Advanced multimedia services

Academic Year: (2022 / 2023) **Review date: 13-05-2022**

Department assigned to the subject: Department of Telematic Engineering

Coordinating teacher: GARCIA MARTINEZ, ALBERTO

Type: Compulsory ECTS Credits : 6.0

Year : 1 Semester : 1

OBJECTIVES

- Ability to communicate conclusions and the knowledge and rationale underpinning to specialists and non-specialists in a clear and unambiguous way (Basic Competence 9, General Competence 11).
- That the students acquire learning skills that enable them to continue studying in a way that will be largely self-directed or autonomous (Basic Competence 10, General Competence 12).
- Ability to design, calculate and design products, processes and facilities in all areas of Telecommunication Engineering (General Competence 1).
- Ability to design and dimension transport, diffusion and distribution networks for multimedia contents (Specific Competence 4).
- Ability to model, design, deploy, manage, operate, administrate and maintain networks, services and contents (Specific Competence 6).
- Capacity for planning, decision making and packaging of networks, services and applications considering the quality of service, direct and operation costs, deploying plan, monitoring, safety procedures, scaling and maintenance, as well as manage and ensure quality in the development process (Specific Competence 7).
- Ability to understand and apply the working principles and organization of the Internet, the technologies and protocols related with next generation Internet, component models, intermediate software and services (Specific Competence 8).
- Ability to solve the convergence, interoperability and design of heterogeneous networks with local networks, access and trunk, as well as the integration of telephony, data, television and interactive services (Specific Competence 9).

To acquire specific skills, the subject is coordinated with the Design and Operation of Communications Networks (DORC) as follows: DORC addresses aspects of provision and multimedia content delivery fundamentally at the link and network layers, from the point of view of the organization which deploys the networks. On the other hand, the course of Advanced Multimedia Services addresses transport level and application related with multimedia service, with emphasis on end-to-end communication, from the point of view of the user and the developer of multimedia software.

DESCRIPTION OF CONTENTS: PROGRAMME

1. Requirements and techniques for the transmission of multimedia information
   - 1.1 Requirements according to the ITU-T G.1010 standard
   - 1.2 Transmission of non-interactive media over TCP
     - 1.2.1 Performance analysis
   - 1.3 Transmission of interactive media
     - 1.3.1 Buffering
     - 1.3.2 Analysis of the use of TCP for interactive media transmission
     - 1.3.3 Analysis of the use of UDP for interactive media transmission
       - 1.3.3.1 Need for timestamps and sequence numbers
     - 1.3.4 VoIP system architecture

2 RTP protocol
   - 2.1 RTP session
   - 2.2 RTP packet format
   - 2.3 RTCP
     - 2.3.1 RTCP functionality
       - 2.3.1.1 Round-trip time and jitter estimation
     - 2.3.2 RTCP message format

3. Developing applications for multimedia content transport

3.1 Linux soundcard programming
3.2 select-based architecture for a multimedia application
3.3 Circular bufer
3.4 Communications programming using the socket interface

4. The SIP protocol
4.1. Introduction to the architecture, components and messages.
4.2 The SIP RFCs umbrella and protocol use cases.
4.3. Message sequences and state machines. SIP transactions.
4.4. Error cases, timers and call routing decisions.

5. SIP services programming
5.1. Frameworks.
5.1.1. Overview
5.1.2. User Agent deployable services
5.1.3. Network element deployable services
5.2. The SIP Proxy as a service execution entity.
5.2.1. Events, triggers and processing.
5.2.2. Service containers.
5.3. SIP Servlets.
5.3.1. Architecture
5.3.2 APIs

6. User service programming in XML
6.1. XML APIs in JAVA.
6.2. Introduction to JAXB

LEARNING ACTIVITIES AND METHODOLOGY

- Lectures, aimed to present and promote discussion with students about technology associated to the subject.
- Practices in pairs for completing two case studies. Students must make two medium-sized projects to acquire the specific competences of the subject, the capacity for teamwork, ability to self-management and self-learning and decomposition of complex problems into parts.
- Personal work and study of the student. Specially oriented to the acquisition of the capacity for self-organization and planning of individual work and learning process.

ASSESSMENT SYSTEM

The course is structured in two parts, the first focuses on the transport of multimedia data, and the second focused on signaling for multimedia communications. Each part includes theoretical content and implementation of a medium-sized project in pairs. The two projects will be carried out throughout the course with the support of the instructors and will be the basis on which to evaluate the course, part through a delivery at the end of the teaching period as a continuous evaluation of the work done and part as a final exam. In this way, both group work and personal contribution to the project can be evaluated.

In particular, the student's grade is calculated by adding:
- 50% for project evaluation conducted in the laboratory to share multimedia data transport, assessed by a personalized review of the work performed consisting of application tests, questions on the implementation and evaluation of a project summary made by the students. The code delivery will be done in two phases. A first before the end of the semester as continuous evaluation and another before the date of the final exam as a basis for it.
- 50% for project evaluation conducted in the laboratory to share multimedia communications signaling, assessed by a personalized review of the work performed consisting of application tests, questions on the implementation and evaluation of a project summary made by the students. The code delivery will be done in two phases. A first before the end of the semester as continuous evaluation and another before the date of the final exam as a basis for it.

The pairs are formed, for each part, considering the results of a test of knowledge of the issues each party related protocols and networks for multimedia communication and multimedia applications programming. In addition, each of these parts allows for up to 5% additional points on the grade for the course.

A minimum grade of each part 4 out of 10 is required.

For the extraordinary evaluation period, the evaluation will consist of the lab parts. The student, if desired, may be examined only a part ('transport of multimedia data' or 'signaling multimedia

communications'), keeping in that case the grade obtained in the regular evaluation period of the other party, but only if the note of the stored portion is greater than 5 out of 10.

% end-of-term-examination:	60
% of continuous assessment (assigments, laboratory, practicals…):	40

BASIC BIBLIOGRAPHY

- Alan B. Johnston SIP: Understanding the Session Initiation Protocol, Artech House Telecommunications Library, 2009
- Alberto García Media Communications, Technical Report (disponible en Aula Global).

BASIC ELECTRONIC RESOURCES

- . JSR-000289 SIP Servlet : https://jcp.org/aboutJava/communityprocess/final/jsr289/
- . rfc3261: SIP: Session Initiation Protocol: https://www.ietf.org/rfc/rfc3261.txt
- . Programming XML in Java: http://www.javaworld.com/article/2076282/java-xml/programming-xml-in-java--part-1.html
- D. Wing . RFC4961. Symmetric RTP / RTP Control Protocol (RTCP): http://www.rfc-editor.org/info/rfc4961
- H. Schulzrinne, S. Casner . RFC3551, RTP Profile for Audio and Video Conferences with Minimal Control: http://www.rfc-editor.org/info/rfc3551
- H. Schulzrinne, S. Casner, R. Frederick, V. Jacobson . RFC3550, RTP: A Transport Protocol for Real-Time Applications: http://www.rfc-editor.org/info/rfc3550
- Jens Gustedt . Modern C: http://icube-icps.unistra.fr/img_auth.php/d/db/ModernC.pdf