SONiC Network Telemetry from User Perspective

OCP SONiC/SAI Engineering Workshop

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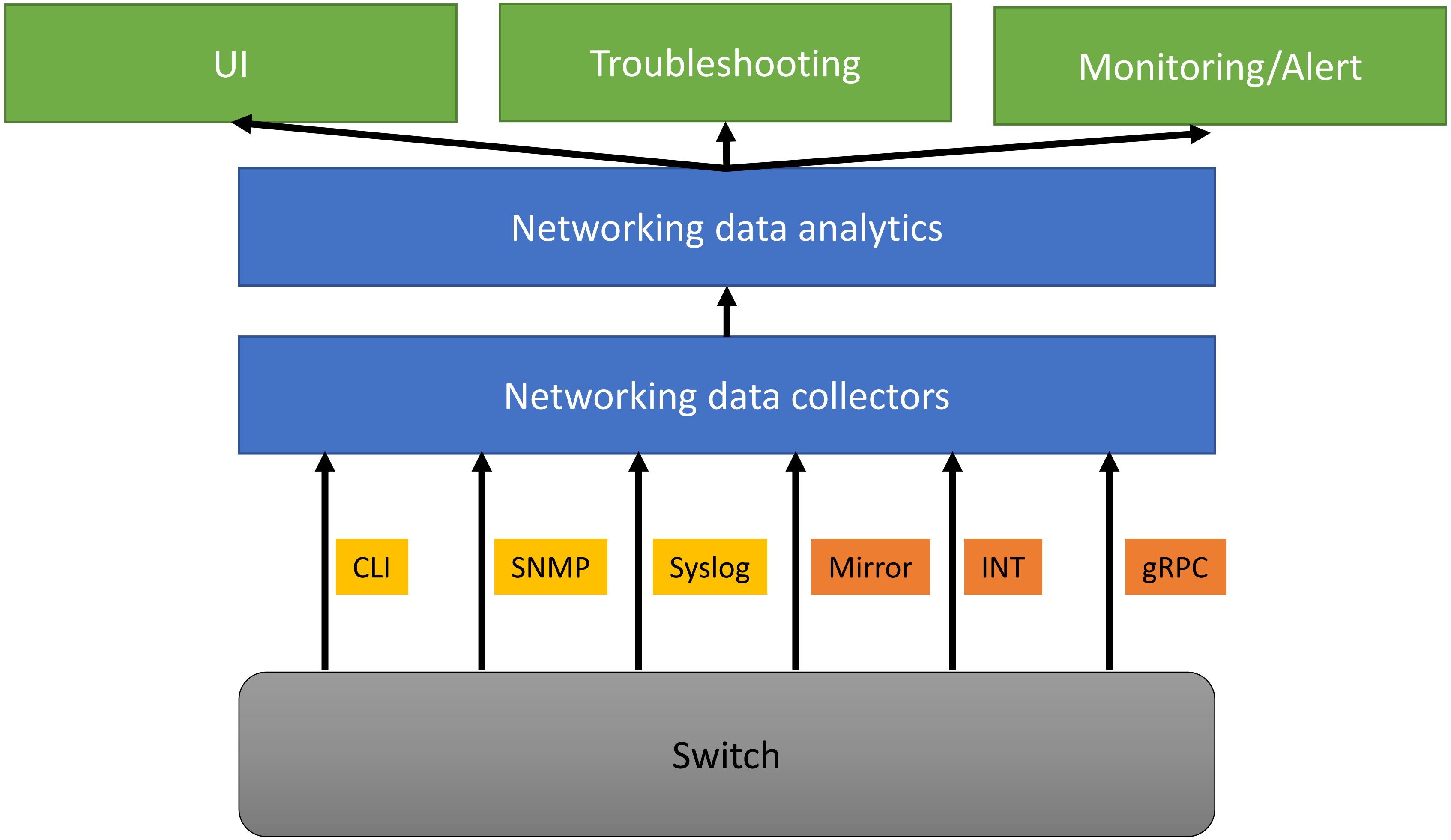
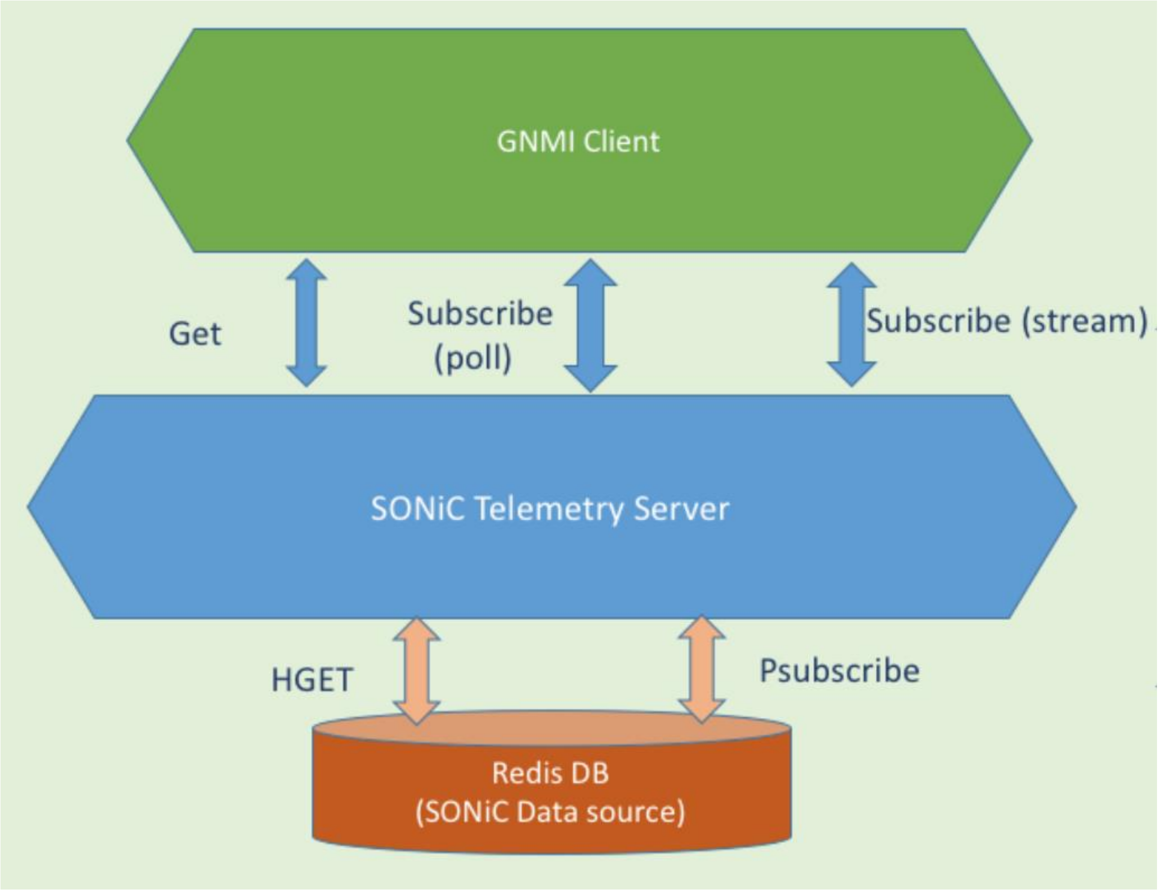
Network Telemetry Overview



Network telemetry on both Control plane and Data plane

- Switch/System level telemetry
  - Switch level ASIC status and statistics
    - Port/Queue counters
    - Buffer utilization/TAM snapshot
    - etc
  - Streamed to external collector from control plane.
- Packet/Flow level telemetry
  - Packet/Flow level event and information
    - Flow tracking event (generate event based on TCP SYN/FIN packet)
    - Per flow Latency/path change/congestion event
    - Packet drop event with detailed reason reported with flow info
  - Sent to external monitor/analyzer from data plane

Switch level telemetry via gRPC

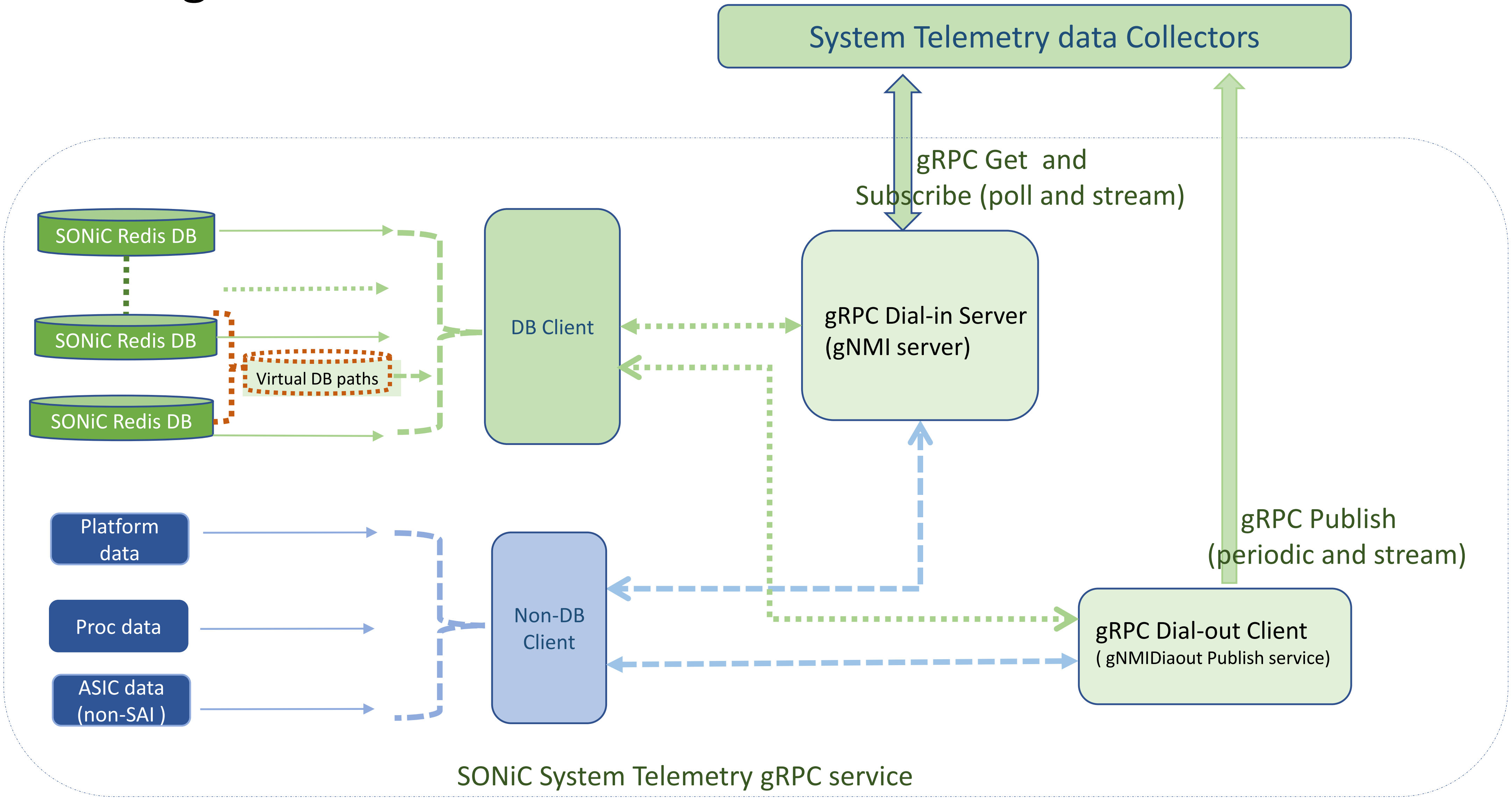


Efficient collection stack

Change only mode

Push instead of poll

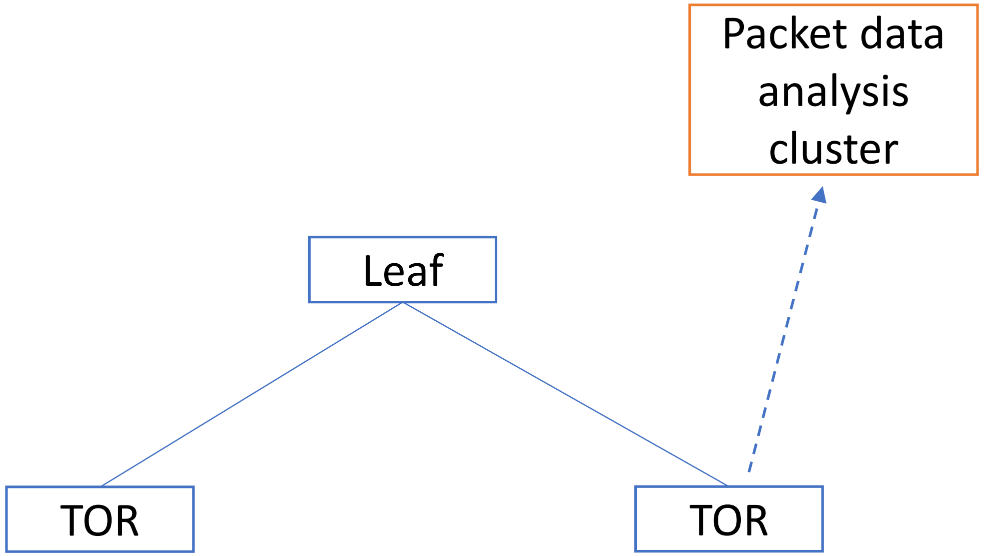
SONiC gRPC Architecture


System Telemetry data Collectors
gRPC Get and Subscribe (poll and stream)
gRPC Publish (periodic and stream)
SONiC Redis DB
SONiC Redis DB
SONiC Redis DB
Virtual DB paths
DB Client
gRPC Dial-in Server (gNMI server)
Platform data
Proc data
ASIC data (non-SAI)
Non-DB Client
gRPC Dial-out Client
(gNMIDiaout Publish service)
SONiC System Telemetry gRPC service

Challenge of flow/packet level telemetry

- Lack of production deployment and operation experience.
- Flow/packet level information process requires heavy ASIC resources.
- Metrix of supporting feature requires flexibility and programmability of switch ASIC on varies aspects.
- Needs minimum side effect to packet forwarding functions.
- Inter-operability between different ASIC vendors.

Packet telemetry analytical framework



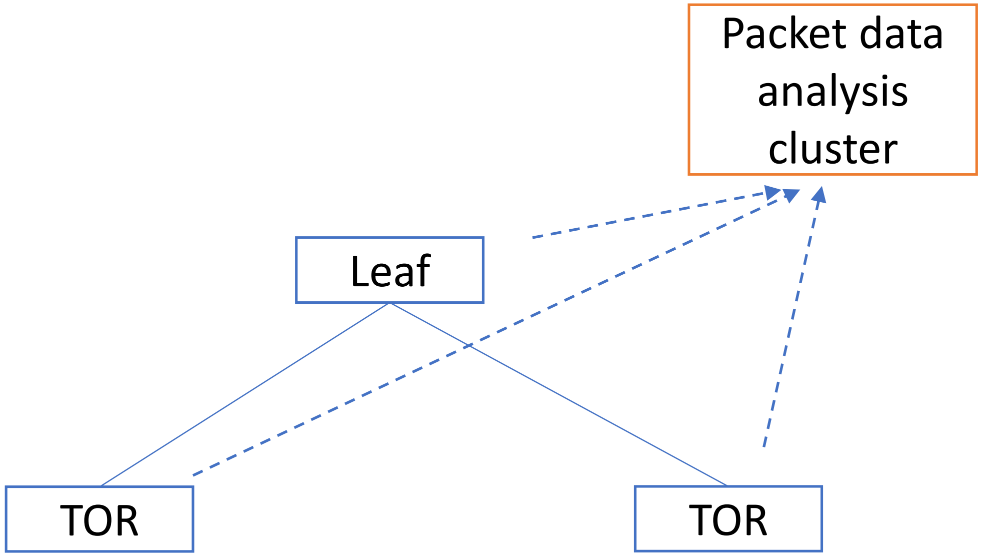
Packet data analysis cluster

Leaf

TOR

TOR

- Switch interoperability need
- Sink sends reports



Packet data analysis cluster

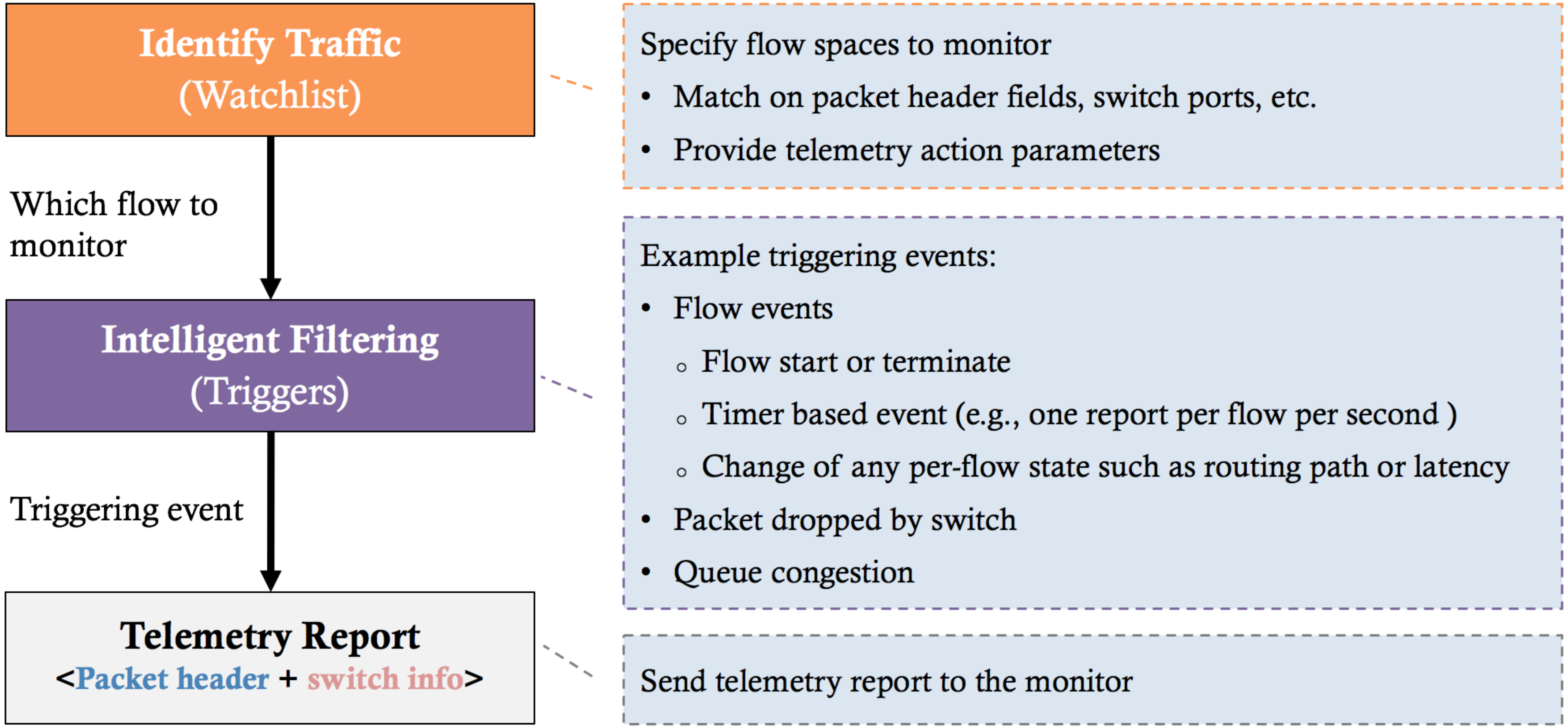
Leaf

TOR

TOR

- No switch interoperability needed
- Each switch sends report

Data plane telemetry workflow



Identify Traffic
(Watchlist)

Which flow to monitor

Intelligent Filtering
(Triggers)

Triggering event

Telemetry Report
<Packet header + switch info>

Specify flow spaces to monitor

- Match on packet header fields, switch ports, etc.
- Provide telemetry action parameters

Example triggering events:

- Flow events
  - Flow start or terminate
  - Timer based event (e.g., one report per flow per second)
  - Change of any per-flow state such as routing path or latency
- Packet dropped by switch
- Queue congestion

Send telemetry report to the monitor

Telemetry Identification Header

- Header format
  - Option 1: Probe marker
  - Option 2: DSCP
- Rule table
  - Option 1: dedicated watch list
  - Option 2: reuse existing ACL
- Action
  - Option 1: apply on original packet
  - Option 2: apply on copied packet
- Policy
  - Option 1: insert header for each packet of matched flow
  - Option 2: insert header with sampled rate of matched flow

Telemetry Instruction Header

- Header format
  - Header version
  - Instruction bit map
- Instruction bitmap could be and not limited to:
  - Switch ID
  - Ingress/egress port ID
  - Hop latency/Ingress timestamp/Egress timestamp
  - Queue ID + Queue occupancy/congestion status
  - TX utilization on egress port

Telemetry event detection

- Listed telemetry event from user perspective
  - TCP flow status reflecting establish and termination event.
  - Path change
  - Latency
  - Queue occupancy
  - Congestion status
  - TX utilization
  - Drop with reason code

Telemetry Report

- Report format
  - UDP/ERSPAN encapsulation
  - Composed with filled telemetry metadata
  - Along with truncated packet header
- Report handling
  - INT vs. Postcard
    - INT: Event detect on sink node
      - Stack metadata according to instruction hop by hop
      - Drop events needs special handling
    - Postcard: Event detect on each node
      - Trigger report as a mirrored packet on each hop
      - Analyzer needs additional steps to correlate mirrored packet of same flow acress multiple hops.
  - Options to periodically trigger report;
  - Options to suppress report without losing effective telemetry info;
  - Options to force report for debug purpose;

References

- on gRPC
  - https://github.com/jipanyang/sonic-telemetry/blob/master/doc/grpc_telemetry.md
- on DTEL (data plane telemetry)
  - https://github.com/p4lang/p4-applications/blob/master/docs/INT.pdf
  - https://github.com/p4lang/p4-applications/blob/master/docs/telemetry_report.pdf
  - https://github.com/CiscoDevNet/iOAM
  - https://tools.ietf.org/html/draft-ietf-ippm-ioam-data-02