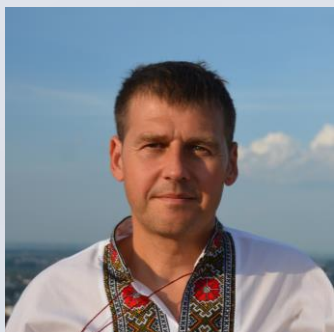


ZABBIX

SUMMIT  
2024

# Zabbix outside IT ecosystem

Environment and industrial  
monitoring using hardware  
solution by BV Grupa



Marcin Gosiewski



**ZABBIX**

SUMMIT  
2024

*With help of a little bit of  
custom hardware, or innovative  
thinking*

*Zabbix can be used in situations  
far beyond typical IT  
infrastructure monitoring.*

---

**Marcin Gosiewski**

[www.bvssystemy.pl](http://www.bvssystemy.pl)

# Innovative Zabbix based projects

Server room environment (HAVAC, Energy, access)

Environment and industrial monitoring

- ▶ Temperature, pressure, humidity, level of gases in atmosphere, level of liquids in tanks, etc.

IOT monitoring

- ▶ Alarm, HVAC, building automation systems, etc.

Energetic system monitoring

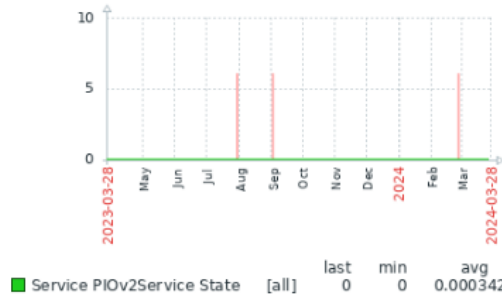
- ▶ Energy counters, Energy flow (several parameters), SLA, redundancy, availability, state of infrastructure (generators, batteries, compensators, transformers)

Human workflow monitoring

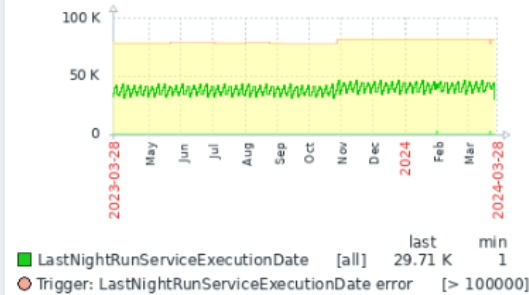
- ▶ How many cases on which stage / in which status
- ▶ Productivity of factory workers

# Monitoring of document flow in insurance company

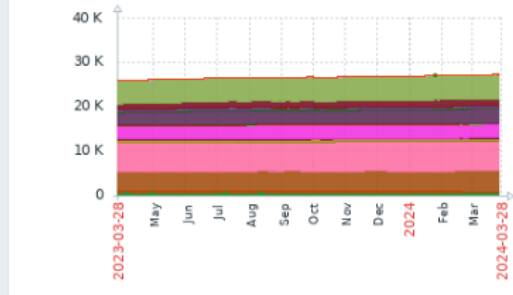
Tarchomin Serwer Wsrv2019 hosting2.bvgrupa.pl: ...



PIO Odszkodowania PRODUKCJA: LastNightRunS...



PIO Odszkodowania PRODUKCJA: Sprawy (z podzi...



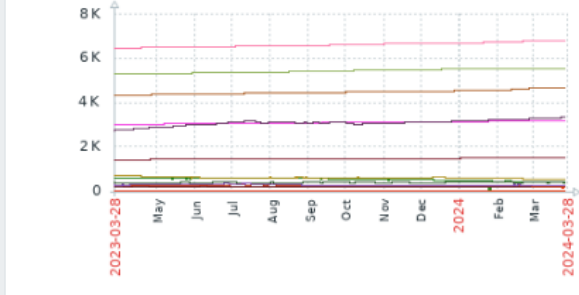
PIO Odszkodowania PRODUKCJA: Podział spraw według statusu



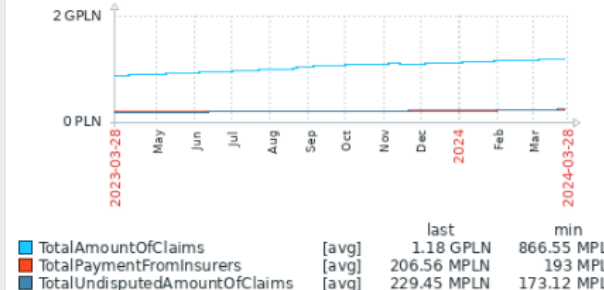
- Sprawy w stanie.1.W kompletacji [avg]
- Sprawy w stanie.2.Zgłoszona do podmiotu zobowiązanego [avg]
- Sprawy w stanie.3.NIEUZYWANY [no data]
- Sprawy w stanie.4.Ugoda lub wyrok [avg]
- Sprawy w stanie.5.Odrzucona [avg]
- Sprawy w stanie.6.Archiwum [avg]
- Sprawy w stanie.7.Zatwierdzona [avg]
- Sprawy w stanie.8.Zgłoszona przez klienta [avg]
- Sprawy w stanie.9.Zakończona [avg]
- Sprawy w stanie.10.W analizie [avg]
- Sprawy w stanie.11.Przygotowanie pozwu [avg]
- Sprawy w stanie.12.Oczekiwanie na rozprawę [avg]
- Sprawy w stanie.13.Przygotowanie wniosku o uzasadnienie [no data]
- Sprawy w stanie.14.Oczekiwanie na uzasadnienie [no data]
- Sprawy w stanie.15.Przygotowanie apelacji [no data]
- Sprawy w stanie.16.Zgłoszona do innego podmiotu [avg]
- Sprawy w stanie.17.Analiza decyzji ZU [avg]
- Sprawy w stanie.18.Pozew wycofany [avg]
- Sprawy w stanie.19.Zakończona wypłatą [avg]
- Sprawy w stanie.20.Ugoda [avg]
- Sprawy w stanie.21.Zgłoszona do banku [avg]
- Sprawy w stanie.22.Decyzja banku [avg]
- Sprawy w stanie.23.Analiza decyzji banku [avg]
- Sprawy w stanie.24.Do wyceny [no data]
- Sprawy w stanie.25.Wyceniana [no data]
- Sprawy w stanie.26.Wyceniona [no data]
- Sprawy w stanie.27.Do przygotowania umowy cesji [no data]
- Sprawy w stanie.28.Wysłana do agenta [no data]
- Sprawy w stanie.29.Umowa podpisana przez agenta [no data]

- Value: 515.4979 (1.95%)
- Value: 178.7766 (0.68%)
- Value: no data
- Value: 4463.8635 (16.88%)
- Value: 6609.7762 (24.99%)
- Value: 1 (0%)
- Value: 594.1939 (2.25%)
- Value: 156.4154 (0.59%)
- Value: 3080.3189 (11.65%)
- Value: 21.4671 (0.08%)
- Value: 235.3801 (0.89%)
- Value: 3075.8658 (11.63%)
- Value: no data
- Value: no data
- Value: no data
- Value: 372.899 (1.41%)
- Value: 260.8465 (0.99%)
- Value: 1.2417 (0%)
- Value: 1449.4889 (5.48%)
- Value: 5421.1815 (20.50%)
- Value: 4.5529 (0.02%)
- Value: 1 (0%)
- Value: 1 (0%)
- Value: no data
- Value: no data
- Value: no data
- Value: no data
- Value: no data
- Value: no data

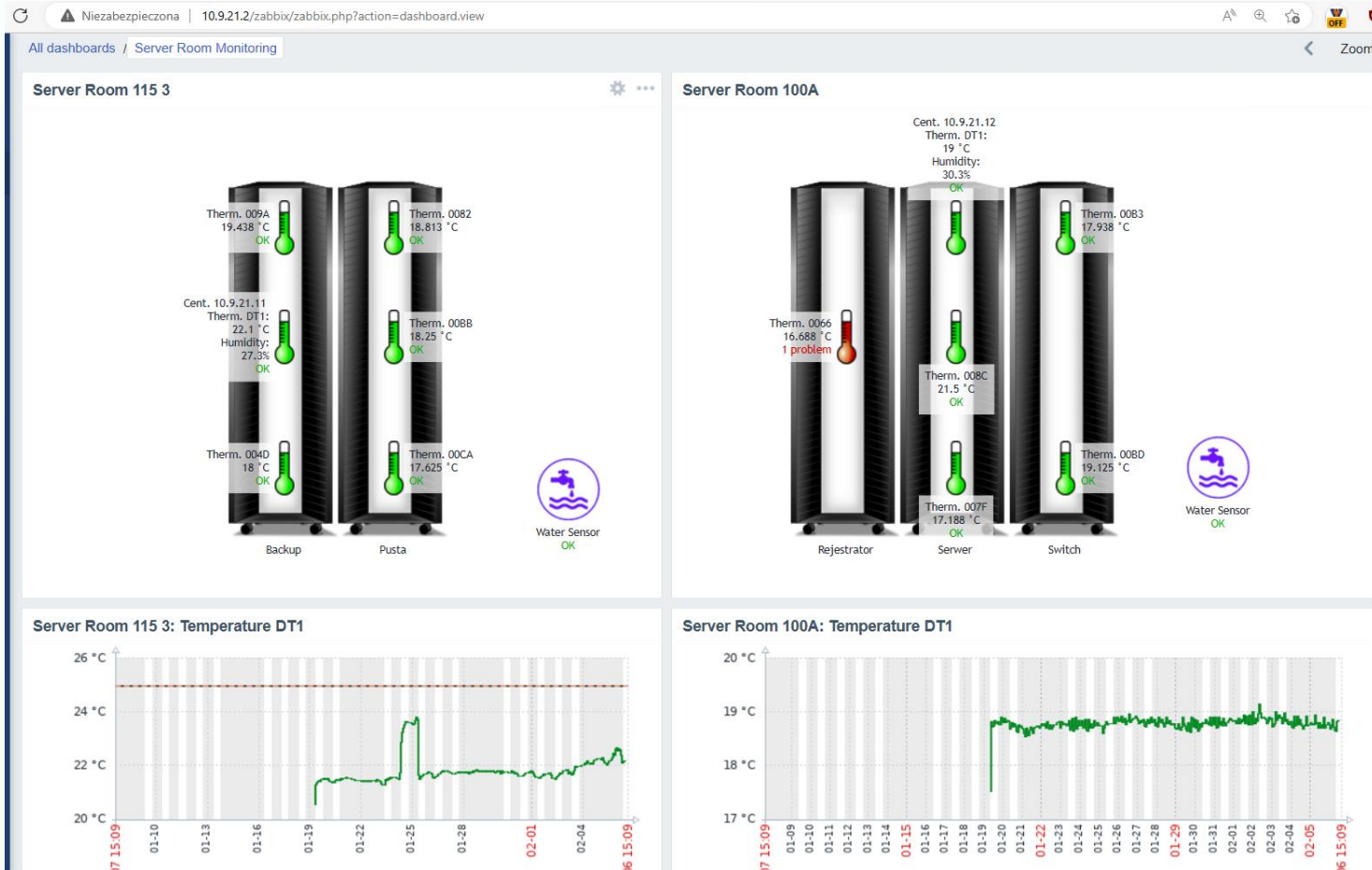
PIO Odszkodowania PRODUKCJA: Sprawy w poszczególn...



PIO Odszkodowania PRODUKCJA: Total Amount Of Claims...



# Server room monitoring



Temp

Humidity

Energy

Leak detection

Fire supression

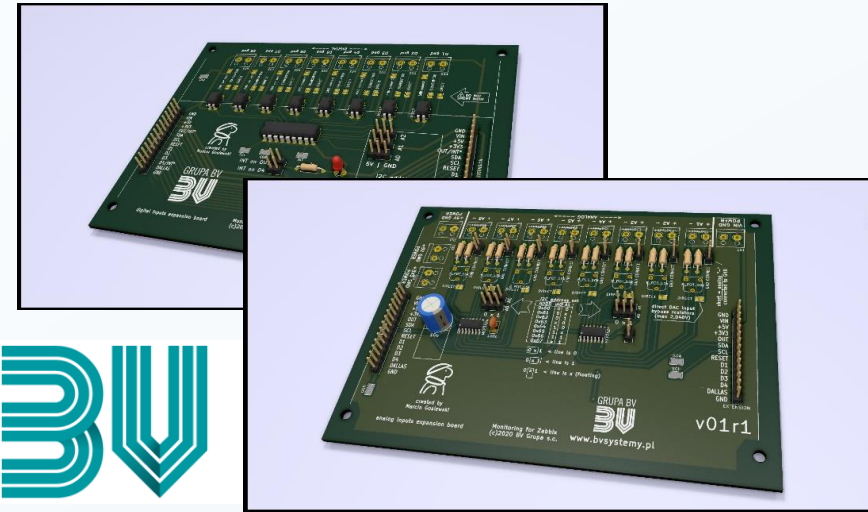
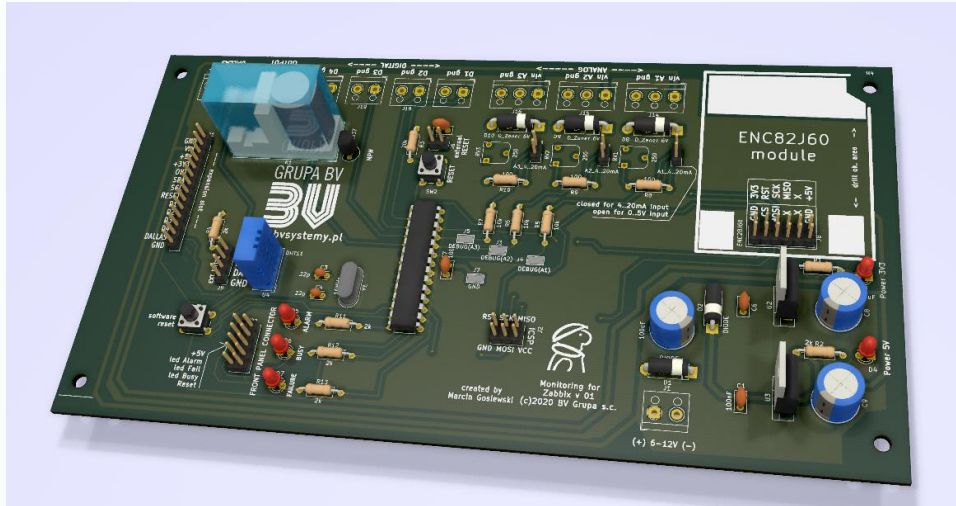
AC real state

UPS real state

People presence

Case opened

# Hardware system for external sensors



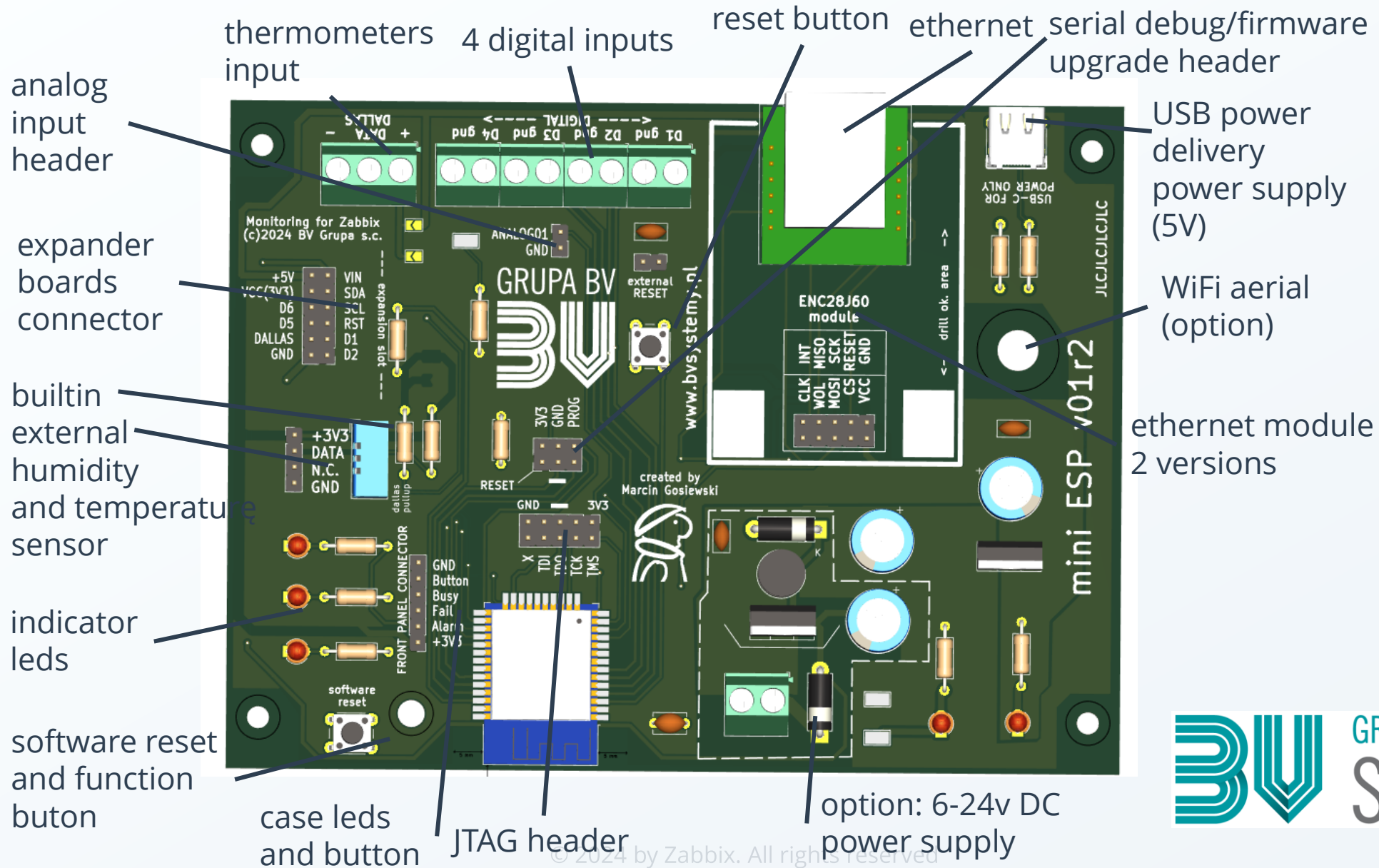
Manufactured and designed in EU by BV Grupa

Adding full non-IT environment monitoring capabilities to Zabbix

Allowing to connect: sensors, machines, digital inputs, outputs etc. to Zabbix

Designed for Zabbix (out of the box compatible)

# Example board



# Connected sensors autodiscovery

- Thermometers
- Humidity sensors
- Digital inputs
- Analog inputs
- Digital outputs
- Custom:
  - Pressure, liquid level, etc.

## Discovery rules

Discovery rule updated

All templates / IOT BVMonitoring Environment Mo... Items 12 Triggers 6 Graphs 2 Dashboards 1 Discovery rules 6 Web scena

Host groups   Type

Templates   Update interval

Name

Key

Keep lost resources period

<input type="checkbox"/>	Template	Name ▲	Items	Triggers	Graphs
<input type="checkbox"/>	IOT BVMonitoring Environment Monitoring BV Grupa	Discover analog	Item prototypes 1	Trigger prototypes	Graph prototypes 1
<input type="checkbox"/>	IOT BVMonitoring Environment Monitoring BV Grupa	Discover digital	Item prototypes 1	Trigger prototypes 1	Graph prototypes
<input type="checkbox"/>	IOT BVMonitoring Environment Monitoring BV Grupa	Discover humidity sensors	Item prototypes 1	Trigger prototypes	Graph prototypes 1
<input type="checkbox"/>	IOT BVMonitoring Environment Monitoring BV Grupa	Discover humidity sensors v2	Item prototypes	Trigger prototypes	Graph prototypes
<input type="checkbox"/>	IOT BVMonitoring Environment Monitoring BV Grupa	Discover output	Item prototypes 1	Trigger prototypes 1	Graph prototypes
<input type="checkbox"/>	IOT BVMonitoring Environment Monitoring BV Grupa	Discover thermometers	Item prototypes 1	Trigger prototypes	Graph prototypes 1



# Configuration for Zabbix (device side)

- 1. Configure device and test connected sensors

The screenshot displays the Zabbix BV Monitoring for Zabbix interface. The top navigation bar includes tabs for SENSORS, SETTINGS, SENSORS SETUP, DEBUG INFO, MAINTENANCE, CLEAR ERRORS, and HELP. The main content area is divided into several sections:

- System Information:** App Version: 1.1, Hardware Version: NODEMCU, Free Memory (kB): 261, Free Stack (bytes): 4996, Mac address: 78:21:84:80:41:10, Uptime: 0d 12h 50m 33s.
- Current state:** NO\_ERRORS, Error history: NO\_ERRORS.
- Sensor Configuration:** Host name: BVMonitoring, Mac address: custom 78:21:84:80:41:10, IP: 10.0.22.1, Gateway: 10.0.0.1, Subnet mask: 255.255.0.0, Primary DNS: 10.0.0.31, Secondary DNS: 8.8.4.4.
- Sensor Values:** A table showing the status of sensors for dht11 and dallas.

A blue arrow points to the 'dht11' sensor configuration section. The 'dht11' sensor values table is as follows:

Sensor values					
dht11					
name	address	value	status	error %	
dht_temp	DHT0	nan	Alert	1	
dht_humidity	DHT1	nan	Alert	1	

The 'dallas' sensor values table is as follows:

dallas					
name	address	value	status	error %	
Serwerownia1	286006C210220B45	-127.00	Missing	1	
Serwerownia2	28388FD60B00003F	22.19	OK	0	
Serwerownia3	280AC99A21230B71	-127.00	Missing	1	
28FA548310220B42	28FA548310220B42	-127.00	Missing	1	
T28EE60292E1601AE	28EE60292E1601AE	22.13	OK	0	
T28EEFA4B2E160133	28EEFA4B2E160133	21.94	OK	0	
T28EED65D2E1601DB	28EED65D2E1601DB	22.19	OK	0	

# Configuration for Zabbix

- 2. Assign meaningful names for sensors (will be used in Zabbix items)

SENSORS	SETTINGS	SENSORS SETUP	DEBUG INFO	MAINTENANCE	CLEAR ERRORS	HELP	SHOW STATUS
dallas							
Enabled	Name	Address	Detected	Status			
<input checked="" type="checkbox"/>	<input type="text" value="Serwerownia1"/>	286006C210220B45	<span style="color: green;">●</span>	OK			
<input checked="" type="checkbox"/>	<input type="text" value="Serwerownia2"/>	28388FD60B00003F	<span style="color: green;">●</span>	OK			
<input checked="" type="checkbox"/>	<input type="text" value="Serwerownia3"/>	280AC99A21230B71	<span style="color: green;">●</span>	OK			
<input checked="" type="checkbox"/>	<input type="text" value="28FA548310220B42"/>	28FA548310220B42	<span style="color: green;">●</span>	OK			
<input checked="" type="checkbox"/>	<input type="text" value="T28EE60292E1601AE"/>	28EE60292E1601AE	<span style="color: green;">●</span>	OK			
<input checked="" type="checkbox"/>	<input type="text" value="T28EEFA4B2E160133"/>	28EEFA4B2E160133	<span style="color: green;">●</span>	OK			
<input checked="" type="checkbox"/>	<input type="text" value="T28EEFA4B2E160133"/>	28EEFA4B2E160133	<span style="color: green;">●</span>	OK			

# Zabbix side: Step 1 - template

- Download and install template:

## IOT BVMonitoring Environment Monitoring BV Grupa

The screenshot displays the Zabbix 'Templates' management interface. At the top right, there are 'Create template' and 'Import' buttons. Below these are search fields for 'Host groups' and 'Linked templates', and a 'Name' field containing 'environment'. To the right, there are 'Tags' options: 'And/Or' and 'Or', and a tag configuration section with 'tag', 'Contains', and 'value' fields, along with 'Add' and 'Remove' buttons. Below the search fields are 'Apply' and 'Reset' buttons. The main content area shows a table of templates. The first row is selected and shows the template 'IOT BVMonitoring Environment Monitoring BV Grupa' with details: Hosts 5, Items 12, Triggers 6, Graphs 2, Dashboards 1, Discovery 6, and Web. The tags 'class: IOT', 'IOT', and 'target: BVMonitoring' are visible. The bottom right corner indicates 'Displaying 1 of 1 found'.

# Zabbix side: 2) Adding Host

Hosts

All hosts / Ogródowa BV New Environment M... Enabled ZBX Items 70 Triggers 30 Graphs 25 Discovery rules 6 Web scenarios

Host Templates 2 IPMI Tags 4 Macros 1 Inventory Encryption Value mapping

\* Host name

Visible name

\* Groups    
type here to search

Interfaces	Type	IP address	DNS name	Connect to	Port
Agent		<input type="text" value="10.0.22.1"/>	<input type="text"/>	<input checked="" type="radio"/> IP <input type="radio"/> DNS	<input type="text" value="10050"/>

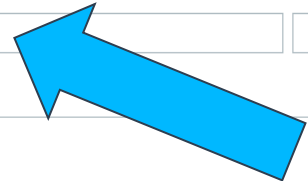
[Add](#)

Description

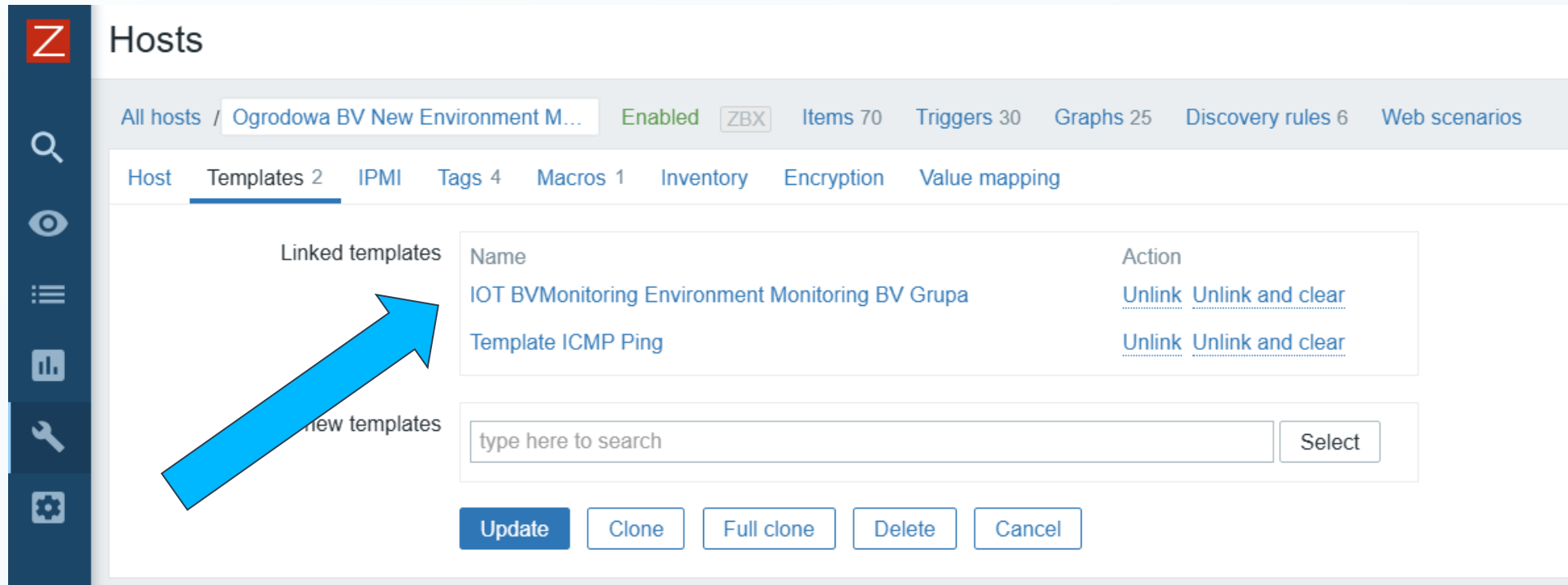
Monitored by proxy

Enabled

port not used



# Zabbix side step 3) link template



The screenshot shows the Zabbix web interface for a host. The breadcrumb path is "All hosts / Ogradowa BV New Environment M...". The host status is "Enabled" with a "ZBX" tag. Statistics show 70 items, 30 triggers, 25 graphs, 6 discovery rules, and 0 web scenarios. The "Templates" tab is active, showing 2 linked templates and 4 tags. A table lists the linked templates with their names and actions. Below the table is a search box for new templates and a "Select" button. At the bottom are buttons for "Update", "Clone", "Full clone", "Delete", and "Cancel". A blue arrow points from the "new templates" search box to the "Linked templates" table.

Hosts

All hosts / Ogradowa BV New Environment M... Enabled ZBX Items 70 Triggers 30 Graphs 25 Discovery rules 6 Web scenarios

Host Templates 2 IPMI Tags 4 Macros 1 Inventory Encryption Value mapping

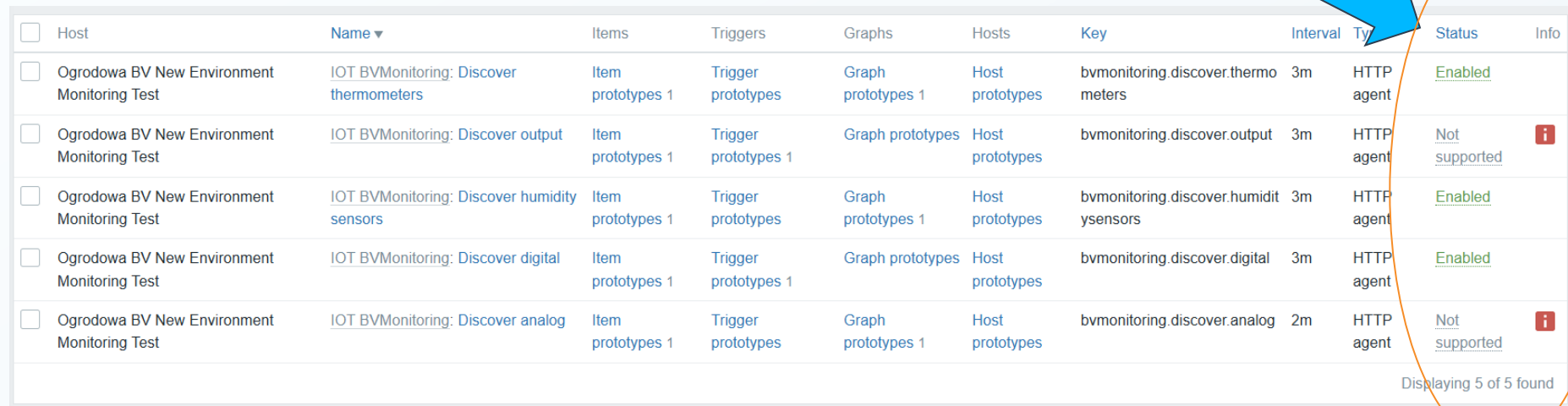
Linked templates	Name	Action
	IOT BVMonitoring Environment Monitoring BV Grupa	<a href="#">Unlink</a> <a href="#">Unlink and clear</a>
	Template ICMP Ping	<a href="#">Unlink</a> <a href="#">Unlink and clear</a>

new templates



type here to search

# Step 4) wait for autodiscovery

Wait for autodiscovery. Note: Some sensor types can be unsupported if they are not connected



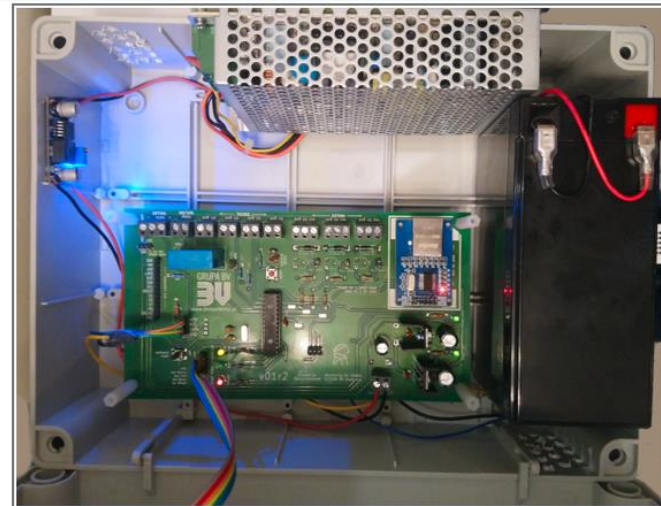
The screenshot shows a table of monitoring items in Zabbix. A blue arrow points to the 'Status' column, and an orange circle highlights the 'Status' and 'Info' columns for the 'Not supported' items.

<input type="checkbox"/>	Host	Name ▼	Items	Triggers	Graphs	Hosts	Key	Interval	Type	Status	Info
<input type="checkbox"/>	Ogrodowa BV New Environment Monitoring Test	<a href="#">IOT BVMonitoring: Discover thermometers</a>	Item prototypes 1	Trigger prototypes	Graph prototypes 1	Host prototypes	bvmonitoring.discover.thermometers	3m	HTTP agent	<a href="#">Enabled</a>	
<input type="checkbox"/>	Ogrodowa BV New Environment Monitoring Test	<a href="#">IOT BVMonitoring: Discover output</a>	Item prototypes 1	Trigger prototypes 1	Graph prototypes	Host prototypes	bvmonitoring.discover.output	3m	HTTP agent	<a href="#">Not supported</a>	
<input type="checkbox"/>	Ogrodowa BV New Environment Monitoring Test	<a href="#">IOT BVMonitoring: Discover humidity sensors</a>	Item prototypes 1	Trigger prototypes	Graph prototypes 1	Host prototypes	bvmonitoring.discover.humiditysensors	3m	HTTP agent	<a href="#">Enabled</a>	
<input type="checkbox"/>	Ogrodowa BV New Environment Monitoring Test	<a href="#">IOT BVMonitoring: Discover digital</a>	Item prototypes 1	Trigger prototypes 1	Graph prototypes	Host prototypes	bvmonitoring.discover.digital	3m	HTTP agent	<a href="#">Enabled</a>	
<input type="checkbox"/>	Ogrodowa BV New Environment Monitoring Test	<a href="#">IOT BVMonitoring: Discover analog</a>	Item prototypes 1	Trigger prototypes	Graph prototypes 1	Host prototypes	bvmonitoring.discover.analog	2m	HTTP agent	<a href="#">Not supported</a>	

Displaying 5 of 5 found

# Why choose this solution?

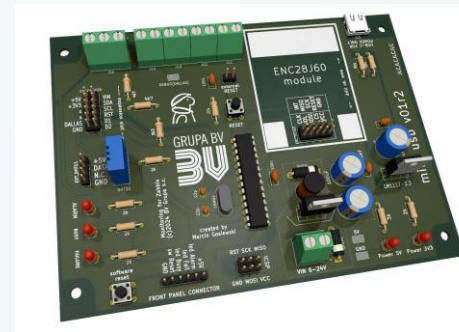
- Solution with Zabbix in mind from the design stage
- Mainboard with digital/analog/thermometers inputs and outputs onboard. Lan connectivity.
- Expansion boards (digital and analog)
- Easily serviceable (schematics and application binaries available for external repair personnel)
- Customizable (we can add customer specific functionalities)
- Self documenting! No documentation needed



# Hardware ecosystem: versions

## Mainboard versions:

- ▶ Large with builtin connectors: analog voltage, analog 4-20mA, digital, I2C, onewire, DHT-11, e
  - externally powered
  - expandible via expansion boards
- ▶ Small (only DHT-11 + onewire)
  - expandible via expansion boards
  - USB-C powered version
  - POE version
  - External power supply version (battery capable)

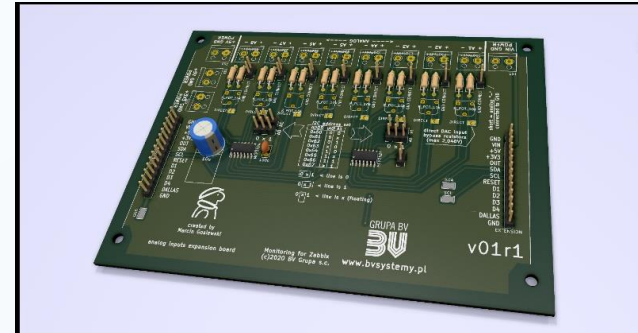




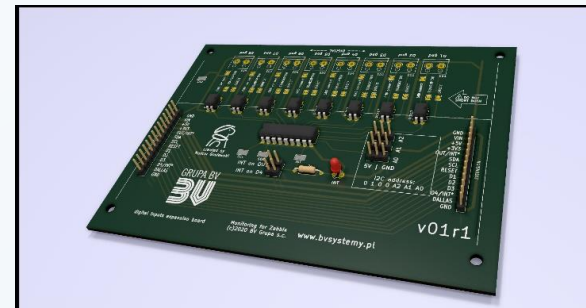
# Hardware versions: expansion boards

## Expansion boards

- ▶ 8 Analog ports expansion board



- ▶ 8 protected digital i/o ports
- ▶ 16 unprotected digital i/o ports



Several expansion boards can be connected to single mainboard

# Self documenting feature

SENSOR T4F44D0C5E6D7

PLC DEVICE  
RS485 port 2 SLAVE 8  
PORT 3821 BIG ENDIAN FLOAT32 (2x16bit)

MOXA RS486 – IP GATEWAY:  
IP 192.168.17.200 PORT: 4001  
PROTOCOL: RTU-OVER-TCP

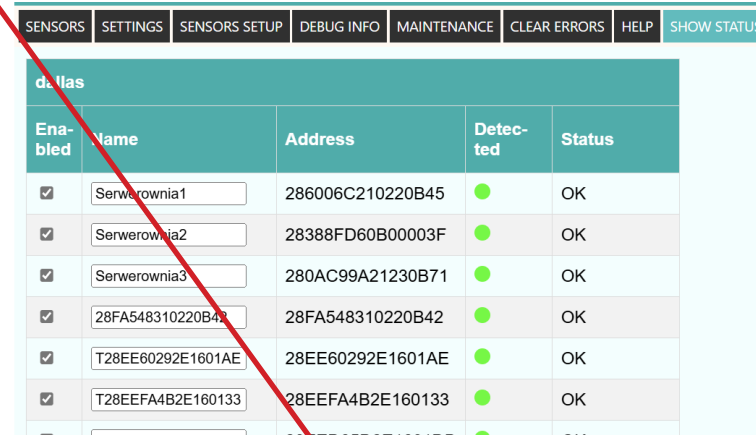
DRIVER  
192.168.17.200 > /dev/ttyS01

ZABBIX  
Modbus\_get(/dev/ttyS01, 8, 3, 3821,  
1,float32,be,0)

NAME: serverroom3\_row2\_case3

SENSOR T4F44D0C5E6D7

BV MONITORING > set name  
Serverroom3\_row2\_case3



The screenshot shows the Zabbix BV Monitoring interface. At the top, there are navigation tabs: SENSORS, SETTINGS, SENSORS SETUP, DEBUG INFO, MAINTENANCE, CLEAR ERRORS, HELP, and SHOW STATUS. Below the tabs, there is a table with the following columns: Enabled, Name, Address, Detected, and Status. The table contains several rows of sensor data, all with 'OK' status and green detection indicators.

Enabled	Name	Address	Detected	Status
<input checked="" type="checkbox"/>	Serwerownia1	286006C210220B45	●	OK
<input checked="" type="checkbox"/>	Serwerownia2	28388FD60B00003F	●	OK
<input checked="" type="checkbox"/>	Serwerownia3	280AC99A21230B71	●	OK
<input checked="" type="checkbox"/>	28FA548310220B42	28FA548310220B42	●	OK
<input checked="" type="checkbox"/>	T28EE60292E1601AE	28EE60292E1601AE	●	OK
<input checked="" type="checkbox"/>	T28EEFA4B2E160133	28EEFA4B2E160133	●	OK
<input checked="" type="checkbox"/>	T28EE60292E1601AE	28EE60292E1601AE	●	OK

Autodiscovery: server-roomp3\_row2\_case3



# Hardware solution – usage scenarios

# Server room monitoring

- ▶ Temperature and humidity
- ▶ State of AC / HVAC devices
- ▶ State of power management infrastructure elements
- ▶ Integration with access control,
- ▶ Integration with security (personel presence detection)
- ▶ Water presence on the floor (leak detection)

# Industrial and environmental

- ▶ All kinds of industrial sensors
- ▶ Monitoring production processes, quality
- ▶ Monitoring machines (predictive alerts for vibrations)
- ▶ Monitoring environment (temperature, pressure, humidity, presence of gases etc)
- ▶ Monitoring buildings



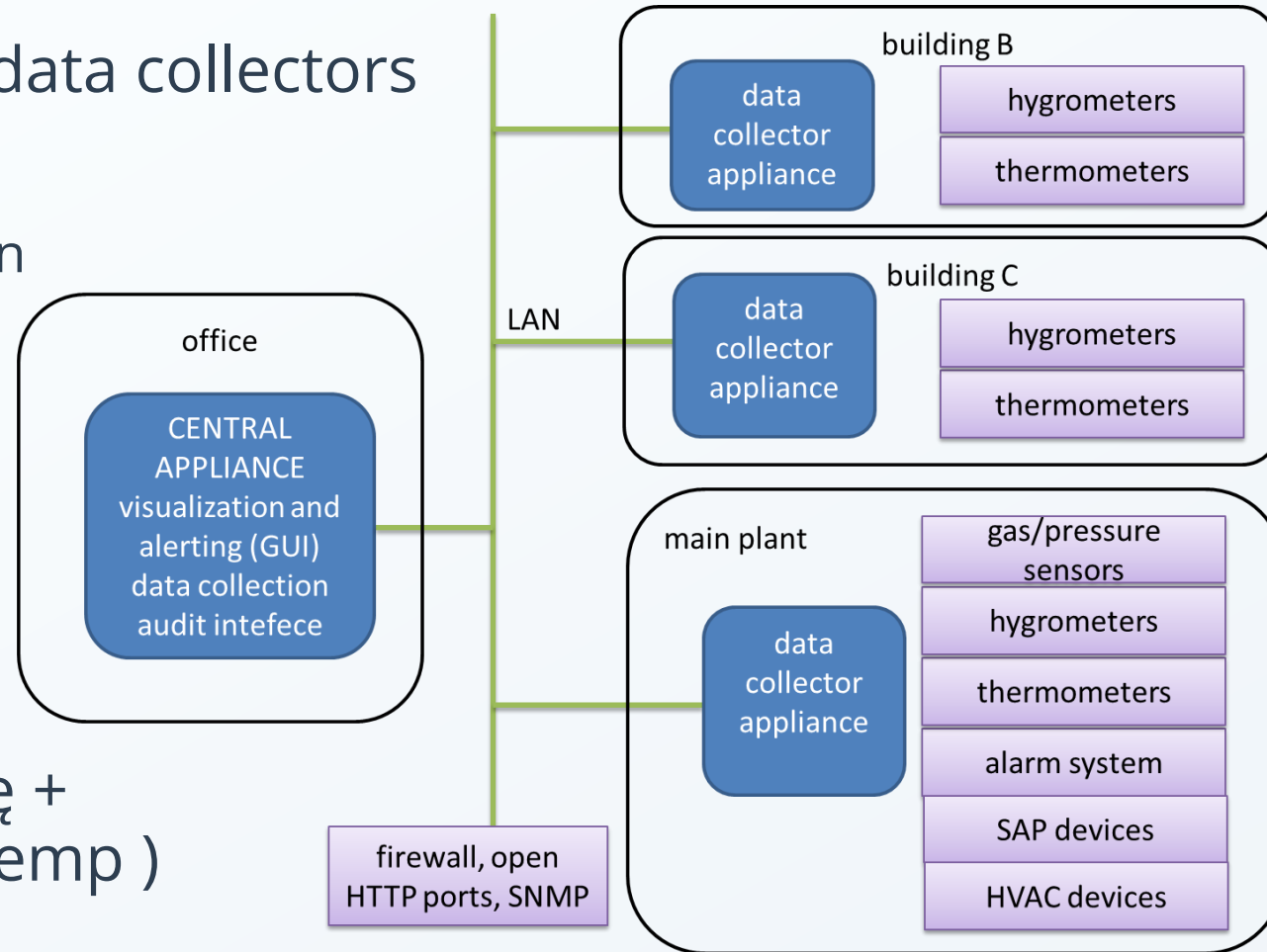
# Example implementations

# Industrial paints factory

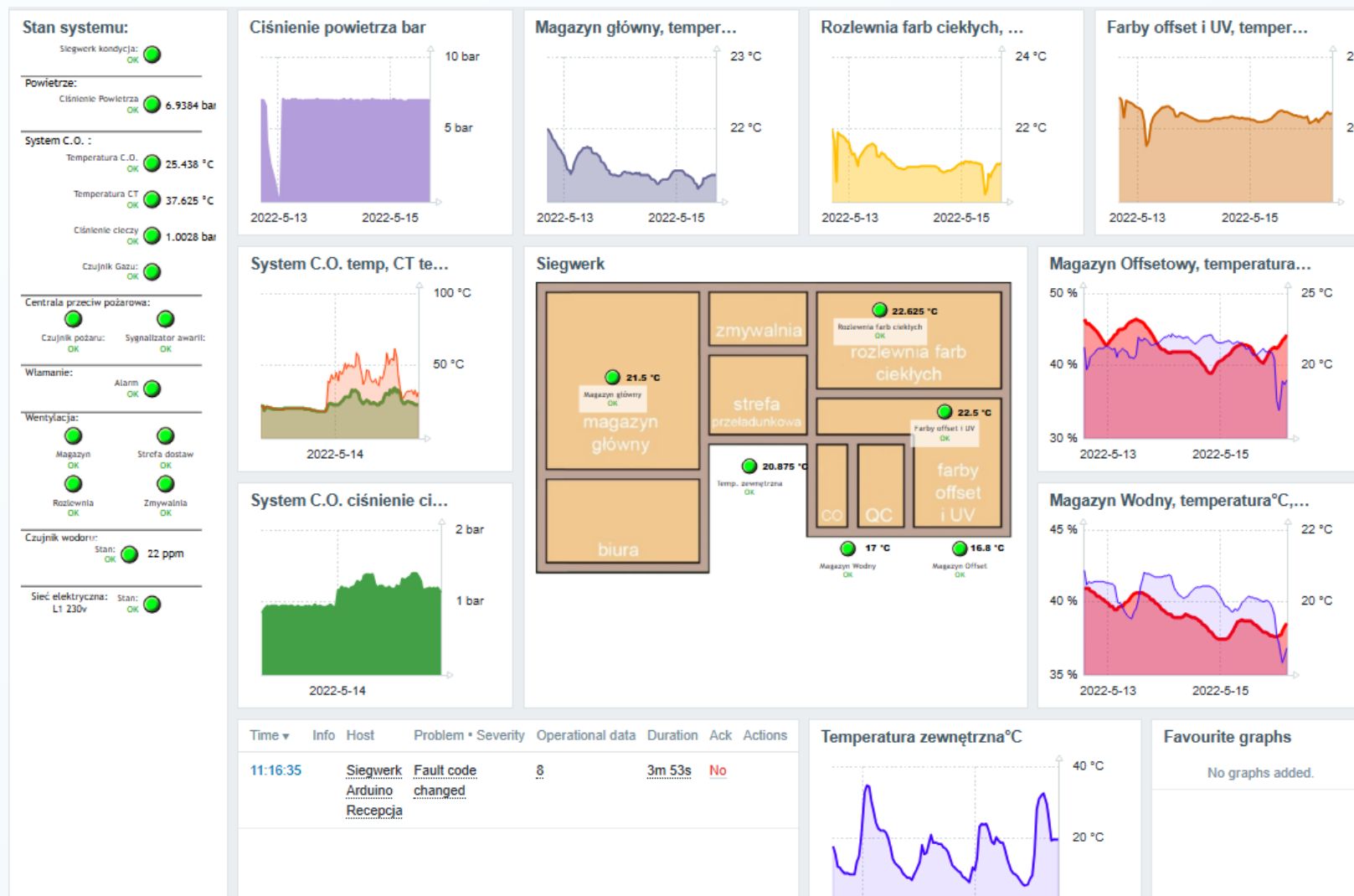
## Hardware appliances as data collectors

- ▶ HVAC integration
- ▶ Alarm system integration
- ▶ Gas pressure
- ▶ Hydrogen level
- ▶ Heating system integration

Alarm correlations:  
low external temperature +  
(low heating pressure | temp )  
= alarm ...



# Paints factory: Zabbix dashboard





# Paints factory

Industrial paints factory:

-Items mostly from autodiscovery,

<input type="checkbox"/>	<a href="#">Discover thermometers: Thermometer - Serwerownia2</a>	bvmonitoring.thermometer. [Serwerownia2]	3m	90d	365d	HTTP agent	Enabled	Application: Thermom...
<input type="checkbox"/>	<a href="#">Discover thermometers: Thermometer - Serwerownia1</a>	bvmonitoring.thermometer. [Serwerownia1]	3m	90d	365d	HTTP agent	Enabled	Application: Thermom...
<input type="checkbox"/>	<a href="#">Discover thermometers: Thermometer - 28FA548310220B42</a>	bvmonitoring.thermometer. [28FA548310220B42]	3m	90d	365d	HTTP agent	Enabled	Application: Thermom...
<input type="checkbox"/>	... <a href="#">IOT BVMonitoring Environment Monitoring BV Grupa:</a>	bvmonitoring.sys.version	1h	90d		HTTP	Enabled	application: system

-Item names given in device configuration visible

for Zabbix operator/administrator

# Use case: Energy monitoring

Critical infrastructure organization in Poland

A couple of server rooms in separate buildings

2 independent power sources dedicated to this organizations  
(high voltage)

Zabbix used for monitoring of all critical environment elements:

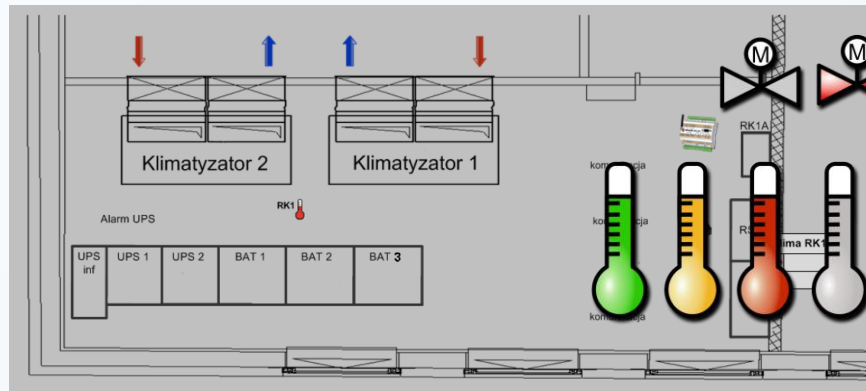
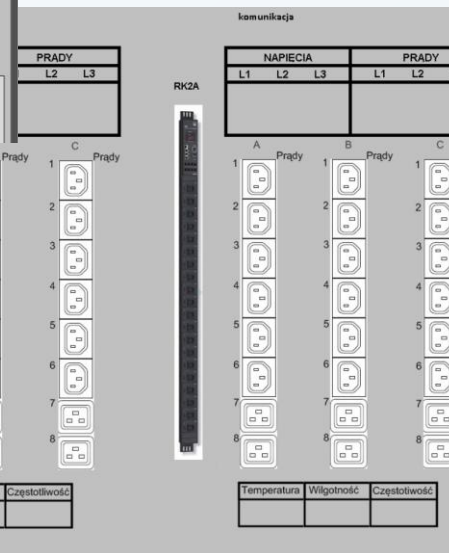
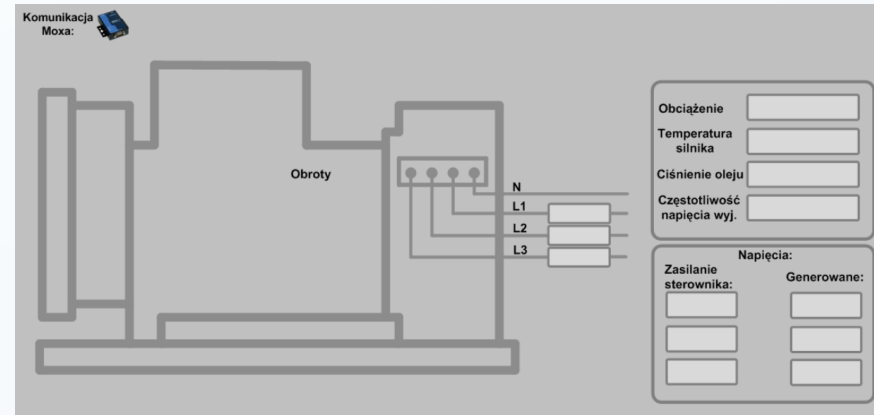
- ▶ 100's of power infrastructure parameters (ups systems, energetic lines, generators, energy meters)
- ▶ HVAC systems
- ▶ Environment (over 100 measurement points of temperatures, humidities, leak detection etc)
- ▶ Building automation systems (integration with KNX)
- ▶ Ca 15 BV Grupa devices, 30-40 other devices connected

# Large project on existing infrastructure



# Energy monitoring

Zabbix maps examples:  
(without data due to NDA)  
Over 40 maps, dashboards



# Use case: human behaviour monitoring

## Packaging production factory

- ▶ Different types of machines and production places (cutting, hot-gluing, etc)
- ▶ Monitoring human presence at the machine
- ▶ Monitoring actions taken by humans (sensors detecting when a tool is lifted by personel)
- ▶ Monitoring actions taken by machines
- ▶ Different scenarios for on or two people at the machine

SCAN ME



## Questions?

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