

Distributed architectures for big data processing and analytics

Teachers

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Office hours

- Class-time (break, end of lesson)
- Or send an e-mail for an appointment

Weekly schedule

- Lectures (62 hours)
 - Monday 8:30-10:00
 - Classroom R3+ Virtual Classroom
 - Wednesday 10:00-13:00
 - Classroom 3P+ Virtual Classroom
- Lab activities (18 hours)
 - Tuesday 11:30-13:00 – Team #1 – A-K
 - LABINF
 - Friday 11:30-13:00 – Team #2 – L-Z
 - LABINF

Lab activities

- Please make sure you have a specific account at LABINF before starting the lab activities
 - It is not the account you use to log into the PCs of the other labs at Politecnico
 - You can register an account at LABINF every day from 2pm to 3pm (check the LABINF website for further details)
 - <http://www.labinf.polito.it>
 - **No lab activities during the first week**

Lab activities

- We will also provide you with a specific account on the BigData@Polito cluster
 - <http://bigdata.polito.it/>
- Detailed information will be provided before the first laboratory practice
 - We will send you an email with username and password

Topics

- Lectures
 - Introduction to Big data
 - Big data pipeline and lambda architecture
 - Hadoop
 - Architecture
 - MapReduce programming paradigm
 - Spark
 - Architecture
 - Spark programs based on RDDs (Resilient Distributed Data sets)
 - Spark SQL and DataFrames

Topics

- Data mining and Machine learning libraries for Big Data
 - MLlib (Apache Spark's scalable machine learning library)
 - GraphX and GraphFrame (Apache Spark's API for graphs)
- Data streaming analytics
 - Spark Streaming
 - Apache Flink, Storm, Kafka, ..

Topics

- Laboratory activities
 - Application development on Hadoop and Spark

Prerequisites / prior knowledge

- Programming skills (**mandatory**)
 - **Java language (basic)**
 - **Python language**
- and basic knowledge of database concepts (recommended)
 - Relational data model
 - SQL language

Material

- Web page
 - https://dbdmg.polito.it/dbdmg_web/2025/distributed-architectures-for-big-data-processing-and-analytics-2024-2025/
 - Slides, exercises, tools
- Video lectures/Virtual classrooms
 - The video lectures will be available on the Teaching portal
 - <https://didattica.polito.it>

Books and Readings

- Reference books:
 - Matei Zaharia, Bill Chambers. Spark: The Definitive Guide (Big Data Processing Made Simple). O'Reilly Media, 2018.
 - Advanced Analytics and Real-Time Data Processing in Apache Spark. Packt Publishing, 2018.
 - Matei Zaharia, Holden Karau, Andy Konwinski, Patrick Wendell. Learning Spark (Lightning-Fast Big Data Analytics). O'Reilly, 2015.
 - Tom White. Hadoop, The Definitive Guide. (Third edition). O'Reilly Media, 2015.
 - Donald Miner, Adam Shook . "MapReduce Design Patterns: Building Effective Algorithms and Analytics for Hadoop and Other Systems." O'Reilly, 2012

Exam rules

- Written exam
 - 2 programming exercises (max 27 points)
 - Design and develop programs based on the MapReduce programming paradigm and Spark APIs
 - 2 questions / theoretical exercises (max 4 points)
 - Topics
 - Technological characteristics and architecture of Hadoop and Spark
 - HDFS
 - MapReduce programming paradigm
 - Spark RDDs, transformations and actions
 - Spark SQL and DataFrames
 - Data mining and Machine learning libraries for Big data (Spark MLlib, GraphX/GraphFrame)
 - Data streaming analytics

Exam rules

- On-site written exam on the **Exam/Moodle platform with Lockdown browser** – **You must bring your own PC**
 - 90 minutes
 - The exam is **open book**
 - Books, notes, handwritten notes, and any other paper materials are allowed
 - Electronic devices of any kind (PC, mobile phone, calculators, etc.) are not allowed, except the PC used for the exam itself
- Exam examples will be available on the web page of the course