

SUBJECT TEACHING GUIDE

G662 - Computer Networks and Distributed Systems

Degree in Computer Systems Engineering

Academic year 2022-2023

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

Department	DPTO. INGENIERÍA INFORMÁTICA Y ELECTRÓNICA				
Name of lecturer	PABLO FUENTES SAEZ				
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Other lecturers	EDUARDO GARCIA TORRE HECTOR PEREZ TIJERO MARIANO BENITO HOZ				

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 fundamentals 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 fundamental 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. COURSE ORGANIZATION	
CONTENTS	
1	<p>Section 1: Circuit and packet switching.</p> <ul style="list-style-type: none"> - Circuit switching, datagrams and virtual circuits. - Basic switch architecture. - Review of the main WAN technologies.
2	<p>Section 2: Network protocols.</p> <ul style="list-style-type: none"> - 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	<p>Section 3: Transport protocols.</p> <ul style="list-style-type: none"> - 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	<p>Section 4: Application layer. Example of HTTP.</p> <ul style="list-style-type: none"> - Resource identification mechanisms. - Message types and format. - Authentication, cookies, security and proxies. - Performance aspects.
5	<p>Section 5: Distributed systems.</p> <ul style="list-style-type: none"> - Introduction to distributed computing. Distribution models. - Process communication, management and synchronication. - Client/Server distribution model: RMI. - Event-based distribution model: DDS.

7. ASSESSMENT METHODS AND CRITERIA				
Description	Type	Final Eval.	Reassessn	%
Computer network lab.	Laboratory evaluation	No	Yes	33,33
Final exam and short tests during lectures.	Written exam	No	Yes	33,34
Distributed systems	Laboratory evaluation	No	Yes	33,33
TOTAL				100,00
Observations				
<p>Evaluation of computer lab sessions will be split between hands-on work during sessions and tests about key knowledge (40%) and a final practical exam at the lab (60%). Evaluation of Distributed Systems will be performed at the lab and during lectures, and requires delivering on time all requested practical assignments with key minimum features.</p> <p>When any of the required minimal grades is not obtained, the final grade will be the minimum between 4.9 and the resulting average.</p> <p>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.</p>				
Observations for part-time students				
<p>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.</p>				

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.