**ESCUELA TÉCNICA SUPERIOR DE INGENIERÍA
INFORMÁTICA**
Departamento de Tecnología Electrónica

Computer Networks

**Theoretical Study of Lab session 2:
Architecture in layers. Basic tools.**

Layered architecture. Basic tools.

Objectives of the lab session

- Manage the ping tool for connectivity tests and round-trip delay measurement from a final system.
- Manage the tracert tool for measuring the delay from round trip.
- Handle the ipconfig tool to view the TCP/IP configuration of an end system with Windows OS.
- Relate the different elements (hardware/software) that appear in the laboratory with the OSI reference model and the TCP/IP architecture.
- Familiarize the student with the basic handling of a protocol analyzer (Wireshark, can be downloaded from http://www.wireshark.org/download.html.

Previous study

In addition to studying the entire theory of topic 1, the following questions must be resolved **in a justified and handwritten manner**, before the laboratory session:

1. Determine the name given to the level that handles datagram routing and forwarding functions in the TCP/IP architecture, indicating how peer-to-peer entities at this level exchange PDUs. Briefly explain, with the help of a graph, how the encapsulation process performs this level.

2. Make a graph showing two end systems, A and B, connected by a router. The graph should show for each device the layers it uses and for each layer which even entities are communicating with each other. Assume that the TCP/IP reference model is used.

3. Assume that the final system A in the previous section sends a message (A_PDU, application-level PDU) containing 1200 bytes of A_UD (application-level UDs) to B and that the final system B immediately returns a response message of 600 bytes of A_UD to A. The time from when A starts transmitting until it receives the full response is 11.8 ms. Justifiably determine the value of R (in bps) of the link between B and the router, as well as the nodal delay that occurs in the router when resending each of the messages. To solve the problem more simply, make the following assumptions, although you should know that the values of this data could be different in a real system:

    a. Each level, except the physical level, adds 10 PCI bytes.

    b. The processing delay, dproc, is so small that it can be neglected.

    c. The propagation delay, dprop, is 0.07 ms on the two communication links.

    d. There are no other end systems, apart from A and B, generating traffic on the network.

    e. The bandwidth of the link between A and the router is 8 Mbps.

4. Find out the meaning of the following acronyms1 for typical Internet protocol names: HTTP, DNS, TCP, UDP, and IP. In addition, for each of those protocols, you must indicate at which level of the TCP/IP architecture it performs its functions.

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[1] You can consult the bibliography or the Internet.