Course guide
270064 - XC2 - Computer Networks II

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Unit in charge: Barcelona School of Informatics
Teaching unit: 701 - DAC - Department of Computer Architecture.

Degree: BACHELOR'S DEGREE IN INFORMATICS ENGINEERING (Syllabus 2010). (Optional subject).

Academic year: 2023 **ECTS Credits:** 6.0 **Languages:** Spanish

LECTURER

Coordinating lecturer: DAVIDE CAREGLIO

Others: Primer quadrimestre:
DAVIDE CAREGLIO - 10
MARC RUIZ RAMÍREZ - 10

Segon quadrimestre:
DAVIDE CAREGLIO - 10
MARC RUIZ RAMÍREZ - 10

PRIOR SKILLS

Students should've learned the basics of communication between terminals connected to a network. This requires having studied the stack TCP / IP protocols and architecture of Local Area Networks (LAN) and wide area network (WAN). In particular protocols and algorithms related to network architecture and protocol stack TCP / IP as the technological aspects of networks (planning and design of a Local Area Network).

REQUIREMENTS

- Prerequisite XC

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CEC2.2. To program taking into account the hardware architecture, using assembly language as well as high-level programming languages.
CEC2.3. To develop and analyse software for systems based on microprocessors and its interfaces with users and other devices.
CEC2.4. To design and implement system and communications software.
CEC4.1. To design, deploy, administrate and manage computer networks.
CT6.1. To demonstrate knowledge and capacity to manage and maintain computer systems, services and applications.
CT6.4. To demonstrate knowledge and capacity to apply the characteristics, functionalities and structure of the Distributed Systems and Computer and Internet Networks guaranteeing its use and management, as well as the design and implementation of application based on them.
CT7.3. To determine the factors that affect negatively the security and reliability of a hardware/software system, and minimize its effects.

Generical:
G2. SUSTAINABILITY AND SOCIAL COMPROMISE: to know and understand the complexity of the economic and social phenomena typical of the welfare society. To be capable of analyse and evaluate the social and environmental impact.

TEACHING METHODOLOGY

1. Activities focused on acquiring theoretical knowledge.
2. Activities (meetings) focused on acquiring the laboratory for testing.
3. The theory classes would be divided into classes of exposure, readings of articles or group work.

Theory:
- Theoretical sessions (2 hours / week)
- Completed application session with the concepts through problem solving (1 hour / week).

Laboratory
- Classes 2 hours every 2 weeks when they learn to set some important protocols. The goal is to complete the practical aspects seen in theory.
- Preparation: reading statement and additional documentation
- Working in the lab in group
- Work at home to finish (report)

Workgroup activities:
- Classroom (teacher and students)
- No person (each student on their own).

LEARNING OBJECTIVES OF THE SUBJECT

1.Students must understand the technological aspects that impact on economic, social and environmental phenomena.
2.The student must know how the whole Internet and how they communicate the applications installed in the terminals.
3.Students will be able to manage and maintain systems, services and applications.
4.Students will be able to design, deploy, mantain and manage computer networks
5.The student will become familiar with the technology, protocols, terminology and specific recommendations of major international character of the area of systems based on microprocessors
6.Students must know how to differentiate and understand the various aspects to ensure safety and reliability of a system.
7.Students will become familiar with the technology, protocols, terminology and specific recommendations of major international the Internet.

STUDY LOAD

Type	Hours	Percentage
Hours large group	30,0	20.00
Hours medium group	15,0	10.00
Self study	84,0	56.00
Hours small group	15,0	10.00
Guided activities	6,0	4.00

Total learning time: 150 h

CONTENTS

Presentation of the course and review of previous concepts

Description:
Review the basics of communications between terminals connected to a network stack and TCP / IP protocols and architecture of Local Area Networks (LAN) and wide area network (WAN).

Architecture and addressing in Internet

Description:
Introduction to various topics of this first part of the syllabus. It examines the hierarchy of the Internet and the definitions of autonomous systems (AS) and Internet Service Provider (ISP). The main actors and organizations of Internet are identified.

Exhaustion IPv4 and introduction of IPv6

Description:
We analyze the problem of IPv4 address exhaustion. IPv6 is introduced as a replacement for IPv4 and its operation explained.

Intra-domain routing

Description:
The OSPF routing protocol for dynamic networks intradomain will be introduced and examples of operation will be given both during theoretical classes and in the laboratory.

MPLS protocol

Description:
Presentation of MultiProtocol Label Switching. Objectives of this protocol. Functioning. Label exchange protocol. Label format. Databases. Traffic Engineering Extensions (TE): OSPF-TE, MPLS-TE and RSVP-TE.

Inter-domain routing protocol: BGP

Description:
BGP-based inter-domain dynamic routing explained. Examples of operation. Databases. Attributes and routing policies. Most common scenarios. BGP improvements: communities, route reflection, sub-AS confederation and route flap damping.

Advanced networking concepts

Description:
This part focuses on some advanced networking concepts. Multicast transmission is introduced, its operation and some protocols such as DVMRP, MOSPF, M-BGP, PIM and BIER are explained. The Software Defined Networks (SDN) and Network Function Virtualisation (NFV) architecture and its application in the current communication model are presented.

Current research activities

Description:
Some research topics related to future Internet networks will be presented and group complementary activities proposed.

ACTIVITIES

Presentation of the course and review of previous concepts

Description:
The student has to know the basics of communications between terminals connected to a network stack and TCP / IP protocols and architecture of Local Area Networks (LAN) and wide area network (WAN).

Specific objectives:
2

Full-or-part-time: 4h
Theory classes: 2h
Self study: 2h

Introduction to administration and maintenance of ISPs

Description:
Students will become familiar with specific terminology and recommendations of major international fora regarding Internet. Students must understand the hierarchy of the Internet and how communication work between the different levels.

Specific objectives:
2, 7

Full-or-part-time: 9h
Theory classes: 2h
Practical classes: 1h
Self study: 6h

IPv6 addressing

Description:
The student will know the situation of IPv4 addressing and its exhaustion and will know how to get information to keep up to date. She will learn about IPv6 addressing, how IPv6 addresses are assigned, and how IPv4 and IPv6 compatibility is achieved in today's Internet.

Specific objectives:
2, 3, 7

Full-or-part-time: 15h
Theory classes: 3h
Practical classes: 2h
Laboratory classes: 2h
Self study: 8h

Intra-domain dynamic routing: the OSPF protocol

Description:
Students will become familiar with the OSPF protocol through theoretical examples in class, practical problems and configuration problems through exercices and in the laboratory.

Specific objectives:
2, 3, 4, 6, 7

Full-or-part-time: 17h 30m
Theory classes: 3h 30m
Practical classes: 2h
Laboratory classes: 2h
Self study: 10h

MPLS protocol

Description:
The student will become familiar with advanced networking concepts currently in use. The student will know, compare and distinguish the different solutions.

Specific objectives:
1, 3, 4, 6

Related competencies :
G2. SUSTAINABILITY AND SOCIAL COMPROMISE: to know and understand the complexity of the economic and social phenomena typical of the welfare society. To be capable of analyse and evaluate the social and environmental impact.

Full-or-part-time: 15h
Theory classes: 3h
Practical classes: 2h
Laboratory classes: 2h
Self study: 8h

Midterm control evaluation

Description:
Midterm control evaluation on the subjects exposed to the theory classes.

Specific objectives:
1, 2, 3, 7

Related competencies :
G2. SUSTAINABILITY AND SOCIAL COMPROMISE: to know and understand the complexity of the economic and social phenomena typical of the welfare society. To be capable of analyse and evaluate the social and environmental impact.

Full-or-part-time: 7h
Guided activities: 1h
Self study: 6h

Interdomain routing: the BGP protocol

Description:
Students will become familiar with the BGP protocol through theoretical examples in class, practical problems and configuration problems in the laboratory.

Specific objectives:
1, 2, 3, 6, 7

Related competencies :
G2. SUSTAINABILITY AND SOCIAL COMPROMISE: to know and understand the complexity of the economic and social phenomena typical of the welfare society. To be capable of analyse and evaluate the social and environmental impact.

Full-or-part-time: 37h
Theory classes: 7h
Practical classes: 6h
Laboratory classes: 8h
Self study: 16h

Advanced networking concepts

Description:
The student will learn some advanced network concepts such as multicast transmission, its operation and the main protocols and the SDN/NFV architecture and its application in the current communication model.

Specific objectives:
2, 7

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

Presentation of research topics

Description:
Students will become familiar with the research and recommendations of major international networks in the field.

Specific objectives:
1, 5

Related competencies :
G2. SUSTAINABILITY AND SOCIAL COMPROMISE: to know and understand the complexity of the economic and social phenomena typical of the welfare society. To be capable of analyse and evaluate the social and environmental impact.

Full-or-part-time: 4h
Theory classes: 2h
Self study: 2h

Development of a presentationt on a topic related to research in Internet.

Description:
Each group must select a topic and present after 3 weeks a presentation describing the problem, analyzing the available solutions and, where appropriate, proposing new solutions.

Specific objectives:
1, 5, 6

Related competencies :
G2. SUSTAINABILITY AND SOCIAL COMPROMISE: to know and understand the complexity of the economic and social phenomena typical of the welfare society. To be capable of analyse and evaluate the social and environmental impact.

Full-or-part-time: 16h
Theory classes: 2h
Self study: 14h

Lab final exam

Description:
Prepare the lab exam study notes and previous practices

Specific objectives:
3, 4, 5

Full-or-part-time: 7h
Laboratory classes: 1h
Self study: 6h

Final control evaluation

Description:
Final control evaluation on the subjects exposed to the theory classes.

Specific objectives:
1, 4, 5, 6

Related competencies :
G2. SUSTAINABILITY AND SOCIAL COMPROMISE: to know and understand the complexity of the economic and social phenomena typical of the welfare society. To be capable of analyse and evaluate the social and environmental impact.

Full-or-part-time: 7h
Guided activities: 1h
Self study: 6h

Final exam

Description:
Final exam on the subjects exposed to the theory classes

Specific objectives:
1, 2, 3, 4, 5, 6, 7

Related competencies :
G2. SUSTAINABILITY AND SOCIAL COMPROMISE: to know and understand the complexity of the economic and social phenomena typical of the welfare society. To be capable of analyse and evaluate the social and environmental impact.

Full-or-part-time: 5h 30m
Guided activities: 1h 30m
Self study: 4h

GRADING SYSTEM

1. A mid-term exam (C1) in the middle of the semester and a second exam at the end (C2) on the material presented in the theory classes.
Theory = 0.5 x C1 + 0.5 x C2

2. Realization of practices. It will be evaluated through a control at the end of each session and a final laboratory exam. The average of the marks of the sessions (50%) and the final exam (50%) will generate the grade "Lab".

3. Implementation of a complementary activity (AC) in a group (2/3 people) proposed by the theory and/or laboratory teachers and presentation in class. The grade for this activity (AC) will be the average grade between the prepared material and the oral presentation.

The final grade (NF) of the subject will be calculated as follows:
NF = 0.6 x Theory + 0.25 x Lab + 0.15 x AC

Students who have taken both tests but have not passed can take a final exam (EF) to improve their theory grade. In this case, the final grade would be:
NF = 0.6 x EF + 0.25 x Lab + 0.15 x AC

The level of achievement of the transversal competence is evaluated based on the final grade. All these evaluation acts are reflected in the note (NF) described above. The grade for the competition will be calculated as follows:
A if NF >= 8.5; B if NF >=7; C if NF >= 5; D if NF

BIBLIOGRAPHY

Basic:
- Huitema, C. Routing in the internet. 2nd ed. Prentice Hall PTR, 2000. ISBN 0130226475.
- Stewart III, J.W. BGP4: inter-domain routing in the Internet. Addison-Wesley, 1999. ISBN 0201379511.
- Dally, W.J.; Towles, B. Principles and practices of interconnection networks. Morgan Kaufmann Publishers, 2003. ISBN 0122007514.
- Pasricha, S.; Dutt, N. On-chip communication architectures: system on chip interconnect. Burlington [etc.]: Elsevier / Morgan Kaufmann Publishers, 2008. ISBN 9780123738929.
- Pasricha, S.; Dutt, N. On-chip communication architectures: system on chip interconnect. Elsevier / Morgan Kaufmann Publishers, 2008. ISBN 9780123738929.

Complementary:
- Nicopoulos, C.; Narayanan, V.; Das, C.R. Network-on-chip architectures: a holistic design exploration. Springer, 2009. ISBN 9789048130306.
- Duato, J.; Yalamanchili, S.; Ni, L.M. Interconnection networks: an engineering approach. Rev. print. San Francisco: Morgan Kaufmann Publishers, 2003. ISBN 1558608524.

- Hubert, B. Linux advanced routing & traffic control HOWTO. 2010.

RESOURCES

Hyperlink:
- http://www.ietf.org- http://www.cisco.com/web/about/ac123/ac147/about_cisco_the_internet_protocol_jou