Security Gateway Manual

SG-5100

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Nov 03, 2026

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This Quick Start Guide covers the first time connection procedures for the Netgate® 5100 Firewall Appliance and will provide the information needed to keep the appliance up and running.

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CHAPTER

ONE

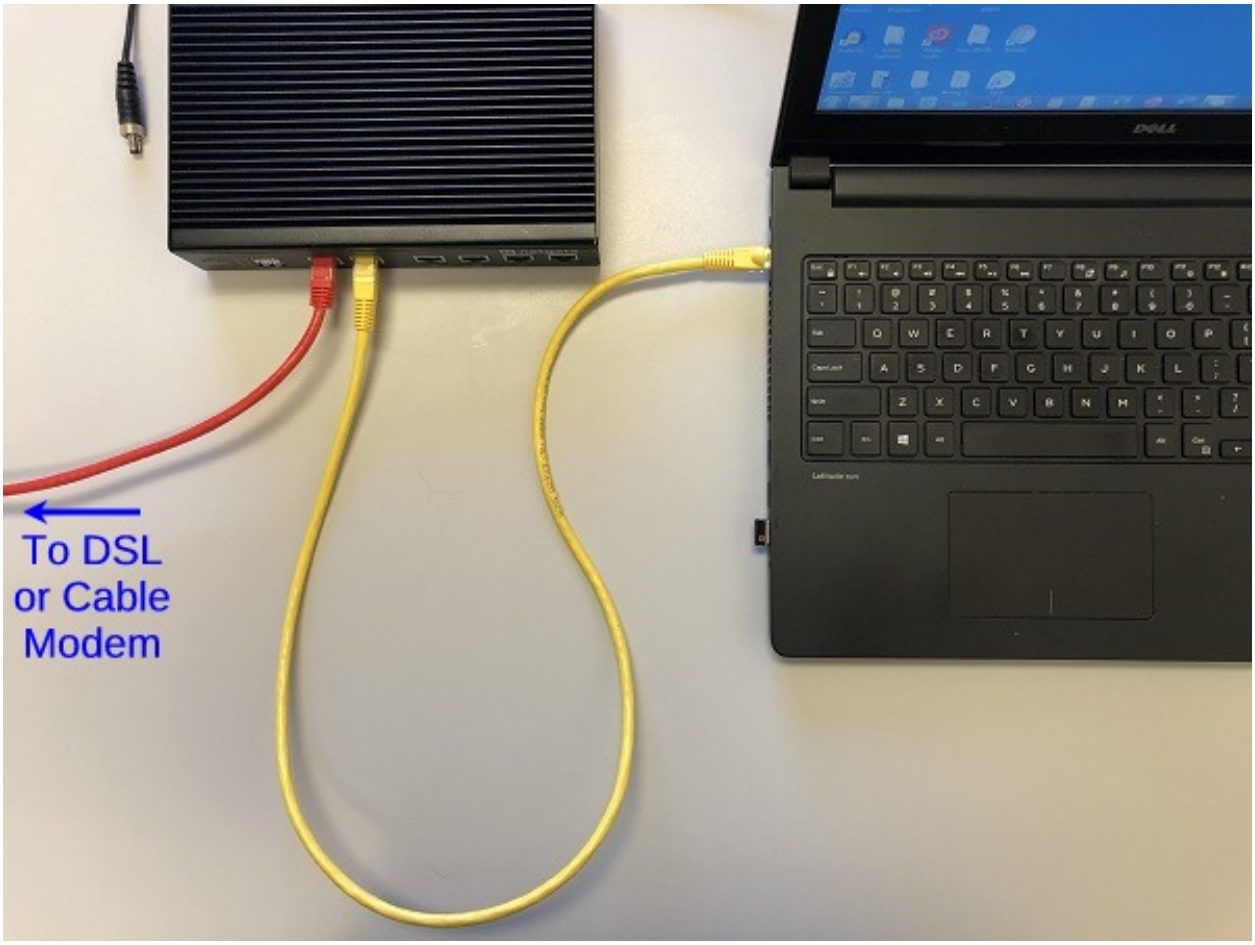
OUT OF THE BOX

1.1 Getting Started

The basic firewall configuration begins with connecting the Netgate® appliance to the Internet. The Netgate appliance should be unplugged at this time.

Connect one end of an Ethernet cable to the WAN port (shown in the *Input and Output Ports* section) of the Netgate appliance. The other end of the same cable should be inserted into a LAN port on the ISP Customer Premise Equipment (CPE) device, such as a cable or fiber router. If the CPE device provided by the ISP has multiple LAN ports, any LAN port should work in most circumstances.

Next, connect one end of a second Ethernet cable to the LAN port (shown in the *Input and Output Ports* section) of the Netgate appliance. Connect the other end to the computer.



1.1.1 What next?

To connect to the GUI and configure the firewall in a browser, continue on to *Initial Configuration*.

To connect to the console and make adjustments before connecting to the GUI, see *Connecting to the USB Console*.

Warning: The default IP Address on the LAN subnet on the Netgate firewall is `192.168.1.1/24`. The same subnet **cannot** be used on both WAN and LAN, so if the default IP address on the ISP-supplied modem is also `192.168.1.1/24`, **disconnect the WAN** interface until the LAN interface on the firewall has been renumbered to a different subnet (like `192.168.2.1/24`) to avoid an IP Address conflict.

To change an interface IP address, choose option 2 from the *Console Menu* and walk through the steps to change it, or from the GUI, go through the Setup Wizard (opens at first boot, also found at **System > Setup Wizard**) and change the IP address on Step 5. Complete the Wizard and save the changes.

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1.2 Initial Configuration

Plug the power cable into the power port and press the power button on the back near the power connector (shown in the *Input and Output Ports* section) to turn on the Netgate® Firewall. Allow 4 or 5 minutes to boot up completely.

Warning: If the ISP Customer Premise Equipment (CPE) on WAN (e.g. Fiber or Cable Router) has a default IP Address of `192.168.1.1`, disconnect the Ethernet cable from the IGB0 port on the Netgate 5100 Security Gateway before proceeding.

Change the default LAN IP Address of the device during a later step in the configuration to avoid having conflicting subnets on the WAN and LAN.

1.2.1 Connecting to the Web Interface (GUI)

1. From the computer, log into the web interface

   Open a web browser (Google Chrome in this example) and enter `192.168.1.1` in the address bar. Press `Enter`.

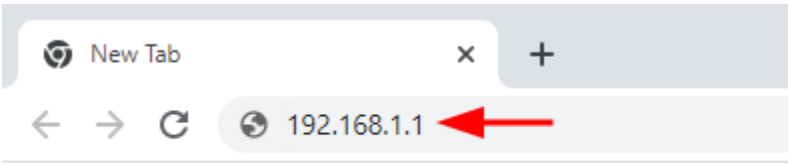

Fig. 1: Enter the default LAN IP address in the browser

2. A warning message may appear. If this message or similar message is encountered, it is safe to proceed. Click the **Advanced** Button and then click **Proceed to 192.168.1.1 (unsafe)** to continue.
3. At the **Sign In** page, enter the default pfSense® Plus username and password and click **Next**.
   - Default Username: `admin`
   - Default Password: `pfsense`

1.2.2 The Setup Wizard

This section steps through each page of the Setup Wizard to perform the initial configuration of the firewall. The wizard collects information one page at a time, but it does not make any changes to the firewall until the wizard is completed.

Tip: The wizard can be safely stopped at any time for those who wish to perform the configuration manually or restore an existing backup (Backup and Restore).

To stop the wizard, navigate away from the wizard pages by clicking the logo in the upper left of the page or by choosing an entry from one of the menus.

Note: Ignore the warning at the top of each wizard page about resetting the `admin` account password. One of the steps in the Setup Wizard is to change the default password, but the new password is not applied until the end of the wizard.

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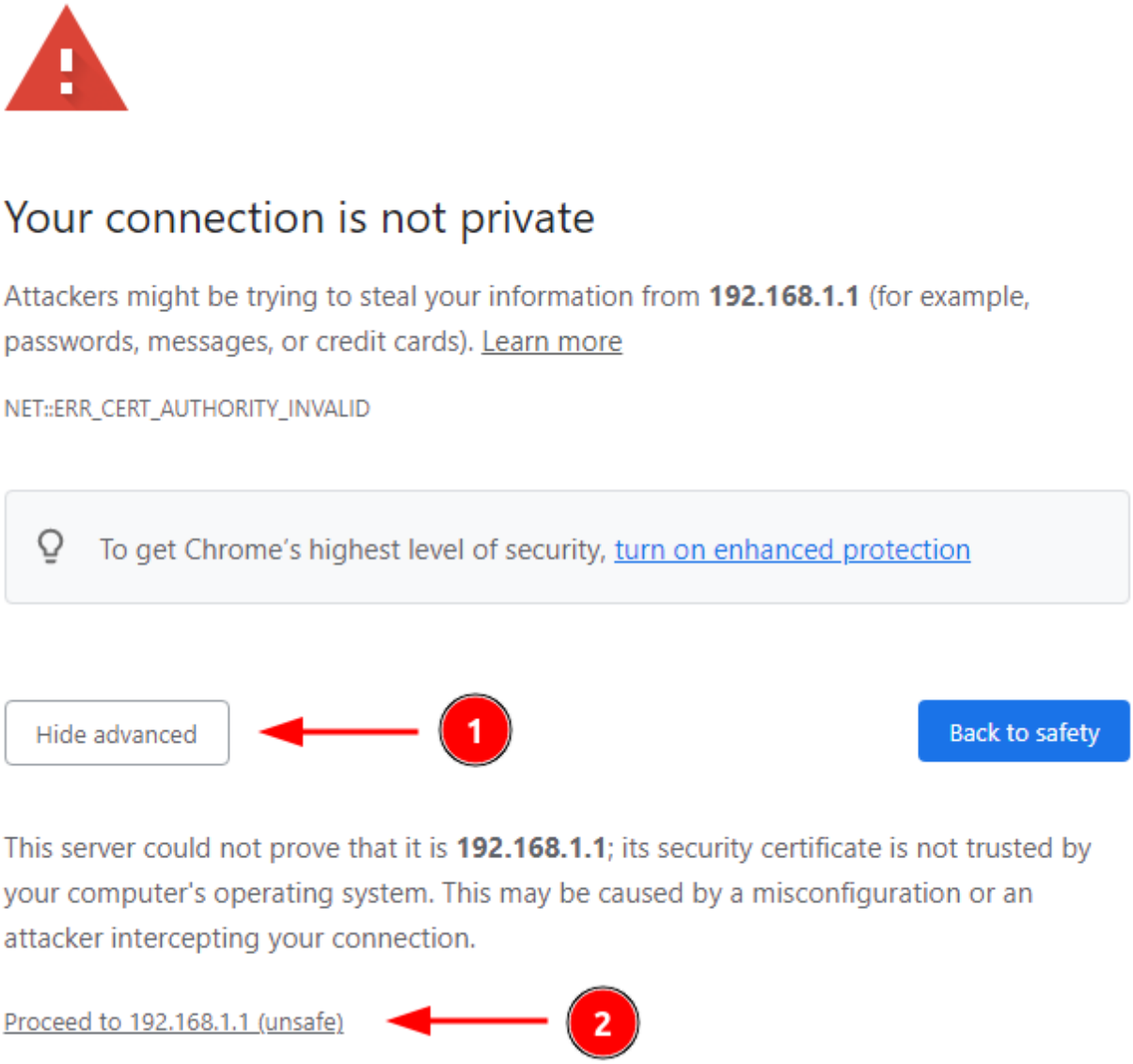

Fig. 2: Example certificate warning message

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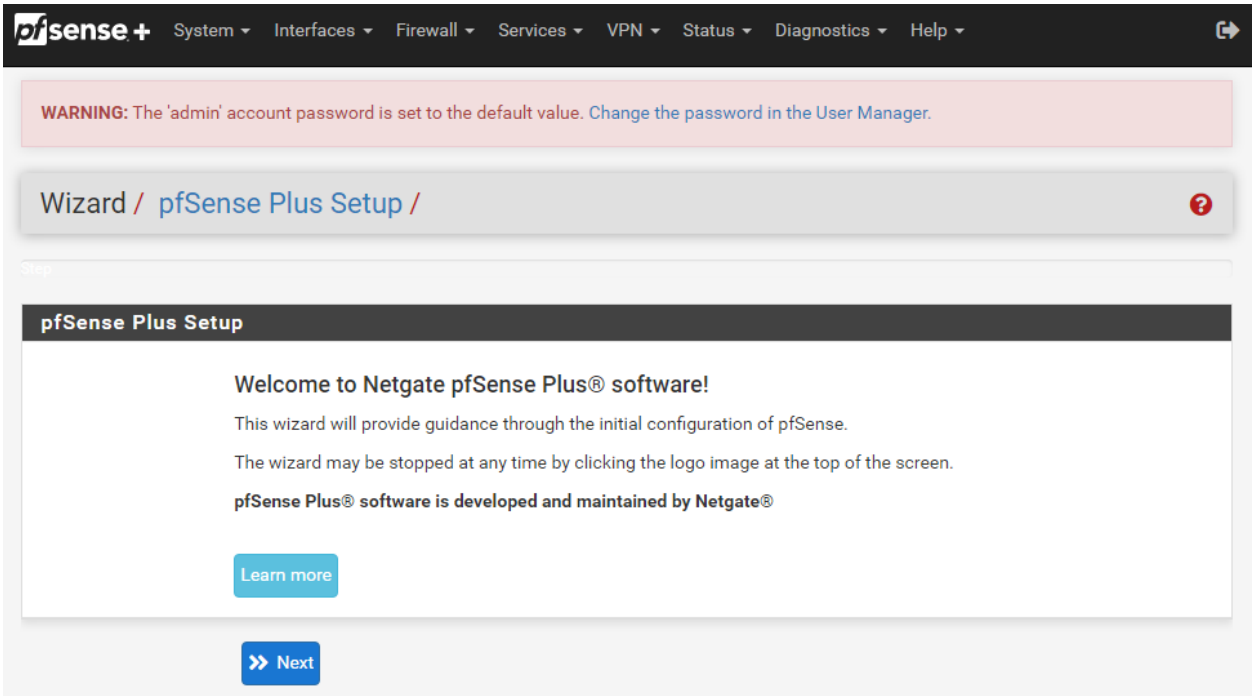

Fig. 3: Setup Wizard starting page

1. Click **Next** to start the **Setup Wizard**.
2. Click **Next** after reading the information on **Netgate Global Support**.
3. Use the following items as a guide to configure the options on the **General Information** page:

   Hostname
   Any desired hostname name can be entered to identify the firewall. For the purposes of this guide, the default hostname `pfsense` is used.

   Domain
   The domain name under which the firewall operates. The default `home.arpa` is used for the purposes of this tutorial.

   DNS Servers
   For purposes of this setup guide, use the Google public DNS servers (`8.8.8.8` and `8.8.4.4`).

   Note: The firewall defaults to acting as a resolver and clients will not utilize these forwarding DNS servers. However, these servers give the firewall itself a way to ensure it has working DNS if resolving the default way does not work properly.

   Type in the DNS Server information and Click **Next**.
4. Use the following information for the **Time Server Information** page:

   Time Server Hostname
   Use the default time server address. The default hostname is suitable for both IPv4 and IPv6 NTP clients.

   Timezone
   Select a geographically named time zone for the location of the firewall.

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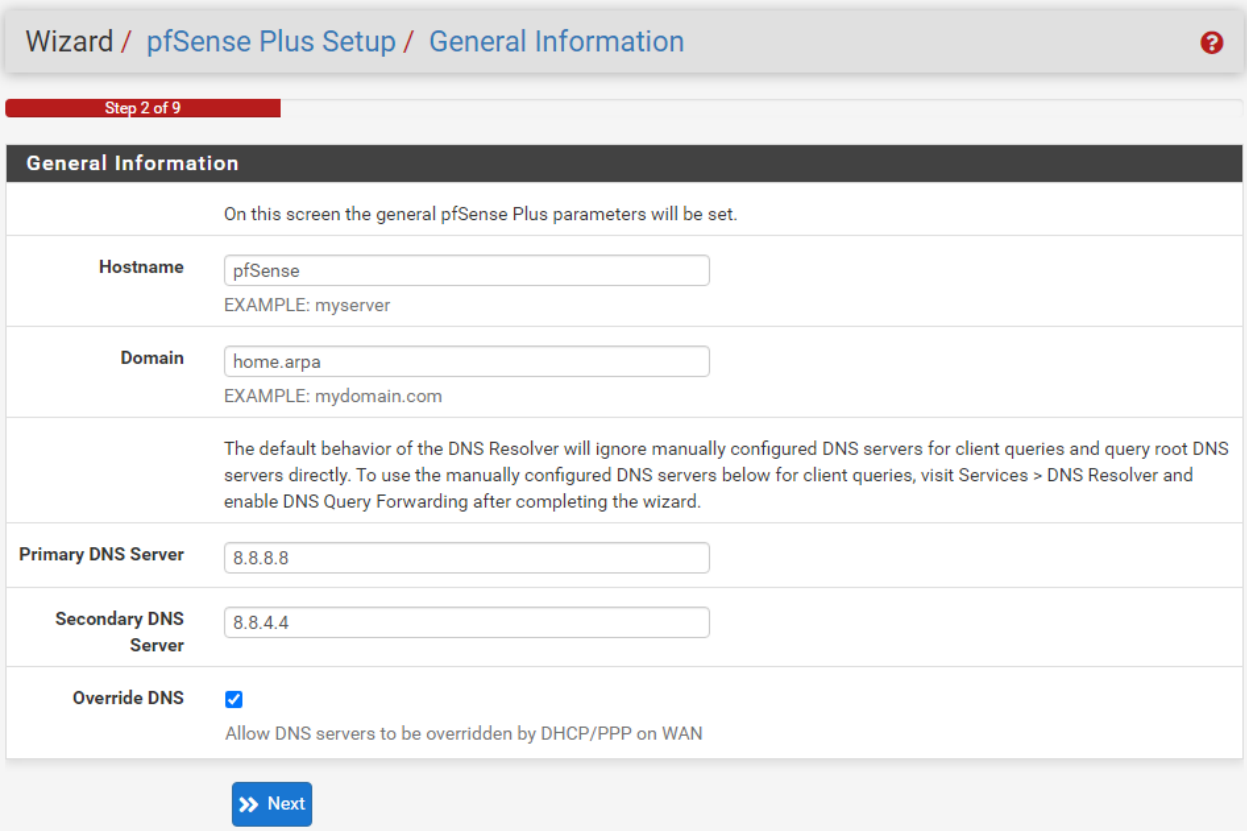

Fig. 4: **General Information** page in the Setup Wizard

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For this guide, the Timezone will be set to `America/Chicago` for US Central time.

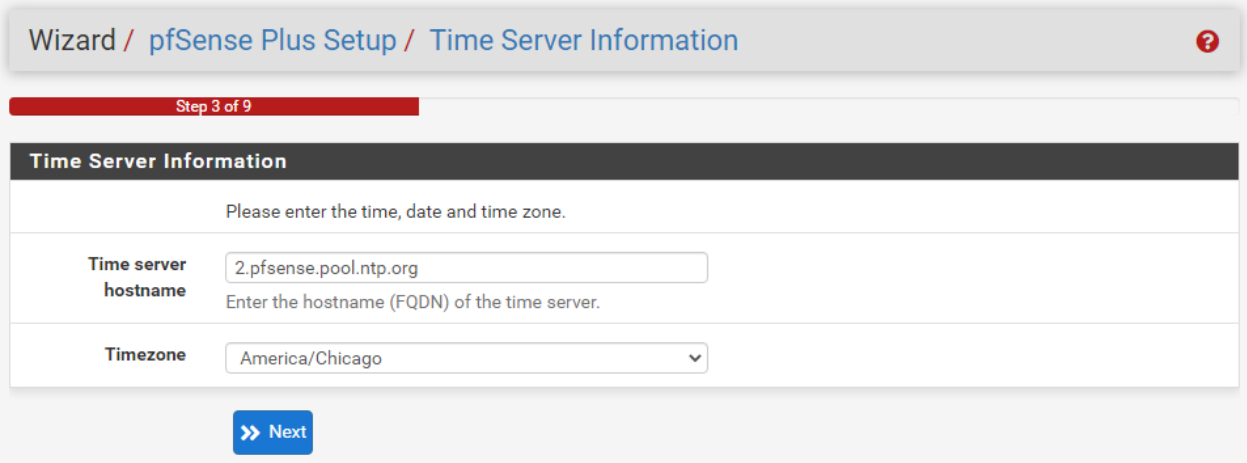

Fig. 5: **Time Server Information** page in the Setup Wizard

Change the Timezone and click **Next**.

5. Use the following information for the **Configure WAN Interface** page:

   The WAN interface is the external (public) IP address the firewall will use to communicate with the Internet.

   DHCP is the default and is the most common type of WAN interface for home fiber and cable modems.

   Default settings for the other items on this page should be acceptable for normal home users.

   Default settings should be acceptable. Click **Next**.

6. Configuring LAN IP Address & Subnet Mask. The default LAN IP address of `192.168.1.1` and subnet mask of `24` is usually sufficient.

   Tip: If the CPE on WAN (e.g. Fiber or Cable Modem) has a default IP Address of `192.168.1.1`, the Ethernet cable should be disconnected from the IGB0 port on the Netgate 5100 Security Gateway before starting.

   Change the default LAN IP Address of the device during this step in the configuration to avoid having conflicting subnets on the WAN and LAN.

   ---

7. Change the **Admin Password**. Enter the same new password in both fields.
8. Click **Reload** to save the configuration.
9. After a few seconds, a message will indicate the Setup Wizard has completed. To proceed to the pfSense® Plus dashboard, click **Finish**.

   Note: This step of the wizard also contains several useful links to Netgate resources and methods of obtaining assistance with the product. Be sure to read through the items on this page before finishing the wizard.

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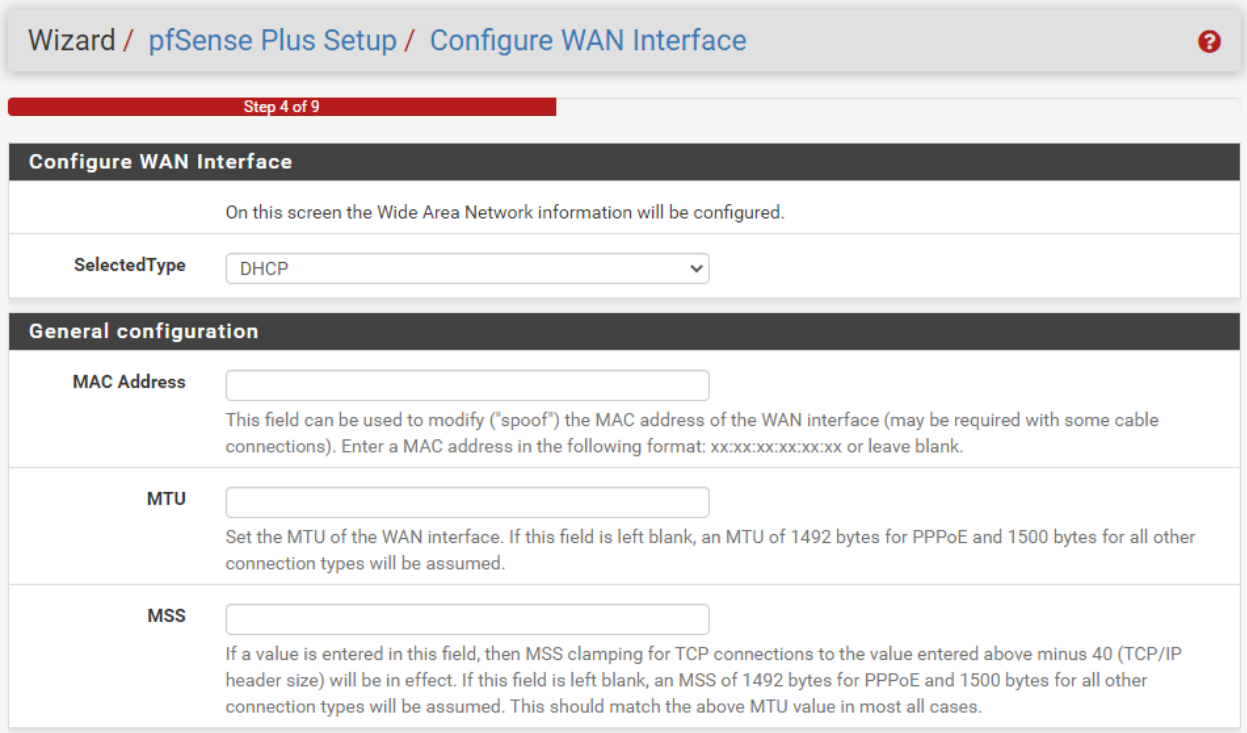

Fig. 6: **Configure WAN Interface** page in the Setup Wizard

1.2.3 Finishing Up

After completing or exiting the wizard, during the first time loading the **Dashboard** the firewall will display a notification modal dialog with the **Copyright and Trademark Notices**.

Read and click **Accept** to continue to the dashboard.

If the Ethernet cable was unplugged at the beginning of this configuration, reconnect it to the IGB0 port now.

This completes the basic configuration for the Netgate appliance.

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Fig. 7: Copyright and Trademark Notices

1.3 pfSense Plus Software Overview

This page provides an overview of the pfSense® Plus dashboard and navigation. It also provides information on how to perform frequent tasks such as backing up the pfSense® Plus software and connecting to the Netgate firewall console.

1.3.1 The Dashboard

pfSense® Plus software is highly configurable, all of which can be done through the dashboard. This orientation will help to navigate and further configure the firewall.

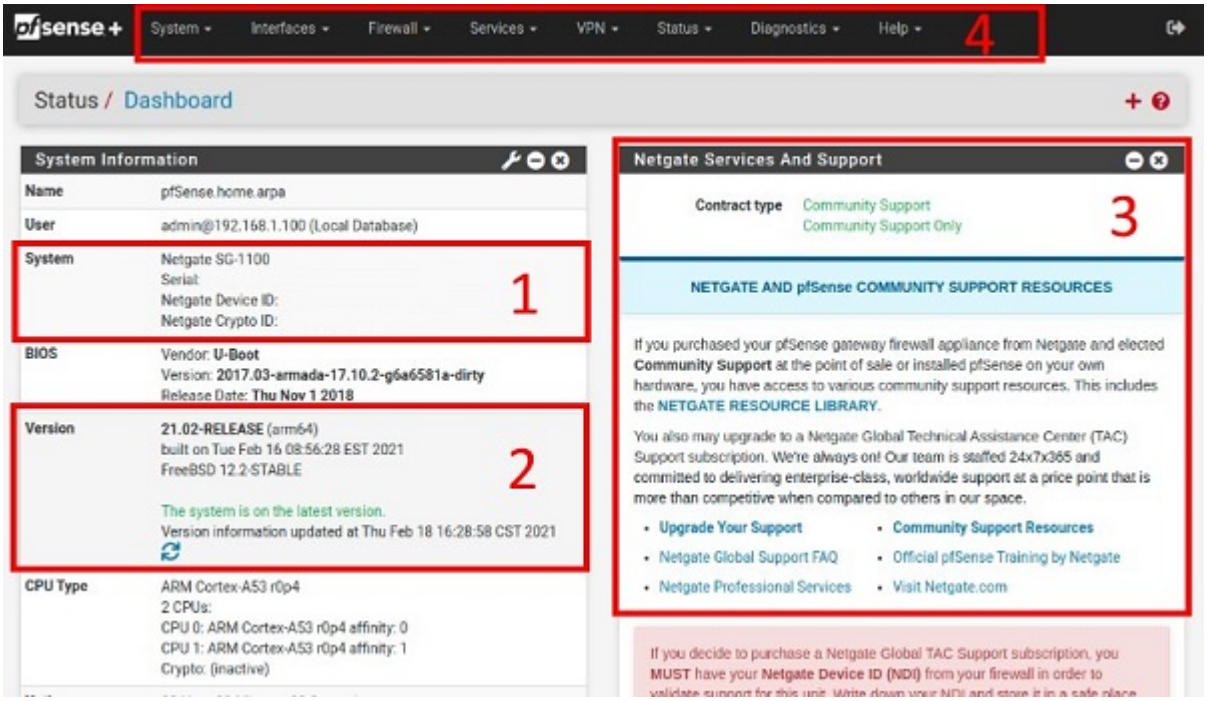

Fig. 8: The pfSense® Plus Dashboard

Section 1
Important system information such as the model, Serial Number, and Netgate Device ID for this Netgate firewall.

Section 2
Identifies what version of pfSense® Plus software is installed, and if an update is available.

Section 3
Describes Netgate Service and Support.

Section 4
Shows the various menu headings. Each menu heading has drop-down options for a wide range of configuration choices.

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1.3.2 Re-running the Setup Wizard

To re-run the Setup Wizard, navigate to **System > Setup Wizard**.

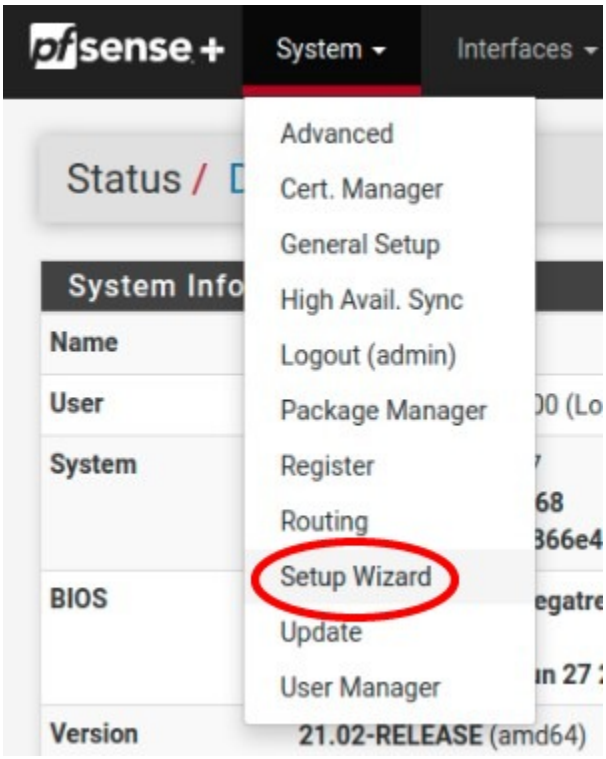

Fig. 9: Re-run the Setup Wizard

1.3.3 Backup and Restore

It is important to back up the firewall configuration prior to updating or making any configuration changes. From the menu at the top of the page, browse to **Diagnostics > Backup/Restore**.

Click `Download configuration as XML` and save a copy of the firewall configuration to the computer connected to the Netgate firewall.

This backup (or any backup) can be restored from the same screen by choosing the backed up file under **Restore Configuration**.

Note: Auto Config Backup is a built-in service located at **Services > Auto Config Backup**. This service will save up to 100 encrypted backup files automatically, any time a change to the configuration has been made. Visit the Auto Config Backup page for more information.

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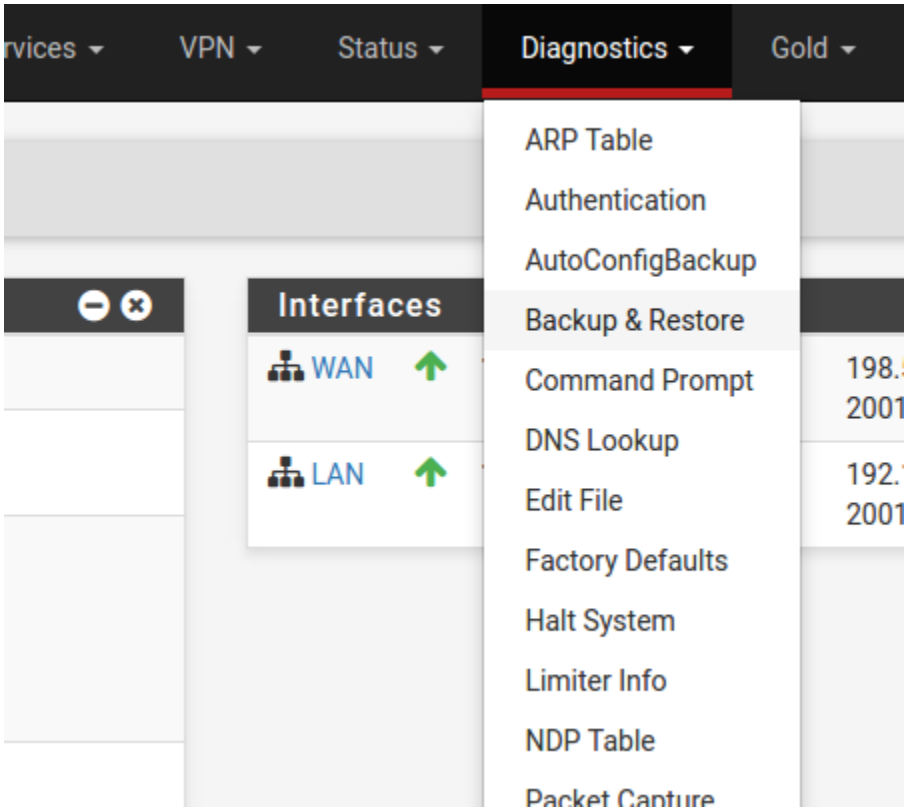

Fig. 10: Backup & Restore

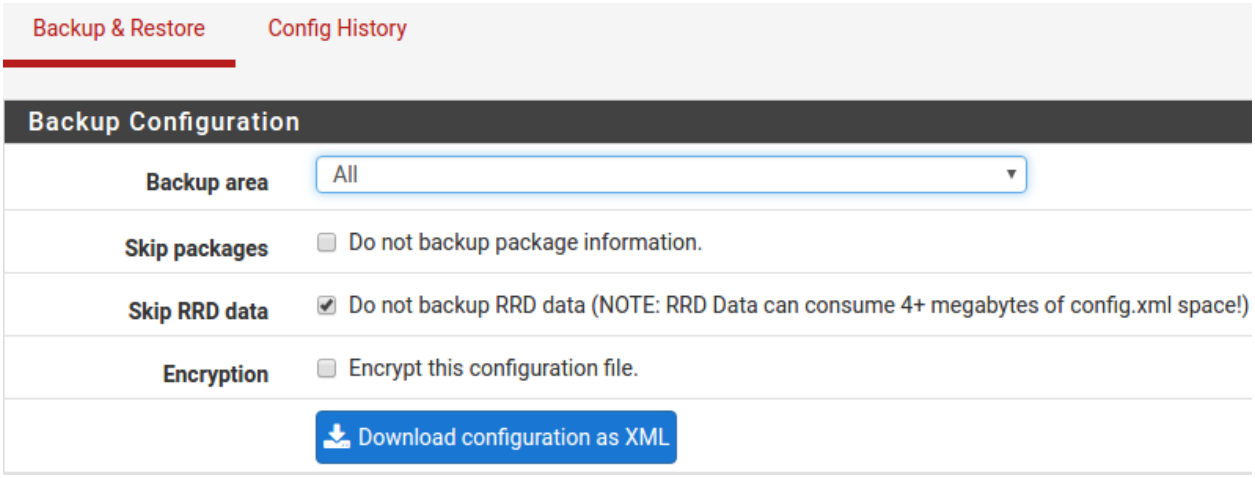

Fig. 11: Click Download configuration as XML

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1.3.4 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 USB Console. Cable is required.

Tip: To learn more about getting the most out of a Netgate appliance, sign up for a pfSense Plus Software Training course or browse the extensive Resource Library.

1.3.5 Updates

When a new version of pfSense Plus software is available, the device will indicate the availability of the new version on the System Information dashboard widget. Users can perform a manual check as well by visiting **System > Update**.

Users can initiate an upgrade from the **System > Update** page as needed.

For more information, see the Upgrade Guide.

1.4 Input and Output Ports

1.4.1 Front Side

Fig. 12: Front view of the Netgate 5100 Firewall Appliance
The items in this image are described by entries in *Ethernet Ports* and *Other Ports and Indicators*.

Ethernet Ports

Interface Name	Port Name	Port Type	Port Speed
WAN	IGB0	RJ-45	1 Gbps
LAN	IGB1	RJ-45	1 Gbps
OPT1	IX0	RJ-45	1 Gbps
OPT2	IX1	RJ-45	1 Gbps
OPT3	IX2	RJ-45	1 Gbps
OPT4	IX3	RJ-45	1 Gbps

Note: The `ix(4)` network interfaces on this device **do not** implement fixed speed operation. These interfaces emulate a speed/duplex choice by limiting the values offered during autonegotiation to the speed/duplex value selected in the GUI.

When connecting different devices to these interfaces the peer should typically be set to autonegotiate, not to a specific speed or duplex value. The exception to this is if the peer interface has the same limitation, in which case both peers should select the same negotiation speed.

Table 1: RJ-45 LEDs Configuration

Status LED	State	Description
Left LED (Link Status)	Solid Amber	Link has been established and there is no activity on this port
	Blinking Amber	Link has been established and there is activity on this port
	Off	No link has been established
Right LED (Speed)	Solid Green	Operating as a 100 Mbps connection
	Blinking Amber	Operating as a Gigabit connection (1000 Mbps)
	Off	No link has been established

Note: All Ethernet ports on the Netgate® appliance are compatible with auto-MDI-X and are capable of utilizing either straight-through or crossover Ethernet cables.

Other Ports and Indicators

- *Mini-USB Serial Console*
- Status LEDs
- 2x USB 3.0 Ports

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USB Ports

USB ports on the device can be used for a variety of purposes.

The primary use for the USB ports is to install or reinstall the operating system on the device. Beyond that, there are numerous USB devices which can expand the base functionality of the hardware, including some implemented by add-on packages. For example, UPS/Battery Backups, Cellular modems, GPS units, and storage devices. Though the operating system also includes drivers for wired and wireless USB network devices, these are not ideal and should be avoided.

LED Patterns

Status LED	State	Description
Top LED	Blinking Amber	Add-on storage activity (does not show eMMC activity)
Middle LED	Solid Green	System booted
	Blinking Green	Software update available
	Solid Red	Halted or in the process of booting
	Blinking Red	Running update process
	Blinking Red/Green	Factory Reset in process
Bottom LED	Solid Green	Power

1.4.2 Rear Side

Fig. 13: Rear side view of the Netgate 5100 Firewall Appliance

1. Recessed Reset Button (performs a *reset to factory default*)
2. Power Button (powers system on, performs graceful shutdown)
3. Power
   - 12VDC with threaded locking connector
   - Power Consumption 7W (idle)

Center Pin Positive

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Note: The power button on the SG-5100 has been programmed to perform a graceful shutdown when depressed.

The reset button is only used to reset the system back to factory defaults. It does not respond when pushed while the system is running. See *Factory Reset Procedure*.

1.5 Safety and Legal

1.5.1 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.

1.5.2 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.

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1.5.3 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.

1.5.4 Industry Canada

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

1.5.5 CE Marking

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

1.5.6 RoHS/WEEE Compliance Statement

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.

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 Haushaltmüll 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.

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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.

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.

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.

1.5.7 Declaration of Conformity

Česky[Czech]

NETGATE tímto prohla uje, e tento NETGATE device, je ve shod se základními po adavky a dal ími p íslu n mi ustanoveními sm rnice 1999/5/ES.

Dansk [Danish]

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

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.

English

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

Eesti [Estonian]

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

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.

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". (BMWi)

Ελληνικ**H [Greek]**

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

Magyar [Hungarian]

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

Íslenska [Icelandic]

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

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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.

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 tajiem noteikumiem.

Lietuviškai [Lithuanian]

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

Malti [Maltese]

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

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.

Slovensky [Slovak]

NETGATE t mto vyhlasuje, e NETGATE device, sp a základné po iadavky a v etky príslu né ustanovenia Smernice 1999/5/ES.

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.

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.

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Polski [Polish]

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

Português [Portuguese]

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

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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CHAPTER

TWO

HOW-TO GUIDES

2.1 Connecting to the USB Console

This guide shows how to access the serial console which can be used for troubleshooting and diagnostics tasks as well as some basic configuration.

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

2.1.1 USB Serial Console Device

This device uses a **Prolific PL2303 USB-to-UART Bridge** which provides access to the console. This device is exposed via the **USB Mini-B (5-pin)** port on the appliance.

Install the Driver

If needed, install an appropriate **Prolific PL2303 USB to UART Bridge** driver on the workstation used to connect with the device.

Windows

There are drivers available for Windows available for download.

macOS

There are drivers available for macOS available for download.

Linux

There are drivers available for Linux available for download.

FreeBSD

Connect a USB Cable

Next, connect to the console port using the cable that has a **USB Mini-B (5-pin)** connector on one end and a **USB Type A** plug on the other end.

Gently push the **USB Mini-B (5-pin)** plug end into the console port on the appliance and connect the **USB Type A** plug into an available USB port on the workstation.

Tip: Be certain to gently push in the **USB Mini-B (5-pin)** connector on the device side completely. With most cables there will be a tangible "click", "snap", or similar indication when the cable is fully engaged.

Apply Power to the Device

On some hardware, the USB serial console port may not be detected by the client operating system until the device is plugged into a power source.

If the client OS does not detect the USB serial console port, connect the power cord to the device to allow it to start booting.

If the USB serial console port appears without power applied to the device, then the best practice is to wait until the terminal is open and connected to the serial console before powering on the device. That way the client can view the entire boot output.

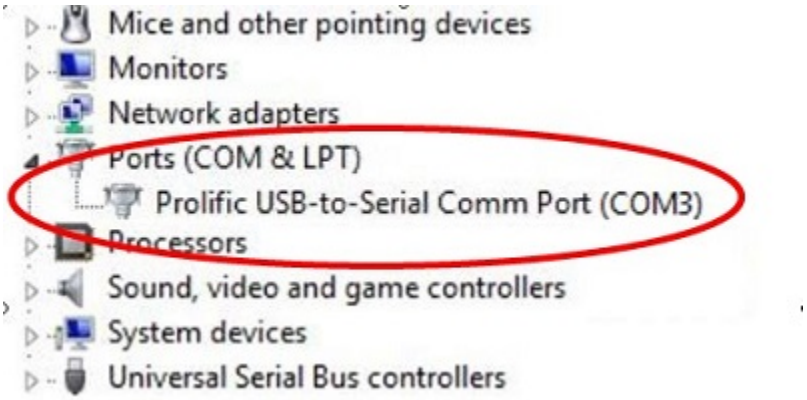
Locate the Console Port Device

The appropriate console port device that the workstation assigned as the serial port must be located before attempting to connect to the console.

Note: Even if the serial port was assigned in the BIOS, the workstation OS may remap it to a different COM Port.

Windows

To locate the device name on Windows, open **Device Manager** and expand the section for **Ports (COM & LPT)**. Look for an entry with a title such as **Prolific USB-to-Serial Comm Port**. If there is a label in the name that contains `COMX` where `X` is a decimal digit (e.g. `COM3`), that value is what would be used as the port in the terminal program.



macOS

The device associated with the system console is likely to show up as, or start with, `/dev/cu.usbserial-<id>`.

Run `ls -l /dev/cu.*` from a Terminal prompt to see a list of available USB serial devices and locate the appropriate one for the hardware. If there are multiple devices, the correct device is likely the one with the most recent timestamp or highest ID.

Linux

The device associated with the system console is likely to show up as `/dev/ttyUSB0`. Look for messages about the device attaching in the system log files or by running `dmesg`.

Note: If the device does not appear in `/dev/`, see the note above in the driver section about manually loading the Linux driver and then try again.

FreeBSD

The device associated with the system console is likely to show up as `/dev/cuaU0`. Look for messages about the device attaching in the system log files or by running `dmesg`.

Note: If the serial device is not present, ensure the device has power and then check again.

2.1.2 Launch a Terminal Program

Use a terminal program to connect to the system console port. Some choices of terminal programs:

Windows

For Windows the best practice is to run *PuTTY on Windows* or SecureCRT. An example of how to configure PuTTY is below.

> **Warning:** Do not use **HyperTerminal**.

macOS

For macOS the best practice is to run GNU `screen`, or `cu`. An example of how to configure GNU `screen` is below.

Linux

For Linux the best practices are to run GNU `screen`, *PuTTY on Linux*, `minicom`, or `dterm`. Examples of how to configure PuTTY and GNU `screen` are below.

FreeBSD

For FreeBSD the best practice is to run GNU `screen` or `cu`. An example of how to configure GNU `screen` is below.

Client-Specific Examples

PuTTY on Windows

- Open PuTTY and select **Session** under **Category** on the left-hand side.
- Set the **Connection type** to **Serial**
- Set **Serial line** to the *console port determined previously*
- Set the **Speed** to `115200` bits per second.

- Click the **Open** button

PuTTY will then display the console.

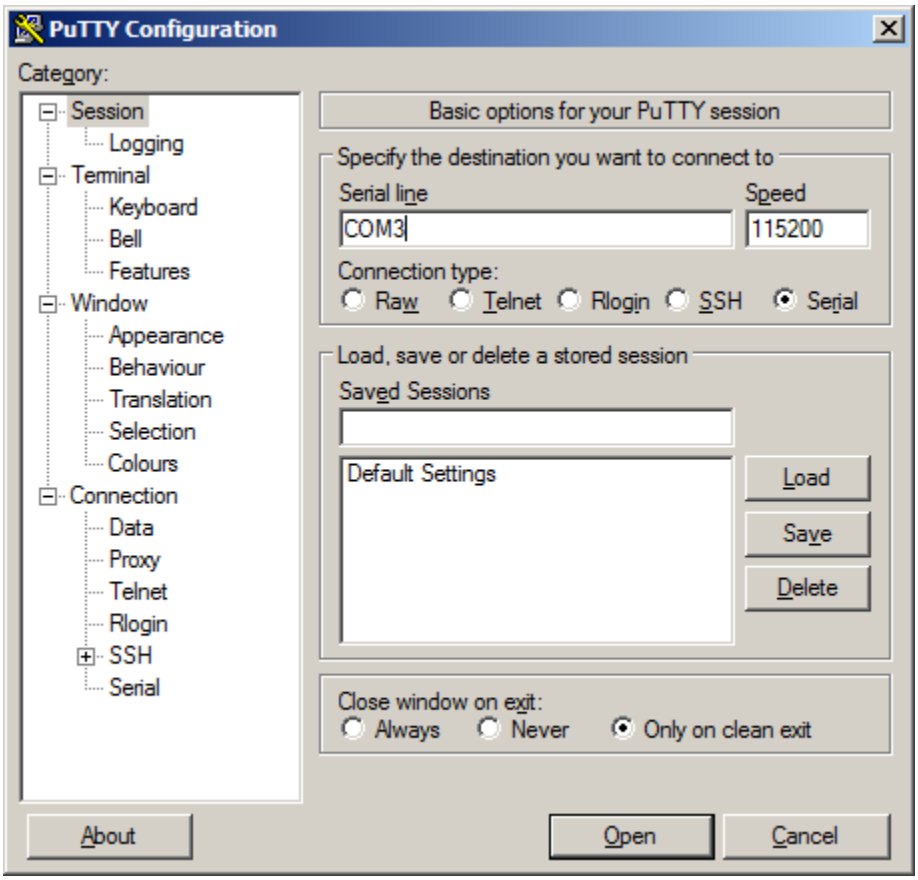


Fig. 1: An example of using PuTTY on Windows

PuTTY on Linux

- Open PuTTY from a terminal by typing `sudo putty`

> **Note:** The `sudo` command will prompt for the local workstation password of the current account.

- Set the **Connection type** to **Serial**
- Set **Serial line** to `/dev/ttyUSB0`
- Set the **Speed** to `115200` bits per second
- Click the **Open** button

PuTTY will then display the console.

Fig. 2: An example of using PuTTY on Linux

GNU screen

In many cases `screen` may be invoked simply by using the proper command line, where `<console-port>` is the console port that was located above.

```
$ sudo screen <console-port> 115200
```

Note: The `sudo` command will prompt for the local workstation password of the current account.

If portions of the text are unreadable but appear to be properly formatted, the most likely culprit is a character encoding mismatch in the terminal. Adding the `-U` parameter to the `screen` command line arguments forces it to use UTF-8 for character encoding:

```
$ sudo screen -U <console-port> 115200
```

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Terminal Settings

The settings to use within the terminal program are:

Speed
`115200` baud, the speed of the BIOS

Data bits
`8`

Parity
None

Stop bits
`1`

Flow Control
Off or XON/OFF.

> **Warning:** Hardware flow control (RTS/CTS) **must** be disabled.

Terminal Optimization

Beyond the required settings there are additional options in terminal programs which will help input behavior and output rendering to ensure the best experience. These settings vary location and client, and may not be available in all clients or terminals.

These are:

Terminal Type
`xterm`

This setting may be under Terminal, Terminal Emulation, or similar areas.

Color Support
ANSI colors / 256 Color / ANSI with 256 Colors

This setting may be under Terminal Emulation, Window Colors, Text, Advanced Terminfo, or similar areas.

Character Set / Character Encoding
`UTF-8`

This setting may be under Terminal Appearance, Window Translation, Advanced International, or similar areas. In GNU screen this is activated by passing the `-U` parameter.

Line Drawing
Look for and enable setting such as “Draw lines graphically”, “Use Unicode graphics characters”, and/or “Use Unicode line drawing code points”.

These settings may be under Terminal Appearance, Window Translation, or similar areas.

Function Keys / Keypad
`Xterm R6`

In Putty this is under **Terminal > Keyboard** and is labeled **The Function Keys and Keypad**.

Font
For the best experience, use a modern monospaced Unicode font such as DejaVu Sans Mono, Liberation Mono, Monaco, Consolas, Fira Code, or similar.

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This setting may be under Terminal Appearance, Window Appearance, Text, or similar areas.

2.1.3 What's Next?

After connecting a terminal client, it may not immediately see any output. This could be because the device has already finished booting, or it may be that the device is waiting for some other input.

If the device does not yet have power applied, plug it in and monitor the terminal output.

If the device is already powered on, try pressing `Space`. If there is still no output, press `Enter`. If the device was booted, it may re-display the console menu or login prompt, or produce other output indicating its status.

From the console, a variety of things are possible, such as changing interface addresses. There is a full explanation of every console menu option in the pfSense software documentation.

2.1.4 Troubleshooting

Serial Device Missing

With a USB serial console there are a few reasons why the serial port may not be present in the client operating system, including:

No Power
Some models require power before the client can connect to the USB serial console.

USB Cable Not Plugged In
For USB consoles, the USB cable may not be fully engaged on both ends. Gently, but firmly, ensure the cable has a good connection on both sides.

Bad USB Cable
Some USB cables are not suitable for use as data cables. For example, some cables are only capable of delivering power for charging devices and not acting as data cables. Others may be of low quality or have poor or worn connectors.

The ideal cable to use is the one that came with the device. Failing that, ensure the cable is of the correct type and specifications, and try multiple cables.

Wrong Device
In some cases there may be multiple serial devices available. Ensure the one used by the serial client is the correct one. Some devices expose multiple ports, so using the incorrect port may lead to no output or unexpected output.

Hardware Failure
There could be a hardware failure preventing the serial console from working. Contact Netgate TAC for assistance.

No Serial Output

If there is no output at all, check the following items:

USB Cable Not Plugged In
For USB consoles, the USB cable may not be fully engaged on both ends. Gently, but firmly, ensure the cable has a good connection on both sides.

Wrong Device
In some cases there may be multiple serial devices available. Ensure the one used by the serial client is the correct one. Some devices expose multiple ports, so using the incorrect port may lead to no output or unexpected output.

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Wrong Terminal Settings
Ensure the terminal program is configured for the correct speed. The default BIOS speed is `115200`, and many other modern operating systems use that speed as well.

Some older operating systems or custom configurations may use slower speeds such as `9600` or `38400`.

Device OS Serial Console Settings
Ensure the operating system is configured for the proper console (e.g. `ttyS1` in Linux). Consult the various operating installation guides on this site for further information.

PuTTY has issues with line drawing

PuTTY generally handles most cases OK but can have issues with line drawing characters on certain platforms.

These settings seem to work best (tested on Windows):

Window

Columns x Rows
`80x24`

Window > Appearance

Font
Courier New 10pt or *Consolas 10pt*

Window > Translation

Remote Character Set
Use font encoding or *UTF-8*

Handling of line drawing characters
Use font in both ANSI and OEM modes or *Use Unicode line drawing code points*

Window > Colours

Indicate bolded text by changing
The colour

Garbled Serial Output

If the serial output appears to be garbled, missing characters, binary, or random characters check the following items:

Flow Control
In some cases flow control can interfere with serial communication, causing dropped characters or other issues. Disabling flow control in the client can potentially correct this problem.

On PuTTY and other GUI clients there is typically a per-session option to disable flow control. In PuTTY, the **Flow Control** option is in the settings tree under **Connection**, then **Serial**.

To disable flow control in GNU Screen, add the `-ixon` and/or `-ixoff` parameters after the serial speed as in the following example:

```
$ sudo screen <console port> 115200,-ixon
```

Terminal Speed
Ensure the terminal program is configured for the correct speed. (See *No Serial Output*)

Character Encoding
Ensure the terminal program is configured for the proper character encoding, such as **UTF-8** or **Latin-1**, depending on the operating system. (See *GNU Screen*)

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Serial Output Stops After the BIOS

If serial output is shown for the BIOS but stops afterward, check the following items:

Terminal Speed
Ensure the terminal program is configured for the correct speed for the installed operating system. (See *No Serial Output*)

Device OS Serial Console Settings
Ensure the installed operating system is configured to activate the serial console and that it is configured for the proper console (e.g. `ttyS1` in Linux). Consult the various operating installation guides on this site for further information.

Bootable Media
If booting from a USB flash drive, ensure that the drive was written correctly and contains a bootable operating system image.

2.2 Reinstalling pfSense Plus Software

This guide uses the Netgate Installer to install pfSense® Plus software on a **Netgate 5100 Desktop** device.

Note: pfSense® Plus is preinstalled on Netgate appliances. It is optimally tuned for Netgate hardware and contains features that cannot be found elsewhere, such as ZFS Boot Environments, OpenVPN DCO, Built-in IPFIX Export, and the AWS VPC Wizard.

2.2.1 Download Installation Media

The Netgate Installer can be downloaded from the Netgate Store using a Netgate Store Account.

See also:

For a more detailed walkthrough of the download process, see Download Installation Media in the pfSense Software Documentation.

The image to download for this device is:

`netgate-installer-amd64.img.gz`

2.2.2 Prepare Installation Media

Next, write the installation image to a USB memstick.

See also:

Locating the image and writing it to a USB memstick is covered in detail under Writing Flash Drives.

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2.2.3 Connect to the Console

The installation process is interactive and utilizes the console. Follow the directions under *Connect to the console* to configure and use the console.

2.2.4 Boot the Installation Media

Insert the memstick into an open USB port and boot the device.

In most cases the BIOS will automatically attempt to boot from USB when starting up. If it does not, check the console for a key to press for a boot menu or to enter the BIOS setup to change boot priorities such that it prefers to boot from USB storage.

2.2.5 Determine Target Drive

During the installation process the installer will prompt to select a target drive. The installer will then write pfSense® Plus to the chosen drive. In most cases a device will have only one potential target drive.

On devices with multiple drives, take care to choose the correct intended target. In some cases a device may have two identical drives which can be used as a mirror in ZFS, so both would be selected. However, certain devices have internal storage (e.g. eMMC) and add-on storage such as SATA, mSATA, M.2 SATA, or NVMe drives. In those cases the correct choice is nearly always the add-on storage.

USB storage devices appear as `daX` where `X` is a device number, such as `da1`. The device number may shift depending on the order in which the OS probes USB devices or the order in which they are inserted while the OS is running.

Note: The installation media is also a USB drive, but the installer does not offer its own disk as a target drive.

2.2.6 Install pfSense Plus Software

The installer will automatically launch and present several options. On Netgate appliances, choosing `Enter` for the default options will complete the installation process in most cases.

Tip: There are options on the Welcome screen of the installer which can recover configuration data from a previous installation or from a USB drive.

See also:

For a complete walkthrough of the installation process, see Installation Walkthrough.

When the installation is complete, remove the USB drive from the USB port.

Important: If the USB drive remains attached, the device may boot into the installer again.

See also:

For information on restoring from a previously saved configuration, go to Backup and Restore.

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Caution: If this device contains multiple disks, such as when adding an SSD to an existing system which previously used MMC, additional steps may be necessary to ensure the device boots from and uses the correct disk. Furthermore, having separate installations of the software on different disks is a known source of problems. For example, the kernel could boot from one disk while the root filesystem is loaded from another, or they could contain conflicting ZFS pools.

In some cases it is possible to adjust the BIOS boot order to prefer the new disk, but the best practice is to wipe the old disk to remove any chance of the previous installation causing boot issues or conflicts.

For information on how to wipe the old disk, see Multiple Disk Boot Issues.

2.3 M.2 SATA Installation

The XG-5100 Desktop has 8 GB of onboard eMMC storage. Optionally, an M.2 SATA drive can be installed as an upgrade or to bypass the onboard eMMC flash memory.

Warning: Before proceeding:

1. Backup the configuration file, if possible.
2. Unplug the system for at least 60 seconds to ensure all phantom power has dissipated.
3. Anti-static protection must be used throughout this procedure.
4. Any hardware damage incurred during this procedure is **not covered** by the hardware warranty.

Note: By default, the M.2 SATA drive will be the first drive recognized by the Netgate® device. pfSense® Plus must be reinstalled on the M.2 SATA drive.

Note: The SG-5100 is **not** compatible with NVMe drives.

Note: The standoff for the M.2 SATA drive is not populated with a screw. A **Standard M3 x 0.5 4mm Long Pan Head Screw** can be used to secure the M.2 SATA drive in place.

The M.2 SATA slot is located underneath a large heatsink/drive carrier, so the entire heatsink must be removed. The standoff is for the 2242 (22mm x 42mm) M.2 SATA drive.

1. Remove the three (3) screws from both sides of the SG-5100 (6 screws total) as shown below.
2. Turn the system over carefully to avoid scratching the top of the appliance. Remove the two (2) screws as indicated below.
3. Remove the cover.
4. Remove the four (4) heatsink screws as indicated.
5. Gently lift the heatsink away from the memory as shown and remove it. Be careful of the thermal transfer pad above the memory and connecting the heatsink to the chassis

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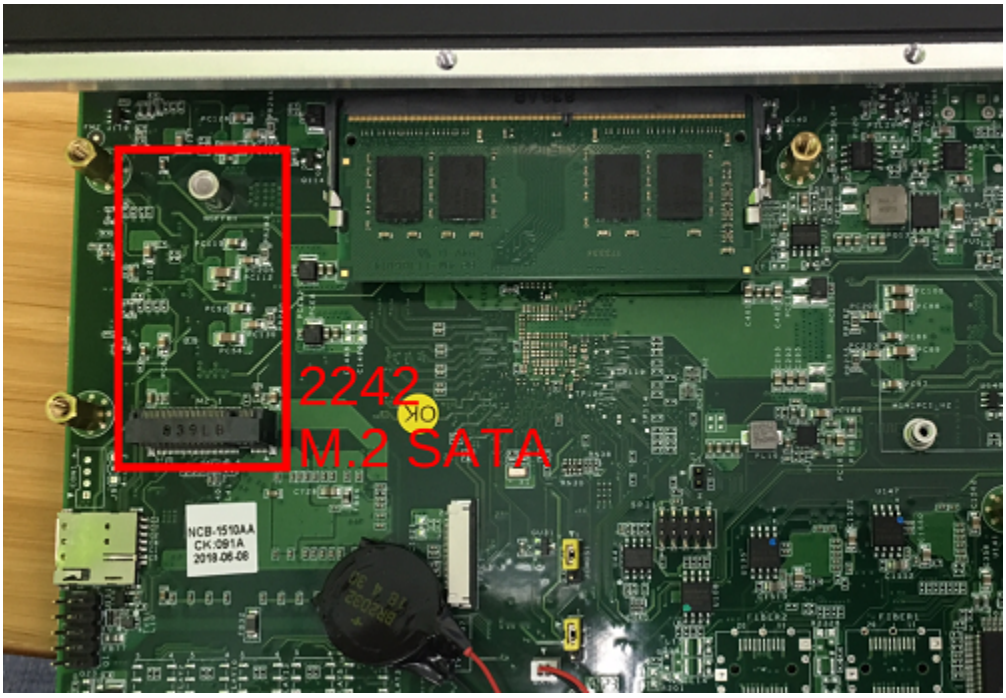

Fig. 3: M.2 SATA Location

Fig. 4: Remove Three (3) Case Screws from Both Sides

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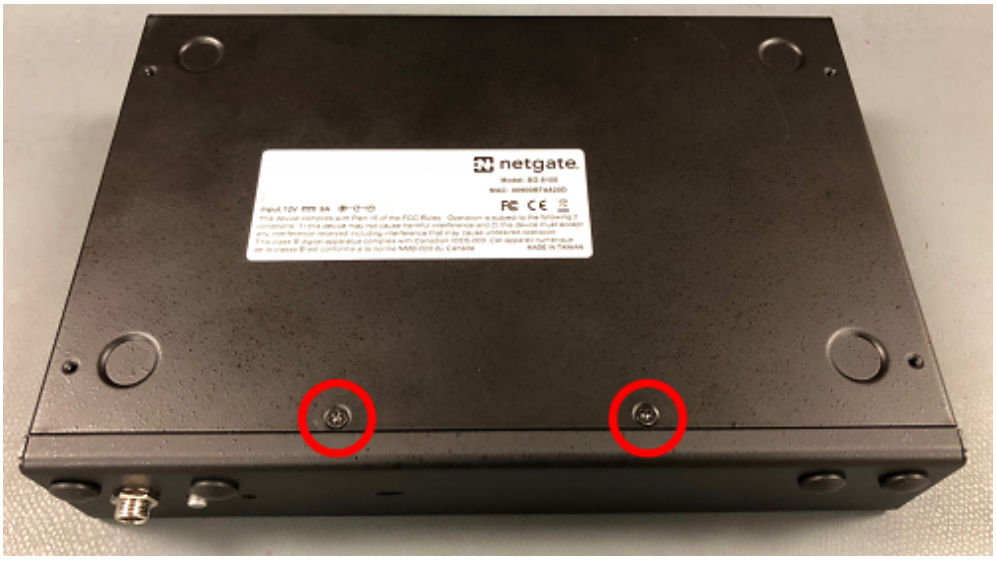

Fig. 5: Remove the Bottom Screws

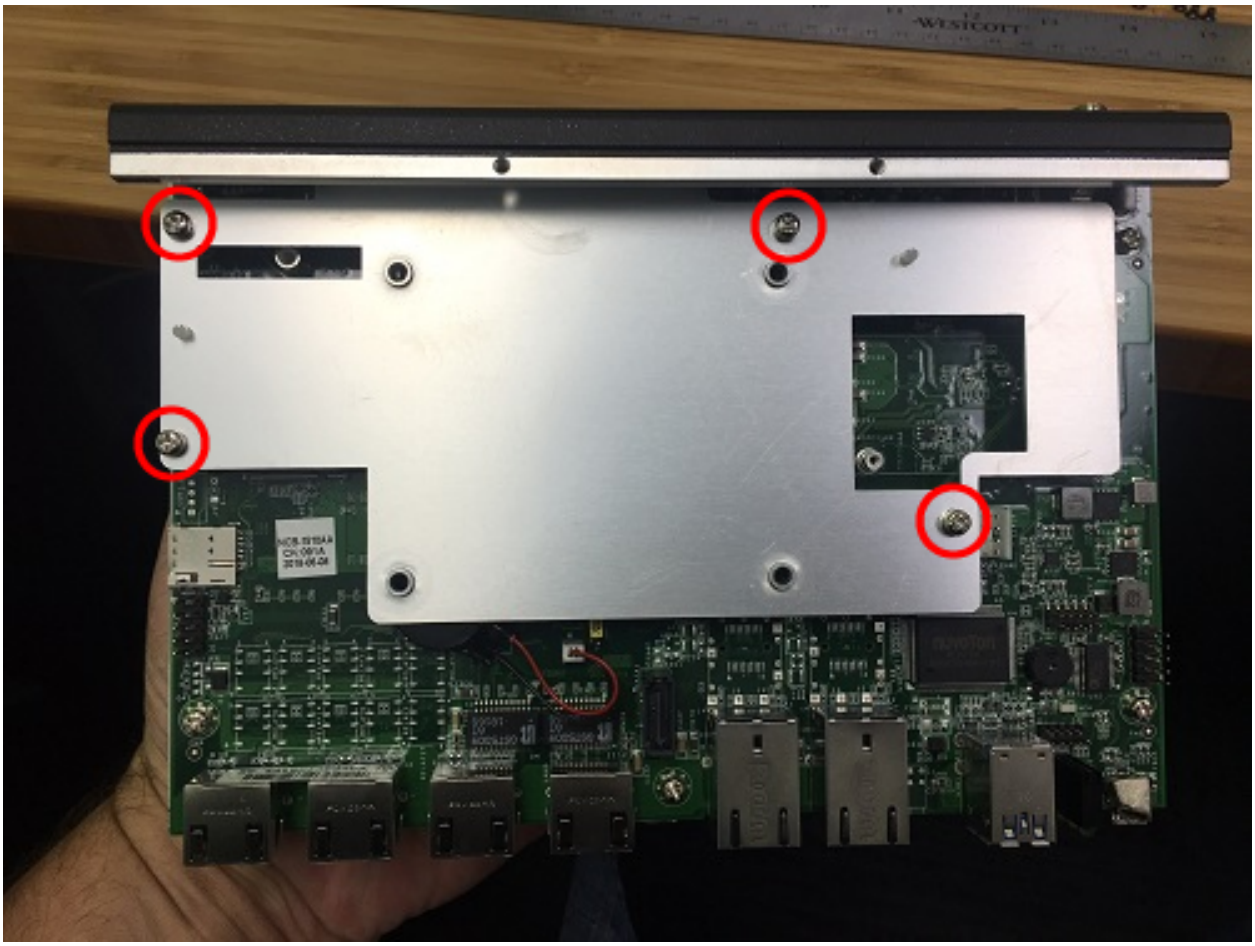

Fig. 6: Remove the heat sink Screws

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Fig. 7: Note the Memory Thermal Transfer Pad

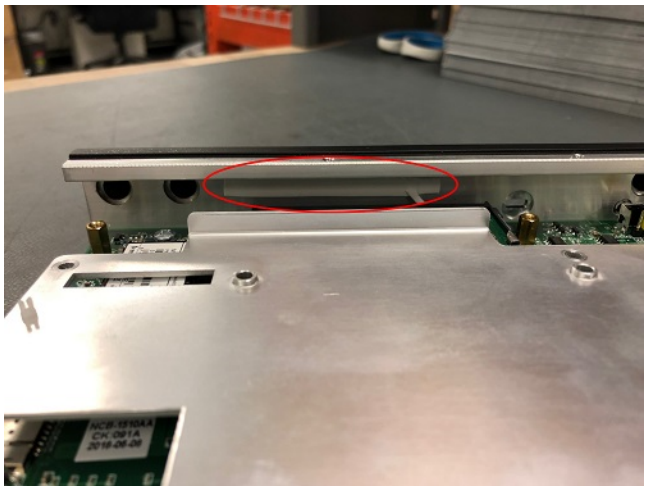

Fig. 8: Note the Chassis Thermal Transfer Pad

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> **Warning:** Be sure to replace these thermal pads if they come off during the upgrade process.

6. Insert the M.2 SATA drive into the slot at about a 30° angle.

> **Warning:** The M.2 SATA card is keyed. Do not force it into the slot.

7. Gently push down the M.2 SATA card and place the screw into the standoff.
8. Locate the Thermal Pads that came with the SG-5100. There will be two (2) in a plastic bag. This procedure uses the **larger** of the two pads.
9. The Thermal Pad has film on both sides. One side is shiny and is sticky. The shiny side will stick the heatsink. The non-shiny side is "tacky", but not sticky. The tacky side will go to the M.2 SATA drive.
10. The Thermal Pad will attach to the large aluminum heatsink.
11. Remove the shiny film from the Thermal Pad and stick it to the heatsink as shown. Try to center it on the cutout, but it doesn't need to be exact.
12. Remove the film from the non-sticky side of the Thermal Pad.
13. Replace the heatsink as shown. Replace the four (4) screws securing the heatsink in place.
14. Replace the system cover and screws.
15. Reinstall the pfSense® Plus software on the new M.2 SATA drive.

    See also:

    Reinstalling pfSense Plus Software

1. Restore the configuration backup if one is available.

See also:

For information on restoring from a previously saved configuration, see Backup and Restore.

Tip: If the new drive is compatible with S.M.A.R.T. it may be possible to view detailed drive status information and run tests from **Diagnostics > S.M.A.R.T. Status**.

See S.M.A.R.T. Hard Disk Status for details.

2.4 Configuring an OPT interface as an additional WAN

Note: The default configuration has the `ix` ports assigned as OPT ports.

This guide configures an OPT port as an additional WAN type interface. These interfaces connect to upstream networks providing connectivity to the Internet or other remote destinations.

See also:

Multi-WAN documentation

Fig. 9: Insert the M.2 SATA Drive at about a 30° Angle

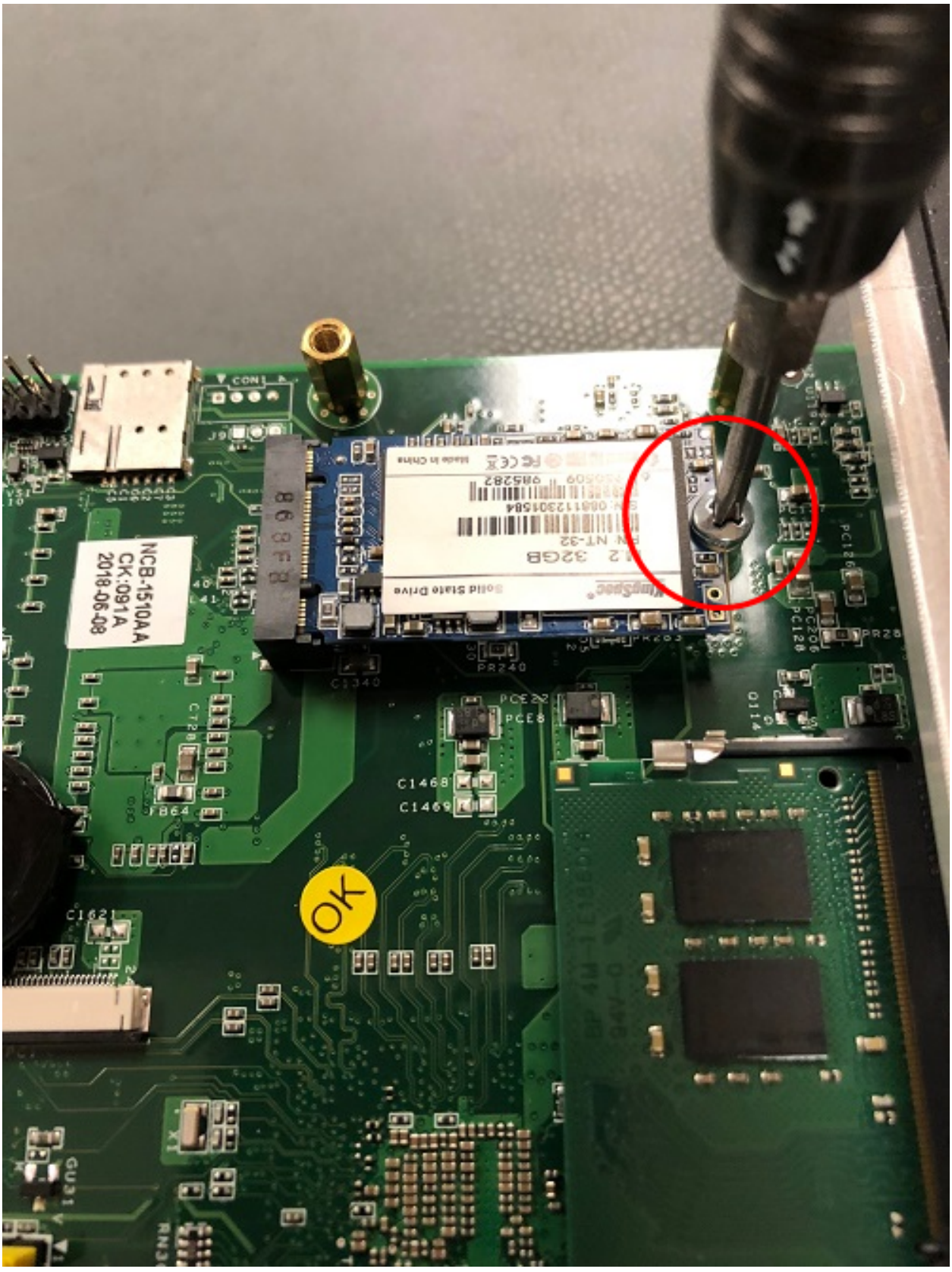

Fig. 10: Secure the M.2 SATA Drive

Fig. 11: Thermal Pads that come with the SG-5100

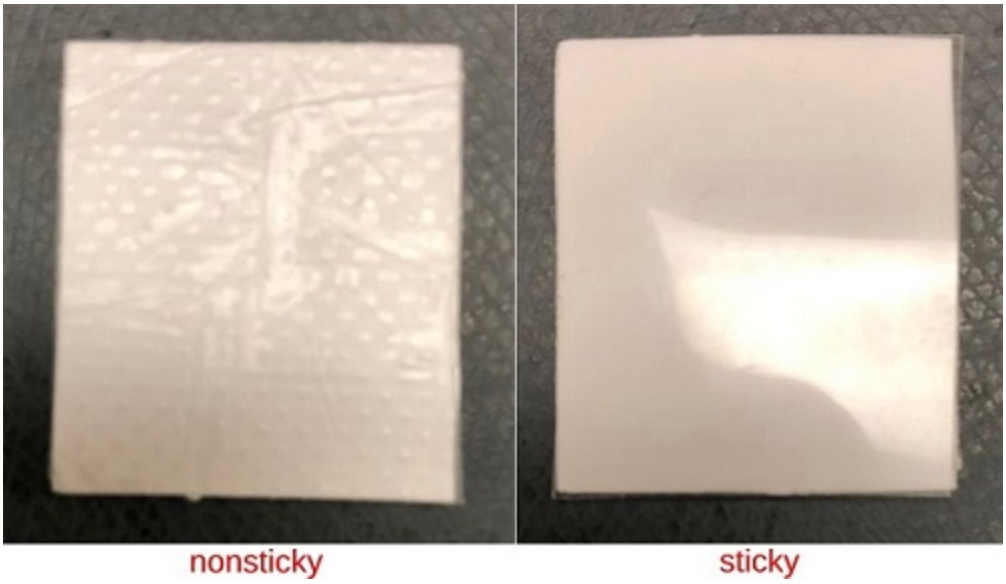

Fig. 12: Both Sides of the Thermal Pads

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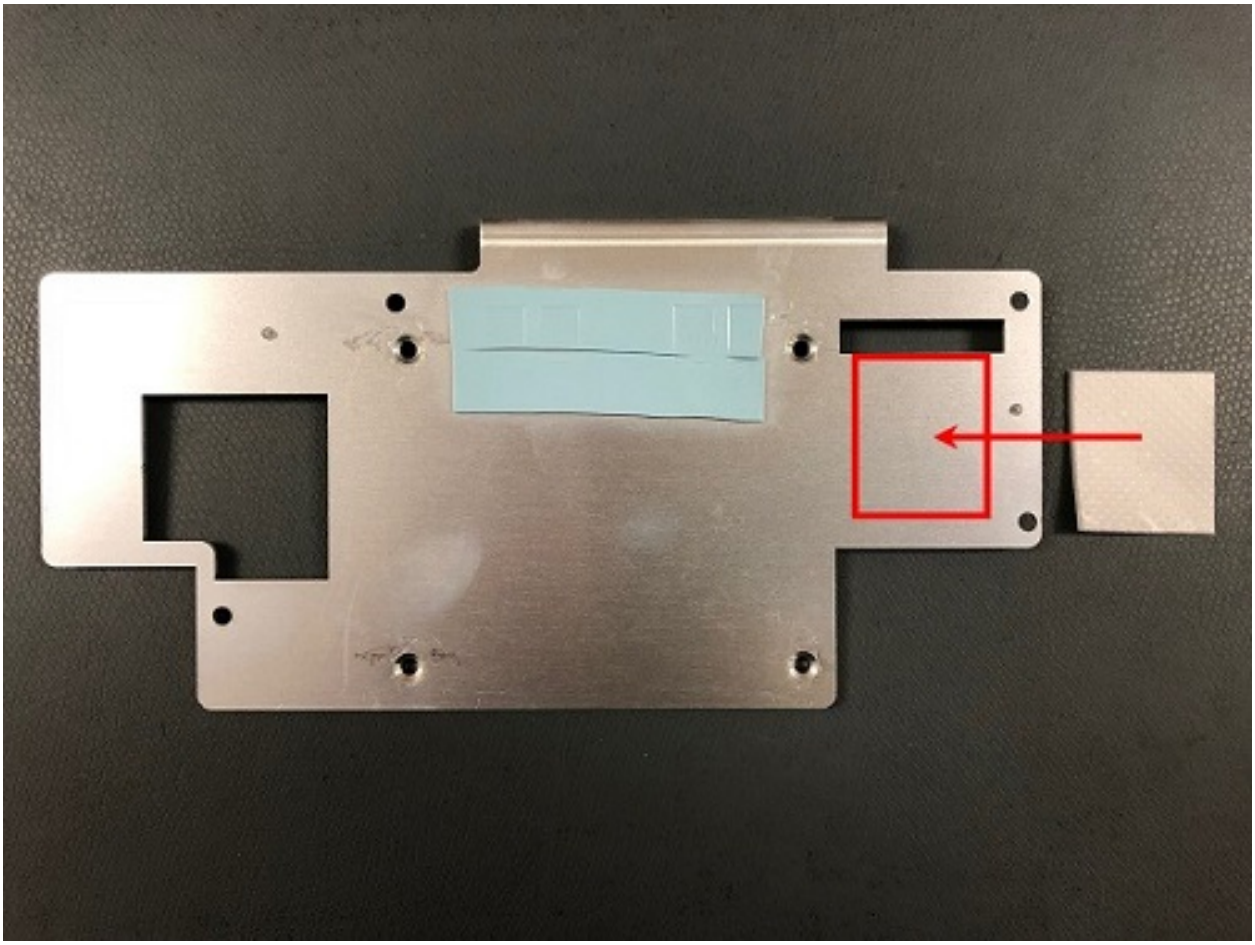

Fig. 13: Thermal Pads that come with the SG-5100

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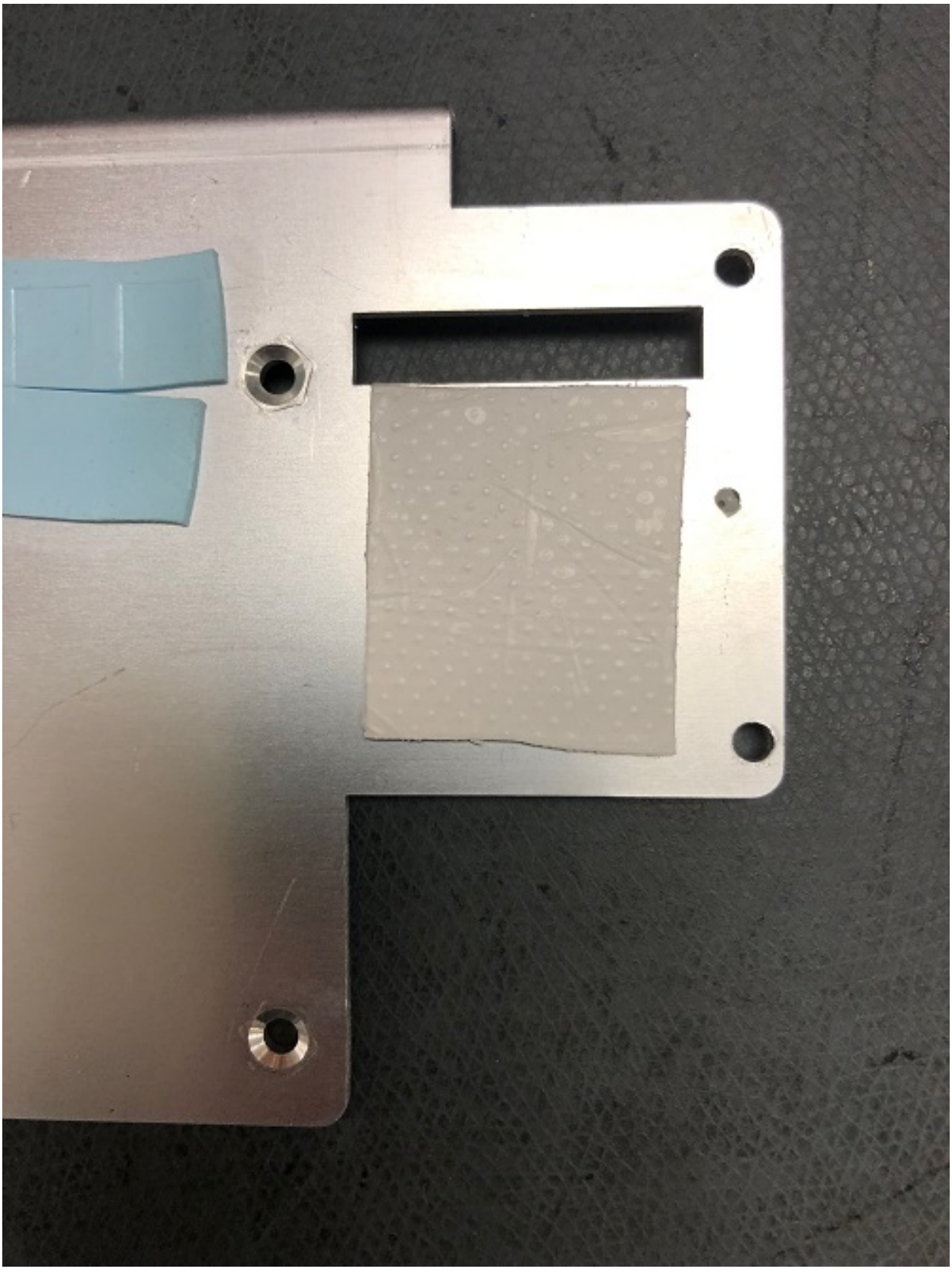

Fig. 14: Stick the Thermal Pad to the heat sink

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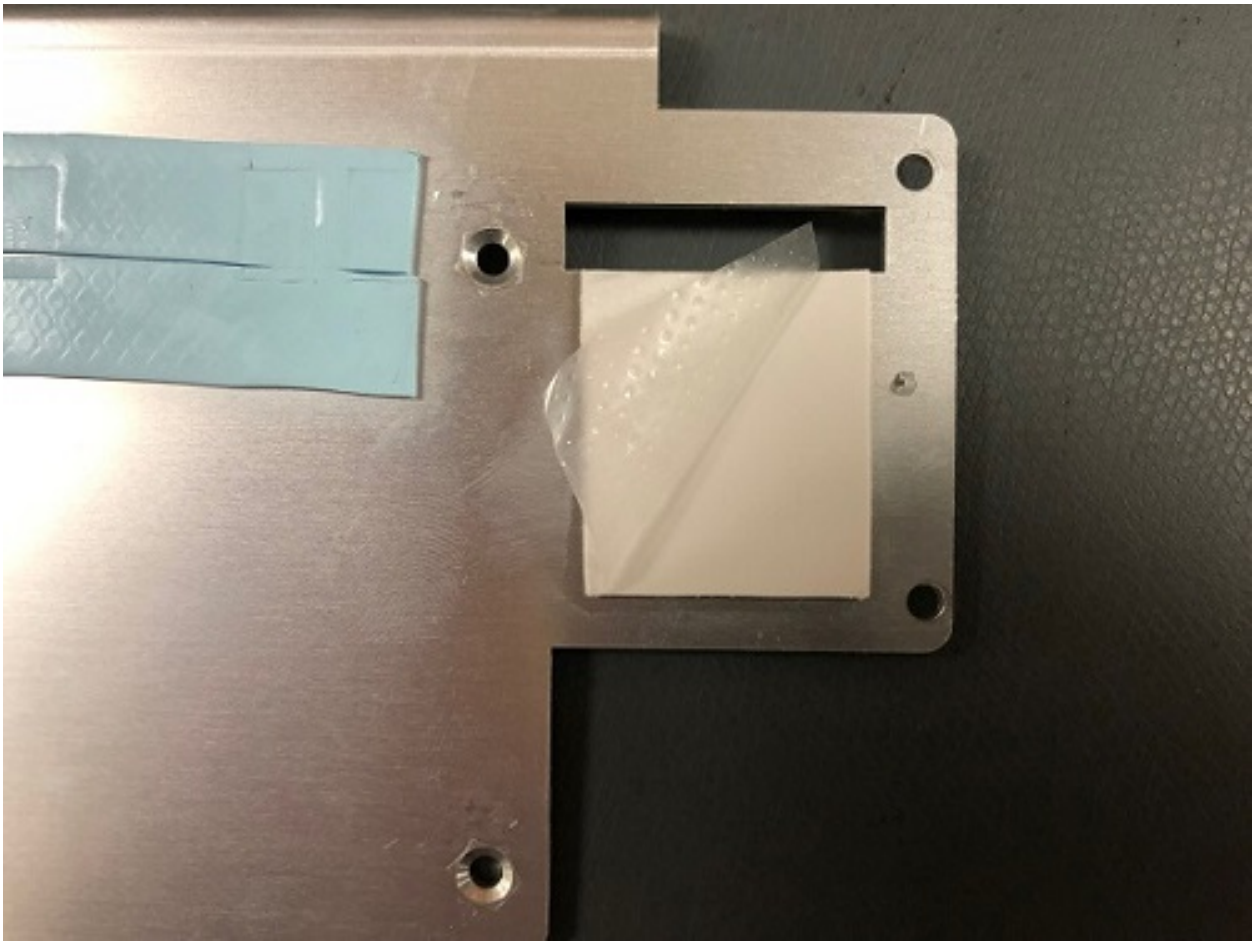

Fig. 15: Stick the Thermal Pad to the heat sink

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Fig. 16: Replace the heat sink

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Configuring an additional WAN

- *Requirements*
- *Assign the Interface*
- *Interface Configuration*
- *Outbound NAT*
  - *Automatic or Hybrid Outbound NAT*
  - *Manual Outbound NAT*
- *Firewall Rules*
- *Gateway Groups*
- *DNS*
- *Setup Policy Routing*
- *Dynamic DNS*
- *VPN Considerations*
- *Testing*

2.4.1 Requirements

- This guide assumes the underlying interface is already present (e.g. physical port, VLAN, etc.).
- The WAN configuration type and settings must be known before starting. For example, this might be an IP address, subnet mask, and gateway value for static addresses or credentials for PPPoE.

2.4.2 Assign the Interface

- Navigate to **Interfaces > Assignments**

  Look at list of current assignments. If the interface in question is already assigned, there is nothing to do. Skip ahead to the interface configuration.

- Pick an available interface in **Available network ports**

  If there are no available interfaces, then one may need to be created first (e.g. VLANs).

- Click **Add**

The firewall will assign the next available OPT interface number corresponding to the internal interface designation. For example, if there are no current OPT interfaces, the new interface will be **OPT1**. The next will be **OPT2**, and so on.

Note: As this guide does not know what that number will be on a given configuration, it will refer to the interface generically as **OPTx** and the customized name **WAN2**.

The newly assigned interface will have its own entry under the **Interfaces** menu and elsewhere in the GUI.

2.4.3 Interface Configuration

The new interface must be enabled and configured.

- Navigate to **Interfaces > OPTx**
- Check **Enable interface**
- Set custom name in the **Description**, e.g. `WAN2`
- Set IP address and CIDR for static, or DHCP/PPPoE/etc.

  See also:

  IPv4 Configuration Types

- Create a Gateway if this is a static IP address WAN:
  - Click **Add a New Gateway**
  - Configure the gateway as follows:

    Default
    Check if this new WAN should be the default gateway.

    Gateway Name
    Name it the same as the interface (e.g. `WAN2`), or a variation thereof.

    Gateway IPv4
    The IPv4 address of the gateway inside the same subnet.

    Description
    Optional text describing the purpose of the gateway.

  - Click **Add**
  - Ensure the new gateway is selected as the **IPv4 Upstream Gateway**
- Check **Block private networks**

  This will block private network traffic on the interface, though if the firewall rules for this WAN are not permissive, this may be unnecessary.
- Check **Block bogon networks**

  This will traffic from bogus or unassigned networks on the interface, though if the firewall rules for this WAN are not permissive, this may be unnecessary.
- Click **Save**
- Click **Apply Changes**

The presence of a selected gateway in the interface configuration causes the firewall to treat the interface as a *WAN type* interface. This is manual for static configurations, as above, but is automatic for dynamic WANs (e.g. DHCP, PPPoE).

The firewall applies outbound NAT to traffic exiting WAN type interfaces but does not use WAN type interface networks as a source for outbound NAT on other interfaces. Firewall rules on WAN type interfaces get `reply-to` added to ensure traffic entering a WAN exits the same WAN, and traffic exiting the interface is nudged toward its gateway. The DNS Resolver will not accept queries from clients on WAN type interfaces without manual ACL entries.

See also:

Interface Configuration

2.4.4 Outbound NAT

For clients on local interfaces to reach the Internet from private addresses to destinations through this WAN, the firewall must apply Outbound NAT on traffic leaving this new WAN.

- Navigate to **Firewall > NAT**, **Outbound** tab
- Check the current outbound NAT mode and follow the section below which matches the mode.

Automatic or Hybrid Outbound NAT

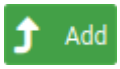
If the mode is set to **Automatic** or **Hybrid**, then this may not need further configuration.

Ensure there are rules for the new WAN listed as an **Interface** in the **Automatic Rules** at the bottom of the page. If so, skip ahead to the next section to configure Firewall Rules.

Manual Outbound NAT

If the mode is set to **Manual**, create a new rule or set of rules to cover the new WAN.

If there are existing rules in the **Mappings** table, they can be copied and adjusted to use the new WAN. Otherwise, create them manually:

- Click 

to add a new rule at the top of the list.
- Configure the rule as follows:

  Interface
  Choose the new WAN interface (e.g. **WAN2**)

  Address Family
  IPv4

  Protocol
  Any

  Source
  Either choose *LAN Subnets*, which will automatically reference any networks on the LAN interface, or choose *Network or Alias* and manually fill in the LAN subnet, e.g. `192.168.1.0/24`.

  If there are multiple local networks, create rules for each or use other methods such as aliases or CIDR summarization to cover them all.

  Destination
  Any

  Translation Address
  WAN2 Address (or the custom name of the new WAN interface)

  Description
  Text describing the rule, e.g. `LAN outbound on WAN2`

- Click **Save**
- Click **Apply Changes**

Repeat as needed for additional local networks.

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2.4.5 Firewall Rules

By default, there are no rules on the new interface, so the firewall will block all traffic. This is ideal for a WAN, so is safe to leave as-is. Adding services on the new WAN, such as VPNs, may require rules, but those should be handled on a case-by-case basis.

Warning: **Do not** add any blanket "allow all" style rules on any WAN.

2.4.6 Gateway Groups

Gateway Groups do not control traffic directly, but can be used in other places, such as firewall rules and service bindings, to influence how those areas use gateways.

For most scenarios it helps to create three gateway groups to start with: `PreferWAN`, `PreferWAN2`, and `LoadBalance`:

- Navigate to **System > Routing**, **Gateway Groups** tab
- Click **Add** to create a new gateway group
- Configure the group as follows:

  Group Name
  `PreferWAN`

  Gateway Priority
  Gateway for WAN on **Tier 1**, Gateway for WAN2 on **Tier 2**

  Description
  `Prefer WAN, fail to WAN2`

- Click **Save**
- Click **Add** to create another gateway group
- Configure the group as follows:

  Group Name
  `PreferWAN2`

  Gateway Priority
  Gateway for WAN on **Tier 2**, Gateway for WAN2 on **Tier 1**

  Description
  `Prefer WAN2, fail to WAN`

- Click **Save**
- Click **Add** to create another gateway group
- Configure the group as follows:

  Group Name
  `LoadBalance`

  Gateway Priority
  Gateways for WAN and WAN2 both on **Tier 1**

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Description
Load Balance Connections on WAN and WAN2

Note: Rules using this group enable connection-based load balancing, not per-packet load balancing.

Rules using this group will also have failover style behavior as WANs which are down are removed from load balancing.

- Click **Save**
- Click **Apply Changes**

Now set the default gateway to a failover group:

- Navigate to **System > Routing**, **Gateways** tab
- Set **Default gateway IPv4** to *PreferWAN*
- Click **Save**
- Click **Apply Changes**

Note: This is important for failover from the firewall itself so it always has outbound access. While this also enables basic failover for client traffic, it's better to use policy routing rules to control client traffic behavior.

2.4.7 DNS

DNS is critical for Internet access, and it is important to ensure the firewall can always resolve hostnames using DNS even when running on a secondary WAN.

The needs here depend upon the configuration of the DNS Resolver or Forwarder.

If the DNS Resolver is in its default resolver mode, then default gateway switching will be sufficient to handle failover in most cases, though it may not be as reliable as using forwarding mode.

If the DNS Resolver is in forwarding mode or the firewall is using the DNS Forwarder instead, then maintaining functional DNS requires manually configuring gateways for forwarding DNS servers.

- Navigate to **System > General Setup**
- Add at least one DNS server for each WAN in the **DNS Server Settings** section, ideally two or more. Click **Add DNS Server** to create additional rows.

  Each entry should be configured as follows:

  Address
  The IP address of a DNS server.

  Each server address **must be unique**, the same server **cannot** be listed more than once.

  DNS Hostname
  Leave this field blank unless the server will be contacted using DNS over TLS through the DNS Resolver. In this case, enter the FQDN of the DNS server, so its name can be validated against its TLS certificate.

  Gateway
  Select a gateway for each DNS server, corresponding to the WAN through which the firewall can reach the DNS server.

For public DNS servers such as CloudFlare or Google, either WAN is OK, but if either WAN uses DNS servers from a specific ISP, ensure those exit the appropriate WAN.

Note: If the gateway drop-down does not appear next to each DNS server, then the firewall does not have more than one gateway configured for any address family. Double-check the gateway settings for all WAN interfaces.

- Uncheck **DNS Server Override**

  This will tell the firewall to use the DNS servers entered on this page and to ignore servers provided by dynamic WANs such as DHCP or PPPoE. Occasionally these providers may push conflicting DNS server information, so the best practice is to assign the DNS servers manually.

- Click **Save**

Note: If the DNS Resolver has specific outgoing interfaces selected in its configuration, select the new WAN there well as well.

2.4.8 Setup Policy Routing

Policy routing involves setting a gateway on firewall rules which direct matching traffic out specific WANs or failover groups.

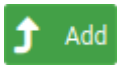
In simple cases (one LAN, no VPNs) the only requirement to configure policy routing is to add a gateway to existing rules.

- Navigate to **Firewall > Rules**, **LAN** tab
- Edit the default pass rule for the LAN
- Click **Display Advanced**
- Set the **Gateway** to one of the gateway groups based on the desired LAN client behavior.

  For example, pick *PreferWAN*, so clients use WAN and then if WAN fails, they use WAN2.

- Click **Save**
- Click **Apply Changes**

If there are other local networks or VPNs which clients on LAN must reach, add rules **above** the default pass rules to pass local traffic without a gateway set:

- Navigate to **Firewall > Rules**, **LAN** tab
- Click 

to add a new rule at the **top** of the list
- Configure the rule as follows:

  Action
  Pass

  Interface
  LAN

  Protocol
  Any

Source
LAN subnets

Destination
The other local subnet, VPN network, or an alias of such networks.

Description
`Pass to local and VPN networks`

Do not set a gateway on this rule.

- Click **Save**
- Click **Apply Changes**

2.4.9 Dynamic DNS

Dynamic DNS provides several benefits for multiple WANs, particularly with VPNs. If the firewall does not already have one or more Dynamic DNS hostnames configured, consider signing up with a provider and creating one or more.

It is a good practice to have a separate DNS entry for each WAN and a shared entry for failover, or one per failover group. If that is not viable, at least have one for the most common needs.

The particulars of configuring Dynamic DNS entries vary by provider and are beyond the scope of this document.

2.4.10 VPN Considerations

IPsec can use a gateway group as an as interface, but needs a dynamic DNS hostname as companion. The remote peer would need to use the Dynamic DNS hostname as the peer address of this firewall instead of an IP address. Because this relies on DNS, failover can be slow.

WireGuard does not bind to an interface, but can work with Multi-WAN. It will respond from WAN2 if client contacts WAN2, but when initiating it will always use the current default gateway. Static routes can nudge traffic for a specific peer out a specific WAN.

OpenVPN can use a gateway group as an interface for clients or servers. Client behavior is OK and should match default failover behavior configured on the group. For servers, it is better to bind the server to localhost and use port forwards from each WAN to localhost. Remote clients can then have multiple remote entries and contact each WAN as needed at any time.

2.4.11 Testing

Methods for testing depend on the type of WANs and gateway groups in use.

- For most WANs, a better test is to unplug the **upstream** connection from the ISP Customer Premise Equipment (CPE). This more accurately simulates a typical type of upstream connectivity failure. Do not power off the CPE or unplug the connection between the firewall and the CPE. While this may work, it's a much less common scenario and can behave differently.
- For testing load balancing, use cURL or multiple browsers/sessions when checking the IP address multiple times. Refreshing the same browser window will reuse a connection to the server and is not helpful for testing connection-based load balancing.

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2.5 Configuring an OPT interface as an additional LAN

Note: The default configuration has the `ix` ports assigned as OPT ports.

This guide configures an OPT port as an additional LAN type interface. These local interfaces can perform a variety of tasks, such as being a guest network, DMZ, IOT isolation, wireless segment, lab network, and more.

Configuring an additional LAN

- *Requirements*
- *Assign the Interface*
- *Interface Configuration*
- *DHCP Server*
- *Outbound NAT*
  - *Automatic or Hybrid Outbound NAT*
  - *Manual Outbound NAT*
- *Firewall Rules*
  - *Open*
  - *Isolated*
- *Other Services*

2.5.1 Requirements

- This guide assumes the underlying interface is already present (e.g. physical port, VLAN, etc.).
- Choose a new local subnet to use for the additional LAN type interface. This example uses `192.168.2.0/24`.

2.5.2 Assign the Interface

The first step is to assign an OPT interface.

- Navigate to **Interfaces > Assignments**

  Look at list of current assignments. If the interface in question is already assigned, there is nothing to do. Skip ahead to the interface configuration.

- Pick an available interface in **Available network ports**

  If there are no available interfaces, then one may need to be created first (e.g. VLANs).

- Click **Add**

The firewall will assign the next available OPT interface number corresponding to the internal interface designation. For example, if there are no current OPT interfaces, the new interface will be **OPT1**. The next will be **OPT2**, and so on.

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Note: As this guide does not know what that number will be on a given configuration, it will refer to the interface generically as **OPTx**.

The newly assigned interface will have its own entry under the **Interfaces** menu and elsewhere in the GUI.

2.5.3 Interface Configuration

The new interface must be enabled and configured.

- Navigate to **Interfaces > OPTx**
- Check **Enable interface**
- Set custom name in the **Description**, e.g. `GUESTS`, `DMZ`, etc.
- Set the **IPv4 Address** and CIDR mask for the new LAN

  For this example, `192.168.2.1/24`.
- **Do not** add or choose an **IPv4 Upstream gateway**
- Uncheck **Block private networks**

  This interface is a private network, this option would prevent it from functioning.
- Uncheck **Block bogon networks**

  The rules on this interface should only allow traffic from the subnet on the interface, making this option unnecessary.
- Click **Save**
- Click **Apply Changes**

The lack of a selected gateway in the interface configuration causes the firewall to treat the interface as a *LAN type* interface.

The firewall uses LAN type interfaces as sources of outbound NAT traffic but does not apply outbound NAT on traffic exiting a LAN. The firewall does not add any extra properties on firewall rules to influence traffic behavior. The DNS Resolver will accept queries from clients on LAN type interfaces.

See also:

Interface Configuration

2.5.4 DHCP Server

Next, configure DHCP service for this local interface. This is a convenient and easy way assign addresses for clients on the interface, but is optional if clients will be statically addressed instead.

This configuration varies slightly depending on the DHCP server and version.

See also:

DHCPv4 Configuration

- Navigate to **Services > DHCP Server**, **OPTx** tab (or the custom name)
- Check **Enable**

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- Configure the **Address Pool Range**, e.g. from `192.168.2.100` to `192.168.2.199`

  This sets the lower (**From**) and upper (**To**) bound of automatic addresses assigned to clients.
- The rest of the settings can be left at defaults
- Click **Save**

2.5.5 Outbound NAT

For clients on this interface to reach the Internet from private addresses, the firewall must apply Outbound NAT for the new subnet.

- Navigate to **Firewall > NAT**, **Outbound** tab
- Check the current outbound NAT mode and follow the section below which matches the mode.

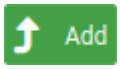
Automatic or Hybrid Outbound NAT

If the mode is set to **Automatic** or **Hybrid**, then this likely does not need further configuration.

Ensure the new LAN subnet is listed as a **Source** in the **Automatic Rules** at the bottom of the page. If so, skip ahead to the next section to configure Firewall Rules.

Manual Outbound NAT

If the mode is set to **Manual**, create a new rule or set of rules to cover the new subnet.

- Click 

to add a new rule at the top of the list
- Configure the rule as follows:

  Interface
  Choose the WAN interface. If there is more than one WAN interface, add separate rules for each WAN interface.

  Address Family
  IPv4

  Protocol
  Any

  Source
  Either choose *OPTx Subnets*, which will automatically reference the new interface, or choose *Network or Alias* and manually fill in the new subnet, e.g. `192.168.2.0/24`.

  Destination
  Any

  Translation Address
  WAN Address (or the customized name matching the WAN/egress interface)

  Description
  Text describing the rule, e.g. `Guest LAN outbound on WAN`
- Click **Save**
- Click **Apply Changes**

Alternately, clone existing NAT rules and adjust as needed to match the new LAN.

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2.5.6 Firewall Rules

By default, there are no firewall rules on the new interface, so the firewall will block all traffic. This is not ideal for a LAN as generally speaking, the clients on this LAN will need to contact hosts through the firewall.

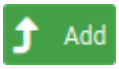
Rules for this interface can be found under **Firewall > Rules**, on the **OPTx** tab (or the custom name, e.g. **GUESTS**).

There are two common scenarios administrators typically choose for local interfaces: Open and Isolated

Open

On an open LAN, hosts in that LAN are free to contact any other host through the firewall. This might be a host on the Internet, across a VPN, or on another local LAN.

In this case a simple "allow all" style rule for the interface will suffice.

- Navigate to **Firewall > Rules**, on the **OPTx** tab (or the custom name)
- Click 

to add a new rule at the top of the list
- Configure the rule as follows:

  Action
  Pass

  Interface
  OPTx (or the custom name) should already be set by default

  Protocol
  Any

  Source
  OPTx subnets (or the custom name)

  Destination
  Any

  Description
  Text describing the rule, e.g. `Default allow all from OPTx`

- Click **Save**
- Click **Apply Changes**

Isolated

In an isolated local network, hosts on the network cannot contact hosts on other networks unless explicitly allowed in the rules. Hosts can still contact the Internet as needed in this example, but that can also be restricted with additional rules.

This scenario is common for locked down networks such as for IOT devices, a DMZ with public services, untrusted Guest/BYOD networks, and other similar scenarios.

> **Warning:** A full set of reject rules as described in this example is the best practice. Do not rely on shortcuts such as using policy routing to isolate clients.

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Create a Private Networks Alias

Create an alias using all RFC 1918 networks (listed in the example below) or at least an alias containing the local/private networks on this firewall, such as VPNs. Using all RFC 1918 networks is a safer practice.

- Navigate to **Firewall > Aliases**
- Click **Add**
- Configure the alias as follows:

  Name
  `PrivateNets`

  Description
  `Private Networks`

  Type
  Network(s)

- Add entries for:
  - `192.168.0.0/16`
  - `172.16.0.0/12`
  - `10.0.0.0/8`
- Click **Save**

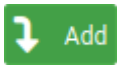
Add Firewall Rules

With the alias in place, the next task is to create firewall rules for the interface.

- Navigate to **Firewall > Rules**, on the **OPTx** tab (or the custom name)

Allow DNS

Add rule to allow DNS requests from local clients to the firewall itself or other DNS servers.

- Click 

to add a new rule at the bottom of the list.
- Configure the rule as follows:

  Action
  Pass

  Interface
  OPTx (or the custom name)

  Protocol
  TCP/UDP

  Source
  OPTx subnets (or the custom name)

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Destination
This Firewall (self)

If clients are configured to query DNS servers other than this firewall, create rules using those as the destination instead.

Destination Port Range
Select the *DNS (53)* entry or choose *Other* and manually enter `53`

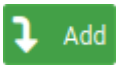
To allow DNS over TLS, create a separate rule using the *DNS over TLS* entry or manually enter port `853`.

Description
Text describing the rule, e.g. `Allow clients to resolve DNS through the firewall`

- Click **Save**

Allow ICMP to the Firewall

Add a rule to allow ICMP traffic from local devices to the firewall.

- Click 

to add a new rule at the bottom of the list.
- Configure the rule as follows:

Action
Pass

Interface
OPTx (or the custom name)

Protocol
ICMP

ICMP Subtype
Any

Tip: While ICMP is useful, some network administrators prefer to limit the allowed ICMP types to *Echo Request* only. This allows devices to use ICMP ping for diagnostic purposes, but no other types of ICMP traffic.

Source
OPTx subnets (or the custom name)

Destination
This Firewall (self)

Description
`Allow client ICMP to the firewall`

- Click **Save**

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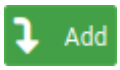
Reject Other Firewall-bound Traffic

Add rule to reject any other traffic to the firewall to ensure users on this interface cannot connect to management services such as the GUI, SSH, and so on.

- Click 

to add a new rule at the bottom of the list.
- Configure the rule as follows:

  Action
  Reject

  Interface
  OPTx (or the custom name)

  Protocol
  Any

  Source
  Any

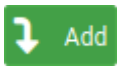
  Destination
  This Firewall (self)

  Description
  `Reject all other traffic to the firewall`

- Click **Save**

Reject Private Traffic

Add rule to reject traffic from this network to all other private networks.

- Click 

to add a new rule at the bottom of the list.
- Configure the rule as follows:

  Action
  Reject

  Interface
  OPTx (or the custom name)

  Protocol
  Any

  Source
  Any

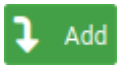
  Destination
  Address or Alias, `PrivateNets` (the alias created earlier)

  Description
  `Reject all other traffic to private networks`

- Click **Save**

Allow Other Traffic

Add rule to allow traffic from this interface network to any other destination, which enables clients on this interface to reach the Internet and/or other remote public networks.

- Click 

to add a new rule at the bottom of the list.
- Configure the rule as follows:

  Action
  Pass

  Interface
  OPTx (or the custom name)

  Protocol
  Any

  Source
  OPTx subnets (or the custom name)

  Destination
  Any

  Description
  `Default allow all from OPTx`

- Click **Save**

Apply Changes

With the rules all in place, click **Apply Changes** to finish and activate the new rules.

The rules should look similar to the following figure:

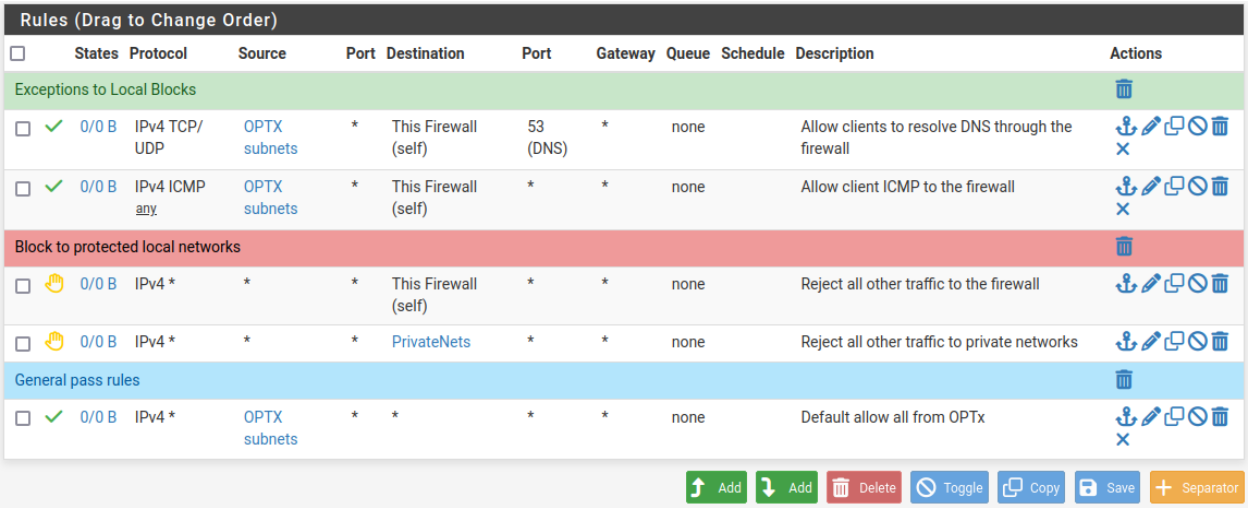


Fig. 17: Example firewall rules for isolated LAN type segment

Tip: Rule separators are useful for documenting a ruleset in place.

Similar to the isolated network scenario, it is also possible to be much more strict with rules to only allow specific outbound ports. When creating this type of configuration,

2.5.7 Other Services

In most cases the above configuration is sufficient and clients on the new LAN can now obtain an address and reach the Internet. However, there may be other custom settings which need accounted for when adding a new local interface:

- If the DNS resolver has specific interface bindings, add the new interface to the list.
- If using ALTQ traffic shaping, re-run the shaper wizard to include this new LAN type interface.
- Consider using captive portal to control access the interface

2.6 Factory Reset Procedure

This procedure performs a factory reset using the hardware button on the Netgate 5100.

See also:

- See *Input and Output Ports* to locate the reset button for the device.
- Factory Reset Video
- Factory Reset from GUI or Console

1. Remove power from the device.
2. Gently use a paper clip or similar tool to depress the reset button.
3. While keeping the button depressed, apply power to the device.
4. Keep the button depressed for about **30 seconds** until the device boots far enough to check the button state.

   The status LED will flash red and green alternately once the reset process starts.
5. Wait for the device to reboot after the reset procedure completes.

When the device boots again, it will be at its factory default settings and accessible from the LAN at `https://192.168.1.1`.

If this procedure fails, *connect to the console* and perform a factory reset there.

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CHAPTER

THREE

REFERENCES

3.1 Additional Resources

3.1.1 Netgate Training

Netgate training offers training courses for increasing your knowledge of pfSense® Plus products and services. Whether you need to maintain or improve the security skills of your staff or offer highly specialized assistance and improve your customer satisfaction; Netgate training has got you covered.

https://www.netgate.com/training

3.1.2 Resource Library

To learn more about how to use Netgate appliances and for other helpful resources, make sure to browse the Netgate Resource Library.

https://www.netgate.com/resources

3.1.3 Professional Services

Netgate TAC 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® Plus software. These items are offered as professional services and can be purchased and scheduled accordingly.

https://www.netgate.com/our-services/professional-services.html

3.1.4 Community Options

Customers who elected not to get a Netgate TAC plan, can seek assistance from the active and knowledgeable pfSense software community on the Netgate forum.

https://forum.netgate.com/

3.2 Warranty and Assistance

- One year manufacturer's warranty.
- Please contact Netgate for warranty information or view the Product Lifecycle page.
- All Specifications subject to change without notice

For information on technical assistance, view TAC plans offered by Netgate.

See also:

For more information on how to use pfSense® Plus software, see the pfSense Documentation and Resource Library.

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