SYLLABUS

1. Information regarding the programme

1.1 Higher education institution	**Babeş-Bolyai University**
1.2 Faculty	**Faculty of Mathematics and Computer Science**
1.3 Department	**Department of Computer Science**
1.4 Field of study	**Computer Science**
1.5 Study cycle	**Bachelor**
1.6 Study programme / Qualification	**Computer Science**

2. Information regarding the discipline

2.1 Name of the discipline (en) (ro)			**Cloud Application Architecture** **Arhitectura aplicațiilor cloud**				
2.2 Course coordinator							
2.3 Seminar coordinator							
2.4. Year of study	**3**	2.5 Semester	**5**	2.6. Type of evaluation	**C**	2.7 Type of discipline	**Optional**
2.8 Code of the discipline		**MLE5153**					

3. Total estimated time (hours/semester of didactic activities)

3.1 Hours per week	**4**	Of which: 3.2 course	**2**	3.3 seminar/laboratory	**1 lab + 1 project**
3.4 Total hours in the curriculum	**56**	Of which: 3.5 course	**28**	3.6 seminar/laboratory	**28**

Time allotment:	hours
Learning using manual, course support, bibliography, course notes	**10**
Additional documentation (in libraries, on electronic platforms, field documentation)	**10**
Preparation for seminars/labs, homework, papers, portfolios and essays	**10**
Tutorship	**4**
Evaluations	**8**
Other activities:	

3.7 Total individual study hours	**42**
3.8 Total hours per semester	**98**
3.9 Number of ECTS credits	**4**

4. Prerequisites

4.1. curriculum	• Computer Networks • Databases • Web Programming
4.2. competencies	• Good programming skills in at least one programming language (Java, JavaScript, C#, etc).

5. Conditions (if necessary)

5.1. for the course	Course hall with projector
5.2. for the seminar /lab activities	Computers with internet access, a modern browser and a programming language environment

6. Specific competencies acquired

Professional competencies	**C1.5** Development of program units and corresponding documentation **C2.1** Identify adequate software systems development methodologies **C4.3** Identify models and methods adequate to real life problem solving **C6** Design and administration of computer networks
Transversal competencies	**CT1** Applying organized and efficient work rules, responsible attitude towards scientific/teaching domains in order to obtain a creative exploitation of own potential, while respecting the principles and rules of professional ethics **CT3** Use of effective methods and techniques for learning, information, research and capacity to exploit knowledge, to adapt to a dynamic society and communication in English language

7. Objectives of the discipline (outcome of the acquired competencies)

7.1 General objective of the discipline	• To introduce the students to cloud computing concepts, the motivation behind migrating to the cloud and the challenges such a migration entails. • Walk through a relatable, real life use case and point out the benefits of using a public cloud provider in most commercial software endeavours.
7.2 Specific objective of the discipline	• Become familiar with Amazon Web Services core offerings. • Get hands on experience in developing cloud native applications.

8. Content

8.1 Course	Teaching methods	Remarks
1. Introduction to the cloud landscape • Basic concepts, types • Motivation • Providers • Pricing models • Layout and topology (regions, availability zones)	Exposure: description, explanation, examples, debate	
2. The IaaS model • Virtual machines • Images • Storage mechanisms (block, file) • Backups	Exposure: description, explanation, examples, debate	
3. Cloud networking • Private cloud networks • Firewalls and access lists • Network address translation	Exposure: description, explanation, examples, debate	

4. Scalability • Vertical vs Horizontal • Load balancing • Auto-scaling	Exposure: description, explanation, examples, debate	
5. Web capabilities • Static website hosting • Content distribution • (Dynamic) Domain name servers	Exposure: description, explanation, examples, debate	
6. Availability, disaster recovery • Resilience • Multi-AZ deployments • Disaster recovery strategies	Exposure: description, explanation, examples, debate	
7. Infrastructure security • Users, roles, permissions	Exposure: description, explanation, examples, debate	
8. The PaaS model • Managed runtimes • Container basics • Docker	Exposure: description, explanation, examples, debate	
9. Managed databases • Relational • Key-value (Redis, S3) • Document (Mongo)	Exposure: description, explanation, examples, debate	
10. Application security • OAuth • Identity providers	Exposure: description, explanation, examples, debate	
11. Integration services • Queues • Pub-sub topics • Email services	Exposure: description, explanation, examples, debate	
12. Serverless • FaaS • Specific databases (Dynamo, Aurora)	Exposure: description, explanation, examples, debate	
13. API Design • REST • API Gateways	Exposure: description, explanation, examples, debate	
14. Recap and closing	Examples, debate	

Bibliography

1. Thomas Erl, Ricardo Puttini, Zaigham Mahmood - Cloud Computing: Concepts, Technology & Architecture, Prentice Hall, 1st edition, 2013
2. Thomas Erl , Robert Cope, Amin Naserpour - Cloud Computing Design Patterns, Prentice Hall, 1st edition, 2015
3. Cornelia Davis - Cloud Native Patterns: Designing change-tolerant software, Manning Publications, 1st edition, 2019
4. Michael J. Kavis - Architecting the Cloud: Design Decisions for Cloud Computing Service Models, Wiley, 1st edition, 2014
5. Kief Morris - Infrastructure as Code: Managing Servers in the Cloud, O'Reilly, 1st edition, 2016
6. Christopher Barnatt - A Brief Guide to Cloud Computing, Robinson Press; 1st edition, 2010
7. Andrew S. Tanenbaum, Maarten van Steen - Distributed Systems: Principles and Paradigms, Pearson Prentice Hall, 3rd edition, 2017

8.2 Seminar / laboratory	Teaching methods	Remarks

1. Introduction to the cloud landscape • Regions • AZs • AWS Management Console	Presentation, Dialogue, Case studies	
2. IaaS basics • EC2 instances • User data • Key pairs • AMI	Presentation, Dialogue, Case studies	
3. Cloud networking • VPCs • Security groups • Auto-scaling groups • Load balancers • Website hosting	Presentation, Dialogue, Case studies	
4. PaaS basics • Docker • ECS • RDS	Presentation, Dialogue, Case studies	
5. Integration services • SQS • SNS • SES • Cognito	Presentation, Dialogue, Case studies	
6. Serverless • Lambda • API Gateway	Presentation, Dialogue, Case studies	
7. Project grading and evaluation	Evaluation	

Bibliography

1. Andreas Wittig, Michael Wittig - Amazon Web Services in Action, Manning Publications, 1st edition, 2015
2. Bert David - AWS: Amazon Web Services Tutorial for Beginners, Independently published, 1st edition, 2018
3. AWS Educate - https://aws.amazon.com/education/awseducate/

9. Corroborating the content of the discipline with the expectations of the epistemic community, professional associations and representative employers within the field of the program

- Similar courses exists in the studying program of major universities in Europe and abroad.
- The software organisations recognize the importance of the concepts discussed during this course for both the development of new applications and migration of legacy applications.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade (%)
10.4 Course	Know the applied	Colloquium, subject	50%

	technologies taught during the course	presentation	
10.5 Seminar/lab activities	Be able to implement course concepts and presented technologies	Project presentation at the end of the semester	50%
10.6 Minimum performance standards			
➢ At least grade 5 (from a scale of 1 to 10) at both presentation and laboratory project.			

Date Signature of course coordinator Signature of seminar coordinator

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Date of approval Signature of the head of department

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