

Getting started with modern Time Series Database and Grafana for Network Engineer

Damien Garros, Managing Director, Network To Code

NANOG 77, Austin, October 2019

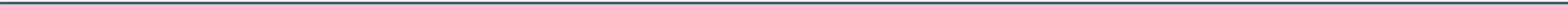
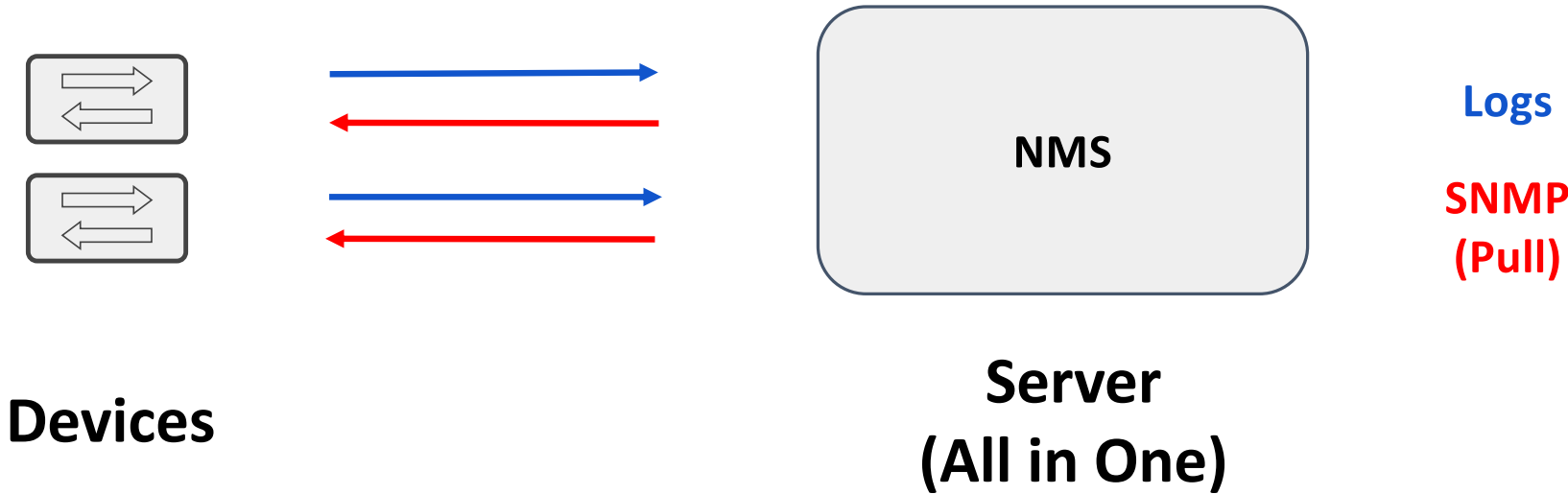
Agenda

- Timeseries Database & Network Monitoring
 - Introduction to Time Series Database
 - Introduction to the Lab
 - Demo : Getting started with Prometheus
 - Demo : Getting started with Grafana
 - Query examples
-

1

Timeseries Database & Network Monitoring?

Legacy Network Monitoring Solution



What tools are you using ?

A word cloud of network monitoring tools. The words are arranged in a roughly diamond shape. The largest word is 'RRDtools' in red. Other words include 'OpenNMS', 'Collectd', 'Observium', 'Cacti', 'MRTG', and 'Nagios'.

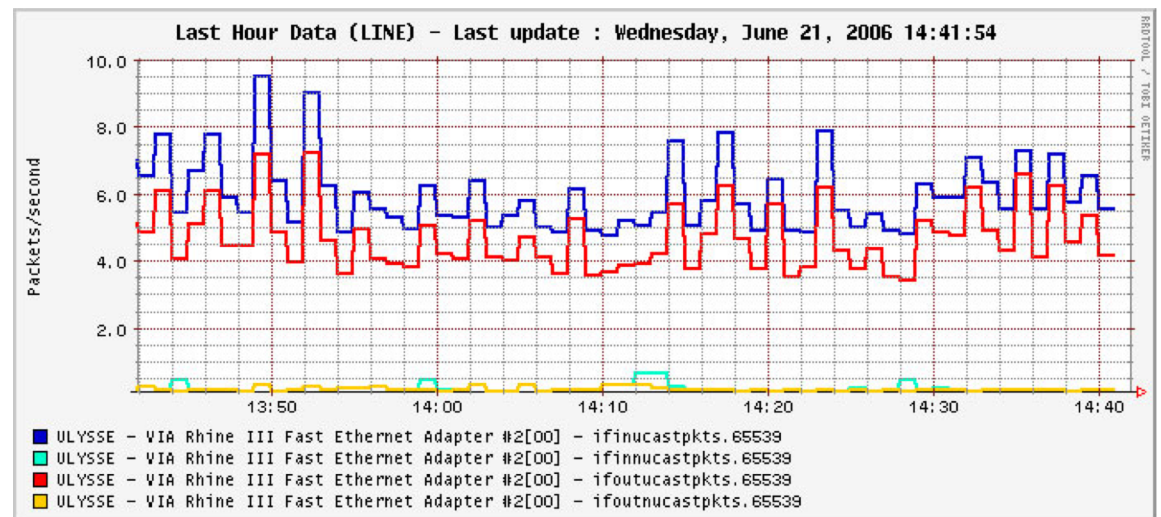
OpenNMS
Collectd
RRDtools
Observium
Cacti
MRTG
Nagios

RRD Tools

- Introduced in 1999
- Storage
- Aggregation
- Visualization

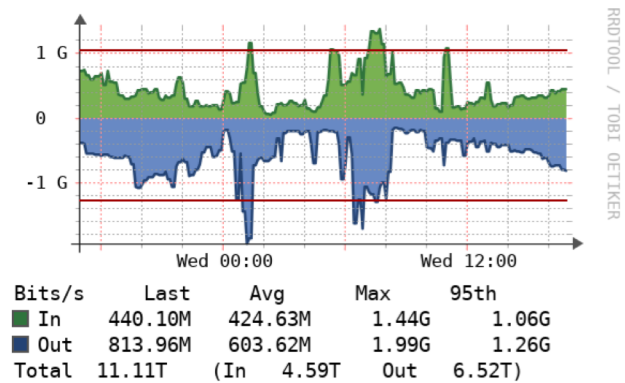
No query engine

Data retention is poor.

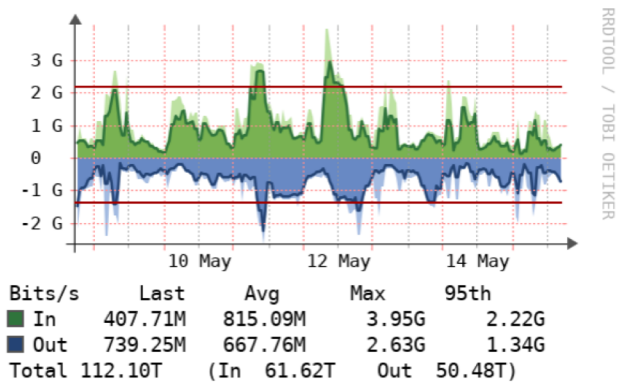


RRD Tools - Down Sampling

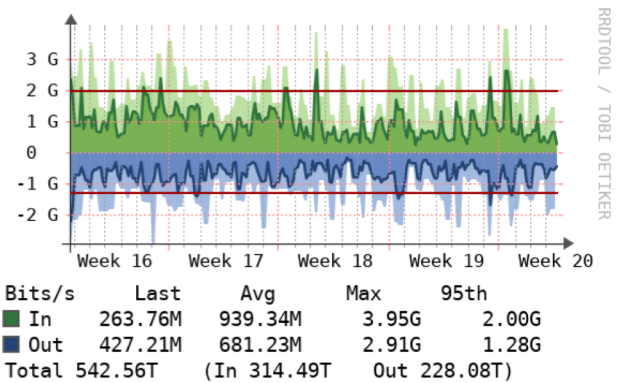
Traffic



1 Day



1 Week



1 Month

Telemetry has been a hot topic in the network industry

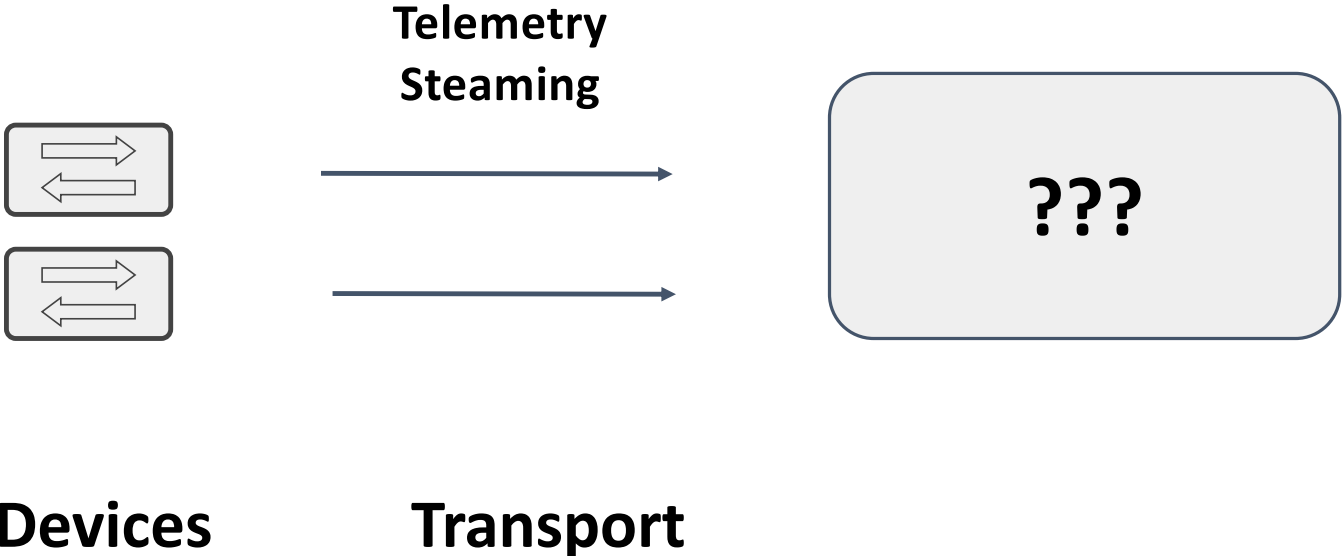
**Telemetry
Streaming**

Kill SNMP

Openconfig

gNMI

... Network Monitoring Solution



PULL

PUSH

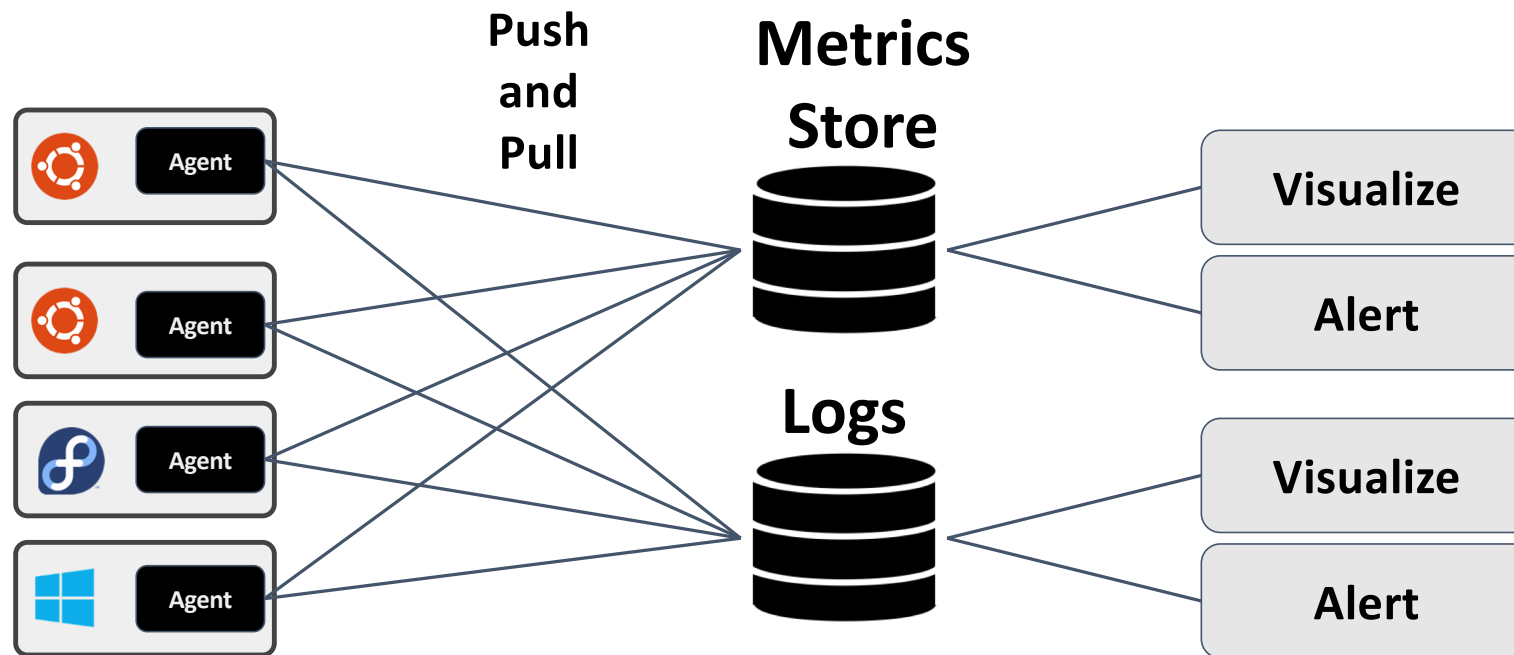


VS

SNMP

Streaming

What are other doing outside of the Network Industry ??














- Each components can scale-out independently
 - The storage and visualization are decoupled.
 - Store once, visualize as required
-

Datastore specialized by data format

Metrics .. Time Series	Logs Events	Structured Data
Numeric value evolving over time Constant Interval Counters CPU Number peers	Mostly Text data Unpredictable interval	Routing/Forwarding Table Configuration

Open source projects Monitoring / Alerting

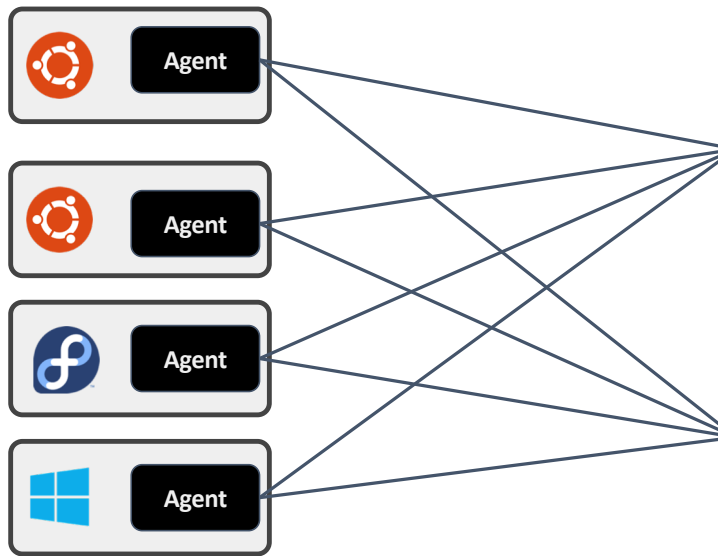
Collector Agent	Time Series Database	Alerting	Visualization
 telegraf	 influxdb	 influxdb	 Grafana
 logstash	 Prometheus	 Prometheus	 kibana
 fluentd	 TIMESCALE	Kapacitor	
	 elasticsearch	Elastalert	

Telegraf - The Swiss Army Knife



- Plugins driven agent / Extensible
 - Support out of the box
 - Over 80 Input Plugins
 - Most Databases (output)
 - Data manipulation
 - SNMP Input Plugin
 - Juniper / Cisco / OpenConfig
-

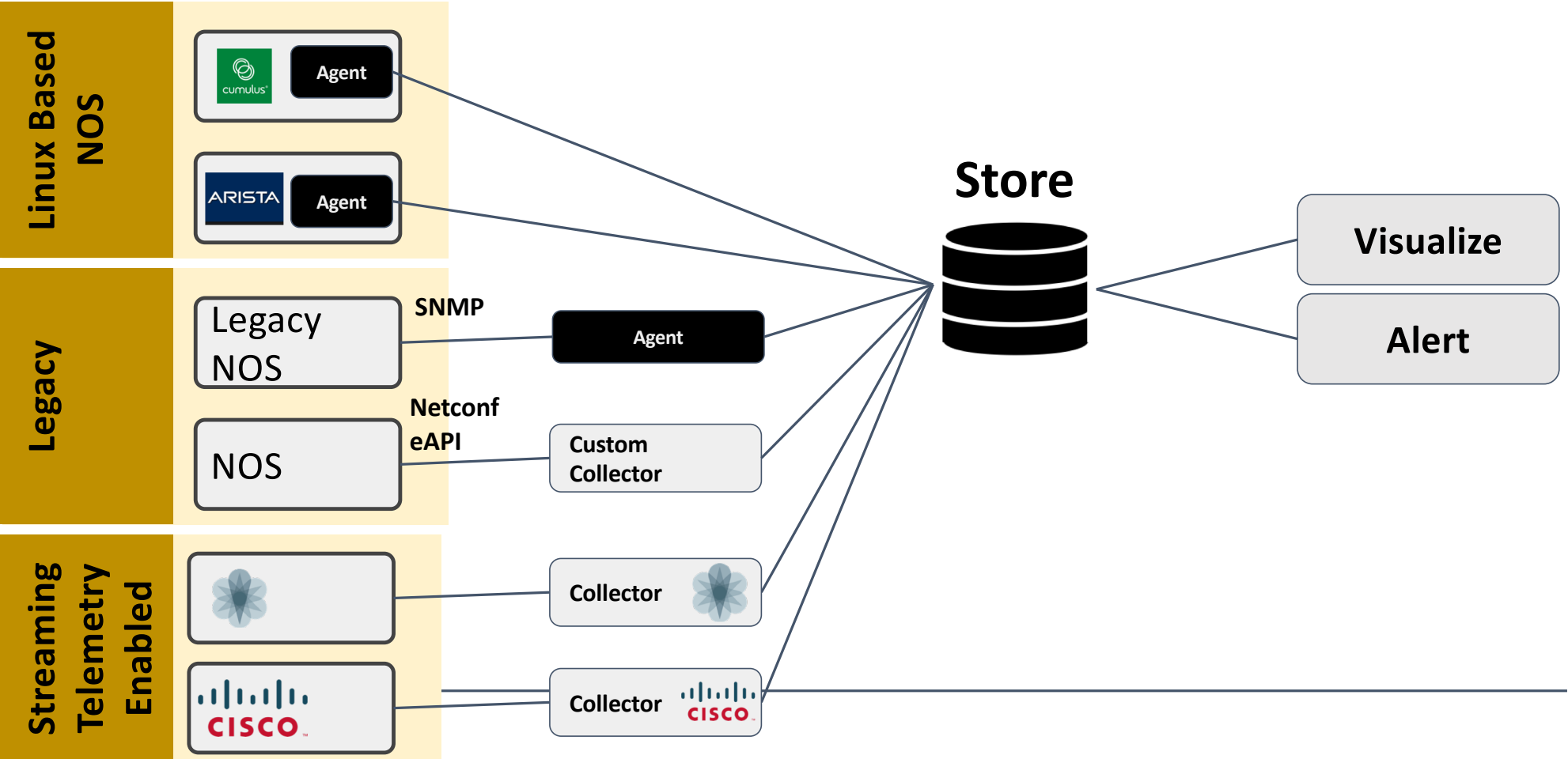
Cloud Based Solutions



The central gray box contains the logos for four cloud-based solutions:

- kentik**: Logo with an orange double arrow icon and the word "kentik" in black.
- WAVEFRONT**: Logo with a blue square icon and the word "WAVEFRONT" in black.
- SignalFx**: Logo with the word "SignalFx" in black, where the "x" is green.
- DATADOG**: Logo with a purple dog icon and the word "DATADOG" in purple.

Reuse the same components for network devices



2

Introduction to Time Series Database

Modern Time Series Database



elasticsearch

- New generation of database optimized for Time series data
 - Started around 2013, Mainstream since 2016
 - Powerful query engine
 - Decorelate storage and visualization
-

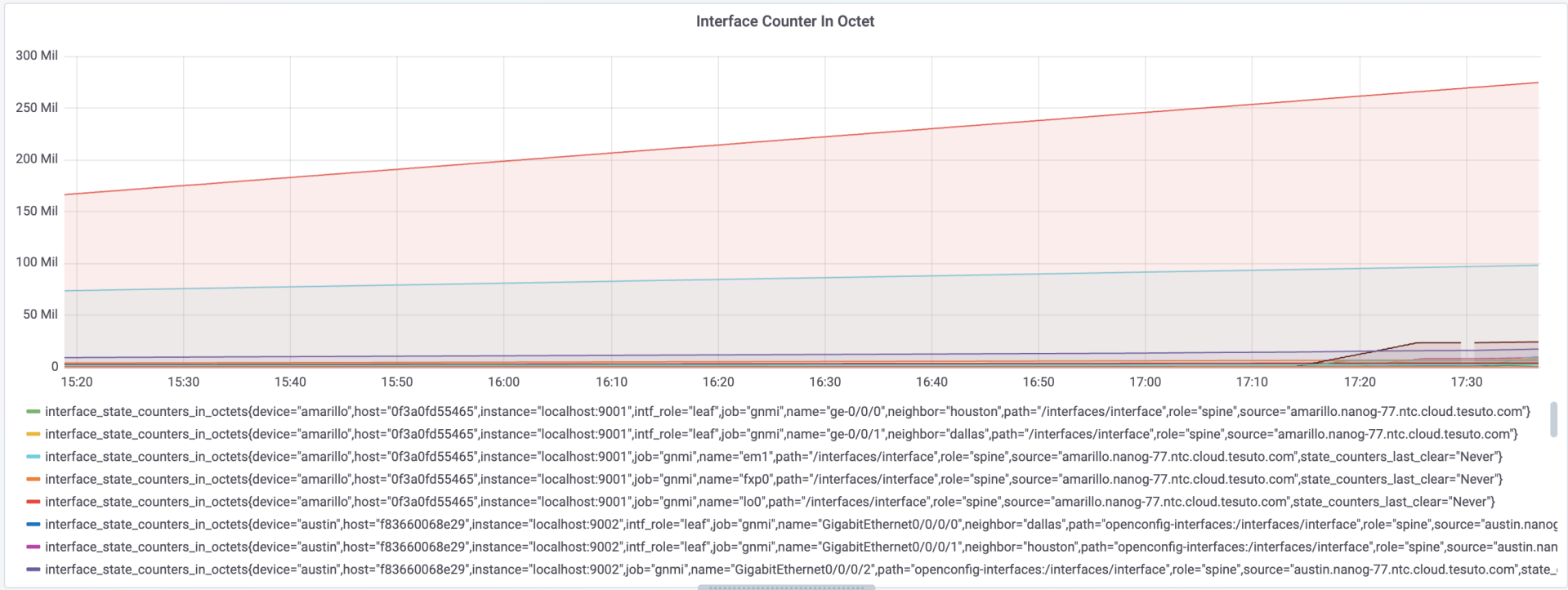
Introduction to Modern TSDB

`interface_output_bytes{device="spine1",interface="et-0/0/4"} 4569765412`



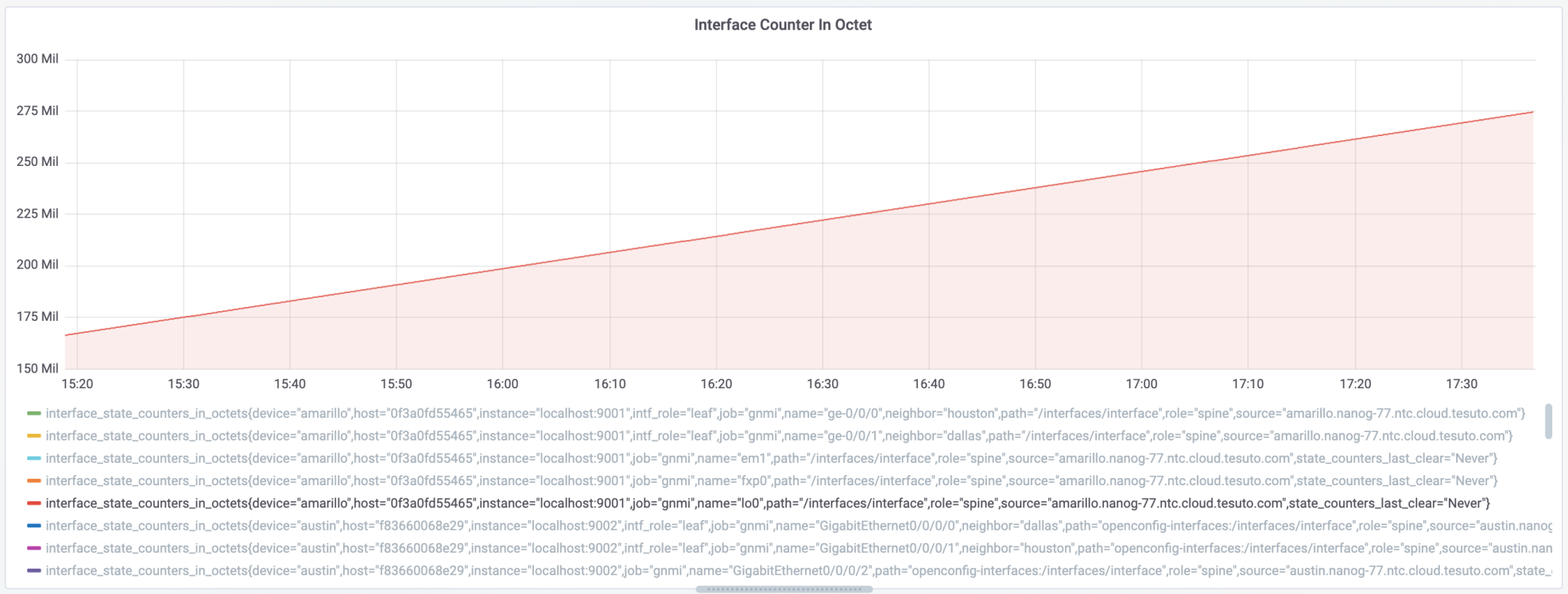
Introduction to Modern TSDB

interface_state_counters_in_octets



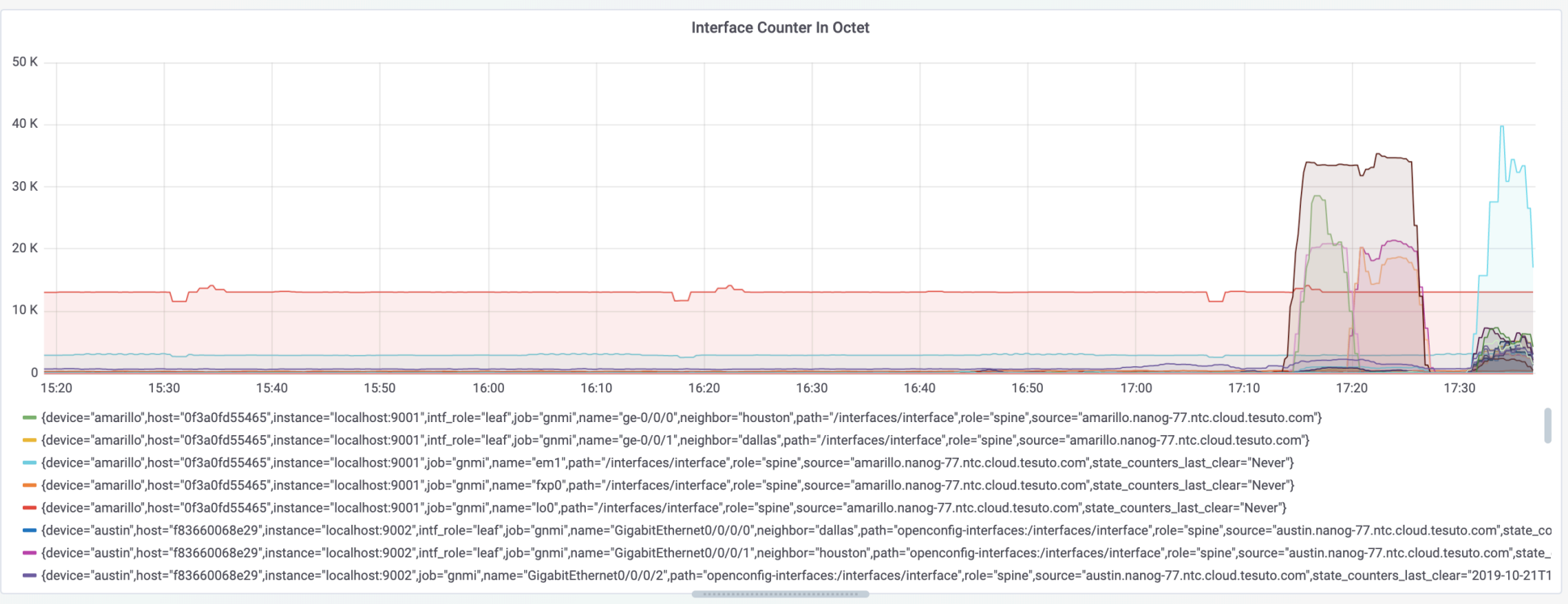
Introduction to Modern TSDB

interface_state_counters_in_octets



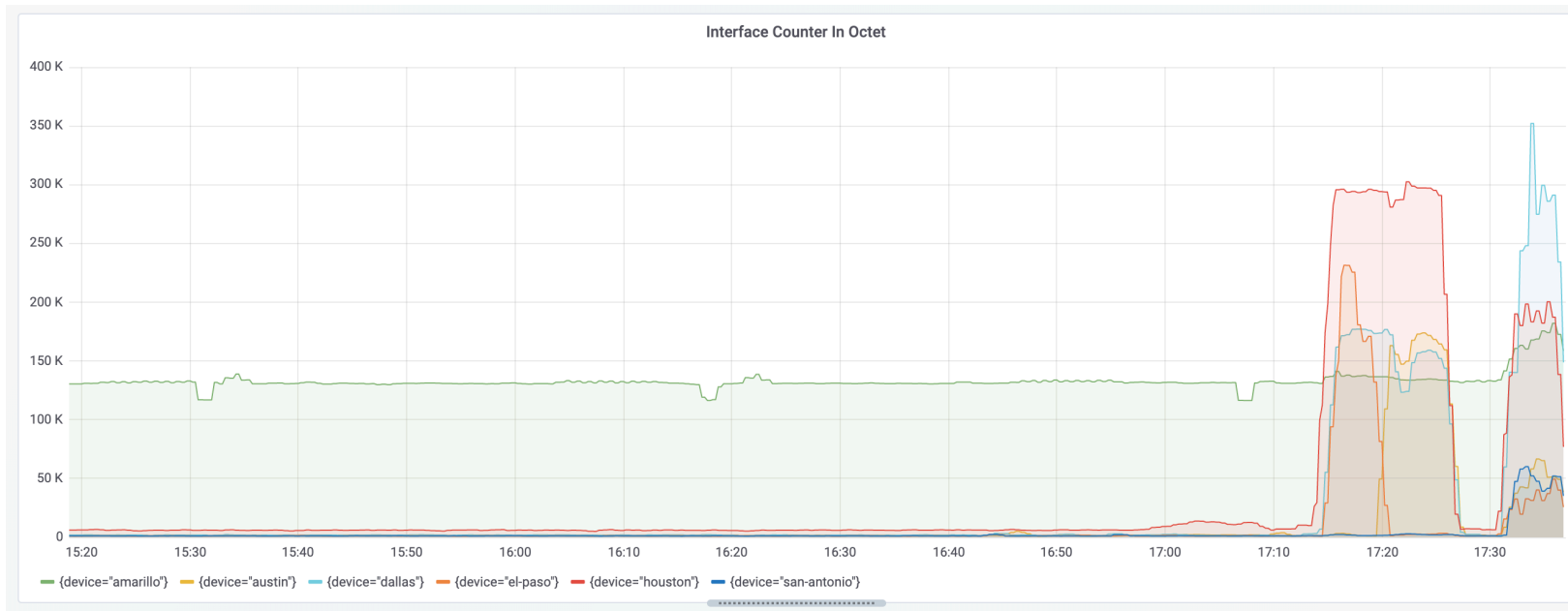
Introduction to Modern TSDB

```
deriv(interface_state_counters_in_octets[2m])*8
```



Introduction to Modern TSDB

```
sum by (device)(  
  deriv(interface_state_counters_in_octets[2m])  
)
```



Introduction to Modern TSDB

```
interface_state_counters_in_octets{device="spine1",interface="et-0/0/4"} 4569765412
```

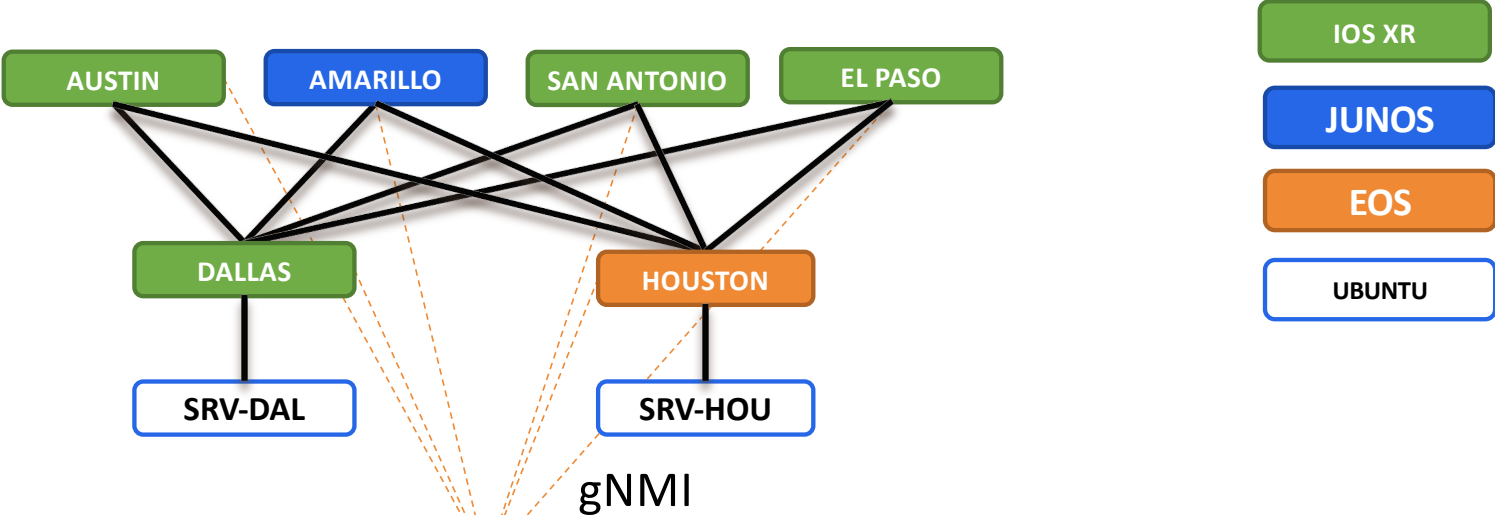
```
interface_state_counters_in_octets{  
    device="spine1",interface="et-0/0/4",  
    role="leaf",site="fra1",provider="level3",  
    intf_role="uplink"  
}
```

3

Lab Introduction

<https://github.com/dgarros/nanog77-tsdb-tutorial>

Lab architecture



Dashboard  **Grafana** Collector
Prometheus Server Time Series Database  **telegraf** Prometheus Client
telegraf

Running on
TESUTO

<https://github.com/dgarros/nanog77-tsd-db-tutorial>

gNMI

- New standard for telemetry streaming
 - Based on Openconfig model
 - Supported by most vendors
 - First generation of collector are starting to be available
 - Transport is gRPC, collector initiate the session
-

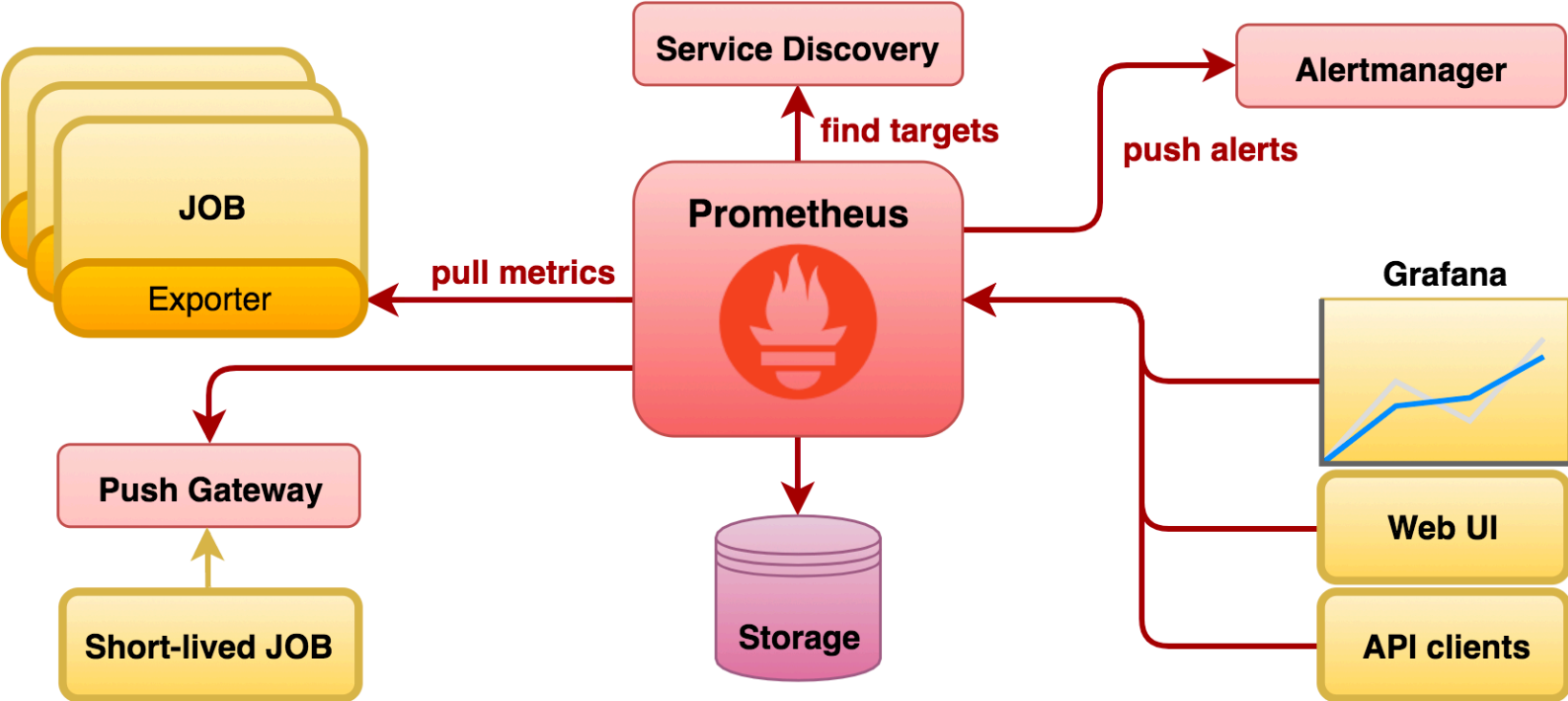
Telegraf - gNMI Collector

- Cisco contributed a gNMI input plugin to telegraf :
cisco_telemetry_gnmi
-

4

Getting started with Prometheus

Prometheus – High level architecture



Demo

1. Setup a Prometheus Client using Telegraf
 2. Setup a Prometheus server
 3. Configure Prometheus to pull data
 4. Prometheus Web Interface
 5. Query Examples
-

Telegraf - gNMI Collector

```
1 [global_tags]
2   -> device = "austin"
3   -> role = "spine"
4
5 [agent]
6   -> interval = "10s"
7   -> debug = true
8
9 [[outputs.prometheus_client]]
10  -> listen = ":9002"
11
12 [[inputs.cisco_telemetry_gnmi]]
13  -> addresses = ["<address>:50000"]
14  -> username = "<login>"
15  -> password = "<pwd>"
16
17  -> ## redial in case of failures after
18  -> redial = "10s"
19  -> tagexclude = ["openconfig-network-instance:/network-instances/network-instance/protocols/protocol/name"]
20
21  -> [[inputs.cisco_telemetry_gnmi.subscription]]
22  -> -> origin = "openconfig-interfaces"
23  -> -> path = "/interfaces/interface"
24
25  -> -> # Subscription mode (one of: "target_defined", "sample", "on_change") and interval
26  -> -> subscription_mode = "sample"
27
28  -> -> sample_interval = "10s"
29
30  -> [[inputs.cisco_telemetry_gnmi.subscription]]
31  -> -> name = "bgp_neighbor"
32  -> -> origin = "openconfig-network-instance"
33  -> -> path = "/network-instances/network-instance/protocols/protocol/bgp/neighbors/neighbor/state"
34
35  -> -> # Subscription mode (one of: "target_defined", "sample", "on_change") and interval
36  -> -> subscription_mode = "sample"
37  -> -> sample_interval = "10s"
38
```


Query examples

1. Aggregate traffic per device
 2. Aggregate traffic per interface role and device
 3. Calculate traffic imbalance between uplinks
 4. ...
-

5

Getting started with Grafana

Demo

1. Setup a Grafana server
 2. Configure Prometheus as a data source
 3. Create a dashboard
 4. Create graphs and diagrams
 5. Use variables inside a dashboard
 6. Export and share a dashboard
-

6

Query examples

Query examples

1. Aggregate traffic per device
 2. Calculate % of utilization per interface
 3. Aggregate traffic per interface role and device
 4. Calculate traffic imbalance between uplinks
 5. ...
-

THANK YOU