

Having Fun with

IPv6

On *MikroTik* RouterOS Today

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MikroTik MUM Presenter (Indonesia, Cambodia, Laos, Malaysia)

Kenapa saya pilih topik ini?

The screenshot shows a web browser window with the URL <https://mum.mikrotik.com/archive?search=ipv6&page=4>. The browser's address bar includes navigation icons (back, forward, refresh), search, star, and various extension icons. The website header features the 'mum' logo on the left and 'Home' and 'Photo gallery' links on the right. The main content area has a dark background with the text 'PRESENTATION SEARCH' in white. Below this is a search bar with the text 'Search for a presentation' and a search button labeled 'Search'. The search input field contains the text 'ipv6'. A red box highlights the search results: '74 presentations found - "ipv6"'. The background image of the website shows a crowd of people.

<https://indonetworkers.com/training/>



A banner for Indonetworkers.com. It features the company logo (a stylized figure with four red and blue dots) and the text "Indonetworkers.com" in green and red. Below the logo is the tagline "Your IT Training Partner To Improve Your Skill" in a red box. To the right is the "CIT" logo. Below the logo and tagline is the text "CARANO INTEGRASI TEKNOLOGI" in bold black letters. At the bottom of the banner is the address "JL. S. PARMAN NO. 189 B PADANG HP. 0811 6619 189".

A close-up of the Indonetworkers.com logo and name on a wall. The logo is a stylized figure with four red and blue dots. The text "Indonetworkers.com" is written in a green and red font.

A close-up of the Indonetworkers.com logo and name on a wall. The logo is a stylized figure with four red and blue dots. The text "Indonetworkers.com" is written in a green and red font.






Hotspot Class in Kuala Lumpur with  on January, 2019



MTCIPv6E Class in Batam Island, Indonesia at 2017



What is an IP
address?

determined by
telecommunications service providers
And Unique Number

+60173916319

International Telecommunication Union (ITU)



INTERNET



Network-ID

Host-ID




103.227.141.254 /24

IP Address

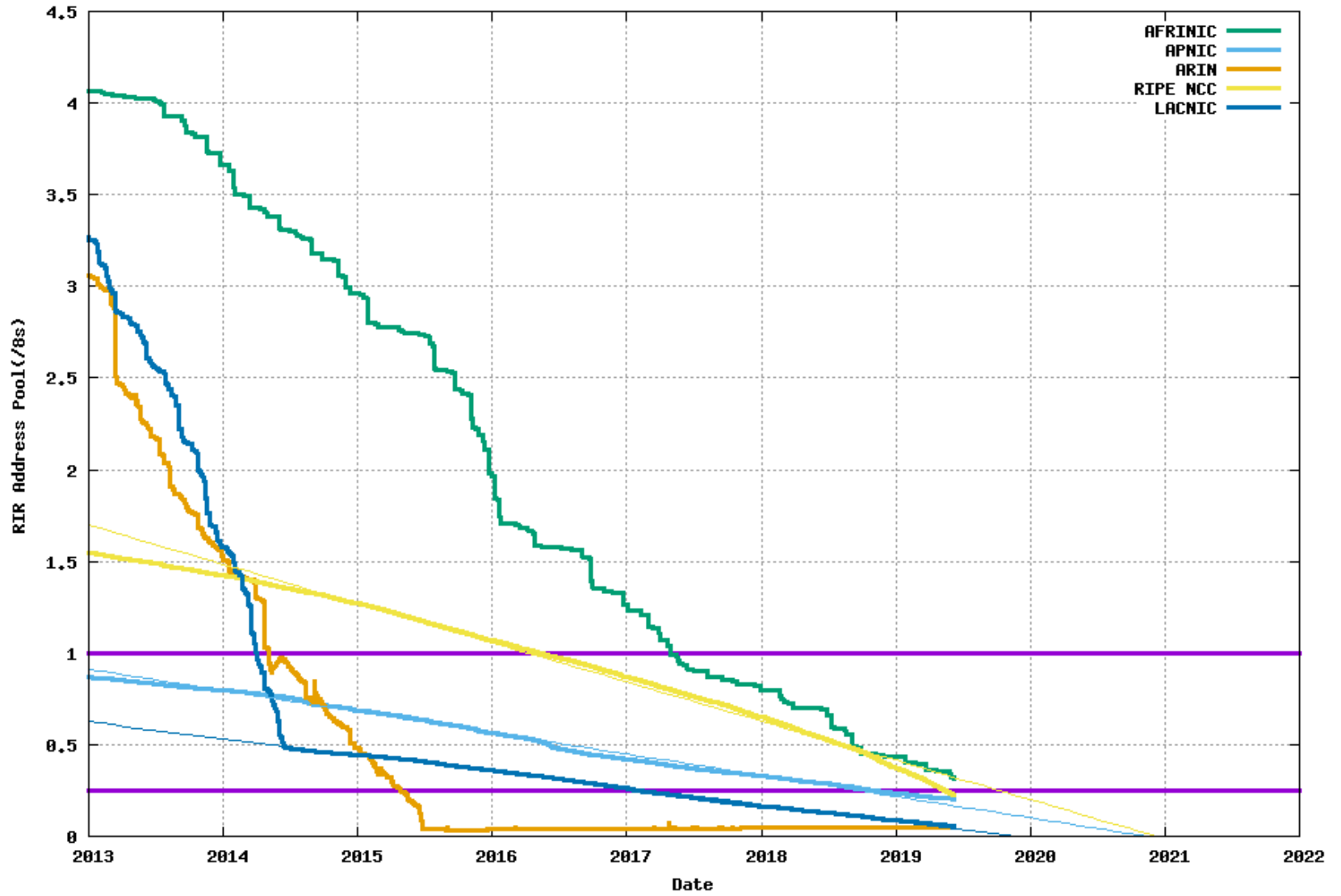


What is the
problem?



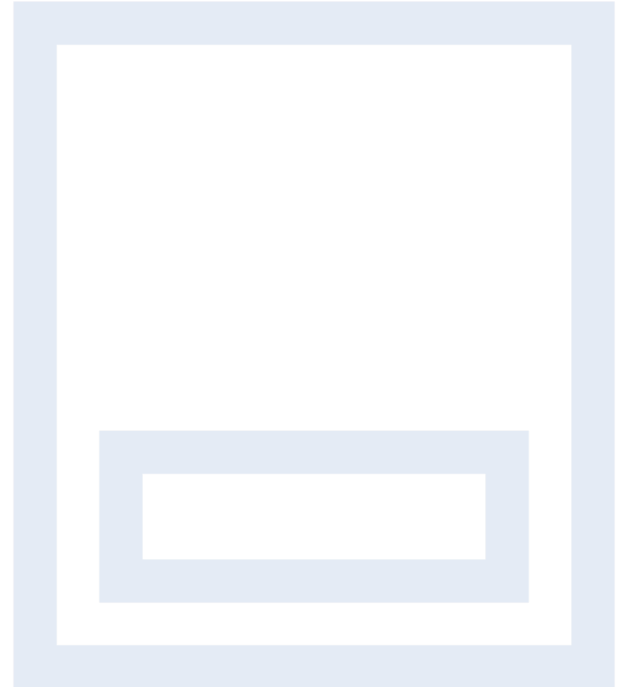
IPv4 exhaustion

RIR IPv4 Address Run-Down Model

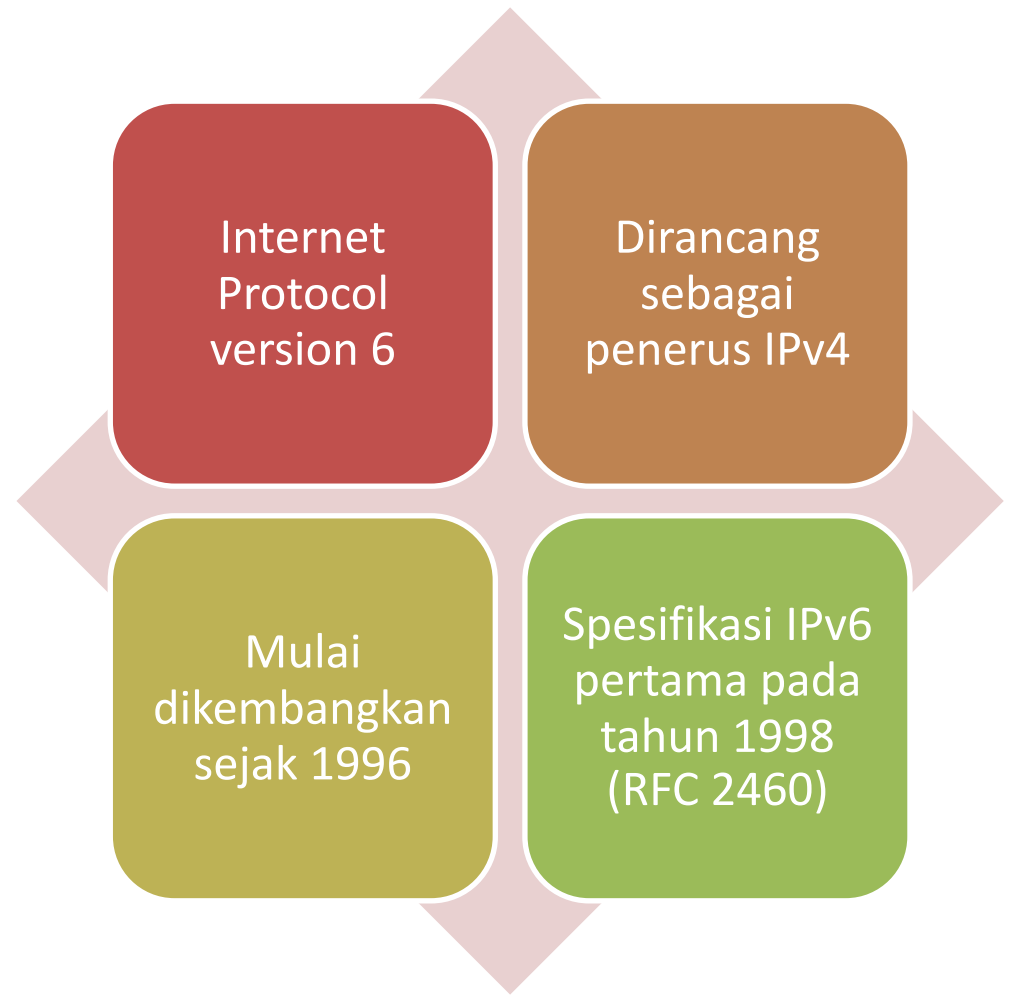




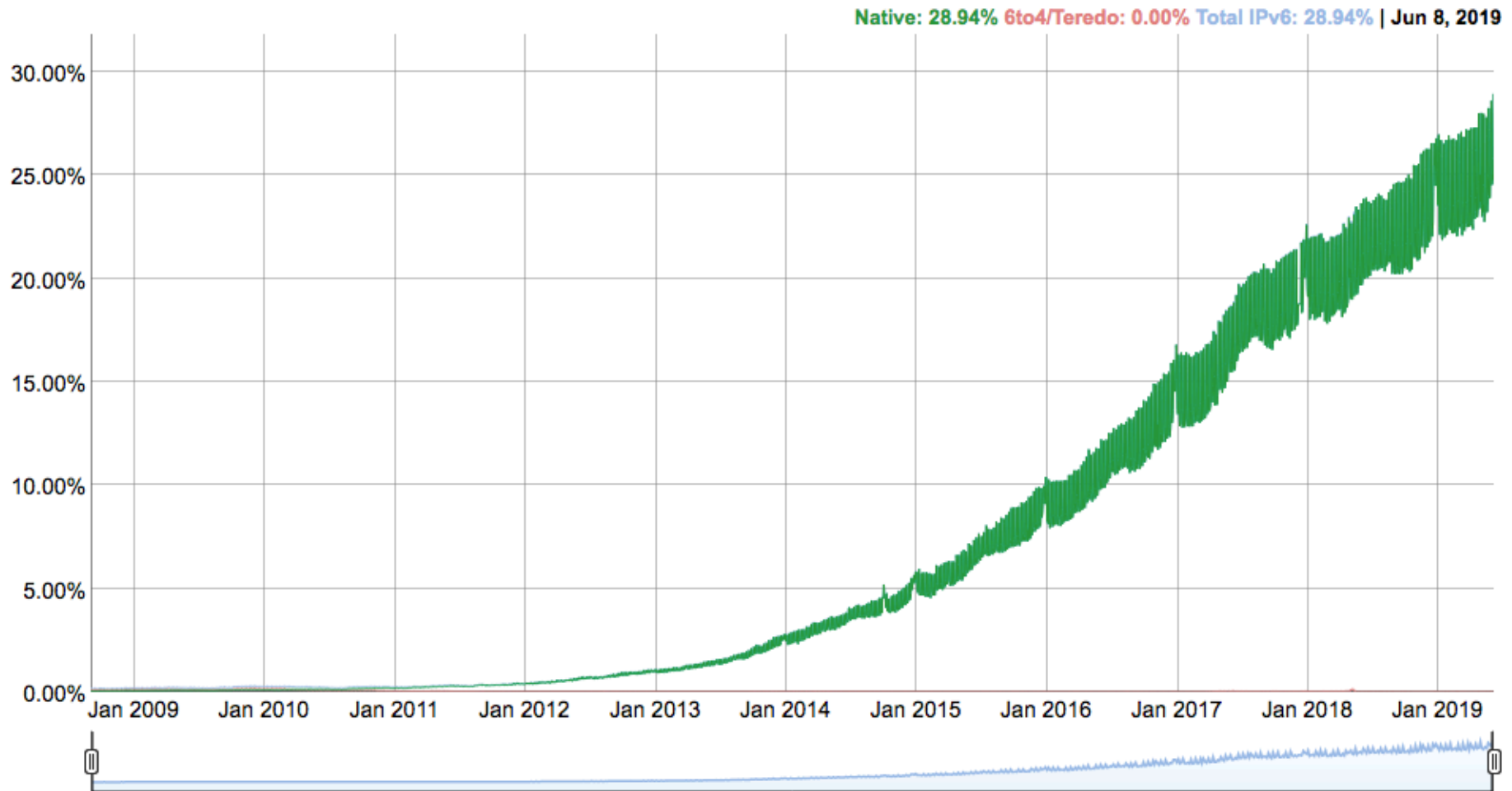
What is the
solution?



IPv6



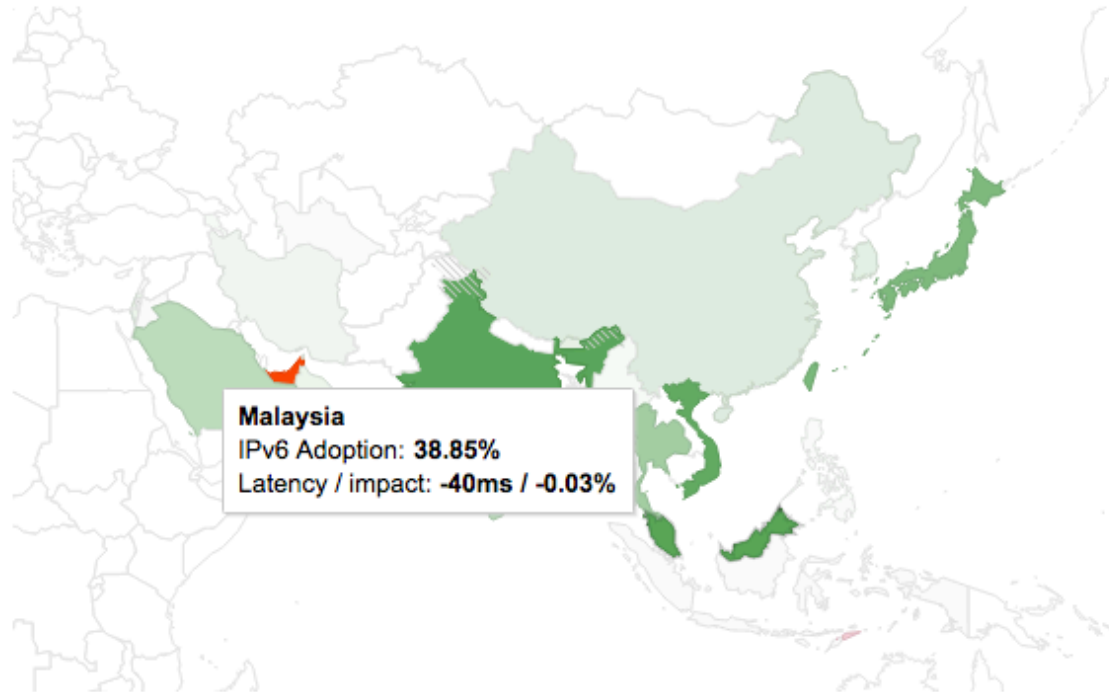
Adopsi IPv6



<https://www.google.com/intl/en/ipv6/statistics.html#tab=ipv6-adoption&tab=ipv6-adoption>

Adopsi IPv6

Per-Country IPv6 adoption



<https://www.google.com/intl/en/ipv6/statistics.html#tab=per-country-ipv6-adoption&tab=ipv6-adoption>

Perbandingan IPv4 & IPv6

| | IPv4 | IPv6 |
|--------------------|-----------|----------------------|
| Address space | 32 bits | 128 bits |
| Possible addresses | 2^{32} | 2^{128} |
| Address format | 192.0.2.1 | 2001:db8:3:4:5:6:7:8 |
| Header length | 20bytes | 40bytes |
| Header fields | 14 | 8 |
| IPsec | optional | SHOULD* |

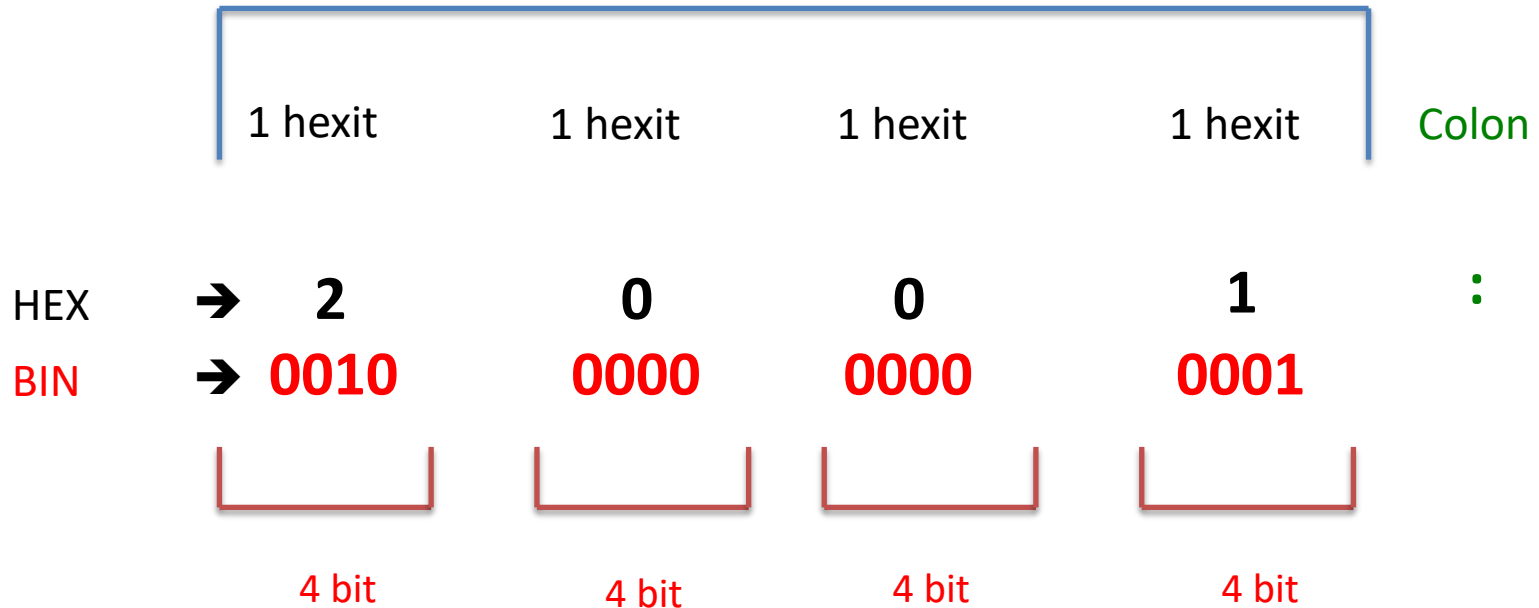
Notasi Alamat

- IPv6 di tulis dalam bentuk **hexadecimal** (0,1,2,3,4,5,6,7,8,9,A,B,C,D,E,F)
- IPv6 di bagi menjadi delapan segmen, tiap segmen disebut dengan **Hextet**
- Tiap hextet terdiri dari 4 hexadecimal digit (hexit). Sehingga dalam satu alamat ipv6 address terdapat 32 Hexit.
- Tiap hexit sama dengan 4 bit (1 Nibble), sehingga tiap hextet berukuran 16 bit, jadi totalnya sama dengan 128 bit.
- Tiap hextet dipisahkan oleh tanda titik dua (colon) :
- Total alamat yang disediakan IPv6 adalah 340.282.366.920.938.463.463.374.607.431.768.211.455 di hitung dari 2^{128}

Contoh Alamat IPv6

2001:0DB8:00A0:0000:0000:BABE:0000:CDF0

HEXTET



Notasi Alamat

| Field (16 bits) | Hexadecimal | Binary |
|--------------------|-------------|---------------------|
| 1 | 2001 | 0010 0000 0000 0001 |
| 2 | 0db8 | 0000 1101 1011 1000 |
| 3 | 0be0 | 0000 1011 1110 0000 |
| 4 | 75a1 | 0111 0101 1010 0001 |
| 5 | 0000 | 0000 0000 0000 0000 |
| 6 | 0000 | 0000 0000 0000 0000 |
| 7 | 0000 | 0000 0000 0000 0000 |
| 8 | 0001 | 0000 0000 0000 0001 |

2001:0db8:0be0:75a1:0000:0000:0000:0001

Notasi Alamat

2001:0db8:0be0:75a2:0000:0000:0000:0000 |

Angka nol yang didepan bisa dihilangkan
4 hexit nol dalam suatu hextet boleh diganti dengan sebuah hexit nol

2001:db8:be0:75a2:0:0:0: |

Beberapa hextet nol boleh diganti dengan sebuah double colon (::)

2001:db8:be0:75a2:: |

Notasi Alamat

2001:0db8:0000:0000:0000:0000:0000:0000

Jika terdapat beberapa hextet bernilai nol maka hanya 1 yang bisa diganti dengan ::

2001:db8::10:0:0:1

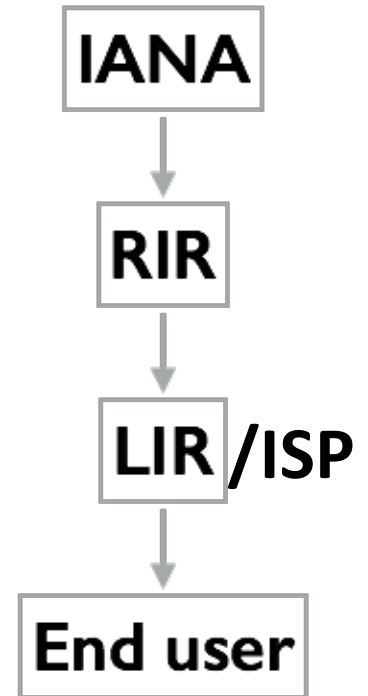
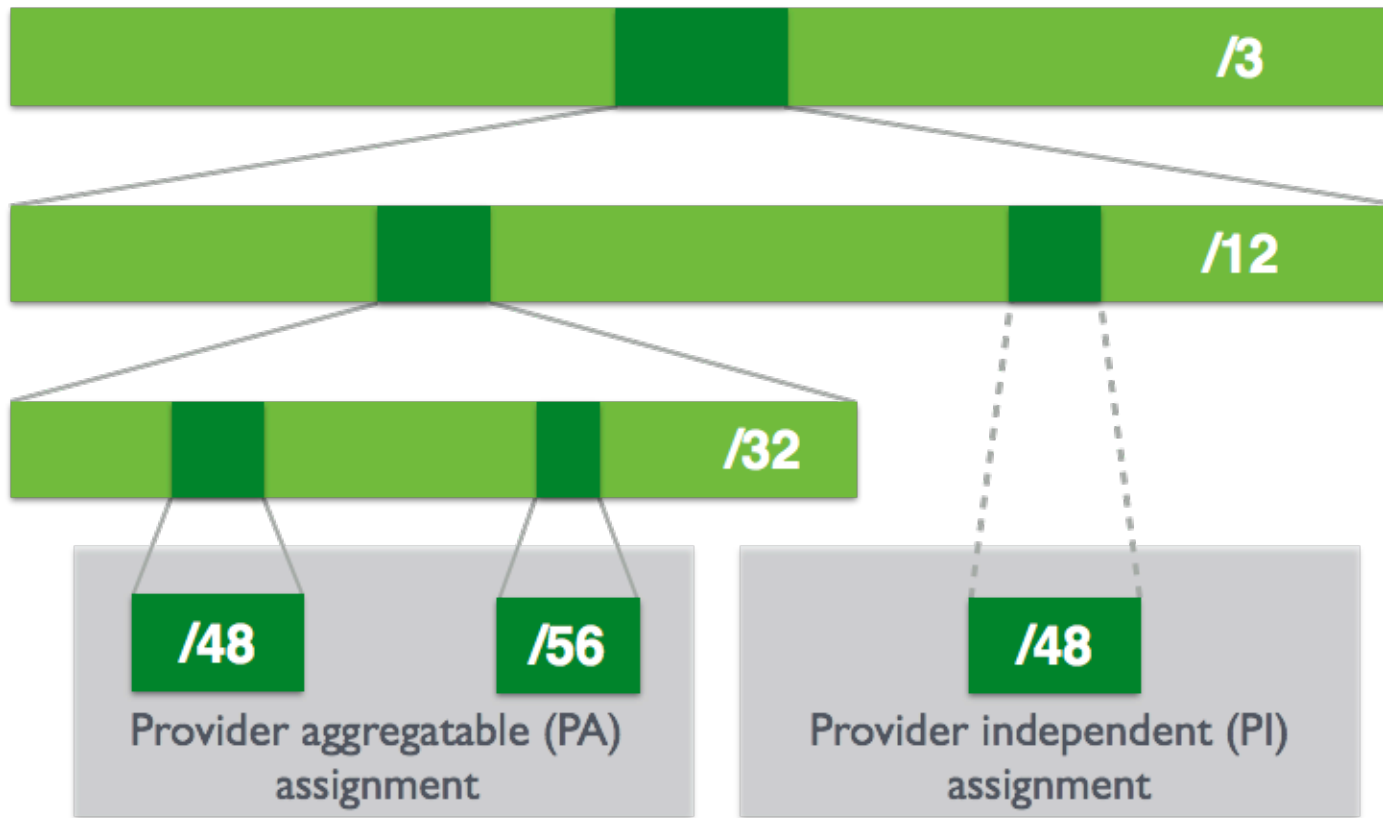
Kita bisa memilih salah satu

2001:db8:0:0:10::1

IP address yang sama dan keduanya valid namun yang rekomendasi adalah yang pertama

Untuk info lebih lanjut “A Recommendation for IPv6 Address Text Representation (RFC5952)”

Pendistribusian Alamat



Global Unicast Address



Type Alamat

| Type | Range |
|----------------|-----------|
| Link Local | Fe80::/10 |
| Global Unicast | 2000::/3 |
| Multicast | Ff00::/8 |
| Unique local | Fc00::/7 |

Global Unicast Address

- Sama dengan Public IPv4 Address yang *unik* secara global.
- Dapat dirutekan ke Internet.
- Dapat di konfigurasi secara statis ataupun dinamis.
- Global Unicast Address dialokasikan oleh The Internet Committee for Assigned Name and Number (ICANN). ICANN merupakan operator dari IANA (Internet Assigned Number Authority) yang bertugas mengalokasikan blok-blok IPv6 Address ke seluruh RIR (Regional Internet Registry) yang ada di dunia.

Prefix 2000::/3

Global Unicast Address

5 RIR (Regional Internet Registry) mendapatkan prefix /12 dari /3 dengan masing-masing Regional mendapatkan network prefix sebagai berikut :

1. APNIC (2400:0000::/12)
2. ARIN (2600:0000::/12)
3. AfriNIC (2c00:0000::/12)
4. LacNIC (2800:0000::/12)
5. RipeNIC (2A00:0000::/12)

Link Local Address

- Link Local Address digunakan untuk komunikasi dengan perangkat lainnya yang berada di link local (subnet) yang sama dan hanya pada link tersebut saja
- Setiap host yang diberikan alamat ini akan berada dalam link atau network yang sama
- Link Local Address tidak bisa komunikasi dengan network lainnya (router tidak akan meneruskannya) Berarti tidak bisa dirutekan ke komunikasi publik (Internet).
- Alamat yang diberikan harus *unik* hanya pada link atau network tersebut saja.

Prefix FE80::/10

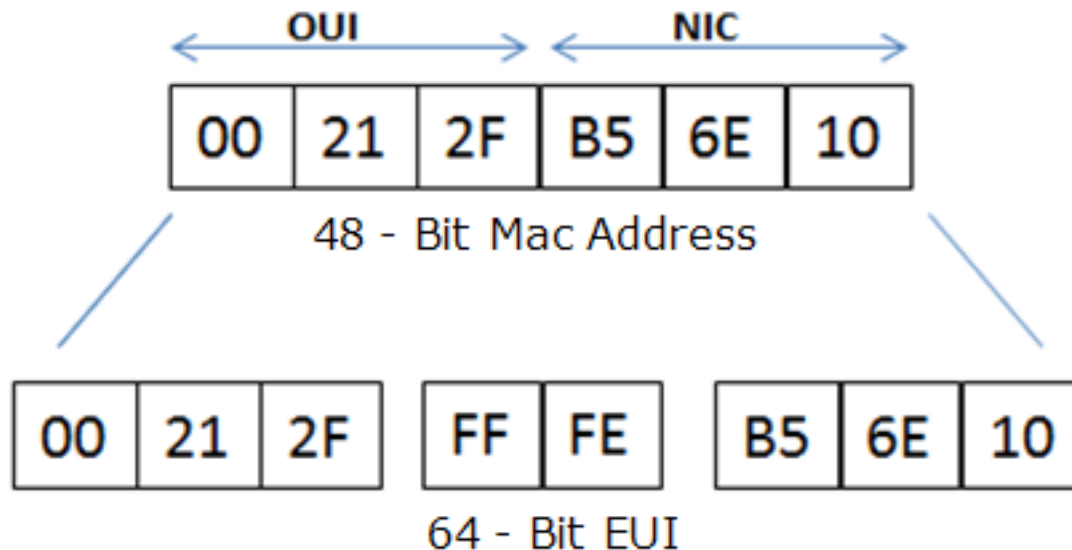
Multicast Address

- Digunakan untuk pengiriman sebuah packet dari satu host ke suatu grup atau kumpulan beberapa host baik di dalam network yang sama, maupun di dalam network yang berbeda.
- IPv6 Multicast Address Hanya dapat digunakan sebagai Destination IPv6 Address.

Prefix FF00::/8

EUI-64

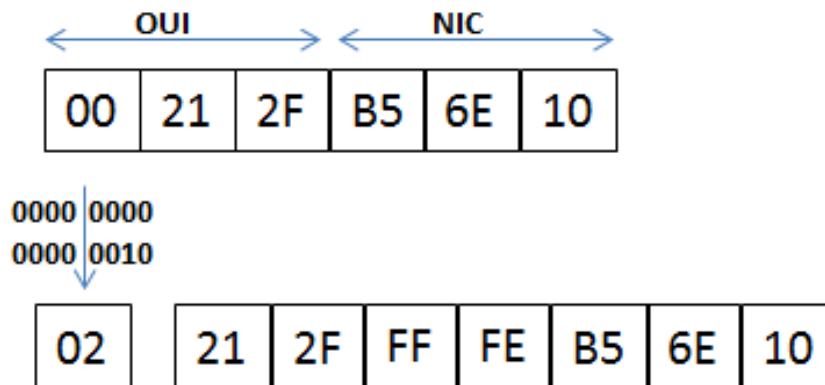
- 64-bit extended unique identifier (EUI)
- Berasal dari 48-bit MAC Address



OUI (Organizationally Unique Identifier) dan yang lain spesifik NIC.

Modifikasi EUI-64

- Digunakan pada Stateless address autoconfiguration (SLAAC)
- Bit ke 7 dari kiri atau bit universal /local (U/L)
- Bit ini mengidentifikasi apakah pengenal interface ini dikelola secara universal atau lokal jika 0 maka alamat dikelola secara lokal,
- jika 1 maka adalah alamat unik global



00 (L) → 02 (U)

Modifikasi EUI-64

Prefix Ipv6

2001:db8:be0:75a2::/64

Dan modifikasi EUI-64 dari Mac Address

02:21:2f:ff:fe:b5:6e:10

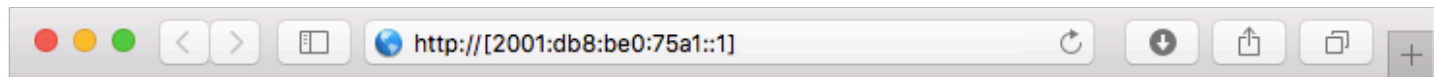
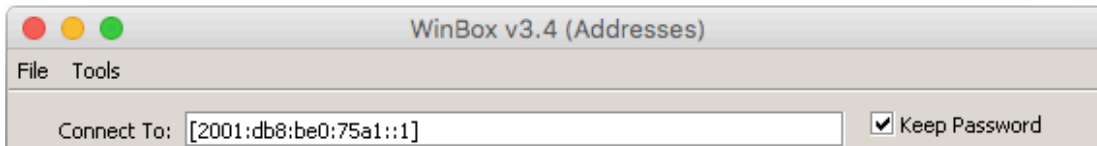
Hasil dari Alamat IPv6 nya

2001:db8:be0:75a2:0221:2fff:feb5:6e10

Special Address

| Type | Range |
|---------------------|------------------------|
| Loopback | ::1/128 |
| Documentation | 2001:db8::/32 |
| 6to4 | 2002::/16 |
| Unspecified Address | ::/128 |
| Teredo | 2001::/32 |
| Anycast | 2001:db8:db1b:1e3::/64 |

Connecting ke Host IPv6 Global



```
scp supout.rif admin@[2001:db8:be0:75a1::1]:
```

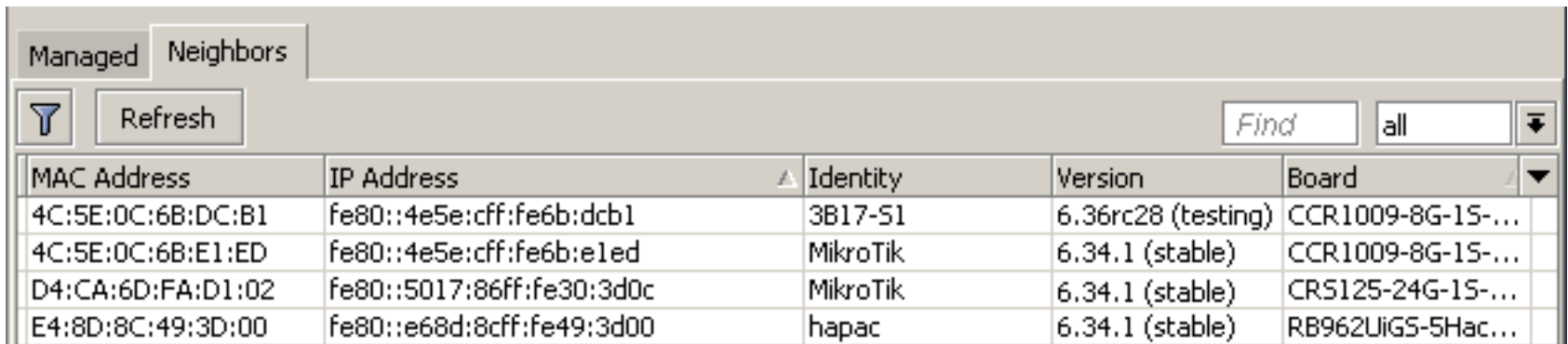
```
[admin@MikroTik] > /ping 2001:db8:be0:75a1::1
```

```
ping6 2001:db8:be0:75a1::1
```

Berdasarkan konteks IPv6 address bisa ditulis dengan atau tanpa kurung siku.

IPv6 Connectivity

- Link-local address bisa digunakan untuk connect ketika perangkat belum memiliki Global Route Ipv6 Address
- Alternatif ke Mac Winbox



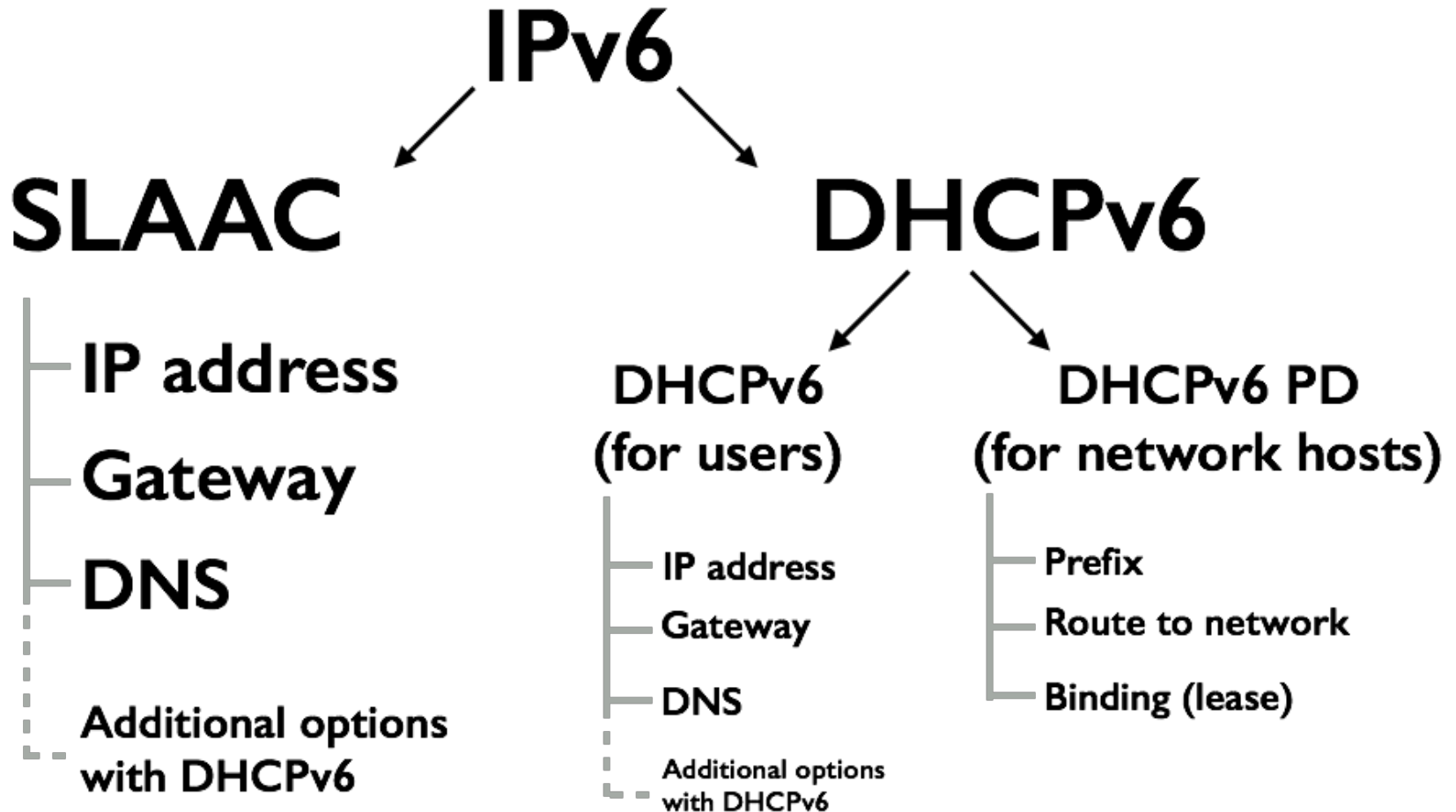
The screenshot shows the WinBox interface with the 'Neighbors' tab selected. It features a filter icon, a 'Refresh' button, and a search field containing 'Find' and 'all'. Below these controls is a table with the following data:

| MAC Address | IP Address | Identity | Version | Board |
|-------------------|---------------------------|----------|--------------------|-------------------|
| 4C:5E:0C:6B:DC:B1 | fe80::4e5e:cff:fe6b:dcb1 | 3B17-S1 | 6.36rc28 (testing) | CCR1009-8G-15-... |
| 4C:5E:0C:6B:E1:ED | fe80::4e5e:cff:fe6b:e1ed | MikroTik | 6.34.1 (stable) | CCR1009-8G-15-... |
| D4:CA:6D:FA:D1:02 | fe80::5017:86ff:fe30:3d0c | MikroTik | 6.34.1 (stable) | CRS125-24G-15-... |
| E4:8D:8C:49:3D:00 | fe80::e68d:8cff:fe49:3d00 | hapac | 6.34.1 (stable) | RB962UiGS-5Hac... |

WinBox → Neighbors

Konfigurasi Address

- Auto Configuration dari link local address
- Stateless
 - Stateless address autoconfiguration (SLAAC)
 - Additional options dengan DHCPv6
- Stateful
 - DHCPv6
- Static



SLAAC

- Stateless address autoconfiguration
- Menggunakan pesan router Solicitation dan Pesan Router Advertisement.
- Meminta router
- Menerima alamat router dan Konfigurasi IP

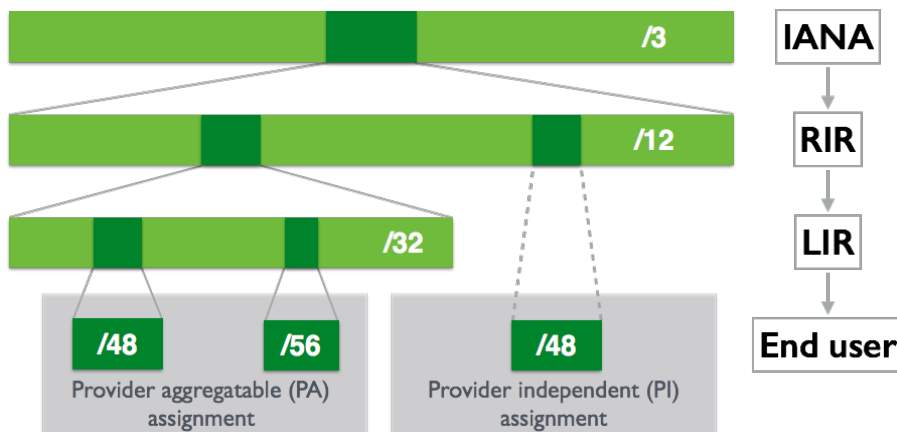
Konstruksi alamat SLAAC

| Routing prefix | Subnet | Interface identifier |
|-----------------------|------------------|-----------------------------|
| 0-64 bits | 0-64 bits | 64 bits |

- Routing prefix + subnet identifier = 64 bits
- /64 adalah prefix terkecil yang bisa di berikan ke pelanggan
- Umumnya seorang pelanggan diberikan /48 - /64 subnet

IPv6 Relative Network Sizes

| | | |
|------|-------------------|---|
| /128 | 1 IPv6 address | A network interface |
| /64 | 1 IPv6 subnet | 18,446,744,073,709,551,616 IPv6 addresses |
| /56 | 256 /64 prefix | Popular prefix size for one subscriber site |
| /48 | 65,536 /64 Prefix | Popular prefix size for one subscriber site |
| /32 | 65,536 /48 prefix | Minimum IPv6 allocation |



Neighbor Discovery Protocol (NDP)

- Mengantikan ARP pada IPv4
- Track dan discover IPv6 Host lainnya.
- Auto-Configures Address
- Menggunakan Protocol ICMPv6

Neighbor Discovery Protocol (NDP)

5 Tipe Pesan NDP :

Router Solicitation (ICMPv6 Tipe 133)



Router Advertisement (ICMPv6 Tipe 134)



Neighbor Solicitation (ICMPv6 Tipe 135)

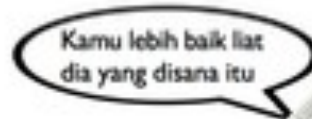


Neighbor Discovery Protocol (NDP)

Neighbor Advertisement (ICMPv6 Tipe 136)



Redirect (ICMPv6 Tipe 137)



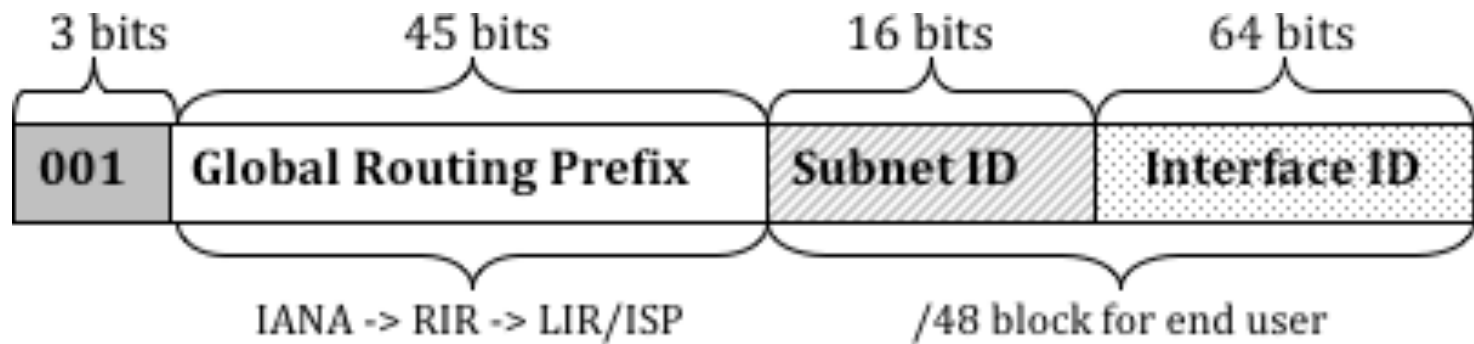


Apa itu
Subnetting ?

Subnetting

- **Subnetting** adalah teknik memecah suatu jaringan besar menjadi jaringan yang lebih kecil dengan cara mengorbankan bit Host ID pada **subnet** mask untuk dijadikan Network ID baru.
- **Subnetting** merupakan teknik memecah network menjadi beberapa subnetwork yang lebih kecil.

IPv6 Address Format



Subnetting

| | | |
|--|------------|-------------|
| 2001:0db8:0be0:75a2:0000:0000:0000:0001 | | |
| Routing prefix: 48 bits | Subnet: 16 | 65536 x /64 |
| 2001:0db8:0be0:75a2:0000:0000:0000:0001 | | |
| Routing prefix: 52 bits | 12 | 4096 x /64 |
| 2001:0db8:0be0:75a2:0000:0000:0000:0001 | | |
| Routing prefix: 56 bits | 8 | 256 x /64 |
| 2001:0db8:0be0:75a2:0000:0000:0000:0001 | | |
| Routing prefix: 60 bits | 4 | 16 x /64 |

IPv6 Subnetting

2001:0db8:0be0:0000::

Routing prefix: 48 bits

12

...

2001:0db8:0be0:FFF0::

Routing prefix: 48 bits

12

You can assign 4096x 60 bit prefixes

2001:0db8:0be0:0000::

Customer routing prefix: 60 bits

4

...

2001:0db8:0be0:000F::

Customer routing prefix: 60 bits

4

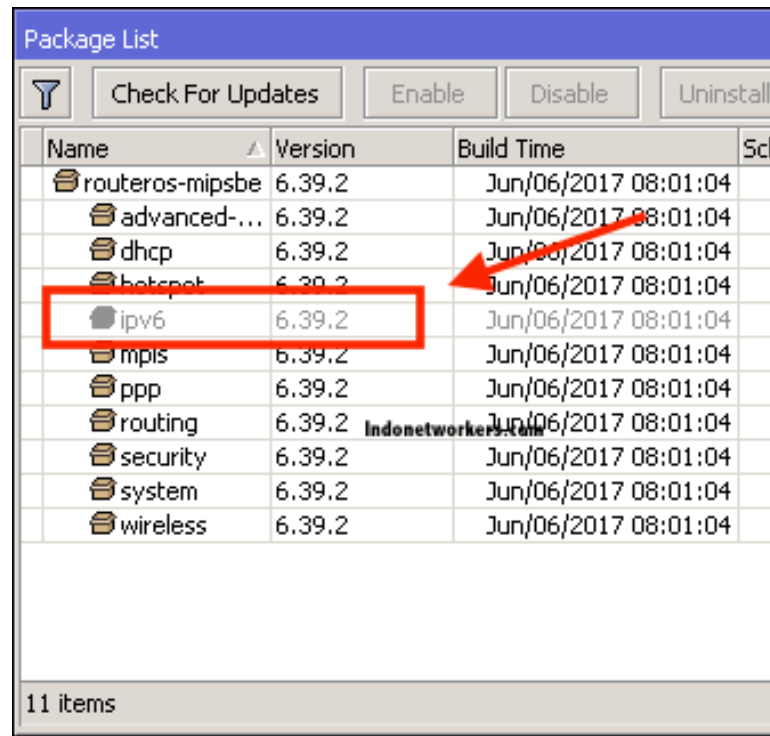
Customer can assign 16x 64 bit prefixes

IPv6 Subnetting

- Kita sebagai ISP diberikan /48 Block prefix
- Kita berencana memberikan /60 kepada pelanggan kita
- $60 - 48 = 12$ maka $2^{12} = 4096$ buah /60 subnets
- Sedangkan di pelanggan $64 - 60 = 4$ maka $2^4 = 16$ x /64 prefix untuk device mereka.

IPv6 on Mikrotik RouterOS

- Package IPv6 by default nya belum Aktif seperti berikut:



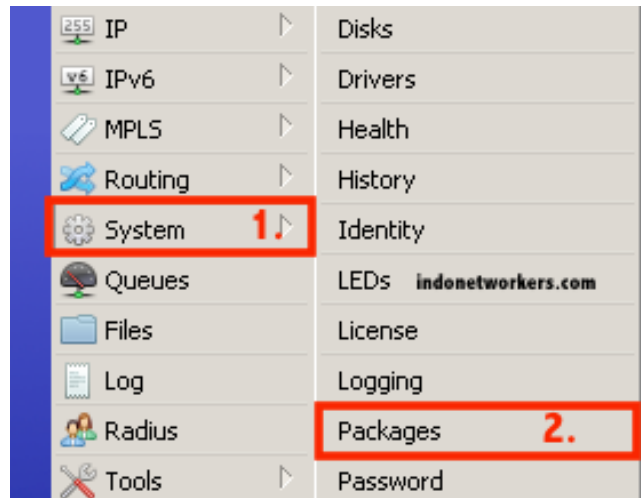
The screenshot shows the 'Package List' window in Mikrotik RouterOS. The window has a blue header and contains a table of installed packages. The 'ipv6' package is highlighted with a red box, and a red arrow points to its status icon, which is a grey circle with a diagonal line through it, indicating it is disabled. Other packages like 'routeros-mipsbe', 'advanced-...', 'dhcp', 'hotspot', 'mpis', 'ppp', 'routing', 'security', 'system', and 'wireless' are all shown with active status icons (brown folder icons).

| Name | Version | Build Time | Sch |
|-----------------|---------|----------------------|-----|
| routeros-mipsbe | 6.39.2 | Jun/06/2017 08:01:04 | |
| advanced-... | 6.39.2 | Jun/06/2017 08:01:04 | |
| dhcp | 6.39.2 | Jun/06/2017 08:01:04 | |
| hotspot | 6.39.2 | Jun/06/2017 08:01:04 | |
| ipv6 | 6.39.2 | Jun/06/2017 08:01:04 | |
| mpis | 6.39.2 | Jun/06/2017 08:01:04 | |
| ppp | 6.39.2 | Jun/06/2017 08:01:04 | |
| routing | 6.39.2 | Jun/06/2017 08:01:04 | |
| security | 6.39.2 | Jun/06/2017 08:01:04 | |
| system | 6.39.2 | Jun/06/2017 08:01:04 | |
| wireless | 6.39.2 | Jun/06/2017 08:01:04 | |

11 items

IPv6 on Mikrotik RouterOS

- Silahkan Aktifkan dengan cara:
 - I. System > Packages



IPv6 on Mikrotik RouterOS

2. Klik Pada Packages ipv6 kemudian enabled , Lalu reboot router nya.

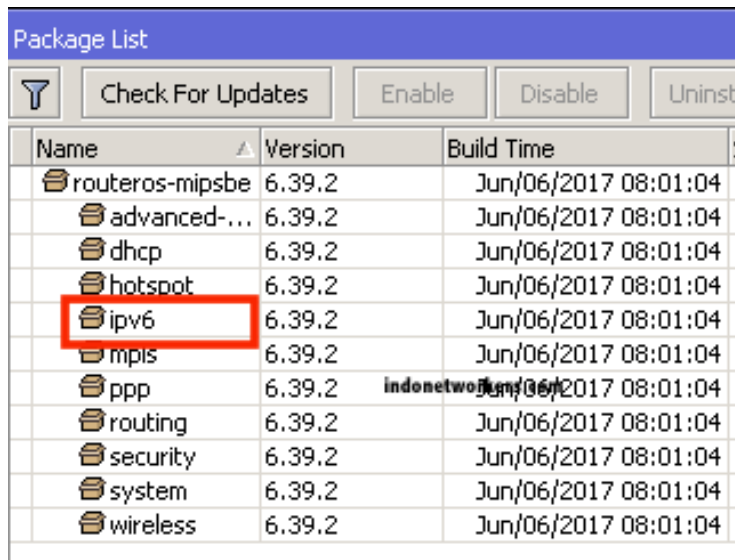
The image shows a screenshot of the Mikrotik WinBox interface. On the left, the 'Package List' window is open, displaying a table of installed packages. The 'ipv6' package is selected, and the 'Enable' button is highlighted with a red box. A red arrow points to the 'ipv6' row with the text '1. Klik sekali'. The 'Check For Updates' button is also highlighted with a red box and labeled '2.'. On the right, the 'System' menu is open, and the 'Reboot' option is highlighted with a red box and labeled '2.'. Below the System menu, a 'Reboot' dialog box is displayed, asking 'Do you want to reboot the router?' with 'Yes' and 'No' buttons. The 'Yes' button is highlighted with a red box.

| Name | Version | Build Time | Sche |
|-----------------|---------|----------------------|------|
| routeros-mipsbe | 6.39.2 | Jun/06/2017 08:01:04 | |
| advanced-... | 6.39.2 | Jun/06/2017 08:01:04 | |
| dhcp | 6.39.2 | Jun/06/2017 08:01:04 | |
| hotspot | 6.39.2 | Jun/06/2017 08:01:04 | |
| ipv6 | 6.39.2 | Jun/06/2017 08:01:04 | |
| mpls | 6.39.2 | Jun/06/2017 08:01:04 | |
| ppp | 6.39.2 | Jun/06/2017 08:01:04 | |
| routing | 6.39.2 | Jun/06/2017 08:01:04 | |
| security | 6.39.2 | Jun/06/2017 08:01:04 | |
| system | 6.39.2 | Jun/06/2017 08:01:04 | |
| wireless | 6.39.2 | Jun/06/2017 08:01:04 | |

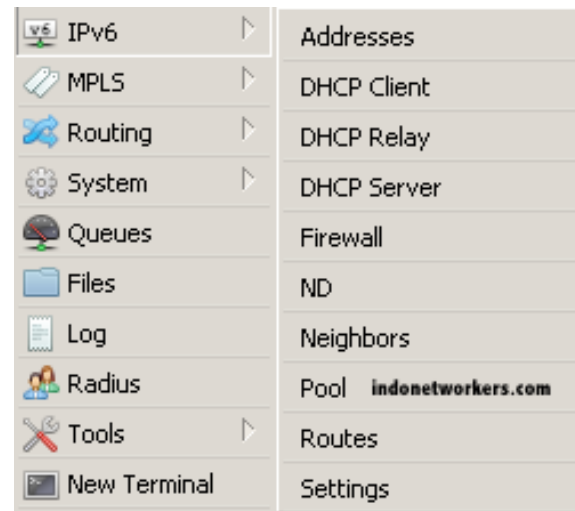
INDONETWORKERS.COM

IPv6 on Mikrotik RouterOS

3. Ketika kita check kembali di System > Packages maka packages ipv6 sudah enable, dan menu nya sudah muncul di winbox.

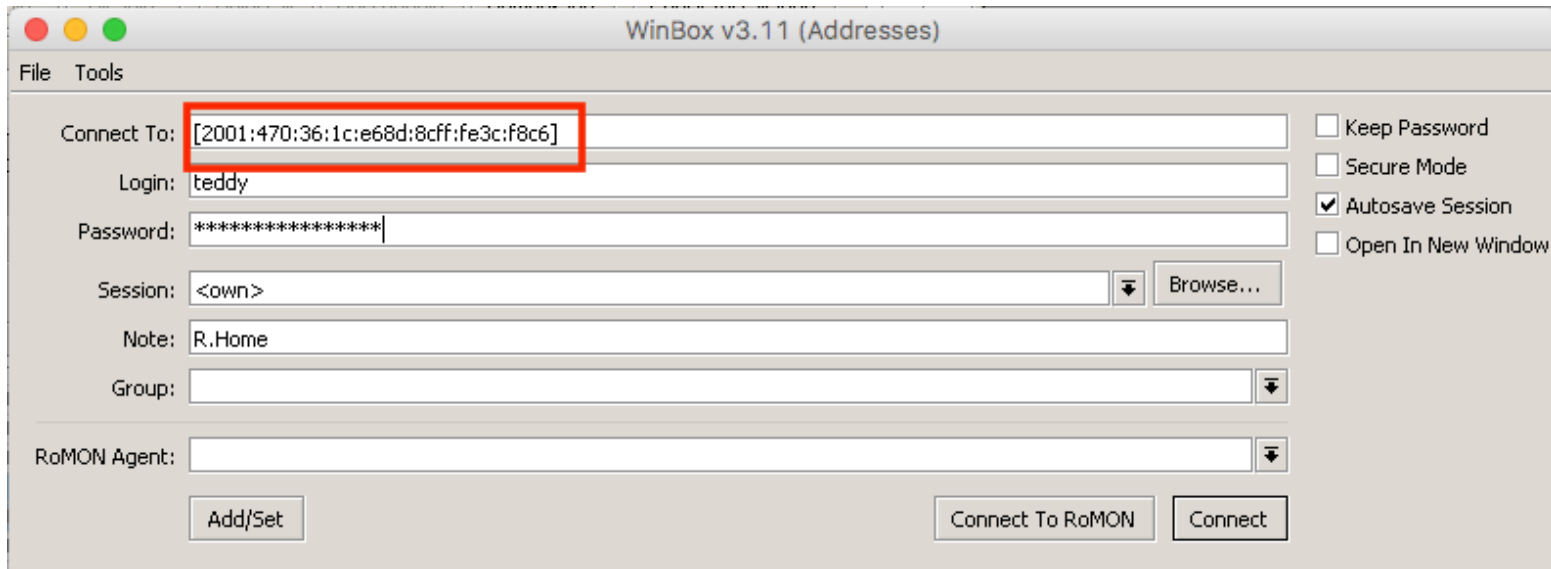


| Name | Version | Build Time |
|-----------------|---------|----------------------|
| routeros-mipsbe | 6.39.2 | Jun/06/2017 08:01:04 |
| advanced-... | 6.39.2 | Jun/06/2017 08:01:04 |
| dhcp | 6.39.2 | Jun/06/2017 08:01:04 |
| hotspot | 6.39.2 | Jun/06/2017 08:01:04 |
| ipv6 | 6.39.2 | Jun/06/2017 08:01:04 |
| mpis | 6.39.2 | Jun/06/2017 08:01:04 |
| ppp | 6.39.2 | Jun/06/2017 08:01:04 |
| routing | 6.39.2 | Jun/06/2017 08:01:04 |
| security | 6.39.2 | Jun/06/2017 08:01:04 |
| system | 6.39.2 | Jun/06/2017 08:01:04 |
| wireless | 6.39.2 | Jun/06/2017 08:01:04 |



IPv6 on Mikrotik RouterOS

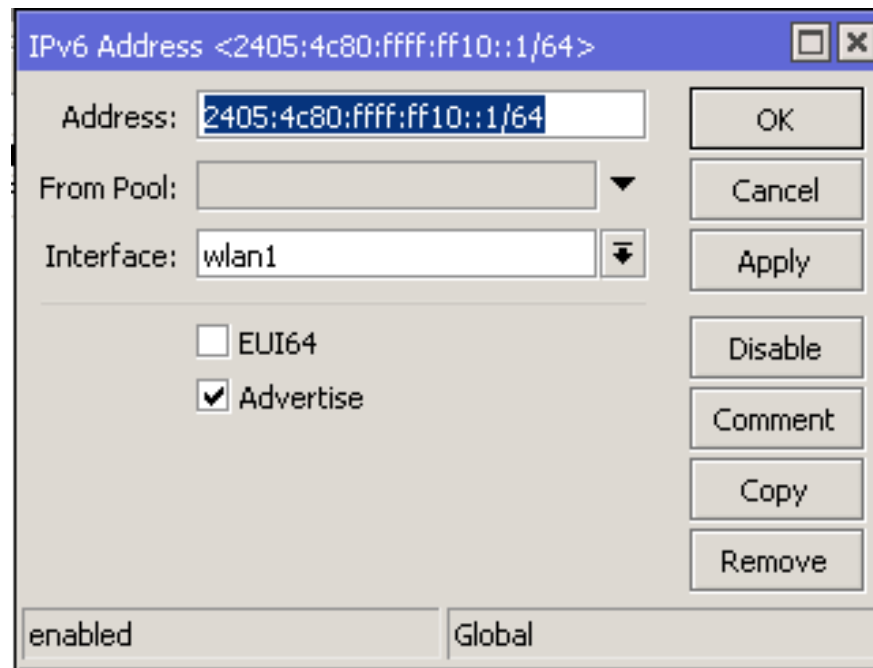
Mengakses Router Mikrotik dengan IPv6 via Winbox dengan format menggunakan tanda [] seperti berikut :



The screenshot shows the WinBox v3.11 (Addresses) window. The 'Connect To:' field is highlighted with a red box and contains the IPv6 address [2001:470:36:1c:e68d:8cff:fe3c:f8c6]. Other fields include Login: teddy, Password: [redacted], Session: <own>, Note: R.Home, Group: [empty], and RoMON Agent: [empty]. There are checkboxes for Keep Password, Secure Mode, Autosave Session, and Open In New Window. Buttons for Add/Set, Connect To RoMON, and Connect are visible at the bottom.

IPv6 on Mikrotik RouterOS

Konfigurasi IP address IPv6 pada IPV6 > Addresses



The screenshot shows the 'IPv6 Address' configuration window in Mikrotik RouterOS. The title bar reads 'IPv6 Address <2405:4c80:ffff:ff10::1/64>'. The main area contains the following fields and options:

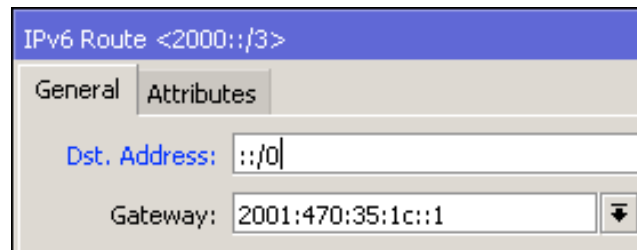
- Address:** 2405:4c80:ffff:ff10::1/64
- From Pool:** (empty dropdown menu)
- Interface:** wlan1
- EUI64
- Advertise

On the right side, there are several buttons: OK, Cancel, Apply, Disable, Comment, Copy, and Remove. At the bottom, there are two status indicators: 'enabled' and 'Global'.

IPv6 on Mikrotik RouterOS

Konfigurasi Gateway IPv6 pada IPV6 > Routes

Destination Address bisa ::/0



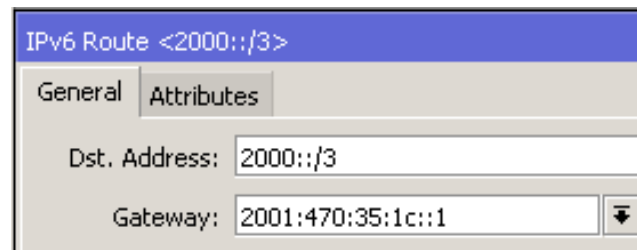
IPv6 Route <2000::/3>

General Attributes

Dst. Address:

Gateway: ▾

atau 2000::/3



IPv6 Route <2000::/3>

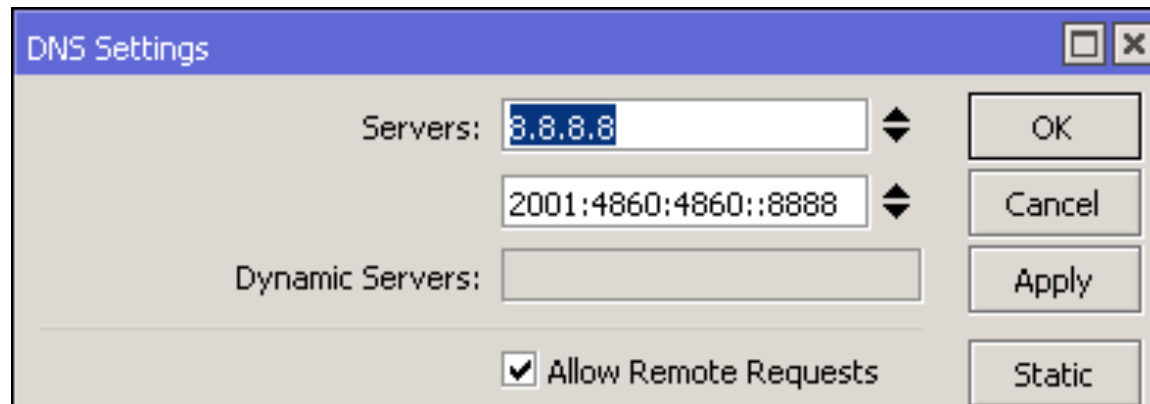
General Attributes

Dst. Address:

Gateway: ▾

IPv6 on Mikrotik RouterOS

Konfigurasi DNS IPv4 dan IPv6 tetap sama di IP > DNS



The screenshot shows the 'DNS Settings' window in Mikrotik RouterOS. The window has a blue title bar with the text 'DNS Settings' and standard window control buttons (minimize, maximize, close). The main area is light gray and contains the following elements:

- Servers:** A list of DNS servers. The first entry is '8.8.8.8' (highlighted in blue) and the second is '2001:4860:4860::8888'. Each entry has a double-headed arrow button to its right.
- Dynamic Servers:** An empty text input field.
- Allow Remote Requests:** A checked checkbox.
- Buttons:** On the right side, there are four buttons: 'OK', 'Cancel', 'Apply', and 'Static'.

IPv6 on Mikrotik RouterOS

1. Ping

```
Terminal
[teddy@R.Home] > ping 2001:4860:4860::8888
```

| SEQ | HOST | SIZE | TTL | TIME | STATUS |
|-----|----------------------|------|-----|------|------------|
| 0 | 2001:4860:4860::8888 | 56 | 55 | 81ms | echo reply |
| 1 | 2001:4860:4860::8888 | 56 | 55 | 81ms | echo reply |
| 2 | 2001:4860:4860::8888 | 56 | 55 | 81ms | echo reply |
| 3 | 2001:4860:4860::8888 | 56 | 55 | 82ms | echo reply |
| 4 | 2001:4860:4860::8888 | 56 | 55 | 81ms | echo reply |
| 5 | 2001:4860:4860::8888 | 56 | 55 | 84ms | echo reply |
| 6 | 2001:4860:4860::8888 | 56 | 55 | 92ms | echo reply |
| 7 | 2001:4860:4860::8888 | 56 | 55 | 87ms | echo reply |

2. Ping domain

```
[teddy@R.Home] > ping [:::resolve ipv6.google.com]
```

| SEQ | HOST | SIZE | TTL | TIME | STATUS |
|-----|------------------------|------|-----|------|------------|
| 0 | 2404:6800:4003:c02::64 | 56 | 49 | 84ms | echo reply |
| 1 | 2404:6800:4003:c02::64 | 56 | 49 | 83ms | echo reply |
| 2 | 2404:6800:4003:c02::64 | 56 | 49 | 85ms | echo reply |
| 3 | 2404:6800:4003:c02::64 | 56 | 49 | 85ms | echo reply |
| 4 | 2404:6800:4003:c02::64 | 56 | 49 | 83ms | echo reply |
| 5 | 2404:6800:4003:c02::64 | 56 | 49 | 86ms | echo reply |
| 6 | 2404:6800:4003:c02::64 | 56 | 49 | 88ms | echo reply |

IPv6 on Mikrotik RouterOS

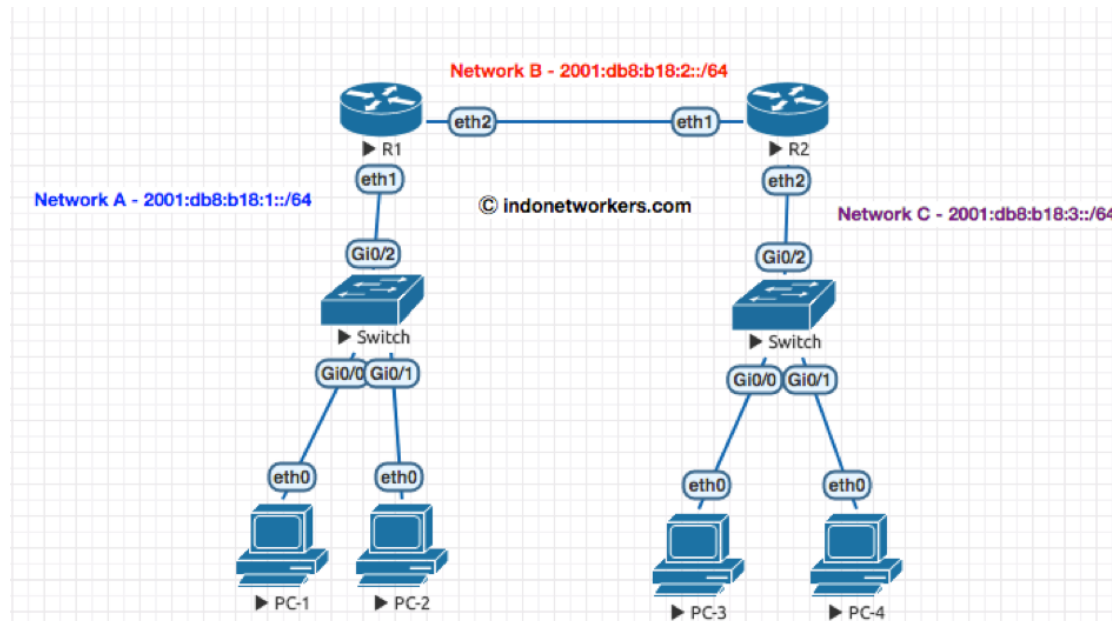
3. Traceroute

```
[teddy@R.Home] > /tool traceroute 2001:4860:4860::8888
```

| # | ADDRESS | LOSS | SENT | LAST | AVG | BEST | WORST |
|---|----------------------|------|------|--------|------|------|-------|
| 1 | 2001:470:35:1c::1 | 0% | 7 | 54.4ms | 53.5 | 49.9 | 55.6 |
| 2 | 2001:470:0:17c::1 | 0% | 7 | 61.3ms | 52.2 | 46.3 | 61.3 |
| 3 | 2001:de8:4::1:5169:1 | 0% | 7 | 46.7ms | 47.6 | 45 | 49.9 |
| 4 | 2001:4860:0:f88::1 | 0% | 6 | 86.3ms | 83.2 | 80.9 | 86.3 |
| 5 | 2001:4860:0:1::dd5 | 0% | 6 | 84.5ms | 85.3 | 84.5 | 85.7 |
| 6 | 2001:4860:4860::8888 | 0% | 6 | 84.6ms | 84 | 80.2 | 87 |

IPv6 Static Route


- LAB



- Silahkan Download Lab lengkap di : <http://s.id/IPv6>

Try Using IPv6 Global Address with Tunnelbroker.net

https://tunnelbroker.net



Tunnelbroker Login

Username:

Password:

[Login](#) [Register](#)
[Forgot Password?](#)

Hurricane Electric Free IPv6 Tunnel Broker

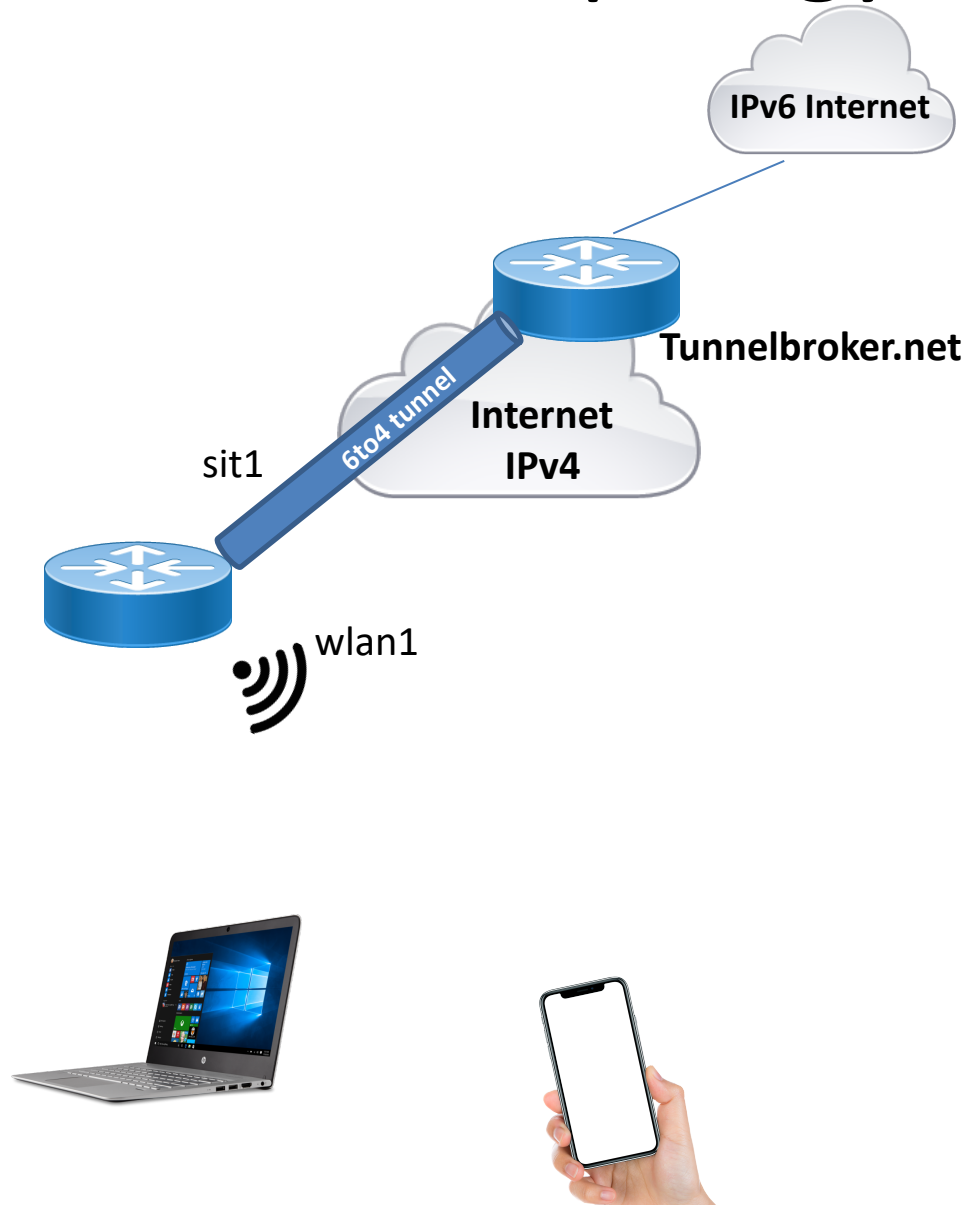
IPv6 Tunnel Broker

Check out our new [usage stats!](#)

And then hit up our new [Forums!](#)

Welcome to the Hurricane Electric IPv6 Tunnel Broker! Our free tunnel broker servi
to reach the IPv6 Internet by tunneling over existing IPv4 connections from your IPv4
connects you to our IPv6 network. To use this service you need to have an IPv4 a

Network Topology



Click “Create Regular Tunnel”

Account Menu

Main Page

Account Info

Logout

User Functions

Create Regular Tunnel

Create BGP Tunnel

IPv6 Portscan



Account Menu

Main Page
Account Info
Logout

User Functions

Create Regular Tunnel
Create BGP Tunnel
IPv6 Portscan

Create New Tunnel

You currently have 2 of 5 tunnels configured.

- If you are trying to reclaim a tunnel simply use your last IPv4 address here. If you have any issues please email ipv6@he.net.
- If you have a public ASN and wish to setup a full BGP feed, please use [this form](#) instead.

IPv4 Endpoint (Your side):

You are viewing from:

113.210.193.119

Available Tunnel Servers:

North America

- Ashburn, VA, US 216.66.22.2
- Calgary, AB, CA 216.218.200.58
- Chicago, IL, US 184.105.253.14
- Dallas, TX, US 184.105.253.10
- Denver, CO, US 184.105.250.46
- Fremont, CA, US 72.52.104.74
- Fremont, CA, US 64.62.134.130
- Honolulu, HI, US 64.71.156.86
- Kansas City, MO, US 216.66.77.230
- Los Angeles, CA, US Not Available (Full)
- Miami, FL, US 209.51.161.58
- New York, NY, US 209.51.161.14
- Phoenix, AZ, US 66.220.7.82
- Seattle, WA, US 216.218.226.238
- Toronto, ON, CA 216.66.38.58
- Winnipeg, MB, CA 184.105.255.26

- Amsterdam, NL 216.66.84.46
- Berlin, DE 216.66.86.114
- Budapest, HU 216.66.87.14
- Frankfurt, DE 216.66.80.30
- Lisbon, PT 216.66.87.102
- London, UK 216.66.80.26
- London, UK 216.66.88.98
- Paris, FR 216.66.84.42
- Prague, CZ 216.66.86.122
- Stockholm, SE 216.66.80.90
- Warsaw, PL 216.66.80.162
- Zurich, CH 216.66.80.98

Asia

- Hong Kong, HK 216.218.221.6
- Singapore, SG Not Available (Full)
- Tokyo, JP Not Available (Full)

Africa

- Djibouti City, DJ 216.66.87.98
- Johannesburg, ZA 216.66.87.134

South America

- Bogota, CO 216.66.64.154

Oceania

- Sydney, NSW, AU 216.218.142.50

Middle East

- Dubai, AE 216.66.90.30

Create Tunnel

20% (15,999,999)

v6 Ready TLDs
98% (1,521/1,547)

v6 Glues
154,606

v6 Domains
10,374,596

0
days remaining
IANA exhausted

HURRICANE ELECTRIC
INTERNET SERVICES

google - Google Search x Tunnel Details x +
 https://tunnelbroker.net/tunnel_detail.php?tid=538781

Account Menu

[Main Page](#)
[Account Info](#)
[Logout](#)

User Functions

[Create Regular Tunnel](#)
[Create BGP Tunnel](#)
[IPv6 Portscan](#)

Tunnel Details

IPv6 Tunnel
Example Configurations
Advanced

📘 Tunnel ID: 538781 [Delete Tunnel](#)
📘 Creation Date: Jun 10, 2019
📘 Description:

IPv6 Tunnel Endpoints

📘 Server IPv4 Address: 216.218.221.6
📘 Server IPv6 Address: 2001:470:18:1a9e::1/64
📘 Client IPv4 Address:
📘 Client IPv6 Address: 2001:470:18:1a9e::2/64

Routed IPv6 Prefixes

📘 Routed /64: 2001:470:19:1a9e::/64
📘 Routed /48: [Assign /48](#)

DNS Resolvers

📘 Anycast IPv6 Caching Nameserver: 2001:470:20::2
 Anycast IPv4 Caching Nameserver: 74.82.42.42

rDNS Delegations [Edit](#)

📘 rDNS Delegated NS1:
 rDNS Delegated NS2:
 rDNS Delegated NS3:
 rDNS Delegated NS4:
 rDNS Delegated NS5:

Quick Links

[Certification](#)
[Tunnelbroker](#)
[Free DNS](#)
[BGP Toolkit](#)
[Net Tools App](#)
[Forums](#)
[FAQ](#)
[Video Presentations](#)
[Usage Statistics](#)
[Tunnel Server Status](#)
[Network Map](#)
[Looking Glass \(v4/v6\)](#)
[Route Server \(telnet\)](#)
[Global IPv6 Report](#)

Services

[Transit](#)
[Colocation](#)
[Dedicated Servers](#)

v4 Exhaustion

IPv4 & IPv6 Statistics

RIR v4 IPs Left

| | |
|---------------------|-----------|
| AfrNIC | 5,212,794 |
| APNIC | 3,437,608 |
| ARIN | 0 |
| LACNIC | 877,201 |
| RIPE | 3,780,739 |
| v6 ASNs | |
| 23% (13,993/58,955) | |

Tunnel Detail



Tunnel Details

IPv6 Tunnel

Example Configurations

Advanced

Mikrotik

Copy and paste the following commands into a command window:

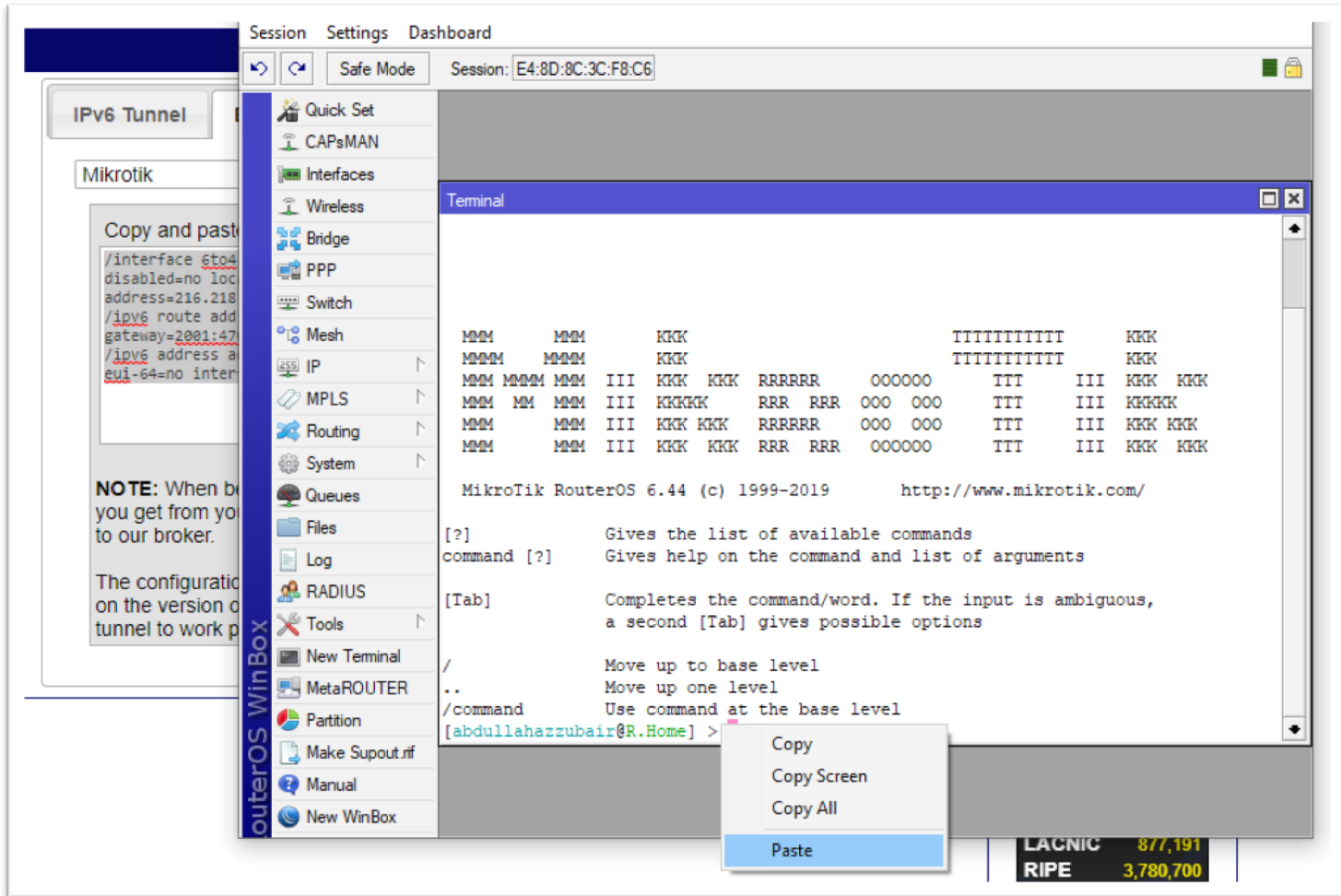
```
/interface 6to4 add comment="Hurricane Electric IPv6 Tunnel Broker"  
disabled=no local-address [REDACTED] mtu=1280 name=sit1 remote-  
address=216.218.221.6  
/ipv6 route add comment="" di  
gateway=2001:470:18:1a9e::1 s  
/ipv6 address add address=200  
eui-64=no interface=sit1
```

Undo

Cut

Copy

Paste



IPv6 Tunnel

Mikrotik

Copy and paste

```
/interface s6to4
disabled=no loopback
address=216.218.112.1
/ipv6 route add
gateway=2001:470:1:1::1
/ipv6 address add
eui-64=no interface
```

NOTE: When you get from you to our broker.

The configuration on the version of tunnel to work p

outerOS WinBox

Session Settings Dashboard
Safe Mode Session: E4:8D:8C:3C:F8:C6

- Quick Set
- CAPsMAN
- Interfaces
- Wireless
- Bridge
- PPP
- Switch
- Mesh
- IP
- MPLS
- Routing
- System
- Queues
- Files
- Log
- RADIUS
- Tools
- New Terminal
- MetaROUTER
- Partition
- Make Spout.rif
- Manual
- New WinBox

```
MMM      MMM      KKK      TTTTTTTTTT      KKK
MMMM     MMMM     KKK      TTTTTTTTTT      KKK
MMM MMMM MMM III  KKK KKK RRRRRR  000000  TTT  III  KKK KKK
MMM MM  MMM III  KKKKKK  RRR  RRR  000  000  TTT  III  KKKKKK
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 6.44 (c) 1999-2019      http://www.mikrotik.com/

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

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

/           Move up to base level
..         Move up one level
/command   Use command at the base level
[abdullahazzubair@R.Home] >
```

- Copy
- Copy Screen
- Copy All
- Paste

| | |
|--------|-----------|
| LACNIC | 877,191 |
| RIPE | 3,780,700 |

Session Settings Dashboard

Safe Mode Session: E4:8D:8C:3C:F8:C6

Interface <sit1>

General Status Traffic

Name: sit1

Type: 6to4 Tunnel

MTU: 1280

Actual MTU: 1280

L2 MTU: 65535

Local Address: [REDACTED]

Remote Address: 216.218.221.6

IPsec Secret: [REDACTED]

Keepalive: [REDACTED]

DSCP: 10

Dont Fragment: no

Clamp TCP MSS

enabled running slave

litesoft winbox

Terminal

Interface List

| Interface | Name |
|-----------|-----------------|
| X | ↔-ovpn-out |
| X | ↔-ovpn-out |
| X | ↔-ovpn-out |
| R | ↔-ovpn-out |
| | ::: Hurricane E |
| R | ↔-sit 1 |
| X | ↔-sstp-out |
| X | ↔-sstp-out |
| X | ↔-sstp-out |
| | ::: Bitech |
| X | ↔-sstp-out |
| X | ↔-sstp-out |
| R | ↔-wlan1 |

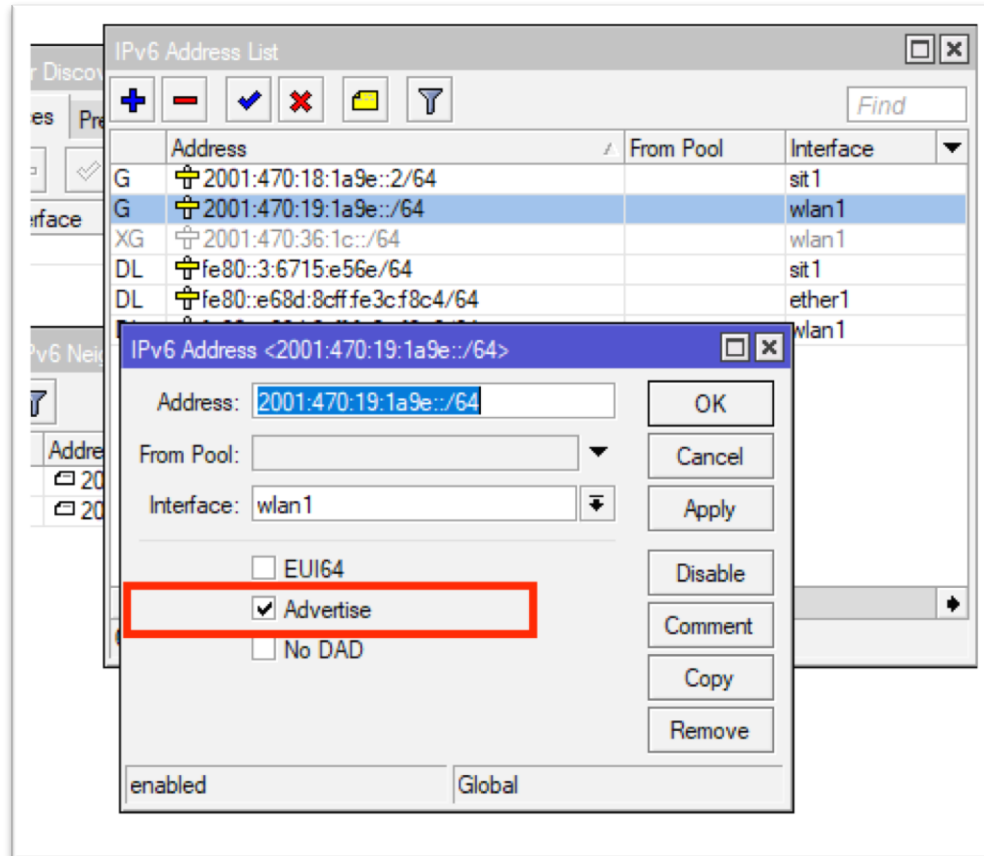
16 items (1 selected)

Test Ping to Google Ipv6 DNS

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

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

/ Move up to base level
.. Move up one level
'command Use command at the base level
[abdullahazzubair@R.Home] > ping 2001:4860:4860::8888
  SEQ HOST                SIZE TTL TIME  STATUS
  0 2001:4860:4860::8888    56  57 86ms echo reply
  1 2001:4860:4860::8888    56  57 83ms echo reply
  2 2001:4860:4860::8888    56  57 84ms echo reply
  3 2001:4860:4860::8888    56  57 83ms echo reply
  4 2001:4860:4860::8888    56  57 86ms echo reply
  5 2001:4860:4860::8888    56  57 86ms echo reply
  6 2001:4860:4860::8888    56  57 83ms echo reply
  7 2001:4860:4860::8888    56  57 92ms echo reply
  8 2001:4860:4860::8888    56  57 86ms echo reply
  9 2001:4860:4860::8888    56  57 84ms echo reply
 10 2001:4860:4860::8888    56  57 83ms echo reply
 11 2001:4860:4860::8888    56  57 85ms echo reply
```



Set IP to Client via Wlan Interface

IPv6 Neighbor List

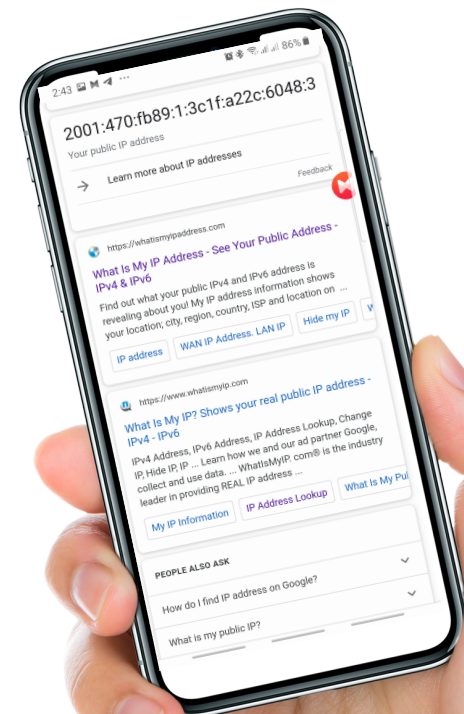
| Address | Interface | MAC Address | Stat |
|--------------------------------------|-----------|-------------------|-------|
| 2001:470:19:1a9e:a051:d0d2:2a2:c23d | wlan1 | 64:5D:86:EF:EF... | stale |
| 2001:470:19:1a9e:3c1f:a22c:6048:350f | wlan1 | 6C:C7:EC:63:D... | stale |

IPv6 Neighbor

Network Connection Details

| Property | Value |
|-------------------------|--------------------------------------|
| IPv4 Address | 172.16.1.183 |
| IPv4 Subnet Mask | 255.255.255.0 |
| Lease Obtained | 11 June 2019 02:58:25 |
| Lease Expires | 11 June 2019 08:12:25 |
| IPv4 Default Gateway | 172.16.1.1 |
| IPv4 DHCP Server | 10.0.0.1 |
| IPv4 DNS Servers | 10.0.0.1 8.8.4.4 8.8.8.8 |
| IPv4 WINS Server | |
| NetBIOS over Tcpi En... | Yes |
| IPv6 Address | 2001:470:19:1a9e:d93e:3692:2714:e... |
| Temporary IPv6 Address | 2001:470:19:1a9e:a051:d0d2:2a2:c2... |
| Link-local IPv6 Address | fe80::d93e:3692:2714:eb37%11 |
| IPv6 Default Gateway | fe80::e68d:8cff:fe3c:f8c6%11 |
| IPv6 DNS Server | 2001:4860:4860::8844 |

Close



Results

IPv6 Security Issue

- CVE-2018-19298, CVE-2018-19299 IPV6 RESOURCE EXHAUSTION
- Keduanya sudah fix di RouterOS versi RouterOS v6.44.2, RouterOS v6.45beta23 and RouterOS v6.43.14 yang di publish di April 2019

So Please Always Update your RouterOS version

Path MTU

- Path MTU (PMTU) adalah ukuran paket terbesar yang bisa dilalui antara sumber dan tujuan tanpa fragmentasi
- IPv6 membutuhkan MTU 1280 bytes atau lebih besar
- IPv4 membutuhkan MTU 68 bytes

Path MTU Discovery

- PMTU Discovery adalah teknik penentuan Path MTU antara dua host IP. Untuk discovery dan memanfaatkan PMTU lebih besar dari 1280, sangat disarankan untuk menerapkan PMTU Discovery
- Untuk paket yang lebih besar dari fragmen PMTU yang digunakan.

Thank you

Telegram : @teddyuliswar