



The Magic of IP Flow

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Citraweb Nusa Infomedia

on Mikrotik User Meeting, Krakow

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Introduction

- Name: Valens Riyadi
- Country: Indonesia
 - Graduated as Architect 1998
 - 1998 Web developer
 - 2001 Make a WISP
 - 2002 Mikrotik Reseller
 - Photographer
 - Administrator of www.fotografer.net
 - Head of Security Dept, Indonesian ISP Association
 - Volunteer for Airputih Foundation, IT Emergency Task Force
 - Steering Committee for ID-SIRTII
Indonesia Security Incident Response Team on Information Infrastructure
 - Mikrotik Certified Consultant





My Company

- Citraweb Nusa Infomedia
 - Web Developer (since 2000)
 - Small ISP (since 2001)
 - Mikrotik Reseller (since 2002)
- Located at : Yogyakarta Indonesia
- Using RouterOS since 2.3.15

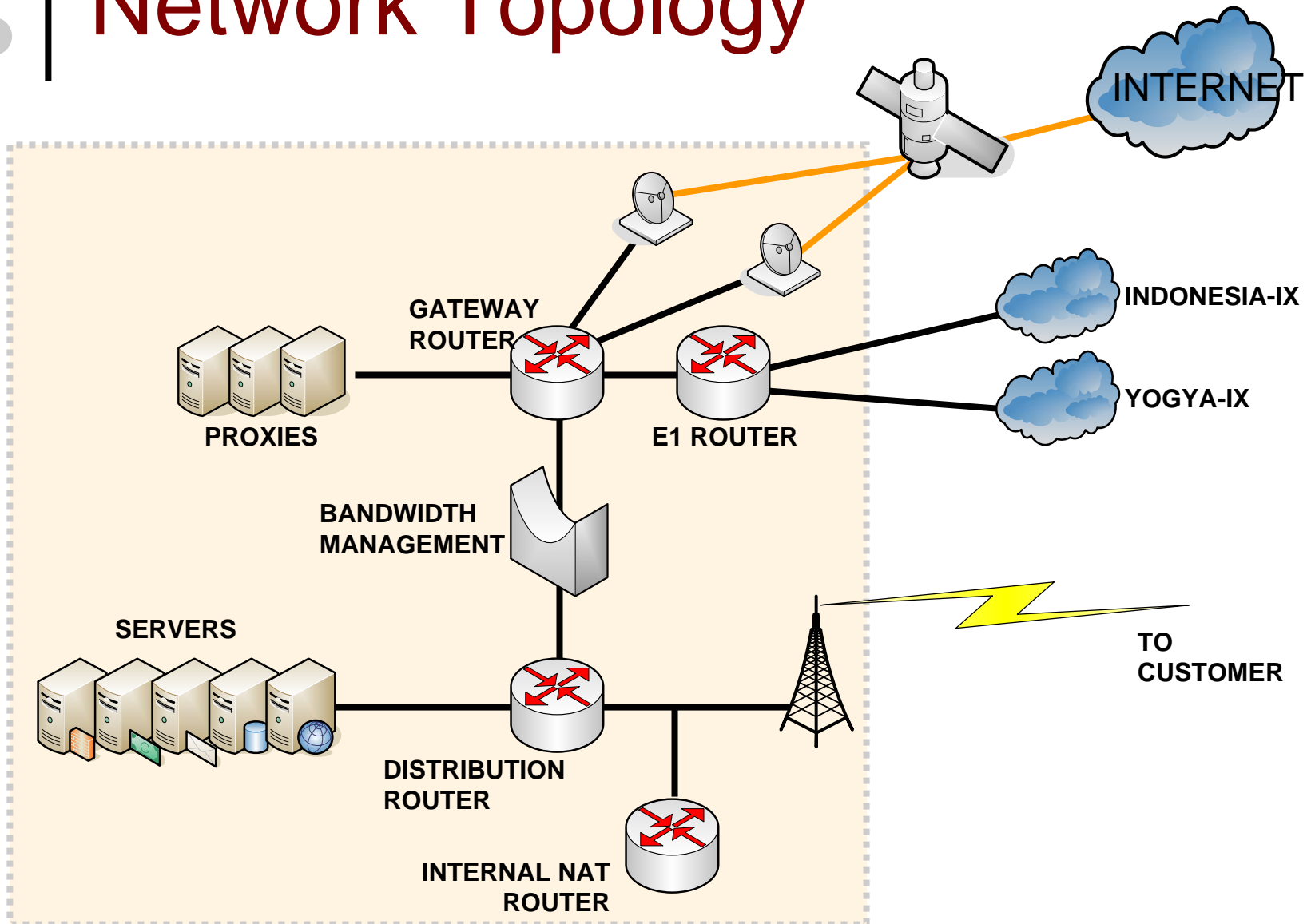
Yogyakarta City

- 3,4 million of population
 - Tourism City
 - Student City
 - Almost 50% of population are students from other cities.
 - Finally Cyber café City



A view of the Prambanan Hindu temple complex in Yogyakarta. The temple features several tall, ornate spires and is surrounded by lush greenery. The sky is blue with some clouds.

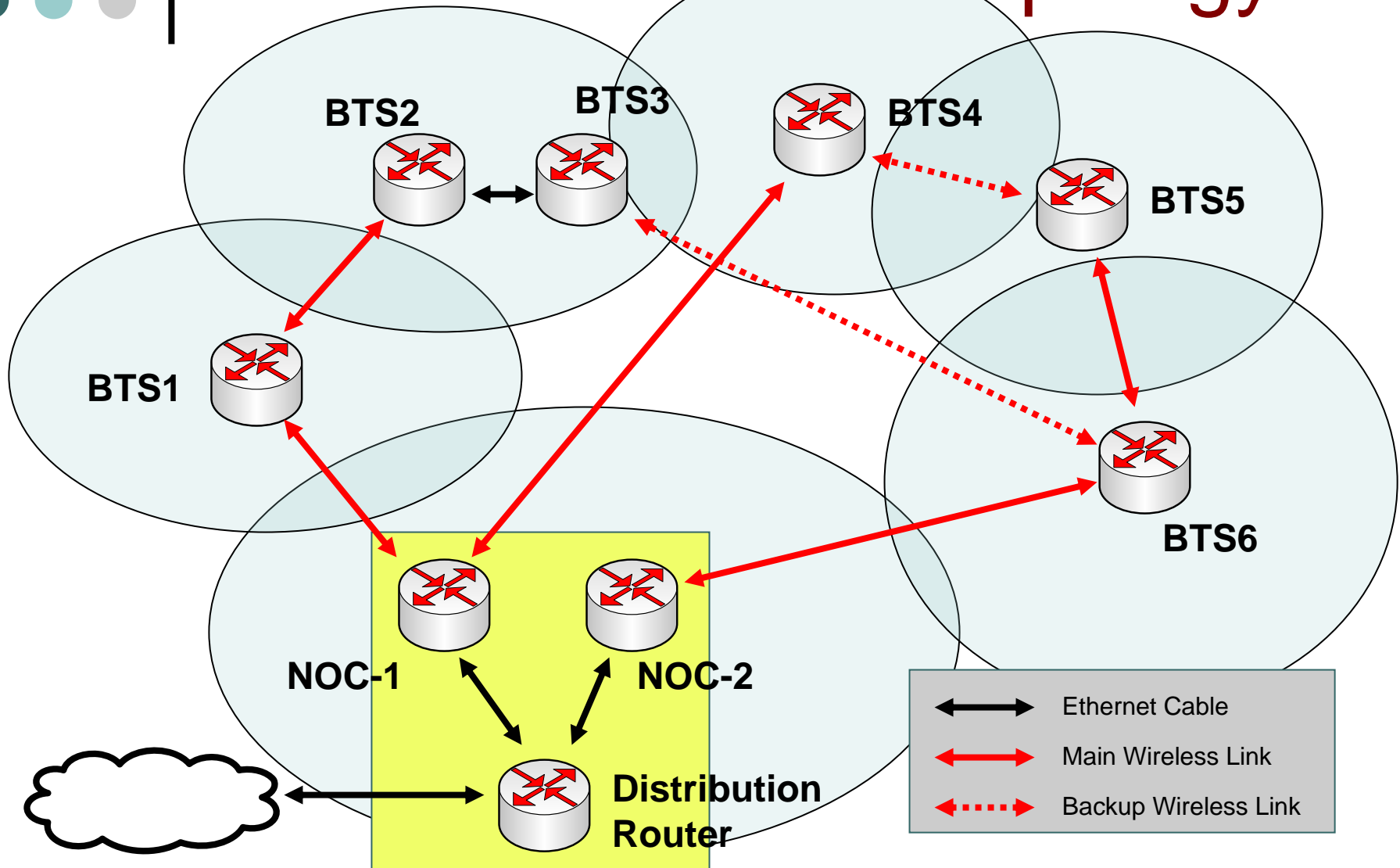
Network Topology



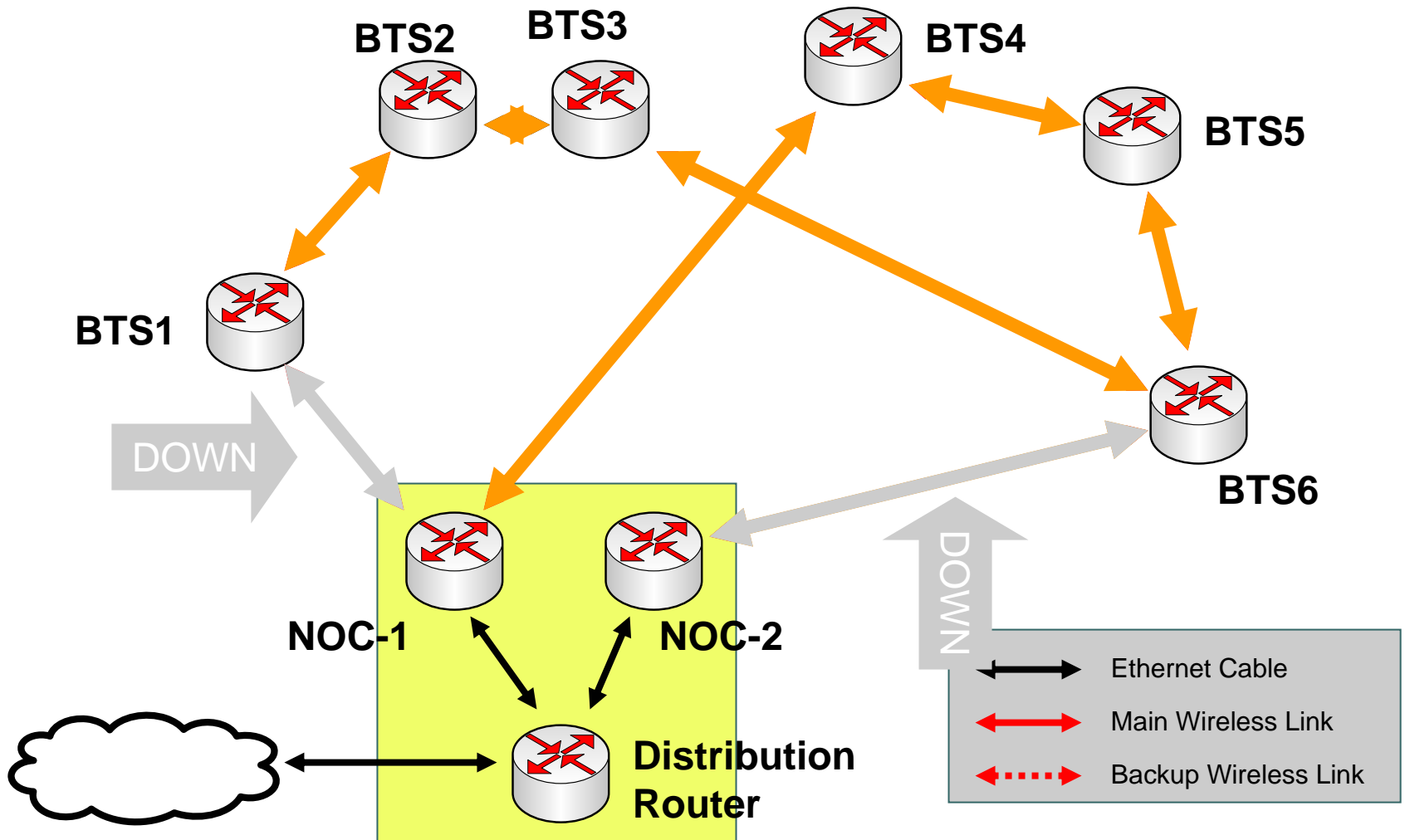
Wireless Instalation



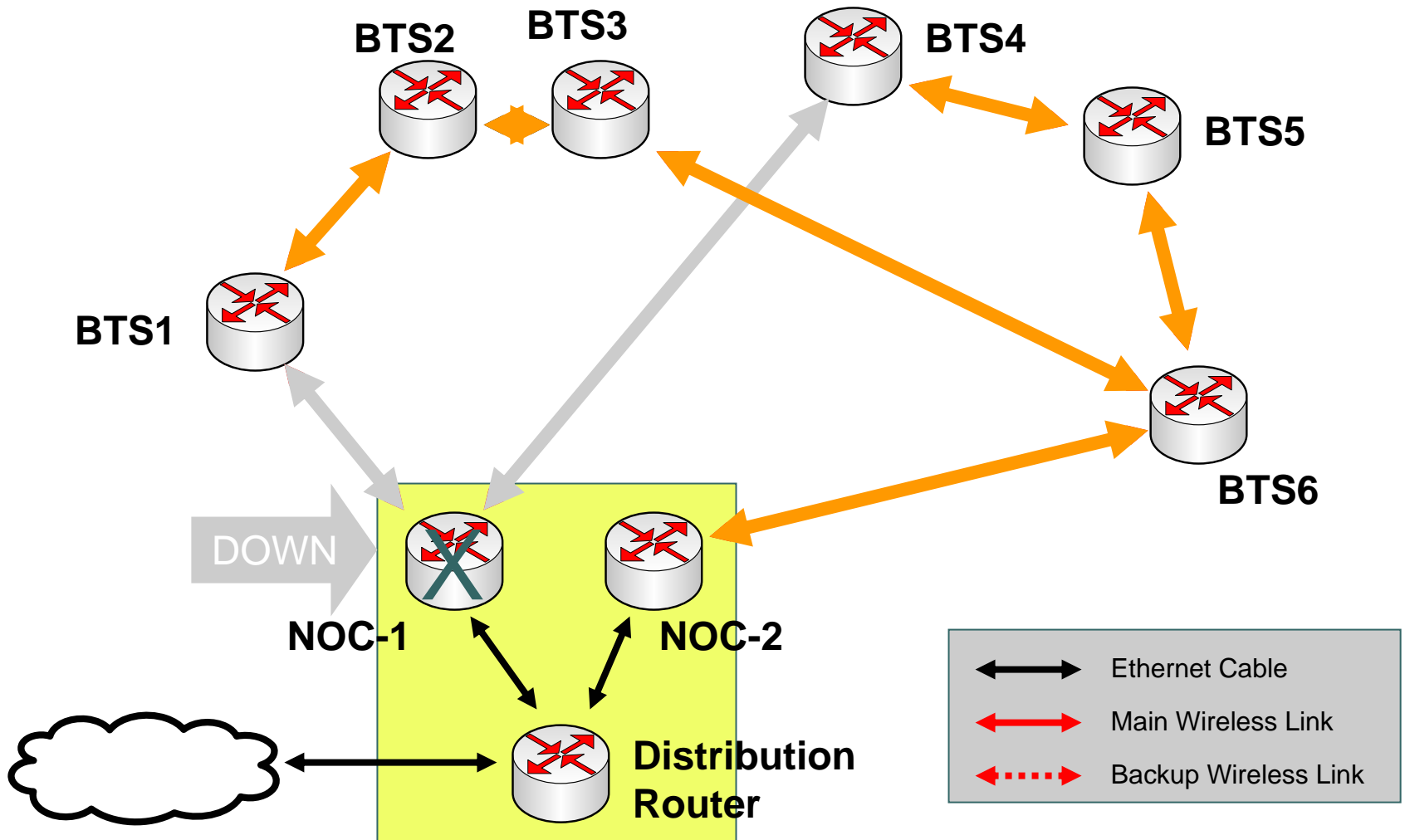
Wireless Network Topology



Fail Over Scenario (1)



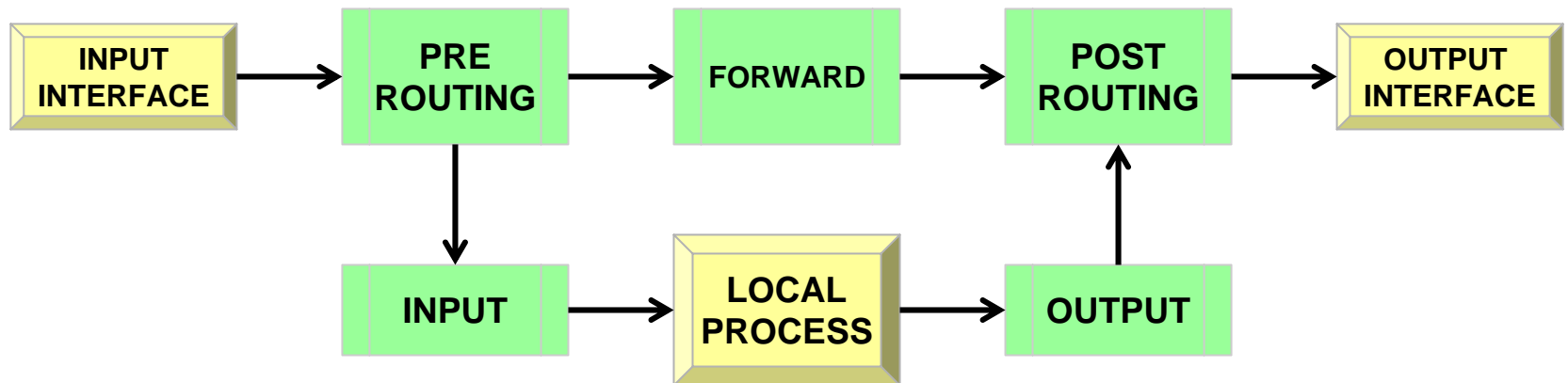
Fail Over Scenario (2)





The Basic of IP Flow

IP Flow (simple diagram)



PREROUTING
 Hotspot Input
 Conn-Tracking
 Mangle
 Dst-NAT
 Global-In Queue
 Global-Total Queue

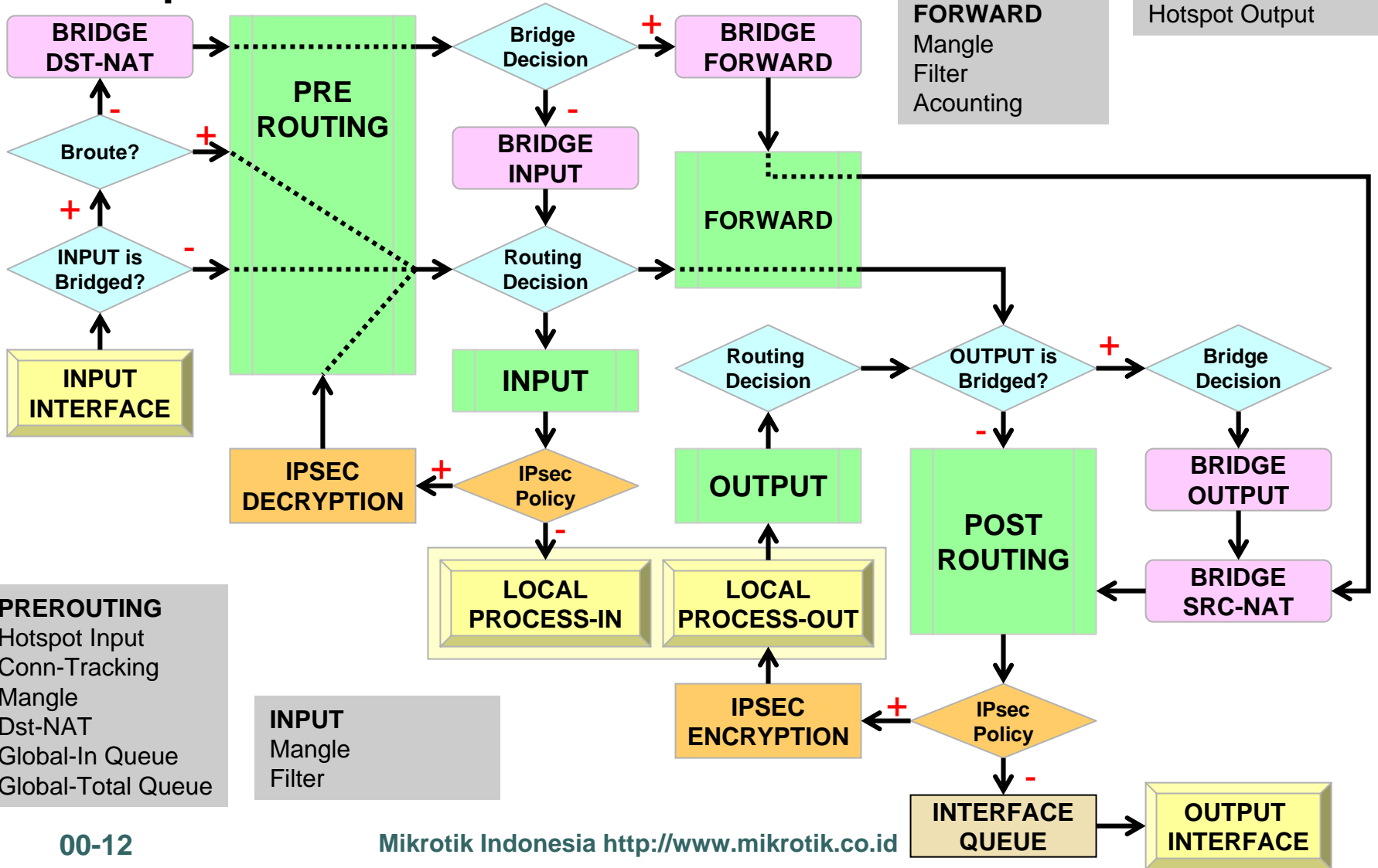
INPUT
 Mangle
 Filter

FORWARD
 Mangle
 Filter
 Accounting

OUTPUT
 Conn-Tracking
 Mangle
 Filter

POSTROUTING
 Mangle
 Global-Out Queue
 Global-Total Queue
 Source-NAT
 Hotspot Output

IP Flow



OUTPUT
Conn-Tracking
Mangle
Filter

FORWARD
Mangle
Filter
Accounting

POSTROUTING
Mangle
Global-Out Queue
Global-Total Queue
Source-NAT
Hotspot Output

PREROUTING
Hotspot Input
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Dst-NAT
Global-In Queue
Global-Total Queue

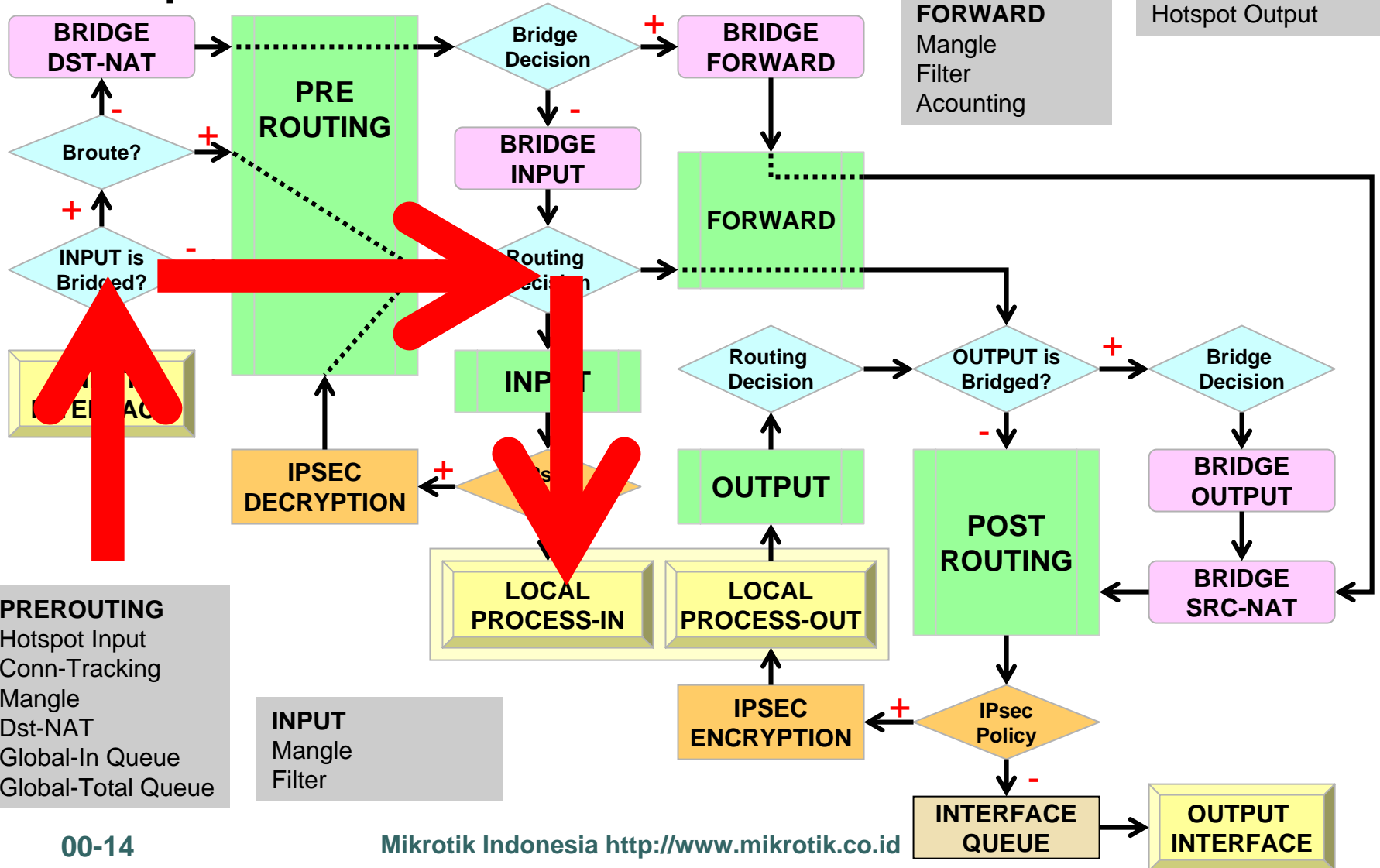
INPUT
Mangle
Filter



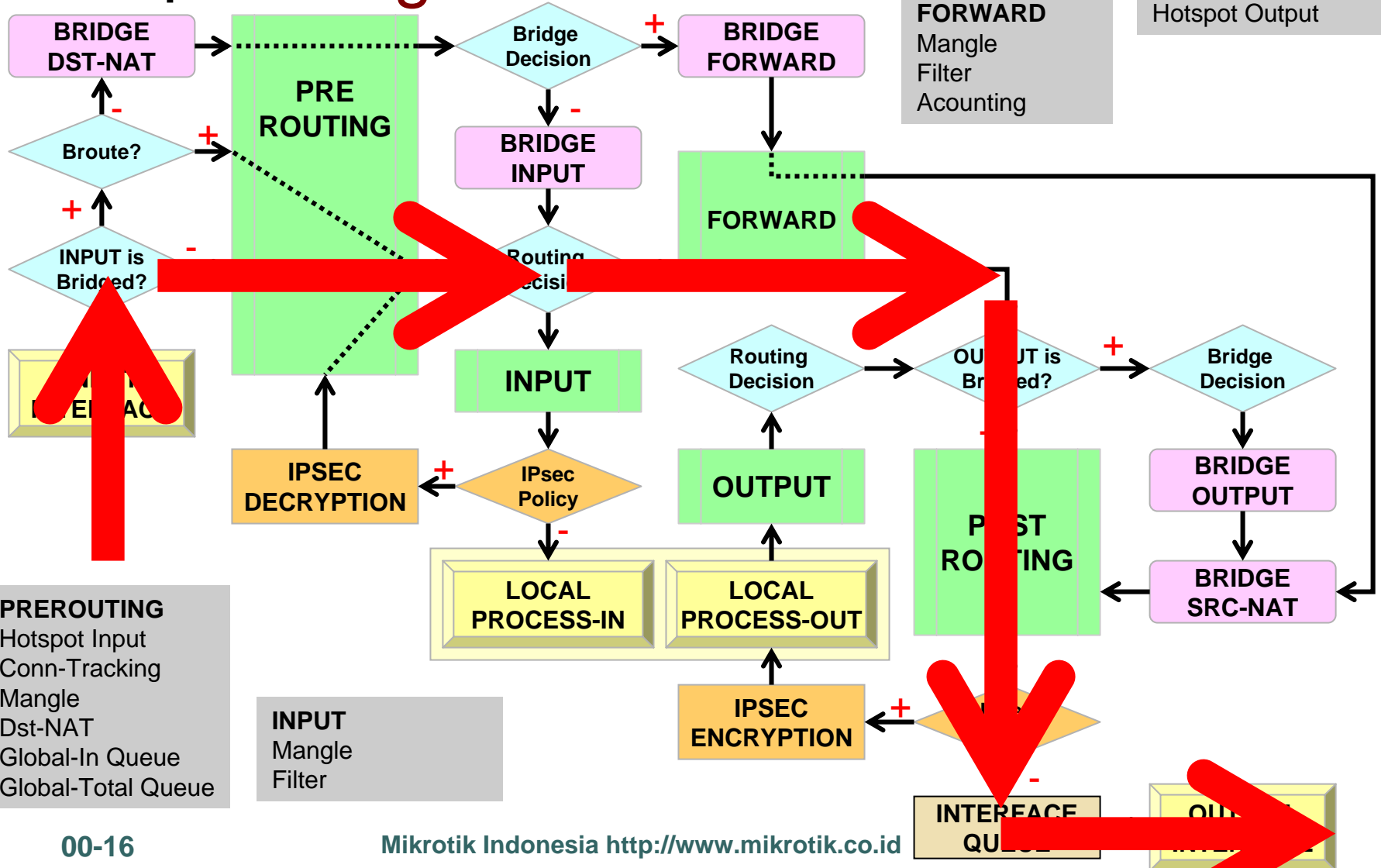
From – To Traffic?

- For each data packet, you have to know:
 - Source of packet
 - From outside
 - From local Process
 - Destination of packet
 - To Local Process
 - To outside

Routed Traffic To Router



Routed Traffic Through Router



OUTPUT
Conn-Tracking
Mangle
Filter

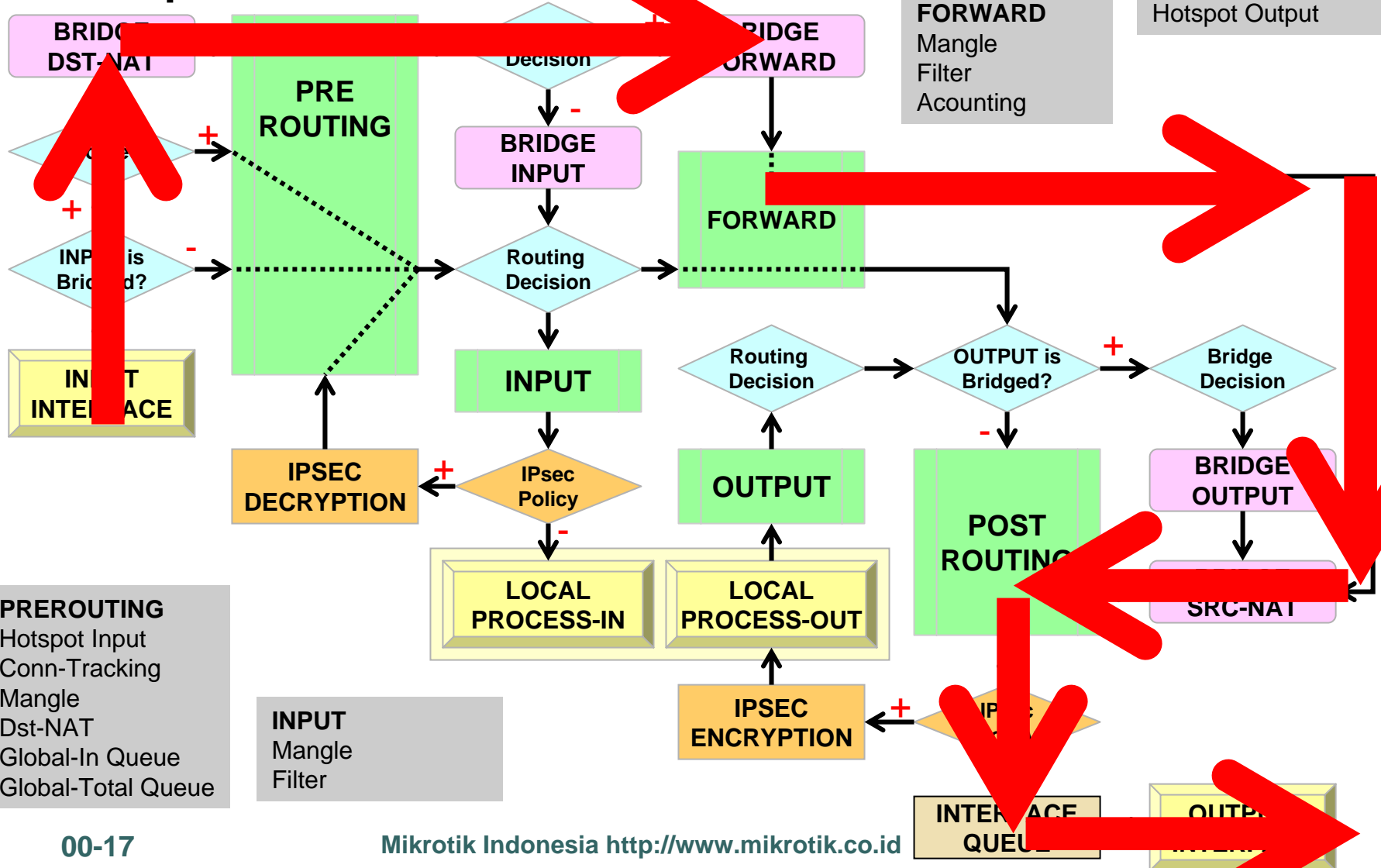
POSTROUTING
Mangle
Global-Out Queue
Global-Total Queue
Source-NAT
Hotspot Output

FORWARD
Mangle
Filter
Accounting

PREROUTING
Hotspot Input
Conn-Tracking
Mangle
Dst-NAT
Global-In Queue
Global-Total Queue

INPUT
Mangle
Filter

Bridge Traffic Through Router



- OUTPUT**
- Conn-Tracking
 - Mangle
 - Filter

- POSTROUTING**
- Mangle
 - Global-Out Queue
 - Global-Total Queue
 - Source-NAT
 - Hotspot Output

- FORWARD**
- Mangle
 - Filter
 - Accounting

- PREROUTING**
- Hotspot Input
 - Conn-Tracking
 - Mangle
 - Dst-NAT
 - Global-In Queue
 - Global-Total Queue

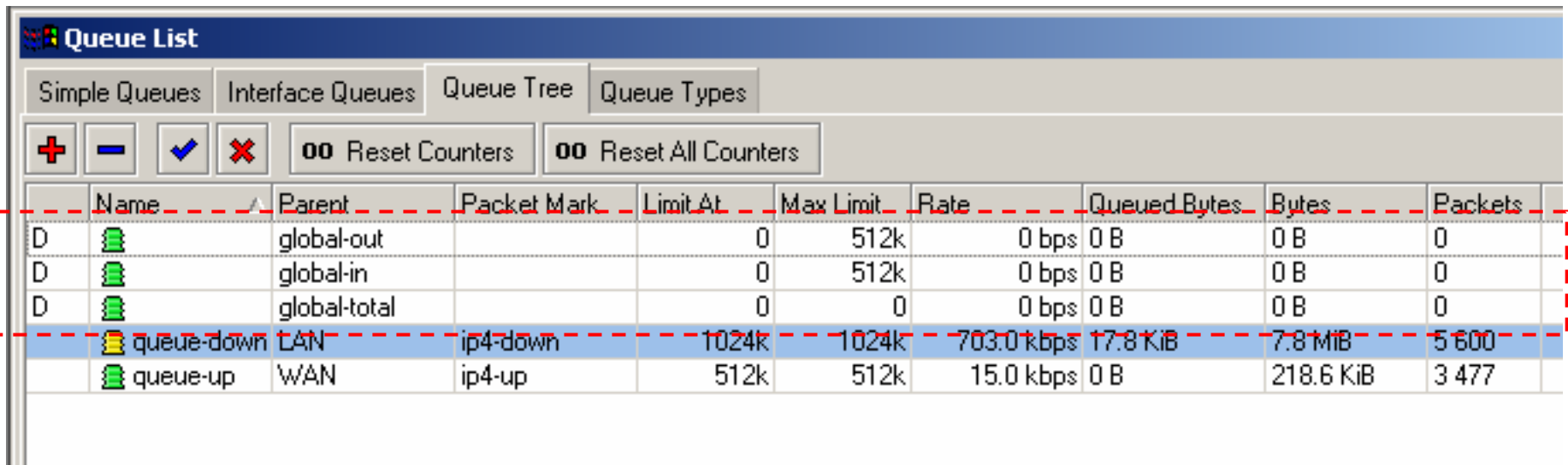
- INPUT**
- Mangle
 - Filter

Chain Position

From	To	Mangle	Firewall	Queue
Outside	Router / Local process	Prerouting		Global-in
		Input	Input	Global-Total
Router/ Local process	Outside	Output	Output	Global-Out
		Postrouting		Global-Total
				Interface
Outside	Outside	Prerouting		Global-in
		Forward	Forward	Global-out
		Postrouting		Global-total
				Interface

Simple Queue

- Simple Queue is located at Global-In and Global-Out.... and also at Global Total



The screenshot shows the Mikrotik WinBox interface for the Queue List. The title bar reads "Queue List". Below the title bar are four tabs: "Simple Queues", "Interface Queues", "Queue Tree", and "Queue Types". Underneath the tabs are several control buttons: a red plus sign, a blue minus sign, a blue checkmark, a red X, a button labeled "Reset Counters", and a button labeled "Reset All Counters". The main area contains a table with the following columns: Name, Parent, Packet Mark, Limit At, Max Limit, Rate, Queued Bytes, Bytes, and Packets. The table lists five queues. The first three are "global-out", "global-in", and "global-total", all with a parent of "global-out", "global-in", and "global-total" respectively, and a limit of 0. The fourth queue is "queue-down" with a parent of "LAN", packet mark "ip4-down", limit at "1024k", max limit "1024k", rate "703.0 kbps", queued bytes "17.8 KiB", bytes "7.8 MiB", and packets "5600". The fifth queue is "queue-up" with a parent of "WAN", packet mark "ip4-up", limit at "512k", max limit "512k", rate "15.0 kbps", queued bytes "0 B", bytes "218.6 KiB", and packets "3477". The "queue-down" row is highlighted in blue and has a red dashed border around it.

Name	Parent	Packet Mark	Limit At	Max Limit	Rate	Queued Bytes	Bytes	Packets
D	global-out		0	512k	0 bps	0 B	0 B	0
D	global-in		0	512k	0 bps	0 B	0 B	0
D	global-total		0	0	0 bps	0 B	0 B	0
queue-down	LAN	ip4-down	1024k	1024k	703.0 kbps	17.8 KiB	7.8 MiB	5600
queue-up	WAN	ip4-up	512k	512k	15.0 kbps	0 B	218.6 KiB	3477



Mangle & Simple Queue

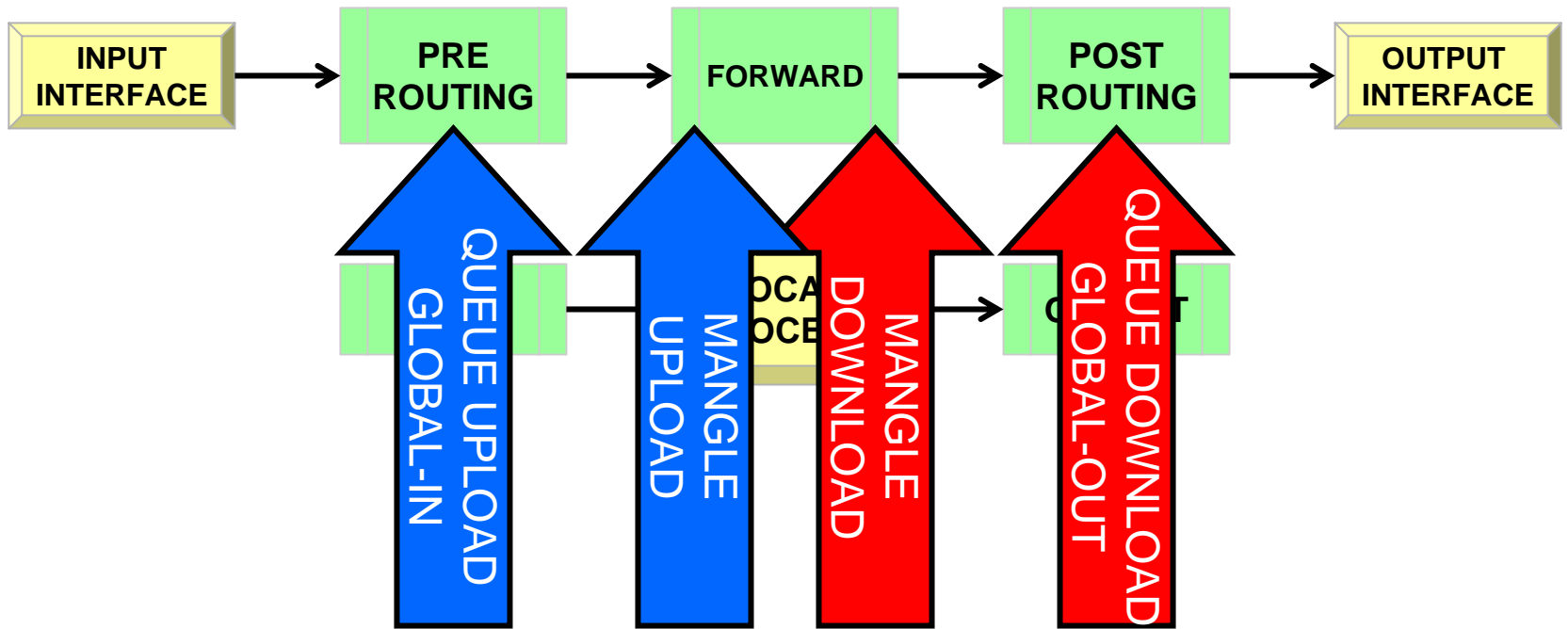
○ Mangle

- chain=forward in-interface=LAN
src-address=192.168.0.4 action=mark-packet
new-packet-mark=client passthrough=no
- chain=forward out-interface=LAN
dst-address=192.168.0.4 action=mark-packet
new-packet-mark=client passthrough=no

○ Simple Queue

- name="queue1" interface=all parent=none
packet-marks=client direction=both
max-limit=512000/512000

IP Flow (simple diagram)



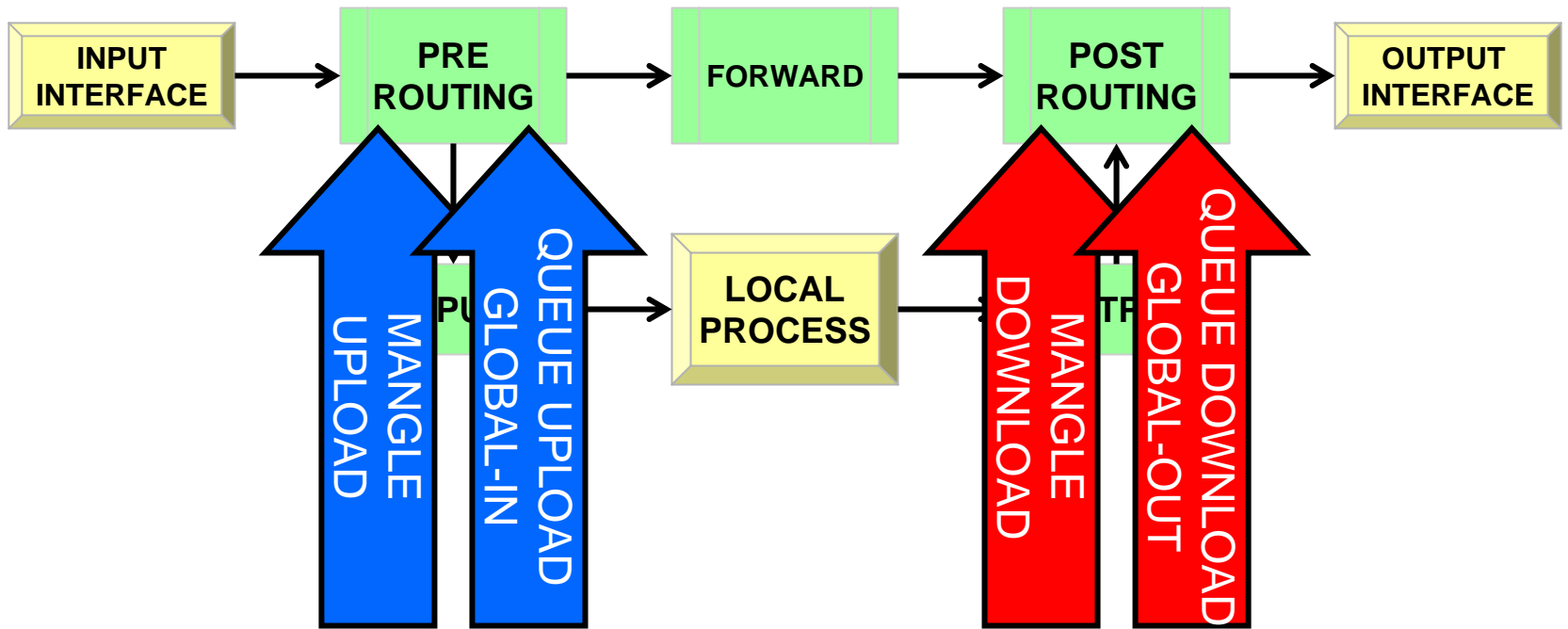
PREROUTING Hotspot Input Conn-Tracking Mangle Dst-NAT Global-In Queue Global-Total Queue	INPUT Mangle Filter	FORWARD Mangle Filter Accounting	OUTPUT Conn-Tracking Mangle Filter	POSTROUTING Mangle Global-Out Queue Global-Total Queue Source-NAT Hotspot Output
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Mangle & Simple Queue

- This sample :
 - will work for download limiting
 - **will not work for upload limiting**
 - because mangle will be done after simple queue process
 - mangle : chain=forward
 - simple queue → global-in (prerouting)
 - mangle should be in prerouting (for upload) and postrouting (for download)

IP Flow (simple diagram)



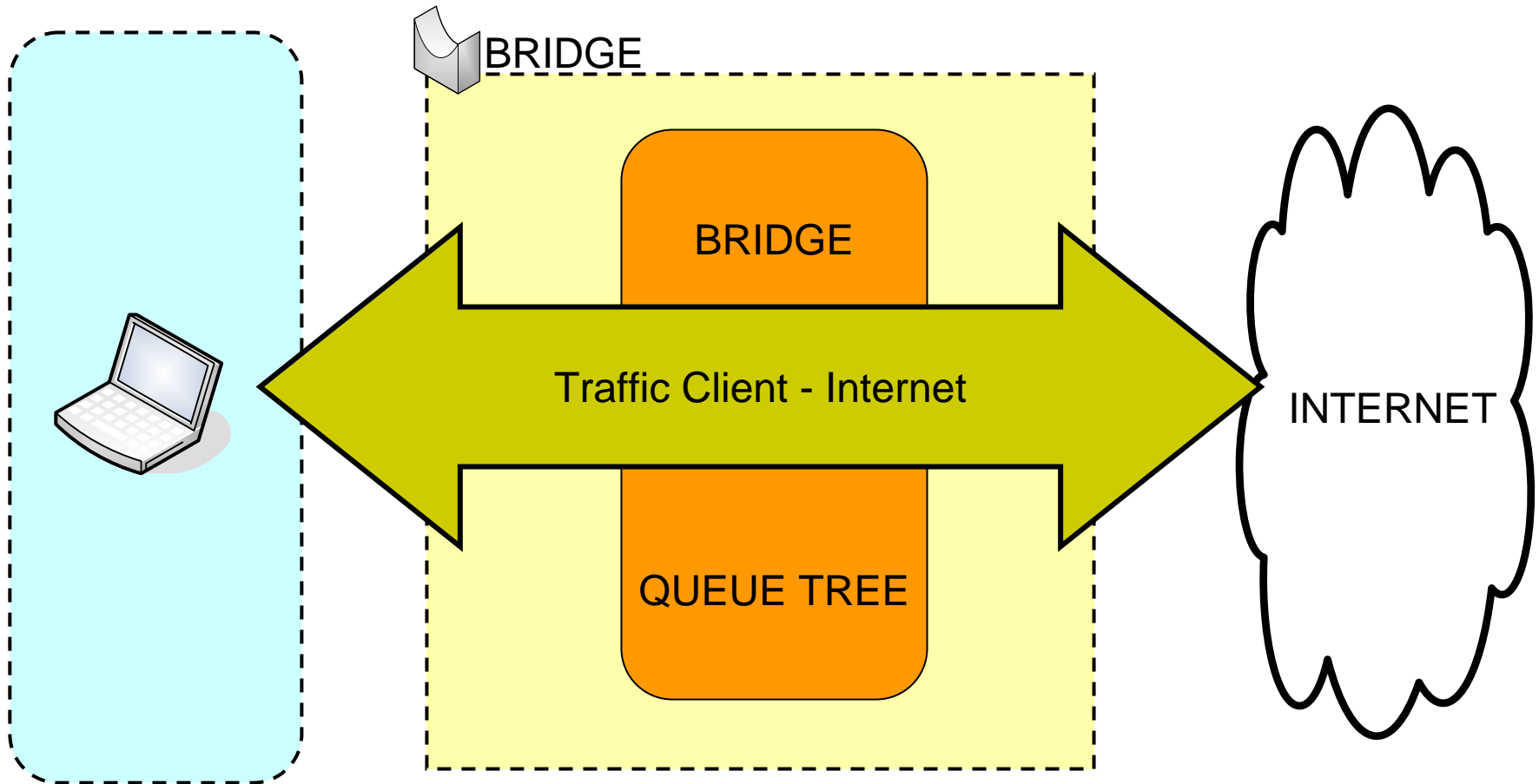
PREROUTING Hotspot Input Conn-Tracking Mangle Dst-NAT Global-In Queue Global-Total Queue	INPUT Mangle Filter	FORWARD Mangle Filter Accounting	OUTPUT Conn-Tracking Mangle Filter	POSTROUTING Mangle Global-Out Queue Global-Total Queue Source-NAT Hotspot Output
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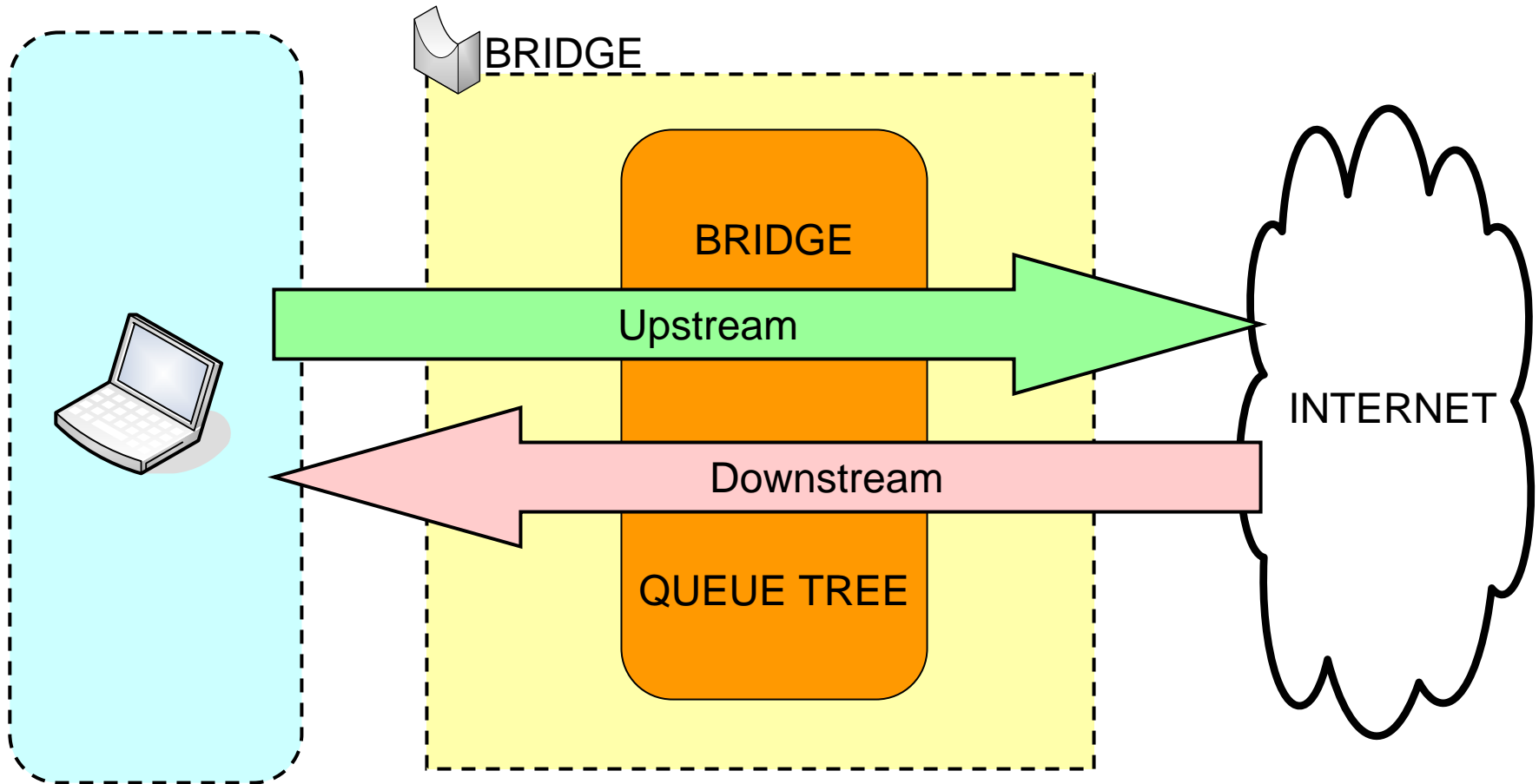
Test Case (1)

Transparent
Bandwidth Management

Queue with Bridge



Queue with Bridge





Interface Setup

```
[admin@MikroTik] > in pr
```

```
Flags: X - disabled, D - dynamic, R - running
```

#	Name	Type	RX-RATE	TX-RATE	MTU
0	R LAN	ether	0	0	1500
1	R WAN	ether	0	0	1500
2	R bridge1	bridge	0	0	1500

```
[admin@MikroTik] interface bridge port> pr
```

```
Flags: X - disabled, I - inactive, D - dynamic
```

#	INTERFACE	BRIDGE	PRIORITY	PATH-COST
0	WAN	bridge1	128	10
1	LAN	bridge1	128	10



Mangle Setup

```
[admin@MikroTik] > ip firewall mangle print
```

```
Flags: X - disabled, I - invalid, D - dynamic
```

```
0 chain=prerouting in-interface=LAN
```

```
src-address=192.168.0.0/24 action=mark-packet
```

```
new-packet-mark=data-up passthrough=no
```

```
1 chain=postrouting out-interface=LAN
```

```
dst-address=192.168.0.0/24 action=mark-packet
```

```
new-packet-mark=data-down passthrough=no
```

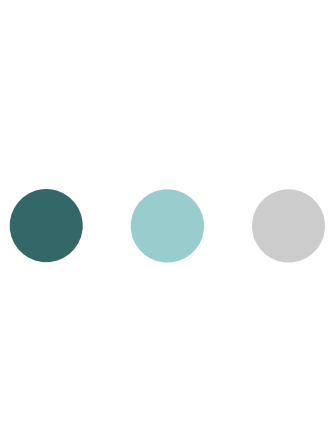


Queue Tree Setup

```
[admin@MikroTik] > queue tree print
```

```
Flags: X - disabled, I - invalid
```

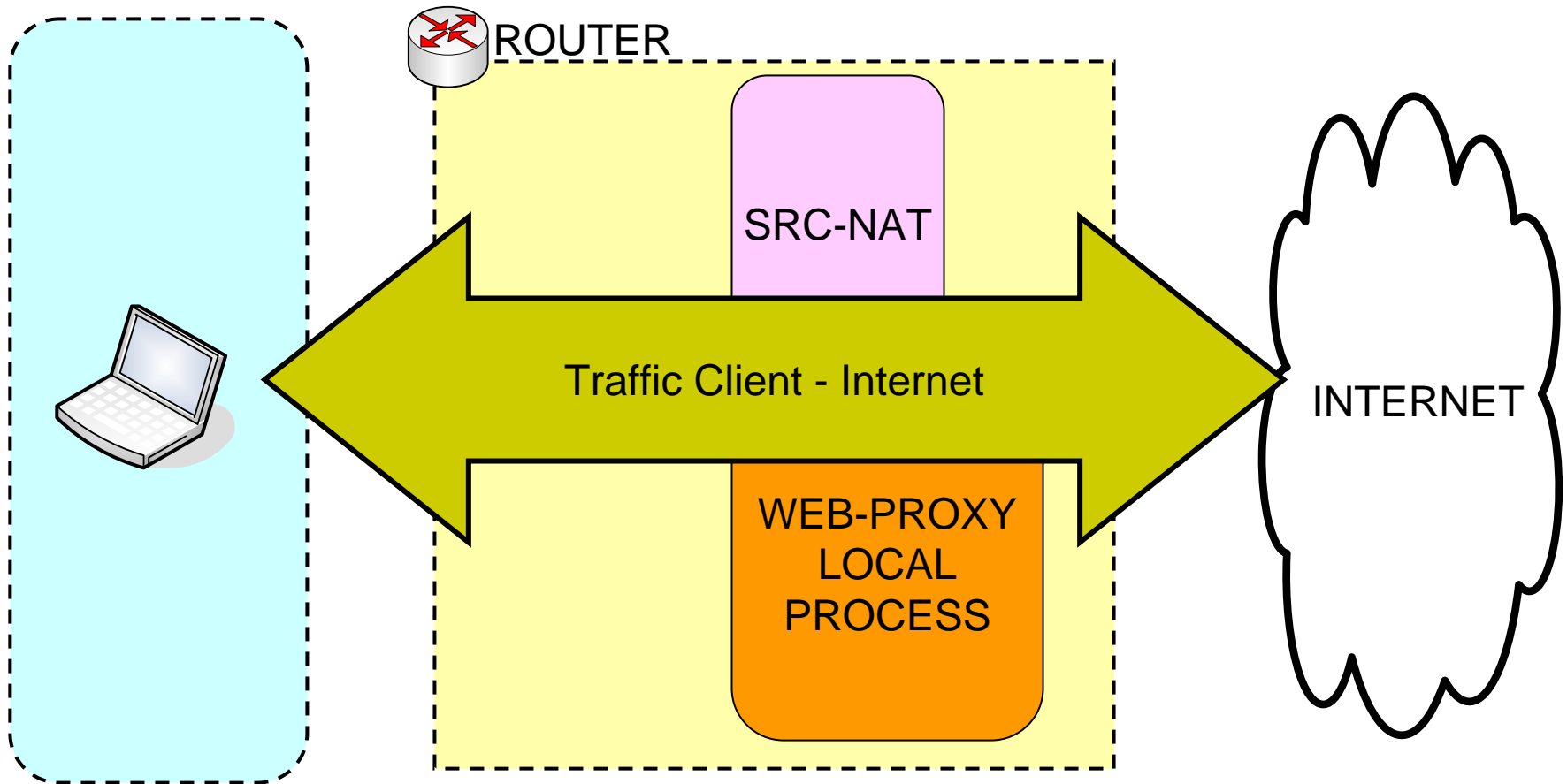
```
0 name="queue-up" parent=WAN  
  packet-mark=data-up limit-at=512000  
  queue=default priority=8 max-limit=512000  
  burst-limit=0 burst-threshold=0 burst-time=0s  
1 name="queue-down" parent=LAN  
  packet-mark=data-down limit-at=1024000  
  queue=default priority=8 max-limit=1024000  
  burst-limit=0 burst-threshold=0 burst-time=0s
```



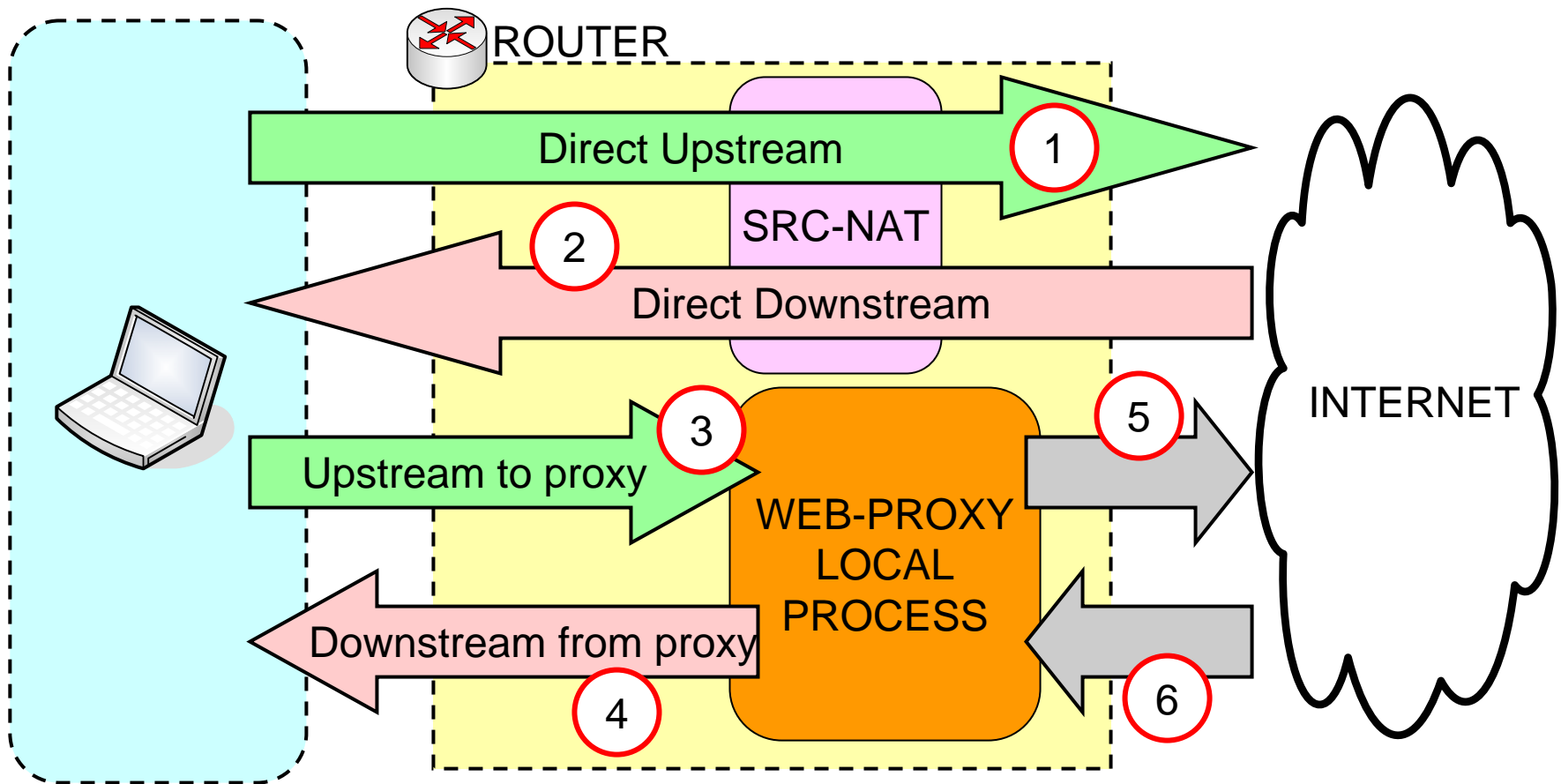
Test Case (2)

Queue with
Src-NAT and Internal Proxy

Queue with SRC-NAT & Internal Proxy



Queue with SRC-NAT & Internal Proxy





Web-Proxy Setup

```
> ip web-proxy pr enabled: yes
src-address: 0.0.0.0
port: 3128
hostname: "proxy"
transparent-proxy: yes
parent-proxy: 0.0.0.0:0
cache-administrator: "webmaster"
max-object-size: 4096KiB
cache-drive: system
max-cache-size: none
max-ram-cache-size: unlimited
status: running
reserved-for-cache: 0KiB
reserved-for-ram-cache: 154624KiB
```



Firewall Setup

- [admin@instaler] ip firewall nat> pr
Flags: X - disabled, I - invalid, D - dynamic
- 0 chain=srcnat out-interface=public
src-address=192.168.1.0/24
action=masquerade
- 1 chain=dstnat in-interface=lan
src-address=192.168.1.0/24 protocol=tcp
dst-port=80 action=redirect to-ports=3128



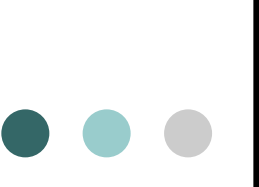
Mangle Setup

- 0 ::: UP TRAFFIC / Traffic #1 and #3
chain=**prerouting** in-interface=lan
src-address=192.168.1.0/24 action=mark-packet
new-packet-mark=**test-up** passthrough=**no**
- 1 ::: CONN-MARK
chain=**forward** src-address=192.168.1.0/24 action=mark-connection
new-connection-mark=**test-conn** passthrough=**yes**
- 2 ::: DOWN-DIRECT CONNECTION / Traffic #2
chain=**forward** in-interface=public
connection-mark=**test-conn** action=mark-packet
new-packet-mark=**test-down** passthrough=**no**
- 3 ::: DOWN-VIA PROXY / Traffic #4
chain=**output** out-interface=lan dst-address=192.168.1.0/24
action=mark-packet new-packet-mark=**test-down**
passthrough=**no**



Queue Setup

- 0 **;;; For traffic #2 and #4 (download)**
name="downstream" parent=**lan**
packet-mark=**test-down** limit-at=1024000
queue=default priority=8 max-limit=1024000
burst-limit=0 burst-threshold=0 burst-time=0s
- 1 **;;; For traffic #1 and #3 (upload)**
name="upstream" parent=**global-in**
packet-mark=**test-up** limit-at=256000
queue=default priority=8 max-limit=256000
burst-limit=0 burst-threshold=0 burst-time=0s



Traffic #5 & #6

- We can not manage traffic #5 and #6 based on client IP Address, because after the traffic hits the proxy, it will change the source IP Address, and the traffic will be a new one:
 - Source : Web Proxy (local process)
 - Destination : Web Server on Internet



Thank You

- **Valens Riyadi**
- `info@mikrotik.co.id`