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Streaming telemetry: The value of "realtime" analytics for the network

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@bigevilbeard

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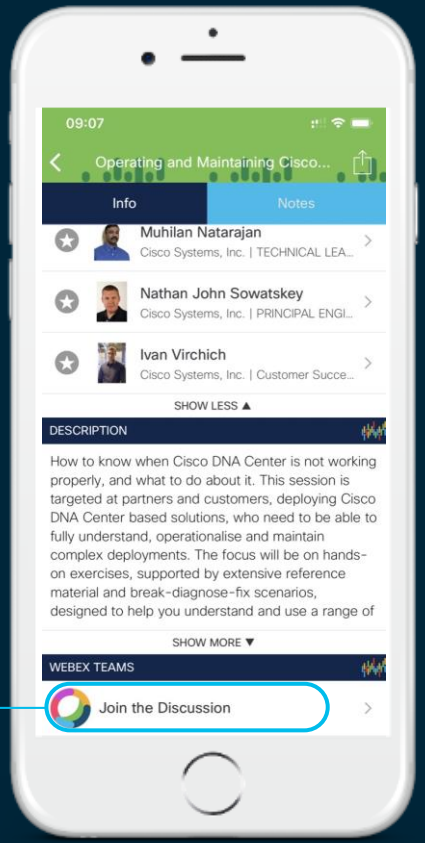


What are we going to talk about?

- ✓ The current state of play, SNMP?
- ✓ Streaming Telemetry gainzzz!
- ✓ Where do gRPC and NETCONF fit in
- ✓ Let's explore open source platforms ELK and Grafana
- ✓ Telemetry Standard Mechanisms
- ✓ Last stop, Streaming Telemetry Enabling

Current Network Visibility

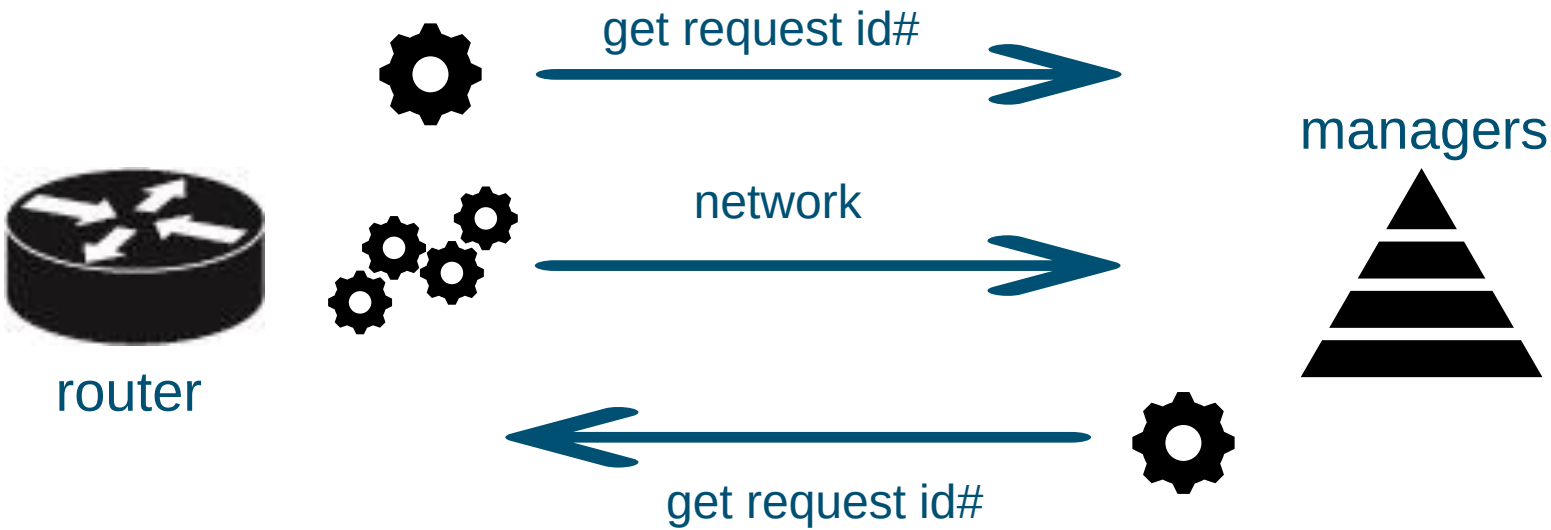
SNMP ⟷ Too Slow

Syslog → Incomplete

CLI ← Network Specific

Hard to Operationalize

SNMP Polling, all hand to pumps



Side effects of pushing SNMP hard

Streaming Telemetry gainzzz!

Telemetry Fundamentals

Definition

te·lem·e·try
təˈlemətrē/
noun
noun: **telemetry**

*"**Telemetry** is an automated communications process by which measurements and other data are collected at remote or inaccessible points and transmitted to receiving equipment for monitoring"*

The word is derived from Greek roots: tele = remote, and metron = measure.

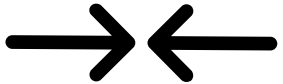
Fundamentals of Streaming Telemetry

Push not Pull

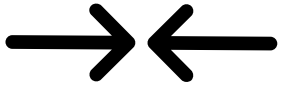
Analytics-Ready Data

Data-Model Driven

performance



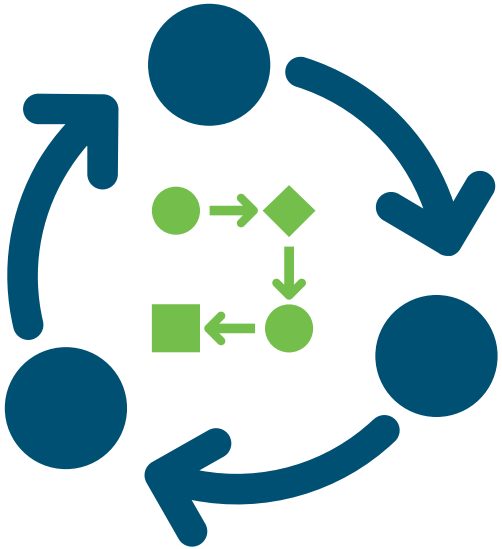
tool-chains



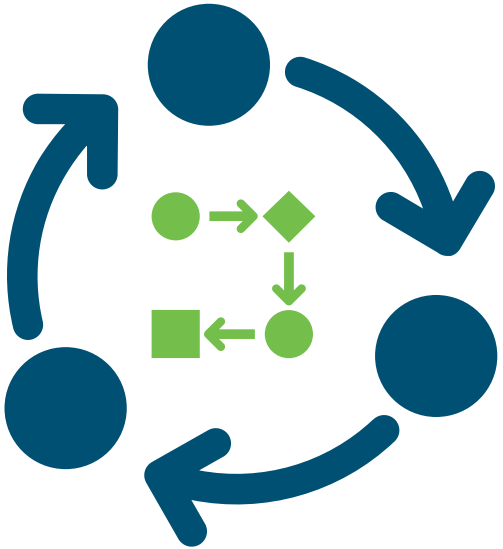
automation

- ✓ Telemetry data is described using YANG
- ✓ Encoded in JSON, XML or using GPB
- ✓ Streamed over TCP, UDP or gRCP

Data Models – What, when and where!

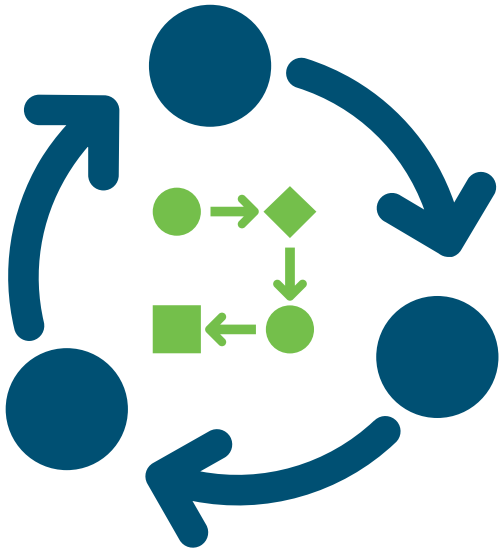


OpenConfig



Native

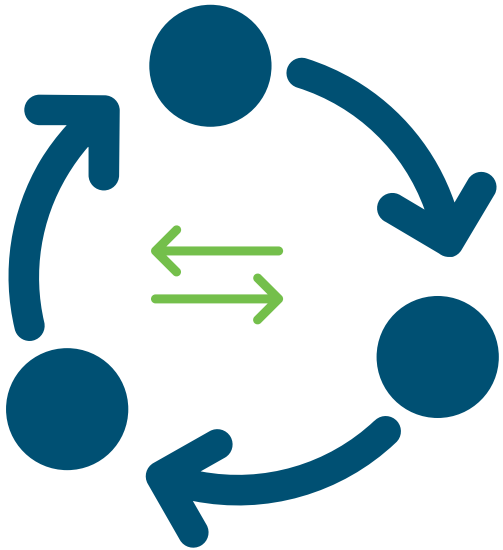
Subscribe to your data!



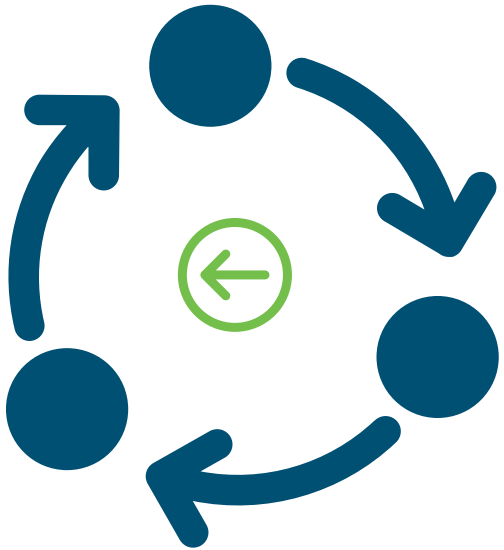
Stream your data at high frequency

- ✓ Control Plane
- ✓ Data Plane
- ✓ System Plane

Telemetry Streaming Methods



Cadence-driven

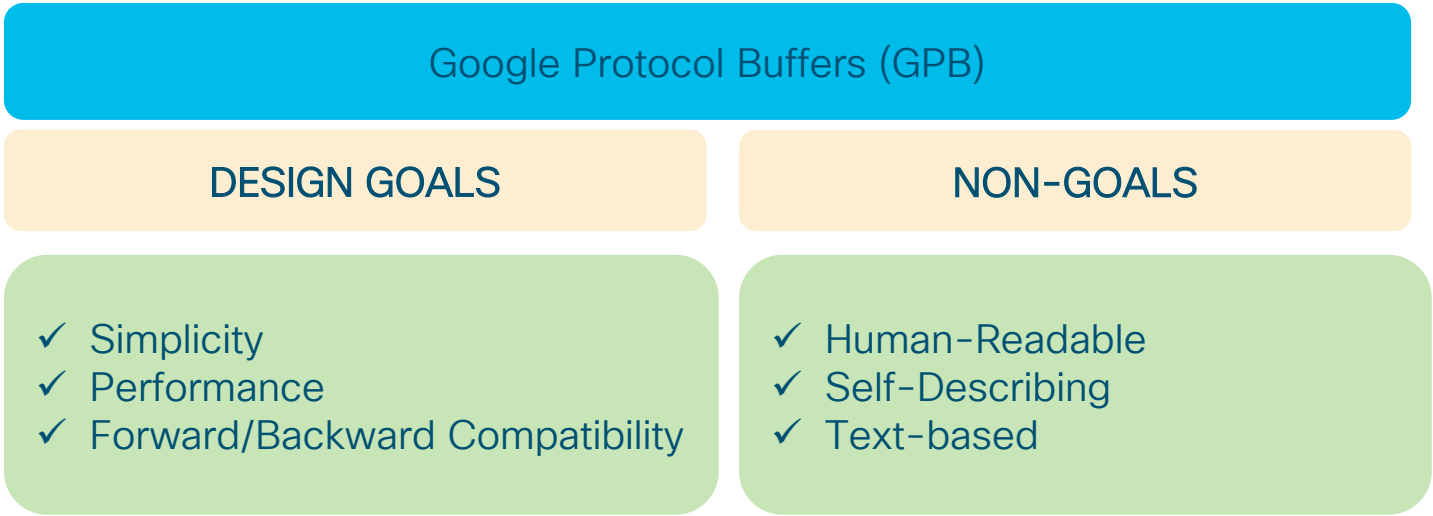


Event-driven

Encoding

Data on the wire

GPB Encoding



"Protocol buffers are Google's language-neutral, platform-neutral, extensible mechanism for serializing structured data – think XML, but smaller, faster, and simpler"

Netconf Encoding

Design Goals

- ✓ Distinction between configuration and state data
- ✓ Multiple configuration data stores (candidate, running, startup)
- ✓ Configuration change transactions

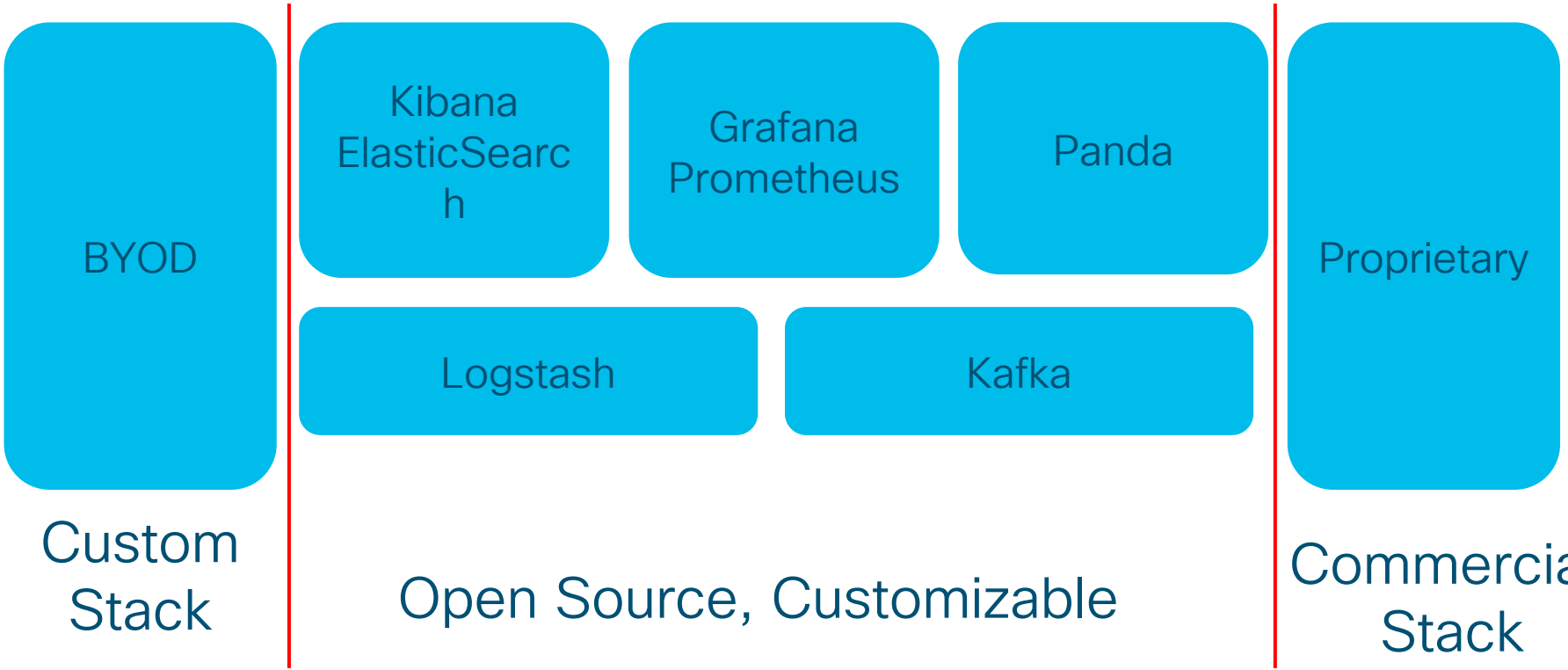
- ✓ Configuration testing and validation support
- ✓ Selective data retrieval with filtering
- ✓ Streaming and playback of event notifications
- ✓ Extensible procedure call mechanism

“Netconf, is an XML based protocol and was specifically designed for machine to machine communication”

Open Source Tools

*Instead of polling data from the network devices, the '**telemetry collector**' subscribes the '**streaming**' data pushed from the data source in network*

Different Collection Models



The Elastic Stack: A Popular OpenSource Stack

- ✓ Kibana is the ‘K’ in the ELK Stack, very popular open source log analysis platform, and provides users with a tool for exploring, visualizing, and building dashboards on top of the log data stored in Elasticsearch clusters.
- ✓ Using various methods, users can search the data indexed in Elasticsearch for specific events or strings within their data for root cause analysis and diagnostics.
- ✓ Commercial/Cloud via elastic.co
- ✓ https://github.com/elastic

Grafana

- ✓ Grafana is an open source visualization tool that can be used on top of a variety of different data stores but is most commonly used together with Graphite, InfluxDB, and also Elasticsearch and Logz.io.
- ✓ Enterprise and Cloud versions
- ✓ Commonly used together with Graphite, InfluxDB, and also Elasticsearch and Logz.io
- ✓ Data stored as documents
- ✓ Full text search and log management
- ✓ https://github.com/grafana/grafana

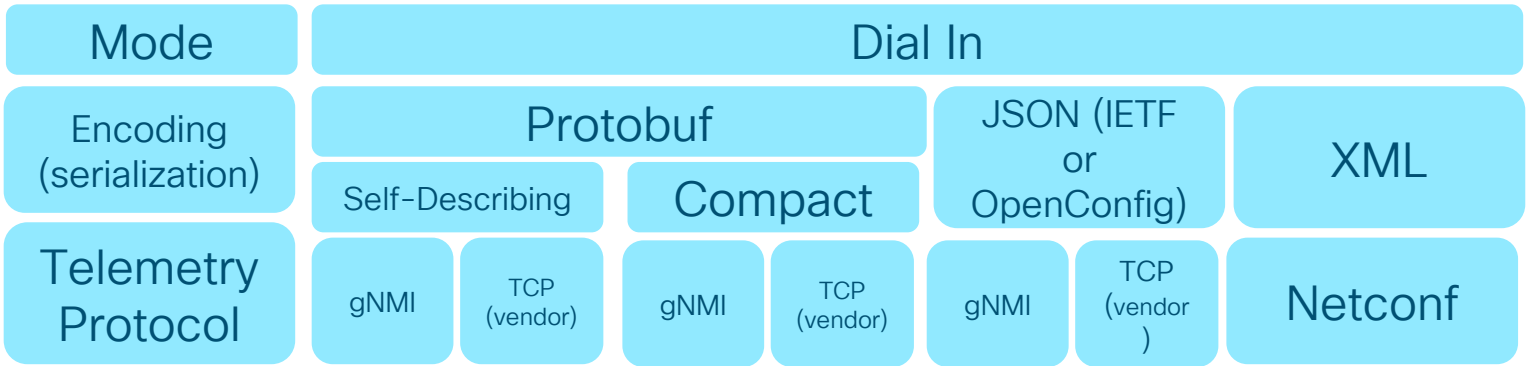
Telemetry Standard Mechanisms

The Background (tl;dr)

- ✓ Transport: The router can deliver telemetry data either across using TCP or gRPC over HTTP/2
- ✓ Session Initiation: There are two options for initiating a telemetry session. The router can “dial-out” to the collector or the collector can “dial-in” to the router
- ✓ Encoding: The router can deliver telemetry data in two different flavors of Google Protocol Buffers: Compact and Self-Describing GPB. Compact GPB is the most efficient encoding but requires a unique .proto for each YANG model that is streamed

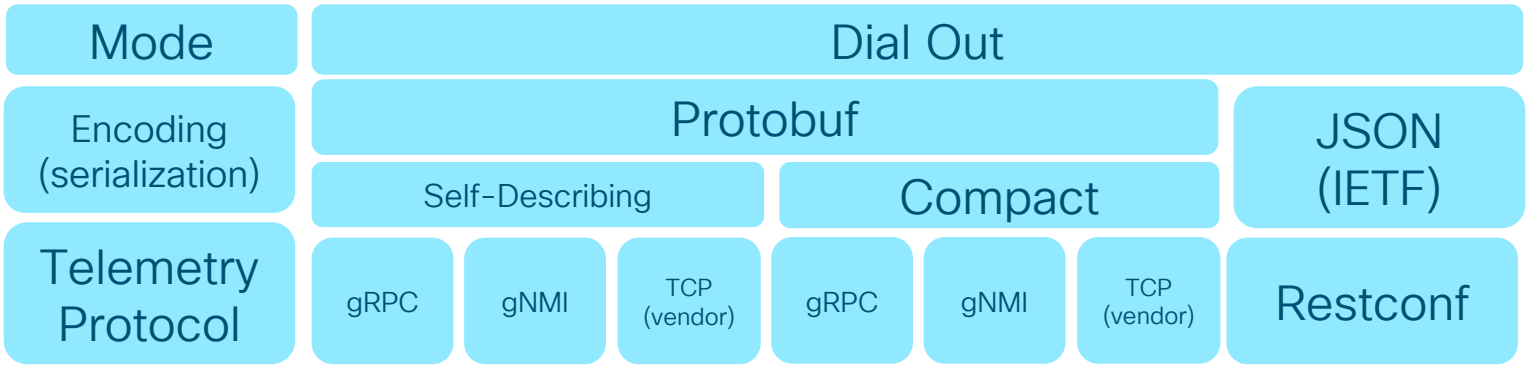
Dial-In Telemetry

With the gRPC Dial-In method, the collector initiates a gRPC session to the router and specifies a subscription. The router sends whatever data is specified by the sensor-group in the subscription requested by the collector.



Dial-Out Telemetry

With the TCP Dial-Out method, the router initiates a TCP session to the collector and sends whatever data is specified by the sensor-group in the subscription.



Last stop, Streaming Telemetry Enabling

Configuring Model-Driven Telemetry (MDT)

Before we begin...

1.3.6.1.4.1.9.2.1.58.0

Cisco-IOS-XR-infra-statsd-oper:infra statistics/interfaces/interface/latest/generic-counters

TCP Dial-Out Router Configuration

```
telemetry model-driven
  destination-group DGroup1
     address family ipv4 192.168.1.2 port 5432
     encoding self-describing-gpb
     protocol tcp
  !
!
sensor-group SGroup1
sensor-path Cisco-IOS-XR-infra-statsd-oper:infra
statistics/interfaces/interface/latest/generic-counters
!
  subscription Sub1
     sensor-group-id SGroup1 sample-interval 30000
     destination-id DGroup1
```

https://www.cisco.com/c/en/us/td/docs/iosxr/asr9000/telemetry/b-telemetry-cg-asr9000-61x/b-telemetry-cg-asr9000-61x_chapter_011.html

gRPC Dial-Out Router Configuration

```
telemetry model-driven
  destination-group DGroup1
     address family ipv4 192.168.2.1 port 57500
     encoding self-describing-gpb
     protocol grpc
 !
!
sensor-group SGroup2
sensor-path Cisco-IOS-XR-nto-misc-oper:memory-summary/nodes/node/summary
!
  subscription Sub2
     sensor-group-id SGroup2 sample-interval 30000
     destination-id DGroup2
```

https://www.cisco.com/c/en/us/td/docs/iosxr/asr9000/telemetry/b-telemetry-cg-asr9000-61x/b-telemetry-cg-asr9000-61x_chapter_011.html

gRPC Dial-In Router Configuration

```
grpc
  port 57500
 !
 telemetry model-driven
 sensor-group SGroup3
  sensor-path openconfig-interfaces:interfaces/interface
 !
 subscription Sub3
    sensor-group-id SGroup3 sample-interval 30000
```

https://www.cisco.com/c/en/us/td/docs/iosxr/asr9000/telemetry/b-telemetry-cg-asr9000-61x/b-telemetry-cg-asr9000-61x_chapter_011.html

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Learn more today....

IOS-XR Streaming Telemetry

SNMP is dead! It is time to move away from slow, polling techniques employed by SNMP for monitoring that are unable to meet the cadence or scale requirements associated with modern networks. Further, Automation is often misunderstood to be a one-way street of imperative (or higher-layer declarative) commands that help bring a network to an intended state. However, a core aspect of automation is the ability to monitor real-time state of a system during and post the automation process to accomplish a feedback loop that helps make your automation framework more robust and accurate across varied circumstances. In this module, we learn how Streaming Telemetry capabilities in IOS-XR are all set to change network monitoring for the better – allowing tools to subscribe to structured data, contractually obliged to the YANG models representing operational state of the IOS-XR internal database (SYSDB) at a cadence and scale that are orders of magnitude higher than SNMP.

- 4 Learning Labs
- 3 Hours

IOS XE Model Driven Telemetry

Cisco IOS XE is the Network Operating System for the Enterprise. It runs on switches like the Catalyst 9000, routers like the ASR 1000, CSR1000v, and ISR 1000 and 4000's, Catalyst 9800 Wireless LAN controllers, as well as a few other devices in IoT and Cable product lines. Since the IOS XE 16.6 release, there has been support for model-driven telemetry, which provides network operators with additional options for getting information from their network

- 4 Learning Labs
- 1 Hour 20 Minutes

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Curated software built around Cisco platforms & APIs

Sample code

Connectors

Open source

Built on GitHub

Software written by the community

Connect to expert developers

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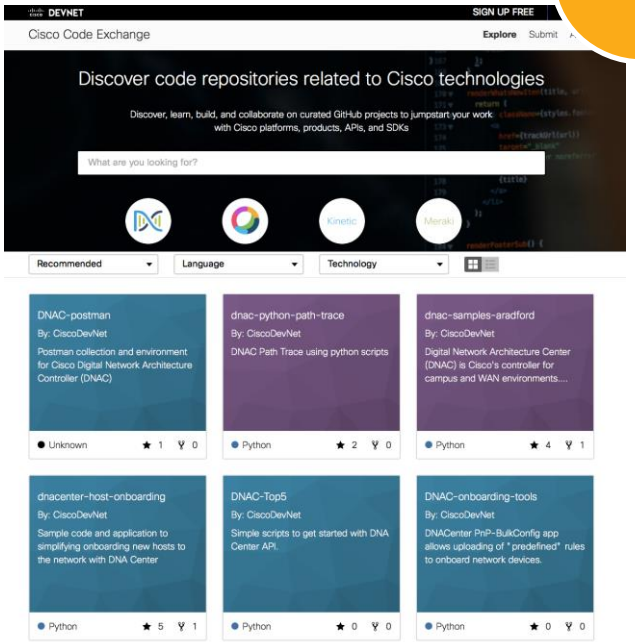

Got more questions? Stay in touch!

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