



Redundancy and Performance on Point to Point link

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Speaker

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distributor servers management, datacentre, wireless
network...

Projects

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



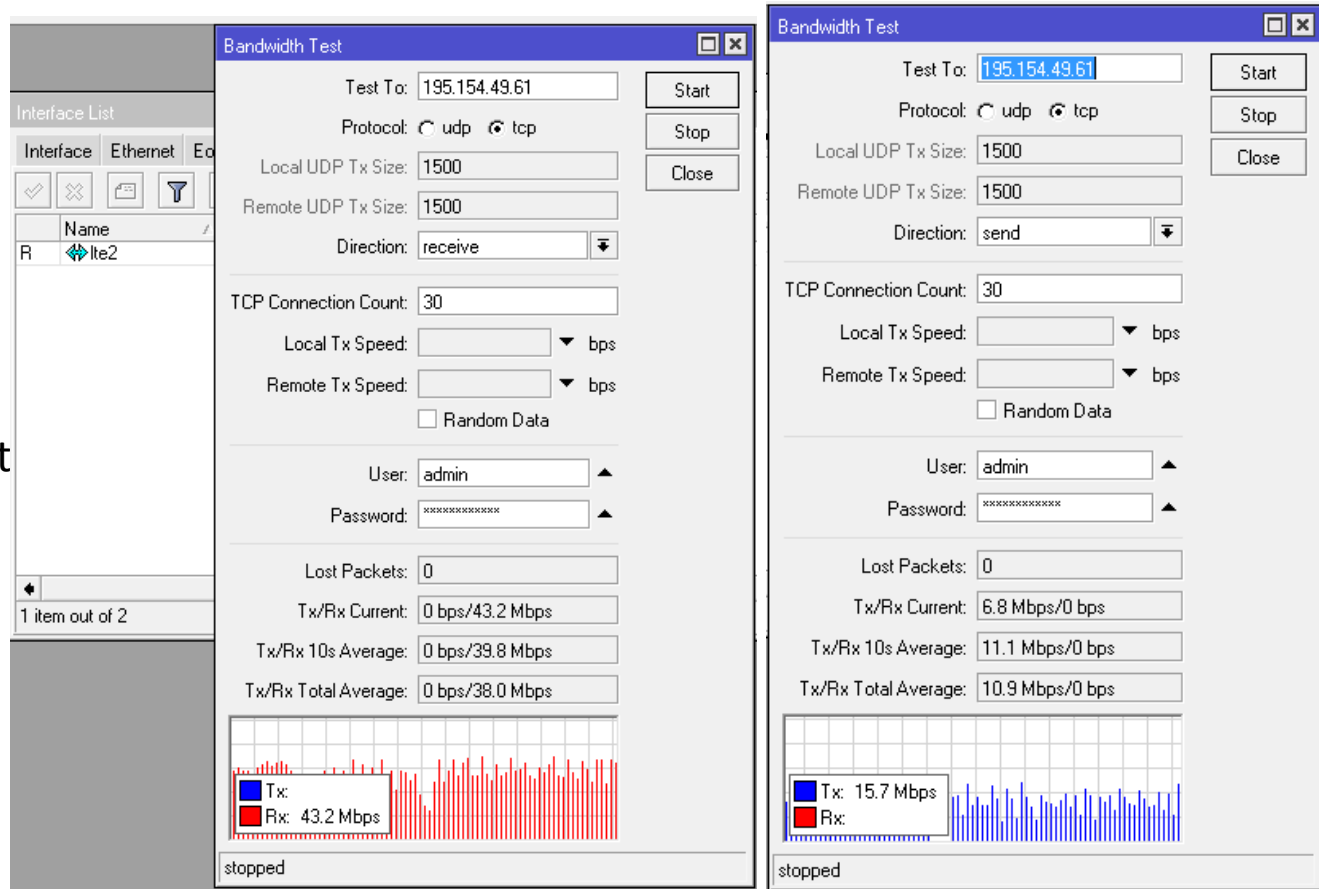


LTE

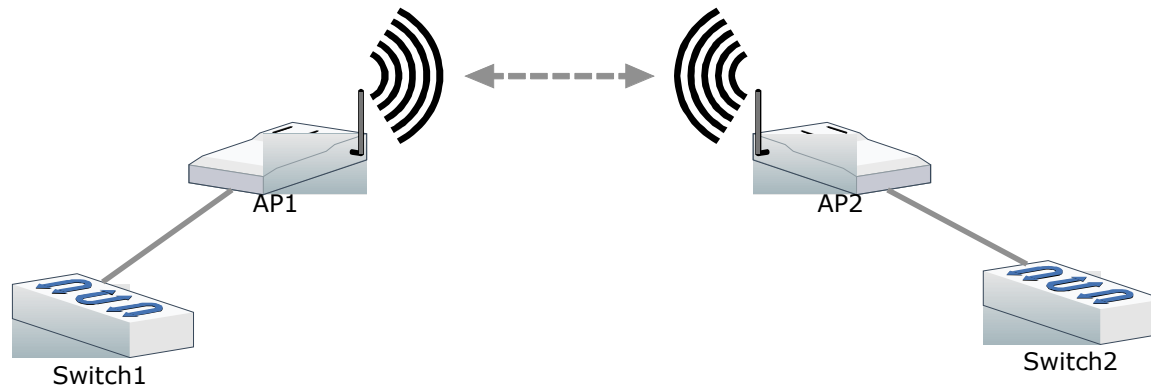
Wireless Antenna
LTE Antenna

40mbps down
10mbps up

Existing ADSL
Setup replacement



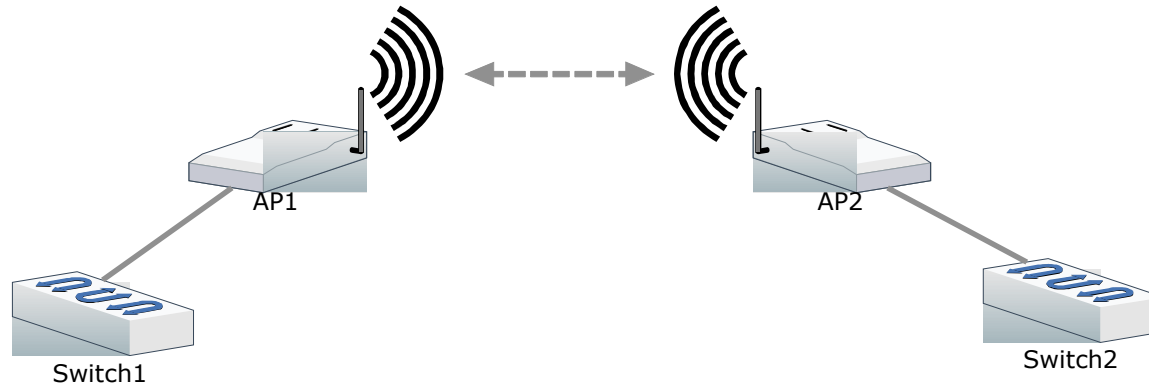
Link 2 Wireless Points



2 possibilities :

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

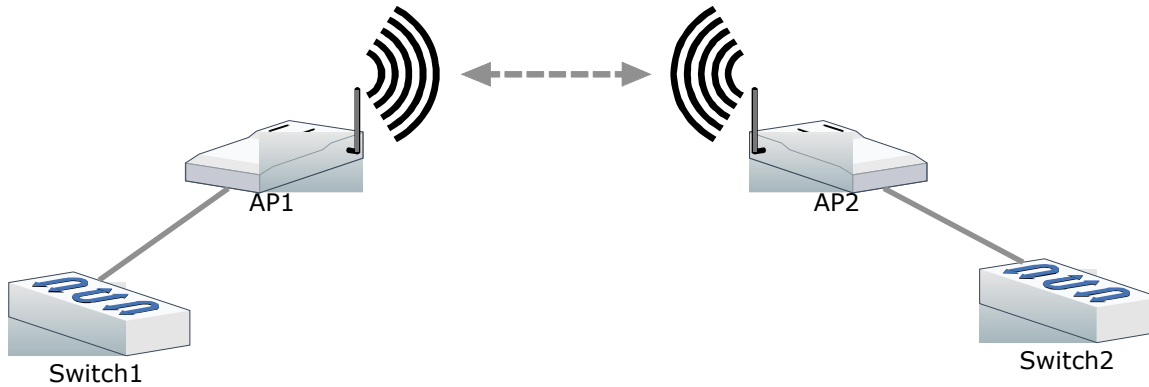
Performance UDP



- Routing: 220mbps - 105/105mbps

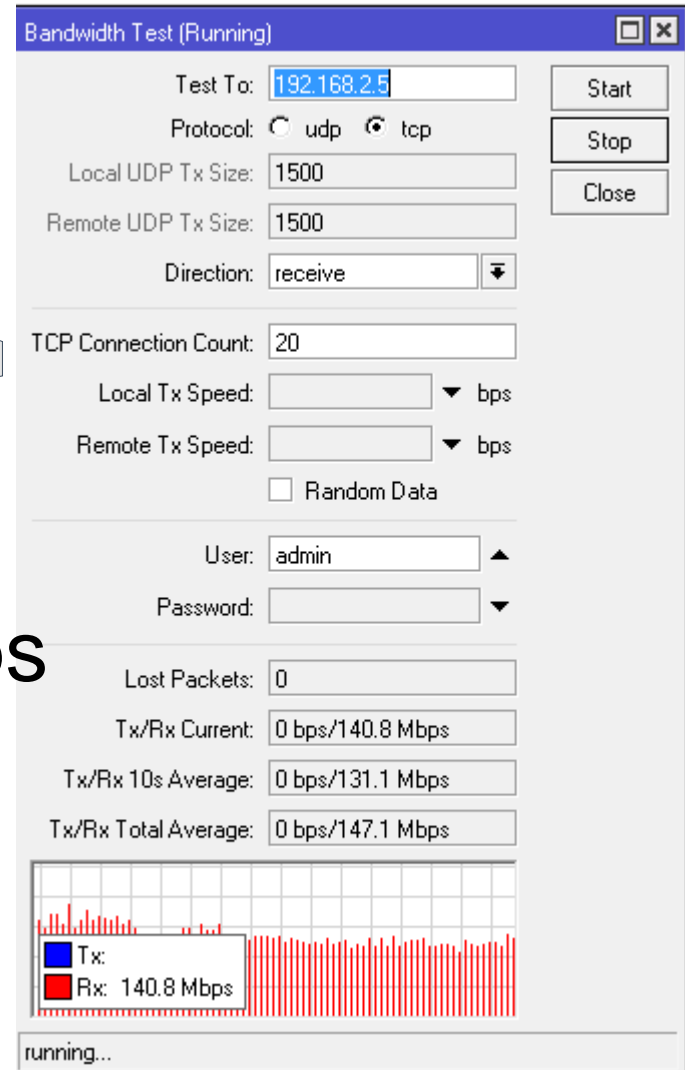
- Bridge: 220mbps - 115/90mbps

TCP Performance

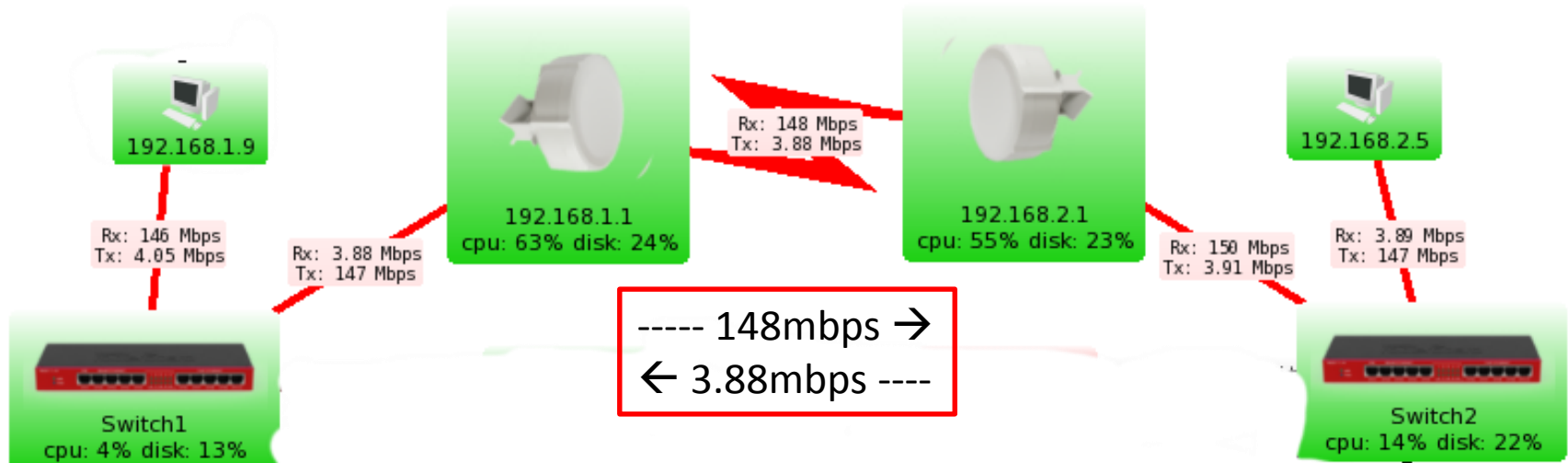


Routing: 140mbps - 75/75mbps

Bridge: 140mbps - 75/75mbps



TCP Performance

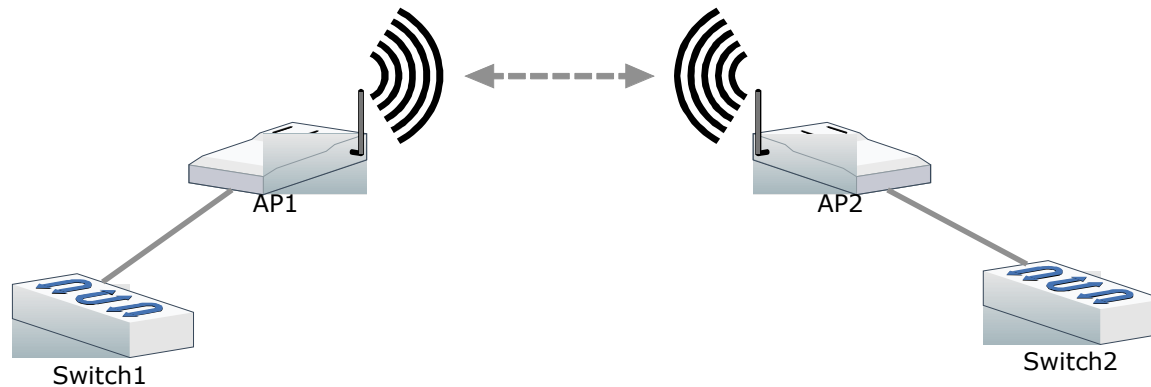


?????

Where does these 3.88mbps
come ?

-> TCP ACK and half-duplex Wireless

Easy to setup – bridge or routing

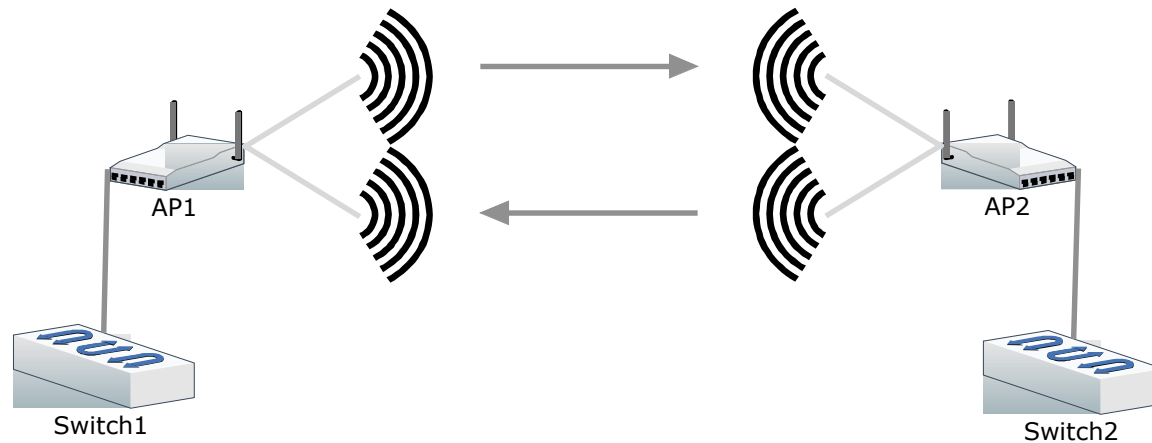


BUT :

- 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 :

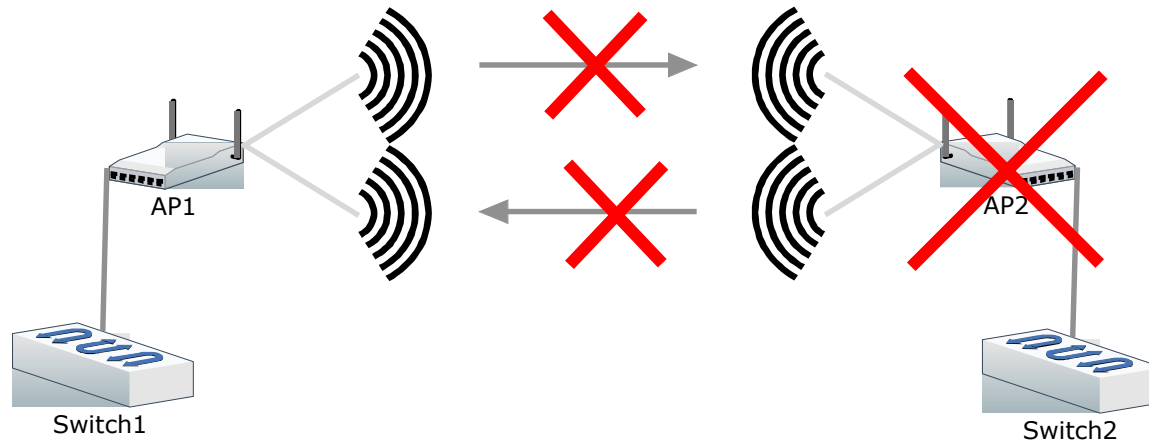
- «FULL-DUPLEX»
- Better speed
- CPU INTENSIVE
- BUT :
 - if one LINK down -> no more communication

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

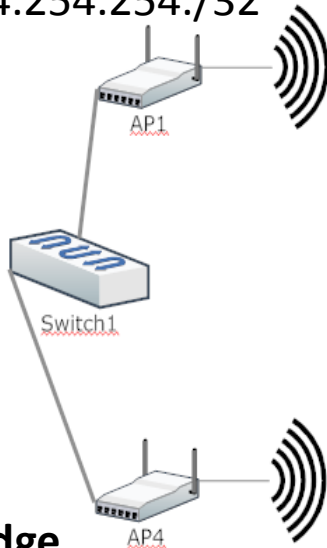
AP2: mode station

ETH1: 192.168.2.1/24

WLAN1: 172.16.16.2/30

LOOPBACK: 10.254.254.253./32

Switch1:
192.168.1.10/24



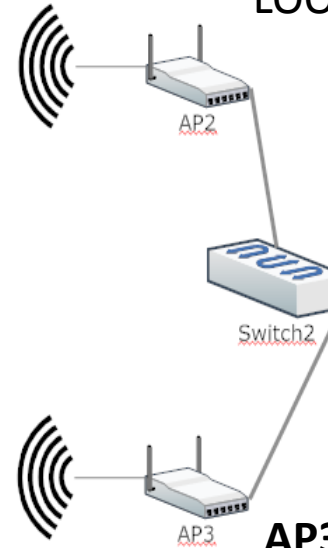
AP4: mode AP Bridge

ETH1: 192.168.1.2/24

WLAN1: 172.16.17.1/30

LOOPBACK: 10.254.254.251./32

Switch2:
192.168.2.10/24



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 agregate 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

Interface <vmp 1>

General VRRP Scripts Traffic

Interface: ether1

VRID: 1

Priority: 100

Interval: 1.00 s

Preemption Mode

Authentication

none simple ah

Password:

Version: 3

V3 Protocol: IPv4

enabled running slave 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

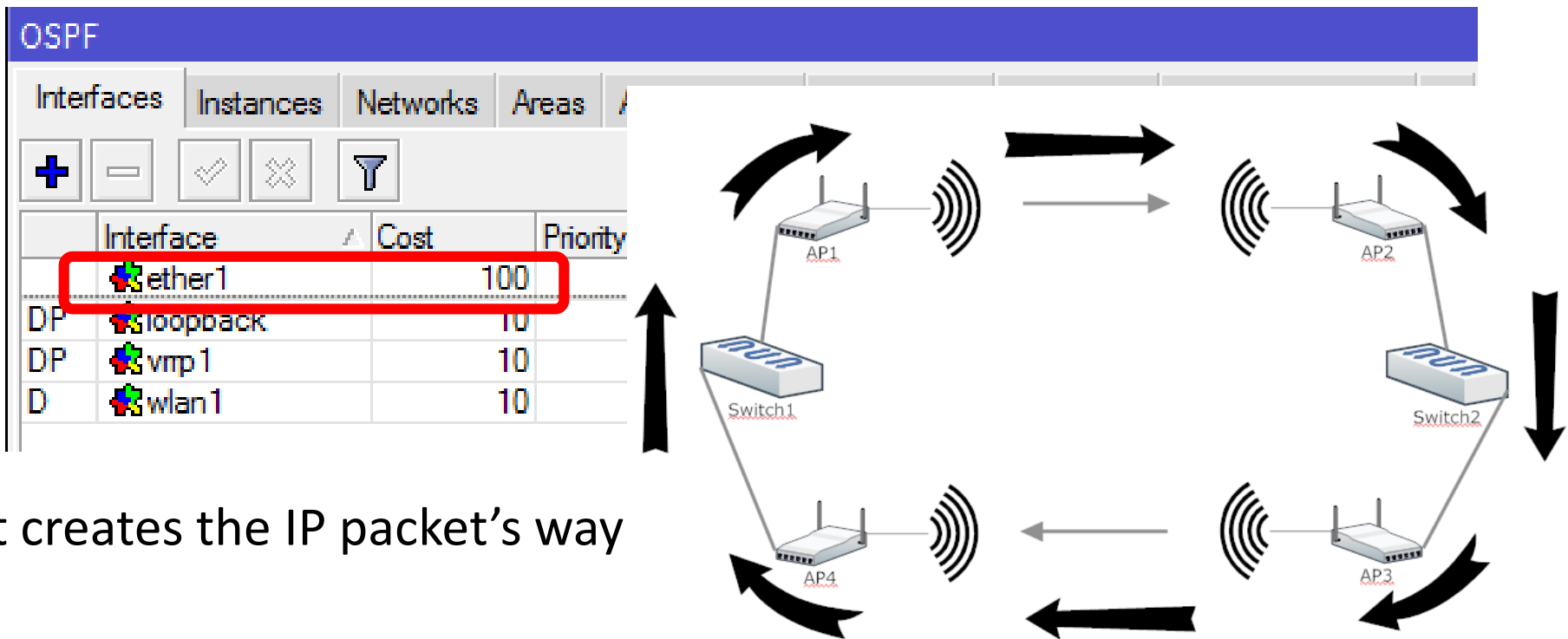
The screenshot shows the 'OSPF Instance <default>' configuration window. The 'General' tab is active. The 'Name' field is set to 'default'. The 'Router ID' field is set to '10.254.254.254' and is highlighted with a red box. Below this, there are several dropdown menus for redistributing routes: 'Redistribute Default Route' (never), 'Redistribute Connected Routes' (no), 'Redistribute Static Routes' (no), 'Redistribute RIP Routes' (no), 'Redistribute BGP Routes' (no), and 'Redistribute Other OSPF Routes' (no). To the right of the configuration fields are buttons for 'OK', 'Cancel', 'Apply', 'Disable', 'Comment', 'Copy', and 'Remove'. Below the configuration window, the 'OSPF' configuration table is visible, showing a list of networks and their associated areas. The table has columns for 'Network' and 'Area'. The first row is highlighted with a red box and contains the following data:

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)
```

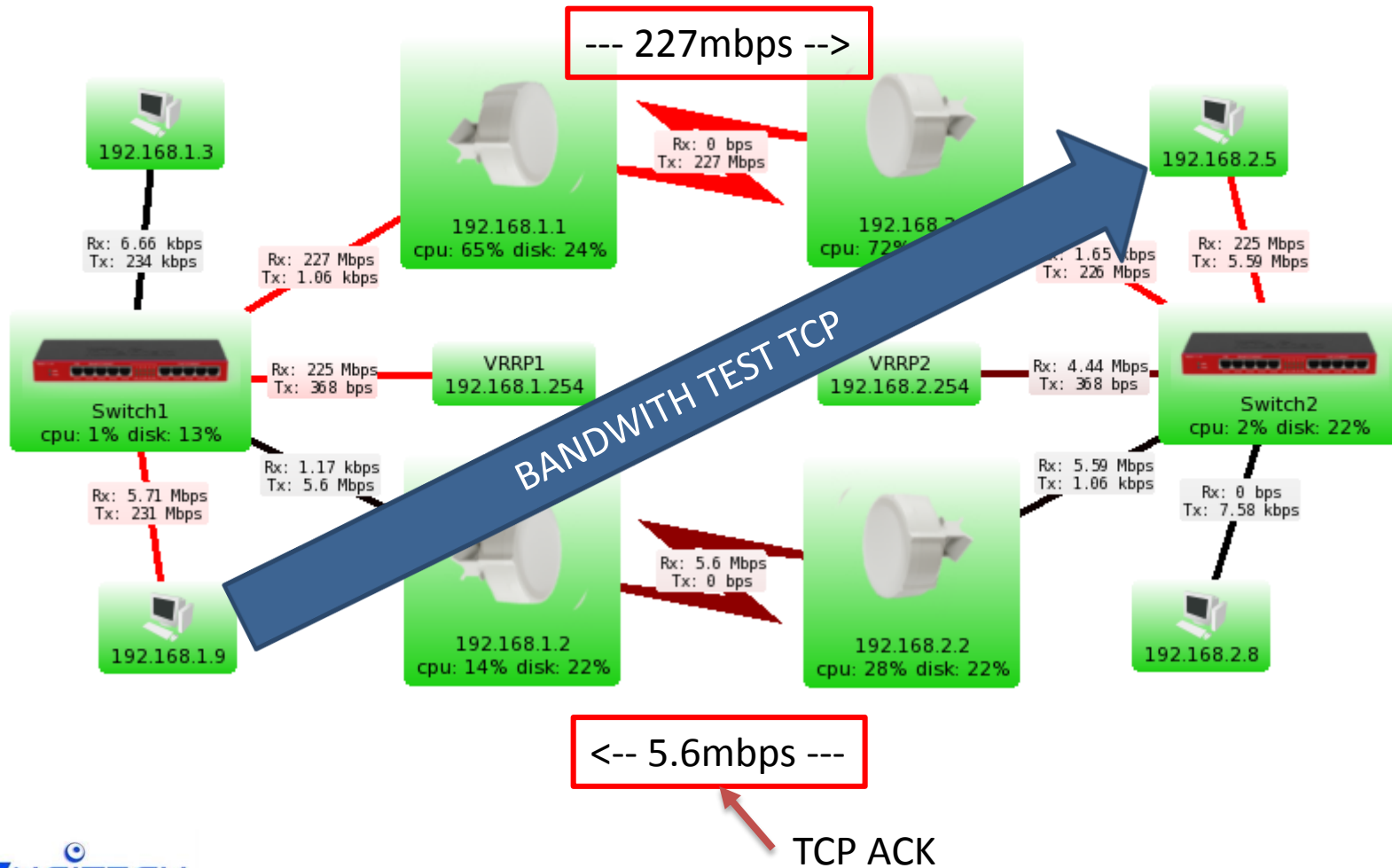
```
/routing ospf interface add interface=wlan1 cost=100 (AP2,AP4)
```



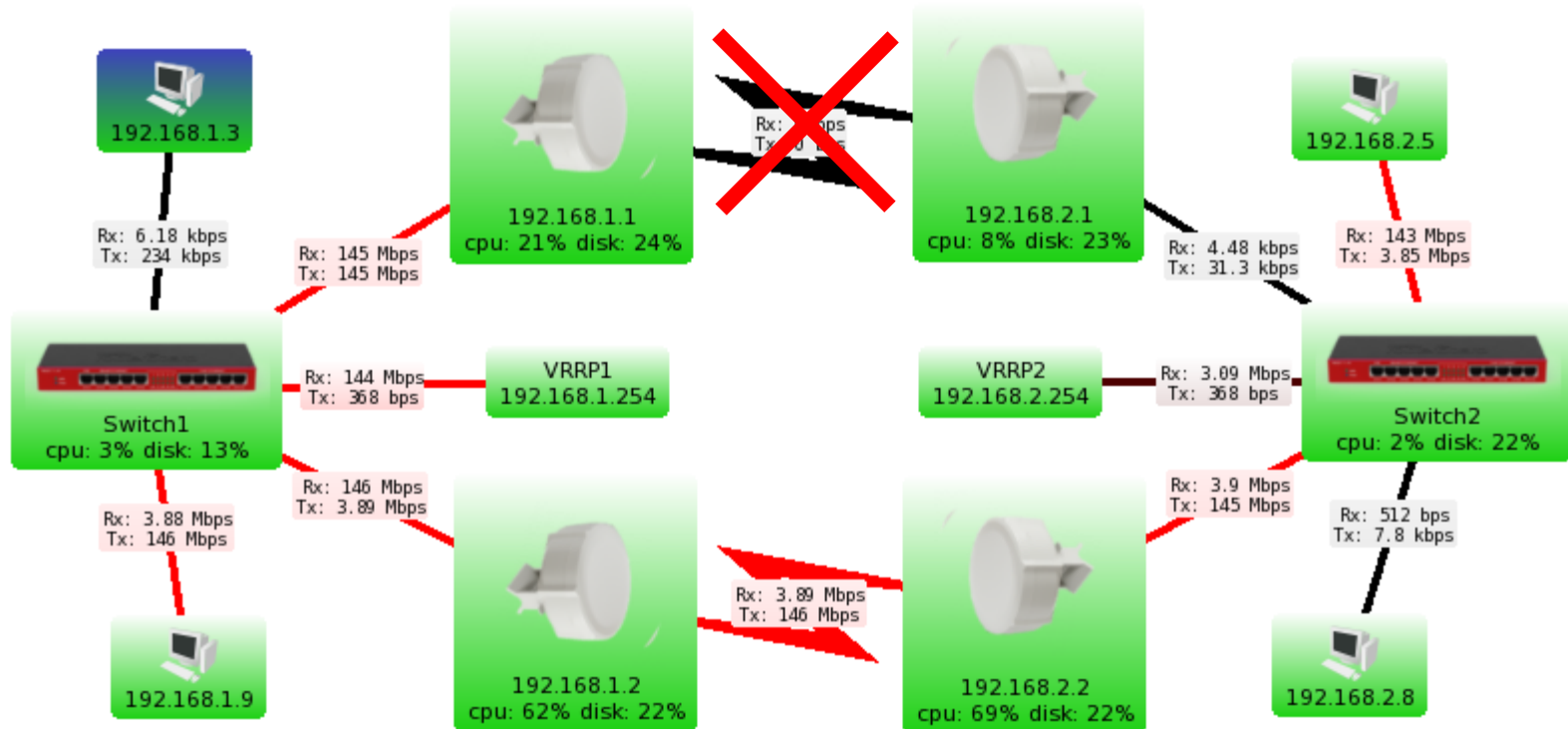
It creates the IP packet's way

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



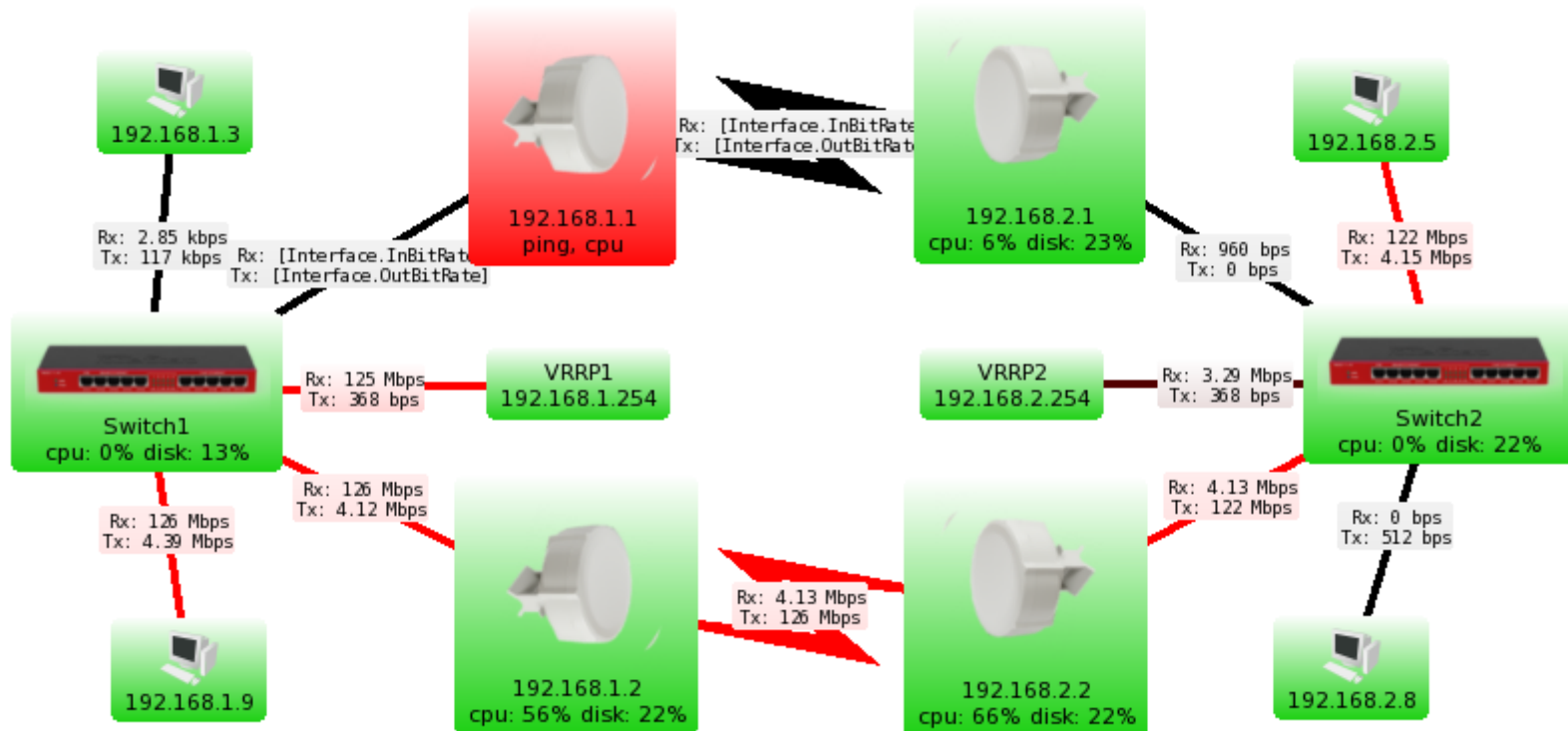
Redundancy – 1 link cut

5 Pings and still running
OSPF bring back the link

The screenshot shows the WinBox Ping utility interface. The 'General' tab is active, showing the destination IP as 192.168.2.8. The Ping Count is set to 135, and the Timeout is 1000 ms. The results table shows 135 ping attempts, with 133 successful and 2 timeouts. The status bar at the bottom indicates 138 items, 133 of 136 packets received, and a 2% packet loss rate. The summary statistics are: Min: 3 ms, Avg: 7 ms, Max: 110 ms.

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	

Redundancy – 1 AP down



Redundancy – 1 AP down

10 Pings everything running

OSPF and VRRP operating

The screenshot shows the Windows Ping utility window. The 'General' tab is selected, and the 'Ping To' field contains '192.168.2.5'. The 'Packet Count' is set to 328, and the 'Timeout' is 1000 ms. The 'Start' button is highlighted. Below the settings is a table of ping results.

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	

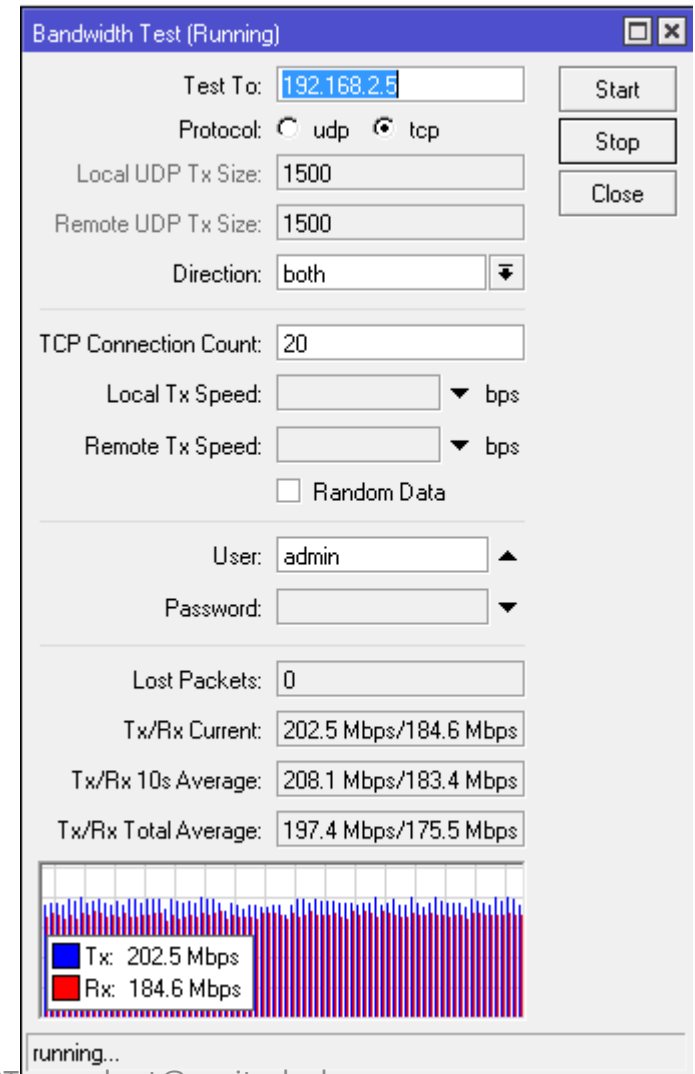
Summary: 328 items, 317 of 328 packets received, 3% packet loss, Min: 1 ms, Avg: 4 ms, Max: 13 ms

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
- ...

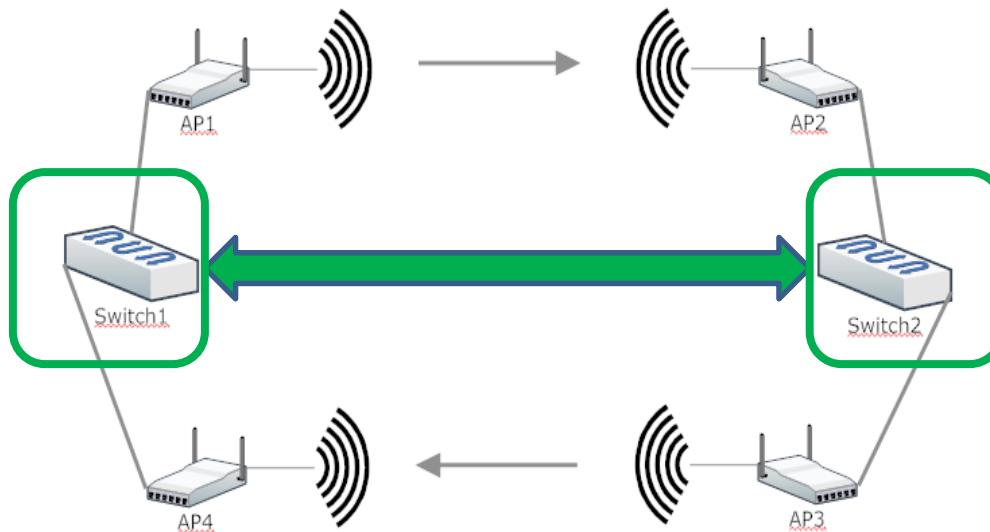
The winner is: VPLS!

- 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 diferrent 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: 16-1048575

Propagate TTL

LDP Settings

Enabled

LSR ID: 10.254.254.254

Transport Address: 10.254.254.254

Path Vector Limit: 255

Hop Limit: 255

Loop Detect

Use Explicit Null

Distribute For Default Route

3 items

LDP -> enabled

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	Remote B
	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

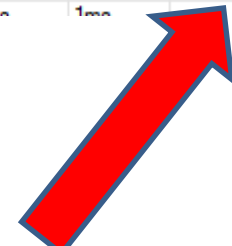
Src. Address:

Interface:

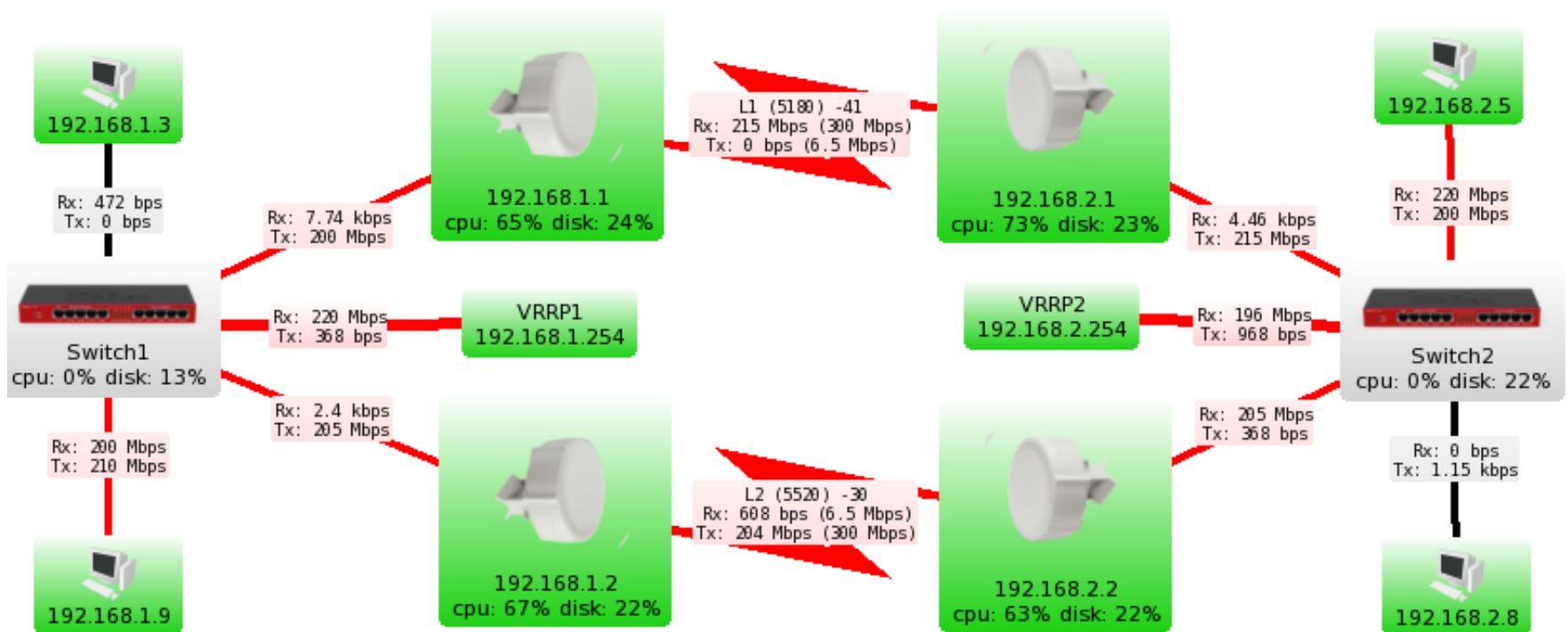
DSCP:

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



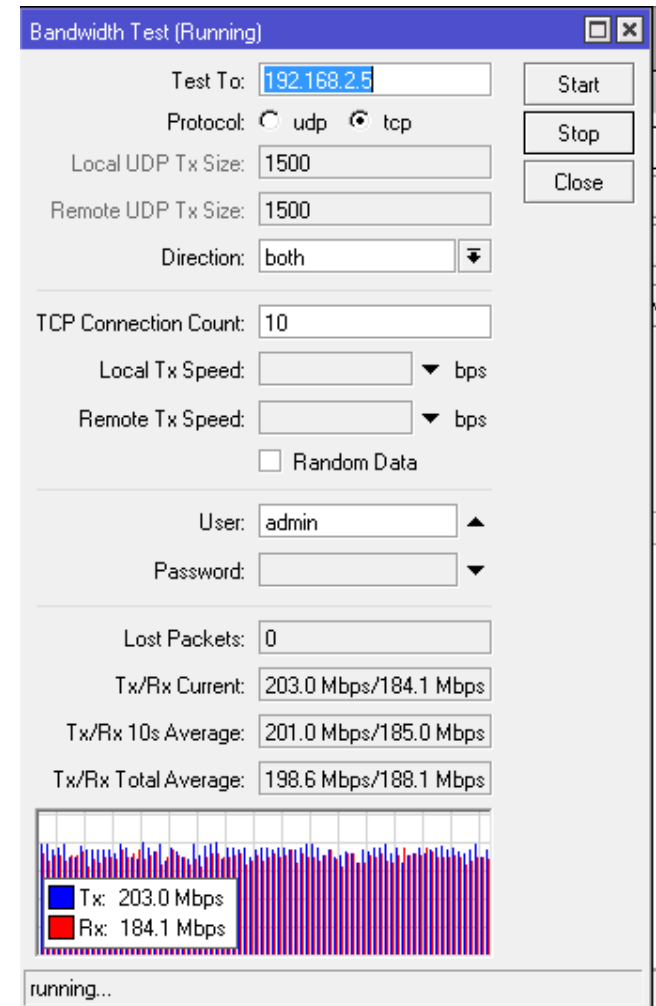
Speed of MPLS network

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

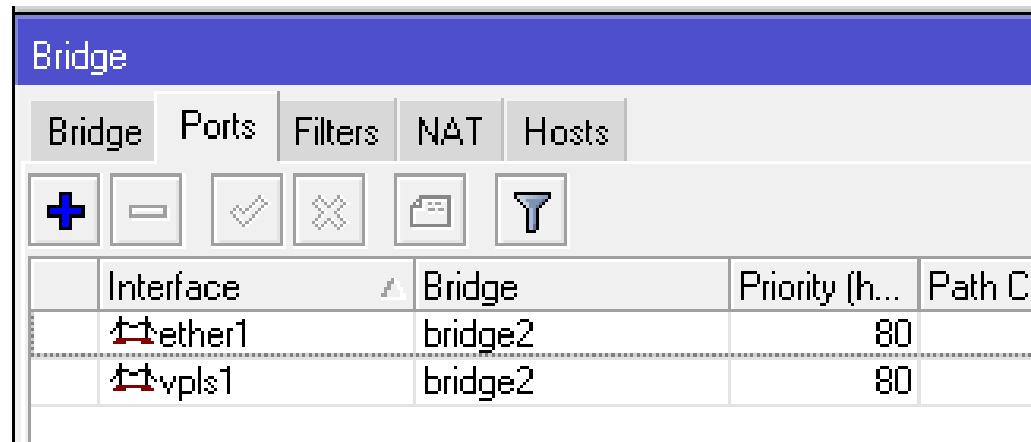
enabled running slave BGP signaled Cisco BGP Si...

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

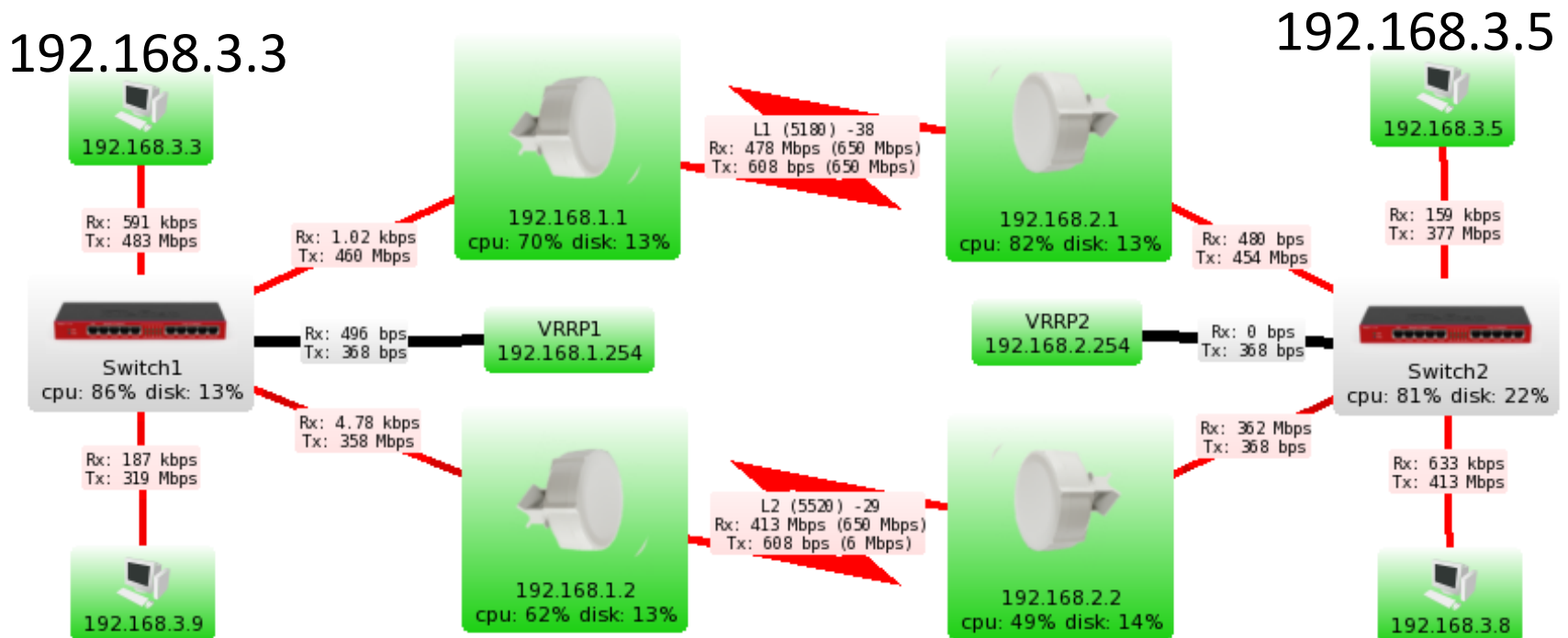


The screenshot shows the Mikrotik WinBox configuration window for a bridge. The window title is "Bridge". Below the title bar, there are tabs for "Bridge", "Ports", "Filters", "NAT", and "Hosts". The "Bridge" tab is selected. Below the tabs, there are several icons: a plus sign (+), a minus sign (-), a checkmark (✓), a cross (✗), a folder icon, and a funnel icon. Below the icons is a table with the following columns: "Interface", "Bridge", "Priority (h...", and "Path C". The table contains two rows of data:

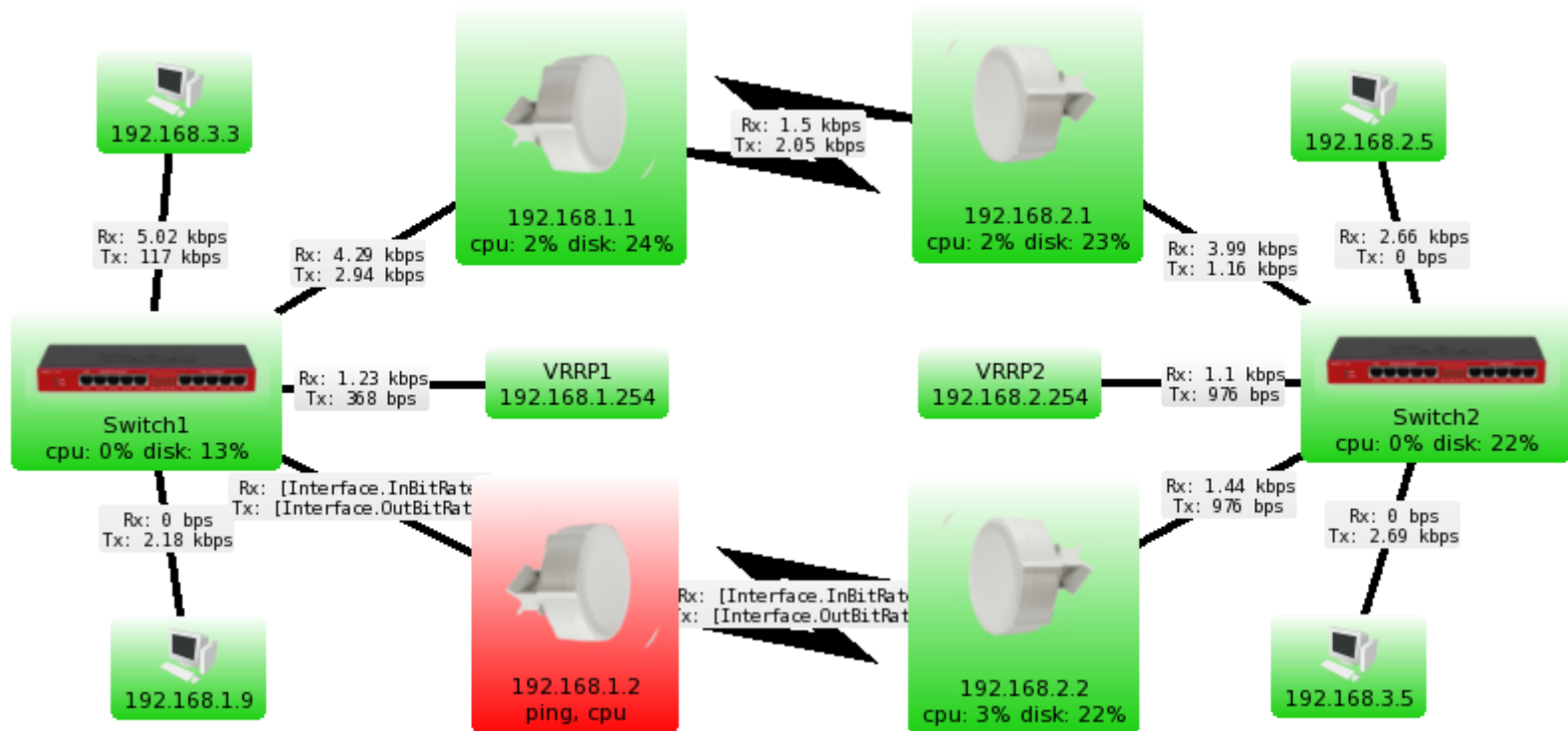
Interface	Bridge	Priority (h...	Path C
ether1	bridge2	80	
vpls1	bridge2	80	

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



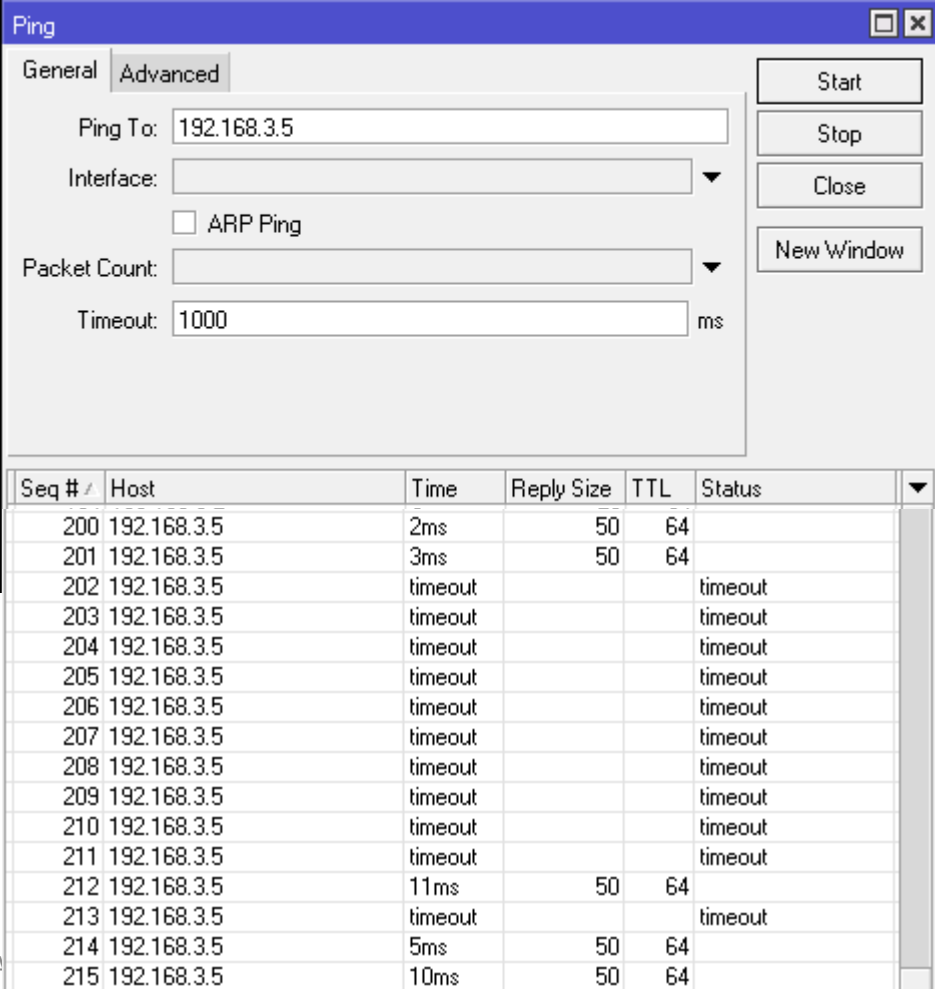
VPLS Redundancy

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



The screenshot shows the Windows 'Ping' utility window with the 'Advanced' tab selected. The 'Ping To:' field is set to '192.168.3.5'. The 'Packet Count' is set to 12. The 'Timeout' is set to 1000 ms. The results table below shows the following data:

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	

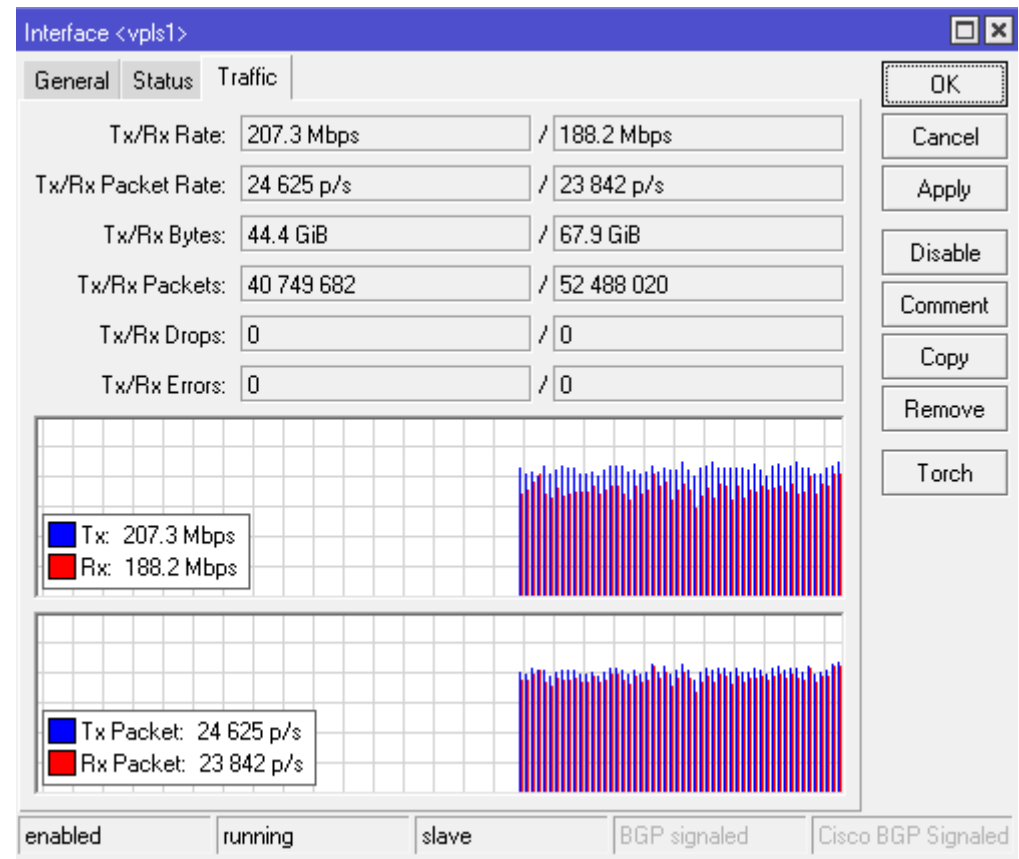
Bridge speed

Result:

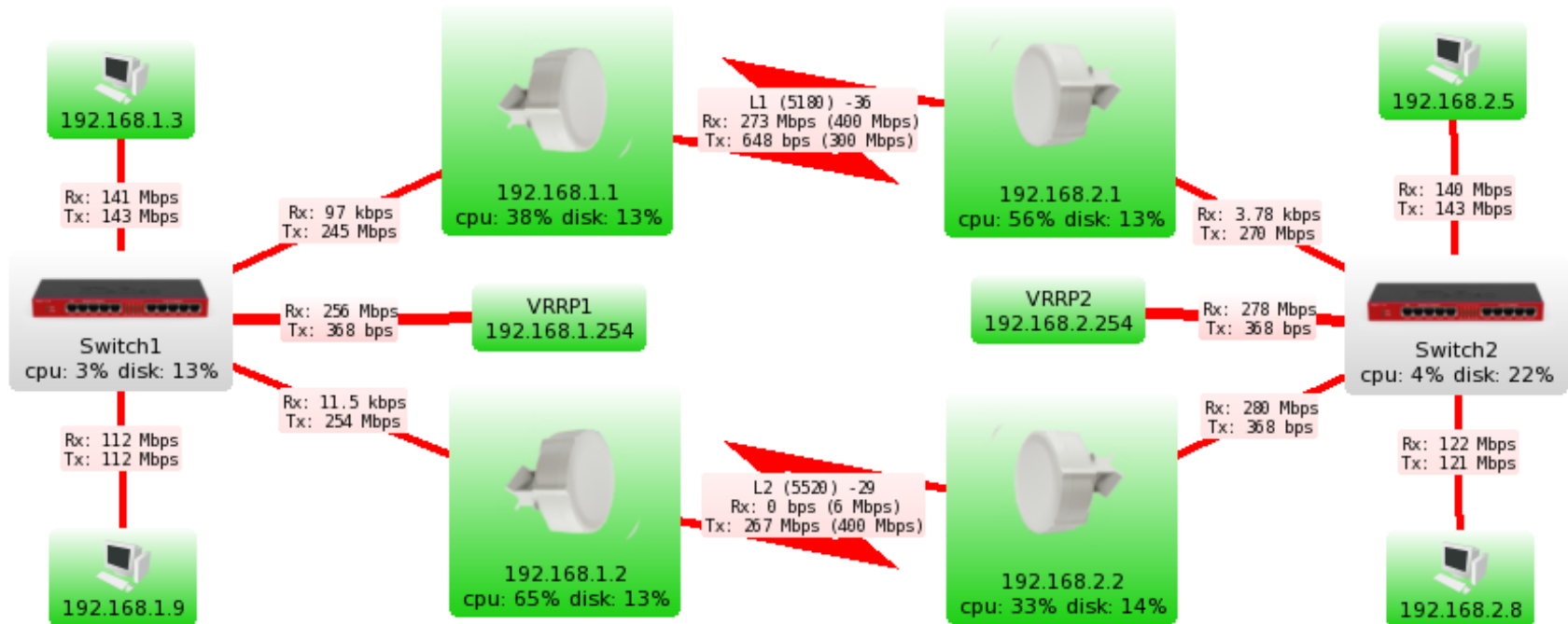
TCP FULL-DUPLEX

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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