

MikroTik Certified Network Associate (MTCNA)



MikroTik Master Distributor
MikroTik Certified Training Partner
www.citraweb.com



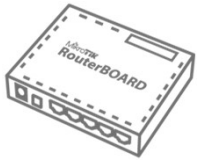
Schedule & Overview

MikroTik Basic – MTCNA Class



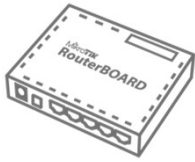
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Jadwal Materi Harian

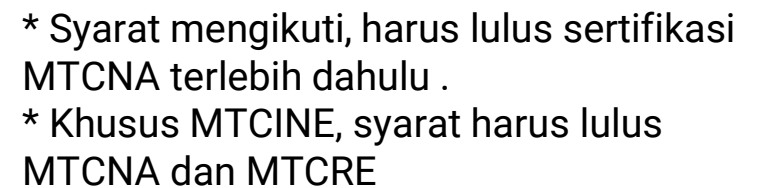
	Sesi 1 (08.30 – 10.00)	Coffee Break 1	Sesi 2 (10.30 – 12.00)	Lunch	Sesi 3 (13.00 – 15.00)	Coffee Break 2	Sesi 4 (15.30 – 17.00)
Hari 1	Overview Introduction Pre Test		Installation & Troubleshoot		Basic Config		Basic Config
Hari 2	Route		Bridge		Wireless		Firewall
Hari 3	QoS		VPN		Certification Test		

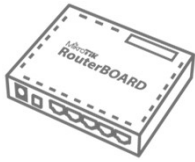


Tata Tertib

Peserta dimohon untuk :

- Mengaktifkan mode silent pada handphone, jika mendapat telepon mohon dijawab di luar kelas
- Tidak merokok di dalam gedung kantor.
- Tidak membawa makanan dan minuman ke dalam kelas (kec. minuman kemasan/botol)
- Mengikuti seluruh proses pelatihan dari awal hingga akhir
- Mematuhi semua peraturan yang berlaku

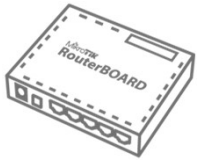




Certification Test



- Ujian online di www.mikrotik.com
- 25 Soal dalam 60 menit
- Syarat Kelulusan : nilai ujian $\geq 60\%$ atau $\geq 75\%$ (Trainer)
- Second Chance (remidial) : syarat nilai **50% – 59%**
- Ujian second chance dilakukan di hari yang sama



Langkah Register www.mikrotik.com

Akses ke halaman
www.mikrotik.com →
Account

Wajib isi yang “required”

Password akan dikirimkan ke
email setelah register selesai
dilakukan

1

LOG IN

REGISTER

Username

Password

[Forgot password?](#)

2

REGISTER

LOG IN

Registration type

☒ Natural person ☐ Legal person

Name

Nama Depan

Surname

Nama Belakang

E-mail

nama@gmail.com

Registered business address

Country

Indonesia

Province/state or region

Daerah Istimewa Yogyakarta

City

Yogyakarta

Postcode

55281

Address line

Jl Magelang km 7

3

Phone Number

Website URL

My location

Latitude, Longitude

☐ Allow to use my account from netinstall and winbox

Prove you are a human



Saya bukan robot



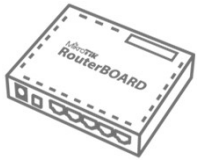
reCAPTCHA

Privasi - Persyaratan

I hereby agree to terms and conditions ([click here](#))



Remember: This information will be used on your invoice, so please fill it accurately. Please set the coordinates of your location if you plan to list your services as a consultant, trainer, reseller or distributor.



Edit Account Details

LOG IN [REGISTER](#)

Username

Password

[Log in](#)

[Forgot password?](#)

Login menggunakan email dan password

MikroTik [Home](#) [About](#) [Buy](#) [Jobs](#) [Hardware](#) [Software](#) [Support](#) [Training](#) [Account](#)

My account [Log out adyatma](#)

☰ Toggle menu

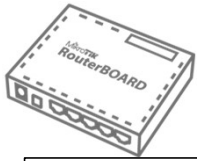
ACCOUNT INFORMATION

- [Home](#)
- [Balance](#)
- [Edit account details](#)
- [Edit email settings](#)
- [Edit consultant profile](#)
- [MUM registration history](#)

Welcome, Adyatma Yoga Kurnia!

Account notices

Pastikan nama sudah benar, bisa diubah pada “edit account detail”



Edit Account Details

MikroTik Home About Buy Jobs Hardware Software Support Training Account

My account Log out *adyatma*

license key
Transfer prepaid keys (*none*)
Make a demo key
Make a key from prepaid key
(3)

CHR LICENCES
All CHR keys
CHR orders and invoices
Transfer CHR prepaid keys
(*none*)

TRAINING
My training sessions
My certificates
Training documentation
Question Center

SUPPORT
Support contact form
My support tickets
Supout.rif viewer

Change User Information

Change password

Email privacy settings

Consultant

Associated payment card

MikroTik Forum Login

Change User Information

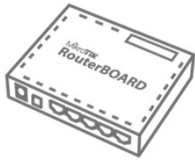
Registration type
☒ Natural person ☐ Legal person

Name
ADYATMA YOGA

Surname
KURNIA

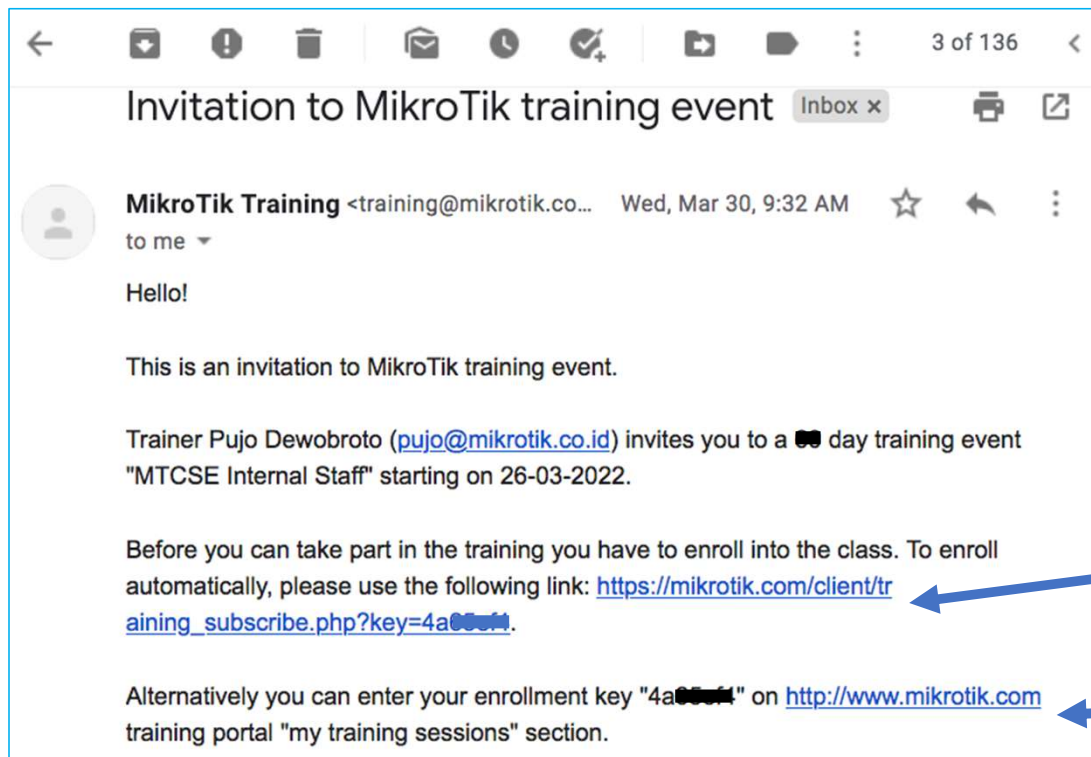
Company or organization
PT Citraweb Solusi Teknologi

Country
Indonesia



Enroll Training Class

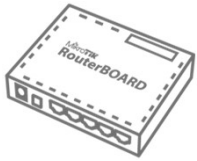
Untuk dapat mengikuti ujian sertifikasi, harus melakukan enrollment dengan cara :



Buka email Anda, cari email invitation training,

Klik link untuk otomatis enroll

Atau masukkan kode enrollment key secara manual pada akun



Enroll Training Class (2)

My account

TRAINING
My training sessions
My certificates
Training documentation
Question Center

SUPPORT
My support tickets
Supout.rif viewer

OTHER
Lockpack creator
Branding maker
Wireless link calculator

Log out

My training sessions

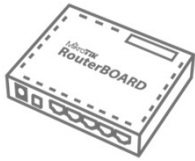
Enter enrollment key Test your knowledge!

As a student

Page: 1

Nr	Date	Place	Topic	Type	Test	WEB
1	March 26 - May 24 2022	Indonesia, Yogyakarta	MTCSE Internal Staff	MTCSE	97%	
2	August 13 - 14 2021	Indonesia, Yogyakarta	MTCRE MTCOPS Test	MTCRE	96%	

Pastikan kelas sudah bertambah, waktu, topik dan lokasi sesuai



Example Test MTCNA

My account

TRAINING
My training sessions
My certificates
Training documentation
Question Center

SUPPORT
My support tickets
Supout.rif viewer

OTHER
Lockpack creator
Branding maker
Wireless link calculator

Log out

My training sessions

Enter enrollment key

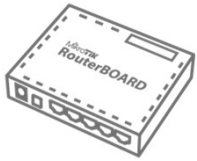
Test your knowledge!

As a student

Page: 1

Nr	Date	Place	Topic	Type	Test	WEB
1	March 26 - May 24 2022	Indonesia, Yogyakarta	MTCSE Internal Staff	MTCSE	97%	
2	August 13 - 14 2021	Indonesia, Yogyakarta	MTCRE MTCOPS Test	MTCRE	96%	

Simulasi model soal ujian sertifikasi



Free Prepaid Key License Level 4

mikrotik

My account

ROUTEROS KEYS

- Search and view all keys
- Request RouterBOARD license key
- Transfer prepaid keys (*none*)
- Make a demo key
- Make a key from prepaid key (3)**

Home About Buy Jobs Hardware Software Support Training Account

Log out *adyatma*

Convert prepaid key to licence key

Prepaid keys

License L4/P1 (3) ▼

Software ID*

Place in folder

Generated keys 2022 ▼

Generate

↑

Setiap kali mengikuti ujian sertifikasi MikroTik akan diberikan 1 License Lv 4 GRATIS

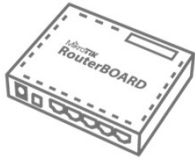
Introduction

MikroTik Basic – MTCNA Class



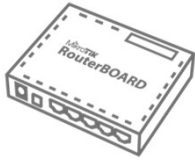
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Citraweb Solusi Teknologi

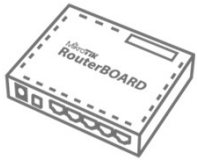
- Using Mikrotik since 2001, as Wireless ISP (CitraNet)
- Mikrotik OEM Authorized Reseller (2002)
<http://www.mikrotik.com/buy>
- One engineer:
Mikrotik Certified Consultant (2005)
<http://www.mikrotik.com/consultants>
Mikrotik Certified Training Partner (2005)
<http://www.mikrotik.com/training>



Citraweb Solusi Teknologi (2)

- Head Office
 - Jalan Petung 31 Papringan
Yogyakarta, 55281
Telp: 0274-554444
Fax: 0274-553055
- Rep. Office
 - Gedung Cyber Lt 11
Jl Kuningan Barat 8 Jakarta 12710
Telp: 021-5209612
Fax: 021-5209614

www.mikrotik.co.id
www.citraweb.com

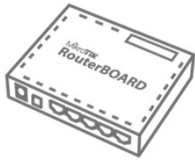


MikroTik ??

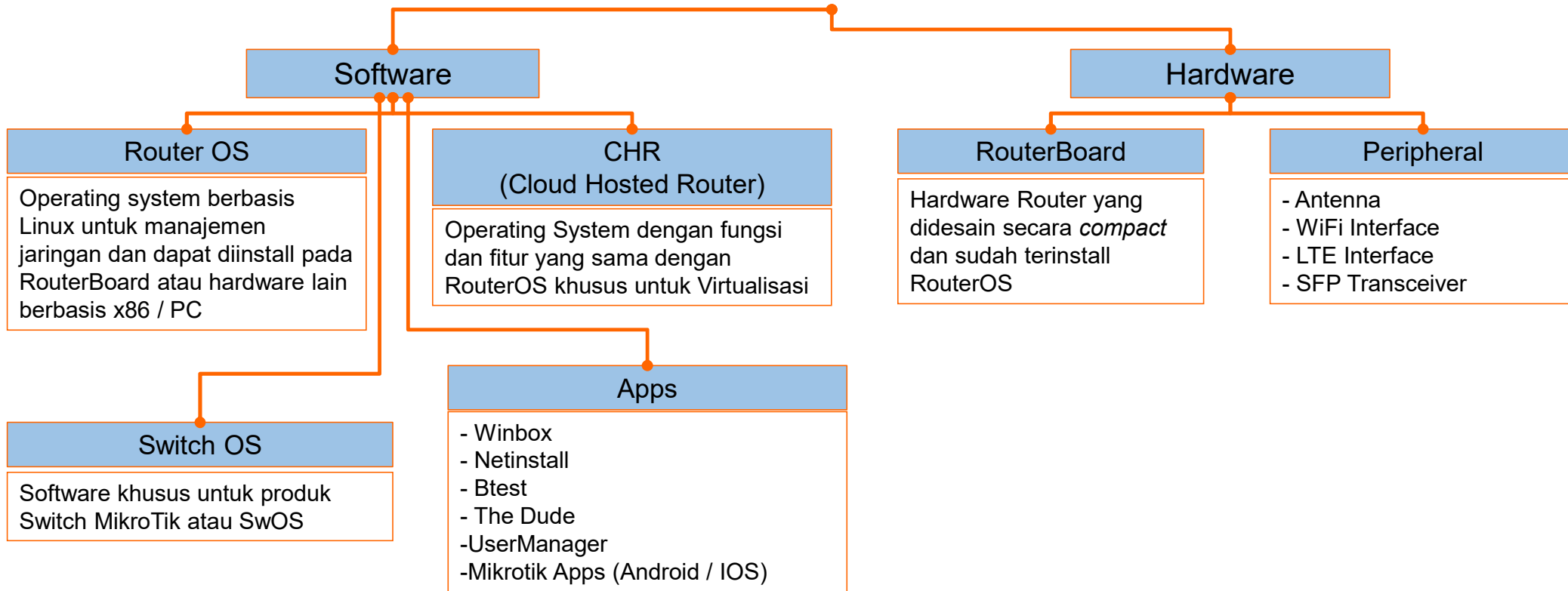
Mikrotik adalah kependekan dari **“mikrotikls”**
Artinya: “network kecil” dalam bahasa Latvia

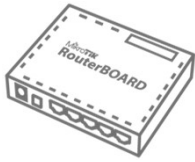


www.mikrotik.com



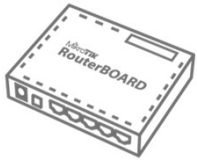
MikroTik Product





RouterOS Feature

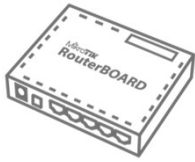
- IP Routing
 - Static, policy, dynamic (RIP, OSPF, BGP), multicast
- Interface
 - Ethernet, Wireless, Bridge, Tunnel, VPN, MPLS
- Firewall
 - Filter, Mangle, NAT, L7 protocol, Fasttrack
- Bandwidth Management
 - HTB, PFIFO, BFIFO, SFQ, PCQ, RED
- Services (Server)
 - Proxy, Hotspot, DHCP, DNS, DDNS, NTP, User-Manager, Samba
- AAA
 - Radius Client, IP Accounting, Traffic Flow
- Monitoring
 - Graphs, Watchdog, Torch, Custom Log, SNMP, The Dude, Netwatch
- Diagnostic Tools & Scripting
 - Ping, Tracert, Scheduler, Scripting, Capsman
- VRRP



RouterOS License Level

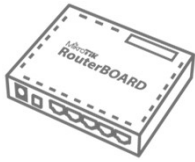
Level	0	1	3	4	5	6
PRICE	GRATIS	DAFTAR	NOT SALE	BERBAYAR		
Wireless AP	24H trial	-	-	Yes		
Wireless Client and Bridge	24H trial	-	Yes			
RIP, OSPF, BGP protocols	24H trial	-	Yes			
EoIP tunnels, KVM, Queues	24H trial	1	unlimited			
PPPoE, PPTP, L2TP tunnels	24H trial	1	200	200	500	unlimited
OVPN tunnels	24H trial	1	200	200	unlimited	
VLAN interfaces	24H trial	1	unlimited			
HotSpot active users	24H trial	1	1	200	500	unlimited
RADIUS client, Web proxy	24H trial	-	yes			
Usermanager active sessions	24H trial	1	10	20	50	unlimited

<http://wiki.mikrotik.com/wiki/Manual:License>



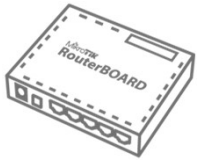
RouterOS License

- Lisensi bersifat lifetime, tidak ada batasan masa aktif dan kewajiban update lisensi berkala
- Tersedia lisensi gratis yang dapat digunakan untuk pengecekan kesesuaian hardware
 - Level 0 (trial) – batas masa aktif 24 jam, tidak ada batasan fitur
 - Level 1 (demo) – tidak terdapat batasan masa aktif, terdapat batasan pembuatan rule
- Tidak ada batasan interface pada semua lisensi / unlimited interfaces
- Upgrade versi RouterOS bisa dilakukan secara gratis tanpa ada batasan



MikroTik RouterBoard (RB)

- Merupakan produk hardware yang dibuat khusus untuk kebutuhan manajemen jaringan. Dan didalamnya sudah terdapat sistem operasi routerOS atau SwitchOS (SwOS).
- Terbagi menjadi beberapa kategori
 - Router
 - Wireless Router
 - LTE Router
 - Switch



RB for Wireless Outdoor



Metal series

CPU : 720MHz
RAM : 64MB
Ethernet : 1GE
Radio : 1

BaseBox series

CPU: 600Mhz
RAM : 64MB
Ethernet : 1GE
Radio : 1
MiniPCI-e slots : 1
SIM slots : 1



Groove series

CPU : 600/720Mhz
RAM : 64MB
Ethernet : 1FE/1GE
Radio : 1

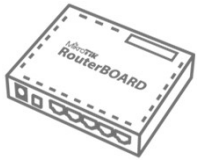


NetMetal series

CPU : 716/720Mhz
RAM : 128/256 MB
Ethernet : 1GE
Radio : 1/2
SFP : 1
MiniPCI-e slots : opt
SIM slots : opt



Seri produk wireless outdoor MikroTik yang dapat ditambahkan antenna external



RB for Wireless Indoor



wAP Series
802.11 a/b/g/n/ac
Dual Chain & Triple Chain



cAP Series
802.11 a/b/g/n/ac
Dual Chain



RB4011iGS+5HacQ2HnD
802.11 a/b/g/n/ac
Dual & Quad Chain



Audience
802.11 a/b/g/n/ac
Dual & Quad Chain



mAP Series

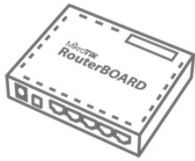


hAP Series
802.11 a/b/g/n/ac
Dual & Triple Chain



RB2011UiAS-2HnD

Seri produk wireless indoor MikroTik yang dapat digunakan untuk distribusi WiFi dalam ruangan



RB for Indoor Router



Cloud Core Router Series

CPU : 1-1,7Ghz(4/9/16/36/72 Core)
RAM : 2/4/16GB
Ethernet : 1/7/8/12GE
SFP (1 G) and SFP+ Cage



RB450Gx4

CPU : 716MHz (4Core)
RAM : 1GB
Ethernet : 5GE



RB3011UiAS-RM

CPU : 1.4Ghz Dual
RAM : 1GB
Ethernet : 10GE
SFP : 1



RB4011iGS+RM

CPU : 1.4Ghz (4Core)
RAM : 1GB
Ethernet : 10GE
SFP : 1SFP+



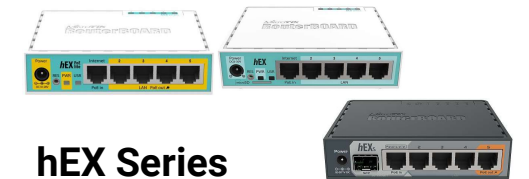
RB1100AHx4 / 1100Dx4

CPU : 1.4Ghz (4Core)
RAM : 1GB
Ethernet : 13GE



RB2011 Series

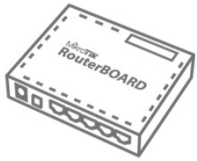
CPU : 600MHz
RAM : 128/64MB
Ethernet : 5FE+5GE
SFP Cage



hEX Series

CPU : 650/800/850/880MHz
RAM : 32/64MB
Ethernet : 5(GE/FE)

Seri produk MikroTik yang ideal digunakan sebagai Router Utama (Core Router)



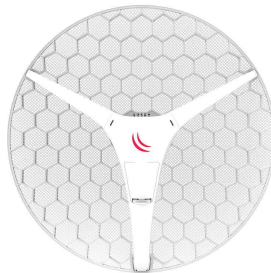
Embbded RB



QRT
802.11 a/n/ac
24 dBi antenna



DynaDish 5
802.11 a/n/ac
25 dBi antenna



LHG Series
802.11 a/b/g/n/ac
18 dBi – 27 dBi antenna



OmniTIK
802.11 a/n/ac
7,5 dBi antenna



mANTBox
802.11 a/b/g/n/ac
12dBi – 19dBi antenna



SXT Series
802.11 a/b/g/n/ac
10dBi – 16dBi antenna

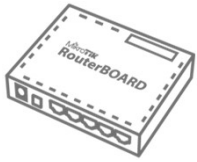


Disc Lite
802.11 a/n/ac
21 dBi antenna



LDF
802.11 a/n/ac
9 dBi antenna
* Dapat ditambah satellite
offset dish antennas

Seri produk wireless outdoor MikroTik yang sudah termasuk antenna



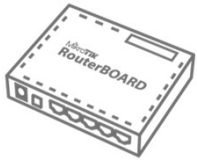
LTE4 Router

- RBLHGR&R11e-LTE (LHG LTE-Kit)
- RBSXTR&R11e-LTE (SXT LTE-Kit)
- RBwAPR-2nD&R11e-LTE (wAP LTE-Kit)
- RBwAPGR-5HacD2HnD&R11e-LTE (wAP ac LTE-Kit)
- RBLtAP-2HnD&R11e-LTE (LtAP LTE-Kit)



support International LTE bands 1, 2, 3, 7, 8, 20, 38 dan 40

Daftar lengkap : <http://mikrotik.co.id/produk.php?kategori=70>



Manageable Switch



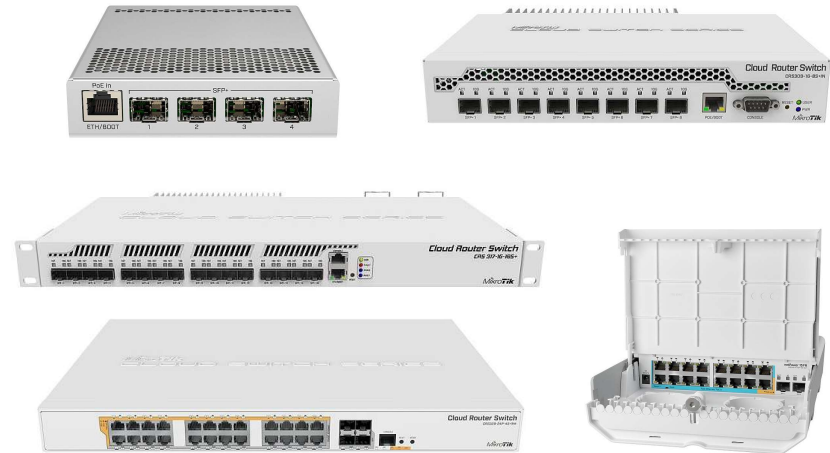
Mikrotik SwOS

RB260 Series, CSS series



Mikrotik RouterOS

CRS 1xx Series, CRS 2xx Series



Dual Boot (RouterOS/SwOS)

CRS 3xx Series

Seri produk Manageable Switch MikroTik dengan kemampuan Layer2 dan Layer3 Management serta pilihan PoE-Output

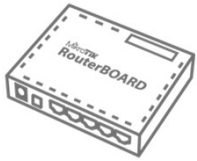


Discontinue RB

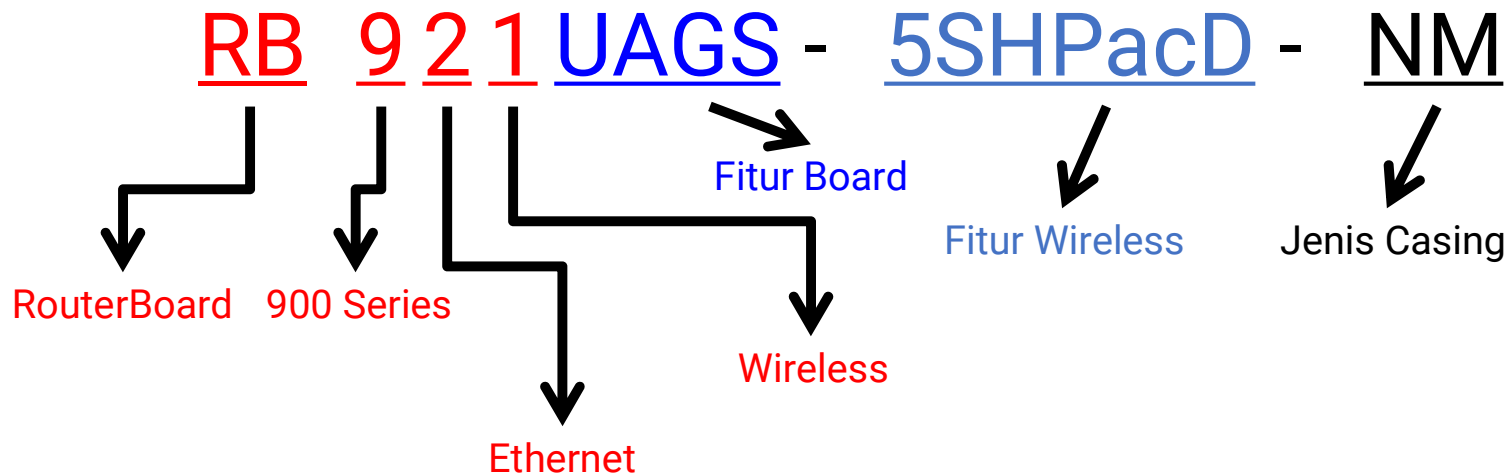
- RB100 series
 - RB112, RB133, RB133C
 - RB153, RB150, RB192
- RB200 series
 - RB230
- RB300 series
 - RB333
- RB400 series
 - RB411A, RB411R, RB 411AH
- RB500 series
 - RB532, RB511
- RB600 series
 - RB600
- RB700 series
 - RB750G, RB750GL, 750Gr, 750Gr2
- RB800 series
- RB1000 series
 - RB1000, RB1200, RB1100, RB1100AH, RB1100AH, RB1100AHx2

Daftar lengkap : <http://mikrotik.co.id/produk.php?kategori=47>



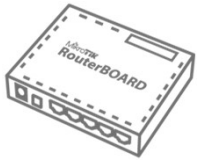


Product Naming (RB)

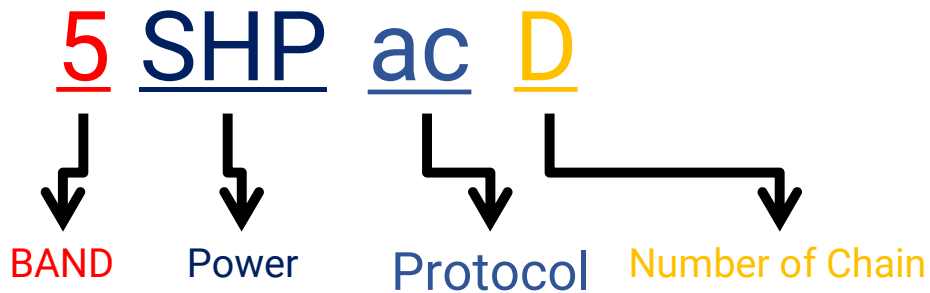


Fitur Board

U	: USB	G	: Gigabit Ethernet
P	: PoE-Out	L	: Lite Edition
i	: Single PoE-Out	S	: SFP
A	: RAM	e	: PCIe
H	: CPU	R	: MiniPCle



Product Naming (2)



Band :

5 : 5GHz
2 : 2GHz
52 : dual band 5GHz dan 2GHz

Power per chain :

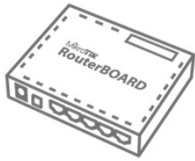
H : High (23-24dBm)
HP : High Power (25-26dBm)
SHP : Super High Power (>27dBm)

Protocol :

n : 802.11n
ac : 802.11ac

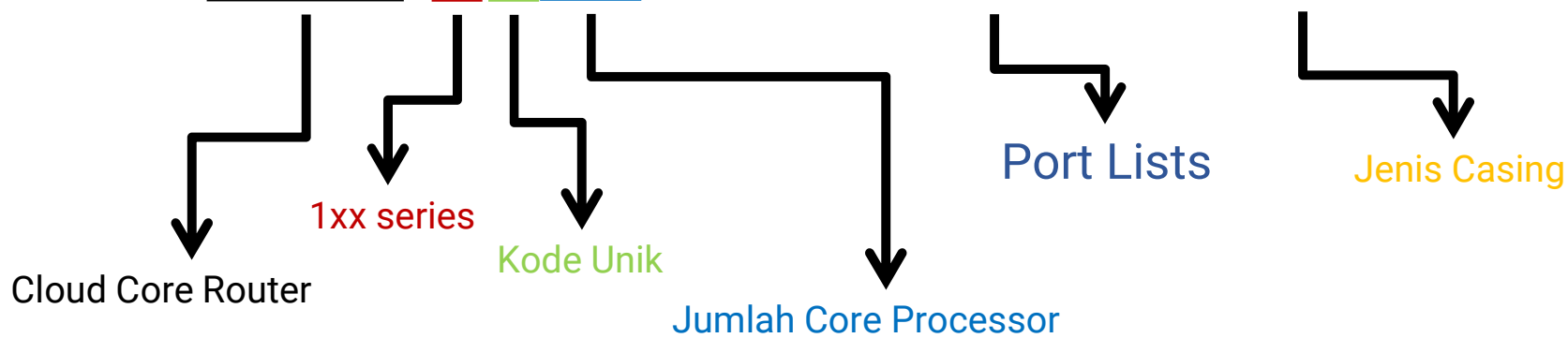
Number of chain :

D : Dual Chain
T : Triple Chain



Product Naming (CCR)

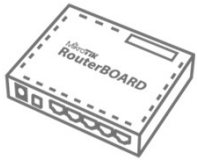
CCR 1009 - 7G-1C-1S+ PC



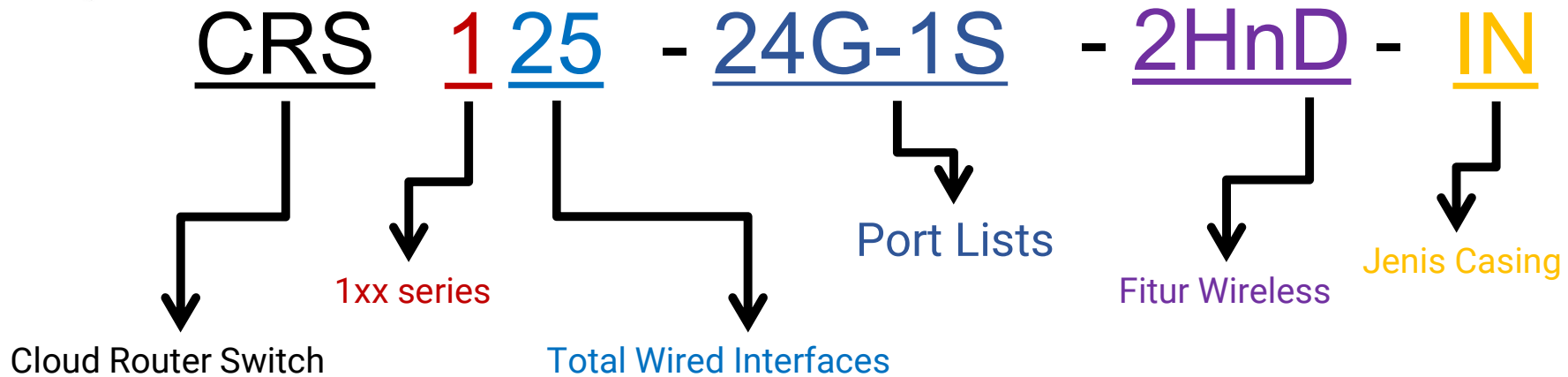
Jenis Casing
 EM : Extended Memory
 PC : Passive Cooling

Port Lists

<n>G	: 1G Ethernet Ports	<n>S+	: 10G SFP+ ports
<n>P	: 1G Ethernet Ports with PoE-out	<n>XG	: 5G/10G Ethernet ports
<n>C	: Combo 1G Ethernet/SFP ports	<n>XP	: 5G/10G Ethernet ports with PoE-out
<n>S	: 1G SFP ports	<n>XC	: Combo 10G/25G SFP+ ports
<n>G+	: 2.5G Ethernet ports	<n>XS	: 25G SFP+ ports
<n>P+	: 2.5G Ethernet ports with PoE-out	<n>Q+	: 40G QSFP+ ports
<n>C+	: Combo 10G Ethernet/SFP+ ports	<n>XQ	: 100G QSFP+ ports



Product Naming (CRS)



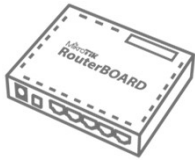
Jenis Casing

BU	: Board Unit	SA	: Sectoral Antenna
RM	: Rack Mount	HG	: High Gain Antenna
IN	: Indoor enclosure	BB	: BaseBox Enclosure
EM	: Extended Memory	NB	: NetBox Enclosure
LM	: Light Memory	NM	: NetMetal Enclosure
BE	: Black Edition	QRT	: QRT Enclosure
TC	: Tower Case	SX	: Sextant Enclosure
PC	: Passive Cooling (CCR)	PB	: PowerBox Enclosure
Out	: Outdoor Enclosure		

https://wiki.mikrotik.com/wiki/Manual:Product_Naming

MikroBits

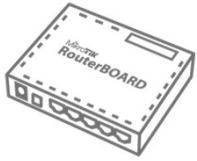




Mikrobits – Ainos

- **Multi Core Processor**
- 1U rackmount
- 4 GB DDR4 2400 ECC RAM
 - Industrial grade
- Performance :
 - **2-4 Gbps** full duplex
- 9000 jumbo frame supported
- **8** Gigabit Ethernet, **2** 10G SFP+ (option extended with PCIe 8x connector interface)

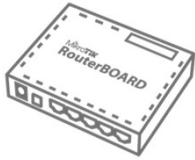




Mikrobits – Dinara

- **Xeon Multi Core Processor**
- 1U rackmount
- 8 GB DDR4 2400 ECC RAM
 - Industrial grade
- Performance :
 - **5-8 Gbps** full duplex
- 300 Watt Redundant PSU
- 9000 jumbo frame supported
- **8** Gigabit Ethernet, **8** 1G SFP, **2** 10G SFP+



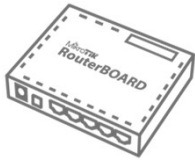


Mikrobits – Etna

- **Entry Level Multi Purpose Server**
- AMD Multi Core Processor
- 2x8GB DDR4 2400 ECC RAM
 - Industrial grade
- 4 x Hot-Swap HDD / SSD
- 300 Watt Redundant PSU
- 9000 jumbo frame supported
- 2 port 10G RJ45
- IPMI (Intelligent Platform Management Interface)
- OS : Linux, Windows, Virtualization Host, FreeNas, RouterOS(v7.1 stable)

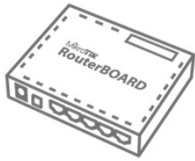


Jadi
Router mana yang sesuai
untuk jaringan Saya ?



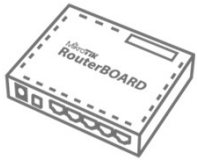
Quick Tips

- Kenalilah kebutuhan Anda :
 - Fungsi perangkat (Router, Server dll)
 - Jumlah trafik (Real Troughput)
 - Fitur yang dibutuhkan (Proxy, Hotspot, Radius)
 - Interface yang dibutuhkan
- Baik menggunakan PC ataupun menggunakan Routerboard, fitur Mikrotik RouterOS selalu sama (tergantung pada level yang digunakan)



Buyer Guide

- Home Network ($\leq$ **10Mbps** Traffic)
 - *hAP lite, hAP mini, hEX-lite, LtAP mini*
- Small Office Home Office Network($\leq$ **30Mbps** Traffic)
 - *hAP series, hEX series, RB2011 Series, Audience*
- Medium Network(Campus, School) ($\leq$ **100Mbps** Traffic)
 - *RB450Gx4, RB3011 series, RB4011 series, RB1100AHx4*
- Corporate Network ($\leq$ **1Gbps** Traffic)
 - *CCR1009, CCR1016*
- Enterprise Network ($\leq$ **5Gbps** Traffic)
 - *Ainos, CCR1036*
- Big Network ($\geq$ **5Gbps** Traffic)
 - *Dinara, CCR 1072*



Product Compare

www.routerboard.co.id



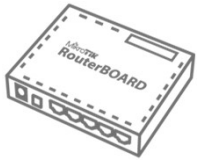
Perbandingan Board Mikrotik

routerboard.co.id

CITRAWEB NUSA INFOMEDIA
www.mikrotik.co.id
info@mikrotik.co.id

Share Tweet

Pilih Board	RB450Gx4	RB760iGS	--pilih board--	--pilih board--	--pilih board--	liha
Product Code	RB450Gx4	RB760iGS				
Picture						
Architecture	ARM	MMIPS				
CPU	IPQ-4019	MT7621A 2 Core 4 thr				
CPU Speed	716MHz	880Mhz				
Current Monitor	No	No				
Main Storage/NAND	512MB	16MB				
RAM	1GB	256MB				
SFP Ports	0	1				
LAN Ports	5	5				
Gigabit	Yes	Yes				
Switch Chip	1	1				



Pembelian Mikrotik



Website :

www.citraweb.com

www.mikrotik.co.id

www.mikrotik.id

Marketplace :



Tokopedia : www.tokopedia.com/citraweb



Bukalapak : www.bukalapak.com/u/citraweb



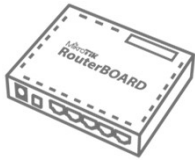
Shopee : www.shopee.co.id/citraweb



Blibli : mtik.id/blibli



Lazada : www.lazada.co.id/shop/citraweb



After Sales

Garansi dan perbaikan
www.mikrotik.id/RMA

Cek Garansi Citraweb

Device Search :

Pencarian Serial Number, Mac-Address dan SoftwareID (max 5 device)

example S/N : 94550B40XXXX
Mac-Add : C4:AD:34:XX:XX:XX
Sof-ID : 8779-XXXX
IMEI : 35565409XXXXXX

Cari

www.mikrotik.co.id/warranty_check.php

Konsultasi dan Pertanyaan
www.mikrotik.id/layanan

Layanan			
Anda dapat mengirimkan pertanyaan seputar produk Mikrotik di aplikasi layanan ini. Pilihlah topik yang sesuai dengan pertanyaan yang ingin Anda ajukan. Pertanyaan Anda dan jawabannya hanya dapat dibaca oleh Anda dan tidak dapat dibaca oleh user lainnya.			
Kategori	#Topik	Topik Terakhir	Posting Terakhir
General Networking	0	Tidak Ada Topik	Tidak Ada Posting
Wireless / Routerboard	0	Tidak Ada Topik	Tidak Ada Posting
Kerusakan Barang	0	Tidak Ada Topik	Tidak Ada Posting
Mikrotik Training	0	Tidak Ada Topik	Tidak Ada Posting
Administrasi	0	Tidak Ada Topik	Tidak Ada Posting
Pertanyaan Lainnya	0	Tidak Ada Topik	Tidak Ada Posting
Pemesanan Barang (inden) dan Informasi Stok	0	Tidak Ada Topik	Tidak Ada Posting
BGP-Peer Mikrotik Indonesia	0	Tidak Ada Topik	Tidak Ada Posting
Event	0	Tidak Ada Topik	Tidak Ada Posting

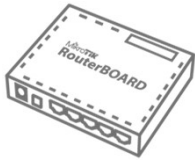
Installation

MikroTik Basic – MTCNA Class



MikroTik Master Distributor
MikroTik Certified Training Partner
www.citraweb.com

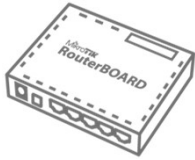




Media Storage

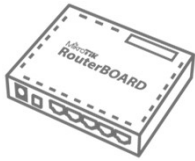
- RouterOS bisa digunakan untuk routerboard ataupun PC (x86)
- Media yang digunakan untuk OS :
 - Harddisk
 - CF Disk
 - DOM (Disk On Module)
 - USB Flashdisk
 - NAND Storage (RB Only)



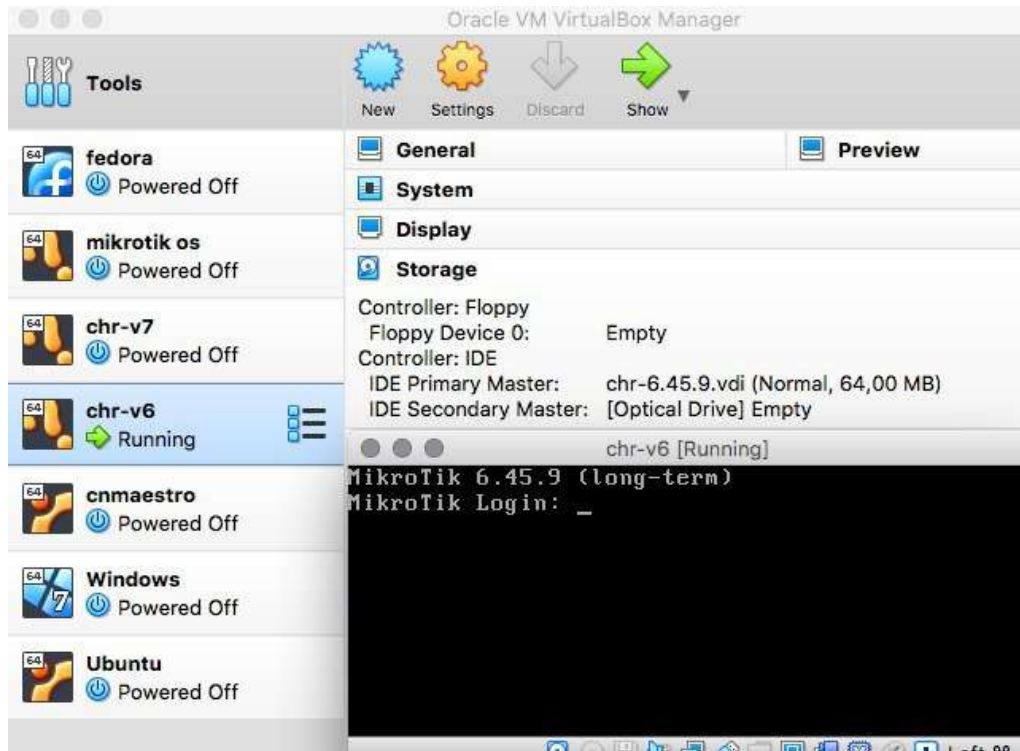


Installation Method RouterOS

- CD (untuk PC x86)
 - Download .iso
 - Burn ke CD
 - Set PC boot to CDRom lalu Install
 - (langkah detil : http://mikrotik.co.id/artikel_lihat.php?id=113)
- Netinstall (untuk PC x86 / RB)
 - Download .npk + Netinstall.exe
 - Set boot to ethernet
 - Install
 - (langkah detil : http://www.mikrotik.co.id/artikel_lihat.php?id=25)
- CHR (Untuk virtualiasi)
 - Download .vdi / .vmdk
 - Mount di virtualbox
 - Running
 - (langkah detil : http://www.mikrotik.co.id/artikel_lihat.php?id=158)



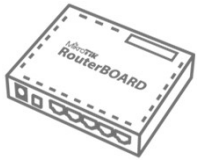
CHR



Lisensi	Speed Limit
Free	1 Mbit
P1	1 Gbit
P10	10 Gbit
P Unlimited	Unlimited

Full RouterOS Feature

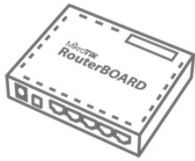
Bisa diinstall di Vmware, VirtualBox, Hyper-V, Linode, AWS, Proxmox, dll.



Download Area

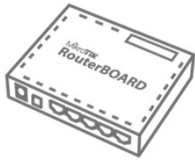
Software			Downloads	Changelogs	Download archive	RouterOS	The Dude	Mobile apps
RouterOS v7								
	7.2.1 Stable	7.3beta37 Testing						
ARM								
Main package								
Extra packages								
ARM64								
Main package								
Extra packages								
MIPSBE								
Main package								
Extra packages								
MMIPS								
Main package								
Extra packages								

www.mikrotik.com/download

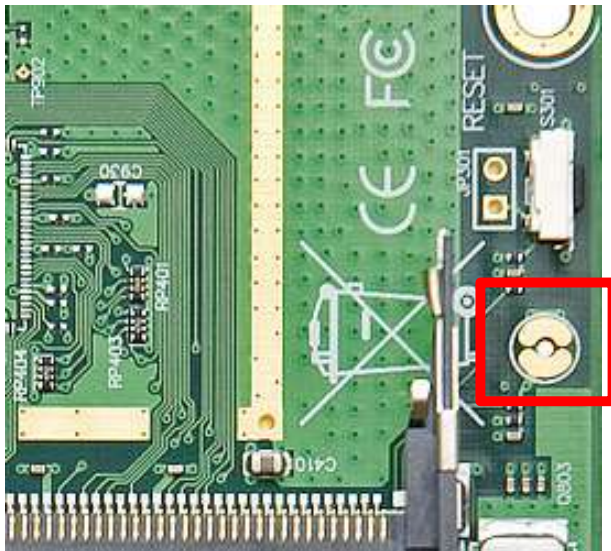
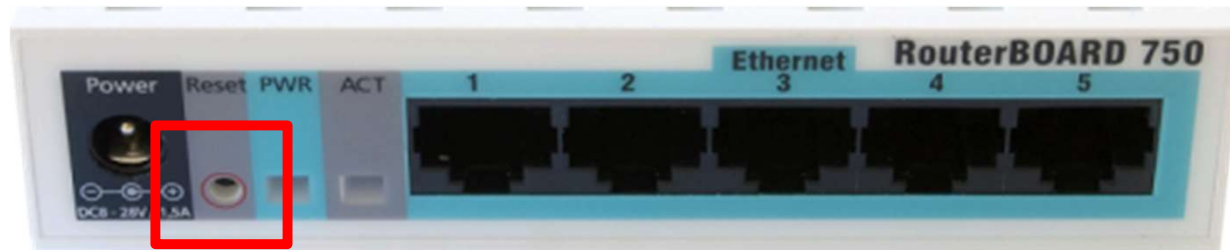


RouterOS Package

Jenis Package	Tipe Router
MIPSBE	RB4xx, RB7xx, RB9xx, Groove, Metal, Omnitik, RB2011 Series, wAP Series, cAP Series
SMIPS	hAPLite, hAPMini, hAPLite-TC
MMIPS	hEX, hEX S
PowerPC (PPC)	RB3xx, RB6xx, RB8xx, RB1100AHx2
Tilera (Tile)	CC1009 Series, CCR1016, CCR1036 Series
ARM	RB3011 Series, RB4011 Series, RB1100AHx4, RB1100Dx4
ARM64	CCR2116, CCR2216, RB5009, CCR2004 Series,
x86	PC x86 / PC Router
CHR	Virtual Machine (virtualbox, dsb)

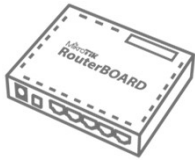


Reset Button



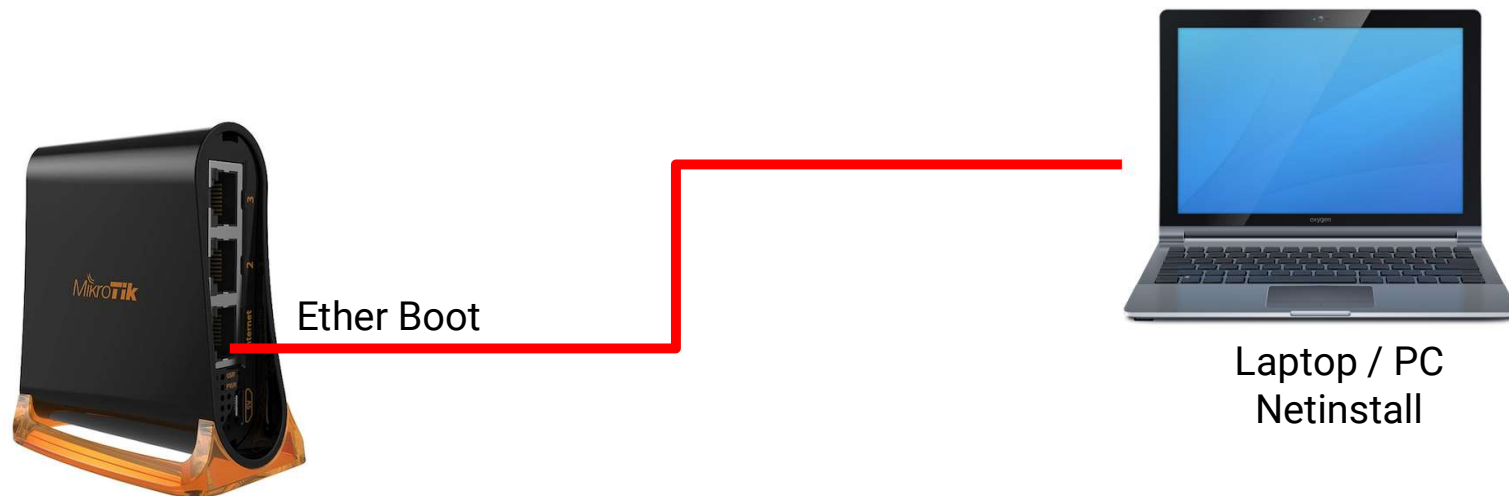
Tombol reset hanya bekerja sebelum proses OS dimulai, jadi router harus dalam kondisi mati dahulu baru ditekan dan ditahan tombol resetnya

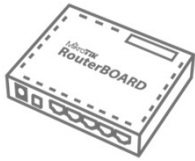
1. Ditahan 3 detik → load backup routerboot loader
2. Ditahan 2 detik → reset configuration (led flash kedip)
3. Ditahan 5 detik → mengaktifkan CAP (led flash nyala solid)
4. Ditahan 5 detik → netinstall mode (led mati)



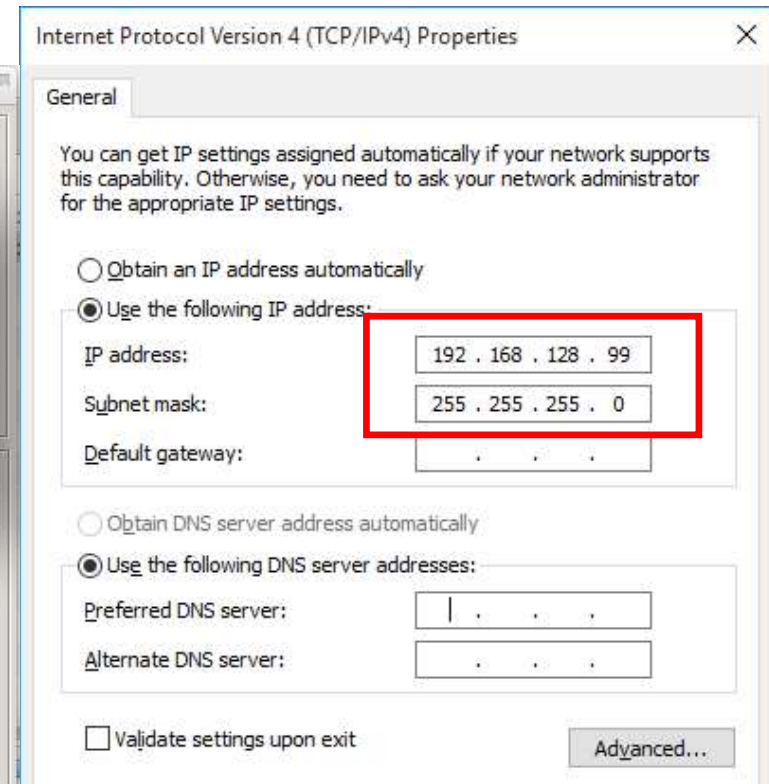
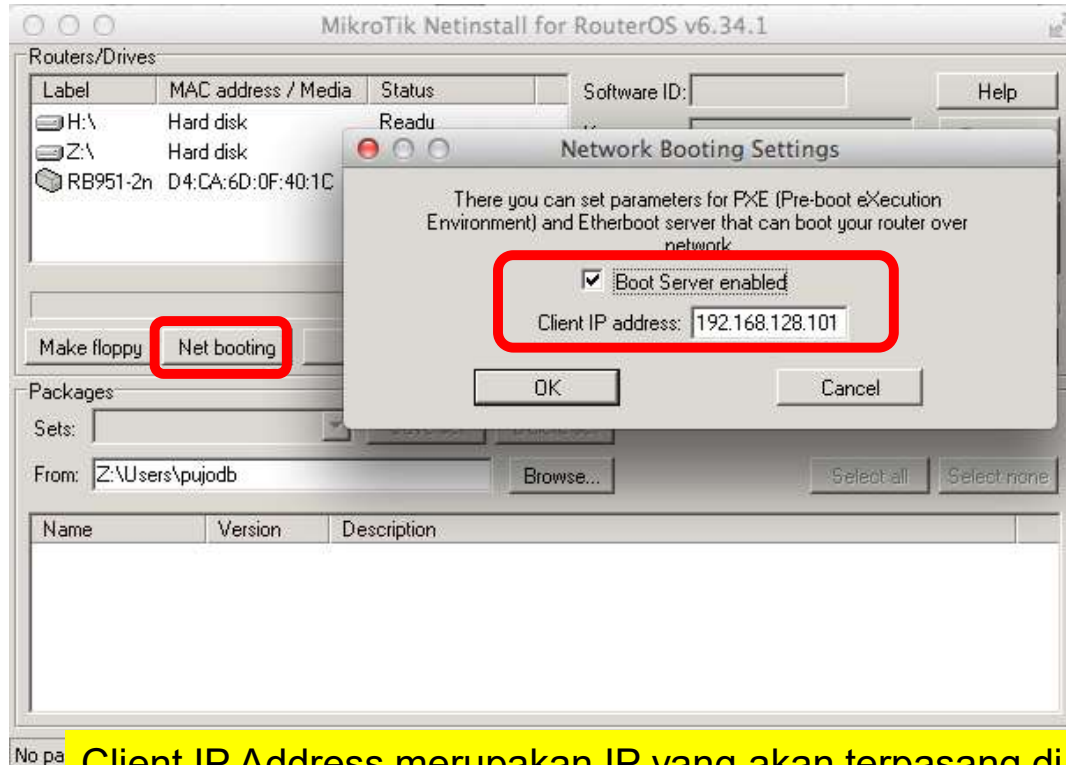
Netinstall (1)

- Kabel Ethernet dari laptop yang menjalankan Netinstall, terhubung ke **ether1** atau ke port **Boot** pada Routerboard
- Selain itu juga bisa untuk netinstall ke sebuah PC router, jika PC router tersebut support boot via ethernet (PXE)
- Untuk mengakses RouterBOOT (Bios) via Serial, dapat menggunakan baud-rate=115200

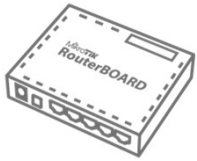




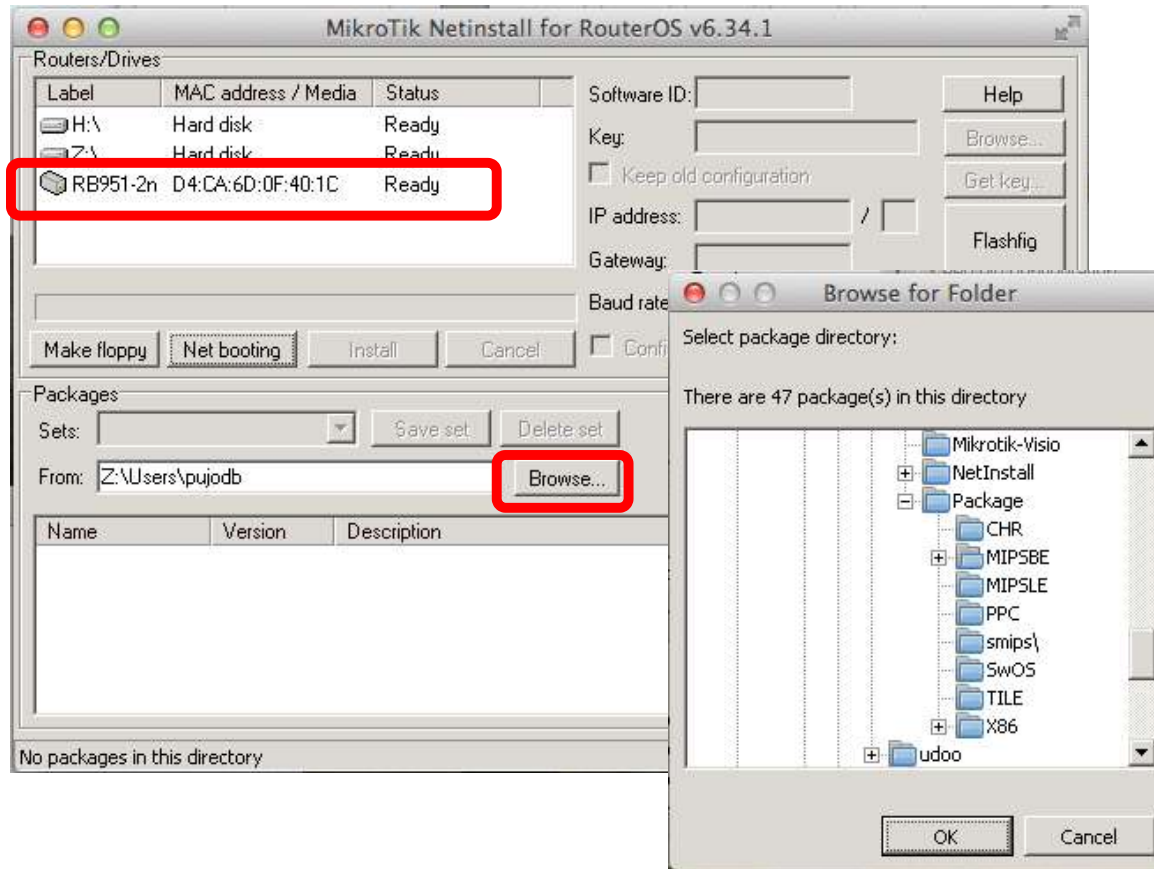
Netinstall (2)

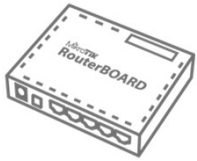


Client IP Address merupakan IP yang akan terpasang di router untuk proses instalasi dan harus 1 network dengan IP laptop

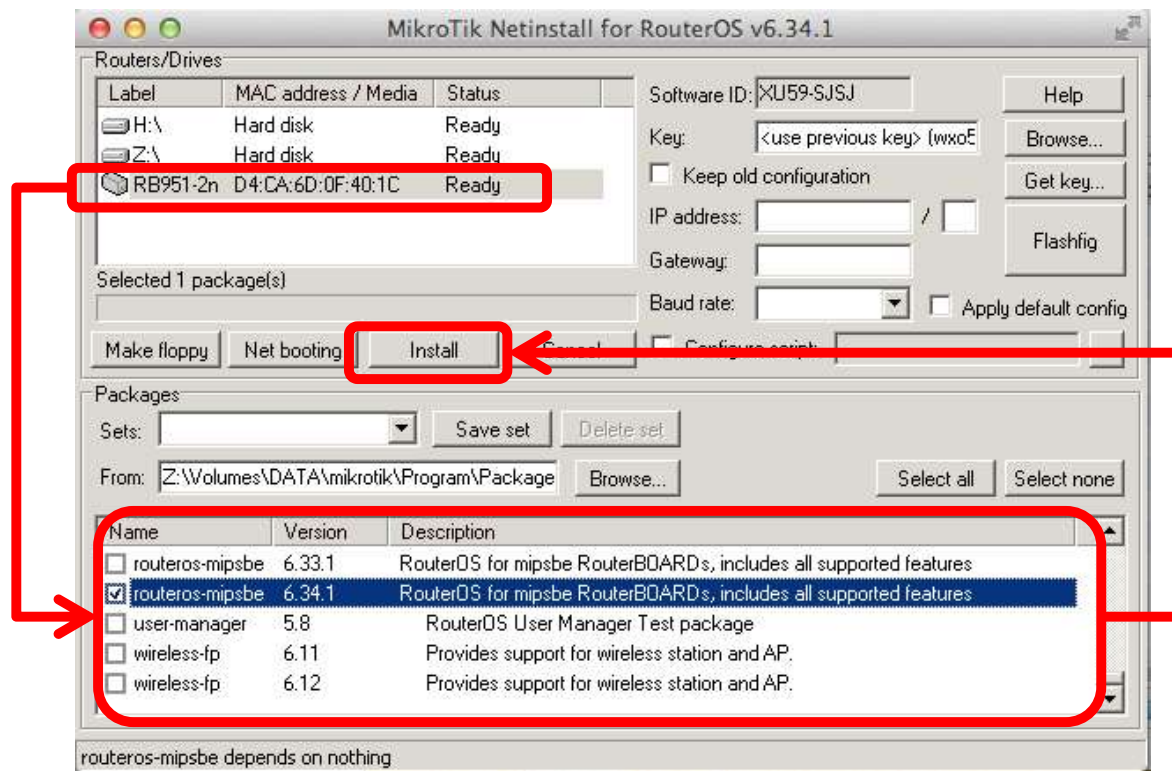


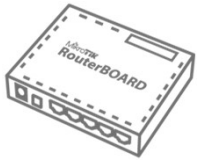
Netinstall (3)





Netinstall (4)





Netinstall (5)

MikroTik Netinstall for RouterOS v6.34.1

Routers/Drives

Label	MAC address / Media	Status
H:\	Hard disk	Ready
Z:\	Hard disk	Ready
☒ RB951-2n	D4:CA:6D:0F:40:1C	OK

Software ID: XU59-SJSJ

Key: <use previous key> (wwwE

☐ Keep old configuration

IP address: /

Gateway:

Baud rate: Apply default config

Flashfig

Installation finished successfully

Make floppy Net booting Install Cancel

Configure script:

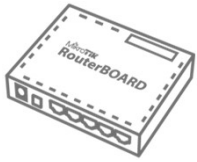
Packages

Sets: Save set Delete set

From: Z:\Volumes\DATA\mikrotik\Program\Package Browse... Select all Select none

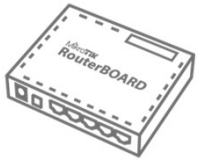
Name	Version	Description
☐ routeros-mipsbe	6.33.1	RouterOS for mipsbe RouterBOARDS, includes all supported features
☒ routeros-mipsbe	6.34.1	RouterOS for mipsbe RouterBOARDS, includes all supported features
☐ user-manager	5.8	RouterOS User Manager Test package
☐ wireless-fp	6.11	Provides support for wireless station and AP.
☐ wireless-fp	6.12	Provides support for wireless station and AP.

routeros-mipsbe depends on nothing



RouterOS Package (RouterOS v6)

Package	Fungsi
Advanced Tools	Advanced ping tools, netwatch, ip-scan, sms, WOL
DHCP	DHCP Server & Client
Hotspot	Hotspot Captive Portal
IPv6	Support IPv6
MPLS	Support MPLS
PPP	PPP, L2TP, PPPoE, PPTP, SSTP, OpenVPN
Routing	RIP, BGP, OSPF dan fungsi dynamic routing filter
Security	IPSec, SSH, Secure Winbox
System	Fungsi dasar router (static route, ip address, telnet, firewall, queue, webproxy, dns, tftp, snmp, email, ping, traceroute)
Wireless	Fitur Wireless router (interface wireless, capsman, dll)



RouterOS Package (RouterOS v7)

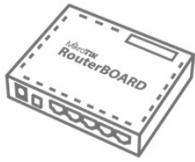
MAIN PACKAGE

Package	Berisi Package
RouterOS	Advanced Tools, DHCP, Hotspot, MPLS, PPP, System, Routing, Wireless, dll

EXTRA PACKAGE

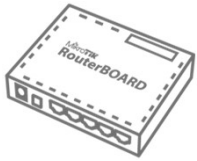
Package	Fungsi
User Manager	Radius Server
Dude	Network Monitoring (Jenis router tertentu)
LTE	Support untuk LTE
GPS	Support untuk GPS

<http://wiki.mikrotik.com/wiki/Manual:System/Packages>



Upgrade RouterOS

- Manual
 - Winbox (drag n drop package ke menu files)
 - FTP (upload file package ke router)
 - The Dude
- Automatic
 - Check for Update (direct to mikrotik.com)
 - Auto Upgrade (mirror lokal)



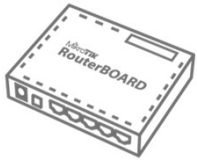
Manual Upgrade

The screenshot illustrates the steps for a manual upgrade in Mikrotik WinBox:

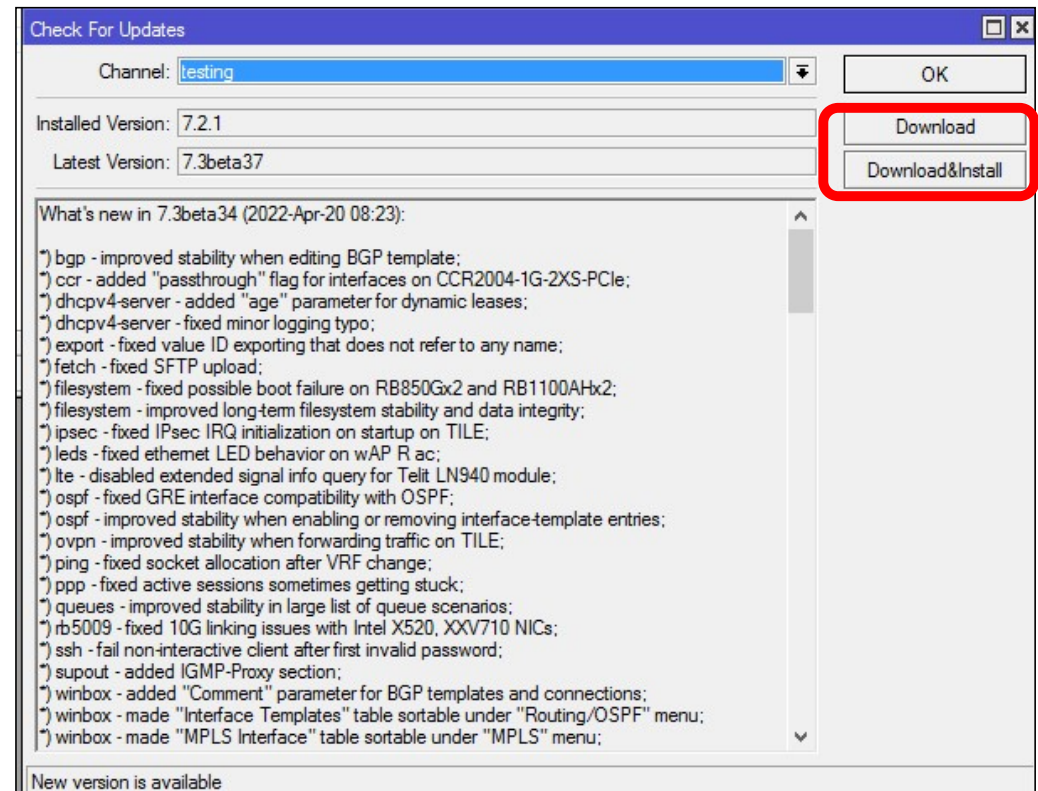
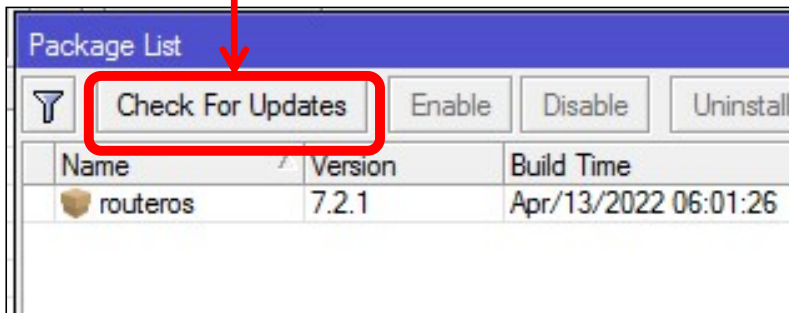
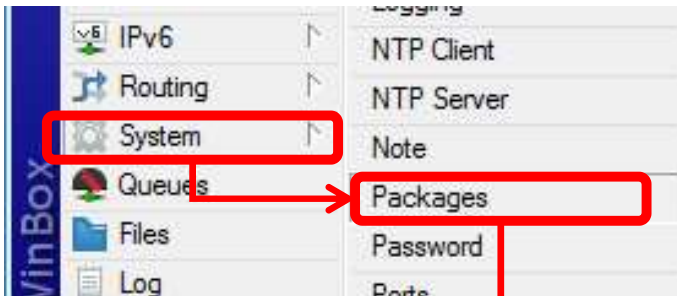
- Click on the **Files** menu in the left sidebar.
- The **File List** window opens. Click on the **Upload...** button.
- Click on the **System** menu in the left sidebar.
- A sub-menu opens. Click on the **Reboot** option.

File Name	Type	Size	Creation Time
routeros-7.1-smips.npk	package	7.3 MiB	Jan/19/1970 23:09:22
skins	directory		Jan/01/1970 00:00:05

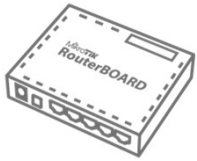
Upgrade cukup dengan soft-reboot
/system reboot



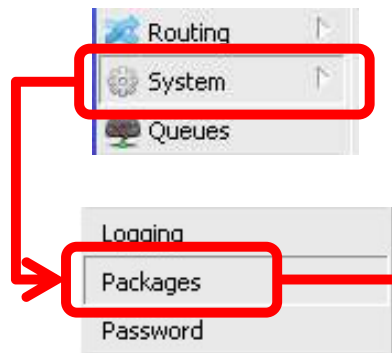
Check For Updates



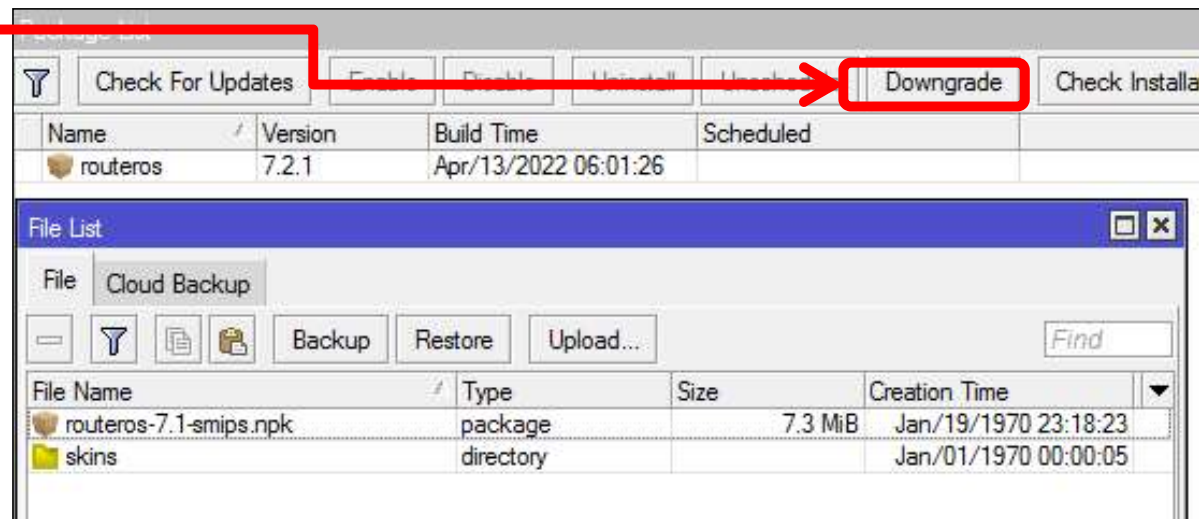
Router harus bisa terkoneksi ke internet



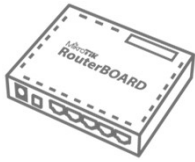
Downgrade RouterOS



/system package downgrade



Cek ulang spesifikasi router, terdapat beberapa router yang hanya support versi 7 saja



Quiz!

- Proses Upgrade versi RouterOS akan menghapus konfigurasi yang sudah tersimpan. (Benar/Salah)
- Netinstall dapat digunakan untuk ?
 - ☐ Install ulang RouterOS
 - ☐ Fresh Install RouterOS
 - ☐ Upgrade RouterOS tanpa menghapus konfigurasi
 - ☐ Reset Username password saja tanpa menghapus konfigurasi

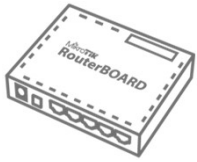
Basic Config

MikroTik Basic – MTCNA Class



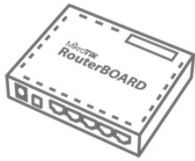
MikroTik Master Distributor
MikroTik Certified Training Partner
www.citraweb.com



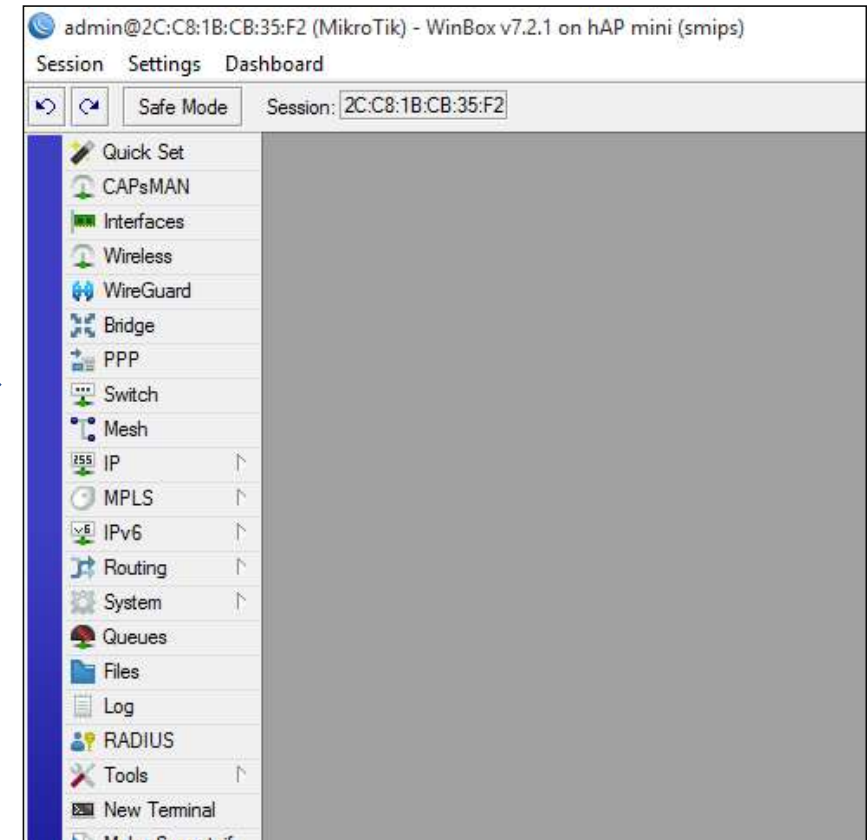
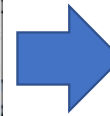
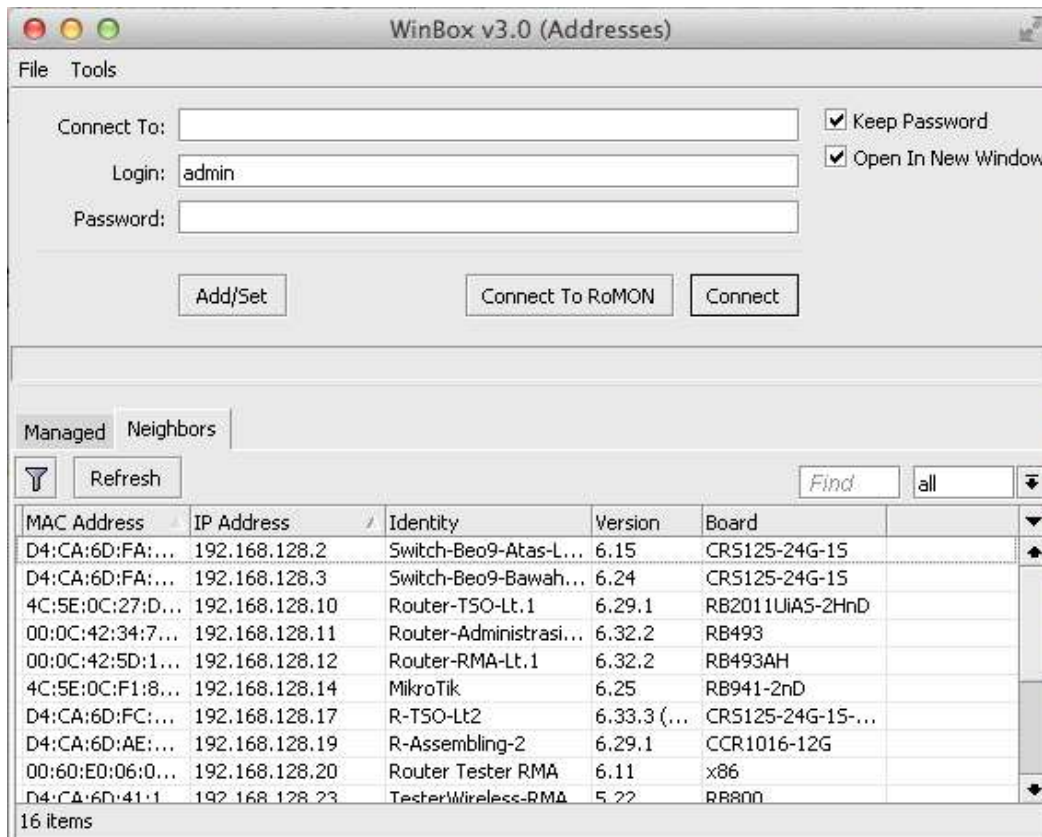


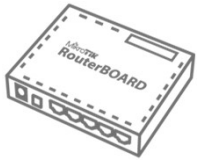
Remote Access

- GUI :
 - Winbox
 - WebFig
 - Mikrotik Apps (IOS / Android)
- CLI
 - SSH
 - Telnet
 - Serial



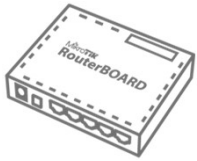
Winbox



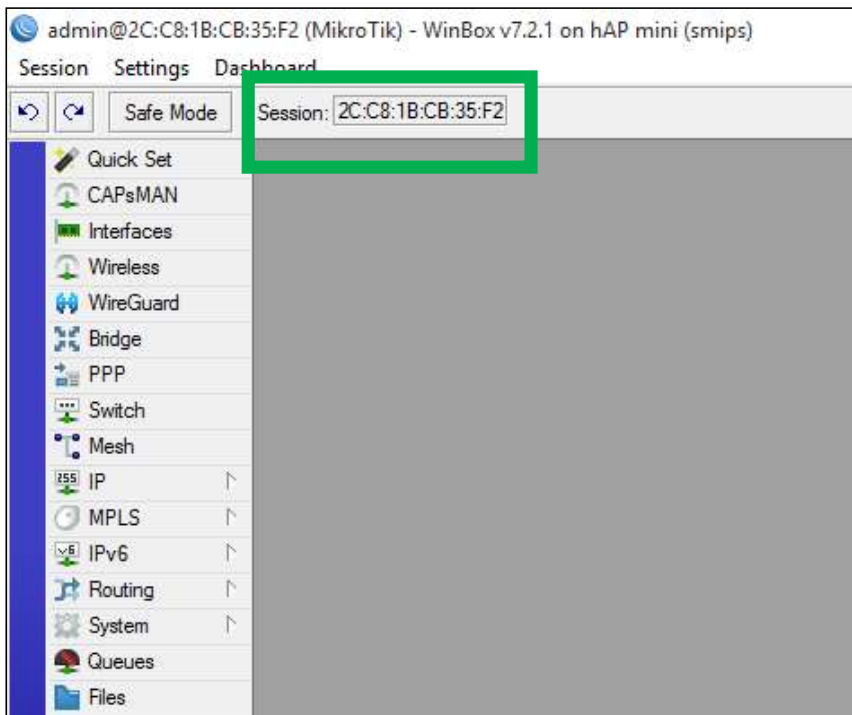


Winbox (2)

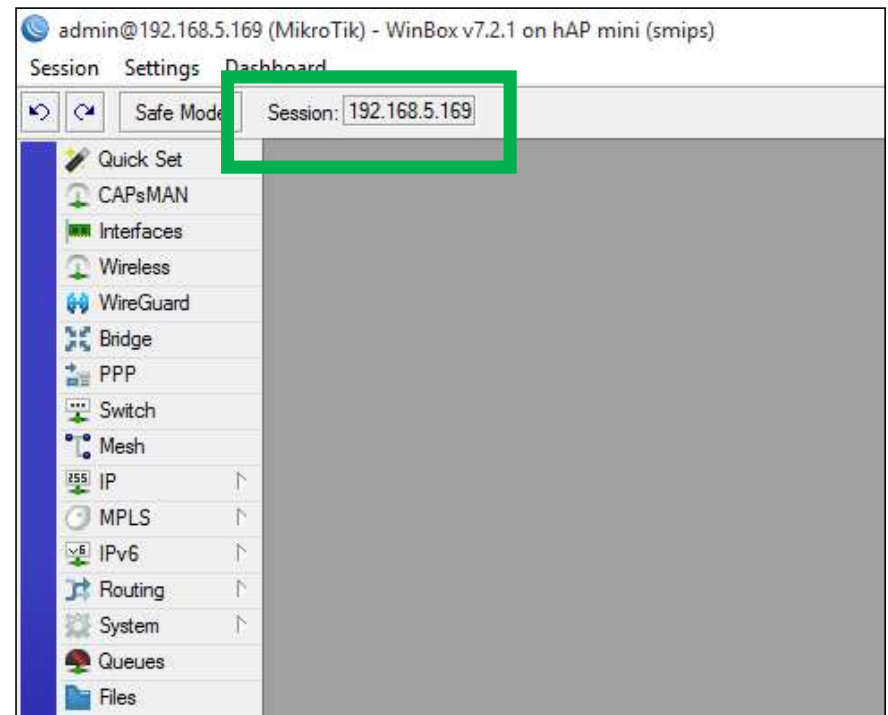
- MAC-Winbox → Digunakan jika router **BELUM** terpasang IP
- IP – Winbox → Digunakan jika router **SUDAH** terpasang IP
- Hindari penggunaan mac-winbox di harian
- Default user : admin
- Default pass : kosong / blank



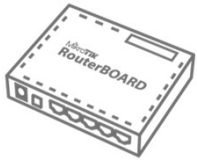
Winbox (3)



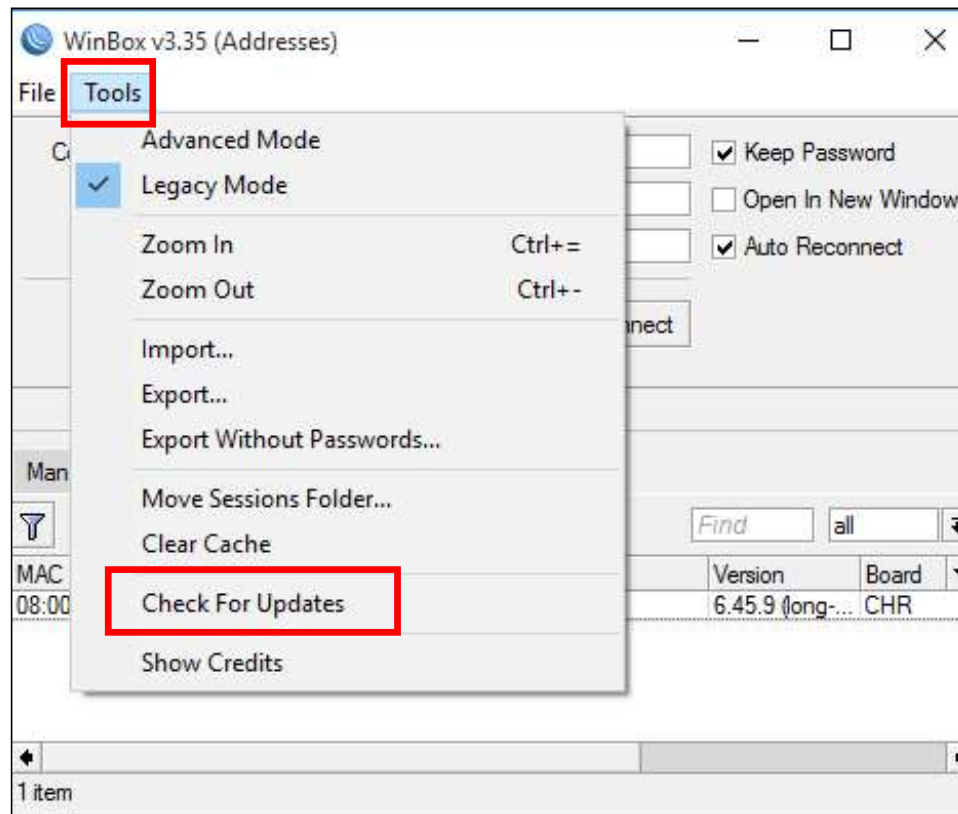
Login By Mac Address

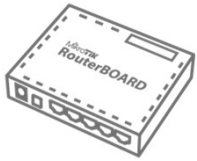


Login By IP Address



Winbox Update





Webfig

WebFig v6.34.1 (stable)

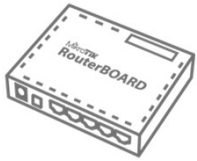
ARP List

Add New

1 item

		▲ IP Address	MAC Address	Interface	
-	D	192.168.128.100	10:DD:B1:E8:F3:87	bridge1	

Menggunakan aplikasi browser dengan membuka alamat IP Router



Mikrotik Apps

11:40 | 292KB/s

MikroTik
v1.3.20

LOG IN SAVED DISCOVER

Address
192.168.5.1

Username
admin

Password
.....

☒ Keep password

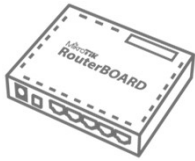
SAVE CONNECT

10:50 | 65.9KB/s

BACK Safe Mode

admin@192.168.5.1

- CAPsMAN
- Interfaces
- Wireless
- Bridge
- PPP
- Switch
- Mesh
- IP
- MPLS
- Routing



SSH & Telnet

```
pujodb — bash — 80x24
Last login: Wed Feb 10 15:14:05 on ttys000
Pujos-MacBook-Pro:~ pujodb$ telnet -l admin 192.168.128.101

pujodb — bash — 80x24
Last login: Wed Feb 10 15:14:05 on ttys000
Pujos-MacBook-Pro:~ pujodb$ ssh admin@192.168.128.101

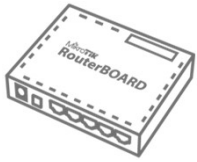
MikroTik RouterOS 6.34.1 (c) 1999-2015      http://www.mikrotik.com/

[?]          Gives the list of available commands
command [?]  Gives help on the command and list of arguments

[Tab]        Completes the command/word. If the input is ambiguous,
              a second [Tab] gives possible options

/            Move up to base level
..          Move up one level
/command     Use command at the base level

[admin@MikroTik] >
```



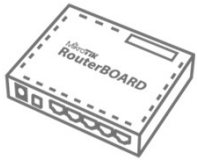
Command Line

- CLI digunakan pada saat kita remote menggunakan serial, telnet, ssh atau “New Terminal” pada winbox
- Struktur perintah (command) pada CLI mirip dengan sistem hierarki menu pada winbox
- Contoh : Menambah IP pada router

`/ip address add address=192.168.128.101/24 interface=ether1`

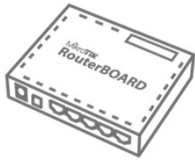
`/ip` → menu utama (level0), `address` → submenu (level1), `add` → command menambahkan rule

```
[admin@MikroTik] > ip address add address=192.168.1.1/24 interface=ether1
```



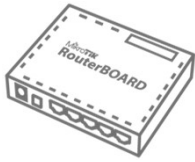
General Command

add	menambahkan entri tertentu
comment	membubuhkan komentar pada suatu entri
disable	menonaktifkan entri tertentu
enable	mengaktifkan entri tertentu
monitor	memonitor parameter secara live
print	menampilkan semua entri secara singkat
print detail	menampilkan semua entri secara lengkap
remove	menghapus entri tertentu
set	mengubah parameter tertentu pada sebuah entri



CLI Navigation

?	Menampilkan pilihan perintah yang tersedia beserta keterangannya
[TAB]	Melengkapi perintah yang baru terketik sebagian
[TAB][TAB]	Menampilkan pilihan perintah yang tersedia beserta keterangannya
..	Berpindah 1 level ke atas pada hirarki menu
/	Berpindah ke level teratas pada hirarki menu



CLI Tips

Quick Typing

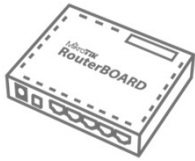
- [TAB] untuk melengkapi perintah tertentu
 - `/system shut [TAB]` = `/system shutdown`
- Juga bisa menggunakan singkatan
 - `/sys shut` = `/system shutdown`

Bisa juga menggunakan sistem scripting terbaru

- Contoh : `/system/shutdown` atau `/ip/firewall/filter`

Contoh penggunaan lebih kompleks

<http://wiki.mikrotik.com/wiki/Scripting>



Quick Set

Quick Set

Home AP Quick Set

Wireless

Network Name: mtcna-testing

Frequency: 2462 MHz

Band: 2GHz-B/G

Country: etsi

MAC Address: 2C:C8:1B:CB:35:F5

☐ Use Access List (ACL)

WiFi Password:

WPS Accept

Internet

Address Acquisition: ☒ Static ☐ Automatic

IP Address: 0.0.0.0

Netmask: 255.0.0.0 (/8)

Gateway: 192.168.5.1

DNS Servers: 8.8.8.8

MAC Address: 2C:C8:1B:CB:35:F1

☒ Firewall Router

☒ MAC Server

☒ MAC Winbox

☒ Discovery

Local Network

IP Address: 192.168.0.1

Netmask: 255.255.255.0 (/24)

☐ Bridge All LAN Ports

☐ DHCP Server

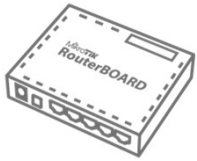
☒ NAT

OK

Cancel

Apply

Melakukan konfigurasi dasar Mikrotik secara cepat



Basic Topologi

Internet

X = Nomor Meja

— Kabel

- - - Wireless

WLAN1
10.10.10.1/24

WLAN1
10.10.10.2/24

WLAN1
10.10.10.X/24

ETHER1
192.168.1.1/24

ETHER1
192.168.2.1/24

ETHER1
192.168.X.1/24

LAN PORT
192.168.1.2/24

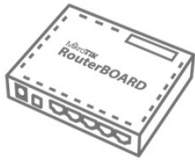
LAN PORT
192.168.2.2/24

LAN PORT
192.168.X.2/24

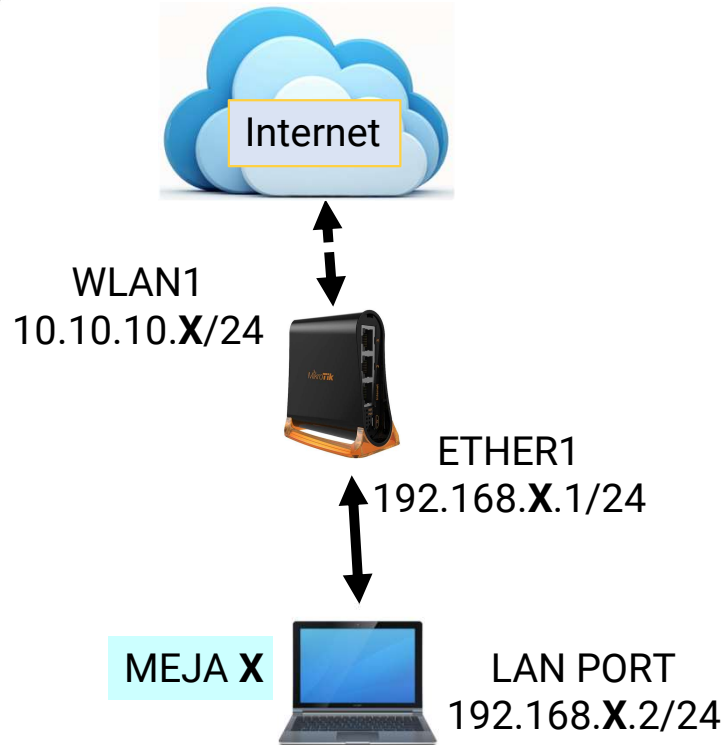
MEJA 1

MEJA 2

MEJA X

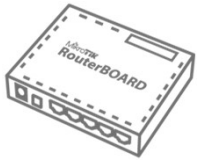


Detail Topologi



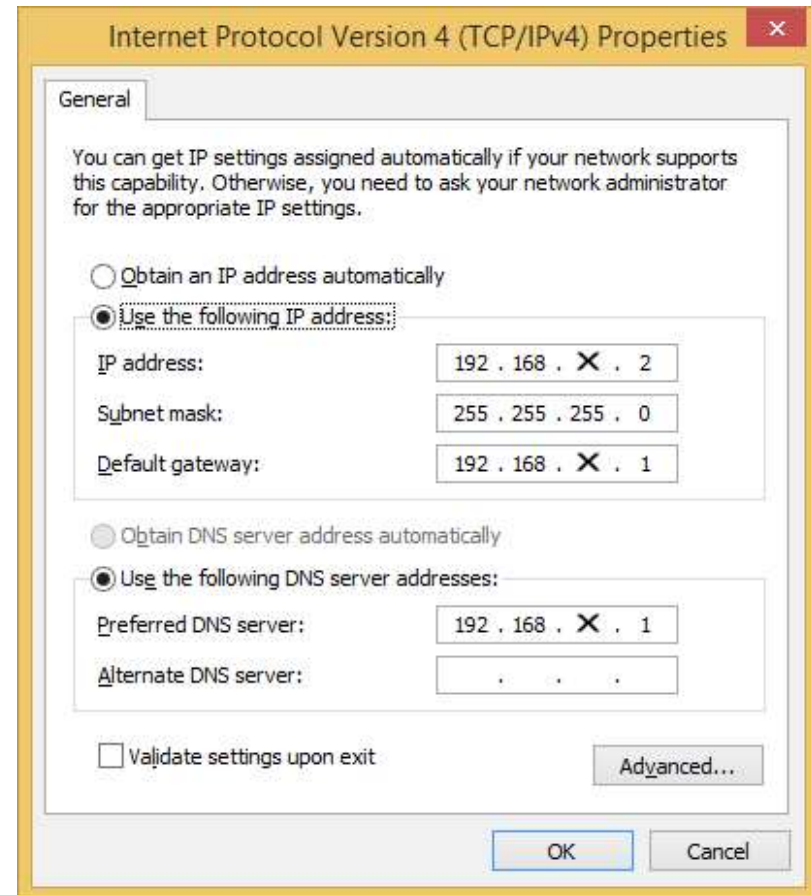
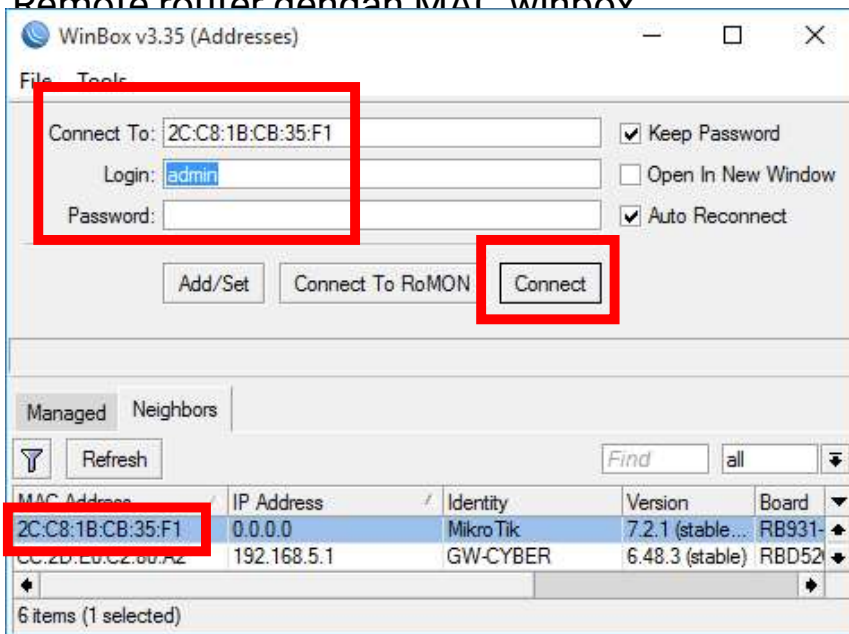
- Router Setting
 - WAN IP : 10.10.10.X/24
 - Gateway : 10.10.10.100
 - LAN IP : 192.168.X.1/24
 - DNS : 10.100.100.1
 - Src-NAT and DNS Server
- Laptop Setting
 - IP Address : 192.168.X.2/24
 - Gateway : 192.168.X.1
 - DNS : 192.168.X.1

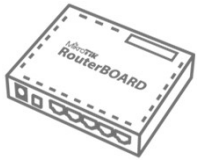
Simulasi konfigurasi dasar sebuah Router Mikrotik yang akan digunakan di jaringan local seperti **Warnet, Office, Kampus, SOHO** atau bahkan di **RT/RW-NET**



[LAB-1] Konfigurasi IP Laptop

1. Matikan Wireless dan Interface selain Ethernet (LAN)
2. Setting IP Manual pada laptop
3. Nonaktifkan Firewall pada Laptop
4. Remote router dengan MAC winbox



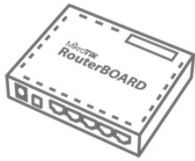


[LAB-2] Konfigurasi IP Router

IP WAN

IP LAN

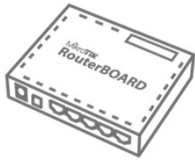
```
/ip address add address=10.10.10.X/24 interface=wlan1  
/ip address add address=192.168.X.1/24 interface=ether1
```



[LAB-3] Connect to WAN via Wireless

The screenshot shows the Mikrotik WinBox interface. On the left sidebar, the 'Wireless' menu item is highlighted with a red box. An arrow points from this menu to the 'wlan1' interface in the 'Wireless Tables' list, which is also highlighted with a red box. Another arrow points from 'wlan1' to the 'Interface <wlan1>' configuration window. In this window, the 'Wireless' tab is selected. The 'Mode' is set to 'station', 'Band' is '2GHz-B/G', 'Channel Width' is '20MHz', 'Frequency' is '2412 MHz', and 'SSID' is 'training'. The 'Enable' button is highlighted with a red box. Arrows indicate the flow of configuration steps from the menu to the interface selection and then to the specific settings.

```
/interface wireless set wlan1 mode=station ssid=training disabled=no
```



[LAB-3] Connect to Wan Security (opt)

Wireless Tables

WiFi Interfaces | W60G Station | Nstreme Dual | Access List | Registration | Connect List | **Security Profiles** | Channels

+

Name	Mode	Authenticatio...	Unicast Ciphers	Group Ciphers	WPA Pre-Shared ...	WPA2 Pre-Shared..
* default	none					

New Security Profile

General | RADIUS | EAP | Static Keys

Name: pass

Mode: dynamic keys

Authentication Types: ☒ WPA PSK ☒ WPA2 PSK

☐ WPA EAP ☐ WPA2 EAP

Unicast Ciphers: ☒ aes ccm ☐ tkip

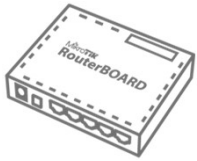
Group Ciphers: ☒ aes ccm ☐ tkip

WPA Pre-Shared Key: citraweb

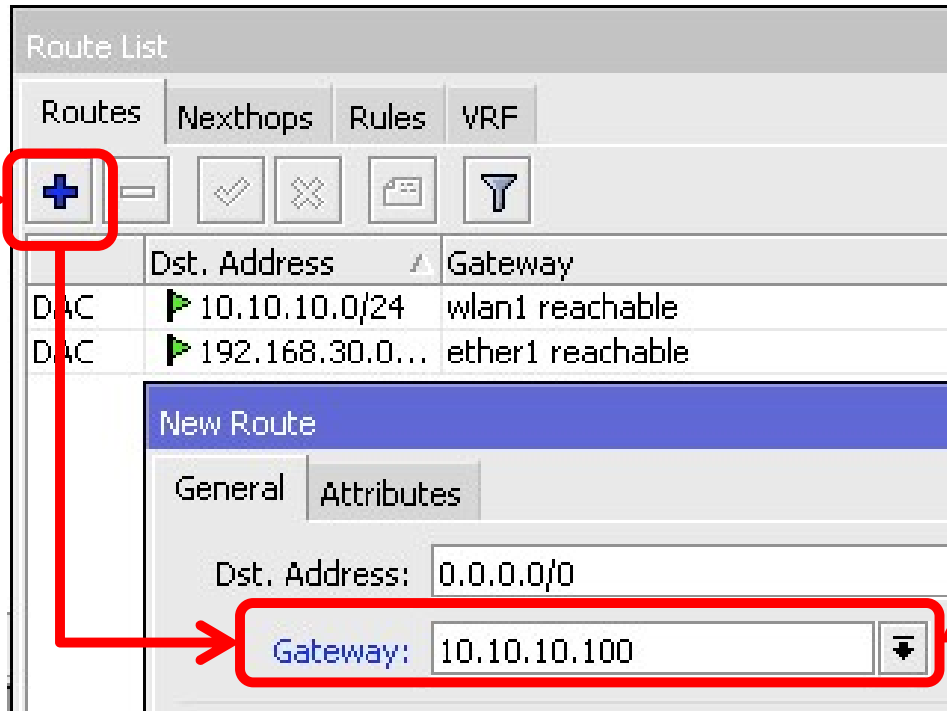
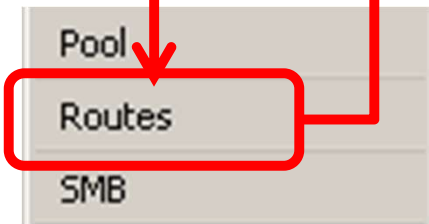
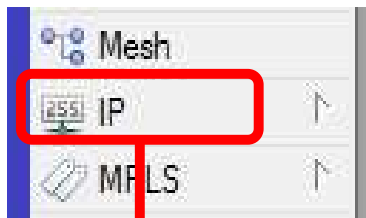
WPA2 Pre-Shared Key: citraweb

Supplicant Identity:

OK Cancel Apply Comment Copy Remove

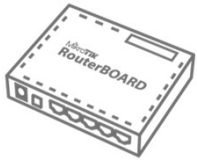


[LAB-4] Default Gateway

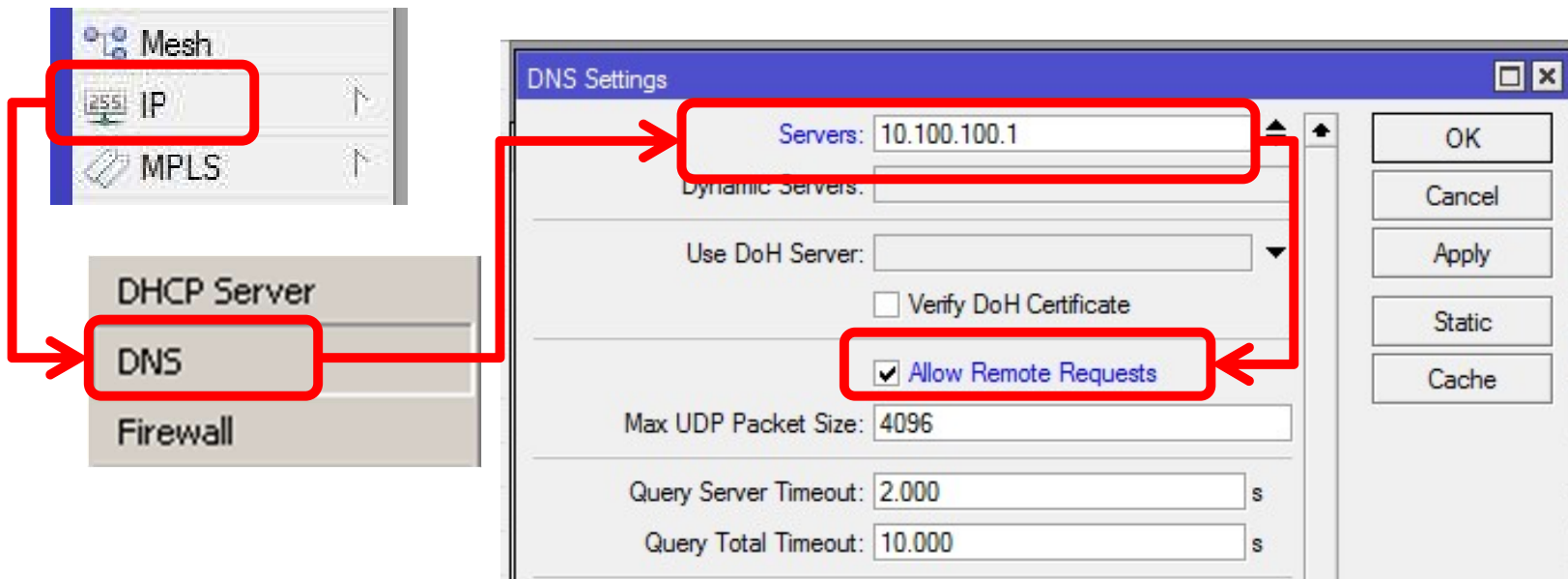


Isikan Default Gateway yang dialokasikan oleh Provider / ISP

```
/ip route add gateway=10.10.10.100
```

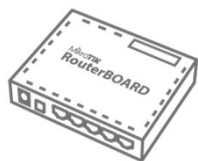


[LAB-5] DNS

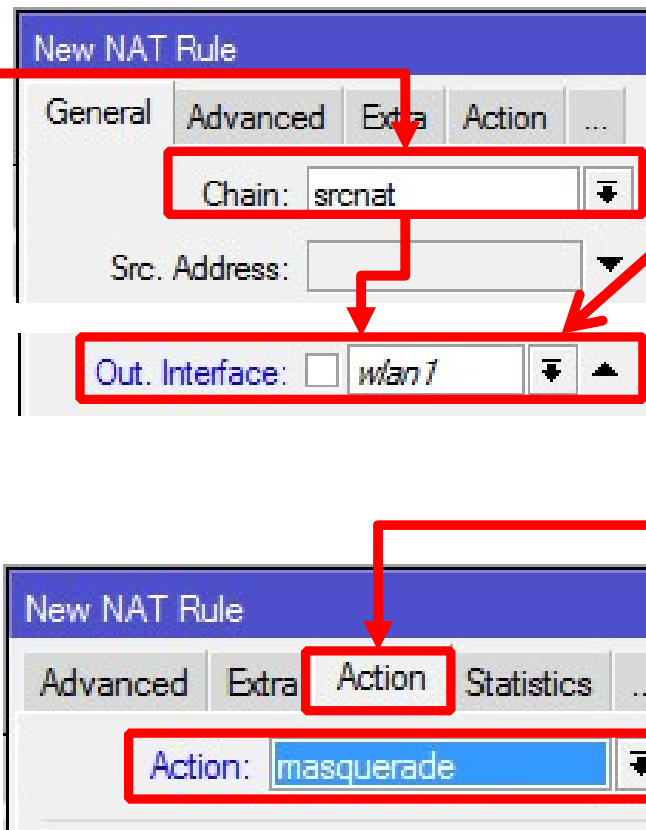
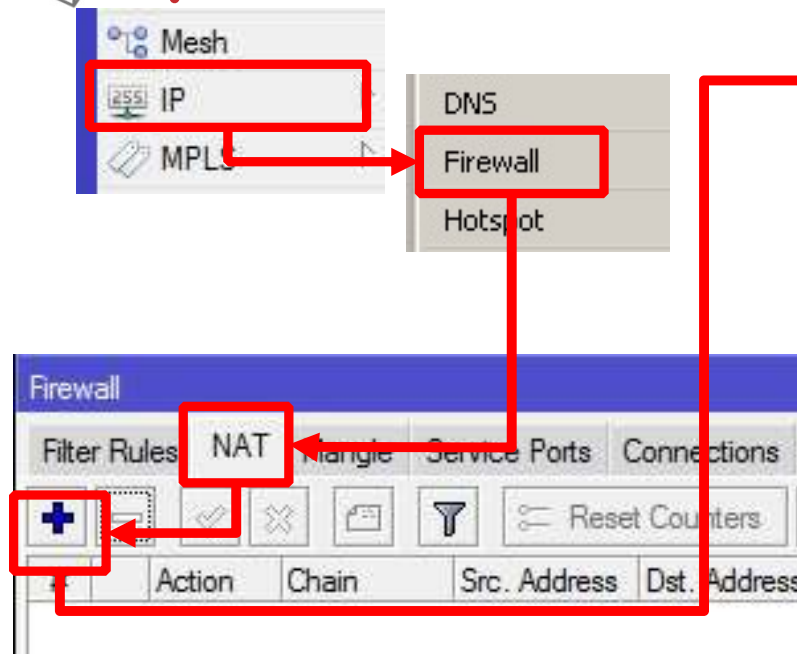


```
/ip dns set servers=10.100.100.1 allow-remote-request=yes
```

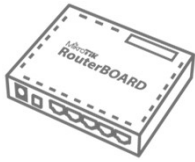
Jika mengaktifkan "Allow Remote Request" biasanya untuk proteksi dari Internet



[LAB-6] Firewall NAT - Masquerade

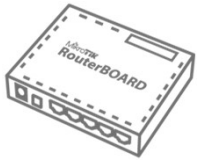


Interface
mengarah ke ISP
(internet)

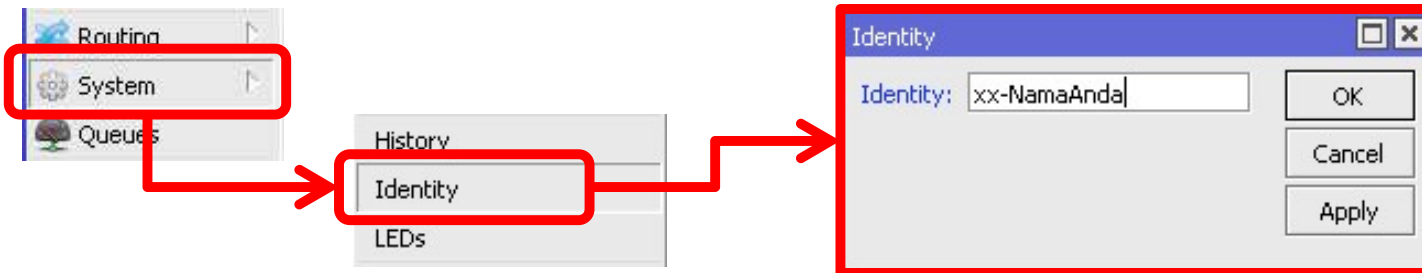


Troubleshoot

- Test ping dari Router ke Gateway (10.10.10.100)
Jika error : Cek Wireless connection, Cek IP Address pada wlan1
- Test ping dari Router ke Internet (contoh: yahoo.com)
Jika error : Cek DNS Server Setting
- Test ping dari Laptop ke Router Anda (10.10.10.x)
Jika error : Cek konfigurasi laptop, Cek IP Address pada Ether1
- Test ping dari Laptop ke Gateway (10.10.10.100)
Jika error : Cek Firewall - NAT
- Test ping dari Laptop ke Internet (contoh: yahoo.com)
Jika error : Cek setting DNS pada laptop dan router
- Cek koneksi Laptop secara menyeluruh (browsing, chatting, download, dsb)



[LAB-7] Identity



admin@192.168.128.99 (30-PujoRiset) - WinBox v6.34.1 on RB951-2n (mipsbe)

Sessions Settings Dashboard

Safe Mode Session: 192.168.128.99

Managed Neighbors

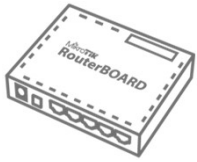
Refresh Find all

MAC Address	IP Address	Identity	Version	Board
D4:CA:6D:A3:6D:02	192.168.128.104	MikroTik	6.31	RB751U-2HnD
D4:CA:6D:A1:E7:3C	192.168.128.103	MikroTik	6.32.3	RB450G
D4:CA:6D:D6:B3:46	192.168.128.102	MikroTik	6.35rc5 ...	RB751U-2HnD
D4:CA:6D:0F:40:1C	192.168.128.99	30-PujoRiset	6.34.1 (...)	RB951-2n
D4:CA:6D:41:1E:AD	192.168.128.23	TesterWireless-R...	5.22	RB800
00:60:E0:06:02:4B	192.168.128.20	Router Tester RMA	6.11	x86
D4:CA:6D:AE:37:54	192.168.128.19	R-Assembling-2	6.29.1	CCR1016-12G
D4:CA:6D:FC:9D:00	192.168.128.17	R-TSO-Lt2	6.33.3 (...)	CR5125-24G-15-...
4C:5E:0C:F1:8F:2A	192.168.128.14	MikroTik	6.25	RB941-2nD
00:0C:42:5D:15:DD	192.168.128.12	Router-RMA-Lt.1	6.32.2	RB493AH

17 items

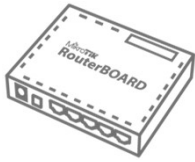
Beri nama router anda dengan menggunakan system identity

Untuk menghindari kesalahan remote atau tertukar dengan router lain



Quiz – Basic Config

- IP mana yang saja dapat dipasang di router
 - ☐ 10.10.10.2
 - ☐ 172.254.179.222/24
 - ☐ 192.168.123.321/25
 - ☐ 123.123.123.0./23
 - ☐ 192.168.88.1/29
- IP/Host apa yang dapat kita gunakan sebagai dns?

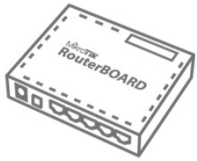


| DHCP

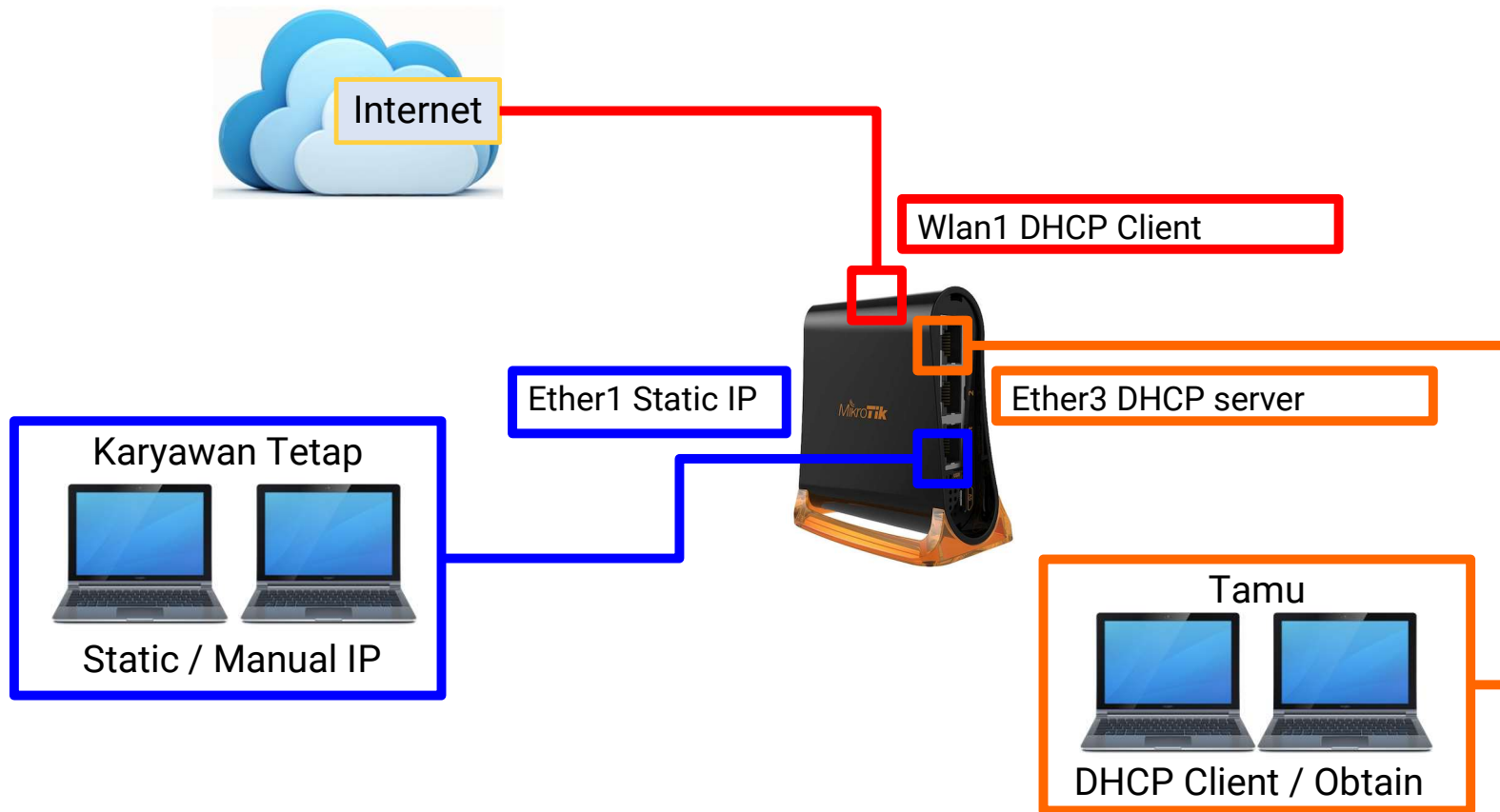
Dynamic Host Configuration Protocol digunakan untuk secara dinamik mendistribusikan konfigurasi jaringan, seperti:

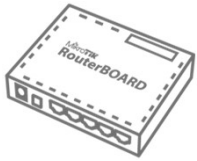
- IP Address dan netmask
- IP Address default gateway
- Konfigurasi DNS dan NTP Server
- Dan masih banyak lagi custom option (tergantung apakah DHCP client bisa support)

Terdapat 2 tipe DHCP yaitu Server dan Client, atau biasa disebut DHCP Server dan DHCP Client. DHCP dianggap tidak terlalu aman dan hanya digunakan pada jaringan yang dipercaya

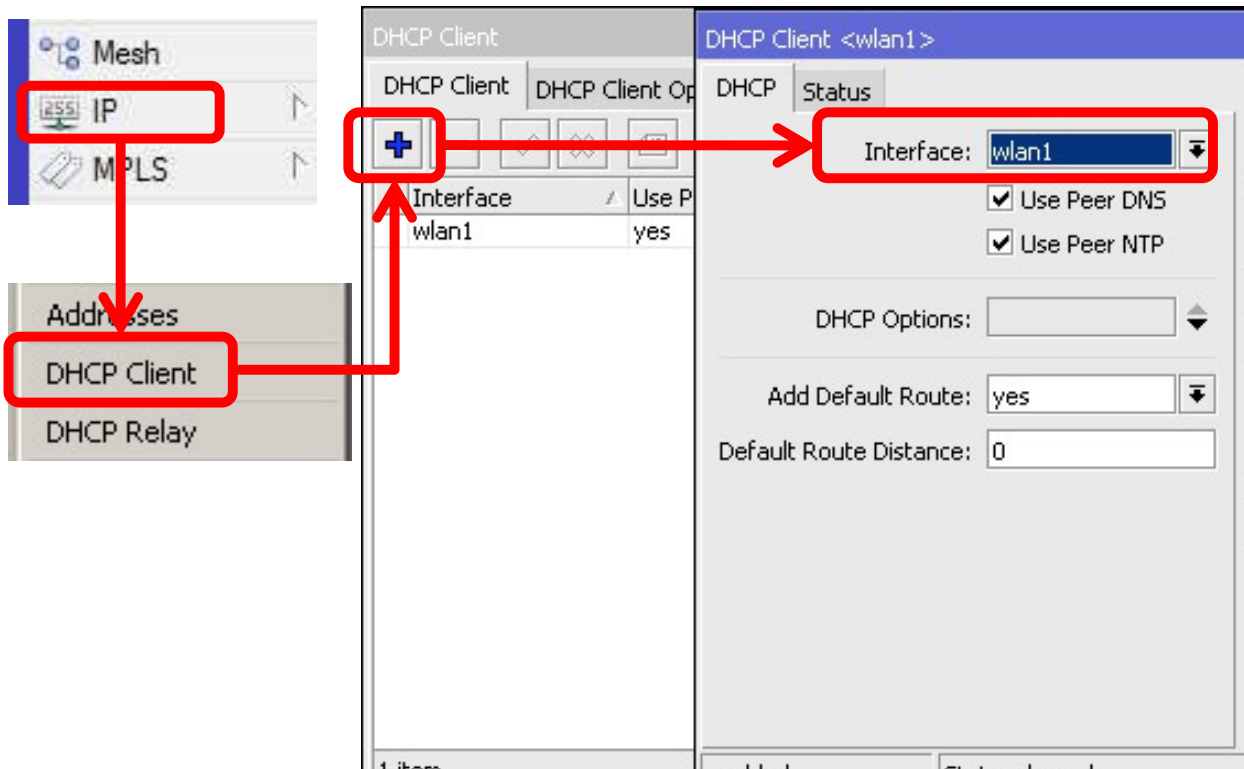


Implementasi DHCP





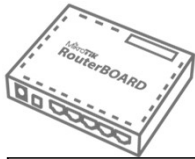
[LAB-8] DHCP Client



Kasus :

Coba tambahkan DHCP Client pada interface yang mengarah ke ISP (WLAN1)

Dalam kondisi tertentu, kita tidak mengetahui IP yang digunakan oleh jaringan (misal : public wifi). Maka kita bisa menggunakan DHCP Client .



DHCP Client Status

DHCP Client

DHCP Client Options

+ - ✓ ✗ 📁 🔍 Release Renew Find

Interface	Use P...	Add D...	IP Address	Expires After	Status
wlan1	yes	yes	10.10.10.99/24	00:07:52	bound

Lalu cek ulang konfigurasi apa saja yang yang didapatkan router dari DHCP Server

DHCP Client <wlan1>

DHCP Status

IP Address: 10.10.10.99/24

Gateway: 10.10.10.100

DHCP Server: 10.10.10.100

Expires After: 00:09:06

Primary DNS: 192.168.128.1

Secondary DNS:

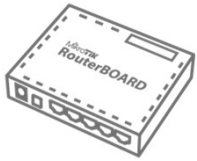
Primary NTP: 203.160.128.3

Secondary NTP: 91.189.89.199

CAPS Managers:

OK Cancel Apply Disable Comment Copy Remove Release Renew

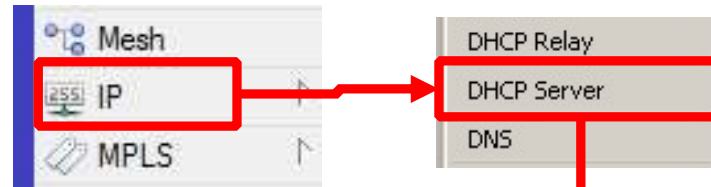
enabled Status: bound



[LAB-9] DHCP Server (1)

Tambahkan IP baru **172.30.X.1/24** pada ether 2
Contoh = 172.30.20.1/24 (Meja 20)

Kemudian set DHCP Server pada ether2



Address List

Address	Network	Interface
New Address		
Address: 172.30.X.1/24		
Network:		
Interface: ether2		

Buttons: OK, Cancel, Apply, Disable, Comment, Copy, Remove

enabled

1 item

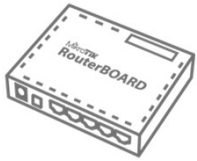
DHCP Server

Tabs: DHCP, Networks, Leases, Options, Alerts

Buttons: +, -, ✓, ✗, Filter, DHCP Config, DHCP Setup, Find

Name	Interface	Relay	Lease Time
------	-----------	-------	------------

/ip dhcp-server setup



[LAB-9] DHCP Server Setup (2)

DHCP Setup

Select interface to run DHCP server on

DHCP Server Interface:

DHCP Setup

Select network for DHCP addresses

DHCP Address Space:

DHCP Setup

Select gateway for given network

Gateway for DHCP Network:

Back Next Cancel

DHCP Setup

Select pool of ip addresses given out by DHCP server

Addresses to Give Out:

Back Next Cancel

DHCP Setup

Select DNS servers

DNS Servers:

DHCP Setup

Select lease time

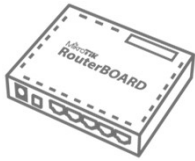
Lease Time:

Back Next

DHCP Setup

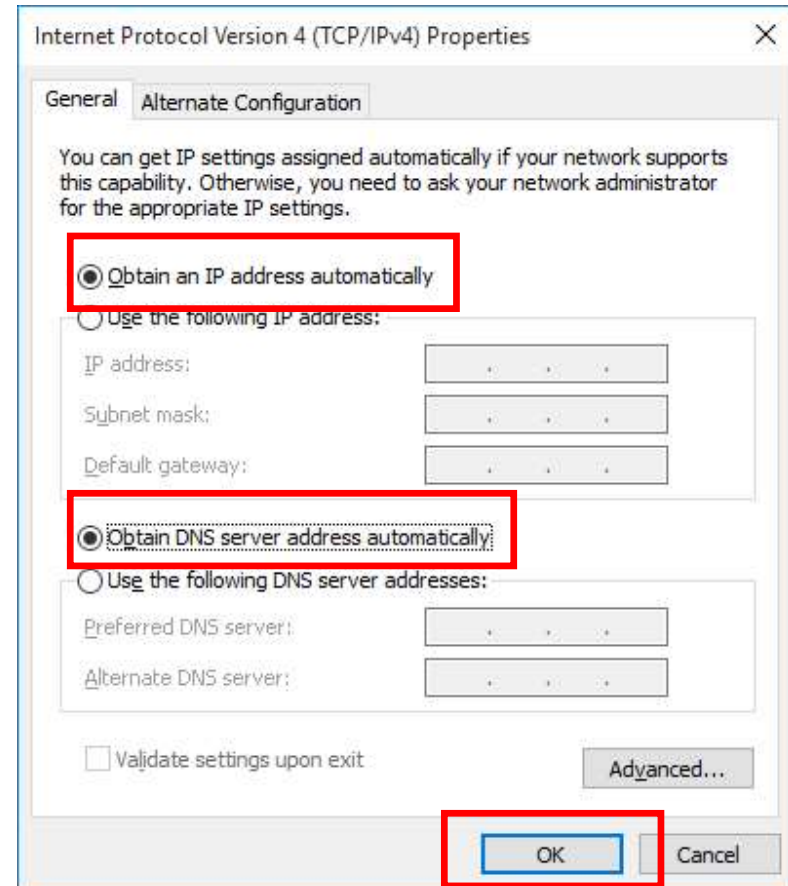
Setup has completed successfully

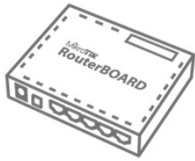
OK



[LAB-9] DHCP Server Test

- Hubungkan Laptop ke Ether2 Router
- Ubahlah konfigurasi IP Address dan DNS pada laptop menjadi otomatis (obtain)
- Cek pada laptop apakah sudah mendapatkan alokasi IP Address dari DHCP Server
- **Run CMD = ipconfig [enter]**
- Lakukan pengecekan dengan PING atau traceroute dari Laptop ke internet





DHCP Leases

DHCP Server

Leases

Static

Dynamic

	Address	MAC Address	Server	Active Address	Active MAC Address	Active Ho...
☐	192.168.135.69	A8:BB:CF:07:FD:46	dhcp2	192.168.135.69	A8:BB:CF:07:FD:46	Pujos-MP
☐	192.168.135.2	C4:36:6C:68:7A:C0	dhcp2	192.168.135.2	C4:36:6C:68:7A:C0	
D						
D						
D						
D						
D						
D						
D						
D						
D						
D						
D						
D						

DHCP Lease <192.168.129.130,192.168.129.130>

Active

Active Address: 192.168.129.130

Active MAC Address: A4:5D:36:99:75:3D

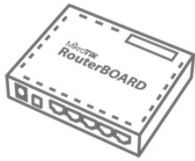
Active Client ID: 1:a4:5d:36:99:75:3d

Active Host Name: Mikrotik-PC

Active Server: dhcp1

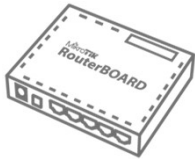
Make Static

Berisi semua list IP yang sudah diberikan ke user
Agar client selalu mendapatkan IP yang sama, bisa diset make static

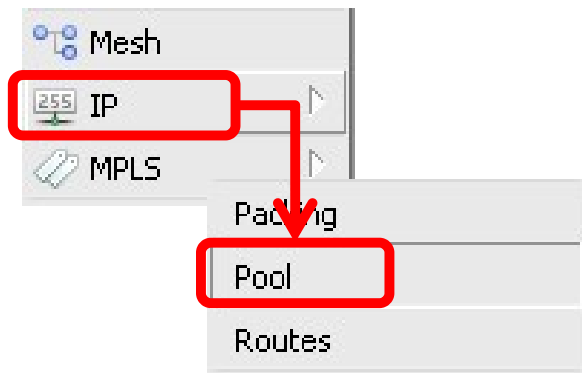


[LAB-10] DHCP Static Lease

- Ubah mac address laptop menjadi static lease
- Lalu request ulang dhcp client ke router
- Untuk request ulang bisa menggunakan run CMD :
ipconfig /release [enter]
ipconfig /renew [enter]
- Cek ulang IP yang didapatkan laptop
CMD : **ipconfig [enter]**



IP Pool



IP Pool

Pools Used Addresses

Name	Addresses	Ne
dhcp_pool1	192.168.129.128-192.168.129....	no
dhcp_pool2	192.168.135.32-192.168.135.254	no
hs-pool-12	192.168.134.32-192.168.134.254	no

3 items

New IP Pool

Name: dhcp_pool0

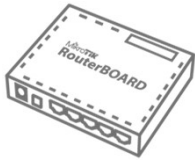
Addresses: 192.168.1.2-192.168.1.254

Next Pool: none

Buttons: OK, Cancel, Apply, Comment, Copy, Remove

Merupakan daftar range IP yang akan diberikan oleh service / fitur yang ada pada router Service tersebut antara lain :

- DHCP
- Hotspot
- PPP (vpn)



DHCP Static Only

The screenshot shows the 'DHCP Server <dhcp1>' configuration window. The 'Name' field is 'dhcp1'. The 'Interface' is 'bridge-local'. The 'Lease Time' is '01:00:00'. The 'Bootp Lease Time' is 'forever'. The 'Address Pool' is 'hs-pool-5'. The 'Src. Address' dropdown menu is open, showing options: 'hs-pool-5', 'relay', and 'static-only' (which is highlighted). The 'Delay Threshold' is empty. The 'Authoritative' setting is 'after 2s delay'. The 'Bootp Support' is 'static'. The 'Lease Script' field is empty. Buttons for 'OK', 'Cancel', 'Apply', 'Disable', 'Copy', and 'Remove' are on the right.

The screenshot shows the 'DHCP Server' window with the 'Leases' tab selected. A red box highlights the '+' button in the toolbar. Below, the 'New DHCP Lease' window is open. The 'General' tab is active. The 'Address' field is '0.0.0.0' and the 'MAC Address' field is '00:00:00:00:00:00'. Both fields are highlighted with a red box. Below these fields is a checkbox for 'Use Src. MAC Address'. Other fields include 'Client ID', 'Server' (set to 'all'), and 'Lease Time'. Buttons for 'OK', 'Cancel', 'Apply', 'Disable', 'Comment', 'Copy', and 'Remove' are on the right.

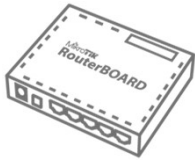
Jika address-pool=static-only maka DHCP Server hanya menerima client yang sudah ditambahkan secara manual pada Static Leases



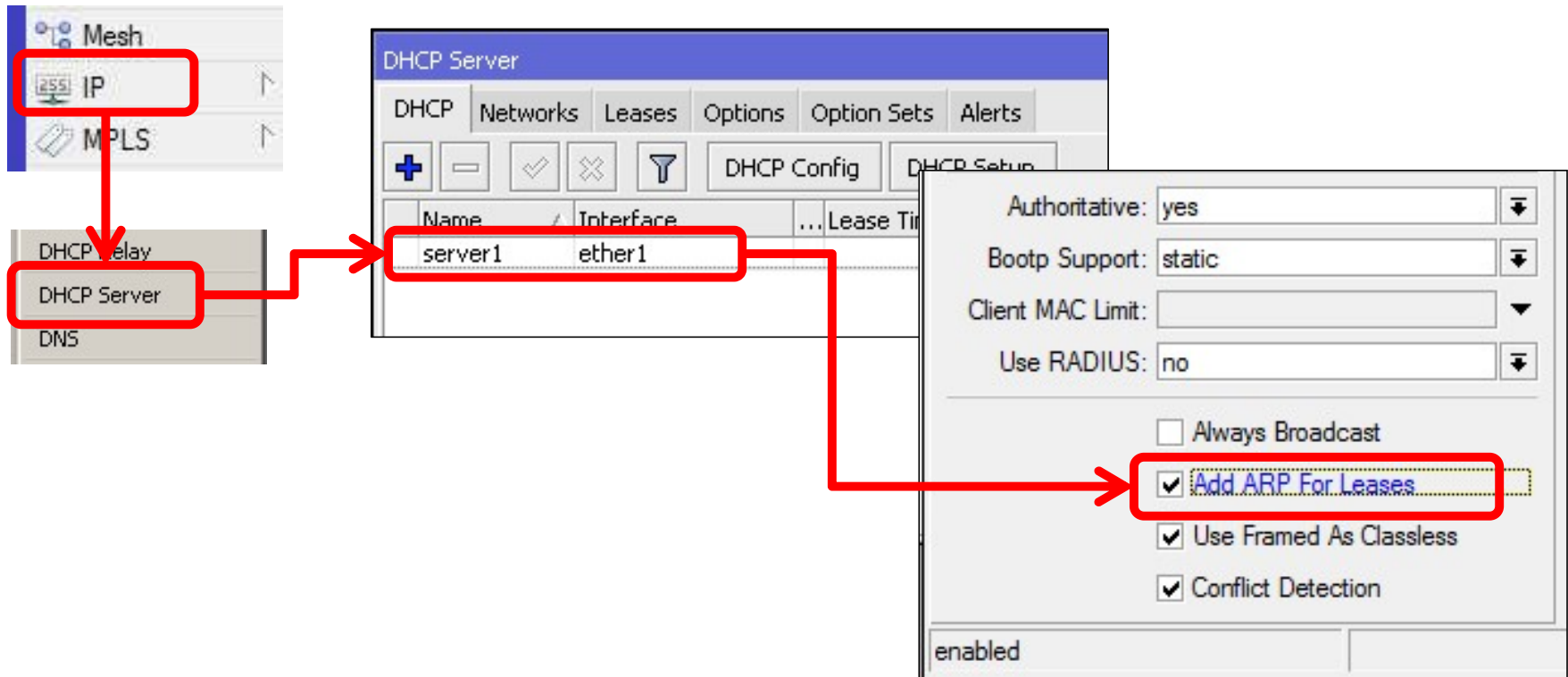
Dengan menggunakan mode ARP=Reply-Only pada interface, maka router hanya akan berkomunikasi ke perangkat yang **sudah terdaftar MAC serta IP address** di ARP List

ARP List			
     			
	IP Address	MAC Address	Interface
D	 192.168.10.240	D8:A2:5E:8C:00:B9	bridge1
D	 192.168.10.242	D8:5D:4C:94:BC:45	bridge1
D	 202.65.113.145	00:0C:42:41:C2:4A	vlan1

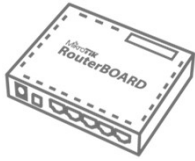
100



Simple DHCP Security (2)

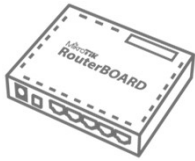


Add ARP For Leases, router akan mengupdate tabel ARP jika ada client yang request / release IP DHCP



Quiz - DHCP

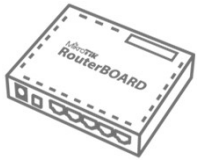
- IP Pool dapat dikonfigurasi secara manual dan dapat berisikan IP yang tidak satu segment / network. (Benar/Salah)
- IP Pool dapat digunakan untuk fitur apa saja?
- DHCP Server bisa dijalankan di semua interface. (Benar / Salah)



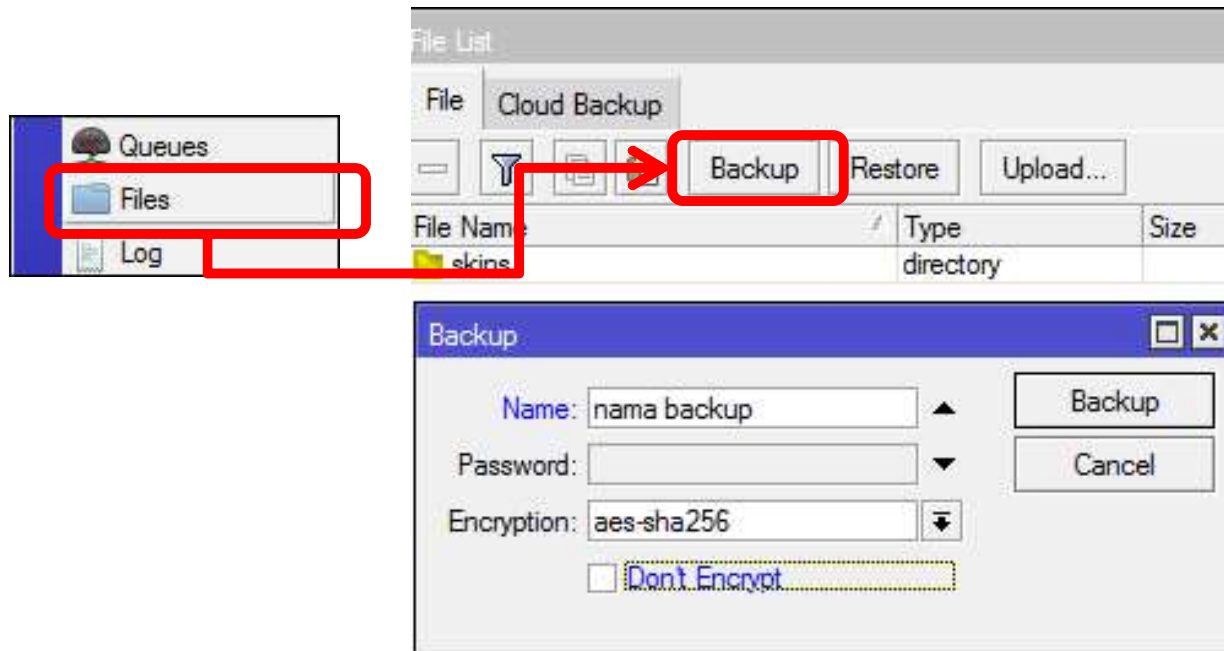
Backup Konfigurasi

Ada 2 metode yang bisa kita gunakan untuk membuat file cadangan konfigurasi router kita

- Metode Backup (.backup)
 - Hasil file berupa binary hanya bisa digunakan di router yang sama dan tidak bisa diedit
 - Menyimpan semua konfigurasi termasuk username & password router
- Metode Export (.rsc)
 - Hasil file berupa script bisa diedit dan juga bisa digunakan di router lain
 - Tidak bisa menyimpan konfigurasi username & password router

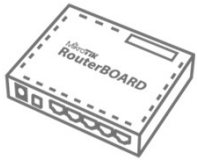


[LAB-9] Backup

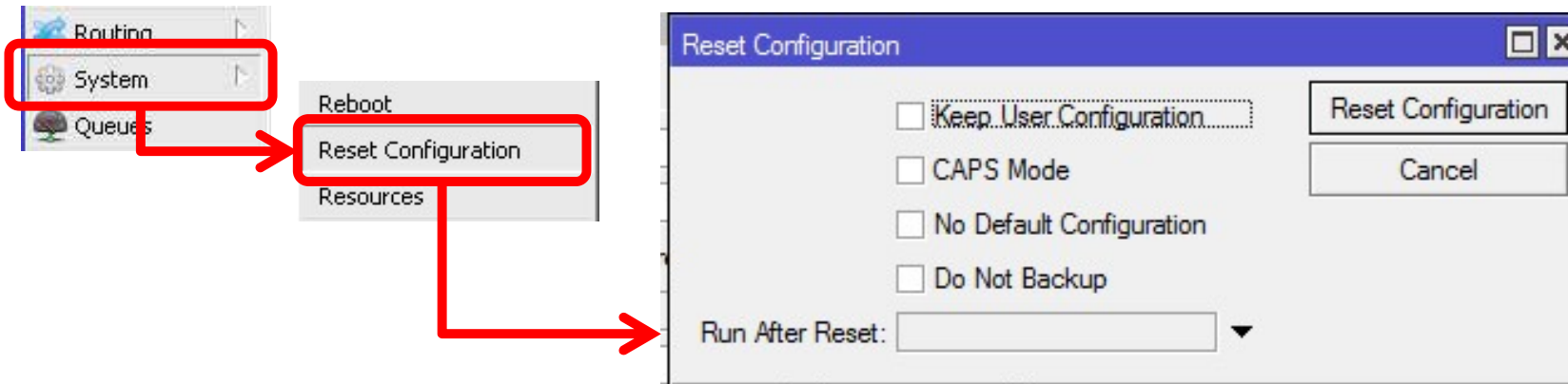


Password Backup
≠
Password Router

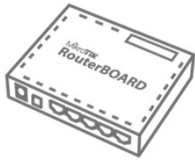
Hati-hati jika menggunakan password saat melakukan backup konfigurasi
Karena akan digunakan saat melakukan restore / mengembalikan konfigurasi



[LAB-10] Reset Configuration

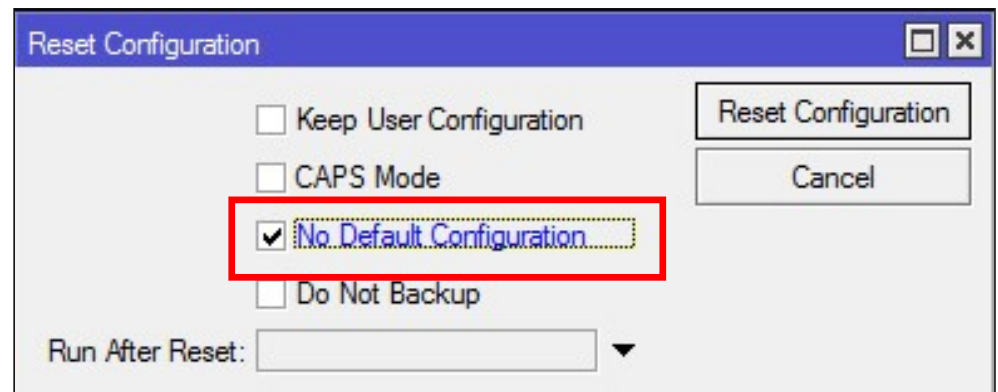


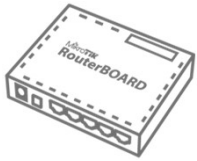
*Hanya bisa dilakukan oleh user yang menggunakan hak akses FULL



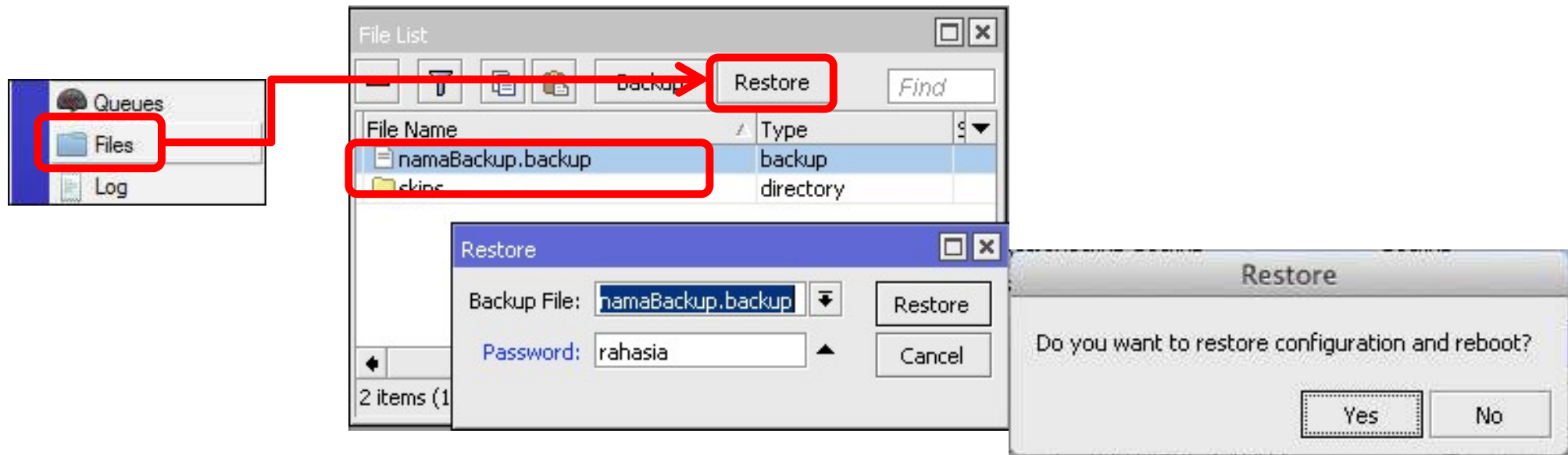
Default Configuration

- Terdapat “default-configuration” pada RouterBoard atau konfigurasi pabrik
- Biasanya, pada RouterBoard dengan 5 port ethernet atau lebih terdapat config :
- Ether2-ether5 dan wireless (jika ada) dikonfigurasi mode bridge atau switch dengan ip 192.168.88.1/24
- Interface wireless (jika ada) menerapkan authentication (WPA/WPA2)
- Ether1 tidak dapat diremote, gunakan port ether lain.
- Jika tidak dibutuhkan bisa dihapus pada saat awal remote Router atau dengan perintah :
`/system reset-configuration no-defaults=yes`

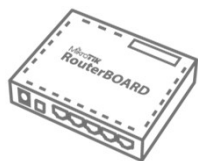




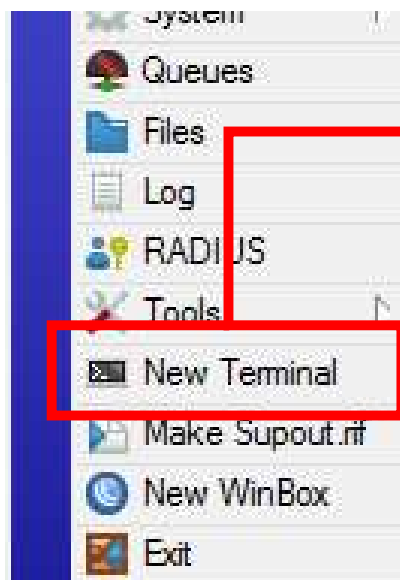
[LAB-11] Restore



Lakukan restore konfigurasi router dengan menggunakan file backup yang sudah dibuat sebelumnya.



Export



Terminal

/command Use command at the base level

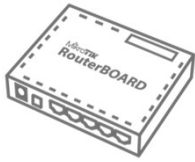
```
[admin@30-PujoRiset] > /export file=namafile  
[admin@30-PujoRiset] > /ip route export file=exp_route_only  
[admin@30-PujoRiset] >
```

File List

Backup Restore Find

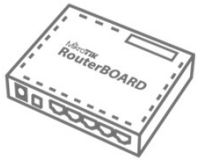
File Name	Type	Size	Creation Time
exp_route_only.rsc	script	121 B	Feb/12/2016 1
namaBackup.backup	backup	9.8 KiB	Feb/11/2016 1
namafile.rsc	script	723 B	Jan/02/1970 0
pub	directory		Jan/02/1970 0
skins	directory		Jan/01/1970 0

Metode export bisa membackup semua konfigurasi yang kita create manual (kecuali username & password) atau bisa juga untuk konfigurasi tertentu



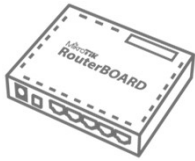
Export Command (1)

- Sebagian atau keseluruhan konfigurasi?
- `/export`
 - Mengambil semua konfigurasi yang telah dilakukan pada Router
- `/[direktori menu] export`
 - Mengambil hanya konfigurasi pada menu yang ditunjuk.
 - Contoh : `/ip address export`



Export Command (2)

- Disimpan dalam bentuk file atau hanya ditampilkan?
- `/export`
 - Menampilkan hasil export / script pada New Terminal
- `/export file=file-name`
 - Hasil export disimpan pada disk dalam bentuk file rsc
 - Contoh : `/ip address export file=IP`



File Export (.rsc)

namafile.rsc

File Path ▾ : ~/Desktop/namafile.rsc

namafile.rsc

```
1 # jan/02/1970 00:03:14 by RouterOS 6.34.1
2 # software id = XU59-SJSJ
3 #
4 /interface wireless
5 set [ find default-name=wlan1 ] band=2ghz-b/g/
6 /interface wireless security-profiles
7 set [ find default=yes ] supplicant-identity=M
8 /ip address
9 add address=10.10.10.30/24 interface=wlan1 network=10.
10 add address=192.168.30.1/24 interface=ether1 network=1
11 /ip dns
12 set allow-remote-requests=yes servers=10.100.100.1
13 /ip firewall nat
14 add action=masquerade chain=srcnat out-interface=wlan1
15 /ip route
16 add distance=1 gateway=10.10.10.100
17 /system identity
18 set name=30-PujoRiset
```

Line 1 Col 1 (none) Unicode (UTF-8) Windows (CRLF)

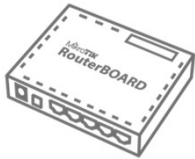
exp_route_only.rsc

File Path ▾ : ~/Desktop/exp_route_only.rsc

exp_route_only.rsc

```
1 # feb/12/2016 10:17:26 by RouterOS 6.34.1
2 # software id = XU59-SJSJ
3 #
4 /ip route
5 add distance=1 gateway=10.10.10.100
6
```

File Export bisa dibuka dan diedit menggunakan editor dan disesuaikan dengan kebutuhan



Import

Terminal

```
Script file loaded and executed successfully  
[admin@30-PujoRiset] >
```

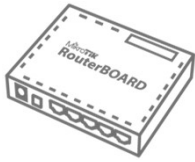
Route List

Routes | Nexthops | Rules | VRF

+ - ✓ ✗ [icon] Find all [dropdown]

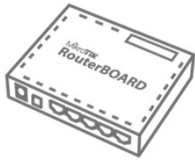
	Dst. Address	Gateway
A5	0.0.0.0/0	10.10.10.100 reachable wlan1
5	0.0.0.0/0	10.10.10.100 reachable wlan1
DAC	10.10.10.0/24	wlan1 reachable
DAC	192.168.30.0...	ether1 reachable

Metode yang dilakukan import adalah menambahkan rule sesuai konfig yang ada file rsc
Hati-hati untuk router yang sudah terdapat konfigurasi



Quiz - Backup

- Perintah `/import file-name=namaBackup.backup` merupakan perintah untuk mengembalikan konfigurasi yang telah disimpan
- Router membutuhkan restart / reboot pada saat proses import. (Benar/Salah)
- Kita dapat melihat username dan password pada file backup. (Benar/Salah)

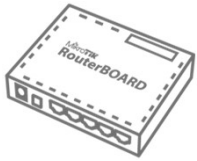


Basic Router Security

GANTI USERNAME + PASSWORD

Untuk keamanan / privacy, fitur yang tidak kita gunakan bisa kita matikan / disable / modifikasi:

- /ip service
- /ip neighbor discovery
- /tool mac-server



RouterOS User

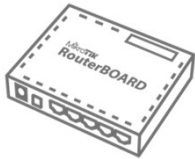
The screenshot shows the Mikrotik WinBox interface. On the left, the 'System' menu is highlighted, leading to the 'Users' option. The 'User List' window is open, showing a table of users. The 'New User' dialog is also open, showing fields for Name, Group, Allowed Address, Password, and Confirm Password.

Name	Group	Allowed Address
admin	full	
cumabaca	read	10.10.10.0/24
rifqi	full	
root	write	

New User dialog fields:

- Name: cumabaca
- Group: read
- Allowed Address: 10.10.10.0/24
- Last Logged In:
- Password: *****
- Confirm Password: *****

Jika dirouter terdapat user "lain" yang memiliki access group FULL, maka username admin bisa kita disable/remove



RouterOS Group

User List

Users Groups SSH Keys SSH Private Keys Active Users

+ - +

Name	Policies
S full	local telnet ssh ftp reboot read write policy test winbox pa
S read	local telnet ssh reboot read test winbox password web sn
S write	local telnet ssh reboot read write test winbox password w

Group <full>

Name: full

Policies:

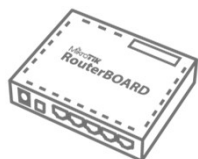
☒ local	☒ telnet	☒ ssh
☒ ftp	☒ reboot	☒ read
☒ write	☒ policy	☒ test
☒ winbox	☒ password	☒ web
☒ sniff	☒ sensitive	☒ api
☒ romon	☐ dude	☒ rest-api

Skin: default

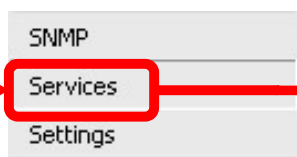
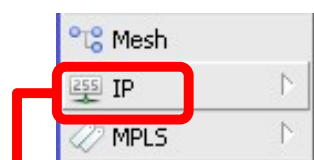
System

OK Cancel Apply Comment Copy Remove

Dengan menggunakan Groups, kita bisa menentukan privilege / hak masing-masing user yang meremote router kita



IP Service



IP Service List					
☒ ☐ ☐ Find					
Name	Port	Available From	Certificate		
api	8728				
api-ssl	8729		none		
ftp	21				
ssh	7777	192.168.30.0/24...			
telnet	23				
winbox	8291				
www	80				
X www-ssl	443				
8 items (1 selected)					

IP Service <ssh>

Name: ssh

Port: 7777

Available From: 192.168.30.0/24

10.10.10.0/24

enabled

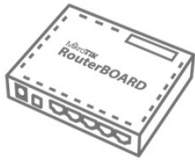
OK

Cancel

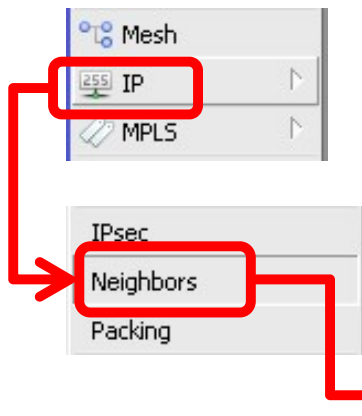
Apply

Disable

Untuk keamanan, bisa dirubah portnya atau hanya bisa diakses dari IP tertentu.
Jika tidak digunakan bisa kita disable servicenya



IP Neighbors



Neighbor List

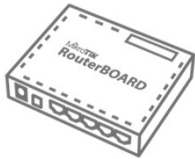
Discovery Settings

Find

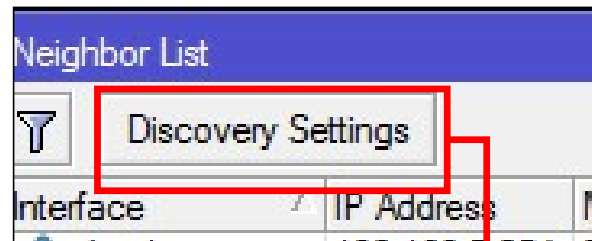
Interface	IP Address	MAC Ad...	Identity	Platform	Version	Board Name	IPv6	Age (s)	Uptime	
 ether1	192.168.5.254	00:0C:4...	sw-meja-2r...	MikroTik	1.6	RB250GS	no	56	23972d 02:06...	
 ether1	192.168.5.2	E4:8D:8...	SW-Cyber	MikroTik	6.45...	CRS125-24G-1S	no	30	156d 01:49:50	
 ether1	192.168.5.1	CC:2D:E...	GW-CYBER	MikroTik	6.48...	RBD52G-5HacD2H...	no	46	72d 00:15:25	
 ether1		00:15:65...	SIP-T20P				no	17	00:00:00	
 ether1	192.168.200.2	E4:8D:8...	SW-Cyber	MikroTik	6.45...		no	30	00:00:00	
 ether1	192.168.5.151	08:00:27...	Rifqi	MikroTik	7.2 (s...	CHR	yes	3	5d 23:26:21	
 ether1	192.168.5.151	78:CA:3...	Rifqi	MikroTik	7.2 (s...	CHR	yes	3	5d 23:26:21	
 ether1		54:E1:A...					no	55	00:00:00	

8 items

Neighbors akan menampilkan semua perangkat yang mengaktifkan MNDP atau CDP dan masih berada di layer 2 yang sama
MNDP = Mikrotik Neighbor Discovery Protocol
CDP = Cisco Discovery Protocol



Neighbors Discovery



Discovery Settings

Interface: ▼

LLDP MED Network Policy VLAN: ▼

Protocol: ☒ CDP ☒ LLDP ☒ MNDP

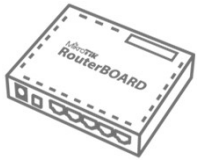
Kita bisa menentukan interface yang menggunakan neighbor discovery, maka router kita hanya akan menampilkan list neighbor yang ada di interface tersebut DAN router kita tidak tertampil di neighbor router lain ataupun di winbox Neighbors

Managed Neighbors

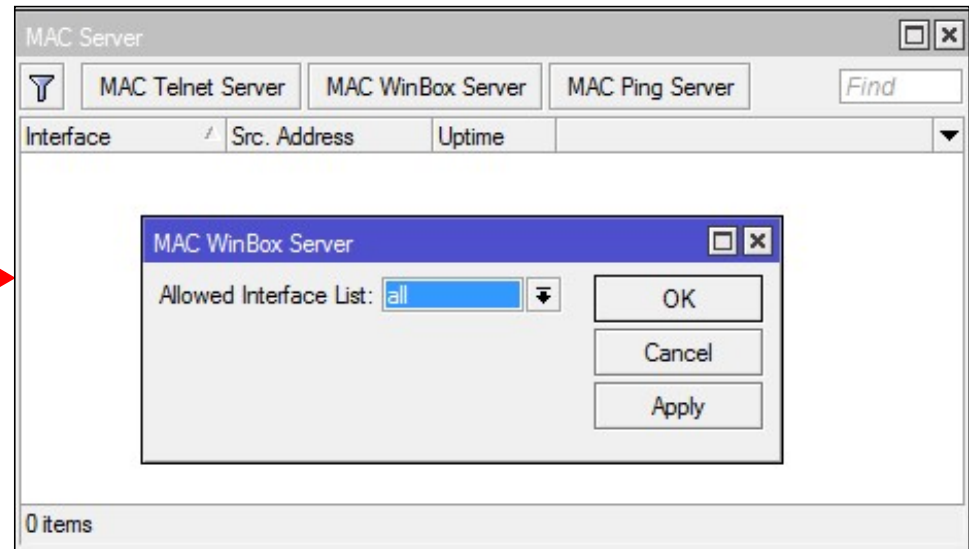
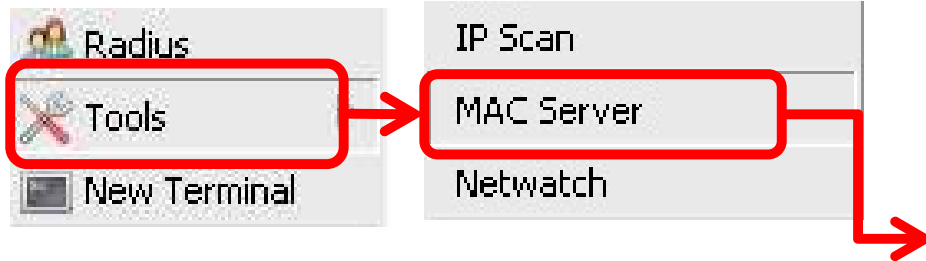
Refresh Find all ▼

MAC Address	IP Address	Identity	Version	Board
D4:CA:6D:0F:40:1C	192.168.30.1	30-PujoRiset	6.34.1 (...)	RB951-2n
D4:CA:6D:FA:11:44	192.168.128.2	Switch-Beo9-Ata...	6.15	CR5125-24G-
D4:CA:6D:FA:10:F9	192.168.128.3	Switch-Beo9-Baw...	6.24	CR5125-24G-
4C:5E:0C:27:D8:4F	192.168.128.10	Router-TSO-Lt.1	6.29.1	RB2011UiAS-2
00:0C:42:34:77:77	192.168.128.11	Router-Administr...	6.32.2	RB493
00:0C:42:5D:15:DD	192.168.128.12	Router-RMA-Lt.1	6.32.2	RB493AH
4C:5E:0C:F1:8F:2A	192.168.128.14	MikroTik	6.25	RB941-2nD
D4:CA:6D:FC:9D:00	192.168.128.17	R-TSO-Lt2	6.33.3 (...)	CR5125-24G-
D4:CA:6D:0E:37:54	192.168.128.19	R-Assembling-2	6.29.1	CCR1016-12G

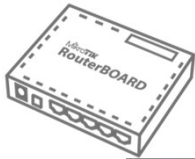
16 items



MAC Server



Di MAC Server, kita bisa menonaktifkan fitur MAC-TELNET, MAC-WINBOX serta MAC PING atau menentukan di interface tertentu saja fitur tersebut aktif



Tools - Email

The 'Email Settings' dialog box is used to configure the SMTP server. It contains the following fields and buttons:

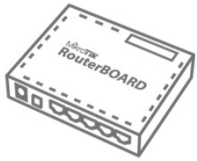
- Server: mail.mikrotik.co.id
- Port: 25
- Start TLS: yes
- From: pujo@mikrotik.co.id
- User: rahasiadonk
- Password: mautauaja
- Buttons: OK, Cancel, Apply, Send Email

The 'Send Email' dialog box is used to send an email manually. It contains the following fields and buttons:

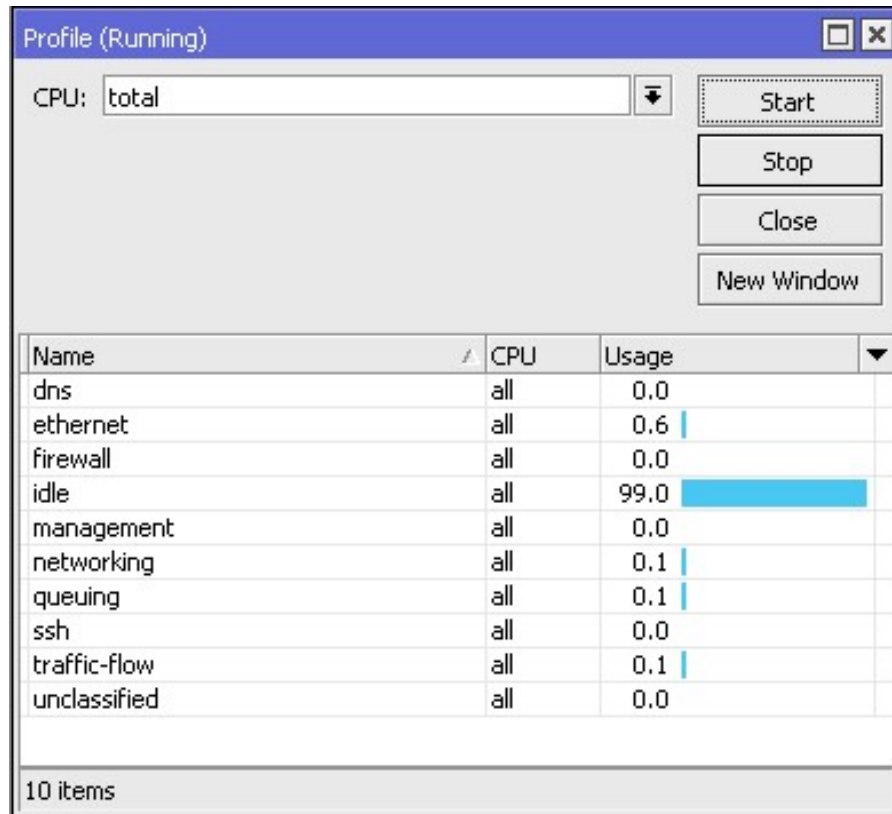
- Address: 0.0.0.0
- Port: (dropdown)
- User: (dropdown)
- Password: (dropdown)
- ☐ TLS
- To: (dropdown)
- CC: (dropdown)
- From: (dropdown)
- Subject: (dropdown)
- Body: (text area)
- Files: (dropdown)
- Buttons: Send Email, Cancel

Email Setting digunakan untuk pengaturan SMTP Server
Fungsi kirim email secara manual bisa dilakukan via "Send Email"
Biasanya dikombinasikan dengan scripting atau scheduler untuk pengiriman warning atau file backup secara rutin

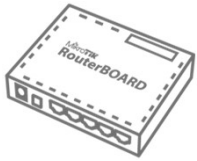
Contoh : http://mikrotik.co.id/artikel_lihat.php?id=119



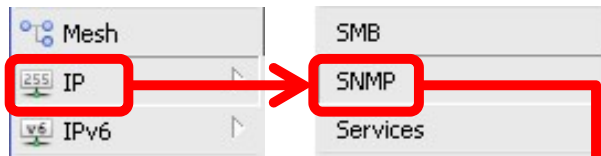
Tools - Profile



Memonitor service yang berjalan di router kita dan efeknya ke cpu load router



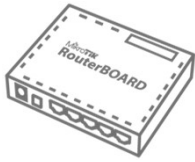
SNMP



Simple Network Management Protocol (SNMP) biasanya terdiri dari 2 mesin, mesin yang mengaktifkan SNMP (agent) dan mesin yang mengambil serta mengolah data (manager)

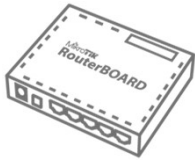
Mikrotik RouterOS support SNMP v1, v2 dan v3

Contoh implementasi : http://mikrotik.co.id/artikel_lihat.php?id=81

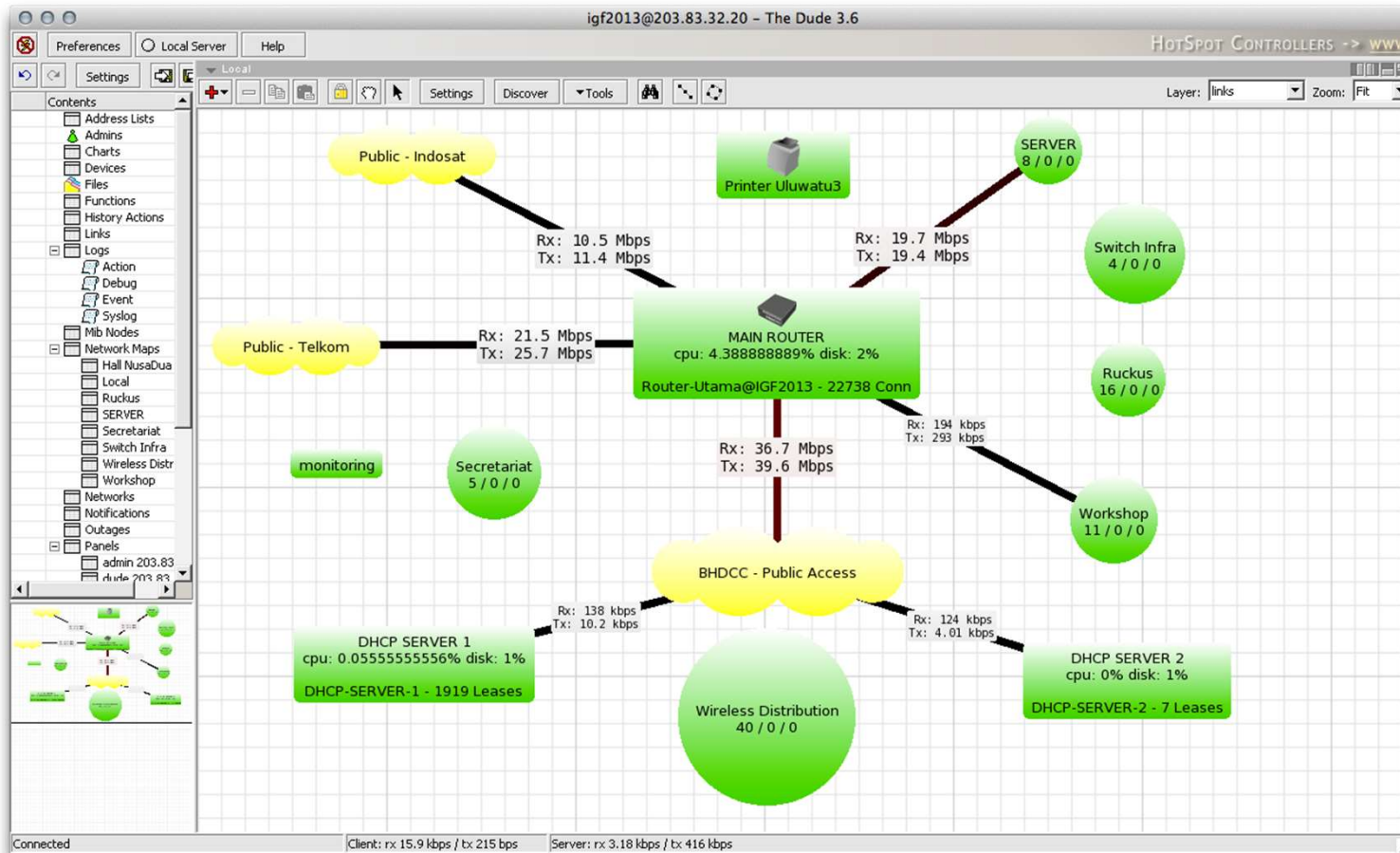


The Dude (1)

- Aplikasi freeware MikroTik yang bisa kita gunakan untuk monitoring jaringan secara utuh.
- Feature :
 - Automatic discovery + layout map of devices
 - Monitoring of services & Alerting
 - Support SNMP, ICMP, DNS & TCP monitoring
 - GRATIS 😊
- Terdapat 2 macam the Dude yaitu Dude Server dan Dude Client
- Dude Server merupakan package tambahan dan bisa diinstall di perangkat dengan arsitektur TILE, CHR, ARM, x86 atau MMIPS
- Sedangkan untuk Dude Client bisa dijalankan di OS Windows



The Dude (2)



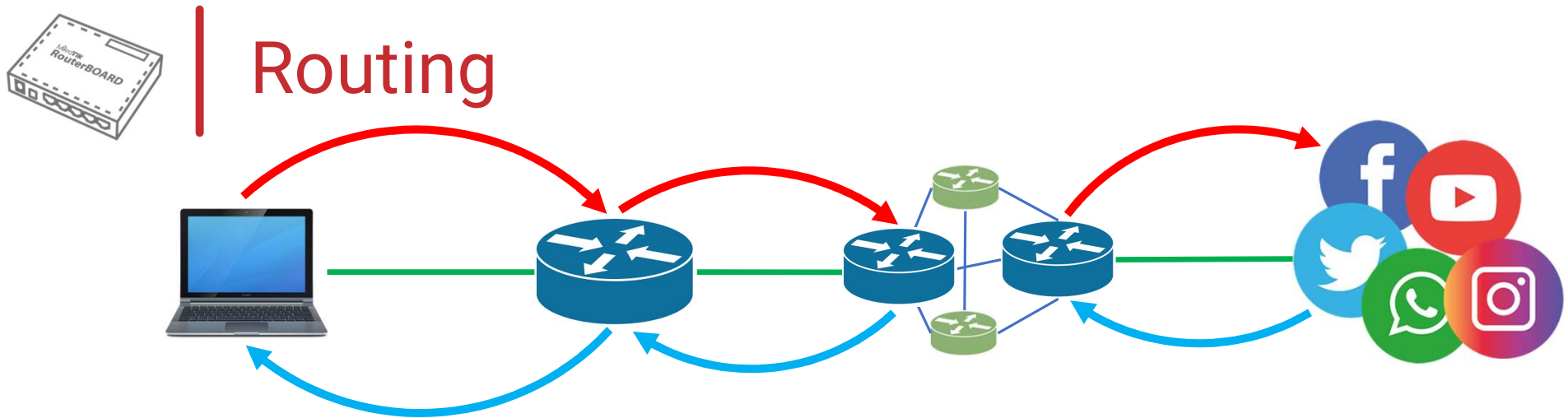
Routing

MikroTik Basic – MTCNA Class

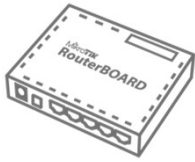


MikroTik Master Distributor
MikroTik Certified Training Partner
www.citraweb.com



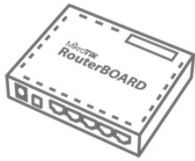


- Metode yang berfungsi untuk meneruskan paket data ke IP tujuan (destination) melalui router (gateway)
- Routing dibutuhkan untuk meneruskan data ke subnet / segment IP yang berbeda
- Data dilewatkan secara estafet dari satu router ke router lain hingga sampai di IP tujuan (destination) dan dapat kembali ke IP pengirim (source)
- Traffic jaringan berjalan 2 arah, request dan response.



Routing : Type

- Static Route
 - Merupakan informasi routing yang dibuat secara manual oleh admin jaringan untuk menentukan jalur mana yang akan digunakan
 - Pada MikroTik, tidak perlu menambah "Extra Package" untuk menjalankan static routing
- Dynamic Route
 - Merupakan informasi routing yang dibuat secara otomatis oleh router karena service tertentu (misal : mengaktifkan DHCP Client, OSPF, BGP dsb)
 - Biasanya digunakan pada jaringan skala besar



Routing : Parameter

Route List

AS+
DAd+
DAC
DAC
DAC

Route <0.0.0.0/0->192.168.76.1>

General Status MPLS

Dst. Address: 0.0.0.0/0

Gateway: 192.168.76.1

Immediate Gateway: 192.168.76.1%ether3

Local Address:

Check Gateway:

☐ Suppress Hw Offload

Distance: 1

Scope: 30

Target Scope: 10

VRF Interface:

Routing Table: main

Pref. Source:

☐ Blackhole

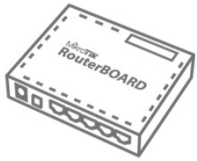
OK
Cancel
Apply
Disable
Comment
Copy
Remove

Destination (Dst. Address) = tujuan traffic

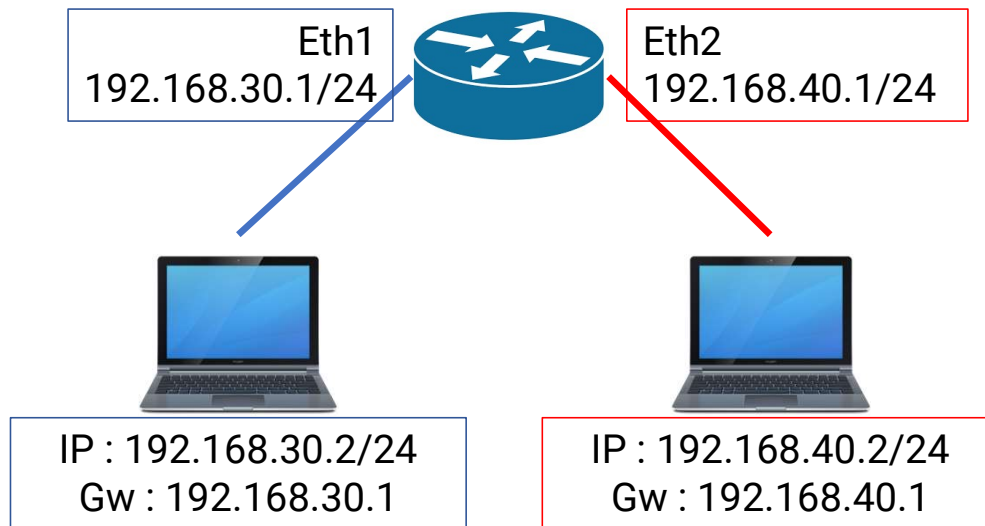
- Sebuah host → 202.65.113.16
- Sebuah network → 202.65.113.0/24
- Semua network → 0.0.0.0/0

Gateway = jalur yang akan digunakan

- IP Address dari router depannya
- Interface yang akan dilewati (biasanya untuk PPP interface)



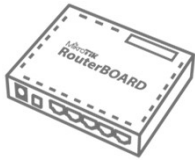
Routing : Example 1



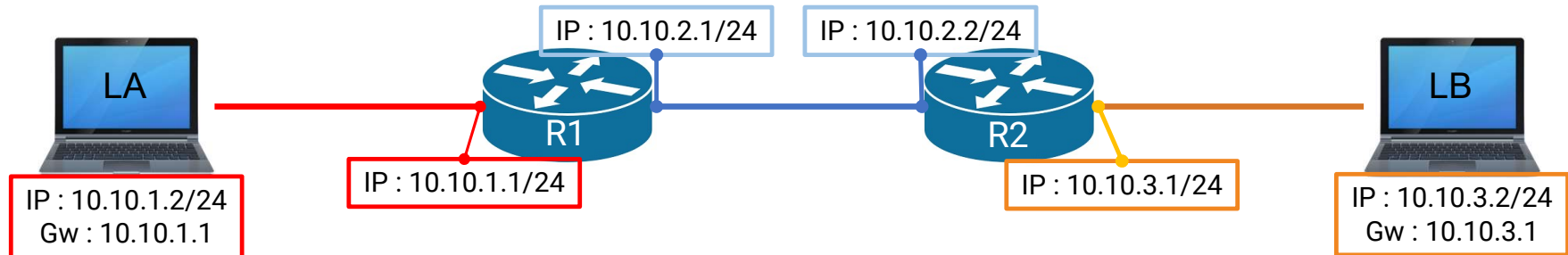
	Dst. Address	Gateway	Distance	Pref. Source
DAC	192.168.30.0/24	ether1	0	
DAC	192.168.40.0/24	ether2	0	

2 items out of 4

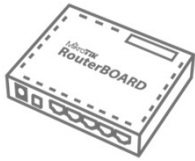
- Pada kondisi ini, tidak dibutuhkan tambahan Static Route pada Router
- Secara otomatis router mengenali Segment IP yang terhubung langsung (Connected)
- Untuk dapat terhubung, cukup atur gateway pada masing-masing pada laptop mengarah ke IP Router



Routing : Example 2 – Static Route



- Pada kondisi ini, LA tidak dapat berkomunikasi dengan LB
- Sebab, R1 tidak mengetahui jalur ke arah segment LB (10.10.3.0/24)
- Begitu juga R2 tidak mengetahui jalur ke arah segment LA (10.10.1.0/24)
- Maka, dibutuhkan tambahan konfigurasi Static Route pada R1 dan R2 agar LA dan LB dapat berkomunikasi
- Konfigurasi Static Route dengan CLI pada R1
 - `/ip/route/add dst-address=10.10.3.0/24 gateway=10.10.2.2`
- Konfigurasi Static Route dengan CLI pada R2
 - `/ip/route/add dst-address=10.10.1.0/24 gateway=10.10.2.1`



Routing : Flags

Route List

	Dst. Address	Gateway	Distance	Pref. Source
AS+	0.0.0.0/0	10.10.10.100	1	
DAv+	0.0.0.0/0	pptp-out1	1	
DAC	10.10.10.0/24	wlan1	0	
IUSH	172.16.1.0/30	192.168.40.1	1	
DAC	172.16.100.100/32	pptp-out1	0	
DAC	192.168.30.0/24	ether1	0	

6 items out of 9

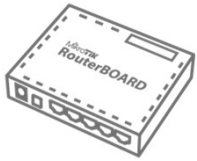
Terminal <1>

```
[admin@MikroTik] > /ip/route/print detail
Flags: D - dynamic; X - disabled, I - inactive, A - active;
c - connect, s - static, r - rip, b - bgp, o - ospf, d - dhcp, v - vpn;
H - hw-offloaded; + - ecmp
DAv + dst-address=0.0.0.0/0 routing-table=main pref-src=""
      gateway=pptp-out1 immediate-gw=pptp-out1 distance=1 scope=30
```

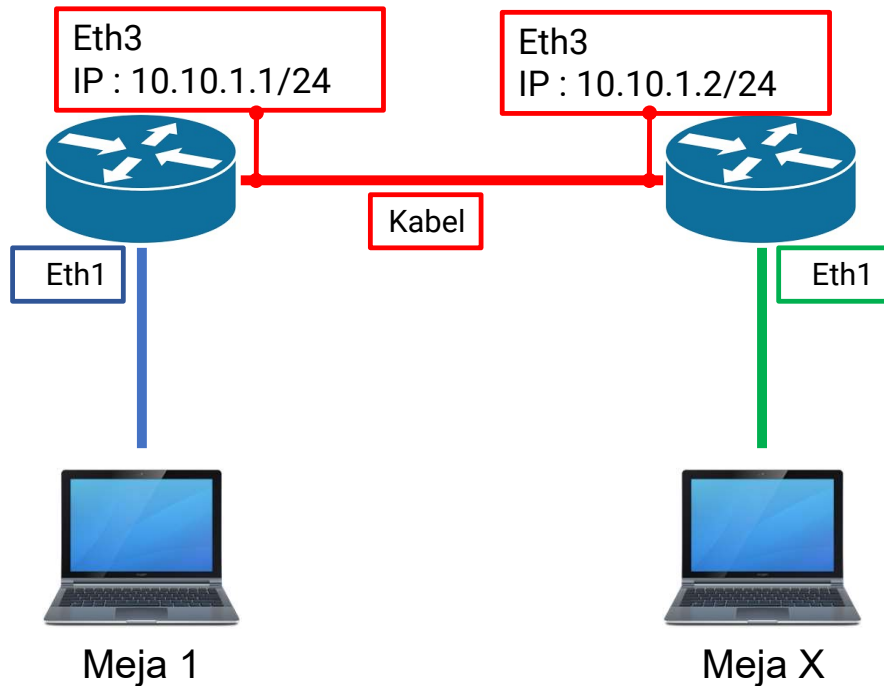
Untuk memudahkan identifikasi type routing, akan terdapat tanda huruf (Flag) pada setiap rule Routing

D – dynamic v – vpn
A – active b – bgp
S – static d – DHCP
C – connect + - ecmp
o – OSPF

Selengkapnya bisa cek melalui Terminal CLI : /ip route print

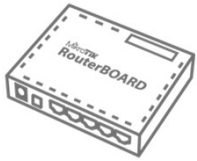


Routing : LAB 1 – Simple Static Route

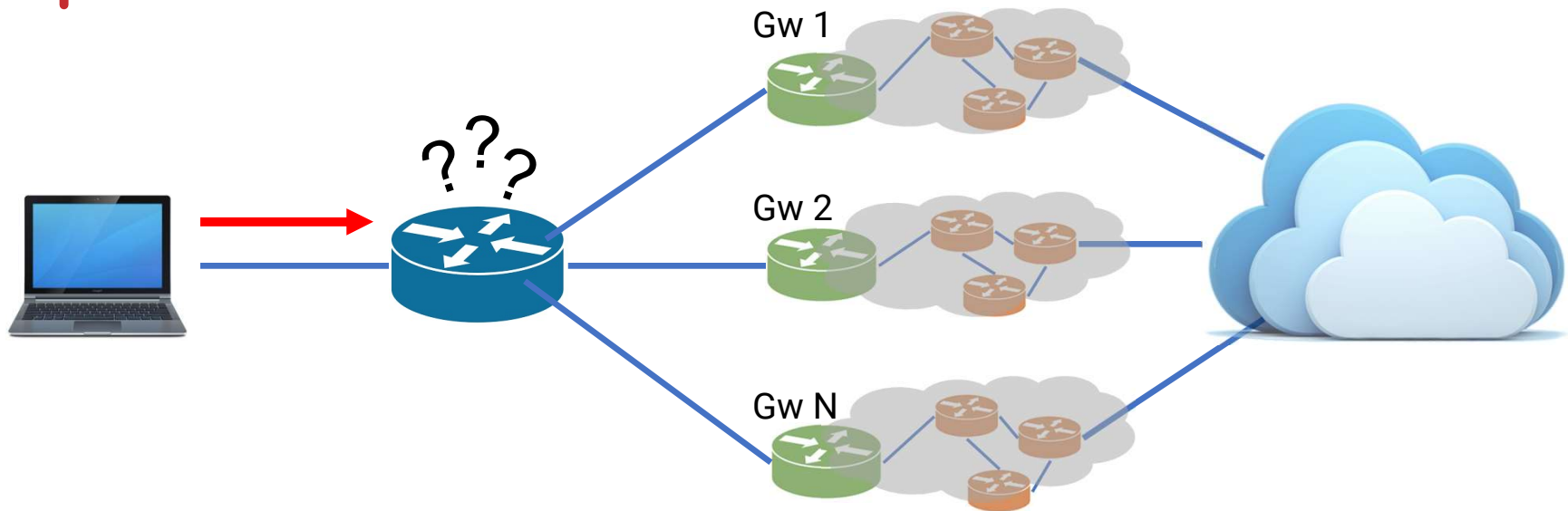


Tugas :

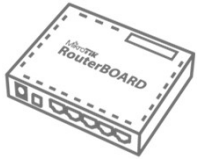
- Bangunlah topologi seperti di samping dengan rekan peserta lain
- Lakukan konfigurasi agar antar laptop dapat berkomunikasi
- Lakukan pengecekan dengan PING dan Traceroute



Routing : Multiple Gateway



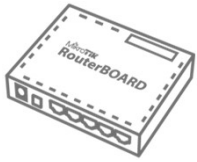
- Router dapat memiliki lebih dari 1 gateway untuk menuju ke suatu tujuan
- Biasa dijumpai pada jaringan yang membutuhkan ketersediaan akses yang tinggi
- Misalnya dengan berlangganan lebih dari 1 ISP untuk backup link
- Gateway mana yang digunakan / dilewati ditentukan berdasarkan perhitungan Route Selection



Routing : Route Selection

Untuk pemilihan routing, router akan memilih berdasarkan:

- Rule routing yang paling spesifik tujuannya
 - Contoh: destination 192.168.0.128/26 lebih spesifik dari 192.168.0.0/24
- Distance
 - Router akan memilih yang distance nya paling kecil
- Round robin (random)

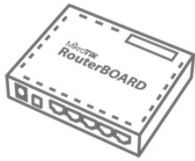


Routing : Route Selection Example

Untuk koneksi dengan destination 192.168.0.9, manakah urutan prioritas rule yang digunakan ?

DESTINATION	DISTANCE	GATEWAY	
192.168.0.0/24	1	10.10.1.1	2
192.168.0.0/27	2	10.10.2.1	1
192.168.0.0/29	4	10.10.3.1	
192.168.0.0/24	5	10.10.4.1	3
0.0.0.0/0	1	10.10.10.100	4

Router OS memiliki fitur Check-Gateway untuk dapat melakukan pengecekan status gateway secara berkala



Routing : Check-Gateway

- Check Gateway bisa kita gunakan untuk mendeteksi apakah gateway kita terkoneksi / tidak.
- Fungsi check gateway akan mengirimkan **arp / icmp echo request** secara berkala (per 10 detik)
- Sebuah rule check gateway, akan berlaku disemua rule yang menggunakan gateway sama
- Jika terjadi 2x timeout, maka gateway tersebut dianggap putus (unreachable) dan rule routing yang menggunakan gateway tersebut tidak digunakan

New Route

General Status MPLS

Dst. Address: 0.0.0.0/0

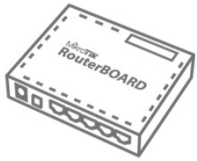
Gateway: 10.10.10.100

Immediate Gateway: [unknown](#)

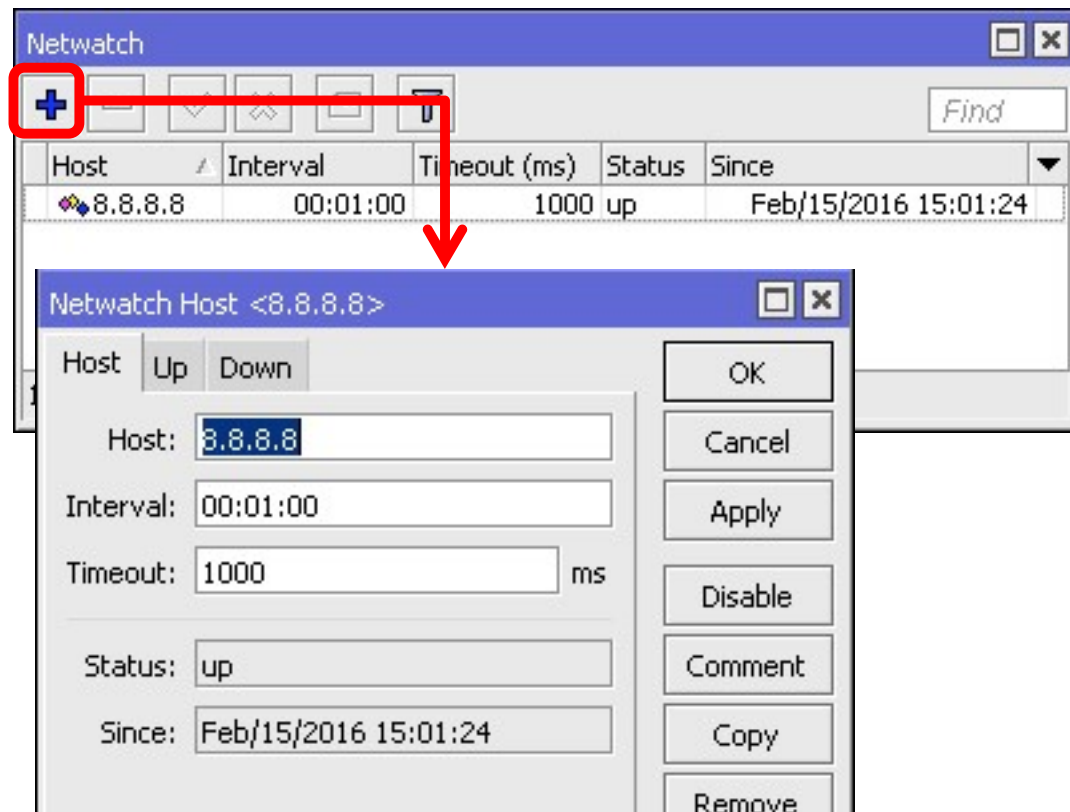
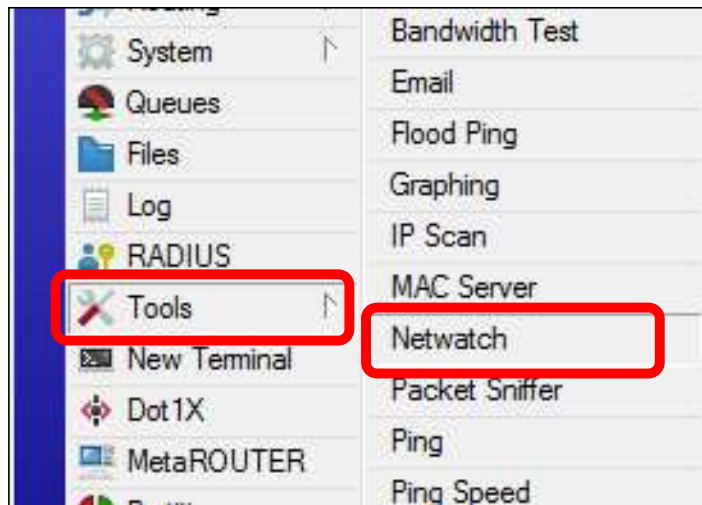
Local Address:

Check Gateway: ping

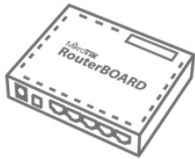
☐ Suppress Hw Offload



Tools - Netwatch



Dengan netwatch, router kita akan mengirimkan icmp ke sebuah host dengan interval yang kita tentukan

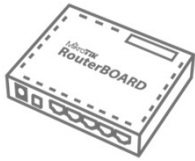


Tools - Netwatch (2)

The image shows two Mikrotik Netwatch configuration windows and a log window. The left window is for the 'Up' state, showing the script ':log info message="Google UP"'. The right window is for the 'Down' state, showing the script ':log warning message="Google Down"'. The log window displays the following entries:

Time	Memory	Script	Message
Feb/15/2016 15:04:51	memory	script, info	Google UP
Feb/15/2016 15:06:03	memory	script, warning	Google Down

Router akan menjalankan script pada tab "UP" atau "DOWN" sesuai kondisi host yang dimonitoring
Contoh : http://mikrotik.co.id/artikel_lihat.php?id=85



Tools - Traceroute

Traceroute (Running)

Traceroute To:

Packet Size:

Timeout: ms

Protocol:

Port:

☒ Use DNS

Count:

Max Hops:

Src. Address:

Interface:

DSCP:

Routing Table:

Start

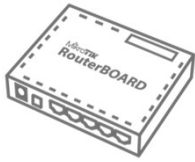
Stop

Close

New Window

Hop	Host	Loss	Sent	Last	Avg.	Best	Worst	Std. Dev.	History
1	10.10.10.100	0.0%	74	21.0ms	8.7	0.6	71.3	14.2	
2	192.168.128.1	0.0%	74	25.7ms	11.4	0.7	103.2	18.8	
3	192.168.0.100	0.0%	74	5.4ms	9.5	1.0	51.9	12.3	
4	202-65-113-1.jogja.citra.n...	0.0%	74	29.2ms	10.5	1.2	52.3	12.3	
5	202.65.112.203	0.0%	74	12.2ms	6.5	1.4	36.2	6.4	
6	www.mikrotik.co.id	0.0%	74	23.4ms	7.7	1.5	59.9	8.6	

Digunakan untuk menampilkan host / gateway yang dilewati untuk ke sebuah tujuan



Quiz - Routing

1. Manakah rule default-route berikut yang akan aktif

/ip route

add dst-address=0.0.0.0/0 distance=3 gateway=192.168.20.1

add dst-address=0.0.0.0/0 distance=1 gateway=192.168.40.1

add dst-address=0.0.0.0/0 distance=5 gateway=192.168.30.1

2. Saat menggunakan check-gateway, berapa lama sebuah gateway akan dianggap unreachable oleh router?

a. 10 Detik

b. 20 Detik

c. 30 Detik

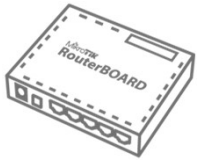
Bridging

MikroTik Basic – MTCNA Class

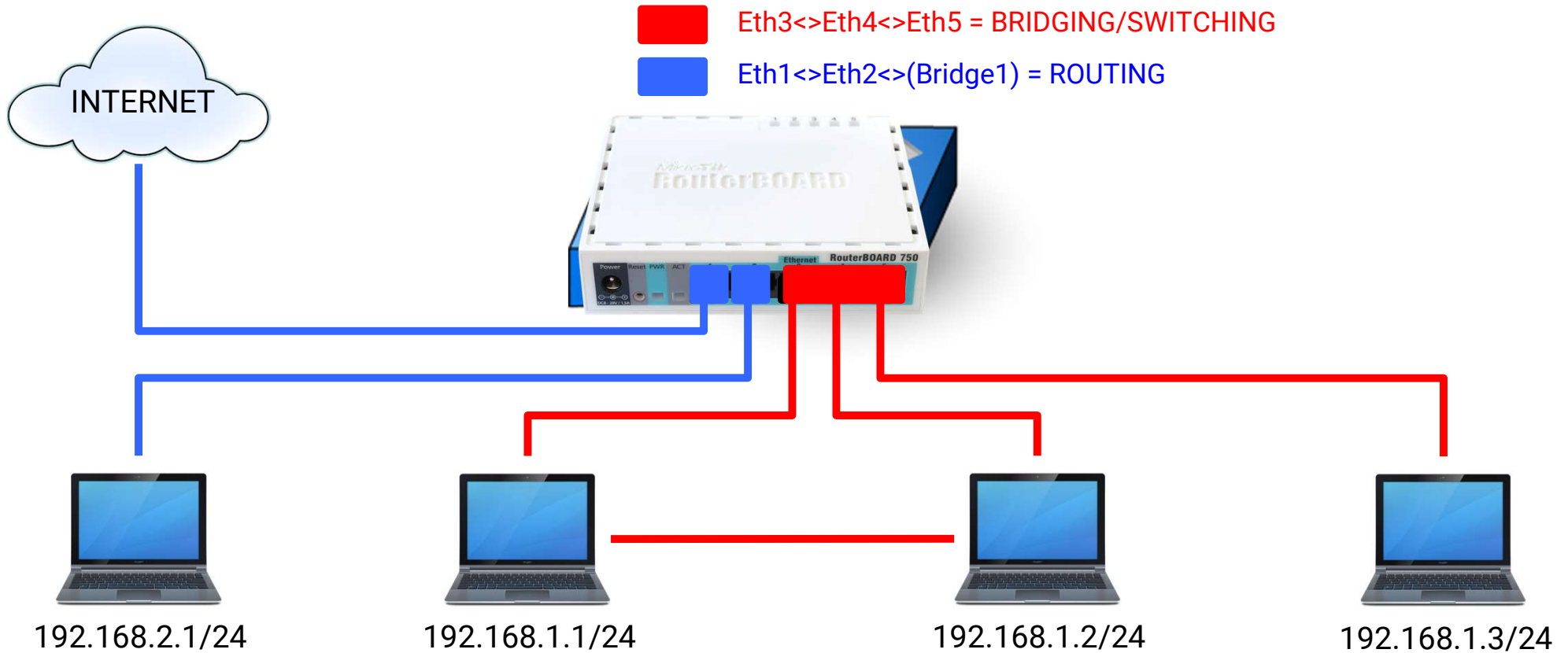


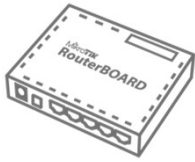
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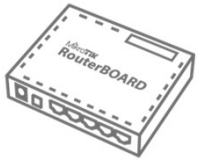
Interconnection





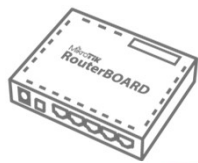
Bridging Concept

- Digunakan untuk menggabungkan 2 atau lebih interface yang bertipe ethernet kedalam sebuah broadcast domain yang sama
- Proses ini dilakukan di OSI layer 2
- Software mode : Bridge
- Hardware Mode : Hardware Offload



Bridge VS Hardware Offload

Feature	BRIDGE	HW OFFLOAD
Level	Software	Hardware
Platform	Semua (RB / PC)	Hanya RB tertentu
Interfaces	Ethernet, VLAN, Wireless, SFP, Tunnel	Ethernet (tergantung chipset)
Monitoring	Trafik antar port bisa dikontrol	Trafik antar port yang dalam 1 switch tidak bisa dikontrol
Firewall	Support	Tidak
Speed	Slower (CPU HOG)	Faster

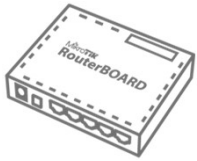


[LAB-1] Bridge Mode

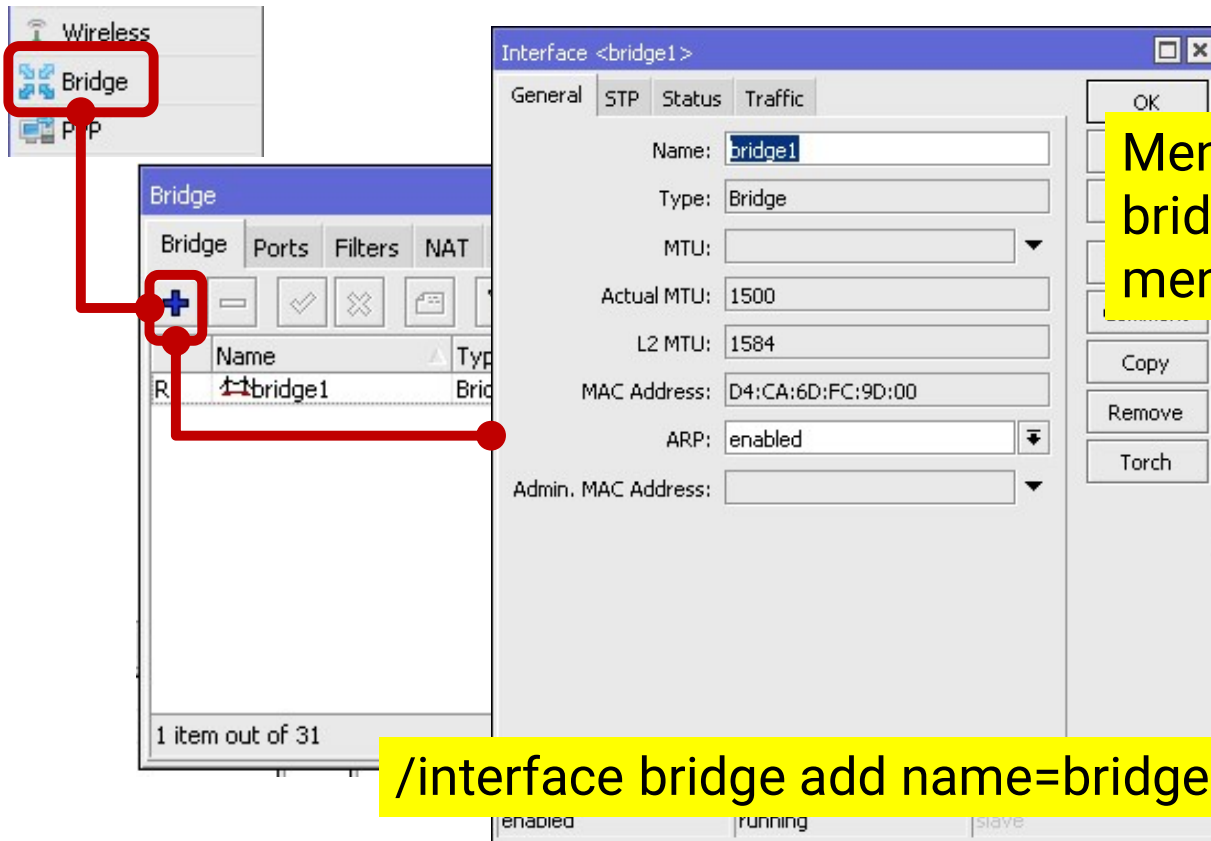


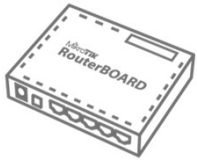
Tugas :

- Bangunlah topologi seperti gambar dengan rekan peserta lain
- Router1 bekerja sebagai router / gateway dan Router2 akan difungsikan sebagai Switch (bridge)
- Ubah konfigurasi IP Address pada laptop menjadi manual
- Cek apakah laptop bisa terkoneksi ke internet

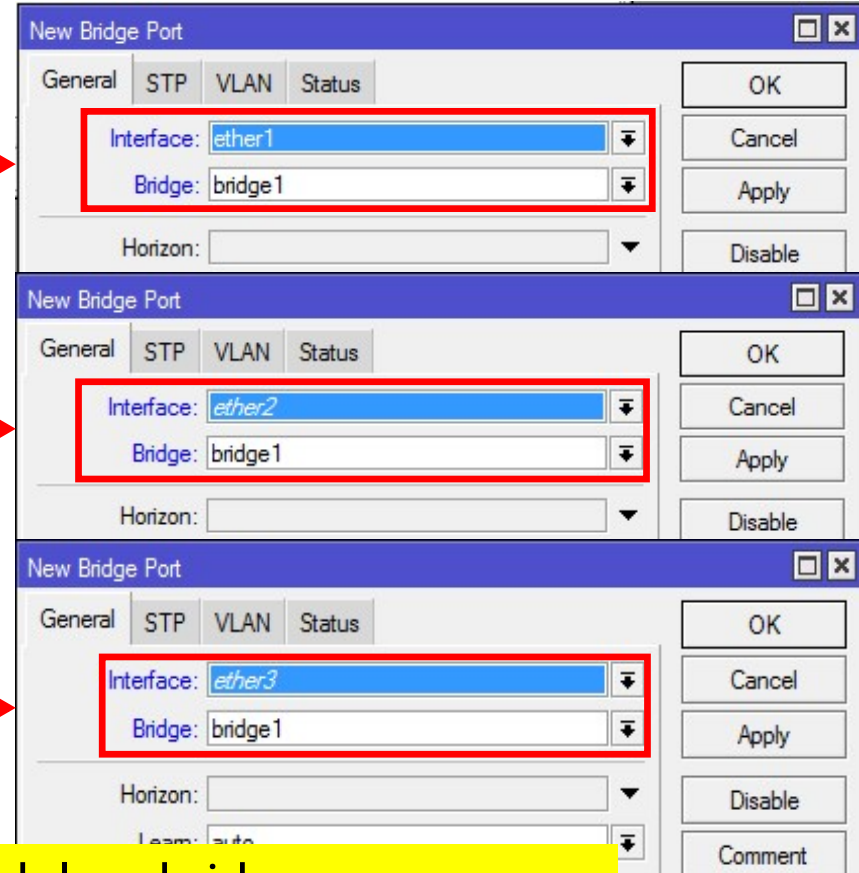
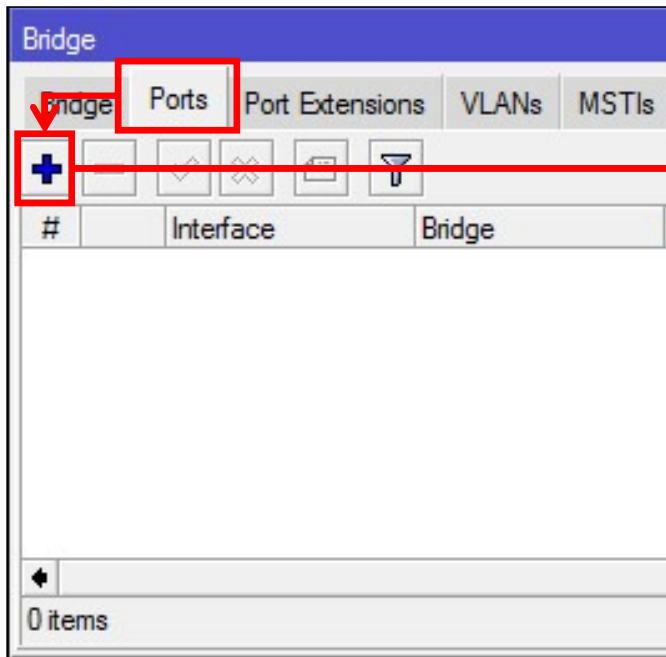


[LAB-1] Bridge Interfaces

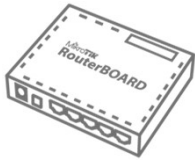




[LAB-1] Bridge Port

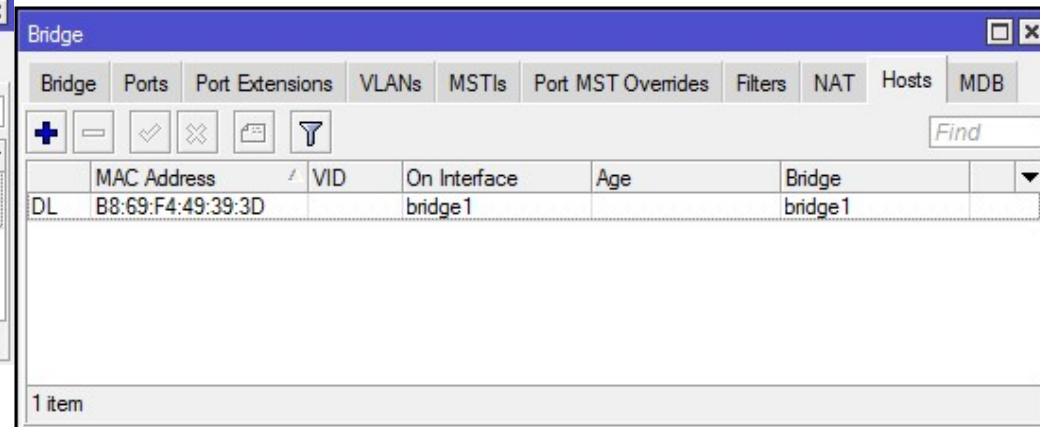
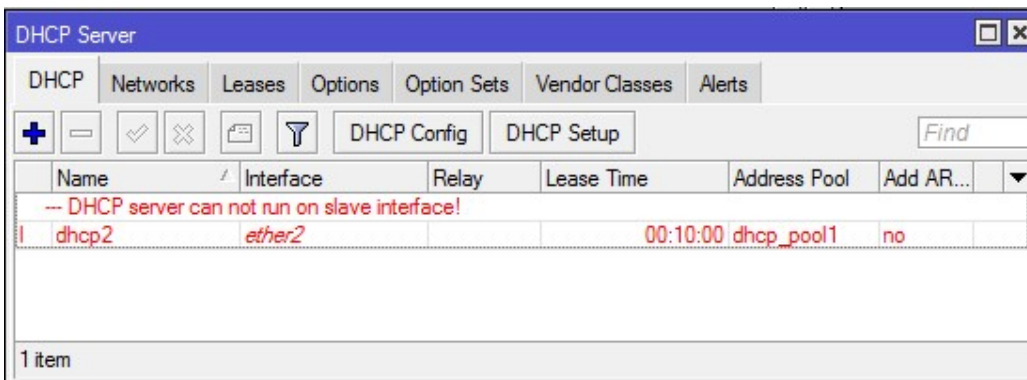


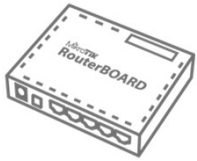
Tambahkan port ethernet ke dalam bridge



[LAB-1] Testing

- Test ping antar laptop
- Test ping dari laptop menuju Router1
- Amati service yang semula dijalankan pada Router2 (DHCP server, IP Address)
- Amati di tabel neighbor dan Bridge HOST
- Test file sharing antar laptop dan amati CPU load serta Interfaces stats





[LAB-2] Hardware Offload Mode

Bridge	
Bridge	Ports
+	-
✓	✗
⌵	⌶
Interface	Bridge
ether1	bridge1
ether2	bridge1

New Bridge Port

General STP VLAN Status

Interface: ether1

Bridge: bridge1

Horizon:

Learn: auto

☒ Unknown Unicast Flood

☒ Unknown Multicast Flood

☒ Broadcast Flood

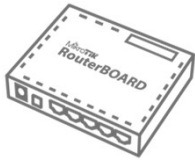
☐ Trusted

☒ Hardware Offload

OK Cancel Apply Disable Comment Copy Remove

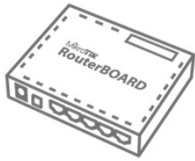
Opsi Hardware Offload

Hardware Offload On = Hardware
Hardware Offload Off = Software



Bridge Note

- Service yang ada di slave port, harus dipasangkan ke interface Bridge agar berjalan normal
- Wireless mode yang support bridging :
 - Ap-bridge, bridge, station-wds, station-pseudobridge, station-pseudobridge-clone, station-bridge, wds-slave
 - Mode STATION tidak support dengan Bridging
- Tunnel yang support bridging : EoIP
- MAC interface bridge akan mengacu ke interface slave yang pertama kali running
- Gunakan bridge host untuk memapping mac perangkat lain di tiap bridge port



STP / RSTP

Bridge

Bridge Ports Filters NAT Hosts

+ - ✓ ✗ 📁 🌐 Settings

	Name	Type	L2 MTU	Tx
R	bridge-local	Bridge	1598	624

Interface <bridge-local>

General STP Status Traffic

Protocol Mode: ☐ none ☐ stp ☒ rstp

Priority: 8000 hex

Max Message Age: 00:00:20

Forward Delay: 00:00:15

Transmit Hold Count: 6

Ageing Time: 00:05:00

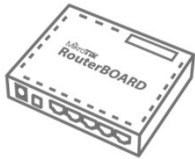
OK Cancel Apply Disable Comment Copy Remove Torch

Spanning Tree Protocol

Rapid Spanning Tree Protocol

By default aktif

Berfungsi untuk mencegah terjadinya bridge loop



Bridge Firewall

Bridge

Bridge Ports Filters NAT Hosts

+ - ✓ ✗ [icon] [icon] Reset Counters 00 Reset All Counters

#	Chain	MAC Pro...	Bytes
0	forward	800 (ip)	562 965 ...
1	forward	800 (ip)	0

2 items

New Bridge Filter Rule

General Advanced ARP STP ...

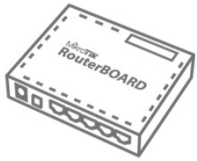
Chain: forward

- Interfaces
- Bridges
- Src. MAC Address
- Dst. MAC Address
- MAC Protocol
- IP
- Packet Mark
- Ingress Priority

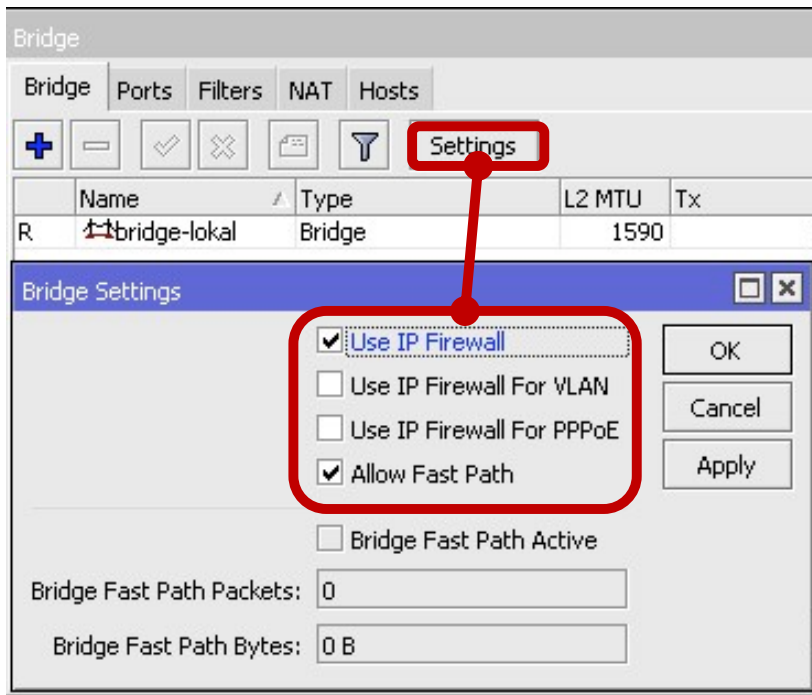
enabled

OK Cancel Apply Disable Comment Copy Remove Reset Counters Reset All Counters

Bridge Filter & Nat bisa kita gunakan untuk melakukan firewall antar port yang masih dalam 1 bridge



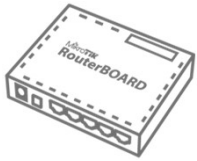
IP Firewall



Aktifkan “Use IP Firewall” jika trafik antar portnya ingin diatur di layer 3

- /ip firewall
- /queue

/interface bridge settings
set use-ip-firewall=yes



Switch Chip

PPP
Switch
Mesh

Switch

Switch Port Host VLAN Rule

Find

Name	Type
switch1	Atheros 7240

1 item (1 selected)

Switch

Switch Port Host VLAN Rule

Find

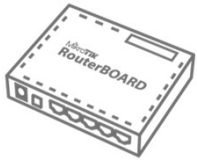
Name	Switch	Default VLAN ID
ether2	switch1	0
ether3	switch1	0
ether4	switch1	0
ether5	switch1	0
switch1 cpu	switch1	0

5 items (1 selected)

Type Switch

Port yang tergabung ke dalam satu switch chip

Hardware offload hanya bisa diaktifkan pada interface yang berada pada switch-chip yang sama



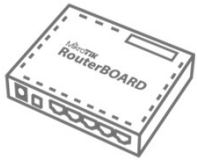
Switch Chip Group

RouterBoard	Switch Group
RB3011 Series	Eth1 – Eth5; Eth6 – Eth10
RB951Ui-2nD	Eth1 – Eth5
RB433	Eth2 – Eth3
RB1100AHx2	Eth1 – Eth5; Eth6 – Eth10

RouterBoard	Switch Group
RB941-2nD (hAP – Lite)	Eth1 – Eth4
RB750 Series	Eth1 – Eth5
RB450	Eth2 – Eth5
RB2011	Eth1 – Eth5 +sfp1 Eth6 – Eth10

Perangkat CCR dan x86 tidak memiliki switch chip sehingga tidak support mode Hardware Offload

Selengkapnya : http://wiki.mikrotik.com/wiki/Manual:Switch_Chip_Features



Quiz – 1

1. Jika ether1 dan ether2 sudah di bridge, dan kita menginginkan DHCP untuk dapat diakses dari kedua interface tersebut, maka DHCP Server bisa dijalankan pada ether1 (Benar/Salah)
2. Switch mode bisa dijalankan untuk interface Wlan1 dan ether3 pada RB931-2nd. (Benar/Salah)

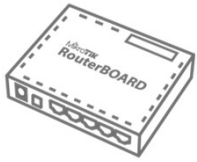
WIRELESS 802.11

MikroTik Basic – MTCNA Class



MikroTik Master Distributor
MikroTik Certified Training Partner
www.citraweb.com

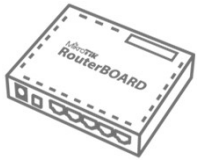




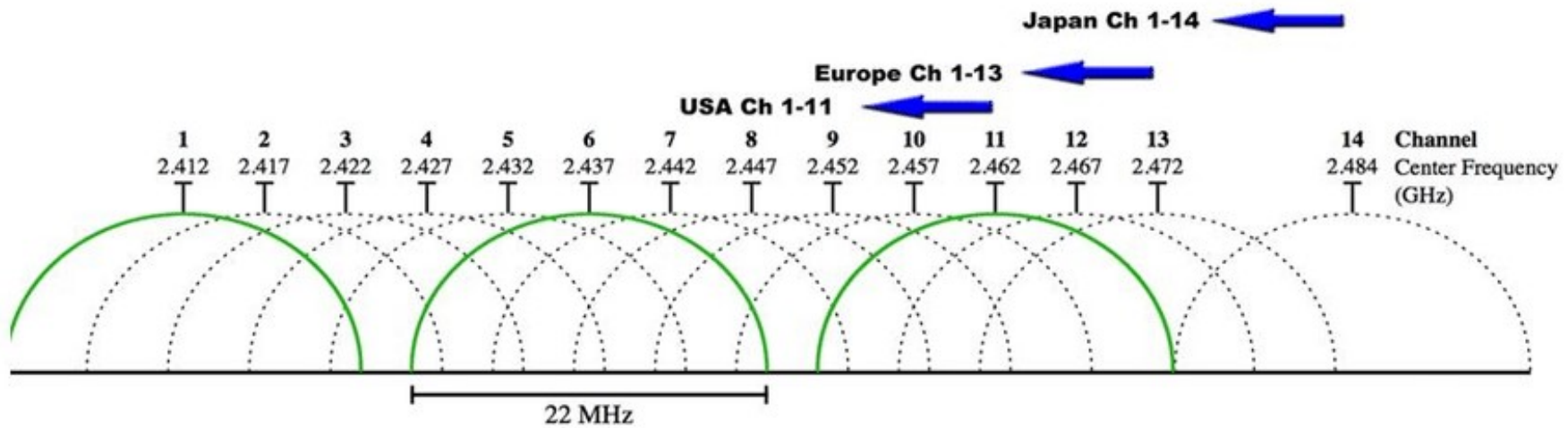
Wireless Protocol – IEEE Standart

Standart	Frequency	Channel Width	Speed
802.11a	5GHz	20MHz	54Mbps
802.11b	2.4GHz	20MHz	11Mbps
802.11g	2.4GHz	20MHz	54Mbps
802.11n	2.4GHz / 5GHz	20, 40MHz	Up to 450Mbps*
802.11ac	5GHz	20, 40, 80, 160MHz	Up to 1300Mbps*

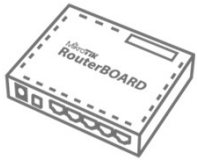
* Routerboard tertentu



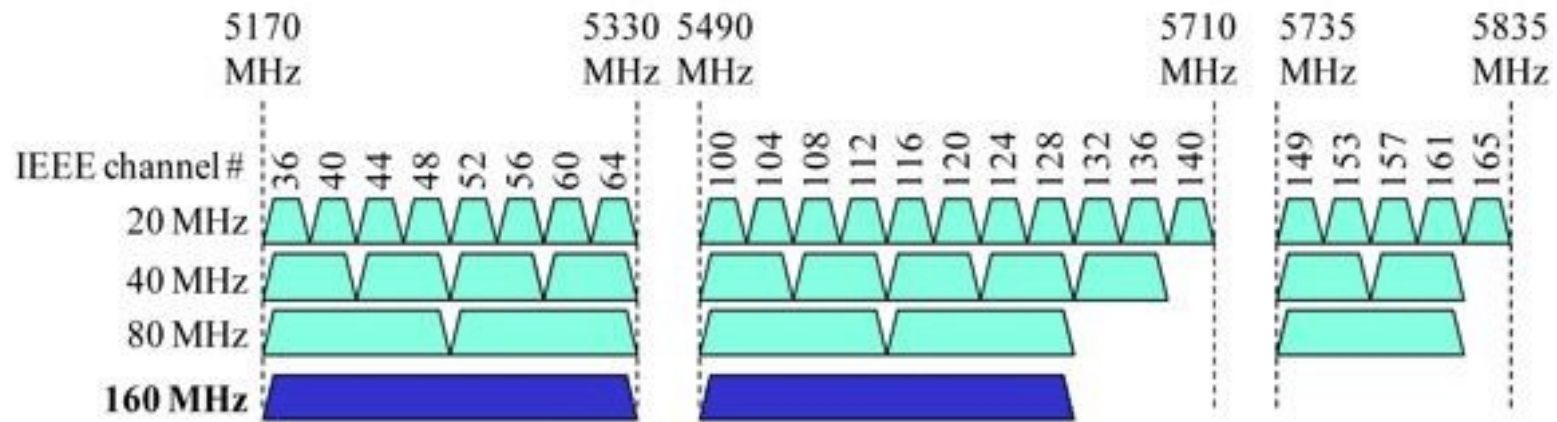
2.4Ghz Frequency



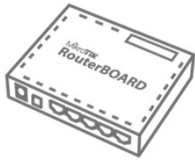
Sumber: Kocaleva, Mirjana. 2017. Self-Organized Networks. https://www.researchgate.net/publication/328064410_Self-Organized_Networks



5.8Ghz Frequency



Sumber: Kocaleva, Mirjana. 2017. Self-Organized Networks. https://www.researchgate.net/publication/328064410_Self-Organized_Networks



Frequency Regulation

- **Tiap negara memiliki regulasi mengenai wireless yang berbeda-beda.** Regulasi ini akan mengatur frekuensi, maximum power / eirp, band dan sebagainya yang boleh digunakan.
- Setting **Country**, sesuai dengan kebijakan dan peraturan pemerintah Indonesia, sudah di-**LOCK** pada frequency yang diizinkan untuk penggunaan secara bebas.

Interface <wlan1>

General Wireless HT HT MCS WDS Nstreme NV2 Status ...

Mode: ap bridge

Band: 2GHz-B/G/N

Channel Width: 20MHz

Frequency: 2412 MHz

SSID: 2412

Security Profile: 2417

WPS Mode: 2422

Frequency Mode: 2427

Country: 2432

Installation: 2437

Default AP Test Link: 2442

2447

2452

2457

2462

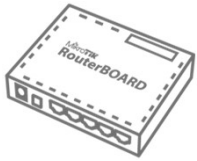
auto

WPS Mode: push button

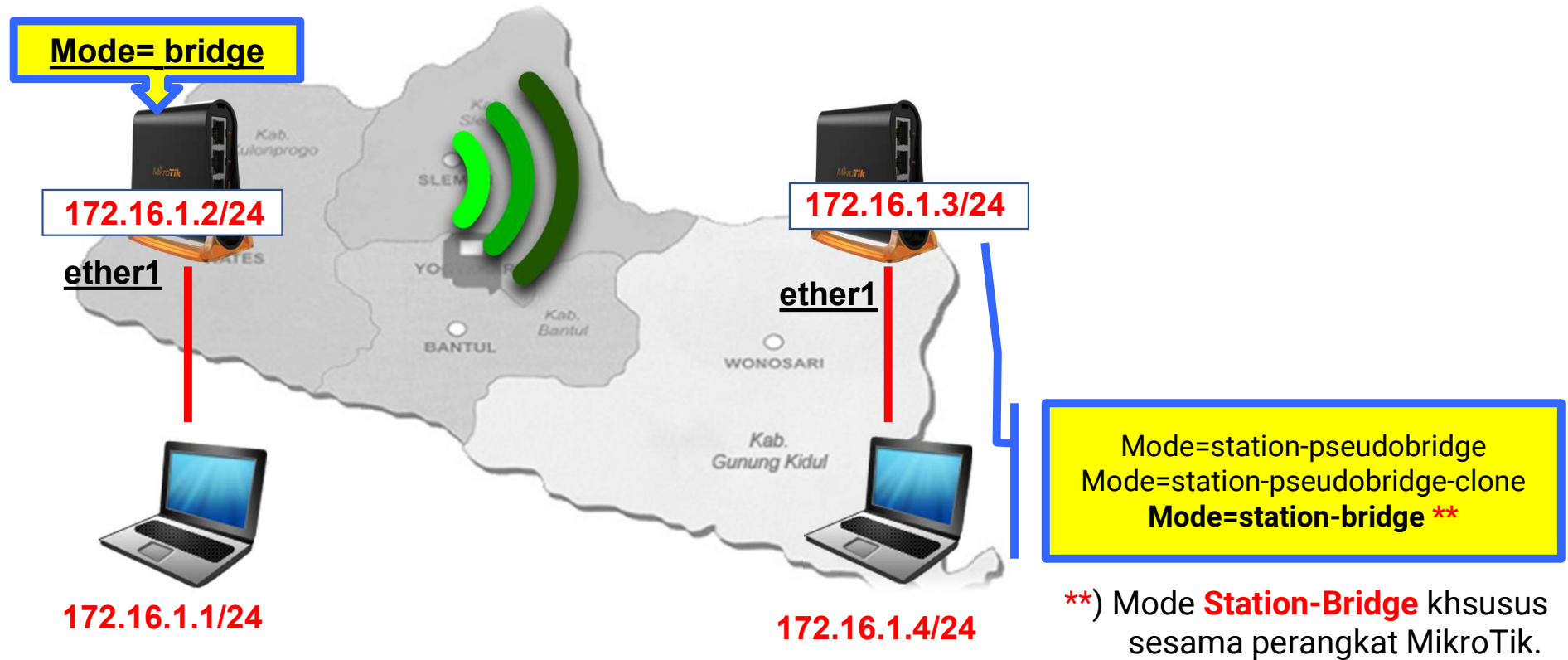
Frequency Mode: regulatory-domain

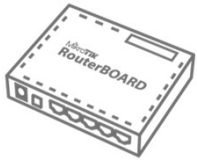
Country: indonesia4

Installation: any



LAB1 – PTP (Point To Point) Bridge





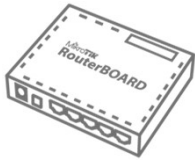
LAB1 – Konfigurasi PTP (AP Side)

Wireless Tables				
WiFi Interfaces				
W60G Station Nstreme Dual Access List Registration				
+ - ✓ ✗ 📁 📶 CAP WPS Client Setup Repeater				
	Name	Type	Actual MTU	Tx
X	wlan1	Wireless (Atheros AR9...	1500	

Langkah Setting:

- **Mode = Bridge**
- **Band**
- Channel Width (optional)*
- **Frequency**
- **SSID**

Interface <wlan1>									
General Wireless HT HT MCS WDS Nstreme NV2 Status ...									
Mode: bridge									
Band: 2GHz-B/G/N									
Channel Width: 20MHz									
Frequency: 2412 MHz									
SSID: Meja X									
Security Profile: default									
WPS Mode: push button									
Frequency Mode: regulatory-domain									
Country: indonesia4									
Installation: any									
Default AP Tx Limit: bps									
Default Client Tx Limit: bps									



LAB1 – Konfigurasi PTP (Client Side)

Interface <wlan1>

General Wireless HT HT MCS WDS Nstreme NV2 ...

Mode: station

Band: 2GHz-B/G/N

Channel Width: 20MHz

Frequency: 2422 MHz

SSID: Meja X

Security Profile: default

Frequency Mode: regulatory-domain

Country: indonesia4

Installation: any

Antenna Gain: 0 dBi

☒ Default Authenticate

OK Cancel Apply Enable Comment Advanced Mode Torch WPS Accept WPS Client Setup Repeater Scan...

Scan List: default

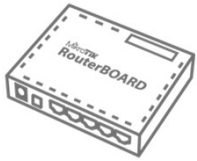
Skip DFS Channels: disabled

Wireless Protocol: any

Security Profile: default

Langkah Setting:

- **Mode = Station Bridge**
- **Band, Channel Width, SSID** disesuaikan sisi AP
- **Scan-List**



LAB1 – Bridging Interface

Bridge

Bridge Ports Port Extensions VLANs MSTIs Port MST Overrides

+ - ✓ ✗ 📁 🗑️ Settings

#	Name	Type	L2 MTU	Tx
R	bridge1	Bridge	65535	

Interface <bridge1>

General STP VLAN Status Traffic

Name:

Type:

MTU:

Actual MTU: 1500

L2 MTU: 65535

Bridge

Bridge Ports Port Extensions VLANs MSTIs Port MST Overrides Filters NAT Hosts MDB

+ - ✓ ✗ 📁 🗑️ Find

#	Interface	Bridge	Horizon	Trusted	Priority (h...	Path Cost	Role
---	-----------	--------	---------	---------	----------------	-----------	------

New Bridge Port

General STP VLAN Status

Interface:

Bridge:

Horizon:

OK Cancel Apply Disable

New Bridge Port

General STP VLAN Status

Interface:

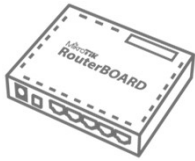
Bridge:

Horizon:

Learn:

OK Cancel Apply Disable Comment

Tambahkan **WLAN1** dan **ETHER1** ke Interface BRIDGE



LAB1 – Set IP Address

Address List

Address Network Interface

New Address

Address: 172.16.1.3/24

Network:

Interface: bridge1

OK

Cancel

Apply

Disable

Comment

Copy

Remove

enabled

2 items

Internet Protocol Version 4 (TCP/IPv4) Properties

General

You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.

☐ Obtain an IP address automatically

☒ Use the following IP address:

IP address: 172 . 16 . 1 . 1

Subnet mask: 255 . 255 . 255 . 0

Default gateway: . . .

☐ Obtain DNS server address automatically

☒ Use the following DNS server addresses:

Preferred DNS server: . . .

Alternate DNS server: . . .

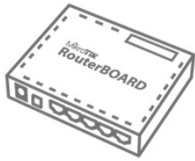
☐ Validate settings upon exit

Advanced...

OK Cancel

Lalu cek koneksi dengan menggunakan Ping

Baik dari router, maupun dari laptop



Monitoring – Registration Table

Wireless Tables

WiFi Interfaces

W60G Station

Nstreme Dual

Access List

Registration

Connect List

Security

Reset

Radio Name	MAC Address	Interface	Uptime	AP	W...	Last Activit...	Tx/Rx Signal
trainingcitraweb	B8:69:F4:4...	wlan1	00:01:30	yes	no	0.340	-12/5

AP Client <B8:69:F4:49:39:43>

General

802.1x

Signal

Nstreme

NV2

Statistics

Last Activity:

0.340 s

Tx/Rx Signal Strength:

-12/5 dBm

Tx/Rx Signal Strength Ch0:

-14/7 dBm

Tx/Rx Signal Strength Ch1:

-16/1 dBm

Tx/Rx Signal Strength Ch2:

-34 dBm

Tx/Rx Signal Strength Ch3:

Signal To Noise:

115 dB

Tx/Rx CCQ:

11/10 %

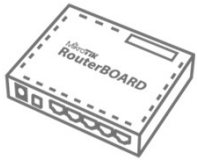
P Throughput:

935 kbps

1 item (1 selected)

Maksimalkan koneksi dengan :

- Signal Strength > -60dBm
- Signal to Noise diatas 40dBm
- CCQ 80% - 100%



Monitoring – Radio Name

Channel Width: 20/40MHz CC

Frequency: 2422 MHz

SSID: training

Radio Name: Meja-X

Scan List: default

Skip DFS Channels: disabled

Disable

Comment

Advanced Mode

Torch

WPS Assist

Wireless Tables

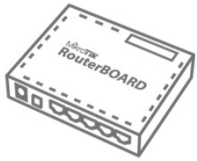
WiFi Interfaces W60G Station Nstreme Dual Access List Registration Connect List Security F

Reset

Radio Name	MAC Address	Interface	Uptime	AP	W...	Last Activit...	Tx/Rx Signal ...
meja-test	00:0C:42:E1:...	wlan1	00:00:07	no	no	0.530	8/-17

Untuk memudahkan monitoring, set **Radio-Name** pada perangkat. **

*** khusus perangkat MikroTik*



Wireless Security (WPA/WPA2 PSK)

Karena sifat dari wireless yang “open access” maka sebuah access point akan rentan terhadap serangan dari pihak yang tidak bertanggung jawab.

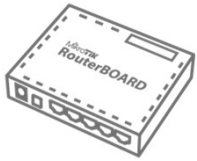
Sudah saatnya untuk mengimplementasikan Wireless Security untuk menjaga AP tersebut dari berbagai serangan.

Wireless Tables

WiFi InterfacesW60G StationNstreme DualAccess ListRegistrationConnect ListSecurity ProfilesChannels



Name	Mode	Authenticatio...	Unicast Ciphers	Group Ciphers	WPA Pre-Shared ...	WPA2 Pre-Shared
* default	none					
training	dynamic keys	WPA PSK W...	aes ccm	aes ccm	citraweb	citraweb



Security Profiles

Security Profile <training>

General | **RADIUS** | EAP | Static Keys

Name:

Mode:

Authentication Types: ☒ WPA PSK ☒ WPA2 PSK
☐ WPA EAP ☐ WPA2 EAP

Unicast Ciphers: ☒ aes ccm ☐ tkip

Group Ciphers: ☒ aes ccm ☐ tkip

WPA Pre-Shared Key:

WPA2 Pre-Shared Key:

Supplicant Identity:

Group Key Update:

Management Protection:

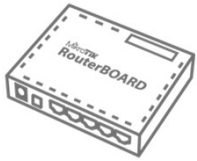
Management Protection Key:

☐ Disable PMKID

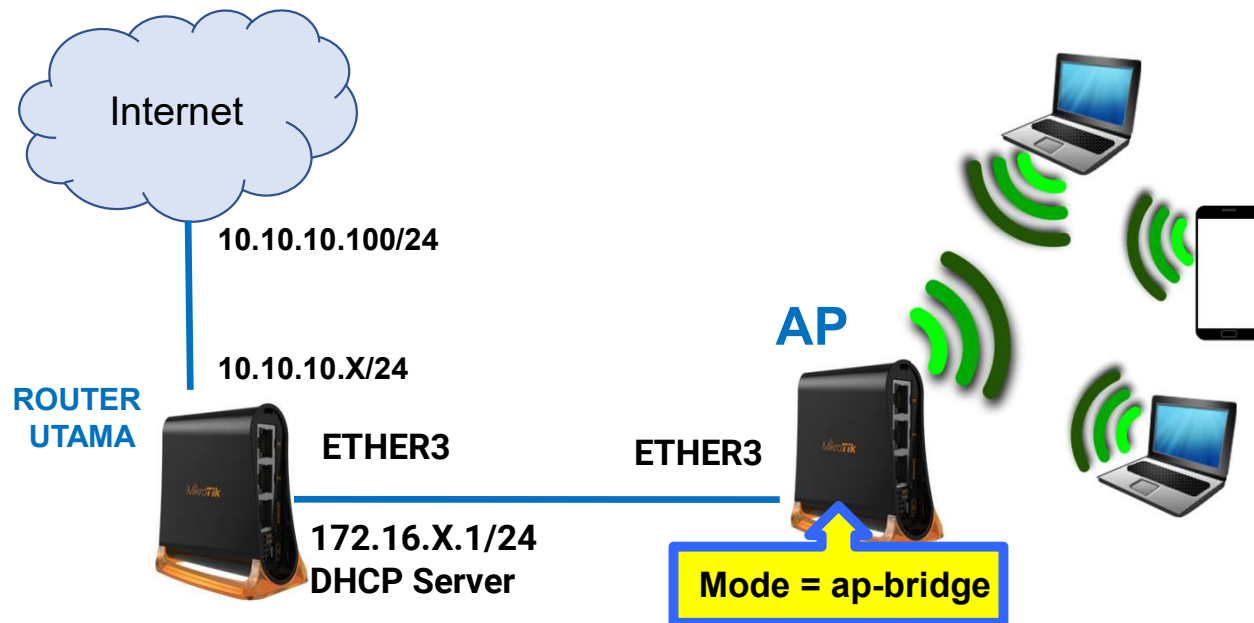
Metode Security

Password

Tambahkan **Security Profile** untuk koneksi Point-toPoint (PTP) pada LAB sebelumnya

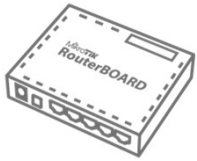


LAB2 – Point-to-MultiPoint (PTMP)



Tugas :

- Buat topologi berikut ini untuk distribusi wireless ke gadget
- Router utama akan digunakan sebagai sumber internet dan router lain akan berfungsi sebagai AP (Accesspoint)
- Konfigurasi IP dan DHCP Server berada pada router utama



LAB2 – Router Utama

ROUTER UTAMA

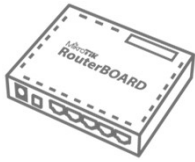


LAN
Mengarah
ke AP

- IP ADDRESS
- DHCP SERVER

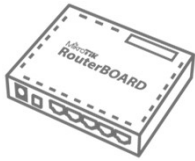
Setting Router Utama dengan **Basic-Config**

- IP ADDRESS = **10.10.10.x/24**
INTERFACE = **Wlan1**
- IP ADDRESS = **172.16.1.1/24**
INTERFACE = **Ether3**
- Default Route 0.0.0.0/0, GW: 10.10.10.100
- NAT – MASQUERADE, IP-DNS
- DHCP SERVER
ETHER3



LAB2 – Access Point (AP)

- Sebelum setting Access Point (AP), lebih baiknya dilakukan site-survey terlebih dahulu.
- Hal ini dimaksudkan untuk memaksimalkan kualitas koneksi, dengan meminimalisir interferensi/noise dengan perangkat AP yang lain.
- Ada dua fitur yang bisa digunakan yaitu **Scanner** dan **Frequency Usage**.



LAB2 – Site Survey (Scanner)

Wireless Tables

WiFi Interfaces W60G Station Nstreme Dual Access List Registration Connect List Security Profile

+ - ✓ ✗ 📁 📶 CAP WPS Client Setup Repeater **Scanner** Freq. Usage

Scanner (Running)

Interface: wlan1 Start Stop Close Connect New Window

☐ Background Scan

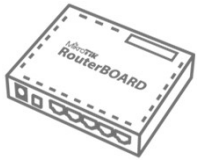
	Address	SSID	Channel	Signal	Noise	Signal	Radio Name	RouterO...
AP	6C:5A:B0:C...	JKLD_STAFF	2417/2...	-76	-113	37		
APRB	CE:2D:E0:C...	MIKROTIK ...	2422/2...	-42	-109	67	CC2DE0C280A6	6.48.3
APRB	CC:2D:E0:C...	private	2422/2...	-43	-109	66	CC2DE0C280A6	6.48.3
AP	6C:5A:B0:B...	meeting-kn	2432/2...	-58	-110	52		
AP	72:5A:B0:B...		2432/2...	-57	-110	53		
AP	94:53:30:9A...	HP-Print-04...	2437/2...	-55	-111	56		
AP	DC:EF:09:A...	NTGR_VM...	2437/2...	-64	-111	47		
AP	E6:E7:49:25...	DIRECT-AD...	2437/2...	-60	-111	51		
AP	B6:FB:E4:A...	INTERTECH	NTGR_VMB_1536056094			53		
AP	38:D5:47:89...	CDTEN	2452/2...	-68	-107	39		

53 items

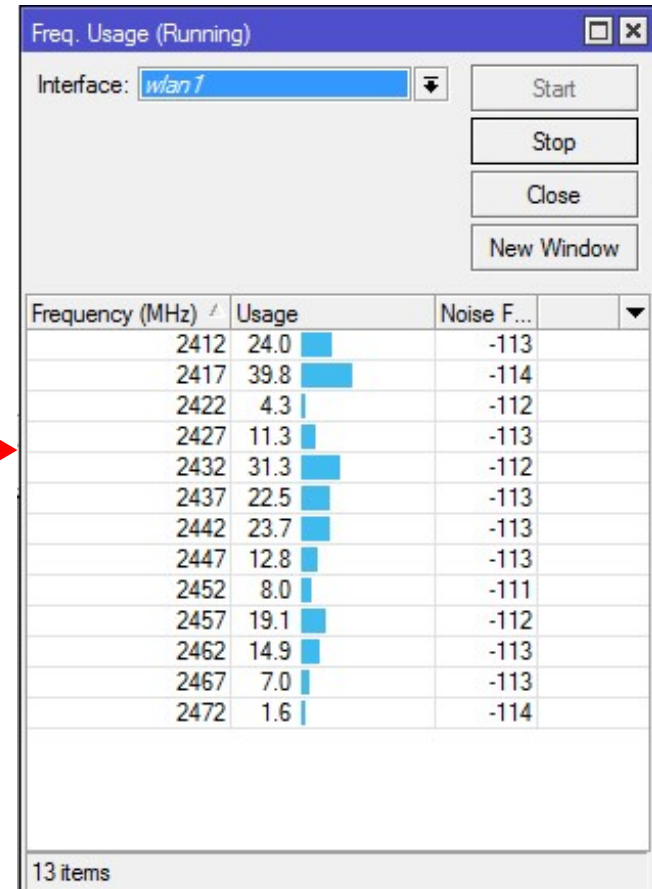
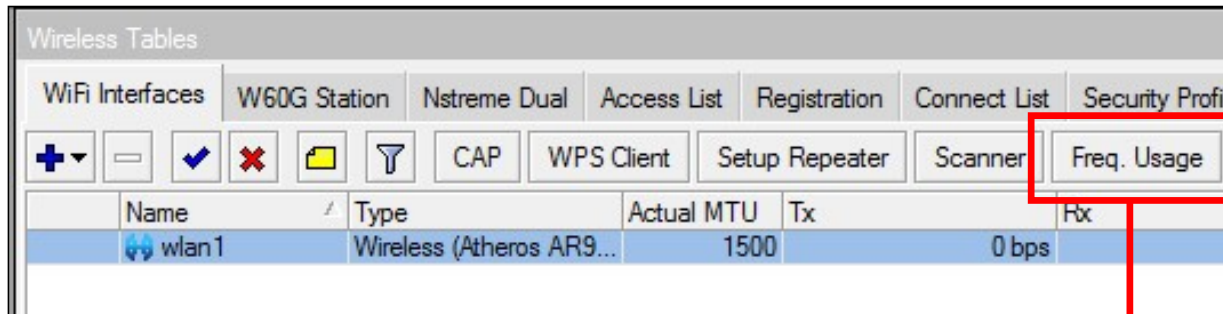
Actual MTU Tx Rx

os AR9... 1500 0 bps

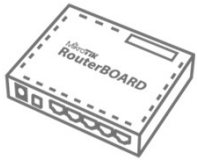
Fitur Scanner ini akan menampilkan seluruh daftar SSID disekitar kita beserta informasi frekuensi yang digunakan



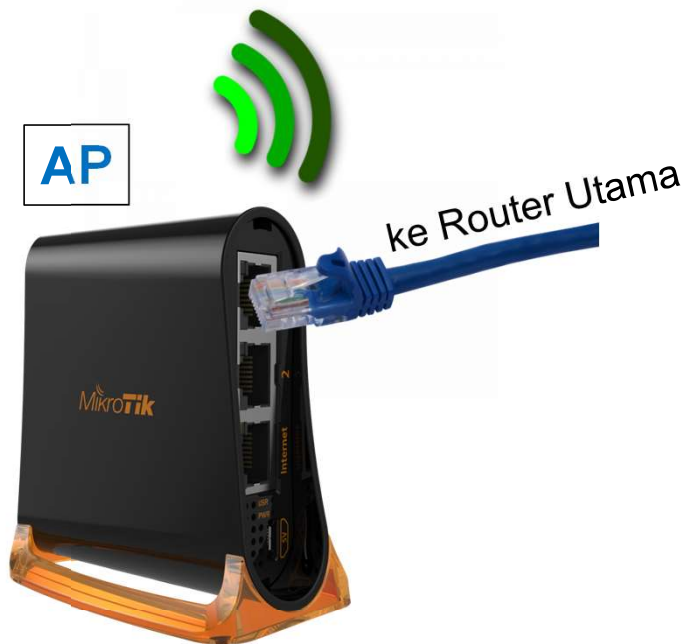
LAB2 – Site Survey (Freq. Usage)



Fitur Frequency Usage akan menampilkan persentase penggunaan frekuensi pada masing-masing channel



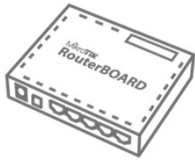
LAB2 – Access Point



Setting Access Point (AP)

- Setting **WLAN1** dengan mode **ap-bridge**
Band = **2ghz b/g/n**
Channel Width = **Default (20Mhz)**
SSID = **mejaX**
- Setting bridging antara **ether3** dan **wlan1**
- **DHCP-Client** di interface **bridge1**

Lalu cek koneksi internet dari router dan client



LAB PTMP Config

Interface <wlan1>

General Wireless HT HT MCS WDS Nstreme NV2 Status ...

Mode: ap bridge

Band: 2GHz-B/G/N

Channel Width: 20MHz

Frequency: 2442 MHz

SSID: lab-ptmp

Security Profile: rahasia

WPS Mode: push button

Frequency Mode: regulatory-domain

Country: etsi

Installation: any

Antenna Gain: 0 dBi

Default AP Tx Limit: bps

Default Client Tx Limit: bps

Bridge

Bridge Ports Port Extensions VLANs MSTIs

+ - ✓ ✗ [icon] [icon] Settings

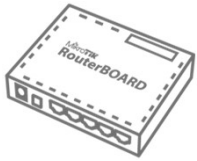
	Name	Type
R	bridge1	Bridge

Bridge

Bridge Ports Port Extensions VLANs MSTIs

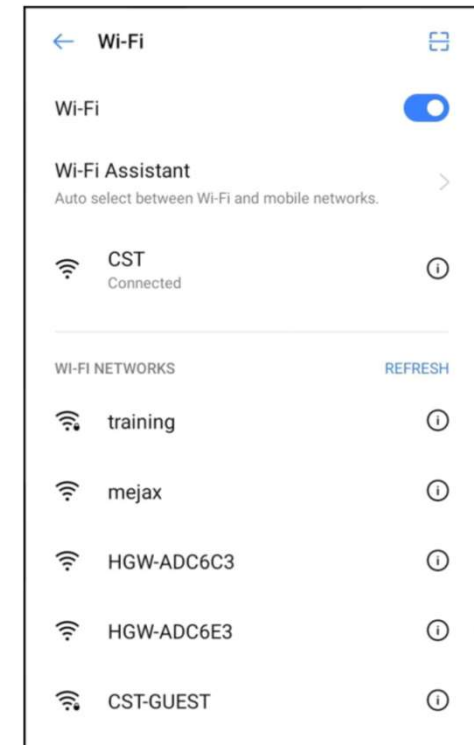
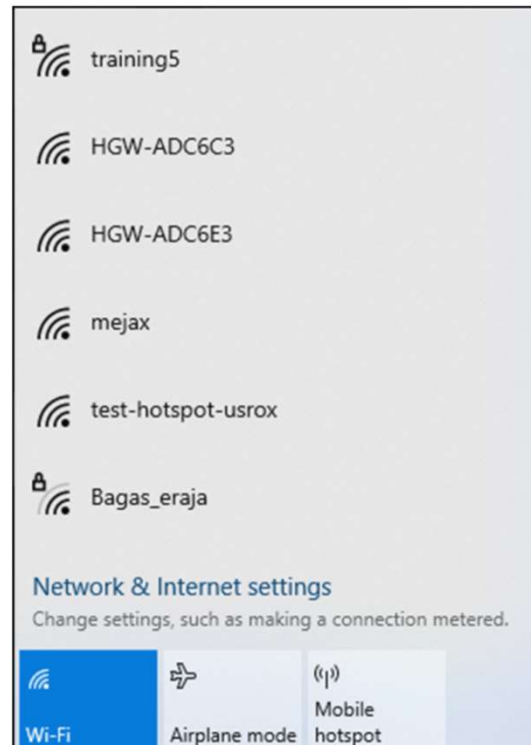
+ - ✓ ✗ [icon] [icon]

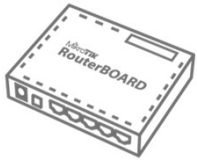
#		Interface	Bridge
0	IH	ether3	bridge1
1	I	wlan1	bridge1



Tes Koneksi

- Koneksikan perangkat mobile (LAPTOP/Smartphone) ke Access Point berdasarkan SSID yang dibuat
- Test koneksi internet

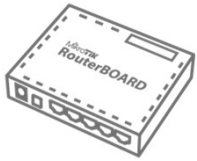




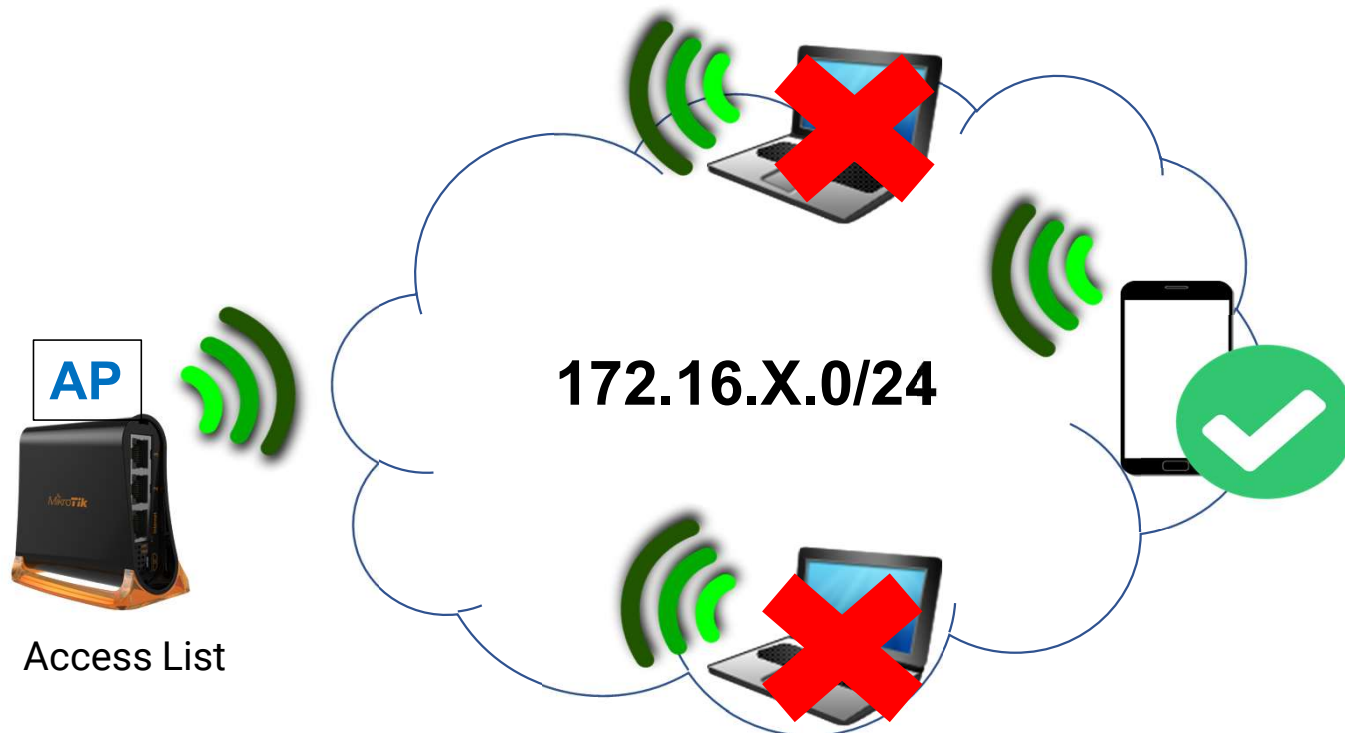
Wireless Security (Access List & Connect List)

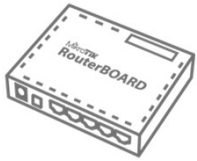
- **Access List** – adalah filter autentikasi sebuah **AP** (AP side) terhadap client yang terkoneksi.
- **Connect List** – adalah filter autentikasi sebuah wireless **CPE/Station** (client side) terhadap AP mana yang ingin terkoneksi.
- Jika tidak ada rule yang ter-setting atau yang sesuai (baik, Access List/Connect List) maka akan digunakan default policy (**default authentication & default forward**) dari wireless interface tersebut.

☒ Default Authenticate
☒ Default Forward
☐ Hide SSID



LAB3 – Access list





LAB3 – Access List

Wireless Tables

WiFi Interfaces W60G Station Nstreme Dual Access List Registration

MAC Address Interface Signal Str... Authentication

- o Pengaturan setiap client yang akan terhubung ke Access point bisa berdasarkan :

- MAC Address
- Signal Strength
- Time
- Private Key

Klasifikasi **mac-address** dari client

Option **policy** boleh terkoneksi atau tidak

Option **waktu** untuk mengaktifkan rule access list

New AP Access Rule

MAC Address: 00:00:00:00:00:00

Interface: any

AP Tx Limit: 0..120

Client Tx Limit: 00:10

AP Tx Limit: [v]

Client Tx Limit: [v]

☒ Authentication

☒ Forwarding

VLAN Mode: default

VLAN ID: 1

Private Key: none [v] Ox []

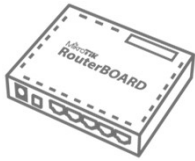
Private Pre Shared Key: []

Management Protection Key: []

Time: 00:00:00 - 00:00:00

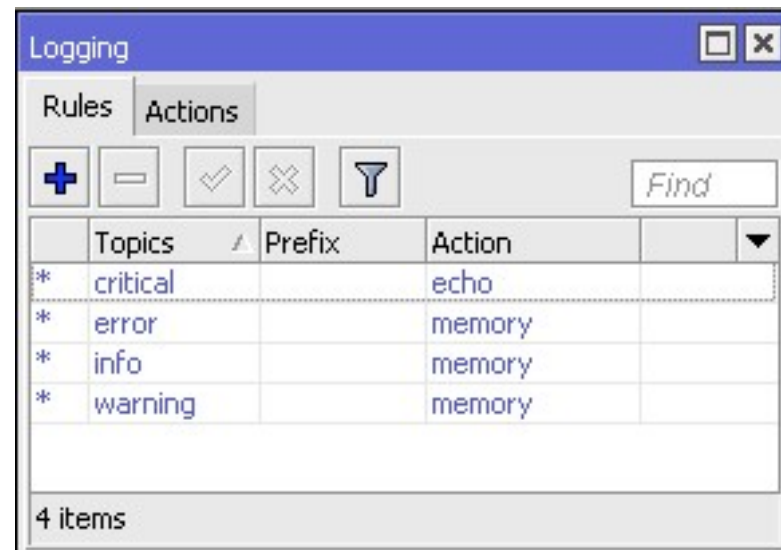
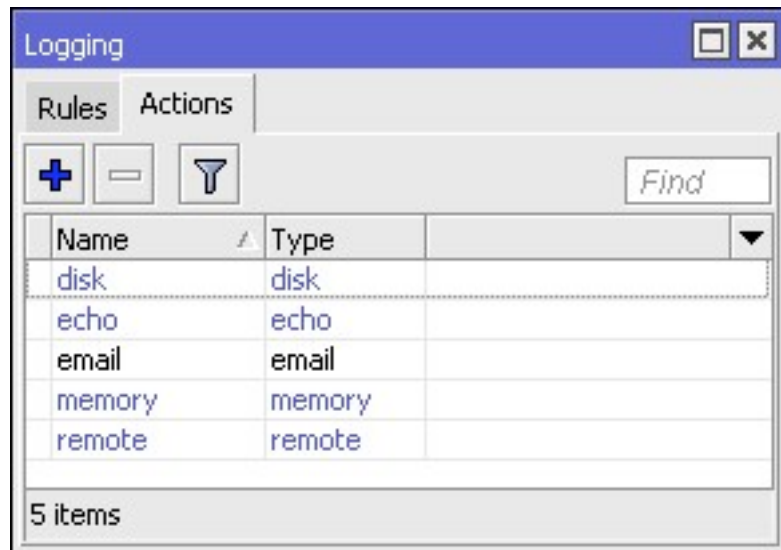
Days: ☐ sun ☐ mon ☐ tue ☐ wed ☐ thu ☐ fri ☐ sat

enabled

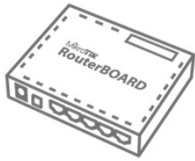


Logging

Digunakan untuk notifikasi aktifitas atau status dari router kita



Default Log disimpan didalam memory



LAB3 – Access List

- Cek pada Registration Table, pastikan hanya perangkat yang masuk di Access List yang terkoneksi.
- Aktifkan logging -> "Debug", "Wireless"
- Kemudian cek informasi log

#	Time	Buffer	Topics	Message
87	Apr/13...	memory	system, info	log rule changed by admin
88	Apr/13...	memory	wireless, debug	wlan1: 7A:2C:58:49:00:1A attempts to associate
89	Apr/13...	memory	wireless, debug	wlan1: reject 7A:2C:58:49:00:1A, banned (last failure - not allowed by access-list)
90	Apr/13...	memory	wireless, debug	wlan1: 7A:2C:58:49:00:1A attempts to associate
91	Apr/13...	memory	wireless, debug	wlan1: reject 7A:2C:58:49:00:1A, banned (last failure - not allowed by access-list)
92	Apr/13...	memory	wireless, debug	wlan1: 7A:2C:58:49:00:1A attempts to associate
93	Apr/13...	memory	wireless, debug	wlan1: reject 7A:2C:58:49:00:1A, banned (last failure - not allowed by access-list)
94	Apr/13...	memory	wireless, debug	wlan1: 7A:2C:58:49:00:1A attempts to associate
95	Apr/13...	memory	wireless, debug	wlan1: reject 7A:2C:58:49:00:1A, banned (last failure - not allowed by access-list)
96	Apr/13...	memory	wireless, debug	wlan1: 7A:2C:58:49:00:1A attempts to associate
97	Apr/13...	memory	wireless, debug	wlan1: 7A:2C:58:49:00:1A not in local ACL, by default reject

98 items

Logging

Rules Actions

Find

Topics	Prefix	Action
* critical		echo
* error		memory
* info		memory
* warning		memory

New Log Rule

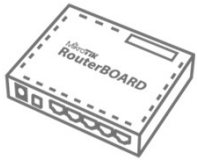
Topics: ☐ debug ☒ wireless

Prefix:

Action: memory

OK Cancel Apply Disable Copy Remove

enabled



Connect List

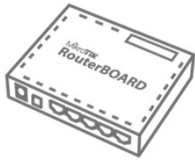


SSID = training



SSID = training





Connect List

Disisi client, kita dapat melakukan pengaturan untuk AP yang akan kita hubungkan

Parameter Connect List:

- MAC Address
- SSID
- Area
- Connect

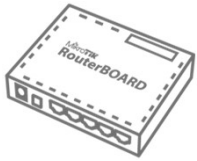
Wireless Tables

WiFi Interfaces W60G Station Nstreme Dual Access List Registration **Connect List**

+ - ✓ ✗ [Icon] [Icon]

#	Interface	MAC Address	Connect	Area Prefix	Signal Str...	Security
New Station Connect Rule						
Interface: wlan1						
MAC Address: 00:0C:42:E1:BB:B7						
☒ Connect						
SSID: training						
Area Prefix:						
Signal Strength Range: -120..120						
Allow Signal Out Of Range: 00:00:10						
Wireless Protocol: any						
Security Profile: none						
enabled						

OK Cancel Apply Disable Comment Copy Remove

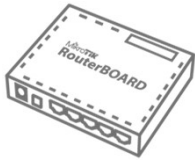


WiFi Protected Setup (WPS)



- Fitur ini menerapkan “manual authentication” dengan menekan tombol WPS
- Tombol WPS ini bisa berupa virtual (menu WPS Accept) ataupun fisik di routerboard tertentu
- Terdapat dua fungsi yaitu **WPS Server** dan **WPS Client**

Wireless Protocol:	any	↓	Torch
Security Profile:	default	↓	WPS Accept
WPS Mode:	push button	↓	Scan...
Bridge Mode:	enabled	↓	Freq. Usage...



WPS Client

<wlan1>

Wireless

Data Rates

Advanced

HT

HT MCS

WD

Mode

station

Band

2GHz-B/G/N

WPS Client

Interface

wlan1

SSID

test-WPS

MAC Address

Create Profile

wps-profile

SSID

test-WPS

MAC Address

D4:CA:6D:0F:40:21

Passphrase

citraweb

Authentication

wpa2-psk

Encryption

aes-ccm

Start

Stop

Close

Simple Mode

Torch

WPS Accept

WPS Client

Scan...

Freq. Usage...

Align...

Sniff...

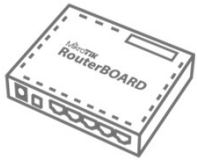
Snooper...

Reset Configuration

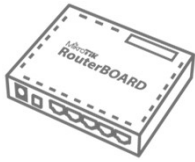
disconnected, success

Perangkat Wireless MikroTik juga support sebagai WPS Client yang bisa digunakan untuk terkoneksi ke Access point dengan metode WPS

Lebih lanjut contoh implementasi WPS
http://mikrotik.co.id/artikel_lihat.php?id=153

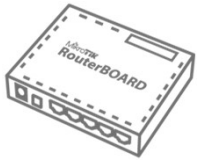


Lebih lanjut contoh implementasi WPS
http://mikrotik.co.id/artikel_lihat.php?id=153



Tx-Power & Rx-Sensitivity

- Setiap produk memiliki spesifikasi yang berbeda pada wireless card & juga built-in antenna.
- Perbedaan ini berpengaruh pada nilai **Tx-Power** & **Rx-Sensitivity** yang menentukan seberapa jauh cover area dan besar data-rate yang dilewatkan.
- **Selalu cek datasheet sebelum membeli atau menggunakan produk wireless MikroTik.**



Contoh SXTsq Lite5 vs LHG XL 5 ac

Wireless specifications

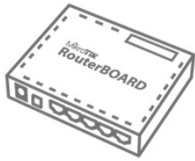
5 GHz	Transmit (dBm)	Receive Sensitivity
6MBit/s	25	-96
54MBit/s	20	-80
MCS0	25	-96
MCS7	19	-75



Wireless specifications

5 GHz	Transmit (dBm)	Receive Sensitivity
6MBit/s	25	-96
54MBit/s	21	-80
MCS0	25	-96
MCS7	20	-75
MCS9	18	-70





Data Rates

Interface <wlan1>

Wireless **Data Rates** Advanced HT WDS Nstreme NV2 Tx Power ...

— Rate —

☐ default ☒ configured

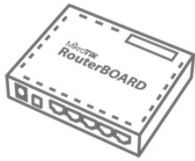
Supported Rates B: ☒ 1Mbps ☒ 2Mbps ☒ 5.5Mbps ☒ 11Mbps

Supported Rates A/G: ☒ 6Mbps ☒ 9Mbps ☒ 12Mbps ☒ 18Mbps
☒ 24Mbps ☒ 36Mbps ☒ 48Mbps ☒ 54Mbps

Basic Rates B: ☒ 1Mbps ☐ 2Mbps ☐ 5.5Mbps ☐ 11Mbps

Basic Rates A/G: ☒ 6Mbps ☐ 9Mbps ☐ 12Mbps ☐ 18Mbps
☐ 24Mbps ☐ 36Mbps ☐ 48Mbps ☐ 54Mbps

Datarate bisa kita tentukan secara manual sesuai kebutuhan kita lapangan.
Digunakan untuk menghindari rate-flapping akibat signal yang tidak stabil

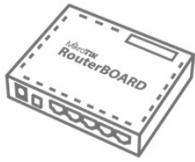


TX-Power

- Digunakan untuk mengatur tx power dari card wireless kita
- Digunakan **HANYA** untuk mengecilkan tx-power
- Check Datasheet sebelum merubah nilainya

Interface <wlan1>

NV2	Tx Power	Current Tx Power	Advanced Status	Status	...
	Tx Power Mode:	all rates fixed			⌵
	Tx Power:	17			dBm



QUIZ

- Jika AP dan Client menggunakan konfigurasi **country yang berbeda**, maka keduanya tidak dapat terkoneksi. (Benar/Salah)
- Jika AP menggunakan band=**2GHz-B/G/N** dan Client diset band=**2GHz-B** maka dapat terbentuk link wireless dengan data rate maksimal 54Mbps. (Benar/ Salah)
- Client **tidak harus** menentukan / setting frekuensi untuk dapat terkoneksi ke sebuah AP. (Benar/Salah)

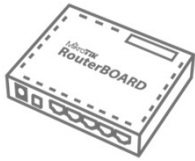
FIREWALL

MikroTik Basic – MTCNA Class



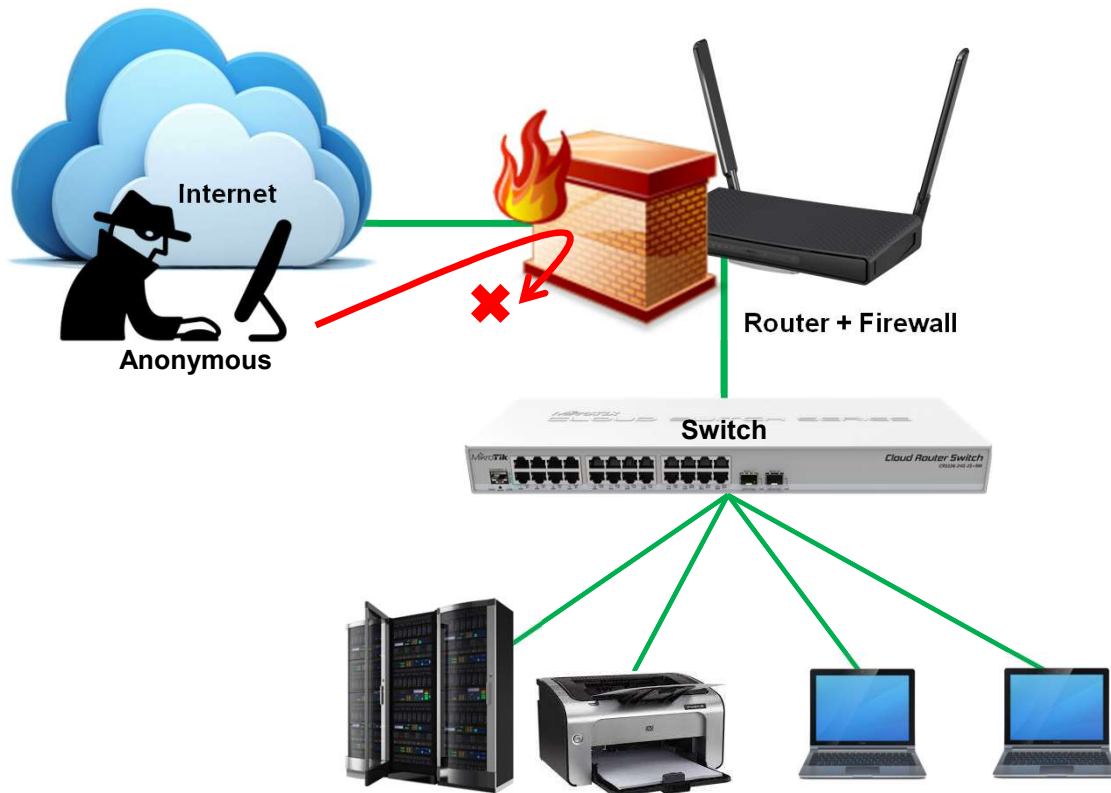
MikroTik Master Distributor
MikroTik Certified Training Partner
www.citraweb.com



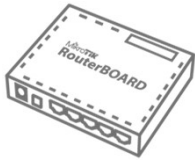


Firewall Concept

Contoh implementasi firewall:

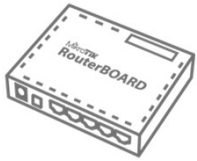


- **Firewall** berfungsi untuk memberikan preventif / keamanan pada jaringan dengan cara melakukan pemfilteran terhadap paket data yang menuju atau melalui router.
- Firewall Mikrotik bisa juga digunakan untuk manajemen user pada jaringan LAN.



How It Work? (1)

- Berdasarkan rule set yang dibuat oleh user dan dieksekusi secara berurutan sampai ada trafik yang cocok (menggunakan logika if-then)
- Rule set ini dipasangkan di “Chain” dimana tergantung flow trafiknya
- Chain ini ada yang default (predefined) dan kita juga bisa membuat custom chain dengan action “JUMP”



How It Work? (2)

New Firewall Rule

General Advanced Extra **Action** Statistics

Chain: forward

Src. Address:

Dst. Address:

Protocol:

Src. Port:

Dst. Port:

Any. Port:

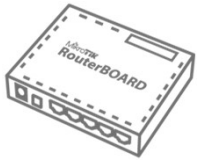
In. Interface:

Out. Interface:

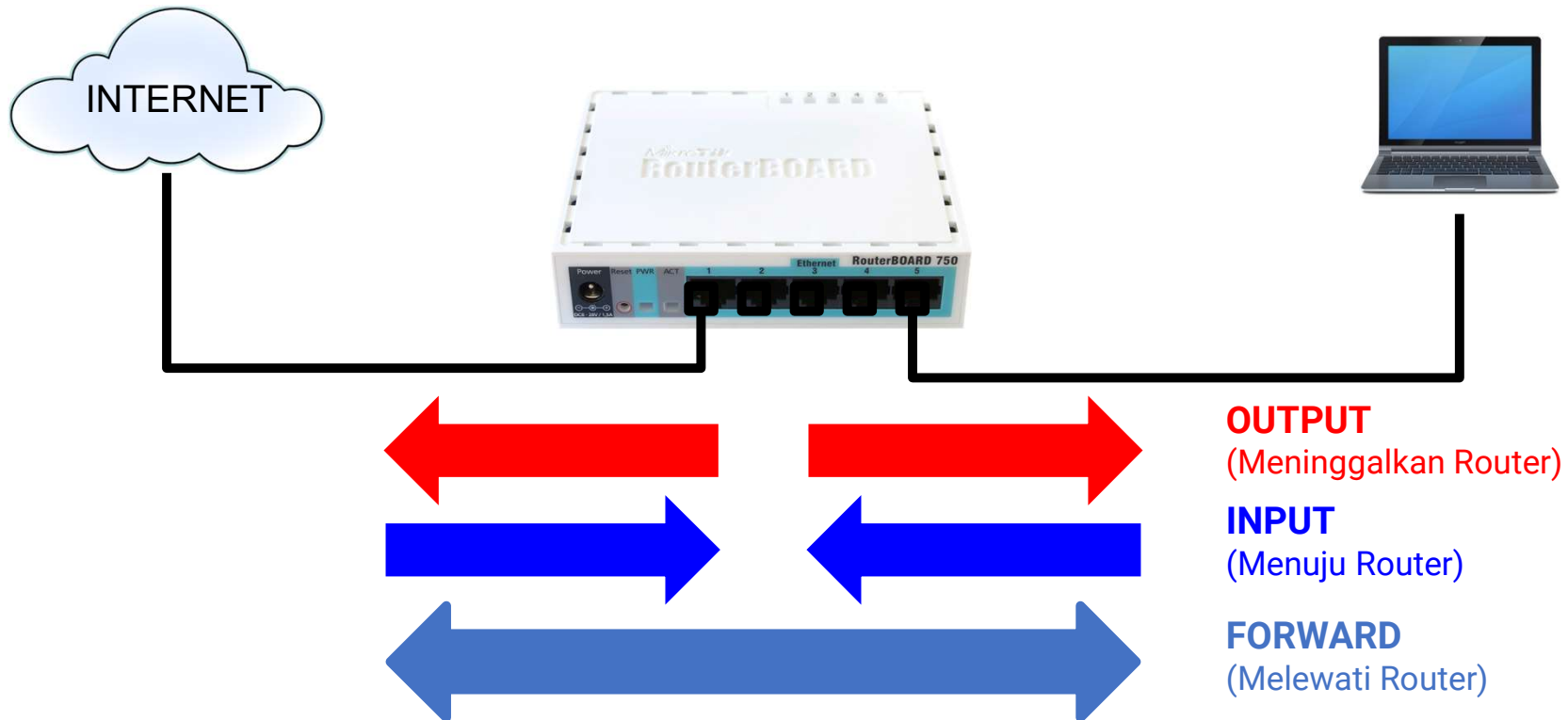
Action

Matcher

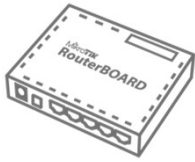
- Setiap rule akan terdiri dari 2 bagian
 - **Matcher** : Digunakan untuk menspesifikan paket data yang akan diatur
 - **Action** : Perlakuan jika paket data sesuai dengan matcher



Firewall Filter Chain

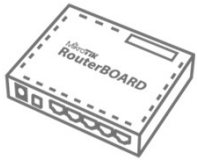


Chain memiliki kegunaan untuk menentukan jenis trafik yang akan di-manage pada fitur firewall
Chain Default: Output, Input, Forward

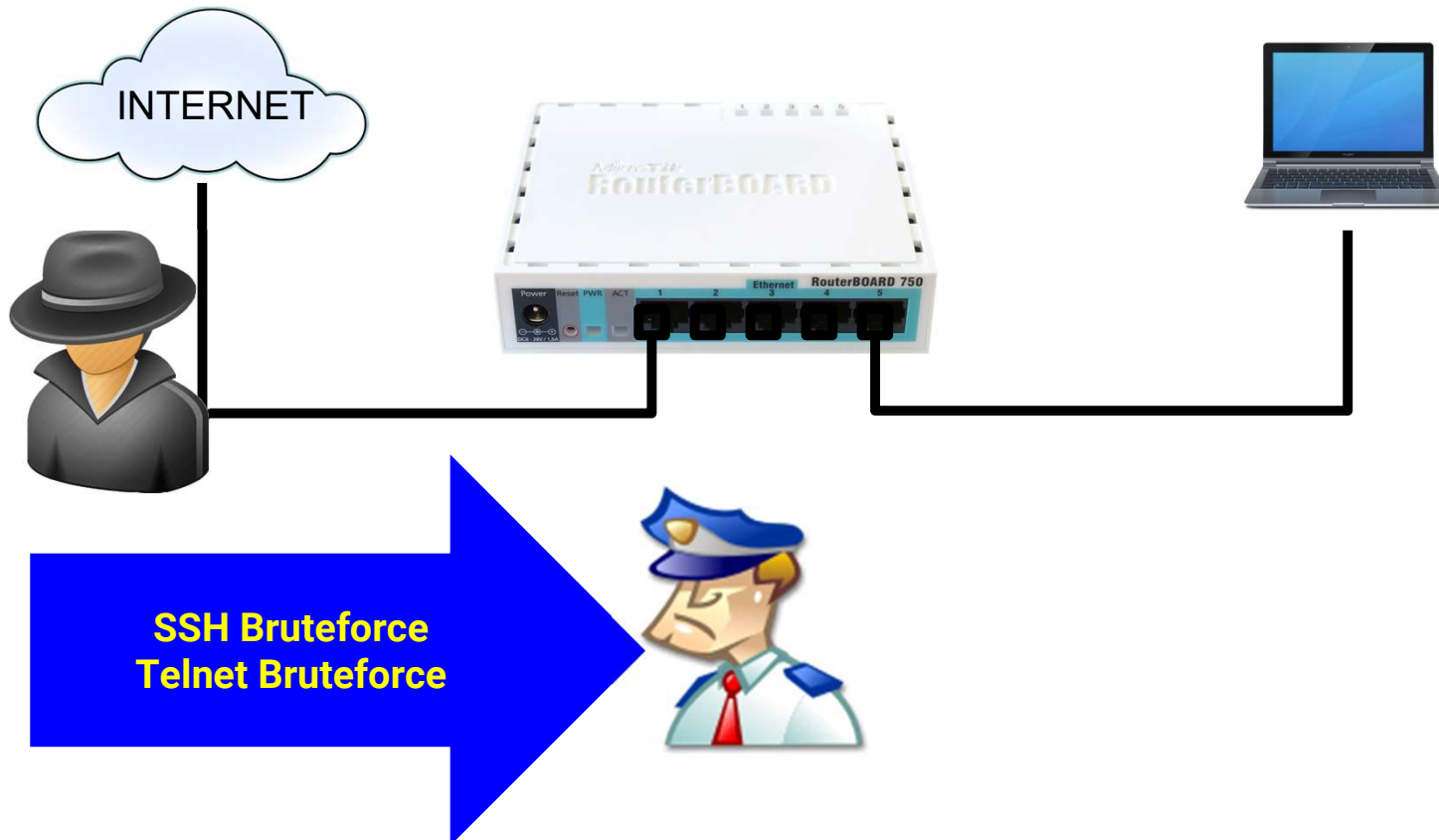


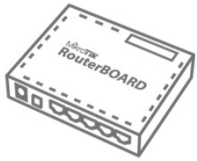
Filter Action

- **accept** – paket diterima dan tidak melanjutkan membaca baris berikutnya
- **drop** – menolak paket secara diam-diam (tidak mengirimkan pesan penolakan ICMP)
- **reject** – menolak paket dan mengirimkan pesan penolakan ICMP
- **tarpit** – menolak, tetapi tetap menjaga TCP connections yang masuk (membalas dengan SYN/ACK untuk paket TCP SYN yang masuk)
- **log** – menambahkan informasi paket data ke log

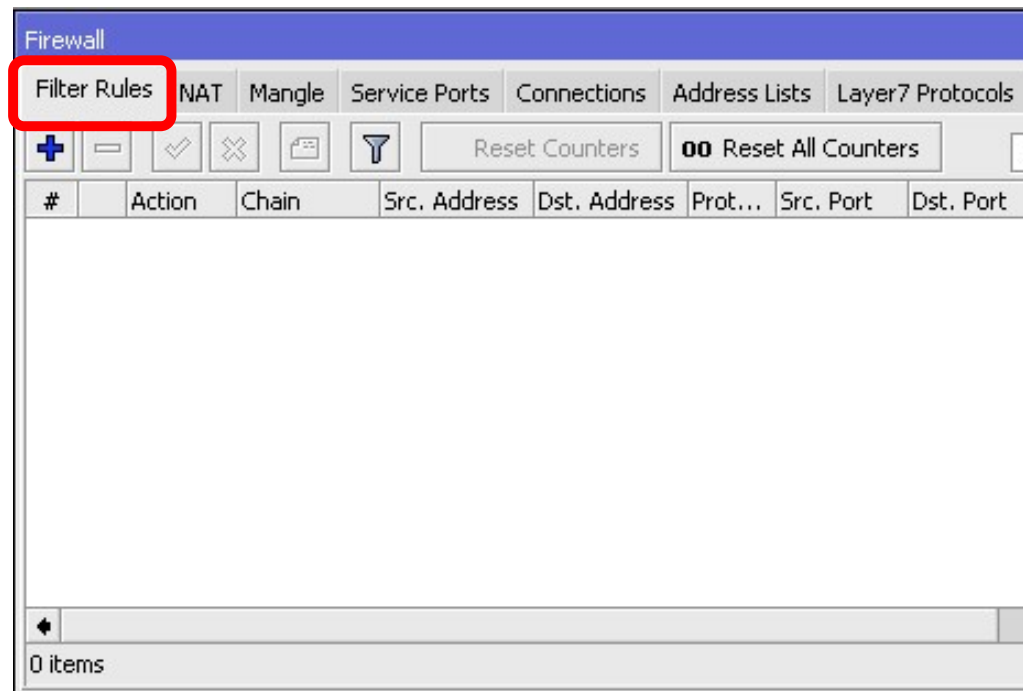
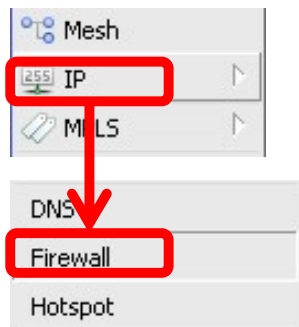


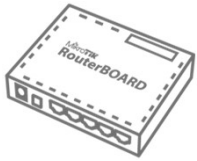
[LAB-1]Securing Router





[LAB-1] Firewall Filter





[LAB-1] Filter Input

Firewall New Firewall Rule

Filter Rule General Advanced Extra Action Statistics

+

#

Chain: input

Src. Address:

Dst. Address:

Protocol: 6 (tcp)

Src. Port:

Dst. Port: 22,23

Any. Port:

P2P:

In. Interface: wlan1

Out. Interface:

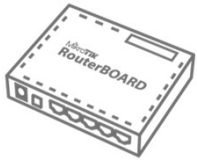
0 items

Menentukan Chain

Pemilihan Protocol

Tentukan port

Menentukan asal traffic dari interface mana



[LAB-1] Filter Input

New Firewall Rule

General Advanced Extra Action Statistics

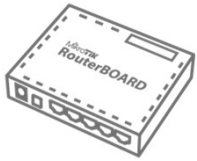
Action: drop

☐ Log

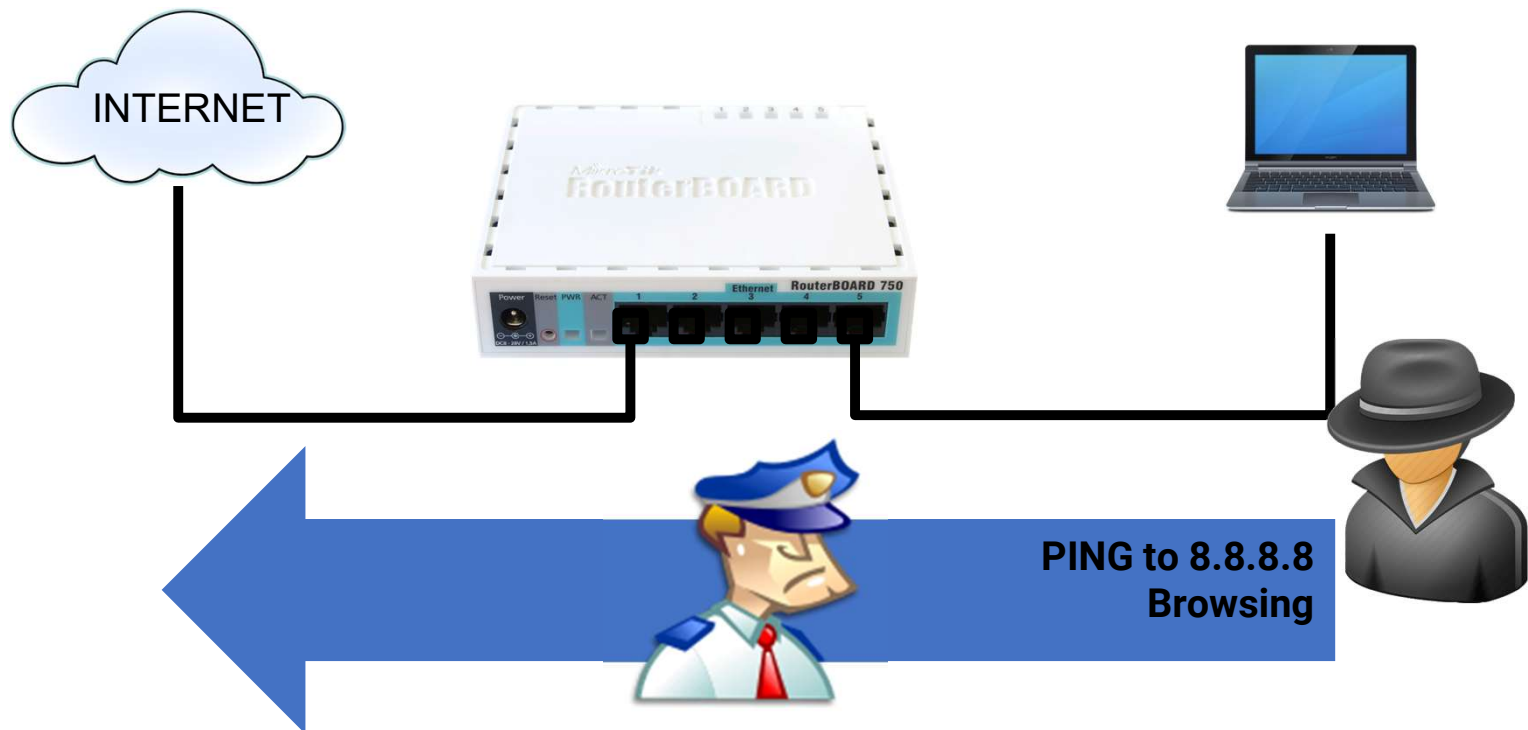
Log Prefix:

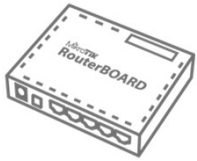
Tentukan Actionnya

```
ip firewall/filter/add chain=input protocol=tcp dst-port=22,23 in-interface=wlan1 action=drop
```

[LAB-2]Securing User





[LAB-2] Filter Forward

Firewall

Filter Rules NAT

#	Action
0	☒ drop
1	☒ reject
2	☒ drop

Firewall Rule <8.8.8.8>

General Advanced Extra Action Statistics

Chain: forward

Src. Address:

Dst. Address: ☐ 8.8.8.8

Protocol: ☐ 1 (icmp)

Src. Port:

Dst. Port:

Any. Port:

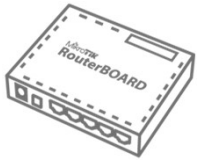
P2P:

In. Interface: ☐ ether1

Menentukan Chain

Tentukan IP Tujuan, dan pilih protocol.

Menentukan asal traffic dari interface mana



[LAB-2] Filter Forward

Firewall Rule <>

General Advanced Extra Action Statistics

Action: **reject**

☐ Log

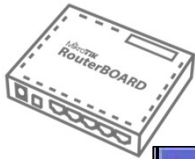
Log Prefix:

Reject With: **icmp admin prohibited**

Tentukan Actionnya

Pilih pesan penolakan

```
ip firewall/filter/add chain=forward dst-address=8.8.8.8 protocol=icmp in-interface=ether1 action=reject reject-with=icmp-admin-prohibited
```



[LAB-2] Filter Forward

New Firewall Rule

General Advanced Extra Action Statistics

Chain: forward

Src. Address: ☐ 192.168.x.0/24

Dst. Address:

Protocol: ☐ 6 (tcp)

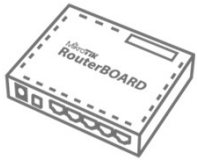
Src. Port:

Dst. Port: ☐ 80,443

Any. Port:

Menentukan Chain dan
Alamat IP asal

Menentukan Protocol dan
Port Tujuan



[LAB-2] Filter Forward

Firewall Rule <192.168.30.0/24->80,443>

General Advanced Extra Action Statistics

Action: **drop**

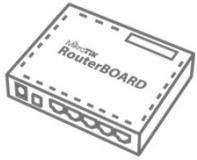
☒ Log

Log Prefix: **coba-coba-ngping**

Tentukan Actionnya

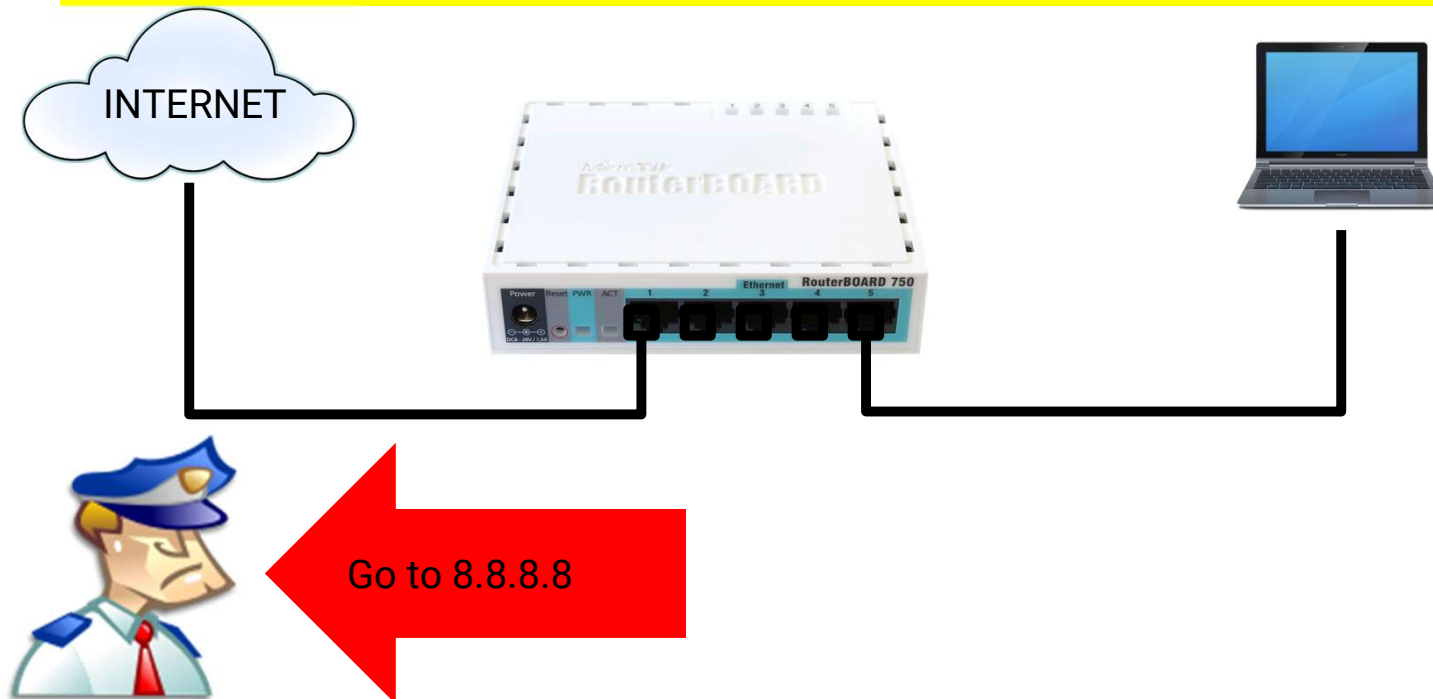
Tambahkan Log, dengan nama
coba-coba-ngping

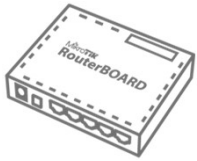
```
ip firewall/filter/add chain=forward src-address=192.168.x.0/24 protocol=tcp  
dst-port=80,443 action=drop log=yes log-prefix=coba-coba-ngping
```



[LAB-3] Router Output

**** Sangat jarang dilakukan, tetapi hal tersebut bisa saja dilakukan ****





[LAB-3] Filter Output

New Firewall Rule

General Advanced Extra Action Statistics

Chain: output

Src. Address:

Dst. Address: ☐ 8.8.8.8

Tentukan Output dan
Alamat IP Tujuan

Firewall Rule <8.8.8.8>

General Advanced Extra Action Statistics

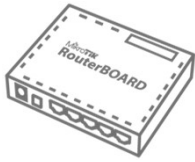
Action: drop

☐ Log

Log Prefix:

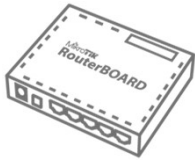
Tentukan Actionnya

```
ip firewall/filter/add chain=output dst-address=8.8.8.8 action=drop
```



[LAB-4]Testing

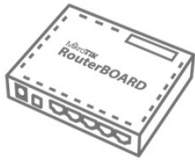
- Silahkan minta teman semeja untuk mencoba telnet / ssh ke router kita
- Test lakukan browsing dari laptop masing-masing
- Test ping ke 8.8.8.8 dan 8.8.4.4 dari laptop
- Test ping dari new terminal router ke 8.8.8.8 dan ke 8.8.4.4



Common Ports & Protocols

PORT	PROTOCOL	DESCRIPTION
20-21	tcp	FTP
22	tcp	SSH, SFTP
23	tcp	Telnet
53	tcp	DNS
80	tcp	HTTP
179	tcp	BGP
443	tcp	HTTPS
646	tcp	LDP (MPLS)
1080	tcp	SoCKS
1723	tcp	PPTP
1968	tcp	MME
2000	tcp	BTest Server
2210	tcp	Dude Server
2211	tcp	Dude Server
2828	tcp	uPnP
3128	tcp	Web Proxy
8291	tcp	Winbox
8728	tcp	API
---	/1	ICMP
---	/2	IGMP (Multicast)
---	/4	IPIP
	/41	IPv6 (encap)
	/46	RSVP (MPLS)

PORT	PROTOCOL	DESCRIPTION
53	udp	DNS
67	udp	DHCP Server
68	udp	DHCP Client
123	udp	NTP
161-162	udp	SNMP
500	udp	IPSec
520-521	udp	RIP
646	udp	LDP (MPLS)
1698	udp	RSVP (MPLS)
1699	udp	RSVP (MPLS)
1701	udp	L2TP
1812	udp	User-Manager
1813	udp	User-Manager
1900	udp	uPnP
1966	udp	MME
5678	udp	MNDP
---	/47	PPRP, EoIP
---	/50	IPSec
---	/51	IPSec
---	/89	OSPF
---	/103	PIM (Multicast)
---	/112	VRRP



Tools - Torch

Torch

Basic

Interface: ether4

Entry Timeout: 00:00:03 s

Collect

☒ Src. Address ☒ Src. Address6

☒ Dst. Address ☒ Dst. Address6

☒ MAC Protocol ☒ Port

☒ Protocol ☒ VLAN Id

Filters

Src. Address: 0.0.0.0/0

Dst. Address: 0.0.0.0/0

Src. Address6: ::/0

Dst. Address6: ::/0

MAC Protocol: all

Protocol: any

Port: any

VLAN Id: any

Start

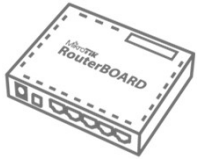
Stop

Close

New Window

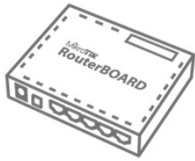
Et...	Protocol	Src.	Dst.	VLA...	Tx Rate	Rx Rate	Tx Pa...	Rx Pac
800 (ip)	17 (udp)	192.168.128.142:56452	173.194.51.200:443 (ht...		2.5 Mbps	87.9 kbps	234	
800 (ip)	17 (udp)	192.168.135.46:62348	84.31.13.127:38363	100	1429.0 k...	31.4 kbps	122	
800 (ip)	6 (tcp)	192.168.135.46:53852	85.150.241.124:33354	100	867.0 kbps	25.9 kbps	71	
800 (ip)	6 (tcp)	192.168.135.52:50887	209.197.3.76:443 (https)	100	722.8 kbps	13.4 kbps	60	
800 (ip)	17 (udp)	192.168.135.46:62348	89.211.193.62:46176	100	497.4 kbps	12.0 kbps	43	
800 (ip)	6 (tcp)	192.168.129.146:53019	192.168.128.17:8291 (...)		383.9 kbps	0 bps	37	
800 (ip)	6 (tcp)	192.168.135.2:48161	202.65.113.16:80 (http)	100	285.4 kbps	9.8 kbps	24	
800 (ip)	17 (udp)	192.168.128.103:55888	216.58.196.78:443 (https)		216.7 kbps	8.2 kbps	20	

Torch bisa digunakan untuk memonitor trafik secara realtime di router kita



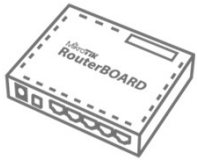
Quiz – Firewall Block DNS

- Buat rule untuk mengamankan router dari serangan DNS, terutama dari jaringan internet

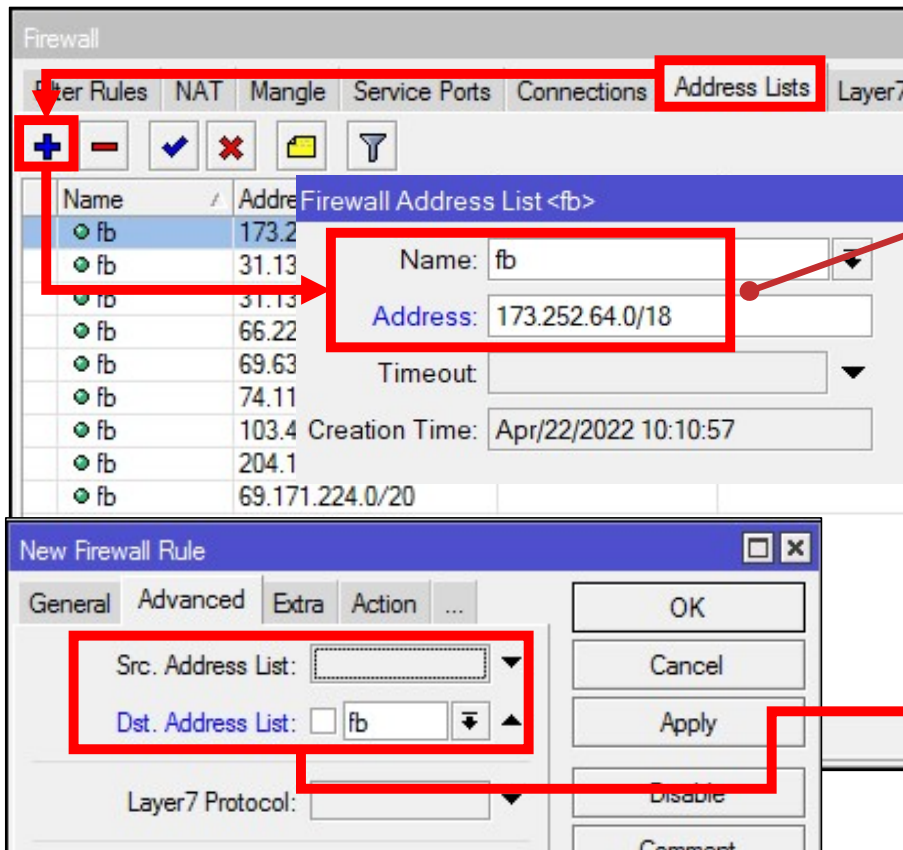


Address List

- Address List firewall berfungsi untuk melakukan pengelompokan alamat IP. Address List bisa digunakan untuk Firewall Filter, NAT, Mangle.
- Setelah IP dikelompokkan, maka kita bisa buat manajemen firewall untuk kelompok IP yang sudah di buat.
- Address List bisa di tambahkan secara manual atau secara dynamic.

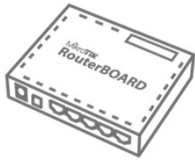


Address List



Tambahkan IP Address yang akan di kelompokkan

Address List bisa digunakan sebagai **SRC** atau **DST Address** pada Firewall



Dynamic Address List

New Firewall Rule

General Advanced Extra **Action** Statistics

Action: add src to address list

☐ Log

Log Prefix:

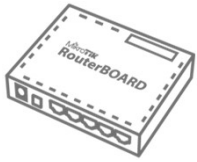
Address List: tukang-winbox

Timeout: 00:01:00

Address List juga bisa ditambahkan dari action yang ada di Firewall.

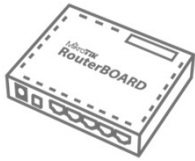
Dengan menggunakan action ***add-src-to-address-list*** atau ***add-dst-to-address-list*** maka IP tersebut akan tercatat di address-list sesuai timeout yang ditentukan

Parameter ***timeout*** jika tidak digunakan, list akan tercatat sampai router reboot



[LAB-6]Ping'ers

- Tambahkan rule untuk cek ICMP dengan action add-src-to-address-list dan add-dst-to-address-list agar tahu siapa yang melakukan ping dan ping ke mana

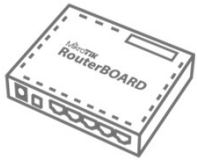


Quiz -1

- Dengan rule Firewall Filter berikut, Client 192.168.20.2 tidak dapat PING ke 8.8.8.8 (Benar/Salah)

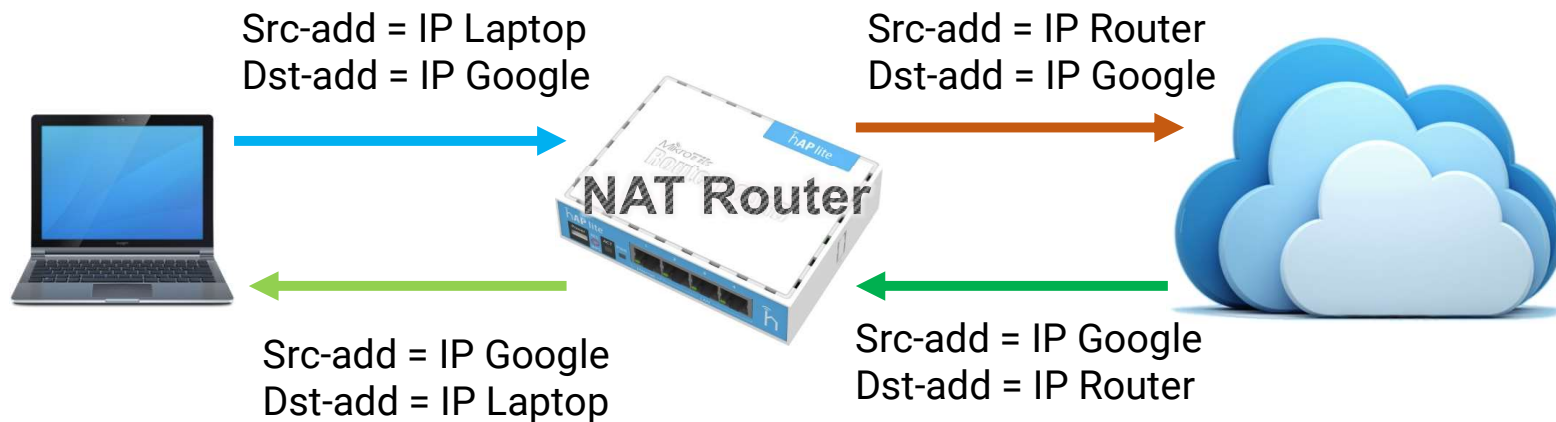
```
/ip firewall filter pr
0 chain=forward action=accept src-address=192.168.20.0/24 dst-address=8.8.8.8 protocol=icmp
1 chain=forward action=drop src-address=192.168.20.0/24 dst-address=8.8.8.8 protocol=icmp
```

- Dalam implementasinya, Firewall bisa digunakan untuk melakukan drop koneksi dari suatu client. Tool apa yang bisa kita gunakan untuk melihat koneksi (port, protocol, address, rate, dll) dari suatu client?

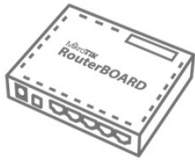


NAT ??

- Merupakan sebuah fitur dalam firewall untuk merubah alamat IP yang ada didalam packet header



Cara kerja NAT ketika client mencoba mengakses google



SRCNAT

New NAT Rule

Advanced Extra Action Statistics

Action: src-nat

To Addresses: 202.65.114.116

To Ports:

Action:
SRCNAT

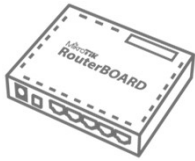
New NAT Rule

Advanced Extra Action Statistics

Action: masquerade

Action:
Masquerade

- **Source NAT** digunakan untuk merubah alamat asal IP ataupun port
- Chain yang digunakan adalah **srcnat**
- Action yang banyak digunakan adalah
 - **Src-nat** : Merubah ke IP atau PORT yang kita tentukan manual
 - **Masquerade** : Merubah ke IP yang ada di out-interface. Action sangat membantu jika out-interfacenya berupa IP dynamic (DCHP, PPPoE, PPTP dsb)



DSTNAT

New NAT Rule

Advanced Extra Action Statistics ...

Action: dst-nat

To Addresses: 192.168.10.1

To Ports: 80

Action: DSTNAT

New NAT Rule

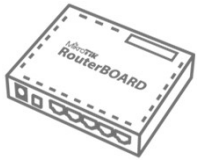
Advanced Extra Action Statistics ...

Action: redirect

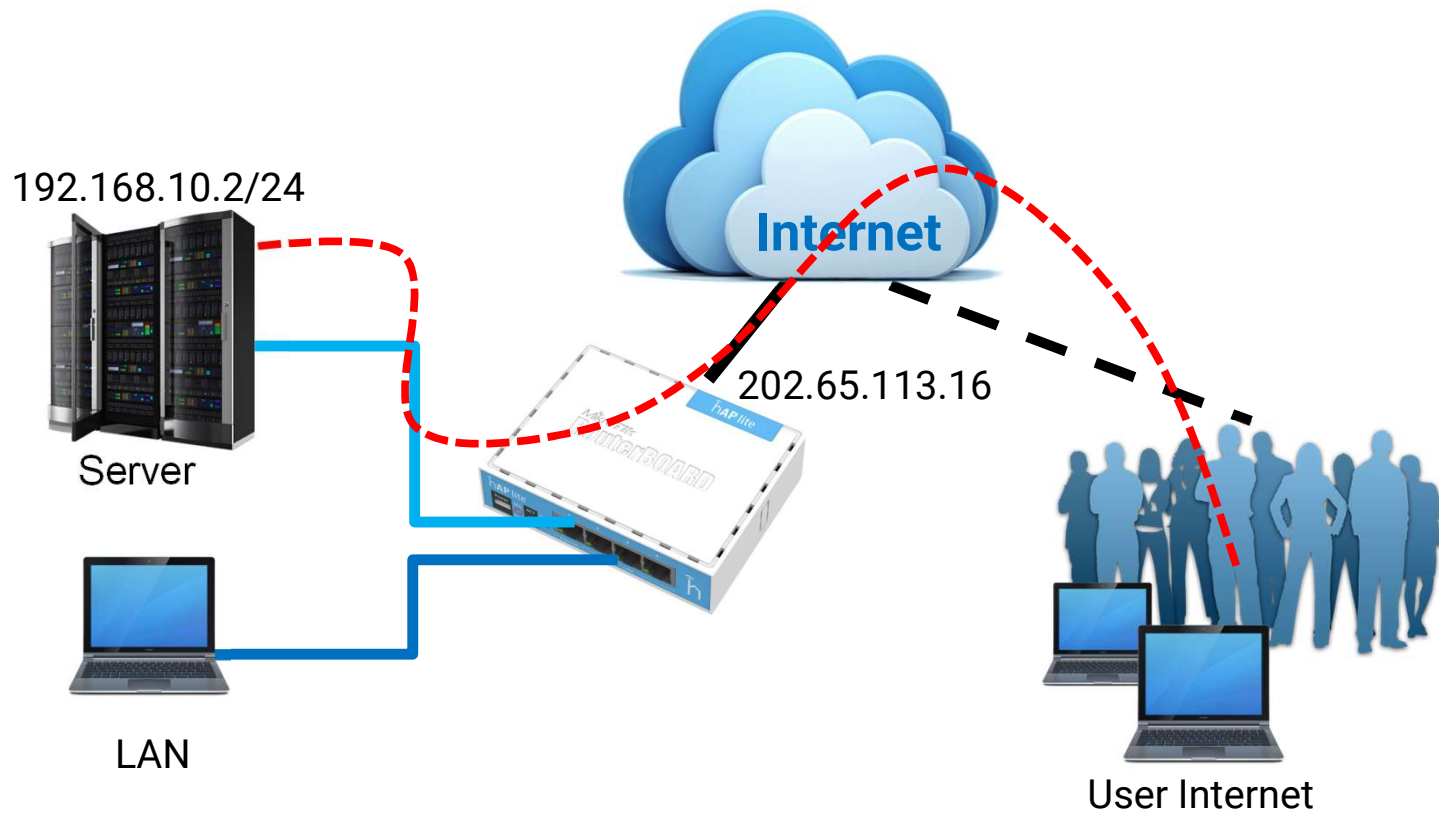
To Ports: 8080

Action: Redirect

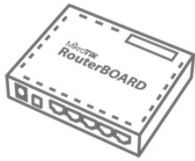
- Kebalikan dari srcnat, **DSTNAT** digunakan untuk merubah alamat IP / Port Tujuan
- Biasa dikenal dengan istilah Port Forwarding
- Action yang sering digunakan :
 - **dst-nat** : Trafik dibelokkan ke mesin lain, kita tentukan secara manual IP dan portnya
 - **Redirect** : Trafik dibelokkan ke router. Biasanya digunakan untuk transparent service (webproxy, dns, hotspot dsb)



NAT Implementation



Contoh ada di artikel : http://www.mikrotik.co.id/artikel_lihat.php?id=75



Connection State (1)

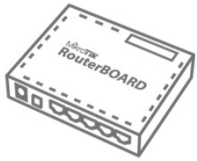
Setiap paket data didalam sebuah koneksi memiliki status:

- **Invalid** – paket tidak dimiliki oleh koneksi apapun, tidak berguna
- **New** – paket yang mengawali sebuah koneksi
- **Established** – merupakan paket kelanjutan dari paket dengan status new.
- **Related** – paket pembuka sebuah koneksi baru, tetapi masih berhubungan dengan koneksi sebelumnya.
- **Untracked** – paket yang sudah di bypass connection tracking oleh Firewall Raw

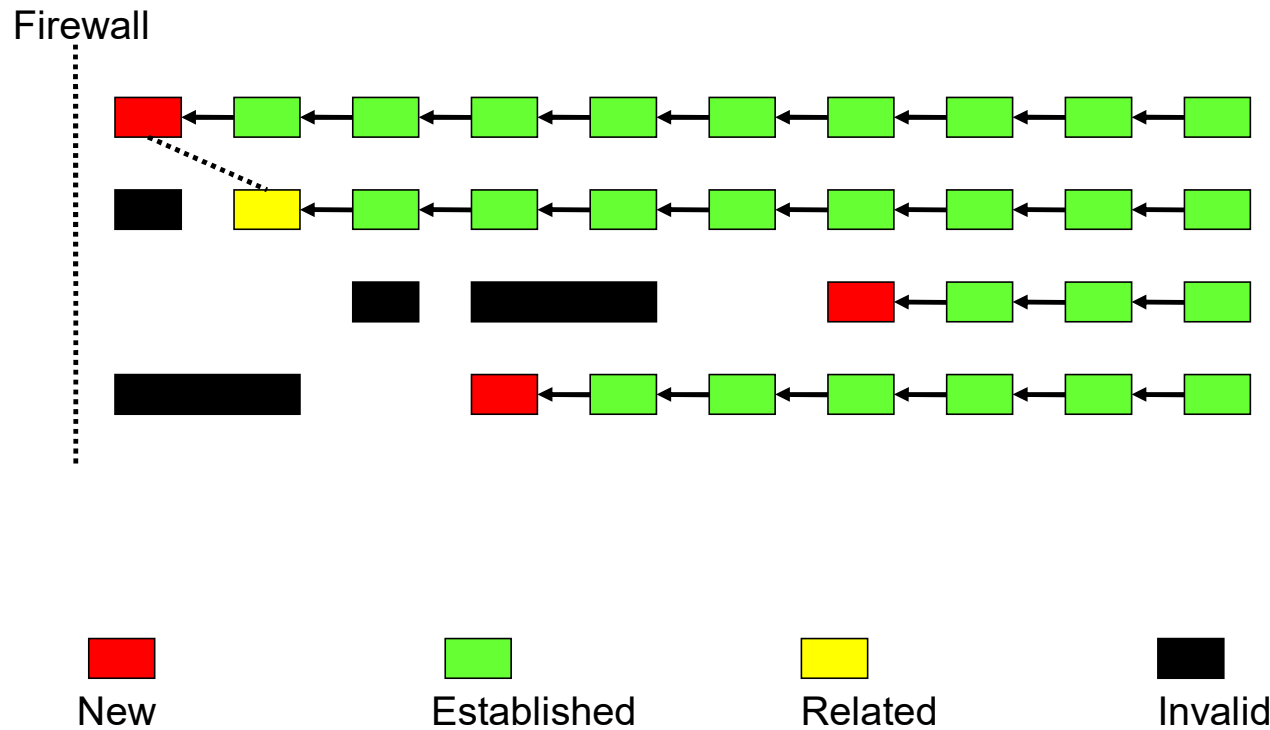
Connection Type:

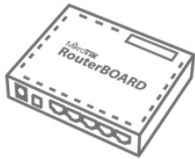
Connection State: ☐ invalid ☐ established ☐ related ☐ new ☐ untracked

Connection NAT State:



Connection State (2)





Connection Tracking

Firewall

Filter Rules NAT Mangle Service Ports **Connections** Address Lists Layer7 Protocols

Tracking

	Src. Address	Dst. Address	Protocol	Co...	Timeout	TCP St...
A	192.168.128.103:...	202.152.128.9:443	6 (tcp)		00:00:01	time wait
A	192.168.128.103:...	202.43.190.235:443	6 (tcp)		00:00:02	time wait
A	192.168.129.129:...	192.168.88.2:2869	6 (tcp)		00:00:02	time wait
A	192.168.129.129:...	192.168.88.2:2869	6 (tcp)		00:00:01	time wait
A	192.168.129.129:...	202.65.113.16:80	6 (tcp)		00:00:01	time wait
A	192.168.134.63:3...	23.212.114.104:80	6 (tcp)		00:00:02	time wait
A	192.168.134.63:3...	52.9.102.9:80	6 (tcp)		00:00:04	time wait
A	192.168.134.63:4...	184.169.137.46:80	6 (tcp)		00:00:01	time wait
		137.46:80	6 (tcp)		00:00:00	time wait
		137.46:80	6 (tcp)		00:00:00	time wait
		137.46:80	6 (tcp)		00:00:00	time wait
A	192.168.134.63:4...	169.137.46:80	6 (tcp)		00:00:01	time wait
A	192.168.134.63:4...	184.137.46:80	6 (tcp)		00:00:01	time wait

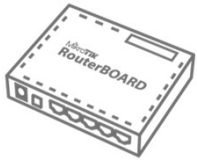
1335 items

Max Entries: 524288

Maximum Connection
yang bisa dihandle

Connection tracking mencatat informasi koneksi yang:

- **Berasal** dari Router
- **Menuju** ke Router
- **Melewati** Router



Connection Tracking (2)

Connection Tracking

Enabled: **no** ▼

☒ Loose TCP Tracking

TCP Syn Sent Timeout: 00:00:05

TCP Syn Received Timeout: 00:00:05

TCP Established Timeout: 1d 00:00:00

TCP Fin Wait Timeout: 00:00:10

TCP Close Wait Timeout: 00:00:10

TCP Last Ack Timeout: 00:00:10

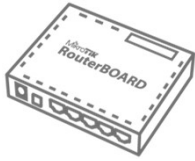
TCP Time Wait: 00:00:10

OK

Cancel

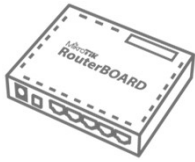
Apply

Untuk router yang tidak membutuhkan fitur connection tracking, fitur tersebut bisa dimatikan



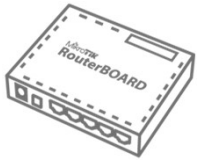
Connection Tracking (3)

- Jika connection-tracking disable, maka fungsi berikut tidak bisa digunakan :
 - NAT
 - Parameter P2P pada simple queue
 - Firewall dengan parameter :
 - connection-bytes
 - connection-mark
 - connection-type
 - connection-state
 - connection-limit
 - connection-rate
 - layer7-protocol
 - p2p
 - new-connection-mark
 - tarpit



FASTTRACK

- Merupakan metode untuk “akselerasi” paket data yang melalui router
- Fasttrack ini diterapkan pada koneksi-koneksi yang statusnya establish atau related
- Setiap paket yang terkena fasttrack, akan membypass connection tracking, queue dan fitur lainnya
- Saat ini support untuk TCP dan UDP saja
- Lebih detil bisa dilihat di http://mikrotik.co.id/artikel_lihat.php?id=162



Fasttrack Performance

Without	With
360Mbps	890Mbps
Total CPU usage 100%	Total CPU usage 86%
44% CPU usage on firewall	6% CPU usage on firewall

* Tested on RB2011 with a single TCP stream

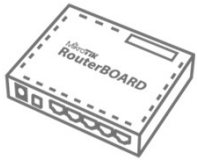
Simple Queue

MikroTik Basic – MTCNA Class

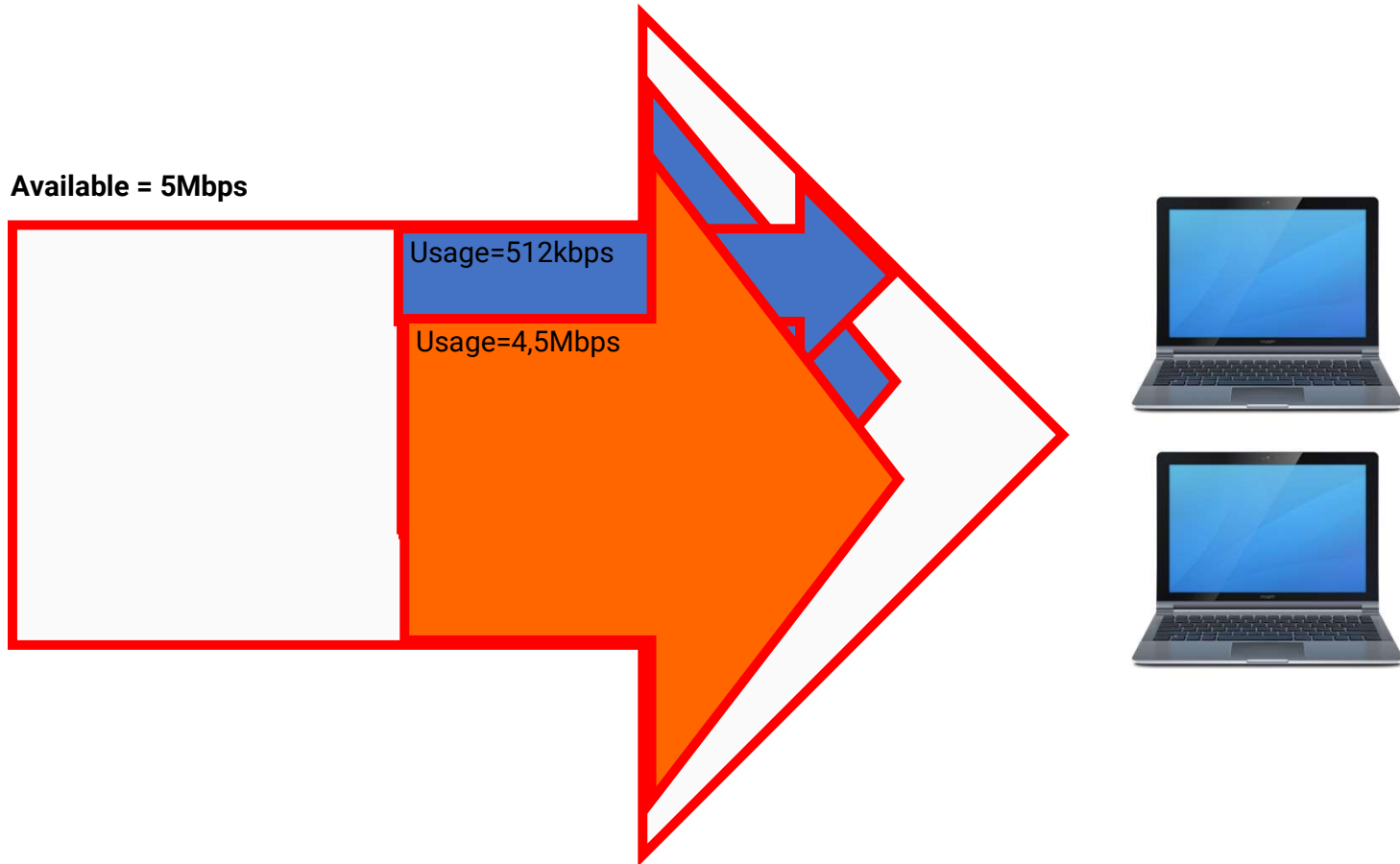


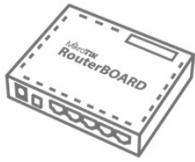
MikroTik Master Distributor
MikroTik Certified Training Partner
www.citraweb.com





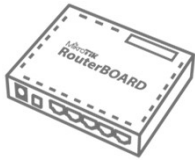
Unmanaged Traffic





Quality Of Service

- QoS tidak hanya berarti bandwidth limiter. Tetapi cara yang digunakan untuk mengatur distribusi bandwidth yang ada secara rasional
- Pada MikroTik ada banyak fitur yang bisa gunakan untuk mengatur bandwidth ini seperti bandwidth shaping, scheduler, guaranty, priority dan sebagainya
- Metode paling mudah menggunakan simple queue



Simple Queue

Simple Queue <Limiter-Operasional>

General Advanced Statistics Traffic Total Total Statistics

Name: Limiter-Operasional

Target: 192.168.128.0/22

Dst.:

Target Upload Target Download

Max Limit: 11M 11M bits/s

▼ Burst

▼ Time

enabled

OK Cancel Apply Disable Comment Copy Remove Reset Counters Reset All Counters Torch

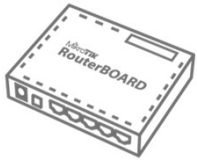
Nama queue

IP address client

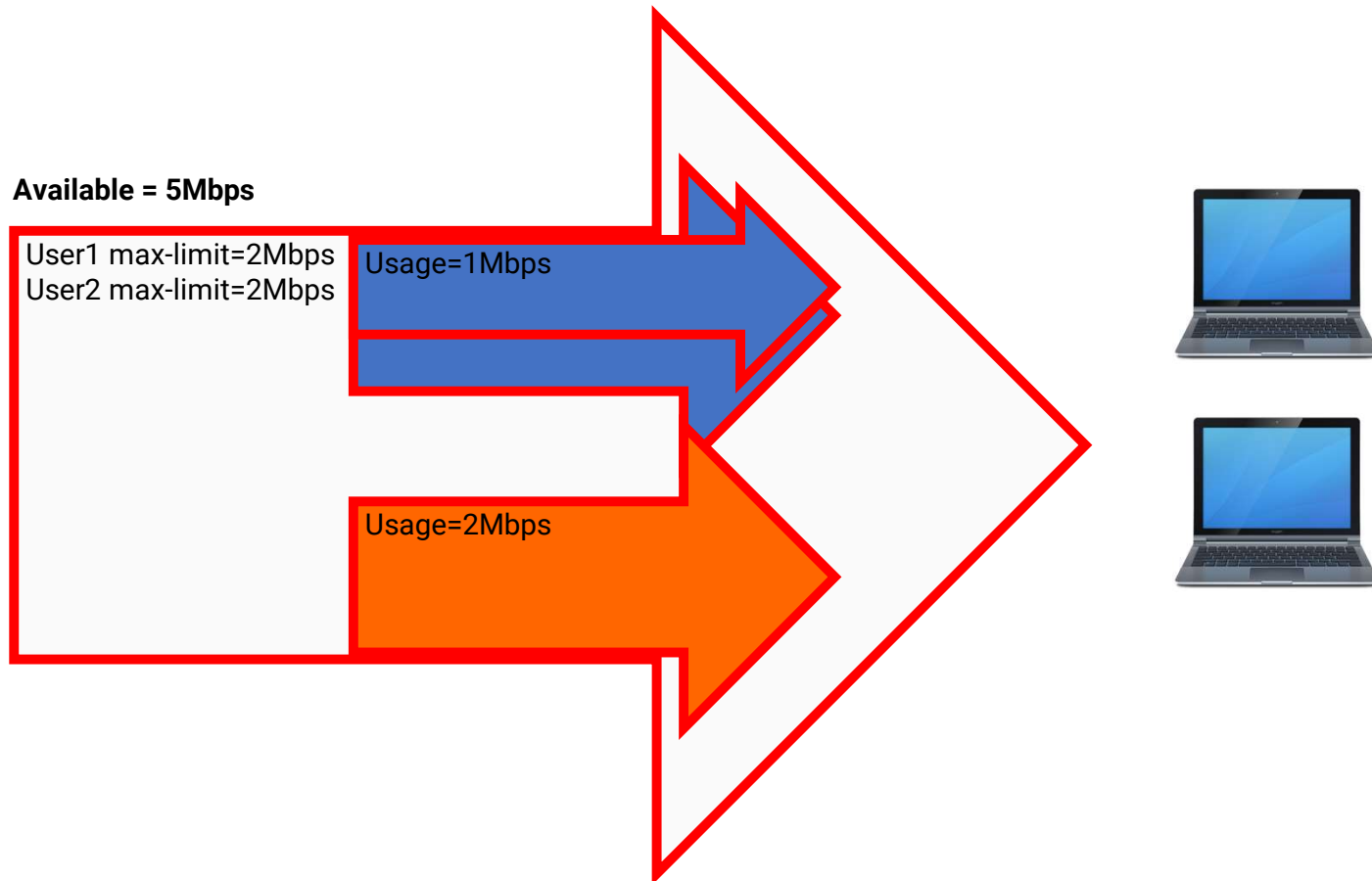
Target : Berupa single atau multiple IP atau Interface yang akan diatur bandwidthnya

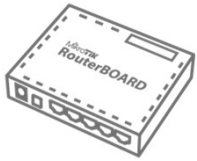
Simple queue bisa melimit **upload, download atau total (upload+download)** sekaligus dalam 1 rule

```
[admin@MikroTik] > /queue/simple/add name=Limiter-Operasional  
target=192.168.128.0/22 max-limit=11M/11M
```

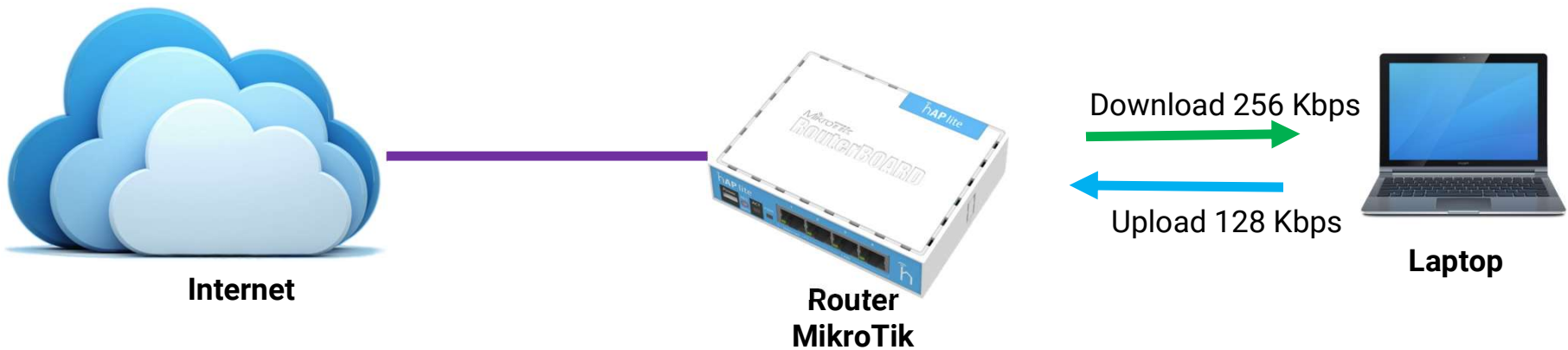


Bandwidth Max-Limit

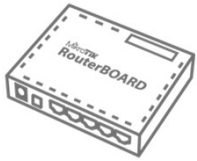




[LAB-1]Max-limit PC



Buatlah queue untuk mengatur maximum bandwidth pc kita



[LAB-1] Queue PC

New Simple Queue

General Advanced Statistics Traffic Total Total Statistics

Name: limit laptop

Target: 192.168.X.2

Dst.:

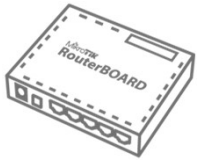
	Target Upload	Target Download
Max Limit:	128k	256k

Nama queue

IP address client

Besarnya bandwidth

```
/queue/simple/add name=limit_laptop target=192.168.x.2 max-limit=128k/256k
```



Custom Destination

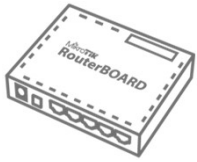
Available = 5Mbps

If open routers.co.id = 3Mbps
User1 max-limit=2Mbps
User2 max-limit=2Mbps

Usage=3Mbps

Usage=2Mbps





[LAB-2] Destination Limit



Internet



Router
MikroTik

Download routers.co.id = 1M Kbps



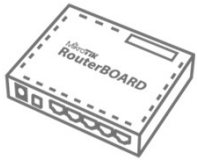
Download 256 Kbps



Upload 128 Kbps



Laptop



[LAB-2] Queue Destination

New Simple Queue

General Advanced Statistics Traffic Total Total Statistics

Name: limit routers

Target: 192.168.X.2

Dst.: 202.65.113.115

Max Limit: 256k 1M bits/s

Nama queue

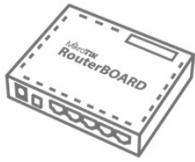
IP address client

IP address tujuan client

Besarnya bandwidth

```
[admin@MikroTik] > /queue/simple/add  
name=limit_routers target=192.168.x.2 max-  
limit=256k/1M dst=202.65.113.115
```

Lakukan test di mikrotik.com dan juga di routers.co.id secara paralel
Amati interface graph dan statistik queue, apakah ada perubahan dari [LAB-1]



Staged Limitation

Pada RouterOS, dikenal 2 buah limitasi:

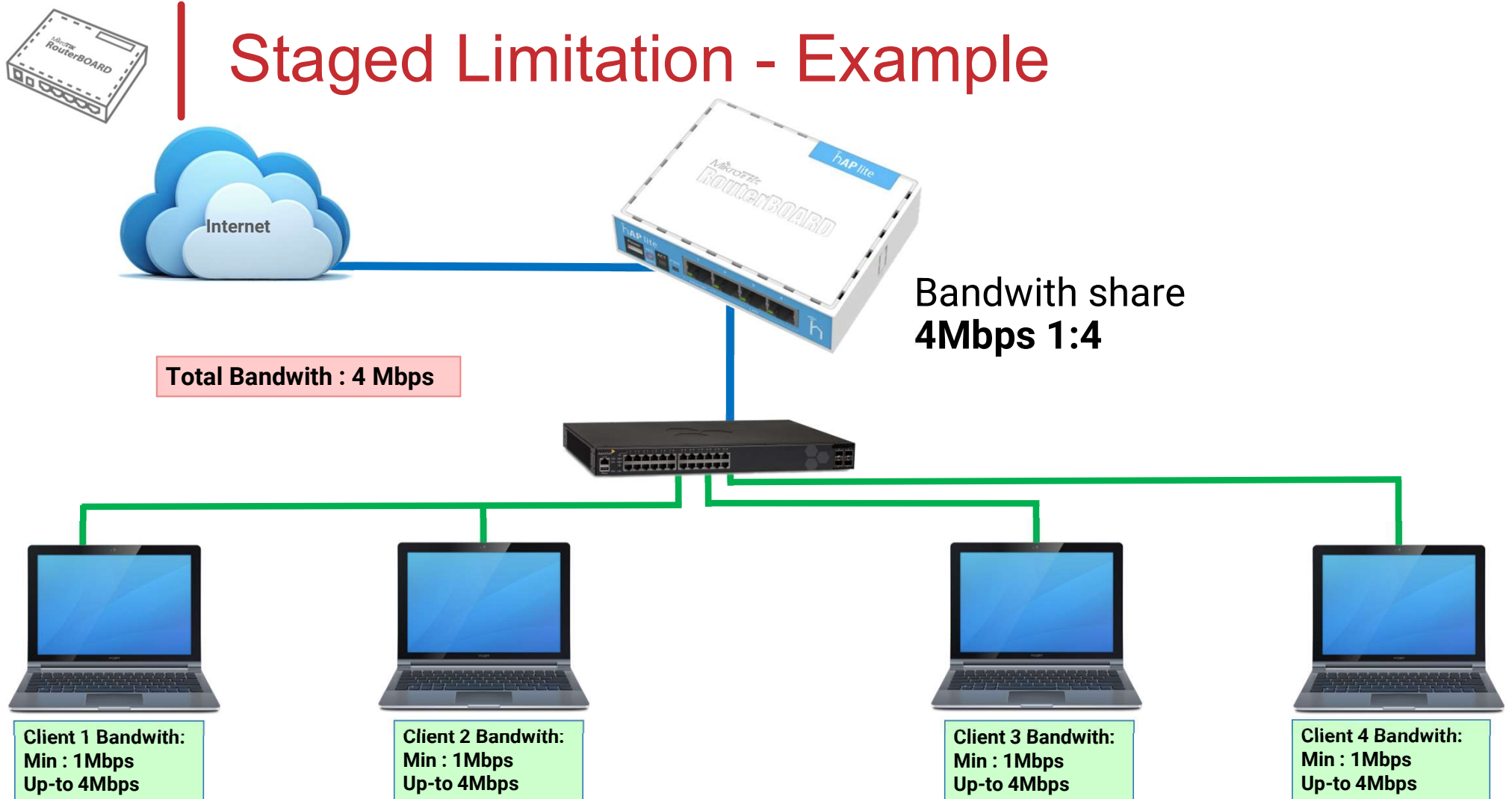
- CIR (Committed Information Rate)

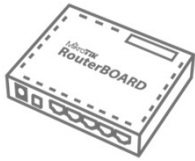
dalam keadaan terburuk, client akan mendapatkan bandwidth sesuai dengan "limit-at" (dengan asumsi bandwidth yang tersedia cukup untuk CIR semua client)

- MIR (Maximal Information Rate)

jika masih ada bandwidth yang tersisa setelah semua client mencapai "limit-at", maka client bisa mendapatkan bandwidth tambahan hingga "max-limit"

Staged Limitation - Example





[LAB-4] Staged Queue - Parent

New Simple Queue

General Advanced Statistics Traffic Total Total Statistics

Name:

Target:

Dst.:

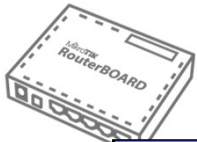
	Target Upload	Target Download
Max Limit:	4M bits/s	4M bits/s
Burst Limit:	unlimited bits/s	unlimited bits/s
Burst Threshold:	unlimited bits/s	unlimited bits/s
Burst Time:	0 s	0 s

Time

enabled

Parent queue harus dibuat terlebih dahulu untuk membantu router menentukan Total bandwidth yang dimiliki.

```
[admin@MikroTik] > /queue/simple/add  
name="total-bandwidth"  
target=10.10.10.0/24 max-limit=4M/4M
```

[LAB-4] Staged Queue - Child

Simple Queue <client1>

General Advanced Statistics Traffic Total Total Statistics

Name: client1

Target: 10.10.10.1

Dst.:

Target Upload Target Download

Max Limit: 4M 4M bits/s

Parameter Max Limit = MIR

Simple Queue <client1>

General Advanced Statistics Traffic Total Total Statistics

Packet Marks:

Target Upload Target Download

Limit At: 1M 1M bits/s

Priority: 8 8

Bucket Size: 0.100 0.100 ratio

Queue Type: default-small default-small

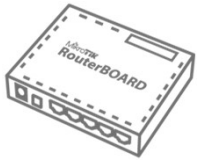
Parent: total-bandwidth

Parameter Limit-At = CIR

Parent ke total bandwidth



- | Queue List | | | | | | | |
|---|---|---------------|------------------|--------------------|-----------------|-------------------|-----------------|
| <div>Simple Queues Interface Queues Queue Tree Queue Types</div> <div> + - ✓ ✗ 📄 🔍 <input type="button" value="Reset Counters"/> <input type="button" value="Reset All Counters"/> <input type="text" value="Find"/> </div> | | | | | | | |
| # | Name | Target | Upload Max Limit | Download Max Limit | Upload Limit At | Download Limit At | Parent |
| 0 |  total-bandwidth | 10.10.10.0/24 | 4M | 4M | unlimited | unlimited | none |
| 1 |  client1 | 10.10.10.1 | 4M | 4M | 1M | 1M | total-bandwidth |
| 2 |  client2 | 10.10.10.2 | 4M | 4M | 1M | 1M | total-bandwidth |
| 3 |  client3 | 10.10.10.3 | 4M | 4M | 1M | 1M | total-bandwidth |
| 4 |  client4 | 10.10.10.4 | 4M | 4M | 1M | 1M | total-bandwidth |



Staged Queue - Priority

New Simple Queue

General Advanced Statistics Traffic Total Total Statistics

Packet Marks:

Target Upload
Limit At: 256k

Target Download
256k bits/s

Priority: 8

Queue Type: default-small

Parent: Bandwidth Total

Memiliki nilai dari 1 sampai 8
Priority : 1 → tertinggi
Priority : 8 → terendah

New Simple Queue

General Advanced Statistics Traffic Total Total Statistics

Packet Marks:

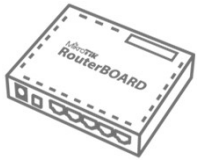
Target Upload
Limit At: 256k

Target Download
256k bits/s

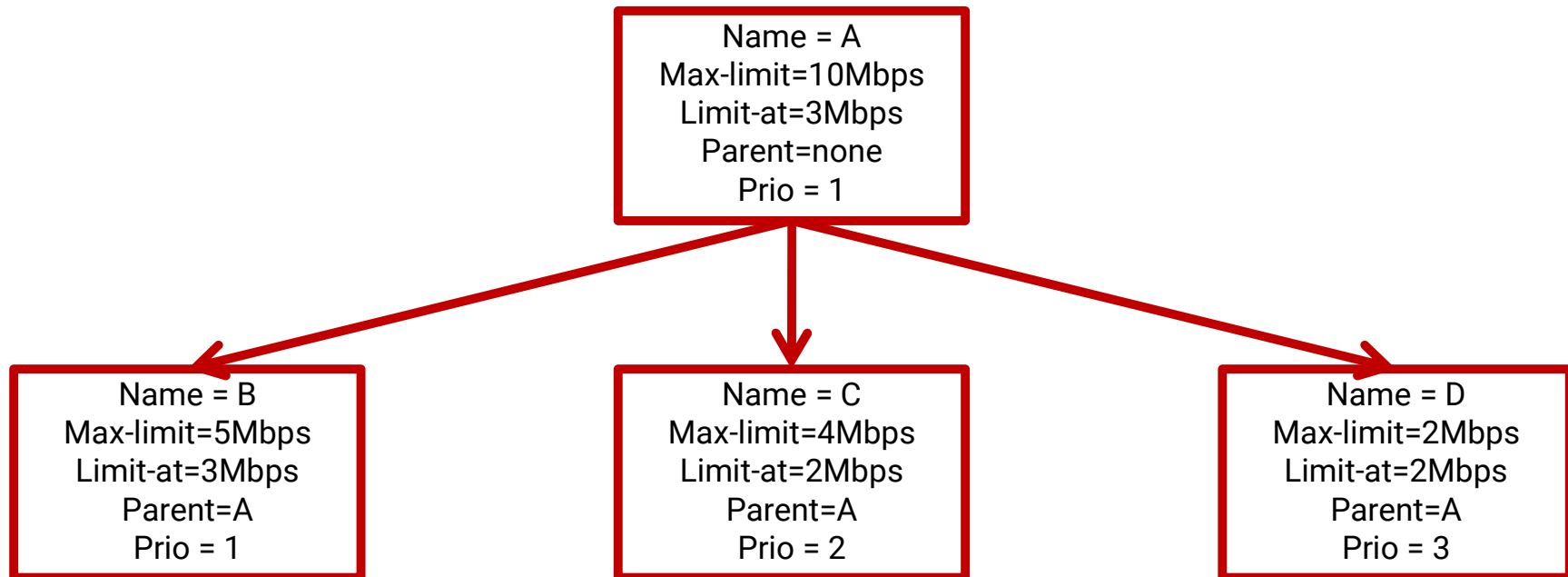
Priority: 6

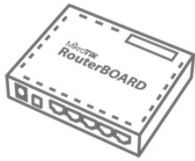
Queue Type: default-small

Parent: Bandwidth Total



Priority Effect

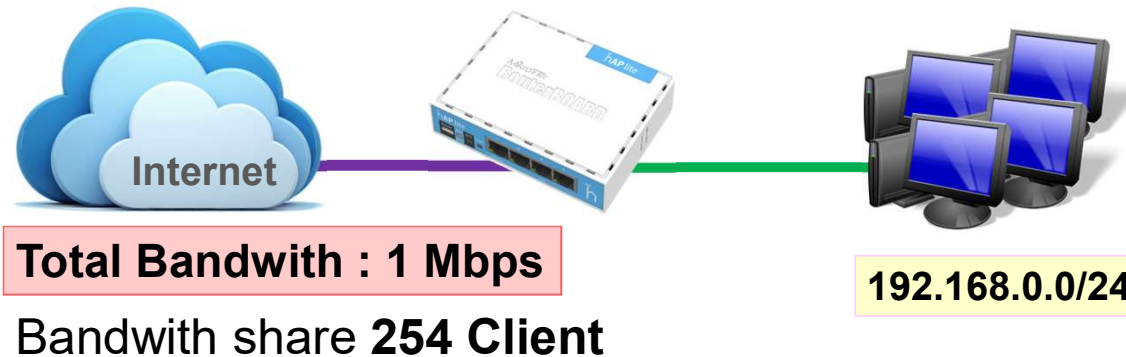


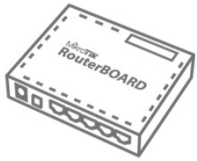


PCQ (Per Connection Queue)

Untuk kondisi client yang sangat banyak dan sangat merepotkan jika harus membuat banyak rule maka bisa menggunakan metode PCQ :

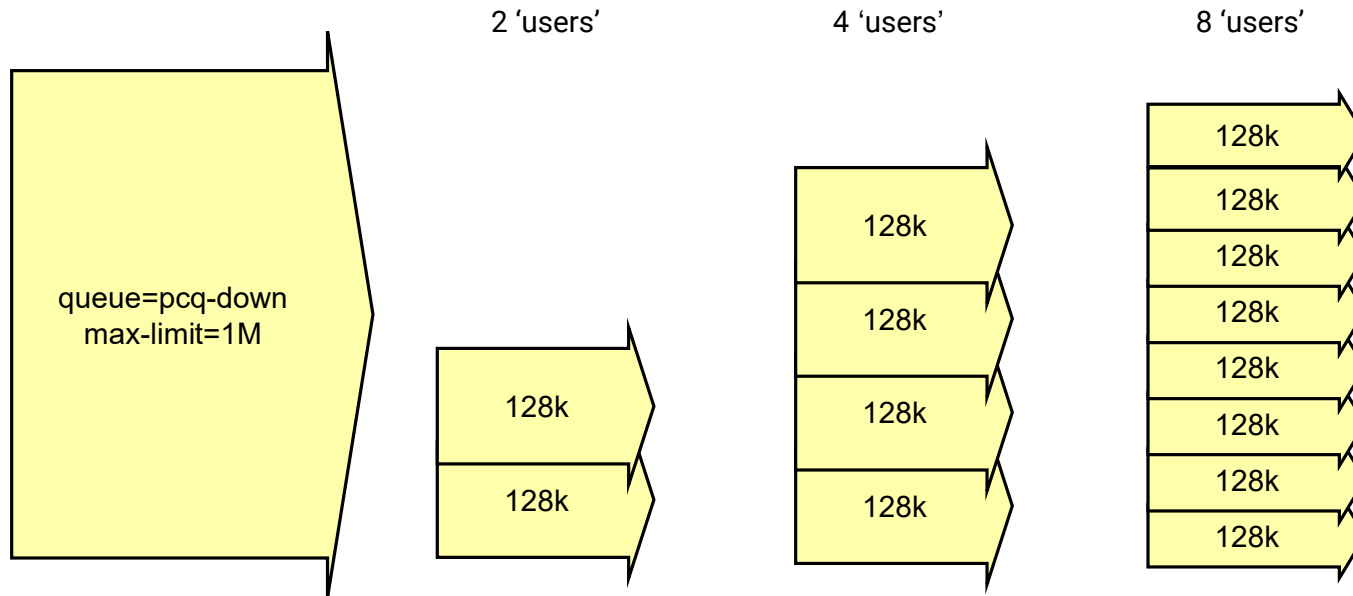
- PCQ bisa **membatasi bandwidth client secara merata** secara dynamic
- PCQ membutuhkan memori yang cukup besar

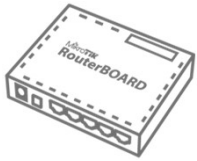




PCQ in Action (1)

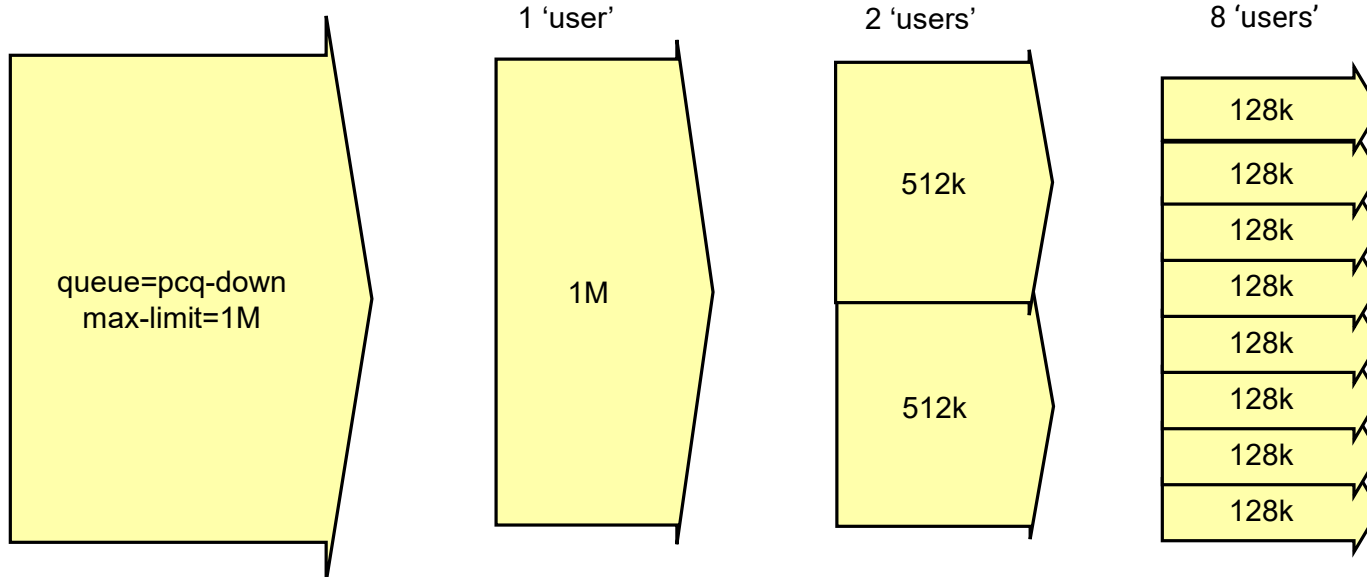
Pcq-rate=128000

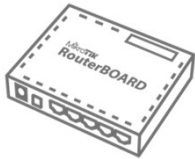




PCQ in Action (2)

Pcq-rate=0





[LAB-5] Queue Kind - PCQ

Queue List

Simple Queues Interface Queues Queue Tree Queue Types

+ - Filter

Type Name
* default
* default-small
* ethernet-default
* hotspot-default
* multi-queue-ethernet-d
* only-hardware-queue
* pcq-download-default
* pcq-upload-default
* synchronous-default
* wireless-default

New Queue Type

Type Name: pcq-download

Kind: pcq

Rate: 128k

Limit: 50

Total Limit: 2000

Burst Rate:

Burst Threshold:

Burst Time: 00:00:10

- Classifier -

☐ Src. Address	☒ Dst. Address
☐ Src. Port	☐ Dst. Port

New Queue Type

Type Name: pcq-upload

Kind: pcq

Rate: 128k

Limit: 50

Total Limit: 2000

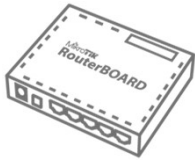
Burst Rate:

Burst Threshold:

Burst Time: 00:00:10

- Classifier -

☒ Src. Address	☐ Dst. Address
☐ Src. Port	☐ Dst. Port



[LAB-5] Queue Kind - PCQ

Simple Queue <Bandwidth Total>

General Advanced Statistics Traffic Total Total Statistics

Name: Limiter Network Client

Target: 192.168.x.0/24

Dst.:

Target Upload Target Download

Max Limit: 1M 1M

Burst

Burst Limit: unlimited unlimited

Burst Threshold: unlimited unlimited

Burst Time: 0 0

Time

Simple Queue <Bandwidth Total>

General Advanced Statistics Traffic Total Total Statistics

Packet Marks:

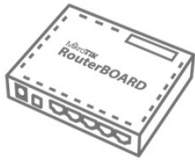
Target Upload Target Download

Limit At: unlimited unlimited bits/s

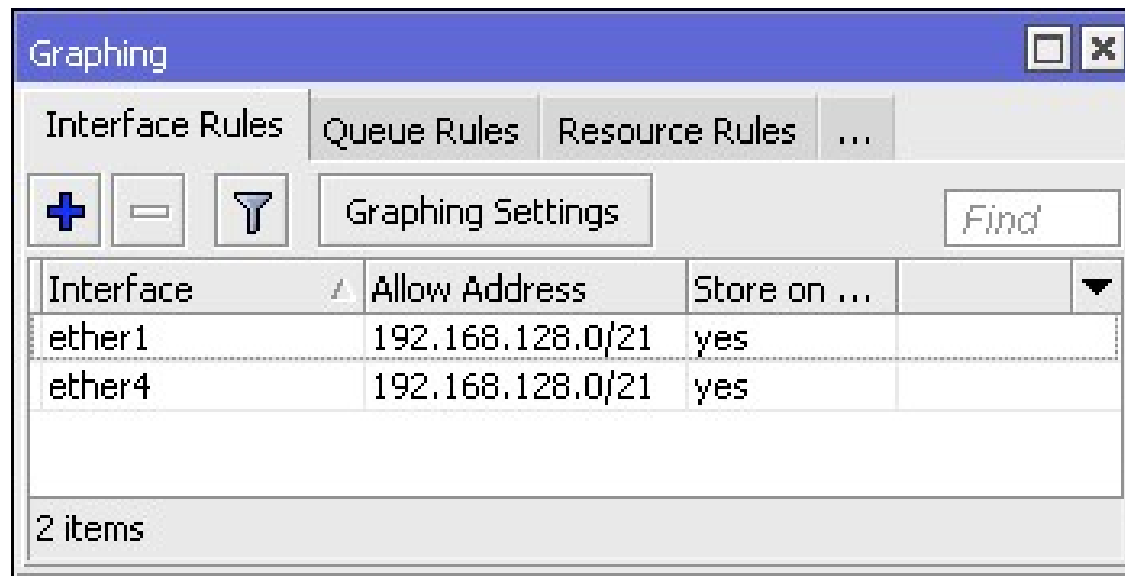
Priority: 8 8

Queue Type: pcq-upload pcq-download

Parent: none



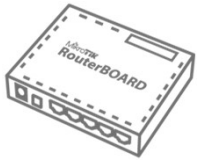
Tool – Graph (1)



Merupakan fitur untuk menampilkan graph dari trafik yang berlangsung di sebuah interface atau Queue simple

Selain itu juga bisa digunakan untuk membuat graph dari resource router kita (CPU, RAM, DISK)

Graph ini bisa akan diupdate per 5menit / per jam atau perhari sesuai interval yang ada di graphing settings



Tool – Graph (2)



Traffic and system resource graphing

[CPU usage](#)

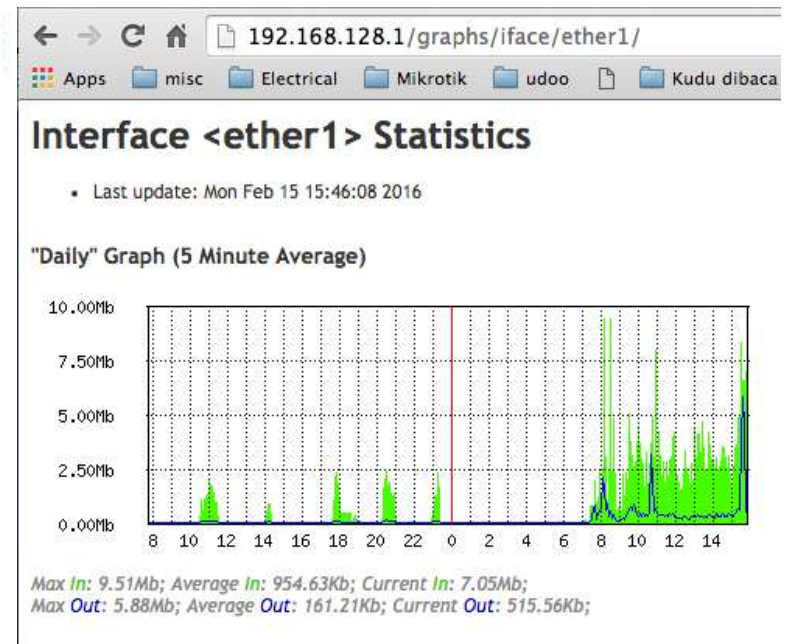
[Memory usage](#)

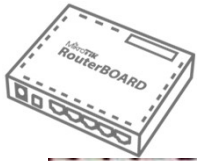
[Disk usage](#)

You have access to 2 interfaces:

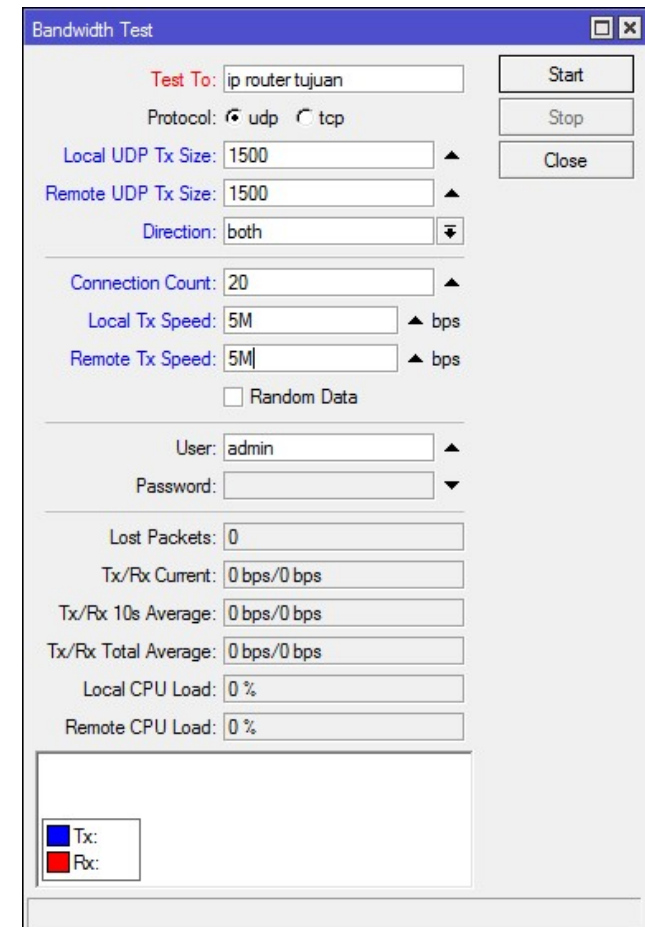
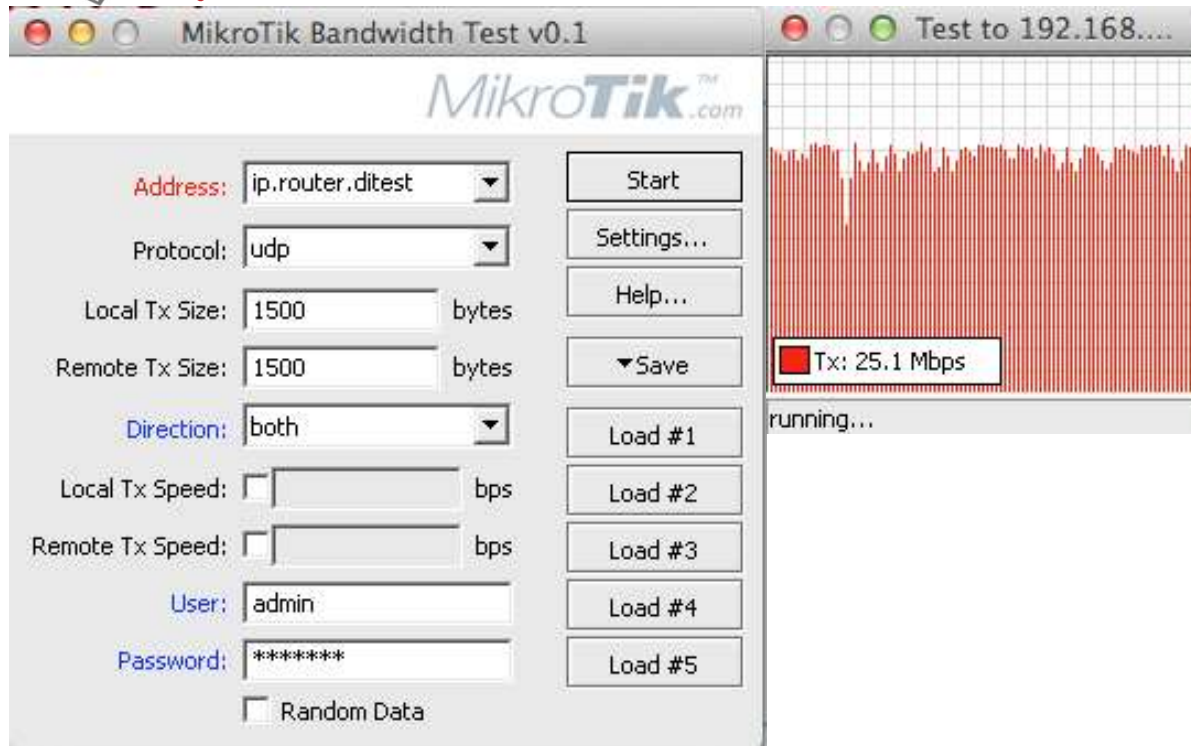
[ether1](#)

[ether4](#)

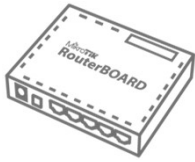




Tools – Btest / Bandwidth Test



Aplikasi yang bisa kita gunakan untuk melakukan bandwidth test ke sesama router mikrotik atau ke PC yang juga menjalankan BTEST



Quiz - Queue

- Berapa kecepatan transfer data maksimal yang akan didapatkan oleh Client, dengan pengaturan Simple Queue berikut?

```
/queue simple pr  
0 name="limit1" target=192.168.20.2/32 max-limit=1M/1M  
1 name="limit2" target=192.168.20.2/32 max-limit=2M/2M
```

- Berapa prioritas tertinggi pada queue?
- Parameter apa yang digunakan untuk PCQ upload dan PCQ download?

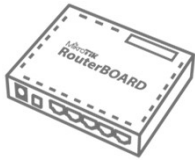
Virtual Private Network

MikroTik Basic – MTCNA Class

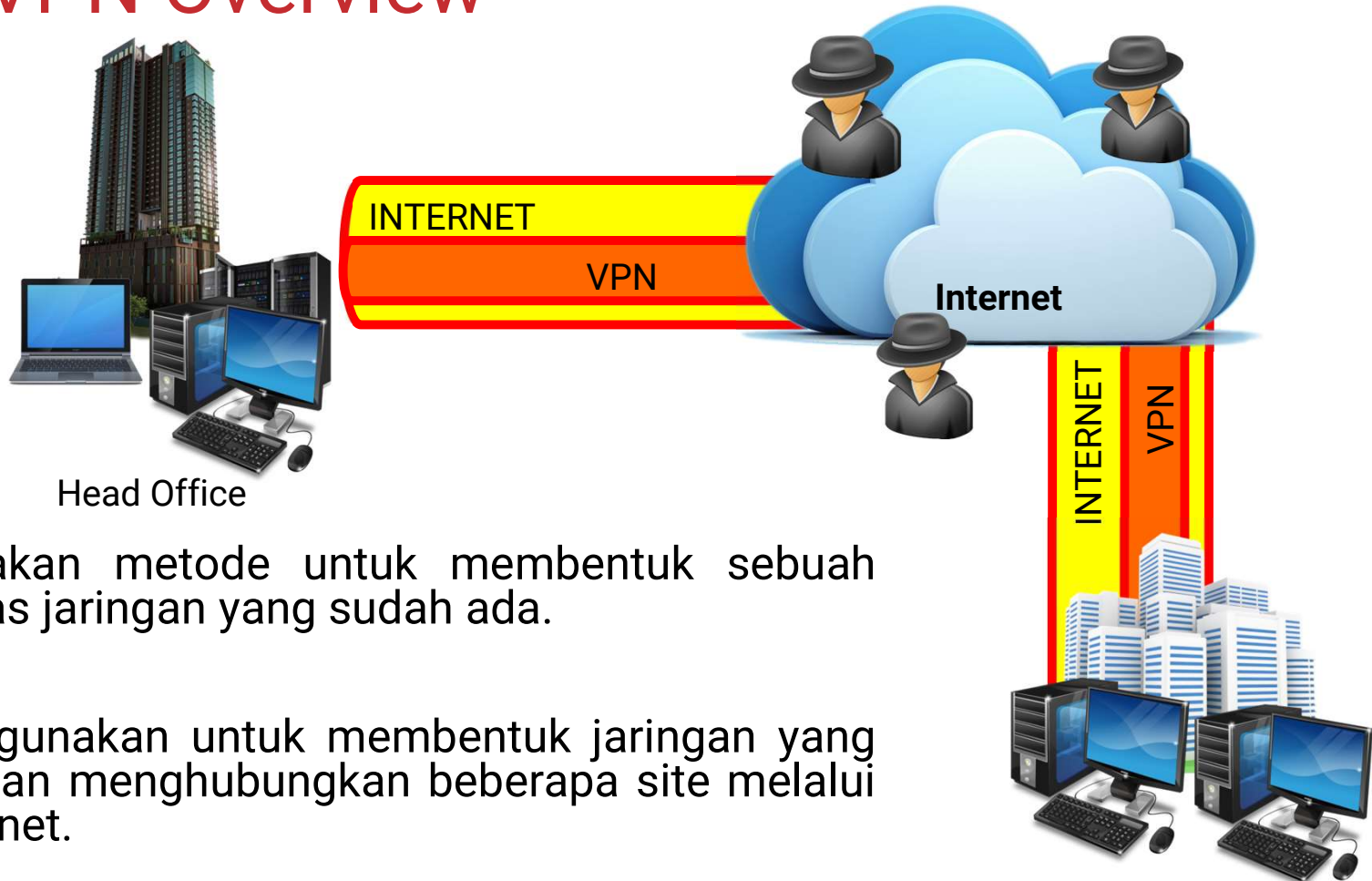


MikroTik Master Distributor
MikroTik Certified Training Partner
www.citraweb.com



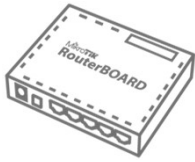


VPN Overview



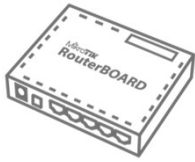
VPN merupakan metode untuk membentuk sebuah jaringan diatas jaringan yang sudah ada.

Umumnya digunakan untuk membentuk jaringan yang lebih aman dan menghubungkan beberapa site melalui jaringan internet.



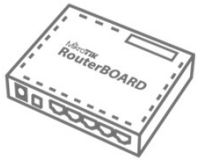
VPN Type

- Routed Network
 - VPN yang digunakan untuk membuat link tunnel dengan melewati beberapa hop router atau melewati Internet
 - Contohnya : PPTP & SSTP
- Bridge Network
 - VPN yang digunakan untuk interkoneksi dalam satu broadcast domain atau segmen yang sama
 - Contohnya : PPPoE



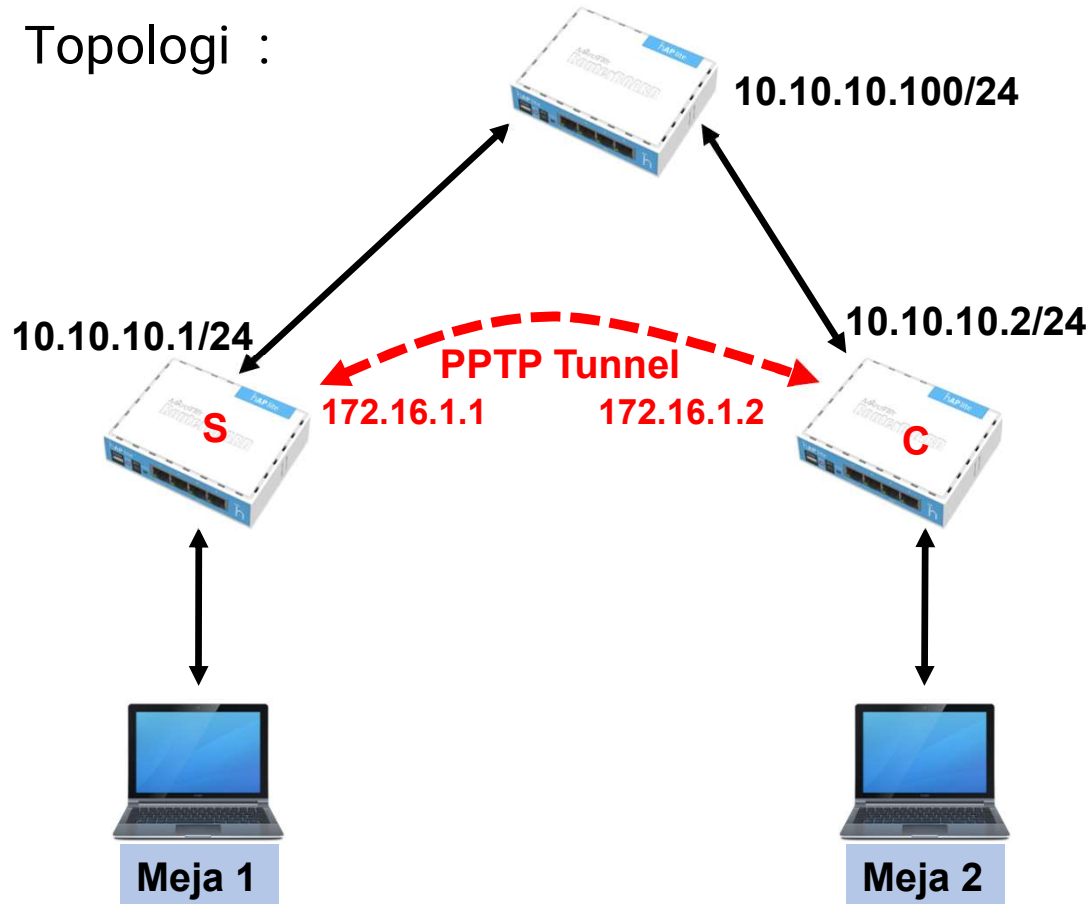
PPTP

- PPTP digunakan untuk membuat tunneling over internet.
- Dapat menghubungkan perangkat-perangkat jaringan seperti Router maupun perangkat mobile (Smartphone & Laptop)
- Menggunakan koneksi **TCP port 1723** dan **IP Protocol 47/GRE**.
- Koneksi dari PPTP terdiri dari Client & Server
- MikroTik dapat berfungsi sebagai PPTP Server, client, maupun keduanya secara bersamaan.



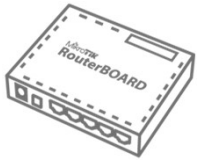
[LAB-1] PPTP

Topologi :

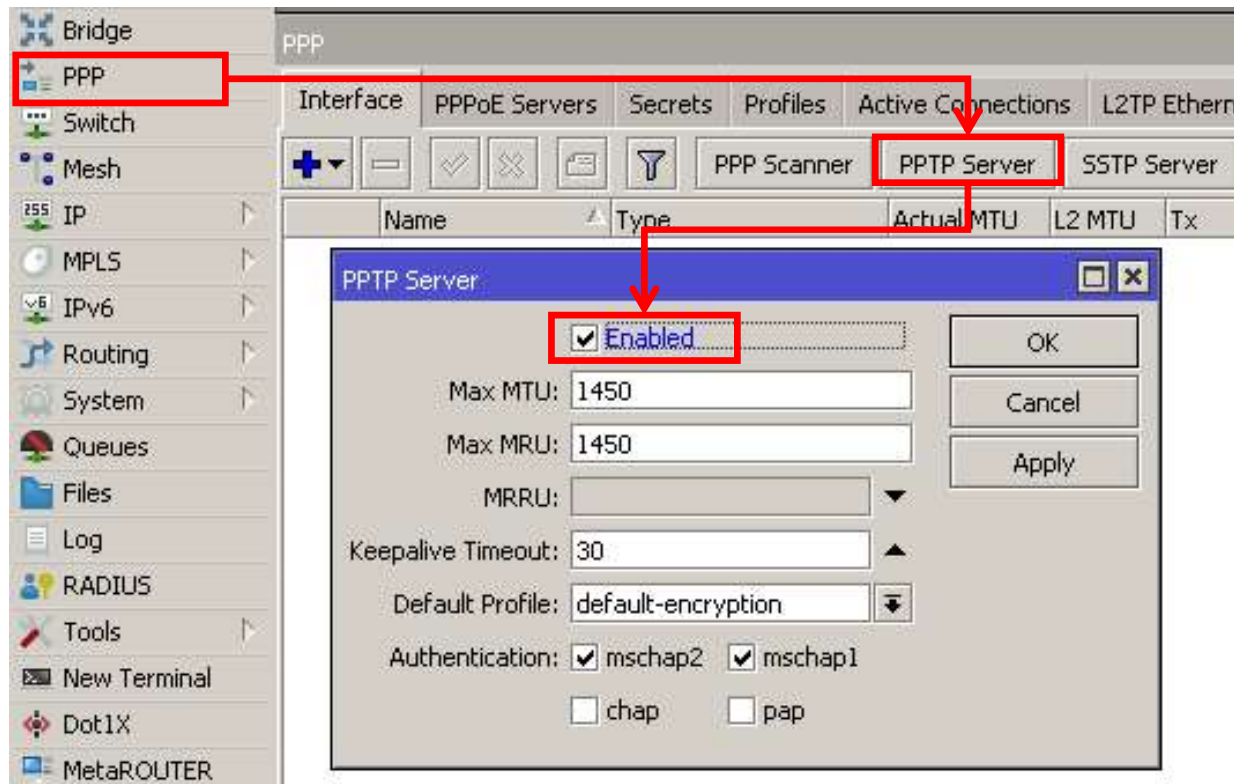


Tugas :

- Buatlah kelompok dengan teman satu meja
- Meja 1 sebagai PPTP Server
- Meja 2 sebagai PPTP Client
- Bentuk PPTP Tunnel untuk menghubungkan jaringan local dari Meja 1 dan Meja 2
- Lakukan pengetesan koneksi dengan menggunakan ping



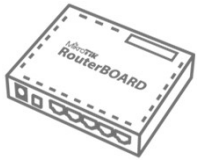
[Lab-1] Server - Enable PPTP



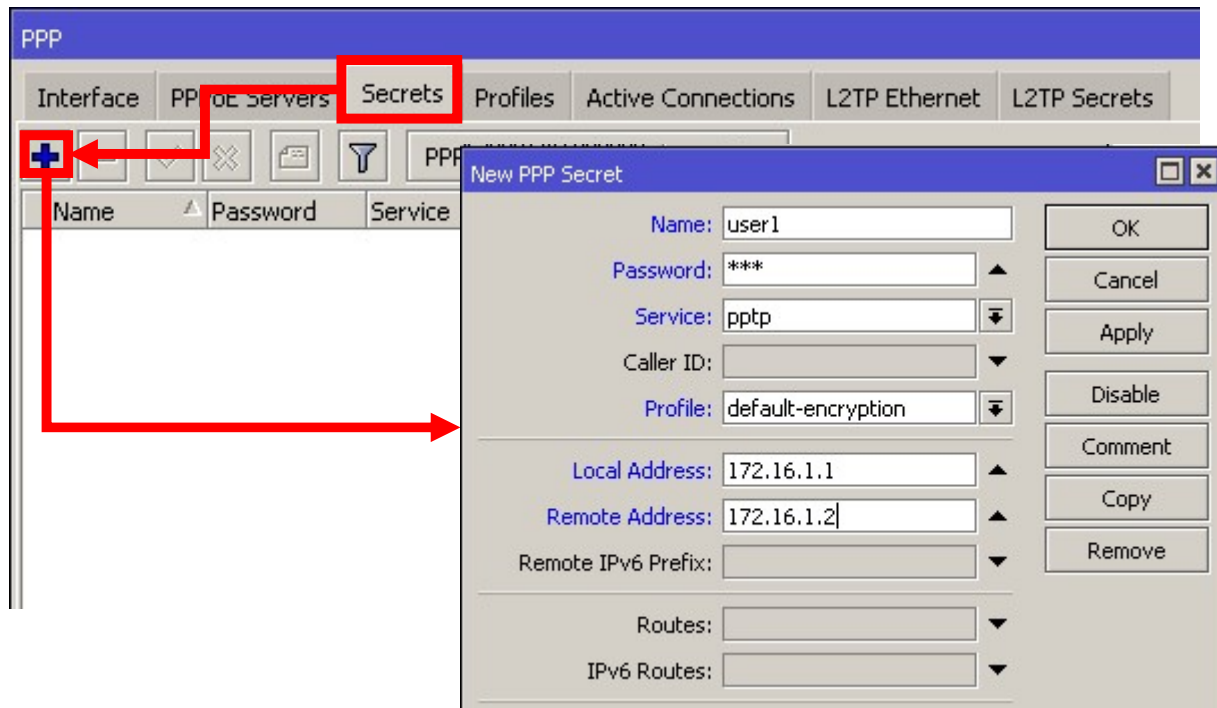
Langkah disamping digunakan untuk mengaktifkan fitur PPTP Server.

Dalam menu PPP ini juga terdapat beberapa pilihan VPN Server lain, seperti : SSTP, OpenVPN, L2TP.

```
/interface/pptp-server/server/set enabled=yes
```

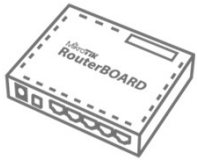


[Lab-1] Server - Create User

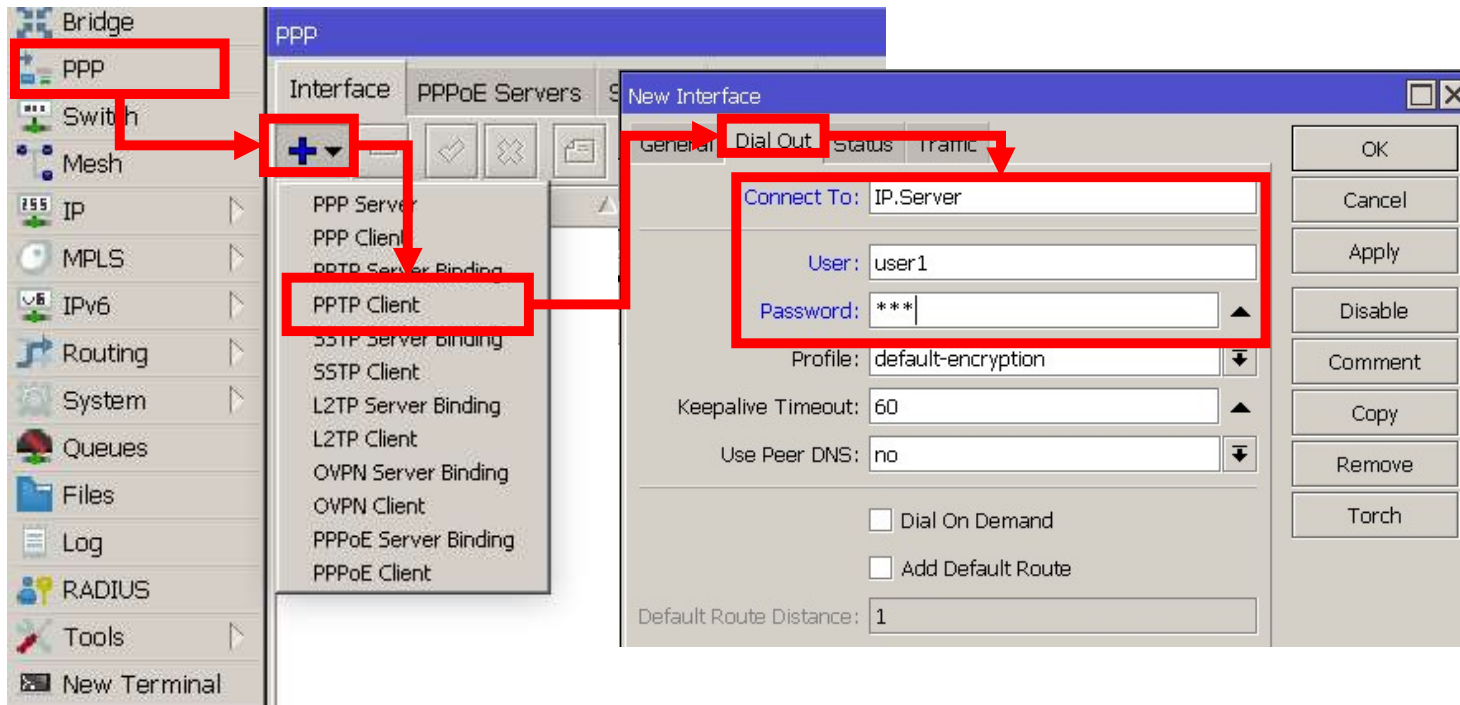


```
/ppp/secret/add name=user1 password=123 profile=default-encryption  
local-address=172.16.1.1 remote-address=172.16.1.2
```

- PPP Secret merupakan database local user VPN Router.
- Parameter :
 - **Name** dan **Password** untuk menentukan username dan password client
 - **Service** menentukan VPN apa yang boleh digunakan. "any" berarti semua jenis.
 - **Local Address** adalah IP Address interface VPN Server
 - **Remote Address** adalah IP Address interface VPN Client
 - **Profile** mengarahkan ke PPP Profile
- Dapat menggunakan RADIUS bila ingin database user terpusat



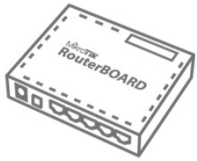
[Lab-1] Client - Dial Out



```
/interface/pptp-client/add connect-to=IP.Server user=user1 password=123
```

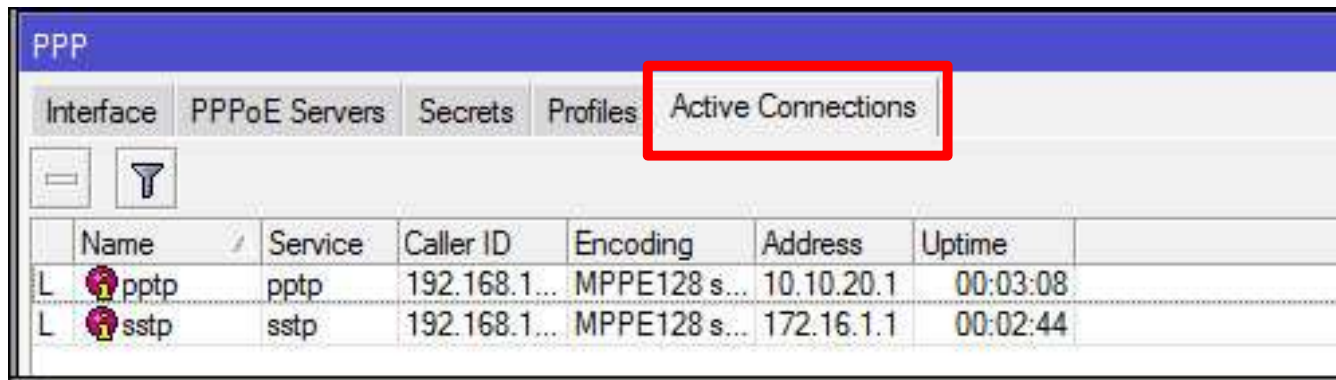
Parameter :

- **Connect To** merupakan parameter untuk menunjuk ke server mana kita akan terhubung.
- **User** dan **password** sesuai dengan akun yang dibuat pada Secret Server
- **Add Default Route** untuk menambahkan default-route melalui link VPN
- **Dial On Demand** : VPN hanya akan aktif bila terdapat traffic



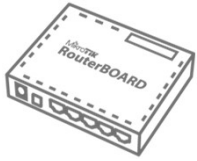
[Lab-1] Test PPTP dan Monitoring

- Lakukan test ping antar router menggunakan ip pptp yang sudah ditentukan
- Lakukan juga test ping dan traceroute antar laptop client, pastikan komunikasi sudah menggunakan jalur vpn
- Pada sisi server bisa dilihat berapa banyak koneksi VPN yang terbentuk (aktif) .



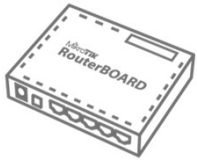
	Name	Service	Caller ID	Encoding	Address	Uptime
L	pptp	pptp	192.168.1...	MPPE128 s...	10.10.20.1	00:03:08
L	sstp	sstp	192.168.1...	MPPE128 s...	172.16.1.1	00:02:44

/ppp/active/print



SSTP (Secure Socket Tunneling Protocol)

- PPP Tunnel over SSL
- Mikrotik RouterOS bisa berfungsi sebagai SSTP server maupun SSTP Client atau gabungan dari keduanya
- Dibutuhkan SSL Certificate untuk dapat terkoneksi, baik pada Server maupun Client (tidak berlaku jika kedua nya Mikrotik RouterOS)
- Koneksi SSTP menggunakan TCP port 443 / HTTPS
- Lebih aman dibandingkan menggunakan PPTP



[Lab-2] SSTP Server

PPP

Interface | PPPoE Servers | Secrets | Profiles | Active Connections | L2TP Secrets

PPP Scanner | PPTP Server | **SSTP Server**

SSTP Server

☒ **Enabled**

Port: 443

Max MTU: 1500

Max MRU: 1500

MRRU: [dropdown]

Keepalive Timeout: 60

Default Profile: default

Authentication: ☒ mschap ☒ mschap1
☒ chap ☒ pap

Certificate: none

TLS Version: any

☐ Verify Client Certificate

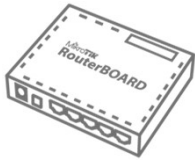
☐ PFS

OK
Cancel
Apply

Parameter :

- **Enabled** untuk mengaktifkan SSTP Server
- **Certificate** digunakan untuk menentukan SSL Certificate Server
- **Verify Client Certificate** untuk memastikan certificate yang digunakan client berada dalam satu chain dengan certificate server

```
/interface/sstp-server/server/set enabled=yes
```

[Lab-2] SSTP Client

New Interface

General | Dial Out | Status | Traffic

Connect To: ip.server

Port: 443

Proxy:

Proxy Port: 443

Certificate: none

TLS Version: any

☒ Verify Server Certificate

☒ Verify Server Address From Certificate

☐ PFS

User: username

Password: password

Profile: default-encryption

Keepalive Timeout: 60

☐ Dial On Demand

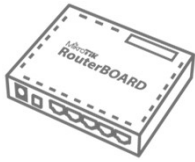
☐ Add Default Route

OK Cancel Apply Disable Comment Copy Remove Torch

```
/interface/sstp-client/add connect-to=ip.server user=username  
password=password
```

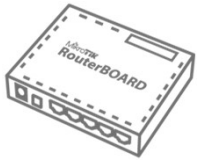
Parameter :

- **Connect To** untuk menentukan alamat SSTP Server
- **Verify Server Certificate** memastikan certificate server masih berada dalam satu chain yang sama
- **Verify Server Address From Certificate** memastikan IP Address Server dengan Address certificate sama
- **Add Default Route** untuk menambahkan default-route melalui link VPN
- **Dial On Demand** : VPN hanya akan aktif bila terdapat traffic

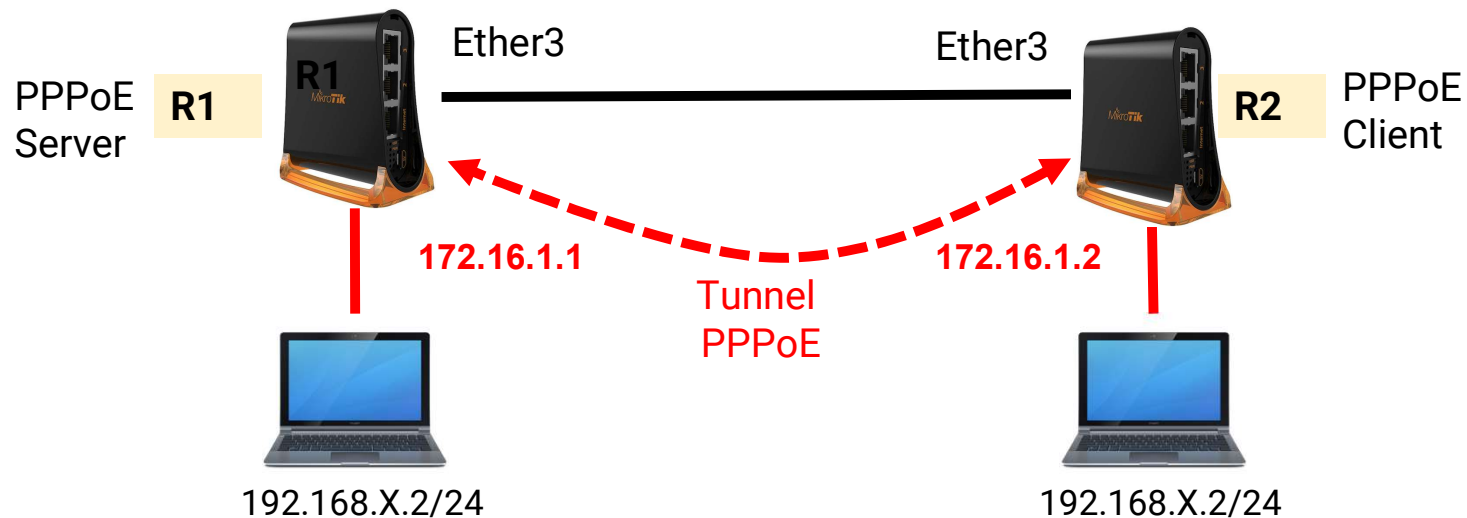


PPPoE (Point to Point Protocol over Ethernet)

- Penggunaan PPPoE :
 - Koneksi antar Client dan Router yang bersifat secure.
 - Untuk digunakan sebagai koneksi internet bersifat secure di jaringan local (LAN).
- Sebuah koneksi PPPoE terdiri dari Server dan Client.
 - Mikrotik RouterOS bisa berfungsi sebagai PPPoE server maupun PPPoE Client atau gabungan dari keduanya.
- Koneksi PPPoE menggunakan Ethernet frame sebagai protocol transportnya.
- Fungsi PPPoE clients sudah tersedia atau termasuk dalam sebagian besar Sistem Operasi.
- PPPoE bisa dijalankan di interface Ethernet, Wireless ataupun Bridge

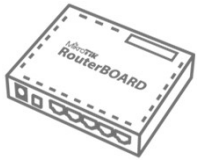


LAB - PPPoE

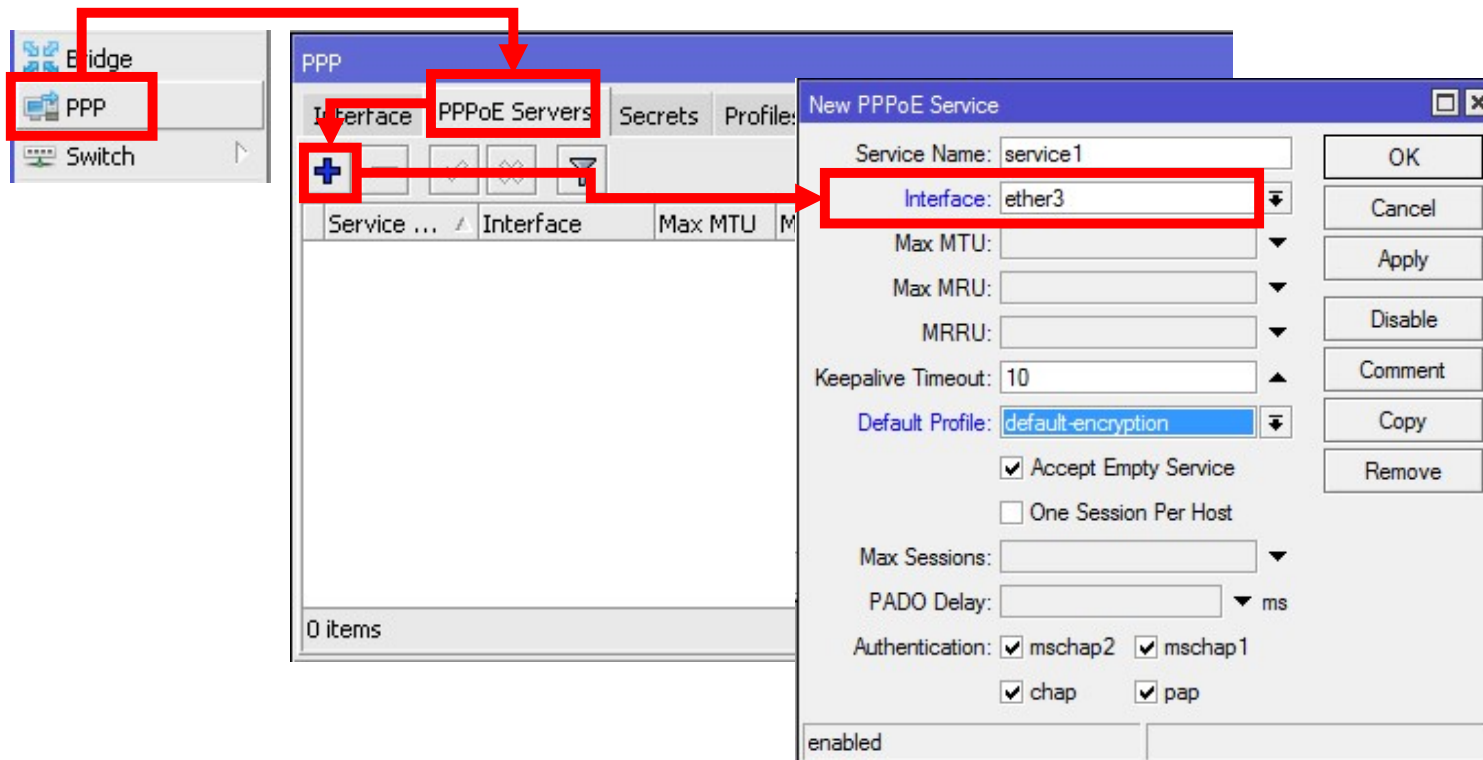


Tugas :

- Bangun koneksi PPPoE antar router dengan rekan peserta lain
- Hubungkan antar router via ether3 tanpa konfigurasi IP Address
- Untuk server, aktifkan service PPPoE Server dan buat username untuk client
- Untuk client, tambahkan PPPoE Client dan gunakan username yang didapatkan dari server



[Lab] PPPoE Server



Parameter :

- **Interface** menentukan interface PPPoE Server akan dijalankan
- **One Session per Host** : hanya memperbolehkan satu host memiliki satu sesi aktif

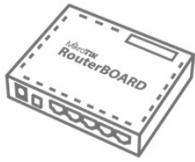


[Lab] PPPoE Client

The image displays two screenshots of the Mikrotik WinBox 'New Interface' configuration window. The left screenshot shows the 'General' tab with the following fields: 'Name: pppoe-out1', 'Type: PPPoE Client', 'Actual MTU:', 'Max MTU:', 'Max MRU:', 'MRRU:', and 'Interfaces: ether3'. The right screenshot shows the 'Dial Out' tab with the following fields: 'Service:', 'AC Name:', 'Host Uniq:', 'User: username', 'Password: password', 'Profile: default', 'Keepalive Timeout: 10', and 'Default Route Distance: 1'. The 'Dial On Demand', 'Use Peer DNS', and 'Add Default Route' checkboxes are also visible. Red boxes highlight the 'General' tab, 'Dial Out' tab, 'User' and 'Password' fields, and the 'Interfaces' field. Red arrows indicate the flow from the General tab to the Dial Out tab and from the 'Interfaces' field to the 'Dial Out' tab.

Parameter :

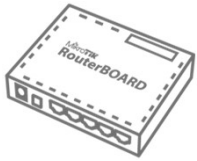
- **Interface** menentukan interface PPPoE Client akan dijalankan
- **Dial On Demand** : VPN hanya akan aktif bila terdapat traffic
- **Add Default Route** untuk menambahkan default-route melalui link PPPoE
- **Default Route Distance** menentukan nilai distance default-route



[Lab] Test PPPoE

- Cek IP Address yang didapatkan oleh Router
- Lakukan ping antar router berdasarkan IP PPPoE
- Buat Static Routing agar kedua jaringan lokal bisa saling berkomunikasi via PPPoE
- Lakukan traceroute antar laptop untuk memastikan jalur sudah melewati PPPoE

CMD = tracert -d 192.168.X.2

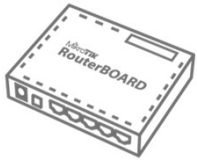


PPP Profiles

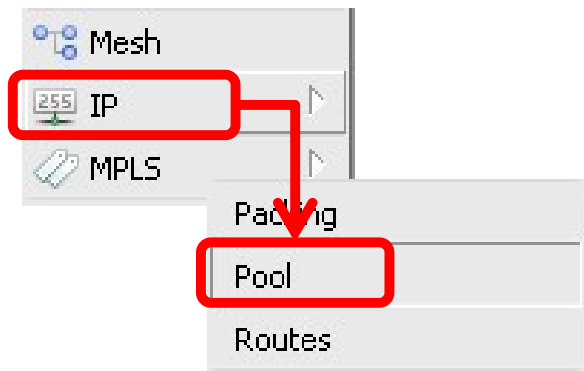
- Profiles digunakan untuk membuat setting custom yang bisa sama atau berbeda antar usernya.
- Profile yang sudah dibuat, harus dipasang di secret user yang bersangkutan

PPP						
Interface PPPoE Servers Secrets Profiles Active Connections L2TP Secrets						
+ -						
Name	Local Address	Remote Address	Bridge	Rate Limi...	Only One	
default					default	
default-enc...					default	
namaprofile	172.16.100.254	pool-vpn			no	

/ppp/profile/print



IP Pool VPN



IP Pool

Pools Used Addresses

+ - [icon] [icon] Find

Name Addresses Next Pool

New IP Pool

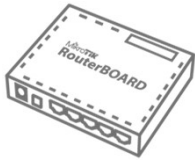
Name: pool-vpn

Addresses: 172.16.100.1-172.16.100.253

Next Pool: none

OK Cancel Apply Comment Copy Remove

Pool VPN untuk memberikan range IP yang akan didistribusikan ke VPN Client



Profile Example

New PPP Profile

General Protocols Limits Queue Scripts

Name: namaprofile

Local Address: 172.16.100.254

Remote Address: pool-vpn

New PPP Profile

General Protocols Limits Queue Scripts

– Use MPLS –
☐ no ☐ yes ☐ required ☒ default

– Use Compression –
☐ no ☐ yes ☒ default

– Use Encryption –
☐ no ☒ yes ☐ required ☐ default

PPP Profile <namaprofile>

General Protocols Limits Queue Scripts

Session Timeout: []

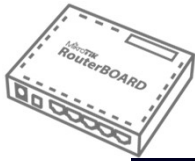
Idle Timeout: []

Rate Limit (rx/tx): []

– Only One –
☒ no ☐ yes ☐ default

- Parameter Remote Address bisa menggunakan Pool-VPN yang sudah dibuat
- Enkripsi MPPE 128 akan diaktifkan
- Satu username bisa digunakan untuk dial beberapa client

```
/ppp/profile/add name=namaprofile local-address=172.16.100.254  
remote-address=pool-vpn use-encryption=yes only-one=no
```



Profile Secret

PPP Secret <username>

Name:

Password:

Service:

Caller ID:

Profile:

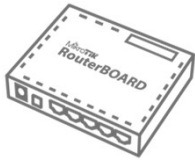
Local Address:

Remote Address:

Setelah Profile dibuat, pasangkan profile pada user agar konfigurasi profile tersebut aktif.

Dan VPN Client yang terkoneksi akan mendapatkan IP Dinamis berdasarkan Range IP Pool yang sudah ditentukan

```
/ppp/secret/set username profile=namaprofile
```



Quiz!

- PPTP Server dan Client dapat dijalankan pada satu Router dalam waktu bersamaan (Benar/Salah)
- PPP Profile dapat digunakan untuk melakukan blocking paket data dari VPN Client. (Benar/Salah)

TERIMA KASIH



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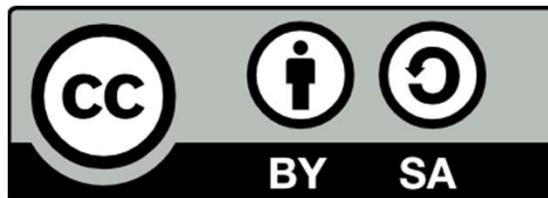
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Dijinkan menggunakan sebagian atau seluruh materi pada modul ini, baik berupa ide, foto, tulisan, konfigurasi dan diagram selama untuk kepentingan pengajaran, dan memberikan kredit kepada penulis serta link ke www.mikrotik.co.id