Introduction to the Course

Distributed Systems
Sistemi Distribuiti

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Distributed Systems: Why?

Distributed Systems: The Course
Nowadays, computational systems...

- ... have become pervasive, since they are everywhere, and tend to affect every aspect of our everyday life and activity.

- ... are at the core of most (if not all) artificial systems, so that every principled discipline for modelling / engineering computational systems affects the modelling and engineering of almost every sort of artificial systems.
Pervasive Computation & Interaction II

Pervasiveness of computations

- how many computational systems today in this room?
  - in our cars, at home, in the workplaces, in hospitals, in public places?
- we live immersed in a sort of computational cloud\(^a\), where an incredible (and always increasing) number of computations are performed at every instant around us
  - distributed, concurrent computations
  - either controlled / triggered, or autonomous computations

\(^a\)we are not merely talking about Cloud Computing here
Pervasiveness of interaction

- almost any computational system of today comes equipped with ICT technologies for interacting with other computational systems
- computational devices continuously interact
  - with humans
  - with each others
  - with the physical environment and its resources
Physical vs. Computational

The physical nature of artificial systems... adds complexity to computational components / systems

- in terms of spatial *distribution*
- in terms of temporal *distribution*
- in terms of unpredictability of the *environment* where they have to work
On the Notion of Distribution I

What is *spatially* distributed?

- computational units
- communication channels
- data / information / knowledge
  - along with their representations
- sensors, actuators, ...
  - the boundary between the system and the surrounding environment is spatially *sparse*
Spatio-temporal unity of systems is lost
- there is no longer a notion of system time, nor a system location
- system components, at different level of abstraction, are only partially correlated
  - temporally & spatially

A number of assumptions over systems no longer hold
- system events no longer constitute a totally-ordered set
  - generally speaking, partial ordering is the only feature
- admissible interactions among system components no longer depend on compresence
  - in space / time
  - within the same physical / virtual topology
Conceiving and constructing artificial systems... 

- ... nowadays means dealing with *distributed systems*
- whose core is represented by (distributed) *computational systems*
- which are to be *modelled* and *built*
Modelling distributed (artificial) systems...

- ... involves new (theoretical) problems
- so, it requires new theoretical frameworks, models, abstractions, techniques
- mostly, computational ones

! it is one of the main objects of study of computer science
Building distributed (artificial) systems...

- ... involves new (practical) problems
- so, it requires new technologies, infrastructures, methods, methodologies
- mostly, computational ones
- it is one of the main objects of study of computer engineering
Next in Line...
Goals of the Course

Students of this course will...

- learn the *fundamental issues* of distributed systems
- re-think some of the most widely used *technologies* in nowadays distributed systems
  - object-based systems as a general trend in moving legacy models & technologies toward distributed systems
  - web-based and mobile systems as the most relevant case of today widespread *distributed, knowledge-intensive* systems
- take a look at some of the most promising *trends*
- experiment with *paradigms* and *technologies* for distributed computing and systems
  - logic-based, agent-based, and coordination-based systems as *general-purpose* approaches for intelligent & pervasive systems
Material of the Course: Base Book

[Tanenbaum and van Steen, 2007a]

*Distributed Systems. Principles and Paradigms*

[Tanenbaum and van Steen, 2007b]

*Sistemi Distribuiti*
Pearson Education Italia, Torino, Italia, 2ª edizione.

This book represents a solid guide throughout the most “classic” part of the course—basics & issues
Material of the Course: Other Books I

[Coulouris et al., 2012]
Coulouris, G., Dollimore, J., Kindberg, T. and Blair, G. (2012)
*Distributed Systems. Concepts and Design*
Pearson

[Kshemkalyani and Singhal, 2011]
Kshemkalyani, A.D. and Singhal, M. (2011)
*Distributed Computing. Principles, Algorithms, and Systems*
Cambridge University Press
Material of the Course: Other Books II

[Birman, 2005]

Birman, K.P. (2005)
*Reliable Distributed Systems. Technologies, Web Services, and Applications*
Springer
Material of the Course: Slides

- slides will be available from the course web site
- along with any additional information—e.g., links, related literature, software, etc.

http://apice.unibo.it/xwiki/bin/view/Courses/Sd1718Slides
Timetable

http://apice.unibo.it/xwiki/bin/view/Courses/Sd1718Schedule

- Tuesday, h. 11-13, Lab 3 / Room C, via Sacchi 3, Cesena
- Wednesday, h. 11-14, Room B, via Sacchi 3, Cesena

Any variation, extension, cancellation will be communicated via
- schedule page
- professor / students mailing list andrea.omicini.SD-1718
Organisation of the Course

Professors-students lists

- are provided by the Alma Mater Studiorum
- mostly work
- are used here for fast communication from the professor

Please register soon...

- ... to the list andrea.omicini.SD-1718
- using password 1718SD
- ! like, say, today
Laboratory

lab slides will be available from the lab web page
along with any additional material—e.g., links, code, exercises

Lab classes will take place
- on (some) Tuesday, in Lab 3
- with the help of Ing. Giovanni Ciatto
- sometimes in presence of Dr. Ing. Stefano Mariani
Attitude toward the Course

Attending lessons is useful

- the topic is really general and rich of subtleties
- a lot of “implicit knowledge” is transferred orally

Material should be enough to pass the exam, anyway...

- ... for those who have problems attending lessons—like, worker students
- ... or, for those who just hate the professor’s voice / face / slides / attitude / whatever

Andrea Omicini (DISI, Univ. Bologna)
C0 – Introduction to the Course
A.Y. 2017/2018
Exams I

The final exam

- consists by default of an **oral discussion** about the main themes of the course
- typically includes some discussion of the **lab exercises**
  - “make it run and explain”
  - “slightly change the lab problem and make it run”
  - typically using your own portable, if available
- can be asked by at **any time of the year**, typically via email
  - then set according to the availability of the professor
Exams II

Alternative: project

- a project constitutes an alternative path w.r.t. oral exam
- it should cover a specific topic of the course
- it may concern theoretical / technological / methodological aspects
- it may be developed by individuals or groups
- it has to be negotiated with the professor, in order to ensure
  - its focus on distributed systems, as well as
  - its feasibility in a reasonable amount of time
References


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