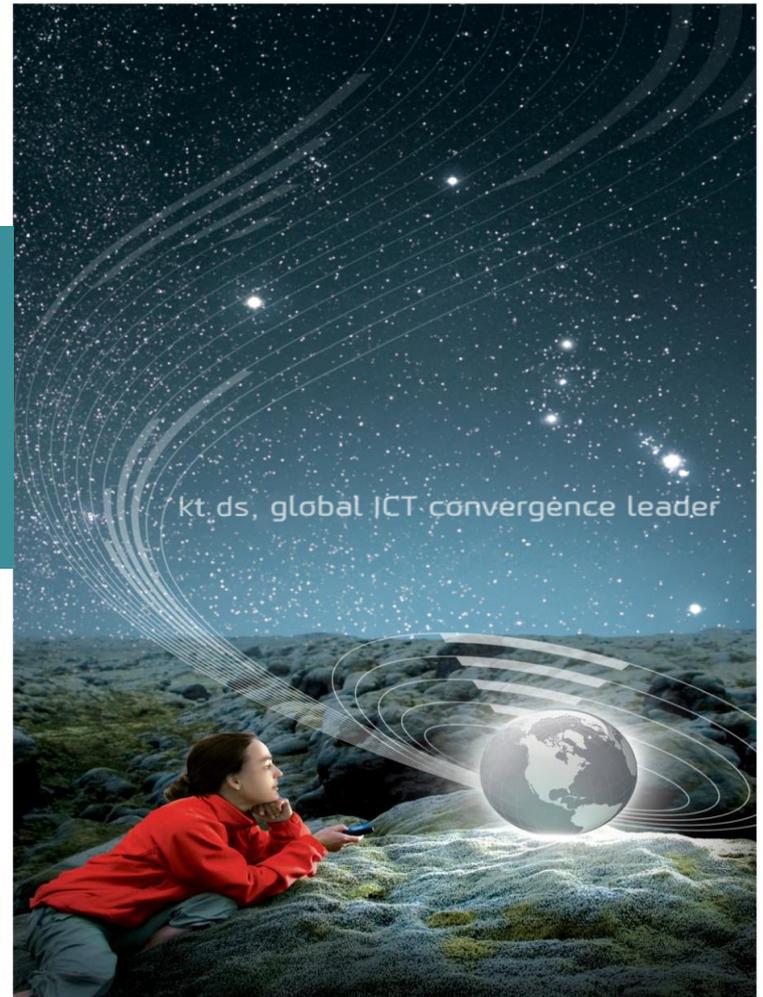




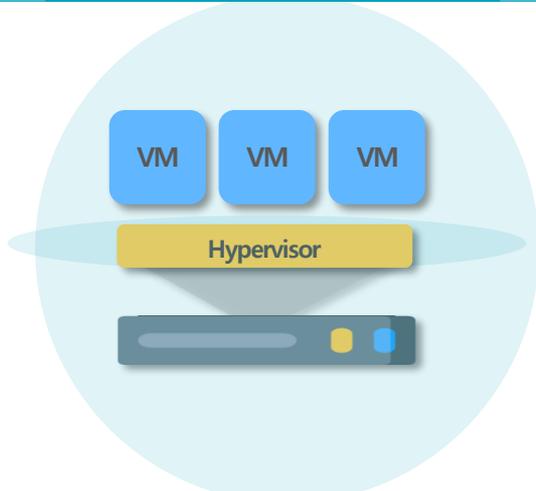
An Example of Establishment of Open Source-based Next Generation Integrated Control System

November 2021



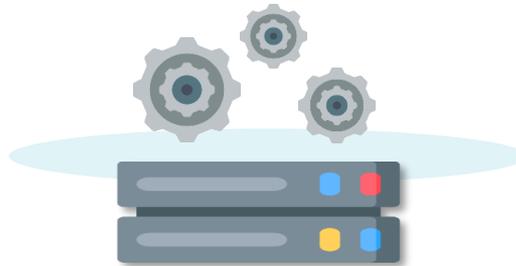
1 Current IT Infra Environment

Virtualization



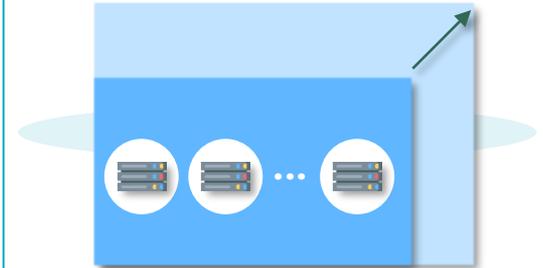
- Creating many virtual machines from one physical machine
- Changing from physical server unit to application unit

Containerization



- Distribution of many applications from one virtual machine
- Independent execution environment
- Micro service architecture

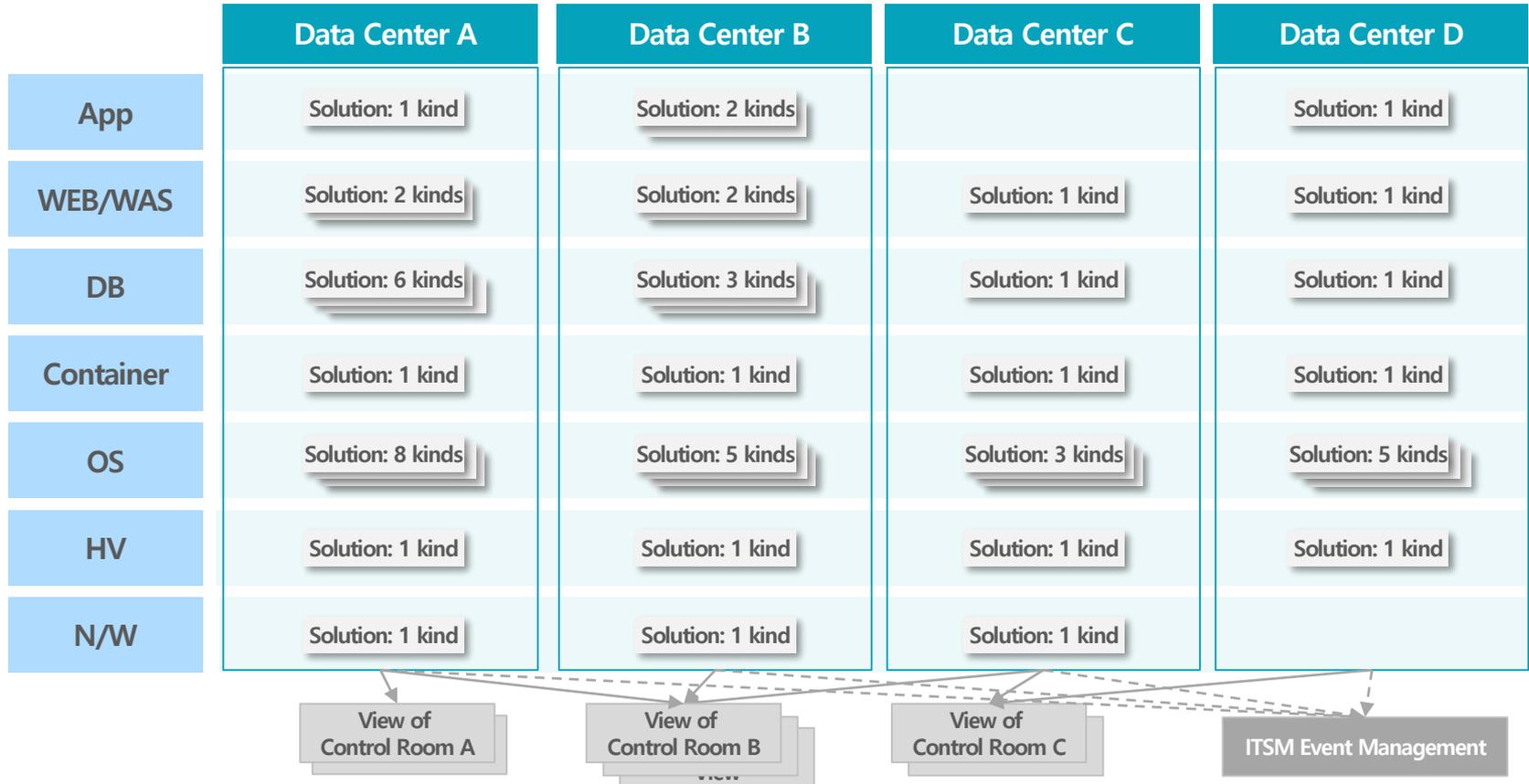
Automation



- Automatic adjustment of resource size
- Flexible response to variable demand

2

As-Was Monitoring



3

Background of Promotion

To make improvements with a unified **integrated control system** in order to resolve the issue of Silo control of each area

AS-WAS

Process

- **Individual control** of each center, service and domain
(Occurrence of control Silo of each area)

Tool

- **Different Control** solution for **each Infra Area**
 - Occurrence of different events in different tools More than 600 kinds in total
 - Introduction of paid commercial control solution
- Complexity High cost Different technical support

View

- **Absence of view of control governance**
- Impossible to manage detailed control activities For view only
- Impossible to check service configuration for control

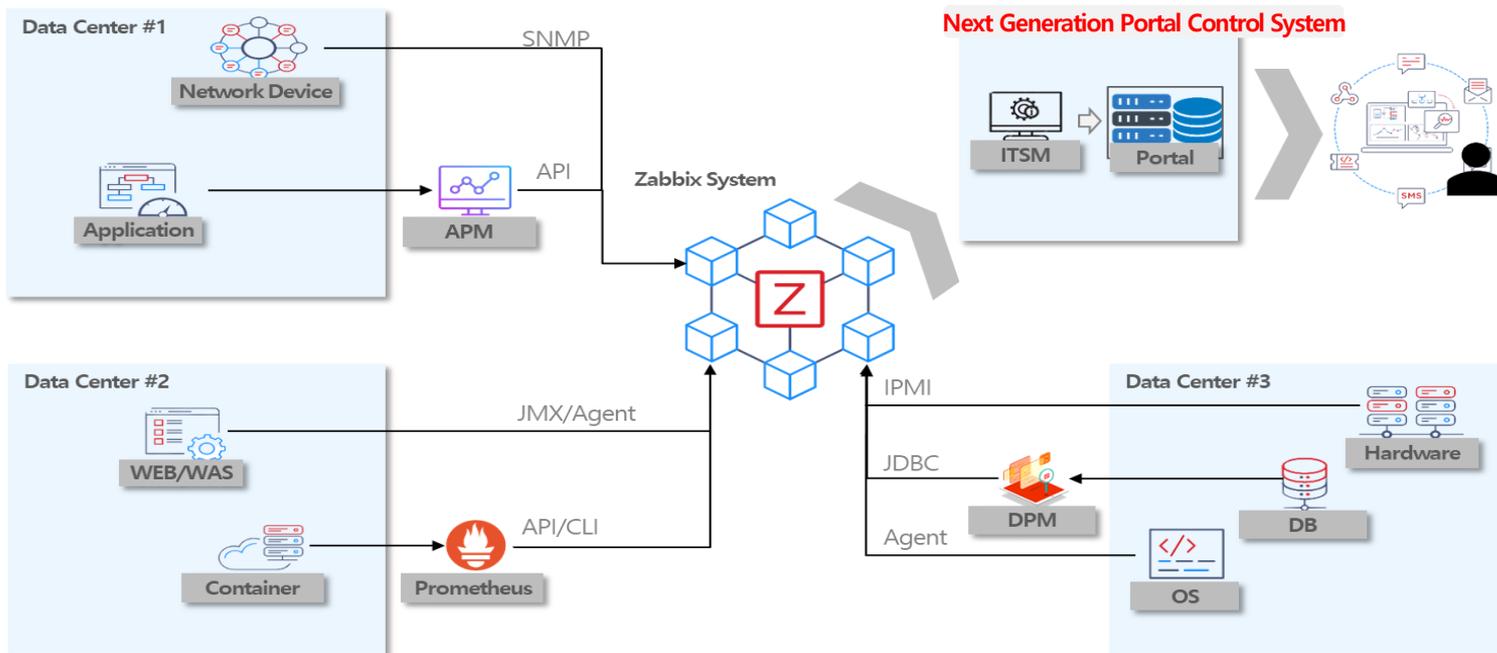
AS-IS

- **Preparation of a unified control system** to resolve Silo of each area

- **Introduction of standard IT Infra solution**
- Refining and standardizing entire IT events
- Using open source-based control solution

- **View of control governance**
- Possible to manage control situation and control specific activities
- Can secure topology-based service readability

4 Target System



1 Establish open source control solution
(Select and establish an open source control solution optimal for realization of integrated control)

2 Develop control portal system
(Design of information structure, control of user manual, arrangement of function, etc. optimized for control service)

3 Standardize control policy
(Essential enterprise control items and failure condition, etc.)

4 Win Back and integrate the existing control solution
(Changing and integrating the existing control solution into open source)

5

Considerations for Selection of Open Source SW



A solution necessary for actual operation

- Develop actually needed function through interview with hands-on staff.



Improving convenience in open source

- Improve user convenience by developing plug-in and module.



Support for viewpoint of various users

- Provide an environment that can be used by various users including control OP, operator, administrator, etc.



6 Zabbix

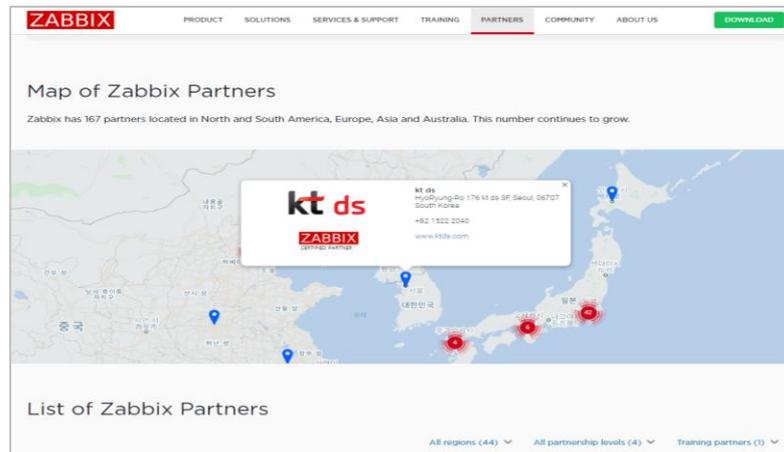
Zabbix is an open source-based system monitoring solution being used the most widely in the world.

Developed in 2001, it is being used the most widely in the world.

Throughout the world, Zabbix has concluded partnerships with **more than 246 partners**.



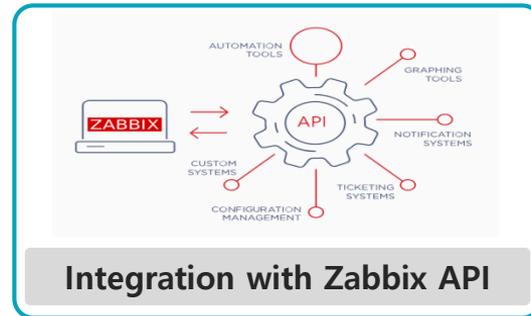
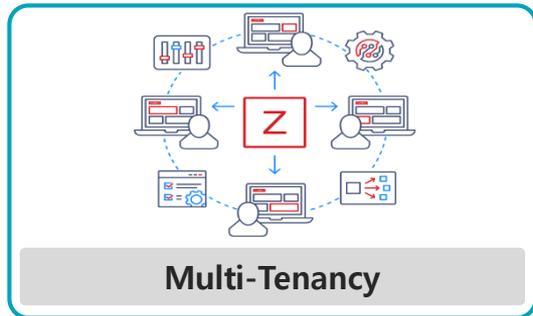
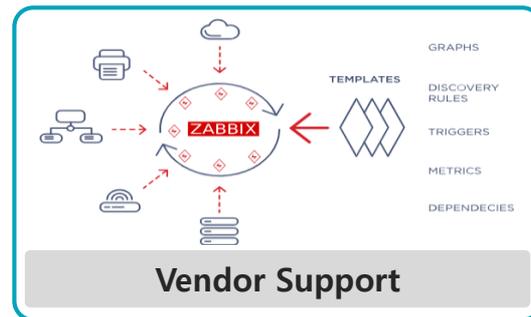
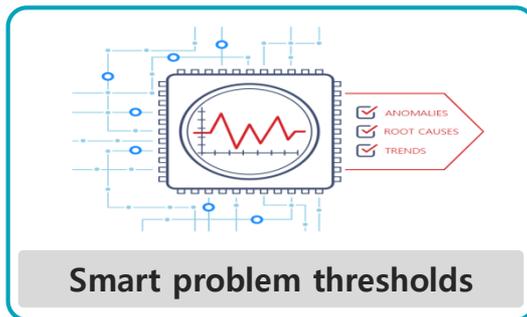
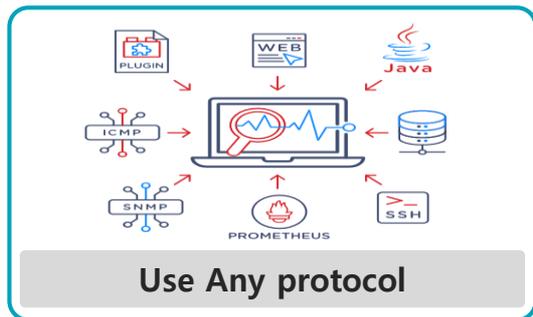
- An open source SW monitoring solution equipped with the best function in the world



- Can perform large-scale monitoring based on exceptional performance.
- 100% open source not charging licensing fees

7 Major Functions of Zabbix

Zabbix offers major functions to realize integrated control.



8

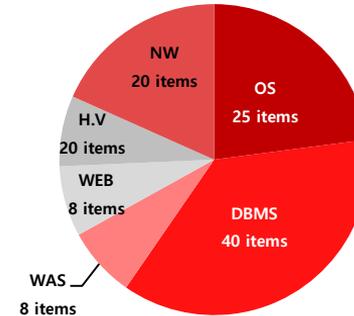
Standardization of Control Policy

Setting up standard control items_(121 items) and developing control items_(63 items)

Control template development target S/W

Area	S/W	Version
OS (8 kinds)	CentOS	6, 7
	Suse	10, 11, 12
	Ubuntu	4.4.0
	HPUX	11.11, 11.23, 11.31
	Solaris	8, 9, 10, 11
	IBM AIX	5.1, 5.2, 5.3, 6.1
	Windows	2008, 2012, 2016, 2019
	Oracle	11g, 12c
DBMS (9 kinds)	Postgres	9, 10.10, 11.1, 11.6, 11.7, 12
	MSSQL	2012, 2014, 2016, 2017, 2019
	MYSQL	5.5.13, 5.6.36, 5.6.39, 5.7
	MariaDB	10.3, 10.4
	Tibero	5, 6
	MongoDB	3.6, 4, 4.2, 4.4
	Redis	5
	Altibase	4,5
	JEUS	5, 6, 7, 8
WAS (4 kinds)	WebLogic	10g, 11g
	Jboss/Wildfly	6, 7, 8, 9
	Tomcat	8.0, 8.5, 9

Standard Infra control items in each area

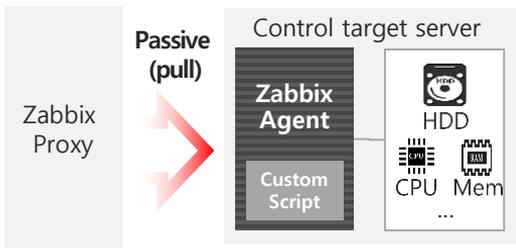


Area	S/W	Version
WEB (5 kinds)	iPlanet	6
	WebtoB	8.1, 9.2, 10.2, 11.2, 12.1
	Apache	2, 2.2, 2.4
	NginX	1.10.1, 1.11.6, 1.14.2
	WebToB	4.1, 5
Hypervisor	VMWare ESXi	6, 6.5, 6.7

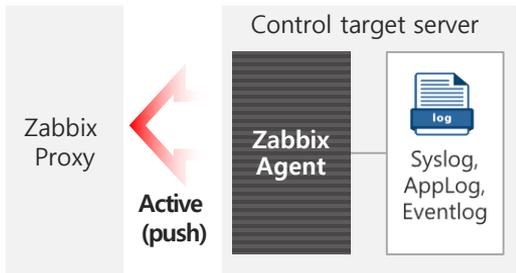
9 Monitoring Integration Plan

Server monitoring

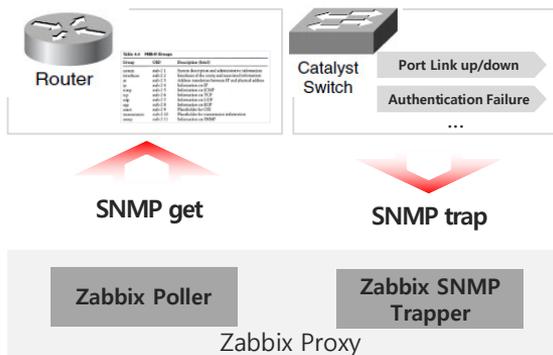
1 Collect performance and configuration information



2 Collect log information



Network equipment monitoring



SNMP get

- Inquire MIB (Management Information Base) information through SNMP
- Acquire performance information by parsing the OID value defined in MIB

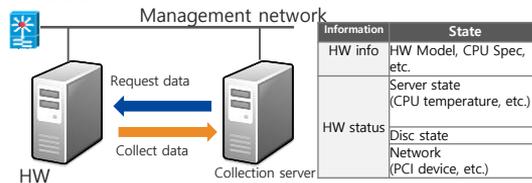
SNMP trap

- Collect event information through SNMP Trap when the status event set in the equipment occurs

Collection of HW control items

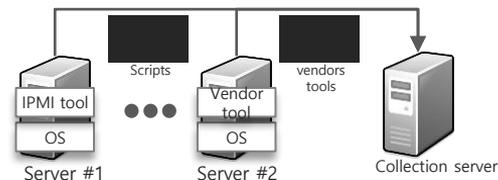
1 Collect data through IPMI

- Collect the information and condition of the HW, etc through the HW IPMI port, etc connected to the internal management network



2 Collect data using IPMI tool

- Collect data using the tools related to operation system HW (ipmitool)
- Collect data by installing a package provided by HW vendor company.



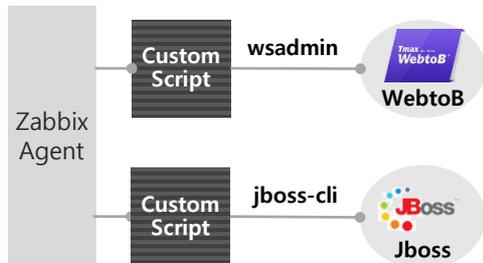
10 Monitoring Integration Plan

Well-Known SW collection

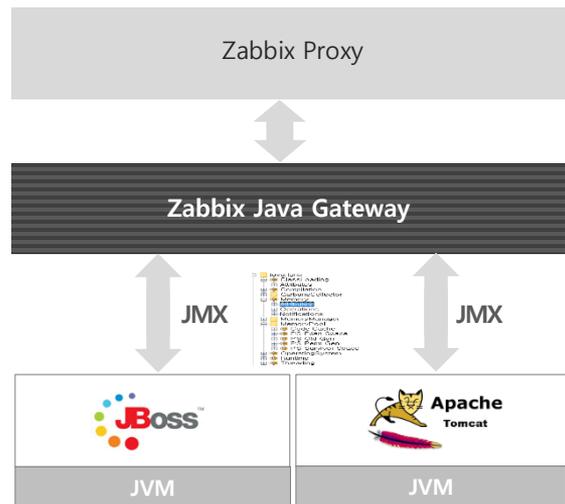
- 1 Apply verified Zabbix provision template



- 2 Additional development using management console command

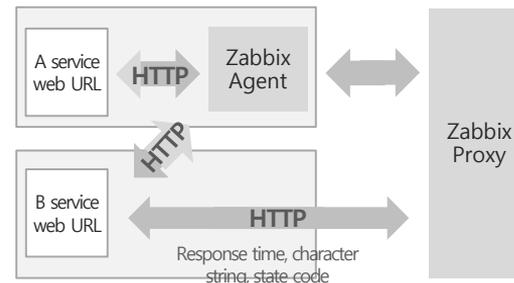


JVM(WAS) monitoring



- Necessary to set link for JMX communication
- Collect performance information such as Thread, Memory, etc. inside JVM by accessing Mbean of JDK

URL monitoring



Simple examination

- Possible to check the contents of web page, page loading time, and character string through agent
- Possible to check availability of web page from several locations distributed geographically

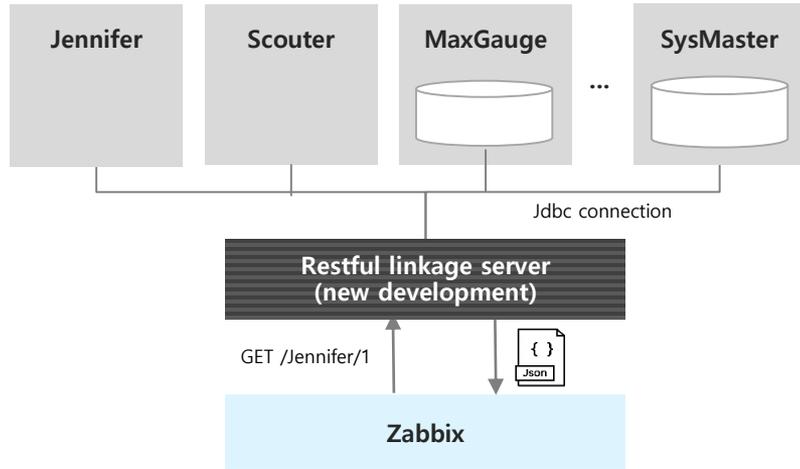
Scenario-based

- Monitoring web page state code, response time, and character string directly in Zabbix Proxy
- Composition of scenario in each step

11

Monitoring/Management Solution Integration Plan

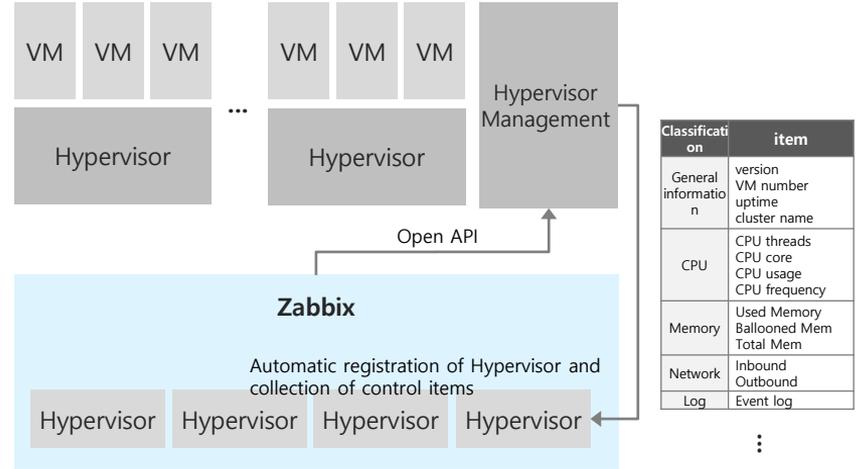
Collection of individual point solution items



Collection logic

- Zabbix registers representative item of each point solution and make a request to linkage server.
- The linkage server returns the data obtained in each point solution through query to Zabbix in Json format.
- Zabbix performs parsing of json data and registers and collects control items automatically through automatic registration function.

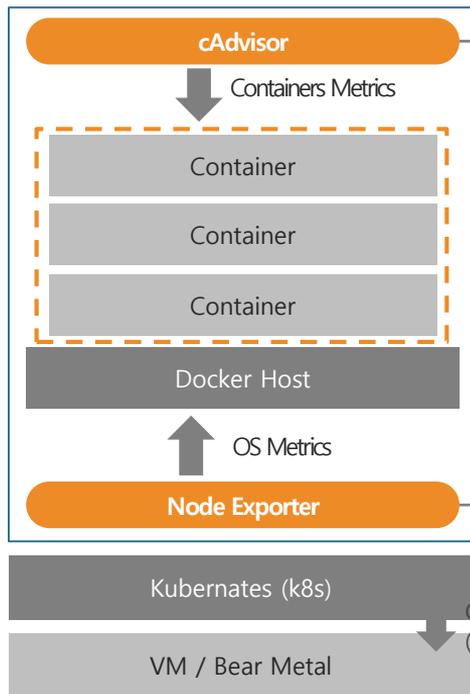
Collection of Hypervisor control items



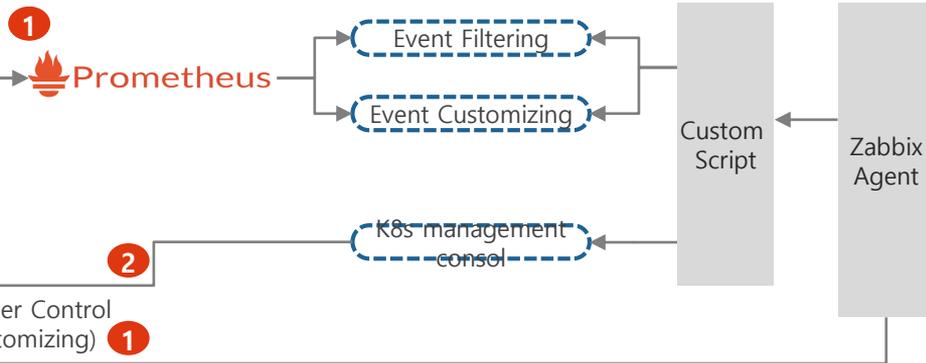
Collection logic

- Acquire Hypervisor list and resource information through Open API provided by Hypervisor Management
- Register Hypervisor automatically by the unit of host
- Apply control policy automatically to automatically registered Hypervisor and collect state and performance information

Kubernetes(k8s) based Container System Monitoring



- 1 Kubernetes Cluster based control performs control of Container and Container OS through cAdvisor / Node Exporter of Prometheus
- 2 Control it through development of Custom Script using K8s management consol command for K8s Cluster
- 3 Basic control of VM (CPU, Mem, Disk, Process, etc.) through application of Zabbix OS control items



13

Result of Establishment

"KT has established the largest integration control system in Korea"

Status of establishment	<ul style="list-style-type: none"> ✓ Designated as the standard control tool by the IT Planning Office of KT ✓ Being applied to more 378 kinds of services, more than 18,000 servers, NW equipment, container, etc. ✓ Being applied to many areas of infrastructure (OS: 8 kinds, DBMS: 9 kinds, MW: 9 kinds)
Effect of establishment	<ul style="list-style-type: none"> ✓ Reduction of failure by about 40% ✓ Increase of failure detection rate by 182%
Cost saving	<ul style="list-style-type: none"> ✓ Saving licensing cost by about KRW5.4 billion ✓ Saving MA cost by KRW1.95 billion a year

* Source: KT IT Integration Control Center



Affiliated companies



Large companies



Financial companies



Public/Education



14 Lessons Learned

• Pilot application and spread

Establish management system

- Establish maintenance and technical support system
- Establish AP operation and control (OP) system



Draw essential control items

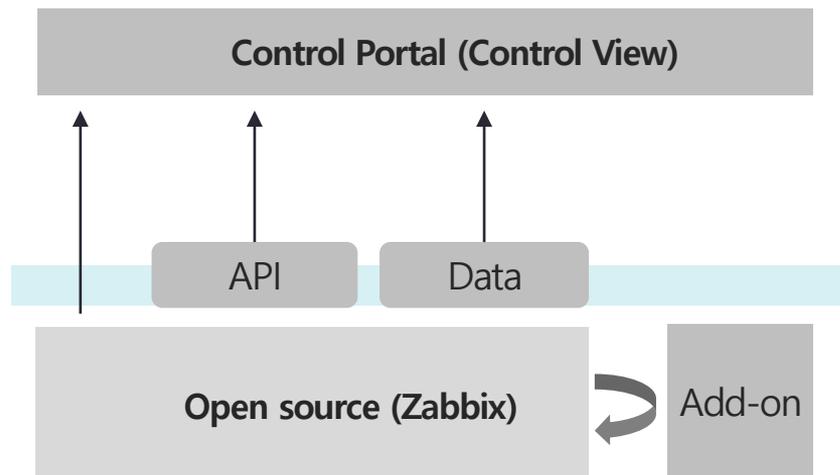
- Draw essential control items from operators
- Develop required items besides built-in functions



Introduce a low grade system before spread

- Verify the function, performance, availability, etc. by introducing a B/C grade system
- Verify the effect of cost saving by accepting S/A grade systems.
- Expand the scope of control from OS to AP territory

• OSS License



- Consider license (duty of notification, source disclosure)

Thank you

