



*Mikro***Tik** MTCNA

MikroTik Certified Network Associate
Training

Okky Tria Saputra, MTCNA, MTCRE, MTCWE, MTCTCE, Trainer, Coordinator
[ID-Networkers | www.TrainingMikroTik.com](http://www.TrainingMikroTik.com)

Okky Tria Saputra

- Using MikroTik since 2009, as IT Support for Internet Café
- 2014, Join Pesantren Networkers studied MikroTik, Cisco, Juniper, English, Religion
- 2014, System Engineer at Softbank Telecom Indonesia
- 2015-Now, Certified Trainer (MTCNA, MTCRE, MTCTCE, MTCWE, Certified Trainer, Academy Coordinator) at **ID-
Networkers**.

CONSULTANT

<http://www.mikrotik.com/consultants/asia/indonesia>

CERTIFIED TRAINER

<http://www.mikrotik.com/training/partners/asia/indonesia>

ID-NETWORKERS

EXPERT LEVEL TRAINERS & CONSULTANS

In the Most Prestigious Networking Certification

OVERVIEW

We are young entrepreneurs, we are only one training partner & consultant who has expert level trainers in the most prestigious networking certification, CCIE Guru , JNCIE Guru and MTCINE guru, which very limited number in Indonesia even Asia. Proven that hundred of our students pass the certification exam every year. We are the biggest certification factory in Indonesia.

WEBSITE

www.id-networkers.com

www.idn.id



ID NETWORKERS
Expert Trainer & Consultant



Our Clients



Perkenalkan Diri Anda

- Silahkan perkenalkan diri anda:
 - Nama?
 - Dari Perusahaan apa?/pekerjaan sehari-hari?
 - Pengalaman menggunakan MikroTik?
 - Pengalaman tentang jaringan?
 - Apa yang diharapkan dari training ini?

Connect Internet

- Wifi = IDN-Trening
- Password = idnmantab



Tujuan Training MTCNA

1. Mempelajari karakteristik, fitur-fitur dan kemampuan MikroTik RouterOS.
2. Mempelajari cara instalasi, konfigurasi, fungsi, maintenance dan troubleshoot dasar MikroTik RouterOS.
3. Mendapatkan kualifikasi sebagai MikroTik Certified Network Associate.

Registrasi Account di Mikrotik.com

- Untuk training dan ujian MTCNA peserta harus teregistrasi di official web mikrotik
- Register account di www.mikrotik.com, pada menu account isi semua form yang disediakan
- Pastikan nama anda ditulis lengkap dalam profil, karena otomatis akan tercetak dalam sertifikat.

User Information	
Company Name (or person name):	Rofiq Fauzi, ID-Networkers *
Authorised Person (<i>Firstname Lastname</i>) or Purchaser (for ordering):	Rofiq Fauzi *
E-mail (License key will be sent here):	rofiq.fauzi@gmail.com *

- Informasikan email anda ke instruktur (rofiq.fauzi@gmail.com), peserta harus mendapat invitation dari instruktur.

Tentang Ujian MTCNA

- Online test terdiri atas 25 soal dalam waktu 1 jam.
- Soal setiap test random, dengan beberapa soal mungkin ada yang sama dengan soal sebelumnya.
- Passing grade **60%**, nilai 50%-59% bisa test ulang.
- Hati-hati membaca soal, disamping bahasa inggris dari soal yang kadang-kadang kurang mudah dipahami, juga banyak jebakan batman 😊.
- **Silahkan melakukan latihan test training di web mikrotik, dan lihat scorenya.**

Latihan Test

- Setelah mendapatkan invitation dari trainer, peserta dapat melakukan latihan ujian MTCNA di website mikrotik.com
- Latihan ujian MTCNA ada di menu Account , My training session, Try example test



Routers & Wireless

Search...

[home](#)

[software](#)

[hardware](#)

[support](#)

[downloads](#)

[purchase](#)

[training](#)

[account](#)

[Overview](#) [Support](#)

[Logout](#)

[\[Back To Main Menu\]](#)

Certification example test

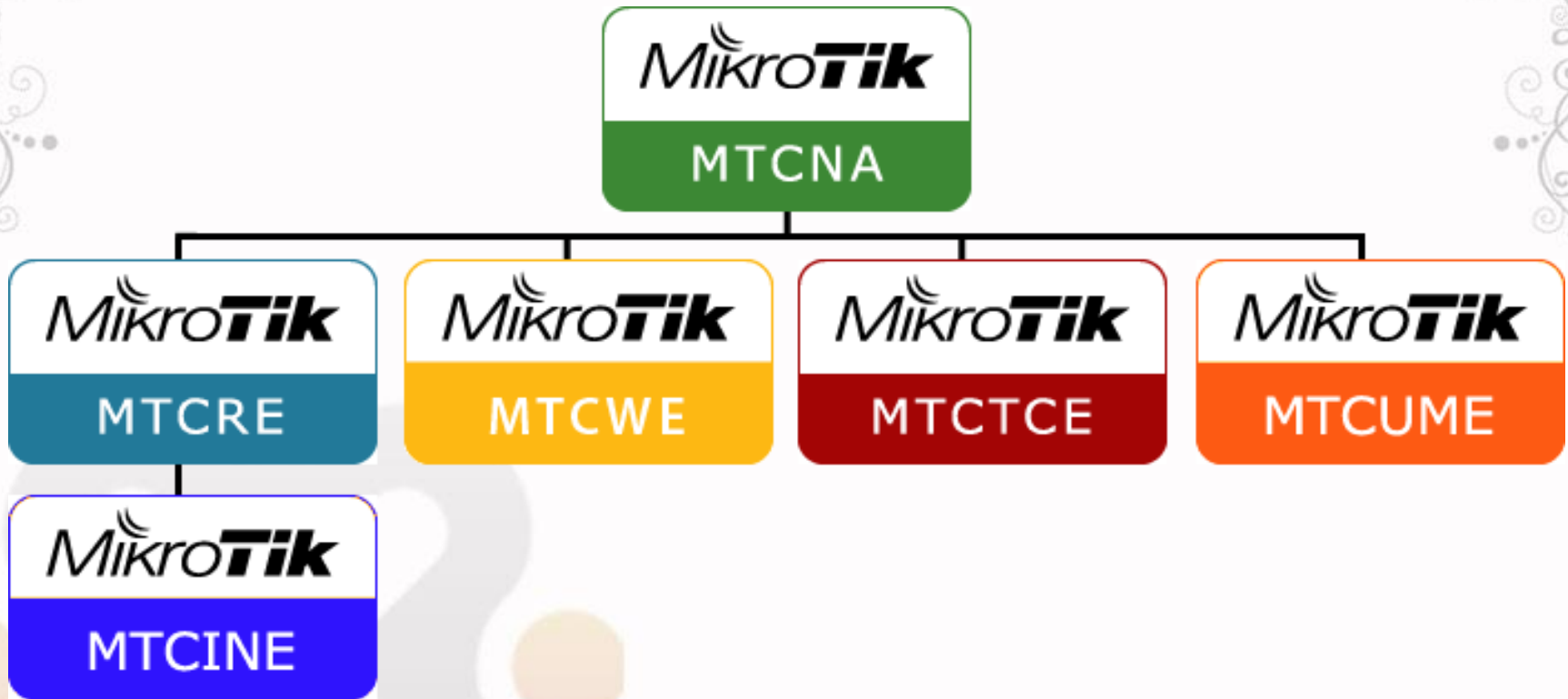
1. Select which of the following are 'Public IP addresses':

- 10.110.50.37
- 172.168.254.2
- 11.63.72.21
- 192.168.0.1
- 172.28.73.21



ID NETWORKERS
Expert Trainer & Consultant

Sertifikasi MikroTik



- Sertifikasi berjenjang, kalau belum lulus MTCNA belum bisa ikut ujian level engineer
- Masa berlaku sertifikat selama 3 tahun, setelah itu bisa diperpanjang dengan cara ujian lagi

MTCNA – Outline

- Module 1 – Introduction of MikroTik RouterOS
 - TCP/IP Review
- Module 2 – Firewall
- Module 3 – Wireless
- Module 4 – Bridging
- Module 5 – Routing
- Module 6 – Tunnel
- Module 7 – QoS
- Module 8 – Network Management






BAB I

Introduction MikroTik RouterOS & RouterBOARD





Sejarah MikroTik

- Lokasi : Riga, Latvia (Eropa Utara) 
- Produsen software dan hardware router.
- Menjadikan teknologi internet lebih murah, cepat, handal dan terjangkau luas.
- Motto Mikrotik : Routing the World.
- Founder (1996): John Trully & Arnis Reikstins.

Jenis MikroTik

- MikroTik RouterOS™
 - ✓ Operating sistem yang bisa diinstall di PC dan menjadikannya sebuah Router yang handal.
 - ✓ Berbasis Linux
 - ✓ Diinstall sebagai Sistem Operasi
 - ✓ Biasanya diinstall pada power PC
- MikroTik RouterBOARD
 - ✓ Built in hardware (board) yang menggunakan RouterOS sebagai Operating Sistemnya.
 - ✓ Tersedia mulai low-end s/d high-end Router.

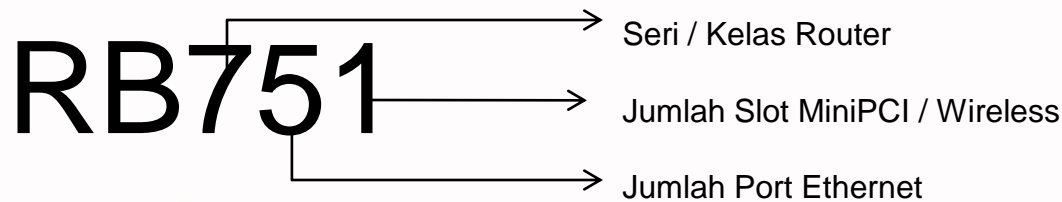
Fitur-Fitur Mikrotik

- Router OS apabila diinstall pada PC/Virtual machine, akan support driver perangkat
 - ✓ Ethernet, Wireless Card, V35, ISDN, USB Mass Storage, USB 3G Modem, E1/T1.
- Memiliki fitur yang melebihi sebuah “router”
 - ✓ User Management (DHCP, Hotspot, Radius, dll).
 - ✓ Routing (RIP, OSPF, BGP, RIPng, OSPF V3).
 - ✓ Firewall & NAT (fully-customized, linux based).
 - ✓ QoS/Bandwidth limiter (fully customized, linux based).
 - ✓ Tunnel (EoIP, PPTP, L2TP, PPPoE, SSTP, OpenVPN).
 - ✓ Real-time Tools (Torch, watchdog, mac-ping, MRTG, sniffer).



RouterBOARD - Type

- RouterBoard memiliki sistem kode tertentu



- Kode Lain ada di belakang tipe
 - ✓ U - dilengkapi port USB
 - ✓ A - Advanced, biasanya diatas lisensi level 4
 - ✓ H - High Performance, processor lebih tinggi
 - ✓ R - dilengkapi wireless card embedded.
 - ✓ G - dilengkapi port ethernet Gigabit
 - ✓ 2nD – dual channel

Arsitektur RouterBoard

- Arsitektur RouterBoard dibedakan berdasarkan jenis dan kinerja processor,
- software/OS untuk setiap arsitektur berbeda

mipsbe BaseBox, CRS series, NetBox, NetMetal, PowerBox, QRT, RB4xx series, RB7xx series, RB9xx series, cAP, mAP, hEX, DynaDish, RB2011 series, SXT, OmniTik, Groove, Metal, Sextant

ppc RB3xx series, RB600 series, RB800 series, RB1100, RB1000

x86 PC / X86, RB230 series

mipsle RB1xx series, RB5xx series, Crossroads

tile CCR series

smips hAP lite

- Secara lengkap dapat dilihat di www.mikrotik.com/download

MikroTik VS Cisco

source: http://wiki.MikroTik.com/wiki/Manual:RouterOS_FAQ

How does this software compare to using a Cisco router?

*You can **do almost everything** that a proprietary router does at a fraction of the **cost** of such a router and have flexibility in upgrading, **ease of management and maintenance**.*

Anda dapat melakukan **hampir semua** yang dilakukan proprietary router tersebut (Cisco) dengan hanya sebagian kecil dari biaya router tersebut dan memiliki **fleksibilitas dalam mengupgrade, kemudahan manajemen dan pemeliharaan**.



Prerequisites MTCNA Training

TCP / IP Basic



Internet Protocol

Internet Protocol adalah sebuah aturan atau standar yang mengatur atau mengizinkan terjadinya hubungan, komunikasi, dan perpindahan data antara dua atau lebih titik komputer.

Tugas Internet Protocol

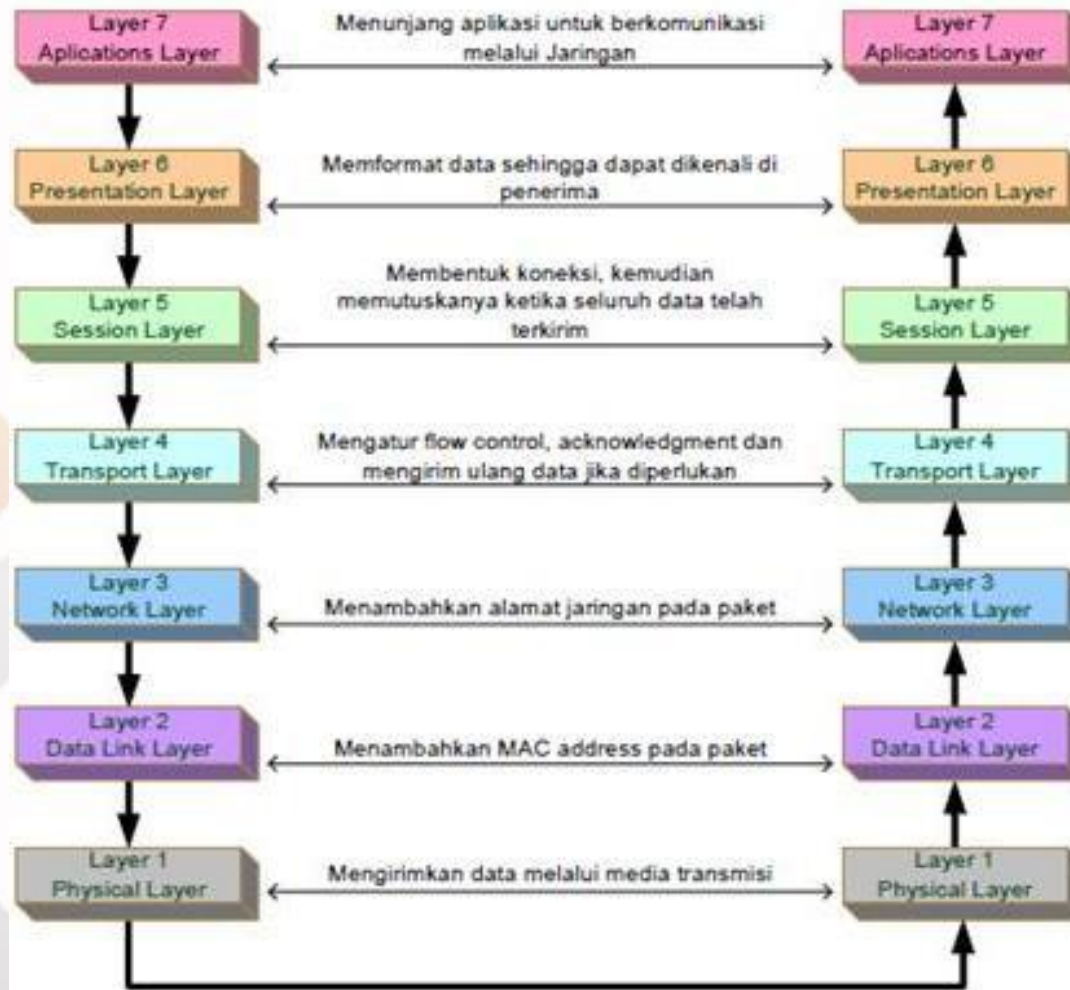
- Melakukan deteksi koneksi fisik.
- Melakukan metode “jabat-tangan” (handshaking).
- Negosiasi berbagai macam karakteristik hubungan.
- Mengawali dan mengakhiri suatu pesan/session.
- Bagaimana format pesan yang digunakan.
- Apa yang dilakukan apabila terjadi error pengiriman?.
- Mengkalkulasi dan menentukan jalur pengiriman.
- Mengakhiri suatu koneksi.





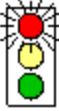




OSI Layer Model

- Tidak adanya suatu protokol yang sama, membuat banyak perangkat tidak bisa saling berkomunikasi.
- ***Open System Interconnection*** atau OSI layer 7 adalah model arsitektural jaringan yang dikembangkan oleh International Organization for Standardization (ISO) di Eropa tahun 1977.
- Sebelum ada OSI, sistem jaringan **sangat tergantung kepada vendor** pemasok perangkat jaringan yang berbeda-beda.
- Model OSI layer 7 merupakan koneksi logis yang harus terjadi agar terjadi komunikasi data dalam jaringan.

OSI 7 Layer - Koneksi Antar Host



OSI Layer

OSI MODEL	
7	 Application Layer Type of communication: E-mail, file transfer, client/server.
6	 Presentation Layer Encryption, data conversion: ASCII to EBCDIC, BCD to binary, etc.
5	 Session Layer Starts, stops session. Maintains order.
4	 Transport Layer Ensures delivery of entire file or message.
3	 Network Layer Routes data to different LANs and WANs based on network address.
2	 Data Link (MAC) Layer Transmits packets from node to node based on station address.
1	 Physical Layer Electrical signals and cabling.

- Apabila 7 OSI Layer susah untuk dihafal, maka Layer 1, Layer 2 dan Layer 3 adalah suatu keharusan, karena dapat menunjukkan bedanya antara Hub/bridge, Switch dan Router
- Ketiganya berada di layer yang berbeda sehingga memiliki cara kerja yang berbeda tentunya

Layer	Name	Device	Data Unit	Addressing
Layer 3	Network	Router	Paket	IP Address
Layer 2	Data Link	Switch	Frame	MAC Address
Layer 1	Physical	Hub	Bit	0111001110

Device	Connectivity	Data Transfer	Memory
Router	Antar network yang berbeda	Destination IP Address	Routing Table
Switch	Antar network yang sama	Berdasar MAC Address Tujuan	MAC Address Table
Hub	Antar network yang sama	Broadcast ke semua port	none

Protocol

- Protocol menentukan prosedur pengiriman data.
- Protocol yang sering digunakan:
 - Transmission Control Protocol (TCP)
 - User Datagram Protocol (UDP) → DNS
 - Internet Control Message Protocol (ICMP) → ping traceroute
 - Hypertext Transfer Protocol (HTTP) → web
 - Post Office Protocol (POP3) → email
 - File Transfer Protocol (FTP)
 - Internet Message Access Protocol (IMAP) → email
 - dll

Port

- Port adalah sebuah aplikasi-spesifik atau proses software spesifik pada Komputer/host yang **menjalankan servise** untuk komunikasi jaringan.
- Jumlah total port Host adalah 65535, dengan klasifikasi penomoran sebagai berikut:
 1. Dari 0 s/d 1023 (*well-known ports*),
 2. Dari 1024 s/d 49151 (*registered port*),
 3. Dari 49152 s/d 65535 (*unregistered / dynamic, private or ephemeral ports*)

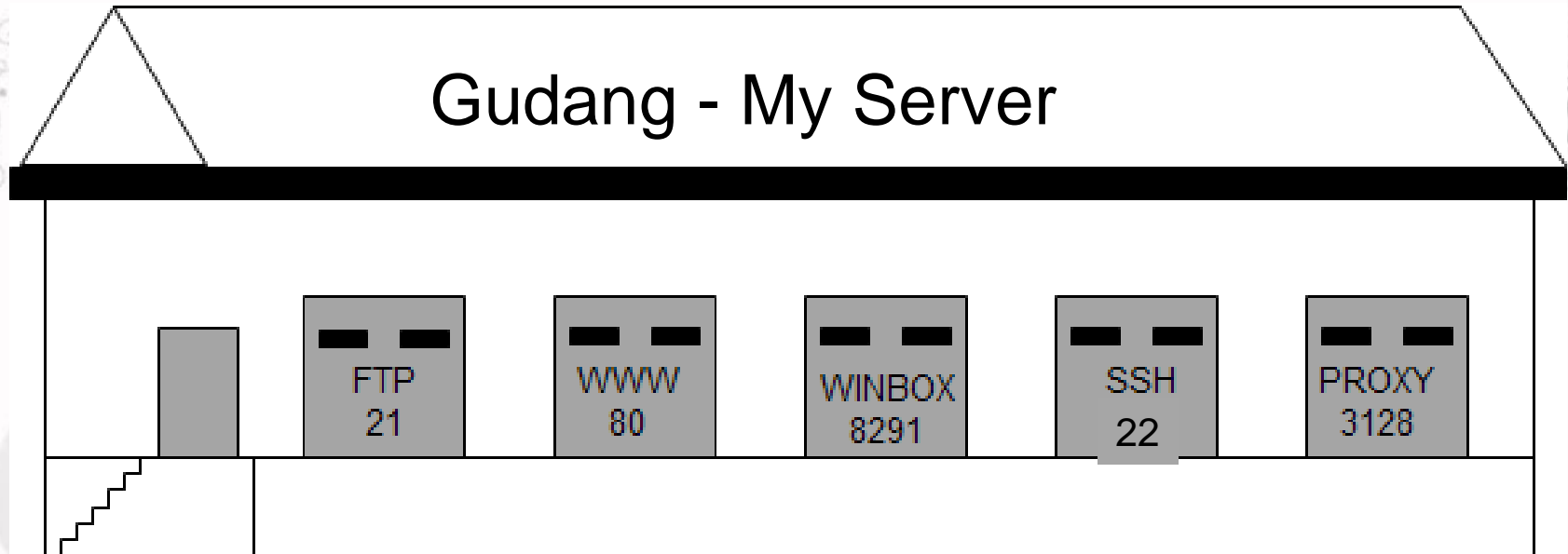


Port yang Biasa Digunakan

Port No	Protocol	Service	Remark
21	TCP	FTP	File Transfer Protocol
23	TCP	Telnet	Remote access
25	TCP	SMTP	Simple Mail Transfer Protocol
53	UDP	DNS	Domain Name Server
80	TCP	HTTP	Hypertext Transfer Protocol
110	TCP	POP3	Post Office Protocol v3
123	UDP	NTP	Network Time Protocol
137	TCP	NetBIOS-ns	NetBIOS – Name Service
161	UDP	SNMP	Simple Network Monitoring Protocol
3128	TCP	HTTP - Proxy	Web-Cache (default by Squid)
8080	TCP	HTTP - Proxy	Web-Cache (customized)

Port

Gudang - My Server



MAC Address

- MAC Address (Media Access Control Address) adalah alamat jaringan pada lapisan data-link (layer 2) dalam OSI 7 Layer Model.
- Dalam sebuah komputer, MAC address ditetapkan ke sebuah kartu jaringan (network interface card/NIC).
- MAC address merupakan alamat yang unik yang memiliki panjang 48-bit.
- MAC terdiri atas 12 digit bilangan heksadesimal (0 s/d F), **6 digit pertama** merepresentasikan **vendor pembuat kartu jaringan**.
- Contoh MAC Address : **02-00-4C-4F-05-50**.



IP Address

- IP (Internet Protocol) terdapat dalam Network Layer (layer 3) OSI.
- IP address digunakan untuk pengalamatan suatu PC / host secara logic
- Terdapat 2 jenis IP Address
 - ✓ IPv4
 - ✓ Pengalamatan 32 bit
 - ✓ Jumlah max host 4,294,967,296
 - ✓ IPv6
 - ✓ Pengalamatan 128 bit
 - ✓ Jumlah max host 340,282,366,920,938,463,374,607,431,768,211,456

IPv4

- IPv4 diekspresikan dalam notasi desimal bertitik, yang dibagi ke dalam 4 buah oktet berukuran 8-bit.
- Karena setiap oktet berukuran 8-bit, maka nilainya berkisar antara 0 hingga 255 (2^0 s/d 2^7)
- Aturan pengalamatan IPv4, misal IP 192.148.41.1

11000000.10010100.00101111.00000001

$$1x2^7 + 0x2^6 + 0x2^5 + 1x2^4 + 0x2^3 + 1x2^2 + 0x2^1 + 0x2^0$$

$$1x128 + 0x64 + 0x32 + 1x16 + 0x8 + 1x4 + 0x2 + 0x1$$

$$128 + 0 + 0 + 16 + 0 + 4 + 0 + 0 = 148$$

192 . 148 . 41 . 1

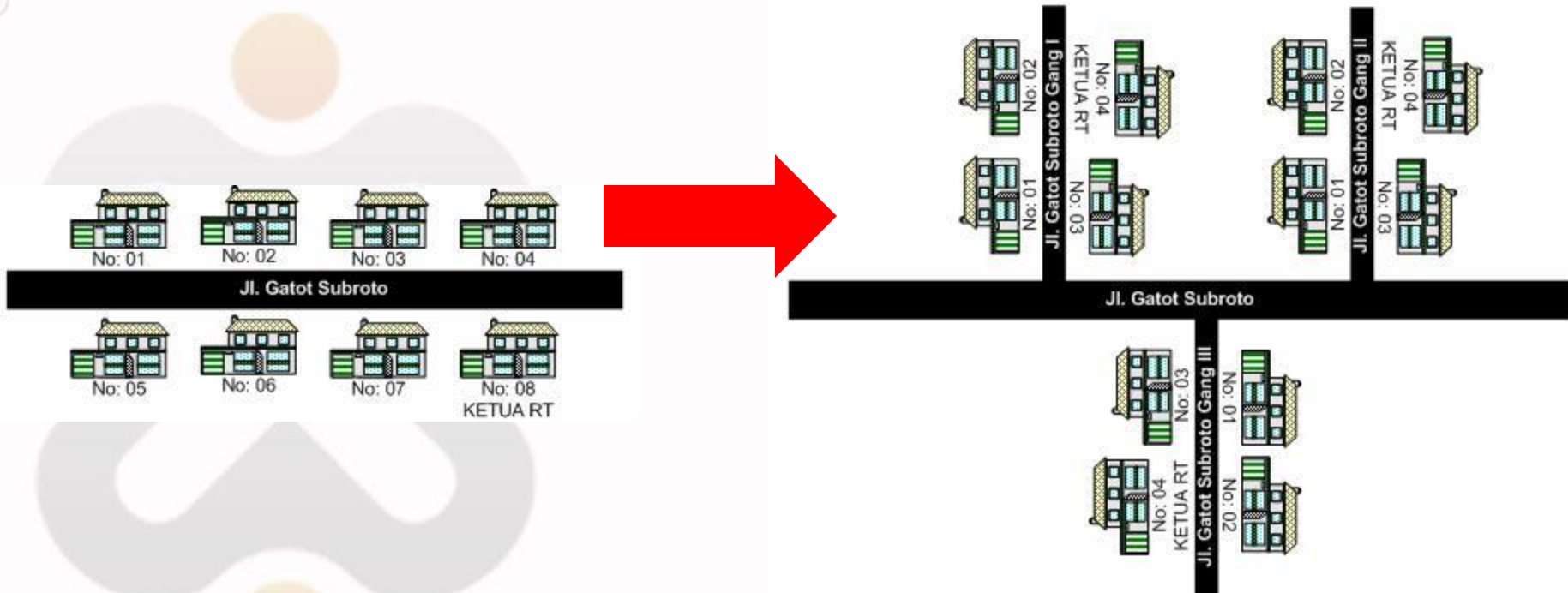
Subneting

- Dari 4 milyar IP address, tidak mungkin diberikan ke satu internet provider saja.
- Alamat IP didesain untuk digunakan secara berkelompok (sub-jaringan/subnet).
- Subneting adalah cara untuk memisahkan dan mendistribusikan beberapa IP address.
- Host/perangkat yang terletak pada subnet yang sama dapat berkomunikasi satu sama lain secara langsung (tanpa melibatkan router/routing).



Subneting

- Apabila jaringan dianalogikan sebuah jalan, apabila disepanjang jalan cuma ada 8 rumah, ketua RT mengumumkan sesuatu dari rumah ke rumah lewat jalan itu.
- Apabila sepanjang jalan sudah penuh rumah butuh ada gang-gang . Butuh ada ketua RT tiap gang untuk meminimalis transportasi saat pengumuman dan mengatur urusan RTnya sendiri



Notasi Subnet

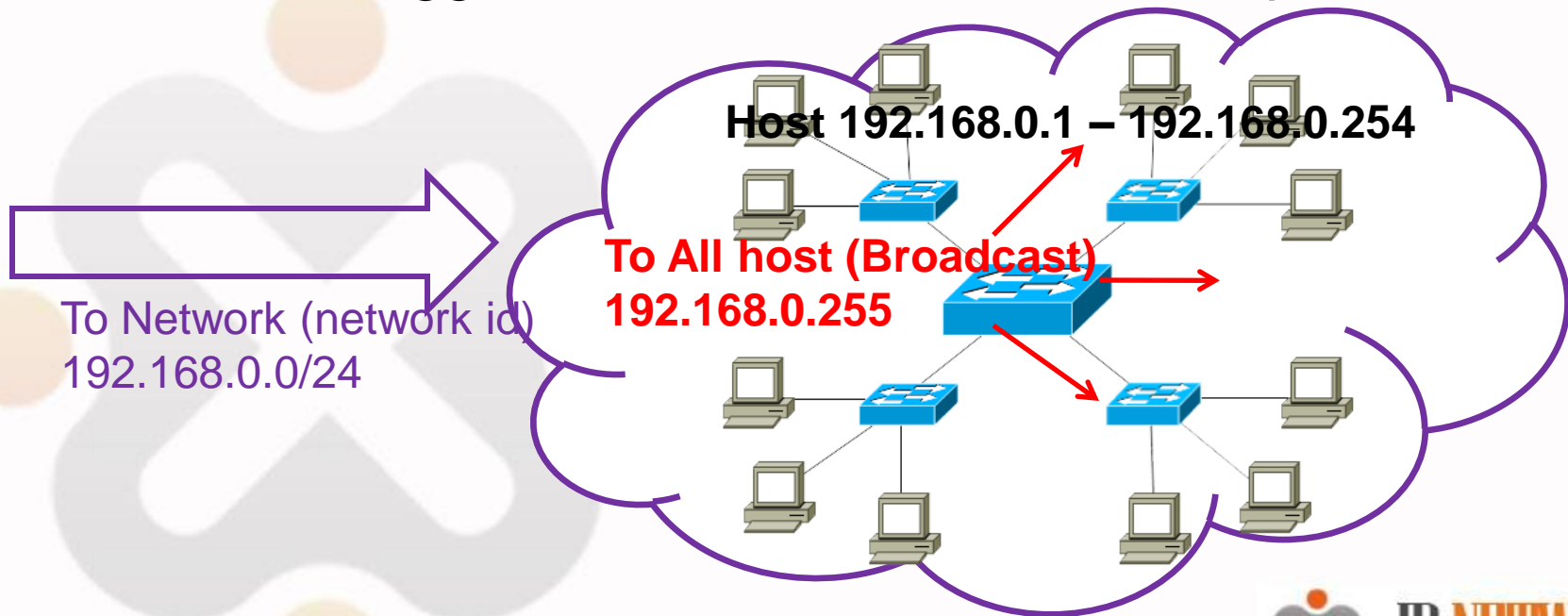
- Subnet ditulis dalam format 32 bit (seperti IP), atau dalam bentuk desimal (prefix Length)

Subnet mask (biner)	Subnet mask (desimal)	Prefix Length
11111111.00000000.00000000.00000000	255.0.0.0	/8
11111111.11111111.00000000.00000000	255.255.0.0	/16
11111111.11111111.11111111.00000000	255.255.255.0	/24

- Sebagai contoh, network 192.168.1.0 yang memiliki subnet mask 255.255.255.0 dapat direpresentasikan di dalam notasi prefix length sebagai **192.168.1.0/24**.

Network ID dan Broadcast

- Dalam kelompok IP address atau satu subnet ada 2 IP yang sifatnya khusus
 - Network ID : identitas suatu kelompok IP / Subnet.
 - Broadcast : alamat IP yang digunakan untuk memanggil semua IP dalam satu kelompok.



Perhitungan IP Subnet

Tabel Subnetting

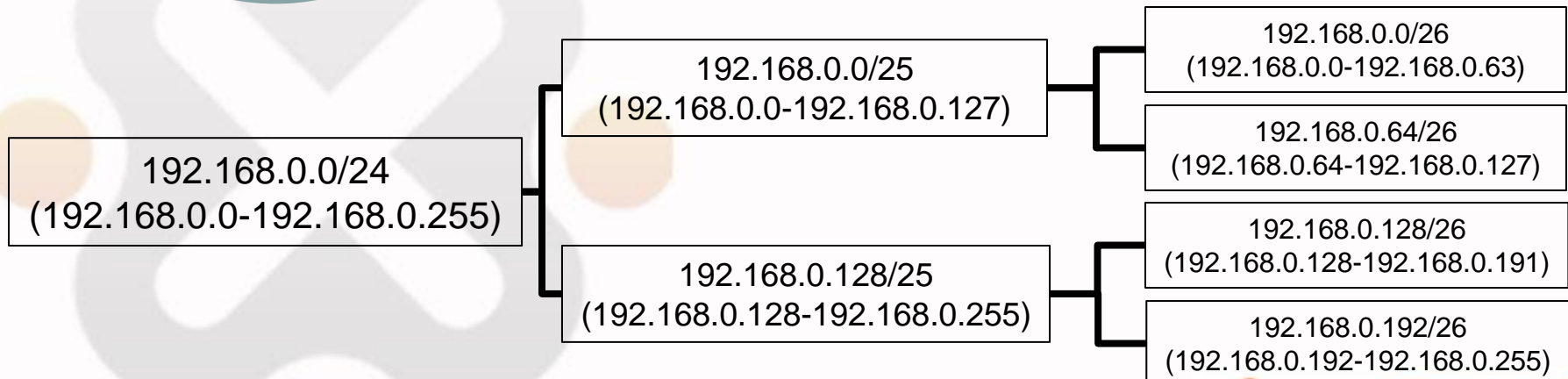
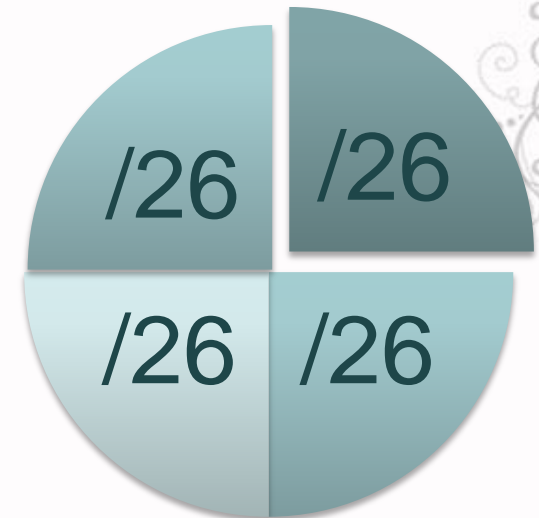
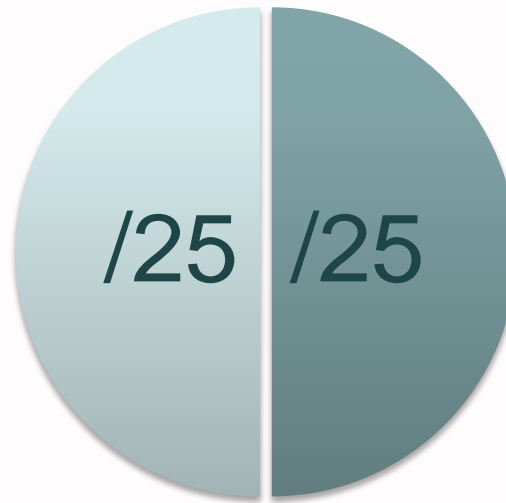
Prefix	Subnet Mask 255.255.255.(256-jml IP)	Jumlah IP	Jumlah Host (Jml IP - 2)
/24	255.255.255.0	256	254
/25	255.255.255.128	128	126
/26	255.255.255.192	64	62
/27	255.255.255.224	32	30
/28	255.255.255.240	16	14
/29	255.255.255.248	8	6
/30	255.255.255.252	4	2
/31	255.255.255.254	2	-
/32	255.255.255.255	1	-

Subnetting

256 IP Address

128 IP / Subnet

64 IP / Subnet



Perhitungan Subnet

Rumus menghitung Jumlah IP address dalam subnetmask:

$$2^{(32-n)}, \text{ dimana } n = \text{prefix subnet}$$

Contoh, IP kelas C: 20.20.20.20/30,

Tentukan Range IP, IP Host, Network ID, Broadcast dan Subnet Masknya:

- Jumlah IP dalam subnet:

Gunakan Rumus $2^{(32-30)} = 2^2 = 4$

- Range IP

Range IP dicari berdasarkan kelipatan Jumlah IPnya (kelipatan 4):

20.20.20.0 s/d 20.20.20.3

20.20.20.4 s/d 20.20.20.7, (8-11), (12-15)...terus sampai (252-255)

IP address pada soal (20.20.20.20) ada pada range:

20.20.20.20 s/d 20.20.20.23

Perhitungan Subnet

IP kelas C: 20.20.20.20/30,

Tentukan Range IP, IP Host , Network ID, Broadcast dan Subnet Masknya :

- Network ID dan Broadcast:

Dari range IP yang telah ditemukan (20.20.20.20 s/d 20.20.20.23)

IP terkecil digunakan untuk network ID, terbesar untuk Broadcast

Network ID → 20.20.20.20, Broadcast → 20.20.20.23

- IP Host → Range IP dikurangi Network ID dan broadcast

IP host → 20.20.20.21 s/d 20.20.20.22

Jumlah IP host → jumlah IP dalam subnet dikurangi dua

- Subnet mask → 255.255.255.(256 – jumlah IP)

Subnet mask → 255.255.255.252

Kerjakan Soal Berikut

Tentukan jumlah IP, network id & broadcast, IP Host, dan subnet mask dari IP address berikut:

1. 11.11.11.11/26
2. 22.22.22.22/28
3. 33.33.33.33/25
4. 44.44.44.44/29
5. 55.55.55.55/27
6. 66.66.66.66/28
7. 77.77.77.77/30
8. 88.88.88.88/31
9. 99.99.99.99/25
10. 100.100.100.100/27
11. 111.111.111.111/30
12. 122.122.122.122/25
13. 133.133.133.133/28
14. 144.144.144.144/24
15. 155.155.155.155/26
16. 166.166.166.166/29

IP Address Kelas B

IP address 12.12.12.12/~~22~~, Tentukan Range IP, IP Host , Network ID, Broadcast dan Subnet Masknya :

- Translate prefix netmask menjadi kelas C dengan ditambah 8, menjadi (~~22~~+8)=30
- Jumlah IP prefix /30 dalam kelas C adalah $2^{(32-30)} = 4$
- Jumlah IP dalam kelas B = $4 \times 256 = 1024$

Range IP Address

- Jumlah IP kelas C nya, yaitu 4, Range IP diimplementasikan pada oktet ke 3
12.12.**0**.0 – 12.12.**3**.255, 12.12.**4**.0 – 12.12.**7**.255, **8 – 11, 12-15**, dan seterusnya
- Range IP → 12.12.**12**.0 s/d 12.12.**15**.255
- Network ID → 12.12.**12**.0, broadcast 12.12.**15**.255
- Jumlah host yg dapat digunakan → 12.12.**12**.1 – 12.12.**15**.254
- Netmask = $255.255.(256-4).0 = 255.255.**252**.0$

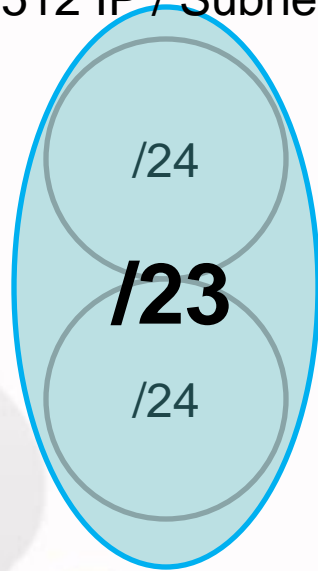


IP Address class B

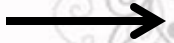
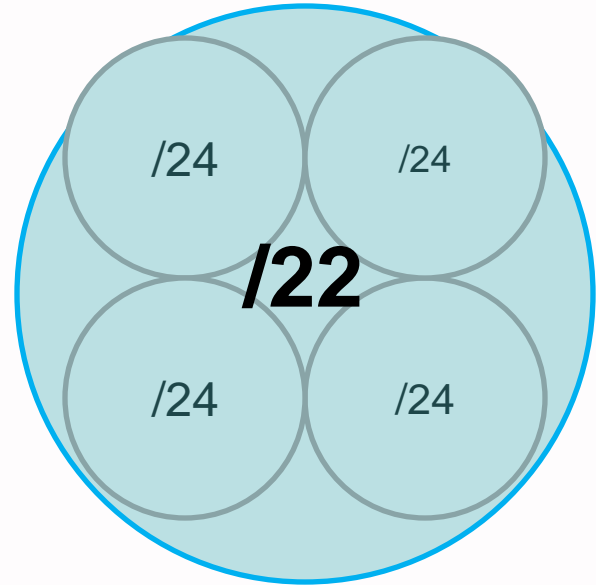
256 IP Address



512 IP / Subnet



1024 IP / Subnet



Kerjakan Soal Berikut

1. 11.11.11.11/23
2. 22.22.22.22/21
3. 33.33.33.33/20
4. 44.44.44.44/22
5. 55.55.55.55/18



IP Privat

- Berdasarkan jenisnya IP address dibedakan menjadi **IP Public** dan **IP Private**.
- IP Public adalah IP address yang digunakan untuk koneksi jaringan **global (internet)** secara langsung dan bersifat unik.
- IP Private digunakan untuk **jaringan lokal (LAN)**
- Alokasi IP Privat adalah sbb:

RFC1918 name	IP address range	number of addresses
24-bit block	10.0.0.0 – 10.255.255.255	16,777,216
20-bit block	172.16.0.0 – 172.31.255.255	1,048,576
16-bit block	192.168.0.0 – 192.168.255.255	65,536

- 127.0.0.0 – 127.255.255.255 (loopback address)
- 224.0.0.0 – 239.255.255.255 (multicast)
- 169.254.0.0 - 169.254.255.255 ("link local" addresses)





Modul 1

Mengkases MikroTik RouterOS



Akses ke MikroTik RouterOS

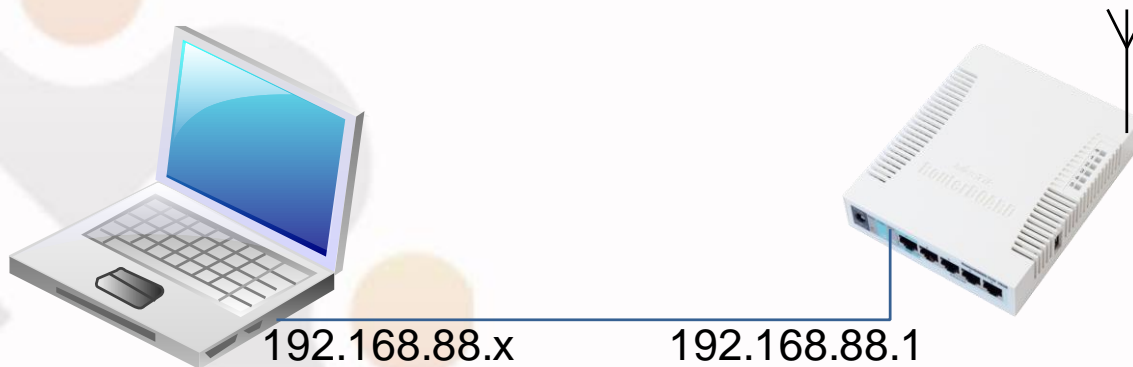
Akses Via	Koneksi	Text Base	GUI	Need IP
Keyboard	Langsung di PC	yes		
Serial Console	Konektor Kabel Serial	yes		
Telnet & SSH	Layer 3	yes		yes
Winbox	Menggunakan OS Windows	yes	yes	
FTP	Layer 3	yes		yes
API	Socket Programing			yes
Web (HTTP)	Layer 3		yes	yes
MAC-Telnet	Layer 2	yes		

Winbox

- Cara paling mudah dalam mengakses dan mengkonfigurasi MikroTik adalah menggunakan winbox.
- Winbox dapat didapatkan dari:
 - Web www.mikrotik.com
 - Via http/web IP atau domain Router MikroTik
 - Copy dari media penyimpanan

Default Setting RouterBoard

- RouterBoard (RB) baru, atau setelah di reset default , memiliki default konfigurasi dari pabrikannya yaitu:
 - IP Address Ether 2-5 : 192.168.88.1/24
 - Username “admin” password blank.
- Untuk meremote, Laptop/PC dihubungkan dengan ether1 dan diset dengan IP 192.168.88.xxx/24.



LAB – Konek Router

Apabila router baru (default) untuk remote menggunakan winbox dengan cara:

- Ubah IP Komputer anda menjadi:
 - IP Address 192.168.88.x
 - Netmask 255.255.255.0
- Ping ke RouterBOARD (192.168.88.1)
- Buka URL RouterBOARD (<http://192.168.88.1>)
- Download winbox dari halaman tersebut.

Winbox Login

- Apabila tidak tahu ip address router gunakan fitur discovery dan mac winbox

The screenshot shows the WinBox v3.0rc2 (Addresses) window. The 'Connect To' field is filled with the MAC address 4C:5E:0C:F1:8D:4A. The 'Login' field contains 'admin'. The 'Password' field is empty. The 'Session' dropdown is set to '<own>'. The 'Note' field contains 'MikroTik'. The 'Group' dropdown is empty. There are 'Add/Set' and 'Connect' buttons. On the right, there are checkboxes for 'Keep Password' (checked), 'Secure Mode', 'Autosave Session', and 'Open In New Window'. Below the form, the 'Managed' tab is active, showing a 'Neighbors' tab. A red box highlights the 'Neighbors' tab, with an arrow pointing to the text 'Network Discovery'. Below this, there is a 'Refresh' button and a search bar with 'Find' and 'all' options. A table displays the discovered neighbor:

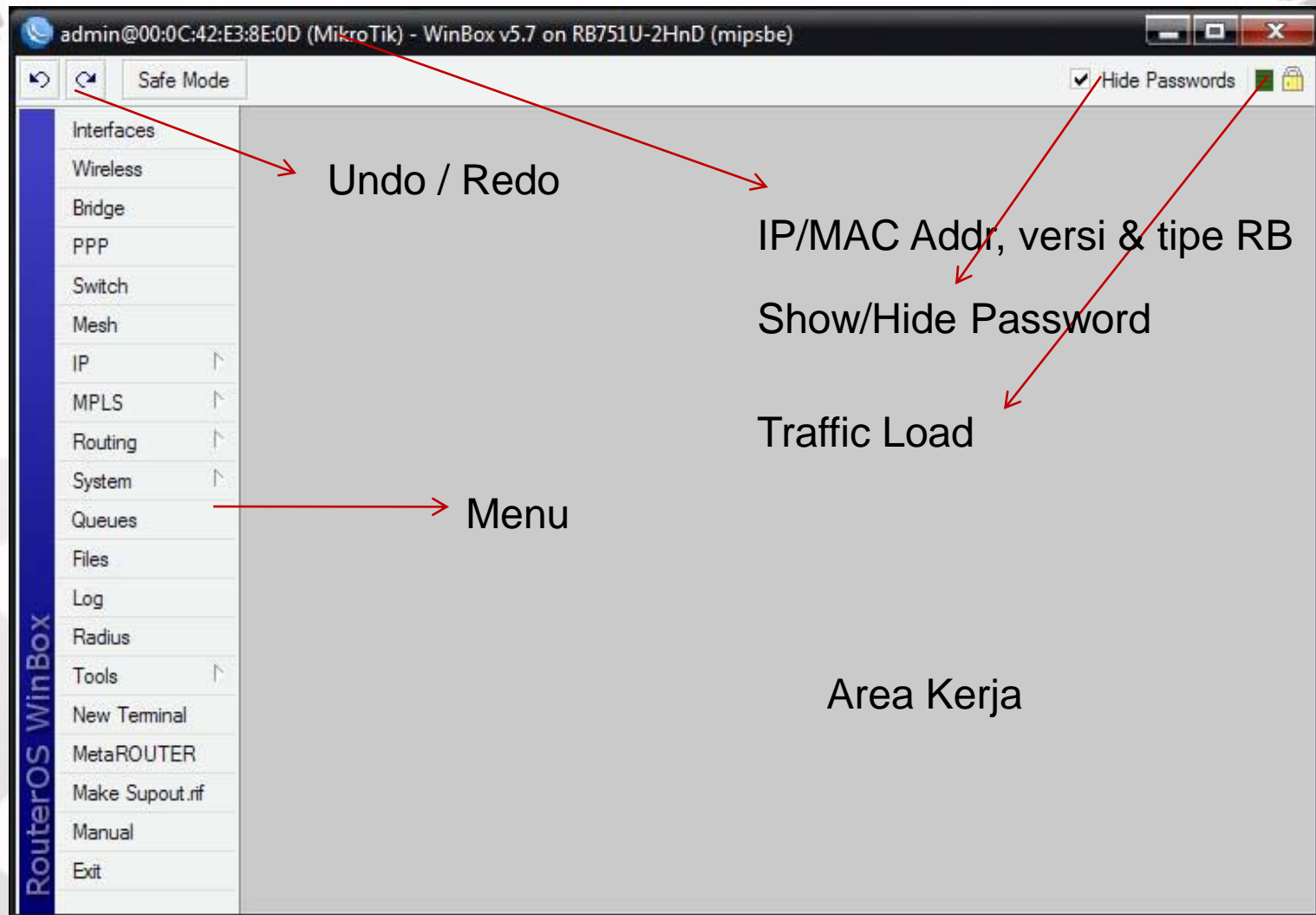
MAC Address	IP Address	Identity	Version	Board
4C:5E:0C:F1:8D:4A	0.0.0.0	MikroTik	6.30.2	RB941-2nD

A red box highlights the MAC address '4C:5E:0C:F1:8D:4A' in the table, with an arrow pointing to the text 'Double click and connect'.

Network Discovery

Double click and connect

Tampilan MikroTik – pada Winbox



WebFig

Sejak versi 5.0, interface via web diperkenalkan, dengan fungsi-fungsi yang sama dengan Winbox.

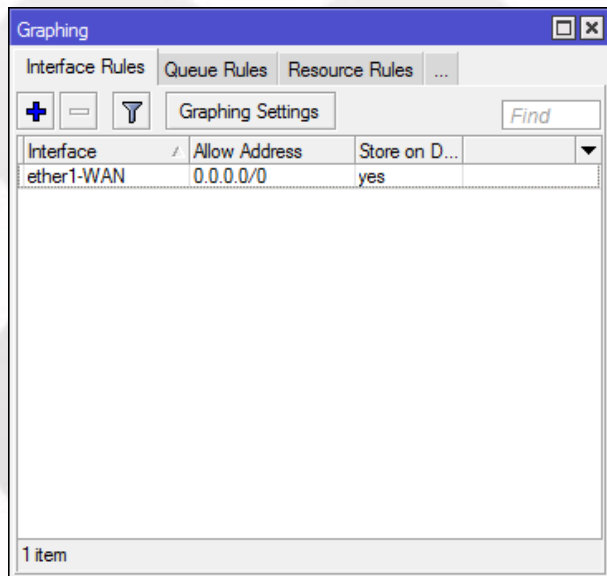
- Tambahkan IP pada router pada menu IP Address
- Coba akses webfig mikrotik router anda dengan browser.
- `http://<ip router>`

The screenshot displays the Mikrotik WebFig v5.7 web interface. On the left is a sidebar menu with categories like Interfaces, Wireless, Bridge, PPP, Mesh, IP, MPLS, Routing, System, Queues, Files, Log, Radius, Tools, New Terminal, Make Supout.rif, and Manual. The main area features a top navigation bar with buttons for Undo, Redo, Hide Passwords, Safe Mode, Design Skin, and Log out. Below this is the 'Interface List' section, which includes tabs for Interface, Ethernet, EoIP Tunnel, IP Tunnel, GRE Tunnel, VLAN, VRRP, and Bonding. An 'Add New' button is present. The interface list shows 7 items in a table with columns for Name, Type, L2 MTU, Tx, Rx, Tx Packets, Rx Packets, Tx Drops, Rx Drops, Tx Errors, and Rx Errors.

		▲ Name	Type	L2 MTU	Tx	Rx	Tx Packets	Rx Packets	Tx Drops	Rx Drops	Tx Errors	Rx Errors
<input type="checkbox"/>	<input type="checkbox"/>	R	bridge-local	Bridge	2290	0 bps	352 bps	0	1	0	0	0
<input type="checkbox"/>	<input type="checkbox"/>		ether1-gateway	Ethernet	1600	0 bps	0 bps	0	0	0	0	0
<input type="checkbox"/>	<input type="checkbox"/>		ether2-master-local	Ethernet	1598	0 bps	0 bps	0	0	0	0	0
<input type="checkbox"/>	<input type="checkbox"/>	S	ether3-slave-local	Ethernet	1598	0 bps	0 bps	0	0	0	0	0
<input type="checkbox"/>	<input type="checkbox"/>	S	ether4-slave-local	Ethernet	1598	0 bps	0 bps	0	0	0	0	0
<input type="checkbox"/>	<input type="checkbox"/>	S	ether5-slave-local	Ethernet	1598	0 bps	0 bps	0	0	0	0	0
<input type="checkbox"/>	<input type="checkbox"/>	R	wlan1	Wireless(Atheros 11N	2290	0 bps	464 bps	0	1	0	0	0

Graphing

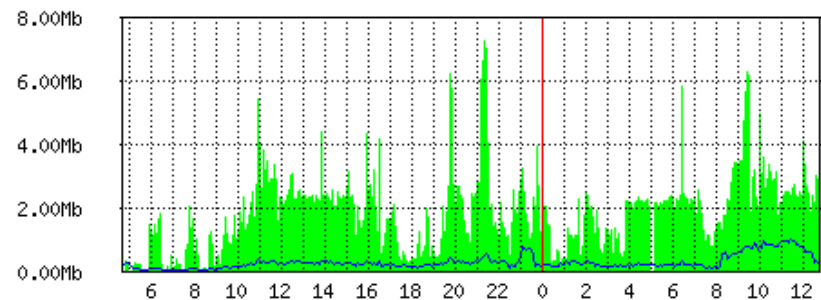
- Di MikroTik ada Tools monitoring nya ada yang bernama Graphing (MRTG)
- Bisa diaktifkan dengan cara Tools – Graphing



Interface <ether1-WAN> Statistics

• Last update: Sun May 1 12:40:40 2016

"Daily" Graph (5 Minute Average)



Max In: 7.28Mb; Average In: 1.86Mb; Current In: 2.89Mb;
Max Out: 1.00Mb; Average Out: 251.43Kb; Current Out: 211.45Kb;

Konfigurasi Via Terminal

- Dalam kondisi tertentu remote dan konfigurasi via GUI tidak memungkinkan dikarenakan hal-hal seperti; keterbatasan bandwidth, kebutuhan untuk running script, remote via ..x console, dll.
- Remote & konfigurasi terminal bisa dilakukan dengan cara:
 - Telnet (via IP port 23, non secure connection)
 - SSH (via IP Port 22, lebih secure dari telnet)
 - Serial console (kabel serial)



LAB-Telnet & SSH

- Gunakan MsDOS prompt (telnet), atau program SSH/Telnet client lainnya, seperti putty, winSCP untuk remote mikrotik.



IP MikroTik dan Port

Serial Console

- Serial Console digunakan apabila kita lupa/salah telah mendisable semua interface pada MikroTik.
- Serial Console dibutuhkan juga saat kita menggunakan Netinstall.
- Remote via serial console membutuhkan kabel DB-9 (atau converter USB ke DB-9).
- Menggunakan program HyperTerminal.
- Baud rate 115200, Data bits 8, Parity None, Stop bits 1, dan Flow Control None.



Versi dan Lisensi Mikrotik



Lisensi MikroTik

- Fitur-fitur RouterOS ditentukan oleh level lisensi yang melekat pada perangkat.
- Level dari lisensi juga menentukan batasan upgrade packet.
- Lisensi melekat pada storage/media penyimpanan (ex. Hardisk, NAND, USB, Compact Flash).
- Bila media penyimpanan diformat dengan non MikroTik, maka lisensi akan hilang.

Level Lisensi MikroTik

Level number	0 (Trial mode)	1 (Free Demo)	3 (WISP CPE)	4 (WISP)	5 (WISP)	6 (Controller)
Price	no key ↗	registration required ↗	volume only ↗	\$45	\$95	\$250
Initial Config Support	-	-	-	15 days	30 days	30 days
Wireless AP	24h trial	-	-	yes	yes	yes
Wireless Client and Bridge	24h trial	-	yes	yes	yes	yes
RIP, OSPF, BGP protocols	24h trial	-	yes(*)	yes	yes	yes
EoIP tunnels	24h trial	1	unlimited	unlimited	unlimited	unlimited
PPPoE tunnels	24h trial	1	200	200	500	unlimited
PPTP tunnels	24h trial	1	200	200	500	unlimited
L2TP tunnels	24h trial	1	200	200	500	unlimited
OVPN tunnels	24h trial	1	200	200	unlimited	unlimited
VLAN interfaces	24h trial	1	unlimited	unlimited	unlimited	unlimited
HotSpot active users	24h trial	1	1	200	500	unlimited
RADIUS client	24h trial	-	yes	yes	yes	yes
Queues	24h trial	1	unlimited	unlimited	unlimited	unlimited
Web proxy	24h trial	-	yes	yes	yes	yes
User manager active sessions	24h trial	1	10	20	50	Unlimited
Number of KVM guests	none	1	Unlimited	Unlimited	Unlimited	Unlimited

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

Coba lihat lisensi router pada menu System license



ID NETWORKERS
Expert Trainer & Consultant

Versi MikroTik

- Fitur-fitur MikroTik selain ditentukan oleh lisensi yang digunakan, juga ditentukan oleh versi dari MikroTik yang terinstall.
- Pada RouterOS, versi MikroTik dapat dilihat dari paket yang terinstall.
- Paket yang terinstall menunjukkan fitur apa saja yang didukung oleh RouterOS.

Melihat Versi MikroTik

System>Packages

admin@00:0C:42:E3:8E:0D (MikroTik) - WinBox v5.7 on RB751U-2HnD (mipsbe)

Safe Mode Hide Passwords

RouterOS WinBox

System Packages

Name	Version	Build Time	Scheduled
routeros-mipsbe	5.7	Sep/14/2011 07:58:40	
advancedt...	5.7	Sep/14/2011 07:56:43	
dhcp	5.7	Sep/14/2011 07:56:52	
hotspot	5.7	Sep/14/2011 07:57:22	
ipv6	5.7	Sep/14/2011 07:57:17	
mpls	5.7	Sep/14/2011 07:57:09	
ppp	5.7	Sep/14/2011 07:57:02	
routerboard	5.7	Sep/14/2011 07:57:44	
routing	5.7	Sep/14/2011 07:57:04	
security	5.7	Sep/14/2011 07:56:51	
system	5.7	Sep/14/2011 07:56:40	
wireless	5.7	Sep/14/2011 07:57:33	

Versi MikroTik

Paket

Paket – Fitur Paket

Package	Features
advanced-tools (<i>mipsle, mipsbe, ppc, x86</i>)	advanced ping tools. netwatch, ip-scan, sms tool, wake-on-LAN
calea (<i>mipsle, mipsbe, ppc, x86</i>)	data gathering tool for specific use due to "Communications Assistance for Law Enforcement Act" in USA
dhcp (<i>mipsle, mipsbe, ppc, x86</i>)	Dynamic Host Control Protocol client and server
gps (<i>mipsle, mipsbe, ppc, x86</i>)	Global Positioning System devices support
hotspot (<i>mipsle, mipsbe, ppc, x86</i>)	HotSpot user management
ipv6 (<i>mipsle, mipsbe, ppc, x86</i>)	IPv6 addressing support
mpls (<i>mipsle, mipsbe, ppc, x86</i>)	Multi Protocol Labels Switching support
multicast (<i>mipsle, mipsbe, ppc, x86</i>)	Protocol Independent Multicast - Sparse Mode; Internet Group Managing Protocol - Proxy
ntp (<i>mipsle, mipsbe, ppc, x86</i>)	Network protocol client and service
ppp (<i>mipsle, mipsbe, ppc, x86</i>)	MIPPP client, PPP, PPTP, L2TP, PPPoE, ISDN PPP clients and servers
routerboard (<i>mipsle, mipsbe, ppc, x86</i>)	accessing and managing RouterBOOT. RouterBOARD specific information.
routing (<i>mipsle, mipsbe, ppc, x86</i>)	dynamic routing protocols like RIP , BGP , OSPF and routing utilities like BFD , filters for routes .
security (<i>mipsle, mipsbe, ppc, x86</i>)	IPSEC, SSH, Secure WinBox
system (<i>mipsle, mipsbe, ppc, x86</i>)	basic router features like <i>static routing, ip addresses, sNTP, telnet, API, queues, firewall, web proxy, DNS cache, TFTP, IP pool, SNMP, packet sniffer, e-mail send tool, graphing, bandwidth-test, torch, EoIP, IPIP, bridging, VLAN, VRRP</i> etc.). Also, for RouterBOARD platform - MetaROUTER Virtualization
ups (<i>mipsle, mipsbe, ppc, x86</i>)	APC ups
user-manager (<i>mipsle, mipsbe, ppc, x86</i>)	MikroTik User Manager
wireless (<i>mipsle, mipsbe, ppc, x86</i>)	wireless interface support

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



ID NETWORKERS
Expert Trainer & Consultant

Package – Enable/Disable

- Pada menu System > Package

The screenshot displays the Mikrotik WinBox interface. On the left, the 'System' menu is highlighted, and the 'Packages' option is selected. The main window shows the 'Package List' window with the following table:

Name	Version	Build Time	Scheduled
advanced-tools	6.0	May/17/2013 14:04:20	
calea	6.0	May/17/2013 14:04:20	
dhcp	6.0	May/17/2013 14:04:20	
hotspot	6.0	May/17/2013 14:04:20	
mpls	6.0	May/17/2013 14:04:20	
multicast	6.0	May/17/2013 14:04:20	
ntp	6.0	May/17/2013 14:04:20	
openflow	6.0	May/17/2013 14:04:20	
ppp	6.0	May/17/2013 14:04:20	
routing	6.0	May/17/2013 14:04:20	
security	6.0	May/17/2013 14:04:20	
system	6.0	May/17/2013 14:04:20	
ups	6.0	May/17/2013 14:04:20	scheduled for disable
user-manager	6.0	May/17/2013 14:04:20	
wireless	6.0	May/17/2013 14:04:20	

The 'ups' package is selected, and its status is 'scheduled for disable'. A red arrow points from the 'ups' package in the table to the 'Disable' button in the window's toolbar. The status bar at the bottom of the window indicates '15 items (1 selected)'.

Package akan di disable setelah router di reboot

Paket – Uninstall

The screenshot shows the Mikrotik WinBox interface. On the left, the 'System' menu is highlighted, and the 'Packages' sub-menu is also highlighted. A red arrow points from the 'Packages' sub-menu to the 'Package List' window. The 'Package List' window displays a table of installed packages. The 'mpls' package is selected and circled in red. The 'Uninstall' button is visible at the top of the window.

Name	Version	Build Time	Scheduled
routeros-mipsbe	5.7	Sep/14/2011 07:58:40	
advanced-t...	5.7	Sep/14/2011 07:56:43	
dhcp	5.7	Sep/14/2011 07:56:52	
hotspot	5.7	Sep/14/2011 07:57:22	
ipv6	5.7	Sep/14/2011 07:57:17	scheduled for uninstall
mpls	5.7	Sep/14/2011 07:57:09	
ppp	5.7	Sep/14/2011 07:57:02	
routerboard	5.7	Sep/14/2011 07:57:44	
routing	5.7	Sep/14/2011 07:57:04	
security	5.7	Sep/14/2011 07:56:51	
system	5.7	Sep/14/2011 07:56:40	
wireless	5.7	Sep/14/2011 07:57:33	

Package akan hilang setelah reboot router

LAB- Paket

- Uninstall mpls packets.
- Lihat kapasitas NAND (menda penyimpanan) sebelum dan sesudah uninstall.

The screenshot displays the Mikrotik WinBox interface. On the left, the 'System' menu is highlighted. The 'Packages' sub-menu is open, showing a list of installed packages. The 'mpls' package is selected, and the 'Uninstall' button is highlighted with a red box. A red arrow points from the 'Uninstall' button to the 'mpls' package. The 'Resources' window is also open, showing system statistics. The 'Free HDD Space' is highlighted with a red circle, showing 31.8 MB.

Name	Version	Build Time	Scheduled
advanced-tools	5.7	Sep/14/2011 07:56:43	
calea	5.7	Sep/14/2011 07:57:39	
dhcp	5.7	Sep/14/2011 07:56:52	
gps	5.7	Sep/14/2011 07:57:38	
hotspot	5.7	Sep/14/2011 07:57:22	
ipv6	5.7	Sep/14/2011 07:57:17	scheduled for uninstal
led	5.7	Sep/14/2011 07:58:33	
mpls	5.7	Sep/14/2011 07:57:09	
multicast	5.7	Sep/14/2011 07:57:51	
ntp	5.7	Sep/14/2011 07:57:36	
ppp	5.7	Sep/14/2011 07:57:02	
routerboard	5.7	Sep/14/2011 07:57:44	
routing	5.7	Sep/14/2011 07:57:04	
security	5.7	Sep/14/2011 07:56:51	
system	5.7	Sep/14/2011 07:56:40	
ups	5.7	Sep/14/2011 07:57:37	
user-manager	5.7	Sep/14/2011 07:57:49	
wireless	5.7	Sep/14/2011 07:57:33	

Resource	Value
Uptime	00:35:05
Free Memory	17.2 MiB
Total Memory	29.0 MiB
CPU	MIPS 24Kc V7.4
CPU Count	1
CPU Frequency	400 MHz
CPU Load	0 %
Free HDD Space	31.8 MB
Total HDD Size	61.4 MB
Sector Writes Since Reboot	125
Total Sector Writes	1 342
Bad Blocks	0.0 %
Architecture Name	mipsbe
Board Name	RB751U-2HnD
Version	5.7

Paket – Upgrade / Downgrade

- Usahakan selalu upgrade versi terbaru, untuk fix bugs, new feature dll.
- Downgrade dilakukan apabila hardware kurang mendukung terhadap versi baru atau terdapat bug pada versi aktifnya.
- Upgrade paket harus memperhatikan aturan level dan lisensi yang berlaku.
- Upgrade dan downgrade juga harus memperhatikan kompatibilitas terhadap jenis arsitektur hardware.

LAB – Upgrade / Downgrade

- Pemilihan paket sangat penting dalam melakukan upgrade / downgrade, **jenis & arsitektur hardware** memiliki software yang berbeda.
- Bila ragu, dapat di crosscek dan didownload di www.mikrotik.com/download.html

mipsbe RB4xx series, **RB7xx series**, RB9xx series, RB2011 series, SXT, OmniTik, Groove, METAL, SEXTANT

v6.2 2013-Aug-02

 Upgrade package

 All packages

 Netinstall

 Torrent

 Changelog

Σ MD5

v5.25 2013-Apr-29

 Upgrade package

 All packages

 Netinstall

 Torrent

 Changelog

Σ MD5

v4.17 2011-Oct-17

 Upgrade package

 All packages

 Netinstall

 Torrent

 Changelog

Σ MD5

ppc RB3xx series, RB600 series, RB800 series, RB1xxx series

x86 PC / X86, RB230 series

LAB – Mengupload Paket

- Paket yang akan diinstall (versi lama/baru) harus diupload terlebih dahulu ke router pada bagian file.
- Upload dapat dilakukan dengan **drag-and drop** (via winbox), ataupun via FTP client.
- Drag and drop menggunakan protocol winbox (tcp port 8291) untuk koneksi IP dan menggunakan frame untuk koneksi mac address.
- Apabila upload menggunakan FTP, pastikan semua packet terupload di folder utama, bukan di sub folder
- Untuk mengeksekusi upgrade, router harus direboot.



LAB – Mengupload Paket Baru

- Upgrade router anda ke versi terbaru.
- Download versi terbaru dari web mikrotik.com
- Drag and drop file-file *.npk ke jendela winbox.

The screenshot displays the WinBox interface for a MikroTik router. On the left, a Windows Explorer window shows a directory of .npk files. A red arrow points from the 'advanced-tools-5.24-mipsbe.npk' file to the 'Safe Mode' button in the WinBox menu. Another red arrow points from the 'Wireless' menu item to the 'File List' dialog box. The 'File List' dialog shows a table of files being uploaded:

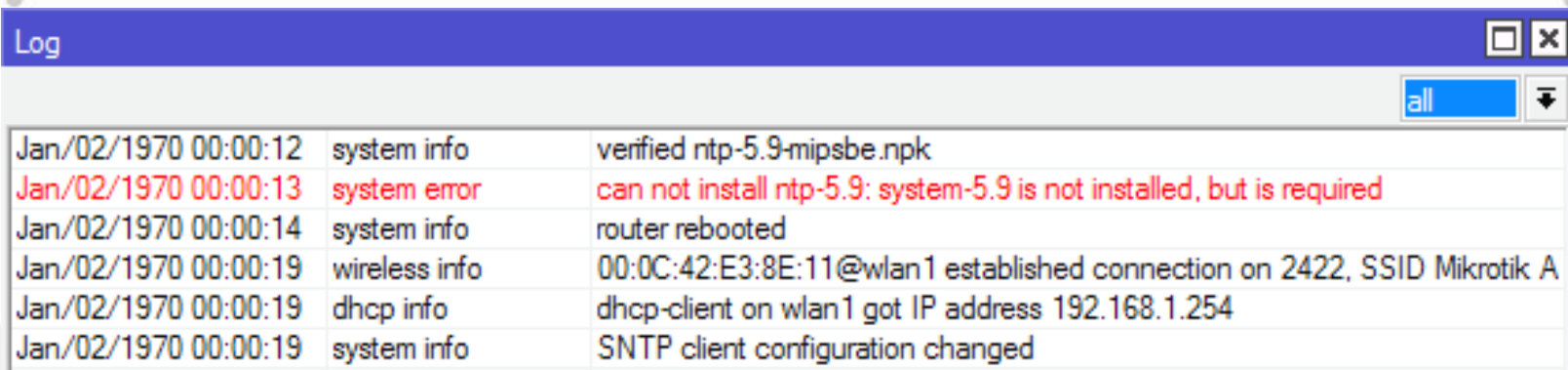
File Name	Type	Size	Created
MikroTik-02011970-0007.backup	backup	15.5 KB	Ja
ppp-5.8-mipsbe.npk	package	429.6 KB	Ja
routerboard-5.8-mipsbe.npk	package	143.3 KB	Ja
routing-5.8-mipsbe.npk	package	496.7 KB	Ja
security-5.8-mipsbe.npk	package	428.1 KB	Ja
system-5.8-mipsbe.npk	package	5.5 MiB	Ja

An 'Uploading Files' dialog box is open, showing the progress of uploading 'system-5.8-mipsbe.npk' (8.2 MiB of 13.7 MiB at 314.14 kb). A 'Cancel' button is visible in the dialog.

- Reboot setelah selesai upload, dan lihat hasilnya.

LAB – Mengupload Paket Baru

Cek log untuk melihat apabila ada error, berikut adalah contoh apabila ada error



The screenshot shows a window titled "Log" with a search filter set to "all". The log entries are as follows:

Jan/02/1970 00:00:12	system info	verified ntp-5.9-mipsbe.npk
Jan/02/1970 00:00:13	system error	can not install ntp-5.9: system-5.9 is not installed, but is required
Jan/02/1970 00:00:14	system info	router rebooted
Jan/02/1970 00:00:19	wireless info	00:0C:42:E3:8E:11@wlan1 established connection on 2422, SSID Mikrotik A
Jan/02/1970 00:00:19	dhcp info	dhcp-client on wlan1 got IP address 192.168.1.254
Jan/02/1970 00:00:19	system info	SNTP client configuration changed

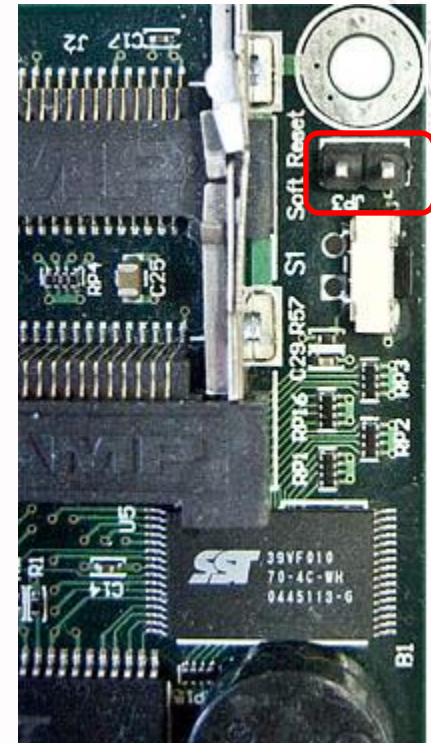
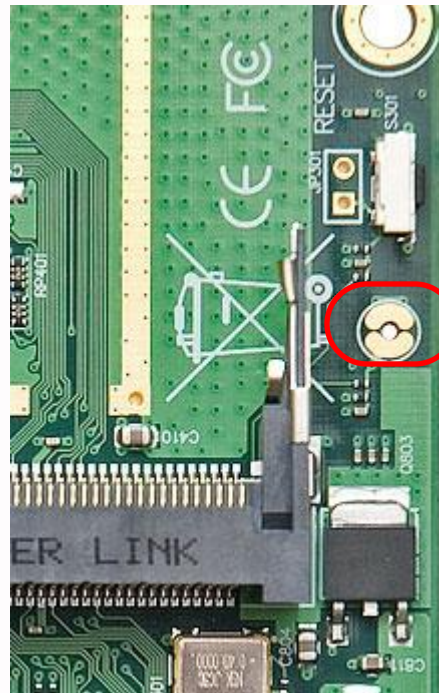
Cek kembali pada menu System>package untuk melihat update pacet yang telah kita lakukan

Reset Konfigurasi

- Reset konfigurasi MikroTik diperlukan jika:
 - Saat lupa username dan atau password
 - Saat konfigurasi terlalu komplek dan perlu ditata dari nol.
- Reset konfigurasi dapat dilakukan dengan cara:
 - Hard Reset, reset secara fisik.
 - Soft reset, reset secara software.
 - Install ulang.

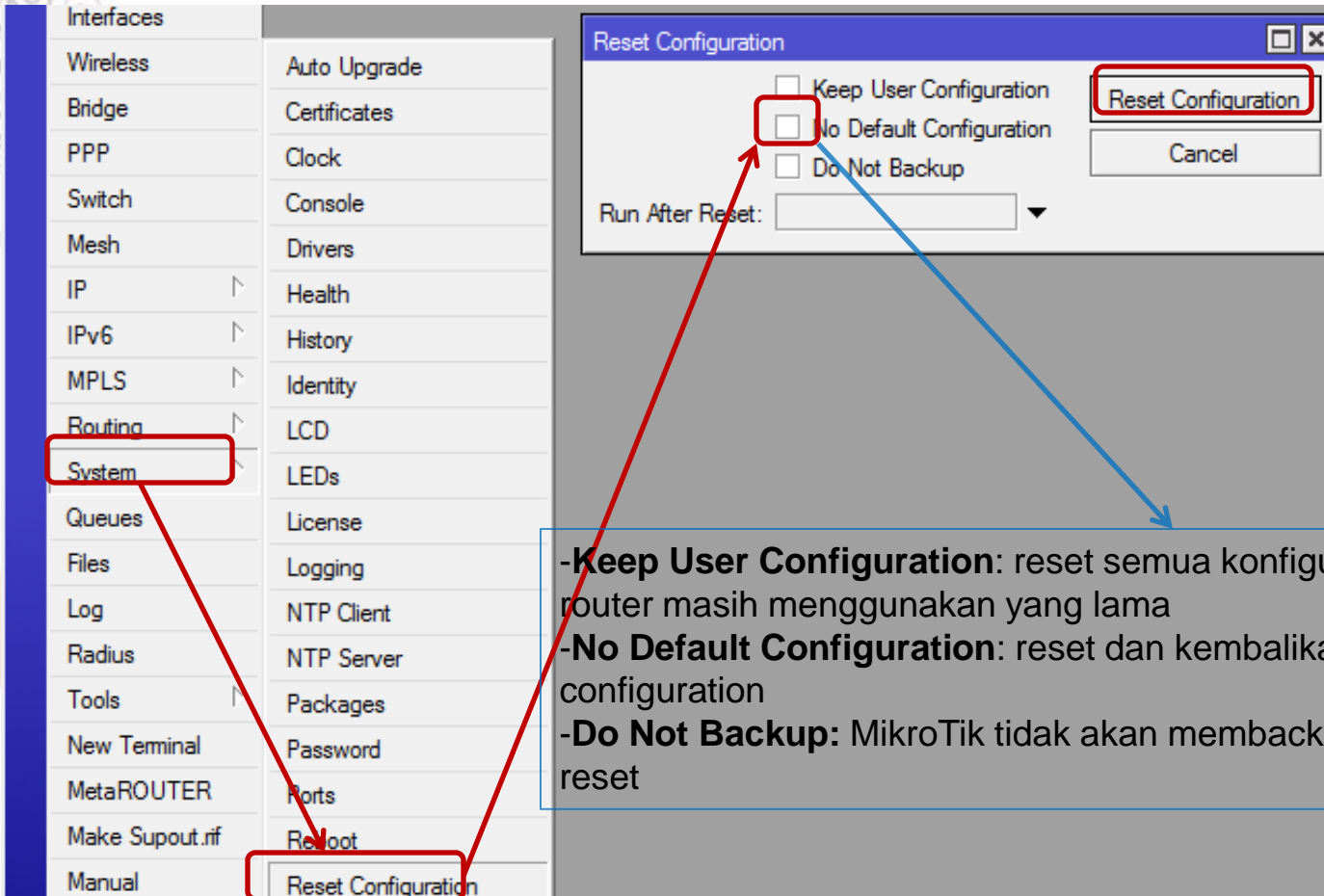
Hard Reset

- Khusus RouterBoard memiliki rangkaian untuk reset pada board dengan cara menjumper sambil menyalakan RB, RB akan kembali ke konfigurasi awal/default.



Soft Reset

- Jika kita masih bisa akses ke MikroTik, lakukan reset lewat reset menu



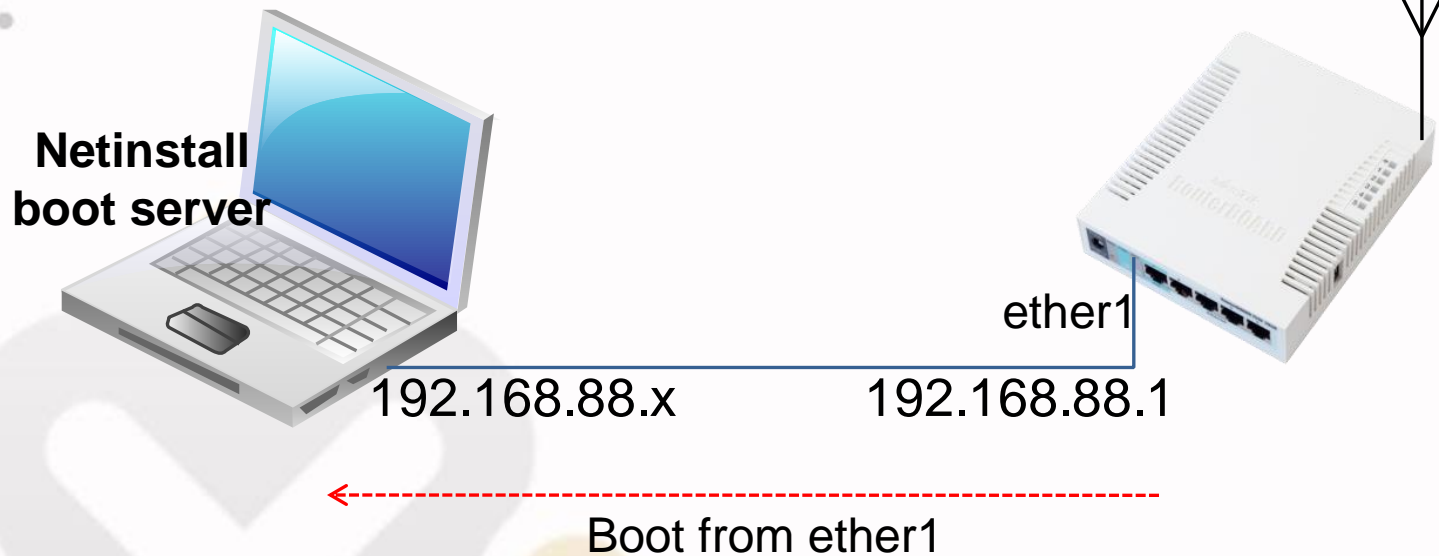
- Keep User Configuration:** reset semua konfigurasi, tapi user untuk login ke router masih menggunakan yang lama
- No Default Configuration:** reset dan kembalikan ke factory default configuration
- Do Not Backup:** MikroTik tidak akan membackup konfigurasi pada proses reset

Install Ulang

- Mikrotik dapat di install ulang lyaknya operating system yang lain
- Install ulang dapat mengembalikan mikrotik ke posisi awal/default.
- Install dapat dilakukan menggunakan media CD dan software Netinstall.
- RouterBOARD hanya dapat diinstall ulang menggunakan software Netinstall.



Install Ulang



Install Ulang via Netinstall

- RB harus dikoneksikan dengan laptop/PC melalui primary ethernetnya (ether1)
- Laptop/PC harus menjalankan program netinstall
- RB harus disetting agar booting dari network/ jaringan (ether1), dengan cara:
 - Setting via serial console
 - Setting via terminal console
 - Winbox
 - Tekan tombol reset


















NetInstall

- Software yang running under windows.
- Digunakan untuk install dan reinstall RouterOS
- Digunakan untuk reset password.
- PC/Laptop yang menjalankan netinstall harus terhubung langsung dengan router melalui kabel UTP atau LAN.
- Software netinstall dapat didownload di web resmi MikroTik.

LAB – Reinstall RB 751

- Download RouterOS dan Software Netinstall terbaru di <http://www.mikrotik.com/download.html>
- Pilih untuk seri routerboard yang sesuai

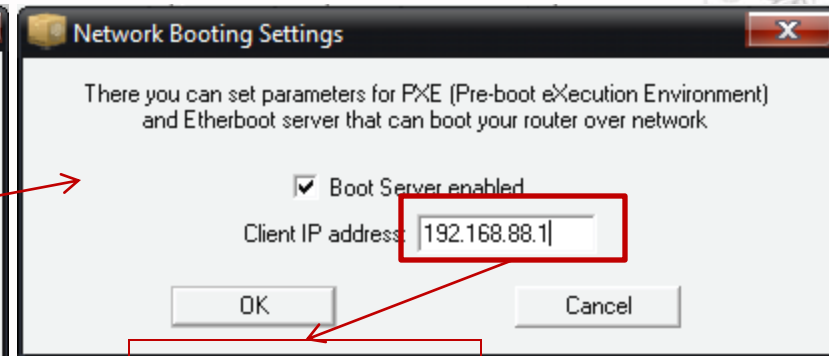
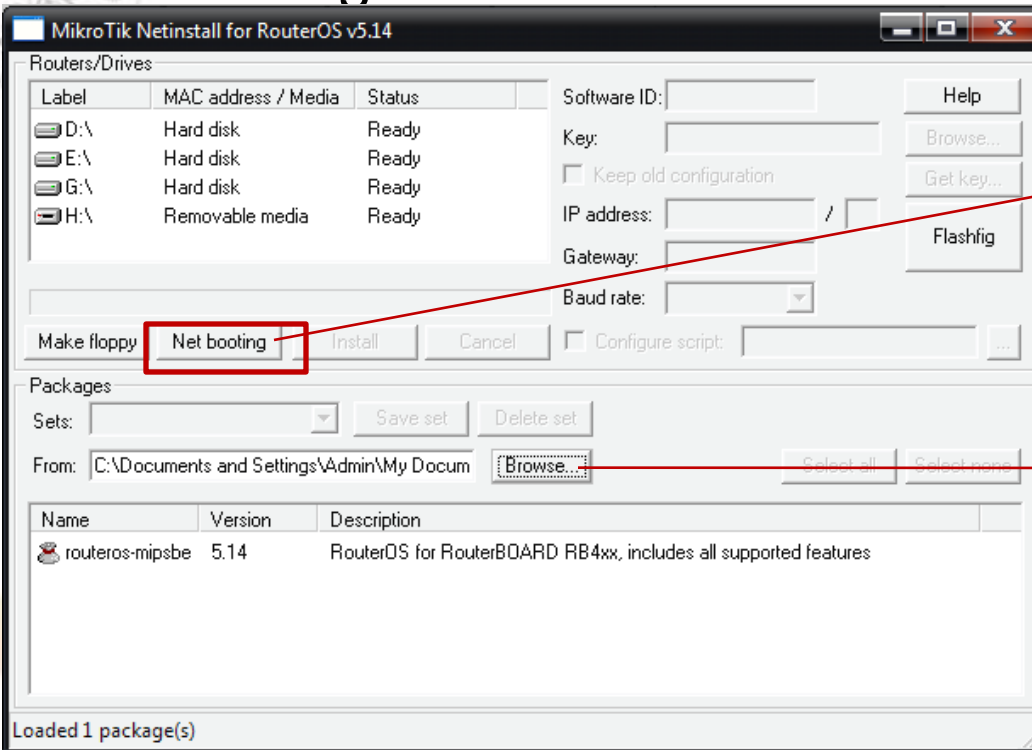
mipsbe RB4xx series, **RB7xx series**, RB9xx series, RB2011 series, SXT, OmniTik, Groove, METAL, SEXTANT

v6.2	2013-Aug-02	v5.25	2013-Apr-29	v4.17	2011-Oct-17
	Upgrade package		Upgrade package		Upgrade package
	All packages		All packages		All packages
	Netinstall		Netinstall		Netinstall
	Torrent		Torrent		Torrent
	Changelog		Changelog		Changelog
Σ	MD5	Σ	MD5	Σ	MD5

- Koneksikan laptop dengan Routerboard di ether1 dan pastikan bisa ping

LAB – Reinstall RB 751

- Setting Netinstall



IP RouterOS

Arahkan ke folder dimana paket (file npk) routeros disimpan di laptop kita

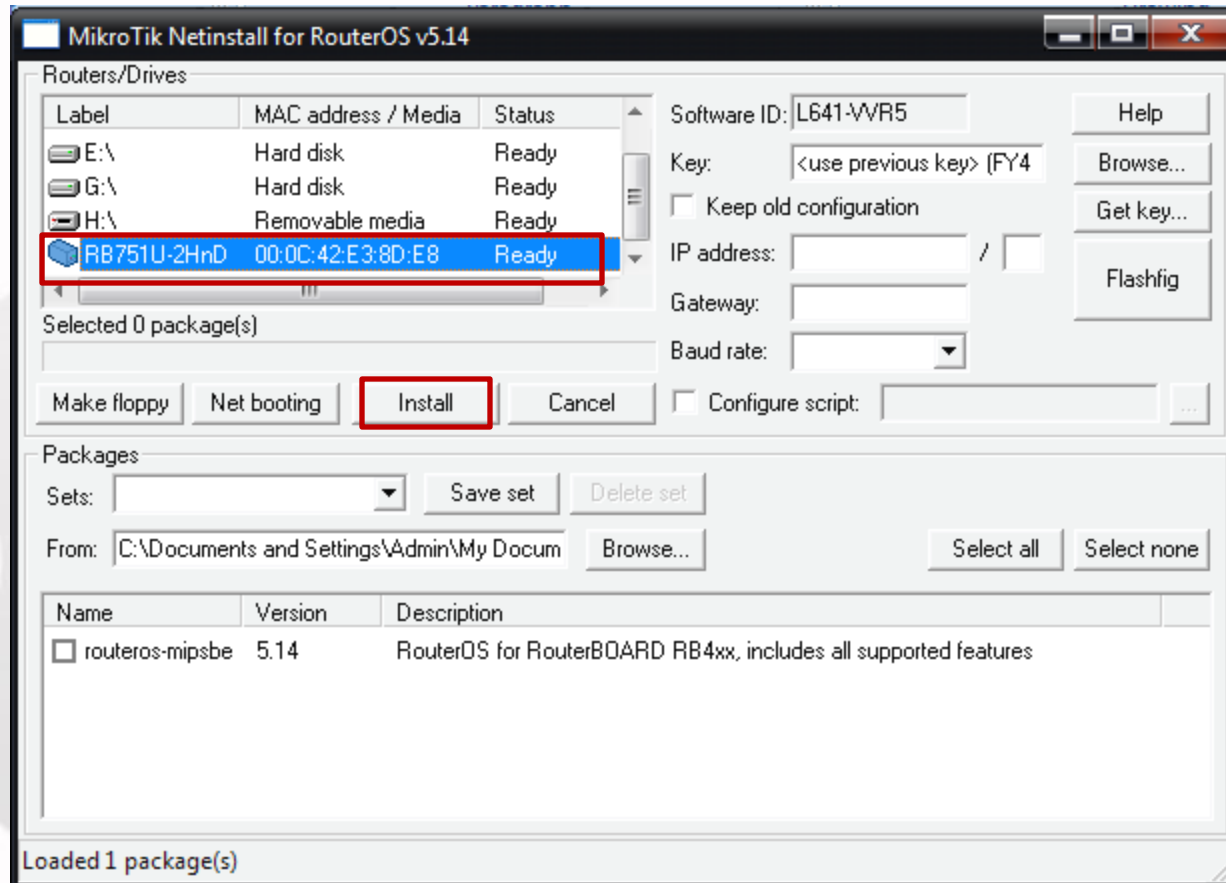
Setting BIOS via winbox

Setting boot device MikroTik ada di menu System>Routerboard>Setting>Boot Device (Try-ethernet-once-then-nand)

The image shows a screenshot of the Mikrotik WinBox interface. On the left, a sidebar menu has 'System' and 'Routerboard' highlighted with red boxes. A red arrow points from 'Routerboard' to the 'Routerboard' dialog box. Inside this dialog, the 'Settings' button is highlighted with a red box, and another red arrow points to the 'Settings' dialog box. In the 'Settings' dialog, the 'Boot Device' dropdown menu is highlighted with a red box and contains the text 'try-ethernet-once-then-nand'. Other settings visible include Baud Rate (115200), Boot Delay (1 s), Enter Setup On (any key), CPU Frequency (400MHz), and Boot Protocol (bootp). There are also checkboxes for 'Enable Jumper Reset', 'Force Backup Booter', and 'Silent Boot'.

LAB – Reinstall RB 751

- Reboot router melalui system reboot, sampai terdeteksi 1 device mikrotik di netinstallnya
- Klik install, untuk memulai instalasi



IP Services

- Menghidukan/mematikan service yang dijalankan oleh Router.
- Setting konfigurasinya ada di menu IP>Services
- Untuk keamanan kita juga dapat mengganti/mengubah default port pada masing-masing services

The image shows two windows from a network configuration interface. The main window is titled "IP Service List" and contains a table with the following data:

Name	Port	Available From	Certificate
api	8728		
ftp	21		
ssh	22		
telnet	23		
winbox	8291		
www	80		
www-ssl	443		

Below the table, it says "7 items".

The second window is titled "IP Service <ssh>" and shows configuration options for the ssh service:

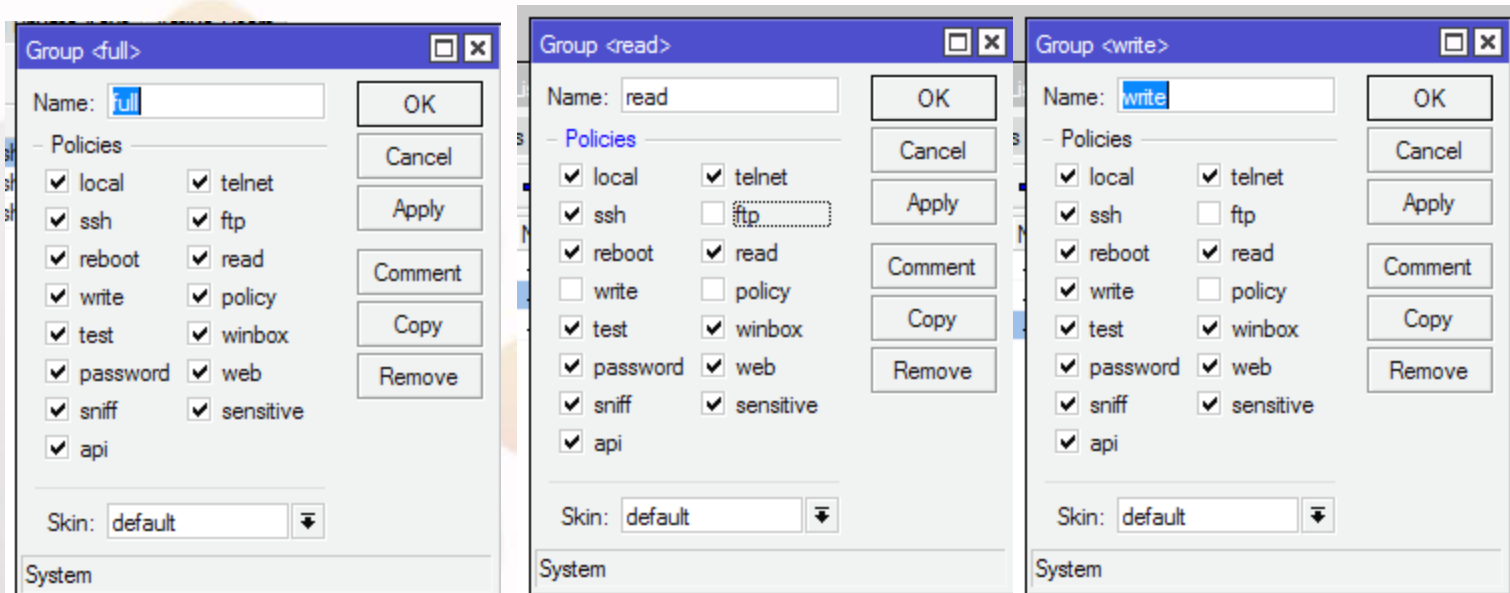
- Name: ssh
- Port: 22
- Available From: 0.0.0.0/0
- Buttons: OK, Cancel, Apply, Disable
- Status: enabled

User Login Management

- Akses ke router ditentukan oleh menu user.
- Manajemen user dilakukan dengan
 - GROUP – profil pengelompokan user, menentukan privilege yang bisa diperoleh suatu user.
 - USER – merupakan login (username & password dari suatu user.
- Sesi user yang sedang melakukan koneksi ke router dapat dilihat pada menu System>Users>Active Users

User Login Management - Group

- Group merupakan pengelompokan privilege/hak akses yang akan diberikan pada user.
- Ada 3 default privilege yang ada di MikroTik yaitu full, read dan write, namun diperbolehkan untuk customize sendiri.



User Login Management - Akses

- Masing-masing user dapat dibatasi hak aksesnya berdasarkan group.
- Masing-masing user juga dapat dibatasi berdasarkan IP address yang digunakannya.
- Misalkan si A hanya boleh login dengan IP A, atau hanya boleh dari network A.

The screenshot shows two windows from a network management interface. The 'User List' window on the left displays a table of users and groups. The 'User <Spv-NOC>' window on the right shows configuration for the 'Spv-NOC' user, including group 'write' and allowed address '192.168.2.145'.

Name	Group	Allowed Address
::: Network Monitoring Center		
NOC1	read	
NOC2	read	
NOC3	read	
Spv-NOC	write	
::: Network Engineer		
admin	full	

User <Spv-NOC> configuration:

- Name: Spv-NOC
- Group: write
- Allowed Address: 192.168.2.145

LAB - User Login Management

- Buatlah satu user dengan nama “katy”
- Berikan privilege agar user katy hanya bisa melakukan reboot router via winbox
- Caranya adalah, buat group dulu dengan privilege reboot dan winbox, baru setelah itu buat user katy dengan group reboot.

LAB - User Login Management

Quick Set
Interfaces
Wireless
Bridge
PPP
Switch
Mesh
IP
IPv6
MPLS
Routing
System
Queues
Files
Log
Radius
Tools
New Terminal
MetaROUTER
Make Supout.rf
Manual
Exit

Auto Upgrade
Certificates
Clock
Console
Drivers
Health
History
Identity
LCD
LEDs
License
Logging
NTP Client
NTP Server
Packages
Password
Ports
Reboot
Reset Configuration
Resources
Routerboard
Scheduler
Scripts
Shutdown
Special Login
Stores
UPS
Users

User List

Name	Policies	Skin
full	local telnet ssh ftp reboot read write policy test winbox passw...	default
read	local telnet ssh reboot read test winbox password web sniff s...	default
rebooter	reboot winbox	default
write	local telnet ssh reboot read write test winbox password web ...	default

Group <rebooter>

Name: rebooter

Policies

- local
- ssh
- reboot
- write
- test
- password
- sniff
- api
- telnet
- ftp
- read
- winbox
- policy
- web
- sensitive

Skin: default

User List

Name	Group	Allowed Address
system	default	user
admin	full	
opix	full	

New User

Name: katy

Group: rebooter

Allowed Address:

Password:

Confirm Password:

enabled

MikroTik Neighbor Discovery Protocol (MNDP)

- MNDP memudahkan konfigurasi dan manajemen jaringan dengan memungkinkan setiap router MikroTik untuk mendeteksi MikroTik lainnya yang terhubung langsung
- MNDP fitur:
 - bekerja pada layer 2
 - bekerja pada semua non-dinamic interface
 - mendistribusikan informasi dasar
- MNDP dapat berkomunikasi dengan CDP (Cisco Discovery Protocol).
- Disarankan untuk tidak memancarkan MNDP ke interface yang mengarah ke jaringan public.

Block MNDP

Untuk menyembunyikan mikrotik anda agar tidak muncul pada Winbox MNDP scan, atau muncul pada neighbors:

1. Disable MNDP pada menu **IP Neighbors Discovery**
2. Block Port UDP protocol port 5678 (port untuk komunikasi MNDP) menggunakan **IP Firewall Filter Rule**

The screenshot shows the Mikrotik WinBox interface. On the left, the 'IP' menu is highlighted with a red box, and the 'Neighbors' sub-menu is also highlighted with a red box. A red arrow points from the 'Neighbors' menu to the 'Discovery Interfaces' tab in the 'Neighbor List' window. The 'Discovery Interfaces' tab is also highlighted with a red box. The 'Neighbor List' window displays a table with the following data:

Interface	
bridge 1	
ether1	
ether2	
ether3	
ether4	
ether5	
wlan 1	

At the bottom of the window, it indicates '7 items'.

Backup dan Restore

- Konfigurasi dalam router dapat dibackup dan disimpan untuk digunakan di kemudian hari. Ada 2 jenis backup yaitu

1. Binary file (.backup)

- ✓ **Tidak dapat dibaca** text editor.
- ✓ Membackup **keseluruhan konfigurasi** router
- ✓ Create return point (dapat kembali seperti semula)

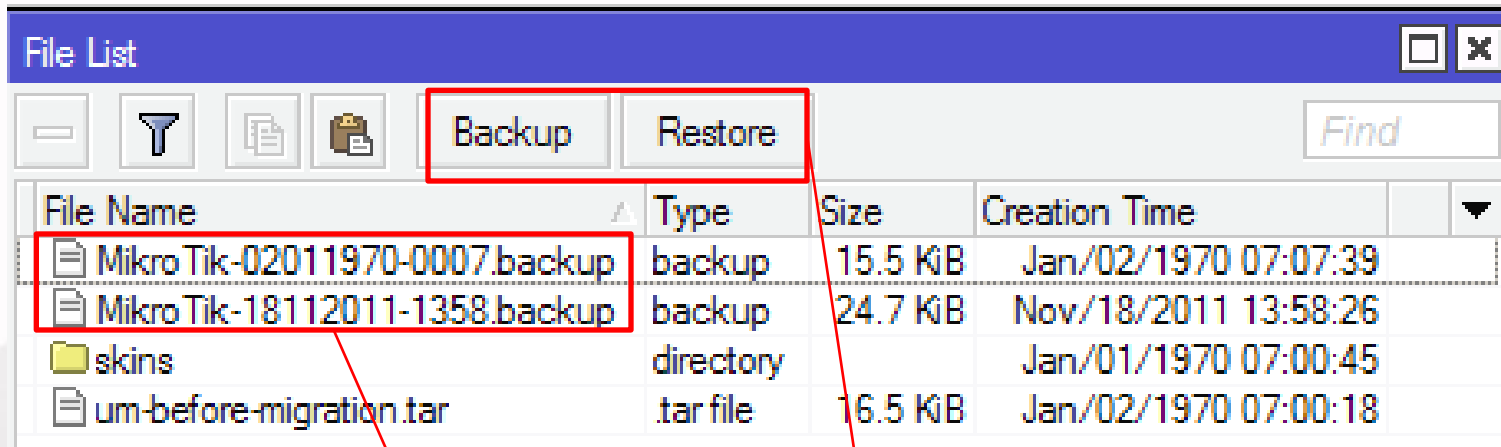
2. Script file (.rsc)

- ✓ Berupa script, **dapat dibaca** dengan text editor.
- ✓ Dapat membackup **sebagian atau keseluruhan konfigurasi** router.
- ✓ Tidak mengembalikan ke konfigurasi seperti semula, melainkan menambahkan script tertentu pada konfigurasi utama.



Binary – Backup & Restore

- Backup ada pada menu File>backup



The screenshot shows a 'File List' window with a toolbar containing buttons for 'Backup' and 'Restore', both highlighted with red boxes. Below the toolbar is a table with columns for File Name, Type, Size, and Creation Time. Two backup files are highlighted with red boxes: 'MikroTik-02011970-0007.backup' and 'MikroTik-18112011-1358.backup'. Red arrows point from these files to explanatory text boxes.

File Name	Type	Size	Creation Time
MikroTik-02011970-0007.backup	backup	15.5 KiB	Jan/02/1970 07:07:39
MikroTik-18112011-1358.backup	backup	24.7 KiB	Nov/18/2011 13:58:26
skins	directory		Jan/01/1970 07:00:45
um-before-migration.tar	.tar file	16.5 KiB	Jan/02/1970 07:00:18

Format backup file:
MikroTik-[tanggal][bulan][tahun]-[jam][menit]
File dapat disimpan di PC dengan cara drag-and-drop atau FTP

1. Tombol backup digunakan untuk backup konfigurasi router aktual.
2. Tombol restore digunakan untuk mengembalikan konfigurasi sesuai dengan file yang dipilih.

Binary – Backup & Restore

- Binary backup dan restore juga dapat dilakukan menggunakan terminal.
- Backup via terminal kelebihannya adalah dapat memberi nama file backup sesuai dengan keinginan kita

```
[admin@MikroTik A] > system backup save name=bakup_18_nov_11
Saving system configuration
Configuration backup saved
[admin@MikroTik A] > file print
```

#	NAME	TYPE	SIZE	CREATION-TIME
0	um-before-mi...	.tar file	16 896	jan/02/1970 07:00:18
1	skins	directory		jan/01/1970 07:00:45
2	MikroTik-181...	backup	25 338	nov/18/2011 13:58:26
3	MikroTik-020...	backup	15 865	jan/02/1970 07:07:39
4	bakup_18_nov...	backup	25 338	nov/18/2011 14:10:52

```
[admin@MikroTik A] > █
```

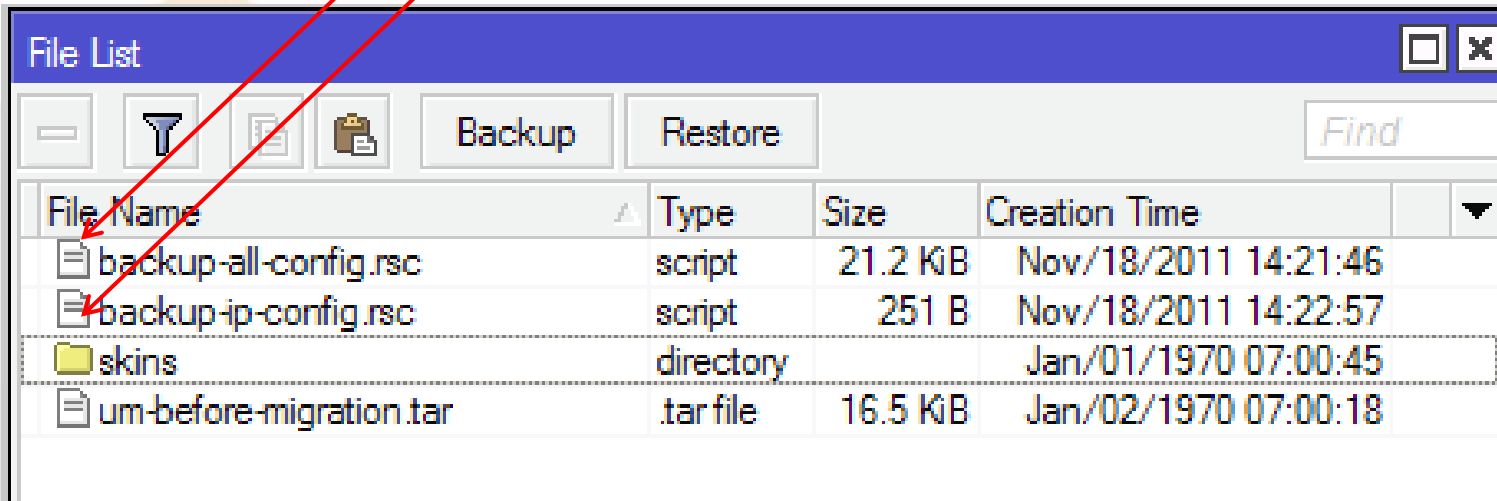
Script – Backup & Restore

- Backup dan restore dengan mode script dilakukan dengan perintah:
 - EXPORT akan menyimpan konfigurasi dengan bentuk script yang dapat dibaca dan diolah.
 - IMPORT akan menjalankan perintah yang terdapat dalam script.
- IMPORT/EXPORT dapat digunakan untuk membackup sebagian konfigurasi.
- IMPORT/EXPORT harus dilakukan melalui terminal.
- EXPORT tidak menyimpan username password

Script – Backup & Restore

- Perintah EXPORT

```
[admin@MikroTik A] > export file=backup-all-config  
[admin@MikroTik A] > /ip address export file=backup-ip-config  
[admin@MikroTik A] >
```



The screenshot shows a 'File List' window with a toolbar containing icons for navigation and actions like 'Backup' and 'Restore'. A table lists the files in the directory, with columns for File Name, Type, Size, and Creation Time. Two red arrows point from the terminal commands above to the corresponding files in the table: one from 'export file=backup-all-config' to 'backup-all-config.rsc' and another from '/ip address export file=backup-ip-config' to 'backup-ip-config.rsc'.

File Name	Type	Size	Creation Time
backup-all-config.rsc	script	21.2 KB	Nov/18/2011 14:21:46
backup-ip-config.rsc	script	251 B	Nov/18/2011 14:22:57
skins	directory		Jan/01/1970 07:00:45
um-before-migration.tar	tar file	16.5 KB	Jan/02/1970 07:00:18

Script – Backup & Restore

- Perintah IMPORT

```
[admin@MikroTik A] > file print
# NAME                                TYPE                                SIZE CREATION-TIME
0 backup-all-config.rsc               script                             21 676 nov/18/2011 14:21:46
1 um-before-migratio...               .tar file                          16 896 jan/02/1970 07:00:18
2 skins                                directory                           jan/01/1970 07:00:45
3 backup-ip-config.rsc                script                             251 nov/18/2011 14:22:57
[admin@MikroTik A] > import backup-all-config.rsc
Opening script file backup-all-config.rsc

Script file loaded successfullyfailure: profile with the same name already exists
[admin@MikroTik A] > █
```

Perbedaan Export & Backup

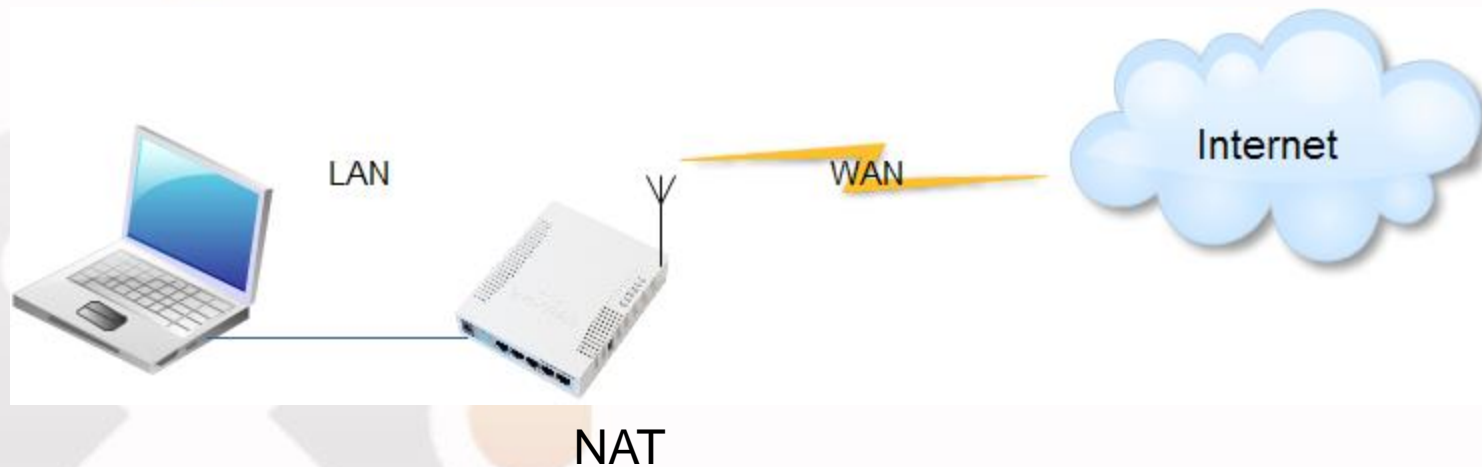
Perbedaan	Script Backup	Binnary Backup
Command	Export / Import	Backup / Restore
Bisa dengan menu klik	No	Yes
Backup all config	No (user&Pass)	Yes
Need reboot to restore	No	Yes
Backup sebagian config	Yes	No
Bisa dibaca test editor	Yes	No

LAB - Backup & Restore

- Buatlah backup konfigurasi dengan perintah backup dan export.
- Pindahkan file backup dan rsc ke komputer/laptop.
- Coba buka dan edit file backup dan file rsc tersebut

LAB – Koneksi Internet

- Ini adalah simulasi jaringan dasar untuk koneksi internet
- Setting koneksi internet menggunakan mikrotik sebagai Network Address Translation (NAT).



Konfigurasi LAN

- Setting IP pada Ethernet Laptop

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: 192 . 168 . 88 . 2

Subnet mask: 255 . 255 . 255 . 0

Default gateway: 192 . 168 . 88 . 1

Obtain DNS server address automatically

Use the following DNS server addresses:

Preferred DNS server: 8 . 8 . 8 . 8

Alternate DNS server: 8 . 8 . 4 . 4

Validate settings upon exit

Advanced...

OK Cancel

IP Laptop satu network dengan IP Mikrotik LAN

Gateway Laptop adalah IP interface mikrotik LAN

Konfigurasi LAN

- Setting IP pada Ether1 (ether yang terhubung dengan laptop)

The screenshot illustrates the process of configuring an IP address on the ether1 interface in Mikrotik WinBox. The main menu on the left shows the navigation path: **IP** > **Addresses**. The **Address List** window shows a table with one entry:

Address	Network	Interface
192.168.88.1/24	192.168.88.0	ether1

The **Address List** window also features a toolbar with a plus sign icon for adding new entries. The configuration details for the selected address are shown in the right-hand pane:

- Address: 192.168.88.1/24
- Network: 192.168.88.0
- Interface: ether1

Buttons for **OK**, **Cancel**, **Apply**, **Disable**, **Comment**, **Copy**, and **Remove** are visible. The status at the bottom indicates "enabled".

Konfigurasi WAN

- Setting wlan pada MikroTik sebagai station.

admin@192.168.100.254 (MikroTik) - WinBox v5.7 on RB751U-2HnD (mipsbe)

Safe Mode Hide Passwords

Interfaces

Wireless

Bridge

PPP

Switch

Mesh

IP

MPLS

Routing

System

Queues

Files

Log

Radius

Tools

Wireless Tables

Interfaces Nstreme Dual Access List Registration Connect List Security Profiles

+ - ✓ ✗ [Folder] [Filter] Scanner Freq. Usage Alignment Wireless Sniffer Wireless Snooper

Name	Type	L2 MTU	Tx	Rx	Tx Pac...	Rx Pac...	Tx Drops	Rx Dro
wlan1	Wireless (Atheros 11N)	2290	0 bps	0 bps	0	0	0	0

Klik 2x untuk konfigure wlan1

Konfigurasi WAN

- Setting wlan1 sebagai station

Interface <wlan1>

General Wireless HT HT MCS WDS Nstreme ...

Mode: station

Band: 2GHz-B/G/N

Channel Width: 20MHz

Frequency: 2432 MHz

SSID: MTCNA

Scan List: default

Wireless Protocol: any

Security Profile: default

Bridge Mode: enabled

Default AP Tx Rate: bps

Default Client Tx Rate: bps

Default Authenticate

Default Forward

OK

Cancel

Apply

Disable

Comment

Torch

Scan...

Freq. Usage...

Align...

Sniff...

Snooper...

Reset Configuration

Advanced Mode

- Setting wireless mode
- Setting SSID
- Security Profile (yang sudah dibuat sebelumnya)

Klik Apply untuk mengeksekusi hasil konfigurasi

Konfigurasi WAN

- Mode station juga dapat digunakan untuk scan network untuk mempermudah konek ke sebuah AP.

	Address	SSID	Channel	Signa...	Noise...	Signa...	Radio Name	RouterO...	
AP	6C:B0:CE:40:7F:1A	idn-staff-2	2412/2...	-61	-106	45			
AP	6E:B0:CE:40:7F:1B	IDN-TRAINING	2412/2...	-61	-106	45			
AP	C4:6E:1F:0F:A0:44	secret3	2412/2...	-76	-106	30			
A	C4:6E:1F:0F:A0:45	@wifi.id	2412/2...	-77	-106	29			
ARB	D4:CA:6D:50:0F:49	DOTA	2422/2...	-61	-107	46	D4CA6D500F49	6.25	
ARB	D4:CA:6D:97:A3:14	MTCNA	2432/2...	-56	-108	52	RADIO-MTCNA	6.27	
A	64:70:02:85:FF:89	@wifi.id	2457/2...	-67	-117	50			
A	64:70:02:85:FF:8A		2457/2...	-67	-117	50			

- Pilih AP yang ingin dikoneksikan dan klik tombol connect



Konfigurasi WAN

- Wireless telah terkoneksi

Wireless Tables

Interfaces Nstreme Dual Access List Registration Connect List Security Profiles

Scanner Freq. Usage Alignment Wireless Sniffer Wireless Snooper Find

Name	Type	L2 MTU	Tx	Rx	T...	Rx...	T...	Rx...	T...	R...	MAC Address	ARP	Mode	Band	Chann...	Frequen...	SSID
R wlan1	Wirel...	2290	51.1 kbps	3.0 kbps	6	5	0	0	0	0	00:0C:42:E3:8E:11	enabled	station	2GHz-B	20MHz	2437	IDN2

Huruf R (Running), menandakan wireless telah terkoneksi

Wireless Tables

Interfaces Nstreme Dual Access List Registration Connect List Security Profiles

Reset Find

Radio Name	MAC Address	Interface	Uptime	AP	W...	Last Activit...	Tx/Rx Signal ...	Tx/Rx Rate
R	C0:C1:C0:E7:BC:F9	wlan1	00:04:12	yes	no	0.000	-59	11.0Mbps...

AP yang terkoneksi terdaftar di Registration

Konfigurasi WAN

- Setting DHCP client

The image shows a Mikrotik WinBox interface with the following elements:

- Left Sidebar:** A tree view of configuration categories. 'IP' is highlighted with a red box, and 'DHCP Client' is selected under it.
- Main Window:** The 'DHCP Client' configuration window. A red box highlights the '+' icon in the top toolbar. Below it is a table with columns: Interface, Use P..., Add D..., IP Address, Expires After, and Status. The table is currently empty.
- Dialog Box:** A 'New DHCP Client' dialog box is open. The 'Interface' dropdown is set to 'wlan1' (highlighted with a red box). Three checkboxes are checked: 'Use Peer DNS', 'Use Peer NTP', and 'Add Default Route' (all highlighted with a red box).
- Annotations:** Red arrows point from the '+' icon to the 'New DHCP Client' dialog. Blue arrows point from the checked checkboxes to a text box.

DHCP Client running di wireless interface (wlan1)

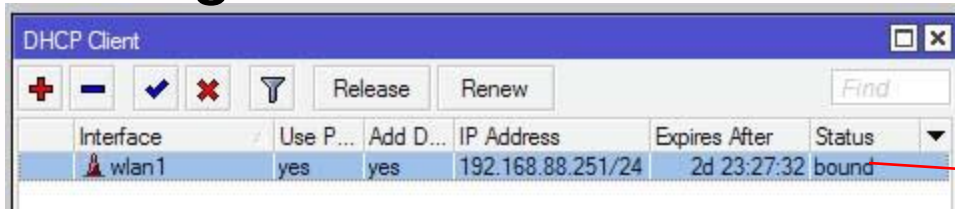
Set agar DNS, NTP dan default route otomatis didapatkan dari server

Status: stopped

NETWORKERS
Expert Trainer & Consultant

Seting DHCP Client

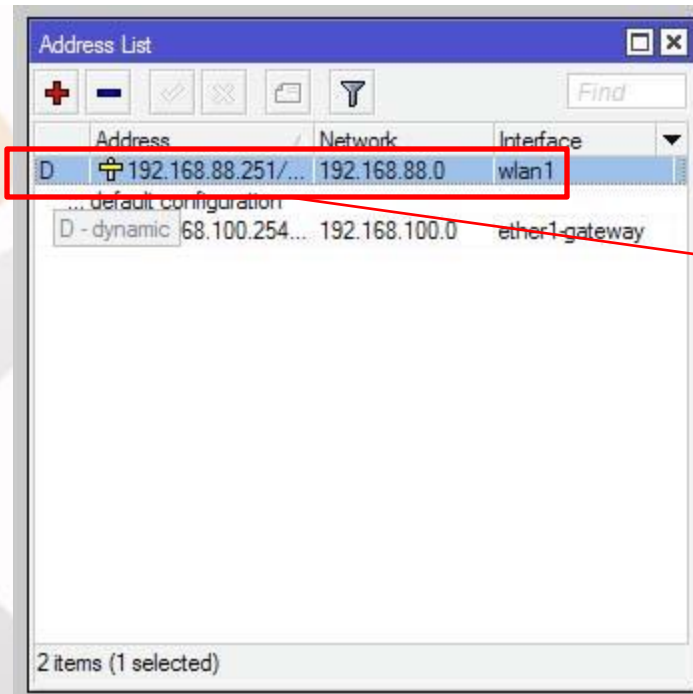
- Setting DHCP client



The screenshot shows the DHCP Client window with a table of interfaces. The 'wlan1' interface is highlighted, showing it is using DHCP and has a bound status.

Interface	Use P...	Add D...	IP Address	Expires After	Status
wlan1	yes	yes	192.168.88.251/24	2d 23:27:32	bound

Status bound menandakan bahwa wlan1 sudah mendapatkan IP address dari AP



The screenshot shows the Address List window with a table of IP addresses. A red box highlights the entry for wlan1, which is a dynamic IP address.

Address	Network	Interface
D 192.168.88.251/...	192.168.88.0	wlan1
D - dynamic 68.100.254...	192.168.100.0	ether1-gateway

Pada IP>address>interface terdapat dynamic IP address pada wlan1

Testing

- Coba lakukan ping dan traceroute dari MikroTik

Ping (Running)

General | Advanced

Ping To:

Interface:

ARP Ping

Packet Count:

Timeout: ms

Start
Stop
Close
New Window

Seq #	Host	Time	Reply Size	TTL	Status
44	98.137.149.56	343ms	50	52	
45	98.137.149.56	248ms	50	52	
46	98.137.149.56	228ms	50	52	
47	98.137.149.56	261ms	50	52	
48	98.137.149.56	235ms	50	52	
49	98.137.149.56	238ms	50	52	
50	98.137.149.56	356ms	50	52	
51	98.137.149.56	236ms	50	52	
52	98.137.149.56	240ms	50	52	
53	98.137.149.56	349ms	50	52	
54	98.137.149.56	235ms	50	52	
55	98.137.149.56	272ms	50	52	
56	98.137.149.56	234ms	50	52	
57	98.137.149.56	257ms	50	52	
58	98.137.149.56	231ms	50	52	
59	98.137.149.56	247ms	50	52	

60 of 60 packets received | 0% packet loss | Min: 225 ms | Avg: 276 ms | Max: 529 ms

Traceroute

Traceroute To:

Packet Size:

Timeout: ms

Protocol:

Port:

Start
Stop
Close
New Window

Src. Address:

Interface:

DSCP:

Routing Table:

#	Host	Time 1	Time 2	Time 3	Status
0	192.168.2.2	3ms	8ms	9ms	
1	192.168.1.1	7ms	8ms	8ms	
2	180.252.16.1	31ms	29ms	28ms	
3	125.160.15.41	24ms	39ms	32ms	
4	118.98.59.6	57ms	60ms	51ms	<MPLS:L=16973,E=0,T=255>
5	118.98.59.42	46ms	53ms	45ms	
6	180.240.190.13	66ms	82ms	48ms	
7	72.14.215.170	105ms	54ms	49ms	
8	209.85.243.158	227ms	50ms	54ms	
9	209.85.242.243	72ms	57ms	95ms	<MPLS:L=797265,E=4>
10	209.85.250.237	58ms	56ms	87ms	
11	66.249.94.126	61ms	161ms	70ms	
12	209.85.175.99	60ms	55ms	62ms	

Setting NAT

The screenshot shows the Mikrotik WinBox interface for configuring NAT. The left sidebar has 'IP' and 'Firewall' highlighted. The main window shows the Firewall NAT rule configuration. The 'Chain' is set to 'srcnat' and the 'Action' is set to 'masquerade'. The 'Out. Interface' is set to 'wlan1'.

IP>firewall>NAT
Chain : srcnat
Out interface :wlan1
Action: masquerade

#	Action	Chain	Src. Address	Dst. Address	Protoc
0	mas...	srcnat			

NAT Rule <>

General Advanced Extra Action Statistics

Chain: srcnat

Src. Address:

Dst. Address:

Protocol:

Src. Port:

Dst. Port:

Any. Port:

In. Interface:

Out. Interface: wlan1

Packet Mark:

Connection Mark:

Routing Mark:

Routing Table:

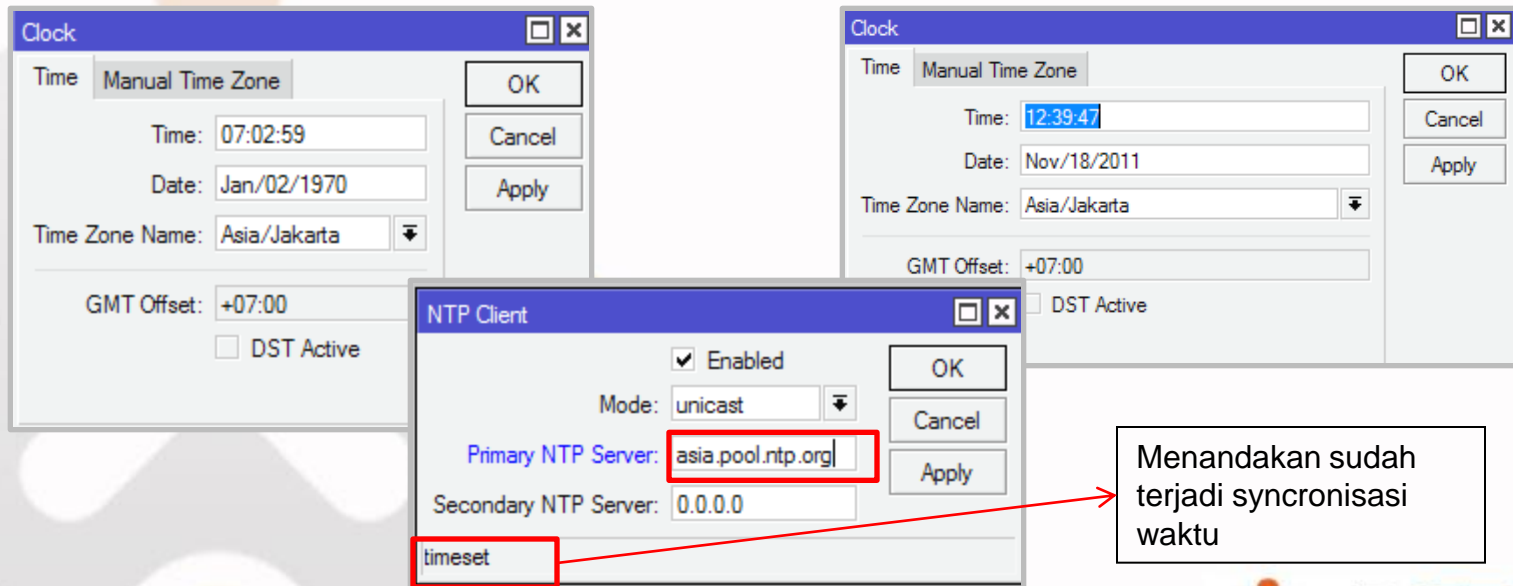
NAT Rule <>

General Advanced Extra Action Statistics

Action: masquerade

Network Time Protocol

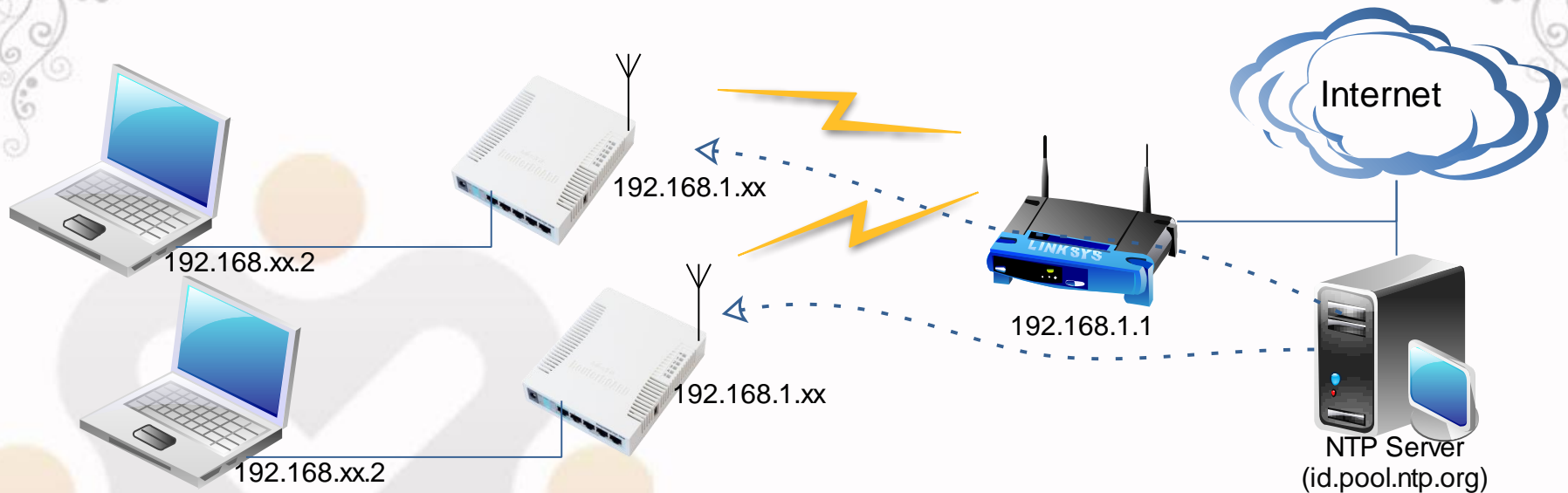
- Kebanyakan RB mikrotik tidak memiliki battery untuk clock internal (kecuali RB230 dan powerpc)
- NTP untuk sinkronisasi waktu antar router/server lainnya.
- NTP juga bisa diarahkan ke public NTP server seperti **asia.pool.ntp.org**, atau **id.pool.ntp.org**
- Konfigurasinya ada di menu **system ntp client**



Menandakan sudah terjadi synchronisasi waktu

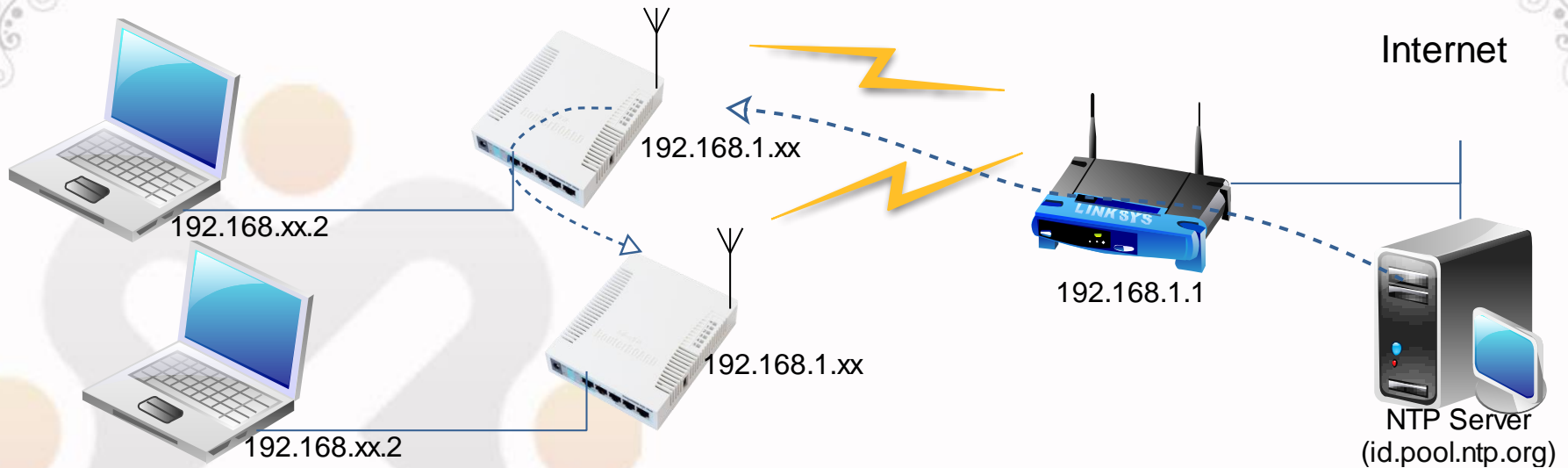
LAB- Network Time Protocol (NTP)

- Cobalah seting Mikrotik menggunakan NTP public service id.pool.ntp.org



LAB- Network Time Protocol (NTP)

- Peserta 1 menggunakan NTP public service id.pool.ntp.org, peserta yang lain NTP server diarahkan ke peserta 1





NTP Client

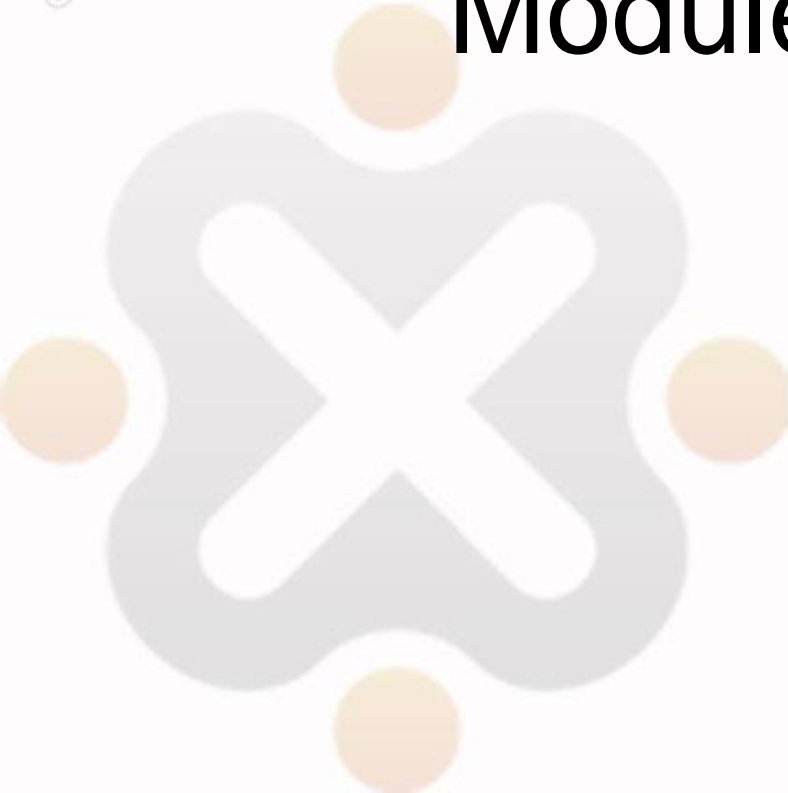
Fase sinkronisasi NTP Client

- **Started** : start service NTP
- **Reached** : terkoneksi dengan NTP server
- **Synchronized** : sinkronisasi waktu dengan NTP server
- **Timeset** : mengganti waktu/tanggal lokal sesuai waktu NTP server





Module 2 - Firewall



Firewall – Overview

- Untuk melindungi router dari luar, baik dari berasal dari WAN (internet) maupun dari client (local).
- Untuk melindungi network dari network lain yang melewati router.
- Dalam MikroTik, firewall ada banyak fitur yang semuanya dimasukkan dalam menu IP Firewall.
- Firewall basic di MikroTik ada di IP Firewall Filter Rule.

Firewall Filter Rule

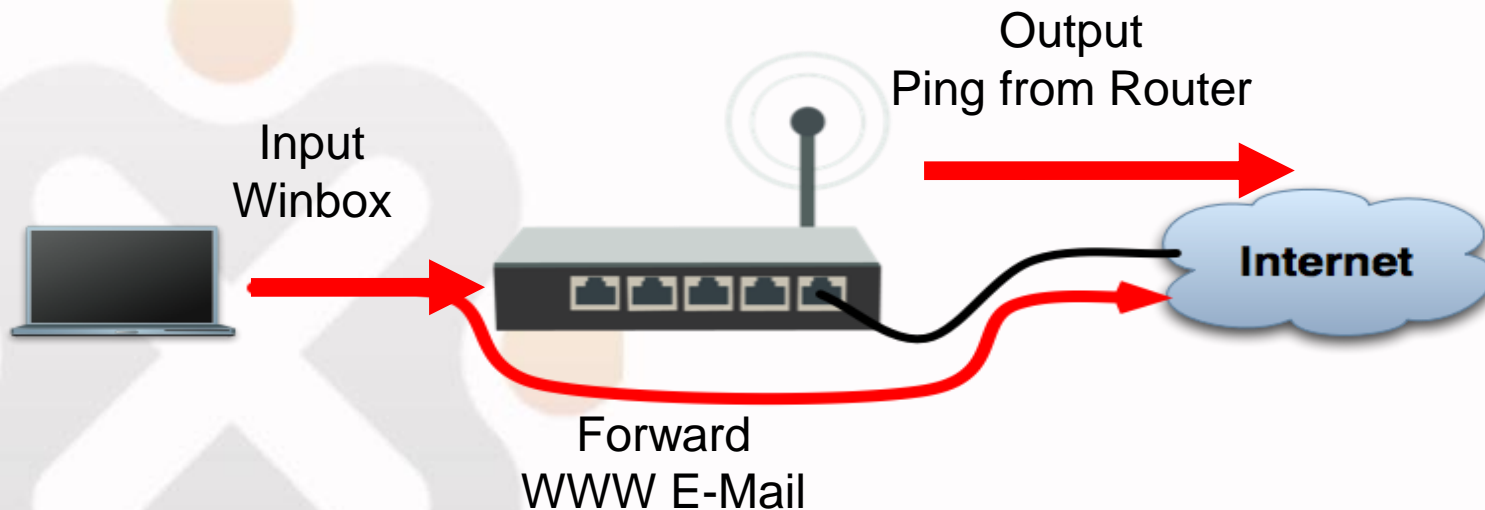
- Setiap Firewall Filter rule diorganisir dalam chain (rantai) yang berurutan.
- Setiap aturan chain yang dibuat akan dibaca oleh router dari atas ke bawah.
- Di Firewall Filter Rule ada 3 default chain (input, forward, output).
- Kita juga boleh membuat nama chain sesuai dengan keinginan kita
- Paket dicocokkan dengan kriteria/persyaratan dalam suatu chain, apabila cocok paket akan melalui kriteria/persyaratan chain berikutnya/ di bawahnya.



Packet Flow

Tiga aturan dasar packet flow

- INPUT – **ke** router
- OUTPUT – **dari** router
- FORWARD – **melewati** router



Firewall Filter Rule

- IP Firewall Filter Rule

The screenshot shows the Mikrotik WinBox interface for configuring Firewall Filter Rules. The left sidebar has 'IP' and 'Firewall' highlighted. The main window shows the 'Filter Rules' tab with a table of rules:

#	Action	Chain	Src. Address	Dst. Address	Proto...	Src. Port	Dst. Port	In. Inter...	Out. Int...	Bytes
0	X add...	forward								
1	X drop	forward								

The 'New Firewall Rule' dialog box is open, showing the 'General' tab with the following fields:

- Chain: forward
- Src. Address: [empty]
- Dst. Address: [empty]
- Protocol: [empty]
- Src. Port: [empty]
- Dst. Port: [empty]
- Any. Port: [empty]
- P2P: [empty]
- In. Interface: [empty]
- Out. Interface: [empty]
- Packet Mark: [empty]
- Connection Mark: [empty]

Firewall Filter Rule

- Prinsip IF....THEN....
- IF (jika) packet memenuhi syarat kriteria yang kita buat.
- THEN (maka) action apa yang akan dilakukan pada packet tersebut



Firewall – IF (Condition)

IP>Firewall>Filter Rules>General

New Firewall Rule

General Advanced Extra Action Statistics

Chain: forward

Src. Address:

Dst. Address:

Protocol:

Src. Port:

Dst. Port:

Any. Port:

P2P:

In. Interface:

Out. Interface:

Packet Mark:

Connection Mark:

Routing Mark:

Routing Table:

Connection Type:

Connection State:

Source IP (IP client)
Destination IP (IP internet)

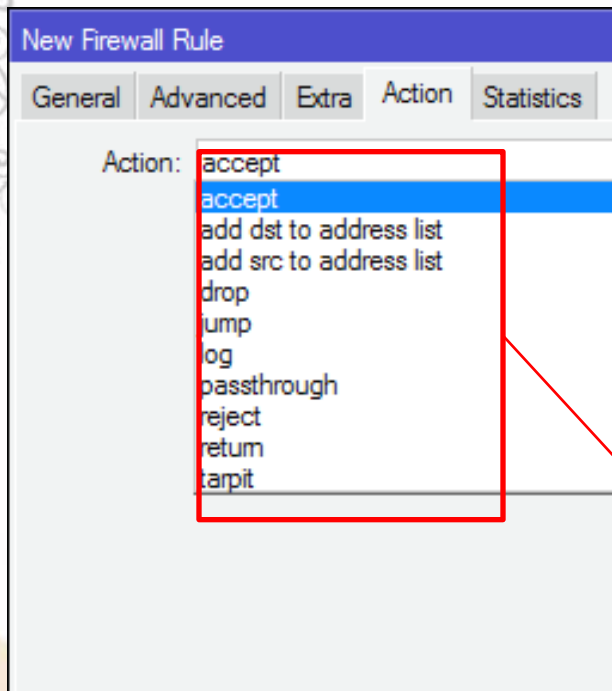
Protocol (TCP/UDP/ICMP, dll)
Source port (biasanya port dari client)
Destination port (service port tujuan)

Interface (traffik masuk atau keluar)

Paket yang sebelumnya telah ditandai

Firewall – THEN (Action)

IP>Firewall>Filter Rules>Action



accept - accept the packet. Packet is not passed to next firewall rule.

add-dst-to-address-list - add destination address to [address list](#) specified by address-list parameter

add-src-to-address-list - add source address to [address list](#) specified by address-list parameter

drop - silently drop the packet

jump - jump to the user defined chain specified by the value of jump-target parameter

log - add a message to the system log containing following data: in-interface, out-interface, src-mac, protocol, src-ip:port->dst-ip:port and length of the packet. After packet is matched it is passed to next rule in the list, similar as passthrough

passthrough - ignore this rule and go to next one (useful for statistics).

reject - drop the packet and send an ICMP reject message

return - passes control back to the chain from where the jump took place

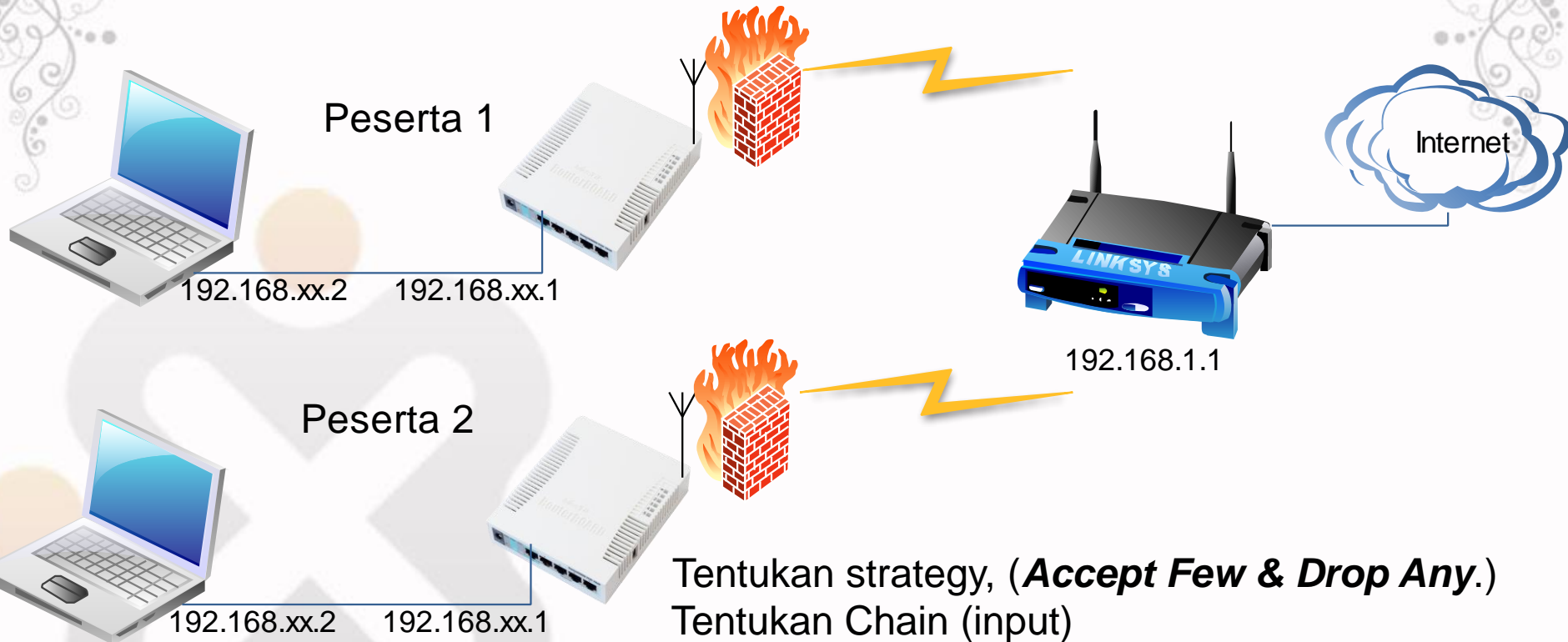
tarpit - captures and holds TCP connections (replies with SYN/ACK to the inbound TCP SYN packet)

Firewall Strategy

- Banyak trafik yang harus difilter dan dipilah mana yang harus di perbolehkan (accept) dan mana yang harus di buang (drop)
- Ada 2 metode untuk menyederhanakan rule firewall yang kita buat:
 - Drop beberapa, lainnya diterima (*drop few, accept any*)
 - Terima beberapa, lainnya dibuang (*accept few, drop any*)
- By default bila tidak ada rule apapun di firewall, semua trafik akan di accept oleh router.

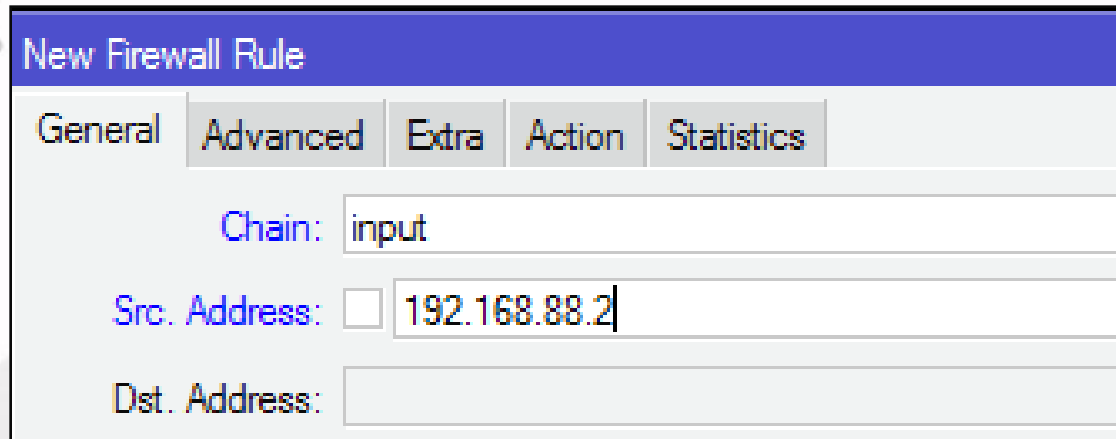
LAB – Protecting Our Router

Cobalah buat firewall hanya memperbolehkan IP laptop sendiri yang hanya bisa akses router



LAB – Protecting Our Router

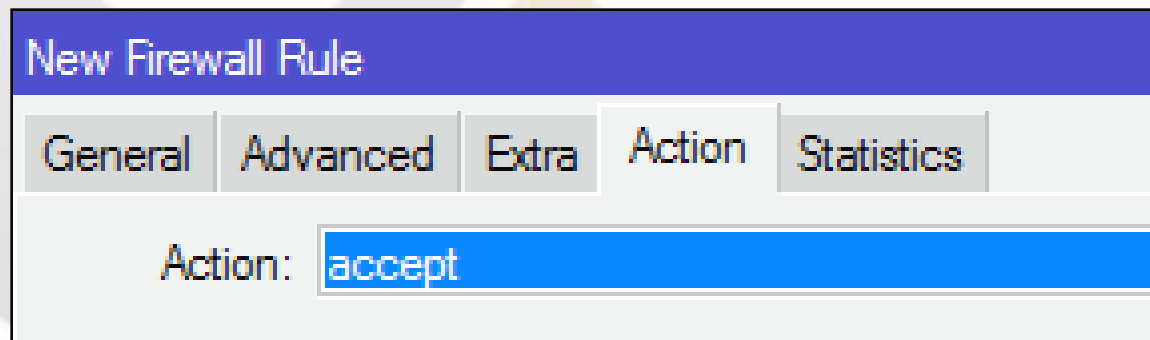
- IF ada traffic **input** yang berasal dari IP Laptop (**192.168.88.2**)



The screenshot shows the 'New Firewall Rule' dialog box in Mikrotik WinBox. The 'General' tab is selected. The 'Chain' field is set to 'input'. The 'Src. Address' field has a checked checkbox and the IP address '192.168.88.2' entered. The 'Dst. Address' field is empty.

New Firewall Rule	
General	Advanced
Extra	Action
Statistics	
Chain:	input
Src. Address:	<input checked="" type="checkbox"/> 192.168.88.2
Dst. Address:	

- Then tentukan action → **accept**



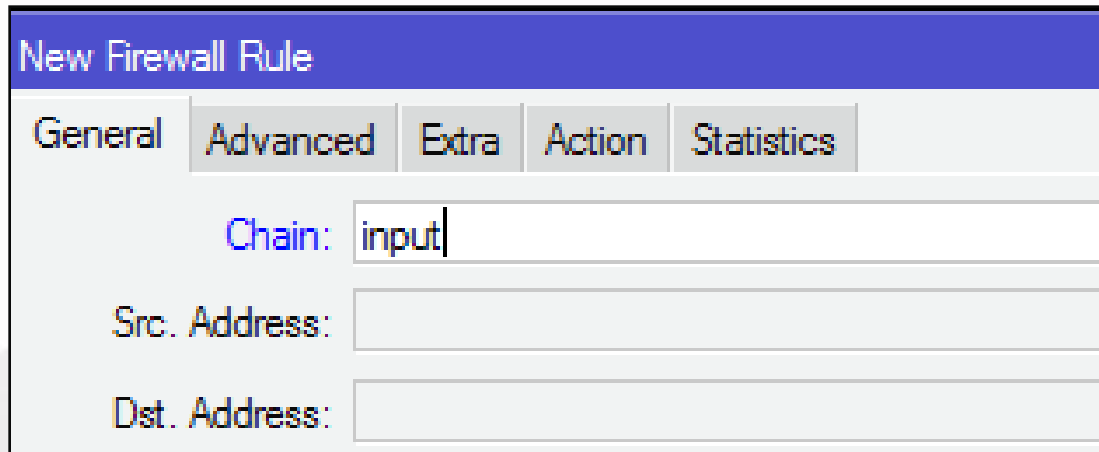
The screenshot shows the 'New Firewall Rule' dialog box in Mikrotik WinBox, with the 'Action' tab selected. The 'Action' field is set to 'accept'.

New Firewall Rule	
General	Advanced
Extra	Action
Statistics	
Action:	accept



LAB – Protecting Our Router

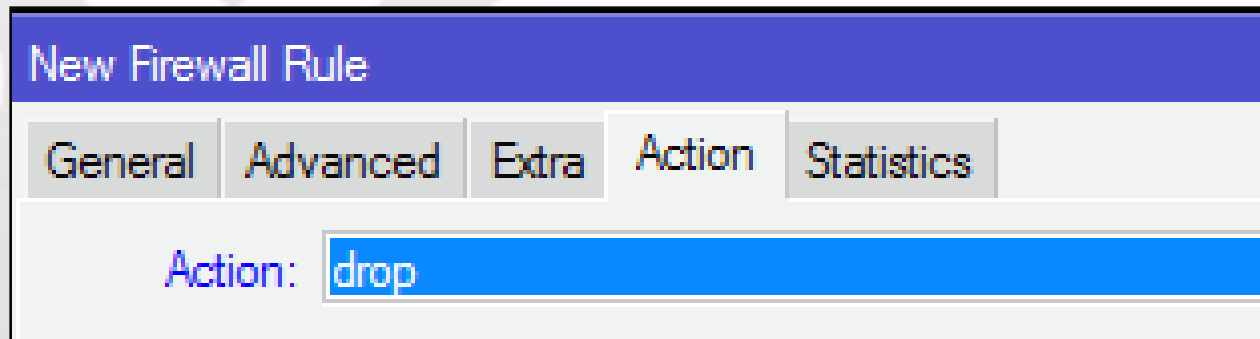
- IF ada traffic yang berasal dari <kosong> atau “all”



The screenshot shows the 'New Firewall Rule' dialog box in Mikrotik WinBox. The 'General' tab is selected. The 'Chain' field is set to 'input'. The 'Src. Address' and 'Dst. Address' fields are empty.

New Firewall Rule				
General	Advanced	Extra	Action	Statistics
Chain: input				
Src. Address:				
Dst. Address:				

- Then tentukan action drop



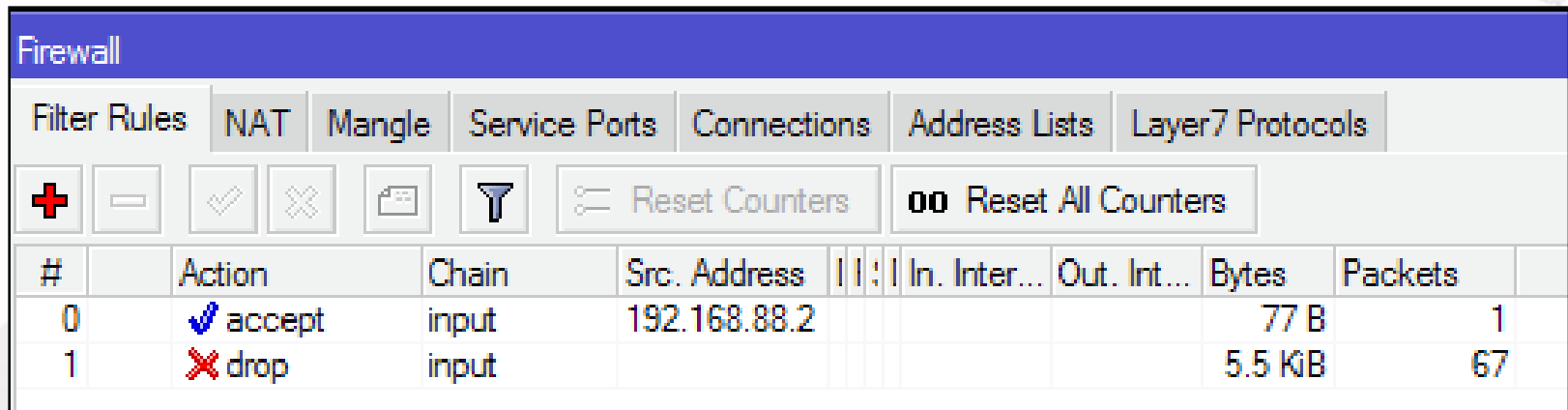
The screenshot shows the 'New Firewall Rule' dialog box in Mikrotik WinBox. The 'Action' tab is selected. The 'Action' field is set to 'drop'.

New Firewall Rule				
General	Advanced	Extra	Action	Statistics
Action: drop				



LAB – Protecting Our Router

- Akan ada 2 chain rules.



#	Action	Chain	Src. Address		In. Inter...	Out. Int...	Bytes	Packets
0	✓ accept	input	192.168.88.2				77 B	1
1	✗ drop	input					5.5 KB	67

- Perhatikan jumlah bytes pada setiap chain rule, tetap ataukah bertambah ketika kita melakukan akses ke router?
- Cobalah masing-masing peserta untuk melakukan ping, akses web, dan remote winbox ke router peserta lain.

LAB – Firewall Logging

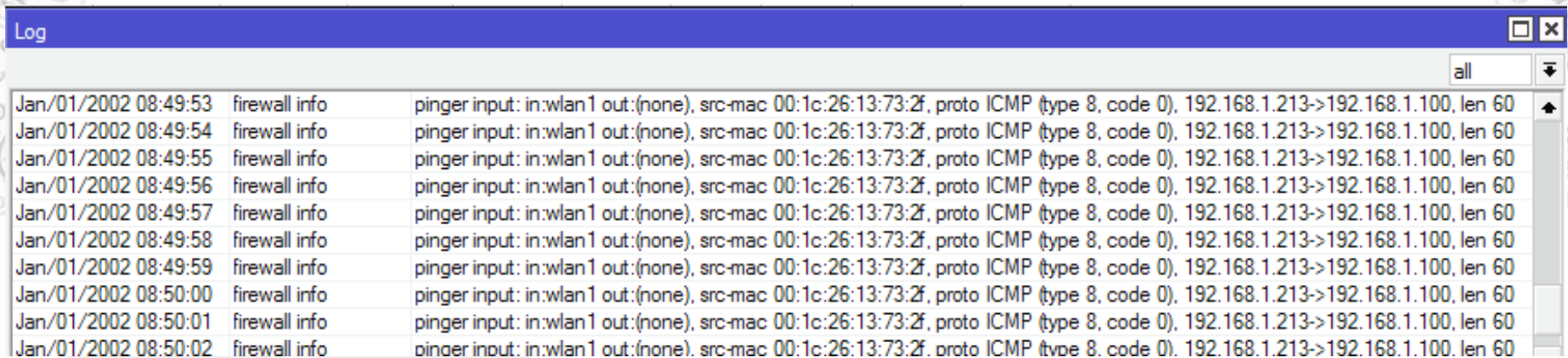
Firewall Logging adalah fitur untuk mencatat (menampilkan pada log) aktifitas yang jaringan yang kita inginkan.

- Buat filter rule pada menu IP>Firewall>Filter Rules, untuk logging semua yang ping router kita

The image displays two screenshots of the Mikrotik WinBox Firewall Rule configuration interface. The left screenshot shows the 'General' tab with the following settings: Chain: input, Src. Address: (empty), Dst. Address: (empty), Protocol: 1 (icmp), Src. Port: (empty), Dst. Port: (empty), Any. Port: (empty), P2P: (empty), In. Interface: (empty), and Out. Interface: (empty). The right screenshot shows the 'Action' tab with the following settings: Action: log and Log Prefix: incoming-ping.

LAB – Firewall Logging

Ping dari laptop IP interface wlan1 dan amati log pada router:

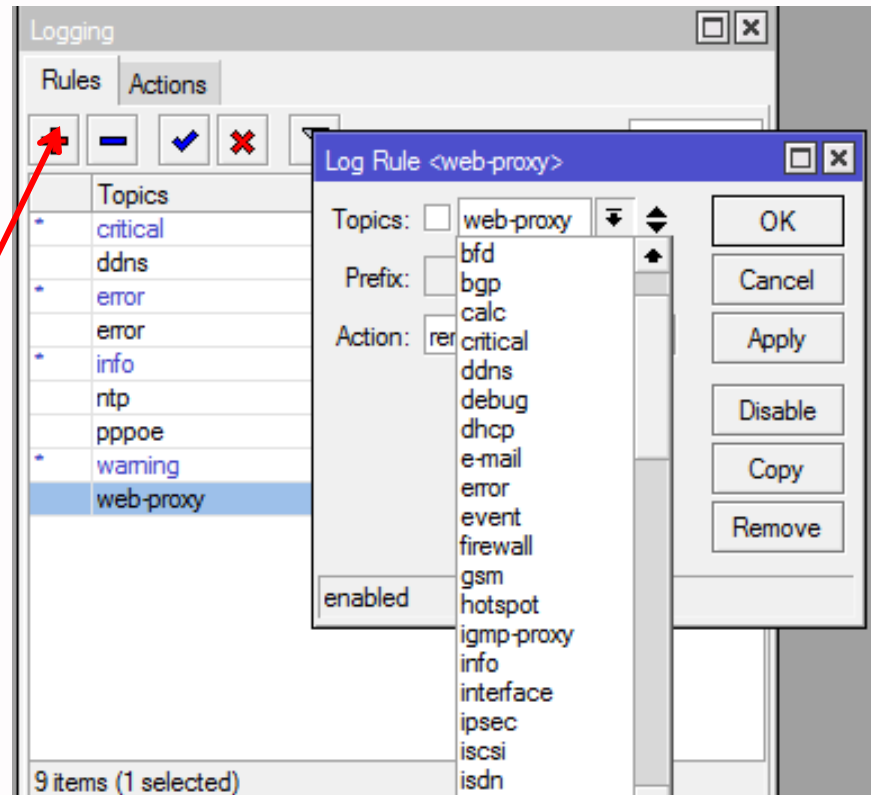
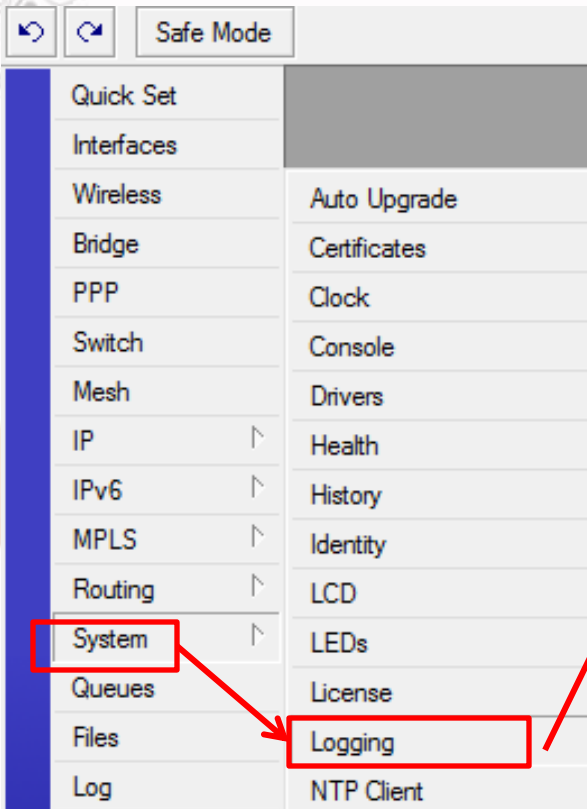


The screenshot shows a window titled "Log" with a search filter set to "all". The log entries are as follows:

Time	Level	Message
Jan/01/2002 08:49:53	firewall info	pinger input: in:wlan1 out:(none), src-mac 00:1c:26:13:73:2f, proto ICMP (type 8, code 0), 192.168.1.213->192.168.1.100, len 60
Jan/01/2002 08:49:54	firewall info	pinger input: in:wlan1 out:(none), src-mac 00:1c:26:13:73:2f, proto ICMP (type 8, code 0), 192.168.1.213->192.168.1.100, len 60
Jan/01/2002 08:49:55	firewall info	pinger input: in:wlan1 out:(none), src-mac 00:1c:26:13:73:2f, proto ICMP (type 8, code 0), 192.168.1.213->192.168.1.100, len 60
Jan/01/2002 08:49:56	firewall info	pinger input: in:wlan1 out:(none), src-mac 00:1c:26:13:73:2f, proto ICMP (type 8, code 0), 192.168.1.213->192.168.1.100, len 60
Jan/01/2002 08:49:57	firewall info	pinger input: in:wlan1 out:(none), src-mac 00:1c:26:13:73:2f, proto ICMP (type 8, code 0), 192.168.1.213->192.168.1.100, len 60
Jan/01/2002 08:49:58	firewall info	pinger input: in:wlan1 out:(none), src-mac 00:1c:26:13:73:2f, proto ICMP (type 8, code 0), 192.168.1.213->192.168.1.100, len 60
Jan/01/2002 08:49:59	firewall info	pinger input: in:wlan1 out:(none), src-mac 00:1c:26:13:73:2f, proto ICMP (type 8, code 0), 192.168.1.213->192.168.1.100, len 60
Jan/01/2002 08:50:00	firewall info	pinger input: in:wlan1 out:(none), src-mac 00:1c:26:13:73:2f, proto ICMP (type 8, code 0), 192.168.1.213->192.168.1.100, len 60
Jan/01/2002 08:50:01	firewall info	pinger input: in:wlan1 out:(none), src-mac 00:1c:26:13:73:2f, proto ICMP (type 8, code 0), 192.168.1.213->192.168.1.100, len 60
Jan/01/2002 08:50:02	firewall info	pinger input: in:wlan1 out:(none), src-mac 00:1c:26:13:73:2f, proto ICMP (type 8, code 0), 192.168.1.213->192.168.1.100, len 60

Logging

- Kita dapat mengatur aktivitas atau fitur apa yang akan ditampilkan dalam log.
- Kita juga dapat mengirimkan log ke syslog server tertentu menggunakan default protocol UDP port 514.
- Pengaturan logging ada dalam menu System Logging



Firewall – Address List

- Address-list digunakan untuk memfilter group IP address dengan 1 rule firewall.
- Address-list juga bisa merupakan list IP hasil dari rule firewall yang memiliki action “add to address list”
- Satu line address-list dapat berupa subnet, range, atau 1 host IP address



LAB– Address List

- Siapa dari lokal kita yang ping ke router, dia tidak bisa akses internet selama 20 detik
- Buat rule firewall untuk memasukkan setiap IP yang melakukan ping ke dalam address-list dan beri nama address list “who-ping-me”.

The image displays two screenshots of the Mikrotik WinBox Firewall Rule configuration interface. The left screenshot shows the 'General' tab with the following settings: Chain: input, Src. Address: (empty), Dst. Address: (empty), Protocol: icmp, Src. Port: (empty), Dst. Port: (empty), Any. Port: (empty), P2P: (empty), In. Interface: ether2, Out. Interface: (empty), and Packet Mark: (empty). The right screenshot shows the 'Action' tab with the following settings: Action: add src to address list, Address List: who-ping-me, and Timeout: 00:00:20.

LAB– Address List

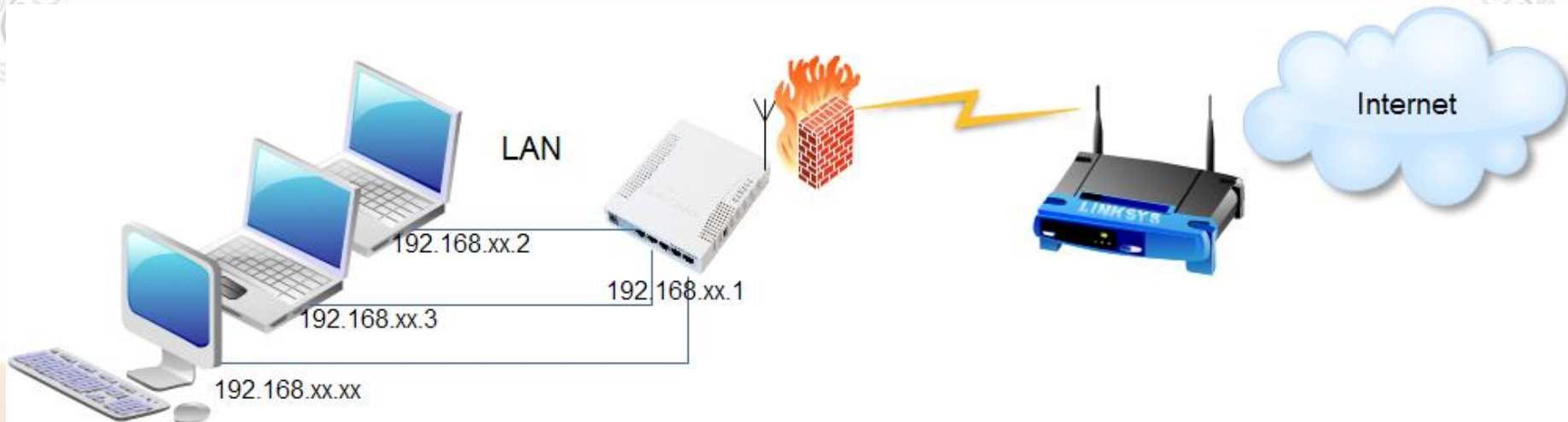
- Buat rule drop untuk address-list “who-ping-me”
- Rule ini akan bekerja jika ada yang ping ke router saja

The image displays three overlapping windows from the Mikrotik WinBox interface:

- New Firewall Rule (Left):** Shows the 'General' tab with 'Chain' set to 'forward'. Other fields like 'Src. Address', 'Dst. Address', 'Protocol', and 'Action' are empty.
- New Firewall Rule (Middle):** Shows the 'General' tab with 'Src. Address List' set to 'who-ping-me'. Other fields are empty.
- Firewall Rule <80> (Right):** Shows the 'Action' tab with 'Action' set to 'drop'.

LAB – Block content

Kita akan block akses dari LAN ke situs tertentu, misalnya situs yang mengandung kata “porno”, tapi porno dalam hal ini kita ganti kata “mikrotik”



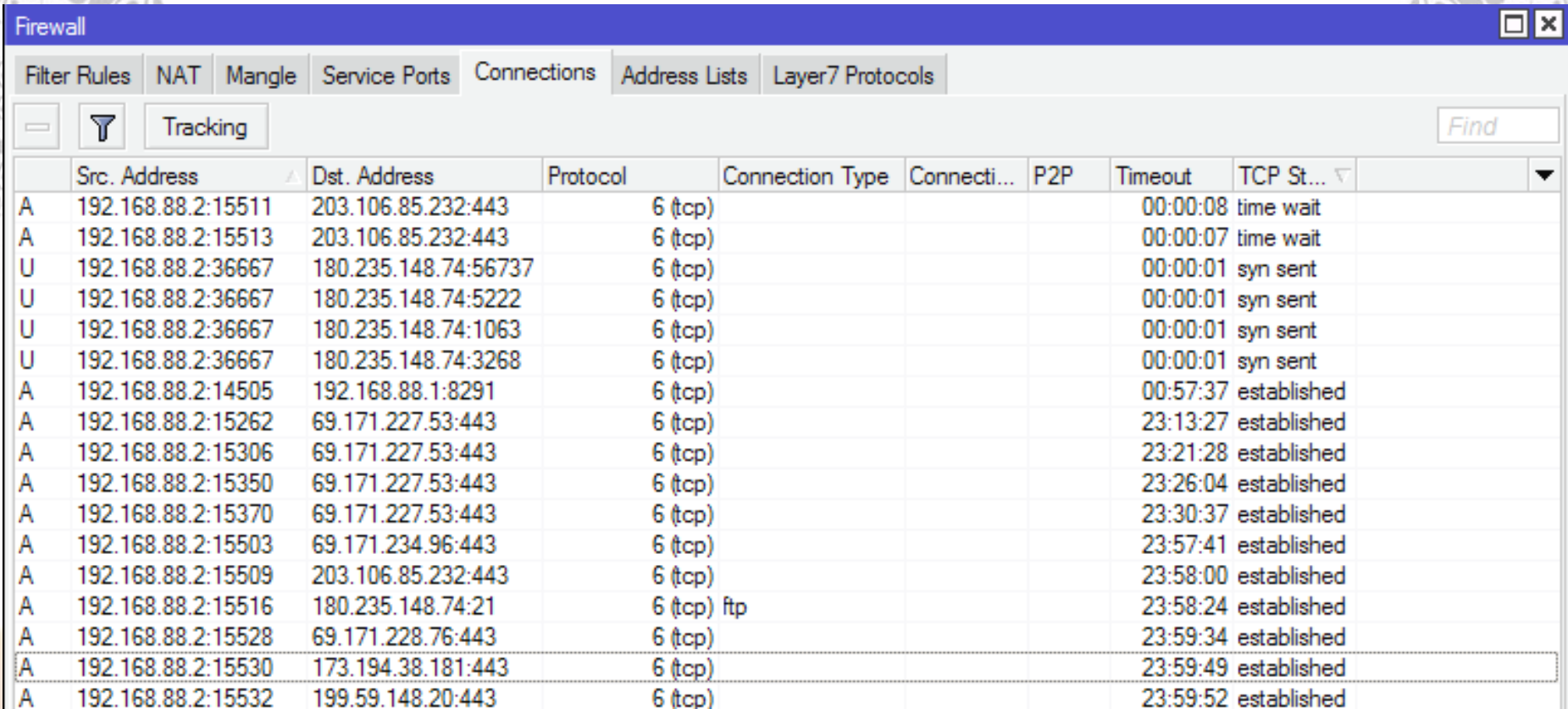
LAB – Block content

IP Firewall Filter Rule

Add chain=forward content=mikrotik action=drop

The image displays three overlapping screenshots of the Mikrotik WinBox Firewall Rule configuration interface. The top-left screenshot shows the 'General' tab with 'Chain' set to 'forward'. The middle screenshot shows the 'Advanced' tab with 'Content' set to 'mikrotik'. The bottom-right screenshot shows the 'Action' tab with 'Action' set to 'drop'. The interface includes various input fields for source and destination addresses, ports, and protocols, as well as tabs for General, Advanced, Extra, Action, and Statistics.

Connection Tracking



The screenshot shows the Mikrotik WinBox Firewall interface. The 'Connections' tab is active, and the 'Tracking' filter is applied. The table below lists the tracked connections with columns for Src. Address, Dst. Address, Protocol, Connection Type, P2P, Timeout, and TCP State.

	Src. Address	Dst. Address	Protocol	Connection Type	P2P	Timeout	TCP St...
A	192.168.88.2:15511	203.106.85.232:443	6 (tcp)			00:00:08	time wait
A	192.168.88.2:15513	203.106.85.232:443	6 (tcp)			00:00:07	time wait
U	192.168.88.2:36667	180.235.148.74:56737	6 (tcp)			00:00:01	syn sent
U	192.168.88.2:36667	180.235.148.74:5222	6 (tcp)			00:00:01	syn sent
U	192.168.88.2:36667	180.235.148.74:1063	6 (tcp)			00:00:01	syn sent
U	192.168.88.2:36667	180.235.148.74:3268	6 (tcp)			00:00:01	syn sent
A	192.168.88.2:14505	192.168.88.1:8291	6 (tcp)			00:57:37	established
A	192.168.88.2:15262	69.171.227.53:443	6 (tcp)			23:13:27	established
A	192.168.88.2:15306	69.171.227.53:443	6 (tcp)			23:21:28	established
A	192.168.88.2:15350	69.171.227.53:443	6 (tcp)			23:26:04	established
A	192.168.88.2:15370	69.171.227.53:443	6 (tcp)			23:30:37	established
A	192.168.88.2:15503	69.171.234.96:443	6 (tcp)			23:57:41	established
A	192.168.88.2:15509	203.106.85.232:443	6 (tcp)			23:58:00	established
A	192.168.88.2:15516	180.235.148.74:21	6 (tcp) ftp			23:58:24	established
A	192.168.88.2:15528	69.171.228.76:443	6 (tcp)			23:59:34	established
A	192.168.88.2:15530	173.194.38.181:443	6 (tcp)			23:59:49	established
A	192.168.88.2:15532	199.59.148.20:443	6 (tcp)			23:59:52	established

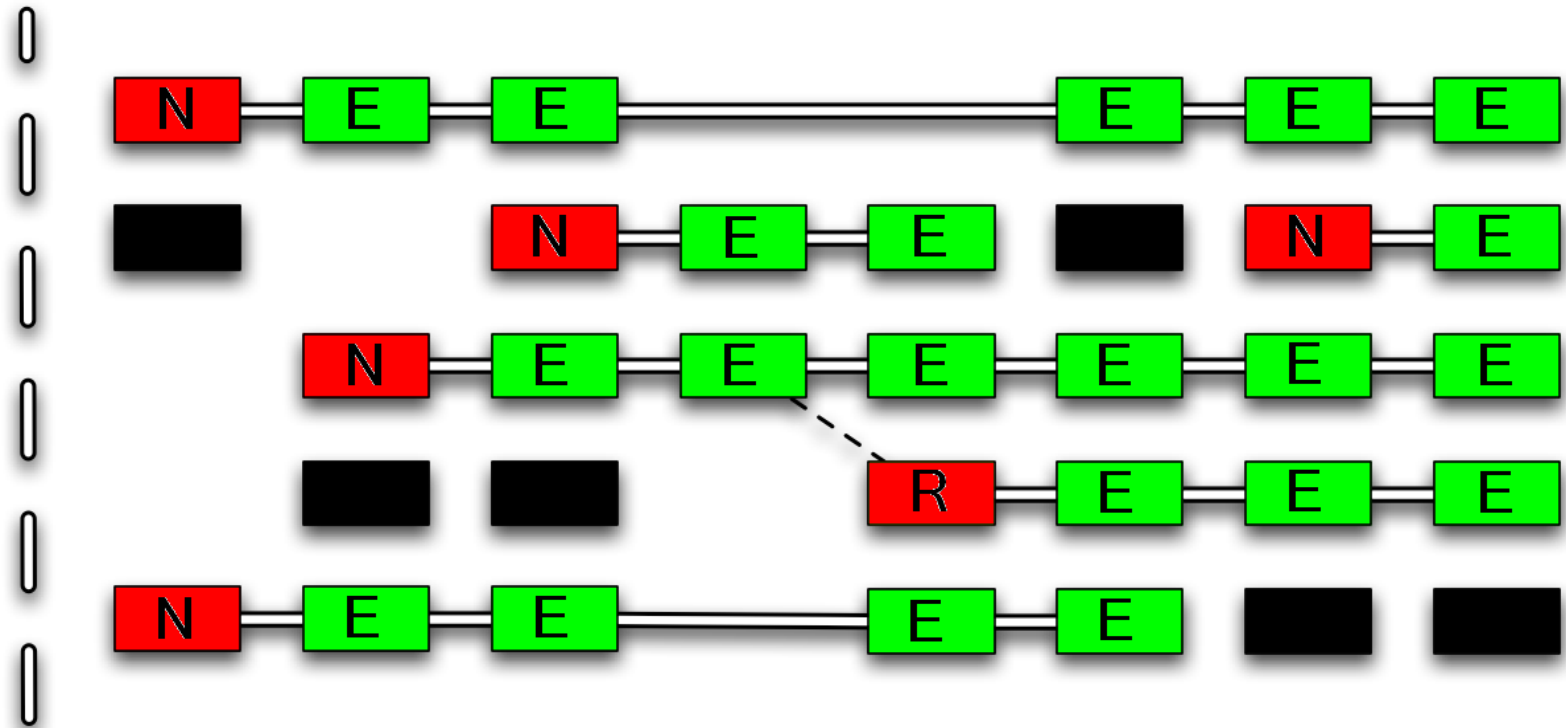


Connection Tracking

- Connection Tracking dapat dilihat pada menu IP>firewall>connection.
- Connection tracking mempunyai kemampuan untuk melihat informasi koneksi seperti source dan destination IP dan port yang sedang digunakan, status koneksi, tipe protocol, dll.
- Status koneksi pada connection tracking:
 - **established** = *the packet is part of already known connection,*
 - **new** = *the packet starts a new connection or belongs to a connection that has not seen packets in both directions yet,*
 - **related** = *the packet starts a new connection, but is associated with an existing connection, such as FTP data transfer or ICMP error message.*
 - **invalid** = *the packet does not belong to any known connection and, at the same time, does not open a valid new connection.*

Connection Tracking

Firewall



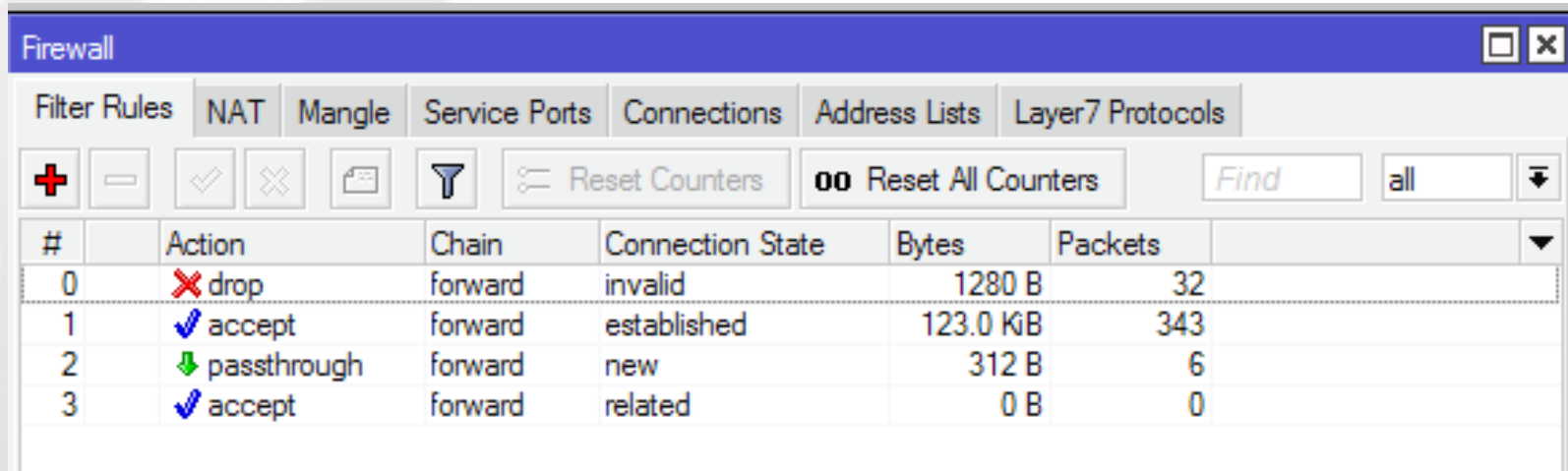
 invalid	 established
 new	 related

Implementasi Connection Tracking

- Pada saat membuat firewall, pada baris paling atas umumnya akan dibuat rule sebagai berikut:
 - Connection state invalid → Drop
 - Connection state established → Accept
 - Connection state related → Accept
 - Connection state new → Diproses ke rule berikutnya
- System rule ini akan sangat menghemat resource router, karena proses filtering selanjutnya akan dilakukan ketika koneksi dimulai (connection state = new)

LAB – Buatlah Firewall untuk Connection State

- Pada IP>Firewall>Filter Rule buat chain
- Chain Foward
 - Connection state invalid → action Drop
 - Connection state established → action Accept
 - Connection state related → action Accept
 - Connection state new → action pass-through

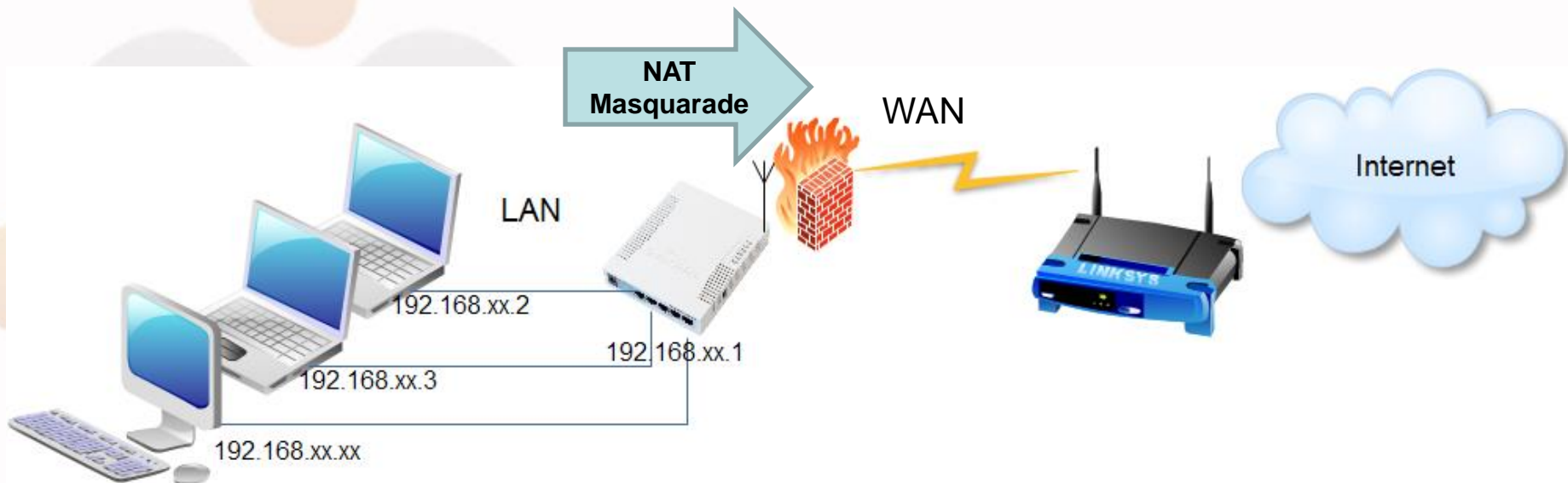


The screenshot shows the Mikrotik WinBox Firewall configuration interface. The 'Connections' tab is active, displaying a table of connection states. The table has columns for #, Action, Chain, Connection State, Bytes, and Packets. The data is as follows:

#	Action	Chain	Connection State	Bytes	Packets
0	drop	forward	invalid	1280 B	32
1	accept	forward	established	123.0 KB	343
2	passthrough	forward	new	312 B	6
3	accept	forward	related	0 B	0

NAT - Masquarade

- NAT adalah suatu metode untuk menghubungkan banyak komputer ke jaringan internet dengan menggunakan satu atau lebih alamat IP.
- NAT digunakan karena ketersediaan alamat IP public.
- NAT juga digunakan untuk alasan keamanan (security), kemudahan dan fleksibilitas dalam administrasi jaringan.



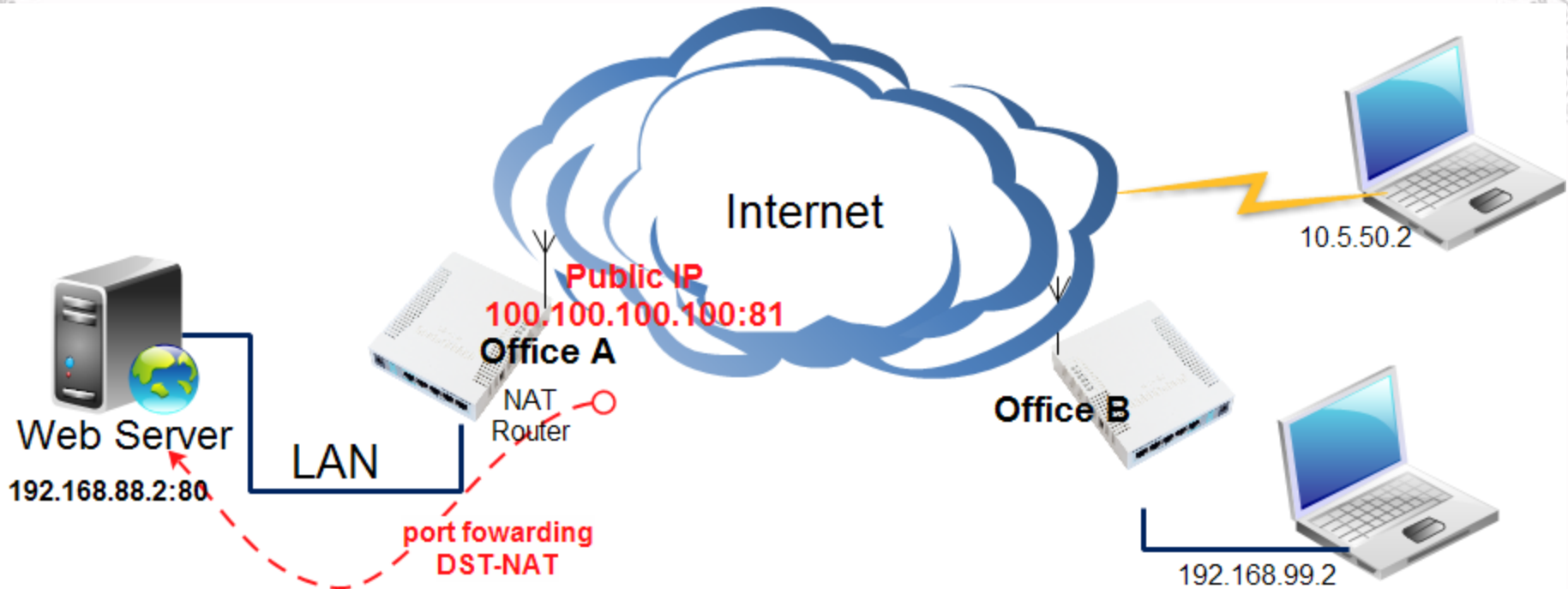
NAT

Chain pada IP Firewall NAT

- 1. srcnat**, dengan action yang diperbolehkan:
 1. Masquarade – subnet LAN to 1 dinamic IP WAN
 2. Src-nat – subnet LAN to 1 static IP WAN

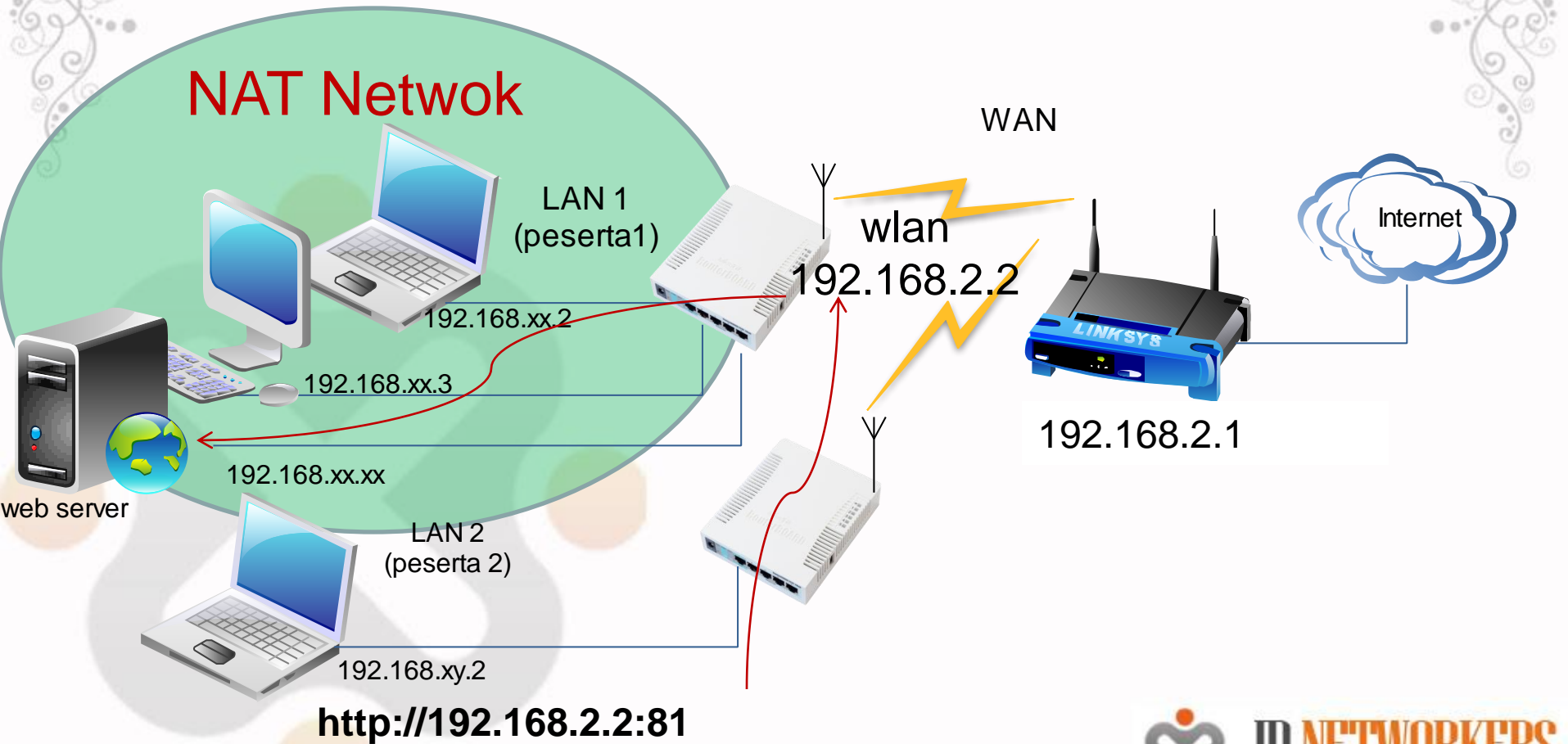
- 2. dsnat** (port fowarding), dengan action yang diperbolehkan:
 1. Dst-nat – membelokkan traffik ke luar router
 2. Redirect – membelokkan traffik ke router sendiri

DSTNAT



LAB- DstNAT

Redirect port http IP WAN router ke IP web server lokal (LAN)



LAB – Dst-nat Web Server

- Install dan Jalankan program web server di laptop
- Buat rule pada IP>Firewall>NAT untuk redirect port 81 router ke IP laptop dan port 80.

The image shows two overlapping screenshots of the Mikrotik WinBox NAT Rule configuration interface. The left screenshot shows the 'General' tab with the following settings: Chain: dstnat, Action: dst-nat, Protocol: 6 (tcp), Dst. Port: 81, In. Interface: wlan1. The right screenshot shows the 'Advanced' tab with the following settings: Action: dst-nat, To Addresses: 192.168.88.2 (highlighted with a red box and labeled 'IP web server (laptop)'), and To Ports: 80.

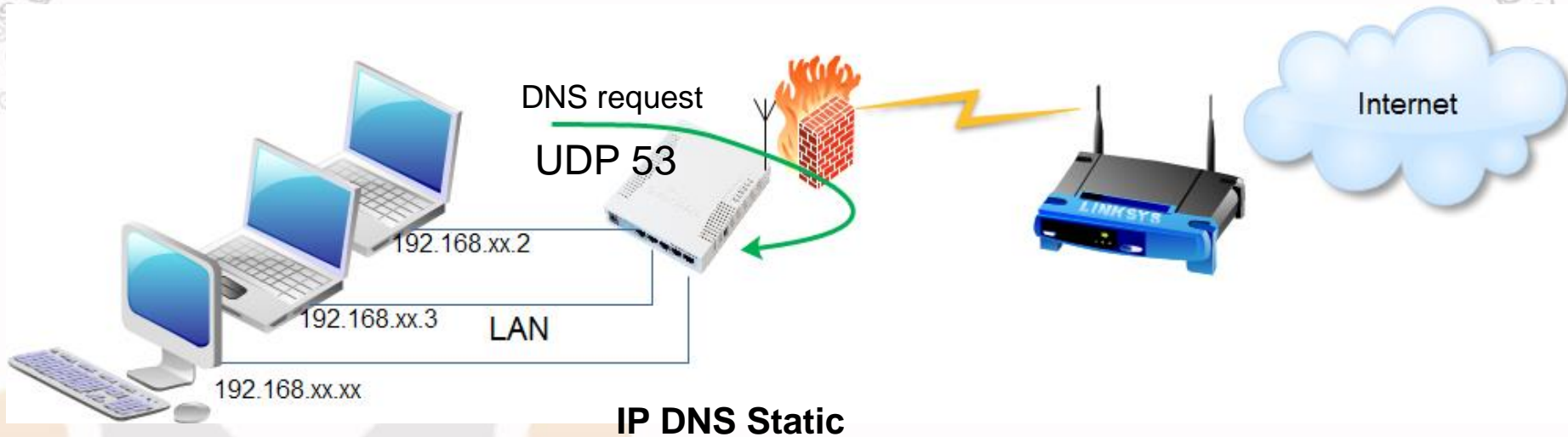
- Coba dengan `http://<ip wlan router>:81` dari laptop peserta lain

DNS

- DNS (Domain Name System) berfungsi untuk menterjemahkan nama domain menjadi IP address.
- Kita lebih mudah mengingat nama domain (detik.com) dibanding dengan IP addressnya (203.190.241.43).
- DNS memiliki database/cache alamat domain dan IP address yang diperoleh dari primary DNS di atasnya.
- Client yang menggunakan DNS server akan menggunakan cache tersebut.
- Pada periode tertentu chache akan diperbaharui mengambil dari DNS server di atasnya.

LAB - Static DNS

- Paksa semua client menggunakan DNS pada router dengan port forwarding (dst-nat)
- Siapkan content warning (web server dengan tampilan index warning)
- Tambahkan static DNS yang ingin difilter



Domain	IP
Kompas.com	192.168.88.10
www.kompas.com	192.168.88.10

LAB – Transparent Static DNS

- Kita dapat memanipulasi cache DNS yang ada dengan static entry pada tabel DNS.
- Misal apabila kita ping atau akses domain kompas.com maka akan direply oleh IP address yang bukan milik kompas, diubah dengan IP yang kita tentukan sendiri
- Caranya adalah sebagai berikut:
 - Set agar router kita menjadi DNS server
 - Set Primary DNS di router kita
 - Set static DNS untuk domain yang ingin kita buat static
 - Buat rule dst-nat agar setiap traffik DNS dibelokkan ke router kita

LAB - Static DNS

Mengaktifkan DNS cache dan membuat static DNS

admin@192.168.2.1 (MikroTik) - WinBox v5.24 on RB751U-2HnD (mipsbe)

The screenshot shows the MikroTik WinBox interface with the following configurations:

- Left Menu:** The 'IP' menu is highlighted, and the 'DNS' option is selected.
- DNS Settings:**
 - Servers: 8.8.8.8
 - Dynamic Servers: 192.168.2.1
 - Allow Remote Requests
 - Max UDP Packet Size: 4096
 - Cache Size: 2048 KB
 - Cache Used: 16
- DNS Static:**
 - Buttons: +, -, ✓, ✗, Filter
 - Table:

#	Name	Address	TTL (s)
0	kompas.com	192.168.88.10	1d 00:00:00
1	www.kompas.com	192.168.88.10	1d 00:00:00
- DNS Static Entry (popup):**
 - Name: kompas.com
 - Address: 192.168.88.10
 - TTL: 1d 00:00:00 s

LAB - Static DNS

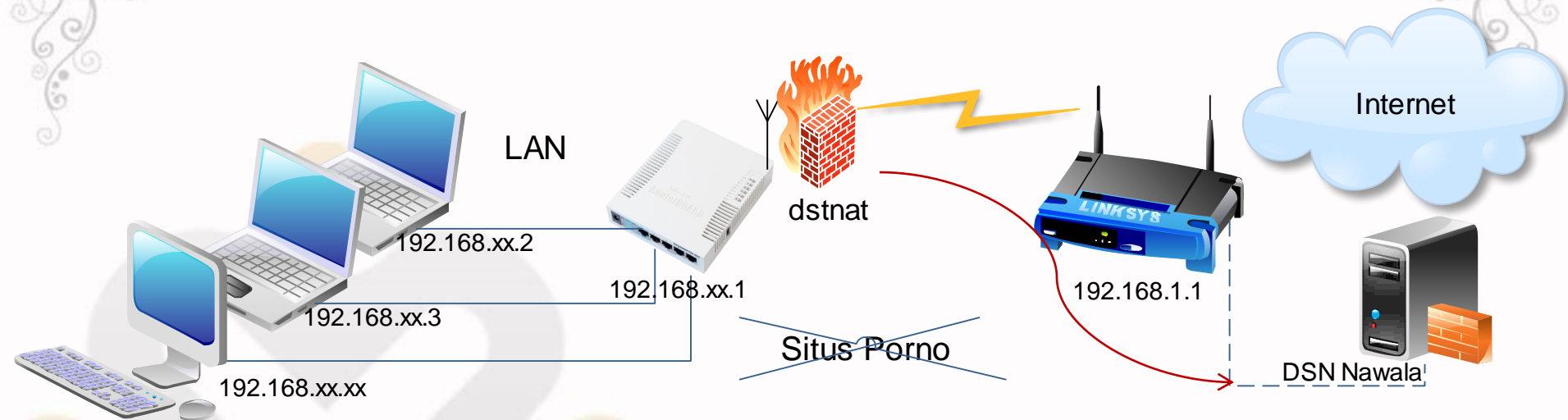
- Memaksa traffic dns request dari client untuk ke router

The screenshot displays the Mikrotik WinBox interface for configuring a NAT rule. The left sidebar shows the 'IP' menu selected, with 'Firewall' highlighted. The main window shows the 'Firewall' configuration page with the 'NAT' tab active. A new NAT rule is being created, with the following configuration:

- Chain: dstnat
- Protocol: 17 (udp)
- Dst. Port: 53
- Action: redirect
- To Ports: 53

LAB-Transparent DNS Nawala

- Kita akan melakukan block situs porno dengan transparent DNS Nawala



LAB – Transparent DNS Nawala

- Transparent DNS memaksa user untuk akses DNS server tertentu
- Buatlah rule baru pada menu IP>Firewall>NAT , redirect protocol TCP dan UDP port 53 ke IP port DNS Nawala **180.131.144.144**, atau bisa juga ke DNS Norton **199.85.127.30**

NAT Rule <53>

General Advanced Extra Action Statistics

Chain: dstnat

Src. Address:

Dst. Address:

Protocol: 17 (udp)

Src. Port:

Dst. Port: 53

NAT Rule <53>

General Advanced Extra Action Statistics

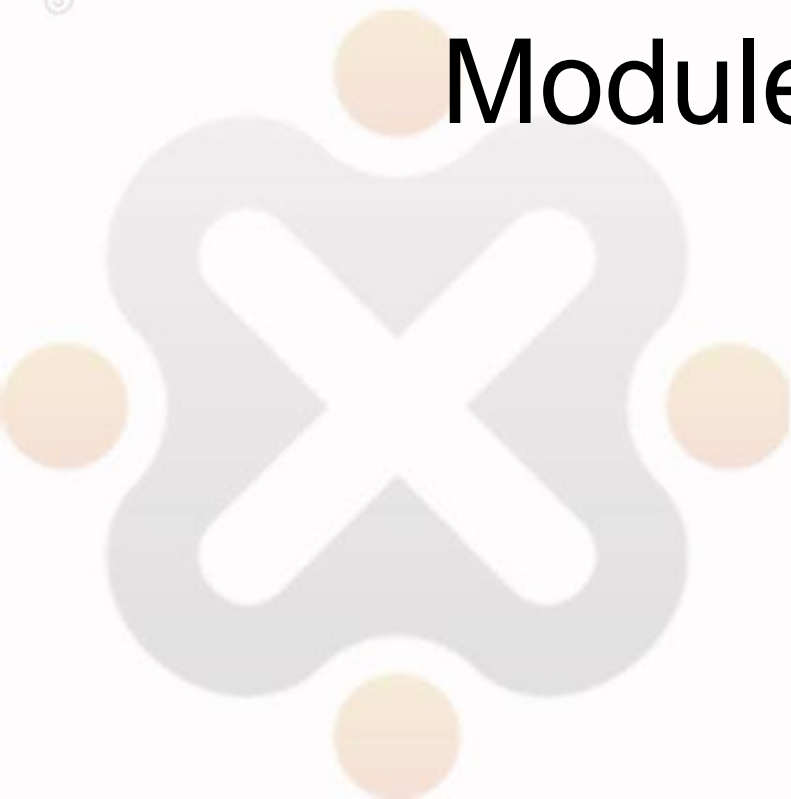
Action: dst-nat

To Addresses: 180.131.144.144

To Ports: 53



Module 3 - Wireless



ID NETWORKERS
Expert Trainer & Consultant

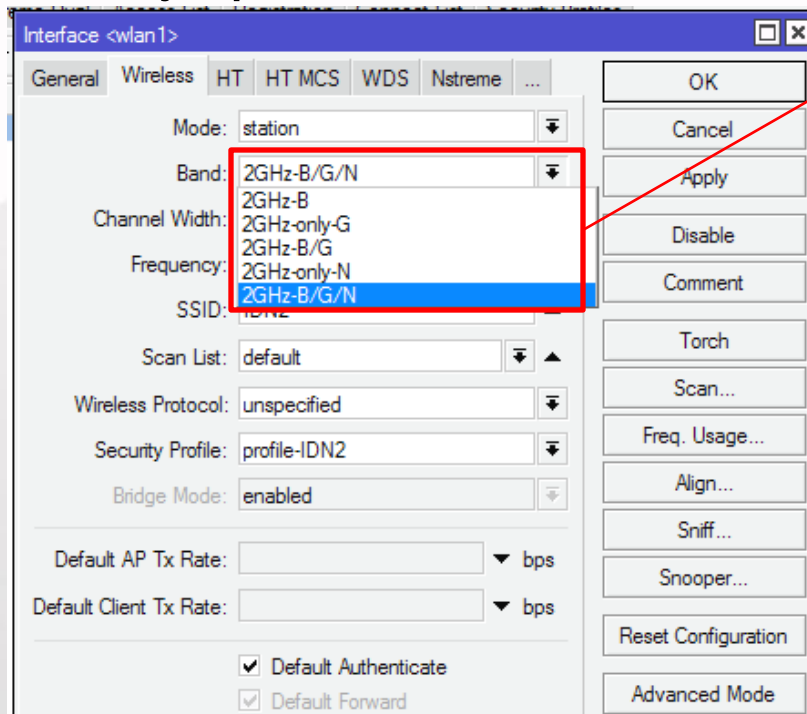
Wireless pada Mikrotik

- RouterOS mendukung beberapa modul radio (wireless card) untuk jaringan WLAN atau Wi-Fi (Wireless Fidelity).
- Wi-Fi memiliki standar & spesifikasi IEEE 802.11 dan menggunakan frekuensi 2,4GHz dan 5,8GHz.
- MikroTik mendukung standar IEEE 802.11a/b/g/n
 - 802.11a – frekuensi 5GHz, 54Mbps.
 - 802.11b – frekuensi 2,4GHz, 11 Mbps.
 - 802.11g – frekuensi 2,4GHz, 54Mbps.
 - 802.11n (Level 4 keatas) – frekuensi 2,4GHz atau 5GHz, 300Mbps



Wireless Band

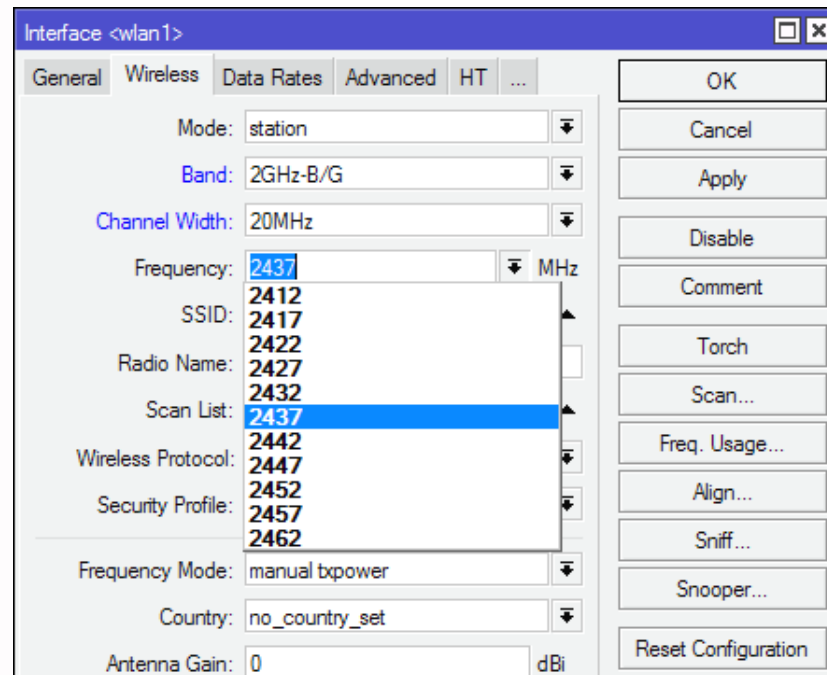
- Band merupakan mode kerja frekuensi dari suatu perangkat wireless.
- Untuk menghubungkan 2 perangkat, keduanya harus bekerja pada band frekuensi yang sama



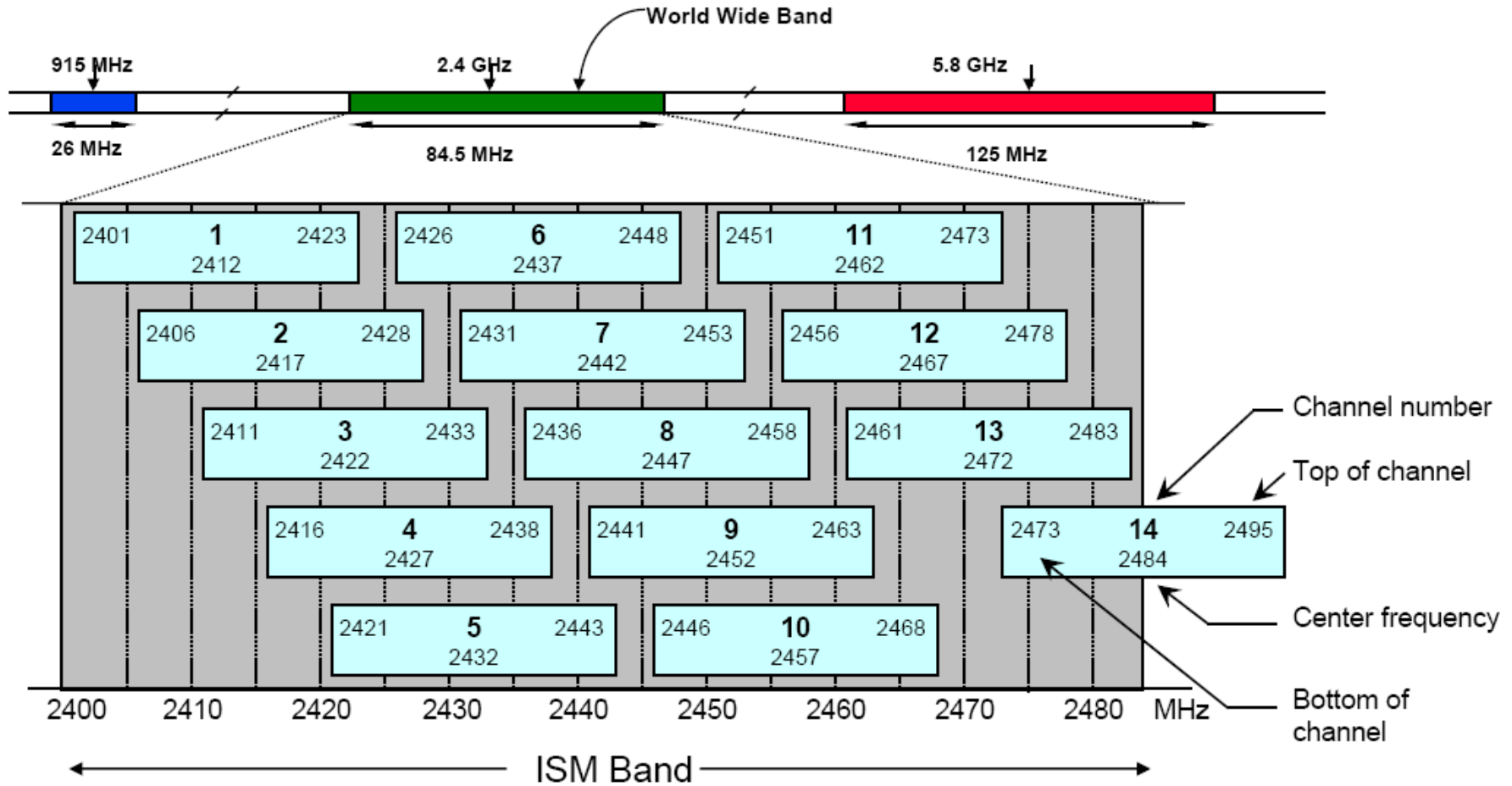
Band yang ada di list, bergantung pada jenis wireless card yang digunakan.

Wireless – Frequency Channel

- Frequency channel adalah pembagian frekuensi dalam suatu band dimana Access Point (AP) beroperasi.
- Nilai-nilai channel bergantung pada band yang dipilih, **kemampuan wireless card**, dan **aturan/regulasi frekuensi suatu negara**.
- Range frequency channel untuk masing-masing band adalah sbb:
 - 2,4Ghz = 2412 s/d 2499MHz
 - 5GHz = 4920 s/d 6100MHz

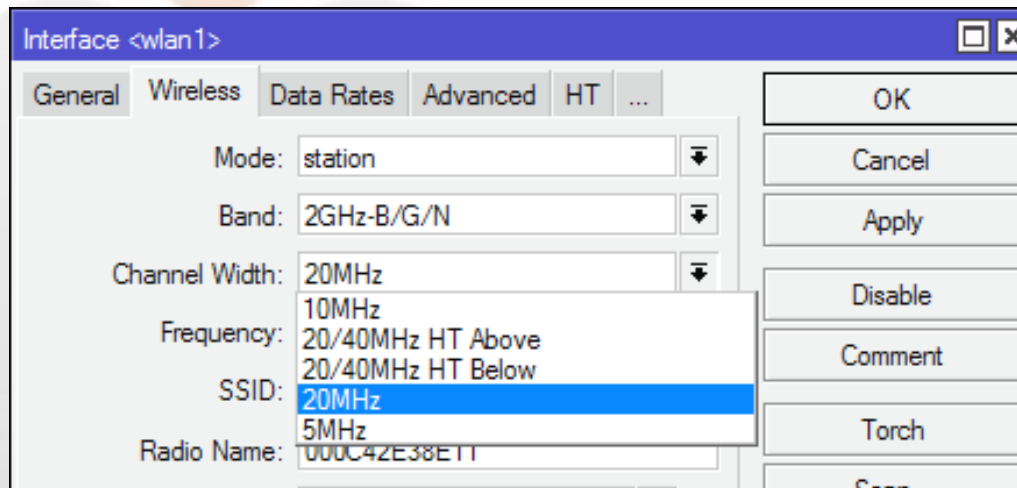


802.11 b/g Channels



Wireless – Lebar Channel

- Lebar channel adalah rentang frekuensi batas bawah dan batas atas dalam 1 channel.
- MikroTik dapat mengatur berapa lebar channel yang akan digunakan.
- Default lebar channel yang digunakan adalah 20Mhz (ditulis 20MHz).
- Lebar channel dapat dikecilkan (5MHz) untuk meminimasil frekuensi, atau dibesarkan (40MHz) untuk mendapatkan trougthput yang lebih besar.

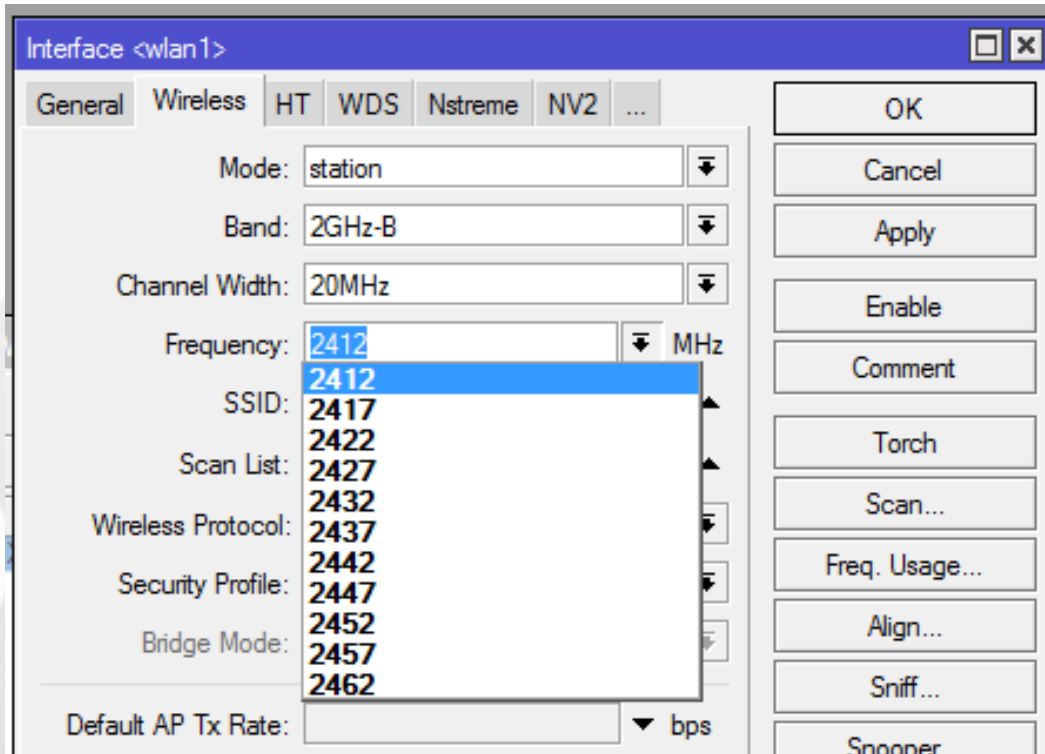


Wireless – Regulasi Frekuensi

- Setiap negara memiliki regulasi tertentu dalam hal frekuensi wireless untuk internet carrier.
- Indonesia telah merdeka untuk menggunakan frekuensi 2.4GHz berdasarkan KEPMENHUB No. 2/2005 berkat perjuangan para penggerak internet sejak tahun 2001
- Regulasi tersebut dalam mikrotik didefinisikan pada bagian Wireless “country-regulation”.
- Namun apabila diinginkan untuk membuka semua frekuensi yang dapat digunakan oleh wireless card, dapat menggunakan pilihan “**superchannel**”.

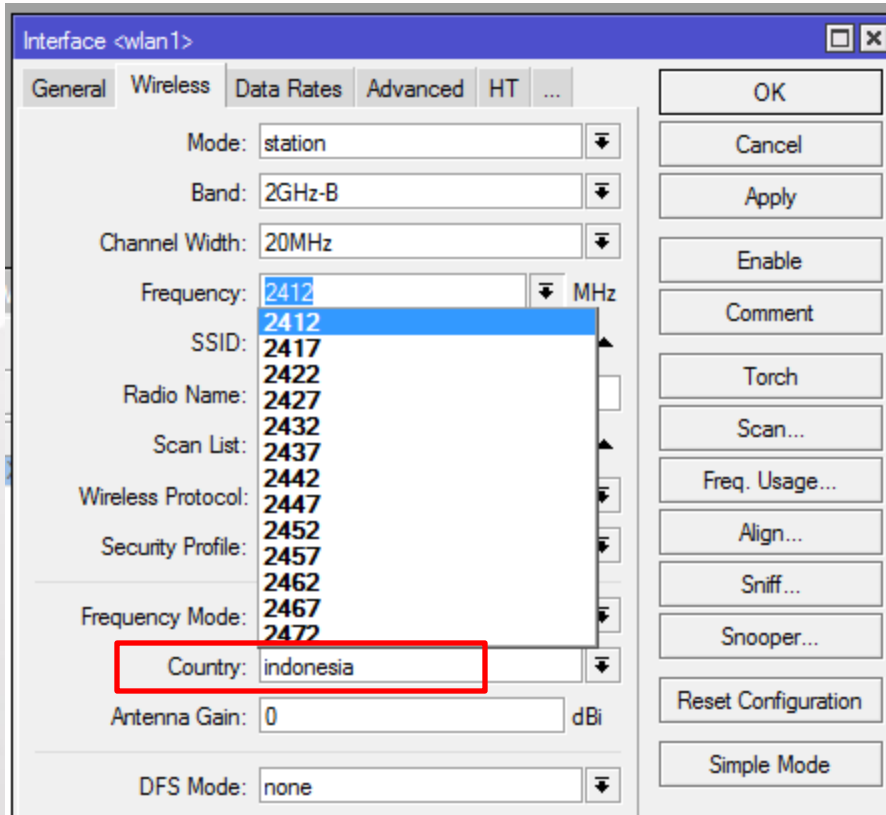
LAB-Regulasi Frekuensi

- Ada berapa channel frekuensi default MikroTik?
- Lihatnya di menu Wireless Wlan1 Wireless



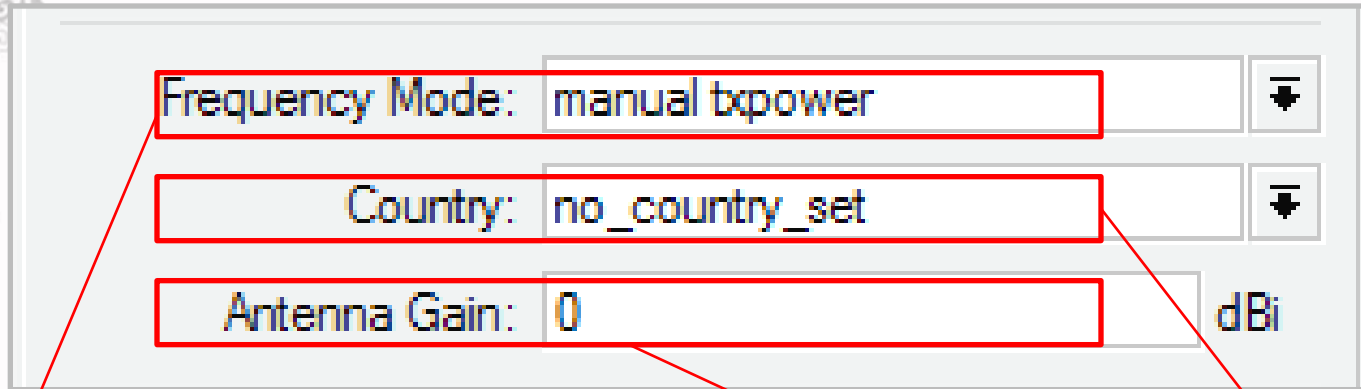
LAB-Regulasi Frekuensi

- Ada berapa channel frekuensi untuk country regulation Indonesia?
- Lihatnya di menu Wireless Wlan1 Wireless Advanced Mode



Coba ganti Frekuensi
Mode = Superchannel

LAB-Regulasi Frekuensi



The screenshot shows a configuration window with three input fields, each highlighted with a red border. The first field is labeled 'Frequency Mode:' and contains the text 'manual txpower'. The second field is labeled 'Country:' and contains the text 'no_country_set'. The third field is labeled 'Antenna Gain:' and contains the text '0', with 'dBi' written to its right. Each field has a dropdown arrow on its right side.

Frequency Mode

1. manual-tx-power
Transmit power diatur manual (tidak menyesuaikan dengan negara tertentu).
2. regulation-domain
Frekuensi channel disesuaikan dengan frekuensi-frekuensi yang diijinkan di suatu negara.
3. Superchannel
Membuka semua frekuensi yang bisa disupport oleh wireless card

Pemilihan Country / Negara

Default 0, akan otomatis menyesuaikan agar tidak melebihi EIRP country regulation

Konsep Koneksi Wireless

- Kesesuaian Mode: (AP-Station, AP-Repeater, Repeater-Repeater)
- Kesesuaian BAND
- Kesesuaian SSID
- Kesesuaian enkripsi dan autentifikasi
- Frekuensi channel tidak perlu sama, station secara otomatis akan mengikuti channel frekuensi pada AP.

Mode Interface Wireless

- Aligement Only
- AP Bridge
- Bridge
- Nstream dual slave
- Station
- Station bridge
- Station pseudobridge
- Station pseudobridge clone
- Station wds
- Wds slave

Interface <wlan1>

General Wireless Data Rates Advanced HT ...

Mode: station
alignment only
ap bridge
bridge
Channel Width: nstream dual slave
station
Frequency: station bridge
station pseudobridge
station pseudobridge clone
SSID: station wds
wds slave
Radio Name:
Scan List: default
Wireless Protocol: unspecified
Security Profile: profile-IDN2
Frequency Mode: manual txpower
Country: no_country_set
Antenna Gain: 0 dBi
DFS Mode: none
Proprietary Extensions: post-2.9.25
WMM Support: disabled
Bridge Mode: enabled
Default AP Tx Rate: bps
Default Client Tx Rate: bps
 Default Authenticate
 Default Forward

OK
Cancel
Apply
Disable
Comment
Torch
Scan...
Freq. Usage...
Align...
Sniff...
Snooper...
Reset Configuration
Simple Mode

Mode Interface Wireless

AP Mode

- **AP-bridge** – wireless difungsikan sebagai Akses Poin.
- **Bridge** - hampir sama dengan AP-bridge, namun hanya bisa dikoneksi oleh 1 station/client, mode ini biasanya digunakan untuk point-to-point.

Station Mode

- **Station** – scan dan content AP dengan frekuensi & SSID yang sama, mode ini TIDAK DAPAT di BRIDGE
- **Station-bridge** – sama seperti station, mode ini adalah MikroTik proprietary. Mode untuk L2 bridging, selain wds.
- **Station-wds** – sama seperti station, namun membentuk koneksi WDS dengan AP yang menjalankan WDS.
- **station-pseudobridge** – sama seperti *station*, dengan tambahan MAC address translation untuk bridge.
- **station-pseudobridge-clone** – Sama seperti *station-pseudobridge*, menggunakan **station-bridge-clone-mac** address untuk konek ke AP.

Interface Wireless Mode

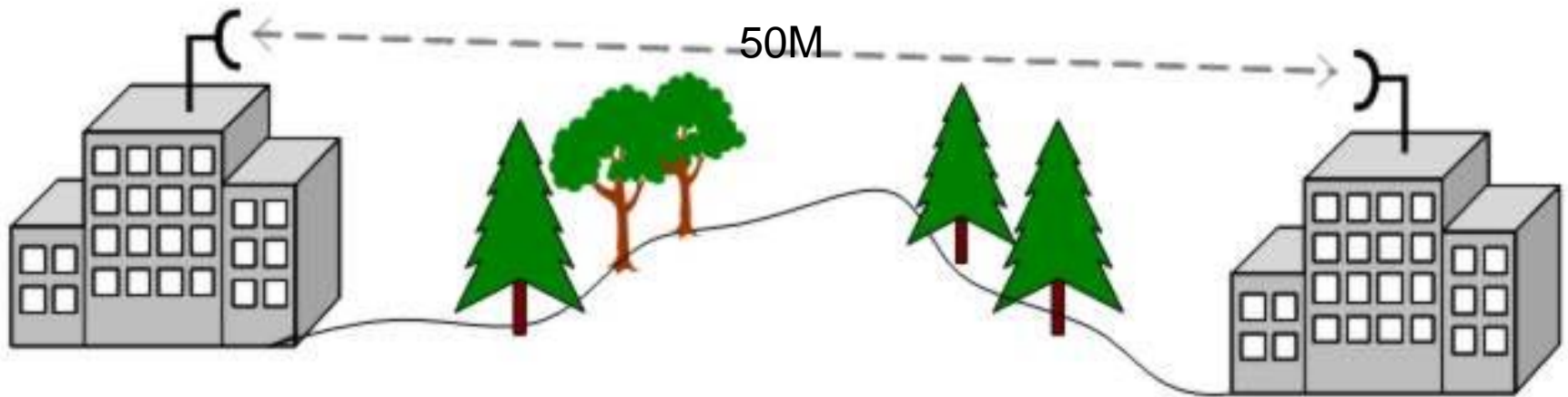
Special Mode

- **alignment-only** – mode transmit secara terus-menerus digunakan untuk positioning antenna jarak jauh.
- **nstreme-dual-slave** – digunakan untuk sistem nstreme-dual.
- **WDS-slave** - Sama seperti ap-bridge, namun melakukan scan ke AP dengan SSID yang sama dan melakukan koneksi dengan WDS. Apabila link terputus, akan melanjutkan scanning.

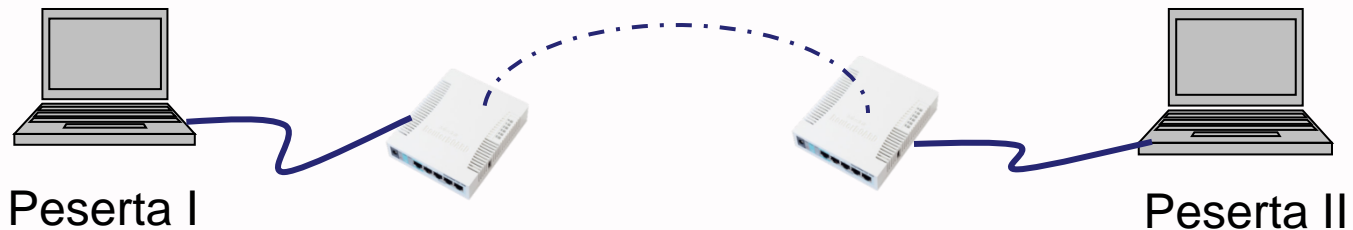


LAB – Wireless AP & Station

- Buatlah link point to point untuk melewati bandwith minimal 10M



LAB – Wireless AP & Station



Konfigurasi	Peserta I	Peserta II
Mode	AP-Bridge/Bridge	Station
Band	Samakan	
SSID	Samakan (unik untuk tiap pasangan)	
Frequensi	Pilih	Tidak harus sama
Security Profile	Samakan	
IP address wlan1	10.10.10.1/24	10.10.10.2/24

LAB – Wireless AP & Station

- Satu peserta menjadi Access Point, satunya menjadi Station (wireless mode)
- Samakan SSID, band dan security profile.
- Setting IP Address interface wlan:
IP AP= 10.10.10.1/24
IP station = 10.10.10.2/24
- Pastikan koneksi wireless (layer 1) terhubung, baru dapat dilakukan ping antar IP (layer 3)
- Lakukan ping dari masing-masing Mikrotik.
- Lakukan bandwidth test antar Mikrotik

Bandwidth Test

- Bandwidth test digunakan untuk mengukur seberapa besar link dapat mendeliver bandwidth
- Untuk menjamin keakuratan, Bandwidth test hanya dijalankan disatu sisi
- Test to = IP lawan kita
- User & password = user password router yang kita test

Bandwidth Test

Test To: 10.10.10.1

Protocol: udp tcp

Local UDP Tx Size: 1500

Remote UDP Tx Size: 1500

Direction: receive

TCP Connection Count: 20

Local Tx Speed: 0 bps

Remote Tx Speed: 0 bps

Random Data

User: admin

Password:

Lost Packets: 0

Tx/Rx Current: 0 bps/0 bps

Tx/Rx 10s Average: 0 bps/0 bps

Tx/Rx Total Average: 0 bps/0 bps

Start

Stop

Close

Tx:

Rx:

LAB – Wireless AP & Station

- Coba gantilah frekuensi untuk mendapatkan signal terbaik.

The screenshot shows the 'AP Client' configuration window for the MAC address <C0:C1:C0:E7:BC:F9>. The 'Signal' tab is selected. The 'Tx/Rx Signal Strength' is -57 dBm, and the 'Tx/Rx Signal Strength Ch0' is also -57 dBm. The 'Signal To Noise' is 44 dB, and the 'Tx/Rx CCQ' is 34%. The 'P Throughput' is 7813 kbps. A table at the bottom shows signal strengths for different rates:

Rate	Strength	Last Measured
1Mbps	-57	00:00:00.10
54Mbps	-56	00:00:55.82

Signal yang dikirim dan diterima oleh antenna

Client Connection Quality (CCQ) yaitu nilai yang menyatakan seberapa efektifkah kapasitas bandwidth yang dapat digunakan

Wireless Tools

- Ada beberapa tool dalam wireless MikroTik yang dapat digunakan untuk optimasi link.
 - **Scan** – untuk melihat informasi AP yang aktif, beserta SSID dan memudahkan untuk membuat koneksi ke AP aktif tersebut.
 - **Align** – untuk pointing antenna.
 - **Sniff** – untuk melihat lalu lintas paket data di jaringan.
 - **Snooper** – seperti tool scan, informasi AP yang aktif secara lengkap, SSID, channel yang digunakan, signal strength, utilisasi/traffic load dan jumlah station pada masing-masing AP.
 - **Bw Test** – digunakan untuk test bandwidth khusus untuk MikroTik, bw test dapat didownload di web resmi MikroTik.

LAB – Wireless Tools

- Gunakan tool Frequency Use dan Snooper untuk pemilihan channel yang optimum, serta lakukan bandwidth test.

Wireless Snooper

Interface: wlan1

Start
Stop
Close
New Window

Frequency (MHz)	Usage	Noise F...
2412	1.9	-101
2417	2.6	-102
2422	0.0	-102
2427	0.0	-102
2432	0.0	-101
2437	1.7	-100
2442	0.0	-101
2447	0.0	-99
2452	0.0	-103
2457	11.6	-103
2462	1.7	-103

Wireless Snooper

Interface: wlan1

Start
Stop
Close
Settings
New Window

all	Frequency	Band	Address	SSID	Signal	Of Freq. (%)	Of Traf. (%)	Bandwidth	Networks	Stations
	2412		00:15:00:35:D1:8C		-85	0.0	0.0	0 bps		
	2412	2GHz-N				0.0	0.0	0 bps	1	5
	2412	2GHz-N	F4:EC:38:C4:DE:D0	IDN2		0.0	0.0	0 bps		4
N	2...		00:1C:26:13:73:2F	IDN2	-28	0.0	0.0	0 bps		
	2...		F4:EC:38:C4:DE:D0	IDN2	-49	0.0	0.0	0 bps		
	2...		00:21:00:6C:64:79	IDN2	-54	0.0	0.0	0 bps		
	2...		C4:17:FE:3A:0D:1C	IDN2	-58	0.0	0.0	0 bps		
	2417	2GHz-N				1.3		11.7 kbps	0	0
	2422	2GHz-N				0.0		0 bps	0	0
	2427		70:1A:04:2C:BD:84		-89	0.0	0.0	0 bps		
	2427	2GHz-N				0.0		0 bps	0	1
	2432	2GHz-N				0.0		0 bps	0	0
	2437		D8:5D:4C:8E:DD:29		-86	0.0	0.0	0 bps		
	2437		00:22:5F:13:BF:ED		-92	0.0	0.0	0 bps		
	2437	2GHz-N				5.3		37.3 kbps	1	3
	2437	2GHz-N	C0:C1:C0:88:34:F0	PUBLICIS		4.2	79.6	37.3 kbps		1
N	2...		C0:C1:C0:88:34:F0	PUBLICIS	-91	4.2	79.6	37.3 kbps		
	2442	2GHz-N				0.8		6.0 kbps	1	1
	2442	2GHz-N	B0:48:7A:C5:BA:20	Praweda01a		0.8	100.0	6.0 kbps		1
N	2...		B0:48:7A:C5:BA:20	Praweda01a	-89	0.8	100.0	6.0 kbps		
	2447		00:26:FF:5B:32:90		-58	0.0	0.0	0 bps		
	2447	2GHz-N				0.0		0 bps	0	1
	2452	2GHz-N				0.0		0 bps	0	0
	2457	2GHz-N				2.2		18.4 kbps	1	1
	2457	2GHz-N	00:22:57:E2:19:70	Praweda03		2.2	100.0	18.4 kbps		1
N	2...		00:22:57:E2:19:70	Praweda03	-85	2.2	100.0	18.4 kbps		
	2462	2GHz-N				1.6		13.8 kbps	0	0

Wireless MAC Filtering

- **Access Point**, dapat dilakukan pembatasan hak akses dimana AP hanya dapat dikonek oleh station yang sudah kita tentukan.
- **Station**, juga dapat dilock agar terkoneksi dengan AP yg sudah ditentukan.
- Mac filtering AP ada di Access List
- Mac filtering Station ada di Connect List.



Access Point – Access List

- Access List pada Access Point, memfilter station mana saja yang boleh terkoneksi

Wireless Tables

Interfaces Nstreme Dual Access List Registration Connect List Security Profiles

Find

#	MAC Address	Interface	Signal Str...	Authentication	Forwarding
---	-------------	-----------	---------------	----------------	------------

New AP Access Rule

MAC Address: OK

Interface: all Cancel

Signal Strength Range: -120..120 Apply

AP Tx Limit: Disable

Client Tx Limit: Comment

Authentication Copy

Forwarding Remove

Private Key: none OX

Private Pre Shared Key:

Management Protection Key:

Time

MAC Address station yang ingin difilter

Batas nilai kekuatan signal dari station yang ingin difilter

Boleh konek atau tidak

Access Point – Default Authenticate

The screenshot shows a configuration interface for an Access Point. The 'Default Authenticate' checkbox is highlighted with a red box. Other visible settings include:

- SSID: IDN Mantab
- Radio Name: 000C42E38DED
- Scan List: default
- Wireless Protocol: unspecified
- Security Profile: profile1
- Frequency Mode: manual txpower
- Country: no_country_set
- Antenna Gain: 0 dBi
- DFS Mode: none
- Proprietary Extensions: post-2.9.25
- WMM Support: disabled
- Bridge Mode: enabled
- Default AP Tx Rate: [] bps
- Default Client Tx Rate: [] bps
- Default Authenticate:
- Default Forward:
- Hide SSID:

Access List dapat berfungsi apabila wireless default authenticate di non aktifkan (uncheck).

Artinya by default station tidak akan bisa konek ke AP apabila tidak di allow di Access List

Station – Connection List

- Pada wireless Station, Connect List membatasi AP mana saja yang boleh/tidak boleh terkoneksi

Wireless Tables

Interfaces Nstreme Dual Access List Registration Connect List Security Profiles

#	Interface	MAC Address	Connect	Area Prefix	Signal Str...
---	-----------	-------------	---------	-------------	---------------

New Station Connect Rule

Interface: wlan1

MAC Address:

Connect

SSID:

Area Prefix:

Signal Strength Range: -120..120

Wireless Protocol: any

Security Profile: default

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

0 items enabled

Interface radio yang difungsikan sebagai client

MAC address AP yang akan dikoneksikan.

Boleh / tidak boleh konek dengan MAC diatas

SSID yang ingin dikoneksikan, bila kosong berarti any AP.

Apabila menggunakan security profile, harus diapply di ruleConnect List

Registration List

- Pada Access Point dan Station, Registered List berisi data AP/station yang sedang terkoneksi.
- Untuk memudahkan filtering pada Access List dan Connection List, menggunakan menu “Copy to Access/Connect List”

The screenshot shows the Mikrotik WinBox interface. The 'Wireless Tables' window is open, displaying the 'Registration' tab. A table lists registered clients, with one entry selected. A red arrow points from the 'Registration' tab to the selected entry. A dialog box titled 'AP Client <F4:EC:38:C4:DE:D0>' is open, showing configuration details for the selected client. The 'Copy to Access List' and 'Copy to Connect List' buttons are highlighted with a red box.

Radio Name	MAC Address	Interface	Uptime	AP	W...	Last Activit...	Tx/Rx Signal ...	Tx/Rx Rate
	F4:EC:38:C4:DE:D0	wlan1	00:03:15	yes	no	10.040	-45	11.0Mbps...

AP Client <F4:EC:38:C4:DE:D0>

General 802.1x Signal Nstreme NV2 Statistics

Radio Name:

MAC Address: F4:EC:38:C4:DE:D0

Interface: wlan1

Uptime: 00:03:15

Distance: 2 km

RouterOS Version:

AP Tx Limit:

Client Tx Limit:

OK

Remove

Reset

Copy to Access List

Copy to Connect List

Ping

MAC Ping

Telnet

MAC Telnet

1 item (1 selected)

Default Authenticated

- Untuk menggunakan pilihan Connection List atau Access List baik pada AP atau Station Default Authenticated harus di uncheck.

Interface <wlan1>

General Wireless HT HT MCS WDS Nstreme ...

Mode: station

Band: 2GHz-B/G/N

Channel Width: 20MHz

Frequency: 2412 MHz

SSID: IDN2

Scan List: default

Wireless Protocol: unspecified

Security Profile: profile-IDN2

Bridge Mode: enabled

Default AP Tx Rate: bps

Default Client Tx Rate: bps

Default Authenticate

Default Forward

Hide SSID

OK Cancel Apply Disable Comment Torch Scan... Freq. Usage... Align... Sniff... Snooper... Reset Configuration Advanced Mode

Interface <wlan1>

General Wireless HT HT MCS WDS Nstreme ...

Mode: ap bridge

Band: 2GHz-B/G/N

Channel Width: 20MHz

Frequency: 2412 MHz

SSID: IDN3

Scan List: default

Wireless Protocol: unspecified

Security Profile: profile-IDN2

Bridge Mode: enabled

Default AP Tx Rate: bps

Default Client Tx Rate: bps

Default Authenticate

Default Forward

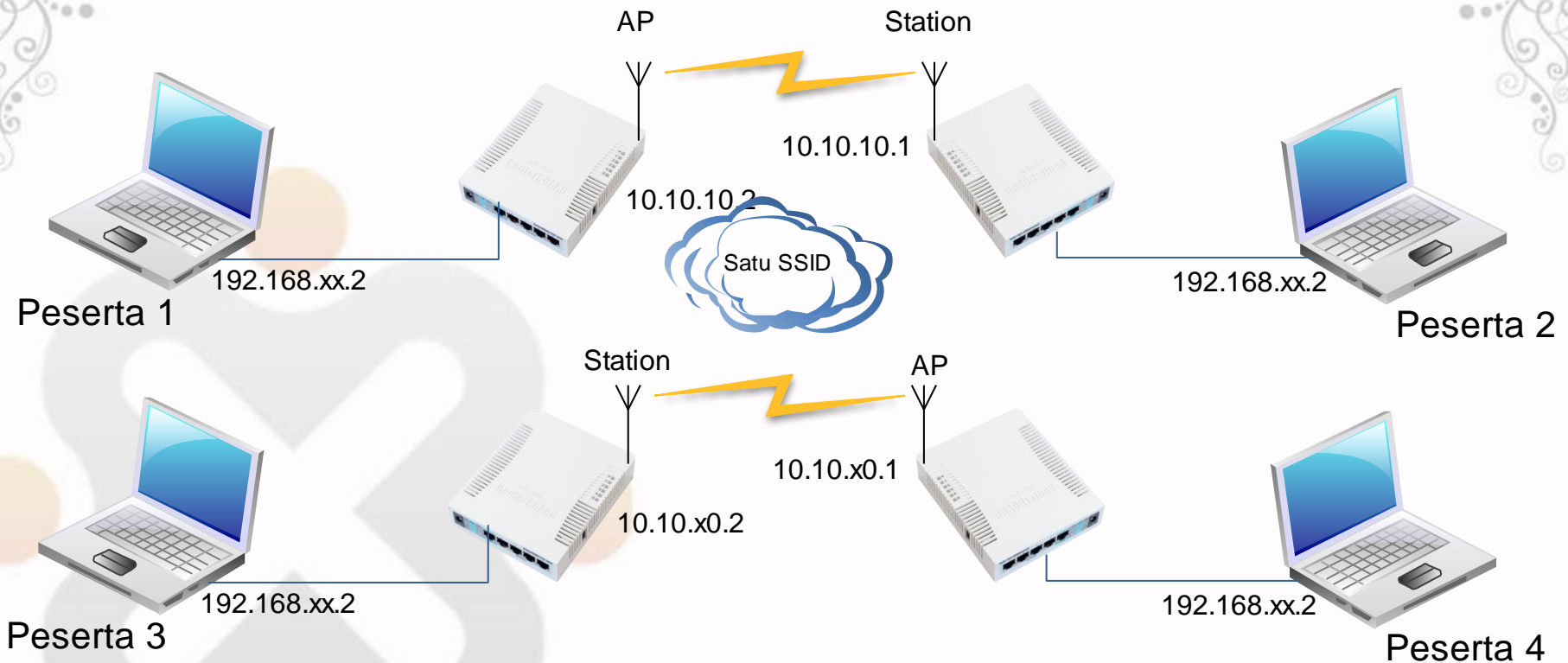
Hide SSID

OK Cancel Apply Disable Comment Torch Scan... Freq. Usage... Align... Sniff... Snooper... Reset Configuration Advanced Mode



LAB-Wireless Mac Filtering

Buatlah topologi AP-Station dengan SSID yang sama.



LAB – MAC Filtering

- Filter mac address agar koneksi point to point anda dengan partner tidak mudah dikacaukan oleh koneksi lain.
- Masukkan data mac address wireless partner ke list yang benar.
- Jika sebagai Station masukkan kedalam Connect-List, apabila sebagai AP masukkan dalam Access-List.
- Untuk setting wireless pada AP, default authenticate harus di-uncheck, agar tidak semua client bisa teraouthentikasi secara otomatis.
- Coba untuk konek ke AP yang bukan pasangan

Drop Koneksi Antar Client

- Default forward (hanya dapat diseting pada Access Point).
- Digunakan untuk mengizinkan/tidak komunikasi antar client/station yang terkoneksi dalam 1 Access Point.

Interface <wlan1>

General Wireless HT HT MCS WDS Nstreme ...

Mode: ap bridge

Band: 2GHz-B/G/N

Channel Width: 20MHz

Frequency: 2412 MHz

SSID: IDN3

Scan List: default

Wireless Protocol: unspecified

Security Profile: profile-IDN2

Bridge Mode: enabled

Default AP Tx Rate: bps

Default Client Tx Rate: bps

Default Authenticate

Default Forward

Hide SSID

OK

Cancel

Apply

Disable

Comment

Torch

Scan...

Freq. Usage...

Align...

Sniff...

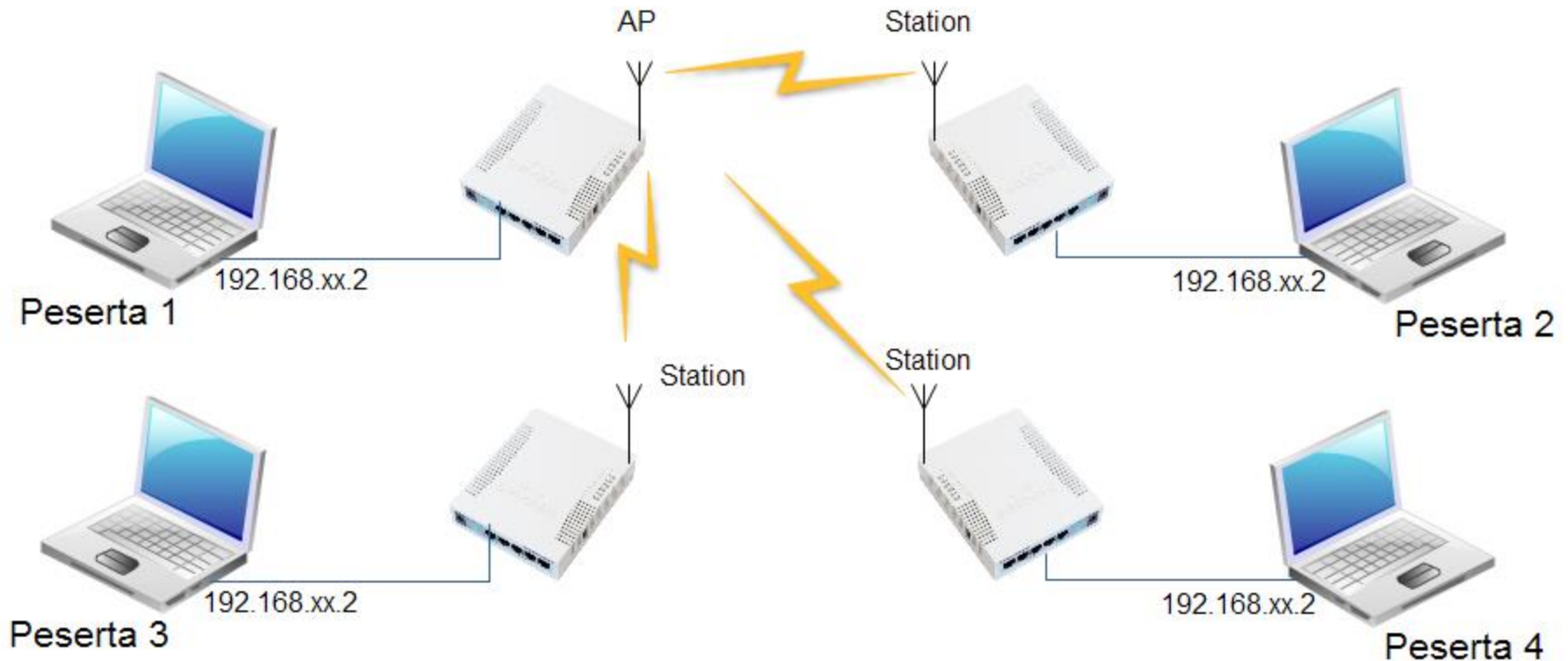
Snooper...

Reset Configuration

Advanced Mode

- Default forward biasanya didisable untuk alasan keamanan.
- Sesama station tidak dapat berkomunikasi, apabila default forward di uncheck

LAB – Default Forwarding



- Cobalah ping antar peserta ketika default forwarding check dan uncheck

Nstreme

- Nstreme adalah protocol wireless proprietary Mikrotik
- Meningkatkan performance link wireless jarak jauh.
- Untuk konek fitur Nstreme harus diaktifkan baik di sisi AP maupun station
- Konfigurasi Nstreme hanya di sisi AP, client hanya meng-enable-kan saja



LAB - Wireless Nstreme

Setting di AP

The screenshot displays the Mikrotik WinBox interface for configuring a wireless interface. The left sidebar shows a tree view with 'Wireless' selected. The main window shows the 'Wireless Tables' configuration for 'wlan1'. The 'Nstreme' tab is active, and the 'Enable Nstreme' checkbox is checked. The 'Framer Policy' is set to 'dynamic size' and the 'Framer Limit' is set to 500.

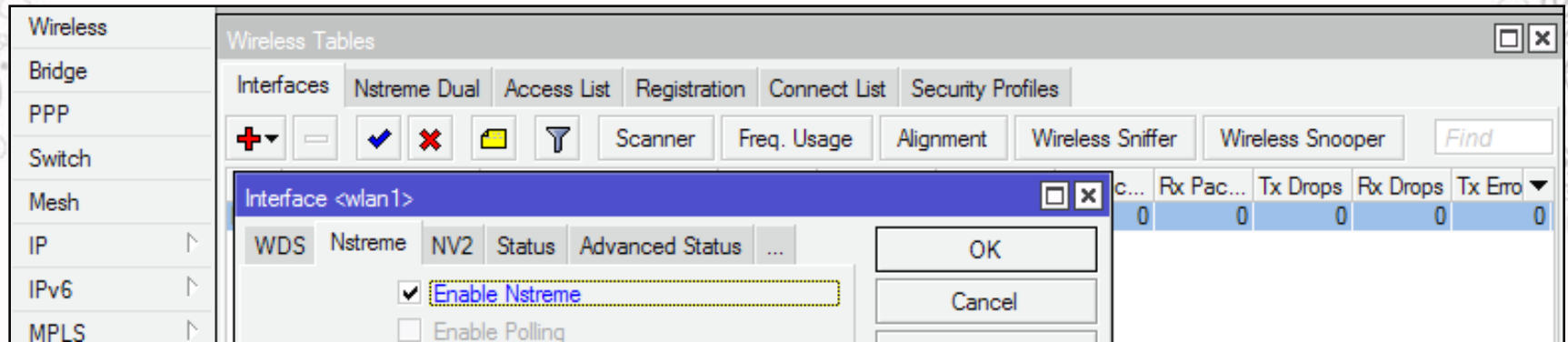
Name	Type	L2 MTU	Tx	Rx	Tx Pac...	Rx Pac...	Tx Drops
wlan1	Wireless (Atheros 11N)	2290	2.7 kbps	0 bps	1	0	0

Interface wlan1 configuration:

- HT MCS
- WDS
- Enable Nstreme
- Enable Polling
- Disable CSMA
- Framer Policy: dynamic size
- Framer Limit: 500

LAB - Wireless Nstreme

Setting di Station

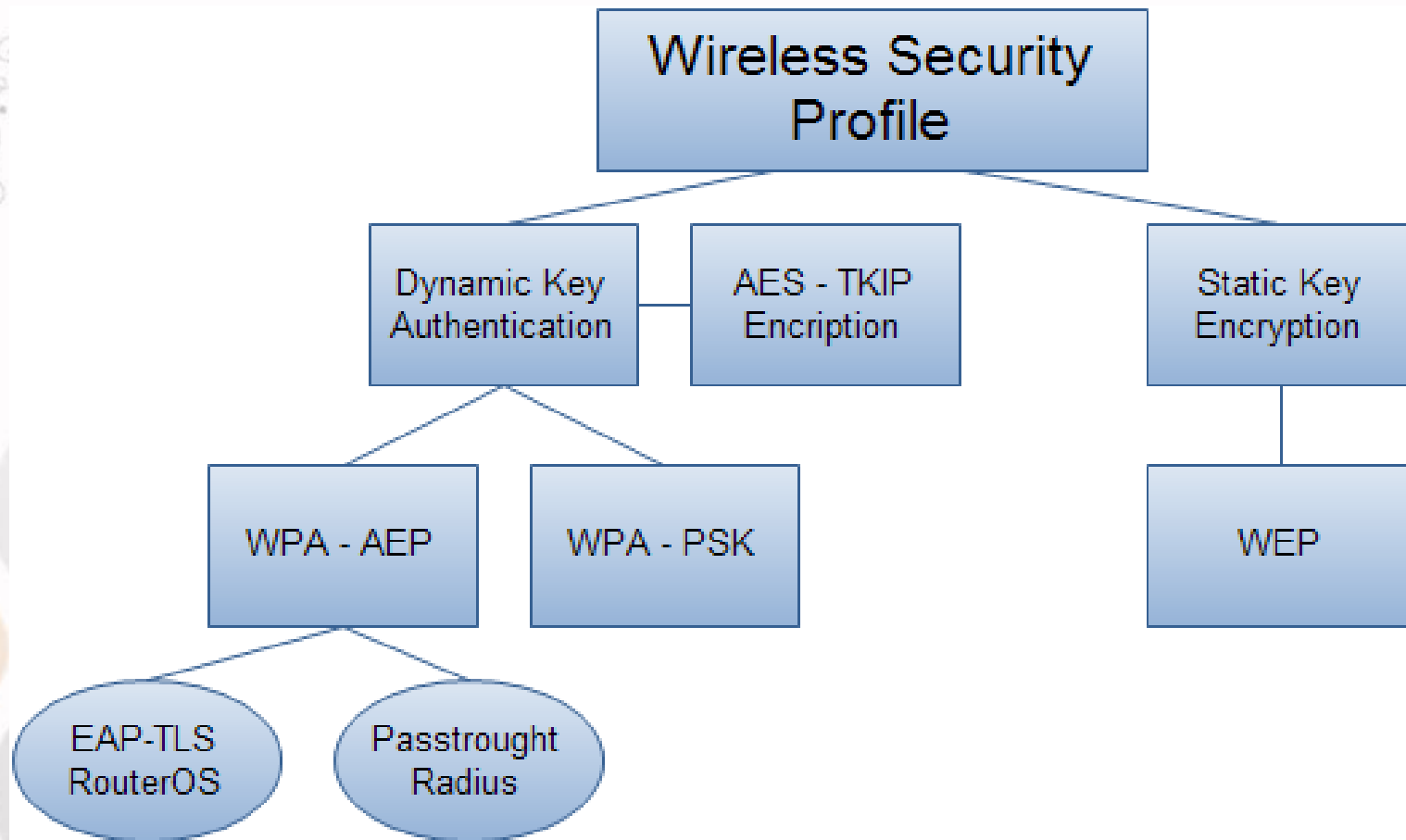


Cobalah konek dengan Laptop ke AP yang mengaktifkan feature nstream

Wireless Security

- Untuk pengamanan koneksi wireless, tidak hanya cukup dengan MAC-Filtering, karena data yang lewat ke jaringan bisa diambil dan dianalisa.
- Terdapat metode keamanan lain yang dapat digunakan yaitu:
 - Authentication (WPA-PSK, WPA-EAP)
 - Enkripsi (AES, TKIP, WEP)

Wireless Security



Wireless Encryption - WPA

- Pilihan wireless encryption terdapat pada menu Wireless>Security Profile.
- Security profile diberi nama tertentu untuk diimplementasikan dalam interface wireless.

The screenshot shows the 'Security Profile <profile-IDN2>' configuration window. It has tabs for 'General', 'RADIUS', 'EAP', and 'Static Keys'. The 'General' tab is active. The 'Name' field contains 'profile-IDN2'. The 'Mode' dropdown is set to 'dynamic keys'. Under 'Authentication Types', 'WPA PSK' and 'WPA2 PSK' are checked. Under 'Unicast Ciphers', 'tkip' and 'aes ccm' are checked. Under 'Group Ciphers', 'tkip' and 'aes ccm' are checked. At the bottom, there are fields for 'WPA Pre-Shared Key' and 'WPA2 Pre-Shared Key', both containing masked characters. On the right side of the window are buttons for 'OK', 'Cancel', 'Apply', 'Copy', and 'Remove'.

Dynamic key = WPA
Static Key = WEP (lama)

Jenis Authentifikasi

Model Enkripsi

Key Authentifikasi / password

Wireless Encryption

- Implementasi security profile

The image displays two side-by-side screenshots of a network configuration window for 'Interface <wlan1>'. Both windows have tabs for 'General', 'Wireless', 'HT', 'HT MCS', 'WDS', and 'Nstreme'. The left window is in 'ap bridge' mode, and the right window is in 'station' mode. In both, the 'Security Profile' dropdown menu is highlighted with a red box and contains the text 'profile-IDN2'. Red arrows originate from these boxes and point towards a text box at the bottom of the slide.

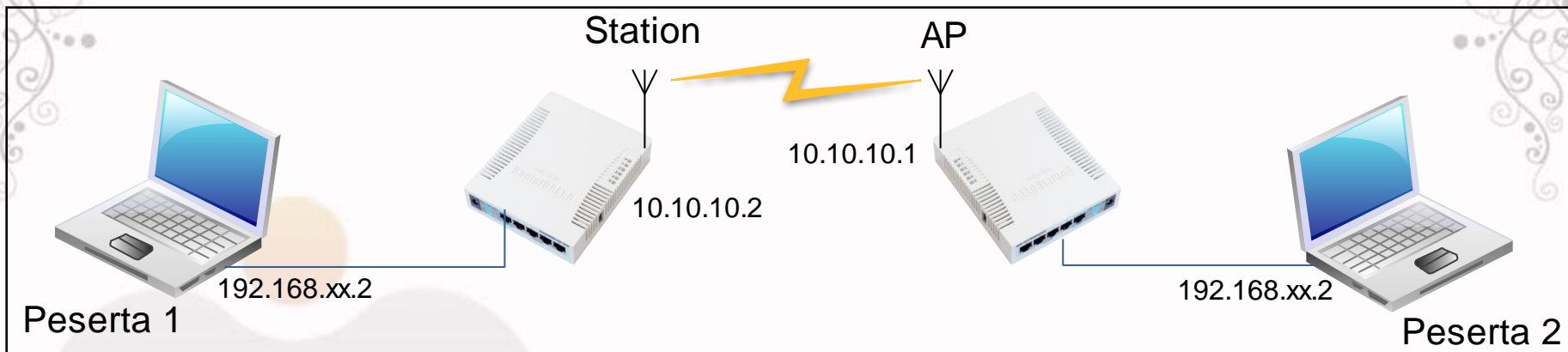
Pilih security profil yang telah kita buat sebelumnya baik di AP maupun Station

WEP Encryption

- WEP (Wired Equivalent Privacy) tipe wireless security yang pertama kali muncul dan masih sangat sederhana
- Tidak mempunyai authenticate method
- Not recommended as it is vulnerable to wireless hacking tools

LAB-WEP Encryption

- Buat koneksi AP-Station dengan pasangan anda.



- Create WEP security profile pada kedua sisi wlan (AP & station), samakan static keynya.
- Apply security profile tersebut pada interface wireless wlan1

LAB-WEP Encryption

Wireless Security Profile:
-Mode: static keys required
-Key 0 : 40 bit
-0x : 1234567890

Security Profile <wep>

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

Name: wep

Mode: static keys required

Authentication Types

WPA PSK WPA2 PSK

WPA EAP WPA2 EAP

Unicast Ciphers

tkip aes ccm

Group Ciphers

tkip aes ccm

WPA Pre-Shared Key:

WPA2 Pre-Shared Key:

Supplicant Identity:

Group Key Update: 00:05:00

Management Protection: allowed

Management Protection Key:

Security Profile <wep>

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

Key 0: 40bit wep 0x 1234567890

Key 1: none 0x

Key 2: none 0x

Key 3: none 0x

Transmit Key: key 0

St. Private Key: none 0x



LAB - Virtual Access Point

- Virtual AP akan menjadi child dari wlan (interface real).
- Satu interface dapat memiliki banyak virtual AP (maksimum 128)
- Virtual AP dapat diset **dengan SSID, security profile dan access list** yang berbeda, namun menggunakan **frekuensi dan band yang sama** dengan wlan induk.
- Virtual AP bersifat sama seperti AP:
 - Dapat dikoneksikan dengan station / client.
 - Dapat difungsikan sebagai DHCP server.
 - Dapat difungsikan sebagai Hotspot server.

Wireless Tables

Interfaces: Nstreme Dual | Access List | Registration | Connect List | Security Profiles

Scanner | Freq. Usage | Alignment | Wireless Sniffer | Wireless Snooper

Name	Type	L2 MTU	Tx	Rx	Tx Pac...	Rx Pac...	Tx Drops	Rx Drops	Tx Errors	Rx Errors	MAC Address	ARP	Mode	Band	Chann...	Frequen...	SSID
R wlan1	Wireless (Atheros 11N)	2290	0 bps	2.1 kbps	0	3	0	0	0	0	00:0C:42:E3:8E:11	enabled	ap bri...	2GHz...	20MHz	2412	IDN2
wlan2	VirtualAP	2290	0 bps	0 bps	0	0	0	0	0	0	02:0C:42:E3:8E:12	enabled					IDN5
wlan3	VirtualAP	2290	0 bps	0 bps	0	0	0	0	0	0	02:0C:42:E3:8E:13	enabled					IDN6
wlan4	VirtualAP	2290	0 bps	0 bps	0	0	0	0	0	0	02:0C:42:E3:8E:13	enabled					IDN7
wlan5	VirtualAP	2290	0 bps	0 bps	0	0	0	0	0	0	02:0C:42:E3:8E:13	enabled					IDN8
wlan6	VirtualAP	2290	0 bps	0 bps	0	0	0	0	0	0	02:0C:42:E3:8E:13	enabled					IDN9



Bridge (Layer 2 Connection)



Bridge

- Menggabungkan 2 atau lebih interface seolah-olah berada dalam 1 segmen network yang sama,
- Bridge juga dapat berjalan pada jaringan wireless
- Proses bridge berjalan pada layer data link (layer 2)
- Interface bridge adalah interface virtual, dimana kita dapat membuat sebanyak yang kita inginkan.
- Tahap pembuatan bridge adalah, membuat bridge baru dan menambahkan interface fisik kedalam port bridge.
- Jika kita membuat interface bride tanpa menambahkan interface fisik pada portnya, maka bridge tersebut dianggap sebagai interface loopback.

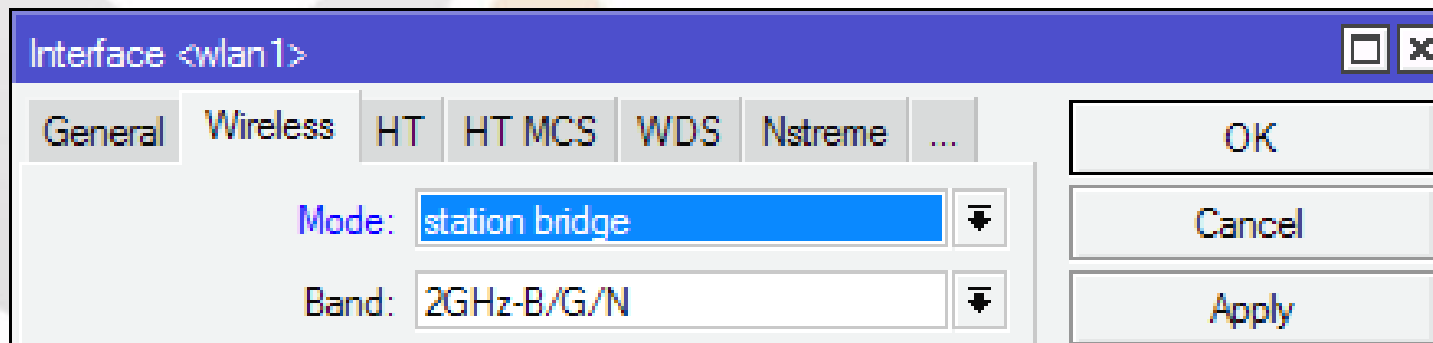


Bridge

- Kelemahan dari Bridge adalah:
 - Sulit untuk mengatur trafik broadcast (misalnya akibat virus, dll)
 - Permasalahan pada satu port/segmen akan membuat masalah di port/segmen pada bridge yang sama
 - Peningkatan beban trafik akibat terjadinya akumulasi traffic broadcast

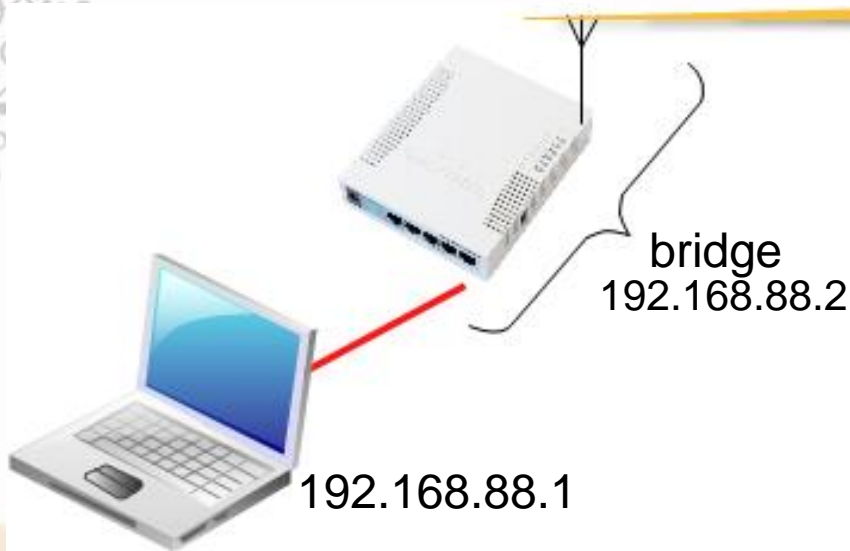
Wireless Bridging

- Semua mode wireless bisa dibridging, kecuali mode station.
- Mode station tidak dapat di bridging, sehingga diciptakan mode station dengan type lain.
- Station bridge adalah fitur MikroTik sejak v5 yang memungkinkan station untuk dibridge.
- Station bridge hanya akan berjalan pada koneksi antar MikroTik (versi 5 keatas).



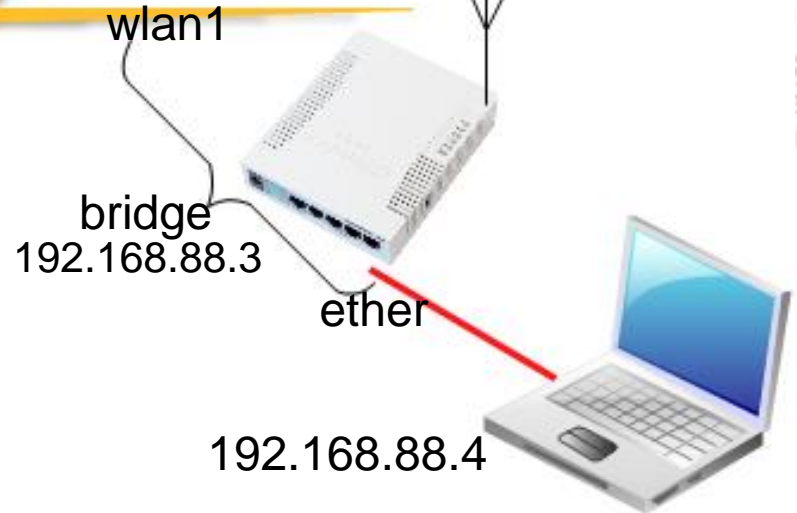
Lab - Bridging

Wireless mode:
AP-bridge



Wireless mode:

1. Station bridge
2. Station
3. Station pseudobridge
4. Station pseudobridge clone



LAB-Simple Wireless Bridge

- Set wireless mode ke station bridge atau pseudobridge

The screenshot shows the MikroTik WinBox v5.24 interface. The top bar displays the user 'admin@192.168.2.1 (MikroTik)' and the device 'RB751U-2HnD (mipsbe)'. The left sidebar contains a menu with options like Quick Set, Interfaces, Wireless, Bridge, PPP, Switch, Mesh, IP, IPv6, MPLS, Routing, System, Queues, Files, Log, Radius, Tools, New Terminal, and MetaROUTER. The main window shows the 'Wireless Tables' section with a table containing one entry: 'wlan1' with type 'W'. A dialog box titled 'Interface <wlan1>' is open, showing the configuration for the 'wlan1' interface. The 'Wireless' tab is selected, and the 'Mode' is set to 'station bridge'. Other settings include Band: 2GHz-B/G, Channel Width: 20MHz, Frequency: 2412 MHz, SSID: MTCNA, Scan List: default, Wireless Protocol: unspecified, Security Profile: default, and Bridge Mode: enabled. There are also fields for Default AP Tx Rate and Default Client Tx Rate, both set to 0 bps. A 'Default Authenticate' checkbox is checked. The dialog box has buttons for OK, Cancel, Apply, Disable, Comment, Torch, Scan..., Freq. Usage..., Align..., Sniff..., Snooper..., and Reset Configuration.

Name	Type
wlan1	W

Drops	Tx Errors	Rx E
0	0	

LAB - Simple Wireless Bridge

- Pada menu Bridge, buatlah satu interface bride dan tambahkan interface ether1 dan wlan1 pada portsnya.

The screenshot shows the Mikrotik WinBox interface for configuring a bridge. The 'Bridge' menu is selected in the left sidebar. The 'Bridge' configuration window shows a table with the following data:

Name	Type
bridge1	Bridge

The 'Interface <bridge1>' configuration window shows the following settings:

- Name: bridge1
- Type: Bridge
- MTU: 1500

Two 'Bridge Port <ether2>' configuration windows are shown, both with the following settings:

- Interface: ether1 (top) and wlan1 (bottom)
- Bridge: bridge1

LAB - Simple Wireless Bridge

- Sambil terus di ping antar laptop, ubahlah mode wireless station menjadi tipe:
 1. Station
 2. Station bridge
 3. Station pseudobridge
 4. Station pseudobridge clone
- Amati ping antar laptop
- Manakah diantara mode tersebut yang tidak bisa di bridging



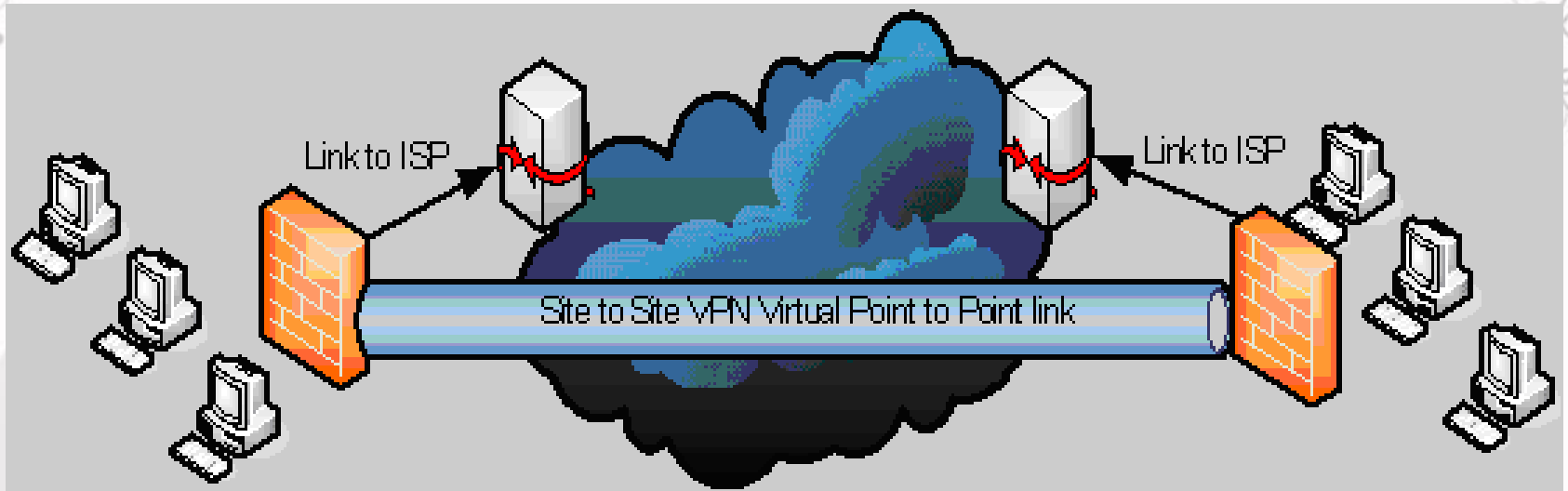
Tunnel



Tunnel

- Tunnel adalah sebuah metode penyelubungan (encapsulation) paket data di jaringan.
- Sebelum dikirim, paket data mengalami sedikit pengubahan atau modifikasi, yaitu penambahan header dari tunnel
- Ketika data sudah melewati tunnel dan sampai di tujuan (ujung) tunnel, maka header dari paket data akan dikembalikan seperti semula (header tunnel dilepas).

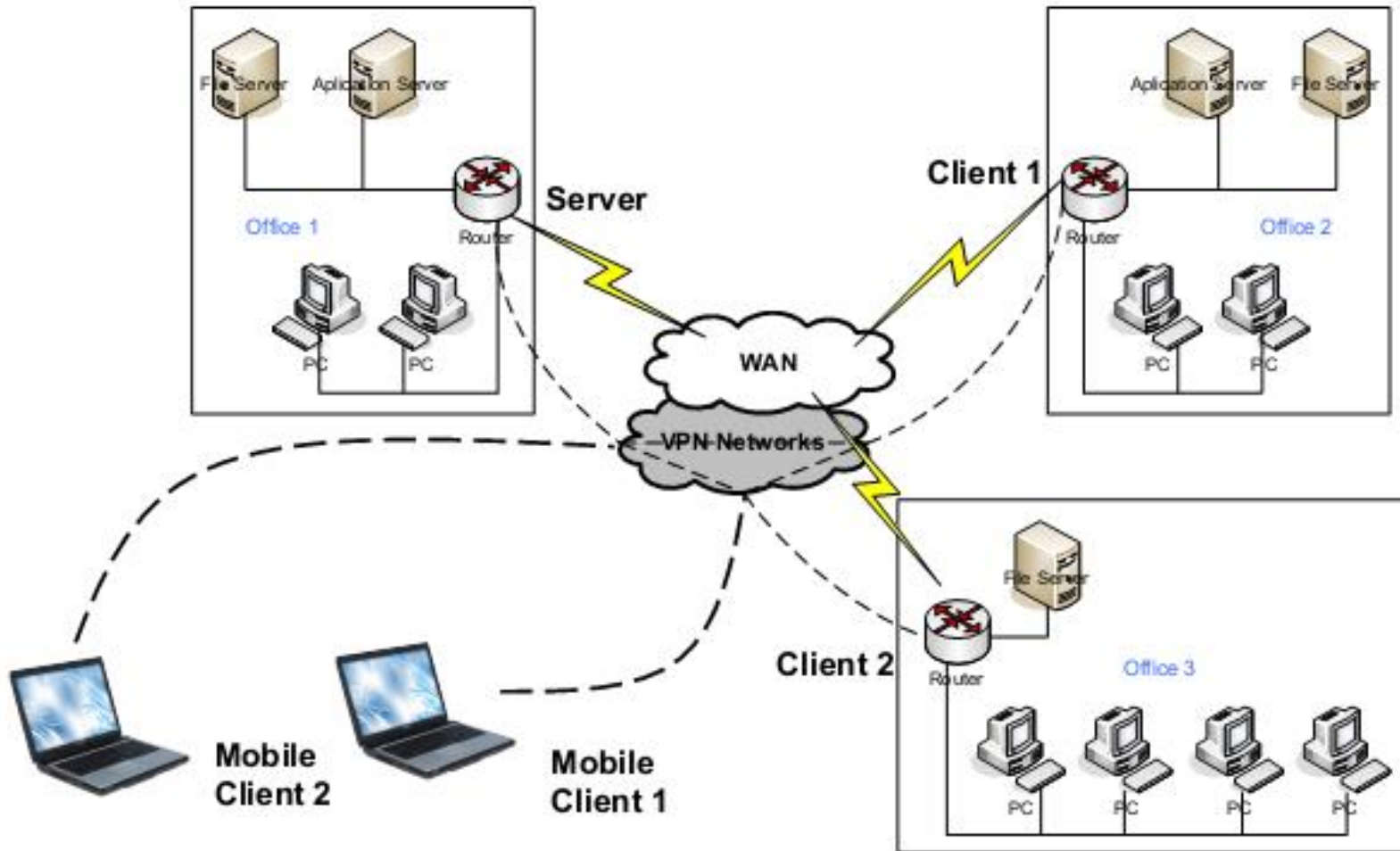
Tunnel



VPN

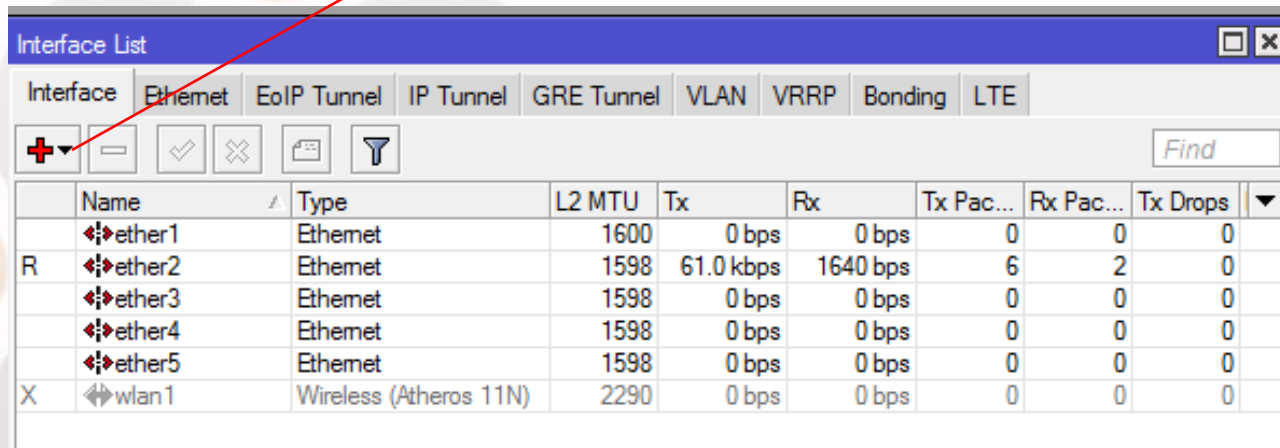
- VPN dibentuk dari beberapa tunnel yang digabung
- VPN adalah sebuah cara aman untuk mengakses local area network dengan menggunakan internet atau jaringan publik.
- Tunnel atau terowongan merupakan kunci utama pada VPN, koneksi pribadi dalam VPN dapat terjadi dimana saja selama terdapat tunnel.

VPN



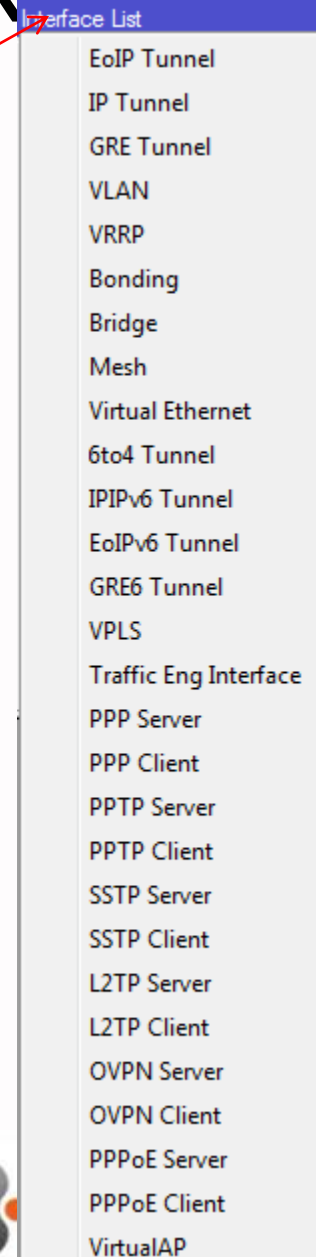
Tunnel Pada Mikrotik

- There are so many tunnel type in Mikrotik : PPTP, L2TP, PPPoE, EoIP, SSTP, OpenVPN, dll
- We can see that in virtual interface that we can add them



The screenshot shows the 'Interface List' window in Mikrotik WinBox. It features a tabbed interface with tabs for 'Interface', 'Ethernet', 'EoIP Tunnel', 'IP Tunnel', 'GRE Tunnel', 'VLAN', 'VRRP', 'Bonding', and 'LTE'. The 'Interface' tab is active, displaying a table of interfaces. The table has columns for Name, Type, L2 MTU, Tx, Rx, Tx Pac..., Rx Pac..., and Tx Drops. A red arrow points from the 'EoIP Tunnel' tab to the 'Interface List' window.

	Name	Type	L2 MTU	Tx	Rx	Tx Pac...	Rx Pac...	Tx Drops
	ether1	Ethernet	1600	0 bps	0 bps	0	0	0
R	ether2	Ethernet	1598	61.0 kbps	1640 bps	6	2	0
	ether3	Ethernet	1598	0 bps	0 bps	0	0	0
	ether4	Ethernet	1598	0 bps	0 bps	0	0	0
	ether5	Ethernet	1598	0 bps	0 bps	0	0	0
X	wlan1	Wireless (Atheros 11N)	2290	0 bps	0 bps	0	0	0



The screenshot shows the dropdown menu for the 'Interface List' window. It lists various interface types, including tunneling protocols and virtual interfaces. A red arrow points from the 'EoIP Tunnel' tab in the screenshot above to this menu.

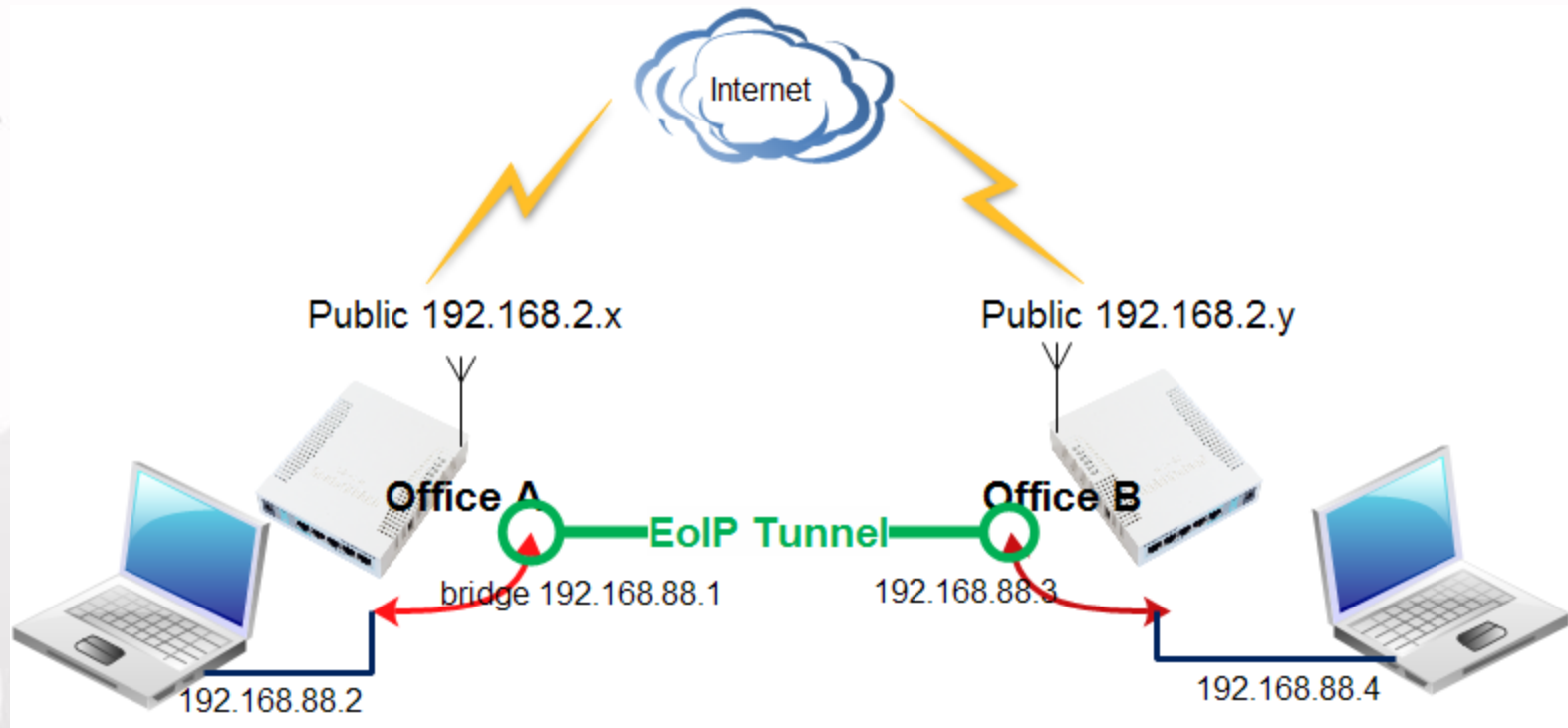
EoIP Tunnel
IP Tunnel
GRE Tunnel
VLAN
VRRP
Bonding
Bridge
Mesh
Virtual Ethernet
6to4 Tunnel
IIPv6 Tunnel
EoIPv6 Tunnel
GRE6 Tunnel
VPLS
Traffic Eng Interface
PPP Server
PPP Client
PPTP Server
PPTP Client
SSTP Server
SSTP Client
L2TP Server
L2TP Client
OVPN Server
OVPN Client
PPPoE Server
PPPoE Client
VirtualAP



EOIP

- Tunnel yang paling sederhana di MikroTik adalah EoIP (Ethernet over IP)
- EOIP merupakan protocol proprietary untuk membangun bridge dan tunnel antar router Mikrotik, dimana interface EOIP akan dianggap sebagai ethernet.
- EoIP menggunakan encapsulation Generic Routing Encapsulation (IP Protocol No 47).
- EoIP tidak menggunakan enkripsi, jadi tidak disarankan digunakan untuk transmisi data yang membutuhkan tingkat keamanan yang tinggi.
- Identifikasi tunnel menggunakan Tunnel ID
- MAC Address diantara interface EOIP harus berbeda

LAB –EOIP -Bridging



EoIP Tunnel

- New Interface EoIP Tunnel

The screenshot shows the Mikrotik WinBox interface. On the left, the 'Interface List' window has a red box around the '+' icon and another red box around the 'EoIP Tunnel' option. A red arrow points from the 'EoIP Tunnel' option to the 'New Interface' dialog box. The dialog box has two tabs: 'General' and 'Traffic'. The 'General' tab is active, showing the following configuration:

- Name: eoip-tunnel1
- Type: EoIP Tunnel
- MTU: 1500
- L2 MTU: (empty)
- MAC Address: 02:5B:4A:96:6D:2B
- ARP: enabled
- Local Address: (empty)
- Remote Address: 192.168.2.2 (highlighted with a red box)
- Tunnel ID: 12 (highlighted with a red box)
- Keepalive Interval: (empty)

On the right side of the dialog, there are buttons: OK, Cancel, Apply, Disable, Comment, Copy, and Remove. A blue arrow points from the 'Remote Address' field to a text box on the right. The text box contains the following text:

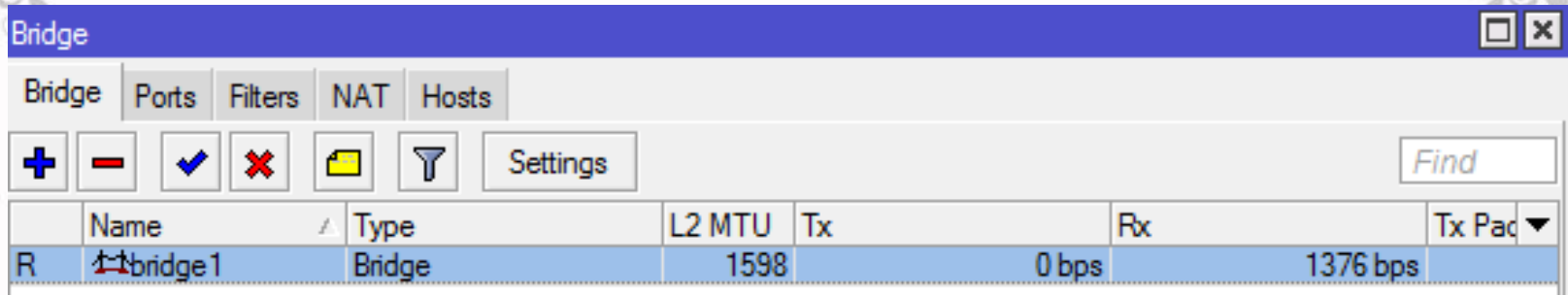
Remote address=IP public lawan
Tunnel ID = harus sama dengan lawan

At the bottom of the dialog, there are three status indicators: 'enabled', 'running', and 'slave'.

...	Tx Drops	Rx Drops	Tx Errors	Rx Errors
3	0	0	0	0
0	0	0	0	0
0	0	0	0	0

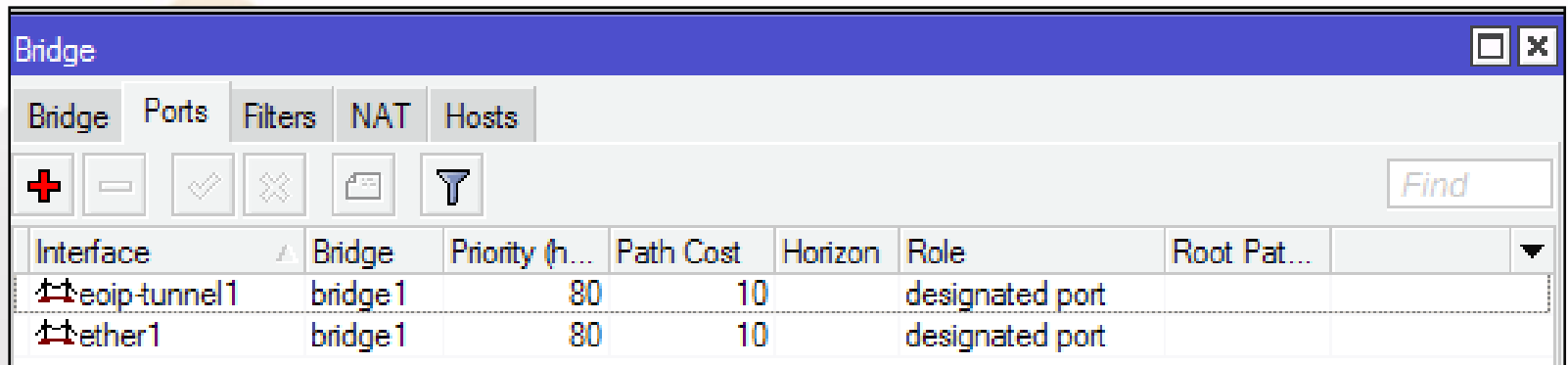
EoIP Tunnel

- Bridge add name=bridge1



	Name	Type	L2 MTU	Tx	Rx	Tx Pac
R	bridge1	Bridge	1598	0 bps	1376 bps	

- Masukkan dalam interface bride interface EoIP dan ether1



Interface	Bridge	Priority (h...	Path Cost	Horizon	Role	Root Pat...
eoip-tunnel1	bridge1	80	10		designated port	
ether1	bridge1	80	10		designated port	

- Tambahkan IP address pada interface bridge

PPP

- PPP (Point to Point Protocol) adalah protocol layer 2 yang digunakan untuk komunikasi secara serial.
- Untuk menjalankan koneksi PPP, mikrotik RouterOS harus memiliki port/interface serial, line telephone port berupa RJ11 (PSTN), atau modem seluler (PCI atau PCMCIA)
- Untuk terbentuk koneksi PPP dilakukan melalui dial up nomer telepon tertentu ke ISP (misal nomor *99***1#).
- Kemudian ppp baru mendapatkan IP address untuk koneksi internet.
- MikroTik dapat digunakan sebagai PPP server dan atau PPP client.

Setting PPP Client

The screenshot displays the MikroTik WinBox interface. On the left, the 'Interface List' window shows a list of interface types, with 'PPP Client' highlighted in a red box. A red arrow points from this box to the 'New Interface' configuration window. In the 'New Interface' window, the 'General' tab is active, showing 'Name: ppp-out1' and 'Type: PPP Client'. The 'Port' dropdown menu is set to 'unknown' and is also highlighted with a red box. A red arrow points from this box to a text box at the bottom. The text box contains the following text:

Apabila ada port serial di Router maka port bisa dipilih untuk komunikasi serial

The 'New Interface' window also shows fields for 'APN' and 'PIN', and a 'Status' section at the bottom with 'enabled', 'running', and 'slave' indicators.

PPTP Tunneling

- PPTP melakukan membentuk tunnel PPP antar IP menggunakan protocol TCP dan GRE (Generic Routing Encapsulation).
- PPTP secure, karena menggunakan enkripsi MPPE (Microsoft Point-to-Point Encryption) panjang 40 dan 128 bit encrypts
- PPTP menggunakan port TCP 1723
- PPTP banyak digunakan karena hampir semua OS dapat menjalankan PPTP client.
- PPTP adalah tunnel tipe client server, dimana PPTP server lebih banyak melakukan konfigurasi untuk setiap client yang ingin konek

Mengaktifkan PPTP Server

- Aktifkan PPTP server pada menu PPP>Interface>PPTP Server

The screenshot shows the configuration window for the PPTP Server. The 'Enabled' checkbox is checked and highlighted with a red box. A red arrow points from the 'PPTP Server' tab to the 'Enabled' checkbox. Other settings include Max MTU: 1460, Max MRU: 1460, MRRU, Keepalive Timeout: 30, and Default Profile: default-encryption. Authentication options include pap, chap, mschap1, and mschap2.

	Rx	Tx Pac...	Rx Pac...	Tx Drops	Rx Dro
	0 bps	0 bps	0	0	0

PPP Secret

- Semua koneksi yang menggunakan protocol PPP selalu melibatkan autentikasi username dan password.
- Secara local, username dan password ini disimpan dan diatur dalam bagian **PPP secret**.
- Username dan password ini juga dapat disimpan dalam RADIUS server terpisah.
- PPP Secret (database local PPP) menyimpan username dan password yang akan digunakan oleh semua pptp clientnya.
- Selain dipakai untuk PPTP client, PPP secret juga dipakai untuk protocol ppp lainnya seperti; **async, l2tp, openvpn, pppoe, pptp dan sstp**.

PPP Secret

The screenshot shows a network configuration interface with a 'Secrets' tab. A table lists a secret for 'user1' with password '123' and service 'any'. A detailed configuration window for 'user1' shows fields for Name, Password, Service, Caller ID, Profile, Local Address (10.10.10.1), and Remote Address (10.10.10.2). Red boxes highlight the '+' button, the table row, and the Name, Password, Service, Local Address, and Remote Address fields. Blue arrows point from text boxes to these elements.

Name	Password	Service	Caller ID	Profile
user1	123	any		default

PPP Secret <user1>

Name: user1
Password: 123
Service: any
Caller ID:
Profile: default
Local Address: 10.10.10.1
Remote Address: 10.10.10.2
Remote IPv6 Prefix:
Routes:

Username dan password untuk user1

Service bisa pilih pptp atau any (all service)

IP yang nantinya akan dibuat untuk komunikasi tunnel point to point antara server dan client user1

Local address=IP yang akan dipakai server

Remote address=IP yang diberikan ke client

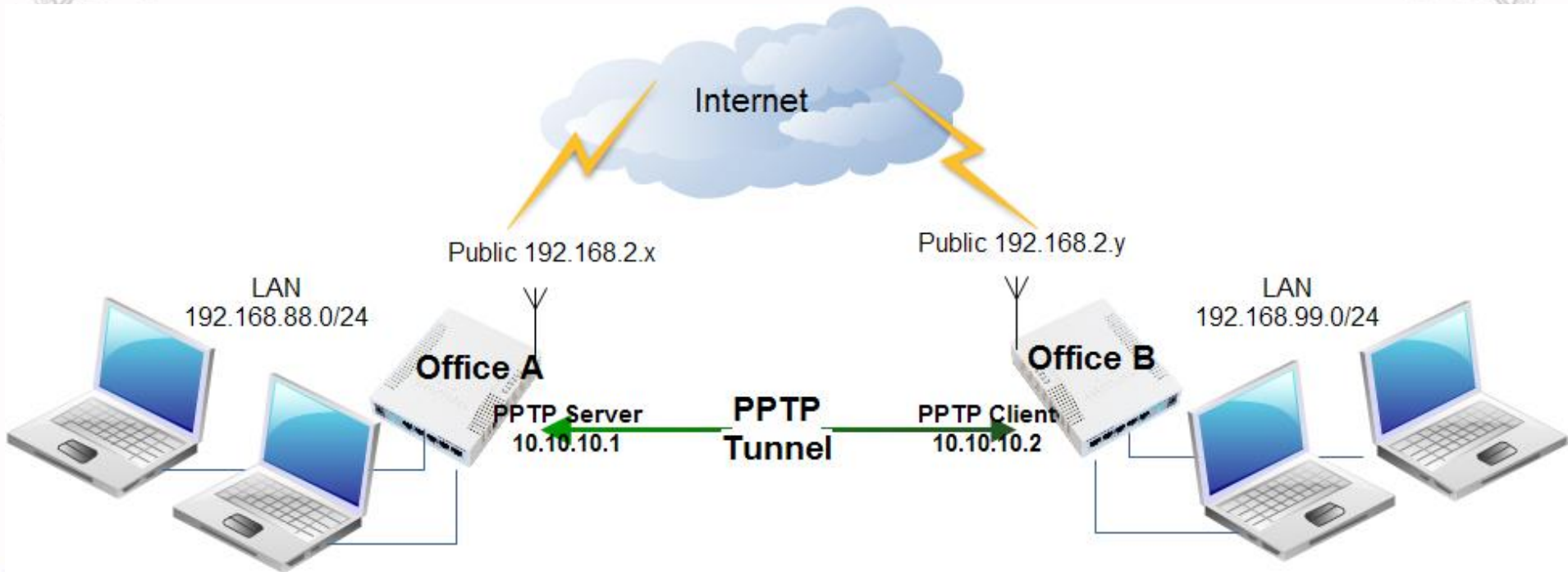
MikroTik PPTP Client

- Pada menu Interface add new PPTP client, pada tab Dial Out isikan dengan IP public dari PPTP server, user dan password, kemudian apply

The screenshot displays the MikroTik WinBox interface. On the left, the 'Quick Set' menu is visible, with 'Interfaces' highlighted. Below it, the 'Interface List' menu is open, showing various interface types, with 'PPTP Client' selected. The main window shows the 'New Interface' dialog box, with the 'Dial Out' tab active. The 'Connect To' field is set to '192.168.2.22', the 'User' field is 'user1', and the 'Password' field is '123'. The 'Profile' is set to 'default-encryption'. Under the 'Allow' section, the checkboxes for 'pap', 'mschap1', 'chap', and 'mschap2' are all checked. A red box highlights the 'Connect To', 'User', and 'Password' fields. A blue arrow points from the 'Connect To' field to a text box. The text box contains the following text: 'Connect to =IP dari PPTP server (IP publicnya) Username dan password = yang telah dibuat sebelumnya di PPTP server'. The status bar at the bottom shows 'enabled', 'running', 'slave', and 'Status:'.

Connect to =IP dari PPTP server (IP publicnya)
Username dan password = yang telah dibuat sebelumnya di PPTP server

LAB PPTP Tunneling (Mikrotik to Mikrotik)



Buat Static Routing

Office A (PPTP Server)

IP Route

```
add dst-address=192.168.99.0/24  
gateway=10.10.10.2
```

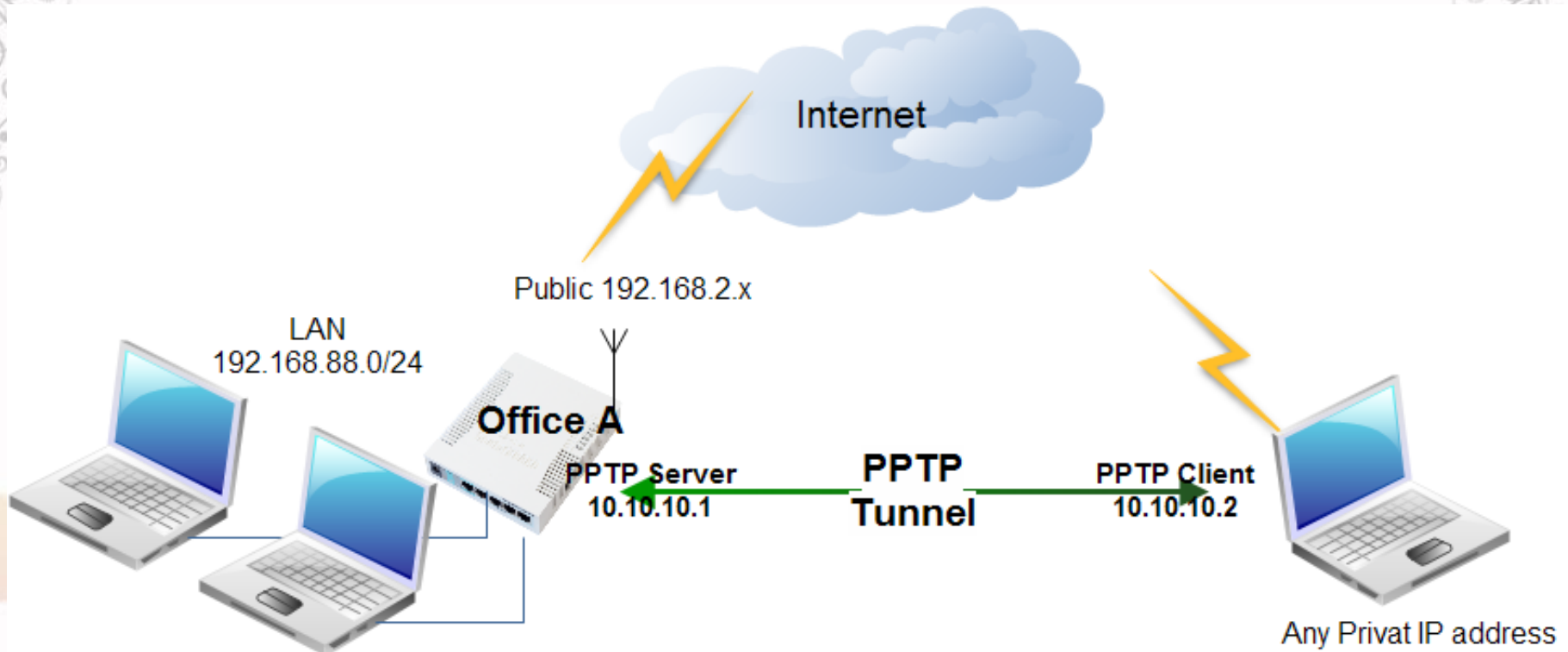
Office B (PPTP Client)

IP Route

```
add dst-address=192.168.88.0/24  
gateway=10.10.10.1
```

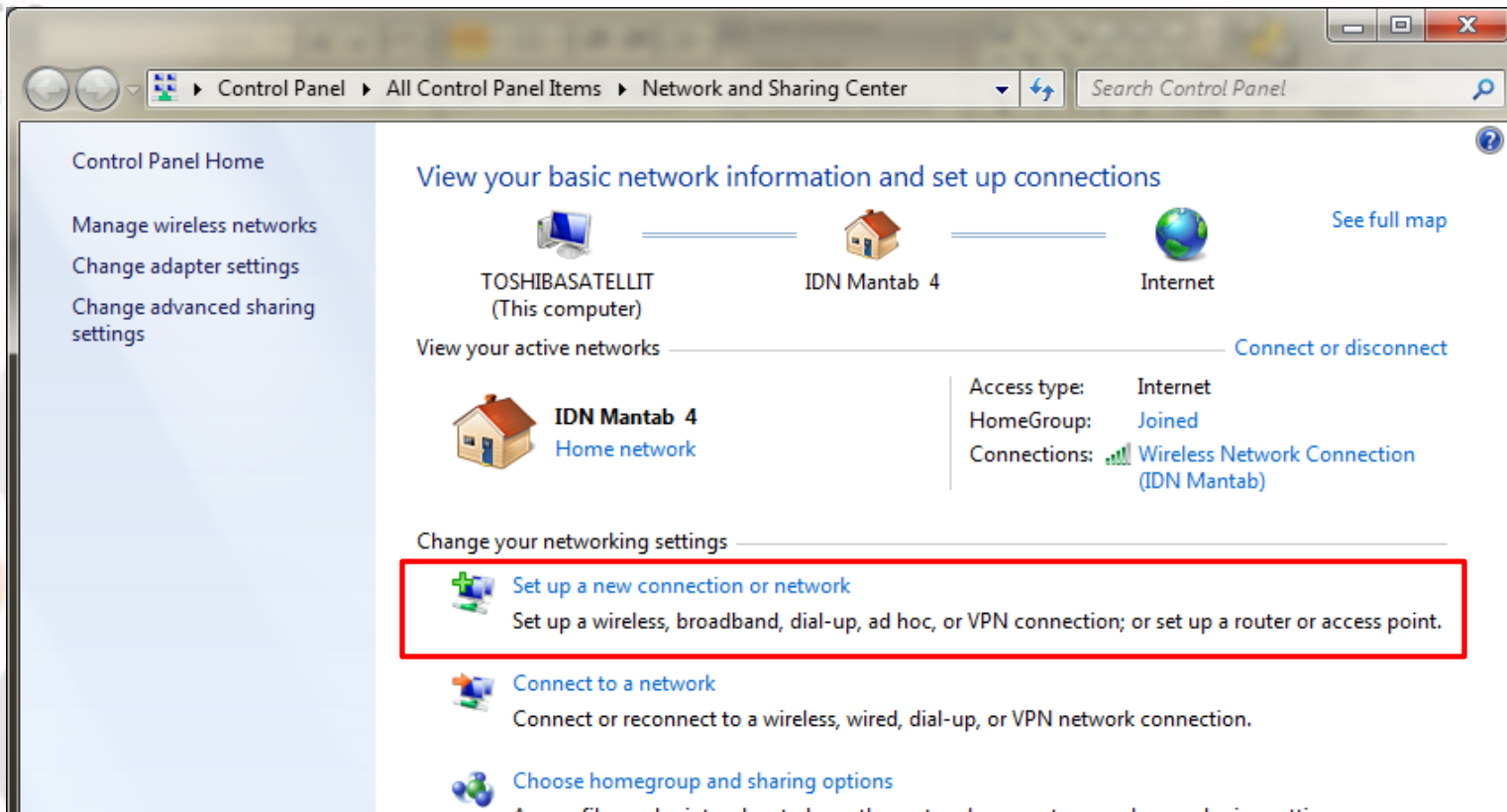
LAB Tunneling (MK-Laptop/PC)

- Koneksi PPTP client dengan Windows



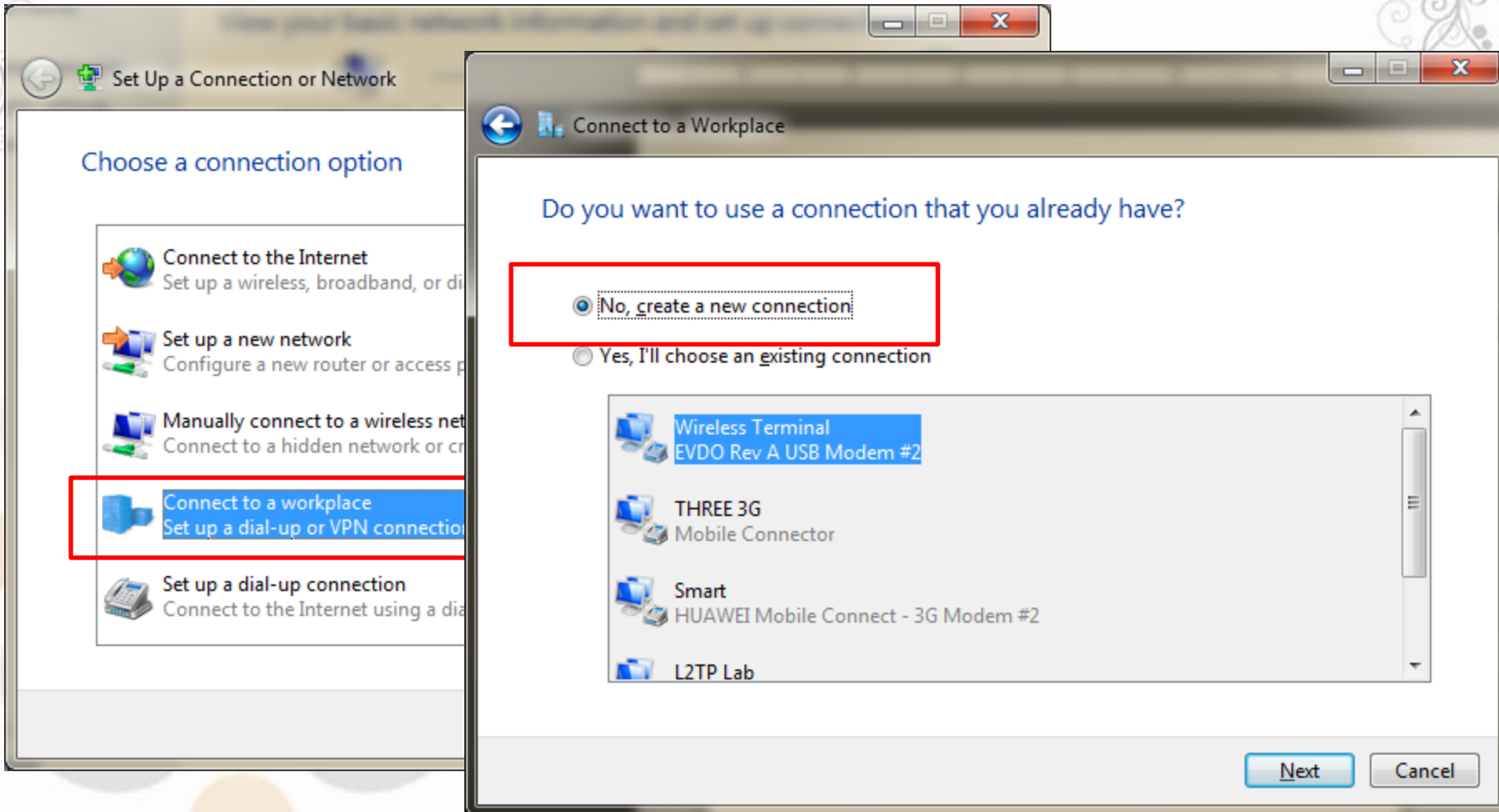
(Windows) PPTP Client

- PPTP server masih menggunakan konfigurasi sebelumnya
- Setup New Connection di Network Connection



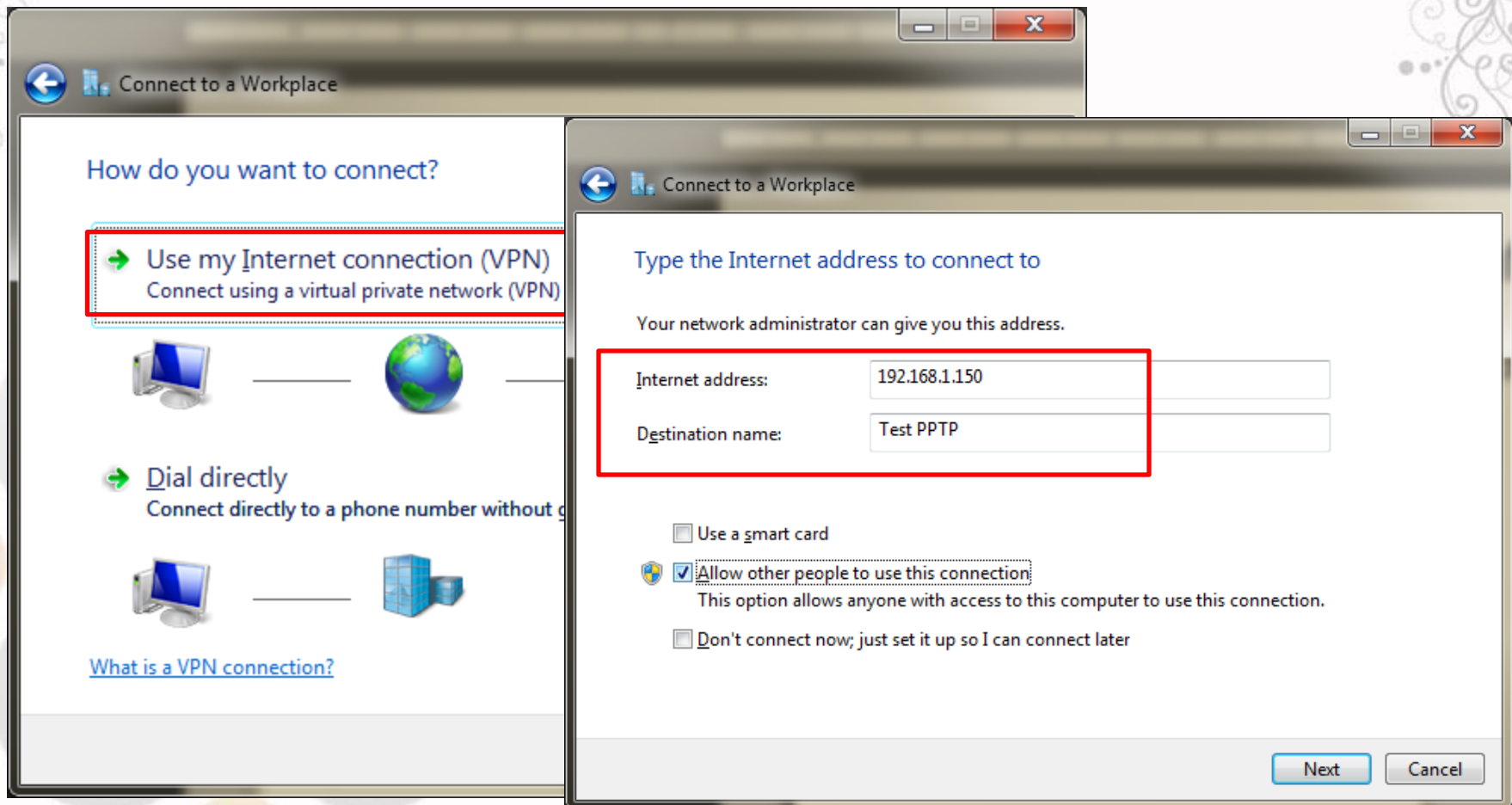
(Windows) PPTP Client

- Setup New Connection di Network Connection



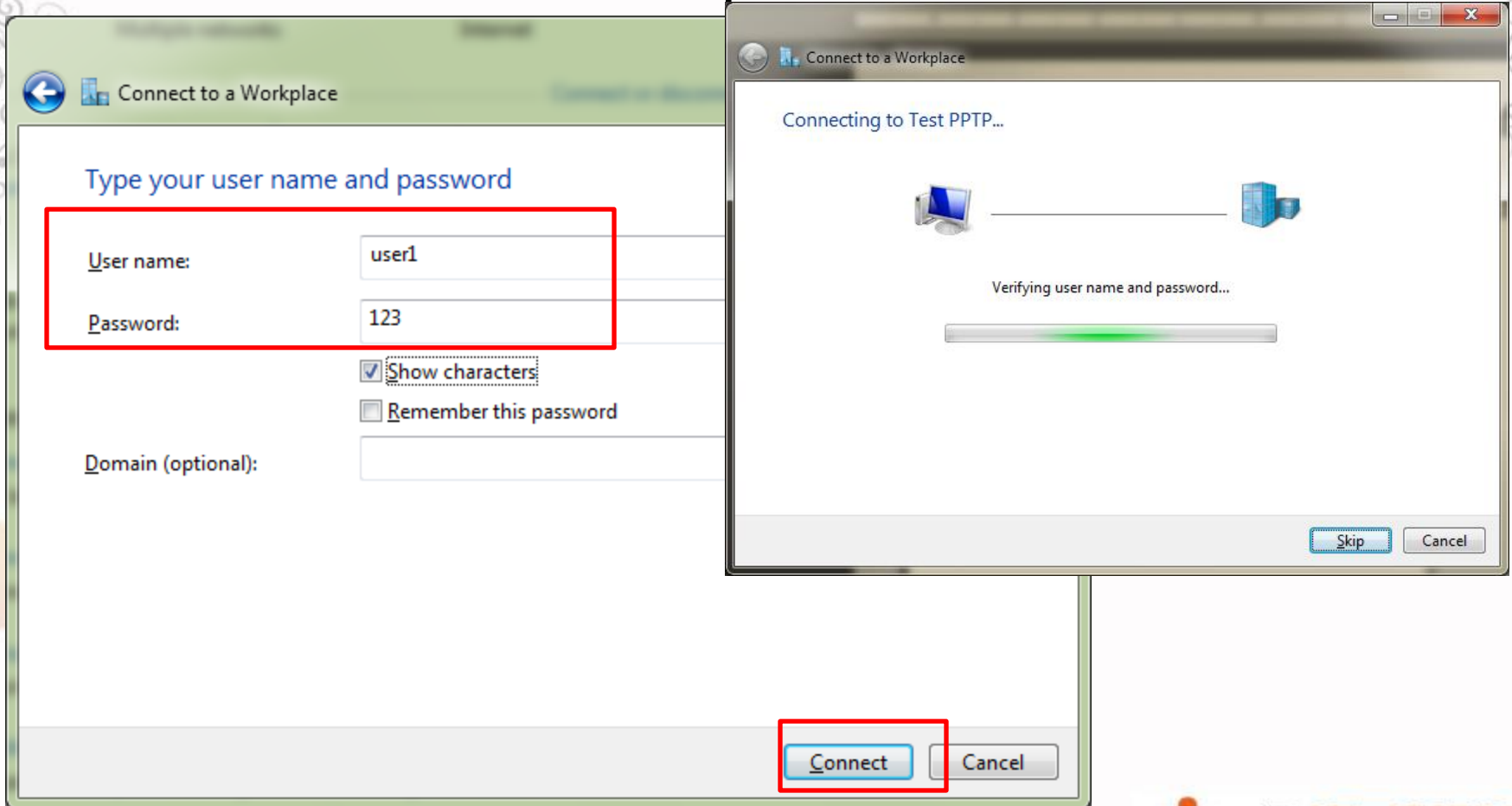
(Windows) PPTP Client

- Pilih Connect Using VPN & Isikan IP PPTP Server



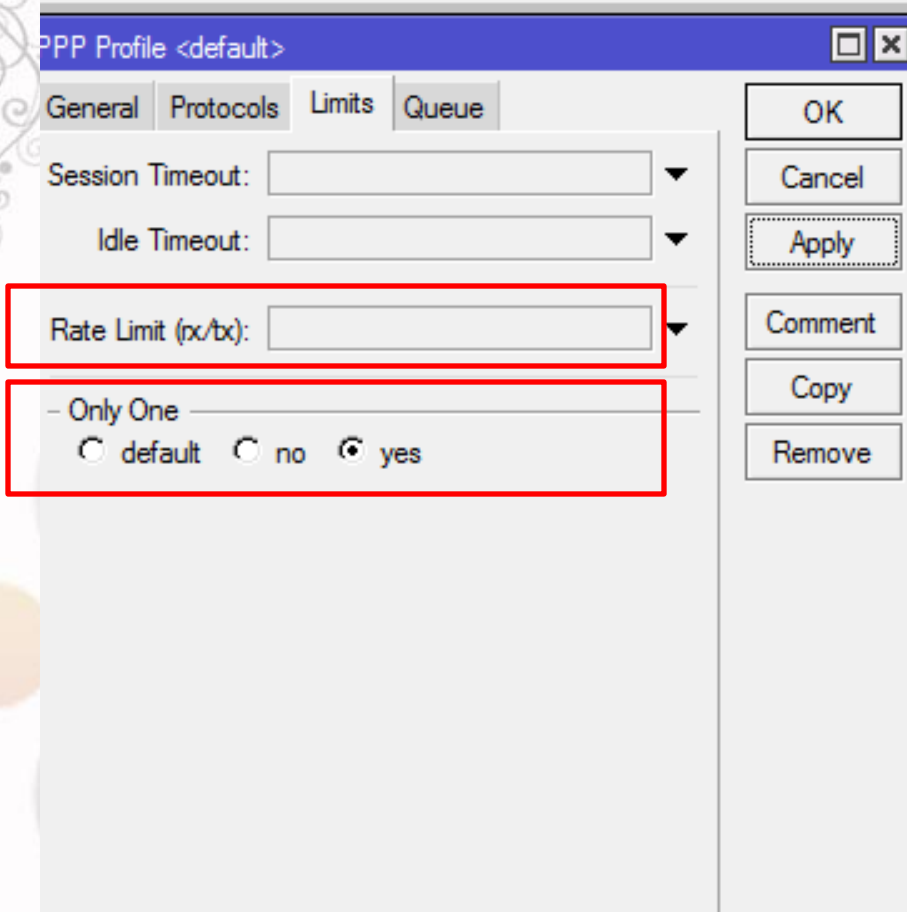
(Windows) PPTP Client

- Masukkan username & password PPTP-Client



Fitur pada PPTP

- PPP Profile Limit



PPP Profile <default>

General Protocols Limits Queue

Session Timeout:

Idle Timeout:

Rate Limit (rx/bx):

- Only One -

default no yes

OK
Cancel
Apply
Comment
Copy
Remove

Limit bandwidth

Satu user 1 session

PPTP Traffic Analyze

Torch (Running)

- Basic
Interface: wlan1
Entry Timeout: 00:00:03 s

- Collect
 Src. Address
 Dst. Address
 MAC Protocol
 Protocol
 Src. Address6
 Dst. Address6
 Port
 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.	VLAN Id	Tx Rate	Rx Rate	Tx Pack...	Rx Pack...
800 (ip)	6 (tcp)	192.168.10.6:50952	192.168.10.1:8291 (winbox)		5.9 kbps	3.3 kbps	2	4
800 (ip)	47	192.168.10.6	192.168.10.1		342.2 k...	36.2 kbps	47	34
800 (ip)	17 (udp)	192.168.10.5:28426	8.8.4.4:53 (dns)		0 bps	324 bps	0	0

- Apabila kita browsing di internet tidak, trafik aktual tidak terdeteksi.
- Koneksi yang terdeteksi adalah koneksi tunnel PPTP dengan Protocol 47 (GRE)

L2TP

- Layer 2 Tunneling Protocol (L2TP) adalah jenis tunneling & encapsulation lain untuk protocol PPP.
- L2TP mensupport non-TCP/IP protocols (Frame Relay, ATM and SONET).
- L2TP dikembangkan atas kerja sama antara Cisco dan Microsoft untuk menggabungkan fitur dari PPTP dengan protocol proprietary Cisco yaitu protokol Layer 2 Forwarding(L2F).
- L2TP tidak melakukan enkripsi paket, untuk enkripsi biasanya L2TP dikombinasikan dengan IPsec.
- L2TP menggunakan UDP port 1701.



L2TP Server

The screenshot shows the PPP configuration window with the 'L2TP Server' dialog box open. The dialog box has the following fields and options:

- Enabled
- Max MTU: 1460
- Max MRU: 1460
- MRRU: []
- Default Profile: default-encryption
- Authentication options:
 - pap
 - mschap1
 - chap
 - mschap2

Buttons: OK, Cancel, Apply. A red box highlights the 'L2TP Server' title bar and the 'OK' button.

The screenshot shows the PPP configuration window with the 'Secrets' tab selected. A table lists the secrets:

Name	Password	Service	Caller ID	Profile
l2tp	*****	l2tp		default
pptp	*****	pptp		pptp-profile

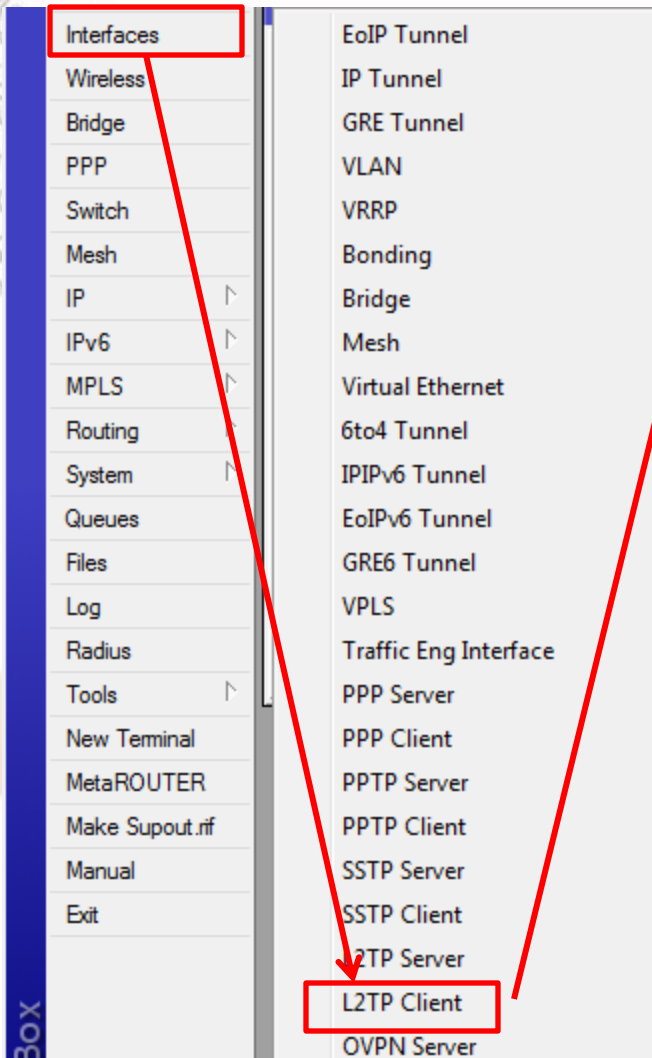
The 'PPP Secret <l2tp>' dialog box is open, showing the following fields:

- Name: l2tp
- Password: ****
- Service: l2tp
- Caller ID: []
- Profile: default
- Local Address: 13.13.13.1
- Remote Address: 13.13.13.3

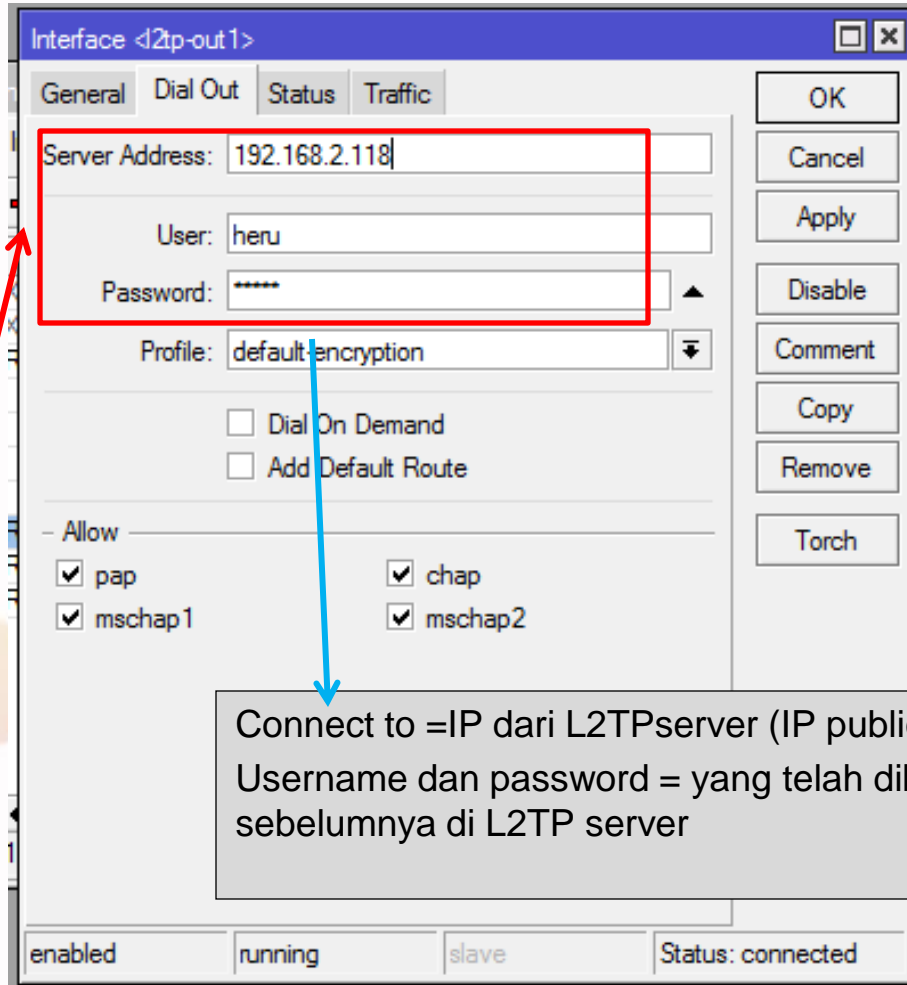
Buttons: OK, Cancel, Apply, Disable, Comment, Copy, Remove. A red box highlights the 'Name', 'Password', and 'Service' fields. A red arrow points from the 'Secrets' tab to the dialog box.



MikroTik L2TP Client



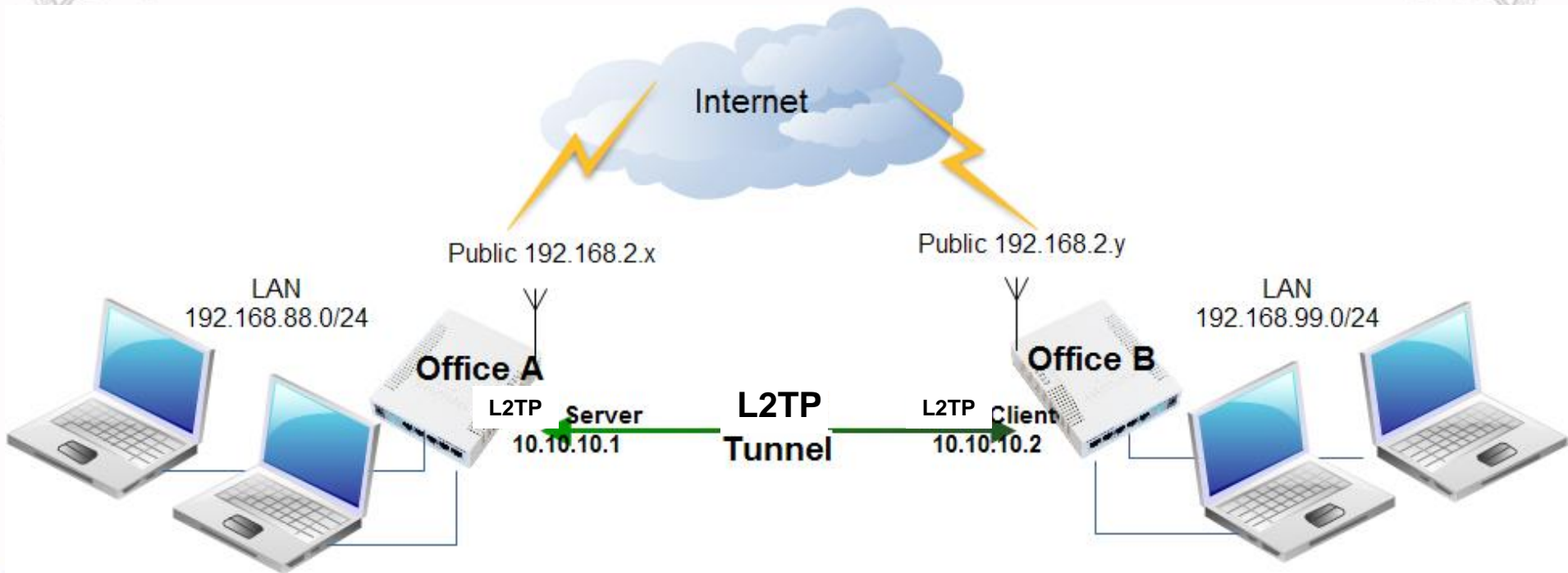
The screenshot shows the WinBox menu structure. The 'Interfaces' menu is highlighted with a red box. A red arrow points from 'Interfaces' to 'L2TP Client' in the 'Interfaces' submenu, which is also highlighted with a red box. Other menu items include Wireless, Bridge, PPP, Switch, Mesh, IP, IPv6, MPLS, Routing, System, Queues, Files, Log, Radius, Tools, New Terminal, MetaROUTER, Make Supout.rif, Manual, and Exit.



The screenshot shows the 'Interface <l2tp-out 1>' configuration window. The 'General' tab is selected. The 'Server Address' field is highlighted with a red box and contains the value '192.168.2.118'. The 'User' field contains 'heru' and the 'Password' field contains '*****'. The 'Profile' dropdown is set to 'default-encryption'. The 'Allow' section has checkboxes for 'pap', 'mschap1', 'chap', and 'mschap2', all of which are checked. The 'Dial On Demand' and 'Add Default Route' checkboxes are unchecked. The status bar at the bottom shows 'enabled', 'running', 'slave', and 'Status: connected'. A blue arrow points from the 'Server Address' field to a text box below.

Connect to =IP dari L2TPserver (IP publicnya)
Username dan password = yang telah dibuat
sebelumnya di L2TP server

LAB L2TP Tunneling (Mikrotik to Mikrotik)



Buat Static Routing

Office A (PPTP Server)

IP Route

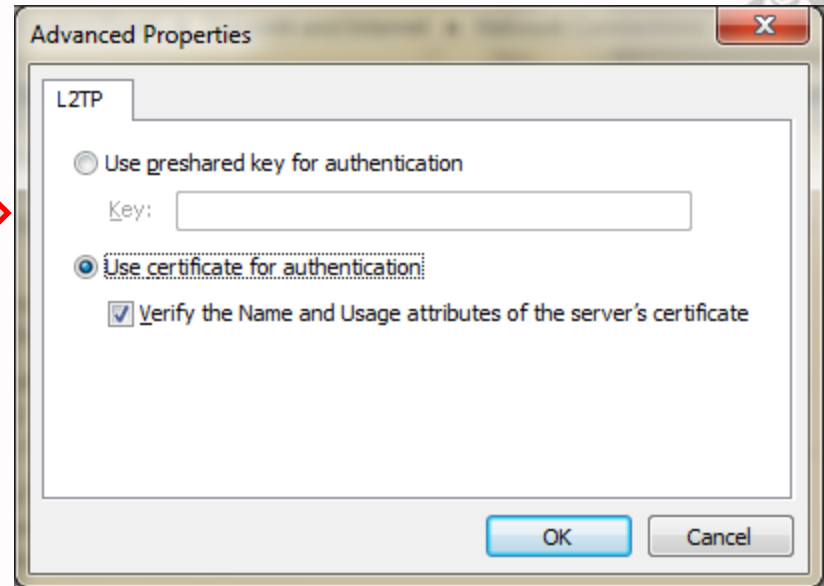
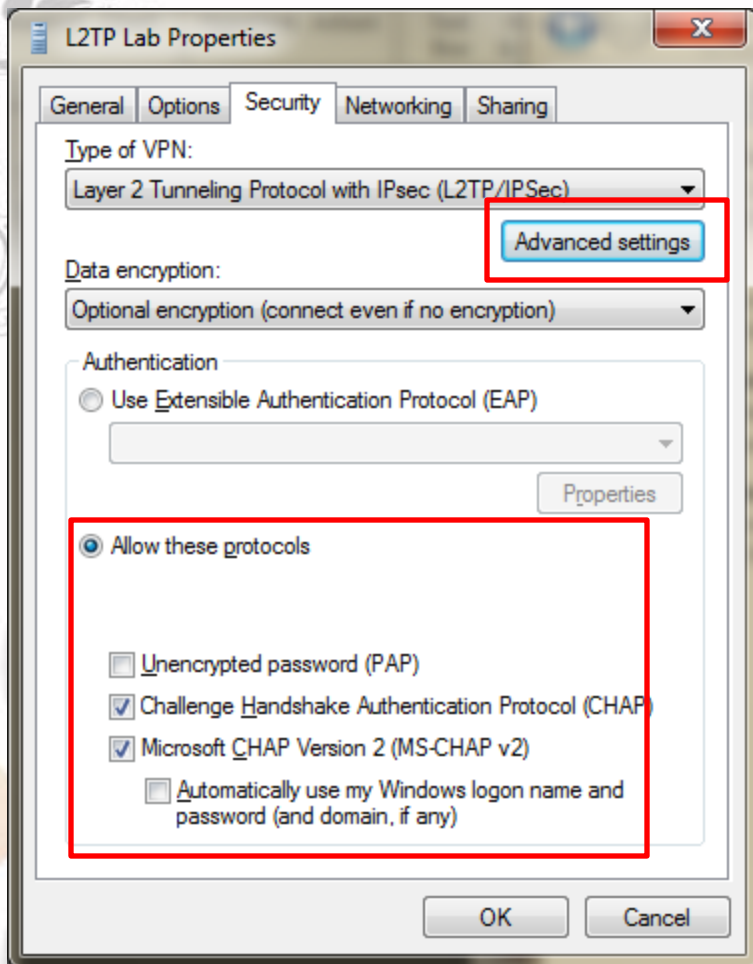
```
add dst-address=192.168.99.0/24  
gateway=10.10.10.2
```

Office B (PPTP Client)

IP Route

```
add dst-address=192.168.88.0/24  
gateway=10.10.10.1
```

Windows L2TP Client



L2TP – Traffic Analyze

Torch (Running)

- Basic
Interface: wlan1
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

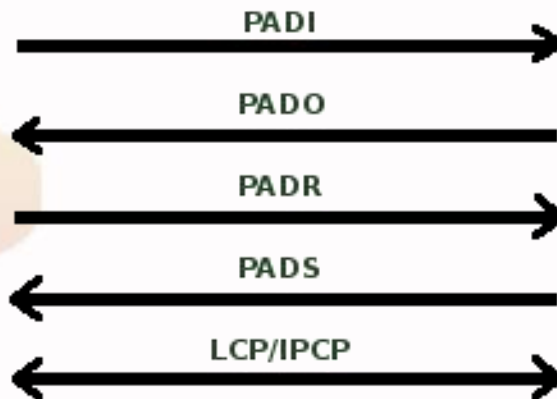
Et...	Protocol	Src.	Dst.	VLAN Id	Tx Rate	Rx Rate	Tx Pack...	Rx F
800 (ip)	6 (tcp)	192.168.10.6:50706	192.168.10.1:8291 (winbox)		5.3 kbps	2.5 kbps	2	
800 (ip)	17 (udp)	192.168.10.6:1701 (l2tp)	192.168.10.1:1701 (l2tp)		928 bps	944 bps	1	

- Setelah menggunakan L2TP tunnel, traffik pada wlan1 merupakan traffic L2TP
- Hanya menggunakan protocol UDP

PPPoE

- PPPoE adalah untuk enkapsulasi frame Point-to-Point Protocol (PPP) di dalam frame Ethernet,
- PPPoE biasanya dipakai untuk jasa layanan ADSL untuk menghubungkan modem ADSL (kabel modem) di dalam jaringan Ethernet (TCP/IP).
- PPPoE, adalah Point-to-Point, di mana harus ada satu point ke satu point lagi. Lalu, apabila point yang pertama adalah router ADSL kita, lalu di mana point satu nya lagi ?
- Tapi, bagaimana si modem ADSL bisa tahu point satunya lagi apabila kita (biasanya) hanya mendapatkan username dan password dari provider?
- Tahap awal dari PPPoE, adalah PADI (PPP Active Discovery Initiation), PADI mengirimkan paket broadcast ke jaringan untuk mencari di mana lokasi Access Concentrator di sisi ISP.

PPPoE



Tahapan Koneksi PPOE

- PADI (PPP Active Discovery Initiation), Di sini PPOE client mengirimkan paket broadcast ke jaringan dengan alamat pengiriman mac address FF:FF:FF:FF:FF:FF. PPPoE client mencari di mana lokasi PPOE server dalam jaringan.
- PADO (PPPoE Active Discovery Offer). PADO ini merupakan jawaban dari PPOE server atas PADI yang didapatkan sebelumnya. PPPoE server memberikan identitas berupa MAC addressnya.
- PADR (PPP Active Discovery Request), merupakan konfirmasi dari PPOE client ke server. Disini PPOE client sudah dapat menghubungi PPOE server menggunakan mac addressnya, berbeda dengan paket PADI yang masih berupa broadcast.

Tahapan Koneksi PPPoE

- PADS (PPP Active Discovery Session-confirmation), dari PPOE server ke client. Session-confirmation di sini memang berarti ada session ID yang diberikan oleh server kepada client. Pada tahap ini juga terjadi negosiasi Username, password dan IP address.
- PADT (PPP Active Discovery Terminate), bisa dikirim dari server ataupun client, ketika salah satu ingin mengakhiri koneksinya

Tahapan Koneksi PPPoE

Log		
		memory
May/29/2012 12:17:35	pppoe ppp info	speedy: dialing...
May/29/2012 12:17:35	pppoe debug pac...	ether1: sent PADI to FF:FF:FF:FF:FF:FF
May/29/2012 12:17:35	pppoe debug pac...	session-id=0x0000
May/29/2012 12:17:35	pppoe debug pac...	host-uniq=0x0
May/29/2012 12:17:35	pppoe debug pac...	service-name=
May/29/2012 12:17:35	pppoe debug pac...	ether1: rcvd PADO from 00:30:88:1A:23:A2
May/29/2012 12:17:35	pppoe debug pac...	session-id=0x0000
May/29/2012 12:17:35	pppoe debug pac...	host-uniq=0x0
May/29/2012 12:17:35	pppoe debug pac...	ac-name=BRAS-D4-GBL-D904L3610L0029
May/29/2012 12:17:35	pppoe debug pac...	service-name=
May/29/2012 12:17:35	pppoe debug pac...	ether1: sent PADR to 00:30:88:1A:23:A2
May/29/2012 12:17:35	pppoe debug pac...	session-id=0x0000
May/29/2012 12:17:35	pppoe debug pac...	host-uniq=0x1
May/29/2012 12:17:35	pppoe debug pac...	service-name=
May/29/2012 12:17:36	pppoe debug pac...	ether1: rcvd PADS from 00:30:88:1A:23:A2
May/29/2012 12:17:36	pppoe debug pac...	session-id=0x3a2c
May/29/2012 12:17:36	pppoe debug pac...	host-uniq=0x1
May/29/2012 12:17:36	pppoe debug pac...	service-name=
May/29/2012 12:17:36	pppoe debug pac...	ac-name=BRAS-D4-GBL-D904L3610L0029



PPPOE SERVER

PPP

Interface PPPoE Servers Secrets Profiles Active Connections

+ - ✓ ✗ ⏏

Service ...	Interface	Max MTU	Max MRU	MRRU	Default Profile	Authentication
service1	wlan1	1480	1480	1600	default	pap chap mschap...

PPPoE Service <service 1>

Service Name:

Interface:

Max MTU:

Max MRU:

MRRU:

Keepalive Timeout:

Default Profile:

One Session Per Host

Max Sessions:

- Authentication -

pap chap

mschap1 mschap2

enabled

OK Cancel Apply Disable Copy Remove

PPOE Client

Interface <pppoe-out1>

General | Dial Out | Status | Traffic

Name: pppoe-out1

Type: PPPoE Client

L2 MTU:

Max MTU: 1480 ▲

Max MRU: 1480 ▲

MRRU: 1600 ▲

Interfaces: wlan1 ▼

OK

Cancel

Apply

Disable

Comment

Copy

Remove

Torch

PPPoE Scan

enabled | running | slave | Status: connected

Interface <pppoe-out1>

General | Dial Out | Status | Traffic

Service: ▼

AC Name: ▼

User: user1

Password: 123 ▲

Profile: default ▼

Keepalive Timeout: 60 ▲

Dial On Demand

Use Peer DNS

Add Default Route

Default Route Distance: 0

Allow: mschap2 mschap1
 chap pap

OK

Cancel

Apply

Disable

Comment

Copy

Remove

Torch

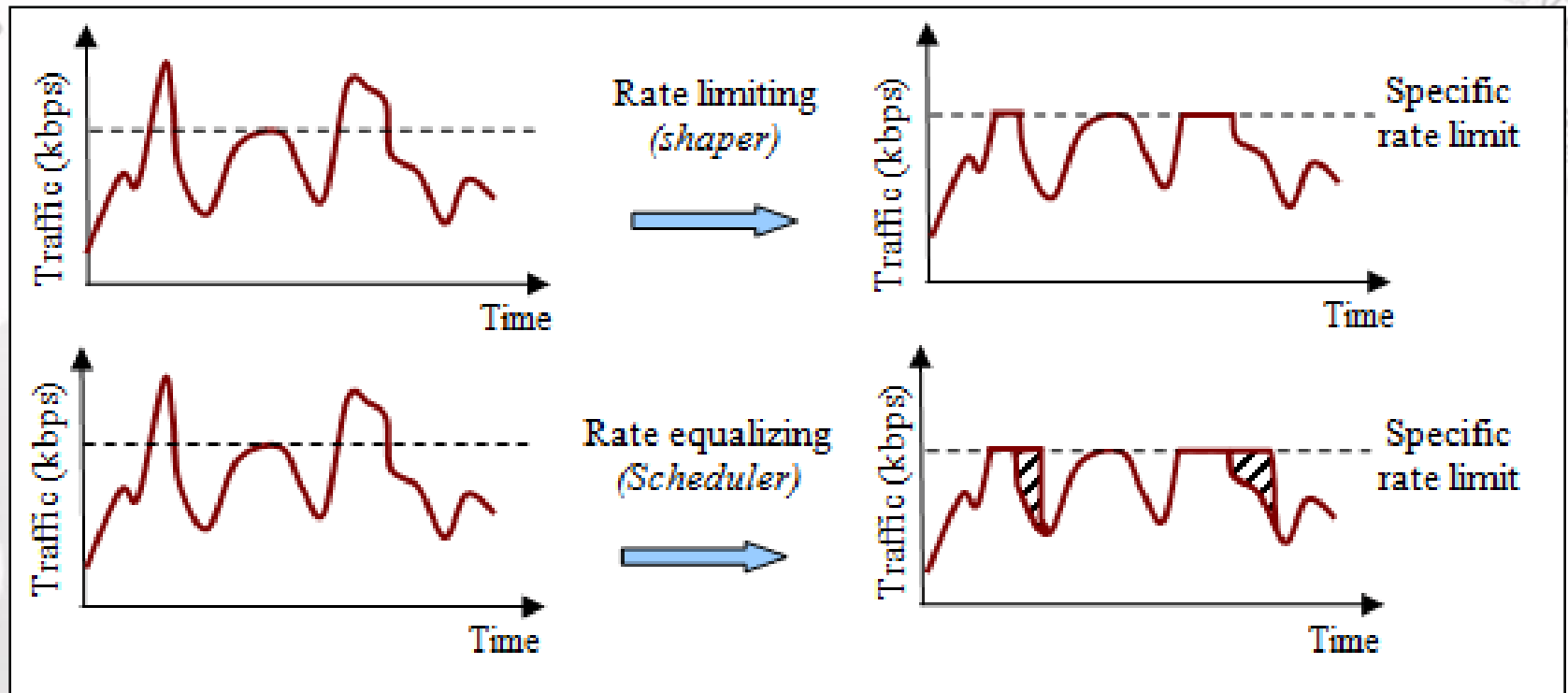
PPPoE Scan

enabled | running | slave | Status: connected

QoS

QoS

- Bandwidth Limiter



Rate Limit

- Pada RouterOS, dikenal 2 jenis batasan rate limit:
- **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**”.



Simple Queue

- Pada RouterOS, Bandwidth Limit dapat dilakukan dengan berbagai cara (wireless access list, ppp secret dan hotspot user)
- Simple queue mengatur pembatasan bandwidth dengan hanya mendefinisikan parameter IP address (target address) dari host/koneksi yang dilimit.
- Simple queue paling sederhana hanya melakukan pembatasan bandwidth max-limit (MIR)

LAB - Simple Queue

Batasi bandwidth Laptop anda 256k Upload, 256k Download

Simple Queue <Laptop>

General | Advanced | Statistics | Traffic | Total | Total Statistics

Name: Laptop

Target: 192.168.88.2

Dst.:

	Target Upload	Target Download
Max Limit:	256k	256k
Burst Limit:	unlimited	unlimited
Burst Threshold:	unlimited	unlimited
Burst Time:	0	0

enabled

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

LAB - Simple Queue

Total adalah penjumlahan upload dan download

Simple Queue <Laptop>

General Advanced Statistics Traffic **Total** Total Statistics

Total Limit At: ▼ bits/s

Total Max Limit: 512k ▲ bits/s

Total Priority: ▼

Total Burst Limit: ▼ bits/s

Total Burst Threshold: ▼ bits/s

Total Burst Time: ▼ s

Total Queue Type: default-small ▼

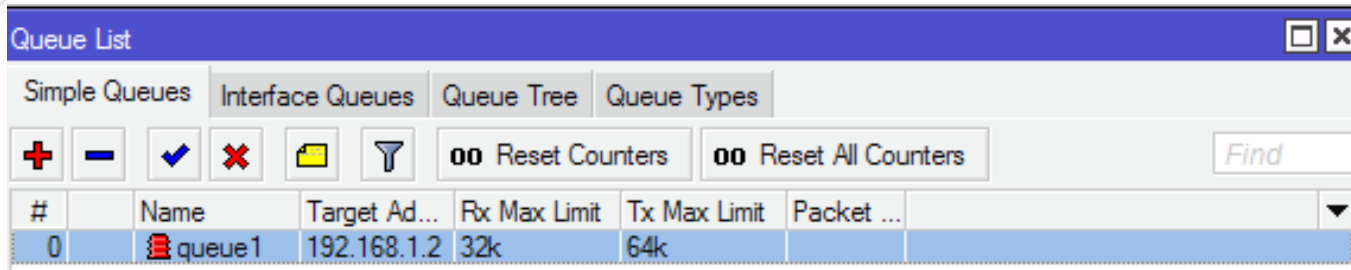
OK
Cancel
Apply
Disable
Comment
Copy
Remove
Reset Counters
Reset All Counters
Torch

enabled



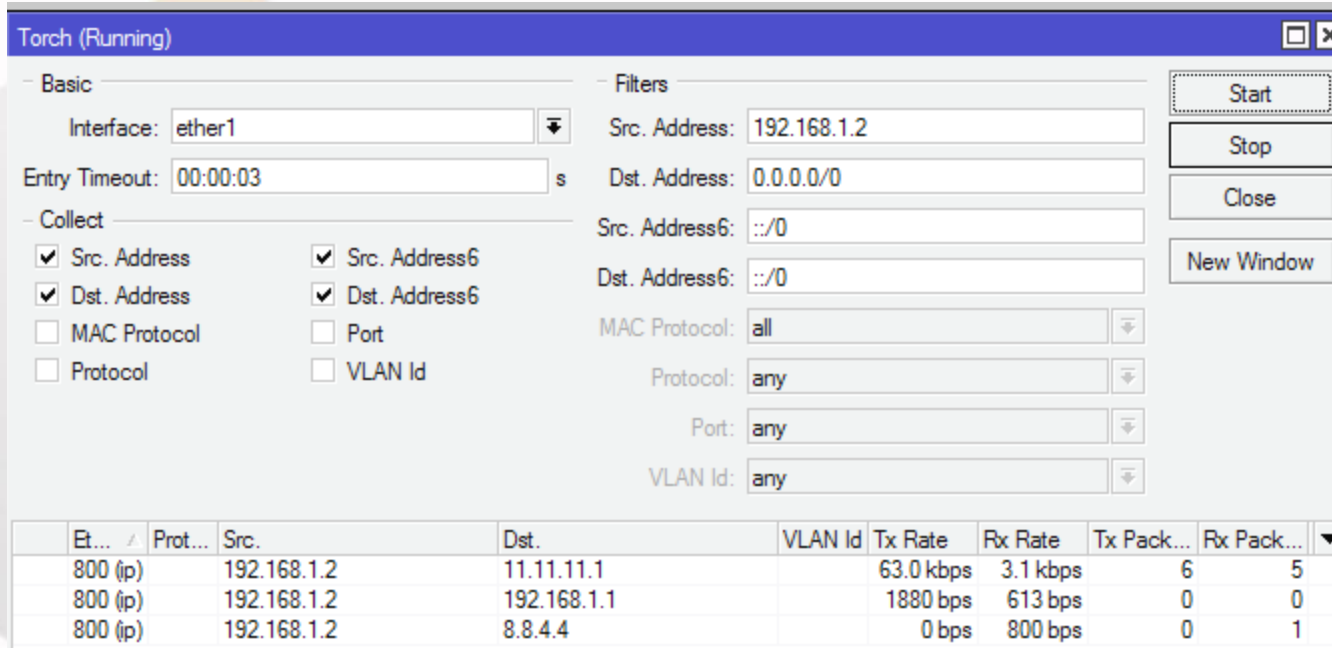
LAB-Cek Bandwidth Status

Simple Queue status



#	Name	Target Ad...	Rx Max Limit	Tx Max Limit	Packet ...
0	queue1	192.168.1.2	32k	64k	

Toot Torch status



Et...	Prot...	Src.	Dst.	VLAN Id	Tx Rate	Rx Rate	Tx Pack...	Rx Pack...
800 (ip)		192.168.1.2	11.11.11.1		63.0 kbps	3.1 kbps	6	5
800 (ip)		192.168.1.2	192.168.1.1		1880 bps	613 bps	0	0
800 (ip)		192.168.1.2	8.8.4.4		0 bps	800 bps	0	1



PCQ

New Queue Type

Type Name: queue1

Kind: pcq

Rate: 0

Limit: 50

Total Limit: 2000

Burst Rate:

Burst Threshold:

Burst Time: 00:00:10

Classifier

Src. Address Dst. Address

Src. Port Dst. Port

Src. Address Mask: 32

Dst. Address Mask: 32

Src. Address6 Mask: 64

Dst. Address6 Mask: 64

OK

Cancel

Apply

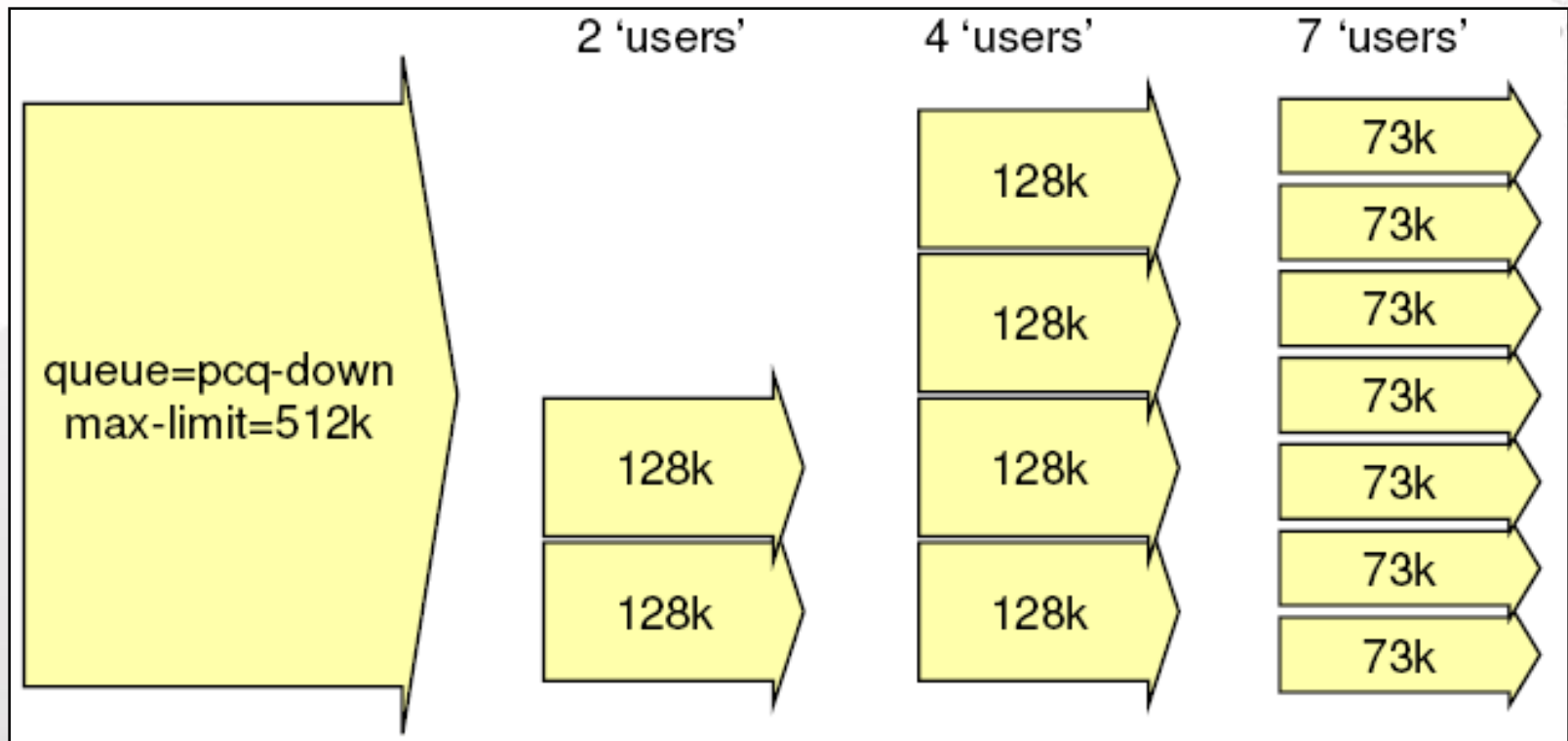
Copy

Remove

- PCQ akan membuat sub-queue, berdasarkan parameter pcq-classifier (src-address, dst-address, src-port, dst-port)
- Dimungkinkan untuk membatasi maksimal data rate untuk setiap sub-queue (pcq-rate) dan jumlah paket data (pcq-limit)
- Total ukuran queue pada PCQ-sub-queue tidak bisa melebihi jumlah paket sesuai pcq-total-limit

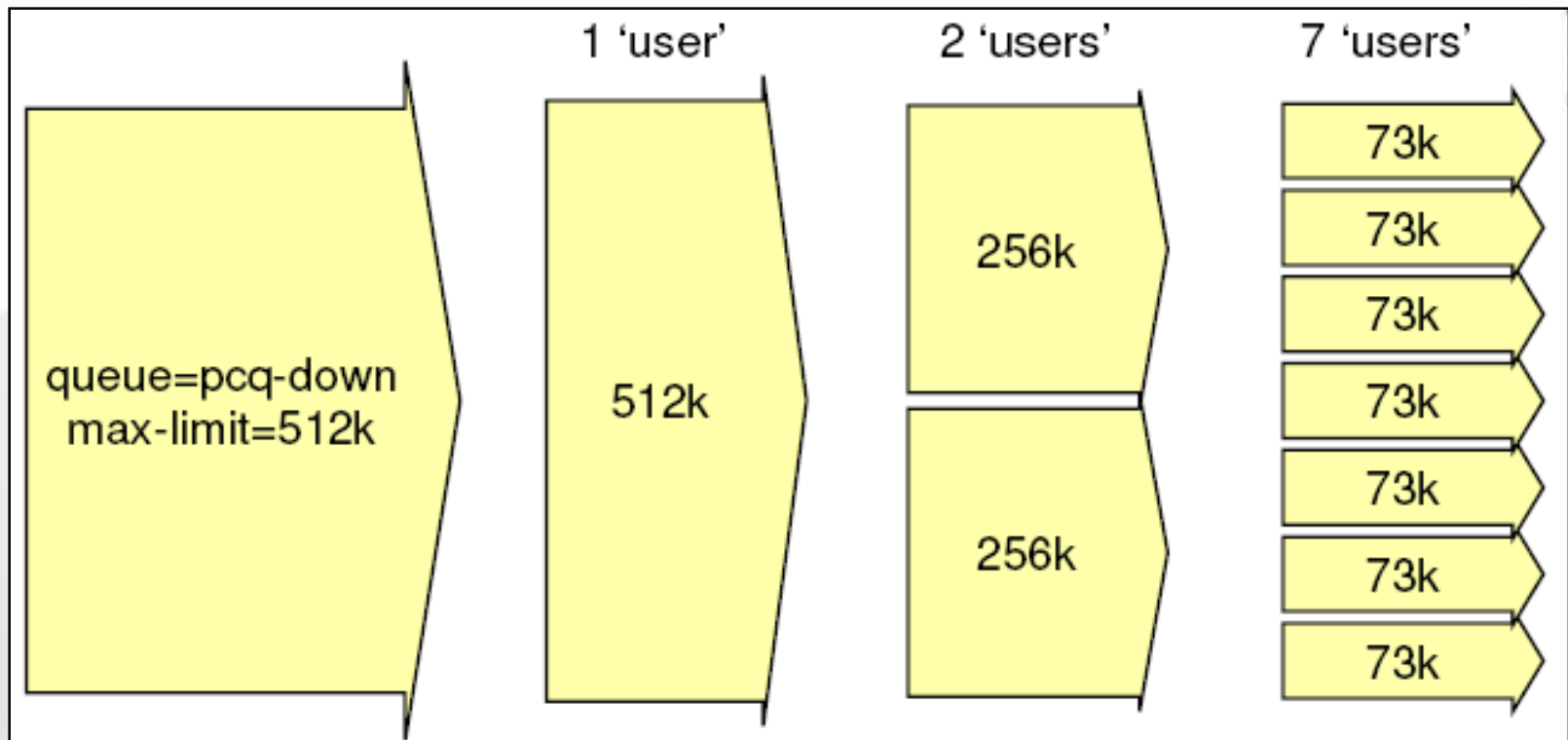
Contoh Penggunaan PCQ

- PCQ Rate = 128k

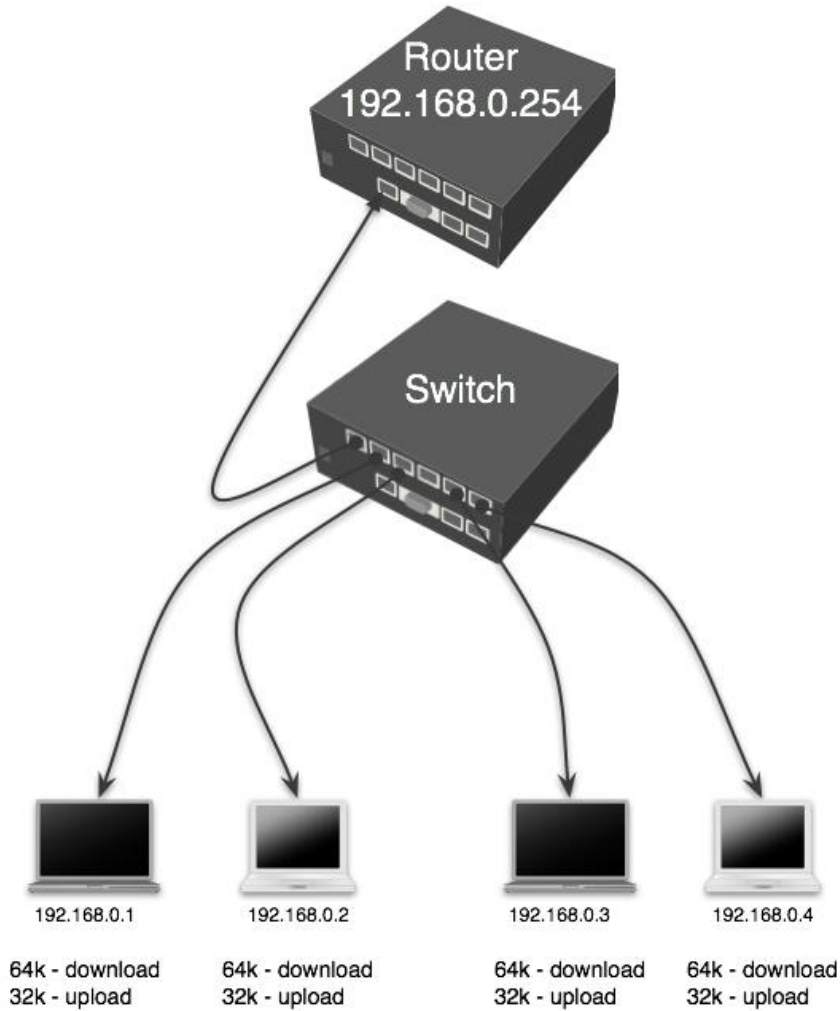


Contoh Penggunaan PCQ

- PCQ Rate = 0



LAB- PCQ



LAB - PCQ

- Buat Mark Packet upload & download

```
/ip firewall mangle add chain=prerouting action=mark-packet in-interface=etherLAN new-packet-mark=client_upload
```

```
/ip firewall mangle add chain=prerouting action=mark-packet in-interface=etherWAN new-packet-mark=client_download
```

- Buat 2 PCQ queue types – satu untuk download dan satu untuk upload. dst-address untuk trafik download user, src-address untuk trafik upload

```
/queue type add name="PCQ_download" kind=pcq pcq-rate=64000 pcq-classifier=dst-address
```

```
/queue type add name="PCQ_upload" kind=pcq pcq-rate=32000 pcq-classifier=src-address
```

- Buat 1 rule simple queue

```
/queue simple add target-addresses=192.168.0.0/24
```

```
queue=PCQ_upload/PCQ_download \ packet-marks=client_download,client_upload
```



Network Management



ARP

- Meskipun pengalamatan paket data menggunakan alamat IP, alamat hardware/hardware address harus digunakan untuk transport data host to host pada connected network.
- ARP digunakan untuk mapping layer OSI level 3 (IP) ke layer OS level 2 (MAC Address).
- Router memiliki tabel entri ARP saat ini digunakan, biasanya tabel ARP dibuat secara dinamis oleh router, tetapi untuk meningkatkan keamanan jaringan, dapat juga dibuat secara statis baik sebagian atau semuanya dengan menambahkan secara manual pada entri ARP tabel.



Interface ARP Mode

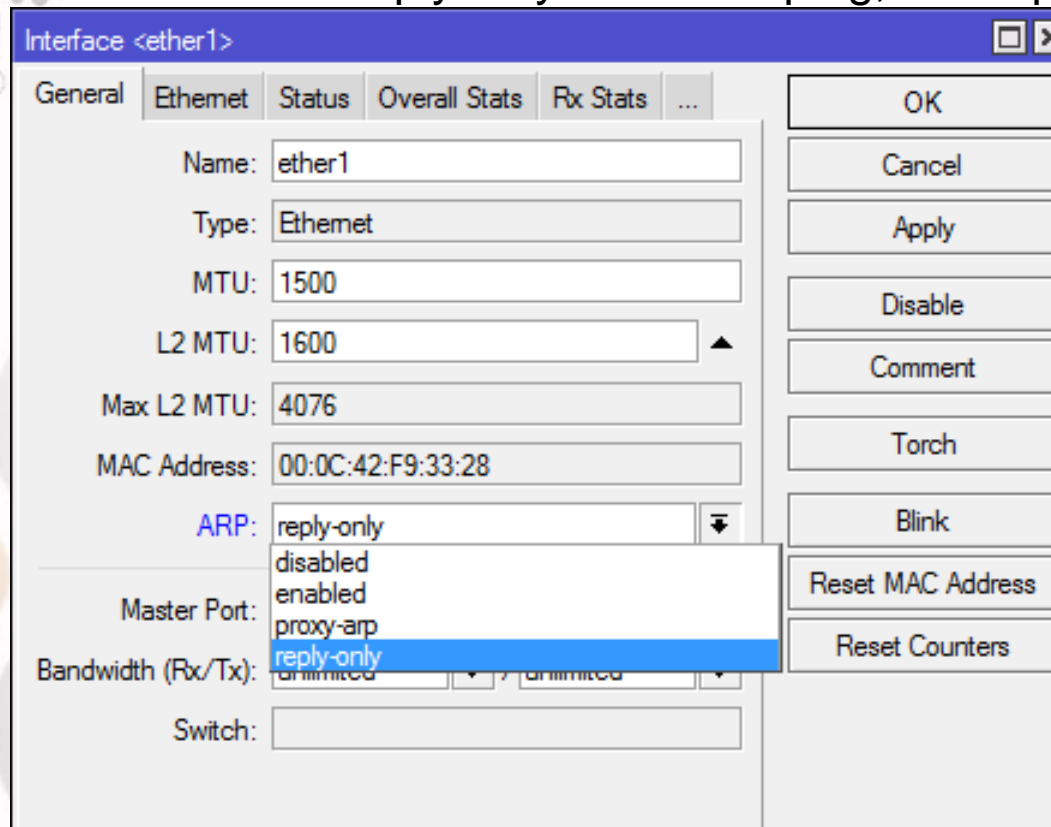
- Enable → Mode ini default enable pada semua interface di MikroTik. Semua ARP akan ditemukan dan secara dinamik ditambahkan dalam ARP tabel.
- Proxy ARP → Router dengan mode ARP proxy akan bertindak sebagai transparan proxy ARP antara dia atau lebih jaringan yang terhubung langsung.
- Reply Only → ARP reply-only memungkinkan router hanya kan mereply ARP statis ditemukan di tabel ARP, akses ke router dan ke jaringan di belakang router hanya dapat diakses oleh kombinasi Ip dan mac address yang ditemukan di tabel ARP.
- Disable → permintaan ARP dari klien tidak dijawab oleh router. Oleh karena itu, statis arp entri harus ditambahkan disamping disisi router juga disisi client. misal pada Windows menggunakan perintah arp:
C: \> arp-s 192.168.2.1 00-aa-00-62-c6-09



LAB- ARP Mode

ARP Reply-Only

- Koneksikan Laptop dengan salah satu interface.
- Set interface reply-only dan coba ping, dari laptop ke router.

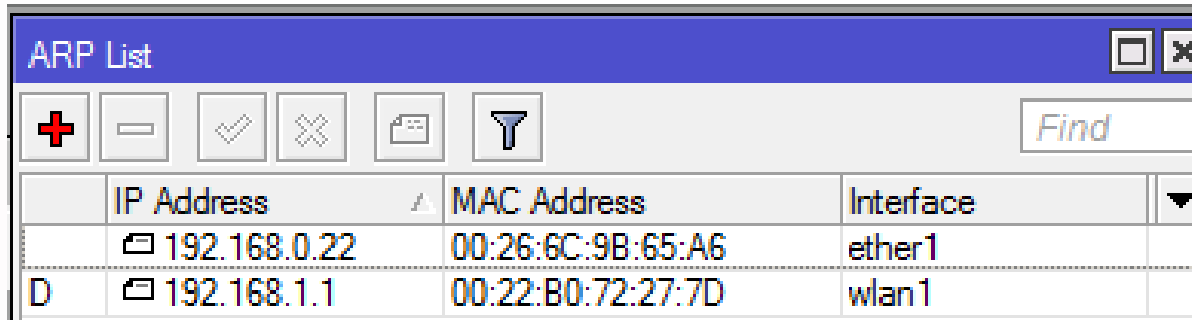


The screenshot shows a configuration window titled "Interface <ether1>". The "General" tab is selected. The "Name" field is "ether1", "Type" is "Ethernet", "MTU" is "1500", "L2 MTU" is "1600", "Max L2 MTU" is "4076", and "MAC Address" is "00:0C:42:F9:33:28". The "ARP" dropdown menu is open, showing options: "disabled", "enabled", "proxy-arp", and "reply-only" (which is highlighted in blue). The "Master Port" field is empty. The "Bandwidth (Rx/Tx)" fields are set to "unlimited". The "Switch" field is empty. On the right side of the window, there are several buttons: "OK", "Cancel", "Apply", "Disable", "Comment", "Torch", "Blink", "Reset MAC Address", and "Reset Counters".

LAB- ARP Mode

ARP Reply-Only

- Tambahkan kombinasi IP dan ARP dari laptop pada menu IP>ARP



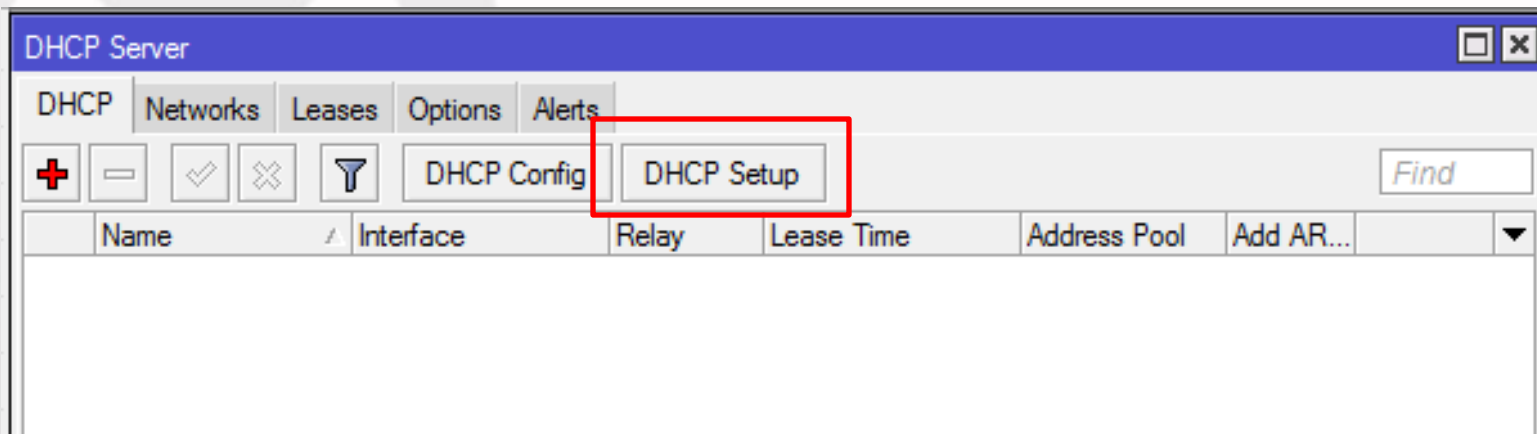
The screenshot shows a window titled "ARP List" with a blue header bar. Below the header is a toolbar with icons for adding (+), removing (-), checking (✓), unchecking (✗), printing, and filtering (funnel), along with a "Find" search box. The main area contains a table with the following data:

	IP Address	MAC Address	Interface	
	192.168.0.22	00:26:6C:9B:65:A6	ether1	
D	192.168.1.1	00:22:B0:72:27:7D	wlan1	

- Coba ping kembali ip router dari laptop.
- Gunakan laptop peserta lain, isikan IP yang sama dengan IP laptop anda sebelumnya.
- Coba ping kembali

LAB - DHCP Server

- DHCP server dapat dijalankan pada masing-masing interface di router.
- Untuk memudahkan seting DHCP server, sebelumnya add IP address untuk interface yang akan menjalankan DHCP server.
- Setting DHCP server pada menu IP>DHCP Server>DHCP Setup



CONTACT

okytria@gmail.com

Skype : okytria

+6285-7807-40217

www.idn.id

www.training-mikrotik.com