HW Monitoring and Management System for Telco Data Center

Jungsoo Kim/R&D Manager/SK Telecom
Agenda

Infrastructure Revolution
Infrastructure Management in VIM & MEC
HMS Overview
  - Objectives
  - Automated HW Lifecycle Management
  - Architecture
  - Open Source in HMS
  - Centralized vs. Distributed
  - Demo
Future Work
Infrastructure Revolution

- Mobile network and data center are converging towards open HW & SW based infrastructure

- Software-Defined Infrastructure
- Open Hardware and Software
- Universal Platform for Diverse Applications
Infrastructure Management

- Management of NFV and MEC’s physical & virtual resources is integral part of 5G building blocks,
- Needs another layer of hardware management system

SKT VIM Ref. Architecture

Multi-access Edge Computing Architecture

- Infrastructure Management System Requirements
  - Support physical & virtual resources
  - Vendor neutral system
  - Automation & Intelligence

Hardware Management System

**Collected Data**
- OS Level Info
  - hostname
  - serial number
  - OS version
  - CPU info
  - Network Info
  - etc.

**Mgmt. Network**
- In-Band

**Monitoring**
- Separated

**Change Mgmt.**
- Manual + Automatic

**Expands Infra Mgmt. Scope**

**[ Existing System ]**

**[ HMS ]**
- HW Level Info
  - Chassis/Board Info
  - BMC info
  - Inlet/Outlet Temperature
  - Power/Fan
  - PCIe device/Memory module
  - etc.

- In-Band & Out-Of-Band

- Unified

- Full Automatic

**HW Level Info**: Collecting low level H/W info like BMC F/W, Temp, Power, Fan, GPU, Memory module etc.

**Standardized Data Collection**: standardize HW information of heterogeneous systems and support next-gen protocols

**Automated Change Management**: Periodical H/W information collection enables detection of H/W changes

**OOB Management**: Out-of-Band system management enables off-line system management
Objectives

- Have an deep knowledge of data center hardware components
  - Asset Data: Memory, GPU, NIC, Raid Controller (location/form factor/asset tag/serial/manufacture ...) etc.
  - Sensor data: Inlet/outlet Temperature, Power Usage etc.

- Automated change management and asset register
  - Automatically detects any hardware and configuration changes
  - Updates asset DB only with the machine generated code to reduce human error
    - ex. Dell Power Edge R720, PE R720, Dell 720 ..., Serial Number, Mac Address

- Vendor neutral management
  - Supports both off-the-shelf system and open source hardware
  - Mapping vendor specific keys to the standardized item

- Flexible system
  - Adding new devices or components easily
  - ex) GPU, Accelerator card etc.
Automated HW Management

- Minimizes human interferences, and detects system installation and changes automatically
Architecture

Web Application Server
- Resource Analytics
- Cluster Manager
- Agent Manager
- Change Manager
- UI

Relational

Time Series

REST API

Telemetry Framework
- Compute Module
- Network Module
- Storage Module
- Rack Module
- Compute Asset
- Network Asset
- Storage Asset
- Rack Asset
- IPMI
- RedFish
- SNMP
- Open Config
- SNMP
- PCIe Stg
- PMBUS
- IPMI/Serial

Application

Common API

Processing Module

Protocol

IT Asset
Open Source SW in HMS

Application

Common API

Processing Module

Protocol

IT Asset

Web Application Server

REST API

Snap

the open telemetry framework

SNMP

PCIe Stg

PMBUS

IPMI/Serial

Compute Asset

Network Asset

Storage Asset

Rack Asset

Dashboard

Grafana

: undecided
SNAP Introduction

Snap is an open telemetry framework designed to simplify the collection, processing and publishing of system data through a single API

- REST & CLI
- Flexible Scheduling
- Plugin Lifecycle Management
- Tribe (Clustering)

Source: https://www.slideshare.net/MatthewBrender/intro-to-open-source-telemetry-linux-con-2016
A controller manages each node's configuration and plugins
A node agent sends raw data, and the aggregator process (if necessary) and publish the data to the database
The cluster controller manages the groups

A controller only sends each groups configurations and plugins to one of the nodes, and the SNAP takes care of rest of the tasks
The node's agent can collect, process and publish the data
No central group manager needed
Plugins

• Developed three collector plugins to collect unsupported hardware data and a processor plugin to process raw data
• Collecting, post-processing, and publishing all done at the agent node

Collector

- **Facter**
  - System Information
  - ~200 metrics

- **HW Component**
  - Dmidecode/lspci/smartctl
  - ~510 metrics

- **IPMI**
  - BMC, Fan, Temp, Power ...
  - ~30 metrics

- **NVIDIA SMI**
  - Temp, Fan, Power, Util. ...
  - ~30 metrics

Processor

- **Tag**
  - Tagging custom data

Publisher

- **InfluxDB**
  - For time series data

: Plugin developed
: Open source plugin
HMS – Main Page

Cluster Stats

Group List

Node List

Detailed Node Info
HMS – Group Management

- Task Management
- Plugin Management
- Node Management
### HMS – Plugin Management

#### Plugin List

<table>
<thead>
<tr>
<th>Name</th>
<th>Version</th>
<th>Type</th>
<th>File Name</th>
<th>Loaded TimeStamp</th>
<th>Update Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>factor</td>
<td>1.0</td>
<td>collector</td>
<td>share/fiu/plugin/factor</td>
<td>2017-10-11 11:16:36</td>
<td>2017-10-11 11:06:42</td>
</tr>
</tbody>
</table>
HMS – Task Management

File List

Task Editor
HMS – Change Management
Dashboard - Grafana
Dashboard - Detailed Node View

- **Hostname**: .006
- **Model**: PowerEdge R730xd
- **Processor Model**: Intel(R) Xeon(R) CPU E5-2670 v3 @ 2.30GHz
- **CPU Core**: 48
- **Memory Count**: 8
- **Disk Count**: 12
- **RAID Controller**: PERC H730P Mini
Dashboard – Detailed Node View (GPU Info)
3DV/HMS Integration Demo

hms_3dv_demo.mp4
Future Work

• Support for Multiple Rooms (Data Centers)
• NFV & MEC Integration
• Complete Next Generation Hardware Management Protocol support (RedFish, OpenConfig etc.)
• Expand Data Coverage (ex. Switch, Enterprise Storage)
• Integration with Facility Management System (FMS)
• Open sourcing developed plugins
Thank you

email: jungsoo.kim@sk.com

- SK Telecom Upcoming Talk:
  - Date: Wednesday March 21, 2018 11:00am - 11:30am
  - Venue: 210 C (EW: Storage)
  - Subject: SK Telecom: Shareable DAS Pool with All NVMe Array (Eric H. Chang)