Personal Mobility Management for SIP-based VoIP Services

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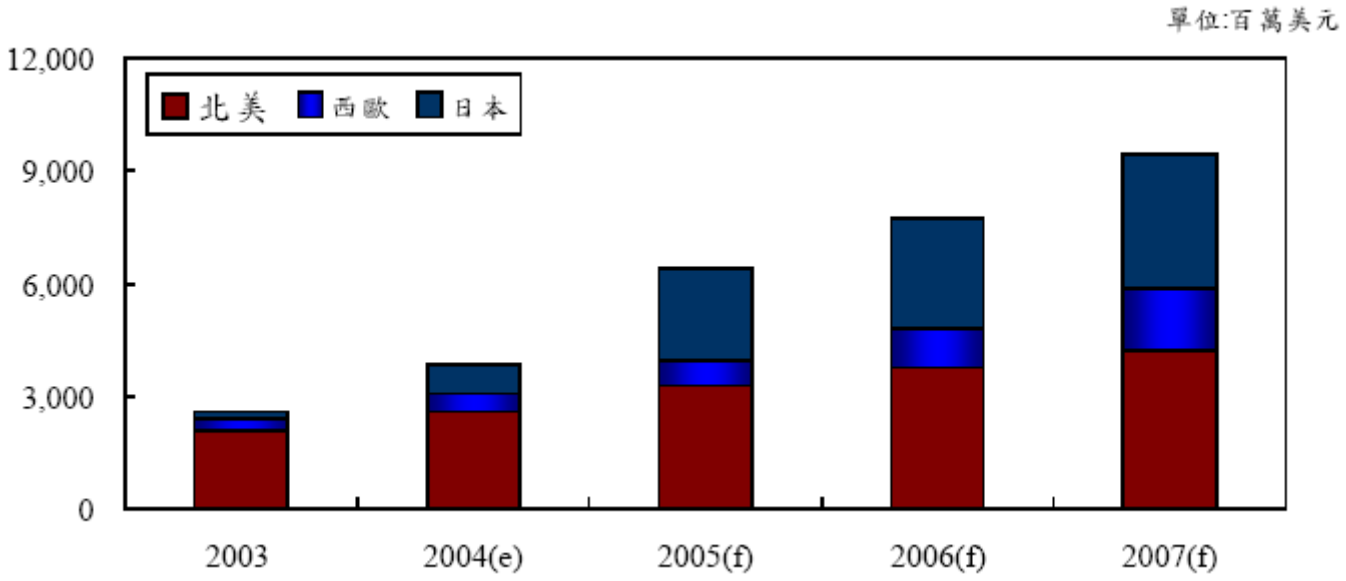
Prepare Yourslef (1)

- 微軟認為好的人才必須具備三個條件
  - 數學好
  - 程式寫的好
  - 態度好
- Google希望網羅的人才
  - 懂得做研究
  - 又會動手寫程式的人才

Prepare Yourself (2)

- At the right time, do the right thing
- Simulation expertice helps
- 努力必有所成

At the right time, do the right thing



2003年全球VoIP企業市場營收約達26億美元。預估至2007年，可達95億美元，成長率達227%。全球企業用戶市場營收也將突破100億美元（資料來源:工研院IEK（2004/10))

Outline

- Introduction
- Voice over IP
- Session Initiation Protocol (SIP)
- Mobility Management
  - Network Layer Solution:
  - Application Layer Solution: SIP
- Personal Mobility Management
- Challenges

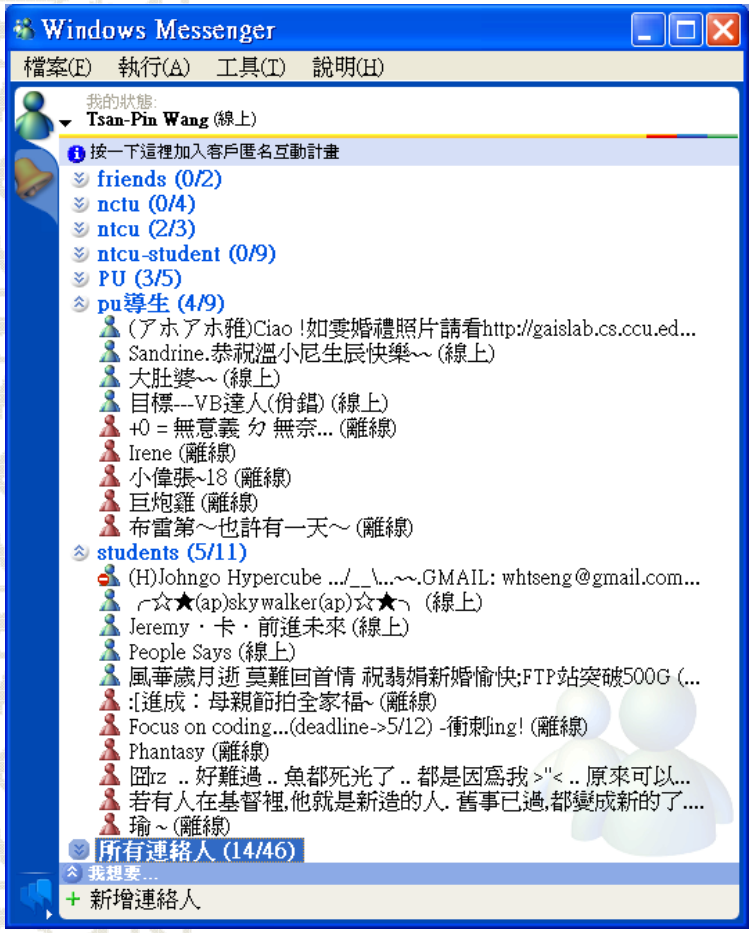
Voice over IP (VoIP)

- VoIP is likely to be a killer application in the convergence of IP-based Internet and mobile cellular networks.
- Why use IP for voice?
  - Lower equipment cost
  - Lower operating expense
  - Integration of voice and data
  - Widespread availability of IP

VoIP Standards

- H.323, ITU-T recommendation, is too complicated to evolve in practice
- Session Initiation Protocol (SIP) is an alternative to H.323
  - More flexible, simpler, and promising

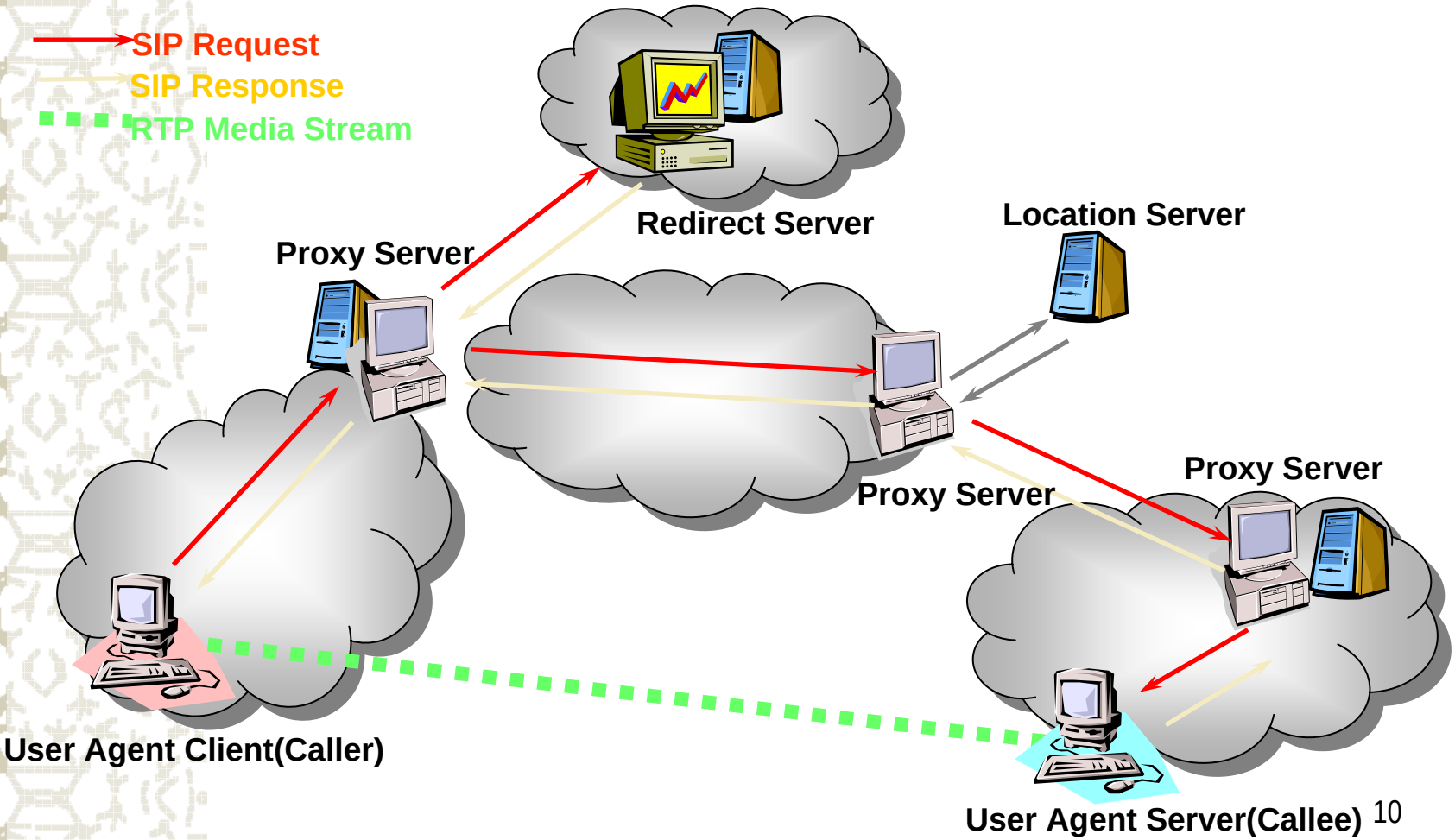
VoIP Applications



SIP Overview

- Developed in SIP Working Group in IETF
  - Proposed standard RFC2543, February 1999
  - New Version of SIP - RFC 3261, June 2002
  - Work began in 1995
  - Split from MMUSIC (Multiparty Multimedia Session Control), Sep. 1999
- Main functions
  - Invite users to sessions
  - Find the user's current location
  - Carry session descriptions
  - Modification of sessions
  - Termination of sessions

SIP Architecture



SIP Methods

- Methods
  - INVITE, ACK, OPTIONS, BYE, CANCLE, REGISTER
- INVITE
  - Initiate a session
  - Information of the calling and called parties
  - ～IAM (initial address message) of ISUP
- REGISTER
  - Log in and register its address with a SIP server
  - Can register with multiple servers
  - Can have several registrations with one server

Registration

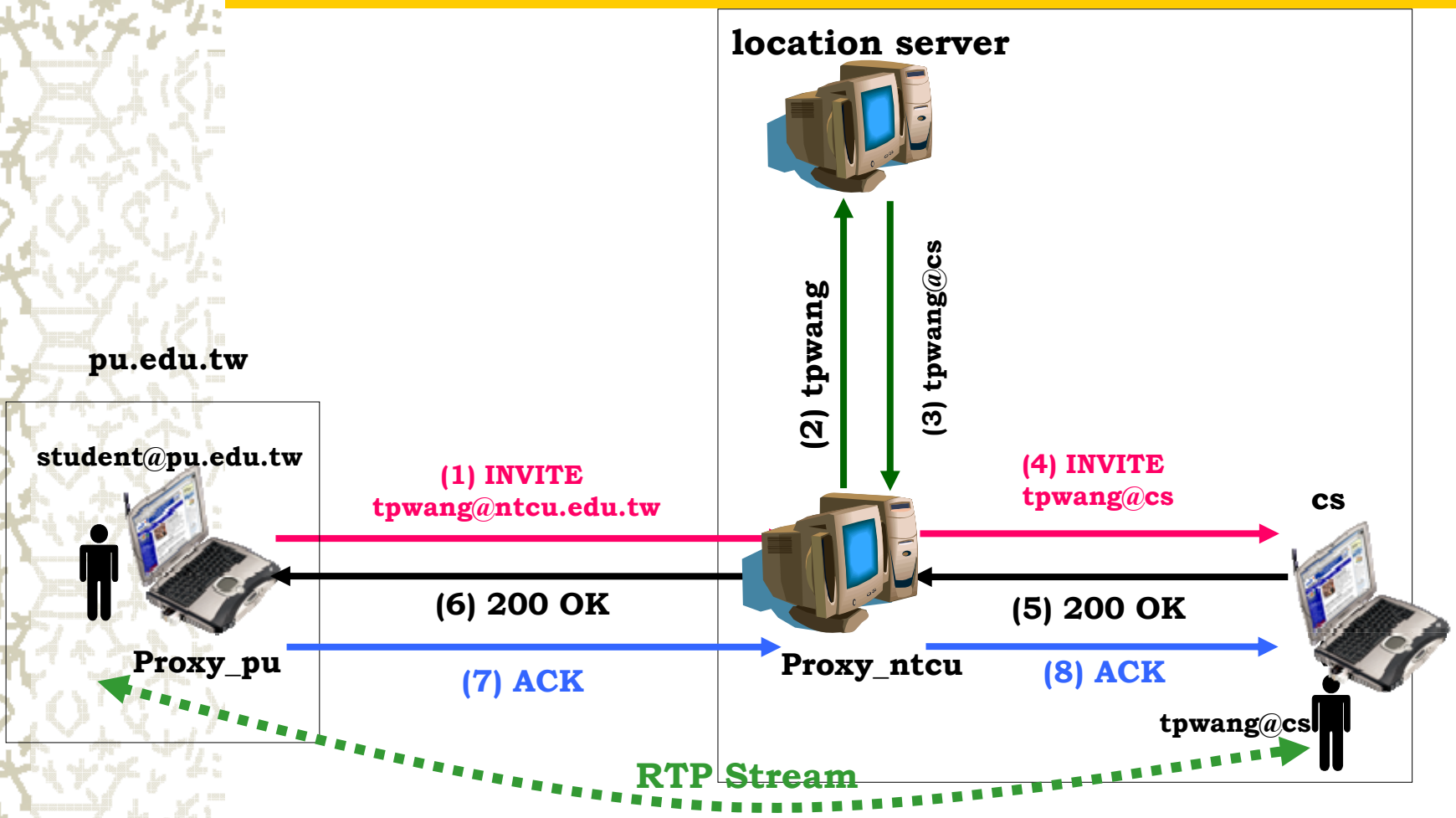
tpwang@cs.ntcu.edu.tw

Registrar

REGISTER sip:registra.ntcu.edu.tw SIP/2.0
Via: SIP/2.0/UDP cs.ntcu.edu.tw
Max-Forwards: 70
From:sip:tpwang@ntcu.edu.tw
To:sip:tpwang@ntcu.edu.tw
Call-ID: 123456@cs.ntcu.edu.tw
CSeq: 1 REGISTER
Contact: sip:tpwang@cs.ntcu.edu.tw
Expires: 7200
Content-Length: 0

SIP/2.0 200 OK
Via: SIP/2.0/UDP cs.ntcu.edu.tw
From:sip:tpwang@ntcu.edu.tw
To:sip:tpwang@ntcu.edu.tw
Call-ID: 123456@cs.ntcu.edu.tw
CSeq: 1 REGISTER
Contact: sip:tpwang@cs.ntcu.edu.tw
Expires: 3600
Content-Length: 0

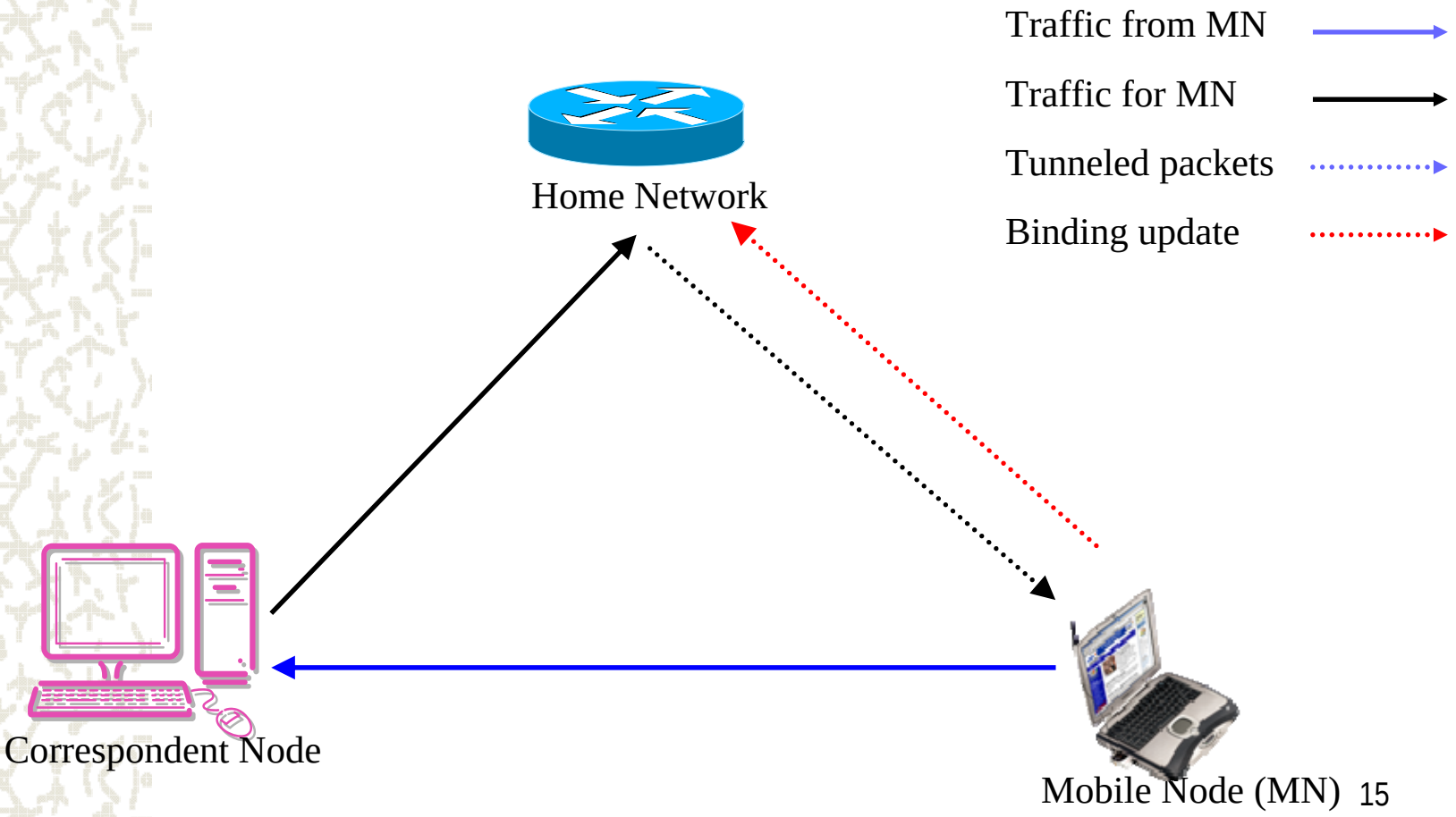
SIP Call Setup



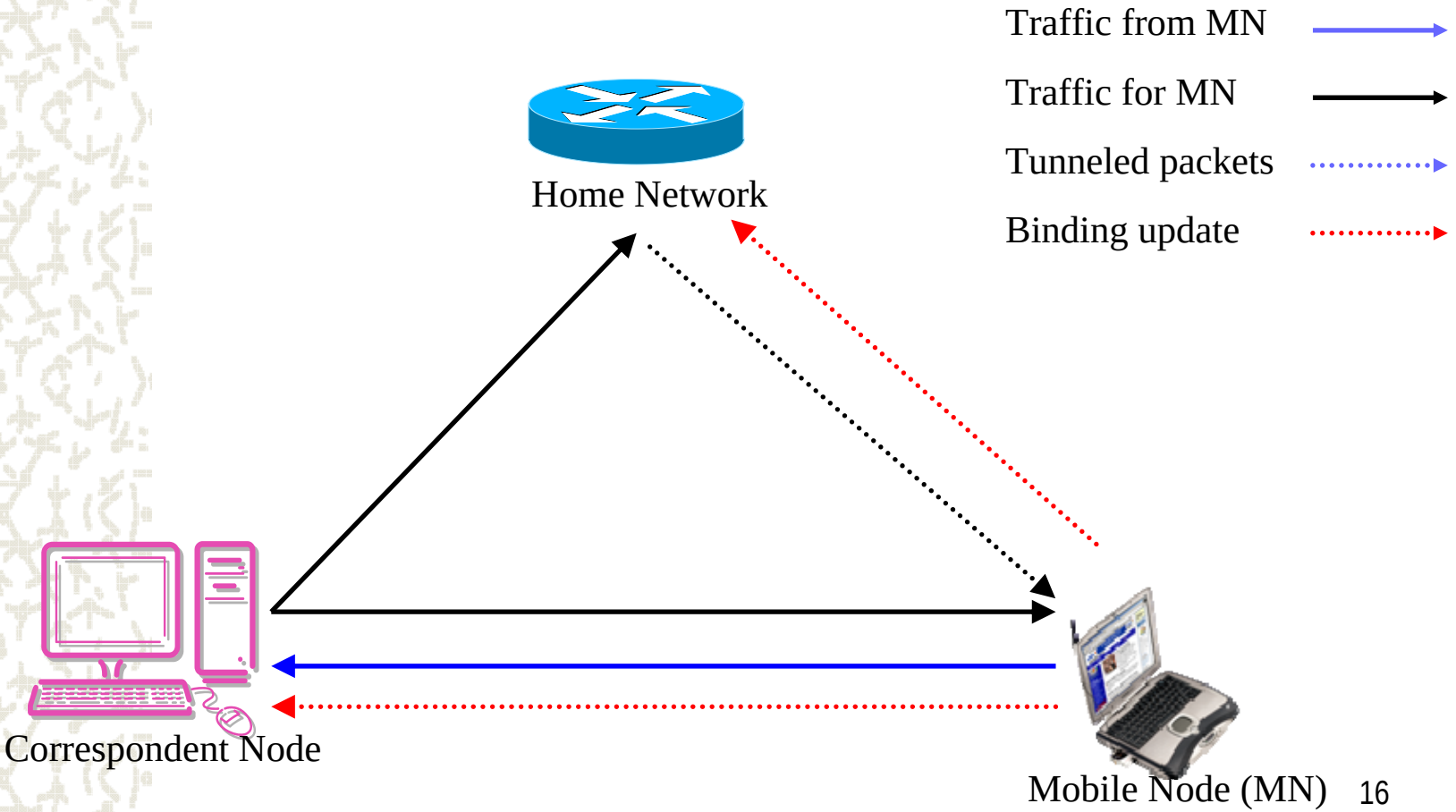
Mobility Management

- Network layer solution
  - Mobile IP
  - Mobile IPv6
- Application layer solution
  - SIP

Triangle Routing in Mobile IP



Route Optimization in Mobile IPv6



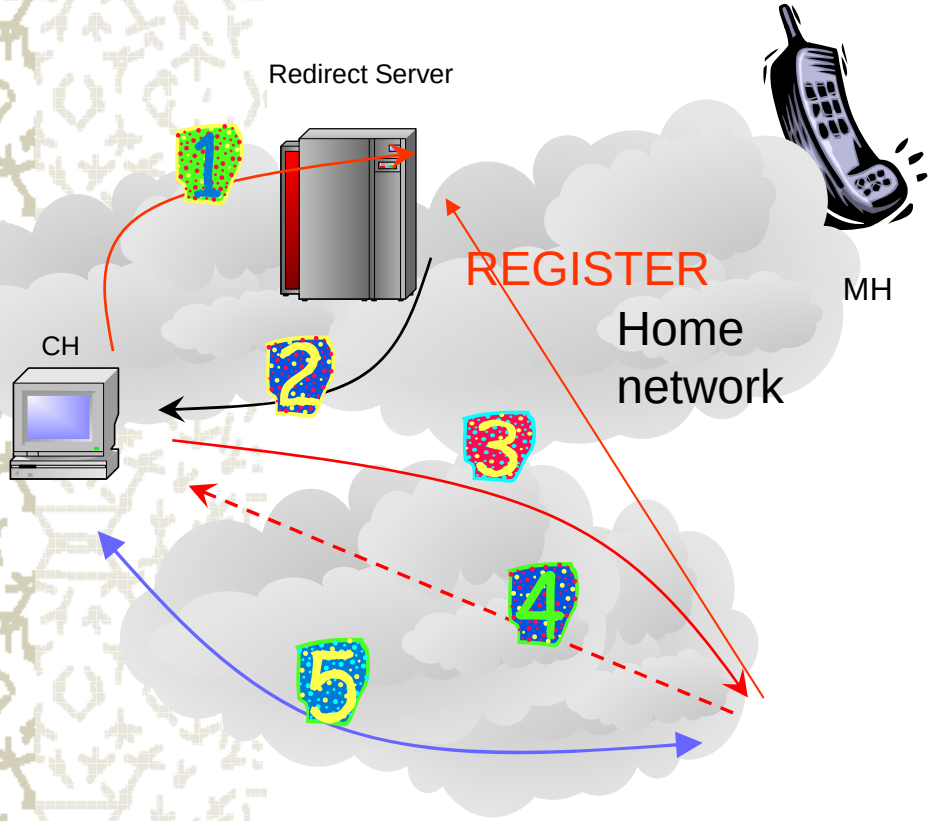
SIP Application-layer Mobility

- Terminal mobility
- Session mobility
- Service mobility
- Personal mobility

Terminal Mobility

- Allows a device to
  - move between subnets while being reachable to other hosts (Pre-call mobility)
  - continue any ongoing session while on the move (Mid-call mobility)
- Solutions
  - Pre-call mobility using REGISTER
  - Mid-call mobility using re-INVITE

Pre-call Mobility



1 SIP INVITE

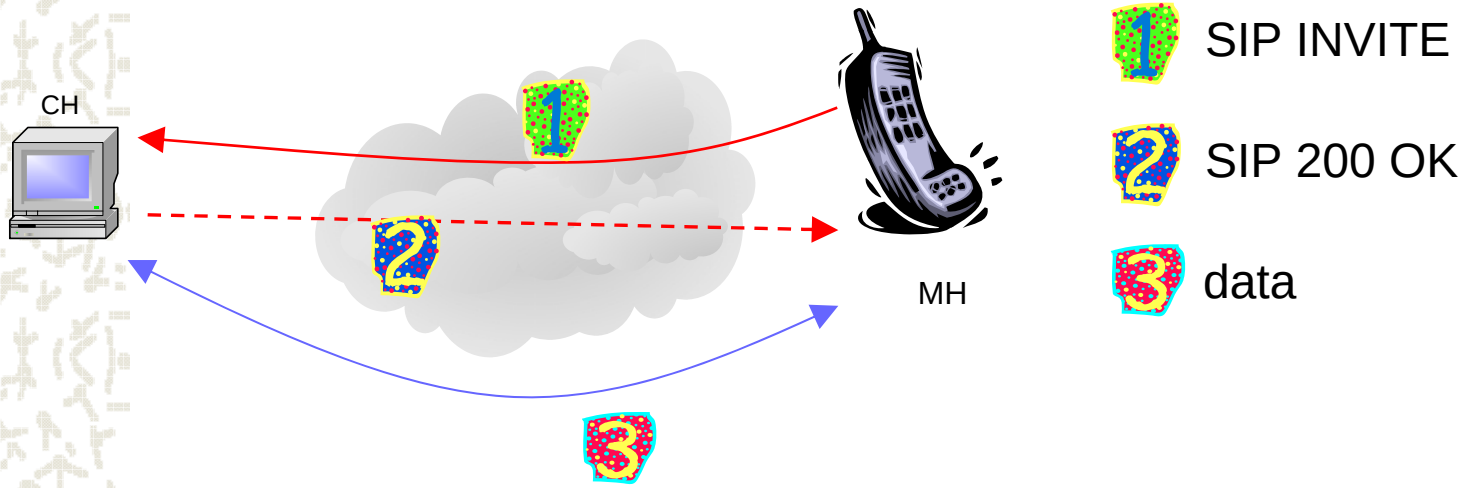
2 SIP 302 temporarily

3 SIP INVITE

4 SIP 200 OK

5 data

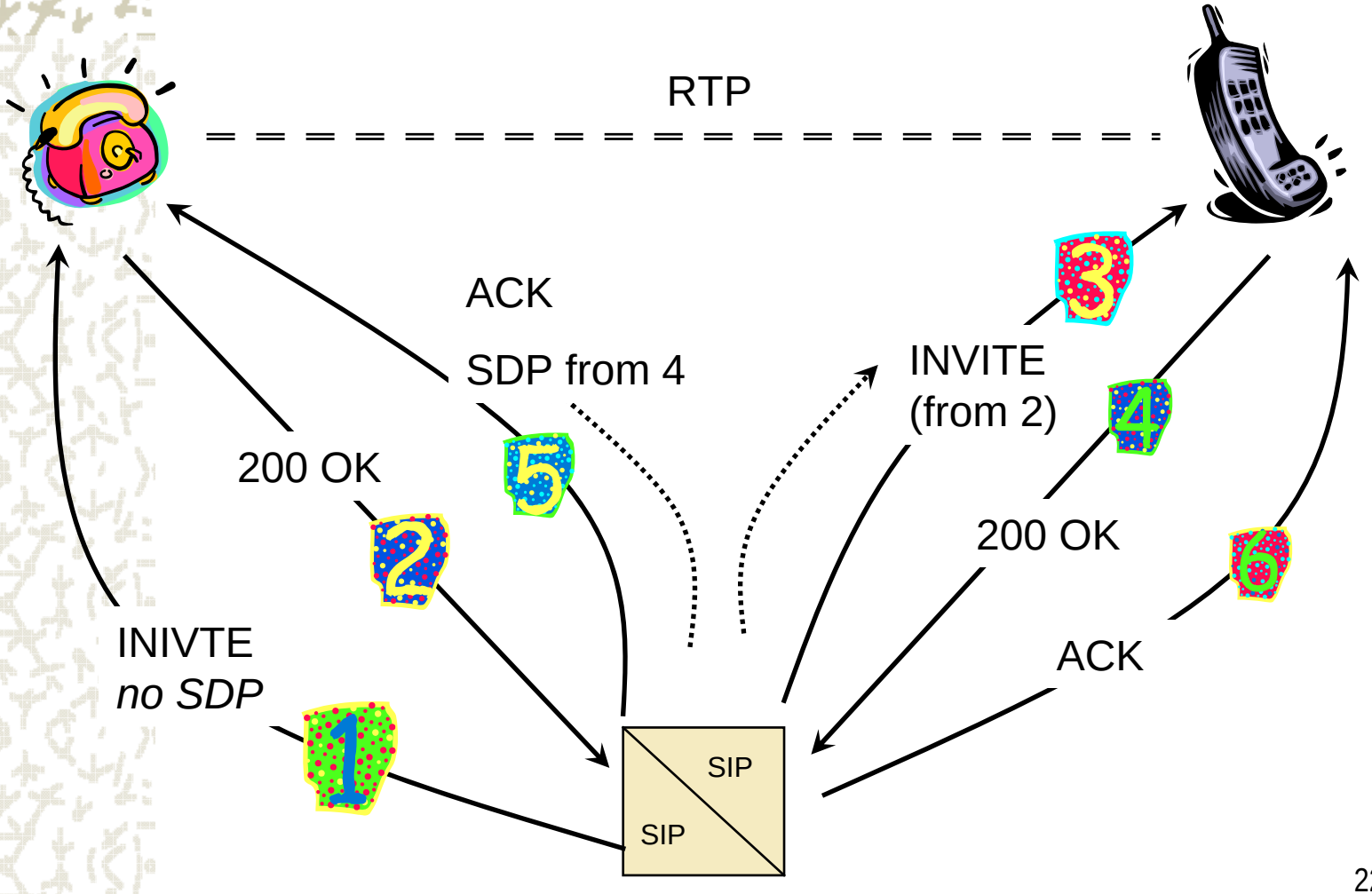
Mid-call Mobility



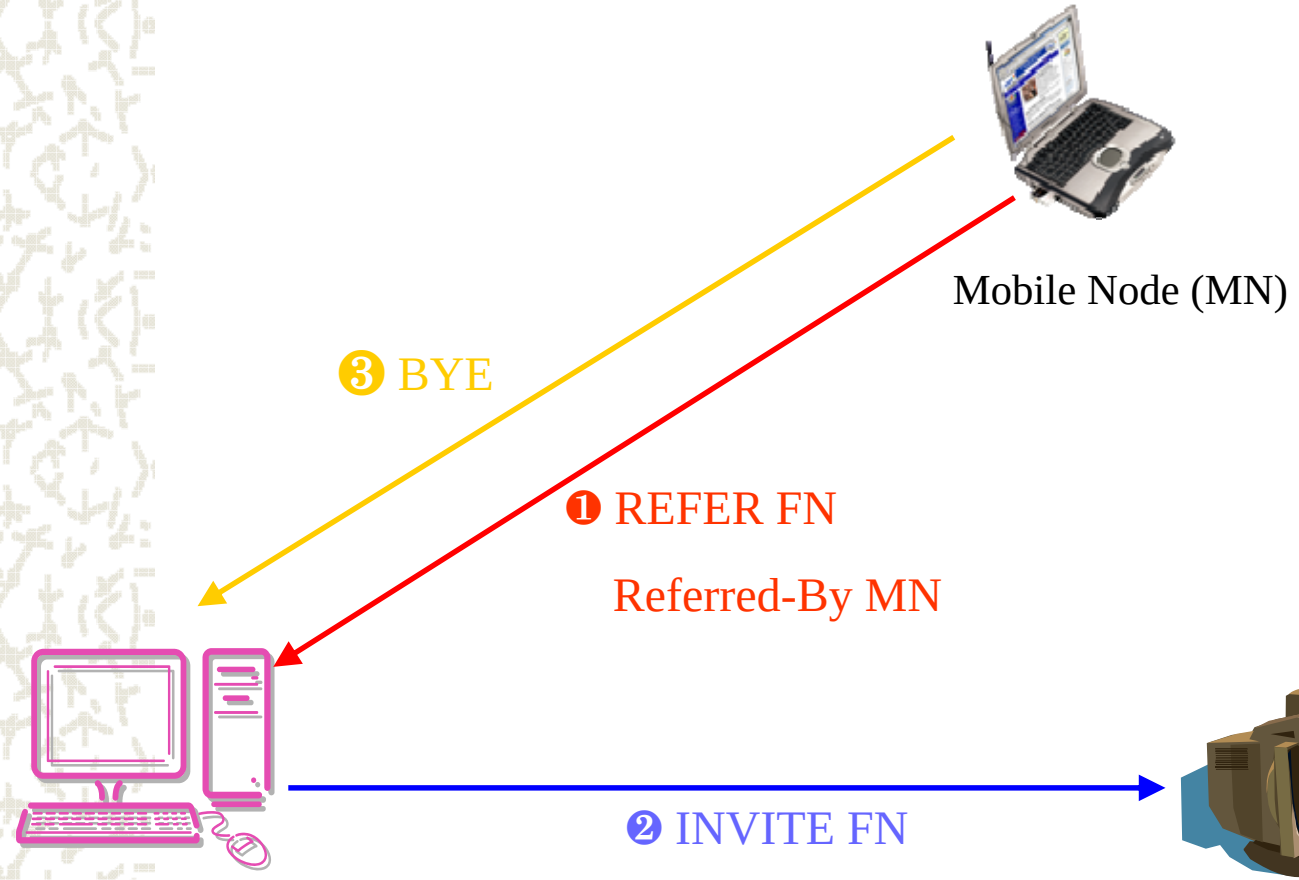
Session Mobility

- Allows a user to maintain a media session while changing terminal
- Solutions
  - A new INVITE request
  - Third party call control
  - REFER mechanism

Session Mobility using Third-Party Call Control



Session Mobility using Call Transfer



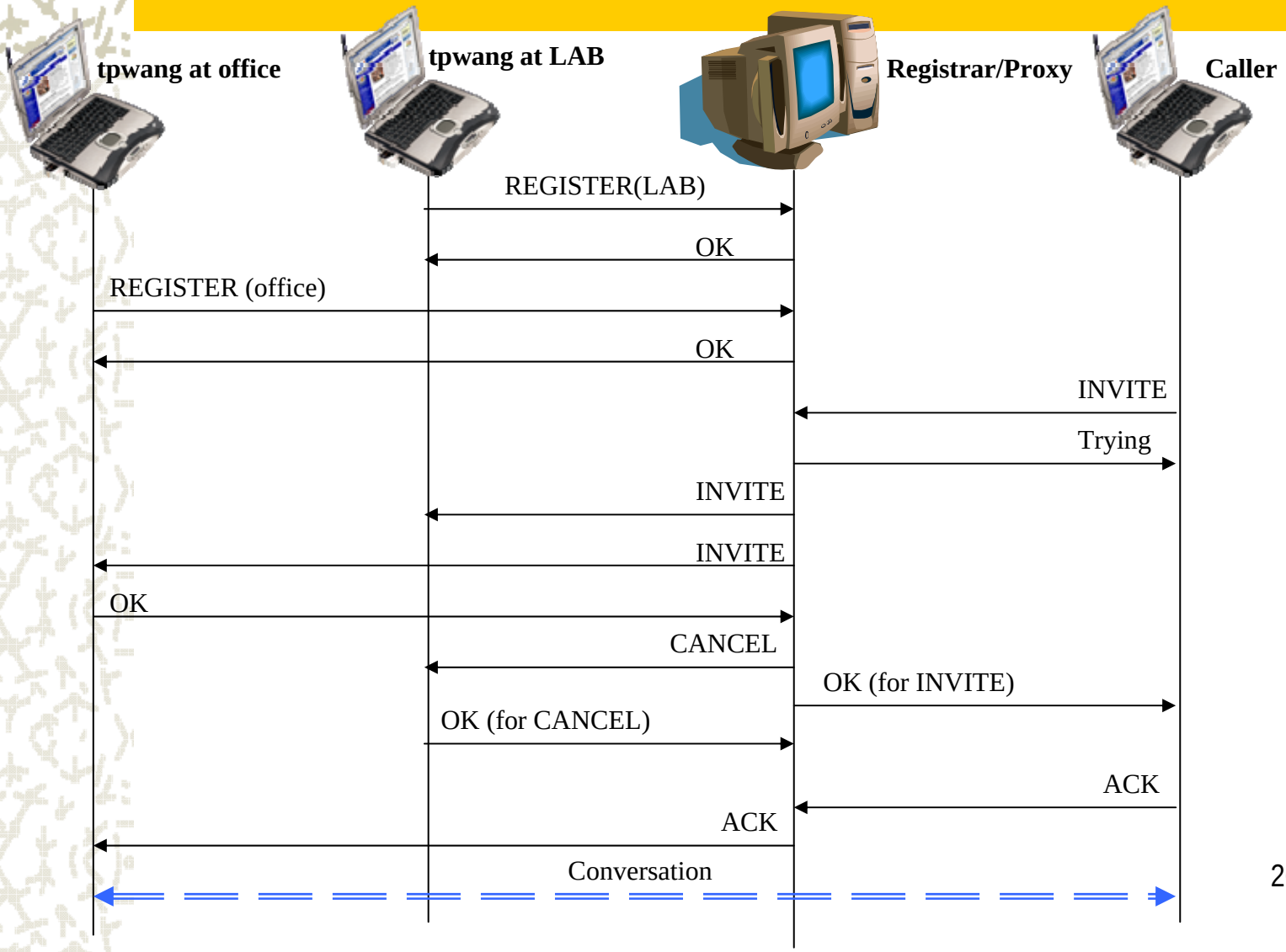
Service Mobility

- Allows a user to maintain access to their services, e.g., dial lists or address books, while moving or changing devices and network providers
- Solutions
  - Users carry the information with him (via SIM cards or Memory cards)
  - A home server stores the personal information profile

Personal Mobility

- Allows a user to be identified by the same logical address, even if the user is at different terminals
- Solutions
  - Allow several registration in location servers and
  - Using SIP forking proxies to parallel search the location

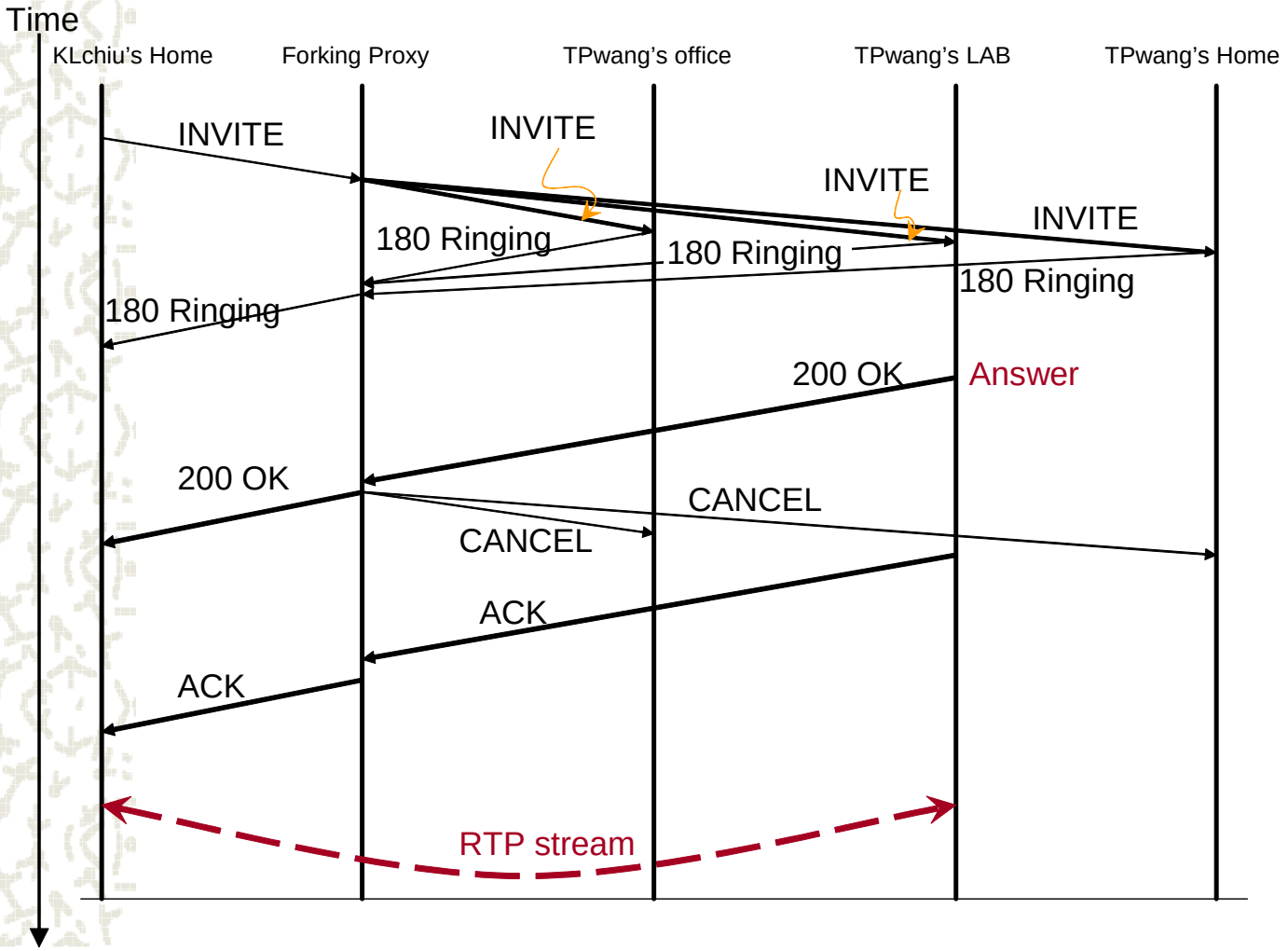
Multiple Registrations for One-Number Service



Parallel Search

- A proxy issues several requests to possible user locations upon receiving an incoming request.
- A parallel search issues requests without waiting for the result of previous requests.

Timing Diagram for Parallel Search



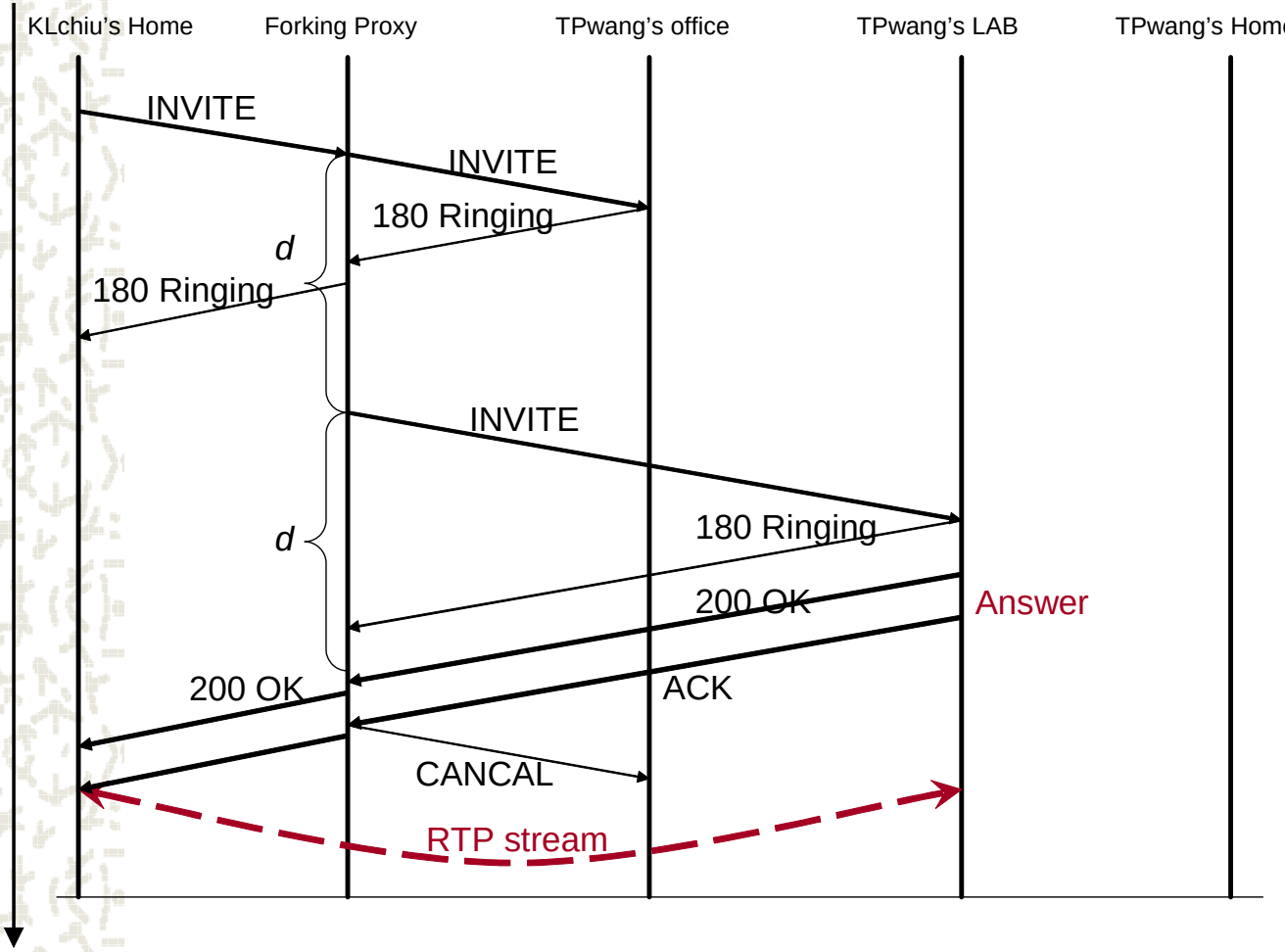
Sequential Search

- Issues one request at a time
- Waits for the final response before issuing the next request
- Cannot work properly since there is no response when the user is not at the first location
  - The default value is 32 seconds for INVITE transaction timeout timer

Pipelined search

- is a hybrid method which combines sequential search and pure parallel search.
- compromises call setup delay and search cost at the same time.

Timing Diagram for Pipeline Search



PSTN Gateway: Cisco 2621XM

Call Server: ser-0.8.14 from www.iptel.org on Red hat 9


The Ethereal Network Analyzer
File Edit Capture Display Tools
Help
No. Time Source Destination Protocol Info
20410 84527.59854 140.128.10.53 140.128.10.94 SIP Request: REGISTER sip:sip4.ipv6.club.tw
20411 84527.59908 140.128.10.94 140.128.10.53 SIP Status: 200 OK
20412 84532.59342 140.128.10.53 140.128.10.94 UDP
20413 84542.84399 140.128.10.53 140.128.10.94 UDP
20414 84553.09470 140.128.10.53 140.128.10.94 UDP
20415 84563.34551 140.128.10.53 140.128.10.94 UDP
20416 84570.48781 140.128.10.167 140.128.10.94 SIP
20417 84570.49044 140.128.10.94 140.128.10.167 SIP
20418 84570.66359 140.128.10.167 140.128.10.94 SIP
20419 84570.66415 140.128.10.94 140.128.10.167 SIP
20420 84576.80159 140.128.10.53 140.128.10.94 UDP
20421 84583.84693 140.128.10.53 140.128.10.94 UDP
20422 84594.09763 140.128.10.53 140.128.10.94 UDP
20423 84604.34833 140.128.10.53 140.128.10.94 UDP
20424 84614.59915 140.128.10.53 140.128.10.94 UDP
Frame 20178 (796 bytes on wire, 796 bytes captured)
Ethernet II, Src: 00:11:2f:2e:4e:8a, Dst: 00:10:db:22:b1:40
Internet Protocol, Src Addr: 140.128.10.94 (140.128.10.94), Dst Addr: 140.12
User Datagram Protocol, Src Port: 5060 (5060), Dst Port: 5060 (5060)
Session Initiation Protocol
Status line: SIP/2.0 407 Proxy Authentication Required
Message Header
Via: SIP/2.0/UDP 140.128.14.102:5060;rport=5060;branch=z9hG4bK
From: 0944021431 <sip:0944021431@sip4.ipv6.club.tw>;tag=1501073632
To: 0944021431 <sip:0944021431@sip4.ipv6.club.tw>;tag=b27e1a1d33761e
Call-ID: 336E1F7BEB0E4A03B19D07E7273B8416@sip4.ipv6.club.tw
CSeq: 38592 REGISTER
Proxy-Authenticate: Digest realm="sip4.ipv6.club.tw", nonce="4237e14b
Server: PU's SIP Call Server (0.8.12 (i386/linux))
Content-Length: 0
Warning: 392 140.128.10.94:5060 "Noisy feedback tells: pid=23084 req
root@sip4: ~ Shell - Konsole
工作階段 編輯 檢視 書籤 設定 說明
[cycle #: 35853; if constant make sure server lives and fifo is op
終止er: PU's SIP Call Server (0.8.12 (i386/linux))
[root@sip4 root]#
Up Since: Tue Mar 15 16:27:53 2005
Up time: 73144 [sec]
Transaction Statistics
Current: 0 (0 waiting) Total: 19 (0 local)
Replied localy: 23
Completion status 6xx: 0, 5xx: 0, 4xx: 3, 3xx: 0,2xx: 16
Stateless Server Statistics
200: 565 202: 0 2xx: 0
300: 0 301: 0 302: 0 3xx: 0
400: 0 401: 0 403: 0 404: 2 407: 3901 408: 0 483: 0 4xx: 0
500: 0 5xx: 0
6xx: 0
xxx: 0
failures: 2
UsrLoc Stats
Domain Registered Expired
'location' 6 13
Apply Message Header in SIP message (sip.
hereal: Capture
15:57
Microsoft

Thanks for your attention.