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OPEN NETWORKING //
Integrate, Automate, Accelerate
Using Prometheus to Monitor a Telco Cloud at Scale
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“Traditional Telco used hardware based appliances and legacy protocols such as SNMP for monitoring. Network Function Virtualization Infrastructure (NFVI) introduces new problems”
Our approach

- Present a **Monitoring Framework** aligned to Telco “Carrier Grade” requirements as well as Enterprise requirements to run business critical workloads.
- Framework a foundation for future applications and MANO integration:
  - Efficient, “near real-time” Fault Notifications
  - Enables enhanced High Availability
- Target sig-scalability requirements of **5K nodes, 200 metrics, 1 sec interval**
- Leverage Open-Source technologies: Collectd, AMQP1.0, Prometheus, …
  - Communities, partners and upstream activities
    - OPNFV Barometer
    - Collectd
    - AMQP
    - Intel, KDDI, NEC
Architecture at a glance

- Hardware / Software metrics / event collection using Collectd
- Distribution of metrics / events using AMQP 1.0
- Metrics storage / processing with Prometheus
- Alert monitoring with Prometheus Alert Manager
- Event logging with Elasticsearch
- Visualization through Grafana
- Third party integration through AMQP 1.0 or Prometheus API, etc…
- “Server Components” running in a Kubernetes cluster for ease of management and performance scaling
Event and metrics collection

- **Why Collectd?**
  - Part of OPNFV Barometer project to standardize metrics and events format
  - Matured been around since 2005, lightweight daemon in C, small enough to run in embedded system
  - Event plugins (VES format) including connectivity, procevent, and sysevent.

- **Other Collectors**
  - Telegraf
  - Node exporter
  - Container native monitoring
    - CAdvisor
    - Kube-state-metrics
Notification Routing and Delivery

- AMQP 1.0 (not 0.9)
  - Despite the name, AMQP 0-9-1 and 1.0 are very much different protocols
  - AMQP 1.0 is available upstream through the Apache QPID project
- Why AMQP 1.0 Qpid Dispatch Router
  - High reliability
  - Low latency
  - High throughput
  - Brokerless inter-system messaging
  - Multiple supported routing patterns
    - Balanced
    - Closest
    - Multicast
AMQP 1.0 latency profile

Latency histograms for router+proton code for 2018-02-19 and 2018-05-31 (rc4)
10 million messages total
1 sender, 1 receiver, colocated
Metrics and Events gateway

- Smart Gateway middleware connecting the messaging bus to the data consumer (business logic engines and storage)
Metric Business logic Engine

- Why Prometheus
  - Open-source systems monitoring and alerting toolkit
  - Prometheus provides a robust query language and a built-in dashboard for querying and visualizing your data
  - The Prometheus Operator simplifies Prometheus setup on Kubernetes
  - Includes an alert manager for notifications

- Prometheus performance evaluation
  - Tested upto 2 million metrics per scrape with modified collectd-tg
  - 1000 nodes with 200 metrics per node per interval
  - Scraped at 5 minute interval (processed ~6666 metrics/sec)
  - Hardware
    - 10 cores used @ 95% load (~1-skt or less in 2-skt machine)
    - Data stored to 7200K SATA drive, less than 10% I/O utilization
AlertManager

- Included with Prometheus toolkit
- Handles alerts sent by client applications such as the Prometheus server and third party tooling.
- Deduplicates, groups, and routes alerts to the correct receiver integrations (SNMP, e-mail, etc.)
Framework overview

AMQP 1.0

Metrics
Events
Qpid proton client
Node-Level Monitoring (Compute)

**Nodes Services** (ea. Managed Node)

- **Ingress Plugins**
  - Connect
  - Procevent
  - kernel
  - Sysevent

- **Egress Plugins**
  - MCE
  - process
  - libVirt
  - cpu
  - network
  - RDT

- **Collectd Core**
- **AMQP1.0**
- **Local Agent**
  - rules / action engine
  - policies / topology

- **Local corrective actions**

**Shared Services** (ea. Managed Domain)

- **Control and Management** usServices
  - Service
  - Service
  - Service

- **Shared Services** (MANO interfaces)

- **Visualization**
  - Grafana

- **API Integration**
  - Prometheus
  - Elastic Search

**Events**
- kernel
- cpu
- mem
- /proc
- net
- syslog

**Metrics**
- pid
- process
- libVirt
- network
- RDT

**Collectd config**

Policy, topology, events

collectd config

**Events**

**Metrics**
Monitoring System Overview

AMQP 1.0

Infrastructure Fabric

MGMT Cluster

3rd Party Integrations

Metrics

Events

ONAP

VNF Manager

Application Components

(VM, Container); VNFs

Controller, Compute, Ceph, RHEV, OpenShift

Nodes (All Infrastructure Nodes)

Collectd

ONAP

OPEN NETWORK AUTOMATION PLATFORM

( MANO interfaces )

Blue QDR

Green QDR

Collectd
Full demo & QA will be available at our Booth at following time..
Demo

AMQP 1.0

- Metrics
- Events
- Qpid proton client

Prometheus
ElasticSearch
AlertManager

SNMP
EMAIL
Demo deployment overview

- Collectd
- Qpid Dispatch Router
- Qpid Dispatch Router
- Smart Gateway
- xN
- Elasticsearch
- Prometheus
- Alert Manager
- Grafana
Thank you! Questions?

Slides available at https://onseu18.sched.com/