

MPLS

Multi Protocol Label Switching



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Biodata

- S2 Magister Teknologi Informasi ITB Bandung
- Pengajar di SMK Telkom Malang
- Pengajar di STMIK Pradnya Paramita Malang
- Pengajar di Universitas Ma Chung Malang
- Trainer dan Konsultan Mikrotik
- Trainer di Belajarmikrotik.com
- Trainer Cisco Networking Academy Program (CNAP), Oracle Academy, Oracle WDP, Mikrotik Academy



SMK Telkom Malang

- Didirikan tahun 1992
- Dahulu bernama SMK Telkom Sandhy Putra Malang sekarang menjadi bagian dari Telkom Schools
- Terdiri dari 2 jurusan RPL dan TKJ
- Sekarang ada 9 kelas paralel kelas 10,11 dan 12
- Milik Yayasan Sandhykara Putra Telkom Bandung

Belajarmikrotik.com

- Didirikan tahun 2013
- Fokus ke dunia pendidikan melalui pelatihan Mikrotik dan Mikrotik Academy

Proses Jaringan Komputer

- Ada 3 proses dalam jaringan computer
 1. Bridging
Protokol : STP, RSTP
 2. Routing
Protokol : Static, RIP, OSPF, BGP
 3. Switching
Protokol : MPLS, ATM (Asynchronous Transfer Mode), Frame relay

Konsep Routing

- Menggunakan layer 3
- Forwarding menggunakan alamat IP yang dituju
- Routing lookup dilakukan di tiap hop sehingga proses routing harus diaktifkan di semua device
- Setiap router menentukan policy routing
- Terjadi beban routing yang tidak seimbang pada router

Konsep Switching

- Menggunakan pengiriman paket data dalam bentuk kelompok-kelompok atau Label
- Setiap label yang ditransmisikan tidak terkait dengan kelompok label lainnya

Teori Dasar MPLS

- MPLS adalah teknologi packet-forwarding (melewatkan paket data sesuai dengan pilihan jalur terbaik) yang menggunakan label untuk forwarding data
- Dengan MPLS keputusan forwarding tidak lagi berdasarkan IP Header dan table routing sehingga beban proses menjadi minimal yang mengakibatkan terjadinya efisiensi proses forwarding
- MPLS tidak membutuhkan tambahan packet header layer 3

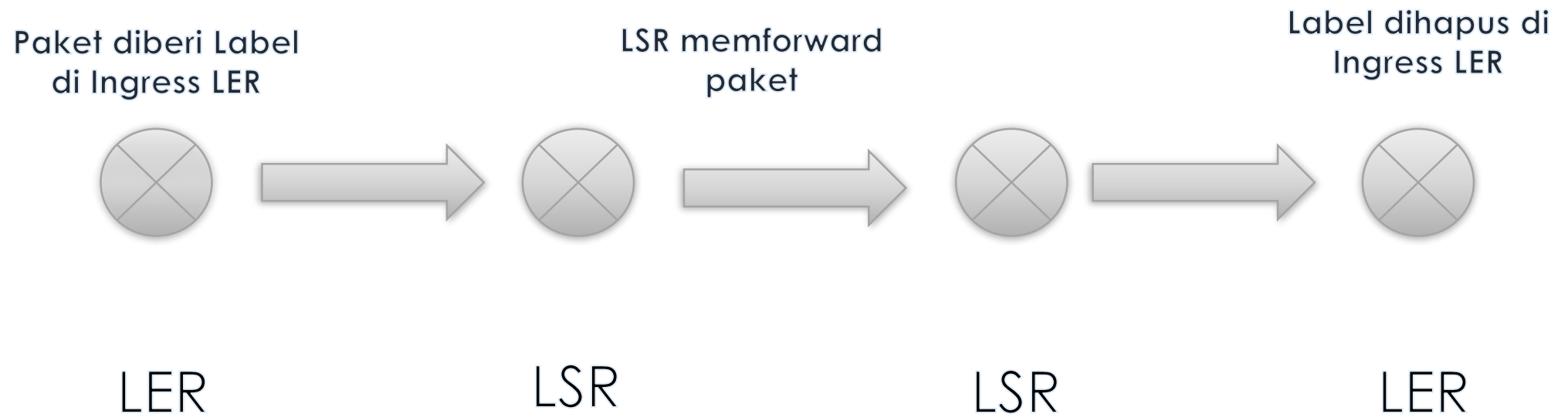
Keuntungan MPLS

- Beban routing lookup dapat secara maksimal di distribusikan secara merata di setiap edge Router
- Mengurangi beban routing lookup di core network router
- Redundancy dan load balancing

Cara kerja MPLS

- Perlu diberikan Header Label pada paket data pada jaringan MPLS. Label dihilangkan atau ditambahkan oleh router **LER (Label Edge Router)**
- Router **LSP (Label Switched Path)** menyiapkan jalur aliran data ke semua kombinasi node (Diumpamakan LSP sebagai unidirectional tunnel ke semua router)
- Selanjutnya paket data dikirimkan ke setiap router **LSR (Label Switching Router)** yang sudah ditentukan sebelumnya oleh LSR

Cara kerja Label MPLS



■ Fungsi LER

- Menambah Label ketika traffic datang (Ingress)
- Menambah Label lagi (Stack) jika ada service lagi
- Menghilangkan semua Label (POP) ketika keluar dari MPLS (Egress).

■ Fungsi LSR

- Forwarding paket (SWAP) berdasarkan label LSP yang sudah dibuat
- Menghilangkan paket terluar (POP) jika terjadi Label Stack

Header MPLS

- Berisi satu atau beberapa label (shims) yang masing-masing berukuran 32 bit yaitu Label (20 bits), EXP (3bits), End of stack flag (1 bit), TTL (8 bits)

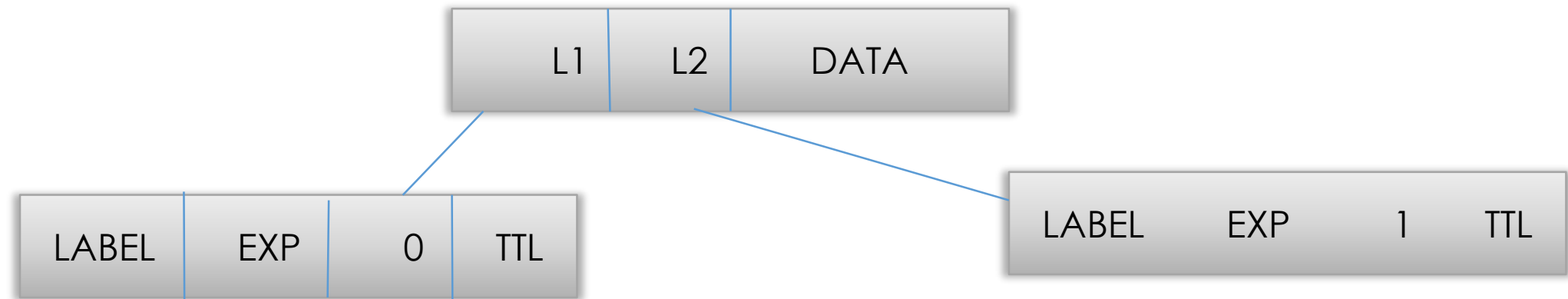
Label MPLS

- Dapat Multiple Label dalam satu paket Label Stack
- Top label atau label terluar digunakan untuk mengatur paket sampai ke tujuan kemudian dihapus
- Label selanjutnya untuk proses berikutnya contoh pointing VPN, menunjuk interface
- Contoh :
 - VPN
 - VPLS
 - Traffic Engineering

Header MPLS



Label MPLS



- MPLS L3VPN biasanya membutuhkan 2 Label
- MPLS L2VPN (VPLS) dan Traffic membutuhkan 2 label atau lebih
- Traffic Engineering dapat menggunakan lebih dari 2 label

Posisi Router MPLS

- **P (Provider Router)**
Router Backbone yang melakukan label Switching (LSR)
- **PE (Provider Edge Router)**
Melakukan label (LER) yang terhubung ke Internet, L3VPN, L2VPN, Traffic Engineering
- **CE (Customer Edge Router)**
Perangkat yang ada di client yang akan berkomunikasi dengan PE

MPLS LSP (Label Switched Path)

Setiap router berfungsi sebagai LSP

Ada 2 proses LSP yaitu :

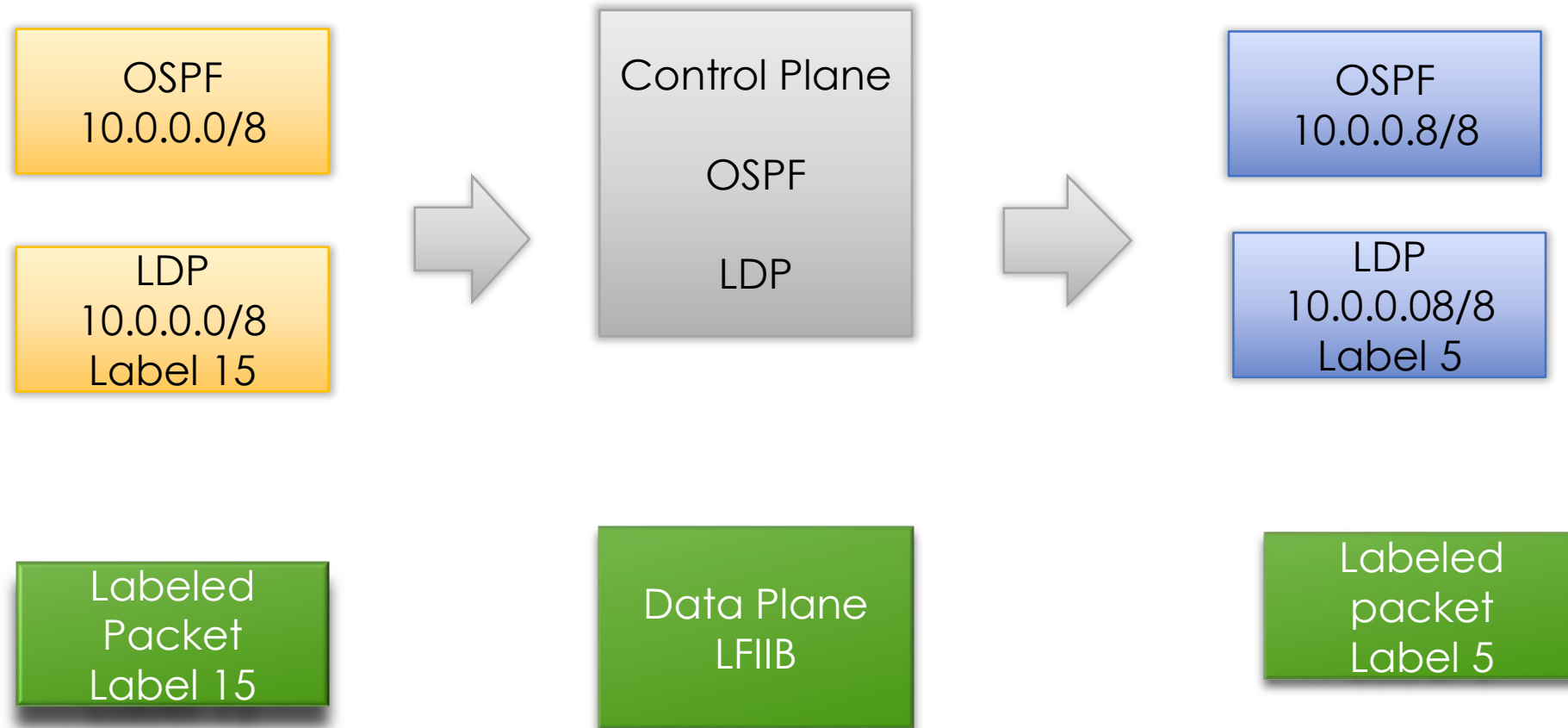
a. **Control Plane**

Proses pertukaran informasi routing layer 3 dan pertukaran informasi Label

b. **Data Plane**

Proses forwarding berdasarkan label dan IP address tujuan

Fungsi LSR (Label Switching Router)



MPLS Control Plane

- Masih dibutuhkan routing layer 3 untuk menyebarkan informasi routing dan informasi Label ke setiap router
- Metode Distribusi Label (Label Exchange Protocol) yang digunakan adalah static Label Mapping, LDP, TDP, BGP(VPN), RSVP (MPLS-TE)

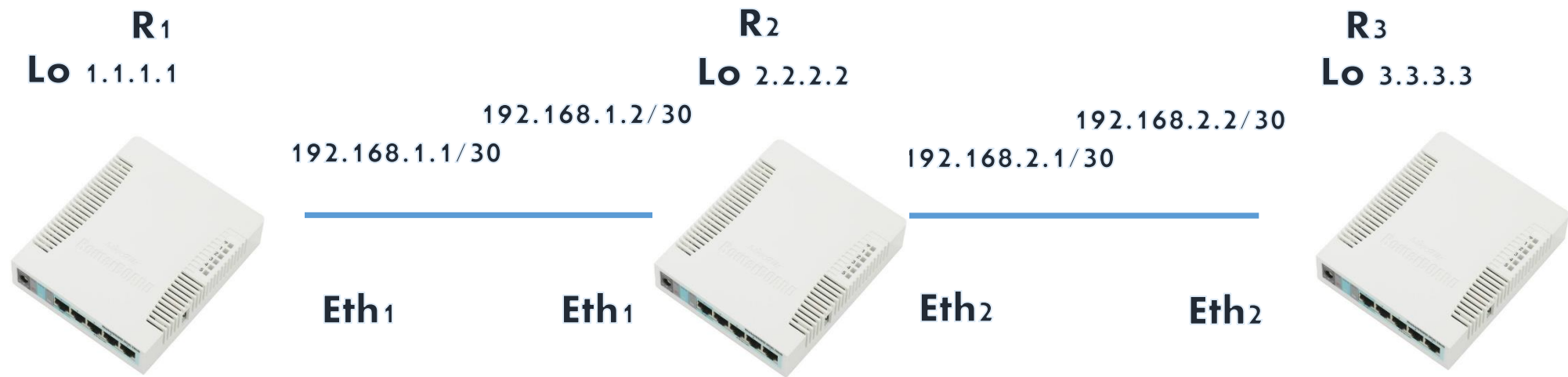
MPLS Data Plane

- Data Plane
 - = Proses forwarding sederhana berisi pertukaran data
- Label Forwarding Information Base (LFIB) menentukan forwarding paket data sesuai label yang sudah ada

Penerapan MPLS

- ✓ Virtual Private Networking (VPN)
- ✓ Traffic Engineering (TE)
- ✓ Quality of Service (QoS)
- ✓ Any Transport over MPLS (AToM)

Lab Static Label



Langkah Awal

- Membuat Loopback pada interface Bridge
- Membuat IP loopback di interface bridge loopback
- Membuat Ip Point to Point
- Mengaktifkan OSPF
- Membuat static label

Konfigurasi loopback di Router 1

The screenshot displays the Mikrotik WinBox Bridge configuration interface. At the top, there are tabs for Bridge, Ports, Filters, NAT, and Hosts. Below the tabs is a toolbar with icons for adding, deleting, enabling, disabling, and saving configurations, along with a Settings button. A table lists the bridge configurations:

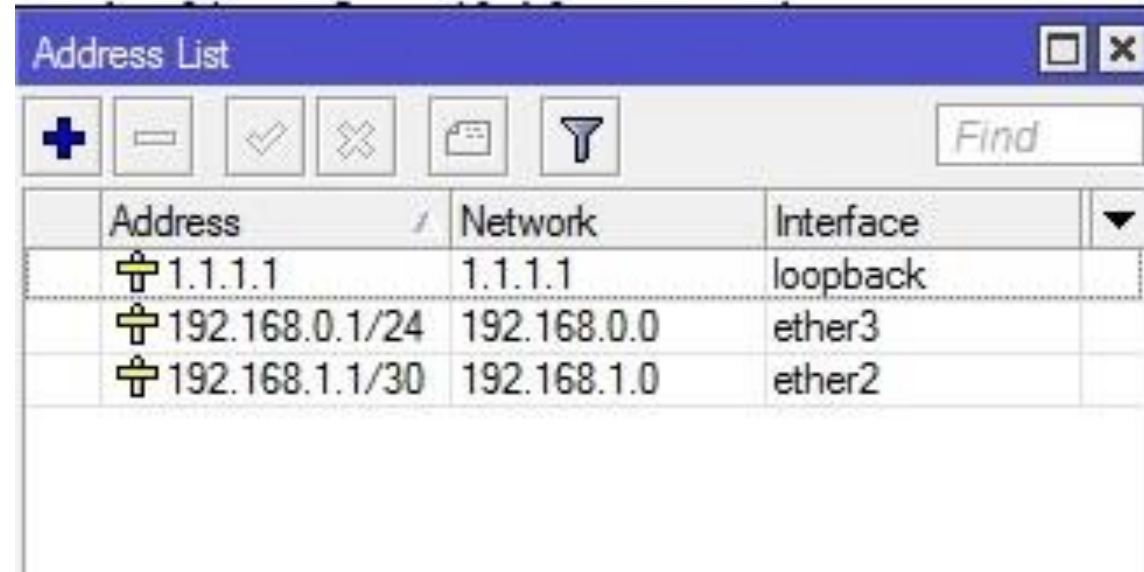
	Name	Type	L2 MTU	Tx	Rx
R	loopback	Bridge	65535		0 bps

An 'Interface <loopback>' dialog box is open, showing the configuration for the selected bridge. The 'General' tab is active, and the following fields are visible:

- Name: loopback
- Type: Bridge
- MTU: 1500
- L2 MTU: 65535
- MAC Address: (empty)
- ARP: enabled
- Admin. MAC Address: (empty)

On the right side of the dialog, there are buttons for OK, Cancel, Apply, Disable, Comment, Copy, Remove, and Torch. At the bottom left of the dialog, it indicates '1 item'.

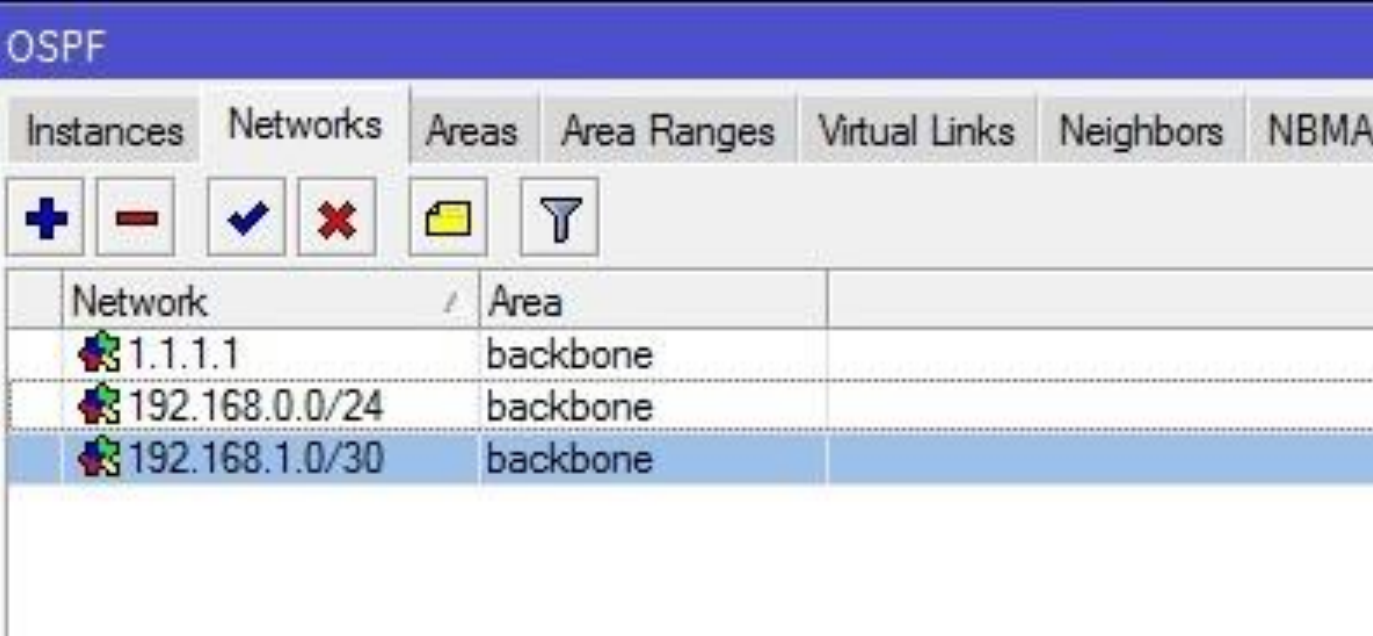
Konfigurasi IP Address di R1



The screenshot shows the 'Address List' window in Mikrotik WinBox. The window title is 'Address List'. Below the title bar is a toolbar with icons for adding (+), deleting (-), checking (✓), unchecking (✗), refreshing (refresh icon), and filtering (funnel icon). To the right of the toolbar is a search box labeled 'Find'. Below the toolbar is a table with the following data:

Address	Network	Interface	
1.1.1.1	1.1.1.1	loopback	
192.168.0.1/24	192.168.0.0	ether3	
192.168.1.1/30	192.168.1.0	ether2	

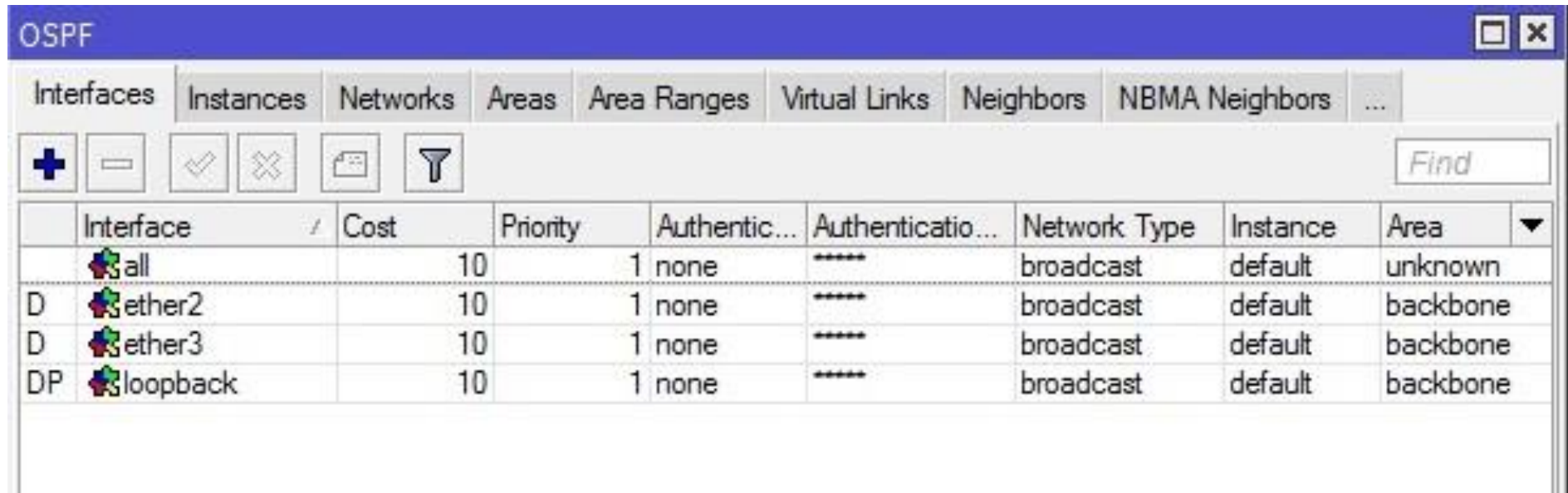
Konfigurasi Network OSPF Di R1



The screenshot displays the OSPF configuration window in Mikrotik WinBox. The 'Networks' tab is selected, showing a list of configured networks. The table below details the entries:

Network	Area
1.1.1.1	backbone
192.168.0.0/24	backbone
192.168.1.0/30	backbone

Tampilan Interface OSPF di R1



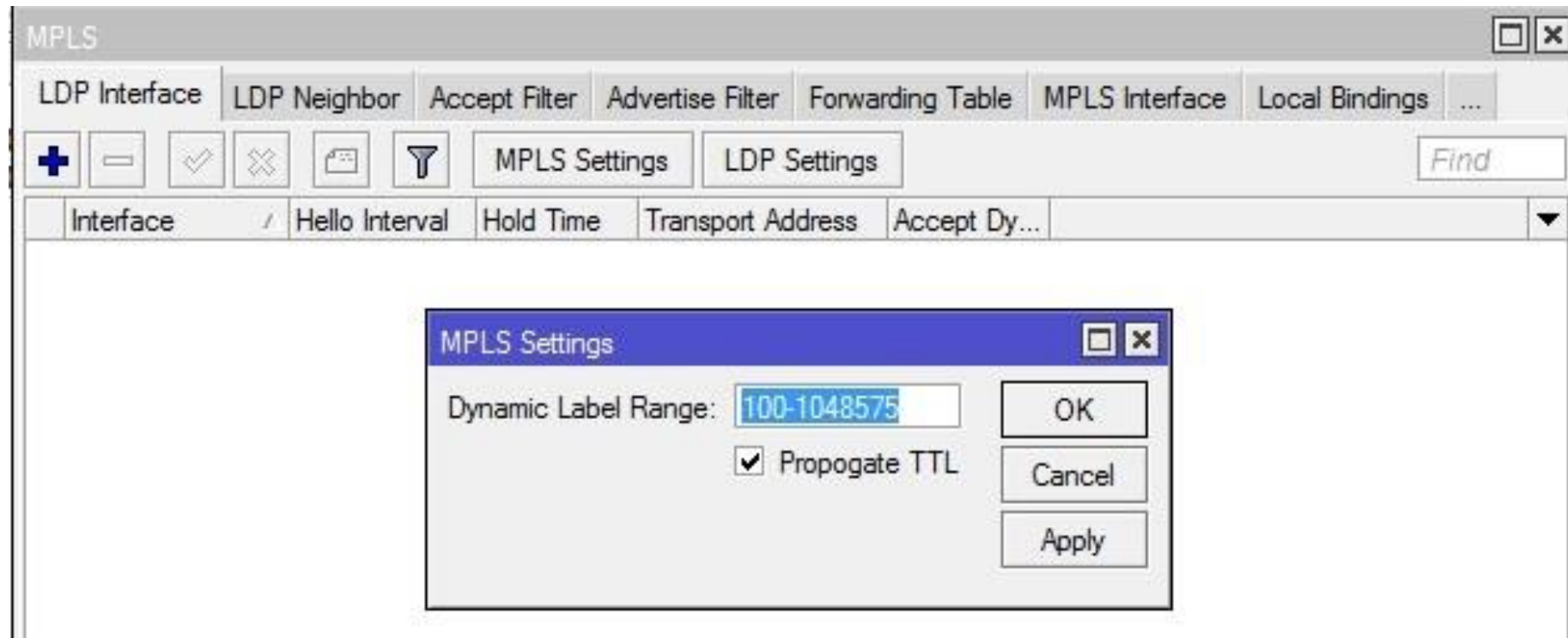
	Interface	Cost	Priority	Authentic...	Authenticatio...	Network Type	Instance	Area
	all	10	1	none	*****	broadcast	default	unknown
D	ether2	10	1	none	*****	broadcast	default	backbone
D	ether3	10	1	none	*****	broadcast	default	backbone
DP	loopback	10	1	none	*****	broadcast	default	backbone

Konfigurasi Static label di R1

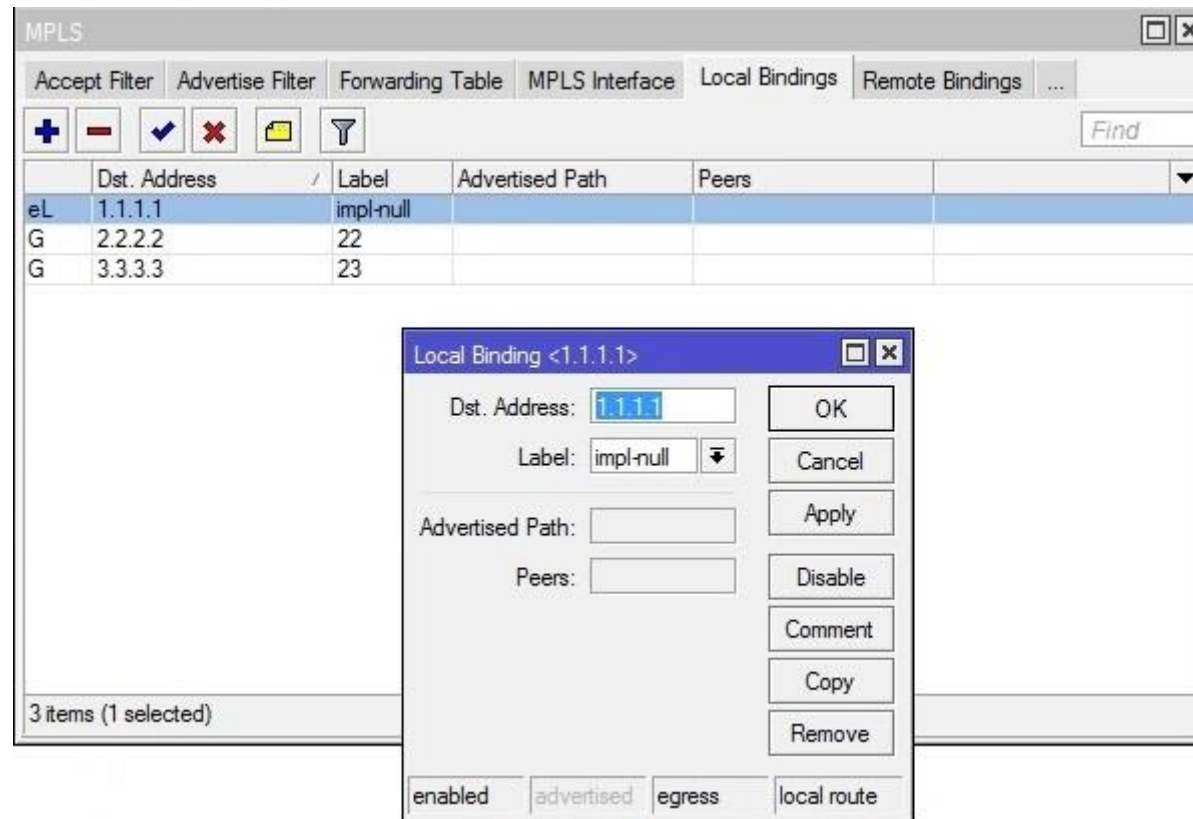
	Dst	Label
Local	1.1.1.1	Impl-null
	2.2.2.2	22
	3.3.3.3	23

	Dst	Label	Hop
Remote	2.2.2.2	Impl-null	192.168.1.2
	3.3.3.3	23	192.168.1.2

Mendefinisikan Range Statik Label di R1



Konfigurasi Local Bindings di R1



Konfigurasi Remote Bindings di R1

MPLS

Accept Filter | Advertise Filter | Forwarding Table | MPLS Interface | Local Bindings | Remote Bindings | ...

+ - ✓ ✗ 📄 🏠 Find

	Dst. Address	Label	Next hop	Peer	Path
A	2.2.2.2	impl-null	192.168.1.2		
A	3.3.3.3	23	192.168.1.2		

2 items (1 selected)

Remote Binding <2.2.2.2>

Dst. Address: 2.2.2.2

Label: impl-null

Next hop: 192.168.1.2

Peer:

Path:

OK

Cancel

Apply

Disable

Comment

Copy

Remove

enabled active

Hasil Trace route di R1

Traceroute (Running)

Traceroute To: 3.3.3.3

Packet Size: 56

Timeout: 1000 ms

Protocol: icmp

Port: 33434

Use DNS

Count: [dropdown]

Max Hops: [dropdown]

Src. Address: 1.1.1.1

Interface: [dropdown]

DSCP: [dropdown]

Routing Table: [dropdown]

Start

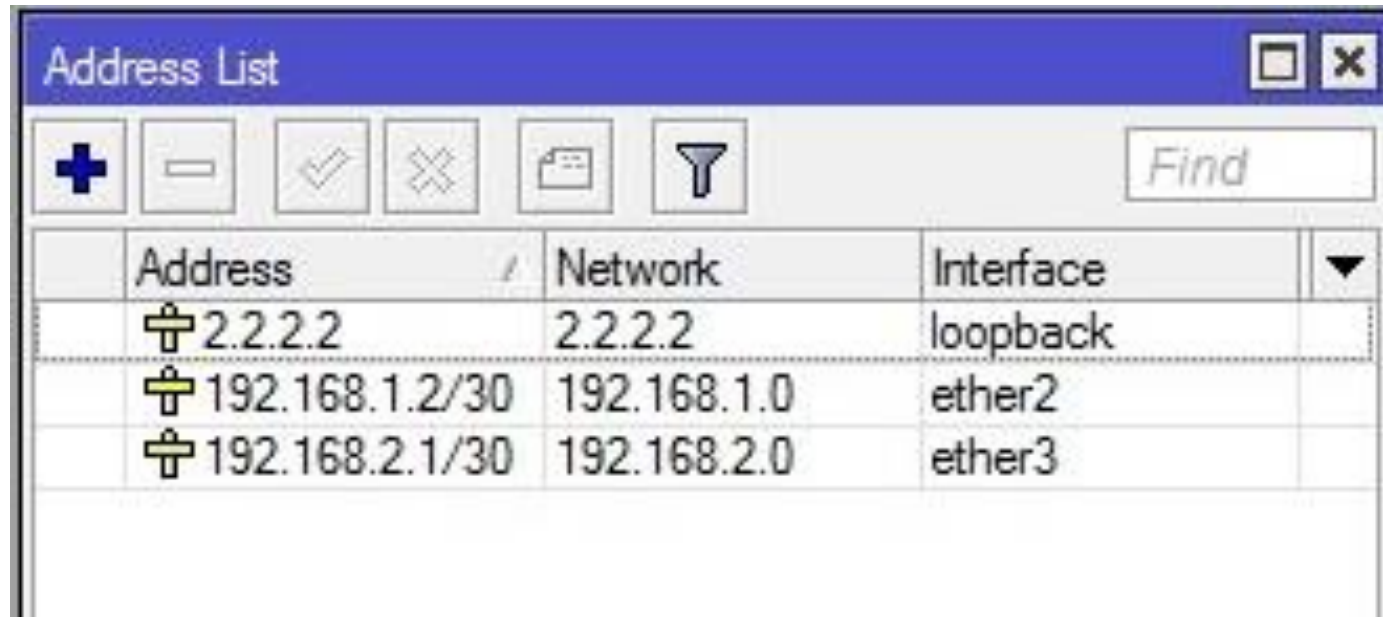
Stop

Close

New Window

Hop	Host	Loss	Sent	Last	Avg.	Best	Worst	Std. Dev.	History	Status
1	192.168.1.2	0.0%	17	0.3ms	0.3	0.3	0.7	0.1		<MPLS:L=23,E=0>
2	3.3.3.3	0.0%	17	0.2ms	0.2	0.2	0.3	0.0		

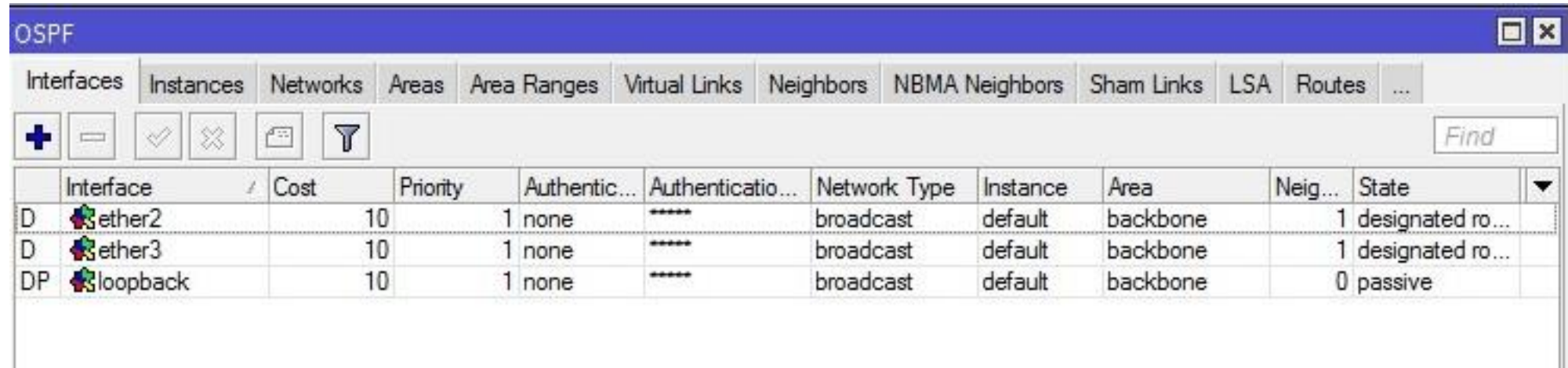
Konfigurasi IP di R2



The screenshot shows the 'Address List' window in Mikrotik WinBox. The window title is 'Address List' and it has standard window controls (minimize, maximize, close). Below the title bar is a toolbar with icons for adding (+), deleting (-), checking (checkmark), unchecking (X), saving (floppy disk), and filtering (funnel), along with a 'Find' search box. The main area contains a table with the following data:

Address	Network	Interface
2.2.2.2	2.2.2.2	loopback
192.168.1.2/30	192.168.1.0	ether2
192.168.2.1/30	192.168.2.0	ether3

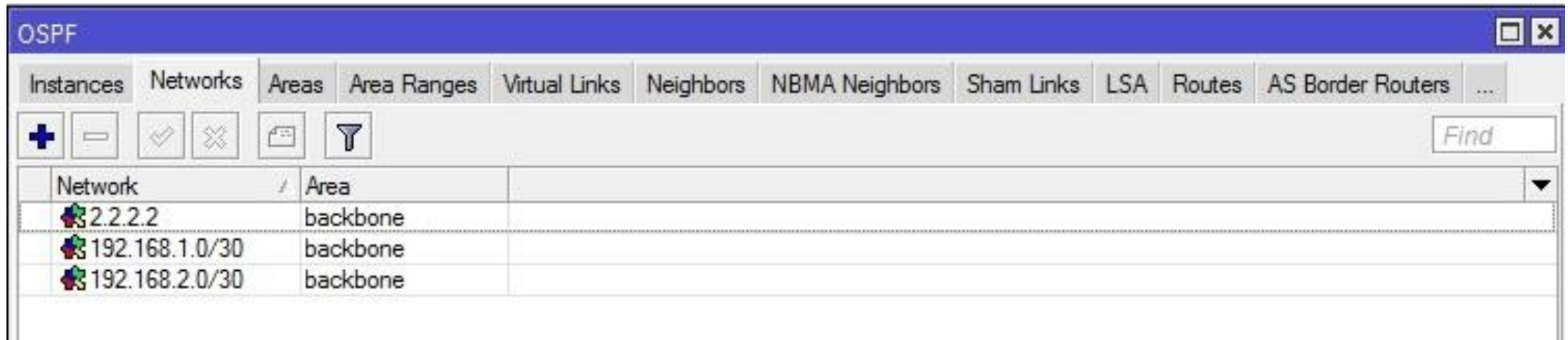
Konfigurasi OSPF di R2



The screenshot shows the OSPF configuration window in Mikrotik WinBox. The 'Interfaces' tab is selected, displaying a table of configured interfaces. The table has columns for Interface, Cost, Priority, Authentication, Authentication, Network Type, Instance, Area, Neighbors, and State. Three interfaces are listed: ether2, ether3, and loopback.

Interface	Cost	Priority	Authentic...	Authenticatio...	Network Type	Instance	Area	Neig...	State
D ether2	10	1	none	*****	broadcast	default	backbone	1	designated ro...
D ether3	10	1	none	*****	broadcast	default	backbone	1	designated ro...
DP loopback	10	1	none	*****	broadcast	default	backbone	0	passive

Konfigurasi OSPF di R2



The screenshot shows the OSPF configuration window in Mikrotik WinBox. The 'Networks' tab is selected, displaying a table of configured networks. The table has two columns: 'Network' and 'Area'. Three networks are listed, all belonging to the 'backbone' area.

Network	Area
2.2.2.2	backbone
192.168.1.0/30	backbone
192.168.2.0/30	backbone

Konfigurasi Static label di R2

	Dst	Label
Local	1.1.1.1	21
	2.2.2.2	Impl-null
	3.3.3.3	23

	Dst	Label	Hop
Remote	1.1.1.1	Impl-null	192.168.1.1
	3.3.3.3	Impl-null	192.168.2.2

Konfigurasi Local Bindings di R2

MPLS

LDP Neighbor | Accept Filter | Advertise Filter | Forwarding Table | MPLS Interface | Local Bindings | Remote Bindings | ...

+ - ✓ ✗ 📄 🏠 Find

	Dst. Address	Label	Advertised Path	Peers
G	1.1.1.1	21		
eL	2.2.2.2	impl-null		
G	3.3.3.3	23		

3 items (1 selected)

Local Binding <1.1.1.1>

Dst. Address: 1.1.1

Label: 21

Advertised Path:

Peers:

OK Cancel Apply Disable Comment

Konfigurasi Remote Bindings di R2

The screenshot shows the Mikrotik WinBox interface for configuring Remote Bindings in an MPLS environment. The main window is titled 'MPLS' and has several tabs: 'LDP Neighbor', 'Accept Filter', 'Advertise Filter', 'Forwarding Table', 'MPLS Interface', 'Local Bindings', and 'Remote Bindings'. The 'Remote Bindings' tab is active, displaying a table with two entries:

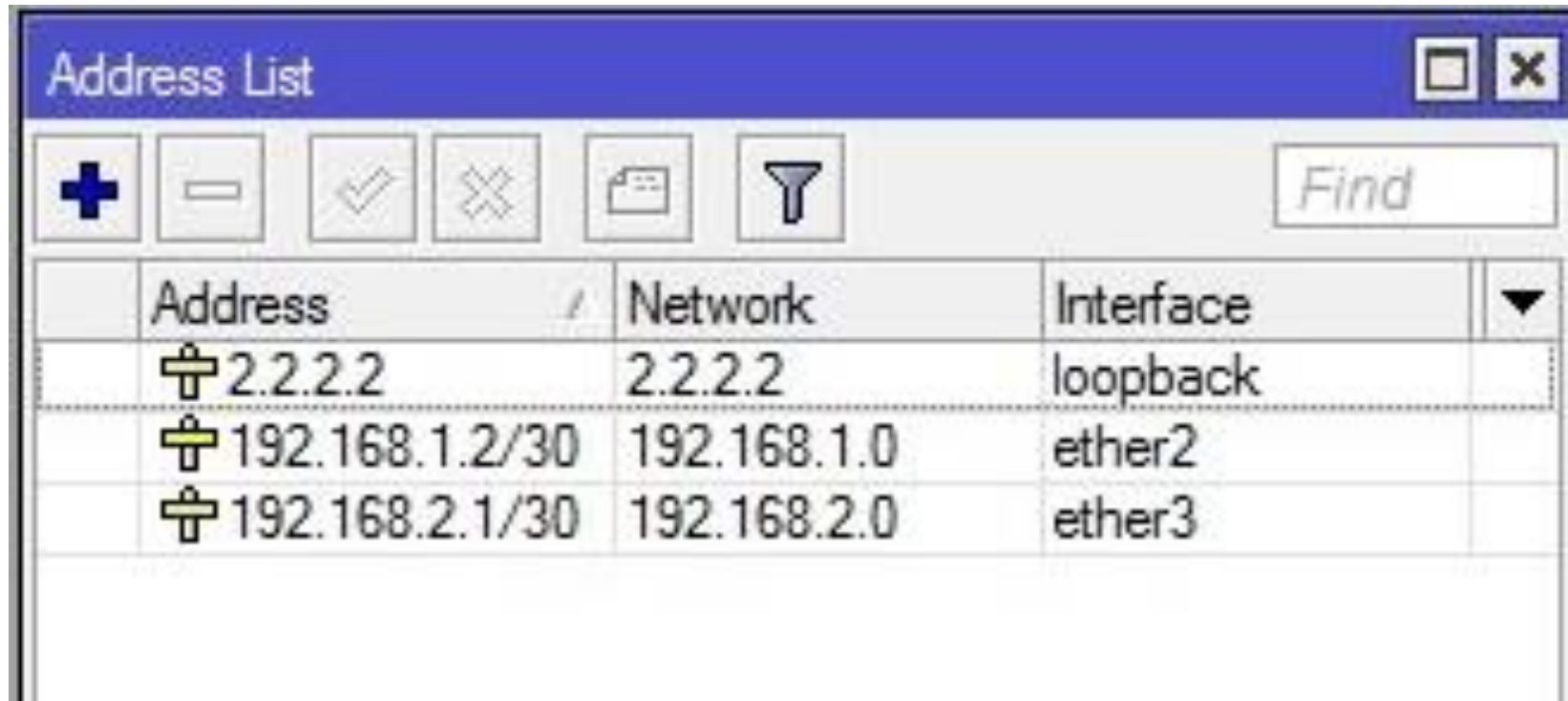
	Dst. Address	Label	Nexthop	Peer	Path
A	1.1.1.1	impl-null	192.168.1.1		
A	3.3.3.3	impl-null	192.168.2.2		

A modal dialog box titled 'Remote Binding <1.1.1.1>' is open, showing the configuration for the selected entry. The fields are:

- Dst. Address: 1.1.1.1
- Label: impl-null
- Nexthop: 192.168.1.1
- Peer: (empty)
- Path: (empty)

Buttons on the right side of the dialog include: OK, Cancel, Apply, Disable, Comment, and Copy. At the bottom left of the main window, it says '2 items (1 selected)'.

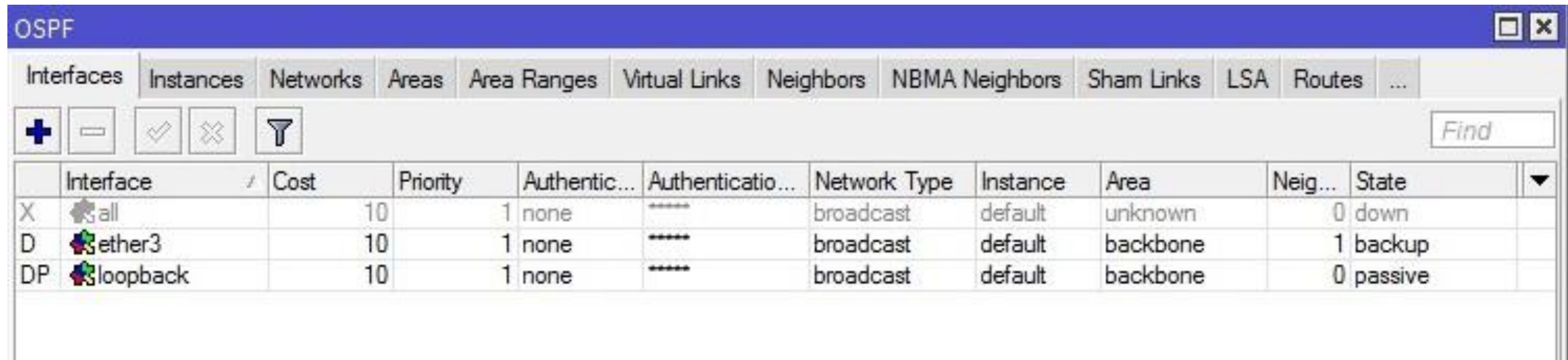
Konfigurasi IP di R3



The screenshot shows the 'Address List' window in Mikrotik WinBox. The window title is 'Address List' and it has standard window controls (minimize, maximize, close). Below the title bar is a toolbar with icons for adding (+), deleting (-), checking (checkmark), unchecking (X), saving (floppy disk), and filtering (funnel). A search box labeled 'Find' is also present. The main area contains a table with the following data:

Address	Network	Interface	
2.2.2.2	2.2.2.2	loopback	
192.168.1.2/30	192.168.1.0	ether2	
192.168.2.1/30	192.168.2.0	ether3	

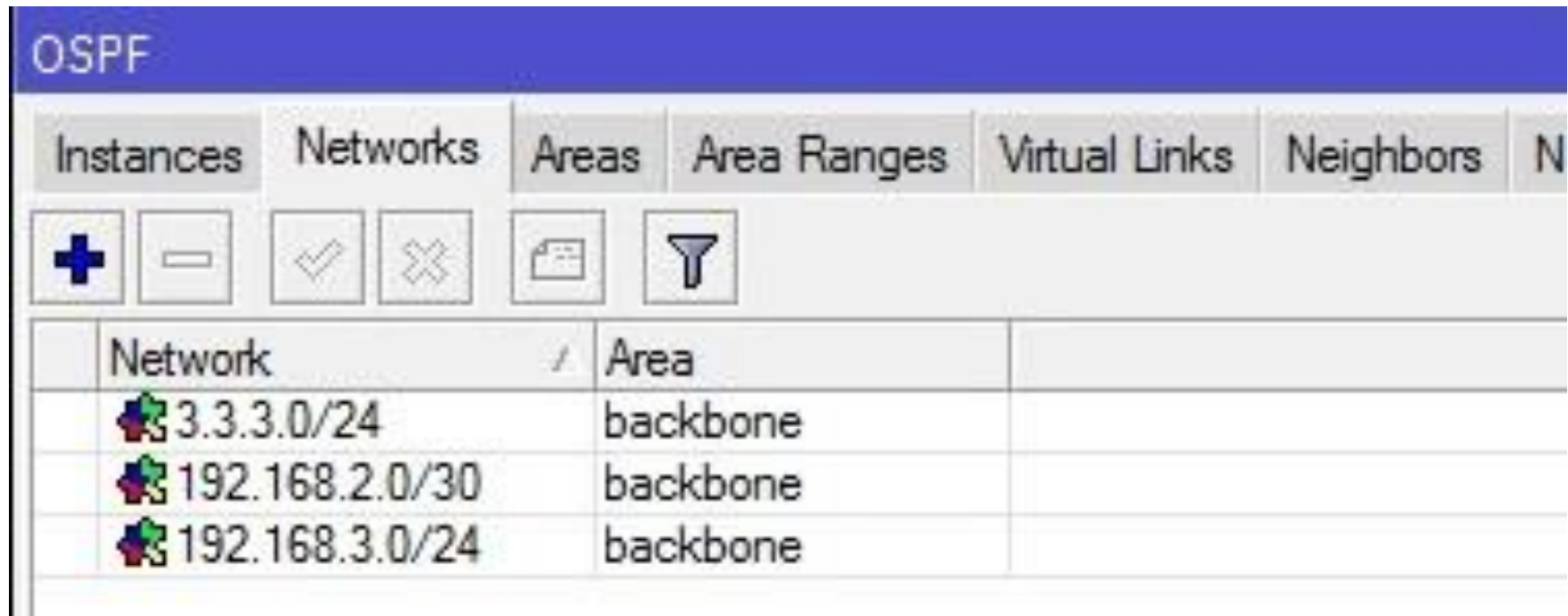
Konfigurasi Interface OSPF di R3



The screenshot shows the OSPF configuration window in Mikrotik WinBox. The 'Interfaces' tab is selected, displaying a table of OSPF interfaces. The table has columns for Interface, Cost, Priority, Authentication, Network Type, Instance, Area, Neighbors, and State. Three interfaces are listed: 'all' (State: down), 'ether3' (State: backup), and 'loopback' (State: passive).

	Interface	Cost	Priority	Authentic...	Authenticatio...	Network Type	Instance	Area	Neig...	State
X	all	10	1	none	*****	broadcast	default	unknown	0	down
D	ether3	10	1	none	*****	broadcast	default	backbone	1	backup
DP	loopback	10	1	none	*****	broadcast	default	backbone	0	passive

Konfigurasi Network OSPF di R3



The screenshot shows the OSPF configuration window in Mikrotik WinBox. The 'Networks' tab is selected, displaying a table of configured networks. The table has two columns: 'Network' and 'Area'. Each network entry is preceded by a small icon representing a network.

Network	Area
3.3.3.0/24	backbone
192.168.2.0/30	backbone
192.168.3.0/24	backbone

Membuat Static label di R3

	Dst	Label
Local	1.1.1.1	21
	2.2.2.2	22
	3.3.3.3	Impl-null

	Dst	Label	Hop
Remote	2.2.2.2	Impl-null	192.168.2.1
	1.1.1.1	21	192.168.2.1

Konfigurasi Local Bindings di R3

MPLS

LDP Interface LDP Neighbor Accept Filter Advertise Filter Forwarding Table MPLS Interface Local Bindings Remote Bindings

+ - ✓ ✗ 📄 🏠

	Dst. Address	/	Label	Advertised Path	Peers
G	1.1.1.1		21		
G	2.2.2.2		22		
eL	3.3.3.3		impl-null		

Local Binding <3.3.3.3>

Dst. Address:

Label:

Advertised Path:

Peers:

OK
Cancel
Apply
Disable
Comment
Copy
Remove

enabled advertised egress local route

Konfigurasi Remote Bindings Di R3

MPLS

LDP Interface | LDP Neighbor | Accept Filter | Advertise Filter | Forwarding Table | MPLS Interface | Local Bindings | Remote Bindings

+ - ✓ ✗ 📄 🏠

	Dst. Address	Label	Nexthop	Peer	Path
A	1.1.1.1	21	192.168.2.1		
A	2.2.2.2	impl-null	192.168.2.1		

Remote Binding <2.2.2.2>

Dst. Address:

Label: ▾

Nexthop:

Peer:

Path:

OK
Cancel
Apply
Disable
Comment
Copy
Remove

enabled active

Hasil Traceroute di R3

Traceroute (Running)

Traceroute To: 1.1.1.1

Packet Size: 56

Timeout: 1000 ms

Protocol: icmp

Port: 33434

Use DNS

Count:

Max Hops:

Src. Address: 3.3.3.3

Interface:

DSCP:

Routing Table:

Start

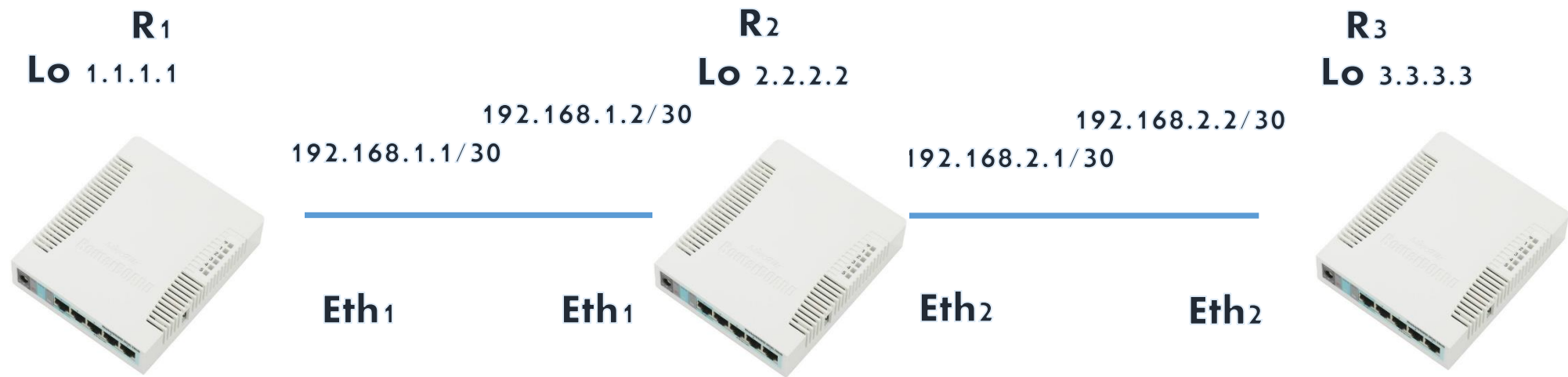
Stop

Close

New Window

Hop	Host	Loss	Sent	Last	Avg.	Best	Worst	Std. Dev.	History	Status
1	192.168.2.1	0.0%	10	0.3ms	0.4	0.3	1.0	0.2		<MPLS:L=21,E=0>
2	1.1.1.1	0.0%	10	0.2ms	0.2	0.2	0.3	0.0		

Lab LDP (Label Distribution Protocol)



Konfigurasi LDP di R1

The screenshot shows the Mikrotik WinBox interface for configuring LDP on interface ether2. The main window displays a table with the following data:

Interface	Hello Interval	Hold Time	Transport Address	Accept Dy...
ether2	00:00:05	00:00:15		yes

The 'LDP Settings' dialog box is open, showing the following configuration:

- Enabled
- LSR ID: 1.1.1.1
- Transport Address: 1.1.1.1
- Path Vector Limit: 255
- Hop Limit: 255
- Loop Detect
- Use Explicit Null
- Distribute For Default Route

Buttons: OK, Cancel, Apply

1 item (1 selected)

Konfigurasi LDP Interface di R1

The screenshot displays the Mikrotik WinBox interface for configuring LDP on a router. The main window is titled 'MPLS' and contains a table of LDP interfaces. A dialog box titled 'MPLS Interface <ether2>' is open, showing the configuration for the 'ether2' interface.

Interface	Hello Interval	Hold Time	Transport Address	Accept Dy...
ether2	00:00:05	00:00:15		yes

MPLS Interface <ether2>

Interface: ether2

Hello Interval: 00:00:05

Hold Time: 00:00:15

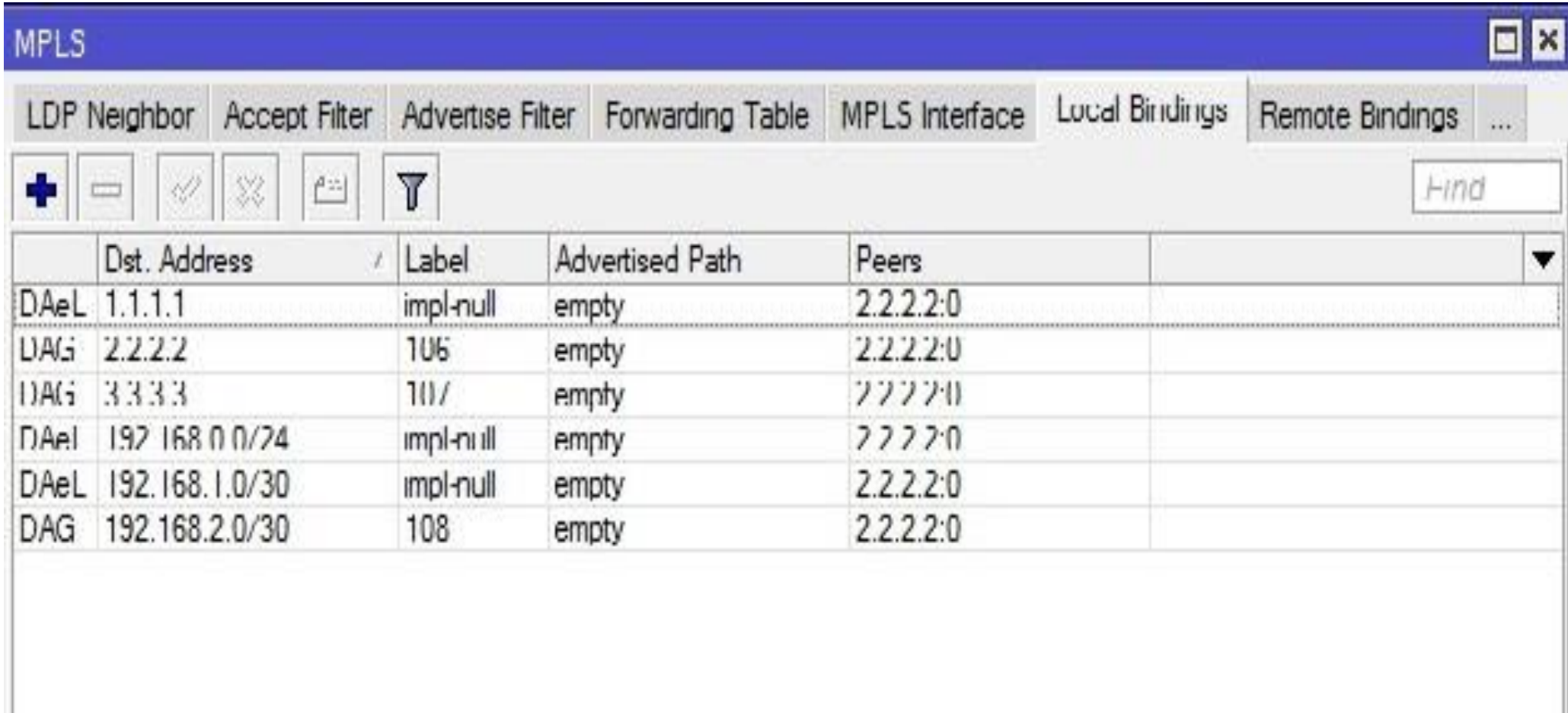
Transport Address: [Empty]

Accept Dynamic Neighbors

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

1 item (1 selected)

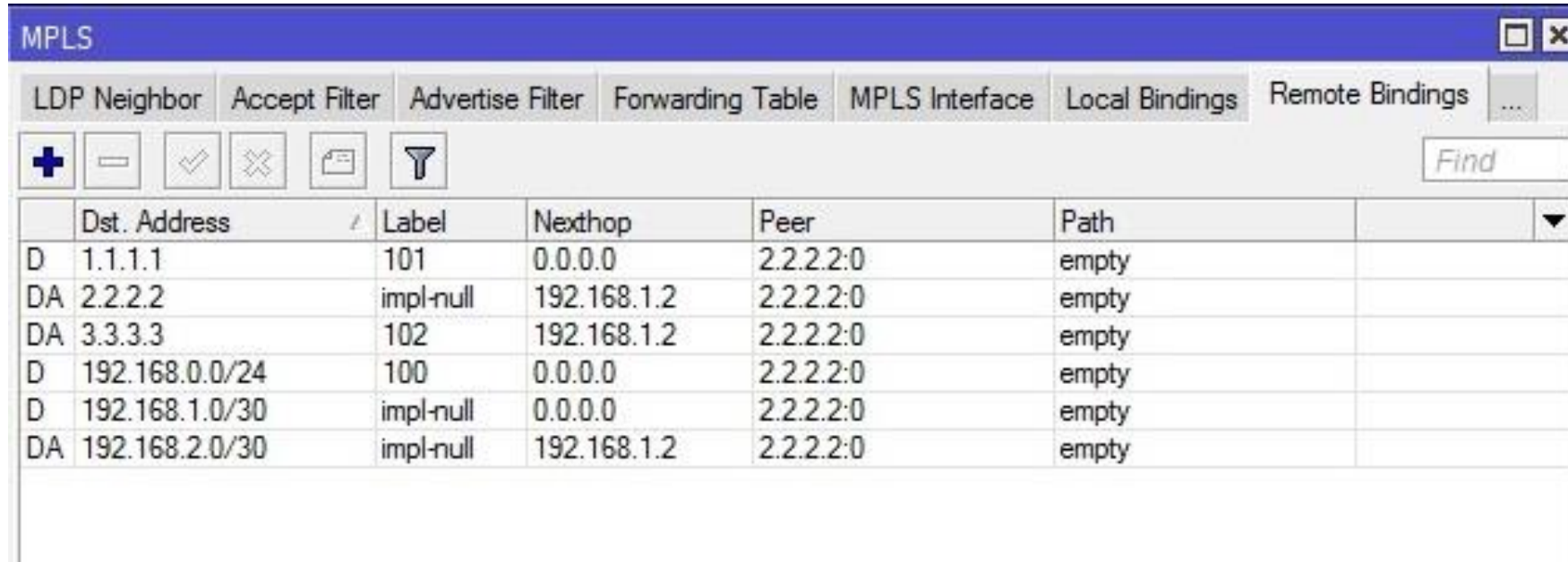
Hasil Local Bindings



The screenshot shows the Mikrotik WinBox interface for MPLS Local Bindings. The window title is 'MPLS'. The navigation tabs include 'LDP Neighbor', 'Accept Filter', 'Advertise Filter', 'Forwarding Table', 'MPLS Interface', 'Local Bindings', and 'Remote Bindings'. The 'Local Bindings' tab is active. Below the tabs is a toolbar with icons for adding (+), removing (-), checking (✓), unchecking (✗), refreshing (refresh icon), and filtering (funnel icon). A search box labeled 'Find' is also present. The main area contains a table with the following data:

	Dst. Address	Label	Advertised Path	Peers	
DAeL	1.1.1.1	impl-null	empty	2.2.2.2:0	
DAG	2.2.2.2	106	empty	2.2.2.2:0	
DAG	3.3.3.3	111	empty	2.2.2.2:0	
DAeL	192.168.0.0/24	impl-null	empty	2.2.2.2:0	
DAeL	192.168.1.0/30	impl-null	empty	2.2.2.2:0	
DAG	192.168.2.0/30	108	empty	2.2.2.2:0	

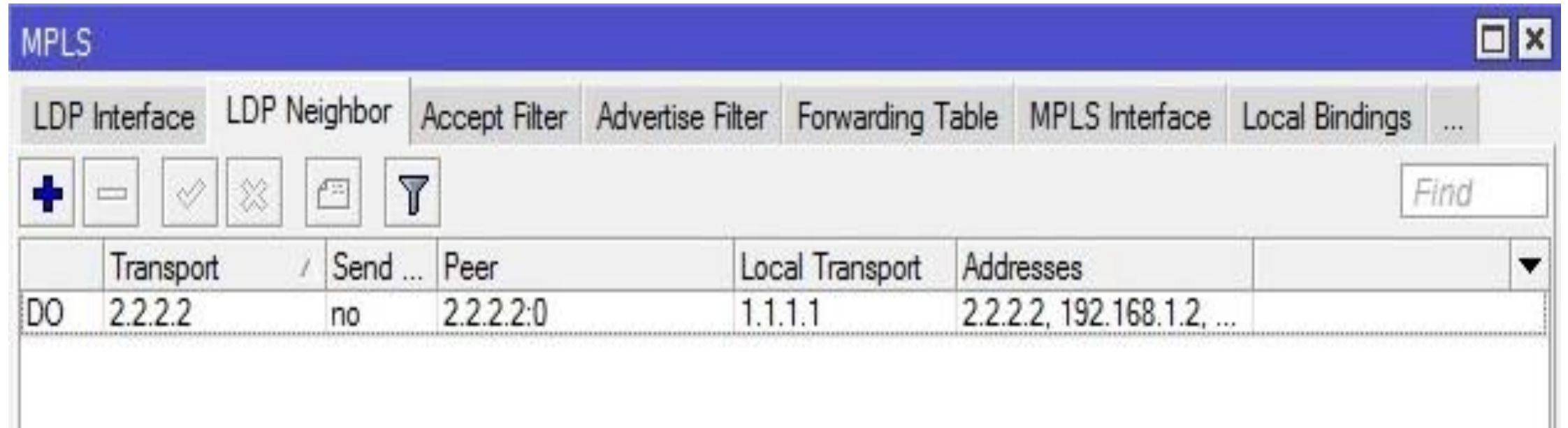
Hasil Remote Bindings



The screenshot shows the Mikrotik WinBox interface for MPLS configuration. The 'Remote Bindings' tab is active, displaying a table of remote bindings. The table has columns for 'Dst. Address', 'Label', 'Nexthop', 'Peer', and 'Path'. The data rows show various destination addresses and their corresponding labels, next hops, and peers.

	Dst. Address	Label	Nexthop	Peer	Path
D	1.1.1.1	101	0.0.0.0	2.2.2.2:0	empty
DA	2.2.2.2	impl-null	192.168.1.2	2.2.2.2:0	empty
DA	3.3.3.3	102	192.168.1.2	2.2.2.2:0	empty
D	192.168.0.0/24	100	0.0.0.0	2.2.2.2:0	empty
D	192.168.1.0/30	impl-null	0.0.0.0	2.2.2.2:0	empty
DA	192.168.2.0/30	impl-null	192.168.1.2	2.2.2.2:0	empty

Hasil LDP Neighbor



The screenshot shows the Mikrotik WinBox interface for MPLS configuration. The 'LDP Neighbor' tab is active. The table below displays the LDP neighbor configuration for interface DO.

	Transport	/	Send ...	Peer	Local Transport	Addresses	
DO	2.2.2.2		no	2.2.2.2:0	1.1.1.1	2.2.2.2, 192.168.1.2, ...	▼

Konfigurasi LDP Interface di R2

MPLS Interface <ether2>

Interface: ether2

Hello Interval: 00:00:05

Hold Time: 00:00:15

Transport Address:

Accept Dynamic Neighbors

OK

Cancel

Apply

Disable

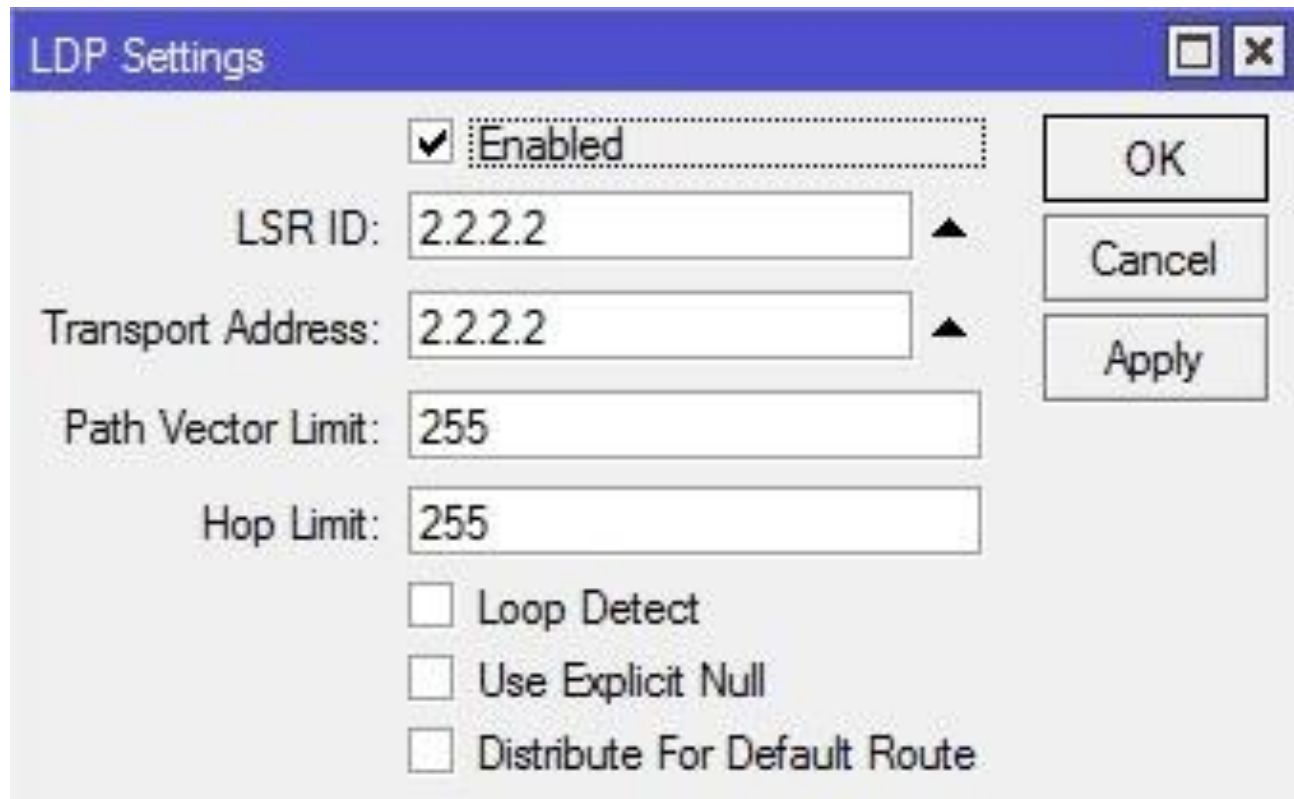
Comment

Copy

Remove

enabled

Konfigurasi LDP di R2



LDP Settings

Enabled

LSR ID: 2.2.2.2 ▲

Transport Address: 2.2.2.2 ▲

Path Vector Limit: 255

Hop Limit: 255

Loop Detect

Use Explicit Null

Distribute For Default Route

OK

Cancel

Apply

Tampilan Local Bindings di R2

MPLS

LDP Interface LDP Neighbor Accept Filter Advertise Filter Forwarding Table MPLS Interface Local Bindings Remote Bindings

+ - ✓ ✗ [icon] [icon]

	Dst. Address	/	Label	Advertised Path	Peers
DAG	1.1.1.1		110	empty	1.1.1.1:0, 3.3.3.3:0
DAeL	2.2.2.2		impl-null	empty	1.1.1.1:0, 3.3.3.3:0
DAG	3.3.3.3		111	empty	1.1.1.1:0, 3.3.3.3:0
DAG	192.168.0.0/24		109	empty	1.1.1.1:0, 3.3.3.3:0
DAeL	192.168.1.0/30		impl-null	empty	1.1.1.1:0, 3.3.3.3:0
DAeL	192.168.2.0/30		impl-null	empty	1.1.1.1:0, 3.3.3.3:0

Tampilan Remote Bindings di R2

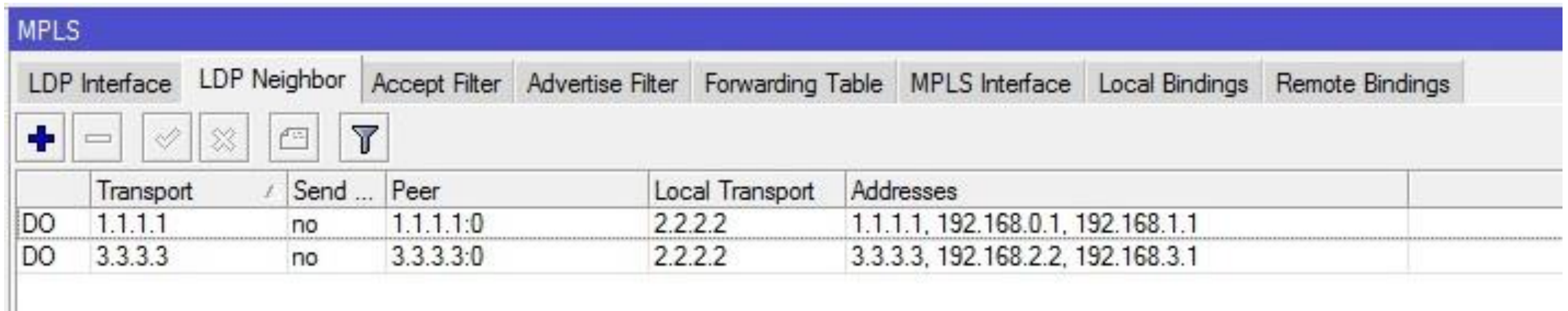
MPLS

LDP Interface | LDP Neighbor | Accept Filter | Advertise Filter | Forwarding Table | MPLS Interface | Local Bindings | Remote Bindings

+ - ✓ ✗ 📄 🔍

	Dst. Address	Label	Nexthop	Peer	Path	
DA	1.1.1.1	impl-null	192.168.1.1	1.1.1.1:0	empty	
D	1.1.1.1	106	0.0.0.0	3.3.3.3:0	empty	
D	2.2.2.2	115	0.0.0.0	1.1.1.1:0	empty	
D	2.2.2.2	105	0.0.0.0	3.3.3.3:0	empty	
D	3.3.3.3	116	0.0.0.0	1.1.1.1:0	empty	
DA	3.3.3.3	impl-null	192.168.2.2	3.3.3.3:0	empty	
DA	192.168.0.0/24	impl-null	192.168.1.1	1.1.1.1:0	empty	
D	192.168.0.0/24	107	0.0.0.0	3.3.3.3:0	empty	
D	192.168.1.0/30	impl-null	0.0.0.0	1.1.1.1:0	empty	
D	192.168.1.0/30	104	0.0.0.0	3.3.3.3:0	empty	
D	192.168.2.0/30	117	0.0.0.0	1.1.1.1:0	empty	
D	192.168.2.0/30	impl-null	0.0.0.0	3.3.3.3:0	empty	

Tampilan LDP Neighbor



	Transport	Send ...	Peer	Local Transport	Addresses
DO	1.1.1.1	no	1.1.1.1:0	2.2.2.2	1.1.1.1, 192.168.0.1, 192.168.1.1
DO	3.3.3.3	no	3.3.3.3:0	2.2.2.2	3.3.3.3, 192.168.2.2, 192.168.3.1

Konfigurasi LDP Interface di R 3

MPLS Interface <ether3>

Interface: ether3

Hello Interval: 00:00:05

Hold Time: 00:00:15

Transport Address:

Accept Dynamic Neighbors

OK

Cancel

Apply

Disable

Comment

Copy

Remove

enabled

Konfigurasi LDP di R3

LDP Settings

Enabled

LSR ID: 3.3.3.3 ▲

Transport Address: 3.3.3.3 ▲

Path Vector Limit: 255

Hop Limit: 255

Loop Detect

Use Explicit Null

Distribute For Default Route

OK

Cancel

Apply

Tampilan Local Bindings di R3

MPLS

LDP Interface LDP Neighbor Accept Filter Advertise Filter Forwarding Table MPLS Interface Local Bindings Remote Bindings

+ - ✓ ✗ 📄 🗑️

	Dst. Address	/	Label	Advertised Path	Peers
DAG	1.1.1.1		118	empty	2.2.2.2:0
DAG	2.2.2.2		117	empty	2.2.2.2:0
DAeL	3.3.3.3		impl-null	empty	2.2.2.2:0
DAG	192.168.0.0/24		119	empty	2.2.2.2:0
DAG	192.168.1.0/30		116	empty	2.2.2.2:0
DAeL	192.168.2.0/30		impl-null	empty	2.2.2.2:0

Tampilan Remote Bindings di R3

MPLS

LDP Interface | LDP Neighbor | Accept Filter | Advertise Filter | Forwarding Table | MPLS Interface | Local Bindings | Remote Bindings

+ - ✓ ✗ ☰ ⏏

	Dst. Address	Label	Nexthop	Peer	Path
DA	1.1.1.1	110	192.168.2.1	2.2.2.2:0	empty
DA	2.2.2.2	impl-null	192.168.2.1	2.2.2.2:0	empty
D	3.3.3.3	111	0.0.0.0	2.2.2.2:0	empty
DA	192.168.0.0/24	109	192.168.2.1	2.2.2.2:0	empty
DA	192.168.1.0/30	impl-null	192.168.2.1	2.2.2.2:0	empty
D	192.168.2.0/30	impl-null	0.0.0.0	2.2.2.2:0	empty

Tampilan LDP Neighbor di R3

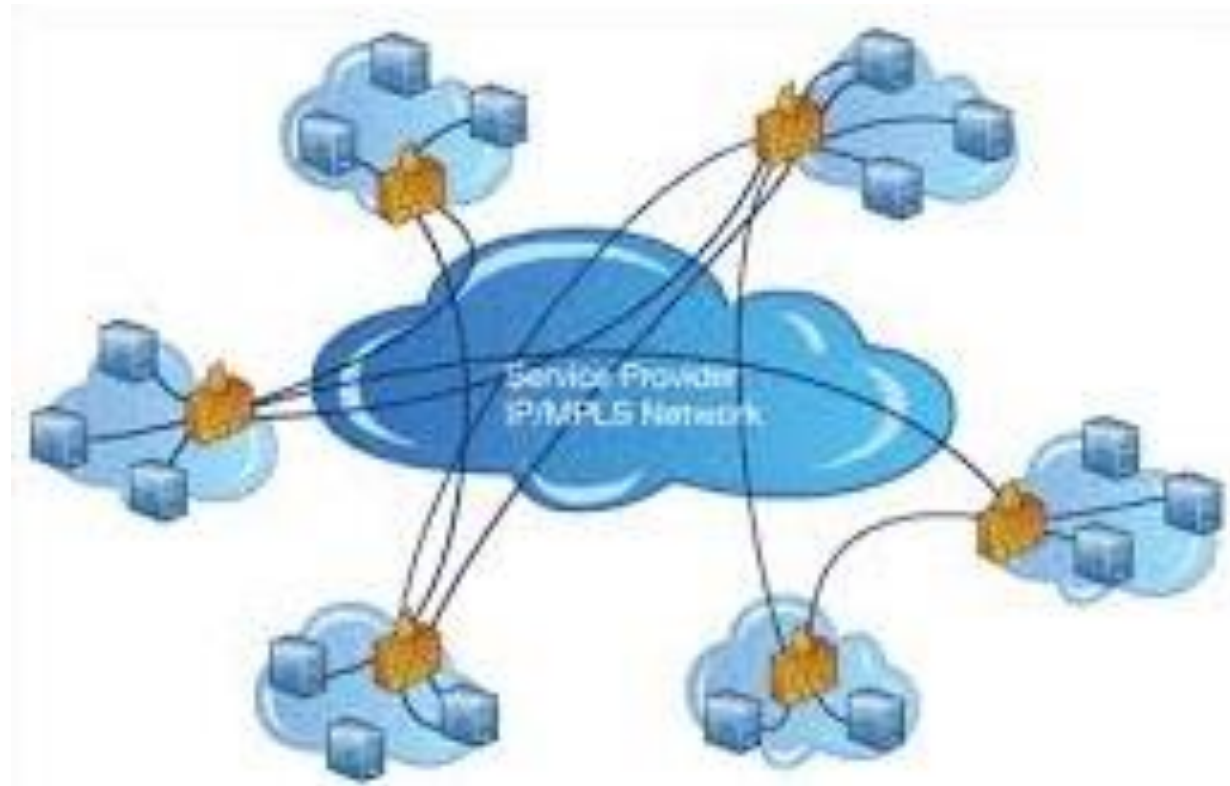
MPLS

LDP Interface LDP Neighbor Accept Filter Advertise Filter Forwarding Table MPLS Interface Local Bindings Remote Bindings

+ - ✓ ✗ 📄 🔍

	Transport	Send ...	Peer	Local Transport	Addresses
DO	2.2.2.2	no	2.2.2.2:0	3.3.3.3	2.2.2.2, 192.168.1.2, ...

Lab Lanjutan



- Penerapan yang lebih advanced dapat menggunakan **L3VPN** atau **L2VPN (VPLS)**



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