10TH ZABBIX SUMMIT 2022

Advanced VMware Monitoring in real life scenario

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Vmware monitoring with Zabbix:
Two years of continuous improvements

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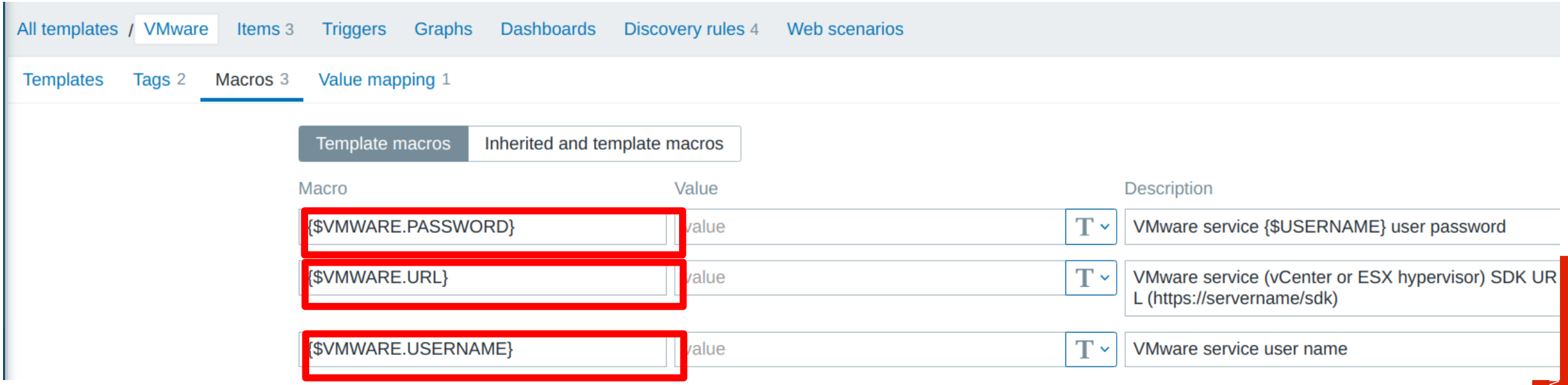
Zabbix VMWare Integration

- *Agentless integration without need to deploy other software*
- *Based on SOAP API calls*
- *Out of the Box, using the provided VMWare Template*



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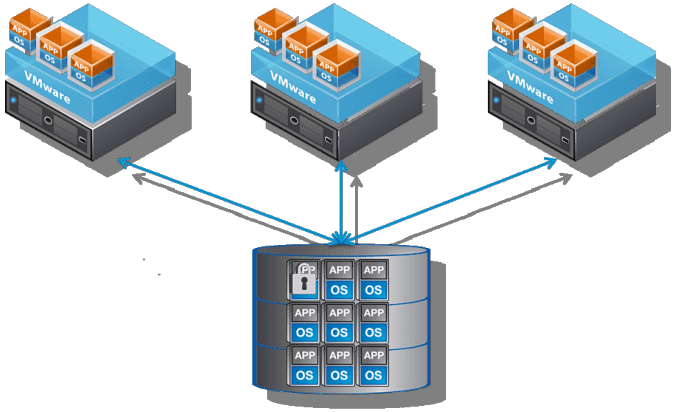
VMware scenario in a real enterprise company

The simple vision



The reality

- 1 vCenter
- 84 Hypervisors
- 1993 VM grouped in many folders:
  - Hundreds of DB servers
  - Hundreds of application servers
  - Hundreds of Web servers
  - Hundreds of forgotten snapshots
  - ...

- VMs with different VMtools releases
- VMs disabled or switched off
- Simple automation for better VMs mangement

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Zabbix up to 5.0 behavior for VMware

- VMware Cluster metrics (vCenter Status, Datastore space, Hypervisor status etc)
- VM Base monitoring (CPU, Memory, Filesystem)

But:

- VM & Hypervisor inherit vCenter IP address
- Most of the configuration options are read-only, except for enabling/disabling the host and host inventory.
- Discovered hosts cannot have host prototypes of their own.

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Zabbix 5.0 VM available LLD Macros

{#VM.UUID}	Unique virtual machine identifier.
{#VM.ID}	Virtual machine identifier (VirtualMachine managed object name).
{#VM.NAME}	Virtual machine name.
{#HV.NAME}	Hypervisor name.
{#CLUSTER.NAME}	Cluster name, might be empty.
{#DATACENTER.NAME}	Datacenter name.

➔*Very few Macros are provided during the VM discovery*

VMware Discoveries on Zabbix 5.0

Fixed IP Address for all discovered Hosts

Hosts

Create host | Import

Filter

Name	Applications	Items	Triggers	Graphs	Discovery	Web	Interface	Proxy	Templates	Status	Availability	Agent encryption	Info	Tags
Discover VMware VMs: ARCA [redacted]	Applications 8	Items 35	Triggers	Graphs	Discovery 3	Web	192.168.148.50: 10050		Template VM VMware Guest	Enabled	ZBX SNMP JMX IPMI	NONE		
Discover VMware VMs: ATS [redacted] a	Applications 8	Items 39	Triggers	Graphs	Discovery 3	Web	192.168.148.50: 10050		Template VM VMware Guest	Enabled	ZBX SNMP JMX IPMI	NONE		
Discover VMware VMs: dc02. [redacted]	Applications 8	Items 39	Triggers	Graphs	Discovery 3	Web	192.168.148.50: 10050		Template VM VMware Guest	Enabled	ZBX SNMP JMX IPMI	NONE		
DELL_VRTX_TBM_Uffici	Applications 4	Items 18	Triggers 1	Graphs	Discovery 4	Web	192.168.148.50: 10050		Template [redacted] Semplice Ping, Template VM VMware	Enabled	ZBX SNMP JMX IPMI	NONE		
Discover VMware hypervisors: sx1 [redacted]	Applications 6	Items 33	Triggers	Graphs	Discovery 1	Web	192.168.148.50: 10050		Template VM VMware Hypervisor	Enabled	ZBX SNMP JMX IPMI	NONE		
Discover VMware hypervisors: sx2 [redacted]	Applications 6	Items 33	Triggers	Graphs	Discovery 1	Web	192.168.148.50: 10050		Template VM VMware Hypervisor	Enabled	ZBX SNMP JMX IPMI	NONE		
Discover VMware hypervisors: sx3 [redacted]	Applications 6	Items 33	Triggers	Graphs	Discovery 1	Web	192.168.148.50: 10050		Template VM VMware Hypervisor	Enabled	ZBX SNMP JMX IPMI	NONE		
Discover VMware VMs: [redacted] _Immobiliare	Applications 8	Items 31	Triggers	Graphs	Discovery 3	Web	192.168.148.50: 10050		Template VM VMware Guest	Enabled	ZBX SNMP JMX IPMI	NONE		

vCenter Host

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Discovered host view

All hosts / ARCA [redacted] Enabled ZBX SNMP JMX IPMI Applications 8 Items 35 Triggers Graphs Discovery rules 3 Web scenarios

Host Templates IPMI Macros Inventory Encryption

Discovered by Discover VMware VMs

* Host name 50376c79-7e47-cbcd-2531-9c5af696762b

Visible name ARCA [redacted]

* Groups [redacted] Virtual machines ✖ VRTX-Cluster1 (vm) ✖ Select

Interfaces

Type	IP address	DNS name	Connect to	Port	Default
Agent	192.168.148.50		IP DNS	10050	◉

Description

Monitored by proxy (no proxy)

Enabled ☑

Most of all parameters are locked

Collected data

Latest data

Filter

Host	Name	Last check	Last value	Change	
Server	**CPU** (3 Items)				
	CPU ready	2022-09-01 19:15:19	7 ms	+1 ms	Graph
	CPU usage	2022-09-01 19:15:20	21 MHz	-110 MHz	Graph
	Number of virtual CPUs	2022-09-01 19:10:18	2		Graph
Server	**Disks** (4 Items)				
	Average number of bytes read from the disk Hard disk 1	2022-09-01 19:14:56	0 Bps		Graph
	Average number of bytes written to the disk Hard disk 1	2022-09-01 19:14:57	13 KBps	+1 KBps	Graph
	Average number of reads from the disk Hard disk 1	2022-09-01 19:14:56	0		Graph
	Average number of writes to the disk Hard disk 1	2022-09-01 19:14:59	0		Graph
Server	**Filesystems** (8 Items)				
	Free disk space on /	2022-09-01 19:14:59	214.85 GB		Graph
	Free disk space on / (percentage)	2022-09-01 19:15:01	87.8428 %		Graph
	Free disk space on /boot/efi	2022-09-01 19:15:00	504.14 MB		Graph
	Free disk space on /boot/efi (percentage)	2022-09-01 19:15:03	98.4672 %		Graph
	Total disk space on /	2022-09-01 19:11:03	244.58 GB		Graph
	Total disk space on /boot/efi	2022-09-01 19:11:04	511.98 MB		Graph
	Used disk space on /	2022-09-01 19:15:05	29.73 GB		Graph
	Used disk space on /boot/efi	2022-09-01 19:15:06	7.85 MB		Graph

Collected data

Server	**General** (5 Items)				
	Cluster name	2022-09-01 19:10:17	VRTX-Cluster1		History
	Datacenter name	2022-09-01 19:10:21	[redacted]-Monaca		History
	Hypervisor name	2022-09-01 19:10:22	esx3.[redacted]		History
	Power state	2022-09-01 19:18:36	poweredOn (1)		Graph
	Uptime	2022-09-01 19:18:40	588 days, 23:21:02	+00:01:00	Graph
Server	**Interfaces** (4 Items)				
	Number of bytes received on interface Network adapter 1	2022-09-01 19:18:51	0 Bps		Graph
	Number of bytes transmitted on interface Network adapter 1	2022-09-01 19:18:53	0 Bps		Graph
	Number of packets received on interface Network adapter 1	2022-09-01 19:18:52	112	+14	Graph
	Number of packets transmitted on interface Network adapter 1	2022-09-01 19:18:54	70	-7	Graph
Server	**Memory** (8 Items)				
	Ballooned memory	2022-09-01 19:18:24	0 B		Graph
	Compressed memory	2022-09-01 19:18:25	0 B		Graph
	Guest memory usage	2022-09-01 19:18:29	450 MB	+123 MB	Graph
	Host memory usage	2022-09-01 19:18:30	4.04 GB		Graph
	Memory size	2022-09-01 19:10:23	4 GB		Graph
	Private memory	2022-09-01 19:18:27	4 GB		Graph
	Shared memory	2022-09-01 19:18:27	0 B		Graph
	Swapped memory	2022-09-01 19:18:28	0 B		Graph
Server	**Storage** (3 Items)				
	Committed storage space	2022-09-01 19:18:37	254.12 GB		Graph
	Uncommitted storage space	2022-09-01 19:18:38	595 B		Graph
	Unshared storage space	2022-09-01 19:18:39	250 GB		Graph

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Zabbix 5.2 and 5.4 Enhancements

Two important enhancements:

- Discovered VMs VMWare with a dedicated network interface (https://support.zabbix.com/browse/ZBXNEXT-6269) – **introduced for Zabbix 5.2.2**
- Zabbix template VMWare FQDN (https://support.zabbix.com/browse/ZBXNEXT-6272 and https://support.zabbix.com/browse/ZBXNEXT-2088) – **introduced for Zabbix 5.4**

Solved Issues:

- We can directly monitor Hypervisor using a simple ping
- We can add Zabbix agent monitoring to a discovered VM
- No more “two” hosts for same VM (one discovered by VMWare integration for VMWare metrics, one for Zabbix Agent metrics)

Warning

- If the guest OS hostname is not accessible, than the VM will not be discovered. Powered off VMs or VMs without vmtools installed will not be discovered, because host FQDN name is absent/unavailable.

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New possibilities but still some problems

- **No more duplicated hosts for VM** (using Zabbix Agent Active)
- **It's now possible link a specific template** based on VM Operating System, using *Override rules* during the HostPrototype creation

But…

- **No easy way to associate a specific template** according to VM role and installed services (i.e. application monitoring).

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Possible workaround for specific application monitoring

Using an LLD Javascript Preprocessing Step to change VMware VM discovery to extend the information of "Host Specialization" using the Zabbix Inventory Field...

Tricky solution with huge performance penalty and Timeout limitation during the PreProc Steps...

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Ugly Workaround…

1) Discover VMs using standard FQDN template
2) Change “software” field in the VM inventory
3) Modify preprocessor Javascript in the VM discovery
4) Add Override rule in order to associate a template related to “software” field in the inventory

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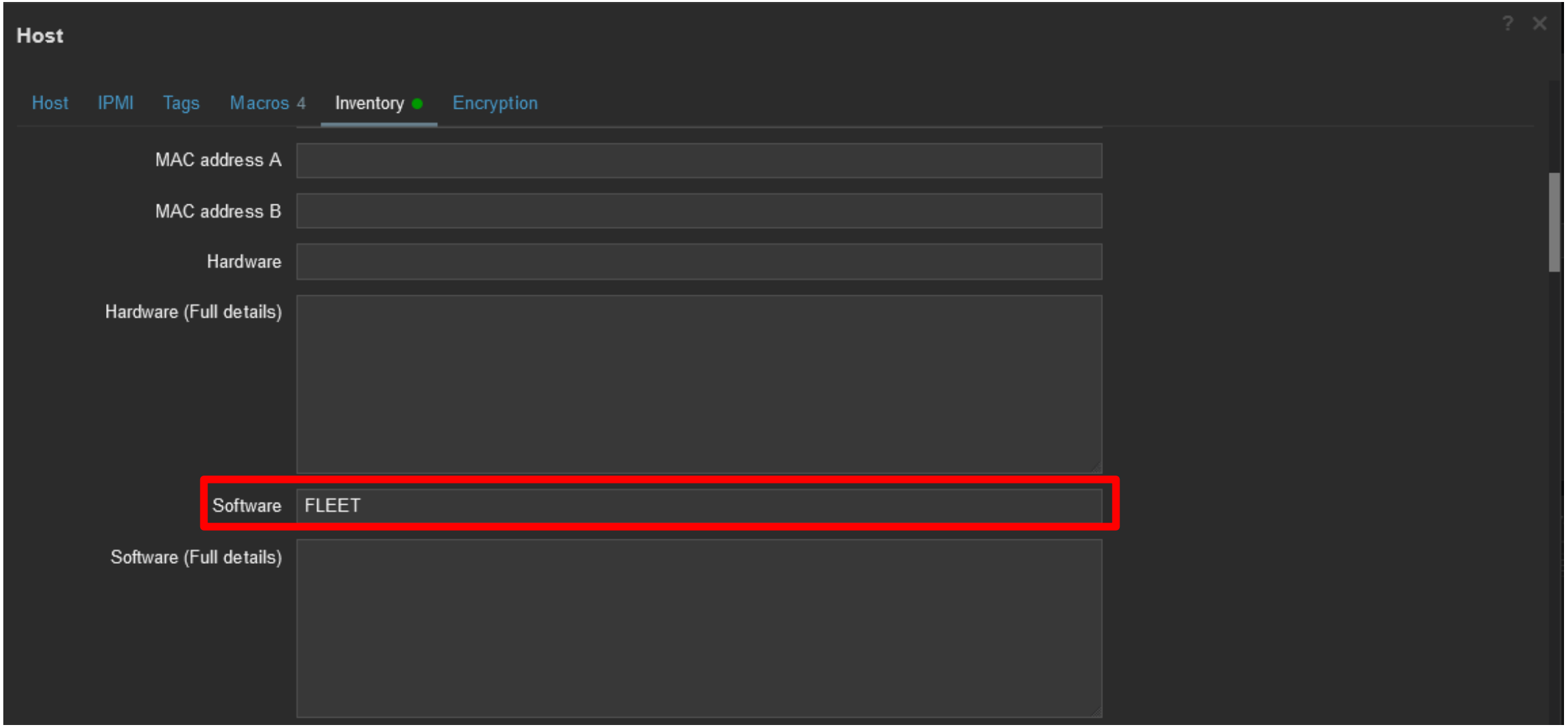
Popolate inventory “software” field



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Preprocessing script real example (relevant part)

```
// look for requested template in inventory software field
var w = disc_array.length;
while (w--) {
	disc_array[w]["{#INV.SOFTWARE}"] = '';
	for (var t in hdata_array) {
		if (disc_array[w]["{#VM.DNS}"] == hdata_array[t]["host"]) {
			disc_array[w]["{#INV.SOFTWARE}"] = hdata_array[t]["inventory"].software;
		}
	}
}
var output = JSON.stringify(disc_array);
Zabbix.Log(1, output);
Zabbix.Log(1, 'END preproc: OK');
```

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Discovery overrides

Override

* Name: FLEET

If filter matches: Continue overrides | Stop processing

Filters

Label	Macro		Regular expressio
A	{#INV.SOFTWARE}	matches	FLEET

Add

Edit operation

Object: Host prototype

Condition: matches .*

Create enabled: Original

Discover: Original

Link templates: FLEET ×
type here to search
Select

Tags: Original

Host inventory: Original

Overrides

	Name	Stop pr
1:	Esclusione "Dabutt", "template", "clone", "old", "tmp", ecc	Yes
2:	ETCD	No
3:	POSTGRES	No
4:	ZBXCLU	No
5:	EXCHANGE	No
6:	DHCP - Windows	No
7:		No
8:	Dollar Universe	No
9:	Genesys	No
10:	FLEET	No
11:	PMS2-PROD	No
12:	OS Linux	Yes
13:	OS Windows - WIN2003	Yes
14:	OS Windows	Yes

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VM with a new associated template

Host

Host | IPMI | Tags | Macros 4 | Inventory | Encryption

Discovered by: Discover VMware VMs FQDN

* Host name: [redacted].master.local

Visible name: [redacted]

Templates ? Name | Action

[redacted]
- FLEET (linked by host discovery)
- ICMP Ping (linked by host discovery)
- Linux by Zabbix agent active (linked by host discovery)
- VMware Guest (linked by host discovery)

type here to search | Select

* Host groups: Templates/Applications ✕ | VMWARE/Cluster VMLinux (vm) ✕ | VMWARE/MasterDC/Fleet/Prod (vm) ✕ | VMWARE/[redacted]aster.local ✕ | Select

Interfaces

Type	IP address	DNS name	Connect to	Port
Agent	[redacted]	[redacted].master.local	IP DNS	10050

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Zabbix 6.2 enhancements

Added support for :

- Host Prototype add custom tags -> **ZBXNEXT-7591**
- Host Prototype add/change custom Macros -> **ZBXNEXT-5517**
- Host Prototype add custom Templates -> **ZBXNEXT-7523**
- VMware tags for HV, VM, DS, CL and DC -> **ZBXNEXT-5229**

  Warning: only Vmware >= 7.0.2 is supported (on Zabbix 6.2.2)
- vmware.dvswitch.discovery and vmware.dvswitch.fetchports.get -> **ZBXNEXT-7029**

- VMware snapshot information (discovery & item) -> **ZBXNEXT-2043**
- VMware vmtools status (discovery & item) -> **ZBXNEXT-2302**

VM discovery LLD Macros in Zabbix 6.2

- {#VM.UUID} Unique virtual machine identifier.
- {#VM.ID} Virtual machine identifier (VirtualMachine managed object name).
- {#VM.NAME} Virtual machine name.
- {#HV.NAME} Hypervisor name.
- {#HV.UUID} Unique hypervisor identifier.
- {#HV.ID} Hypervisor identifier (HostSystem managed object name).
- {#CLUSTER.NAME} Cluster name, might be empty.
- {#DATACENTER.NAME} Datacenter name.
- {#DATASTORE.NAME} Datastore name.
- {#DATASTORE.UUID} Datastore identifier.
- {#VM.IP} Virtual machine IP address, might be empty.
- {#VM.DNS} Virtual machine DNS name, might be empty.
- {#VM.GUESTFAMILY} Guest virtual machine OS family, might be empty.

- {#VM.GUESTFAMILY} Guest virtual machine OS family, might be empty.
- {#VM.GUESTFULLNAME} Full guest virtual machine OS name, might be empty.
- {#VM.FOLDER} The chain of virtual machine parent folders, can be used as value for nested groups; folder names are combined with "/". Might be empty.
- **{#VM.TOOLS.STATUS}** VMware virtual machine tools state. {#VM.POWERSTATE} VMware virtual machine power state (poweredOFF, poweredOn, or suspended).
- {#VM.RPOOL.ID} Resource pool identifier.
- {#VM.RPOOL.PATH} Full resource pool path excluding the "root" name "Resources". Folder names are combined with "/". **{#VM.SNAPSHOT.COUNT}** Number of VM snapshots.

"tags" An array containing tags with tag name, description and category:

- **[{"tag":"tag name","tag_description":"tag description", "category":"tag category"}]**
- vm.customattribute = [{}] An array of virtual machine custom attributes (if defined):
- [{"name":"custom field name", "value":"custom field value"}]

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Zabbix 6.2 VMware host prototype

Host

Host | IPMI | Tags | Macros 7 | Inventory | Encryption

Discovered by VM

* Host name [redacted]_VBR

Visible name farcon_VBR

Templates Name Action

VMware Guest - [redacted] (linked by host discovery)

Windows vm checks (linked by host discovery)

HTTP ×

type here to search

Select

* Host groups [redacted] Type/Virtual Machine × Select

Interfaces

Type	IP address	DNS name	Connect to	Port	Default
Agent	172.16.10.4		IP DNS	10050	

Description

Monitored by proxy [redacted]_proxy

Enabled ✓

FQDN Hostname based on VMTools

Assign Template after Host creation

Dedicated Interface per VM

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Zabbix 6.2 VMware host prototype

Host

Host | IPMI | Tags | Macros 7 | Inventory | Encryption

Host macros | Inherited and host macros

Macro	Value	Description	
{$CUSTOMER.GRP}	[redacted]	Customer name for hostgroup and hostname prefix	Change Remove (created by host discovery)
{$CUSTOMER.ID}	3870	[redacted] ID	Change Remove (created by host discovery)
{$VMWARE.PASSWORD}	[redacted]	VMware service {$USERNAME} user password	Change Remove (created by host discovery)
{$VMWARE.URL}	https://172.16.10.10/sdk	VMware service (vCenter or ESX hypervisor) SDK URL (https://servername/sdk)	Change Remove (created by host discovery)
{$VMWARE.USERNAME}	isrc	[redacted]	Change Remove (created by host discovery)
{$VMWARE.VM.NAME.EXCLUDED}	SynetoOS|SynetoFileRecovery		
{$VMWARE.VM.UUID}	564d0617-8446-6666-4506-036c03a7fb1c	UUID of guest virtual machine.	Revert Remove (created by host discovery)
{$MACRO}	value	description	Remove

Add

Change inherited Macro per VM

Add new Custom Macro per VM

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We achieved some good goals!

- Template linking Automation based on VMWare Tags/Custom attribute for VMs monitoring
- We can change some specific details of an HostPrototype (aka custom macros, template etc)
- No more Dual Hosts for a single VM
- Extened VMWare metrics

  Snapshot [size/number] → Check old Snapshot or Snapshot size

  VMTools [version/presence] → Check the version to prevent weird monitoring data collection
- More pre-built LLD Macros on VMWare Discoveries (granular control of discovered objects)
- Better VMWare components (VMs,Hypervisors) organization using Folder/Resource Pool

Final question: Can we monitor an Enterprise grade VMWare installation easily and with needed detail level?

Yes, we can! Using Zabbix :-)

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VMWare Snapshot details

Snapshot items “Grand Total per VM”

Host	Name ▲	Last check	Last value	Change	Tags
[redacted]_Backup	VMware: Snapshots Count	15m 26s	1		component: snapshot
[redacted]_Backup	VMware: Snapshots get	15m 26s	{"snapshot":[{"name"…		component: raw
[redacted]_Backup	VMware: Snapshots Last execution date	15m 26s	2021-11-23T08:39:3…		component: snapshot
[redacted]_Backup	VMware: Snapshots Total Size	15m 26s	60.56 GB		component: snapshot
[redacted]_Backup	VMware: Snapshots Total Uniquesize	15m 26s	60.56 GB		component: snapshot


```
[
  {
    "snapshot": [
      {
        "name": "MyHost-VM-Snapshot",
        "description": "",
        "createtime": "2020-12-31T19:10:52.897813Z",
        "size": 44970372562,
        "uniquesize": 44970372562
      }
    ],
    "count": 1,
    "latestdate": "2020-12-31T19:10:52.897813Z",
    "size": 44970372562,
    "uniquesize": 44970372562
  }
]
```


JSON output of “vmware.vm.snapshot.get”

You can use it for a *Snapshot Discovery!*

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VMWare Tags for Automation

VMWare Tag/Custom Attribute used to automate the Template association

All templates / BCOM - VMware FQDN | Discovery list / Discover VMware VMs FQDN | Item prototypes | Trigger prototypes | Graph prototypes | Host prototypes 1

Discovery rule | Preprocessing 3 | LLD macros 3 | Filters 2 | Overrides 2

LLD macros

LLD macro	JSONPath	
{#VM.CA.MONITORING.DEPARTMENT}	$..vmcustomattribute[?(@.name == "monitoring-department")].value.first()	Remove
{#VM.CA.MONITORING.ZBXAGENT}	$..vmcustomattribute[?(@.name == "monitoring-zbxagent")].value.first()	Remove
{#VM.TAG.CATEGORY.MONITORING}	$.tags[?(@.category == "Monitoring")].name.first()	Remove

Override

* Name: QS WINDOWS

If filter matches: Continue overrides | Stop processing

Filters

Type of calculation: And/Or — A and B

Label	Macro		Regular expression
A	{#VM.CA.MONITORING.ZBXAGENT}	matches	yes
B	{#VM.GUESTFAMILY}	matches	windowsGuest

Add

Operations

Condition

Host prototype matches .*

Add

Edit operation

Object: Host prototype

Condition: matches .*

Create enabled: Original

Discover: Original

Link templates: BCOM - Windows by Zabbix agent active ✕

type here to search

Tags: Original

Host inventory: Original

More nice and complete VMWare Dashboard

VMware Hypervisor state

Edit dashboard

All dashboards / VMware Hypervisor state

Zoom out

2022-08-31 15:31:29 – 2022-08-31 22:27:50

ESX7-01 Status

2022-09-09 08:35:41

red (3)

VMware: Overall status

ESX7-02 Status

2022-09-09 08:35:59

yellow (2)

VMware: Overall status

ESX7-03 Status

2022-09-09 08:36:07

yellow (2)

VMware: Overall status

Problems by severity

0	1	3	0	0	0
Disaster	High	Average	Warning	Information	Not classified

Top Hypervisors by CPU usage

Hypervisor Name	CPU usage
esx7-03-host.zabbix.sandbox	3.72 %
esx7-02-host.zabbix.sandbox	1.06 %
esx7-01-host.zabbix.sandbox	0.78 %

Top Hypervisors by Used memory

Hypervisor Name	Used Memory	Hypervisor Ping
esx7-03-host.zabbix.sandbox	14.92 GB	Up (1)
esx7-02-host.zabbix.sandbox	9.23 GB	Up (1)
esx7-01-host.zabbix.sandbox	8.6 GB	Down (0)

Hypervisor CPU usage (MHz)

900 MHz, 800 MHz, 700 MHz, 600 MHz, 500 MHz, 400 MHz, 300 MHz, 200 MHz, 100 MHz, 0 Hz

8-31 16:04, 8-31 16:54, 8-31 17:45, 8-31 18:36, 8-31 19:27, 8-31 20:18, 8-31 21:09, 8-31 22:00

avg(esx7-01-host.zabbix.sandbox: VMware: CPU… avg(esx7-02-host.zabbix.sandbox: VMware: CPU… avg(esx7-03-host.zabbix.sandbox: VMware: CPU…

esx7-01 HV traffic

40 KBps, 32 KBps, 24 KBps, 16 KBps, 8 KBps

8-31 15:34, 8-31 17:03, 8-31 18:33, 8-31 20:03, 8-31 21:32

esx7-01-host.zabbix.sandbox: VMware: Nu… esx7-01-host.zabbix.sandbox: VMware: Nu…

esx7-02 HV traffic

40 KBps, 32 KBps, 24 KBps, 16 KBps, 8 KBps, 0 Bps

8-31 15:34, 8-31 17:03, 8-31 18:33, 8-31 20:03, 8-31 21:32

esx7-02-host.zabbix.sandbox: VMware: Nu… esx7-02-host.zabbix.sandbox: VMware: Nu…

esx7-03 HV traffic

10 KBps, 8 KBps, 6 KBps, 4 KBps, 2 KBps, 0 Bps

8-31 15:34, 8-31 17:03, 8-31 18:33, 8-31 20:03, 8-31 21:32

esx7-03-host.zabbix.sandbox: VMware: Nu… esx7-03-host.zabbix.sandbox: VMware: Nu…

More nice and complete VMWare Dashboard

Guest VM status

Edit dashboard

All dashboards / Guest VM status

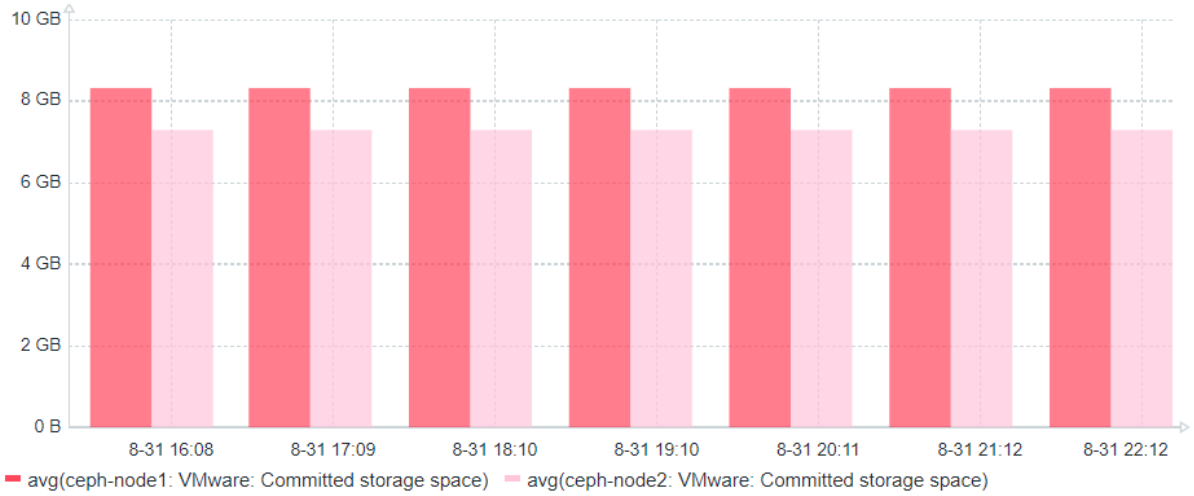
Zoom out

2022-08-31 15:30:13 – 2022-08-31 22:24:01

PROD Node Guest VM memory usage

Guest VM name	Memory usage		CPU usage in percent	
vCenter		2.52 GB		8.32 %
vSAN-Witness		245 MB		2.16 %
vCLS-a3b73ff6-5d23-4867-8d97-69f75f987d93		20 MB		0.08 %
vCLS-a96e64cc-6c96-499b-a04b-d513b7361c29		20 MB		0.11 %
Debian 2		10 MB		0.09 %
Debian		10 MB		0.14 %

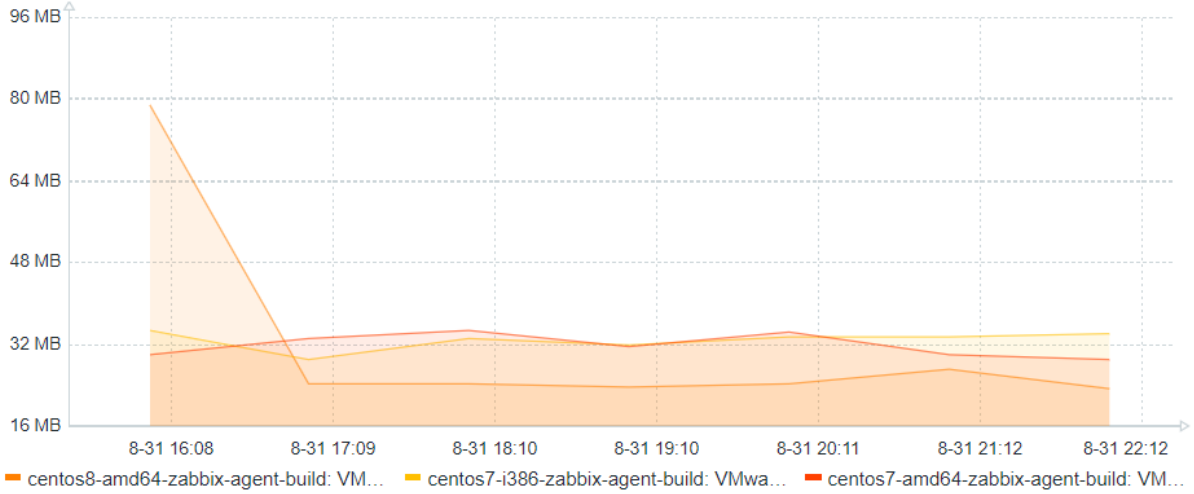
Ceph node commited storage



Problem hosts

Host group ▲	Without problems	With problems	Total
esx7-02-host.zabbix.sandbox	4		4
esx7-03-host.zabbix.sandbox	2		2

CentOS Build node memory usage



Problems by severity

0	1	4	0	0	0
Disaster	High	Average	Warning	Information	Not classified

Future interesting enhancements

- **Ability to show LLD rule output** → ZBXNEXT-6812 (Show output generated by a discovery)
- **Creating vmware.hv.sensor.health.state via lld discovery** → ZBX-20564 (Template VMWare broken since VMWare version 6.5)

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Thank you!

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