Universitat Autònoma de Barcelona

2022/2023

Networks

Code: 102746
ECTS Credits: 6

Degree	Type	Year	Semester
2502441 Computer Engineering	OB	2	2

Contact

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Use of Languages

Principal working language: catalan (cat)
Some groups entirely in English: Yes
Some groups entirely in Catalan: Yes
Some groups entirely in Spanish: Yes

Teachers

Juan Antonio Martínez Carrascal
Carlos Borrego Iglesias
Hing Fai Kevin Chow
Lino de la Muñoza Muñoz

Prerequisites

There are no prerequisites. However, students should be familiar with the most basic concepts of Operating Systems. It is also recommended for students to have taken the courses on basic programming.

Objectives and Contextualisation

This is the second course of the subject "Operating Systems and Computer Networks", where the concepts about the operation of TCP/IP based networks (and Internet in particular) are shown, both from the point of view of the network interconnection and from the perspective of the relationship between end computers and applications providing services to users.

The formative objectives of the course are, on the one hand, that students get a general vision of the concepts related to computer networks and with the interconnection of heterogeneous networks; that they thoughfully know the issues and protocols related with the joint operation of heterogeneous systems over a set of interconnected networks and the main distributed application in these systems, with a notion of their development. On the other hand, students have to be able to design extensible and robust internet networks, to configure connections to internet networks, and to detect and solve network problems due to missconfigurations or protocol attacks.

Competences

- Acquire personal work habits.

- Capacity to design, develop, select and evaluate computer applications and systems, ensuring reliability, security and quality, in accordance with ethical principles, and applicable standards and legislation.
- Conceive and develop centralised or distributed computer systems or architectures by integrating hardware, software and networks.
- Know and apply the basic and main techniques of parallel, concurrent, distributed and real time programming.
- Know and apply the functional and structural characteristics of distributed systems and computer and Internet networks, and design and implement applications based on these.
- Know the characteristics, functionalities and structure of operating systems and design and implement applications based on their services.

Learning Outcomes

1. Analyse the main protocols and know about the international standards and standardisation bodies.
2. Create thread and socket based applications, including mutex primitives and condition-type variables.
3. Design, develop, select and evaluate computer systems, ensuring their reliability, security and quality.
4. Know and apply the basic and main techniques of concurrent and distributed programming.
5. Know and apply the characteristics, functionalities and structure of distributed hardware systems and computer networks to design and implement applications based on the same.
6. Know and understand the concepts related to computer networks , knowing to place them in a hierarchical system protocols .
7. Know how to administer and maintain computer systems, services and applications in terms of the base software.
8. Know the details of local and wide area networks and how they operate.
9. Manage time and resources available. Work in an organized manner .
10. Understand the essential mechanisms of data transmission.
11. Work independently.

Content

Unit 1. Introduction

- Computer networks and network of networks
- The TCP/IP protocol family
- Basic networks typologies and technologies

Unit 2. Netork interconnection protocols

- Principles of network interconnection
- Addressing
- Local address resolution
- IP protocol
- Basic routing
- ICMP Protocol

Unit 3. End-to-end protocols

- Principles of end-to-end communications
- User Datagram Protocol UDP
- Reliable byte stream protocol TCP

Unit 4. Apploication protocols

- Principles of TCP/IP applications
- Application access to lower layers. Socket of Berkeley interface
- Domain Name System DNS
- Configuration Protocol DHCP

Unit 5. Advanced protocols for network interconnections

- Internet architecture
- Autonomous Systems and Neutral Points
- Routing protocols within Autonomous Systems (RIP, OSPF)
- Routing protocols between Autonomous System (BGP)

Methodology

These activities will be carried out during the course:

- Lectures (theory sessions), where the teacher will provide information about the knowledge of the course and about strategies to obtain, extend, and organise this knowledge. Student active participation will be encouraged during these sessions, for example by proposing a debate where multiple technological approaches are accepted.
- Problem solving sessions, where students will have to actively participate to consolidate their knowledge by resolving, presenting and debating related problems.
- Laboratory practical sessions, where small projects are proposed to be anlised and developed by groups of two stiudents. These sessions will be prepared, documented, and programmed by the teache beforehand, and students will have to prepare them before attending to the lab, reviewing theory technological aspects about the development.
- Resolution of problems related to the theory sessions to be discussed during the problem resolution sessions, as a continuous activity during the course.
- Several supervised activities proposed by the teachers during the course to consolidate the knowledge on the subject and to explore its practical application.

There will no be differentiated treatment for students who repeat the subject.

The UAB virtual platform (Campus Virtual, https://cv.uab.cat/) will be used for communication between teachers and students, and between students. It will be also used to deliver activities and accessing working documents of the course.

Transverse competences worked in this course are T02.01 Autonomous work, and T02.03 Time and available resource management. Working in an organised way. These competences are worked in different parts of the course, such in the resolution of problems, or in the laboratory sessions.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Laboratory sessions	12	0.48	4, 5, 7, 2, 3, 9, 11
Problem resolution sessions	12	0.48	1, 8, 4, 6, 3, 10

Theory classes	26	1.04	1, 8, 4, 6, 3, 10
Type: Supervised			
Supervised activities proposed in class	8	0.32	1, 8, 4, 6, 10
Type: Autonomous			
Course problems writing	30	1.2	1, 8, 10, 9, 11
Preparation and autonomous work for the laboratory sessions	24	0.96	4, 5, 7, 2, 3, 9, 11
Study and preparation for the assessment tests	30	1.2	1, 8, 4, 5, 6, 7, 3, 10, 9, 11

Assessment

Assessment criteria

The assesment of the course is continuous and formative, using a number of learning evidences generated by students along the course.

Activities and instruments for the assessment:

Class activities

These activities are carried out during the classe, without any regularity. Because they are face-to-face activities, these activities are not compulsory (they do not need to be done to pass the subject, although they are part of the assessment). Examples of these activities can be: a commentary on a short documentary passed in class, the description of a theatrical activity done in class, some test questions about the theory session or newly created problems, analyze the functioning of the classroom, a protocol for the exchange of routing information, etc.

Mid-term control and final validation examinations of knowledge

The mid-term control is an individual written test that aims to validate if each student has achieved the minimum knowledge of the subject worked up to that moment. It does not eliminate matter for the final exam nor a minimal note for this control. The final examinations of validation of knowledge and practices are individual written tests that aim to validate if each student has achieved in a minimum way the global knowledge and the abilities of the subject. These exams are motivated by the high importance given to the successful achievement of the knowledge and skills of the subjects in the engineering environment where the degree is framed. The final examination of knowledge validation is mandatory for all students.

Practical case

There will be a small test in which the student will solve individually a practical case, applying the competences acquired until half of the course, approximately. In this exercise, it is valid as the student has integrated what he has learned in order to solve a plausible case that could be found, for example, in their professional future.

Laboratory projects

The practical lab projects consist in the accomplishment of a series of projects with which they try to obtain knowledge and abilities related to the subject. It is equally important to have worked in all the development of the practice, such as having understood and learned the knowledge that is derived from it. The specific details on the organization of the labs (projects, groups, calendar, weighting ...) and on their follow-up (reports, assistance requirements, code of originality policy ...) can be downloaded from Virtual Campus Attendance at practice sessions (closed laboratory) is mandatory. To be evaluated it will be essential to have assisted at least 80% of the laboratory sessions. To pass this part of the evaluation each lab project has to be passed.

Indicators that will be used to qualify the learning achieved

In the problems and supervised work the indicators that we will use will be the individual record in the work, the cooperation between the members of each team, the quality of the work done and the degree of participation in the set of evidences. Quality indicators are the correct use of the technical terms, the correct wording of the paragraphs, and the good structure of the contents delivered. We will also value the certainty in the work. We will value that the resolutions of the problems are well argued and corrected if applicable. In class activities, we will value the participation of the students and the reports or documents delivered. In the practical part we will use as indicators the preparation (previous reports) and active participation in the sessions of practices and in the session of evaluation and the quality in the elaboration of the reports of complete development. In the control and in the final examinations of validation of knowledge and validation of practices the main indication will be the degree of correctionof the answers to the questions raised.

Remarks about copying, plagiarism and cheating

Notwithstanding other disciplinary measures deemed appropriate, and in accordance with the academic regulations in force, assessment activities will receive a zero (0) whenever a student commits academic irregularities that may alter such assessment. Assessment activities graded in this way and by this procedure will notbe re-assessable. If passing the assessment activuty or activities in question is required to pass the subject, the awarding of a zero (0) for disciplinary measures will also entail a direct fail for the subject, with no opportunity to re-assess this in the same acadeimc year. Irregularities contemplated in this procedure include, among others:

- the total or partial copying of a practical exercice, report, or any other evaluation activity;
- allowing others to copy;
- presenting group work that has not been done entirely by the members of the group;
- presenting anymaterials prepared by a third party as one's own work, even if these materials are translations or adaptations, including work that is not original or exclusively that of the student;
- having communication devices (such as mobile phones, smart watches, etc.) accessible during theoretical-practical assessment tests (individual exams).
- talk to other student during the individual practical or theoretical tests.
- copying or trying to copy from other students during the individual practical or theoretical tests.
- using or trying to use writen material related to the subject during the individual practical or theoretical tests when they have not been explicitly allowed.

When a student is involved in any evaluation irregularity, the final mark of the course will be the lowest value considering 3.0 and the weighted average of the grades (and no compensation is thuspossible).

All in all: copying, allowing the copy, plagiarism (or just trying) in any of the assessment activities means failing th

Final grade

The final grade of the subject, which includes assessment of the acquisition of knowledge, skills and competencies, will be the averageofthe assessment parts weighted in this way:

- 35% the qualification of the final examination of validation of knowledge. The minimum mark required by this part is 5 out of 10.
- 35% the final grade of the practical part. The minimum mark required by this part is 5 out of 10.
- 15% the qualification of the mid-term control of knowledge. No minimum mark is required for this part.
- 5% the classification of the practical case. No minimum mark is required for this part.
- 10% of the grade of work done in class activities. No minimum mark is required for this part.

The final grade of 20% corresponding to the mid-year control (15%) and the practical case (5%), MCSP, will be calculated based on the mark obtained in the final exam. If the MCSP grade is equal to or greater than 1.5 and the final exam score is equal to or greater than 5, then it will be taken as MCSP, the maximum between 5 and its value. This is due to the fact that the final exam evaluates all the theoretical content of the subject.

If the student do not pass the subject due to the fact that none of the assessment activities do not reach the minimum grade required, the numerical grade of the file will be the lowest value between 4.0 and the weighted

average of the grades. With the exceptions that the "non-evaluable" qualification will be awarded to students who do not participate in any of the assessmentactivities, and that the numerical grade of the file will be the lowest value between 3.0 and the weighted average of the grades in case the student has committed irregularities in an evaluation act (and therefore not approved for compensation).

The granting of honors will be made taking into account the active participation in the development of the subject, for example collaborating in the resolution of problems in the forum of thesubject, the obtaining of non-evaluable merits indicated during the course,the final grade of the subject, and the mark of the final proof of knowledge.

Evaluation schedule

Constantly: class activity and practices in the laboratory, with the corresponding reports.
After practical projects: evaluation session.
Mid-term knowledge control and practical validation.
At the end: validation exams of knowledge.
The evaluation dates will be published on the Campus Virtual and may be subject to changes of programming for reasons of adaptationtopossible incidents. The Virtual Campus will always be informed about these changes as it is understood to be the usual mechanism for exchanging information between the teacher and students.

A resit of the final validation exam of knowledge is expected for those students who do not pass it on the first opportunity. It is also planned to make a second assessment of the lab projects for those students who have not delivered them at due time, although have been working on them during the term.

It is not possible to re-assess the class activities, nor the mid-term control, nor the practical case, because they are parts of the assessment that can not be failed (no minimum mark is required) and because they are part of the Continuous assessment (they do not make sense outside of the temporary context in which they are performed).

Students repeating the course

There will be no automatic re-use of previous. Validations must be requested explicitly following the procedure that will be indicated on the first day of class.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Class activities	10%. No minimum mark is required for this part	2	0.08	1, 8, 6, 7, 10, 9
Final validation test	35%. The minimum grade required by this part is 5 out of 10	2	0.08	1, 8, 4, 6, 10, 9, 11
Mid-term control	15%. No minimum mark is required for this part	0.5	0.02	1, 8, 6, 9, 11
Practical case	5%. No minimum mark is required for this part	0.5	0.02	1, 8, 6, 9, 11
Practical laboratory session follow up, with the possibility of undertaking a validation test	35%. The minimum mark required by this part is 5 out of 10	3	0.12	5, 2, 3, 9, 11

Bibliography

Basic references:

- D.E. Comer (2013). Internetworking with TCP/IP. Prentice Hall.

Supplementary references:

- G. Tomsho (2011). Guide to Networking Essentials, 6th Edition. Cengage.
- W. R. Stevens (1993). TCP/IP Illustrated, Volume I. Addison-Wesley.
- A.S. Tanenbaum (2013). Computer Networks, 5th Edition. Prentice Hall.
- W. Stallings (2015). Comunicaciones y redes de computadores, 10a Edición. Pearson Prentice Hall.
- N. Barcia, C. Fernández, S. Frutos, G. López, L. Mengual, F.J. Soriano, F.J. Yágüez (2005). Redes de computadores y arquitecturas de comunicaciones. Supuestos prácticos. Pearson Prentice Hall.

Web links:

- cv.uab.cat
- http://www.cs.purdue.edu/homes/dec/netbooks.html

Software

This course will only use free software, such as the GNU/Linux operating system, or the gcc C compiler.