

Course guide

300108 - DCDESIG - Datacenter Design and Operations

Last modified: 21/01/2026

Unit in charge: Castelldefels School of Telecommunications and Aerospace Engineering
Teaching unit: **Degree:** MASTER'S DEGREE IN ARTIFICIAL INTELLIGENCE FOR CONNECTED INDUSTRIES (AI4CI) (Syllabus 2025). (Optional subject).
Academic year: 2025 **ECTS Credits:** 4.0 **Languages:** English

LECTURER

Coordinating lecturer: Francesco De Pellegrin (Univ. Avignon)
Antonio Cisternino (Univ. Pisa)
Salvatore Spadaro (UPC)

Others:

PRIOR SKILLS

Algorithmic design, network protocols, data-structures

TEACHING METHODOLOGY

On-line lectures, laboratories, autonomous work

LEARNING OBJECTIVES OF THE SUBJECT

This course is meant to provide an introduction to datacenter technologies. It addresses the properties of datacenter computing and networking infrastructures, and provides elements on the management of computing and networking resources therein. It introduces the fundamental problems of scheduling tasks on multiple machines. Additional elements to be covered are datacenter networking, hyper-converged architectures, security and SLAs in cloud computing.

STUDY LOAD

Type	Hours	Percentage
Hours large group	36,0	36.00
Self study	64,0	64.00

Total learning time: 100 h

CONTENTS

Datacenter Design and Operations

Description:

The course will cover a legacy syllabus focusing on the technological specificities of datacenter networks.

- Introduction to datacenter architecture; history of data centers; data center structure. Datacenters and constructive metrics: energy, robustness, and load distribution. Power and cooling in datacenters.
- Datacenter management techniques. Introduction to fabric, Fabric cabling and active fabric. L2 fabric and architectures CLI management, network overlay and spine and leaf.
- Datacenter operations: capacity planning and service operations.
- Scheduling. Classification of scheduling problems. Scheduling for one machine. Scheduling for several machines. Scheduling with deadlines. Scheduling of jobs in a cluster. Scheduling containers with Kubernetes.
- Allocation of computing resources in data centers. Distributed computing applications and resource allocation. Migration models and hot/cold models. Caching and registries.

Complementary content:

- Hyper-converged infrastructure (HCI) a distributed approach to storage. Introduction to storage systems. Drives (HDD and solid state). NAS and SAN. Storage abstraction functions and interconnect (deduplication, compression, LUN, Fibre channel, iSCSI)
- Server architectures and form factors. Server architecture and management (BMC).
- Inter-datacenter networks: computational issues for multi-region datacenters; calendaring and synchronization of operations.
- Datacenter networks: learn routing techniques and resource allocation (wavelength) to estimate traffic load and better size inter-datacenter networks. Learn the main network architectures in datacenters, and the roles of SDN controllers for dynamic routing. Learn flow scheduling techniques in data center networks, particularly for the problem of scheduling flows and coflows.
- Datacenter operations with a security perspective: tools and processes.
- Compliance to regulation and to service level agreements, a brief legal overview of the datacenter landscape.

Full-or-part-time: 100h

Theory classes: 36h

Self study : 64h

GRADING SYSTEM

Final exam (oral or written) and/or continuous monitoring

RESOURCES

Other resources:

In the Moodle platform