

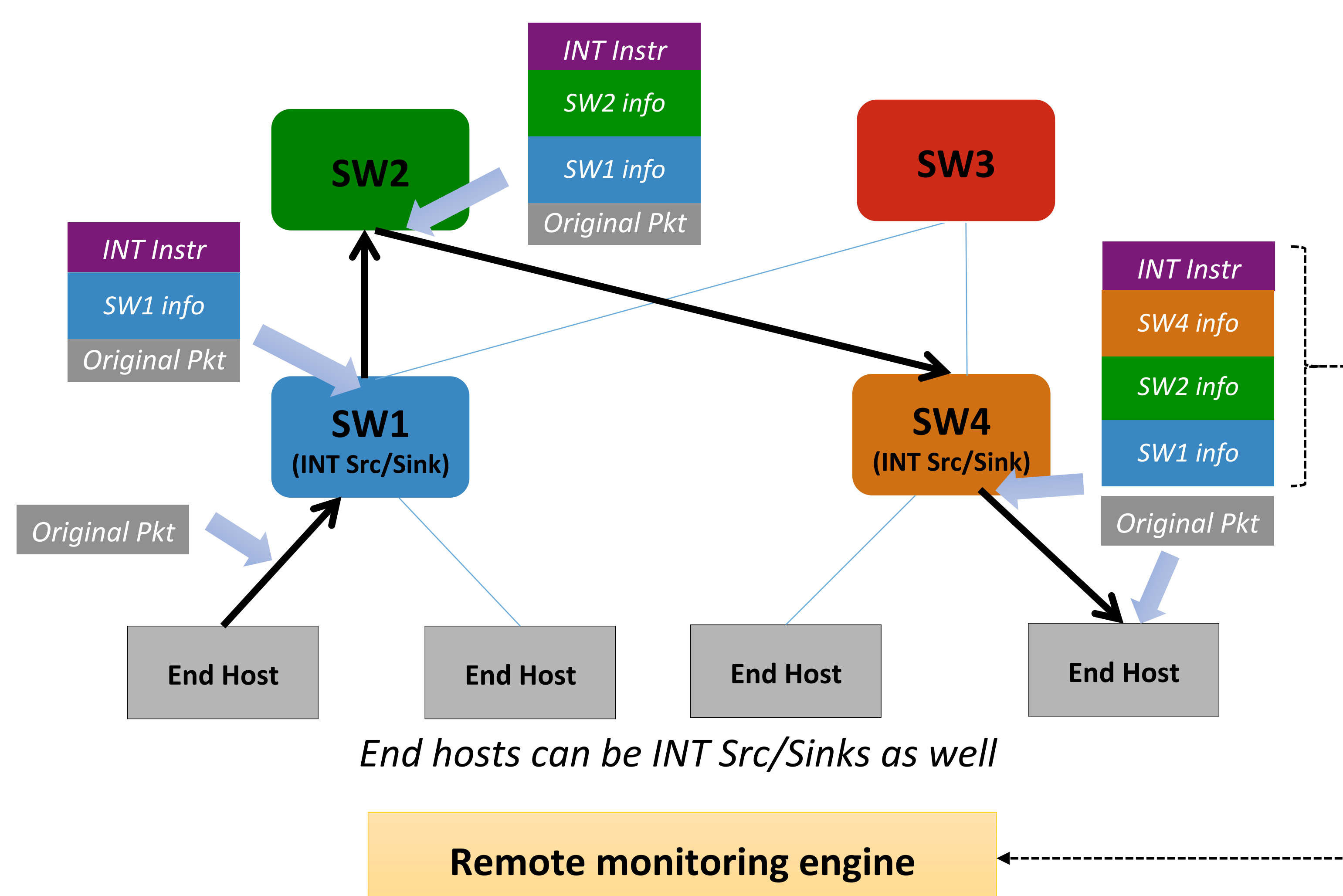
Tracking Any Packet's Path and Latency In a Network via INT

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(1) What is INT?

- Recruit any data packet for monitoring
- Collect *data-plane state* directly from *within the data plane*; zero involvement of the control plane
- Metadata to collect: device ID, in/out port ID, queueing latency, instantaneous queue depth, link utilization, ... (any info associated with packets)

(2) How does INT work?



- Can work with any encapsulation format: VXLAN, Geneve, TCP options, custom L4.5 header, etc.
- INT Spec (contribution from Arista, Barefoot, Dell, Intel, and VMware): <http://p4.org/wp-content/uploads/fixed/INT/INT-current-spec.pdf>
- INT prototype: <https://github.com/p4lang/p4factory/tree/master/apps/int>

(3) Facebook's INT use cases

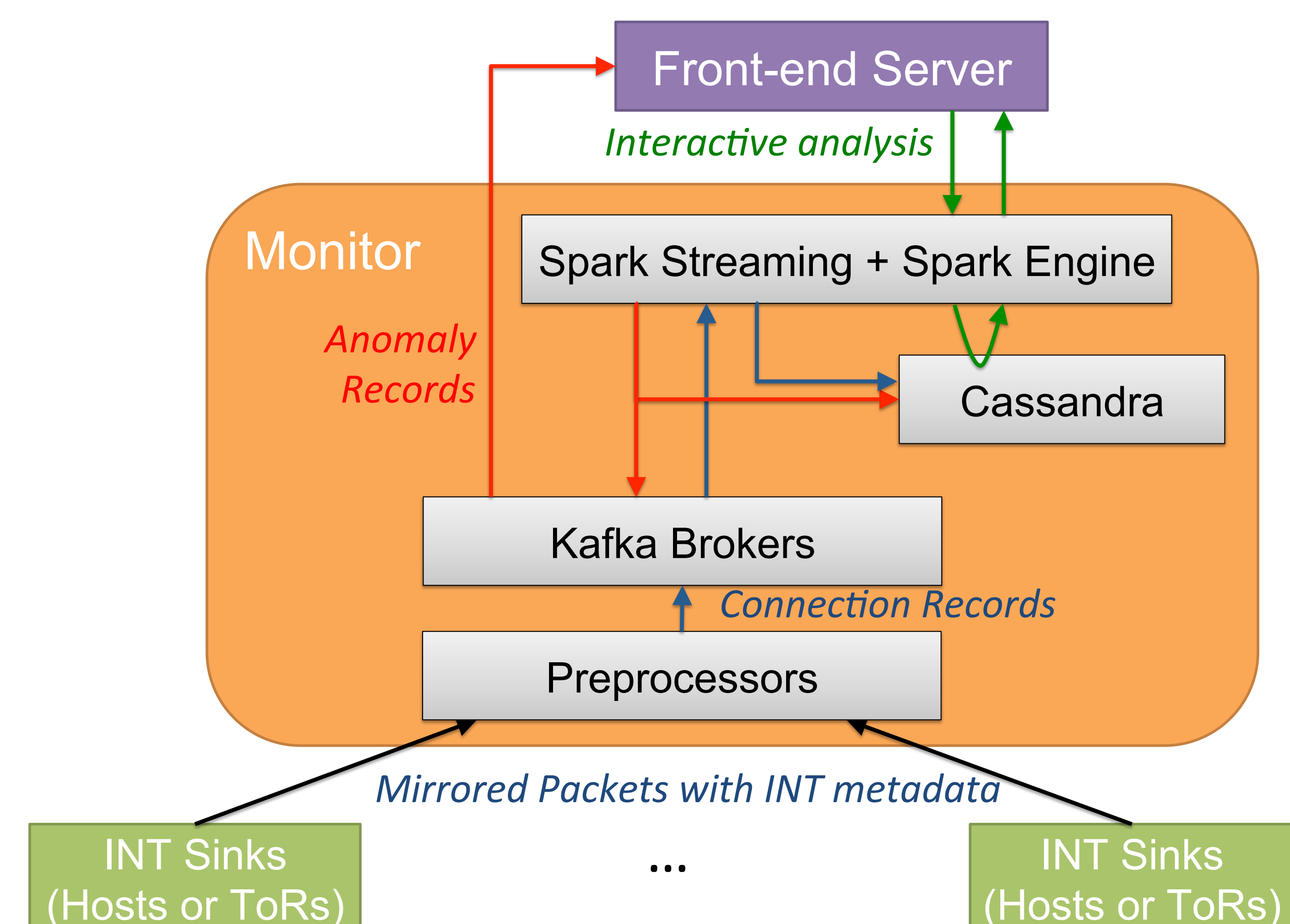
- Goal: Localize and isolate fault quickly and reliably
- Approach: Recruit UDP probes to collect device ID, port ID, and per-hop latency
- INT metadata stack is part of the UDP payload
- Working with IETF to form consensus: *draft-lapukhov-dataplane-probe*

(4) PLT: Always-on Path & Latency Tracking

"Another use case of INT"

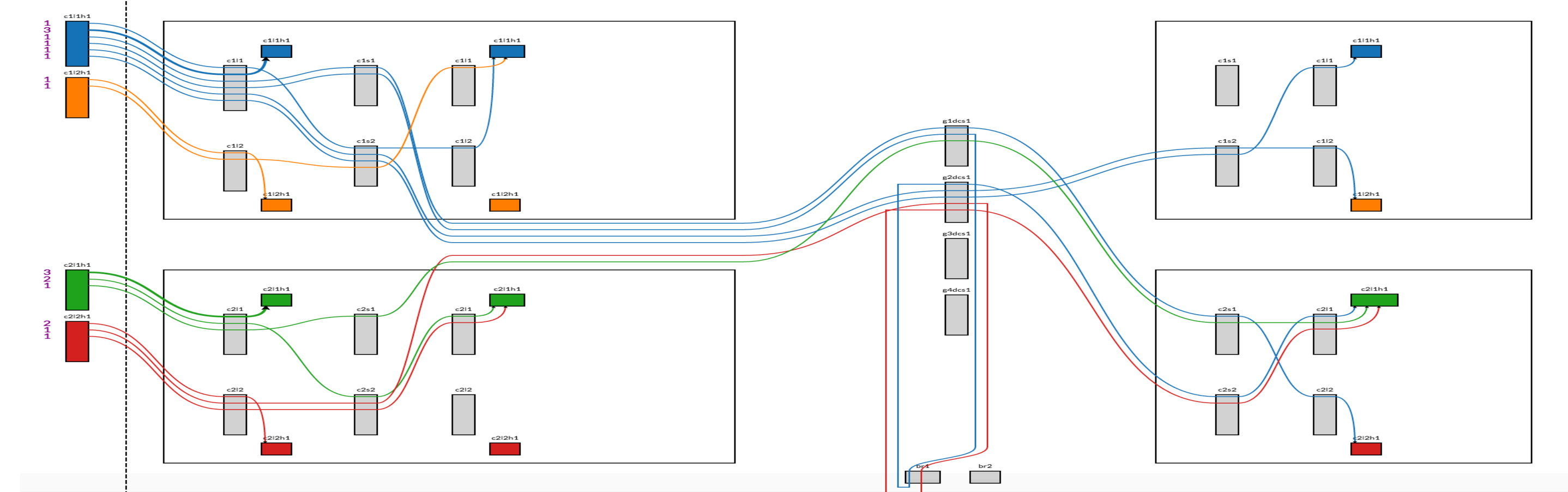
- Collect physical path & hop latency of every packet via INT
- Data planes of INT Sinks (last-hop switches) de-duplicate path & latency info and generate a record for each:
 - ✓ New connection
 - ✓ Physical path change in an existing connection
 - ✓ Hop/E2E latency fluctuation in an existing connection
- One can gather/filter/log/search/analyze the records
- We'll contribute the PLT P4 code to P4.org very soon

(5) Monitoring Engine

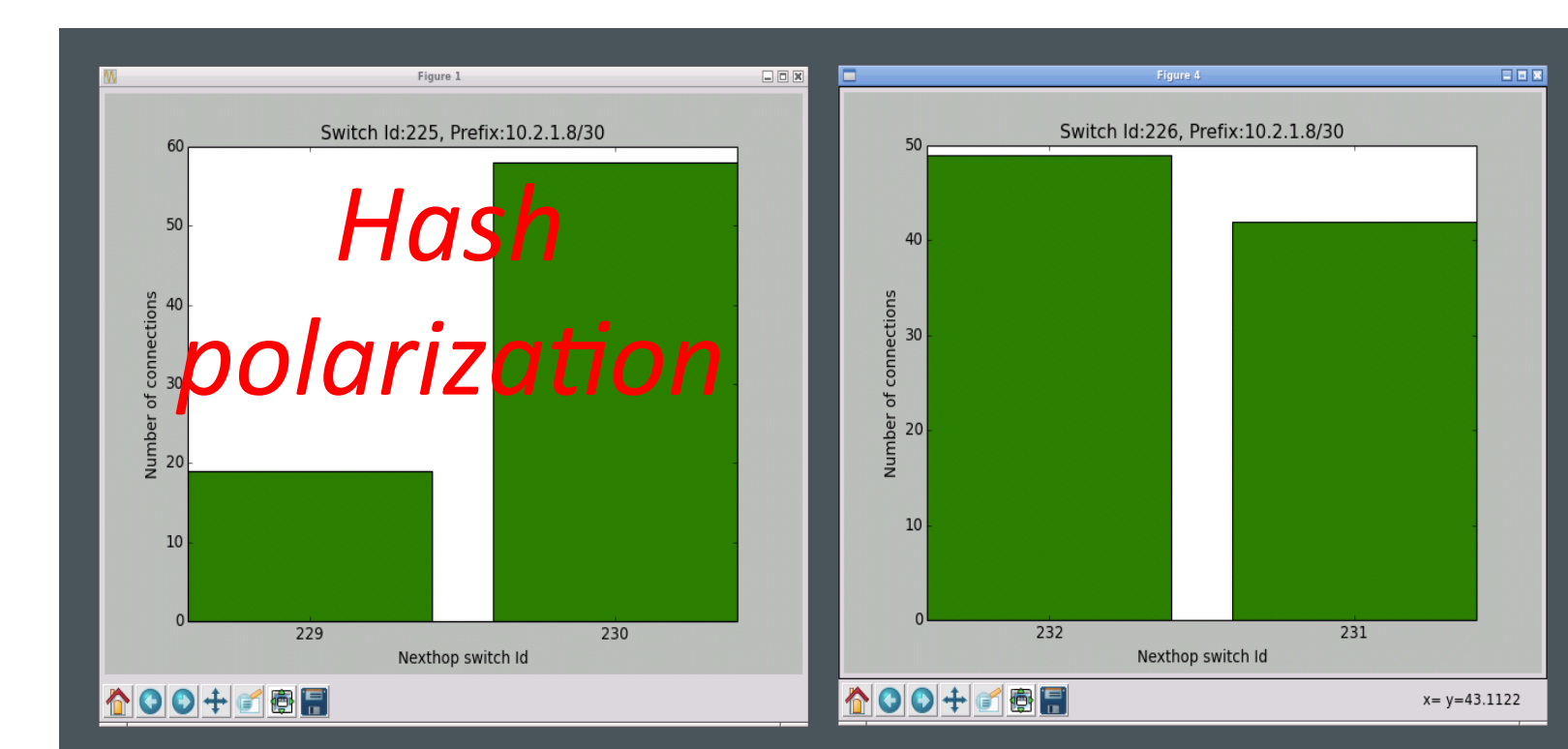


(6) What is PLT useful for?

- Detect and debug anomalous routing behavior



- Verify multi-path forwarding (ECMP, LAG, etc.)



- Answer network vs. application questions

