IETF117 Hackathon : OPUS / WebRTC

Analyse and integrate
Deep Audio Redundancy (DRED) Extension in Opus in Gstreamer

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For use case of spike in loss (heavy jitter) such as burtsy network which could be a result of NAT rebinding or network handover, the audio codec needs to be resistant to heavy loss. One way is to overcome the missing data by synthetically reconstructing long sequences of lost packets.

This is achieved by **Deep REDundancy (DRED)** which works by adding side information inside the regular Opus packets. OPUS is the default WebRTC audio codec.

More explanation:
https://www.amazon.science/blog/neural-encoding-enables-more-efficient-recovery-of-lost-audio-packets

Aim of this hackathon project:

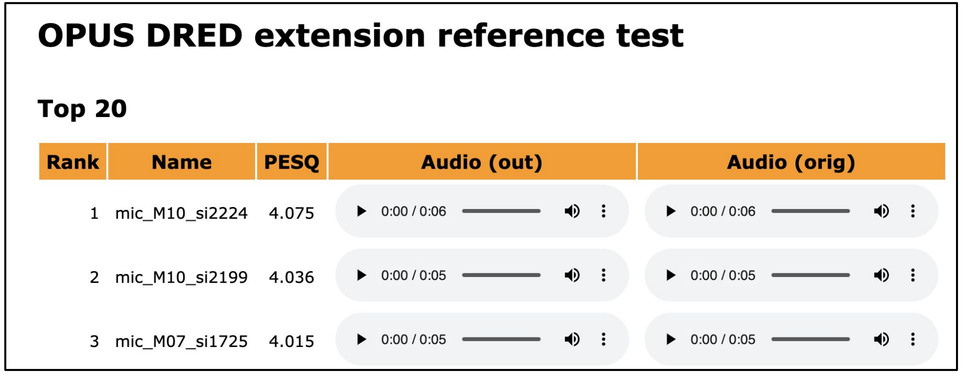
1. To analyse Deep Audio Redundancy (DRED) Extension for the Opus Codec via PSEQ and waveform on large Voice dataset
2. Implement the Coder and Decoder change in Gstreamer base plugin implementation of OPUS

draft-valin-opus-dred-01

https://datatracker.ietf.org/doc/draft-valin-opus-dred/

1. To analyse Deep Audio Redundancy (DRED) Extension for the Opus Codec via PESQ and waveform

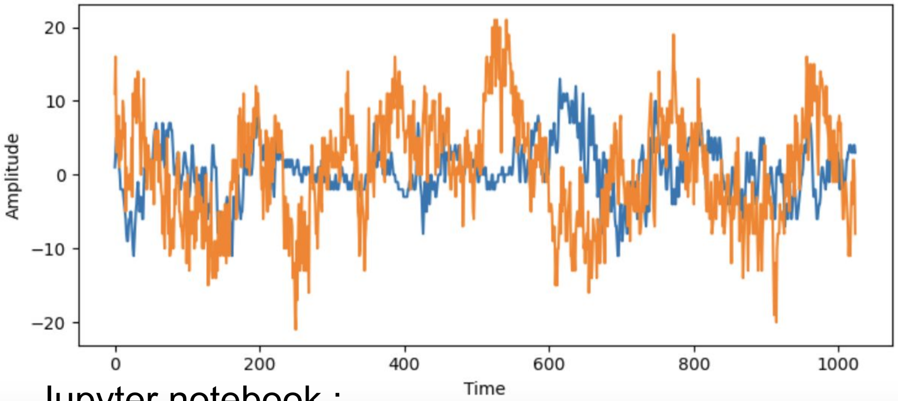
DataSet: PTDB-TUG size:4GB source: https://www2.spsc.tugraz.at/databases/PTDB-TUG/



OPUS DRED extension reference test

Top 20

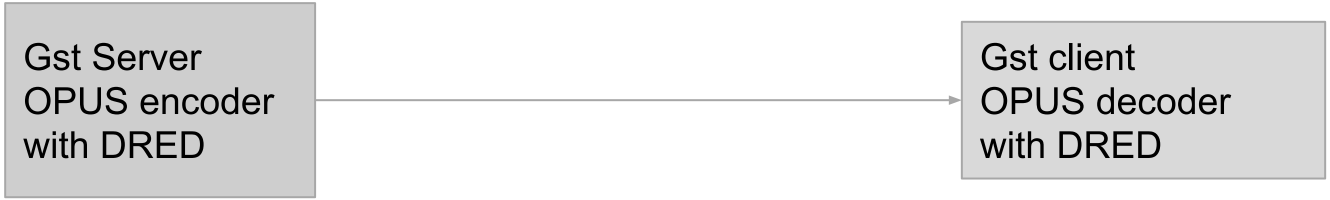
Rank	Name	PESQ	Audio (out)	Audio (orig)
1	mic_M10_si2224	4.075	▶ 0:00 / 0:06	▶ 0:00 / 0:06
2	mic_M10_si2199	4.036	▶ 0:00 / 0:05	▶ 0:00 / 0:05
3	mic_M07_si1725	4.015	▶ 0:00 / 0:05	▶ 0:00 / 0:05



Tool Used : lpcnet-testsuite
https://gitlab.xiph.org/xiph/opus/-/tree/opus-ng/dnn/torch/testsuite

Jupyter notebook :
https://github.com/altanai/IETF117-OPUS-APPLICATION/blob/main/AudioWaveform_OPUS-ng.ipynb

2. POC for Coder and Decoder change in Gstreamer plugins-base implementation of OPUS for DRED


Gst Server
OPUS encoder
with DRED

Gst client
OPUS decoder
with DRED

Encoder.c :Set OPUS_SET_DRED_DURATION
as 1s and loss percentage to 20%

Also add changes to header file

Decoder Changes : monitor Seq number for loss and invoke
opus_dred_parse params

- OpusDREDDecoder ,
- OpusDRED,
- data,
- len,
- max_dred_samples,
- sampling_rate,
- defer_processing flag

Wrap Up

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- DRED IETF draft: https://datatracker.ietf.org/doc/draft-valin-opus-dred/
- Hacathin repo (work in progress) https://github.com/altanai/IETF117-OPUS-APPLICATION
- Source Code of the OPUS codec with DRED extension https://gitlab.xiph.org/xiph/opus/-/tree/opus-ng?ref_type=heads
- Gstreamer (work in progress - incomplete) https://github.com/altanai/gst-build