

COMPUTER ARCHITECTURE (9 CFU)
Computer Engineering (CE) degree

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The need to use online tools
can impose a reorganization of the course day by day.

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COMPUTER ARCHITECTURE

Topics selection:

- *Classes of computers, technology trends, power consumption, performance evaluation and benchmarks*
- *Memory hierarchy, cache memory and virtual memory* *conoscere l'architettura di una memoria*
- *Instruction Level Parallelism, dynamic scheduling, multiple issue, speculation and multithreading* *cosa è il parallelismo a livello di istruzione e come si realizza*
- *Vector architecture and Graphics Processing Unit (GPU)* *architettura per i calcoli grafici*
- *Symmetric shared-memory multiprocessors, distributed shared-memory multiprocessor; cache coherence and memory consistency* *modellare e simulare sistemi a memoria condivisa*
- *Domain-Specific Architectures*

Goals:

- *Skills on the architecture of current microprocessors*
- *Skills on power consumption and processing performance*
- *Using of resources and features of current microprocessors*
- *Sizing the resources of a computer according to the application features*

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Exercise activities:

The goal is to understand the features of current computers.

The activities will be developed in groups of two or three students.

Each group will deepen 3 arguments concerning current computers and prepare the presentations.

1st presentation: microprocessor architecture, features of the instruction set, TLB and cache memory organization, microcontroller, DSP,

Goal: **verify that you have the basis for understanding the architectures of current computing systems**

2nd presentation: multiprocessor architecture, multicore organization, GPU, coherence protocols, memory consistency model, ...

Examination (only spoken):

Evaluation of the presentations developed during the semester.

Questions about the course program.

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1st presentation

- Arduino
- Computer Data Storage
- Simultaneous Multithreading
- Memory Management Unit
- General Purpose computing on Graphics Processing Units
- Samsung Galaxy Tab 2 7.0
- ARM: history, characteristics and the arm11 MPCore
- Multi Level Cache
- Java Processors
- AMD vs INTEL General purpose microprocessors comparison
- Hardware security solutions. Trust Zone technology in ARM architecture
- Cache performances
- Raspberry PI
- Journal papers

Possible
Arguments

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2nd presentation

- Intel-core-i7 Dynamic power-management
- PARALLELISM IN DATABASE SYSTEMS
- Arm Cortex A9
- Hardware / Software parallelism techniques for power reduction in ARM Cortex A11 MPCore
- Automatic Parallelization
- OpenCL: heterogeneous computing
- INTRODUCTION TO PROGRAMMING ON GPU AND MANAGING OF PARALLELISM
- Exploit Multicore and Multithreading CPU
- GPU: analysis of the memory subsystem
- Hyper-Threading
- Multicore CPU comparison
- Cache coherence in multicore processors
- Multicore programming: increasing performance through software multithreading
- C Parallel Programming: OpenMP

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Team practices

Organization

Step 1: 1-5 March, define the team (2 or 3 students)

Step 2: 5 March, define the subject of presentation

Step 3: prepare the presentation

Step 4: show the presentation at the class

Completion of activities and presentation to the course attendees:

March 29th: Draft of first presentation and **verify that you have the basis for understanding the architectures of current computing systems.**

May 15th: Work begins on the second presentation.

May 24th: Presentation of both presentations.

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Consistent
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Books

- **Computer Architecture, Fifth Edition: A Quantitative Approach**, John L. Hennessy, David A. Patterson
- **Advanced Computer Architecture and Computing**, S.S. Jadhav
- **Microprocessor Architecture: From Simple Pipelines to Chip Multiprocessors**, Jean-Loup Baer
- **Parallel computer organization and design**, M. Dubois, M. Annavaram, P. Stenstrom

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PDF?

- Microsoft Teams
 - Please send me a mail by specifying:
 - The name
 - The student identifier “matricola”
 - The degree

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TIMETABLE

IM Computer Eng				
	Lu	Ma	Me	Gi
8:30/9:30	Internet of things AD11	Cloud computing SI 5	Internet of things CI 1	Internet of things AD11
	Fondations of cybersecurity AD1		Fondations of cybersecurity AD1	Fondations of cybersecurity AD1
9:30/10:30	Internet of things AD11	Cloud computing SI 5	Internet of things CI 1	Internet of things AD11
	Fondations of cybersecurity AD1		Fondations of cybersecurity AD1	Fondations of cybersecurity AD1
10:30/11:30	Computer architecture AD11		Fondations of cybersecurity SI 7	Fondations of cybersecurity AD11
11:30/12:30	Computer architecture AD11	Intelligent systems SI 3	Fondations of cybersecurity SI 7	Fondations of cybersecurity AD11
12:30/13:30	Computer architecture AD11	Intelligent systems SI 3	Fondations of cybersecurity SI 7	
13:30/14:30	Fondations of cybersecurity AD11			Intelligent systems FO1
14:30/15:30	Fondations of cybersecurity AD11			Intelligent systems FO1
15:30/16:30	Fondations of cybersecurity AD11	Cloud computing A21		Intelligent systems FO1
16:30/17:30		Cloud computing A21		Computer architecture AD11
17:30/18:30		Cloud computing A21		Computer architecture AD11

Theory lessons

Team practices