

## Why are Out-of-Order Packets Bad for VoIP?

If your network is designed to support low latency, low jitter, and low packet loss for real-time protocols like VoIP and video, you might think that's all you need.

However, if packets arrive shuffled at the destination, the receiving codec is not able to re-order the packets to play them in real-time (otherwise, you might end up sounding like Yoda!). This means that a lot of successfully delivered packets are dropped by the codec, and users will encounter clipping and dropped words.

If the out-of-order situation is bad enough, the codec may drop one side of the conversation, resulting in one-way-audio, or the entire call may drop.

Out-of-order packets can occur when there are multiple layer-2 or layer-3 paths to the destination, and the wrong load balancing mechanism is employed. For example: Two gigabit links are trunked together to create a large, fault-tolerant pipe between two switches, and are configured for per-packet load balancing. In this case, packets for a single VoIP conversation may take *either* trunk link to reach its destination.

This is similar to multiple checkout lanes at the supermarket – there's no guarantee of the order in which shoppers are processed (and the other line always moves faster anyway).

Instead, configure the trunk port for per-flow load balancing. In the supermarket example, this is when there is one long line and the shopper at the front of the line goes to the next open checkout counter.

The same problem may occur at layer-3, when multiple equal-cost route paths are configured to carry data. Having equal-cost route paths may cause other problems like additional jitter during the conversation as well as asymmetric routing problems.

If your network didn't drop a single packet, how do you detect this problem?

There are two ways to investigate out-of-order packet problems:

- 1) Employ a call simulator that detects out-of-order packet reception.
- 2) Interrogate the codec for error counters related to out-of-order drops.

PathSolutions TotalView's Call Simulator automatically tracks out-of-order packets to make sure that this problem is not happening in your environment.

