

# ZABBIX AGENT EMULATOR FOR AS/400

Experience of monitoring  
IBM iSeries systems with Zabbix

**ZABBIX** 2017  
Conference

# AGENDA

- ▶ Introduction
- ▶ History and tasks during migration to Zabbix
- ▶ Looking for an approach
- ▶ IBM Toolbox for Java
- ▶ Eureka! Idea for a solution
- ▶ Specifications

# AGENDA

*(continuing)*

- ▶ Implementation
- ▶ Limitations and specificity
- ▶ Examples of screenshots
- ▶ Troubles
- ▶ Community and support
- ▶ Conclusion

# INTRODUCTION

# ABOUT ME



- ▶ Constantin Oshmyan
- ▶ [COshmyan@gmail.com](mailto:COshmyan@gmail.com)
- ▶ Systems Analyst
- ▶ [Rietumu Banka](#) since 2003

# ABOUT RIETUMU BANK

- ▶ Leading private bank in the Baltic states offers an extensive range of banking products and services for corporate clients and high net worth individuals
- ▶ Over 20 years of successful operating experience in the Baltic states, CIS, Europe and Asia
- ▶ Operating in more than 40 countries worldwide
- ▶ Services provided in English, Latvian, Russian and French



# HISTORY

## Operating systems:

- ▶ Windows
- ▶ Unix (AIX and Solaris)
- ▶ Linux
- ▶ OS/400

## Monitoring system:

- ▶ IBM Tivoli Distributed Monitoring v3.6 -> 3.7 -> 4.x -> (Omegamon 5.x) -> IBM Tivoli Monitoring 6.x
- ▶ Zabbix v2.0 -> 2.2 -> 3.0

# REASONS FOR MIGRATION TO ZABBIX

- ▶ Simplicity and price
- ▶ History and charts just “out of the box”
- ▶ SLA (IT Services)
- ▶ Local and friendly technical support

# FEW WORDS ABOUT AS/400

- ▶ Platform: **IBM Power Systems** (formerly known as: **System i, eServer iSeries, AS/400**)
- ▶ Operating system: **IBM i** (formerly known as: **i5/OS, OS/400**)
- ▶ Very specific (architecture, API, filesystem, etc.)

# TASK: TO MONITOR AS/400 SYSTEMS USING ZABBIX

- ▶ ASP used (>N%)
- ▶ Disk unit state (!="Active")
- ▶ Jobs: critical job absent
- ▶ Jobs: some job consumes a lot of CPU (>N%)
- ▶ Jobs: status (="LCKW")
- ▶ Jobs: number of jobs in specific subsystem (<N)

# TASK: TO MONITOR AS/400 SYSTEMS USING ZABBIX

*(continuing)*

- ▶ Subsystem: status (!="\*ACTIVE")
- ▶ Spooled files queues: number of files is too high or is increasing too fast (spam)
- ▶ Message queues: messages in operator queue (QSYSOPR)

# LOOKING FOR APPROACH: STANDARD AGENT?

- ▶ Standard agent for this platform?
- Unfortunately, does not exist 😞  
    POSIX only

# LOOKING FOR APPROACH: POSIX SUBSYSTEM?

- ▶ PASE (Portable Application Solutions Environment) provides a subset of AIX functionality: shells (ksh by default), grep/awk/sed/Perl.
- ▶ Binary compatibility with AIX (for example, zabbix\_sender from Zabbix agent for AIX does work).
- Programs are limited by this environment only, it's impossible to monitor AS/400-specific metrics (subsystems, message queues, etc.)☹

# LOOKING FOR APPROACH: SNMP?

- ▶ Yes, some success:
- ▶ System ASP (ASP1)
- ▶ Network interfaces
- ▶ Number of running processes
- ▶ Number of users logged in

# LOOKING FOR APPROACH: SNMP?

- ▶ Yes, however:
- ▶ SNMP version 1 only (*currently v3 is available with fixes*)
- ▶ The only configurable parameter is community name
- ▶ Lack of some needed info
- ▶ There is no AS/400-specific information (subsystems, jobs, queues)
- ▶ Some metrics are unreliable (CPU's: quantity, utilization), clustered ASP

# LOOKING FOR APPROACH: COMPLEX SOLUTION?

- ▶ SNMP (what is possible)
- ▶ Some internal code + **zabbix\_sender**
- ▶ Some external scripts (**cwbping** for connectivity tests) + **zabbix\_sender**
- It's possible; but is difficult to maintain
- lack of messages monitoring, anyway

# THE IBM® TOOLBOX FOR JAVA™

▶ The IBM® Toolbox for Java™: access classes represent OS/400 data and resources, including:

- Job
- Subsystem
- QueuedMessage
- MessageQueue

[https://www.ibm.com/support/knowledgecenter/en/ssw\\_ibm\\_i\\_71/rzahh/classes.htm](https://www.ibm.com/support/knowledgecenter/en/ssw_ibm_i_71/rzahh/classes.htm)

# THE IBM® TOOLBOX FOR JAVA™

- ▶ Yes, it works! 😊
- ▶ It's possible to retrieve, for example, list of messages from the Message Queue and get for each message:
  - ID (identifying code of the message, non-unique)
  - Severity level (Integer)
  - Name of the job that sent the message (String)
  - Key to the message received (4-byte, unique)
  - Date and time the message arrived in the message queue
  - Message text

# EUREKA!

## Idea for a solution:

- ▶ There is an API to AS/400 that allows to access the needed objects and attributes
- ▶ There is a documented protocol (link 1 and link 2) describing the interaction between Zabbix-server and Zabbix-agent
- ▶ There is a “reference implementation” of this protocol: open sources of Zabbix agent

<https://www.zabbix.com/documentation/3.0/manual/appendix/items/activepassive>

[https://www.zabbix.org/wiki/Docs/protocols/zabbix\\_agent/3.0](https://www.zabbix.org/wiki/Docs/protocols/zabbix_agent/3.0)

# EUREKA!

## Idea for a solution (*continued*):

- ▶ Zabbix Agent for Windows sends to Zabbix-server data from Windows Event Log together with a metadata (timestamp of message, Severity, EventID, Source). Additionally, Zabbix-server could store lastlogsize (bigint in the database schema) – reference to the last examined message. It is very similar to AS/400 message queue.

# EUREKA!

## Idea for a solution (*continued*):

- ▶ Idea: Zabbix agent emulator written on Java.
  - One side: using IBM Toolbox for Java, communicate to AS/400 system and retrieve the messages from message queue.
  - Another side: pretend to be a Zabbix-agent for Zabbix-server, sending there these messages. Ideally, all needed metrics.

# EUREKA!



# EUREKA!

## Idea for a solution (*continued*):

- ▶ Requirements specifications for Zabbix development team (custom development).
- ▶ Small project: “proof of concept”. Interesting! :-)

# SPECIFICATIONS (MINIMUM):

- ▶ Java program emulating for a Zabbix-server the behavior of Zabbix-agent in active mode
- ▶ Support of the following standard metrics:
  - **agent.hostname**
  - **agent.ping**
  - **agent.version**
  - **eventlog** (with possibility to return metadata: original date/time, severity, eventID, source; possibility to filter by these fields, preferably – using regular expressions)

# SPECIFICATIONS (MINIMUM):

*(continued)*

- ▶ Support of the following standard metrics *(continued)*:
  - **vfs.fs.size** (current state of ASP's)
  - **vfs.fs.discovery** (list of ASP's available)
  - **proc.num** (number of jobs, filtered by name, state, user and subsystem)
  - **system.uname**

# SPECIFICATIONS (MINIMUM):

*(continued)*

- ▶ Additionally the following non-standard metrics:
  - **as400.subsystem** (state of subsystem)
  - **as400.outputqueue.size** (number of spool files in output queue)
  - **as400.disk.state** (state of disk units)

# SPECIFICATIONS (MINIMUM):

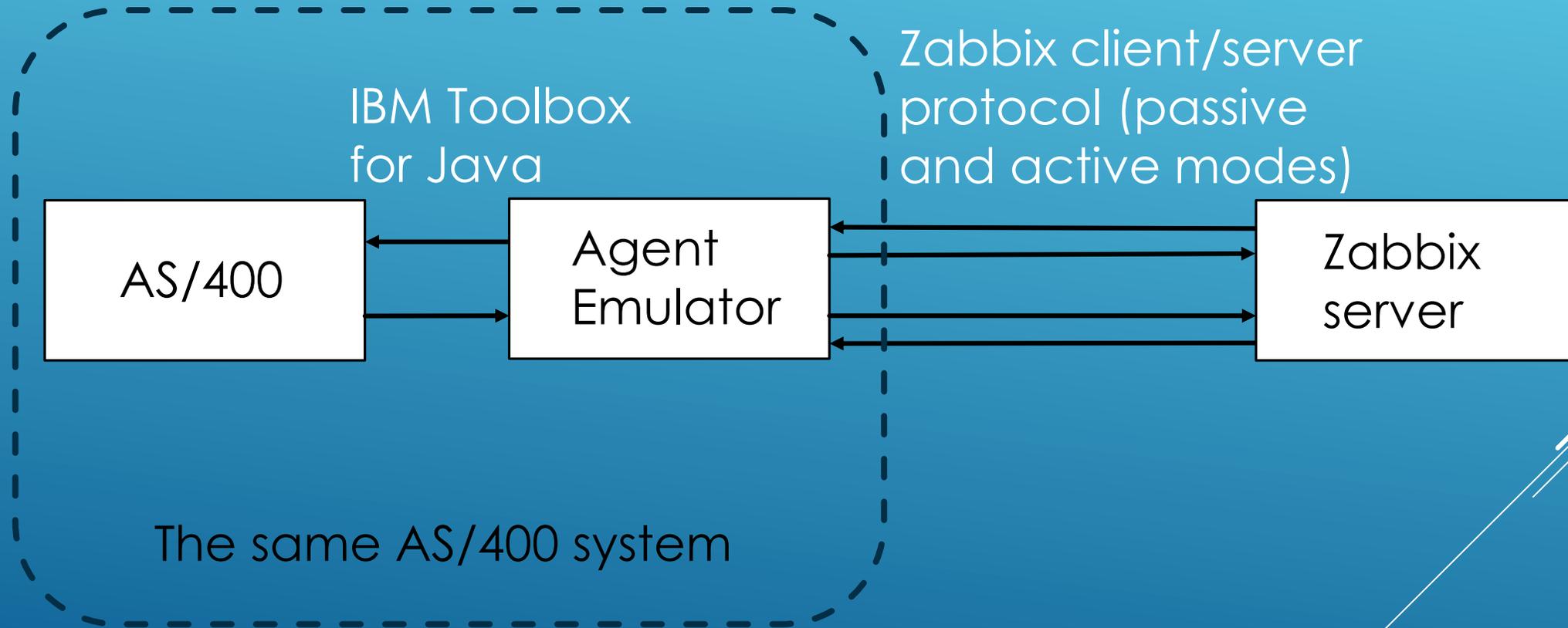
*(continued)*

- ▶ Behaviour should be as close as similar to standard Zabbix-agents on other platforms (the same config- and log- file format, same logic, default values, etc.);
- ▶ At the same time, program could use the Java-specific features (threads instead of processes, standard data structures like **Hashtable** or **ArrayList**, etc.).

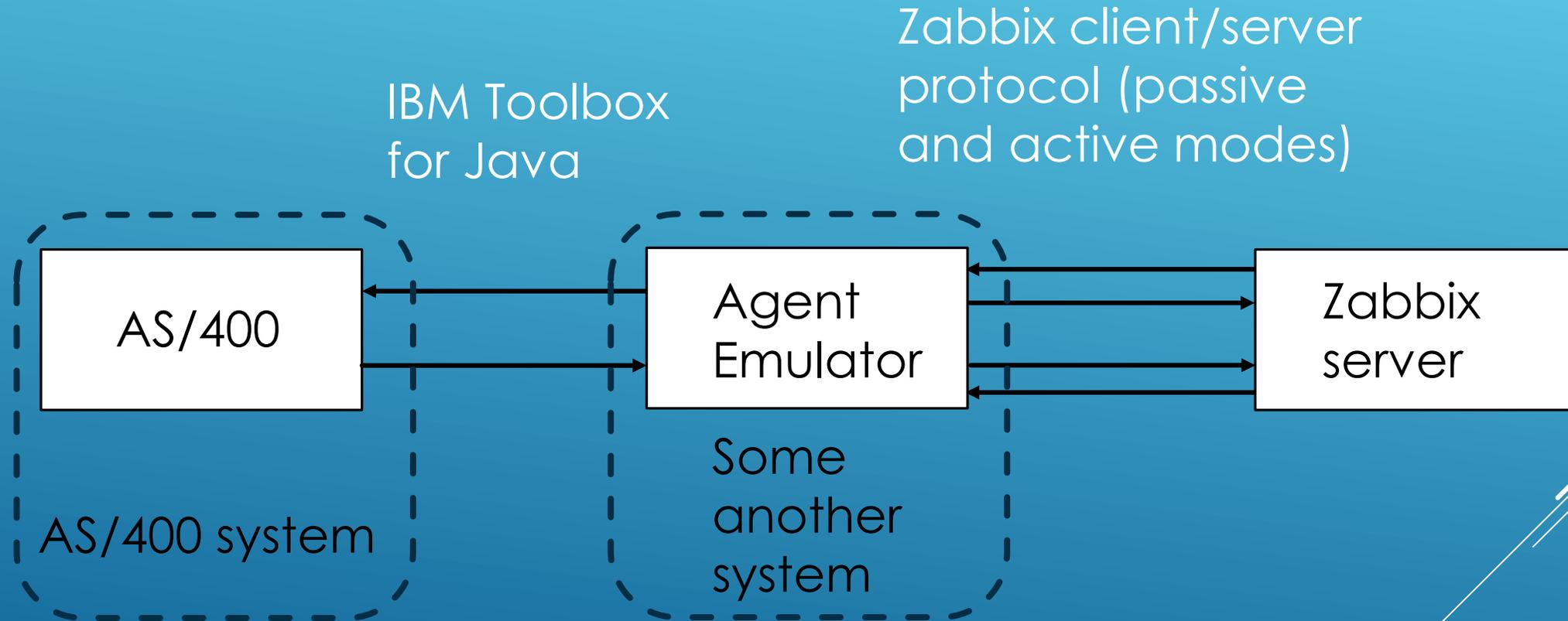
# SPECIFICATIONS (MAXIMUM):

- ▶ There should be possibility to run this program in 2 modes:
  - Locally (directly on the AS/400 system)
  - Remotely (on the different host, connecting to AS/400 via network)
- ▶ Design should allow to extend functionality gradually;
- ▶ Work both in active and in passive modes;
- ▶ Processing of most standard metrics of Zabbix-agent as far as they have sense for this platform

# LOCAL MODE



# REMOTE MODE



# IMPLEMENTATION

- ▶ Communications to Zabbix-server: protocol description + sources of Zabbix-agent (just repeat the same logic)
- ▶ Using Java-specific features:
  - Threads
  - Exceptions (instead of return codes)
  - Standard data structures (**ArrayList**, **Hashtable**, **StringBuilder**, etc.)

# IMPLEMENTATION

*(continued)*

## ▶ Communications to AS/400:

- Using the JTOpen classes where if possible (jobs, subsystems, queues);
- Otherwise: using JTOpen interface to native AS/400 API (ASP's, disk units);
- Collecting of CPU Usage statistics (by jobs) using a special "collector" thread;
- Limitations for obtaining information about OS using direct Java API: data should arrive exactly from AS/400 system

# IMPLEMENTATION

*(continued)*

- ▶ Minimum dependencies: **jt400.jar** and **json-simple-1.1.1.jar** (23.5 KB) only;
- ▶ Parsing of metric key and calls of the appropriate processing method: code is shared between all threads (both for active and passive modes)

# LIMITATIONS AND DISTINCTIONS FROM THE STANDARD AGENT

- ▶ minimum JRE version is 1.7
- ▶ lack of IPv6 (IPv4 only supported)
- ▶ no encryption (sorry, no plans)
- ▶ some config file's parameters are recognized, but really ignored (PidFile, EnableRemoteCommand, Alias, AllowRoot, Include, UserParameter and LoadModule)

# LIMITATIONS AND DISTINCTIONS FROM THE STANDARD AGENT

*(continued)*

- ▶ configuration parameter **ListenIP** allows to set only one IP-address (contrary to list in original Zabbix-agent)
- ▶ minimum value for the **StartAgents** parameter is 1 (i.e. active-only mode is not supported)
- ▶ only limited subset of standard metrics supported, and even in this case: some of them have a bit different semantics of parameters (see **proc.num[]** or **eventlog[]** for examples)

# LIMITATIONS AND DISTINCTIONS FROM THE STANDARD AGENT

*(continued)*

- ▶ during message queue monitoring the integer part only of the message's EventID is transferred to Zabbix-server. It is restriction of Zabbix database schema (it has the integer type for the appropriate attribute). However, it's possible to use a regular expression in the item's key to filter by the full text value of EventID
- ▶ filtering of messages in message queue by userID
- ▶ some AS/400-specific metrics (as400.services)

# EXAMPLES

How it looks?

## Latest data



Filter ▲

Host groups   Name

Hosts    Show items without data

Application   Show details

Filter

Reset

<input type="checkbox"/> Name ▲	Interval	History	Trends	Type	Last check	Last value	Change	Info
▶ ASP (12 Items)								
▶ CPU Usage by process (17 Items)								
▶ Disks (72 Items)								
▶ Generic (9 Items)								
▶ Message Queue (5 Items)								
▶ Output Queue (7 Items)								
▼ Zabbix agent (3 Items)								
<input type="checkbox"/> Agent ping <a href="#">agent.ping</a>	60	7	365	Zabbix agent	2017-09-13 18:34:48	Up (1)		<a href="#">Graph</a>
<input type="checkbox"/> Host name of zabbix_agentd running <a href="#">agent.hostname</a>	3600	7		Zabbix agent	2017-09-13 18:25:49	as400-test		<a href="#">History</a>
<input type="checkbox"/> Version of zabbix_agent(d) running <a href="#">agent.version</a>	3600	7		Zabbix agent	2017-09-13 18:25:50	0.7.3		<a href="#">History</a>

0 selected

Display stacked graph

Display graph

Generic (10 Items)									
<input type="checkbox"/>	CPU Usage for all process <a href="#">proc.cpu.util[,total,...</a>	60	7	365	Zabbix agent (...)	2017-09-13 19:04:54	0.35 %		Graph
<input type="checkbox"/>	Number of jobs in state LCKW <a href="#">proc.num[,LCKW,]</a>	300	7	365	Zabbix agent (...)	2017-09-13 19:03:39	0		Graph
<input type="checkbox"/>	Number of jobs in state run with global RE (active) <a href="#">proc.num[,run,@test_as400]</a>	300	7	365	Zabbix agent (...)	2017-09-13 19:03:43	0		Graph
<input type="checkbox"/>	Number of jobs with global RE (passive) <a href="#">proc.num[,,@test_as400]</a>	300	7	365	Zabbix agent	2017-09-13 19:00:53	0		Graph
<input type="checkbox"/>	Number of running jobs (total) <a href="#">proc.num[,run]</a>	300	7	365	Zabbix agent (...)	2017-09-13 19:03:44	216	+2	Graph
<input type="checkbox"/>	Number of users <a href="#">system.users.num</a>	60	7	365	Zabbix agent (...)	2017-09-13 19:03:58	0		Graph
<input type="checkbox"/>	Services availability <a href="#">as400.services</a>	300	7	365	Zabbix agent (...)	2017-09-13 19:03:42	0		Graph
<input type="checkbox"/>	Status of subsystem QTRMEQIF in library QGPL <a href="#">as400.subsystem[QTRMEQIF,QGPL]</a>	300	7		Zabbix agent (...)	2017-09-13 19:03:38	*INACTIVE		History
<input type="checkbox"/>	Status of subsystem qtrmeqpl5 in library qgpl <a href="#">as400.subsystem[qtrmeqpl5,qgpl]</a>	300	7		Zabbix agent (...)				History
<input type="checkbox"/>	System information <a href="#">system.uname</a>	120	7		Zabbix agent	2017-09-13 19:03:51	IBM OS/4		

There is no subsystem with name='qtrmeqpl5' in library 'qgpl'

```

10:20170913:191428.847 Starting Zabbix Agent v0.7.3
10:20170913:191428.851 using configuration file: zabbix_agentd.conf
10:20170913:191428.852 Oracle Corporation Java version "1.8.0_20"
10:20170913:191428.852 Java(TM) SE Runtime Environment (build 1.8.0_20-b26)
10:20170913:191428.852 Java HotSpot(TM) 64-Bit Server VM (build 25.20-b23, mixed mode)
10:20170913:191428.853 Open Source Software, JTOpen 9.1, codebase 5770-SS1 V7R3M0.00 built=20160705 @RF
10:20170913:191429.012 Agent hostname: 'as400-test', System info: IBM OS/400 V7R1M0, Oracle Corporation Java HotSpot(TM) 64-Bit Server VM (v1.8.0_20)
14:20170913:191429.033 agent #1 started [collector]
16:20170913:191429.037 agent #3 started [listener #1]
17:20170913:191429.038 agent #4 started [listener #2]
15:20170913:191429.038 agent #2 (zabbix.rietumu.lv) started [active checks #3]
15:20170913:191430.580 As400Metric.process() error: com.ibm.as400.access.AS400Exception: CPF9801 Object QPRINTPL5 in library QGPL not found.

```

CPF9801 Object QPRINTPL5 in library QGPL not found.

ASP (12 Items)									
<input type="checkbox"/>	ASP1 capacity <i>vfs.fs.size[1,total]</i>	3600	7	365	Zabbix agent (...)	2017-09-13 19:14:31	426.67 GB		<a href="#">Graph</a>
<input type="checkbox"/>	ASP1 free <i>vfs.fs.size[1,free]</i>	300	7	365	Zabbix agent (...)	2017-09-13 19:24:32	191.03 GB	-14.31 MB	<a href="#">Graph</a>
<input type="checkbox"/>	ASP1 free, % <i>vfs.fs.size[1,pfree]</i>	300	7	365	Zabbix agent (...)	2017-09-13 19:24:32	44.77 %		<a href="#">Graph</a>
<input type="checkbox"/>	ASP1 pused, % <i>vfs.fs.size[1,pused]</i>	300	7	365	Zabbix agent (...)	2017-09-13 19:24:32	55.23 %		<a href="#">Graph</a>
<input type="checkbox"/>	ASP1 status <i>vfs.fs.state[1]</i>	300	7	365	Zabbix agent (...)	2017-09-13 19:24:29	no status (0)		<a href="#">Graph</a>
<input type="checkbox"/>	ASP1 used <i>vfs.fs.size[1,used]</i>	300	7	365	Zabbix agent (...)	2017-09-13 19:24:32	235.63 GB	+14.31 MB	<a href="#">Graph</a>
<input type="checkbox"/>	ASP33 capacity <i>vfs.fs.size[33,total]</i>	3600	7	365	Zabbix agent (...)	2017-09-13 19:14:29	426.67 GB		<a href="#">Graph</a>
<input type="checkbox"/>	ASP33 free <i>vfs.fs.size[33,free]</i>	300	7	365	Zabbix agent (...)	2017-09-13 19:24:29	326.08 GB		<a href="#">Graph</a>
<input type="checkbox"/>	ASP33 free, % <i>vfs.fs.size[33,pfree]</i>	300	7	365	Zabbix agent (...)	2017-09-13 19:24:29	76.43 %		<a href="#">Graph</a>
<input type="checkbox"/>	ASP33 pused, % <i>vfs.fs.size[33,pused]</i>	300	7	365	Zabbix agent (...)	2017-09-13 19:24:29	23.57 %		<a href="#">Graph</a>
<input type="checkbox"/>	ASP33 status <i>vfs.fs.state[33]</i>	300	7	365	Zabbix agent (...)	2017-09-13 19:24:29	available (4)		<a href="#">Graph</a>
<input type="checkbox"/>	ASP33 used <i>vfs.fs.size[33,used]</i>	300	7	365	Zabbix agent (...)	2017-09-13 19:24:29	100.59 GB		<a href="#">Graph</a>

▶ CPU Usage by process (18 Items)

ASP (12 Items)									
<input type="checkbox"/>	ASP1 capacity <i>vfs.fs.size[1,total]</i>	3600	7	365	Zabbix agent (...	2017-09-13 18:36:41	426.67 GB		Graph
<input type="checkbox"/>	ASP1 free <i>vfs.fs.size[1,free]</i>	300	7	365	Zabbix agent (...	2017-09-13 19:31:15	270.05 GB	-9.54 MB	Graph
<input type="checkbox"/>	ASP1 free, % <i>vfs.fs.size[1,pfree]</i>	300	7	365	Zabbix agent (...	2017-09-13 19:30:59	63.3 %		Graph
<input type="checkbox"/>	ASP1 pused, % <i>vfs.fs.size[1,pused]</i>	300	7	365	Zabbix agent (...	2017-09-13 19:31:15	36.71 %		Graph
<input type="checkbox"/>	ASP1 status <i>vfs.fs.state[1]</i>	300	7	365	Zabbix agent (...	2017-09-13 19:31:23	no status (0)		Graph
<input type="checkbox"/>	ASP1 used <i>vfs.fs.size[1,used]</i>	300	7	365	Zabbix agent (...	2017-09-13 19:31:06	156.61 GB	+9.54 MB	Graph
<input type="checkbox"/>	ASP33 capacity <i>vfs.fs.size[33,total]</i>	3600	7	365	Zabbix agent (...	2017-09-13 18:36:41	0 B		Graph
<input type="checkbox"/>	ASP33 free <i>vfs.fs.size[33,free]</i>	300	7	365	Zabbix agent (...	2017-09-13 19:31:15	0 B		Graph
<input type="checkbox"/>	ASP33 free, % <i>vfs.fs.size[33,pfree]</i>	300	7	365	Zabbix agent (...	2017-09-13 19:30:59	100 %		Graph
<input type="checkbox"/>	ASP33 pused, % <i>vfs.fs.size[33,pused]</i>	300	7	365	Zabbix agent (...	2017-09-13 19:31:16	0 %		Graph
<input type="checkbox"/>	ASP33 status <i>vfs.fs.state[33]</i>	300	7	365	Zabbix agent (...	2017-09-13 19:31:23	varyoff (1)		Graph
<input type="checkbox"/>	ASP33 used <i>vfs.fs.size[33,used]</i>	300	7	365	Zabbix agent (...	2017-09-13 19:31:06	0 B		Graph

**Inactive node of cluster**

▼ Disks (72 items)								
	Disk 1: DMP008 (2145 0050, E0-D00001A) status <a href="#">as400.disk.state[E0-D00001A]</a>	300	7	365	Zabbix agent (...	2017-09-13 19:39:35	The disk unit is active (1)	<a href="#">Graph</a>
	Disk 1: DMP008 capacity <a href="#">as400.disk.size[E0-D00001A,total]</a>	3600	7	365	Zabbix agent (...	2017-09-13 19:14:31	71.11 GB	<a href="#">Graph</a>
	Disk 1: DMP008 free space <a href="#">as400.disk.size[E0-D00001A,free]</a>	300	7	365	Zabbix agent (...	2017-09-13 19:39:35	31.84 GB	-2.86 MB <a href="#">Graph</a>
	Disk 1: DMP008 free space, % <a href="#">as400.disk.size[E0-D00001A,pfree]</a>	300	7	365	Zabbix agent (...	2017-09-13 19:39:35	44.77 %	<a href="#">Graph</a>
	Disk 1: DMP008 used space <a href="#">as400.disk.size[E0-D00001A,used]</a>	300	7	365	Zabbix agent (...	2017-09-13 19:39:35	39.27 GB	+2.86 MB <a href="#">Graph</a>
	Disk 1: DMP008 used space, % <a href="#">as400.disk.size[E0-D00001A,pused]</a>	300	7	365	Zabbix agent (...	2017-09-13 19:39:35	55.23 %	<a href="#">Graph</a>
	Disk 2: DMP032 (2145 0050, E0-D00001B) status <a href="#">as400.disk.state[E0-D00001B]</a>	300	7	365	Zabbix agent (...	2017-09-13 19:39:35	The disk unit is active (1)	<a href="#">Graph</a>
	Disk 2: DMP032 capacity <a href="#">as400.disk.size[E0-D00001B,total]</a>	3600	7	365	Zabbix agent (...	2017-09-13 19:14:31	71.11 GB	<a href="#">Graph</a>
	Disk 2: DMP032 free space <a href="#">as400.disk.size[E0-D00001B,free]</a>	300	7	365	Zabbix agent (...	2017-09-13 19:39:35	31.84 GB	-1.91 MB <a href="#">Graph</a>
	Disk 2: DMP032 free space, % <a href="#">as400.disk.size[E0-D00001B,pfree]</a>	300	7	365	Zabbix agent (...	2017-09-13 19:39:35	44.77 %	<a href="#">Graph</a>
	Disk 2: DMP032 used space <a href="#">as400.disk.size[E0-D00001B,used]</a>	300	7	365	Zabbix agent (...	2017-09-13 19:39:35	39.27 GB	+1.91 MB <a href="#">Graph</a>
	Disk 2: DMP032 used space, % <a href="#">as400.disk.size[E0-D00001B,pused]</a>	300	7	365	Zabbix agent (...	2017-09-13 19:39:35	55.23 %	<a href="#">Graph</a>
	Disk 3: DMP037 (2145 0050, E0-D00001C) status <a href="#">as400.disk.state[E0-D00001C]</a>	300	7	365	Zabbix agent (...	2017-09-13 19:39:35	The disk unit is active (1)	<a href="#">Graph</a>

# Example of failed disks

Disks (12 Items)								
<input type="checkbox"/>	Disk 1: DD001 (433C 0050, 03-QN4A3H8) status <code>as400.disk.state[03-QN4A3H8]</code>	300	7	365	Zabbix agent (...	2017-09-13 19:35:54	<u>Hardware failure (affects p...</u>	<a href="#">Graph</a>
<input type="checkbox"/>	Disk 1: DD001 capacity <code>as400.disk.size[03-QN4A3H8,total]</code>	3600	7	365	Zabbix agent (...	2017-09-13 19:36:59	130.01 GB	<a href="#">Graph</a>
<input type="checkbox"/>	Disk 1: DD001 free space <code>as400.disk.size[03-QN4A3H8,free]</code>	300	7	365	Zabbix agent (...	2017-09-13 19:35:54	77.81 GB	<a href="#">Graph</a>
<input type="checkbox"/>	Disk 1: DD001 free space, % <code>as400.disk.size[03-QN4A3H8,pfree]</code>	300	7	365	Zabbix agent (...	2017-09-13 19:35:54	59.85 %	<a href="#">Graph</a>
<input type="checkbox"/>	Disk 1: DD001 used space <code>as400.disk.size[03-QN4A3H8,used]</code>	300	7	365	Zabbix agent (...	2017-09-13 19:35:54	52.2 GB	<a href="#">Graph</a>
<input type="checkbox"/>	Disk 1: DD001 used space, % <code>as400.disk.size[03-QN4A3H8,pused]</code>	300	7	365	Zabbix agent (...	2017-09-13 19:35:54	40.15 %	<a href="#">Graph</a>
<input type="checkbox"/>	Disk 1: DD002 (433C 0050, 03-QN441JV) status <code>as400.disk.state[03-QN441JV]</code>	300	7	365	Zabbix agent (...	2017-09-13 19:35:54	Hardware failure (affects p...	<a href="#">Graph</a>
<input type="checkbox"/>	Disk 1: DD002 capacity <code>as400.disk.size[03-QN441JV,total]</code>	3600	7	365	Zabbix agent (...	2017-09-13 19:36:59	130.01 GB	<a href="#">Graph</a>
<input type="checkbox"/>	Disk 1: DD002 free space <code>as400.disk.size[03-QN441JV,free]</code>	300	7	365	Zabbix agent (...	2017-09-13 19:35:54	77.81 GB	<a href="#">Graph</a>
<input type="checkbox"/>	Disk 1: DD002 free space, % <code>as400.disk.size[03-QN441JV,pfree]</code>	300	7	365	Zabbix agent (...	2017-09-13 19:35:54	59.85 %	<a href="#">Graph</a>
<input type="checkbox"/>	Disk 1: DD002 used space <code>as400.disk.size[03-QN441JV,used]</code>	300	7	365	Zabbix agent (...	2017-09-13 19:35:54	52.2 GB	<a href="#">Graph</a>
<input type="checkbox"/>	Disk 1: DD002 used space, % <code>as400.disk.size[03-QN441JV,pused]</code>	300	7	365	Zabbix agent (...	2017-09-13 19:35:54	40.15 %	<a href="#">Graph</a>

▼ Message Queue (5 Items)							
<input type="checkbox"/>	Messages in the queue QSYSOPR(clone for debugging) <a href="#">eventlog[QSYSOPR,,,,,100,,]</a>	20	7		Zabbix agent (...	2017-09-13 19:24:13	ZABBIX Job message que... <a href="#">History</a>
<input type="checkbox"/>	Messages in the queue QSYSOPR (errors) <a href="#">eventlog[QSYSOPR,,70,,,100,skip]</a>	20	7		Zabbix agent (...	2017-09-13 17:43:29	QSYS Damaged object fou... <a href="#">History</a>
<input type="checkbox"/>	Messages in the queue QSYSOPR (errors) <a href="#">eventlog[QSYSOPR,@test_as400,40,,,100,skip]</a>	20	7		Zabbix agent (...	2017-09-13 19:24:13	ZABBIX Job message que... <a href="#">History</a>
<input type="checkbox"/>	Messages in the queue QSYSOPR (errors) with filter by user without ... <a href="#">eventlog[QSYSOPR,,40,,,100,,zabbix QsYs]</a>	20	7		Zabbix agent (...	2017-09-13 19:24:13	ZABBIX Job message que... <a href="#">History</a>
<input type="checkbox"/>	Messages in the queue QSYSOPR (errors) without filter by user and ... <a href="#">eventlog[QSYSOPR,,40,,,100,,]</a>	20	7		Zabbix agent (...	2017-09-13 19:24:13	ZABBIX Job message que... <a href="#">History</a>
▼ Output Queue (7 Items)							
<input type="checkbox"/>	Size of output queue QEZDEBUG in library QUSRSYS <a href="#">as400.outputqueue.size[QEZDEBUG,QUSRSYS]</a>	900	7	365	Zabbix agent (...	2017-09-13 19:44:32	45 <a href="#">Graph</a>
<input type="checkbox"/>	Size of output queue QEZJOBLOG in library QUSRSYS <a href="#">as400.outputqueue.size[QEZJOBLOG,QUSRSYS]</a>	900	7	365	Zabbix agent (...	2017-09-13 19:44:32	147 <a href="#">Graph</a>
<input type="checkbox"/>	Size of output queue QPRINT2 in library QGPL <a href="#">as400.outputqueue.size[QPRINT2,QGPL]</a>	900	7	365	Zabbix agent (...	2017-09-13 19:44:29	0 <a href="#">Graph</a>
<input type="checkbox"/>	Size of output queue QPRINTBNK in library QGPL <a href="#">as400.outputqueue.size[QPRINTBNK,QGPL]</a>	900	7	365	Zabbix agent (...	2017-09-13 19:44:32	10349 <a href="#">Graph</a>
<input type="checkbox"/>	Size of output queue QPRINT in library QGPL <a href="#">as400.outputqueue.size[QPRINT,QGPL]</a>	900	7	365	Zabbix agent (...	2017-09-13 19:44:29	286 <a href="#">Graph</a>
<input type="checkbox"/>	Size of output queue QPRINTPL5 in library QGPL <a href="#">as400.outputqueue.size[QPRINTPL5,QGPL]</a>	900	7	365	Zabbix agent (...		<a href="#">Graph</a>
<input type="checkbox"/>	Size of output queue QPRINTS in library QGPL <a href="#">as400.outputqueue.size[QPRINTS,QGPL]</a>	900	7	365	Zabbix agent (...	2017-09-13 19:44:29	<a href="#">Graph</a>
▶ Zabbix agent (3 Items)							

com.ibm.as400.access.AS400Exception: CPF9801 Object QPRINTPL5 in library QGPL not found.

CPU Usage by process (18 Items)									
<input type="checkbox"/>	CPU Usage by process 000000/QSYS/SCPF <a href="#">proc.cpu.util[SCPF,QSYS,total,,avg1,000000]</a>	60	7	365	Zabbix agent (...	2017-09-13 19:46:41	0 %		<a href="#">Graph</a>
<input type="checkbox"/>	CPU Usage by process 396271/QSYS/QPFRADJ <a href="#">proc.cpu.util[QPFRADJ,QSYS,total,,avg1,396271]</a>	60	7	365	Zabbix agent (...	2017-09-13 19:46:41	0 %		<a href="#">Graph</a>
<input type="checkbox"/>	CPU Usage by process 396287/QSYS/QDBSRVXR2 <a href="#">proc.cpu.util[QDBSRVXR2,QSYS,total,,avg1,396287]</a>	60	7	365	Zabbix agent (...	2017-09-13 19:46:41	0 %		<a href="#">Graph</a>
<input type="checkbox"/>	CPU Usage by process 396289/QSYS/QDBFSTCCOL <a href="#">proc.cpu.util[QDBFSTCCOL,QSYS,total,,avg1,396289]</a>	60	7	365	Zabbix agent (...	2017-09-13 19:46:41	0 %		<a href="#">Graph</a>
<input type="checkbox"/>	CPU Usage by process 396478/QSYS/QUSRWRK <a href="#">proc.cpu.util[QUSRWRK,QSYS,total,,avg1,396478]</a>	60	7	365	Zabbix agent (...	2017-09-13 19:46:41	0 %		<a href="#">Graph</a>
<input type="checkbox"/>	CPU Usage by process 396498/QUSER/QNPSEVS <a href="#">proc.cpu.util[QNPSEVS,QUSER,total,,avg1,396498]</a>	60	7	365	Zabbix agent (...	2017-09-13 19:46:41	0 %	-0.02 %	<a href="#">Graph</a>
<input type="checkbox"/>	CPU Usage by process 396524/QSYS/QYPSPFRCOL <a href="#">proc.cpu.util[QYPSPFRCOL,QSYS,total,,avg1,396524]</a>	60	7	365	Zabbix agent (...	2017-09-13 19:46:41	0 %	-0.01 %	<a href="#">Graph</a>
<input type="checkbox"/>	CPU Usage by process 396564/QSECOFR/QUMECIMOM <a href="#">proc.cpu.util[QUMECIMOM,QSECOFR,total,,avg1,396564]</a>	60	7	365	Zabbix agent (...	2017-09-13 19:46:41	0 %		<a href="#">Graph</a>
<input type="checkbox"/>	CPU Usage by process 396566/QDIRSRV/QUSRDIR <a href="#">proc.cpu.util[QUSRDIR,QDIRSRV,total,,avg1,396566]</a>	60	7	365	Zabbix agent (...	2017-09-13 19:46:41	0 %		<a href="#">Graph</a>
<input type="checkbox"/>	CPU Usage by process 396586/QSYS/QRMCCTRMCD <a href="#">proc.cpu.util[QRMCCTRMCD,QSYS,total,,avg1,396586]</a>	60	7	365	Zabbix agent (...	2017-09-13 19:46:41	0 %		<a href="#">Graph</a>
<input type="checkbox"/>	CPU Usage by process 396598/QSYS/QSLPSVR <a href="#">proc.cpu.util[QSLPSVR,QSYS,total,,avg1,396598]</a>	60	7	365	Zabbix agent (...	2017-09-13 19:46:41	0.02 %	+0.01 %	<a href="#">Graph</a>
<input type="checkbox"/>	CPU Usage by process 396684/QUSER/QZRCRSVS <a href="#">proc.cpu.util[QZRCRSVS,QUSER,total,,avg1,396684]</a>	60	7	365	Zabbix agent (...	2017-09-13 19:46:41	0.04 %	-0.01 %	<a href="#">Graph</a>
<input type="checkbox"/>	CPU Usage by process 396694/ZABBIX/ZBXAGT <a href="#">proc.cpu.util[ZBXAGT,ZABBIX,total,,avg1,396694]</a>	60	7	365	Zabbix agent (...	2017-09-13 19:46:41	0.11 %	+0.05 %	<a href="#">Graph</a>
<input type="checkbox"/>	CPU Usage by process 396697/QUSER/QZRCRSVS <a href="#">proc.cpu.util[QZRCRSVS,QUSER,total,,avg1,396697]</a>	60	7	365	Zabbix agent (...	2017-09-13 19:46:41	0 %		<a href="#">Graph</a>
<input type="checkbox"/>	CPU Usage by process 406065/QYPSJSVR/QYPSJSVR <a href="#">proc.cpu.util[QYPSJSVR,QYPSJSVR,total,,avg1,406065]</a>	60	7	365	Zabbix agent (...	2017-09-13 19:46:41	0 %	-0.02 %	<a href="#">Graph</a>

# Example normal log for default DebugLevel=3

```
10:20170913:191428.847 Starting Zabbix Agent v0.7.3
10:20170913:191428.851 using configuration file: zabbix_agentd.conf
10:20170913:191428.852 Oracle Corporation Java version "1.8.0_20"
10:20170913:191428.852 Java(TM) SE Runtime Environment (build 1.8.0_20-b26)
10:20170913:191428.852 Java HotSpot(TM) 64-Bit Server VM (build 25.20-b23, mixed mode)
10:20170913:191428.853 Open Source Software, JTOpen 9.1, codebase 5770-SS1 V7R3M0.00 built=20160705 @RF
10:20170913:191429.012 Agent hostname: 'as400-test', System info: IBM OS/400 AS400 V7R1M0, Oracle Corporation Java HotSpot(TM) 64-Bit Server VM (v1.8.0_20)
14:20170913:191429.033 agent #1 started [collector]
16:20170913:191429.037 agent #3 started [listener #1]
17:20170913:191429.038 agent #4 started [listener #2]
15:20170913:191429.038 agent #2 (zabbix.rietumu.lv) started [active checks #3]
15:20170913:191430.580 As400Metric.process() error: com.ibm.as400.access.AS400Exception: CPF9801 Object QPRINTPL5 in library QGPL not found.
15:20170913:192530.816 active check "as400.subsystem[qtrmeqp15,qgp1]" is not supported: There is no subsystem with name='qtrmeqp15' in library 'qgp1'
15:20170913:192931.555 As400Metric.process() error: com.ibm.as400.access.AS400Exception: CPF9801 Object QPRINTPL5 in library QGPL not found.
15:20170913:192931.556 active check "as400.outputqueue.size[QPRINTPL5,QGPL]" is not supported: com.ibm.as400.access.AS400Exception: CPF9801 Object QPRINTPL5 in library QGPL not found.
15:20170913:194035.283 As400Metric.process() error: com.ibm.as400.access.AS400Exception: CPF9801 Object QPRINTPL5 in library QGPL not found.
15:20170913:194135.188 active check "as400.subsystem[qtrmeqp15,qgp1]" is not supported: There is no subsystem with name='qtrmeqp15' in library 'qgp1'
17:20170913:195009.239 agent #4 stopped [listener #2]
15:20170913:195010.023 agent #2 (zabbix.rietumu.lv) stopped [active checks #3]
16:20170913:195011.227 agent #3 stopped [listener #1]
14:20170913:195011.230 agent #1 stopped [collector]
1:20170913:195011.231 Zabbix Agent stopped. v0.7.3
```

# TROUBLES

- ▶ messages with “Reply” type in message queue: impossibility to position on these messages causes to infinite loop
- ▶ short-term connections are very noisy (number of background jobs, spam to spool-files)
- ▶ auto-reconnection mechanism

# TROUBLES

*(continued)*

- ▶ API strangeness sometimes requires an additional checks:
  - null references
  - zero-time CPU usage
  - `JobList.load()` vs just `JobList.getJobs()`
- ▶ Careful initialization (order, checks, default values, config-file parsing, logging)

# COMMUNITY AND TECHNICAL SUPPORT

- ▶ License: BSD-like, open source. You can do what you want respecting my copyrights.
- ▶ Distribution: an archive containing both binary, sources, config file example and documentation could be downloaded from <https://share.zabbix.com/operating-systems/ibm-i-i5-os-os-400-for-ibm-system-i-as-400/zabbix-agent-emulator-for-as-400-platform>

# COMMUNITY AND TECHNICAL SUPPORT

*(continued)*

- ▶ Example of template could be downloaded from the same site:  
<https://share.zabbix.com/operating-systems/ibm-i-i5-os-os-400-for-ibm-system-i-as-400/template-example-for-as-400-agent-emulator>
- ▶ Discussion on the Zabbix forum:  
<https://www.zabbix.com/forum/showthread.php?t=47525>
- ▶ Thanks to Zabbix support team!

THANKS!  
QUESTIONS?