Problem Statement
of Queuing Mechanism
with Multiple Cyclic Buffers
draft-dang-queuing-with-multiple-cyclic-buffers-00

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A reminder to new attendees …

- DetNet is about an upper bound on end-to-end latency – not low average latency.

- Bounded latency is the ability for IETF Deterministic Networking (DetNet) or IEEE 802.1 Time-Sensitive Networking to compute exactly how many buffers are required to achieve zero congestion loss.

- draft-ietf-detnet-bounded-latency describes requirements for queuing mechanisms of Cyclic Queuing and Forwarding (IEEE8021Q). For a given DetNet class of service, a set of two or more buffers is provided at the output queue layer.

2-buffer CQF

Short Link Propagation Delay

End-to-end Jitter ≤ worst case-best case =2*T
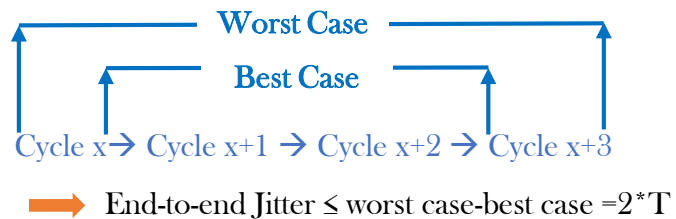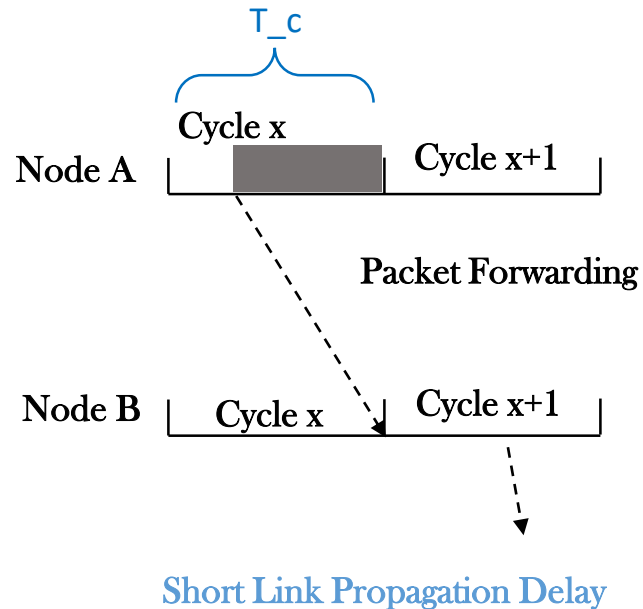
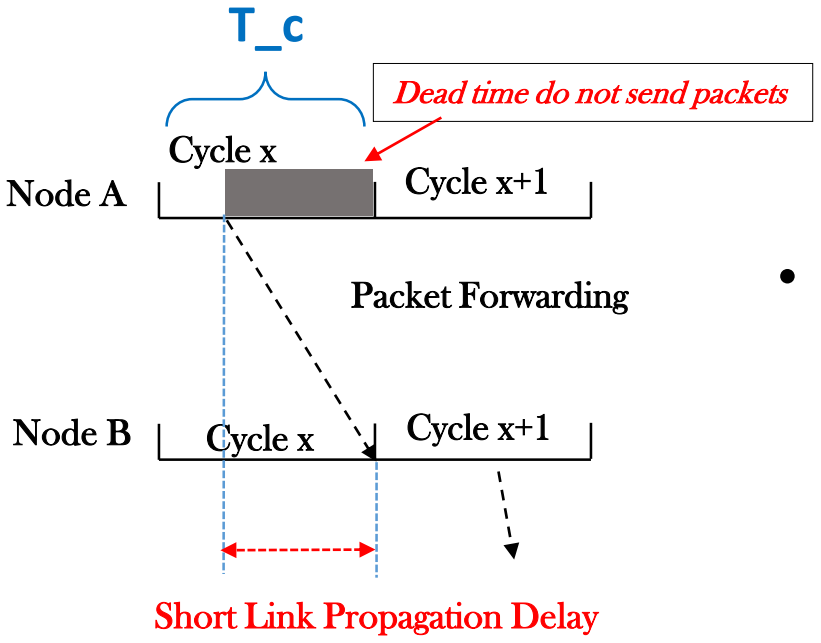2-buffer CFQ has been defined in IEEE 802.1 Qch (TSN-CQF)

Introduction：Two buffers per outport.

- That link propagation delay should be absorbed by a cycle.
- Every nodes is required to support per-flows dynamic state.
- Guard band, which is end of cycle buffer dead time, is used to identify different cycle.

For example
The packets sent by up-stream node (e.g., A) at cycle x much be received by node B at the same cycle.

Problem Statement of 2-buffer CQF

T_c

Dead time do not send packets

Cycle x

Node A | Cycle x+1

Packet Forwarding

Node B | Cycle x | Cycle x+1

Short Link Propagation Delay

- **Dead time wastes bandwidth resources.**
  - When the method is applicable, the sum of link delay, output delay, preemption delay and processing delay takes a portion of T_c, called dead time in [draft-ietf-detnet-bounded-latency], which cannot be used to send packets with deterministic services.

- **Prohibit the method from being used with long links, such as in WAN and MAN scenarios.**
  - The link propagation delay must be smaller than the T_c. the link propagation delay must be smaller than the T_c. Therefore, T_c must be larger than the link delay, resulting in high latency, jitter and buffer upper bound.

Worst Latency

Best Latency

Cycle x → Cycle x+1 → Cycle x+2 → Cycle x+3
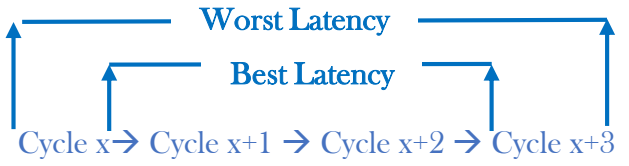
➡ End-to-end Jitter ≤ worst case-best case = $2*T\_c$

While T_c is bigger, the bounded latency is bigger ☹ and the jitter is bigger ☹.

A Queuing Mechanism with Multiple Cyclic Buffers

- [draft-ietf-detnet-bounded-latency](#) describes requirements for CQF with more buffers.

- Norman Finn recommended to support long links and give good latency and bandwidth utilization in the paper named ["Multiple Cyclic Queuing and Forwarding"](#).
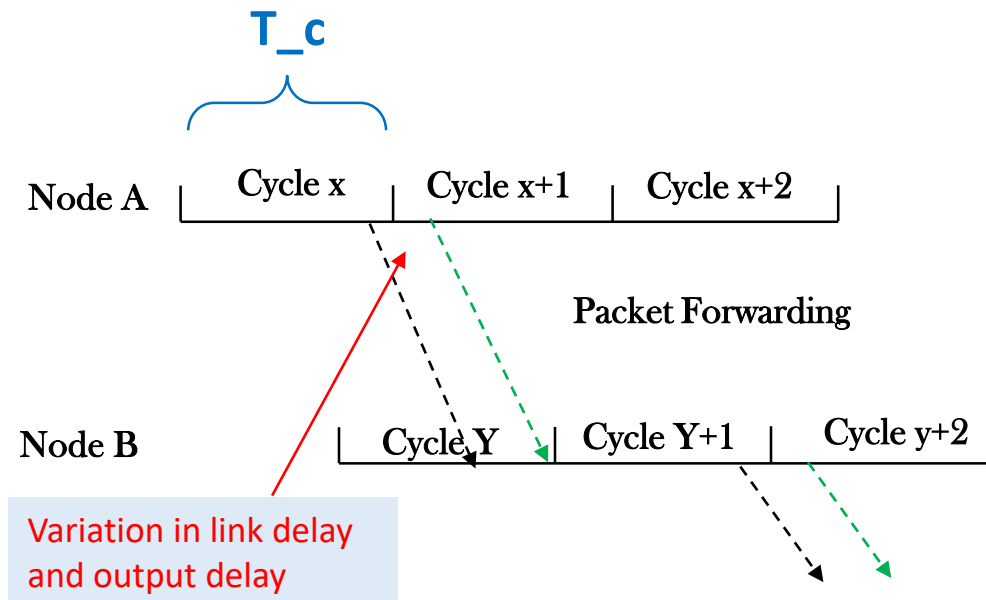
- **Reduce T_c and add multiple buffers** to further improve bandwidth utilization

- **Decouple the link propagation delay and T_c** to improve the bandwidth utilization and latency.

- **To resolve the cycle ambiguity, a cycle label can be put in a packet**, which identifies which cycle the packet belongs with. Packets in different cycles carry different cycle labels.

Next Step

- Welcome to review or contribute it.

Thank you!