

# Nubes Privadas con Mikrotik

The logo for the MikroTik User Meeting (MUM), featuring the letters "mum" in a large, white, lowercase sans-serif font, with "MikroTik User Meeting" in a smaller, white, sans-serif font below it.

mum  
MikroTik User Meeting

BUENOS AIRES, ARGENTINA, NOVEMBER 15 – 16, 2018

# Buenos días!

## Me llamo Luis María Carriles

Ing. Sistemas de Información  
Cofundador Bejuca Consulting  
MTCNA - MTCTCE  
Mikrotik Certified Trainer



Me pueden encontrar como:  
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lmcarriles@bejuca.com.ar

# Bejuca Consulting

Consultora de Sistemas de Información

Centro de Entrenamiento Mikrotik

Experiencia desde el 2008 en Infraestructuras de  
Sistemas de Información

Networking-Cloud Computing-Servicios  
Empresariales

[www.bejuca.com.ar](http://www.bejuca.com.ar)

[informes@bejuca.com.ar](mailto:informes@bejuca.com.ar)



Ing. Silvana C. Marsiglia



Ing. Luis Maria Carriles

# Nubes Privadas con Mikrotik

A decorative network diagram in the top-left corner, consisting of various sized circles (nodes) connected by thin lines, some solid and some dashed, creating a complex web-like structure.

1.

# Nube

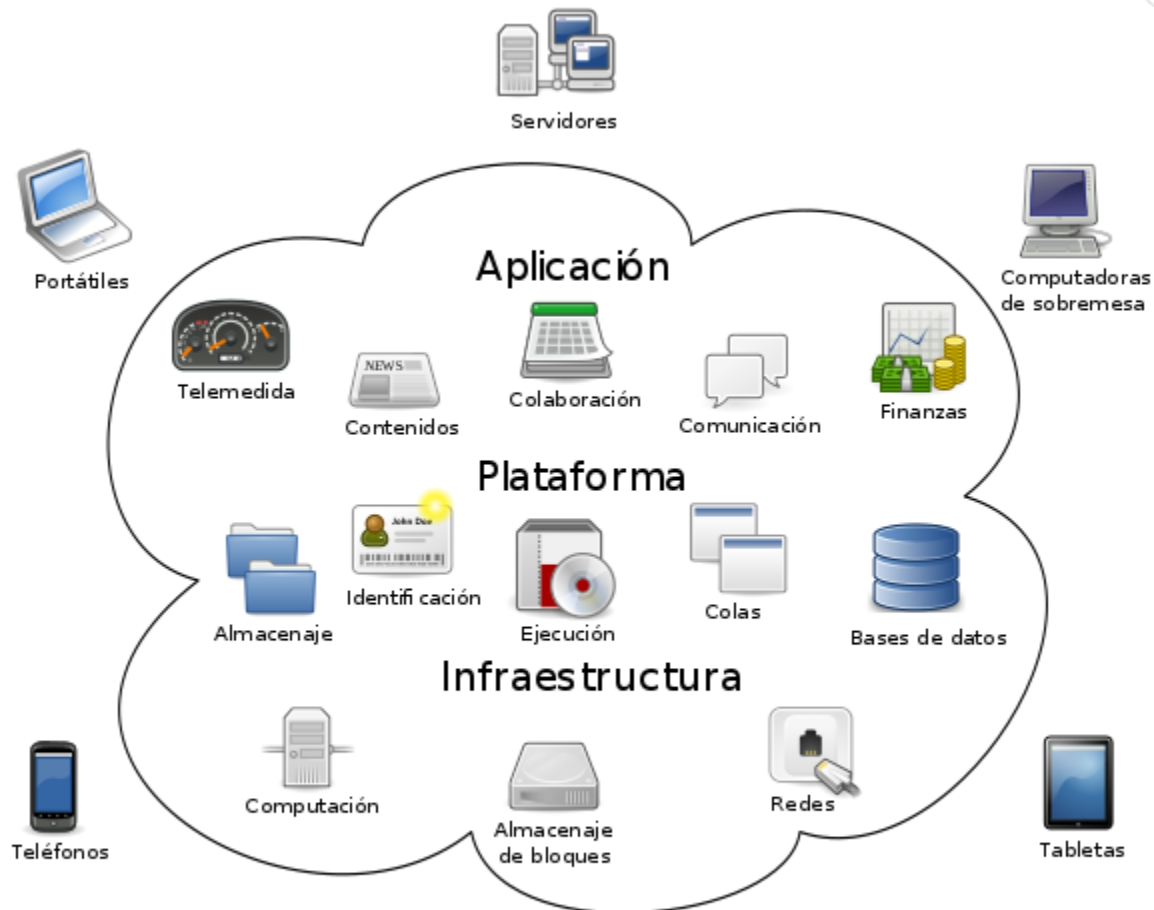
Marco Conceptual

“

*Computación en la nube (Cloud Computing) es un paradigma que permite ofrecer **servicios de computación** a través de una red.*

*Wikipedia*

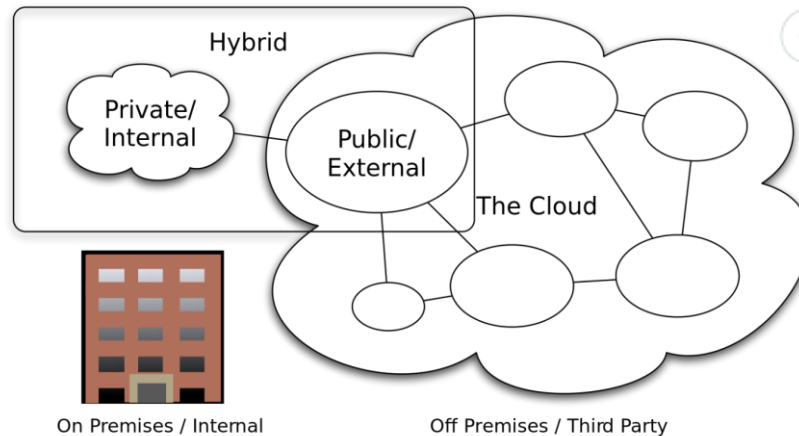
# Computación en la Nube



## Computación en la nube

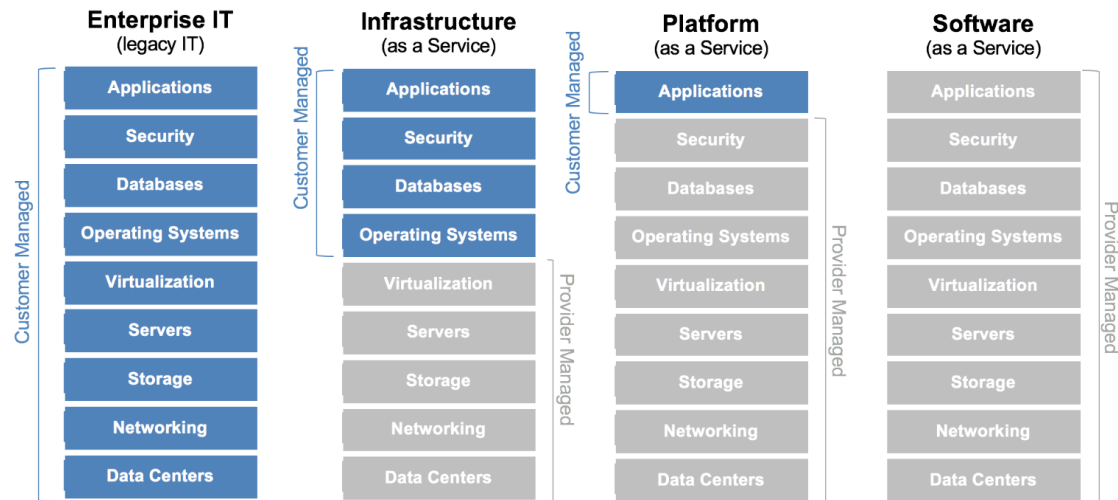
## Tipos de Nubes

- ◎ Publicas
- ◎ Privadas
- ◎ Mixtas



### Cloud Computing Types

CC-BY-SA 3.0 by Sam Johnston



# 2.

# Bonding

Marco Conceptual

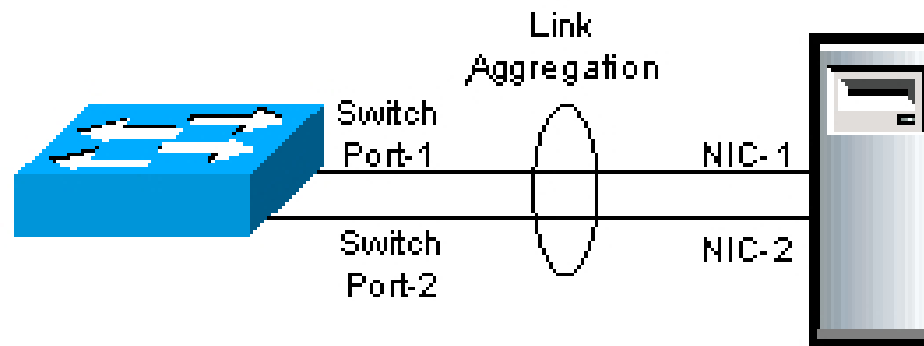


“

*Es una tecnología que permite el  
agregado de múltiples interfaces  
similares en un solo enlace virtual,  
obteniendo mayores tasas de  
transferencia de datos y  
proporcionando conmutación por  
error*

Wiki Mikrotik

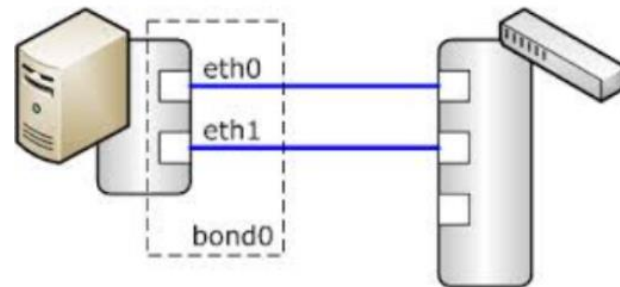
# Bonding



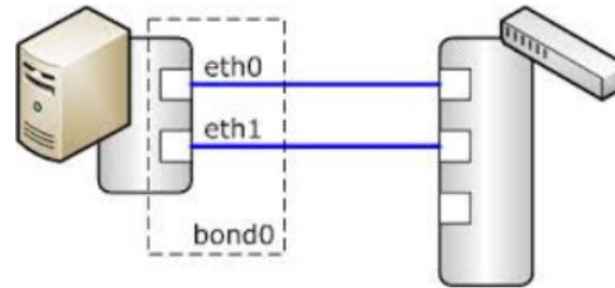
## Ethernet Bonding

El controlador bonding, está incluido en prácticamente todas las distribuciones de GNU/Linux, el cual permite sumar las capacidades de varias interfaces físicas de red con objeto de crear una interfaz lógica.

`bond0 = eth0, eth1`



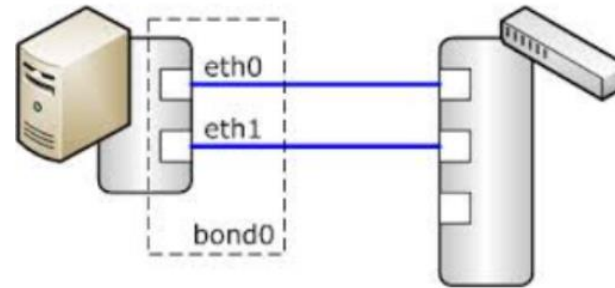
## Bonding: Modos



### © Modo 0 - balance-rr

Utiliza el método Round-Robin entre las tarjetas de red que forman el enlace. Es decir, transmite los paquetes en orden secuencial desde la primera tarjeta esclava hasta la última, y entonces vuelve a empezar por la primera de nuevo. Esta opción ofrece balanceo de carga y tolerancia a fallos. Todas las transmisiones de datos son enviadas y recibidas de forma secuencial en cada interfaz esclava del arreglo empezando con la primera que esté disponible. Es la política predeterminada del controlador y la que funciona para la mayoría de los casos.

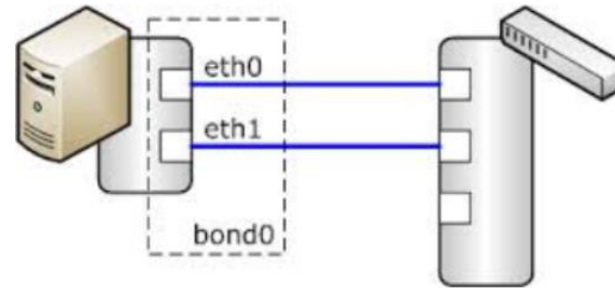
## Bonding: Modos



### © Modo I - active-backup

Sólo una de las tarjetas esclavas está activa la otra está pasiva. Si la tarjeta activa falla, otra tarjeta se vuelve activa y recibe el tráfico. Esta opción ofrece tolerancia a fallos.

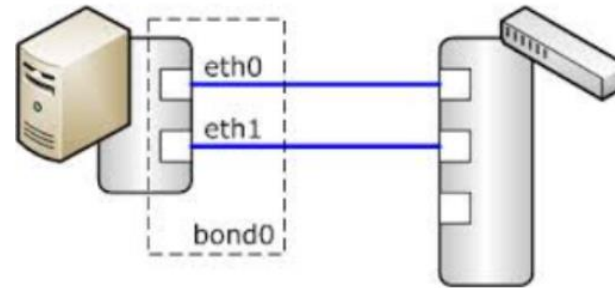
## Bonding: Modos



### © Modo 2 - balance-xor

Se aplica una política XOR basada en dirección MAC origen XOR dirección MAC destino. De esta forma se selecciona la misma tarjeta esclava para cada MAC destino. Esta opción ofrece balanceo de carga y tolerancia a fallos. Es decir un conjunto de clientes a una MAC y otro conjunto a otra MAC.

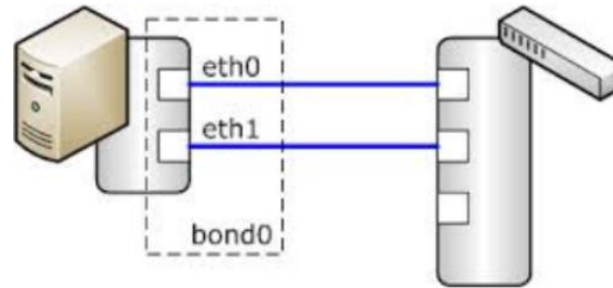
## Bonding: Modos



### © Modo 3 - broadcast

Se retransmiten todos los paquetes a todas las tarjetas esclavas. Esta opción ofrece tolerancia a fallos. Y se puede utilizar cuando nodos se tiene conexión redundante a dos switch que utilizan ISL (Inter Switch Link)

## Bonding: Modos

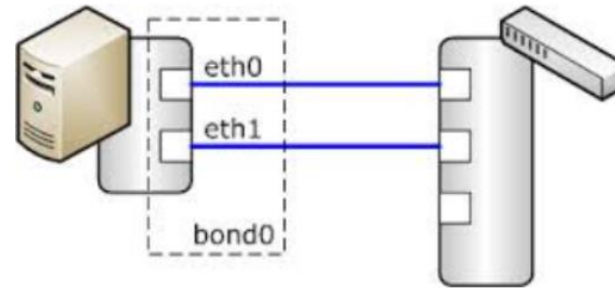


### © Modo 4 - 802.ad

802.3ad (Dynamic link aggregation), permite agregar varios enlaces para conseguir un mayor ancho de banda. En el tráfico entrante y saliente.

Todos los enlaces deben tener la misma velocidad y ancho de banda. Es necesario equipamiento de red que soporte 802.3ad. En redes esto se conoce como Port Trunking y en Cisco como EtherChannel. Se debe configurar manualmente los puertos de switch de red utilizadas por cada interfaz para funcionar correctamente.

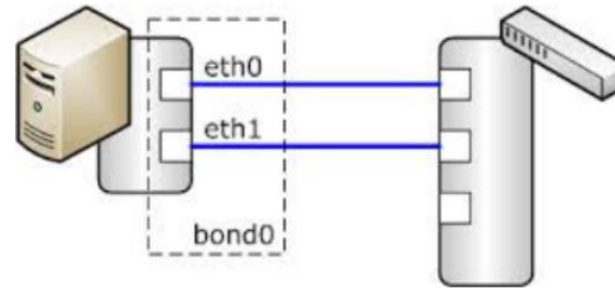
## Bonding: Modos



### © Modo 5 - balance-tbl

balance-tlb: El tráfico saliente se distribuye según la carga de trabajo en cada tarjeta esclava. Balancea la carga de transmisión entre los esclavos dependiendo de la velocidad de estos y de la carga total. El tráfico es recibido por un esclavo, en caso de fallar otro esclavo toma su MAC y continúa recibiendo tráfico.

## Bonding: Modos



### © Modo 6 - balance-alb

Incluye el balanceo del tráfico saliente (modo 5) más el balanceo del tráfico entrante. realiza el balanceo anterior además de un balanceo también en la recepción. Para el balanceo del tráfico recibido se utiliza negociación ARP. Este método debe modificar las MAC de los esclavos estando las tarjetas activas, esto debe estar soportado por el driver para poder usar este método

# 3.

## Caso de Estudio

Mikrotik + Proxmox

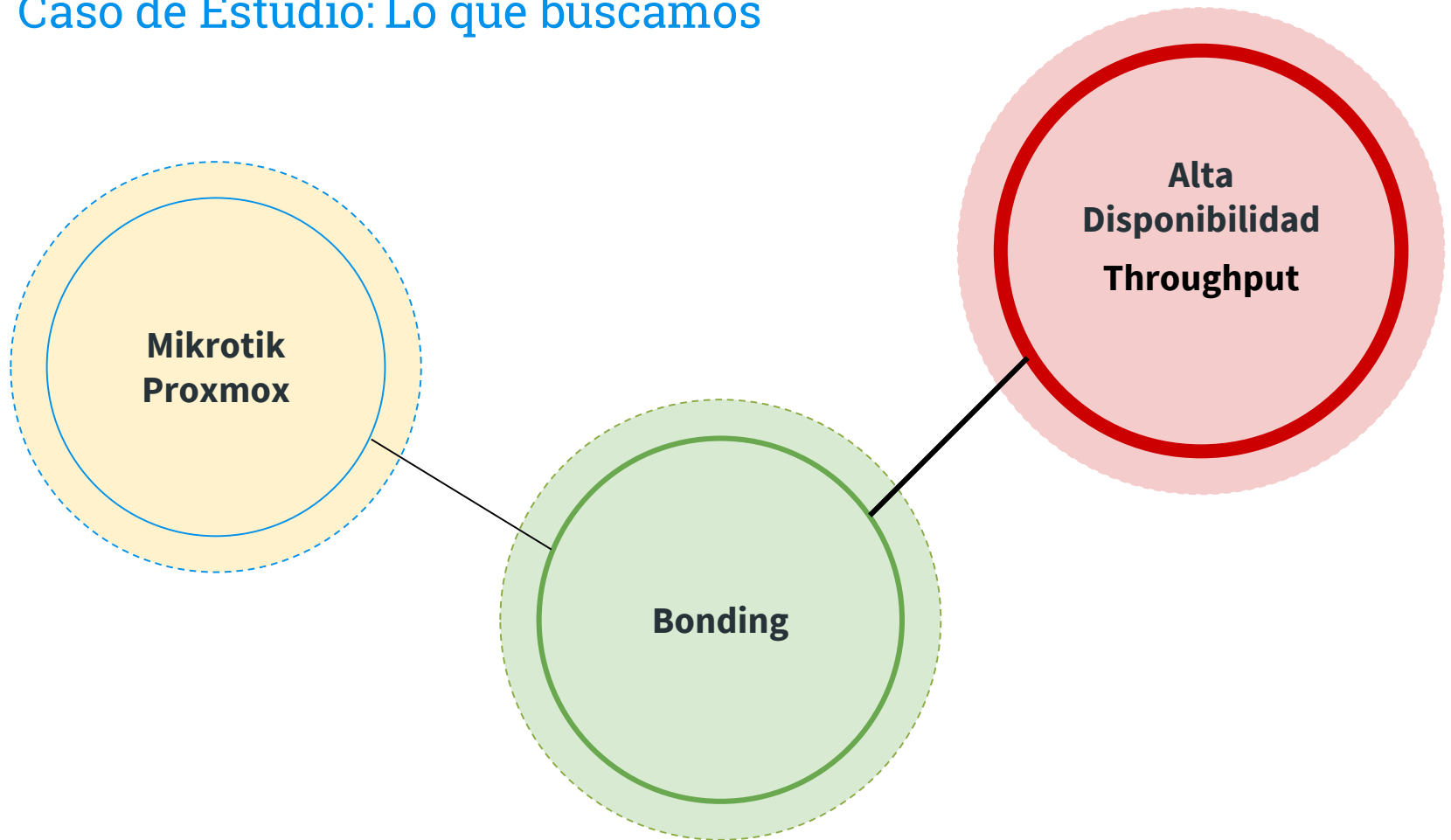


“

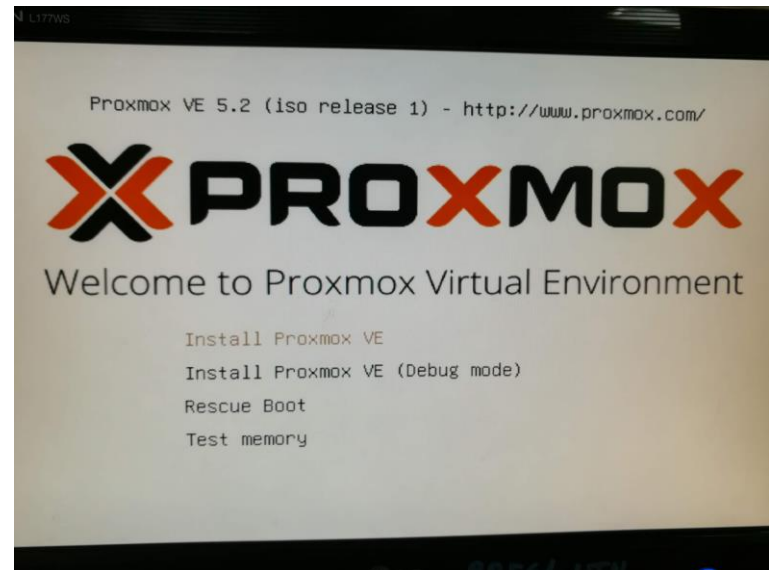
*Lograr fortalecer el uso del  
bonding en dos aspectos críticos  
en la implementación de una nube  
privada como lo son:*

***Alta Disponibilidad y el máximo  
Throughput***

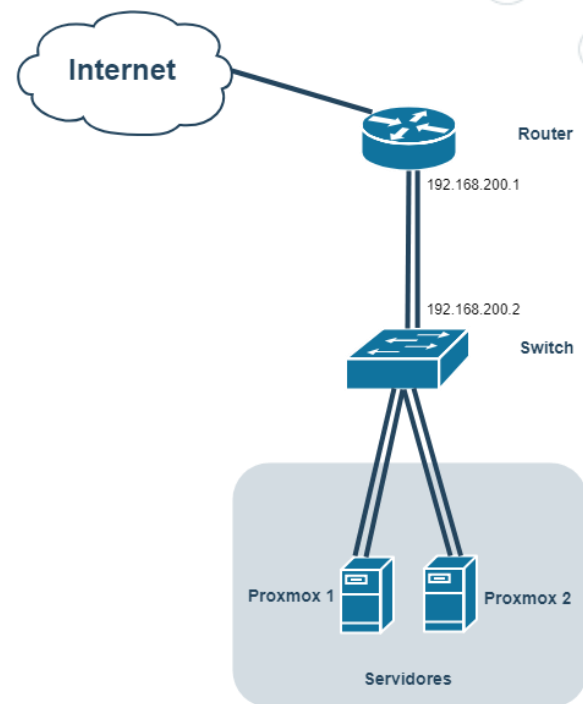
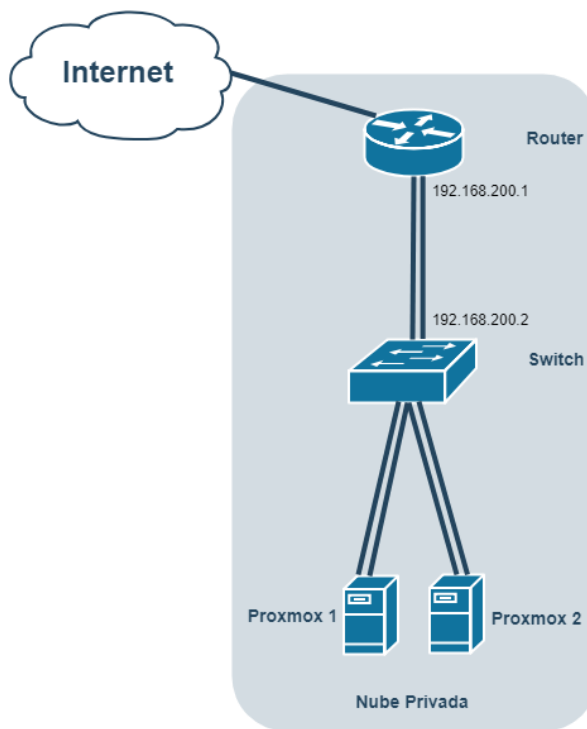
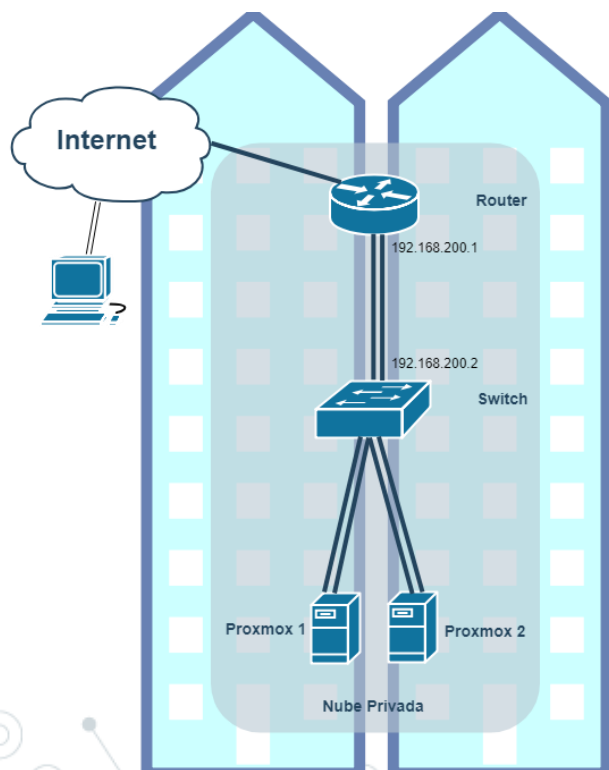
## Caso de Estudio: Lo que buscamos



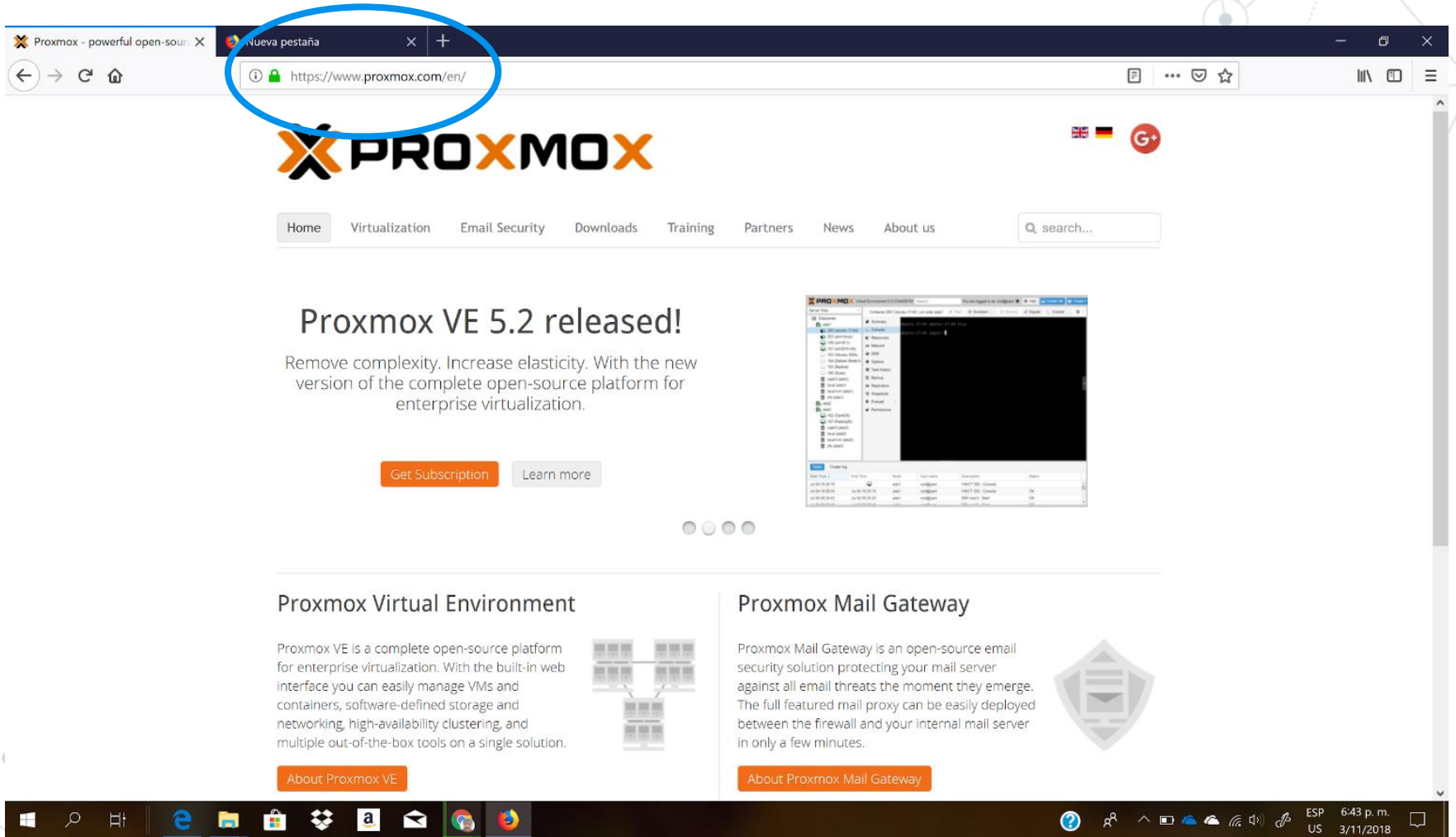
## Caso de Estudio: Equipamiento



## Caso de Estudo: Proxmox - Mikrotik



# Proxmox



Proxmox - powerful open-source

Nueva pestaña

https://www.proxmox.com/en/

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Proxmox VE 5.2 released!

Remove complexity. Increase elasticity. With the new version of the complete open-source platform for enterprise virtualization.

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Proxmox Virtual Environment

Proxmox VE is a complete open-source platform for enterprise virtualization. With the built-in web interface you can easily manage VMs and containers, software-defined storage and networking, high-availability clustering, and multiple out-of-the-box tools on a single solution.

About Proxmox VE

Proxmox Mail Gateway

Proxmox Mail Gateway is an open-source email security solution protecting your mail server against all email threats the moment they emerge. The full featured mail proxy can be easily deployed between the firewall and your internal mail server in only a few minutes.

About Proxmox Mail Gateway

# Proxmox: Download

The screenshot shows the Proxmox website's download page. The browser address bar displays <https://www.proxmox.com/en/downloads>. The Proxmox logo is prominently displayed at the top. Below the logo, there is a navigation menu with links to Home, Virtualization, Email Security, Downloads, Training, Partners, News, and About us. A search bar is also present. The main content area is titled 'Download Proxmox software, datasheets and documentation'. It features two main sections: 'Proxmox Virtual Environment (12)' and 'Proxmox Mail Gateway (13)'. Below these, there is a section titled 'Download Proxmox software, datasheets and documentation Files'. This section contains four download options, each with a version number and a 'Download' button. A blue circle highlights the 'Proxmox VE 5.2 ISO Installer' download button.

| Product                                   | Version         | Updated on                   | Download Button |
|-------------------------------------------|-----------------|------------------------------|-----------------|
| Proxmox VE 5.2 ISO Installer              | Version: 5.2-1  | Updated on 16 May 2018       | Download        |
| Proxmox Mail Gateway 5.1 ISO Installer    | Version: 5.1-1  | Updated on 09 October 2018   | Download        |
| Proxmox VE 5.2 ISO Installer (BitTorrent) | Version: 5.2-1  | Updated on 18 September 2018 | Download        |
| Proxmox Mail Gateway 5.0 ISO Installer    | Version: 5.0-12 | Updated on 01 February 2018  | Download        |

# Configuración: Router

admin@4C:5E:0C:DF:B7:89 (MikroTik) - WinBox v6.43.4 on CCR1009-8G-1S-1S+ (tile)

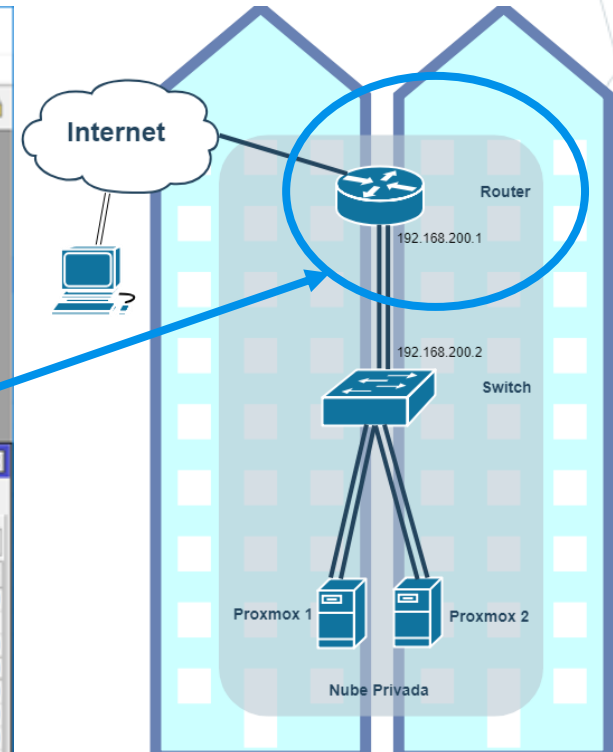
Session Settings Dashboard

Safe Mode Session: 4C:5E:0C:DF:B7:89

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  
New WinBox

Interface List

| Interface        | Type     | Actual MTU | L2 MTU | Tx         | Rx    |
|------------------|----------|------------|--------|------------|-------|
| ether1           | Ethernet | 1500       | 1578   | 0 bps      | 0     |
| Trunk            |          |            |        |            |       |
| R ether2 - Trunk | Ethernet | 1500       | 1578   | 0 bps      | 0     |
| R ether3 - Trunk | Ethernet | 1500       | 1578   | 0 bps      | 0     |
| ether4           | Ethernet | 1500       | 1578   | 0 bps      | 0     |
| ether5           | Ethernet | 1500       | 1580   | 0 bps      | 0     |
| ether6           | Ethernet | 1500       | 1580   | 0 bps      | 0     |
| ether7           | Ethernet | 1500       | 1580   | 0 bps      | 0     |
| R ether8         | Ethernet | 1500       | 1580   | 103.6 kbps | 6.4 k |
| afp-afplus1      | Ethernet | 1500       | 1580   | 0 bps      | 0     |
| afp1             | Ethernet | 1500       | 1580   | 0 bps      | 0     |



# Configuración: Router

admin@4C:5E:0C:DF:B7:89 (MikroTik) - WinBox v6.43.4 on CCR1009-8G-1S-15+ (tile)

Session Settings Dashboard

Safe Mode Session: 4C:5E:0C:DF:B7:89

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

Address List

| Address       | Network       | Interface         |
|---------------|---------------|-------------------|
| 192.168.200.1 | 192.168.200.0 | Bonding-Router... |

Interface List

Interface: ether2-Trunk

Mode: balance rr

Primary: none

Link Monitoring: ms

Transmit Hash Policy: layer 2 and 3

Min Links: 0

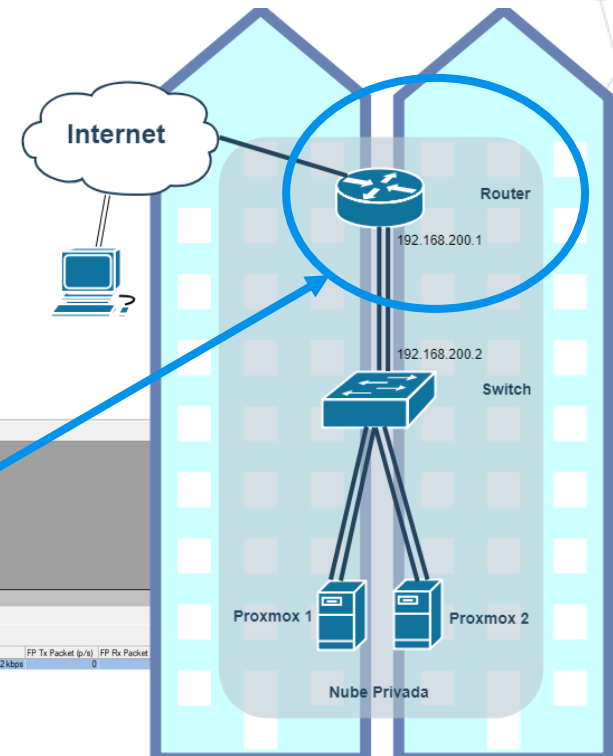
Down Delay: 0 ms

Up Delay: 0 ms

LACP Rate: 1 s

Min Interval: 100 ms

enabled running save



# Configuración: Switch

admin@6C:3B:6B:0B:0C:D9 (Switch) - WinBox v6.43.4 on CRS125-24G-1S (mipsbe)

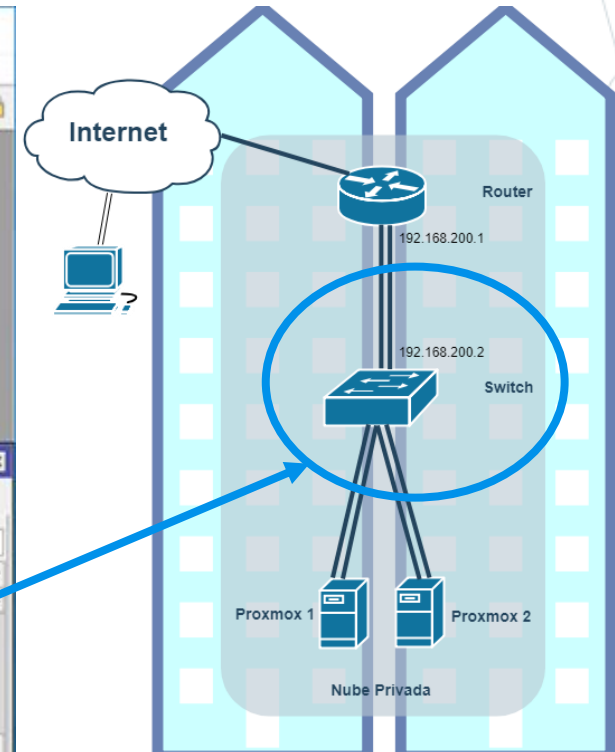
Session Settings Dashboard

Safe Mode Session: 6C:3B:6B:0B:0C:D9

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

Interface List

| Interface | Name            | Type     | Actual MTU | L2 MTU | Tx   |
|-----------|-----------------|----------|------------|--------|------|
| S         | ether11         | Ethernet | 1500       | 1500   |      |
| S         | ether12         | Ethernet | 1500       | 1500   |      |
| S         | ether13         | Ethernet | 1500       | 1500   |      |
| S         | ether14         | Ethernet | 1500       | 1500   |      |
| S         | ether15         | Ethernet | 1500       | 1500   |      |
| S         | ether16         | Ethernet | 1500       | 1500   |      |
| S         | ether17         | Ethernet | 1500       | 1500   |      |
| S         | ether18         | Ethernet | 1500       | 1500   |      |
| S         | ether19         | Ethernet | 1500       | 1500   |      |
| S         | ether20         | Ethernet | 1500       | 1500   |      |
| S         | ether21         | Ethernet | 1500       | 1500   |      |
| S         | ether22         | Ethernet | 1500       | 1500   |      |
| RS        | ether23 - Trunk | Ethernet | 1500       | 1500   | 19.3 |
| RS        | ether24 - Trunk | Ethernet | 1500       | 1500   | 19.3 |



# Configuración: Switch

**New Interface**

General Bonding Status Traffic

Name: Bonding - Router - Switch

Type: Bonding

MTU: 1500

Actual MTU:

L2 MTU:

MAC Address: 00:00:00:00:00:00

ARP: enabled

ARP Timeout:

Forced MAC Address:

OK Cancel Apply Disable Comment Copy Remove Torch

**New Interface**

General Bonding Status Traffic

Slaves: ether1-gateway

ether1-gateway

Mode: balance rr

Primary: 802.3ad

Link Monitoring: active backup

Transmit Hash Policy: balance alb

balance rr

balance tlb

balance xor

broadcast

Min. Links: 0

Down Delay: 0 ms

Up Delay: 0 ms

LACP Rate: 30 s

OK Cancel Apply Disable Comment Copy Remove Torch

Incubator 192.168.200.1 (Router) - WinBox v6.43.4 on CCR1009-BG-15-15+ (tile)

Session Settings Dashboard

Safe Mode Session: 192.168.200.1

Quick Set CAPMAN Interfaces Wireless Bridge PPP Mesh IP MPLS Routing System Queues Files Log Packets Tools New Terminal LCD Partition Make Snapshot Manual New WinBox Exit

enabled

Interface List

| Name                  | Type    | MTU  | Actual MTU | L2 MTU | Tx       | Rx |
|-----------------------|---------|------|------------|--------|----------|----|
| Bonding-Router-Switch | Bonding | 1500 | 1500       | 1578   | 3.2 Mbps |    |

1 item out of 15 (1 selected)

Interface (Bonding-Router-Switch)

General Bonding Status Traffic

Slaves: ether2 - Trunk

ether3 - Trunk

Mode: balance rr

Primary: none

Link Monitoring: mii

Transmit Hash Policy: layer 2 and 3

Min. Links: 0

Down Delay: 0 ms

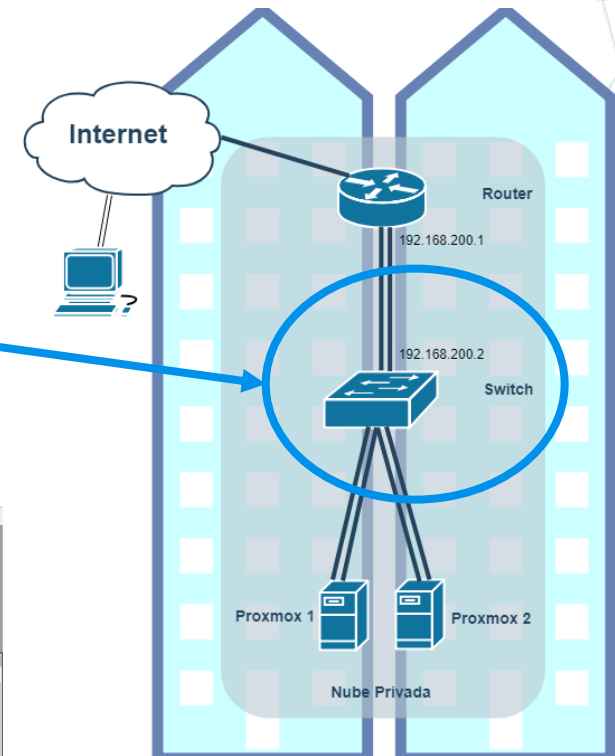
Up Delay: 0 ms

LACP Rate: 1 s

MII Interval: 100 ms

OK Cancel Apply Disable Comment Copy Remove Torch

enabled running



# Configuración: Switch

admin@6C:3B:6B:0B:0C:D9 (Switch) - WinBox v6.43.4 on CRS125-24G-1S (mipsbe)

Session Settings Dashboard

Safe Mode Session: 6C:3B:6B:0B:0C:D9

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

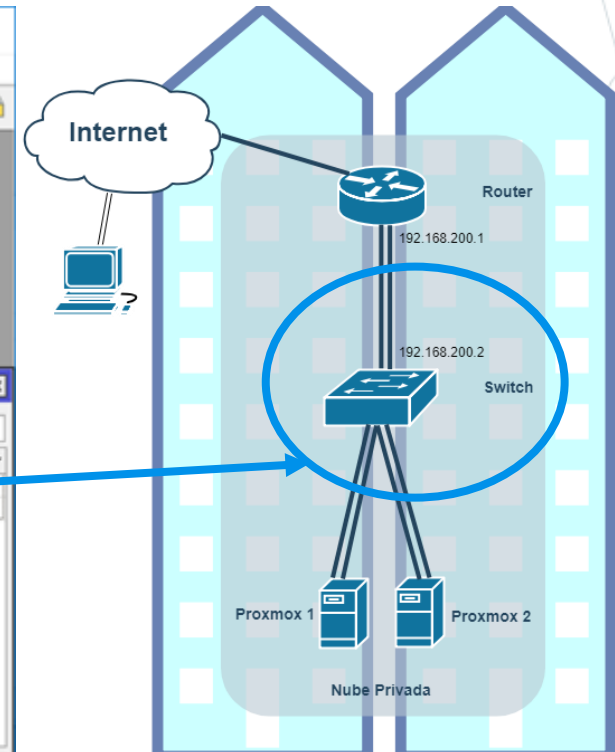
Interface List

| Interface | Interface List            | Ethernet | EoIP Tunnel | IP |
|-----------|---------------------------|----------|-------------|----|
| R         | Bonding - Router - Switch | Bonding  |             |    |

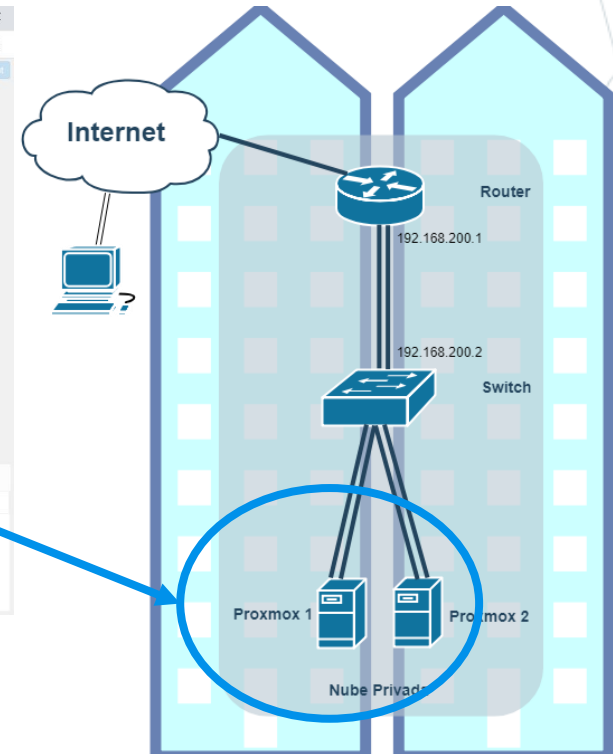
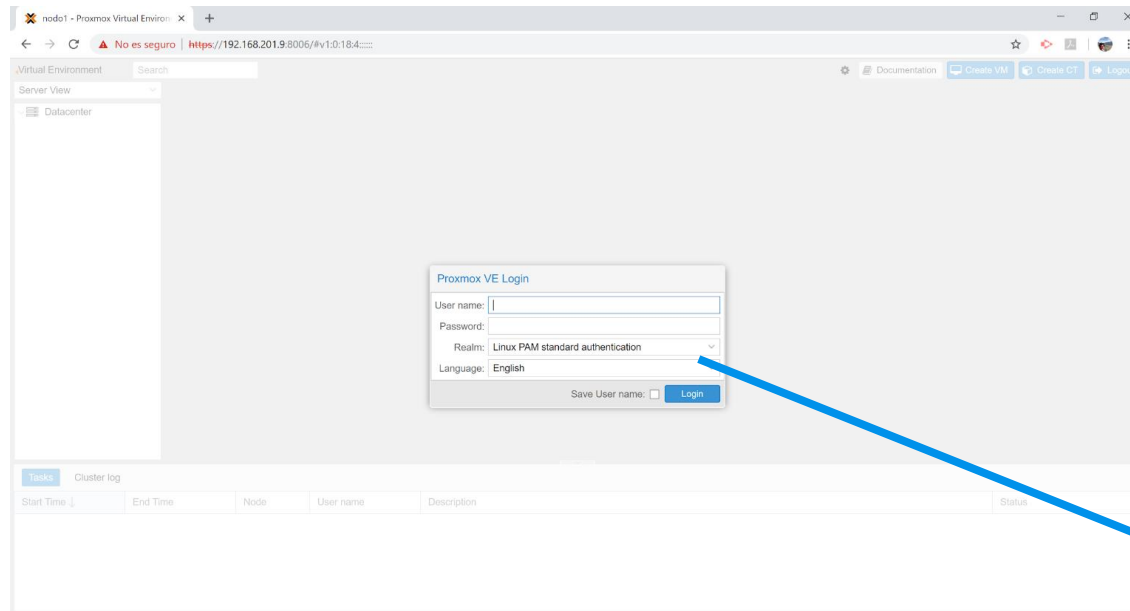
Address List

| Address       | Network       | Interface         |
|---------------|---------------|-------------------|
| 192.168.200.2 | 192.168.200.0 | Bonding - Rout... |

1 item



# Configuración: Proxmox



# Configuración: Proxmox

node1 - Proxmox Virtual Environment

Server View

Datacenter

node1

100 (Mikrotik)

101 (Mikrotik)

102 (Mikrotik)

local (node1)

local-lvm (node1)

Search

Summary

Shell

System

Network

Certificates

DNS

Time

Syslog

Updates

Firewall

Disks

Ceph

Replication

Create

Revert

Edit

Remove

Name

Type

Active

Autostart

VLAN a...

Ports/Slaves

IP address

Subnet mask

Gateway

Comment

bond0

Linux Bond

Yes

Yes

No

enp0s8 enp0s9

Bonding

enp0s8

Network Device

Yes

No

No

enp0s9

Network Device

Yes

No

No

vmbx0

255.255.255.0

192.168.201.1

Create: Linux Bond

Name: bond1

Autostart: ☒

IP address:

Subnet mask:

Gateway:

IPv6 address:

Prefix length:

Gateway:

Slaves: enp0s8 enp0s9

Mode: balance-rr

Hash policy:

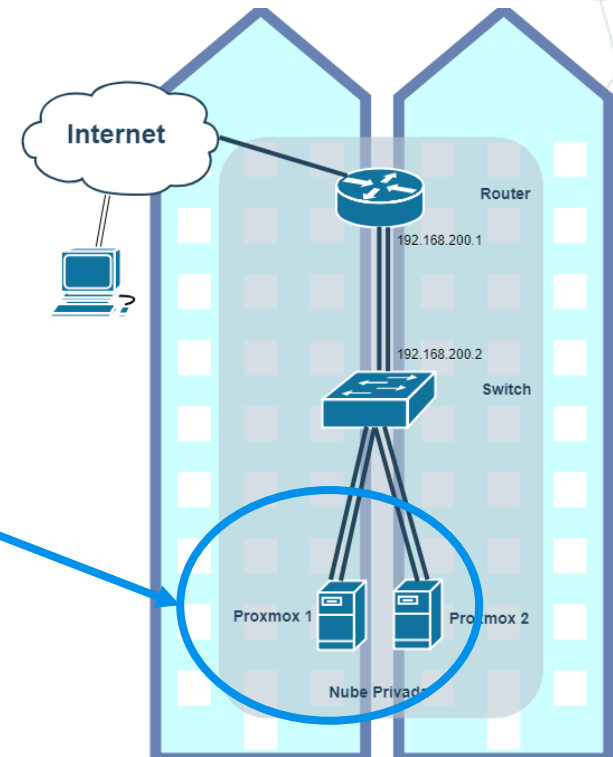
Comment:

Create

Tasks

Cluster log

| Start Time      | End Time        | Node  | User name | Description                 | Status                         |
|-----------------|-----------------|-------|-----------|-----------------------------|--------------------------------|
| Nov 04 04:04:35 | Nov 04 04:05:13 | node1 | root@pam  | Update package database     | Error: command 'apt-get upd... |
| Nov 03 20:37:46 | Nov 03 20:37:46 | node1 | root@pam  | Stop all VMs and Containers | OK                             |
| Nov 03 20:36:48 | Nov 03 20:36:49 | node1 | root@pam  | VMCT 100 - Console          | Error: Failed to run vncproxy. |
| Nov 03 20:33:26 | Nov 03 20:33:27 | node1 | root@pam  | VMCT 100 - Console          | Error: Failed to run vncproxy. |
| Nov 03 20:31:31 | Nov 03 20:31:32 | node1 | root@pam  | VM 100 - Configure          | OK                             |



# Configuración: Proxmox

PROXMOX Virtual Environment 5.2-1

You are logged in as 'root@pam'

Node 'node1'

Package versions

node1 (Uptime: 5 days 20:00:30)

CPU usage: 12.76% of 2 CPU(s)

Load average: 0.54, 0.20, 0.07

IO delay: 0.62%

RAM usage: 24.42% (963.38 MB of 3.85 GiB)

KSM sharing: 0 B

HD space(root): 4.84% (1.75 GiB of 36.17 GiB)

SWAP usage: 0.00% (0 B of 4.00 GiB)

CPU(s): 2 x Dual-Core AMD Opteron(tm) Processor 1210 (1 Socket)

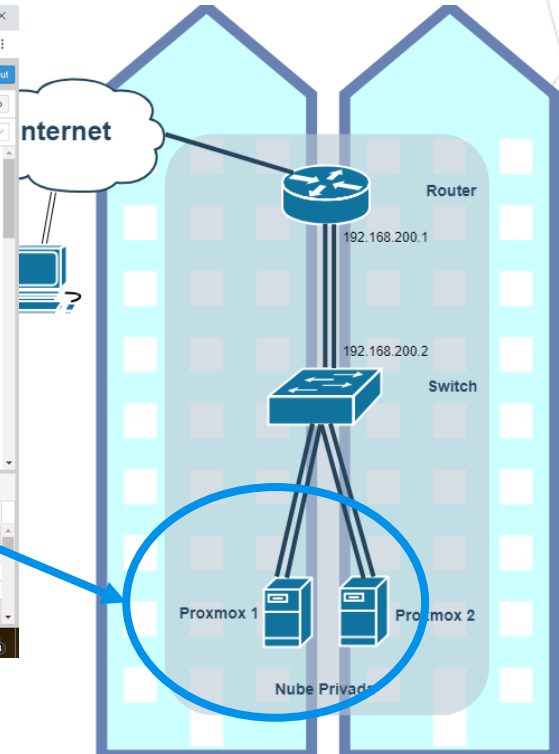
Kernel Version: Linux 4.15.17-1-pve #1 SMP PVE 4.15.17-9 (Wed, 9 May 2018 13:31:43 +0200)

PVE Manager Version: pve-manager/5.2-1/0fcd7879

CPU usage

Cluster log

| Start Time      | End Time        | Node  | User name | Description         | Status                        |
|-----------------|-----------------|-------|-----------|---------------------|-------------------------------|
| Nov 09 10:16:38 | Nov 09 10:16:40 | node1 | root@pam  | VM/CT 101 - Console | Error: Failed to run vncproxy |
| Nov 09 10:16:17 | Nov 09 10:16:37 | node1 | root@pam  | VM/CT 101 - Console | OK                            |
| Nov 09 10:16:12 | Nov 09 10:16:14 | node1 | root@pam  | VM 102 - Start      | OK                            |
| Nov 09 10:16:11 | Nov 09 10:16:15 | node1 | root@pam  | VM 101 - Start      | OK                            |
| Nov 09 10:16:02 | Nov 09 10:16:04 | node1 | root@pam  | VM/CT 101 - Console | Error: Failed to run vncproxy |



# Configuración: Proxmox

nod01 - Proxmox Virtual Environment

No es seguro | [https://192.168.201.9:8006/#v1.0=node%2Fnode1.4:11:...](https://192.168.201.9:8006/#v1.0=node%2Fnode1.4:11:)

You are logged in as 'root@pam'

Documentation | Create VM | Create CT | Logout

Server View

Datacenter

nod01

100 (Mikrotik)

101 (Mikrotik)

102 (Mikrotik)

local (nod01)

local-vm (nod01)

Search

Summary

Shell

System

Network

Certificates

DNS

Time

Syslog

Updates

Firewall

Disks

Ceph

Replication

Create

Revert

Edit

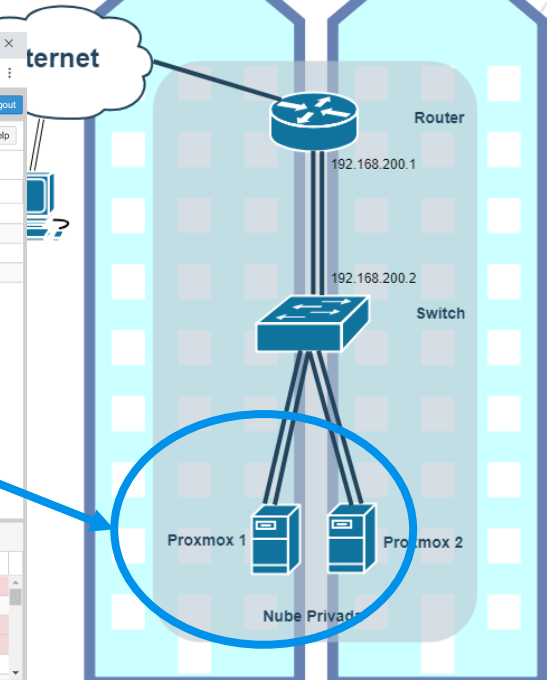
Remove

| Name   | Type           | Active | Autostart | VLAN a... | Ports/Slaves  | IP address    | Subnet mask   | Gateway       | Comment |
|--------|----------------|--------|-----------|-----------|---------------|---------------|---------------|---------------|---------|
| bond0  | Linux Bond     | Yes    | Yes       | No        | enp0s8 enp0s9 |               |               |               | Bonding |
| enp0s8 | Network Device | Yes    | No        | No        |               |               |               |               |         |
| enp0s9 | Network Device | Yes    | No        | No        |               |               |               |               |         |
| vmbr0  | Linux Bridge   | Yes    | Yes       | No        | bond0         | 192.168.201.9 | 255.255.255.0 | 192.168.201.1 |         |

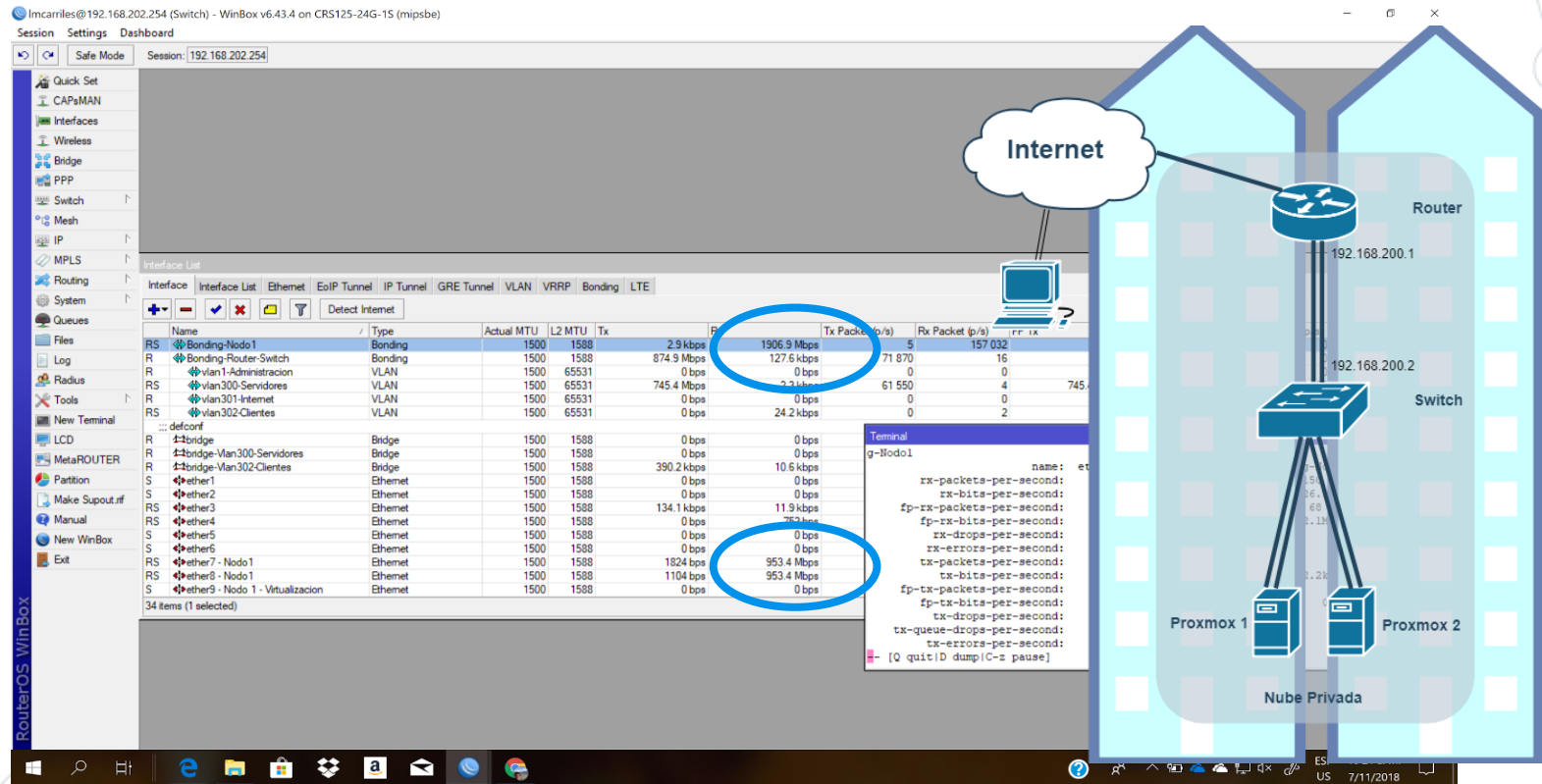
Tasks

Cluster log

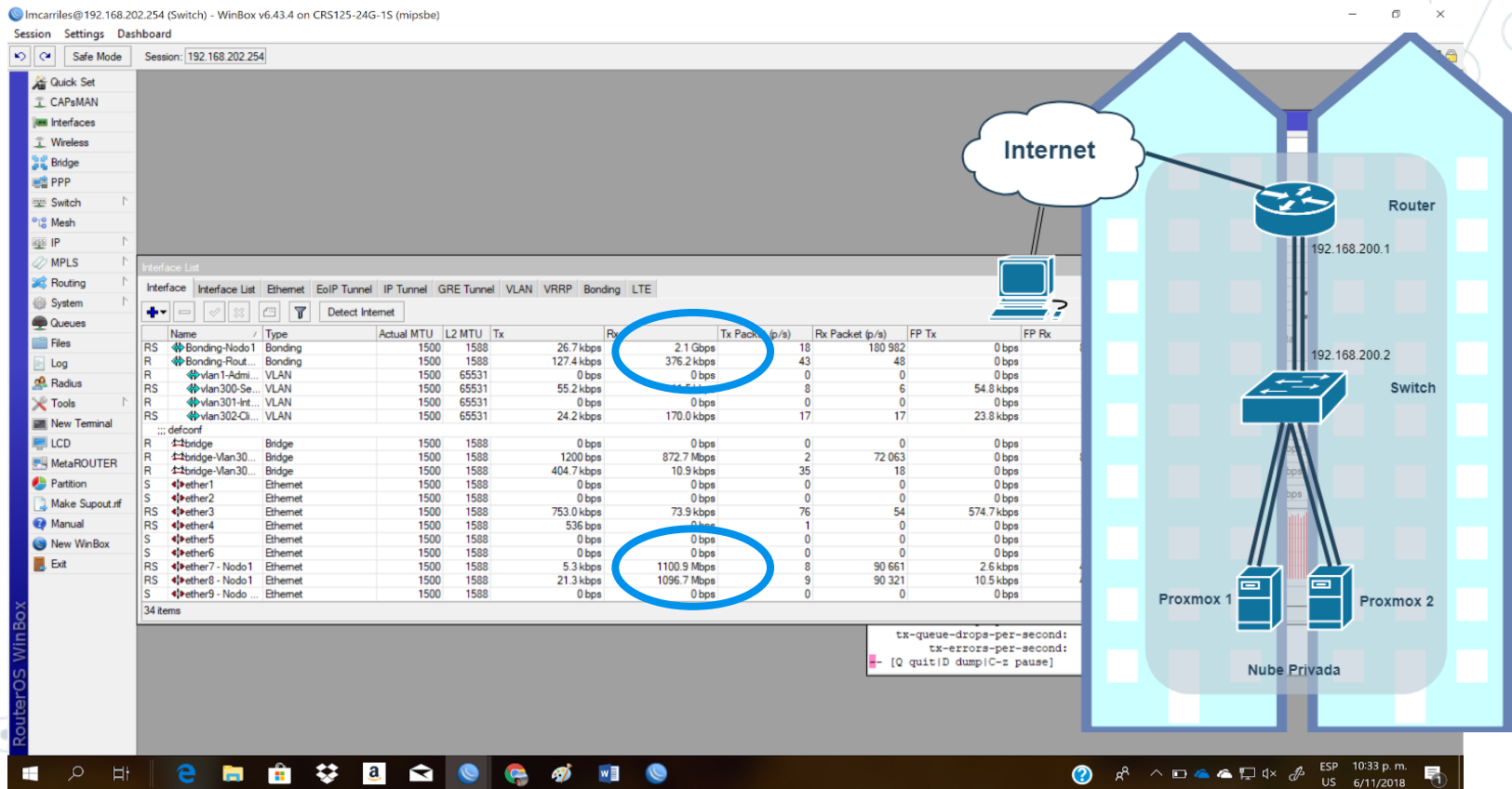
| Start Time      | End Time        | Node  | User name | Description                 | Status                         |
|-----------------|-----------------|-------|-----------|-----------------------------|--------------------------------|
| Nov 04 04:04:35 | Nov 04 04:05:13 | nod01 | root@pam  | Update package database     | Error: command 'apt-get upd... |
| Nov 03 20:37:46 | Nov 03 20:37:46 | nod01 | root@pam  | Stop all VMs and Containers | OK                             |
| Nov 03 20:36:48 | Nov 03 20:36:49 | nod01 | root@pam  | VM/CT 100 - Console         | Error: Failed to run vncproxy. |
| Nov 03 20:33:26 | Nov 03 20:33:27 | nod01 | root@pam  | VM/CT 100 - Console         | Error: Failed to run vncproxy. |
| Nov 03 20:31:31 | Nov 03 20:31:32 | nod01 | root@pam  | VM 100 - Configure          | OK                             |



# Algunos resultados



# Algunos resultados



## Referencias

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- © Mikrotik - [www.mikrotik.com](http://www.mikrotik.com)

# Gracias!

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