



Open Network Monitoring System

Arkadip Basu
Rishi Singh



Our Global Footprint





Our business

Walmart U.S.

1.5 million U.S. Associates

4,700+ Stores

\$331.7 billion in FY2019 Sales

Sam's Club

100,000 U.S. Associates

590+ Locations

\$57.8 billion in FY2019 Sales

Walmart International

700,000 Associates

6,000+ Retail Units

\$120.8 billion in FY2019 Sales

We're making every day easier for busy families



Walmart 

Improving experiences in-store & online



Walmart 

Sam's Club Scan & Go

Walmart Pay

Pickup Towers

**Grocery Pickup &
Delivery**

The future of work: jobs are changing



Walmart



In the era of cloud we believe in High Availability

Total RAM

CPU cores

Uptime

Disk Space Usage

FileSystem Fill Up Time

8.4 GB**4****3.9 day**

Metric ▾

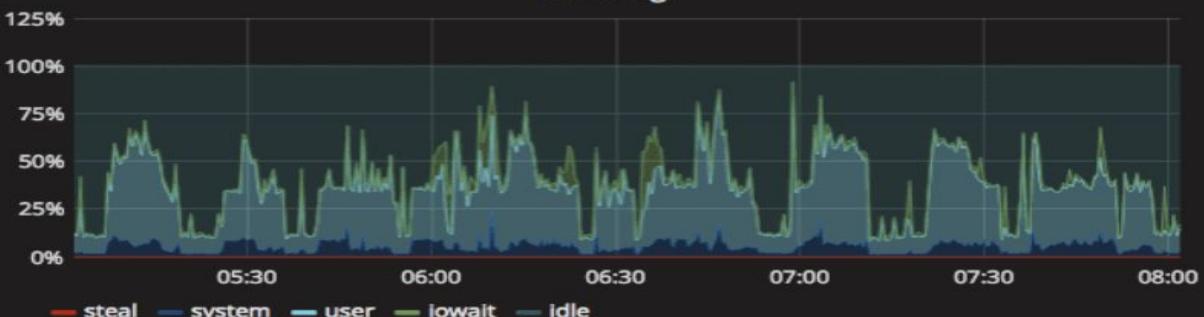
/dev/sda9

4.89 week

Current

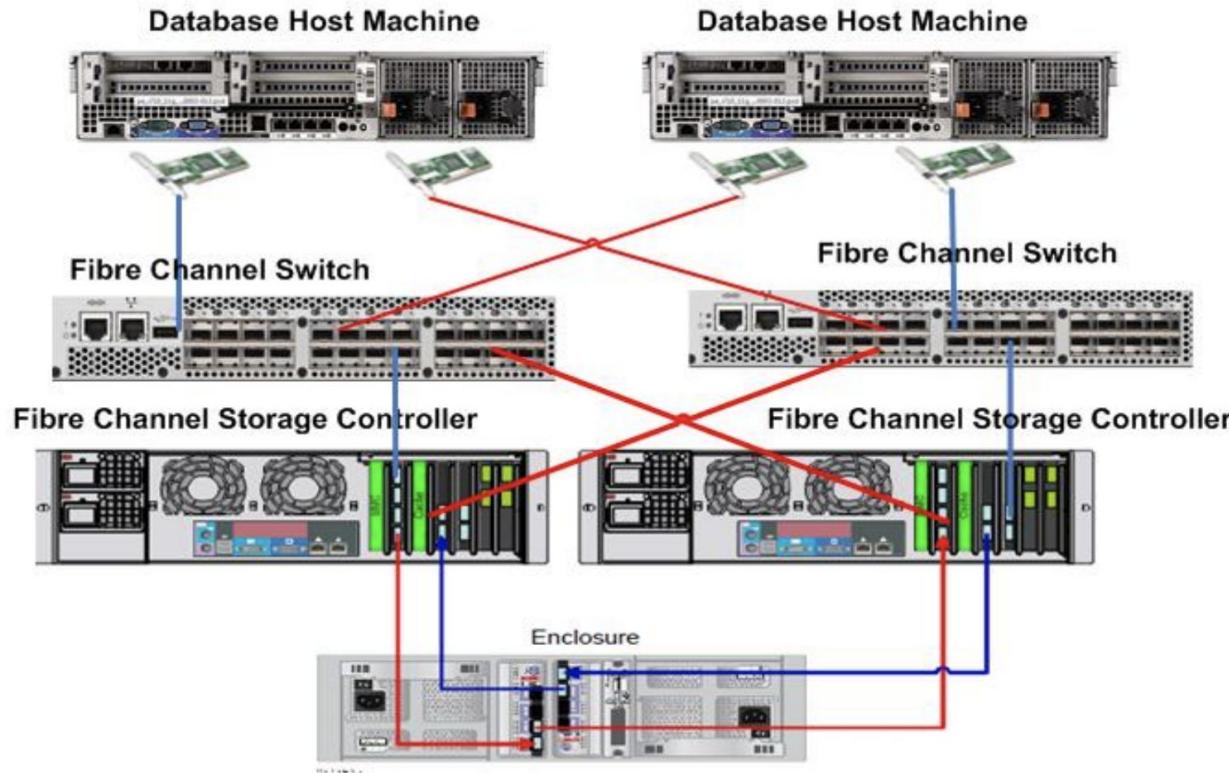
Top 10 Ram hungry PODs

	max	avg	current
gluster-964335860-2557415581-p4xhf	4.435 GB	4.176 GB	4.029 GB
gluster-964335860-2557415581-kftmz	4.016 GB	3.825 GB	4.016 GB
dining-parrot-prometheus-server-3678979116-wgjd4	2.939 GB	2.463 GB	2.259 GB
joking-antelope-plex-3711553304-ntfkq	2.097 GB	1.940 GB	1.918 GB
womping-goose-gitlab-3515636912-v5nd9	2.147 GB	1.716 GB	1.745 GB
gluster-928487666-1452019903-nzpp0	2.165 GB	1.430 GB	1.963 GB
kube-apiserver-gs9b8	272 MB	266 MB	272 MB
kube-apiserver-kftmz	228 MB	225 MB	226 MB
gluster-1000184054-2853507312-blfdv	220 MB	215 MB	219 MB
kube-apiserver-8pphr	213 MB	209 MB	212 MB

Memory**CPU usage****Load average**

Monitoring Insights

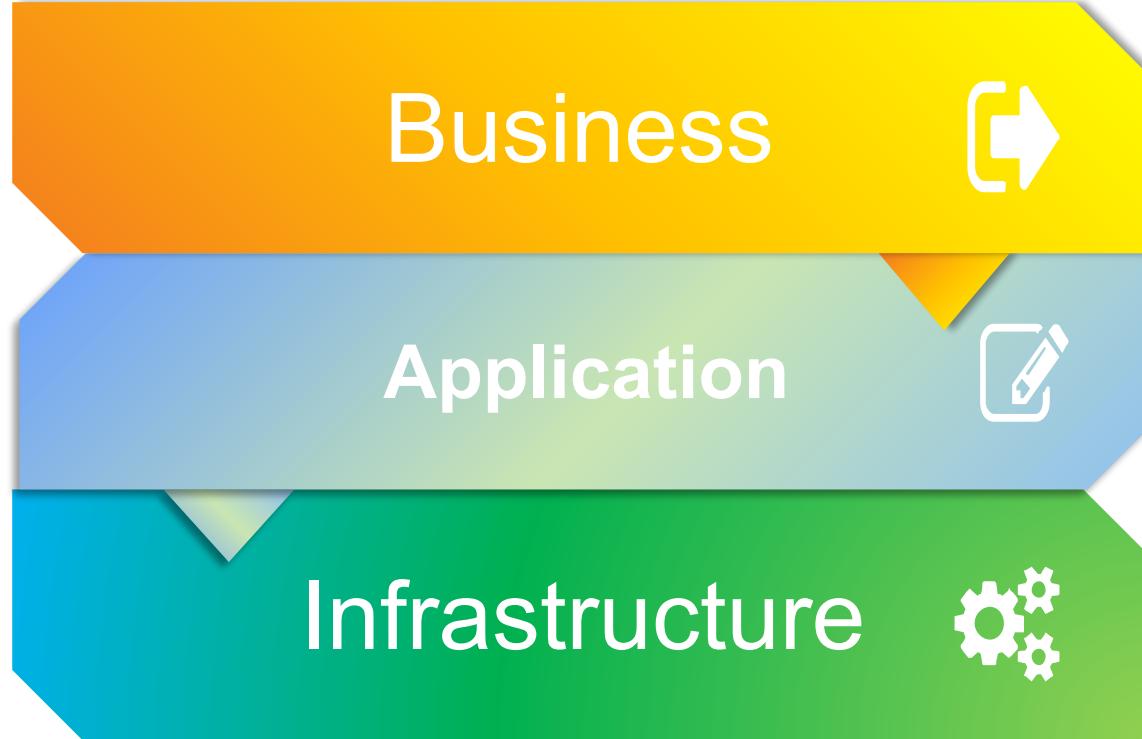
For Network there can be majorly two kinds of traffic



Operational Traffic



Business Traffic



0

1

2

3

Business

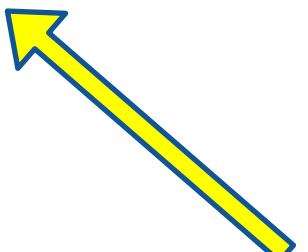
Here comes the main core offerings/ service from the organization

Application

The Software and services run on this layer

Infrastructure

Where all the core backend devices reside,
Network + Compute + Storage



ONMS Monitoring Focus Zone

For all Router, Switch, Load Balancers
across all our Data Centers

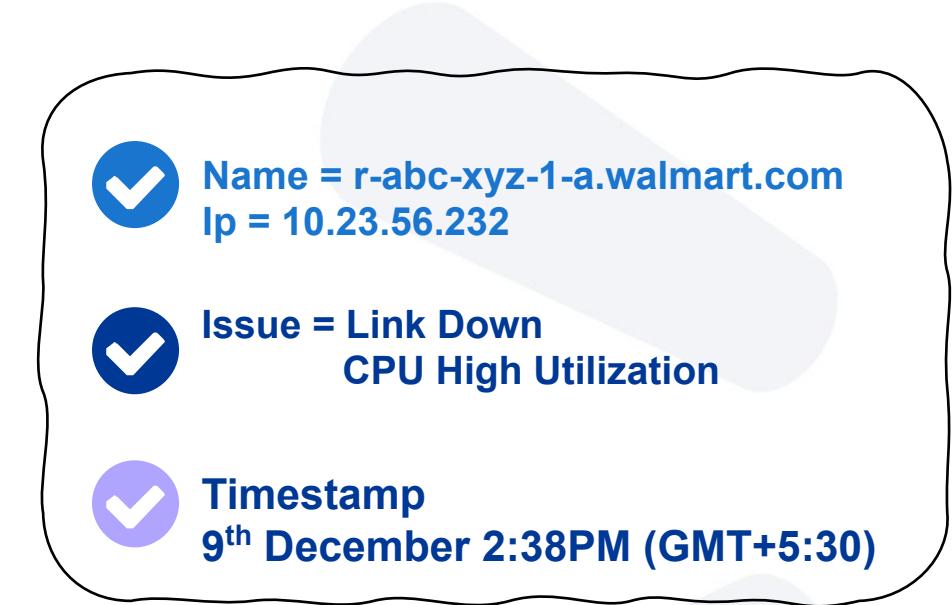
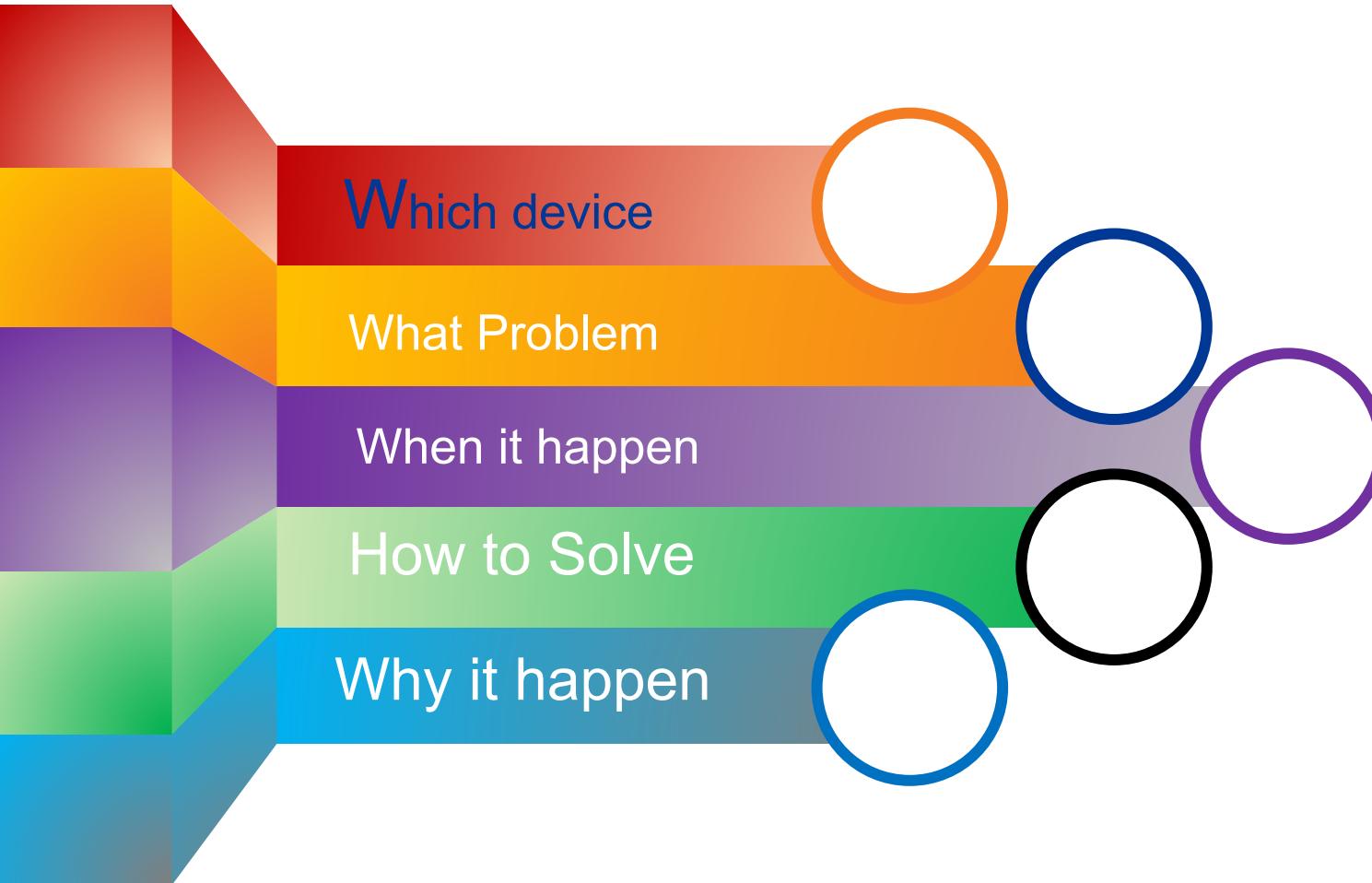


Service Availability

Service Reliability



Monitoring System Necessity



Re-Active Monitoring & Pro-Active Monitoring

Problem statement could be anything

- 1. Device Link Up / Down**
- 2. Device Auto Failover**
- 3. Memory High Utilization**
- 4. Fan Status Change / High Temperature**

Based on the Pro-Active Alerts we can have Capacity Planning

ONMS Technology Stack

***Application UI,
Scheduling,
Configuration***

***Applications are
hosted over the
Docker Pods***

***Mostly all underlying
codes are written
in Python3***

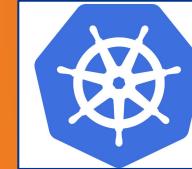
ONMS backend

ONMS Minion

Docker



Kubernetes



Python



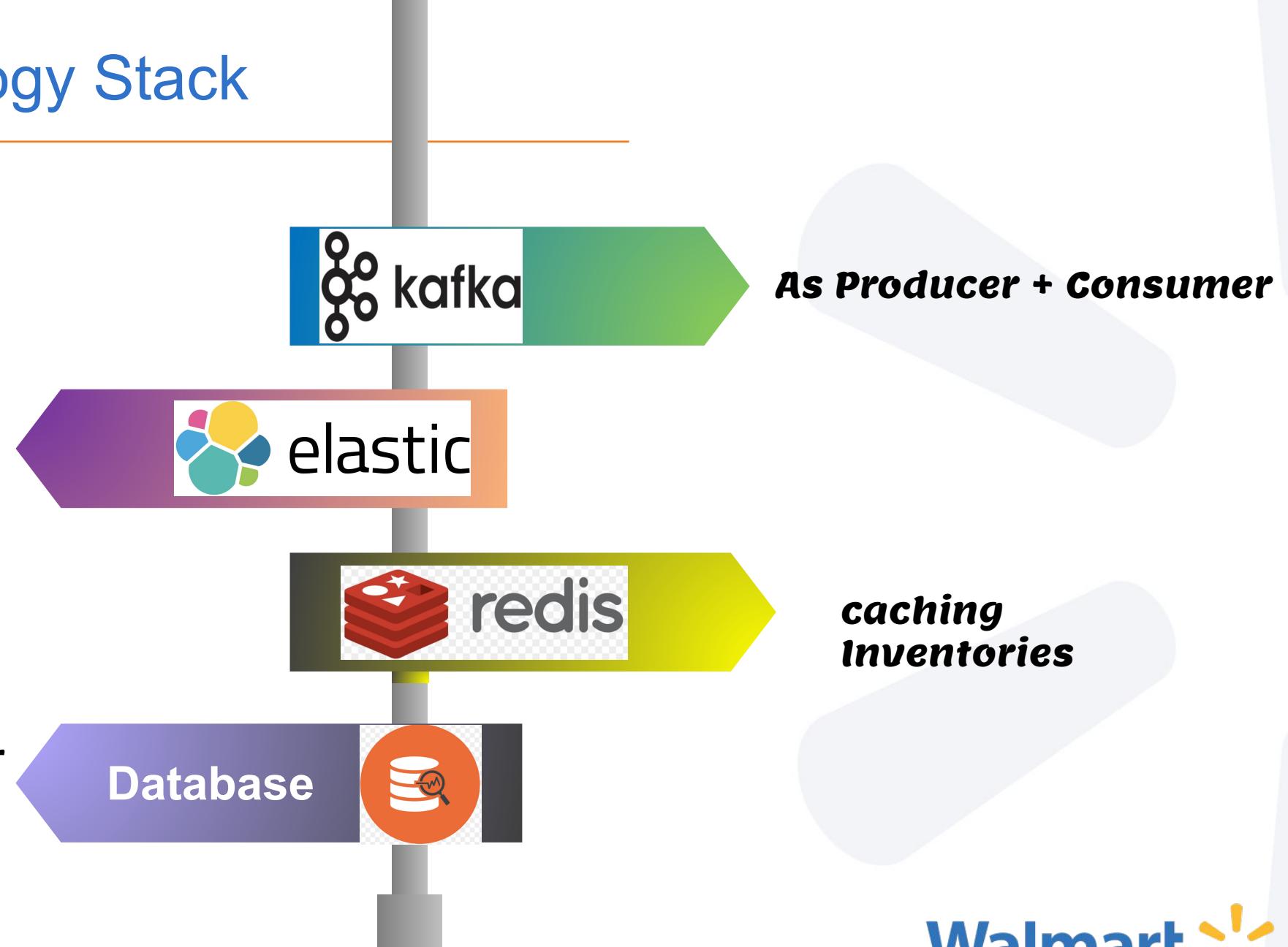
***initiate SNMP polling,
receive SNMP trap***

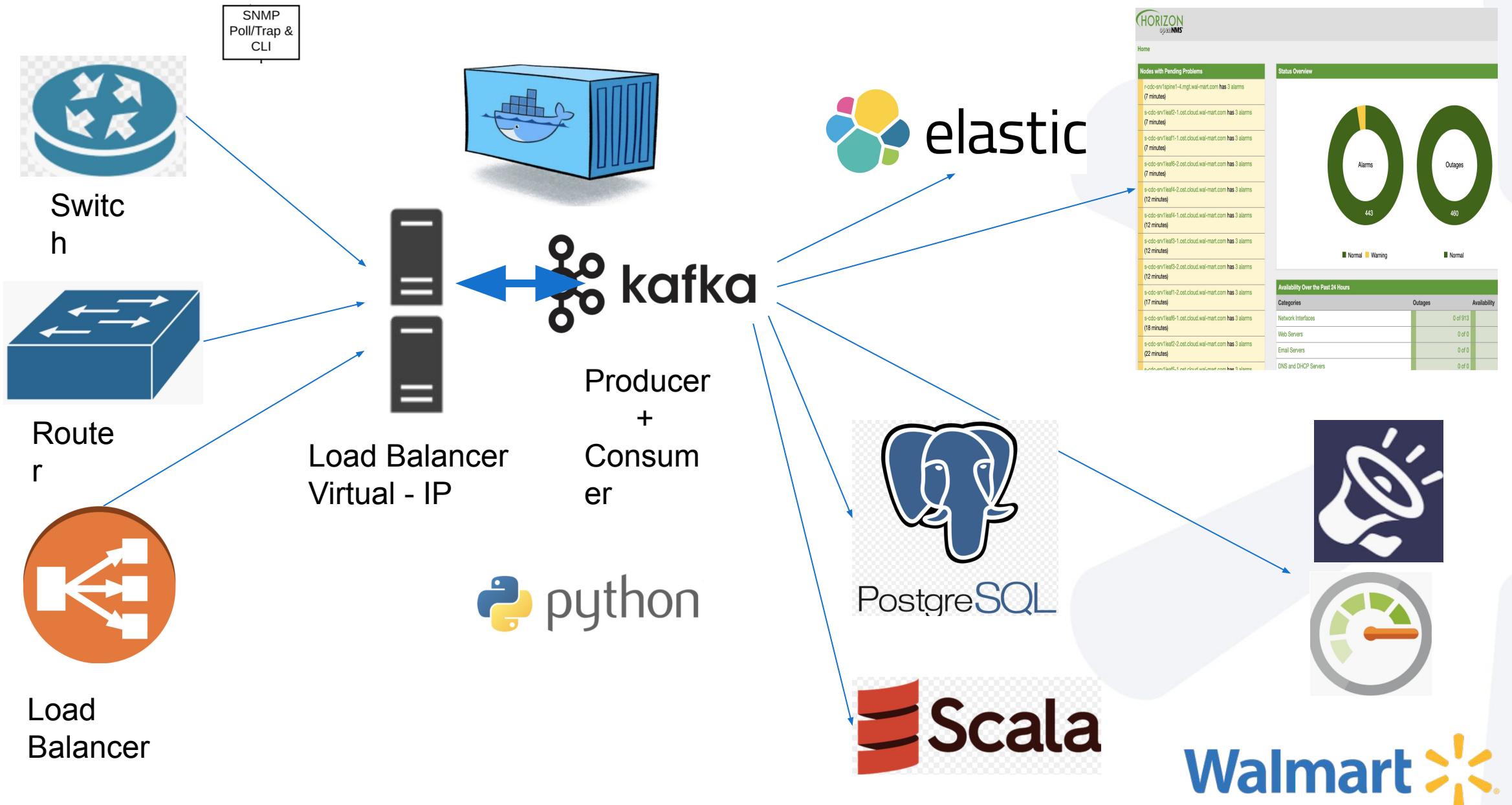
***To manage the Pods
&
orchestrate the flow***

ONMS Technology Stack

To store enriched event data for future Analytics

All the related logs are stored over SQL & No-SQL Database Postgress + Scylla





OpenNMS is the world's first enterprise grade network management application platform developed under the open source model.

Enterprise Grade

It was designed from "day one" to monitor tens of thousands to ultimately unlimited devices with a single instance. It brings the power, scalability and flexibility that enterprises and carriers demand.

Application Platform

While OpenNMS is useful "out of the box," it is designed to be highly customizable to create an unique and integrated management solution.

Open Source

This is 100% Free and Open Source software, with no license fees, software subscriptions or special "enterprise" versions.

OpenNMS is published mainly under the GNU Affero General Public License or “AGPLv3”

<http://docs.opennms.org/>

<https://github.com/OpenNMS/opennms>



ONMS Feature

Event-Driven Architecture

Alarms and Notifications

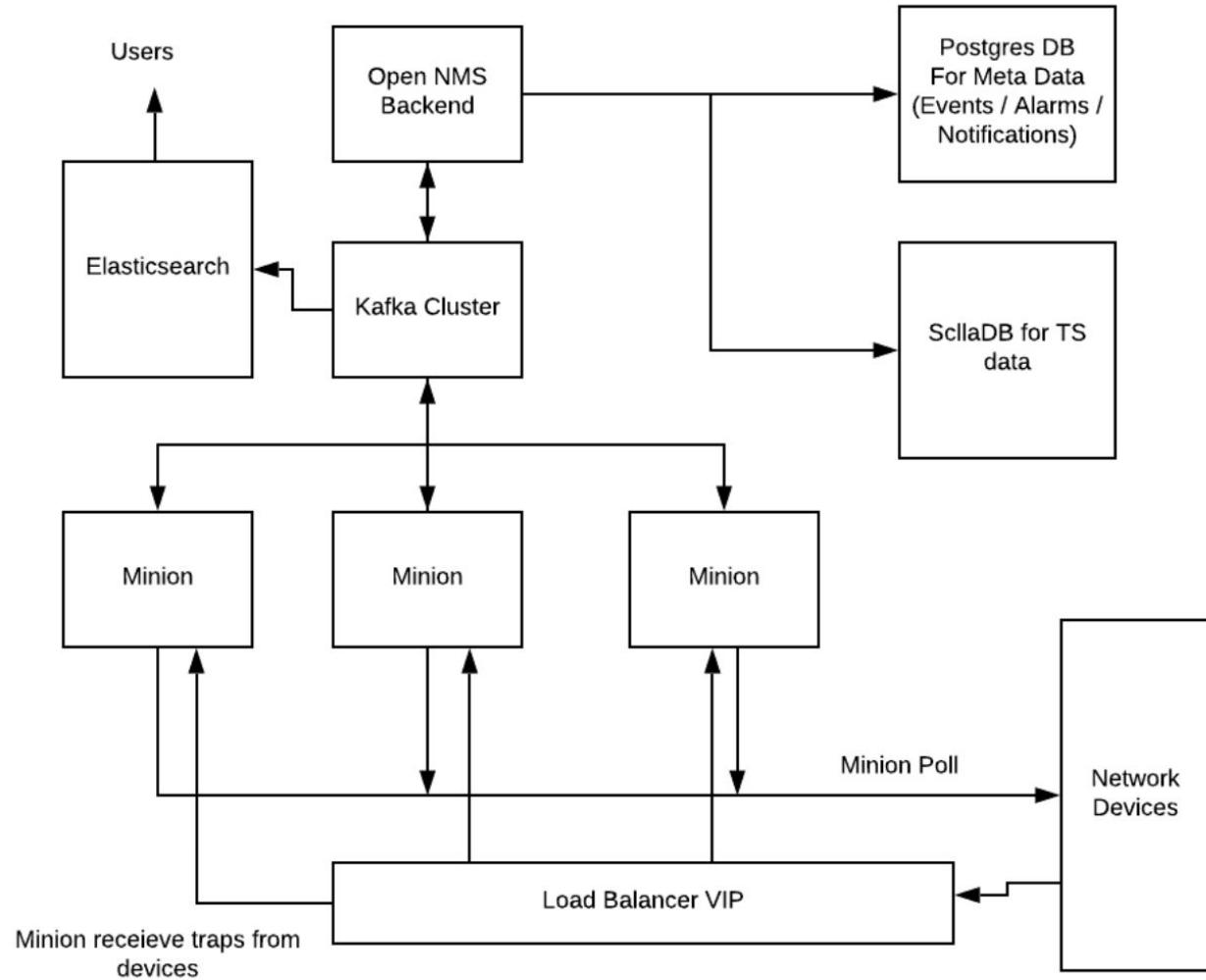
Visualization Support + Restful API

Performance Management & Database Support

Elasticsearch Forwarder + Analytics

Auto Discovery and Provisioning

High Level Data Flow



Major Components

- Python based Open NMS consumer
- Decode / Enrich events
- Send enriched events to Elastic Search
- Forward enriched events to Kafka
- e-mail/ other notification, Ticket platform integration

Sample Alerts

neteng_onms APP 1:50 AM

=====

Link Down (Trap)

Device Name: [REDACTED]mgt.wal-mart.com
Event Time: 2019-12-08T20:20:03Z
Interface Name: Ethernet9/12
IP: 10.65.9.13

1:50 AM =====

Link Up (Trap)

Device Name: [REDACTED]mgt.wal-mart.com
Event Time: 2019-12-08T20:20:06Z
Interface Name: Ethernet9/12
IP: 10.65.9.13

neteng_onms APP 8:42 AM

=====

Link Down (Trap)

Device Name: [REDACTED]mgt.wal-mart.com
Event Time: 2019-12-09T03:12:57Z
Interface Name: Ethernet9/12
IP: 10.65.9.13

=====

Link Up (Trap)

Device Name: [REDACTED]mgt.wal-mart.com
Event Time: 2019-12-09T03:13:00Z
Interface Name: Ethernet9/12
IP: 10.65.9.13

6:55 PM =====

Module Status Change

Device Name: [REDACTED]-1.mgt.wal-mart.com
Event Time: 2019-12-05T13:25:45Z
Module Name:
Module Status:

neteng_onms APP 7:01 PM

=====

Module Status Change

Device Name: [REDACTED].mgt.wal-mart.com
Event Time: 2019-12-05T13:31:10Z
Module Name:
Module Status:

 2 replies Last reply 4 days ago

neteng_onms APP 7:01 PM

=====

Power Status Change

Device Name: [REDACTED].mgt.wal-mart.com
Event Time: 2019-12-05T13:31:11Z
Module Name:
Power Status:

Home for Open NMS event search! Hello r0s026e!

X

i ONMS event search**startTime**

endTime

 last 1 hour
 last 4 hour
 last 12 hour
subject type:

nodeLabel

entity

site

severity

 only search currently active events

Clear Time
Search
🔥 ONMS event home, please choose mode (default is search): 

eventUEI	nodeLabel	entity	EventTime (localTime)	ticketId	status	Edit
uei.opennms.org/class/intf_discard	01.net.walmart.com	LA/1	Sun Dec 08 2019 18:28:41 GMT+0530 (India Standard Time)		active	Edit
uei.opennms.org/class/intf_discard	.net.walmart.com	10/3	Sun Dec 08 2019 18:28:41 GMT+0530 (India Standard Time)		active	Edit
uei.opennms.org/class/intf_oututil_high	2.mgt.wal-mart.com	Vlan731	Sun Dec 08 2019 18:27:50 GMT+0530 (India Standard Time)		active	Edit
uei.opennms.org/class/intf_inutil_high	2.mgt.wal-mart.com	Vlan717	Sun Dec 08 2019 18:27:49 GMT+0530		active	Edit

ONMS User front end event List

HORIZON openNMS

Search Info ▾ Status ▾ Reports ▾ Dashb

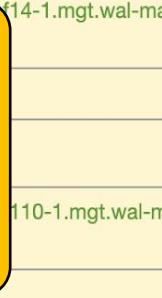
Home / Events / List

[View all events](#) [Search](#) [Severity Legend](#)

[Unsaved filter](#) [▼](#) **Event(s) outstanding ✕**

Results 1-20

[First](#) [Previous](#) [Next](#)

ID	Severity	Time	Source Location	System-ID	Node	Node Location	Interface	⋮
2144834	Warning ⊕ ⊖	2019-10-09T05:35:06+00:00 🕒 🕒	cdc-onms-srv	onms-minion-1 ⊕ ⊖		f14-1.mgt.wal-mart... ⊕ ⊖	cdc-onms-srv ⊕ ⊖	10.38.57.4 ⊕ ⊖
				uei.opennms.org/vendor/Cisco/traps/entSensorThresholdNotification ⊕ ⊖				
				Cisco Event: Sensor has reached Threshold.				
2144833	Warning ⊕ ⊖	2019-10-09T05:34:50+00:00 🕒 🕒	cdc-onms-srv	onms-minion-2 ⊕ ⊖		110-1.mgt.wal-mar... ⊕ ⊖	cdc-onms-srv ⊕ ⊖	10.38.56.116 ⊕ ⊖
				uei.opennms.org/vendor/Cisco/traps/entSensorThresholdNotification ⊕ ⊖				
				Cisco Event: Sensor has reached Threshold.				
2144832	Warning ⊕ ⊖	2019-10-09T05:34:49+00:00 🕒 🕒	cdc-onms-srv	onms-minion-0 ⊕ ⊖				10.38.62.70 ⊕ ⊖
				⊕ ⊖				

Future Plans | ONMS

Extract L1 Debug Logs of affected devices

Auto Remediation of devices

Device Auto Provisioning

Cloud integration



Thank you !

Questions, Feedbacks !!

Reach out to

Arkadip.Basu@walmartlabs.com

Rishi.Singh@walmartlabs.com

Walmart - GIEO
Network Engineering Team, India.

