Packet loss is the major source of errors when transmitting video over the public Internet while also impacting local and conditioned networks.

The purpose of this note is to demonstrate the performance of DVEO's DOZER technology and video streaming appliances using a commercially available Wide Area Network error emulator.
Using a WAN Emulator to Demonstrate DVEO’s DOZER Automated Packet Recovery

Question
How does packet loss and bit error rate (BER) over a network affect video streams with and without being protected by the DOZER Automated Packet Recovery technology?

Hypothesis
With DOZER, the video stream should be able to recover from minor to severe packet loss and BERs.

Equipment
- Video source, such as a video camera with SDI output
- DVEO MultiStreamer DIG/IP encoder and streamer, SDI input, DOZER option enabled
- DVEO D-Streamer IP video professional decoder/receiver, DOZER option enabled
- Apposite Linktropy WAN Emulator, such as the MINI² model
- PC with 2 x VLC Players and 2 x Video Monitors

Equipment Set-up and Procedure
- Set up the video source and MultiStreamer, and feed the video to the SDI input
- Output two identical 720p streams, at 2 Mbps each, to the Linktropy LAN A port
  - One stream with DOZER enabled, the other without
- Set Linktropy to apply packet loss anywhere from 0.5%-30%, and BER between $1\times10^{-5}$ and $1\times10^{-14}$ for LAN A to LAN B on both outputs
- Connect the D-Streamer to LAN B, and to accept both streams, with and without DOZER
- Connect the two D-Streamer outputs to two separate VLC players and perform playback side by side

Result
The D-Streamer shows that the output streams from the Linktropy are dropping packets per the packet loss and BER settings. The first output stream, which does not use DOZER protection, shows video artifacts on the monitor. The second stream, which is DOZER enabled, is able to recover the missing packets and plays the video smoothly without displaying any artifacts at all.

During the testing the packet loss on the Linktropy was varied from 0.5% (enough to start causing artifacts on the non-DOZER stream), all the way up to 30%. In all cases the DOZER-enabled stream played perfectly while, as expected, the non-DOZER stream had issues from smaller and temporary artifacts at lower packet loss rates to becoming completely unwatchable as the packet losses percentage was increased.

See the screen shots on the following pages for detailed parameter settings.
Figure 1: MultiStreamer Video Out 1 - With DOZER

Figure 2: MultiStreamer - DOZER Setup
Figure 3: MultiStreamer Video Out 2 - Without DOZER

Figure 4: D-Streamer Input without DOZER
Figure 5: D-Streamer Input with DOZER

Figure 6: D-Streamer DOZER Setup
Figure 7: Example of Linktropy Settings

Figure 8: Example of Linktropy Monitor and Settings
Figure 9: Stream Log Example without DOZER - Multiple Decoding Errors per Second

Figure 10: Stream Log Example with DOZER - No Decoding Errors
The pictures below show the distorted video at left, where DOZER is not used, and the perfect picture at right where DOZER performs automated packet recovery. The packet loss is set to 10%, 20% and 30%, respectively.

**Figure 11: Snapshot, 10% Packet Loss**

**Figure 12: Snapshot, 20% Packet Loss**

**Figure 13: Snapshot, 30% Packet Loss**

**Conclusion**

The DOZER-protected stream was able to recover from severe packet loss and bit error rates while the non-protected stream was impacted in proportion to the packet loss levels. The DOZER technology ensures error free video delivery over UDP even under the most demanding network conditions.
Background and More Information

Video operators need to deliver high-quality services at the lowest possible cost, which increasingly leads them to IP network based approaches including the public Internet. However, neither the Internet nor dedicated networks are optimized for time critical streaming video delivery during periods of high packet volume, thus impacting video service quality.

The UDP real-time data delivery protocol was designed for streaming video applications and assumes network nodes are not congested. However, IP network routers will simply drop UDP packets when overloaded, without notifying the sender. This is the most critical problem with video delivery over IP networks, and especially when UDP video has to compete with TCP/IP data traffic. It is well understood that streaming video using UDP is affected by TCP traffic and its demanding flow control mechanism whenever TCP and UDP share a node, and hence the UDP transmission may experience packet loss. Since TCP traffic accounts for 75% of all Internet traffic, the potential problem is obvious.

Therefore, delivering studio quality video over IP networks represents a formidable challenge to achieving a high quality television experience that consumers are accustomed to from traditional broadcasting.

DVEO Perfects IP Video Transmission via "DOZER" Automated Packet Recovery Technology

Enter the award winning 1 "DOZER" technology, integrated in a wide range of DVEO encoders/transcoders and receivers. DOZER routes video through all types of IP networks, including the public Internet, in a deterministic way thanks to its ability to correct for UDP packet loss, thereby enabling a broadcast quality TV experience. DOZER literally “bulldozes” through routers and enables IPTV/OTT operators to improve the user experience by ensuring smooth, low latency UDP video services.

DOZERbox is a real-time IP gateway technology featuring an end-to-end error correcting protocol that delivers time critical video reliably over UDP, whether unicast or multicast. It enables smooth MPEG-2 and H.264 SPTS and MPTS delivery of both SD and HD services by implementing DVEO patent pending Automated Packet Recovery algorithms for alleviation of packet delay variation or outright packet loss, and re-ordering out-of-sequence packets.

DOZERbox is available in three versions (click links to download data sheets):

1. DOZERbox II IP/IP™, a compact stand-alone product (pictured)
2. DOZER Racks IP/IP™, 1 RU form factor
3. DOZER APR: LIC™, a software license for third-party products, and an option in DVEO encoders/transcoders and receivers

For more information call DVEO at +1 858 613-1818 or visit www.dveo.com

Next Steps and Resources

The ultimate proof of the DOZER technology is of course to test it in the network environment that applies to each potential user entity. Upon request, DVEO will provide a pair of loaner DOZER boxes for evaluation purposes; please contact DVEO using the contact information on the cover.

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1 Society of Broadcast Engineers (SBE) Technology Award 2014 for DVEO’s DOZER IP video traffic smoothing technology