



Course guide

300105 - NETARCH - Network Architecture

Last modified: 07/10/2025

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:** 6.0 **Languages:** English

LECTURER

Coordinating lecturer: Michele Pagano (Università di Pisa)

Others: Michele Pagano (Università di Pisa)
Enrica Zola (UPC)

PRIOR SKILLS

The concepts related to networking in general are introduced during the course; however, a basic knowledge about computer programming and cryptography might be useful

REQUIREMENTS

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TEACHING METHODOLOGY

On-line lectures
Autonomous laboratory sessions

LEARNING OBJECTIVES OF THE SUBJECT

The aim of the course is twofold: on one side it provides an introduction to the general principles of networking and an overview of the main protocols of the TCP/IP stack, on the other side more advanced topics involving the evolution of network and transport layer protocols are presented.

At the end of the course the student will be able to understand the working principles of Internet, will know the main protocols of the TCP/IP stack and will be able to use wireshark for network traffic analysis.

STUDY LOAD

Type	Hours	Percentage
Hours large group	54,0	36.00
Self study	96,0	64.00

Total learning time: 150 h



CONTENTS

Introduction to Computer Networks and the Internet

Description:

- Architectural elements and standardization bodies
- Packet switching vs. circuit switching
- Protocol layers and their service models
- Delay, loss, and throughput in packet-switched networks

Full-or-part-time: 25h

Theory classes: 9h

Self study : 16h

Application Layer

Description:

- Principles of network applications
- The Web and HTTP
- DNS: basic mechanism and security-oriented evolution

Full-or-part-time: 25h

Theory classes: 9h

Self study : 16h

Transport Layer

Description:

- Transport-layer services and protocols
- Connectionless transport: UDP
- Connection-oriented transport: TCP
- TCP congestion control: Reno, Cubic, linux TCP variants
- Evolution of transport-layer functionality: QUIC, HTTP/3

Full-or-part-time: 44h 30m

Theory classes: 16h

Self study : 28h 30m

Network layer: Data plane

Description:

- Forwarding and routing: the data and control planes
- IPv4 datagram format
- IPv4 addressing
- IPv6 and IPsec

Full-or-part-time: 19h 30m

Theory classes: 7h

Self study : 12h 30m



Network layer: Control plane

Description:

- Routing algorithms: Link-State vs. Distance-Vector
- Intra-AS routing in the Internet: OSPF
- Routing among the ISPs: BGP
- ICMP – labs on traceroute and ping

Full-or-part-time: 14h

Theory classes: 5h

Self study : 9h

Software tools

Description:

- Network-related Linux utilities
- Packet sniffers and analyzers: wireshark and tshark
- Network simulation
- Data processing utilities

Full-or-part-time: 22h

Laboratory classes: 8h

Self study : 14h

GRADING SYSTEM

The exam consists of an oral test (that includes an interview on theoretical topics and a practical test on traffic analysis) and/or written exam (50%), questionnaires (20%), and evaluation of lab reports/assignments (30%)

BIBLIOGRAPHY

Basic:

- Kurose, James F; Ross, Keith W. Computer networking : a top-down approach . Global edition. ©2022. ISBN 9781292405469.

RESOURCES

Other resources:

Provided in the Moodle platform