

>>> network .toCode()

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

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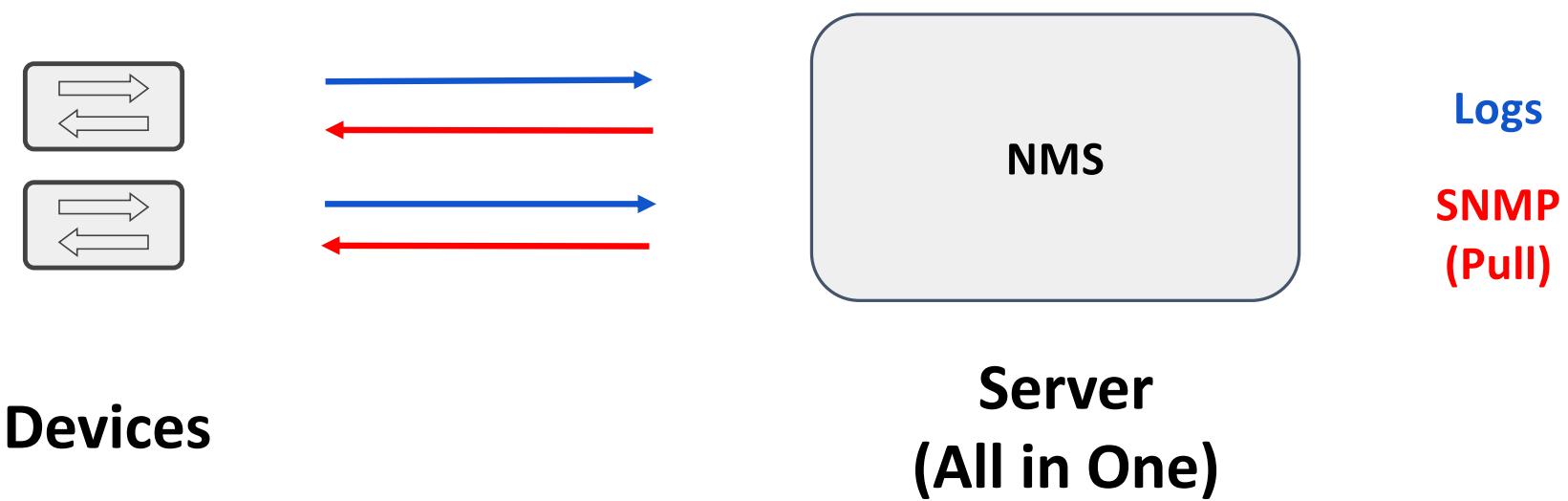
Agenda

- 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
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1

Timeseries Database & Network Monitoring?

Legacy Network Monitoring Solution



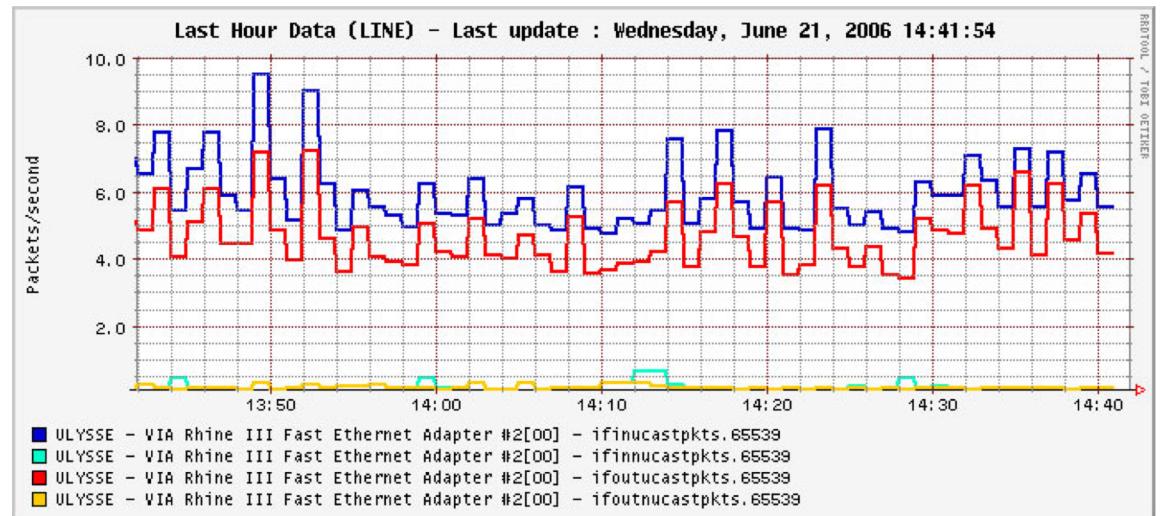
What tools are you using ?

OpenNMS
Collectd
RRDtools
Observium
Cacti
MRTG
Nagios

RRD Tools

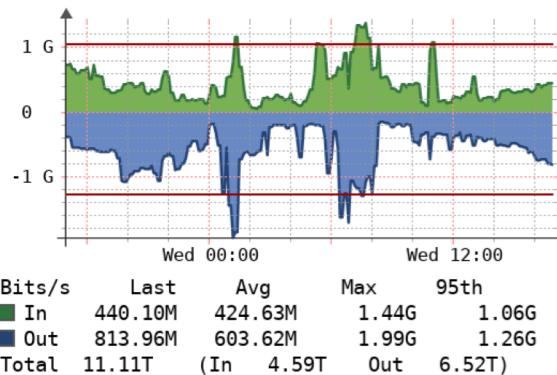
- Introduced in 1999
- Storage
- Aggregation
- Visualization

No query engine
Data retention is poor.

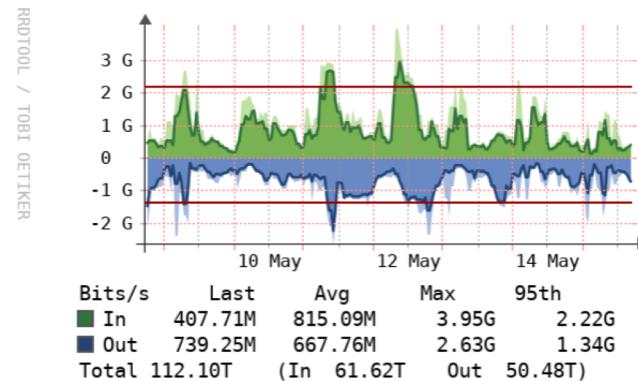


RRD Tools - Down Sampling

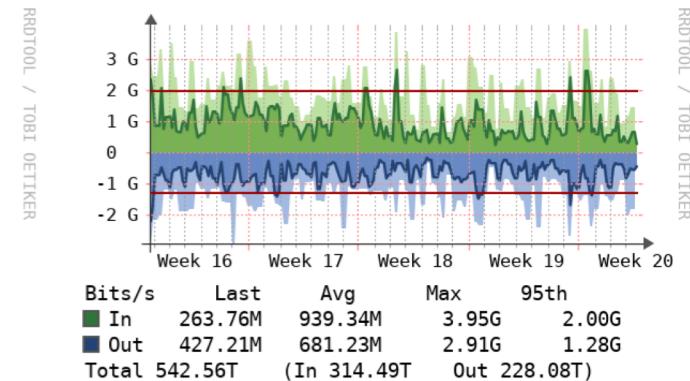
Traffic



1 Day



1 Week



1 Month

Telemetry has been a hot topic in the network industry

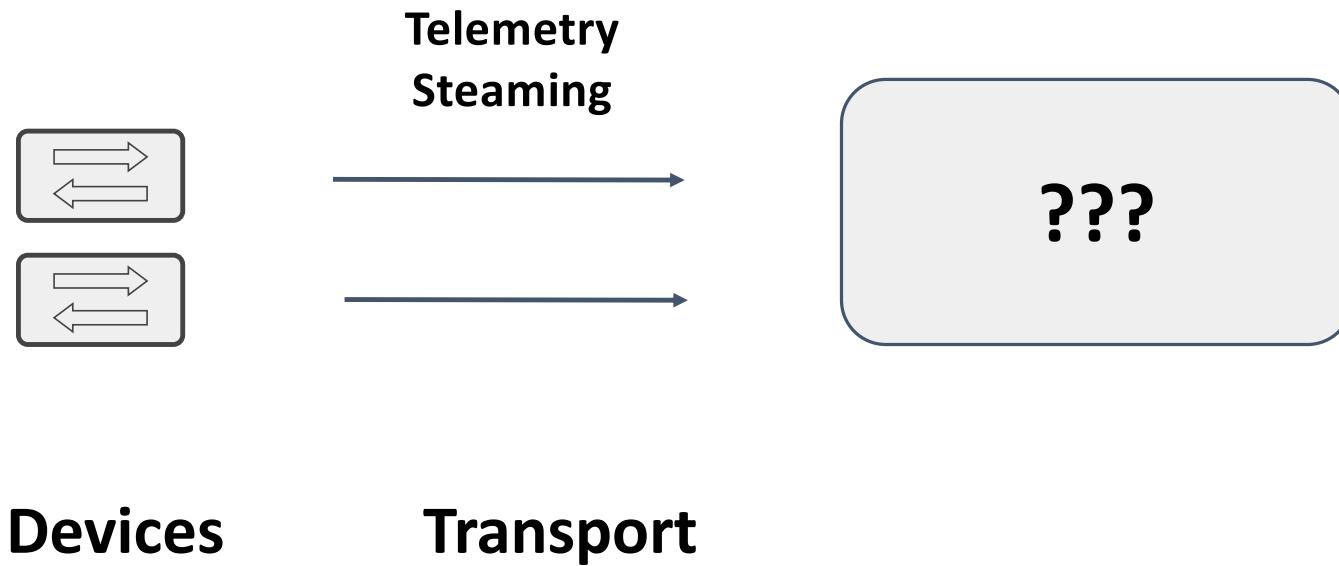
**Telemetry
Streaming**

Kill SNMP

Openconfig

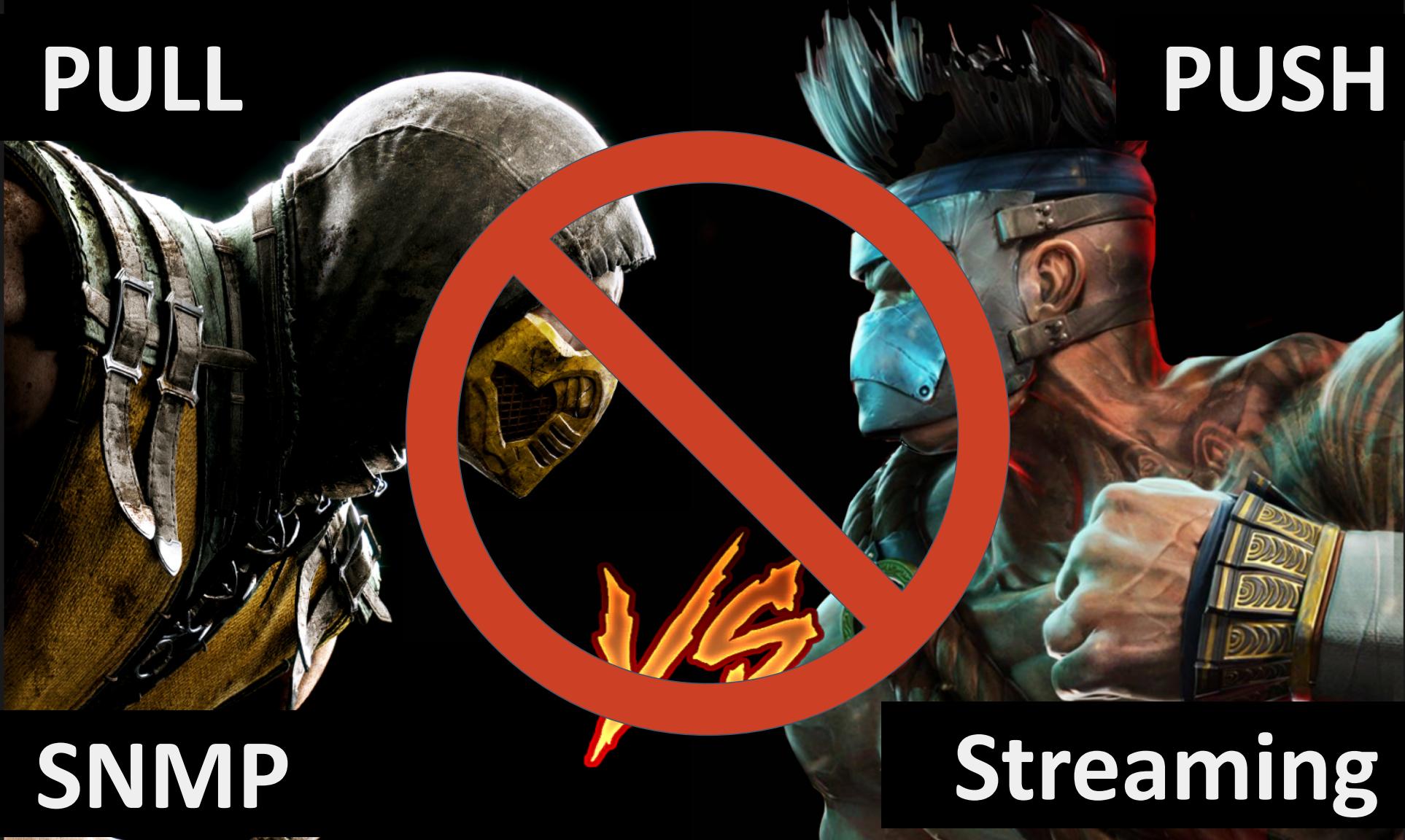
gNMI

... Network Monitoring Solution

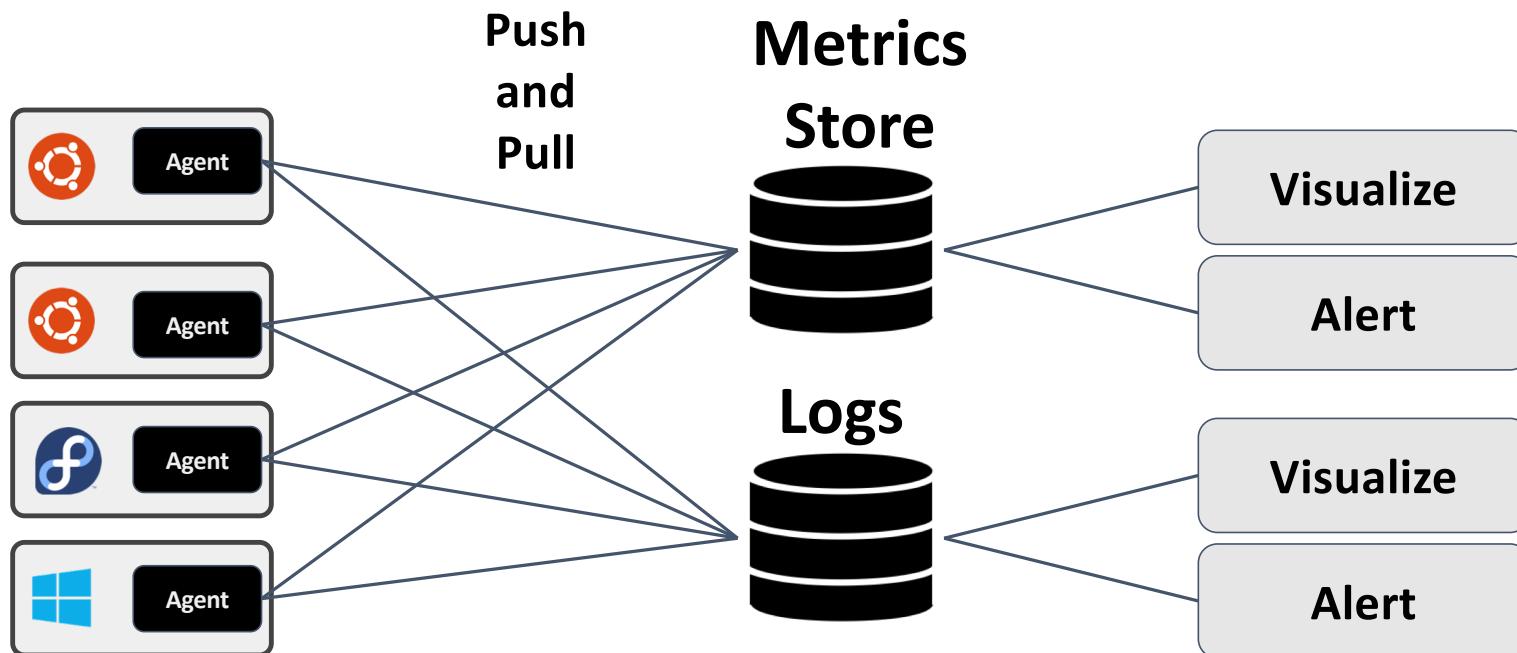


PULL

PUSH



What are others doing outside of the Network Industry ??



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

Datastore specialized by data format

Metrics .. Time Series

Numeric value evolving
over time

Constant Interval

Counters
CPU
Number peers

Logs Events

Mostly Text data
Unpredictable interval

Structured Data

Routing/Forwarding Table
Configuration

Open source projects Monitoring / Alerting

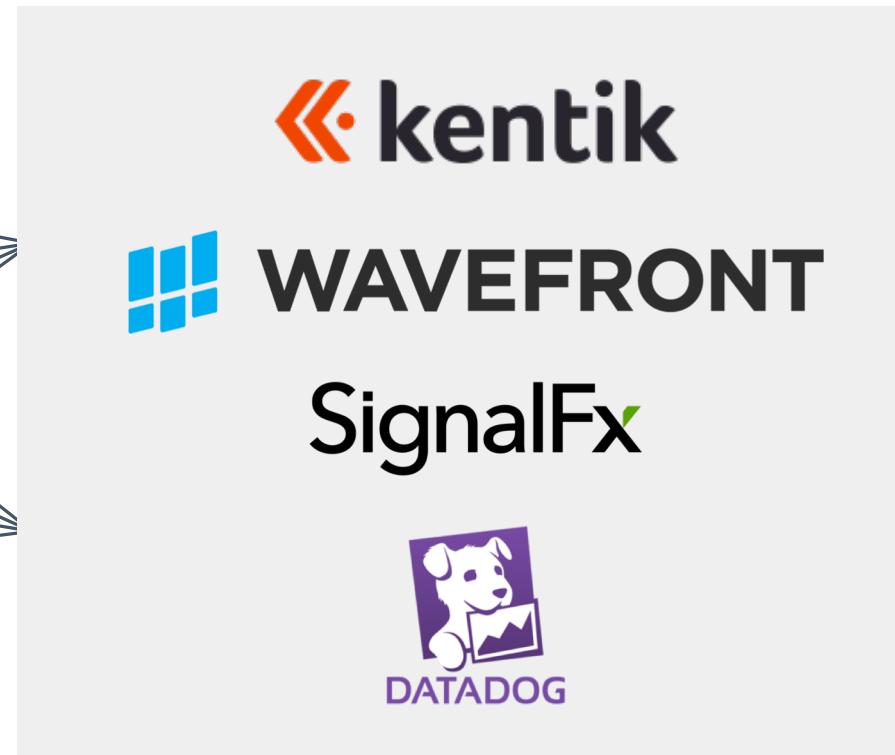
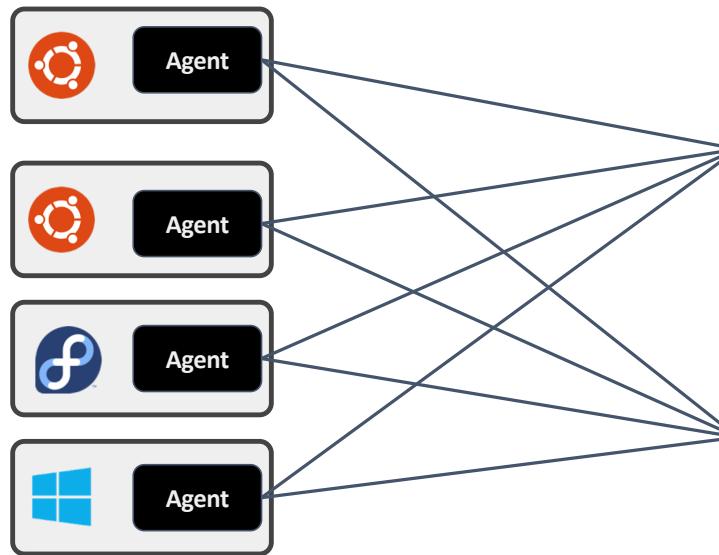
Collector Agent	Time Series Database	Alerting	Visualization
 telegraf  logstash  fluentd	 influxdb  Prometheus  TIMESCALE  elasticsearch	 influxdb  Prometheus Kapacitor Elastalert	 Grafana  kibana

Telegraf - The Swiss Army Knife

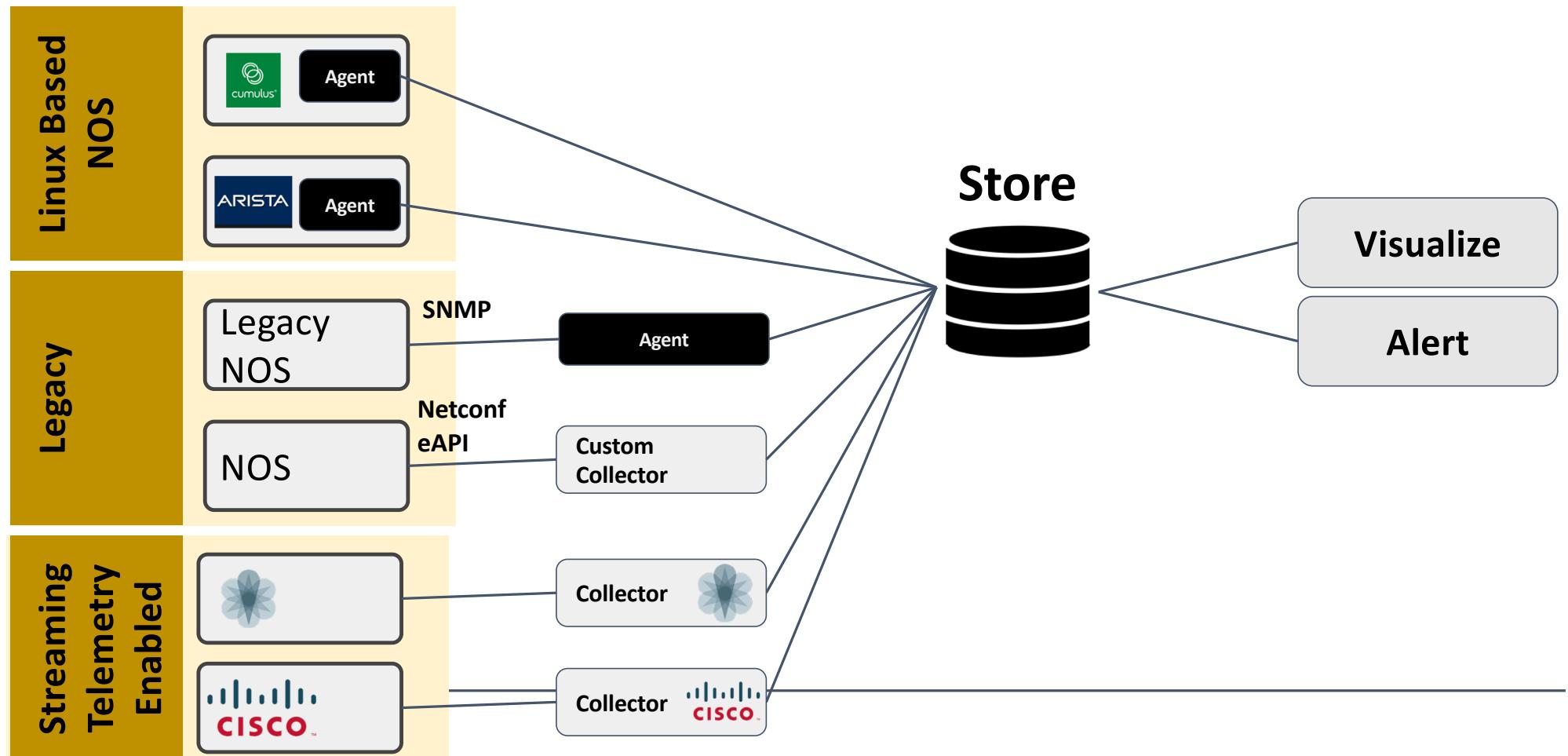


- Plugins driven agent / Extensible
 - Support out of the box
 - Over 80 Input Plugins
 - Most Databases (output)
 - Data manipulation
 - SNMP Input Plugin
 - Juniper / Cisco / OpenConfig
-

Cloud Based Solutions



Reuse the same components for network devices



2

Introduction to Time Series Database

Modern Time Series Database



- **New generation of database optimized for Time serie 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`

measurement name

What is it ?

Tags/Labels

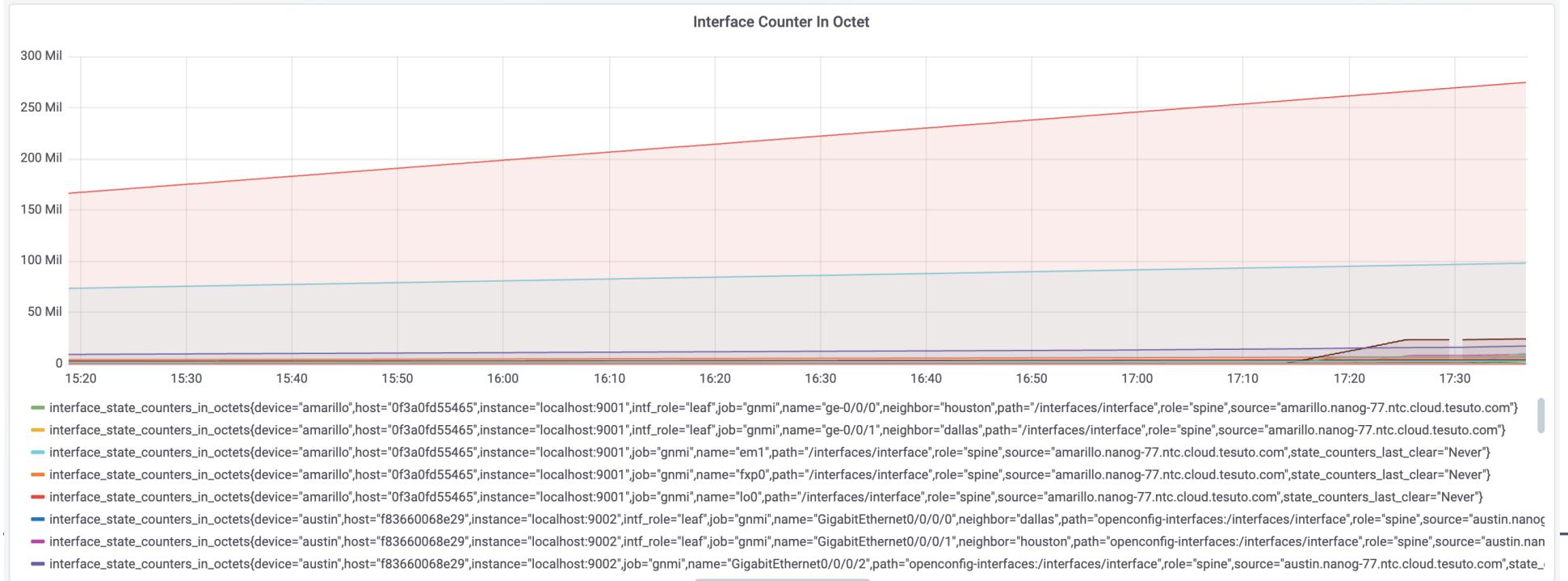
Contextual information

4569765412

Value

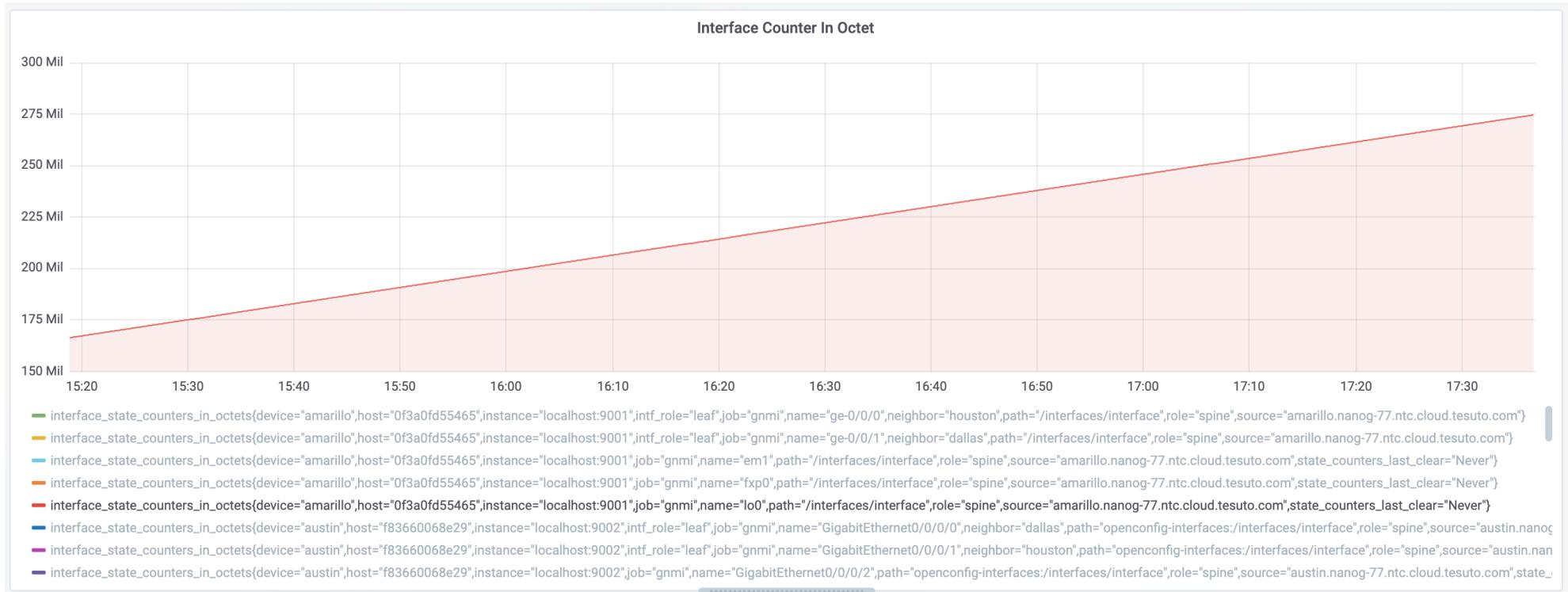
Introduction to Modern TSDB

[interface_state_counters_in_octets](#)



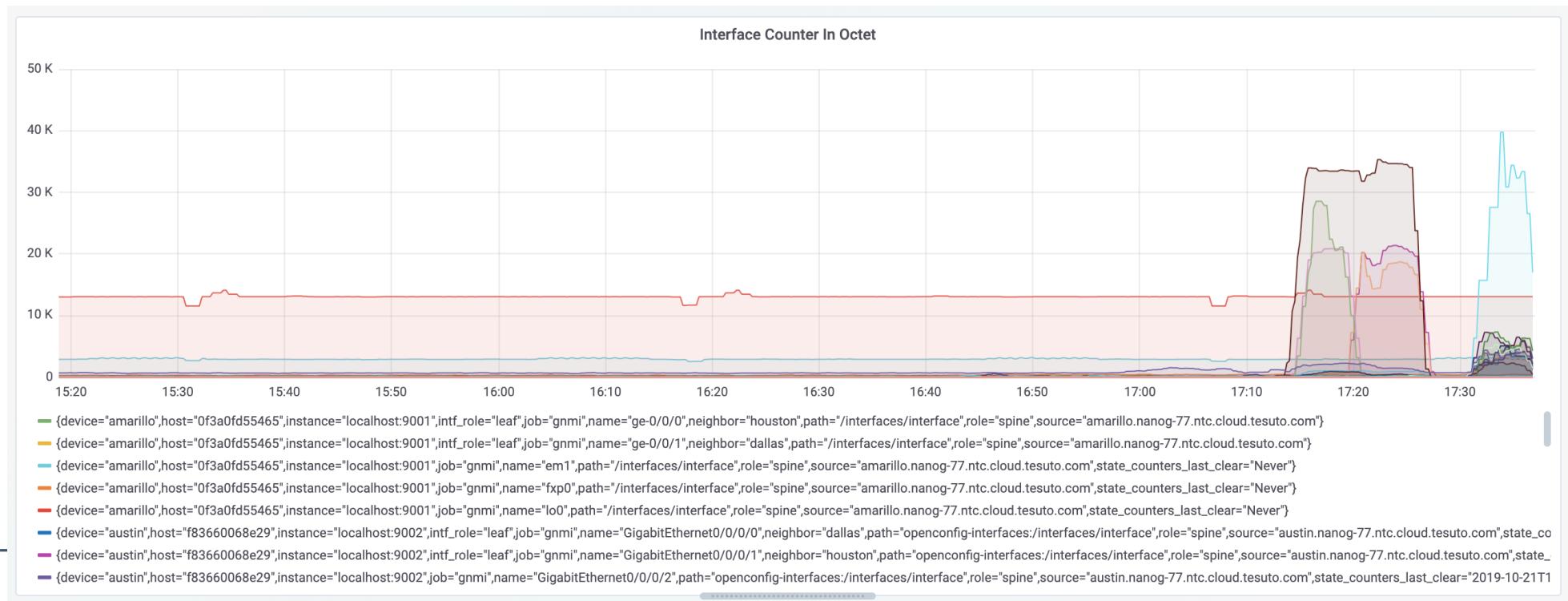
Introduction to Modern TSDB

[interface_state_counters_in_octets](#)



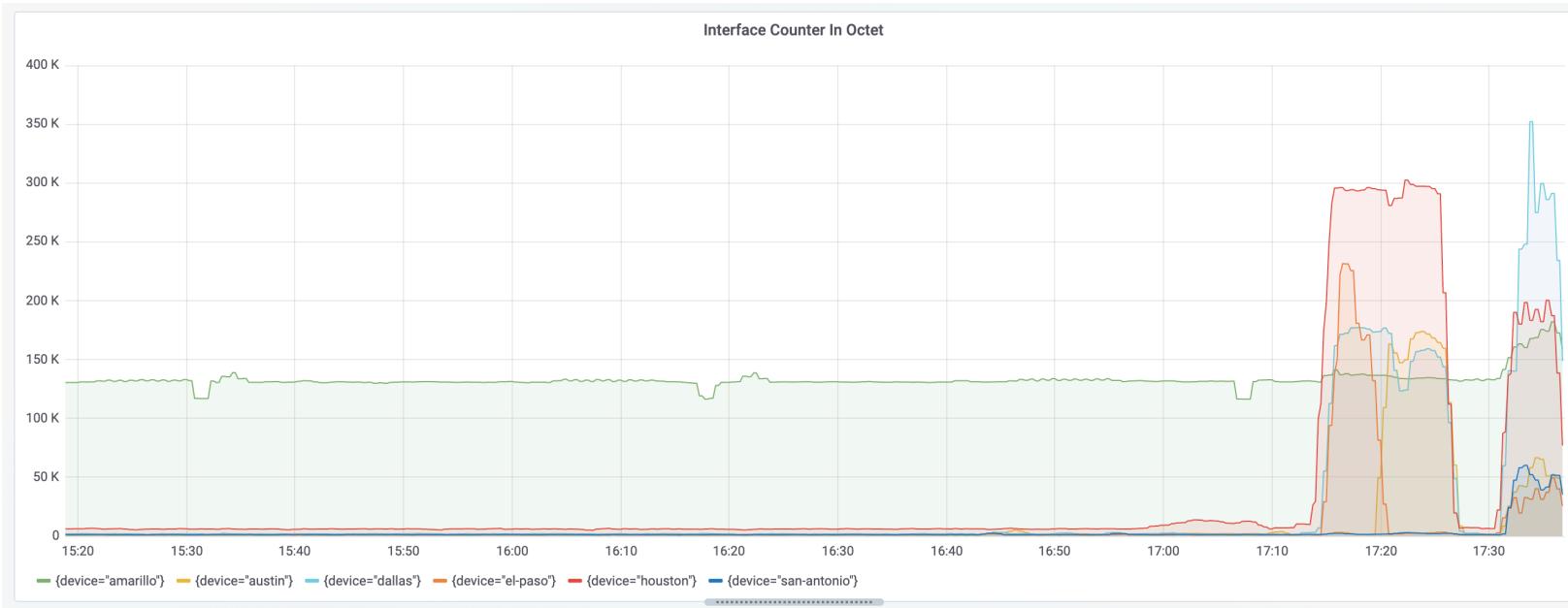
Introduction to Modern TSDB

`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
```

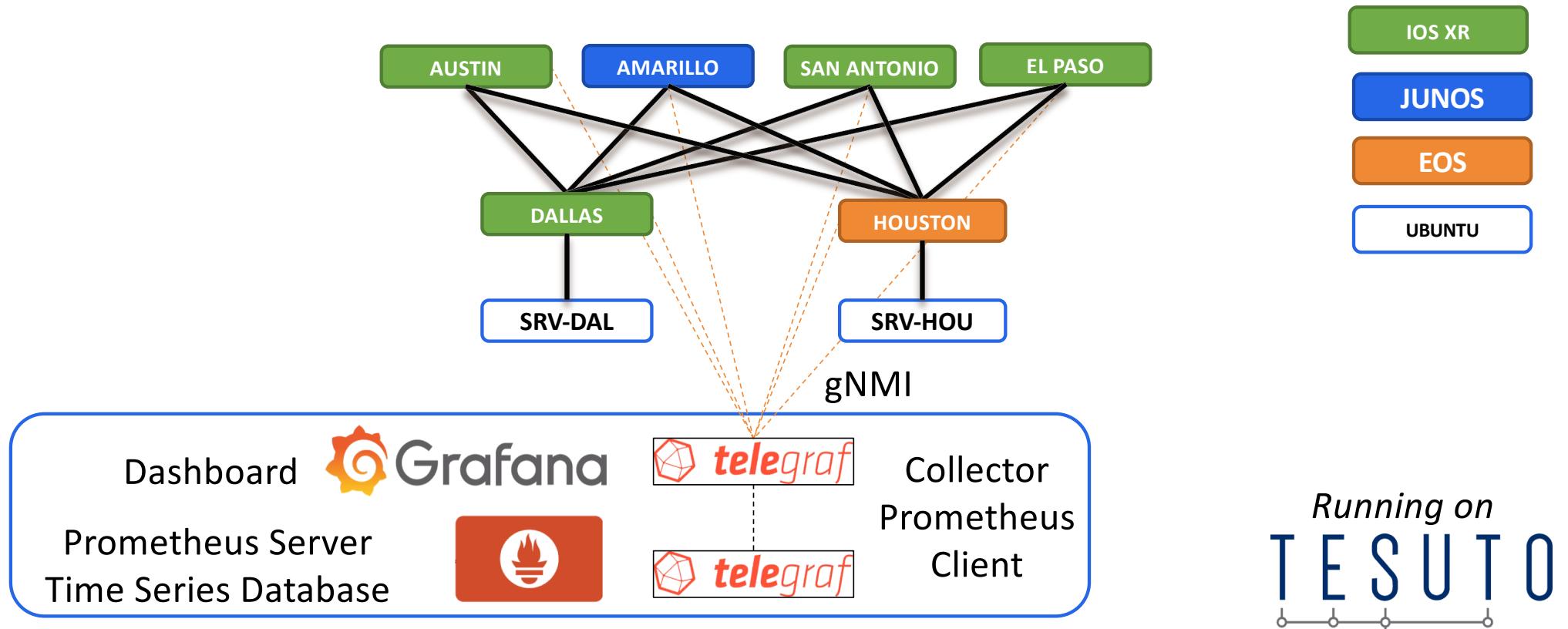
```
interface_state_counters_in_octets{  
    device="spine1",interface="et-0/0/4",  
    role="leaf",site="fra1",provider="level3",  
    intf_role="uplink"  
}
```

3

Lab Introduction

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

Lab architecture



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

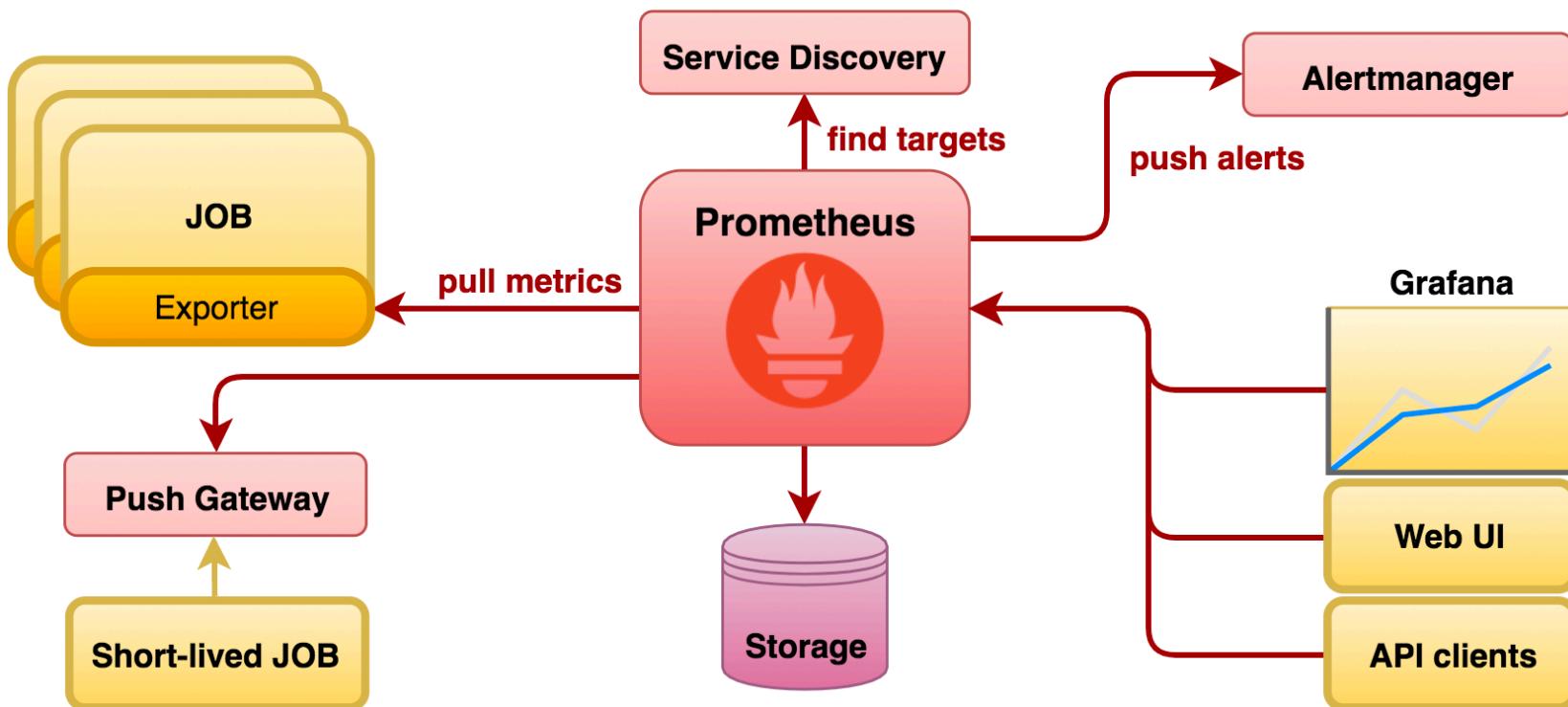
Telegraf - gNMI Collector

- 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