Distributed Systems

Lecture 1

By : Dr.Nahla Bishri

Reference: Prof.Dr.Hisham Arafat 2014

Agenda

- Distributed Systems History
- Reasons For the Appearance of Distributed Systems
- What are Distributed Systems?
- Distributed Systems Goals
- Development in Distributed Systems
- Distributed Systems Evolution.
- Distributed Systems Examples
- Why Distributed Systems?

History

- 1945~1985
  - Computers were large and expensive.
  - No way to connect them.
  - All systems were Centralized Systems.
- Mid-1980s
  - Powerful microprocessors.
  - High Speed Computer Networks (LANs , WANs

Cont. History

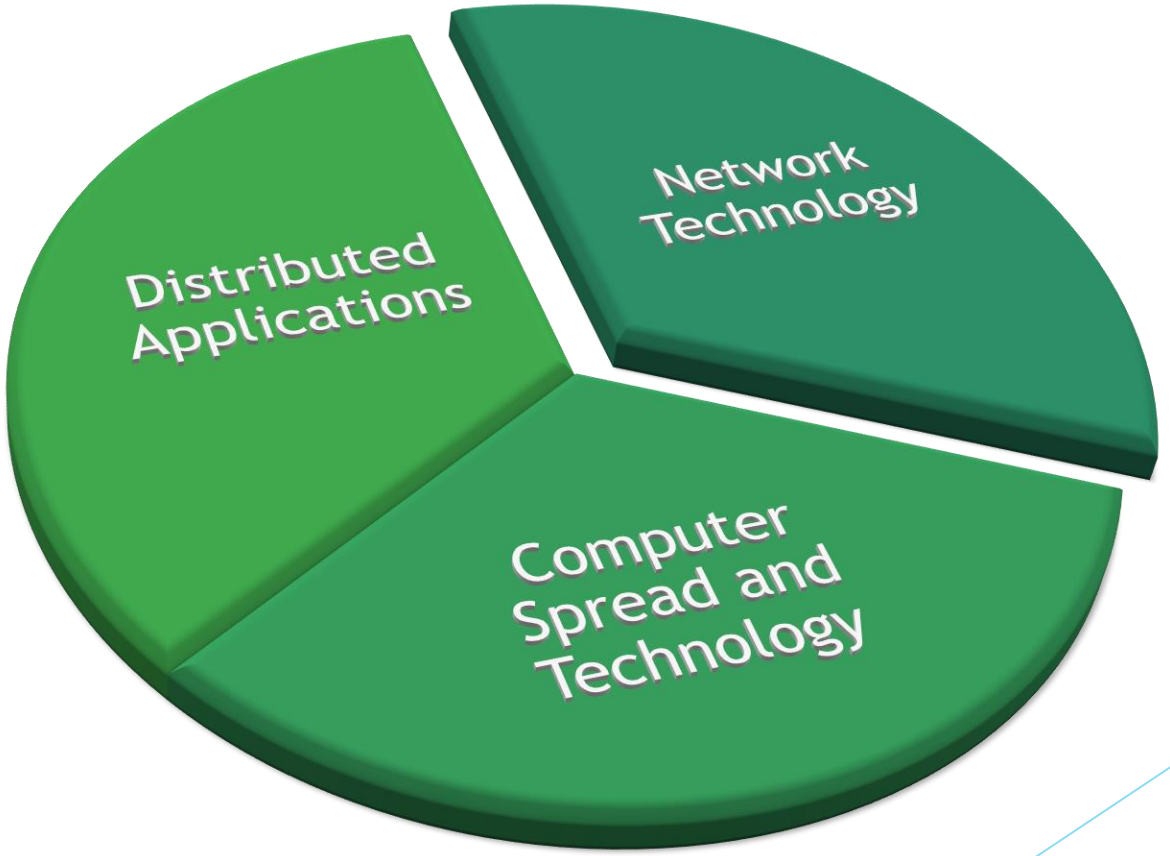
Then came the

DISTRIBUTED SYSTEMS…

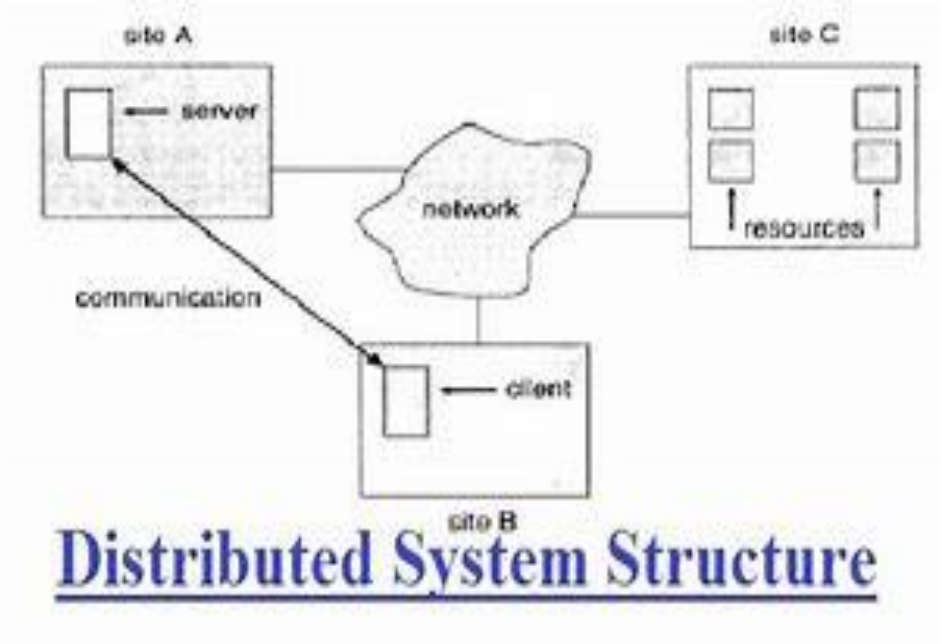
Why Distributed systems?

- availability of powerful yet cheap microprocessors (PCs, workstations),
- continuing advances in communication technology

Distributed Systems



- As soon as computers are **interconnected** and communicating we have a "distributed system“
- This approach of interconnectivity has been known by several names:
  - **multi-computers,**
  - **distributed computers,**
  - **parallel computers,**
  - **cluster,**
  - **and computational grid**



Distributed System Structure

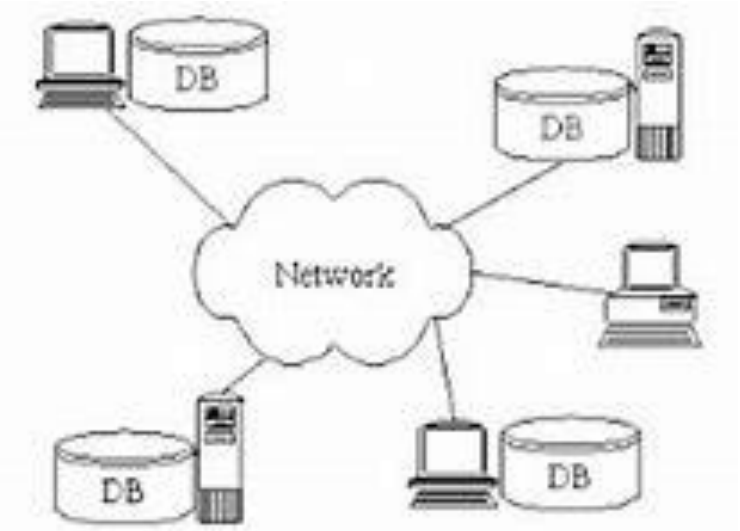
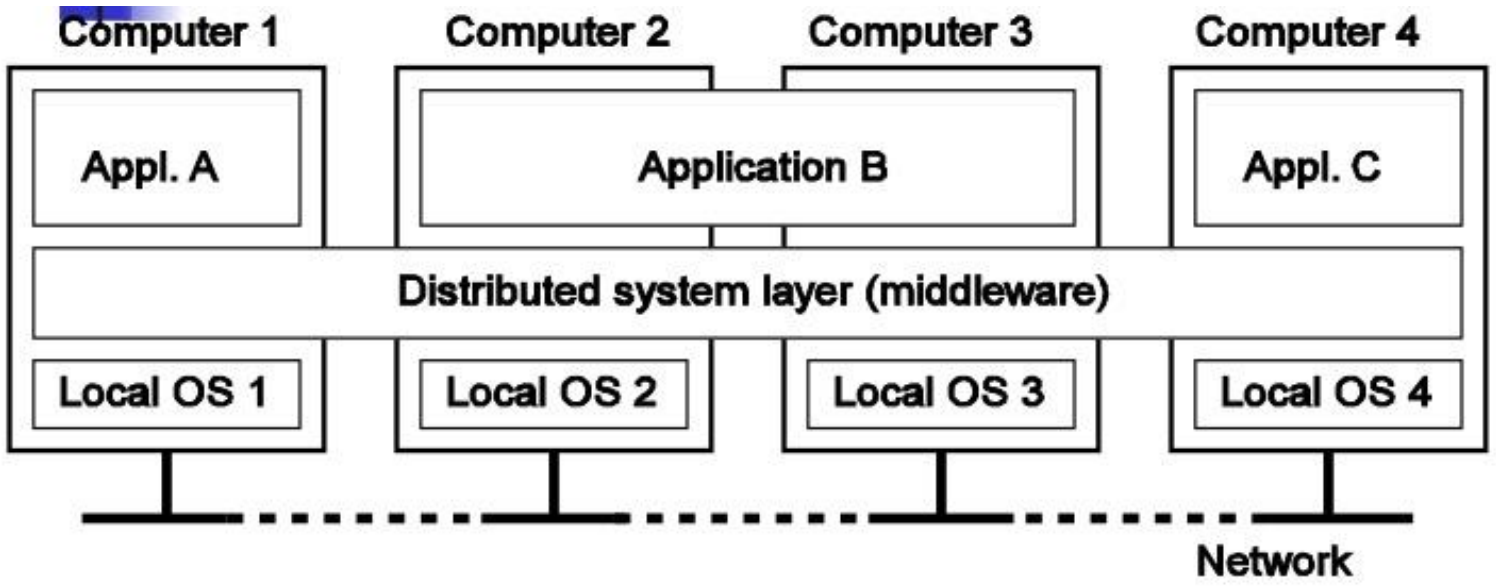


Figure. Distributed database System

What are Distributed systems?

- A distributed system is a piece of software that ensures that:
  - a collection of independent computers appears to its users as a single coherent system.
- Two aspects:
  - (1) independent computers and (2) single system => **middleware**.

Organization of Distributed system



A distributed system organized as middleware.

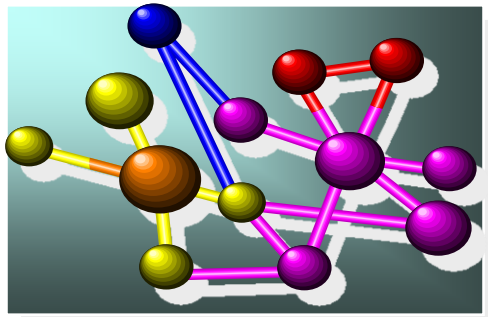
- The middleware layer extends over multiple machines, and offers each application the same interface.

Distributed Systems Goals and Motivation

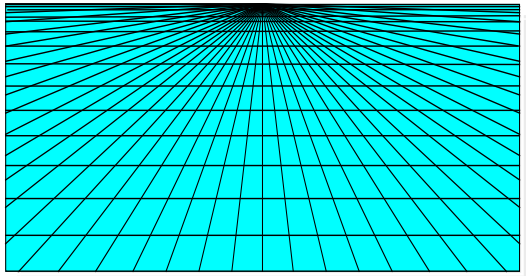
The Need For High Performance Computers

Solving technology problems using

computer *modeling*, *simulation* and *analysis*

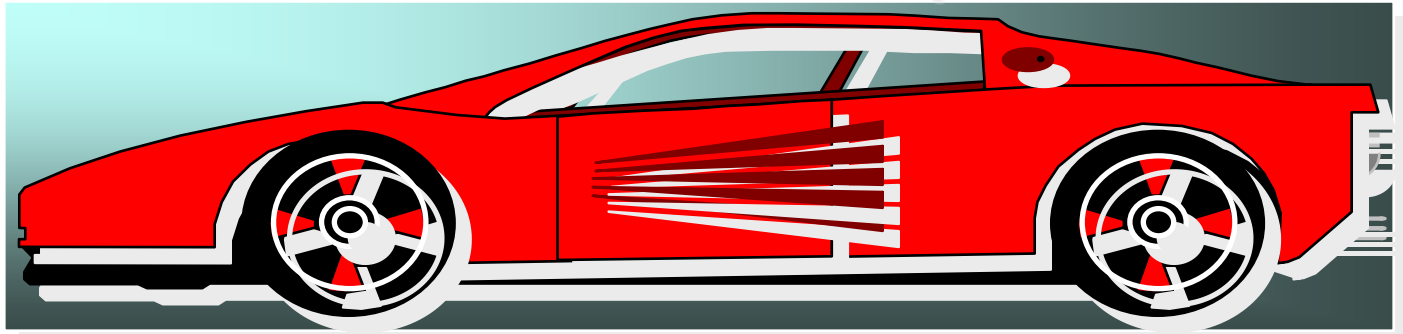


Life Sciences



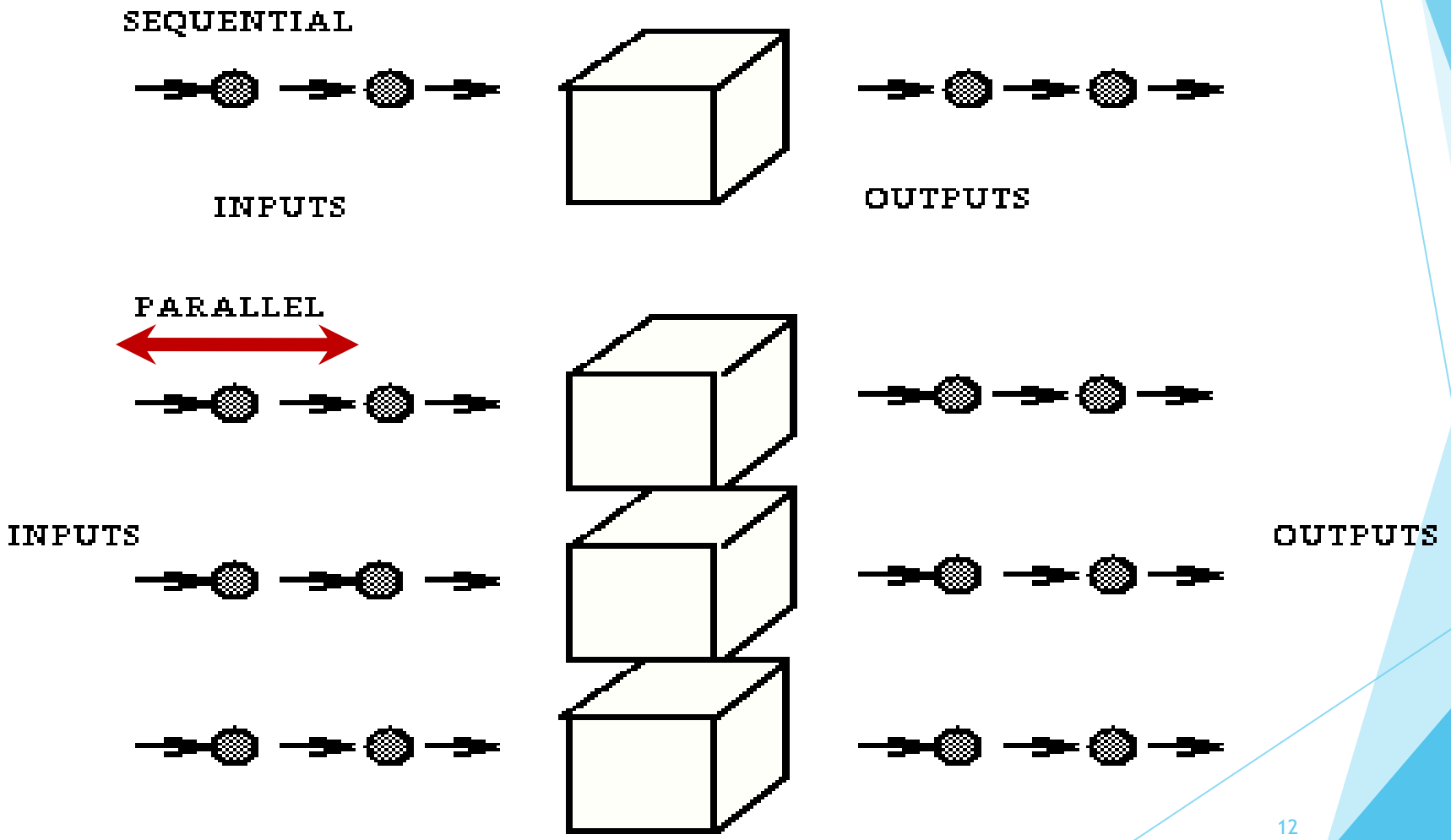
Aerospace

Geographic Information Systems



Mechanical Design & Analysis (CAD/CAM)

The Need For High Performance Computers



What is a Distributed System?

A distributed system is a collection of independent computers that appear to the users of the system as a single computer

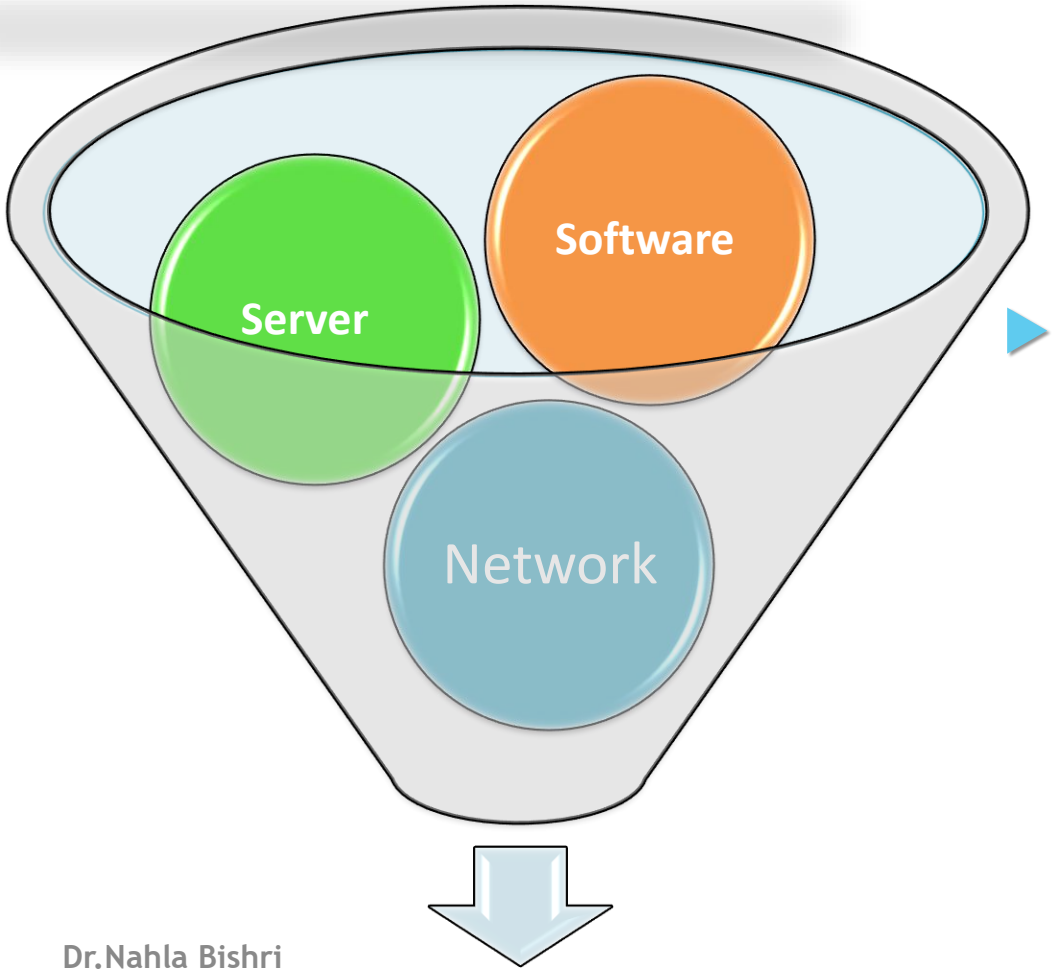
What is a Distributed System?

A collection of independent computers linked by a computer network that appears to its users as a single coherent system.

Parallel *system* is a collection of processing elements that communicate and cooperate to achieve a common goal.

Ideal Distributed system: to present a single-system image.

What is a Distributed System?



- Hardware is distributed
  - n processing elements (processor + memory), PE
  - Interconnected by some network
  - No shared memory
- Software is distributed
  - No centralized OS, each PE has its own OS
  - No physically centralized file system
  - Inter-process communication via message passing at the lowest level

What is a Distributed System?

- Two important considerations
  - Autonomous hardware
  - Unifying software

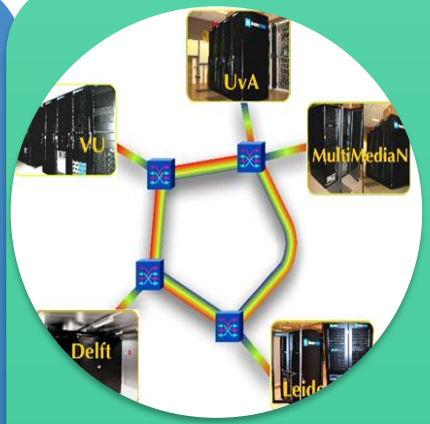
the users think of the system as a single computer

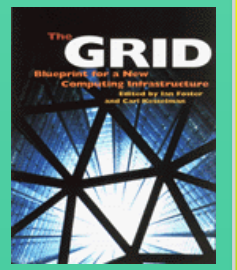
- Interfaces users can plausibly view as a single system
  - Masking machine boundaries in several ways

Distributed systems evolution

Distributed Systems: 1980s

- Networks of Workstations (NOWs)
- Collections of Workstations (COWs)
- Processor pools (Amoeba)
- Condor pools
- Clusters





Distributed Systems: 1990s

- Metacomputing (Smarr & Catlett)
- Flocking Condor (Epema)
- DAS (Distributed ASCI Supercomputer)
- Grid Blueprint (Foster & Kesselman)
- Desktop grids

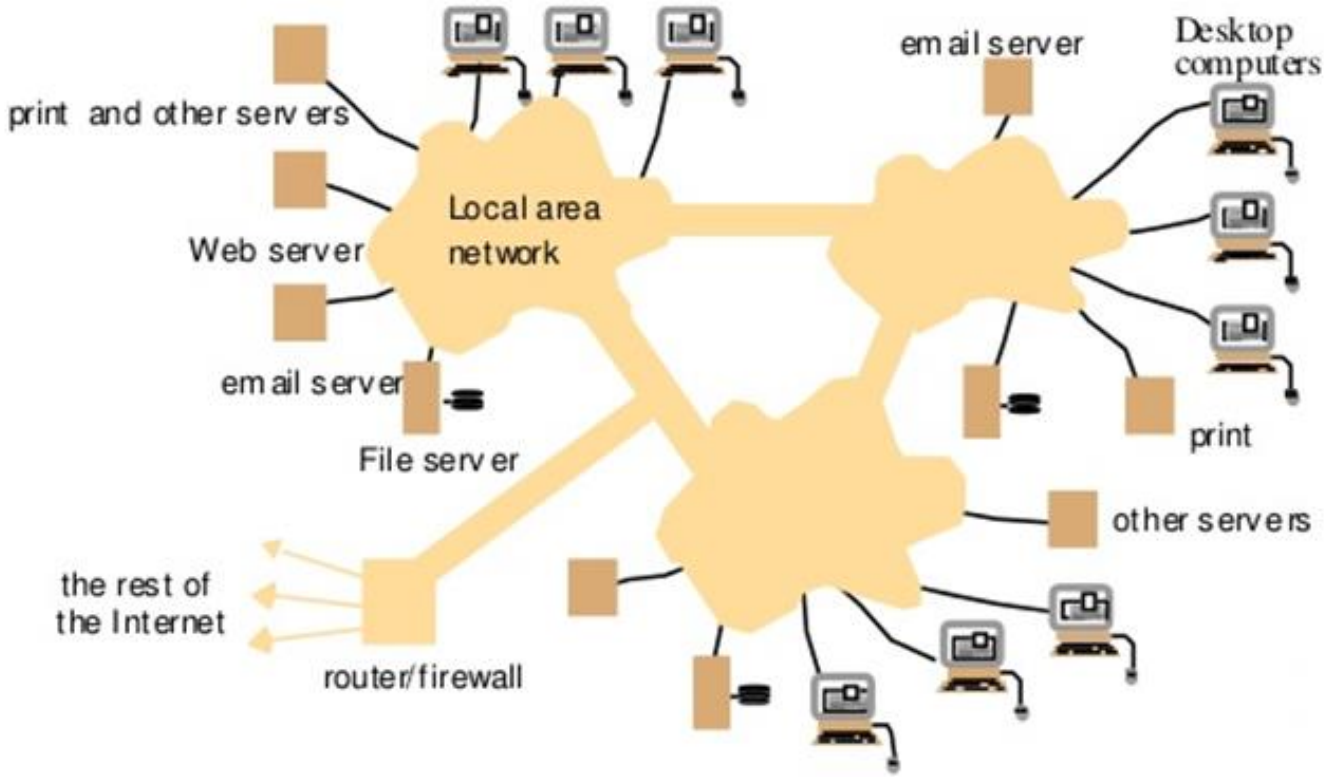
Distributed Systems: 2000s

- Cloud computing
  - Infrastructure as a service
  - Virtualization
- Mobile computing
  - Sensor networks
  - Smart phones
- The Networked World

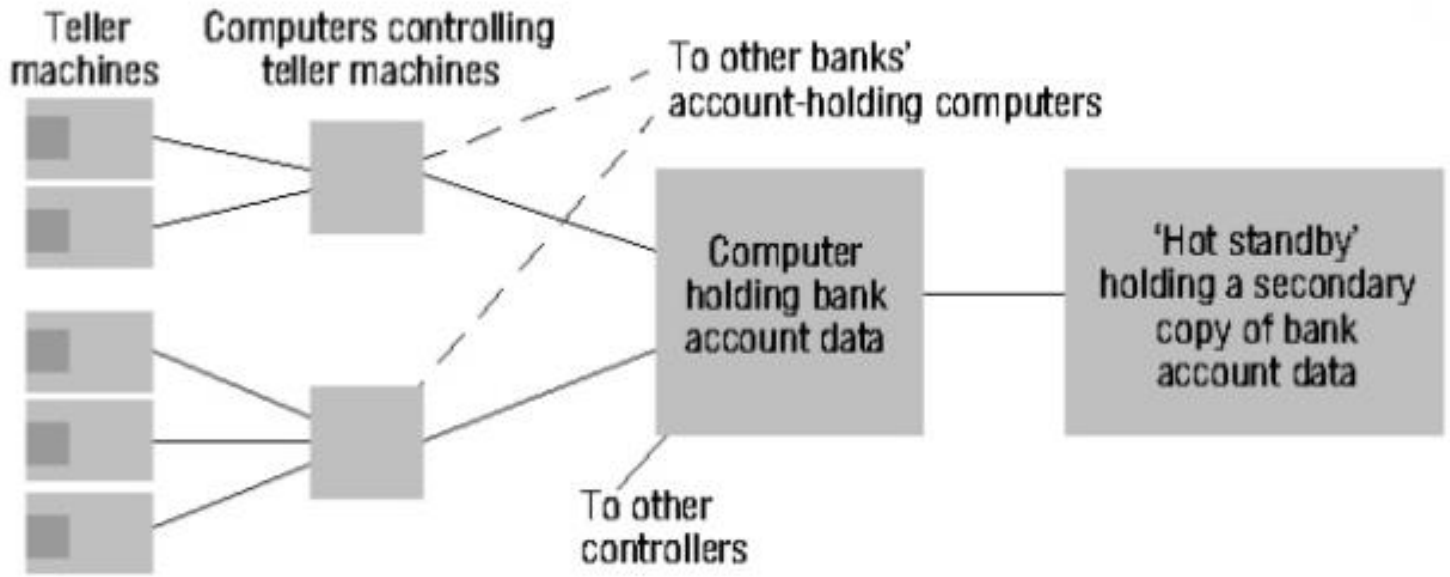
Examples of Distributed Systems

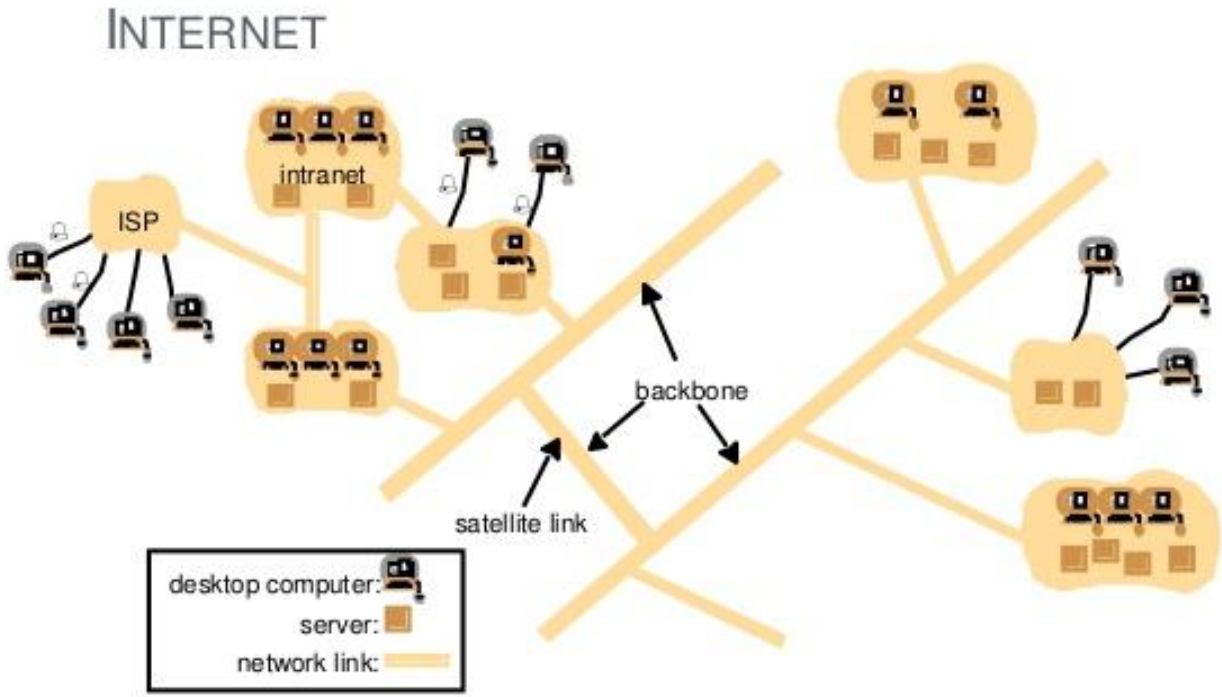
- Local Area Network and Intranet
- Database Management System
- Automatic Teller Machine Network
- Internet/World-Wide Web
- Mobile and Ubiquitous Computing

LOCAL AREA NETWORK



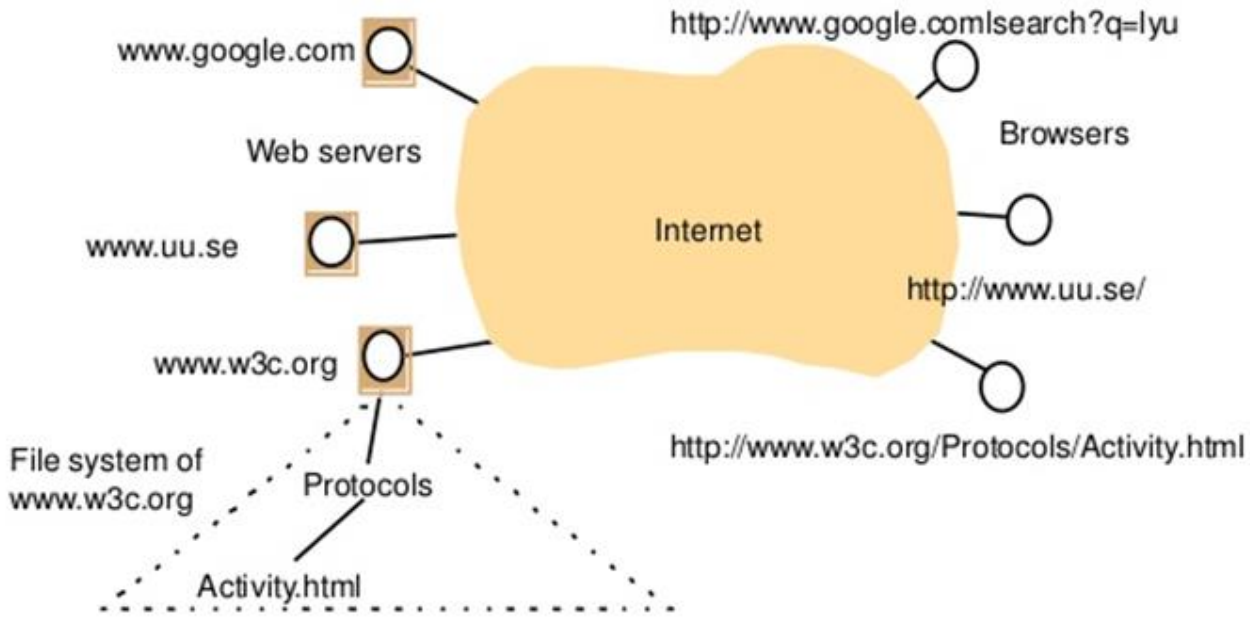
AUTOMATIC TELLER MACHINE NETWORK



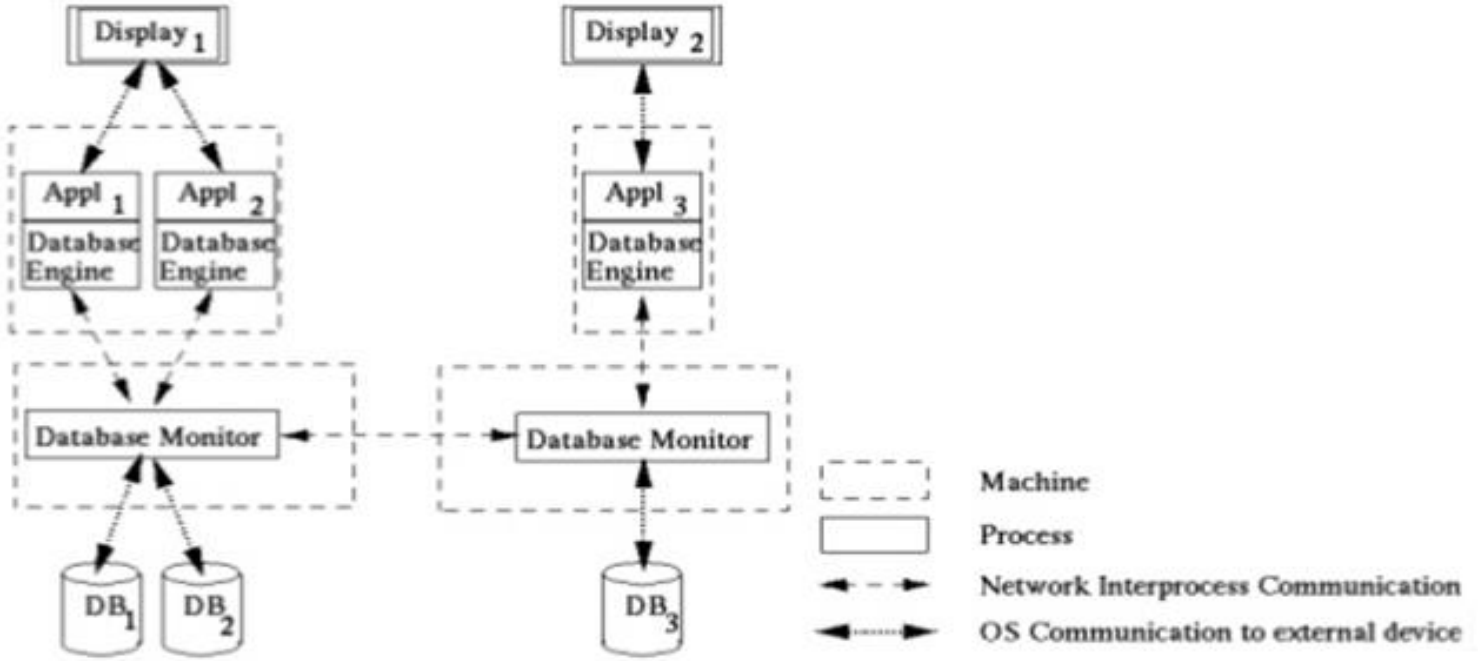

INTERNET
intranet
ISP
backbone
satellite link
desktop computer:
server:
network link:

WORLD-WIDE-WEB

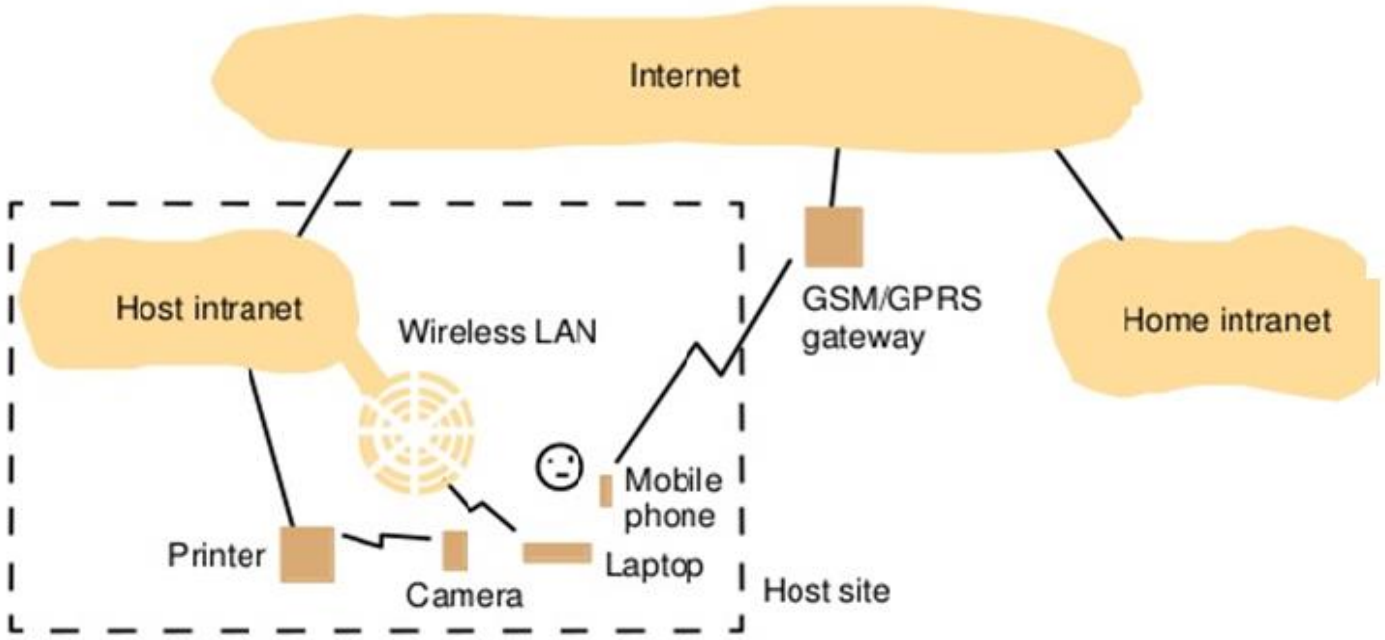
Web Servers and Web Browsers



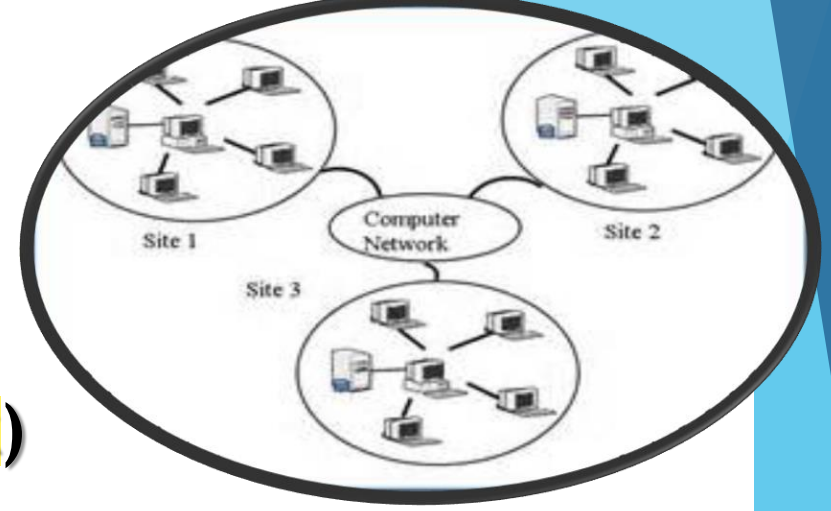
DATABASE MANAGEMENT SYSTEM



MOBILE AND UBIQUITOUS COMPUTING



Why Distributed System?



- Information exchange (collaborative work)
- Hardware Resource sharing (e.g. printer, backup storage, disk units, etc.)
- Software Resource sharing (applications, information)

Cont. Why Distributed System?

- **Cost reduction**
- **Increase of availability (partial failure)**
- **Increase of performance through parallelism, ... (Executing two or more instructions simultaneously)**

Thank you