Università di Roma "La Sapienza"
Dipartimento di Informatica e Sistemistica

www.dis.uniroma1.it/~midlab

Sistemi di Calcolo – Introduzione ai Sistemi Distribuiti

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Prof. Roberto Baldoni

Introduction

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A definition

- A distributed system is a set of spatially separate entities, each of these with a certain computational power that are able to communicate and to coordinate among themselves for reaching a common goal

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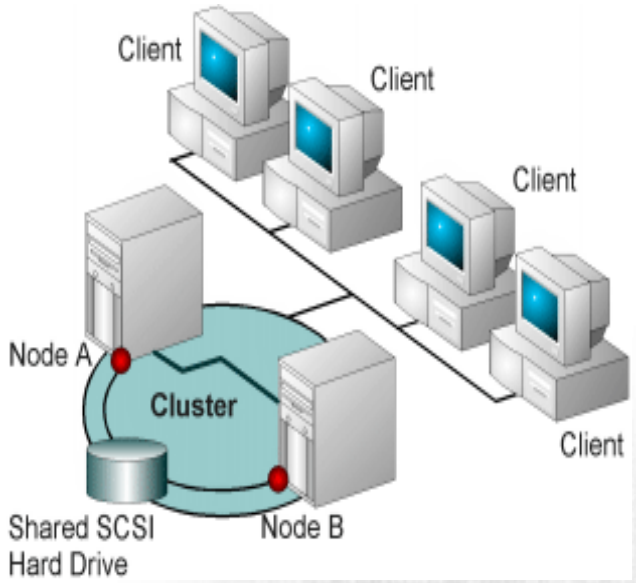
Primary Goal: sharing data/resources

Problems

- Synchronization
- Coordination



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Coordination has to be implemented taking into account the following condition that deviates from centralized systems:

1. Temporal and spatial concurrency
2. No global Clock
3. Failures
4. Unpredictable latencies

These limitations restrict the set of coordination problems we can be solve in a distributed setting

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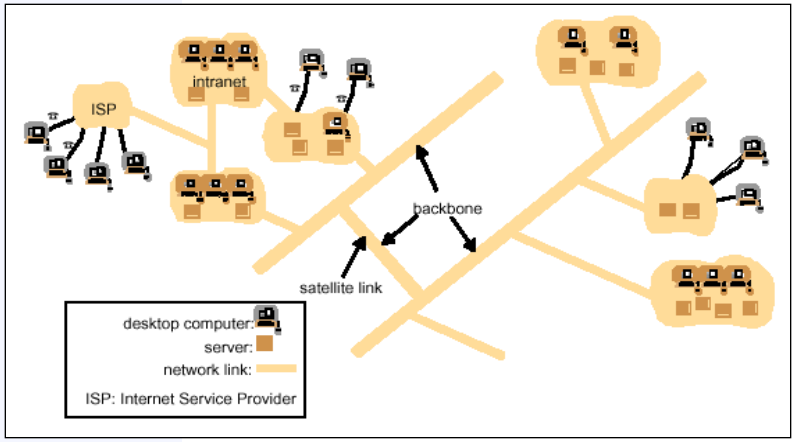
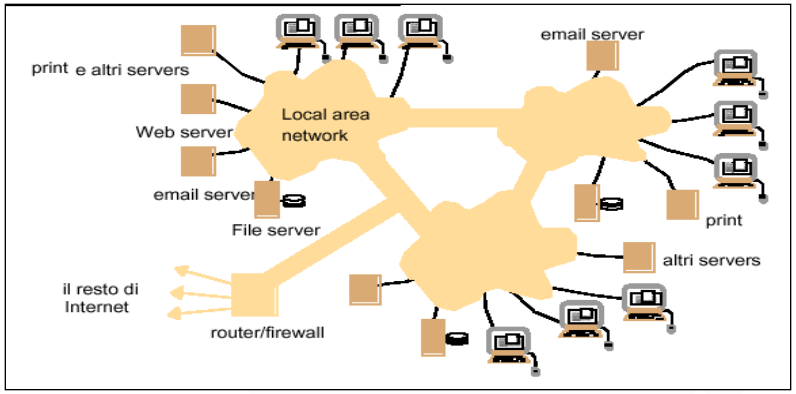
Distributed Systems Examples

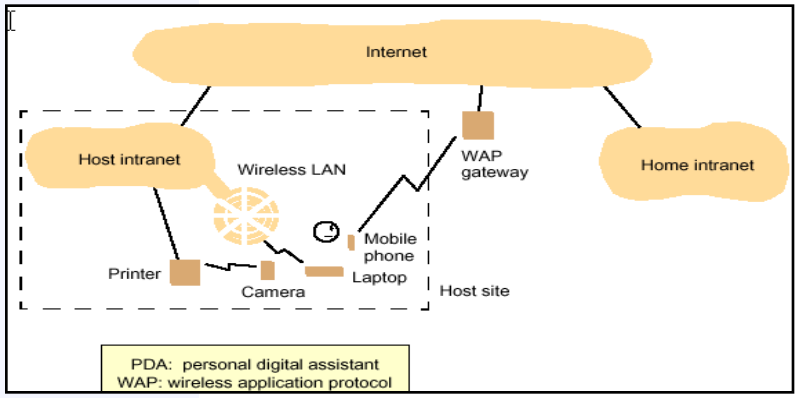
internet



intranet



sistema mobile



But also.....
Service Oriented Architectures
Overlay Networks
Grid
P2P
Pervasive Systems&Ubiquitous Computing
Cloud Computing
Big Data Computing

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From Client/Server Environments to large scale distributed systems

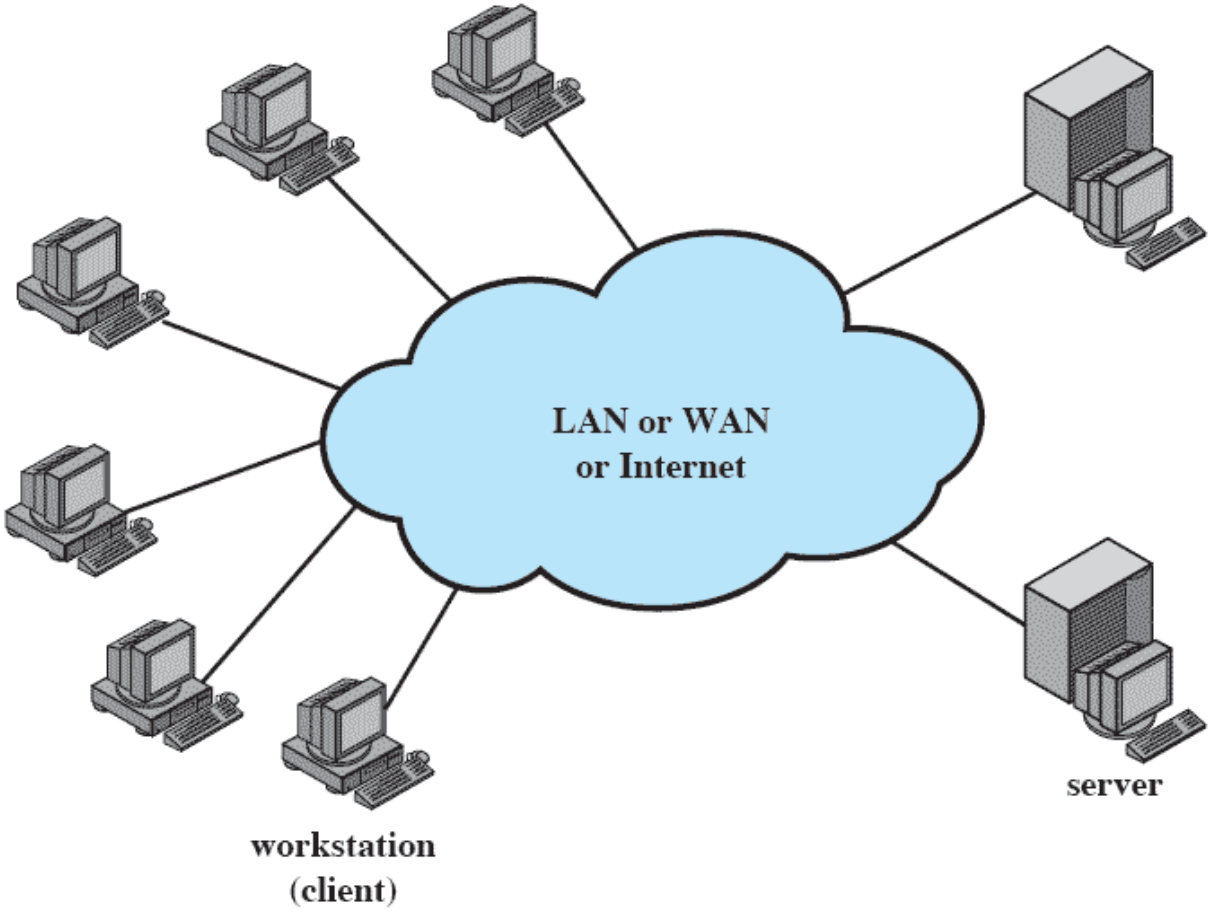

Figure 16.1 Generic Client/Server Environment

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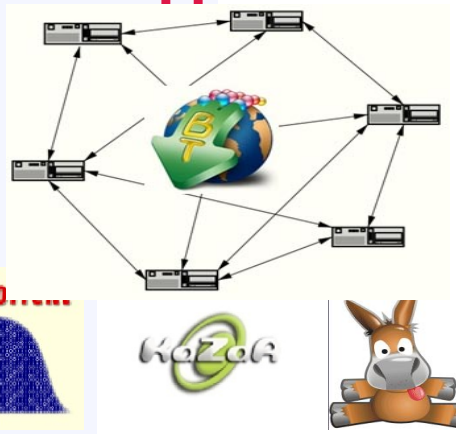
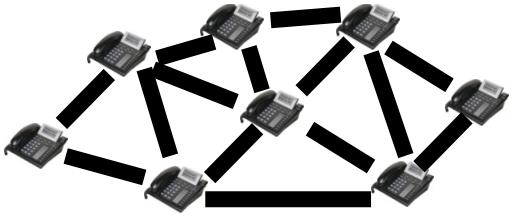
Internet-scale Applications

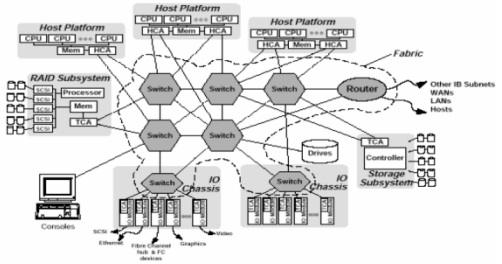


Scalable Consistency-based Applications



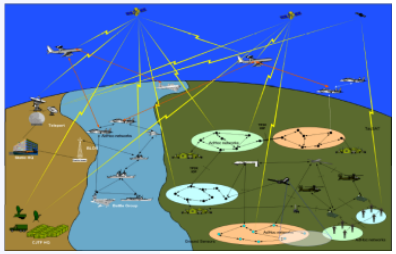
skype P2P SIP

Enterprise Data Centers



IBM Google

Scalable QoS based Applications



OMG OBJECT MANAGEMENT GROUP RTI

Cooperative Information Systems

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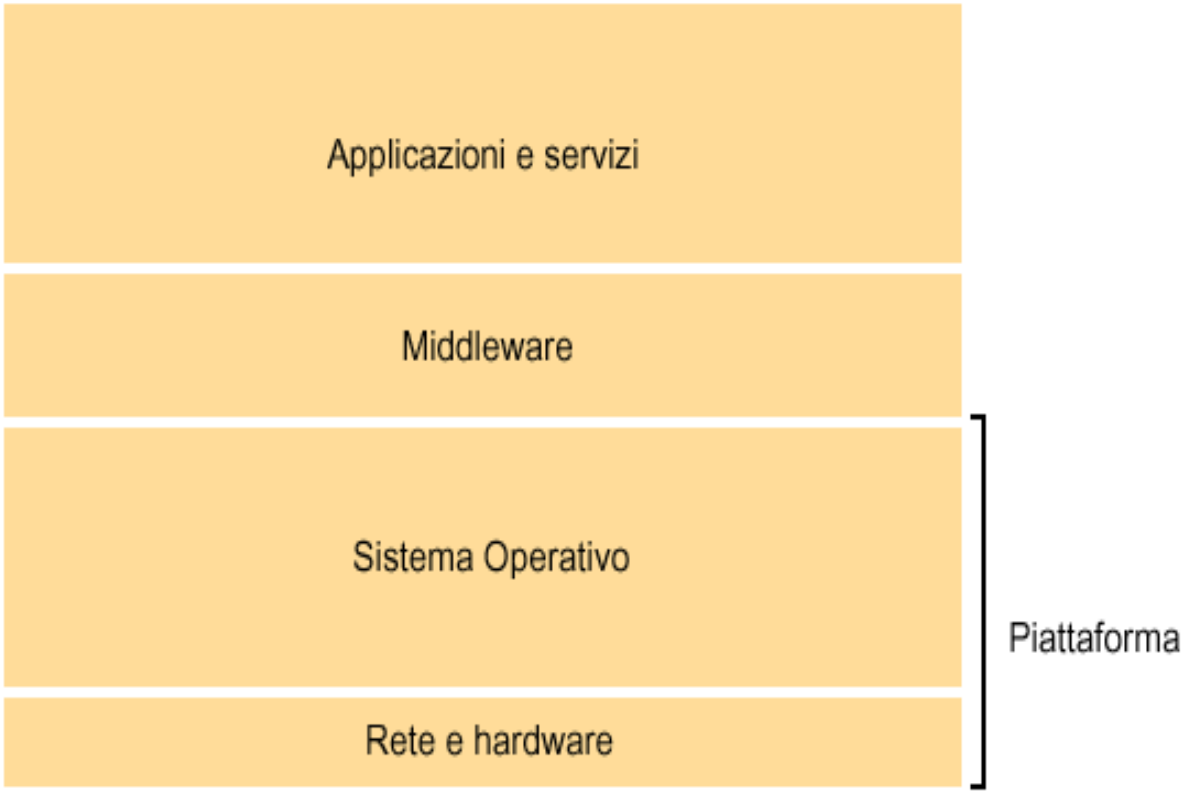
Layering hw and sw



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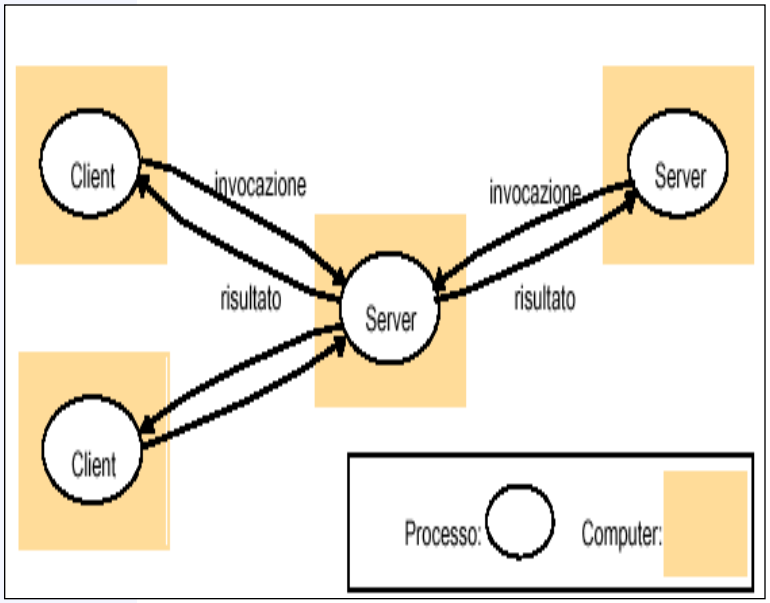
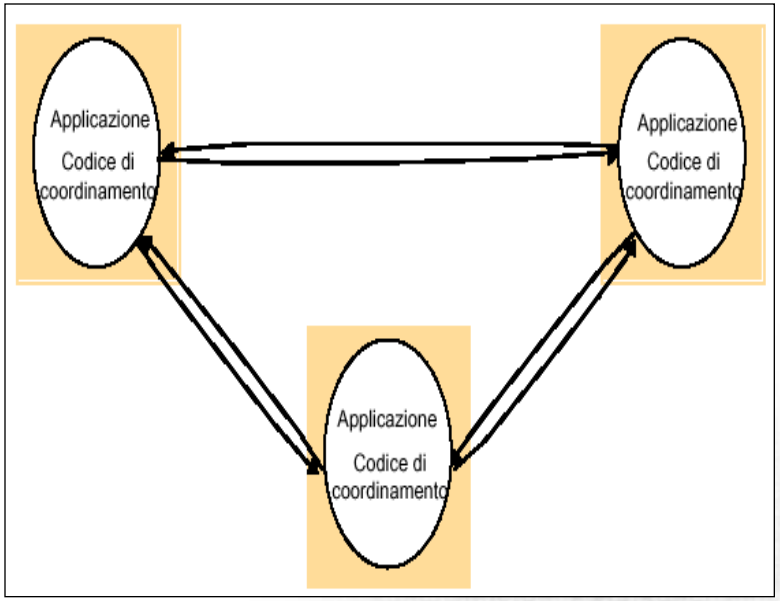
Interaction Models



client/server



peer-to-peer

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Middleware: problemi da affrontare

- **Heterogeneity**: OS, clock speeds, data representation, memory, architecture HW
- **Local Asynchrony**: **load on a noad, diffeent OW, Interrupts**
- **Lack of global knowledge:** knowledge propagates through messages whose messages whose propagation times will be much slower than time taken by the execution of an internal event
- **Network Asyncrony**: **propagation times of message can be unpredictable**.
- **Failures of nodes or network partitions**.
- **Lack of a global order of events**
- **Consistency vs Availability vs Network Partitions**

This limits the set of problems that can be solved through deterministic algorithms on some distributed systems