UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

SYLLABUS DEL CORSO

Cloud Computing

2526-2-F1801Q157

Aims

Knowledge and Understanding

At the end of the course, students will be able to:

- Understand the fundamental principles of Cloud Computing and distributed service-oriented architectures
- Know the evolution of the Internet and the Web and the paradigm of convergence between networks, devices and applications
- Master the basic concepts of the REST (Web API) architectural style and its applications in the Web of Services, Web of Data and Web of Things
- Understand the models and principles of service-oriented systems (SOA) and their evolution towards XaaS (Everything-as-a-Service) architectures
- Know the principles of Cloud and Fog Computing and their impact on organizations and the design of business solutions
- Understand the fundamental concepts of virtualization and container-based technologies

Applying Knowledge and Understanding

At the end of the course, students will be able to:

- Design and develop distributed applications based on microservice architectures
- Implement practical solutions using containerization technologies such as Docker
- Manage services and workloads at runtime using orchestration platforms such as Kubernetes
- Apply architectural patterns for microservices in real-world contexts
- Develop "smart" ecosystems (smart city, smart building, smart mobility) using service-oriented architectures
- Operate application systems based on microservices and container technologies
- Implement principles of monitoring, scalable deployment and security in distributed environments

Transferable Skills

Making Judgements: The course develops the ability to critically evaluate different architectural solutions for distributed systems, choosing the most appropriate approaches based on the specific requirements of the application context, through practical exercises and case study analysis.

Communication Skills: Students develop communication competencies through active participation in laboratory sessions, presentation of technical solutions and collaboration in group projects, acquiring the ability to illustrate complex architectural solutions to different stakeholders.

Learning Skills: The course provides students with methodological foundations and conceptual tools to autonomously continue the study of emerging technologies in the field of Cloud Computing and distributed systems, through access to interactive teaching materials and updated resources available on the e-learning platform.

Contents

Current distributed applications exploits the Web as a reference platform, and the concept of service as a metaphor for building independent components that implement the requested functionalities. This course studies the emerging distributed software technology principles and models, and their impact on "Cloud Computing" and "Internet of Things" (IoT) applications.

In particular, the course will analyse how the design paradigms of software architectures and the services that populate them are evolving. The course includes a part devoted to the close examination of technologies to virtualize microservices into containers and their operational management with practical exercises.

Detailed program

- Introduction. Evolution of the Internet and the Web: network, devices and applications convergence. The REST (Web API) architectural style: Web of Services, Web of Data, and Web of Things.
- Service-oriented systems: Definition of service and service model; service oriented architecture (SOA); Service Science: business processed and design alternatives; Principles and models of Cloud and Fog computing and their impact on organizations and design of business solutions: system-of-record and system-of-engagement models.
- Cloud Computing: basic concepts and virtualization. XaaS (everythig-as-a-Service) architectures. Service-oriented architectures for "smart" ecosystems: smart city, smart building, smart mobility, etc. Interoperability principles for IoT and other types of systems.
- Microservice-based architecture: basic concepts and architectural patterns. DevOps development modes (overview). Container-based architecture: basic concepts and architectural patterns. Principles of monitoring, deployment at scale e security (overview).
- Laboratory: Design and implementation of microservice applications in containers with Docker technology. Management of services and workload at run-time with Kubernates.

Prerequisites

Thorough comprehension of networking and distributed system principles to design and develop distributed

applications.

Teaching form

Lecture-based teaching. The teaching form for the course includes 24 hours of classroom lectures, with at most 20% of the hours delivered remotely (audio-video recordings).
Interactive teaching. Interactive teaching is provided in the form of additional 36 hours of classroom lab sessions, along with demonstrations or explanations available on the website (e-learning) such as web forums and FAQs. The purpose of these activities is to provide support from teachers and participating students with demonstrations or practical advice on how to solve a problem, an exercise, and similar tasks.
Individual study activities are supported by teaching materials and interactive activities available in the e-learning site.

Teaching language: English

Textbook and teaching resource

There is not a single reference text. Articles and resources will be indicated on the e-learning site.

Semester

First semester

Assessment method

The examination consists of a written test with open-answer and multiple-choice questions (on lecture and laboratory topics) with a value of 28 points.

The test deals with:
(a) questions on the concepts presented
(b) requests for reasoning and deduction
(c) resolution of exercises that require the development of a solution to an assigned problem

Structure of the written test:
General part: 10 closed + 2 open questions (10*2 + 2*4 = 28 points)

Students that attended the laboratories can obtain 5 additional points thus awarded:
1 point for frequency (>=75%)
1 point for active participation (carrying out of classroom exercises)
3 points for the performance of the final exercise (agreed with the teacher)

The exam may be supplemented by an oral exam at the request of the teacher and/or student.
The oral test may result in an increase or decrease in the mark in the written test.

In-itinere examination
The written test for the first exam (appello) will be replaced by two in-itinere tests.
Each test shall consist of open-answer and multiple-choice questions, with a value of points 33.
Access to the second test will be obtained by scoring 15 or more points in the first test.
The marks in the written test are given by the average of the two tests. No recovery tests are foreseen.

FINAL MARK = WRITTEN MARKS + LABORATORY MARKS (if attended) + (possible oral integration)

Office hours

prof. Ciavotta: Tuesday from 12:30 to 14:30 or by appointment by writing to michele.ciavotta@unimib.it

Questions and discussions on teaching topics can be posed using the forums in e-learning.

Sustainable Development Goals