



OCP SUMMIT

March 20-21
2018
San Jose, CA

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HW Monitoring and Management System for Telco Data Center

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Agenda

Infrastructure Revolution

Infrastructure Management in VIM & MEC

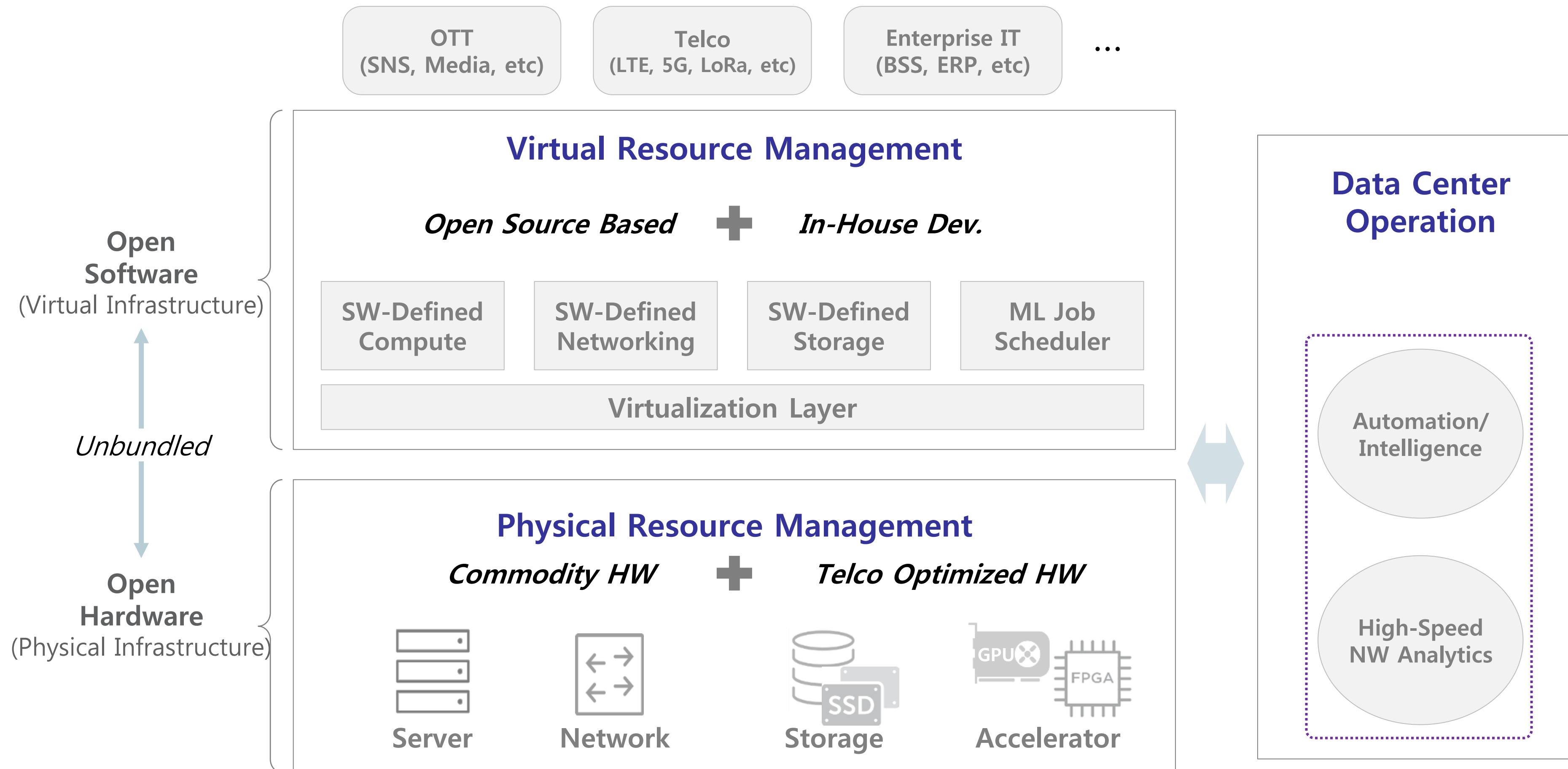
HMS Overview

- 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

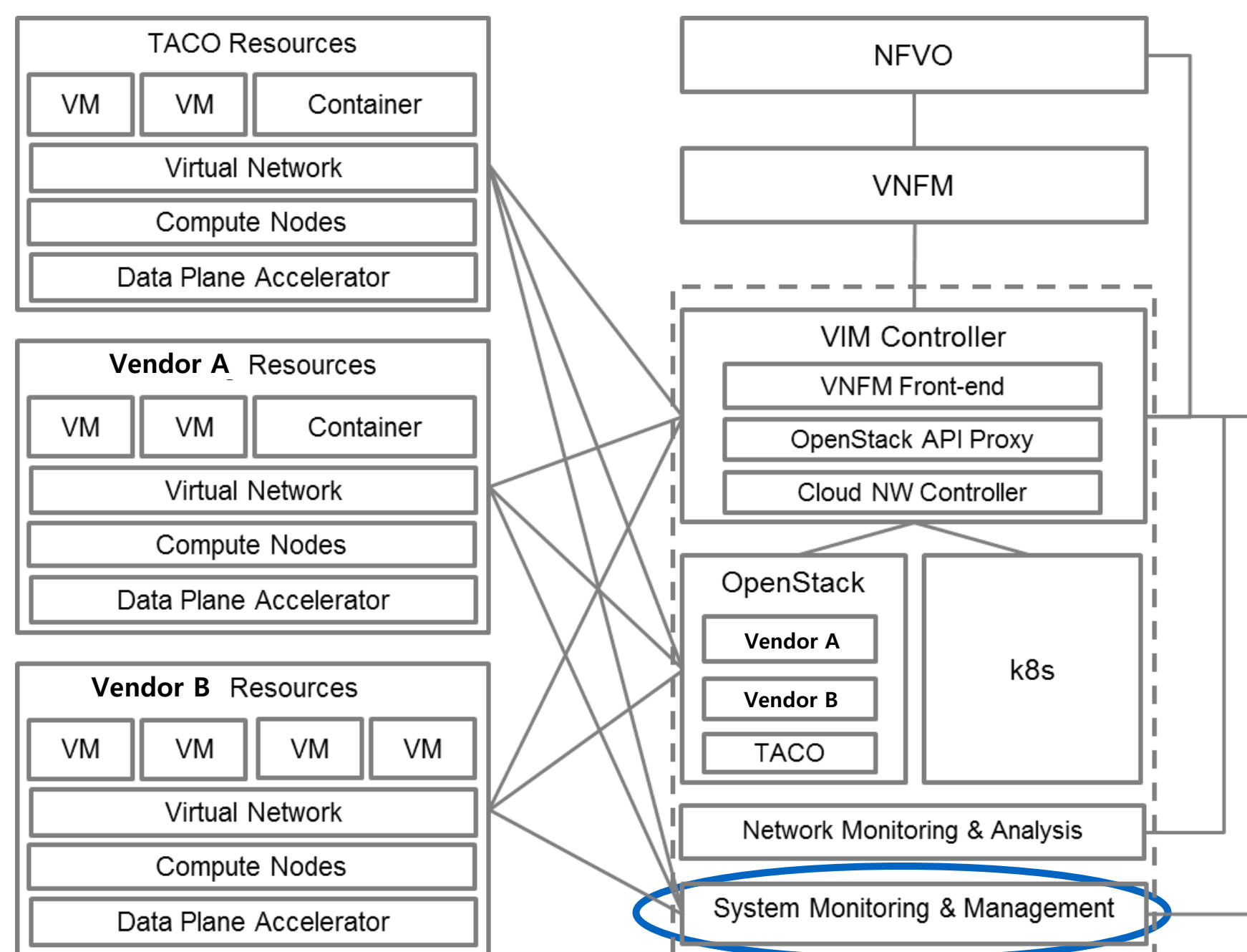


- Software-Defined Infrastructure ● Open Hardware and Software ● Universal Platform for Diverse Applications

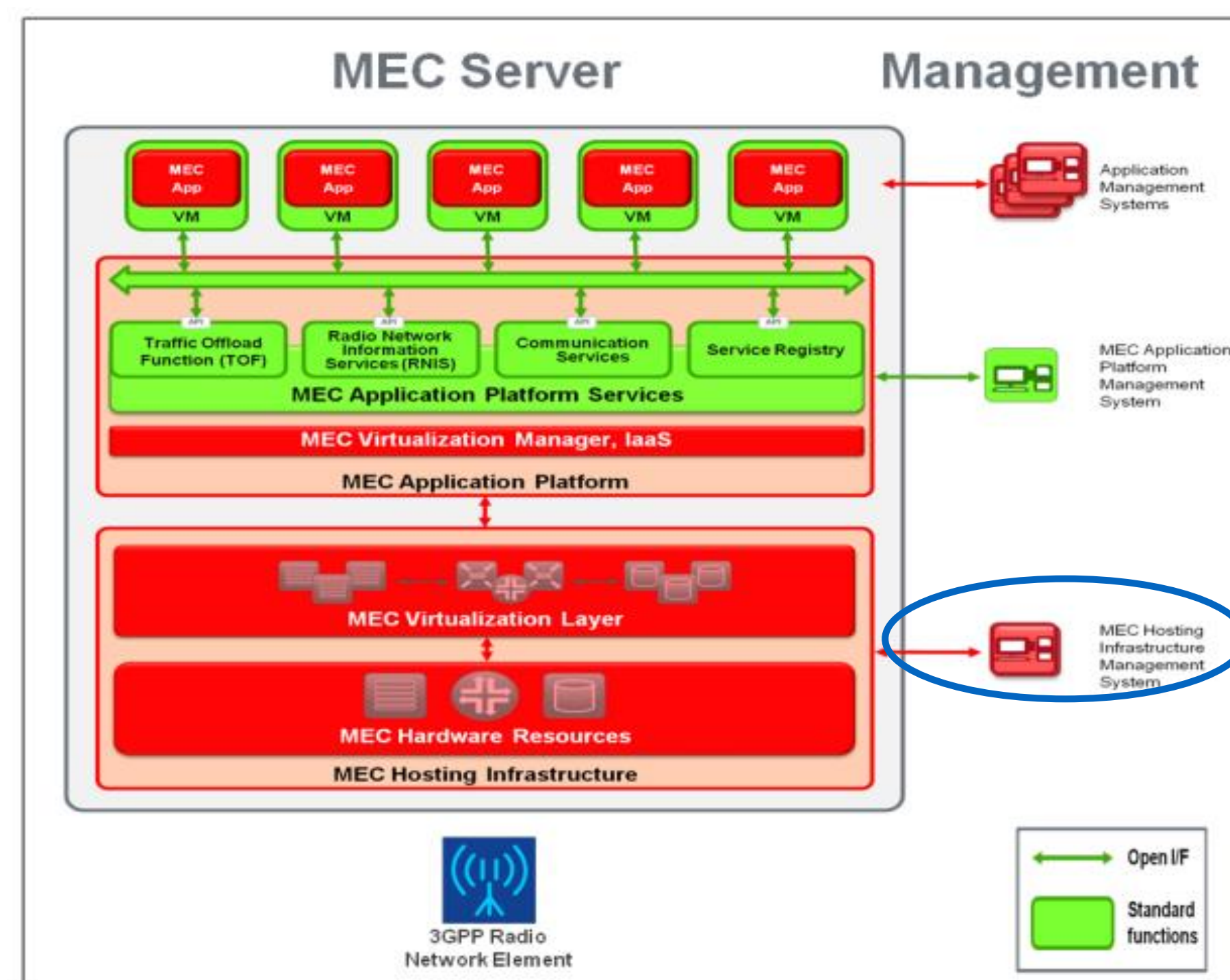
Infrastructure Management

- 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



Source: ETSI Mobile-Edge Computing Technical White Paper, 2014

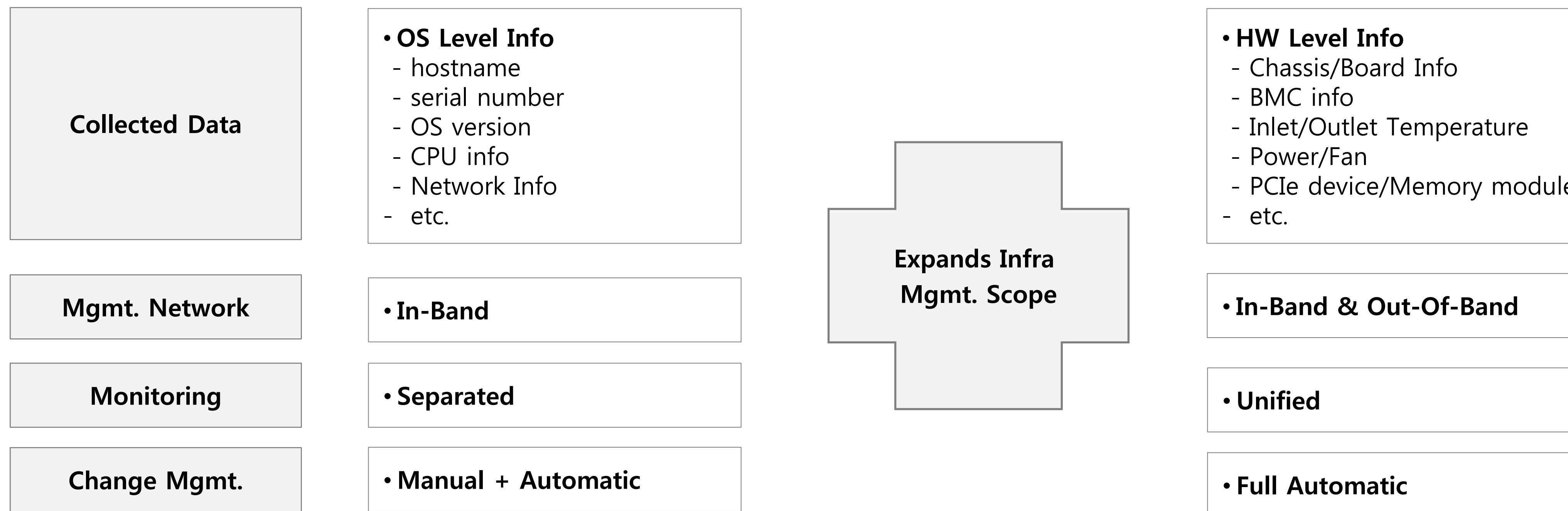
- Infrastructure Management System Requirements
 - Support physical & virtual resources
 - Vendor neutral system
 - Automation & Intelligence

 : Infrastructure Management System

Hardware Management System

【 Existing System 】

【 HMS 】



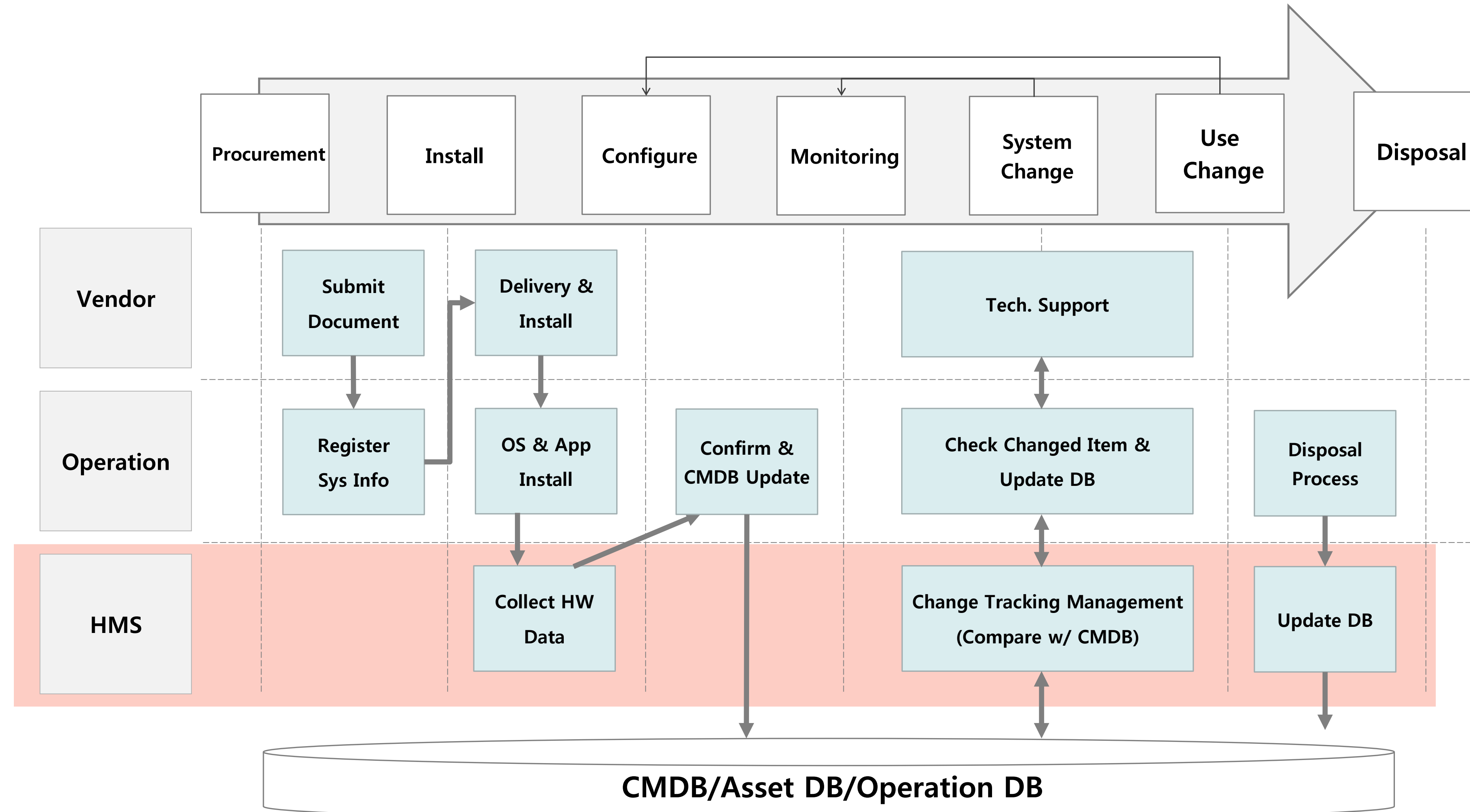
- **HW Level Info:** Collecting low level H/W info like BMC F/W, Temp, Power, Fan, GPU, Memory module etc.
- **Standardized Data Collection:** standardize HW information of heterogeneous systems and support next-gen protocols
- **Automated Change Management:** Periodical H/W information collection enables detection of H/W changes
- **OOB Management:** Out-of-Band system management enables off-line system management

Objectives

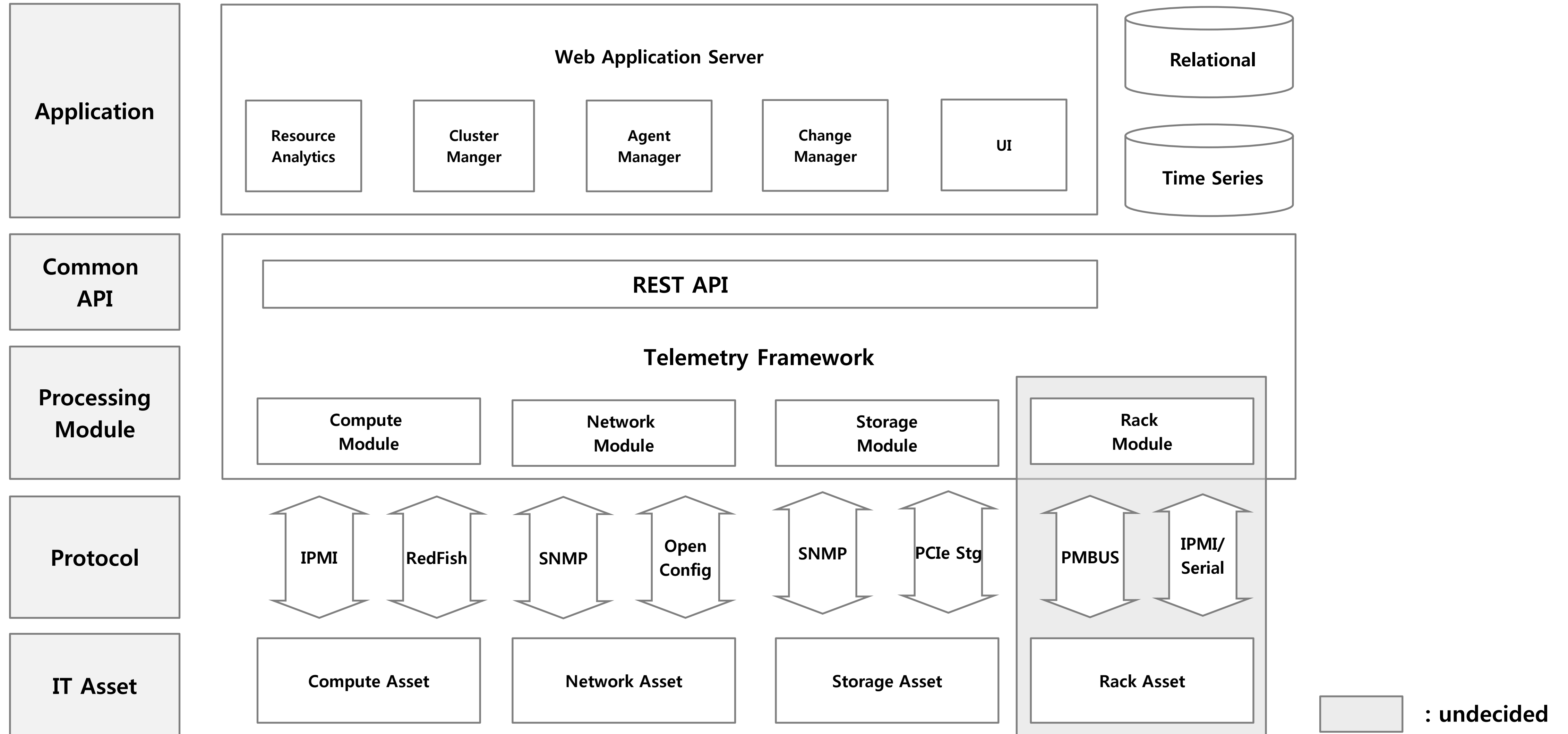
- **Have an deep knowledge of data center hardware components**
 - Asset Data: Memory, GPU, NIC, Raid Controller (location/form factor/asset tag/serial/manufacture ...) etc.
 - Sensor data : Inlet/outlet Temperature, Power Usage etc.
- **Automated change management and asset register**
 - Automatically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

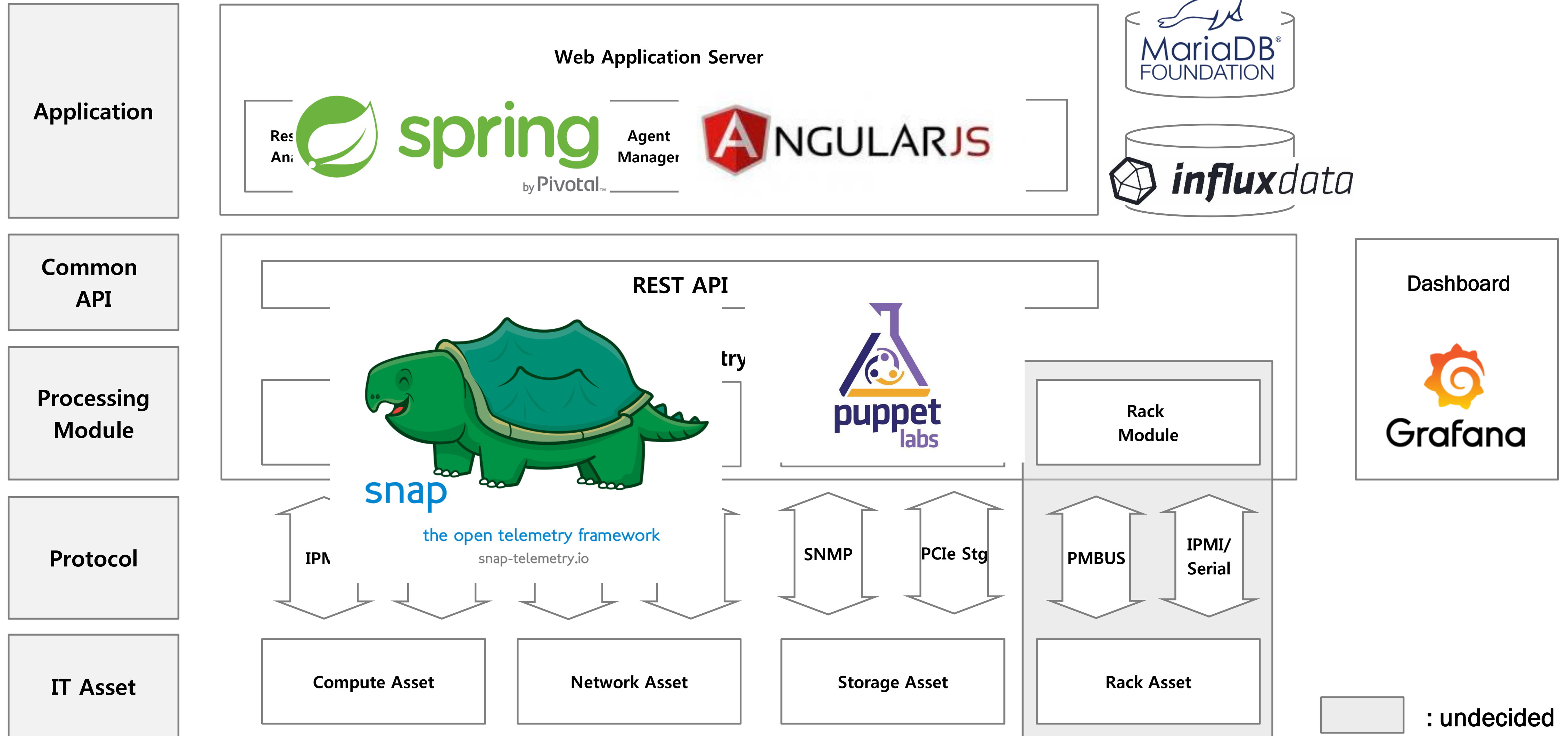
- Minimizes human interferences, and detects system installation and changes automatically



Architecture



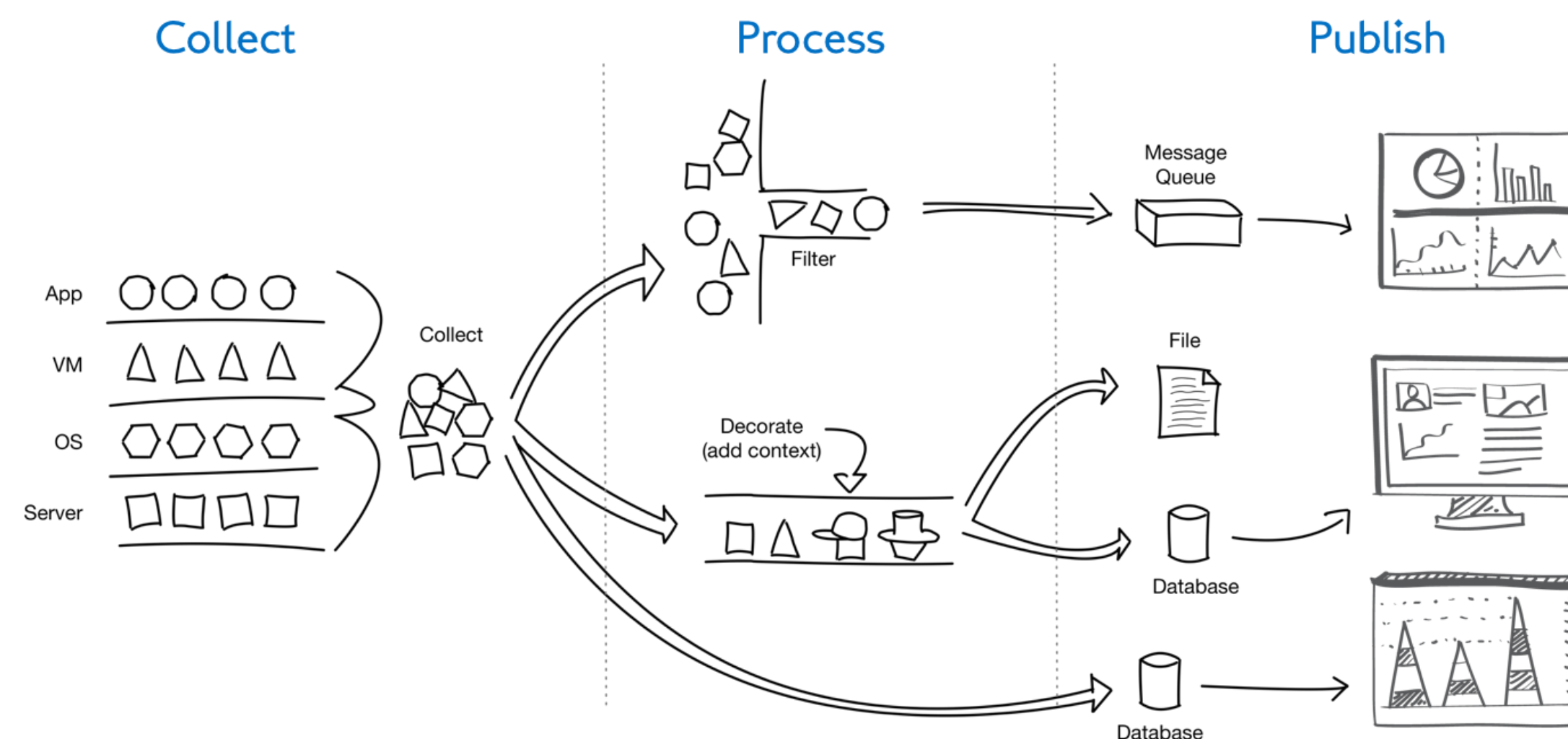
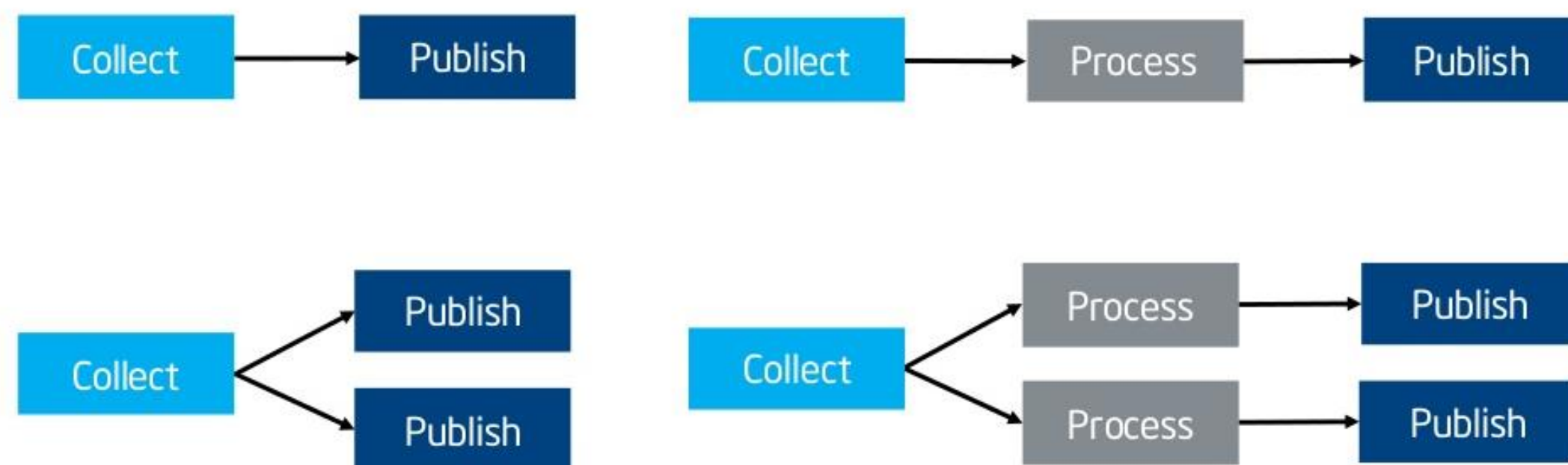
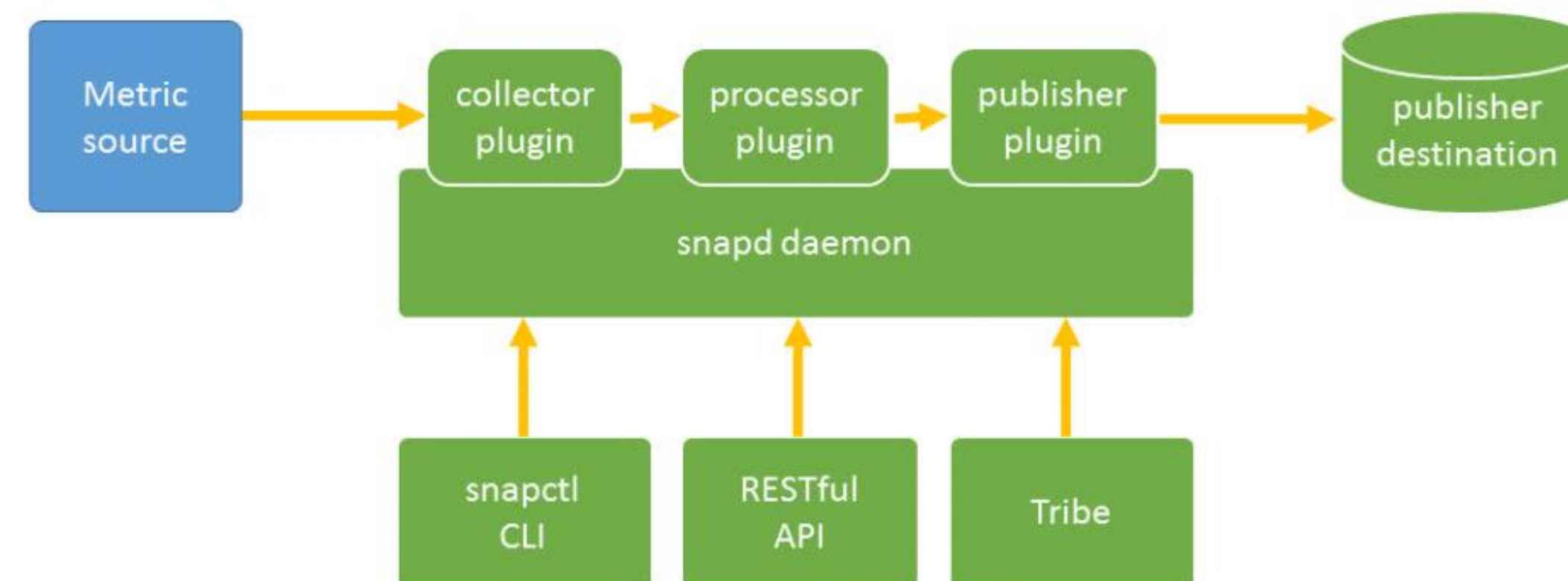
Open Source SW in HMS



SNAP Introduction

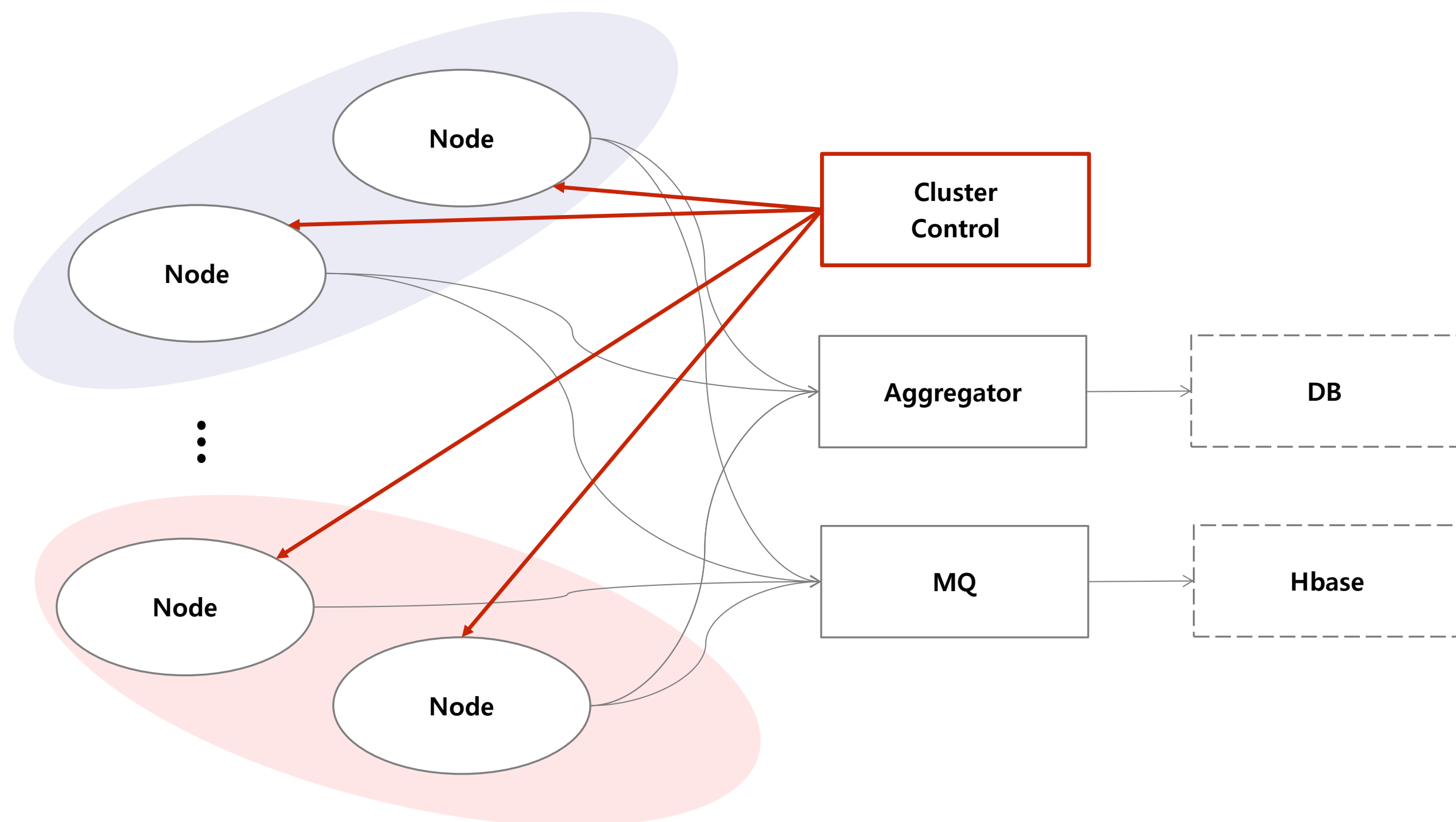
Snap is an open telemetry framework designed to simplify the collection, processing and publishing of system data through a single API

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



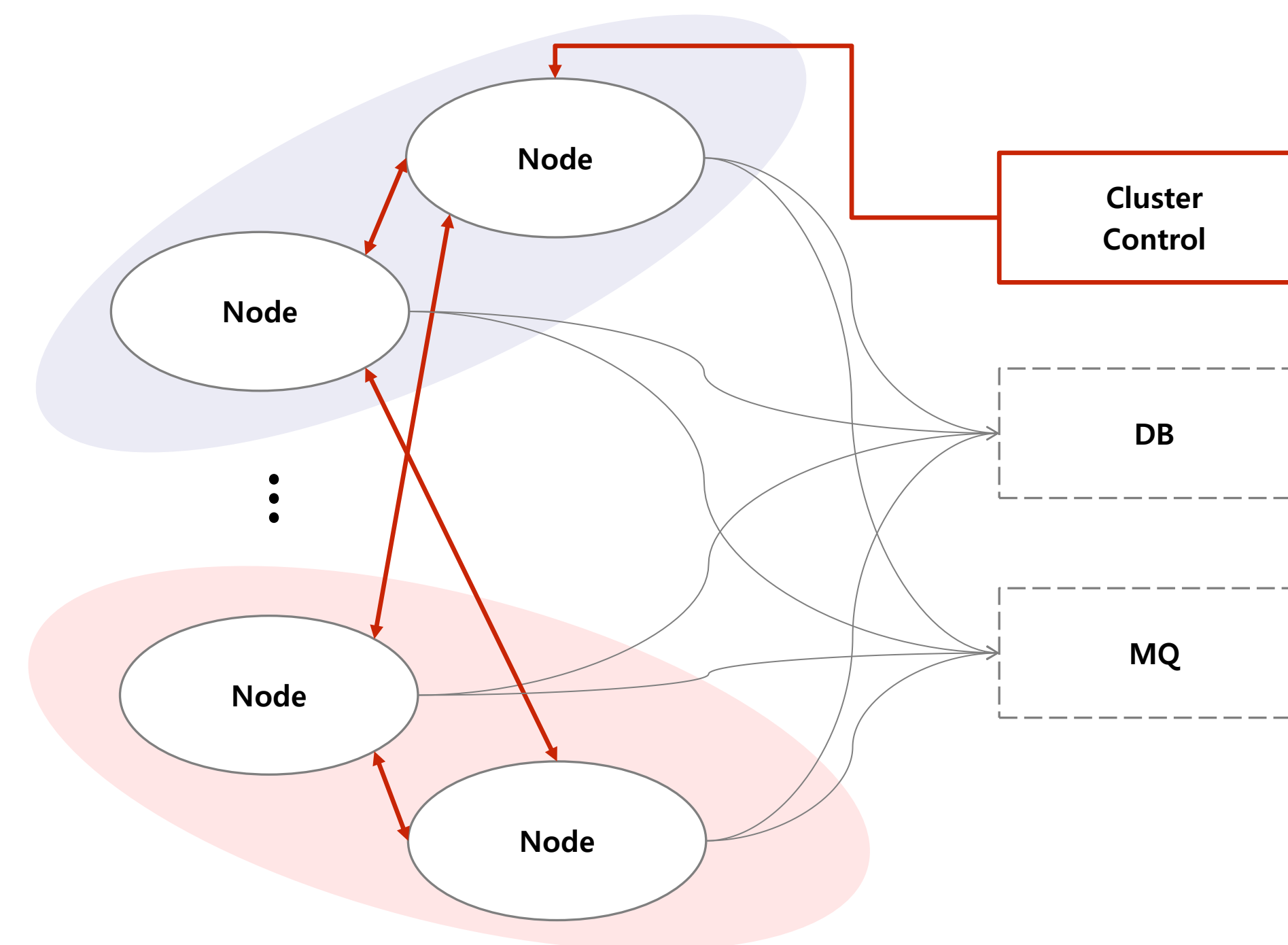
Centralized vs. Distributed

Legacy



- 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

SNAP



- 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 manger needed

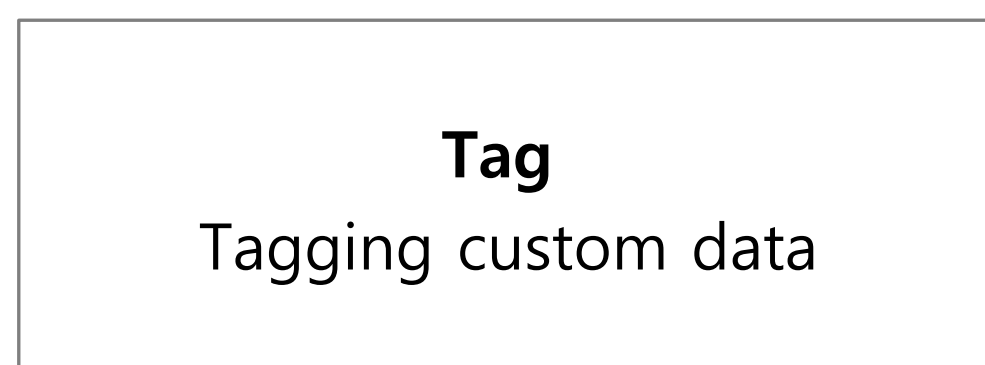
Plugins

- 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



Processor



Publisher



: Plugin developed



: Open source plugin

HMS - Main Page

Node Count			Agent Status		Last Update	Change Status	
Total (HMS / CMDB)	Physical Machine	Virtual Machine	Normal	Abnormal	2018/03/06 19:42:44	Total	Changes
130 / 0	128	2	125	5		130	0

Cluster Stats

Search for...

Group	Type	Host Name	IP	Model	CPU Model	CPU Count	Memory	Disk	OS Name	OS Ver
No Group	PM			PowerEdge R730	Intel(R) Xeon(R) CPU E5-2670 v3 @ 2.30GHz	48	125.64G	11458G	CentOS	7
No Group	PM			PowerEdge R730	Intel(R) Xeon(R) CPU E5-2670 v3 @ 2.30GHz	48	125.64G	11458G	CentOS	7
No Group	PM			PowerEdge R730	Intel(R) Xeon(R) CPU E5-2670 v3 @ 2.30GHz	48	125.64G	11458G	CentOS	7
No Group	PM			PowerEdge R730	Intel(R) Xeon(R) CPU E5-2670 v3 @ 2.30GHz	48	125.64G	11458G	CentOS	7
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No Group	PM			PowerEdge R730	Intel(R) Xeon(R) CPU E5-2670 v3 @ 2.30GHz	48	125.64G	11458G	CentOS	7
No Group	PM			PowerEdge R730	Intel(R) Xeon(R) CPU E5-2670 v3 @ 2.30GHz	48	125.64G	11458G	CentOS	7

Total : 130

Group List

Node List

Node info detail

Main Category	Sub Category	Name	Value
All	All	/dmidecode/memory/locator/6	B3
		/dmidecode/memory/locator/7	B4
		/dmidecode/memory/manufacture/0	002C00B3002C
		/dmidecode/memory/manufacture/1	002C00B3002C
		/dmidecode/memory/manufacture/2	002C00B3002C
		/dmidecode/memory/manufacture/3	002C00B3002C
		/dmidecode/memory/manufacture/4	002C00B3002C
		/dmidecode/memory/manufacture/5	002C00B3002C
		/dmidecode/memory/manufacture/6	002C00B3002C
		/dmidecode/memory/manufacture/7	002C00B3002C
		/dmidecode/memory/memory_count	8.0
		/dmidecode/memory/part_number/0	36ASF2G72PZ-2G1A2
		/dmidecode/memory/part_number/1	36ASF2G72PZ-2G1A2
		/dmidecode/memory/part_number/2	36ASF2G72PZ-2G1A2
		/dmidecode/memory/part_number/3	36ASF2G72PZ-2G1A2
		/dmidecode/memory/part_number/4	36ASF2G72PZ-2G1A2
		/dmidecode/memory/part_number/5	36ASF2G72PZ-2G1A2
		/dmidecode/memory/part_number/6	36ASF2G72PZ-2G1A2
		/dmidecode/memory/part_number/7	36ASF2G72PZ-2G1A2
		/dmidecode/memory/serial_number/0	0FFA765C
		/dmidecode/memory/serial_number/1	0FFA7559

Apply Close

Detailed Node Info

HMS – Group Management

SK telecom HMS Hardware Management System

Group Management Plugin Management Task Management Agent Status Change Management

No Group mlinfra operation testinfra

Task Update + Create - Remove ✕

<input type="checkbox"/>	Action	Group	ID	Name	Deadline	Creation timestamp	Last run timestamp	Hit count	Task state	
<input type="checkbox"/>	Stop	operation	6bb1f246-8ffd-415c-9241-cc12a2996e73	TIDC MLinfra VM facter tagskt influx	10s	2017/11/21 23:53:05	2018/03/14 03:53:10	2,693	Running	http://
<input type="checkbox"/>	Stop	operation	14c4869b-a3a6-4bd1-94a4-958b6e0c96c4	TIDC MLinfra VM facter tagskt influx	10s	2017/11/22 00:08:22	2018/03/14 04:08:29	2,693	Running	http://

Plugin Selected type Collector Processor Publisher Update + Load - Unload ✕

<input type="checkbox"/>	Group	Name	Version	Type	Signed	Status	Loaded timestamp	Href
<input type="checkbox"/>	operation	influxdb	22	publisher	0	loaded	2017/11/21 23:52:55	http://172.27.109.63:8181/v1/plugins/publisher/influxdb/22
<input type="checkbox"/>	operation	tag-skt	1	processor	0	loaded	2017/11/21 23:52:55	http://172.27.109.63:8181/v1/plugins/processor/tag-skt/1
<input type="checkbox"/>	operation	facter	10	collector	0	loaded	2017/11/21 23:51:40	http://172.27.109.63:8181/v1/plugins/collector/facter/10

Node Update + Include - Exclude ✕

Search for...

<input type="checkbox"/>	Action	Group	Host Name	Serial Number	IP	CPU Count	CPU Model	Memory	Disk	Type	OS Name	OS
<input type="checkbox"/>	Info	operation		VMware-42 39 a6 ...	172.27.109.63	8	Intel(R) Xeon(R) CPU E5-2630 v4 @ 2.20GHz	15.50G	551G	VM	CentOS	
<input type="checkbox"/>	Info	operation		VMware-42 39 0e ...	172.27.109.64	8	Intel(R) Xeon(R) CPU E5-2630 v4 @ 2.20GHz	15.50G	551G	VM	CentOS	

Total :2

Group Create Group Delete Trash Bin

Task Management

Plugin Management

Node Management

HMS – Plugin Management

SK telecom HMS Hardware Management System

Group Management Plugin Management Task Management Agent Status Change Management

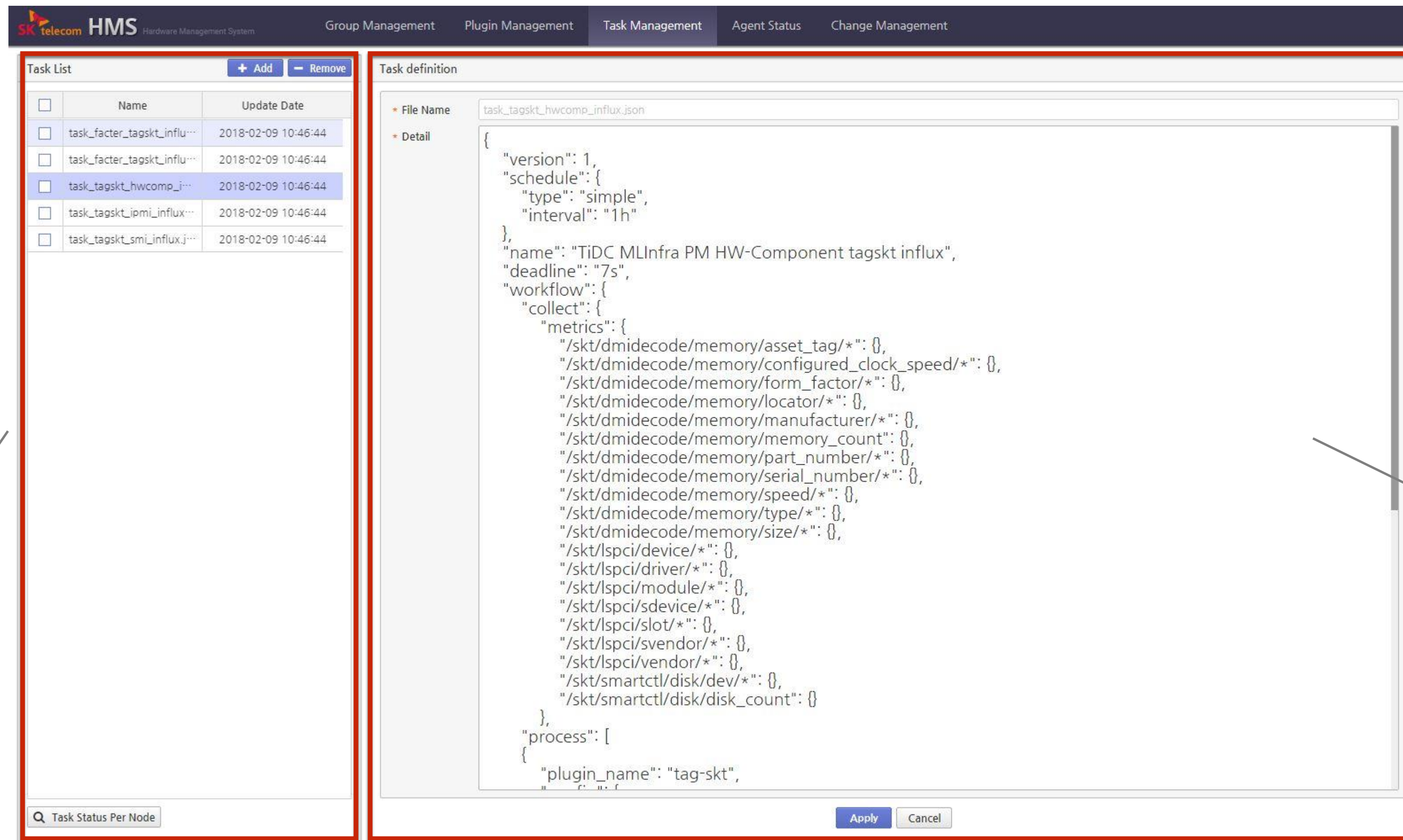
Plugin List Update + Add - Remove

Selected type Collector Processor Publisher Name Search Reset

<input type="checkbox"/>	Load	Name	Version	Type	File Name	Loaded timestamp	Update Date
<input type="checkbox"/>	Load	facter	10	collector	snap-plugin-collector-facter	2017-10-11 11:10:38	2017-10-11 11:04:42
<input type="checkbox"/>	Load	skt-nvidia-smi	2	collector	snap-plugin-collector-skt-smi	2017-11-29 15:37:03	2017-11-29 15:36:48
<input type="checkbox"/>	Load	skt-ipmitool	2	collector	snap-plugin-collector-skt-ipmi	2017-11-29 15:37:09	2017-11-29 15:36:58
<input type="checkbox"/>	Load	skt-hw-component	2	collector	snap-plugin-collector-skt-hwinfo	2017-11-30 16:13:07	2017-11-30 16:13:01
<input type="checkbox"/>	Load	tag-skt	1	processor	snap-plugin-processor-tag-skt	2017-10-11 11:10:43	2017-10-11 11:04:42
<input type="checkbox"/>	Load	influxdb	22	publisher	snap-plugin-publisher-influxdb_linux_...	2017-10-11 11:10:31	2017-10-11 11:04:42

Plugin List

HMS – Task Management



The screenshot shows the HMS (Hardware Management System) interface. The top navigation bar includes "Group Management", "Plugin Management", "Task Management", "Agent Status", and "Change Management". The main content area is divided into two panels:

- Task List:** A table with columns "Name" and "Update Date". It contains six entries, with the third one selected. The selected entry is "task_tagskt_hwcomp_influ..." with an update date of "2018-02-09 10:46:44".
- Task definition:** A text editor showing the JSON configuration for the selected task. The file name is "task_tagskt_hwcomp_influx.json". The JSON content is as follows:

```
{
  "version": 1,
  "schedule": {
    "type": "simple",
    "interval": "1h"
  },
  "name": "TiDC MLInfra PM HW-Component tagskt influx",
  "deadline": "7s",
  "workflow": {
    "collect": {
      "metrics": {
        "/skt/dmidecode/memory/asset_tag/*": {},
        "/skt/dmidecode/memory/configured_clock_speed/*": {},
        "/skt/dmidecode/memory/form_factor/*": {},
        "/skt/dmidecode/memory/locator/*": {},
        "/skt/dmidecode/memory/manufacture/*": {},
        "/skt/dmidecode/memory/memory_count/*": {},
        "/skt/dmidecode/memory/part_number/*": {},
        "/skt/dmidecode/memory/serial_number/*": {},
        "/skt/dmidecode/memory/speed/*": {},
        "/skt/dmidecode/memory/type/*": {},
        "/skt/dmidecode/memory/size/*": {},
        "/skt/lspci/device/*": {},
        "/skt/lspci/driver/*": {},
        "/skt/lspci/module/*": {},
        "/skt/lspci/sdevice/*": {},
        "/skt/lspci/slot/*": {},
        "/skt/lspci/svendor/*": {},
        "/skt/lspci/vendor/*": {},
        "/skt/smartctl/disk/dev/*": {},
        "/skt/smartctl/disk/disk_count/*": {}
      }
    }
  },
  "process": [
    {
      "plugin_name": "tag-skt",
      "..."
    }
  ]
}
```

At the bottom of the Task List panel, there is a search bar labeled "Task Status Per Node". At the bottom of the Task definition panel, there are "Apply" and "Cancel" buttons.

File List

Task Editor

HMS – Change Management

SK telecom HMS Hardware Management System

Group Management Plugin Management Task Management Agent Status Change Management

Change Management List Update

Search for...

Change history

Change time: 2018-03-06 00:00:00 ~ 2018-03-13 00:00:00 Search Reset

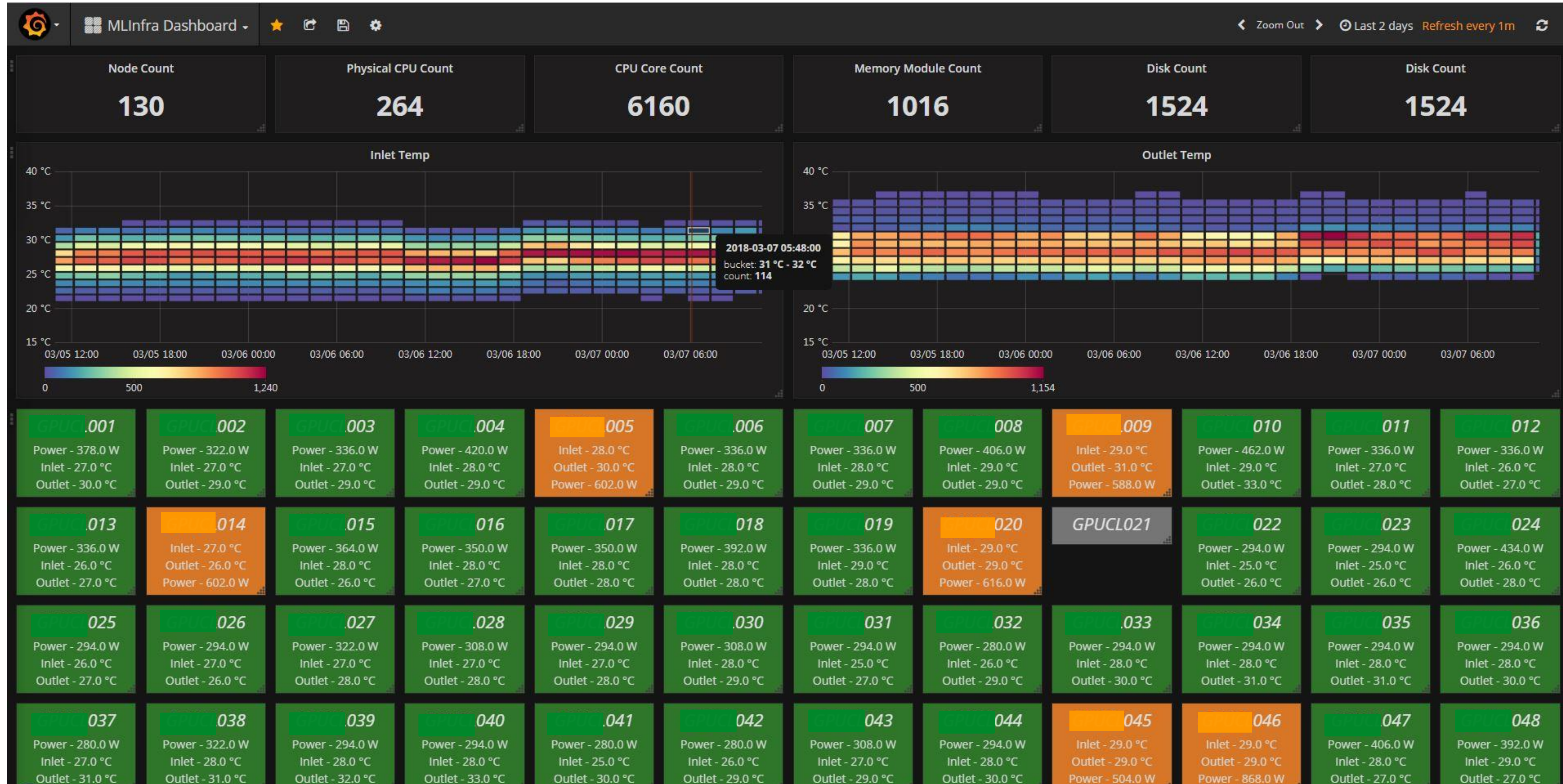
Data Time	Name	Value	Old Value
2018-03-02 10:02:34	/factor/networking/interfaces/vethfc908ca/bindings6/...	fe80::9034:f4ff:fe91:e994	
2018-02-28 11:04:17	/factor/networking/interfaces/vethfc908ca/bindings6/...	ffff:ffff:ffff:ffff::	
2018-02-23 18:04:17	/factor/networking/interfaces/vethfc908ca/bindings6/...	fe80::	
2018-02-23 17:04:17	/factor/networking/interfaces/vethfc908ca/ip6	fe80::9034:f4ff:fe91:e994	
2018-02-23 09:04:17	/factor/networking/interfaces/vethfc908ca/mac	92:34:f4:91:e9:94	
2018-02-23 08:04:17	/factor/networking/interfaces/vethfc908ca/mtu	1500.0	
2018-02-13 18:04:17	/factor/networking/interfaces/vethfc908ca/netmask6	ffff:ffff:ffff:ffff::	
2018-02-13 15:04:17	/factor/networking/interfaces/vethfc908ca/network6	fe80::	
2018-02-08 16:04:17	/factor/networking/interfaces/vethwepl193759/bindin...	fe80::8c3:77ff:fec0:b756	
2018-02-08 14:04:17	/factor/networking/interfaces/vethwepl193759/bindin...	ffff:ffff:ffff:ffff::	
2018-02-08 12:04:17	/factor/networking/interfaces/vethwepl193759/bindin...	fe80::	
2018-02-08 07:04:17	/factor/networking/interfaces/vethwepl193759/ip6	fe80::8c3:77ff:fec0:b756	
2018-02-07 16:04:17	/factor/networking/interfaces/vethwepl193759/mac	0a:c3:77:c0:b7:56	
2018-02-07 09:02:33	/factor/networking/interfaces/vethwepl193759/mtu	1376.0	
2018-02-06 20:04:17	/factor/networking/interfaces/vethwepl193759/netm...	ffff:ffff:ffff:ffff::	
2018-02-06 16:04:17	/factor/networking/interfaces/vethwepl193759/netw...	fe80::	

Close

Time	OS Name	OS Version
2018-03-02 10:02:34	CentOS	7.3
2018-02-23 18:30:25	CentOS	7.3
2018-02-23 18:03:54	CentOS	7.3
2018-02-23 18:03:37	CentOS	7.3
2018-02-23 18:03:27	CentOS	7.3
2018-02-23 18:03:04	CentOS	7.3
2018-02-23 18:02:46	CentOS	7.3
2018-02-23 18:02:19	CentOS	7.3
2018-02-22 13:00:31	CentOS	7.3
2018-02-12 11:05:25	CentOS	7.3
2018-02-12 10:51:15	CentOS	7.3
2018-02-07 17:01:57	CentOS	7.3
2018-02-07 17:01:34	CentOS	7.3
2018-01-29 15:00:40	CentOS	7.3
2018-01-23 17:40:58	CentOS	7.3
2018-01-04 13:06:55	CentOS	7.3
2017-12-21 12:08:07	CentOS	7.3
2017-12-21 12:04:53	CentOS	7.3
2017-12-19 09:40:34	CentOS	7.3
2017-12-08 17:11:14	CentOS	7.3
2017-12-08 17:08:02	CentOS	7.3
2017-12-08 17:07:38	CentOS	7.3
2017-12-08 16:53:46	CentOS	7.3

Change History

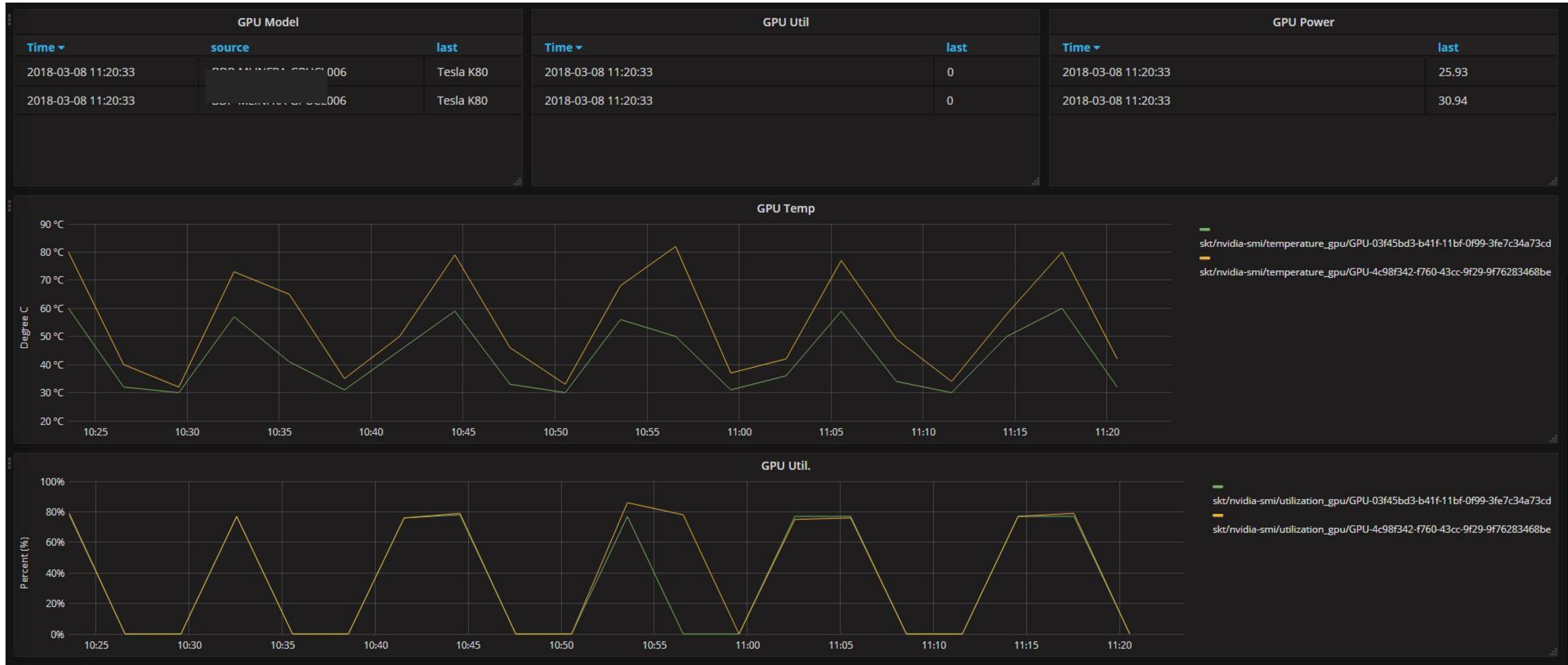
Dashboard - Grafana



Dashboard - Detailed Node View



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)



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