Advanced Networking

ENUM: Migrating to VoIP

Skype
&
P2P Voice Applications

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Credits for part of the original material to Saverio Niccolini NEC Heidelberg

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  - How it works?
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  - Implications of P2P approaches
- H.323 → SIP → VoP2P (o SIP-peer?)
  - Can we have a standard P2P VoIP architecture?

What is the ENUM protocol?

- ENUM is part of a general framework whose goal is
  - **"How to find SIP services"**
- The preferred solution is DNS based: the answer tells the IP and ports associated to a SIP URI
- DNS supports two relevant records for this purpose:
  - SRV (Service) record
  - NAPTR (Naming Authority Pointer) record
- Both can be used in combination with ENUM to find SIP services

How to find SIP services?

- Services must be separated from supporting machines
- Alice uses:
  - mailserver.atlanta.com (come mail server)
  - sip-proxy.atlanta.com (come SIP server)
- Correct URIs will only change the prefix for the different services:
  - mailto:alice@atlanta.com
  - sip:alice@atlanta.com
- And not
  - mailto:alice@mailserver.atlanta.com
  - sip:alice@sip-proxy.atlanta.com
- Service loc. is given by SRV records (RFC 2782, Feb. 2000)
  - A domain name is mapped on more services and more machines
- SRV records are used to
  - Differentiate services
  - Replication/Redundancy (multiple SIP proxy)
  - backup (SIP proxy)
  - Transport protocol differentiation (UDP, TCP, TLS over TCP)

What is ENUM useful for?

- Internet URIs:
  - mailto:saverio.niccolini@mymaildomain.org
  - sip:callme@mysipdomain.com

- E.164 telephone numbers:
  - +39 050 2217678
  - +49 6221 563423

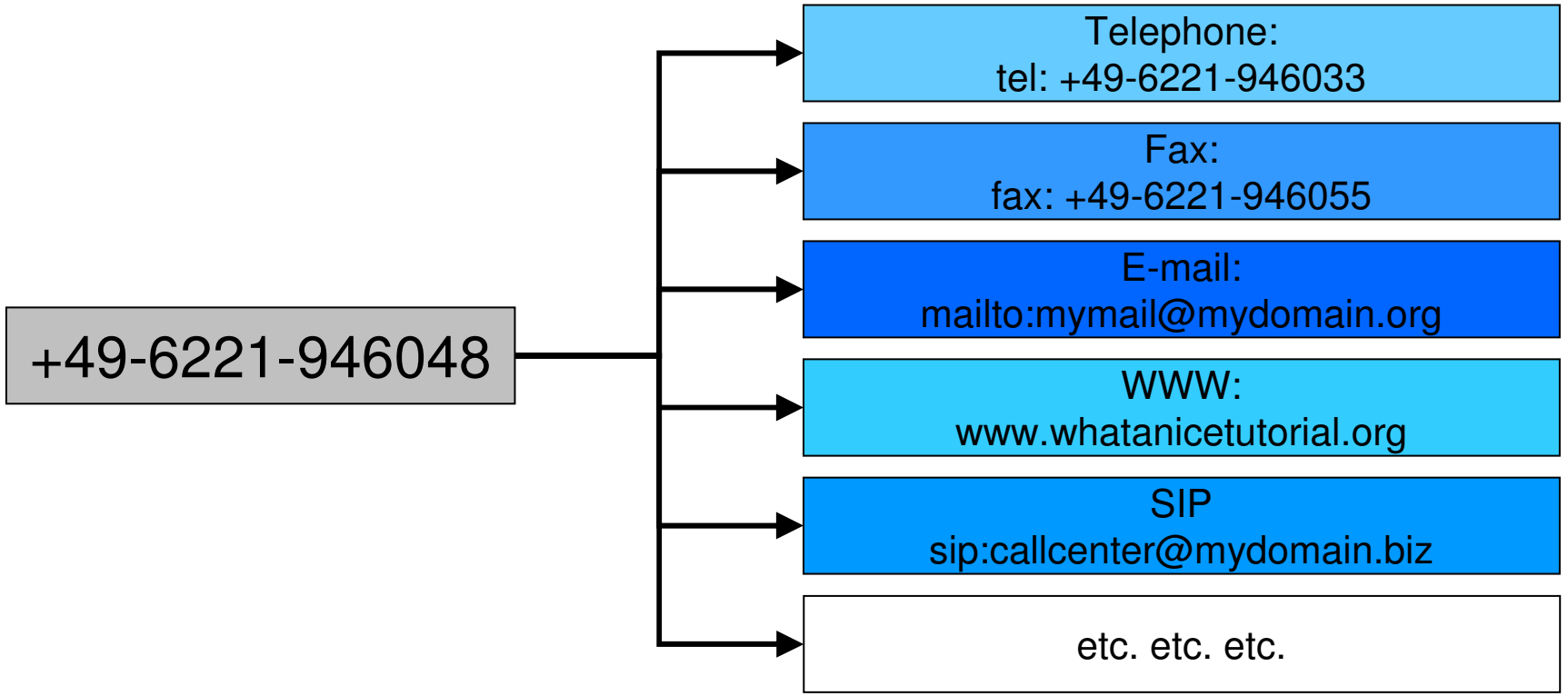
- ENUM role is mapping the two addressing schemes
- ENUM (E.164 Number Mapping) is a standard
  - E.164 numbers are mapped on URI
  - IETF RFC 3761, Apr. 2004
    - The E.164 to Uniform Resource Identifiers (URI) Dynamic Delegation Discovery System (DDDS) Application (ENUM)

ENUM basics

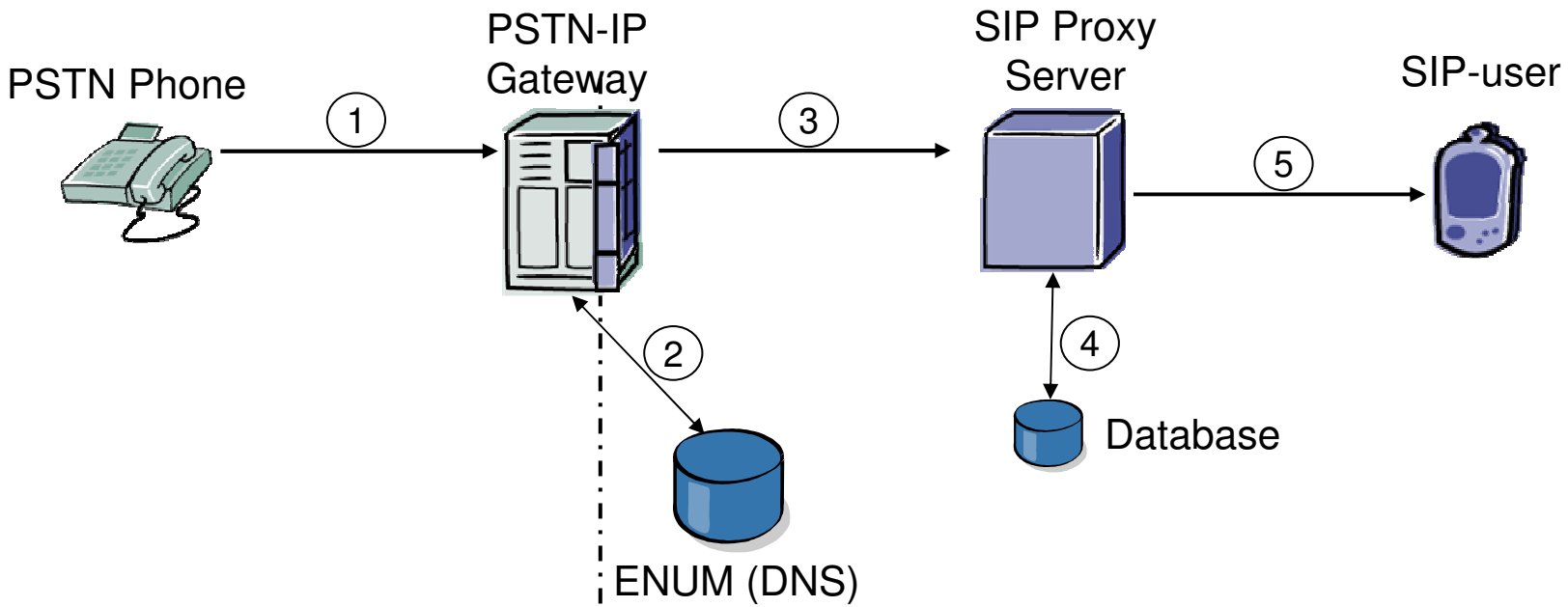
- Start from the plain number
  - +44-207-9460-148 → 442079460148
- Dot-separate numbers
  - 442079460148 → 4.4.2.0.7.9.4.6.0.1.4.8
- Reverse the order
  - 4.4.2.0.7.9.4.6.0.1.4.8 → 8.4.1.0.6.4.9.7.0.2.4.4
- Add ".e164.arpa"
  - 8.4.1.0.6.4.9.7.0.2.4.4 → 8.4.1.0.6.4.9.7.0.2.4.4.e164.arpa
- 8.4.1.0.6.4.9.7.0.2.4.4.e164.arpa is now the DNS entry of the original number
- The DNS entry is used to ask the NAPTR record and SRV records to the DNS service and realize the proper final mapping

ENUM: from a number to a set of services

- ENUM can associate to a single number multiple URI based on the actual service required



ENUM example: from PSTN toa SIP



1. The call wueries the PSTN-IP Gateway (GW)
2. GW searches the ENUM records on DNS and gets the SIP URI of the callee
3. GW forwarde the call to the SIP Proxy Server
4. The SIP Proxy server find the actual location of the callee
5. The call is forwarded to the user

Advanced Networking

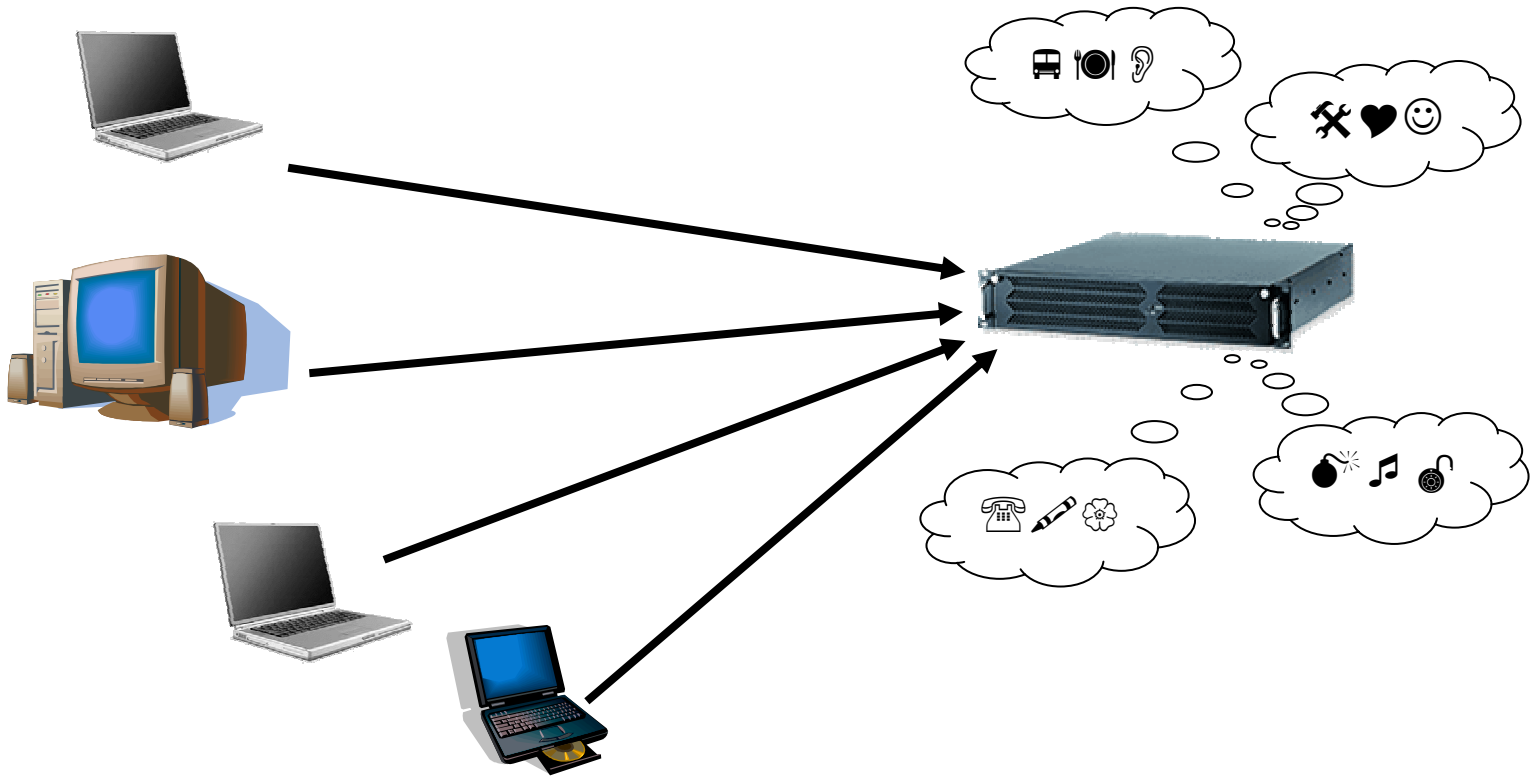
P2P VoIP and Skype

What is Peer-to-Peer (not specific to VoIP)?

- Peer-to-Peer (P2P) paradigm
  - Fundamentally different than client server
  - Nodes cooperate with each other
    - to provide (collectively) the functionality a central server would provide
  - Not all nodes provide all services/know everything, but as a group they do

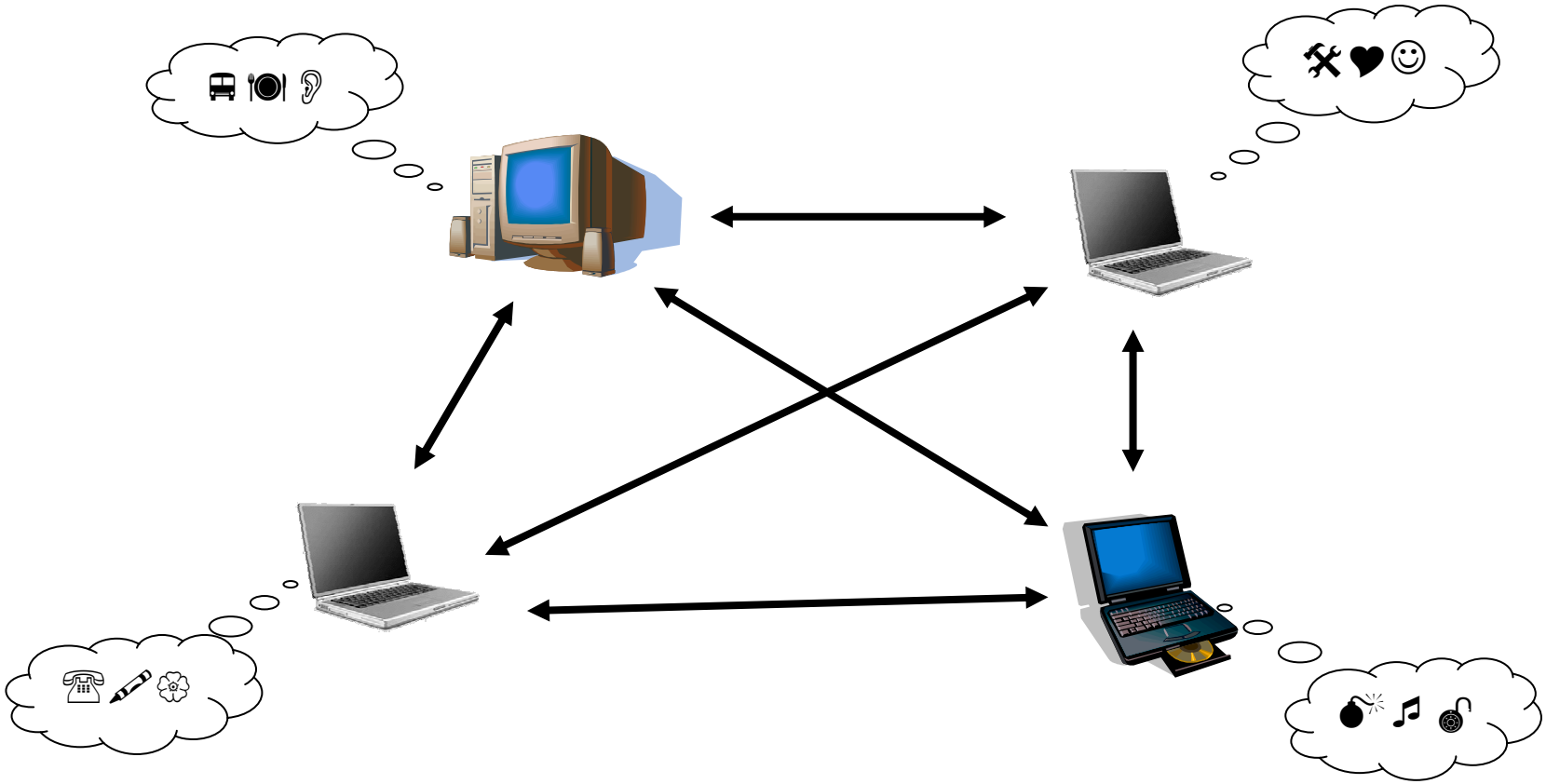
What is Peer-to-Peer (not specific to VoIP)?

Client-Server

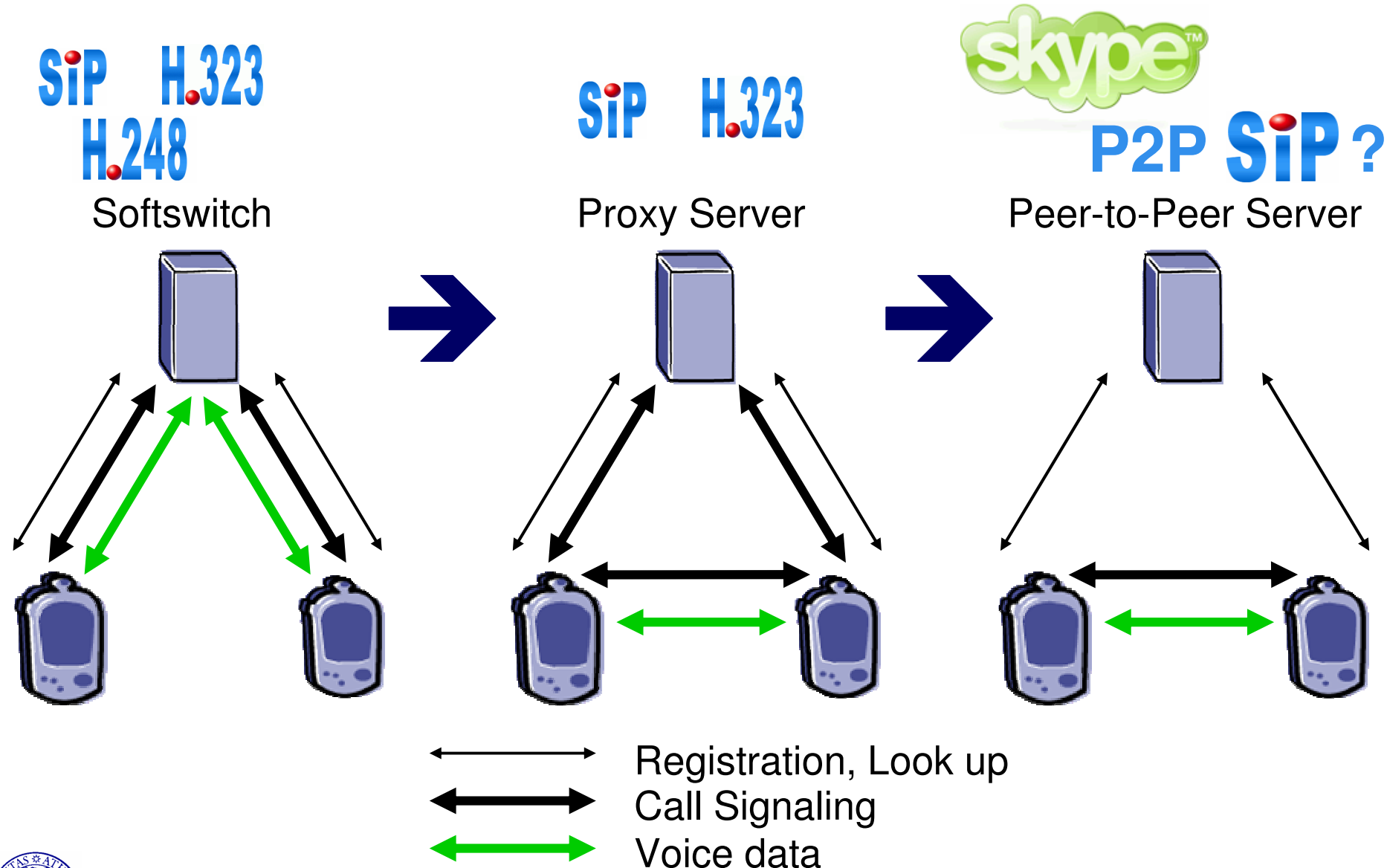


What is Peer-to-Peer (not specific to VoIP)?

Peer-to-Peer



Towards VoIP P2P: Evolution



Why P2P?

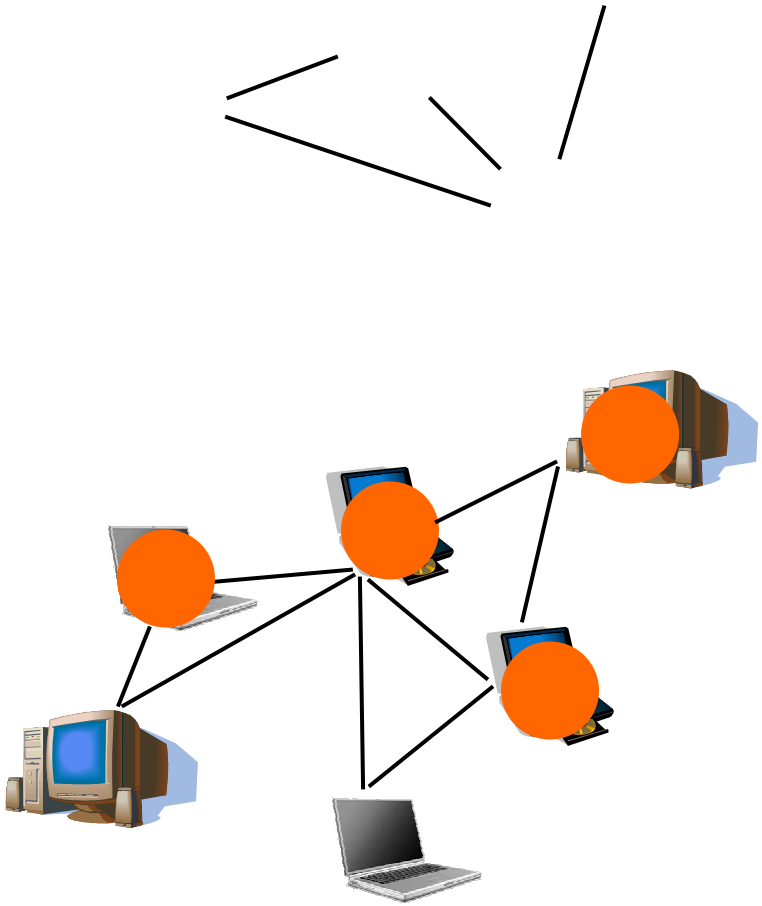
- Infrastructure independence
  - No central servers (up to a a certain limit)
  - Don’t need connectivity (up to a certain limit)
- Simple discovery and setup
- Privacy
- Highly scalable
- Lack of central control
- Dynamic DNS doesn’t offer all of this

P2P Basics

- Most famous instance of P2P is file sharing
  - Each user stores some number of files on the network, ask peers for the file
- Can also share other resources or services, no need to be files
- Connected to each other in a logical network called an overlay

Overlay Network

- **Collection of nodes, connected logically in some way**
- **The connections in the overlay are frequently not related to those in the physical network**



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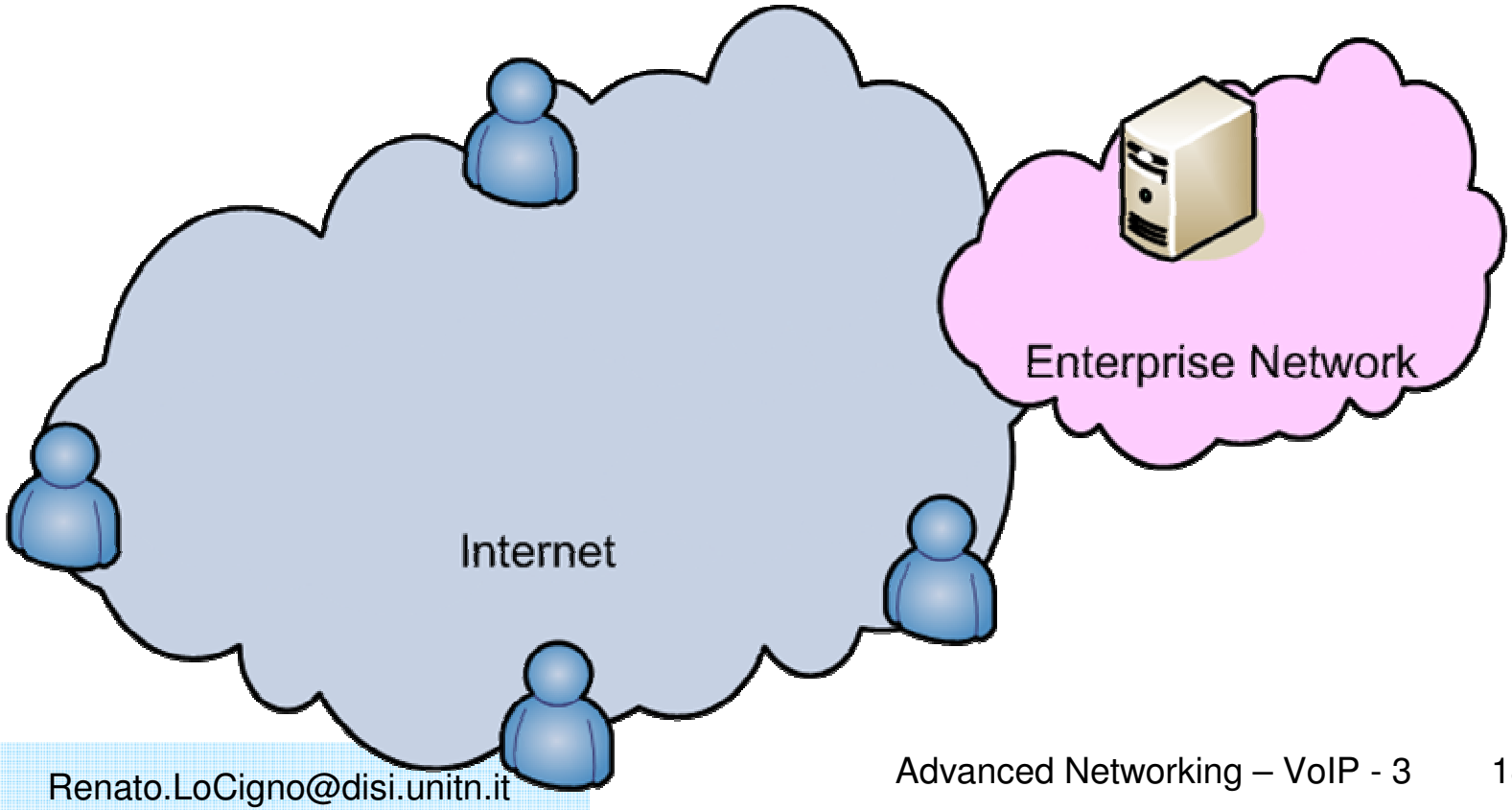
Motivating Cases

- Small deployments
  - Distributed remote office solutions
    - different from centralized VPN
  - Better enforcement of security
  - Lack of resources
- Limited/No Internet connectivity
- Ad-Hoc groups
- Censorship or impeded access
- Large scale decentralized communications
  - Skype (sort of)

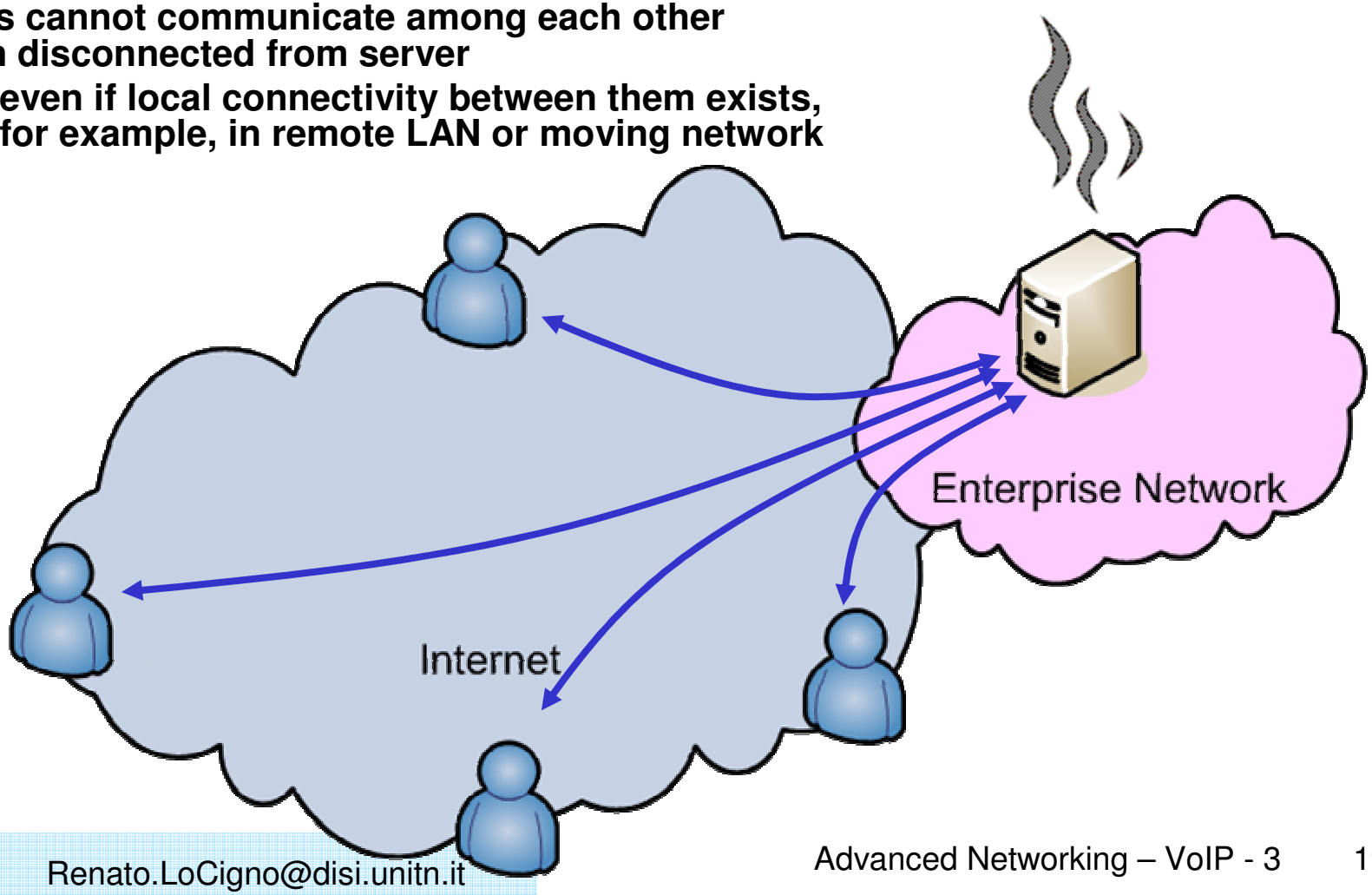
Distributed remote office solutions

- **Road warriors need virtual office network**
- **Collaborative network between employees**
- **Employees need access to company data as well**



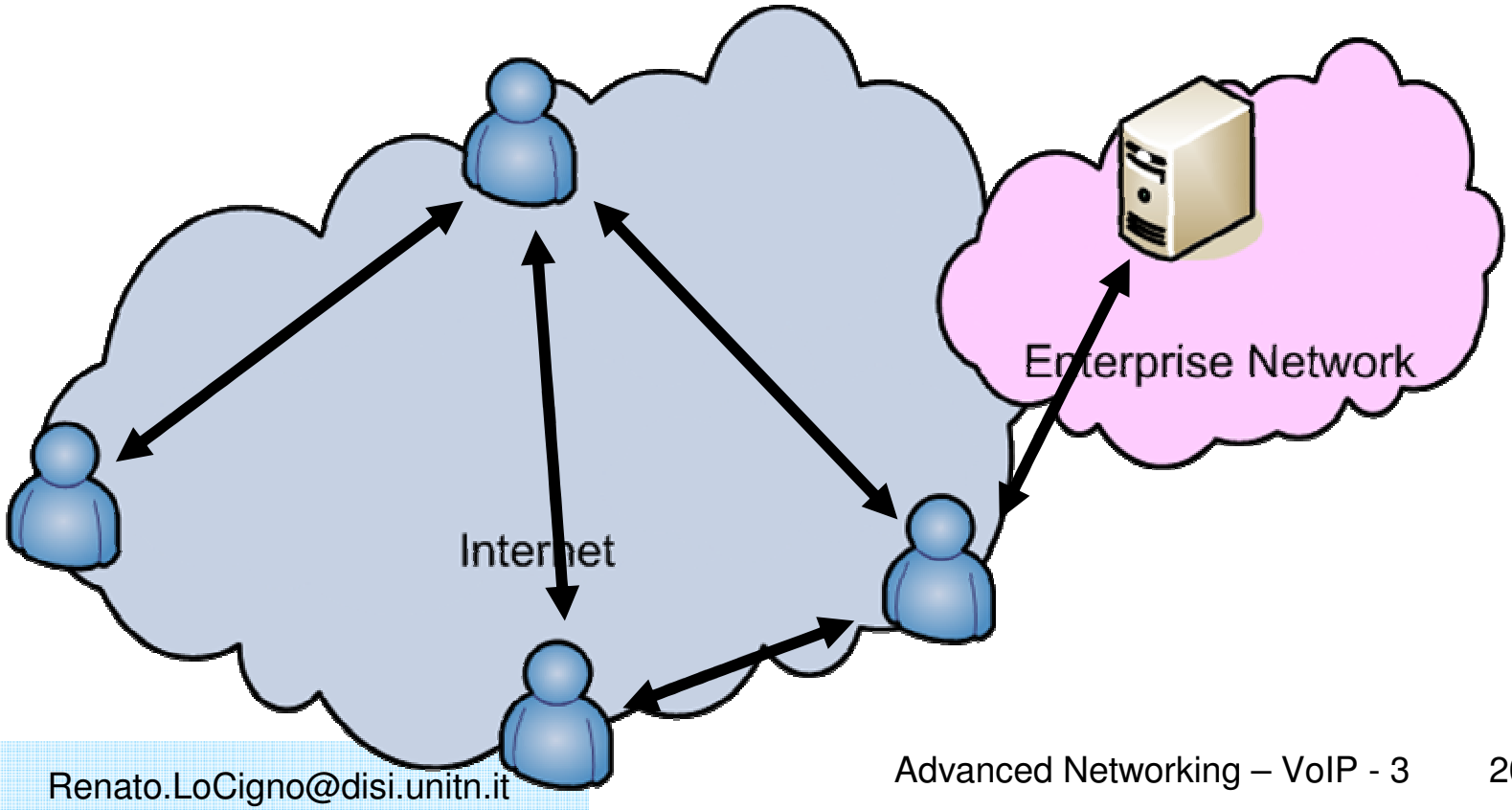
Background: Conventional VPN

- Provides private and secure connections over the public network.
- All users connect to this server: server is data hub.
- Server is bottleneck, server is single point of failure.
- Users cannot communicate among each other when disconnected from server
  - even if local connectivity between them exists, for example, in remote LAN or moving network

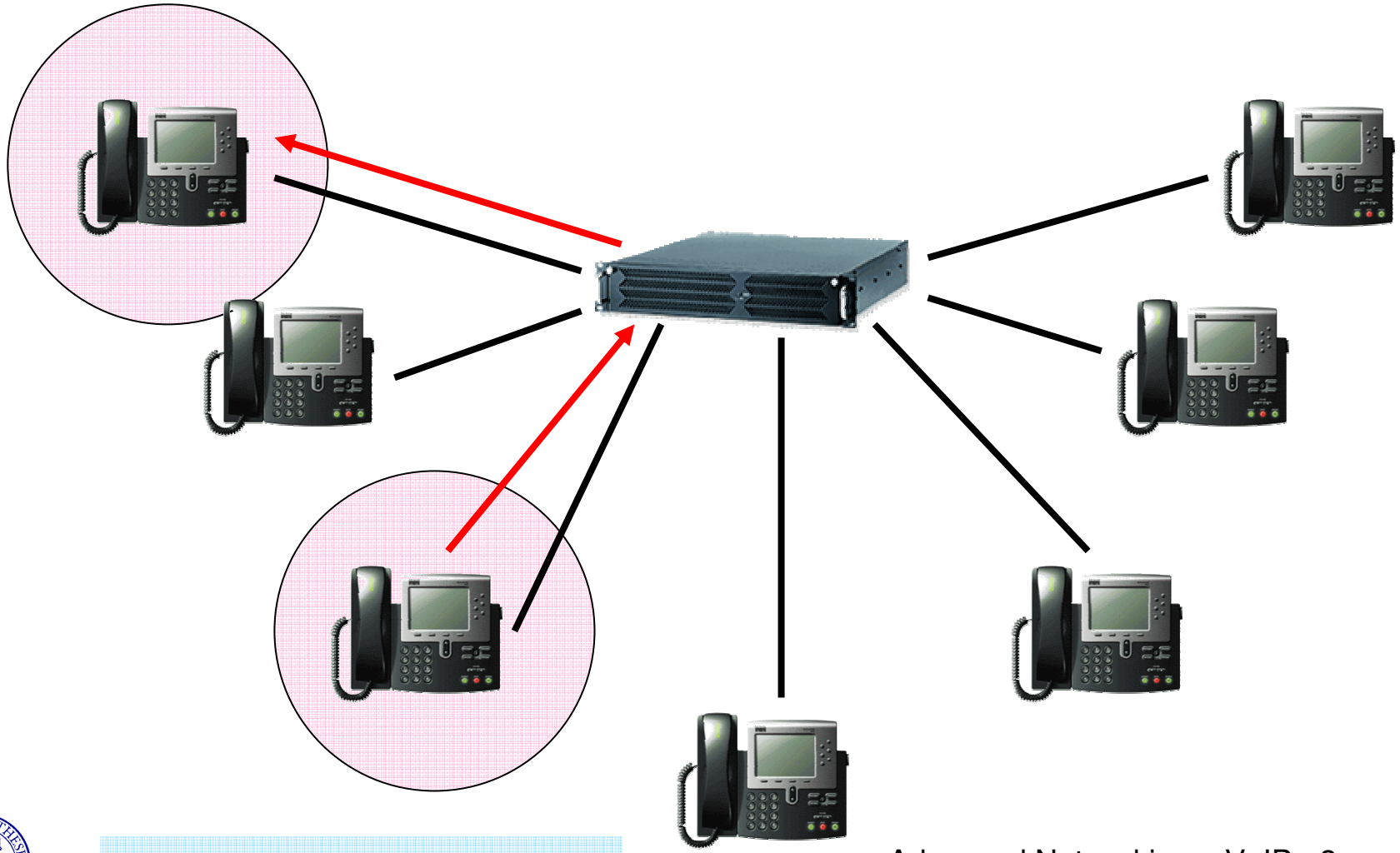


Background: Peer-To-Peer Networks

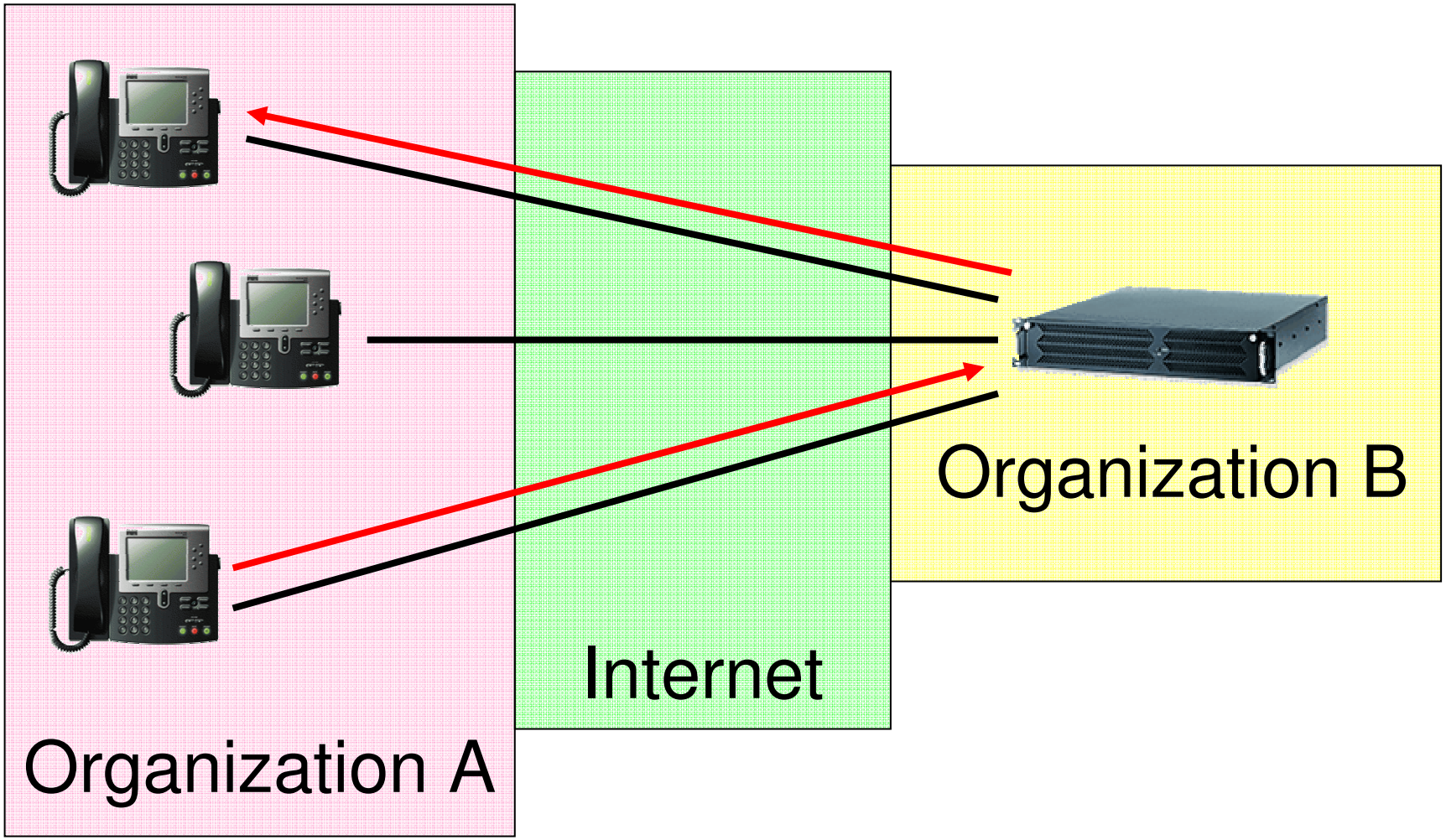
- **flexible network**
- **no data hub**



Client-Server Session



Problem with Remote Server



Related Work

- Skype
  - non-standard
  - not completely P2P
    - so far no completely distributed approach available
- Openwengo
  - open-source software similar to Skype
  - planned use of SIP in future releases
- EarthLink's SIP Share
  - Use SIP messages to perform file sharing
- Other work in this area
  - Columbia University
  - Panasonic
  - standardization effort at IETF for P2P-SIP