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 interoperabilty 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