Part 5: Development and Testing of Simple Internet Phones

Application of the Previous Concepts
Overview

• A (very!) brief introduction to Internet, Telephony and Internet Telephony.

• Project description & logistics.

• Implementation conventions and test harnesses.
Introduction

• If you have a “desk”, you have at least these two devices on it:
  – a telephone,
  – a computer.

• If you are in an “office”, you have access to two networks:
  – the telephone network,
  – the internet.

• Why two devices and two networks?

• Internet Telephony = Telephony over the Internet.
Why the Interest?

• Short-term: cheaper long distance, especially international.

• Mid- to long-term: the promise of a more efficient infrastructure.
  – Combine all traffic in packet network.
  – Use same tools for simple management and service access.

• Long-term: put voice networking and applications on the same growth and learning curve as the Internet and WWW.
  – Take telecom services to a more open environment.
  – Create greater opportunities for innovation.
Why the Interest Now?

• Favorable price structure.
  – Market pressure to lower costs for telephone calls (and faxes).

• Internet success.
  – Many potential customers.

• Technology advances.
  – In hardware, fiber optics, software...

• Telecom competition.
  – Monopolies tend to disappear.
Public Switched Telephone Network: Basic Characteristics

• Evolving for 100+ years, the biggest network in the world.

• Sophisticated infrastructure:
  – Lots of features available (flexibility), SS7/IN control (sophisticated network management), fiber transport (efficiency), ...
  – Switches and application software closed to outsiders.

• High-quality connections:
  – low delay, high reliability, dedicated full-duplex channels.

• Per-minute connection fees:
  – long-distance and international, local in many countries.
  – Price and cost not aligned due to 100 years of regulation and universal service goals.
Internet: Basic Characteristics

- Evolving since establishment of ARPA Net in 1969.
- Explosion in popularity since free browsers and WWW.
- Provides a connection-less, best effort, single-priority service.
- Designed for non-real-time applications.
- IP and related protocols are de-facto standards.
- Open environment encourages creativity and innovation.
- Most access fees are flat rate based on bandwidth.
Challenge for Internet Telephony

• How to provide “connections” in a connection-less network?

• How to manage bandwidth on the internet?

• The best of both worlds:
  – price and diversity of data networking
  – with guaranteed bandwidth and high reliability of the telephone network.
Protocols

- **IP (Internet Protocol):**
  - Network layer (level 3) protocol used for switching and routing within the internet and many corporate networks (intranets).
  - Includes source and destination address.
  - Provides a connection-less, unreliable packet-delivery service.

- **UDP (User Datagram Protocol):**
  - Transport layer (level 4) protocol used for applications where acknowledgements are unnecessary or retransmission is not appropriate (like Internet Telephony).
  - Provides an “unreliable” transport service since no acknowledgements.
  - Essentially adds port numbers and checksum to layer 3 (lower overhead than TCP).
Protocols (Continued)

• TCP (Transmission Control Protocol):
  – Provides reliable virtual circuit and flow control.
  – Determines and adapt to network congestion.
  – TCP is processed in the endpoints, not in network routers/switches.

• There are many other protocols…
  – Example: Some protocols for the support of real-time services:
    • RSVP (Resource Reservations Protocol).
    • Diff Serv (Differentiated Services).
    • RTP (Real-time Transport Protocol).
    • RTCP (RTP Control Protocol).
Project

• Project: Development and Testing of Simple Internet Phones.

• This project will apply and illustrate the concepts previously presented in this course.
  – Steps of the software development process.
    • Requirement analysis, design, coding, unit testing, integration and interoperability testing.
  – The difficulty of developing and testing communication software.
    • Concurrency issues.
  – Systematic software testing using VeriSoft.
  – “Internet Telephony”...
    • Combined with a telephone GUI, a sound API and TCP (or UDP), the signaling and call-processing software developed by the participants could be used to implement (very!) simple internet phones (for a LAN for instance)…
Project (Continued)

• Project description and logistics:
  – See 8-pages project description document.

• Implementation conventions and test harnesses:
  – See the files in “~patrice1/verisoft/examples/project” on saga3.
  – README
  – network.c
  – switch.c
  – system_file.VS