Flowd-go: An eBPF-Driven Architecture for High-Speed Network Traffic Identification

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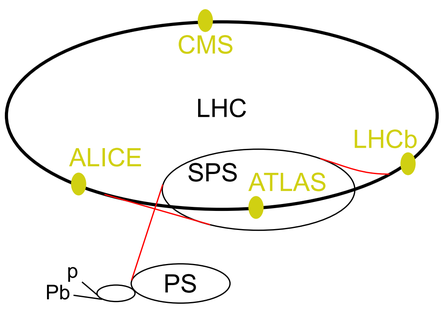
Problem Statement

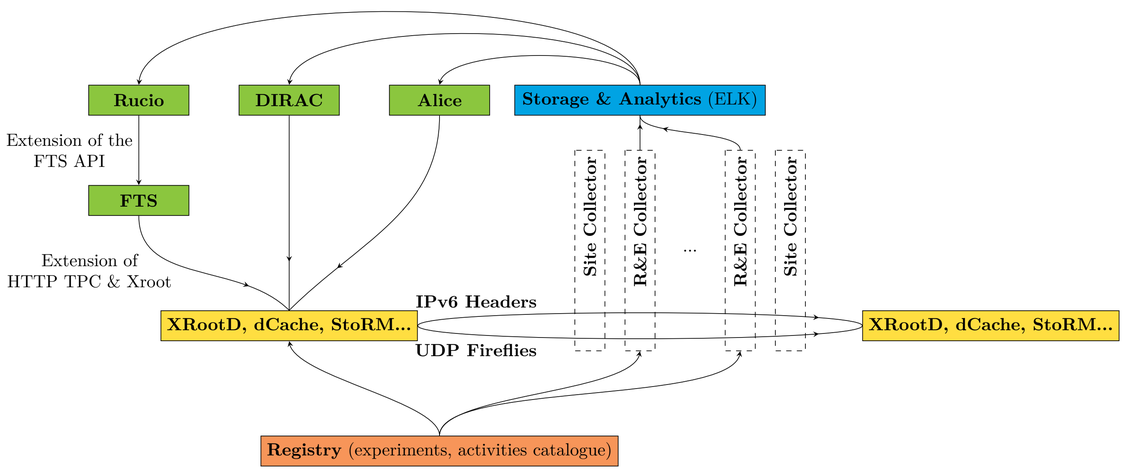
The **Large Hadron Collider** (LHC) produces **large amounts of data** that traverse the **Worldwide LHC Computing Grid** (WLCG) through **LHC{ONE,OPN}**. **Understanding** these flows is **challenging**.



LHCOPN

The Scitags Framework

The **Scientific Network Tags** (Scitags) framework allows identifying the **owner** and **purpose** of traffic within the **WLCG**. Several key actors **cooperate** to **propagate** information.



The **owner** and **purpose** of traffic can be conveyed by:

1. **Packet Marking**: in-band approach for IPv6.
2. **Flow Labelling**: out-of-band approach for IPv{4,6}.

The **favoured** strategy is **packet marking** through the **Flow Label** or a **Hop-By-Hop Extension Header**.

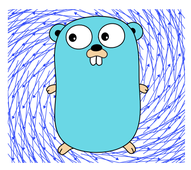
```
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|Version| Traffic Class |E|E|C|C|C|C|C|C|C|C|E|A|A|A|A|A|A|E|E|
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|         Payload Length        |  Next Header  |   Hop Limit   |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+

+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|  Next Header  |  Hdr Ext Len  |                               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+                               +
.                                                               .
.                            Options                            .
.                                                               .
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

IETF Draft

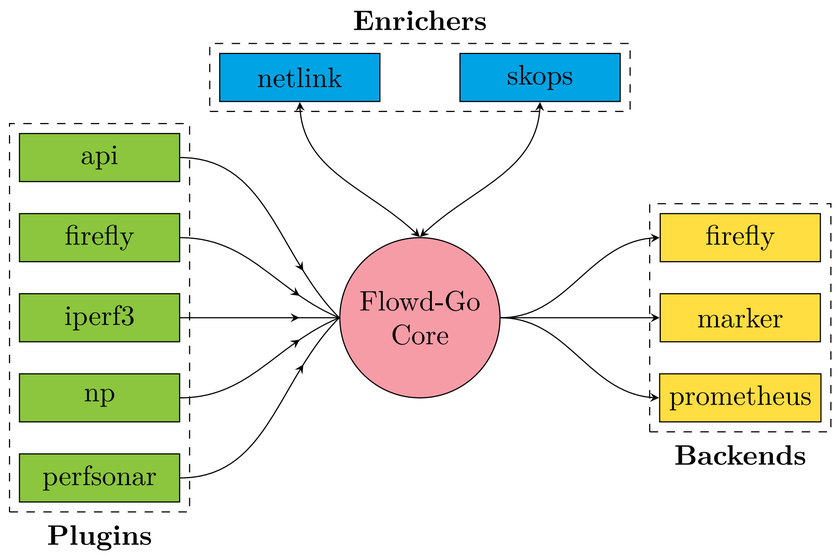
Flowd-go

Traffic marking and **flow labelling** are implemented by **flowd-go**. A key **enabler** is **eBPF**.

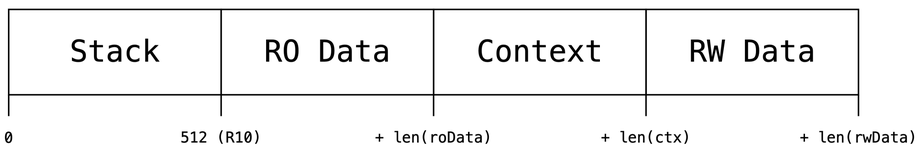


eBPF

With a **modular architecture**, integrating flowd-go with **storage** and **measurement** systems is smooth.

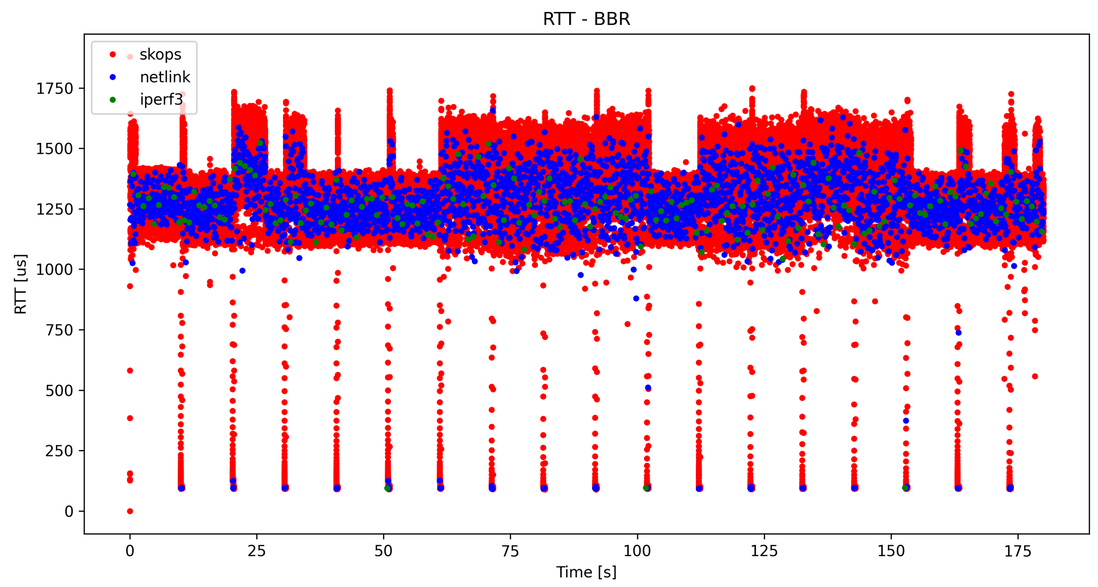


We have also implemented an **eBPF VM** (**gBPF**) to **validate** eBPF programs in **user space**.

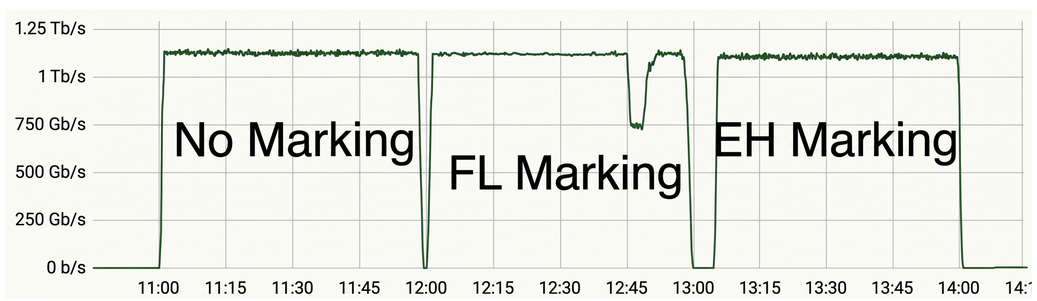


TCP Statistics

Flowd-go can gather **TCP** statistics each **RTT** by directly **inspecting** the backing **`struct tcp_sock`**.



SuperComputing (SC) 25



Future Work

1. **Measure** the effect of marking on **latency**, **jitter**...
2. **Gauge** the **support** for **IPv6 EHs** in **NRENs**.
3. **Push flowd-go** with a **1.6 Tbps** rate at **SC 26**.
4. **Expand Scitags** to other **communities**.
5. **Integrate** with services like **ESnet**'s **High-Touch**.