

A Tale of Two Checksums

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Abstract. UDP Options draft [1] proposes adding options to UDP in the same way that TCP provides options. UDP Options are carried in the space beyond the end of the UDP Datagram unto the IP Payload length. This extra space carries TLV-formatted transport options.

In TSVWG at IETF-101 we presented a single slide showing a UDP checksum bug in the FreeBSD UDP output code. We fixed that bug upstream and thought that was the end of checksum issues! Little did we know the trials we were to face in implementing and testing UDP Options.

We started measuring whether Internet paths transparently support UDP Options datagrams and were met by a whole mess of issues, one was the innocuously little checksum bug that we fixed in FreeBSD. There are still opportunities to miscalculate the checksum, causing datagrams to fail to reach the remote endpoint.

So, we asked, "What would happen if the options space itself carried a value that magically improved ability to work across the Internet?". We found such a value in what we call the checksum compensation option (CCO) [2].

An endpoint that receives a UDP-Options datagram containing a CCO, can compute a valid UDP checksum using either the UDP Length, or the length deduced from the IP header information. The CCO not only dramatically improves the chance of successful transmission, and the same checksum also protects the integrity of the UDP options space.

Our presentation will take a fast trip through this story, using measurement data from paths to 400K IPv4 addresses (17K ASes) and 30K IPv6 addresses (200 ASes) to assess the range of pathologies that result, and whether the CCO improves the probability of successful use of UDP Options. The targets list included 200K authoritative DNS servers and 100K HTTP servers from the Top-1m Alexa and about 70K STUN servers from a full IPv4 range scan.

Keywords: UDP · Checksum · UDP Options · Checksum Compensation Option.

References

1. J. Touch, "Transport options for UDP," 2019, draft-touch-tsvwg-udp-options, Work in progress.
2. G. Fairhurst, T. Jones, and R. Zullo, "Checksum Compensation Options for UDP Options," 2018, draft-fairhurst-udp-options-cco, Work-in-Progress.