

**SRv6**  
**On-Path Delay**  
**Measurement with**  
**Anomaly Detection**  
**OPSAWG WG**

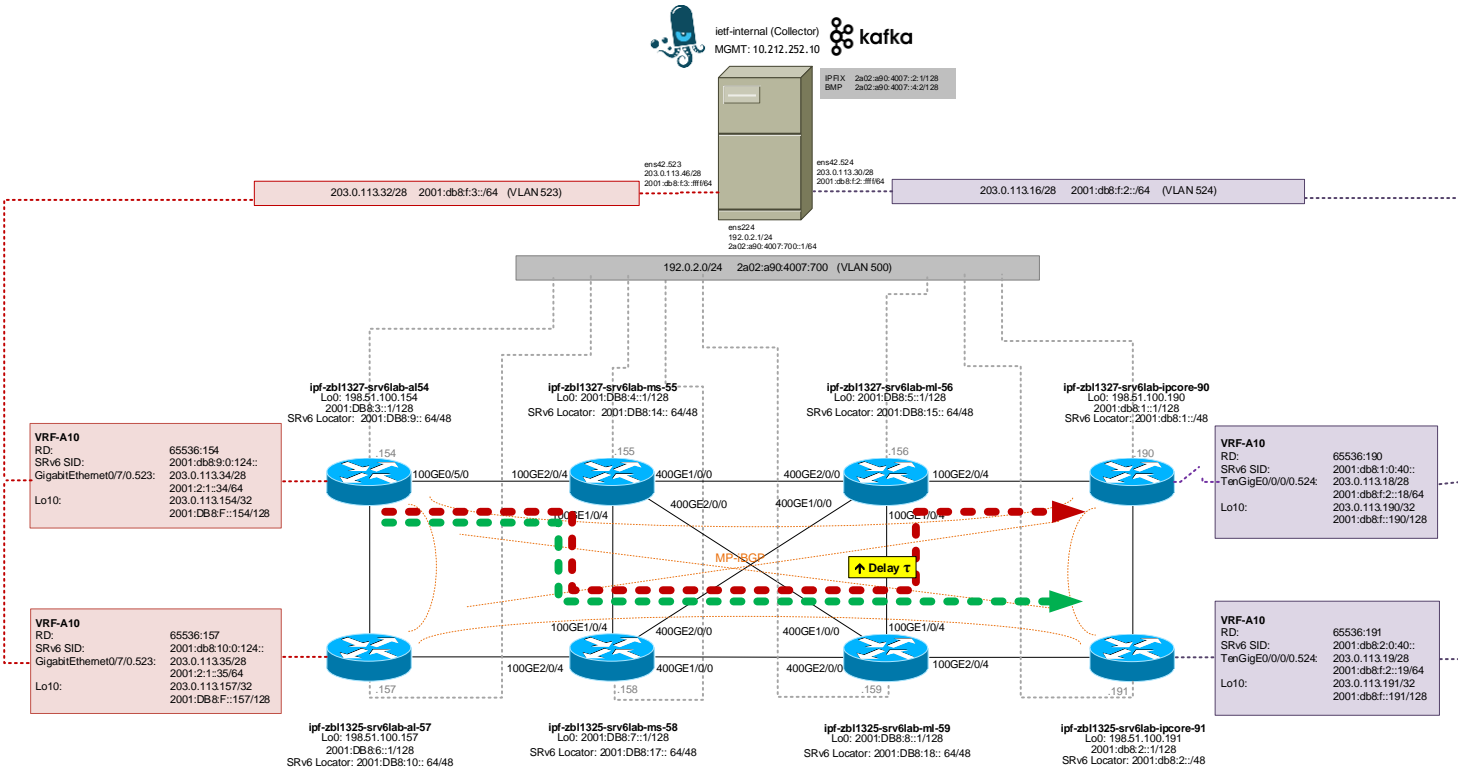
IETF 116  
March 25-26th, 2023  
Hackathon



# Hackathon - Plan

- Establish multivendor SRv6 network topology with network telemetry data collection and data processing pipeline.
- Validate and visualize two IPFIX implementations of [draft-ietf-opsawg-ipfix-srv6-srh](#) (AD review) and [draft-ietf-opsawg-ipfix-on-path-telemetry](#) in [FD.io](#) VPP and on Huawei VRP.
- Calculate PathDelayMeanDeltaMicroseconds by dividing PathDelaySumDeltaMicroseconds by packetDeltaCount in [pmacct](#) data collection
- Extend Network Anomaly Detection to recognize on-path delay increase and include delay in Max Concern Score calculation.

# Hackathon – Network (1/2)

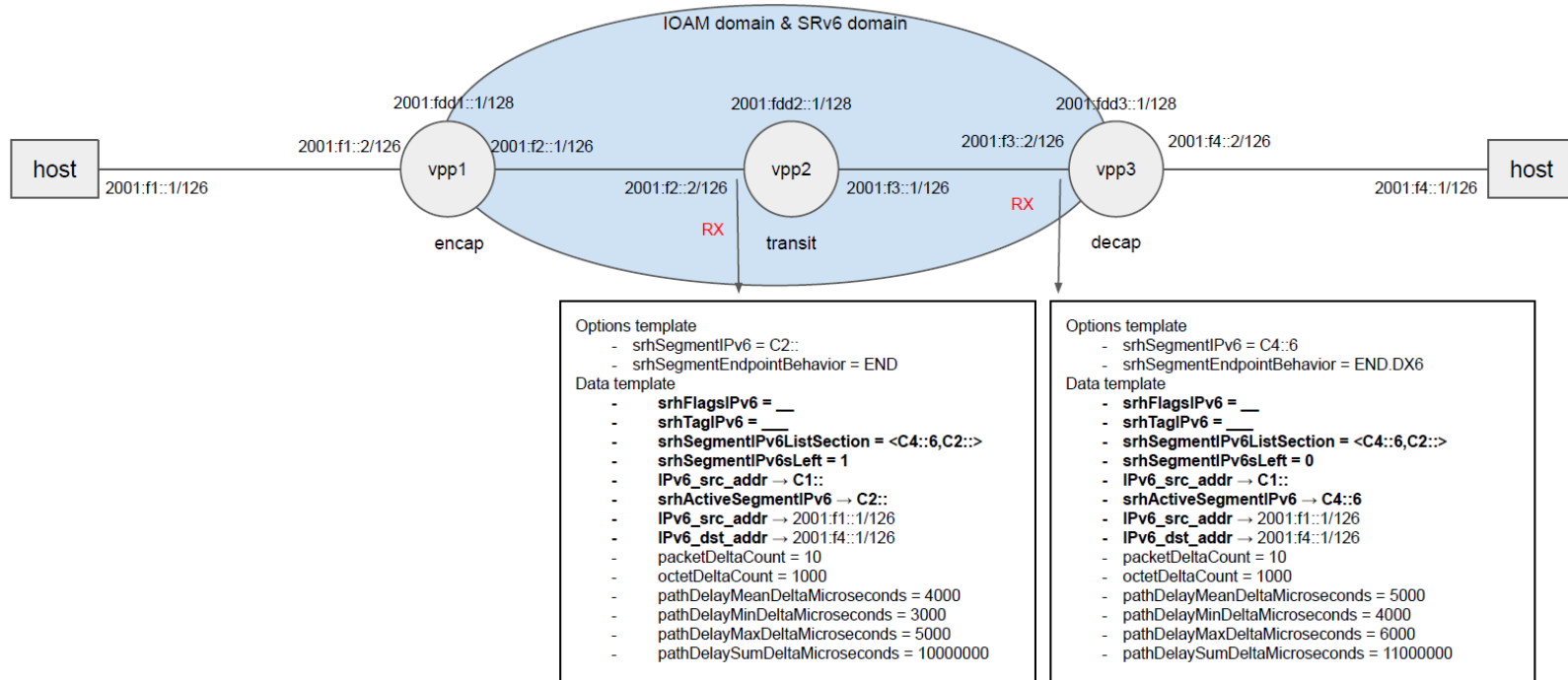


SRv6 network topology with two vendors and IPFIX data processing pipeline.

Huawei with four P and two PE nodes exposing SRH provider data-plane [draft-ietf-opsawg-ipfix-srv6-srh](#) and on-path delay as described in [draft-ietf-opsawg-ipfix-on-path-telemetry](#).

Cisco with two PE nodes exposing customer data-plane.

# Hackathon – Network (2/2)



- FD.io VPP Open Source Code published: <https://github.com/network-analytics/vpp-srh-onpath-telemetry>



# Visualization & Conclusion



- (1) Shows **SRv6 SID list change** of the traffic engineered paths.
- (2) Shows **on which node** how much **on-path delay** was being measured.
- (3) Shows the **BGP update/withdrawals** from the **topology change**.
- (4) Shows that **Network Anomaly Detection** detects the **topology and delay change** and the **Max Concern Score** calculation.

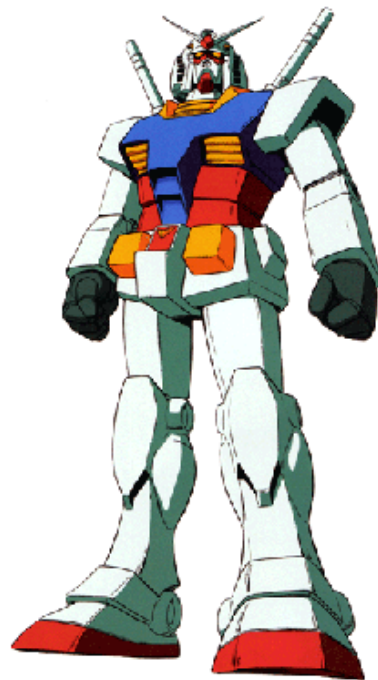
# What we learned (again)

- Good

- Preparation and good team setup is gold.
- As always... the beers were most welcome!

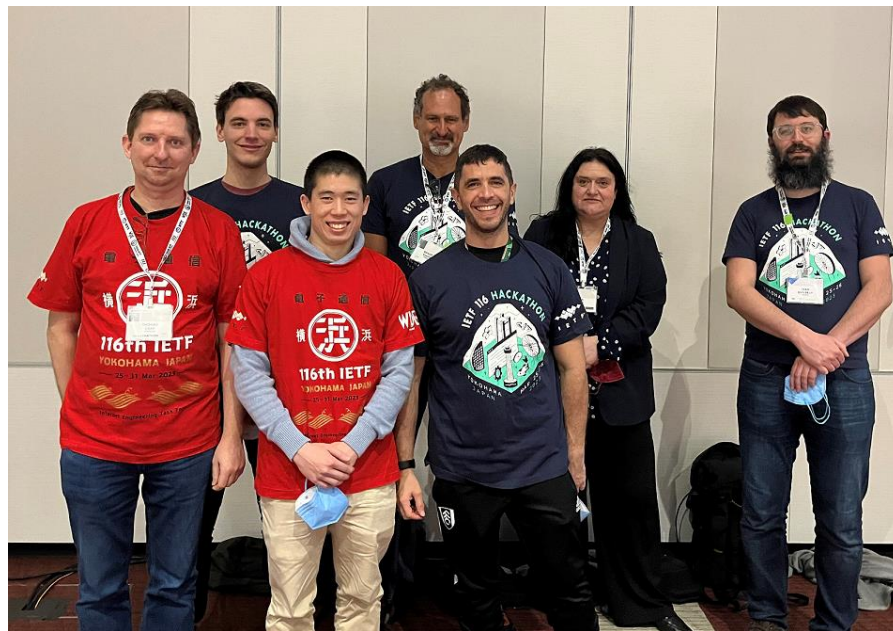
- Surprise

- Yuta and his colleagues joining our table and implementing draft-ietf-opsawg-ipfix-srv6-srh in XDP/DPDK.



# Thanks to...

- Alex Huang Feng – INSA
- Severin Dellsperger - OST University (remote)
- Camilo Cardona – NTT
- Paolo Lucente – NTT
- Benoit Claise – Huawei
- Jean Quilbeuf - Huawei
- Olga Havel – Huawei
- Wanting Du – Swisscom (remote)
- Yannick Buchs – Swisscom (remote)
- Marco Tollini - Swisscom
- Thomas Graf - Swisscom



....and Huawei, INSA Lyon and [Pmacct](#) for the network environment, software and test cases.

# IETF 116 Hackathon - VPP Implementation Status

## Records exposed

### (1) PathDelayMeanDeltaMicroseconds

32-bit unsigned integer that identifies the **mean path delay** in microseconds, between the IOAM encapsulation node and the local node with the IOAM domain (either an IOAM transit node or an IOAM decapsulation node).

### (2) PathDelayMaxDeltaMicroseconds

32-bit unsigned integer that identifies the **highest path delay** in microseconds, between the IOAM encapsulation node and the local node with the IOAM domain (either an IOAM transit node or an IOAM decapsulation node).

### (3) PathDelayMinDeltaMicroseconds

32-bit unsigned integer that identifies the **lowest path delay** in microseconds, between the IOAM encapsulation node and the local node with the IOAM domain (either an IOAM transit node or an IOAM decapsulation node).

### (4) PathDelaySumDeltaMicroseconds

64-bit unsigned integer that identifies the **sum of the path delay** in microseconds, between the IOAM encapsulation node and the local node with the IOAM domain (either an IOAM transit node or an IOAM decapsulation node).

```
FlowSet Id: Data Template (V10 [IPFIX]) (2)
FlowSet Length: 68
  Template (Id = 256, Count = 15)
    Template Id: 256
    Field Count: 15
    > Field (1/15): IPV6_SRC_ADDR
    > Field (2/15): Unknown(503)
    > Field (3/15): Unknown(510)
    > Field (4/15): Unknown(506)
    > Field (5/15): Unknown(500)
    > Field (6/15): Unknown(501)
    > Field (7/15): Unknown(505)
    > Field (8/15): IPV6_SRC_ADDR
    > Field (9/15): IPV6_DST_ADDR
    > Field (10/15): PKTS
    > Field (11/15): BYTES
    > Field (12/15): Unknown(600)
      0... .. = Pen provided: No
      .000 0010 0101 1000 = Type: Unknown (600)
      Length: 4
    > Field (13/15): Unknown(601)
      0... .. = Pen provided: No
      .000 0010 0101 1001 = Type: Unknown (601)
      Length: 4
    > Field (14/15): Unknown(602)
      0... .. = Pen provided: No
      .000 0010 0101 1010 = Type: Unknown (602)
      Length: 4
    > Field (15/15): Unknown(603)
      0... .. = Pen provided: No
      .000 0010 0101 1011 = Type: Unknown (603)
      Length: 8
```

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# IETF 116 Hackathon - Huawei Implementation Status

## Records exposed

### (1) PathDelayMeanDeltaMicroseconds

32-bit unsigned integer that identifies the **mean path delay** in microseconds, between the IOAM encapsulation node and the local node with the IOAM domain (either an IOAM transit node or an IOAM decapsulation node).

### (2) PathDelayMaxDeltaMicroseconds

32-bit unsigned integer that identifies the **highest path delay** in microseconds, between the IOAM encapsulation node and the local node with the IOAM domain (either an IOAM transit node or an IOAM decapsulation node).

### (3) PathDelayMinDeltaMicroseconds

32-bit unsigned integer that identifies the **lowest path delay** in microseconds, between the IOAM encapsulation node and the local node with the IOAM domain (either an IOAM transit node or an IOAM decapsulation node).

### (4) PathDelaySumDeltaMicroseconds

64-bit unsigned integer that identifies the **sum of the path delay** in microseconds, between the IOAM encapsulation node and the local node with the IOAM domain (either an IOAM transit node or an IOAM decapsulation node).

```
> Field (25/36): FORWARDING_STATUS
> Field (26/36): flowEndReason
> Field (27/36): paddingOctets
v Field (28/36): 528 [pen: HUAWEI Technology Co.,Ltd]
  1... .. = Pen provided: Yes
  .000 0010 0001 0000 = Type: 528 [pen: HUAWEI Technology Co.,Ltd]
  Length: 8
  PEN: HUAWEI Technology Co.,Ltd (2011)
v Field (29/36): 527 [pen: HUAWEI Technology Co.,Ltd]
  1... .. = Pen provided: Yes
  .000 0010 0000 1111 = Type: 527 [pen: HUAWEI Technology Co.,Ltd]
  Length: 4
  PEN: HUAWEI Technology Co.,Ltd (2011)
v Field (30/36): 524 [pen: HUAWEI Technology Co.,Ltd]
  1... .. = Pen provided: Yes
  .000 0010 0000 1100 = Type: 524 [pen: HUAWEI Technology Co.,Ltd]
  Length: 4
  PEN: HUAWEI Technology Co.,Ltd (2011)
v Field (31/36): 526 [pen: HUAWEI Technology Co.,Ltd]
  1... .. = Pen provided: Yes
  .000 0010 0000 1110 = Type: 526 [pen: HUAWEI Technology Co.,Ltd]
  Length: 4
  PEN: HUAWEI Technology Co.,Ltd (2011)
v Field (32/36): 522 [pen: HUAWEI Technology Co.,Ltd]
  1... .. = Pen provided: Yes
  .000 0010 0000 1010 = Type: 522 [pen: HUAWEI Technology Co.,Ltd]
  Length: 4
  PEN: HUAWEI Technology Co.,Ltd (2011)
v Field (33/36): 523 [pen: HUAWEI Technology Co.,Ltd]
  1... .. = Pen provided: Yes
  .000 0010 0000 1011 = Type: 523 [pen: HUAWEI Technology Co.,Ltd]
  Length: 2
  PEN: HUAWEI Technology Co.,Ltd (2011)
v Field (34/36): 525 [pen: HUAWEI Technology Co.,Ltd]
  1... .. = Pen provided: Yes
  .000 0010 0000 1101 = Type: 525 [pen: HUAWEI Technology Co.,Ltd]
  Length: 2
  PEN: HUAWEI Technology Co.,Ltd (2011)
v Field (35/36): 521 [pen: HUAWEI Technology Co.,Ltd]
  1... .. = Pen provided: Yes
  .000 0010 0000 1001 = Type: 521 [pen: HUAWEI Technology Co.,Ltd]
  Length: 2
  PEN: HUAWEI Technology Co.,Ltd (2011)
> Field (36/36): paddingOctets
```

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