Interworking Internet Telephony and Wireless Telecommunications Networks

Jonathan Lennox
Bell Laboratories & Columbia University
lennox@{bell-labs.com,cs.columbia.edu}
Kazutaka Murakami, Mehmet Karaul, Thomas F. La Porta
Bell Laboratories
{kmurakami,karaul,tlp}@bell-labs.com

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Interworking SIP and Mobile Telephony: Outline

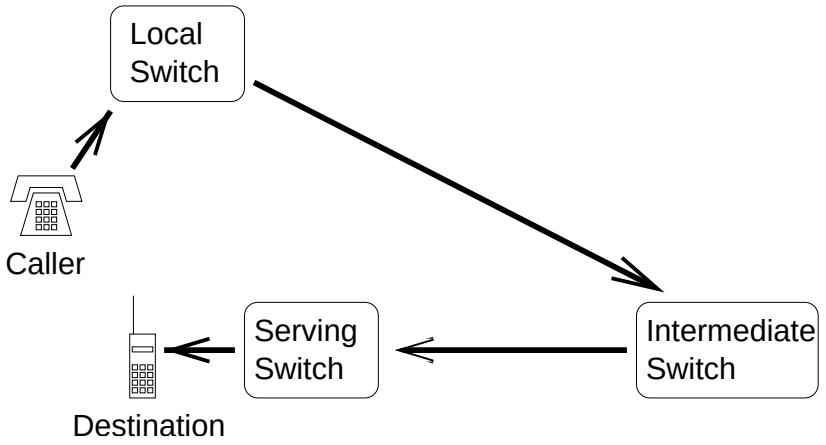
- Motivation
- Interworking Architecture and Proposals
- Evaluation
- Analysis
- Conclusion

Motivation

- Two rapidly-growing components of telephony:
  - Internet Telephony (SIP)
  - Mobile Telephony
    In particular, 2nd-generation digital systems:
    * GSM (Europe)
    * IS-41 (USA)
- Third-generation mobile telephony systems (3GPP) will be IP networks with telephony provided by voice-over-IP
  - This is still a ways away
- We need able to interwork Internet telephony with second-generation systems as well
- The obvious way to connect them would be to use PSTN in the middle
- Directly interworking them can be much more efficient

Why is direct interworking more efficient?

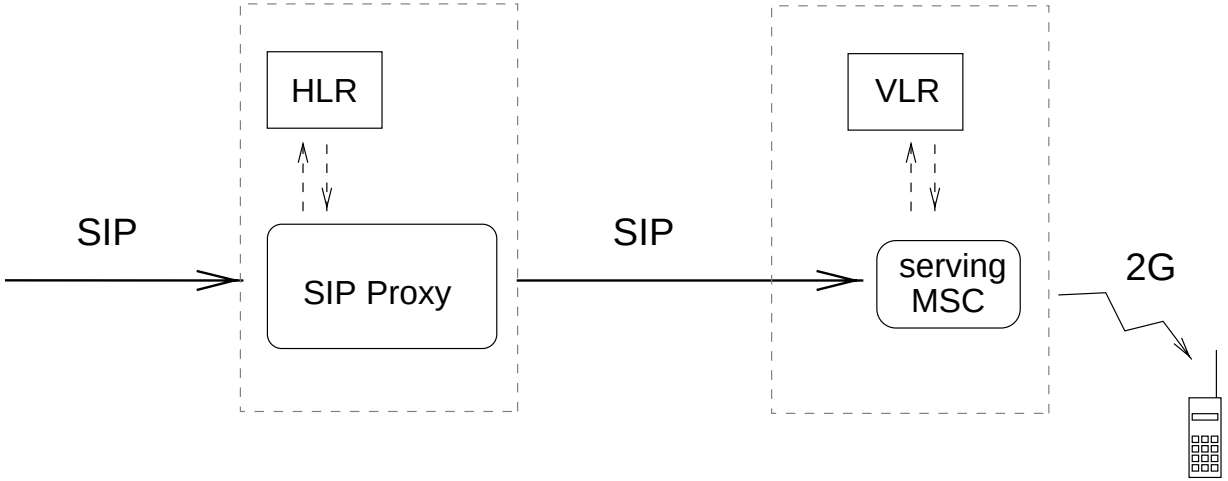
- Eliminate triangular (“trombone”) routing



- Eliminate media transcoding
  - Many SIP terminals can use GSM 06.10
- Ease transition in future evolution
  - 3GPP
  - IP-based switching centers

Interworking Architecture

- 2G air interfaces (GSM, CDMA/TDMA) are unchanged
- Fixed parts of mobile network (inter-MSC) use SIP (and RTP)



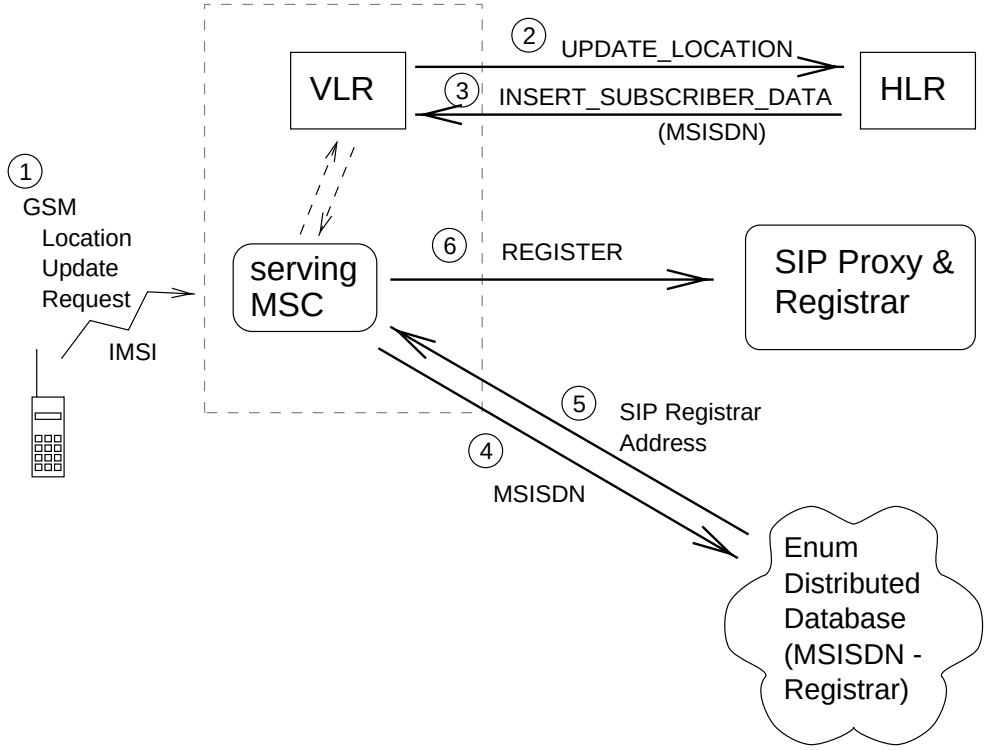
Interworking: “easy” parts

- Calls from 2G to SIP
  - Subscriber’s HLR knows whether calls should be placed using SIP
    - Could use custom dialing plan prefixes, e.g.
  - Enum lookups of phone numbers
  - Same as PSTN-to-SIP
- In-call mobility
  - Re-INVITE for intra-MSC mobility
  - Possibly REFER, possibly anchoring for inter-MSC mobility

Interworking: Registration and calls from SIP to 2G

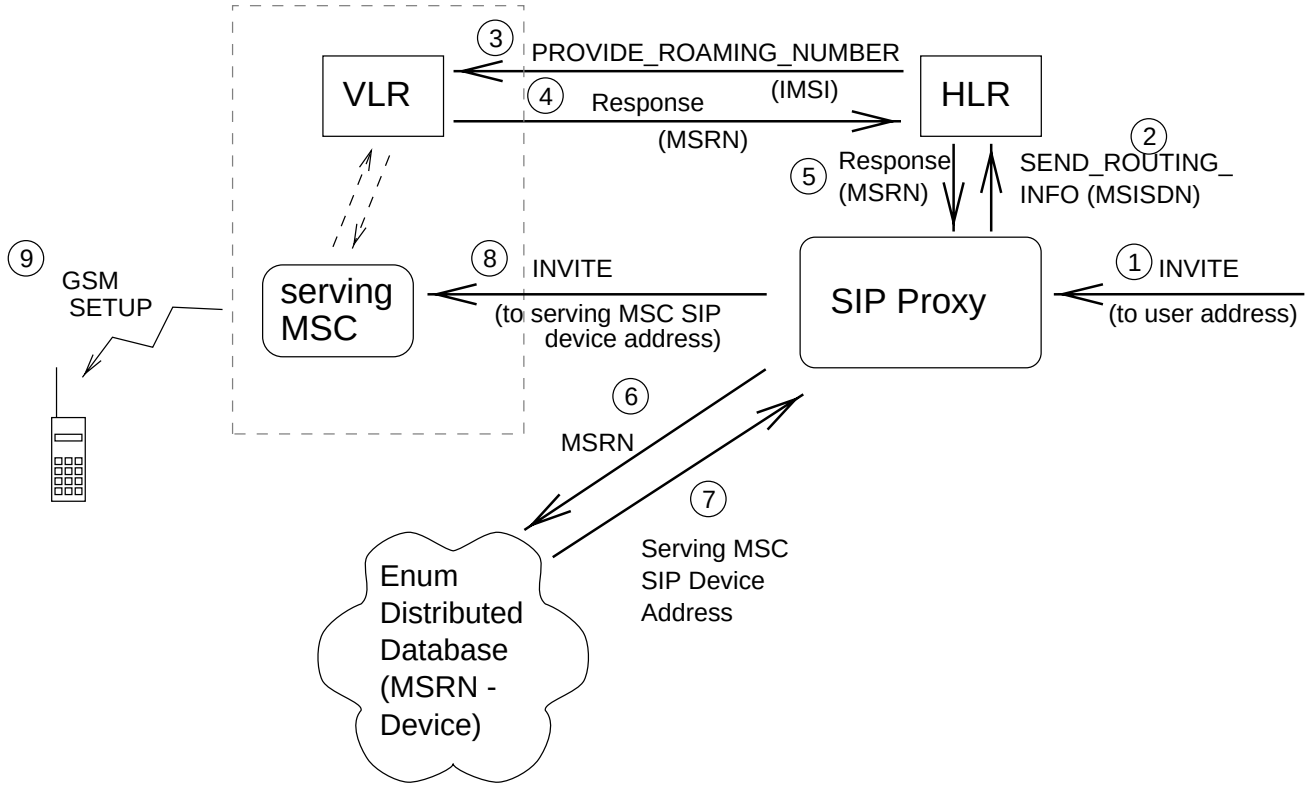
- We want to have calls from SIP to 2G devices be SIP/RTP to the serving MSC
- So, the user's home SIP proxy server needs to be able to find the serving MSC
- Three techiques possible:
  - Modified Registration
  - Modified Call Setup
  - Modified HLR
- Will illustrate 2G with GSM

SIP-to-GSM Technique 1: Modified Registration



- Serving MSC locates subscriber's home registrar based on MSISDN
- Parallel registrations — GSM and SIP
- SIP call setup procedures are standard

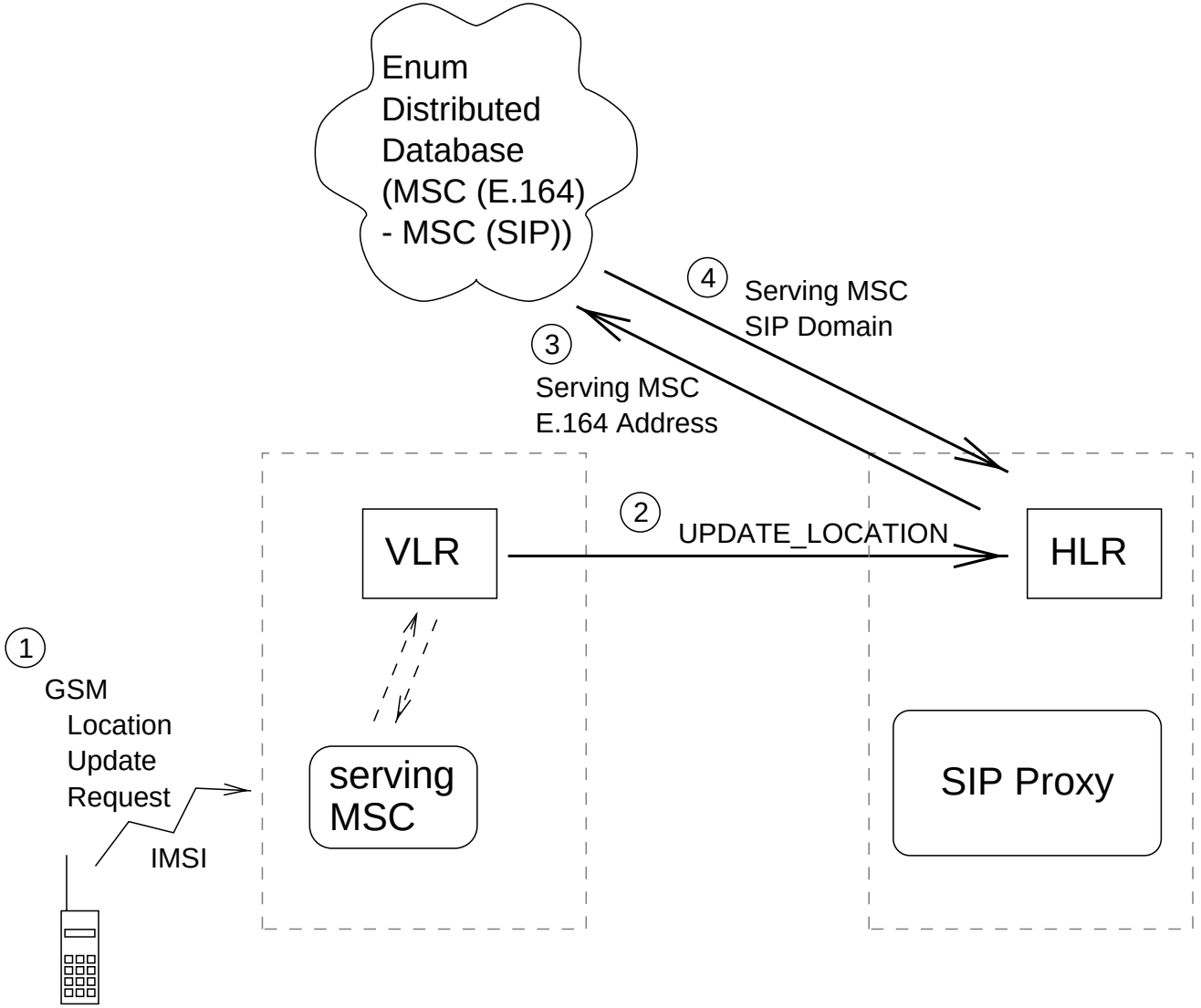
SIP-to-GSM Technique 2: Modified Call Setup



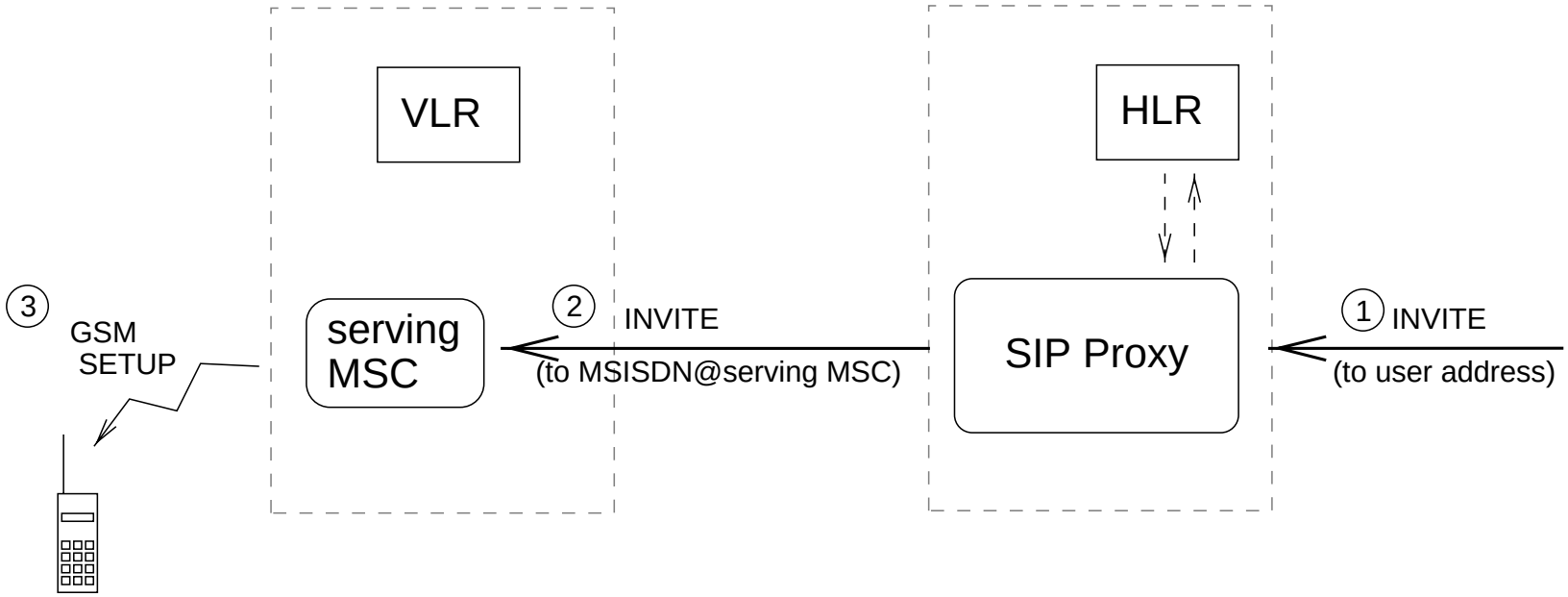
- GSM/IS-41 registration is standard
- SIP proxy server initiates GSM MSRN lookup procedure
- Locates SIP address of sMSC based on MSRN

SIP-to-GSM Technique 3: Modified HLR

- GSM HLR co-located with SIP registration database
- Can map GSM registrations to SIP locations
- Proxy server queries registration database



Modified HLR — Registration



Modified HLR — Call Setup

SIP-to-GSM Techniques: Evaluation (1)

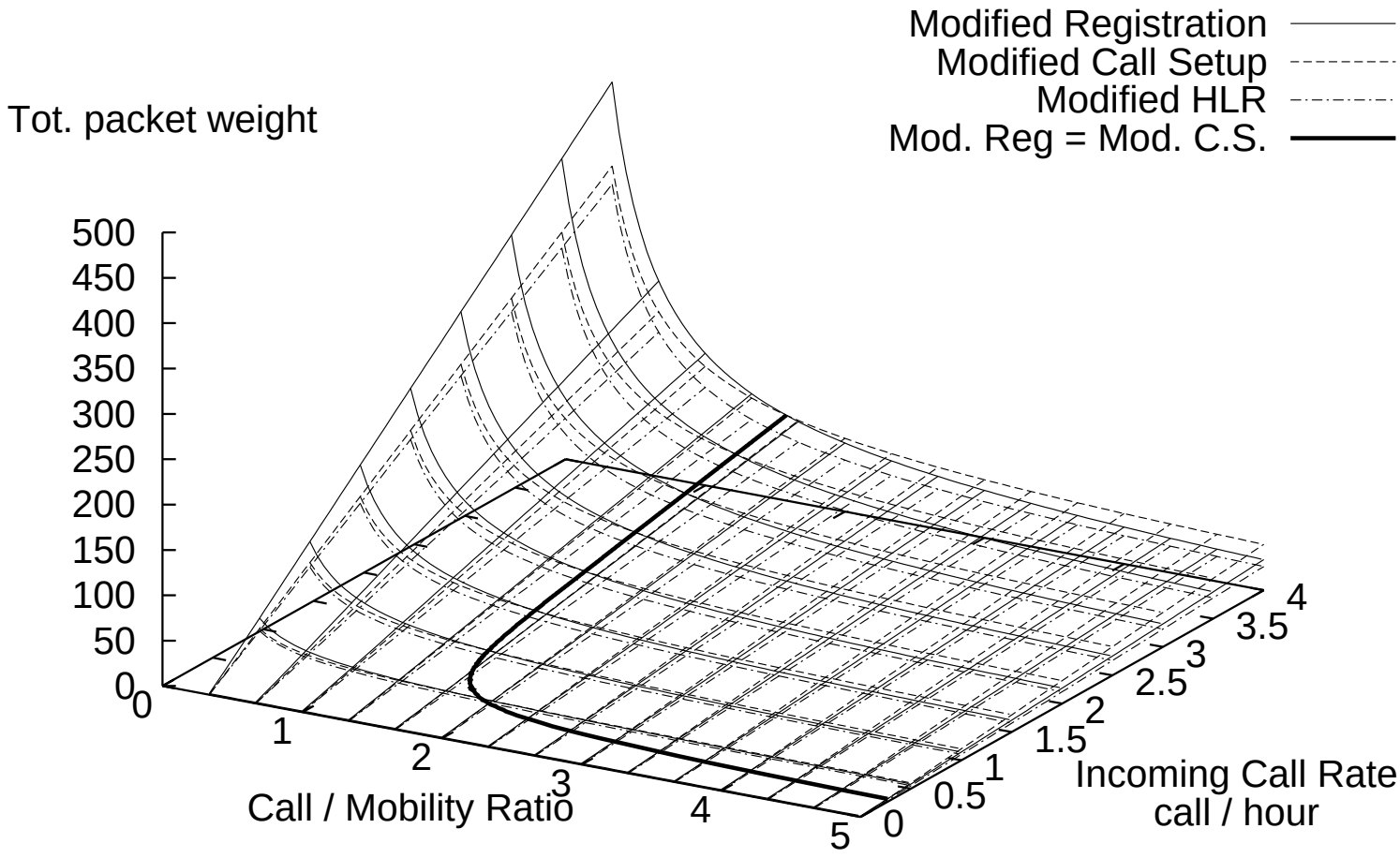
- Modified Registration
  - Least modification to existing infrastructure
    SIP proxy and registrar, GSM HLR and gMSC unchanged
  - Call setup is fast
  - Two separate databases — can get out of sync
  - High overhead with low mobility rates
- Modified Call Setup
  - No database inconsistencies
  - Low registration overhead
  - *Triple*-phase call setup: high signalling load, latency
  - HLR, SIP Proxy must be able to communicate

SIP-to-GSM Techniques: Evaluation (2)

- Modified HLR
  - Relatively low signalling requirements for registration; quite low requirements for call setup
  - Call setup latency similarly low
  - Invasive modifications of HLRs
  - SIP proxy and HLR must be co-located, or have communication channel

SIP-to-GSM Techniques: analysis

- We analyzed message weights for each of the three approaches
- Depending on characteristics, modified registration or modified call setup has lower signalling load
- Modified HLR is always lowest



Weighted signalling load of the three proposals

Implementation

- Implemented modified call setup scheme atop Bell Labs RIMA — experimental distributed MSC/VLR.
- Didn’t (at the time) have a HLR or gMSC to play with; had to “fake it” by having SIP proxy contact VLR
- Further development of the modified HLR scheme is in progress

Conclusions

- Efficient interworking of SIP and GSM is possible
- Modified HLR is the best technique for registration and call setup, though it requires the most development work