In-situ Flow Information Telemetry (iFIT) Framework

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Data Plane Telemetry Requirements

- Path Compliance
- SLA Compliance
- Root Cause Analysis
- Path Optimization
Data Plane Telemetry Techniques

**Tradeoffs**
- Performance Impact
  - Observer Effect
- Encapsulation and Overhead
  - Scalability
- Security
- Configuration and correlation

- Data as passport stamps
  - User packet
  - Data as passport stamps
  - e.g., IOAM
- Data as postcards
  - Postcard INT (PBT-I)
- Data as postcards
  - Postcard INT (PBT-M)
Challenges for Deployment in Carrier Networks

- Performance
  - Forwarding impact due to packet processing
  - Bandwidth and server overload due to exported data
- Limited data flexibility and extensibility
- Deployment issues
  - Encapsulation
  - Tunnel
iFIT Solution Framework

Performance

Deployability

Flexibility

Smart Flow/Data Selection

Export Data Reduction

Encapsulation & Tunnel Modes

Dynamic Network Probe
Smart Flow/Data Selection

- Collect Network Information
  - Flow sketch
  - Network condition
- Analyze the Network Information and User Intent
  - Target flows
  - Packet sample rate
  - Collected data set
- Apply Policies
  - ACL
  - Configuration
Export Data Reduction

- Batch
- Dedup and compression
- Policy-based export
  - On change
  - On exception
  - On timeout
  - On threshold

IFIT Data Collection

Controller

Export policy

IPFIX export
Encapsulation

- **iOAM or PBT Header**
- **MPLS/SR-MPLS**
- **IPv6/SRv6**
- **MAC**

**Original Packet**
- **Destination MAC (6B)**
- **Source MAC (6B)**
- **Ethertype = TIH (0x088F)**
- **TIH (next protocol = UL)**

**Table: EH Header**

<table>
<thead>
<tr>
<th>R</th>
<th>EH Count</th>
<th>EH Total Length</th>
<th>Next Header</th>
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<tr>
<td>0</td>
<td>1</td>
<td>5</td>
<td>UL</td>
</tr>
</tbody>
</table>

**IPv6/SRv6**

- **iOAM or PBT Header**
- **NH = UL**
- **EHLen = 2**
- **TIH**
Tunnel Modes

- Uniform Model
  - True E2E data

- Pipe Model
  - Tunnel as a single logical node to customer
  - Tunnel provider can do INT independently
Dynamic Network Probes

- Runtime data customization and processing through configuration and programming
  - Data processing near or in network device for system efficiency and cost
- Applied for
  - Flow/Data Filter and Statistics
  - Event Monitoring
  - Data Processing
Discussion & Next Steps

- Collect feedbacks
  - What other challenges for carrier network data plane telemetry?
  - What other suggestions to make the framework more complete?
- Demonstrate prototype in carrier networks based on the framework
- Future work
  - Data consumption
  - Cross domain operation