SIP for Mobility

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Overview

- next-generation wireless systems

- mobility modes and application-layer mobility

- mobile code

- signaling, inter-domain events and messaging

Third-Generation wireless

- goal: 144 kb/s moving, 384 kb/s stationary, 2 Mb/s indoors

- based on GSM or wideband CDMA

- implement IP(v6) in the hand set

- SIP as signaling system for voice calls in 3GPP

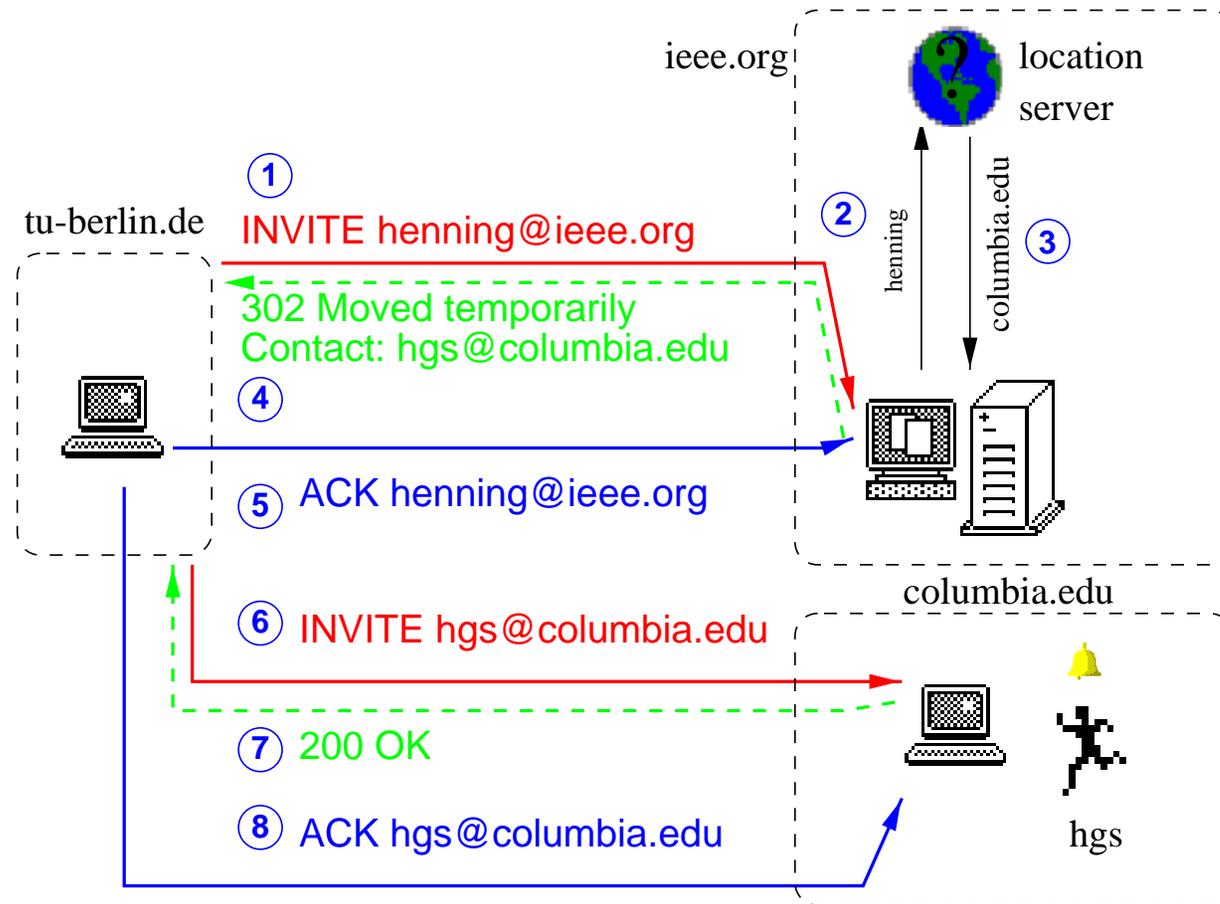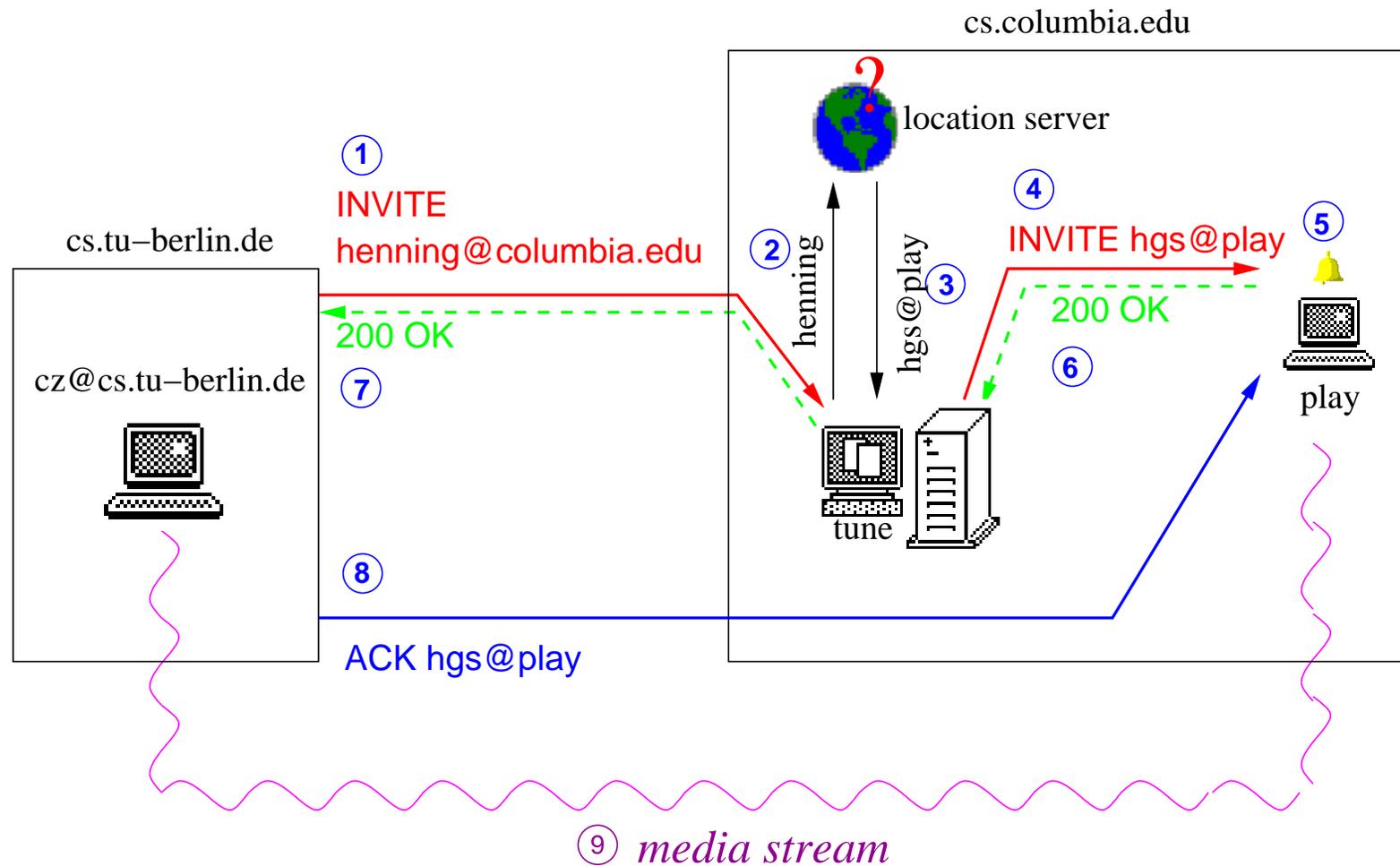- in standardization now, deployment $\approx$ 2003

SIP Components

entity	does	examples
proxy server	forward calls	firewall controller, "call router"
redirect server		"application server"
user agent	end system	SIP phone, gateway, "softswitch"
registrar	location mgt.	mobility support

Roles are changeable, on a request-by-request basis

SIP example: redirection

tu-berlin.de

ieee.org

location server

1 INVITE henning@ieee.org

2 henning

3 columbia.edu

302 Moved temporarily
Contact: hgs@columbia.edu

4

5 ACK henning@ieee.org

columbia.edu

6 INVITE hgs@columbia.edu

7 200 OK

8 ACK hgs@columbia.edu

hgs

SIP example: proxying

cs.columbia.edu

location server

1

INVITE
henning@columbia.edu

cs.tu−berlin.de

2 henning

hgs@play **3**

4

5

INVITE hgs@play

cz@cs.tu−berlin.de

200 OK

7

200 OK

6

play

8

ACK hgs@play

tune

9 *media stream*

SIP forking proxies

macrosoft.com

bob@b.macrosoft.com

a.wonderland.com

INVITE bob@b

INVITE sales@macrosoft.com

CANCEL bob@c

INVITE carol@c

carol@c.macrosoft.com

ACK

200 OK

BYE carol@c.macrosoft.com

200 OK

Mobility in an IP environment

Roaming users: logging in away from home network: hotel, home office

Terminal mobility: terminal moves between subnets

Personal mobility: different terminals, same address

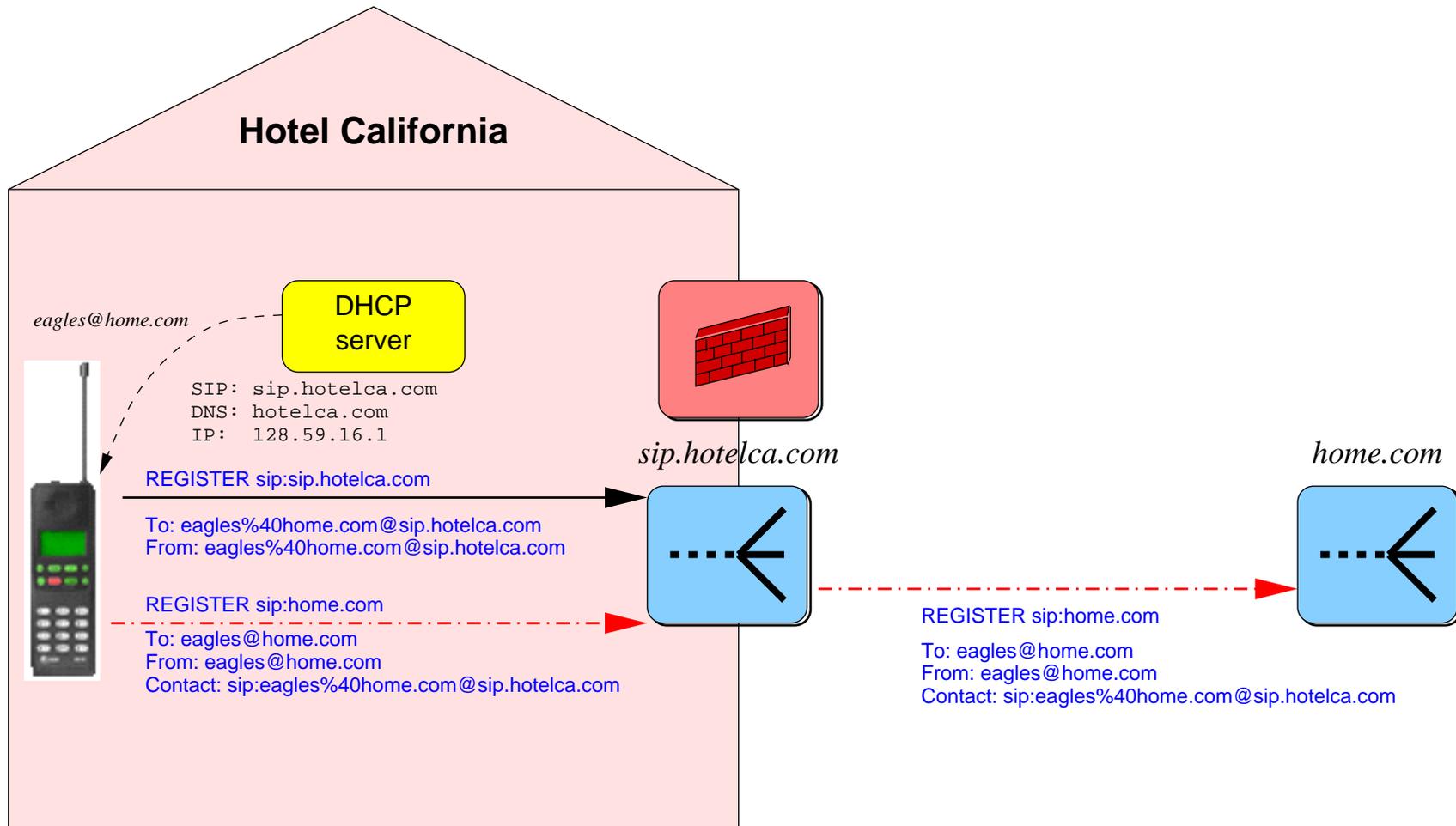**Service mobility:** keep same services while mobile

Session mobility: move active session between terminals
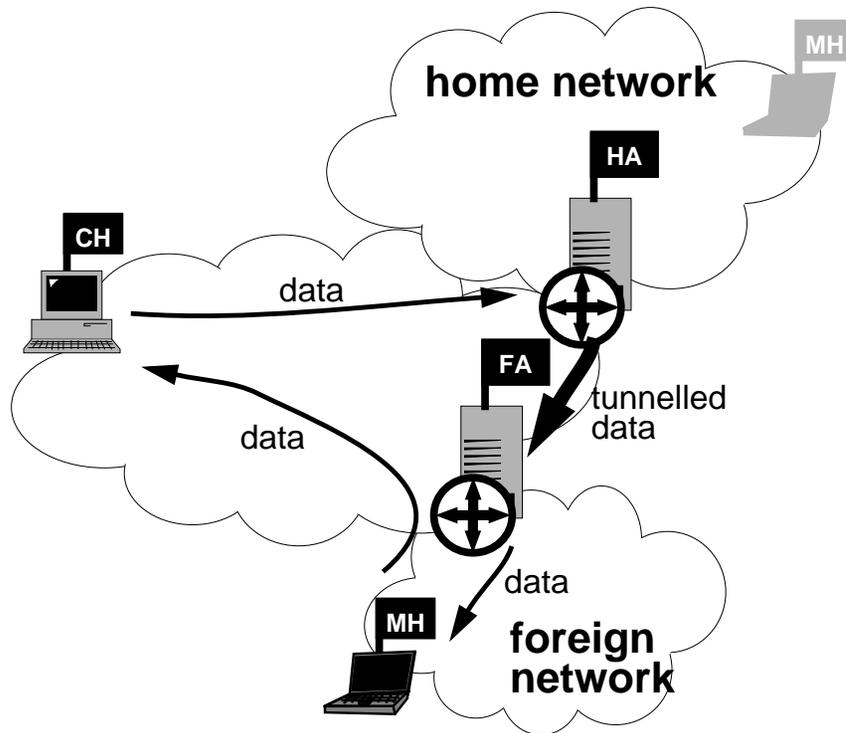
Simple mobility: roaming users

- users visit other networks: laptop, PDA, hotel phone, ...

- want to maintain external identity

- usually, just pass IP address to home registrar

- difficult if firewalls and NATs

  - requests need to use local proxy

  - thus, need to register locally

Roaming Users – Dual Registration

Hotel California

eagles@home.com

DHCP
server

SIP: sip.hotelca.com
DNS: hotelca.com
IP: 128.59.16.1

sip.hotelca.com

home.com

REGISTER sip:sip.hotelca.com

To: eagles%40home.com@sip.hotelca.com
From: eagles%40home.com@sip.hotelca.com

REGISTER sip:home.com

To: eagles@home.com
From: eagles@home.com
Contact: sip:eagles%40home.com@sip.hotelca.com

REGISTER sip:home.com

To: eagles@home.com
From: eagles@home.com
Contact: sip:eagles%40home.com@sip.hotelca.com

Terminal mobility – mobile IP

home network

MH

HA

CH

data

FA

tunnelled
data

data

data

MH

foreign
network

MH   mobile host

CH   correspondent host

HA   router with home agent
      functionality

HA   router with foreign agent
      functionality

Terminal mobility – mobile IP difficulties

- domain of IEEE 802.11 (link layer), 3GPP (radio access network), mobile IP (network layer), ...

- network-layer mobility has problems:

  – lack of deployment – home provider has no interest

  – need two addresses – home and visiting

  – dog-legged routing in IPv4

  – may not work with IP address filtering except through triangle routing

  – encapsulation overhead for voice: 8–20 bytes/packet for a 50-byte payload
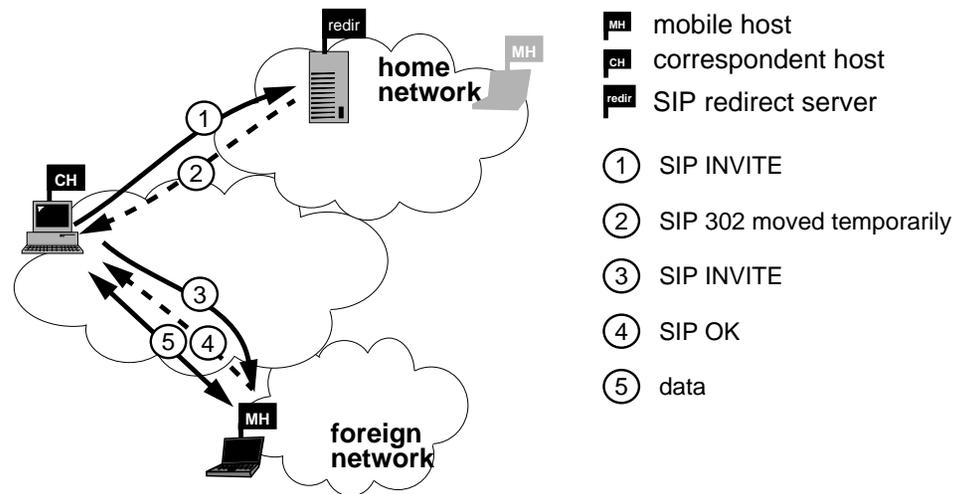
  – authentication of redirection

SIP terminal mobility overview

- pre-call mobility ⇒ SIP proxy, redirect

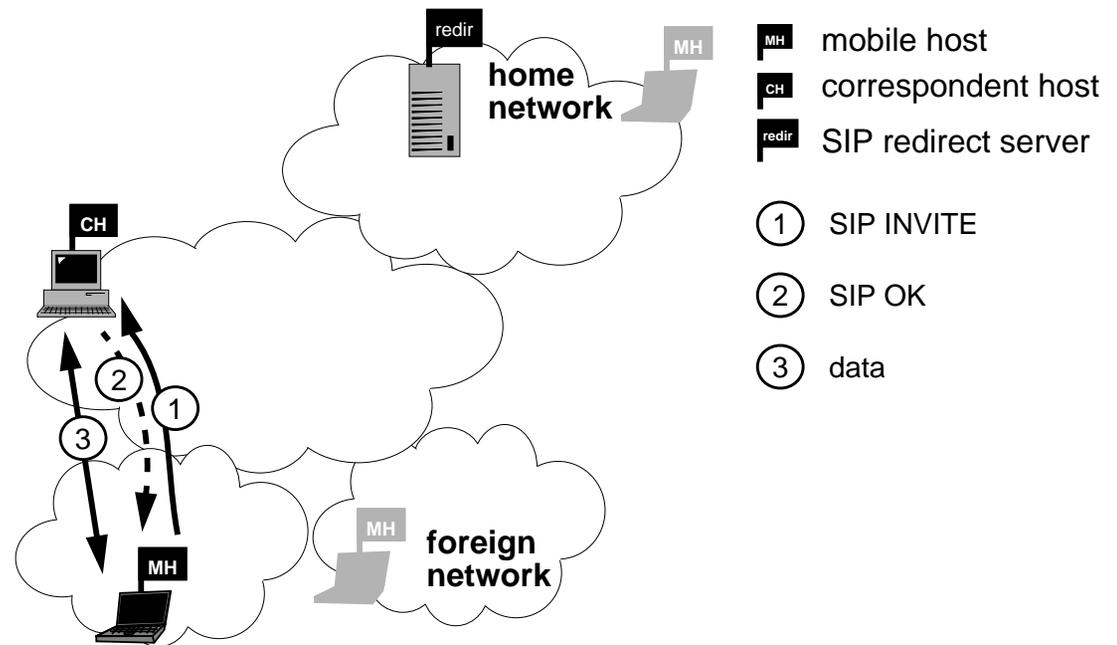- mid-call mobility ⇒ SIP re-INVITE, RTP

- recovery from disconnection

SIP terminal mobility: pre-call

- MH acquires IP address via DHCP

- optional: MH finds SIP server via multicast REGISTER

- MH updates home SIP server – deregister old, register new
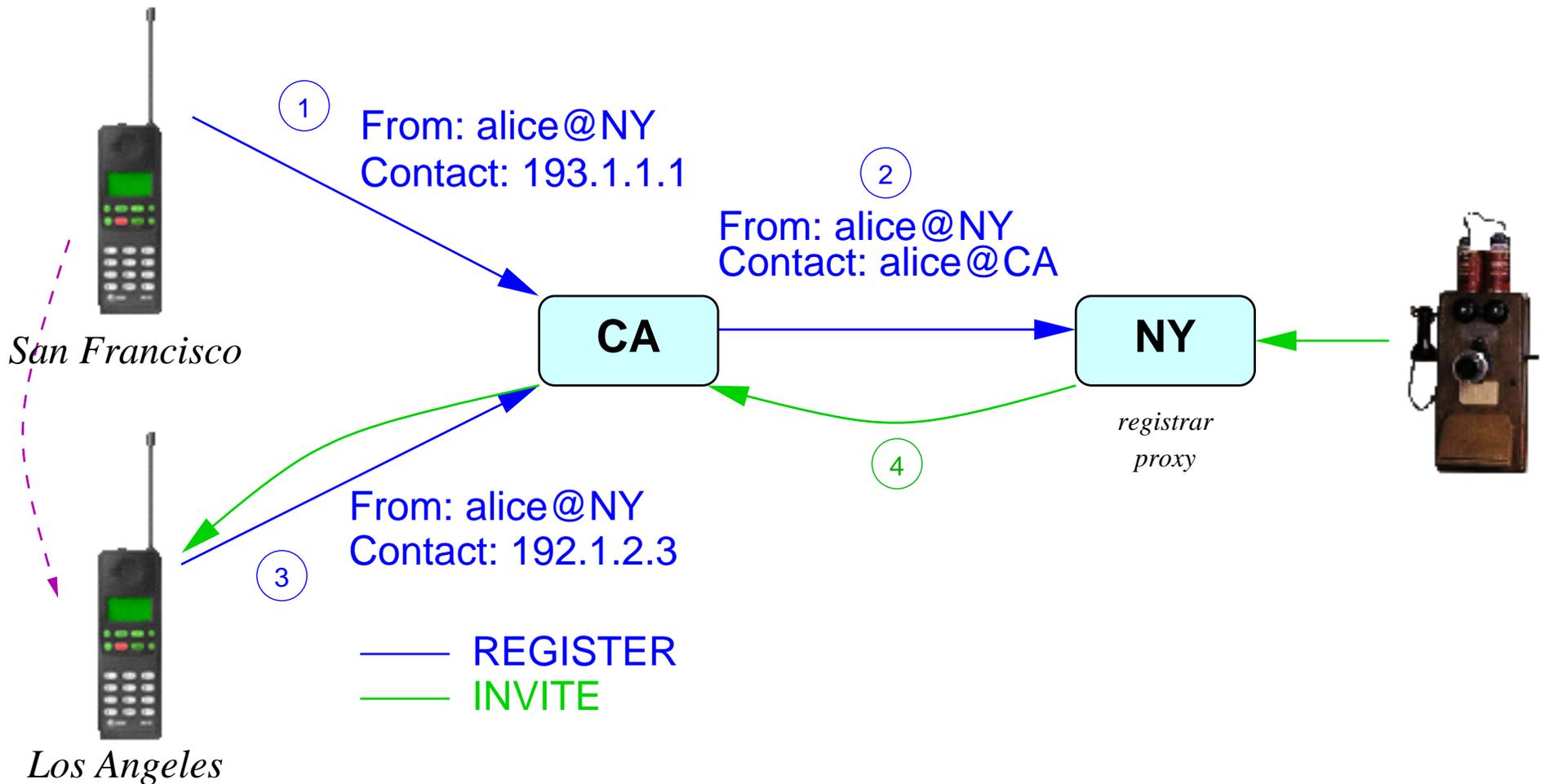
- optimization: hierarchical LR (later)

MH	mobile host
CH	correspondent host
redir	SIP redirect server
①	SIP INVITE
②	SIP 302 moved temporarily
③	SIP INVITE
④	SIP OK
⑤	data

SIP terminal mobility: mid-call

- MH→CH: new INVITE, with Contact header and updated SDP

- re-registers with home registrar
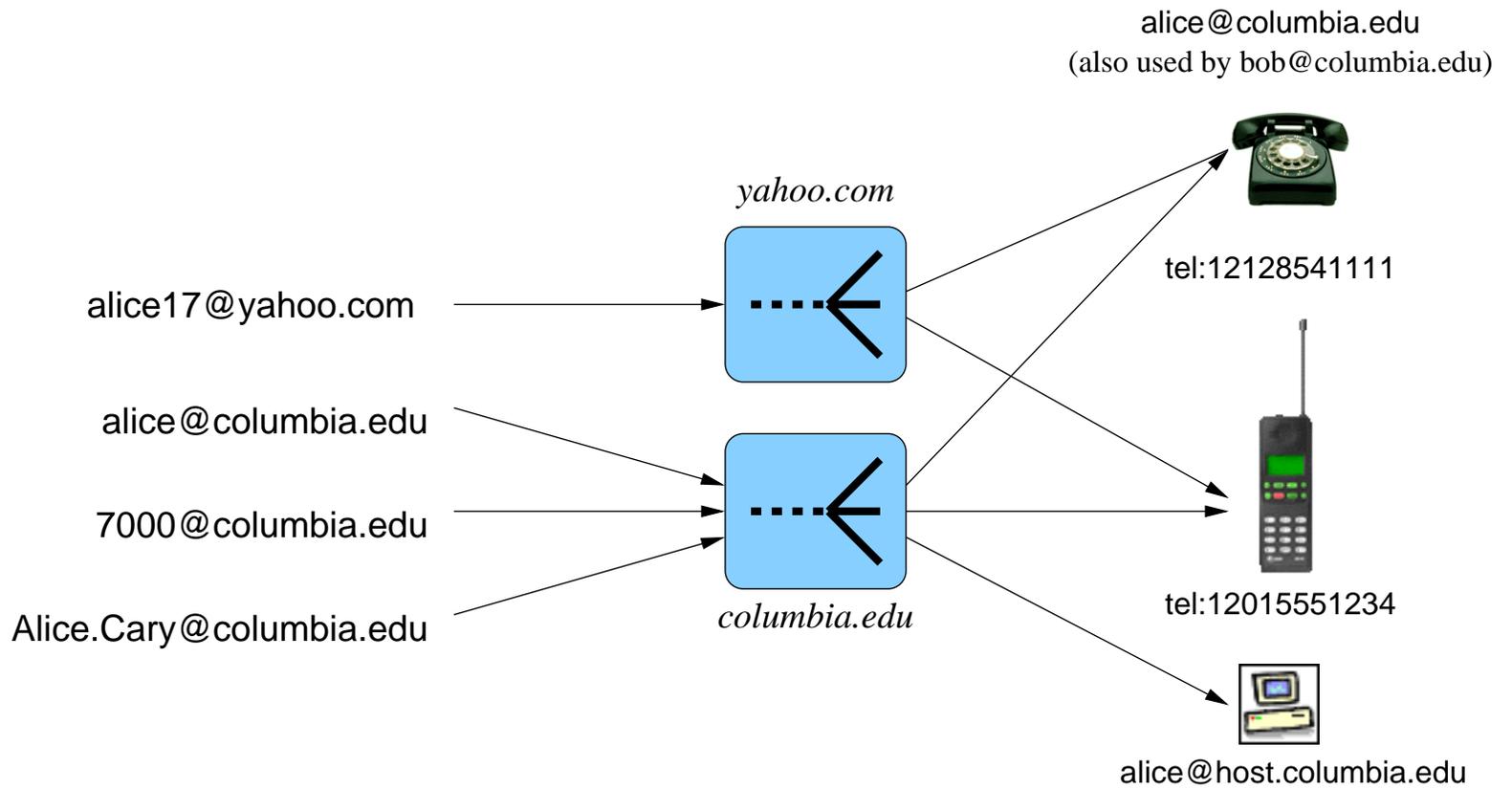
- requires one one-way delay

redir

home network

MH

CH

②

①

③

MH

MH

foreign network

MH	mobile host
CH	correspondent host
redir	SIP redirect server

① SIP INVITE

② SIP OK

③ data

SIP terminal mobility: multi-stage registration

Don't want to bother home registrar with each move

From: alice@NY
Contact: 193.1.1.1

From: alice@NY
Contact: alice@CA

San Francisco

CA

NY

registrar
proxy

From: alice@NY
Contact: 192.1.2.3

REGISTER
INVITE

Los Angeles

Personal mobility

alice@columbia.edu
(also used by bob@columbia.edu)

yahoo.com

alice17@yahoo.com

tel:12128541111

alice@columbia.edu

7000@columbia.edu

columbia.edu

Alice.Cary@columbia.edu

tel:12015551234

alice@host.columbia.edu

Personal mobility

- switch between PDA, cell phone, PC, Ethernet phone, Internet appliance, …

- several "generic" addresses, one person/function, many terminals

- e.g., `tel:2129397042`, `hgs@cs.columbia.edu`,
  `schulzrinne@yahoo.com` or `support@acme.com`

- SIP is designed for that – proxying and redirection does translation

- but: need mapping mechanisms to recognize registrations as belonging to the
  same person

- some possible solutions:

  - dip into LDAP personnel database or `/etc/passwd` to match phone number
    and variations of name (*J.Doe*, *John.Doe*, *Doe*)

  - need dialing plan to recognize `7042@cs.columbia.edu` and
    `tel:2129397042` as same

Service mobility

Examples:

- speed dial & address book

- media preferences

- special feature buttons (voice mail, do-not-disturb)

- incoming call handling instructions

- buddy lists

- features in home provider server

$\longrightarrow$ independent of terminal (including pay phone!), across providers

Service mobility

- REGISTER can retrieve configuration information (e.g., speed dial settings, distinctive ringing or voice mail settings)

- but needs to be device-independent

- most such services (e.g., voicemail forwarding, call filtering) should remain on server(s)

- use SIP Route mechanism to direct path of outgoing calls via home server

  ```
  Route: <sip:alice@home.net>, <sip:alice@services-r-us.com>
  ```

Service mobility – call handling

- need uniform basic service description model $\longrightarrow$ Call Processing Language (CPL)

- CPL for local call handling

- update CPL from terminal: add telemarketer to block list

- harder: synchronize CPL changes across multiple providers

- one possibility: REGISTER updates information, but device needs to know that it has multiple identities

- merging of call logs

SIP and mobility: issues

- doesn't work for TCP applications – solutions:

  - punt: "don't type and drive"

  - application-layer awareness: restart web, email, ftp transfer – need for deep fade anyway...

  - TCP redirect (Snoeren/Balakrishnan)

  - NAT-style boxes controlled by SIP (see Telcordia ITSUMO project)

- fast hand-off via SIP proxies with media translators

- but: works nicely for "vertical handoff" between different technologies - e.g., transfer call from mobile handset to office videophone when arriving at work

Conclusion

- uniform solution for wired and wireless multimedia terminals

- network-layer mobility neither sufficient nor available

- many common services don't need network-layer support

- application-layer mobility for sessions

- one SIP-based approach for multimedia sessions, presence & events