NETWORKS AND PROTOCOLS

Lab 1

Objectives

get you familiar with basic networking tools.

Exercise 01: ifconfig (Network interfaces and their names)

The ifconfig utility lists a computer's network interfaces and displays or updates their configuration. Type ifconfig in the command line and answer the following questions:

(a) How many network interfaces does your computer have?

(b) Can you guess why it has more than one?

(c) What is the IP address of each interface?

(d) What is the MAC address of each interface?

(e) Why could it be that some interfaces do not have a MAC address? (This is a tough question.)

(f) The equivalent command in windows is ipconfig

Exercise 02: dig Humans use special names to refer to computers (more precisely, to the network interfaces of computers). When you instruct your computer to communicate with a remote computer that has a given name, your computer translates the given name to an IP address.

- What are the IP addresses of www.ensia.edu.dz?
- What are the IP addresses of www.yahoo.fr ?
  - Why could it be that www.yahoo.fr maps to more than one IP addresses?
- What is the IP address of www.google.com?
- Answer the same question again in an hour or so. Has anything changed? If so,
  - What could be the reason for the change?

  - Which is the IP address of the Google site (www.google.com)?
  - n your opinion, what is the reason of having several IP addresses as an output?
- Find out name of the IP address 127.0.0.1. What is special about this IP address

The equivalent command in windows is nslookup.

Exercise 02: Use ping to test host reachability

Are the following hosts reachable from your machine by using ping:

- www.ensia.edu.dz
- www.cerist.com
- www.mit.edu
- www.intel.com
- www.algeria.dz
- www.hola.hp
- www.amazon.com
- www.tsinghua.edu.cn
- www.kremlin.ru
- 8.8.8.8

If you observe that some hosts are not reachable, then can you explain why? Check if the addresses unreachable by the ping command are reachable from the Web browser.

Exercise 03: Use traceroute to understand network topology

When two computers (end-systems) communicate with each other over the Internet, their communication traverses multiple packet switches. There are two general types of packet switches on the Internet: link-layer switches and network-layer switches (the latter are also called routers).

The traceroute utility lists the routers that are located between your computer and a remote one. e.g., if you type traceroute target in the command line, where target is a website name or IP address, that will display a list of router names and/or IP addresses and the RTTs that were measured between your computer and each router.

(a) Run traceroute on your machine to www.mit.edu

(b) How many routers are there between your workstation and www.mit.edu ?

(c) Between which two routers do packets cross the Atlantic Ocean?

Run traceroute from your machine to the following destinations: (I)www.ucla.edu (II)www.u-tokyo.ac.jp and (III)www.lancaster.ac.uk.

(a) At which router do the paths from your machine to these three destinations diverge?

(b) Find out further details about this router.

(c) Is the number of hops on each path proportional to the physical distance?

Several servers distributed around the world provide a web interface from which you can perform a traceroute to any other host in the Internet. Here are two examples:
(I) http://www.speedtest.com.sg/tr.php and (ii) https://www.telstra.net/cgi-bin/trace. You can find other traceroute servers at www.traceroute.org

(a) Run traceroute from both these servers towards your machine and in the reverse direction (i.e. from your machine to these servers)

(b) What are the IP addresses of the two servers that you have chosen?

(c) Does the reverse path go through the same routers as the forward path?

(d) If you observe common routers between the forward and the reverse path, do you also observe the same IP addresses? Why or why not?

The equivalent command in windows is tracert.

Exercise 04: Use ping to gain insights into network performance

For each of these locations (www.qu.edu.qa , www.nd.edu , www.imperial.ac.uk) find the (approximate) physical distance from ENSIA using Google Maps and compute the shortest possible time T for a packet to reach that location from ENSIA. You should assume that the packet moves (i.e. propagates) at the speed of light, 3 x 108 m/s. Note that the shortest possible time will simply be the distance divided by the propagation speed. Plot a graph where the x-axis represents the distance to each city (i.e. Doha, Indiana and London), and the y-axis represents the ratio between the minimum delay (i.e. RTT) as measured by the ping program (select the values for 50 byte packets) and the shortest possible time T to reach that city from ENSIA. (Note that the y-values are no smaller than 2 since it takes at least 2*T time for any packet to reach the destination from ENSIA and get back).

(a) Can you think of at least two reasons why the y-axis values that you plot are greater than 2?

(b) Is the delay to the destinations constant or does it vary over time? Explain why.

(c) The measured delay (i.e., the delay you can see in the graphs) is composed of propagation delay, transmission delay, processing delay and queuing delay. Which of these delays depend on the packet size and which do not?