

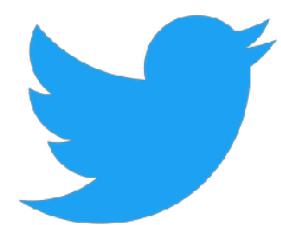
ZABBIX 5.0 LTS

Freedom and integrity
of monitoring



Alexei Vladishev

Founder and CEO of Zabbix



@avladishev





Quick recap of Zabbix 4.2 and 4.4

Zabbix 4.2

April, 2019

- High frequency monitoring with throttling
- Data collection: [HTTP agent](#), Prometheus
- Preprocessing: validation and [JavaScript!](#)
- Preprocessing by Proxies
- Enhanced [tag management](#)

Zabbix 4.4

September, 2019

New Zabbix Agent: **plugins**, scheduler and more

Web hooks for alerting and notifications

Support of **TimescaleDB**

Built-in **knowledge base** for metrics and triggers

Standard for Zabbix Templates

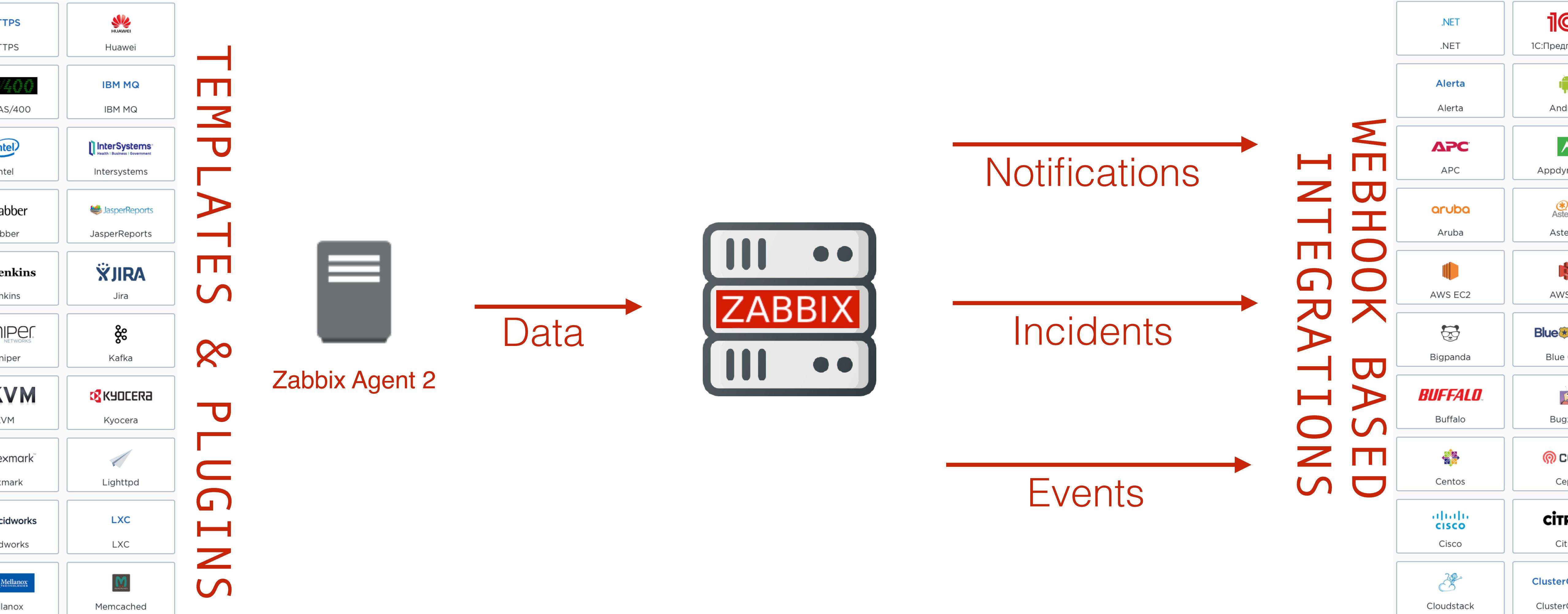
5.0

LTS release
May 12, 2020

Available templates for monitoring & integrations

.NET	1C:Предприятие	Active Directory	Apache ACTIVEMQ	Alcatel-Lucent Enterprise	Cloudstack	ClusterControl	Confluence	Cooling	CoreOS	HTTP	HTTPS	Huawei
Alerta	Android	ANSIBLE	Antivirus	Apache	Couchbase	cPanel	D-Link	Database monitoring	DATACOM	IBM AIX	IBM AS/400	IBM MQ
APC	Appdynamics	Application monitoring	ARDUINO	ARISTA	DB2	Debian	Dell	DNS	Docker	Ingress	Intel	InterSystems
Aruba	Asterisk	AVAYA	AWS	AWS CloudWatch	Drupal	Elasticsearch	Eltex	DELL EMC	Emerson	IRC	Jabber	JasperReports
AWS EC2	AWS S3	Backup	Bacula	Barracuda	Exim	Extreme Networks	F5 Networks	Facebook Messenger	Fedora	JBoss	Jenkins	Jira
Bigpanda	Blue Coat	bmc Remedy	Borg	Brocade	firebird	Firewalls	flowdock	FORTINET	FreeBSD	Julia	Juniper	Kafka
Buffalo	Bugzilla	C#	Capacity planning	Cassandra	FreshDesk	Fujitsu Siemens	Galera cluster	Geckoboard	git	Kubernetes	KVM	Kyocera
Centos	ceph	Check Point	Chef	Chrome extension	Glassfish	GLPI	Go	Google Apps	Google Cloud	Lenovo	Lexmark	Lighttpd
Cisco	Citrix	Cloud Foundry	cloudera	Google Maps	Grafana	Graylog	Hadoop	HAProxy	Logstash	Lucidworks	LXC	
Cloudstack	ClusterControl	Confluence	Cooling	CoreOS	High Availability	Hipchat	HITACHI	HP Enterprise	HP-UX	Mattermost	Mellanox	Memcached

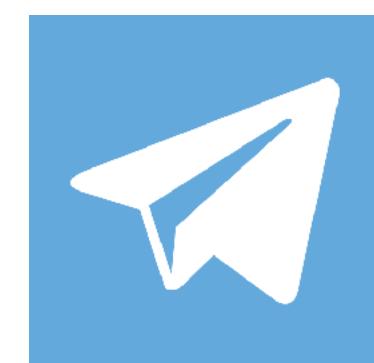
Making a platform for high quality solutions



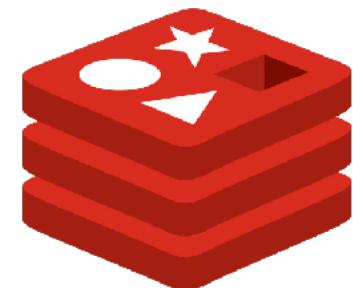
Ticketing



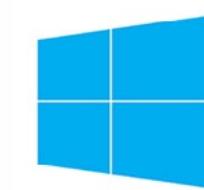
Alerting



Monitoring



redis



Windows®



elasticsearch

Easy to contribute!

3 simple steps

Sign Zabbix Contributor Agreement ([ZCA](#))

<https://www.zabbix.com/developers>

Make Zabbix Pull Request

<https://git.zabbix.com>

Zabbix Dev Team will review and accept if everything is fine

Available everywhere!

Linux distributions and containers



RHEL and CentOS 6, 7 and 8



Debian 8, 9, 10



SuSE 12, 15



16.04 (Xenial), 18.04 (Bionic) and 20.04 (Focal Fossa)



Raspbian 9 (Stretch), 10 (Buster)

Docker

Linux appliance images

ISO

VMWare, VirtualBox

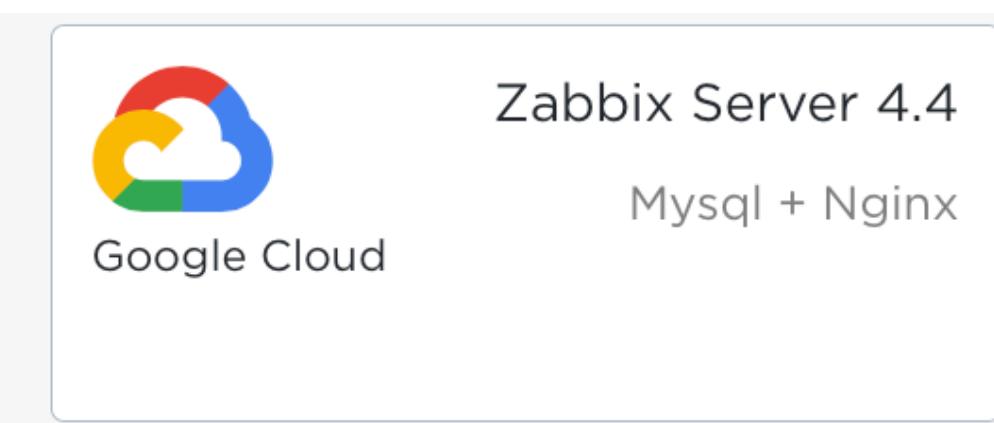
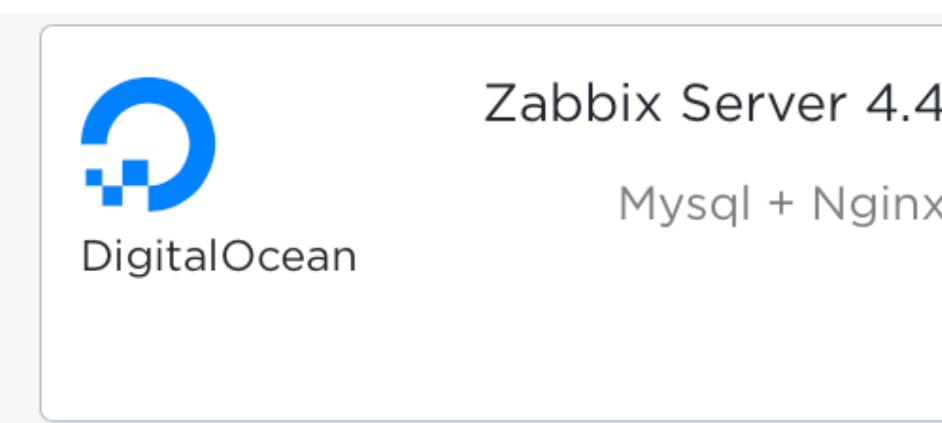
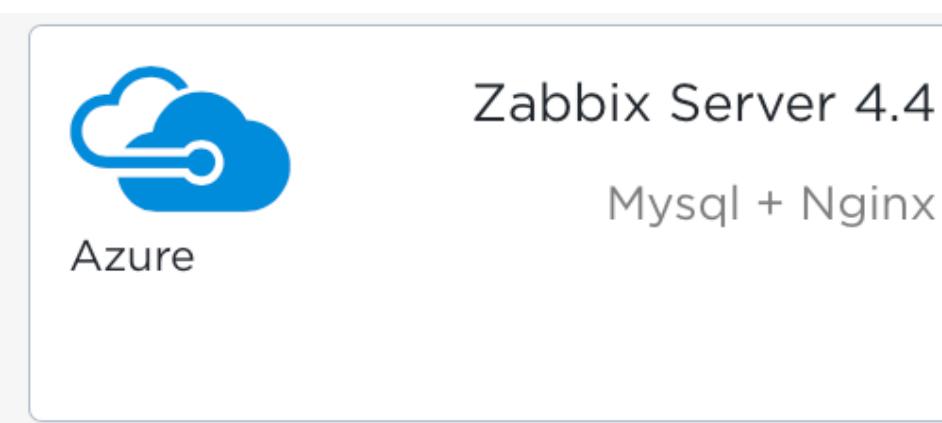
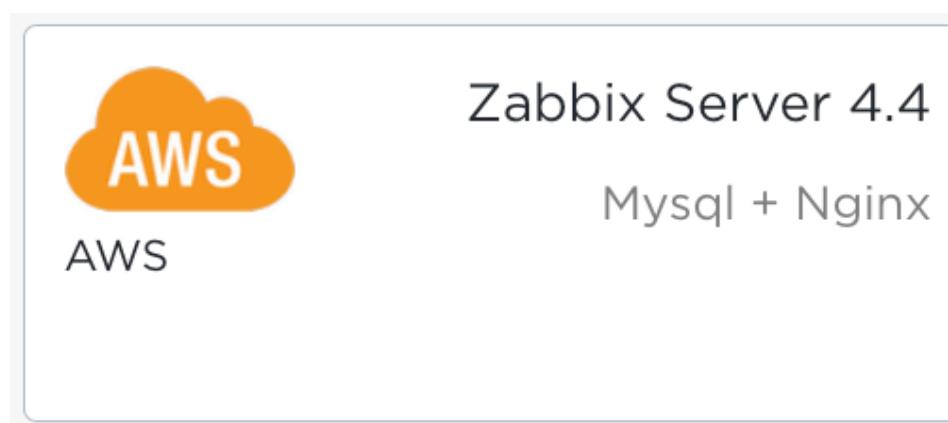
Microsoft Hyper-V

KVM

XEN

LiveCD

Public clouds



Official support of Zabbix
Agent2 for Linux and
Windows

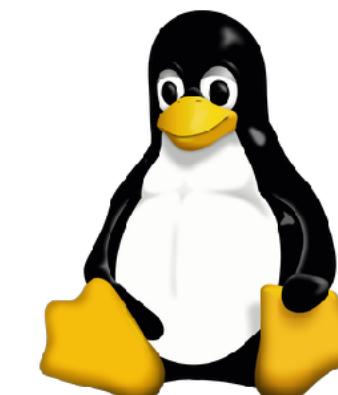
Most advanced monitoring agent on the market!



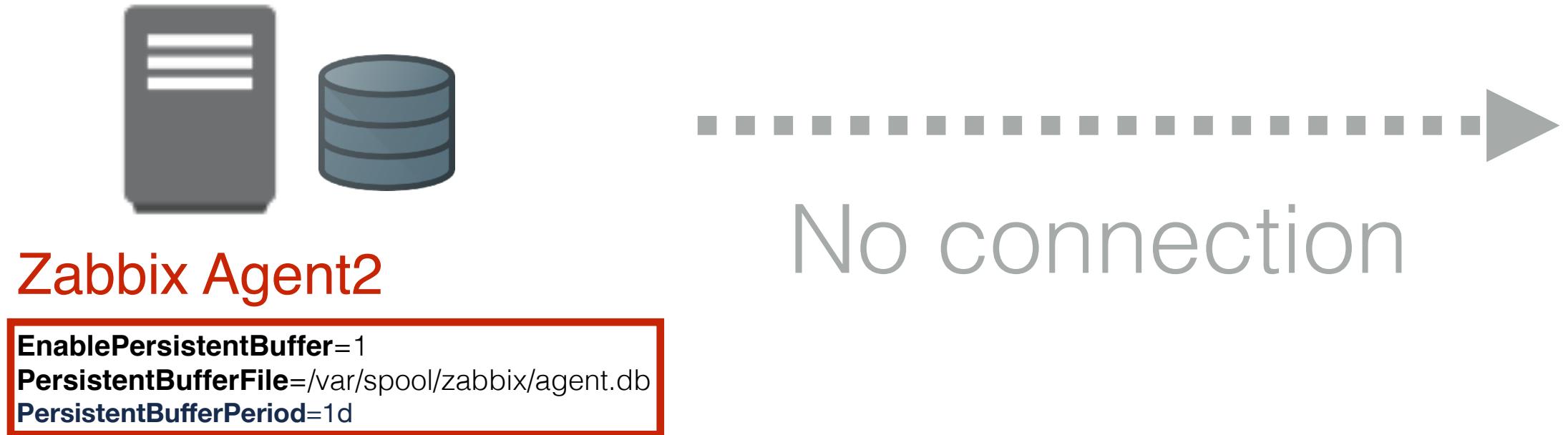
New Zabbix Agent
(`zabbix_agent2`)



Plugin infrastructure
Support of long running scripts
Parallel active checks
Support of flexible intervals for all checks
Support of persistent connections (DB connections)
Accepting incoming traps and events (MQTT subscribe,
listening TCP/UDP ports, etc)
Monitoring of systemd services out of the box
Drop-in replacement of the existing agent!



Persistent storage for Agent2



Use cases

Unstable communications
Monitoring of critical data
Bursts of data

Your data is safe!



Secure by design



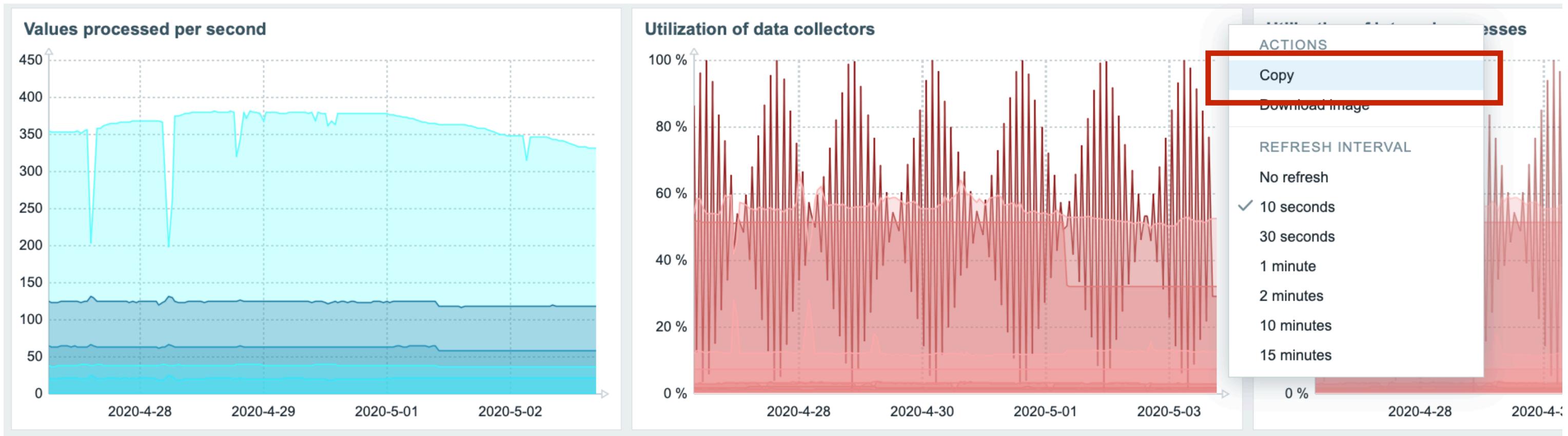
Usability improvements

Optimized for wide screens

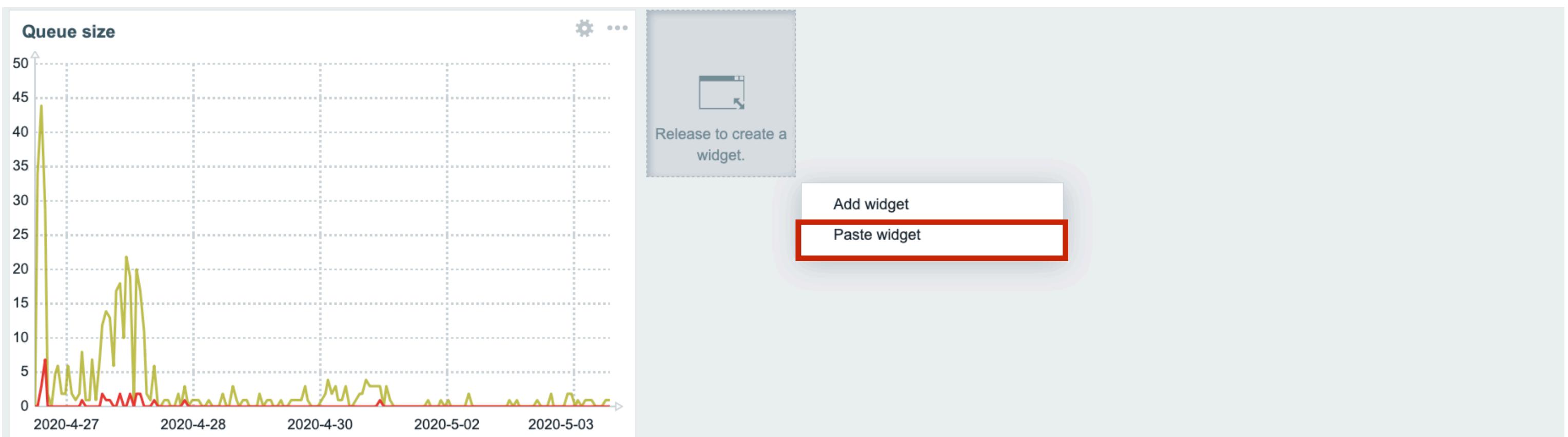
The screenshot displays the Zabbix Server status dashboard. The left sidebar contains navigation links for Monitoring, Inventory, Reports, Configuration, Administration, Support, Share, Help, User settings, and Sign out. The main content area includes a table for 'Zabbix internal problems' with columns for Time, Recovery time, Status, Info, Host, Problem + Severity, Duration, Ack, and Actions, showing 'No data found.' A large clock icon indicates the local time. Below the table are six line charts: 'Values processed per second' (blue line, fluctuating between 100 and 400), 'Utilization of data collectors' (red line, high volatility between 0% and 100%), 'Utilization of internal processes' (red line, high volatility between 0% and 100%), 'Cache usage' (multiple green lines, mostly above 80%), 'Value cache hits' (green line, stable around 3.2 K), and 'Queue size' (yellow line, spikes up to 20). A 'Problems by severity' chart is partially visible at the bottom.

Build dashboards faster

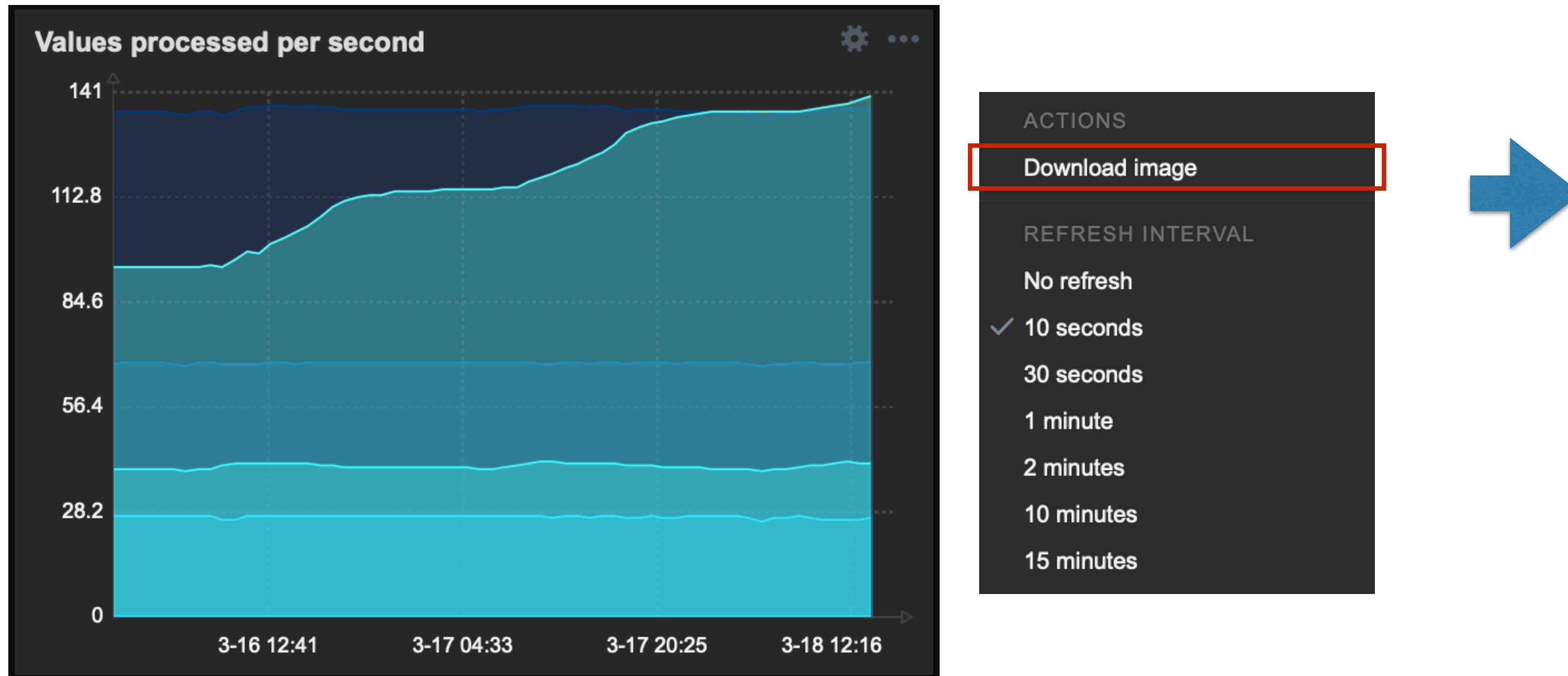
Copy



Paste to the same or different dashboard



Export graphs as PNG image



Filter by tags for some widgets

Problem by severity & Problem hosts

Edit widget

Type: Problems by severity

Name: New York datacenters

Refresh interval: Default (1 minute)

Host groups:

Exclude host groups:

Hosts:

Problem:

Severity: Not classified Warning High
 Information Average Disaster

Tags: And/Or Or

Service Contains Equals value

Datacenter Contains Equals NY

Show: Host groups Totals

Layout: Horizontal Vertical

Show operational data: None Separately With problem name

Show suppressed problems:

Hide groups without problems:

Host group ▲	Disaster	High	Average	Warning	Information	Not classified
Cloud/AWS				1		
Cloud/Azure				1	1	
End user services				4	1	
HPC Cluster		2		27	1	
Internal infrastructure	2	7		42	3	
R&D Lab2				1		
Region/Australia				1		
Region/China	1			1		
Region/USA				1		



UI modules

- Create new menu entries
- Create new pages
- Extend existing functionality
- Use and share 3rd party extensions
- Permission control

Monitoring

Dashboard

Problems

Hosts

Overview

Latest data

Screens

Maps

Discovery

Services

Inventory

Reports

Configuration

Administration

Support

Share

Help

User settings

Sign out

Example:

Structure

```
modules/
  demo_module/
    manifest.json
    Module.php
  actions/
    DemoReportAction.php
  views/
    demo.report.php
  ...
  ...
```

manifest.json

```
{ "manifest_version": 1.0,
  "id": "demo.report",
  "version": "1.0",
  "name": "Custom report",
  "namespace": "Demo",
  "author": "Zabbix",
  "url": "http://www.zabbix.com",
  "description": "Demo report module",
  "actions": {
    "demo.report": {
      "class": "DemoReportAction",
      "view": "demo.report"
    }
  }
}
```

module.php

```
<?php declare(strict_types = 1);
namespace Modules\Demo;
use APP;
use Core\CM offense as BaseModule;
class Module extends BaseModule {
  public function init(): void {
    (APP::Component()->get('menu.main'))
      ->find(_('Reports'))
      ->add('Custom report', [
        'action' => 'demo.report'
      ]);
  }
}
```

List of monitored devices

Monitoring->Hosts

Name ▲	Interface	Availability	Tags	Problems	Status	Latest data	Problems	Graphs	Screens	Web
AWS N30	127.0.0.1: 10050	ZBX SNMP JMX IPMI	OS: Linux Region: us-east-1 Service: Oracle Cluster	1	Enabled	Latest data	Problems 1	Graphs 14	Screens 2	Web
AWS N34	127.0.0.1: 10050	ZBX SNMP JMX IPMI	OS: Linux	1 1	Enabled	Latest data	Problems 2	Graphs 14	Screens 2	Web
AWS N90	127.0.0.1: 10050	ZBX SNMP JMX IPMI	OS: Linux	1 1 1	Enabled	Latest data	Problems 3	Graphs 14	Screens 2	Web
AZ M08	127.0.0.1: 10050	ZBX SNMP JMX IPMI	OS: Linux	1 1	Enabled	Latest data	Problems 2	Graphs 14	Screens 2	Web
AZ M10	127.0.0.1: 10050	ZBX SNMP JMX IPMI	OS: Linux	1 1	Enabled	Latest data	Problems 2	Graphs 14	Screens 2	Web
AZ M18	127.0.0.1: 10050	ZBX SNMP JMX IPMI	OS: Linux	1 1	Enabled	Latest data	Problems 2	Graphs 14	Screens 2	Web
Linux001	127.0.0.1: 10050	ZBX SNMP JMX IPMI	OS: Linux	1 1	Enabled	Latest data	Problems 2	Graphs 14	Screens 2	Web

No more Monitoring->WEB and Monitoring->Graphs
Easy navigation to host related resources

List of monitored devices

Advanced filtering options

ZABBIX Monitoring Inventory Reports Configuration Administration

Dashboard Problems **Hosts** Overview Latest data Screens Maps Discovery Services Central NOC

Hosts

Filter

Name	Status		
	Any	Enabled	Disabled
Host groups	Tags		
<input type="text" value="type here to search"/> <input type="button" value="Select"/>	And/Or	Or	
IP	<input type="text" value="Service"/> Contains Equals <input type="text" value="value"/> <input type="button" value="Remove"/>		
DNS	Add		
Port			
Severity	<input type="checkbox"/> Not classified	<input type="checkbox"/> Warning	<input type="checkbox"/> High
	<input type="checkbox"/> Information	<input type="checkbox"/> Average	<input type="checkbox"/> Disaster
<input type="checkbox"/> Show hosts in maintenance <input checked="" type="checkbox"/> <input type="checkbox"/> Show suppressed problems <input type="checkbox"/>			
<input type="button" value="Apply"/> <input type="button" value="Reset"/>			

Name	Interface	Availability	Tags	Problems	Status	Latest data	Problems	Graphs	Screens	Web
AWS N30	127.0.0.1: 10050	ZBX SNMP JMX IPMI	Service: Oracle Cluster OS: Linux Region: us-east-1	1	Enabled	Latest data	Problems 1	Graphs 14	Screens 2	Web
Linux902	127.0.0.1: 10050	ZBX SNMP JMX IPMI	Service: MySQL OS: Linux	1	Enabled	Latest data	Problems 1	Graphs 14	Screens 2	Web

Displaying 2 of 2 found

New preprocessing operator: Replace

The sidebar contains the following categories and items:

- Text
 - Regular expression
 - Replace (selected)
 - Trim
 - Right trim
 - Left trim
- Structured data
 - XML XPath
 - JSONPath
 - CSV to JSON
- Arithmetic
 - Custom multiplier
- Change
 - Simple change
 - Change per second
- Numerical systems
 - Boolean to decimal
 - Octal to decimal
 - Hexadecimal to decimal
- Custom scripts
 - JavaScript
- Validation
 - In range
 - Matches regular expression
 - Does not match regular expression
 - Check for error in JSON
 - Check for error in XML
 - Check for error using regular expression
- Throttling
 - Discard unchanged

Configuration->Items

The 'Preprocessing' tab shows two 'Replace' steps configured:

Preprocessing steps	Name	Parameters
1:	Replace	Up 0
2:	Replace	Down 1

Buttons at the bottom: Add, Update, Clone, Test, Delete, Cancel.

Typical use cases

- mappings (text -> numeric, numeric -> text)
- removing characters and strings
- replacing characters and strings
- in many cases easier than dealing with regular expressions!

New operator for JSONPath: ~

It returns property names of matching elements

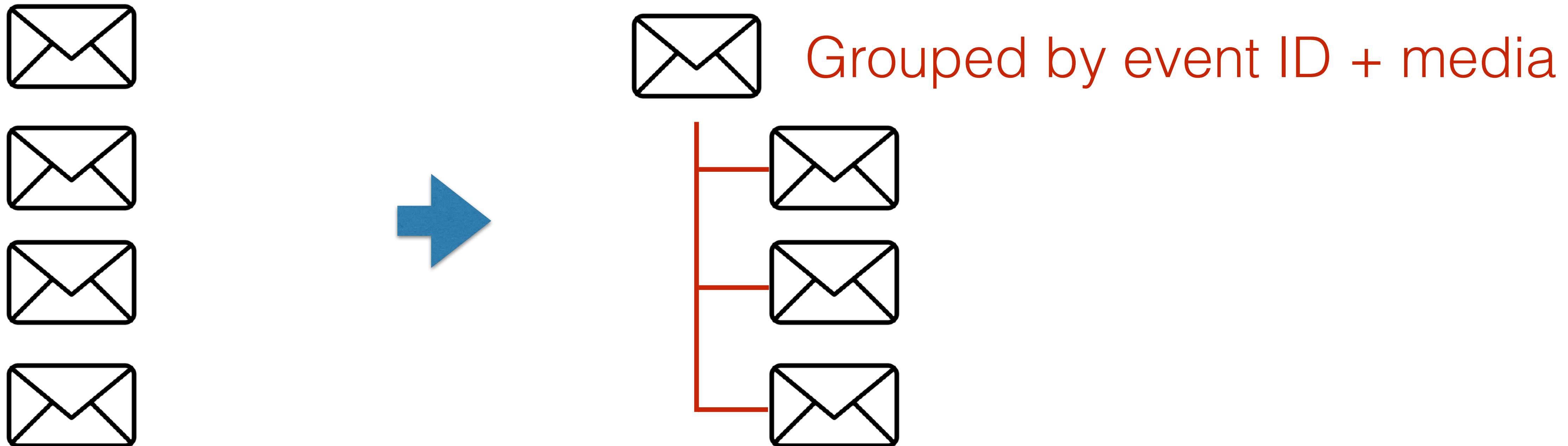


```
{  
    "consul": [],  
    "content": [  
        "2020.01.05",  
        "golang"  
    ],  
    "login": [  
        "2019.11.02",  
        "java"  
    ],  
    "mail": [  
        "2020.01.02",  
        "golang"  
    ]  
}
```

→ \$.* ~ →

```
[  
    "consul",  
    "content",  
    "login",  
    "mail"  
]
```

Threading for email notifications



Mass update of user macros for hosts & templates

Host Templates IPMI Tags Macros Inventory Encryption

Macros Add Update Remove Remove all

Macro	Value	Description	Actions
{\$SERVICE}	PostgreSQL cluster	T	Our primary production data store Remove

[Add](#)
 [Update existing](#)

Update Cancel

Host Templates IPMI Tags Macros Inventory Encryption

Macros Update Add Remove Remove all

Macro	Value	Description	Actions
{\$SERVICE}	PostgreSQL cluster	T	Our primary production data store Remove

[Add](#)
 [Add missing](#)

Update Cancel

Mass update of user macros for hosts & templates

Host Templates IPMI Tags Macros Inventory Encryption

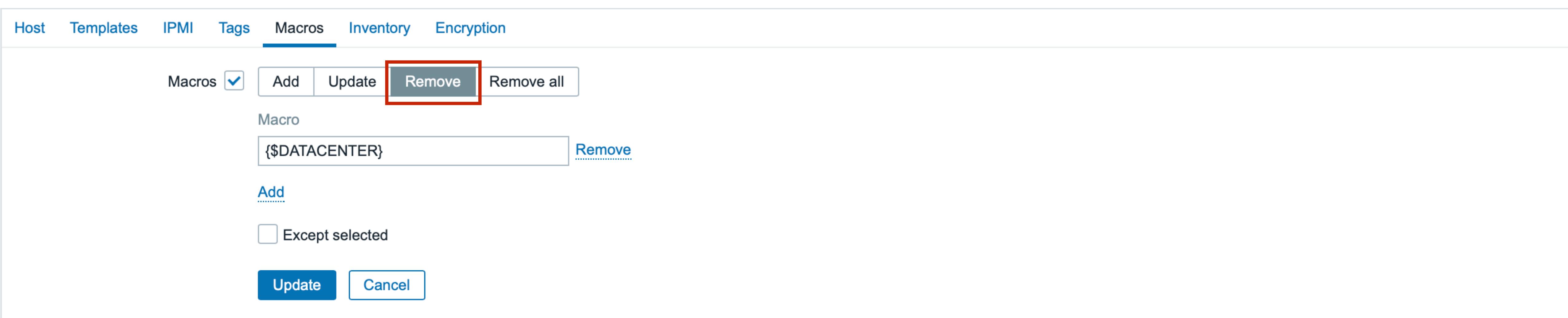
Macros Add Update Remove Remove all

Macro
{\$DATACENTER} [Remove](#)

Add

Except selected

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

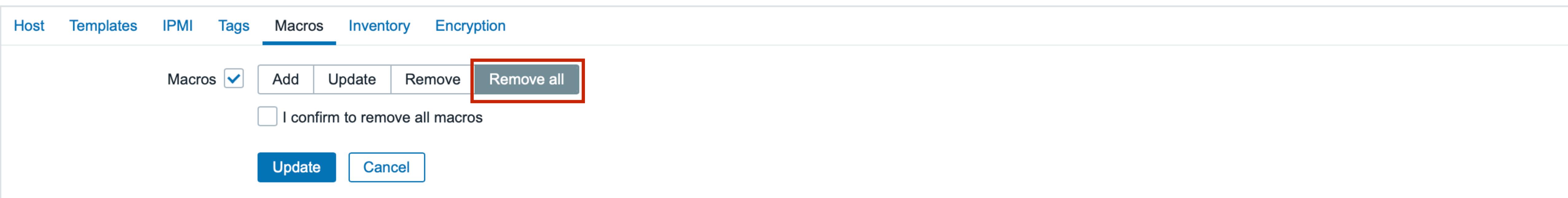


Host Templates IPMI Tags Macros Inventory Encryption

Macros Add Update Remove Remove all

I confirm to remove all macros

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



CLI tool to test JS
scripts

Why

Typical use cases

Test JavaScript code from **command line**:

- webhooks
- complex preprocessing scripts

How to use it?

```
shell> zabbix_js -help
```

Execute script using Zabbix embedded scripting engine.

General options:

- | | |
|-------------------------|--|
| -s,--script script-file | Specify the filename of script to execute. Specify - for standard input. |
| -i,--input input-file | Specify input parameter file name. Specify - for standard input. |
| -p,--param input-param | Specify input parameter |
| -l,--loglevel log-level | Specify log level |
| -t,--timeout timeout | Specify timeout in seconds |
| -h --help | Display this help message |
| -V --version | Display version number |

Example 1

```
shell> cat test.js  
  
return Math.log(value)  
  
shell> zabbix_js -s test.js -p 10  
2.302585092994046
```

Example 2

```
shell> zabbix_js -s test.js -i my.json # reading input from file
```

Example 3

```
shell> cat test.js  
  
Zabbix.Log(3, value) // use Zabbix.Log(log level, text) for debug purposes  
  
return Math.log(value)
```

Triggers support
text operations

Text data

Typical use cases

Working with software versions

Log file monitoring

Comparing string values of different items

Comparing last and previous values

Supported operators: = <>

Comparing with text constant

```
{host:zabbix.version.last()}="5.0.0"  
{host:zabbix.version.last()}="${$ZABBIX.VERSION}"
```

Comparing last value with previous one

```
{host:text.last()}<>{host:text.prev()}
```

OR

```
{host:text.last(#1)}<>{host:text.last(#2)}
```

Comparing values of different items

```
{hostA:textA.last()}={hostB:textB.last()}
```

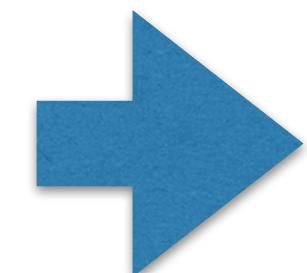
Automation & Discovery

Discovery for JMX counters

New JMX checks

jmx.get[]

jmx.discovery[]



jmx.get[] is similar to the jmx.discovery[] item, but it does not turn Java object properties into low-level discovery macro names and therefore can return values without limitations that are associated with LLD macro name generation such as hyphens or non-ASCII characters.

jmx.get[beans,"com.example:type=*,*"]

```
[  
  {  
    "object": "com.example:type=Hello,data-src=data-base,ключ=значен  
    "domain": "com.example",  
    "properties": {  
      "data-src": "data-base",  
      "ключ": "значение",  
      "type": "Hello"  
    }  
  },  
  {  
    "object": "com.example:type=Atomic",  
    "domain": "com.example",  
    "properties": {  
      "type": "Atomic"  
    }  
  }  
]
```

jmx.discovery[...]

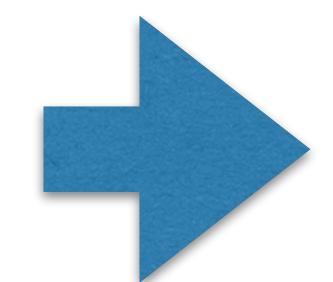
```
[  
  {  
    "#JMXDOMAIN": "java.lang",  
    "#JMXTYPE": "GarbageCollector",  
    "#JMXOBJ": "java.lang:type=GarbageCollector,name=PS Scavenge",  
    "#JMXNAME": "PS Scavenge"  
  }  
]
```

Discovery for Windows perf counters

Zabbix Agent and Agent2

perf_counter.discovery[object]

perf_counter_en.discovery[object]



```
[  
  { "#INSTANCE": "0" },  
  { "#INSTANCE": "1" },  
  { "#INSTANCE": "_Total" }  
]
```

Discovery of IPMI sensors

ipmi.get

Typical use cases

Simpler templates

```
[ {  
    "id": "SubTemp12",  
    "name": "(7.1).SubTemp12",  
    "sensor": {  
        "type": "1",  
        "text": "temperature"  
    },  
    "reading": {  
        "type": "1",  
        "text": "threshold"  
    },  
    "state": {  
        "state": "3",  
        "text": "lower Critical - going high"  
    },  
    "value": "32",  
    "units": "C",  
    "threshold": {  
        "low": {  
            "non_crit": "48",  
            "crit": "32",  
            "non_recover": "16"  
        },  
        "up": {  
            "non_crit": "112",  
            "crit": "144",  
            "non_recover": "160"  
        }  
    }  
},  
{  
    "id": "1.8V Switch",  
    "name": "(7.1).1.8V Switch",  
    "sensor": {  
        "type": "2",  
        "text": "voltage"  
    },  
    "reading": {  
        "type": "2",  
        "text": "discrete_usage"  
    },  
    "state": {  
        "state": "1",  
        "text": "transition to active"  
    }  
}]
```

Support of user macros
for host prototypes

User macros for host prototypes

ZABBIX Monitoring Inventory Reports Configuration Administration

Host groups Templates Hosts Maintenance Actions Event correlation Discovery Services

Host prototypes

All hosts / lld-discoverer-host Enabled ZBX SNMP JMX IPMI Discovery list / host.json Item prototypes Trigger prototypes Graph prototypes Host prototypes 1

Host Groups Templates IPMI Macros Inventory Encryption

Host prototype macros Inherited and host prototype macros

Macro	Value	Description
{\$MACRO}	value	T description

Add Remove

Update Clone Delete Cancel

Use LLD macros in macro value and description!

Support of **Float64**
data types

Float64

Benefits

Compatible with Float64 returned by Prometheus

Execute to upgrade existing installation:

MySQL: database/mysql/double.sql

PostgreSQL: database/postgresql/double.sql

MySQL: database/oracle/double.sql

Scalability improvements

Zabbix UI Ready to handle **Millions** of devices

Improvements made

No drop-downs for host selections anymore, replaced with host search control

Hardcoded maximum size of the Overview grid

Redesigned Monitoring->Hosts->Graphs
(multiselection of graphs, displaying of all graphs, pattern matching)

Introduced paging whenever possible (Monitoring->Hosts->Web)



Compression for
efficiency

Manage LLD rules
globally

Filter for discovery rules

The screenshot shows the Zabbix interface for managing discovery rules. The left sidebar includes sections for Monitoring, Inventory, Reports, Configuration, Host groups, Templates, Hosts, Maintenance, Actions, Event correlation, and Discovery. The main content area is titled 'Discovery rules' and displays a search and filter section at the top. The 'Status' dropdown is set to 'Not supported', which is highlighted with a red box. Below this, a table lists three discovery rules:

	Host	Name	Items	Triggers	Graphs	Hosts	Key	Interval	Type	Status	Info
<input type="checkbox"/>	confluence	TCP port discovery: Discover TCP ports	Item prototypes 1	Trigger prototypes 1	Graph prototypes	Host prototypes	tcp.port.discover	60	Zabbix agent	Enabled	
<input type="checkbox"/>	confluence	Template_File_System_Discovery: File system discovery	Item prototypes 10	Trigger prototypes 2	Graph prototypes 2	Host prototypes	vfs.fs.discovery	10m	Zabbix agent	Enabled	
<input type="checkbox"/>	confluence	Template_Network: Network discovery	Item prototypes 13	Trigger prototypes	Graph prototypes 1	Host prototypes	net.if.discovery	10m	Zabbix agent	Enabled	

At the bottom right of the table, it says 'Displaying 3 of 3 found'.

Useful for: troubleshooting (find all not supported or disabled), mass operations

Ability to
unacknowledge event

Unacknowledge it!

The screenshot shows the Zabbix Problem module interface. On the left, there's a sidebar with severity filters: Average (selected), Information, Information, Average, Average, High, High, Warning, Warning, Warning, Warning, Warning, Warning, Warning, Warning, Warning, Warning. The main area has tabs: Recovery time, Status, Info, Host, Problem (selected), Duration, Ack, Actions, Tags.

Problem: Low CPU utilization on host machines

Message: Sorry, it was incorrectly acknowledged! This issue should be fixed by DevOps team.

History:

Time	User	User action	Message
2020-05-12 12:10:33	John	✓ 🗣	I'm working on this problem. To be resolved in 10-15 minutes.

Scope:

- Only selected problem
- Selected and all other problems of related triggers 1 event

Change severity: Not classified, Information, Warning, Average, High, Disaster

Unacknowledge: (highlighted with a red box)

Close problem:

* At least one update operation or message must exist.

Buttons: Update, Cancel

Bottom status bar: PROBLEM Linux922 Processor load is too high on Linux922 1m 37s No Service: Jira Datace

Useful for

fixing mistakes

better workflow between various teams

Overrides for LLD rules

Discovery of filesystems

ZABBIX <

Trigger prototypes

[Create trigger prototype](#)

All templates / Template OS Linux / Discovery list / Mounted filesystem discovery / Item prototypes 5 / Trigger prototypes 2 / Graph prototypes 1 / Host prototypes

Severity	Name ▲	Operational data	Expression	Create enabled	Discover	Tags
Warning	Free disk space is less than 20% on volume {#FSNAME}		{Template OS Linux:vfs.fs.size[{#FSNAME},pfree].last(0)}<20	Yes	Yes	
Warning	Free inodes is less than 20% on volume {#FSNAME}		{Template OS Linux:vfs.fs.inode[{#FSNAME},pfree].last(0)}<20	Yes	Yes	

Displaying 2 of 2 found

Special treating of Oracle related filesystems

Override

* Name: Special processing of Oracle directories

Stop processing next overrides if matches:

Filters: Type of calculation: And/Or

A	{#FSNAME}	matches	oradata	Remove
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Operations: Condition: Add

New operation

Object: Trigger prototype

Condition: contains: Free disk space

Create enabled: Original

Discover: Original

Severity: Not classified Information Warning Average High Disaster

Tags: Original

Add Cancel

Do not discover temporary filesystems

Override

* Name

Stop processing next overrides if matches

Filters

Type of calculation

Label Macro

Regular expression Action

Add

Operations

Condition

Trigger prototype equals

Item prototype equals

Add

New operation

Object

Condition

Create enabled Original

Discover Yes

Update interval Original

History storage period Original

Trend storage period Original

Add Cancel

New macros

ZBXNEXT-1797 support of macro {HOST.ID} in notifications

Can be used to build URLs to Zabbix UI. For example, Latest data:

`{$ZABBIX.URL}/zabbix.php?action=latest.view&filter_set=1&filter_hostids%5B0%5D={HOST.ID}`

ZBXNEXT-5369 support of macro {EVENT.TAGSJSON} in notifications

Easier to pass all tags to webhooks

ZBXNEXT-252 support of macro {EVENT.DURATION} in notifications.

Recovery subject “Resolved in **5m**: Service Nginx is down.”

Other improvements

ZBXNEXT-5848 increased size of acknowledge messages to 4K (was 256)

ZBXNEXT-5690 added support of LIBSSH to support newer platforms like RHEL 8

ZBXNEXT-5825 support of ElasticSearch 7.x (7.4, 7.6)

ZBXNEXT-5720 Latest data displays data if filter is not set

ZBXNEXT-1561 increased zabbix_sender time resolution to nanoseconds

ZBXNEXT-1234 Monitoring->Latest data: show data if filter is empty

ZBXNEXT-5734 Base64 processing in JavaScript, functions atob() and btoa()

ZBXNEXT-5604 Do not log system.run[] for local use

ZBXNEXT-4584 New API method to get auditlog

ZBXNEXT-5851 Remote monitoring of versions of Zabbix components

And more

ZBXNEXT-1989 Increased size of item key to 2048 characters (was 255)

ZBXNEXT-3940 Ability to flush SNMP cache, SNMPv3 context changes

ZBXNEXT-5829 Faster hash function for internal operations

ZBXNEXT-2081 Documented how to do filtering for vmware.event monitoring

ZBX-15914 Improved consistency of map labels

Removing legacy to make a better product, faster

ZBXNEXT-5697 No support of Internet Explorer 11 anymore

ZBXNEXT-5592 Dropped support of IBM DB2 database

ZBXNEXT-5716 mbedTLS (former polarSSL) is no longer supported for encryption.
Only OpenSSL and GnuTLS libraries

Minimum supported version for PHP is now 7.2: safer and more strict code

Upgrade!

Alexander will cover it in his talk today! :-)

Thank you!