

3 低级别发现

概述

Low-level discovery provides a way to automatically create items, triggers, and graphs for different entities on a computer. For instance, Zabbix can automatically start monitoring file systems or network interfaces on your machine, without the need to create items for each file system or network interface manually. Additionally it is possible to configure Zabbix to remove unneeded entities automatically based on actual results of periodically performed discovery.

自动发现[LLD]提供了一种在计算机上为不同实体自动创建监控项，触发器和图形的方法。例如[Zabbix]可以在你的机器上自动开始监控文件系统或网络接口，而无需为每个文件系统或网络接口手动创建监控项。此外，可以配置Zabbix根据定期执行发现后的得到实际结果，来移除不需要的监控项。

In Zabbix, six types of discovery items are supported out of the box:

在Zabbix中，支持六种类型的发现项目：

- discovery of file systems;
• 系统文件的发现;
- discovery of network interfaces;
• 网络接口的发现;
- discovery of CPUs and CPU cores;
• CPU和CPU内核的发现
- discovery of SNMP OIDs;
• SNMP OID的发现
- discovery using ODBC SQL queries;
• 使用ODBC SQL查询的发现
- discovery of Windows services.
• Windows服务的发现

A user can define their own types of discovery, provided they follow a particular JSON protocol.

用户可以自己定义发现类型，只要它们遵循特定的JSON协议。

The general architecture of the discovery process is as follows.

发现过程的一般架构如下。

First, a user creates a discovery rule in “Configuration” → “Templates” → “Discovery” column. A discovery rule consists of (1) an item that discovers the necessary entities (for instance, file systems or network interfaces) and (2) prototypes of items, triggers, and graphs that should be created based on the value of that item.

首先，用户在“配置” → “模板” → “发现”列中创建一个发现规则。发现规则包括（1）发现必要实体（例如，文件系统或网络接口）的项目和（2）应该根据该项目的值创建的监控项，触发器和图形的原型

An item that discovers the necessary entities is like a regular item seen elsewhere: the server asks a Zabbix agent (or whatever the type of the item is set to) for a value of that item, the agent responds with a textual value. The difference is that the value the agent responds with should contain a list of discovered entities in a specific JSON format. While the details of this format are only important for implementers of custom discovery checks, it is necessary to know that the returned value contains a

list of macro → value pairs. For instance, item “net.if.discovery” might return two pairs: “{#IFNAME}” → “lo” and “{#IFNAME}” → “eth0”.

Low-level discovery items “vfs.fs.discovery” and “net.if.discovery” are supported since Zabbix agent version 2.0.

Discovery item “system.cpu.discovery” is supported since Zabbix agent version 2.4.

Discovery of SNMP OIDs is supported since Zabbix server and proxy version 2.0.

Discovery using ODBC SQL queries is supported since Zabbix server and proxy version 3.0.

Return values of a low-level discovery rule are limited to 2048 bytes on a Zabbix proxy run with IBM DB2 database. This limit does not apply to Zabbix server as return values are processed without being stored in a database.

These macros are used in names, keys and other prototype fields where they are then substituted with the received values for creating real items, triggers, graphs or even hosts for each discovered entity. See the full list of [options](#) for using LLD macros.

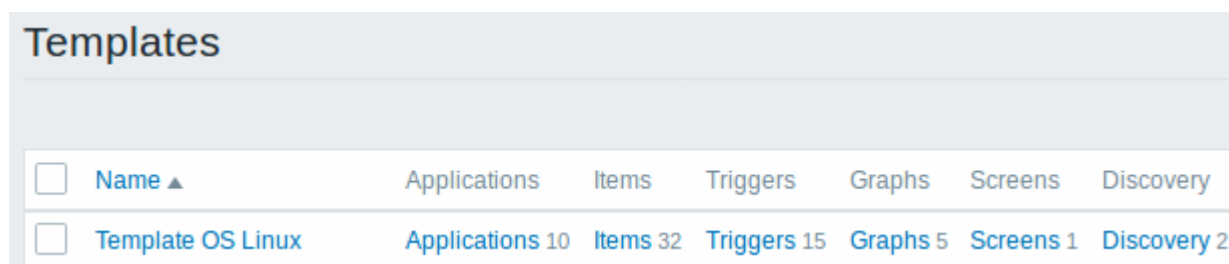
When the server receives a value for a discovery item, it looks at the macro → value pairs and for each pair generates real items, triggers, and graphs, based on their prototypes. In the example with “net.if.discovery” above, the server would generate one set of items, triggers, and graphs for the loopback interface “lo”, and another set for interface “eth0”.

The following sections illustrate the process described above in detail and serve as a how-to for performing all types of discovery mentioned above. The last section describes the JSON format for discovery items and gives an example of how to implement your own file system discoverer as a Perl script.

3.1 Discovery of file systems

To configure the discovery of file systems, do the following:

- Go to: *Configuration* → *Templates*
- Click on *Discovery* in the row of an appropriate template



<input type="checkbox"/>	Name ▲	Applications	Items	Triggers	Graphs	Screens	Discovery
<input type="checkbox"/>	Template OS Linux	Applications 10	Items 32	Triggers 15	Graphs 5	Screens 1	Discovery 2

- Click on *Create discovery rule* in the upper right corner of the screen
- Fill in the form with the following details

The **Discovery rule** tab contains general discovery rule attributes:

Discovery rule
Filters

Name

Type

Key

Update interval

Custom intervals

Type	Interval	Period
Flexible	Scheduling	50s
		1-7,00:00-24:00

[Add](#)

Keep lost resources period

Description

Enabled

Parameter	Description
<i>Name</i>	Name of discovery rule.
<i>Type</i>	The type of check to perform discovery; should be <i>Zabbix agent</i> or <i>Zabbix agent (active)</i> for file system discovery.
<i>Key</i>	An item with “ <i>vfs.fs.discovery</i> ” key is built into the Zabbix agent on many platforms (see supported item key list for details), and will return a JSON with the list of file systems present on the computer and their types.
<i>Update interval (in sec)</i>	This field specifies how often Zabbix performs discovery. In the beginning, when you are just setting up file system discovery, you might wish to set it to a small interval, but once you know it works you can set it to 30 minutes or more, because file systems usually do not change very often. <i>Note:</i> If set to '0', the item will not be polled. However, if a flexible interval also exists with a non-zero value, the item will be polled during the flexible interval duration.
<i>Custom intervals</i>	You can create custom rules for checking the item: Flexible - create an exception to the <i>Update interval</i> (interval with different frequency) Scheduling - create a custom polling schedule. For detailed information see Custom intervals . Scheduling is supported since Zabbix 3.0.0.

Parameter	Description
<i>Keep lost resources period (in days)</i>	This field allows you to specify for how many days the discovered entity will be retained (won't be deleted) once its discovery status becomes "Not discovered anymore" (max 3650 days). <i>Note:</i> If set to "0", entities will be deleted immediately. Using "0" is not recommended, since just wrongly editing the filter may end up in the entity being deleted with all the historical data.
<i>Description</i>	Enter a description.
<i>Enabled</i>	If checked, the rule will be processed.

The **Filters** tab contains discovery rule filter definitions:

Parameter	Description
<i>Type of calculation</i>	The following options for calculating filters are available: And - all filters must be passed; Or - enough if one filter is passed; And/Or - uses <i>And</i> with different macro names and <i>Or</i> with the same macro name; Custom expression - offers the possibility to define a custom calculation of filters. The formula must include all filters in the list. Limited to 255 symbols.
<i>Filters</i>	A filter can be used to generate real items, triggers, and graphs only for certain file systems. It expects a POSIX Extended Regular Expression . For instance, if you are only interested in C:, D:, and E: file systems, you could put {#FSNAME} into "Macro" and "^C ^D ^E" regular expression into "Regular expression" text fields. Filtering is also possible by file system types using {#FSTYPE} macro (e.g. "^ext ^reiserfs") and by drive types (supported only by Windows agent) using {#FSDRIVETYPE} macro (e.g., "fixed"). You can enter a regular expression or reference a global regular expression in "Regular expression" field. In order to test a regular expression you can use "grep -E", for example: <pre>for f in ext2 nfs reiserfs smbfs; do echo \$f grep -E '^ext ^reiserfs' echo "SKIP: \$f"; done</pre> {#FSDRIVETYPE} macro on Windows is supported since Zabbix 3.0.0 . Defining several filters is supported since Zabbix 2.4.0 . Note that if some macro from the filter is missing in the response, the found entity will be ignored.

Zabbix database in MySQL must be created as case-sensitive if file system names that differ only by

case are to be discovered correctly.
Discovery rule history is not preserved.

Once a rule is created, go to the items for that rule and press “Create prototype” to create an item prototype. Note how macro `{#FSNAME}` is used where a file system name is required. When the discovery rule is processed, this macro will be substituted with the discovered file system.

Item prototype **Preprocessing**

Name

Type

Key

Type of information

Units

Update interval

Custom intervals

Type	Interval	Period
<input type="checkbox"/> Flexible <input checked="" type="checkbox"/> Scheduling	<input type="text" value="50s"/>	<input type="text" value="1-7,00:00-24:00"/>

[Add](#)

History storage period

Trend storage period

Show value [show value mappings](#)

New application

Applications

- None-
- CPU
- Filesystems
- General
- Memory
- Network interfaces
- OS
- Performance
- Processes
- Security

New application prototype

Application prototypes

- None-

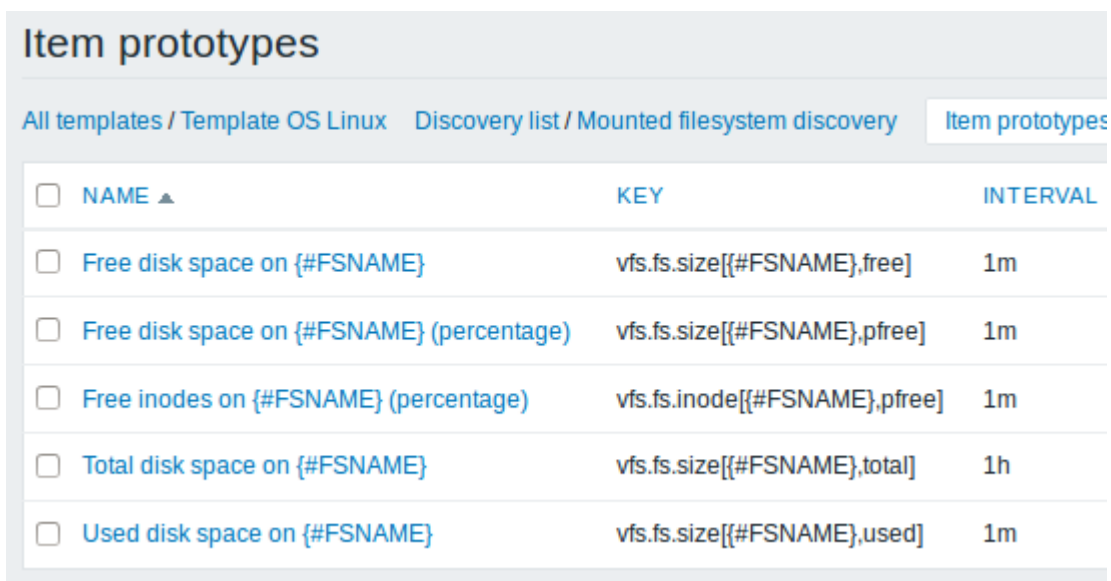
Description

Create enabled

Attributes that are specific for item prototypes:

Parameter	Description
<i>New application prototype</i>	You may define a new application prototype. In application prototypes you can use low-level discovery macros that, after discovery, will be substituted with real values to create applications that are specific for the discovered entity. See also application discovery notes for more specific information.
<i>Application prototypes</i>	Select from the existing application prototypes.
<i>Create enabled</i>	If checked the item will be added in an enabled state. If unchecked, the item will be added to a discovered entity, but in a disabled state.

We can create several item prototypes for each file system metric we are interested in:



The screenshot shows the Zabbix web interface for 'Item prototypes'. The breadcrumb navigation is 'All templates / Template OS Linux / Discovery list / Mounted filesystem discovery / Item prototypes'. The table below lists several item prototypes with columns for NAME, KEY, and INTERVAL.

NAME	KEY	INTERVAL
<input type="checkbox"/> Free disk space on {#FSNAME}	vfs.fs.size[{#FSNAME},free]	1m
<input type="checkbox"/> Free disk space on {#FSNAME} (percentage)	vfs.fs.size[{#FSNAME},pfree]	1m
<input type="checkbox"/> Free inodes on {#FSNAME} (percentage)	vfs.fs.inode[{#FSNAME},pfree]	1m
<input type="checkbox"/> Total disk space on {#FSNAME}	vfs.fs.size[{#FSNAME},total]	1h
<input type="checkbox"/> Used disk space on {#FSNAME}	vfs.fs.size[{#FSNAME},used]	1m

Then, we create trigger prototypes in a similar way:

Trigger prototype
Dependencies

Name

Severity Not classified Information Warning Average High Critical

Expression

[Expression constructor](#)

OK event generation Expression Recovery expression None

PROBLEM event generation mode Single Multiple

OK event closes All problems All problems if tag values match

Tags

[Add](#)

Allow manual close

URL

Description

Create enabled

Attributes that are specific for trigger prototypes:

Parameter	Description
<i>Create enabled</i>	If checked the trigger will be added in an enabled state. If unchecked, the trigger will be added to a discovered entity, but in a disabled state.

When real triggers are created from the prototypes, there may be a need to be flexible as to what constant ('20' in our example) is used for comparison in the expression. See how [user macros with context](#) can be useful to accomplish such flexibility.

You can define [dependencies](#) between trigger prototypes as well (supported since Zabbix 3.0). To do that, go to the *Dependencies* tab. A trigger prototype may depend on another trigger prototype from the same low-level discovery (LLD) rule or on a regular trigger. A trigger prototype may not depend on a trigger prototype from a different LLD rule or on a trigger created from trigger prototype. Host trigger prototype cannot depend on a trigger from a template.

Trigger prototypes

[All templates / Template OS Linux](#) [Discovery list / Mounted filesystem discovery](#) [Item prototypes 5](#)

<input type="checkbox"/>	SEVERITY	NAME ▲	EXPRESSION
<input type="checkbox"/>	Warning	Free disk space is less than 20% on volume {#FSNAME}	{Template OS
<input type="checkbox"/>	Warning	Free inodes is less than 20% on volume {#FSNAME}	{Template OS

We can create graph prototypes, too:

Graph prototype [Preview](#)

Name

Width

Height

Graph type

Show legend

3D view

Items

	Name	Type
⋮	1: Template OS Linux: Total disk space on {#FSNAME}	<input type="text" value="Graph"/>
⋮	2: Template OS Linux: Free disk space on {#FSNAME}	<input type="text" value="Simple"/>

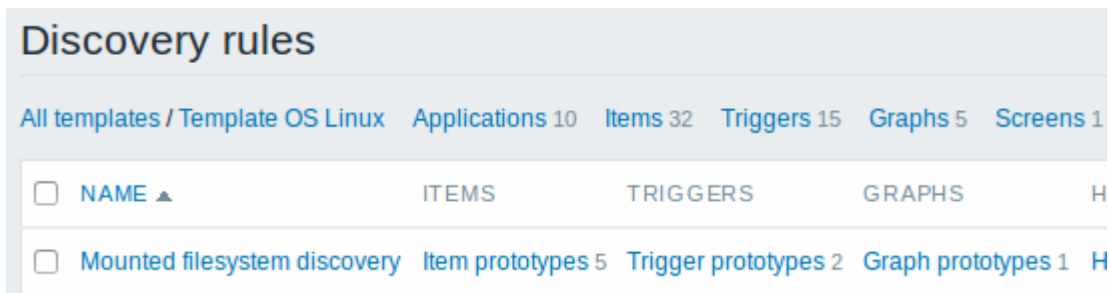
[Add](#) [Add prototype](#)

Graph prototypes

[All templates / Template OS Linux](#) [Discovery list / Mounted filesystem discovery](#) [Item prototypes 5](#)

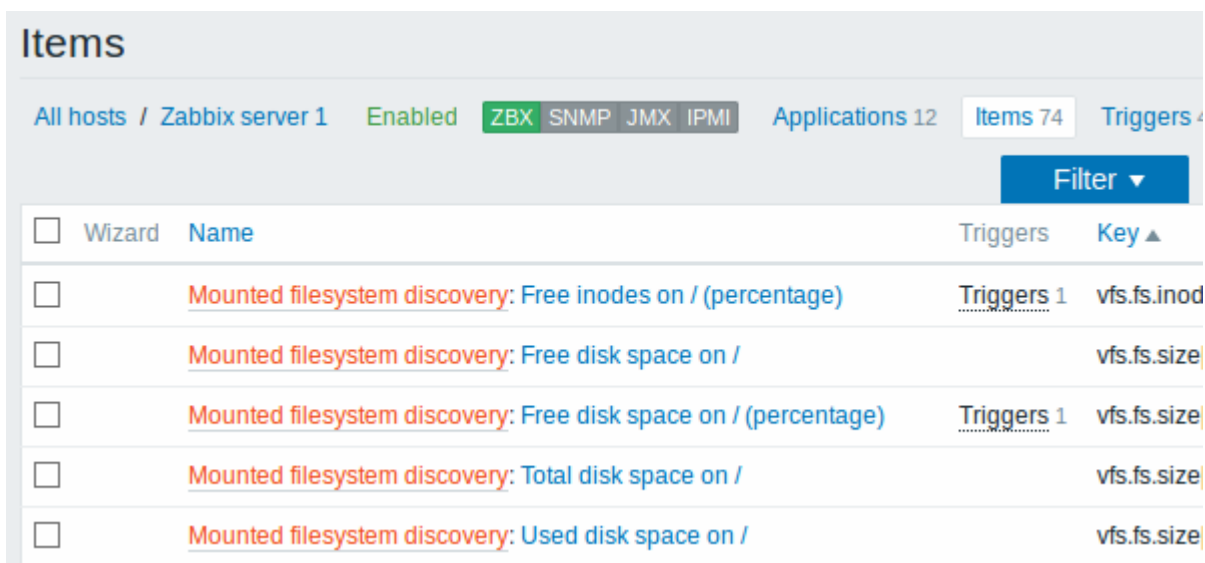
<input type="checkbox"/>	NAME ▲	WIDTH
<input type="checkbox"/>	Disk space usage {#FSNAME}	600

Finally, we have created a discovery rule that looks like shown below. It has five item prototypes, two trigger prototypes, and one graph prototype.



Note: For configuring host prototypes, see the section about [host prototype](#) configuration in virtual machine monitoring.

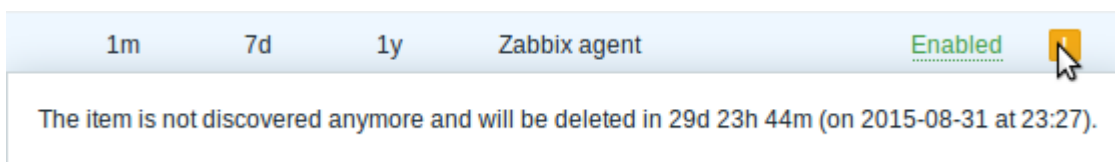
The screenshots below illustrate how discovered items, triggers, and graphs look like in the host's configuration. Discovered entities are prefixed with an orange link to a discovery rule they come from.



Note that discovered entities will not be created in case there are already existing entities with the same uniqueness criteria, for example, an item with the same key or graph with the same name.

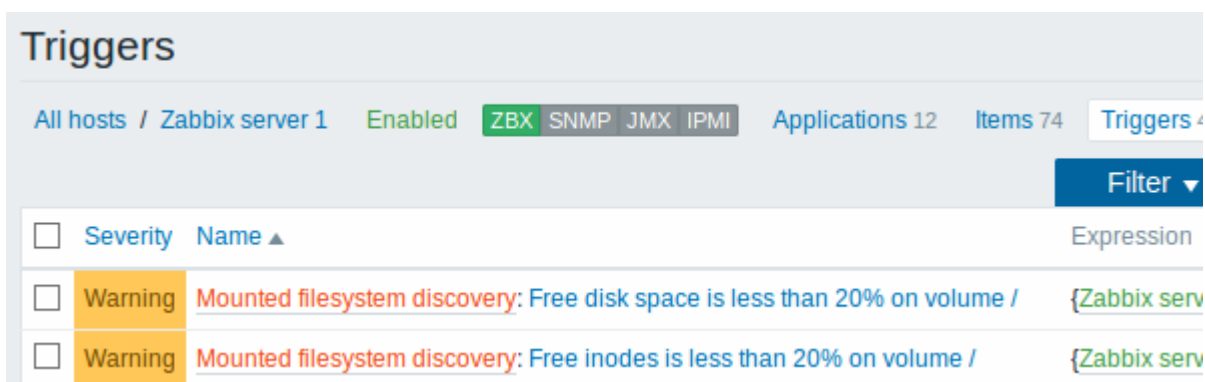
Items (similarly, triggers and graphs) created by a low-level discovery rule will be deleted automatically if a discovered entity (file system, interface, etc) stops being discovered (or does not pass the filter anymore). In this case the items, triggers and graphs will be deleted after the days defined in the *Keep lost resources period* field pass.

When discovered entities become 'Not discovered anymore', a lifetime indicator is displayed in the item list. Move your mouse pointer over it and a message will be displayed indicating how many days are left until the item is deleted.

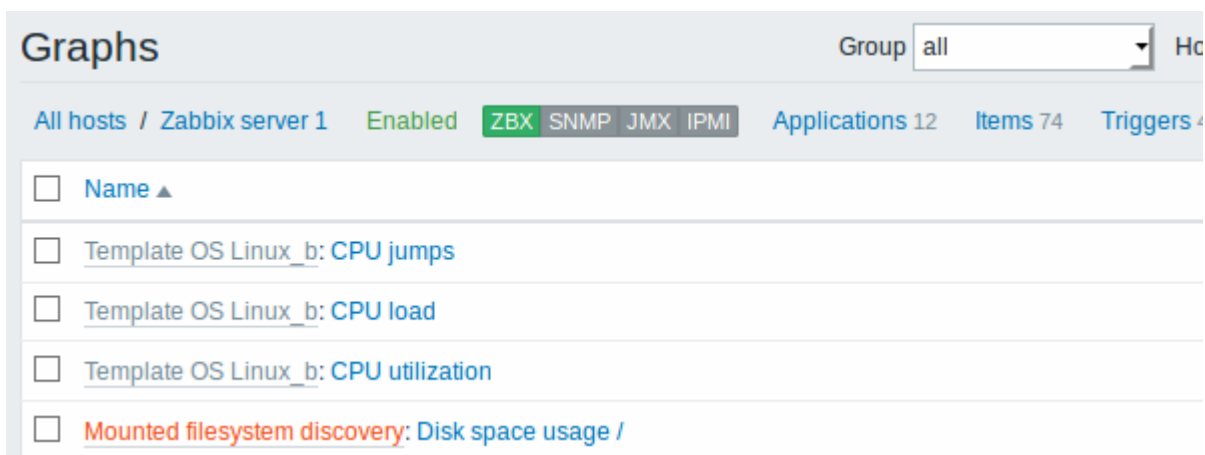


If entities were marked for deletion, but were not deleted at the expected time (disabled discovery rule or item host), they will be deleted the next time the discovery rule is processed.

Entities containing other entities, which are marked for deletion, will not update if changed on the discovery rule level. For example, LLD-based triggers will not update if they contain items that are marked for deletion.



The screenshot shows the Zabbix Triggers page. At the top, there is a navigation bar with 'All hosts / Zabbix server 1' and a status 'Enabled'. Below this are tabs for 'ZBX', 'SNMP', 'JMX', and 'IPMI'. The main content area shows a list of triggers. The first two triggers are highlighted in yellow and have a 'Warning' severity. The first trigger is 'Mounted filesystem discovery: Free disk space is less than 20% on volume /' and the second is 'Mounted filesystem discovery: Free inodes is less than 20% on volume /'. A 'Filter' dropdown menu is visible on the right side of the table.



The screenshot shows the Zabbix Graphs page. At the top, there is a navigation bar with 'All hosts / Zabbix server 1' and a status 'Enabled'. Below this are tabs for 'ZBX', 'SNMP', 'JMX', and 'IPMI'. The main content area shows a list of graphs. The first four graphs are highlighted in blue and have a 'Warning' severity. The first graph is 'Template OS Linux_b: CPU jumps', the second is 'Template OS Linux_b: CPU load', the third is 'Template OS Linux_b: CPU utilization', and the fourth is 'Mounted filesystem discovery: Disk space usage /'. A 'Group' dropdown menu is visible on the right side of the table.

3.2 Discovery of network interfaces

Discovery of network interfaces is done in exactly the same way as discovery of file systems, except that you use the discovery rule key “net.if.discovery” instead of “vfs.fs.discovery” and use macro {#IFNAME} instead of {#FSNAME} in filter and item/trigger/graph prototypes.

Examples of item prototypes that you might wish to create based on “net.if.discovery”:
“net.if.in[{#IFNAME},bytes]”, “net.if.out[{#IFNAME},bytes]”.

[See above](#) for more information about the filter.

3.3 Discovery of CPUs and CPU cores

Discovery of CPUs and CPU cores is done in a similar fashion as network interface discovery with the exception being that the discovery rule key is “system.cpu.discovery”. This discovery key returns two macros - {#CPU.NUMBER} and {#CPU.STATUS} identifying the CPU order number and status respectively. To note, a clear distinction cannot be made between actual, physical processors, cores and hyperthreads. {#CPU.STATUS} on Linux, UNIX and BSD systems returns the status of the processor, which can be either “online” or “offline”. On Windows systems, this same macro may represent a third value - “unknown” - which indicates that a processor has been detected, but no information has been collected for it yet.

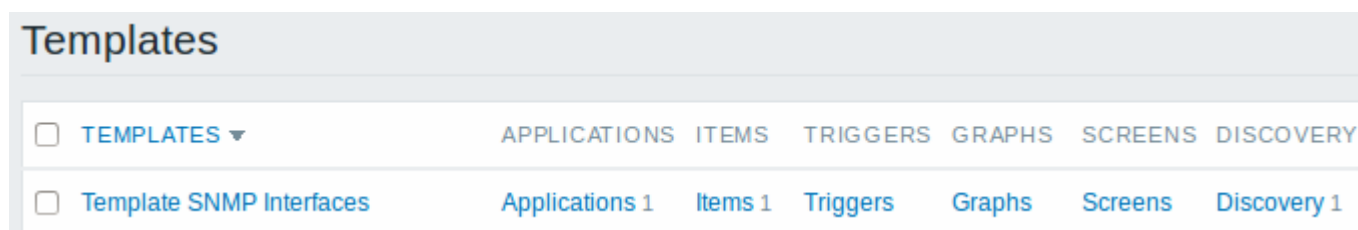
CPU discovery relies on the agent's collector process to remain consistent with the data provided by the collector and save resources on obtaining the data. This has the effect of this item key not

working with the test (-t) command line flag of the agent binary, which will return a NOT_SUPPORTED status and an accompanying message indicating that the collector process has not been started.

Item prototypes that can be created based on CPU discovery include, for example, "system.cpu.util[#{CPU.NUMBER}, <type>, <mode>]" or "system.hw.cpu[#{CPU.NUMBER}, <info>]".

3.4 Discovery of SNMP OIDs

In this example, we will perform SNMP discovery on a switch. First, go to "Configuration" → "Templates".



To edit discovery rules for a template, click on the link in the "Discovery" column.

Then, press "Create rule" and fill the form with the details in the screenshot below.

Unlike file system and network interface discovery, the item does not necessarily have to have "snmp.discovery" key - item type of SNMP agent is sufficient.

The OIDs to discover are defined in SNMP OID field in the following format: `discovery[#{MACRO1}, oid1, #{MACRO2}, oid2, ...,]`

where `{#MACRO1}`, `{#MACRO2}` ... are valid lld macro names and `oid1`, `oid2`... are OIDs capable of generating meaningful values for these macros. A built-in macro `{#SNMPINDEX}` containing index of the discovered OID is applied to discovered entities. The discovered entities are grouped by `{#SNMPINDEX}` macro value.

To understand what we mean, let us perform few snmpwalks on our switch:

```
$ snmpwalk -v 2c -c public 192.168.1.1 IF-MIB::ifDescr
IF-MIB::ifDescr.1 = STRING: WAN
IF-MIB::ifDescr.2 = STRING: LAN1
IF-MIB::ifDescr.3 = STRING: LAN2

$ snmpwalk -v 2c -c public 192.168.1.1 IF-MIB::ifPhysAddress
IF-MIB::ifPhysAddress.1 = STRING: 8:0:27:90:7a:75
IF-MIB::ifPhysAddress.2 = STRING: 8:0:27:90:7a:76
IF-MIB::ifPhysAddress.3 = STRING: 8:0:27:2b:af:9e
```

And set SNMP OID to: `discovery[#{IFDESCR}, ifDescr, #{IFPHYSADDRESS}, ifPhysAddress]`

Now this rule will discover entities with `{#IFDESCR}` macros set to **WAN**, **LAN1** and **LAN2**, `{#IFPHYSADDRESS}` macros set to **8:0:27:90:7a:75**, **8:0:27:90:7a:76**, and **8:0:27:2b:af:9e**,

{#SNMPINDEX} macros set to the discovered OIDs indexes **1**, **2** and **3**:

```
{
  "data": [
    {
      "{#SNMPINDEX}": "1",
      "{#IFDESCR}": "WAN",
      "{#IFPHYSADDRESS}": "8:0:27:90:7a:75"
    },
    {
      "{#SNMPINDEX}": "2",
      "{#IFDESCR}": "LAN1",
      "{#IFPHYSADDRESS}": "8:0:27:90:7a:76"
    },
    {
      "{#SNMPINDEX}": "3",
      "{#IFDESCR}": "LAN2",
      "{#IFPHYSADDRESS}": "8:0:27:2b:af:9e"
    }
  ]
}
```

If an entity does not have the specified OID, then the corresponding macro will be omitted for this entity. For example if we have the following data:

```
ifDescr.1 "Interface #1"
ifDescr.2 "Interface #2"
ifDescr.4 "Interface #4"

ifAlias.1 "eth0"
ifAlias.2 "eth1"
ifAlias.3 "eth2"
ifAlias.5 "eth4"
```

Then in this case SNMP discovery `discovery[{#IFDESCR}, ifDescr, {#IFALIAS}, ifAlias]` will return the following structure:

```
{
  "data": [
    {
      "{#SNMPINDEX}": 1,
      "{#IFDESCR}": "Interface #1",
      "{#IFALIAS}": "eth0"
    },
    {
      "{#SNMPINDEX}": 2,
      "{#IFDESCR}": "Interface #2",
      "{#IFALIAS}": "eth1"
    },
  ],
}
```

```
{
  {
    "#SNMPINDEX": 3,
    "#IFALIAS": "eth2"
  },
  {
    "#SNMPINDEX": 4,
    "#IFDESCR": "Interface #4"
  },
  {
    "#SNMPINDEX": 5,
    "#IFALIAS": "eth4"
  }
}
```

Discovery rule **Filters**

Name

Type

Key

SNMP OID

SNMP community

Port

Update interval

Custom intervals

Type	Interval	Period
<input checked="" type="checkbox"/> Flexible <input type="checkbox"/> Scheduling	<input type="text" value="50s"/>	<input type="text" value="1-7,00:00-24:00"/>

[Add](#)

Keep lost resources period

Description

You may also consider using IF-MIB::ifType or IF-MIB::ifAlias for discovery depending on your filtering needs.

{ \$SNMP_COMMUNITY } is a global macro.

Enabled

The following screenshot illustrates how we can use these macros in item prototypes:

Item prototype **Preprocessing**

Name Incoming traffic on interface \$1

Type SNMPv2 agent

Key ifInOctets[#{IFDESCR}]

SNMP OID IF-MIB::ifInOctets.#{SNMPINDEX}

SNMP community {\$SNMP_COMMUNITY}

Port

Type of information Numeric (unsigned)

Units bps

Update interval 1m

Custom intervals

Type	Interval	Period
<input checked="" type="checkbox"/> Flexible <input type="checkbox"/> Scheduling	50s	1-7,00:00-24:00

[Add](#)

History storage period 1w

Trend storage period 365d

Show value As is [show value mappings](#)

New application

Again, creating as many item prototypes as needed:

Item prototypes

All templates / Template SNMP Interfaces Discovery list / Network interfaces **Item prototypes 8**

<input type="checkbox"/> NAME ▲	KEY	INTERVAL	HI
<input type="checkbox"/> Admin status of interface {#IFDESCR}	ifAdminStatus[{#IFDESCR}]	1m	7d
<input type="checkbox"/> Alias of interface {#IFDESCR}	ifAlias[{#IFDESCR}]	1h	7d
<input type="checkbox"/> Description of interface {#IFDESCR}	ifDescr[{#IFDESCR}]	1h	7d
<input type="checkbox"/> Inbound errors on interface {#IFDESCR}	ifInErrors[{#IFDESCR}]	1m	7d
<input type="checkbox"/> Incoming traffic on interface {#IFDESCR}	ifInOctets[{#IFDESCR}]	1m	7d
<input type="checkbox"/> Operational status of interface {#IFDESCR}	ifOperStatus[{#IFDESCR}]	1m	7d
<input type="checkbox"/> Outbound errors on interface {#IFDESCR}	ifOutErrors[{#IFDESCR}]	1m	7d
<input type="checkbox"/> Outgoing traffic on interface {#IFDESCR}	ifOutOctets[{#IFDESCR}]	1m	7d

As well as trigger prototypes:

Trigger prototype Dependencies

Name

Severity Not classified Information Warning Average High Critical

Expression

[Expression constructor](#)

OK event generation Expression Recovery expression None

PROBLEM event generation mode Single Multiple

OK event closes All problems All problems if tag values match

Tags
 [Add](#)

Allow manual close

URL

Description

Create enabled

Trigger prototypes

All templates / Template SNMP Interfaces Discovery list / Network interfaces Item prototypes 8

<input type="checkbox"/>	SEVERITY	NAME ▲	EXPR
<input type="checkbox"/>	Information	Operational status was changed on {HOST.NAME} interface {#IFDESCR}	{Temp

And graph prototypes:

Graph prototype [Preview](#)

Name

Width

Height

Graph type

Show legend

Show working time

Show triggers

Percentile line (left)

Percentile line (right)

Y axis MIN value

Y axis MAX value

Items	Name	Function	Draw st
⋮	1: Template SNMP Interfaces: Incoming traffic on interface {#IFDESCR}	<input type="text" value="avg"/>	<input type="text" value="Gradie"/>
⋮	2: Template SNMP Interfaces: Outgoing traffic on interface {#IFDESCR}	<input type="text" value="avg"/>	<input type="text" value="Gradie"/>

[Add](#) [Add prototype](#)

Graph prototypes

[All templates / Template SNMP Interfaces](#) [Discovery list / Network interfaces](#) [Item prototypes 8](#) [T](#)

<input type="checkbox"/> NAME ▲	WIDTH
<input type="checkbox"/> Traffic on interface {#SNMPVALUE}	900

A summary of our discovery rule:

Discovery rules

[All templates / Template SNMP Interfaces](#) [Applications 1](#) [Items 1](#) [Triggers](#) [Graphs](#) [Screens](#)

<input type="checkbox"/> NAME ▲	ITEMS	TRIGGERS	GRAPHS	HO
<input type="checkbox"/> Network interfaces	Item prototypes 8	Trigger prototypes 1	Graph prototypes 1	Ho:

When server runs, it will create real items, triggers and graphs based on the values the SNMP

discovery rule returns. In the host configuration they are prefixed with an orange link to a discovery rule they come from.

Items

All hosts / Switch1 Enabled ZBX SNMP JMX IPMI Applications 1 Items 241 Triggers 30 Gr

Filter ▼

<input type="checkbox"/>	Wizard	Name	Triggers	Key ▲
<input type="checkbox"/>		Network interfaces: Admin status of interface 1		ifAdminStatus[1]
<input type="checkbox"/>		Network interfaces: Admin status of interface 2		ifAdminStatus[2]
<input type="checkbox"/>		Network interfaces: Admin status of interface 3		ifAdminStatus[3]
<input type="checkbox"/>		Network interfaces: Admin status of interface 4		ifAdminStatus[4]

Triggers

All hosts / Switch1 Enabled ZBX SNMP JMX IPMI Applications 1 Items 241 Triggers 30 Gr

Filter ▼

<input type="checkbox"/>	Severity	Name ▲	Exp
<input type="checkbox"/>	Information	Network interfaces: Operational status was changed on {HOST.NAME} interface 1	{pr
<input type="checkbox"/>	Information	Network interfaces: Operational status was changed on {HOST.NAME} interface 2	{pr
<input type="checkbox"/>	Information	Network interfaces: Operational status was changed on {HOST.NAME} interface 3	{pr
<input type="checkbox"/>	Information	Network interfaces: Operational status was changed on {HOST.NAME} interface 4	{pr

Graphs

Group all

All hosts / Switch1 Enabled ZBX SNMP JMX IPMI Applications 1 Items 241 Triggers 30 Gr

<input type="checkbox"/>	Name ▲
<input type="checkbox"/>	Network interfaces: Traffic on interface 1
<input type="checkbox"/>	Network interfaces: Traffic on interface 2
<input type="checkbox"/>	Network interfaces: Traffic on interface 3
<input type="checkbox"/>	Network interfaces: Traffic on interface 4

3.5 Discovery using ODBC SQL queries

This type of discovery is done using SQL queries, whose results get automatically transformed into a JSON object suitable for low-level discovery. SQL queries are performed using items of type “Database monitor”. Therefore, most of the instructions on [ODBC monitoring](#) page apply in order to get a working “Database monitor” discovery rule, the only difference being that “db.odbc.discovery[<description>,<dsn>]” key should be used instead of “db.odbc.select[<description>,<dsn>]”.

As a practical example to illustrate how the SQL query is transformed into JSON, let us consider low-level discovery of Zabbix proxies by performing an ODBC query on Zabbix database. This is useful for automatic creation of “zabbix[proxy,<name>,lastaccess]” [internal items](#) to monitor which proxies are alive.

Let us start with discovery rule configuration:

The screenshot shows the configuration page for a discovery rule named "Proxy discovery". The "Type" is set to "Database monitor". The "Key" is "db.odbc.discovery[proxies,{\$DSN}]". The "SQL query" field contains the following SQL code:

```
SELECT h1.host, COUNT (h2.host) AS count FROM hosts h1 LEFT JOIN hosts h2 ON h1.hostid = h2.proxy_hostid WHERE h1.status IN (5, 6) GROUP BY h1.host;
```

 The "Update interval" is set to "1h". Under "Custom intervals", there is one entry with "Type" set to "Flexible Scheduling", "Interval" set to "50s", and "Period" set to "1-7,00:00-24:00". The "Keep lost resources period" is set to "30d". The "Enabled" checkbox is checked. At the bottom, there are "Add" and "Cancel" buttons.

Here, the following direct query on Zabbix database is used to select all Zabbix proxies, together with the number of hosts they are monitoring. The number of hosts can be used, for instance, to filter out empty proxies:

```
mysql> SELECT h1.host, COUNT(h2.host) AS count FROM hosts h1 LEFT JOIN hosts h2 ON h1.hostid = h2.proxy_hostid WHERE h1.status IN (5, 6) GROUP BY h1.host;
+-----+-----+
| host   | count |
+-----+-----+
| Japan 1 |     5 |
| Japan 2 |    12 |
| Latvia  |     3 |
+-----+-----+
3 rows in set (0.01 sec)
```

By the internal workings of “db.odbc.discovery[]” item, the result of this query gets automatically transformed into the following JSON:

```
{
  "data": [
    {
      "#{HOST}": "Japan 1",
      "#{COUNT}": "5"
    },
    {
      "#{HOST}": "Japan 2",
      "#{COUNT}": "12"
    },
    {
      "#{HOST}": "Latvia",
      "#{COUNT}": "3"
    }
  ]
}
```

It can be seen that column names become macro names and selected rows become the values of these macros.

If it is not obvious how a column name would be transformed into a macro name, it is suggested to use column aliases like “COUNT(h2.host) AS count” in the example above.

In case a column name cannot be converted into a valid macro name, the discovery rule becomes not supported, with the error message detailing the offending column number. If additional help is desired, the obtained column names are provided under DebugLevel=4 in Zabbix server log file:

```
$ grep db.odbc.discovery /tmp/zabbix_server.log
...
23876:20150114:153410.856 In db_odbc_discovery() query:'SELECT h1.host,
COUNT(h2.host) FROM hosts h1 LEFT JOIN hosts h2 ON h1.hostid =
```

```

h2.proxy_hostid WHERE h1.status IN (5, 6) GROUP BY h1.host;'
23876:20150114:153410.860 db_odbc_discovery() column[1]:'host'
23876:20150114:153410.860 db_odbc_discovery() column[2]:'COUNT(h2.host)'
23876:20150114:153410.860 End of db_odbc_discovery():NOTSUPPORTED
23876:20150114:153410.860 Item [Zabbix
server:db.odbc.discovery[proxies,{ $DSN}]] error: Cannot convert column #2
name to macro.

```

Now that we understand how a SQL query is transformed into a JSON object, we can use {#HOST} macro in item prototypes:

Item prototype Preprocessing

Name

Type

Key

Type of information

Units

Update interval

Custom intervals

Type	Interval	Period
Flexible Scheduling	50s	1-7,00:00-24:00

[Add](#)

History storage period

Trend storage period

Show value [show value mappings](#)

Once discovery is performed, an item will be created for each proxy:

Items

All hosts / Zabbix server 1 Enabled ZBX SNMP JMX IPMI Applications 12 Items 70 Triggers

[Filter](#) ▼

<input type="checkbox"/>	Wizard	Name	Triggers	Key ▲
<input type="checkbox"/>		Proxy discovery: Last access time of proxy Japan1		zabbix[proxy,Japan1,lastacce
<input type="checkbox"/>		Proxy discovery: Last access time of proxy Japan2		zabbix[proxy,Japan2,lastacce
<input type="checkbox"/>		Proxy discovery: Last access time of proxy Latvia		zabbix[proxy,Latvia,lastaccess

3.6 Discovery of Windows services

Windows service discovery is done in the same way as discovery of file systems. The key to use in the discovery rule is “service.discovery” and the following macros are supported for use in the [filter](#) and item/trigger/graph prototypes:

```
{#SERVICE.NAME}  
{#SERVICE.DISPLAYNAME}  
{#SERVICE.DESCRPTION}  
{#SERVICE.STATE}  
{#SERVICE.STATENAME}  
{#SERVICE.PATH}  
{#SERVICE.USER}  
{#SERVICE.STARTUP}  
{#SERVICE.STARTUPNAME}
```

Based on Windows service discovery you may create an item prototype like “service.info[`{#SERVICE.NAME},<param>`]”, where *param* accepts the following values: *state*, *displayname*, *path*, *user*, *startup* or *description*. For example, to acquire the display name of a service you should use a “service.info[`{#SERVICE.NAME},displayname`]” item. If *param* value is not specified (“service.info[`{#SERVICE.NAME}`]”), the default parameter *state* is used.

`{#SERVICE.STATE}` and `{#SERVICE.STATENAME}` macros return the same content, however, `{#SERVICE.STATE}` returns a numerical value (0-7), while `{#SERVICE.STATENAME}` returns text (*running*, *paused*, *start pending*, *pause pending*, *continue pending*, *stop pending*, *stopped* or *unknown*). The same applies to `{#SERVICE.STARTUP}` and `{#SERVICE.STARTUPNAME}`, where one returns a numerical value (0-4) while the other - text (*automatic*, *automatic delayed*, *manual*, *disabled*, *unknown*).

3.7 Setting up multiple LLD rules for the same item

Since Zabbix agent version 3.2 it is possible to alter low-level discovery item keys using “Alias” parameter in [zabbix_agentd.conf](#) file to enable configuration of several LLD rules for the same item.

3.8 Creating custom LLD rules

It is also possible to create a completely custom LLD rule, discovering any type of entities - for example, databases on a database server.

To do so, a custom item should be created that returns JSON, specifying found objects and optionally - some properties of them. The amount of macros per entity is not limited - while the built-in discovery rules return either one or two macros (for example, two for filesystem discovery), it is possible to return more.

The required JSON format is best illustrated with an example. Suppose we are running an old Zabbix

1.8 agent (one that does not support “vfs.fs.discovery”), but we still need to discover file systems. Here is a simple Perl script for Linux that discovers mounted file systems and outputs JSON, which includes both file system name and type. One way to use it would be as a UserParameter with key “vfs.fs.discovery_perl”:

```
#!/usr/bin/perl

$first = 1;

print "{\n";
print "\t\"data\": [\n\n";

for (`cat /proc/mounts`)
{
    ($fsname, $fstype) = m/\S+ (\S+) (\S+)/;

    print "\t,\n" if not $first;
    $first = 0;

    print "\t{\n";
    print "\t\t\"{#FSNAME}\" : \"$fsname\", \n";
    print "\t\t\"{#FSTYPE}\" : \"$fstype\" \n";
    print "\t}\n";
}

print "\n\t]\n";
print "}\n";
```

Allowed symbols for LLD macro names are **0-9** , **A-Z** , **_** , **.**

Lowercase letters are not supported in the names.

An example of its output (reformatted for clarity) is shown below. JSON for custom discovery checks has to follow the same format.

```
{
  "data": [
    { "{#FSNAME}": "/", "{#FSTYPE}": "rootfs" },
    { "{#FSNAME}": "/sys", "{#FSTYPE}": "sysfs" },
    { "{#FSNAME}": "/proc", "{#FSTYPE}": "proc" },
    { "{#FSNAME}": "/dev", "{#FSTYPE}": "devtmpfs" },
    { "{#FSNAME}": "/dev/pts", "{#FSTYPE}": "devpts" },
    { "{#FSNAME}": "/lib/init/rw", "{#FSTYPE}": "tmpfs" },
    { "{#FSNAME}": "/dev/shm", "{#FSTYPE}": "tmpfs" },
    { "{#FSNAME}": "/home", "{#FSTYPE}": "ext3" },
    { "{#FSNAME}": "/tmp", "{#FSTYPE}": "ext3" },
    { "{#FSNAME}": "/usr", "{#FSTYPE}": "ext3" },
    { "{#FSNAME}": "/var", "{#FSTYPE}": "ext3" },
    { "{#FSNAME}": "/sys/fs/fuse/connections", "{#FSTYPE}": "fusectl" }
  ]
}
```

```
}
```

Then, in the discovery rule's "Filter" field, we could specify "{#FSTYPE}" as a macro and "rootfs|ext3" as a regular expression.

You don't have to use macro names FSNAME/FSTYPE with custom LLD rules, you are free to use whatever names you like.

3.9 Using LLD macros in user macro contexts

User macros [with context](#) can be used to accomplish more flexible thresholds in trigger expressions. Different thresholds may be defined on user macro level and then used in trigger constants depending on the discovered context. Discovered context appears when the [low-level discovery macros](#) used in the macros are resolved to real values.

To illustrate we can use data from the example above and assume that the following file systems will be discovered: /, /home, /tmp, /usr, /var.

We may define a free-disk-space trigger prototype for a host, where the threshold is expressed by a user macro with context:

```
{host:vfs.fs.size[{#FSNAME},pfree].last()}<{${LOW_SPACE_LIMIT:"{#FSNAME}"}
```

Then add user macros:

- `{${LOW_SPACE_LIMIT} 10`
- `{${LOW_SPACE_LIMIT:/home} 20`
- `{${LOW_SPACE_LIMIT:/tmp} 50`

Now, once the file systems are discovered, events will be generated if /, /usr and /var filesystems have less than **10%** of free disk space, the /home filesystem - less than **20%** of free disk space or the /tmp filesystem - less than **50%** of free disk space.

LLD macros are not supported inside of user macro contexts in [trigger function parameters](#).

From: <https://www.zabbix.com/documentation/3.4/> - **Zabbix Documentation 3.4**

Permanent link: https://www.zabbix.com/documentation/3.4/zh/manual/discovery/low_level_discovery?rev=1491275483

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