



Product Manual

XG-1541

Netgate

Sep 21, 2018

CONTENTS

1	I/O Ports	2
2	Getting Started	4
3	Connecting to the Console Port	15
4	Additional Resources	16
5	Warranty and Support Information	17
6	Safety and Legal	18
7	High Availability	26
8	Reinstalling pfSense	44



Thank you for your purchase of the pfSense® XG-1541 Firewall Appliance. This hardware platform provides a powerful, reliable, cost-effective solution.

Quick Start Guide

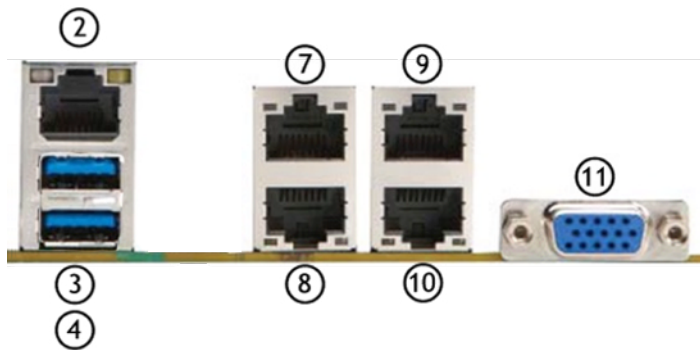
The Quick Start Guide covers the first time connection procedures and will provide you with the information you need to get your appliance up and running.

I/O PORTS

Contents

- *I/O Ports*
 - *Default Configuration*
 - *With 4 Port Intel 1 Gb Ethernet Expansion Card*
 - *With 2 Port Chelsio 10 Gb Ethernet Expansion Card*

1.1 Default Configuration



2) IPMI Port	8) OPT1 (igb0)
3) USB1 (USB 3.0)	9) LAN (ix1)
4) USB0 (USB 3.0)	10) WAN (ix0)
7) OPT2 (igb1)	11) VGA Port

Note: Both the WAN and LAN ports of the pfSense appliance support auto-MDIX and are capable of utilizing either straight-through or crossover ethernet cables.

1.2 With 4 Port Intel 1 Gb Ethernet Expansion Card



0) OPT6 (igb0)	4) WAN (igb4)
1) OPT5 (igb1)	5) OPT1 (ix0)
2) OPT4 (igb2)	6) LAN (igb5)
3) OPT3 (igb3)	7) OPT2 (ix1)

1.3 With 2 Port Chelsio 10 Gb Ethernet Expansion Card



0) WAN (cxl0)	3) OPT2 (ix0)
1) LAN (cxl1)	4) OPT3 (igb1)
2) OPT1 (igb0)	5) OPT4 (ix1)

GETTING STARTED

Tip: Before configuring the pfSense appliance it is best to activate it by following the instructions at <https://www.netgate.com/register/>.

The basic firewall configuration begins with connecting the pfSense appliance to the Internet. Neither the modem nor the pfSense appliance should be powered up at this time.

Establishing a connection to the Internet Service Provider (ISP) starts with connecting one end of an ethernet cable to the WAN port (shown in the *I/O Ports* section) of the pfSense appliance.

<p>Warning: The default LAN subnet on the firewall is 192.168.1.0/24. The same subnet cannot be used on both WAN and LAN, so if the subnet on the WAN side of the firewall is also 192.168.1.0/24, disconnect the WAN interface until the LAN interface has been renumbered to a different subnet.</p>

The opposite end of the same ethernet cable should be inserted in to the LAN port of the ISP-supplied modem. The modem provided by the ISP might have multiple LAN ports. If so, they are usually numbered. For the purpose of this installation, please select port 1.

The next step is to connect the LAN port (shown in the *I/O Ports* section) of the pfSense appliance to the computer which will be used to access the firewall console.

Connect one end of the second ethernet cable to the LAN port (shown in the *I/O Ports* section) of the pfSense appliance. Connect the other end to the network connection on the computer. In order to access the web configurator, the PC network interface must be set to use DHCP, or have a static IP set in the 192.168.1.x subnet with a subnet mask of 255.255.255.0. Do not use 192.168.1.1, as this is the address of the firewall, and will cause an IP conflict.

2.1 Initial Setup

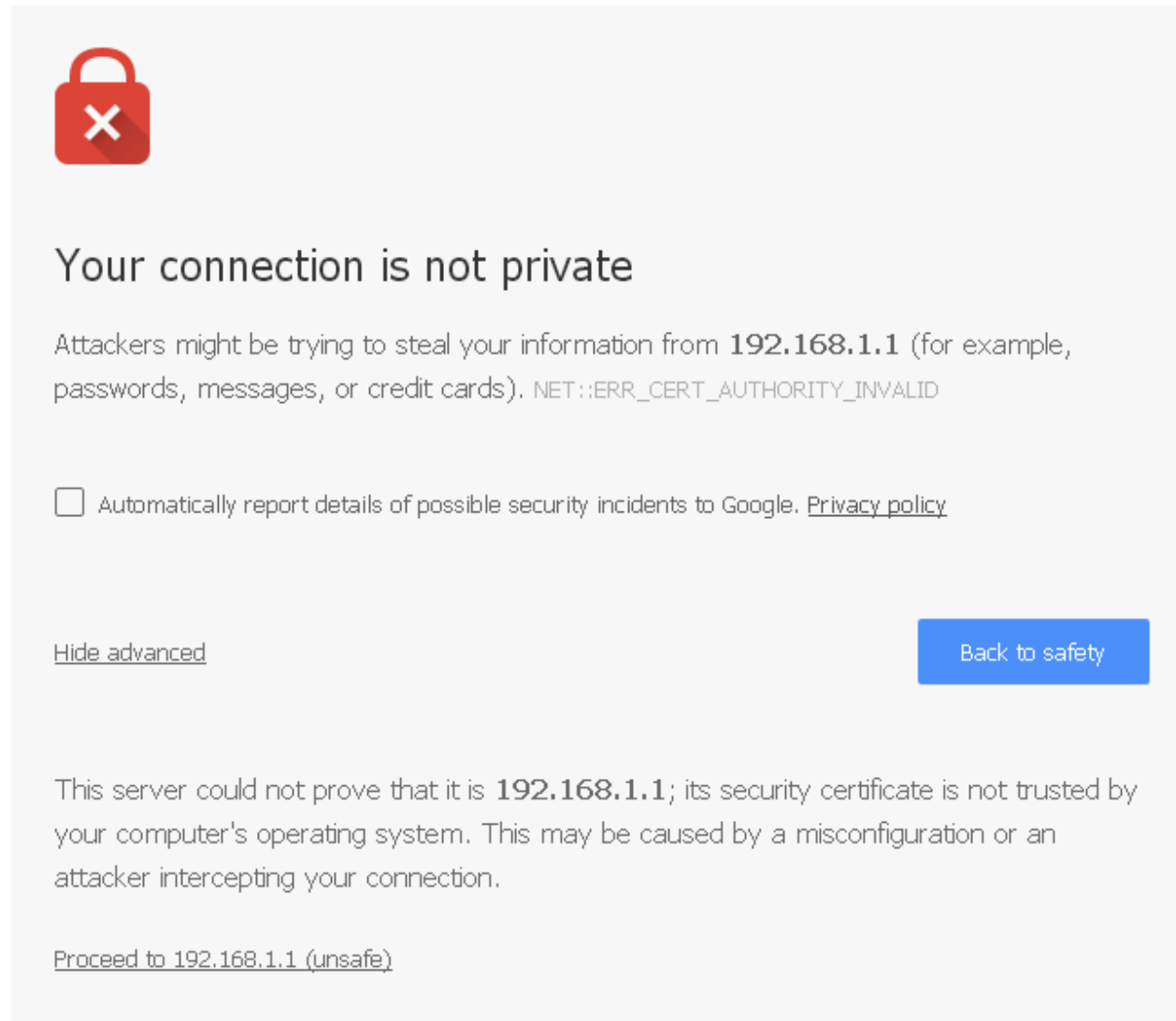
The next step is to power up the modem and the firewall. Plug in the power supply to the power port (shown in the *I/O Ports* section).

Once the modem and pfSense appliance are powered up, the next step is to power up the computer.

Once the pfSense appliance is booted, the attached computer should receive a 192.168.1.x IP address via DHCP from the pfSense appliance.

2.2 Logging Into the Web Interface

Browse to <https://192.168.1.1> to access the web interface. In some instances, the browser may respond with a message indicating a problem with website security. Below is a typical example in Google Chrome. If this message or similar message is encountered, it is safe to proceed.



At the login page enter the default pfSense password and username:

Username admin

Password pfsense

Click **Login** to continue

2.3 Wizard

Upon successful login, the following is displayed.

pfSense Setup

This wizard will guide you through the initial configuration of pfSense.

The wizard may be stopped at any time by clicking the logo image at the top of the screen.

» Next

2.4 Configuring Hostname, Domain Name and DNS Servers

On this screen the general pfSense parameters will be set.

Hostname
EXAMPLE: myserver

Domain
EXAMPLE: mydomain.com

The default behavior of the DNS Resolver will ignore manually configured DNS servers for client queries and query root DNS servers directly. To use the manually configured DNS servers below for client queries, visit Services > DNS Resolver and enable DNS Query Forwarding after completing the wizard.

Primary DNS Server

Secondary DNS Server

Override DNS ☒ Allow DNS servers to be overridden by DHCP/PPP on WAN

» Next

2.5 Hostname

For **Hostname**, any desired name can be entered as it does not affect functionality of the firewall. Assigning a hostname to the firewall will allow the GUI to be accessed by hostname as well as IP address.

For the purposes of this guide, use `pfsense` for the hostname. The default hostname, `pfsense` may be left unchanged.

Once saved in the configuration, the GUI may be accessed by entering <http://pfsense> as well as <http://192.168.1.1>

2.6 Domain

If an existing DNS domain is in use within the local network (such as a Microsoft Active Directory domain), use that domain here. This is the domain suffix assigned to DHCP clients, which should match the internal network.

For networks without any internal DNS domains, enter any desired domain name. The default `localdomain` is used for the purposes of this tutorial.

2.7 DNS Servers

The DNS server fields can be left blank if the DNS Resolver is used in non-forwarding mode, which is the default behavior. The settings may also be left blank if the WAN connection is using DHCP, PPTP or PPPoE types of Internet

connections and the ISP automatically assigns DNS server IP addresses. When using a static IP on WAN, DNS server IP addresses must be entered here for name resolution to function if the default DNS Resolver settings are not used.

DNS servers can be specified here even if they differ from the servers assigned by the ISP. Either enter the IP addresses provided by the ISP, or consider using Google public DNS servers (8.8.8.8, 8.8.4.4). Google DNS servers are used for the purpose of this tutorial. Click **Next** after filling in the fields as appropriate.

2.8 Time Server Configuration

Time Server Information	
Please enter the time, date and time zone.	
Time server hostname	<input type="text" value="0.pfsense.pool.ntp.org"/> Enter the hostname (FQDN) of the time server.
Timezone	<input type="text" value="America/Chicago"/>
<input type="button" value="» Next"/>	

2.9 Time Server Synchronization

Setting time server synchronization is quite simple. We recommend using the default pfSense time server address, which will randomly select an NTP server from a pool.

2.10 Setting Time Zone

Select an appropriate time zone for the location of the firewall. For purposes of this manual, the Timezone setting will be set to *America/Chicago* for US Central time.

2.11 Configuring Wide Area Network (WAN) Type

The WAN interface type is the next to be configured. The IP address assigned to this section becomes the Public IP address that this network will use to communicate with the Internet.

Configure WAN Interface	
On this screen the Wide Area Network information will be configured.	
SelectedType	<input type="text" value="DHCP"/> Static
General configuration	<input type="text" value="DHCP"/> PPPoE
MAC Address	<input type="text" value="PPTP"/>

This depicts the four possible WAN interface types. Static, DHCP, PPPoE and PPTP. One must be selected from the drop-down list.

Further information from the ISP is required to proceed when selecting *Static*, *PPPoE* and *PPTP* such as login name and password or as with static addresses, an IP address, subnet mask and gateway address.

DHCP is the most common type of interface for home cable modems. One dynamic IP address is issued from the ISP DHCP server and will become the public IP address of the network behind this firewall. This address will change periodically at the discretion of the ISP. Select *DHCP* as shown and proceed to the next section.

2.12 MAC Address

MAC Address	<input type="text"/> This field can be used to modify ("spoof") the MAC address of the WAN interface (may be required with some cable connections). Enter a MAC address in the following format: xx:xx:xx:xx:xx:xx or leave blank.
--------------------	---

If replacing an existing firewall, the WAN MAC address of the old firewall may be entered here, if it can be determined. This can help avoid issues involved in switching out firewalls, such as ARP caches, ISPs locking to single MAC addresses, etc.

If the MAC address of the old firewall cannot be located, the impact is most likely insignificant. Power cycle the ISP router and modem and the new MAC address will usually be able to get online. For some ISPs, it may be necessary to call them when switching devices, or an activation process may be required.

2.13 Configuring MTU and MSS

MTU	<input type="text"/> Set the MTU of the WAN interface. If this field is left blank, an MTU of 1492 bytes for PPPoE and 1500 bytes for all other connection types will be assumed.
MSS	<input type="text"/> If a value is entered in this field, then MSS clamping for TCP connections to the value entered above minus 40 (TCP/IP header size) will be in effect. If this field is left blank, an MSS of 1492 bytes for PPPoE and 1500 bytes for all other connection types will be assumed. This should match the above MTU value in most all cases.

MTU or Maximum Transmission Unit determines the largest protocol data unit that can be passed onwards. A 1500-byte packet is the largest packet size allowed by Ethernet at the network layer and for the most part, the Internet so leaving this field blank allows the system to default to 1500-byte packets. PPPoE is slightly smaller at 1492-bytes. Leave this blank for a basic configuration.

2.14 Configuring DHCP Hostname

DHCP client configuration	
DHCP Hostname	<input type="text"/> The value in this field is sent as the DHCP client identifier and hostname when requesting a DHCP lease. Some ISPs may require this (for client identification).

Some ISPs specifically require a **DHCP Hostname** entry. Unless the ISP requires the setting, leave it blank.

2.15 Configuring PPPoE and PPTP Interfaces

PPPoE configuration	
PPPoE Username	<input type="text"/>
PPPoE Password	<input type="password"/>
Show PPPoE password	<input type="checkbox"/> Reveal password characters
PPPoE Service name	<input type="text"/> Hint: this field can usually be left empty
PPPoE Dial on demand	<input type="checkbox"/> Enable Dial-On-Demand mode This option causes the interface to operate in dial-on-demand mode, allowing a virtual full time connection. The interface is configured, but the actual connection of the link is delayed until qualifying outgoing traffic is detected.
PPPoE Idle timeout	<input type="text"/> If no qualifying outgoing packets are transmitted for the specified number of seconds, the connection is brought down. An idle timeout of zero disables this feature.

Information added in these sections is assigned by the ISP. Configure these settings as directed by the ISP

2.16 Block Private Networks and Bogons

RFC1918 Networks	
Block RFC1918 Private Networks	<input checked="" type="checkbox"/> Block private networks from entering via WAN When set, this option blocks traffic from IP addresses that are reserved for private networks as per RFC 1918 (10/8, 172.16/12, 192.168/16) as well as loopback addresses (127/8). This option should generally be left turned on, unless the WAN network lies in such a private address space, too.
Block bogon networks	
Block bogon networks	<input checked="" type="checkbox"/> Block non-Internet routed networks from entering via WAN When set, this option blocks traffic from IP addresses that are reserved (but not RFC 1918) or not yet assigned by IANA. Bogons are prefixes that should never appear in the Internet routing table, and obviously should not appear as the source address in any packets received.

When enabled, all private network traffic originating on the internet is blocked.

Private addresses are reserved for use on internal LANs and blocked from outside traffic so these address ranges may be reused by all private networks.

The following inbound address Ranges are blocked by this firewall rule:

- 10.0.0.1 to 10.255.255.255
- 172.16.0.1 to 172.31.255.254
- 192.168.0.1 to 192.168.255.254
- 127.0.0.0/8
- 100.64.0.0/10
- fc00::/7

Bogons are public IP addresses that have not yet been allocated, so they may typically also be safely blocked as they should not be in active use.

Check **Block RFC1918 Private Networks** and **Block Bogon Networks**.

Click **Next** to continue.

2.17 Configuring LAN IP Address & Subnet Mask

Configure LAN Interface	
On this screen the Local Area Network information will be configured.	
LAN IP Address	<input type="text" value="192.168.1.1"/> Type dhcp if this interface uses DHCP to obtain its IP address.
Subnet Mask	<input type="text" value="24"/>
<input type="button" value="» Next"/>	

A static IP address of 192.168.1.1 and a subnet mask (CIDR) of 24 was chosen for this installation. If there are no plans to connect this network to any other network via VPN, the 192.168.1.x default is sufficient.

Click **Next** to continue.

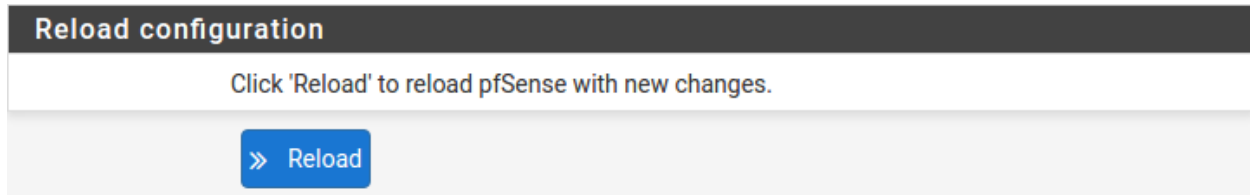
Note: If a Virtual Private Network (VPN) is configured to remote locations, choose a private IP address range more obscure than the very common 192.168.1.0/24. IP addresses within the 172.16.0.0/12 RFC1918 private address block are the least frequently used. We recommend selecting a block of addresses between 172.16.x.x and 172.31.x.x for least likelihood of having VPN connectivity difficulties. An example of a conflict would be If the local LAN is set to 192.168.1.x and a remote user is connected to a wireless hotspot using 192.168.1.x (very common), the remote client won't be able to communicate across the VPN to the local network.

2.18 Change Administrator Password

Set Admin WebGUI Password	
On this screen the admin password will be set, which is used to access the WebGUI and also SSH services if enabled.	
Admin Password	<input type="password" value="*****"/>
Admin Password AGAIN	<input type="password" value="*****"/>
<input type="button" value="» Next"/>	

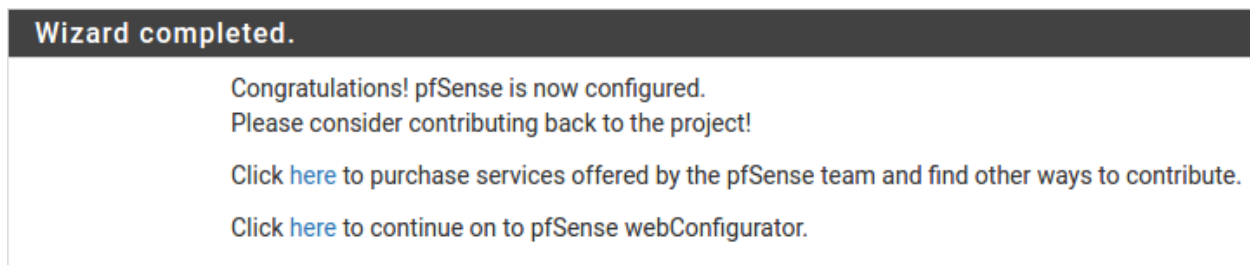
Select a new **Administrator Password** and enter it twice, then click **Next** to continue.

2.19 Save Changes

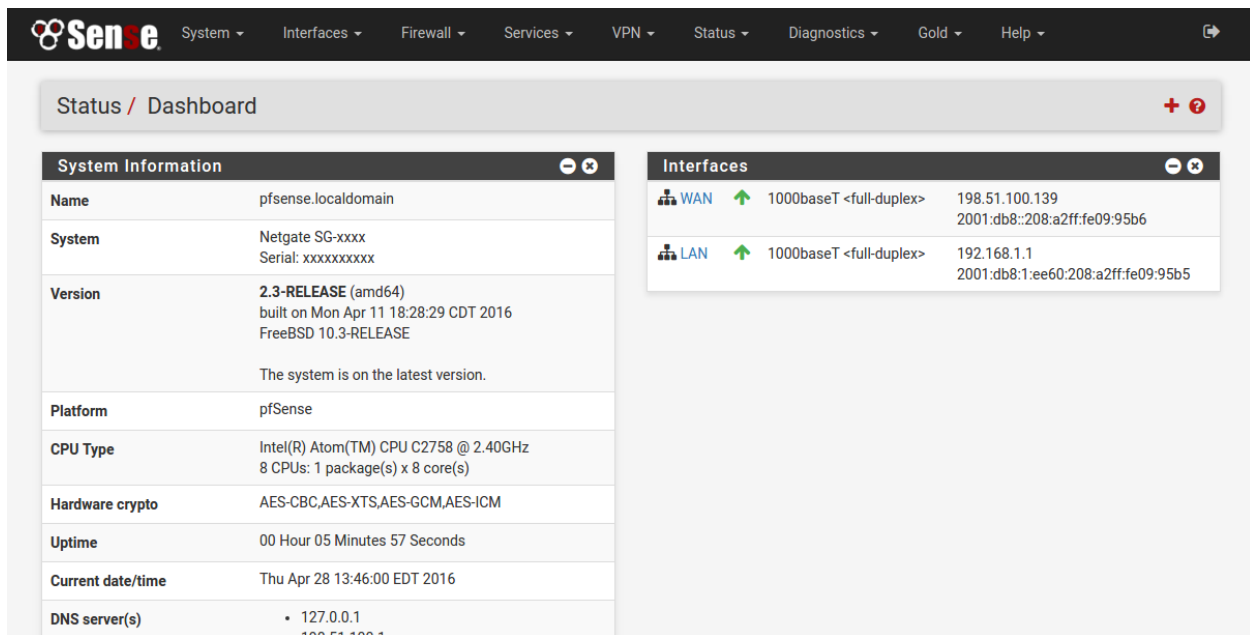


Click **Reload** to save configuration.

2.20 Basic Firewall Configured

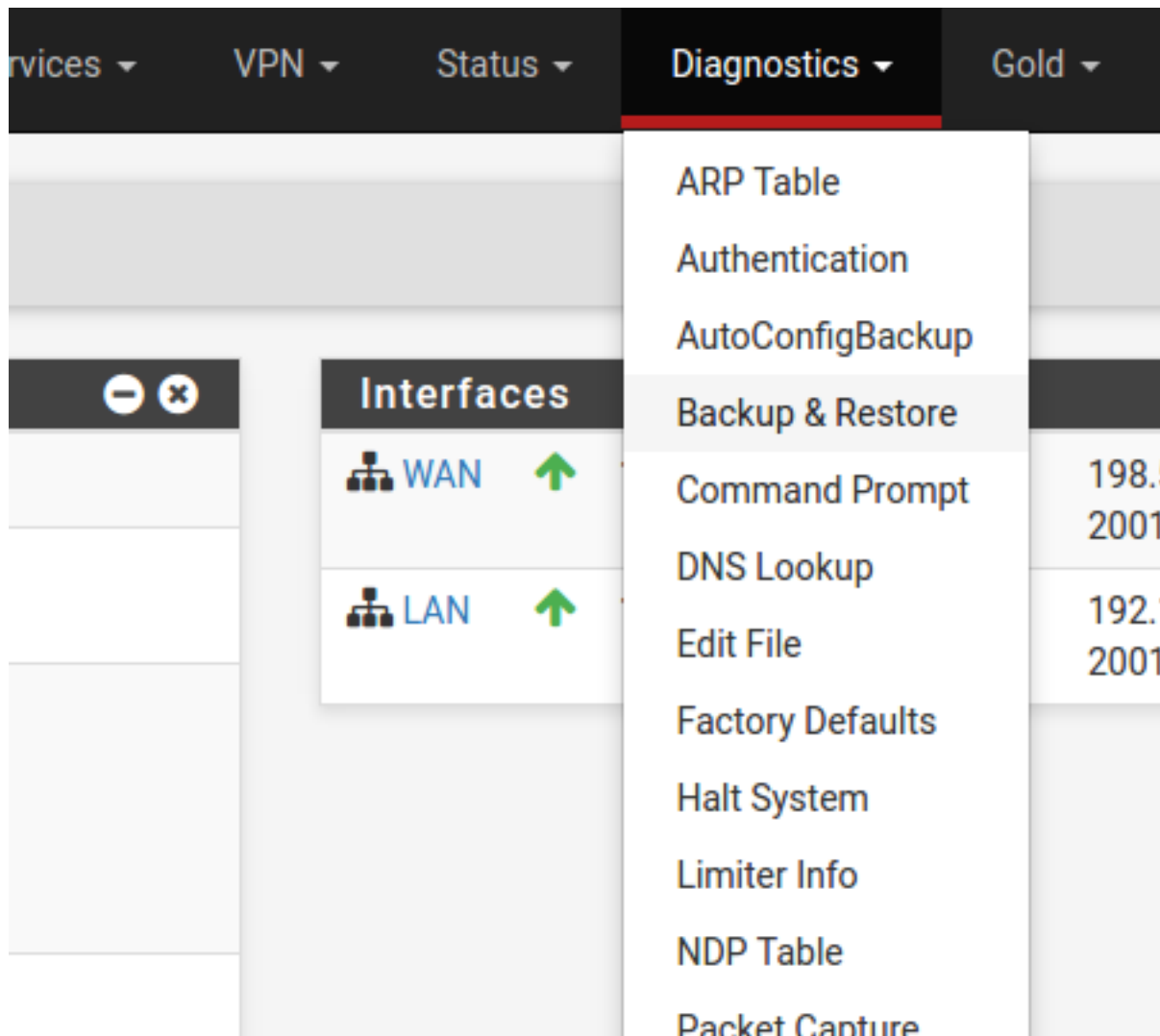


To proceed to the webConfigurator, make the selection as highlighted. The Dashboard display will follow.



2.21 Backing Up and Restoring

At this point, basic LAN and WAN interface configuration is complete. Before proceeding, backup the firewall configuration. From the menu at the top of the page, browse to **Diagnostics > Backup/Restore**.



Click **Download Configuration** and save a copy of the firewall configuration.

Backup & Restore Config History

Backup Configuration

Backup area: All

Skip packages: ☐ Do not backup package information.

Skip RRD data: ☒ Do not backup RRD data (NOTE: RRD Data can consume 4+ megabytes of config.xml space!)

Encryption: ☐ Encrypt this configuration file.

[Download configuration as XML](#)

This configuration can be restored from the same screen by choosing the backup file under **Restore configuration**.

2.22 Connecting to the Console

There are times when accessing the console is required. Perhaps GUI console access has been locked out, or the password has been lost or forgotten.

See also:

Connecting to the Console Port Connect to the console. Cable is required.

CONNECTING TO THE CONSOLE PORT

Connecting to the VGA console is identical to connecting any computer to a monitor. Just connect the VGA cable (DB-15) between the pfSense system and the monitor. Use USB or PS/2 keyboard and mouse as applicable to your hardware.

Note: If your system has both USB 2.0 (black) and USB 3.0 (blue) ports, use the USB 2.0 ports, as USB 3.0 is not supported in earlier versions of pfSense.

Note: If your system has both VGA and serial, it is possible that the boot console will default to serial. If your boot process seems to hang after mounting the root volume, please see <https://www.netgate.com/docs/pfsense/hardware/boot-troubleshooting.html#booting-with-an-alternate-console>

ADDITIONAL RESOURCES

4.1 Professional Services

Support does not cover more complex tasks such as CARP configuration for redundancy on multiple firewalls or circuits, network design, and conversion from other firewalls to pfSense. These items are offered as professional services and can be purchased and scheduled accordingly.

Please see <https://www.netgate.com/our-services/professional-services.html> for more details

4.2 Netgate Training

Netgate training offers training courses for increasing your knowledge of pfSense products and services. Whether you need to maintain or improve the security skills of your staff or offer highly specialized support and improve your customer satisfaction; Netgate training has got you covered. Check us out at <https://www.netgate.com/training/>

4.3 Community Support Options

You can find out more information about our active forums, subreddit, IRC, mailing lists and more here: <https://www.netgate.com/support/contact-support.html#community-support>

WARRANTY AND SUPPORT INFORMATION

- One year manufacturer's warranty.
- Please contact Netgate for warranty information or view our [Product Lifecycle](#) page.
- All Specifications subject to change without notice

For support information, view our [support plans](#).

SAFETY AND LEGAL

Contents

- *Safety and Legal*
 - *Safety Notices*
 - *Electrical Safety Information*
 - *FCC Compliance*
 - *Industry Canada*
 - *Australia and New Zealand*
 - *CE Marking*
 - *RoHS/WEEE Compliance Statement*
 - *Declaration of Conformity*
 - *Disputes*
 - *Applicable Law*
 - *Site Policies, Modification, and Severability*
 - *Miscellaneous*
 - *Limited Warranty*

6.1 Safety Notices

1. Read, follow, and keep these instructions.
2. Heed all warnings.
3. Only use attachments/accessories specified by the manufacturer

Warning: Do not use this product in location that can be submerged by water.

Warning: Do not use this product during an electrical storm to avoid electrical shock.

6.2 Electrical Safety Information

1. Compliance is required with respect to voltage, frequency, and current requirements indicated on the manufacturer's label. Connection to a different power source than those specified may result in improper operation, damage to the equipment or pose a fire hazard if the limitations are not followed.
2. There are no operator serviceable parts inside this equipment. Service should be provided only by a qualified service technician.
3. This equipment is provided with a detachable power cord which has an integral safety ground wire intended for connection to a grounded safety outlet.
 - (a) Do not substitute the power cord with one that is not the provided approved type. If a 3 prong plug is provided, never use an adapter plug to connect to a 2-wire outlet as this will defeat the continuity of the grounding wire.
 - (b) The equipment requires the use of the ground wire as a part of the safety certification, modification or misuse can provide a shock hazard that can result in serious injury or death.
 - (c) Contact a qualified electrician or the manufacturer if there are questions about the installation prior to connecting the equipment.
 - (d) Protective grounding/earthing is provided by Listed AC adapter. Building installation shall provide appropriate short-circuit backup protection.
 - (e) Protective bonding must be installed in accordance with local national wiring rules and regulations.

6.3 FCC Compliance

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential environment.

6.4 Industry Canada

This Class B digital apparatus complies with Canadian ICES-3(B). Cet appareil numérique de la classe A est conforme à la norme NMB-(3)B Canada.

6.5 Australia and New Zealand

This is a AMC Compliance level 2 product. This product is suitable for domestic environments.

6.6 CE Marking

CE marking on this product represents the product is in compliance with all directives that are applicable to it.

6.7 RoHS/WEEE Compliance Statement

6.7.1 English

European Directive 2002/96/EC requires that the equipment bearing this symbol on the product and/or its packaging must not be disposed of with unsorted municipal waste. The symbol indicates that this product should be disposed of separately from regular household waste streams. It is your responsibility to dispose of this and other electric and electronic equipment via designated collection facilities appointed by the government or local authorities. Correct disposal and recycling will help prevent potential negative consequences to the environment and human health. For more detailed information about the disposal of your old equipment, please contact your local authorities, waste disposal service, or the shop where you purchased the product.

6.7.2 Deutsch

Die Europäische Richtlinie 2002/96/EC verlangt, dass technische Ausrüstung, die direkt am Gerät und/oder an der Verpackung mit diesem Symbol versehen ist, nicht zusammen mit unsortiertem Gemeindeabfall entsorgt werden darf. Das Symbol weist darauf hin, dass das Produkt von regulärem Haushaltsmüll getrennt entsorgt werden sollte. Es liegt in Ihrer Verantwortung, dieses Gerät und andere elektrische und elektronische Geräte über die dafür zuständigen und von der Regierung oder örtlichen Behörden dazu bestimmten Sammelstellen zu entsorgen. Ordnungsgemäßes Entsorgen und Recyceln trägt dazu bei, potentielle negative Folgen für Umwelt und die menschliche Gesundheit zu vermeiden. Wenn Sie weitere Informationen zur Entsorgung Ihrer Altgeräte benötigen, wenden Sie sich bitte an die örtlichen Behörden oder städtischen Entsorgungsdienste oder an den Händler, bei dem Sie das Produkt erworben haben.

6.7.3 Español

La Directiva 2002/96/CE de la UE exige que los equipos que lleven este símbolo en el propio aparato y/o en su embalaje no deben eliminarse junto con otros residuos urbanos no seleccionados. El símbolo indica que el producto en cuestión debe separarse de los residuos domésticos convencionales con vistas a su eliminación. Es responsabilidad suya desechar este y cualesquiera otros aparatos eléctricos y electrónicos a través de los puntos de recogida que ponen a su disposición el gobierno y las autoridades locales. Al desechar y reciclar correctamente estos aparatos estará contribuyendo a evitar posibles consecuencias negativas para el medio ambiente y la salud de las personas. Si desea obtener información más detallada sobre la eliminación segura de su aparato usado, consulte a las autoridades locales, al servicio de recogida y eliminación de residuos de su zona o pregunte en la tienda donde adquirió el producto.

6.7.4 Français

La directive européenne 2002/96/CE exige que l'équipement sur lequel est apposé ce symbole sur le produit et/ou son emballage ne soit pas jeté avec les autres ordures ménagères. Ce symbole indique que le produit doit être éliminé dans un circuit distinct de celui pour les déchets des ménages. Il est de votre responsabilité de jeter ce matériel ainsi que tout autre matériel électrique ou électronique par les moyens de collecte indiqués par le gouvernement et les pouvoirs publics des collectivités territoriales. L'élimination et le recyclage en bonne et due forme ont pour but de lutter contre l'impact néfaste potentiel de ce type de produits sur l'environnement et la santé publique. Pour plus d'informations sur le mode d'élimination de votre ancien équipement, veuillez prendre contact avec les pouvoirs publics locaux, le service de traitement des déchets, ou l'endroit où vous avez acheté le produit.

6.7.5 Italiano

La direttiva europea 2002/96/EC richiede che le apparecchiature contrassegnate con questo simbolo sul prodotto e/o sull'imballaggio non siano smaltite insieme ai rifiuti urbani non differenziati. Il simbolo indica che questo prodotto non deve essere smaltito insieme ai normali rifiuti domestici. È responsabilità del proprietario smaltire sia questi prodotti sia le altre apparecchiature elettriche ed elettroniche mediante le specifiche strutture di raccolta indicate dal governo o dagli enti pubblici locali. Il corretto smaltimento ed il riciclaggio aiuteranno a prevenire conseguenze potenzialmente negative per l'ambiente e per la salute dell'essere umano. Per ricevere informazioni più dettagliate circa lo smaltimento delle vecchie apparecchiature in Vostro possesso, Vi invitiamo a contattare gli enti pubblici di competenza, il servizio di smaltimento rifiuti o il negozio nel quale avete acquistato il prodotto.

6.8 Declaration of Conformity

6.8.1 Český[Czech]

NETGATE tímto prohlašuje, že tento NETGATE device, je ve shodě se základními požadavky a dalšími požadavky ustanovenými směrnicí 1999/5/ES.

6.8.2 Dansk [Danish]

Undertegnede NETGATE erklærer herved, at følgende udstyr NETGATE device, overholder de væsentlige krav og øvrige relevante krav i direktiv 1999/5/EF.

6.8.3 Nederlands [Dutch]

Hierbij verklaart NETGATE dat het toestel NETGATE device, in overeenstemming is met de essentiële eisen en de andere relevante bepalingen van richtlijn 1999/5/EG. Bij deze verklaart NETGATE dat deze NETGATE device, voldoet aan de essentiële eisen en aan de overige relevante bepalingen van Richtlijn 1999/5/EC.

6.8.4 English

Hereby, NETGATE , declares that this NETGATE device, is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.

6.8.5 Eesti [Estonian]

Käesolevaga kinnitab NETGATE seadme NETGATE device, vastavust direktiivi 1999/5/EÜ põhinõuetele ja nimetatud direktiivist tulenevatele teistele asjakohastele sätetele.

6.8.6 Suomi [Finnish]

NETGATE vakuuttaa täten että NETGATE device, tyyppinen laite on direktiivin 1999/5/EY oleellisten vaatimusten ja sitä koskevien direktiivin muiden ehtojen mukainen. Français [French] Par la présente NETGATE déclare que l'appareil Netgate, device est conforme aux exigences essentielles et aux autres dispositions pertinentes de la directive 1999/5/CE.

6.8.7 Deutsch [German]

Hiermit erklärt Netgate, dass sich diese NETGATE device, in Übereinstimmung mit den grundlegenden Anforderungen und den anderen relevanten Vorschriften der Richtlinie 1999/5/EG befindet". (BMW)

6.8.8 Ελληνική [Greek]

ΜΕ ΤΗΝ ΠΑΡΟΥΣΑ NETGATE ΔΗΛΩΝΕΙ ΟΤΙ NETGATE device, ΣΥΜΜΟΡΦΩΝΕΤΑΙ ΠΡΟΣ ΤΙΣ ΟΥΣΙΩΔΕΙΣ ΑΠΑΙΤΗΣΕΙΣ ΚΑΙ ΤΙΣ ΛΟΙΠΕΣ ΣΧΕΤΙΚΕΣ ΔΙΑΤΑΞΕΙΣ ΤΗΣ ΟΔΗΓΙΑΣ 1995/5/ΕΚ.

6.8.9 Magyar [Hungarian]

Alulírott, NETGATE nyilatkozom, hogy a NETGATE device, megfelel a vonatkozó alapvető követelményeknek és az 1999/5/EC irányelv egyéb előírásainak.

6.8.10 Íslenska [Icelandic]

Hér me l sír NETGATE yfir ví a NETGATE device, er í samræmi við grunnkröfur og a rar kröfur, sem ger ar eru í tilskipun 1999/5/EC.

6.8.11 Italiano [Italian]

Con la presente NETGATE dichiara che questo NETGATE device, è conforme ai requisiti essenziali ed alle altre disposizioni pertinenti stabilite dalla direttiva 1999/5/CE.

6.8.12 Latviski [Latvian]

Ar o NETGATE deklar , ka NETGATE device, atbilst Direkt vas 1999/5/EK b tiskaj m pras b m un citiem ar to saist tjiem noteikumiem.

6.8.13 Lietuviškai [Lithuanian]

NETGATE deklaruoja, kad šis NETGATE įrenginys atitinka esminius reikalavimus ir kitas 1999/5/EB Direktyvos nuostatas.

6.8.14 Malti [Maltese]

Hawnhekk, Netgate, jiddikjara li dan NETGATE device, jikkonforma mal- ti ijjiet essenzjali u ma provvedimenti o rajn rilevanti li hemm fid-Dirrettiva 1999/5/EC.

6.8.15 Norsk [Norwegian]

NETGATE erklærer herved at utstyret NETGATE device, er i samsvar med de grunnleggende krav og øvrige relevante krav i direktiv 1999/5/EF.

6.8.16 Slovensky [Slovak]

NETGATE týmto vyhlasuje, že NETGATE device, spĺňa základné požiadavky a všetky príslušné ustanovenia Smernice 1999/5/ES.

6.8.17 Svenska [Swedish]

Härmed intygar NETGATE att denna NETGATE device, står i överensstämmelse med de väsentliga egenskapskrav och övriga relevanta bestämmelser som framgår av direktiv 1999/5/EG.

6.8.18 Español [Spanish]

Por medio de la presente NETGATE declara que el NETGATE device, cumple con los requisitos esenciales y cualesquiera otras disposiciones aplicables o exigibles de la Directiva 1999/5/CE.

6.8.19 Polski [Polish]

Niniejszym, firma NETGATE oświadczają, że produkt serii NETGATE device, spełnia zasadnicze wymagania i inne istotne postanowienia Dyrektywy 1999/5/EC.

6.8.20 Português [Portuguese]

NETGATE declara que este NETGATE device, está conforme com os requisitos essenciais e outras disposições da Directiva 1999/5/CE.

6.8.21 Română [Romanian]

Prin prezenta, NETGATE declară că acest dispozitiv NETGATE este în conformitate cu cerințele esențiale și alte prevederi relevante ale Directivei 1999/5/CE.

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To begin an arbitration proceeding, you must send a letter requesting arbitration and describing your claim to the following:

Rubicon Communications LLC
Attn.: Legal Dept.

4616 West Howard Lane, Suite 900
Austin, Texas 78728
legal@netgate.com

The arbitration will be conducted by the American Arbitration Association (AAA) under its rules. The AAA's rules are available at www.adr.org. Payment of all filing, administration and arbitrator fees will be governed by the AAA's rules.

We each agree that any dispute resolution proceedings will be conducted only on an individual basis and not in a class, consolidated or representative action. We also both agree that you or we may bring suit in court to enjoin infringement or other misuse of intellectual property rights.

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References

- [*High Availability*](#)
- [*Reinstalling pfSense*](#)
- [*pfSense Documentation*](#)

HIGH AVAILABILITY

This document covers configuration of a High Availability cluster using the following features:

- CARP for IP address redundancy
- XMLRPC for configuration synchronization
- pfsync for state table synchronization

With this configuration, two units act as an “active/passive” cluster with the primary node working as the master unit and the secondary node in a backup role, taking over as needed if the primary node fails.

7.1 High Availability Prerequisites

Before a redundant configuration can be achieved, a few prerequisites must be met.

7.1.1 Assumptions

This guide assumes that:

- Only two cluster nodes are used.
- Both cluster nodes are the same model with identical hardware specs.
- Both units have a factory default configuration and there are no existing settings on these units.

Warning: Do not connect the LAN port of both units into the same LAN switch until some basic settings have been applied to each node, which will be done by the end of this section. Otherwise there will be an IP address conflict and communication with each node individually will not be possible until the conflict is resolved.

7.1.2 Determine the Synchronization Interface

One interface on each node will be dedicated for synchronization tasks. This is typically referred to as the “Sync” interface, and it is used for configuration synchronization and pfsync state synchronization. Any available interface may be used. It isn’t necessary for it to be a high speed port, but it is necessary to choose the same port on both nodes.

Note: Some call this the “CARP” interface but that is incorrect and very misleading. CARP heartbeats happen on each interface with a CARP VIP; CARP traffic and failover actions do not utilize the Sync interface.

7.1.3 Interface Assignments

Interfaces must be assigned in the same order on all nodes exactly. If the interfaces are not aligned, configuration synchronization and other tasks will not behave correctly. The default configuration has all interfaces assigned by default, as seen in the IO Ports section of the unit's product manual, which makes a good starting point for this guide. If any adjustments have been made to the interface assignments, they must be replicated identically on both nodes.

7.1.4 IP Address Requirements

A High Availability cluster needs three IP addresses in each subnet along with a separate unused subnet for the Sync interface. For WANs, this means that a /29 subnet or larger is required for an optimal configuration. One IP address is used by each node, plus a shared CARP VIP address for failover. The synchronization interface only requires one IP address per node.

The IP addresses used in this guide are shown in the following tables, substitute the real IP addresses as needed.

Table 1: WAN IP Address Assignments

IP Address	Usage
198.51.100.200/24	CARP shared IP address
198.51.100.201/24	Primary node WAN IP address
198.51.100.202/24	Secondary node WAN IP address

Table 2: LAN IP Address Assignments

IP Address	Usage
192.168.1.1/24	CARP shared IP address
192.168.1.2/24	Primary node LAN IP address
192.168.1.3/24	Secondary node LAN IP address

Table 3: Sync IP Address Assignments

IP Address	Usage
172.16.1.2/24	Primary node Sync IP address
172.16.1.3/24	Secondary node Sync IP address

Single address CARP

It is technically possible to configure an interface with a CARP VIP as the only IP address in a given subnet, but it is not generally recommended. When used on a WAN, this type of configuration will only allow communication from the primary node to the WAN, which greatly complicates tasks such as updates, package installations, gateway monitoring, or anything that requires external connectivity from the secondary node. It can be a better fit for an internal interface, however internal interfaces do not typically suffer from the same IP address limitations as a WAN, so it is still preferable to configure IP addresses on all nodes. Such a configuration is not covered in this guide.

7.1.5 Determine CARP VHID Availability

CARP can interfere with VRRP, HSRP, or other systems using CARP if conflicting identifiers are used. In order to ensure that a segment is clear of conflicting traffic, perform a packet capture on each interface looking for CARP/VRRP traffic. A given VHID must be unique on each layer 2, so each interface must be checked separately. The same VHID may be used on different segments so long as they are separate broadcast domains.

If any CARP or VRRP traffic is shown, note the VHID/VRID and avoid using that identifier when configuring the CARP VIP VHIDs later.

This guide assumes there is no other potentially conflicting traffic present.

7.1.6 Setup Requirements

Using the Setup Wizard, or manually afterward, configure each firewall with a unique hostname and non-conflicting static IP addresses.

For example, one node could be “firewall-a.example.com” and the other “firewall-b.example.com”, or a more personalized pair of names. Avoid naming the nodes “master” and “backup” since those are states and not roles, instead they could be named “primary” and “secondary”.

For IP addresses, the factory default LAN address is 192.168.1.1. In a High Availability environment, that address would be a CARP VIP instead. Using that subnet, move each node to its own address there, such as 192.168.1.2 for the primary and 192.168.1.3 for the secondary. This layout is shown in [LAN IP Address Assignments](#)

Once each node has a unique LAN IP address, then both nodes may be plugged into the same LAN switch.

Both nodes must have the GUI running on the same port and protocol. This guide assumes both use HTTPS on port 443.

The admin account cannot be disabled and both nodes must have the same admin account password.

Both nodes must have static IP addresses in the same subnet and have a proper gateway configured on the WAN interface settings.

Both nodes must have DNS configured properly under **System > General Setup**.

Visit **Services > DNS Resolver**. Review the settings and even if nothing has been changed, click **Save** once to ensure the default values are respected.

7.1.7 Switch / Layer 2 Configuration

CARP Concerns

CARP heartbeats utilize multicast and may require special handling on the switches involved with the cluster. Some switches filter, rate limit, or otherwise interfere with multicast in ways that can cause CARP to fail. Also, some switches employ port security methods which may not work properly with CARP.

At a minimum, the switch must:

- Allow Multicast traffic to be sent and received without interference on ports using CARP VIPs.
- Allow traffic to be sent and received using multiple MAC addresses.
- Allow the CARP VIP MAC address to move between ports.

Nearly all problems with CARP failing to properly reflect the expected status are failures of the switch or other layer 2 issues, so be sure the switches are properly configured before continuing.

Port Configuration

Each node must be connected to a common, but separate, layer 2 on each interface. This means that WAN, LAN, and other interfaces must be connected to separate switches or VLANS with each node being connected to the same segments on each.

For example, the WAN ports of each node must connect to the same WAN switch, which then connects to the WAN CPE/Modem/Upstream link. The LAN ports would all connect to the same LAN switch, and so on. The Sync interface may be connected directly between the two nodes without a switch. See *Example High Availability Cluster* for an example connection layout.

7.2 Configuring a HA Cluster

Note: The WAN and LAN should be configured to static addresses prior to configuring a HA Cluster. Please see *High Availability Prerequisites* for IP address details.

This is the heart of the process, making the changes that will link the systems and allow them to function together.

7.2.1 Setup Sync Interface

Before proceeding, the Sync interfaces on the cluster nodes must be configured. *Sync IP Address Assignments* lists the addresses to use for the Sync interfaces on each node.

1. Navigate to **Interfaces** and choose the interface to use on the SYNC port
2. Check **Enable Interface**
3. Enter SYNC for the **Description**
4. Set **IPv4 Configuration Type** to *Static IPv4*
5. Set **IPv4 address** to `172.16.1.2` when configuring the primary node, or `172.16.1.3` when configuring the secondary node
6. Select `24` for the subnet mask in the CIDR drop-down next to **IPv4 address**
7. Do not check **Block private networks** or **Block bogon networks**
8. Click **Save**
9. Click **Apply Changes**

Once that procedure has been completed on the primary node, perform it again on the secondary node with the appropriate **IPv4 address** value. Remember they must be the same on both nodes.

After configuring the sync interface, the interface assignments should have one labeled SYNC.


Add Firewall Rules for Synchronization

To complete the Sync interface configuration, firewall rules must be added to both nodes to allow synchronization.

At a minimum, the firewall rules must pass the configuration synchronization traffic (by default, HTTPS on port 443) and pfsync traffic. In most cases, a simple “allow all” style rule is used. For this guide, both will be shown and it will also serve as an indicator that synchronization is working.


On the primary node:

Set up a rule to allow configuration synchronization:


1. Navigate to **Firewall > Rules** on the SYNC tab
2. Click  at the top of the list to create a new rule

3. Set **Action** to *Pass*
4. Set **Source** to *SYNC Net*
5. Set **Destination** to *SYNC Address*
6. Set **Destination port range** to 443 or choose *HTTPS (443)* from the drop-down selector
7. Set **Description** to *Allow configuration synchronization*
8. Click **Save**










Set up a rule to allow state synchronization:

1. Click  at the top of the list to create another new rule
2. Set **Action** to *Pass*
3. Set **Protocol** to *pfsync*
4. Set **Source** to *SYNC Net*
5. Set **Destination** to *any*
6. Set **Description** to *Allow state synchronization*
7. Click **Save**

Set up a rule to allow ICMP echo (ping) for Diagnostics:

1. Click  at the top of the list to create another new rule
2. Set **Action** to *Pass*
3. Set **Protocol** to *ICMP*
4. Set **Source** to *SYNC Net*
5. Set **Destination** to *SYNC Net*
6. Set **Description** to *Allow ICMP echo (ping) for Diagnostics*
7. Click **Save**
8. Click **Apply Changes**

When complete, the rules will look like the following, which also includes a rule to allow ICMP echo (ping) for diagnostic purposes.

Rules (Drag to Change Order)											
	States	Protocol	Source	Port	Destination	Port	Gateway	Queue	Schedule	Description	Actions
<input type="checkbox"/>	✓	0/0 B	IPv4 TCP	SYNC net	*	SYNC address	443 (HTTPS)	*	none	Allow configuration synchronization	  
<input type="checkbox"/>	✓	0/0 B	IPv4 PFSYNC	SYNC net	*	*	*	none		Allow state synchronization	  
<input type="checkbox"/>	✓	0/0 B	IPv4 ICMP	SYNC net	*	SYNC net	*	none		Allow ICMP echo (ping) for Diagnostics	  













Fig. 1: Example Sync Interface Firewall Rules

On the secondary node:

1. Navigate to **Firewall > Rules** on the **SYNC** tab
2. Click  at the top of the list to create a new rule
3. Set **Action** to *Pass*
4. Set **Protocol** to *any*
5. Set **Source** to *SYNC Net*
6. Set **Destination** to *any*
7. Set **Description** to *Temp rule for sync*
8. Click **Save**
9. Click **Apply Changes**

Note: The rule on the secondary is different, but that is intended at this point. Once the first configuration synchronization has taken place, the temporary rule on the secondary will be replaced by the rules from the primary. Seeing that the rules on the Sync interface changed is a good indicator that it worked!

7.2.2 Configure pfsync

State synchronization using pfsync must be configured on both the primary and secondary nodes to function.

First on the primary node and then on the secondary, perform the following:

1. Navigate to **System > High Avail. Sync**
2. Check **Synchronize States**
3. Set **Synchronize Interface** to *SYNC*
4. Set **pfsync Synchronize Peer IP** to the other node. Set this to *172.16.1.3* when configuring the primary node, or *172.16.1.2* when configuring the secondary node
5. Click **Save**

7.2.3 Configure XMLRPC

Warning: Configuration synchronization **must only be configured on the primary node**. Never activate options in this section on the secondary node of a two-member cluster.

On the primary node only, perform the following:

1. Navigate to **System > High Avail. Sync**
2. Set **Synchronize Config to IP** to the secondary node's Sync interface IP address, *172.16.1.3*
3. Set **Remote System Username** to *admin*.

Note: This must always be *admin*. No other user will work!

4. Set **Remote System Password** to the admin user account password and be sure to confirm the password.

5. Check the boxes for each area to synchronize to the secondary node. For this guide, as with most configurations, all boxes are checked.
6. Click **Save**


As a quick confirmation that the synchronization worked, on the secondary node navigate to **Firewall > Rules** on the **SYNC** tab. The rules entered on the primary are now there, and the temporary rule is gone.

The two nodes are now linked for configuration synchronization! Changes made to the primary node in supported areas will be synchronized to the secondary whenever a change is made.

Warning: Do not make changes to the secondary in areas set to be synchronized! These changes will be overwritten the next time the primary node performs a synchronization.

7.2.4 Add CARP VIPs

Now that the configuration synchronization is complete, the CARP Virtual IP addresses need only be added to the primary node and they will be automatically copied to the secondary. For this demonstration, two CARP VIPs will be added: One for WAN, and one for LAN.

1. Navigate to **Firewall > Virtual IPs** on the primary node.
2. Click  at the top of the list to create a new VIP
3. Set **Type** to *CARP*
4. Set **Interface** to *WAN*
5. Enter the WAN CARP VIP into the **IP Address(es)** section **Address** box and pick the appropriate subnet mask. For this example, enter 198.51.100.200 and 24 (See [WAN IP Address Assignments](#)).
6. Enter a random password in **Virtual IP Password**. This need only match between the two nodes, which will be handled by synchronization.
7. Select an unused **VHID Group** as determined in [Determine CARP VHID Availability](#).


Note: A common tactic is to make the VHID match the last octet of the IP address, so in this case 200 would be chosen.

8. Set the **Advertising Frequency** to a **Base** of 1 and a **Skew** of 0. This value will be automatically adjusted when it is copied to the secondary.
9. Enter a **Description** such as WAN CARP VIP.
10. Click **Save**
11. Click **Apply Changes**

The **Base** and **Skew** together determine how often a CARP heartbeat is sent. The value of **Base** adds whole seconds and should match between the two nodes. The **Skew** value adds 1/256th of a second increments. The primary node should always have a **Skew** of 0 or 1. The secondary node must be higher, typically 100+. That adjustment is handled automatically by the configuration synchronization process.

Note: If CARP appears to be too sensitive to latency on a given network, adjusting the **Base** by adding one second at a time is recommended until stability is achieved.

Repeat the above process for the LAN CARP VIP:

1. Navigate to **Firewall > Virtual IPs**
2. Click  at the top of the list to create a new VIP
3. Set **Type** to *CARP*
4. Set **Interface** to *LAN*
5. Enter the LAN CARP VIP into the **IP Address(es)** section **Address** box and pick the appropriate subnet mask. For this example, enter 192.168.1.1 and 24 (See *LAN IP Address Assignments*).
6. Enter a random password in **Virtual IP Password**.
7. Select an unused **VHID Group** as determined in *Determine CARP VHID Availability*.
8. Set the **Advertising Frequency** to a **Base** of 1 and a **Skew** of 0.
9. Enter a **Description** such as LAN CARP VIP.
10. Click **Save**
11. Click **Apply Changes**

If there are any additional IP addresses in the WAN subnet that will be used for purposes such as 1:1 NAT, port forwards, VPNs, etc, they may be added now as well.

Check **Firewall > Virtual IPs** on the secondary node to ensure that the VIPs synchronized as expected.

The Virtual IP addresses on both nodes will look like the following if the process was successful.






Virtual IP Address				
Virtual IP address	Interface	Type	Description	Actions
198.51.100.200/24 (vhid: 200)	WAN	CARP	WAN CARP VIP	 
192.168.1.1/24 (vhid: 1)	LAN	CARP	LAN CARP VIP	 
				

Fig. 2: CARP Virtual IP Address List

Check CARP Status

Now visit **Status > CARP** on both nodes to confirm the proper status. The primary node should indicate MASTER status for all VIPs, and the secondary node should indicate BACKUP status for all VIPs. If the status is incorrect, see *Troubleshooting High Availability*.

CARP Interfaces		
CARP Interface	Virtual IP	Status
WAN@200	198.51.100.200/24	 MASTER
LAN@1	192.168.1.1/24	 MASTER

Fig. 3: CARP VIP Status on Primary

CARP Interfaces		
CARP Interface	Virtual IP	Status
WAN@200	198.51.100.200/24	BACKUP
LAN@1	192.168.1.1/24	BACKUP


Fig. 4: CARP VIP Status on Secondary

7.2.5 Setup Manual Outbound NAT

Now it is time to put the new CARP VIPs to use. The NAT settings will synchronize so these changes need only be made to the primary node.

1. Navigate to **Firewall > NAT, Outbound** tab on the primary node
2. Change the **Mode** to *Manual Outbound NAT rule generation*
3. Click **Save**, the rule list will be populated with rules equivalent to what was in use for the default, Automatic Outbound NAT.

Note: If no rules appear in the list, ensure the WAN has a gateway selected under **Interfaces > WAN**

4. Click  to edit the rule for the LAN subnet
5. Set **Translation** to the WAN CARP VIP, *198.51.100.200* in this example.
6. Click **Save**
7. Repeat that edit for each rule in the list except the rules with a source of *127.0.0.0/8*.
8. Click **Apply Changes**
9. Visit **Firewall > NAT, Outbound** tab on the secondary node to ensure the rule changes are reflected there.

<input checked="" type="checkbox"/>	✓	WAN	192.168.1.0/24	*	*	500	198.51.100.200	*	✓	Auto created rule for ISAKMP - LAN to WAN	  
<input checked="" type="checkbox"/>	✓	WAN	192.168.1.0/24	*	*	*	198.51.100.200	*	✗	Auto created rule - LAN to WAN	  

Fig. 5: Outbound NAT Rules for LAN with CARP VIP

Warning: If additional local interfaces are added later, such as a second LAN, DMZ, etc, and that interface uses private IP addresses, then additional manual outbound NAT rules must be added at that time.

7.2.6 Other NAT Concerns

If there are any port forwards to be added using the WAN CARP VIP, they may be added now using **Firewall > NAT, Port Forward** tab. Port forwards will work the same as usual, but the **Destination** will be the WAN CARP VIP.

7.2.7 Setup DHCP

The DHCP server daemons on the cluster nodes need adjustments so that they can work together. The changes will synchronize from the primary to the secondary, so as with the VIPs and Outbound NAT, these changes need only be made on the primary node.

1. Navigate to **Services > DHCP Server, LAN*** tab.
2. Set the **DNS Server** to the LAN CARP VIP, here 192.168.1.1
3. Set the **Gateway** to the LAN CARP VIP, here 192.168.1.1
4. Set the **Failover Peer IP** to the actual LAN IP address of the secondary node, here 192.168.1.3
5. Click **Save**

Setting the **DNS Server** and **Gateway** to a CARP VIP ensures that the local clients are talking to the failover address and not directly to either node. This way if the primary fails, the local clients will continue talking to the secondary node.

The **Failover Peer IP** allows the daemon to communicate with the peer directly in this subnet to exchange data such as lease information. When the settings synchronize to the secondary, this value is adjusted automatically so the secondary points back to the primary.

On both nodes, visit **Status > DHCP Leases** to see the status. A section will be displayed at the top containing the failover pool status, one line will be shown for each local interface pool. When the two nodes are working properly, both will indicate a “normal” status.

Failover Group	My State	Since	Peer State	Since
dhcp_lan (LAN)	normal	2015/06/25 15:55:55	normal	2015/06/25 15:55:55

Fig. 6: DHCP Failover Status

7.2.8 VPNs and Other Services

When configuring a VPN, such as OpenVPN or IPsec, pick a WAN CARP VIP as the **Interface** for the VPN and ensure the remote peer also builds the other side of the tunnel using the CARP VIP as the peer address.

For other local services, packages, etc. likewise a CARP VIP is recommended for binding if the service will work on both nodes.

High Availability support in packages varies. Check the package documentation for information on if, or how, various aspects of High Availability work with a specific package.

7.2.9 Additional Interfaces

Additional local interfaces may also be configured, repeating some of the previous steps as needed:

1. Assign the interface on both nodes identically
2. Enable the interface on both nodes, using different IP addresses within the same subnet
3. Add a CARP VIP inside the new subnet (Primary node only)
4. Add firewall rules (Primary node only)
5. Add Manual Outbound NAT for a source of the new subnet, utilizing the CARP VIP for translation (Primary node only)

6. Configure the DHCP server for the new subnet, utilizing the CARP VIP for DNS and Gateway roles (Optional, Primary node only)

7.3 Components of a High Availability Cluster

Though often erroneously called a “CARP Cluster”, two or more redundant pfSense firewalls are more aptly titled a “High Availability Cluster”, since CARP is only one of several technologies used to achieve High Availability with pfSense.

The most common High Availability cluster configuration includes only two nodes. It is possible to have more nodes in a cluster, but they do not provide a significant advantage. This guide assumes two SG-4860 nodes are in use, one acting as the primary node and the other as the secondary node.

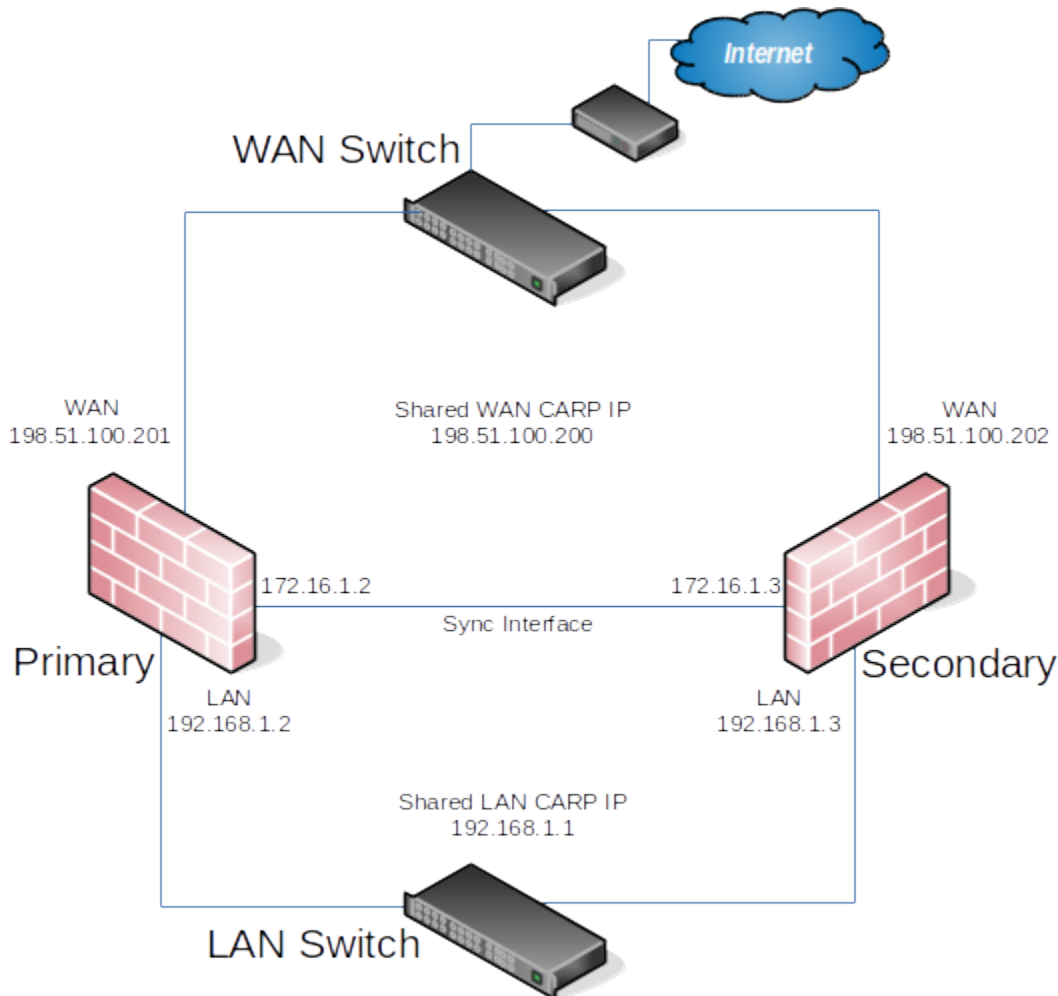


Fig. 7: Example High Availability Cluster

7.3.1 IP Address Redundancy (CARP)

For connectivity through a cluster to continue seamlessly during failover, traffic to and from the cluster must use redundant IP addresses. In pfSense, Common Address Redundancy Protocol (CARP) is used for this task.

A CARP type Virtual IP address (VIP) is shared between nodes of a cluster. One node is master and receives traffic for the IP address, and the other nodes maintain backup status and monitor for heartbeats to see if they need to assume the master role if the previous master fails. Since only one member of the cluster at a time is using the IP address, there is no IP address conflict for CARP VIPs.

In order for failover to work properly it is important that inbound traffic coming to the cluster (routed upstream traffic, VPNs, NAT, local client gateway, DNS requests, etc) be sent to a CARP VIP and for outgoing traffic such as Outbound NAT to be sent from a CARP VIP. If traffic is addressed to a node directly and not a CARP VIP, then that traffic will not be picked up by other nodes.

CARP works similar to VRRP and HSRP, and may even conflict in some cases. Heartbeats are sent out on each interface containing a CARP VIP, one heartbeat per VIP per interface. At the default values for skew and base, a VIP sends out heartbeats about once per second. The skew determines which node is master at a given point in time. Whichever node transmits heartbeats the fastest assumes the master role. A higher skew value causes heartbeats to be transmitted with more delay, so a node with a lower skew will be the master unless a network or other issue causes the heartbeats to be delayed or lost.

Note: Never access the firewall GUI, SSH, or other management mechanism using a CARP VIP. For management purposes, only use the actual IP address on the interface and not the VIP. Otherwise it cannot be determined beforehand which unit is being accessed.

7.3.2 Configuration Synchronization (XMLRPC)

To make the job of maintaining two practically identical firewall nodes easier, configuration synchronization is possible using XMLRPC. Some areas cannot be synchronized, such as the Interface configuration, but many other areas can: Firewall rules, aliases, users, certificates, VPNs, DHCP, routes, gateways, and more. As a general rule, items specific to hardware or a particular installation, such as Interfaces or values under **System > General** or **System > Advanced** do not synchronize. For a list of areas that will synchronize, see the checkbox items on **System > High Avail Sync** in the XMLRPC section. Most packages will not synchronize but some contain their own synchronization settings. Consult package documentation for more details.

When XMLRPC Synchronization is enabled, settings from supported areas are copied to the secondary and activated after each configuration change.

XMLRPC Synchronization is optional, but maintaining a cluster is a lot more work without it.

7.3.3 State Table Synchronization (pfsync)

Active connection state information is exchanged between nodes using the pfsync protocol to achieve seamless failover. When pfsync is active and properly configured, all nodes will have knowledge of each connection flowing through the cluster. If the master node fails, the backup node will take over and clients will not notice the transition since both nodes knew about the connection beforehand.

Failover can still operate without pfsync, but it will not be seamless. Without pfsync if a node fails and another takes over, user connections would be dropped. Users may immediately reconnect through the other node, but they would be disrupted during the transition.

7.4 Testing High Availability

With all of the configuration complete, the time has come for testing. Tests for each aspect of the system are listed below. If any of the tests fails, review the configuration and consult *Troubleshooting High Availability* for assistance.

7.4.1 Verify General Functionality

Setup a client on the LAN and ensure that it receives a DHCP IP address and that it shows the LAN CARP VIP as its gateway and DNS server. Verify that the client can reach the Internet and otherwise function as expected.

7.4.2 Verify XMLRPC Sync is working

XMLRPC Configuration Synchronization can be tested several ways. The easiest method is to make a change to any supported area on the primary, such as a firewall rule, and then see if the change is reflected on the secondary after a few moments.

The manual method for forcing a synchronization task to test XMLRPC is to visit **Status > Filter Reload** on the primary node and click **Force Config Sync**. The status will change briefly and then if everything is working properly, a message will be displayed indicating the sync completed successfully.

7.4.3 Verify CARP is working

Visit **Status > CARP** on both nodes to check if CARP is functional. The primary node will display “MASTER” for all CARP VIPs and the secondary will display “BACKUP” for all CARP VIPs. If the status screen indicates that CARP is disabled, press the **Enable CARP** button.

7.4.4 Verify State Synchronization is working

The **Status > CARP** page lists **pfsync nodes** which give an indication of the state synchronization status. The values may not always match identically on both nodes, but they will be close. If the two are very different, it can indicate a problem with state synchronization. If they are identical or nearly identical, then state synchronization is working.

7.4.5 Testing Failover

A manual failover test may be initiated in one of four ways:

1. Click **Temporarily Disable CARP** on **Status > CARP** on the primary node. This will disable CARP temporarily, and if the primary node is rebooted it will turn back on. Click **Enable CARP** to turn it back on.
2. Click **Enter Persistent CARP Maintenance Mode** on **Status > CARP** on the primary node. This will disable CARP persistently, even if the primary node is rebooted. To exit maintenance mode, click **Leave Persistent CARP Maintenance Mode** to enable CARP once again.
3. Unplug a network cable from an interface with a CARP VIP present, such as WAN or LAN. This will trigger a failover event. Plug the cable back in to recover.
4. Shut down or reboot the primary node.

During any of the above tests, visit **Status > CARP** on the secondary to confirm that the CARP VIPs have taken over and show a “MASTER” status.

Before, during, and after triggering a failover, test connections from a client on the LAN through to the Internet to ensure connectivity works at each step. Downloading a file, streaming audio, or streaming video will most likely continue uninterrupted. VoIP-based phone calls may have a slight disruption as they are not buffered like the others.

Also have a client attempt to obtain an IP address by DHCP while running from the secondary.

If VPNs or other services have been configured, check those during the test as well to ensure the VPN established on the secondary node and continues to pass traffic.

Once the primary node has returned to “MASTER” status, ensure everything continues to work.

7.5 Troubleshooting High Availability

In the event that any of the testing fails (*Testing High Availability*), there are a few common things to check.

7.5.1 Review the Configuration

Before digging too deep into the technical details below, first review the configuration and ensure all steps were followed accurately.

7.5.2 Troubleshooting CARP

Check Interface Status

If an interface shows “INIT” for the CARP state, as shown in *CARP Status on Primary with Disconnected Interface*, most commonly this indicates that the interface upon which this VIP resides is not connected to anything. If there is no link to a switch or another port, the interface is down and the VIP cannot be fully initialized. If the NIC is plugged in and appears to have a link when this occurs, edit, save, and apply changes for the VIP in question to reconfigure it.

CARP has detected a problem and this unit has been demoted to BACKUP status.

Check the link status on all interfaces with configured CARP VIPs.

Search the [system log](#) for CARP demotion-related events.

Close

Reset CARP Demotion Status

Temporarily Disable CARP

Enter Persistent CARP Maintenance Mode

CARP Interface	Virtual IP	Status
WAN@200	198.51.100.200	BACKUP
LAN@1	192.168.1.1	INIT

Fig. 8: CARP Status on Primary with Disconnected Interface

Conflicting VHIDs

The **VHID** determines the virtual MAC address used by that CARP IP. The input validation in pfSense will not permit using conflicting VHIDs on a single pair of systems, however if there are multiple systems on the same broadcast domain running CARP, it is possible to create a conflict. VRRP also uses the same virtual MAC address scheme, so a VRRP IP using the same VRID as a CARP IP VHID will also generate the same MAC address conflict.

When using CARP on the WAN interface, this also means VRRP or CARP used by the ISP can also conflict. Be sure to use VHIDs that are not in use by the ISP on that broadcast domain.

In addition to creating a MAC conflict which can interfere with traffic, it can also interfere with the CARP VIP status.

Incorrect Subnet Mask

The subnet mask for a CARP VIP must match the subnet mask on the Interface IP address for the same subnet. For example, if an interface IP address is 192.168.1.2/24, the CARP VIP must also be 192.168.1.1/24.

Switch/Layer 2 Issues

Typically a switch or layer 2 issue manifests itself as both units showing “MASTER” status for one or more CARP VIPs. If this happens, check the following items:

1. Ensure that the interfaces on both boxes (The WANs, LANs, etc, etc) are connected to the proper switch/VLAN/layer 2. For example, ensure that the LAN port on both units is connected to the same switch/VLAN.
2. Verify that the two nodes can reach each other (via ICMP echo, for example) on each segment. Firewall rules may need to be added to WAN to accommodate this test.
3. If the units are plugged into separate switches, ensure that the switches are properly trunking and passing broadcast/multicast traffic.
4. If the switch on the back of a modem/CPE is being used, try a real switch instead. These built-in switches often do not properly handle CARP traffic. Often plugging the firewalls into a proper switch and then uplinking to the CPE will eliminate problems.
5. Disable IGMP snooping or other multicast limiting and inspecting features. If they are already off, try enabling the feature and disabling it again.

7.5.3 Troubleshooting XMLRPC

If an XMLRPC synchronization attempt fails, a notice is generated in the GUI to bring attention to it, as seen in *XMLRPC Sync Failure Notice*. The notice typically contains some information about why it failed that points to a fix, but if that is not enough, check the other items in this section.

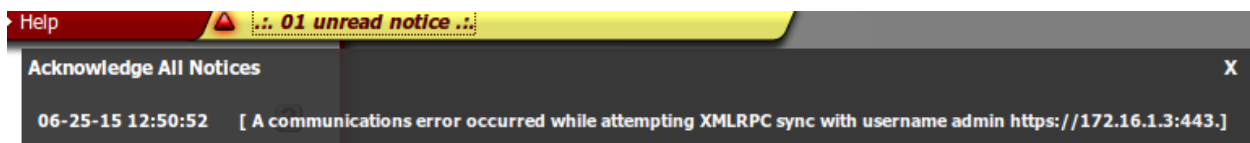


Fig. 9: XMLRPC Sync Failure Notice

Check the System Log

XMLRPC failure details are logged to the main system log (**Status > System Logs, General** tab). Usually the error is stated plainly, for example an authentication failure would indicate that the password entered for the Admin user on the synchronization settings was incorrect. As shown in *XMLRPC Sync Failure Log Entry* a timeout happened during the synchronization attempt. In this example it was due to a missing firewall rule.

Jun 25 12:50:52	php-fpm[244]: /rc.filter_synchronize: XML_RPC_Client: Connection to RPC server 172.16.1.3:443 failed. Operation timed out 103
Jun 25 12:50:52	php-fpm[244]: /rc.filter_synchronize: A communications error occurred while attempting XMLRPC sync with username admin https://172.16.1.3:443.

Fig. 10: XMLRPC Sync Failure Log Entry

Check the Firewall Log

Visit **Status > System Logs, Firewall** tab on the secondary node. Check the log for entries failing to reach the secondary’s Sync interface on the GUI port, as seen in *XMLRPC Sync Failure Firewall Log Entry*. If the traffic is shown as blocked, adjust the Sync interface rules as needed.






	Jun 25 12:50:36	SYNC	  172.16.1.2:8845	  172.16.1.3:443	TCP:S
---	-----------------	------	---	---	-------

Fig. 11: XMLRPC Sync Failure Firewall Log Entry

Check the Admin User

Visit **System > User Manager** and ensure that the admin user is enabled on both systems and that the admin password is the same on both systems. Visit **System > High Avail Sync** and double check that the admin username has been entered and that the correct password is present.

Verify Connectivity

Check **Status > Interfaces** and ensure the Sync interface shows a link on both units. If there is no link, ensure a cable is connected between the two units. The ports on the SG-4860 are Auto-MDIX so either a straight-through patch or a crossover cable will work. If a short cable is in use, try a longer cable (minimum 3ft/1m). If a link can still not be achieved, try using a small switch or VLAN between the two nodes.

Add a firewall rule to the Sync interface to allow ICMP echo requests and then attempt to ping from one firewall to the other to ensure they can reach each other at layer 3. If they cannot, double check the interface IP address and subnet mask settings, along with the cabling.

7.5.4 Troubleshooting pfsync

If the pfsync nodes do not line up under **Status > CARP**, that can indicate that the states have not been synchronized.

Check Firewall Rules

Check the firewall log at **Status > System Logs, Firewall** tab on both nodes. If any pfsync protocol traffic is present, the firewall rules on the Sync interface are probably incorrect.

Look at **Firewall > Rules** on the **Sync** interface tab. Make sure that the rules will pass *pfsync* protocol traffic, or traffic of *any* protocol, to *any* destination. Adjust the rules accordingly and check the logs and CARP status again to see if it starts working.

Verify Connectivity

See *Verify Connectivity* above to check the connection between the nodes.

Check Interfaces

If the states appear to sync but failover is still not seamless, check **Interfaces > (Assign)** and make sure the interfaces all line up physically as well as by name. In pfSense 2.2 and later, the states are bound to the interface so if, for example, the LAN interface is igb0 on one unit but igb3 on the other, then the states will not line up. Fix the interfaces so they are identical on both units.

7.5.5 Troubleshooting Local Services



DNS Resolution

If local clients are unable to obtain DNS responses from a CARP VIP on the cluster, check the following items:

- If using the default DNS Resolver (unbound), visit **Services > DNS Resolver** and click Save on the primary to ensure the default values are fully respected.
- If using either the DNS Resolver or DNS Forwarder, ensure the daemon is configured to listen on All interfaces or at least Localhost and the internal CARP VIPs.
- Ensure the local interface firewall rules pass both TCP and UDP port 53 to the CARP VIPs used for local DNS.
- Ensure the firewall itself has DNS servers configured under **System > General**, especially if using the DNS Forwarder (dnsmasq) instead of the DNS Resolver (unbound).

DHCP

If the DHCP failover pool status does not reach “normal”, there are a few items to check:

- Ensure both units are connected to the same switch/subnet on the correct interface.
- Verify connectivity between the two units on that interface.
- Ensure the failover peer IP address has been properly configured
- Ensure that there is a CARP VIP on the interface in question
- Ensure that the CARP VIP on the primary node has a skew of 0 or 1, and the secondary has a skew of 100 or higher.
- If all else fails:
 - Click  to stop the DHCP service from **Status > Services** on both nodes
 - Visit **Diagnostics > Command Prompt** on both nodes
 - Run the following command in the **Shell Execute** box on both nodes: `rm /var/dhcpd/var/db/dhcpd.leases*`
 - Click  to start the DHCP service from **Status > Services** on both nodes

7.6 Upgrading pfSense on a High Availability Cluster

There is more to updating a cluster than the typical process, but in all updating a cluster is much less disruptive as the users will not have any downtime in most all cases.

If at any point in this procedure a failure condition is encountered, seek assistance from [support](#).

7.6.1 Review the Changelog and Upgrade Guide

Before starting any part of an upgrade, first look at the [Netgate Blog](#) and [release changelogs](#) for any notable changes or items to be aware of between the version currently in use and the one that will be in use after upgrading.

Common issues are also listed in the [upgrade guide](#), especially for major version upgrades.

7.6.2 Backup

Before starting, take a fresh backup from **Diagnostics > Backup/Restore** on both nodes.

Warning: Do not skip this step! A backup is quick and easy to do, and invaluable to have if the upgrade does not go as expected!

Download installation media for the release currently in use if a reinstall is necessary.

7.6.3 Upgrade Secondary

Perform the OS upgrade on the secondary node first. This way, if the upgrade fails, there is no interruption and if a reinstall is needed, it can be done without worry.

7.6.4 Test Secondary

Once the secondary has booted back up, login and confirm that it is running as expected. If all services are active, the CARP status is OK, and so on then it is time to test. Force a failover from the primary node by placing it into maintenance mode (See [Testing Failover](#)) and observe what happens on the secondary. If the secondary takes over OK and traffic continues to flow, then it is OK to proceed.

7.6.5 Upgrade Primary

With the primary node in maintenance mode, it is safe to upgrade without additional interference. Initiate the OS upgrade and let the system reboot. Once it has rebooted, confirm that local services are running as expected and then take the node out of maintenance mode.

7.6.6 Test Again

With both units on the current OS and active, run some final tests to ensure that services are operational, traffic is flowing, and that the CARP, DHCP, and other status areas are all running properly.

REINSTALLING PFSENSE

1. [Registered users](#) can log in to their [Portal account page](#) and download the appropriate factory installer image:

`pfSense-netgate-memstick-2.4.3-RELEASE-p1-amd64.img.gz`

If you no longer have an active portal subscription, please [contact support](#) to re-enable access to the image free of charge.

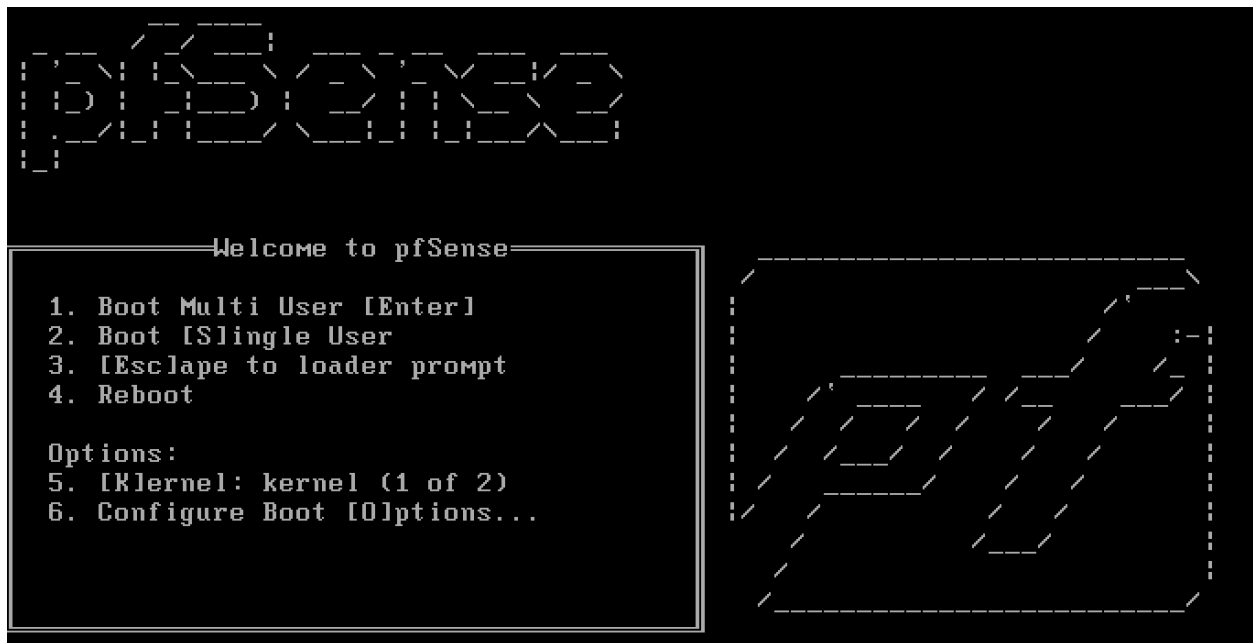
Note: The pfSense factory version is the version that is preinstalled on units purchased from Netgate. The factory image is optimally tuned for our hardware and contains some features that cannot be found elsewhere, such as the AWS VPN Wizard.

2. Write the image to a USB memstick. Locating the image and writing it to a USB memstick is covered in detail under [Writing Flash Drives](#).
3. Connect to the console port of the pfSense device.

See also:

[Connecting to the Console Port](#) Connecting to the console port. Cable is required.

4. Insert the memstick into an open USB port and boot the system.
5. After a minute the pfSense loader menu will be displayed that contains options to **Boot Multi User**, **Boot Single User**, **Escape to loader prompt**, **Reboot**, select a non-default kernel or configure boot options. Either allow the menu to timeout and boot on its own, or press `1` to boot normally. The factory images of pfSense already have appropriate console port options.
6. The installer will automatically launch once the boot process completes and offer the choice of a Quick/Easy Install, Custom Install, and several other options. Select **Quick/Easy Install** and press `Enter`. Another screen will prompt for confirmation. Select **OK** and press `Enter` to continue.
7. pfSense will be installed to the first available disk in the system. If the system contains an optional SSD storage disk, it will be chosen. Otherwise, the onboard eMMC will be used. It will take a couple of minutes to copy all of the files to the target disk. When the files have finished being copied, the installer will prompt to select either the **Embedded Kernel** or **Standard Kernel**. Select the **Embedded Kernel** and press `Enter`.
8. If you are on the factory version, the installer will then prompt to choose the type of system being installed, which pre-configures device-specific defaults. Choose the option that exactly matches the unit being reinstalled. If the model is unknown, check the sticker on the bottom of the unit.
9. The installer will then prompt to Reboot the system. Select **Reboot** and press `Enter`. The system will reboot.
10. Remove the USB drive from the USB port. pfSense will restart automatically. If the USB drive remains attached, the system will boot into the installer again because by default the system firmware is configured so that a device plugged into the USB port will be booted with a higher priority.



pfSense is now rebooting

After the reboot is complete, open a web browser and enter <https://192.168.1.1> (or the LAN IP Address) in the location bar.

You might need to acknowledge the HTTPS certificate if your browser reports it as untrusted. This is normal as a self-signed certificate is used by default.

DEFAULT Username: admin
DEFAULT Password: pfsense

Rebooting in 5 seconds. CTRL-C to abort.
Rebooting in 4 seconds. CTRL-C to abort.
Rebooting in 3 seconds. CTRL-C to abort.
Rebooting in 2 seconds. CTRL-C to abort.
Rebooting in 1 second.. CTRL-C to abort.

pfSense is now rebooting.

Dec 14 18:25:18 lighttpd[38936]: (server.c.1567) server stopped by UID = 0 PID = 35875