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

1. COURSE TITLE

Network Architecture I (AR1)

1.1. Course number

18476 at the Telecommunication Technologies and Services Engineering degree

1.2. Course area

Network Architecture

1.3. Course type

Core course common to the Telecommunications Branch

1.4. Course level

Undergraduate

1.5. Year

2nd

1.6. Semester

1st

1.7. Credit allotment

6 ECTS credits

1.8. Prerequisites

Network Architecture I is part of the Network Architecture subject (12 ECTS credits) in the Syllabus. This subject is split in two semesters: *Network Architecture I* and *Network Architecture II*. This course is given in the first semester of the second course, and it is necessary to enroll first *Programming I and II*, as well as those courses that are necessary for them. This course is a prerequisite for *Network Architecture II* in the second semester, second year.
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://www.uam-virtual.es). It is recommended to have English 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.ii.uam.es/~ldepedro
Student meetings: Agree previously by e-mail.

Laboratory:

Pedro María Santiago del Río
Departamento TEC
Escuela Politécnica Superior
Lab: C-113
Phone: +34 91 497 22 68
e-mail: pedro.santiago

Juan Antonio Andrés
Departamento TEC
Escuela Politécnica Superior
Lab: C-113
Phone: +34 91 497 22 68
e-mail: juanantonio.andres@uam.es

1.11. Course objectives

Network Architecture I is an introductory course to the architecture of communication networks that precedes *Network Architecture II*. 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 communication networks to real problems.

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

CO7: Knowledge and use of the fundamentals of network, systems and telecommunications services programming.

CO12: Knowledge and use of the concepts of network architecture, protocols and communication interfaces.

CO13: Capacity to differentiate the concepts of access and transport networks, circuit switching networks and packets, fixed and mobile networks as well as distributed network systems and applications, voice, data, audio, video and interactive and multimedia services.

CO14: Knowledge of network connection and routing methods as well as the fundamentals of planning, network dimensioning according to traffic parameters.

The objectives to be achieved with this subject are:

GENERAL OBJECTIVES	
G1	Understand the general principles of computer networks architectures
G2	Understand and apply general principles of computer networks applications
G3	Understand the transport layer components in computer networks
G4	Understand the network layer components in computer networks

UNIT BY UNIT SPECIFIC OBJECTIVES

UNIT 1.- INTRODUCTION	
1.1.	Understand Internet principles and associated services
1.2.	Understand access networks features
1.3.	Understand the main switching technologies used in backbone networks
1.4.	Understand and apply packet networks concepts: delay, packet loss, bandwidth
1.5.	Understand the rationale of computer networks layer architecture
1.6.	List the main security problems in modern computer networks
1.7.	List the main milestones in computer networks history
UNIT 2.- APPLICATION LAYER	
2.1.	Understand computer networks applications design principles
2.2.	Describe, recognize in traces and apply HTTP features
2.3.	Describe, recognize in traces and apply FTP features
2.4.	Describe, recognize in traces and apply e-mail features
2.5.	Describe, recognize in traces and apply DNS features. Design a DNS server
2.6.	Design a peer-to-peer application
2.7.	Program applications using sockets API
UNIT 3.- TRANSPORT LAYER	
3.1.	Understand general principles of transport layers
3.2.	Describe, recognize in traces and apply UDP features
3.3.	Understand multiplexation an demultiplexation principles
3.4.	List reliable communications principles
3.5.	Describe, recognize in traces TCP features and architecture
3.6.	Describe congestion avoidance principles
3.7.	Describe, recognize in traces TCP congestion avoidance principles
UNIT 4.- NETWORK LAYER	
4.1	Understand forwarding and routing concepts
4.2	Understand virtual circuit and datagram concepts
4.3	Explain router operations using packet switching principles
4.4	Design IPv4 network addressing and topology
4.5	Understand and apply routing algorithms (distance vector, link state)
4.6	Design routing architecture for a computer network
4.7	Describe multicast and broadcast routing

1.12. Course contents

Syllabus overview

UNIT 1. Introduction
UNIT 2. Application Layer
UNIT 3. Transport Layer
UNIT 4. Network Layer

Detailed Syllabus

1. INTRODUCTION
- 1.1. Internet
- 1.2. Access Networks
- 1.3. Backbone Networks
- 1.4. Delay, Loss and Bandwidth
- 1.5. Layered architecture
- 1.6. Security principles
- 1.7. Computer Networks history
- 1.8. Examples

2.- APPLICATION LAYER
- 2.1. Design principles
- 2.2. HTTP and Web
- 2.3. File transfer service: FTP
- 2.4. E-mail
- 2.5. Internet directory service: DNS
- 2.6. Peer-to-peer applications
- 2.7. Application programming in UDP
- 2.8. Application programming in TCP
- 2.9. Examples

3.- TRANSPORT LAYER
- 3.1. Introduction
- 3.2. Multiplexation and demultiplexation
- 3.3. UDP protocol
- 3.4. Reliable communications design principles
- 3.5. TCP protocol
- 3.6. Congestion control design principles
- 3.7. TCP congestion control
- 3.8. Examples

4.- NETWORK LAYER
- 4.1. Introduction
- 4.2. Virtual circuits and datagrams
- 4.3. Switching architectures
- 4.4. IP protocol
- 4.5. Dynamic routing algorithms
- 4.6. Internet routing
- 4.7. Multicast and broadcast routing
- 4.8. Examples

1.13. Course bibliography

Basic:

"Computer Networking", James F. Kurose, Keith W. Ross, Ed. Addison-Wesley, 5th ed. (*topics 2-5*)

"Fundamentals of Queueing Theory", Donald Gross, Carl M. Harris, Ed. Wiley, 4th ed. (*topic 1*)

Complementary:

"Redes de computadoras", Andrew. S Tanenbaum, Ed. Prentice Hall. 4th ed. (topics *2-5*)

"Comunicaciones y redes de computadores", William Stallings, Ed. Prentice Hall, 7th ed. (*topics 2-5*)

"Communication Networks. Fundamental concepts and key architectures", Alberto Leon-Garcia, Indra Widjaja, Ed. McGraw-Hill. 2nd ed. (*topics 1-5*)