Subject: Multimedia Networks
Code: 18476
Center: Escuela Politécnica Superior
Degree: Telecommunication Technologies and Services Engineering
Level: Undergraduate
Type: Core Course
ECTS: 6

1. COURSE TITLE

Multimedia Networks (RRM)

1.1. Course number

18504 at the Telecommunication Technologies and Services Engineering degree

1.2. Course area

Multimedia networks technology

1.3. Course type

Core course complementary to the Video and Audio processing and communications branch (PCAV)

1.4. Course level

Undergraduate

1.5. Year

3nd

1.6. Semester

2nd

1.7. Credit allotment

6 ECTS credits

1.8. Prerequisites

Multimedia Networks is part of the Video and Audio processing and communications subject. It is necessary to enroll first *Network Architecture I* and *Network Architecture II* as well as those courses that are necessary for them.

It is recommended to verify the comprehension of the contents and basic skills of this subject by solving the Problem Guides, which can be complemented with other proposed and/or solved cases in the bibliography. The electronic material is available in the Moodle platform (http://moodle.uam.es). It is recommended to have English

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reading skills, because the documentation of the international standards (IEEE, ETSI, etc.), as well as vendors (data sheets, etc.) are written in English. Personal initiative and design tenacity are also required to design and start up lab assignments. Finally, it is also important to have work group skills.

1.9.   Minimum attendance requirement

Two methods are proposed: continuous and non-continuous assessment, both for theory and practice. All students are continuous assessed by default.

Continuous assessment for theory is done if the students do with a minimum score all the proposed activities in the course. Lecture attendance is not mandatory but recommended. There can be, without prior notice, tests for the assessment. If a student does not attend that session, s/he will leave the continuous assessment.

Continuous assessment for practice is done if the students attend and do all the activities in the laboratory. The students can miss a maximum of two sessions just in very justified cases, and they have to present the results of these sessions anyway. If the student misses more sessions, s/he will leave the continuous assessment.

1.10.   Faculty data

Add @uam.es to all email addresses below.

Theory:

> **Dr. Luis de Pedro Sánchez** (Coordinator)
> Departamento TEC
> Escuela Politécnica Superior
> Office - C-227
> Phone: +34 91 497 25 22
> e-mail: luis.depedro
> Web page: http://www.eps.uam.es/~ldepedro
> Student meetings: Agree previously by e-mail.

Laboratory:
> **Dr. Jorge López de Vergara** (Coordinator)
> Departamento TEC
> Escuela Politécnica Superior
> Office – C224
> Phone: +34 91 497 2246
> e-mail: jorge.lopez_vergara@uam.es
> Web page: http://www.eps.uam.es/~jlopezv
> Student meetings: Agree previously by e-mail.

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1.11.   Course objectives

Multimedia Networks is an introductory course to the architecture of multimedia networks designed to transport multimedia contents. It is intended that students acquire knowledge on the general foundations of these architectures and the technologies used in them. The course is aimed at developing students' ability to understand and apply the fundamental ideas that govern the design of the architecture of modern multimedia communication networks to real problems.

The **specific competencies** to be acquired in this course are:

CORM1 Ability to build, operate and manage communications networks, services, processes and applications, including acquiring systems, transportation layers, rendering, processing and storage of multimedia contents, all considered from networking point of view

CORM2 Ability to design multimedia networks and services

The **results** to be obtained in this course are:

RRM1 Ability to apply quality of service techniques (QoS) and traffic engineering to match traffic flow requisites to networking performance

RRM2 Ability to program, simulate and validate communications services and applications for multimedia contents

RRM3 Ability to integrate acquiring, rendering, processing and storage systems of multimedia contents to set up multimedia applications and services

The objectives to be achieved with this subject are:

GENERAL OBJECTIVES	
G1	Understand the general principles of multimedia networks architectures
G2	Understand performance issues in multimedia networks
G3	Understand and apply general principles of quality of services in multimedia networks

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UNIT BY UNIT SPECIFIC OBJECTIVES	

UNIT 1.- INTRODUCTION	
1.1.	Understand Multimedia networks principles
1.2.	Understand multimedia networks features
1.3.	Understand the main switching technologies used in multimedia networks
1.4.	Understand and apply quality, performance and perceived quality concepts in multimedia networks
1.5.	Understand the rationale of multimedia networks layer architecture
1.6.	List the main performance problems in modern multimedia networks
1.7.	List the main QoS problems in multimedia networks

UNIT 2.- PERFORMANCE	
2.1.	Understand and apply jitter problems and related solutions
2.2.	Understand the problems and apply solutions related to multimedia contents transmission delay
2.3.	Understand the problems and apply solutions related to multimedia contents Bandwidth limitations
2.4.	Understand the problems and apply solutions related to multimedia wireless networks

UNIT 3.- MULTICAST	
3.1.	Understand multicast protocols general principles
3.2.	Understand multicast protocols over IP networks
3.3.	Understand multicast protocols design principles
3.4.	Understand multicast protocols applications to multimedia contents transmission

UNIT 4.- MULTIMEDIA PROTOCOLS	
4.1	Understand and apply SIP protocol architecture design principles
4.2	Understand and apply RTSP protocol architecture design principles
4.3	Understand and apply RTP protocol architecture design principles
4.4	Understand and apply RTCP protocol architecture design principles
4.5	Understand and apply VoIP architecture design principles
4.6	Understand and apply IPTV architecture design principles

UNIT 5.- TRAFFIC ENGINEERING AND QUALITY OF SERVICE	
5.1.	Understand and apply MPLS protocol architecture design principles
5.2.	Understand DiffServ and IntServ QoS concepts
5.3.	Understand and apply RSVP protocol architecture design principles
5.4.	Understand the main queuing architectures and the consequences for traffic performance

TEMA 6.- CONTENT DISTRIBUTION NETWORKS	
6.1.	Understand multimedia CDN architecture design principles
6.2.	Understand CDN architecture
6.3.	Understand OTT architecture

1.12. Course contents

Syllabus Overview

UNIT 1. Introduction
UNIT 2. Performance
UNIT 3. Multicast
UNIT 4. Multimedia Protocols
UNIT 5. Traffic Engineering and Quality of Service
UNIT 6. Content Distribution Networks

Detailed Syllabus

1.- INTRODUCTION
  1.1 Multimedia Networks Introduction
  1.2 Multimedia Networks Applications
  1.3 Audio and Video Streaming
  1.4 Best effort delivery optimum utilization
  1.5 Interactive and real time applications protocols
  1.6 Multiple Service classes
  1.7 Quality of service
  1.8 Problems
2.- PERFORMANCE
  2.1 Introduction to Multimedia Networks Performance RRM
  2.2 Jitter
  2.3 Multimedia Networks delay
  2.4 Multimedia Networks Bandwidth
  2.5 Wireless networks performance
  2.6 Problems
3.- MULTICAST
  3.1 Introduction to Multicast Architecture
  3.2 IP multicast
  3.3 Multimedia applications
  3.4 Problems
4.- MULTIMEDIA PROTOCOLS
  4.1 Introduction
  4.2 SIP
  4.3 RTSP
  4.4 RTP
  4.5 RTCP
  4.6 VoIP
  4.7 IPTV architecture

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1.13.   Course bibliography

1. **Multimedia Communications: Protocols and Applications**, Prentice Hall, 1998 (optional textbook). - Franklin Kuo, J.J Luna-Aceves, and Wolfgan Effelsberg

2. **Computer Networking: A Top-Down Approach Featuring the Internet**, Addison Wesley, 2003 (reference) - James Kurose and Keith Ross

3. **Computer Networking: A Top-Down Approach (4th edition**), by J. Kurose and K. Ross, Addison-Wesley, 2008.

4. **Multimedia Communications: Protocols and Applications**, F. Kuo, W. Effelsberg, and J.Garcia-Luna-Aceves, Prentice Hall PTR, 2000.

5. **QoS in Packet Networks** , by Kun I. Park, Springer 2005.

6. **Introduction To Multimedia Communications**, by K. R. Rao, Z. S. Bojkovic, D. A. Milovanovic,Wiley Interscience, 2006.

7. **Multimedia over IP and Wireless Networks: Compression, Networking, and Systems**, by M. Van der Schaar, P. Chou, Academic Press, 2007.

8. **Multimedia Communications Applications, Networks, Protocols and Standards** Fred Halsall, Addison Wesley, 2001, ISBN: 0-201-39818-4

9. **Packet Video Communications over ATM Networks** K.R. Rao and Z.S. Bojkovic, Prentice Hall, 2000, ISBN: 0-13-011518-5

10. **Wireless Video Communications Second to Third Generation Systems and Beyond** Lajos Hanzo, Peter J. Cherriman and Jurgen Streit, IEEE Series on Digital and Mobile Communications, John B. Anderson, Series Editor, ISBN: 0-7803-6032-X,IEEE order number PC5880.

11. **Emerging Multimedia Computer Communication Technologies,**Chwan-Hwa Wu and J.D. Irwin, Prentice Hall, 1998, ISBN: 0-13-079967-X