



Maestría en Redes de Computadoras

Alumnos:

Iván Moises Aranda Muñoz

Emmanuel Castorena González

Alejandra Montiel Fernández

Materia: Redes LAN y WAN

Maestra: M.C. Martha Delgado Pérez

Redundancia y Balanceo de Carga con MultiWAN

Fecha de Entrega: 8 de Diciembre de 2012

Redundancia y Balanceo de Carga con MultiWAN sobre servidor pfSense

Requerimientos del Hardware

Tarjeta Madre: Intel E210882.

Tarjeta de Red WAN1: ENL832-TX-RE | Adaptador PCI Ethernet Rápido 10/100Mbps.

Tarjeta de Red LAN: TPLink Adaptador de Red PCI 10/100 Mbps TF-3200.

Tarjeta de Red WAN2: TPLink Adaptador de Red PCI 10/100 Mbps TF-3200

Disco duro: 20 Gb

Memoria Ram: 512Mb.

Procesador: Intel Pentium (R) 4, 2.80 GHz Socket 4.23, 400MHz front Side bus

Requerimientos de Software

Servidor

Pfsense v2.0.1- REALSE (i386)

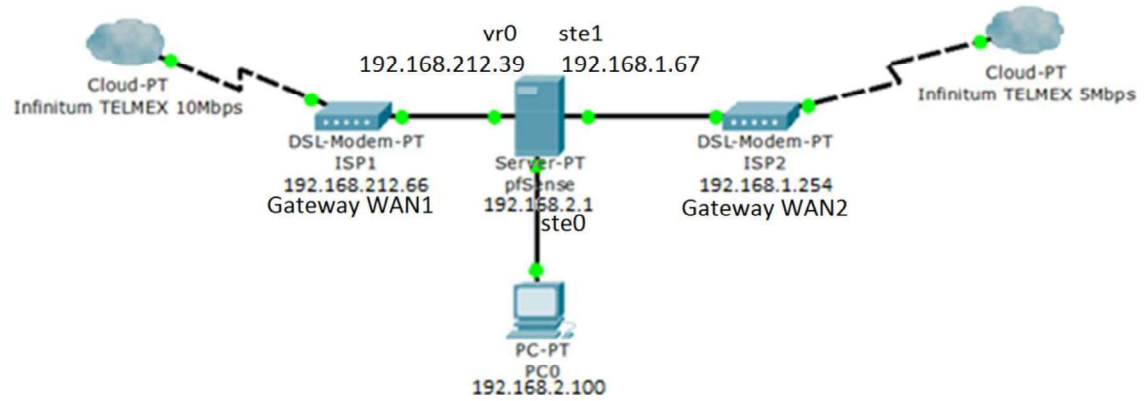
FreeBSD 8.1- REALSE-p6

Provedores de Servicios de Internet

ISP1: Infinitum TELMEX 10Mbps

ISP2: Infinitum TELMEX 5Mbps

ARQUITECTURA DE CONEXIÓN DE SERVIDORES, EQUIPOS ACTIVOS Y CLIENTES



Introducción

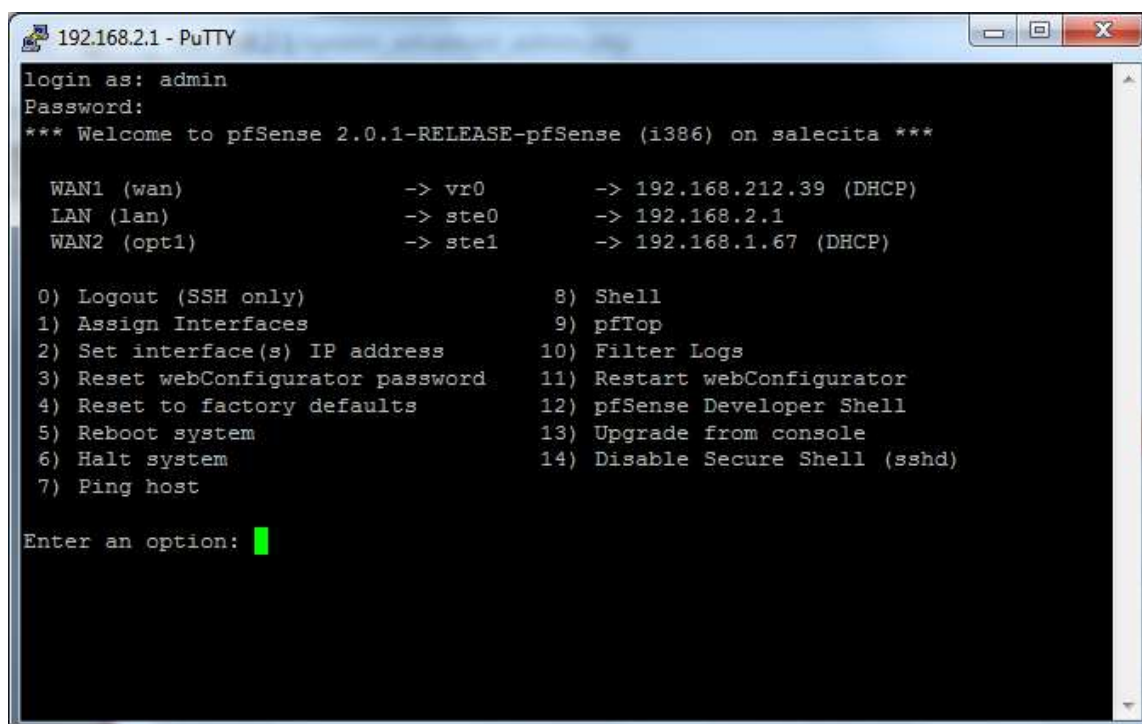
El servicio de internet puede llegar a convertirse en un servicio crítico, dependiendo del rubro de la empresa o los servicios que presta la misma.

Las empresas que tienen como vital importancia el servicio de internet, suelen contratar 2 o más proveedores de servicios e instalar un servidor de redundancia y balanceo de carga entre otros tipos de servidores.

La redundancia sobre varios ISP, permite que si en algún momento un proveedor llega a fallar, automáticamente entra en funcionamiento el segundo ISP, y en caso de que los 2 ISP se encuentren en correcto funcionamiento, realiza una asignación y reparto de cargas para que el servicio de internet sea lo mas eficiente posible para la LAN a la que provee de servicios.

Configuración de servidor pfSense para redundancia y balanceo de cargas con multiWAN.

Se asignan las direcciones necesarias a las interfaces de red.



```
192.168.2.1 - PuTTY
login as: admin
Password:
*** Welcome to pfSense 2.0.1-RELEASE-pfSense (i386) on salecita ***

WAN1 (wan)          -> vr0          -> 192.168.212.39 (DHCP)
LAN (lan)           -> ste0         -> 192.168.2.1
WAN2 (opt1)         -> ste1         -> 192.168.1.67 (DHCP)

0) Logout (SSH only)      8) Shell
1) Assign Interfaces      9) pfTop
2) Set interface(s) IP address 10) Filter Logs
3) Reset webConfigurator password 11) Restart webConfigurator
4) Reset to factory defaults 12) pfSense Developer Shell
5) Reboot system         13) Upgrade from console
6) Halt system           14) Disable Secure Shell (sshd)
7) Ping host

Enter an option: █
```

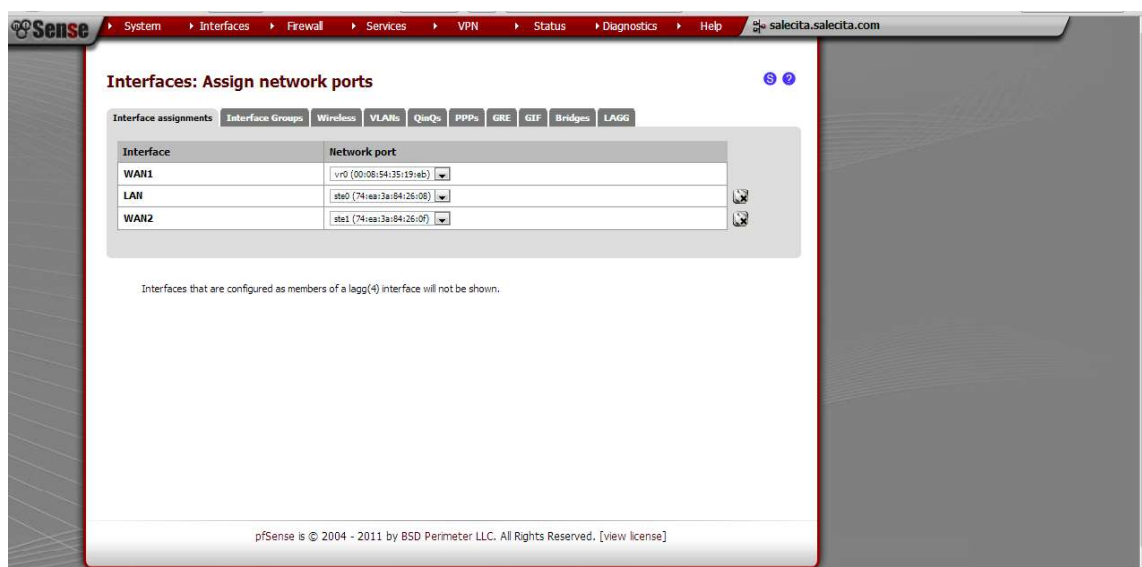
Ingresamos al configurador web para realizar los siguientes ajustes.

Se designa en **Interfaces > assign** el servicio que va a ir conectado en cada interfaz de red, en nuestro caso:

WAN1 -> ISP1

LAN -> Red Local

WAN2 -> ISP2



Se definen los gateways para lo que usaremos las direcciones que tienen los ISP's desde **System > Routing**.

Gateway1

Nombre: WAN1

DireccionIP: 192.168.212.66

The screenshot shows the 'System: Gateways: Edit gateway' page in the Sense router web interface. The page has a red header with the 'Sense' logo and a navigation menu. The main content area is white with a red border. The configuration form includes the following fields:

- Interface:** A dropdown menu set to 'WAN1'.
- Name:** A text field containing 'WAN1'.
- Gateway:** A text field containing '192.168.212.66'.
- Default Gateway:** A checkbox labeled 'Default Gateway' which is checked.
- Disable Gateway Monitoring:** A checkbox labeled 'Disable Gateway Monitoring' which is unchecked.
- Monitor IP:** A text field with a placeholder 'Alternative monitor IP'.
- Advanced:** A checkbox labeled 'Advanced' which is unchecked.
- Description:** A text field containing 'Interface WAN1'.

At the bottom of the form are 'Save' and 'Cancel' buttons.

Gateway2

Nombre: WAN2

DireccionIP: 192.168.1.254

The screenshot shows the 'System: Gateways: Edit gateway' page in the Sense router web interface for Gateway2. The configuration form includes the following fields:

- Interface:** A dropdown menu set to 'WAN2'.
- Name:** A text field containing 'WAN2'.
- Gateway:** A text field containing '192.168.1.254'.
- Default Gateway:** A checkbox labeled 'Default Gateway' which is unchecked.
- Disable Gateway Monitoring:** A checkbox labeled 'Disable Gateway Monitoring' which is unchecked.
- Monitor IP:** A text field with a placeholder 'Alternative monitor IP'.
- Advanced:** A checkbox labeled 'Advanced' which is unchecked.
- Description:** A text field containing 'Interface WAN2'.

At the bottom of the form are 'Save' and 'Cancel' buttons.

Ahora, con los gateways que acabamos de crear, vamos a crear un nuevo grupo de gateways desde **System > Routing > Groups**.

Creamos un nuevo grupo llamado MultiWAN, y seleccionamos los gateways con el mismo valor de prioridad en Tier, esto es para que realice a su vez el balanceo de cargas y la redundancia.

The screenshot shows the 'System: Gateways: Edit gateway' form in the pfSense web interface. The form is titled 'Edit gateway entry' and contains the following fields:

- Group Name:** MultiWAN
- Gateway Priority:** Tier 2 (selected). Below this, two gateways are listed: 'WAN1 - Interface WAN1 Dynamic Gateway' and 'WAN2 - Interface WAN2 Dynamic Gateway'.
- Link Priority:** A dropdown menu set to 'Member Down'. A note explains: 'The priority selected here defines in what order failover and balancing of links will be done. Multiple links of the same priority will balance connections until all links in the priority will be exhausted. If all links in a priority level are exhausted we will use the next available link(s) in the next priority level.'
- Trigger Level:** Member Down. A note says: 'When to trigger exclusion of a member'.
- Description:** MultiWAN Group. A note says: 'You may enter a description here for your reference (not parsed).'

At the bottom of the form are 'Save' and 'Cancel' buttons. The footer of the page reads: 'pfSense is © 2004 - 2011 by BSD Perimeter LLC. All Rights Reserved. [view license]'.

Asi queda creado nuestro grupo de Gateways.

The screenshot shows the 'System: Gateway Groups' page in the pfSense web interface. The page has three tabs: 'Gateways', 'Routes', and 'Groups', with 'Groups' being the active tab. Below the tabs is a table listing the gateway groups:

Group Name	Gateways	Priority	Description
MultiWAN	WAN1 WAN2	Tier 2 Tier 2	MultiWAN Group

Below the table, there is a note: 'Note: Remember to use these Gateway Groups in firewall rules in order to enable load balancing, failover, or policy based routing. Without rules directing traffic into the Gateway Groups, they will not be used.'

The footer of the page reads: 'pfSense is © 2004 - 2011 by BSD Perimeter LLC. All Rights Reserved. [view license]'.

Debemos crear una regla en **Firewall > Rules** para redirigir el tráfico saliente por nuestro grupo de gateways MultiWAN definido anteriormente.

La regla debe permitir el paso de los paquetes desde nuestra subred LAN, a través de nuestra interfaz LAN con cualquier destino.

Senseless | System | Interfaces | Firewall | Services | VPN | Status | Diagnostics | Help | salecita.salecita.com

Firewall: Rules: Edit

Edit Firewall rule

Action
Choose what to do with packets that match the criteria specified below.
Hint: the difference between block and reject is that with reject, a packet (ICMP KS-I or ICMP port unreachable for UDP) is returned to the sender, whereas with block the packet is dropped silently. In either case, the original packet is discarded.
Pass

Disabled
☐ **Disable this rule**
Set this option to disable this rule without removing it from the list.

Interface
Choose on which interface packets must come in to match this rule.
LAN

Protocol
Choose which IP protocol this rule should match.
Hint: in most cases, you should specify TCP here.
any

Source
☐ **not**
Use this option to invert the sense of the match.
Type: LAN subnet
Address: /

Destination
☐ **not**
Use this option to invert the sense of the match.
Type: any
Address: /

Log
☒ **Log packets that are handled by this rule**
Hint: the firewall has limited local log space. Don't turn on logging for everything. If you want to do a lot of logging, consider using a remote syslog server (see the Diagnostics: System logs: Settings page).

Description
You may enter a description here for your reference.

Además de asignar como Gateway el grupo MultiWAN.

Senseless | System | Interfaces | Firewall | Services | VPN | Status | Diagnostics | Help | salecita.salecita.com

Advanced features

Source OS: Advanced - Show advanced option

Diffserv Code Point: Advanced - Show advanced option

Advanced Options: Advanced - Show advanced option

State Type: Advanced - Show advanced option

No XMLRPC Sync: Advanced - Show advanced option

Schedule: Advanced - Show advanced option

Gateway: MultiWAN
Leave as 'default' to use the system routing table. Or choose a gateway to utilize policy based routing.

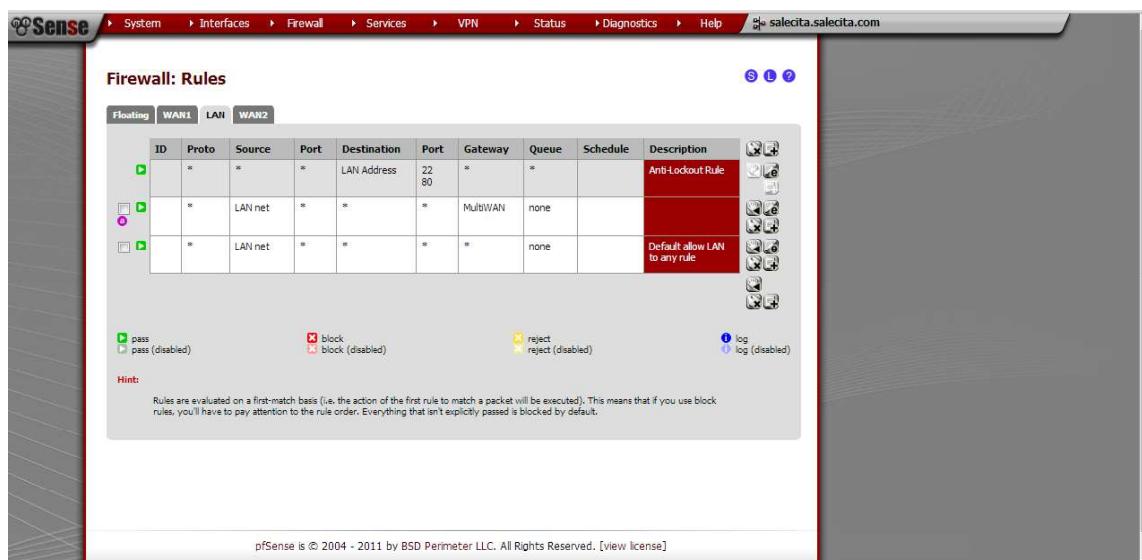
In/Out: Advanced - Show advanced option

Ackqueue/Queue: Advanced - Show advanced option

Layer7: Advanced - Show advanced option

Save **Cancel**

Asi queda nuestra regla creada.



Para corroborar que la configuración se ha realizado de manera correcta, podemos visualizar el estado de los gateways desde **Status > Gateways**.

Status: Gateways

Gateways					
Gateway Groups					
Name	Gateway	Monitor	RTT	Loss	Status
WAN1	192.168.212.66	192.168.212.66	0.453ms	0.0%	Online
WAN2	192.168.1.254	192.168.1.254	0.412ms	0.0%	Online

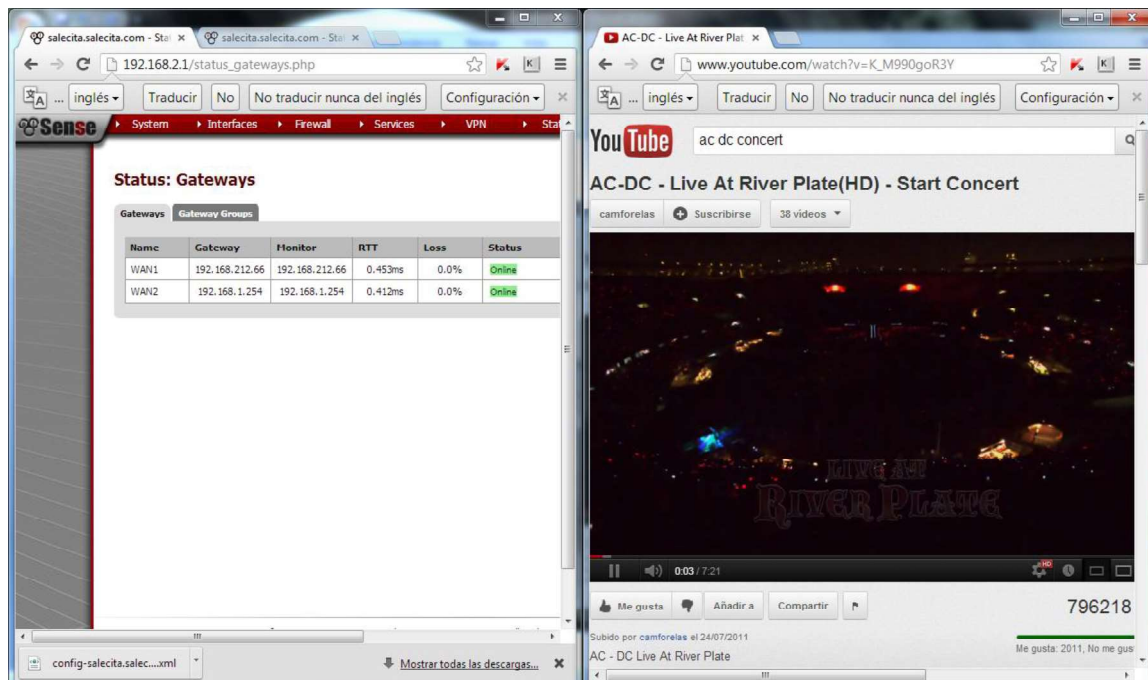
Pruebas de servicio Failover y Balanceo de Cargas

Failover

Para probar la configuración de failover, desconectamos uno de los 2 ISP's que tenemos configurados para que automáticamente el ISP disponible, asuma todas las actividades de servicios de Internet.

Con los 2 ISP's disponibles, abrimos un video, lo suficientemente largo para poder observar que el video sigue cargando y que el servicio de internet no se interrumpe.

Los gateways configurados estan en Online, y el video está cargando.



The image consists of two side-by-side screenshots from a web browser. The left screenshot shows the 'Status: Gateways' page of a Sense router. It displays a table with gateway information. The right screenshot shows a YouTube video player for 'AC-DC - Live At River Plate(HD) - Start Concert'.

Left Screenshot: Status: Gateways

Name	Gateway	Monitor	RTT	Loss	Status
WAN1	192.168.212.66	192.168.212.66	0.453ms	0.0%	Online
WAN2	192.168.1.254	192.168.1.254	0.412ms	0.0%	Online

Right Screenshot: YouTube Video Player

Video Title: AC-DC - Live At River Plate(HD) - Start Concert

Channel: camforelas

Video Duration: 0:03 / 7:21

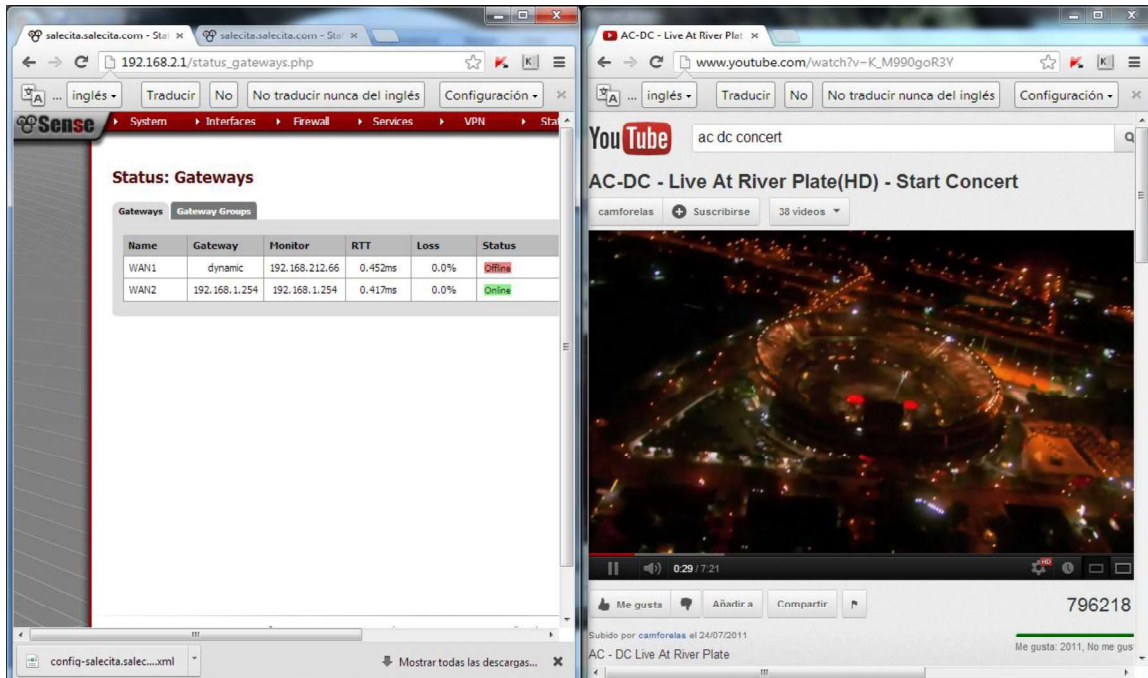
Views: 796218

Uploaded by: camforelas el 24/07/2011

Video Description: AC - DC Live At River Plate

Desconectamos el ISP1 conectado a WAN1.

El Status del gateway WAN1 pasa a Offline y automáticamente el WAN2 asume todas las actividades pendientes por lo que el video sigue cargando.

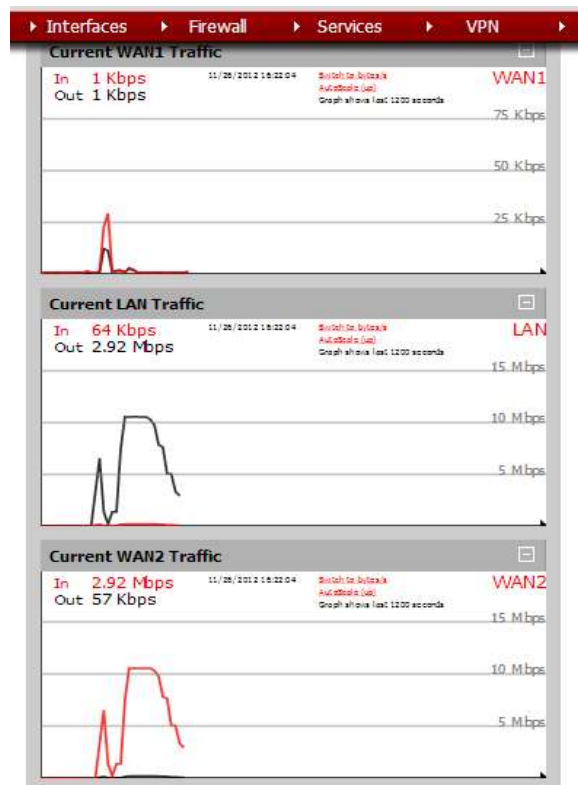


The left screenshot shows the 'Status: Gateways' page in a web interface. It contains a table with the following data:

Name	Gateway	Monitor	RTT	Loss	Status
WAN1	dynamic	192.168.212.66	0.452ms	0.0%	Offline
WAN2	192.168.1.254	192.168.1.254	0.417ms	0.0%	Online

The right screenshot shows a YouTube video player for 'AC-DC - Live At River Plate(HD) - Start Concert'. The video is playing at 0:29 / 7:21. The video title is 'AC-DC - Live At River Plate(HD) - Start Concert' and the channel is 'camforelas'. The video has 796218 views.

En la gráfica de tráfico, observamos que la WAN1 deja de tener tráfico, y la WAN2 tiene el mismo tráfico que la LAN, lo que significa que WAN2 se encuentra proveiendo de todos los servicios de internet a LAN.



Restablecemos la conexión del ISP1 para que los 2 gateways estén Online.

Y ahora desconectamos el ISP2 conectado a WAN2.

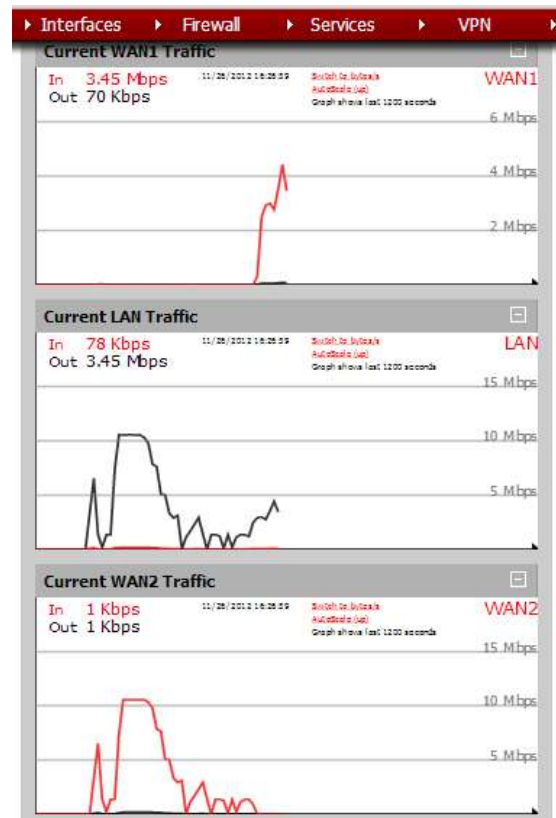
El Status del gateway WAN2 pasa a Offline y automáticamente el WAN1 asume todas las actividades pendientes por lo que el video sigue cargando.

The left screenshot shows a web interface with the title 'Status: Gateways'. It contains a table with the following data:

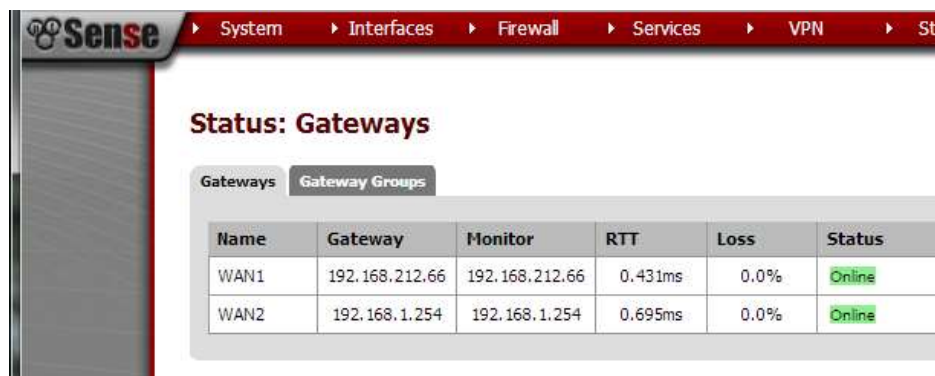
Nome	Gateway	Monitor	RTT	Loss	Status
WAN1	192.168.212.66	192.168.212.66	0.448ms	0.0%	Online
WAN2		192.168.1.254	0.430ms	0.0%	Offline

The right screenshot shows a YouTube video player for 'AC-DC - Live At River Plate(HD) - Start Concert'. The video is playing, showing a band performing on stage. The video has 796218 views and was uploaded by 'camforelas' on 24/07/2011.

En la gráfica de tráfico, observamos que la WAN2 deja de tener tráfico, y la WAN1 tiene el mismo tráfico que la LAN, lo que significa que WAN2 se encuentra proveiendo de todos los servicios de internet a LAN.



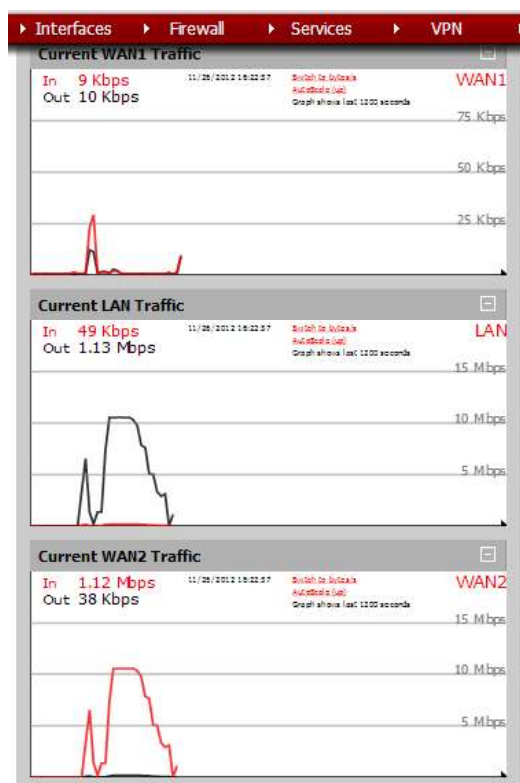
Cuando se restauran los 2 ISP's, el balanceo de carga, se realiza de manera automática por el servidor pfSense.



The screenshot shows the pfSense web interface with the 'Status: Gateways' page. The 'Gateways' tab is selected, showing a table with two active gateways, WAN1 and WAN2, both with 0.0% loss and 'Online' status.

Name	Gateway	Monitor	RTT	Loss	Status
WAN1	192.168.212.66	192.168.212.66	0.431ms	0.0%	Online
WAN2	192.168.1.254	192.168.1.254	0.695ms	0.0%	Online

En la gráfica de tráfico, se puede observar que cuando los 2 ISP's están prestando servicio, WAN1 y WAN2 tienen tráfico, lo que significa que las 2 interfaces están proveiendo a LAN de Internet.



Configuración de servidor pfSense para redundancia con multiWAN.

En ocasiones las empresas cuentan con 2 ISP's pero uno de ellos es el que esta designado para proveer de servicios de internet a la empresa y el otro está designado para entrar en funcionamiento en caso de que el 1° falle.

En esta configuración de MultiWAN, no se hace presente el servicio de balanceo de cargas, únicamente el servicio de failover.

Para configurar únicamente el servicio de failover, se hacen las mismas configuraciones que mencionamos antes, al inicio del reprot, sólo que ahora se creará un nuevo grupo de gateways llamado FAILOVERMultiWAN desde **System > Routing > Groups**, en el que se se asigna una prioridad mayor (Tier 1) al ISP primario y una prioridad menor (Tier 2) al ISP secundario.

The screenshot shows the pfSense web interface with the 'System: Gateways: Edit gateway' page. The page has a red header bar with the title 'Edit gateway entry'. Below this, there are several fields for configuring the gateway group:

- Group Name:** A text box containing 'FAILOVERMultiWAN'.
- Gateway Priority:** Two dropdown menus. The first is set to 'Tier 1' and the second to 'Tier 2'. Below these are labels: 'WAN1 - Interface WAN1 Dynamic Gateway' and 'WAN2 - Interface WAN2 Dynamic Gateway'.
- Link Priority:** A section with a title and a paragraph explaining that the priority selected here defines the order of failover and balancing of links.
- Trigger Level:** A dropdown menu set to 'Member Down'.
- Description:** A text box containing 'MultiWAN Group'.

At the bottom of the form are 'Save' and 'Cancel' buttons. The footer of the page reads: 'pfSense is © 2004 - 2011 by BSD Perimeter LLC. All Rights Reserved. [view license]'.

Después creamos una nueva regla que permita a la LAN conectarse a internet por medio de este nuevo grupo llamado **FAILOVERMultiWAN** desde **Firewall > Rules**.

Firewall: Rules: Edit

Edit Firewall rule

Action Choose what to do with packets that match the criteria specified below.
Hint: the difference between block and reject is that with reject, a packet (TCP RST or ICMP port unreachable for UDP) is returned to the sender, whereas with block the packet is dropped silently. In either case, the original packet is discarded.

Disabled ☐ **Disable this rule**
Set this option to disable this rule without removing it from the list.

Interface Choose on which interface packets must come in to match this rule.

Protocol Choose which IP protocol this rule should match.
Hint: in most cases, you should specify TCP here.

Source ☒ **not**
Use this option to invert the sense of the match.
Type: Address: /

Destination ☒ **not**
Use this option to invert the sense of the match.
Type: Address: /

Log ☒ **Log packets that are handled by this rule**
Hint: the Firewall has limited local log space. Don't turn on logging for everything. If you want to do a lot of logging, consider using a remote syslog server (see the Diagnostics: System logs: Settings page).

Description You may enter a description here for your reference.

Advanced features

Source OS - Show advanced option

Diffserv Code Point - Show advanced option

Advanced Options - Show advanced option

State Type - Show advanced option

No XMLRPC Sync - Show advanced option

Schedule - Show advanced option

Gateway Leave as 'default' to use the system routing table. Or choose a gateway to utilize policy based routing.

In/Out - Show advanced option

Ackqueue/Queue - Show advanced option

Layer7 - Show advanced option

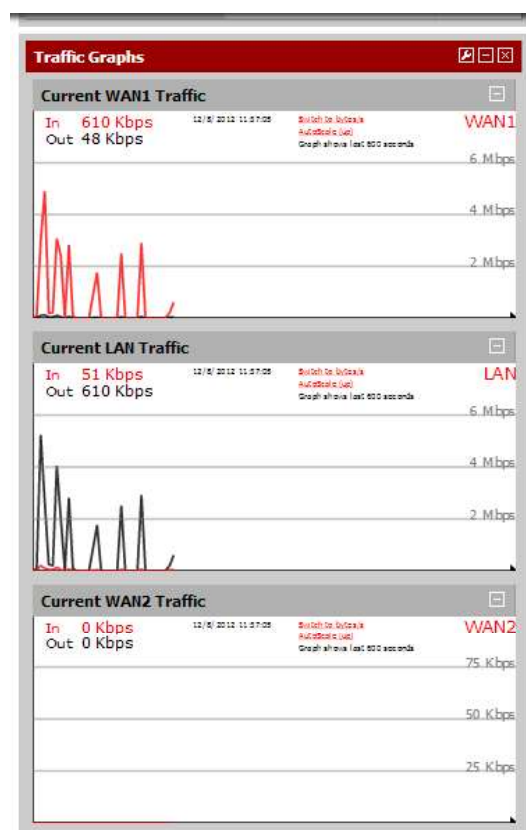
Pruebas de servicio Failover

Con los 2 ISP's activos.

Status: Gateways

Gateways					
Gateway Groups					
Name	Gateway	Monitor	RTT	Loss	Status
WAN1	192.168.212.66	192.168.212.66	0.431ms	0.0%	Online
WAN2	192.168.1.254	192.168.1.254	0.695ms	0.0%	Online

Se observa en la gráfica de tráfico que todo lo que LAN consume, lo esta proveiendo ISP1 a través de WAN1,



Ahora desconectamos el ISP1 conectado a WAN1.

Status: Gateways

Gateways					
Gateway Groups					
Name	Gateway	Monitor	RTT	Loss	Status
WAN1	dynamic	192.168.212.66	0.452ms	0.0%	Offline
WAN2	192.168.1.254	192.168.1.254	0.417ms	0.0%	Online

Se observa en la gráfica de tráfico que todo lo que LAN consume, lo está proveiendo ISP2 a través de WAN2, lo que significa que cuando ISP1 a través de WAN1 falla, entra en funcionamiento ISP2 a través de WAN2.

