Universidad Zaragoza

Year : 2020/21

30239 - Network Design and Administration

Syllabus Information

Academic Year: 2020/21
Subject: 30239 - Network Design and Administration
Faculty / School: 110 - Escuela de Ingeniería y Arquitectura
326 - Escuela Universitaria Politécnica de Teruel
Degree: 443 - Bachelor's Degree in Informatics Engineering
439 - Bachelor's Degree in Informatics Engineering
ECTS: 6.0
Year: 4
Semester: 439 - First semester
439 - First semester
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443 - First semester
443 - First semester
443 - First semester
443 - First semester
Subject Type: ---
Module: ---

1.General information

1.1.Aims of the course

The course and its expected aims respond to the following approaches and objectives:

Enable the student to design and manage various aspects related to TCP/IP networks. For this purpose, the set of fundamental objectives can be summarized as:

It is capable of experimentally analyzing the requirements and characteristics of network communications and the communication protocols of the applications and services offered in an organization.

It is capable of configuring and managing network appliance and Internet access, integrating different networks with each other automatically and robustly.

Build controlled environments for network and service integration where you apply equipment management procedures and access technologies.

Knows and uses autonomously and correctly the tools, instruments and software applications available in the laboratories and correctly carries out the analysis of the data collected.

1.2.Context and importance of this course in the degree

This course take it on an obligatory basis in two mentions of the Computer Engineering Degree: Computer Engineering and Information Technologies.

Within the mention of Computer Engineering it belongs to the subject Computer and Network Infrastructures together with the subjects Data Center and Guarantee and Security. Within the mention of Information Technologies it belongs to the common subject of Hardware, Software and Network Infrastructures, together with the subjects System Administration 2 and Data Center.

1.3.Recommendations to take this course

The course will be taught by teachers from the Telematic Engineering Area of the Department of Electronic and Communications Engineering.

To continue this course normally, it is especially recommended that the student have previously taken the courses of Computer Network.

On the other hand, students are recommended to actively attend class, which basically consists of: Continuous study of theoretical concepts. Solving the exercises proposed in the problem classes. Interaction with the teacher. And prior preparation and carrying out of laboratory practices in a methodological and rigorous way and during the recommended

dates.

2.Learning goals

2.1.Competences

Upon passing the course, the student will be more competent to:

CT7. Analyze and assess the social and environmental impact of technical solutions acting with ethics, professional responsibility and social commitment.

CETI2. Select, design, deploy, integrate, evaluate, build, manage, exploit and maintain hardware, software and network technologies, within the appropriate cost and quality parameters.

CETI4. Select, design, deploy, integrate and manage communication networks and infrastructures in an organization.

CEIC8. Design, deploy, administer and manage computer networks.

2.2.Learning goals

The student, to pass this course, must demonstrate the following learning goals:

Study and analyze the requirements and characteristics of quality and cost of network communications and the communication protocols of the applications and services offered in an organization.

Analyzes the characteristics of the IP network construction equipment (switch, router, access points, etc.) and the Internet access infrastructures (ADSL, HFC, WIFI, etc.) and relates them to the communications requirements and protocols in such a way that it is able to select the most suitable equipment and infrastructures.

Set up and manage network construction and Internet access teams, being able to integrate different networks with each other automatically and robustly.

Evaluates the parameters that characterize communications, equipment and access technologies, making end-to-end cost and quality parameter estimates and monitoring from the equipment where the applications are located.

It designs and integrates networks and IP services on controlled laboratory environments where it applies evaluation procedures for the quality and cost characteristics of communications, equipment and Internet access infrastructures that allow it to select the best alternatives.

2.3.Importance of learning goals

Today it is unthinkable that in any organization there is no computer network. For this reason, the design and administration of networks in an important niche of the job market, and the competences in this matter are an excellent complement to the rest of the knowledge that a computer engineer must have, providing it with a very versatile profile capable of facing and solving a spectrum. wider problems.

The training received in the laboratory in the subjects covered by the subject is especially relevant in this course.

3.Assessment (1st and 2nd call)

3.1.Assessment tasks (description of tasks, marking system and assessment criteria)

The student must demonstrate that they have achieved the expected learning outcomes through the following assessment activities

The student will have a global test in each of the calls established throughout the course. The dates and times of the tests will be determined by the School. The qualification of this test will be obtained as follows:

E1: Final exam (100%). Score from 0 to 10 points. It consists of two parts:

E1A: Exam of theoretical / practical content (50%). This test will ask questions and / or problems related to the program taught in the subject, both in the classroom sessions and in the laboratory. Therefore, the exam will include both theoretical questions, such as problem solving, or questions on configuration or monitoring aspects, related to the development of practical sessions.

To pass the course, a minimum score of 5 points out of 10 is required in the Theoretical / Practical Contents Exam.

E1B: Final exam of laboratory practices (50%). It should only be done by students who have not passed the continuous assessment during the laboratory sessions period. It consists of solving a practical exercise that will be evaluated orally and through a questionnaire. This exercise may include contents of all the practices carried out during the teaching period, including aspects specifically related to the management of the tools used in them. In principle, the exam will be carried out in the laboratory on the same day that the theoretical / practical content exam is performed, although, given the individual nature of the evaluation, it may be necessary to schedule these tests on different days, which will be Notified affected students well in advance.

To pass the subject, a minimum score of 5 points out of 10 is required in the final test of laboratory practices.

E2: midterm assessment tests

E2B: Laboratory practices (50%): The performance of laboratory practices is compulsory for all students. The evaluation of the laboratory practices, in the sessions scheduled during the course, will be carried out, for the students who attend all of them, by means of the presentation of studies or previous works when these are necessary for the development of the practice, the report of follow-up of the same and the resolution of a series of questions or activities at the end of the practice (complete unit of one or more sessions).

Obtaining a minimum grade of 7 will exempt the student from taking the final exam of laboratory practices. Students who do not attend the practices must take the final exam of laboratory practices according to the procedure described in E1B.

In summary:

The final grade will be calculated using the following expression:

0.5xE1A + 0.5xEB provided the following three conditions are met:

(0.5xE1A + 0.5xEB)> 5

E1A> 5

EB> 5

where EB corresponds to the note of the laboratory practices obtained either by scheduled sessions and continuous assessment (E2B) or by the final test of laboratory practices (E1B) according to the procedures described above. So:

EB = maximum (E1B, E2B).

If the above conditions are not met, the final grade will include failed.

4.Methodology, learning tasks, syllabus and resources

4.1.Methodological overview

The learning process is based on the following activities:

Classroom activities
Activity Type 1 (lectures) 20 hours
Activity Type 2 (class of problems) 10 hours
Activity Type 3 (lab sessions) 30 hours
Activity Type 6 (practical work) 08 hours

Off-site activities
Activity type 7 78 hours (personal study)

Final evaluation Activity
Activity Type 8 (written test) 04 hours

4.2.Learning tasks

The course includes the following learning tasks:

- Activity Type 1 (lectures): 20 hours
- Activity Type 2 (class of problems): 10 hours. A total of 30 hours of theoretical sessions, problems and case studies are presented in the classroom.
- Activity Type 3 (lab sessions): 30 hours. 15 laboratory class sessions, aimed at the development of techniques and procedures seen in theoretical and problem sessions.
- Activity Type 6 (practical work): 8 hours. During the course, practical work is developed, in which apply the concepts and skills acquired in the subject, especially network management concepts, under lecturer supervision.

4.3.Syllabus

The course will address the following topics:

Introduction.

Overview of design and network management.

- **1. Interconnection IPv4 networks.** Review of the IPv4 protocol. NAT: Network Address Translation. Routing protocols. RIP and OSPF. Control functions. Support for other protocols. Management of TCP / IP networks: SNMP architecture. Problems.
- **2. Interconnection IPv6 networks.** Introduction to IPv6. Coexistence and transition of IPv4-IPv6. Addressing. PDU: Extension Headers. Autoconfiguration. Control functions. Routing.
- **3. Building networks using switched Ethernet technology.**

Ethernet review.
Switched Ethernet. Switch's structure. MAC routing. MAC switching. Multicast. virtual LAN. Problems.

- **4. Wireless access technologies.**
  Special features of wireless access. Impact of mobility (fixed access vs. mobile access). General characteristics. Standards. Functional architecture of the access network and network topologies. Medium access mechanisms. IP technology in the access network. Wireless local area networks (WLAN). IEEE 802.11 networks. Other wireless access networks.
- **5. Wired access technologies.**
  The most relevant features of the different physical media used in access networks today. General characteristics. Functional architecture of the access network and network topologies. User equipment and network. Medium access mechanisms. IP technology in the access network. Access networks copper pair (xDSL.) Hybrid networks and fibre cable (HFC). Other wired access networks.

The lab sessions are organized as follows:

- **1. GNS3 Introduction.**
  After completing this practice, the student must be able to:
  Install and configure the GNS3 tool. Paying special attention to the different GNS3 servers (real, virtual and remote).
  Configure different types of machines (IOS, Qemu, virtualBox, docker, ...) on the real and virtual servers and interconnect them in the same scenario.
  Configure and interconnect GNS3 scenarios located on different computers.
- **1.1 Configuring an IPv4 scenario.**
  After completing this practice, the student must be able to:
  Assign an IPv4 address scheme according to certain network interconnection specifications.
  Decide and configure the routing (static or dynamic) that needs to be established to ensure full connectivity in a network interconnection scenario.
  Properly configure basic connections using Ethernet technology.
  Analyze and evaluate the behavior of a network interconnection scenario:
  Properly use the necessary verification tools.
  Detect possible configuration errors, predict results.
- **1.2 Configuring an IPv4-NAT scenario.**
  The aim of this lab session is the configuration of Internet access from a private subnet (IPv4), identifying limitations of the basic NAT and implementing appropriate solutions.
- **2. Design and Administration of an IPv6 scenario.**
  After completing this practice, the student must be able to:
  Configure a network interconnection scenario using the IPv6 protocol guaranteeing both internal and external connectivity as well as interoperability with the IPv4 protocol.
  Analyze and evaluate the behavior of a network interconnection scenario in IPv6:
  Properly use all necessary verification tools.
  Detect possible configuration errors, predict results.
- **3. Design and Administration of an switched Ethernet** scenario.
  The practical proposal involves the design and management of a scenario aimed at interconnecting IP networks using switched LAN technologies. On this scenario it is put into practice the theoretical knowledge acquired: Switching and Virtual LAN MAC.
- **4. Design and Administration of an switched WIFI scenario.**
  The practical proposal involves the design and management of a scenario aimed at interconnecting IP networks using WiFi technology. On this scenario it is put into practice the theoretical knowledge acquired: Rate of Access Points, Access, etc.

The proposed type 6 activities (practical work):

- **Activity A: Configuring and Managing network servers.**
  It must be configured DHCP and NTP server for the internal network machines. It should be checked that the network equipment takes the IP address automatically and simultaneously synchronizes its clock with the server. It should also be observed the information exchange of relevant protocol using tools for monitoring and analysis of network traffic.
  In addition, a TFTP server must be configured, and the traffic generated when downloading a file will be monitored.

This activity must be done without the support of the information provided in the scripts of lab sessions. It is, therefore, a challenge, although it seems simple, requires the active participation of students in the search for the necessary information.

- **Activity B: Developing a management application using SNMP.**
  In this activity, students should develop an application that allows by means of an user interface, assign every port to a segment of an concentration element and show a list of ports for every segment, it is compulsory using the SNMP protocol. The lecturer will provide the necessary documentation for implementation. This activity must be done by every student (individual work).

4.4.Course planning and calendar

Schedule sessions and presentation of works

The course is given for 15 weeks with the following distribution of activities:
During the 15 weeks (4 hours per week):

- Development of lectures
- Solve problems
- Development lab sessions

Program
See in the corresponding section.

Further information concerning the timetable, classroom, office hours, assessment dates and other details regarding this course will be provided on the first day of class or please refer to the EINA website (http://eina.unizar.es) and EUPT website (http://eupt.unizar.es).

4.5.Bibliography and recommended resources

[BB: Bibliografía básica / BC: Bibliografía complementaria]

Zaragoza:

http://psfunizar7.unizar.es/br13/egAsignaturas.php?codigo=30239&Identificador=14704

- [BB] Kurose, James F., Ross, Keith W. Redes de computadores : un enfoque descendente, 7ª ed. Madrid : Pearson Educación, D.L. 2017.
- [BB] Stevens, W. Richard. TCP/IP illustrated. Vol. 1, The protocols / W. Richard Stevens . 2nd Edition Reading, Massachusetts [etc.] : Addison-Wesley, 2012

Listado de URLs:

- IETF Request For Comments (RFC): documentos de especificaciones (varios) [http://www.ietf.org/rfc.html]
- The TCP/IP guide. [http://www.tcpipguide.com/free/t_toc.htm]

Teruel:

http://psfunizar7.unizar.es/br13/egAsignaturas.php?codigo=30239&Identificador=14734

- [BB] Kurose, James F., Ross, Keith W.. Redes de computadores : un enfoque descendente, 7ª ed. Madrid : Pearson Educación, D.L. 2017
- [BB] Stevens, W. Richard. TCP/IP illustrated. Vol. 1, The protocols / W. Richard Stevens . 2nd Edition Reading, Massachusetts [etc.] : Addison-Wesley, 2012

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