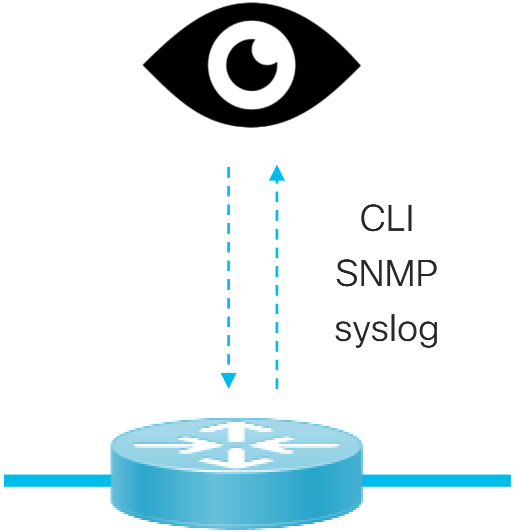
Ultimate network insights – Advances in network telemetry

Frank Brockners

DNAC’18 - November 16, 2018

Network Monitoring…

An Unlikely Target for Radical Innovation



CLI
SNMP
syslog

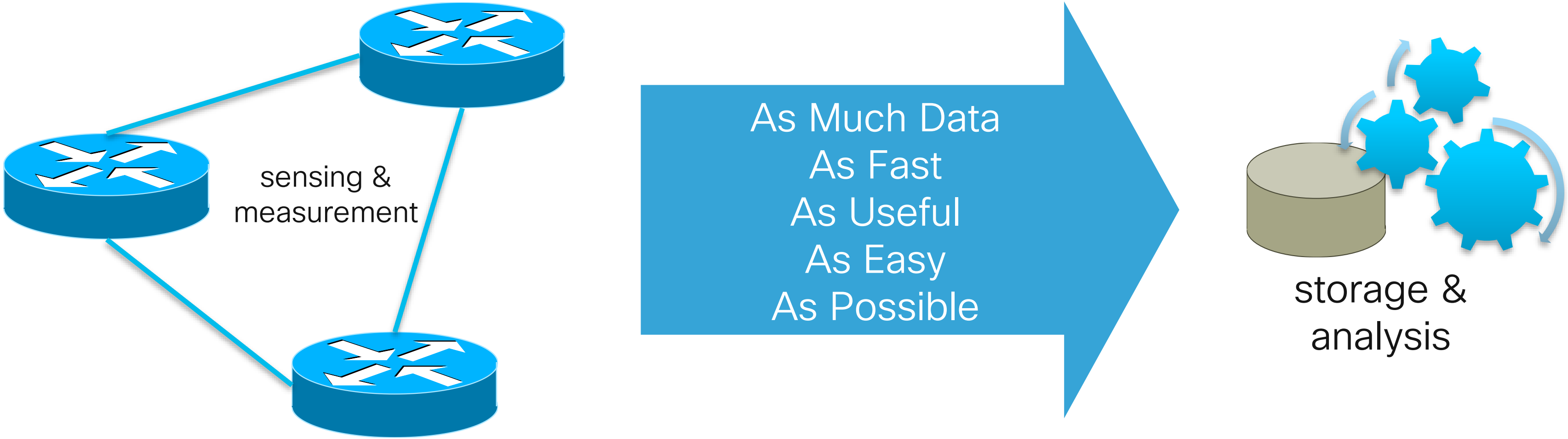
- Too Slow
- Incomplete
- Device-Specific
- Hard to Operationalize

“Free the data”

Network Telemetry Paradigm

Where Data Is Created

Where Data Is Useful

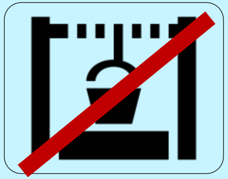


sensing & measurement

As Much Data
As Fast
As Useful
As Easy
As Possible

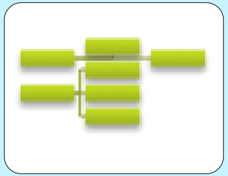
storage & analysis

Three Enablers for Telemetry



Don’t Pull: Push!

Analytics-Ready Data



Data-Model Driven

Performance

Tool-Chains

Automation

Three Enablers Map to Three Parts of Telemetry

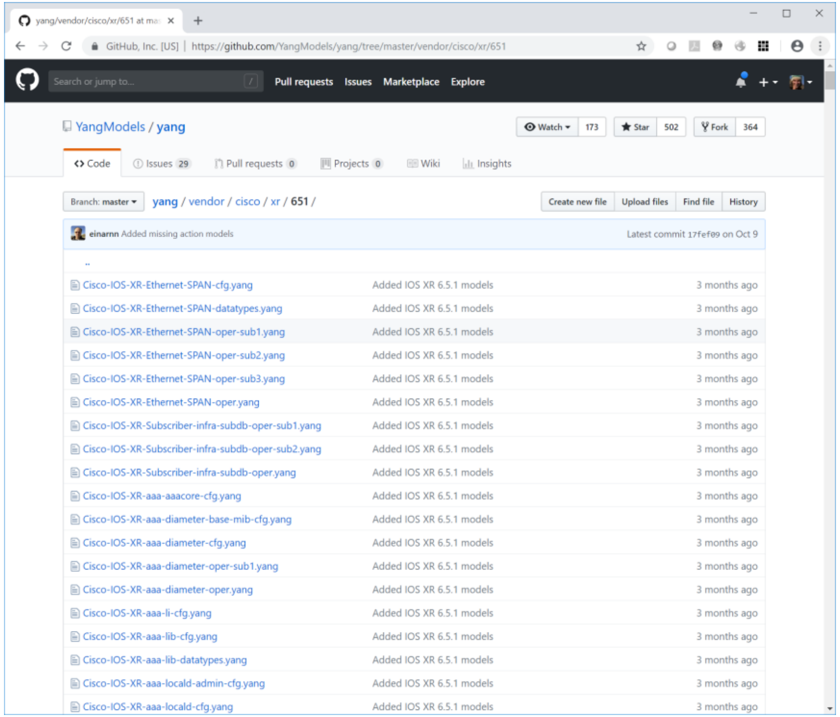
Sensor-Group	Destination-Group	Subscription
▪ "What" ▪ Data Models	▪ "Where/How" ▪ Analytics-Ready	▪ "How Often" ▪ Push, Not Pull

Data Models Define What You Want to Stream

```
telemetry model-driven

 sensor-group SGROUP1

  sensor-path Cisco-IOS-XR-infra-statsd-oper:
    infra-
    statistics/interfaces/interface/latest/ge
    neric-counters
```

Model-Driven Means You Can Work With Models Offline

https://github.com/YangModels/yang/tree/master/vendor/cisco/xr



einarnn Added missing action models — Latest commit 17fef09 on Oct 9

..		
Cisco-IOS-XR-Ethernet-SPAN-cfg.yang	Added IOS XR 6.5.1 models	3 months ago
Cisco-IOS-XR-Ethernet-SPAN-datatypes.yang	Added IOS XR 6.5.1 models	3 months ago
Cisco-IOS-XR-Ethernet-SPAN-oper-sub1.yang	Added IOS XR 6.5.1 models	3 months ago
Cisco-IOS-XR-Ethernet-SPAN-oper-sub2.yang	Added IOS XR 6.5.1 models	3 months ago
Cisco-IOS-XR-Ethernet-SPAN-oper-sub3.yang	Added IOS XR 6.5.1 models	3 months ago
Cisco-IOS-XR-Ethernet-SPAN-oper.yang	Added IOS XR 6.5.1 models	3 months ago
Cisco-IOS-XR-Subscriber-infra-subdb-oper-sub1.yang	Added IOS XR 6.5.1 models	3 months ago
Cisco-IOS-XR-Subscriber-infra-subdb-oper-sub2.yang	Added IOS XR 6.5.1 models	3 months ago
Cisco-IOS-XR-Subscriber-infra-subdb-oper.yang	Added IOS XR 6.5.1 models	3 months ago
Cisco-IOS-XR-aaa-aaacore-cfg.yang	Added IOS XR 6.5.1 models	3 months ago
Cisco-IOS-XR-aaa-diameter-base-mib-cfg.yang	Added IOS XR 6.5.1 models	3 months ago
Cisco-IOS-XR-aaa-diameter-cfg.yang	Added IOS XR 6.5.1 models	3 months ago
Cisco-IOS-XR-aaa-diameter-oper-sub1.yang	Added IOS XR 6.5.1 models	3 months ago
Cisco-IOS-XR-aaa-diameter-oper.yang	Added IOS XR 6.5.1 models	3 months ago
Cisco-IOS-XR-aaa-li-cfg.yang	Added IOS XR 6.5.1 models	3 months ago
Cisco-IOS-XR-aaa-lib-cfg.yang	Added IOS XR 6.5.1 models	3 months ago
Cisco-IOS-XR-aaa-lib-datatypes.yang	Added IOS XR 6.5.1 models	3 months ago
Cisco-IOS-XR-aaa-locald-admin-cfg.yang	Added IOS XR 6.5.1 models	3 months ago
Cisco-IOS-XR-aaa-locald-cfg.yang	Added IOS XR 6.5.1 models	3 months ago

Telemetry only cares about operational (*-oper.yang) models, not config (*-cfg.yang) or action (*-act.yang).

- IOS-XR 5.3.0: 36 published *-oper*.yang models
- IOS-XR 5.3.4: 66 published *-oper*.yang models
- IOS-XR 6.0.1: 288 published *-oper*.yang models
- IOS-XR 6.2.1: 445 published *-oper*.yang models
- IOS-XR 6.5.1: 456 published *-oper*.yang models

There Are Many Tools To Explore What’s In A Model

```
$ pyang -f tree Cisco-IOS-XR-infra-statsd-oper.yang
    --tree-path infra-statistics/interfaces/interface/latest/generic-
counters

module: Cisco-IOS-XR-infra-statsd-oper
   +--ro infra-statistics
      +--ro interfaces
         +--ro interface* [interface-name]
            +--ro latest
               +--ro generic-counters
                  +--ro packets-received?                     uint64
                  +--ro bytes-received?                       uint64
                  +--ro packets-sent?                         uint64
                  +--ro bytes-sent?                           uint64
                  +--ro multicast-packets-received?           uint64
                  …
```

Or try the Advanced Netconf Explorer ANX: https://github.com/cisco-ie/anx

Common Sensor Paths: System and Interfaces

Data	Model
Interface Oper State	Cisco-IOS-XR-pfi-im-cmd-oper:interfaces/interface-xr/interface
Interface Data Rate	Cisco-IOS-XR-infra-statsd-oper:infra-statistics/interfaces/interface/latest/data-rate
Interfaces Stats	Cisco-IOS-XR-infra-statsd-oper:infra-statistics/interfaces/interface/latest/generic-counters
Optics Ports Info	Cisco-IOS-XR-controller-optics-oper:optics-oper/optics-ports/optics-port/optics-Info
Uptime Info	Cisco-IOS-XR-shellutil-oper:system-time/uptime
CPU State	Cisco-IOS-XR-wdsysmon-fd-oper:system-monitoring/cpu-utilization
Memory Info	Cisco-IOS-XR-nto-misc-oper:memory-summary/nodes/node/summary
Processes Memory	Cisco-IOS-XR-procmem-oper:processes-memory/nodes
NCS5500 NPU Stats	Cisco-IOS-XR-fretta-bcm-dpa-npu-stats-oper:dpa/stats/nodes/node
NCS5500 NPU Resources	Cisco-IOS-XR-fretta-bcm-dpa-hw-resources-oper:dpa/stats/nodes/node/hw-resources-datas/hw-resources-data

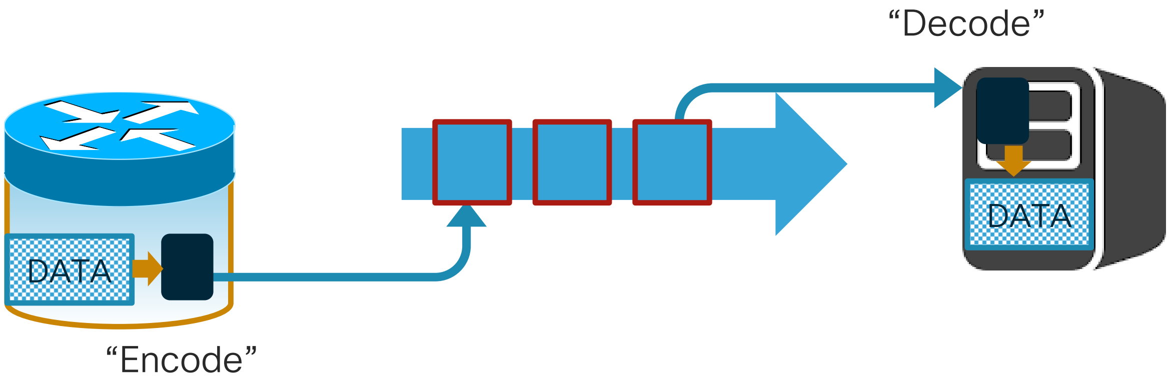
Common Sensor Paths: Protocols

Data	Model
LLDP Info	Cisco-IOS-XR-ethernet-lldp-oper:lldp/nodes/node/neighbors/summaries/summary
IPv4 RIB Info	Cisco-IOS-XR-ip-rib-ipv4-oper:rib/vrfs/vrf/afs/af/safs/saf/ip-rib-route-table-names/ip-rib-route-table-name/routes/route
IPv6 RIB Info	Cisco-IOS-XR-ip-rib-ipv6-oper:ipv6-rib/vrfs/vrf/afs/af/safs/saf/ip-rib-route-table-names/ip-rib-route-table-name/routes/route
BGP IPv4 Routes Info	Cisco-IOS-XR-ip-rib-ipv4-oper:rib/vrfs/vrf/afs/af/safs/saf/ip-rib-route-table-names/ip-rib-route-table-name/protocol/bgp/as/information
BGP IPv6 Routes Info	Cisco-IOS-XR-ip-rib-ipv6-oper:ipv6-rib/vrfs/vrf/afs/af/safs/saf/ip-rib-route-table-names/ip-rib-route-table-name/protocol/bgp/as/information
BGP IPv4 Neighbor	Cisco-IOS-XR-ipv4-bgp-oper:bgp/instances/instance/instance-active/default-vrf/neighbors/neighbor
MPLS-TE Tunnels	Cisco-IOS-XR-mpls-te-oper:mpls-te/tunnels/summary
RSVP Interface Info	Cisco-IOS-XR-ip-rsvp-oper:rsvp/interface-briefs/interface-brief

Where and How Do You Want to Stream It

```
telemetry model-driven

 destination-group DGROUP

  address family ipv4 192.168.1.1 port 2104

                 ---- and/or ----

  address family ipv6 2001:db8::1 port 2104

   encoding self-describing-gpb

   protocol tcp
```

Encoding Impacts Efficiency, Scale and Your Collector



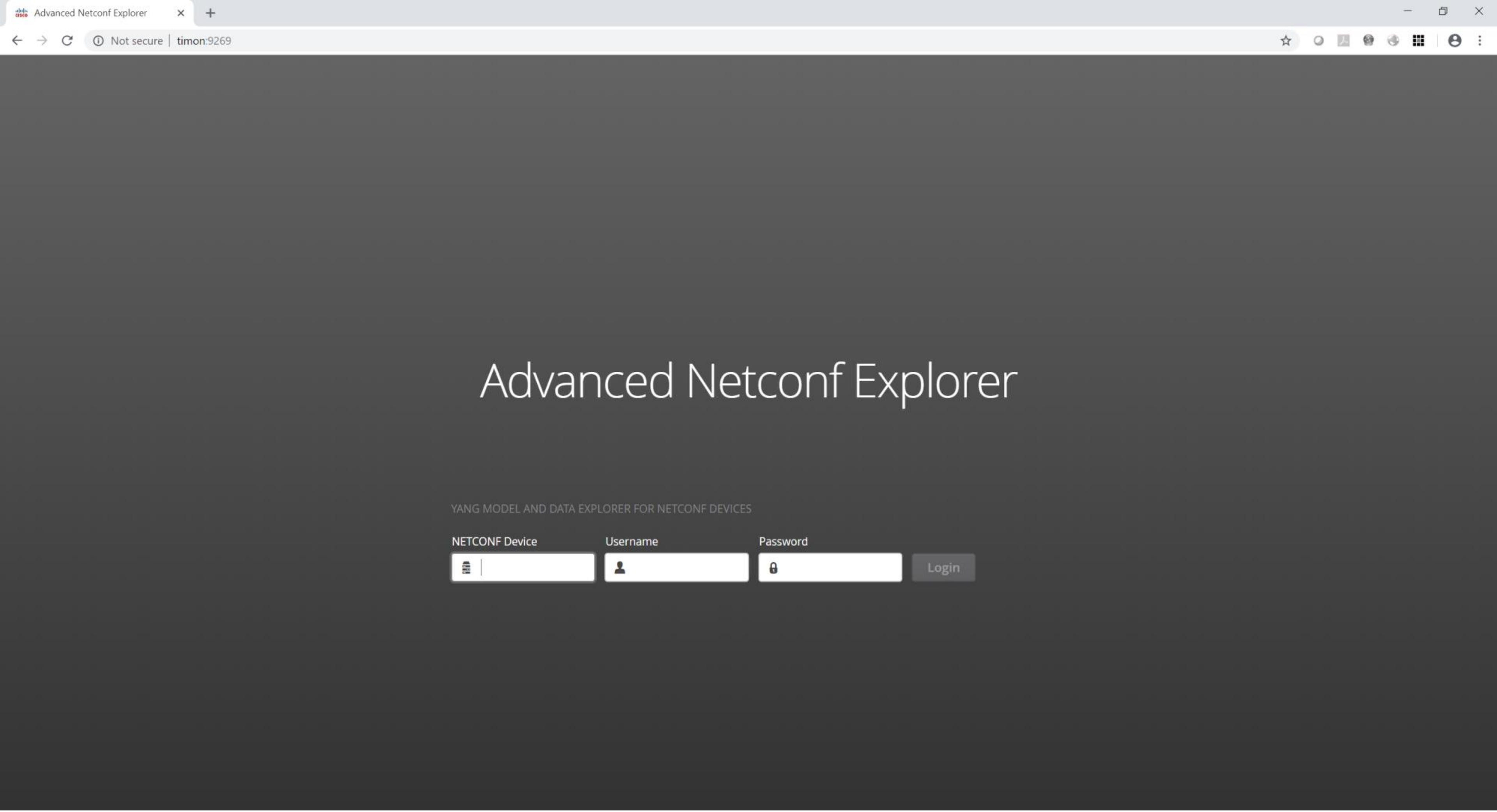
Encodings for Telemetry

- Compact GPB
- Self-describing GPB
- JSON (XR 6.3.1)

Encoding (or "serialization") translates data (objects, state) into a format that can be transmitted across the network. When the receiver decodes ("de-serializes") the data, it has a semantically identical copy of the original data.

Tie It All Together With A Subscription

```
telemetry model-driven
 subscription SUB1
  sensor-group-id SGROUP1 sample-interval 30000
  destination-id DGROUP1
```



Advanced Netconf Explorer

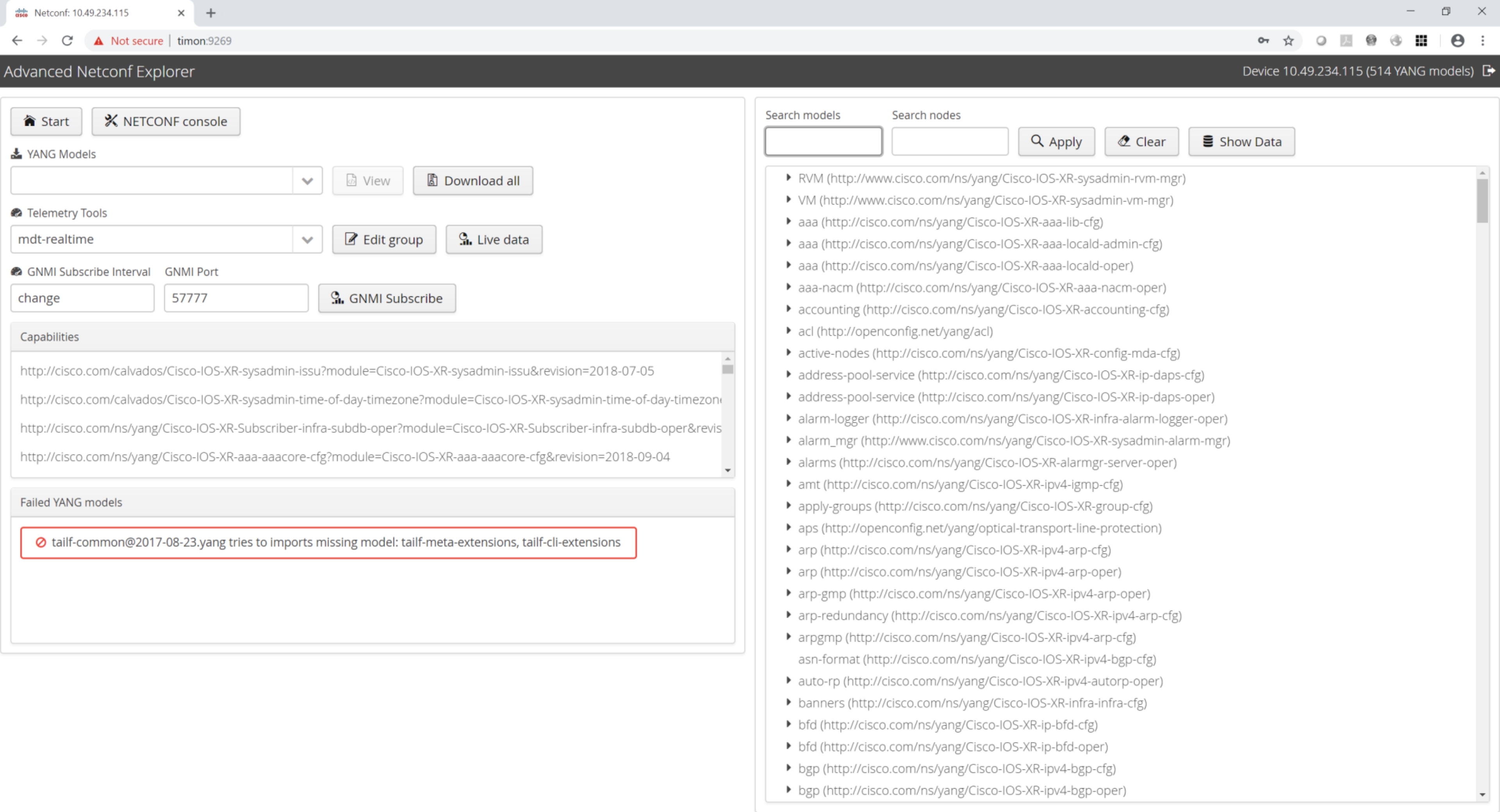
YANG MODEL AND DATA EXPLORER FOR NETCONF DEVICES

NETCONF Device

Username

Password

ANX: https://github.com/cisco-ie/anx



YANG Models

Telemetry Tools: mdt-realtime

GNMI Subscribe Interval: change

GNMI Port: 57777

Capabilities

http://cisco.com/calvados/Cisco-IOS-XR-sysadmin-issu?module=Cisco-IOS-XR-sysadmin-issu&revision=2018-07-05

http://cisco.com/calvados/Cisco-IOS-XR-sysadmin-time-of-day-timezone?module=Cisco-IOS-XR-sysadmin-time-of-day-timezon

http://cisco.com/ns/yang/Cisco-IOS-XR-Subscriber-infra-subdb-oper?module=Cisco-IOS-XR-Subscriber-infra-subdb-oper&revis

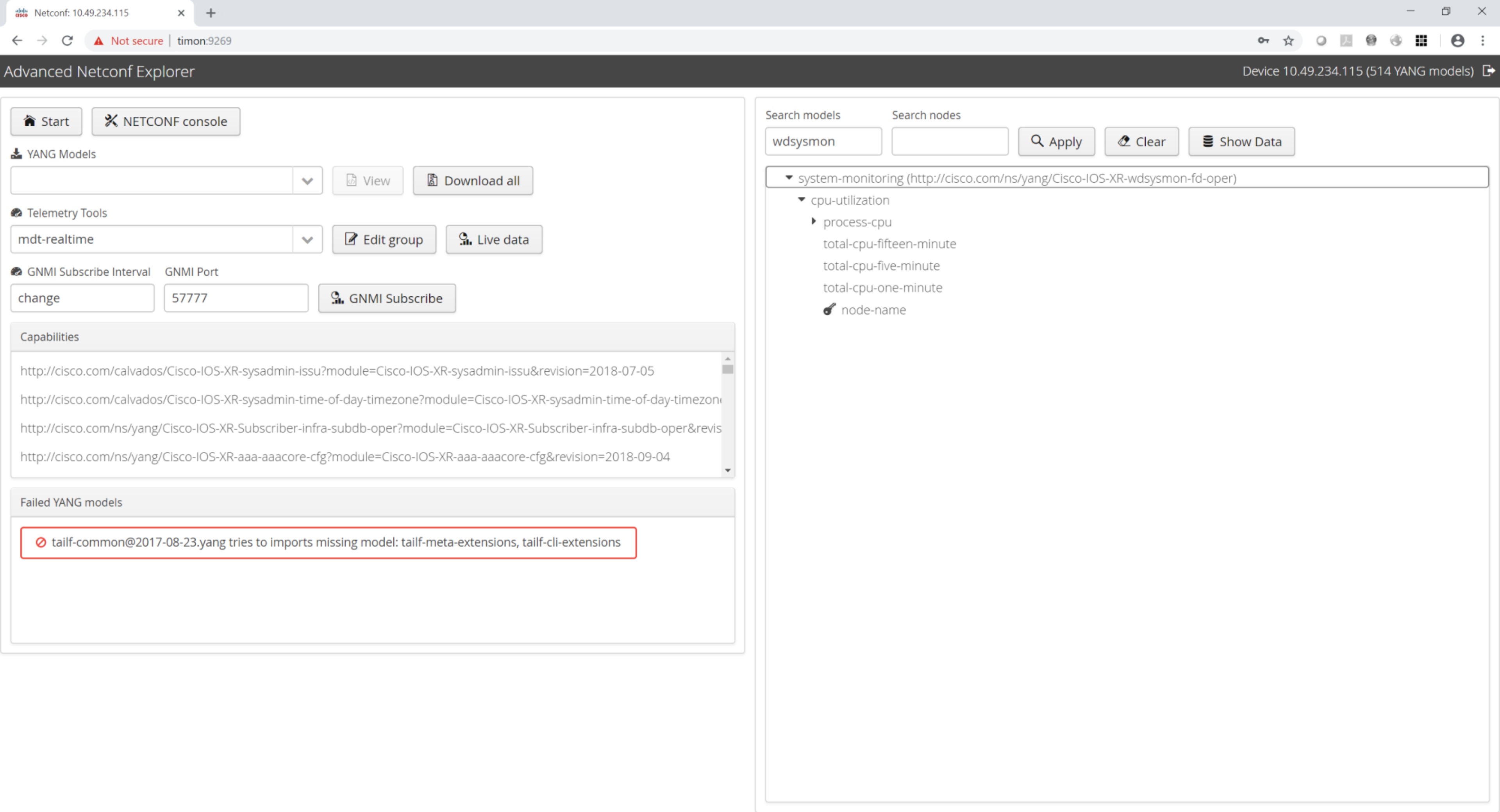
http://cisco.com/ns/yang/Cisco-IOS-XR-aaa-aaacore-cfg?module=Cisco-IOS-XR-aaa-aaacore-cfg&revision=2018-09-04

Failed YANG models

⊘ tailf-common@2017-08-23.yang tries to imports missing model: tailf-meta-extensions, tailf-cli-extensions

- RVM (http://www.cisco.com/ns/yang/Cisco-IOS-XR-sysadmin-rvm-mgr)
- VM (http://www.cisco.com/ns/yang/Cisco-IOS-XR-sysadmin-vm-mgr)
- aaa (http://cisco.com/ns/yang/Cisco-IOS-XR-aaa-lib-cfg)
- aaa (http://cisco.com/ns/yang/Cisco-IOS-XR-aaa-locald-admin-cfg)
- aaa (http://cisco.com/ns/yang/Cisco-IOS-XR-aaa-locald-oper)
- aaa-nacm (http://cisco.com/ns/yang/Cisco-IOS-XR-aaa-nacm-oper)
- accounting (http://cisco.com/ns/yang/Cisco-IOS-XR-accounting-cfg)
- acl (http://openconfig.net/yang/acl)
- active-nodes (http://cisco.com/ns/yang/Cisco-IOS-XR-config-mda-cfg)
- address-pool-service (http://cisco.com/ns/yang/Cisco-IOS-XR-ip-daps-cfg)
- address-pool-service (http://cisco.com/ns/yang/Cisco-IOS-XR-ip-daps-oper)
- alarm-logger (http://cisco.com/ns/yang/Cisco-IOS-XR-infra-alarm-logger-oper)
- alarm_mgr (http://www.cisco.com/ns/yang/Cisco-IOS-XR-sysadmin-alarm-mgr)
- alarms (http://cisco.com/ns/yang/Cisco-IOS-XR-alarmgr-server-oper)
- amt (http://cisco.com/ns/yang/Cisco-IOS-XR-ipv4-igmp-cfg)
- apply-groups (http://cisco.com/ns/yang/Cisco-IOS-XR-group-cfg)
- aps (http://openconfig.net/yang/optical-transport-line-protection)
- arp (http://cisco.com/ns/yang/Cisco-IOS-XR-ipv4-arp-cfg)
- arp (http://cisco.com/ns/yang/Cisco-IOS-XR-ipv4-arp-oper)
- arp-gmp (http://cisco.com/ns/yang/Cisco-IOS-XR-ipv4-arp-oper)
- arp-redundancy (http://cisco.com/ns/yang/Cisco-IOS-XR-ipv4-arp-cfg)
- arpgmp (http://cisco.com/ns/yang/Cisco-IOS-XR-ipv4-arp-cfg)
- asn-format (http://cisco.com/ns/yang/Cisco-IOS-XR-ipv4-bgp-cfg)
- auto-rp (http://cisco.com/ns/yang/Cisco-IOS-XR-ipv4-autorp-oper)
- banners (http://cisco.com/ns/yang/Cisco-IOS-XR-infra-infra-cfg)
- bfd (http://cisco.com/ns/yang/Cisco-IOS-XR-ip-bfd-cfg)
- bfd (http://cisco.com/ns/yang/Cisco-IOS-XR-ip-bfd-oper)
- bgp (http://cisco.com/ns/yang/Cisco-IOS-XR-ipv4-bgp-cfg)
- bgp (http://cisco.com/ns/yang/Cisco-IOS-XR-ipv4-bgp-oper)

ANX: https://github.com/cisco-ie/anx



Telemetry Tools: mdt-realtime

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http://cisco.com/calvados/Cisco-IOS-XR-sysadmin-time-of-day-timezone?module=Cisco-IOS-XR-sysadmin-time-of-day-timezon

http://cisco.com/ns/yang/Cisco-IOS-XR-Subscriber-infra-subdb-oper?module=Cisco-IOS-XR-Subscriber-infra-subdb-oper&revis

http://cisco.com/ns/yang/Cisco-IOS-XR-aaa-aaacore-cfg?module=Cisco-IOS-XR-aaa-aaacore-cfg&revision=2018-09-04

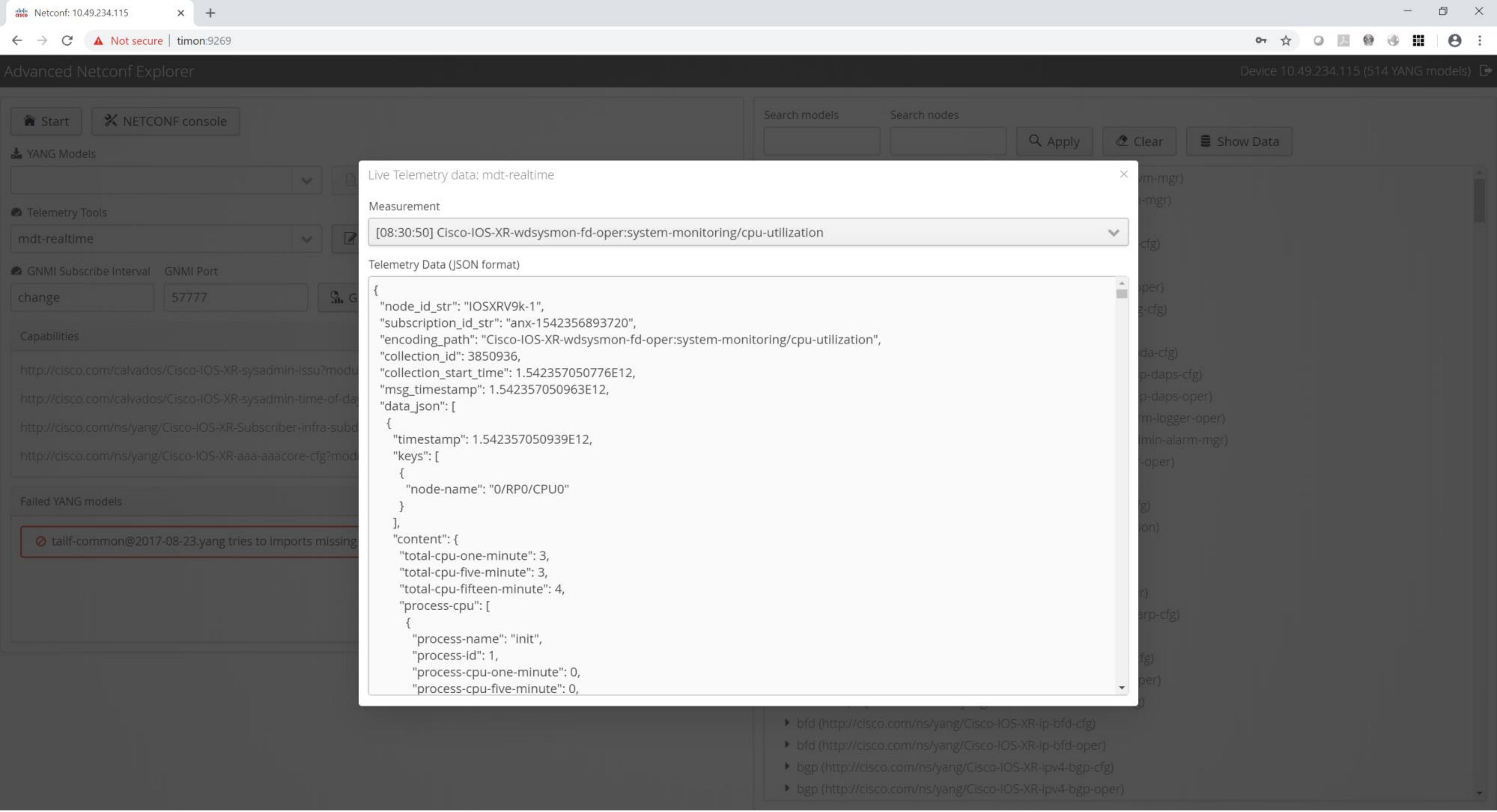
Failed YANG models

tailf-common@2017-08-23.yang tries to imports missing model: tailf-meta-extensions, tailf-cli-extensions

Search models: wdsysmon

```
▾ system-monitoring (http://cisco.com/ns/yang/Cisco-IOS-XR-wdsysmon-fd-oper)
  ▾ cpu-utilization
    ▸ process-cpu
      total-cpu-fifteen-minute
      total-cpu-five-minute
      total-cpu-one-minute
      node-name
```

ANX: https://github.com/cisco-ie/anx



Telemetry Tools: mdt-realtime

GNMI Subscribe Interval: change

GNMI Port: 57777

http://cisco.com/calvados/Cisco-IOS-XR-sysadmin-issu?modu

http://cisco.com/calvados/Cisco-IOS-XR-sysadmin-time-of-da

http://cisco.com/ns/yang/Cisco-IOS-XR-Subscriber-infra-subd

http://cisco.com/ns/yang/Cisco-IOS-XR-aaa-aaacore-cfg?mod

tailf-common@2017-08-23.yang tries to imports missing

bfd (http://cisco.com/ns/yang/Cisco-IOS-XR-ip-bfd-cfg)

bfd (http://cisco.com/ns/yang/Cisco-IOS-XR-ip-bfd-oper)

bgp (http://cisco.com/ns/yang/Cisco-IOS-XR-ipv4-bgp-cfg)

bgp (http://cisco.com/ns/yang/Cisco-IOS-XR-ipv4-bgp-oper)

Live Telemetry data: mdt-realtime

Measurement

[08:30:50] Cisco-IOS-XR-wdsysmon-fd-oper:system-monitoring/cpu-utilization

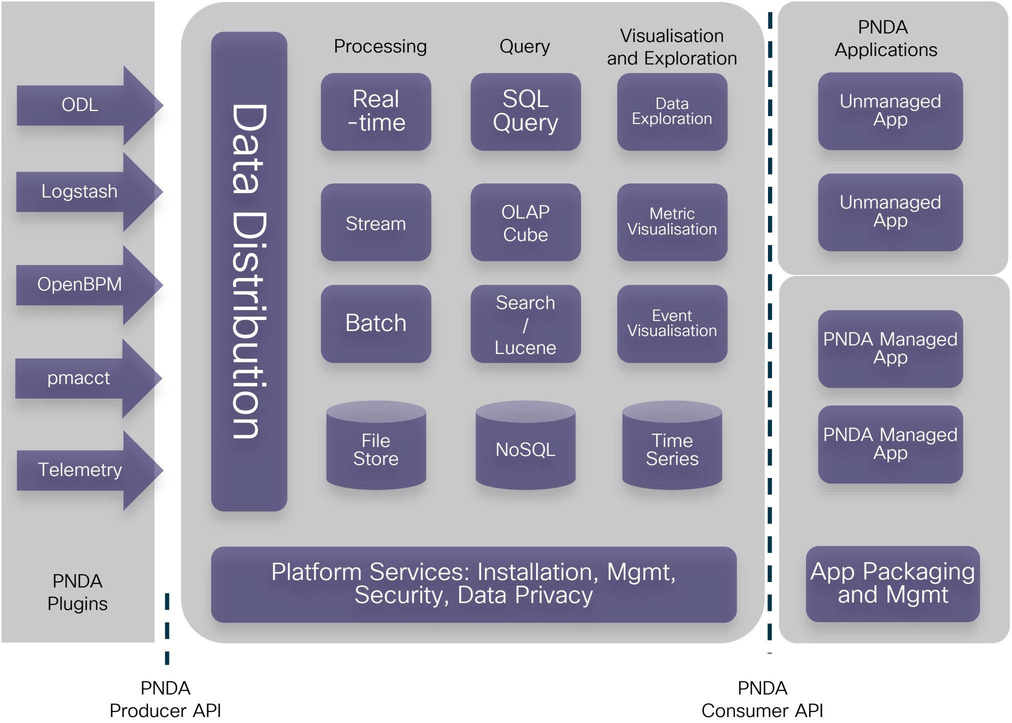
Telemetry Data (JSON format)

```
{
 "node_id_str": "IOSXRV9k-1",
 "subscription_id_str": "anx-1542356893720",
 "encoding_path": "Cisco-IOS-XR-wdsysmon-fd-oper:system-monitoring/cpu-utilization",
 "collection_id": 3850936,
 "collection_start_time": 1.542357050776E12,
 "msg_timestamp": 1.542357050963E12,
 "data_json": [
  {
   "timestamp": 1.542357050939E12,
   "keys": [
    {
     "node-name": "0/RP0/CPU0"
    }
   ],
   "content": {
    "total-cpu-one-minute": 3,
    "total-cpu-five-minute": 3,
    "total-cpu-fifteen-minute": 4,
    "process-cpu": [
     {
      "process-name": "init",
      "process-id": 1,
      "process-cpu-one-minute": 0,
      "process-cpu-five-minute": 0,
```

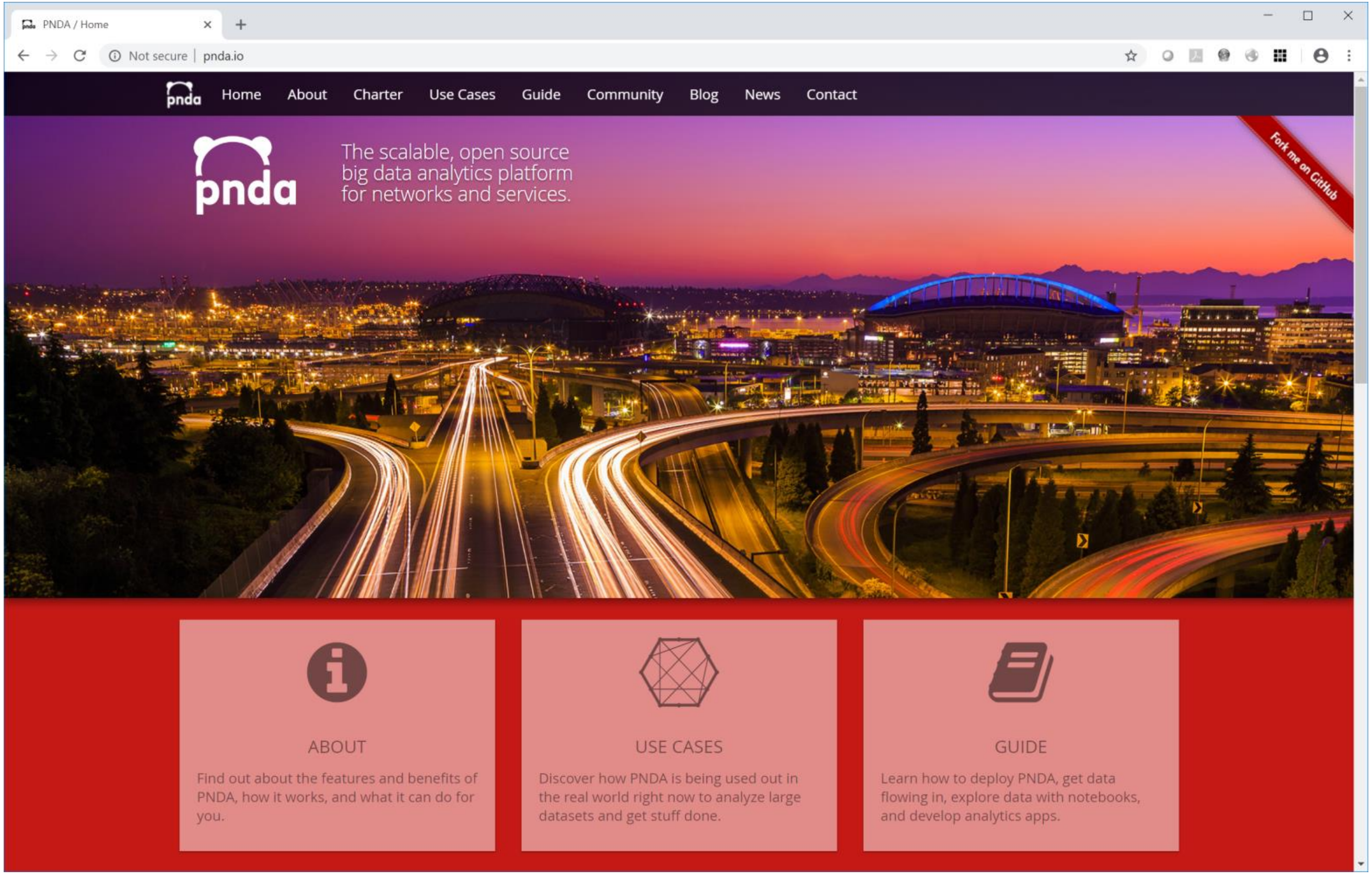
ANX: https://github.com/cisco-ie/anx

Where does the data go?

Platform for Network Data Analytics: PNDA.io



- Simple, scalable open data platform
- Provides a common set of services for developing analytics applications
- Accelerates the process of developing big data analytics applications whilst significantly reducing the TCO
- PNDA provides a platform for convergence of network data analytics



pnda

The scalable, open source big data analytics platform for networks and services.

ABOUT

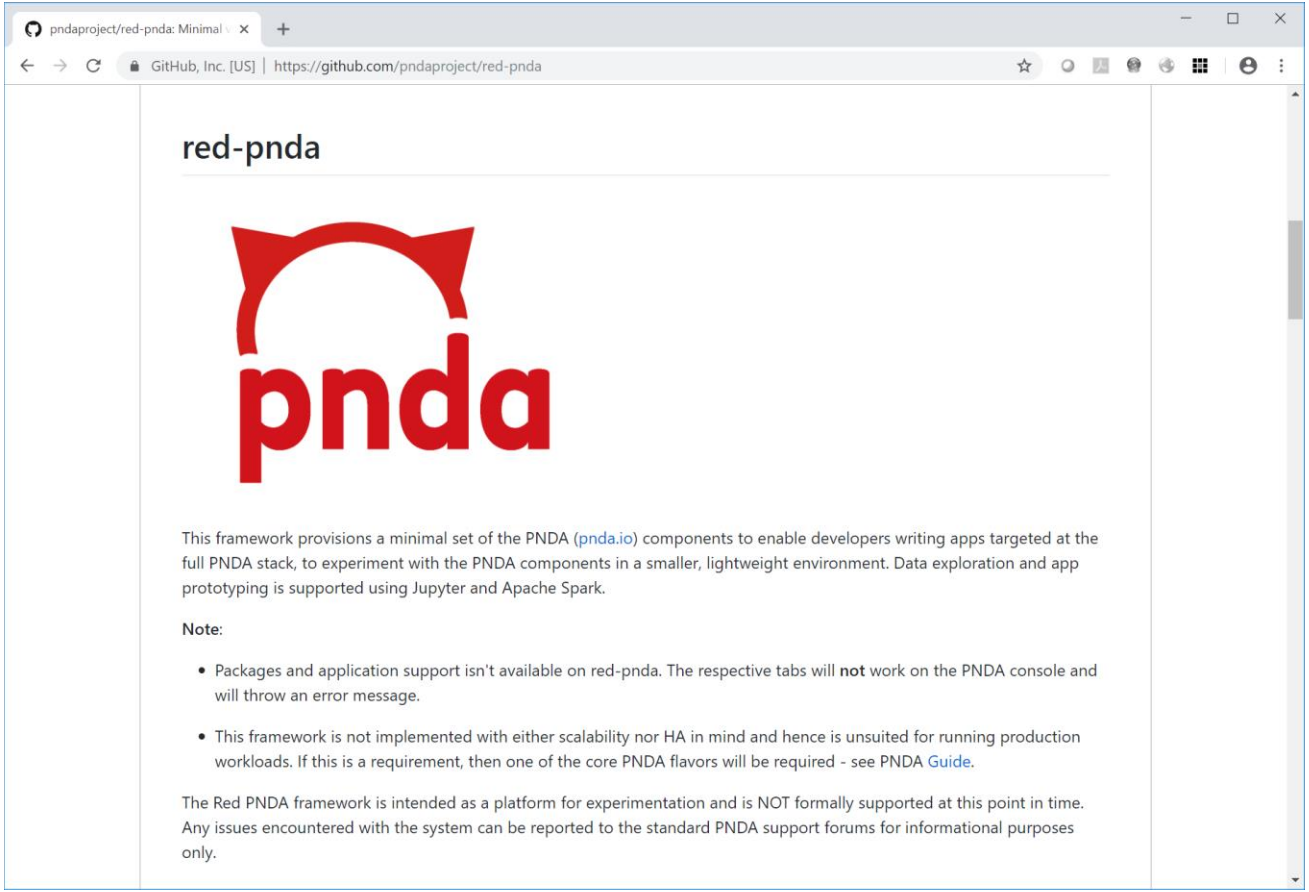
Find out about the features and benefits of PNDA, how it works, and what it can do for you.

USE CASES

Discover how PNDA is being used out in the real world right now to analyze large datasets and get stuff done.

GUIDE

Learn how to deploy PNDA, get data flowing in, explore data with notebooks, and develop analytics apps.



pndaproject/red-pnda: Minimal
GitHub, Inc. [US] | https://github.com/pndaproject/red-pnda

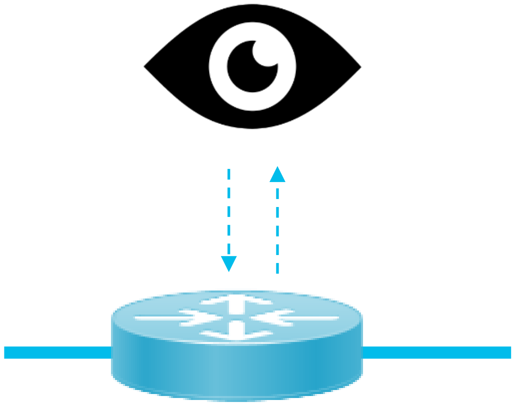
red-pnda

This framework provisions a minimal set of the PNDA (pnda.io) components to enable developers writing apps targeted at the full PNDA stack, to experiment with the PNDA components in a smaller, lightweight environment. Data exploration and app prototyping is supported using Jupyter and Apache Spark.

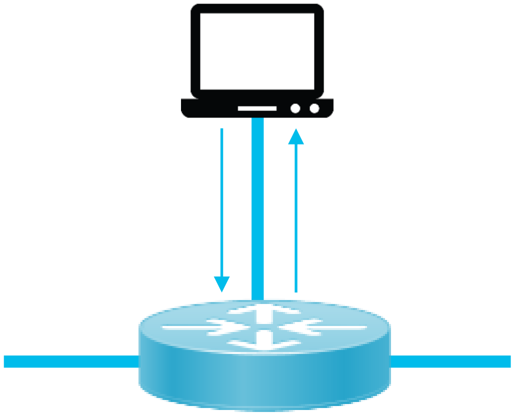
Note:

- Packages and application support isn't available on red-pnda. The respective tabs will **not** work on the PNDA console and will throw an error message.
- This framework is not implemented with either scalability nor HA in mind and hence is unsuited for running production workloads. If this is a requirement, then one of the core PNDA flavors will be required - see PNDA Guide.

The Red PNDA framework is intended as a platform for experimentation and is NOT formally supported at this point in time. Any issues encountered with the system can be reported to the standard PNDA support forums for informational purposes only.



Observe
(SNMP, Syslog
Streaming Telemetry)



Probe
(ping, traceroute)

But what about my live user traffic?

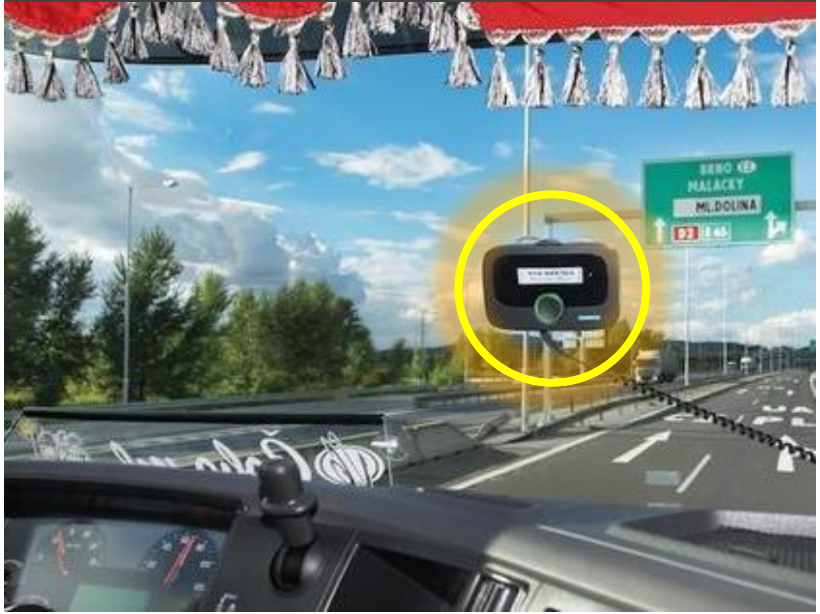
Let’s assume you’re interested in the behavior of your live user-data traffic.

What is the best source of information?

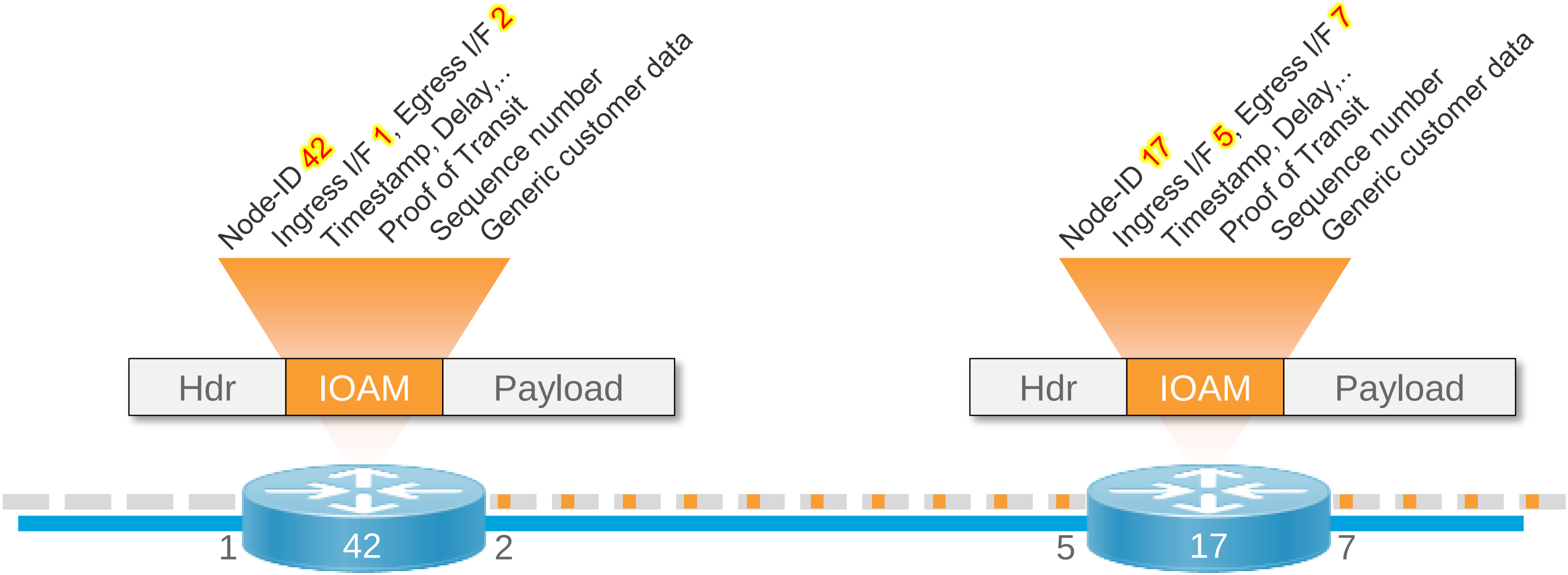
Well… probably the live user-data traffic itself.

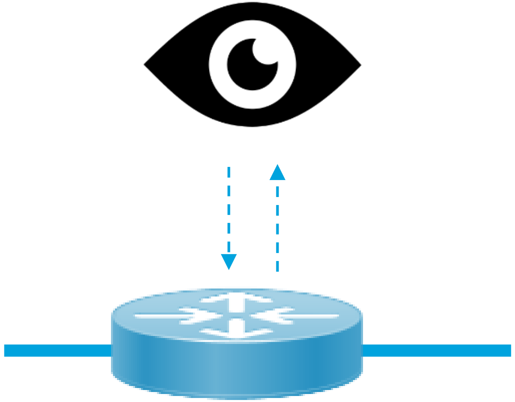
Speed control by police car

“On-Board Unit”

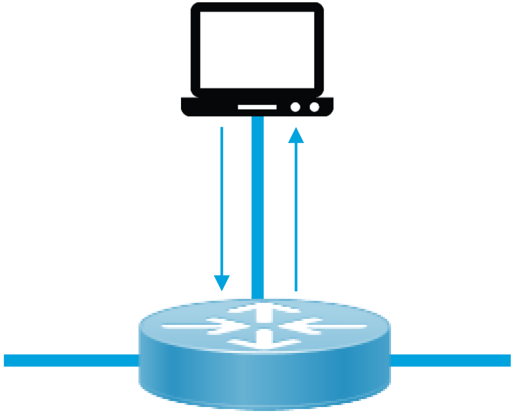


Let’s add meta-data to the customer traffic,
so that we can observe the customer traffic itself

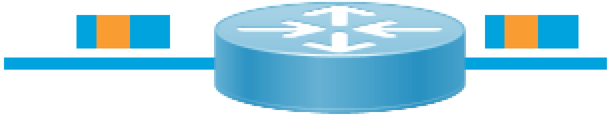

Node-ID 42
Ingress I/F 1, Egress I/F 2
Timestamp, Delay,…
Proof of Transit
Sequence number
Generic customer data
Hdr
IOAM
Payload
Node-ID 17
Ingress I/F 5, Egress I/F 7
Timestamp, Delay,…
Proof of Transit
Sequence number
Generic customer data
Hdr
IOAM
Payload
1
42
2
5
17
7



Observe
(SNMP, Syslog
Streaming Telemetry)

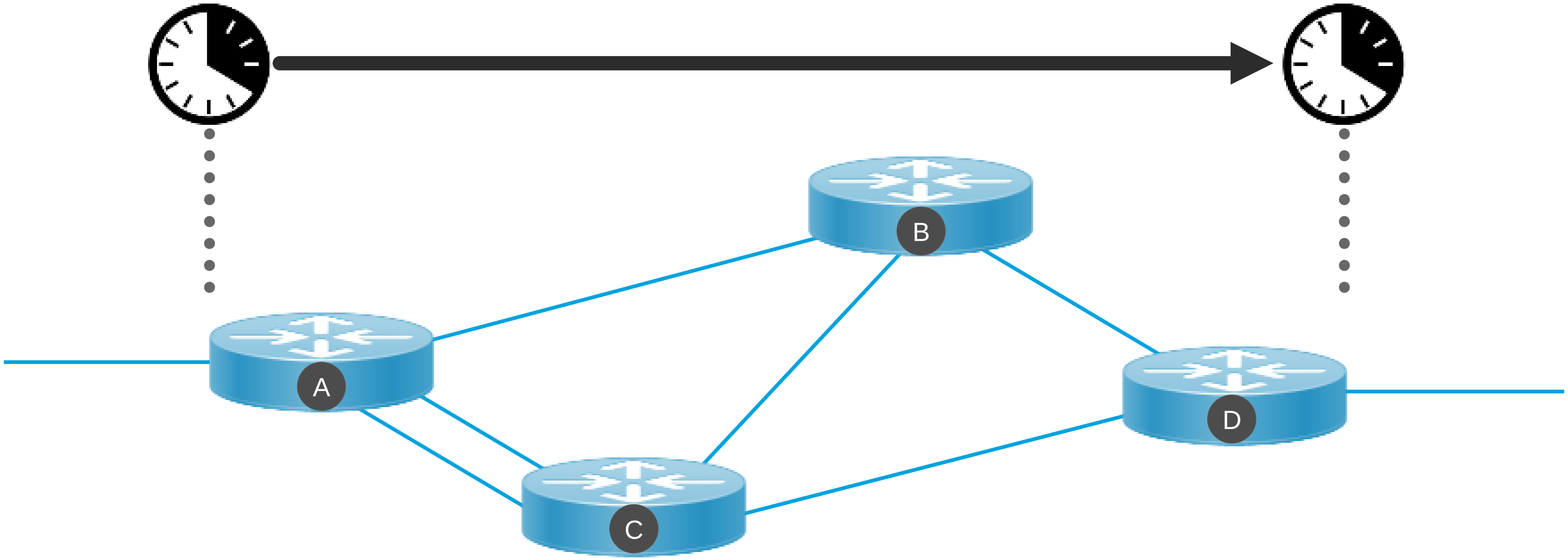


Probe
(ping, traceroute)

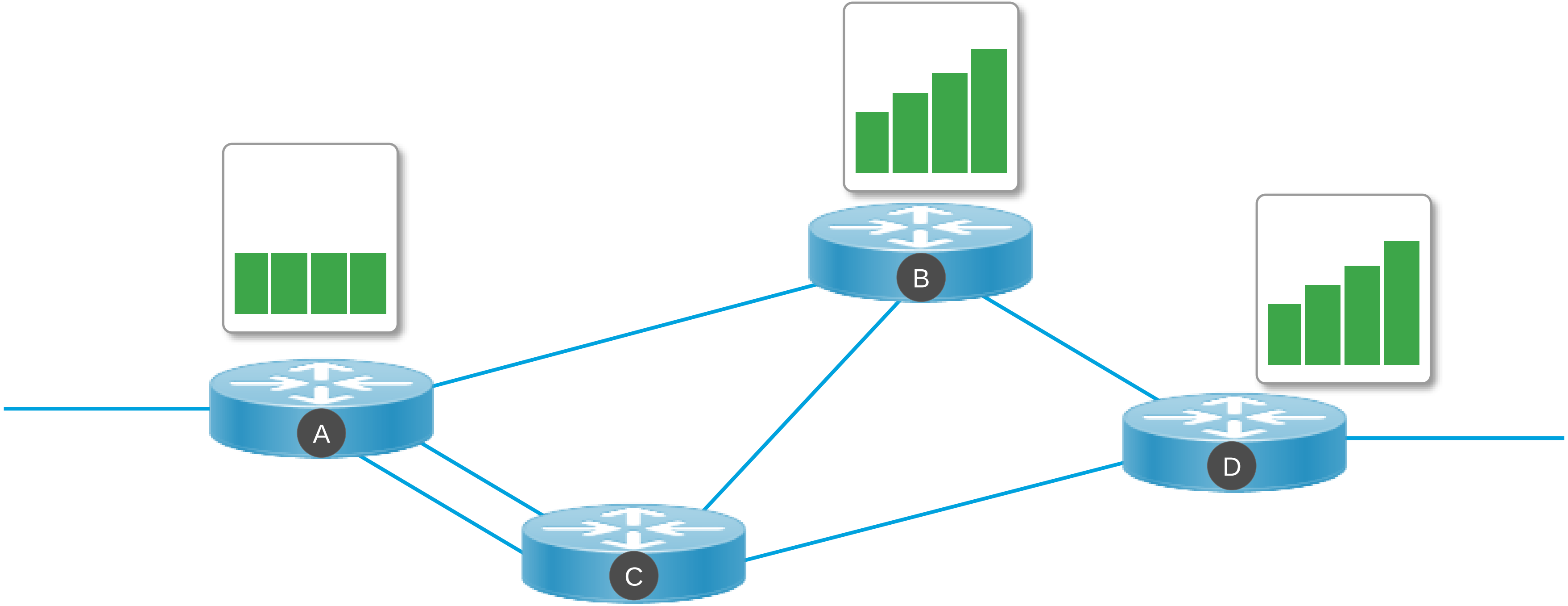


In-situ OAM
(per packet telemetry)

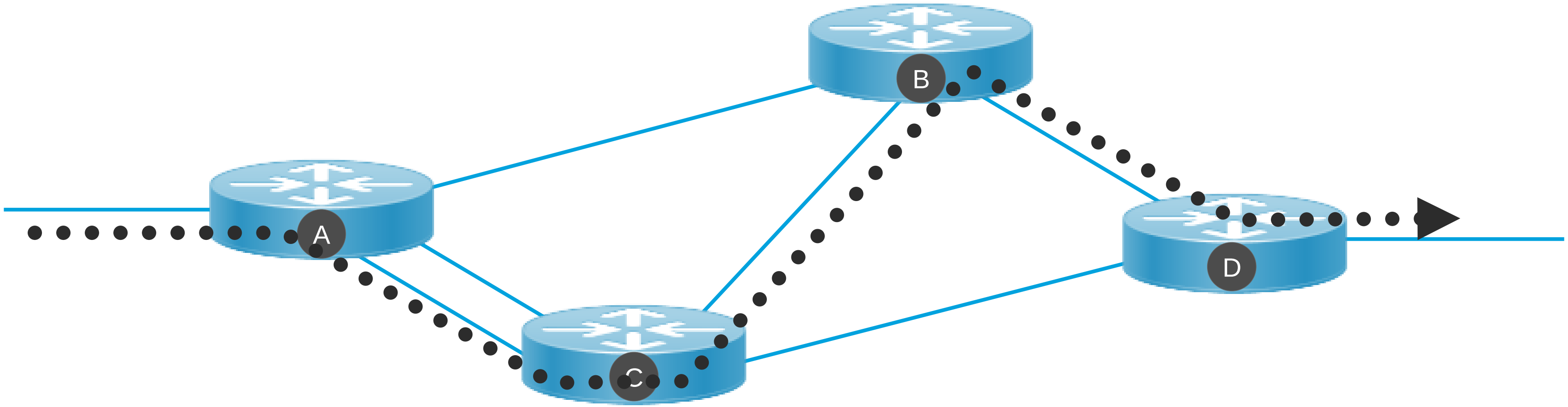
Analyze when a packet enters and exists the network…



…at what rate packets arrive at a particular hop…



… what path a packet takes …



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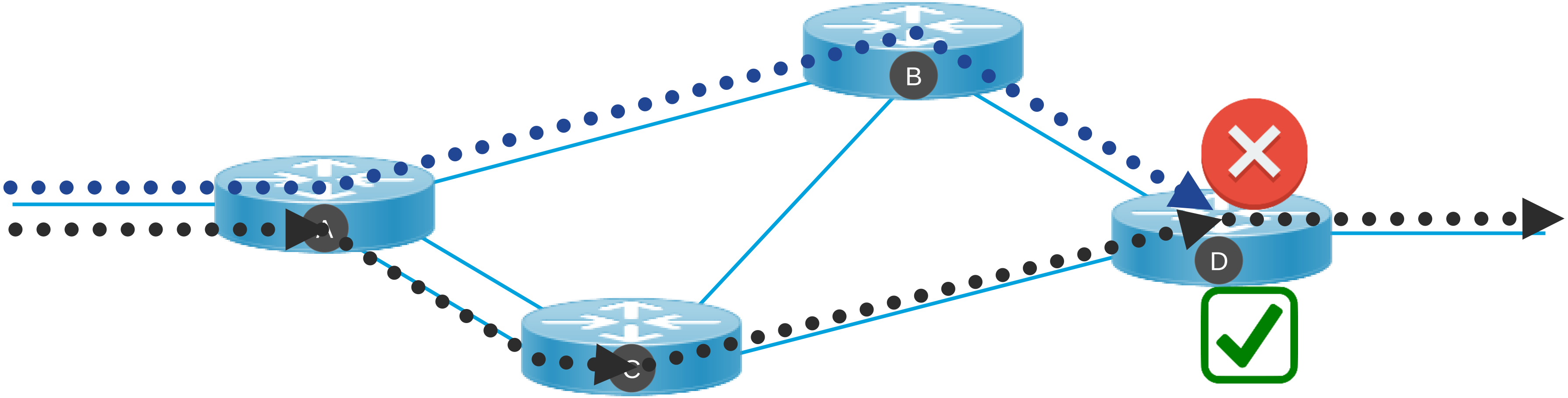
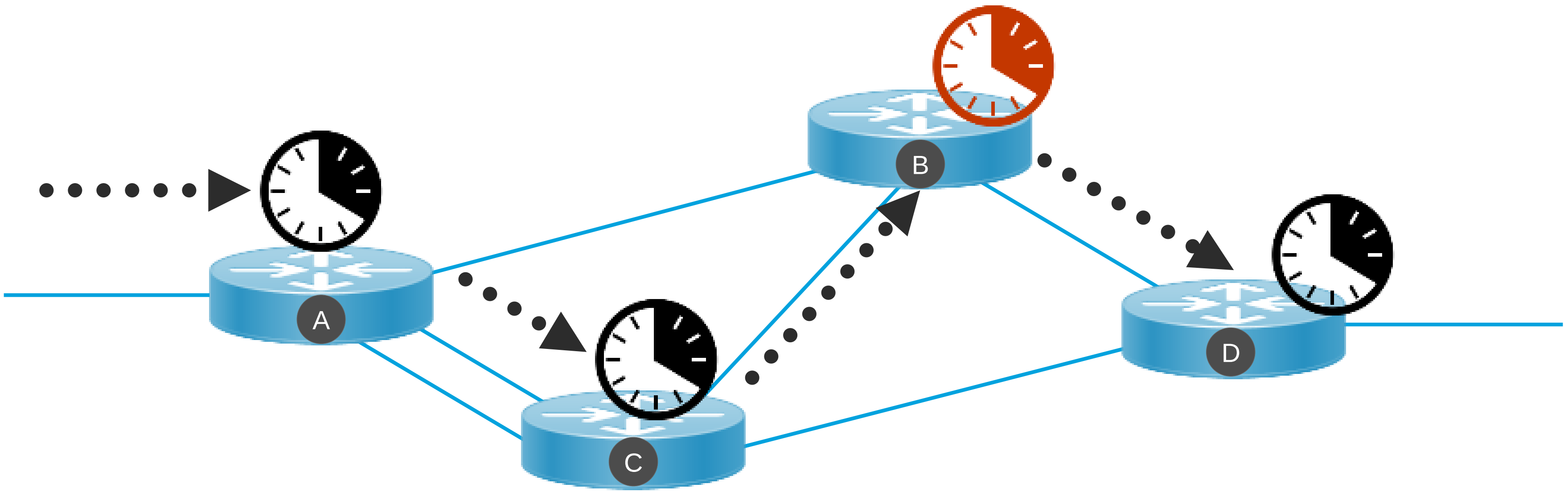
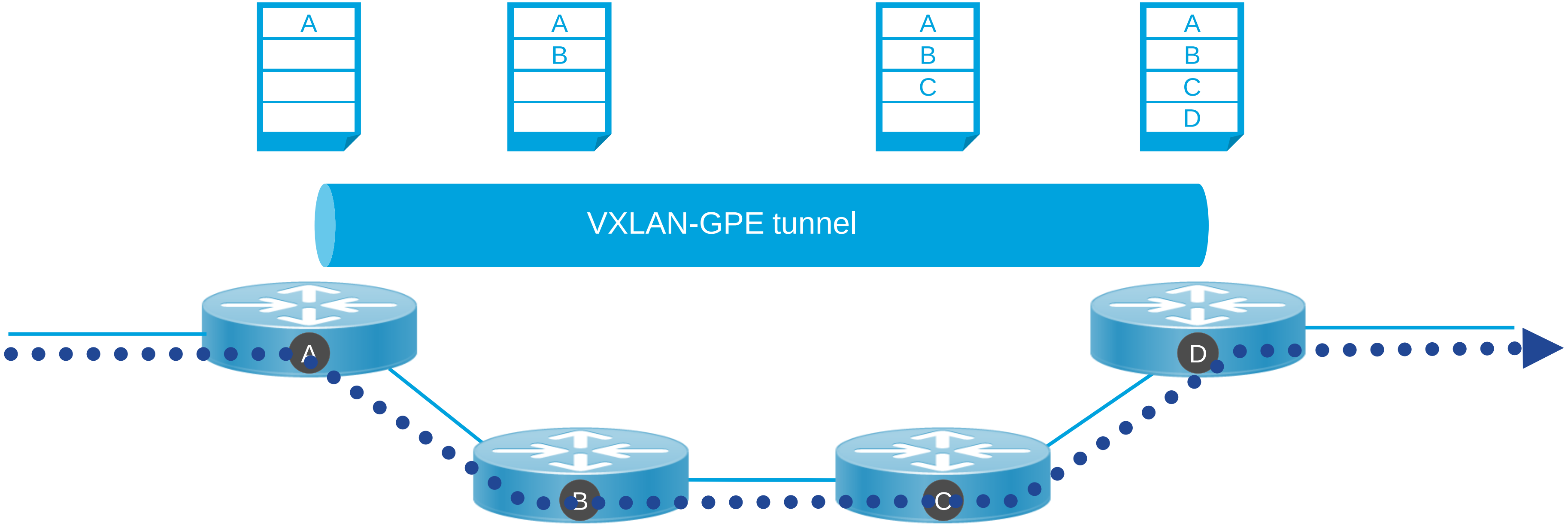
… whether the packet takes the path it is supposed to take (because of TE, NSH, SR)…

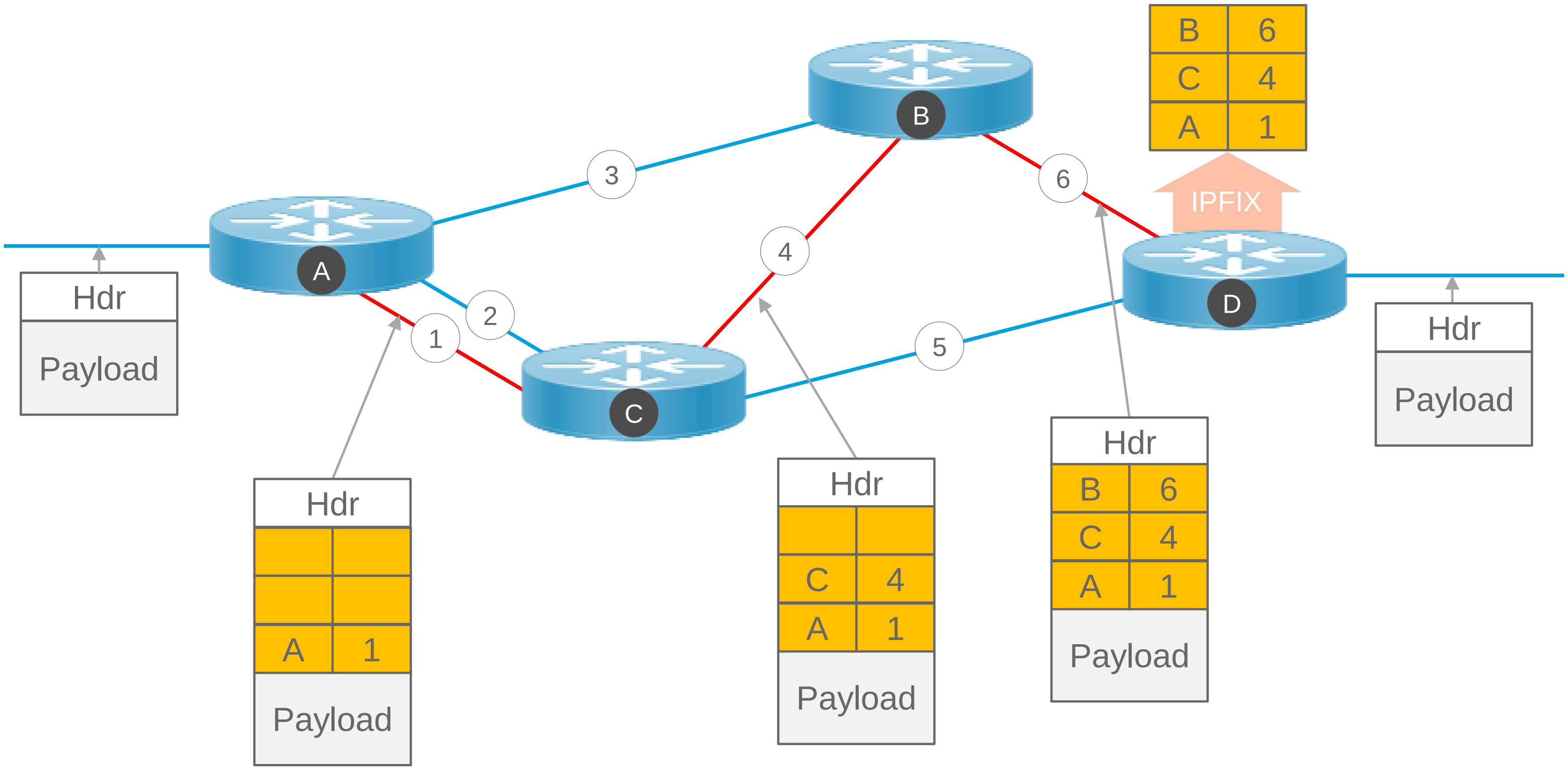


…how long the packet spends at each hop, and which node is experiencing congestion…



… or which underlay nodes a VXLAN-GPE tunnel traverses.





B	6
C	4
A	1

A	1

C	4
A	1

B	6
C	4
A	1

IOAM Specification

IOAM data fields are defined in a protocol independent way

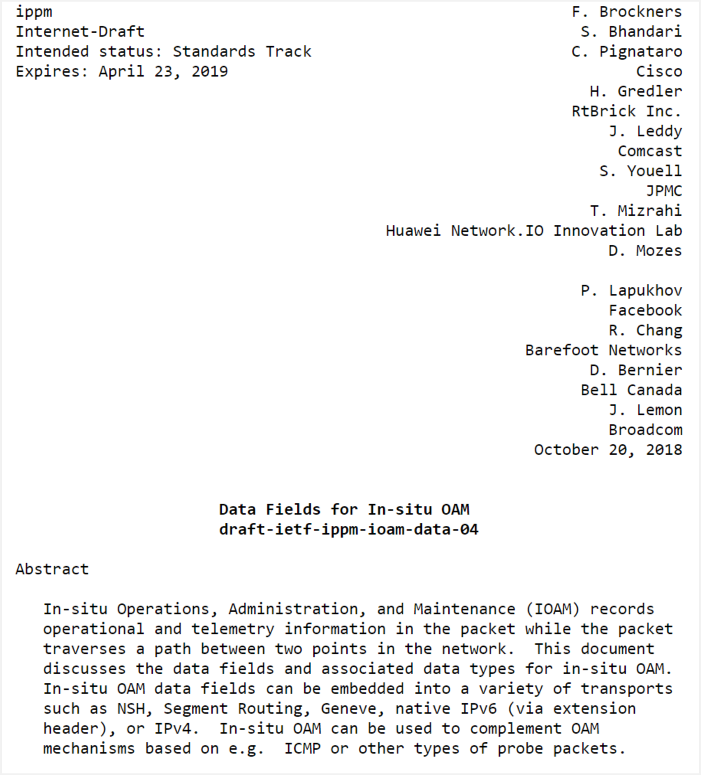
IOAM data fields can be carried in various protocols

IPv6
VXLAN-GPE
NSH
Segment-Routing v6
GRE
…

IOAM is standardized by the IETF...

Latest IETF Drafts

- In-situ OAM Authors: Cisco, Comcast, Facebook, JPMC, Bell Canada, Mellanox, Marvell, Barefoot, Huawei, rtBrick
  - In-situ OAM data types: draft-ietf-ippm-ioam-data-04
  - Encapsulations:
    - VXLAN-GPE: draft-brockners-ippm-ioam-vxlan-gpe-00
    - NSH: draft-ietf-sfc-ioam-nsh-00
    - Geneve: draft-brockners-ippm-ioam-geneve-01
    - Ethertype (GRE, Geneve, ...): draft-weis-ippm-ioam-eth-00
    - SRv6: draft-ali-spring-ioam-srv6-00
    - SR-MPLS: draft-gandhi-spring-ioam-sr-mpls-00
  - In-situ OAM transport:
    Proof-of-transit: draft-ietf-sfc-proof-of-transit-01
  - Raw export of IOAM data:
    draft-spiegel-ippm-ioam-rawexport-01
- In-situ OAM manageability
  - draft-zhou-ippm-ioam-yang-01



```
ippm                                                         F. Brockners
Internet-Draft                                                S. Bhandari
Intended status: Standards Track                             C. Pignataro
Expires: April 23, 2019                                             Cisco
                                                               H. Gredler
                                                             RtBrick Inc.
                                                                 J. Leddy
                                                                  Comcast
                                                                S. Youell
                                                                     JPMC
                                                                T. Mizrahi
                                          Huawei Network.IO Innovation Lab
                                                                  D. Mozes

                                                               P. Lapukhov
                                                                  Facebook
                                                                  R. Chang
                                                         Barefoot Networks
                                                                D. Bernier
                                                               Bell Canada
                                                                  J. Lemon
                                                                  Broadcom
                                                          October 20, 2018


                        Data Fields for In-situ OAM
                        draft-ietf-ippm-ioam-data-04

Abstract

   In-situ Operations, Administration, and Maintenance (IOAM) records
   operational and telemetry information in the packet while the packet
   traverses a path between two points in the network.  This document
   discusses the data fields and associated data types for in-situ OAM.
   In-situ OAM data fields can be embedded into a variety of transports
   such as NSH, Segment Routing, Geneve, native IPv6 (via extension
   header), or IPv4.  In-situ OAM can be used to complement OAM
   mechanisms based on e.g.  ICMP or other types of probe packets.
```

In-situ OAM Data Fields Overview

- Per node scope
  - Hop-by-Hop information processing
    - Hop Limit
    - Node_ID (long/short)
    - Ingress Interface ID (long/short)
    - Egress Interface ID (long/short)
    - Timestamp
      - Wall clock (seconds, nanoseconds)
      - Transit delay
    - Queue length
    - Opaque data
    - Namespace specific data (long/short)

Two transport options:

- Pre-allocated array (SW friendly)
- Incrementally grown array (HW friendly)

- Set of nodes scope
  - Hop-by-Hop information processing
    - Service Chain Validation (Random, Cumulative)

- Edge to Edge scope
  - Edge-to-Edge information processing
    - Sequence Number

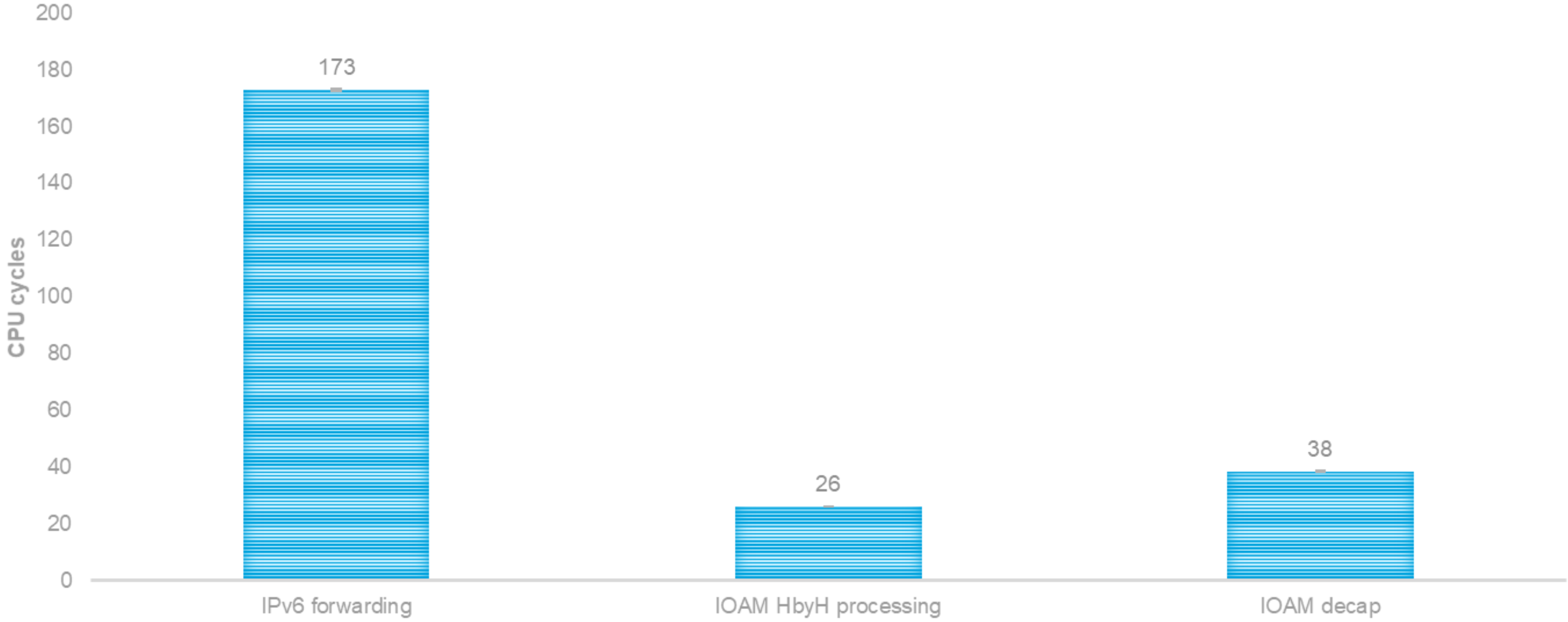
Note:
IOAM data fields use a dedicated namespace.
IOAM data fields are layer independent and can be filled by any node capable of filling-in IOAM data fields.

... and running IOAM code exists.

IOAM Implementation

- Dataplane Implementation:
  - Open-Source:
    - FD.io/VPP (see fd.io)
    - Linux Kernel (PoC for 4.12)
  - IOS (ISR-G2) – PI31 (CCO: End of July/16)
- Silicon vendors supporting IOAM
  - Cisco, Broadcom (Trident T3), Netronome (Agilo), Barefoot (Tofino), Mellanox
- Controller Implementation:
  - OpenDaylight (Carbon release)

VPP Implementation: CPU cycles per feature group



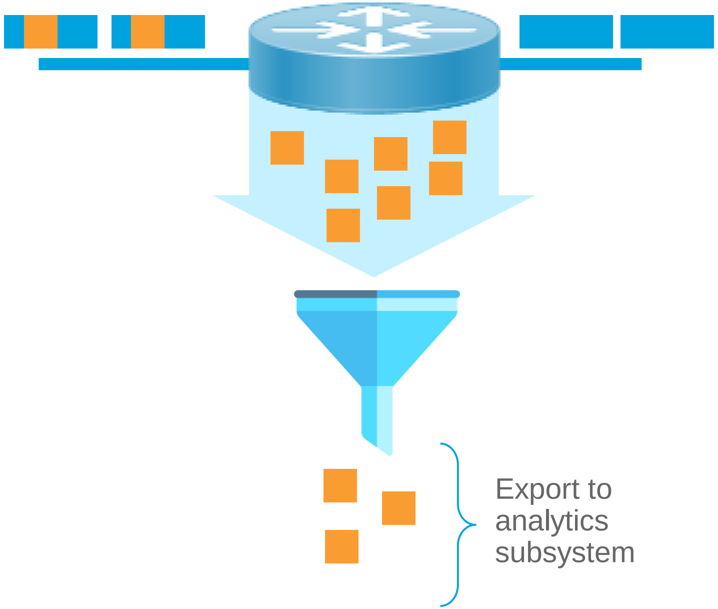
One more thing...

IOAM can create a lot of data for you...

... How to deal with all this data?

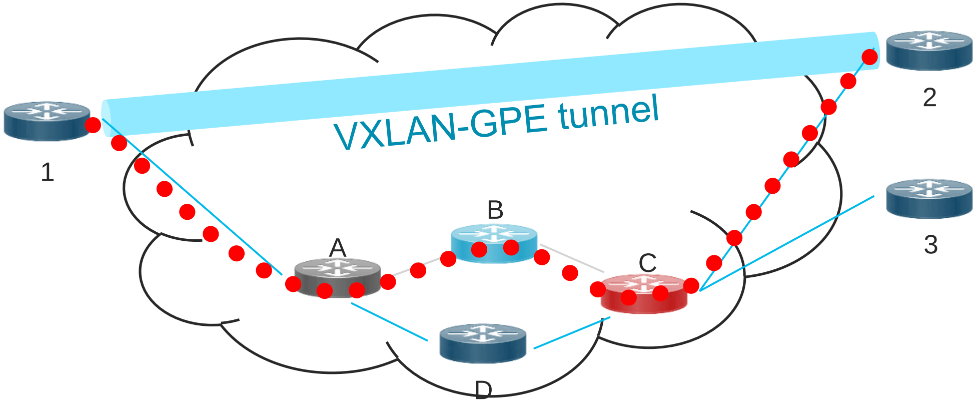
IOAM data filtering

- If added to every packet, IOAM can create a lot of additional information
  - Overall amount of information can be too much to export from the decapsulating node
- Triggered IOAM
- Selected Flows for IOAM
- Sampling of IOAM data
- Pre-Processing of IOAM data on the switch/router

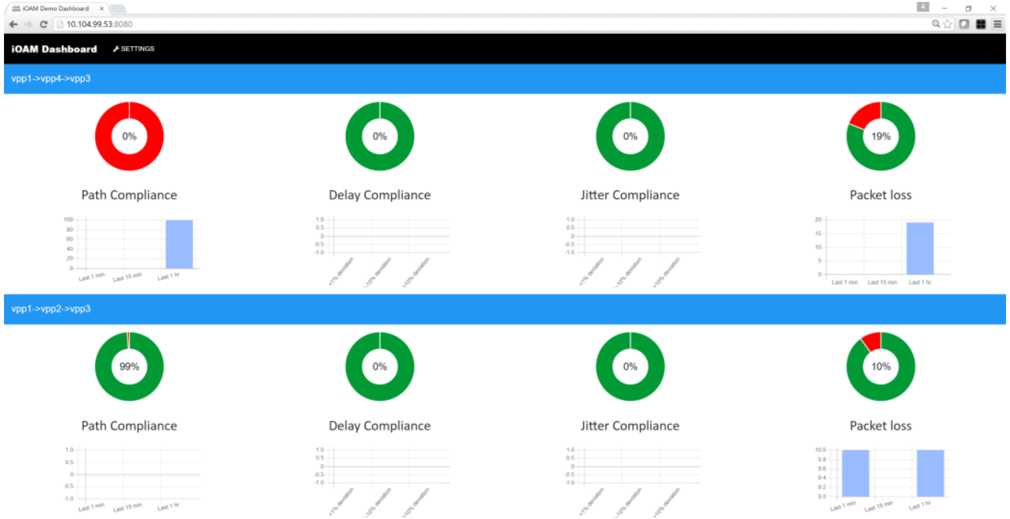


A few example use-cases

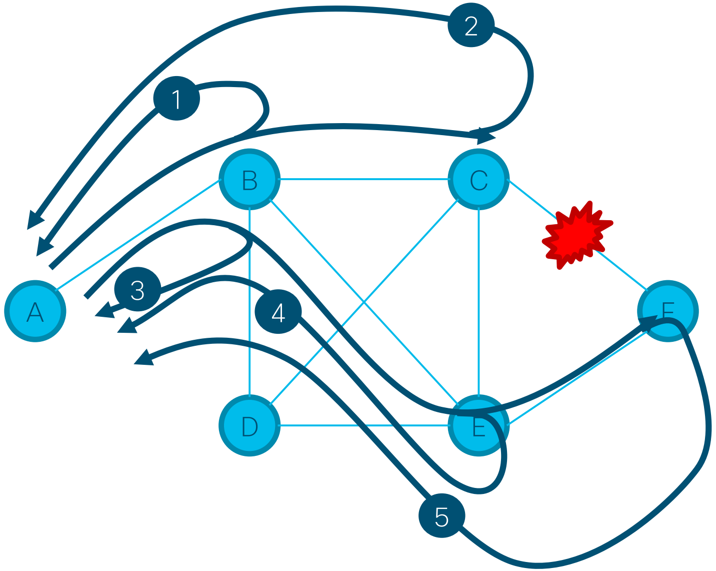
Overlay-Underlay Correlation for VXLAN-GPE in the smart fabric



Ongoing customer centric reporting of network SLA/Health

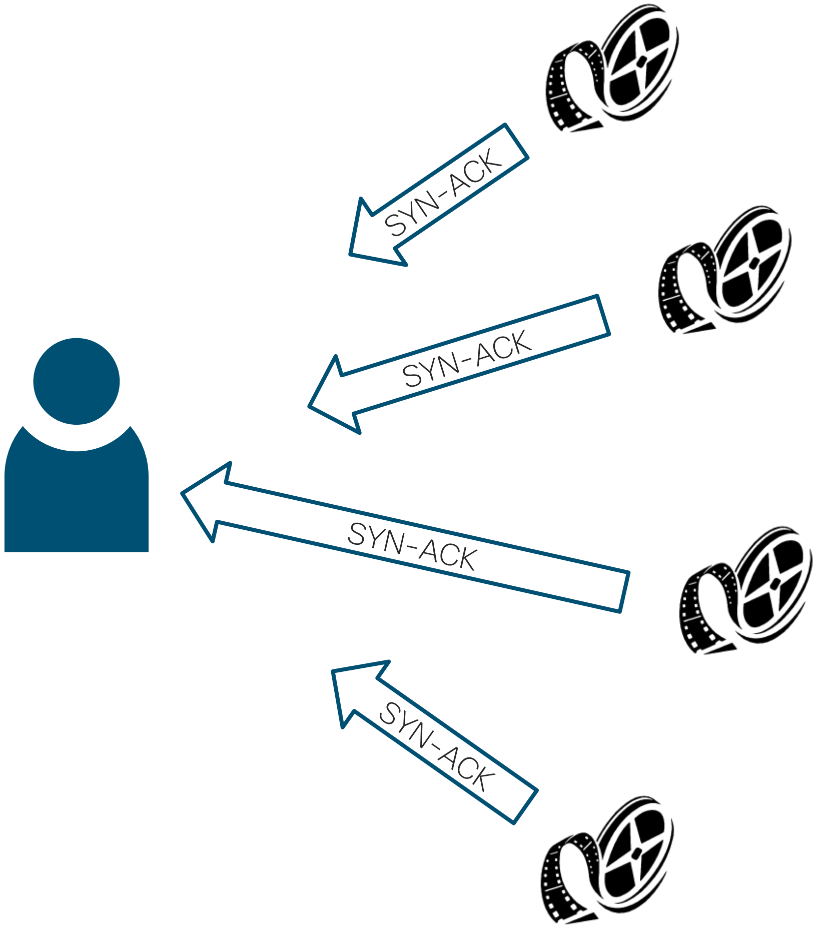


Rapid Failure Isolation: Probing with IOAM loopback



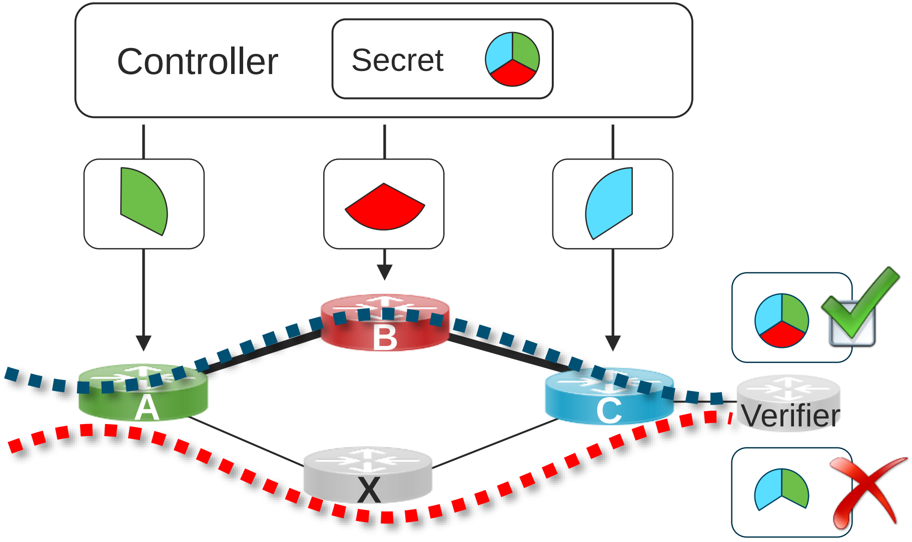
Micro-Service Selection: M-Anycast

COMCAST



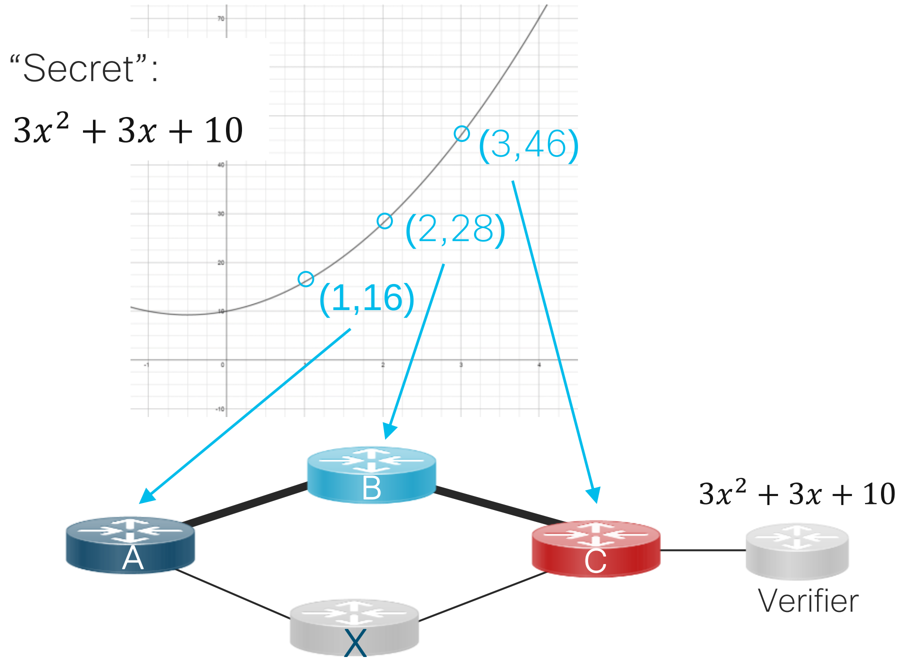
Proof of Transit (POT)

JPMorgan Chase & Co.



POT: Leverage Shamir's Secret Sharing "A polynomial as secret"

- Each service is given a point on the curve
- When the packet travels through each service it collects these points
- A verifier can reconstruct the curve using the collected points
- Operations done over a finite field (mod prime) to protect against differential analysis



IOAM: Try a simple example yourself?

https://github.com/CiscoDevNet/iOAM/blob/master/scripts/vpp_sandbox/example/simple-ip6/Readme.md

More Information:

https://xrdocs.io/telemetry/

https://github.com/CiscoDevNet/iOAM

http://pnda.io/

Thank You