![UNIVERSITAT POLITÈCNICA DE CATALUNYA BARCELONATECH]

Course guide
340362 - SEAX-C9X44 - Network Security and Administration

Last modified: 05/02/2025

Unit in charge:	Vilanova i la Geltrú School of Engineering
Teaching unit:	744 - ENTEL - Department of Network Engineering.

Degree:	BACHELOR'S DEGREE IN INFORMATICS ENGINEERING (Syllabus 2018). (Compulsory subject).

Academic year: 2024   **ECTS Credits:** 6.0   **Languages:** Catalan

LECTURER

Coordinating lecturer:	Guasch Murillo, Daniel
Others:	Guasch Murillo, Daniel
	Vidal Ferré, Rafael
	Casals Ibáñez, Lluís
	Garcia Villegas, Eduard

PRIOR SKILLS

It is necessary that the students who take the subject have assimilated the basic knowledge about operating systems (SIOP and ADSO) and communication networks (XACO and INTE).

REQUIREMENTS

It is recommended that students of the computer science degree have taken the subjects of computer networks (XACO and INTE) and operating systems (SIOP and ADSO).

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

1. CEFC18. Knowledge of legislation and regulation of computing at national, european and international level.
2. CEFC5. Knowledge, management and maintenance of systems, computing services and applications.
3. CEFC8. Ability to analyze, to design, to construct and to maintain applications in a well built, secure and efficient way choosing the most adequated paradigms and languages.
4. CEIC6. Ability to understand, implement and manage security and safety of computing systems.
5. CEIC8. Ability to design, deploy, administer and manage computer networks.
6. CEIS1. Ability to develop, to maintain and avaluate programming services and systems which satisfy all requirements of user having a reliable and efficient behavior, being comprehensible to develop and maintain and observe to current rules, applying theory, principals, methods, practices of pragramming engineering.
7. CEIS2. Ability to assess customer needs and specify software requirements to meet these needs, reconciling conflicting goals by finding acceptable compromises within limitations arising from the cost, time, existence of systems already developed and from organizations themselves.
8. CESI1. Ability to integrate solutions for Information and Communications Technology and business processes to meet information needs of organizations, enabling them to reach their goals effectively and efficiently, thus giving them competitive advantages.
9. CESI2. Ability to determine the requirements of information and communication systems of an organization paying attention to safety aspects according to security and compliance with regulations and legislation.
10. CETI1. Ability to understand the environment of an organization and its needs in the field of information technology and communications.

11. CETI4. Ability to select, design, deploy, integrate and manage network and communications infrastructure in an organization.

12. CETI5. Ability to select, to develop, integrate and manage information systems which satisfy organization necessities with indentified costs and quality criteria.
13. CETI6. Ability to design systems, applications and services based on network technologies, including internet, website, e-commerce, multimedia, interactive services and mobile computing.

TEACHING METHODOLOGY

The subject is organized around a project that will be carried out throughout the course. This project will be carried out individually and will consist of implementing a network of virtualized equipment with all the features of a real network. The development of the course has been conceived as a laboratory where the student will have to assimilate the necessary knowledge to design and implement a fully functional computer network. The work teams will be virtualizations of current systems and will offer the student the possibility to experience the creation of a network. In each session of the subject, a new service will be proposed that will need to be incorporated into the network; while allowing the student to incorporate it into an existing server or create a new one as they see fit. The design criteria will be based on the technical recommendations that are currently applied in the industry.

The student will be provided with the basic theoretical documentation that should allow him to understand the basics of the services he will implement. This theoretical basis will be summarized at the beginning of the sessions and its individual study outside the classroom will be proposed. The student will also have a virtual reference system in order to homogenize developments throughout the course.

LEARNING OBJECTIVES OF THE SUBJECT

The objective of the subject is to offer the student the possibility of creating a fully functional computer network with real benefits. The evolution of the subject will simulate the creation of a network of virtualized equipment in the laboratory. Once the subject is completed, the student must be able to design, implement and administer a computer network taking into account the security, efficiency and reliability criteria in force in the industry.

STUDY LOAD

Type	Hours	Percentage
Hours small group	60,0	40.00
Self study	90,0	60.00

Total learning time: 150 h

CONTENTS

Network access servers

Description:
- Description of the theoretical foundations.
- Identification of the main protocols used.
- Analysis of management and security guidelines.
- Implementation on a virtualized server.

Specific objectives:
One, or more, services from the following categories will be worked on:
- Virtualization services (VirtualBox).
- Network interfaces (Ethernet, Wi-Fi).
- Addressing services (DNS, DHCP).
- Routing services (static, RIP, OSPF).
- Remote access services (SSH, SFTP, OpenVPN).
- Monitoring services (Webmin, Netdata, Nmap, Tcpdump, Nessus).

Related activities:
Implementation of the servers using a Debian Linux distribution.

Related competencies :
I_CETI6. CETI6. Ability to design systems, applications and services based on network technologies, including internet, website, e-commerce, multimedia, interactive services and mobile computing.
I_CETI5. CETI5. Ability to select, to develop, integrate and manage information systems which satisfy organization necessities with indentified costs and quality criteria.
I_CETI4. CETI4. Ability to select, design, deploy, integrate and manage network and communications infrastructure in an organization.

I_CETI1. CETI1. Ability to understand the environment of an organization and its needs in the field of information technology and communications.

I_CESI2. CESI2. Ability to determine the requirements of information and communication systems of an organization paying attention to safety aspects according to security and compliance with regulations and legislation.
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I_CEFC8. CEFC8. Ability to analyze, to design, to construct and to maintain applications in a well built, secure and efficient way choosing the most adequated paradigms and languages.
I_CEFC5. CEFC5. Knowledge, management and maintenance of systems, computing services and applications.
I_CEFC18. CEFC18. Knowledge of legislation and regulation of computing at national, european and international level.

Full-or-part-time: 10h
Laboratory classes: 4h
Self study : 6h

Data access servers

Description:
- Description of the theoretical foundations.
- Identification of the main protocols used.
- Analysis of management and security guidelines.
- Implementation on a virtualized server.

Specific objectives:
One, or more, services from the following categories will be worked on:
- File services (NFS, SAMBA, Owncloud, Webdav, Rsync).
- Web services (HTTP/HTTPS with Apache2, Joomla, Wordpress).

Related activities:
Implementation of the servers using a Debian Linux distribution.

Related competencies :
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I_CETI5. CETI5. Ability to select, to develop, integrate and manage information systems which satisfy organization necessities with indentified costs and quality criteria.
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Full-or-part-time: 10h
Laboratory classes: 4h
Self study : 6h

ACTIVITIES

Virtualization system.

Description:
Get to know the VirtualBox virtualization environment.

Specific objectives:
Know the virtualization system.

Material:
A computer with VirtualBox.

Delivery:
A technical paper will be delivered on how to implement a virtual server with Debian. As well as the configuration files developed and the verification tests performed.

Related competencies :
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Laboratory classes: 4h
Self study: 6h

Network interfaces.

Description:
Configure wired and wireless network interfaces.

Specific objectives:
Set up a computer's network environment.

Material:
A computer with VirtualBox.

Delivery:
A technical report describing the actions taken, the files edited in the implementation and the verification tests carried out will be delivered.

Related competencies :
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I_CETI4. CETI4. Ability to select, design, deploy, integrate and manage network and communications infrastructure in an organization.

Full-or-part-time: 20h
Practical classes: 8h
Self study: 12h

Networkh dile service.

Description:
Implement a network file service (NFA, SAMBA, etc).

Specific objectives:
Deploy a network file service with Linux Debian.

Material:
A computer with VirtualBox.

Delivery:
A technical report describing the actions taken, the files edited in the implementation and the verification tests carried out will be delivered.

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Full-or-part-time: 10h
Self study: 6h
Laboratory classes: 4h

Routing, filtering and NAT service.

Description:
Implement a routing, filtering and NAT service (router).

Specific objectives:
Deploy a router with Linux Debian.

Material:
A computer with VirtualBox.

Delivery:
A technical report describing the actions taken, the files edited in the implementation and the verification tests carried out will be delivered.

Related competencies :
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Full-or-part-time: 20h
Self study: 12h
Laboratory classes: 8h

Addressing service.

Description:
Configure a dynamic addressing server (DHCP).

Specific objectives:
Configuring a DHCP service with Linux Debian.

Material:
A computer with VirtualBox.

Delivery:
A technical report describing the actions taken, the files edited in the implementation and the verification tests carried out will be delivered.

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I_CEIC8. CEIC8. Ability to design, deploy, administer and manage computer networks.

Full-or-part-time: 10h
Self study: 6h
Laboratory classes: 4h

Domain name service.

Description:
Implement a domain name service.

Specific objectives:
Implement a DNS server with Linux Debian.

Material:
A computer with VirtualBox.

Delivery:
A technical report describing the actions taken, the files edited in the implementation and the verification tests carried out will be delivered.

Related competencies :
I_CEFC18. CEFC18. Knowledge of legislation and regulation of computing at national, european and international level.
I_CEFC8. CEFC8. Ability to analyze, to design, to construct and to maintain applications in a well built, secure and efficient way choosing the most adequated paradigms and languages.
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I_CEIC6. CEIC6. Ability to understand, implement and manage security and safety of computing systems.

Full-or-part-time: 10h
Self study: 6h
Laboratory classes: 4h

Virtual private network service.

Description:
Implement an access service to a virtual private network.

Specific objectives:
Deploy an OpenVPN server with Linux Debian.

Material:
A computer with VirtualBox.

Delivery:
A technical report describing the actions taken, the files edited in the implementation and the verification tests carried out will be delivered.

Related competencies :
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Full-or-part-time: 10h
Self study: 6h
Laboratory classes: 4h

Network diagnostics.

Description:
Program a shell script to analyze certain elements of the network, to be specified.

Specific objectives:
Know how to use the basic network tools available in Linux Debian.

Material:
A computer with VirtualBox.

Delivery:
A technical report describing the actions taken, the files edited in the implementation and the verification tests carried out will be delivered.

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Laboratory classes: 4h
Self study: 6h

Web service.

Description:
Implement a web service.

Specific objectives:
Deploy a web service.

Material:
A computer with VirtualBox.

Delivery:
A technical report describing the actions taken, the files edited in the implementation and the verification tests carried out will be delivered.

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I_CEIC8. CEIC8. Ability to design, deploy, administer and manage computer networks.
I_CETI5. CETI5. Ability to select, to develop, integrate and manage information systems which satisfy organization necessities with indentified costs and quality criteria.
I_CEIS2. CEIS2. Ability to assess customer needs and specify software requirements to meet these needs, reconciling conflicting goals by finding acceptable compromises within limitations arising from the cost, time, existence of systems already developed and from organizations themselves.
I_CETI4. CETI4. Ability to select, design, deploy, integrate and manage network and communications infrastructure in an organization.

I_CEFC8. CEFC8. Ability to analyze, to design, to construct and to maintain applications in a well built, secure and efficient way choosing the most adequated paradigms and languages.

Full-or-part-time: 10h
Laboratory classes: 4h
Self study: 6h

Forensic analysis.

Description:
Forensic analysis of systems and networks by the teaching staff of the subject.

Specific objectives:
Know, in a practical way, basic concepts of forensic analysis of systems and networks.

Material:
A computer with VirtualBox.

Delivery:
There is no delivery.

Related competencies :
I_CEIS2. CEIS2. Ability to assess customer needs and specify software requirements to meet these needs, reconciling conflicting goals by finding acceptable compromises within limitations arising from the cost, time, existence of systems already developed and from organizations themselves.
I_CEFC18. CEFC18. Knowledge of legislation and regulation of computing at national, european and international level.
I_CEFC8. CEFC8. Ability to analyze, to design, to construct and to maintain applications in a well built, secure and efficient way choosing the most adequated paradigms and languages.
I_CETI6. CETI6. Ability to design systems, applications and services based on network technologies, including internet, website, e-commerce, multimedia, interactive services and mobile computing.
I_CETI1. CETI1. Ability to understand the environment of an organization and its needs in the field of information technology and communications.

I_CEFC5. CEFC5. Knowledge, management and maintenance of systems, computing services and applications.
I_CESI2. CESI2. Ability to determine the requirements of information and communication systems of an organization paying attention to safety aspects according to security and compliance with regulations and legislation.
I_CEIC8. CEIC8. Ability to design, deploy, administer and manage computer networks.
I_CESI1. CESI1. Ability to integrate solutions for Information and Communications Technology and business processes to meet information needs of organizations, enabling them to reach their goals effectively and efficiently, thus giving them competitive advantages.
I_CETI5. CETI5. Ability to select, to develop, integrate and manage information systems which satisfy organization necessities with indentified costs and quality criteria.
I_CETI4. CETI4. Ability to select, design, deploy, integrate and manage network and communications infrastructure in an organization.

I_CEIS1. CEIS1. Ability to develop, to maintain and avaluate programming services and systems which satisfy all requirements of user having a reliable and efficient behavior, being comprehensible to develop and maintain and observe to current rules, applying theory, principals, methods, practices of pragramming engineering.
I_CEIC6. CEIC6. Ability to understand, implement and manage security and safety of computing systems.

Full-or-part-time: 20h
Laboratory classes: 8h
Self study: 12h

GRADING SYSTEM

The evaluation of the subject will be carried out continuously according to the number of services incorporated in the virtual network and the quality of the implementations. A precedence will also be defined in the sequence of development of the elements of the virtual network. The evaluation method will consist of evaluating the implementations of the network services defined by the professors of the subject, weighted according to their difficulty. Optionally, it is possible to consider a project in the subject that allows a 10% increase in the final grade. As it is a 100% laboratory subject, without exams, there is no re-evaluation test.

EXAMINATION RULES.

Server implementations will be personal; they must be justified based on the requirements presented in class and the recommendations of the bibliography provided; the actions carried out must be commented on; and it will be necessary to demonstrate its correct operation based on experimental tests.

If it is detected that part of the content of an assessable test (practice, problem, assignment, exam, etc.) has been plagiarised or generated by artificial intelligence, the entire test will be graded with a zero. In case of recidivism, the entire subject will be graded with a zero. In both cases, the faculty head of studies will be informed. At the same time, any test submitted after the deadline or by a means other than that established, will be considered as not delivered.

RESOURCES

Other resources:

The bibliography and resources of the subject are available on the Atenea virtual campus. Reference is made to the Internet notes and forensic analysis demonstrations published on the APREN platform by the teaching staff of the subject. Links are provided to the official documentation of the Debian Linux distribution, to the VirtualBox program, to forensic analysis tools, and to reference entities in computer security such as CCN-cert. In addition, links are included to the free software used in the subject.