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Congestion Signaling (CSIG) for Linux TCP Data Center Networking

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This proposal presents the overall design, challenges, and solutions for adding support for the Congestion Signaling (CSIG) protocol to the Linux networking stack. CSIG is being standardized within the UEC (https://github.com/opencomputeproject NET-UEC-CSIG) and has broad support from prominent switch vendors.

CSIG is an in-band network telemetry protocol that allows end-hosts to obtain visibility into fine-grained network signals for congestion control, traffic management, and network debuggability. CSIG uses fixed-size L2 tags to collect metrics from network devices via a compare-and-replace mechanism, with data reflected from receiver to sender via transport layer options (e.g. TCP options). Additional reference: IETF draft (https://www.ietf.org/archive/id/draft-ravi-ippm-csig-01.html)

The talk will focus on topics such as:

1. Format and placement of CSIG tag and CSIG reflection header
2. Adapting Hardware and Software Generic Receive Offload (GRO) to handle CSIG-tagged packets.
3. Life of a CSIG-tagged packet in Linux TCP:

(a) End-host negotiation of CSIG feature during TCP connection establishment
(b) Receive path: L2 tag processing (reusing VLAN-handling logic), extraction of CSIG data, and CSIG data reflection back to the sender via TCP options on ACK packets
(c) Transmit path: CSIG L2 tag insertion with initial values.
(d) Use of the bottleneck link metrics in congestion control algorithms for making decisions on sending rate

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