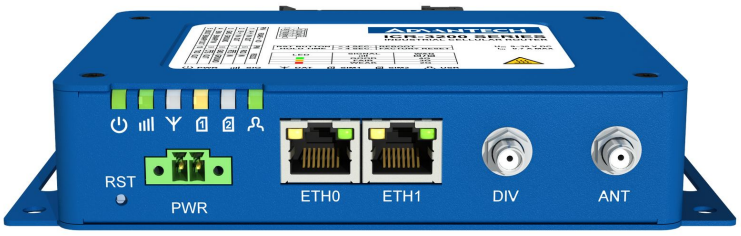
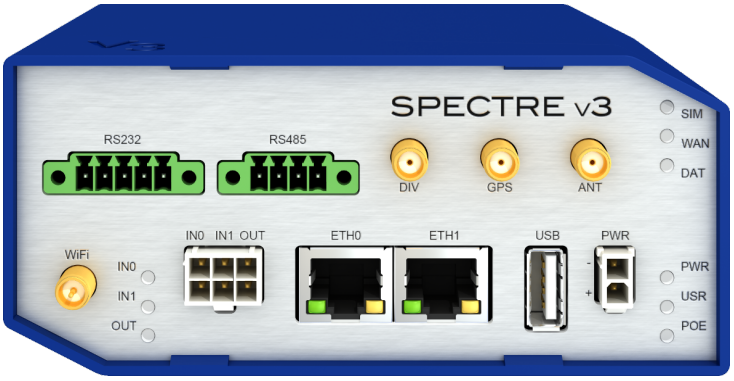
Zabbix Integration Guide

APPLICATION NOTE





ADVANTECH

01-03-21

Used symbols

Danger – Information regarding user safety or potential damage to the router.

Attention – Problems that can arise in specific situations.

Information, notice – Useful tips or information of special interest.

Example – Example of function, command or script.

Open Source Software License

The software in this device uses various pieces of open source software governed by following licenses: GPL versions 2 and 3, LGPL version 2, BSD-style licenses, MIT-style licenses. The list of components together with complete license texts can be found on the device itself: See *Licenses* link at the bottom of the router's main Web page (*General Status*) or point your browser to address DEVICE_IP/licenses.cgi. If you are interested in obtaining the source, please contact us at:

techSupport@advantech-bb.com

Modifications and debugging of LGPL-linked executables:

The manufacturer of the device hereby grants the right to use debugging techniques (e.g. decompilation) and making customer modifications of any executable linked with a LGPL library for own purposes. Note these rights are limited to the customer's own usage. No further distribution of such modified executables and no transmission of the information obtained during these actions may be done.

Advantech Czech s.r.o., Sokolska 71, 562 04 Usti nad Orlici, Czech Republic.
Document No. APP-0089-EN, revision from February 26, 2021. Released in the Czech Republic.

Contents

01-03-21

List of Figures

List of Tables

1. Zabbix Server

Remote monitoring is the process of supervising IT systems from a central management server. In general, monitoring improves reliability and security of your network because it facilitates early detection of erroneous conditions.

For an introduction of remote monitoring and a list of other monitoring tools, please see the Remote Monitoring Application Note [1]. This document describes monitoring of Advantech cellular routers using Zabbix 5.0 LTS.

Zabbix is an open-source monitoring software tool for diverse IT components, including networks, servers, virtual machines (VMs) and cloud services. It can monitor numerous parameters of a network and the health and integrity of servers[1].

1.1 Monitoring Operations

Zabbix monitors Hosts (e.g. routers) through one or more Interfaces. There are two interface types (protocols) that can be used with Advantech routers:

- **SNMP**, which supports also SNMP Traps (see Section 2).
- **Agent**, which supports both active and passive checks (see Section 3).

Individual status checks are defined as Items. Each Item represents a specific Type of information (numeric or character), obtained via a specific check type (SNMP, SSH, passive or active agent) with a specific update period and storage interval. Each item has a unique Key, e.g. “system.cpu.load”.

A set of Items (and other entities such as Triggers, Graphs, or Discovery Rules) can be grouped together into a Template to speed up the deployment of monitoring tasks on a host. Templates are linked to Hosts or to other Templates.

Templates for Advantech router monitoring **zbx_conel_templates.xml** can be downloaded from the Advantech Engineering Portal[2].

Items are logically grouped into Applications (e.g. Info, Status, Interfaces). Some Items also auto-populate host Inventory fields (e.g. Name, OS, Serial Number).

[1] https://www.zabbix.com
[2] https://ep.advantech-bb.cz/products/software/user-modules#zabbix-agent

01-03-21

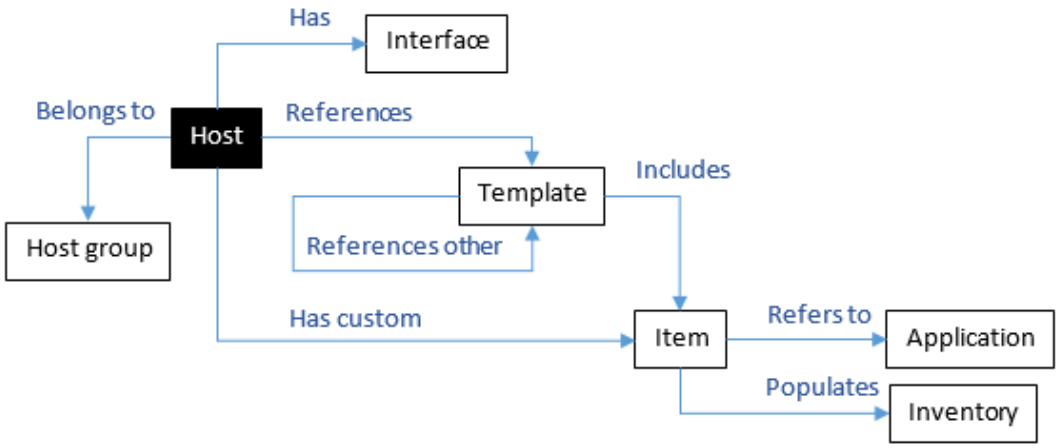


Figure 1: Logical Schema of a Zabbix Configuration

To start monitoring a router you need to create a Host, and:

1. Give it an arbitrary but unique Host name,
2. Assign the Host to a Host group, e.g. “Routers”,
3. Set Interfaces that should be used (SNMP or Agent), possibly including Encryption keys,
4. Link templates that define the Items to be monitored (see the following sections for a list of compatible templates).

If everything works fine, you should after some minutes see:

- Green Availability and Agent encryption indicators under Configuration – Hosts,
- Router inventory details under Inventory – Hosts,
- Retrieved status information under Monitoring – Latest data

Every item has a defied refresh rate, so some items may populated later than others. If you want to request an immediate update of specific (or all) items, open the Host Configuration, click Items on the top bar, then check the items you want to update and click the Execute now button.

1.2 Server Installation and Configuration

The easiest way to install a Zabbix server is to download[3] the ISO image and install[4] a Zabbix Appliance on a virtual machine, e.g. VirtualBox[5]. The „root“ password will be „zabbix“; you will need this only for advanced configuration changes, such as deployment of TLS certificates.

Once installed, connect from your Web browser to the admin Web page at `http://<ip_address>` and login as „Admin“ with a password „zabbix“.

If you want to use Advantech Templates, download zbx_conel_templates.xml from the Advantech Engineering Portal, then enter the Zabbix Configuration section and click Templates, or enter `http://<ip_address>/templates.php` and then import the zbx_conel_templates.xml file.

[3] https://www.zabbix.com/download_appliance
[4] https://www.zabbix.com/documentation/current/manual/appliance
[5] https://www.virtualbox.org

01-03-21

2. Zabbix SNMP Templates

To monitor an Advantech cellular router via the standard SNMP:

- In the router configuration [2], enable the SNMP service,
- In the Zabbix Host Configuration, add a SNMP Interface and link the Host to one or more SNMP Templates (see below).

The Zabbix User Module is not required for the SNMP monitoring. The following SNMP Templates can be used with Advantech cellular routers (indentation shows nested templates):

Template	Item name	Populated inventory
Module Conel Basic SNMP [3]	Product name Firmware Serial number RTC battery Temperature Voltage	Type OS Serial Number A
Module Generic SNMP	SNMP agent availability System name System object ID System description System location System contact details Uptime	 Name Location Contact
Module ICMP Ping	ICMP ping ICMP loss ICMP response time	
Module Interfaces Simple SNMP	Interface type Operational status Speed Bits received Bits sent Inbound packets discarded Inbound packets with errors Outbound packets discarded Outbound packets with errors	

Continued on next page

01-03-21

Continued from previous page

Template	Description	Populated inventory
Module Conel Mobile 1 SNMP [3]	Modem IMEI Modem ESN Modem MEID Mobile registration Mobile technology Mobile operator Mobile card Mobile uptime Mobile signal quality Mobile signal level (CSQ) Mobile signal strength Strength threshold Fair (A) Strength threshold Weak (B)	Serial Number B
Module Conel Mobile 1 Data SNMP [3]	Mobile inbound data 1/2 Mobile outbound data 1/2 Mobile connections 1/2 Mobile online time 1/2 Mobile offline time Mobile signal average Mobile signal min Mobile signal max	
Module Conel GPS SNMP [3]	Location altitude Location latitude Location longitude GPS satellites	 Latitude Longitude

Table 1: Template Items

We recommend you create a template specific to your router (e.g. “ICR-3211”) and then include (or not) the individual template modules depending on the router functions and your monitoring needs. For example, you should include the “Conel GPS SNMP” only if the GPS position is available.

Advantech custom templates, denoted by [3], are not included in the default installation; they need to be downloaded and installed manually. The name “Conel” is used for consistency with the SNMP OID [3].

The strength thresholds A and B are auto-calculated items that depend on the used mobile technology. They are used by the signal strength triggers.

From the Mobile-2 OIDs [3] only the MobileYesterday table is represented in the Template Module Conel Mobile Data SNMP. The MobileToday table contains incomplete interim values only and the other table such as MobileThisWeek are not needed because Zabbix maintains its own statistics of past data.

The templates listed above define the following triggers:

Template	Trigger name	Condition
Module Generic SNMP	System name has changed Host has been restarted No SNMP data collection	Uptime < 10m
Module ICMP Ping	Unavailable by ICMP ping High ICMP ping loss High ICMP ping response time	20 < ICMP loss < 100 ICMP response time > 0.15
Module Conel Mobile SNMP [3]	Fair Mobile Signal Weak Mobile Signal	B < signal strength $\leq$ A signal strength $\leq$ B

Table 2: Defined Triggers

3. Zabbix Agent User Module

3.1 Connectivity Configuration

To monitor an Advantech cellular router via the Zabbix agent:

- Install the Zabbix Agent User Module to the router. For more information on how to upload a user module see the Configuration Manual [2], chapter Customization –> User Modules.
- In the Agent Configuration, configure connectivity to the Zabbix sever.
- In the Zabbix Host Configuration, add an Agent Interface, define Encryption settings to be aligned with the Agent configuration, and link the Host to one or more Agent Templates.

Configuration of the Agent connectivity is in the upper part of the Configuration screen. The bottom part is used for custom key configuration (see Section 3.3).

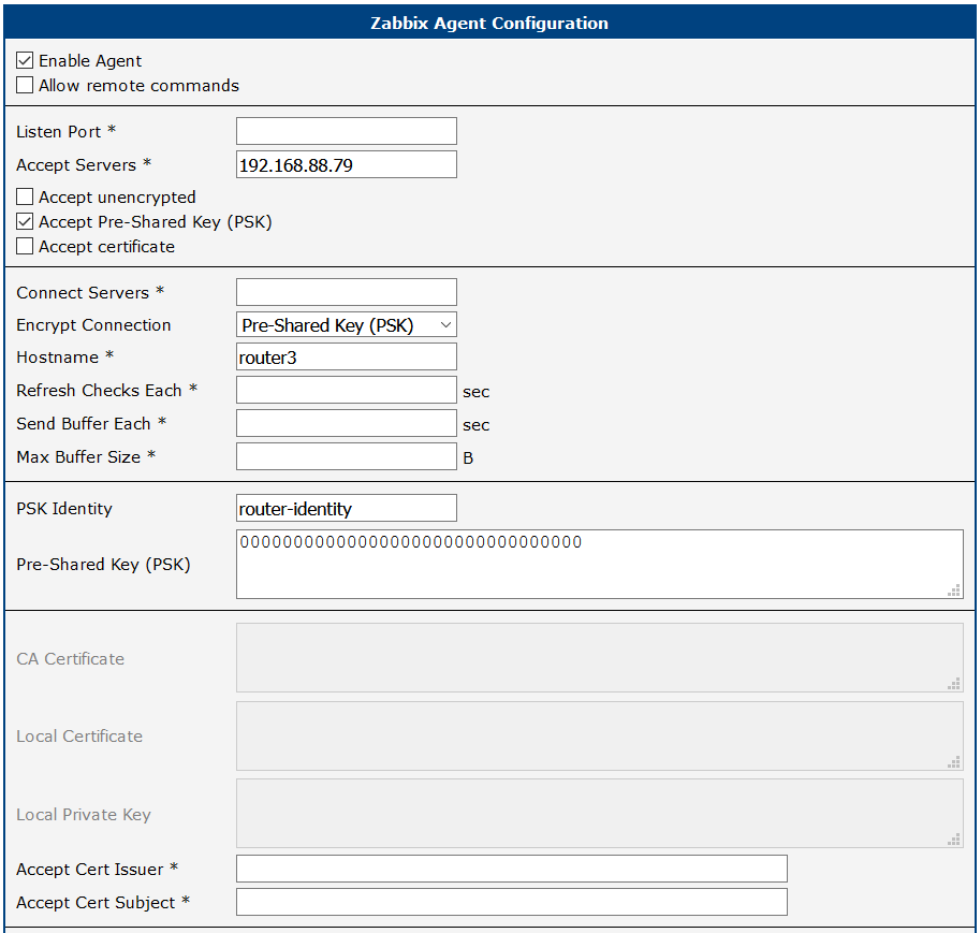


Figure 2: Zabbix Agent Configuration

01-03-21

Item	Description
Enable Agent	Whether the agent will be started.
Allow Remote Commands	Whether remote commands from Zabbix server are allowed. When disabled, the „system.run“ checks will be rejected.
Listen Port	Agent (passive mode) will listen on this port for connections from the server. Default is 10050.
Accept Server	Incoming (passive mode) connections will be accepted only from the hosts listed here. Enter an IP address of your Zabbix server. When empty, passive mode is disabled.
Accept unencrypted	Accept (passive) connections without encryption. Not recommended! The following „Accept xxx“ checks shall match the „Connections to host“ field in the Zabbix Encryption config, see Figure X.
Accept Pre-Shared Key (PSK)	Accept (passive) connections with TLS and a pre-shared key (PSK). When enabled, the PSK and its identity must be configured.
Accept certificate	Accept (passive) connections with TLS and a certificate. When enabled, the CA and Local Certificate and Local Private Key must be configured.
Connect Servers	IP:port (or hostname:port) of Zabbix server for active checks. Multiple comma-delimited addresses can be provided to use several independent Zabbix servers in parallel. When empty, active checks will be disabled.
Encrypt Connection	How the agent should connect to Zabbix server. Shall match the „Connections from host“ field in the Zabbix Encryption config, Figure X.
Hostname	Unique hostname. Shall match the „Host name“ field in the Zabbix Host config, Figure Y.
Refresh Checks Each	How often does the Agent retrieve the list of active checks from the Server, in seconds. Default is 10 s.
Send Buffer Each	How many check results (items) shall the Agent buffer before establishing a connection and syncing values from this buffer to Zabbix server. Default is 5 s.
Max Buffer Size	Defines maximum size of the buffer. When this buffer size is reached, the Agent will sync buffered values immediately. Default is 100 B.

Continued on next page

Continued from previous page

Item	Description
PSK Identity	Pre-shared key identity string. Shall match the „PSK identity“ field in the Zabbix Encryption config, Figure X. The same PSK is used for both passive and active checks.
Pre-Shared Key (PSK)	Pre-shared key to be used. Shall match the „PSK“ field in the Zabbix Encryption config, Figure X.
CA Certificate	CA certificate chain for the authority that issued the Zabbix server certificates.
Local Certificate	Certificate of the router, corresponding to the private key. The purpose must include „client autentication“. When generated by OpenSSL, the „extendedKeyUsage = clientAuth“ must be set. The CA certificate of the authority that issued this certificate must be included in the TLSCAFile in the server configuration.
Local Private Key	Private key of the router. The same private key and certificates are used for both passive and active checks.
Accept Cert Issuer	Allowed server certificate issuer. When specified, shall match the server certificate.
Accept Cert Subject	Allowed server certificate subject. When specified, shall match the server certificate.

Table 3: Zabbix Agent Configuration, Connectivity Fields

Each Router needs a corresponding entry in the Zabbix Host configuration.

- The „Host name“ in the server config shall match the „Hostname“ in the Agent configuration.
- The monitoring interfaces (protocols) need to be explicitly listed and the router IP address or DNS name shall be specified.

The Encryption tab shall match the Agent configuration described above.

- The „Connections to host“ in the server config shall match the Accept unencrypted, Accept Pre-Shared Key (PSK) and Accept certificate fields.
- The „Connection from host“ in the server config shall match the Encrypt Connection in the Agent config.
- The PSK and its identity (if used) shall also match.

To use the TLS certificates, the Zabbix server needs its own certificates (TLSCAFile, TLSCertFile and TLSKeyFile) as described in the Zabbix Manual. See https://www.zabbix.com/documentation/current/manual/encryption/using_certificates

The purpose of the certificate must include „server autentication“. When generated by OpenSSL, the „extendedKeyUsage = serverAuth“ must be set.

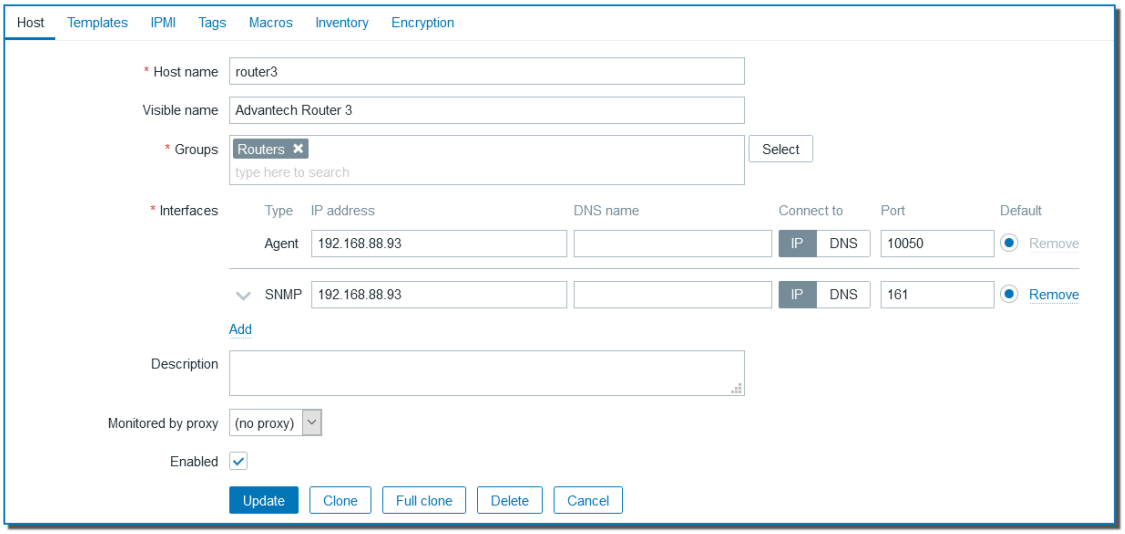


Figure 3: Zabbix Server Host Configuration

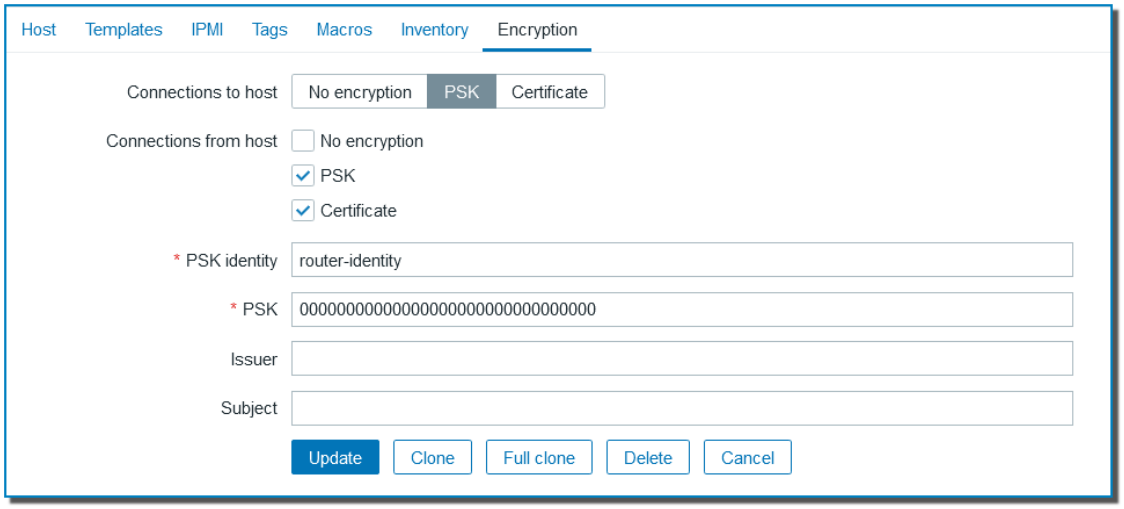


Figure 4: Zabbix Server Encryption Configuration

3.2 Zabbix Agent Templates

Depending on the Zabbix server configuration, the agent can perform a large amount of checks (measurements). Data are gathered in „items“. In the Section 3.4 you can see a complete list of items supported.

Please don’t create unnecessary load on the router and avoid using too many metrics.

The following (passive) Agent templates can be used with Advantech cellular routers (indentation shows nested templates):

Template	Item name	Populated inventory
Module Linux CPU by Zabbix agent	Load average Interrupts per second Context switches per second CPU guest time (and similar)	
Module Conel Resources by Agent [3]	Storage / free Storage / used Storage /opt free Storage /opt used Storage /var/data free Storage /var/data used System memory available System memory used	
Module Conel Integrity by Agent [3]	Checksum /etc/passwd Checksum /etc/settings.*	

Table 4: Agent Templates

There is another, a similar list of Agent templates for active checks.

01-03-21

3.3 Custom Items Configuration

In addition to the standard items you can define custom items to be monitored by your agent, active or passive. Configuration of the custom items is in the bottom part of the Configuration screen.

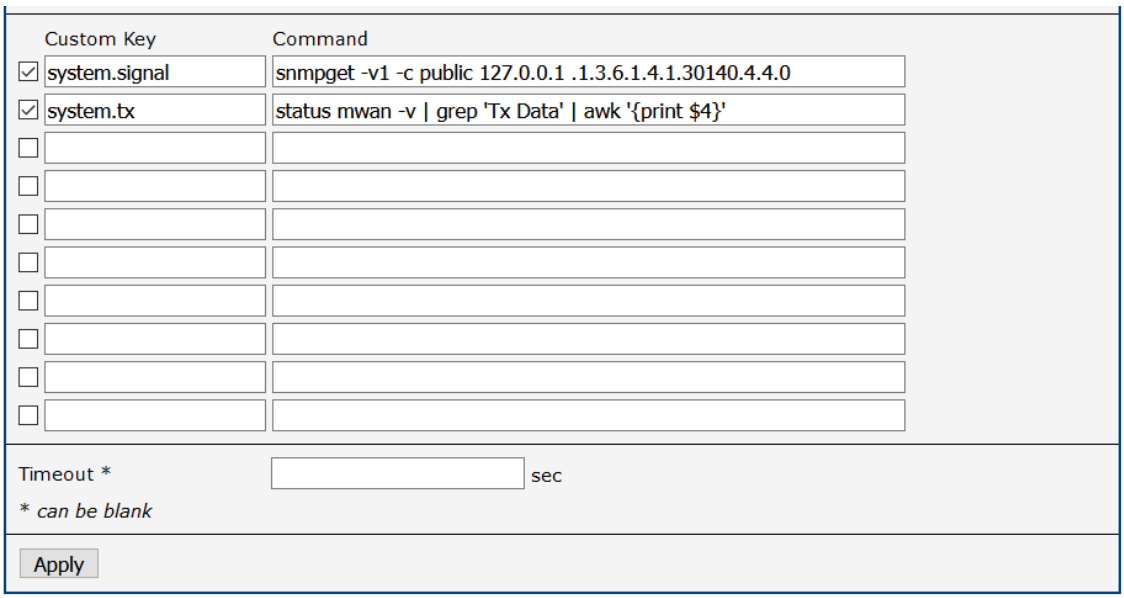


Figure 5: Zabbix Agent Configuration, Custom Keys

Item	Description
Custom Key	Key of a Zabbix item.
Command	Command to execute, with optional arguments. This must be a single command on a single line. The command will be executed and a first line of the textual output (stdout) will be used as a value.
Timeout	Limits computation time of one check. Default 3 s.

Table 5: Zabbix Agent Configuration, Custom Keys

The *Command* field supports only a limited set of characters: double-quotes (“) are not allowed and dollar signs “$” have to be prefixed with a backslash “\$”. If you need to build a more complex check, please create a shell script and use the *Command* field to trigger it.

3.4 Items Supported by Zabbix Agent

Standard Zabbix items (checks) are described in details https://www.zabbix.com/documentation/current/manual/config/items/itemtypes/zabbix_agent

Zabbix documentation also indicates which of the items are supported on various platforms: https://www.zabbix.com/documentation/current/manual/appendix/items/supported_by_platform

The following table complements that information and explains which of the standard agent items are supported on Advantech cellular routers.

Item Key	Supported
agent.hostname	Yes
agent.ping	Yes
agent.version	Yes
kernel.maxfiles	Yes
kernel.maxproc	Yes
log[file,<regexp>,<encoding>,<maxlines>,<mode>,<output>,<maxdelay>] e.g.: *log[/var/log/messages,"authentication failure",,skip,]*	Active only
log.count[file,<regexp>,<encoding>,<maxproclines>,<mode>,<maxdelay>]	Active only
logrt[file_regexp,<regexp>,<encoding>,<maxlines>,<mode>,<output>, <maxdelay>,<options>]	Active only
logrt.count[file_regexp,<regexp>,<encoding>,<maxproclines>,<mode>, <maxdelay>,<options>]	Active only
net.dns[<ip>,zone,<type>,<timeout>,<count>]	Yes
net.dns.record[<ip>,zone,<type>,<timeout>,<count>]	Yes
net.if.collisions[if]	Yes
net.if.discovery	Yes
net.if.in[if,<mode>]	Yes
net.if.out[if,<mode>]	Yes
net.if.total[if,<mode>]	Yes
net.tcp.listen[port]	Yes
net.tcp.port[<ip>,port]	Yes
net.tcp.service[service,<ip>,<port>]	Yes
net.tcp.service.perf[service,<ip>,<port>]	Yes
net.udp.listen[port]	Yes

Continued on next page

Continued from previous page

Item Key	Supported
net.udp.service[service,<ip>,<port>]	Yes
net.udp.service.perf[service,<ip>,<port>]	Yes
proc.cpu.util[<name>,<user>,<type>,<cmdline>,<mode>,<zone>]	Yes
proc.mem[<name>,<user>,<mode>,<cmdline><memtype>]	Yes
proc.num[<name>,<user>,<state>,<cmdline><zone>]	Yes
sensor[device,sensor,<mode>]	No
system.boottime	Yes
system.cpu.discovery	Yes
system.cpu.intr	Yes
system.cpu.load[<cpu>,<mode>]	Yes
system.cpu.num[<type>]	Yes
system.cpu.switches	Yes
system.cpu.util[<cpu>,<type>,<mode>]	Yes
system.hostname	Yes
system.hw.chassis[<info>]	No
system.hw.cpu[<cpu>,<info>]	Yes
system.hw.devices[<type>]	No
system.hw.macaddr[<interface>,<format>]	Yes
system.localtime[<type>]	Passive only
system.run[command,<mode>] e.g. *system.run*[ls /]	If enabled
system.stat[resource,<type>]	No
system.sw.arch	Yes
system.sw.os[<info>]	Yes
system.sw.packages[<package>,<manager>,<format>]	No
system.swap.in[<device>,<type>]	No
system.swap.out[<device>,<type>]	No
system.swap.size[<device>,<type>]	No
system.uname	Yes
system.uptime	Yes
system.users.num	No
vfs.dev.discovery	No

Continued on next page

01-03-21

Continued from previous page

Item Key	Supported
vfs.dev.read[<device>,<type>,<mode>]	No
vfs.dev.write[<device>,<type>,<mode>]	No
vfs.dir.count[dir,<regex_incl>,<regex_excl>,<types_incl>,<types_excl>,<max_depth>,<min_size>,<max_size>,<min_age>,<max_age>] e.g. *vfs.dir.count[/dev]*	Yes
vfs.dir.size[dir,<regex_incl>,<regex_excl>,<mode>,<max_depth>]	Yes
vfs.file.cksum[file]	Yes
vfs.file.contents[file,<encoding>]	Yes
vfs.file.exists[file,<types_incl>,<types_excl>]	Yes
vfs.file.md5sum[file]	Yes
vfs.file.regexp[file,regexp,<encoding>,<output>]	Yes
vfs.file.regmatch[file,regexp,<encoding>]	Yes
vfs.file.size[file]	Yes
vfs.file.time[file,<mode>]	Yes
vfs.fs.discovery	Yes
vfs.fs.get	No
vfs.fs.inode[fs,<mode>]	No
vfs.fs.size[fs,<mode>]	Yes
vm.memory.size[<mode>]	Yes
web.page.get[host,<path>,<port>]	Yes
web.page.perf[host,<path>,<port>]	Yes
web.page.regexp[host,<path>,<port>,regexp,<length>,<output>]	Yes

Table 6: Agent Items Support

In addition to the above, the following Advantech specific items are supported:

Item Key	Description
vfs.settings.discovery	List of /etc/settings.* and /opt/*/etc/settings files for autodiscovery
vfs.settings.value[name,parameter] e.g. *vfs.settings.value[wifi_ap, WIFI_AP_SSID]*	Retrieves a single value from the router config /etc/settings.[name]
vfs.settings.umod[name,parameter] e.g. *vfs.settings.umod[gps, MOD_GPS_ENABLED]*	Retrieves a single value from a user module config /opt/[name]/etc/settings

Table 7: Specific Items Support

4. Related Documents

[1] Advantech Czech: **Remote Monitoring Application Note**
[2] Advantech Czech: **Configuration Manuals**
[3] Advantech Czech: **SNMP OID Application Note**

Product related documents can be obtained on *Engineering Portal* at www.ep.advantech-bb.cz address.