On-time Forwarding with Push-In First-Out (PIFO) Queue

draft-ryoo-detnet-ontime-forwarding-02

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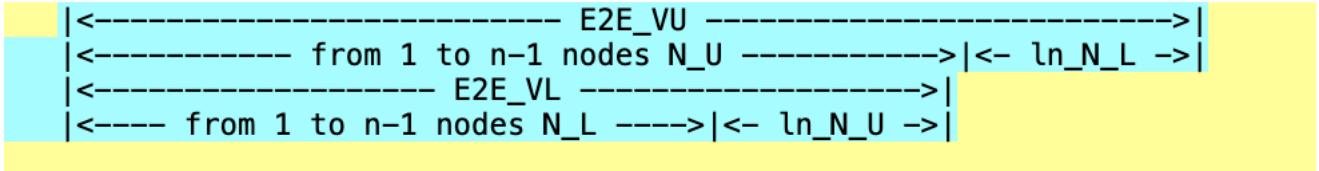
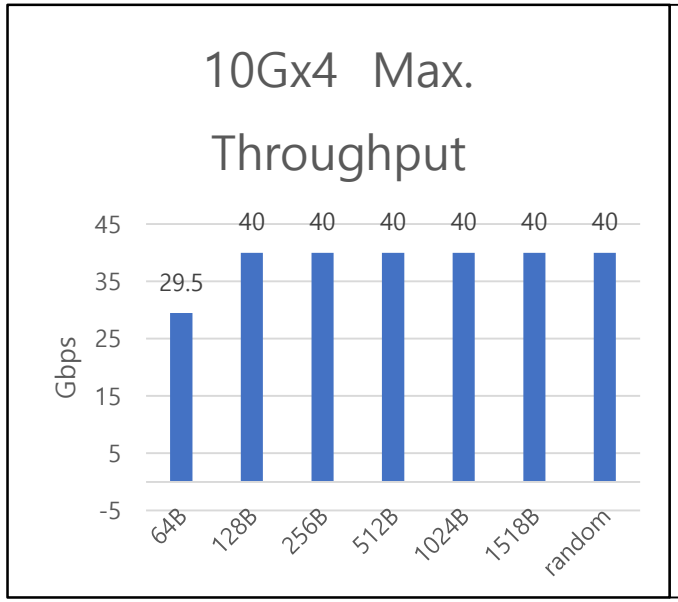
V01 Updates

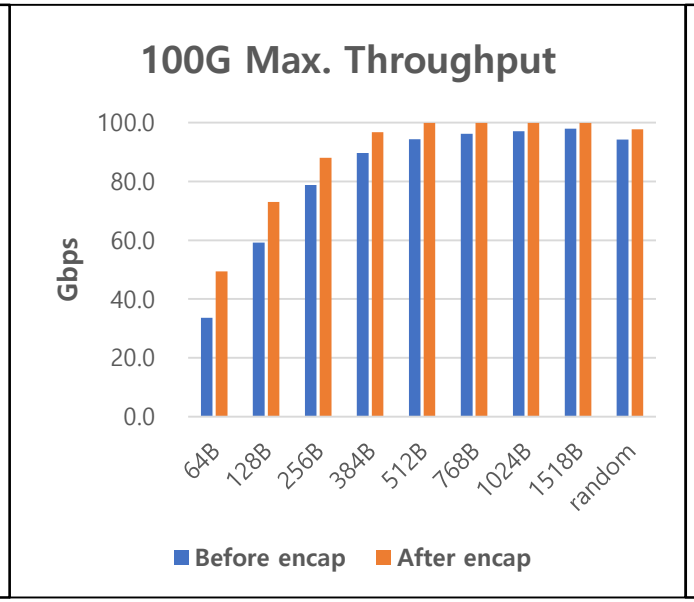
- **The first draft was proposed at the 119th meeting**
  - Motivations
  - Temporal model
  - Data plane operation
  - Controller plane operation
  - Capability analysis
- **V01 draft updates the data plane queuing operation part**
  - Description of the relationship between queuing delay and non-queuing delay based on N_U and N_L
  - Description of the relationship between the variable delay of end-to-end and nodes N_U and N_L

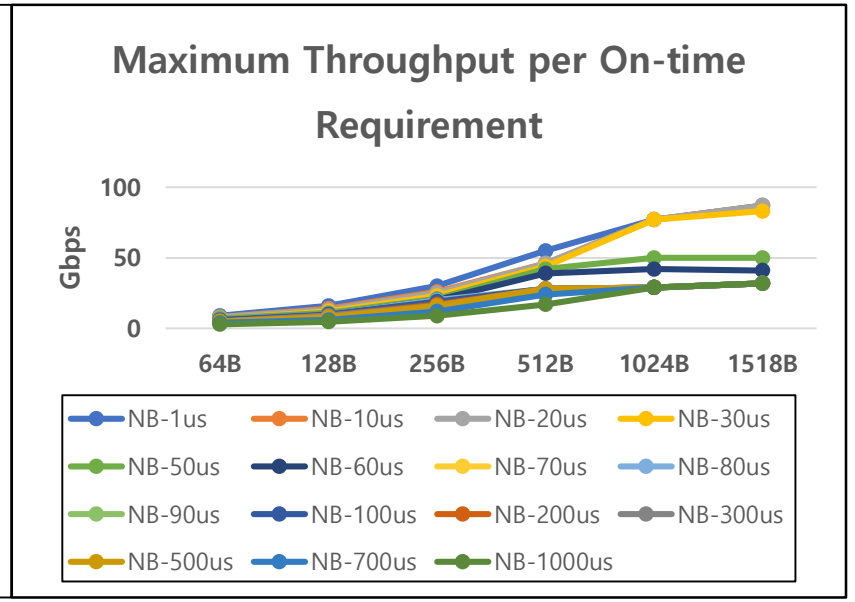


V01 Main Works

- **On-time service testing using PIFO queues with a single node**
  - There was a comment that implementing a PIFO queue would be challenging, we first conducted FPGA-based DetNet throughput tests of 40Gbps and 100Gbps, followed by a single node PIFO queue performance test.







V02 Updates

- **V02 draft updates the controller plane operation part**
  - Description of the relationship between the maximum queuing delay depending on buffer size and service rate

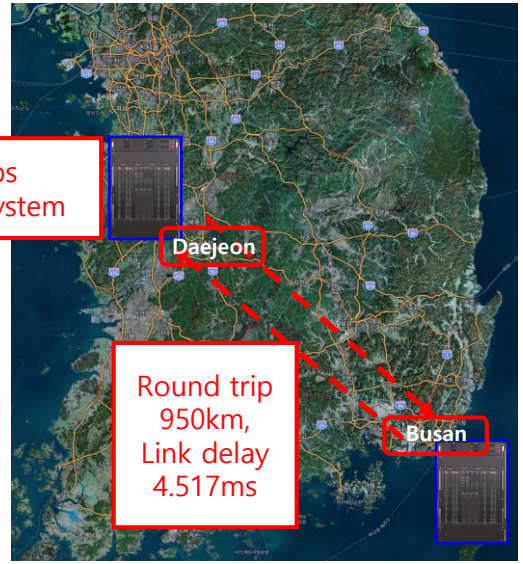
> The second condition represents the minimum end-to-end queuing delay which is the minimum packet queuing time that nodes along the end-to-end path must guarantee. Since the maximum queuing delay can be obtained by dividing the buffer size by the service rate, whether condition 2 is satisfied can be checked as ∑[h=0,H] {buffer sizes} / the service rate >= E2E_VL - minimum e2e variable non-queuing delay.

  - Description of the relationship N_U and N_L depending on maximum queuing delay

> last node allows for the flow. N_U is computed as the maximum queuing delay plus the minimum node variable non-queuing delay. Since the maximum queuing delay is determined by the buffer size allocated to a flow, If a policy is defined, such as setting a maximum buffer size per flow to prevent a single flow from occupying all the buffer resources of the node, the maximum queuing delay is calculated based on the maximum buffer size specified by the policy. If no such policy exists, the operator considers the buffer size allocated per flow and determines N_U to be as large as possible without exceeding the total buffer size of the node. Then, the

V02 Main Works

- **On-time service testing using PIFO queues between single path**
  - We performed an on-time service performance test of the PIFO queue across four nodes in the actual KOREN network over a 475km section between Daejeon and Busan (64~1518byte random size test packets)



BE flow = 50Gbps
DetNet In-time 40G x 2 = 80Gbps
DetNet On-time 2.5G x 7 = 17.5Gbps

~7us Per node
45us x 4 = 200us
295us x 4 = 1.18ms
545us x 4 = 2.18ms
795us x 4 = 3.18ms
1,045us x 4 = 4.18ms
2,545us x 4 = 10.18ms
5,045us x 4 = 20.18ms

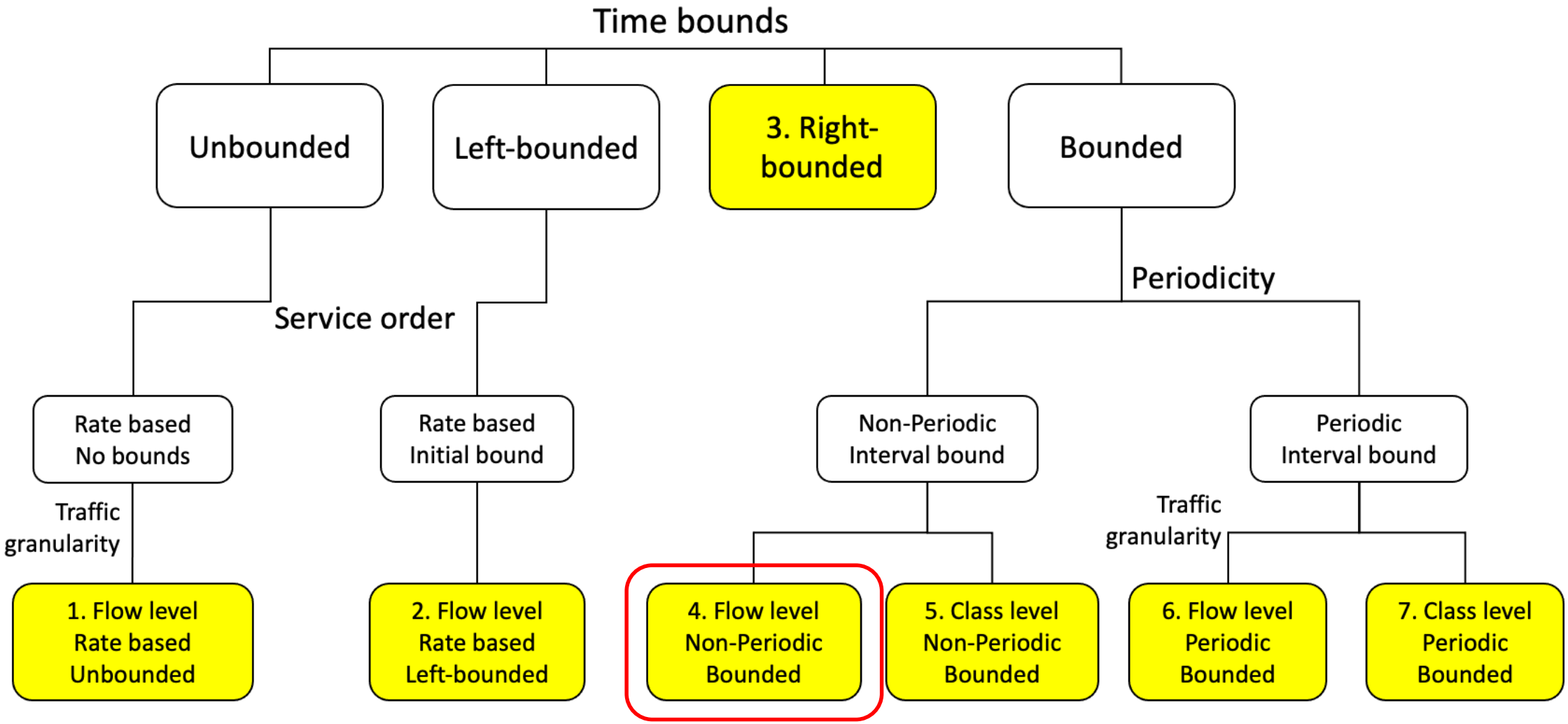
PGID	Total # Frames Rec.	Latency Min (탈)	Latency Max (탈)	Latency Max-Min (탈)	Latency Avg (탈)	Bit Rate (/sec)	Small Error	Big Error
Chassis: 129.254.73.170, Card: 01, Port: 01								
							BE Congestion Loss	
1	65,170,859	4,524.265	16,798.135	12,273.870	4,699.286	29,266,486	9	323,848
Chassis: 129.254.73.170, Card: 01, Port: 02								
			DetNet In-time					
2	1,756,990,618	4,532.295	4,552.305	20.010	4,544.436	39,385,180,496	0	0
3	1,756,991,259	4,532.292	4,552.312	20.020	4,544.426	39,385,139,710	0	0
11	109,812,210	4,720.247	4,730.922	10.675	4,723.094	2,461,591,305	0	0
12	109,812,008	5,722.567	5,732.590	10.023	5,724.569	2,461,576,011	0	0
13	109,811,816	6,722.507	6,731.995	9.488	6,724.173	2,461,637,189	0	0
14	109,811,611	7,722.777	7,732.507	9.730	7,724.517	2,461,632,091	0	0
15	109,811,407	8,722.985	8,732.995	10.010	8,724.918	2,461,626,993	0	0
16	109,810,000	14,722.565	14,733.260	10.695	14,724.855	2,461,626,993	0	0
17	109,807,635	24,722.565	24,732.565	10.000	24,724.506	2,461,632,091	0	0
			DetNet On-time					

Next step

- **We will conduct an on-time service performance test of the PIFO queue across multiple paths (including P2MP) in the actual KOREN network over a 725km section connecting Seoul, Daejeon, and Busan**
- Update the document and address the comments
- Any questions/comments?

Thank you!

Classification according to the suitable category of the newly proposed taxonomy



On-time forwarding with PIFO queue