



Redundancy and Performance on Point to Point link

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Speaker

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Consulting, training et MikroTik official Switzerland
distributor servers management, datacentre, wireless
network...

Projects

- Network infra support:
ISP – WISP – VPN
Brussell: myfifi.net
- Setup & Services
WIFI – VPN ...
- LTE



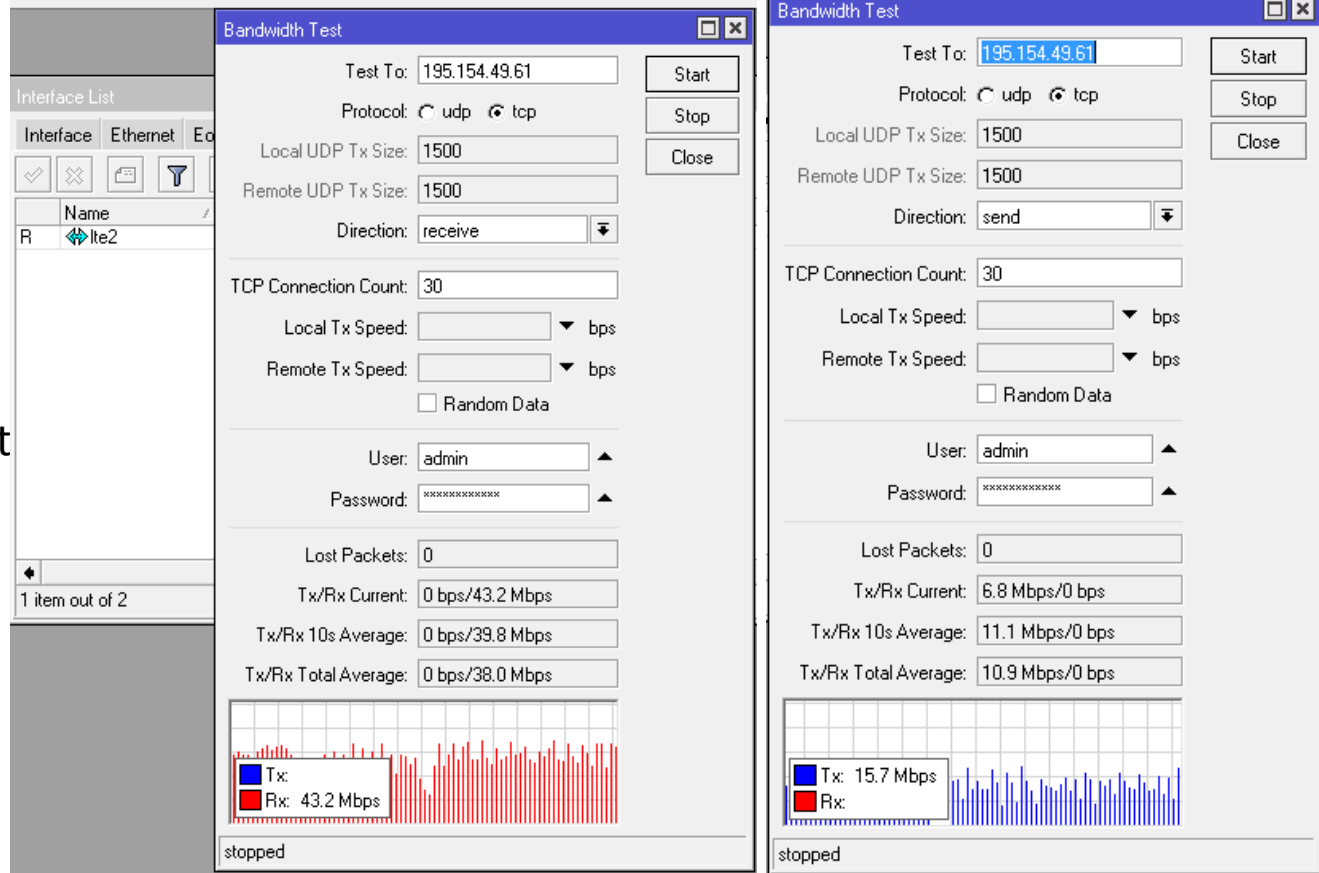


LTE

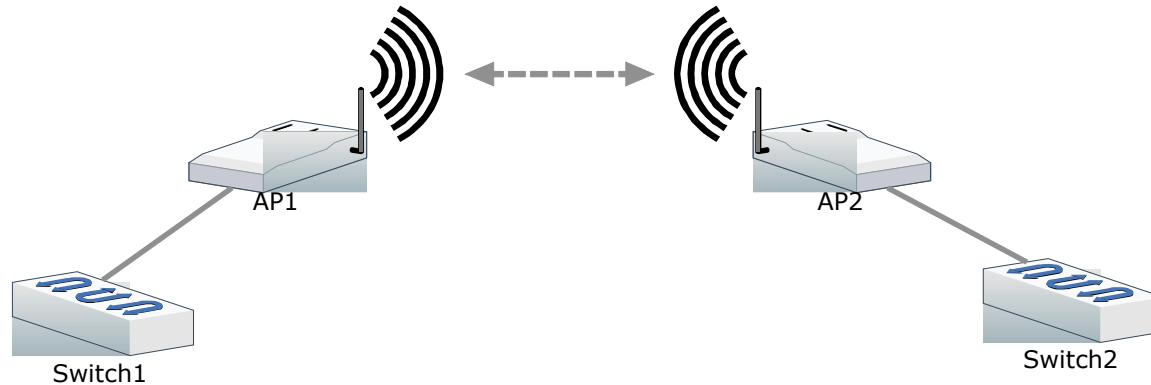
Wireless Antenna
LTE Antenna

40mbps down
10mbps up

Existing ADSL
Setup replacement



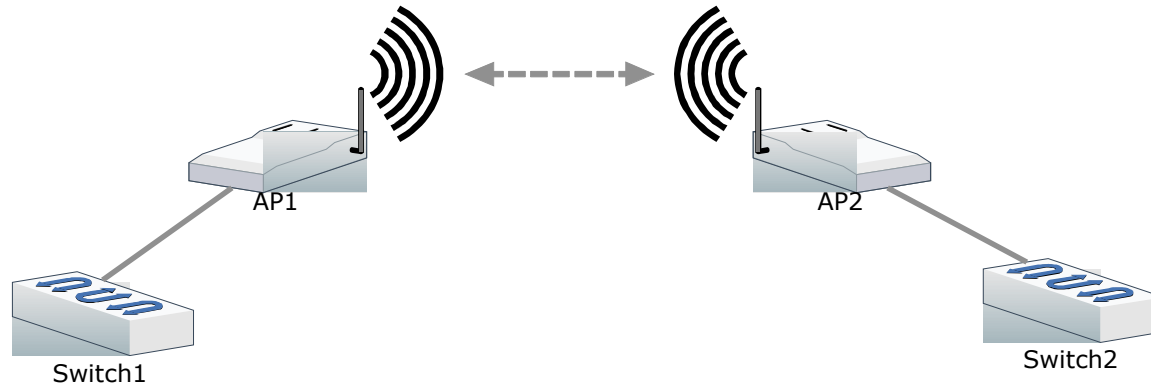
Link 2 Wireless Points



2 possibilities :

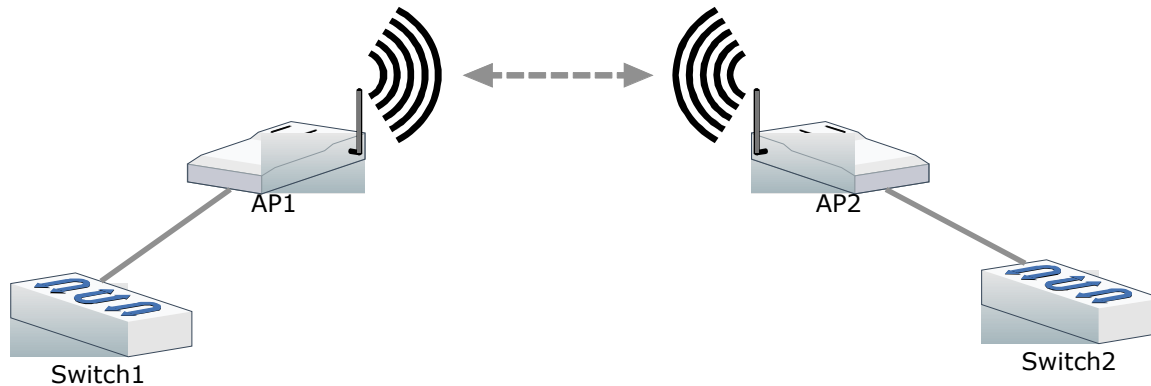
- Routing (Layer3) -> need a gateway
- Bridge (Layer2) -> network transparent

Performance UDP



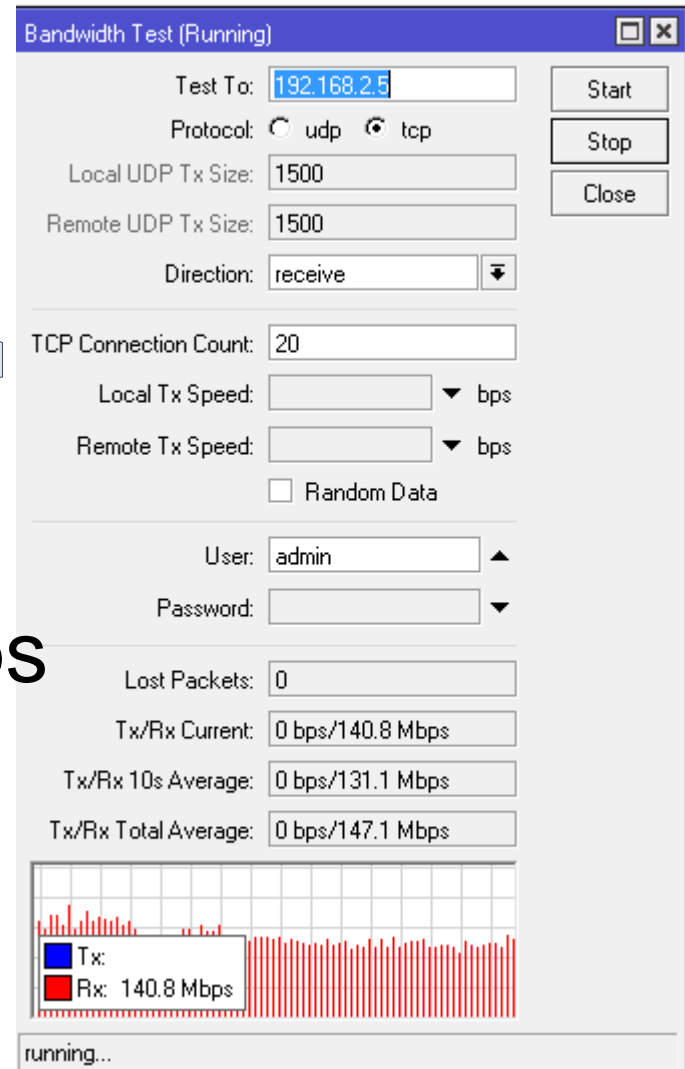
- Routing: 220mbps - 105/105mbps
- Bridge: 220mbps - 115/90mbps

TCP Performance



Routing: 140mbps - 75/75mbps

Bridge: 140mbps - 75/75mbps



TCP Performance

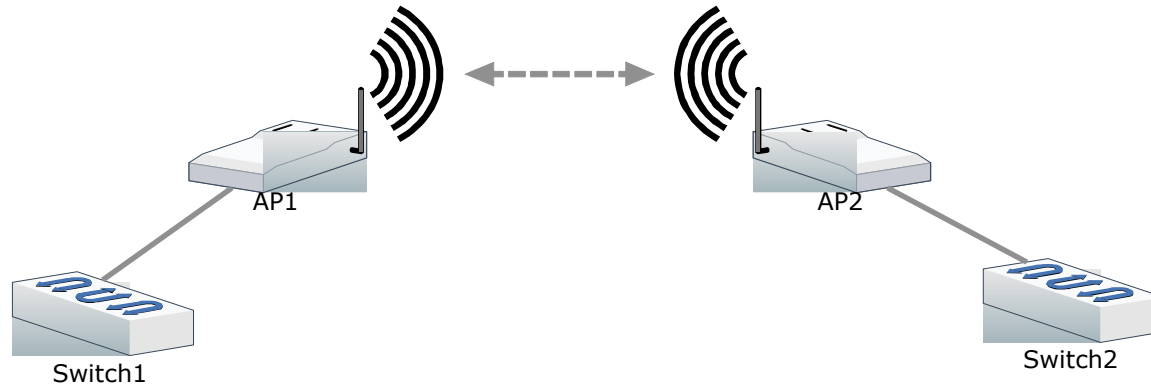


?????

Where does these 3.88mbps
come ?

-> TCP ACK and half-duplex Wireless

Easy to setup – bridge or routing

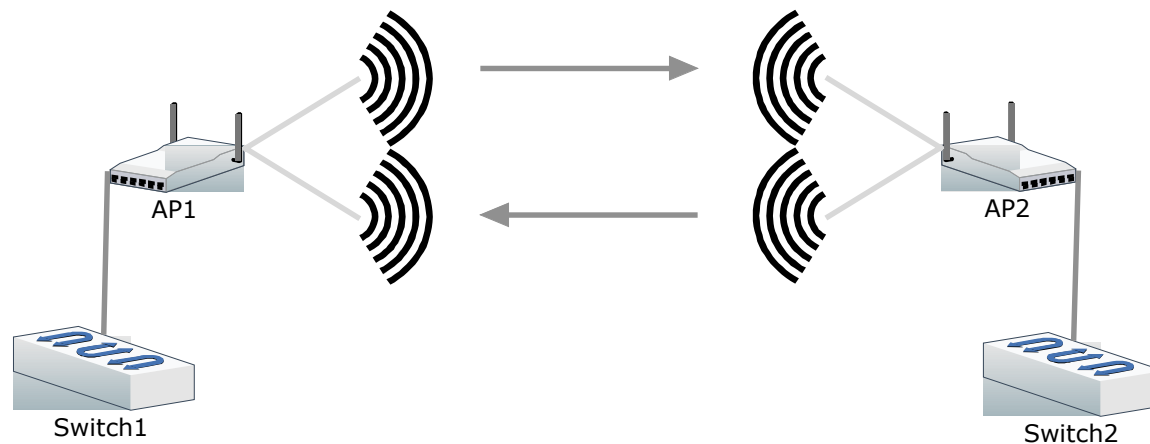


BUT :

- no redundancy
- half-duplex (may we solve it?)

Solution :

2 WIFI links with 2 APs



How to do it?

Many way to do it :

- Bonding
- NSTREME DUAL
- OSPF routing (one or another routing way) between the 2 APs
- ...

Pro's / Con's

With NSTREME DUAL :

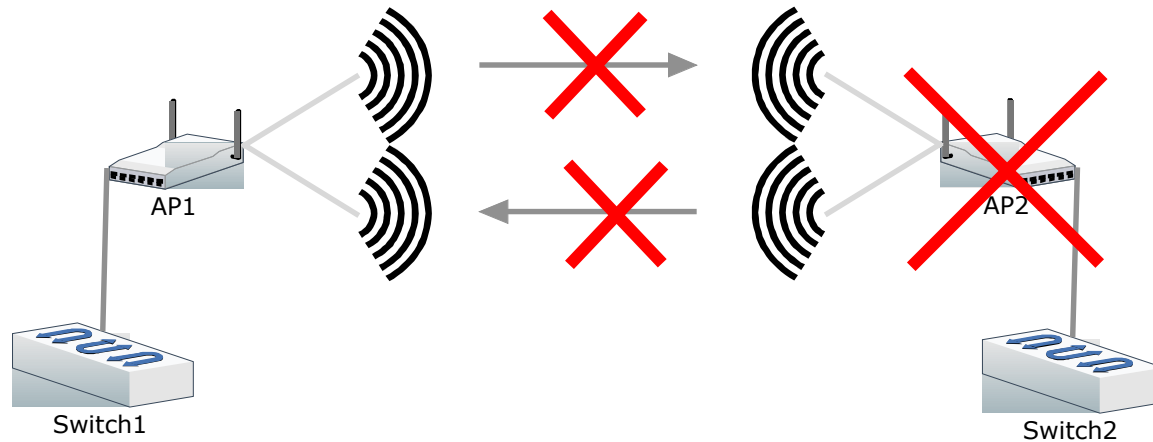
- «FULL-DUPLEX»
- Better speed
- CPU INTENSIVE
- BUT :
if one LINK down -> no more communication

With OSPF :

- «FULL DUPLEX» emulation
- FAILOVER on the link UP
- Not same disadvantages but...

BUT!

- If one AP down, link is down between the two points ->



- We may want more redundancy on critical links...

Better solution: 4 APs – 2 wifi links

Full redundancy

AP1: mode AP Bridge

ETH1: 192.168.1.1/24

WLAN1: 172.16.16.1/30

LOOPBACK: 10.254.254.254./32

AP2: mode station

ETH1: 192.168.2.1/24

WLAN1: 172.16.16.2/30

LOOPBACK: 10.254.254.253./32

Switch1:

192.168.1.10/24

Switch2:

192.168.2.10/24

AP4: mode AP Bridge

ETH1: 192.168.1.2/24

WLAN1: 172.16.17.1/30

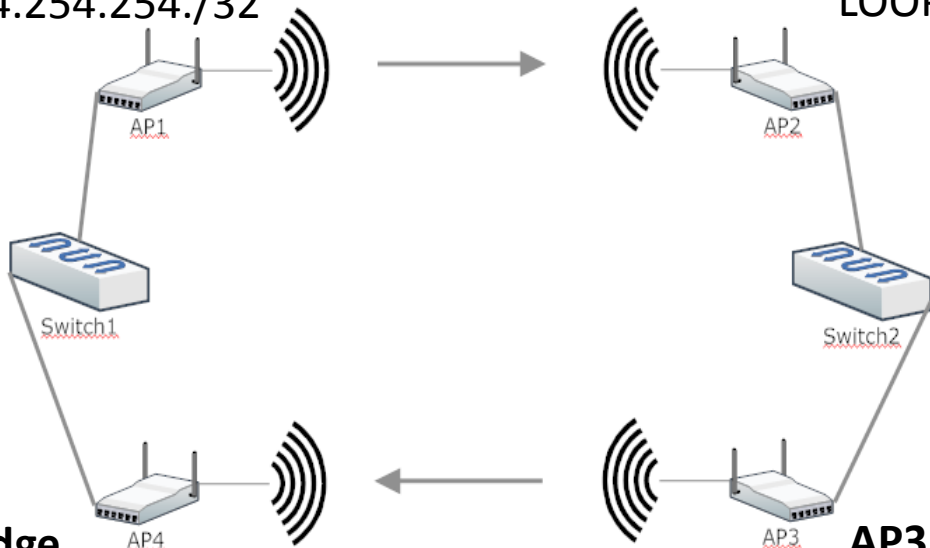
LOOPBACK: 10.254.254.251./32

AP3: mode station

ETH1: 192.168.2.2/24

WLAN1: 172.16.17.2/30

LOOPBACK: 10.254.254.252./32



How to setup it?

- With RouterOS there are many ways to do it
- In this example we are going to use VRRP for the Gateway redundancy and OPSF for routing packets and creating a « full-duplex »

V.R.R.P.

- «Virtual Router Redundancy Protocol» provide a solution for aggregate routers in a logical group called « Virtual Router »
- Routers from the same group shared the IP Gateway used for the routing
- Link will be UP in less than 3 seconds

V.R.R.P. Setup

Add an interface :

- Interface linked (ether1)
- Setup VRID – unique id unique for the group
- Priority setup
 - -> 100 for the master (AP1 et AP3)
 - -> 50 for the backup (AP2 et AP4)

Once the interface created assign a IP which will be shared between the routers

VRRP1 : 192.168.1.254/32 (AP1 et AP4)

VRRP2 : 192.168.2.254/32 (AP2 et AP3)

Important : always use a /32

The screenshot shows the 'Interface <vmp1>' configuration window with the 'VRRP' tab selected. The configuration is as follows:

- Interface: ether1
- VRID: 1
- Priority: 100
- Interval: 1.00 s
- ☒ Preemption Mode
- Authentication: none (selected), simple, ah
- Password: (empty)
- Version: 3
- V3 Protocol: IPv4

On the right side, there are buttons: OK, Cancel, Apply, Disable, Comment, Copy, Remove, and Torch. At the bottom, there is a status bar with the following indicators: enabled, running, slave, and master.

OSPF

Link state routing protocol. It collects link state of all available routers and constructs a network map. With this, it identifies the fastest route to reach the destination.

Very quick to fault detection and rebuild its routes, it will bring automatic redundancy to our network of roads

Next, we will configure the "full duplex »

The idea is to create all links and configure OSPF. Then we will add costs to OSPF interfaces for packet traffic takes only 1 way.

OSPF Setup

Add a loopback address:

Create a bridge without interface

Assign an address / 32

-> Example (AP1: 10.254.254.254/32)

2 and OSPF configurations:

- Router ID = loopback IP address
- Add the different networks that are part of your configuration

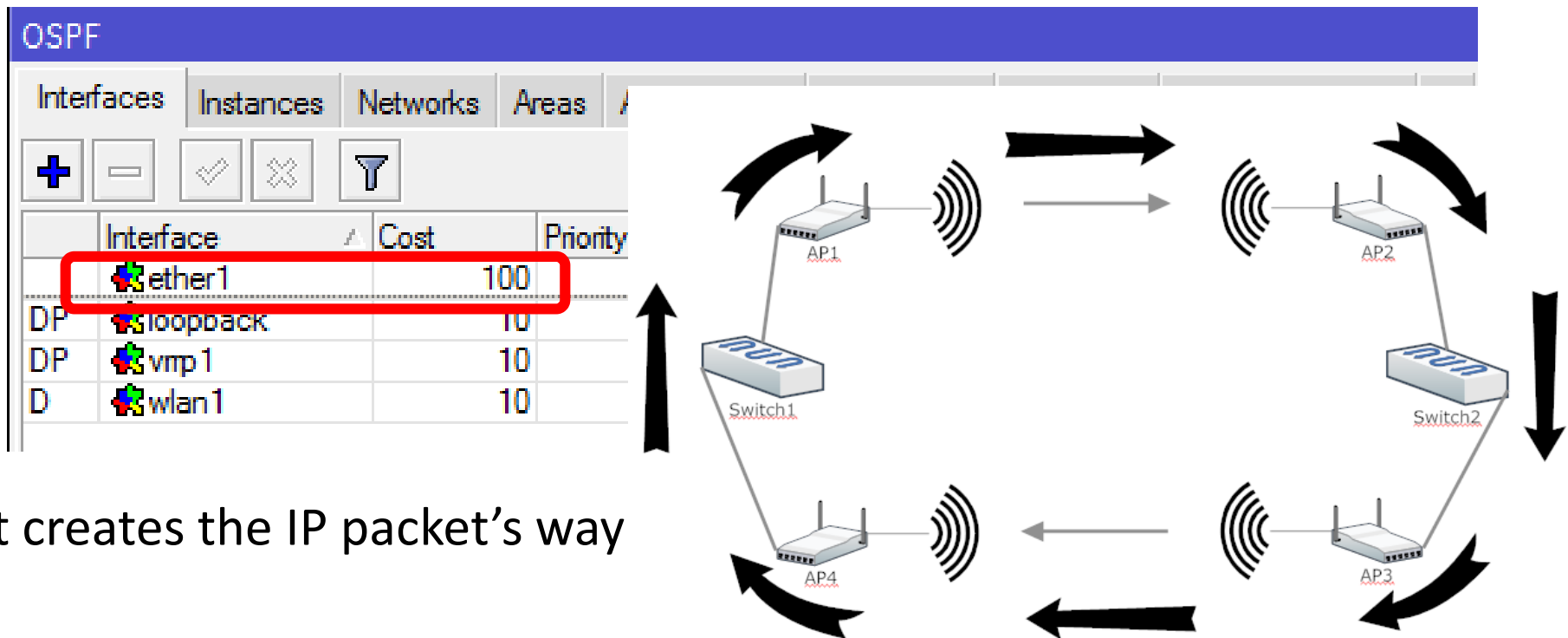
The screenshot displays the 'OSPF Instance <default>' configuration window. The 'General' tab is active, showing the 'Name' as 'default' and the 'Router ID' as '10.254.254.254', which is highlighted with a red box. Below this, several redistribution options are listed with dropdown menus. A red arrow points from the text 'Router ID = loopback IP address' to the 'Router ID' field. Another red arrow points from the text 'Add the different networks that are part of your configuration' to a table in the 'OSPF' section below. This table, titled 'OSPF', has tabs for 'Instances', 'Networks', 'Areas', 'Area Ranges', and 'Virtual Links'. The 'Networks' tab is selected, showing a table with three entries, all in the 'backbone' area, which is also highlighted with a red box.

| Network | Area |
|----------------|----------|
| 10.254.254.254 | backbone |
| 172.16.16.0/30 | backbone |
| 192.168.1.0/24 | backbone |

«Full-duplex» setup

/routing ospf interface add interface=ether1 cost=100 (AP1,AP3)

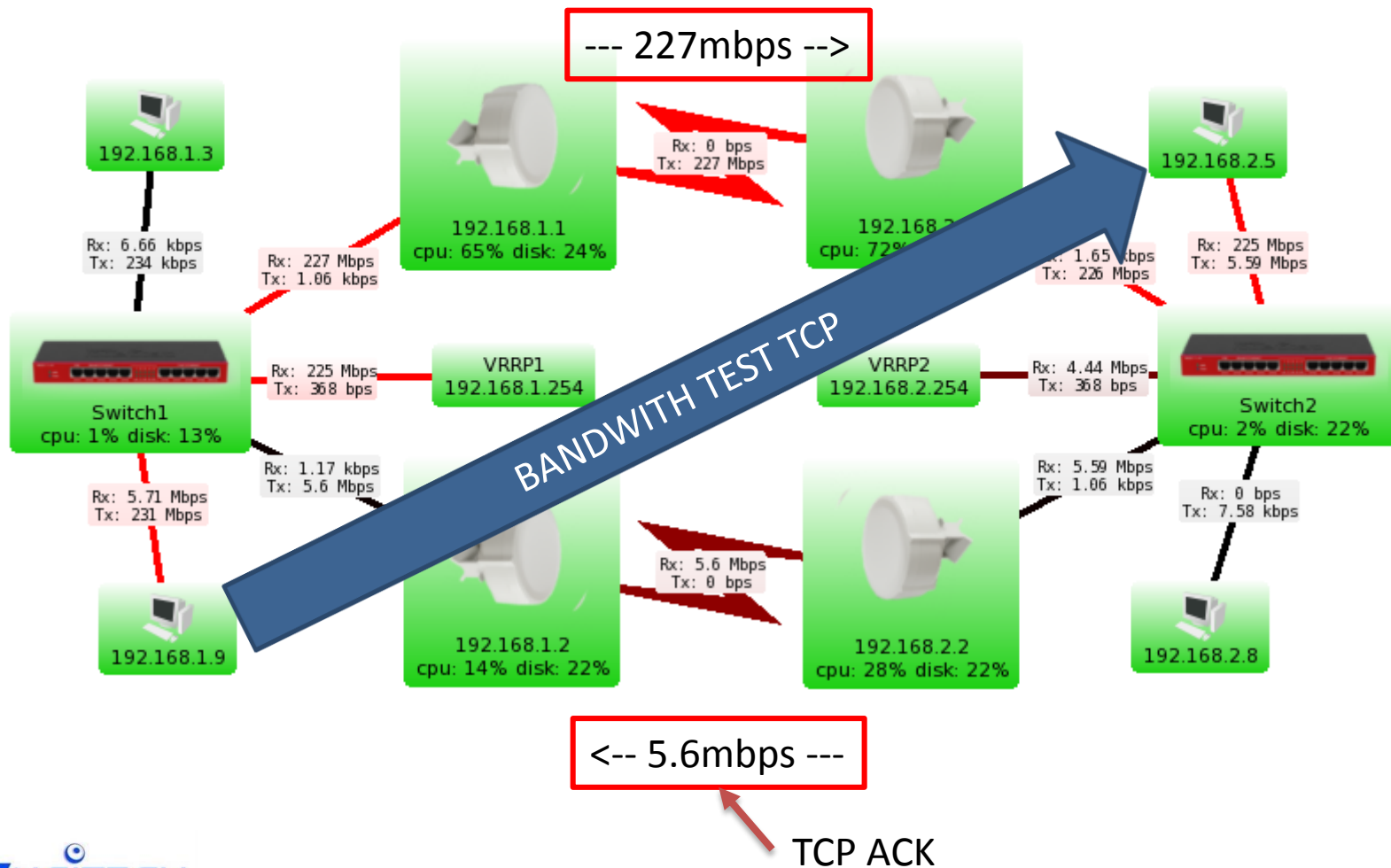
/routing ospf interface add interface=wlan1 cost=100 (AP2,AP4)



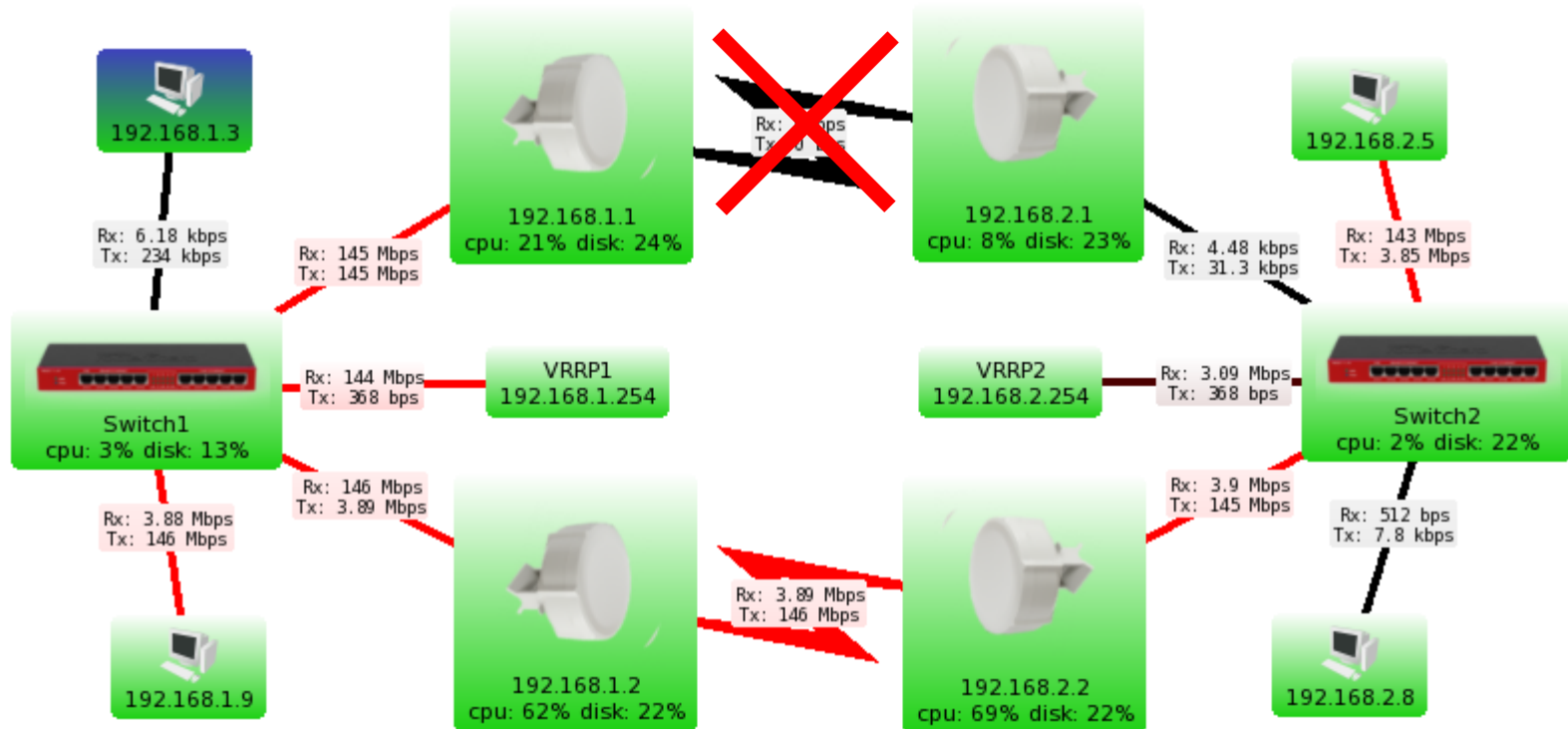
It creates the IP packet's way

VRRP & OSPF done

If you remember we were at 140mbps for TCP bandwidth test
NOW -> TCP ACK packets are handled correctly with this design



Redundancy – 1 link cut



Redundancy – 1 link cut

5 Pings and still running
OSPF bring back the link

admin@192.168.1.3 (CCR1016-2) - WinBox v6.29rc24 on CCR1016-12G (tile)

Safe Mode

RouterOS WinBox

Quick Set
Interfaces
Wireless
Bridge
PPP
Mesh
IP
MPLS
Routing
System
Queues
Files
Log
Radius
Tools
New Terminal
LCD
Partition
Make Supout.tif
Manual
Exit

Ping

General Advanced

Ping To: 192.168.2.8

Interface:
ARP Ping ☐

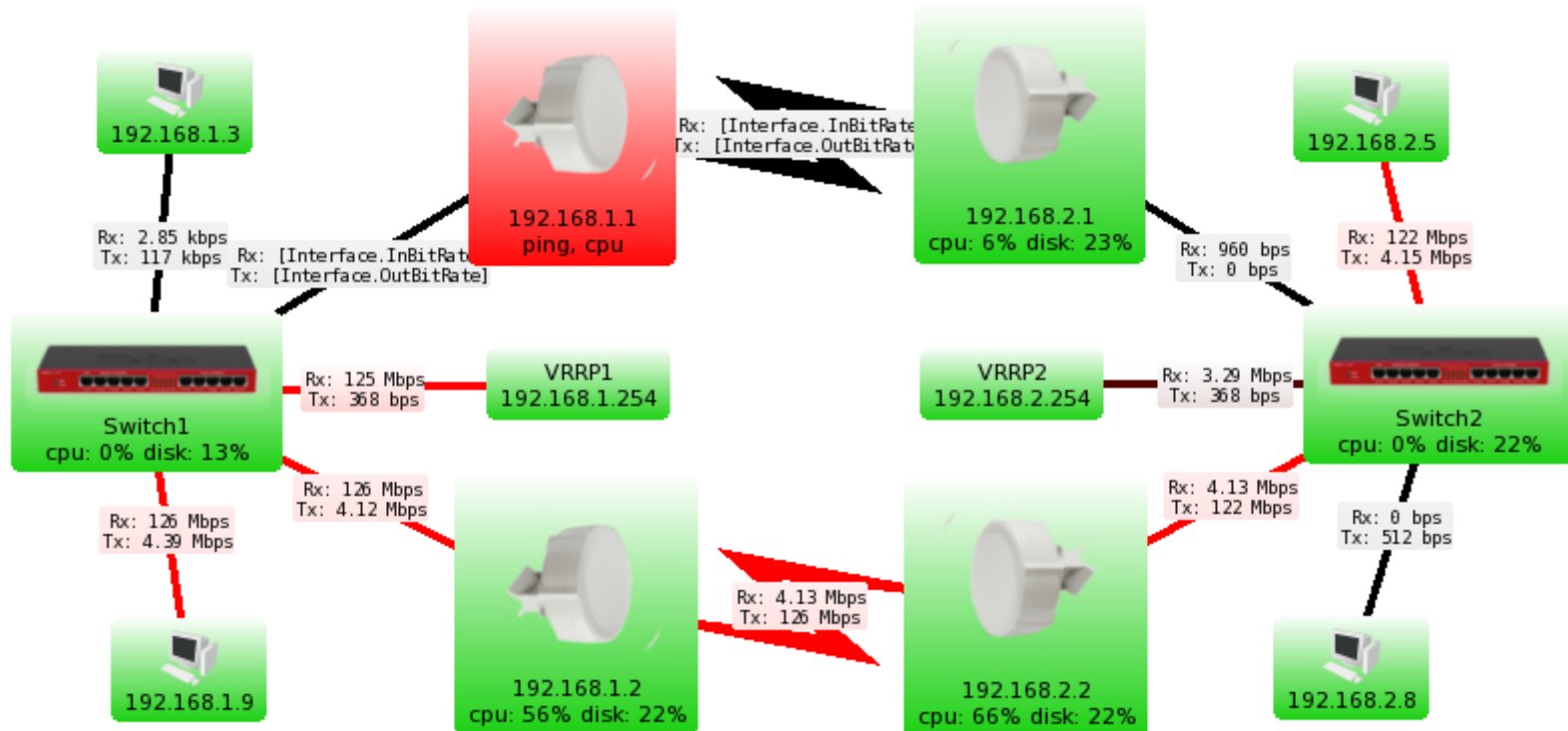
Packet Count:
Timeout: 1000 ms

Start
Stop
Close
New Window

| Seq # | Host | Time | Reply Size | TTL | Status |
|-------|-------------|---------|------------|-----|---------------|
| 123 | 192.168.2.8 | 6ms | 50 | 62 | |
| 124 | 192.168.2.8 | 5ms | 50 | 62 | |
| 125 | 192.168.2.8 | 7ms | 50 | 62 | |
| 126 | 192.168.2.8 | 5ms | 50 | 62 | |
| 127 | 192.168.2.8 | timeout | | | timeout |
| 128 | 192.168.2.8 | timeout | | | timeout |
| 129 | 192.168.1.2 | 0ms | 78 | 64 | redirect host |
| 129 | 192.168.1.1 | 0ms | 78 | 64 | redirect host |
| 129 | 192.168.1.1 | 5ms | 78 | 64 | TTL exceeded |
| 130 | 192.168.2.8 | 4ms | 50 | 62 | |
| 131 | 192.168.2.8 | 5ms | 50 | 62 | |
| 132 | 192.168.2.8 | 4ms | 50 | 62 | |
| 133 | 192.168.2.8 | 4ms | 50 | 62 | |
| 134 | 192.168.2.8 | 5ms | 50 | 62 | |
| 135 | 192.168.2.8 | 5ms | 50 | 62 | |

138 items | 133 of 136 packets... | 2% packet loss | Min: 3 ms | Avg: 7 ms | Max: 110 ms

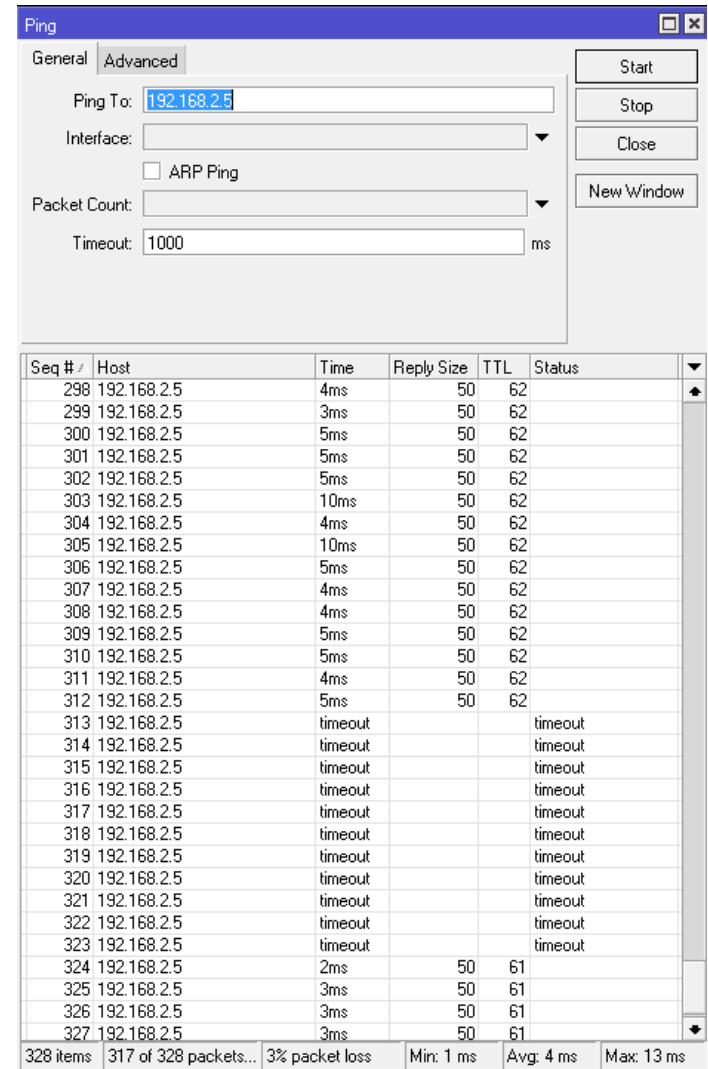
Redundancy – 1 AP down



Redundancy – 1 AP down

10 Pings everything running

OSPF and VRRP operating



| Seq # | Host | Time | Reply Size | TTL | Status |
|-------|-------------|---------|------------|-----|---------|
| 298 | 192.168.2.5 | 4ms | 50 | 62 | |
| 299 | 192.168.2.5 | 3ms | 50 | 62 | |
| 300 | 192.168.2.5 | 5ms | 50 | 62 | |
| 301 | 192.168.2.5 | 5ms | 50 | 62 | |
| 302 | 192.168.2.5 | 5ms | 50 | 62 | |
| 303 | 192.168.2.5 | 10ms | 50 | 62 | |
| 304 | 192.168.2.5 | 4ms | 50 | 62 | |
| 305 | 192.168.2.5 | 10ms | 50 | 62 | |
| 306 | 192.168.2.5 | 5ms | 50 | 62 | |
| 307 | 192.168.2.5 | 4ms | 50 | 62 | |
| 308 | 192.168.2.5 | 4ms | 50 | 62 | |
| 309 | 192.168.2.5 | 5ms | 50 | 62 | |
| 310 | 192.168.2.5 | 5ms | 50 | 62 | |
| 311 | 192.168.2.5 | 4ms | 50 | 62 | |
| 312 | 192.168.2.5 | 5ms | 50 | 62 | |
| 313 | 192.168.2.5 | timeout | | | timeout |
| 314 | 192.168.2.5 | timeout | | | timeout |
| 315 | 192.168.2.5 | timeout | | | timeout |
| 316 | 192.168.2.5 | timeout | | | timeout |
| 317 | 192.168.2.5 | timeout | | | timeout |
| 318 | 192.168.2.5 | timeout | | | timeout |
| 319 | 192.168.2.5 | timeout | | | timeout |
| 320 | 192.168.2.5 | timeout | | | timeout |
| 321 | 192.168.2.5 | timeout | | | timeout |
| 322 | 192.168.2.5 | timeout | | | timeout |
| 323 | 192.168.2.5 | timeout | | | timeout |
| 324 | 192.168.2.5 | 2ms | 50 | 61 | |
| 325 | 192.168.2.5 | 3ms | 50 | 61 | |
| 326 | 192.168.2.5 | 3ms | 50 | 61 | |
| 327 | 192.168.2.5 | 3ms | 50 | 61 | |

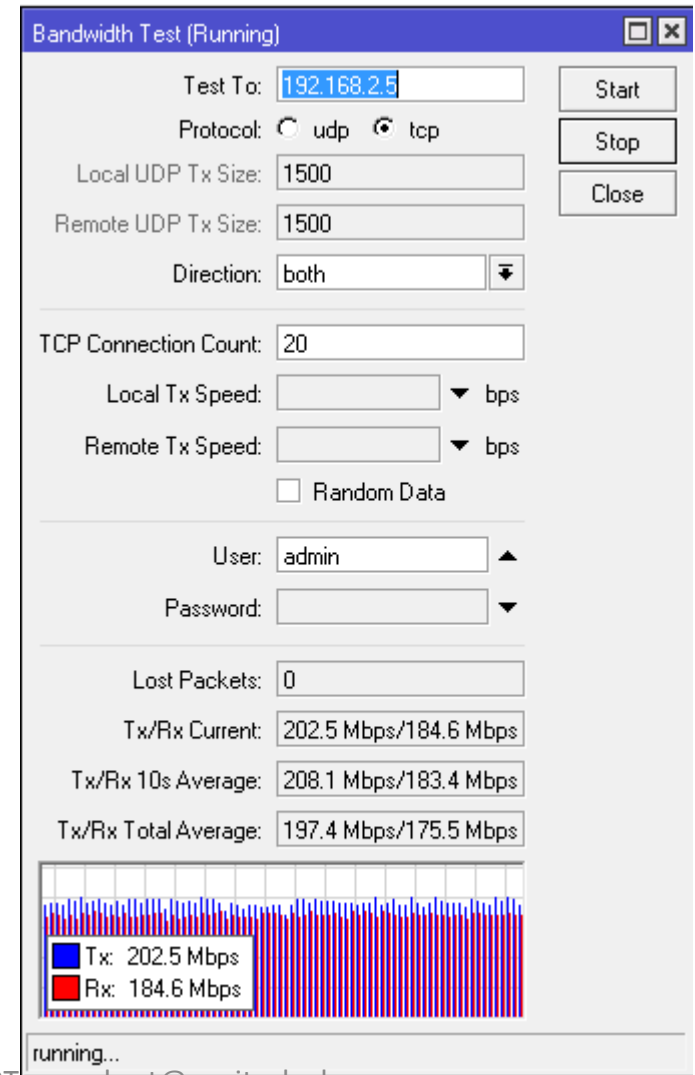
328 items | 317 of 328 packets... | 3% packet loss | Min: 1 ms | Avg: 4 ms | Max: 13 ms

Redundancy running ... what about the performance?

TCP : 200mbps/185mbps
385mbs in total

Before setup, TCP provided
oneway 140mbs ...

2x hardware -> 3x
performance!



Routing done

- Full Redundancy
- Full-duplex maximum speed

...Could we use this setup for doing a bridge (Layer 2) ?

Bridge

How to do it:

- EOIP
- VPLS
- ...

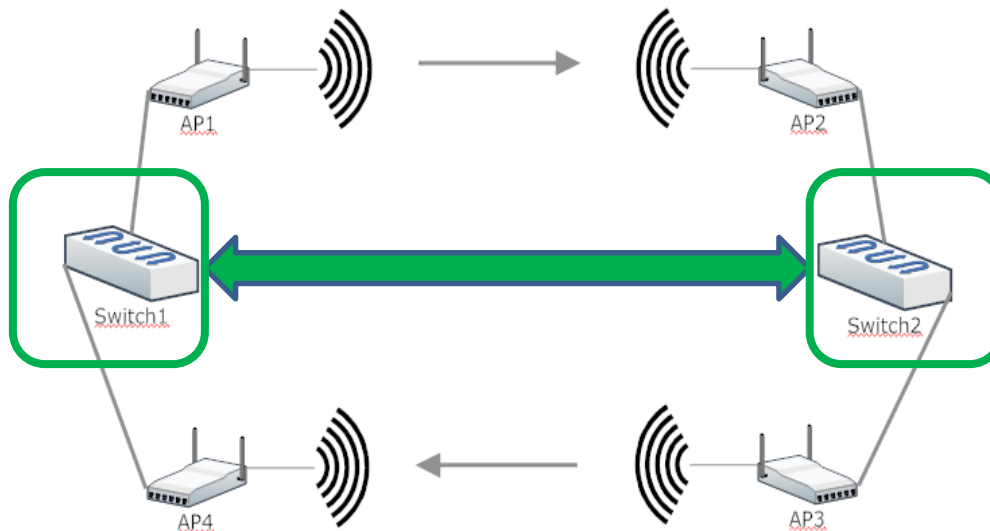
The winner is: VPLS!

- Less CPU usage and better speed

VPLS ?

VPLS is a point to point vpn (or multipoint)
It creates a tunnel over **MPLS**.

The VPN TUNNEL will be created on Switchs (RB2011).



MPLS

MPLS?

MPLS is a high level performance way for delivery data from one network node to another

All the component of the solution need to be compatible and configured with MPLS (SXT and RB2011 in this case).

MPLS is acting like a switch over IP packet

MPLS is creating tags for all different routes between routers

The only think which has the router to do, is to saw the MPLS tag. This tag is built of a header of 4 bytes (to compare with a IPV4 header = 40bytes, 10 times greater). With this information, the router knows where to forward the packet.

MPLS Setup

MPLS

LDP Interface LDP Neighbor Accept Filter Advertise Filter Forwarding Table MPLS Interface ...

+ MPLS Settings **LDP Settings**

| Interface | Hello Interval | Hold Time | Transport Address | Accept Dy... |
|-----------|----------------|-----------|-------------------|--------------|
| ether1 | 00:00:05 | 00:00:15 | | yes |
| loopback | 00:00:05 | 00:00:15 | | yes |
| wlan1 | 00:00:05 | 00:00:15 | | yes |

MPLS Settings

Dynamic Label Range:

☒ Propagate TTL

3 items

LDP -> enabled

LDP Settings

☒ Enabled

LSR ID: ▲

Transport Address: ▲

Path Vector Limit:

Hop Limit:

☐ Loop Detect

☐ Use Explicit Null

☐ Distribute For Default Route

Add LDP interface: all interfaces that belong to the MPLS network

Setup the ID and destination address (Loopback IP)

MPLS verification

- Traceroute -> Labels MPLS

| MPLS | | | | |
|--------------------|------------------|------------------|--------------------------|----------------|
| Accept Filter | Advertise Filter | Forwarding Table | MPLS Interface | Local Bindings |
| | | | | |
| Dst. Address | Label | Advertised Path | Peers | |
| DAG 10.254.254.251 | 45 | empty | 10.254.254.252:0, 10.... | |
| DAG 10.254.254.252 | 35 | empty | 10.254.254.252:0, 10.... | |
| DAG 10.254.254.253 | 42 | empty | 10.254.254.252:0, 10.... | |
| DAE 10.254.254.254 | impl-null | empty | 10.254.254.252:0, 10.... | |
| DAE 172.16.16.0/30 | impl-null | empty | 10.254.254.252:0, 10.... | |
| DAG 172.16.17.0/30 | 44 | empty | 10.254.254.252:0, 10.... | |
| DAE 192.168.1.0/24 | impl-null | empty | 10.254.254.252:0, 10.... | |
| DAE 192.168.1.254 | impl-null | empty | 10.254.254.252:0, 10.... | |
| DAG 192.168.2.0/24 | 38 | empty | 10.254.254.252:0, 10.... | |
| DAG 192.168.2.254 | 37 | empty | 10.254.254.252:0, 10.... | |

Traceroute

Traceroute To: 192.168.1.1

Packet Size: 56

Timeout: 1000 ms

Protocol: icmp

Port: 33434

Start

Stop

Close

New Window

Src. Address:

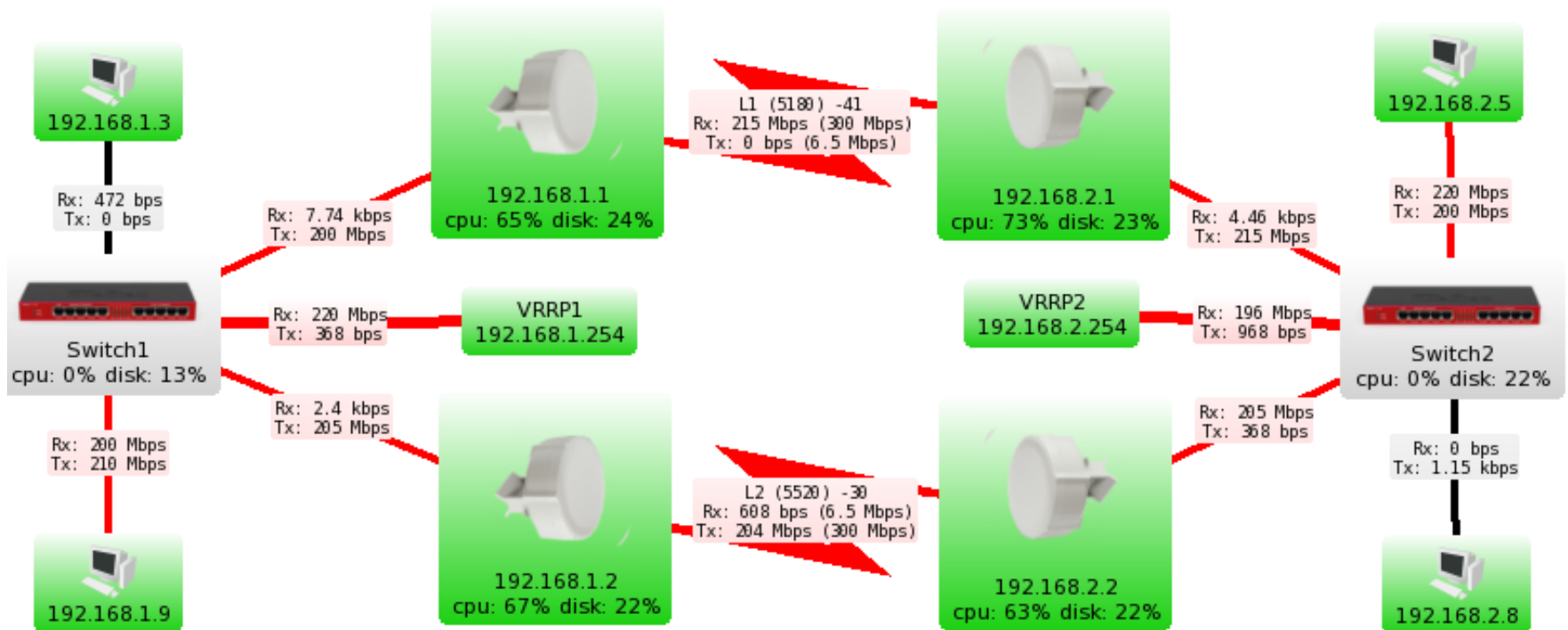
Interface:

DSCP:

Routing Table:

| # | Host | Time 1 | Time 2 | Time 3 | Status |
|---|-------------|--------|--------|--------|-----------------|
| 0 | 192.168.2.2 | 2ms | 2ms | 1ms | <MPLS:L=45,E=0> |
| 1 | 192.168.1.2 | 1ms | 1ms | 2ms | |
| 2 | 192.168.1.1 | 1ms | 1ms | 1ms | |

MPLS



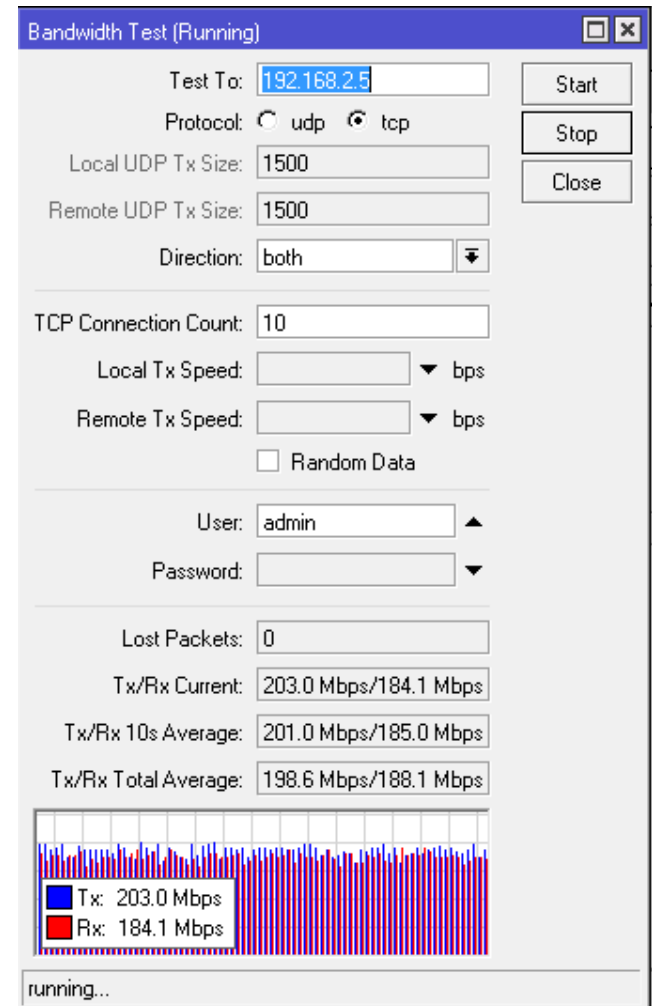
Speed of MPLS network

Result:

TCP FULL-DUPLEX

Almost 200mbps / 200mbps

Indeed 400mbps in total.



VPLS setup

It's needed to create the interface on both side of the tunnel, on the two RB2011. Only two parameters need to be setup in our case:

- Remote Peer, with the Switch IP address on the other side of the tunnel
- VPLS ID

Interface <vpls1>

General Status Traffic

Name: vpls1

Type: VPLS

MTU: 1500

L2 MTU: 1500

MAC Address: 02:84:47:AF:17:65

ARP: enabled

Remote Peer: 10.254.254.252

VPLS ID: 0:0

☐ Cisco Style

Cisco Style ID: 0

Advertised L2MTU: 1500

PW Type: ☐ tagged ethernet ☒ raw ethernet

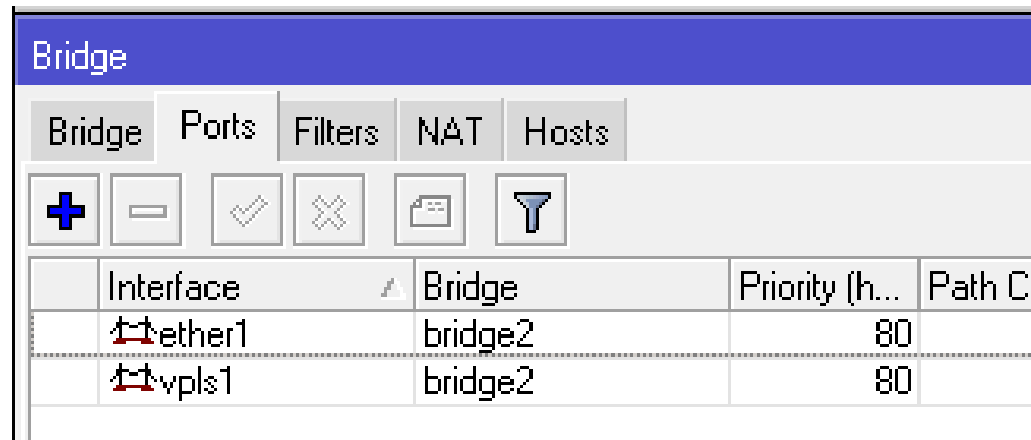
enabled running slave BGP signaled Cisco BGP Si...

OK Cancel Apply Disable Comment Copy Remove Torch

VPLS Bridge

At the RB2011 level, eth1 to eth5 are defined on the switch.

Just create a bridge, add the port eth1 (which is the master) and the tunnel VPLS interface



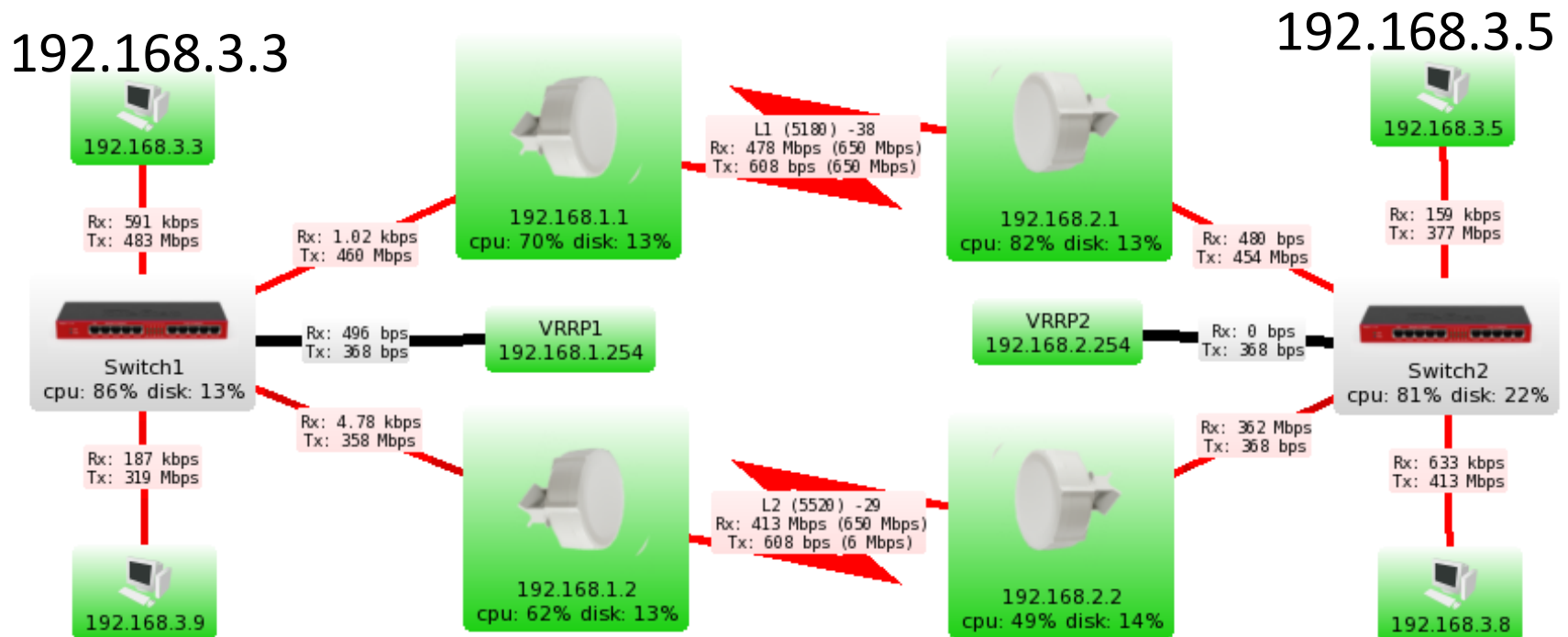
The screenshot shows the Mikrotik WinBox interface for configuring a bridge. The 'Bridge' tab is selected, and the 'Ports' sub-tab is active. Below the sub-tabs, there are icons for adding (+), removing (-), enabling (checkmark), disabling (X), saving (floppy disk), and filtering (funnel). A table lists the configured ports for 'bridge2'.

| Interface | Bridge | Priority (h... | Path C |
|-----------|---------|----------------|--------|
| ether1 | bridge2 | 80 | |
| vpls1 | bridge2 | 80 | |

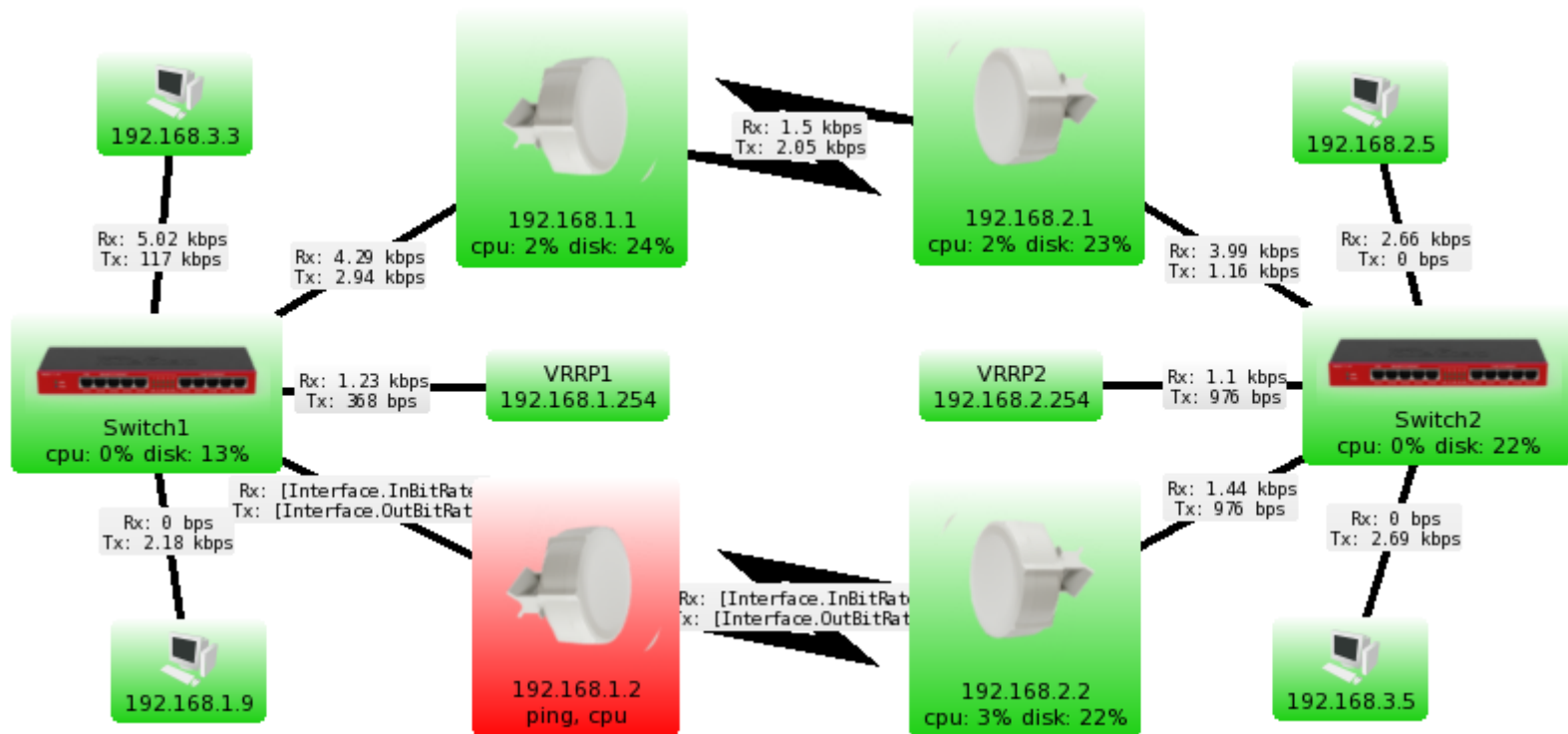
VPLS

Once the tunnel is created, we have a Layer 2 network, computers on the both side will be in the same IP range.

In Bridge mode, we are not using VRRP created before...



VPLS Redundancy



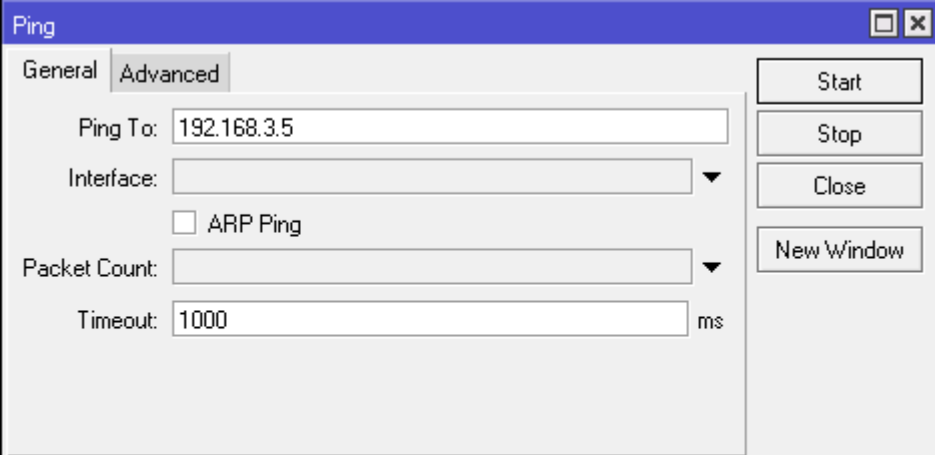
VPLS Redundancy

PING de 192.168.3.3 vers 192.168.3.5 :

12 pings and it's running

OSPF is again calculating a new path

Once done the VPLS tunnel must be recreated over MPLS



| Seq # / | Host | Time | Reply Size | TTL | Status |
|---------|-------------|---------|------------|-----|---------|
| 200 | 192.168.3.5 | 2ms | 50 | 64 | |
| 201 | 192.168.3.5 | 3ms | 50 | 64 | |
| 202 | 192.168.3.5 | timeout | | | timeout |
| 203 | 192.168.3.5 | timeout | | | timeout |
| 204 | 192.168.3.5 | timeout | | | timeout |
| 205 | 192.168.3.5 | timeout | | | timeout |
| 206 | 192.168.3.5 | timeout | | | timeout |
| 207 | 192.168.3.5 | timeout | | | timeout |
| 208 | 192.168.3.5 | timeout | | | timeout |
| 209 | 192.168.3.5 | timeout | | | timeout |
| 210 | 192.168.3.5 | timeout | | | timeout |
| 211 | 192.168.3.5 | timeout | | | timeout |
| 212 | 192.168.3.5 | 11ms | 50 | 64 | |
| 213 | 192.168.3.5 | timeout | | | timeout |
| 214 | 192.168.3.5 | 5ms | 50 | 64 | |
| 215 | 192.168.3.5 | 10ms | 50 | 64 | |

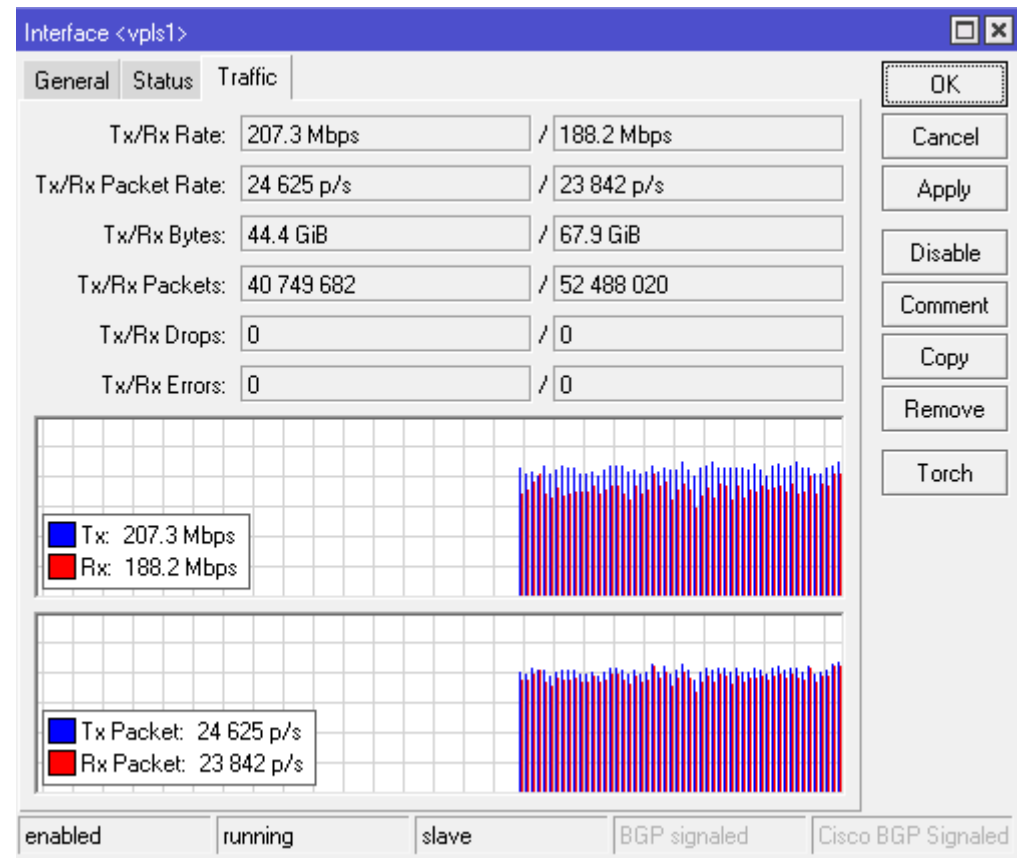
Bridge speed

Result:

TCP FULL-DUPLEX

200mbps / 200mbps

400mbps in total.



Some result with 802.11ac



In 20mhz -> TCP -> 130mbps / 130mbps

In 40mhz -> TCP -> 250mbps / 250mbps

Conclusion

- We can reach on the same configuration redundancy for the routing or the bridge
- Why not?

Hardware used : 4x SXT G and 2x RB2011

This is one of the possible configuration. Other are possible that will fit within your infrastructure.

Do not hesitate to contact me.

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