

Computing Infrastructures

 POLITECNICO DI MILANO

Course Introduction

Prof. Manuel Roveri

Prof. Gianluca Palermo, Prof. Danilo Ardagna



- **Full Professor**
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Email: manuel.roveri@polimi.it
Web: <http://roveri.faculty.polimi.it>
- **Research interests:** TinyML, IoT and edge computing, privacy-preserving machine and deep learning
- **Lecturer of « Computing Infrastructures» and «Hardware Architecture for Embedded and edge AI»**
- **Associate Editor** of IEEE Trans. on Artificial Intelligence, Neural Networks, IEEE Trans. on Emerging Technologies in Computational Intelligence, IEEE Trans. on Neural Networks and Learning Systems
- **Chair** of the IEEE CIS **Technical Activities** strategic planning committee and IEEE CIS **Neural Network** Technical Committee
- **Co-Founder** of **DHIRIA**, a Spin-Off of Politecnico di Milano



The AI-Tech Research Lab @ POLIMI





The research activity

Cyber-
physical
Systems

Artificial
Intelligence
(Machine
learning
and deep
learning)



The research activity

Internet-of-Things

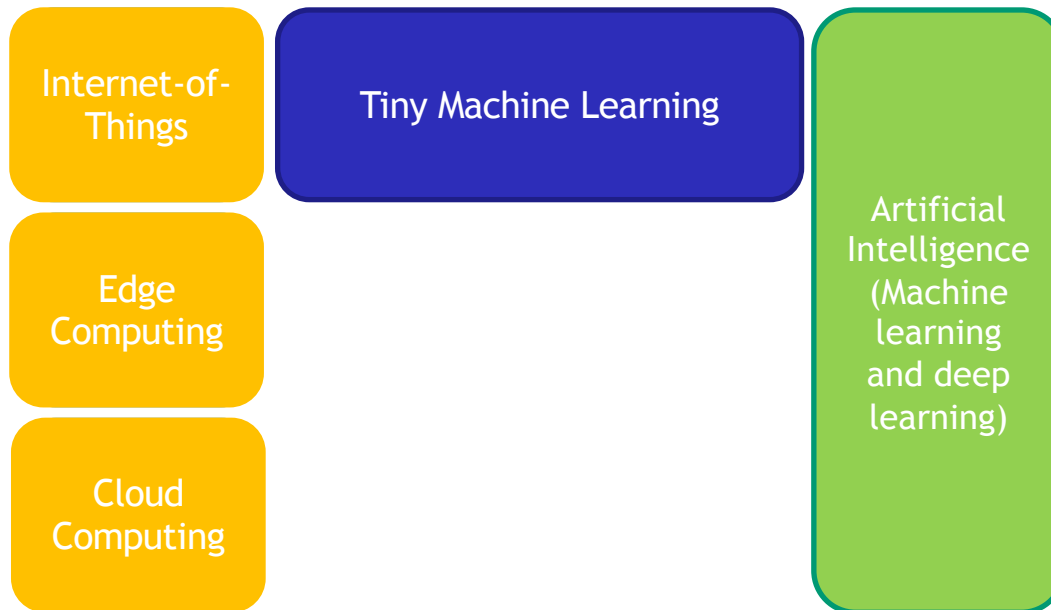
Edge Computing

Cloud Computing

Artificial Intelligence
(Machine learning and deep learning)

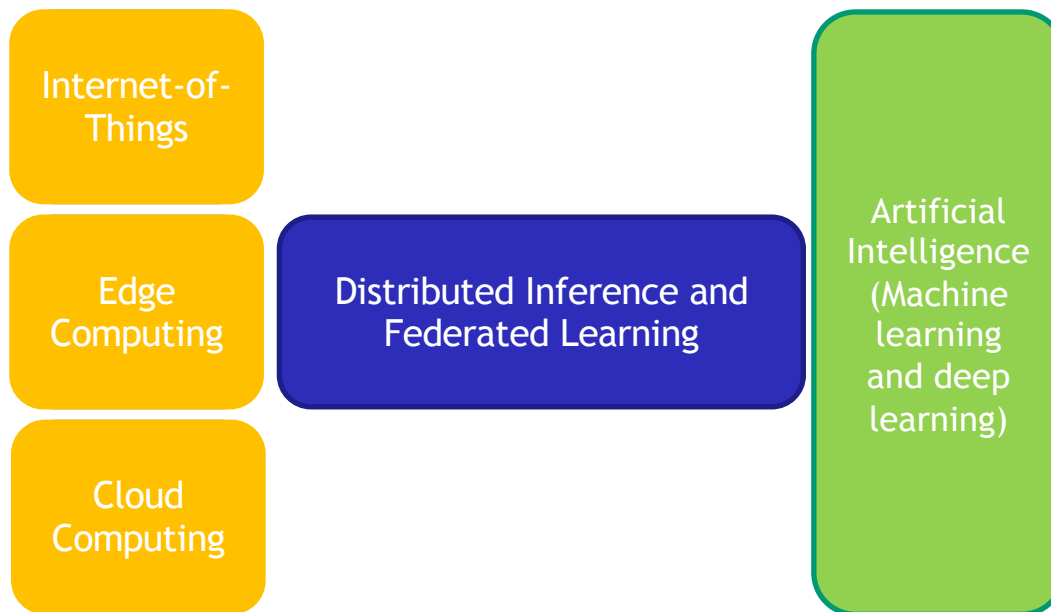


The research activity



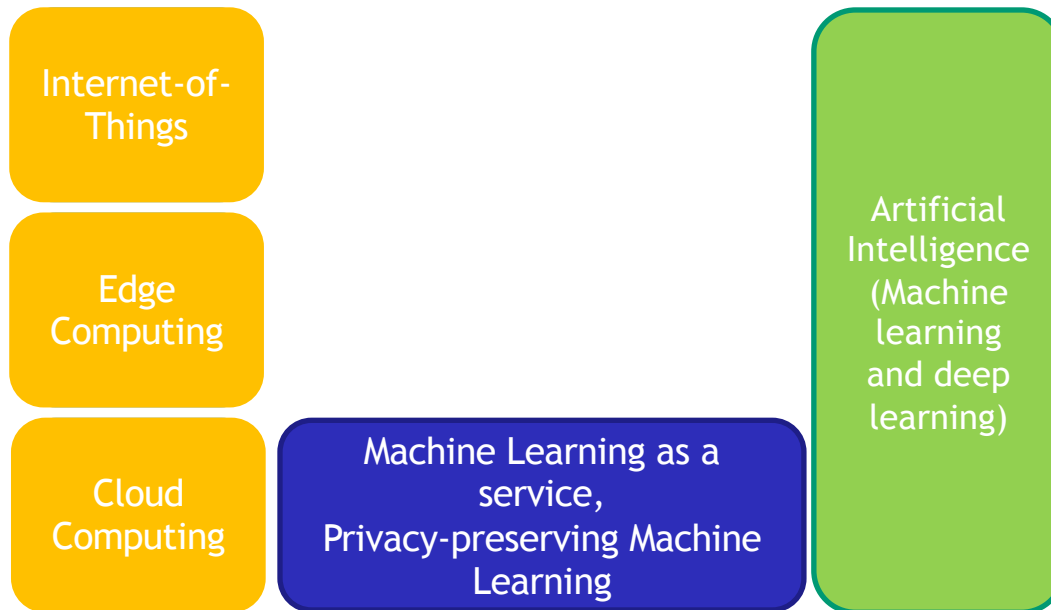


The research activity



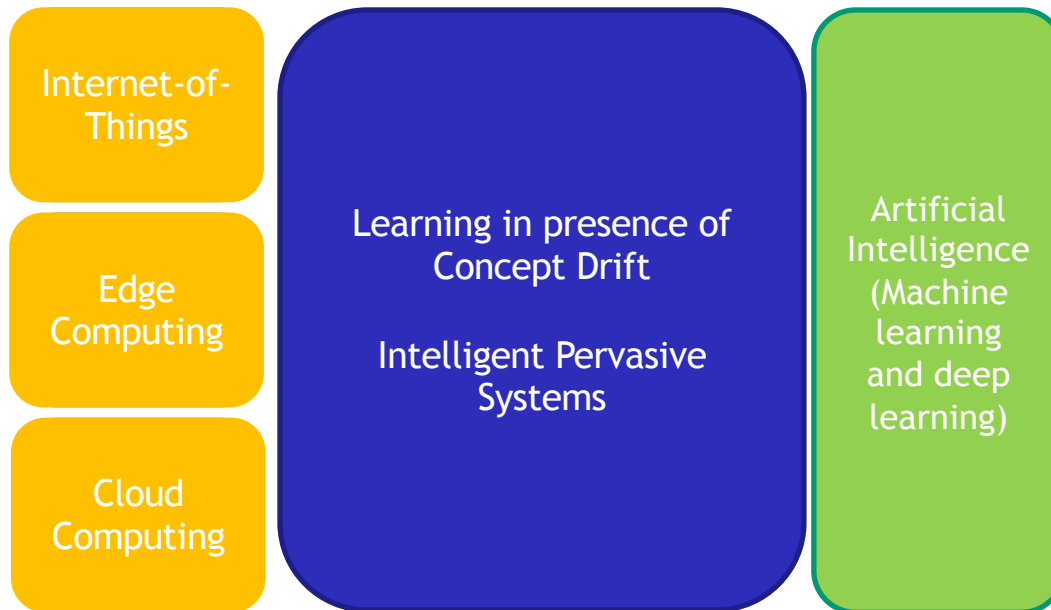


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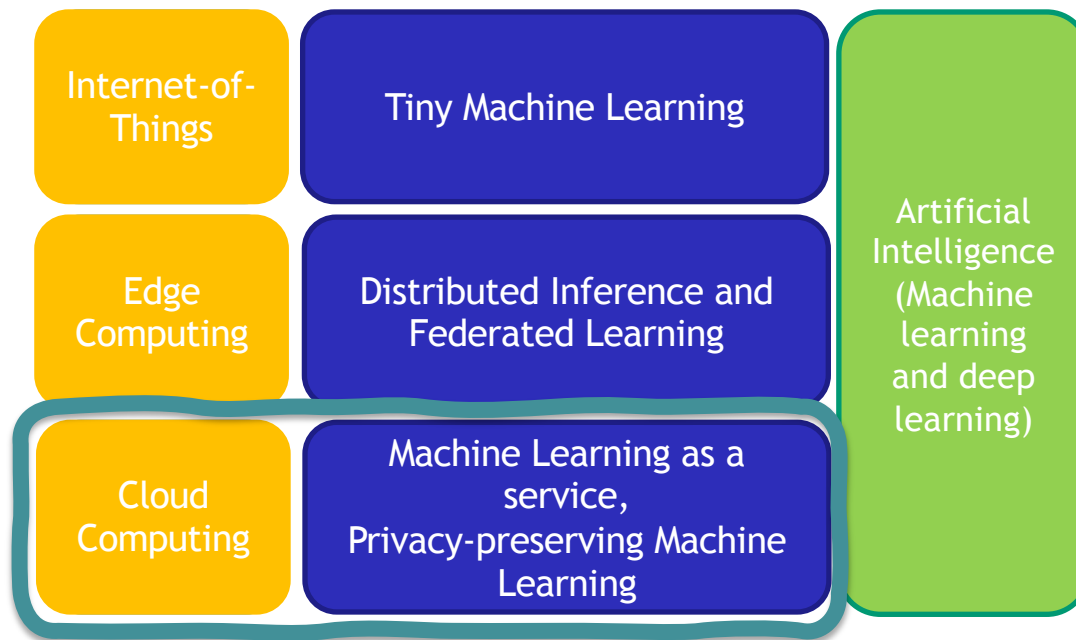


The research activity





The research activity



Topics of this course!!!

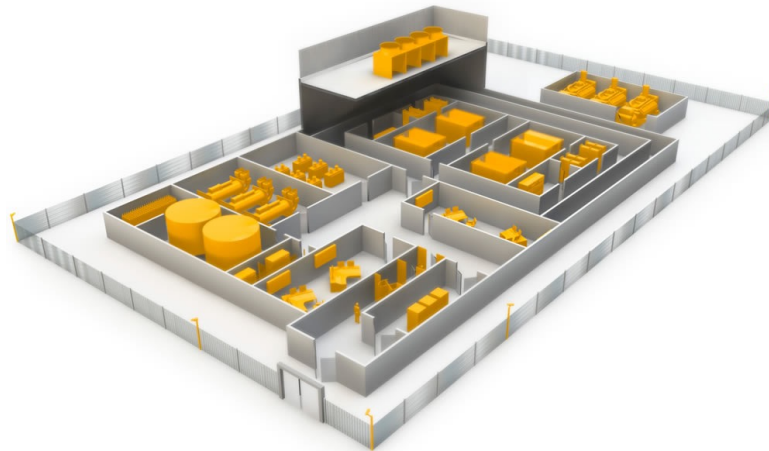


Introduction to the course

- Modern large-scale datacenters require the seamless integration of different components - applications, computation nodes, storage devices, and networks - into one computing infrastructure.



Google Cloud



- The course covers the basics of current datacenters architectures, ranging from the analysis of the single components to the global infrastructure.



The topics of the course

A. HW Infrastructures:

- **System-level**: Computing Infrastructures and Data Center Architectures, Rack/Structure;
- **Node-level**: Server (computation, HW accelerators), Storage (Type, technology), Networking (architecture and technology);
- **Building-level**: Cooling systems, power supply, failure recovery

B. SW Infrastructures:

- **Virtualization**: Process/System VM, Virtualization Mechanisms (Hypervisor, Para/Full virtualization)
- **Computing Architectures**: Cloud Computing (types, characteristics), Edge/Fog Computing, X-as-a service
- **Machine and deep learning-as-a-service**

C. Methods:

- **Reliability and availability of datacenters** (definition, fundamental laws, RBDs)
- **Disk performance** (Type, Performance, RAID)
- **Scalability and performance of datacenters** (definitions, fundamental laws, queuing network theory)



1. Prof. Manuel Roveri

- HW-SW infrastructure, Cloud, MLaaS, Disks
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2. Prof. Danilo Ardagna

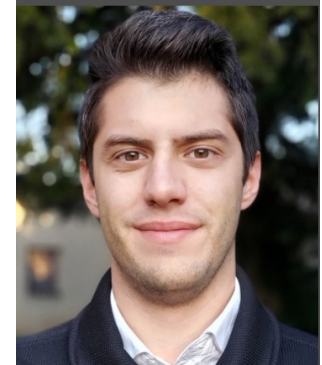
- Performance
- Dipartimento di Elettronica, Informazione e Bioingegneria
- danilo.ardagna@polimi.it
- <http://ardagna.faculty.polimi.it>





3. Ing. Roberto Sala

- Dependability
- Dipartimento di Elettronica, Informazione e Bioingegneria
- roberto.sala@polimi.it



4. Prof. Marco Gribaudo

- Dependability, disks, and performance exercises
- Dipartimento di Elettronica, Informazione e Bioingegneria
- marco.gribaudo@polimi.it





	CS [E-P], MUS[E-P], BIO, TEL[E-P], GEO
Monday	14:15-16:15 9.1.2
Tuesday	12:15-14:15 B.4.4



Schedule of the Course



- A detailed schedule is available on WeBeep (



IT

 Assistenza



Dashboard - I miei corsi - 095898 - COMPUTING INFRASTRUTTURE - Materiali - Schedule

Cartella

Impostazioni

Altro ▾



Schedule

Modifica



CI-Schedule-2024.pdf

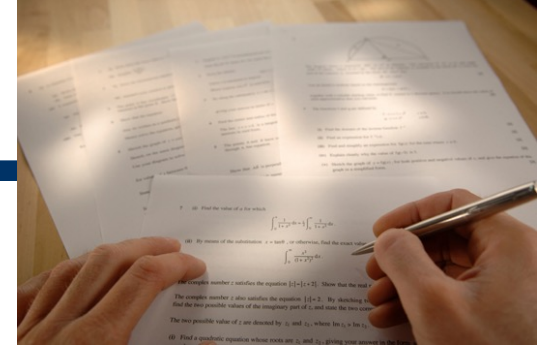


Vai a...

	Class 1	Docente Class 1
19/2	Course Introduction and Computing	Roveri
20/2	Data centers introduction	Roveri
26/2	Datacenter as a Computer	Roveri
27/2	Servers	Roveri
4/3	Servers & Storage	Roveri
5/3	Storage	Roveri
11/3	NAS/SAN & Networking	Roveri
12/3	Networking & Buildings	Roveri-Maier-Ardagna
18/3	Introduction to Cloud Computing	Roveri
19/3	Virtualization	Roveri
25/3	Virtualization	Roveri
26/3	X-as-a-Service & ML-as-a-Service	Roveri
8/4	Dependability 1	Sala
16/4	Dependability 2	Sala
22/4	Ex Dependability 1	Sala
23/4	Raid	Roveri
29/4	Ex Dependability 2	Sala
30/4	Raid	Roveri
6/5	Ex Raid	Gribaudo
7/5	Performance 1	Ardagna
13/5	Performance 2	Ardagna
14/5	Es Performance 1	Gribaudo
20/5	Performance 3	Ardagna
21/5	Es Performance 2	Gribaudo
27/5	Es Performance 3	Gribaudo



Evaluation



- The course will have a written exam
- The exam will consist in:
 - a set of exercises, i.e., simple problems to solve (similar to the ones that will be covered during the classes)
 - **one or more** questions dealing with more general topics covered by the course
- Closed book
- Exercises and Exams will be made available
- Thesis about course topics will be made available



Slides of the course will be published on the WeBeep website

Materiali [↗](#)



Consulta i materiali forniti dal docente.



Cartella

Lectures [↗](#)



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Schedule [↗](#)



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Additional Materials [↗](#)





References

- Luiz André Barroso and Urs Hölzle, **The Datacenter as a Computer: An Introduction to the Design of Warehouse-Scale Machines**
- James Smith and Ravi Nair, **"Virtual Machines" Versatile Platforms for Systems and Processes**
- Caesar Wu and Rajkumar Buyya, **Cloud Data Centers and Cost Modeling**
- Edward D. Lazowska, John Zahorjan, G. Scott Graham, Kenneth C. Sevcik, **Quantitative System Performance: Computer System Analysis Using Queueing Network Models**
- Massimo Lazzaroni, Loredana Cristaldi, Lorenzo Peretto, Paola Rinaldi, Marcantonio Catelani. **Reliability Engineering: Basic Concepts and Applications in ICT**