Introduction to the course, textbook, exam…
- Modules aims and subjects covered
- Why distributed systems?
- Examples of DS
- Challenges of design and implementation of DS

Introducing the course:
Distributed Systems
Extended Distributed Systems
Lectures:
- Tue 11:00-12:00, 203, Haworth
- Thu 10:00-11:00, 203, Haworth

Textbook and general information
Textbook (essential):
George Coulouris, Jean Dollimore and Tim Kindberg
Distributed Systems, Concepts and Design
Fourth edition, 2005
Handouts on the web, printed, library
Web page: www.cs.bham.ac.uk/~bxb/
Examination:
- 100% Assessment
- Extended Distributed Systems: essay

What are the modules aims?
Selected from module’s web page:
- Give overview of fundamental problems and techniques for their solution
- Introduce the principles and concepts involved in design of distributed systems
- Familiarise with mechanisms and protocols for inter-process communication
- …

Some of the subjects covered
- Challenges of design implementation of DS (this lecture)
- Networking and interprocess communication
- Distributed Objects
- Security
- Web services, P2P networks
- Time, coordination and agreement
- Distributed Transaction…
Also, exercise classes
I may give a lecture on a new subject
Warning: DS is a fun, but it is not an easy subject
Distributed Systems: definition

Common theme of many technologies
Internet, Intranet, PAN (bluetooth), Web services,
Mobile and Ubiquitous systems, …
Every day use: viza card
How does it work? subject of the course
Definition: a system in which hardware or
software components located at networked
computers communicate and coordinate their
actions only by passing messages.

Why distributed system?

Sharing resources and ensuring availability
hardware: printer, disk space, Camera, …
Information and communication: databases,
mobile phones
Media and entertainment: music, video, …
Examples:
Internet
Intranet
Mobile and Ubiquitous systems

Internet

large interconnected collection of computers
Interaction is via message passing
Various protocols help with messages:
IP
TCP (TCP/IP)
UDP
FTP, http, …
WWW is not the same as the Internet!

Intranet

Portion of the Internet

Intranet

Portion of the Internet that is separately
administered and has a boundary to configured
to enforce local security policies.
### Challenges of …

... the design and implementation of DS:
- Heterogeneity
- Openness
- Security
- Scalability
- Failure handling
- Concurrency
- Transparency

### Heterogeneity

Systems must work on different networks, hardware, Operating System, Programming language, and also implementation by different people.

How? use standards.

Middleware: programming abstraction as well as masking the heterogeneity

Mobile code (Applets) and virtual machine

### Openness

i.e. extensibility, the system can be extended and re-implemented in various ways

Adding new:
- Hardware (Ex. more computers)
- Software (Ex. support for transfer of music)
- Services (Ex. directory, naming services)
- and sharing resources (Ex. bandwidth for stream)

How? publishing interfaces

### Security

- Confidentiality: protection against disclosure to unauthorized individuals
- Integrity: protection against alteration or corruption
- Availability: protection against interference with the means to access the resources

### Scalability

remain effective when there are significant increase in number of resources and users (ex. Internet)

- Controlling the cost of physical resources
- Controlling the performance loss
- Preventing resources from running out
- Avoid performance bottlenecks

### Failure handling

Failure detection is partial (difficult)

- Detecting failure (some fails are impossible to detect)
- Masking failure, e.g. retransmission
- Tolerating failure
- Recovery from failure, e.g. role back in databases/transactions
- Redundancy (duplicate data)
Concurrency

Services and resources are shared by the clients in a DS
Correct synchronisation is essential
Example: online shopping

Transparency

Concealment of the distributed nature of system from user/programmer.
Access transparency
Location transparency
Concurrency transparency
Replication transparency
Failure transparency
Mobility transparency

Summary

- Definition of DS
- Examples of DS
- Challenges of the design
  - Heterogeneity
  - Openness
  - Security
  - Scalability
  - Failure handling
  - Concurrency
  - Transparency

Further reading:
Pages 1-27 of the course book

Selected Exercises:

1.1 Give five types of hardware resource and five types of data or software resource that can usefully be shared. Give examples of their sharing as it occurs in practice in distributed systems.

1.3 A user arrives at a railway station that she has never visited before, carrying a PDA that is capable of wireless networking. Suggest how the user could be provided with information about the local services and amenities at that station, without entering the station’s name or attributes. What technical challenges must be overcome?