



UNIVERSITÀ  
DEGLI STUDI DI MILANO-BICOCCA

## SYLLABUS DEL CORSO

### Sistemi Distribuiti

2425-2-E3101Q112

---

#### Aims

Students will know the characteristic properties, communication models 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 distributed 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-to-peer 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-to-peer models.  
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.
4. Dynamic Web applications  
Introduction to JavaScript and AJAX techniques. Sample web applications: basic JavaScript examples,

- debugging, dynamic web page modification, remote services invocation
5. HTML5 & CSS as a model for data representation and presentation. XML/ JSON as a model for data transfer RDF as a data model for the semantic web, simple mashups.
  6. Concurrent programming: synchronization and monitors. Models based on shared memory multi-thread programming in Java. Hints of finite-state automata modeling.

## Prerequisites

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

## Teaching form

Didattica erogativa. The teaching form includes 32 hours of lectures, 20 hours of classroom exercises. Up to 20% of the lectures and exercises will be delivered remotely via telecommunication (audio-video recordings).

Didattica interattiva. Interactive teaching is provided in the form of additional 24 hours in the laboratory, 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, particularly to support the optional project at the end of the laboratory activities.

Individual study activities are supported by textbooks, teaching materials, and interactive activities available on the e-learning site.

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: Fixed-choice questions. Admission to a second phase with 50% of correct answers.

Phase 2: Mixed questions (essay or fixed choice with comments)

The exam is passed with a score  $\geq 18/30$

### **Oral exam (optional)**

It consists on the restitution of written tests with discussion, and any additional questions at the teacher's discretion.

### **Laboratory**

Evaluation: final project -> up to 4 points (optional)

### **In itinere tests (replace exam)**

First test: Closed questions

Second test: Closed questions + mixed questions

Whoever has scored  $\geq 18/30$  in the first test is admitted to the second test. There are no recovery tests.

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

FINAL VOTE = EXAMINATION (+ optional work project)

## **Office hours**

Prof. De Paoli: Thursday from 10:00 to 12:00 or by appointment by writing to [flavio.depaoli@unimib.it](mailto:flavio.depaoli@unimib.it)

Prof. Ciavotta: Tuesday from 12:30 to 14:30 by appointment.

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

# Sustainable Development Goals

---