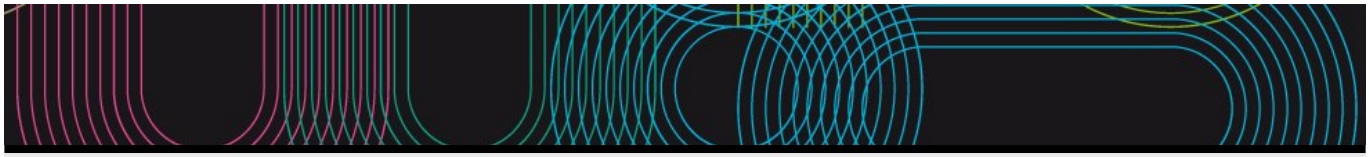

IDENTIFYING DATA				
Computer Networks				
Subject	Computer Networks			
Code	V05G300V01403			
Study programme	(*)Grao en Enxeñaría de Tecnoloxías de Telecomunicación			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	2nd	2nd
Teaching language	Spanish Galician			
Department				
Coordinator	López Ardao, José Carlos			
Lecturers	López Ardao, José Carlos López Bravo, Cristina Manso Vázquez, Mario Rodríguez Pérez, Miguel Sousa Vieira, Estrella Suárez González, Andrés			
E-mail	jardao@det.uvigo.es			
Web	http://www.socialwire.es			
General description	Operating principles, architecture, technology and norms of computer networks, especially of Internet. Design-oriented course, complemented by practical skills			

Competencies	
Code	
A1	CG1: The ability to write, develop and sign projects in the field of Telecommunication Engineering, according to the knowledge acquired as considered in section 5 of this Law, the conception and development or operation of networks, services and applications of Telecommunication and Electronics.
A3	CG3: The knowledge of basic subjects and technologies that capacitates the student to learn new methods and technologies, as well as to give him great versatility to confront and update to new situations
A4	CG4: The ability to solve problems with initiative, to make creative decisions and to communicate and transmit knowledge and skills, understanding the ethical and professional responsibility of the Technical Telecommunication Engineer activity.
A6	CG6: The aptitude to manage mandatory specifications, procedures and laws.
A9	CG9: The ability to work in multidisciplinary groups in a Multilanguage environment and to communicate, in writing and orally, knowledge, procedures, results and ideas related with Telecommunications and Electronics.
A20	CE11/T6: The ability to conceive, deploy, organize and manage networks, systems, services and Telecommunication infrastructures in residential (home, city, digital communities), business and institutional environments, being responsible for launching of projects and continuous improvement like knowing their social and economical impact.
A26	CE17/T12: The knowledge and usage of concepts of communication network architecture, protocols and interfaces.
A27	CE18/T13: The ability to differentiate the concepts of access and transport networks, packet and circuit switched networks, mobile and fixed networks, as well as distributed newtwork application and systems, voice, data, video, audio, interactive and multimedia services.
A28	CE19/T14: The knowledge of methods of networking and routing, as well as the fundamentals of planning and network evaluation based on traffic parameters.

Learning aims	
Expected results from this subject	Training and Learning Results
CG1 The ability to write, develop and sign projects in the field of Telecommunication Engineering, according to the knowledge acquired as considered in section 5 of this Law, the conception and development or operation of networks, services and applications of Telecommunication and Electronics.	A1

CG3 The knowledge of basic subjects and technologies that capacitates the student to learn new methods and technologies, as well as to give him great versatility to confront and update to new situations	A3
CG4 The ability to solve problems with initiative, to make creative decisions and to communicate and transmit knowledge and skills, understanding the ethical and professional responsibility of the Technical Telecommunication Engineer activity.	A4
CG6: The aptitude to manage mandatory specifications, procedures and laws.	A6
CG9 The ability to work in multidisciplinary groups in a Multilanguage environment and to communicate, in writing and orally, knowledge, procedures, results and ideas related with Telecommunications and Electronics	A9
CE11/T6 The ability to conceive, deploy, organize and manage networks, systems, services and Telecommunication infrastructures in residential (home, city, digital communities), business and institutional environments, being responsible for launching of projects and continuous improvement like knowing their social and economical impact.	A20
CE17/T12 The knowledge and usage of concepts of communication network architecture, protocols and interfaces	A26
CE18/T13 The ability to differentiate the concepts of access and transport networks, packet and circuit switched networks, mobile and fixed networks, as well as distributed newtwork application and systems, voice, data, video, audio, interactive and multimedia services	A27
CE19/T14 The knowledge of methods of networking and routing, as well as the fundamentals of planning and network evaluation based on traffic parameters	A28

Contents

Topic	
1. Introduction	a) Network Infrastructure: Nodes, links and netwoks b) Circuit and Packet Switching c) Communications Architecture: Layers, encapsulating, models
2. Packet Networks. Internet	a) Performance: Throughput, delays, losses b) The Internet ecosystem
3. Links and subnetworks	a) Concept of link and subnetwork b) Interconnection of networks at level 2: Bridges
4. Ethernet and WiFi	a) Ethernet Switching. b) VLANs and trunking c) Spanning Tree d) WiFi networks
5. Internet and IP	a) Interconnection of subnetworks. Routers b) IP Addressing c) IP datagram format d) Fragmentation e) The ICMP protocol
6. IP Forwarding	a) IP Forwarding mechanism b) Connected and Next-Hop Routes c) The DHCP protocol
7. Name and address translation	a) ARP b) DNS c) NAT
8. Routing	a) Graph theory. Shortest distance paths b) Link state: Dijkstra's algorithm c) Distance vector: Bellman-Ford d) Broadcast routing
9. Internet routing	a) Routing hierarchy b) Intradomain routing: RIP, OSPF c) Interdomain routing: BGP
10. Midterm Exam	Lectures 1 to 7
11. Transport protocols	a) Service model b) TCP & UDP c) Transport connections: establishment, retransmissions, flow control
12. Congestion control	a) Network model b) Dynamics, fairness and stability c) TCP Reno, Vegas, FAST
13. Web. Content distribution networks	a) HTTP protocol b) Proxy web. Caching. Persistence c) Content distribution networks: architecture and operations

14. Network security	a) Vulnerabilities. Protection c) Secure network and transport layers c) Denial of service. Spoofing d) Fundamentals of cryptography e) Digital signatures

Planning

	Class hours	Hours outside the classroom	Total hours
Master Session	26	39	65
Troubleshooting and / or exercises	10	15	25
Autonomous practices through ICT	6	15	21
Integrated methodologies	0	10	10
Practice in computer rooms	10	15	25
Long answer tests and development	2	0	2
Long answer tests and development	2	0	2

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Master Session	Exposition of ideas, concepts, techniques and algorithms that shape every lecture.
Troubleshooting and / or exercises	Resolution by part of the students of problems and exercises of some of the lessons, and resolution by the teacher in the classroom
Autonomous practices through ICT	The students must develop a network program. There will be several sessions for tutoring with the professor and development, test and debugging of the programs in the laboratories where these will be tested and evaluated
Integrated methodologies	Participation in on-line activities to be proposed along the course, and in activities of making questions and answer of these
Practice in computer rooms	Practices in the computers of the computer classroom, guided by the professor

Personalized attention

Methodologies	Description
Master Session	Individual tuition will be dispensed to the students in the office hours announced at the beginning of the term. It is not mandatory to book the appointment.

Assessment

	Description	Qualification
Autonomous practices through ICT	The students must develop a network program. There will be several sessions for tutoring with the professor and development, test and debugging of the programs in the laboratories where these will be tested and evaluated	20
Integrated methodologies	Participation in on-line activities to be proposed along the course, and in activities of making questions and answer of these	10
Long answer tests and development	Final exam	50
Long answer tests and development	Midterm exam	20

Other comments on the Evaluation

The students can choose the method of evaluation, continuous or single.

The Continuous Evaluation (CE) consist of three previous tests plus a final exam:

- A midterm exam (ME) in the 10th week, which will cover the contents of lectures 1 to 7, and represents 20% of the final grade (FG)
- The development of a network program (NP). The deadline will be the day of the final exam. The compliance of prescriptions and the quality of the software will determine the qualification of this test. Depending on the number of students, teachers may allow this program to be done by couples of students but in that case both members of the couple must belong to the same group of laboratory and both of them must follow continuous assessment. The NP represents 20% of the final (NF)
- Participation in online activities (AO) that will be proposed along the course and in the activities of raising questions and answer them. The OA represents 10% of the final grade (NG)
- A final exam (FE) covering all the contents, which has a weight of 50% of the final grade (FG)

FG-CE = 0.2xME + 0.1xOA + 0.2xNP + 0.5xFE

The Single Evaluation (SE) will consist of the same Final Exam at the end of the semester and the same Network Program (NP) proposed for CE. In this case, the program must be made mandatory and delivered individually.

The grade of NP in this case is simply APT (with a numeric value 1), if it meets the minimum requirements or NOT APT (with a numeric value 0) in the other case or if the NP is not delivered, in which case the grade will be 40% of the FE. That is,

FG-SE = (0.4 + 0.6xNP) x FE

It is considered that a student choose CE when presenting to the midterm exam. The students not doing this exam must opt for SE.

In July there will be a new FE and also it will be allowed the delivery of a new NP consisting of a modified version of the May program, and whose specifications will be published with at least 4 weeks with respect to the deadline of the Final Exam. Any student, regardless opting for CE or SE, will be able to do this FE and present a new NP

For students who chose CE, these FE and NP represent an opportunity to improve the grade in these with respect to May, and so the calculation of the final grade considers the best grade obtained between May and July.

For students who chose to SE, the FE and the NP are considered joint and inseparable, that is,

FG-SE = Max[(0.4 + 0.6xNP-May) x FE-May, (0.4 + 0.6xNP-July) x FE-July]

The grades of all written tests, partial or final, programs and activities will only take effect in the academic year in which they are proposed.

Sources of information

J.F. Kurose, K.W. Ross, **Computer networking: a top-down approach featuring the Internet**, 6,
L. Peterson, B. Davie, **Computer networks: a systems approach**, 5,
C. López, M. Rodríguez, S. Herrería, M. Fernández, **Cuestiones de redes de datos: principios y protocolos**, 1,

Recommendations

Subjects that continue the syllabus

Data Networks: Technology and Architecture/V05G300V01542
Network and Switching Theory/V05G300V01642

Subjects that are recommended to be taken simultaneously

Data Communication/V05G300V01301

Other comments

Though advisable, it is not necessary prior exposure to computer programming.