



CCNA 200-301

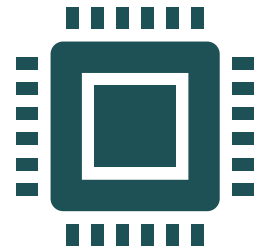
Lesson 2



Introduction to IPv4
(Internet Protocol)

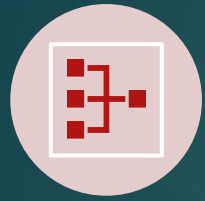


TCP and UDP

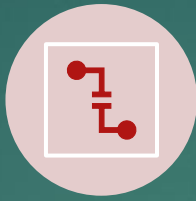


ARP (Address
Resolution Protocol)

Introduction to IPv4 (Internet Protocol)



Network Layer protocol.



Connectionless protocol means that IPv4 does not set up any connection.



Hierarchical protocol (Network part + Host Part)



The length is 4 bytes = 32 bit.



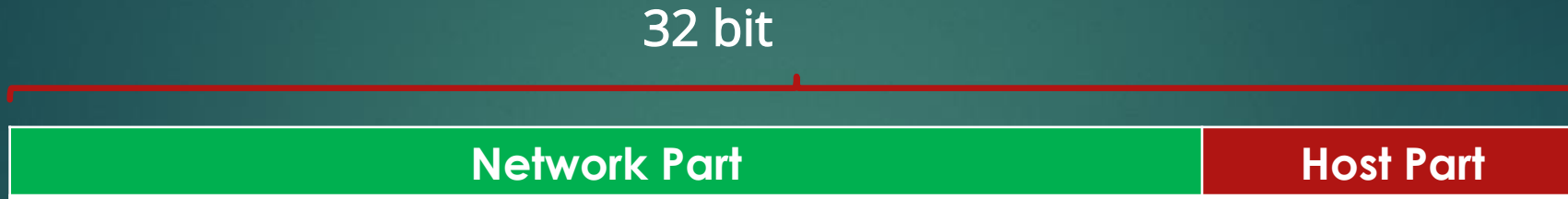
Each device needs unique IP address in network.



| |
|--------------|
| Application |
| Presentation |
| Session |
| Transport |
| Network |
| Data Link |
| Physical |

IPv4 (cont.)

An IP address is 32-bit and consists of 2 parts, the network part and the host part:



Each IPv4 address has four octets and each one equals to 8 bit (1 Byte). Let's write down IPv4 with the four separate parts.



Network part says which "network" the IPv4 address belongs to. The "host" part uniquely identifies the network device.

It is analogy to telephone number, the city code for all subscribers are the same, but each subscriber has a unique telephone number.

IPv4 (cont.)

IPv4 address all 32 bits are in binary format and looks like this:

1 1 0 0 0 0 0 0 1 0 1 0 1 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 1

Let's separate each octet:

1 1 0 0 0 0 0 0 | 1 0 1 0 1 0 0 0 | 0 0 0 0 0 0 0 1 | 0 0 0 0 0 0 0 1

This type of written is not human-friendly but is used for IP address calculations.

Conversion to decimal format.

11000000 – 192

10101000 – 168

00000000 – 1

00000000 – 1

192.168.1.1

IPv4 (cont.)

IPv4 addresses are divided into five classes and each class has own range:

Class A: 0.0.0.0 – 126.255.255.255

Class B: 128.0.0.0 – 191.255.255.255

Class C: 192.0.0.0 – 223.255.255.255

Class D: 224.0.0.0 – 239.255.255.255 → Reserved for Multicasting

Class E: 240.0.0.0 – 254.255.255.255 → Experimental



Where is the range 127.0.0.0 – 127.255.255.255



Each computer has its own TCP/IP stack installed in OS. This stack is used to test computer's networking functions. And 127.0.0.0 – 127.255.255.255 range is used for this purpose.

Put **Win + R** and ping 127.0.0.1 for checking whether your computer's TCP/IP stack is operational.

IPv4 (cont.)



Can we use all IPv4 address in our local network ?

Of course NOT, IPv4 addresses are separated into public and private addresses.

- Public IP addresses are **used on the Internet**.
- Private IP addresses **are used on your local area network** and should not be used on the Internet.

Each IPv4 Class maintains its own Private IP address range:

- Class A: 10.0.0.0 – 10.255.255.255
- Class B: 172.16.0.0 – 172.31.255.255
- Class C: 192.168.0.0 – 192.168.255.255

Can we use all IPv4 addresses in a whole class ?



Absolutely NOT. There are 2 IP addresses we cannot use on our network.

- **Network address.**
- **Broadcast address.**

IPv4 (cont.)

Network address is utilized to “define” network.

Broadcast address is used for broadcast application. When packet is sent to broadcast address that is received by all devices in your network.

Example:

Given address: 192.168.1.1 /24

| | | | |
|----------|----------|----------|----------|
| 11000000 | 10101000 | 00000001 | 00000001 |
|----------|----------|----------|----------|

What is Network address for 192.168.1.1 /24 ?

What is Broadcast address for 192.168.1.1/24 ?

Rule 1: To find network address we convert all host bits to zero.



Rule 1: To find broadcast address we convert all host bits to one.

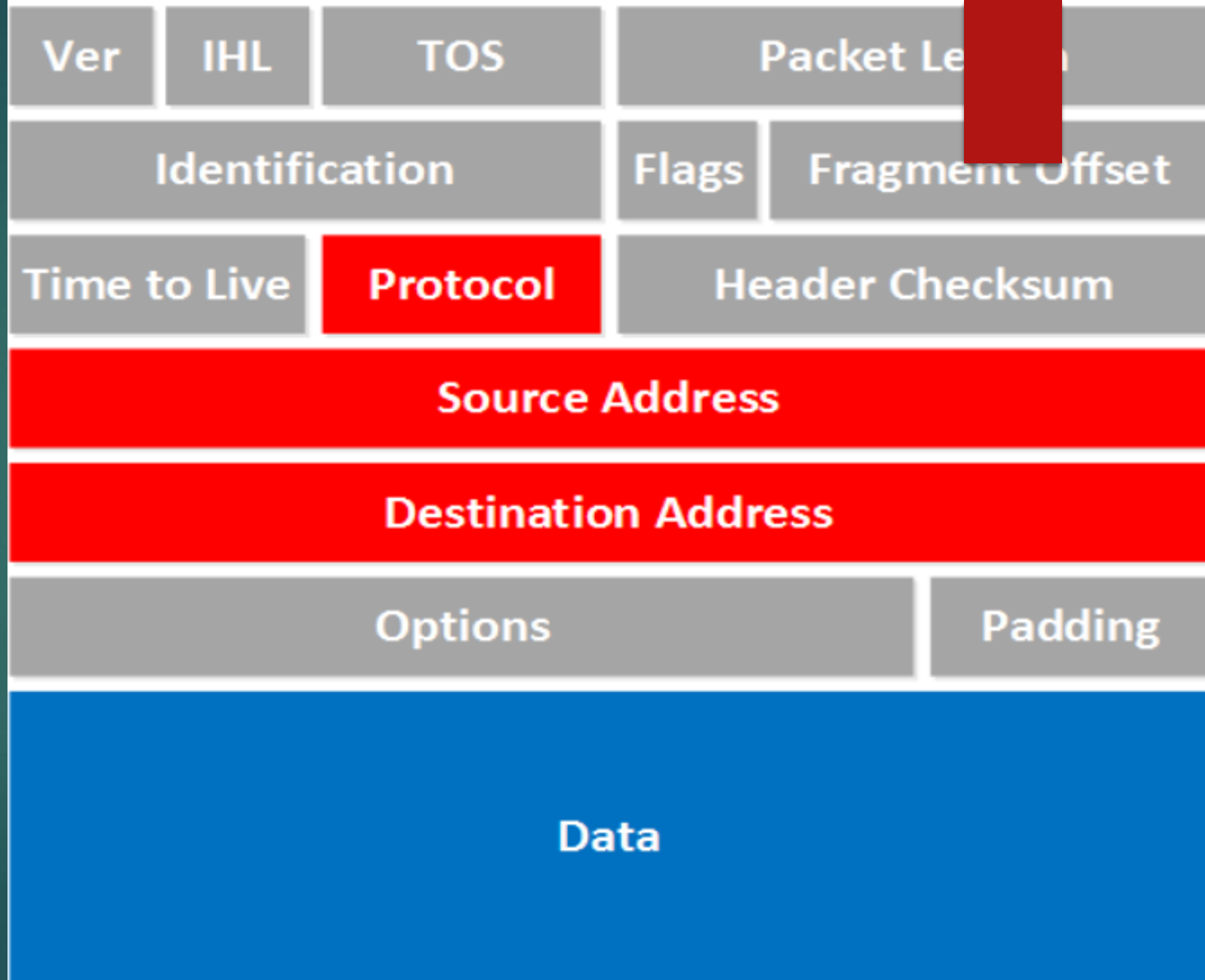


Result: 192.168.1.0 – Network address

192.168.1.255 – Broadcast address

IPv4 (cont.)

► IPv4 Header



Configuration of IPv4 on host PCs

Practical view on Simulator (Packet Tracer)

192.168.1.1/24



PC-PT
PC0

Fa0

192.168.1.2/24



PC-PT
PC1

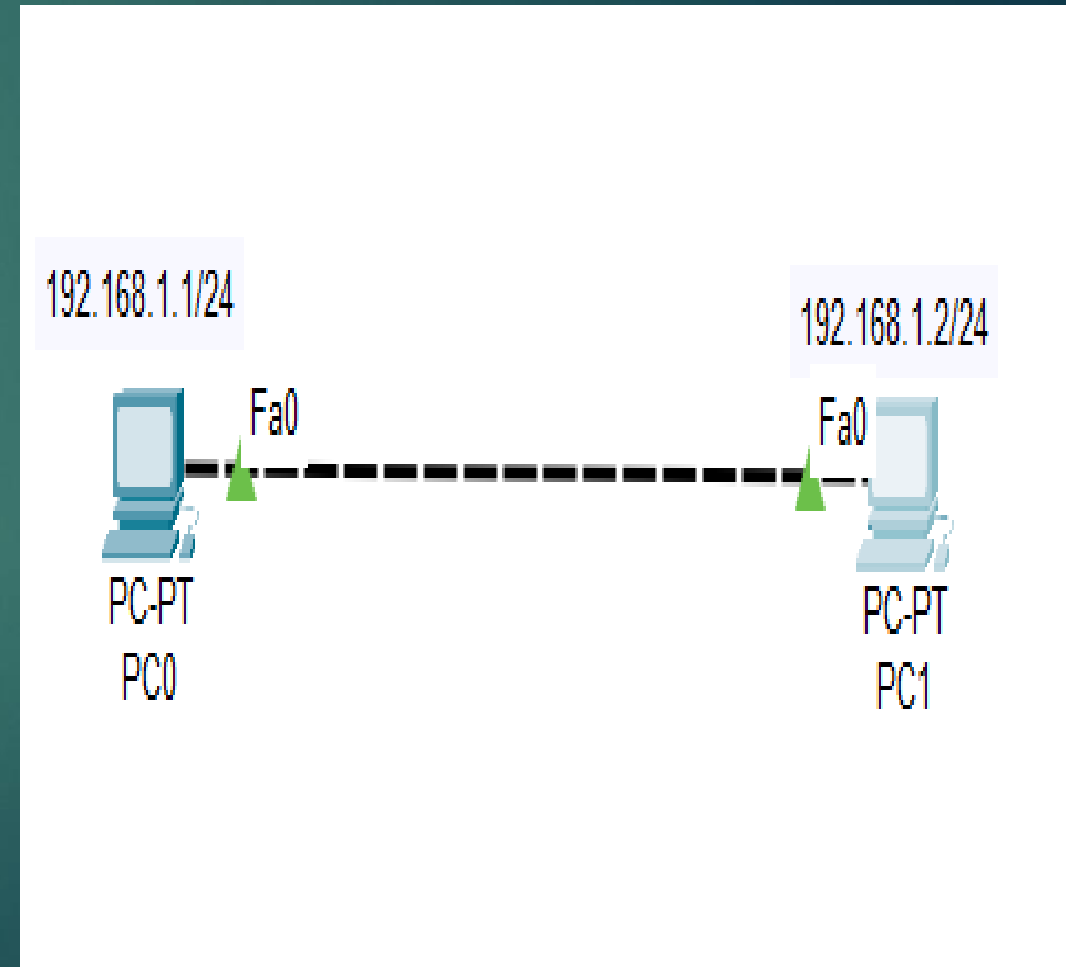
Fa0

ARP (Address Resolution Protocol)

ARP is used to translate Layer 3 addresses to Layer 2 addresses. Let's suppose we have got two hosts and they want to communicate each other.

The IP packet is encapsulated at Layer 3 and goes down to Layer 2. For building Layer 2 Header Data Link Layer needs source and destination MAC Address.

PC0 wants to communicate to PC1. PC0 knows its own MAC address, IP address, and destination IP address. For learning PC1 MAC address PC1 uses ARP protocol.



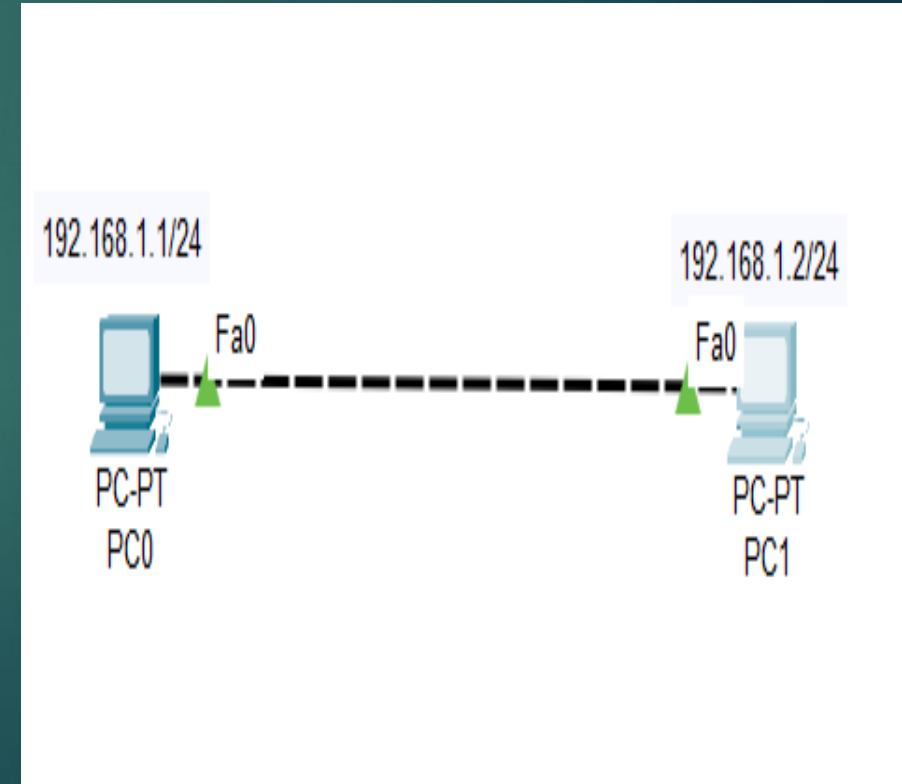
ARP (cont.)

Let's follow next steps:

1. PC0 sees it has no entry in its ARP table about PC1. (`>arp -a`)
2. PC0 sends ARP request to broadcast FFFF.FFFF.FFFF MAC address
Who is 192.168.1.2 ?
3. PC1 identifies its IP address and reply with the ARP Reply message.
4. PC0 adds the MAC address of PC1 to PC0 ARP table.
“that's me! And this is my MAC address”.

Using `arp -d` command we can clear ARP table cache.

Practice time on simulator (Packet Tracer).



That is all for Lesson 2



The key is :



Learn



Repeat



Practice



You will be able to reach your goals.



GOOD LUCK !!!!!...