



B2- Introduction to Networks

B-NET-155

Bootstrap 1

OSI & TCP/IP Models

v1.1

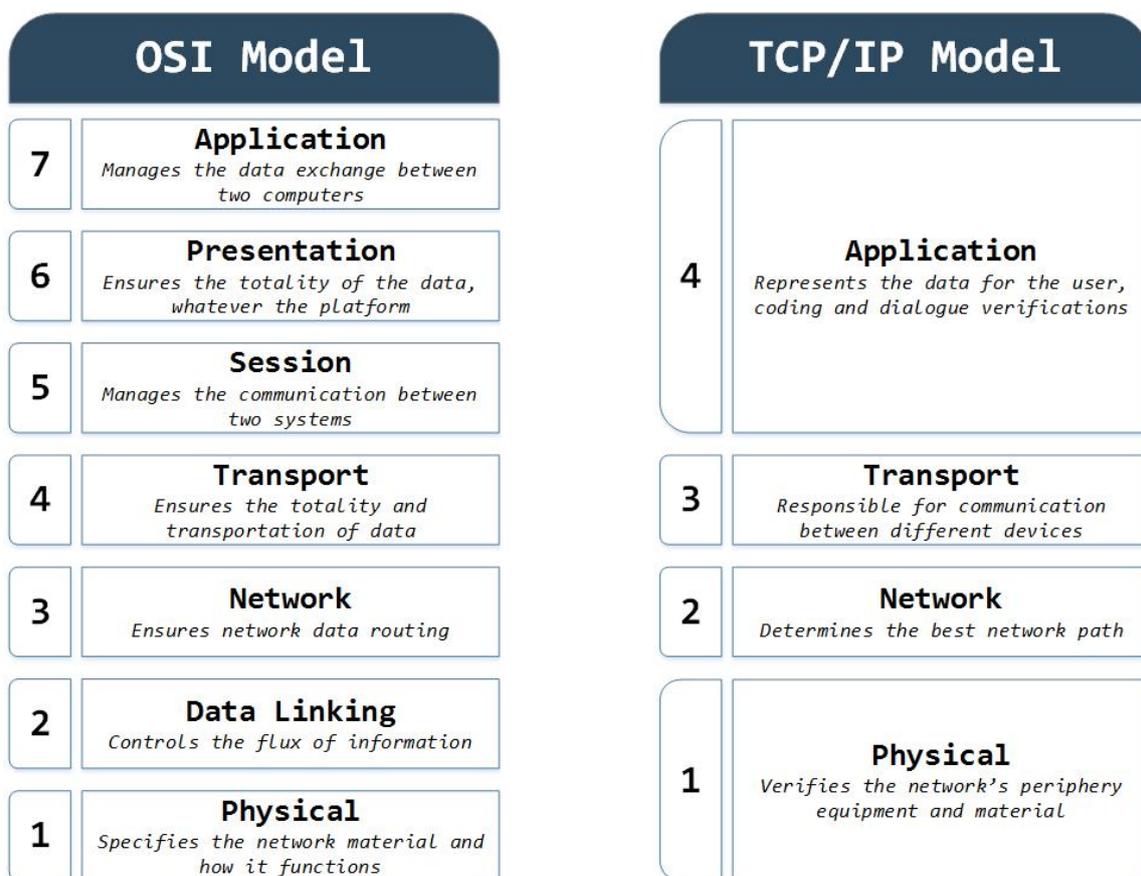


Bootstrap 1

OSI & TCP/IP Models

OSI Model: "Open Systems Interconnection", is a communication standard between computers that is proposed by ISO. It describes the necessary functions for network communication.

TCP/IP Model: "Transmission Control Protocol/Internet Protocol", is the entirety of protocols used in order to transfer data on the Internet.



IP Protocol

A family of protocols designed to be used by the Internet.

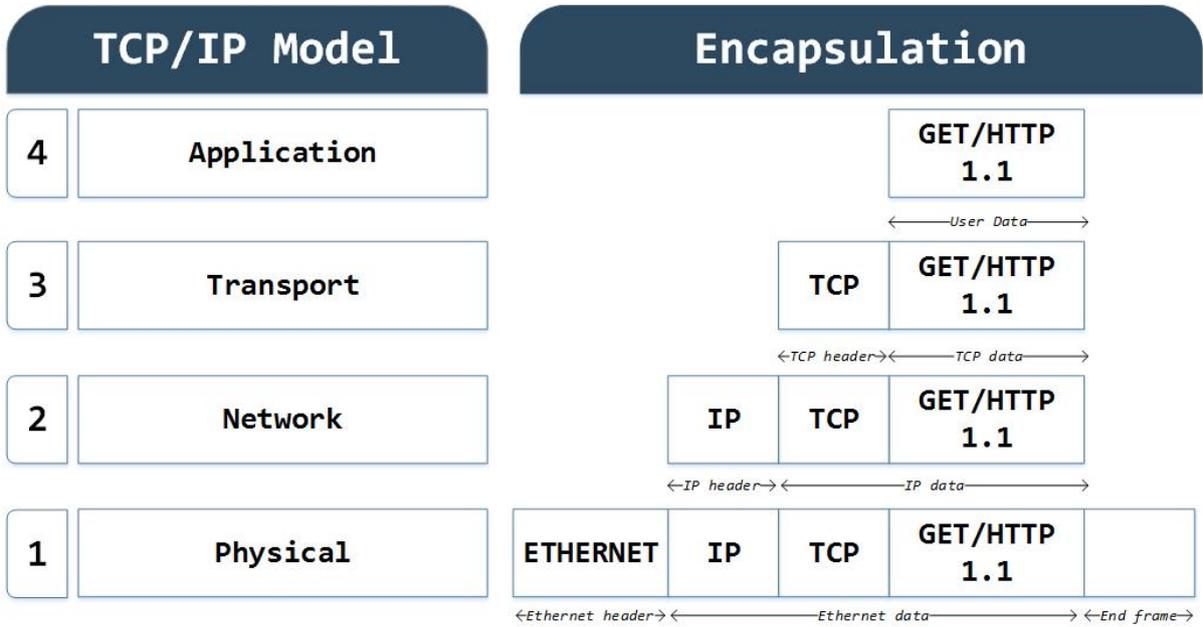
These protocols are located in the third layer of the OSI model (network layer).

The packets are encapsulated with each implementation in an OSI model layer. They are called IP datagrams.

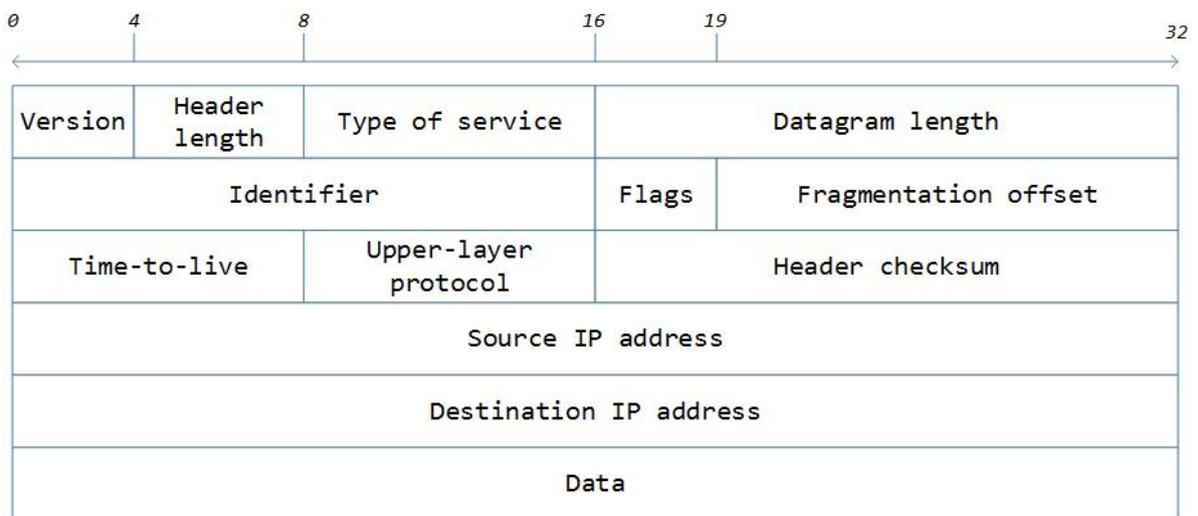
The datagrams are analyzed by network equipment, like a router, for example, in order to recognize the packet's recipient.

Encapsulation

A procedure that consists of including data from one protocol into another protocol.



IPv4 Datagrams





IPv4 Addresses

1. Introduction

IPv4 addresses are identification numbers that are attributed, either temporarily or permanently, to each machine that is connected to a network.

They are represented in decimal notation by 4-number (4 bytes) between 0 and 255 and separated by dots. Therefore, IPv4 addresses have 32 bits.

The addresses are made up of two parts: the **NetID** and the **HostID**, whose sizes can vary depending on its class. They are manually assigned by the network administrator, or automatically assigned thanks to the DHCP protocol.

2. Classes

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
Class A	0	NetID (8 bits)							HostID (24 bits)																								
Class B	1	0	NetID (16 bits)													HostID (16 bits)																	
Class C	1	1	0	NetID (24 bits)																				HostID (8 bits)									
Class D	1	1	1	0	Multicast Addresses																												
Class E	1	1	1	1	0	Reserved Addresses																											

Class A

Range: 0.0.0.0 to 127.255.255.255

Number of addresses: $2^{24} - 2 = 16777214$ host addresses

Class B

Range: 128.0.0.0 to 191.255.255.255

Number of addresses: $2^{16} - 2 = 65534$ host addresses

Class C

Range: 192.0.0.0 to 223.255.255.255

Number of addresses: $2^8 - 2 = 254$ host addresses

3. Private Addresses

These are addresses that are not routable on the Internet and that must be unique within a local network.

Class A

10.0.0.0 to 10.255.255.255 (Mask: 255.0.0.0 - /8)

Class B

172.16.0.0 to 172.31.255.255 (Mask: 255.255.0.0 - /16)

Class C

192.168.0.0 to 192.168.255.255 (Mask: 255.255.0.0 - /16)



4. Special Addresses

These are addresses that are reserved for a special purpose.

Network Address:

- The first network address that specifies the network itself.
- All of the host's bits are 0.

Broadcast Address:

- The last address of a network.
- It enables all of a network's hosts to be contacted.
- All of the host's bits are 1.

The Subnetwork Mask

A mask that indicates the number of bits in an IPv4 address, which are used to identify the NetID and HostID sections, respectively.

It has the same form as an IP address:

- The bits are 1 for the NetID section.
- The bits are 0 for the HostID section.

For instance:

Class C IP address: 192.168.0.1

Subnetwork Mask:

- Decimal representation: 255.255.255.0
- CIDR representation: /24
- Binary representation: 11111111.11111111.11111111.00000000

Network Equipment

Repeater

Electronic device that receives and then retransmits a signal (by amplifying it) so that the signal can cover large distances.

Bridge

The link between two networks. It is based on physical addresses (MAC addresses).

Hub

A multiport repeater.

Switch

A multiport bridge.

Router

A device that enables packets to be transmitted between different networks. It is based on logical addresses.

Physical Links

Coaxial Cable

A cable used to transmit digital or analog signals at high or low-level frequency (between a TV antenna and a television).

Serial Cable

A cable that is frequently used to connect two hardware to a network. (Between two routers). It is known for being sturdy and easy to install.

RJ45 Cable

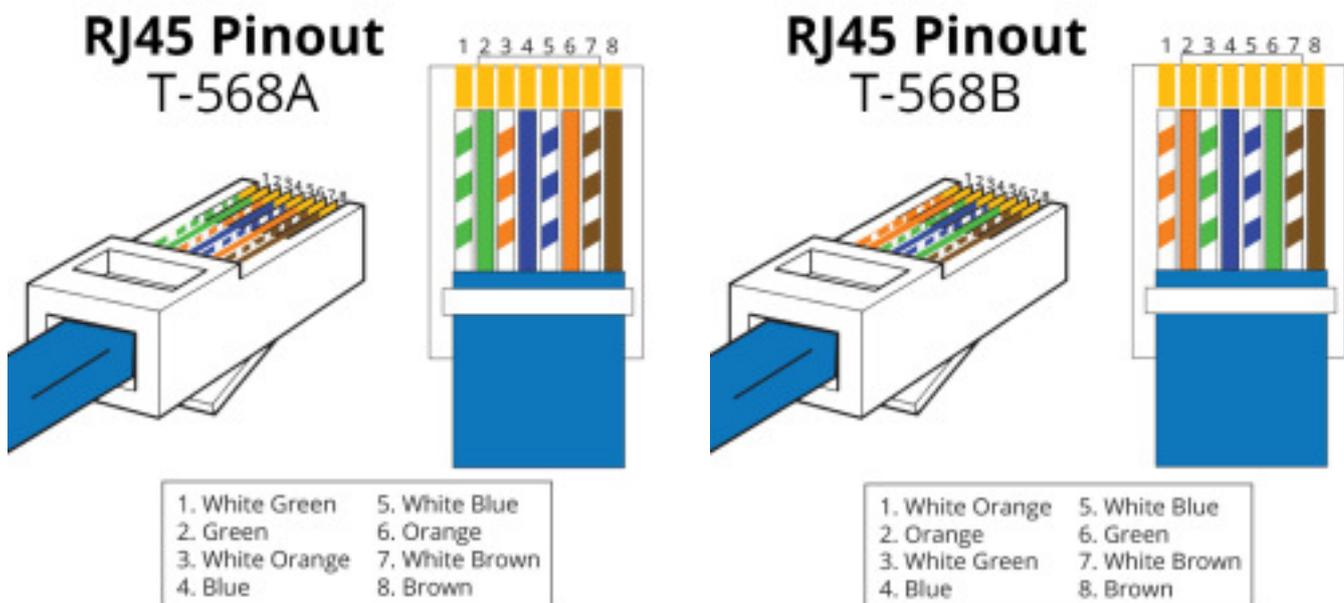
A cable used for Ethernet connections. (Between a PC and a switch). Exists in both straight and crossover.

Fiber Optic Cable

A cable that contains either a glass or plastic wire that is able to conduct light.

Hands-On Work

Now, work in pairs: one person must create a straight cable (used to connect two different hardware - PC/Switch, Router/Switch), and the other a crossover cable (used to connect two hardware on the same level - PC/PC, Router/Router).





Install a Debian virtual machine, without GUI, and configure an IP address on your virtual machine.



In your group, IP addresses must be in the same network.

Connect a cable between your computer and your friend's computer and make sure that both virtual machines can communicate with each other.