

Sistemi Distribuiti

seminario per il Corso di Dottorato

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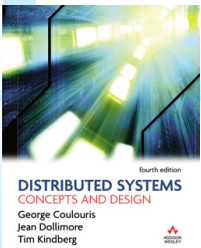


Struttura del Corso

- Sistemi Distribuiti: introduzione, proprietà, etc.
- Servizi WEB e Architetture n-tier
- Modelli e Architetture
- Middleware
- Chiamate Remote, RPC e RMI
- Esempio di Middleware: CORBA
- Sistemi Peer to Peer, P2P
- Sistemi GRID computing
- Sistemi Cooperativi, CSCW
- Sistemi Mobili, Mobile Computing
- .net, MPEG M3W remoting
- Modelli di Transazione, commercio elettronico
- MPEG-21

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





Distributed Systems

- Coulouris, Dollimore and Kindberg
Edition 3, Addison-Wesley 2005

- Computer Supported Cooperative Work, Introduction to Distributed Applications, U. M. Borghoff, J. H. Schlinchter, Springer
- A Methodology for Client/Server and WEB Application Development, Ro. Fournier, Yourdon Press.
- The GRID: Blue Print for a new Computing Structure, I. Foster, C. Kesselman, Morgan Kaufmann.
- Advanced CORBA, Programming C++, M. Henning, S. Vinoski, Addison Wesley.
- Client/Server Programming with Java and CORBA, R. Orfali, D. Harkey, Wiley.
- Applied Microsoft .NET Framework Programming, J. Richter, Microsoft .net press





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Sistemi Distribuiti

- Un Sistema distribuito è composto da componenti/strumenti SW messi in relazione tramite una rete di computer. Tali componenti comunicano fra di loro tramite messaggi
- Messaggi portano:
 - ♣ Controlli, oppure
 - ♣ Dati
- Esempi di sistemi distribuiti sono:
 - ♣ Internet, intranet, mobile and ubiquitous computing
- Vediamoli....in breve....ma prima ...





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Sistemi Distribuiti

- Problemi e tecnologie per la gestione di
 - ♣ Concorrenza, fra processi distribuiti
 - ♣ Sincronizzazione
 - Sincronizzazione temporale
 - mancanza di un clock comune
 - Precisione della Sincronizzazione ...
 - ♣ Fault (fallimenti) in sistemi distribuiti
 - Fallimenti Indipendenti/dipendenti, coincidenti/sparsi
 - Azioni di Recovering from failure
 - Architetture fault tolerance

- Sistemi tipicamente eterogenei
 - ♣ Ulteriore complicazione
 - ♣ Diversi per: Sistema operativo, interfaccia di comunicazione, potenza, CPU, etc.



 

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Sistemi Distribuiti

DEVICE	Laptop	PDA	Handset		
NETWORK	WLAN	GSM	GPRS	UMTS	
PROTOCOL	SMS	EMS	MMS	I-mode	WAP
LANGUAGE	WML	XML	HTML		
INTERACTION	Alert	Download	Near real time browsing	Real time browsing	
CONSULTATION MODE	Location based	Non-Location based			
SUPPORT	Text	Image	Video	Software	Audio
APPLICATION	Gaming	News	Financial info	Travel	Edutainment
INDUSTRY PROVIDER	Public inst.	Newspapers	...	Software devel.	

Source: Andersen



 

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Sistemi Distribuiti

Condivisione delle Risorse

- Condivisione di Stampanti, Printers
- Condivisione di files, NFS
- WEB pages..HTML... XML....XSL
- Cooperative Work on the same data
 - ♣ Cooperative Work, CSCW
 - ♣ Configuration Management and development tools, CVS
 - ♣ Applicazioni P2P
- Condivisione di servizi
 - ♣ WEB Services
 - ♣ Remote Procedure Calls, RPC, ...RMI
 - ♣ Distributed Objects
 - ♣ GRID computing, parallel distributed computing





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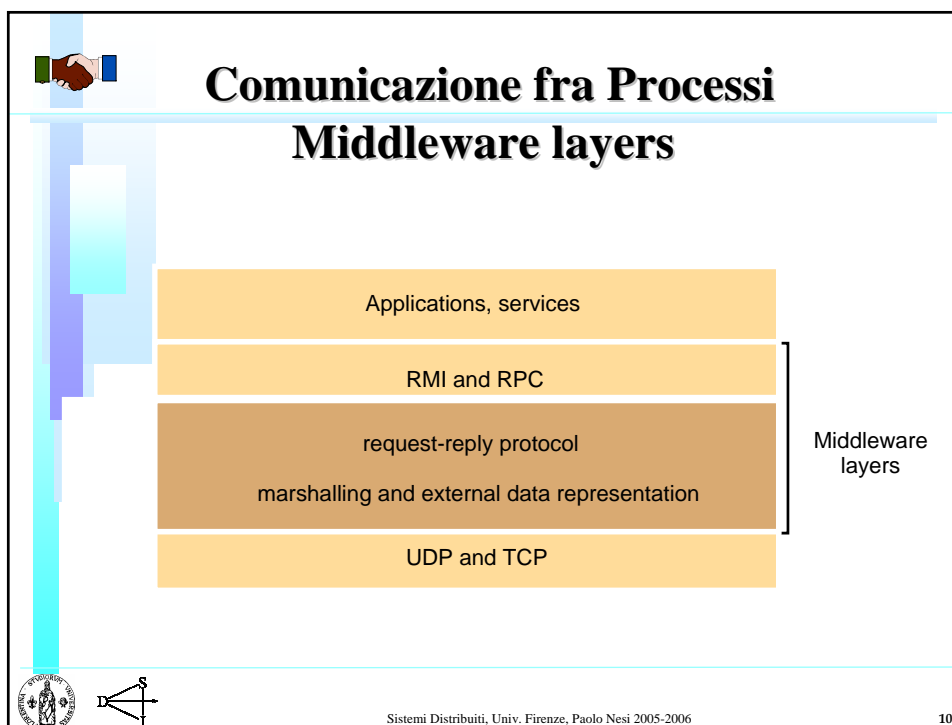
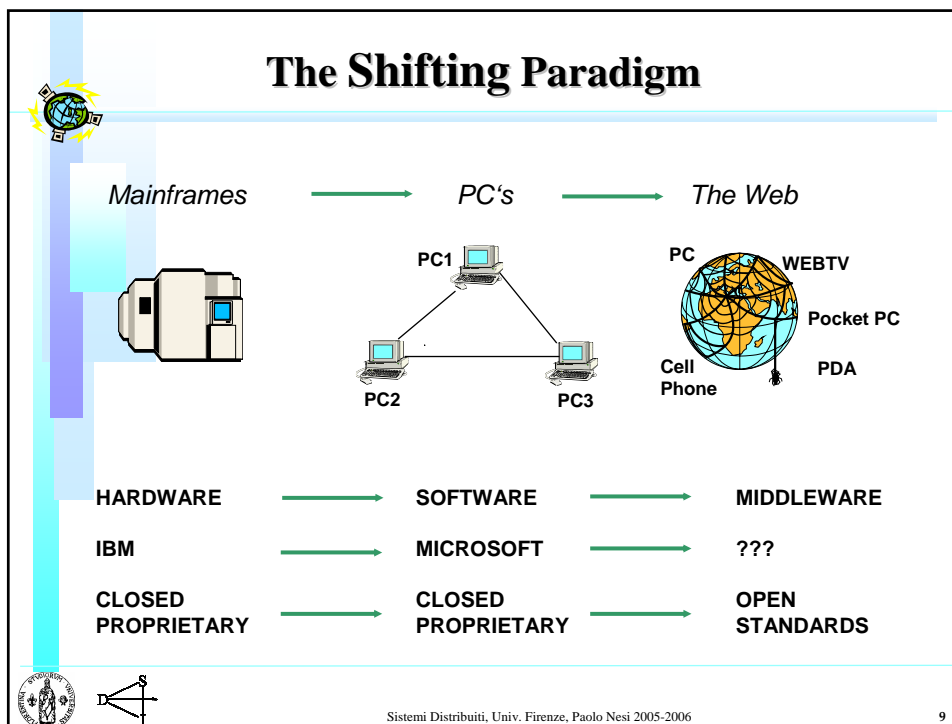
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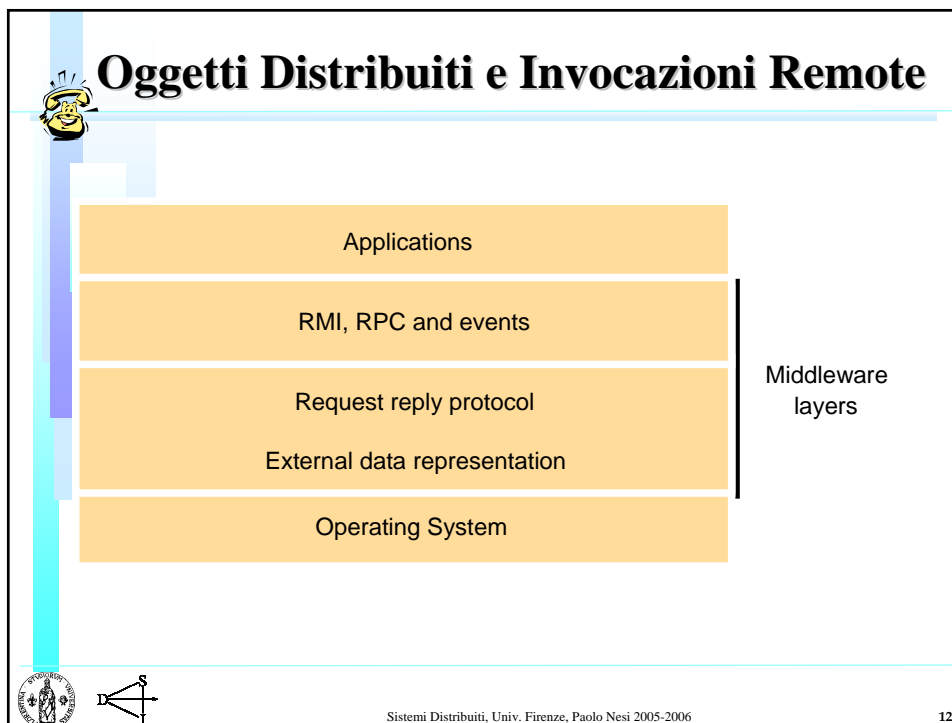
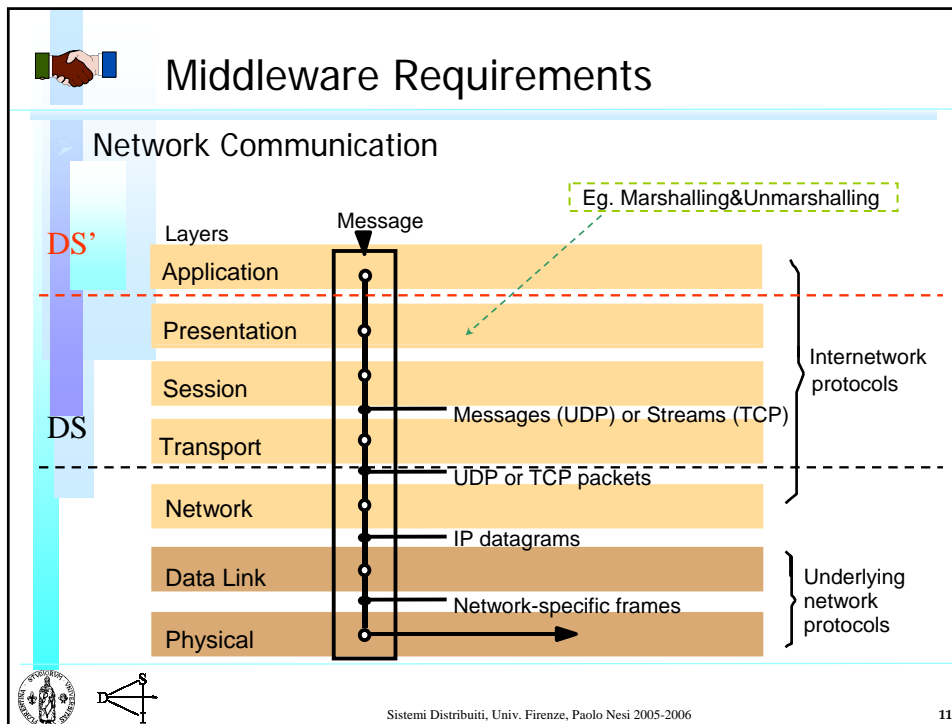
Sistemi Eterogenei

- Reti con diversi supporti e protocolli
- Computer con hardware diversi
- Sistemi operativi diversi con gli stessi protocolli
- Linguaggi di programmazione diversi per servizi e per la realizzazione di oggetti condivisi e chiamate remote
- Implementazione dei servizi con persone diverse
- Middleware to mask heterogeneity
 - ♣ CORBA, Java RMI, J2EE,
 - ♣ .NET, DCOM....
 - ♣ Accesso distribuito a SQL
- Sistemi Mobili
 - ♣ Mobile code, virtual machine, PDA, PocketPC, TabletPC...



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Remote and local method invocations

- each process contains objects, some of which can receive remote invocations, others only local invocations
- those that can receive remote invocations are called *remote objects*
- objects need to know the *remote object reference* of an object in another process in order to invoke its methods. *How do they get it?*
- the *remote interface* specifies which methods can be invoked remotely



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A remote object and its remote interface

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Descrizione delle Interfacce

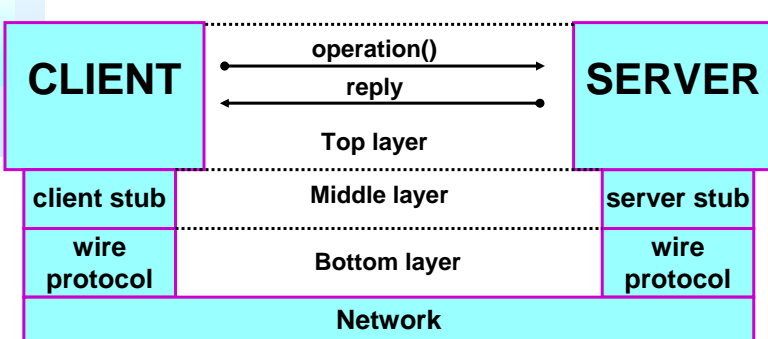
- RMI: Remote Method Invocation
- RCP: Remote Procedure Call
- L'interfaccia di comunicazione deve essere pubblica:
 - ♣ Nome dei metodi, tipo, ordine e numero di parametri della RPC/RMI, in-out parameter
- La descrizione dell'interfaccia puo' essere utile per la generazione automatica del contesto di Marshalling
- Esistono linguaggi per la descrizione delle interfacce, IDL, Interface Description Language
- Oggetti che presentano RMI vengono detti oggetti distribuiti

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
Remote Procedure Call



The diagram illustrates the Remote Procedure Call (RPC) architecture. It shows a **CLIENT** on the left and a **SERVER** on the right. The interaction is divided into three layers:

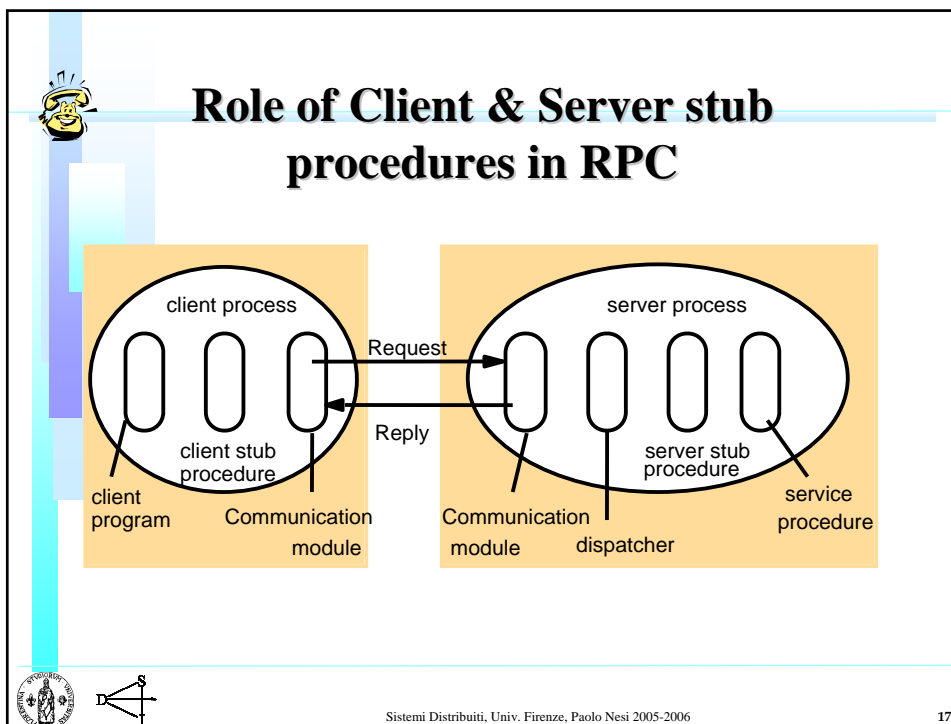
- Top layer:** The client sends an `operation()` message to the server, and the server returns a `reply` message to the client.
- Middle layer:** This layer contains the **client stub** on the client side and the **server stub** on the server side.
- Bottom layer:** This layer contains the **wire protocol** on both the client and server sides.

All these layers are connected to a **Network** at the bottom.

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CORBA IDL example

- Interface Definition Language
- Data hiding, utilizzato in OO
- L'interfaccia è il solo modo di accedere all'informazione
- Formalizzazione della chiamata con parametri di In/out
- L'interfaccia trova la sua implementazione nella classe

```
// In file Person.idl
struct Person {
    string name;
    string place;
    long year;
};



interface PersonList {
    readonly attribute string listname;
    void addPerson(in Person p);
    void getPerson(in string name, out Person p);
    long getyear();
};
```

- Parametri per valore nelle due direzioni
- puntatori non hanno senso, i processi sono diversi, la memoria è diversa
- Reference: in alcuni casi esistono reference assoluti del sistema distribuito che si possono usare come OBJECT-ID

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Object Model

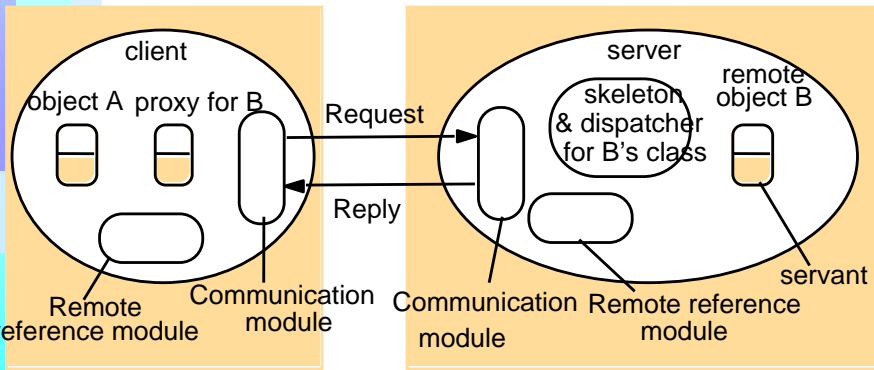
- Object References
 - ♣ Java and C++, possono essere passati
- Interfaces
 - ♣ Insieme di metodi con la loro signature (tipo e ordine dei parametri incluso quello di ritorno)
 - ♣ una classe puo' implementare diverse interfacce
 - ♣ L'interfaccia è considerata anche un tipo
- Actions
 - ♣ Per cambiare lo stato
 - ♣ Per attivare altre azioni, chiamare altri metodi
- Exceptions
 - ♣ Throw-catches
- Garbage Collection
 - ♣ Singolo o distribuito






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The role of proxy and skeleton in remote method invocation



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History of Distributed Object Models

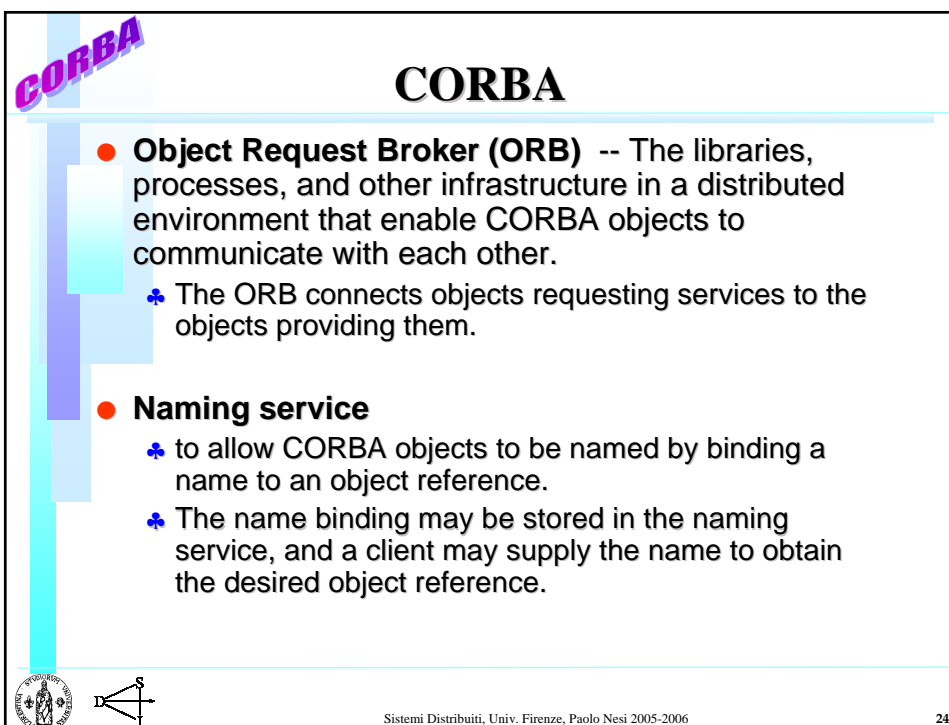
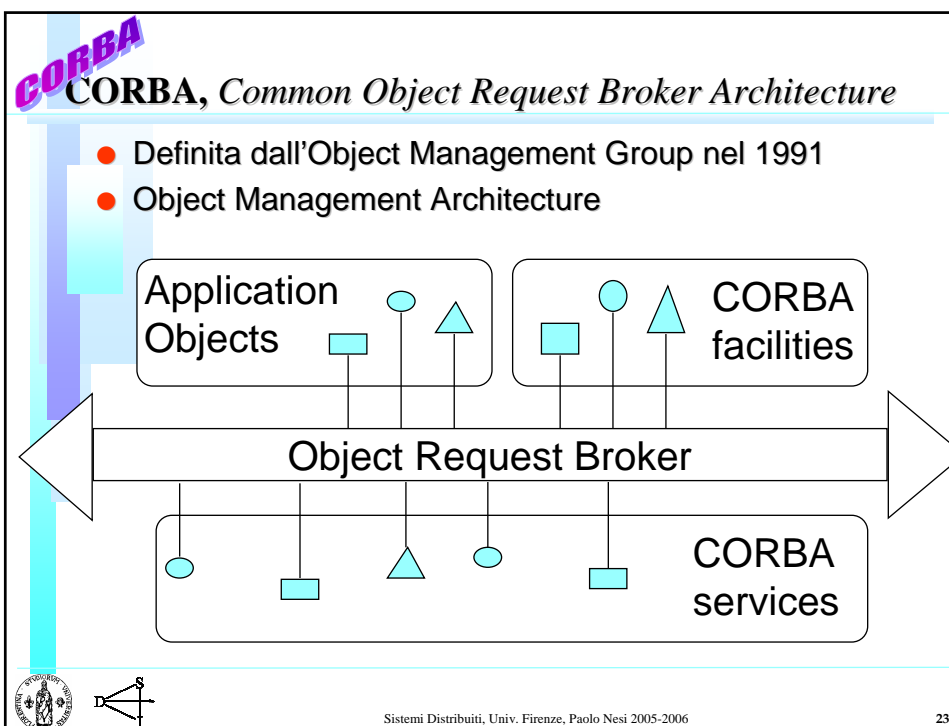
- **Communication Protocol Models:**
 - ♣ Message passing/queuing (DCE, Distrib. Comp. Environment),
 - ♣ Request/response, (RPC, Remote Procedure Code)
 - ♣ Virtual processes: PVM (Parallel Virtual Machine), etc.
- 1980 model based on network layer (NFS, DCE, RPC)
- 1990 object-oriented RPC, to link objects
- 1993 COM (Comp. Object Model), (from OLE, Active X)
- 1996 Java
- 1997 Mary Kirtland's articles in Microsoft System Journal first sketch (COM+)
- 1997 Sun vs Microsoft over Java licensing
- 1999 Java 1.2
- 2000 Microsoft announces .net, C#

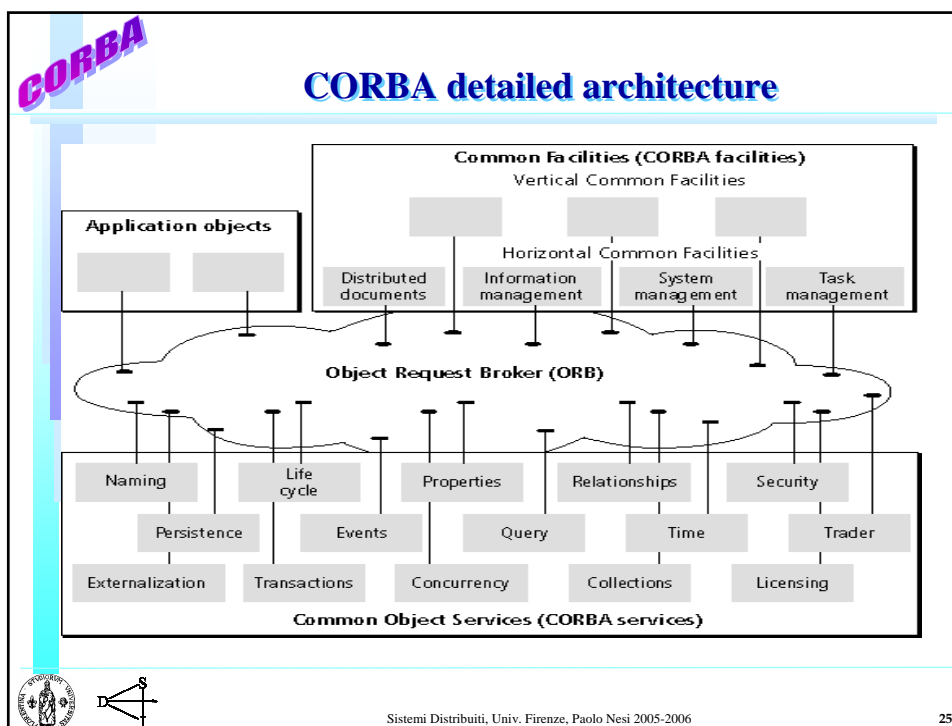


Common Object Request Broker Architecture

- **OMG's** (Object Management Group) specification for interoperability between distributed computing nodes (1989)
- **ORB:** middleware that establishes requestor-provider relationship
- **Goal:**
 - ♣ Usage of OO programming in Distrib. Sys.
 - ♣ Allow heterogeneous environments communicating at object level,
 - ♣ regardless of implementation of endpoints
 - ➔ Different languages in the applications
 - ➔ Different implementations of the same ORB
- CORBA 1 (1990), CORBA 2 (1996)







-
- CORBA**
- ## 4 Componenti di CORBA
- **ORB, Object Request Broker**
 - ♣ Applicazione distribuita
 - ♣ rende trasparente la locazione fisica degli oggetti, naming
 - ♣ unmarshal-marshal, e invocazione dei metodi
 - **CORBA Services**
 - ♣ Security, time, etc..
 - ♣ persitency, events, transactions, etc..
 - **CORBA Facilities**
 - ♣ Servizi di base condivisi da molte applicazioni
 - ♣ Non vitali come i CORBA Services, OS esteso....
 - ♣ E.g.: amministrazione sistema, mail, etc.
 - **Application Objects**
 - ♣ Objects basati su CORBA
- Logos: University of Florence and a compass rose.
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CORBA

The main components of the CORBA architecture

- The CORBA architecture is designed to allow clients to invoke methods in CORBA objects
 - ♣ clients and objects can be implemented in a variety of programming languages
 - ♣ it has the following additional components compared
 - object adapter, implementation repository and interface repository

client: client program, proxy for A, ORB core
 implementation repository, interface repository
 server: ORB core, object adapter, skeleton, Servant A
 Request, Reply
 or dynamic invocation, or dynamic skeleton

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CORBA

CORBA Characteristics

- Object-Oriented Programming
- Support multiple languages
 - ♣ Official: JAVA, C, C++, Smalltalk, COBOL
 - ♣ Also: eiffel, modula, perl, TCL, Python, etc.

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Interface Definition Language

- Language neutral specification

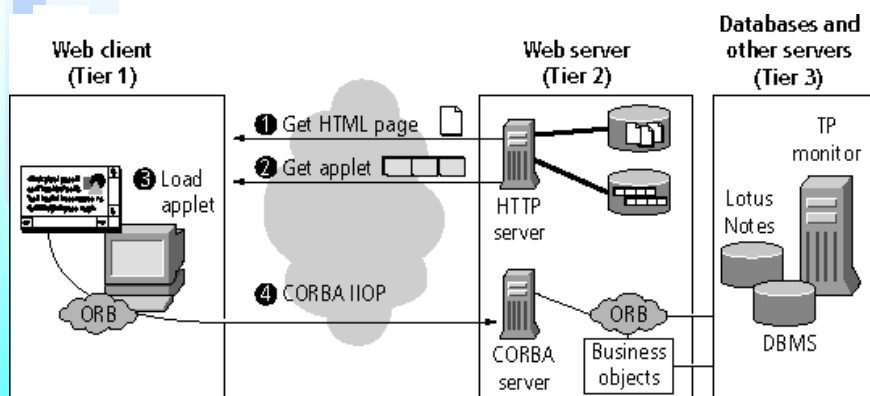
```
interface Polynomial : MathObject {
    sequence<Monomial> monomials;
    int rank;
    Polynomial add(in Polynomial p);
};
```

- Mappings to several languages
- Tools (compilers) generate stubs and skeletons in various languages

Note. No way to know at run-time which interfaces an objects provides: IDL is compiled away

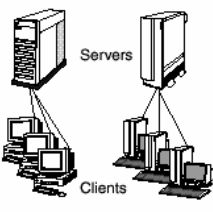


CORBA and the invocation of HTML pages

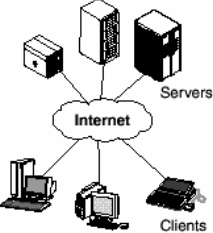


Peer-To-Peer Computing

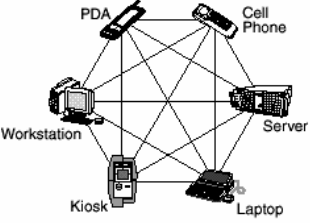
A network-based computing model for applications where computers *share resources* via *direct exchanges* between the participating computers



a. Client-server stacks with limited interoperability and homogeneous client and server systems





b. Web-based computing supports heterogeneous clients and servers



c. Peer-to-peer computing enables direct communication between peers and new interaction styles

Source: Sun Microsystems, Project JXTA, 2001



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Application areas


- **Content and resource sharing**
 - ♣ Network-wide file/document sharing (e.g. Mangosoft, napster, eDonkey, Gnutella, Freenet)
 - ♣ Distributed databases: Mariposa
 - ♣ knowledge management (e.g. NextPage)
 - ♣ Resource sharing: seti@home, Popular power, mojo natio
 - ♣ Cascaded content distribution
 - ♣ Edge services
 - ♣ P2P search and discovery (e.g. www.fedstats.gov)
 - ♣ Network bandwidth sharing

- **Distributed computation (GRID)**
 - ♣ Internet-based (e.g. United devices, entropia)
 - ♣ Intranet-based (www.datasynapse.com, NetBatch of Intel)
 - ♣ Web testing (e.g., United devices)
 - ♣ Esempio: gridella, etc....



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Application areas

- **Interactive collaborations → CSCW (Computer Support Cooperative Work)**
 - ♣ On-demand, multi-institutional virtual organizations
 - ♣ Marketplace (e.g. www.firstpeer.com)
 - ♣ Peer communities of common interests
 - ♣ Online development projects (e.g. www.oculustech.com)
 - ♣ Online games
 - ♣ Virus detection and protection
 - ♣ Remote maintenance
 - ♣ Examples: Groovem Buzpad, WuWu
 - ♣ E-commerce: ebay, B2B market, etc.





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P2P Main requirements



- **Creation of the P2P community**
 - ♣ Resource discovery
- **Managing updates in the information shared**
- **Interoperability**
- **Scalability of the P2P solution**
- **Performance**
- **Assessment**
- **Security and Trust of users**
- **Security and Trust of Content**
- **Security and Trust of Peer applications**
- **Robustness, Fault tolerance**



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Concentrated Architetture P2P

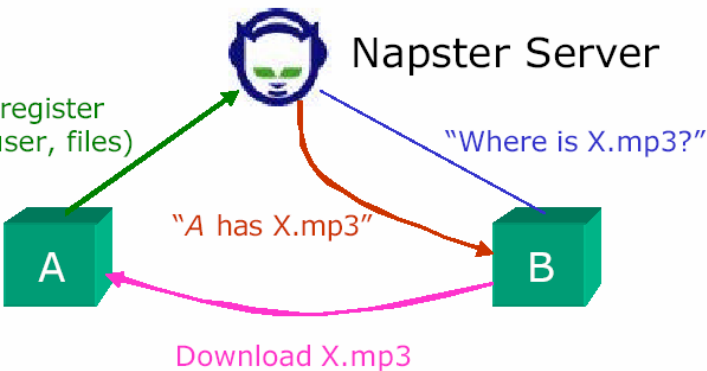
- **Concentrated, centralized**
 - ♣ One server and N peers, in some cases, more servers
 - ♣ Example: Napster (central index)
- **Also called “Server-based”**
 - ♣ Log, registrazione peer, etc.
 - ♣ Boot: performed asking to the server
 - ♣ Search: performed asking to the server
 - ♣ Collezione dei dati o/e degli indici, query, etc.
 - tabella per sapere dove sono i file anche i loro duplicati:
obj45: n3, n4, n56, n78
 - ♣ Server problem: fault, size, performance, cost, etc.
- **Gli scambi dei file/risorse possono essere:**
 - ♣ Centralised or P2P

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
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Napster: search files




The diagram illustrates the search process in a centralized P2P system like Napster. It features a central **Napster Server** (represented by a green face icon) and two peers, **A** and **B** (represented by green cubes). The process is as follows:

- Peer **A** sends a **register (user, files)** message to the Napster Server.
- Peer **B** sends a query **"Where is X.mp3?"** to the Napster Server.
- The Napster Server responds to Peer **B** with the information **"A has X.mp3"**.
- Peer **B** then performs a **Download X.mp3** from Peer **A**.



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Distributed P2P Architettura

- **Distribuite, decentralizzate**
- **Also called Pure P2P networks**
 - ♣ N peers all identical
 - ♣ Example: Gnutella (gnutella hosts), freenet
 - ♣ Boot: massive discovery, highly complex
 - ♣ Search: fully distributed !, high complexity
 - ♣ No problems of fault
 - Redundance of information
 - ♣ Problems:
 - performance on search and discovery (distributed), etc.
 - No Administration, no Certification





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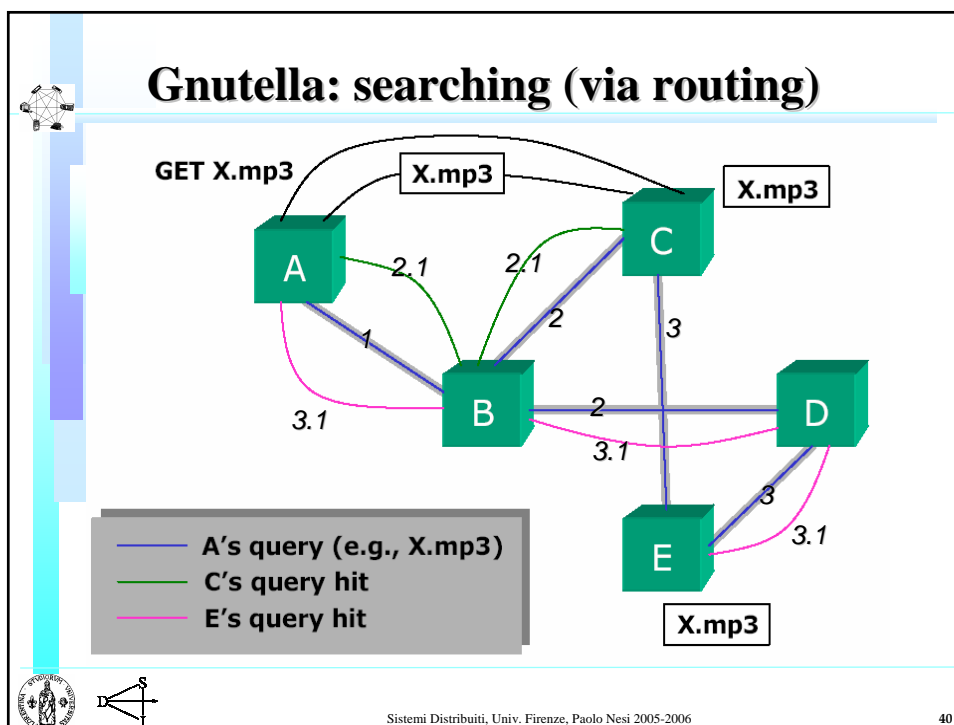
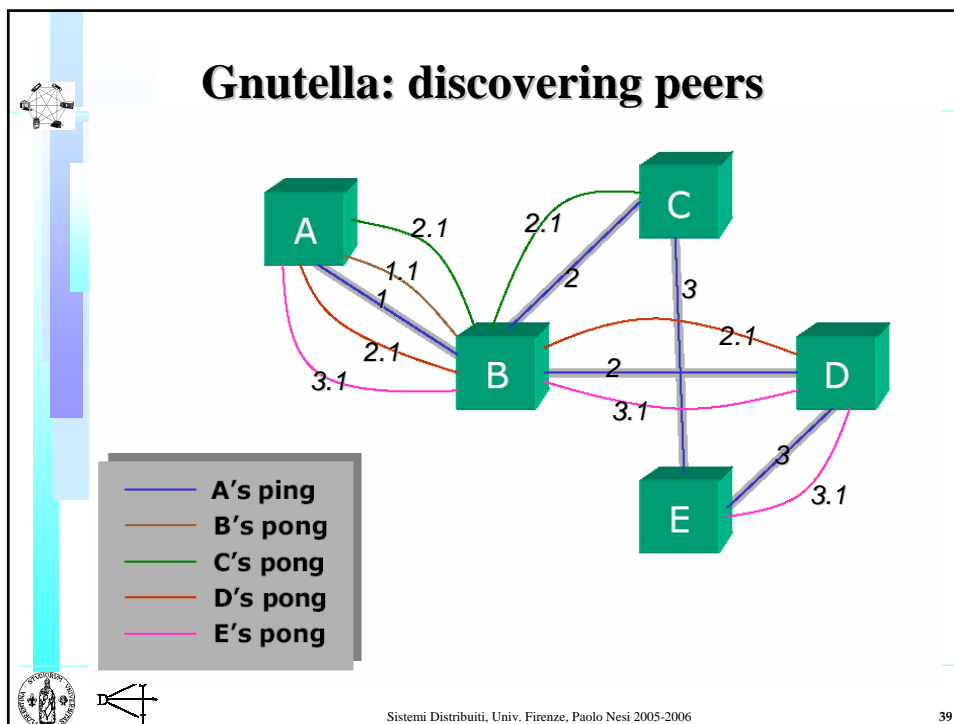
Hybrid P2P Architettura

- **Hierarchical, hybrid**
 - ♣ Mix of centralized and decentralized
 - ♣ N peers not all identical (at least in the role)
 - some with the role of local concentrator that can be activated when needed, the so called "super peers"
 - Some with the role for facilitating the starting/booting of the peer network, recovering the list of closer peers
 - ♣ Example:
 - Fast Track
 - Emule: with the servers for boot
 - ♣ In most cases, the superpeers create a sort of a restricted community around which the content is shared and are marginally connected with others communities
 - In some cases, the link can be established



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P2P layers

	P2P User Interaction	P2P application	P2P information management
e-Bay	Y	N	N
Napster	Y	Y	N
Gnutella, freenet	Y	Y	Y

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
Download Multisorgente

- File diviso in Parti di dimensioni ragionevoli per la rete, qualche Kbyte o decina di Kbyte:
 - ♣ F1: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10
- Nodi hanno delle parti nella loro memoria cache:
 - ♣ N1: 1, 3, 5, 7, 8
 - ♣ N2: 2, 4, 5, 7, 8, 10
 - ♣ N3: 5, 6, 2, 9
 - ♣ Etc..
- Alcuni nodi possono anche averle tutte, cioè il file completo
- Un nodo può scaricare parti diverse da nodi diversi anche allo stesso tempo sfruttando in questo modo un parallelismo
 - ♣ P.es.: N3 può scaricare 4 e 10 da N2, ed 3, 1, 8 da N1

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Download Multisorgente

- **Politiche per scaricare le parti/file dai nodi:**
 - ♣ Il Nodo permette lo scarico in base ad una coda di richieste
 - Il nodo che chiede viene messo in coda, quando quelli prima hanno avuto almeno una parte vengono messi in fondo alla coda
 - Il nodo puo' salire nella coda se ha da dare delle parti anche lui all'altro nodo, per esempio
 - ♣ Il Nodo ha una limitazione
 - sul numero di scaricamenti contemporanei
 - sulla banda sfruttata in uscita e/o ingresso
 - ♣ Un Nodo puo' acquisire un credito (uno score/voto) in base al suo comportamento nel lasciare scaricare file o nel permettere in uscita una banda larga.
 - In base a questo credito potrebbe/dovrebbe avere delle facilitazioni/score in caso di richieste, per scalare delle posizioni nelle code, etc.






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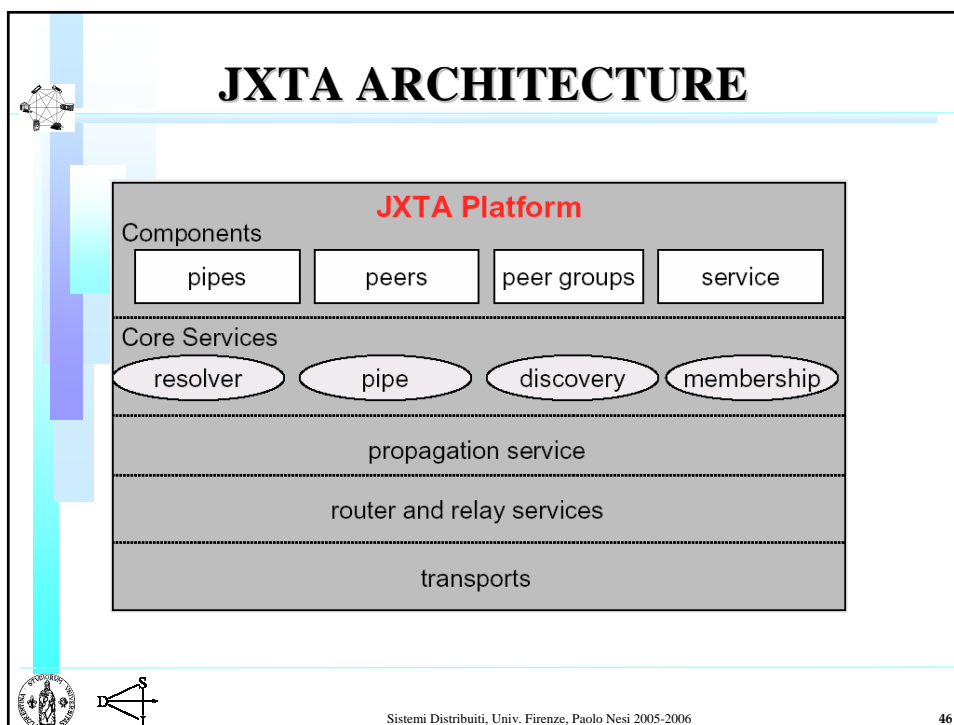
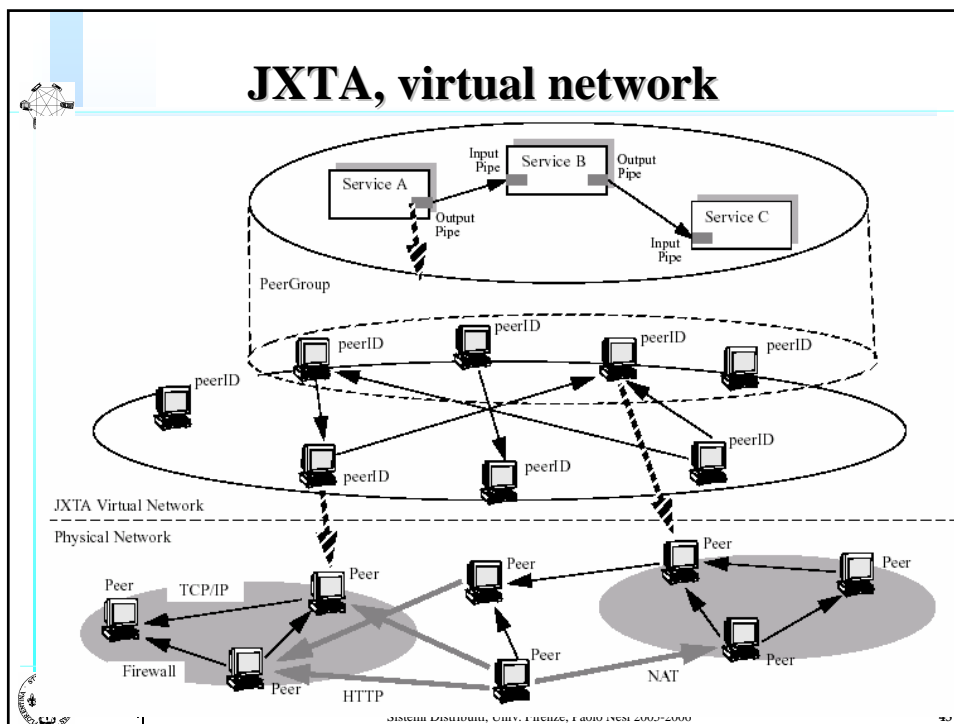
Confronto di Struttura di rete

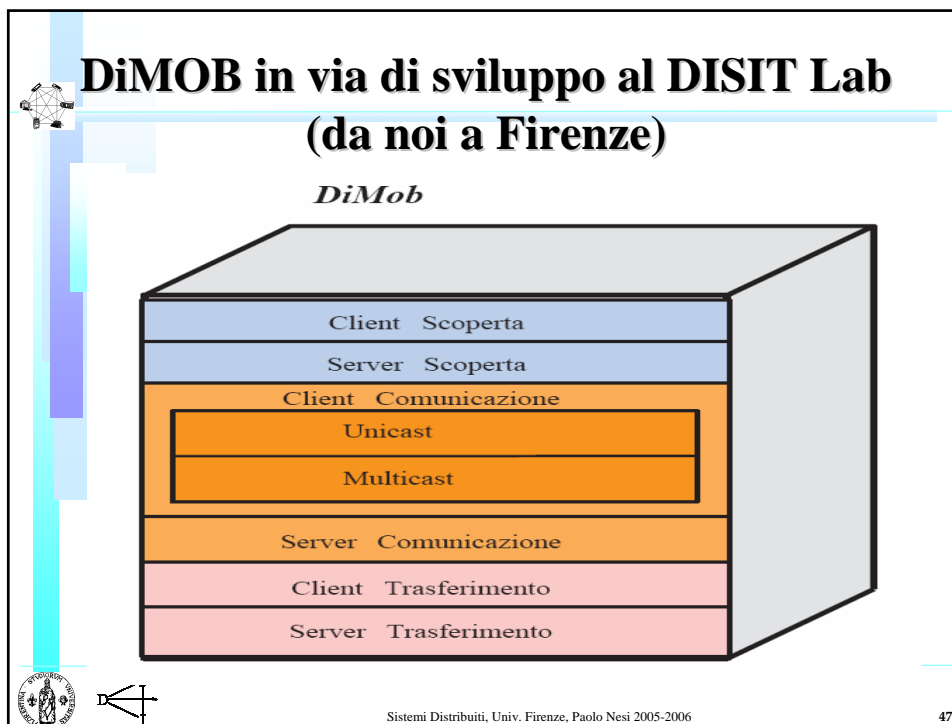
	Hybrid Centralized	Partially Centralized	No Centralized
Unstructured	Napster, Publius	Kazaa, Morpheus, Gnutella, Edutella	Gnutella, Freehaven
Structured Infrastructure			chord, CAN, Tapestry, Pastry
Structured System			Ocean Store Mnemosyne, Scan, PAST, Kademlia, Tarzan

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- ## DiMOB, features
- Scoperta dei nodi:
 - ♣ Discovering fra sistemi mobili e non
 - ♣ Rendere disponibile il peer agli altri
 - Comunicazione di Messaggi:
 - ♣ Inviare un messaggio ad un particolare peer (unicast)
 - ♣ Inviare un messaggio a tutti (multicast)
 - ♣ Ricevere messaggi dagli altri peer
 - Trasferimento File:
 - ♣ Inviare/ricevere un file ad/da uno specifico peer
 - Generali
 - ♣ Parallelismo: Effettuare piu' cose di queste in parallelo
 - ♣ Interoperabile: PC e PDA
 - ♣ Efficiente in termini di risorse consumate
- Sistemi Distribuiti, Univ. Firenze, Paolo Nesi 2005-2006 48

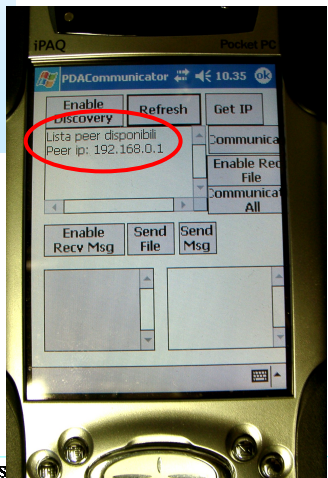
Caratteristiche di DIMOB

- Scritto in C++
- Portabile su:
 - ♣ Windows, Linux e PDA (pocket PC 2003)
 - ♣ TCP/IP
 - ♣ Comunicazioni: connessione di rete, Bluetooth, WiFi
- Basso Footprint
 - ♣ Adatto per sistemi mobili
- Esiste uno strato non completo per CSCW
- Applicazioni "private":
 - ♣ Music Editing cooperativo
 - ♣ File sharing
 - ♣ Chat
 - ♣ Editing cooperativo di grafici
 - ♣ Editing cooperativo di stringhe

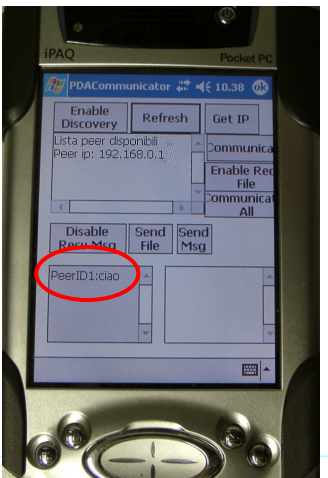
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Applicazione di test per DiMob su PDA (1)

Lista dei peer presenti



Messaggio ricevuto da PeerID1

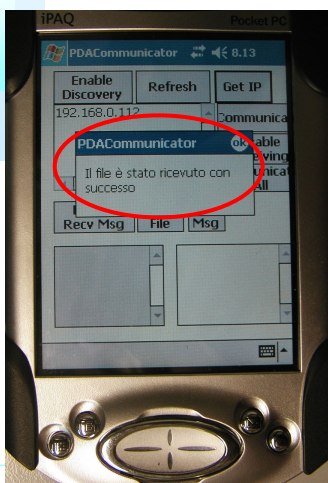


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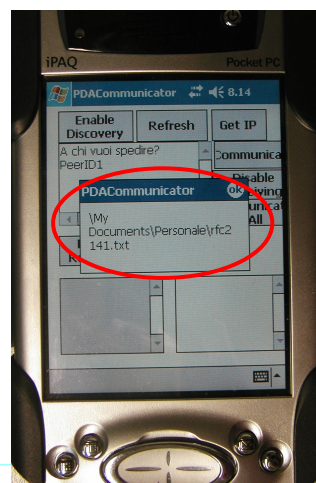


Applicazione di test per DiMob su PDA (2)

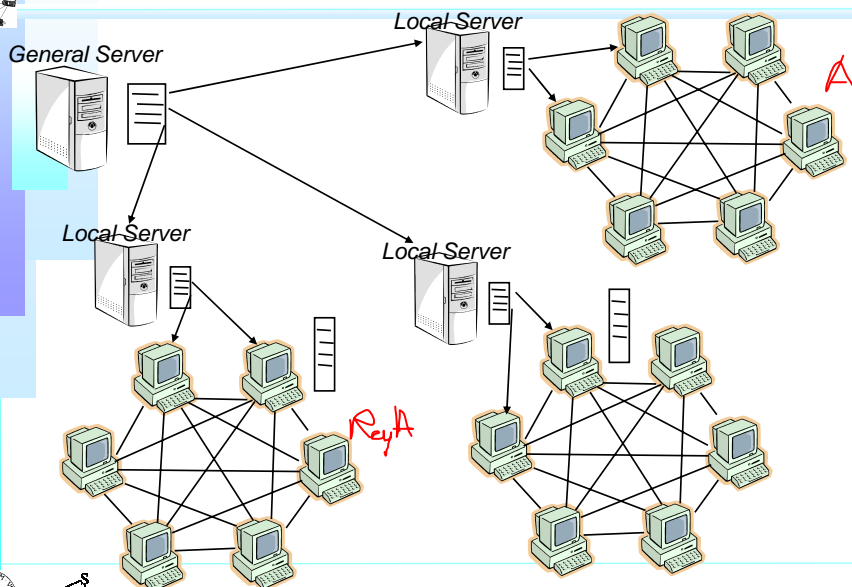
File Ricevuto con successo




File inviato a PeerID1



Possibile Boot della rete di Peer a basso costo







GRID definitions


The Access Grid: *The infrastructure and software technologies enabling linking together distributed Active(Work)Spaces to support highly distributed collaborations in science, engineering and education, integrated with and providing seamless access to the resources of the National Technology Grid.*

Access Grid Node: *The ensemble of systems and services managed and scheduled as a coherent unit (i.e. basic component of a virtual venue).*

Access Grid Site: *A physical site (admin domain, networking POP, etc.) that supports one or more Access Grid Nodes. Access Grid Sites need to be Grid services enabled (authentication, QoS, security, resource management, etc.)*





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GRID



- Struttura per il calcolo distribuito
- Meccanismi di scoperta di servizi
 - ♣ Virtualizzazione del servizio
 - ♣ Organizzazione dinamica dello sfruttamento delle risorse
 - ♣ Negoziazione del servizio
- tratta il *distributed supercomputing*, risoluzione di applicazioni ad alta complessità computazionale, sfruttando risorse di calcolo aggregate
- comprende l'*high-throughput computing*, utilizzando processori in *idle* per i propri scopi
- soddisfa l'*on-demand computing*, la necessità di ottenere risorse immediate, di cui non si dispone localmente
- abilita ed intensifica il *collaborative computing*, il calcolo che coinvolge numerosi individui ed organizzazioni.



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Applications

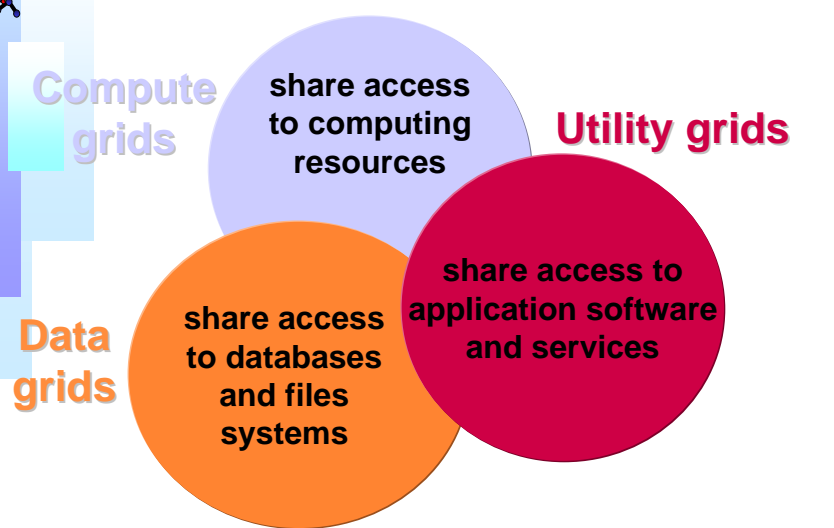
- Calcolo parallelo
- Sfruttamento di risorse distribuite a basso costo al posto di supercalcolatori
- Applicazioni di calcolo massivo:
 - ♣ Medicali
 - E.g.: From TAC to 3D real models
 - ♣ Profiling and personalization
 - ♣ Visione artificiale
 - E.g.: Composition/mosaicing of GIS images
 - ♣ Risoluzione delle licenze per DRM
 - ♣ Adattamento di risorse digitali, conversione di formato
 - ♣ Stima di fingerprint di risorse digitali
 - ♣ Generazione di descrittori di risorse digitali



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

Types of Grid Computing



Compute grids share access to computing resources

Data grids share access to databases and files systems

Utility grids share access to application software and services









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Summary

- **Condor**
 - ♣ Unix and windows
 - ♣ Small scale GRID, non parallelism
- **Globus**
 - ♣ Parallel
 - ♣ Unix like
 - ♣ C and java
- **Legion**
 - ♣ Parallel, C++
 - ♣ Unix like
 - ♣ Too much space needed, 300Mbyte
- **Unicore**
 - ♣ Java
 - ♣ Unix like
 - ♣ Open source






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Globus GRID Tool Kit

- Sicurezza (GSI)
- Gestione delle risorse (GRAM)
- Gestione dei dati (GASS, GridFTP, GRM)
- Servizi di informazione (GIS)
- Comunicazione (I/O, Nexus, MPICH)
- Supervisione dei processi e gestione guasti (MDS, HBM)



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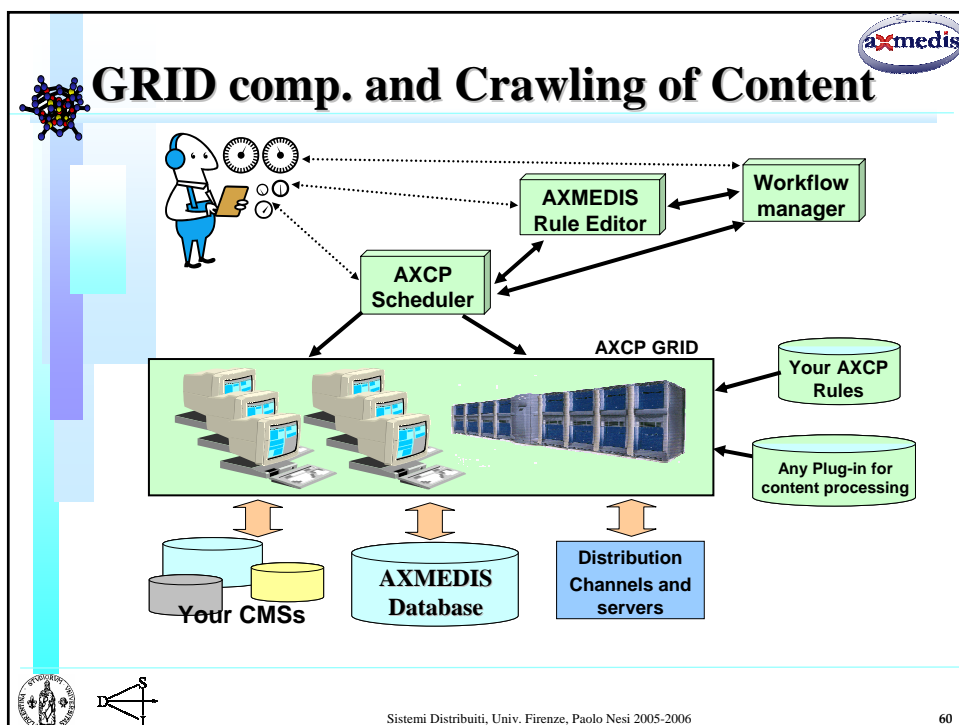



AXMEDIS Content Processing GRID

- **GRID per il Content Processing**
 - ♣ Creazione di regole
 - ♣ Discovery di nodi
 - ♣ Valutazione dei nodi
 - ♣ Esecuzione di regole/processi, che attivano anche processi locali scritti non in forma di regole
 - ♣ Comunicazione con il gestore ma anche fra nodi
 - ♣ Allocazione ed ottimizzazione dei processi
 - ♣ Tracciamento e controllo dei processi
 - ♣ Workflow





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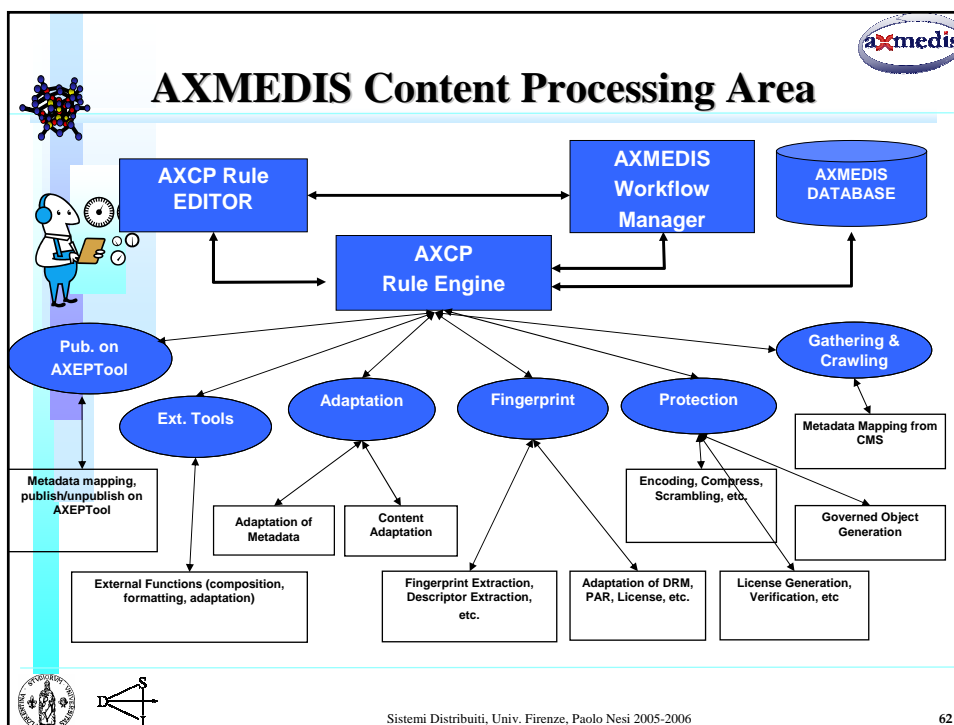
Processing Capabilities


- Content Ingestion and Gathering
- Content Retrieval, Storage
- Content Production
 - ♣ Content Processing
 - ♣ Content Composition
 - ♣ Content Formatting
- Content Protection
- Content Licensing
- Content Publication and Distribution

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AXCP processing capabilities

- Any type of resource in any format
 - ♣ Also MPEG21, IMS, SCORM, etc.
- Processing functionalities:
 - ♣ Production of new objects: composition, etc.
 - ♣ Formatting: SMIL, XSLT, etc.
 - ♣ Synchronization of media, etc.
 - ♣ Adaptation, transcoding,
 - ♣ Reasoning on device capabilities and user preferences
 - ♣ Production of licenses
 - ♣ Verification of Licenses against them and PAR
 - ♣ Extraction of descriptors and fingerprints

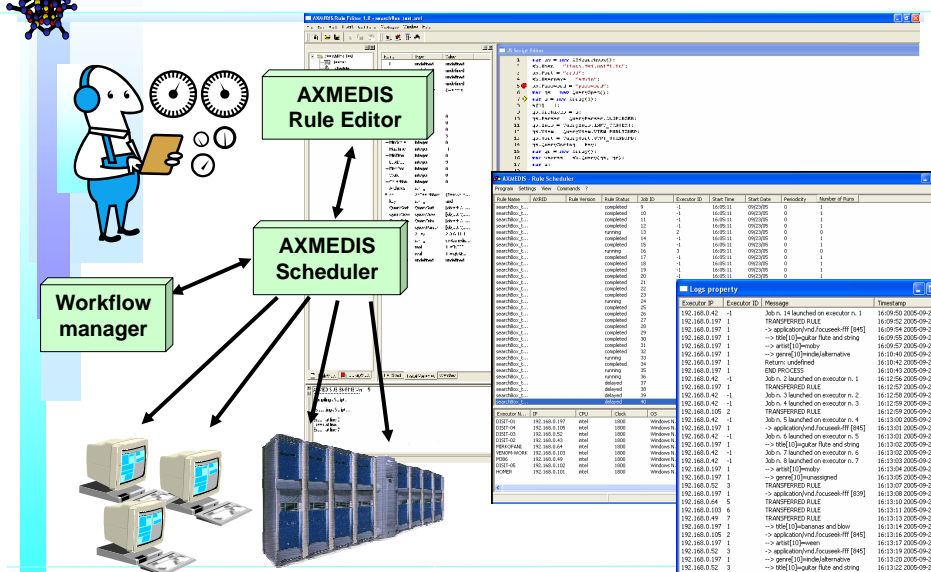





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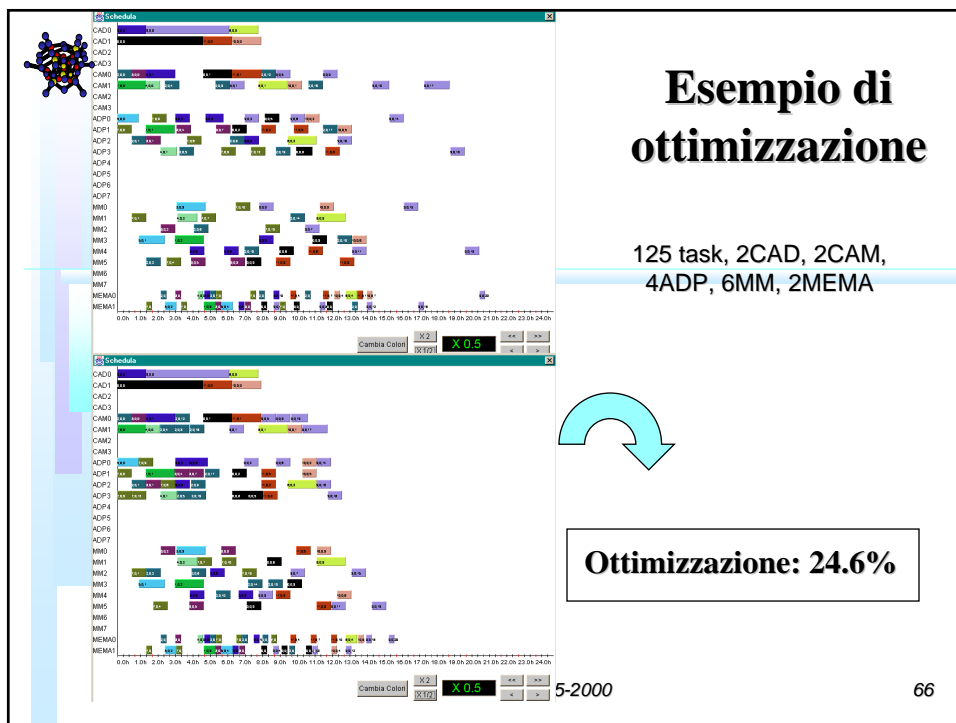
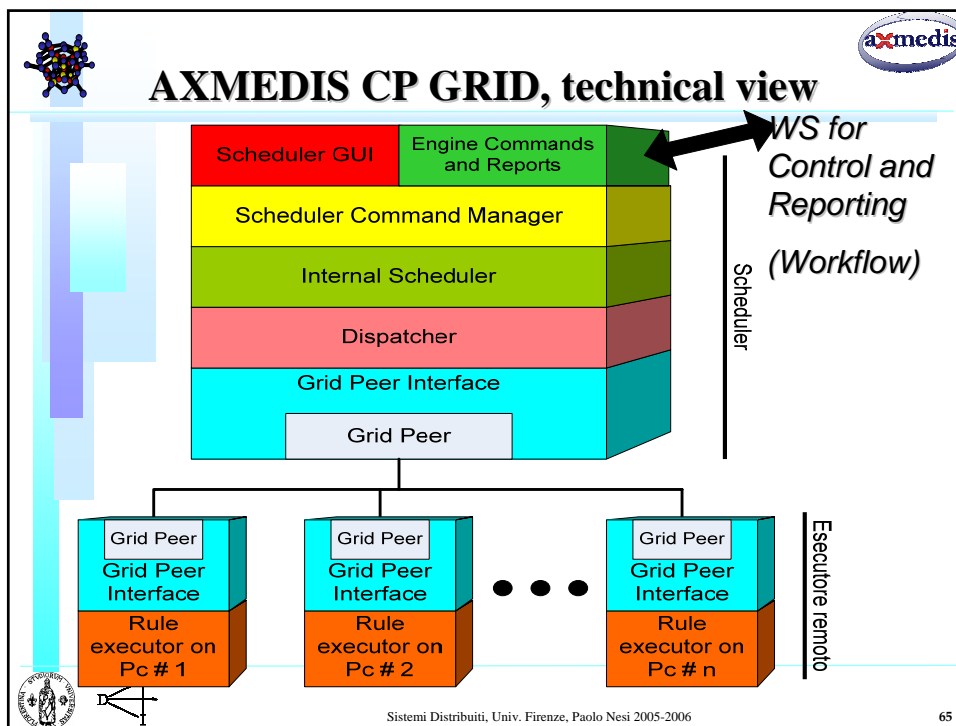
AXMEDIS Content Processing GRID

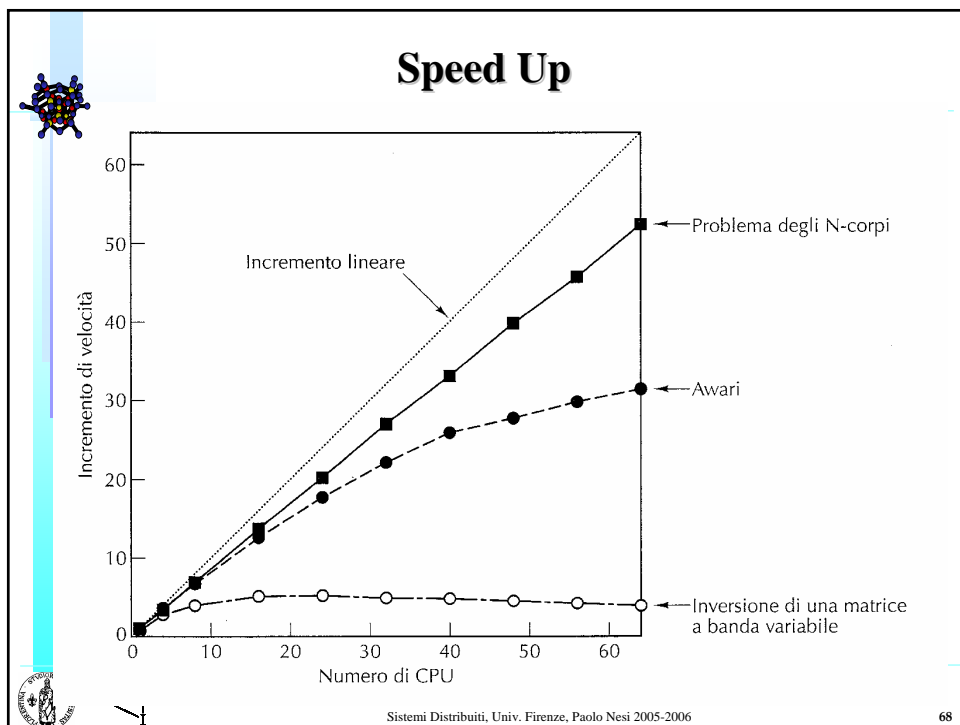
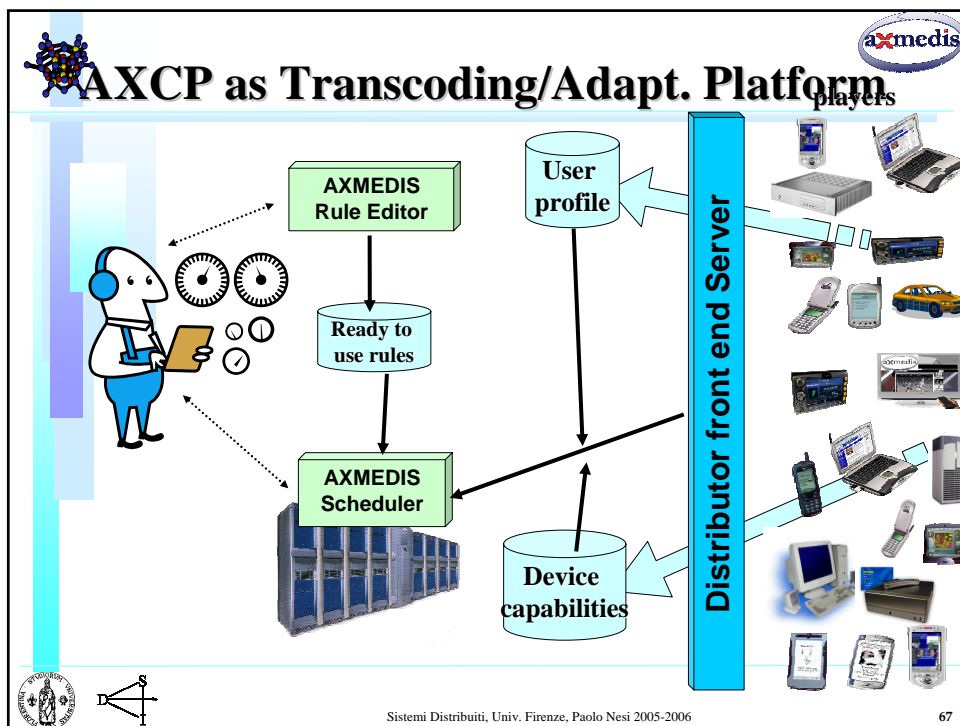



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






Attualmente




- Computer è tipicamente utilizzato solo per la produttività del singolo
- La rete permette di creare delle comunità virtuali
- Allora il computer nasce come supporto alla collaborazione fra individui, groupware
 - ♣ managers to rethink how they run their businesses
 - ♣ People no longer need to work in same place
 - ♣ The cost of employee communication is significantly lowered
 - ♣ Getting status of work in progress is easier





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Concepts of C-S-C-W




- Computer Supported Cooperative Work
- **Computer:** Computer has the potential to improve the technology of cooperative work
- **Supported:** the support is provided by the computer at the cooperative work, new forms of cooperative work
- **Cooperative:** the execution of task, division and organisation of work, ne forms of cooperation
- **Work:** what is cooperative, the task to be executed in cooperative manner






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Definition of CSCW

- Definition of cooperative work
 - A **work process** involving **several people** acting together, in a shared context to **perform some tasks** in order to achieve a pre-specified **common goal**.
- Contenuti/Conoscenza condivisa
- Attività coordinate per raggiungere obiettivi comuni
 - ♣ Collaborazione alla pianificazione
 - ♣ Collaborazione alla realizzazione
 - ♣ Comunicazione dei risultati
 - ♣ Decisioni congiunte





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Perché CSCW, pros

- Incremento della produttività
- Riduzione di tempi
 - ♣ Tempi di modifica e integrazione dei dati
 - ♣ Tempi di convergenza ad una comprensione comune...
- Riduzione dei costi
 - ♣ Costo di comunicazione e' minore del costo di viaggio
 - ♣ Costo del controllo e monitoraggio e' minore se effettuato sul supporto SW per il CSCW rispetto a chiedere alle persone o analizzare il loro lavoro tramite documenti
- Incremento della qualità
- Più divertimento ed interesse, più motivazioni
- Crescita culturale e professionale delle persone
 - ♣ Soddisfazione, più motivazioni





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Examples of CSCW Applications

- Email
- NewGroups
- Mailing Lists
- Web Pages
- Common Calendar
- Wiki Portals
- White and life boards
- Virtual/remote meetings
- Workflow tools
- Multiplayer game
- Decision Support Systems
- Chat lines
- Cooperative Editors (real time and for development)
- Distributed database, connected archives, P2P





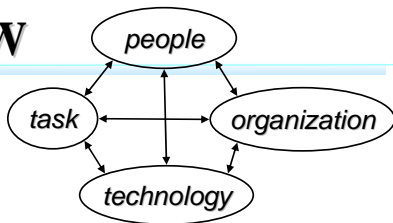
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Discipline of CSCW

Analyze for:

- ♣ **Task/work:**
 - Actions, processes,
 - dependencies, parallelisms
- ♣ **People/users:**
 - How they interact
 - Hierarchy among them
 - user interface
 - Omogenei e non
- ♣ **Organisation/information**
 - Data
 - Flow of data
 - Granularity needed
- ♣ **Technology/tools**
 - Sinc/async, granularity possible, real-time or not
 - Etc.





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Discipline of CSCW

- Determining how to build interfaces that support communication and sharing
 - ♣ studies of electronic meeting systems
 - ♣ studies of how people verbally negotiate work
 - ♣ studies of how people write together
 - ♣ studies of the impact of desktop video conferencing
- Comportamento e comunicazione:
 - ♣ Verbale
 - ♣ Non verbale:
 - ➔ Gesti, espressioni, movimenti del corpo



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CSCW, Tipologie di massima

- **Asincrone, Asynchronous**
 - ♣ collaborazione non in tempo reale (real-time)
 - ➔ Reply, forwarding, distribution list
 - ➔ Org by topic, linking
 - ➔ Usually text, images, etc.
 - ♣ Per esempio:
 - ➔ mailing
 - ➔ Versioning del testo, integrazione delle versioni, etc.
- **Sincrone, Synchronous**
 - ♣ Real-time
 - ♣ Tutti vogliono vedere la stessa versione aggiornata allo stesso tempo
 - ♣ Editing cooperativo, video conferencing, media spaces, virtual reality, audio conference



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The board

The board is a large, dark surface covered with numerous handwritten notes and sticky papers. The notes are organized into several distinct sections, each with a title written in large, bold letters. The sections include:

- Display:** Notes on how to present information, such as "Display the data" and "Use the data to make decisions".
- Use Geographic Names:** Notes on how to use geographic names to describe locations, such as "Use the name of the location" and "Use the name of the location to describe the location".
- Moving in Space & Time:** Notes on how to move through space and time, such as "Move in space" and "Move in time".
- Options:** Notes on how to choose between different options, such as "Choose the best option" and "Choose the best option for the situation".
- Error Handling:** Notes on how to handle errors, such as "Handle the error" and "Handle the error in a way that is consistent with the rest of the system".
- Make Choices Visible:** Notes on how to make choices visible to others, such as "Make the choice visible" and "Make the choice visible to the others".

The board is a central tool for collaborative problem-solving, allowing team members to share their ideas and work together to solve a problem. The notes are written in various colors and styles, and are often connected by lines and arrows, indicating a flow of thought and collaboration.

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Examples of Synchronous Groupware

The image shows a synchronous groupware environment. It features a large, circular table with a map of the world on it, surrounded by several computer monitors displaying video feeds of participants. The setup is designed for collaborative work in a virtual space. The participants are seated around the table, and their video feeds are visible on the monitors. The table is illuminated by a central light fixture, and the floor is covered with a grid pattern. The overall atmosphere is one of a professional, collaborative workspace.

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Collaborative Virtual Environments

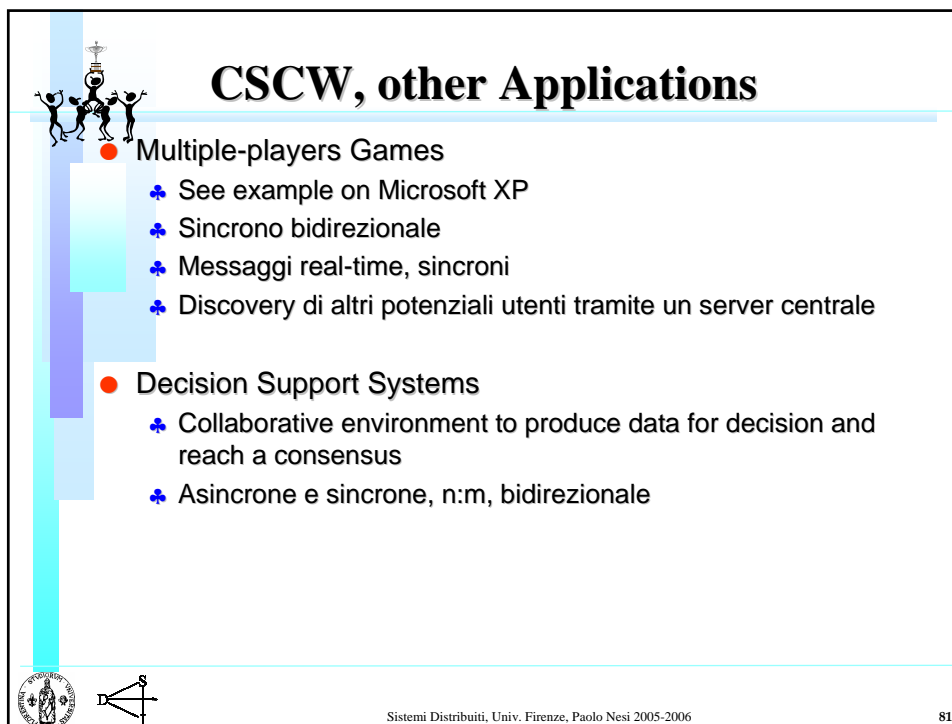
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WIKI portals

- Editing di pagine WEB con particolare sintassi
 - ♣ Sintassi simile a HTML ma diversa
 - ♣ Complesso l'uso di tabelle e strutture, immagini, formule, etc.
 - ♣ Accesso in lettura/scrittura a pagine web
 - ♣ Possibilita' di definire gerarchie di utenti
 - ♣ Possibilita' di definire un processo di produzione delle pagine dalla creazione alla revisione, validazione, etc.
 - ♣ La pagina viene
 - prelevata per l'editing (bloccata per altri utenti),
 - manipolata ed infine deve essere
 - salvata per provocare l'aggiornamento e la
 - pubblicazione nell'area visibile
- Per esempio
 - ♣ WikiMedia
 - ♣ Wiki Tiki, see its usage on AXMEDIS Wiki pages



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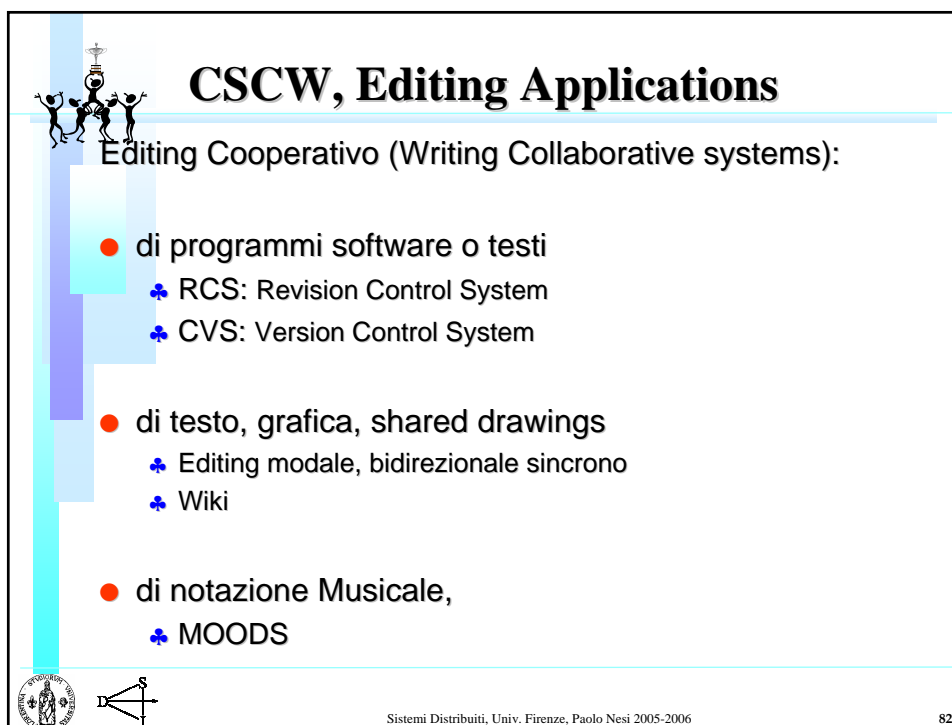


CSCW, other Applications

- Multiple-players Games
 - ♣ See example on Microsoft XP
 - ♣ Sincrono bidirezionale
 - ♣ Messaggi real-time, sincroni
 - ♣ Discovery di altri potenziali utenti tramite un server centrale
- Decision Support Systems
 - ♣ Collaborative environment to produce data for decision and reach a consensus
 - ♣ Asincrone e sincrone, n:m, bidirezionale



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CSCW, Editing Applications

Editing Cooperativo (Writing Collaborative systems):

- di programmi software o testi
 - ♣ RCS: Revision Control System
 - ♣ CVS: Version Control System
- di testo, grafica, shared drawings
 - ♣ Editing modale, bidirezionale sincrone
 - ♣ Wiki
- di notazione Musicale,
 - ♣ MOODS


 

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Valutazione di CSCW

- Prima di realizzare e' meglio valutare
- Prima di valutare il proprio e' meglio valutare quelli degli altri per capire successi ed insuccessi
- Successi:
 - ♣ Web, email, mobile phone,
 - ♣ P2P
 - ♣ Chat
 - ♣ Telconferences, video and phone
- Insuccessi:
 - ♣ Net Meeting
 - ♣ Virtual reality
 - ♣ Etc.




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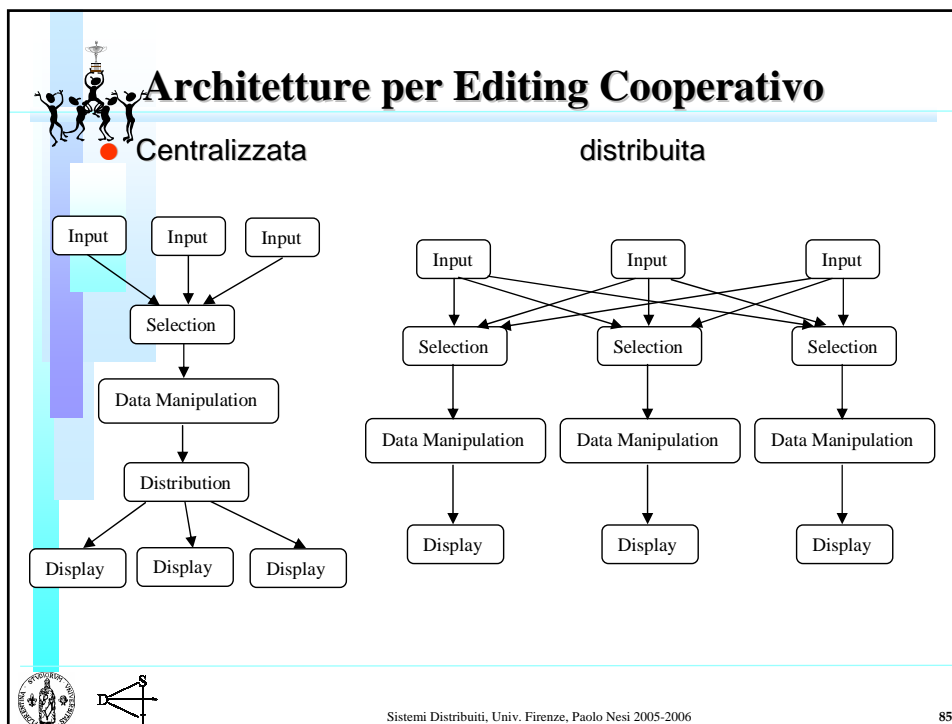


Space and time taxonomy (Borghoff-98)

Space/time	Same time (sync)	Diff time (async) predictable	Diff time (async) Unpredictable
Same place	Face to face meeting, games, class rooms	Shift work	Blackboard, posti it note
Different place (predictable)	Video conference, chat	Email, RCS, netnews	Joint editing of documents
Different place (unpredictable)	Mobile phone conference	Non real time computer conference	Workflow management, letter

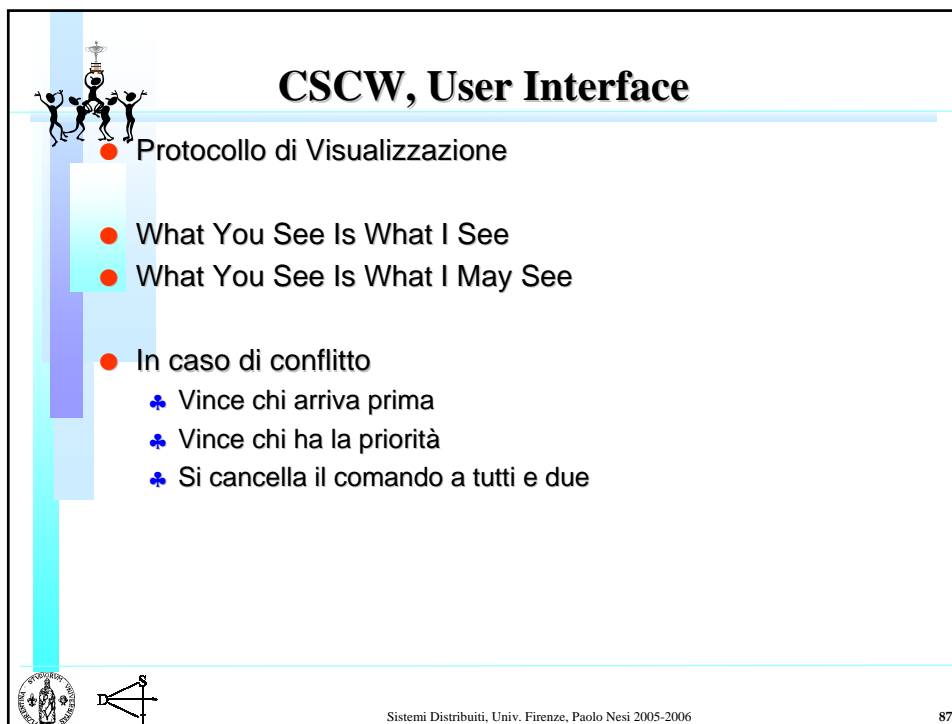


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
- ## Major Features of a CSCW system 2/2
- User Interaction and feeling
 - ♣ The users **see** the same representation at each instant
 - ♣ The users **may** see the same representation at each instant
 - ♣ The users **may** see the same representation
 - Interaction
 - ♣ Synchronous/asynchronous (real-time/off line)
 - ♣ Già discusso in precedenza
 - Fault tolerance, fault correction and prevention
 - ♣ Collisioni, causalita', soddisfazione delle intensioni
 - Undo support, lineare o non lineare
 - ♣ Storie dei cambiamenti e/o comandi
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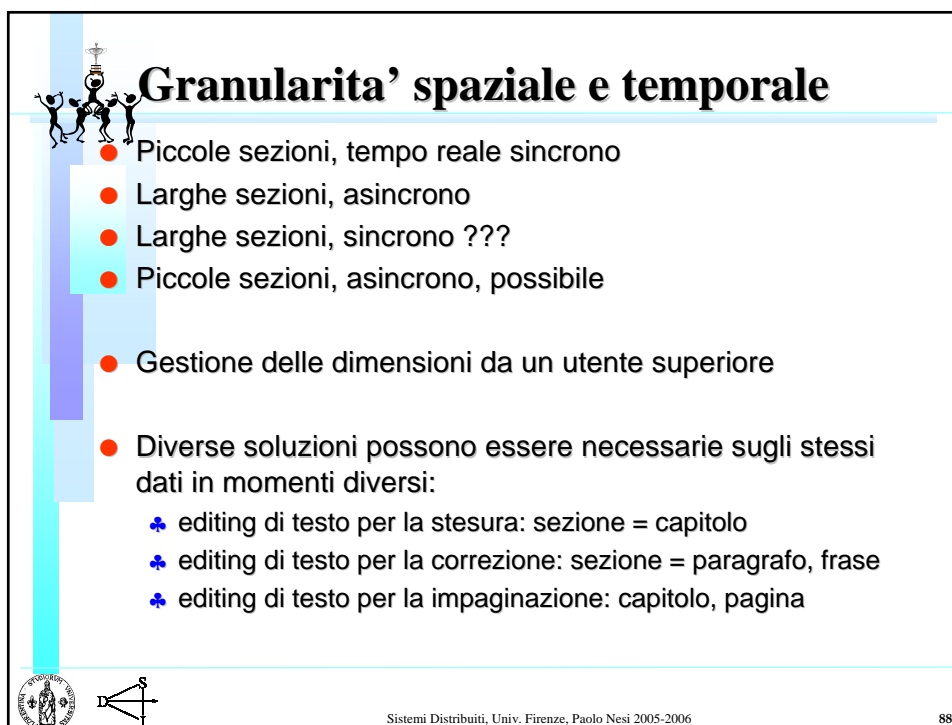


CSCW, User Interface

- Protocollo di Visualizzazione
 - What You See Is What I See
 - What You See Is What I May See
- In caso di conflitto
 - ♣ Vince chi arriva prima
 - ♣ Vince chi ha la priorità
 - ♣ Si cancella il comando a tutti e due



 

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Granularita' spaziale e temporale

- Piccole sezioni, tempo reale sincrono
- Larghe sezioni, asincrono
- Larghe sezioni, sincrono ???
- Piccole sezioni, asincrono, possibile
- Gestione delle dimensioni da un utente superiore
- Diverse soluzioni possono essere necessarie sugli stessi dati in momenti diversi:
 - ♣ editing di testo per la stesura: sezione = capitolo
 - ♣ editing di testo per la correzione: sezione = paragrafo, frase
 - ♣ editing di testo per la impaginazione: capitolo, pagina


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Undo support, lineare o non lineare

Se ho un utente solo la lista dei comandi elementari (INS, DEL, ADD,..) e' reversibile dallo stesso utente

- ♣ I comandi si possono invertire in ordine opposto a come sono stati creati
- Se si hanno piu' utenti non e' detto che un utente navigando nella sua lista di comandi ne possa fare l'UNDO poiche' alcuni comandi di altri utenti sono stati inseriti. Tali comandi possono essere stati efftuati su oggetti che l'eventuale undo potrebbe modificare invalidando il comando di un altro utente
 - ♣ Chi ha l'autorita' di fare il cambiamento
- Si puo' in questo modo fare un UNDO selettivo, che permette di saltare nella lista dei comandi e chiedere di fare UNDO di un comando specifico nella lista.
 - ♣ Questo puo' creare molti problemi anche in liste lineari come quelle prodotte in applicativi singolo utente
 - ♣ Complesso in applicativi multiutente



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Undo non Lineare, selettivo


- 1)
- 2)
- 3) DEL(5.36.1.4)
- 4) INS(X, 1.23.1.65) ->1.23.1.74
- 5) INS(Y, 1.5.1.87) ->1.5.1.75
- 6) INS(Z, 5.6.2.120) ->1.6.2.76
- 7) DEL(2.2.2.34)
- 8) INS(Y, 1.23.1.74) ->1.23.1.75
- 9) DEL(3.234.1.43)
- 10) DEL(1.22.1.29)
- 11) INS(Z, 1.23.1.65) ->1.23.1.876
- 12) ADD(R, 1.23.1.74)
- 13) INS(F, 1.55.1.99) ->1.55.1.34
- 14) INS(W, 5.7.1.130) ->5.7.1.92
- 15) DEL(3.29.2.89)
- 16) ADDH(SL, 1.23.1.74, 1.25.1.34)-> 1.1.12
- 17) ADD(A, 1.23.1.75)
- 18)

R	A	SL	
..	X	Y	..
65	74	75	34

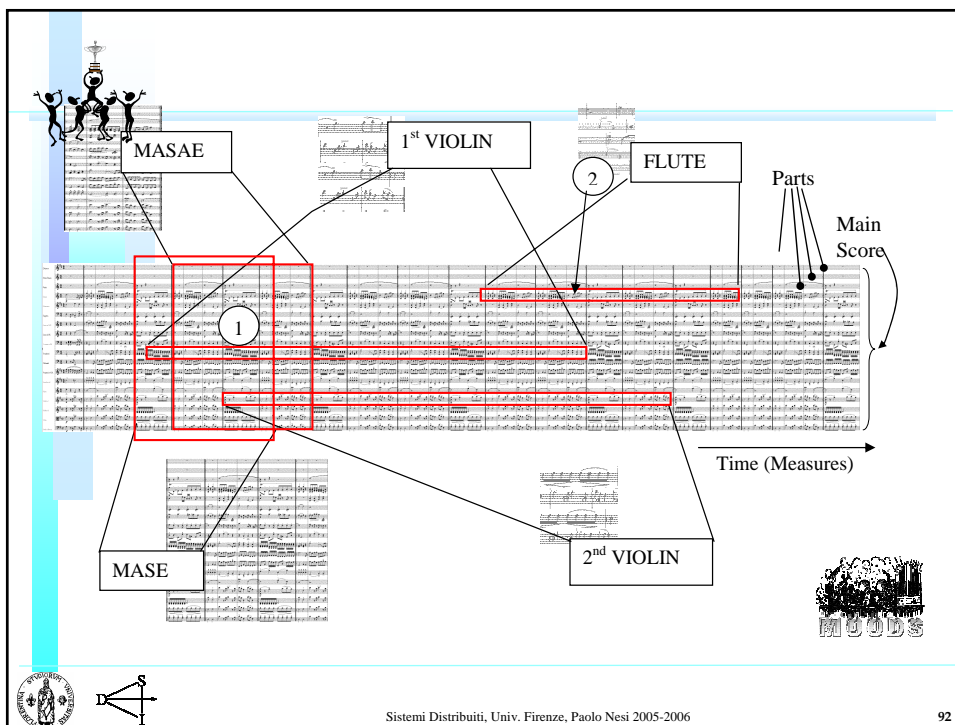
INS

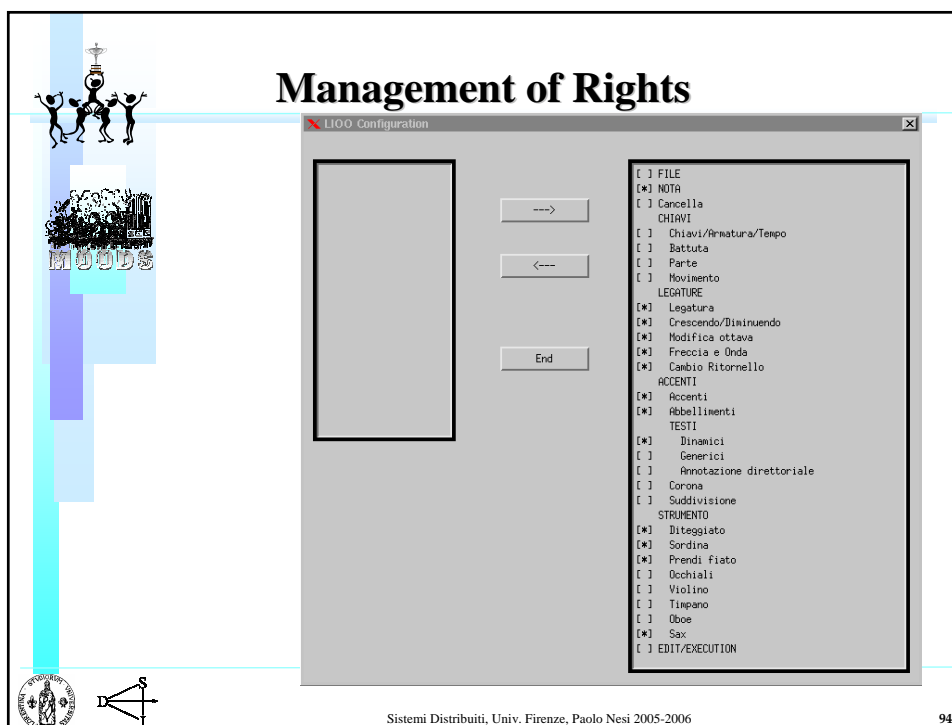
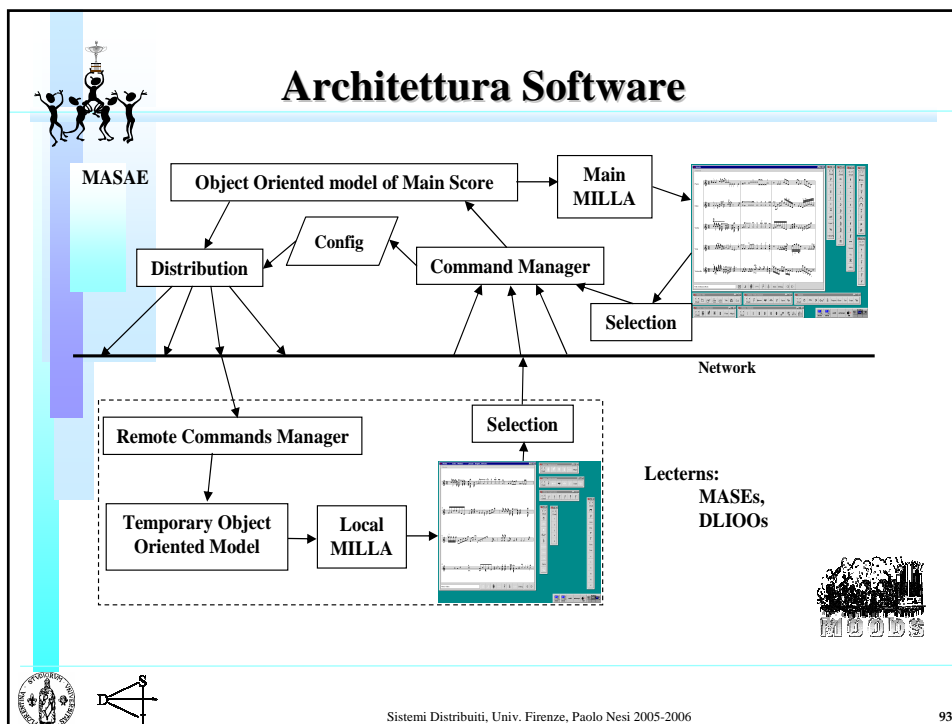
ADD ADDH DEL

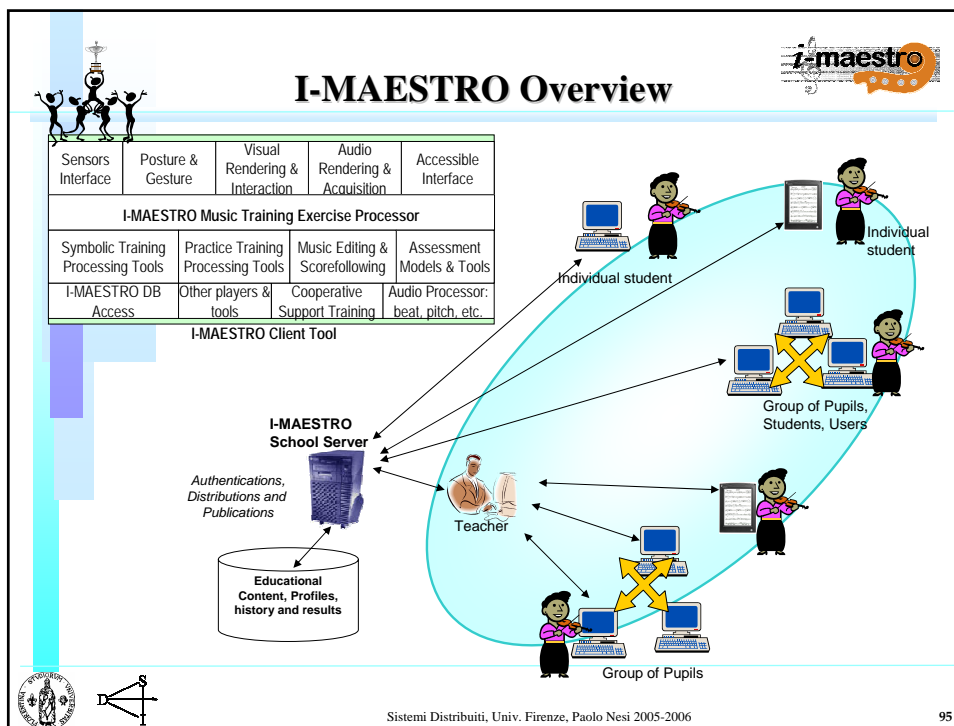
DELH



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W.A. Mozart - eine kleine nachtmusik

Violin I score



Velocity Annotations

Violin I - video












Violin I	▶
Violin II	▶
Viola	▶
Violoncello	▶
Basso	▶



Some DISIT Projects

- **Multimedia Content Modeling and distribution:**
 - ♣ **MOODS**, cooperative work on Music notation
 - ♣ **WEDELMUSIC** platform (chair), IST Fp5
 - WEDELMUSIC conference series
 - WEDELAUTHORING (chairs)
 - ♣ **MUSICNETWORK** Environment (chair), IST Fp5
 - Workshops, emerging European associations
 - ♣ **IMUTUS**, music tuition, distance learning, IST Fp5
 - ♣ **MPEG-SMR** integration (co-chair)
 - ♣ **MPEG M3W**, Multimedia Middleware
 - ♣ **AXMEDIS**, Automating cont. prod. and protection
 - ♣ **IMAESTRO**, music education, cooperative, gesture, etc.
 - ♣ **Other minor projects:** archives, mobile distribution, etc.



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