

D diconfig

*Shine more brightly*



# Implementing IoT on MikroTik Product for NMS purpose.

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Muhammad Nanda Jabar Rozaq

Position: *Anak Bapak Ibu + Calonmu (hiya siapa?)*

MikroTik : Routing the world!  
Me : Routing your heart!

Searching . . . .

*Trying to connect . . .*

***Heart not found!***



# Who I am?

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**Muhammad Nanda Jabar Rozaq (21)**



Product Manager – SekolahStartup



Software Engineer – DTEDI SV UGM



CEO and Founder – Gone Sinau



Software Dev for Tech Ops - Midtrans

# Campus

## **Finalist Allianz Indonesia Master Class (on going)**

2020 – Allianz Indonesia

## **Favorite Winner Hackathon BCA Young HackR**

2020 – Bank Central Asia

## **3<sup>rd</sup> Winner Best Expo Indonesia Student Entrepreneur Award**

2019 – Ministry of Research and Technology of the Republic of Indonesia

## **3<sup>rd</sup> Winner Business Plan Competition**

2019 – Fakultas Ekonomi dan Bisnis Universitas Jember

## **International Ideathon/Hackathon Robotic x IoT x Mobility Japan**

2019 – PROPOLYS JAPAN

## **1<sup>ST</sup> Winner of Indonesian Incubation Young Sociopreneur**

2018 - Fakultas Ilmu Sosial dan Ilmu Politik UGM

# Activity

## **Leader of the Organization**

2020 – Forum Komunikasi Teknologi Rekayasa Internet SV UGM

## **Leader of the Startup – Gone Sinau**

2019 – Student Entrepreneurship Program UGM

## **Co-Founder Startup of Explore Klaten**

2019 – Student Entrepreneurship Program UGM

## **Staff Human Resource Development**

2019 – Keluarga Mahasiswa Teknik Elektro dan Informatika

## **Staff Creative Division**

2019 – Komunitas Mahasiswa TIK UGM

## **Staff Most Outstanding Student Corner**

2019 – Penalaran Center Community SV UGM

***DIV Teknologi Rekayasa Internet – SV UGM***

Teachers: Presenter session 2



Teachers: Presenter session 4



- 1. Problem Statement!**
- 2. Internet of Things**
  - a) Raspberry Pi
  - b) Automation
- 3. Network Monitoring System on MikroTik Product**
  - a) SNMP
  - b) Zabbix
- 4. Demo (if possible)**
  - a) Network Topology
  - b) Device Configuration
  - c) Trigger and Notification
  - d) Data Visualization
- 5. Today's Implementation and Future Plan**
- 6. Q n A!**

## disclaimer -/

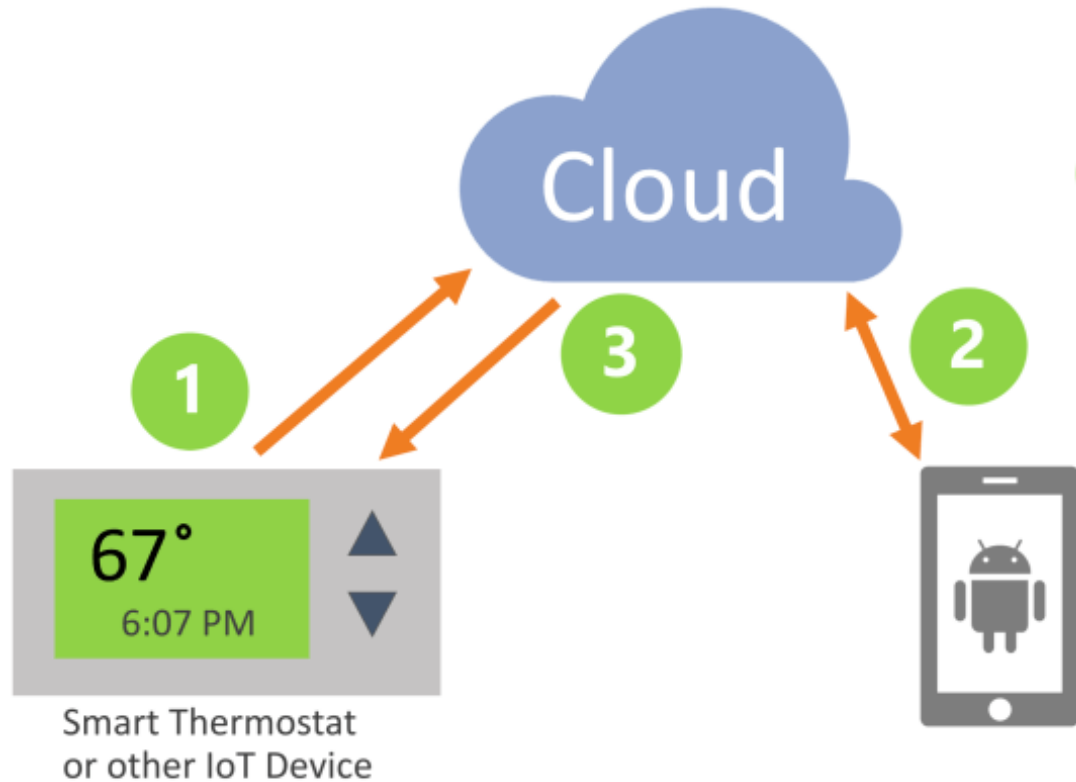
*Maybe I'm not yet call as professional in this area.  
I'm stand here as student from academic program  
But, I hope this material that I deliver will be useful to others*



- Real time network monitoring?
- Network Monitoring System need big resources?
- Network problems but User know earlier than Network Administrator/Engineer?

# Internet of Things!

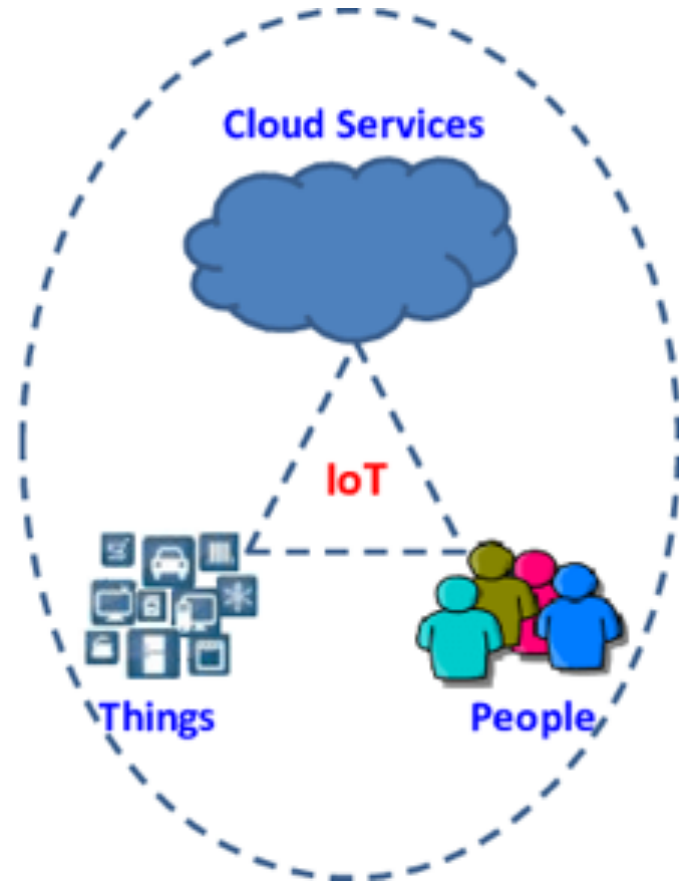
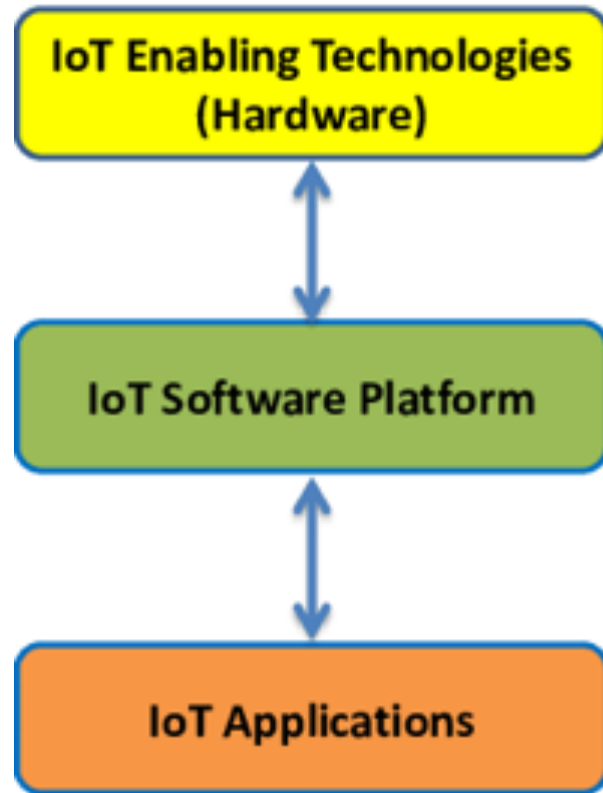
## 2-Way IoT Messaging

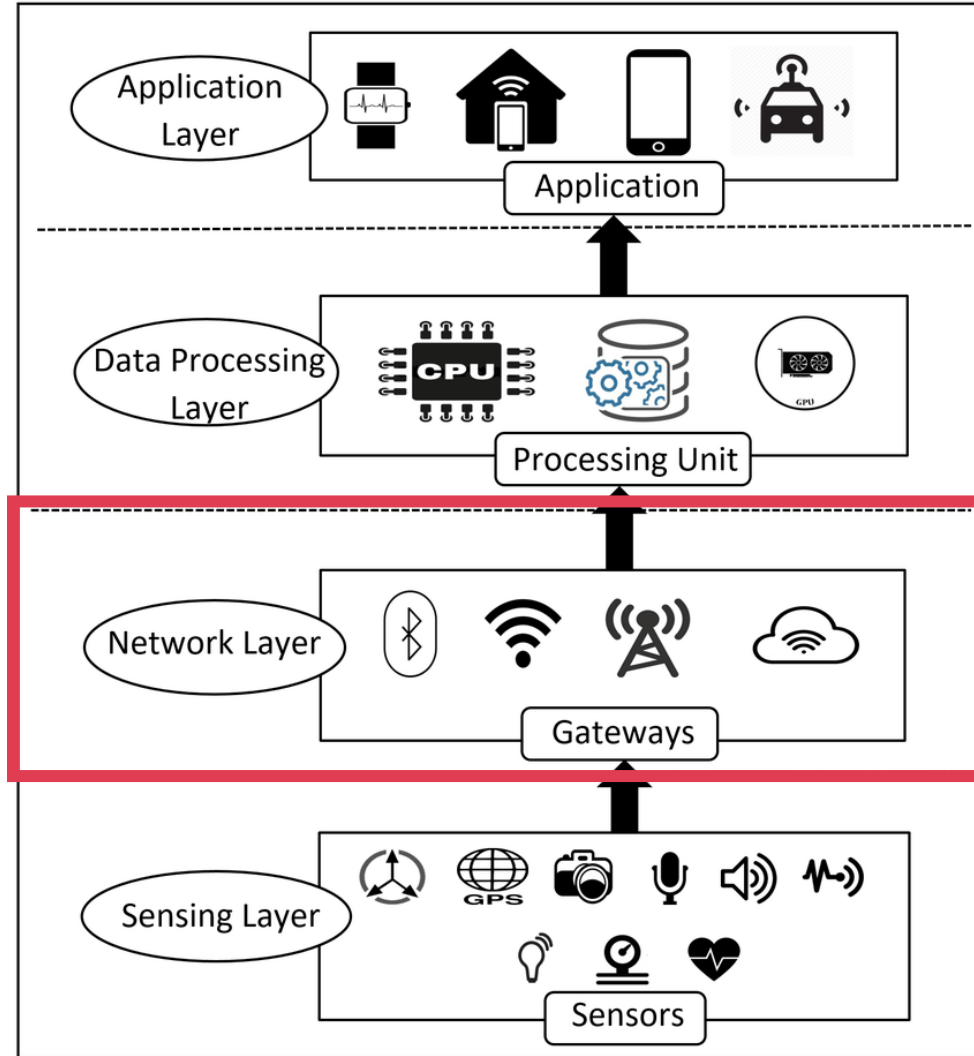


- 1 Device-to-Cloud
- 2 User Interaction
- 3 Cloud-to-Device

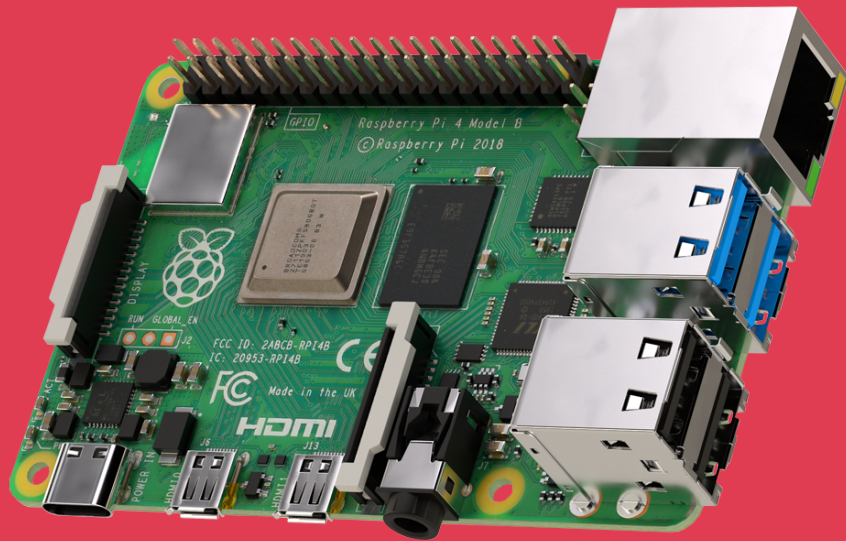


# IoT Architecture!

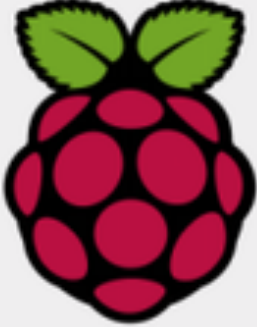




# Raspberry Pi



Small single board computers that can run computational process.

	Raspberry Pi 3 Model B	Raspberry Pi Zero	Raspberry Pi 2 Model B	Raspberry Pi Model B+
Introduction Date	2/29/2016	11/25/2015	2/2/2015	7/14/2014
SoC	BCM2837	BCM2835	BCM2836	BCM2835
CPU	Quad Cortex A53 @ 1.2GHz	ARM11 @ 1GHz	Quad Cortex A7 @ 900MHz	ARM11 @ 700MHz
Instruction set	ARMv8-A	ARMv6	ARMv7-A	ARMv6
GPU	400MHz VideoCore IV	250MHz VideoCore IV	250MHz VideoCore IV	250MHz VideoCore IV
RAM	1GB SDRAM	512 MB SDRAM	1GB SDRAM	512MB SDRAM
Storage	micro-SD	micro-SD	micro-SD	micro-SD
Ethernet	10/100	none	10/100	10/100
Wireless	802.11n / Bluetooth 4.0	none	none	none
Video Output	HDMI / Composite	HDMI / Composite	HDMI / Composite	HDMI / Composite
Audio Output	HDMI / Headphone	HDMI	HDMI / Headphone	HDMI / Headphone
GPIO	40	40	40	40
Price	\$35	\$5	\$35	\$35



*3 things important in Zabbix*  
**To implement NMS for MikroTik Product**

# Monitor any possible performance metrics and incidents in your network:

## Network performance

- Network bandwidth usage
- Packet loss rate
- Interface errorrate
- High CPU or memory utilization
- Number of tcp connections is anomaly high for this day of the week
- Aggregate throughput of core routers is low

## Network health

- Link is down
- System status is in warning/critical state
- Device temperature is too high / too low
- Power supply is in critical state
- Free disk space is low
- Fan is in critical state
- No SNMP data collection

## Configuration changes

- New device added or removed
- Network module is added, removed or replaced
- Firmware has been upgraded
- Device serial number has changed
- Interface has changed to lower speed or half-duplex mode

This is a sample list of network-related metrics and incidents, monitored by Zabbix out of the box. See the full list in template descriptions. You can extend/customize the scope of monitored objects by adding new items, writing custom data collection scripts, building custom templates, etc.





Out-of-the-box templates come with preconfigured items, triggers, graphs, applications, screens, low-level discovery rules, web scenarios, etc.

More templates:



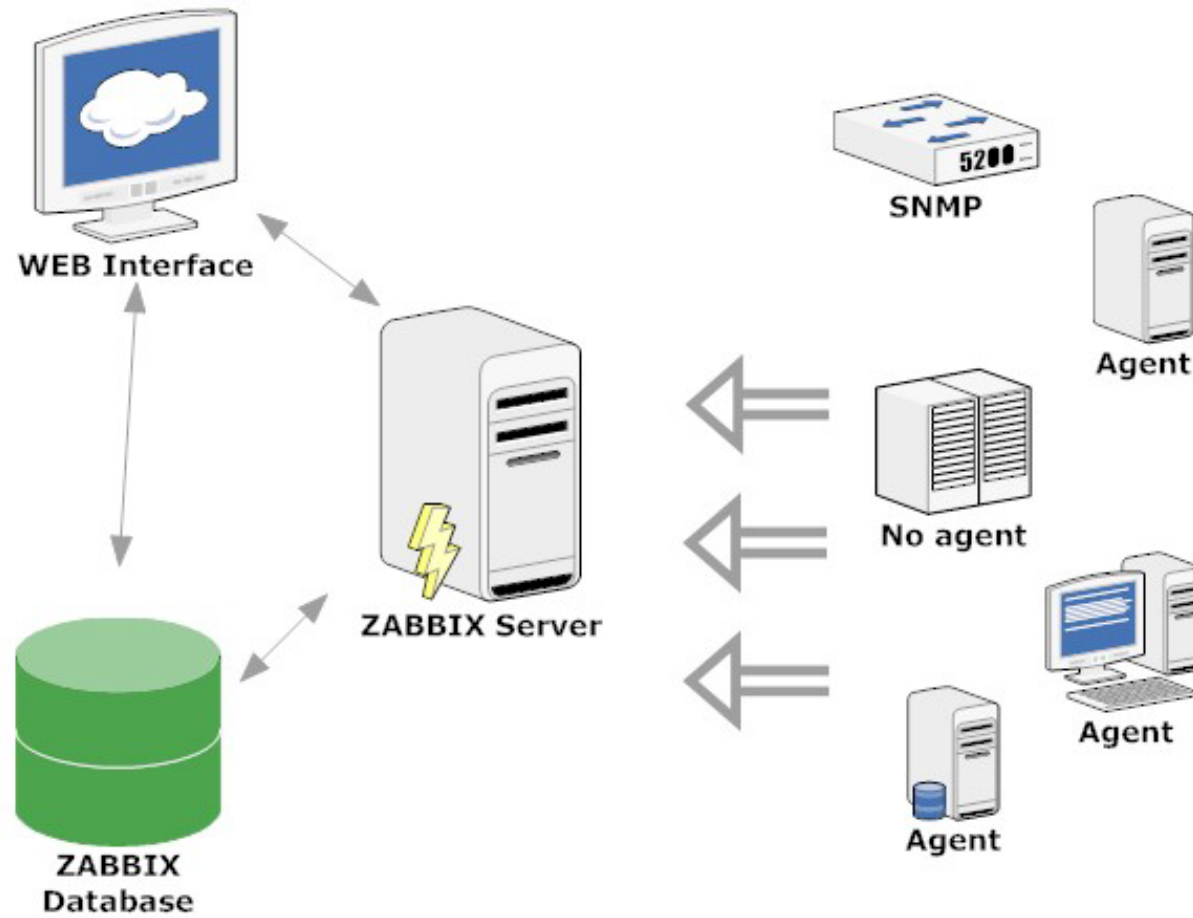
All official Zabbix templates:  
[zabbix.org](https://zabbix.org)

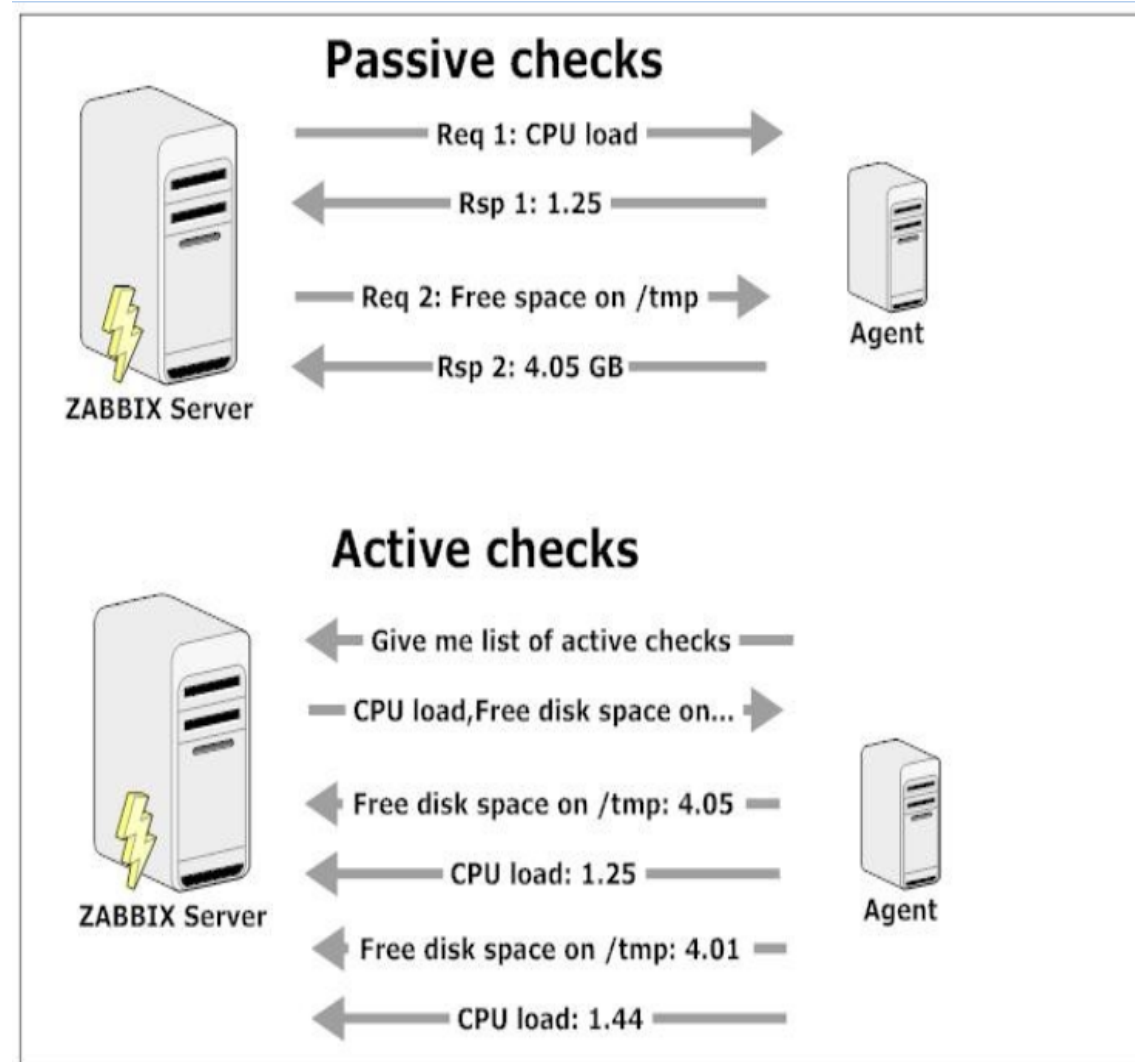


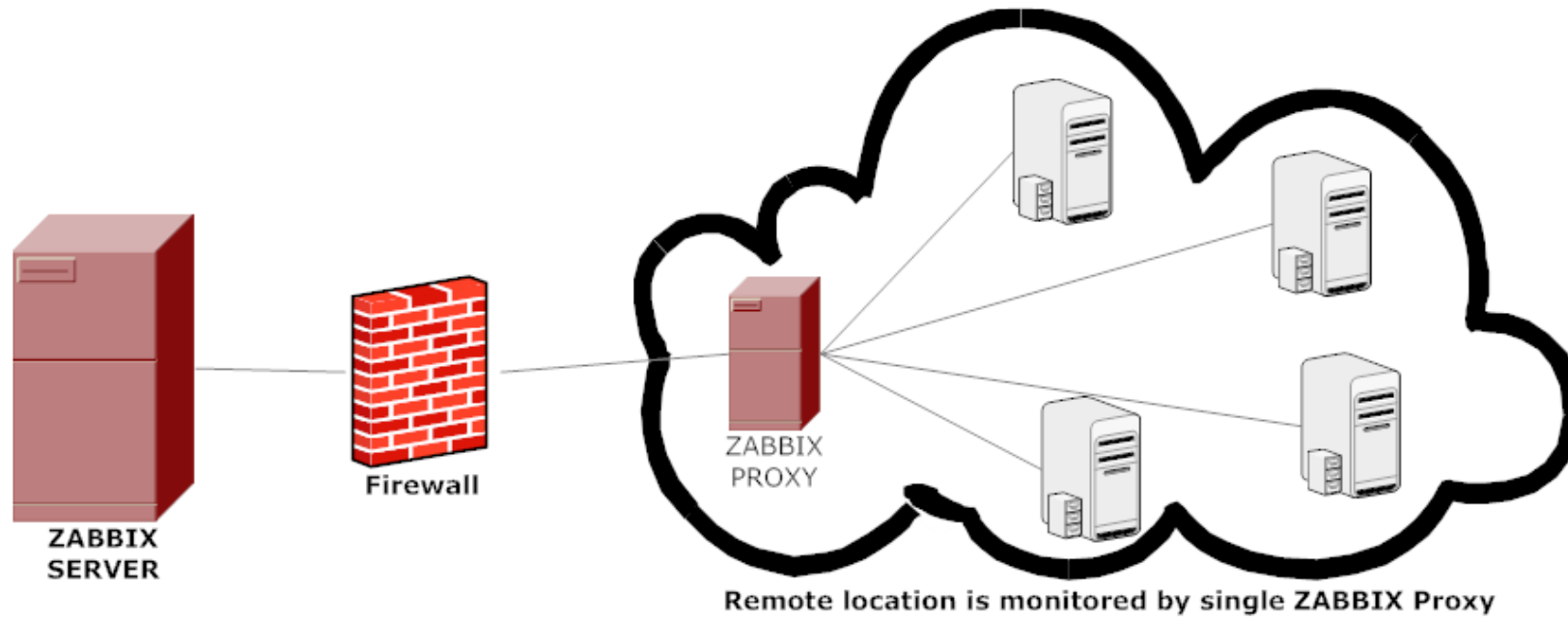
Community templates:  
[share.zabbix.com](https://share.zabbix.com)



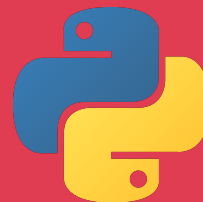
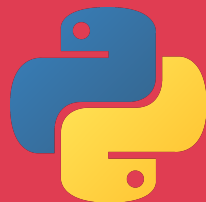
Get help from Zabbix team:  
Template Building Services



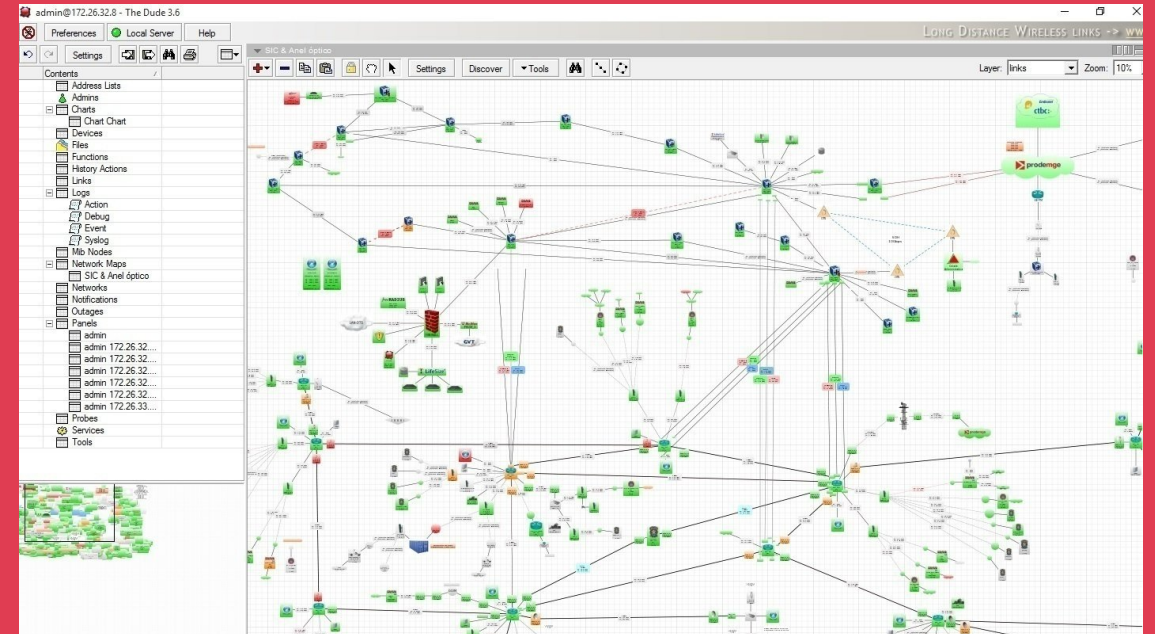
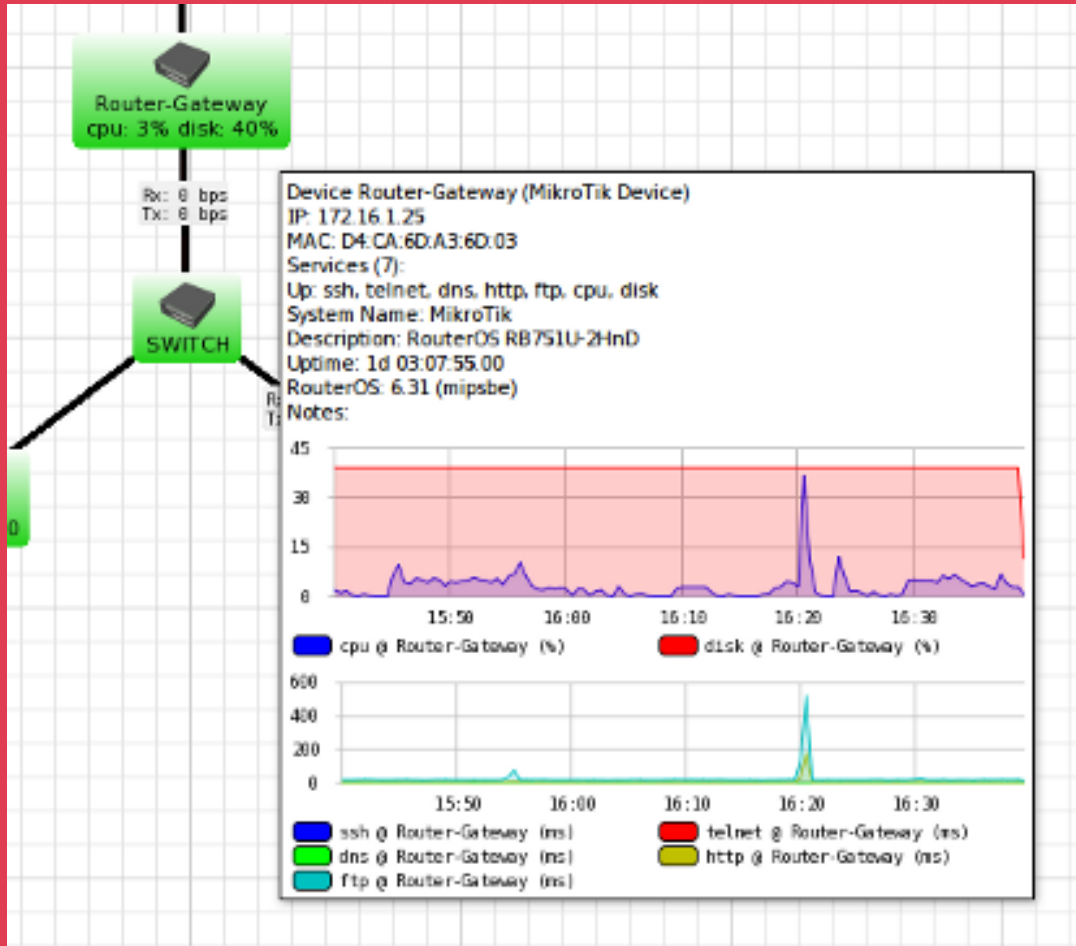




*Switched manual process that by human -> machine*



# NMS on MikroTik Product



The Dude MikroTik

Pages /... / Tools

## Torch

MikroTik Torch is a real-time traffic monitoring tool that can be used to monitor the traffic flow through an interface.

⚠ Traffic that appears in torch is before it has been filtered by a Firewall. This means you will be able to see packets that might get dropped by your Firewall rules.

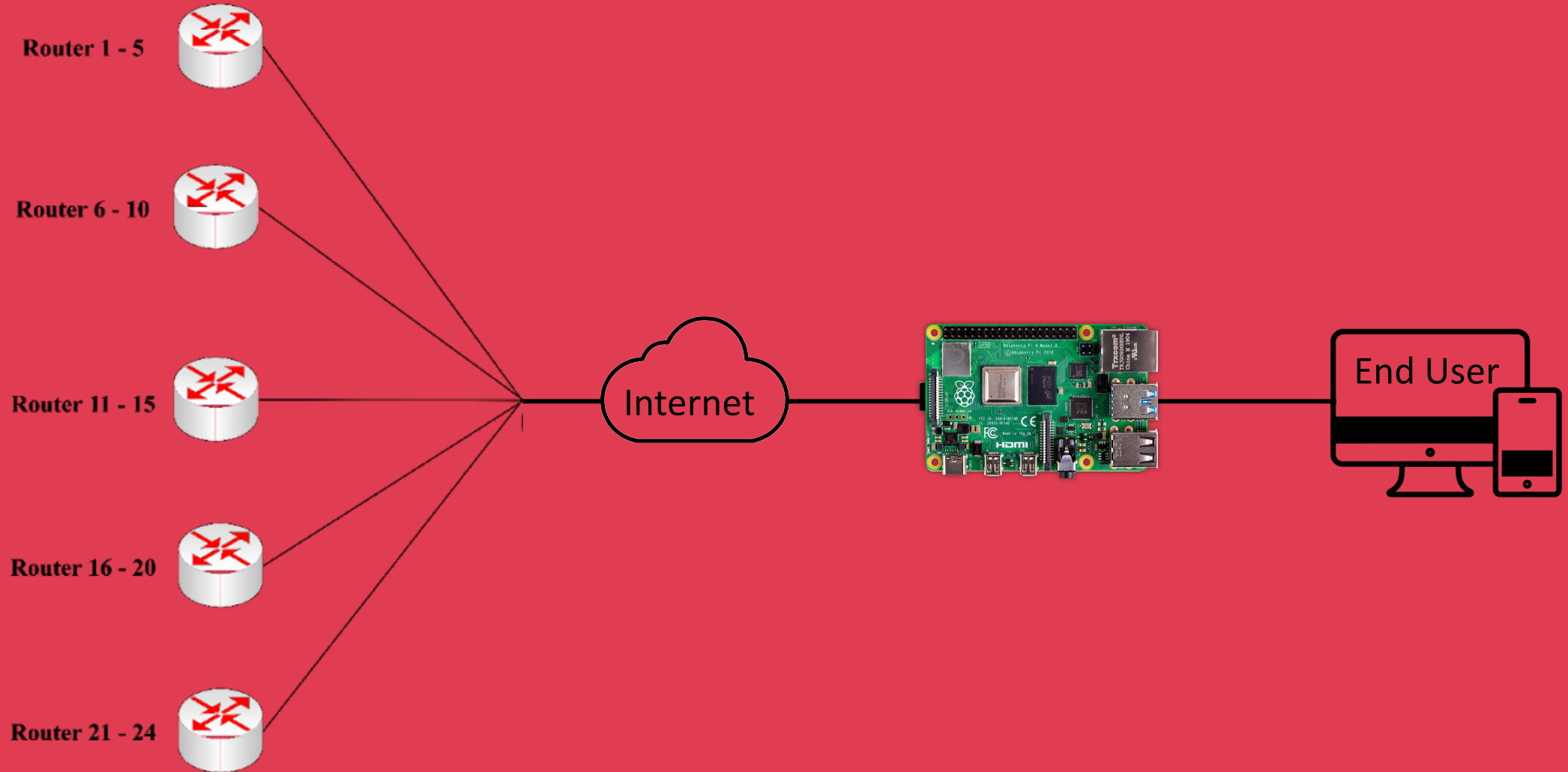
```
[admin@MikroTik] > /tool/torch
```

You can monitor traffic classified by:

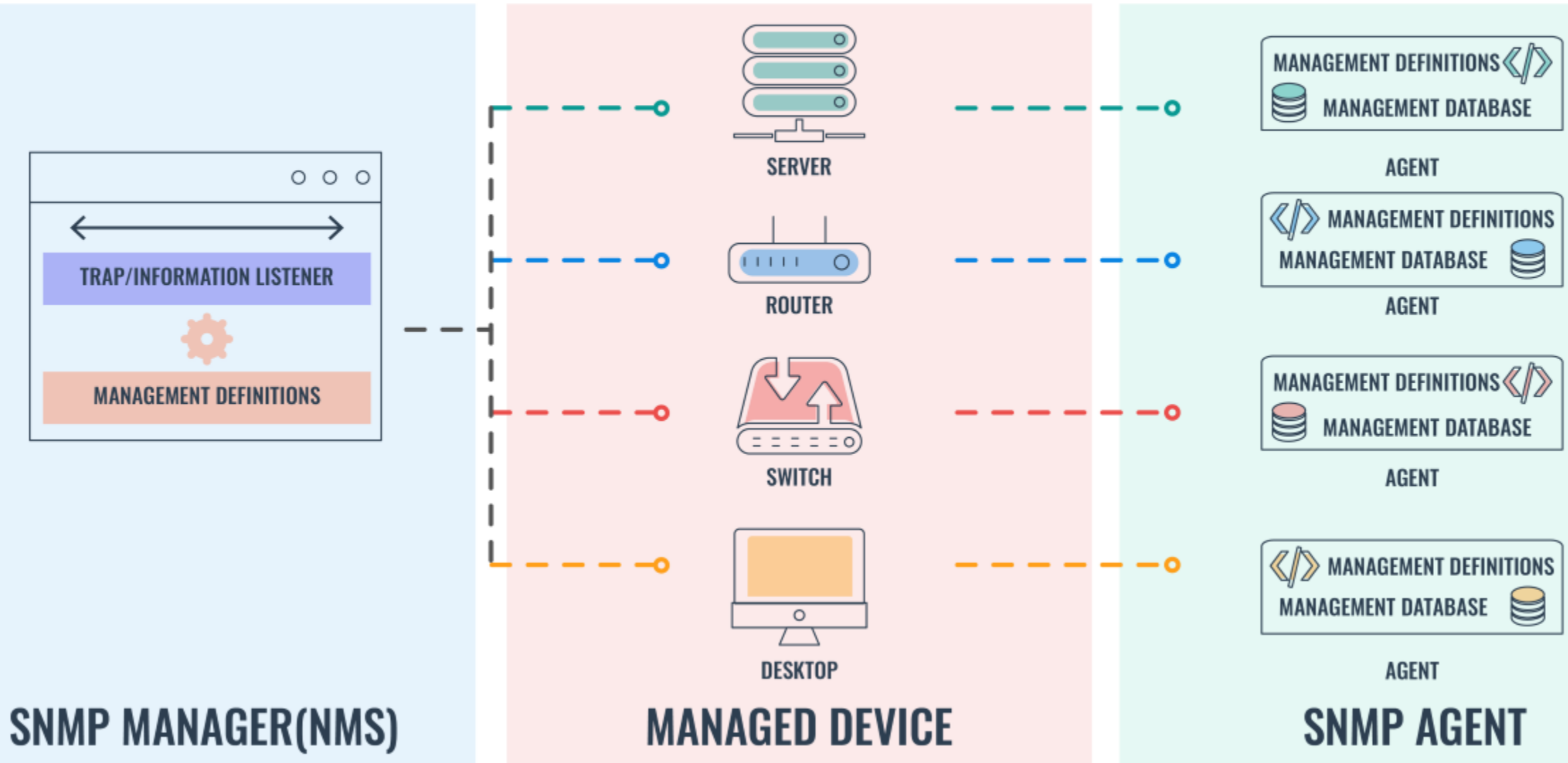
- source address (IPv4 and IPv6);
- destination address (IPv4 and IPv6);
- port;
- protocol;
- mac-protocol;
- VLAN ID;
- mac-address;
- DSCP;

|| MikroTik Torch shows the protocols you have chosen and the TX/RX data rate for each of them on the particular interface.

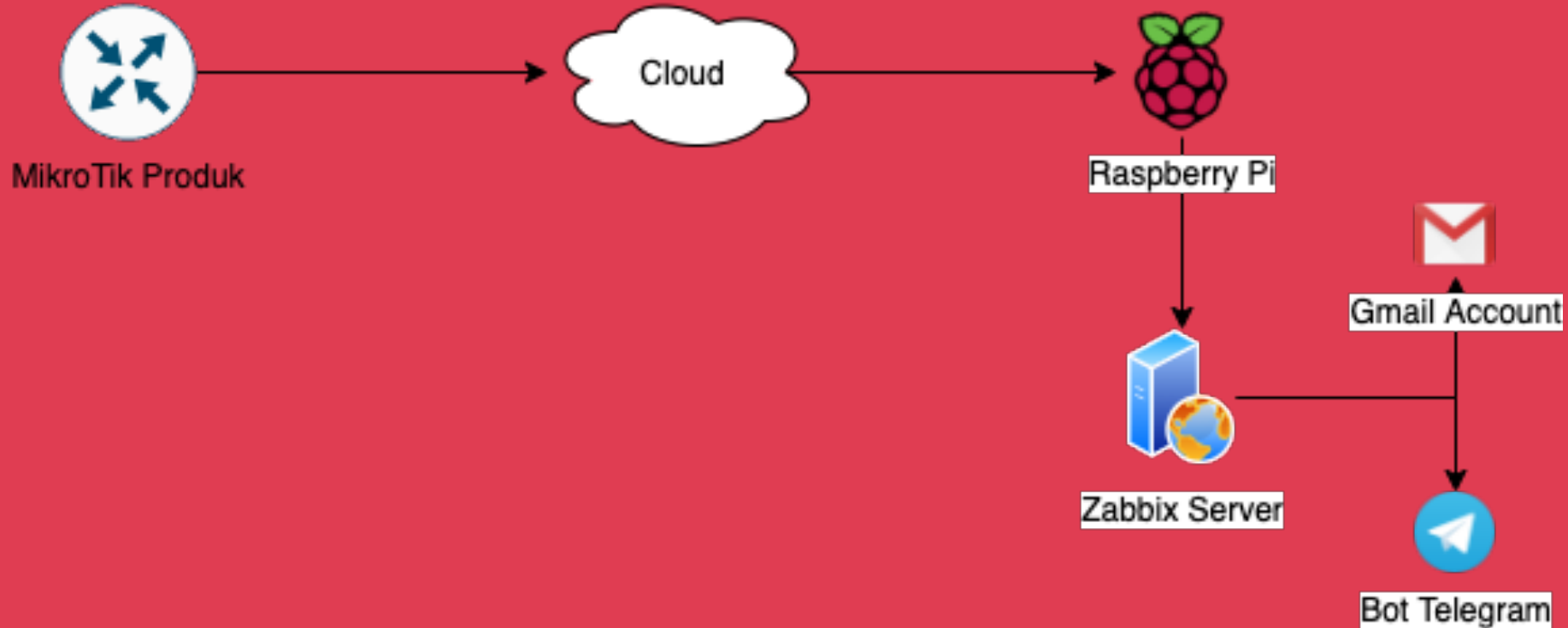
# NMS on MikroTik Product





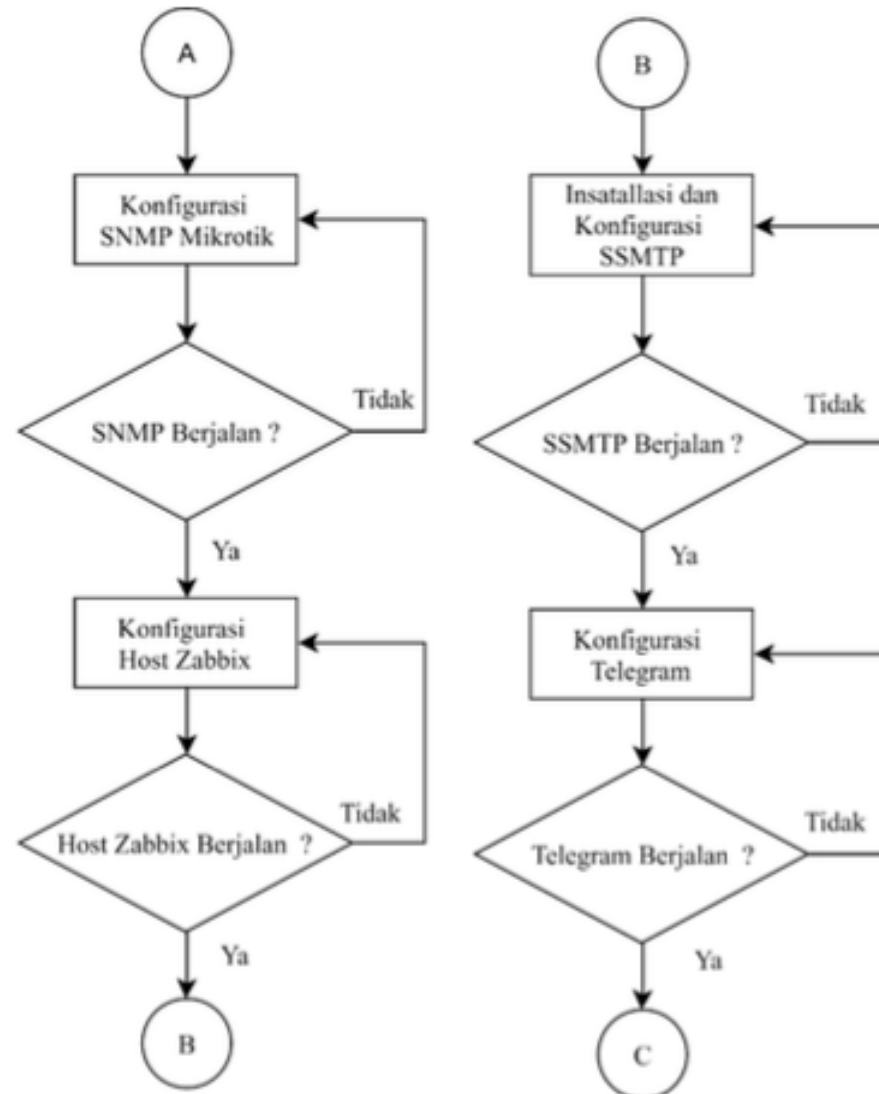


# Current Implementation

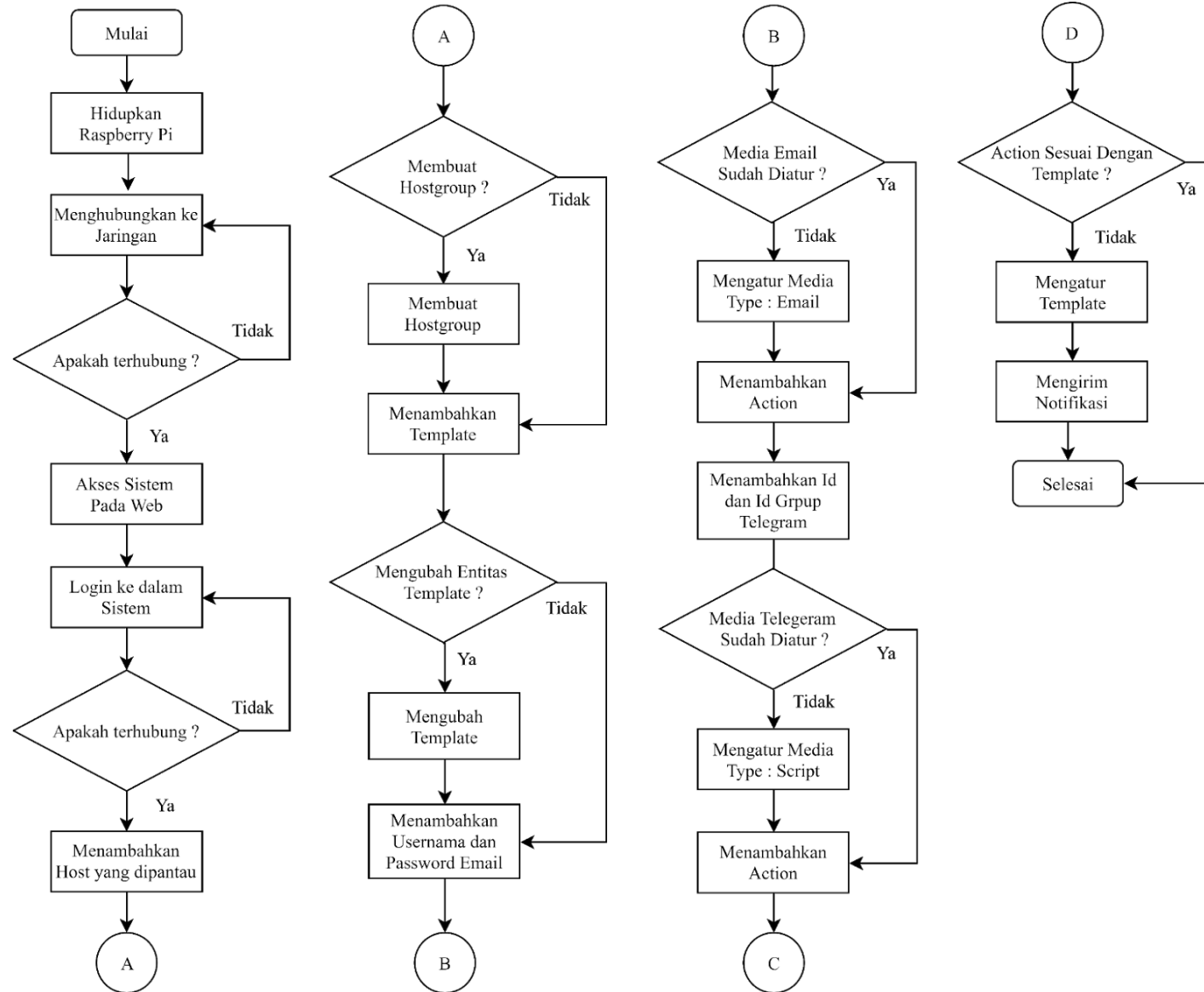


Router -> Raspberry Pi -> Email + Telegram

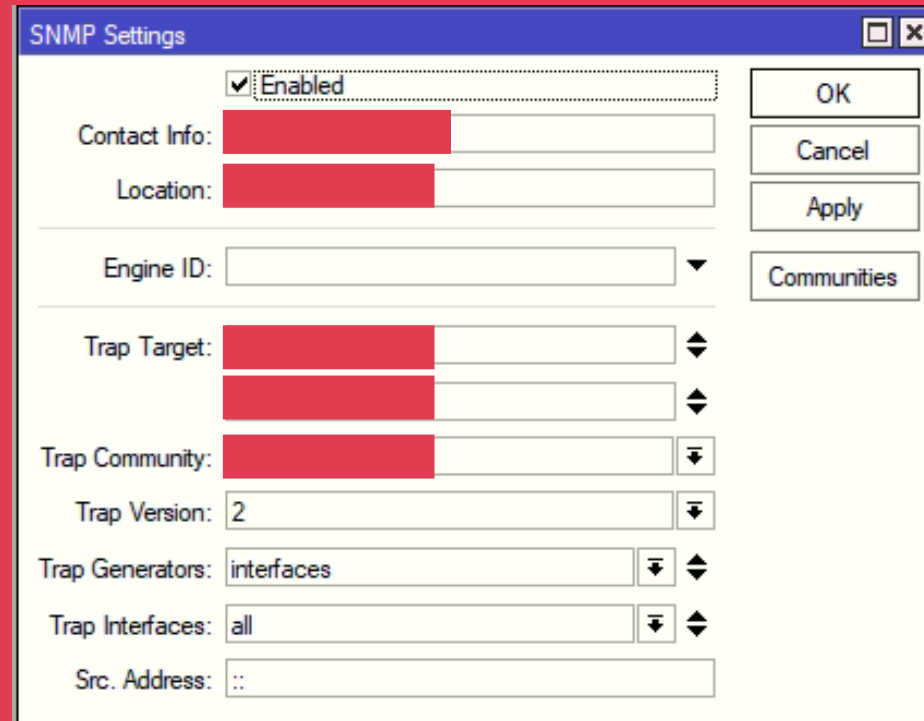
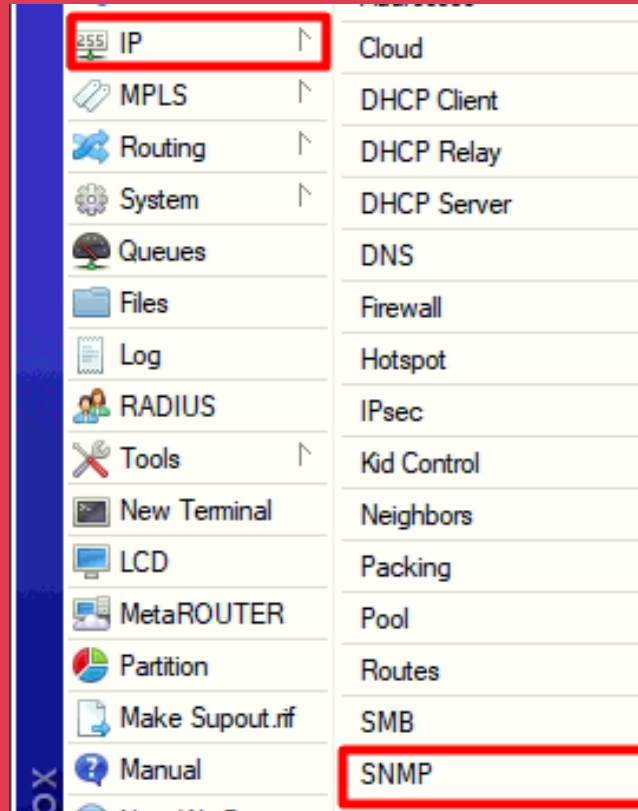
# IoT on Mikrotik Product



# IoT on MikroTik Product



# SNMP Configuration



**ZABBIX** Monitoring Inventory Reports Configuration Administration

Host groups Templates **Hosts** Maintenance Actions Event correlation Discovery Services

## Hosts

Host Templates IPMI Tags Macros Inventory Encryption

\* Host name

Visible name

\* Groups    
type here to search

\* At least one interface must exist.

Agent interfaces  IP address  DNS name  Connect to  Port  Default

SNMP interfaces         
 Use bulk requests

JMX interfaces

IPMI interfaces

Description

Monitored by proxy (no proxy)

Enabled

Templates

Group: Templates

- Template Net D-Link DES 7200 SNMPv2
- Template Net D-Link DES\_DGS Switch SNMPv2
- Template Net Dell Force S-Series SNMPv2
- Template Net Extreme EXOS SNMPv2
- Template Net HP Comware HH3C SNMPv2
- Template Net HP Enterprise Switch SNMPv2
- Template Net Huawei VRP SNMPv2
- Template Net Intel\_Qlogic Infiniband SNMPv2
- Template Net Juniper SNMPv2
- Template Net Mellanox SNMPv2
- Template Net Mikrotik SNMPv2
- Template Net Netgear Fastpath SNMPv2
- Template Net Network Generic Device SNMPv1
- Template Net Network Generic Device SNMPv2
- Template Net QTech QSW SNMPv2
- Template Net TP-LINK SNMPv2
- Template Net Ubiquiti AirOS SNMPv1
- Template OS AIX
- Template OS FreeBSD
- Template OS HP-UX
- Template OS Linux

Select Cancel

**ZABBIX** Monitoring Inventory Reports Configuration Administration

General Proxies Authentication User groups Users **Media types** Scripts Queue

## Media types

Media type Options

\* Name

Type

\* SMTP server

SMTP server port

\* SMTP helo

\* SMTP email

Connection security  None  STARTTLS  SSL/TLS

SSL verify peer

SSL verify host

Authentication  None  Username and password

Username

Password

Message format  HTML  Plain text

Enabled



**ZABBIX** Monitoring Inventory Reports Configuration Administration

Host groups Templates Hosts Maintenance Actions Event correlation Discovery Services

## Actions

Action Operations Recovery operations Update operations

Default subject Resolved: {TRIGGER.NAME}

Default message Trigger: {TRIGGER.NAME}  
Trigger status: {TRIGGER.STATUS}  
Trigger severity: {TRIGGER.SEVERITY}  
Original event ID: {EVENT.ID}

zbxtd.graphs  
zbxtd.graphs\_period=10800

Operations Details Action

Operation details

Operation type Send message

\* At least one user or user group must be selected.

Send to User groups	User group	Action
	Enabled debug mode	<a href="#">Remove</a>
	<a href="#">Add</a>	

Send to Users	User	Action
	Admin (Zabbix Administrator)	<a href="#">Remove</a>
	<a href="#">Add</a>	

Send only to telegram-notification-group

Default message

[Add](#) [Cancel](#)

\* At least one operation, recovery operation or update operation must exist.

[Add](#) [Cancel](#)

# How we can get message from Zabbix?

A trigger may have the following status:

VALUE	DESCRIPTION
OK	This is a normal trigger state.
PROBLEM	Normally means that something happened. For example, the processor load is too high.

*OK and PROBLEM parameters*

**Template Net Mikrotik SNMPv2** Featured Popular ★★★★★

Official templates for Mikrotik RouterOS devices. Please see Template Description and follow documentation link for more info.  
 Depends on: <https://share.zabbix.com/official-templates/template-modules-pack> Please download and import them first.  
 Category: [Mikrotik](#)

## Zabbix RouterOS BGP Monitoring Popular

For more details using this template, take a look at the [repository](#)

**RouterOS 6.x** Popular ★★★★★

Review of monitoring item name Fix LLD rule multi core CPU CPU temperature Network interface [send, receive, error, discard, status] Storage Monitoring Power-comsuption, Power-current [can not be acquired with some Routerboards.] monitoring ...  
 Category: [Mikrotik](#)

Type [Template](#) Min Zabbix version [4.0.x](#)

**Template Mikrotik RB750-RB1100** Popular ★★★★★

Template Mikrotik para RB 750 e RB1100. Zabbix 3.0  
 Category: [Mikrotik](#)

Type [Template](#) Min Zabbix version [3.0.x](#)

**Mikrotik RouterOS v6.x - v3.0.x** Popular ★★★★★

Working on all Mikrotik routers, but not all position are used by each router. Many of position like: 3.3 voltage 5 voltage 12 voltage Active fan Board temperature Core voltage CPU frequency CPU temperature Current DHCP leases Fan Speed 1 ...  
 Category: [Mikrotik](#)

Type [Template](#) Min Zabbix version [3.0.x](#)

Trigger
High CPU utilization
Server has been restarted
Device: Temperature is above critical threshold: >60
Device: Temperature is above critical threshold: >50
Device: Temperature is too low: <5
Device has been replaced (new serial number received)
Disk-131072: Disk space is critically low
Disk-131072: Disk space is low
Firmware has changed
High ICMP ping loss
High ICMP ping response time
High memory utilization
Interface wlan1(): Link down
Interface ether1(): Ethernet has changed to lower speed than it was before
Interface ether1(): High bandwidth usage >90%
Interface ether1(): High error rate
No SNMP data collection
Unavailable by ICMP ping

# Output NMS on MikroTik Product

**ZABBIX** Monitoring Inventory Reports Configuration Administration

Dashboard Problems Overview Web Latest data Graphs Screens Maps Discovery Services

Global view Edit dashboard

All dashboards / Global view

### System information

Parameter	Value	Details
Zabbix server is running	Yes	localhost:10051
Number of hosts (enabled/disabled/templates)	111	26 / 0 / 85
Number of items (enabled/disabled/not supported)	4513	4507 / 0 / 6
Number of triggers (enabled/disabled [problem/ok])	2108	2108 / 0 [16 / 2092]
Number of users (online)	4	1
Required server performance, new values per second	24.14	

### Problems by severity

Host group	Disaster	High	Average	Warning	Information	Not classified
Templates/Network devices			10	4	1	
Zabbix servers		1				

### Local

### Problems

Time	Info	Host	Problem • Severity	Duration	Ack	Actions	Tags
09:06:12			Device: Temperature is above warning threshold: >50	26m 1s	No	1	
09:00							
08:49:08			Interface ether5(): Link down	43m 5s	No	1	
08:30:09			Device: Temperature is above warning threshold: >50	1h 2m 4s	No	1	
08:18:09			Interface ether9(): Link down	1h 14m 4s	No	1	
08:12:20			Interface wlan1(): Link down	1h 19m 53s	No	1	
08:00							
07:45:31			Device: Temperature is above warning threshold: >50	1h 46m 42s	No	1	
07:18:03			Interface bridge1(created from master port): High bandwidth usage >90%	2h 14m 11s	No	4	

### Text

Timestamp	Name	Value
2019-09-04 09:31:26	CPU user time	27.8123
2019-09-04 09:30:26	CPU user time	27.927
2019-09-04 09:29:26	CPU user time	29.5242
2019-09-04 09:28:26	CPU user time	29.8786
2019-09-04 09:27:26	CPU user time	29.5142
2019-09-04 09:26:26	CPU user time	30.3644

# Output NMS on MikroTik Product

The screenshot shows a Gmail interface with a search bar containing '3777028'. The left sidebar lists folders like 'Kotak Masuk' (25.763), 'Berbintang', 'Ditunda', 'Ter kirim', 'Draf', and 'Selengkapnya'. The main content area displays an email from 'zabbix.notifikasi@gmail.com' with the subject 'Problem: High ICMP ping response time'. The email body contains the following details:

- Problem started at 12:45:03 on 2019.09.04
- Problem name: High ICMP ping response time
- Host
- Severity: Warning
- Original problem ID: 3777028

At the bottom of the email, there are two buttons: 'Balas' (Reply) and 'Teruskan' (Forward).

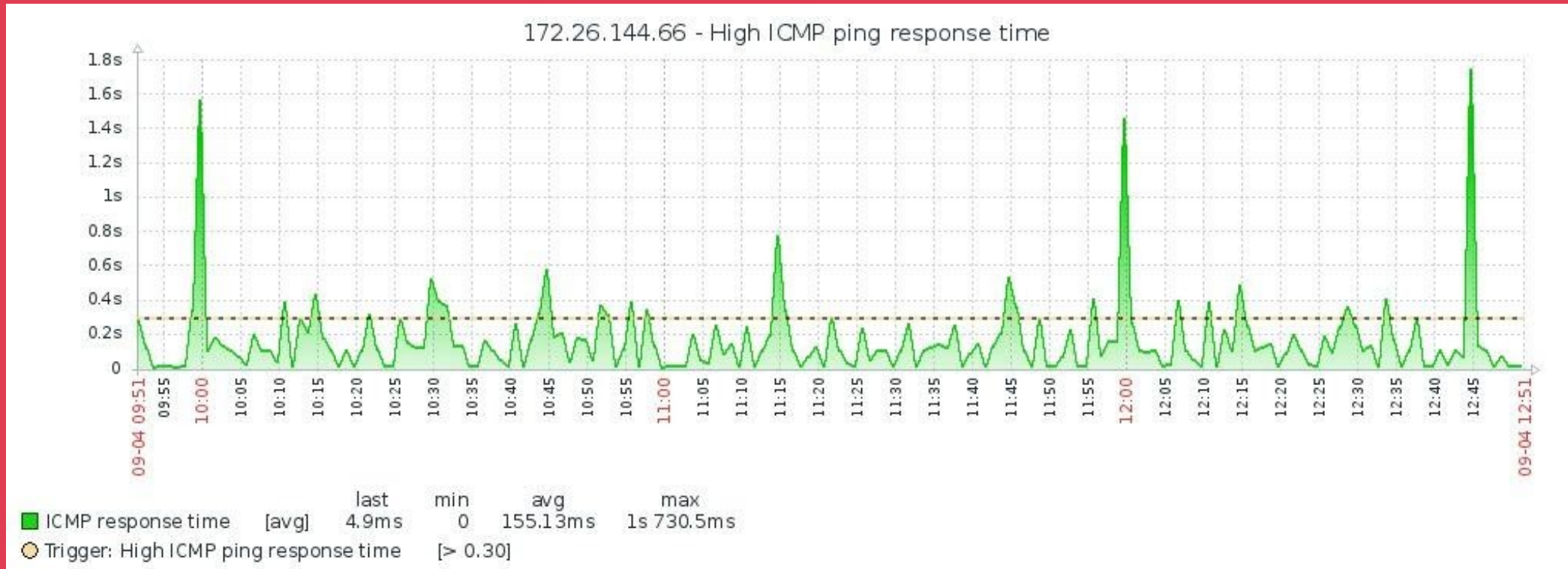
# Output NMS on MikroTik Product

The image displays two side-by-side screenshots of a WhatsApp chat interface. The chat is titled 'Zabbix MSRTI' and has 2 members. The status bar at the top shows 'TELKOMSEL' as the carrier, the time '20.22', and a battery level of 52%. The chat messages are as follows:

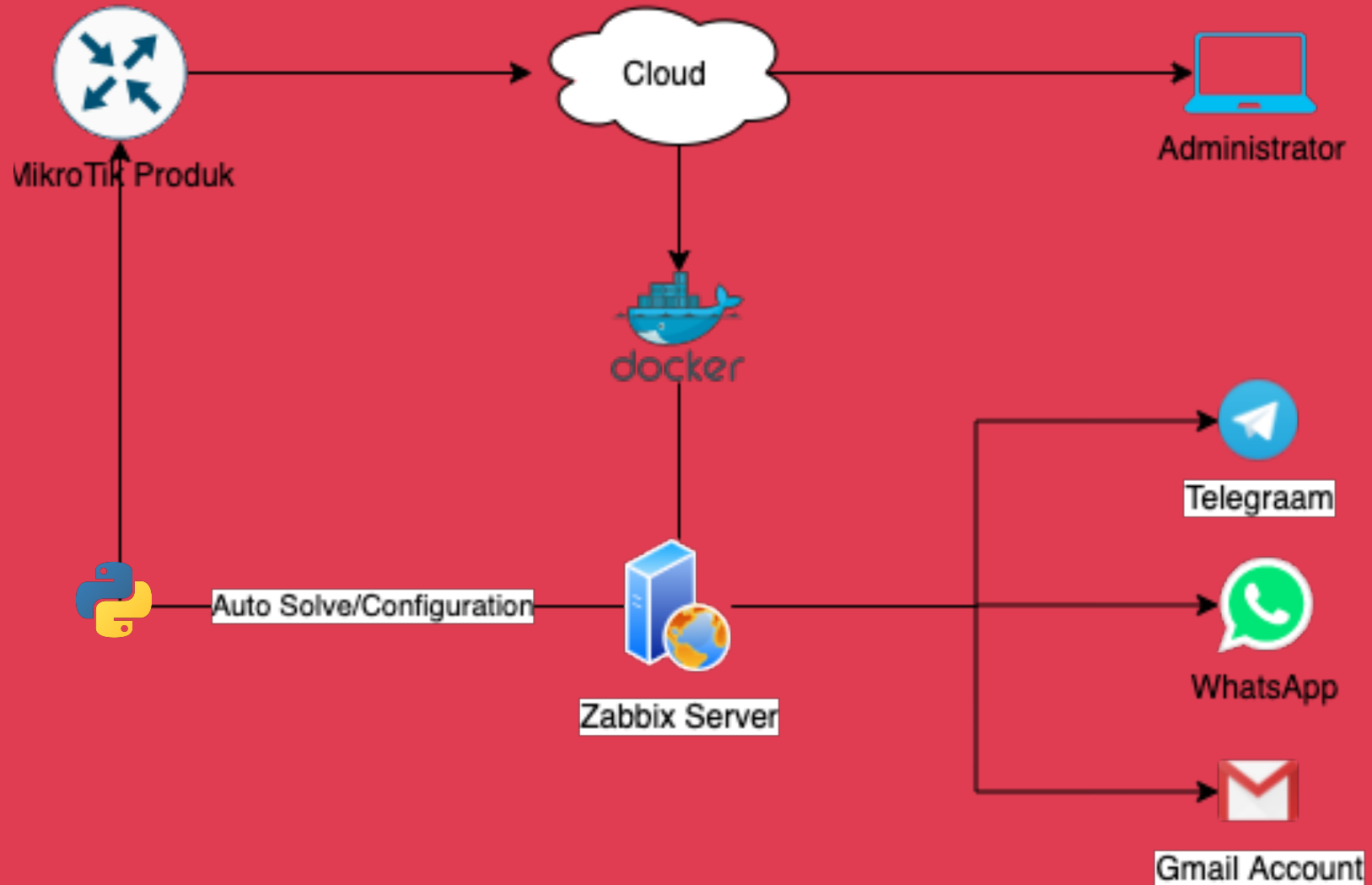
- Message 1 (12:45):** Problem name: High ICMP ping response time  
Value: 1s 731ms PROBLEM  
Severity: Warning
- Message 2 (12:45):** MonitoringZabbixMSRTIBot: Problem:# [redacted]: High ICMP pin...  
A line graph showing 'High ICMP ping response time' with a red threshold line. The graph shows several peaks exceeding the threshold. Below the graph, it indicates: 'Trigger: High ICMP ping response time (>= 0.30)'. The time is 12:45.
- Message 3 (12:51):** Resolved: High ICMP ping response time  
Trigger: High ICMP ping response time  
Trigger status: OK  
Trigger severity: Warning  
Original event ID: 3777028
- Message 4 (12:51):** MonitoringZabbixMSRTIBot: Resolved: High ICMP ping response tim...  
A line graph showing 'High ICMP ping response time' with a red threshold line. The graph shows several peaks exceeding the threshold. Below the graph, it indicates: 'Trigger: High ICMP ping response time (>= 0.30)'. The time is 12:51.

The chat interface includes a bottom bar with a 'Pesan' (Message) input field and various icons for attachments, voice recording, and navigation. The chat background features a light blue pattern of various icons.

# Output NMS on MikroTik Product



# Future Implementation





# Con: Internet of Things and Automation in Networking

- Real time network monitoring system in Web App
- Network Monitoring System with low resources (Cloud, Microcontroller)
- Automation error/problem message trough Telegram and Google Mail
- Auto solve problem in the network using Python (machine learning)

# Question and Answer?



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[linkedin.com/in/muhnandajr](https://www.linkedin.com/in/muhnandajr)

# Thank you!

Need training or B2B project contact me at [@nandajabarr](#)

[www.diconfig.id](http://www.diconfig.id)

[@diconfig](#)

[diconfigindonesia@gmail.com](mailto:diconfigindonesia@gmail.com)

- Telegram Notification

<https://git.zabbix.com/projects/ZBX/repos/zabbix/browse/templates/media/telegram/README.md>

- Email Notification

<https://www.zabbix.com/documentation/current/manual/config/notifications/media/email>