VLAN Workshop.

Presenter:
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About this presentation

- A seed from the forum by Randy (Graham)?: http://forum.mikrotik.com/viewtopic.php?f=2&t=24352
- This Workshop could last for hours...,
  but there is only 45 min.

About the company

- RoamingNet Sweden.
  - Helps organizations to increase the ROI in networking.
  - Designing and deployment of wired and wireless networks.
  - Network analysis and problem solving.
  - Project managing.
  - Worldwide support for different clients in different countries. Cooperates with Roamingwire Inc.

About me

- Have a technical degree as a Electric Engineer
- Been in networking since 1989.
- Senior networking consultant
- Certified MikroTik network consultant. (MTCZ0016).
- Certified MikroTik Trainer. (TR0027).

Topics

- Why VLANs.?
- Brief Ethernet fundamentals.
- Brief VLAN fundamentals
- Switch configurations.
- How VLANs are built in MikroTik RouterOS.

Topics

- How VLANs are built in a wireless environment.
- Demo system.
- Summary.
- Questions.

Why VLANs

- Segment traffic, “Tripple Play”
- Limiting broadcast domains
- Provide unique traffic shaping opportunities (firewall, QoS, etc.)
- Secure the network
- Provide remote maintenance without interfering with the running network.

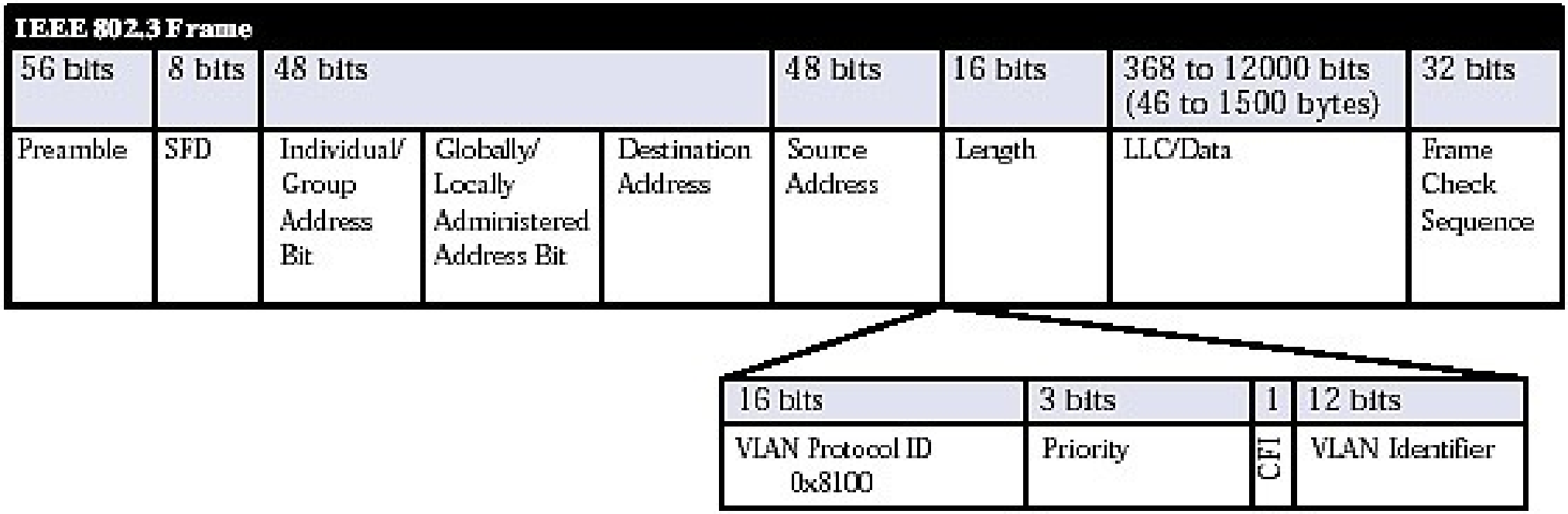
Why VLANs

- Providing a single HotSpot model

Ethernet fundamentals

- The two types of Ethernet frames used in networking are similar. The DIX V2.0 frame, frequently referred to as the Ethernet II frame, and the IEEE 802.3 frame.
- Both providing OSI level 3 with the needed data field. This field is also sometimes referred to as the MTU size of the packet.

VLAN fundamentals



VLAN fundamentals

- 802.1Q working group provided a VLAN standard that inserts a four-byte tag into a standard Ethernet frame. Since 802.1Q arrived more then 20 years after the invention of Ethernet, there are plenty of VLAN-unaware devices. There still are lots of NICs that do not support the 4 byte extra field. These devices are not suitable for VLAN tagging because the MTU (layer 3 packet) size needs to be limited.

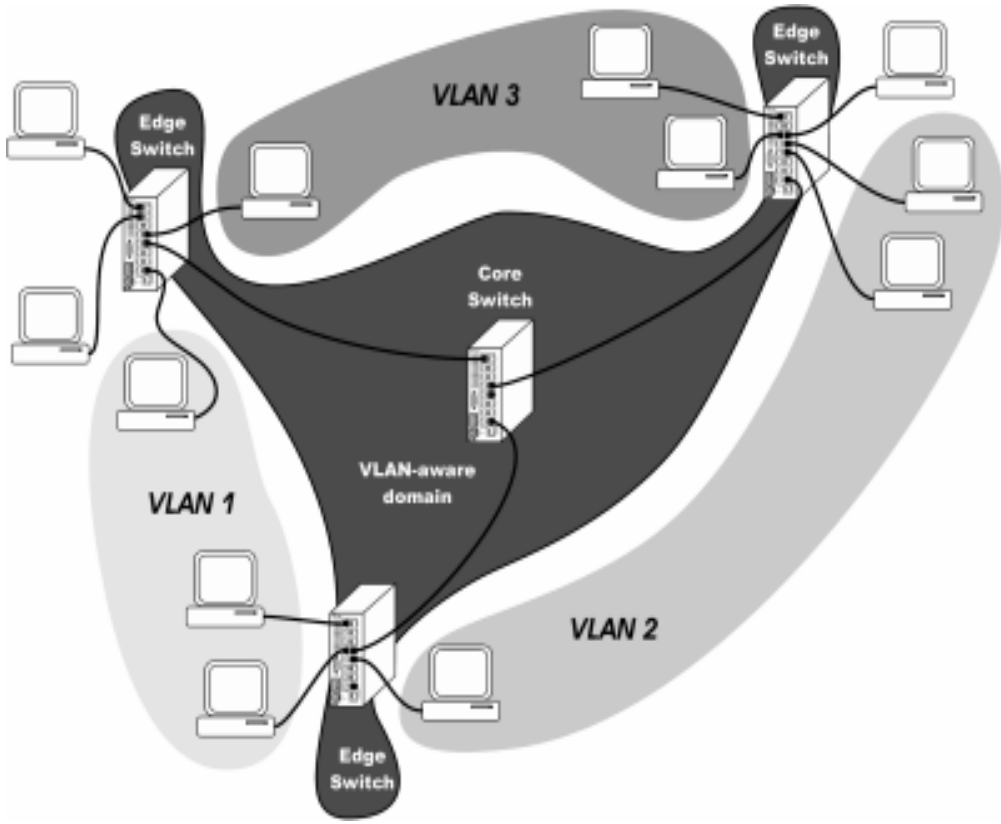
Switch configurations

There are two different types of switch ports.

- Edge ports: (Untagged, Cisco: Access Port)
  A switch port is configured to be part of a VLAN without sending the 4 byte tag. Used with VLAN unaware devices i.e client computer, printer.
- Core port: (Tagged, Cisco: Trunk Port)
  A switch port is configured to send out the 4 byte tag. Used with VLAN aware devices i.e switches, routers and servers.

Switch configurations

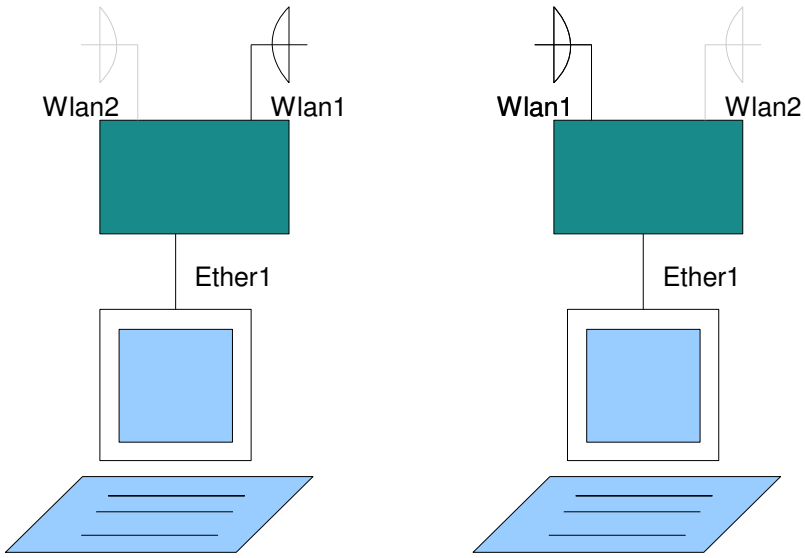
- Core switches interconnect with other switches.
- Edge switches connects to the core and to client computers, printers and other non VLAN aware devices.



How VLANs are built in RouterOS

- Commands:
  - /interface bridge add name=br2
  - /interface bridge port add bridge=br2 interface=ether2
  - /interface bridge port add bridge=br2 interface=ether3
  - /interface vlan add name=br2-vl2 interface=br2 vlan-id=2 disabled=no
- But now we cannot use untagged interfaces in the VLAN

How VLANs are built in a wireless environment.



- Create a WDS interface on both ends.
- Add the WDS interface into the bridge.

How VLANs are built in a wireless environment.

- Commands:
  - /interface wireless wds add name=wds-mt2 master-interface=wlan1 wds-address=01:02:03:04:05:06 disabled=no
  - /interface bridge port add bridge=br2 interface=wds-rt-rnet-02

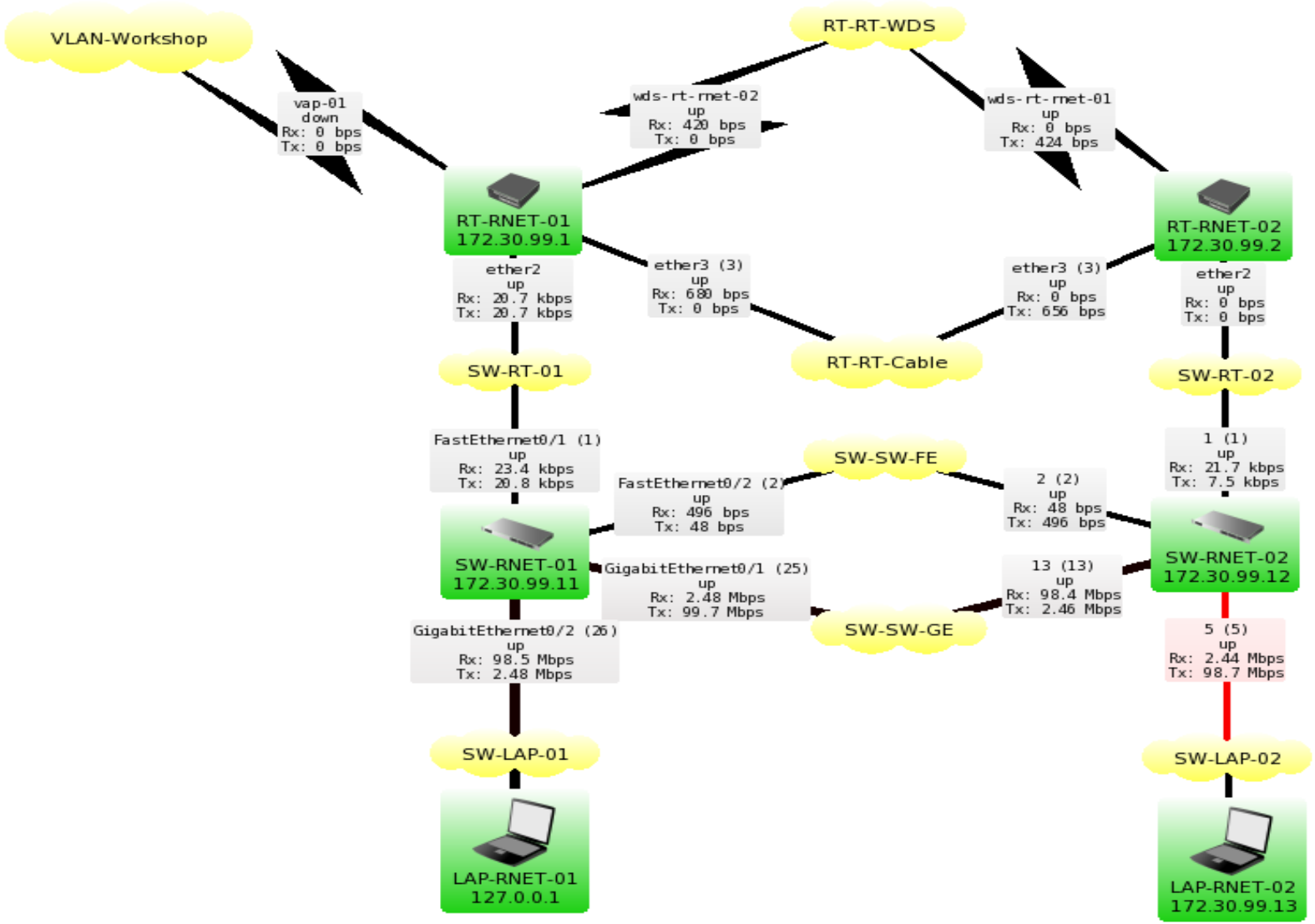
STP and RSTP

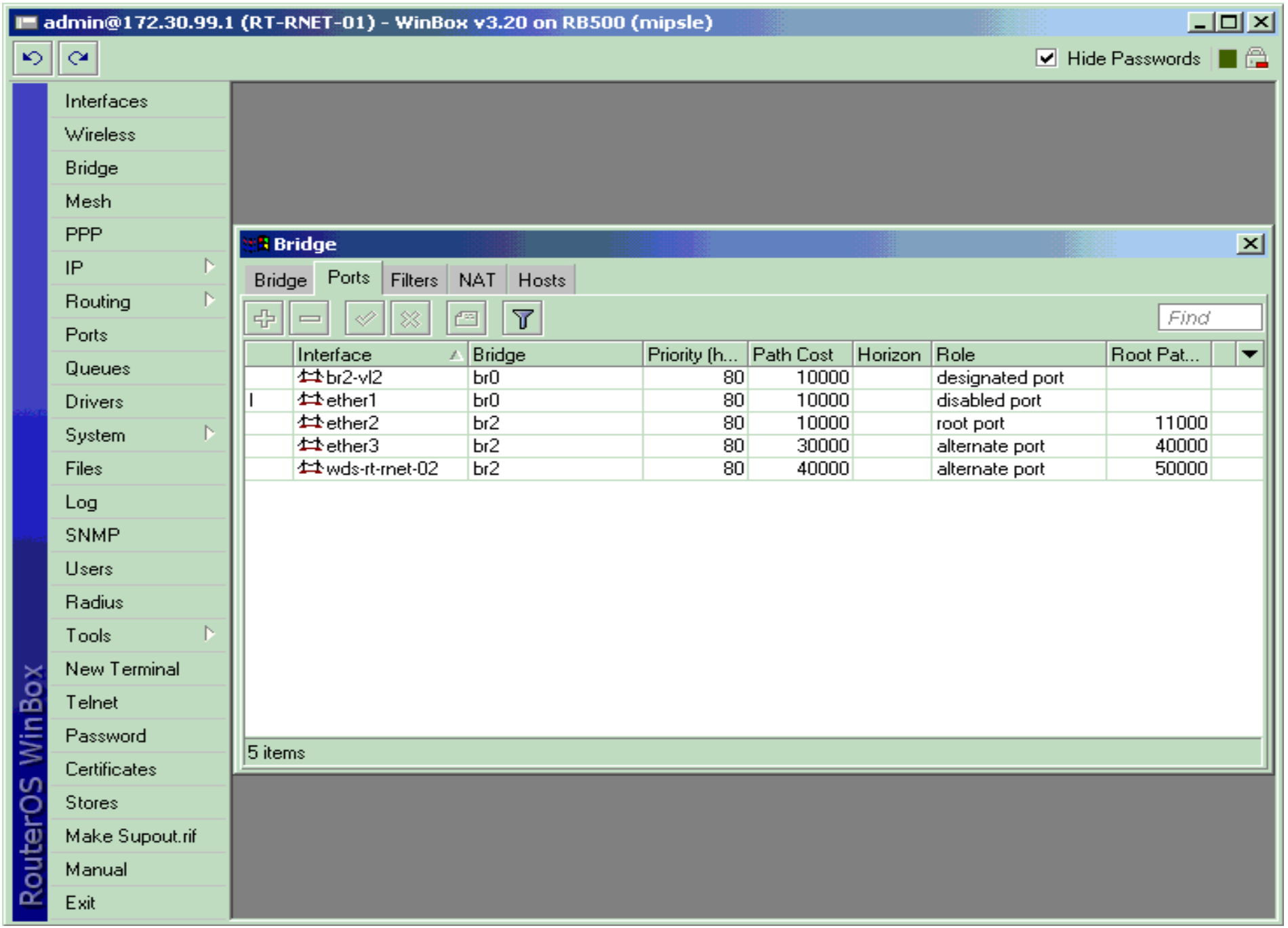
- The problems with multiple bridge and STP/RSTP seem to caused of un mature linux kernel 2.6 software.
- The configuration works well, but the RSTP-PVST (PVST=Per VLAN Spanning Tree), meaning Per Bridge Spanning Tree in ROS function would be great. Support for MST 802.1s Multiple Spanning Tree are needed.

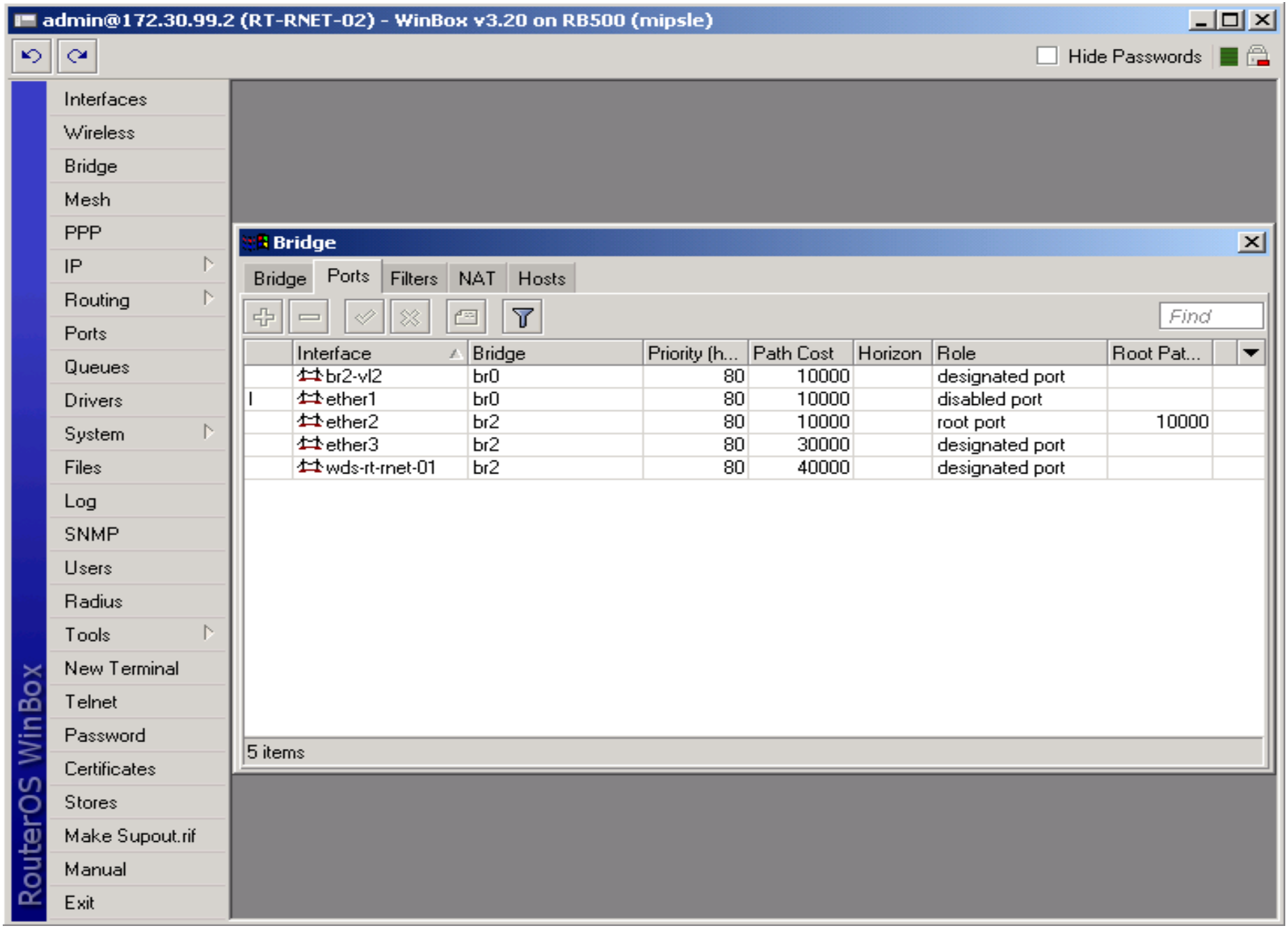
Demo network

- The network are built with:
  2 RouterBoard 532A
  1 Cisco Catalyst 2950 (SW-RNET-01)
  1 HP Procurve 2512 (SW-RNET-02)
- There is one main switch network (SW-SW-GE) and tree redundant networks (SW-SW-FE), (RT-RT-Cable) and (RT-RT-WDS)
- Test traffic from LAP-RNET-01 to LAP-RNET-02

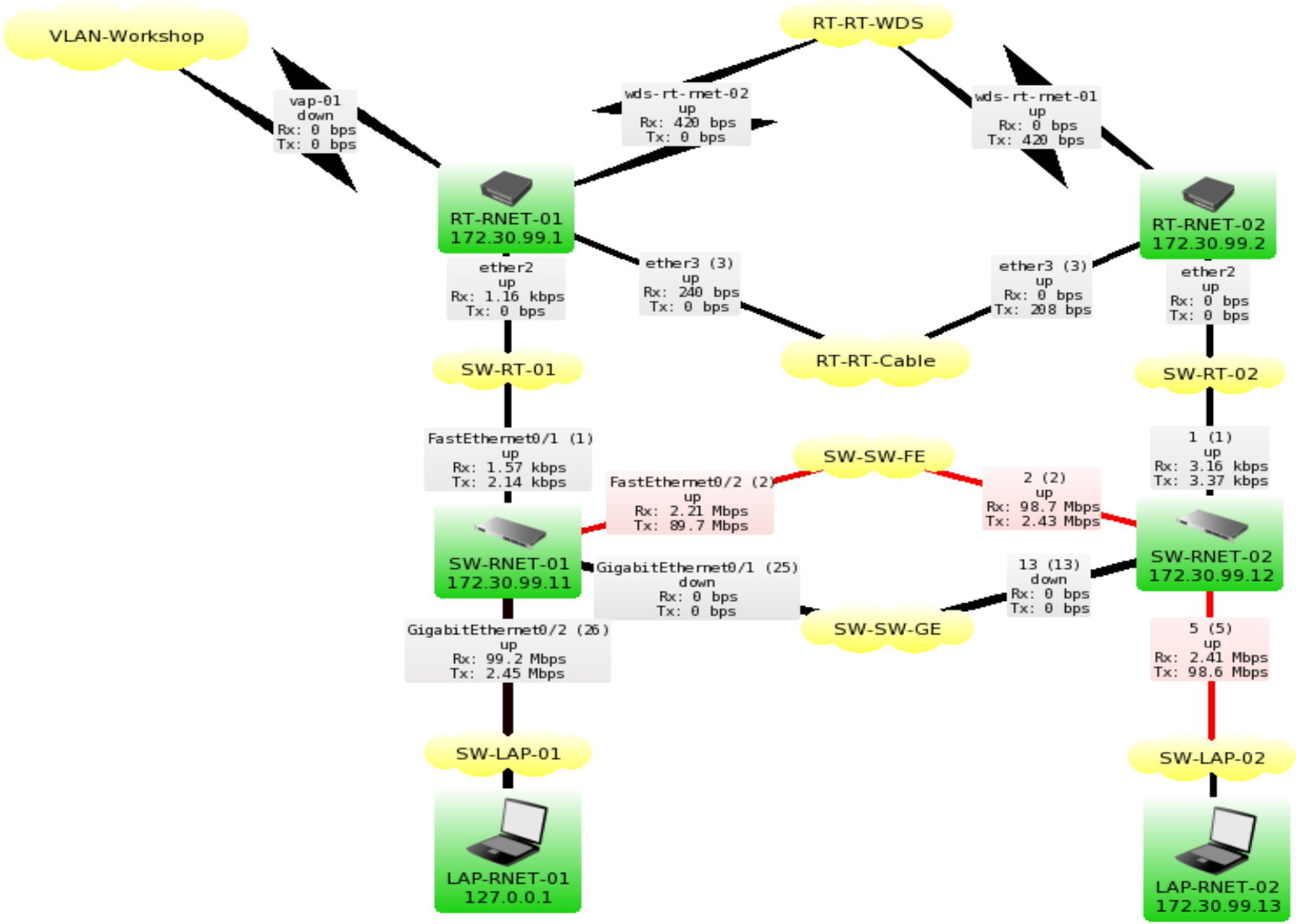
Demo network



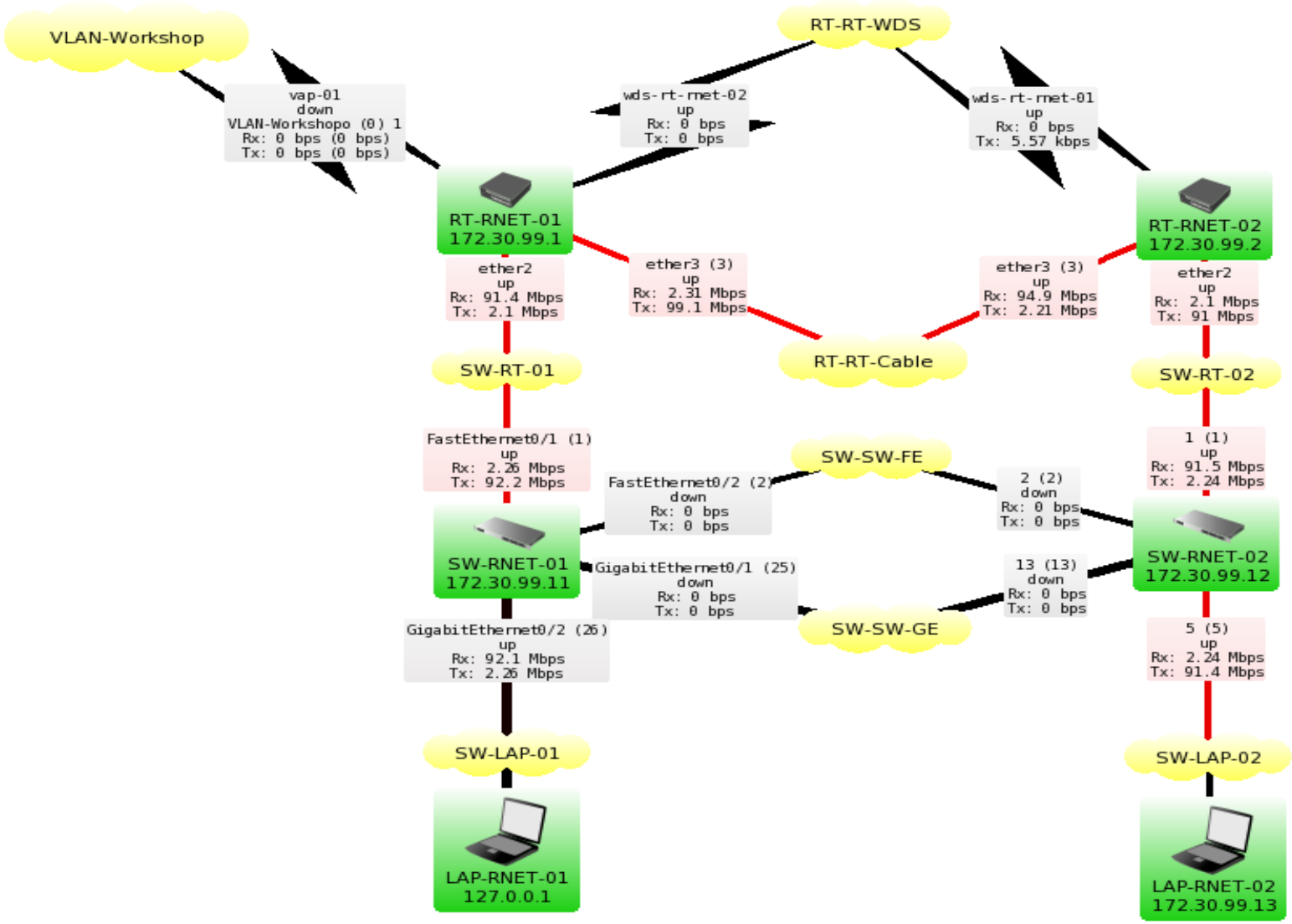

admin@172.30.99.1 (RT-RNET-01) - WinBox v3.20 on RB500 (mipsle)
Hide Passwords
Interfaces
Wireless
Bridge
Mesh
PPP
IP
Routing
Ports
Queues
Drivers
System
Files
Log
SNMP
Users
Radius
Tools
New Terminal
Telnet
Password
Certificates
Stores
Make Supout.rif
Manual
Exit
RouterOS WinBox
Bridge
Bridge
Ports
Filters
NAT
Hosts
Find
Interface
Bridge
Priority (h...
Path Cost
Horizon
Role
Root Pat...
br2-vl2 br0 80 10000 designated port
ether1 br0 80 10000 disabled port
ether2 br2 80 10000 root port 11000
ether3 br2 80 30000 alternate port 40000
wds-rt-rnet-02 br2 80 40000 alternate port 50000
5 items


admin@172.30.99.2 (RT-RNET-02) - WinBox v3.20 on RB500 (mipsle)
Hide Passwords
RouterOS WinBox
Interfaces
Wireless
Bridge
Mesh
PPP
IP
Routing
Ports
Queues
Drivers
System
Files
Log
SNMP
Users
Radius
Tools
New Terminal
Telnet
Password
Certificates
Stores
Make Supout.rif
Manual
Exit
Bridge
Bridge
Ports
Filters
NAT
Hosts
Find
Interface
Bridge
Priority (h...
Path Cost
Horizon
Role
Root Pat...
br2-vl2 br0 80 10000 designated port
ether1 br0 80 10000 disabled port
ether2 br2 80 10000 root port 10000
ether3 br2 80 30000 designated port
wds-rt-rnet-01 br2 80 40000 designated port
5 items

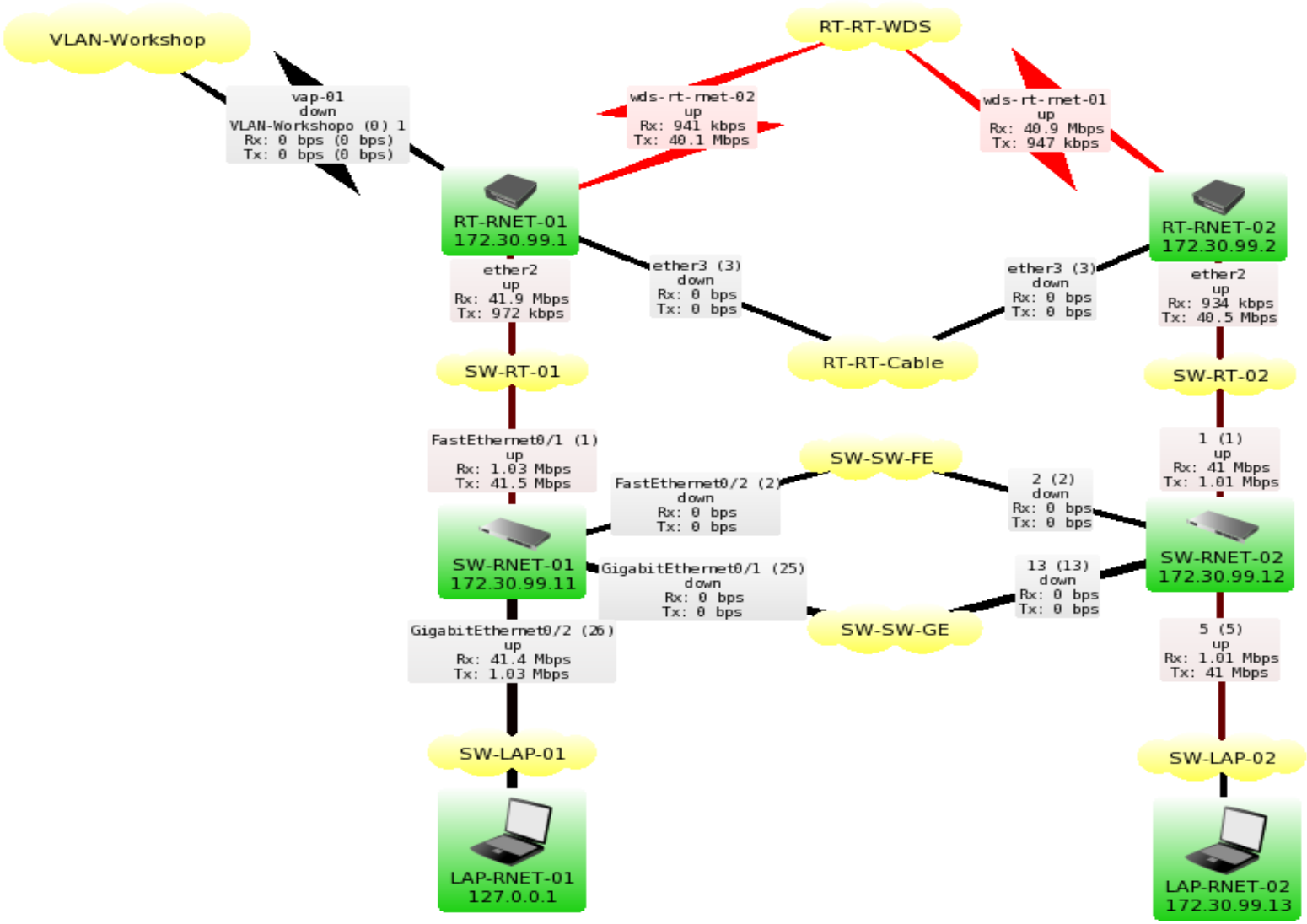
SW-SW-GE cable disconnected



SW-SW-FE disconnected



RT-RT-Cable disconnected



Configuration of RT-RNET-01

```
#Script for configuring the Mikrotik to have one single bridge and create the VLAN ontop of that bridge.

/sys id set name=RT-RNET-01

#Set up wireless
/int wire set wlan1 mode ap country="czech republic" band=5ghz hide yes wds-mode static disabled no
/int wire wds add master wlan1 name=wds-rt-rnet-02 wds-address=00:0C:42:05:AA:B5
/int wire acc add auth yes forw yes int wlan1 mac=00:0C:42:05:AA:B5

#Adding the bridges
/int br add name br2 prot rstp pri 0xffff

#Adding interfaces to the bridges
/int br po add bridge br2 int ether2 path 10000
/int br po add bridge br2 int ether3 path 30000
/int br po add bridge br2 int wds-rt-rnet-02 path 40000

#Adding the VLAN interfaces
/int vlan add name br2-vl2 int br2 vlan 2 dis no
/int vlan add name br2-vl5 int br2 vlan 5 dis no
/int vlan add name br2-vl10 int br2 vlan 10 dis no

#Adding an mgmt IP
/ip addr add add 172.30.99.1/24 int br2-vl2

#Setup SNMP
/snmp set contact=noc@roamingnet.com enabled=yes location="Prag MuM 2009"
```

Configuration of RT-RNET-02

```
#Script for configuring the Mikrotik to have one single bridge and create the VLAN ontop of that bridge.

/sys id set name=RT-RNET-02

#Set up wireless
/int wire set wlan1 mode ap country="czech republic" band=5ghz hide yes wds-mode static disabled no
/int wire wds add master wlan1 name=wds-rt-rnet-01 wds-address=00:0C:42:05:AA:B0 disabled no
/int wire acc add auth yes forw yes int wlan1 mac=00:0C:42:05:AA:B0

#Adding the bridges
/int br add name br2 prot rstp pri 0xffff

#Adding interfaces to the bridges
/int br po add bridge br2 int ether2 path 10000
/int br po add bridge br2 int ether3 path 30000
/int br po add bridge br2 int wds-rt-rnet-01 path 40000

#Adding the VLAN interfaces
/int vlan add name br2-vl2 int br2 vlan 2 dis no
/int vlan add name br2-vl5 int br2 vlan 5 dis no
/int vlan add name br2-vl10 int br2 vlan 10 dis no

#Adding an mgmt IP
/ip addr add add 172.30.99.2/24 int br2-vl2

#Setup SNMP
/snmp set contact=noc@roamingnet.com enabled=yes location="Prag MuM 2009"
```

Configuration of SW-RNET-01

```
SW-RNET-01#sho conf
Using 2181 out of 32768 bytes
!
version 12.1
no service pad
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname SW-RNET-01
!
enable secret 5 xxxxxxxxxxxxxxxxxxxxxxxxxx
!
ip subnet-zero
!
ip ssh time-out 120
ip ssh authentication-retries 3
vtp mode transparent
!
!
spanning-tree mode mst
no spanning-tree optimize bpdu transmission
spanning-tree extend system-id
!
!
!
!
vlan 2
 name mgmt
!
vlan 5
 name ISP-1
!
vlan 10
 name ISP-2
!
vlan 97
!
interface FastEthernet0/1
 switchport trunk allowed vlan 1,2,5,10
 switchport mode trunk
 spanning-tree cost 10000
!
interface FastEthernet0/2
 switchport trunk allowed vlan 2,5,10
 switchport mode trunk
 spanning-tree cost 10000
!
interface FastEthernet0/3
!
interface FastEthernet0/4
!
interface FastEthernet0/5
!
interface FastEthernet0/6
!
interface FastEthernet0/7
!
interface FastEthernet0/8
!
interface FastEthernet0/9
!
interface FastEthernet0/10
!
interface FastEthernet0/11
!
interface FastEthernet0/12
!
interface FastEthernet0/13
!
interface FastEthernet0/14
!
interface FastEthernet0/15
!
interface FastEthernet0/16
!
interface FastEthernet0/17
!
interface FastEthernet0/18
!
interface FastEthernet0/19
!
interface FastEthernet0/20
!
interface FastEthernet0/21
!
interface FastEthernet0/22
!
interface FastEthernet0/23
!
interface FastEthernet0/24
!
interface GigabitEthernet0/1
 switchport trunk allowed vlan 2,5,10
 switchport mode trunk
 spanning-tree cost 1000
!
interface GigabitEthernet0/2
 switchport trunk allowed vlan 1,2,5,10
 switchport mode trunk
!
interface Vlan1
 no ip address
 no ip route-cache
 shutdown
!
interface Vlan2
 ip address 172.30.99.11 255.255.255.0
 no ip route-cache
!
interface Vlan5
 no ip address
 no ip route-cache
 shutdown
!
interface Vlan10
 no ip address
 no ip route-cache
 shutdown
!
ip http server
snmp-server community public RO
snmp-server location Prag MuM 2009
snmp-server contact noc@roamingnet.com
!
line con 0
line vty 0 4
 password RoamingNet
 login
line vty 5 15
 password RoamingNet
 login
!
!
end
```

Configuration of SW-RNET-02

Startup configuration:

```
; J4812A Configuration Editor; Created on release #F.05.69

hostname "SW-RNET-02"
snmp-server contact "noc@roamingnet.com"
snmp-server location "Prag MuM 2009"
max-vlans 16
cdp run
snmp-server community "public" Unrestricted
vlan 1
   name "DEFAULT_VLAN"
   forbid 1-2,13
   untagged 5-12,14
   no ip address
   no untagged 1-4,13
   exit
vlan 2
   name "mgmt"
   ip address 172.30.99.12 255.255.255.0
   tagged 1-2,5-6,12-13
   exit
vlan 5
   name "ISP-1"
   untagged 3-4
   tagged 1-2,5-6,12-13
   exit
vlan 10
   name "ISP-2"
   tagged 1-2,5-6,12-13
   exit
management-vlan 2
no aaa port-access authenticator active
spanning-tree
spanning-tree priority 5
spanning-tree 13 path-cost 1000
spanning-tree 1-4 path-cost 10000
password manager
password operator
exit
```

Summary

- VLANs segments the broadcast domain.
- VLANs helps you secure the network.
- For VLAN in wireless networks, create WDS connections first, then layer on the VLAN!
- Spanning Tree can only be used on bridges with physical and WDS interfaces.
- Support for MST 802.1s (Multiple Spanning Tree) is a need if different pathcosts on physical and VLAN interfaces shall be used.

Thank You!

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