SYLLABUS

1. Data about the program of study

1.1	Institution	Technical University of Cluj-Napoca
1.2	Faculty	Electronics, Telecommunications and Information Technology
1.3	Department	Communications
1.4	Field of study	Electronics and Telecommunications Engineering
1.5	Cycle of study	Master of Science
1.6	Program of study/Qualification	Multimedia Technologies/ Telecommunications/ Master
1.7	Form of education	Full time
1.8	Subject code	TM-E16.30/ TC-E02.00

2. Data about the subject

2.1	Subject name					Unified Communications in Cloud					
2.2	Subject area					Electronics and Telecommunications Engineering					
2.3	Course responsible/lecturer					Professor Virgil DOBROTA, PhD					
2.4	Teachers in charge of applications					Professor Virgil DOBROTA, PhD					
2.5	Year of study	II	2.6	Semester	3	2.7	Assessment	Exam	2.8	Subject category	DS/DO

3. Estimated total time

Year/ Sem.	Subject name	No. of weeks	Course [hours/ week]	Applications [hours/ week]			Course [hours/ semester]	Applications [hours/ semester]			Indiv. study [hours/ semester]	TOTAL	Credits
				S	L	P		S	L	P			
I/1	Unified Communications in Cloud	14	1		2		14		28		58	100	4

3.1	Number of hours per week	3	3.2	of which, course	1	3.3	applications	2
3.4	Total hours in the curriculum	42	3.5	of which, course	14	3.6	applications	28

Individual study	Hours
Manual, lecture material and notes, bibliography	20
Supplementary study in the library, online and in the field	12
Preparation for seminars/laboratory works, homework, reports, portfolios, essays	20
Tutoring	3
Exams and tests	3
Other activities	

3.7	Total hours of individual study	58
3.8	Total hours per semester	100
3.9	Number of credit points	4

4. Pre-requisites (where appropriate)

4.1	Curriculum	Computer Networks, Switching and Routing Systems, Internet Protocols

4.2	Competence	NA

5. Requirements (where appropriate)

5.1	For the course	Cluj-Napoca
5.2	For the applications	Cluj-Napoca

6. Specific competences

Professional competences	CP 5 - Development of software applications for telecommunications CP 7 - Evaluation of performance, service quality and security of telecommunications systems
Cross competences	CT 6 - Ability to integrate into the organization's management team

7. Discipline objectives (as results from the key competences gained)

7.1	General objectives	• To know the main packet switching WAN technologies • To know the architectures used in unified communications
7.2	Specific objectives	1. To be able to evaluate the performance of unified communications (voice, data, images) 2. To be able to design and implement real applications for unified communications in cloud

8. Contents

8.1. Lecture (syllabus)		Teaching methods	Notes
1	VoIP using the H.323 standard (Part 1): ITU-T recommendations for audio-video and multimedia systems. H.323 standard. RTP and RTCP protocols.	Presentation, heuristic conversation, exemplification, problem presentation, teaching exercise, case study, formative evaluation	Use of .ppt presentation, projector, blackboard (whiteboard)
2	VoIP using the H.323 standard (Part 2): H.323 gatekeeper.		
3	VoIP using the SIP standard: Architecture, signaling, examples of interworking between SIP devices.		
4	VoIP using the IAX standard: Architecture, signaling, examples of interworking between IAX2 devices.		
5	STUN (Session Traversal Utilities for NAT), TURN (Traversal Using Relays around NAT) and ICE (Interactive Connectivity Establishment). Example of solution: AnyFirewall Eyeball.		
6	VoIP using the MGCP/ Megaco standard: Architecture, signaling, examples of interworking between MGCP devices. VoIP using Skype.		
7	VoIP using the SCCP (Skinny Client Control Protocol): Architecture, signaling, examples of interworking between SCCP devices (Cisco Unified Communications Manager Express, Cisco IP Phones).		
8	Project assignment.		
9	Calculation of the transfer rate per VoIP call.		
10	Comparison between VoIP and other packet switching technologies: VoMPLS/ VoATM/ VoFR/ Vo802.11/ VoLTE.		
11	Design of the unified communications models: single-site, centralized multi-site, distributed multi-site, WAN IP clustering. The impact of using virtual servers in unified communications.		
12	Management software for IP-based PBXes. Practical demonstrations		

	for Cisco Configuration Professional, Nokia (formerly Alcatel-Lucent) OmniVista 4760, Micro Focus Network Node Manager i (integration) (NNMi) 10.50, OpenNMS.		
13	Software-defined networks (SDN) and their interaction with OpenFlow, OpenStack, NFV, OpenDaylight, MPLS and 5G.		
14	Recapitulation. Examples of subjects from the previous year exam.		
8.2. Applications (lab/project)		Teaching methods	Notes
1	VoIP applications using H.323: H.323-PSTN and H.323-ISDN gateways.	Didactic and experimental proof, didactic exercise, team work	Use of laboratory instrumentation, experimental boards, computers, magnetic board
2	H.323 Gatekeeper emulated with GNS3 (Part 1): GNS3. H.323 devices.		
3	H.323 Gatekeeper emulated with GNS3 (Part 2): VoIP call in a network with H.323 gateway and H.323 gatekeeper.		
4	Asterisk IP PBX using SIP and IAX: Asterisk architecture. SIP and IAX softphones. Configuration of an Asterisk (physical machine).		
5	Asterisk IP PBX using SIP and MGCP: SIP hardware terminals. Cisco MGCP gateway. Configuration of an Asterisk (virtual machine).		
6	Cisco IP PBX using SCCP: Hardware and software SCCP terminals. Cisco Unified Communications Manager Express (CUCME).		
7	OpenStack private cloud orchestrator: OpenStack architecture. Unified communications applications in cloud.		
8	Project work Stage 1: Documentation		
9	Project work Stage 2: Testbed scenario		
10	Project work Stage 3: Configurations and experiments		
11	Project work Stage 4: Configurations and experiments in private/public cloud		
12	Project work Stage 5: Signaling captures		
13	Application and project work recovery		
14	Project defending		

Bibliography

1. V. Dobrota, Digital Networks in Telecommunications. Volume III: OSI and TCP/IP. Second Edition. Mediamira Science Publishers, Cluj-Napoca 2003, ISBN: 973-9357-34-2 (in Romanian)
2. J. Van Meggelen, R.Bryant, L.Madsen. Asterisk™: The Definitive Guide. Fifth Edition. O'Reilly Media Inc, 2019
3. ***, Cisco Collaboration System 12.x Solution Reference Network Designs (SRND), March 1, 2018, https://www.cisco.com/c/en/us/td/docs/voice_ip_comm/cucm/srnd/collab12/collab12.pdf
4. K. Wallace, Implementing Cisco Unified Communications Voice over IP and QoS (CVOICE). Fourth Edition, Cisco Systems Inc, 2012
5. G.A.A. Santana, CCNA Cloud CLDFND 210-451 Official Certification Guide. First Edition. Pearson Education Inc, 2016

On-line references

1. V. Dobrota, Unified Communications in Cloud, Technical University of Cluj-Napoca, 2020. Available: http://el.el.obs.utcluj.ro/cuc/

9. Bridging course contents with the expectations of the representatives of the community, professional associations and employers in the field

Competences acquired will be used in the following COR occupations (Electronics Engineer; Telecommunications Engineer; Electronics Design Engineer; System and Computer Design Engineer; Communications Design Engineer) or in the new occupations proposed to be included in COR (Sale Support Engineer; Multimedia Applications Developer; Network Engineer; Communications Systems Test Engineer; Project Manager; Traffic Engineer; Communications Systems Consultant).

10. Evaluations

Activity type	10.1	Assessment criteria	10.2	Assessment methods	10.3	Weight in the final grade
Course		The level of acquired theoretical knowledge and practical skills		Theoretical Test (mark T) : 10 questions with multiple choice answers + 4 problems		T, max 10 pts. 50%
Applications		The level of acquired abilities		Project (P): oral and practical exam based on laboratory and project work		P, max. 10 pts. 50%
10.4 Minimum standard of performance						
$N=(T+P)/2$, $N \geq 5$, $T \geq 5$, $P \geq 5$						

Date of filling in
01.07.2020

Course responsible
Professor
Virgil DOBROTA, PhD

Teachers in charge of applications
Professor
Virgil DOBROTA, PhD

Date of approval
in the department
01.10.2020

Head of Communications
Department
Professor Virgil DOBROTA, PhD