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Curriculum

SE Foundations ^

Average: 100.13% v

0x07. Networking basics #0

DevOps

Network

⚙ Weight: 1

📅 Project over - took place from Jan 31, 2024 4:00 AM to Feb 2, 2024 4:00 AM

☑ An auto review will be launched at the deadline

In a nutshell...

- **Auto QA review:** 5.5/13 mandatory
- **Altogether: 42.31%**
 - Mandatory: 42.31%
 - Optional: no optional tasks

Resources

Read or watch:

- OSI model (/rltoken/k2uCsynicuNbu1cAQhXqVQ)
- Different types of network (/rltoken/XW3ZGm5Ya_a8XVDXcAKT_A)
- LAN network (/rltoken/en370-Hrwgi_GUvFc3bKg)
- WAN network (/rltoken/Ah1EKqnINR85IM4P2WnLSw)
- Internet (/rltoken/Lwh9xQxFD4dWh5sIApXI1g)
- MAC address (/rltoken/j-Wp-YRvFTVP04SpleRzHQ)
- What is an IP address (/rltoken/HaZZvrmGaQ3U7ZLDYgZb6w)
- Private and public address (/rltoken/OPJCZYuWSEXLIZOqU9Uc0A)
- IPv4 and IPv6 (/rltoken/M8g-egWLlIdTI6Y0QECdwA)
- Localhost (/rltoken/7lj-zoZQ7xFTkj4MTyos_g)
- TCP and UDP (/rltoken/uJbs8E9-FyATfsELpmtTIg)
- TCP/UDP ports List (/rltoken/4PYkqDfOvlZZb9aUPGOOzQ)
- What is ping /ICMP (/rltoken/3zBgO6r2M1Q8IUvt9g8aJw)
- Positional parameters (/rltoken/U5CMxsErz85edWap3fNEoQ)



man or help:

(/)

- netstat
- ping

Learning Objectives

At the end of this project, you are expected to be able to explain to anyone (/rltoken/RowLuXQWMOPFHaboo_3odA), **without the help of Google**:

OSI Model

- What it is
- How many layers it has
- How it is organized

What is a LAN

- Typical usage
- Typical geographical size

What is a WAN

- Typical usage
- Typical geographical size

What is the Internet

- What is an IP address
- What are the 2 types of IP address
- What is localhost
- What is a subnet
- Why IPv6 was created

TCP/UDP

- What are the 2 mainly used data transfer protocols for IP (transfer level on the OSI schema)
- What is the main difference between TCP and UDP
- What is a port
- Memorize SSH, HTTP and HTTPS port numbers
- What tool/protocol is often used to check if a device is connected to a network

Copyright - Plagiarism

- You are tasked to come up with solutions for the tasks below yourself to meet with the above learning objectives.
- You will not be able to meet the objectives of this or any following project by copying and pasting someone else's work.
- You are not allowed to publish any content of this project.
- Any form of plagiarism is strictly forbidden and will result in removal from the program.



Requirements

General

- Allowed editors: `vi`, `vim`, `emacs`
- All your Bash script files will be interpreted on Ubuntu 20.04 LTS
- All your files should end with a new line
- A `README.md` file, at the root of the folder of the project, is mandatory
- All your Bash script files must be executable
- Your Bash script must pass `shellcheck` without any error
- The first line of all your Bash scripts should be exactly `#!/usr/bin/env bash`
- The second line of all your Bash scripts should be a comment explaining what is the script doing

More Info

The second line of all your Bash scripts should be a comment explaining what is the script doing

For multiple choice question type tasks, just type the number of the correct answer in your answer file, add a new line for every new answer, example:

What is the most important position in a software company?

1. Project manager
2. Backend developer
3. System administrator

```
sylvain@ubuntu$ cat foo_answer_file
3
sylvain@ubuntu$
```

Source for question 1 here (</rltoken/iEZZ6SemL1HJHjaJOjIPYQ>)

Tasks

0. OSI model

mandatory

Score: 50.0% (*Checks completed: 100.0%*)

OSI (Open Systems Interconnection) is an abstract model to describe layered communication and computer network design. The idea is to segregate the different parts of what make communication possible.

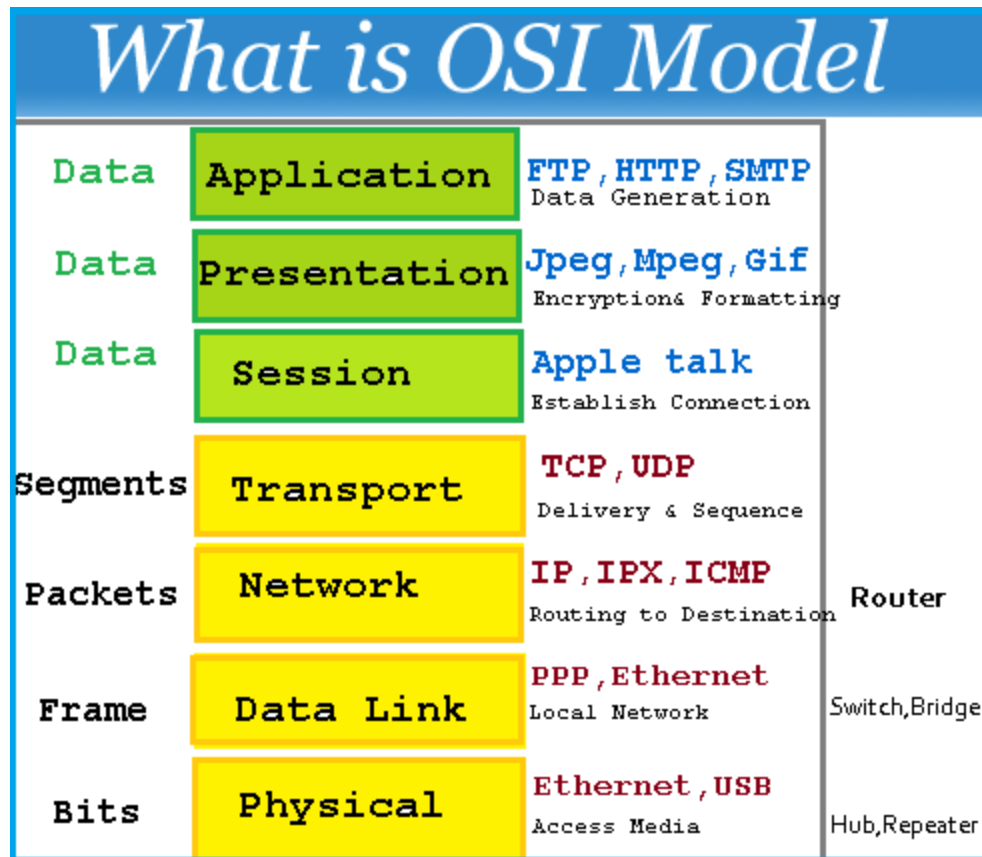


It is organized from the lowest level to the highest level:

- The lowest level: layer 1 which is for transmission on physical layers with electrical impulse, light or radio signal

- The highest level: layer 7 which is for application specific communication like SNMP for emails, HTTP for your web browser, etc

Keep in mind that the OSI model is a concept, it's not even tangible. The OSI model doesn't perform any functions in the networking process. It is a conceptual framework so we can better understand complex interactions that are happening. Most of the functionality in the OSI model exists in all communications systems.



In this project we will mainly focus on:

- The Transport layer and especially TCP/UDP
- On the Network layer with IP and ICMP

The image bellow describes more concretely how you can relate to every level.



Questions:

LAN connect local devices together, WAN connects LANs together, and WANs are operating over the Internet.

Questions:

What type of network a computer in local is connected to?

1. Internet
2. WAN
3. LAN

What type of network could connect an office in one building to another office in a building a few streets away?

1. Internet
2. WAN
3. LAN

What network do you use when you browse www.google.com from your smartphone (not connected to the Wifi)?


1. Internet
2. WAN
3. LAN

Repo:

- GitHub repository: `alx-system_engineering-devops`
- Directory: `0x07-networking_basics`
- File: `1-types_of_network`

☒ Done!

Check your code

 Get a sandbox

QA Review

2. MAC and IP address

mandatory

Score: 50.0% (*Checks completed: 100.0%*)





Questions:

What is a MAC address?

1. The name of a network interface
2. The unique identifier of a network interface
3. A network interface

What is an IP address?


1. Is to devices connected to a network what postal address is to houses
2. The unique identifier of a network interface
3. Is a number that network devices use to connect to networks

Repo:

- GitHub repository: alx-system_engineering-devops
- Directory: 0x07-networking_basics
- File: 2-MAC_and_IP_address

☒ Done!

Check your code

 Get a sandbox

QA Review

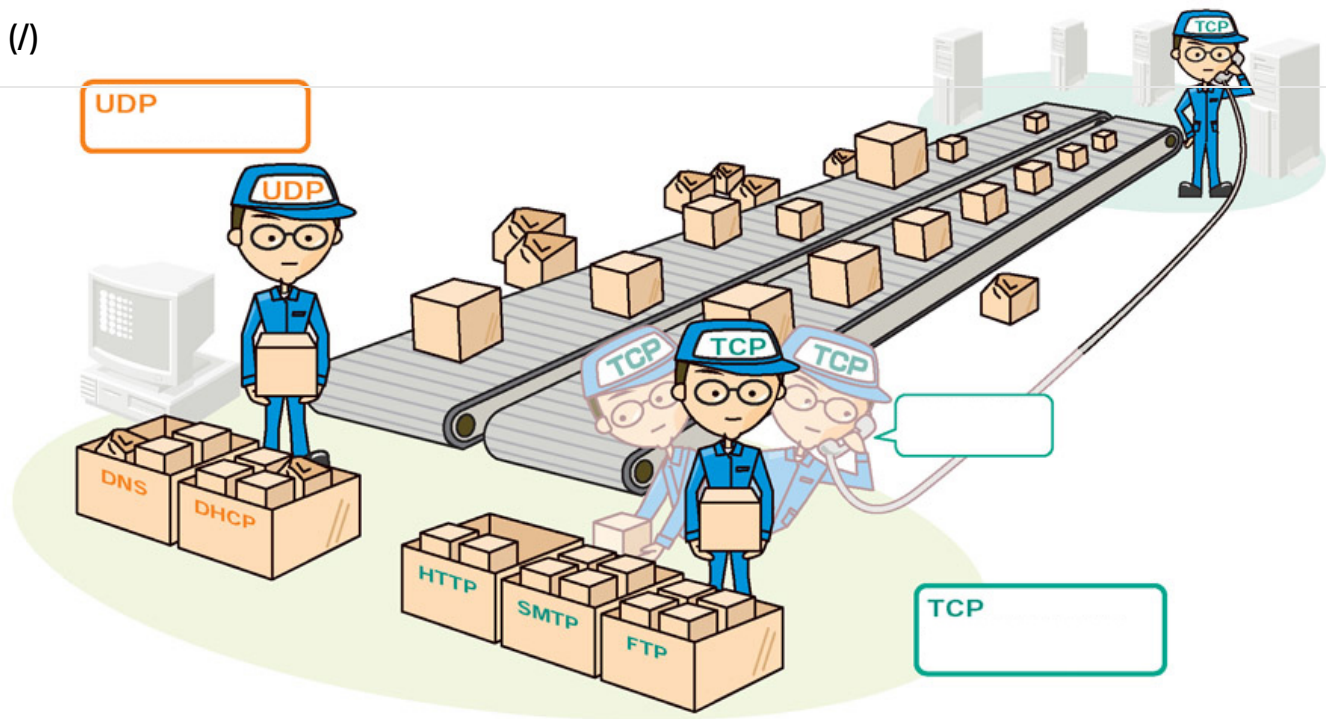
3. UDP and TCP

mandatory

Score: 50.0% (Checks completed: 100.0%)



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Let's fill the empty parts in the drawing above.

Questions:


- Which statement is correct for the TCP box:
 1. It is a protocol that is transferring data in a slow way but surely
 2. It is a protocol that is transferring data in a fast way and might loss data along in the process
- Which statement is correct for the UDP box:
 1. It is a protocol that is transferring data in a slow way but surely
 2. It is a protocol that is transferring data in a fast way and might loss data along in the process
- Which statement is correct for the TCP worker:
 1. Have you received boxes x, y, z?
 2. May I increase the rate at which I am sending you boxes?

Repo:

- GitHub repository: alx-system_engineering-devops
- Directory: 0x07-networking_basics
- File: 3-UDP_and_TCP


☒ Done!

Check your code

 Get a sandbox

QA Review

4. TCP and UDP ports

 mandatory

Score: 50.0% (Checks completed: 100.0%)

Once packets have been sent to the right network device using IP using either UDP or TCP as a mode of transportation, it needs to actually enter the network device.

If we continue the comparison of a network device to your house, where IP address is like your postal address, UDP and TCP ports are like the windows and doors of your place. A TCP/UDP network device has 65535 ports. Some of them are officially reserved for a specific usage, some of them are known to be used for a specific usage (but nothing is officially declared) and the rest are free of use.

While the full list of ports should not be memorized, it is important to know the most used ports, let's start by remembering 3 of them:

- **22** for SSH
- **80** for HTTP
- **443** for HTTPS

Note that a specific IP + port = socket (/rltoken/tMKODilbDVpB8EgfIRDJVw).

Write a Bash script that displays listening ports:

- That only shows listening sockets
- That shows the PID and name of the program to which each socket belongs

Example:



```

sylvain@ubuntu$ sudo ./4-TCP_and_UDP_ports
Active Internet connections (only servers)

```

Proto	Recv-Q	Send-Q	Local Address	Foreign Address	State	PID/Program name
tcp	0	0	*:sunrpc	:::	LISTEN	518/rpcbind
tcp	0	0	*:ssh	:::	LISTEN	124/sshd
tcp	0	0	*:32938	:::	LISTEN	547/rpc.statd
tcp6	0	0	:::sunrpc	:::*	LISTEN	518/rpcbind
tcp6	0	0	:::ssh	:::*	LISTEN	124/sshd
tcp6	0	0	:::33737	:::*	LISTEN	547/rpc.statd
udp	0	0	*:sunrpc	:::		518/rpcbind
udp	0	0	*:691	:::		518/rpcbind
udp	0	0	localhost:723	:::		547/rpc.statd
udp	0	0	*:60129	:::		547/rpc.statd
udp	0	0	*:3845	:::		562/dhclient
udp	0	0	*:bootpc	:::		562/dhclient
udp6	0	0	:::47444	:::*		547/rpc.statd
udp6	0	0	:::sunrpc	:::*		518/rpcbind
udp6	0	0	:::50038	:::*		562/dhclient
udp6	0	0	:::691	:::*		518/rpcbind

```

Active UNIX domain sockets (only servers)

```

Proto	RefCnt	Flags	Type	State	I-Node	PID/Program name	Path
unix	2	[ACC]	STREAM	LISTENING	7724	518/rpcbind	/run/rpcbind.sock
unix	2	[ACC]	STREAM	LISTENING	6525	1/init	@/com/ubuntu/upstart
unix	2	[ACC]	STREAM	LISTENING	8559	835/dbus-daemon	/var/run/dbus/system_bus_socket
unix	2	[ACC]	STREAM	LISTENING	9190	1087/acpid	/var/run/acpid.socket
unix	2	[ACC]	SEQPACKET	LISTENING	7156	378/systemd-udevd	/run/udev/control

```

sylvain@ubuntu$

```

Repo:

- GitHub repository: alx-system_engineering-devops
- Directory: 0x07-networking_basics
- File: 4-TCP_and_UDP_ports

☒ Done!

Check your code

>_ Get a sandbox

QA Review

5. Is the host on the network**mandatory**

Score: 0.0% (Checks completed: 0.0%)



The Internet Control Message Protocol (ICMP) is a protocol in the Internet protocol suite. It is used by network devices, to check if other network devices are available on the network. The command `ping` uses ICMP to make sure that a network device remains online or to troubleshoot issues on the network.

Write a Bash script that pings an IP address passed as an argument.

Requirements:

- Accepts a string as an argument
- Displays `Usage: 5-is_the_host_on_the_network {IP_ADDRESS}` if no argument passed
- Ping the IP 5 times

Example:



```
sylvain@ubuntu$ ./5-is_the_host_on_the_network 8.8.8.8
PING 8.8.8.8 (8.8.8.8) 56(84) bytes of data:
64 bytes from 8.8.8.8: icmp_seq=1 ttl=63 time=12.9 ms
64 bytes from 8.8.8.8: icmp_seq=2 ttl=63 time=13.6 ms
64 bytes from 8.8.8.8: icmp_seq=3 ttl=63 time=7.83 ms
64 bytes from 8.8.8.8: icmp_seq=4 ttl=63 time=11.3 ms
64 bytes from 8.8.8.8: icmp_seq=5 ttl=63 time=7.57 ms

--- 8.8.8.8 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4006ms
rtt min/avg/max/mdev = 7.570/10.682/13.679/2.546 ms
sylvain@ubuntu$
sylvain@ubuntu$ ./5-is_the_host_on_the_network
Usage: 5-is_the_host_on_the_network {IP_ADDRESS}
sylvain@ubuntu$
```

It is interesting to look at the `time` value, which is the time that it took for the ICMP request to go to the `8.8.8.8` IP and come back to my host. The IP `8.8.8.8` is owned by Google, and the quickest roundtrip between my computer and Google was `7.57 ms` which is pretty fast, which is a sign that the network path between my computer and Google's datacenter is in good shape. A slow ping would indicate a slow network.

Next time you feel that your connection is slow, try the `ping` command to see what is going on!

Repo:

- GitHub repository: `alx-system_engineering-devops`
- Directory: `0x07-networking_basics`
- File: `5-is_the_host_on_the_network`

☒ Done!