



Programme of Integrated course "Reti di Calcolatori Evolute"

This course is composed of 2 Modules: 1) Reti di calcolatori Evolute: Architetture, 2) Advanced Computer Networks: Internetworking

Programme of Module "Reti di calcolatori Evolute: Architetture"

- Code: DT0041
- Type of course unit: Elective (Master Degree in Computer Science curriculum General)
- Level of course unit: Postgraduate Degrees
- Semester: 1

Number of ects credits: (Master Degree in Computer Science) 6 (workload 150 hours)

Teachers: Giuliano Paris (giulianoparis@alice.it)

1	Course objectives	The module presents the architectures, protocols and services of the current and future telecommunication networks. After introducing the requirements (bandwidth, real time, etc.) of voice, data and video and a brief description of the legacy PSTN (TDM) infrastructures (originally designed only for phone services), the main features of an integrated multiservice IP-based backbone are described. Such IP based architecture is an essential element for the growing digital services and applications (i.e. web 2.0, cloud computing, big data, etc.) Among the various access networks the fixed access (i.e. ADSL, NGAN-fiber based, etc.) and mobile and wireless access are covered. Regarding the mobile technologies, the course presents the evolution from GSM/GPRS/EDGE to 3G systems (UMTS/HSPA) up to 4G-LTE architectures, services and applications. For the local environments wired (LAN) and wireless (WiFi) standards are described including the upcoming wifi-mobile integration. Finally Voice over IP and audio/video streaming architectures and protocols are described.
2	Course content and learning outcomes (dublin descriptors)	<p>Topics of the module include:</p> <ul style="list-style-type: none"> • Services requirements and Network architectures (access technologies, switching nodes, etc.) • Basics on transmission and information theory • Circuit and packet switching • Legacy PSTN/ISDN infrastructures • The fixed access (Fiber to the X architectures) towards the UltraBroadband Services • Signaling protocols (SS7) and call scenarios (PSTN services, IN services) • Intro to mobile networks and GSM architecture and services • Mobile procedures (authentication, location update, handover, call scenario, roaming) • TCP/IP architecture fundamentals • Local Area Networks (LANs) standards and protocols • Wi-Fi networks and security issues • Mobile data networks evolution: from GPRS/EDGE to UMTS/HSPA and 4G-LTE systems; Voice over IP (VoIP) architectures and protocols (H.323, SIP) and audio/video streaming <p>On successful completion of this module, the student should :</p> <ul style="list-style-type: none"> • Understand the main features of current and future IP multimedia network architectures and Protocols • Analyze and evaluate the performance of fixed, mobile and wireless access networks
3	Course prerequisites	Basics on mathematics and physics
4	Teaching methods and language	The course consists of a main part and a series of seminars on topics such as Fiber optics and next generation access networks Language: Italian

		<p>Reference textbooks</p> <ul style="list-style-type: none"> • A.R. Prasad, N.R. Prasad, <i>802.11 WLANs and IP Networking: Security, QoS, and Mobility</i>. Artech House. • C. Cox, <i>An Introduction to LTE: LTE, LTE-Advanced, SAE, VoLTE and 4G Mobile Communications</i>. WILEY. • D. Collins, <i>Carrier Grade Voice Over IP</i>. McGraw-Hill. • D. E. Comer, <i>TCP/IP principles, protocols, and architectures</i>. Prentice Hall. • E. Brynjolfsson, A. McAfee, <i>The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies</i>.
5	Assessment methods	The exam consists of a single oral test (questions and exercises)
Programme of Module "Advanced Computer Networks: Internetworking"		
<ul style="list-style-type: none"> • Code: DT0042 • Type of course unit: Elective (Master Degree in Computer Science curriculum General) • Level of course unit: Postgraduate Degrees • Semester: 2 		
Number of ects credits: (Master Degree in Computer Science) 6 (workload 150 hours)		
Teachers: Dajana Cassioli (dajana.cassioli@univaq.it)		
1	Course objectives	This module invites students to explore the networking, routing, transport and application protocols that are used in the Internet. The module encourages students to understand the key architectural issues in the design, development and implementation of Internet protocols using lectures, seminars and tutorials. Protocol specifications and standards such as IPv6 as necessary evolution of IPv4, IntServ and DiffServ to manage the quality of service (QoS), IPsec to ensure security, etc. will be examined and the use of techniques such as MPLS to improve the performance of forwarding, and protocols such as Mobile IP to manage mobility, and RTP/RTSP for Video transmission will also be investigated. Finally, in the light of the knowledge gained on internetworking protocols, we present some IP-based applications, such as VoIP and 6LoWPAN.
2	Course content and learning outcomes (dublin descriptors)	<p>Topics of the module include:</p> <ul style="list-style-type: none"> • The routing IP in Internet • IP version 6 • IP and mobility: Mobile IP • IP protocols for multimedia streaming (SIP, RTP, RTCP, RTSP) • Quality of Service in InternetIP switching and Multi-Protocol Label Switching (MPLS) • Security in Internet • IP network management and Simple Network Management Protocol (SNMP) • Some IP-based applications: Internet Protocol Television (IPTV) and Sensor Networks (IPv6 -6LoWPAN) <p>On successful completion of this module, the student should :</p> <ol style="list-style-type: none"> 1. Demonstrate the knowledge of the essential features and operation of Internet Protocols; 2) Understand the principle and operation of a set of protocols in the TCP/IP suite <p>Protocols</p> <ol style="list-style-type: none"> 1. Analyze a range of network protocols; 2) Design a protocol with a finite state structure to meet pre-specified requirements <ol style="list-style-type: none"> 1. Analyze and evaluate performance of complex networks; 2) Implement or analyze new networking applications <ul style="list-style-type: none"> • Explain the use of network monitoring and performance tools
3	Course prerequisites	It is strongly recommended to have passed the exam of Computer Networks in order to have a knowledge of the problems of networking and internetworking.
4	Teaching methods and language	<p>The course consists of a series of lectures, few hours of exercises and homework.</p> <p>Language: English</p> <p>Reference textbooks</p> <ul style="list-style-type: none"> • M. Baldi, P. Nicoletti, <i>Internetworking</i>. McGraw-Hill Milano. 1999.

		<ul style="list-style-type: none">• Fred Halsall, Networking e Internet, 5ed.. Pearson Education – Addison Wesley. 2006.• W. Stallings, Sicurezza delle reti – Applicazioni e standard, 3ed.. Pearson – Prentice Hall. 2007.
5	Assessment methods	The exam consists of a single written test, with numerical exercises and open-ended questions.