

ETSI STQ Workshop "Compensating for Packet Loss in Real-Time Applications", Feb 2003

#### Speech/Audio Coding for IP networks

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# Agenda

- Introduction
- Traditional approach to speech coding for VoIP applications
- New paradigm
- iLBC
- Questions
- Demo





#### QoS – (endpoints) perspective

- Year after year the same story
- More then 3000 papers since 1984
- Limited ToS support at the end points
- Introduction of new technologies and applications is making situation even more difficult

QoS is already 19 years old – is it time to get a real job !? 😊





# Traditional approach to speech coding for VoIP





#### CELP SPECIFICS

- Current low bit rate codecs: ITU G.729, G.723.1, GSM-EFR, and 3GPP-AMR were developed for circuit switched & wireless telephony and are all based on the CELP (Code Excited Linear Prediction) paradigm.
- CELP coders are stateful, they have memory, error propagation results from lost or delayed packets.
- Long time is needed to resynchronize coder and decoder (often 70-100 ms)





# iLBC Advantage over CELP

original MMMMMMMMMMMMMM

ilbc mmmmmmmmmmmmmmmm

g729 MMMMMMMMM

g723 MMMMMMMMMMMMMMM

PLC

iLBC, like other GIPS codecs treats every packet individually, making it suitable for packet communications. State recovery

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# New Paradigm

- Approach & diagnose
- What can be improved?
- How?
- Proof of (concept and design)





#### Approach

We need holistic view/approach for both

- Horizontal (end-to-end) QoS perspective
- Vertical (top-down) QoS perspective





## Vertical (Top Down) Perspective

Presentation	Speech Codecs/
Session	SIP/H.323
Transport	RTP/UDP/RSVP
Network	IP/WFQ/IP-prec
Link	MLPPP/FR/ATM AAL1
Physical	





#### What impacts perceived quality?

VoIP End Point

VoIP End Point





#### What can be improved?

- One side solutions:
  - Advanced Playout Controller
  - AEC, NEC with right design
- Both end solution:
  - Codec





## Design principles

- High basic quality
- Robustness (e.g. for codec no inter-frame dependency, MDC)
- Low complexity
- ...
- Realistic test methodology and tools during design phases





#### MDC







#### Improvements for "one-side" solutions



Source: Lockheed Martin Global Telecommunications (COMSAT)

Saved approximately 30-80 ms





#### iLBC Performance



The tests were performed by Dynstat, Inc., an independent test laboratory. Score system range: 1 = bad, 2 = poor, 3 = fair, 4 = good, 5 = excellent

Source: Dynastat





## Proof of concept and design (part 3)

#### telephony band sound quality

#### wide band sound quality



Source Lockheed Martin global Telecommunication (comsat)

**GLOBAL IP SOUND** 



# iLBC (Internet Low Bitrate Codec)





#### iLBC (internet Low Bitrate Codec)

- Speech sampled at 8 kHZ,
- using a block-independent linear-predictive coding (LPC) algorithm.
- Bandwidth 13.33 kbps (50 bytes per 30 ms)
- Frame size 30 ms (support for 20 ms in the next revision)
- Complexity and memory requirements are similar to ITU G.729A
- Basic Quality is equal to or better than G.729. Packet loss robustness is significantly better than G.729.
- Packet loss concealment Integrated example solution





# The Core iLBC method

- Start state encoding
- Gain-shape waveform matching forward in time
- Gain-shape waveform matching backward in time
- Pitch enhancement
- Packet loss concealment





#### iLBC - IETF work

- IETF deliverables, submitted during February '02:
  - iLBC codec specification draft
    experimental standards track
  - iLBC RTP Payload Profile
    regular standards track (AVT)
  - Statement about IPRs in ILBC and its "freeware nature"





#### Summary

- Accelerate deployment of VoIP technology by using realistic QoS enhancements and solutions that are already available
- VoIP endpoints, focus on both: one side improving solutions and both end improving solution
- Move quality exprience to the next level with wideband coders





# Questions ???





#### Demo







# More information

#### Web site www.ilbcfreeware.org with:

- Info about initiative
- Info about codec
- Latest iLBC IETF drafts (spec and payload format)
- Latest iLBC float point Source code
- FAQ list
- IETF drafts:

  - draft-ietf-avt-ilbc-00.txt
    codec spec (exper. stds track)
  - draft-ietf-avt-rtp-ilbc-00.txt
- RTP payload profile (AVT group)
- Web site www.globalipsound.com
- Free demo SIP client available, please request at: SIP/email: alan.duric@globalipsound.com

