SYLLABUS

Discipline name	Internet Protocols
Profile	Electronics and Telecommunications Engineering
Specialization	Telecommunications Technologies and Systems
Code	51324609
Course leader	Professor Virgil Dobrota, Ph.D – virgil.dobrota@com.utcluj.ro
Collaborators	Assistant Mihai Vancea – mihai.vancea@com.utcluj.ro
Department	Comunications
Faculty	Electronics, Telecommunications and Information Technology

Sem.	Type of discipline	Course	Applications			Course	Applications			Ind. study	TOTAL	Credits	Form of assessment
		[hours/week]				[hours/semester]							
			S	L	P		S	L	P				
7	**Speciality**	**2**	**-**	**2**	**-**	**28**	**-**	**28**	**-**	**94**	**150**	**5**	**Exam**

Acquired competences :
- To know the packet switching principles
- To know the major protocols used in Internet, according to TCP/IP stack
- To know the basics of routing protocols

Acquired skills (what the student is able to do):
- To know the major TCP/IP commands used in Windows XP/Vista and Linux (Fedora Core 10)
- To be able to configure IPv4/IPv6 hosts with routing options
- To write a C-based TCP/UDP client/server application
- To evaluate the practical performances of an Internet protocol using a software packet analyzer

Acquired abilities (what type of equipment/ instruments/ software the student is able to handle):
- To work with Cisco routers (1750, 1812, 2501, 2811, 3000): address configuration, static routing, dynamic routing using RIP and OSPF
- To use Linux routers and Asterisk IP-based PBX under Fedora Core 10: address configuration, static routing, dynamic routing using RIP and OSPF
- To use packet analyzers: Wireshark, Ethereal
- To use zebra and quagga software packages

Prerequisites (if necessary):

Knowledge about computer networks, queueing systems, routing algorithms, C programming skills

A. Course/Lecture (course/lecture titles)	
1	TCP/IP Reference Model. Short history of Internet. TCP/IP Architecture. IPv4 Header.
2	IPv4 Addresses. IPv6 Header. IPv6 Extension Headers. Hop-by-Hop Header. Routing Header.
3	IPv6 Addresses. Unicast, multicast and anycast addresses.
4	IPv6 unicast addresses: unspecified, loopback, IPv4-compatible, global unicast, link-local, site-local.
5	IPv6 multicast addresses. IPv6 anycast addresses. Conclusions about IPv6. Comparison to IPv4
6	IP in mobile communications. Mobile Node. Home Agent. Foreign Agent. Care-of Address. Mobile IPv4. Mobile IPv6. Tunneling methods. IP in IP encapsulation
7	Transport Layer. TCP Header. UDP Header.
8	Client-server architecture. Client. Server. Berkeley sockets. TCP connection management. 3-Way Handshake. Finite-state machine
9	Protocols: ICMP, ICMPv6, ARP, RARP, BOOTP, DHCP, DHCPv6, DNS, DNS6
10	Routed/non-routed protocols. Distance-Vector based routing. Bellman-Ford algorithm. Routing protocols: RIPv1, RIPv2, RIPng.
11	Link-state based routing. Neighbor Discovery. Dijkstra's algorithm. Routing protocols: OSPFv2, OSPFv3.
12	TCP congestion control. Congestion prevention policies for Layer 2, 3 and 4. "Slow-start" and Congestion Avoidance algorithms.
13	Retransmission timer. Algorithms: Jacobson, Karn, Bakre-Badrinath, Balakrishnan. Fast Retransmit/Fast Recovery algorithms
14	Review. Examples of subjects given in the previous academic year

B. Applications – **Laboratory** (list of laboratories), **Seminar** (contents), **Project** (project contents)	
1	IPv4 addresses. Host address. Subnet address. Subnet mask. (seminar)
2	Linux/Windows-based commands for IPv4: w, who, finger, ping, traceroute, tracert, telnet, ssh, putty, ftp, ws_ftp, talk, pine

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3	Linux/Windows-based commands for IPv6: ping6, traceroute6, tracert6, ssh.
4	Packet analyzers: Ethereal, Wireshark.
5	Configuration of Linux/Windows-based workstations for IPv4: address, mask, DNS, gateway, proxy. Configuration of Linux/Windows-based workstations for IPv6. IPv6 addresses. Auto-configuration. Routing options..
6	Client-server architecture. Datagram-socket. Stream-socket. Primitives: socket, bind, listen, select, accept, send, receive, connect, close. TCP/UDP clients and servers.
7	Mini-projects involving: a) TCP client running on each team's workstation under Windows XP, with IPv4 protocol enabled; b) IP PBX Asterisk runs on a computer with a given IPv6 address under Fedora Core 10 Linux, with IPv6 protocol enabled; c) TCP server is waiting clients at a given port. An IPv6 client and an IPv4 server have to be implemented with given functionalities.
8	IPv6 client implementation: commands sent and received (core show uptime, core show version, core show channels etc.) to/from IP PBX Asterisk.
9	IPv4 server: connections and commands from given IPv4 client, returning the confirmation
10	Defending the mini-project
11	ICMP, ICMPv6, ARP, RARP, BOOTP, DHCP, DHCPv6, DNS, DNS6.
12	Zebra/quagga software. Distance-vector based routing protocols: RIPv1, RIPv2, RIPng
13	Link-state based routing protocols: OSPFv1, OSPFv2, OSPPv3
14	Recovered laboratories

C. Individual study (reference study contents, synthesis materials, projects, applications etc.)

1. A Linux-based IPv6 client has to be implemented with given functionalities. Commands will be sent to an Asterisk IP-based PBX.
2. A Linux-based IPv4 server has to be implemented with given functionalities. Commands will be received from a Windows-based IPv4 client.

Individual study structure	Course study	Problem solving, laboratory, project	Applications preparation	Examination time	Additional reference study	Total no. of individual study hours
Hours	28	36	18	3	9	94

References (Textbooks, courses, laboratory manual, exercise book)

1. V.Dobrota, *Retele digitale in telecomunicatii. Volumul 3: OSI si TCP/IP.* Editia a II-a, Editura Mediamira, Cluj-Napoca 2003
2. D.Zinca, *Retele de calculatoare.* Editura Risoprint, Cluj-Napoca 2006
3. L. Peterson & B. Davie – *Computer Networks. A Systems Approach.* 4th Edition. Elsevier Inc., 2007
4. A. Tanenbaum, *Computer Networks*, Fourth Edition, Prentice Hall, 2003
5. D.E. Comer, *Computer Networks and Internets with Internet Applications.* 4th Edition, Pearson 2004
6. P. Loshin, *IPv6 Clearly Explained.* Morgan Kaufmann, 2000

On – line references

1. V. Dobrota, *Protocols for Internet,* Course and Applications, http://el.el.obs.utcluj.ro/pi/en_index.htm
2. ***, Asterisk: http://www.voip-info.org/wiki/index.php?page=Asterisk
3. ***, Berkeley sockets: http://en.wikipedia.org/wiki/Berkeley_sockets

Final evaluation	
Evaluation method	Exam including 2 parts (theory + applications): a test (T) with 9 questions from course and laboratory (1 hour) and a multiple-choice grill test (P2) covering all chapters (1 hour). The mark obtained for the mini-project (P1) represents 50% of the mark for applications.
Mark components	Test (T)= 0...10 p, Problems P=P1+P2=0...10 p, Problem P1=project=0...5 p, Problem P2=0...5 p.
Mark computation	N=(T+P)/2, the credits are obtained if N≥5; T≥5; P≥4.5 (P1 ≥2.5, P2≥2)

Course leader,

Professor Virgil DOBROTA, Ph.D.

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