Introduction to the Course

Distributed Systems

Sistemi Distribuiti

Andrea Omicini

andrea.omicini@unibo.it

Dipartimento di Informatica – Scienza e Ingegneria (DISI)

Alma Mater Studiorum – Università di Bologna a Cesena

Academic Year 2013/2014

Outline

Computational Systems

What is a computational system?

- any system with computational capabilities
- how many computational systems today in this room?
  - how many a few years ago?

Interactivity & Interoperability

- Almost any computational system of today comes equipped with ICT technologies for interacting with other computational systems
- We live immersed in a sort of *computational cloud*, where an incredible (and always increasing) number of computations are performed at every instant
  - distributed, concurrent computations
  - either controlled / triggered, or autonomous computations

Pervasiveness of Computational Systems

Nowadays, computational systems...

- ...have become *pervasive*
- ...are at the core of *most* artificial systems

The physical nature of artificial systems...

...adds complexity to computational components / systems

- in terms of physical *distribution*
- in terms of temporal *distribution*
- in terms of unpredictability of the scenarios

On the Notion of Distribution

What is distributed?

- computational units, communication channels. . .
- data, information, knowledge
  - as well as their representations
- sensors, actuators, . . .
  - the boundaries between the systems and the surrounding environment are topologically 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 related*
  - temporally & topologically

What has Changed?

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 a physical / virtual topology

Outline

Goals of the Course

Students of this course should

- Learn the basics of distributed systems
- Take a look at some of the hottest new trends
- Experiment with *distributed technologies*
  - object-based as a general trend in moving legacy models & technologies toward distributed systems
  - web-based as the most relevant case of today widespread distributed, knowldege-intensive systems
  - coordination-based and agent-based as general-purpose approaches to advanced technologies for intelligent & pervasive systems

Structure of the Course: Main Topics I

Generality on distributed systems

- Basic problems and definitions
- Software architectures
- Middleware & Infrastructure

Issues of distributed systems

- Communication
- Naming
- Synchronisation
- Consistency & replication
- Fault tolerance

Structure of the Course: Main Topics II

Main sorts of distributed systems

- From distributed object-based systems to agent-based systems
- Web-based systems
- Coordination-based systems

Material of the Course: Main Book

[Tanenbaum and van Steen, 2007a]

Tanenbaum, A. S. and van Steen, M. (2007)
Distributed Systems. Principles and Paradigms
Pearson Prentice Hall, Upper Saddle River, NJ, USA, 2nd edition.

[Tanenbaum and van Steen, 2007b]

Tanenbaum, A. S. and van Steen, M. (2007)
Sistemi Distribuiti
Pearson Education Italia, Torino, Italia, 2^a edizione.

This book represents the main guide throughout the first two parts of the course—Basics & Issues

Material of the Course: Slides

http://apice.unibo.it/xwiki/bin/view/Courses/SdLm1314Slides

- Slides will be available from the course's web site
- Along with any additional information—e.g., related literature

The last part of the course, on the three main sorts of distributed systems,

- will contain several references to the Tanenbaum & van Steen book chapters
- but will mainly evolve according to a *different perspective*, as reported on the course's slide.

Schedule

Classes

- Tuesday, h. 11-13, Room A, via Sacchi 3
- Friday, h. 11-13, Room A, via Sacchi 3

Laboratory

Where, when, who

- In Lab 3, via Sacchi 3
- Thursday, h. 10–13
- with Prof. Marco Fabbri

http://apice.unibo.it/xwiki/bin/view/Courses/SdLm1314Lab

- The Lab will be the place where the technologies for distributed systems are presented and experimented
- It will the make theoretical part meaningful
- It will be essential for the exam

Attitude toward the Course

Attending lessons is important

- The topic is rich of subtleties
- A lot of "implicit knowledge" is transferred orally
- In particular, attending to Lab classes is essential

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

- ... for those who have problems attending lessons
- ... or, for those who just hate the Professor's voice / face / slides / attitude / whatever

Registering to the Course

Professors-students lists...

- are provided for free by the Alma Mater Studiorum
- they mostly work
- we will use them here

Please register *soon*...

- to the list `andrea.omicini.SD-LM-1314`
- using password `1314SDLM`
- like, say, *today*.

References

Tanenbaum, A. S. and van Steen, M. (2007a).
Distributed Systems. Principles and Paradigms.
Pearson Prentice Hall, Upper Saddle River, NJ, USA, 2nd edition.

Tanenbaum, A. S. and van Steen, M. (2007b).
Sistemi Distribuiti.
Pearson Education Italia, Torino, Italia, 2^a edition.

Introduction to the Course

Distributed Systems

Sistemi Distribuiti

Andrea Omicini

andrea.omicini@unibo.it

Dipartimento di Informatica – Scienza e Ingegneria (DISI)

Alma Mater Studiorum – Università di Bologna a Cesena

Academic Year 2013/2014