

Improving the quality of video calls

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Who is Olivier ?

- GnomeICU since 1997
- Gentoo Developer since 2003
- Farstream at Collabora since 2007

Farstream

- Formerly Farsight2 (well almost)
- VoIP Framework
- GStreamer elements
- High-level API

Farstream users

- Maemo / Meego
- Empathy
- Pidgin
- aMSN
- Gajim
- Minibif
- Future KDE Telepathy Call client



VoIP

- Streamed media over the IP
- Interactive
- Low latency

Low latency

- No retransmission
- UDP

Voice

- Relatively low bandwidth
- Mostly constant bit rates
 - Possibly adjustable
- Gaps BAD!



Video

- High bandwidth
- Codecs intolerant to losses
- Tolerant to limited stuttering

Bit rate control

- Static (none)
- Simple RTCP
- Pre-compute
- Fully dynamic

TFRC

- TCP Friendly Rate Control
- Equation-based
- RFC 3448 & 5348
- Regular
 - Video
- Small Packets
 - RFC 4828
 - Audio



TCP Throughput Equation

$$X_{Bps} = \frac{s}{R \sqrt{2b \frac{p}{3}} + (t_{RTO} (3p \sqrt{3b \frac{p}{8}} (1 + 32p^2)))}$$

s = Segment Size

p = Loss Event Rate

R = Round Trip Time

t_{RTO} = TCP retransmission timeout = 8

b = packets per TCP Ack = 1

TCP Throughput Equation

$$X_{Bps} = \frac{1460}{R \sqrt{2 \frac{p}{3} + (24 p \sqrt{3 \frac{p}{8} (1 + 32 p^2)})}}$$

p = Loss Event Rate

$$0 < p < 1$$

R = Round Trip Time

Extra RTP information

- Extended RTP Profile for Real-time Transport Control Protocol (RTCP)-Based Feedback
 - AVPF
- RTP Header Extensions
- Negotiated in XMPP, SIP, etc
- Approximated ?

Packet losses

- Retransmissions ?

NO

- Loss Indications

- Picture
- Slice

Video Repair

- New keyframe (IDR)
- Older reference

Codec tricks

- Long lived reference frames
- Slice/MTU alignment
- H.264 SI/SP frames
- Decoder magic
 - VP8 is now implementing concealment

Concealment for Audio

- Replay
- Generic
- Codec specific (Speex, Opus, Silk)

FEC

Forward **E**rase **C**oncealment

- Parity
- Reed-Solomon
- Opus built-in

Video adaptation

- Bit rate
- Quality
- Resolution
- Frame rate

Audio adaption

- Quality
- Sample rate

Echo

- Concealment
 - Skype, etc
- Cancellation

Farstream will...

- Bitrate control
 - TFRC
- Forward Erasure Correction
- Support concealment

Future

- DCCP
- Open Codecs
- VP8, etc
- Large scale testing

Thank you

- #farsight, #telepathy, #gstreamer @ FreeNode
- #empathy @ GimpNet
- <http://farsight.freedesktop.org/>
- <http://telepathy.freedesktop.org/>
- <http://gstreamer.net/>