

# Mikrotik Training Basic

Certified Mikrotik Training Basic Class  
STMIK KHARISMA Makassar-Mikrotik Certified Academy

# Mikrotik Academy

- Educational institutions such as universities, technical schools, colleges, vocational schools, and other educational institutions offering semester time based Internet networking courses for their academic students using MikroTik RouterOS as a learning tool.
- **Credit Training Material :**  
[www.mikrotik.co.id](http://www.mikrotik.co.id) (Citraweb Nusa Infomedia - *Mikrotik Certified Training Partner*)

# Trainer & Staff

- **Saiful Rahman (Koordinator)**
  - *MTCNA (Mikrotik Certified Network Associate)*
  - *MTCTCE (Mikrotik Certified Traffic Control Expert)*
- **Abd. Munir S.**
  - *MTCNA (Mikrotik Certified Network Associate)*
  - *MTCTCE (Mikrotik Certified Traffic Control Expert)*
  - *MTCIPv6E (Mikrotik Certified IPv6 Engineer)*
- **Agus Halid**
  - *MTCNA (Mikrotik Certified Network Associate)*
  - *MTCTCE (Mikrotik Certified Traffic Control Expert)*

# New Training Scheme 2010

- **Basic/Essential Training**
  - MikroTik Certified Network Associate (MTCNA)
- **Advanced Training**
  - Certified Wireless Engineer (MTCWE)
  - Certified Routing Engineer (MTCRE)
  - Certified Traffic Control Engineer (MTCTCE)
  - Certified User Managing Engineer (MTCUME)
  - Certified Inter Networking Engineer (MTCINE)

# Certification Test

- Diadakan oleh **Mikrotik.com** secara online
- Dilakukan pada sesi terakhir
- Jumlah soal : **25** Waktu: **60 menit**
- Nilai minimal kelulusan : **60%**
- Yang mendapatkan nilai **50%** hingga **59%** berkesempatan mengambil “***second chance***”
- Yang lulus akan mendapatkan sertifikat yang diakui secara internasional

# Module 1

## Mikrotik RouterOS Introduction

# STMIK KHARISMA Makassar

- Menjadi bagian dari Mikrotik Academy pada tahun 2013.
- Resmi menyelenggarakan Mikrotik Training Basic yang bersertifikasi Internasional

# Where is MikroTik ?





# Arti Kata Mikrotik

- Mikrotik adalah kependekan dari ***mikrotikls*** yang dalam bahasa Latvia berarti “***network kecil***”

# What Is Mikrotik?

- Software Router untuk PC (x86, AMD, dll)  
**#RouterOS#**
  - Menjadikan PC biasa memiliki fungsi router yang lengkap
  - Diinstall sebagai Operating System, tidak membutuhkan operating system lainnya
- Hardware untuk jaringan (terutama wireless)  
**#Routerboard#**
  - Wireless board  
contoh: RB400, RB600, RB750, RB1000
  - Wireless interface (R52, R52H, R5H, R52N, R2N)  
menggunakan RouterOS sebagai software

# Routerboard

- RouterBOARD is the hardware platform made by MikroTik. Our routers are powered by the powerful **RouterOS Software**. RouterBOARD routers are used by ISPs, integrators, system builders and large corporations around the world.
- Routerboard seperti sebuah pc mini yang terintegrasi karena dalam satu board tertanam prosesor, ram, rom, dan memori flash

# Keunggulan

- Harga lebih murah dibanding berbagai macam product sekelas
- Compability hardware banyak
- Feature cukup banyak
- Untuk product Router Board yang udah dibundle dengan mikrotik performancenya sangat memenuhi kebutuhan dan sangat bisa bersaing dengan product yang lebih mahal

# Routerboard for Wireless

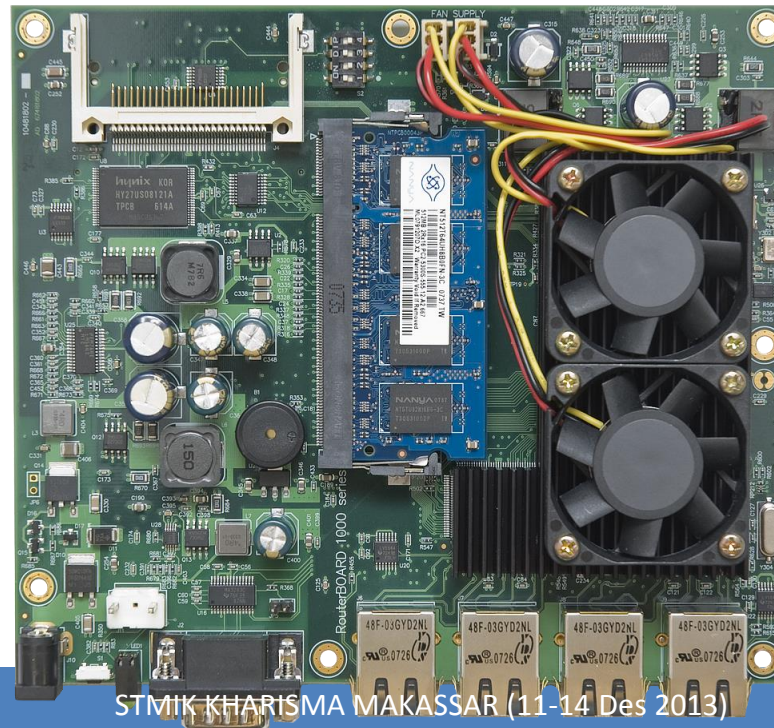
Jenis	Processor	RAM	Ether	MiniPC I	USB	Radio	Lisensi
RB800	MPC8544 800MHz	256MB	3 (gig)	4	-	-	6
RB435G	AR71xx 680MHz	256MB	3 (gig)	5	2	-	5
RB433UAH	AR71xx 680MHz	128MB	3	3	2	-	5
RB433/ AH	AR71xx 300/680MHz	64MB/128MB	3	3	-	-	4/5
RB411UAHR	AR71xx 680 MHz	64MB	1	1	1	1	4
RB411AH	AR71xx 680 MHz	64MB	1	1	-	-	4
RB411U/ AR	AR71xx 300 MHz	32MB/64MB	1	1	1/-	-/1	4
GrooveA-5Hn	AR72xx 400MHz	64MB	1	-	-	1	4
RB711A-5nH	AR72xx 400MHz	64MB	1	-	-	1	4
<b>Groove-5Hn</b>	<b>AR72xx 400MHz</b>	<b>32MB</b>	<b>1</b>	<b>-</b>	<b>-</b>	<b>1</b>	<b>3</b>
<b>RB711-5nH</b>	<b>AR72xx 400MHz</b>	<b>32M</b>	<b>1</b>	<b>-</b>	<b>-</b>	<b>1</b>	<b>3</b>

# Routerboard for Indoor Router

Jenis	Processor	RAM	Ethernet	Mini PCI	Lisensi
<b>RB1100AH X2</b>	<b>PPC 1Ghz dual Core</b>	<b>2GB</b>	13 (gigabit)	0	6
<b>RB1100AH</b>	<b>PPC 1Ghz</b>	<b>2GB</b>	13 (gigabit)	0	6
<b>RB1200</b>	<b>PPC 1Ghz</b>	<b>512MB</b>	10 (gigabit)	0	6
<b>RB493G</b>	<b>AR71xx 680 MHz</b>	<b>256MB</b>	9 (gigabit)	3	5
<b>RB493 / AH</b>	<b>AR71xx 300 / 680 MHz</b>	<b>64MB / 128MB</b>	9	3	4/5
<b>RB450G</b>	<b>AR71xx 680 MHz</b>	<b>256MB</b>	5 (gigabit)	0	5
<b>RB450</b>	<b>AR71xx 300 MHz</b>	<b>32MB</b>	5	0	5
<b>RB750</b>	<b>AR72xx 400MHz</b>	<b>32MB</b>	5	0	4
<b>RB750GL</b>	<b>AR72xx 400MHz</b>	<b>64MB</b>	5 (gigabit)	0	4

# Discontinued Hardware

- RB100 series
  - RB112,RB133,RB133C
  - RB153,RB150,RB192
- RB200 series
  - RB230
- RB300series
  - RB333
- RB400 series
  - RB411A,RB411R
- RB500 series
  - RB532,RB511
- RB600 series
  - RB600
- RB700 series
  - RB750G
- RB1000 series
  - RB1000, RB1100



# RB1100AH / X2

- **13 Port** Gigabit ethernet
- **1GHz** Network Processor / Dual Core
- RAM: **2GB**
- up to:
  - 2 Gbps
  - 250.000 pps / 1M pps
- **1U** rackmount





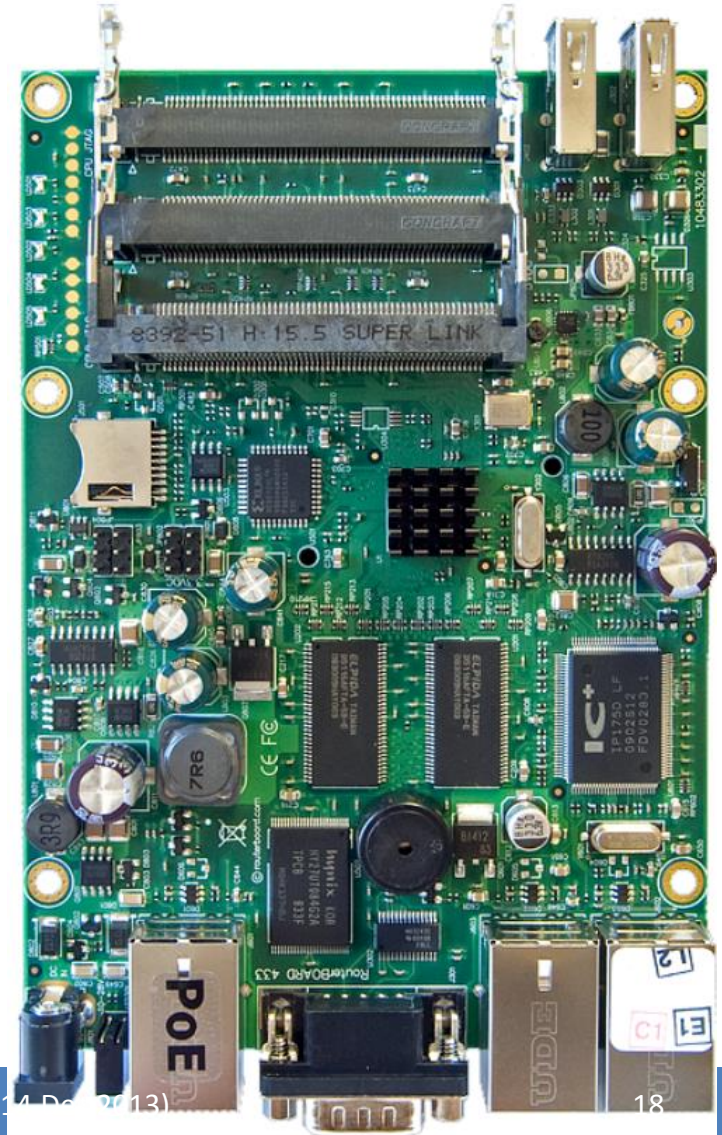
# RB800

- 3 Gigabit Ethernet
- 4 Minipci Slot
- DaughterBoard Expandable
- CF slot
- MPC8544 800MHz CPU
- 256 DDR SDRAM



# RB433UAH

- 3 Ethernet, 3 Minipci
- Atheros AR7161 680MHz
- RAM: 128MB
- With micro-SD slot
- RouterOS Level 5
- 2 port USB





# RB411 / U / AR / AH / UAHR

- CPU: Atheros
  - AR7130 300MHz (411/U/AR)
  - AR7161 680 MHz (411AH/UAHR)
- Memory:
  - 32 MB (411/U)
  - 64MB (411AR/UAHR/AH)
- Wireless Embedded (411AR/UAHR)
- 1 ethernet
- 1 MiniPCI (411/U/AR/AH/UAHR)
- Lisensi RouterOS:
  - Level 3 (411)
  - Level 4 (411U/AR/AH/UAHR)



# RB493/AH/G

- 9 ethernet (gigabit di 493G)
- 3 Minipci Slot
- Processor :
  - Atheros AR7161 680MHz (493AH & G)
  - Atheros AR7130 300MHz (493)
- RAM: 64MB
- RouterOS:
  - Level 4 (RB493)
  - Level 5 (RB493AH & G)



# Embedded Solution

- Embedded Antenna 2,4GHz & 5GHz
- With Routerboard 411 series / 711 Series



# RB450 / G

- 5 port Ethernet / gigabit
- Tanpa minipci port
- Processor : Atheros  
300MHz / 680 MHz
- RAM: 64 / 256 MB
- RouterOS Level 5





# RB750 / GL

- Produk routerboard terhemat dan terkecil
- Processor : AR7240  
400Mhz
- ethernet port (750)
- 5 gigabit port (750GL)
- Lisensi Level 4



# RB751U-2HND

- High power 1W  
802.11b/g/n wireless  
AP
- 5 Port Ethernet
- 1 Port USB
  - For Modem
  - For Flashdisk
- 2x2 MIMO  
Integrated Antenna





# Wireless Interface

- **R52/H (a/b/g)**
  - Atheros chipset
  - MiniPCI type interface
  - 65 mWatt / **350 mWatt**
  - 3 band wireless
    - 2.4 GHz, 5.2 GHz, 5.8 GHz
  - Custom Frequency Support
    - 2.1 – 2.5 GHz
    - 4.9 – 6.0 GHz



# Mikrotik RouterOS

- Mikrotik RouterOS™ adalah sistem operasi dan perangkat lunak yang dapat digunakan untuk menjadikan komputer menjadi router network yang handal, mencakup berbagai fitur yang dibuat untuk ip network dan jaringan wireless, cocok digunakan oleh ISP dan provider hotspot. ([www.mikrotik.co.id](http://www.mikrotik.co.id))
- Mikrotik routerOS merupakan sistem operasi Linux base yang diperuntukkan sebagai network router. Didesain untuk memberikan kemudahan bagi penggunaanya.

# Fitur

- IP Routing
  - Static route & Policy route
  - Dynamic Routing (RIP, OSPF, BGP)
  - Multicast Routing
- Interface
  - Ethernet, V35, G703, ISDN, Dial Up Modem
  - Wireless : PTP, PTMP, Nstream, WDS, Mesh
  - Bridge, Bonding, STP, RSTP
  - Tunnel: EoIP, IPSec, IPIP, L2TP, PPPoE, PPTP, VLAN, MPLS, OpenVPN, SSTP
- Firewall
  - Mangle, NAT, Address List, Filter Rules, L7 protocol
- Bandwidth Management
  - HTB, PFIFO, BFIFO, SFQ, PCQ, RED

# Fitur

- Services (Server)
  - Proxy (cache), Hotspot, DHCP, IP Pool, DNS, NTP,
- Radius Server (User-Manager)
- AAA
  - PPP, Radius Client
  - IP Accounting, Traffic Flow
- Monitoring
  - Graphs, Watchdog, Torch, Custom Log, SNMP, The Dude Monitoring Tools
- Diagnostic Tools & Scripting
  - Ping, TCP Ping, Tracert, Network Monitoring, Traffic Monitoring, Scheduller, Scripting
  - VRRP

# Manage RouterOS services

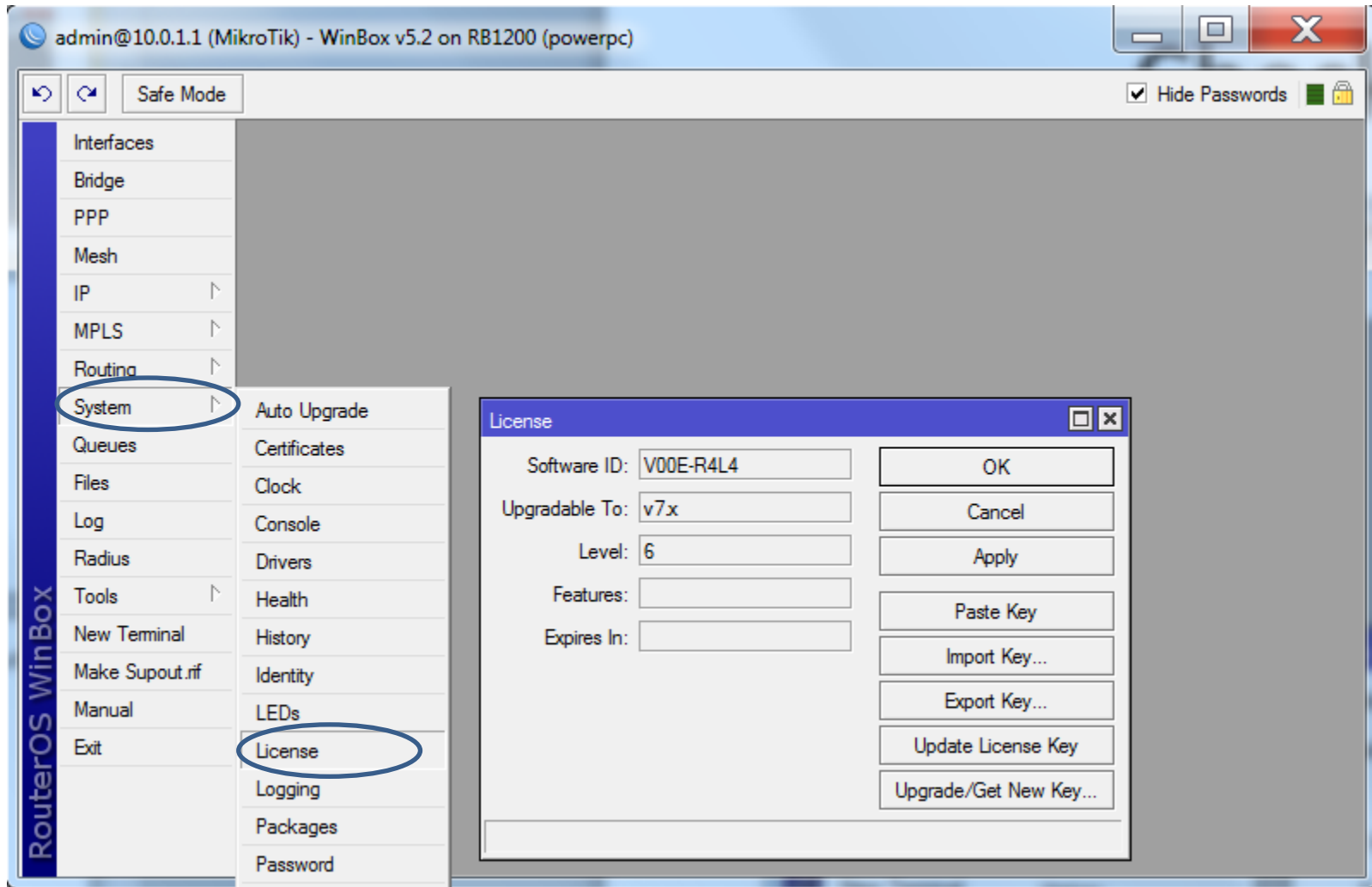
The screenshot shows the Mikrotik WinBox interface. On the left, the 'Services' menu item is highlighted in the 'IP' category. On the right, the 'IP Service List' window is open, displaying a table of services. The 'ssh' service is selected.

Name	Port	Available From	Certificate
api	8728		
ftp	21		
ssh	22		
telnet	23		
winbox	8291		
www	80		
www-ssl	443		none

# RouterOS license

Level number	0 (Demo mode)	1 (Free)	3 (WISP CPE)	4 (WISP)	5 (WISP)	6 (Controller)
<b>Price</b>	<a href="#">no key</a>	<a href="#">registrati on required</a>	<a href="#">volum e only</a>	\$45	\$95	\$250
<b>Upgradable To</b>	-	no upgrades	ROS v7.x	ROS v7.x	ROS v8.x	ROS v8.x
<b>Wireless AP</b>	24h trial	-	-	yes		
<b>Wireless Client and Bridge</b>	24h trial	-	yes			
<b>RIP, OSPF, BGP protocols</b>	24h trial	-	yes(*)	yes		
<b>EoIP tunnels, VLAN interfaces, Queues</b>	24h trial	1	unlimited			
<b>PPPoE tunnels</b>	24h trial	1	200	200	500	unlimited
<b>PPTP tunnels</b>	24h trial	1	200	200	500	unlimited
<b>L2TP tunnels</b>	24h trial	1	200	200	500	unlimited
<b>OVPN tunnels</b>	24h trial	1	200	200	unlimited	unlimited
<b>HotSpot active users</b>	24h trial	1	1	200	500	unlimited
<b>RADIUS client</b>	24h trial	-	yes			
<b>Web proxy</b>	24h trial	-	yes			
<b>User manager active sessions</b>	24h trial	1	10	20	50	Unlimited

# Checking Licence



# Buy Licence

- Online di [www.mikrotik.com](http://www.mikrotik.com)
  - Real time, pembayaran dengan kartu kredit,
- Online di [www.mikrotik.co.id](http://www.mikrotik.co.id)
  - Waktu proses 1 hari kerja
  - Transfer ke rekening bank lokal
  - Lebih murah !
  - Real time licence processing! Setelah pembayaran diterima
  - Real time payment processing, via IndoMOG



# Produk Mana Yang Dipilih

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

# Buyer's Guide

- 300 / 400 Mhz Processor ( < **5Mbps** Traffic)
  - *RB450, RB750, RB433, RB493*
- 680 Mhz Processor ( **5 ~ 20 Mbps** Traffic)
  - *RB450G, RB433AH, RB493G*
- 1Ghz Processor ( **20 ~ 100 Mbps** Traffic)
  - *RB1200, RB1100AH*
- 1Ghz Dual Core Processor ( > **100 Mbps** Traffic)
  - *RB1100AHx2*
- Multi Core x86 Processor ( > **1 Gbps** Traffic)
  - *Mikrobits : Aneto, Ainos, Dinara*
- Xeon Processor ( > **10 Gbps** Traffic)
  - *Mikrobits : Dinara*

# Useful Links

- [www.mikrotik.com](http://www.mikrotik.com) - manage licenses, documentation
- [forum.mikrotik.com](http://forum.mikrotik.com) - share experience with other users
- [wiki.mikrotik.com](http://wiki.mikrotik.com) - tons of examples

# Mikrotik Installation

# Instalasi Mikrotik

- Media Instalasi (Penyimpan) Mikrotik RouterOS
  - Harddisk
  - CF Disk
  - DOM (Disk On Module)
    - SATA DOM (coming soon on [mikrotik.co.id](http://mikrotik.co.id))
  - USB Flash Disk
    - Komputer harus bisa booting dari USB (setting BIOS)
  - Routerboard

# Installation Method

- **CD**
  - Create CD from CD image (iso file)
  - For PC Router Fresh-Install
    - CD-Rom Required
- **Netinstall**
  - Via network using NetInstall program.
  - For PC Router (Fresh-Install / Re-Install)
    - PXE, EtherBoot Required
  - For Reinstall Routerboard

# Download Area

- **Mikrotik.co.id – Download Area**
  - Connected 1Gbps to OpenIXP.
- **Mikrotik.com – Download Area**

## Software Instalasi

Berikut ini adalah software MikroTik RouterOS terbaru:

- [CHANGELOG\\_5](#) (19.31 KByte, 1132 download)
- [all\\_packages-mipsbe-5.25.zip](#) (13.76 MByte, 10257 download)
- [all\\_packages-mipsle-5.25.zip](#) (13.32 MByte, 686 download)
- [all\\_packages-ppc-5.25.zip](#) (19.01 MByte, 1930 download)
- [all\\_packages-x86-5.25.zip](#) (18.52 MByte, 1897 download)
- [mikrotik-5.25.iso](#) (20.85 MByte, 8084 download)
- [netinstall-5.25.zip](#) (14.41 MByte, 5197 download)
- [routeros-mipsbe-5.25.npk](#) (11.86 MByte, 4123 download)
- [routeros-mipsle-5.25.npk](#) (11.5 MByte, 417 download)
- [routeros-powerpc-5.25.npk](#) (17.28 MByte, 962 download)
- [routeros-x86-5.25.npk](#) (15.39 MByte, 955 download)

**Untuk versi-versi sebelumnya, bisa didownload di [www.RouterOS.co.id](http://www.RouterOS.co.id).**

# CD Installation (1)

- Gunakanlah CD yang telah dibuat untuk melakukan booting pada komputer
- Pilihlah module yang ingin diinstall

```
Welcome to MikroTik Router Software installation
```

```
Move around menu using 'p' and 'n' or arrow keys, select with 'spacebar'.  
Select all with 'a', minimum with 'm'. Press 'i' to install locally or 'r' to  
install remote router or 'q' to cancel and reboot.
```

```
[X] system          [ ] isdn           [ ] synchronous  
[X] ppp            [ ] lcd           [ ] telephony  
[X] dhcp          [ ] ntp           [ ] ups  
[X] advanced-tools [ ] radiolan      [ ] web-proxy  
[ ] arlan         [ ] routerboard  [ ] wireless  
[ ] gps           [X] routing  
[ ] hotspot      [X] security
```



# CD Installation (3)

- **Warning: all data on the disk will be erased!**  
**Continue? [y/n]**

**Choose Yes**

- **Do you want to keep old configuration? [y/n]:**

**Yes/No**

- **Creating partition...**
- **Formatting disk...**
- **Software installed.**
- **Press ENTER to reboot**

# Installation Check

- Default Login User dan password
  - user = admin dan password = [kosong]
- Welcome menu

```
MikroTik 3.20
MikroTik Login: admin
Password: _
```

# Demo

- License level 0 = Demo time 24 jam

```
MMM      MMM      KKK      TTTTTTTTTTTT      KKK
MMMM     MMMM     KKK      TTTTTTTTTTTT      KKK
MMM MMMM MMM III  KKK  KKK  RRRRRR      000000      TTT      III  KKK  KKK
MMM  MM  MMM  III  KKKKK  RRR  RRR  000  000      TTT      III  KKKKK
MMM      MMM  III  KKK  KKK  RRRRRR      000  000      TTT      III  KKK  KKK
MMM      MMM  III  KKK  KKK  RRR  RRR  000000      TTT      III  KKK  KKK
```

MikroTik RouterOS 3.20 (c) 1999-2009

<http://www.mikrotik.com/>

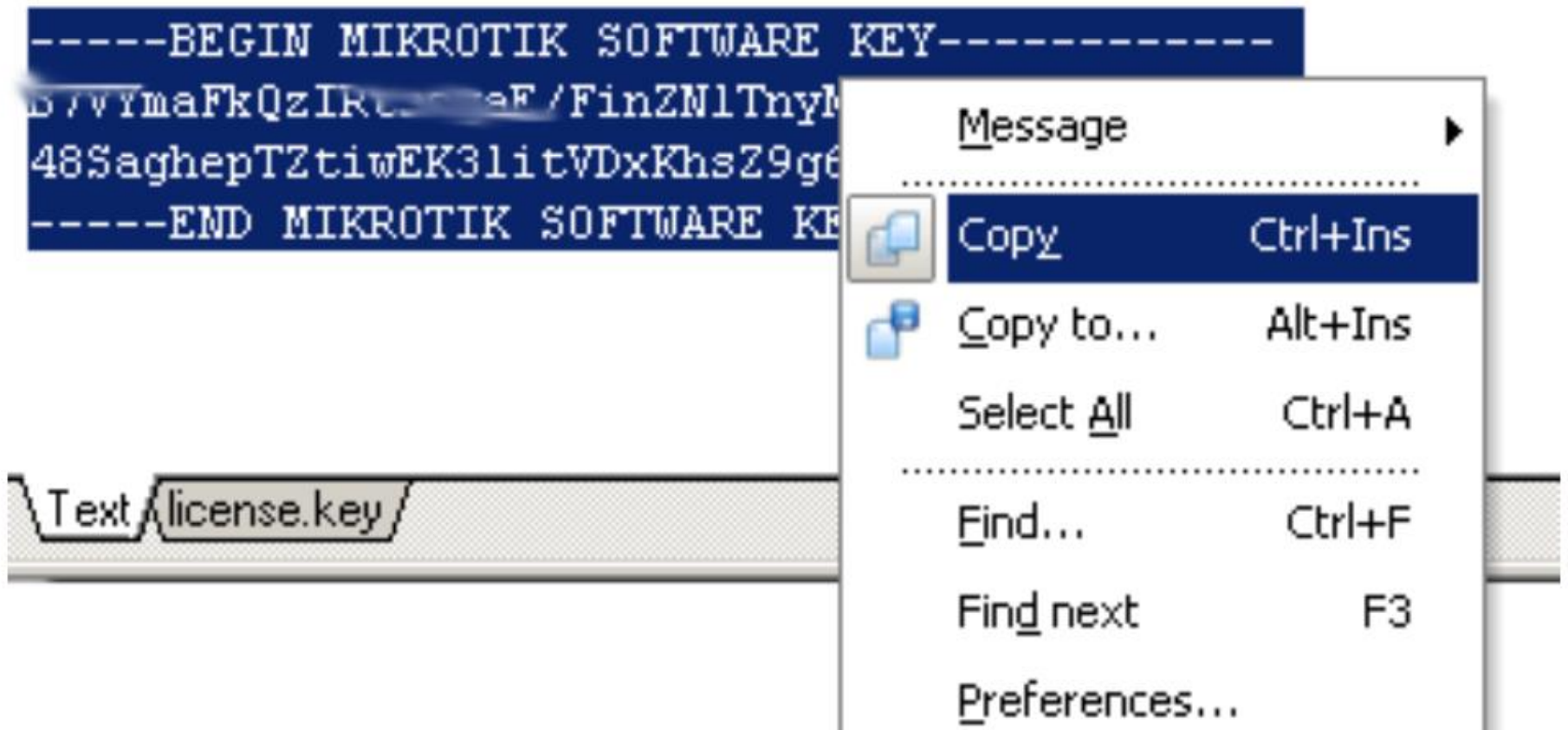
ROUTER HAS NO SOFTWARE KEY  
-----

You have 23h49m to configure the router to be remotely accessible,  
and to enter the key by pasting it in a Telnet window or in Winbox.  
See [www.mikrotik.com/key](http://www.mikrotik.com/key) for more details.

Current installation "software ID": FTGX-E1M  
Please press "Enter" to continue!

[admin@MikroTik] > \_

# Input License (Telnet)



```
Mikrotik v2.9.7
Login: admin
Password:
  MMM      MMM      KKK      TTTTTTTTTT
  MMMM     MMMM     KKK      TTTTTTTTTT
  MMM MMMM  MMM  III  KKK  KKK  RRRRRR      000000      TTT
  MMM  MM   MMM  III  KKKKK  RRR  RRR  000  000      TTT
  MMM      MMM  III  KKK  KKK  RRRRRR      000  000      TTT
  MMM      MMM  III  KKK  KKK  RRR  RRR  000000      TTT
Mikrotik RouterOS 2.9.7 (c) 1999-2005      www.mikrotik.
```

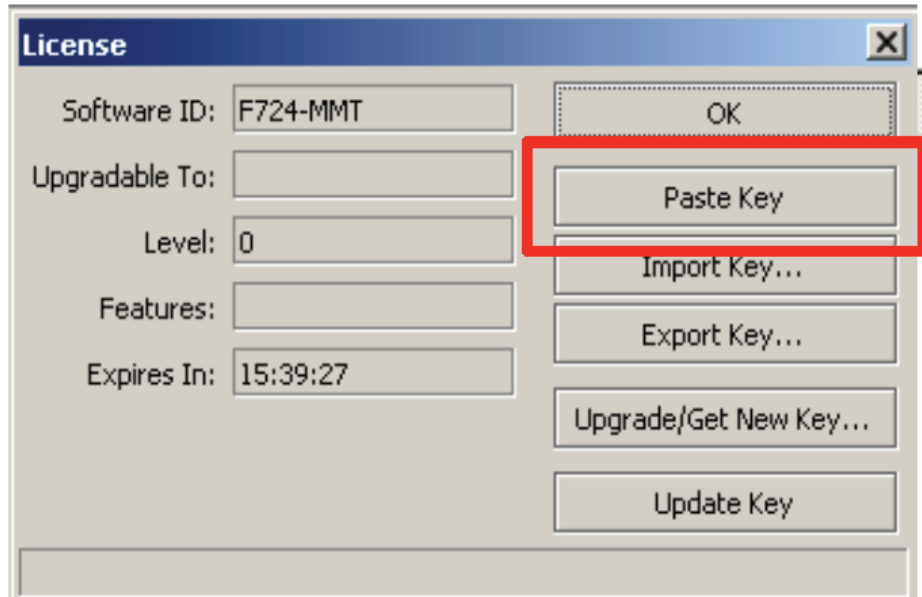
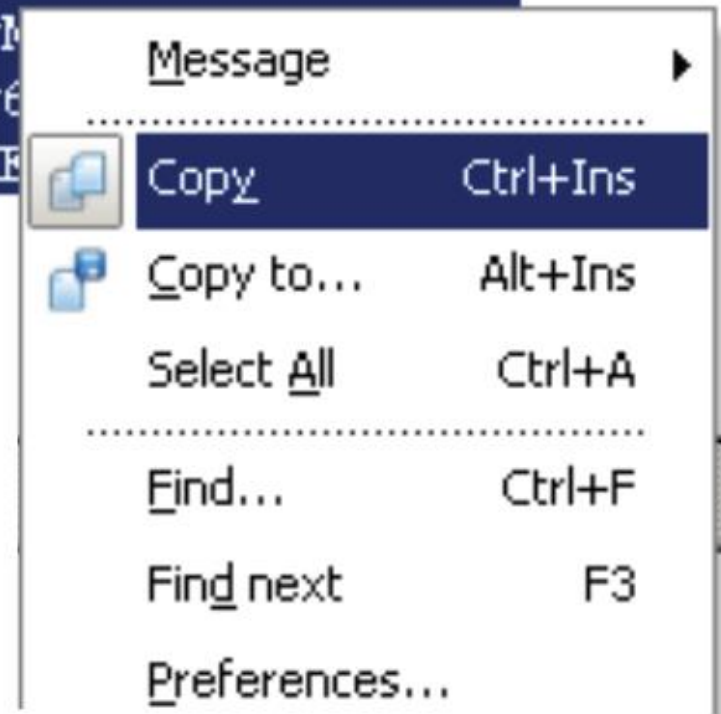
```
Terminal ansi detected, using single line input mode
[admin@3] > _
```

- Mark
- Copy    Enter
- Paste
- Select All
- Scroll

```
[admin@3] > -----BEGIN MIKROTIK SOFTWARE KEY-----
key> -----BEGIN MIKROTIK SOFTWARE KEY-----
key> 1XQjbaQuuwNIiUtplpyv...@CMPRg/9...==
key> -----END MIKROTIK SOFTWARE KEY-----
<ect. Reboot? [y/N]: _
```

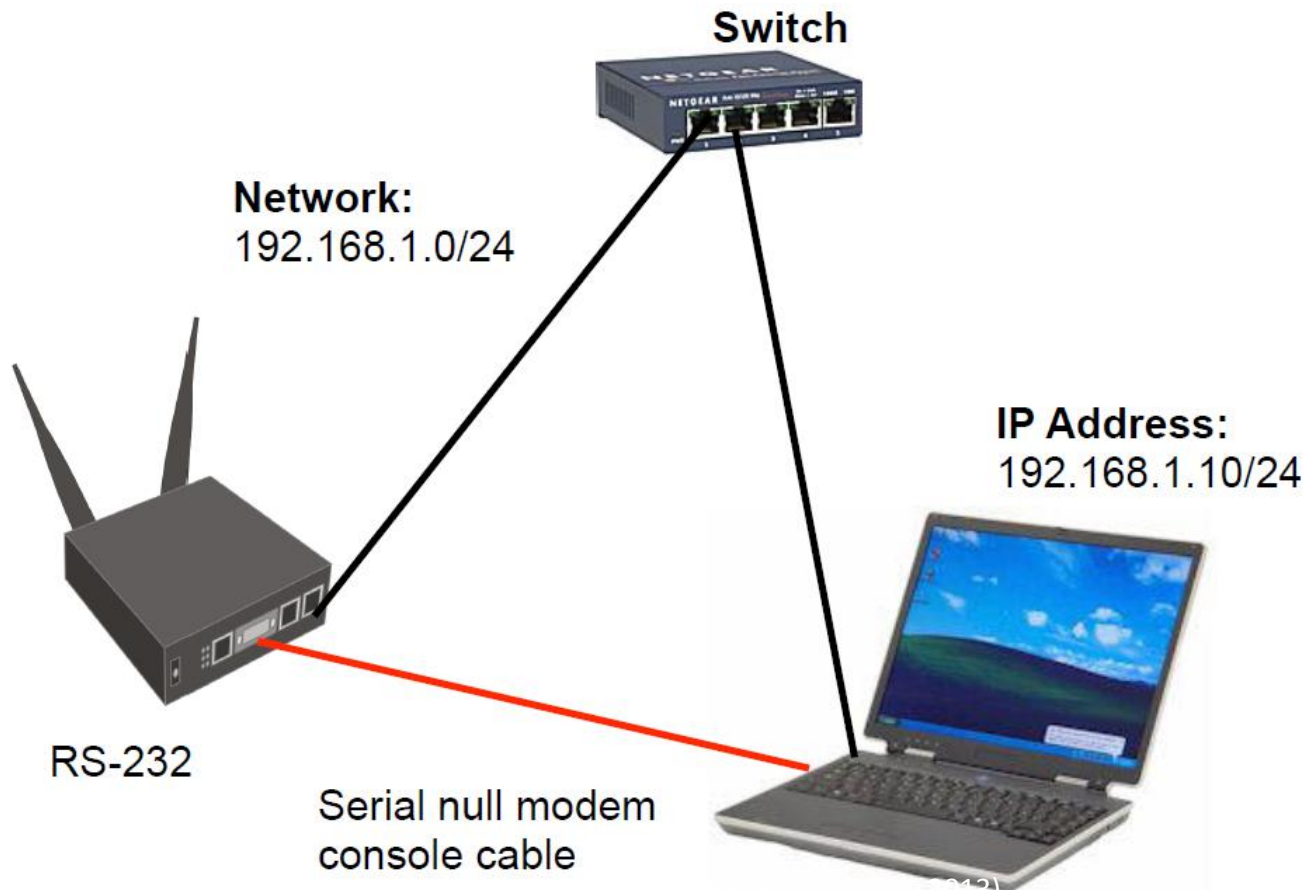
# Input License (Winbox)

```
-----BEGIN MIKROTIK SOFTWARE KEY-----  
b/vYmaFkQzIR...eF/FinZN1ThyM  
48SaghepTZtiwEK3litVDxKhsZ9g6  
-----END MIKROTIK SOFTWARE KE
```



# Netinstall

- Metode Netinstall biasa digunakan untuk melakukan install ulang RouterBoard / PC Router yang sudah support net-boot.



# Netinstall

- Download program netinstall dan module yang dibutuhkan

## Software Instalasi

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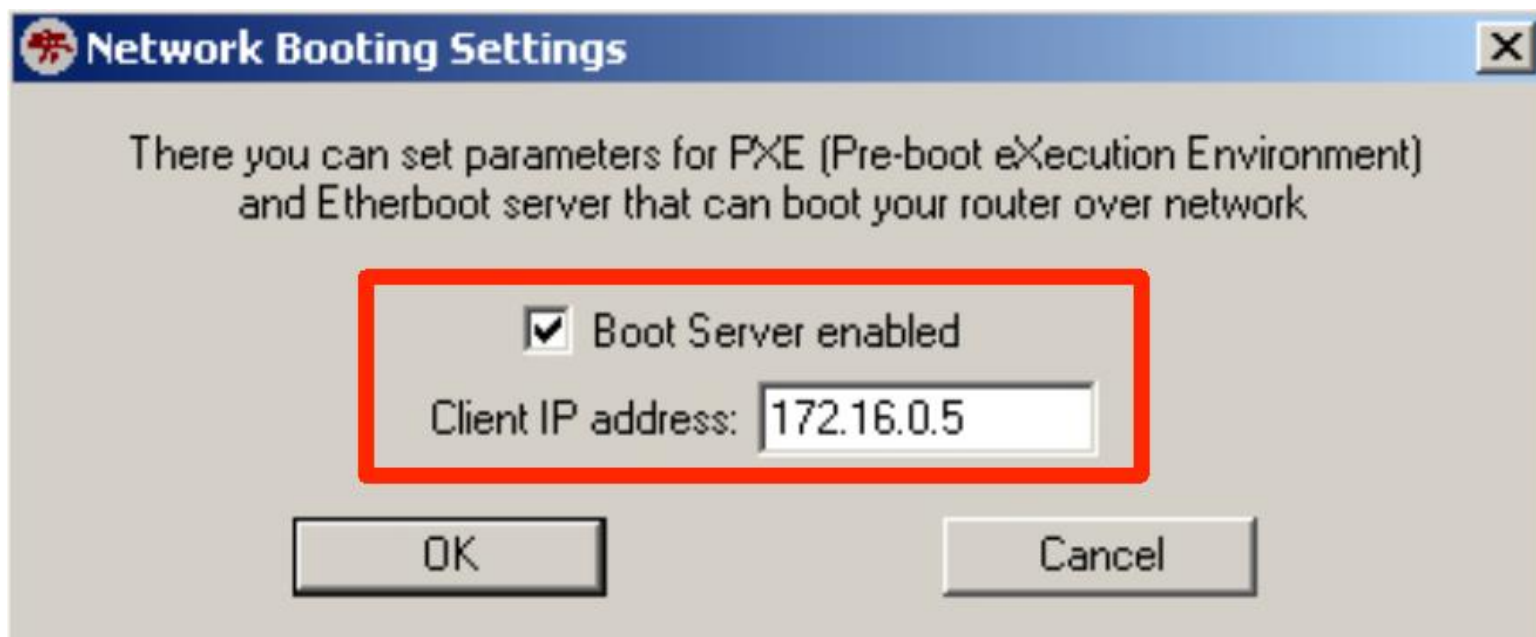
# Netinstall

- Hubungkan **Router** dengan PC Installer via cross utp cable atau via switch
- Hubungkan juga router dengan PC Installer via console cable
- Jalankan program **netinstall.exe**, dan hidupkan **Boot service**



# Netinstall - Config

- Masukkanlah **IP Address** yang berbeda dengan IP Address laptop / komputer Anda, namun berada dalam **subnet yang sama**



# Netinstall – BIOS Setting

## Hidupkan router, masuk ke setting BIOS

```
RouterBOOT booter 2.12
```

```
RouterBoard 333
```

```
CPU frequency: 333 MHz
```

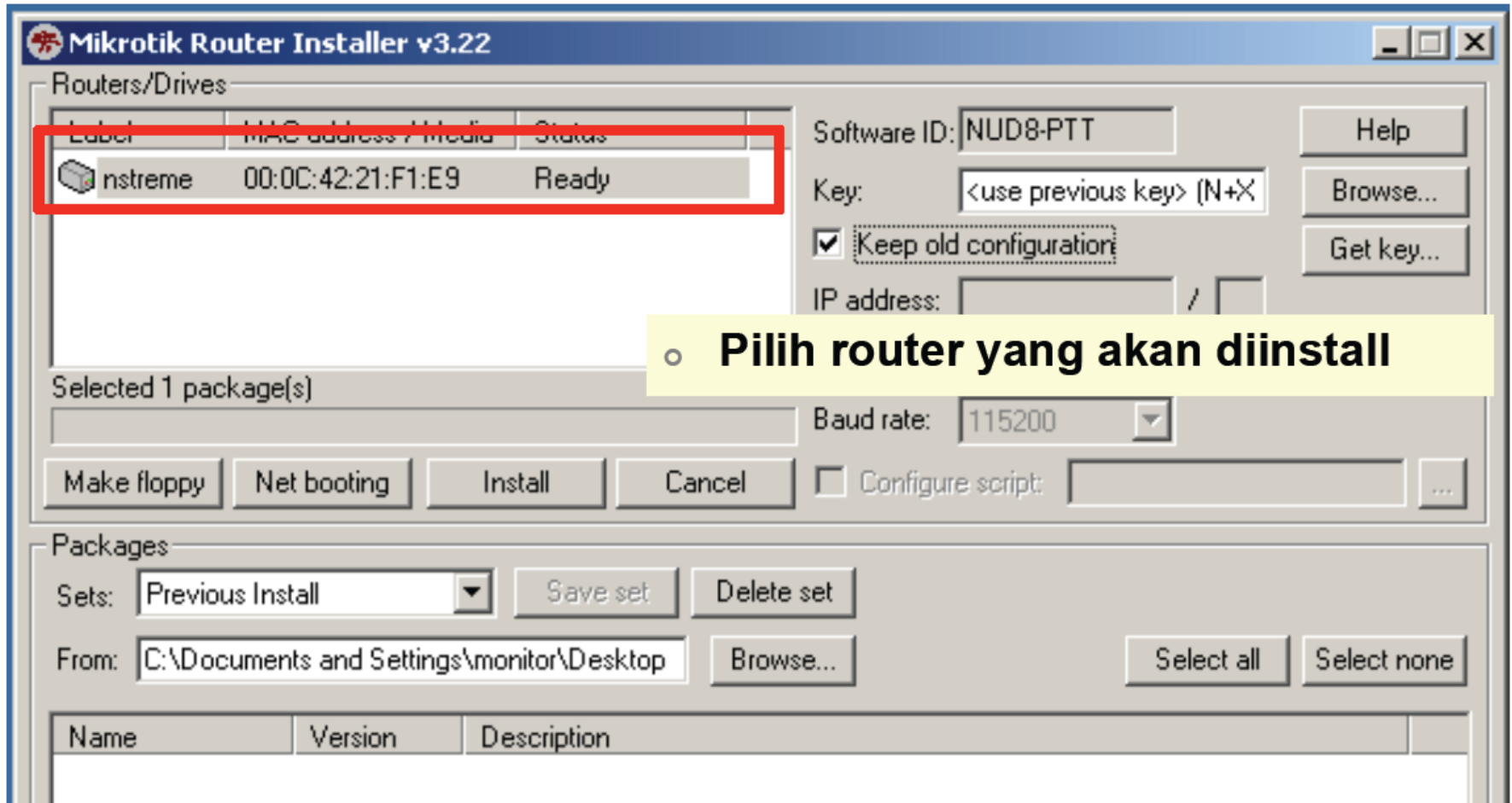
```
Memory size: 64 MB
```

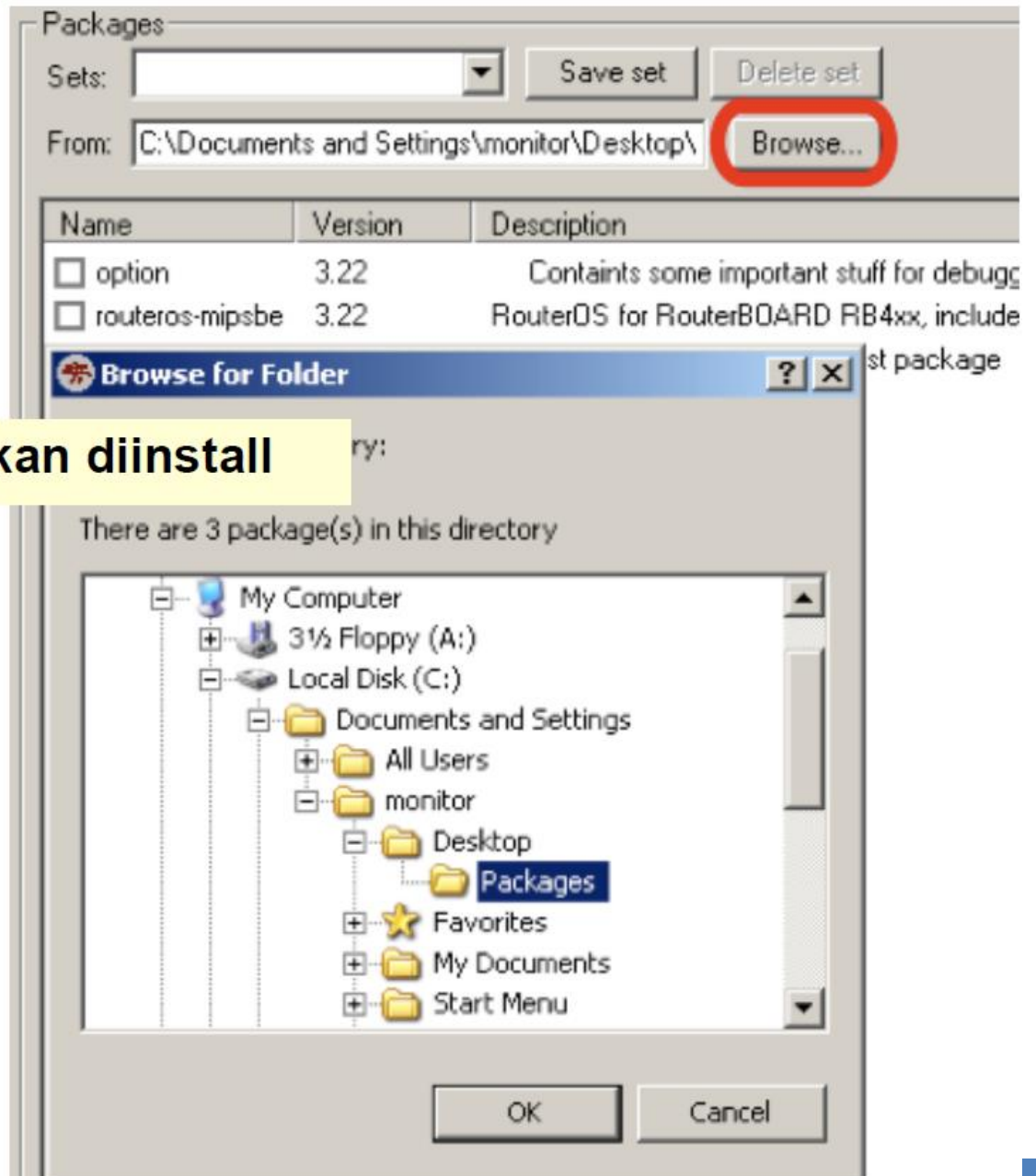
```
Press any key within 2 seconds to enter setup
```

# Netinstall – BIOS Setting

- **RouterBOOT-2.41**  
**What do you want to configure?**  
**d – boot delay**  
**k – boot key**  
**s – serial console**  
**n – silent boot**  
**o – boot device**  
**u – cpu mode**  
**f – cpu frequency**  
**r – reset booter configuration**  
**e – format nand**  
**g – upgrade firmware**  
**i – board info**  
**p – boot protocol**  
**b – booter options**  
**t – do memory testing**  
**x – exit setup**  
**your choice: o – boot device**
- **Select boot device:**  
**e – boot over Ethernet**  
**\* n – boot from NAND, if fail then Ethernet**  
**1 – boot Ethernet once, then NAND**  
**o – boot from NAND only**  
**b – boot chosen device**  
**f – boot Flash Configure Mode**  
**3 – boot Flash Configure Mode once, then NAND**  
**your choice: 1 – boot Ethernet once, then NAND**

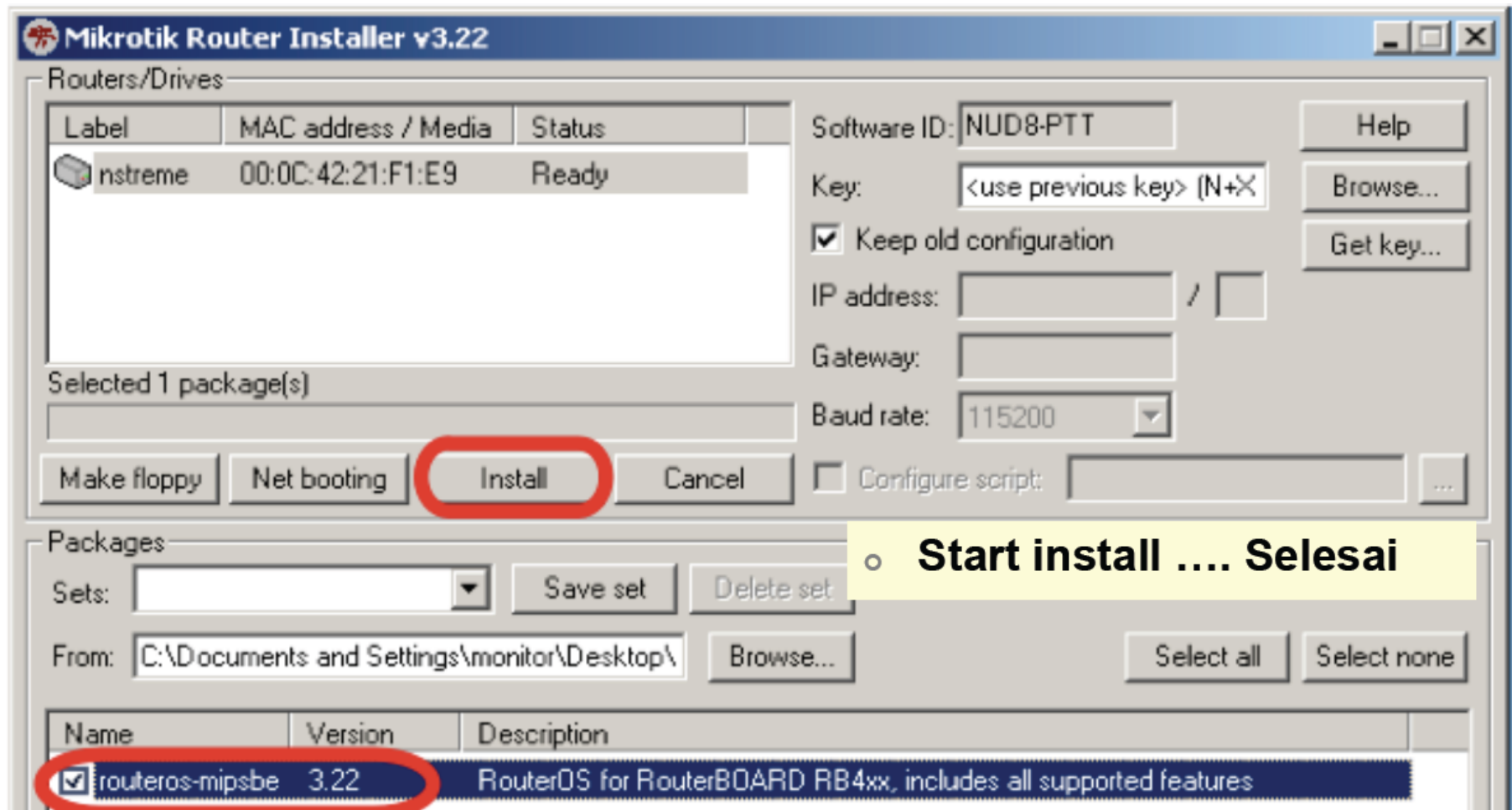
# Netinstall - Install



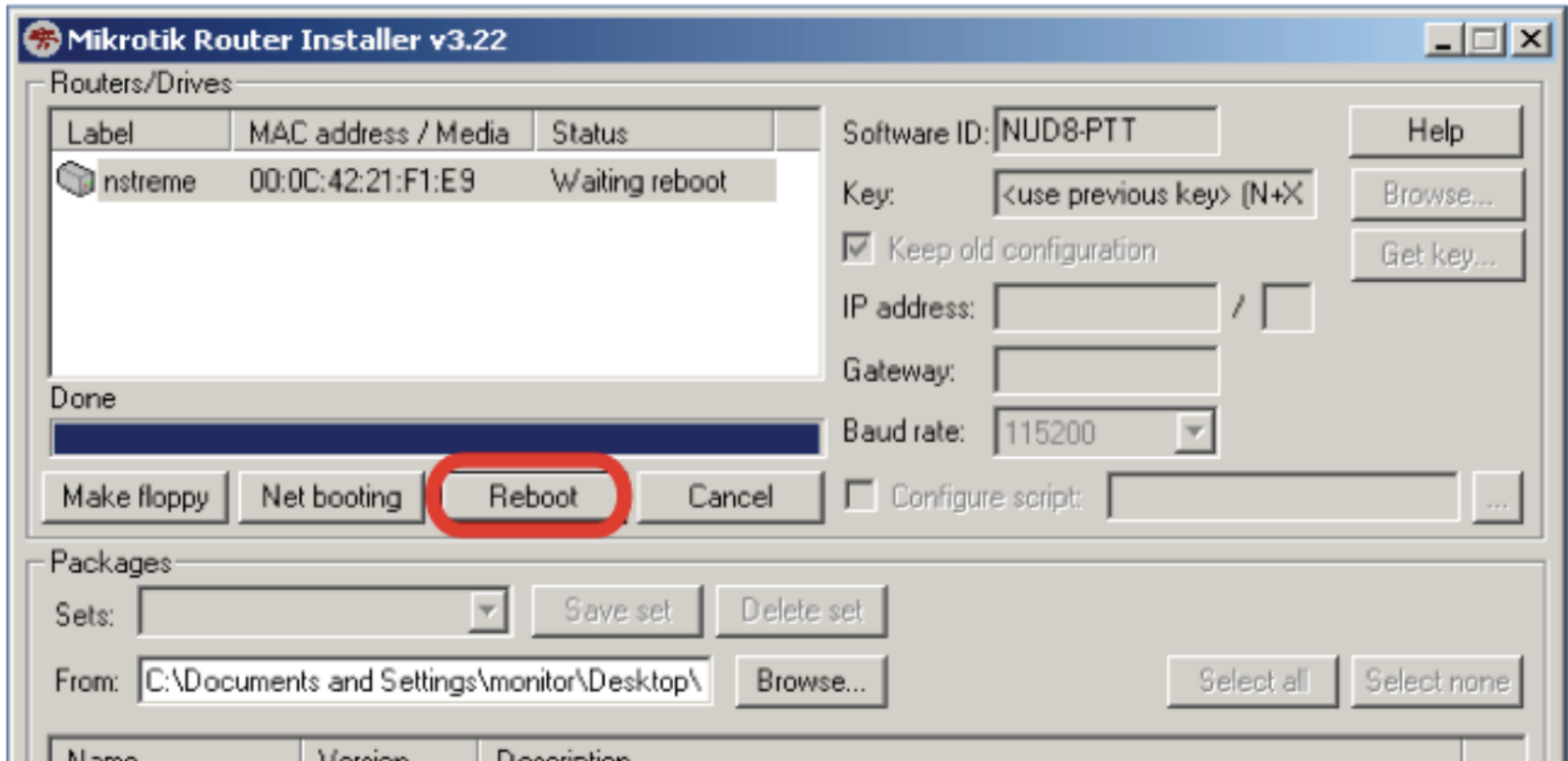


- **Pilih module yang akan diinstall**

# Netinstall - Install



# Netinstall – Reboot





# Netinstall - Cleanup

- **Kembalikan boot ke IDE / NAND drive**
- **Video Tutorial :**
  - [http://www.mikrotik.co.id/artikel\\_lihat.php?id=25](http://www.mikrotik.co.id/artikel_lihat.php?id=25)

```
Select boot device:
```

```
* e - boot over Ethernet
```

```
n - boot from NAND, if fail then Ethernet
```

```
l - boot Ethernet once, then NAND
```

```
o - boot from NAND only
```

```
b - boot chosen device
```

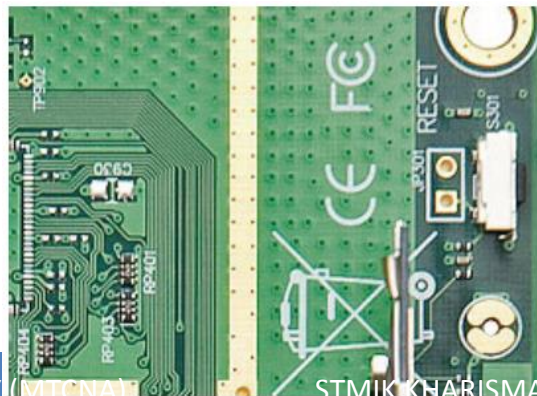
```
your choice: █
```

# Reset Password

- Reset password bisa dilakukan di beberapa routerboard menggunakan tombol “Reset”



- Hard reset

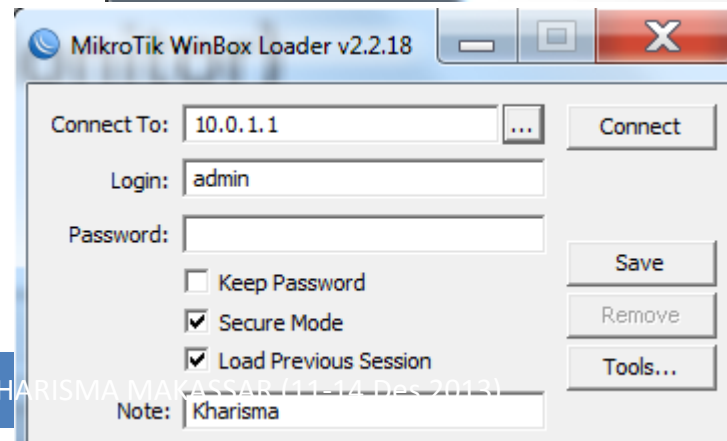
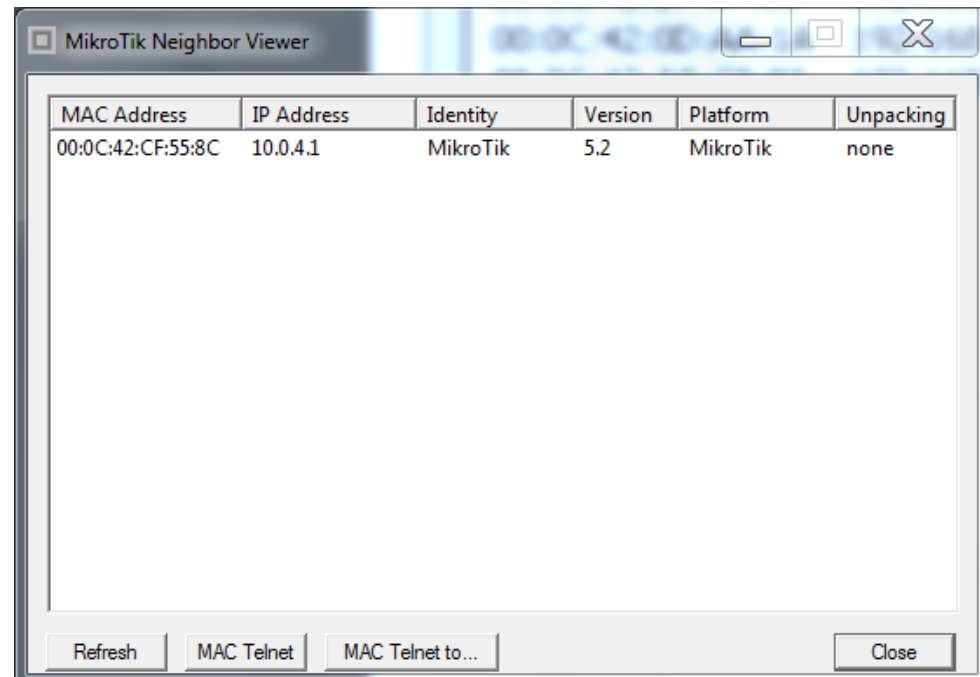


To reset RouterOS config  
Hold metal object in here  
while the board boots.



# First Time Accessing The Router

- Direct Console (Keyboard & Monitor)
- MAC-Winbox – [Winbox.exe](#)
- MAC-Telnet – [NeighbourViewer.exe](#)
- Null Modem cable
- SSH and Telnet



# Access to Router - WebFig

Konfigurasi realtime berbasis Web memungkinkan konfigurasi mikrotik menggunakan perangkat mobile

## RouterOS v5.2

You have connected to a router. Administrative access only. If this administrator.

Select action:



Winbox



Webfig



Telnet



Graphs



License

The server 192.168.5.1:80 at RouterOS requires a username and password.

User Name:

Password:

Cancel

Log In

# Access to Router - WebFig

WebFig v5.2 MikroTik

Undo Redo Hide Passwords Safe Mode Log out

## Interface List

Interface Ethernet EoIP Tunnel IP Tunnel GRE Tunnel VLAN VRRP Bonding

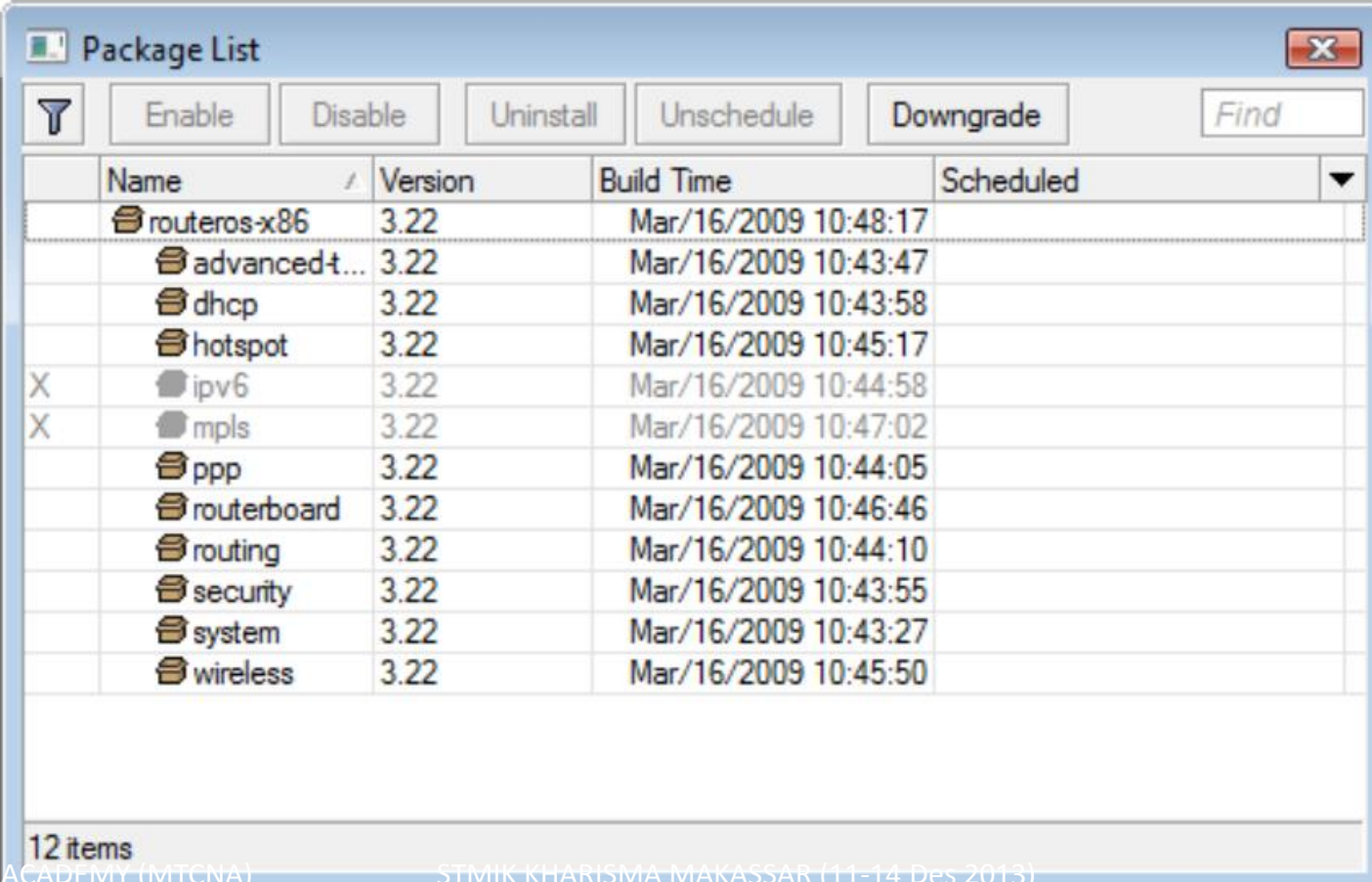
Add New ▼

20 items

		▲ Name	Type	L2 MTU	Tx	Rx	Tx Pack	Rx Pack	Tx Drop	Rx Drop	Tx Erro	Rx Erro
-	D	D	<pptp-0>	PPTP Server		0 bps	0 bps	0	0	0	0	0
-	D	R	bridge-local	Bridge	1520	88.8 kbps	0 bps	50	0	0	0	0
-	D	R	bridge-public	Bridge	1520	0 bps	0 bps	0	0	0	0	0
-	D	R	eoip-ke-jogja	EoIP Tunnel	65535	0 bps	0 bps	0	0	0	0	0
-	E	X	eoip-to-larangan	EoIP Tunnel		0 bps	0 bps	0	0	0	0	0
-	D	R	eoip-to-rajawali	EoIP Tunnel	65535	0 bps	0 bps	0	0	0	0	0
-	E	X	eoip-to-wonocati	EoIP Tunnel		0 bps	0 bps	0	0	0	0	0
	D	R	ether1	Ethernet	1524	0 bps	88.8 kbps	0	50	0	0	0
	D	R	ether2	Ethernet	1524	91.2 kbps	0 bps	50	0	0	0	0

# System Package Check

- Pada terminal: `/system package print`



The screenshot shows the 'Package List' window in Mikrotik WinBox. The window has a toolbar with buttons for 'Enable', 'Disable', 'Uninstall', 'Unschedule', and 'Downgrade', along with a 'Find' search box. Below the toolbar is a table with columns for 'Name', 'Version', 'Build Time', and 'Scheduled'. The table lists 12 packages, all with version 3.22 and build times from March 16, 2009. The 'Scheduled' column is empty for all packages. The status of each package is indicated by a checkbox in the left margin: 'routeros-x86', 'advanced-t...', 'dhcp', 'hotspot', 'ppp', 'routerboard', 'routing', 'security', 'system', and 'wireless' are checked, while 'ipv6' and 'mpls' are unchecked.

	Name	Version	Build Time	Scheduled
	routeros-x86	3.22	Mar/16/2009 10:48:17	
	advanced-t...	3.22	Mar/16/2009 10:43:47	
	dhcp	3.22	Mar/16/2009 10:43:58	
	hotspot	3.22	Mar/16/2009 10:45:17	
X	ipv6	3.22	Mar/16/2009 10:44:58	
X	mpls	3.22	Mar/16/2009 10:47:02	
	ppp	3.22	Mar/16/2009 10:44:05	
	routerboard	3.22	Mar/16/2009 10:46:46	
	routing	3.22	Mar/16/2009 10:44:10	
	security	3.22	Mar/16/2009 10:43:55	
	system	3.22	Mar/16/2009 10:43:27	
	wireless	3.22	Mar/16/2009 10:45:50	

12 items

# RouterOS Package

Nama Paket	Fungsi
advanced-tools	email client, ping, netwatch
dhcp	DHCP server dan client
Hotspot	hotspot gateway
Ntp	NTP server
Ppp	PPP,PPTP,L2TP,PPPoE
Routerboard	Fungsi khusus Routerboard
Routing	RIP, OSPF, BGP
Security	secure winbox, SSH, IPSec
Wireless	Wireless 802.11a/b/g
user-manager	User-Manager management system
Ipv6	IPv6

# Version Upgrade

- Download modul terlebih dahulu
  - routers-**mipsbe**-3.xx.npk (RB400 & RB700)
  - routers-**mipsle**-3.xx.npk (RB100 & RB500)
  - routers-**powerpc**-3.xx.npk (RB300 & RB600)
  - routers-**x86**-3.xx.npk (PC & RB200)
- FTP modul tersebut ke router
  - Harus menggunakan userid yang full access
  - FTP://xxx.xxx.xxx.xxx ← **IP Router**
- Soft Reboot, jangan hard reboot
  - Command - **"/system reboot"**



# Version Downgrade

- Download modul yang lama
- FTP dan copykan modul OS versi yang lama tersebut ke FTP router.
- Cek modul : */file print*
- ***“/system package downgrade”***  
*admin@MikroTik] system package> downgrade*  
*Router will be rebooted. Continue? [y/N]: y*  
*system will reboot shortly*

# Command Line Interface

- Struktur *Command* dalam mikrotik mirip dengan shell dalam unix
- Dibagi ke dalam beberapa kelompok sesuai hirarki menu levelnya
- Misalnya menambahkan ip address
  - *ip address add address=192.168.0.1/24 interface=ether1*
  - Menu *ip (level0)* memiliki sub menu *address (level1)*

# General Command CLI

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

# Navigasi pada CLI

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

# Command Line Interface

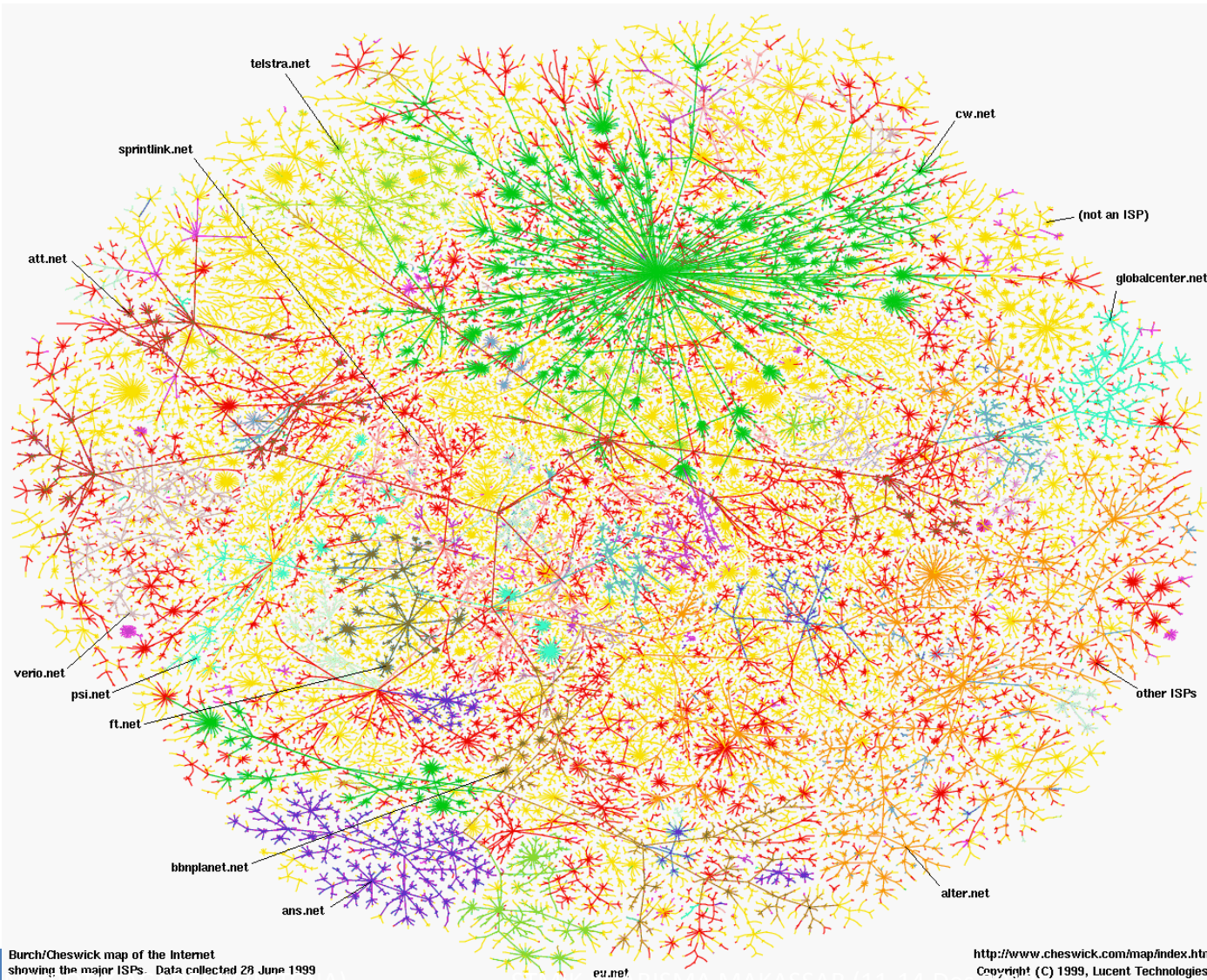
- Quick Typing
  - [TAB] untuk melengkapi perintah tertentu
    - */system shut [TAB] = /system shutdown*
  - Juga bisa menggunakan singkatan
    - */sys shut = /system shutdown*

# TCP/IP Basics

# TCP/IP Outline

- OSI Layer
- Packet Header
- Mac Address
- IP Address and subnetting
- IP Protocol
- Basic networking, DNS, gateway

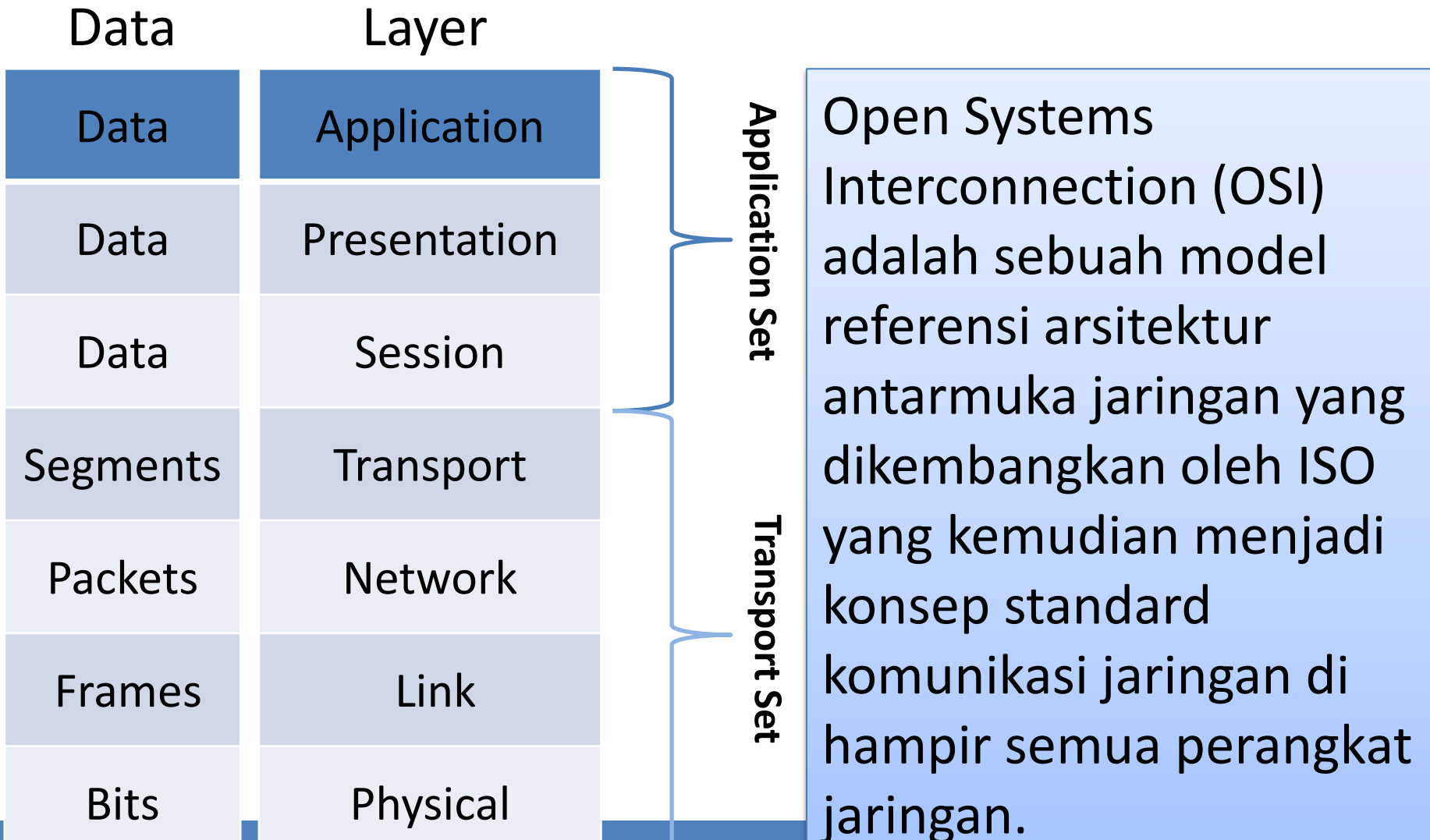
# Internet Topologi



Jutaan host yang harus bisa berkomunikasi satu sama lain.



# OSI Layer dan Protokol



# OSI Layer dan Protokol

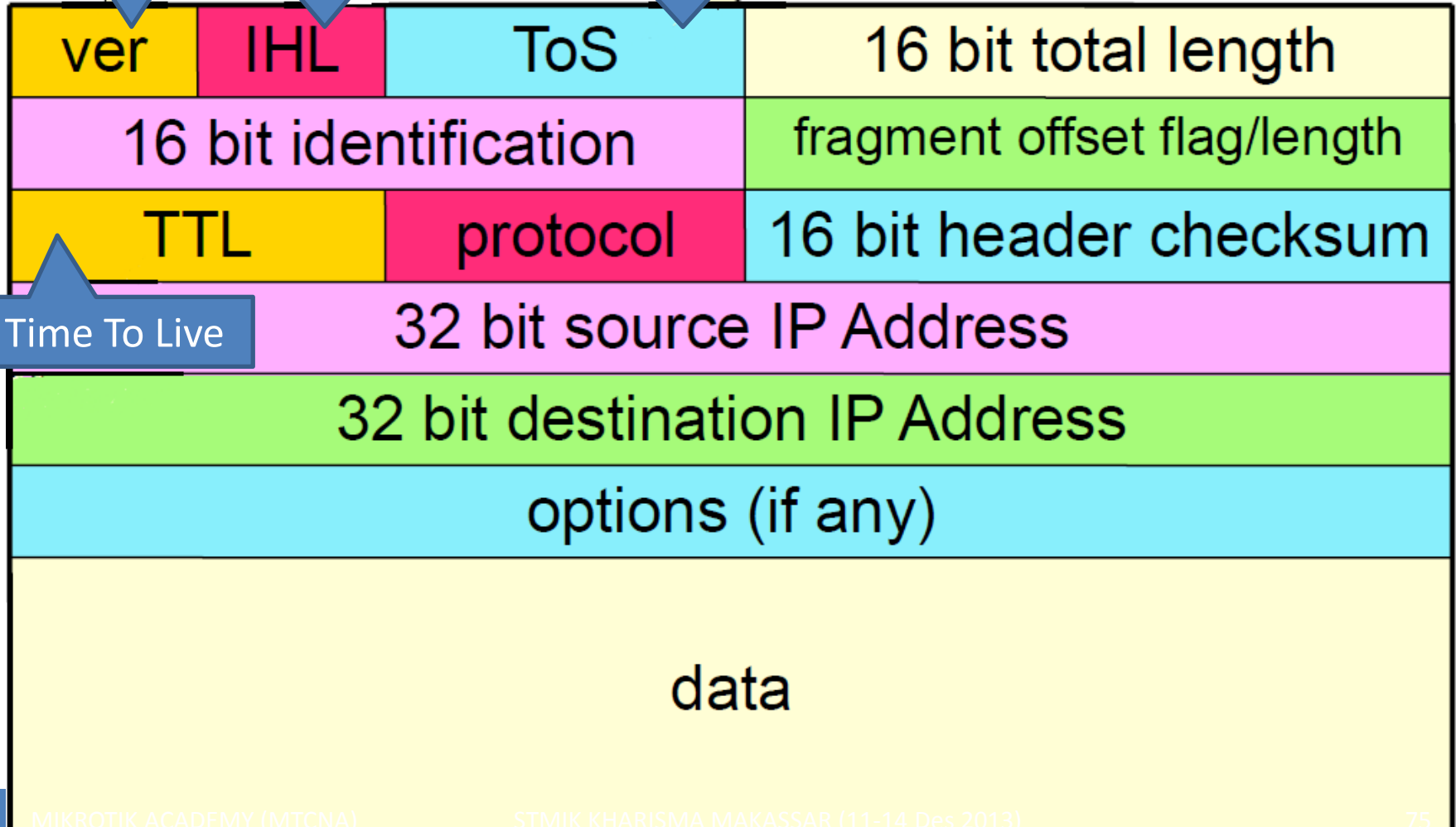
Application		SMTP	HTTP	FTP	Telnet	DNS	DHCP	SNMP	TFTP
Presentation		Enkripsi, dekripsi, mime							
Session		TCP Data Session Maintenance				Domain Resolve			
Transport		TCP Transmission Control Protocol				UDP User Datagram Protocol			
Network		IP						Routing Protocols RIP, OSPF, BGP	
		ICMP							
Link		Mac Address, Switch							ARP
Physical		Ethernet, Wireless, ATM, Frame Relay, PPP							

# Packet Header

IP Version (4)

IP Header Length

Type Of Service

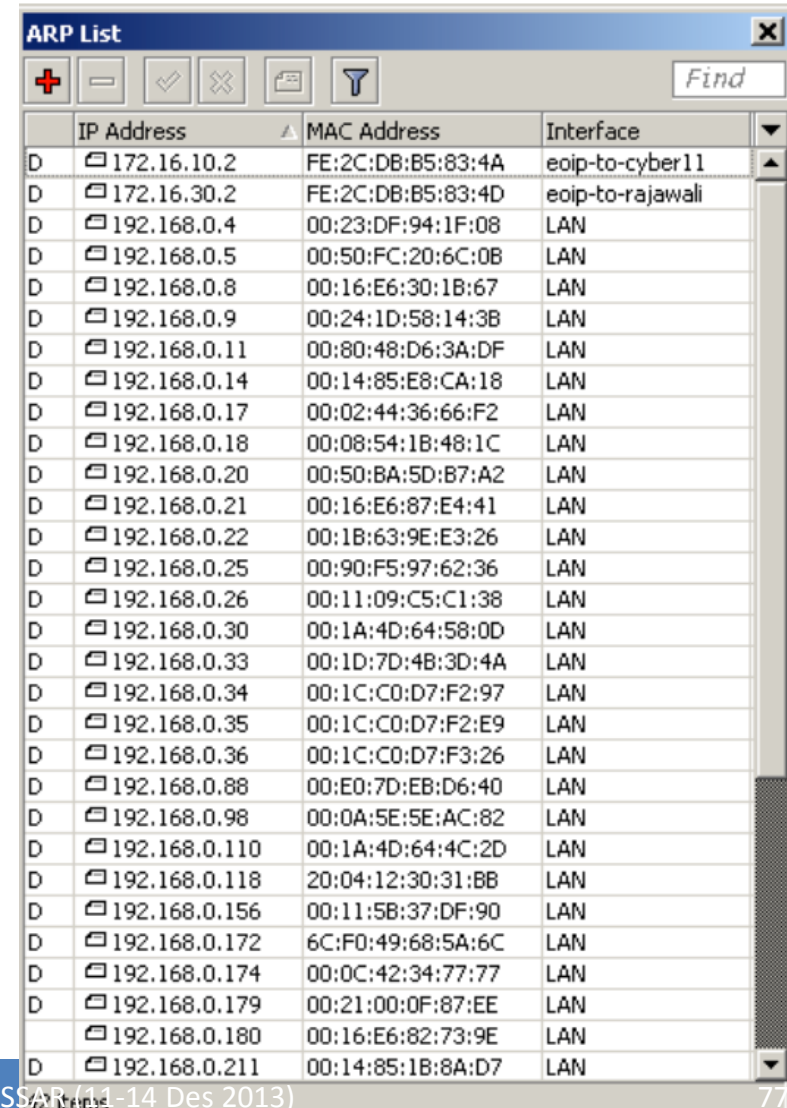


# MAC Address

- MAC = Media Access Control
- Digunakan sebagai identitas yang unik dari setiap interface hardware, yang merupakan identitas untuk berkomunikasi di OSI layer 2.
- Sebagian bit merupakan identitas pabrik pembuat hardware
- 48 bit hex. Contoh: “**AA:BB:CC:DD:EE:FF**”
- Jika sebuah router memiliki 3 interface fisik, maka akan memiliki 3 buah mac address
- Untuk virtual interface (VLAN, EoIP) maka ditambahkan mac address virtual.

# ARP Table

- Merupakan protokol penghubung antara layer **2** data-link dan **3** network.
- ARP Table di router merupakan daftar host yang terhubung langsung berisi informasi pasangan macaddress dan ip address.
- Di **IPv6** arp digantikan dengan **NDP** (Network Discovery Protocol).



The screenshot shows the 'ARP List' window in Mikrotik WinBox. The window title is 'ARP List' and it has a search bar labeled 'Find'. The table below lists the ARP entries:

	IP Address	MAC Address	Interface
D	172.16.10.2	FE:2C:DB:B5:83:4A	eoip-to-cyber11
D	172.16.30.2	FE:2C:DB:B5:83:4D	eoip-to-rajawali
D	192.168.0.4	00:23:DF:94:1F:08	LAN
D	192.168.0.5	00:50:FC:20:6C:0B	LAN
D	192.168.0.8	00:16:E6:30:1B:67	LAN
D	192.168.0.9	00:24:1D:58:14:3B	LAN
D	192.168.0.11	00:80:48:D6:3A:DF	LAN
D	192.168.0.14	00:14:85:E8:CA:18	LAN
D	192.168.0.17	00:02:44:36:66:F2	LAN
D	192.168.0.18	00:08:54:1B:48:1C	LAN
D	192.168.0.20	00:50:BA:5D:B7:A2	LAN
D	192.168.0.21	00:16:E6:87:E4:41	LAN
D	192.168.0.22	00:1B:63:9E:E3:26	LAN
D	192.168.0.25	00:90:F5:97:62:36	LAN
D	192.168.0.26	00:11:09:C5:C1:38	LAN
D	192.168.0.30	00:1A:4D:64:58:0D	LAN
D	192.168.0.33	00:1D:7D:4B:3D:4A	LAN
D	192.168.0.34	00:1C:C0:D7:F2:97	LAN
D	192.168.0.35	00:1C:C0:D7:F2:E9	LAN
D	192.168.0.36	00:1C:C0:D7:F3:26	LAN
D	192.168.0.88	00:E0:7D:EB:D6:40	LAN
D	192.168.0.98	00:0A:5E:5E:AC:82	LAN
D	192.168.0.110	00:1A:4D:64:4C:2D	LAN
D	192.168.0.118	20:04:12:30:31:BB	LAN
D	192.168.0.156	00:11:5B:37:DF:90	LAN
D	192.168.0.172	6C:F0:49:68:5A:6C	LAN
D	192.168.0.174	00:0C:42:34:77:77	LAN
D	192.168.0.179	00:21:00:0F:87:EE	LAN
D	192.168.0.180	00:16:E6:82:73:9E	LAN
D	192.168.0.211	00:14:85:1B:8A:D7	LAN

# IP Address

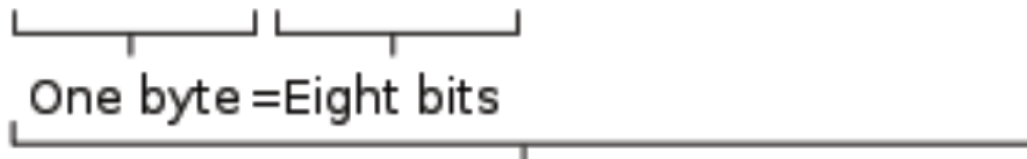
- Adalah sistem pengalamatan setiap host yang terhubung ke jaringan
- Saat ini IP Address yang banyak digunakan adalah IP versi 4. (32 bits / 4 bytes) - 4,294,967,296 hosts

An IPv4 address (dotted-decimal notation)

**172 . 16 . 254 . 1**



10101100 ,00010000 ,11111110 ,00000001



Thirty-two bits ( 4 \* 8 ), or 4 bytes

# Pengelompokan IP Address

- Pengelompokan IP Address dilakukan dengan subnet-ing.
- Subnet ..... 0 – 32
  - Melambangkan jumlah IP dalam subnet tersebut dengan rumus  $2^{(32-x)}$
  - Subnet 0 berarti semua IP Address
  - Subnet 32 berarti 1 IP Address

# IP Subneting (contoh 1)

- Contoh: 192.168.0.0/24
  - Netmask : 255.255.255.0
  - Prefix : /24
  - IP Network : 192.168.0.0
  - First HostIP: 192.168.0.1
  - Last HostIP : 192.168.0.254
  - Broadcast : 192.168.0.255
  - HostIP : total IP di dalam Subnet (–) minus 2



# IP Subneting (contoh 2)

- Contoh: 192.168.0.0/25
  - Netmask : 255.255.255.128
  - Prefix : /25
  - IP Network : 192.168.0.0
  - First HostIP: 192.168.0.1
  - Last HostIP : 192.168.0.126
  - Broadcast : 192.168.0.127
  - HostIP : total IP di dalam Subnet (–) minus 2

# Tabel Subnet

Subnet Mask	Prefix	No of IP	Usable IP
255.255.255.0	/24	256	254
255.255.255.128	/25	128	126
255.255.255.192	/26	64	62
255.255.255.224	/27	32	30
255.255.255.240	/28	16	14
255.255.255.248	/29	8	6
255.255.255.252	/30	4	2
255.255.255.254	/31	2	-
255.255.255.255	/32	1	-

# Public and Private IP Address

- **Public IP Address**

IP Address yang dapat diakses di jaringan internet. Kita bisa mendapatkan Public IP Address dari:

- Dipinjami dari ISP
- Alokasi dari APNIC/IDNIC ([www.idnic.net](http://www.idnic.net))

- **Private IP Address**

IP Address yang diperuntukkan untuk jaringan lokal (tidak dapat diakses di jaringan internet)

- 10.0.0.0 – 10.255.255.255 (10./8)
- 172.16.0.0 – 172.31.255.255 (172.16./12)
- 192.168.0.0 – 192.168.255.255 (192.168./16)

# IP Address Khusus Lainnya

Penggunaan	IP / subnet
Self Identification	0.0.0.0/8
Localhost	127.0.0.1
Not Used	Other 127.0.0.0/8
Multicast	224.0.0.0/4
Local link/DHCP error	169.245.0.0/16
TEST-NET-1	192.0.2.0/24
TEST-NET-2	198.51.100.0/24
TEST-NET-3	203.0.113.0/24
6to4 Relay Anycast	192.88.99.0/24
Benchmark Test	198.18.0.0/15
Future Used	240.0.0.0/4
Limited Broadcast	255.255.255.255/32

# IP Protocol

- Adalah protokol standart yang digunakan untuk mengkomunikasikan data melalui berbagai jenis perangkat dan layer.
- Pengiriman data dilakukan dengan sistem “per paket” dan/atau “per connection”.
- Sistem ini menjamin keutuhan data, dan mencegah terjadinya kekurangan ataupun duplikasi data.
- Ada beragam protokol yang biasa digunakan, yang umum adalah TCP, UDP, dan ICMP.

# ICMP (Internet Control Message Protocol)

- Disalurkan berbasis “best effort” sehingga bisa terjadi error (datagram lost)
- Banyak digunakan untuk pengecekan jaringan
- Prinsip kerja:
  - Host (router ataupun tujuan) akan mendeteksi apabila terjadi permasalahan tranmisi, dan membuat “ICMP message” yang akan dikirimkan ke host asal.
- Aplikasi ICMP yang paling banyak digunakan: Ping dan Traceroute

Type	Name
0	Echo Reply
1	Unassigned
2	Unassigned
3	Destination Unreachable
4	Source Quench
5	Redirect
6	Alternate Host Address
7	Unassigned
8	Echo
9	Router Advertisement
10	Router Solicitation
11	Time Exceeded

# UDP (User Datagram Protocol)

- Komputer yang satu bisa mengirimkan pesan/datagram ke komputer lainnya di jaringan, tanpa terlebih dahulu melakukan “hand-shake” (connectionless communication)
- Biasanya digunakan untuk servis yang mengirimkan data kecil ke banyak host
- Tidak ada flow control ataupun mekanisme lain untuk menjaga keutuhan datagram
- Aplikasi yang paling umum menggunakan UDP adalah DNS dan berbagai game online

# TCP (Transmission Control Protocol)

- Merupakan protokol yang paling banyak digunakan di internet.
- Bekerja dengan pengalamatan port
  - Port 1 – 1024 : low port (standard service port)
  - Port 1025...: high port (untuk transmisi lanjutan)
- Contoh aplikasi: http, email, ftp, dll
- Prinsip Kerja: Connection Oriented, Reliable Transmission, Error Detection, Flow Control, Segment Size Control, Congestion Control



# Prinsip Kerja TCP

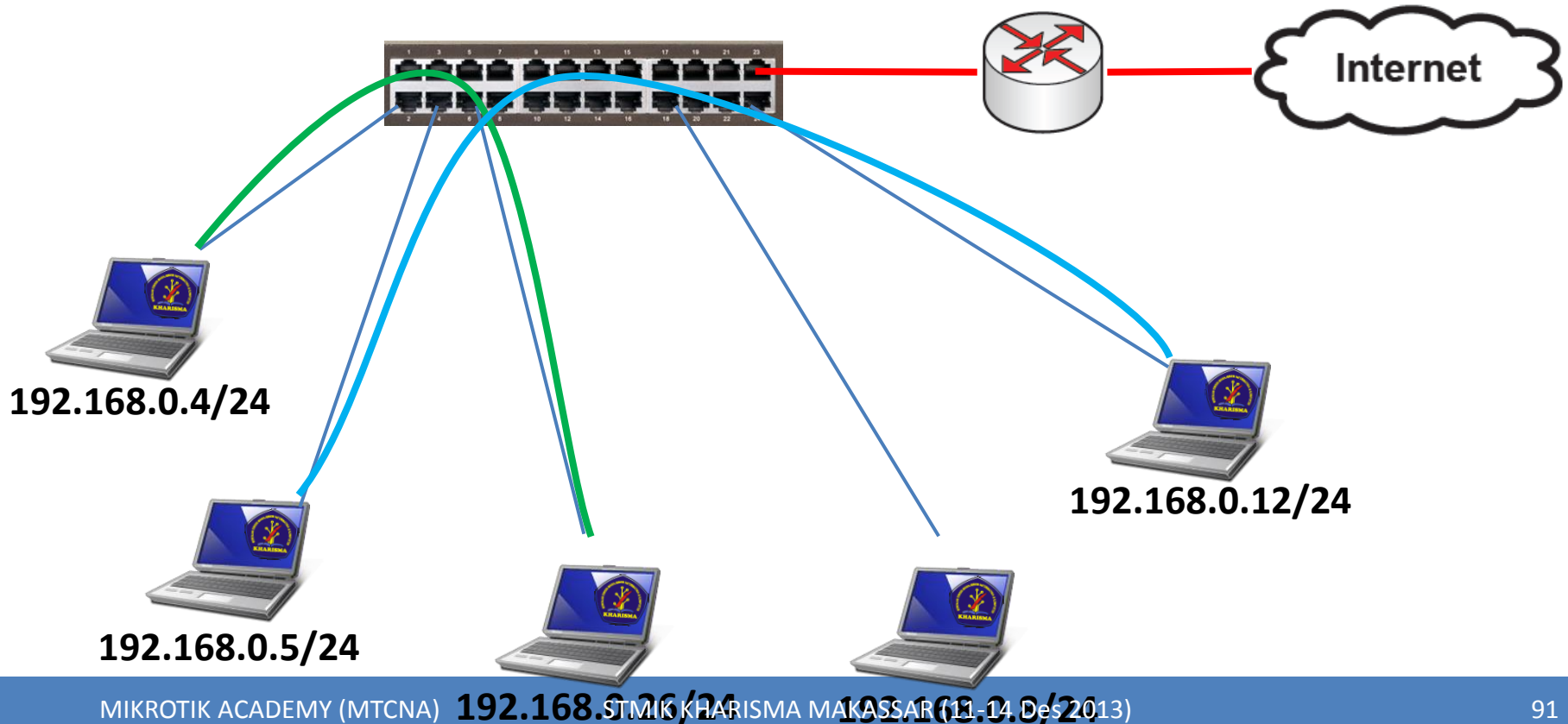
- Connection Oriented
  - Koneksi diawali dengan proses “handshake”
    - Client → SYN → Server
    - Server → SYN-ACK → Client
    - Client → ACK → Server
- Reliable Transmission
  - Mampu melakukan pengurutan paket data, setiap byte data ditandai dengan nomor yang unik
- Error Detection
  - Jika terjadi error, bisa dilakukan pengiriman ulangdata

# Prinsip Kerja TCP

- Flow Control
  - Mendeteksi supaya satu host tidak mengirimkan data ke host lainnya terlalu cepat
- Segment Size Control
  - Mendeteksi besaran MSS (maximum segment size) yang bisa dikirimkan supaya tidak terjadi IP fragmentation
- Congestion Control
  - TCP menggunakan beberapa mekanisme untuk mencegah terjadinya congestion pada network

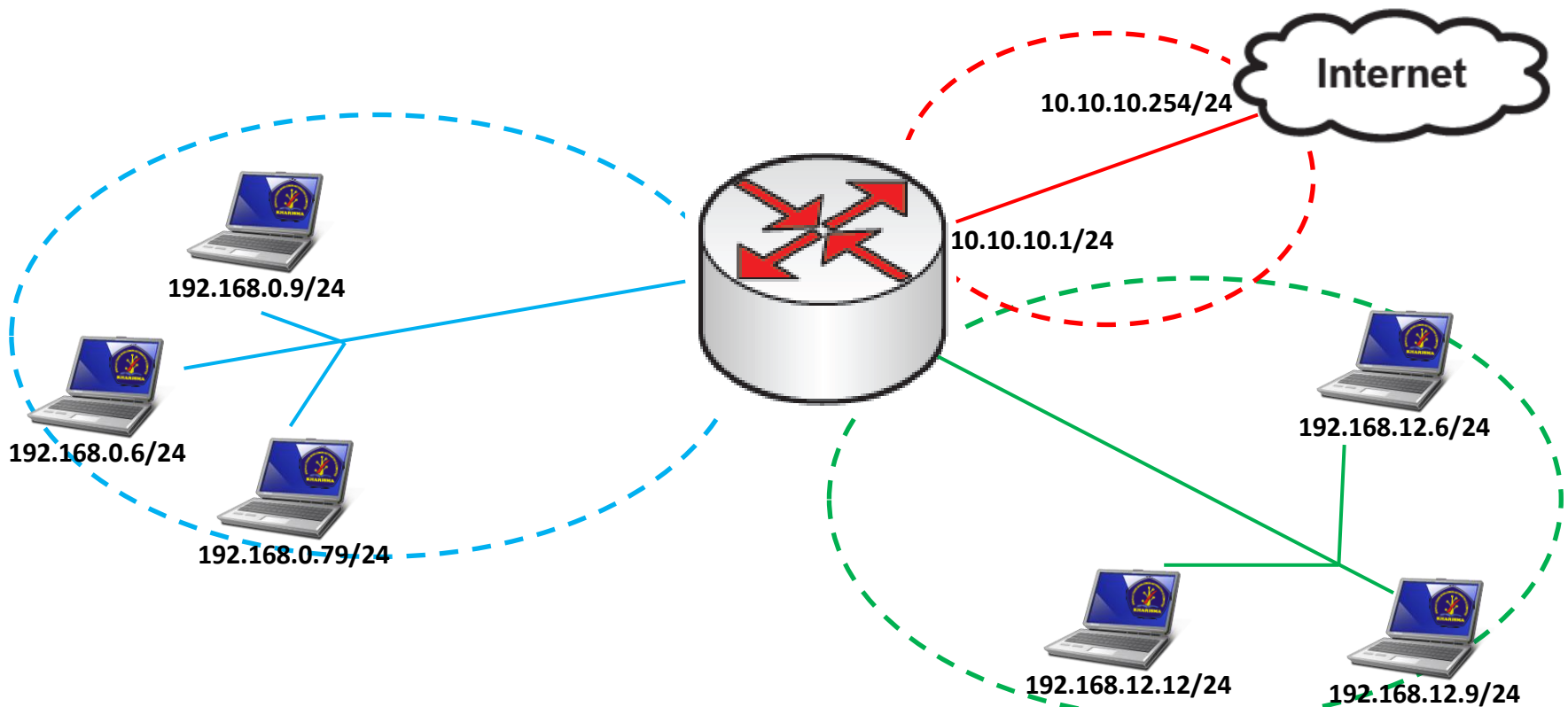
# Konsep Dasar Jaringan

- Host yang memiliki IP Address dari subnet yang sama bisa terkoneksi langsung, tanpa melalui router
  - From : **192.168.0.4** To : **192.168.0.26**



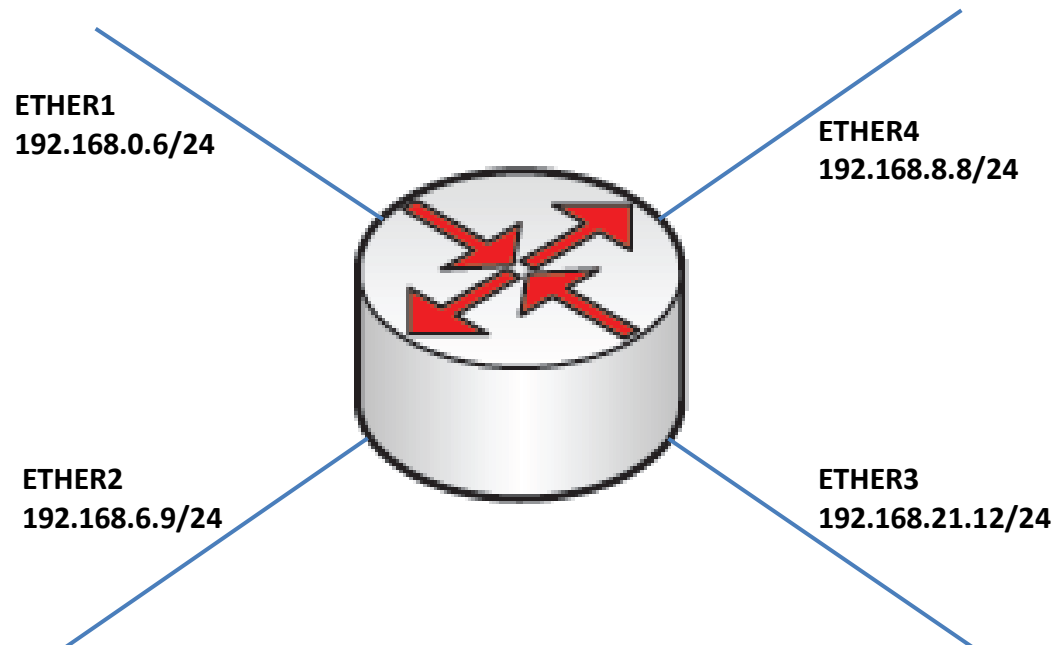
# Konsep Dasar Jaringan

- Router bertugas untuk menghubungkan dua atau lebih jaringan yang memiliki subnet yang berbeda



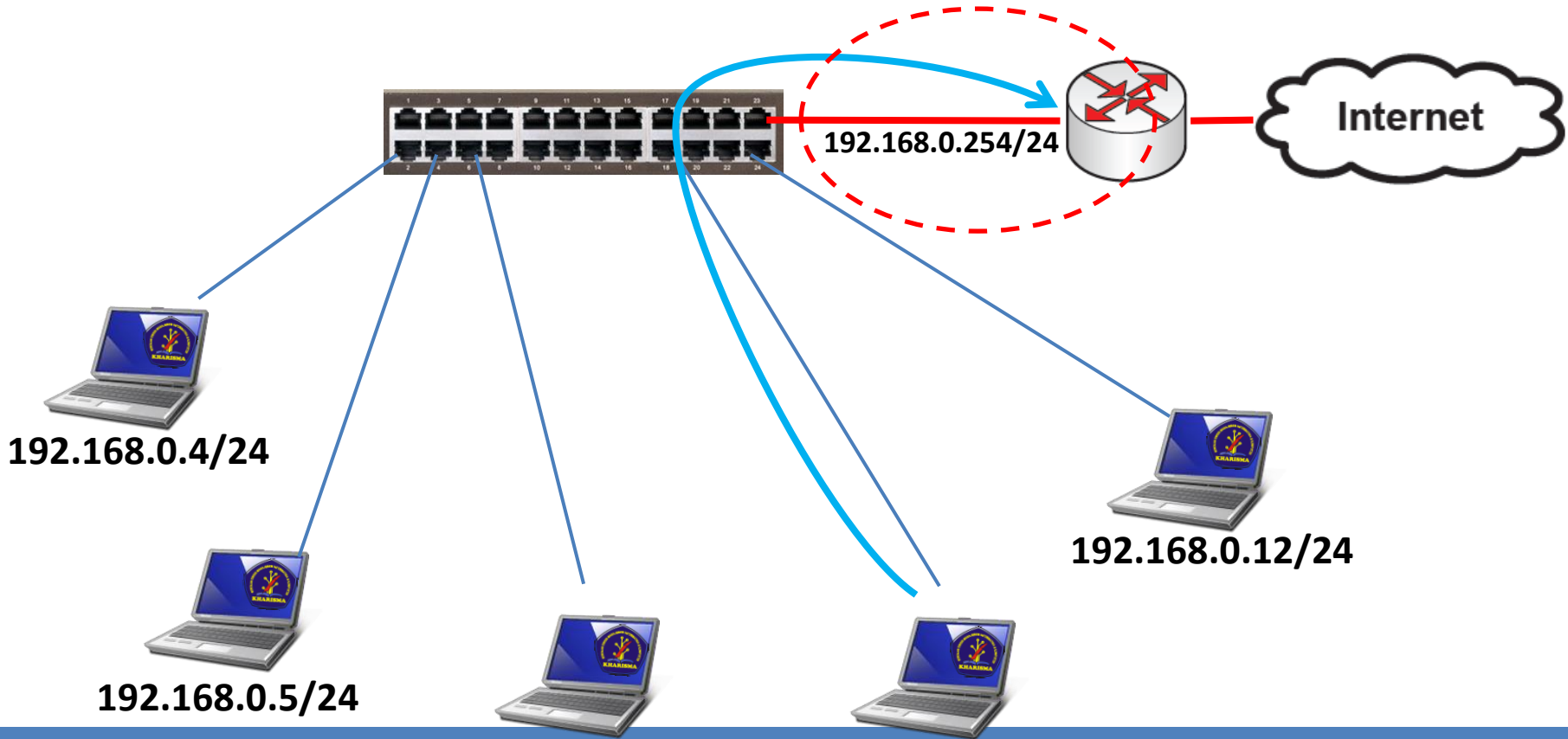
# Konsep Dasar Jaringan

- Dua buah IP Address yang berasal dari subnet yang sama tidak boleh dipasang pada dua buah interface yang berbeda pada sebuah router



# Konsep Dasar Jaringan

- **Default gateway** menentukan ke arah mana trafik harus disalurkan untuk menuju ke internet
  - From : **192.168.0.8** To : **222.24.112.34**



# Konsep Dasar Jaringan

- DNS diperlukan untuk melakukan pengubahan nama domain menjadi ip address, karena seluruh proses pengaturan trafik dilakukan berdasarkan layer 3 OSI, yaitu ip address
- Contoh:
  - www.yahoo.com → 203.0.113.5

# RouterOS

## Basic Configuration



# Winbox - Download

- Download terlebih dahulu program **winbox.exe** untuk mengkonfigurasi RouterOS Mikrotik.

## Mikrotik Utility

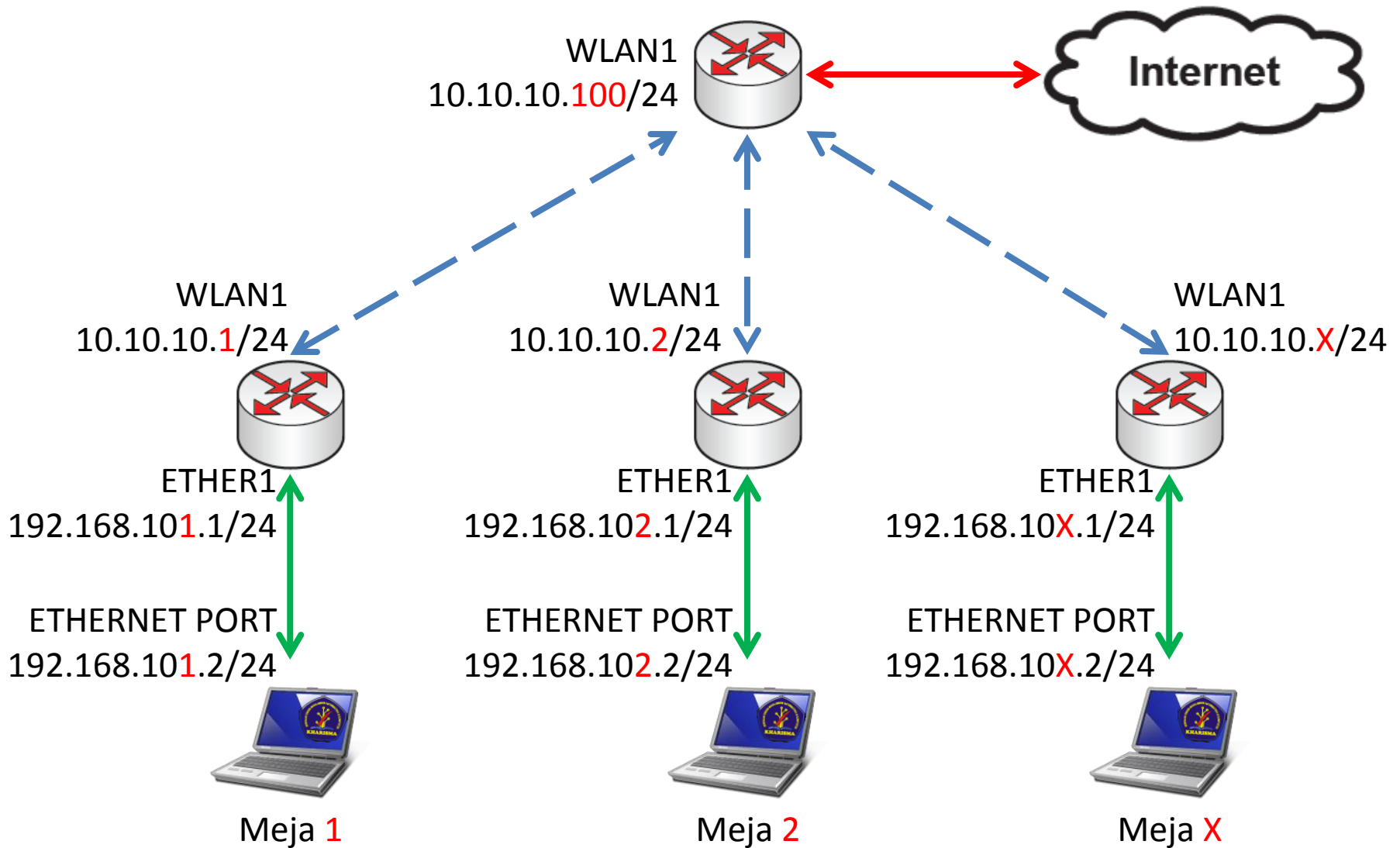
### Winbox

Utility untuk melakukan remote GUI ke Router Mikrotik. For windows.

[winbox-2.2.16.exe](#) (53 KByte, didownload 174940 kali)

[winbox-2.2.18.exe](#) (111.5 KByte, didownload 152844 kali)

# Basic Config - Topology



# IP Configuration

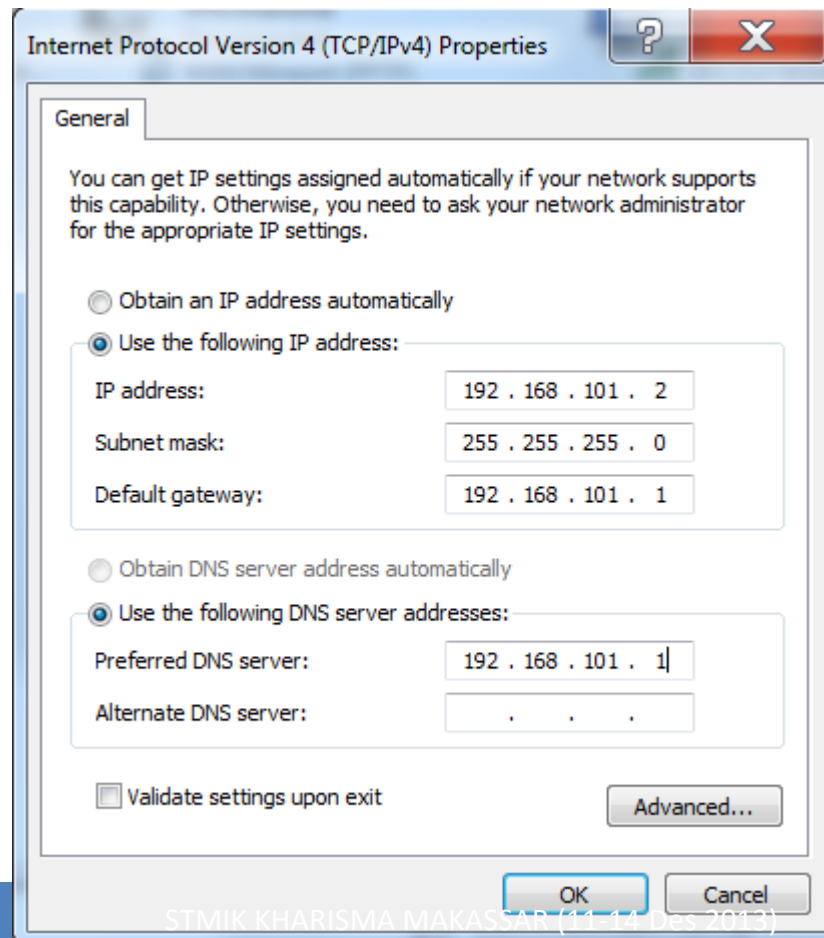
- Routerboard Setting
  - WAN IP : 10.10.10.X/24
  - Gateway : 10.10.10.100
  - LAN IP : 192.168.10X.1/24
  - DNS : 10.10.10.100
  - Src-NAT and DNS Server
- Laptop Setting
  - IP Address : 192.168.10X.2/24
  - Gateway : 192.168.10X.1
  - DNS : 192.168.10X.1

Lab-1 adalah sebuah simulasi konfigurasi dasar sebuah Router Mikrotik yang akan digunakan di jaringan local seperti **Warnet, Office, Kampus** atau bahkan di **RT/RW-NET**

**X = nomor peserta**

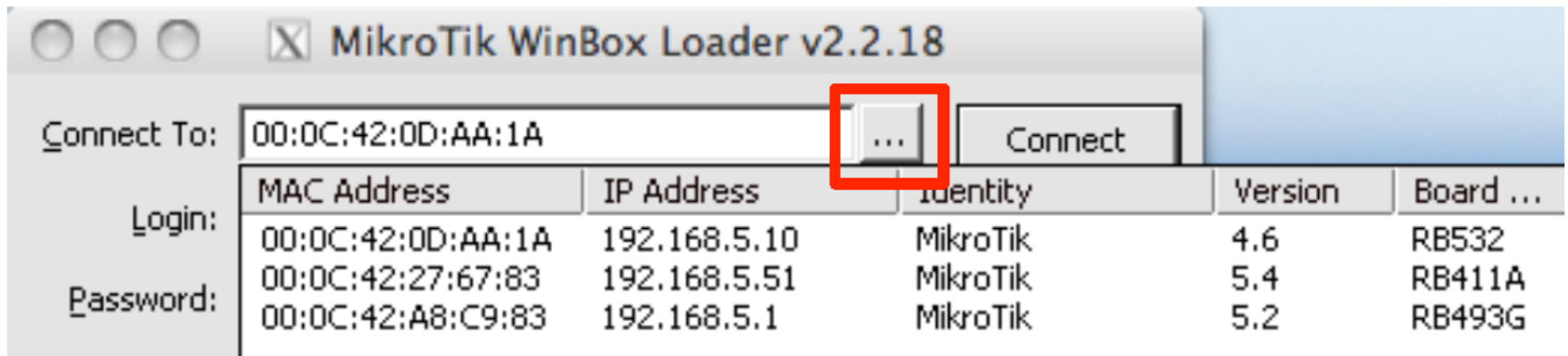
# Laptop Config

- Konfigurasi IP Address statik pada laptop.



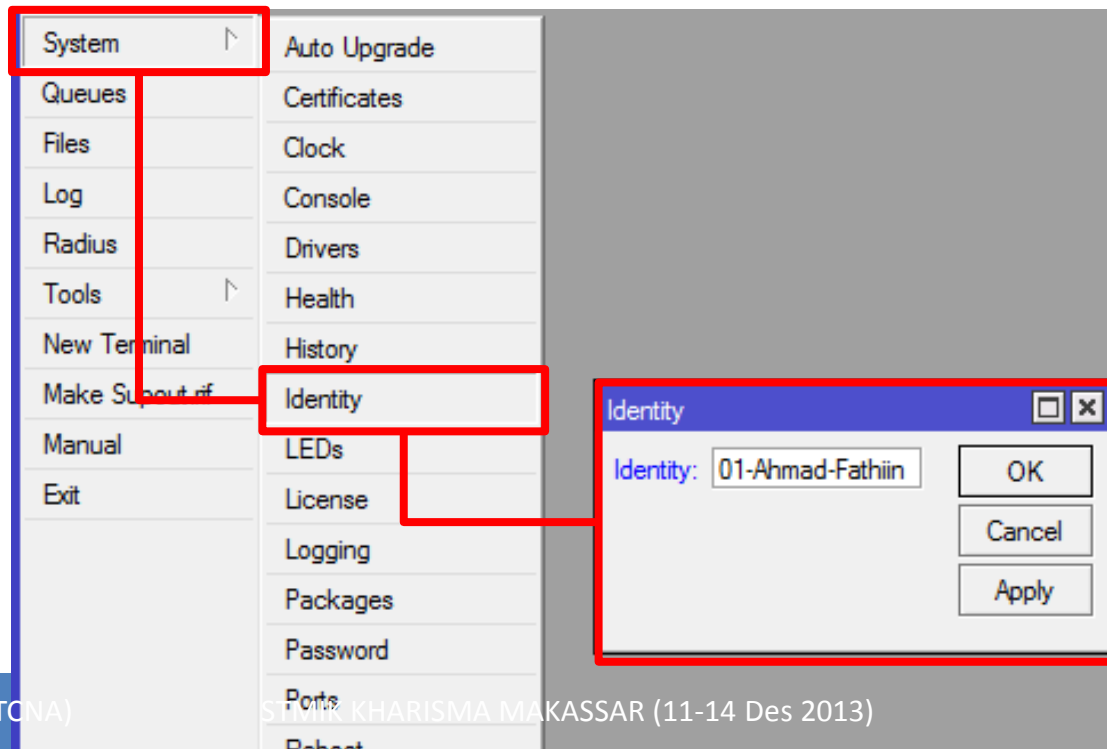
# First Setup

- Hubungkan port ethernet Laptop Anda dengan **ether1** pada Routerboard.
- Pastikan ethernet port di laptop Anda memiliki IP statik
- Jalankan program winbox.exe, klik pada tombol [...] untuk melihat router Anda.



# [LAB-1] System Identity

- Supaya tidak membingungkan, ubahlah nama router Anda.
- Format: **xx>NamaAnda**
- Contoh: 01-Ahmad-Fathiin
- Aktifkan semua interface



# [LAB-2] Wireless Config

The image shows a screenshot of the Mikrotik WinBox interface. On the left, the 'Wireless' menu item is circled in red. In the 'Wireless Tables' section, the 'wlan1' interface is selected and circled in red. The 'Interface <wlan1>' configuration window is open, showing the 'Wireless' tab. The 'Mode' is set to 'station', 'Band' is '2GHz-B/G/N', 'Channel Width' is '20MHz', 'Frequency' is '2412 MHz', and 'SSID' is 'Academy'. These four fields are each enclosed in a red rectangular box. Other fields like 'Scan List', 'Wireless Protocol', 'Security Profile', and 'Bridge Mode' are also visible.

Aktifkan interface wireless –  
WLAN1

# [LAB-3] IP Address Config

The image illustrates the process of adding a new IP address in Mikrotik WinBox. It shows the following components:

- Sidebar Menu:** A list of configuration categories including ARP, Accounting, **Addresses** (circled in red), DHCP Client, DHCP Relay, DHCP Server, DNS, Firewall, Hotspot, IPsec, Neighbors, and Packing.
- Address List Window:** A window titled "Address List" with a toolbar containing a red '+' icon (circled in red), a dropdown arrow, a refresh icon, a search icon, and a filter icon. Below the toolbar is a table with columns for "Address", "Network", and "Interface".
- New Address Dialog (Left):** A dialog box titled "New Address" with the following fields:
  - Address: 10.10.10.X/24
  - Network: (empty dropdown)
  - Interface: wlan1Buttons include OK, Cancel, Apply, Disable, Comment, Copy, and Remove. A checkbox at the bottom is labeled "enabled".
- New Address Dialog (Right):** A dialog box titled "New Address" with the following fields:
  - Address: 192.168.10X.1/24
  - Network: (empty dropdown)
  - Interface: ether1Buttons include OK, Cancel, Apply, Disable, Comment, Copy, and Remove. A checkbox at the bottom is labeled "enabled".

Red lines indicate the workflow: from the "Addresses" menu item to the "+" icon in the "Address List" window, and from the "+" icon to the "New Address" dialog boxes.



# [LAB-4] Gateway Config

The image shows the Mikrotik WinBox interface. On the left is a vertical menu with items: ARP, Accounting, Addresses, DHCP Client, DHCP Relay, DHCP Server, DNS, Firewall, Hotspot, IPsec, Neighbors, Packing, Pool, Routes, SMB, and SNMP. The 'Routes' item is circled in red. A red line extends from this circle to a '+' button in the 'Route List' window. The 'Route List' window has tabs for 'Routes', 'Nexthops', 'Rules', and 'VRF'. Below the tabs is a table with columns: 'Dst. Address', 'Gateway', 'Distance', 'Routing Mark', and 'Pref. Source'. Below the table is a 'New Route' configuration window. This window has two tabs: 'General' and 'Attributes'. The 'General' tab is active. It contains the following fields: 'Dst. Address' (text box with '0.0.0.0/0'), 'Gateway' (dropdown menu with '10.10.10.100'), 'Check Gateway' (dropdown menu), 'Type' (dropdown menu with 'unicast'), 'Distance' (dropdown menu), and 'Scope' (text box with '30'). A red box highlights the 'Dst. Address' and 'Gateway' fields.

# [LAB-5] DNS Config

The image shows the Mikrotik WinBox interface. On the left is a vertical menu with the following items: ARP, Accounting, Addresses, DHCP Client, DHCP Relay, DHCP Server, DNS (circled in red), Firewall, Hotspot, IPsec, Neighbors, Packing, Pool, Routes, SMB, and SNMP. A red line connects the 'DNS' menu item to a 'DNS Settings' dialog box on the right. The dialog box has a blue title bar and contains the following fields and controls:

- Servers:** A list of IP addresses. The first entry is `10.10.10.100` and the second is `8.8.8.8`. Each entry has a double-headed arrow icon to its right.
- Dynamic Servers:** An empty text input field.
- Max UDP Packet Size:** A text input field containing `4096`.
- Cache Size:** A text input field containing `2048` with `KB` to its right.
- Cache Used:** A text input field containing `7`.
- Allow Remote Requests:** A checked checkbox with the text `Allow Remote Requests` next to it.
- Buttons:** A vertical stack of buttons on the right side: `OK`, `Cancel`, `Apply`, `Static`, and `Cache`.

# [LAB-6] Src-NAT Config

The image displays three screenshots from Mikrotik WinBox illustrating the configuration of a Source NAT (Src-NAT) rule.

**Top Left Screenshot:** Shows the Firewall configuration window. The 'NAT' tab is selected and circled in red. A red circle highlights the '+' button used to add a new rule. Below the toolbar, a table with columns '#', 'Action', 'Chain', and 'Src. Address' is visible.

**Top Right Screenshot:** Shows the 'New NAT Rule' dialog box, 'General' tab. The 'Chain' dropdown is set to 'srcnat' and is circled in red. The 'Out. Interface' dropdown is set to 'wan1' and is also circled in red. Other fields like 'Src. Address', 'Dst. Address', 'Protocol', 'Src. Port', 'Dst. Port', 'Any. Port', and 'In. Interface' are present but empty.

**Bottom Screenshot:** Shows the 'New NAT Rule' dialog box, 'Action' tab. The 'Action' dropdown is set to 'masquerade' and is circled in red. The 'OK', 'Cancel', 'Apply', 'Disable', 'Comment', 'Copy', and 'Remove' buttons are visible on the right side.

# Terminal / Console Config

- Konfigurasi wireless sebagai media untuk backbone
  - interface wireless set wlan1 mode=station ssid=training band=2.4.ghz-b/g/n scan-list=2400-2500 disabled=no
- Konfigurasi IP Address
  - /ip address add address=10.10.10.x/24 interface=wlan1
  - /ip address add address=192.168.x.1/24 interface=ether1
- Konfigurasi Routing – Default Gateway
  - /ip route add gateway=10.10.10.100
- Konfigurasi DNS
  - /ip dns set servers=10.10.10.100 allow-remote-request=yes
- Konfigurasi NAT
  - /ip firewall nat add chain=srcnat out-interface=wlan1 action=masquerade

# Installation Debug

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

# Network Time Protocol (NTP)

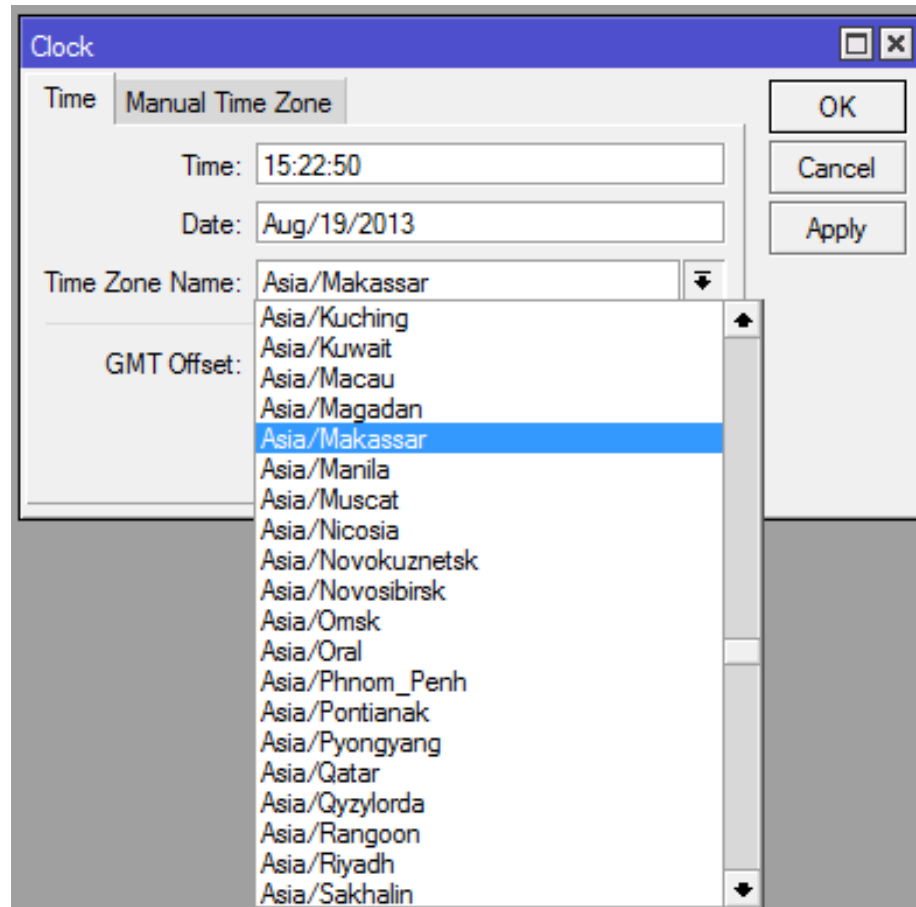
- NTP protocol memungkinkan sinkronisasi waktu dalam sebuah jaringan
- Mikrotik support sebagai NTP server dan sebagai NTP Client
- NTP Server
  - Install paket **ntp-xxxx-(versi).npk**, karena paket 'system' hanya menyertakan servis ntp client
  - Mode:**broadcast,manycast,multicast**

# [LAB-7] NTP

The screenshot displays the Mikrotik WinBox interface. On the left, the 'System' menu is highlighted with a red box. Below it, the 'SNTP Client' option is also highlighted with a red box. The main window shows the 'SNTP Client' configuration dialog. The 'Enabled' checkbox is checked. The 'Mode' is set to 'unicast'. The 'Primary NTP Server' is '203.160.128.6' and the 'Secondary NTP Server' is '202.169.224.16'. Other fields include 'Poll Interval: 900 s', 'Active Server: 203.160.128.6', 'Last Update From: 203.160.128.6', 'Last Update: 00:02:34 ago', 'Last Adjustment: 18:415 us', 'Last Bad Packet From: 203.160.128.6', 'Last Bad Packet: 19/11/33:54 ago', and 'Last Bad Packet Reason: server-not-synchronized'. A blue callout box on the right contains the following text:

Set enable  
Set mode unicast  
Set IP NTP server  
- id.pool.ntp.org  
- pool.ntp.org  
- ntp.nasa.gov

# System - Clock



Sesuaikan time zone lokasi



# Backup from CLI

- Jika ingin menentukan nama file backup, bisa melakukan backup melalui console
- Membuat file backup:  
[admin@MikroTik] > /system backup save name=backup-1  
Saving system configuration  
Configuration backup saved  
[admin@MikroTik] >
- File backup dapat dilihat di submenu /file
- Dapat didownload via FTP
- File backup tidak dapat di-edit !

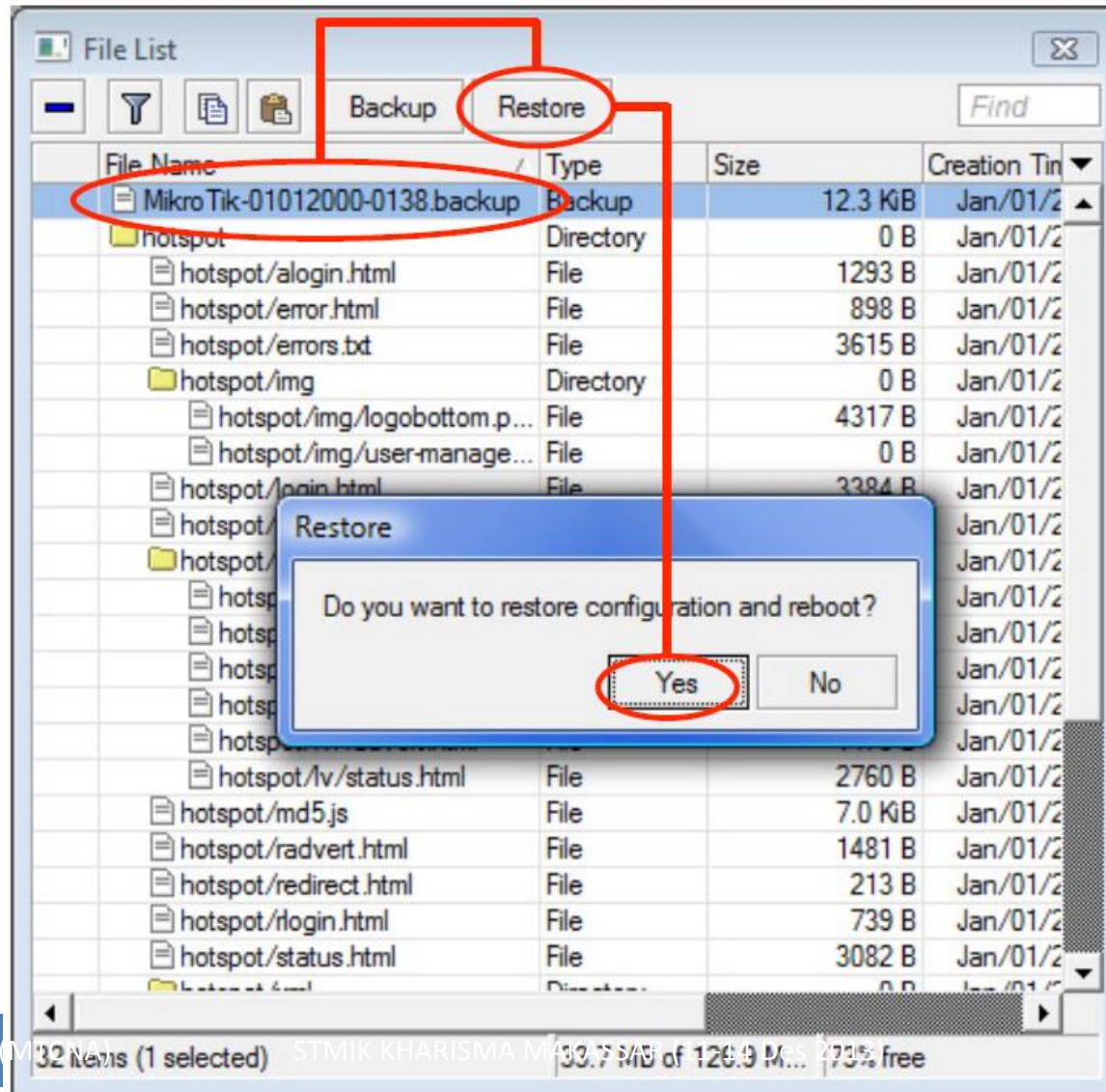
# System Reset

- Untuk mengembalikan ke konfigurasi awal (default).
- Perintah ini menghapus semua konfigurasi yang telah dibuat, termasuk user dan password.
- Hanya bisa dilakukan oleh user dengan hak penuh (grup: full)

```
[admin@Router-MikroTik] > system reset
```

```
Dangerous! Reset anyway? [y/N]: y
```

# [LAB-9] Restore Configuration



# Backup – Export Configuration

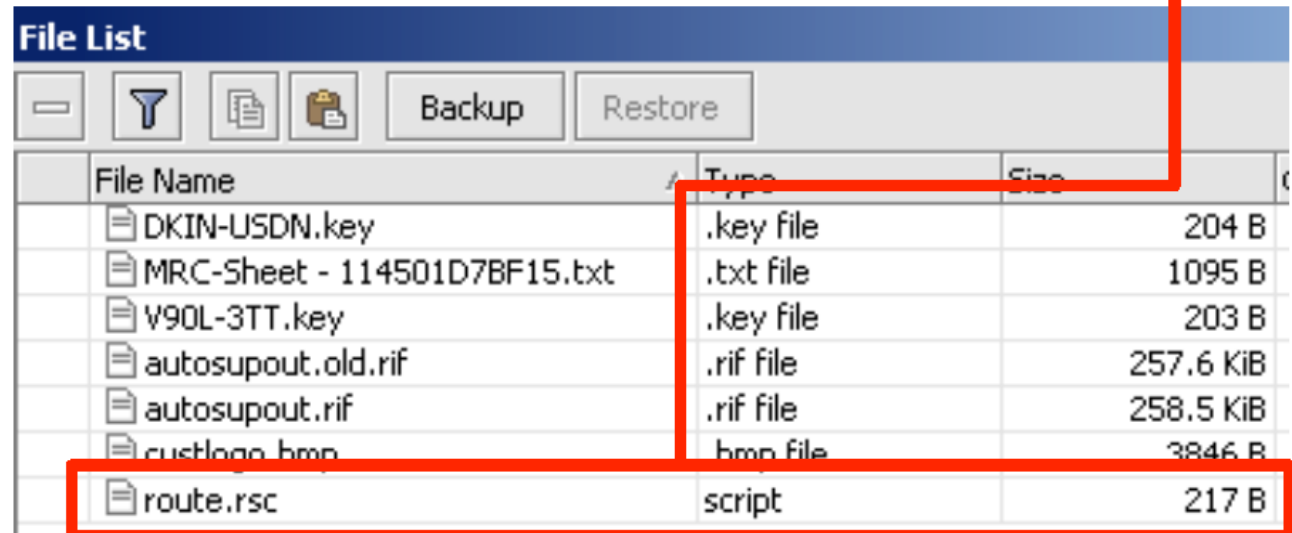
- Backup bisa dilakukan juga menggunakan perintah export.

```
[admin@MikroTik] > /ip route export
# jun/30/2011 10:16:16 by RouterOS 4.6
# software id = DKIN-USDN
#
/ip route
add comment="" disabled=no distance=1 dst-address=0.0.0.0/0 \
    gateway=192.168.5.1 pref-src=192.168.5.201 scope=30 \
    target-scope=10
[admin@MikroTik] >
```

# Backup – Export to File

- Hasil export ini berupa script (text base configuration) yang bisa dilihat dan diedit menggunakan text editor.

```
[admin@MikroTik] > /ip route export file=route.rsc  
[admin@MikroTik] >
```



File Name	Type	Size
DKIN-USDN.key	.key file	204 B
MRC-Sheet - 114501D7BF15.txt	.txt file	1095 B
V90L-3TT.key	.key file	203 B
autosupout.old.rif	.rif file	257.6 KiB
autosupout.rif	.rif file	258.5 KiB
custlogo.bmp	bmp file	3846 B
route.rsc	script	217 B

# Restore – Import Script

- File script bisa langsung di restore ke router

```
MMM      MMM      KKK      TTTTTTTTTTTT      KKK
MMMM     MMMM     KKK      TTTTTTTTTTTT      KKK
MMM MMMM  MMM  III  KKK  KKK  RRRRRR      000000      TTT      III  KKK  KKK
MMM  MM   MMM  III  KKKKK  RRR  RRR  000  000      TTT      III  KKKKK
MMM      MMM  III  KKK  KKK  RRRRRR      000  000      TTT      III  KKK  KKK
MMM      MMM  III  KKK  KKK  RRR  RRR  000000      TTT      III  KKK  KKK
```

MikroTik RouterOS 4.6 (c) 1999-2010

<http://www.mikrotik.com/>

```
[admin@MikroTik] > import route.rsc
Opening script file route.rsc

Script file loaded and executed successfully
[admin@MikroTik] >
```

# DHCP Server

- Dynamic Host Configuration Protocol digunakan untuk secara dinamik mendistribusikan konfigurasi jaringan, seperti:
  - IP Address dan netmask
  - IP Address default gateway
  - Konfigurasi DNS dan NTP Server
  - Dan masih banyak lagi custom option (tergantungkan apakah DHCP client bisa support)

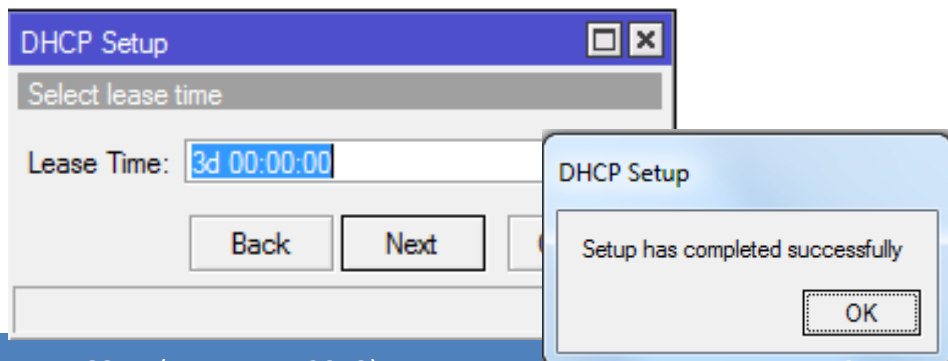
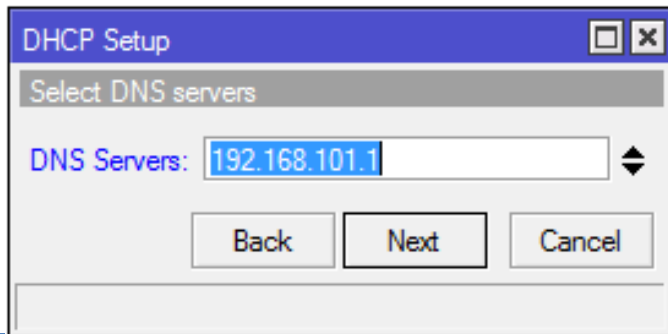
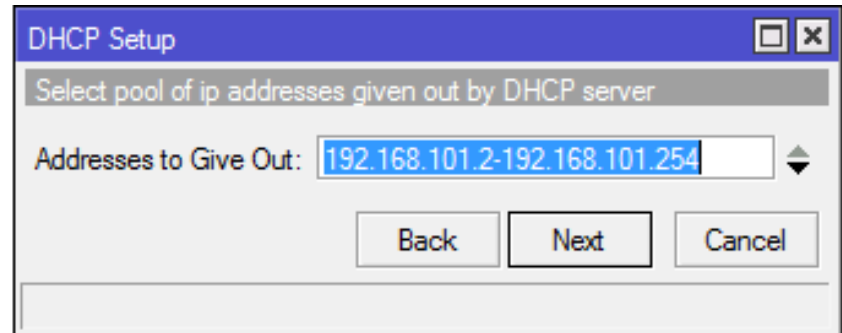
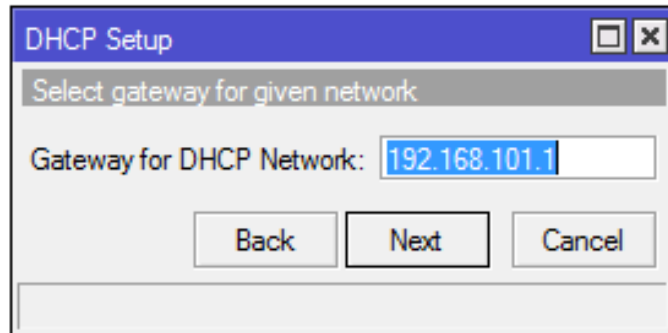
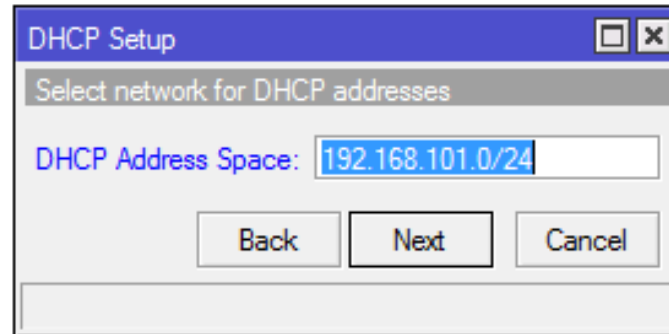
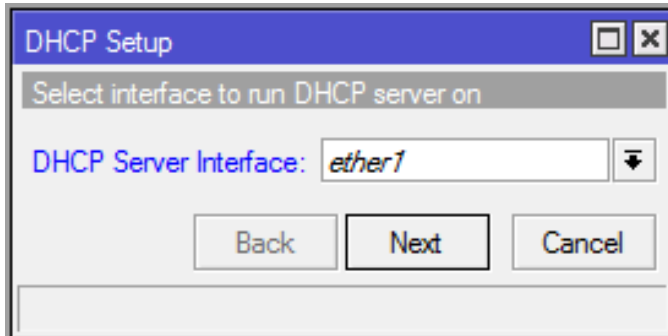
# [LAB-10] DHCP Server (1)

The screenshot shows the Mikrotik WinBox interface for configuring a DHCP server. The left sidebar contains a menu with 'IP' circled in red. Under 'IP', 'DHCP Server' is also circled in red. A 'DHCP Setup' dialog box is open, titled 'DHCP Setup', with the instruction 'Select interface to run DHCP server on'. The 'DHCP Server Interface' dropdown menu is set to 'ether1'. Below the dropdown are 'Back', 'Next', and 'Cancel' buttons. In the main window, the 'DHCP Server' configuration page is active, with the 'DHCP Setup' button circled in red. The table below shows the DHCP server configuration:

Name	Interface	Relay	Lease Time	Address Pool	Add AR...



# [LAB-10] DHCP Server (2)



# Terminal – DHCP Server Wizard

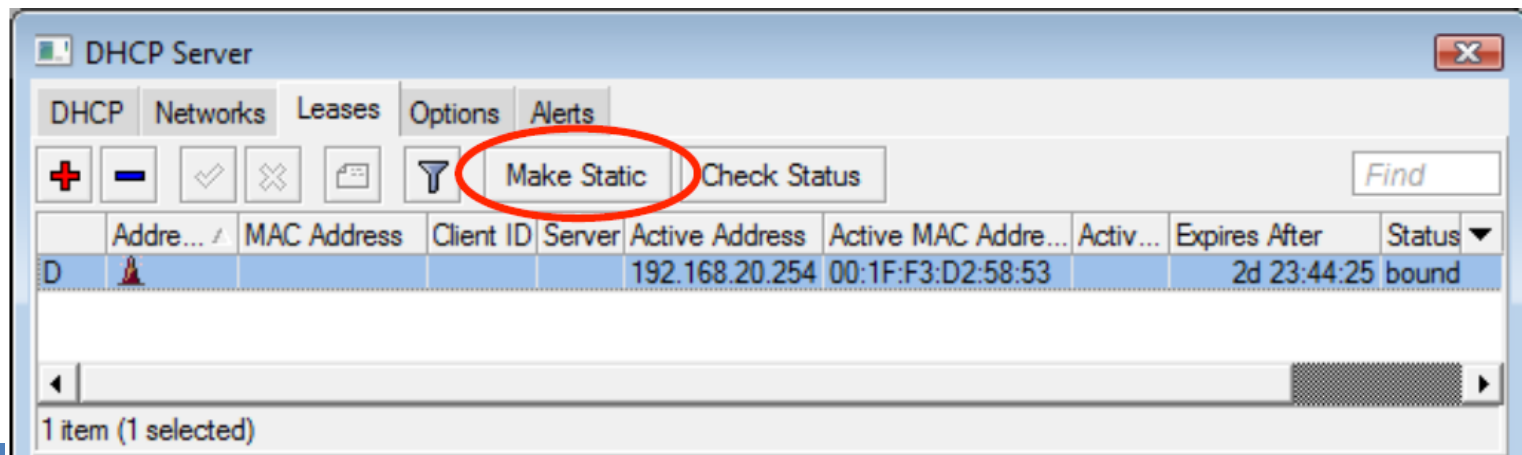
- Konfigurasi DHCP-Server setup
  - /ip dhcp-server setup
  - dhcp server interface: ether1
  - dhcp address space: 192.168.10X.0/24
  - gateway for dhcp network: 192.168.10X.1
  - dhcp relay: 192.168.10X.1
  - addresses to give out: 192.168.10X.10-192.168.10X.20
  - dns servers: 192.168.10X.1
  - lease time: 3d

# DHCP Test

- Ubahlah konfigurasi IP Address dan DNS pada laptop menjadi otomatis
- Cek pada laptop apakah sudah mendapatkan alokasi IP Address dari DHCP
  - **C:\ ipconfig [enter]**
- Cobalah melakukan koneksi internet

# DHCP Management

- Daftar DHCP client yang aktif terlihat pada menu **DHCP-Server – Leases**
- Untuk membuat IP Address tertentu hanya digunakan oleh Mac Address tertentu, bisa menggunakan **DHCP-Statik**



# DHCP Static

DHCP Lease <192.168.20.254, 192.168.20.254>

General Active

Address: 192.168.20.254

MAC Address: 00:1F:F3:D2:58:53

Use Src. MAC Address

Client ID: 1:0:1ff3:d2:58:53

Server: dhcp1

Lease Time: [ ]

Block Access

Always Broadcast

Rate Limit: [ ]

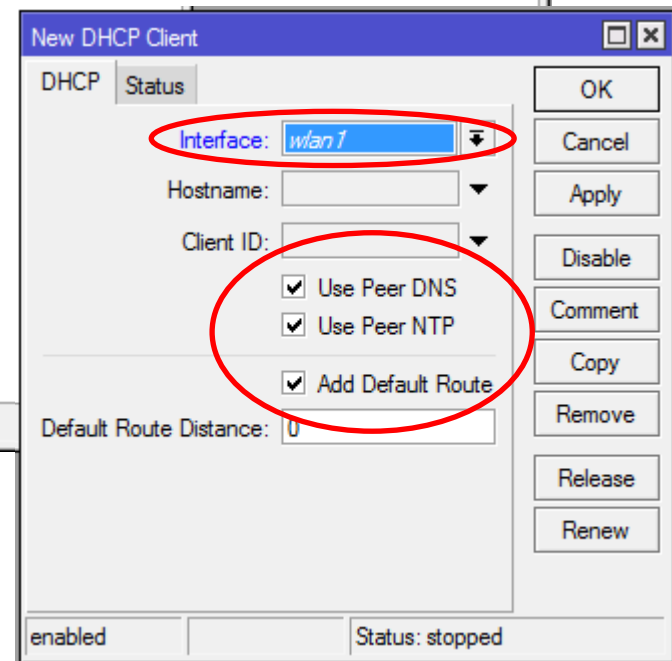
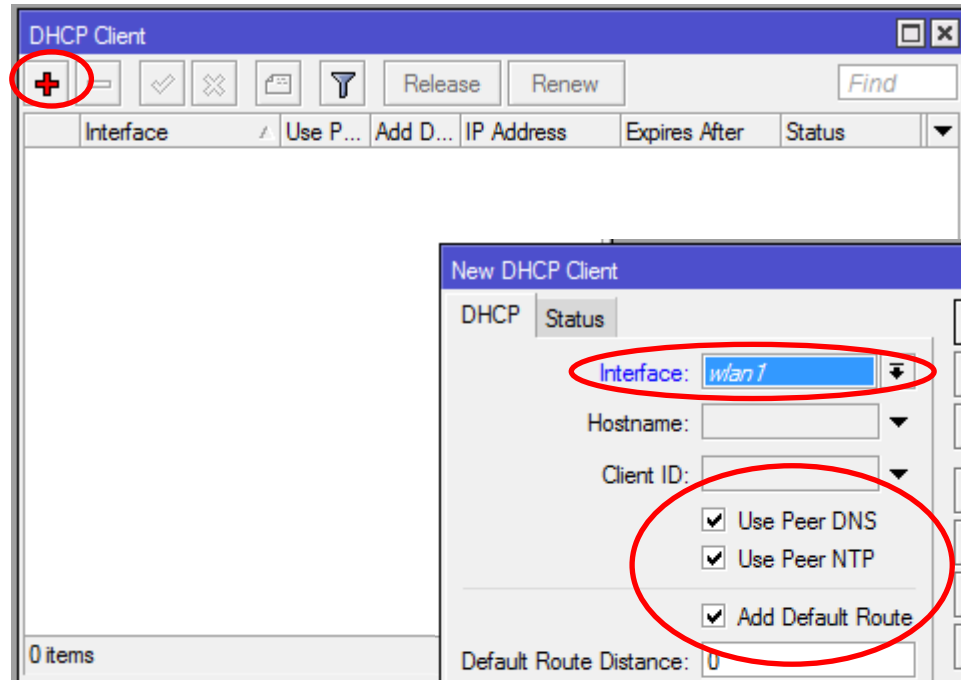
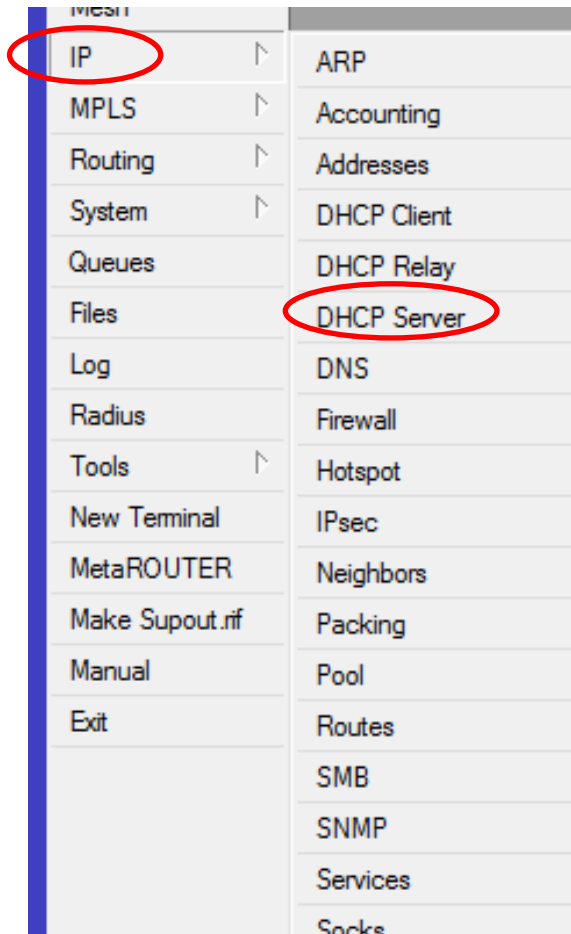
disabled radius blocked bound

OK  
Cancel  
Apply  
Disable  
Comment  
Copy  
Remove  
Make Static  
Check Status

# DHCP Client

- Dalam kondisi tertentu, IP Address yang diberikan oleh ISP yang akan dipasang pada router bukanlah IP Address statik, melainkan IP Address dinamis yang didapatkan melalui DHCP.
- Dalam kasus ini, kita bisa menggunakan fitur DHCP-Client.

# [LAB-11] DHCP Client



# DHCP Client (1)

- **Interface**
  - Pilihlah interface yang sesuai yang terkoneksi ke DHCP Server
- **Host name** (*tidak harus diisi*)
  - Nama DHCP client yang akan dikenali oleh DHCP Server
- **Client ID** (*tidak harus diisi*)
  - Biasanya merupakan mac-address interface yang kita gunakan, apabila proses DHCP di server menggunakan sistem radius



# DHCP Client (2)

- **Add default route**
  - Bila kita menginginkan default route kita mengarah sesuai dengan informasi DHCP
- **Use Peer DNS**
  - Bila kita hendak menggunakan DNS server sesuai dengan informasi DHCP
- **Use Peer NTP**
  - Bila kita hendak menggunakan informasi pengaturan waktu di router (NTP) sesuai dengan informasi dari DHCP
- **Default route distance**
  - Menentukan prioritas routing jika terdapat lebih dari satu DHCP Server yang digunakan. Routing akan melalui distance yang lebih kecil

# DHCP Client – Automatic Gateway

The screenshot shows the Mikrotik WinBox interface. The left sidebar contains a menu with items: Interfaces, Wireless, Bridge, PPP, IP, Routing, Ports, Queues, Drivers, System, Files, Log, SNMP, Users, Radius, Tools, New Terminal, Telnet, Password, Certificates, Make Supout.rif, Manual, and Exit. The main window displays two configuration windows:

- Address List:** A table with columns: Address, Network, Broadcast, and Interface. The second row is highlighted with a red circle.
- Route List:** A table with columns: Destination, Gateway, Gateway..., Interface, Distance, Routing Mark, and Pref. Source. The first row is highlighted with a red circle.

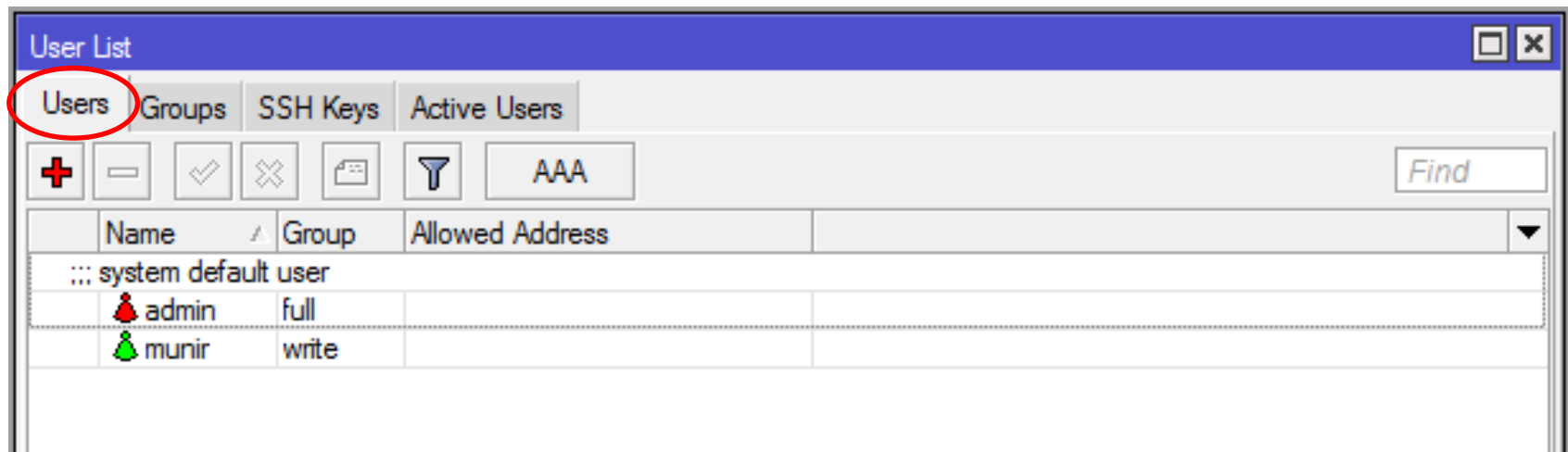
Address	Network	Broadcast	Interface
20.20.20.254/24	20.20.20.0	20.20.20.255	ether2
30.30.30.22/24	30.30.30.0	30.30.30.255	ether3

Destination	Gateway	Gateway ...	Interface	Distance	Routing Mark	Pref. Source
0.0.0.0/0	20.20.20.1		ether2	5		
0.0.0.0/0	30.30.30.1			10		
20.20.20.0/24			ether2	0		20.20.20.254
30.30.30.0/24			ether3	0		30.30.30.22

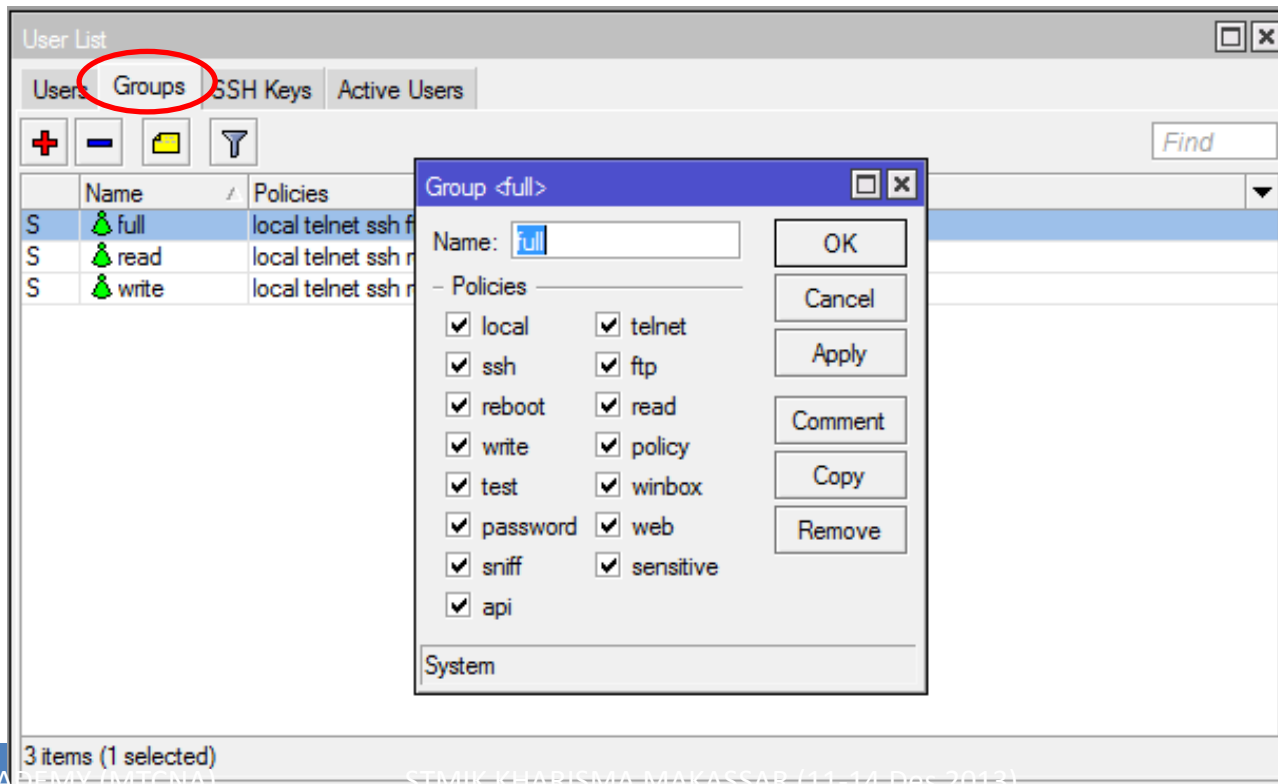
# Manage RouterOS logins

- Secara default, akan ada user admin dengan password [kosong]
- System → Users



# Internal User Groups

- User dapat dikategorikan hak nya berdasarkan grupnya.
- Kita bisa menambahkan user baru dengan hak tertentu.



# About User

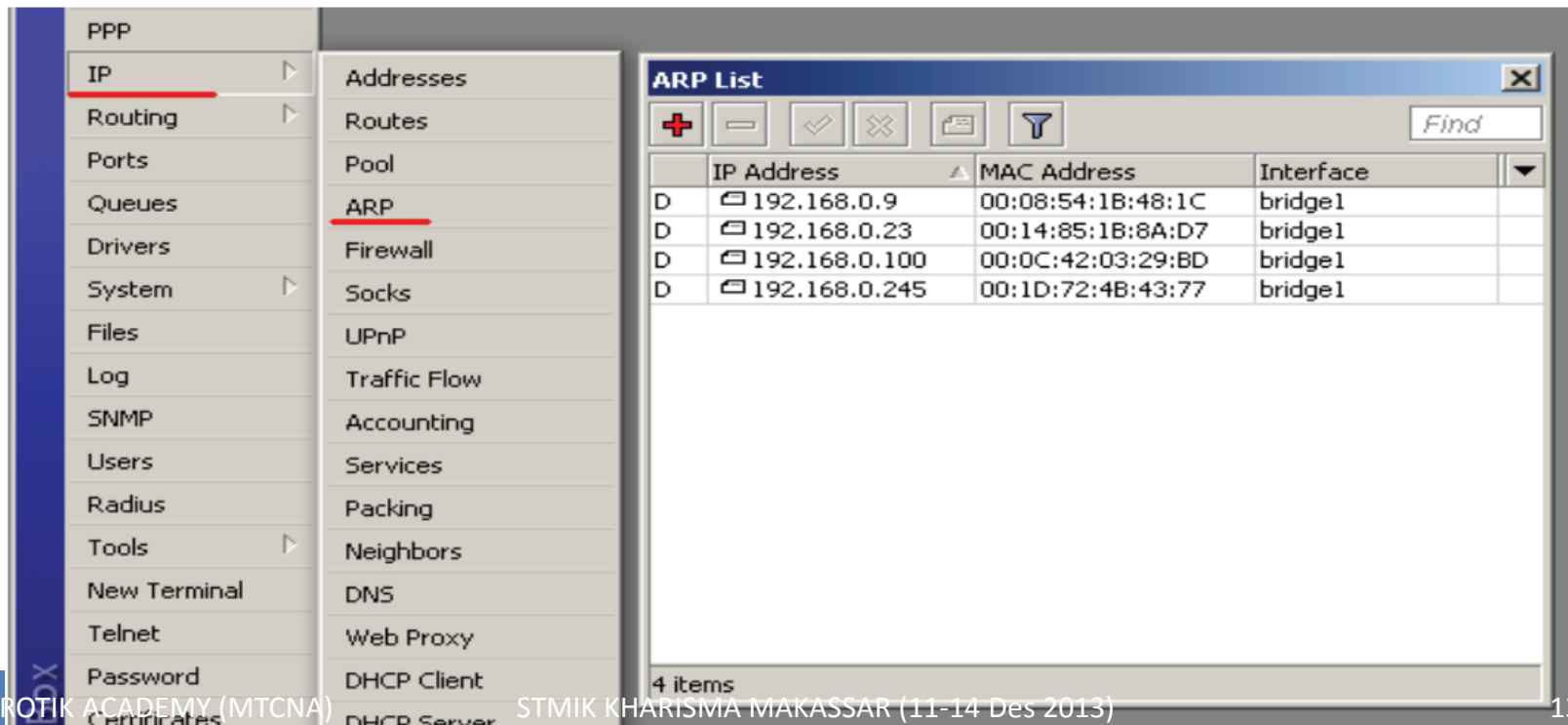
- Buatlah user baru yang memiliki hak penuh dan non aktifkan user “**admin**”
- Untuk teknisi bisa diberikan grup **write** (bukan **full**) sehingga kita masih memiliki hak penuh terhadap router kita
- Untuk pemantauan, bisa menggunakan user dengan grup **read**

# [LAB-12] Internal User

- Buat user tambahan untuk rekan semeja anda
- Buat grup beserta hak yang dimiliki
- Tentukan juga address yang diijinkan untuk mengakses router

# Address Resolution Protocol

- Untuk memetakan OSI level 3 IP address ke OSI level 2 MAC address
- Digunakan dalam transport data antara host dengan router



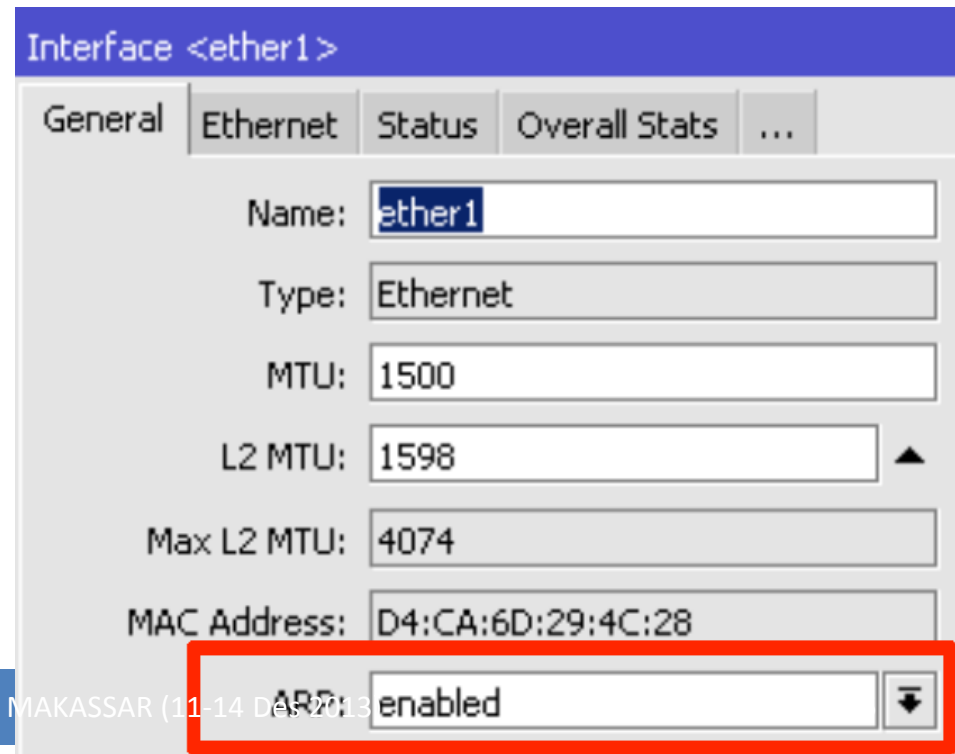
The screenshot shows the Mikrotik WinBox interface. On the left, the 'IP' menu is expanded, and 'ARP' is selected. The main window displays the 'ARP List' window, which contains a table with the following data:

	IP Address	MAC Address	Interface
D	192.168.0.9	00:08:54:18:48:1C	bridge1
D	192.168.0.23	00:14:85:18:8A:D7	bridge1
D	192.168.0.100	00:0C:42:03:29:BD	bridge1
D	192.168.0.245	00:1D:72:4B:43:77	bridge1

4 items

# ARP Protocol

- ARP protocol secara “default” aktif di setiap interface.
- ARP = Enabled – menandakan Interface akan mengupdate tabel ARP secara otomatis



The screenshot shows the configuration page for the 'ether1' interface in Mikrotik WinBox. The 'General' tab is selected, and the 'ARP' field is highlighted with a red box, showing it is set to 'enabled'. Other fields include Name: ether1, Type: Ethernet, MTU: 1500, L2 MTU: 1598, Max L2 MTU: 4074, and MAC Address: D4:CA:6D:29:4C:28.

Field	Value
Name	ether1
Type	Ethernet
MTU	1500
L2 MTU	1598
Max L2 MTU	4074
MAC Address	D4:CA:6D:29:4C:28
ARP	enabled



# ARP – Security !

- ARP = Reply-only – menandakan ARP protocol pada interface tidak mengupdate data di ARP table secara otomatis.

The image shows two windows from Mikrotik WinBox. The left window is titled 'ARP List' and contains a table with columns for IP Address, MAC Address, and Interface. A red box highlights the '+' icon in the toolbar above the table. Below the table is a 'New ARP' form with fields for IP Address (192.168.123.4), MAC Address (AA:BB:CC:DD:EE:FF), and Interface (ether1). The right window is titled 'Interface <ether1>' and shows configuration options for the ether1 interface. A red box highlights the 'ARP' dropdown menu, which is set to 'reply-only'.

	IP Address	MAC Address	Int
D	192.168.10.240	D8:A2:5E:8C:00:B9	bri
D	192.168.10.242	D8:5D:4C:94:BC:45	bri
D	202.65.113.145	00:0C:42:41:C2:4A	vla

**New ARP**

IP Address: 192.168.123.4

MAC Address: AA:BB:CC:DD:EE:FF

Interface: ether1

**Interface <ether1>**

General | Ethernet | Status | Overall Stats | ...

Name: ether1

Type: Ethernet

MTU: 1500

L2 MTU: 1598 ▲

Max L2 MTU: 4074

MAC Address: D4:CA:6D:29:4C:28

ARP: reply-only ▼

# Monitoring - Ping

- Tool monitoring

- Ping

- Ping uses Internet Control Message Protocol (ICMP) Echo messages to determine if a remote host is active or inactive and to determine the round-trip delay when communicating with it.

```
[user1@MKI] > ping 192.168.0.100
```

```
192.168.0.100 64 byte ping: ttl=64 time=1 ms
```

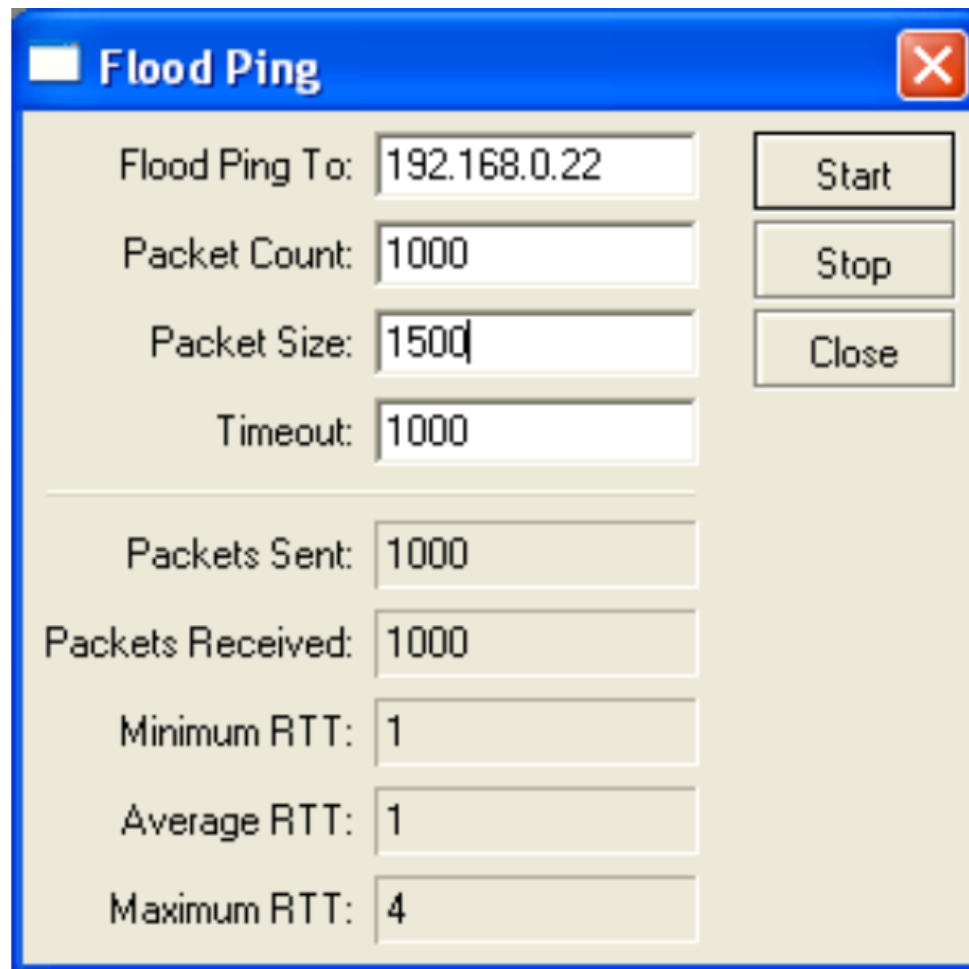
```
192.168.0.100 64 byte ping: ttl=64 time=1 ms
```

```
192.168.0.100 64 byte ping: ttl=64 time=1 ms
```

```
3 packets transmitted, 3 packets received, 0% packet loss
```

```
round-trip min/avg/max = 1/1.0/1 ms
```

# Monitoring – Ping Flood



**Flood Ping**

Flood Ping To: 192.168.0.22

Packet Count: 1000

Packet Size: 1500

Timeout: 1000

Packets Sent: 1000

Packets Received: 1000

Minimum RTT: 1

Average RTT: 1

Maximum RTT: 4

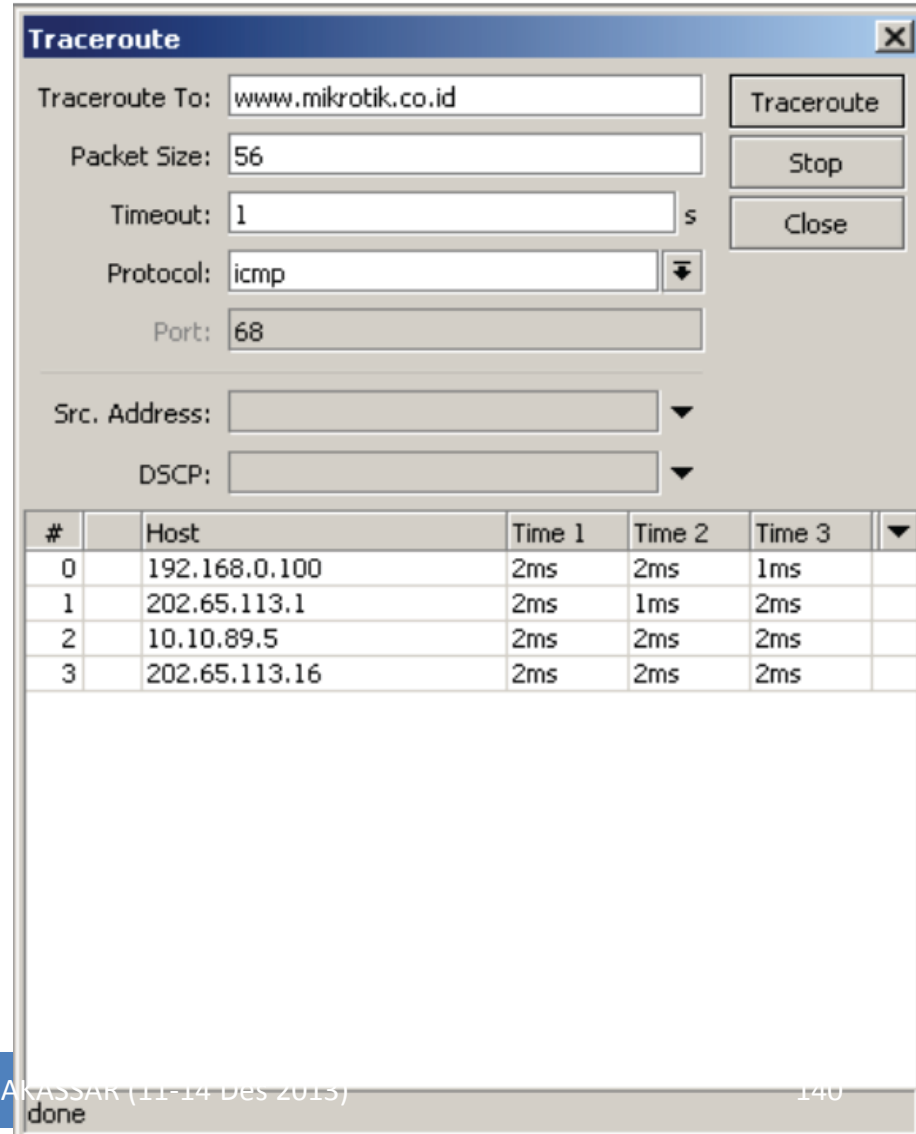
Start

Stop

Close

# Monitoring - Traceroute

- Traceroute
  - Traceroute determines how packets are being routed to a particular host
  - We can choose the protocol : ICMP or UDP



The screenshot shows the Traceroute utility window with the following configuration and results:

Traceroute To:  Traceroute

Packet Size:  Stop

Timeout:  s Close

Protocol:  ▾

Port:

Src. Address:  ▾

DSCP:  ▾

#	Host	Time 1	Time 2	Time 3	▾
0	192.168.0.100	2ms	2ms	1ms	
1	202.65.113.1	2ms	1ms	2ms	
2	10.10.89.5	2ms	2ms	2ms	
3	202.65.113.16	2ms	2ms	2ms	

done

# Monitoring - Torch

**Torch (running)** ✕

— Basic —

Interface: ether7 ▼

Entry Timeout: 00:00:03 s

— Collect —

Src. Address       Protocol

Dst. Address       Port

VLAN Id

— Filters —

Src. Address: 0.0.0.0/0

Dst. Address: 0.0.0.0/0

Protocol: any ▼

Port: any ▼

VLAN Id: any ▼

Start

Stop

Close

Find

	Protocol	Src. Address	Src. Port	Dst. Address	Dst. Port	Tx Rate	Rx Rate	Tx Pack...	Rx Pack...	▼
	6 (tcp)	192.168.5.215	62381	192.168.5.10	8291 (winbox)	45.0 kbps	5.5 kbps	6	9	▲
	17 (udp)	192.168.5.215	51413	123.237.86.2	60203	1365 bps	65.7 kbps	3	6	
	17 (udp)	192.168.5.215	51413	117.199.1.58	38556	928 bps	51.1 kbps	2	5	
	17 (udp)	192.168.5.215	51413	184.74.34.15	12046	901 bps	6.0 kbps	1	1	
	17 (udp)	192.168.5.215	51413	67.242.132.53	31319	128 bps	637 bps	0	0	
	6 (tcp)	192.168.5.215	49346	58.179.43.56	24443	0 bps	3.8 kbps	0	0	
	17 (udp)	192.168.5.215	51413	173.25.84.47	34585	501 bps	6.1 kbps	1	1	
	6 (tcp)	192.168.5.215	49361	60.241.80.137	6881	277 bps	2.3 kbps	0	0	

# Monitoring - Resource

- Resource
  - To monitor the System.
  - Detail Resource monitor located on right side buttons

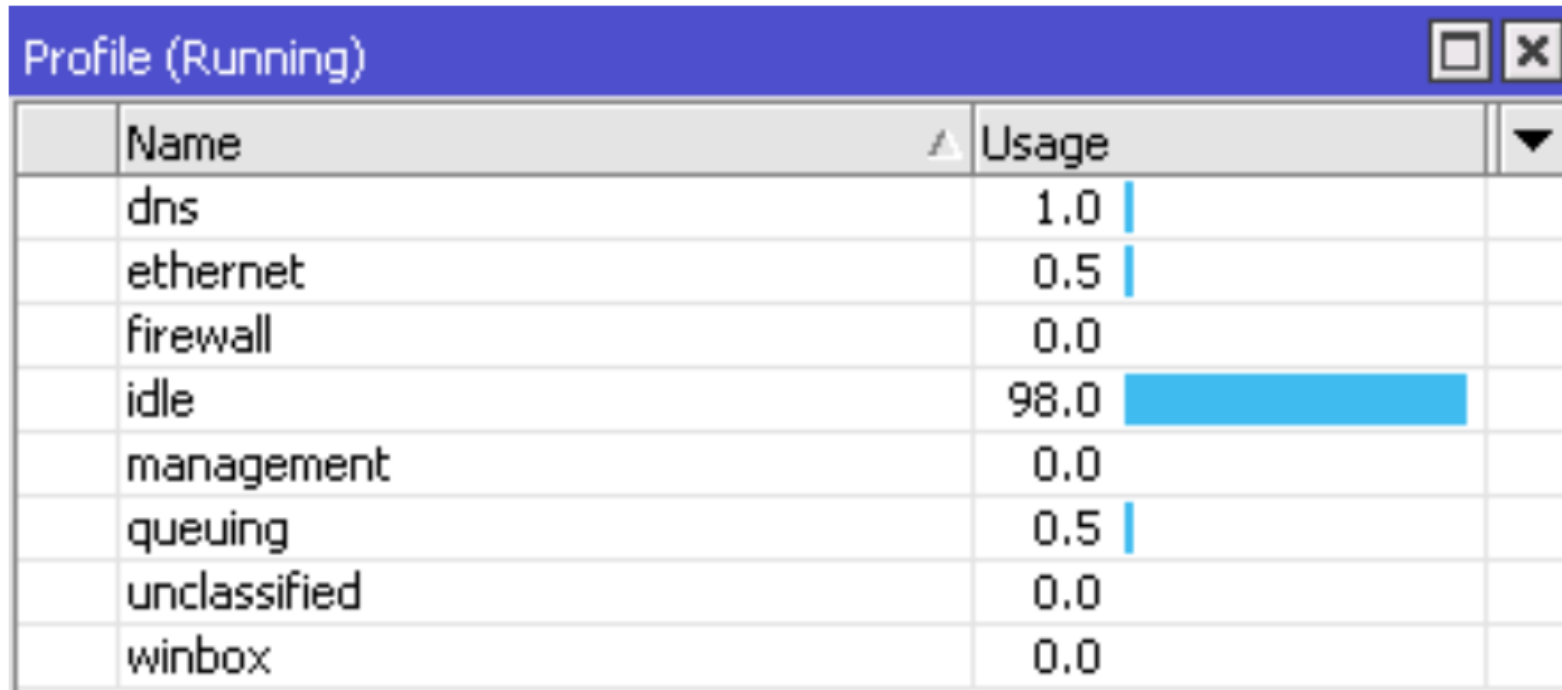
The screenshot shows the 'Resources' window with the following data:

Uptime:	4d 00:48:48
Free Memory:	471.1 MiB
Total Memory:	504.5 MiB
CPU:	e500v2
CPU Count:	1
CPU Frequency:	799 MHz
CPU Load:	0 %
Free HDD Space:	455.4 MB
Total HDD Size:	520.1 MB
Sector Writes Since Reboot:	40 407
Total Sector Writes:	1 030 036
Bad Blocks:	0.1 %
Architecture Name:	powerpc
Board Name:	RB1100

Buttons on the right side: OK, PCI, USB, CPU, IRQ.

# Monitoring – CPU Load

Tool – Profile untuk monitoring CPU Load



Name	Usage
dns	1.0
ethernet	0.5
firewall	0.0
idle	98.0
management	0.0
queuing	0.5
unclassified	0.0
winbox	0.0

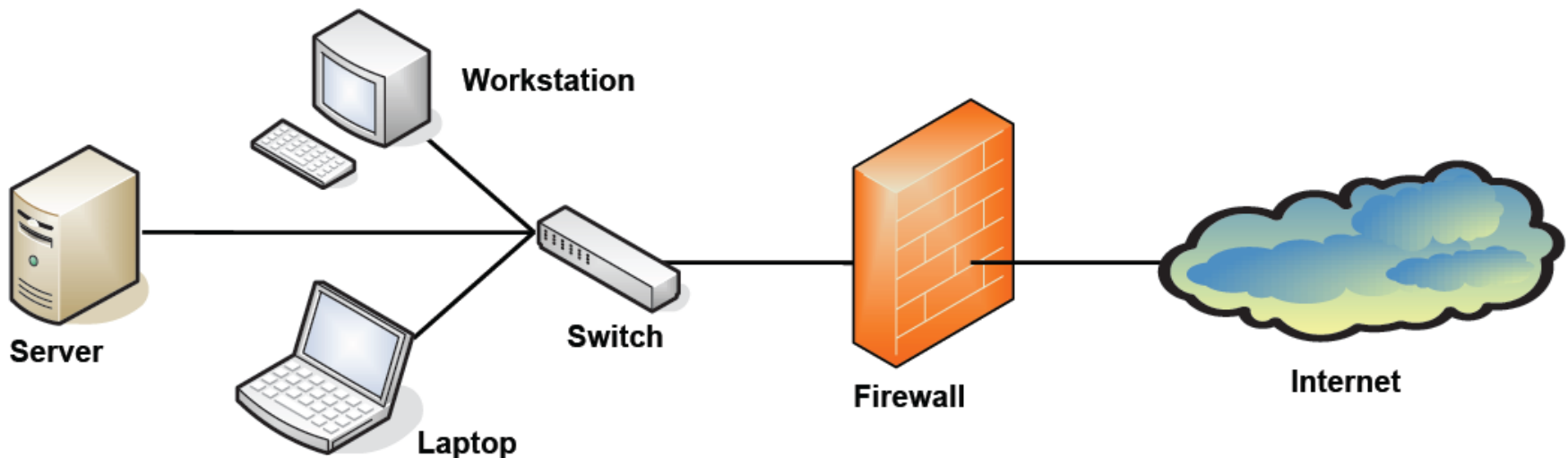
# Module 2

## MikroTik RouterOS Firewall



# Firewall

Firewall diposisikan antara jaringan lokal dan jaringan publik, bertujuan melindungi komputer dari serangan, dan secara efektif mengontrol koneksi data menuju, dari, dan melalui router.



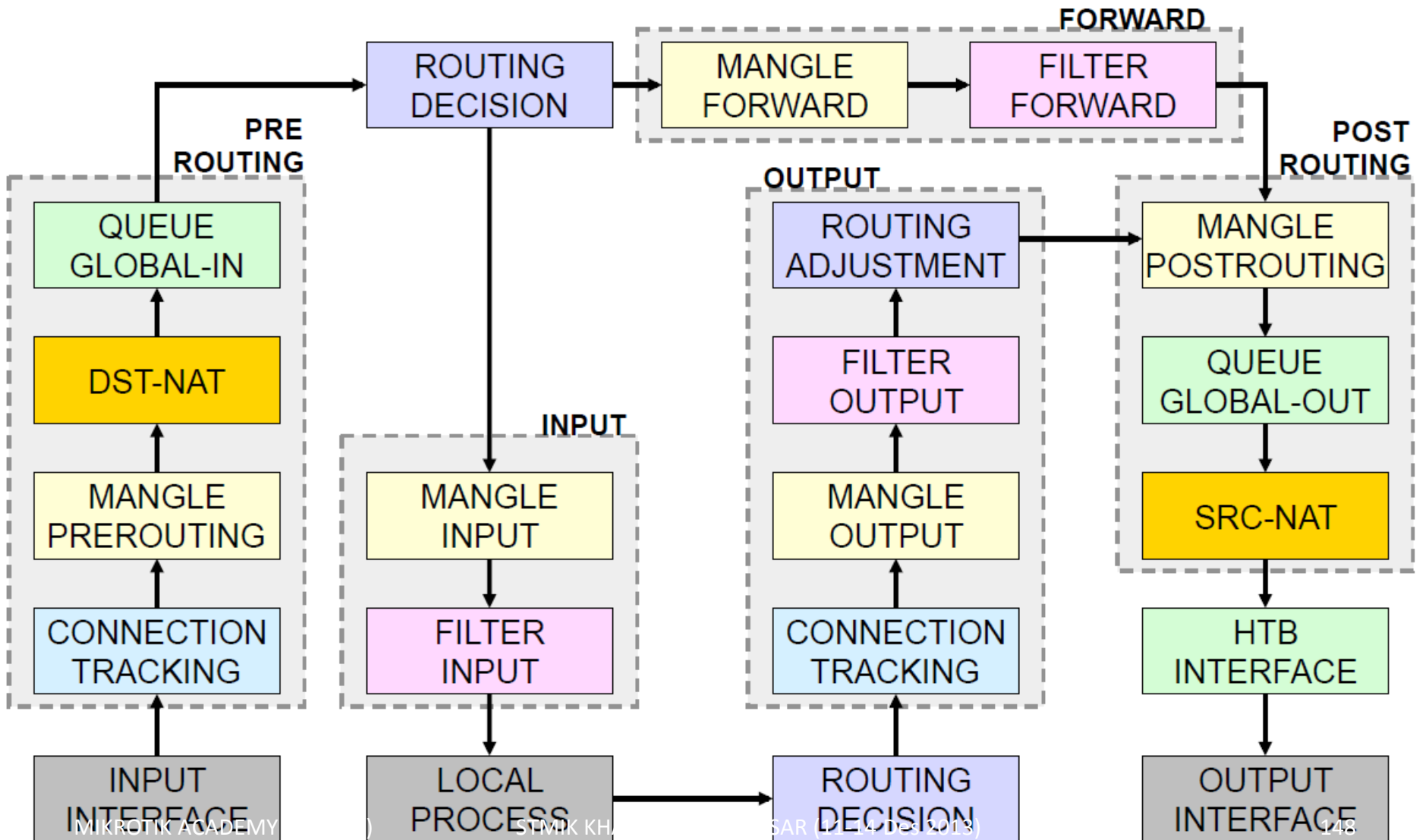
# Mikrotik Firewall - Features

- Rules
- NAT (source-nat and destination-nat)
- Mangle
- Address List
- Layer 7 Protocol (baru di versi 3)
- Service Ports
- Connections
  - For monitoring only

# Traffic Flow (Aliran Data)

- Setiap paket data memiliki asal (source) dan tujuan (destination).
- Traffic flow bisa dibedakan menjadi 3 kategori, dilihat dari sudut pandang router.
  - **Dari Luar router menuju ke luar router lagi**
    - Contoh : traffic client browsing ke internet
  - **Dari luar router menuju ke dalam router itu sendiri (Local process).**
    - Contoh : traffic winbox ke router
  - **Dari dalam router (local process) menuju ke luar router.**
    - Contoh : traffic ping dari new terminal winbox

# Simple Packet Flow



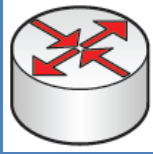
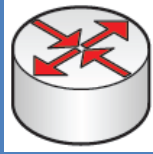
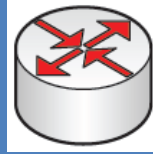
# Posisi Chain / Parent

From	To	Mangle	Firewall	Queue
Outside	Router/ Local Proses	Prerouting		Global-In
		Input	Input	Global-Total
Router/ Local Proses	Outside	Output	Output	Global-Out
		Postrouting		Global-Total
				Interface
Outside	Outside	Prerouting		Global-In
		Forward	Forward	Global-Out
		Postrouting		Global-Total
				Interface

# Firewall Filters – Blocking Rules

- Adalah cara untuk memfilter paket, dilakukan untuk meningkatkan keamanan jaringan, dan mengatur flow data dari, ke client, ataupun router
- Pembacaan rule filter dilakukan dari atas ke bawah secara berurutan. Jika melewati rule yang kriterianya sesuai akan dilakukan action yang ditentukan, jika tidak sesuai, akan dianalisa ke baris selanjutnya.

# Chain pada Filter

			
Prerouting	Not Implemented	Not Implemented	Not Implemented
Input	Yes	No	No
Forward	No	Yes	No
Output	No	No	Yes
Postrouting	Not Implemented	Not Implemented	Not Implemented

# Action Filter

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



# RouterOS v5 Services

	PORT	PROTOCOL	DESCRIPTION
1	20	tcp	FTP
2	21	tcp	FTP
3	22	tcp	SSH, SFTP
4	23	tcp	Telnet
5	53	tcp	DNS
6	80	tcp	HTTP
7	179	tcp	BGP
8	443	tcp	SHTTP (Hotspot)
9	646	tcp	LDP (MPLS)
10	1080	tcp	SoCKS (Hotspot)
11	1723	tcp	PPTP
12	1968	tcp	MME
13	2000	tcp	Bandwidth Server
14	2210	tcp	Dude Server
15	2211	tcp	Dude Server
16	2828	tcp	uPnP
17	3128	tcp	Web Proxy
18	8291	tcp	Winbox
19	8728	tcp	API
20	---	/1	ICMP
21	---	/2	IGMP (Multicast)
22	---	/4	IPIP

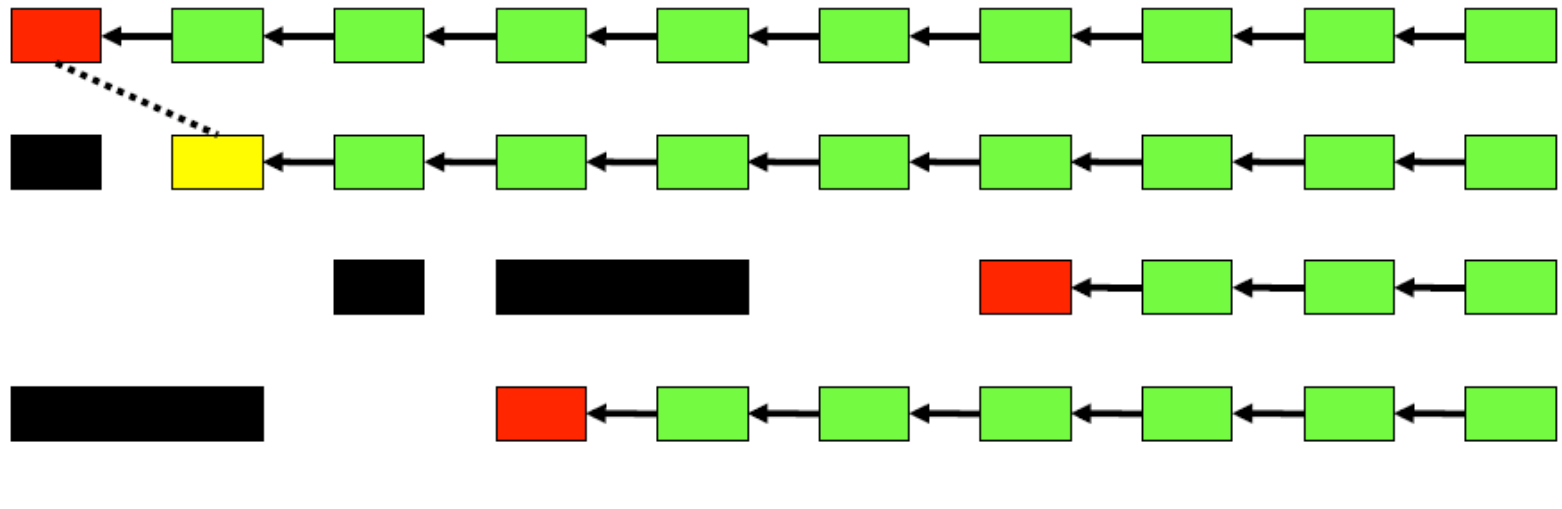
	PORT	PROTOCOL	DESCRIPTION
23	53	udp	DNS
24	123	udp	NTP
25	161	udp	SNMP
26	500	udp	IPSec
27	520	udp	RIP
28	521	udp	RIP
29	646	udp	LDP (MPLS)
30	1698	udp	RSVP (MPLS)
31	1699	udp	RSVP (MPLS)
32	1701	udp	L2TP
33	1812	udp	User-Manager
34	1813	udp	User-Manager
35	1900	udp	uPnP
36	1966	udp	MME
37	5678	udp	Neighbor Discovery
38	---	/46	RSVP (MPLS)
39	---	/47	PPRP, EoIP
40	---	/50	IPSec
41	---	/51	IPSec
42	---	/89	OSPF
43	---	/103	PIM (Multicast)
44	---	/112	VRRP

# Connection State

- Setiap paket data yang lewat memiliki status:
  - **Invalid** – paket tidak dimiliki oleh koneksi apapun, tidak berguna
  - **New** – paket yang merupakan pembuka sebuah koneksi/paket pertama dari sebuah koneksi
  - **Established** – merupakan paket kelanjutan dari paket dengan status new.
  - **Related** – paket pembuka sebuah koneksi baru, tetapi masih berhubungan dengan koneksi sebelumnya.

# Connection State

Firewall



New



Established



Related

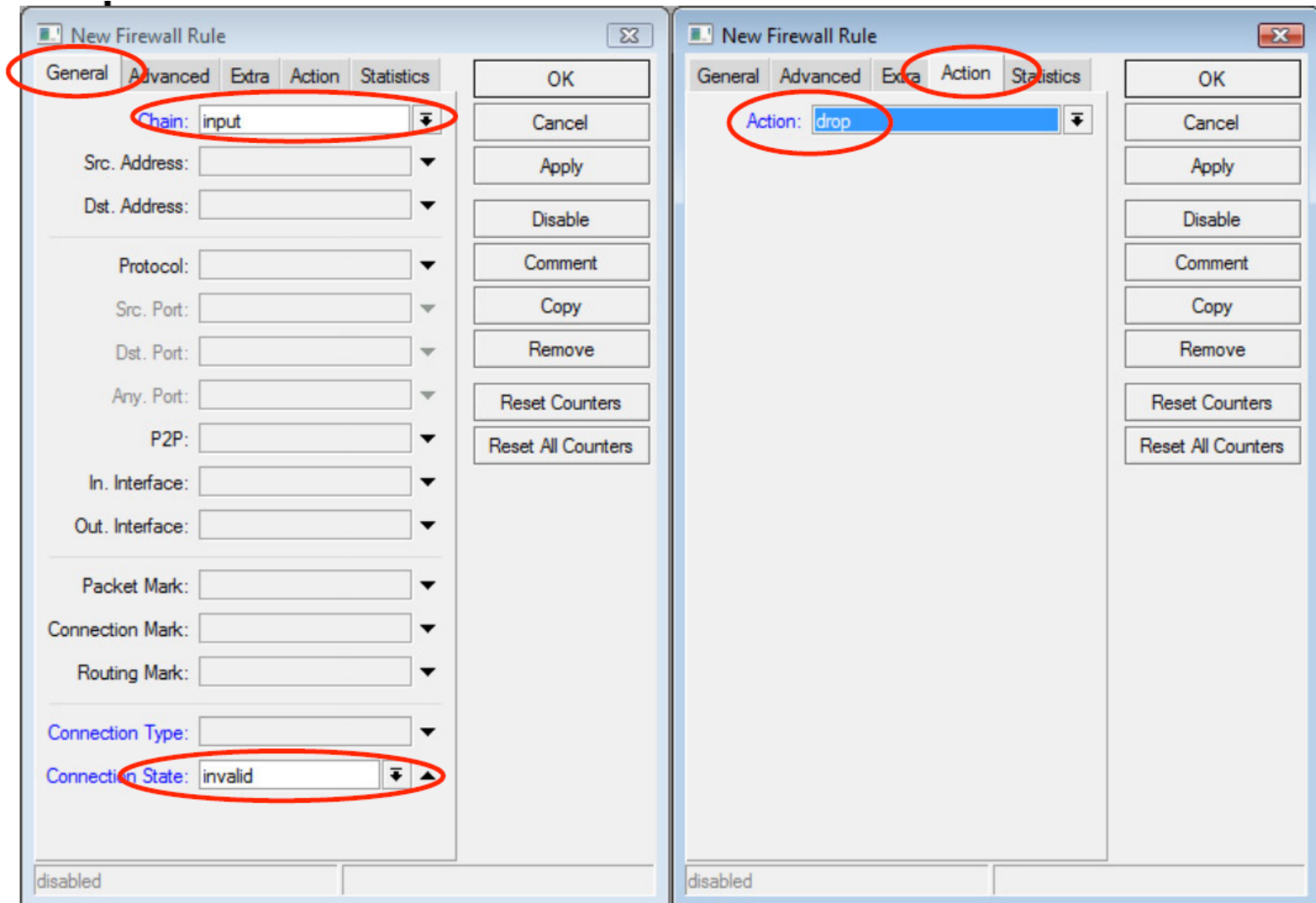


Invalid

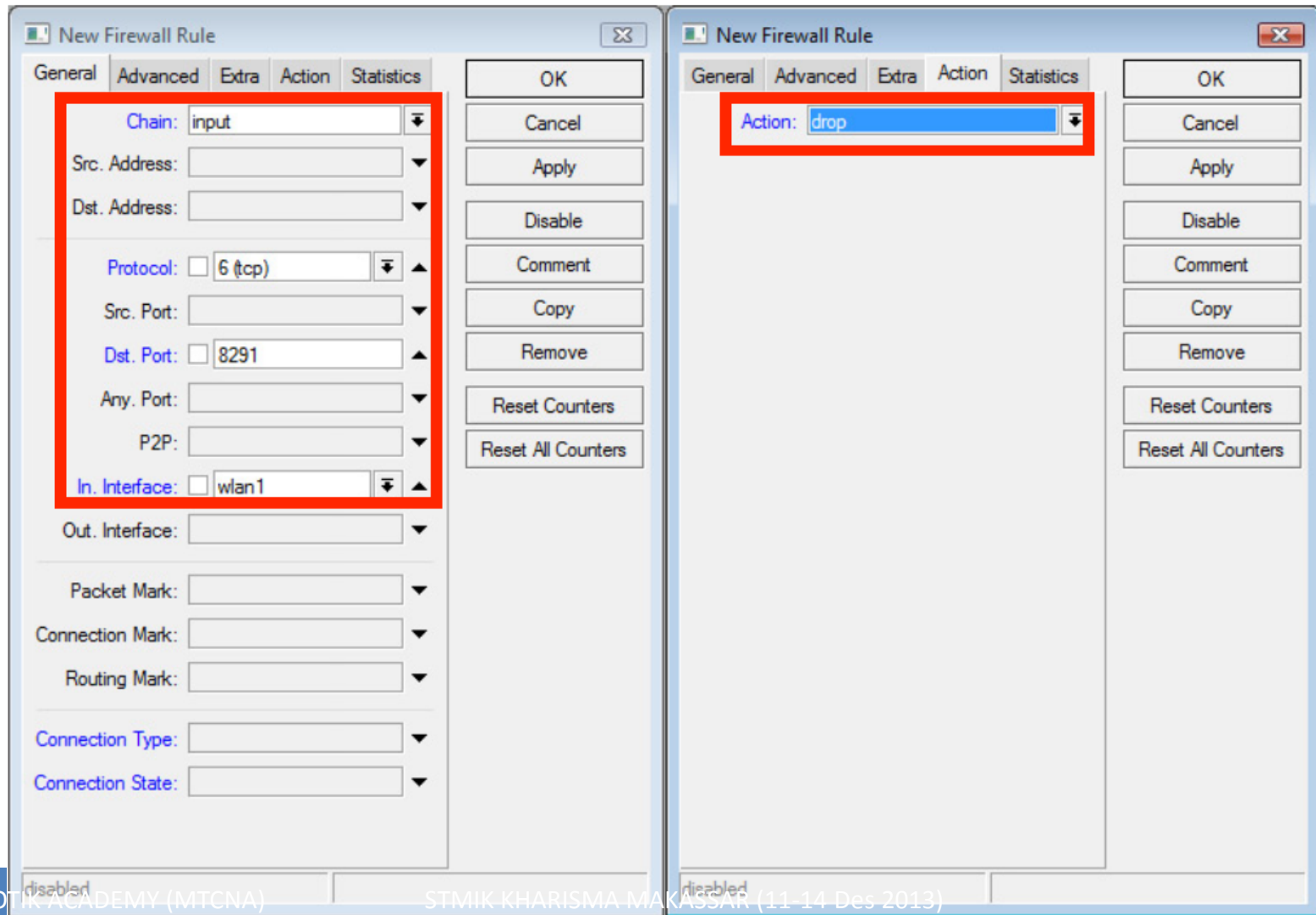
# [LAB-2] Simple Blocking

- Blok semua invalid connection ke router
- Accept koneksi related dan established
- Blok koneksi winbox ke router yang masuk melalui interface public (wlan)
- Blok koneksi dari laptop ke ip tertentu, contoh: 10.10.10.100

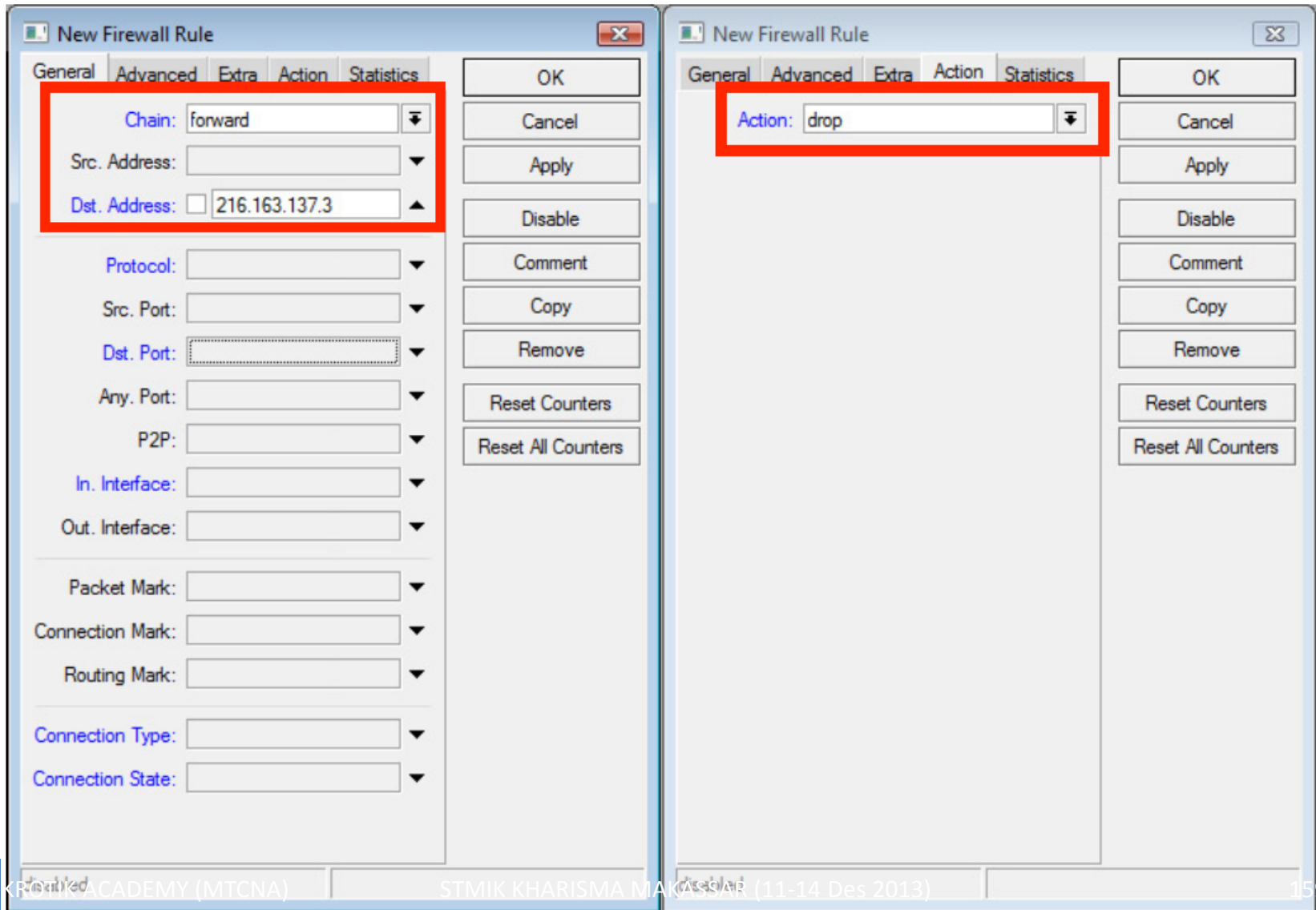
# Blok Invalid Connection



# Blok Koneksi Winbox ke Router dari interface publik (wlan)



# Blok Nude Site



# IP Address List

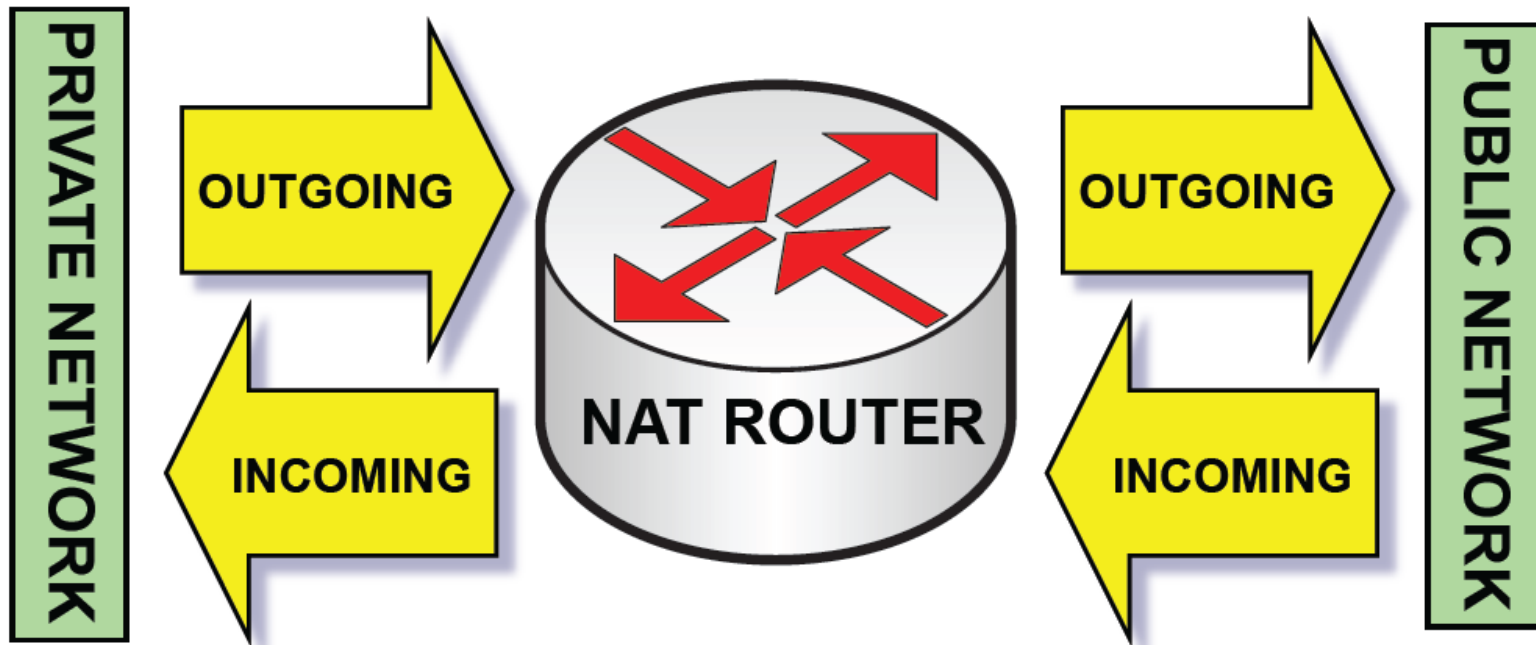
- Kita dapat melakukan pengelompokan IP Address dengan **Address List**
- Address List (seperti halnya mangle) bisa dijadikan parameter dalam pembuatan filter, queue, mangle, NAT, dll.
- Dengan Filter dan Mangle, kita bisa secara otomatis memasukkan IP Address tertentu ke dalam **address list** dan juga menentukan jangka waktu expire nya.



# Network Address Translation (NAT)

- NAT digunakan untuk melakukan pengubahan baik src-address ataupun dst-address.
- Setelah paket data pertama dari sebuah koneksi terkena NAT, maka paket berikutnya pada koneksi tersebut juga akan terkena NAT.
- NAT akan diproses terurut mulai baris paling atas hingga ke bawah.

# Firewall NAT



The NAT router translates traffic coming into and leaving the private network

# src-nat and masquerade

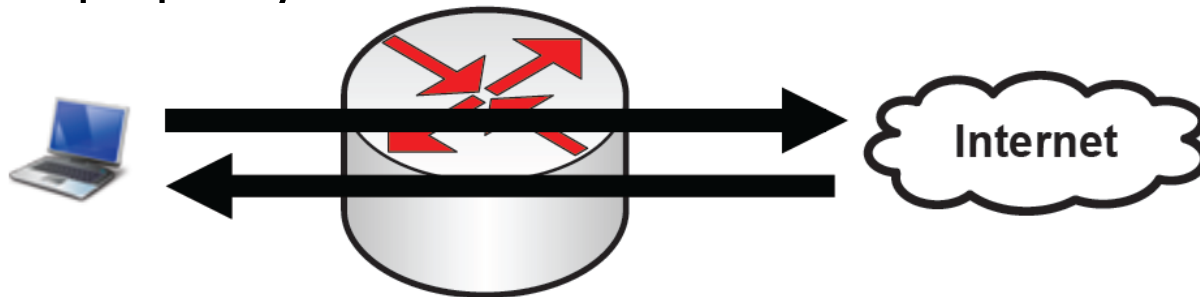
- Untuk menyembunyikan IP Address lokal dan menggantikannya dengan IP Address publik yang sudah terpasang pada router
- **src-nat**
  - Kita bisa memilih IP Address publik yang digunakan untuk menggantikan.
- **masquerade**
  - Secara otomatis akan menggunakan IP Address pada interface publik.
  - Digunakan untuk mempermudah instalasi dan bila IP Address publik pada interface publik menggunakan IP Address yang dinamik (misalnya DHCP, PPTP atau EoIP)

# dst-nat and redirect

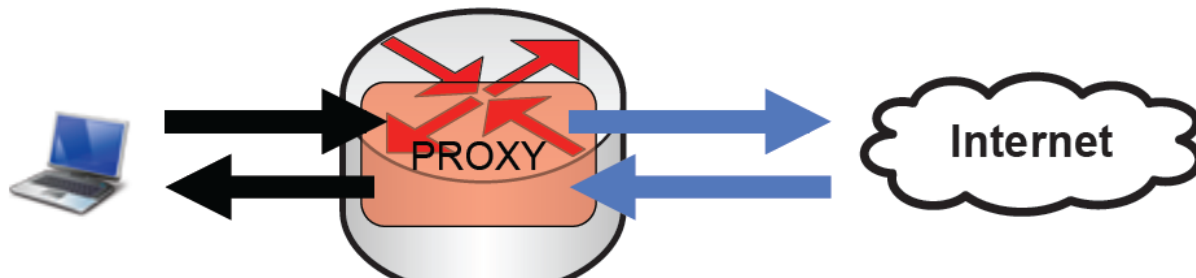
- Untuk melakukan penggantian IP Address tujuan, atau mengarahkan koneksi ke localhost.
- **dst-nat**
  - Kita bisa mengganti IP Address dan port tujuan dari sesuatu koneksi.
- **redirect**
  - Untuk mengalihkan koneksi yang tadinya melwati router, dan dialihkan menuju ke localhost

# Konsep Proxy

- Pada semua level routers, baik yang diinstall pada PC maupun yang diinstall pada routerboard, kita bisa mengaktifkan fitur proxy
- Koneksi tanpa proxy



- Koneksi dengan proxy



# Fitur Proxy di RouterOS

- **Regular HTTP proxy**
- **Transparent proxy**
  - Dapat berfungsi juga sebagai transparan dan sekaligus normal pada saat yang bersamaan
- **Access list**
  - Berdasarkan source, destination, URL dan requested method
- **Cache Access list**
  - Menentukan objek mana yang disimpan pada cache
- **Direct Access List**
  - Mengatur koneksi mana yang diakses secara langsung dan yang melalui proxy server lainnya
- **Logging facility**

# [LAB-5] dst-nat & local proxy

- Aktifkanlah service **web-proxy** pada router Anda.
- Lakukanlah pengalihan koneksi secara **transparan** sehingga semua koneksi HTTP akan **melalui web proxy** pada router.

# Mengaktifkan Proxy

The screenshot shows the Mikrotik WinBox interface. The left sidebar contains a tree view of system settings, with 'Web Proxy' highlighted under the 'Tools' category. The main window displays the 'Web Proxy' configuration page, with the 'Web Proxy Settings' dialog box open. The 'Enabled' checkbox is checked, and the 'Port' is set to 3128. Other settings like 'Src. Address', 'Parent Proxy', 'Cache Drive', and 'Max. Client Connections' are also visible.

admin@00:0C:42:1B:5C:C1 (MikroTik) - WinBox v3.2 on RB500R5 (mipsle)

Web Proxy Settings

Web Proxy Settings

General Status Lookups Inserts

Enabled

Src. Address: [ ]

Port: 3128

Parent Proxy: [ ]

Parent Proxy Port: [ ]

Cache Drive: system

Cache Administrator: webmaster

Max. Cache Size: none KIB

Cache On Disk

Max. Client Connections: 600

Max. Server Connections: 600

Max Fresh Time: 3d 00:00:00

Serialize Connections

Always From Cache

Cache Hit DSCP (TOS): 4



# Redirect TCP-80

The image displays two windows from the Mikrotik WinBox interface. The left window, titled "NAT Rule <80>", shows the configuration for an existing NAT rule. The right window, titled "New NAT Rule", shows the configuration for a new NAT rule. Both windows have tabs for "General", "Advanced", "Extra", "Action", and "Statistics".

**NAT Rule <80> Configuration:**

- Chain: dstnat
- Src. Address: (empty)
- Dst. Address: (empty)
- Protocol:  6 (tcp)
- Src. Port: (empty)
- Dst. Port:  80
- Any. Port: (empty)
- In. Interface:  ether1
- Out. Interface: (empty)
- Packet Mark: (empty)
- Connection Mark: (empty)
- Routing Mark: (empty)
- Connection Type: (empty)

**New NAT Rule Configuration:**

- Action: redirect
- To Ports: 3128

Buttons on the right side of the "New NAT Rule" window include: OK, Cancel, Apply, Disable, Comment, Copy, Remove, Reset Counters, and Reset All Counters.

# Akses

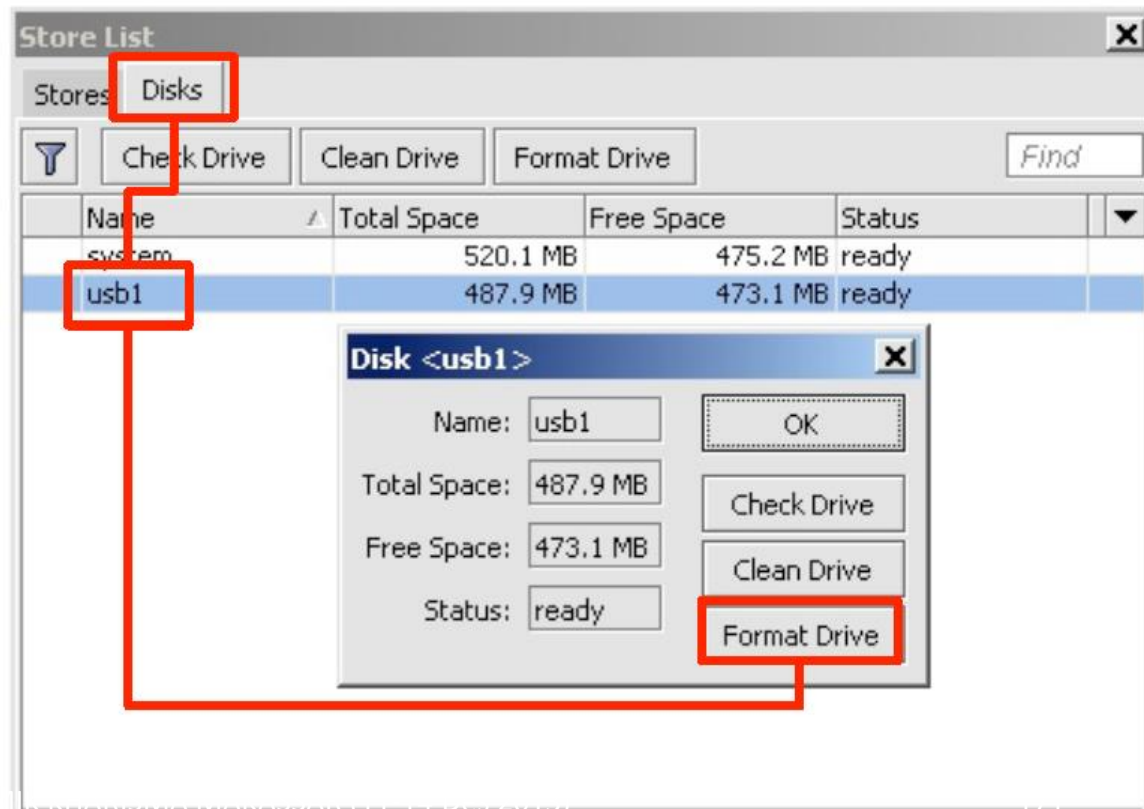
The image shows the Mikrotik WinBox interface for configuring a Web Proxy Rule. It is divided into three main sections:

- Web Proxy:** The leftmost panel shows a list of rules. A red circle highlights a '+' button, indicating the process of adding a new rule.
- New Web Proxy Rule:** The middle panel shows the configuration for a new rule. The following fields are highlighted with red boxes:
  - Path:** Set to `/*mp3|`.
  - Action:** Set to `deny`.
- Web Proxy Rule <>:** The rightmost panel shows the configuration for an existing rule. The following fields are highlighted with red boxes:
  - Dst. Host:** Set to `*yahoo*`.
  - Action:** Set to `deny`.

Red lines connect the '+' button to the 'New Web Proxy Rule' panel, and the 'Path' and 'Action' fields in the 'New Web Proxy Rule' panel to the corresponding 'Dst. Host' and 'Action' fields in the 'Web Proxy Rule <>' panel, illustrating the configuration flow.

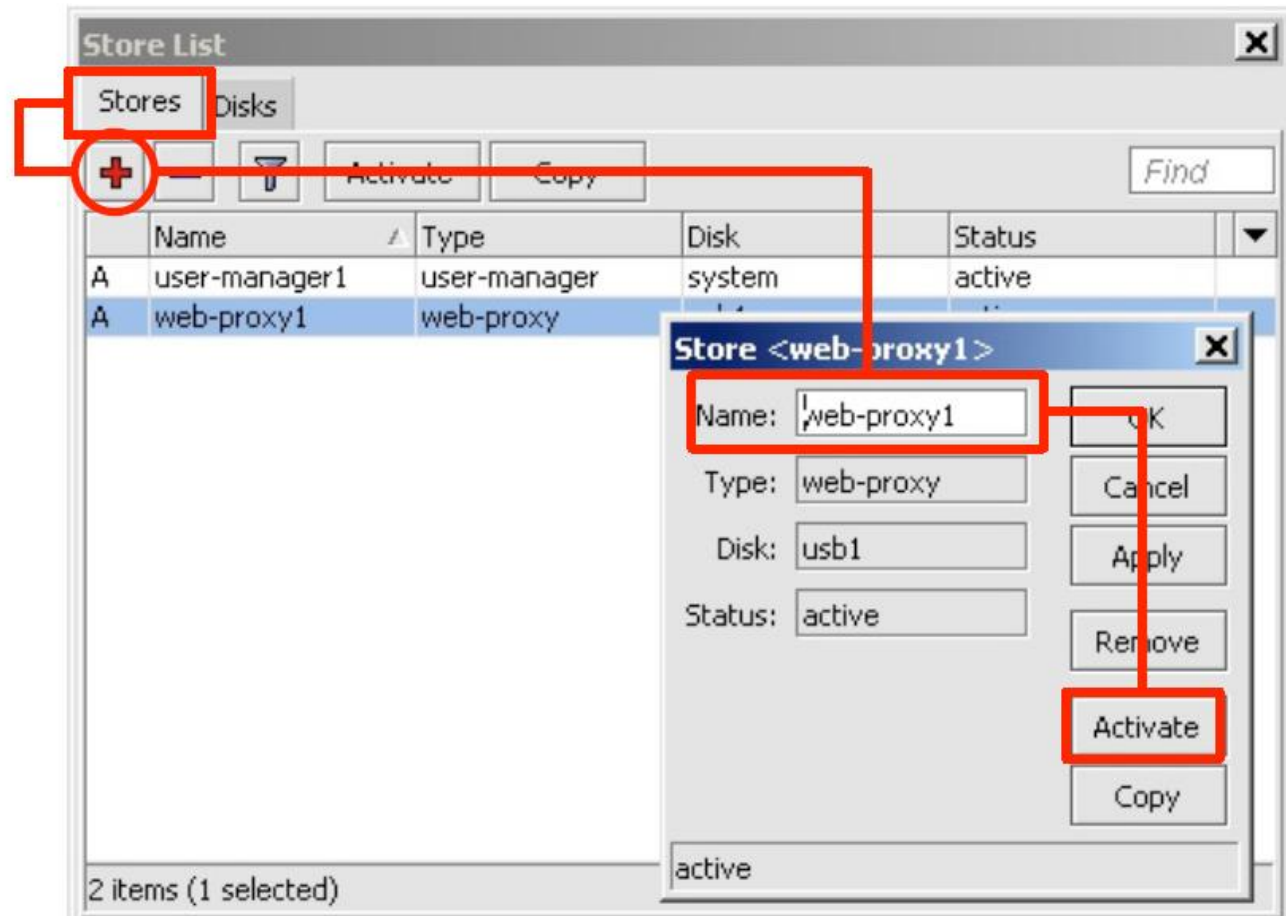
# System Store - Disk

- Penyimpanan Cache
  - System Disk
  - Hardisk
  - Flash memory
- Format terlebih dahulu



# System Store – Store Mount

- Setelah diformat Disk di mount untuk service proxy.



# Proxy - Cache

- Aktifkan “Cache On Disk” untuk mengaktifkan Mikrotik Proxy Cache.
- Perhatikan pada parameter “Cache Drive” sudah menggunakan USB disk.

The screenshot shows the 'Web Proxy Settings' window with the 'General' tab selected. The 'Enabled' checkbox is checked. The 'Cache On Disk' checkbox is also checked and highlighted with a red box. The 'Max. Cache Size' is set to 'unlimited' KIB, also highlighted with a red box. The 'Cache Drive' is set to 'usb1', highlighted with a red box. Other settings include 'Src. Address', 'Port: 3128', 'Parent Proxy', 'Parent Proxy Port', 'Cache Administrator: webmaster', 'Max. Client Connections: 600', 'Max. Server Connections: 600', 'Max Fresh Time: 3d 00:00:00', 'Serialize Connections' (unchecked), 'Always From Cache' (checked and highlighted with a red box), and 'Cache Hit DSCP (TOS): 4'.

# Daftar Protokol dan Port yang Sebaiknya Ditutup

Karena Virus, Spyware, dll

# Block Bogus IP Address

- add chain=forward src-address=0.0.0.0/8 action=drop
- add chain=forward dst-address=0.0.0.0/8 action=drop
- add chain=forward src-address=127.0.0.0/8  
action=drop
- add chain=forward dst-address=127.0.0.0/8  
action=drop
- add chain=forward src-address=224.0.0.0/3  
action=drop
- add chain=forward dst-address=224.0.0.0/3  
action=drop

# Separate Protocol into Chains

- add chain=forward protocol=tcp action=jump  
jump-target=tcp
- add chain=forward protocol=udp action=jump  
jump-target=udp
- add chain=forward protocol=icmp  
action=jump jump-target=icmp



# Blocking UDP Packet

- `add chain=udp protocol=udp dst-port=69 action=drop comment="deny TFTP"`
- `add chain=udp protocol=udp dst-port=111 action=drop comment="deny PRC portmapper"`
- `add chain=udp protocol=udp dst-port=135 action=drop comment="deny PRC portmapper"`
- `add chain=udp protocol=udp dst-port=137-139 action=drop comment="deny NBT"`
- `add chain=udp protocol=udp dst-port=2049 action=drop comment="deny NFS"`
- `add chain=udp protocol=udp dst-port=3133 action=drop comment="deny BackOriffice"`

# Only needed icmp codes in icmp chain

- add chain=icmp protocol=icmp icmp-options=0:0 action=accept comment="drop invalid connections"
- add chain=icmp protocol=icmp icmp-options=3:0 action=accept comment="allow established connections"
- add chain=icmp protocol=icmp icmp-options=3:1 action=accept comment="allow already established connections"
- add chain=icmp protocol=icmp icmp-options=4:0 action=accept comment="allow source quench"
- add chain=icmp protocol=icmp icmp-options=8:0 action=accept comment="allow echo request"
- add chain=icmp protocol=icmp icmp-options=11:0 action=accept comment="allow time exceed"
- add chain=icmp protocol=icmp icmp-options=12:0 action=accept comment="allow parameter bad"
- add chain=icmp action=drop comment="deny all other types"

# Deny Some TCP Ports

- `add chain=tcp protocol=tcp dst-port=69 action=drop comment="deny TFTP"`
- `add chain=tcp protocol=tcp dst-port=111 action=drop comment="deny RPC portmapper"`
- `add chain=tcp protocol=tcp dst-port=135 action=drop comment="deny RPC portmapper"`
- `add chain=tcp protocol=tcp dst-port=137-139 action=drop comment="deny NBT"`
- `add chain=tcp protocol=tcp dst-port=445 action=drop comment="deny cifs"`
- `add chain=tcp protocol=tcp dst-port=2049 action=drop comment="deny NFS"`
- `add chain=tcp protocol=tcp dst-port=12345-12346 action=drop comment="deny NetBus"`
- `add chain=tcp protocol=tcp dst-port=20034 action=drop comment="deny NetBus"`
- `add chain=tcp protocol=tcp dst-port=3133 action=drop comment="deny BackOriffice"`
- `add chain=tcp protocol=tcp dst-port=67-68 action=drop comment="deny DHCP"`

# Virus and Worms (1)

- Worm tcp dst-port=135-139
- Messenger Worm udp dst-port=135-139
- Blaster Worm tcp dst-port=445
- Blaster Worm udp dst-port=445
- Virus tcp dst-port=593
- Virus tcp dst-port=1024-1030
- MyDoom tcp dst-port=1080
- Virus tcp dst-port=1214
- ndm requester tcp dst-port=1363
- ndm server tcp dst-port=1364
- screen cast tcp dst-port=1368
- hromgrafx tcp dst-port=1373
- cichlid tcp dst-port=1377
- Worm tcp dst-port=1433-1434
- Bagle Virus tcp dst-port=2745

# Virus and Worms (2)

- Dumaru.Y tcp dst-port=2283
- Beagle tcp dst-port=2535
- Beagle.C-K tcp dst-port=2745
- MyDoom tcp dst-port=3127-3128
- Backdoor OptixPro tcp dst-port=3410
- Worm tcp dst-port=4444
- Worm udp dst-port=4444
- Sasser tcp dst-port=5554
- Beagle.B tcp dst-port=8866
- Dabber.A-B tcp dst-port=9898
- Dumaru.Y tcp dst-port=10000
- MyDoom.B tcp dst-port=10080
- NetBus tcp dst-port=12345
- Kuang2 tcp dst-port=17300
- SubSeven tcp dst-port=27374
- PhatBot, Gaobot tcp dst-port=65506

# Terima Kasih