SUBJECT TEACHING GUIDE

G662 - Computer Networks and Distributed Systems

Degree in Computer Systems Engineering

Academic year 2023-2024

1. IDENTIFYING DATA					
Degree	Degree in Computer Systems Engineering			Type and Year	Compulsory. Year 3
Faculty	Faculty of Sciences				
Discipline	Subject Area: Computer Systems and Networks Compulsory Module				
Course unit title and code	G662 - Computer Networks and Distributed Systems				
Number of ECTS credits allocated	6	Term		Semester based (2)	
Web					
Language of instruction	Spanish	English Friendly	No	Mode of delivery	Face-to-face

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3.1 LEARNING OUTCOMES
- Know the main concepts related to routing and the different routing and congestion control protocols employed in networks.
- Be able to define, select and evaluate hardware and software platforms for the development of network systems.
- Be able to design and implement network-based applications.
- Understand the foundamentals of distributed application development and the different architectures.
- Be able to design and implement applications which offer and use services in networks and the Internet.
- Know the foundamental distributed programming models: client/server, web services, P2P.
- Be aware of the specific problems of the distributed programming paradigm: fault tolerance, deadlock.
- Be able to conceive and specify a computer system as a distributed system.
- Be able to discern advantages and difficulties of distributed architectures compared to centralized ones.
- Be able to implement a distributed application using RMI Java and DDS middlewares.

4. OBJECTIVES
The student must understand the operation of communication networks, including routing and end-to-end flow control mechanisms.
The student must be able to design and manage a network at a basic level, as well as develop applications which communicate using it.
Train the student in the design of complex distributed systems supported by different distribution middlewares . In particular, middlewares implementing the client/server and publish/subscribe models.

6. SUBJECT PROGRAM	
CONTENTS	
1	Section 1: Circuit and packet switching. - Circuit switching, datagrams and virtual circuits. - Basic switch architecture. - Review of the main WAN technologies.
2	Section 2: Network protocols. - IP addressing. Networks and subnetworks, CIDR, VLSM. Other aspects of IP. - Algorithms for path search in graphs. - Dynamic routing protocols: Classes and implementations. Examples of RIP and OSPF. - Protocol IP. Packet format, forwarding rules, fragmentation. - Other related protocols: ICMP, ARP, DHCP, DNS, IGMP. - Network address translation mechanisms. Port overloading. - IPv6. Addresses, packet format, and fundamental differences with IPv4.
3	Section 3: Transport protocols. - Socket programming. - TCP. Segment format. Finite State Machine. Connection establishment and release. Flow and error control. Congestion control. - UDP. Format and examples of use. - Other transport protocols. QUIC.
4	Section 4: Application layer. Example of HTTP. - Resource identification mechanisms. - Message types and format. - Authentication, cookies, security and proxies. - Performance aspects.
5	Section 5: Distributed systems. - Introduction to distributed computing. Distribution models. - Process communication, management and synchronization. - Client/Server distribution model: RMI. - Publish/suscribe distribution model: DDS.

7. ASSESSMENT METHODS AND CRITERIA

Description	Type	Final Eval.	Reassessn	%
Computer networks lab	Laboratory evaluation	No	Yes	33,33
Written computer networks exam	Written exam	No	Yes	33,34
Distributed systems	Laboratory evaluation	No	Yes	33,33
Additional evaluation tests that increase the mark	Work	No	No	0,00
TOTAL				100,00

Observations

Tests of continuous assessment will not remove content from following tests.
Evaluation of computer lab sessions will be split between hands-on work during sessions and tests about key knowledgement (40%) and a final practical exam at the lab (60%). Evaluation of Distributed Systems will be performed at the lab through an exercise about distributed programming. Course materials and basic/complementary bibliography will be allowed during this exercise. Along the course, questionnaires and short tests about this block may be requested. Extra works will consist of short tests during lectures or problem-solving sessions, performed through electronic means (preferably Moodle) or on paper, and will allow up to an additional point over the final exam section, provided that the grade on such part is above 4.5 points and at least 60% of the extra works have been performed.

When any of the required minimal grades is not obtained, the final grade will be the minimum between 4.9 and the resulting average.

The sessions at the laboratory on the second evaluation period will be performed at a time different from the written exam when required for the coordination of the tests.

Observations for part-time students

Part-time students will be allowed to embrace the continuous evaluation model. Otherwise, they will have a single evaluation in each of the two evaluation periods, which will comprise a written exam and two laboratory sessions, Computer Networks and Distributed Systems.

8. BIBLIOGRAPHY AND TEACHING MATERIALS

BASIC

William Stallings: "Data and Computer Communications", 10th Ed. Pearson, 2013

George Couloris, Jean Dollimore, Tim Kindberg: "Distributed Systems: Concepts and Design", Addison Wesley, 4 edition. 2005.

David Gourley, Brian Totty: "HTTP: The Definitive Guide", 1a Ed. O'Reilly, 2002.