



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 > 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

 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.

Availability report

Monitoring

Inventory

Reports

System information

Availability report

Triggers top 100

From: now/d

To: now/d

Apply

Mode: By trigger template

By host

By trigger template

Zoom out

Last 2 days

Yesterday

Today

Last 5 minutes

Last 7 days

Day before yesterday

Today so far

Last 15 minutes

Last 30 days

This day last week

This week

Last 30 minutes

Last 3 months

Previous week

This week so far

Last 1 hour

Last 6 months

Previous month

This month

Last 3 hours

Last 1 year

Previous year

This month so far

Last 6 hours

Last 2 years

This year

Last 12 hours

This year so far

Last 1 day



[.../5.0/manual/web_interface/frontend_sections/reports/availability](https://www.zabbix.com/manual/web_interface/frontend_sections/reports/availability)

Triggers by hosts availability report:

- ⚡ set the time frame
- ⚡ filter by host groups or hosts

Availability report

Mode By host v

< Zoom out >
Today 🕒
Filter ⌵

Host groups 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 ▼

< Zoom out >
Today 🕒
Filter 🔍

Template group Training/Templates ▼

Template Template Basic ▼

Template trigger all ▼

Host group Training/Servers ▼

all ▼

all

CPU Load is high on {HOST.NAME}

CPU Load is very high on {HOST.NAME}

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 |

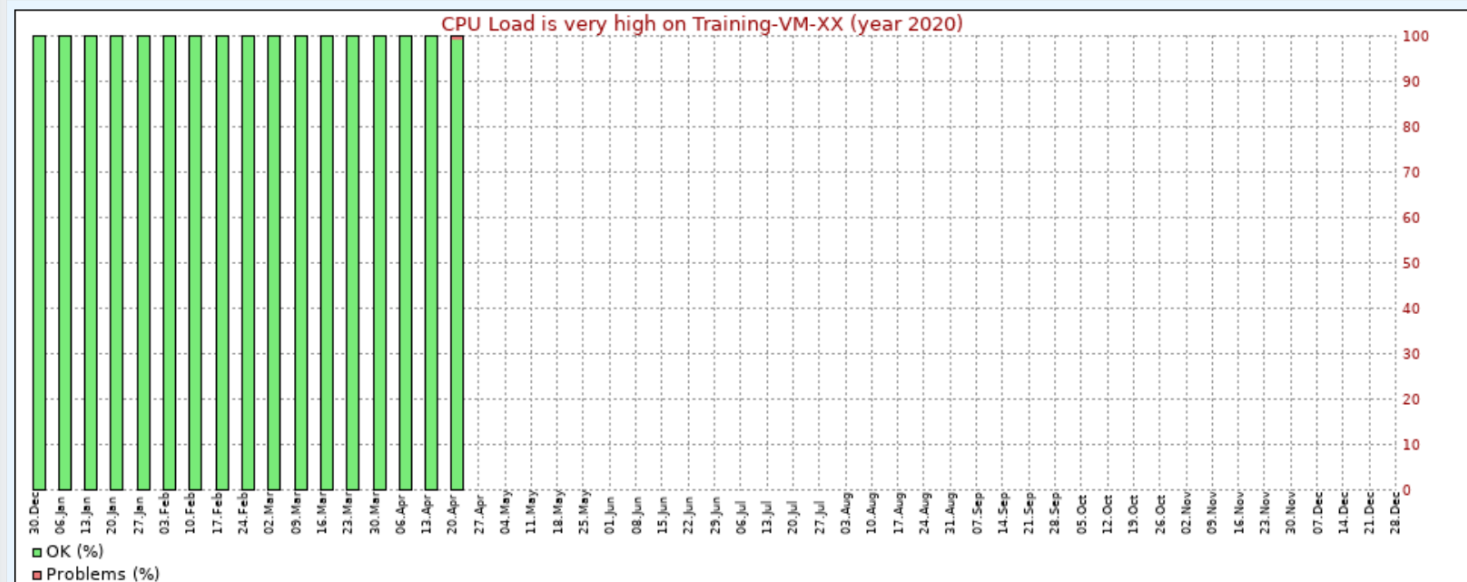
Displaying 2 of 2 found

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

| Problems | Ok | Graph |
|----------|-----------|-------|
| 7.3149% | 92.6851% | Show |
| 7.9654% | 92.0346% | Show |
| | 100.0000% | Show |

Availability report

Training-VM-XX CPU Load is very high on Training-VM-XX



Triggers that have changed their state most often:

- ⚡ Set the period of evaluation and adjust filters
- ⚡ Sorted by the number of status changes
- ⚡ Useful to detect flapping triggers

Host groups

Hosts

Severity Not classified Warning High
 Information Average Disaster

100 busiest triggers

< Zoom out > Today

From

To

| | | | |
|---------------|----------------------|-------------------|-----------------|
| Last 2 days | Yesterday | Today | Last 5 minutes |
| Last 7 days | Day before yesterday | Today so far | Last 15 minutes |
| Last 30 days | This day last week | This week | Last 30 minutes |
| Last 3 months | Previous week | This week so far | Last 1 hour |
| Last 6 months | Previous month | This month | Last 3 hours |
| Last 1 year | Previous year | This month so far | Last 6 hours |
| Last 2 years | | This year | Last 12 hours |
| | | This year so far | Last 1 day |

| 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 > Hosts > {Host} > Host inventory

⚡ By default: inventory is disabled

Tags Macros **Inventory** Encryption

Disabled Manual Automatic

Type

⚡ Set to Manual and fill in necessary fields

Disabled **Manual** Automatic

Type

Type (Full details)

Name

1. Host inventory mode must be set to Automatic

⚡ Configuration > Hosts > {host} > Inventory

Host Templates IPMI Tags Macros **Inventory** Encryption

Disabled Manual **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 ← System name

Alias

OS Linux version 3.10.0-1062.18.1.el7.x86_64 (mockbuild@kbuilder.bsys.centos.org) (gcc version 4.8.5) ← Operating system

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

Host inventory overview

Filter 

Host groups:
type here to search

Grouping by:

| Vendor | Host count |
|-------------------|------------|
| MikroTik | 7 |
| D-Link | 4 |
| Juniper | 3 |
| Extreme | 2 |
| Brocade | 2 |
| Ubiquiti Networks | 2 |
| Cisco | 2 |
| Alcatel | 1 |
| Q-Tech | 1 |


Grouped by filter field

Click to access 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 groups

Field

| 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.snmp labs.com (you can change this!) | Network device | 6.38.5 | 49DF046080AB | | |
| net.mikrotik.941-2nD | Europe Data center, Linux servers, Network | zeus.snmp labs.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 | 47B8029xxxxxx | | |
| 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 | vc core-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:

⚡ 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

⚡ 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 |
|-------------------------|--------------------------------|--|------------------|----------------------------------|
| <code>10.100.0.5</code> | <code>net.mikrotik.450g</code> | <input type="radio"/> IP <input type="radio"/> DNS | <code>161</code> | <input checked="" type="radio"/> |

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

- 📧 Email
- 📧 SMS (Modem support)
- 📧 Webhooks
- 📧 Custom "alert" scripts

Media types

Create media type Import

Filter

Name Status Any Enabled Disabled

Apply Reset

| <input type="checkbox"/> | Name ▲ | Type | Status | Used in actions | Details | Action |
|-------------------------------------|------------|---------|---------|-----------------|---|--------|
| <input type="checkbox"/> | Discord | Webhook | Enabled | | | Test |
| <input checked="" type="checkbox"/> | Email | Email | Enabled | | SMTP server: "mail.example.com", SMTP helo: "example.com", SMTP email: "zabbix@example.com" | Test |
| <input type="checkbox"/> | Mattermost | Webhook | Enabled | | | Test |
| <input type="checkbox"/> | Opsgenie | Webhook | Enabled | | | Test |
| <input type="checkbox"/> | PagerDuty | Webhook | Enabled | | | Test |
| <input type="checkbox"/> | Pushover | Webhook | Enabled | | | Test |
| <input type="checkbox"/> | Slack | Webhook | Enabled | | | Test |
| <input type="checkbox"/> | SMS | SMS | Enabled | | GSM modem: "/dev/ttyS0" | Test |

Displaying 8 of 8 found

1 selected Enable Disable Export Delete

There are plenty of media types in the default dataset

- 📧 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

Type

* SMTP server

SMTP server port

* SMTP helo

* SMTP email

Connection security

Authentication

Message format

Description

* Name

Type

* GSM modem

* Name

Type

* Script name

Script parameters

| Parameter |
|--|
| <input type="text" value="{HOST.CONN}"/> |

[Add](#)

* Name

Type

Parameters

| Name | Value |
|--|--|
| <input type="text" value="URL"/> | <input type="text"/> |
| <input type="text" value="HTTPProxy"/> | <input type="text"/> |
| <input type="text" value="To"/> | <input type="text" value="{ALERT.SENDTO}"/> |
| <input type="text" value="Subject"/> | <input type="text" value="{ALERT.SUBJECT}"/> |
| <input type="text" value="Message"/> | <input type="text" value="{ALERT.MESSAGE}"/> |

[Add](#)

* Script

Timeout

Process tags

Include event menu entry

* Menu entry name

* Menu entry URL

 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

And additional options:

Media types

Media type Message templates Options

| Message type | Template | Actions |
|---------------------|--|---|
| Problem | Problem started at {EVENT.TIME} on {EVENT.DATE} Pro... | Edit Remove |
| Problem recovery | Problem has been resolved at {EVENT.RECOVERY.TIME}... | Edit Remove |
| Problem update | {USER.FULLNAME} {EVENT.UPDATE.ACTION} problem... | Edit Remove |
| Discovery | Discovery rule: {DISCOVERY.RULE.NAME} Device IP: {D... | Edit Remove |
| Autoregistration | Host name: {HOST.HOST} Host IP: {HOST.IP} Agent port:... | Edit Remove |
| Add | | |

Media type Message templates Options

Concurrent sessions One Unlimited Custom

* Attempts

* Attempt interval

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

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

| Media | Type | Send to | When active | Use if severity | Status | Action |
|-------|------------------------|------------------------|-------------|-----------------|--------|--------|
| | Add | | | | | |
| | Update | Cancel | | | | |

Media

Type

* Send to [Remove](#)

[Add](#)

* When active

Use if severity Not classified
 Information
 Warning
 Average
 High
 Disaster

Enabled

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



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

Trigger actions ▾

- Trigger actions
- Discovery actions
- Autoregistration actions
- Internal actions



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

- 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

Conditions

| Label | Name | Action |
|---------------------|--|------------------------|
| A | Value of tag <i>Environment</i> equals <i>Training</i> | Remove |
| Add | | |

Enabled

* At least one operation must exist.

Flexible conditions:

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

Type of calculation

Type of calculation

Conditions

- And/Or
- And
- Or
- Custom expression

New condition

Type

Operator

Value

- Trigger name
- Trigger
- Trigger severity
- Application
- Host
- Host group
- Problem is suppressed
- Tag
- Tag value
- Template
- Time period

Action **Operations**

* Name

Type of calculation A and B and (C or D)

| Label | Name | Action |
|-------|--|------------------------|
| A | Value of tag <i>Environment</i> equals <i>Training</i> | Remove |
| B | Trigger severity is greater than or equals <i>High</i> | Remove |
| C | Host group equals <i>Training/Servers</i> | Remove |
| D | Host group equals <i>Zabbix servers</i> | Remove |

[Add](#)

Enabled

* At least one operation must exist.

⚠️ 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

Action
Operations

* Default operation step duration

Pause operations for suppressed problems

Operations

| | Steps | Details | Start in | Duration | Action |
|---|-------------------------------------|--------------------------------------|-------------|----------|---|
| 1 | Send message to user groups: | Zabbix administrators via Email | Immediately | Default | Edit Remove |
| 2 | Send message to users: | Admin (Zabbix Administrator) via SMS | 01:00:00 | Default | Edit Remove |

[Add](#)

Recovery operations

Details

Notify all involved

[Add](#)

Action

[Edit](#) [Remove](#)

Update operations

Details

Notify all involved

[Add](#)

Action

[Edit](#) [Remove](#)

* 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) | Remove |
| Add | |

Send to Users

| User | Action |
|-----------------------------|------------------------|
| meggy.wilson (Meggy Wilson) | Remove |
| Add | |

Send only to Email (HTML) ▾

Custom message

Conditions

| Label | Name | Action |
|---------------------|---------------------------|------------------------|
| A | Event is not acknowledged | Remove |
| Add | | |

Update
Cancel

- ⚡ Recovery operations allow you to be notified when problems are resolved
 - by a trigger going back to "OK" state
 - by manually closing a problem
- ⚡ Both, messages and remote commands, are supported in recovery operations
- ⚡ Recovery operations do not support escalations - all operations are assigned to a single step

Operation details

Operation type: Send message ▼

Send to User groups: Notify all involved Action

[Add](#)

Send to Users: User Action

[Add](#)

Send only to: - All - ▼

Custom message

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

- 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
- Both, messages and remote commands, are supported in update operations
- Update operations do not support escalations - all operations are assigned to a single step

Operation details

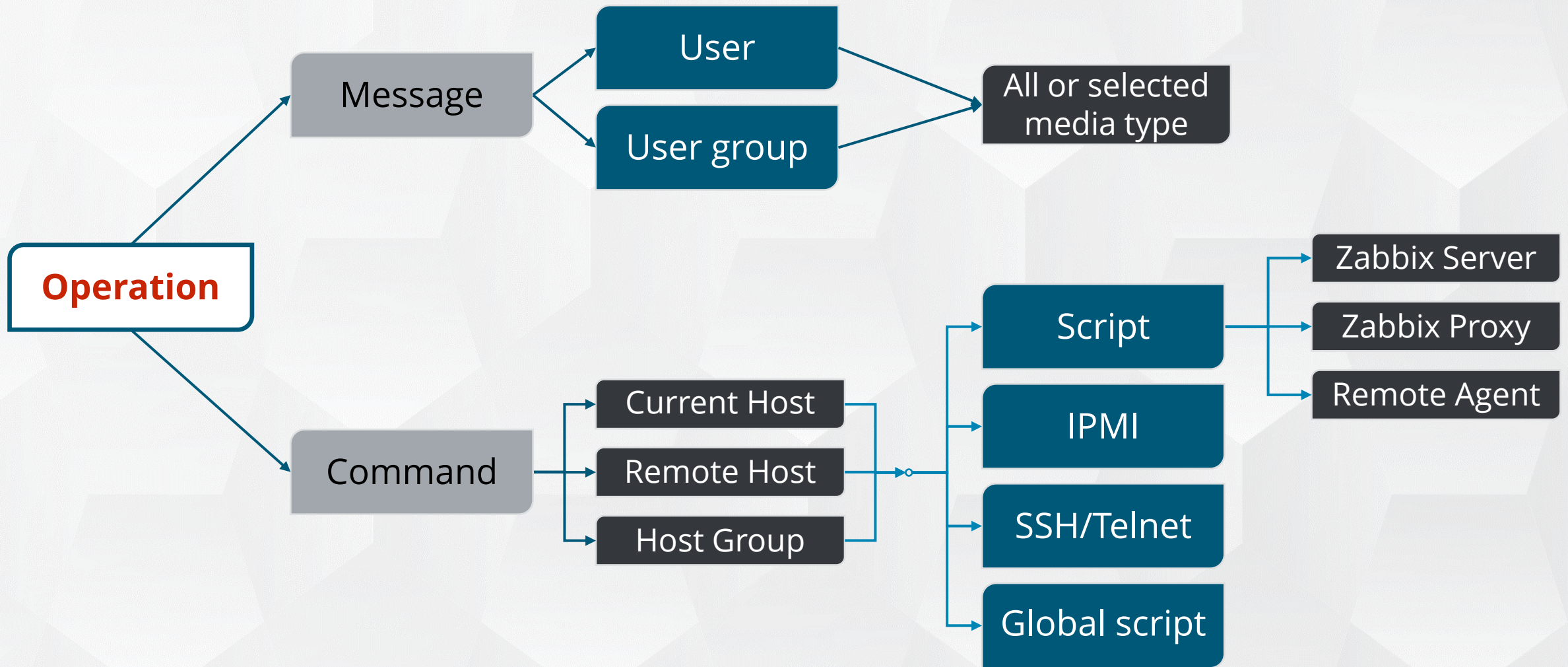
Operation type

Send to User groups

Send to Users

Send only to

Custom message



! 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

Message template

Message type:

Subject:

Message:



Problem started at 14:18:04 on 2018-02-22

Severity: High

R-JPTY01-DC2-L-3845-F10RC2: The router is unreachable!

Location: Rack 2, 10 Floor, Data center 2, Tokyo

Contact: [Mizui Okada](#)

Original problem ID: 17268

Based on steps

Default interval can be overridden in operations

If step intervals collide, the smallest interval wins

⚡ 1. Duration of every operation step:

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

⚡ 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

Action Operations

* Default operation step duration

Pause operations for suppressed problems

Steps - (0 - infinitely)

Step duration (0 - use action default)

📶 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 |
| | | New | | |

📶 Example 2. Sending a postponed notification:

| Operations | Steps | Details | Start in | Duration |
|------------|-------|--|----------|----------|
| | 2 | Send message to user groups: NOC Team via Email | 00:15:00 | Default |
| | | New | | |

* Default operation step duration

📶 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 |
| | | New | | |

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


- 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

Action log

< Zoom out > This month Filter

Recipient Select

Apply Reset

| Time | Action | Type | Recipient | Message | Status | Info |
|---------------------|----------------------|------|-------------------|--------------------------|--------|---|
| 2020-05-27 14:48:33 | Report Host problems | | john (John Smith) | Subject: Message: | Failed |  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: trainingXX@training.lan

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

🚨 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

Apply 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

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

Configuration > Actions > Internal actions > [Create action]

⚡ Define Conditions and Operations

Action **Operations**

* Name

Conditions

| Label | Name | Action |
|---------------------|------|--------|
| Add | | |

Enabled

New condition ✕

Type

Operator equals contains does not contain

Value

Action **Operations**

* Default operation step duration

Operations

| Steps | Details | Start in | Duration | Action |
|---------------------|---|-------------|----------|---|
| 1 | Send message to user groups: Zabbix administrators via all media | Immediately | Default | Edit Remove |
| Add | | | | |

Recovery operations

| Details | Action |
|----------------------------|---|
| Notify all involved | Edit Remove |
| Add | |

* At least one operation must exist.

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"

The screenshot shows the 'Media type' configuration page in Zabbix. The 'Name' field is 'Notification script', the 'Type' is 'Script', and the 'Script name' is 'notification.sh'. Under 'Script parameters', there are three input fields containing '{ALERT.SENDTO}', '{ALERT.SUBJECT}', and '{ALERT.MESSAGE}'. There is an 'Add' button below these fields. The 'Description' field is empty. At the bottom, the 'Enabled' checkbox is checked.



<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

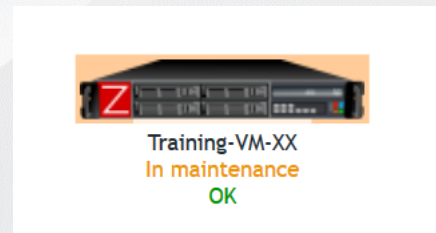
Problems

| Time ▼ | <input type="checkbox"/> | Severity | Recovery time | Status | Info | Host | Problem | Operational data | Duration | Ack | Actions |
|----------|--------------------------|----------|---------------|---------|------|------------------|---------------------------------------|------------------|----------|-----|---------|
| 16:39:04 | <input type="checkbox"/> | Average | | PROBLEM | 👁 | Training-VM-XX 🚩 | SSH service is down on Training-VM-XX | Up (1) | 5m 30s | No | |
| 16:38:46 | <input type="checkbox"/> | Warning | | PROBLEM | 👁 | Training-VM-XX 🚩 | 🔊 CPU Load is high on Training-VM-XX | 0.12/0.3 | 5m 48s | No | |

Always in maintenance [Maintenance with data collection]

Hosts

| Name ▲ | Interface | Availability |
|-------------------|--|-------------------|
| Training-VM-XX 🚩 | student-xx: 10050 | ZBX SNMP JMX IPMI |
| Training-VM-XX Ac | Always in maintenance [Maintenance with data collection] | IPMI |



- 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

Maintenance **Periods** Hosts and groups

* Name

Maintenance type With data collection No data collection

* Active since 📅

* Active till 📅

Periods **Hosts and groups**

Hosts and groups

* At least one host group or host must be selected.

Host groups

Hosts

Tags And/Or Or

[Add](#)

| * Periods | Period type | Schedule | Period | Action |
|-----------|---------------------|------------------|--------|---|
| | One time only | 2020-04-29 16:54 | 1h | Edit Remove |
| | Add | | | |

⚠️ 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.

- ⚡ Maintenance rule:
 - Period 60 minutes
 - From 11:00 till 12:00

⚡ Operation step duration 10 minutes

| | | | Pause operations for suppressed problems | | | |
|-------------------|--------------|---------------------|--|---------------------|-------------|---------------------|
| | | | Yes | | No | |
| Event | Action steps | Operation | 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 | | | Pause for 60 minutes | | | |
| | 2 | Sms to Admin | +10 +60 | 12:05 | +10 | 11:05 |
| | 3 | Open ticket in Jira | +20 +60 | 12:15 | +20 | 11:15 |

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

⚡ Maintenance rule:

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

⚡ Operation step duration 10 minutes

| | | | Pause operations for suppressed problems | | | |
|-------------------|--------------|---------------------|--|---------------------|-------------|---------------------|
| | | | Yes | | No | |
| Event | Action steps | Operation | Step timing | Step execution time | Step timing | Step execution time |
| 11:00 Maintenance | | | Pause for 60 minutes | | | |
| 11:10 Problem | 1 | Mail to Admin | +50 | 12:00 | Immediately | 11:10 |
| | 2 | Sms to Admin | +10 +50 | 12:10 | +10 | 11:20 |
| | 3 | Open ticket in Jira | +20 +50 | 12:20 | +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

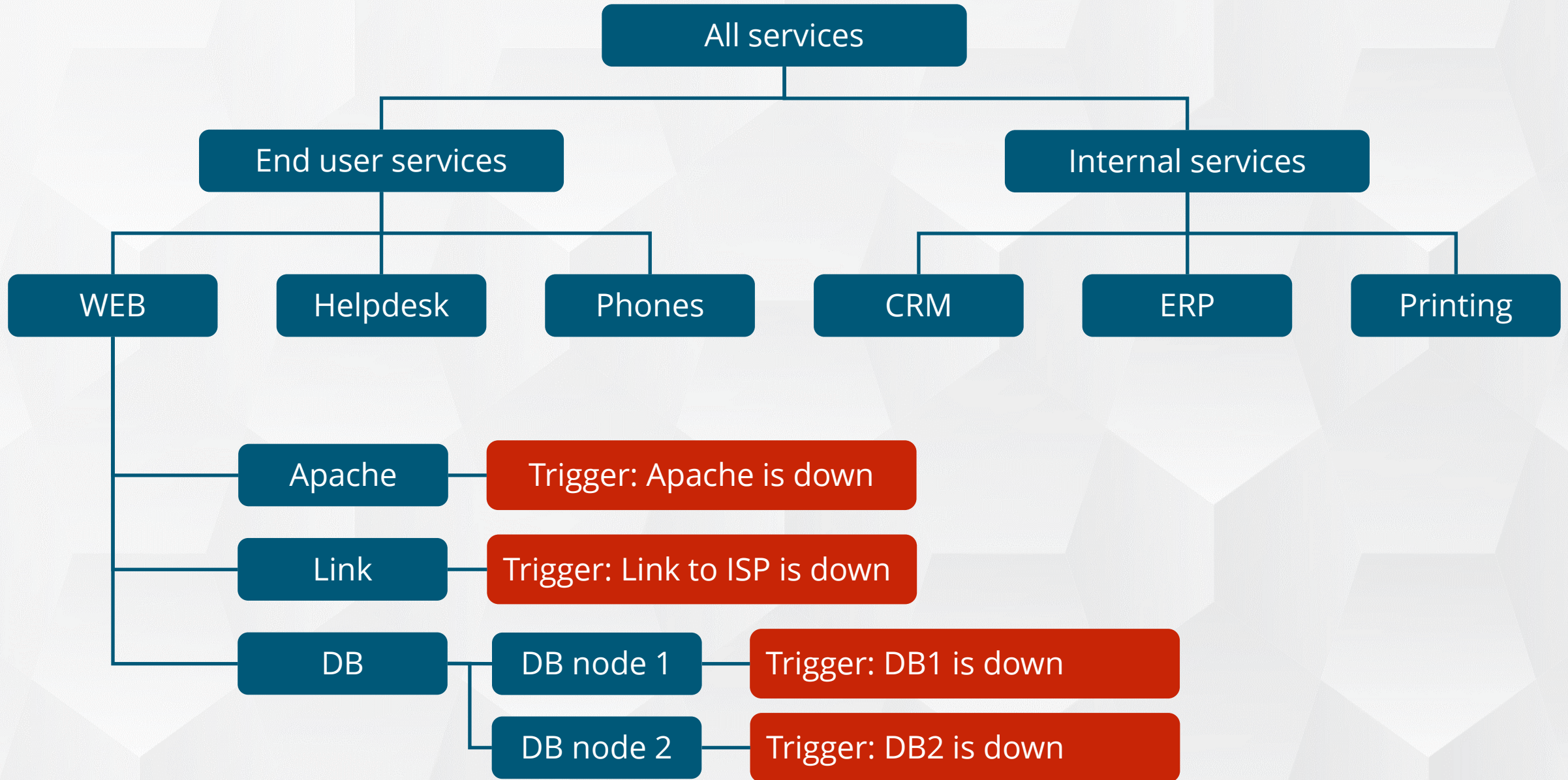
Measure your SLAs

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

Configuration > 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 | Add child | | |
| ▼ Card system | Add child | Problem, if at least one child has a problem | |
| ▶ Application | Add child | Problem, if all children have problems | |
| ▶ Middleware | Add child | Problem, if at least one child has a problem | |
| ▶ Infrastructure | Add child | Problem, if at least one child has a problem | |
| ▼ Channels | Add child | Problem, if at least one child has a problem | |
| ▼ Riga office | Add child | Problem, if all children have problems | |
| iNet | Add child Delete | Problem, if at least one child has a problem | Incoming traffic for Provider eth2 (10.0.2.15) is too low |
| Baltic | Add child Delete | Problem, if at least one child has a problem | Incoming traffic for Provider eth3 (192.168.56.30) is too low |
| ▶ Tokyo office | Add child | Problem, if all children have problems | |
| ▶ Providers | Add child | Problem, if at least one child has a problem | |



Monitoring > Services

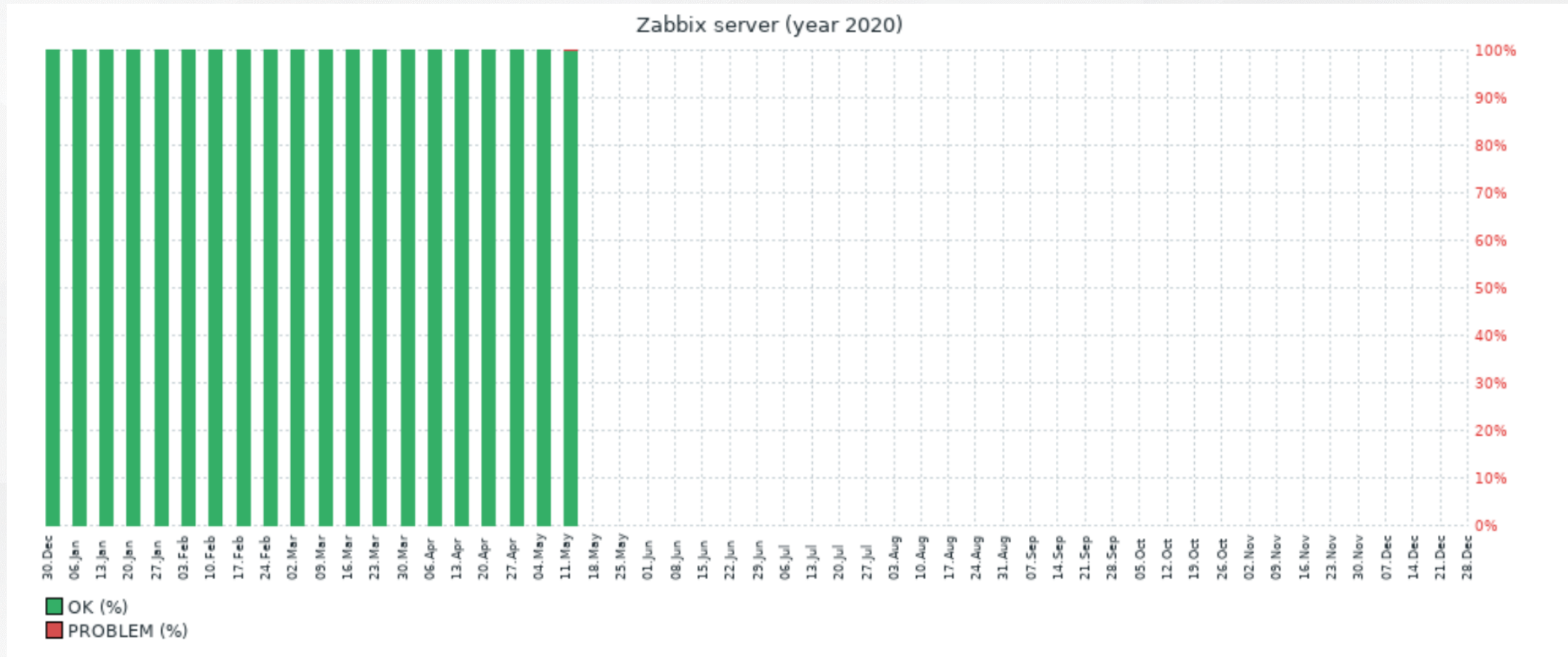
- ⚡ SLA displaying
- ⚡ SLA graphs
- ⚡ Can't be calculated retroactively
- ⚡ "Not classified" and "Information" severity triggers are ignored for SLA calculation!

Services Period

| Service | Status | Reason | Problem time | SLA / Acceptable SLA |
|---|---------|--|--------------|---------------------------|
| root | | | | |
| ▼ Zabbix server | Average | High memory utilization (>90% for 5m) | | 0.0885 99.9115 / 99.5000 |
| ▼ Database | OK | | | 0.0000 100.0000 / 99.5000 |
| MySQL | OK | | | |
| ▼ Frontend | OK | | | 0.0000 100.0000 / 99.5000 |
| Apache | OK | | | |
| PHP fpm | OK | | | |
| ▼ Zabbix server daemon | Average | High memory utilization (>90% for 5m) | | 0.0885 99.9115 / 99.5000 |
| Caches - High memory utilization (>90% for 5m) | Average | High memory utilization (>90% for 5m) | | |


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 | | Remove | |
| Downtime | Saturday 23:00 - Saturday 23:59 | | Remove | |
| Downtime | Sunday 00:00 - Saturday 03:00 | | Remove | |
| One-time downtime | 2020-05-17 13:00 - 2020-05-17 15:00 | Critical patch install | Remove | |

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

New file system
added!



Low-
Level
Discovery

For existing hosts

Periodically search on
all Hosts for a new or
missing components

Action

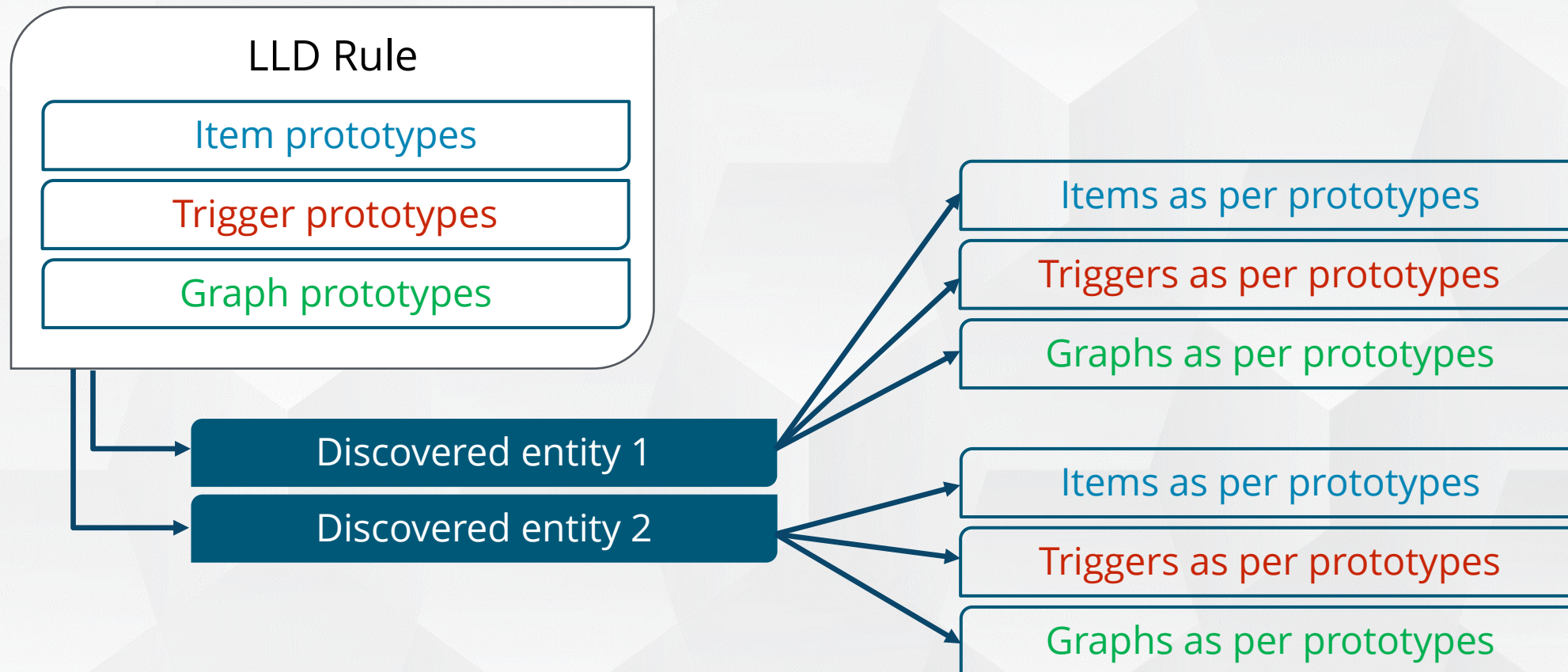
Create/delete
Items/Triggers for
the existing host



https://www.zabbix.com/documentation/5.0/manual/discovery/low_level_discovery

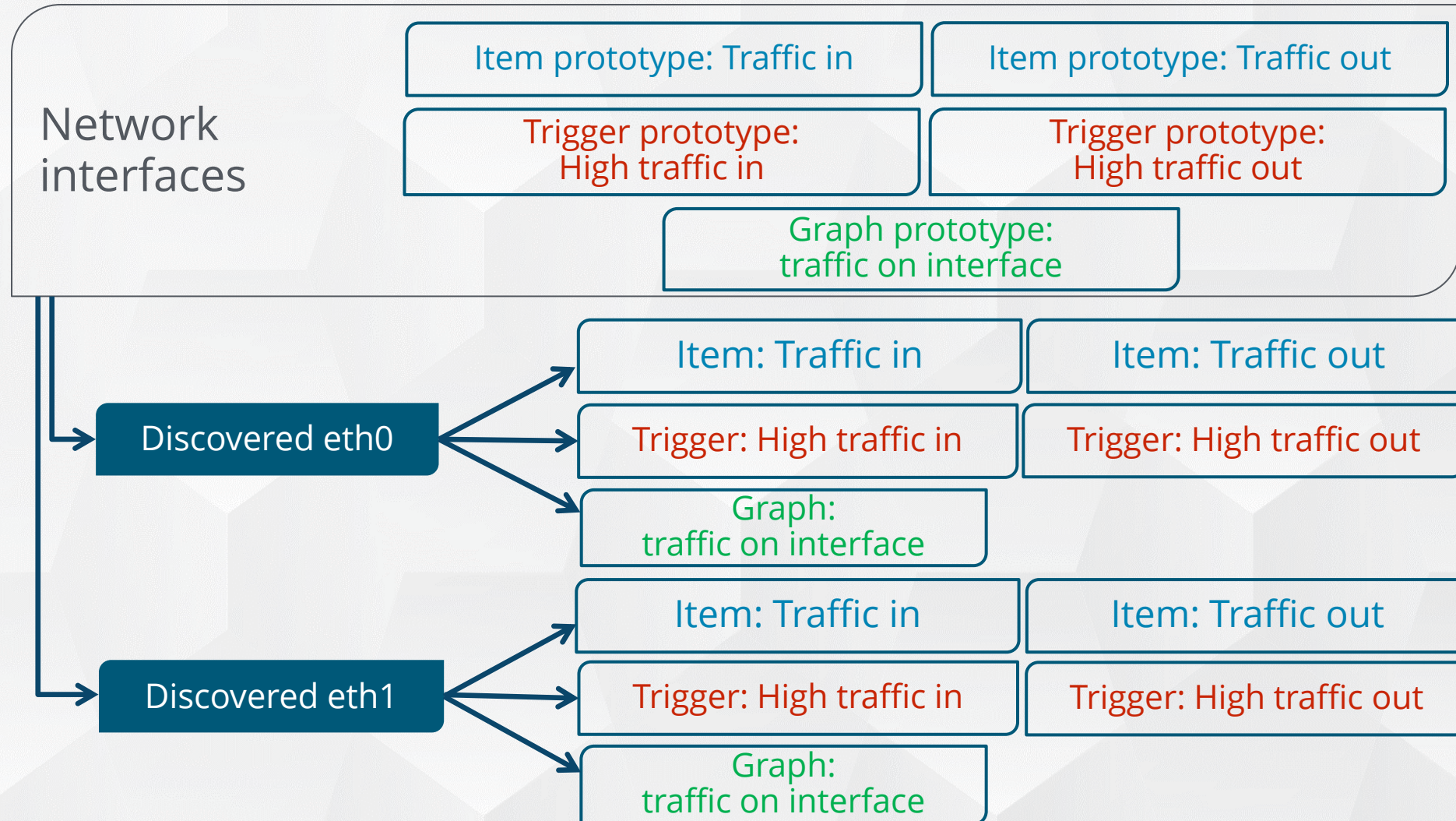
Workflow:

- ⚡ 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:



⚡ Zabbix agent

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

⚡ Linux systemd services (only for Agent2)

⚡ SNMP entities

⚡ JMX entities

⚡ IPMI entities

⚡ SQL entities

⚡ Zabbix host interfaces

⚡ ...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

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

The screenshot shows a table of hosts in the Zabbix interface. Two hosts, HOST2 and HOST1, are selected. Below the table are buttons for '2 selected', 'Enable', 'Disable', 'Export', 'Mass update', and 'Delete'. The 'Export' button is highlighted in dark blue.

| <input type="checkbox"/> | Name | Applications | Items | Triggers | Graphs | Discovery | Web |
|-------------------------------------|-------|-----------------|----------|-------------|-----------|-------------|-----|
| <input checked="" type="checkbox"/> | HOST2 | Applications 16 | Items 78 | Triggers 24 | Graphs 19 | Discovery 3 | Web |
| <input checked="" type="checkbox"/> | HOST1 | Applications 16 | Items 78 | Triggers 24 | Graphs 19 | Discovery 3 | Web |

2 selected Enable Disable **Export** Mass update Delete

Configuration > Hosts/Templates > [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

| Rules | Update existing | Create new | Delete missing |
|------------------|-------------------------------------|-------------------------------------|--------------------------|
| Groups | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| Hosts | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Templates | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| Template screens | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| Template linkage | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| Applications | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| Items | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| Discovery rules | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| Triggers | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| Graphs | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| Web scenarios | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| Screens | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Maps | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Images | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Media types | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Value mappings | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <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.):

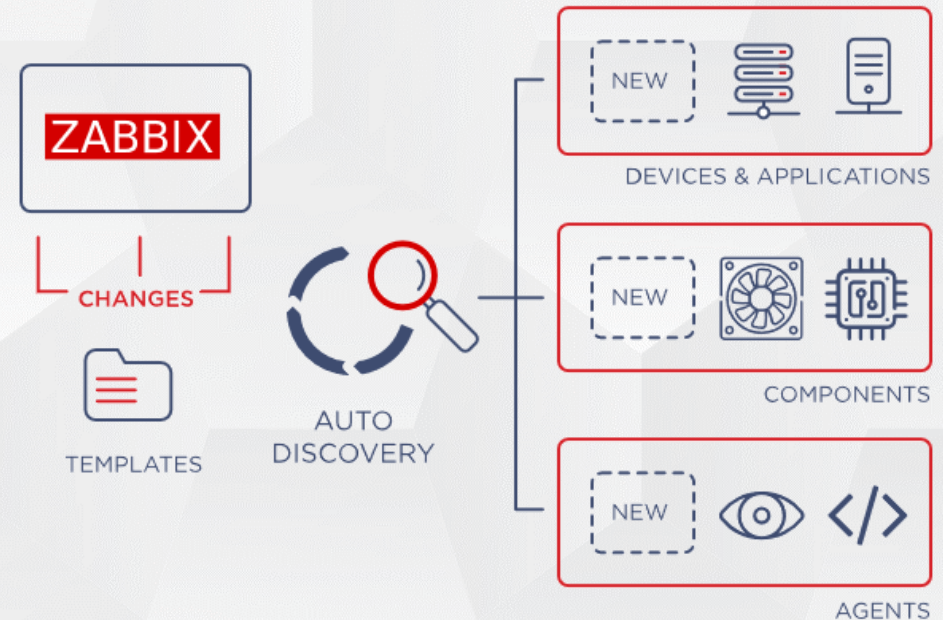
- Add/remove
- Enable/disable
- Link/unlink templates
- Change groups
- Etc.

📶 Auto-registration of active agent

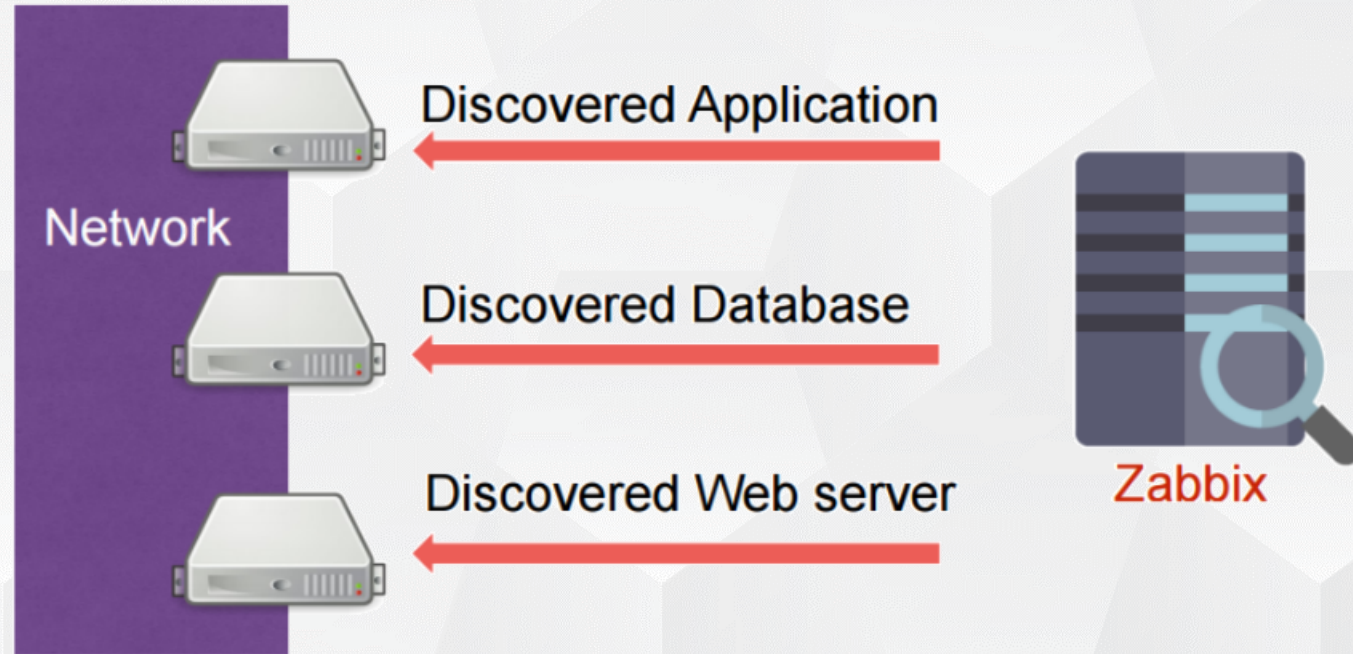
📶 Network discovery

📶 Low-level discovery

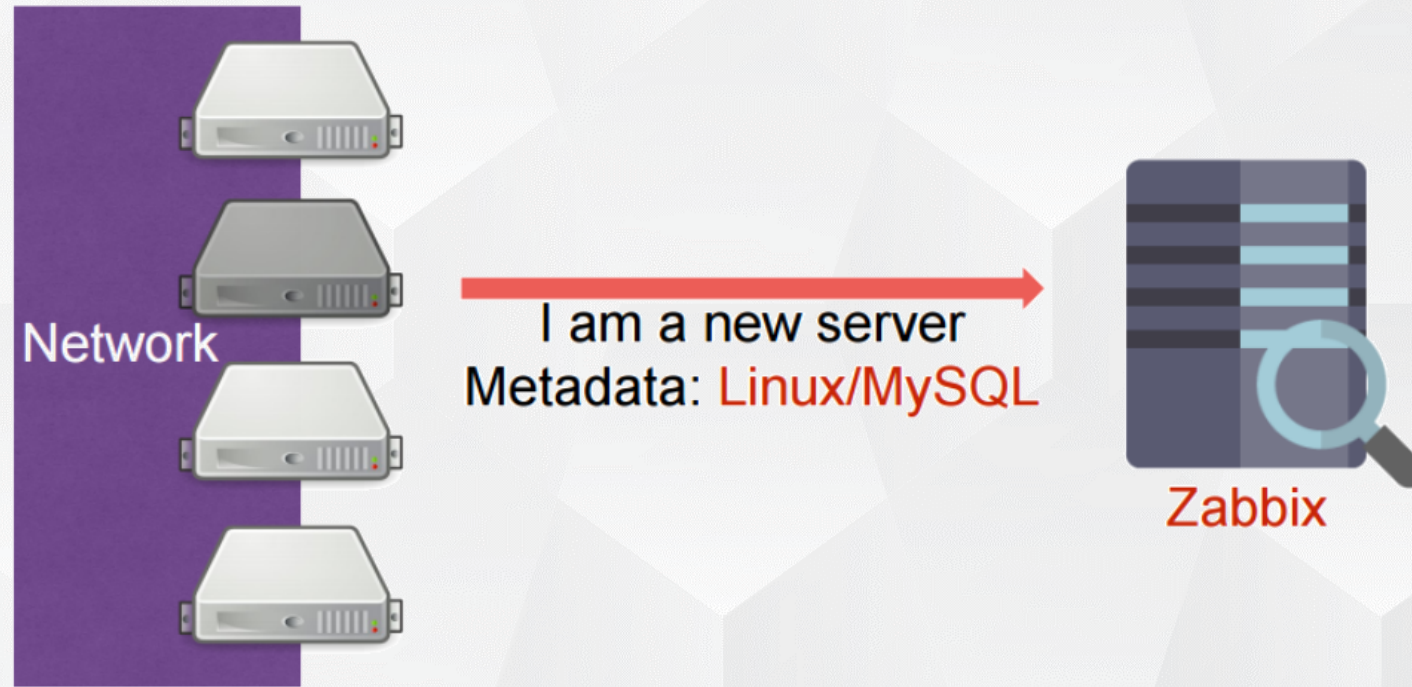
📶 Zabbix API



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

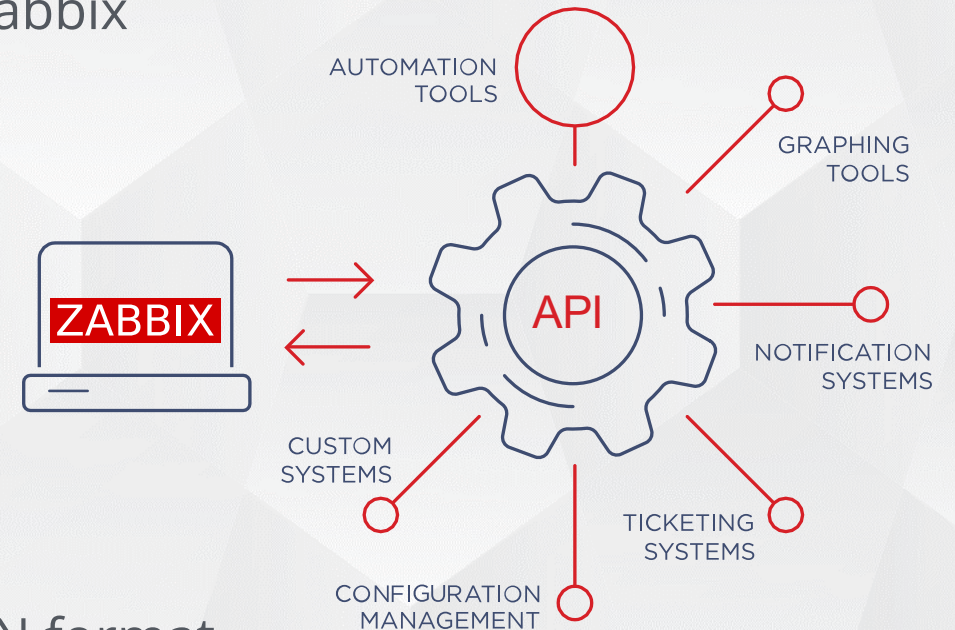


Add new hosts with installed Zabbix agent in active mode for monitoring without any manual configuration



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/mariadbbbackup (full physical backup)
- xtrabackup/mariadbbbackup (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 :)