Deadline based Forwarding

draft-peng-detnet-deadline-based-forwarding-14

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Main Updates (12 -> 14)

1) Evaluation on the Ring-Mesh Referrence Topology .

2) Supplement the existing EDF research conclusions in the academic community.

3) Other editorial modifications.

EDF Overview

which category ?
- **Final bound** (for EDF in-time)
- **Interval bound.Non Periodic.Class level** (for EDF on-time)

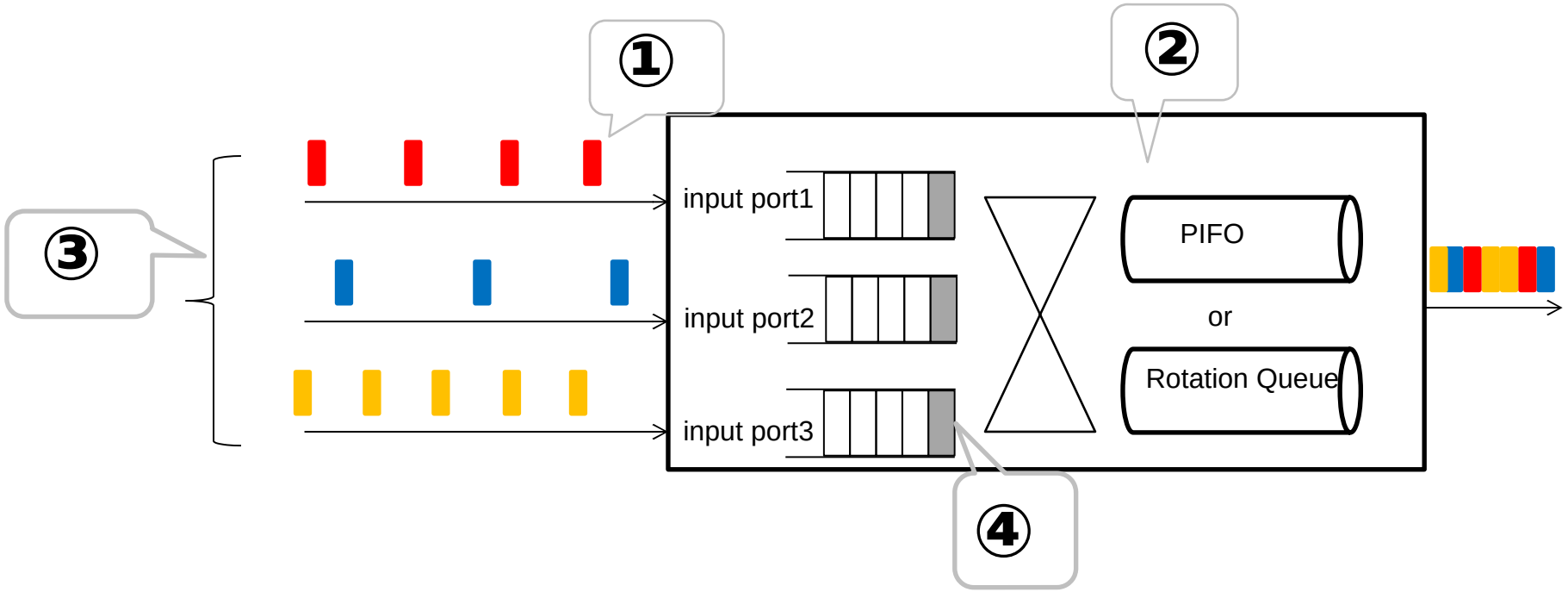
Target: Based on the quantified delay level resources in the network, different flows are assigned different delay levels to ensure scheduling before their deadline.

① Packet's deadline = arrival time (A) + planned residence time (D) + latency deviation (E).
② Packet inserted into the the sorted queue (or approximate sorted queue) based on its deadline.
③ All eligible arrivals must meet the schedulability conditions.

for PIFO: $C*t \geq \sum_{i=1}^{N} A_i\,(t - \mathrm{d}_i) + M$

for RPQ: $C*t \geq A_1\,(t - d_1) + \sum_{i=2}^{N} A_i\,(t + \mathrm{AT} - \mathrm{d}_i) + M$

④ When actual arrivals violates eligible arrival, take re-shaping or latency compensation (preferred).



Evaluation on Ring-mesh RT

- In the ring network (1 Gbps), on each hop, there are two bursts competing for the outgoing interface. Their sizes are 1 flow-set and 6 flow-sets, respectively. The designed delay level resource table:

Delay Level	Burst Resource	Bandwidth Resource	Allowed Admited Flows
225 us	1223.6 Kbits	725 Mbps	CC/Audio/Video of 7 flow-sets

- In the core network (10 Gbps), on the bottleneck link, there are 12 bursts competing for the outgoing interface. Their sizes are 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 30, and 30 flow-sets respectively. The designed delay level resource table:

Delay Level	Burst Resource	Bandwidth Resource	Allowed Admited Flows
400 us	6356 Kbits	1860 Mbps	CC/Audio of 70 flow-sets
700 us	5880 Kbits	5390 Mbps	Video of 70 flow-sets

- E2E bounded delay for CC/Audio is 4.75 ms (225*14 + 400*4), for Video is 5.95 ms (225*14 + 700*4).
- E2E bounded jitter is 0 with the help of latency deviation (E) and on-time mode.

Handling Status of All Received Comments

[Q1] There has been a lot of previous work on this topic, it would be good to understand what is novel in this document. (from gengxuesong, IETF115)
[Q2] What have you contributed here which is not in the 1986 reference publication you quoted, ... in your case it is highly simplified without sufficient proof. I think the calculation is invalid..... (from gengxuesong, IETF117)
[A] This document proposes a core stateless EDF mechanism to better adapt to the Diffserv architecture, and also aims to quantify delay level resources and provide a foundation for path computation. The appendix provides proof. The latest version supplements the research result of the academic community.

[Q3] What preparations should be made before the deadline: such as: bandwidth guarantee, path planning, etc.....(from chengzuopin, https://mailarchive.ietf.org/arch/msg/detnet/HLaJZx5bhJYCUGgqwj68Paek7jI/)
[A] Add section for path computation and resource reservation.

[Q4] A question for clarification on the admission criteria (or the schedulability condition) of the Deadline based forwarding... ... (from Jinoo, https://mailarchive.ietf.org/arch/msg/detnet/4VaZEQ1nmisd-SsHGIEnQf-hgKE/)
[A] consensus reached on the understanding of schedulability conditions, and a summary of in-time/on-time has been added as suggested by Jinoo.

Other issues in interim meetings have been clarified, see https://notes.ietf.org/notes-ietf-interim-2023-detnet-02-detnet, https://mailarchive.ietf.org/arch/msg/detnet/UbXwJ8rOOEROYXL__OyQQmg1-mg/

Next step

- Sync well with the plan of WG dataplane solutions adoptions.
- Any questions/comments ?

Thank you!