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
- Minbif
- 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

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

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

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

\[ p = \text{Loss Event Rate} \quad 0 < p < 1 \]

\[ R = \text{Round Trip Time} \]
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 **Erasure** Concealment

- Parity
- Reed-Solomon
- Opus built-in
Video adaptation

- Bit rate
- Quality
- Resolution
- Frame rate
Audio adaptation

- 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/