



Certain technologies described in this presentation are the subject of patent applications in the U.S. and other countries.

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Applications for Narrow-Band Audio Streams

Eric William Burger

Chief Scientist

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Focus

- ◆ What Characteristics of Applications Are Applicable for Consumer Users of Voice-over-IP Technology?

Roadmap

- ◆ Current State of the Art
- ◆ Issues Affecting Streaming Multimedia Quality
- ◆ Implications for Applications
- ◆ Application Examples
- ◆ Summary

Where's IP Telephony Today

- ◆ Important Advances Made Since 1995
 - **Protocols**
 - **Codecs**

Important Protocols: RSVP/ MPLS

- ◆ Effect is to Create Switched Virtual Circuits
- ◆ Bandwidth and Latency Allocated and Statistically Available
- ◆ Makes Sense in the Backbone:
Lots of Bandwidth and Low Latency

Important Protocols: RTP/ RTCP

- ◆ Monitors Bandwidth and Latency
- ◆ Provides Data to Application about Available Quality of Service
- ◆ Provides Capability to Application to Modify Codec on Fly

What Works

- ◆ Managed IP Backbone
 - **Guaranteed Latency**
 - **Guaranteed Bandwidth**
- ◆ Long-distance Toll-bypass
 - **Two-stage or Tandem Access**
 - **Inter-PBX Access**

Latency Issues

- ◆ Narrow-Band Environment is Over 90% of Consumer IP Access (Dial-Up)
- ◆ Intractable Given Current Technology
 - **Low Bit-Rate Connection**
 - **V.42bis Buffering**
 - **Hardware Compression Buffering**
 - **(Goodman - TON 5/99 & VON '99)**

Why Do Consumers Use VoIP?

- ◆ Satisfactory for Price-Sensitive, Quality-Insensitive Users
- ◆ PC-to-PC
- ◆ PC-to-PSTN
- ◆ Similar to Quality of Early MCI Long-Lines

Latency Futures

- ◆ Will Be Addressed With DSL, Cable, and Broadband Wireless
- ◆ **BUT:** Even in 2003, 77% of Consumer IP Access will be Via Dial-Up (Jupiter Communications)

Narrow-Band Streaming Audio

- ◆ “It Sounds Good” Phenomena
- ◆ Until You Answer Back
- ◆ Quality
 - **Full-Duplex: Not So Good**
 - **Half-Duplex: Quite Satisfactory**

Leverage What Works

- ◆ Full-Duplex Issues
 - **Will Be Solved**
 - **Over Time**
 - **Not Today For Vast Majority of Consumer Users**
- ◆ Consumer-Oriented Applications
 - **Leverage Half-Duplex Operation**

Summary

- ◆ Do What Works Well
- ◆ Half-Duplex Voice-over-IP for Consumer Applications
- ◆ Full-Duplex Is Far In The Future for Broad Consumer Use
 - **Will Be Available for High-End Consumer Use**

Discussion

Contact Information

Eric W. Burger

Chief Scientist

Centigram Communications Corporation

Maryland Technology Center

1375 Piccard Dr., MS 150V

Rockville, MD 20850-4311 USA

Tel./Fax: +1 301/212-3320

E-Mail: e.burger@ieee.org