Telematic Applications

Academic Year: (2020 / 2021) **Review date: 03-07-2020**

Department assigned to the subject: Telematic Engineering Department

Coordinating teacher: CAMPO VAZQUEZ, MARIA CELESTE

Type: Compulsory ECTS Credits : 6.0

Year : 3 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Access Networks and Shared Media
Communications Networks and Services
Systems Architecture I
Systems Programming

OBJECTIVES

The goal of this subject is to study the end-to-end protocols that support Internet applications, i.e., the advanced aspects of transport layer protocols, and the main application layer protocols: DNS, e-mail, file transfer, remote terminal, web, etc.
The student will acquire the following competences:
- Understanding the advanced functions of the transport layer protocols (e.g., the flow control and congestion control mechanisms in TCP).
- Knowing the basic principles of cryptography and security, symmetric and public key algorithms, digital signature, message digest, public key infrastructure, security in transport layer (TLS) and application layer.
- Knowing the architecture, message format, and how the different application layer protocols studied in the subject work: name service, file transfer, remote terminal, e-mail. Web, and time protocol.
- Being able to program applications using sockets.
- Solving practical cases of use of the different application layer protocols in different computer networks.
The general skills are:
- (PO a) ability to apply knowledge telecommunication technologies and engineering, specifically the ones related with transport and application layer protocols.
- (PO e) ability to identify, formulate, and solve engineering problems related with communication protocols at the network and application layers.
- (PO i) recognize the need for, and an ability to engage in life-long learning. Students will have to obtain information for self-study and for the practice from Internet standards (RFCs).

DESCRIPTION OF CONTENTS: PROGRAMME

The content of the program will be the following:
1. Advanced aspects of transport protocols
- Introduction to TCP
- Establishing and finishing connections. State diagram. Massive and interactive traffic. TCP algorithms: Nagle, slow start, congestion control, fast recovery/fast retransmit, etc.
- TCP timers: retransmission, persistence, keep-alive. Calculus and practical considerations.
- New variants of TCP.
- Programming applications using sockets.
2. Security in application and transport layer protocols.
- Basic principles: Symmetric Key Cryptography, Public Key Encryption, Message Integrity and Digital Signatures
- Securing TCP Connections (TLS) and application.
3. Domain name servers: DNS
4. Synchronization protocols: NTP
5. Classic protocols:
- Remote login: telnet y rlogin
- File transfer: FTP y TFTP
6. E-mail:
- Formats: RFC 822, MIME
- Sending protocols: SMTP

- Final delivery protocols: POP e IMAP
7. Web: HTTP.
- HTTP/1.0.
- HTTP/1.1.
- Content Distribution Networks
- HTTP/2, HTTP/3, QUIC, CoAP

LEARNING ACTIVITIES AND METHODOLOGY

- Theoretical lectures. The teacher will present the main concepts. Participation of the students, interactions, and discussions about the presented problems will be promoted (PO a, i).
- Practical exercises. Sessions in which the teacher will raise some problems that will allow the students to propose and analyze some solutions (PO e).
- Practices in lab. Sessions in which the student will have to solve some simple problems that illustrate the behavior of the different protocols studied in the subject, and a big practice consisting in the implementation of a protocol (PO i).

ASSESSMENT SYSTEM

- Practices and exercises: 70%. Practices and exercises made in the lab will be evaluated. The students will develop a project working in teams. It will consist on:
* The implementation of a client and/or a server following the specification of an application layer protocol, in which the knowledge and capacities acquired in the course will have to be applied (PO a, e). This protocol will complement some of the ones studied in the theoretical lectures. It will be based on an RFC-like specification (PO i). The mark obtained in this part will be the 20% of the final mark.
* Guided practical assignments about different protocols. The mark obtained in this part will be the 50% of the final mark.

- Final exam: 30%. It will consist on a written exam to assess both the theoretical and the practical concepts acquired by the student (PO a, e). It will be neccessary to obtain at least 4.0 points over 10 in this part to pass the subject.

As an alternative to the continuous evaluation, there will be a final exam with a total value of 60% in the ordinary exam, and of 100% in the extraordinary exam, for the students that will decide not to integrate in the previous scheme of continuous evaluation

% end-of-term-examination:	30
% of continuous assessment (assigments, laboratory, practicals…):	70

BASIC BIBLIOGRAPHY

- - RFCs of the protocols (see references in the course material)., -.

- Ilya Grigorik "High Performance Browser Networking" (available in https://hpbn.co/), O'Reilly, 2013/2015

- Kevin R. Fall; W. Richard Stevens "TCP/IP Illustrated, Volume 1: The Protocols, 2/E", Addison-Wesley Professional, 2011
- Kurose, James F.; Ross, Keith W. "Computer Networking: A Top-Down Approach 7ed", Pearson Education, 2016

- W.R. Stevens "TCP/IP Illustrated Vol.1 The protocols", Prentice Hall, 1993

- Ying-Dar Lin, Ren-Hung Hwang, Fred Baker "Computer networks: an open source approach", McGraw-Hill, 2012

ADDITIONAL BIBLIOGRAPHY

- Andrew S. Tanenbaum "Computer Networks" 5ed, Prentice Hall International, 2011

- B. Forouzan "TCP/IP Protocol Suite" 4ed, McGraw-Hill, 2010

- Barry Pollard HTTP/2 in Action (https://learning.oreilly.com/library/view/http2-in-action/9781617295164/), Manning Publications, 2019
- Dordal, Peter L An Introduction to Computer Networks (http://intronetworks.cs.luc.edu), Department of Computer Science. Loyola University Chicago, 2019
- Dr. W. Li, C. Matthews, L. Parziale, N. Rosselot, C. Davis, J. Forrester and D. T. Britt "TCP/IP Tutorial and Technical Overview", IBM Redbooks, 2006