Export of Forwarding Path Delay in IPFIX

draft-tgraf-opsawg-ipfix-inband-telemetry-00

Enabling a statistical network delay view, giving insights where delay is being accumulated in the forwarding path

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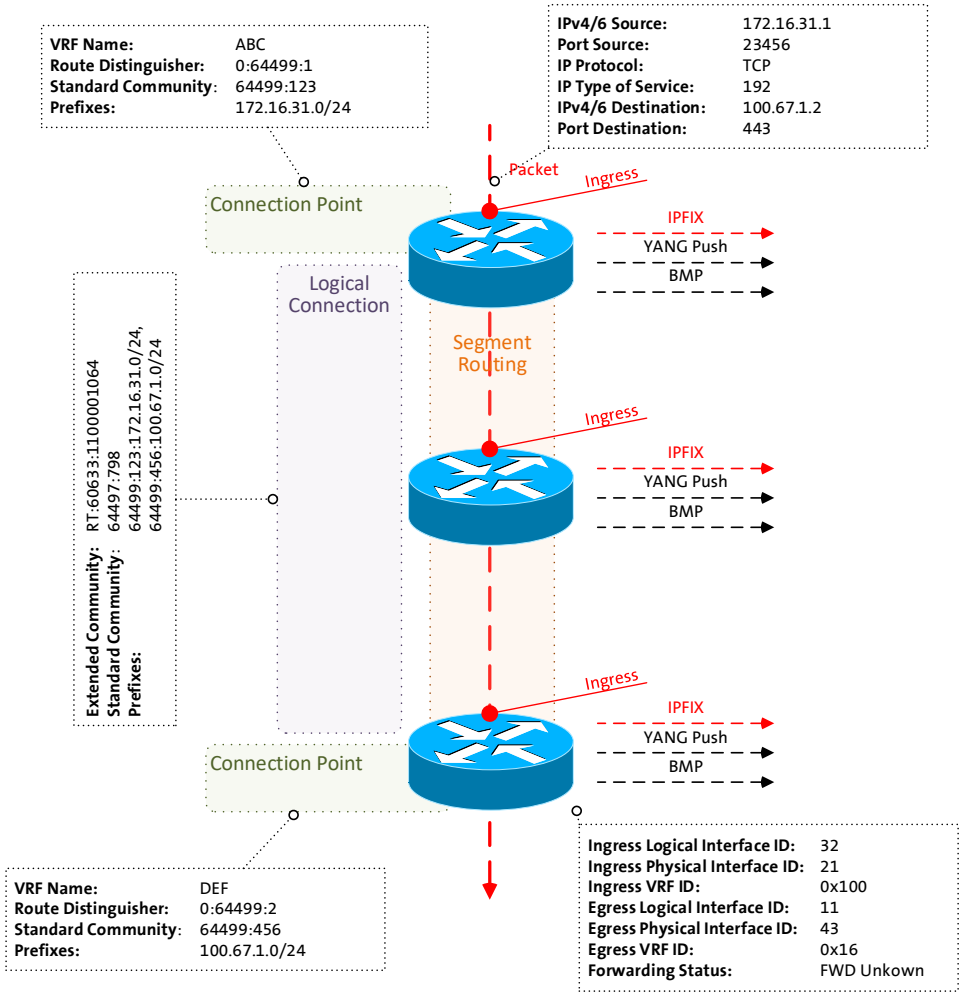
Inband Telemetry with IPFIX Flow-Aggregation

Aggregate and sample as early as possible – Chose your Cardinality



- IPFIX defines two key data engineering tools to reduce collected and exported amount of data. **Sampling and Aggregation.** Enabling **a statistical view from the network usage.** Also called **connectivity matrix.**
- IPFIX **measures packets and bytes** and give **device and control-plane context**.
- **IPFIX lacks the ability to measure delay.** A key element for monitoring **Customer Service Level Agreements.**
- **With Inband Telemetry**, iOAM, Path Tracing and iFIT, **delay can be measured** actively (probing) or passively. Metrics are exposed on every node, postcards or only at the last node (passport).
- **Inband Telemetry lacks Flow Aggregation support** as defined in RFC 7015. Therefore, **scalability** in terms of data export and collection is **drastically limited** today.
- draft-tgraf-opsawg-ipfix-inband-telemetry not only **addresses this two impediments**, but also **adds the Inband Telemetry path delay metric definition** in the performance registry for proper delay definition.

Measure delay and give network context

Enabling a statistical network delay view

IPv4/6 Source:	172.16.31.1
Port Source:	23456
IP Protocol:	TCP
IP Type of Service:	192
IPv4/6 Destination:	100.67.1.2
Port Destination:	443
Ingress Logical Interface ID:	32
Ingress Physical Interface ID:	21
Ingress VRF ID:	0x100
Egress Logical Interface ID:	11
Egress Physical Interface ID:	43
Egress VRF ID:	0x16
Forwarding Status:	FWD Unkown

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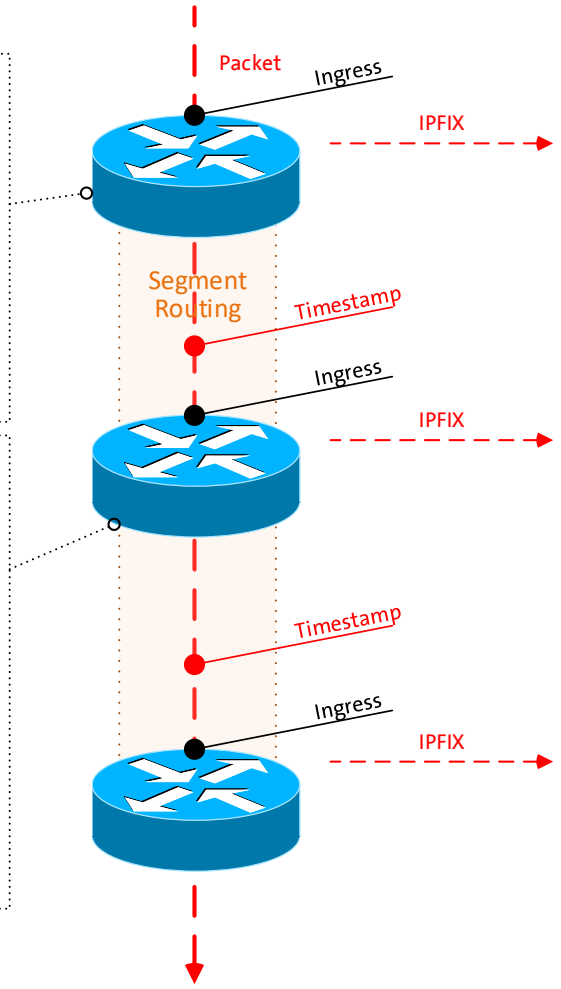
Egress VRF ID:	0x16
Forwarding Status:	FWD Unkown
SID List:	17001, 34002
Delay Min	1
Delay Sum	5
Delay Max	7

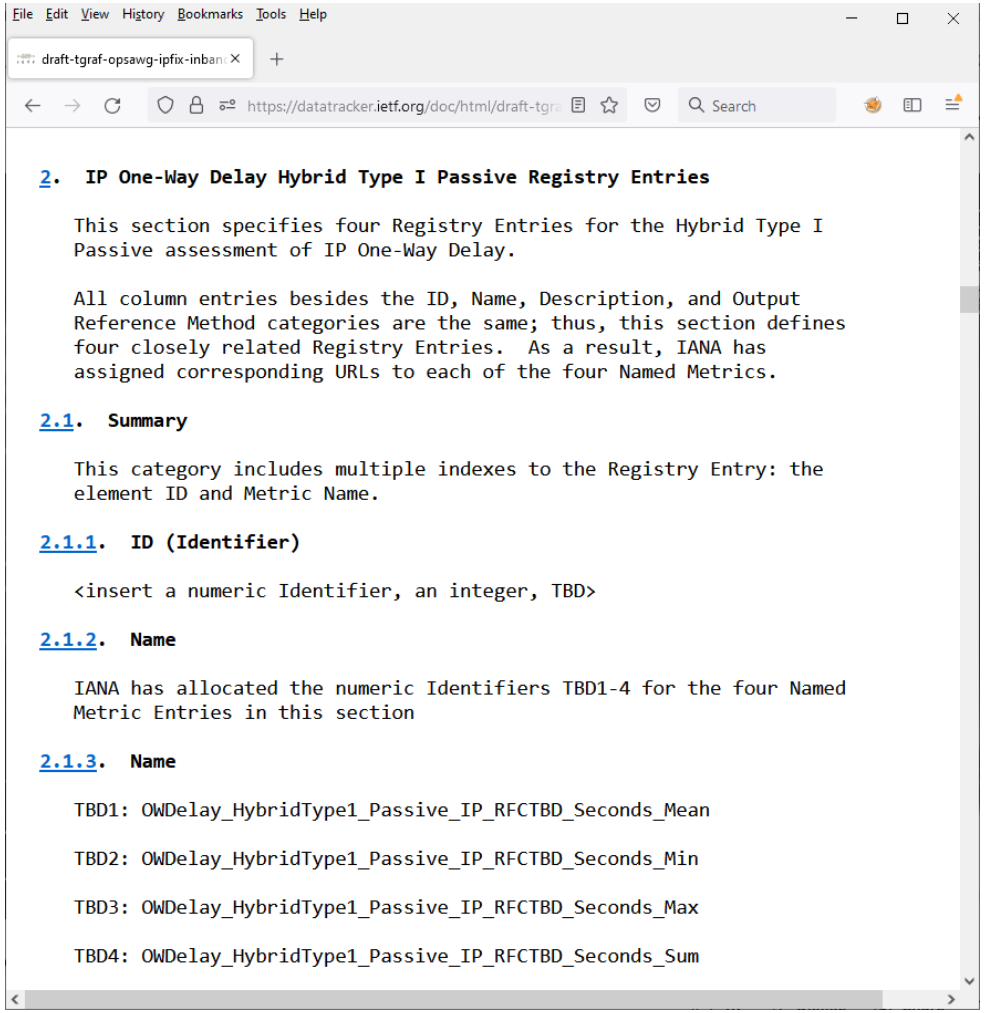


- Packets are captured ingress with an optional sampler, data-plane dimensions extracted, enriched with device and control-plane dimensions and **added with a unique flow ID to a flow cache on the node for aggregation.**
- The data-plane dimensions answers **which packet**. The control-plane **which customer**. The device dimensions **where in the network**.
- In case of Inband Telemetry, **a timestamp and optionally a direct export tag is added** to the packet header when entering the Inband Telemetry domain.
- Each subsequent packet for the same flow increases byte and packet count. Each new flow creates a new flow ID in the flow cache.
- In case of Inband Telemetry, At each node in transit (postcard) or only at the last node (passport), **the delay is calculated by comparing the timestamp in the packet and when packet is received** on the node**. Delay is populated into the flow cache besides packet and byte count.**

Performance Registry

Defining new entries

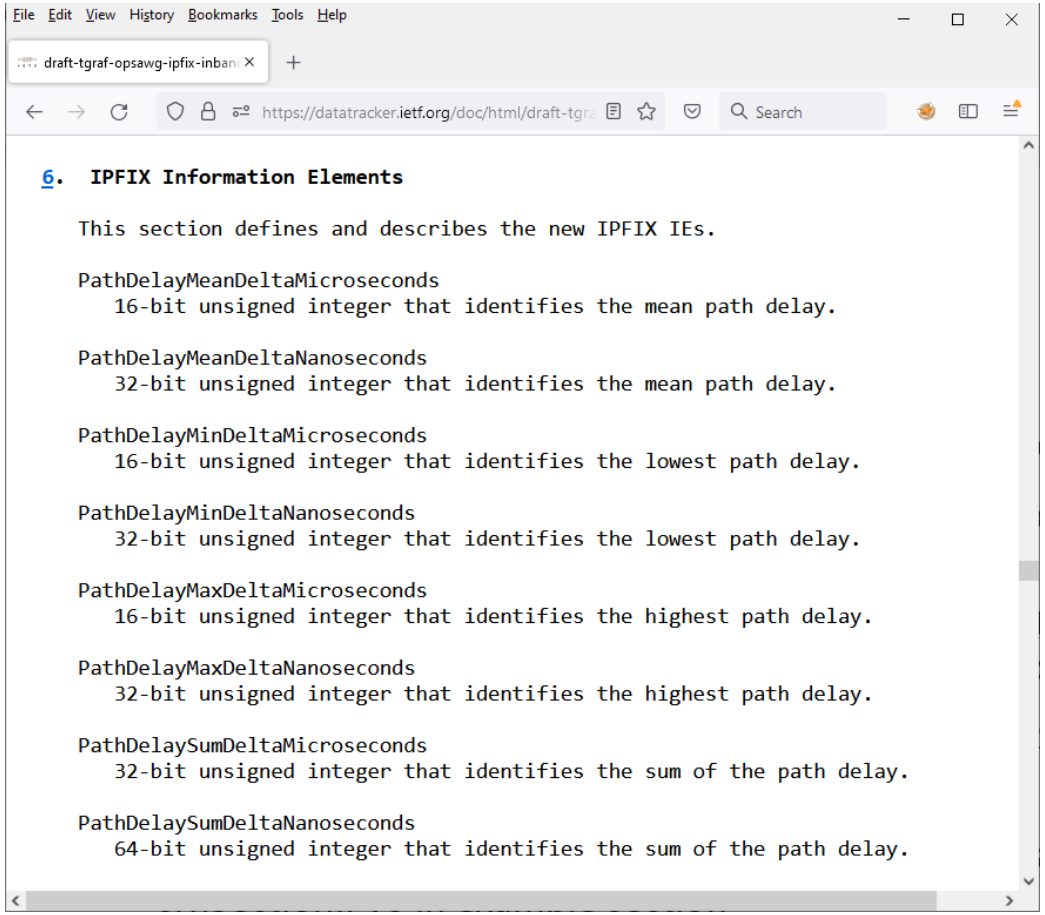
- **4 new IP One-Way Delay Hybrid Type I Passive Registry Entries.**
  - **Minimum Delay** – Describing the lowest delay of all accounted packets for a given flow id.
  - **Maximum Delay** – Describing the highest delay of all accounted packets for a given flow id.
  - **Sum of the Delay** – Describing the summed delay of all accounted packets for a given flow id.
  - **Mean Delay** – Describing the average delay of all accounted packets for a given flow id. Applicable only on data collection.



IPFIX Registry

Defining new entries

- **8 new Path Delay Registry Entries.**
  - **Minimum Delay** – Describing the lowest delay of all accounted packets for a given flow id in **micro or in nanoseconds**.
  - **Maximum Delay** – Describing the highest delay of all accounted packets for a given flow id in **micro or in nanoseconds**.
  - **Sum of the Delay** – Describing the summed delay of all accounted packets for a given flow id in **micro or in nanoseconds**.
  - **Mean Delay** – Describing the average delay of all accounted packets for a given flow id in **micro or in nanoseconds**. Applicable only on data collection.



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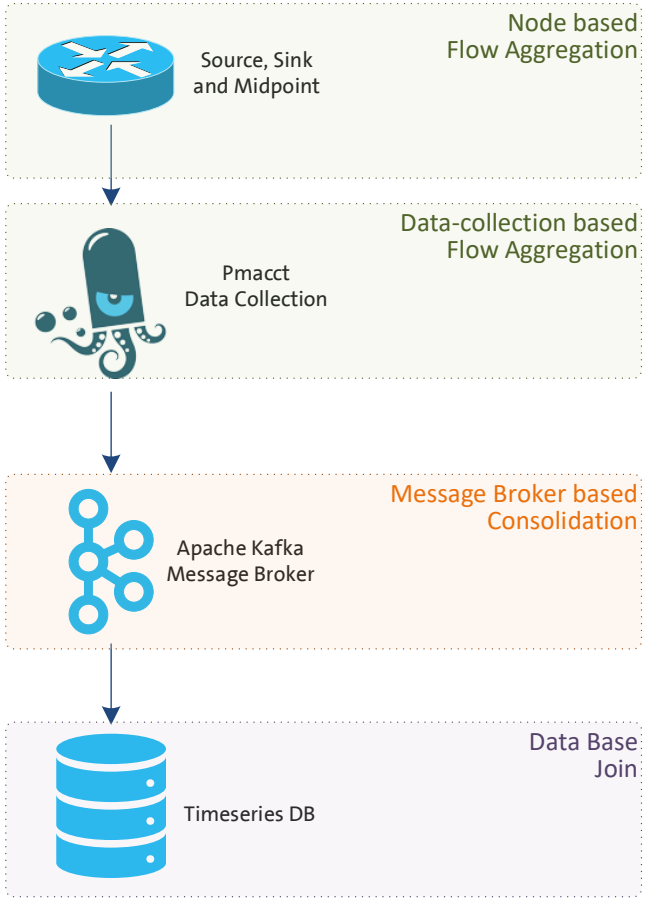
Draft Status and Next Steps

- **Do you recognize the problem statement?**
- Network operators want to understand
  - **where delay with which network and device dimensions** is being accumulated
  - at highest scale **for a statistical network delay view**.
- Huawei validated technical feasibility and working on an implementation. Cisco is currently validating technical feasibility. Other network vendors showing interest.
- INSA Lyon working on running open-source code in FD.io VPP. **Will be shown at IETF 115 hackathon.**
- Draft version -01 will contain data record and template examples.
- **-> Requesting review and collecting comments in OPSAWG and IPPM working groups.**



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