UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Distributed Systems

2021-2-E3101Q112

Aims

Students will know the characteristic properties and reference organizations of concurrent, client-server and peer-to-peer distributed systems. They will be able to develop simple distributed applications in Web/Internet environments.

Contents

Concepts, models and architecture of concurrent and distributes systems. Fundamentals of design and behavior of distributed systems, with specific reference to the Web and the Internet.

Detailed program

1. Basic concepts: definition and characteristic properties; client-server and peer-topeer models; Software architectures (layers vs tiers); naming, identifier and address (URI e DNS);
2. Basic technologies
   Socket TCP/IP: client server and application protocols.Client/server and peer-topeermodels. Communication by procedure call: Remote Procedure Call (RPC) and Remote Object Invocation (Java RMI).
3. Web Applications
   Web Foundations (URI & HTTP) HTTP request/response. Web applications:
   servlet/JSP Pattern MVC. Client Web: Browser: Rich Interface Applications (Ajax).
   Web services: REST and Web API vs WSDL/SOAP.
4. Monografic topics
   Semantic Web Services: Service annotation.
5. Dynamic Web applications

Introduction to JavaScript; introduction to the jQuery framework; jQuery and AJAX techniques Sample web applications: basic JavaScript examples, debugging, dynamic web page modification, remote services invocation.

6. Rappresentazione dei dati HTML5 & CSS as a model for data represenation and presentation XML/ JSON as a model for data transfer RDF as data model for the semantic web SPARQL as query language for the semantic web Sample semantic web applications: querying DBPedia and other SPARQL endpoints, simple mashups.
7. Concurrent programming: synchronization and monitors. Models based on shared memory multi-thread programming in Java. Hints of finite state automata modelling.

Prerequisites

Principles of Object-Oriented programming in java and Junit tests (Programming 2); Process and Interprocess Communication (Network and Operating Systems); TCP/IP protocol and Sockets (Network and Operating Systems); Markup languages (XML and HTML), related manipulation tools, and Finite State Automata (Languages and Computability) .

Teaching form

The course includes theoretical and exercises lectures integrated by individual study activities with e-learning support. Individual and group laboratory activities to develop simple distributed systems and Web applications will be also part of the course.

In the Covid-19 emergency period the lessons will be held in mixed mode: asynchronous video-recorded lessons and synchronous teleconference lessons, with some events in physical presence. Similar modalities are foreseen for the workshop: asynchronous sessions with presentation of exercises and assignment of new exercises to be carried out autonomously, synchronous teleconference sessions to review and discuss the exercises carried out by the students.

Teaching language: Italian

Textbook and teaching resource

On the e-learning site are available :

- slides of the lessons in pdf format.
- further material (articles to complete the reference texts, links to online resources, exercises to be carried out).
- equipment and solutions for exercises carried out in the laboratory.

Textbooks:

Distributed Systems: Principles and Paradigms - 2nd edition, Andrew S. Tanenbaum and Maarten van Steen,

Pearson - Prentice Hall, 2007.

Already adopted in the course of Networks and Operating Systems:

Reti di calcolatori e internet – Un approccio top-down 4a Edizione, James F. Kurose, Keith W. Ross Addison Wesley – 2008, ISBN 9788871924557
Chapter 1, 2

A. Silberschatz, P. Baer Galvin, G. Gagne, Sistemi operativi - Concetti ed esempi, 8/Ed. 2009, ISBN 9788871925691
Chapter 3, 4, 6, 7, 16

Semester

second semester

Assessment method

Examination: separate written test and optional oral exam -> up to 30 points
Laboratory -> up to 4 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

Written test in the laboratory
Phase 1: Multiple chiose questions on basic subjects for admission to Phase 2 (score higher then 4/6)
Phase 2: Multiple chiose questions + open questions
The exam is passed with score >= 18/30
Oral exam (optional)
It consists of the restitution of written tests with discussion, and any additional questions at the teacher's discretion.

Laboratory
Evaluation: development and delivery of exercises and a final small project -> up to 4 points
Alternative for student workers: PROJECT to be agreed with teachers -> up to 4 points

In itinere tests (replace exam)
First test: Closed questions
Second test: Closed questions + open questions
Whoever has scored >= 18/30 in the first test is admitted in the second test. There are no recovery tests.

It is possible to make additional work projects (optional, evaluated)

FINAL VOTE = EXAMINATION + LABORATORY (if attended) (+ optional work project)
FINAL VOTE for working students = EXAMINATION (+ optional PROJECT)

In the Covid-19 emergency period the written test will be replaced by a supervised remote test: a session with open/closed questions on ESAMI-ONLINE (HTTPS://ESAMIONLINE.ELEARNING.UNIMIB.IT) with monitoring with PROCTORING/RESPONDUS, and an oral session in teleconference for a sample of students selected by the teachers. The in-itinere tests may not be held

Office hours

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

Prof. Vizzari: Wednesday from 9:30 to 11:30 or other days/times always by appointment.

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