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Implementing IoT on MikroTik Product for NMS purpose.

Muhammad Nanda Jabar Rozaq

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



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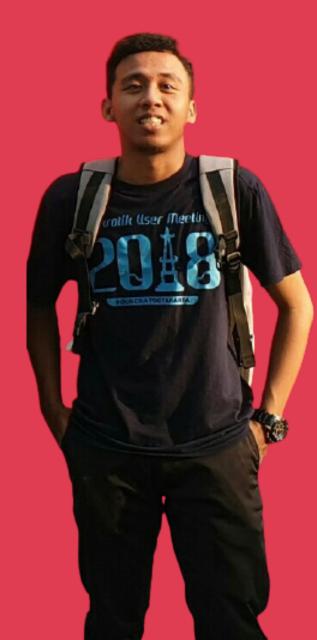
MikroTik: Routing the world! Me : Routing your heart!

Searching . . .

Trying to connect . . .

Heart not found!

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Who I am?

Muhammad Nanda Jabar Rozaq (21)

Product Manager – SekolahStartup



St

Software Engineer – DTEDI SV UGM



CEO and Founder – Gone Sinau



Software Dev for Tech Ops - Midtrans

Campus

Activity

Finalist Allianz Indonesia Master Class (on going) 2020 – Allianz Indonesia

Favorite Winner Hackathon BCA Young HackR 2020 – Bank Central Asia

3rd Winner Best Expo Indonesia Student Entrepreneur Award 2019 – Ministry of Research and Technology of the Republic of Indonesia

3rd **Winner Business Plan Competition** 2019 – Fakultas Ekonomi dan Bisnis Universitas Jember

International Ideathon/Hackathon Robotic x IoT x Mobility Japan 2019 – PROPOLYS JAPAN

1ST Winner of Indonesian Incubantion Young Sociopreneur2018 - Fakultas Ilmu Sosial dan Ilmu Politik UGM

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

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Few years ago . . .

Teachers: Presenter session 2



Teachers: Presenter session 4



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TODAY'S OUTLINE

- **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 c) Trigger and Notification
 - b) Device Configuration d) Data Visualization
- 5. Today's Implementation and Future Plan
- 6. Q n A!

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disclaimer -/

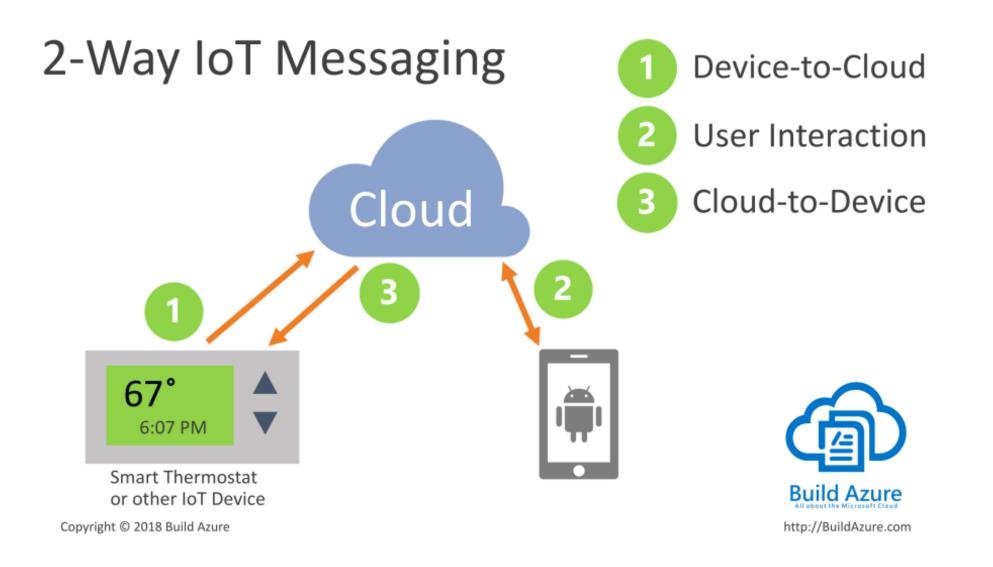
Maybe I'm not yet call as professional in this area. I'm stand here as student from academic program But, I hope this material that I deliver will be useful to others

Problem Statement!

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

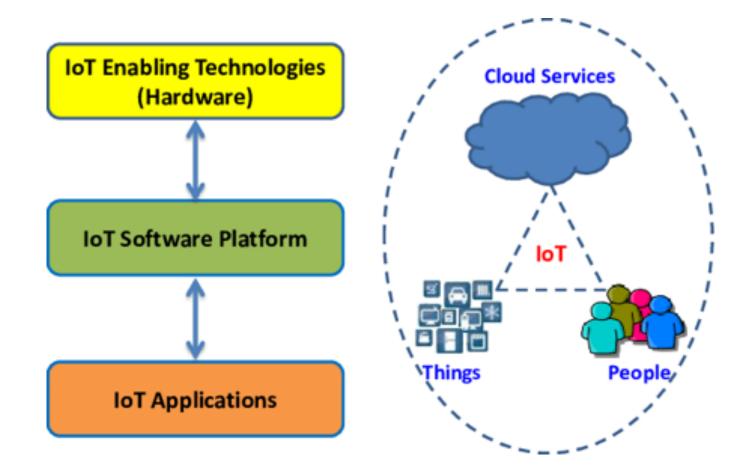






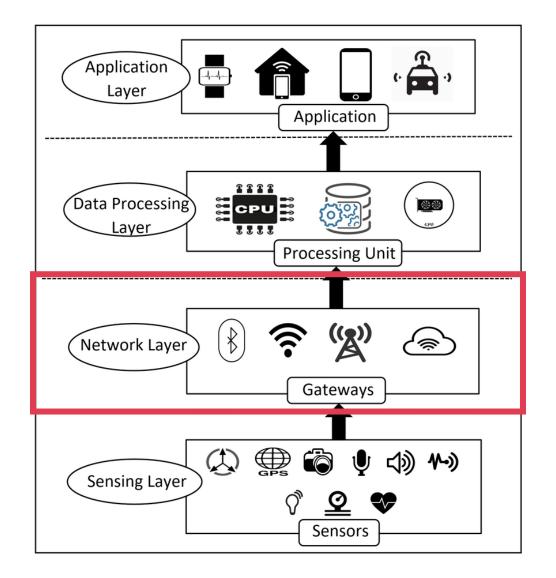
IoT Architecture!





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IoT Architecture!



Raspberry Pi



Small single board computers that can run computational process.

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Raspberry Pi!

	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

Zabbix Server



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



ZABBIX

ZABBIX	PRODUCT	SOLUTIONS	SUPPORT & SERVICES	TRAINING	PARTNERS	COMMUNITY	ABOUT US	DOWNLOAD
Overview		Platforms	V	Vhy Zabbix			Customer reviews	

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.

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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



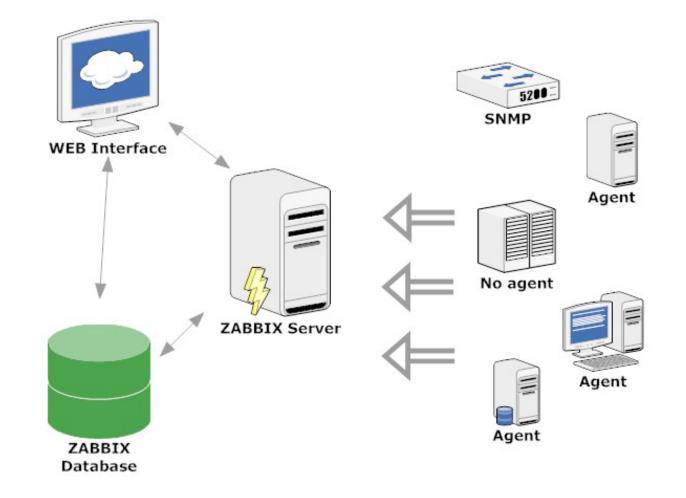
Community templates: share.zabbix.com



Get help from Zabbix team: **Template Building Services**

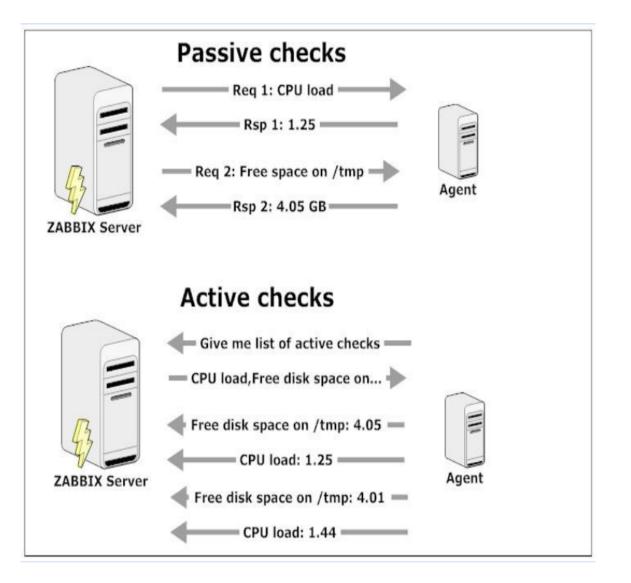
Zabbix Server





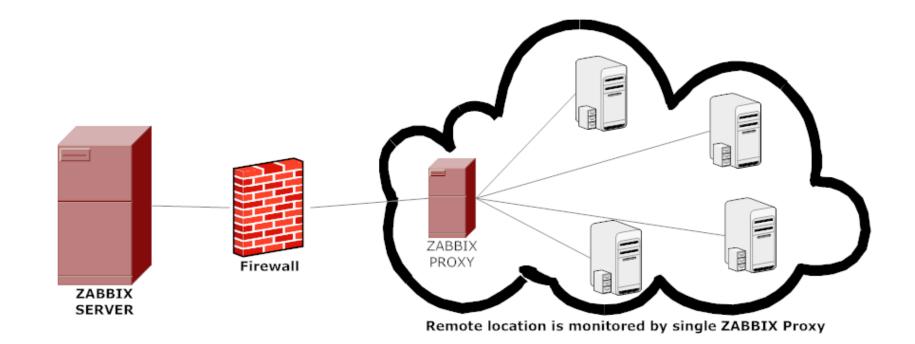
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Zabbix Agent





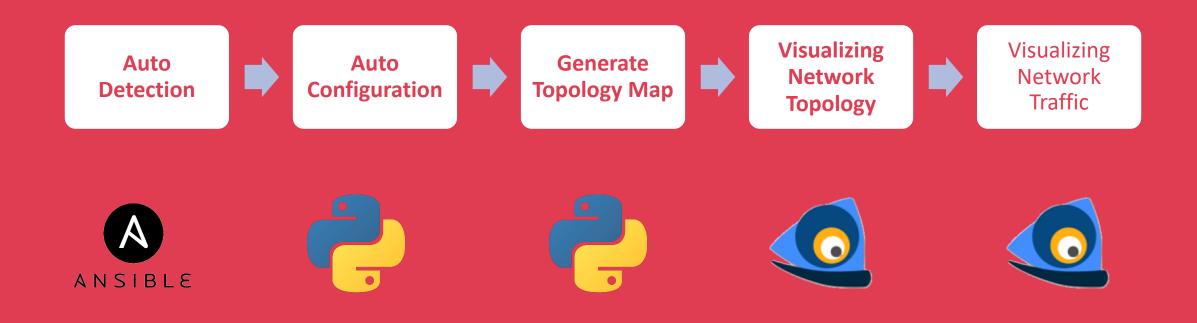




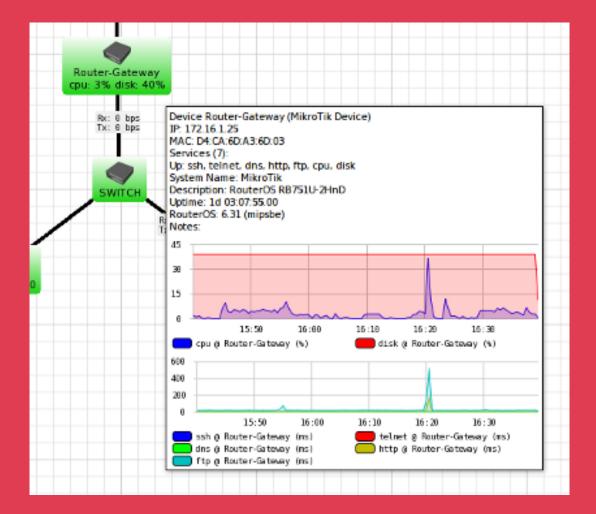
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Automation?

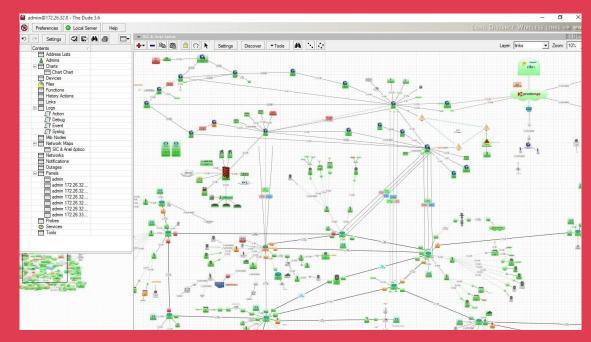
Switched manual process that by human -> machine



NMS on MikroTik Product



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The Dude MikroTik



Torch 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.

A 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.

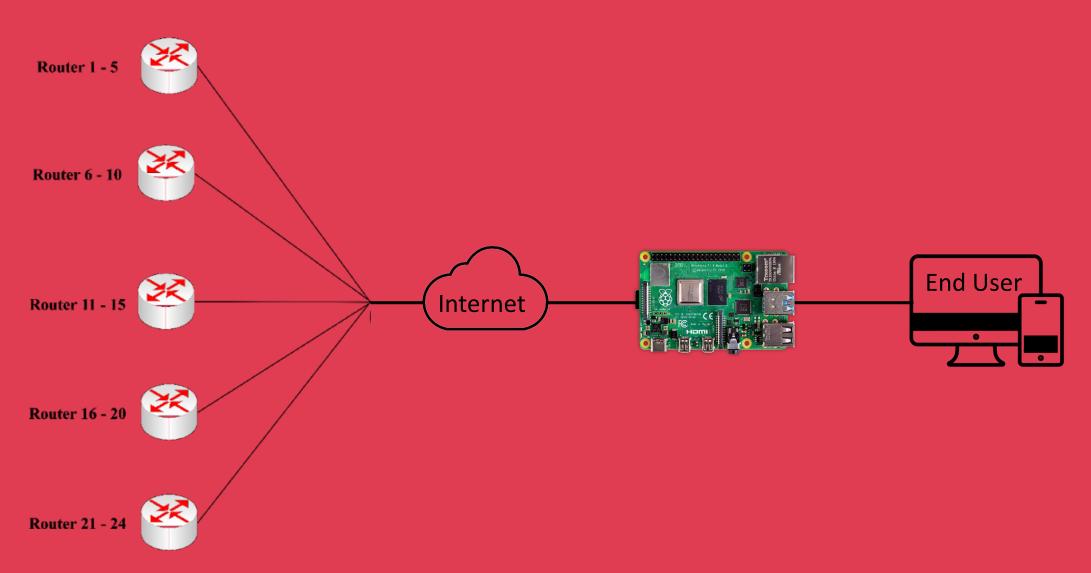
[admin@MikroTik] > /tool/torch

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.

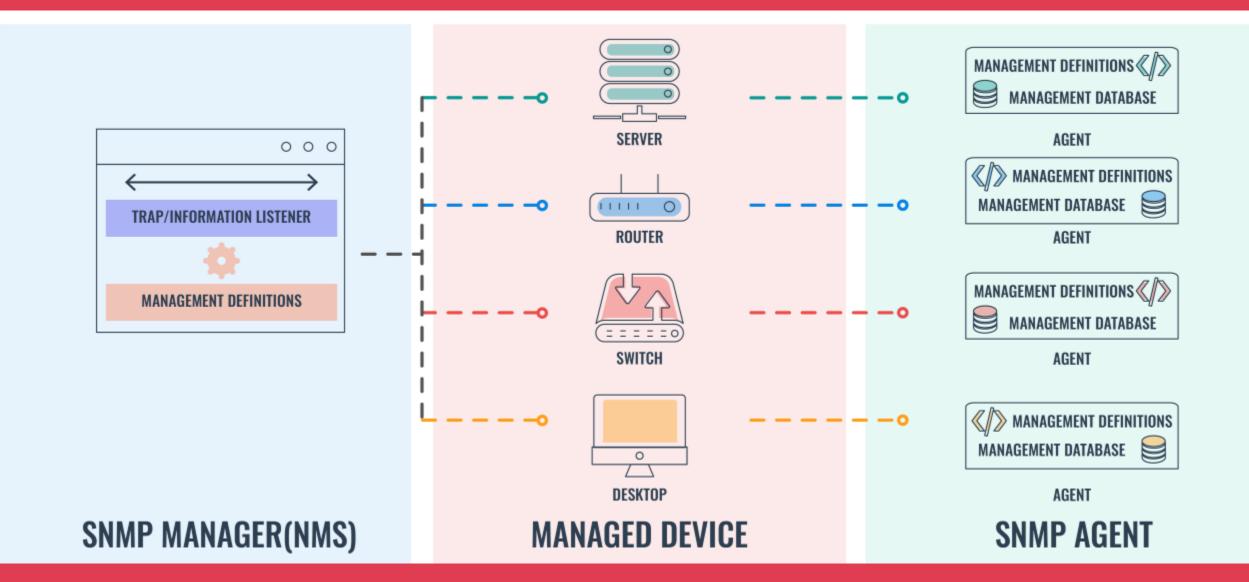
NMS on MikroTik Product



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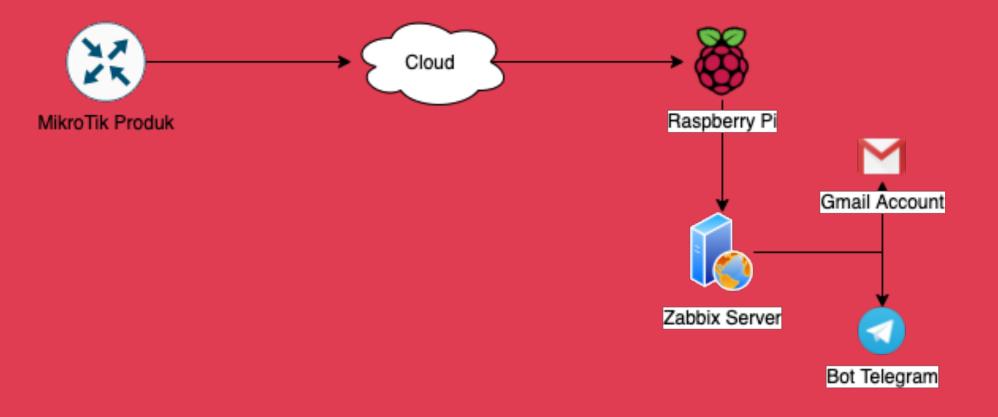
SNMP Architecture





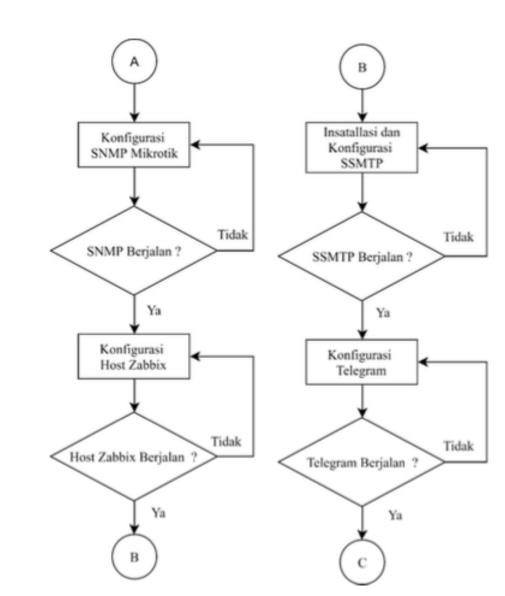
Current Implementation

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Router -> Raspberry Pi -> Email + Telegram

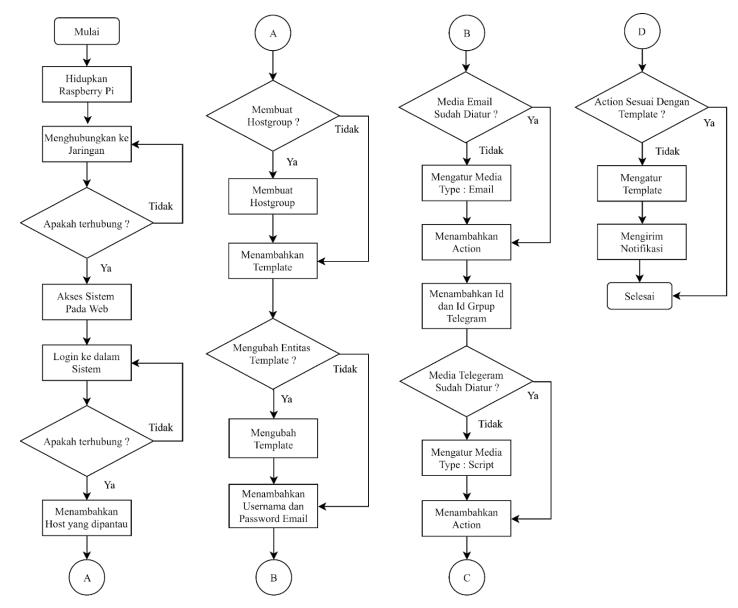
IoT on MikroTik Product



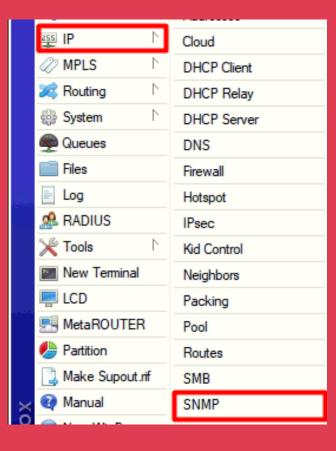
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IoT on MikroTik Product



SNMP Configuration



SNMP Settings		
	✓ Enabled	ОК
Contact Info:		Cancel
Location:		Apply
Engine ID:	•	Communities
Trap Target:	↓	
Trap Community:		
Trap Version:	2 🗧	
Trap Generators:	interfaces 🗧 🗧	
Trap Interfaces:	all 두 🜩	
Src. Address:	::	

Host Configuration

ZABBIX Monito	oring Inventory	Reports Configuration Administration	
Host groups Templates	Hosts Maintenan	ce Actions Event correlation Discovery Services	
Hosts			
Host Templates IPMI	Tags Macros	Inventory Encryption	
	* Host name		
	Visible name		
	* Groups	Templates/Network devices × Select type here to search	
		* At least one interface must exist.	
	Agent interfaces	IP address DNS name Connect to Port Default Add	
	SNMP interfaces	Use bulk requests	
	JMX interfaces	Add	
	IPMI interfaces	Add	
	Description		
	Monitored by proxy	(no proxy) 🔻	
	Enabled	Add Cancel	

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MikroTik Template Conf

Temp	lates					3
		Group	Templa	ites		•
	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					
				Selec	ct C	ancel

SSMTP Configuration

ZABB	IX	Monitoring	Inventory	Reports	Configuration	Admir	nistration	
General P	roxies	Authentication	n User grou	ıps Users	Media types	Scripts	Queue	
Media t	ypes							
Media type	Opti	ons						
			* Name	Email]
			Туре	Email	•			
		* (SMTP server	smtp.gmail.	com]
		SMT	P server port	587	•			
			* SMTP helo	gmail.com]
		*	SMTP email	zabbix.notifi	ikasi@gmail.com]
		Connec	ction security	None S	STARTTLS SS	L/TLS		
		ss	L verify peer	✓				
		SS	L verify host	✓				
		A	uthentication	None U	Jsername and pas	sword		
			Username	zabbix.notifi	ikasi@gmail.cc			
			Password	•••••				
		Mes	ssage format	HTML	Plain text			
			Enabled	✓				
			l	Add	Cancel			

Telegram Configuration

ZABBIX Monitor	ring Inventory	Reports Configu	uration Administration	1	
Host groups Templates	Hosts Maintenan	ce Actions Event	correlation Discovery	Services	
Actions					
Action Operations Re	covery operations	Update operations			
[[Default subject	Resolved: {TRIGGER	NAME}		
	Default message	Trigger: {TRIGGER.N/ Trigger status: {TRIG Trigger severity: {TRIG Original event ID: {EV	GER.STATUS}]
		zbxtg;graphs zbxtg;graphs_period=			z
	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 Enabled debug mode		Action Remove
			Add		
		Send to Users	User Admin (Zabbix Administra Add	ator)	Action Remove
		Send only to	telegram-notification-grou	p 🔻	
		Default message			
	[* At least one operation Add Cancel	i, recovery operation or upd	ate operation must exist.	

How we can get message from Zabbix?

A trigger may have the following status:

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

OK and **PROBLEM parameters**

MikroTik Template

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 Adminis	ration								Q G Support	Z Share	? 💄 🖖
Dashboard Problems Overview Web Latest data	Graphs Screens Maps	Discovery Services										zabbix
Global view										E	dit dashboard	= 2
All dashboards / Global view												
System information		··· Problems by severity								Local		
Parameter	Value Details	Host group ▲	Disaster	High Ave	rage Warni	ng Information	No	t classified			1	
Zabbix server is running	Yes localhost:10051	Templates/Network devices		<u>10</u>	4	1					- /	
Number of hosts (enabled/disabled/templates)	111 26 / <mark>0</mark> / 85	Zabbix servers		1						~		-
Number of items (enabled/disabled/not supported)	4513 4507 / 0 / 6											-
Number of triggers (enabled/disabled [problem/ok])	2108 2108 / 0 [16 / 20	2]										
Number of users (online)	4 1									-		~
Required server performance, new values per second	24.14									1	·	
Problems										Text		
Time ▼ Info Host		Problem · Severity				Duration	Ack /	\ctions	Tags	Timestamp	Name	Value
09:06:12		Device: Temperature is above	ve warning threshold: >50			26m 1s	No	1 →		2019-09-04 09:31:2		27.8123
09:00 0											time	
08:49:08		Interface ether5(): Link dowr	<u>n</u>			43m 5s	No	1 →		2019-09-04 09:30:2	6 CPU user time	27.927
08:30:09		Device: Temperature is above	ve warning threshold: >50			1h 2m 4s	No	1 →		2019-09-04 09:29:2	6 CPU user	29.5242
08:18:09		Interface ether9(): Link down	<u>n</u>			1h 14m 4s	No	1 →			time	
08:12:20 -		Interface wlan1(): Link down	1			1h 19m 53s	No	1 →		2019-09-04 09:28:2	6 CPU user time	29.8786
08:00 •										2019-09-04 09:27:2		29.5142
07:45:31 -		Device: Temperature is above	ve warning threshold: >50			1h 46m 42s	No	1 →		2010 00-04 00.21.2	time	
07:18:03 -		Interface bridge1(created fro	om master port): High bandwid	th usage >90%		2h 14m 11s	No	4 →		2019-09-04 09:26:2		30.3644
07.00											time	

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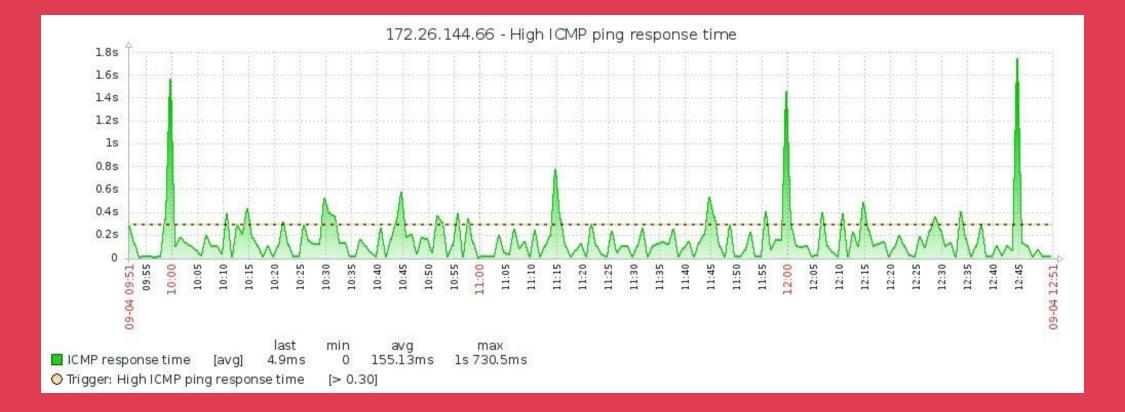
Output NMS on MikroTik Product

≡	M Gmail	٩ :	3777028						
(+	Tulis	\leftarrow	0 1 0 0 .						
	Kotak Masuk 25.763								
*	Berbintang		zabbix.notifikasi@gmail.com						
C	Ditunda	•	Problem started at 12:45:03 on 2019.09.04 Problem name: High ICMP ping response time						
\geq	Terkirim								
	Draf		Host						
~	Selengkapnya		Severity: Warning						
	zabbix - +		Original problem ID: 3777028						
			K Balas Teruskan						

Output NMS on MikroTik Product

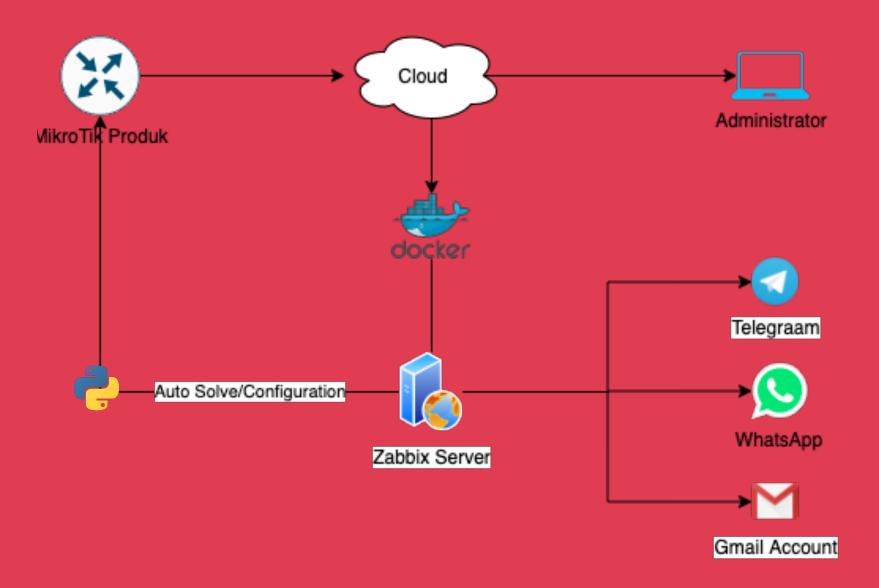
•••I TEL	_KOMSEL 🗢	20.22	۵ 52% 🔳	••II TEL	Komsel 奈	20.22	Ĩ	52% 🔳
Pok	orolan	Zabbix MSRTI 2 anggota	Z		orolan	Zabbix MSRTI 2 anggota		Z
	response	ame: High ICMP ping time 731ms PROBLEM			response	name: High ICMP ping time 731ms PROBLEM		
000	Severity: V	Warning 12	2:45		Severity: \	Warning	12:45	
P	Monitorin Problem:#	gZabbixMSRTIBot High ICMP p	in		Monitorin Problem:#	gZabbixMSRTIBot # High ICM	P pin	3
		1 11 11 11 11 11 11 11 11 11 11 11 11 1	2:45		1 10 10 10 10 10 10 10 10 10 10		12:45	
	time Trigger: H Trigger sta Trigger se	High ICMP ping responsi igh ICMP ping response atus: OK everity: Warning vent ID: 3777028			time Trigger: H Trigger sta Trigger se	High ICMP ping resp ligh ICMP ping respor atus: OK everity: Warning vent ID: 3777028		
		<mark>gZabbixMSRTIBot</mark> High ICMP ping response tir	m			gZabbixMSRTIBot High ICMP ping response	e tim	
M	140 141 141 141 141 141 141 141 141 141	High 10.99 pig response time			Lis Lis dis dis dis dis dis dis dis dis dis d	**************************************	12:51	
Ø	Pesan		00	0	Pesan		/	00

Output NMS on MikroTik Product



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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?



nanda@sekolahstartup.com



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Thank you!

Need training or B2B project contact me at @nandajabarr

www.diconfig.id @diconfig diconfigindonesia@gmail.com



References

- Telegram Notification
 <u>https://git.zabbix.com/projects/ZBX/repos/zabbi</u>
 <u>x/browse/templates/media/telegram/README.</u>
 <u>md</u>
- Email Notification
 <u>https://www.zabbix.com/documentation/curren</u>
 <u>t/manual/config/notifications/media/email</u>