Course guide
230041 - IX - Network Infrastructure

Last modified: 24/05/2024

Unit in charge:	Barcelona School of Telecommunications Engineering
Teaching unit:	744 - ENTEL - Department of Network Engineering.

Degree:	BACHELOR'S DEGREE IN TELECOMMUNICATIONS TECHNOLOGIES AND SERVICES ENGINEERING (Syllabus 2015). (Optional subject).

Academic year: 2024   **ECTS Credits:** 6.0   **Languages:** Catalan

LECTURER

Coordinating lecturer:	XAVIER HESSELBACH SERRA
Others:	Primer quadrimestre: JORDI CASADEMONT SERRA - 51 XAVIER HESSELBACH SERRA - 51
	Segon quadrimestre: JORDI CASADEMONT SERRA - 11, 13 XAVIER HESSELBACH SERRA - 11, 13

PRIOR SKILLS

Protocols architectures.
Switching strategies.
Definitions and basic concepts in circuits and packets networks.
MAC protocols. Deterministic and random, centralized and distributed.
Protocols and services in Internet (basic level).
Probability and stochastic processes.
Propagation in copper and optical fiber.
Digital signals modulation.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Generical:
10 ECI N3. They will have acquired knowledge related to experiments and laboratory instruments and will be competent in a laboratory environment in the ICC field. They will know how to use the instruments and tools of telecommunications and electronic engineering and how to interpret manuals and specifications. They will be able to evaluate the errors and limitations associated with simulation measures and results.

TEACHING METHODOLOGY

Application sessions
Lectures
Laboratory sessions
Works in groups (not in classroom)
Individual works (not in classroom)
Short questions exams (control)
Short questions exams (Test)
Long questions exams (Final exam)
Laboratory exercises

LEARNING OBJECTIVES OF THE SUBJECT

The main goal of this subject is the introduction of the concepts and current technologies in networks infrastructures. The subject shows the physical layer in order to transmit information, services, the data and control planes and the classificaction of the networks in access, transport and broadcast.

The student will be able to identify and study the problems, the current existing solutions and the tendecies, in order to learn procedures to take decisions among available technologies.

Learning procedure outputs:

- Skills to build, exploit and manage networks, services, processes and applications in teleccomunications, from the view of Internet services.
- Understand and use the concepts of quality of service in several scenarios.
- Utilize the tools to build, exploit and manage the Internet services, including web and multimedia information.
- Protocols and interfaces in the protocols architecture, including the knowledge to program them, test and optimize.
- Learn the technological challenges in transmission and switching in networking and services.
- Use of books and papers, including skills to write a report or technical work in english, including the capacity to participate in technical meetings.
- Individual use of the tools and software applications of the labs ranging from basic to advances concepts. Discover the procedures and limitations.

STUDY LOAD

Type	Hours	Percentage
Hours small group	26,0	17.33
Self study	85,0	56.67
Hours large group	39,0	26.00

Total learning time: 150 h

CONTENTS

Topic 1. Introduction.

Description:
Concepts review
Definitions

Related activities:
Lab:
Introduction and fundamental concepts..(3 weeks)
Types of devices and wires
Devices configuration
Topologies
Parameters and metrics
Evaluation tools

Full-or-part-time: 14h
Theory classes: 2h
Laboratory classes: 6h
Self study : 6h

Topic 2. Access networks

Description:
Local loop
Features
Local loop model
Unbundled local loop
Twisted pair access networks. xDSL
Types and features
Hybrid fiber coaxial HFC
Optical fiber access networks. FTTx
Networks of the power line. PLC

Related activities:
Lab: Performance evaluation of networks infrastructures..(4 weeks)
Methodology
Use cases measurements
Exercise realized individually at the lab.
Mid-term Exam: 2h

Full-or-part-time: 25h
Theory classes: 8h
Laboratory classes: 6h
Self study : 11h

Topic 3. Transport networks

Description:
Circuits switching based networks. PDH and SDH. Basic concepts.
Fundamental concepts in transport networks
Requirements
Traffic classification
Control mechanisms
Admission control and police control.
Leaky Bucket and Token Bucket.
Fairness in traffic management for the backbone.
Examples: MPLS and SDN networks
Motivation
SDN architecture. Control and data plane separation.
Applications: Network configuration, virtualization.

Full-or-part-time: 30h
Theory classes: 14h
Self study : 16h

Topic 4. Local area networks

Description:
Ethernet:
Ethernet basics
Ethernet physical mediums
Ethernet Implementations
Switches and Spanning Tree Protocol
Flow Control
Auto-negotiation
VLAN
Link aggregation
Power over Ethernet
Wireless Local Area Networks (WLAN)
IEEE802.11 standard: 802.11a/b/g/n/ac
Physical layer
MAC layer and access schemes (PCF and DCF)
Quality of service: 802.11e
Power management
Fairness and performance analysis

Related activities:
Lab:
Ethernet network configuration and Wifi Access Point usage............................(3 weeks)
Connections and types of devices
Measures: Throughput, delay and others.
Final exam: 3h

Ethernet network configuration and Wifi connected to the backbone.................(3 weeks)
The physical medium.
Configuration and connection of devices.
IPv6 configuration and QoS allocation concerning network topology.
Exercise realized individually at the lab.

Full-or-part-time: 56h
Theory classes: 15h
Laboratory classes: 10h
Self study : 31h

Evaluation

Description:
Activities to evaluate the contents of the subject.

Related activities:
Mid-semester evaluation
2 evaluation exercises at the laboratory
Exam

Full-or-part-time: 25h
Laboratory classes: 4h
Self study : 21h

GRADING SYSTEM

Laboratory exams: 30%
Laboratory exercises reports: 10%
First exam: 25%
Final exam: 35%

This subject evaluate the following generic competences:
- Third languaje (Medium level)
- Experimentality and instruments knowledge (medium level)

EXAMINATION RULES.

Regulations concerning "reavaluació" from ETSETB: Only applies to "Final Exam".

BIBLIOGRAPHY

Basic:
- Stallings, W. Comunicaciones y redes de computadores [on line]. 7a ed. Madrid: Pearson Educación, 2004 [Consultation: 15/05/2020]. Available on: http://www.ingebook.com/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=1245. ISBN 8420541109.
- Rauschmayer, D.J. ADSL/VDSL principles: a practical and precise study of asymetric digital subscriber lines and very high speed digital subscriber lines. Indianapolis: Macmillan Technical Publishing, 1999. ISBN 1578700159.
- Ilyas, M; Mouftah, H.T. The handbook of optical communication networks [on line]. CRC Press, 2003 [Consultation: 10/10/2022]. Available on: https://ebookcentral.proquest.com/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=2010212. ISBN 9780203489642.
- Perahia, E.; Stacey, R. Next generation wireless LANs : throughput, robustness, and reliability in 802.11n, 802ac [on line]. 2a ed. New York: Cambridge University Press, 2013 [Consultation: 01/04/2020]. Available on: https://ebookcentral.proquest.com/lib/upcatalunya-ebooks/detail.action?docID=1139677. ISBN 9781107347793.
- Perros, H.G. Connection-oriented networks: SONET/SDH, ATM, MPLS, and optical networks. Hoboken: John Wiley, 2005. ISBN 0470021632.

Complementary:
- Held, G. Ethernet networks: design, implementation, operation, management. 4th ed. West Sussex: John Wiley & Sons, 2003. ISBN 0470844760.
- Olifer, N.; Olifer, V. Computer networks: principles, technologies and protocols for network design. Chichester: John Wiley, 2006. ISBN 9780470869826.
- Spurgeon, C.E. Ethernet: the definitive guide [on line]. 2nd ed. Sebastopol, CA: O'Reilly, 2014 [Consultation: 19/02/2019]. Available on: https://ebookcentral.proquest.com/lib/upcatalunya-ebooks/detail.action?docID=1651722. ISBN 9781449361846.
- Chen, W.Y. DSL simulation techniques and standards: development for digital subscriber line systems. Indianapolis: Macmillan, 1998. ISBN 1578700175.