introduction
Voice-over-IP protocols: H.323 & SIP
HW architecture
SW architecture
lessons learned
future activities
The VoIP Story (199x)

- VoIP hype in 1995 - 2001
- CAPEX reduction
  - one infrastructure for voice and data
  - routers + LAN switches cheaper than TDM switches
- OPEX reduction
  - auto configuration
  - simplified operation
- new business opportunities
  - unified messaging, integration

VoIP Now (2002)

- CAPEX reduction difficult:
  - TDM equipment cheap
  - LAN infrastructure re-use only in new buildings
  - QoS: VoIP requires managed IP NWs
- traditional Telcos: OPEX not only influenced by technology
- new Telcos: tight financial situation
- new apps delayed: acceptance problems
=> investments in VoIP behind initial expectations
Siemens VoIP Activities

H.323 Protocol Components

- H.323 Terminal
- H.323 Gateway
- H.323 Gatekeeper
- Packet Based Network
- N-ISDN
- B-ISDN
- Guaranteed QOS LAN
- GSTN
- V.70 Terminal
- H.324 Terminal
- Speech Terminal
- H.322 Terminal
- Speech Terminal
- H.320 Terminal
- Speech Terminal
- H.321 Terminal
- Speech Terminal

Scope of H.323

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### H.323 Stack

- **Audio I/O**
- **System Control/User Interface**
- **H.323**
  - RAS (gatekeeper protocol)
  - Q.931 (call signaling)
  - H.245 (media control)
  - RTP/RTCP
  - UDP
  - TCP
  - IP
  - LAN interface

### H.323 vs. SIP – Overview

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<td>modular</td>
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The OpenH323 Project

- Open Source (MPL)
- pushed by Equivalence and Vovida
  - Equivalence Pty Limited was acquired by Quicknet 09/2000
  - Vovida Networks, Inc was acquired by CISCO 09/2000
- libraries and clients for Linux and Windows
  - e.g. graphical / CLI based voip clients
  - OpenH323: class library for H.323 protocol
  - OPAL: OpenH323v2 library
  - H.323 Gatekeeper and MCU software
- support for Linux kernel telephony driver

Motivation for a LAN Phone

- gain experiences in rapid prototyping
- HW platform
  - for evaluation, development and presentations
  - look-and feel of standard-phone
  - modular and extensible hardware
  - off-the-shelf PC like hardware
- SW platform
  - build knowledge on “embedded” Linux
  - gain experience with OpenH323 and VoIP in general
VIP – Voxilla Internet Phone

- CPU 486/66 Mhz
- 16 MB RAM
- 16 MB Flash ROM
- duplex audio
- network interface
- serial interface/LCD

Hardware Architecture

AMD 486 with sound onboard (133 Mhz, 32 MB)

- PCMCIA module
  - network IF
  - flash memory

- PC/104
- RS-232
- four wire

- audio I/O
- display
- keyboard

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**HW Development Environment**

**Software Architecture**

- **user interface**
- **LDC.tcl**
- **wrapper**
- **LDCd**
- **client (e.g. H.323)**
- **standard libraries**
- **Linux kernel**
  - device driver: network, sound, serial, ...

*free software*
Linux OS - tomsrtbt

tomsrtbt stands for:
- "Tom's floppy which has a root filesystem and is also bootable."

Linux-On-A-Disc with:
- 2.0.36 kernel, libc5, bunch of rescue tools
- modified for VIP
  - 2.2.10 kernel, libc6, pthreads …
  - full-duplex ALSA audio, new PCMCIA pack
  - tclsh 8.0

SIP Extension

SIP signaling with sipc
- communication with SIP redirect, proxy and registration servers
  - available for Windows, Linux and Solaris

robust Audio Tool (RAT) as audio application
- used without GUI

additional development
- wrapper for sipc for adaptation to VIP user interface
- minor modifications to use RAT without GUI

phone can now operate in H.323 and SIP mode
Lessons Learned (I)

-experiences
  - getting the system to boot is half the work
  - having the system on PCMCIA flash is a good idea
  - trouble with the sound system: use ALSA instead of OSS!

-project data
  - manpower: diploma thesis + internship
  - timeframe: 7 months diploma thesis + 2 months internship

-advantages of Linux-based approach
  - community support: tomsrft, bootstrap, ALSA
  - tons of archived discussions and private web pages

Lessons Learned (II)

- Linux OS
  - boot and init process, system layout
  - pcmcia package: tools, drivers, configuration
  - problem analysis

-modular design paid off
  - TCL script wrapper allowed quick design/testing
  - during internship extension with SIP and RAT

-user interface design is really hard work
  - limited by two line LCD and 12 button keyboard
  - be prepared for all different cases of user intervention
Voxilla Internet Phone

Future Activities

- extend to video phone, voice controlled phone …
- deployment in QoS testbed
- deployment in IPv6 testbed
- deployment in Ad-Hoc testbed
- build a commercial product 😊
  - estimated costs about 200 USD