FlexAlgo Deterministic Routing

draft-peng-lsr-flex-algo-deterministic-routing-02

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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.

- A deterministic path is typically (but not necessarily) a traffic engineered path with explicit routing calculated by a controller.

- Flex-algo provides an alternate way to compute constraint-based paths. We propose a distributed deterministic routing extension for Flex-algo.

Gaps

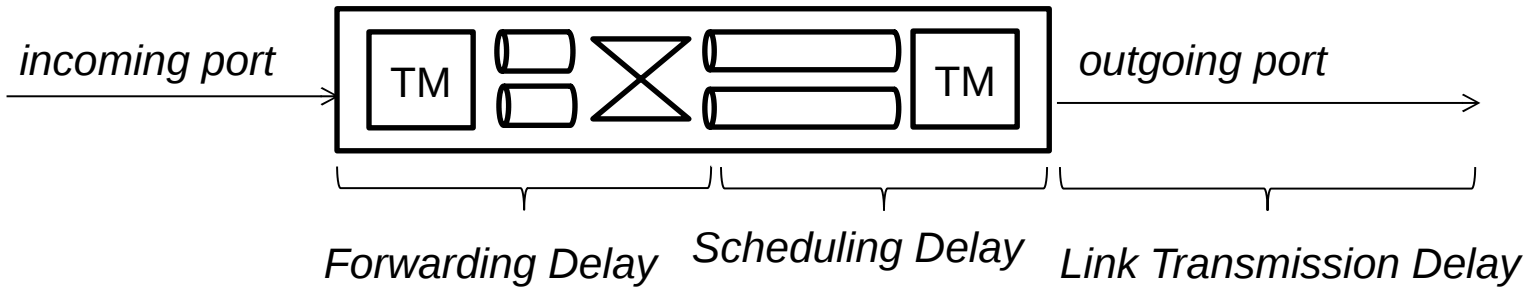
- Flex-Algo already supports the min delay metric type that considers link delay but not node delay (including queuing delays)
- Delay = node delay + link transmission delay. To obtain a deterministic path, the node delay must be considered
- Example: a link of 1~10KM in length and 5~50us in transmission delay. Node delay may be 10~50us.

How ?

DetNet Architecture	Flex-algo Deterministic Routing
Resource reservation	Deterministic Link Resource, with deterministic node delay attributes.
Explicit routing	Flex-algo path calculated with Deterministic Delay Metric type
Service protection	**Additional redundant deterministic delay path, consistent with the delay of the primary path.**

Deterministic Link Attributes Advertised

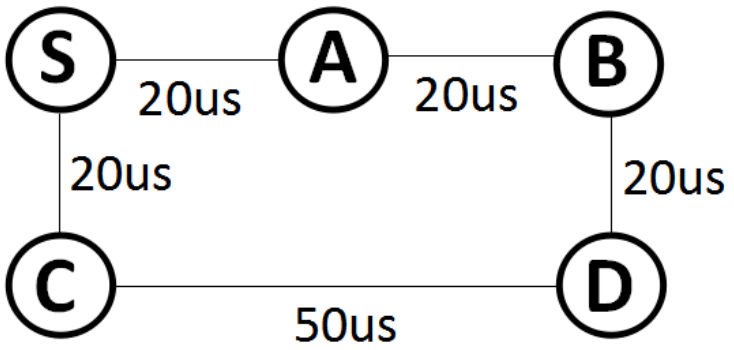
- Including:
  - Link transmission delay
    - The average measured link transmission delay value.
  - Intra-Node Forwarding Delay
    - The latency of a packet from reception on the incoming port (or generated from control plane) to queuing on the outgoing port
  - Intra-Node Scheduling Delay
    - The scheduling delays that are related to the scheduling algorithm such as CQF, Deadline, CBS, etc
    - Multiple scheduling delays may be provided by each scheduling algorithm.



Deterministic Delay Path Calculation

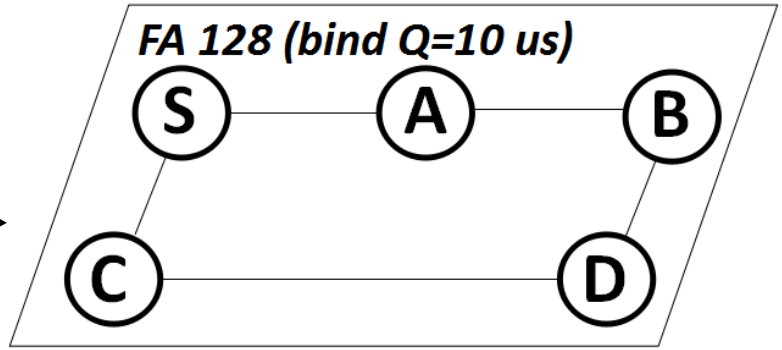
- FAD explicitly contains the deterministic link resources and an scheduling delay.
- A new metric type, Deterministic Delay Metric type (3?), is used to indicate the calculation of deterministic delay path.

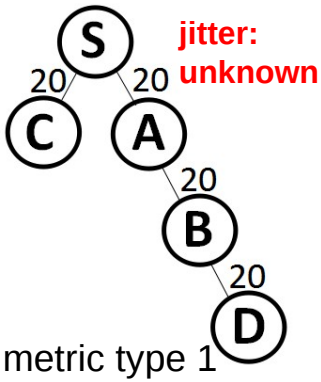
e.g,



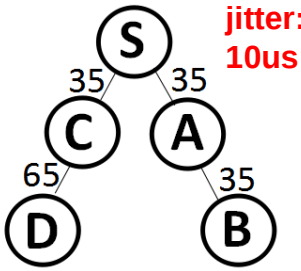
physical network with deterministic links

--- Intra Node Forwarding Delay: 5us
--- Intra Node Scheduling Delay: [1, 60] us
--- Link Transmission Delay: in the fig.





metric type 1



metric type 3

Redundant Deterministic Delay Paths

- Redundant deterministic delay paths are calculated by PLR according to local policy. Somewhat like TI-LFA FRR paths, but not identical.
- Constraints for a redundant path:
  - Contained in the FAD, and
  - The number of nodes intersecting the primary and redundant paths is minimized, and
  - The difference between the number of hops of the primary and redundant paths is minimized, and
  - The difference between the cumulative link transmission delay of the primary and redundant paths is minimized.
- The primary and redundant paths each use specific scheduling delays and should have similar cumulative delays. The packet is sent along the primary and redundant paths at the same time.

Next step

- Any questions and comments ?

Thank you!