



POLITÉCNICA

INTERNATIONAL
CAMPUS OF
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COORDINATION PROCESS OF
LEARNING ACTIVITIES
PR/CL/001



E.T.S. de Ingeniería y Sistemas
de Telecomunicación

ANX-PR/CL/001-01

LEARNING GUIDE

SUBJECT

593000510 - Cloud Computing For Iot

DEGREE PROGRAMME

59AH - Master Universitario en Internet Of Things (iot)

ACADEMIC YEAR & SEMESTER

2020/21 - Semester 2

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1. Description

1.1. Subject details

Name of the subject	593000510 - Cloud Computing For Iot
No of credits	4.5 ECTS
Type	Compulsory
Academic year of the programme	First year
Semester of tuition	Semester 2
Tuition period	February-June
Tuition languages	English
Degree programme	59AH - Master Universitario en Internet Of Things (IOT)
Centre	59 - Escuela Técnica Superior de Ingeniería y Sistemas de Telecomunicación
Academic year	2020-21

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Jessica Diaz Fernandez (Subject coordinator)	1119	yesica.diaz@upm.es	Sin horario. Sin horario
Fernando De Mingo Lopez	1122	fernando.demingo@upm.es	Sin horario. Sin horario

* The tutoring schedule is indicative and subject to possible changes. Please check tutoring times with the faculty member in charge.

3. Prior knowledge recommended to take the subject

3.1. Recommended (passed) subjects

The subject - recommended (passed), are not defined.

3.2. Other recommended learning outcomes

- Programming languages
- Version control

4. Skills and learning outcomes *

4.1. Skills to be learned

CB09 - Que los estudiantes sepan comunicar sus conclusiones y los conocimientos y razones últimas que las sustentan a públicos especializados y no especializados de un modo claro y sin ambigüedades

CB10 - Que los estudiantes posean las habilidades de aprendizaje que les permitan continuar estudiando de un modo que habrá de ser en gran medida autodirigido o autónomo.

CE.12 - Analizar las tecnologías de virtualización y el diseño de servicios basados en dichas tecnologías incluyendo contenedores y servicios en la nube

CG02 - Los alumnos serán capaces de aplicar métodos y tecnologías avanzadas que les permitan abordar necesidades y problemas en aplicaciones IoT

CG03 - Los alumnos demostrarán tener las destrezas necesarias para integrar y aplicar los conocimientos adquiridos de forma que puedan desarrollar soluciones innovadoras y servicios IoT en general

CT.01 - Capacidad de uso de la lengua inglesa para el trabajo en contextos internacionales

CT.02 - Capacidad para el trabajo en grupo y dirigir, organizar y supervisar equipos multidisciplinares.

4.2. Learning outcomes

RA18 - To design IoT application architectures that meet flexibility, scalability and performance requirements using technologies and virtualization and Cloud platforms

RA19 - To develop applications for IoT using the main support frameworks for software construction

RA17 - To evaluate the main strengths and weaknesses among different technologies and virtualization and Cloud platforms

RA20 - To use the most important Cloud platforms to develop and deploy IoT applications

* The Learning Guides should reflect the Skills and Learning Outcomes in the same way as indicated in the Degree Verification Memory. For this reason, they have not been translated into English and appear in Spanish.

5. Brief description of the subject and syllabus

5.1. Brief description of the subject

The exponential growth of data generated by IoT-based systems is a challenge. Cloud computing offers self-provisioning infrastructure and platform, which makes it the natural candidate for supporting the needs of IoT-based systems, i.e. data processing, data storing, and data analysis. Cloud services process such data satisfying flexibility, scalability and performance requirements. This course is focused on the study of cloud computing architectures and emerging technologies and platforms applied to IoT systems, such as containerization, serverless, and DevOps culture and automation practices (specifically, Continuous Integration and Continuous Delivery). The course addresses both the theoretical basis and different application scenarios.

5.2. Syllabus

1. Virtualization

1.1. Concept

1.2. Key features. Advantages and disadvantages

1.3. Software for virtualization

2. Containers

2.1. Concept

2.2. Key features. Advantages and disadvantages

2.3. Software for containerization

2.4. Software for container orchestration

3. Cloud computing

3.1. Overview

3.2. Cloud service model

3.2.1. Infrastructure as a Service

3.2.2. Platform as a Service

3.2.3. Software as a Service

3.3. Cloud deployment model

3.3.1. Private cloud

3.3.2. Public cloud

3.3.3. Hybrid cloud

3.4. Cloud architecture and quality attributes

3.5. Trends & Challenges

3.6. Cloud providers: Microsoft Azure, Google Cloud, Amazon WS, etc.

3.7. Cloud Computing, DevOps and IoT

4. Microsoft Azure

4.1. Overview

4.2. Azure Virtual Machines & Azure Containers

4.3. Azure DevOps

4.4. Other services: Azure App Service, SQL Service, Active Directory. Azure Storage

5. Cloud IoT services

5.1. IoT Reference Architecture

5.2. Azure IoT

5.3. Azure IoT Edge

5.4. Serverless (Backendless, Firebase, ThingSpeak)

5.5. Other cloud providers (AWS)

6. Schedule

6.1. Subject schedule*

Week	Face-to-face classroom activities	Face-to-face laboratory activities	Distant / On-line	Assessment activities
1	1. Virtualization Duration: 01:15 2. Containers Duration: 01:15	Exercise1.1: virtual machines Duration: 01:00		
2		Exercise1.2: containers Duration: 03:30		Evaluation: Exercise1 Virtual Machines and Containers (RA18) Continuous assessment Not Presential Duration: 00:00
3	3. Cloud Computing & DevOps as enablers of IoT Duration: 01:00	Exercise2.1: Azure DevOps Pipelines Duration: 02:30		
4	4. Microsoft Azure Duration: 01:00 5. Cloud IoT service (Azure IoT) Duration: 01:00	Exercise2.2: Azure IoT Duration: 01:30		
5	5. Cloud IoT services (Azure IoT) Duration: 01:30	Exercise2.3: Azure IoT Duration: 02:00		
6	5. Cloud IoT services (Azure IoT Edge) & DevOps Duration: 01:30	Exercise2.4: Azure IoT Edge Duration: 02:00 Exercise2.5: Azure IoT Edge DevOps Duration: 03:00		
7	5. Cloud IoT serverless Duration: 03:30			Evaluation: Exercise2 Cloud IoT (RA18, RA20) Continuous assessment Not Presential Duration: 00:00
8		Lab assigment: development and deployment of an IoT app Duration: 02:30		Test (RA17) Continuous assessment Presential Duration: 01:00

9		Lab assignment: development and deployment of an IoT app Duration: 03:30		
10				Oral presentation of the lab assignment (RA17) Continuous assessment Presential Duration: 06:30
11		5. Cloud IoT - other cloud providers Duration: 03:30		Evaluation: Lab assignment (RA18, RA19, RA20) Continuous assessment Not Presential Duration: 00:00
12				Test (Final Examination) (RA17) Final examination Presential Duration: 01:00 Oral presentation of the lab assignment (Final examination) (RA17) Final examination Presential Duration: 02:00 Evaluation: Lab assignment (Final examination) (RA18, RA19, RA20) Final examination Not Presential Duration: 00:00
13				
14				
15				
16				
17				

Depending on the programme study plan, total values will be calculated according to the ECTS credit unit as 26/27 hours of student face-to-face contact and independent study time.

* The schedule is based on an a priori planning of the subject; it might be modified during the academic year, especially considering the COVID19 evolution.

7. Activities and assessment criteria

7.1. Assessment activities

7.1.1. Continuous assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
2	Evaluation: Exercise1 Virtual Machines and Containers (RA18)		No Presential	00:00	10%	5 / 10	CG02
7	Evaluation: Exercise2 Cloud IoT (RA18, RA20)		No Presential	00:00	10%	5 / 10	CG02
8	Test (RA17)		Face-to-face	01:00	20%	4 / 10	CE.12
10	Oral presentation of the lab assignment (RA17)		Face-to-face	06:30	20%	5 / 10	CB09 CT.01
11	Evaluation: Lab assignment (RA18, RA19, RA20)		No Presential	00:00	40%	5 / 10	CG02 CB10 CE.12 CT.02 CG03

7.1.2. Final examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
12	Test (Final Examination) (RA17)		Face-to-face	01:00	40%	5 / 10	
12	Oral presentation of the lab assignment (Final examination) (RA17)		Face-to-face	02:00	20%	5 / 10	CB09 CT.01
12	Evaluation: Lab assignment (Final examination) (RA18, RA19, RA20)		No Presential	00:00	40%	5 / 10	CB10 CG02 CE.12 CT.02 CG03

7.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Oral presentation of the lab assignment (Final examination) (RA17)		Face-to-face	03:00	20%	5 / 10	CB09 CT.01
Evaluation: Lab assignment (Final examination) (RA18, RA19, RA20)		Face-to-face	00:00	40%	5 / 10	CB10 CG02 CE.12 CT.02 CG03
Test (RA17)		Face-to-face	01:00	40%	5 / 10	CE.12

7.2. Assessment criteria

The students who want to follow final examination (vs. continuous assessment) have to request it to professors before 27 March.

The transversal competence / soft skill CT.01 (Capacidad de uso de la lengua inglesa para el trabajo en contextos internacionales) is evaluated through the oral presentation of the lab assignment (10% of the score).

The transversal competence / soft skill CT02 (Capacidad para el trabajo en grupo y dirigir, organizar y supervisar equipos multidisciplinares) is evaluated through the realization of the lab assignment (10% of the score). The report should include an effort table (hours per student). Also the use of an agile project management tool (team and tasks management) (e.g. trello.com) from which you must capture your status in several milestones throughout the implementation of the practice .

8. Teaching resources

8.1. Teaching resources for the subject

Name	Type	Notes
Cloud Computing	Bibliography	Cloud Computing By: Lizhe Wang; Rajiv Ranjan; Jinjun Chen; Boualem Benatallah Publisher: CRC Press Pub. Date: December 21, 2017 Print ISBN-13: 978-1-4398-5641-3
The Docker Book	Bibliography	THE DOCKER BOOK CONTAINERIZATION IS THE NEW VIRTUALIZATION https://dockerbook.com/
Microsoft Azure Essentials: Fundamentals of Azure	Bibliography	Microsoft Azure Essentials: Fundamentals of Azure, Second Edition Michael S. Collier and Robin E. Shahan
Microsoft Azure Essentials: Azure Web Apps for Developers	Bibliography	Microsoft Azure Essentials: Azure Web Apps for Developers
Aula con dispositivos audiovisuales	Equipment	
Laboratorios con recursos informáticos para la realización de las prácticas	Equipment	
Moodle	Web resource	https://moodle.upm.es/titulaciones/oficiales