Net Centric Systems

Introduction

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Today's Lecture: Agenda

- Course Outline
- Marks Distribution
- Deliverables
- Lesson 1

Course Outline

- Text Book:
  - Holt J. A Pragmatic Guide to Business Process Management. 2nd Edition, BCS, 2009.
  - Linthicum D.S. Cloud Computing and SOA Convergence in Your Enterprise, Addison-Wesley, 2010.
- References:
  - • M. Weiser, “The Computer for the 21st Century”, Scientific American, Sept. 1991.
  - • M. Satyanarayanan, “Pervasive Computing: Vision and Challenges”, IEEE Personal Communications,1991,p.p.10-17, http://www-2.cs.cmu.edu/~aura/docdir/pcs01.pdf.
  - • IBMResearch Autonomic Computing, http://www.research.ibm.com/autonomic/.
  - • Thomas H.Davenport, “Putting the Enterprise into the Enterprise System”, Harvard Business Review, Vol.76, Issue 4, 1998.

Course Outline

- **Basic concepts,** advantages & disadvantages of net-centric systems and services, criteria for the investment in relevant technologies, acceptance management, change management.
- **E-services** focusing on e-procurement, e-government, e-health, e-prescribing.
- Business process management, service-oriented architectures, web-services.
- **Ubiquitous, pervasive systems (1):** Main concepts, advantages-disadvantages, evaluation.
- Ubiquitous, pervasive systems (2): Relevant technologies and benefits, context-awareness, smart phones, sensor networks.
- Ubiquitous, pervasive systems (3): Applications on smart spaces, smart homes, smart offices.
- **ERP Systems (1):** Introduction, objectives, operations, services provision, benefits.
- ERP Systems (2): Case studies, example applications
- **Cloud computing (1):** Basic concepts, new service provisioning model, pay-per-use.
- Cloud computing (2): Software-as-a-Service (SaaS), Hardware-as-a-Service (HaaS), Platform-as-a-Service (PaaS).

Marks Distribution

- Quizzes (x4) 05
- Assignments (x1) 05
- Project (x1) 10

- Midterm 30
- Final (x1) 50

Assignment

Summary/Overview of the assigned research paper

Assignment + Presentation

Project

Mirpur University of Science & Technology, MUST Mirpur AJ&K

Department of Software Engineering

Net Centric Systems

Session: 2012-16 **Section A**

Semester Project

Develop a physical model for the assigned computing architecture showing its important features/ weaknesses/ Stregnths. Also prepare a report (Minimum 10 Pages) on your project.

Project Report Hard Copy Submission Date : 15 Jan, 2015

Model Presentation Date: 22 Jan, 2015

10 pages project report on the assigned topic:10 marks

Physical Model Preperation and Presentation:10 marks

Word of Caution

- Copying = multiply by Zero

- Every deliverable will be checked for plagiarism through turnitin and Similarity Index (SI) must be less than 10% in the Plagiarism report generated from Turnitin

Finally…

What will be taught in this class ?

- Network application architectures and services
  - A touch on “here-and-there”.

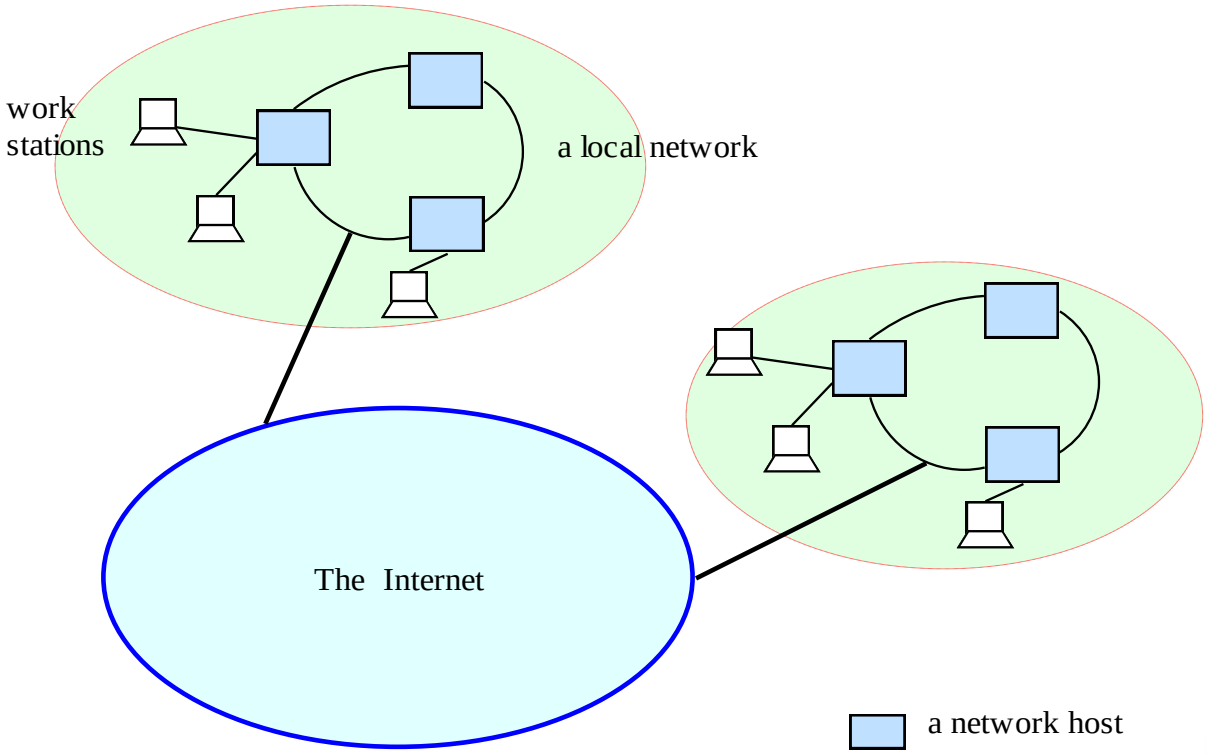
What will NOT be taught in this class ?

- How to write a Java (or other languages) program.
- How to create a web page.
- How to write a network game
  - You should study Distributed System.
- Low-level protocols (e.g. physical layer).

Distributed system, distributed computing

- Early computing was performed on a single processor. Uni-processor computing can be called *centralized computing*.
- A *distributed system* is a collection of independent computers, interconnected via a network, capable of collaborating on a task.
- *Distributed computing* is computing performed in a distributed system.

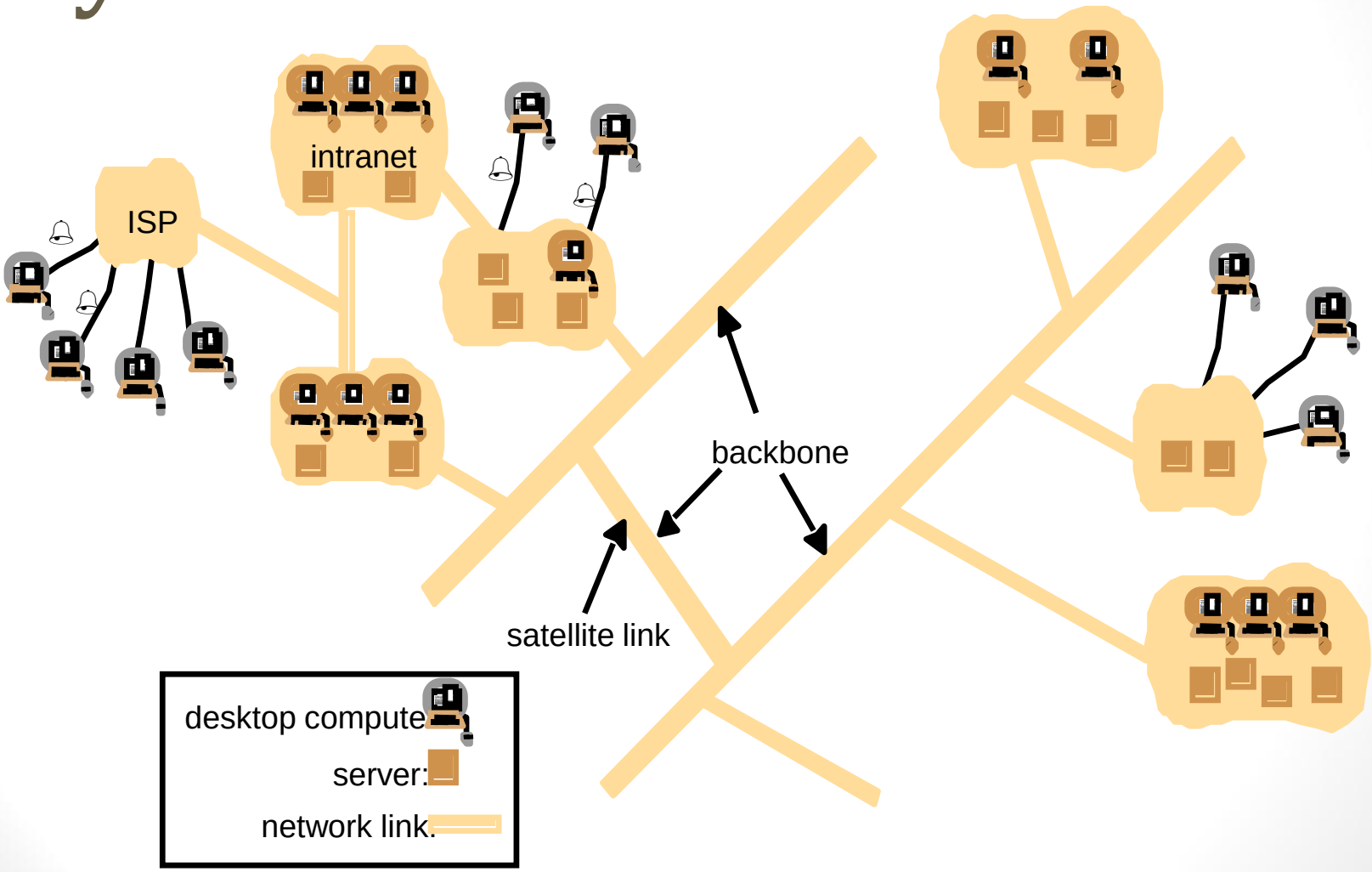
Distributed Systems



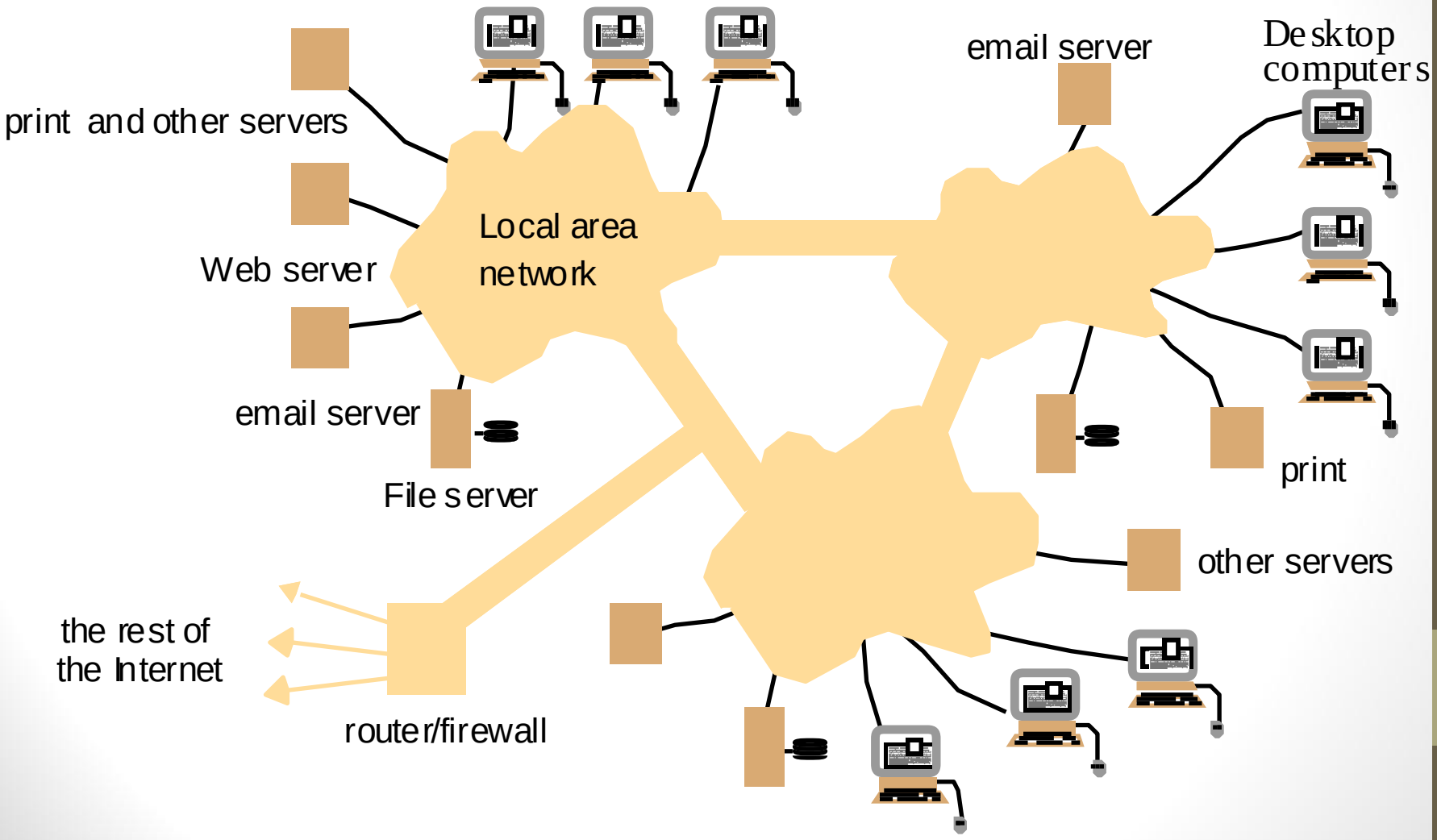
Examples of Distributed systems

- Network of workstations (NOW) / PCs: a group of networked personal workstations or PCs connected to one or more server machines.
- The Internet
- An intranet: a network of computers and workstations within an organization, segregated from the Internet via a protective device (a firewall).

A typical distributed system



A typical intranet



An example small-scale distributed system at your home

Mobile and ubiquitous computing

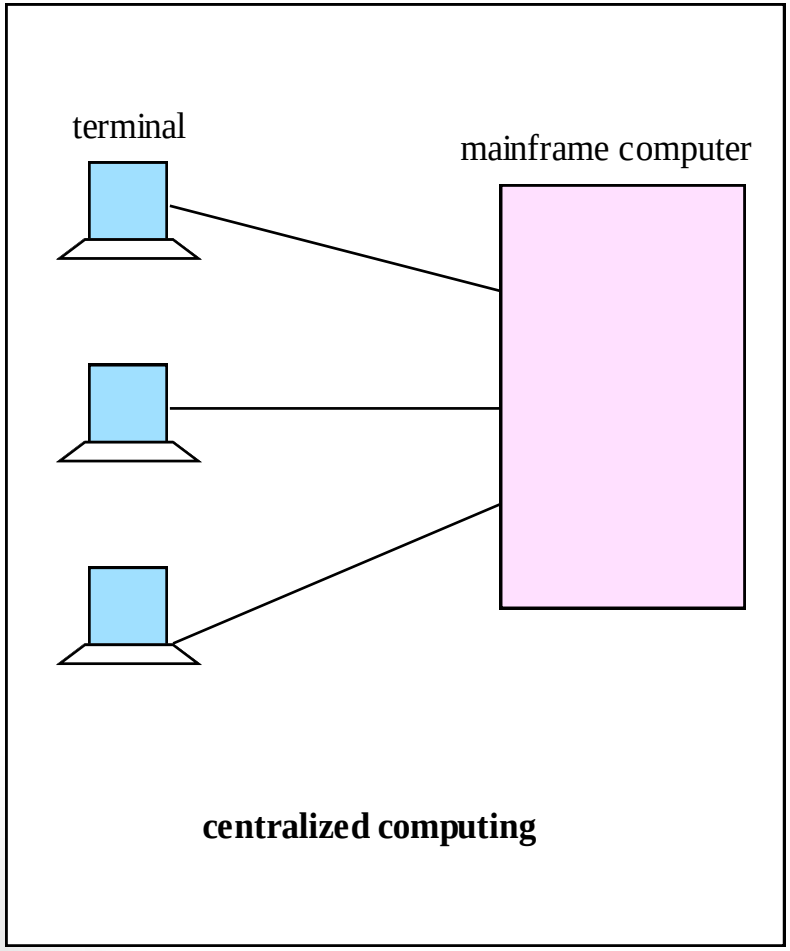
- Mobile computing
  - continuous service is available to the internet, company intranets
  - ex. Cell phone can access simple information
- Ubiquitous computing
  - computing devices will become so pervasive they will not be noticeable
    - wearables, PDAs, digital cameras
- Issues
  - discovery of resources, eliminating reconfiguration of devices from movement, coping with limited connectivity, privacy and security

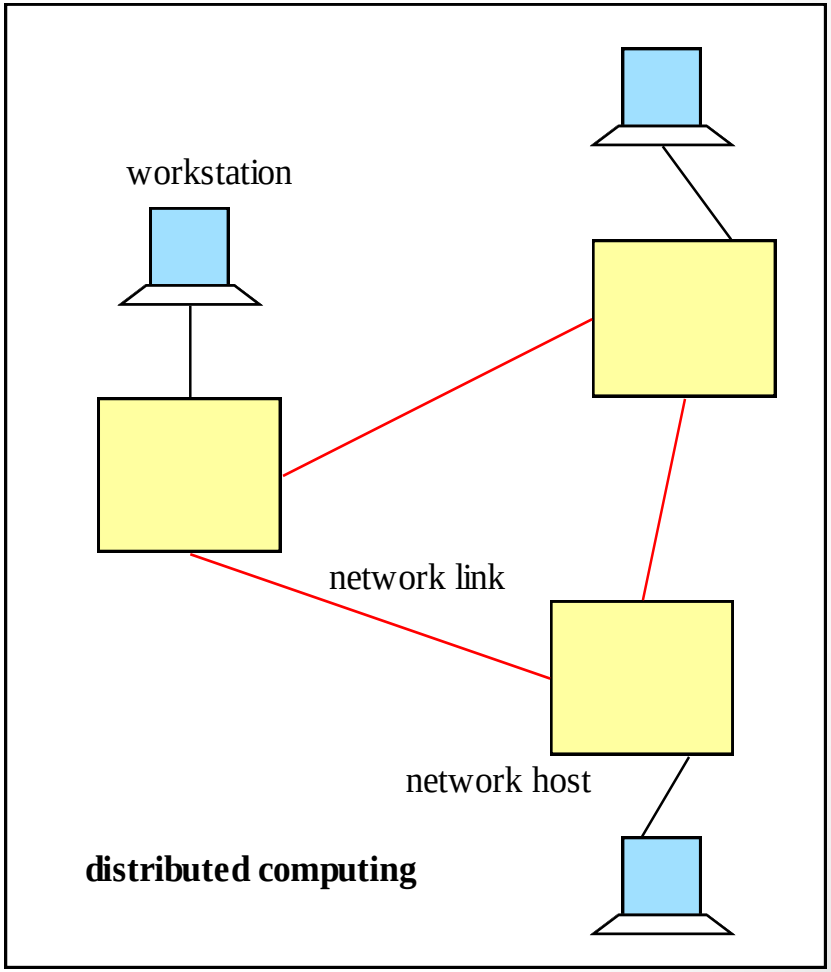
NASA super computer

From centralized to super computers

- Super computer at Virginia Tech : how to build a cheap super computer (in the top 5!)
  - http://www.youtube.com/watch?v=vLujLtgBJC0
- CRAY - NSA Supercomputer
  - http://www.youtube.com/watch?v=A5RwZz9UPUs&feature=related
- Big Data
  - http://www.youtube.com/watch?v=7D1CQ_LOizA&feature=related

From centralized to Distributed Computing





Monolithic mainframe applications vs. distributed applications based on http://www.inprise.com/visibroker/papers/distributed/wp.html

- The monolithic mainframe application architecture:
  - Separate, single-function applications, such as order-entry or billing
  - Applications cannot share data or other resources
  - Developers must create multiple instances of the same functionality (service).
- The distributed application architecture:
  - Integrated applications
  - Applications can share resources
  - A single instance of functionality (service) can be reused.

Evolution of paradigms

- Communication with floppies, … and then messages
- Client-server: Socket API, RPC, remote method invocation
- Distributed objects
- Object broker: CORBA
- Network service: Jini
- Message oriented middleware (MOM): Java Message Service
- Collaborative applications
- Web services, services

Why distributed computing?

- Economics: distributed systems allow the sharing of resources, including CPU, data storage, input/output devices, and services.
- Large application : to tackle large applications working on very large data
- Reliability: a distributed system allow replication of resources and/or services, thus reducing service outage due to failures.

The Weaknesses and Strength of Distributed Computing

- In any form of computing, there is always a tradeoff in advantages and disadvantages
- Some of the reasons for the popularity of distributed computing :
  - The affordability of computers and availability of network access
  - Resource sharing
  - Scalability
  - Fault Tolerance
  - Costs
  - The omni presence of Internet and its introduction in the business world

Benefits

- **Cost :** Better price/performance as long as everyday hardware is used for the component computers – Better use of existing hardware
- **Performance :** By using the combined processing and storage capacity of many nodes, performance levels can be reached that are out of the scope of centralised machines
- **Scalability :** Resources such as processing and storage capacity can be increased incrementally
- **Inherent distribution :** Some applications like the Web are naturally distributed
- **Reliability :** By having redundant components the impact of hardware and software faults on users can be reduced

The Weaknesses and Strength of Distributed Computing

The disadvantages of distributed computing:

- **Multiple Points of Failures:** the failure of one or more participating computers, or one or more network links, can generate trouble.
- **Security Concerns:** In a distributed system, there are more opportunities for unauthorized attack.
- **Software:** Distributed software is harder to develop than conventional software; hence, it is more expensive

Why distributed systems ?

- We have a mature technology to address challenging problems: Big Data
- Distributed systems are available within a University, an R&D center, an entreprise, …
- Internet and its related technologies make it possible

Towards a definition (1/3)

- *« A system in which hardware and software components located on networked computers communicate and coordinate their actions only by passing messages » (Coulouris)*
- *« A distributed system is a collection of independent computers that appear to the users of the system as a single computer » (Tannenbaum)*

Towards a definition (2/3)

- *« A distributed system is one that stops you from getting any work done whenever a machine you've never even heard of crashes »* (Leslie Lamport)
- *« A distributed system is a collection of autonomous computers linked by a network, with software designed to produce an integrated computing facility »* (Brazier)

Towards a definition (3/3)

- The former definitions highligh different features and relate to diverse situations
  - Existence of processors and a communication medium
  - Requirements to cooperate and communicate … with messages only
  - Association of software and hardware …to provide and access services

Communication medium

- Tightly coupled distributed systems
  - Communication is fast and reliable
  - Multi computers – with specific high speed communication lins
- Loosely coupled systems
  - Communication is slow and unreliable
  - Distributed systems over a LAN / WAN

Summary

We discussed the following topics:

- What is meant by distributed computing
- Distributed system
- Distributed computing vs. parallel computing
- Communication issues

What is assumed :

- Basic concepts in operating system: processes and threads