

Full Duplex Wireless Links using VPLS and Traffic Engineering

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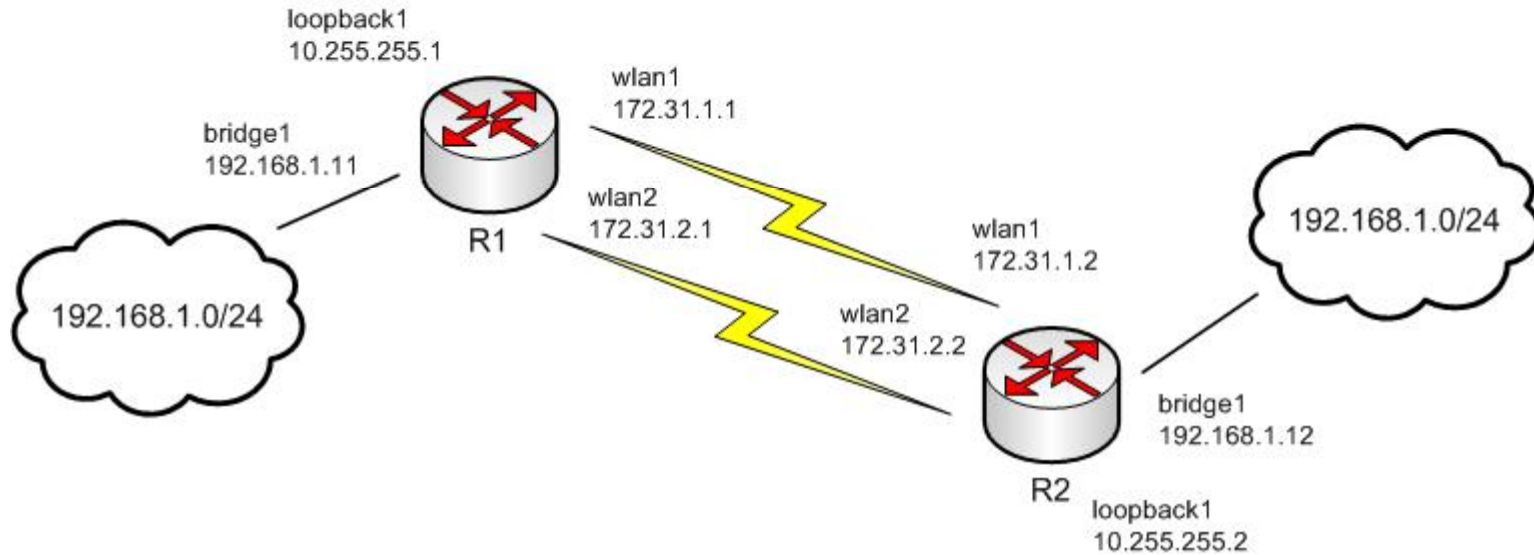
About Me

- Jesse Liu, Lethbridge
 - Over 9 years experience using RouterOS
 - Specialization in Wireless and Tunnel
 - MikroTik Certified Consultant
 - MikroTik MTCNA, MTCWE, MTCTCE Certifications
 - Cisco CCNP, CCDP Certifications

Summary

- This presentation shows how to create full duplex wireless links using BGP based VPLS and Traffic Engineering tunnels. It also shows how to steer traffic over the tunnel.
- We are working with 2 RB800 units with two R52Hn at each end.
- BGP/MPLS/VPLS/TE knowledge is needed

Network Diagram



Setup steps

- Bridge
- Wireless
- IP connectivity
- BGP
- VPLS
- TE Tunnel

Bridge – R1 and R2

```
/interface bridge add name=bridge1 disabled=no auto-mac=no protocol-mode=none;  
/interface bridge set bridge1 admin-mac=[/interface ethernet get ether1 mac-address];  
/interface bridge port add bridge=bridge1 interface=ether1;  
/interface bridge port add bridge=bridge1 interface=ether2;  
/interface bridge port add bridge=bridge1 interface=ether3;
```

Wireless – R1

```
/interface wireless security-profiles add name=profile1 mode=dynamic-keys \  
    authentication-types=wpa2-psk wpa2-pre-shared-key=gb4fnw7q;  
  
/interface wireless set wlan1 mode=bridge band=5ghz-onlyn ht-txchains=0 ht-rxchains=0 \  
    channel-width=20/40mhz-ht-above ssid=W1 wireless-protocol=802.11 frequency=5745 \  
    radio-name=W1_A security-profile=profile1 disabled=no;  
/interface wireless set wlan2 mode=bridge band=5ghz-onlyn ht-txchains=0 ht-rxchains=0 \  
    channel-width=20/40mhz-ht-above ssid=W2 wireless-protocol=802.11 frequency=5825 \  
    radio-name=W2_A security-profile=profile1 disabled=no;  
  
/interface wireless set wlan1 rate-set=configured \  
    basic-rates-b="" supported-rates-b="" basic-rates-a/g="" supported-rates-a/g="" \  
    ht-basic-mcs=mcs-0,mcs-1,mcs-2,mcs-3,mcs-4,mcs-5,mcs-6,mcs-7 \  
    ht-supported-mcs=mcs-0,mcs-1,mcs-2,mcs-3,mcs-4,mcs-5,mcs-6,mcs-7;  
  
/interface wireless set wlan2 rate-set=configured \  
    basic-rates-b="" supported-rates-b="" basic-rates-a/g="" supported-rates-a/g="" \  
    ht-basic-mcs=mcs-0,mcs-1,mcs-2,mcs-3,mcs-4,mcs-5,mcs-6,mcs-7 \  
    ht-supported-mcs=mcs-0,mcs-1,mcs-2,mcs-3,mcs-4,mcs-5,mcs-6,mcs-7;
```

Wireless – R2

```
/interface wireless security-profiles add name=profile1 mode=dynamic-keys \  
    authentication-types=wpa2-psk wpa2-pre-shared-key=gb4fnw7q;  
  
/interface wireless set wlan1 mode=station band=5ghz-onlyn ht-txchains=0 ht-rxchains=0 \  
    channel-width=20/40mhz-ht-above ssid=W1 wireless-protocol=802.11 radio-name=W1_C \  
    security-profile=profile1 disabled=no;  
/interface wireless set wlan2 mode=station band=5ghz-onlyn ht-txchains=0 ht-rxchains=0 \  
    channel-width=20/40mhz-ht-above ssid=W2 wireless-protocol=802.11 radio-name=W2_C \  
    security-profile=profile1 disabled=no;  
  
/interface wireless set wlan1 rate-set=configured \  
    basic-rates-b="" supported-rates-b="" basic-rates-a/g="" supported-rates-a/g="" \  
    ht-basic-mcs=mcs-0,mcs-1,mcs-2,mcs-3,mcs-4,mcs-5,mcs-6,mcs-7 \  
    ht-supported-mcs=mcs-0,mcs-1,mcs-2,mcs-3,mcs-4,mcs-5,mcs-6,mcs-7;  
  
/interface wireless set wlan2 rate-set=configured \  
    basic-rates-b="" supported-rates-b="" basic-rates-a/g="" supported-rates-a/g="" \  
    ht-basic-mcs=mcs-0,mcs-1,mcs-2,mcs-3,mcs-4,mcs-5,mcs-6,mcs-7 \  
    ht-supported-mcs=mcs-0,mcs-1,mcs-2,mcs-3,mcs-4,mcs-5,mcs-6,mcs-7;
```


Loopback IP address

- In RouterOS loopback IP address can be configured by creating dummy bridge interface without any ports and adding address to it.

Loopback interface, IP addressing and Route – R1

```
/interface bridge add name=loopback1 disabled=no;
/ip address add address 10.255.255.1/32 interface=loopback1;

/ip address add address=172.31.1.1/30 interface=wlan1;
/ip address add address=172.31.2.1/30 interface=wlan2;

/ip route add check-gateway=ping dst-address=10.255.255.2/32 \
gateway=172.31.1.2,172.31.2.2;

/ip address add address 192.168.1.11/24 interface=bridge1;

/ip route add check-gateway=ping dst-address=0.0.0.0/0 \
gateway=192.168.1.1;
```

Loopback interface, IP addressing and Route – R2

```
/interface bridge add name=loopback1 disabled=no;
/ip address add address 10.255.255.2/32 interface=loopback1;

/ip address add address=172.31.1.2/30 interface=wlan1;
/ip address add address=172.31.2.2/30 interface=wlan2;

/ip route add check-gateway=ping dst-address=10.255.255.1/32 \
gateway=172.31.1.1,172.31.2.1;

/ip address add address 192.168.1.12/24 interface=bridge1;

/ip route add check-gateway=ping dst-address=0.0.0.0/0 \
gateway=192.168.1.1;
```

IBGP session

- On Router 1:

```
/routing bgp instance set [ find default=yes ] router-id=10.255.255.1;  
/routing bgp peer add name=peer1 remote-address=10.255.255.2 remote-as=65530 \  
address-families=l2vpn update-source=loopback1;
```

- On Router 2:

```
/routing bgp instance set [ find default=yes ] router-id=10.255.255.2;  
/routing bgp peer add name=peer1 remote-address=10.255.255.1 remote-as=65530 \  
address-families=l2vpn update-source=loopback1;
```

Check that BGP connection is established

WinBox v6.12 on R8800 (powerpc)

BGP

Instances VRFs Peers Networks Aggregates VPN4 Routes Advertisements

+ - ✓ ✗ [Filter] Refresh Refresh All Resend Resend All Find

Name	Instance	Remote Address	Remote AS	Multihop	Route Reflect	TTL	Remote ID	Uptime	Prefix Count	State
peer1	default	10.255.255.1	65530	no	no	255	10.255.255.1	00:21:54		established

BGP signaled VPLS

- On Router 1:

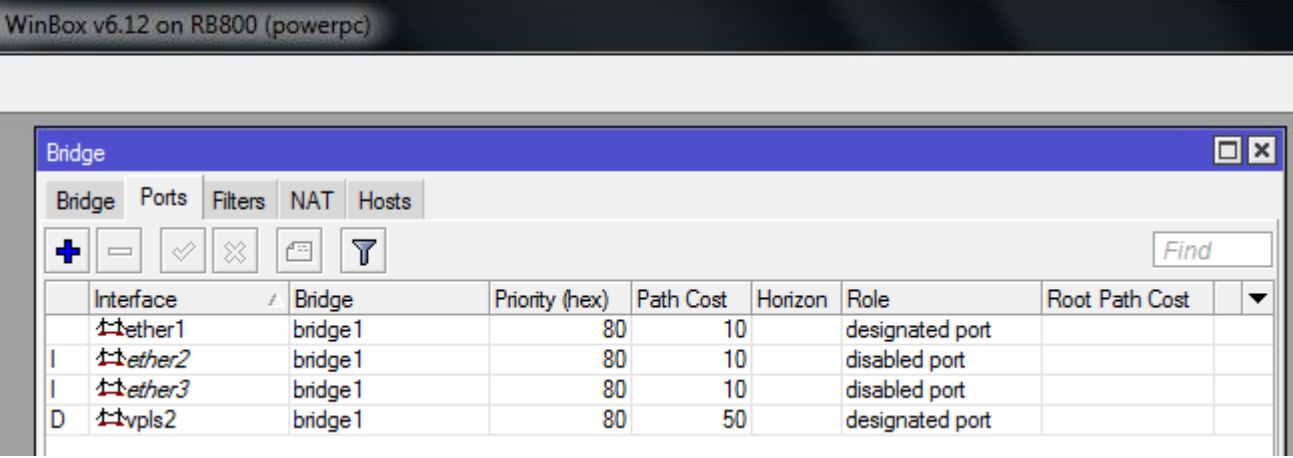
```
/interface vpls bgp-vpls add name=bgp-vpls1 site-id=1 bridge=bridge1 bridge-cost=50 \  
route-distinguisher=1:1 import-route-targets=1:1 export-route-targets=1:1;
```

- On Router 2:

```
/interface vpls bgp-vpls add name=bgp-vpls1 site-id=2 bridge=bridge1 bridge-cost=50 \  
route-distinguisher=1:1 import-route-targets=1:1 export-route-targets=1:1;
```

Dynamic VPLS tunnel gets created on both R1 and R2

WinBox v6.12 on RB800 (powerpc)



The screenshot shows the Mikrotik WinBox interface for configuring a bridge. The 'Bridge' window is open, displaying a table of bridge ports. The table has columns for Interface, Bridge, Priority (hex), Path Cost, Horizon, Role, and Root Path Cost. The 'Interface' column shows four entries: ether1, ether2, ether3, and vpls2. The 'Bridge' column for all entries is 'bridge 1'. The 'Priority (hex)' column shows 80 for ether1, ether2, and ether3, and 80 for vpls2. The 'Path Cost' column shows 10 for ether1, ether2, and ether3, and 50 for vpls2. The 'Role' column shows 'designated port' for ether1 and vpls2, and 'disabled port' for ether2 and ether3. The 'Root Path Cost' column is empty for all entries.

Interface	Bridge	Priority (hex)	Path Cost	Horizon	Role	Root Path Cost
ether1	bridge 1	80	10		designated port	
ether2	bridge 1	80	10		disabled port	
ether3	bridge 1	80	10		disabled port	
vpls2	bridge 1	80	50		designated port	

Traffic Engineering needs RSVP protocol enabled – R1 and R2

```
/mpls traffic-eng interface add interface=wlan1;  
/mpls traffic-eng interface add interface=wlan2;
```


Traffic Engineering tunnels

- On Router 1:

```
/mpls traffic-eng tunnel-path add name=tp1 hops=172.31.1.2:strict use-cspf=no;  
/mpls traffic-eng tunnel-path add name=tp2 hops=172.31.2.2:strict use-cspf=no;  
  
/interface traffic-eng add name=traffic-eng1 primary-path=tp1 secondary-paths=tp2 \  
    from-address=10.255.255.1 to-address=10.255.255.2 disabled=no;
```

- On Router 2:

```
/mpls traffic-eng tunnel-path add name=tp1 hops=172.31.1.1:strict use-cspf=no;  
/mpls traffic-eng tunnel-path add name=tp2 hops=172.31.2.1:strict use-cspf=no;  
  
/interface traffic-eng add name=traffic-eng1 primary-path=tp2 secondary-paths=tp1 \  
    from-address=10.255.255.2 to-address=10.255.255.1 disabled=no;
```

Verify that TE tunnels are working

WinBox v6.12 on RB800 (powerpc)

Interface <traffic-eng1>

General TE Bandwidth Status Traffic

Tunnel ID: 3

Primary Path State: established

Primary Path: tp2

Secondary Path State: not necessary

Secondary Path:

Active Path: tp2

Active Label: impl null

Explicit Route: S:172.31.2.1/32

Recorded Route:

Reserved Bandwidth:

Rate Limit:

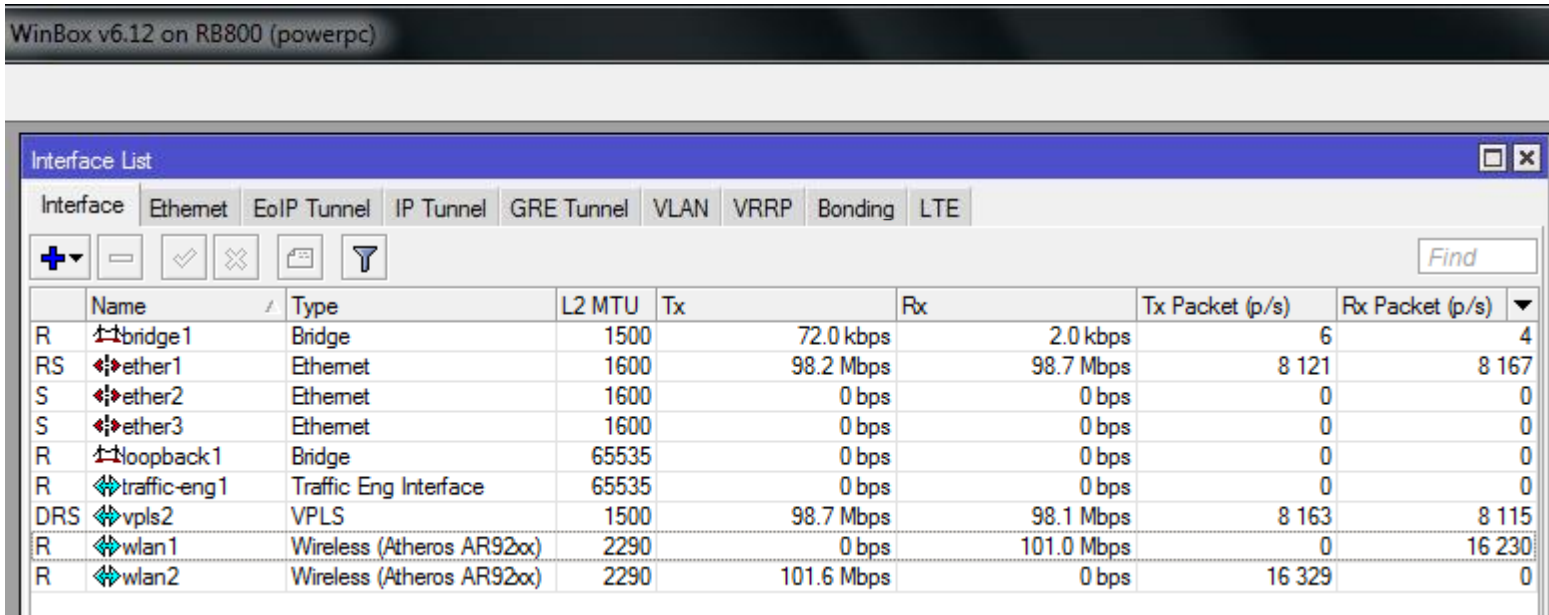
Rate Measured Last:

Rate Measured Highest:

OK
Cancel
Apply
Disable
Comment
Copy
Remove
Torch

Run a iperf test between the routers

WinBox v6.12 on RB800 (powerpc)

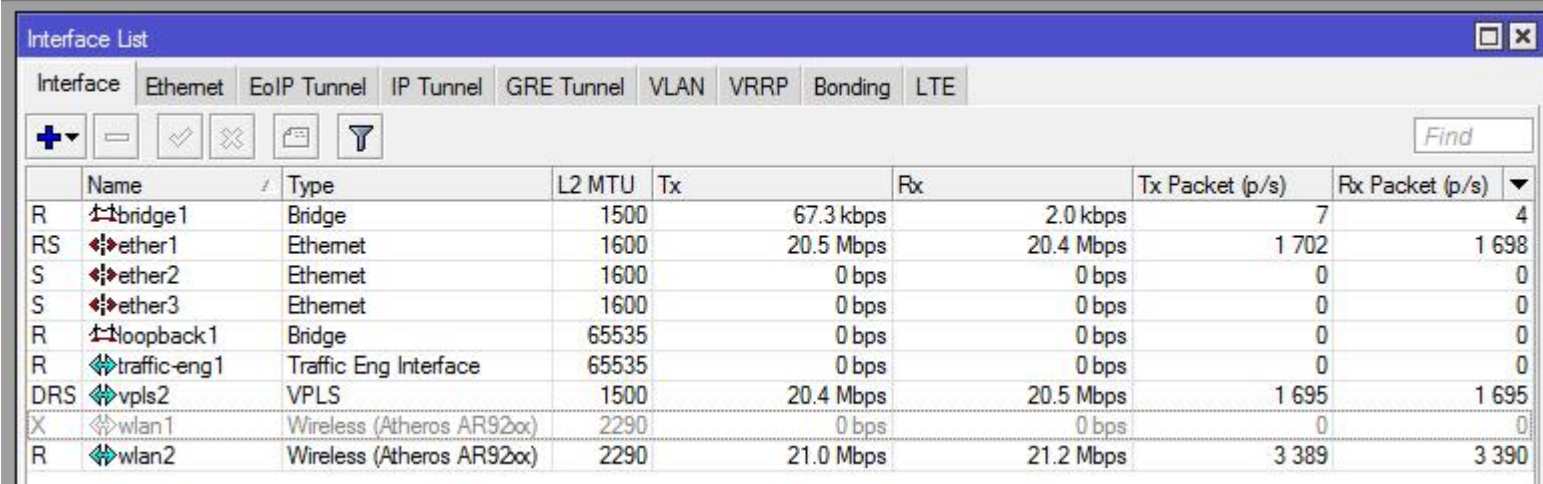


	Name	Type	L2 MTU	Tx	Rx	Tx Packet (p/s)	Rx Packet (p/s)
R	bridge1	Bridge	1500	72.0 kbps	2.0 kbps	6	4
RS	ether1	Ethernet	1600	98.2 Mbps	98.7 Mbps	8 121	8 167
S	ether2	Ethernet	1600	0 bps	0 bps	0	0
S	ether3	Ethernet	1600	0 bps	0 bps	0	0
R	loopback1	Bridge	65535	0 bps	0 bps	0	0
R	traffic-eng1	Traffic Eng Interface	65535	0 bps	0 bps	0	0
DRS	vpls2	VPLS	1500	98.7 Mbps	98.1 Mbps	8 163	8 115
R	wlan1	Wireless (Atheros AR92xx)	2290	0 bps	101.0 Mbps	0	16 230
R	wlan2	Wireless (Atheros AR92xx)	2290	101.6 Mbps	0 bps	16 329	0

Failover Testing

- Lets consider that wlan1 went down, and whole traffic needs to be switched over wlan2.

WinBox v6.12 on RB800 (powerpc)

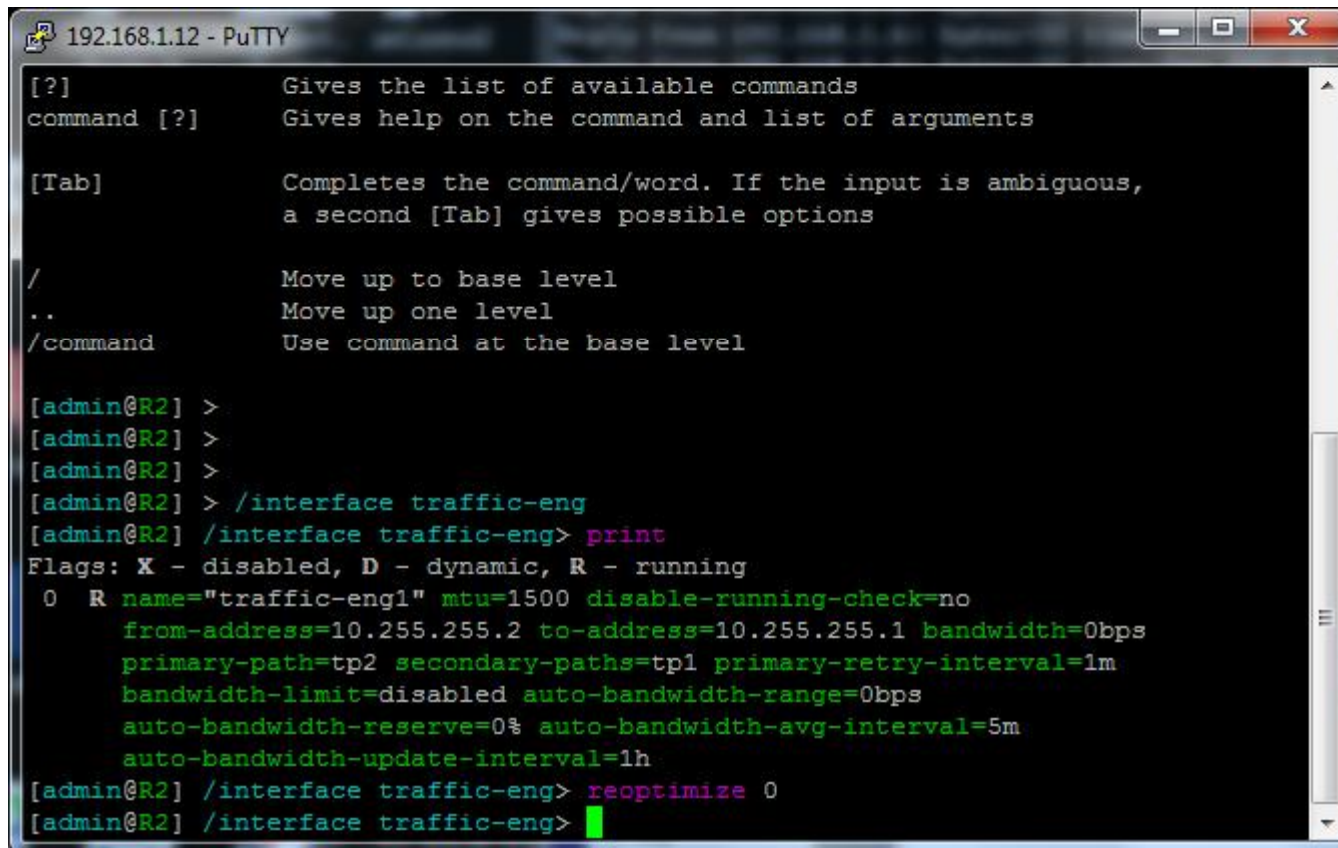


Interface	Ethernet	EoIP Tunnel	IP Tunnel	GRE Tunnel	VLAN	VRRP	Bonding	LTE
	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Name	Type	L2 MTU	Tx	Rx	Tx Packet (p/s)	Rx Packet (p/s)		
R bridge1	Bridge	1500	67.3 kbps	2.0 kbps	7	4		
RS ether1	Ethernet	1600	20.5 Mbps	20.4 Mbps	1 702	1 698		
S ether2	Ethernet	1600	0 bps	0 bps	0	0		
S ether3	Ethernet	1600	0 bps	0 bps	0	0		
R loopback1	Bridge	65535	0 bps	0 bps	0	0		
R traffic-eng1	Traffic Eng Interface	65535	0 bps	0 bps	0	0		
DRS vpls2	VPLS	1500	20.4 Mbps	20.5 Mbps	1 695	1 695		
X wlan1	Wireless (Atheros AR92xx)	2290	0 bps	0 bps	0	0		
R wlan2	Wireless (Atheros AR92xx)	2290	21.0 Mbps	21.2 Mbps	3 389	3 390		

Switch back to primary path

- By default tunnel will try to switch back to primary path every minute. This setting can be changed with `primary-retry-interval` parameter.

re-optimize the tunnel



```
192.168.1.12 - PuTTY
[?] 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

[admin@R2] >
[admin@R2] >
[admin@R2] >
[admin@R2] > /interface traffic-eng
[admin@R2] /interface traffic-eng> print
Flags: X - disabled, D - dynamic, R - running
 0 R name="traffic-eng1" mtu=1500 disable-running-check=no
    from-address=10.255.255.2 to-address=10.255.255.1 bandwidth=0bps
    primary-path=tp2 secondary-paths=tp1 primary-retry-interval=1m
    bandwidth-limit=disabled auto-bandwidth-range=0bps
    auto-bandwidth-reserve=0% auto-bandwidth-avg-interval=5m
    auto-bandwidth-update-interval=1h
[admin@R2] /interface traffic-eng> reoptimize 0
[admin@R2] /interface traffic-eng>
```

More information at:
<http://wiki.mikrotik.com/wiki/Events>

Thank you for participating