

# Augmenting Multiple Routerboard for port expansion by using VLAN



# Internet in the Philippines

- According to ASEAN DNA study/survey; Internet in the Philippine has an average speed of 3.6mbps
- Fiber is not widely available even in the big cities
- DSL is the most widely used medium of connectivity and it has a maximum top speed of 10mbps in areas where DSLAM has a better copper wires and a good contention ratio per user.
- Both DSL, LTE and Fiber are capped somewhere between 2-10GB a day.
- Fiber connection is very expensive even for an 8mbps (almost 75 USD per month)
- Simply we have poor internet infrastructure.



## Who can benefit from this topic?

- Organizations who requires high download capacity but no any other means of getting a fast internet connection (as such the fiber connection), but to use multiple DSL, especially in provinces where fiber connection is non-existent.
- Internet Café Operators without access to high speed fiber line
- WiSP and mini ISPs (Databytes Computer Services)
- Even individuals who simply want hundreds of mbps. 😊



## Who can benefit from this topic?

- Organizations who requires high download capacity but no any other means of getting a fast internet connection (as such the fiber connection), except to use multiple DSL.
- Internet Café Operators
- WiSP and mini ISPs
- Even individuals who simply want hundreds of mbps. 😊

## Top 6 Most common questions about the router's functionalities

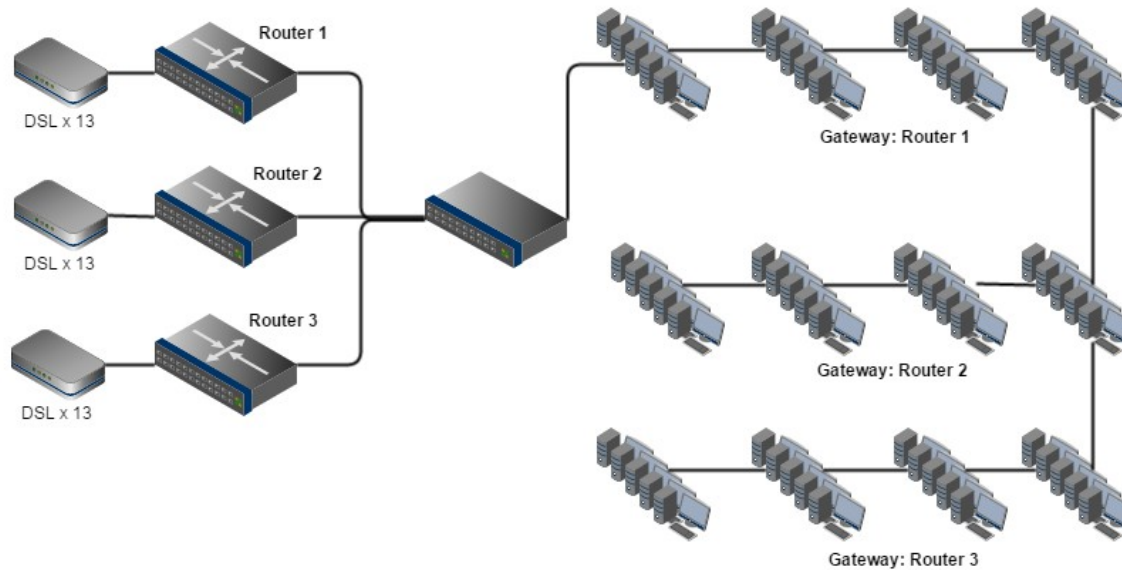
1. How many WAN it can support
2. Can it do load balance.
3. Can it separate browsing and gaming (policy routing)
4. Can it block keywords, DNS, IP address etc.
5. Does it have fail-over.
6. Mixed source of connection and ISP i.e. DSL + LTE + Fiber



# Case Study: Internet Café with more than a thousand terminals

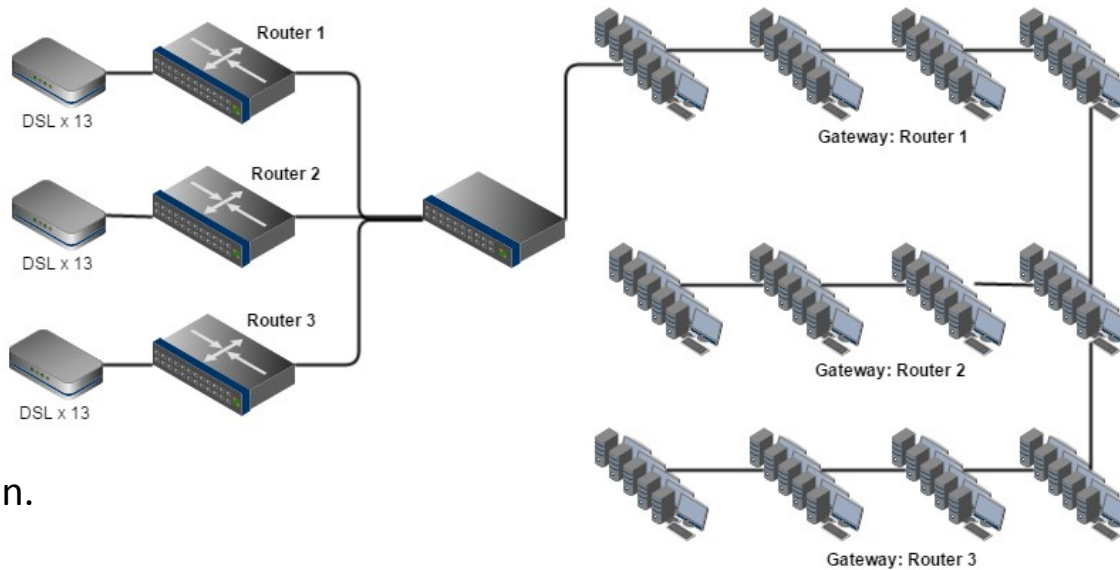
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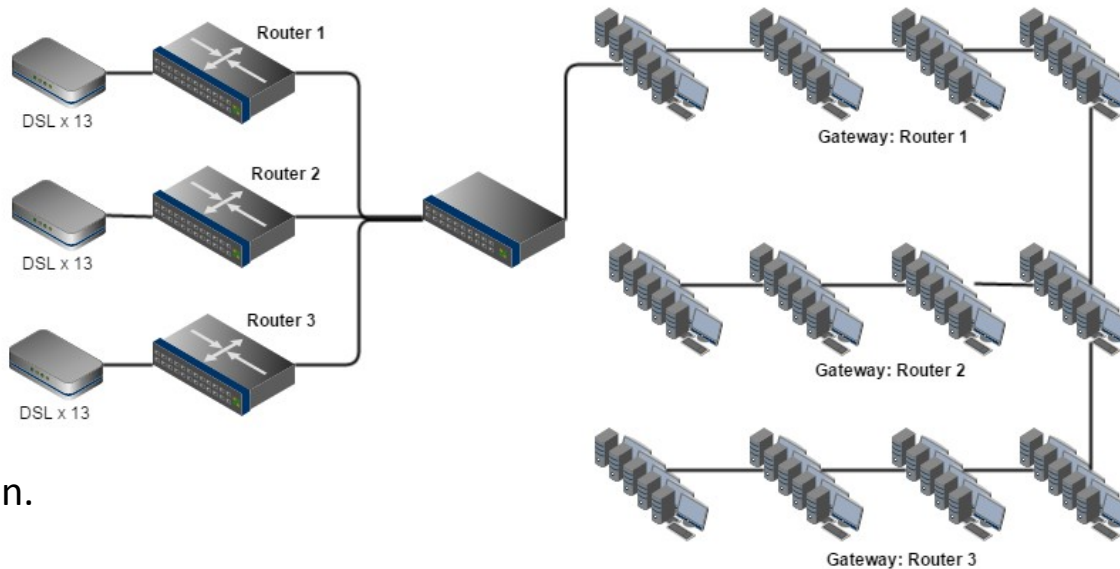


- 3 routers to maintain.



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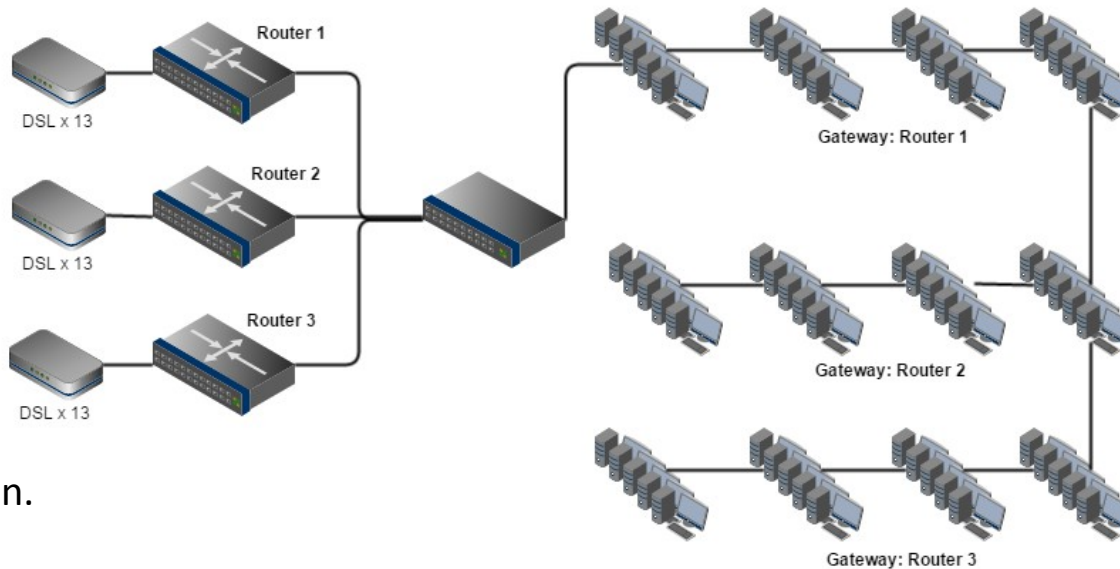
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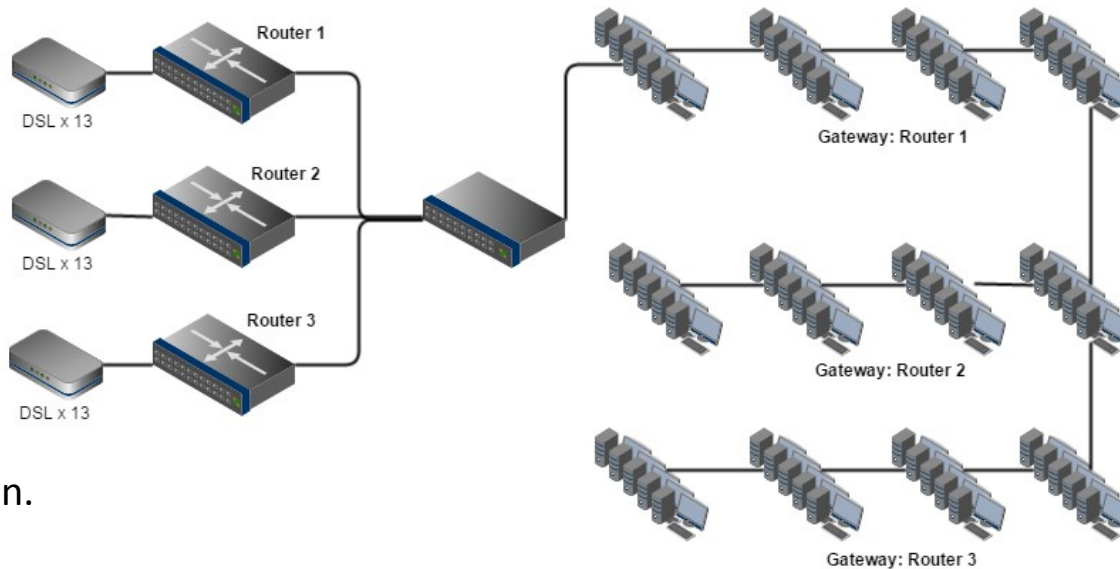
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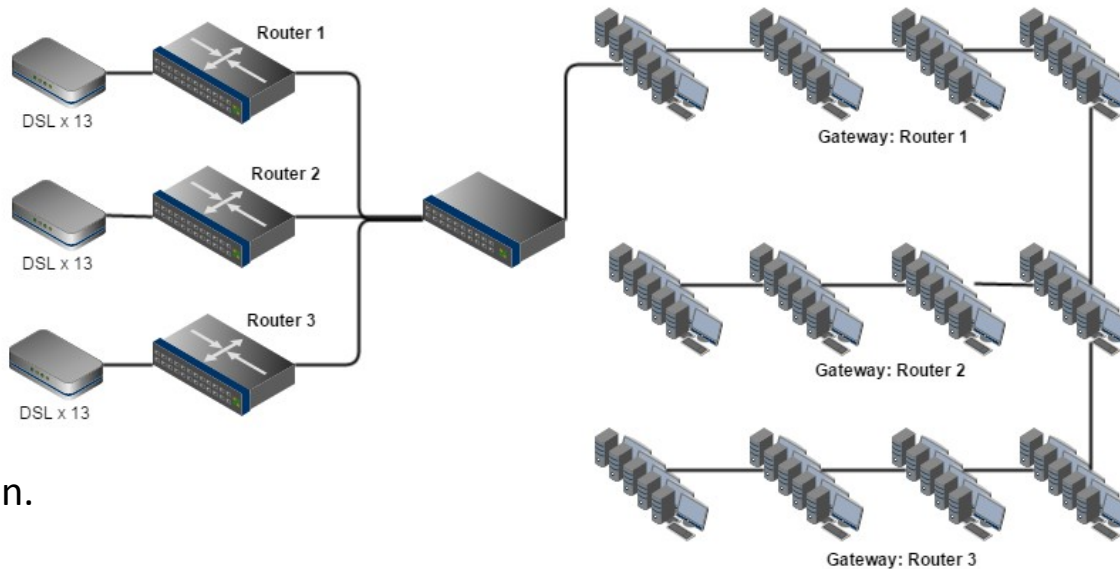
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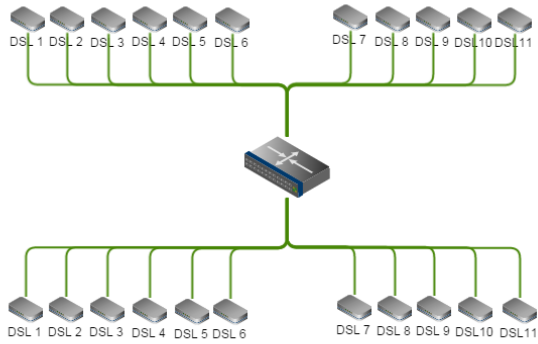
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-WAN Routers		
Balance 1350	#BPL-135 List Price: \$7,999.00 <b>Our Price: \$7,599.00</b>	+ Add to Cart

# Tasks

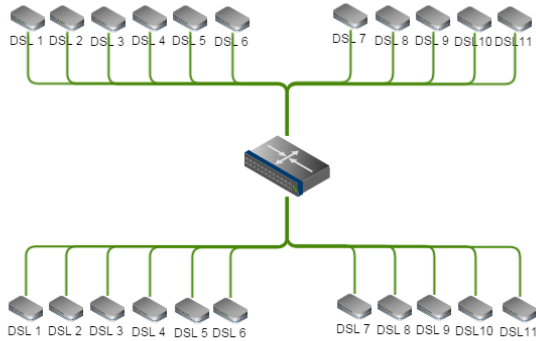


# Tasks

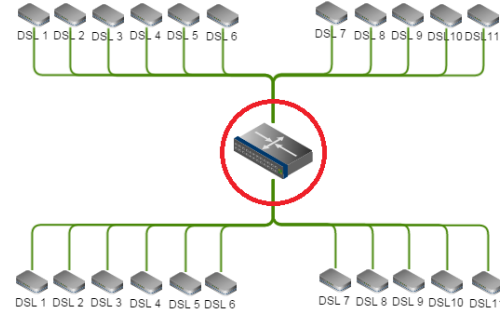


- Consolidate all DSL into one router.

# Tasks



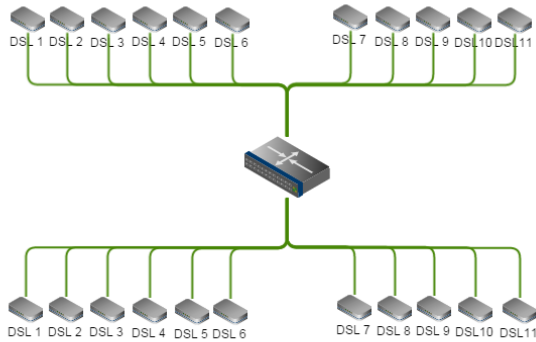
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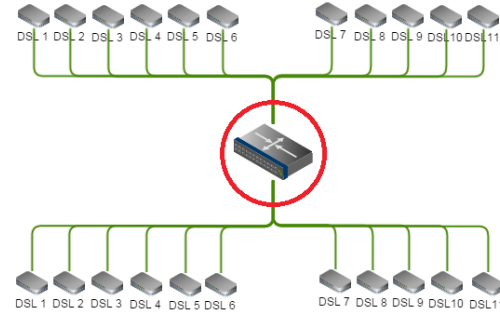
- To have a single point of operation.
- All firewall/filter/mangle rules must be in one place only for easy operation and uniformity.



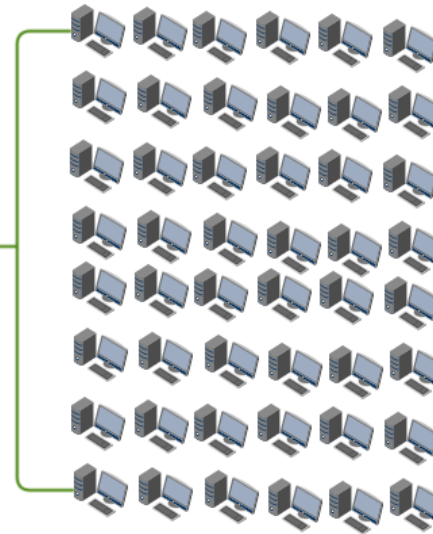
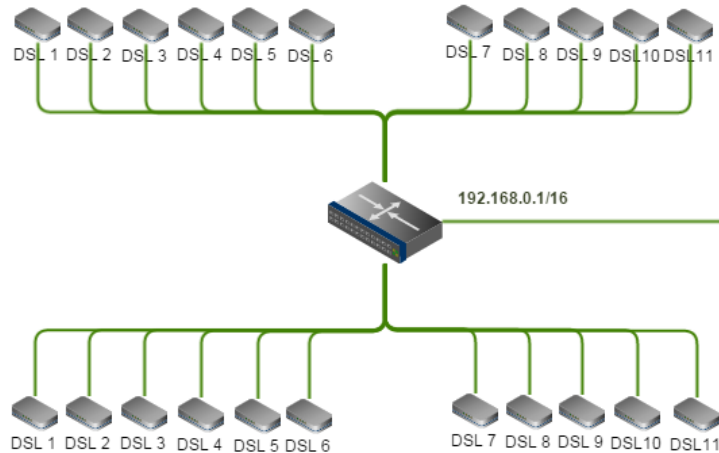
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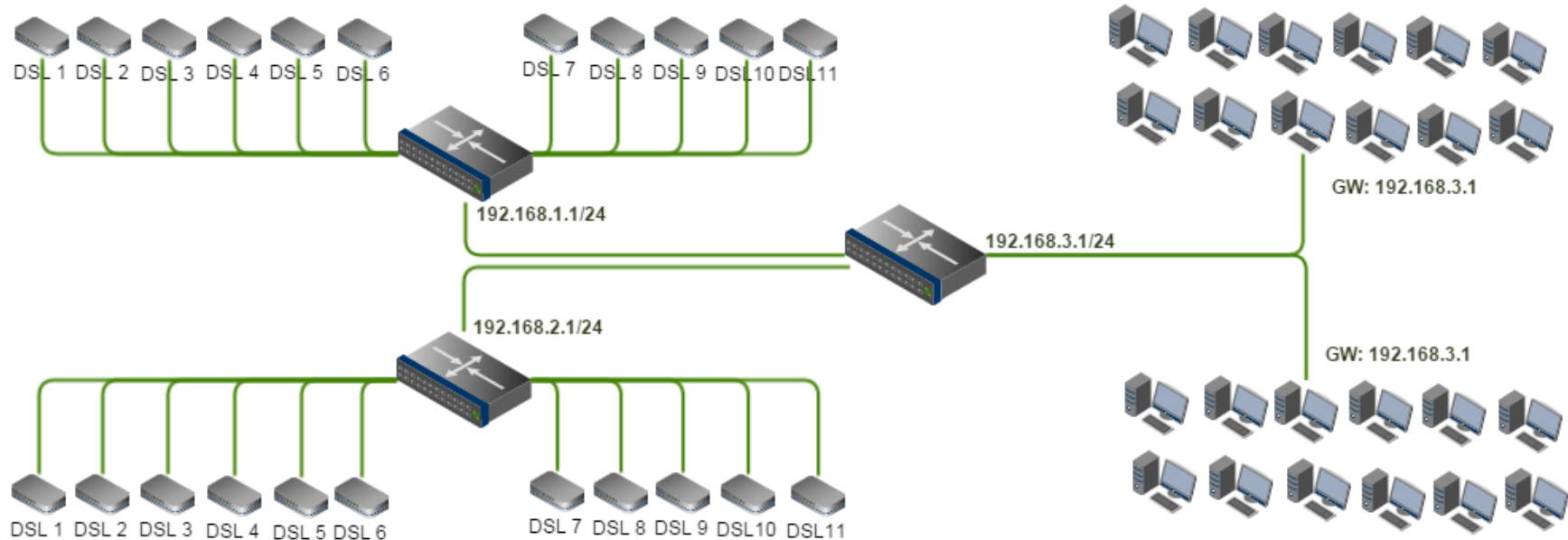


- Utilized and optimize the use of all available bandwidth from all sources.
- Lastly, Single Gateway only





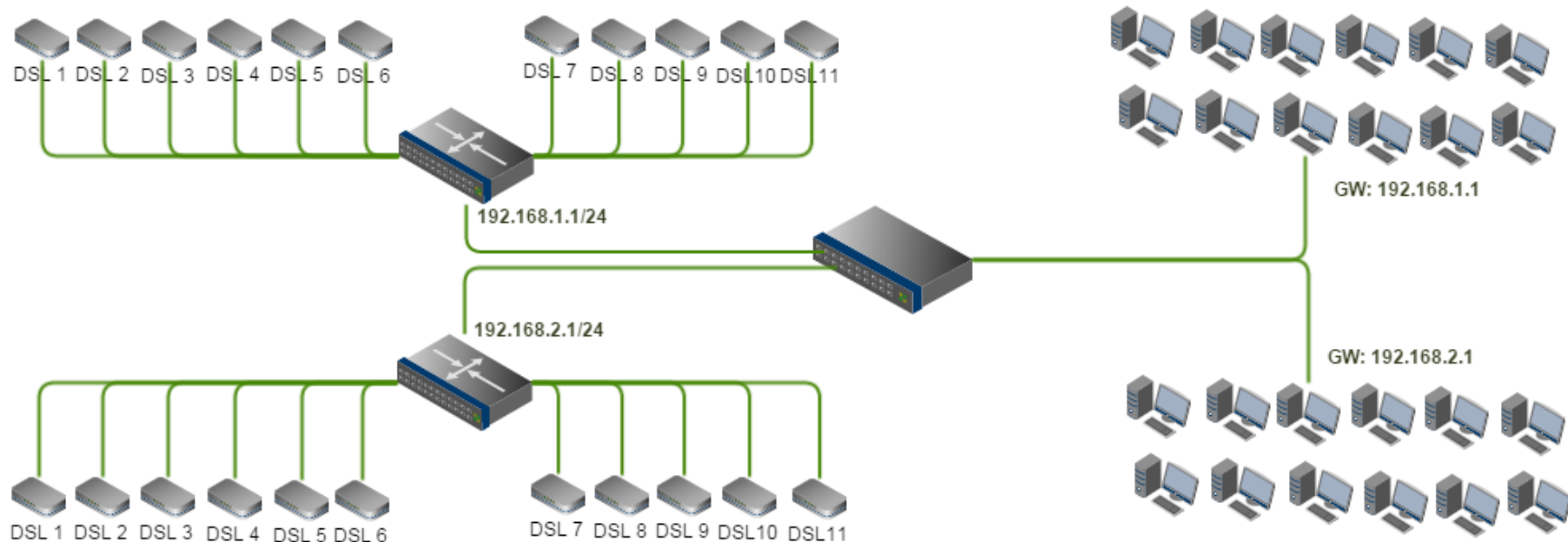
# Typical Deployment



- 3 Routers
- 3 Subnet segments
- Single gateway

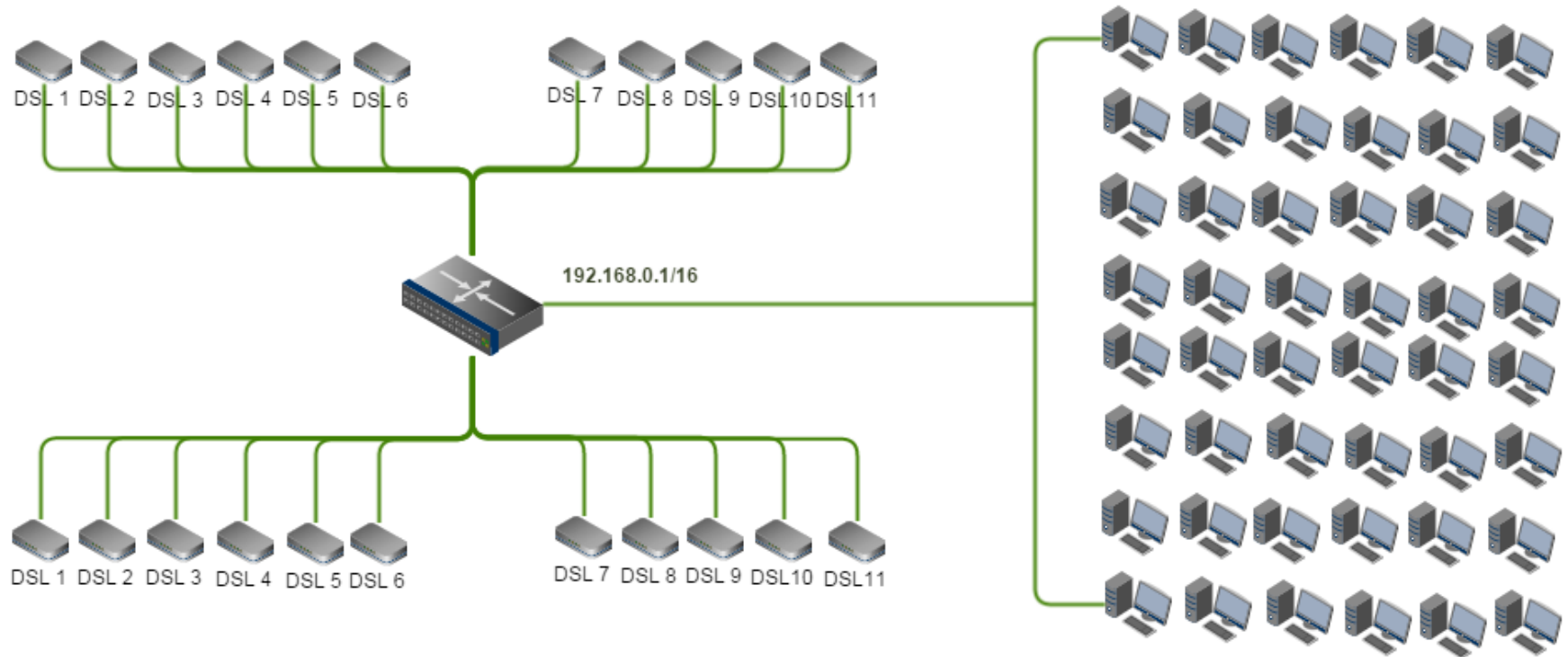
- Individual filter/ mangle rules per device
- No single point of operation
- Difficult to maintain
- Fail-over issues.
- Very costly.

# Another typical deployment



- 2 Routers
- 2 Segments
- 2 gateways
- Individual filter/mangle rules per device.
- No single point of operation.
- Computers must be grouped together and each group must go to a specific gateway.
- Under utilized internet connection, if one group is not at peak usage, the bandwidth cannot be utilized by the other groups.
- Difficult to maintain.
- Fail-over issues.
- Costly.

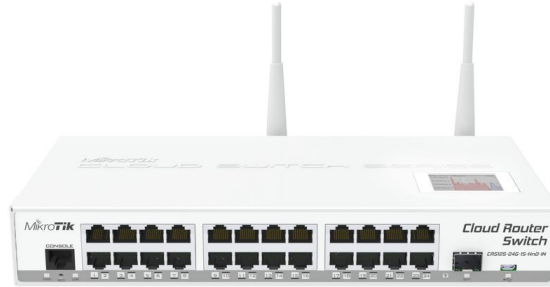
# What we want



- Single router
- Single Subnet segment
- Single point of operation  
(all filter/mangle rules stored in one device only)
- Fully utilized bandwidth
- Easy to maintain
- Full control of each DSL Line
- Many Fail-over lines.
- Cost Effective.



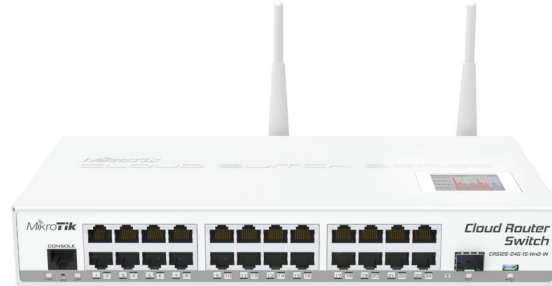
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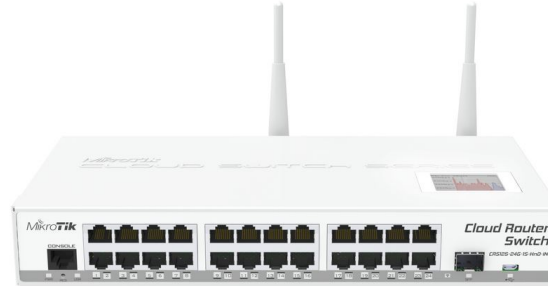


But... can it handle the task?..

- ✓ In a multi-wan setup, each WAN must have at least 3 basic mangle rules for Input, Output and Forward chains to properly forward the packets to the right interface.  
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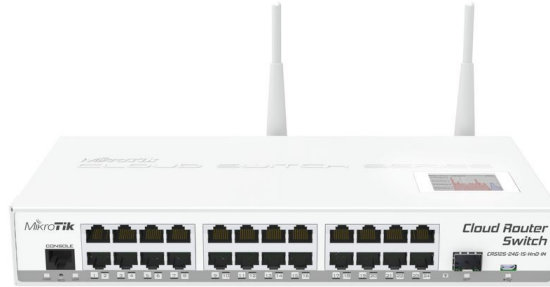
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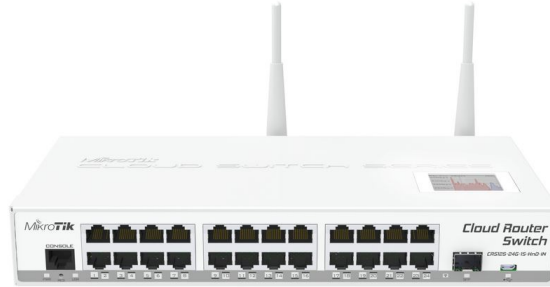


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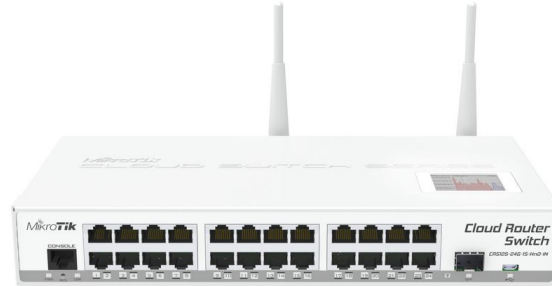


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- ✓ QoS rules (Queue Tree, Simple Queues, Etc..)



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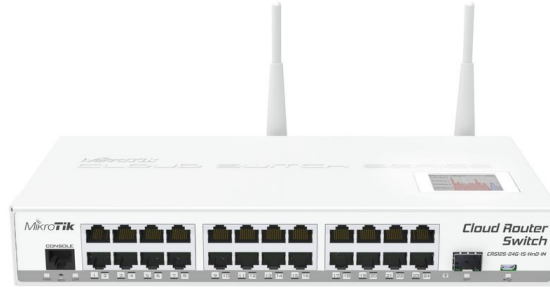
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Why CRS is not viable?

- Low processing power for many WANS (400-600Mhz)
- Cannot handle many mangle and filter rules for many WANS
- Designed for SOHO.



Would be nice if we can have this?....



# Would be nice if we can have this?....



Mikrotik to produce a Multi-core high-end Cloud Core Router with more than 24 ports, Or a CCR model with a provision or an add-on module for port expansion that can be controlled individually just like an ordinary port?

It can make our life easier! 😊

How can we have more ports for our wan?

Mikrotik doesn't have any powerful Model with many ports.

What is the solution?

**Solution is to use VLAN to expand the ports**



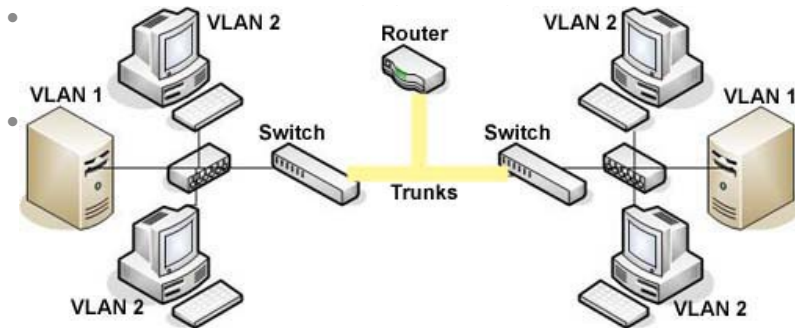


# VLAN



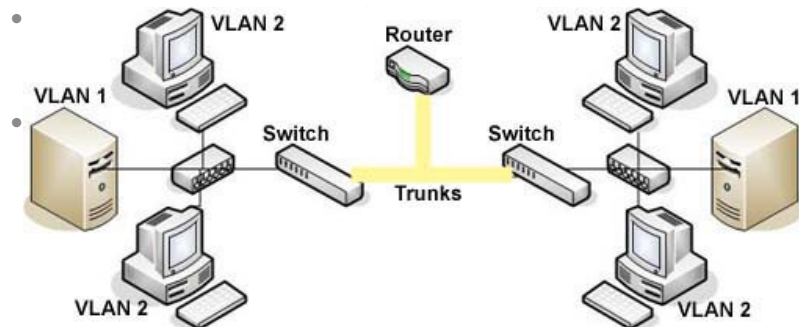
# VLAN

Most people always think



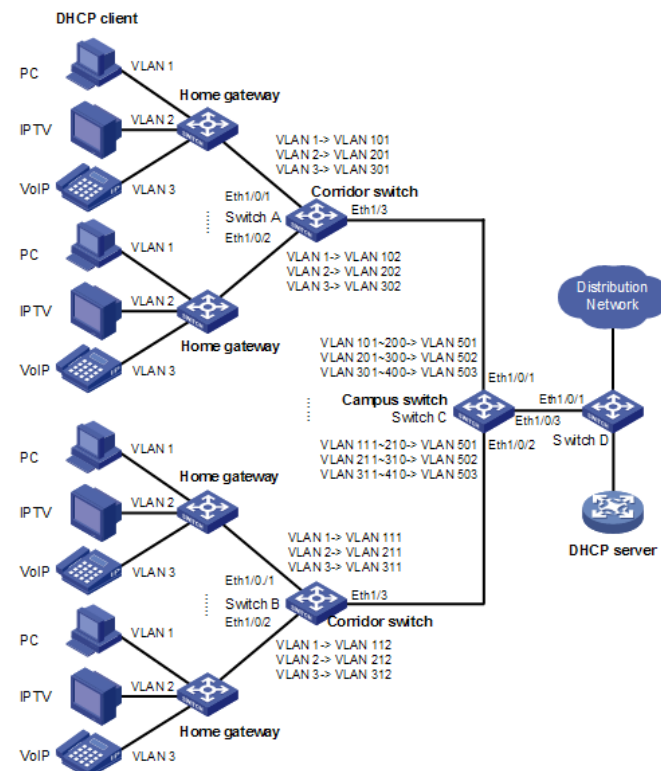
# VLAN

## Most people always think



## What we can actually use it for

- ✓ VLAN ports can be used as an ordinary physical port, therefore, treat it as such, (but with some limitations.)
- ✓ VLAN port can be used to connect other devices, such as modems, IP Printers, IP camera, etc..
- ✓ VLAN ports can be used as an DHCP client too.
- ✓ VLAN ports can be used as a routing interface.



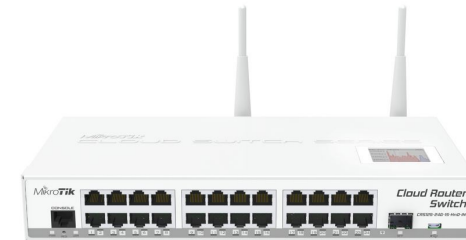
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- Use a fast RouterBoard preferably dual-core or the High-end CCR series such as CCR1009 or higher (CCR1036)

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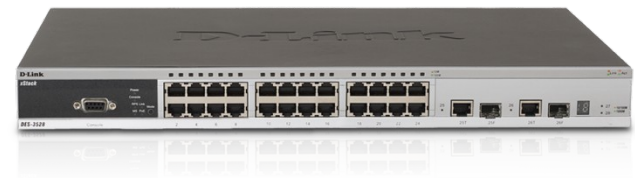
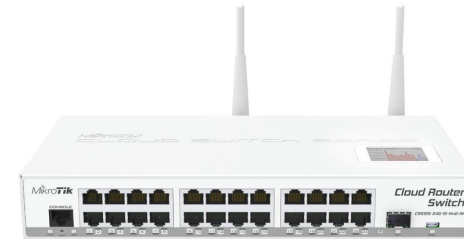


- Use a low cost Routerboard to be used for port augmentation such as the CRS125-24G-1S-2HnD-IN



# Solution is to use VLAN to expand the ports

- Use a fast RouterBoard preferably dual-core or the High-end CCR series such as CCR1009 or higher (CCR1036)
- Use a low cost Routerboard to be used for port augmentation such as the CRS125-24G-1S-2HnD-IN
- Alternatively, you can also use any managed switch with VLAN capability.
- Lastly, and the most important of all is to use the VLAN function of RouterOS.

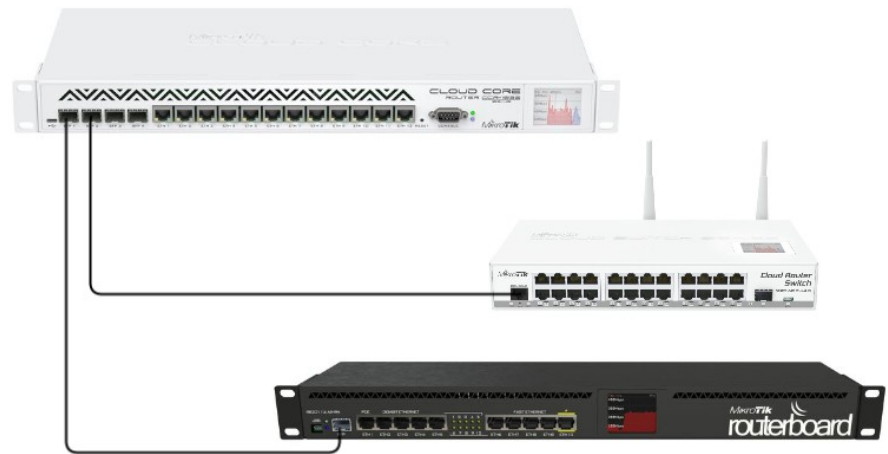


# Solution is to use VLAN to expand the ports

- Use a faster RouterBoard preferably dual-core or the High-end CCR series such as CCR1009 or higher (CCR1036)
- Use a low cost Routerboard for port augmentation such as the CRS model or the RB2011 series.
- Alternatively, you can also use any managed switch with VLAN capability.
- Use the VLAN function of RouterOS

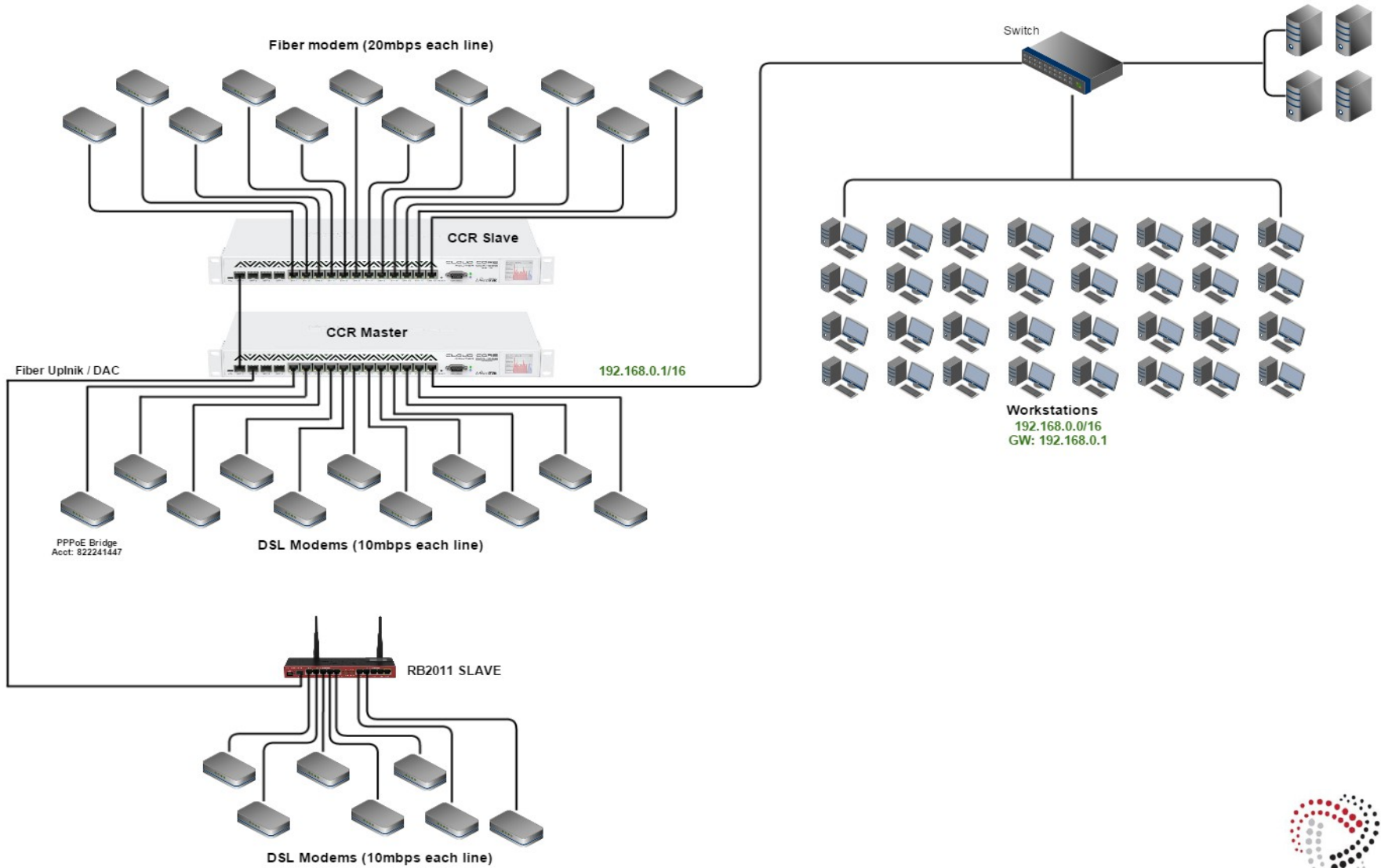
## Why CCR Series?

- It has Multiple Core Processor
- It can handle possibly thousands of Firewall/Filter and Mangle Rules
- It can process millions of packets per second.
- It can satisfy our need for a Single Point of Operation.



43 Ports available for our WAN !!

## Actual Deployment





# Configuration

**Things we need...**



Cygnaltech

## Things we need...



- ✓ Cloud Core Router CCR1009-8G-1S-1S+ (master)

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- ✓ Cloud Core Router CCR1009-8G-1S-1S+ (master)



- ✓ RB2011UiAS-2HnD-RM



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- ✓ DAC (Direct Attached Cable)



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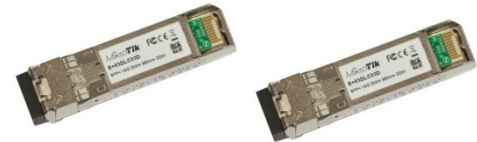
- ✓ Cloud Core Router CCR1009-8G-1S-1S+ (master)



- ✓ DAC (Direct Attached Cable)



- ✓ RB2011UiAS-2HnD-RM



- ✓ SFP Module S-85DLC05D



- ✓ Fiber Patch Cord

## Things we need...



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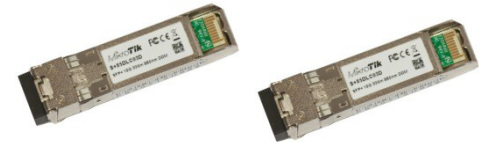
- ✓ DAC (Direct Attached Cable)

How many port we can use for WAN?

17 Ports available for our WAN



- ✓ RB2011UiAS-2HnD-RM



- ✓ SFP Module S-85DLC05D



- ✓ Fiber Patch Cord

# Configuration Guide



- Master

1. Use the SFP as the trunk port
2. Create a VLAN interface and bind it to the trunk port
3. Use the VLAN port as DHCP client.
4. Create NAT rules.

- Slave

1. Use the SFP as the trunk port
2. Create a VLAN interface and bind it to the trunk port
3. Create a bridge interface
4. Bridge the VLAN port and the Physical port.





## STEP 1 - Add VLAN interface with unique VLAN ID

admin@192.168.88.1 (Cygnal) - WinBox v6.22 on CCR1009-8G-1S-1S+ (tile)

Safe Mode

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

Interface List

Interface	Ethernet	EoIP Tunnel	IP Tunnel	GRE Tunnel	VLAN	VRRP	Bonding	LTE
Name	Type	Tx	Rx	VLAN ID	Interface			
vlan1	VLAN	0 bps	0 bps	1	sfp 1			
vlan2	VLAN	0 bps	0 bps	2	sfp 1			
vlan3	VLAN	0 bps	0 bps	3	sfp 1			
vlan4	VLAN	0 bps	0 bps	4	sfp 1			
vlan5	VLAN	0 bps	0 bps	5	sfp 1			
vlan6	VLAN	0 bps	0 bps	6	sfp 1			

6 items out of 16 (1 selected)

Interface <vlan6>

General Traffic

Name: vlan6

Type: VLAN

MTU: 1500

L2 MTU: 1586

MAC Address: 4C:5E:0C:59:79:5C

ARP: enabled

VLAN ID: 6

Interface: sfp 1

☒ Use Service Tag

OK  
Cancel  
Apply  
Disable  
Comment  
Copy  
Remove  
Torch

enabled running slave

## STEP 2- Add VLAN interface to DHCP Client to obtain IP address from the ISP/DSL

admin@192.168.88.1 (Cygnal) - WinBox v6.22 on CCR1009-8G-1S-1S+ (tile)

Safe Mode

Hide Passwords

RouterOS WinBox

Quick Set  
CAPsMAN  
Interfaces  
Wireless  
Bridge  
PPP  
Switch  
Mesh  
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MPLS  
Routing  
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Queues  
Files  
Log  
Radius  
Tools  
New Terminal  
LCD  
Partition  
Make Supout.nif  
Manual  
Exit

DHCP Client

DHCP Client Options

+ - ✓ ✗ 📁 🔍 Release Renew Find

Interface	Default Route Distance	IP Address	Expires After	Status
vlan1	1			searching...
vlan2	2			searching...
vlan3	3			searching...
vlan4	4			searching...
vlan5	5			searching...
vlan6	6			searching...

6 items (1 selected)

DHCP Client <vlan6>

DHCP Status

Interface: **vlan6**

☒ Use Peer DNS  
☒ Use Peer NTP

DHCP Options: hostname  
clientid

Add Default Route: yes

Default Route Distance: **6**

enabled Status: searching...

OK  
Cancel  
Apply  
Disable  
Comment  
Copy  
Remove  
Release  
Renew

## STEP 3 - Add VLAN interface to Firewall/NAT

admin@192.168.88.1 (Cygnal) - WinBox v6.22 on CCR1009-8G-1S-1S+ (tile)

Safe Mode

RouterOS WinBox

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

Firewall

Filter Rules NAT Mangle Service Ports Connections Address Lists Lay

+ - ✓ ✗ [icon] [icon] 00 Reset Counters 00 Reset All Count

#	Action	Chain	Out. Interface	Bytes	Packets
0	masquerade	srcnat	vlan1	0 B	
1	masquerade	srcnat	vlan2	0 B	
2	masquerade	srcnat	vlan3	0 B	
3	masquerade	srcnat	vlan4	0 B	
4	masquerade	srcnat	vlan5	0 B	
5	masquerade	srcnat	vlan6	0 B	

6 items (1 selected)

NAT Rule <>

General Advanced Extra Action Statistics

Chain: srcnat

Src. Address: [dropdown]  
Dst. Address: [dropdown]  
Protocol: [dropdown]  
Src. Port: [dropdown]  
Dst. Port: [dropdown]  
Any. Port: [dropdown]  
In. Interface: [dropdown]  
Out. Interface: ☐ vlan6  
Packet Mark: [dropdown]  
Connection Mark: [dropdown]  
Routing Mark: [dropdown]  
Routing Table: [dropdown]  
Connection Type: [dropdown]

OK  
Cancel  
Apply  
Disable  
Comment  
Copy  
Remove  
Reset Counters  
Reset All Counters



admin@192.168.88.1 (Cygnal) - WinBox v6.22 on CCR1009-8G-1S-1S+ (tile)

Safe Mode

Hide Passwords

RouterOS WinBox

Quick Set  
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3	masquerade	srcnat	vlan4	0 B	
4	masquerade	srcnat	vlan5	0 B	
5	masquerade	srcnat	vlan6	0 B	

6 items (1 selected)

NAT Rule <>

General Advanced Extra Action Statistics

Action: masquerade

☐ Log

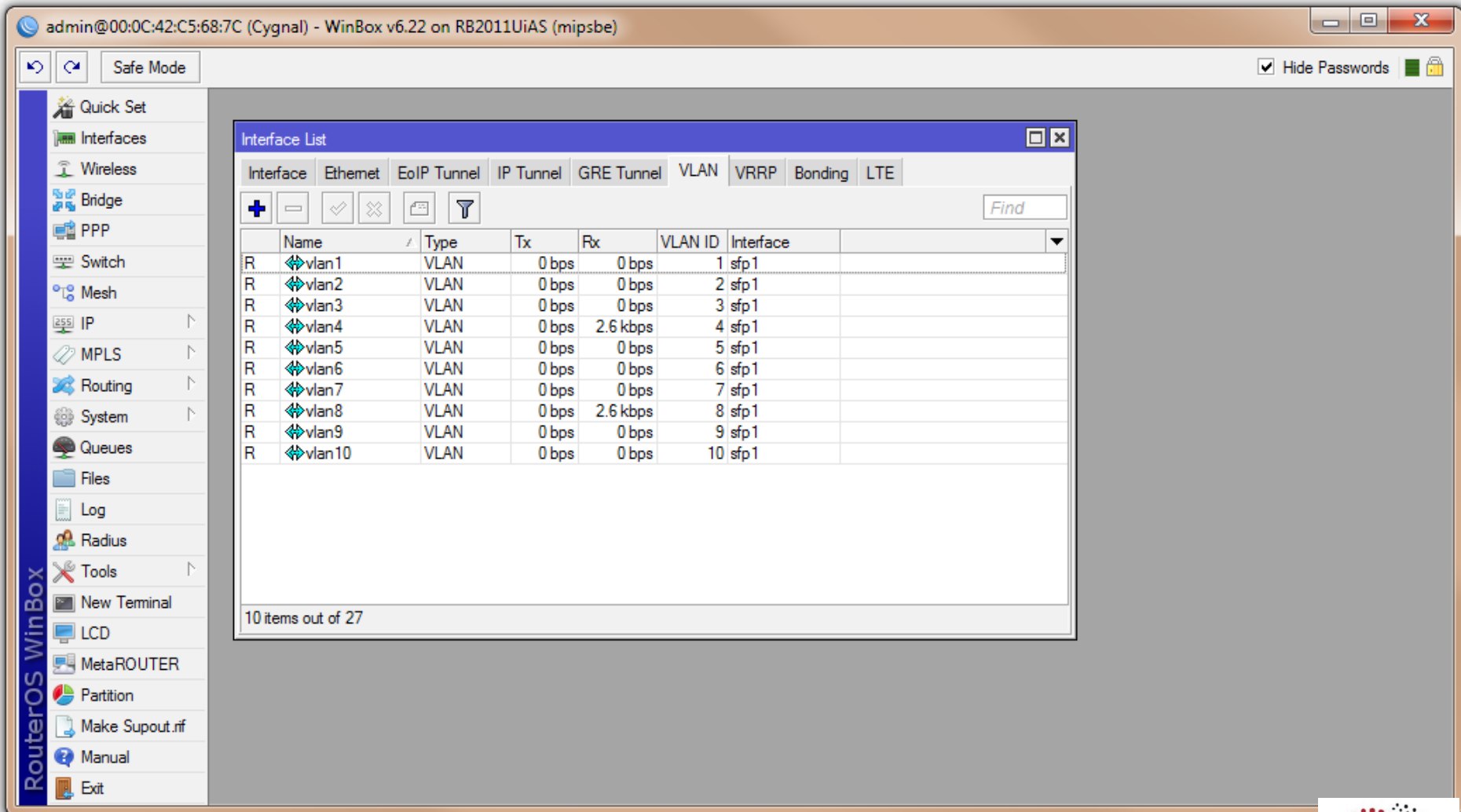
Log Prefix: [dropdown]

OK  
Cancel  
Apply  
Disable  
Comment  
Copy  
Remove  
Reset Counters  
Reset All Counters





## STEP 1 – Add VLAN Interface with VLAN ID to match the CCR1009



## STEP 2 – Add a Bridge Interface

admin@00:0C:42:C5:68:7C (Cygnal) - WinBox v6.22 on RB2011UiAS (mipsbe)

Safe Mode

Hide Passwords

RouterOS WinBox

- Quick Set
- Interfaces
- Wireless
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- Partition
- Make Supout.tif
- Manual
- Exit

Bridge

Bridge Ports Filters NAT Hosts Settings

	Name	Type	Tx	Rx	Proto...
R	bridge1	Bridge	1584 ...	0 bps	rstp
R	bridge2	Bridge	1584 ...	0 bps	rstp
R	bridge3	Bridge	1584 ...	0 bps	rstp
R	bridge4	Bridge	1584 ...	0 bps	rstp
R	bridge5	Bridge	1584 ...	0 bps	rstp
R	bridge6	Bridge	1584 ...	0 bps	rstp
R	bridge7	Bridge	1584 ...	0 bps	rstp
R	bridge8	Bridge	1584 ...	0 bps	rstp
R	bridge9	Bridge	1584 ...	0 bps	rstp
R	bridge10	Bridge	1600 ...	0 bps	rstp

10 items out of 31 (1 selected)

Interface <bridge10>

General STP Status Traffic

Name: bridge10

Type: Bridge

MTU: [dropdown]

Actual MTU: 1500

L2 MTU: 65535

MAC Address: [text box]

ARP: enabled [dropdown]

Admin. MAC Address: [text box]

OK Cancel Apply Disable Comment Copy Remove Torch

enabled running slave

## STEP 3 – Bind the VLAN interface with the physical ports by bridging

admin@00:0C:42:C5:68:7C (Cygnal) - WinBox v6.22 on RB2011UiAS (mipsbe)

Safe Mode

Hide Passwords

RouterOS WinBox

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

Bridge

Bridge Ports Filters NAT Hosts

Find

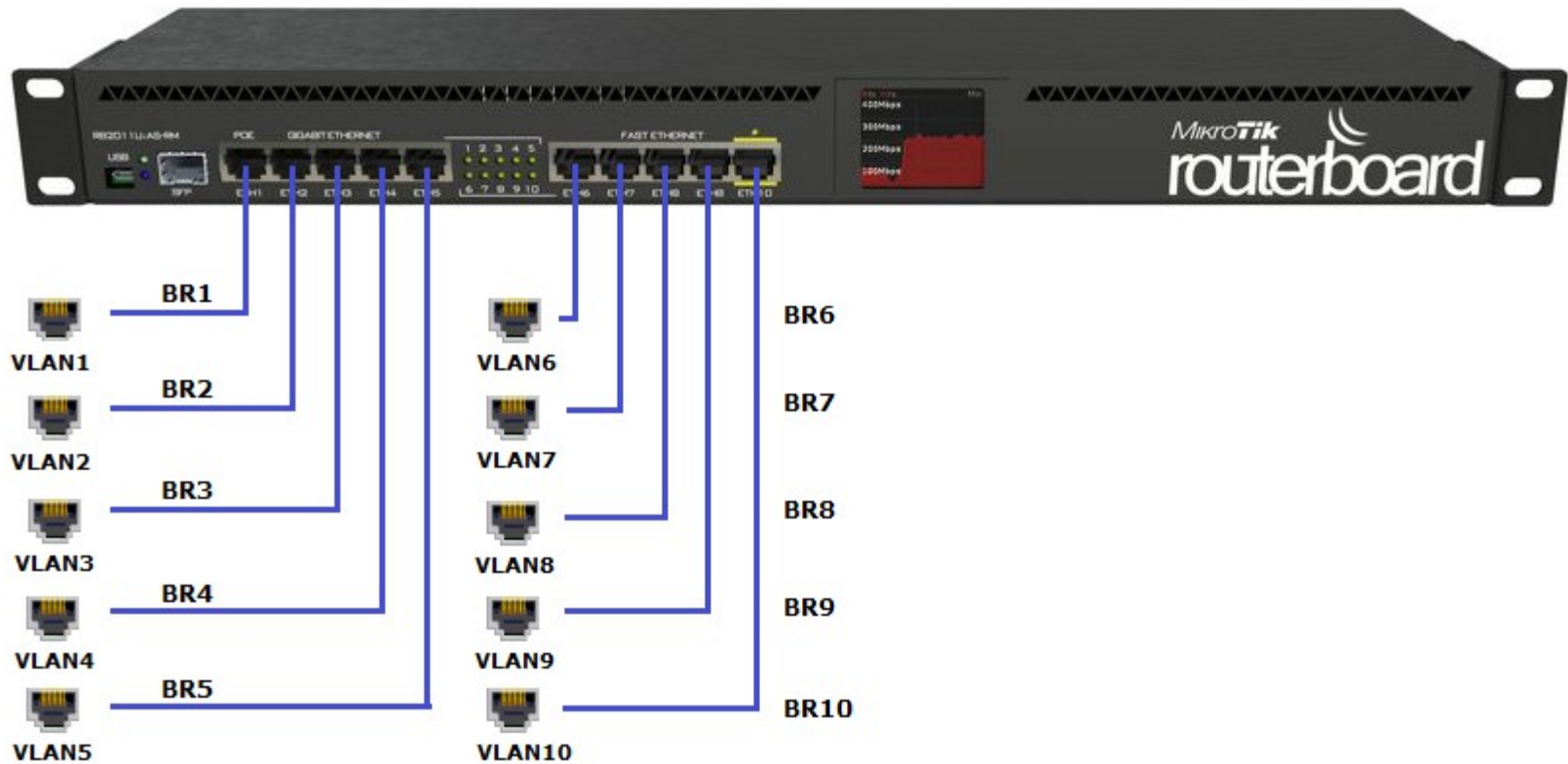
	Interface	Bridge	Role	Comment
	ether1	bridge1	disabled port	vlan1-port1
	vlan1	bridge1	designated port	vlan1-port1
	ether10	bridge10	disabled port	vlan10-port10
	vlan10	bridge10	designated port	vlan10-port10
	ether2	bridge2	disabled port	vlan2-port2
	vlan2	bridge2	designated port	vlan2-port2
	ether3	bridge3	disabled port	vlan3-port3
	vlan3	bridge3	designated port	vlan3-port3
	ether4	bridge4	disabled port	vlan4-port4
	vlan4	bridge4	designated port	vlan4-port4
	ether5	bridge5	disabled port	vlan5-port5
	vlan5	bridge5	designated port	vlan5-port5
	ether6	bridge6	disabled port	vlan6-port6
	vlan6	bridge6	designated port	vlan6-port6
	ether7	bridge7	disabled port	vlan7-port7
	vlan7	bridge7	designated port	vlan7-port7
	ether8	bridge8	disabled port	vlan8-port8
	vlan8	bridge8	designated port	vlan8-port8
	ether9	bridge9	disabled port	vlan9-port9
	vlan9	bridge9	designated port	vlan9-port9

20 items (1 selected)

Cygnaltech

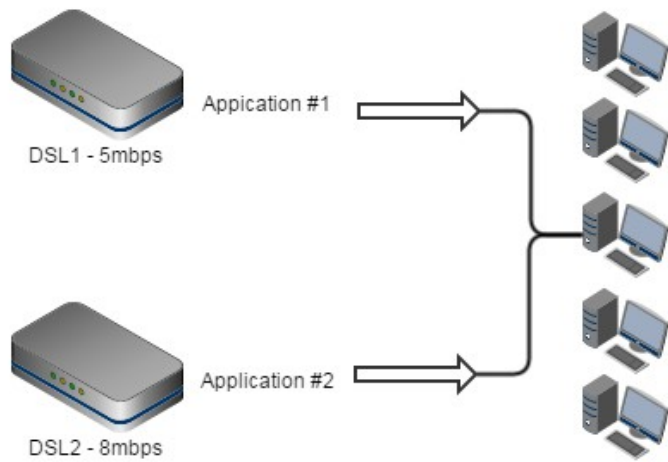


## VLAN interface and Physical port (visual help)

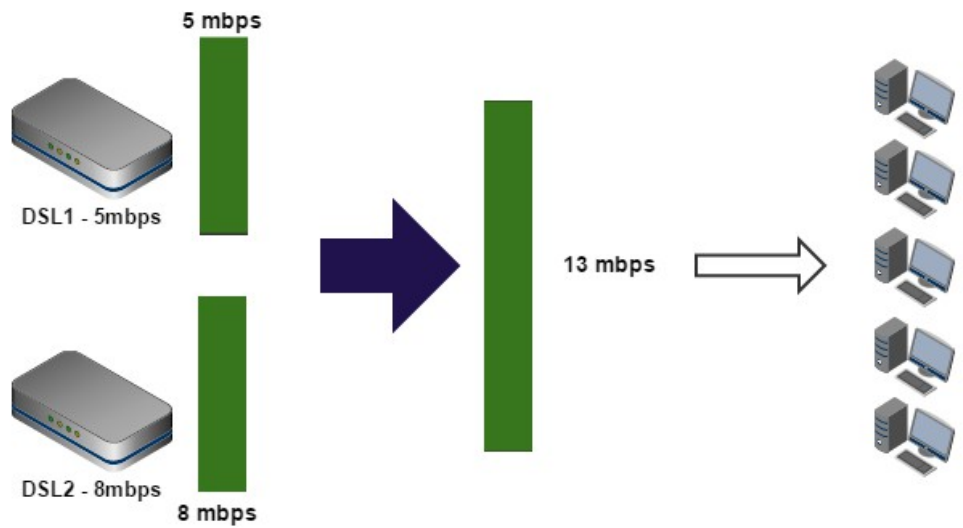


# Managing Bandwidth

## Standard Load Balancing Implementation

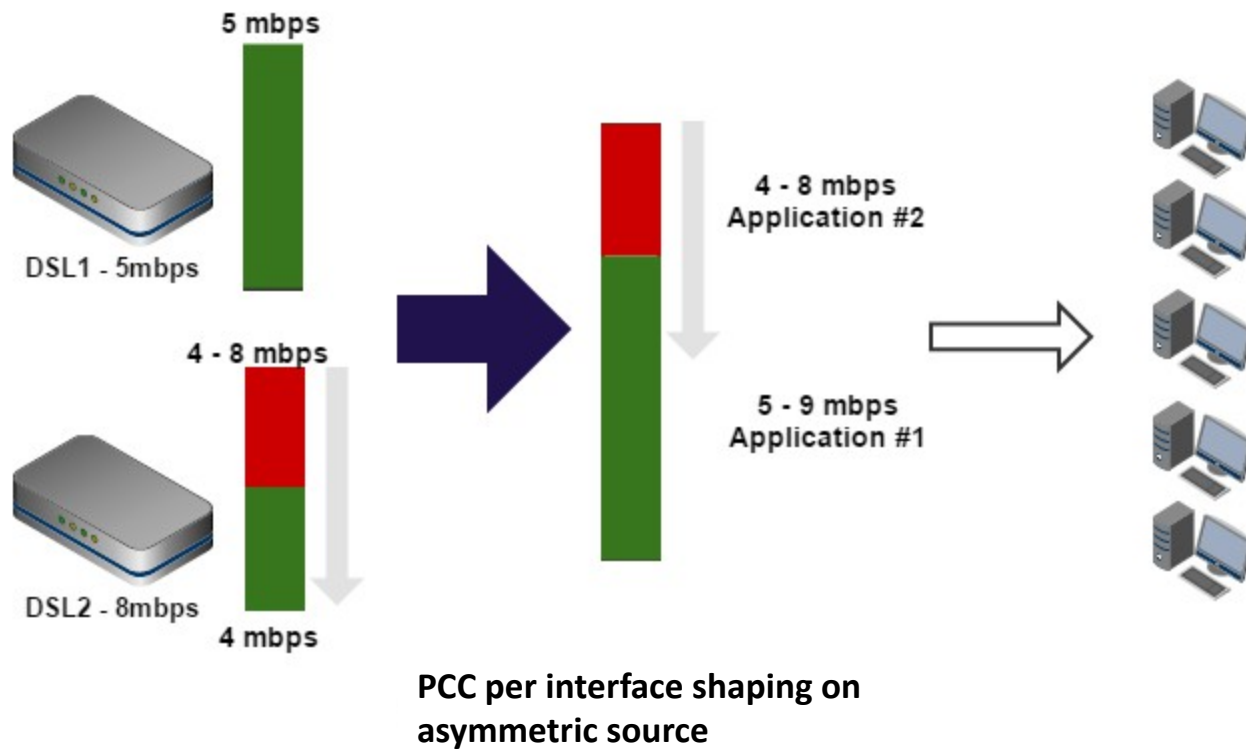


**Policy Routing**

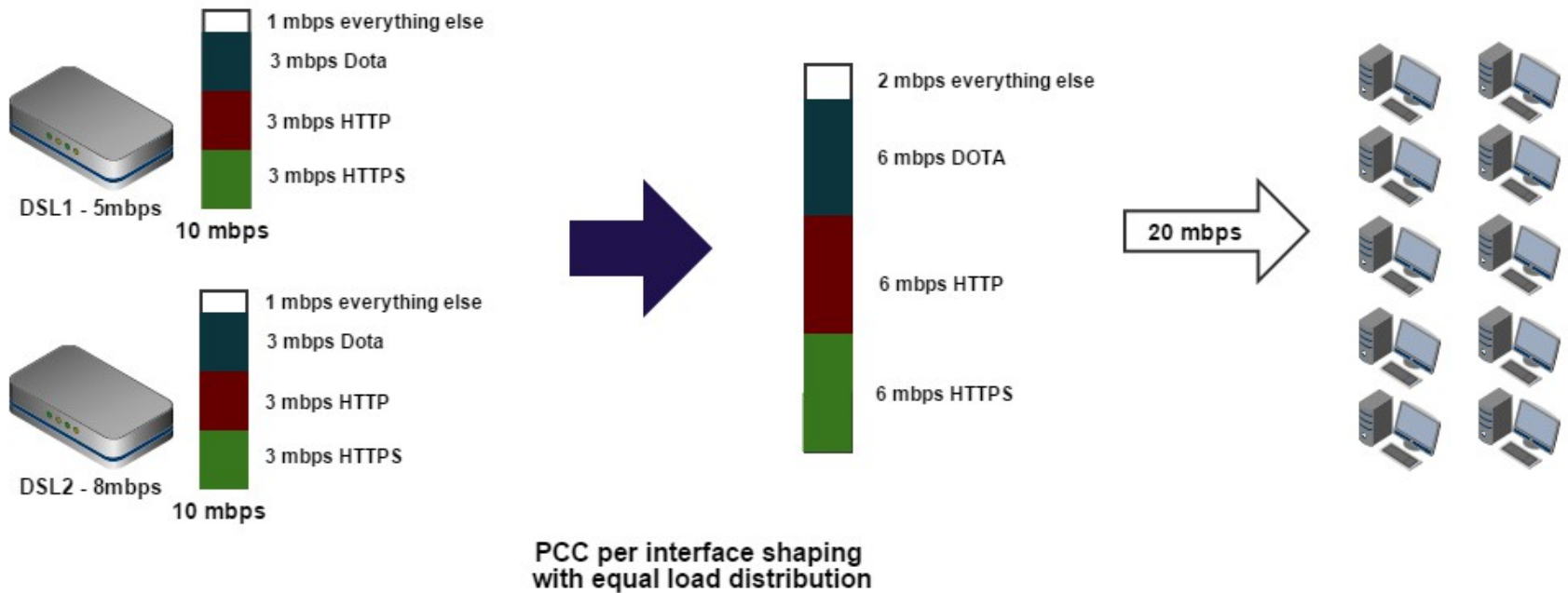


**Standard PCC**

## PCC with per interface shaping with dynamic distribution



# PCC per interface Shaping with equal load distribution





VLAN Reference:

[http://wiki.mikrotik.com/wiki/Vlans\\_on\\_Mikrotik\\_environment](http://wiki.mikrotik.com/wiki/Vlans_on_Mikrotik_environment)

Thanks to :

Louie Datahan of Databyte Computer Sales

Andrian Laping of Lhean's i-Café (CCBoot)