Packet Loss Concealment — Decision & Diagnostics Cheat Sheet

How a receiver hides missing audio packets: the four PLC families, how PLC compares with FEC and RTX, and what to watch.

The four PLC families (worst to best)

Zero insertion	Fill gap with silence	Cheap; clicks at each edge - abandoned
Waveform substitution	Loop + fade a pitch period	ITU-T G.711 App I; good for short loss
Model-based	Extend codec speech params	Opus/SILK; rides out slightly longer gaps
Neural PLC	DNN generates new speech	WaveNetEQ, Opus 1.5 deep PLC; best quality

What WebRTC does (inside NetEQ)

Expand	Packet missing	Extrapolate sync buffer OR ask codec decoder
Merge	Real packet returns	Cross-fade concealment into real audio

PLC vs FEC vs retransmission — three different jobs

Retransmission (RTX)	Latency: 1 round trip | BW: on loss only | Exact: YES
FEC / RED	Latency: none | BW: every packet | Exact: YES (within redundancy)
PLC	Latency: none | BW: none | Exact: NO - it is a guess

Opus 1.5 neural concealment (March 2024)

- Deep PLC: --enable-deep-plc, set decoder complexity >= 5, ~1% of a CPU core, ~1 MB binary.
- Decoder-only upgrade: fully compatible with RFC 6716; any Opus encoder talks to a deep-PLC decoder.
- FARGAN vocoder: ~600 MFLOPS (1/5 of LPCNet) - what makes neural PLC cheap enough to ship.
- DRED redundancy: up to 1 s of audio in 12-32 kb/s; each 20 ms frame effectively sent ~50x; intelligible at 90% loss.

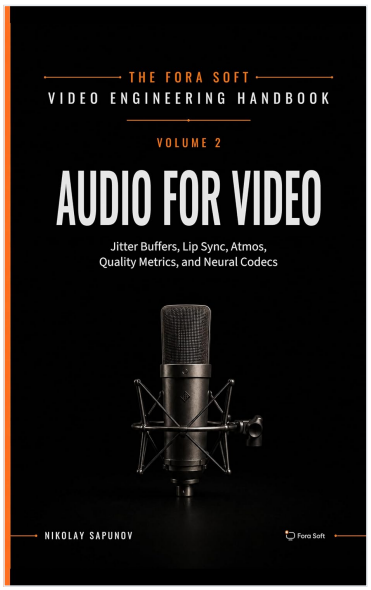
Diagnosis rules

- High concealment usually = real packet loss UPSTREAM - fix the network or add redundancy, don't just swap PLC.
- Loss % hides burstiness: 5% isolated = inaudible; 5% bursty = robotic smear. Test on bursty traces.
- Compare PLCs on realistic bursty loss with a concealment metric (PLCMOS), not uniform random + PESQ.
- Expecting neural PLC? Confirm the build compiled it in AND decoder complexity is high enough to switch it on.

Remember

- [ ] PLC fills a lost packet with manufactured audio - it conceals the loss, it does not recover the original.
- [ ] Four families: zero insertion (clicks), waveform substitution, model-based, neural PLC.
- [ ] WebRTC conceals with NetEQ's Expand; Merge cross-fades the real packet back in.
- [ ] PLC continues from the past; only redundancy (FEC, DRED) can bring back lost words.
- [ ] Burstiness, not the loss percentage, decides how robotic the audio sounds.

Companion to: 'Packet Loss Concealment (PLC): Hiding the Missing Frames'
www.forasoft.com/learn/audio-for-video/articles-audio/packet-loss-concealment-plc



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This cheat sheet ranks the four PLC families, compares PLC with FEC and retransmission and lists diagnosis rules. Volume 5 explains what happens to audio on a lossy network in detail: jitter buffers and NetEq, loss concealment, FEC and RED, bitrate decisions and incident triage by symptom.

WHAT YOU WILL FIND INSIDE

- Jitter buffers and NetEq behaviour
- Loss concealment, FEC and RED compared
- Neural codecs and their trade-offs
- Triage of audio incidents by symptom

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