

Program	59TL – Telematics Engineering B. Eng.
----------------	---------------------------------------

Course number and name	
Number	595000227
Name	Signaling and Switching
Semester	S5 [(September-January)]

Credits and contact hours	
ECTS Credits	6
Contact hours	60

Coordinator's name	Parada Gélvez, Hugo Alexer [hugoalexer.parada@upm.es]
---------------------------	---

Specific course information

Description of course content

It delves into the modern network service provision systems, mainly through connection-oriented packet-switching technologies and virtual circuits.

The course begins with an introduction to the concepts of "tunneling" and virtual private networks (VPN). The student also study the switching systems used in the core network, the technologies that allow managing the traffic to offer the required quality of service and the basics of VoIP.

It also includes the techniques of configuration and management of IP networks with dynamic routing, as well as an introduction to the concepts of the IPv6 protocol.

At the end of the course the student acquires, both from the theoretical and practical point of view, a more specialized and in-depth knowledge of telematic mechanisms used in most of the current core networks of telecommunications.

List of topics to be covered

1. Virtual Private Network (VPN)
 - 1.1. Introduction and most common uses.
 - 1.2. Basic requirements.
 - 1.3. Tunneling.
 - 1.4. OpenVPN
2. Voice on IP (VoIP).
 - 2.1. Introduction and causes.
 - 2.2. Architecture of a VoIP network.
 - 2.3. RTP/RTCP
 - 2.4. Signaling protocol SIP (Session Initiation Protocol)
3. Packet switching techniques: MPLS
 - 3.1. Origins and causes.
 - 3.2. Basic principles of MPLS operation.
 - 3.2.1. MPLS tunnels.

<p>3.3. Signaling protocols LSP. 3.3.1. LDP.</p> <p>4. QoS:</p> <p>4.1. Characterization of traffic. 4.2. Requirements for Quality of Service. 4.3. Contractual agreement: SLA, SLS. 4.4. Traffic management. 4.5. Illustration of Quality of Service in specific technologies. 4.6. Principles of Traffic Engineering.</p> <p>5. IPv6:</p> <p>5.1. Introduction and characteristics. 5.2. IPv6 header and extension headers. 5.3. IPv6 addressing. 5.5. Auto-configuration addresses.</p> <p>Lab sessions:</p> <p>1. Basic principles of tunneling and VPN. 2. Configuration and administration of an IP network with dynamic routing (OSPF). 3. Configuration and administration of a VoIP network. 4. Basic configuration of a MPLS network.</p>
<p>Prerequisites or co-requisites</p> <ul style="list-style-type: none"> – Statistics and Stochastics Processes – Telecommunication Networks and Services – Computer Networks

Specific goals for the course
<p>Specific outcomes of instruction</p> <ul style="list-style-type: none"> • RA727 – To configure a network that uses a connection-oriented packet-switching technologies. • RA718 – To define the parameters that characterize traffic in origin. • RA717 – To analyze a real flow of signaling traffic. • RA719 – To define the parameters that characterize the requirements of quality of service. • RA720 – To define the management procedures of traffic more common in the QoS networks. • RA721 – To explain what kind of information is on a traffic contractual-agreement, or Service Level Agreement. • RA722 – To define the basic principles and models applied to traffic engineering. • RA724 – To describe the characteristics of the nodes, architectures, protocols and functions of traffic management of the connection-oriented packet-switching technologies. • RA1064 – To describe and prove the functional elements and the characteristics of the protocols used in a VoIP network. • RA1178 – To describe and show the characteristics that distinguish IPv6 and IPv4. • RA1063 – To identify the required elements, functions and protocols for the interconnection between VoIP and the circuit switching networks.

- RA723 – To measure the resources of a simple network thanks to the traffic engineering principles.
- RA725 – To explain the basic principles of tunneling and VPNS.
- RA1062 – To apply the knowledges of IP networks to the configuration and administration of a network with a dynamic routing.
- RA1204 – To apply the knowledges of VoIP networks to the configuration and administration of a real network with this technology.

Further reading and supplementary materials

- Data and computer communications. W. Stallings. 9th ed. Upper Saddle River (New Jersey): Pearson, cop., 2011.
- ISDN and Broadband ISDN with Frame Relay and ATM. William Stallings. 4th ed. Ed. Prentice Hall, 1999.
- Connection-oriented networks: SONET/SDH, ATM, MPLS and optical networks. Harry G. Perros. John Wiley & Sons, 2005.
- IP telephony: packet-based multimedia communications systems. Olivier Hersent. Pearson Education, 2000.
- <http://www.tech-invite.com/index.html>
- End-to-End QoS Network Design: Quality of Service for Rich-Media & Cloud Networks. T. Szigeti, C. Hattingh, R. Barton, K. Briley Jr. Cisco Press, November, 2013.
- The Internet Engineering Task Force: <http://www.ietf.org/>
- Broadband Forum: <http://www.broadbandforum.org/>
- International Telecommunication Union: <http://www.itu.int/>
- VoipForo. H.323: <http://www.voipforo.com/H323/H323objetivo.php>
- IPv6 Forum - The new Internet: <http://www.ipv6forum.com/>
- OpenVPN. Community Resources: <https://openvpn.net/community-resources/#documentation>
- TIC CCNSTIC 836. ENS. Security in VPN. National Cryptology Centre:: <https://www.ccn-cert.cni.es/series-ccn-stic/800-guia-esquema-nacional-de-seguridad/2299-ccn-stic-836-seguridad-en-vpn-en-el-marcodel-ens/file.html>
- Moodle.