Deadline based Forwarding

draft-peng-detnet-deadline-based-forwarding-01

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Motivations

- Detnet(RFC8655) defines QoS goals of deterministic routing: bounded delay/jitter; bounded packet loss ratio; bounded out-of-order delivery.
  - Uses resource reservation, explicit routing, and service protection, to archieve these goals.

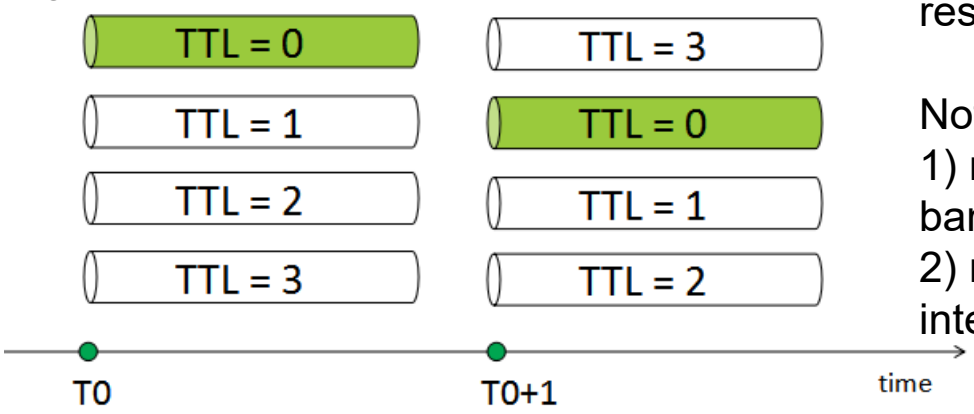
- Resource reservation is the basis of ensuring bounded delay/jitter, and ultimately depends on the queue mechanism of the forwarding plane.

- The widely used priority based queuing scheme may give better average latency, but with worst case latency. Thus, an enhancement scheme of PQ is proposed.

Deadline Queues

- Deadline queues are variants of PQ and are also based on priority scheduling.
  - All deadline queues have **TTL attributes**, staggered from each other, decreasing with the passage of time (timer interval I).
  - The deadline queue with **TTL=0, has the highest priority**, higher than the existing SP's priority. Subsequently, 0 will be reversed to the maximum initial value.
  - The deadline queue with **TTL≠0, has normal priority if in-time policy**, and **prohibition priority if on-time policy**. The former can be involved in scheduling, while the latter cannot.

e.g, 4 deadline queues:



buffer size =
reserved bandwidth * measure interval

Note:
1) reserved bandwidth may equal to port bandwidth.
2) measure interval may equal to timer interval

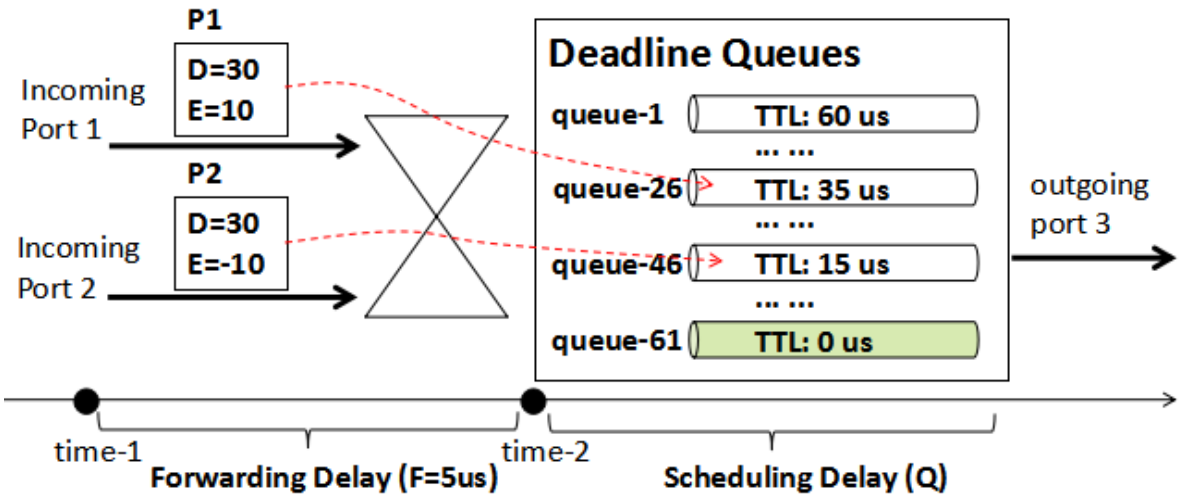
Put Packets to Deadline Queues

- First, get the deadline information of the packet, including:
  - **Planned deadline (D)** (E2E_delay - accumulative_link_delay) / hot_count
  - **Accumulated delay variation (E)** by all upstream nodes.

  can be get from: packet itself, FIB entry, policy entry, etc.

- Second, put the packet in the specific deadline queue.
  - Allowable scheduling delay **(Q) = D + E - F**
  - **Q ---> TTL**

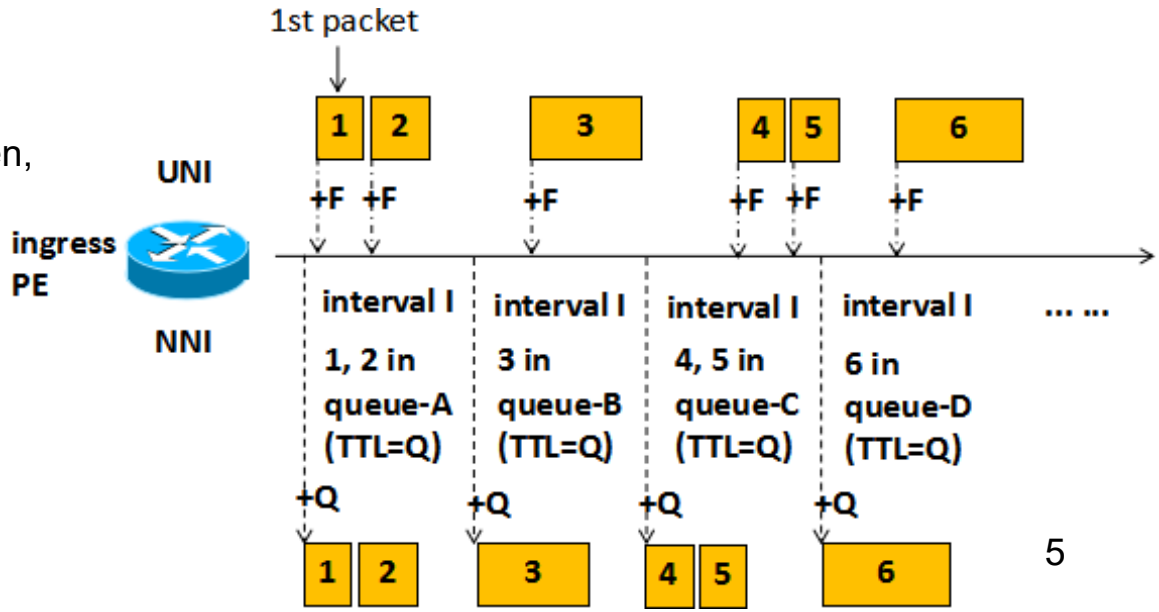
packet 1 to queue-26
packet 2 to queue-46



Traffic Regulation and Shaping

- Traffic regulation on UNI port, to ensure that the reserved bandwidth of service, M0, is not exceeded.
  - If there are N source, the resreved bandwidth of deadline queue at the intermediate aggregate node, Mx, should meet: **N * M0 < = Mx**.
  - For simplicity, **Mx may equal to port bandwidth**. It does not necessarily consume the whole port bandwidth due to admission control on all ingress.
- Traffic shaping on NNI port, to distribute packets into deadline queues.

If allowable queuing delay is Q, then,
Time1:
packet 1,2 in queue-A with TTL=Q;
Time2:
packet 3 in queue-B with TTL=Q;
Time3:
packet 4,5 in queue-C with TTL=Q;
Time4:
packet 6 in queue-A with TTL=Q;



Benefits

- Cost:
  - Time synchronization is not required between network nodes. Operate based on relative time.
- Deployment:
  - Packet multiplexing based, it is an enhancement of PQ scheduling algorithm, friendly to upgrade.
  - Each node can independently set the authorization time of the deadline queues, based on self port bandwidth.
  - Support partial upgrade.
- Scalability:
  - A single set of deadline queues supports multiple levels of dwell time.
- Performance:
  - Good jitter control, just a single authorization time.

Next step

- Any questions and comments ?

Thank you!