V.0.1.1

Practical Exercises in Computer Networks and Distributed Systems

Reference Solutions to Questionnaire on the Conceptual Basis chapter of CN

The following questions are meant for you to review the concepts and structures we introduced in the first lecture and lab. I recommend that you have at hand the textbook and the relevant lecture presentation (Conceptual Basis chapter, sections 1 and 2) and lab script so you can readily consult the materials as you work each question.

1. Name the types of networking equipment you can recall from the lecture and the lab session of this week.
   We briefly introduced Hosts, NIC's (Network Interface Cards), Switches and IP Routers

2. Regarding the concept of value of a network (Metcalf's Law), what role do you think scalability plays in this context?
   Metcalf's law states that the value of a network that has N hosts increases with N^2. This law, however, assumes that the one-to-one communication capability is preserved as we increase N, which is not true for all the technologies (See Figure 1, also included in the presentation of the first lecture).

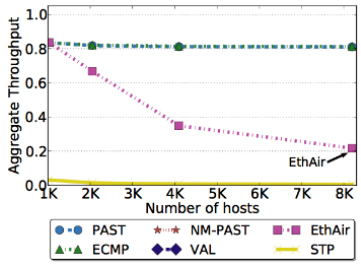

Figure 1: Not all network technologies scale equally

   When a technology is not capable of providing its function when the number of users (In our case, the number of hosts, represented by N) grows beyond some value N_0, we state it doesn't scale beyond N_0. All in all, Metcalf's law doesn't consider whether the network technology under study scales well or not.

3. The network architectures relevant to this course (CN), are they organized into layers or otherwise?
   The two network architectures considered in this course are organized into 4 layers (TCP/IP) and 7 layers (OSI). Each layer is to be conceived as black box that offers services to the upper layers. Upper layers access the services offered by lower layers by way of *service interfaces*. Each layer, in fulfilling their responsibilities interacts with the counterpart layer at the remote communicating system, that interaction comprises the so-called *peer-to-peer* interface. Each layer includes a number of protocols, each of them conforms to a peer-to-peer interface (Remote communicating system), and offers its service by way of a service interface (To upper layers). The remote communicating systems can be, either hosts or network nodes.

4. What do you think is the most significant difference between the OSI and the Internet (TCP/IP) architecture?

Besides the fact that the number of layers are different, the most significant difference stems from the OSI Architecture enacting strict layering, *i.e.,* an application can only use the services provided by the protocols belonging to their contiguous lower layer protocol. In the TCP/IP architecture, applications can call whichever SIF (Service Interface), from any of the underlying lower layers.

5. Consult the lecture presentation mentioned above to determine what the network layer does
   Let's consider the Internet Architecture. The network layer in this architecture is the second layer and its main responsibility consists in interconnecting the sundry of different subnetwork technologies and forming a uniform, logical internetwork.

6. Which of the Internet applications mentioned in the lecture (Slide no. 4) do you think is the most challenging for the network?
   In my opinion, it's Video Conferencing the application that poses that highest requirements over the network.

7. In which units is the bandwidth of your internet access specified: bits, bytes, bits per sec or bytes per sec?
   The point-to-point bandwidth of your internet access connection is usually specified in Mbps, ie., Mega bits per second or $\frac{Mbits}{sec} = \frac{10^6\ bits}{sec}$

8. Calculate the maximum potential connectivity of a network comprised of 10 IP routers.
   The maximum potential bidirectional connectivity reachable with 10 routers is equal to 10 ·(10-1) = 90