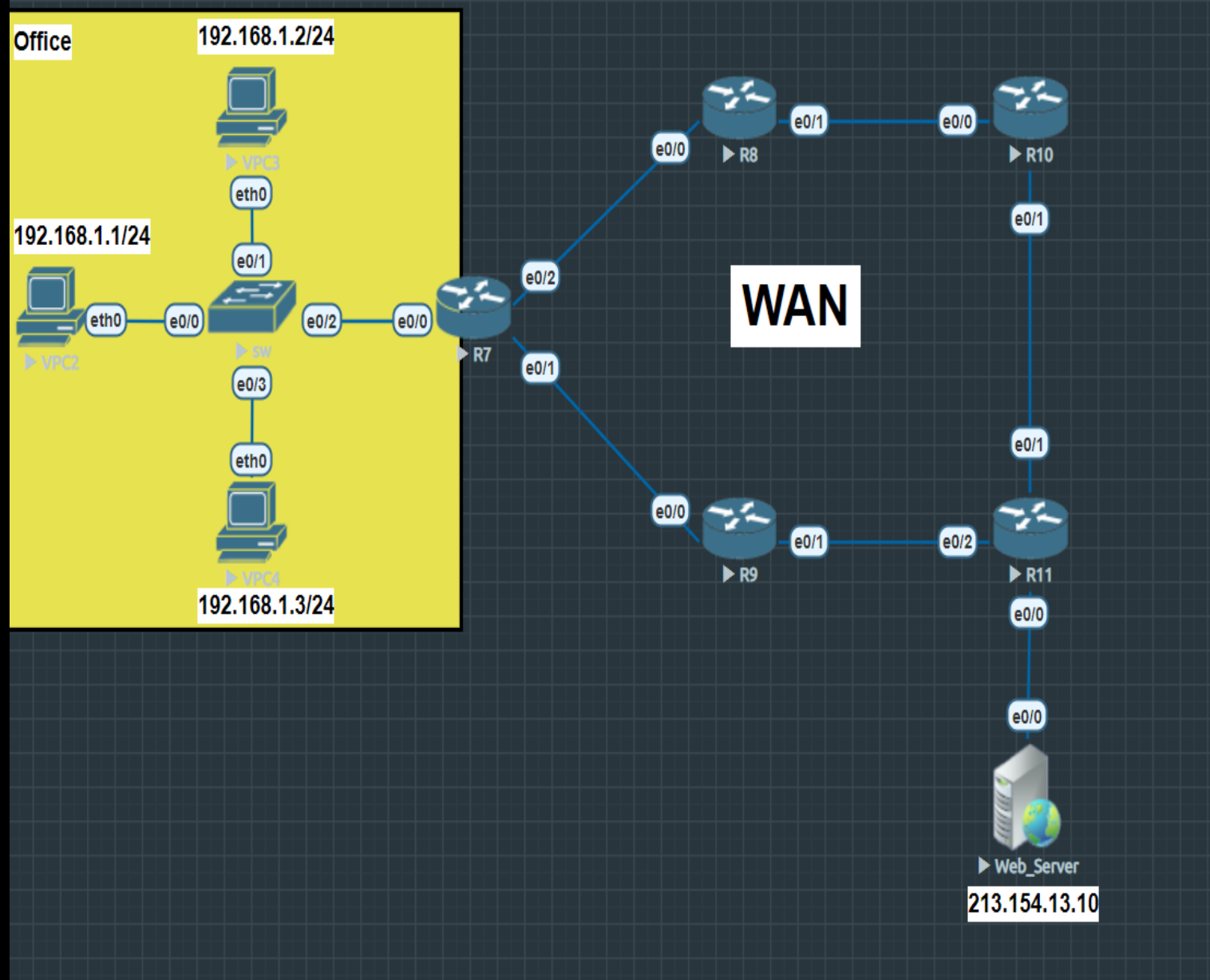
R3 identifies the destination as a connected network and send IP packet to PC2.



Ip routing cont.

In the image, the user on VPC2 wants to access web page on Web Server (213.154.13.10).

How VPC2 makes decision the destination is outside network?



IP routing cont.

VPC2 IP address: 192.168.1.1 (in decimal format)

VPC2 Subnet mask: 255.255.255.0 (In decimal format)

VPC2 IP address: 11000000.10101000.00000001.00000001 (in binary format)

VPC2 subnet mask: 11111111.11111111.11111111.00000000 (in binary format)

Step 1. VPC2 makes logical AND operation with its subnet mask.

11000000.10101000.00000001.00000001

11111111.11111111.11111111.00000000

11000000.10101000.00000001.00000000



result is VPC2 Network ID.

if we convert the result to decimal-format we'll get 192.168.1.0.

In the **Step 1** VPC2 determines its subnet or network portion.

Step 2. Next Slide...

IP routing cont.

Step 2. VPC2 compares the same bit in its network mask with the same bits of destination IP address.

Dest. IP address: 213.154.13.10 (in decimal format)

Dest. IP address: 11010101.10011010.00001101.00001010 (in binary format)

VPC2 network mask in binary-format: 11000000.10101000.00000001.

11000000.10101000.00000001

11010101.10011010.00001101.00001010

The bits in the network mask are different and means that VPC2 and Web Server is not in the same network.

Table.1 Logical AND Operation

Inputs		Output
A	B	$Y = A \cdot B$
0	0	0
0	1	0
1	0	0
1	1	1

That is all for Lesson 5



The key is :



Learn



Repeat



Practice



You will be able to reach your goals.



GOOD LUCK !!!!!....