

Telematica di Base

Applicazioni P2P

The Peer-to-Peer System Architecture

- ✧ peer-to-peer is a network architecture where computer resources and services are direct exchanged between computer systems.
- ✧ In such an architecture, computers that have traditionally been used solely as clients **communicate directly among themselves and can act as both clients and servers**, assuming whatever role is most efficient for the network.
- ✧ <http://www.peer-to-peerwg.org/whatis/index.html>

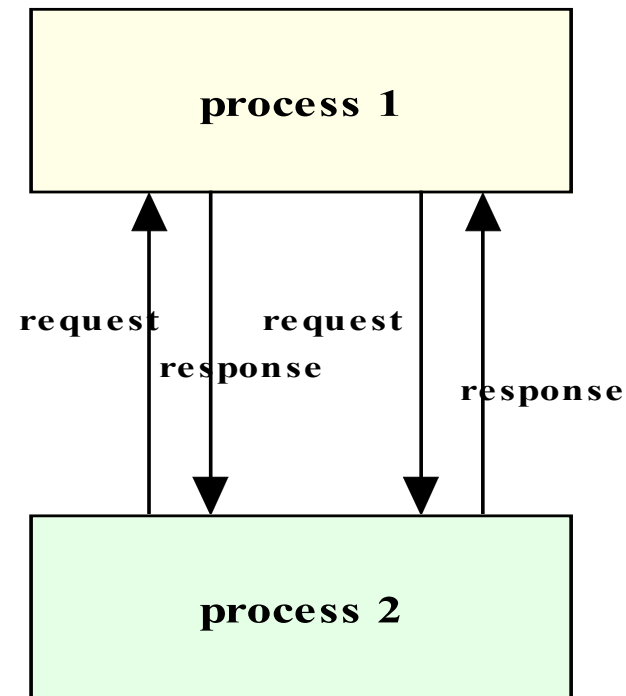
Definition of P2P

“P2P is a way of structuring distributed applications such that the individual nodes have symmetric roles. Rather than being divided into clients and servers each with quite distinct roles, in P2P applications a node may act as both a client and a server.”

*Excerpt from the Charter of Peer-to-Peer research Group,
IETF/IRTF, June 24, 2003*

P2P

- In the peer-to-peer paradigm, the participating processes play equal roles, **with equivalent capabilities and responsibilities** (hence the term "peer").
- Each participant may issue a request to another participant and receive a response.



P2P


The peer-to-peer paradigm is appropriate for applications such as instant messaging, peer-to-peer file transfers, video conferencing, and collaborative work.

P2P file sharing

- ✧ Alice runs P2P client application on her notebook computer
 - ✧ Intermittently connects to Internet; gets new IP address for each connection
 - ✧ Asks for “Hey Jude”
 - ✧ Application displays other peers that have copy of Hey Jude.
 - ✧ Alice chooses one of the peers, Bob.
 - ✧ File is copied from Bob’s PC to Alice’s notebook: HTTP GET
 - ✧ While Alice downloads, other users uploading from Alice.
 - ✧ Alice’s peer is both a Web client and a transient Web server.
- All peers are servers = highly scalable!

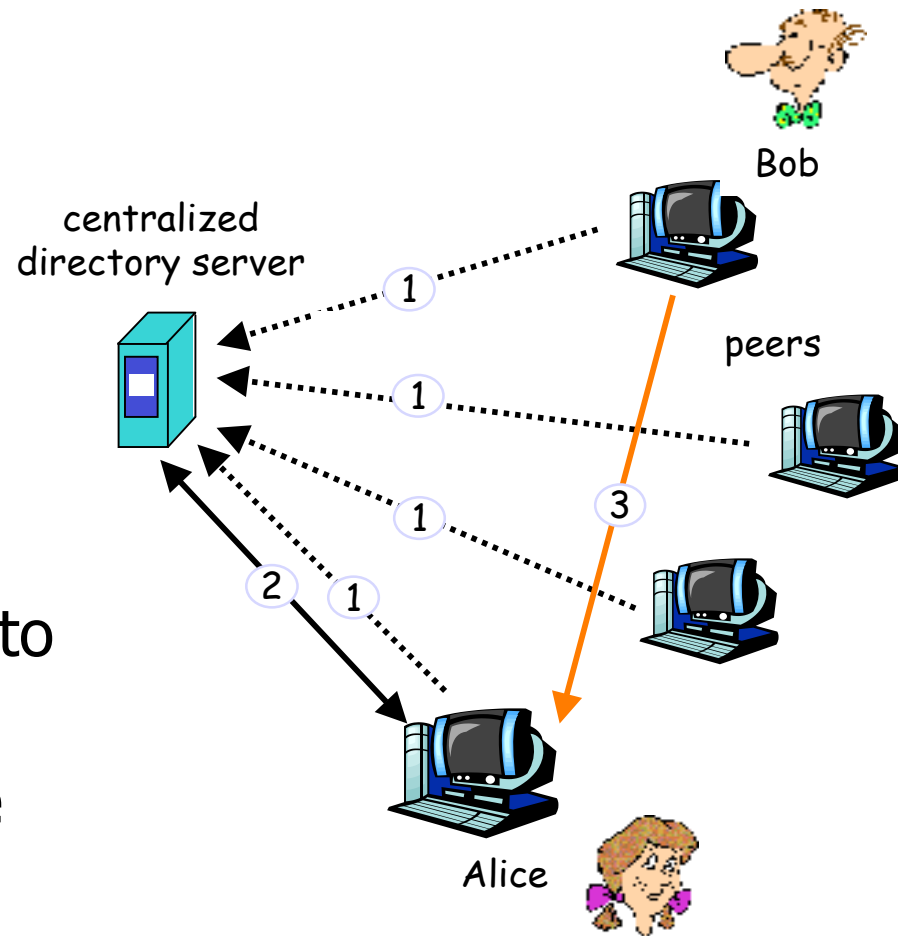
P2P: Centralized Directory

NAPSTER

 The peer establishes a connection to a centralized server

- IP address
- Shared information

- 2) Alice produces a query to find "Hey Jude"
- 3) Alice downloads the file from Bob



Discussion

- ✧ Single failure point
- ✧ limited performance
- ✧ Copyright

Two aspects

- a) **distributed**
file transfer
- b) **centralized**
information

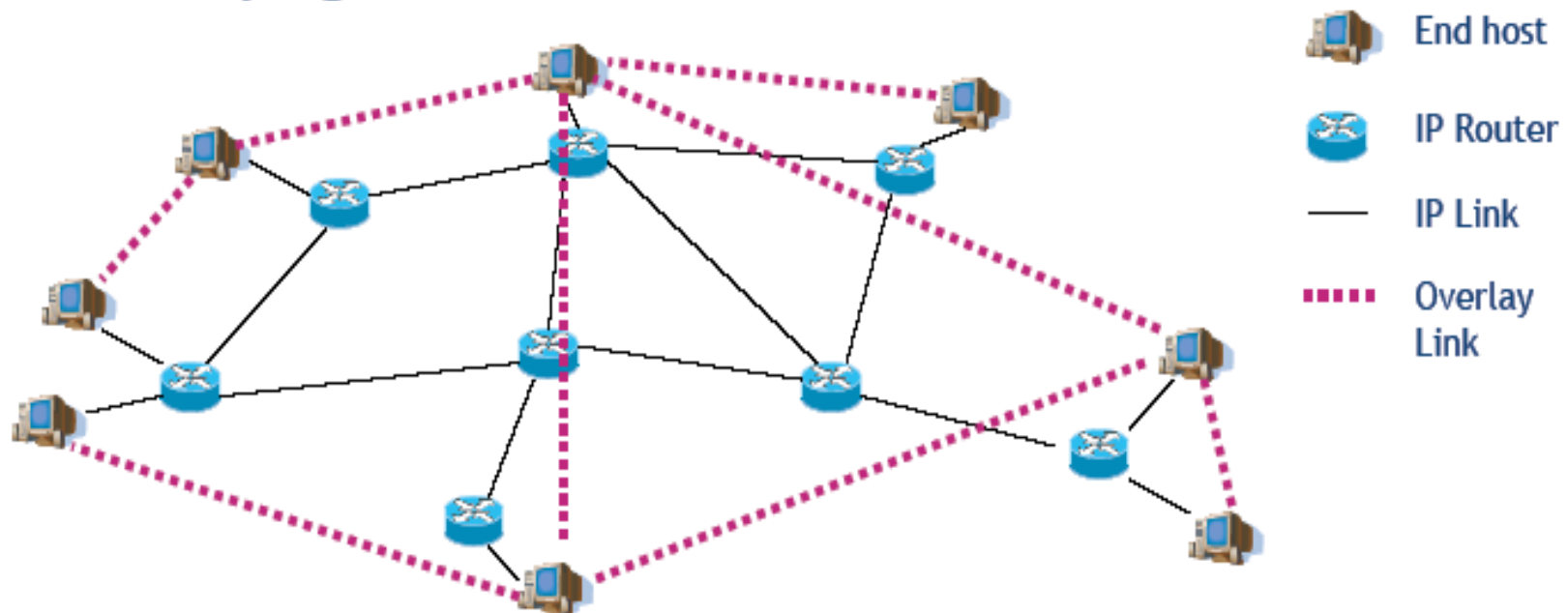
- ✧ Distributed: no global server
- ✧ public domain

Gnutella

overlay network: graph structure

- ✧ The nodes are the peers
- ✧ arc between X e Y : it exists a TCP connection between X e Y
- ✧ overlay network= active peers and their connections
- ✧ typically, for each node there are (at maximum) 10 "close" nodes

- Gnutella is based on an overlay network
- Overlay network means a virtual network on top of the underlying IP network



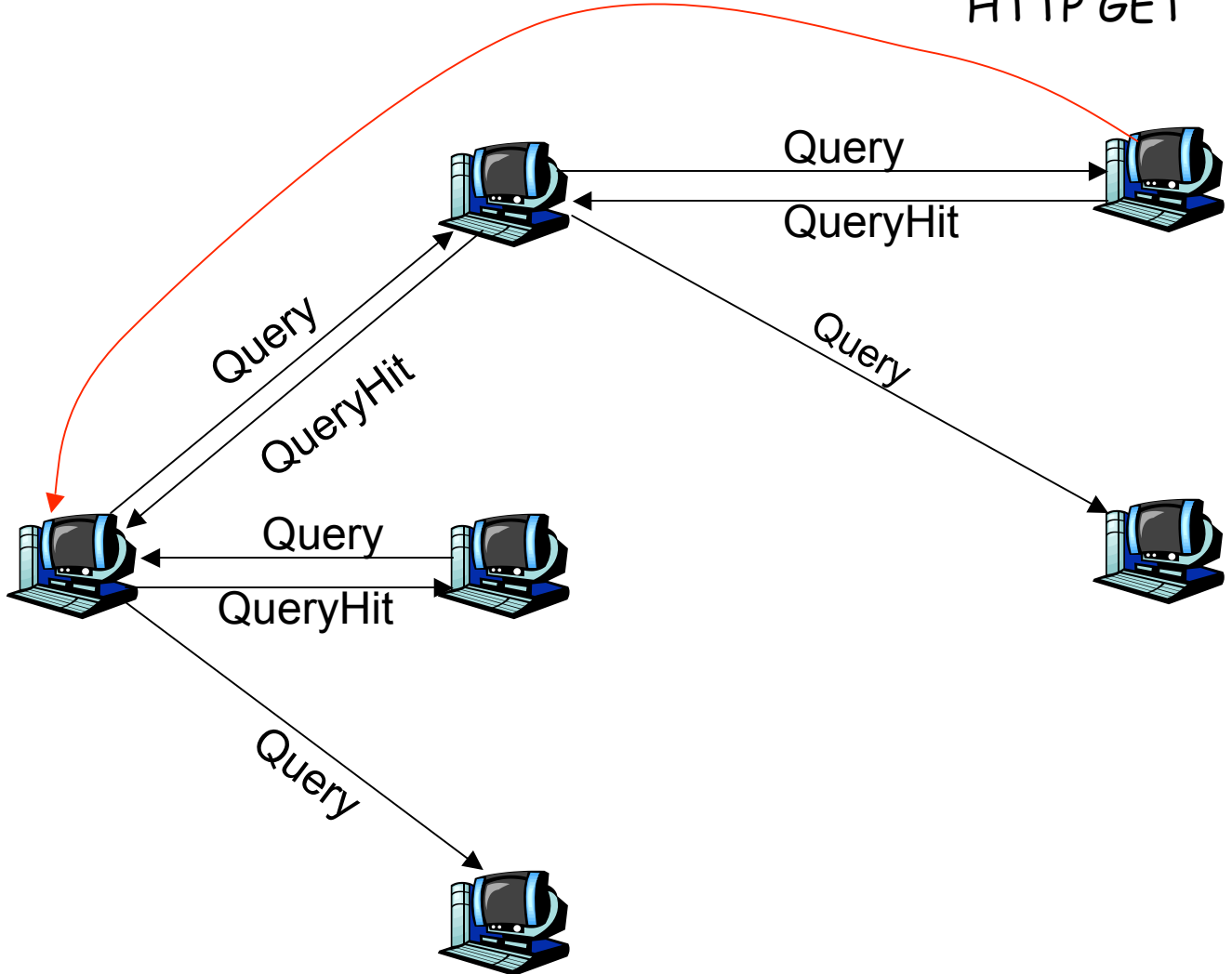
Most current P2P systems based on some kind of overlay

Gnutella

- ❑ **the query** is transmitted on the TCP con.
- ❑ **Query Forward**: peers forward the msg on the overlay network
- ❑ **QueryHit** : the response to the query is sent on the "reverse" path of the overlay network

Gnutella

File transfer:
HTTP GET



Gnutella: Peer joining

1. Joining peer X must find some other peer in Gnutella network: **use list of candidate peers**
2. X sequentially attempts to make TCP with peers on list until connection setup with Y
3. X sends Ping message to Y; Y forwards Ping message.
4. All peers receiving Ping message respond with Pong message
5. X receives many Pong messages. It can then setup additional TCP connections

Gnutella: Query flooding

- ✧ Queries are sent to the close nodes
- ✧ Query forwarding
- ✧ If the object is found, its reference is directly sent to the starting node.

Gnutella:innovative features

overlay network

- ✧ Peers are nodes
- ✧ Connections among peers
- ✧ Virtual network

bootstrap node

- ✧ a connecting peer (peer join) must find a peer in the overlay network

vantages

- ✧ There isn't a centralized directory
 - ✧ The localization service is distributed among the peers

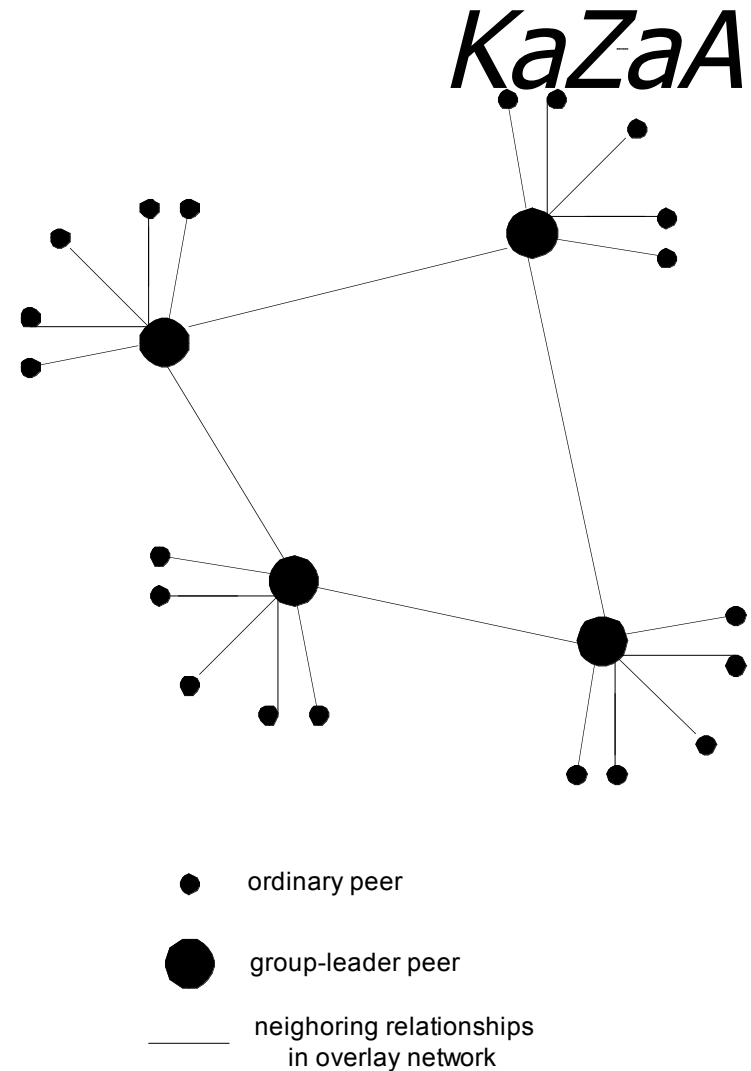
disavantages

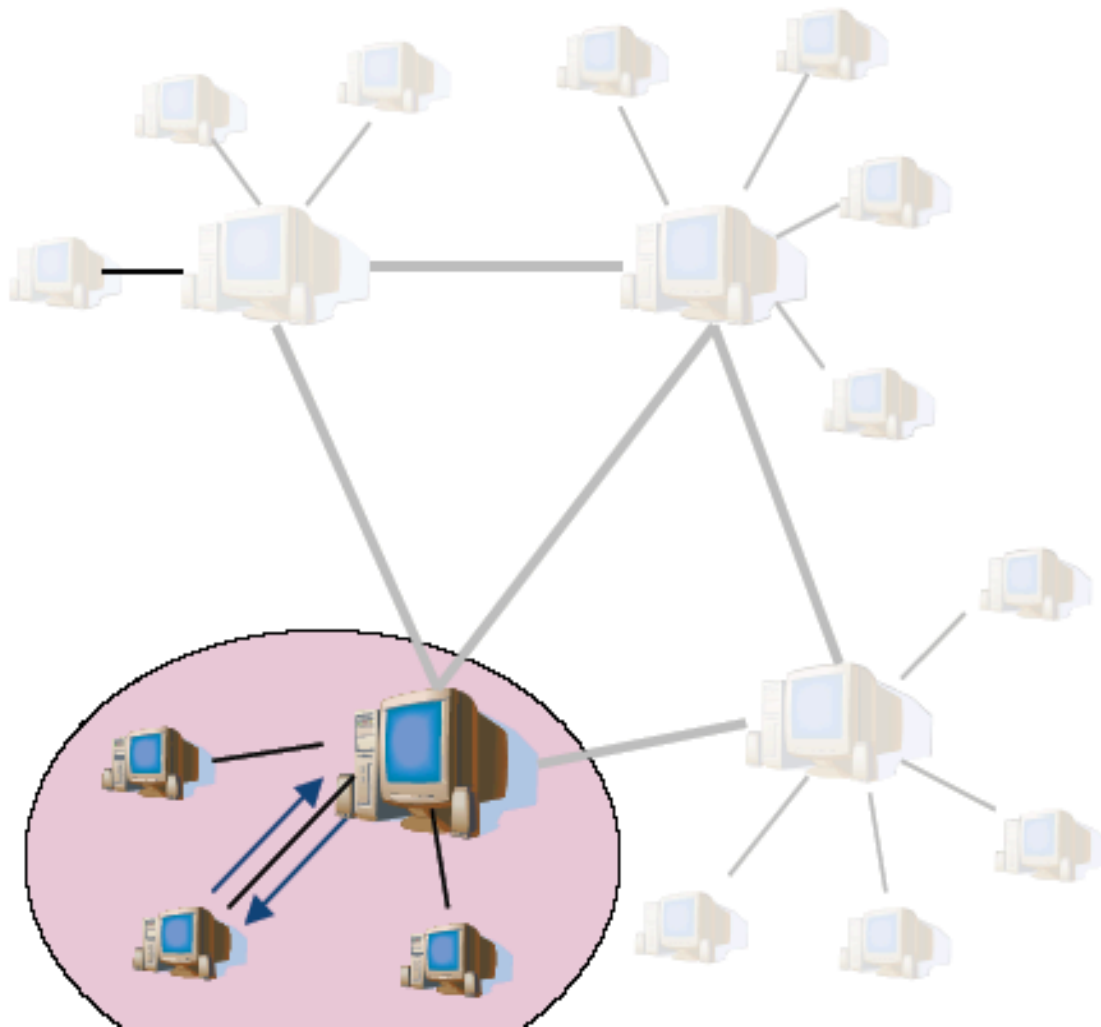
- ✧ Query flooding
 - ✧ Restriction of the area of the query

✧ peer structure

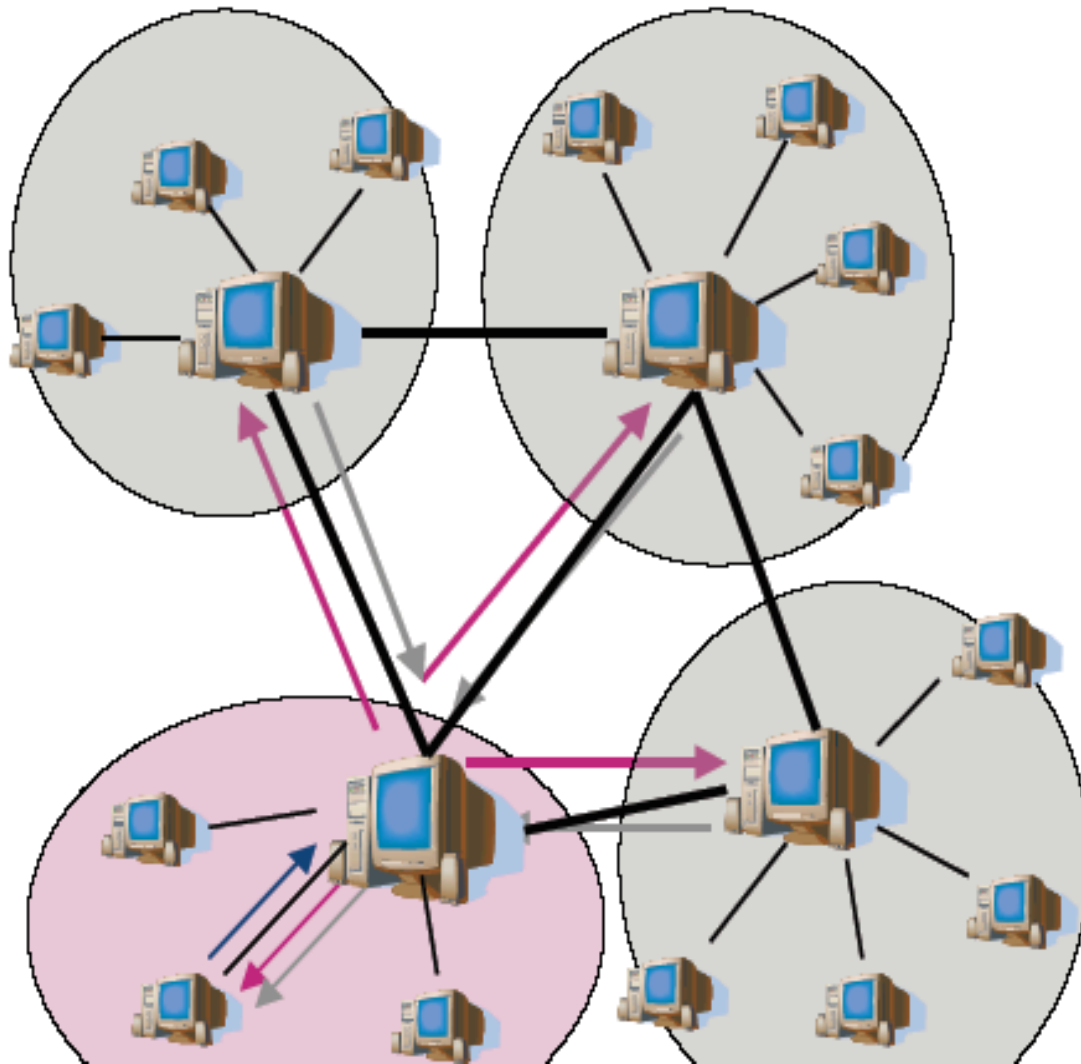
- ✧ Peer = group leader or it is associated to a group leader.
- ✧ TCP with Peer -- Group leader
- ✧ TCP cons among pairs of group leader.

✧ Group leaders: is a particular type of centralized directory for the peers associated to the group





- Peer obtains address of SN from “somewhere”
 - Bootstrap server or included in software
- Peer sends request to SN, gives list of files to share
- SN starts keeping track of this peer
- Other SN not aware of the new peer



1. Peer sends query to its own supernode
2. Supernode answers for all of its peers and forwards query to other supernodes
3. Other supernodes reply for all of their peers

P2P Communications: IM

- ✧ Instant Messaging
 - ✧ central server with the buddy list
 - ✧ User connects the server
- ✧ chatting among peers
- ✧ centralized server
 - ✧ Solution like Napster

P2P Communications

- ✧ Skype: Internet Telephony Software
 - ✧ It allows to use internet for telephone calls.
 - ✧ telephonic networks reached via internet
- ✧ Architecture analogous to KaZaA

Skype

- ✧ Proprietary application: technical description is not available
- ✧ Some informations:
 - ✧ Central server for “billing”
 - ✧ GroupLeader as KaZaA
 - ✧ Similar features
 - ✧ directory service for the on-line users

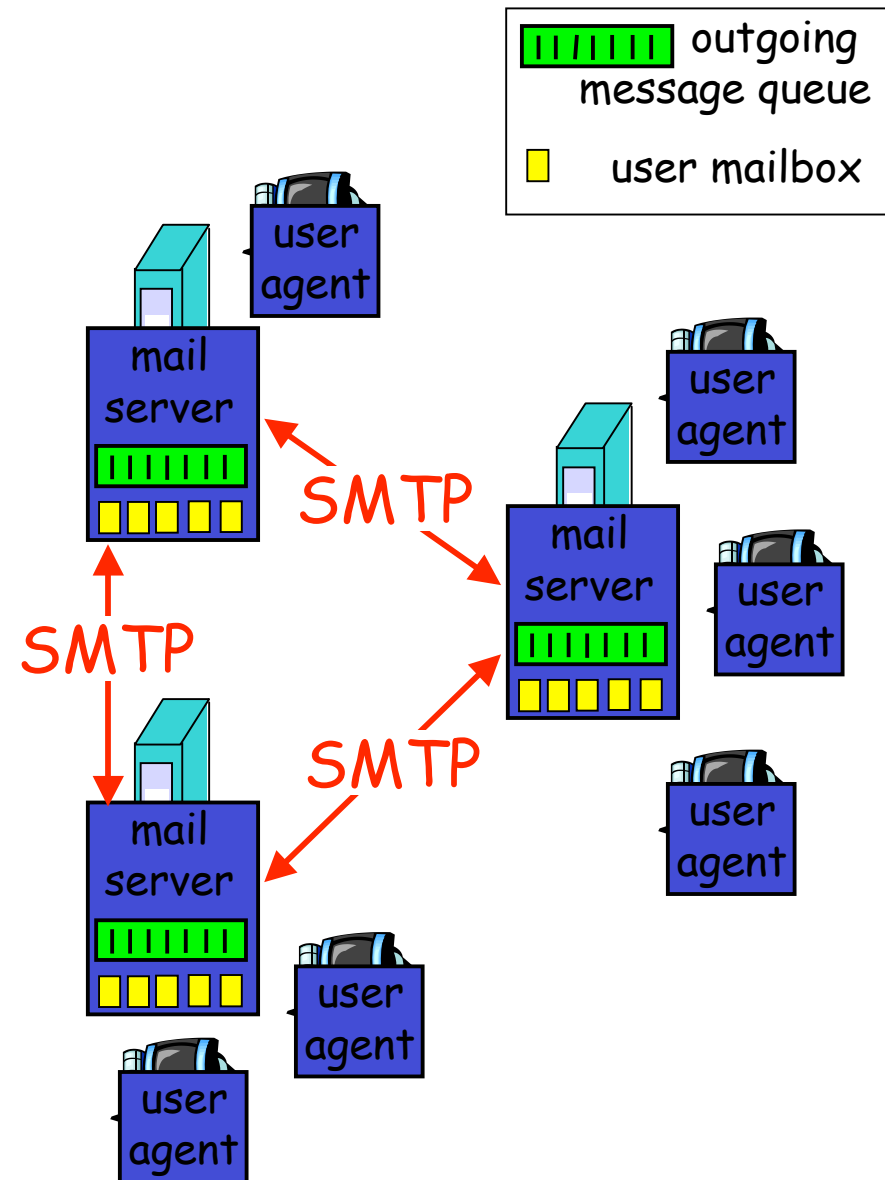
Email

Three components:

- ✧ user agent
- ✧ mail server
- ✧ simple mail transfer protocol: smtp

User Agent

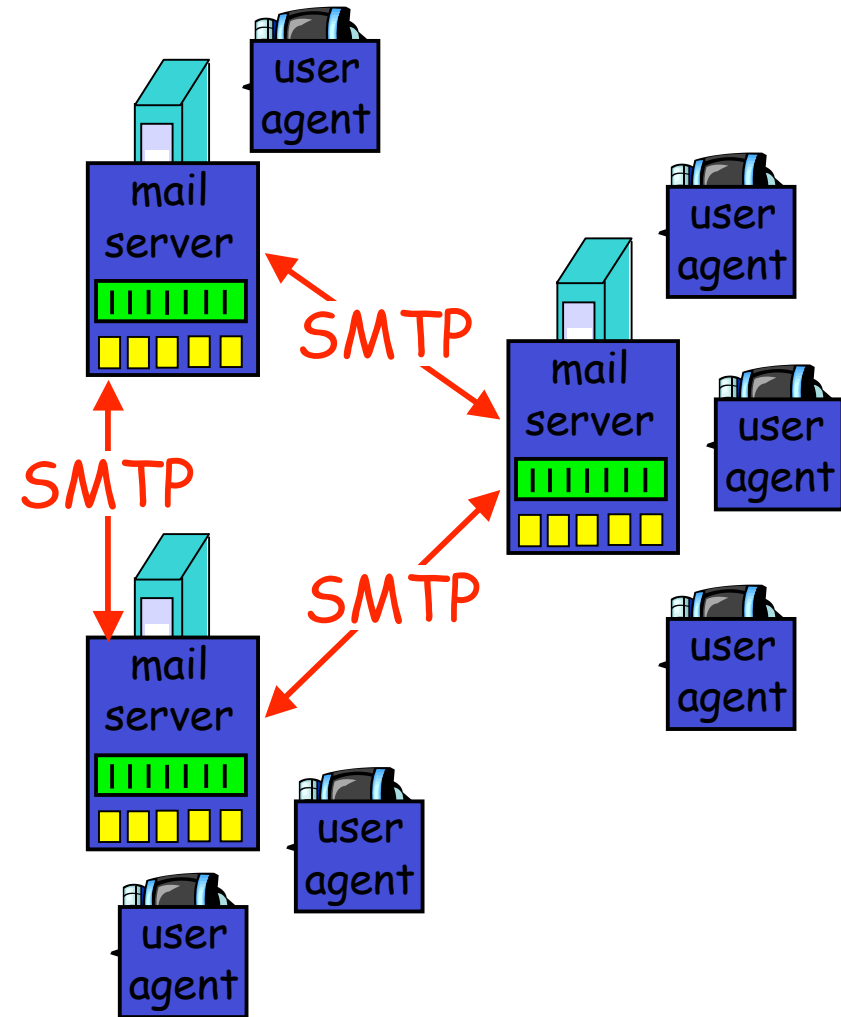
- ✧ features: reading, writing and sending mail
- ✧ Eudora, Outlook, Pine, MacMail
- ✧ Messages are stored in the server



E-Mail: mail server

Mail Server

- ✧ mailbox contains messages not i msg non still read by the users
- ✧ Smtp: communication protocol among the mail servers



Alice e Bob

- 1) Alice sends a e-mail to bob@school.edu
- 2) The message is inserted è inserito in the queue of the mail server
- 3) SMTP (client side) defines a connection TCP with the Bob mail server
- 4) SMTP (client side) sends the Alice message on the TCP connection
- 5) Il mailserver di Bob memorizza il messaggio nella mailbox di Bob
- 6) Bob legge il messaggio tramite il suo user agent (usando POP3 o IMAP)

