UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Cloud Computing

2122-2-F1801Q157

Aims

The goal of the course is to provide students with fundamental elements to understand and design distributed service-oriented applications. After the course, students will master the most important models for distributed systems based on Cloud technology, and the basic characteristics of languages and tools for their development.

They will be able to design, develop and operate application systems based on microservices and container-based technology.

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

The course includes theoretical and exercise (laboratory) lectures integrated with individual study activities with e-learning support.

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 may 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)

In the Covid-19 emergency period the written test will be replaced by a supervised remote test: a session with open/closed questions on the e-learning site with active monitoring by the teachers, and an oral session in teleconference. The in-itinere tests may not be held.

Office hours

prof. De Paoli: Wednesday from 10:00 to 12:00 or by appointment by writing to flavio.depaoli@unimib.it

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.