



# ZABBIX 5.0

## Certified Specialist Training

### Day 4

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# AGENDA

Reports



Inventory



Notifications  
&  
Escalations



Detection  
of  
Misconfiguration



Maintenance



Business Level  
Monitoring (SLA)



Low Level Discovery  
&  
Automation



XML  
import/export



Backups





# Reports

## Reports &gt; System information

Parameter	Value	Details
Zabbix server is running	Yes	192.168.7.105:10051
Number of hosts (enabled/disabled)	111	110 / 1
Number of templates	161	
Number of items (enabled/disabled/not supported)	16195	15192 / 638 / 365
Number of triggers (enabled/disabled [problem/ok])	7027	6710 / 317 [139 / 6571]
Number of users (online)	42	2
Required server performance, new values per second	75.79	
Database history tables upgraded	No	

Parameter	Value	Details
Zabbix server is running	Whether Zabbix server is running: Yes/No	Location and port of Zabbix server
Number of hosts	Total number of hosts	Number of monitored/not monitored hosts
Number of templates	Total number of templates	
Number of items	Total number of items	Number of monitored/disabled/unsupported items
Number of triggers	Total number of triggers	Number of enabled/disabled triggers. [Triggers in problem/ok state.]
Number of users	Total number of users configured	Number of users online
Required server performance new values per second	The expected number of new values per second	Required server performance is an estimate and can be useful as a guideline
Database history tables upgraded	Whether history table is using double float datatype: Yes/No	History table must be manually upgraded if migrated from previous version

**!** For precise numbers of values processed, use the zabbix[wcache,values,all] internal item

**i** [https://www.zabbix.com/.../frontend\\_sections/reports/status\\_of\\_zabbix](https://www.zabbix.com/.../frontend_sections/reports/status_of_zabbix)

❖ Proportion of time each trigger has been in the problem/ok state:

- is displayed as percentage
- easy to determine the availability

❖ You can choose the mode:

- triggers by host
- by triggers belonging to a template

❖ The time period selector allows to select often required periods with one mouse click.

From	To	Mode
now/d	now/d	Last 2 days
now/d	now/d	Yesterday
now/d	now/d	Today
now/d	now/d	Last 5 minutes
now/d	now/d	Last 7 days
now/d	now/d	Day before yesterday
now/d	now/d	Today so far
now/d	now/d	Last 15 minutes
now/d	now/d	Last 30 days
now/d	now/d	This day last week
now/d	now/d	This week
now/d	now/d	Last 30 minutes
now/d	now/d	Last 3 months
now/d	now/d	Previous week
now/d	now/d	This week so far
now/d	now/d	Last 1 hour
now/d	now/d	Last 6 months
now/d	now/d	Previous month
now/d	now/d	This month
now/d	now/d	Last 3 hours
now/d	now/d	Last 1 year
now/d	now/d	Previous year
now/d	now/d	This month so far
now/d	now/d	Last 6 hours
now/d	now/d	Last 2 years
now/d	now/d	This year
now/d	now/d	Last 12 hours
now/d	now/d	This year so far
now/d	now/d	Last 1 day



[.../5.0/manual/web\\_interface/frontend\\_sections/reports/availability](https://www.zabbix.com/documentation/5.0/manual/web_interface/frontend_sections/reports/availability)

## Triggers by hosts availability report:

- 心脏病图标 set the time frame
- 心脏病图标 filter by host groups or hosts

Availability report Mode By host

Host groups type here to search Select

Hosts Training-VM-XX ✖ Zabbix server ✖ Select

type here to search

Apply Reset

Host	Name	Problems	Ok	Graph
Training-VM-XX	CPU Load is high on Training-VM-XX	7.3149%	92.6851%	Show
Training-VM-XX	CPU Load is very high on Training-VM-XX	7.9654%	92.0346%	Show
Training-VM-XX	SSH service is down on Training-VM-XX	100.0000%		Show

# Triggers belonging to a template:

Availability report Mode By trigger template

Template group: Training/Templates

Template: Template Basic

Template trigger: all

Host group: Training/Servers

Apply Reset

all

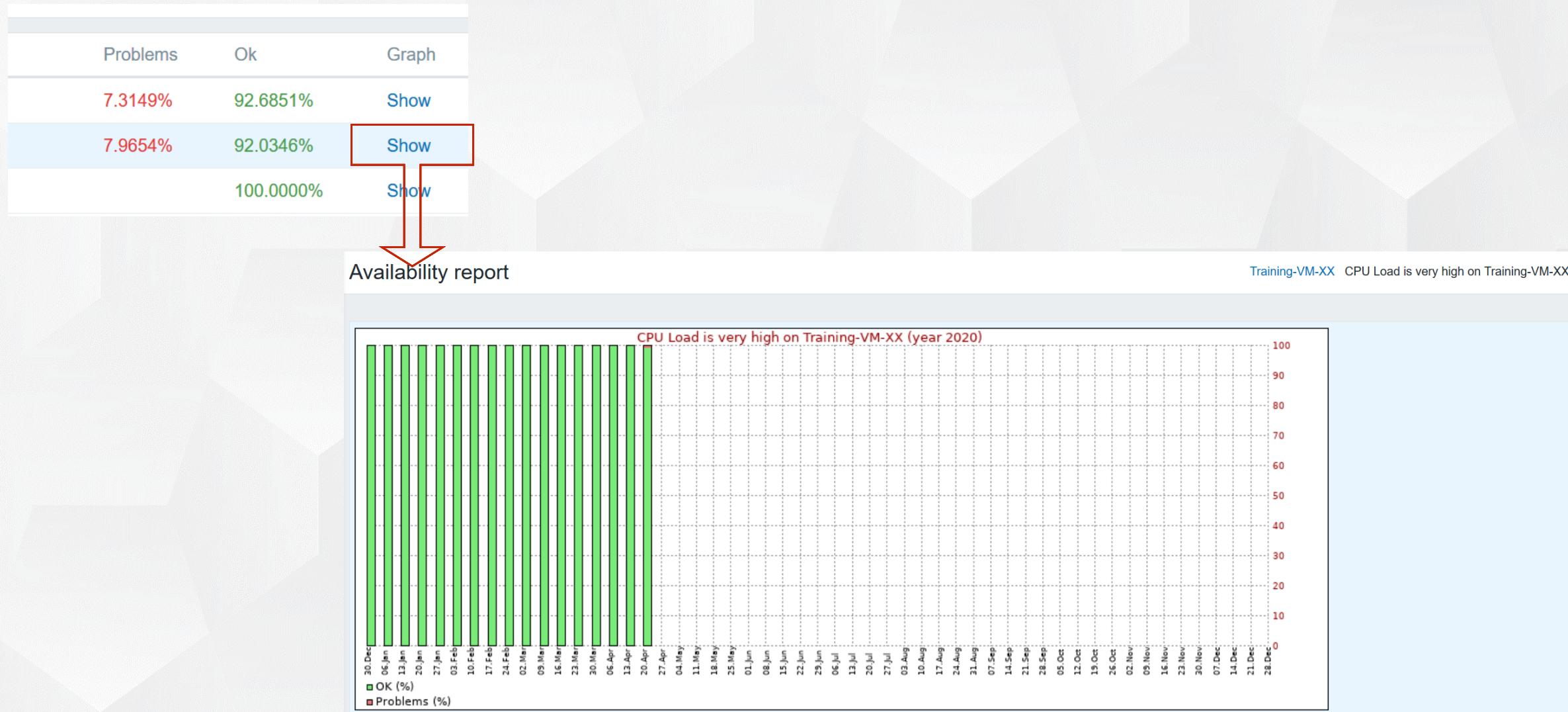
CPU Load is high on {HOST.NAME}

CPU Load is very high on {HOST.NAME}

Host	Name	Problems	Ok	Graph
Training-VM-XX	CPU Load is high on Training-VM-XX	7.3149%	92.6851%	Show
Training-VM-XX	CPU Load is very high on Training-VM-XX	7.9654%	92.0346%	Show

Displaying 2 of 2 found

Clicking on Show in the Graph column opens a bar graph:



## Triggers that have changed their state most often:

- 心脏病图标 Set the period of evaluation and adjust filters
- 心脏病图标 Sorted by the number of status changes
- 心脏病图标 Useful to detect flapping triggers

Host groups  Select

Hosts  Select

Severity  Not classified  Warning  High  
 Information  Average  Disaster

Apply Reset

100 busiest triggers

From   
To   
[Last 2 days](#)
[Yesterday](#)
[Today](#)
[Last 5 minutes](#)

From	To	Last 2 days	Yesterday	Today	Last 5 minutes
<input type="text" value="now/d"/>	<input type="text" value="now/d"/>	<a href="#">Last 7 days</a>	<a href="#">Day before yesterday</a>	<a href="#">Today so far</a>	<a href="#">Last 15 minutes</a>
		<a href="#">Last 30 days</a>	<a href="#">This day last week</a>	<a href="#">This week</a>	<a href="#">Last 30 minutes</a>
		<a href="#">Last 3 months</a>	<a href="#">Previous week</a>	<a href="#">This week so far</a>	<a href="#">Last 1 hour</a>
		<a href="#">Last 6 months</a>	<a href="#">Previous month</a>	<a href="#">This month</a>	<a href="#">Last 3 hours</a>
		<a href="#">Last 1 year</a>	<a href="#">Previous year</a>	<a href="#">This month so far</a>	<a href="#">Last 6 hours</a>
		<a href="#">Last 2 years</a>		<a href="#">This year</a>	<a href="#">Last 12 hours</a>
				<a href="#">This year so far</a>	<a href="#">Last 1 day</a>

Host	Trigger	Severity	Number of status changes
Training-VM-XX	CPU Load is very high on Training-VM-XX	High	31
Training-VM-XX	CPU Load is high on Training-VM-XX	Warning	8
Zabbix server	Load average is too high (per CPU load over 1.5 for 5m)	Average	8
Zabbix server	High CPU utilization (over 90% for 5m)	Warning	2



# Reports demo



# Inventory Auto-collection

You can keep the inventory of devices and applications in Zabbix

⚠ In the inventory tab you can enter such details as name, serial number, location, etc.

- Inventory fields are hardcoded

⚠ Default inventory mode for new hosts is defined in Administration > General > Other

- By default, it is set to "disabled"
- Inventory mode for a host can be changed in the host configuration form

⚠ Populating inventory can be done manually or automatically

- Manual mode – you can enter the details including type, location, etc.
- Automatic mode - items can be used to add data to inventory

⚠ Autoregistration and Network discovery actions can override discovery mode for new or existing hosts



<https://www.zabbix.com/documentation/5.0/manual/config/hosts/inventory>

## Configuration &gt; Hosts &gt; {Host} &gt; Host inventory

⚠ By default: inventory is disabled

The screenshot shows a top navigation bar with tabs: Tags, Macros, Inventory (which is underlined in blue), and Encryption. Below the tabs is a horizontal button bar with three options: Disabled (selected), Manual, and Automatic. A large input field labeled 'Type' is present below the button bar.

⚠ Set to Manual and fill in necessary fields

The screenshot shows the same interface as the first one, but with the 'Manual' tab selected. The 'Type' field now contains the value 'Linux'. The 'Type (Full details)' field contains the detailed system information: 'Linux student-XX 3.10.0-1062.18.1.el7.x86\_64 #1 SMP Tue Mar 17 2'. The 'Name' field contains the host name 'student-XX'.

## 1. Host inventory mode must be set to Automatic

➡ Configuration > Hosts > {host} > Inventory

Host	Templates	IPMI	Tags	Macros	Inventory	Encryption
<input type="radio"/> Disabled <input type="radio"/> Manual <input checked="" type="radio"/> Automatic						
Type	Linux					
Type (Full details)	Linux student-XX 3.10.0-1062.18.1.el7.x86_64 #1 SMP Tue Mar 17 2					
Name	student-XX <small>← System name</small>					
Alias						
OS	Linux version 3.10.0-1062.18.1.el7.x86_64 (mockbuild@kbuilder.bsys.centos.org) (gcc version 4.8.5) <small>← Operating system</small>					

## 2. Configure an item to populate inventory field with value

➡ Configuration > Hosts > {host} > Items > <Item>

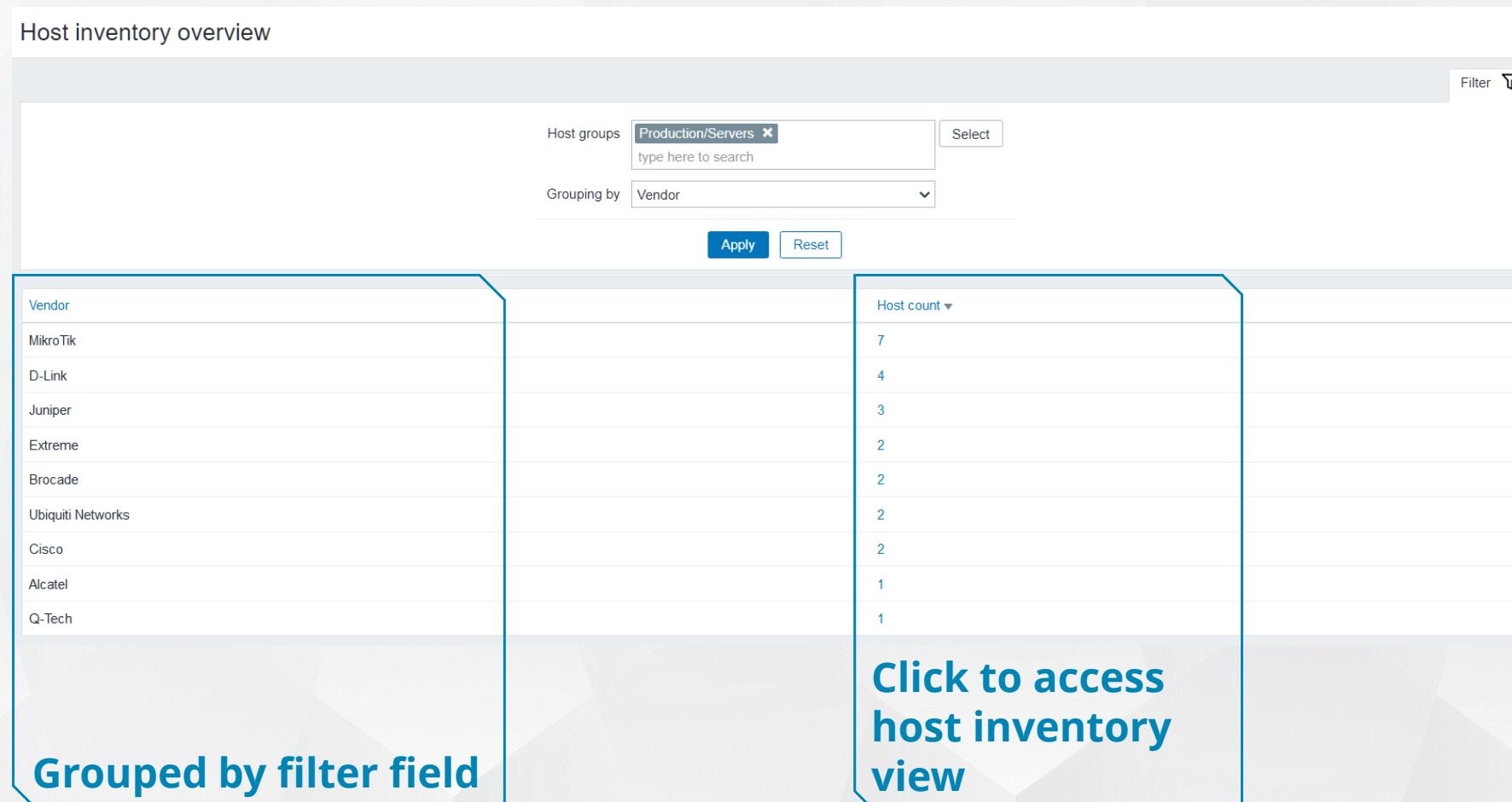
Populates host inventory field   Location

Items that are especially useful for automated inventory data collection:

- ~ system.uname - identification of the system
- ~ system.hostname - system host name
- ~ system.hw.chassis[full|type|vendor|model|serial] - default is [full], need root
- ~ system.hw.devices[pci|usb] - default is [pci]
- ~ system.hw.macaddr[interface,short|full] - default is [all,full], interface is regexp
- ~ system.sw.os[name|short|full] - default is [name]
- ~ system.sw.packages[package,manager,short|full] - default is [all,all,full], package is regexp
- ~ SNMPv2-MIB::sysLocation - device location
- ~ SNMPv2-MIB::sysContact - contact person
- ~ etc.

## Inventory > Overview:

- Shows host count having the same inventory value
- Host count column entries are links to host inventory view



## Inventory > Host inventory

- ~ Lists all hosts matching filter criteria
- ~ Clicking on a host name will open the inventory details

Host inventory

Filter 

Host	Group	Name	Type	OS	Serial number A	Tag	MAC address A
net.mikrotik.450g	Discovered hosts, Europe Data center, Network	450g-len.gorod	Network device	6.23	33B60260D66E		
net.mikrotik.912UAG-5HPnD	Discovered hosts, Europe Data center, Linux servers, Network	zeus.snmplabs.com (you can change this!)	Network device	6.38.5	49DF046080AB		
net.mikrotik.941-2nD	Europe Data center, Linux servers, Network	zeus.snmplabs.com (you can change this!)	Network device	6.38.5	5B32055AE099		
net.mikrotik.1100ahx2	Discovered hosts, Europe Data center, Network	COLO	Network device	6.37.1	47B8029xxxxx		
net.mikrotik.CCR1036-12G-4S	Discovered hosts, Europe Data center, Network	bababab.selo	Network device	6.32.4	574F05BC2605		
net.mikrotik.rb1100ah	Discovered hosts, Europe Data center, Network	vcore-router	Network device	6.20	319F02497FF5		
net.mikrotik.rb2011uas-2hnd	Discovered hosts, Europe Data center, Network	MikroTik	Network device	6.28	3F0602FD9511		

Displaying 7 of 7 found

**Click to access details**

## Inventory details:

的心 The form has two tabs:

- General information page displays common information and has some useful links
- Details tab displays all inventory data collected from a host

的心 Can be accessed from Inventory view, Problems page and other frontend sections

### general information about the host

Overview Details

Host name net.mikrotik.450g

SNMP interfaces	IP address	DNS name	Connect to	Port	Default
	10.100.0.5	net.mikrotik.450g	IP	DNS	161

OS 6.23

Hardware RouterOS RB450G

Monitoring [Web](#) [Latest data](#) [Problems](#) [Graphs](#) [Screens](#)

Configuration [Host Applications](#) 8 [Items](#) 95 [Triggers](#) 46 [Graphs](#) 10 [Discovery](#) 4 [Web](#)

[Cancel](#)

### all available inventory details

Details

Type Network device

Name 450g-len.gorod

OS 6.23

Serial number A 33B60260D66E

Hardware RouterOS RB450G

Location leninskiy\_luch

Model RouterOS RB450G

Vendor MikroTik

[Cancel](#)

- ~ Only one item can be used to populate an inventory field on same host
- ~ Host inventory can be opened from different views (e.g. Dashboard, Maps, Problems, etc.)
- ~ Inventory data can be used in the filters and actions
- ~ There are host inventory macros {INVENTORY.\*} available for use in notifications and tags
- ~ There is no way to customize inventory fields - current list is hardcoded

# PRACTICAL SETUP

1. Enable automatic inventory mode for all hosts
2. Create a new template:
  - ~ Name: Template Basic module system info
  - ~ Group: Training/Templates
3. Create new Zabbix agent items
  - 1) System OS:
    - ~ Use system.sw.os[name] key to get OS information
    - ~ Populate inventory field: "OS"
  - 2) System hostname:
    - ~ Find a key can to the hostname
    - ~ Populate inventory field: Name
4. Link the template to "Template Basic"
5. Manually populate inventory field Location for all hosts
6. Make sure that the tabs Overview and Details contain information



# Notifications and Media types

## Administration > Media types

Configure the ways for delivery of notifications and alerts

心跳图标 Email

心跳图标 SMS (Modem support)

心跳图标 Webhooks

心跳图标 Custom "alert" scripts

Media types						Create media type	Import
						Filter ▾	
<input type="text"/> Name <input type="button" value="Apply"/> <input type="button" value="Reset"/>						Status Any Enabled Disabled	
Name	Type	Status	Used in actions	Details	Action		
<input type="checkbox"/> Discord	Webhook	Enabled				<input type="button" value="Test"/>	
<input checked="" type="checkbox"/> Email	Email	Enabled		SMTP server: "mail.example.com", SMTP helo: "example.com", SMTP email: "zabbix@example.com"		<input type="button" value="Test"/>	
<input type="checkbox"/> Mattermost	Webhook	Enabled				<input type="button" value="Test"/>	
<input type="checkbox"/> Opsgenie	Webhook	Enabled				<input type="button" value="Test"/>	
<input type="checkbox"/> PagerDuty	Webhook	Enabled				<input type="button" value="Test"/>	
<input type="checkbox"/> Pushover	Webhook	Enabled				<input type="button" value="Test"/>	
<input type="checkbox"/> Slack	Webhook	Enabled				<input type="button" value="Test"/>	
<input type="checkbox"/> SMS	SMS	Enabled		GSM modem: "/dev/ttyS0"		<input type="button" value="Test"/>	
1 selected		<input type="button" value="Enable"/>	<input type="button" value="Disable"/>	<input type="button" value="Export"/>	<input type="button" value="Delete"/>	Displaying 8 of 8 found	

There are plenty of media types in the default dataset

心跳图标 All you need is to finetune the parameters to make them work

Every media type can be tested directly from the frontend



Available only to Zabbix Super Administrators

# NOTIFICATIONS AND ESCALATIONS - MEDIA TYPES

To create a new media, press the [Create media type] button

Media type    Message templates    Options

\* Name some nice name  
Type Email  
\* SMTP server mail.example.com  
SMTP server port 25  
\* SMTP helo example.com  
\* SMTP email zabbix@example.com  
Connection security None STARTTLS SSL/TLS  
Authentication None Username and password  
Message format HTML Plain text  
Description

\* Name some nice name  
Type SMS  
\* GSM modem /dev/ttyS0

\* Name some nice name  
Type Script  
\* Script name script.file.name

Script parameters Parameter {HOST.CONN}

Add

\* Name some nice name  
Type Webhook  
Parameters

Name	Value
URL	
HTTPProxy	
To	{ALERT.SENDTO}
Subject	{ALERT.SUBJECT}
Message	{ALERT.MESSAGE}

Add

\* Script script  
Timeout 30s  
Process tags   
Include event menu entry   
\* Menu entry name  
\* Menu entry URL

心脏病图标 Import/export of media is also supported.

# NOTIFICATIONS AND ESCALATIONS - MESSAGE TEMPLATES

Administration > Media types > Message templates

Message type has 7 options:

- ⌚ Problem
- ⌚ Problem recovery
- ⌚ Problem update
- ⌚ Discovery
- ⌚ Autoregistration
- ⌚ Internal problem
- ⌚ Internal problem recovery

Media types

Media type	Message templates	Options
Problem	Problem started at {EVENT.TIME} on {EVENT.DATE} Pro...	<a href="#">Edit</a> <a href="#">Remove</a>
Problem recovery	Problem has been resolved at {EVENT.RECOVERY.TIME}...	<a href="#">Edit</a> <a href="#">Remove</a>
Problem update	{USER.FULLNAME} {EVENT.UPDATE.ACTION} problem...	<a href="#">Edit</a> <a href="#">Remove</a>
Discovery	Discovery rule: {DISCOVERY.RULE.NAME} Device IP: {D...	<a href="#">Edit</a> <a href="#">Remove</a>
Autoregistration	Host name: {HOST.HOST} Host IP: {HOST.IP} Agent port:...	<a href="#">Edit</a> <a href="#">Remove</a>
Add		

Add Cancel

Media type	Message templates	Options
Concurrent sessions	<input checked="" type="radio"/> One <input type="radio"/> Unlimited <input type="radio"/> Custom	
* Attempts	<input type="text" value="3"/>	
* Attempt interval	<input type="text" value="10s"/>	
Add		Cancel

And additional options:



When creating a new media type - don't forget to create message templates for it!

## NOTIFICATIONS AND ESCALATIONS - USER MEDIA

In the user profile configuration form you can define your own media details

- Only Admin and Super Admin can change their own media details
  - One or more user media
  - Usually e-mail, phone number or other identifier
  - Active based on:
    - Time period
    - Trigger severity



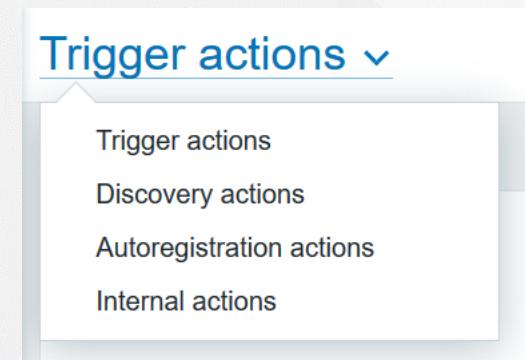
# Actions and Escalations

## Configuration > Actions

~ A flexible set of conditions followed by automatically executed set of operations (notifications, remote commands, script execution etc.)

~ Actions can be defined for:

- Trigger events
- Discovery events
- Auto registration events
- Internal events



<https://www.zabbix.com/documentation/5.0/manual/config/notifications/actions>

~ Notify users

~ Delayed notifications and remote commands

~ Repeated notifications until the problem is resolved

~ Different messages for acknowledged and unacknowledged problems

~ Escalations to other users or user groups

~ Unlimited number of escalation steps

~ Execute remote commands :

- On Zabbix server, proxy and agent
- Via SSH and Telnet
- Via IPMI

~ Run global scripts and custom scripts

~ Provide information with macros

Configuration > Actions > Trigger Actions > [Create action]

Available options:

✓ Name

✓ Conditions

✓ Operations (Main, recovery and update)

Action      Operations

\* Name Report Training problems

Conditions	Label	Name	Action
A		Value of tag <i>Environment</i> equals <i>Training</i>	<a href="#">Remove</a>
	<a href="#">Add</a>		

Enabled

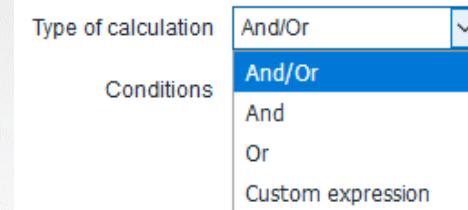
\* At least one operation must exist.

[Add](#)    [Cancel](#)

## Flexible conditions:

- ~ Host, host group
- ~ Trigger name, severity or value
- ~ Tag, Application, time period and more

## Type of calculation



**New condition**

Type	Trigger name
Operator	Trigger name
Value	<ul style="list-style-type: none"> <li>Trigger</li> <li>Trigger severity</li> <li>Application</li> <li>Host</li> <li>Host group</li> <li>Problem is suppressed</li> <li>Tag</li> <li>Tag value</li> <li>Template</li> <li>Time period</li> </ul>

Add Cancel

**Action Operations**

* Name	Training Action															
Type of calculation	And/Or															
Conditions	<table border="1"> <tr> <td>Label</td> <td>Name</td> <td>Action</td> </tr> <tr> <td>A</td> <td>Value of tag Environment equals Training</td> <td><a href="#">Remove</a></td> </tr> <tr> <td>B</td> <td>Trigger severity is greater than or equals High</td> <td><a href="#">Remove</a></td> </tr> <tr> <td>C</td> <td>Host group equals Training/Servers</td> <td><a href="#">Remove</a></td> </tr> <tr> <td>D</td> <td>Host group equals Zabbix servers</td> <td><a href="#">Remove</a></td> </tr> </table>	Label	Name	Action	A	Value of tag Environment equals Training	<a href="#">Remove</a>	B	Trigger severity is greater than or equals High	<a href="#">Remove</a>	C	Host group equals Training/Servers	<a href="#">Remove</a>	D	Host group equals Zabbix servers	<a href="#">Remove</a>
Label	Name	Action														
A	Value of tag Environment equals Training	<a href="#">Remove</a>														
B	Trigger severity is greater than or equals High	<a href="#">Remove</a>														
C	Host group equals Training/Servers	<a href="#">Remove</a>														
D	Host group equals Zabbix servers	<a href="#">Remove</a>														
<p>Add</p> <p>Enabled <input checked="" type="checkbox"/></p> <p>* At least one operation must exist.</p> <p>Update Clone Delete Cancel</p>																



Notifications depend on permissions - no permissions = no notifications

## For Trigger actions:

- ♥ Operations
- ♥ Recovery operations
- ♥ Update operations

## Default operation step duration:

- ♥ 60 seconds to 1 week
- ♥ Supports:
  - Time suffixes e.g. 60s, 1m, 2h, 1d
  - User macros

## Pause operations for suppressed problems:

- ♥ Delays the start of operations if the event is suppressed
  - Maintenance
  - Trigger dependency

The screenshot shows the 'Operations' configuration page in Zabbix. At the top, there are tabs for 'Action' and 'Operations'. Under 'Operations', there is a field for 'Default operation step duration' set to '1h' and a checked checkbox for 'Pause operations for suppressed problems'. Below this, there are three main sections: 'Operations', 'Recovery operations', and 'Update operations'. Each section has a 'Details' table with one row, both labeled 'Notify all involved', with 'Edit' and 'Remove' links. There is also an 'Add' link for each section. A note at the bottom states '\* At least one operation must exist.' and two buttons: 'Add' and 'Cancel'.

	Steps Details	Start in	Duration	Action
Operations	1 Send message to user groups: Zabbix administrators via Email Immediately Default			<a href="#">Edit</a> <a href="#">Remove</a>
	2 Send message to users: Admin (Zabbix Administrator) via SMS 01:00:00 Default			<a href="#">Edit</a> <a href="#">Remove</a>
	<a href="#">Add</a>			
Recovery operations	Details			Action
	Notify all involved			<a href="#">Edit</a> <a href="#">Remove</a>
	<a href="#">Add</a>			
Update operations	Details			Action
	Notify all involved			<a href="#">Edit</a> <a href="#">Remove</a>
	<a href="#">Add</a>			

\* At least one operation must exist.

Add Cancel

## Send message:

- ~ Single user, group
- ~ Single media, all
- ~ Message
- ~ Condition based on acknowledgement

## Run remote command:

- ~ On the server or by agent
- ~ IPMI
- ~ SSH, telnet
- ~ Global script

### Operation details

Operation type: Send message

Steps: 1 - 1 (0 - infinitely)

Step duration: 0 (0 - use action default)

\* At least one user or user group must be selected.

Send to User groups	User group	Action	
	Production (Read)	<a href="#">Remove</a>	
	<a href="#">Add</a>		
Send to Users	User	Action	
	meggy.wilson (Meggy Wilson)	<a href="#">Remove</a>	
	<a href="#">Add</a>		
Send only to	Email (HTML)	Action	
Custom message	<input type="checkbox"/>		
Conditions	Label	Name	Action
	A	Event is not acknowledged	<a href="#">Remove</a>
	<a href="#">Add</a>		

[Update](#) [Cancel](#)

复苏操作允许您在问题解决时收到通知

- 由触发器返回“OK”状态
- 手动关闭问题

复苏操作支持消息和远程命令

复苏操作不支持升级 - 所有操作都分配到一个步骤

**Operation details**

Send to User groups	Action
Send message	User group must be selected.
Remote command	
Notify all involved	
Add	

Send to Users	Action
User	
Add	

Send only to
- All -

Custom message
<input type="checkbox"/>

**Add** **Cancel**

心脏病图标 Update operations allow you to be notified when problems are updated. If someone:

- adds a message to the problem
- acknowledges the problem
- changes problem severity

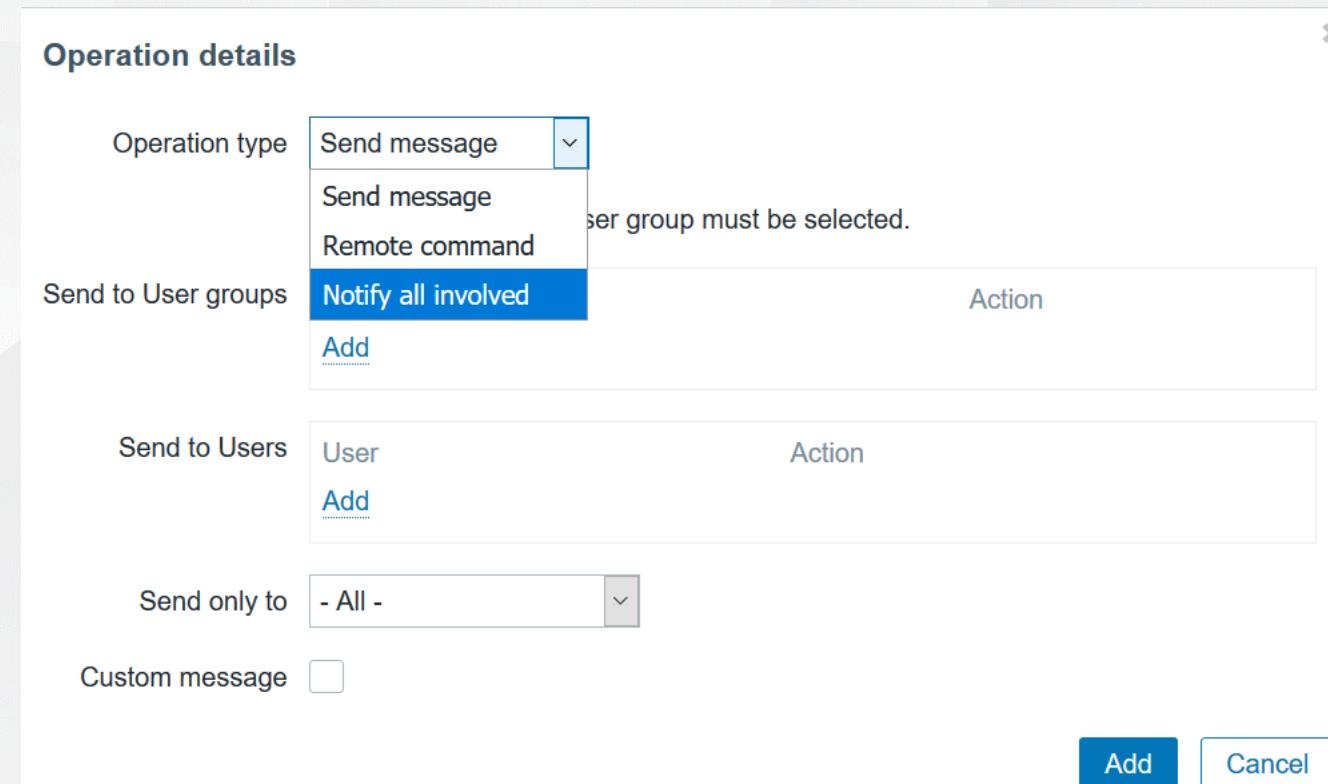
心脏病图标 Both, messages and remote commands, are supported in update operations

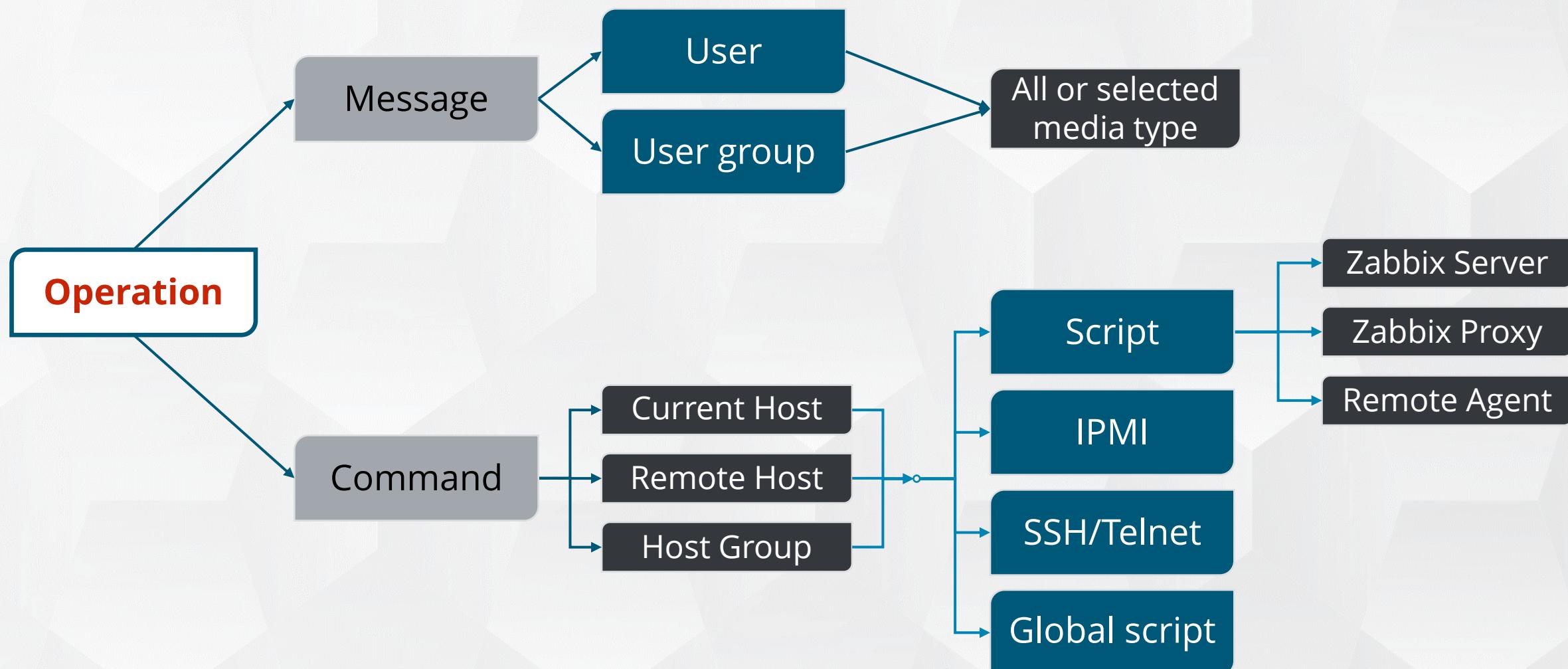
心脏病图标 Update operations do not support escalations - all operations are assigned to a single step

**Operation details**

Operation type	Send message	▼
	Send message	User group must be selected.
	Remote command	
Send to User groups	Notify all involved	Action
	Add	
Send to Users	User	Action
	Add	
Send only to	- All -	▼
Custom message	<input type="checkbox"/>	

**Add** **Cancel**





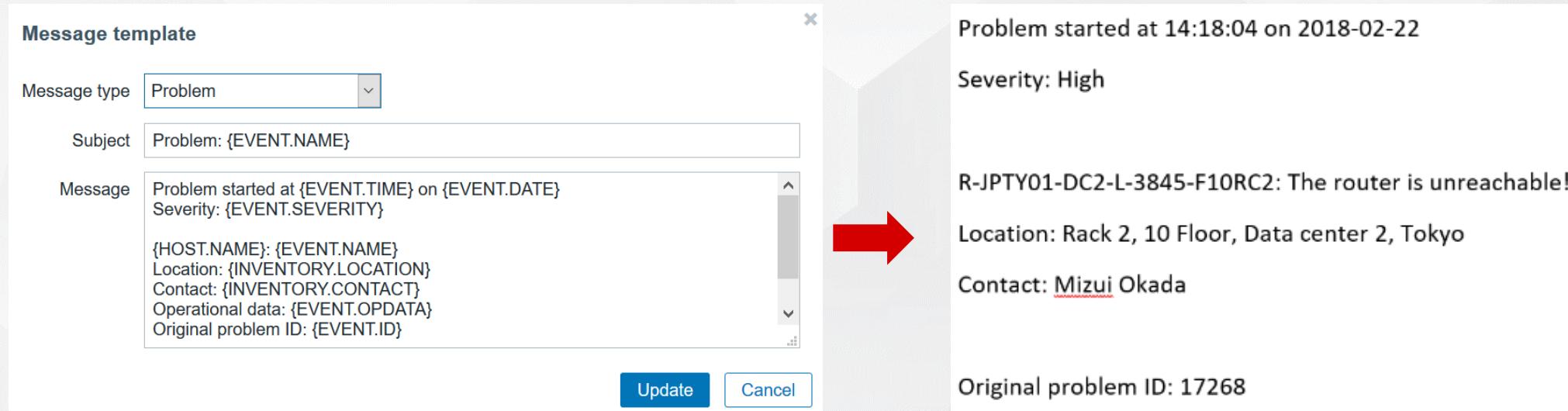
! Remote commands must be enabled on Zabbix agent and proxies

## Use macros to include in notifications:

- ~ Technical data such as last gathered value or host details
- ~ Problem details using {EVENT.\*} macros
  - The {ESC.HISTORY} macro includes full escalation history
- ~ Host inventory details using {INVENTORY.\*} macros

## Useful for:

- ~ Providing information without logging in to Zabbix frontend
- ~ Integrations with ticketing systems



Based on steps

Default interval can be overridden in operations

If step intervals collide, the smallest interval wins

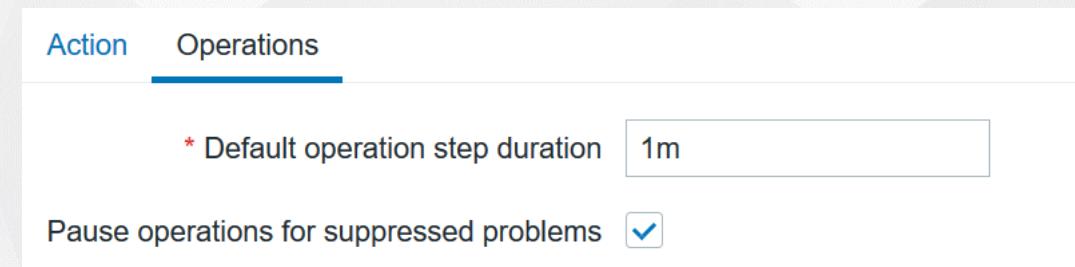
之心 1. Duration of every operation step:

- 1 minute to 1 week
- Can be overridden in step configuration
- Suppressed problems can be paused

Action Operations

\* Default operation step duration

Pause operations for suppressed problems



之心 2. Steps:

- From - execute starting with this step
- To - execute until this step
- 0 = infinity, execution will not be limited
- Custom duration for a single step

Steps  -  (0 - infinitely)

Step duration  (0 - use action default)



心脏病图标 Example 1. Sending a repeated notification once every hour (5 times in total):

Operations	Steps Details	Start in	Duration
1 - 5	Send message to user groups: NOC Team via Email	Immediately	Default
<a href="#">New</a>			

心脏病图标 Example 2. Sending a postponed notification:

* Default operation step duration	15m		
Operations	Steps Details	Start in	Duration
2	Send message to user groups: NOC Team via Email	00:15:00	Default
<a href="#">New</a>			

心脏病图标 Example 3. Escalating the problem after 1 hour to the Boss:

Operations	Steps Details	Start in	Duration
1	Send message to user groups: NOC Team via Email	Immediately	Default
2	Send message to users: jfisher (Jürgen Fisher) via Email	01:00:00	Default
<a href="#">New</a>			

Immediately	email administrator
10 minutes	send SMS to admin
15 minutes	open a report at helpdesk system
30 minutes	email management
1 hour	send SMS to management
2 hours	restart Apache
6 hours	reboot the server
24 hours	power cycle whole server room

Situation	Behavior
<b>Escalation in progress</b>	
Based on any type of event: - the action is disabled - the event is deleted - the trigger is disabled or deleted - the host or item is disabled  - action is deleted	The message in progress is sent Another message on the escalation is sent: <ul style="list-style-type: none"><li>• "NOTE: Escalation cancelled"</li><li>• The recipient is informed that escalation is cancelled</li><li>• No more steps are executed</li></ul> <ul style="list-style-type: none"><li>• No more messages are sent.</li><li>• Information is logged to the server log file. Example: "escalation cancelled: action id:555 deleted"</li></ul>

- ⚠ Make sure the user has at least read permissions on the host that generated the event
- ⚠ Verify that both , email settings and action conditions, have been configured properly
- ⚠ Check user media conditions in user profile
- ⚠ Check that all media templates are defined
- ⚠ Check the details by navigating to Monitoring > Problems and clicking on time for the event
- ⚠ Check action log by navigating to Reports > Action log

The screenshot shows the Zabbix Action log interface. At the top, there is a search bar with fields for 'Recipient' and 'Select', and buttons for 'Apply' and 'Reset'. Below the search bar is a table header with columns: Time, Action, Type, Recipient, Message, Status, and Info. A single row of data is shown in the table:  
Time: 2020-05-27 14:48:33  
Action: Report Host problems  
Type:   
Recipient: john (John Smith)  
Message: Subject:  
Status: Failed  
Info: No media defined for user.

# PRACTICAL SETUP

## 1. Add Email Media type:

~ Name:	Training email
~ SMTP server:	training.lan
~ SMTP server port:	25
~ SMTP helo:	training.lan
~ SMTP email:	<u><a href="#">trainingXX@training.lan</a></u>

## 2. Configure your user media - add email address

## 3. Customize messages

~ Add OS details and location to message body (use inventory fields )

## 4. Update your user profile - add an email

## 5. Create an action with 2 steps:

- ~ send email message immediately in case of a problem
- ~ execute a command after 1 minute

## 6. Generate a problem to test notifications (e.g. CPU load is high )



# Detection of misconfiguration

Navigate to: Configuration > Actions > Internal actions

之心 Detection of problems in configuration:

- Not supported items
- Not supported low level discovery rules
- Unknown triggers

Internal actions Create action

Filter 

Name	Status	Any	Enabled	Disabled
<input type="button" value="Apply"/> <input type="button" value="Reset"/>				

<input type="checkbox"/> Name ▲	Conditions	Operations	Status
<input checked="" type="checkbox"/> Report not supported items	Event type equals <i>Item in "not supported" state</i>	Send message to user groups: Zabbix administrators via all media	Disabled
<input type="checkbox"/> Report not supported low level discovery rules	Event type equals <i>Low-level discovery rule in "not supported" state</i>	Send message to user groups: Zabbix administrators via all media	Disabled
<input type="checkbox"/> Report unknown triggers	Event type equals <i>Trigger in "unknown" state</i>	Send message to user groups: Zabbix administrators via all media	Disabled

Displaying 3 of 3 found

1 selected Enable Disable Delete

之心 By default there are three example actions created to report all problems with entities.

## Configuration &gt; Actions &gt; Internal actions &gt; [Create action]

## ⚡ Define Conditions and Operations

Action    Operations

\* Name

Conditions     
[Add](#)

Enabled

New condition ×

Type   

Operator  equals  contains  does not contain

Value

[Add](#) [Cancel](#)

Action    Operations

\* Default operation step duration

Operations    Action  
1 **Send message to user groups:** Zabbix administrators via all media Immediately Default [Edit](#) [Remove](#)  
[Add](#)

Recovery operations  Action  
**Notify all involved** [Edit](#) [Remove](#)  
[Add](#)

\* At least one operation must exist.

[Add](#) [Cancel](#)

# PRACTICAL SETUP

1. Set up a media type for internal actions:
  - ~ Create a Problem message template
  - ~ Create a Recovery message template
2. Set up an action to report not supported SSH items:
  - ~ Make an SSH item "Not supported"
  - ~ Check the problem message
  - ~ Make the SSH item supported again
  - ~ Check the recovery message
3. Check reports for actions.



Advanced task: Create internal action for triggers, use tag "Location", test it, break trigger.



# Custom notifications

On the Zabbix server side, add a new Media type with type Script

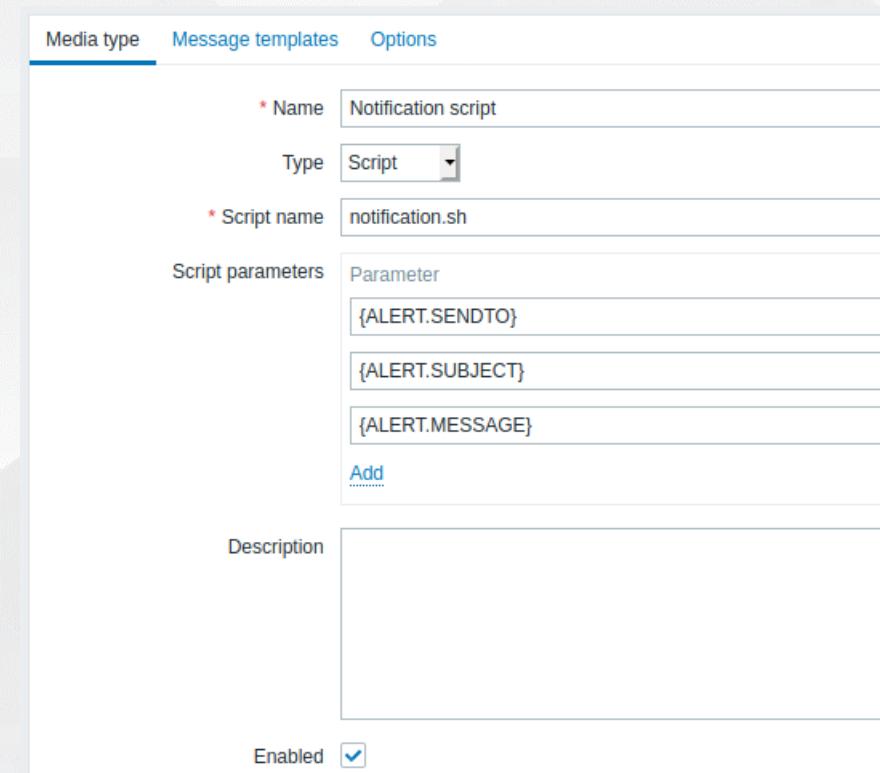
- ~ Script must be located in a directory, specified by AlertScriptsPath directive in zabbix\_server.conf

Command-line parameters can be defined per each script

Example:

- ~ {ALERT.SENDTO} – Send to
- ~ {ALERT.SUBJECT} – Subject
- ~ {ALERT.MESSAGE} – Body

Executed by Zabbix server daemon  
as user "zabbix"



<https://www.zabbix.com/documentation/5.0/manual/config/notifications/media/script>

# PRACTICAL SETUP

1. Create a script to echo messages to log file:
  - ~ Name: Write to log
    - Send as much information to log as possible, including values from the items
2. Upload script to the server media scripts folder
  - ~ Make script executable
  - ~ Set proper access permissions
3. Create an action to push events to the log file



# MAINTENANCE

Maintenance is used to:

- ~ Suppress notifications
- ~ Suppress data collection

The screenshot illustrates the Zabbix interface for managing maintenance. It shows three main sections: 'Problems', 'Hosts', and a map.

**Problems:** A table listing two problems. The first is a 'PROBLEM' for 'Training-VM-XX' with severity 'Average' (orange), indicating 'SSH service is down'. The second is a 'PROBLEM' for 'Training-VM-XX' with severity 'Warning' (yellow), indicating 'CPU Load is high'. Both entries have an 'Actions' column with a red 'No' button.

**Hosts:** A table showing host details. The first host, 'Training-VM-XX', has an 'Interface' of 'student-xx: 10050' and is connected via 'ZBX' (green). The second host, also 'Training-VM-XX', is in 'Maintenance' mode with a note 'Allways in maintenance [Maintenance with data collection]'. Its interface is 'student-xx: 10050' and it is connected via 'IPMI' (grey).

**Map:** A small map icon for 'Training-VM-XX' showing its status as 'In maintenance' with a green 'OK' status.

- Visually identified in problems, maps and dashboard, depending on filter settings



<https://www.zabbix.com/documentation/5.0/manual/maintenance>

⚠ The Timer processes are responsible for switching host status to/from maintenance at 0 seconds of every minute:

- Maintenance periods for hosts, host groups and problems
- No maintenance for a specific item, application or template
- History of maintenance periods is not stored
- If tags are specified:
  - the hosts will be activated
  - problems will be suppressed if tags match

The screenshot shows the 'Maintenance' tab selected in the top navigation bar. A new maintenance rule is being created with the following details:

- Name:** Critical fixes
- Maintenance type:** With data collection
- Active since:** 2020-04-29 00:00
- Active till:** 2025-04-01 00:00

Below the main form, a table displays the associated period:

Periods	Hosts and groups
* Periods	Period type: One time only
	Schedule: 2020-04-29 16:54
	Period: 1h
	Action: <a href="#">Edit</a> <a href="#">Remove</a>

[Add](#) button is visible at the bottom of the period section.

The 'Hosts and groups' tab is selected in the top navigation bar. The configuration includes:

- Host groups:** Zabbix servers (with a 'Select' button)
- Hosts:** (with a 'Select' button)
- Tags:** And/Or Or
  - Environment: Contains Production (with a 'Remove' button)

An 'Add' button is located at the bottom of the tags section.



Periods must be inside the Maintenance rule Active timeframe!

When a host is in maintenance:

- ~ all problems will be suppressed

Time ▾	<input type="checkbox"/>	Severity	Info	Host	Problem
11:59:02 AM	<input type="checkbox"/>	Average		net.brocade.fc.300	FAN #3: Fan is in critical state
11:59:02 AM	<input type="checkbox"/>	High		net.brocade.fc.300	SLOT #1: critical state

If the tags have been specified:

- ~ maintenance for selected hosts will be limited to problems with the corresponding tags

Time ▾	<input type="checkbox"/>	Severity	Info	Host	Problem
11:59:02 AM	<input type="checkbox"/>	Average		net.brocade.fc.300	FAN #3: Fan is in critical state
11:59:02 AM	<input type="checkbox"/>	High		net.brocade.fc.300	SLOT #1: critical state

## Workflow:

- ~ Problem > Action executed > Escalator generates steps

## Example:

- ~ Simple action with 3 operation steps

Action steps	Operation	Execution time
Step 1	Mail to Admin	immediately
Step 2	Sms to Admin	+10
Step 3	Open ticket in Jira	+20

With maintenance, there are two scenarios:

- ~ A problem starts and the host goes into maintenance
- ~ A host goes into maintenance and a problem starts

! Maintenance uses Zabbix server time

A problem starts, but 5 minutes later the host goes into maintenance.

的心 Maintenance rule:

- Period 60 minutes
- From 11:00 till 12:00

的心 Operation step duration 10 minutes

Pause operations for suppressed problems						
Event	Action steps	Operation	Yes		No	
			Step timing	Step execution time	Step timing	Step execution time
10:55 Problem	1	Mail to Admin	Immediately	10:55	Immediately	10:55
11:00 Maintenance			<b>Pause for 60 minutes</b>		+10	11:05
	2	Sms to Admin	+10 +60	12:05	+20	11:15
	3	Open ticket in Jira	+20 +60	12:15		

A host goes into maintenance and the problem starts 10 minutes later

的心 Maintenance rule:

- Period 60 minutes
- From 11:00 till 12:00

的心 Operation step duration 10 minutes

Event	Action steps	Operation	Pause operations for suppressed problems	
			Step timing	Step execution time
11:00 Maintenance			<b>Yes</b>	
11:10 Problem	1	Mail to Admin	+50	12:00
	2	Sms to Admin	+10 +50	12:10
	3	Open ticket in Jira	+20 +50	12:20
			<b>No</b>	
			Step timing	Step execution time
			Immediately	11:10
			+10	11:20
			+20	11:30

# PRACTICAL SETUP

1. Create a new maintenance:
  - ~ Name: Training maintenance
2. Configure new maintenance period for your host:
  - ~ Period type: One time only
  - ~ Date: today as soon as possible
  - ~ Maintenance period length: 1 hour
3. Check frontend for maintenance status (orange background/wrench icon).



Advanced task: Create another daily maintenance by using Tags



# Business level monitoring

## Define your SLAs

- ~ Understand business-level impacts and set reasonable targets
- ~ Translate business-level SLAs to component SLAs

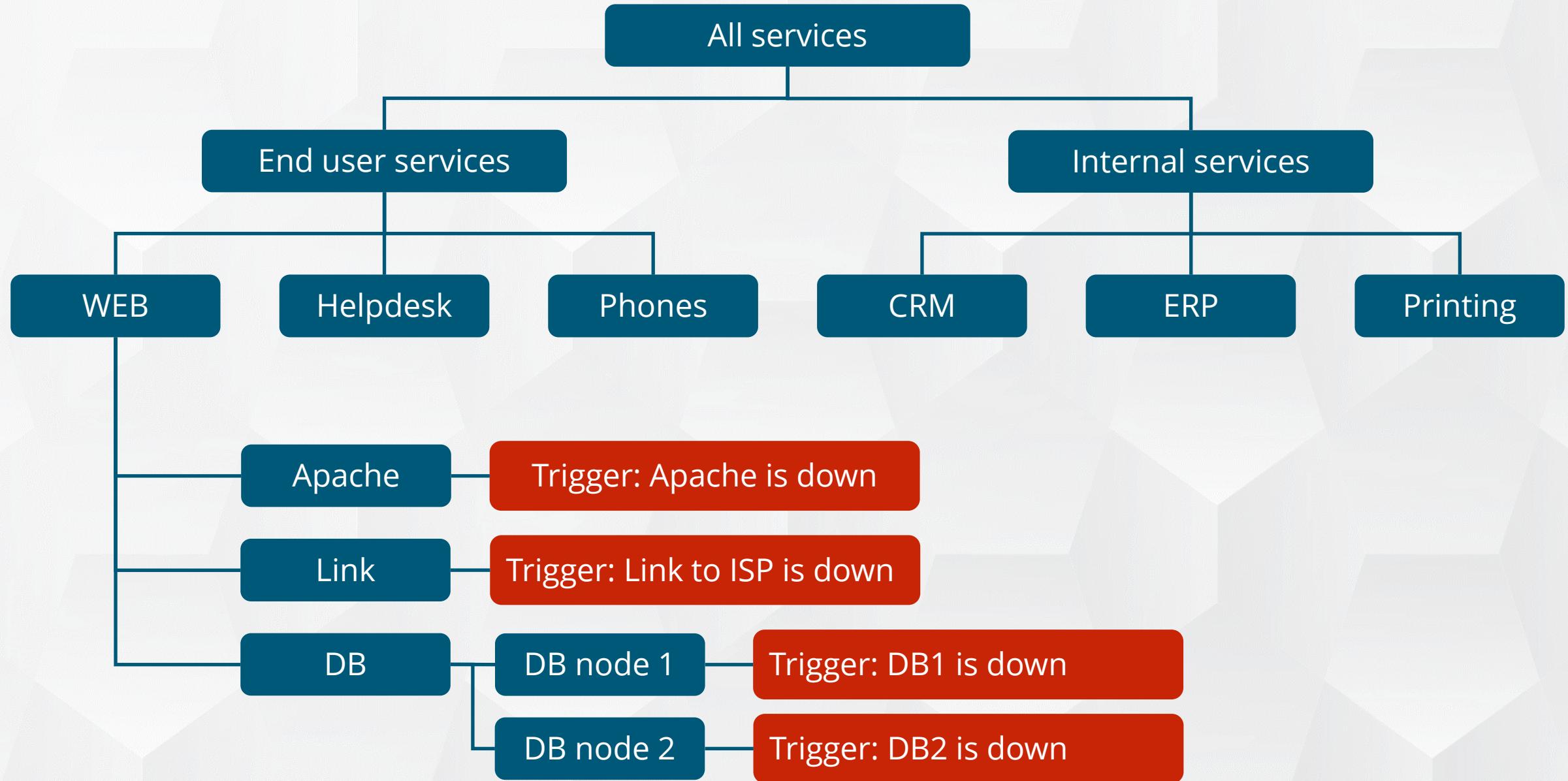
## Measure your SLAs

- ~ Service/application monitoring
- ~ Middleware (App server, JMX, ODBC)
- ~ Log files
- ~ Host/OS level monitoring

## Configuration &gt; Services

- ♥ Parent-child relationship
- ♥ Linked to triggers, problem if all/any child has a problem
- ♥ Optional SLA calculation per service

SERVICE	ACTION	STATUS CALCULATION	TRIGGER
root	<a href="#">Add child</a>		
▼ Card system	<a href="#">Add child</a>	Problem, if at least one child has a problem	
▶ Application	<a href="#">Add child</a>	Problem, if all children have problems	
▶ Middleware	<a href="#">Add child</a>	Problem, if at least one child has a problem	
▶ Infrastructure	<a href="#">Add child</a>	Problem, if at least one child has a problem	
▼ Channels	<a href="#">Add child</a>	Problem, if at least one child has a problem	
▼ Riga office	<a href="#">Add child</a>	Problem, if all children have problems	
iNet	<a href="#">Add child</a> <a href="#">Delete</a>	Problem, if at least one child has a problem	Incoming traffic for Provider eth2 (10.0.2.15) is too low
Baltic	<a href="#">Add child</a> <a href="#">Delete</a>	Problem, if at least one child has a problem	Incoming traffic for Provider eth3 (192.168.56.30) is too low
▶ Tokyo office	<a href="#">Add child</a>	Problem, if all children have problems	
▶ Providers	<a href="#">Add child</a>	Problem, if at least one child has a problem	



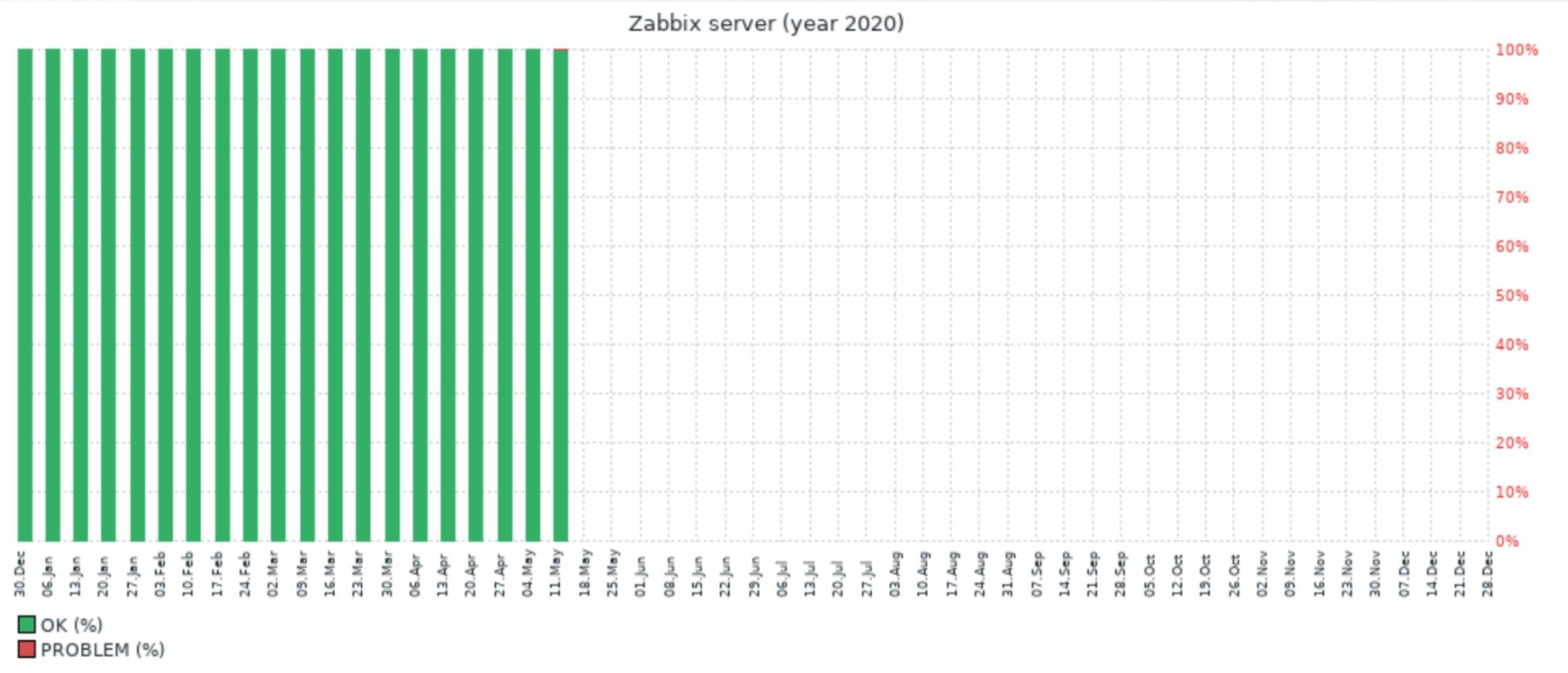
## Monitoring &gt; Services

- ♥ SLA displaying
- ♥ SLA graphs
- ♥ Can't be calculated retroactively
- ♥ "Not classified" and "Information" severity triggers are ignored for SLA calculation!

Services					Period	Last 7 days	
Service	Status	Reason	Problem time	SLA / Acceptable SLA			
root							
▼ Zabbix server	Average	High memory utilization ( >90% for 5m)	<div style="width: 88.5%; background-color: #2e7131;"></div> 0.0885	99.9115	/ 99.5000		
▼ Database	OK		<div style="width: 100%; background-color: #2e7131;"></div> 0.0000	100.0000	/ 99.5000		
MySQL	OK		<div style="width: 100%; background-color: #2e7131;"></div> 0.0000	100.0000	/ 99.5000		
▼ Frontend	OK		<div style="width: 100%; background-color: #2e7131;"></div> 0.0000	100.0000	/ 99.5000		
Apache	OK		<div style="width: 100%; background-color: #2e7131;"></div> 0.0000	100.0000	/ 99.5000		
PHP fpm	OK		<div style="width: 100%; background-color: #2e7131;"></div> 0.0000	100.0000	/ 99.5000		
▼ Zabbix server daemon	Average	High memory utilization ( >90% for 5m)	<div style="width: 88.5%; background-color: #2e7131;"></div> 0.0885	99.9115	/ 99.5000		
Caches - High memory utilization ( >90% for 5m)	Average	High memory utilization ( >90% for 5m)	<div style="width: 100%; background-color: #2e7131;"></div> 0.0000	100.0000	/ 99.5000		

Weekly based.

Shows only problem/OK states



## Daily / Weekly / Monthly / Yearly

## Service availability report: Zabbix server

Period  Year  

From	Till	Ok	Problems	Downtime	SLA	Acceptable SLA
2020-05-11 00:00	2020-05-16 12:17	5d 12h 3m	0d 0h 13m		99.8299	99.5
2020-05-04 00:00	2020-05-11 00:00	7d 0h 0m			100.0000	99.5
2020-04-27 00:00	2020-05-04 00:00	7d 0h 0m			100.0000	99.5
2020-04-20 00:00	2020-04-27 00:00	7d 0h 0m			100.0000	99.5
2020-04-13 00:00	2020-04-20 00:00	7d 0h 0m			100.0000	99.5
2020-04-06 00:00	2020-04-13 00:00	7d 0h 0m			100.0000	99.5

Every service has its own time settings:

- ✓ Uptime - service uptime
- ✓ Downtime - service state within this period does not affect SLA
- ✓ One-time downtime - a single downtime
  - Service state within this period does not affect SLA
- ✓ Service times affect calculation of service status and SLA by the frontend
- ✓ The "No data collection" maintenance can be used to configure the maintenance period for a service (no data = no problems = no downtime)

Services					
Service	Dependencies	Time			
Service times	Type	Interval	Note	Action	
	Uptime	Monday 08:00 - Friday 18:00		<a href="#">Remove</a>	
	Downtime	Saturday 23:00 - Saturday 23:59		<a href="#">Remove</a>	
	Downtime	Sunday 00:00 - Saturday 03:00		<a href="#">Remove</a>	
	One-time downtime	2020-05-17 13:00 - 2020-05-17 15:00	Critical patch install	<a href="#">Remove</a>	

# PRACTICAL SETUP

1. Create a new SLA:
  - ~ Name: Zabbix training SLA
  - ~ Acceptable SLA 95%
  - ~ Status calculating algorithm: Problem if at least one child has a problem
  - ~ Add training schedule including lunchtime for every day as Uptime/Downtime
2. Children: you and 2 other trainees(example : student-XX)
  - ~ Add a trigger: CPU Load is very high on {HOST.NAME}
3. Make the triggers switch to problem state
4. Check service counters



# Low-Level Discovery

Low-level discovery provides a way to automatically create:

- Items
- Triggers
- Graphs
- Screens
- Hosts

- ✓ Automatically start monitoring file systems, network interfaces and other things.
- ✓ No need to create items manually – prototypes are used
- ✓ Possible to remove unneeded entities automatically



## Low-Level Discovery

### For existing hosts

Periodically search on all Hosts for a new or missing components

### Action

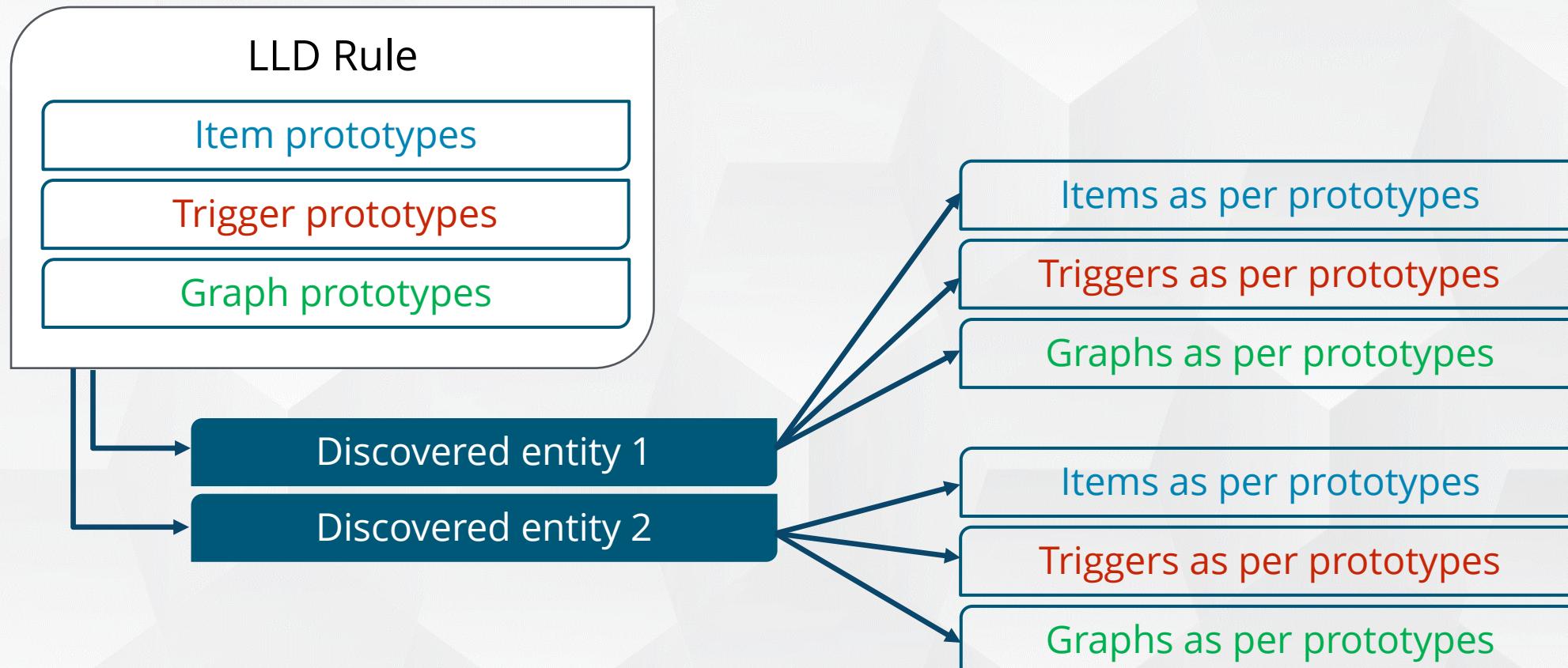
Create/delete Items/Triggers for the existing host



[https://www.zabbix.com/documentation/5.0/manual/discovery/low\\_level\\_discovery](https://www.zabbix.com/documentation/5.0/manual/discovery/low_level_discovery)

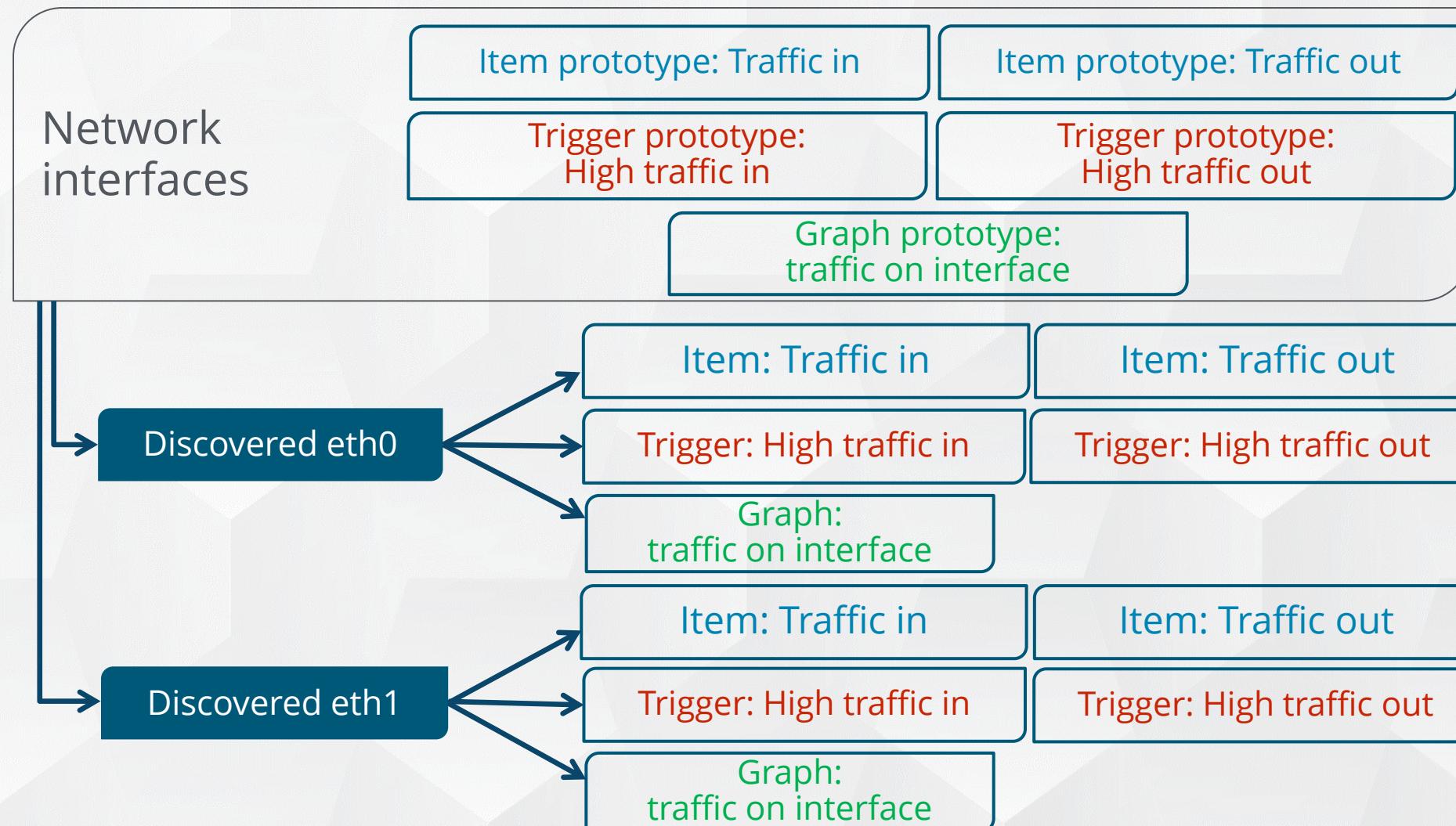
## Workflow:

- ~ Create discovery item/rule in Configuration > Templates > Discovery
- ~ Create prototypes of items, triggers and graphs that should be created by the rule



This topic is discussed in Professional and Expert level training

Example of the network interface discovery:



## 心跳 Zabbix agent

- Filesystems
- Block devices
- Network interfaces
- CPUs and CPU cores
- Only on Windows
  - Services
  - WMI queries
  - Performance counters

## 心跳 Linux systemd services (only for Agent2)

## 心跳 SNMP entities

## 心跳 JMX entities

## 心跳 IPMI entities

## 心跳 SQL entities

## 心跳 Zabbix host interfaces

## 心跳 ...anything using scripting

# PRACTICAL SETUP

## 1. Use host: Training-VM-XX

- ~ Link to template "Template Module Linux filesystems by Zabbix agent"
- ~ Reload server configuration cache
- ~ Manually execute the discovery rule
- ~ Check for automatically created items and values for existing filesystems

## 2. Check that discovery rule is working as expected

- ~ Create new virtual filesystem
- ~ Manually execute the discovery rule
- ~ Check for automatically created items for new filesystem



Advanced task: Link "Template Module Linux network interfaces by Zabbix agent" check



# XML IMPORT/EXPORT

## Exports

### Hosts and templates:

- ♥ Items
- ♥ Triggers
- ♥ Graphs
- ♥ Template linkage
- ♥ Host macros
- ♥ Applications
- ♥ Screens
- ♥ WEB scenarios
- ♥ Value maps used by items

Value mapping

Media types

Screens

Network maps

♥ Images are exported in base64 format

♥ Hosts must be exported separately

Supports XML exports from previous Zabbix releases 4.X, 3.X, 2.X and 1.8



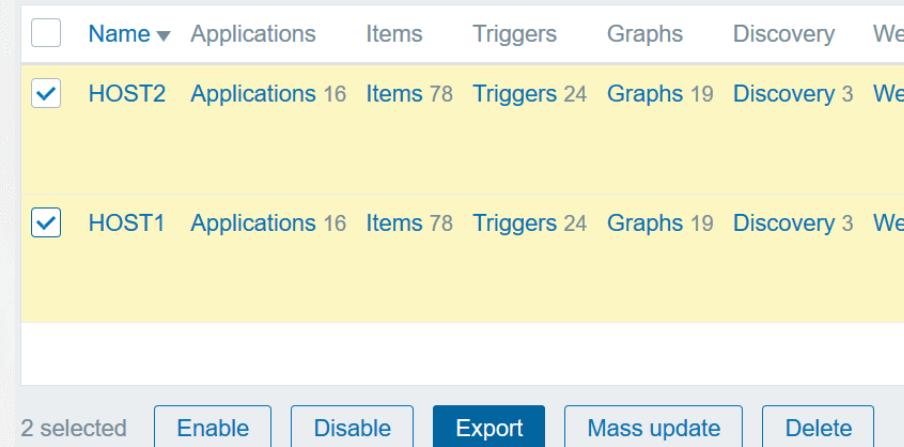
Values of "Secret text" macros are not exported!



[https://www.zabbix.com/documentation/current/manual/xml\\_export\\_import](https://www.zabbix.com/documentation/current/manual/xml_export_import)

Configuration > Hosts/Templates > Select hosts > [Export]

- ✓ Partial configuration backup purposes
- ✓ Automated/scripted configuration generation
- ✓ Scripted large-scale configuration changes
- ✓ Configuration transfer from development machine to production



## Configuration &gt; Hosts/Templates &gt; [Import]

## ⚡ Global import form

Rule	Description
Update existing	Existing elements will be updated with data taken from the import file. Otherwise, they will not be updated.
Create new	Import will add new elements using data from the import file. Otherwise, it will not add them.
Delete missing	Import will remove existing elements not present in the import file. Otherwise, it will not remove them. If Delete missing is marked for template linkage, existing template linkage not present in the import file will be removed from the host along with all entities inherited from the potentially unlinked templates (items, triggers, etc).

Import

\* Import file  No file selected.

Rules      Update existing  Create new  Delete missing

Groups	<input checked="" type="checkbox"/>
Hosts	<input type="checkbox"/>
Templates	<input checked="" type="checkbox"/>
Template screens	<input checked="" type="checkbox"/>
Template linkage	<input checked="" type="checkbox"/>
Applications	<input checked="" type="checkbox"/>
Items	<input checked="" type="checkbox"/>
Discovery rules	<input checked="" type="checkbox"/>
Triggers	<input checked="" type="checkbox"/>
Graphs	<input checked="" type="checkbox"/>
Web scenarios	<input checked="" type="checkbox"/>
Screens	<input type="checkbox"/>
Maps	<input type="checkbox"/>
Images	<input type="checkbox"/>
Media types	<input type="checkbox"/>
Value mappings	<input type="checkbox"/>

```
<?xml version="1.0" encoding="UTF-8"?>
<zabbix_export>
  <version>5.0</version>
  <date>2020-04-22T07:47:33Z</date>
  <groups>
    <group>
      <name>Discovered hosts</name>
    </group>
    <group>
      <name>Zabbix servers</name>
    </group>
  </groups>
  <hosts>
    <host>
      <host>Zabbix server 1</host>
      <name>Main Zabbix server</name>
      <proxy>
        <name>Remote proxy</name>
      </proxy>
      <tls_connect>TLS_PSK</tls_connect>
      <tls_accept>
        <option>NO_ENCRYPTION</option>
        <option>TLS_PSK</option>
      </tls_accept>
      <tls_psk_identity>z112</tls_psk_identity>
      <tls_psk>1f87b595725ac58dd977beef14b97461a7c1045b9a1c963065002c5473194952</tls_psk>
      <templates>
        <template>
          <name>Template App Zabbix Server</name>
        </template>
      </templates>
    </host>
  </hosts>
</zabbix_export>
```

# PRACTICAL SETUP

1. Export:
  - ~ Your training host
2. Modify XML file and add:
  - ~ Change: Hostname to trainers VM
  - ~ Visible name: Use trainers name + VM
  - ~ Interface: Use "trainer" as DNS name
3. Import modified XML files back



Advanced task: Add a description for trainer's host in XML file.

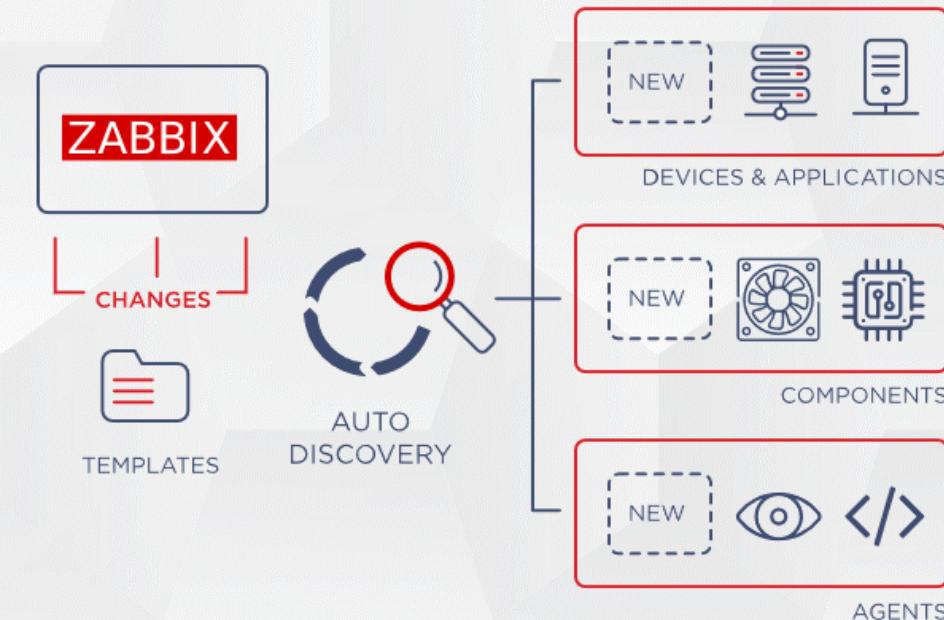


# Automation

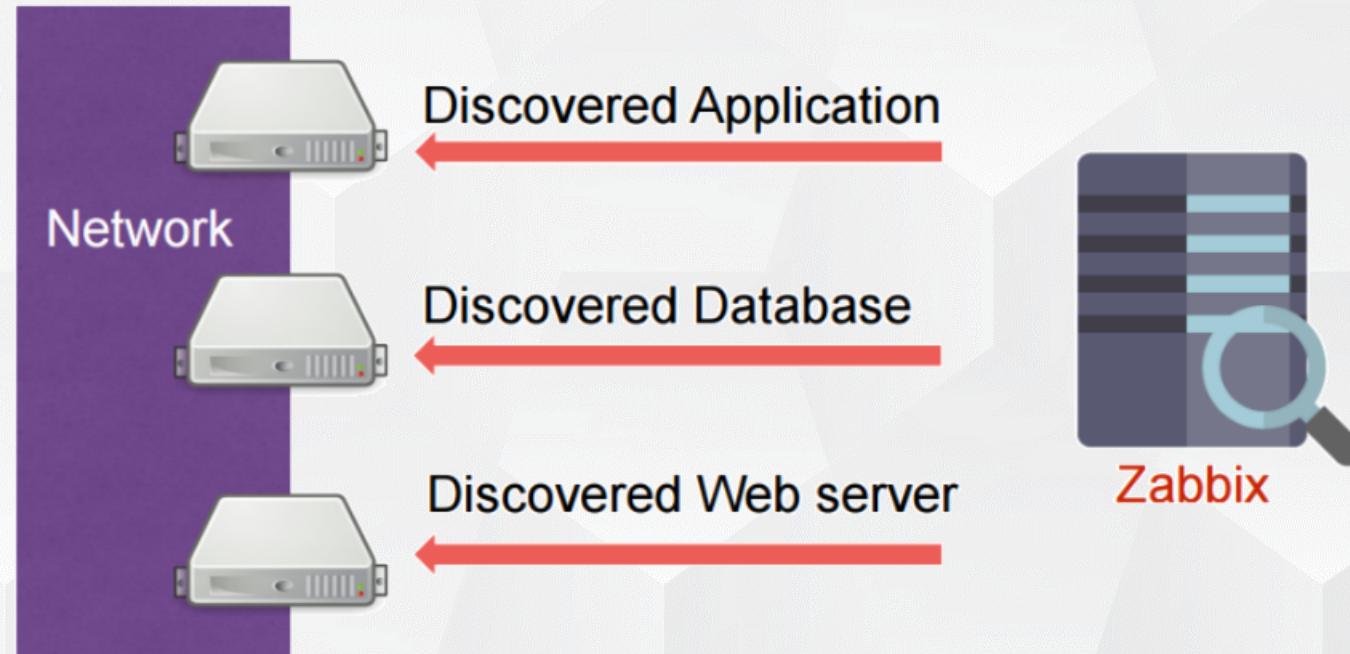
## Automate actions for different elements (hosts, applications, etc.):

- Add/remove
- Enable/disable
- Link/unlink templates
- Change groups
- Etc.

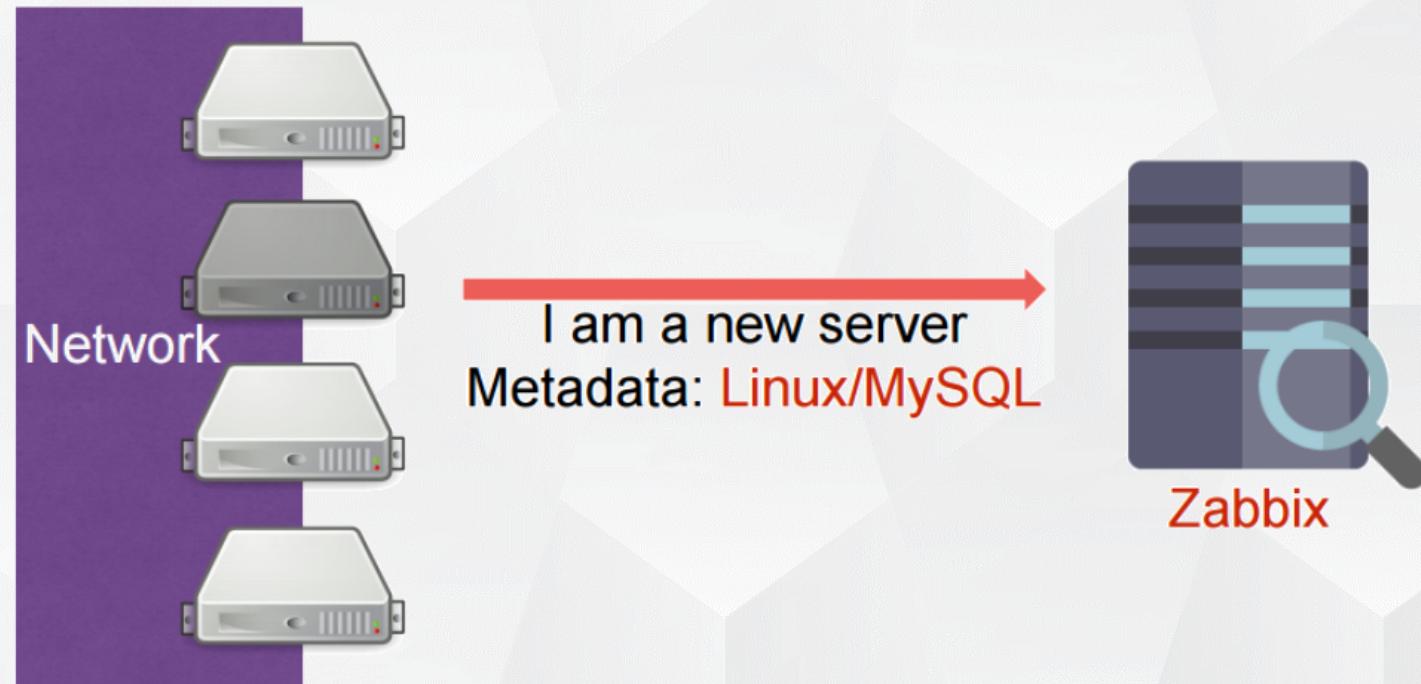
- Auto-registration of active agent
- Network discovery
- Low-level discovery
- Zabbix API



Scan the network for services or devices and take pre-defined actions

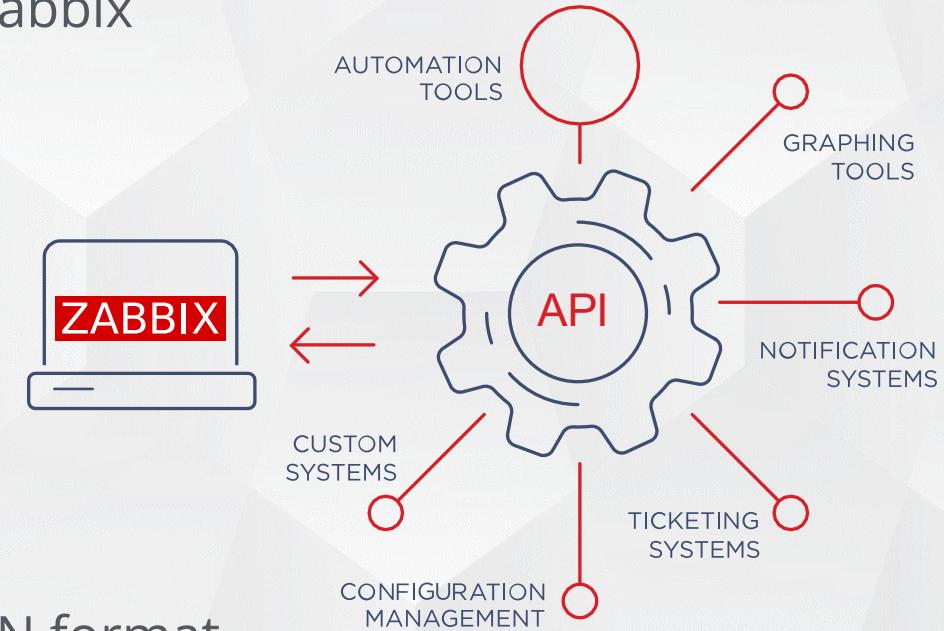


Add new hosts with installed Zabbix agent in active mode for monitoring without any manual configuration



## Zabbix API

- ~ Web based and is shipped as part of web frontend
- ~ Allows to retrieve and modify the configuration of Zabbix
- ~ Provides access to historical data
- ~ 230+ different API methods
- ~ Create new applications to work with Zabbix
- ~ Integrate with third party software
- ~ Custom reports
- ~ Respects permissions
- ~ Requests and responses are encoded using the JSON format





# BACKUPS

We strongly recommend that you always maintain regular backups as well as make a fresh backup before every upgrade.

- ~ Database backup

- ~ Historical data can be separated: history\*, trends\*, events\*

Configuration files:

- ~ zabbix\_server.conf, zabbix\_agentd.conf, zabbix\_proxy.conf

Scripts, modules, alert and external scripts.

Optional:

- ~ Binaries, frontend files

There are various ways to backup Zabbix DB.

Example for MySQL:

- ✓ xtrabackup/mariadbbackup (full physical backup)
- ✓ xtrabackup/mariadbbackup (incremental physical backup)
- ✓ mysqldump (logical backup)
- ✓ binary logging
- ✓ replication

The mysqldump is the most popular MySQL backup method.

- ✓ safe, but slow (e.g. 100GB/1 hour)
- ✓ may cause performance degradation

Xtra/mariadb backup has more recovery options and better performance.

The commands to backup/restore will vary depending on your database and selected backup method

Zabbix database backup:

- ~ PostgreSQL: pg\_dump zabbix > zabbix\_db
- ~ MySQL: mysqldump --single-transaction -p --tab /mnt/backup zabbix

Restore a backup:

- ~ PostgreSQL: psql zabbix < zabbix\_db
- ~ MySQL: cat /mnt/backup/\*.sql | mysql -p zabbix
- ~ mysqlimport -p --use-threads=4 zabbix /mnt/backup/\*.txt

XML export can be used for other objects in Zabbix, for example, templates or hosts.

Default MySQL settings could cost you 10x restore slowdown.

InnoDB log file size and buffer pool size are important.

When importing data, you can speed up table imports by temporarily turning off the uniqueness checks:

- ~`unique\_checks=0
- ~`foreign\_key\_checks=0
- ~`innodb\_doublewrite=0
- ~`sql\_log\_bin=0

Load files in parallel using N threads.

Restore operation takes more time than the backup.



# QUESTIONS?



**Time for a break :)**