

Deterministic QoS for MPLS data plane considerations:

draft-eckert-detnet-mpls-tc-tcqf-01

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Background / History

Concept of Tagged Cyclic-Queuing and Forwarding proposed to DetNet for a long time

2018 - draft-qiang-detnet-large-scale-detnet

2021 - draft-dang-queuing-with-multiple-cyclic-buffers

Both introduce (informationally) the mechanism without specifying a specific encap (but list options)

This draft draft-eckert-detnet-mpls-tc-tcqf now introduces a target standardized encap option

Using existing encap and semantics: MPLS Traffic Class (TC) Field with [RFC3270], TC- Inferred-PSC LSP (E-LSP) QoS

Introduced in September 2021 DetNet Interrim

-01 revision

Added co-author

Reformulated data model as “non-YANG”

After longer discussion with YANG expert and recognizing that it would overload document with YANG specific

Makes text simpler, gives more freedom to write YANG model draft separately to go along with this spec.

Technology Summary

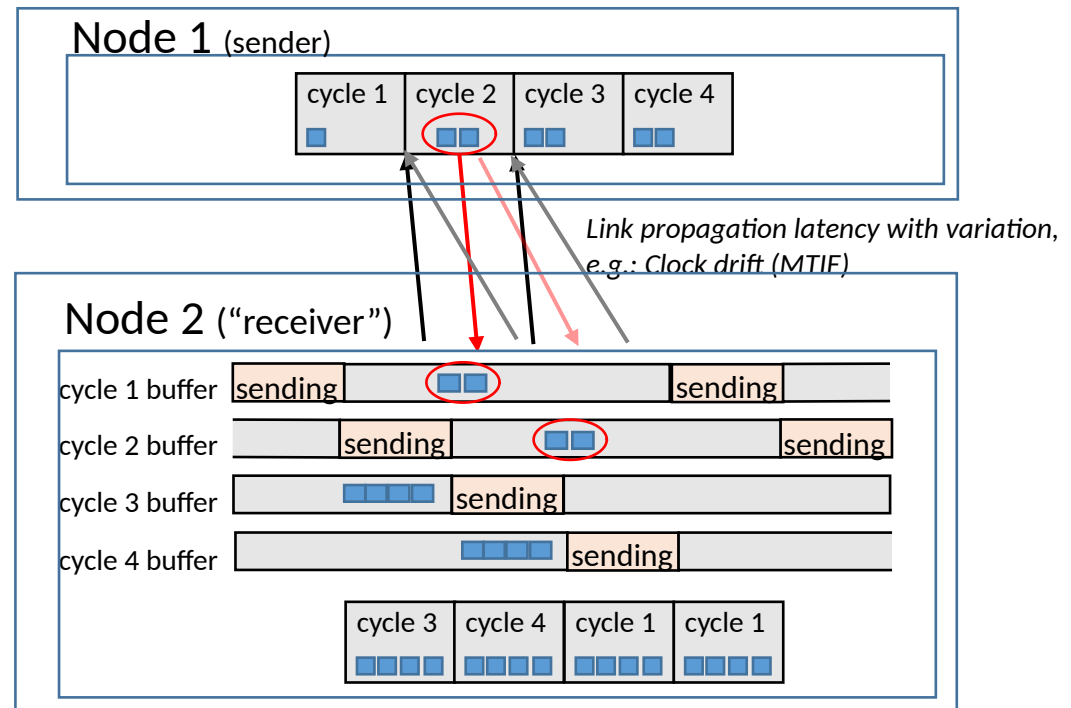
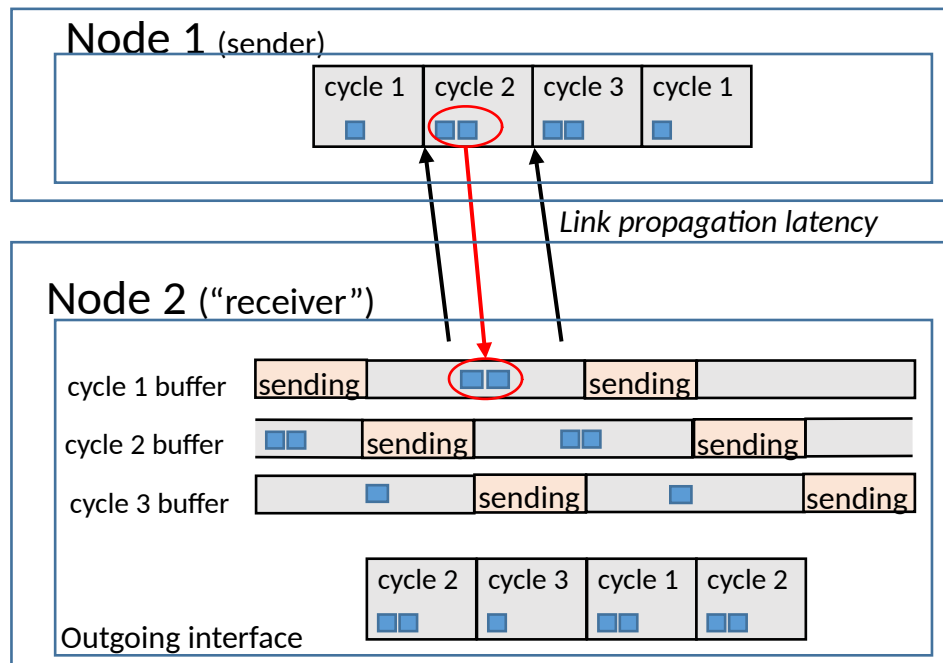
TSN CQF (Cyclic Queuing and Forwarding)

2 cycles. Used in ≤ 10 Gbps in-building/industrial networks Packets are received into cycle based on receive time
Very strict clock sync needed in 100Gbps+ network. Can not well support higher latency links((beyond few Km).

Tagged-CQF

Indicate Cycle # in packet field. Eliminates length restrictions of links. Reduces clock sync accuracy by factor 10..100
Minimum 3 cycles. More cycles allow relaxing requirements further - e.g.: for links with propation jitter (FEC, ARQ)

Proof of Concept +100Gbps deployment since 2018, 2000 KM range, ≤ 100 usec end-to-end jitter



Why is this important ?

- Challenge 1: Network Operator
 - IMHO: Want to have a Service-Provider Class network solution for DetNet to succeed.
 - Even enterprises want to adopt standard network ops models from SP for WANs
 - Per-hop, per-flow/tunnel stateless forwarding: SR
 - CQF is only (relevant) proven/standardized option today
 - T-CQF simply expands it to make it work better in WANs
- Challenge 2: Applications
 - Most industrial TSN applications want/need low jitter
 - E.g.: Jitter may introduce PTP need into constrained application devices to resync control loops
 - Guaranteed Service / TSN Asynchronous Time service have MAXIMUM jitter
- IMHO: T-CQF is only short term option that solves both challenges
 - Some other options, but all would require new packet headers
 - And many options to consider. None of which had any prior Stds experience.

Challenges of adding new headers for QoS

- We may only want better bounded latency now.
- But it would be great to not have encaps “one-offs”, but be able to easily add header fields for upcoming requirements when they occur
- Bounded latency: Alternative (to T-CQF): Per-hop, per-flow - stateless, 'zero-jitter' deterministic
 - Multiple options – probably some ideas as old as 30 years
 - New one E.g.: <http://dl.ifip.org/db/conf/cnsm/cnsm2021/1570754857.pdf> (gLBF)
 - Ideally requires a 'timestamp' packet header field (e.g.: 16 bit) and sequence of 4-bit priority values per hop
 - Different options likely would need different parameters
- Ability to support same QoS parameters across MPLS (SR) and IP
 - E.g.: common extension header introduced with MPLS-DT carrying PREOF and LPREOF:
Would like to have 'sequence-number' header field not only for MPLS, but in a form it could duplicate also as IP extension header. Maybe not same encoding, but single parameter space.
- Stochastic bounded latency
 - draft-stein-srtsn – sequence of per-hop 'deadlines' (usec time values – 16..32 bit?)
- Other QoS – per-hop, per-flow stateless!
 - DSCP: BIER header (RFC8296) already allows MPLS with DSCP
 - Given how MPLS payload is most often IP, using DSCP instead of TC can make ops easier
- More

Asks

- Want to ask WG to adopt draft-eckert-detnet-mpls-tc-tcwf
 - Or resolve any charter / responsibility issues quickly
 - Not fundamentally different in amount of “QoS” than our PREOF work
- Create a design team for DetNet QoS
 - More regular, informal (no WG chair admin work ;-) meetings
 - PREOF, Latency (is there anything else ?)
 - Round 1 targets: Discuss current drfts targeted for WG (PREOF, Latency)
 - Round 2: Discuss reasonable scope for extension header data
 - Collaborates with MPLS-DT.
 - Seek input from more QoS experts.

The End