Clavister Virtual Series
Getting Started Guide for KVM

Version: 11.02.00

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Table of Contents

Preface

Target Audience

The target audience for this guide is the administrator who wants to run the cOS Core network operating system under a KVM virtual environment with QEMU as the hypervisor on a Linux platform. The guide takes the user from the installation of cOS Core through to startup of the software, including network connections and initial cOS Core configuration.

Text Structure

The text is divided into chapters and subsections. Numbered subsections are shown in the table of contents at the beginning of the document.

Text links

Where a "See section" link is provided in the main text, this can be clicked on to take the reader directly to that reference. For example, see *Section 6.6, “Setup Troubleshooting ”*.

Web links

Web links included in the document are clickable. For example, *http://www.clavister.com*.

Notes to the main text

Special sections of text which the reader should pay special attention to are indicated by icons on the left hand side of the page followed by a short paragraph in italicized text. There are the following types of such sections:

Note

This indicates some piece of information that is an addition to the preceding text. It may concern something that is being emphasized or something that is not obvious or explicitly stated in the preceding text.

Tip

This indicates a piece of non-critical information that is useful to know in certain situations but is not essential reading.

Caution

This indicates where the reader should be careful with their actions as an undesirable situation may result if care is not exercised.

Important

This is an essential point that the reader should read and understand.

Warning
This is essential reading for the user as they should be aware that a serious situation may result if certain actions are taken or not taken.

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Chapter 1: Overview & Requirements

cOS Core with KVM

By using the open source *Kernel-based Virtual Machine* (KVM) software, it is possible to have a single computer running multiple, virtual Clavister Security Gateways with each virtual gateway running a separate copy of cOS Core. This technique is referred to as *virtualization* and each virtual Clavister Security Gateway can be said to be running in its own *virtual machine*. This is the basis for the Clavister *Virtual Series* of products which also includes cOS Core running under the commercial VMware™ environment.

cOS Core is an Operating System

cOS Core is a network security operating system that is not built on a pre-existing operating system like Linux. Instead, it is itself both the operating system and security gateway. This means cOS Core has modest resource requirements under KVM, such as only needing a very small disk space footprint of under 64 megabytes. A detailed list of resource requirements can be found later in this chapter.

cOS Core Management

Not only can cOS Core run in its own virtual machine under KVM, the management workstation that is used to administer cOS Core can also run under the same KVM installation or it can be on a separate, external computer. To perform management tasks, the management workstation may run InControl, the Web Interface or a CLI console through a secure shell client.

KVM Runs Under Linux With QEMU

KVM itself is not a hypervisor but provides an infrastructure for creating virtual machines. It is the *Quick EMUlator* (QEMU) that provides the hypervisor functions under the Linux operation system and this is also required when using KVM to create cOS Core virtual machines. The combination is known as *QEMU-KVM* and is distributed as a single package so that the two can be installed together.

Referencing KVM Documentation

This guide describes the steps involved when installing cOS Core with KVM on x86 based hardware as well as covering many of the issues that may be encountered with cOS Core running in a KVM virtual environment.

The guide tries to deal specifically with the subject of cOS Core running under KVM and, unless relevant, does not detail the installation of KVM itself or issues which are related only to KVM. Pure KVM subjects are best explained by other, KVM specific, documentation.

Server Hardware Requirements

The server running KVM must satisfy the following criteria:

- The hardware architecture must be 64-bit x86.
- It must support virtualization using Intel VT-x or AMD-V architectures.
- Intel processors must be from either the Intel *Core* (or later) workstation or Intel server family of products.
- It must support a ratio of 1-to-1 for threads to defined virtual CPU.
- It must support at least one core per virtual CPU.

Intel Hardware Drivers

The following additional hardware driver requirements should be noted:

- If used, the IXGBE (Intel 10 Gigabit network) driver should be version 3.21.2 or later.
- Also note that if used, the IXGBE driver should be recompiled with the LRO (Large Packet Receive) feature **disabled**. Information about how to do this can be found in the README file included with the driver distribution.
- If used, the IGB (Intel Network) driver should be version 5.2.5 or later.

cOS Core Resource Requirements

A single installation of cOS Core as a virtual security gateway will require the following resource requirements:

- Minimum of 1 x virtual CPU.
- Minimum 128 Mbytes RAM (512 recommended, depending on features used).
- Maximum 4096 Mbytes RAM. Requirements differ according to cOS Core license.
- 64 Mbytes of free disk space for cOS Core installation.

Supported Linux Distributions

KVM with QEMU will run under the Linux operating system and will require one of the following Linux distributions:

- Ubuntu version 13.04 or later.
- openSUSE version 12.2 or later.
- Centos version 6.4 or later.

- Red Hat Enterprise Linux 6.4 or later.

Other Linux distributions might be used successfully but have not been tested by Clavister with cOS Core. The installation of Linux will not be discussed further in this guide. It is assumed the administrator is familiar with basic Linux networking.

Supported KVM Distributions

cOS Core can run under the latest distribution of KVM. These distributions also include QEMU. The QEMU release (or later) that must be used for cOS Core to function properly:

- QEMU emulator version 2.0.0 (Debian 2.0.0+dfsg-2ubuntu1.17) © 2003-2008 Fabrice Bellard.

Other distributions might be used successfully but have not been tested by Clavister. The installation of QEMU with KVM will not be discussed further in this guide and the administrator should refer to the software's own documentation. The QEMU/KVM binaries for a particular Linux distribution can normally can normally be installed from the repositories of the distribution.

Note that the SeaBIOS version used with KVM for guest x86 operating systems should be version 1.7.4 or later.

Additional Linux Software

The following should also be installed on the base Linux system:

- The *libvirt* virtualization API must be installed under Linux. This is needed for the libvirt daemon (*libvirtd*) and the *virsh* command.

- The *vhost-net* enhancement for networking is required. This moves packets between cOS Core and the host system using the Linux kernel instead of QEMU and provides a significant performance boost to throughput. The Clavister setup script described later will terminate with an error message if this is not installed.

- Either *bridge-utils* or *Open vSwitch* must be installed to provide networking functions. It is not possible to install both. If the virtual machine will be part of a cOS Core HA cluster, then *Open vSwitch* must be installed.

  If a high availability (HA) cluster is to be set up, *Open vSwitch* must be installed. HA will not function with *bridge-utils* and this must be removed. HA setup is discussed further in *Chapter 7, High Availability Setup*.

Software Tools for Management

The following are the software requirements for management:

- KVM virtual machine management software must be installed under Linux. This guide assumes that the *Virtual Machine Manager* (virt-manager) software is installed.

- Optionally use a VNC client on a separate computer workstation to access the Linux environment. This guide assumes *UltraVNC Viewer* is used but other clients may be suitable.

The installation of these software tools will not be discussed further in this guide. The administrator should refer to the tool's own documentation for guidance.

The cOS Core installation files for these servers can be downloaded from the Clavister website *https://www.clavister.com*. KVM files and further information can be found by going to *http://www.linux-kvm.org*.

Chapter 2: Installation

This section describes the overall installation steps of cOS Core in a virtual environment. It includes details of customer registration and license installation. The steps are organized into the following stages:

A. Register as a User and Download cOS Core

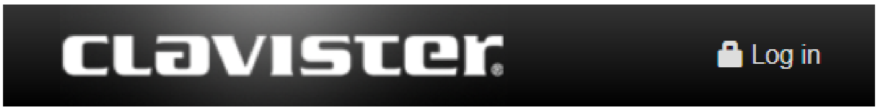
B. Create a cOS Core Virtual Machine

C. Configure cOS Core for Management Access

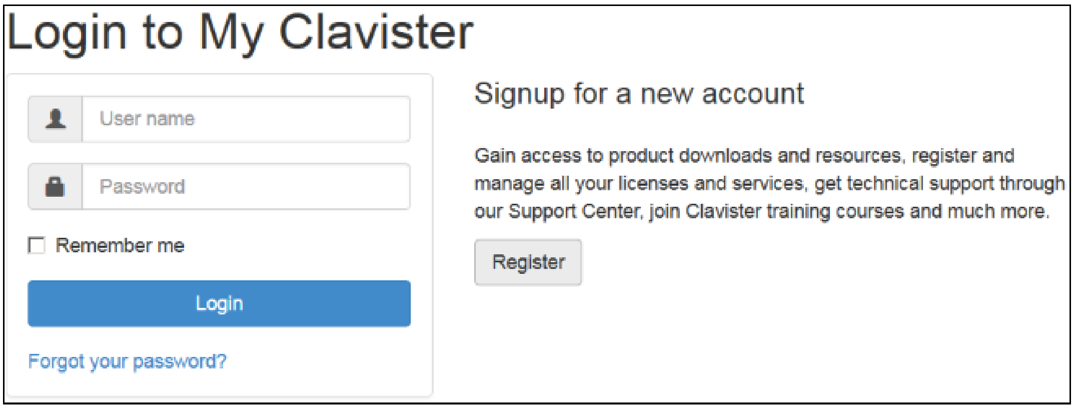
D. Register a License and Bind it to cOS Core

A. Register as a User and Download cOS Core

1. Open a web browser, surf to ***http://www.clavister.com*** and select the **Log in** option.



2. The customer login page is presented. It is assumed that a new customer is accessing the site for the first time so they should press the **Register** button.



Login to My Clavister

User name

Password

□ Remember me

Login

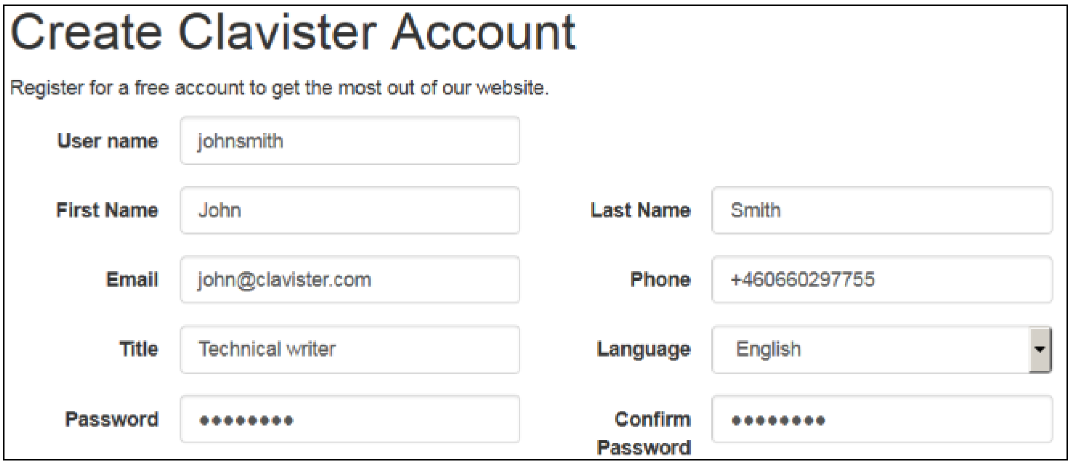
Forgot your password?

Signup for a new account

Gain access to product downloads and resources, register and manage all your licenses and services, get technical support through our Support Center, join Clavister training courses and much more.

Register

3. The registration webpage is presented. The required information should be filled in. In the example below, a user called *John Smith* registers. The company details must be entered as well if licenses are to be created and downloaded.

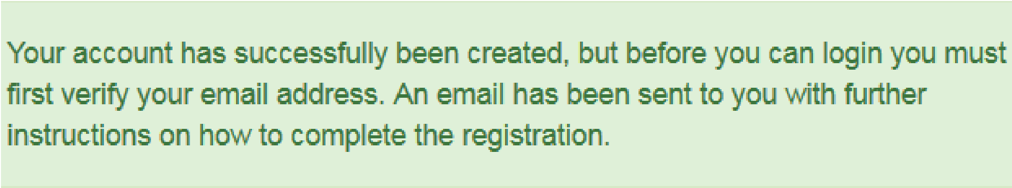


Create Clavister Account

Register for a free account to get the most out of our website.

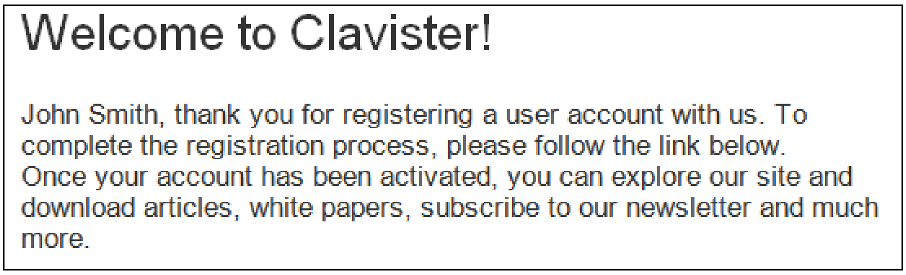
User name	johnsmith		
First Name	John	Last Name	Smith
Email	john@clavister.com	Phone	+460660297755
Title	Technical writer	Language	English
Password	••••••••	Confirm Password	••••••••

4. When the registration is accepted, an email is sent to the email address given so that the registration can be confirmed.



Your account has successfully been created, but before you can login you must first verify your email address. An email has been sent to you with further instructions on how to complete the registration.

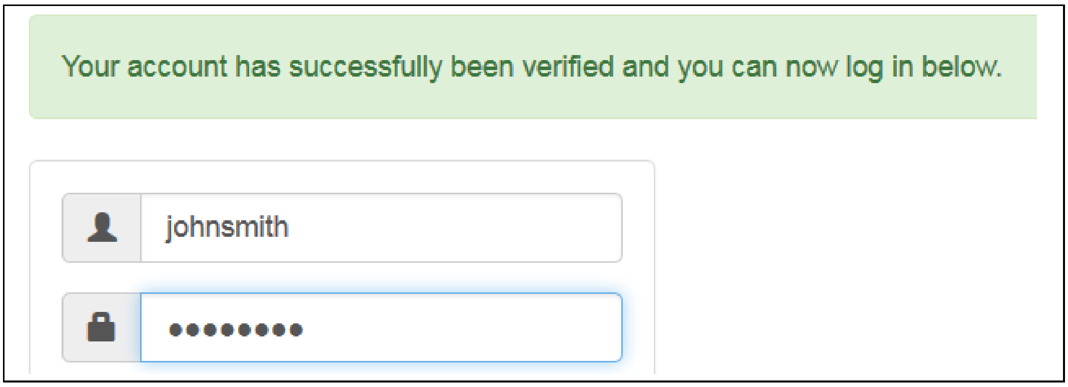
5. Below is an example of the email that John Smith would receive.



Welcome to Clavister!

John Smith, thank you for registering a user account with us. To complete the registration process, please follow the link below.
Once your account has been activated, you can explore our site and download articles, white papers, subscribe to our newsletter and much more.

6. When the email link is clicked, the new customer is taken to a webpage to indicate that confirmation has been successful. The customer should now log in to the Clavister website with the credentials they have submitted during registration.

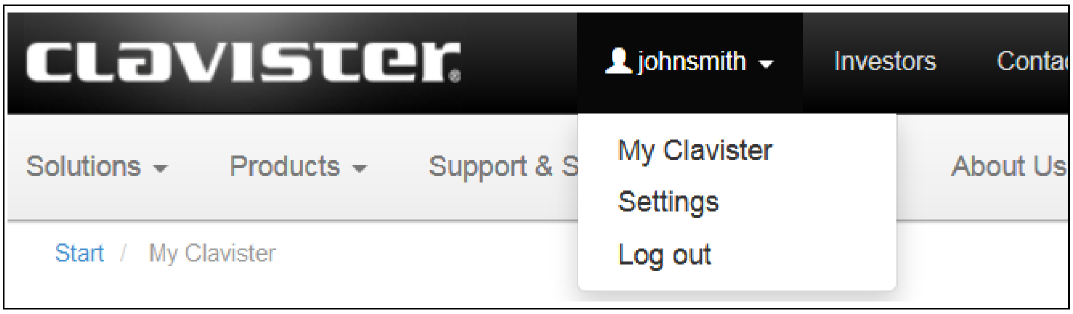


Your account has successfully been verified and you can now log in below.

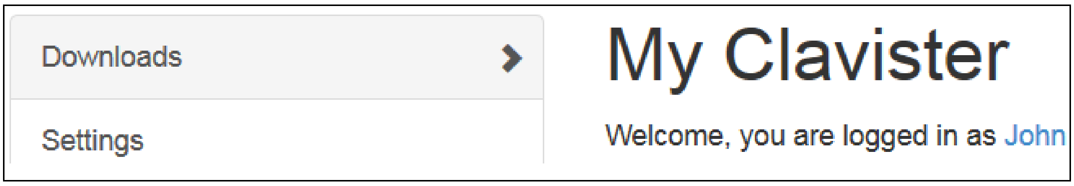
johnsmith

••••••••

7. After login, the website toolbar will show the name of the currently logged in customer.



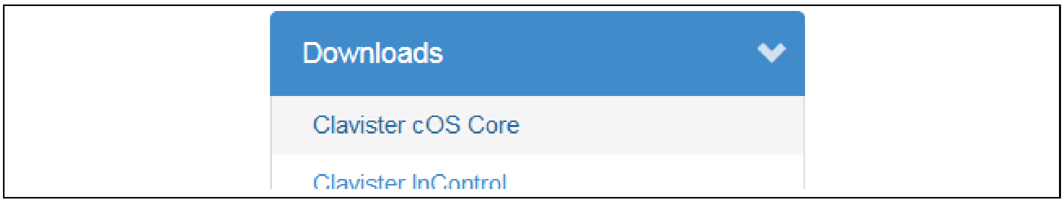
8. To download cOS Core for all platforms, select **Downloads**.



My Clavister

Welcome, you are logged in as John

9. Select *cOS Core* under downloads.



10. Select and download the ZIP file containing the relevant cOS Core distribution to the local disk.

Clavister cOS Core 11.01.00 for KVM

92200 KB, ZIP

B. Create a cOS Core Virtual Machine

Unzip the downloaded file and follow the instructions for creating the relevant cOS Core virtual machine using the instructions in ***Chapter 3, Importing Virtual Machines***.

C. Configure cOS Core for Management Access

1. cOS Core can now be configured using the CLI for public Internet access and to allow management access via the **If1** interface. The CLI steps are as follows:

    i. The cOS Core *address book* is automatically filled with address objects for the IPv4 address and network of all the Ethernet interfaces. Assign the IPv4 address of the **If1** interface. This will be used for remote management:

    ```
    Device:/> set Address IP4Address
                         InterfaceAddresses/If1_ip
                         Address=203.0.113.10
    ```

    Next, assign the IPv4 network for the **If1** interface:

    ```
    Device:/> set Address IP4Address
                         InterfaceAddresses/If1_net
                         Address=203.0.113.0/24
    ```

    ii. An *all-nets* default route needs to be added to the *main* routing table which includes the gateway address of a router for public Internet access. Unless there is a narrower route that matches for traffic, this route will be used. To add the route, the CLI context needs to be changed to be the *main* routing table:

    ```
    Device:/> cc RoutingTable main
    ```

    The command prompt will change to show that the current context is the *main* routing table:

    ```
    Device:/main>
    ```

    Now, routes can be added to the *main* table. Assuming that the *If1* interface is connected to a router with the IPv4 address *203.0.113.1* then a default route is added with the following CLI:

    ```
    Device:/main> add Route Interface=If1 Network=all-nets
                         Gateway=203.0.113.1
    ```

    iii. Next, restore the CLI context to the default:

    ```
    Device:/> cc
    ```

    iv. For management access, the *RemoteManagement* object needs to be changed so it allows the source IP to connect. This could be a specific IPv4 address or network but here it is set to *all-nets* so any source IP will be acceptable:

```
Device:/> set RemoteManagement HTTP_If1 Network=all-nets
```

Normally, an *IP Rule* configuration object should be created for any data traffic to be allowed to flow to or from cOS Core but management access does not require a separate rule.

v. The cOS Core configuration changes now needs to be activated:

```
Device:/> activate
```

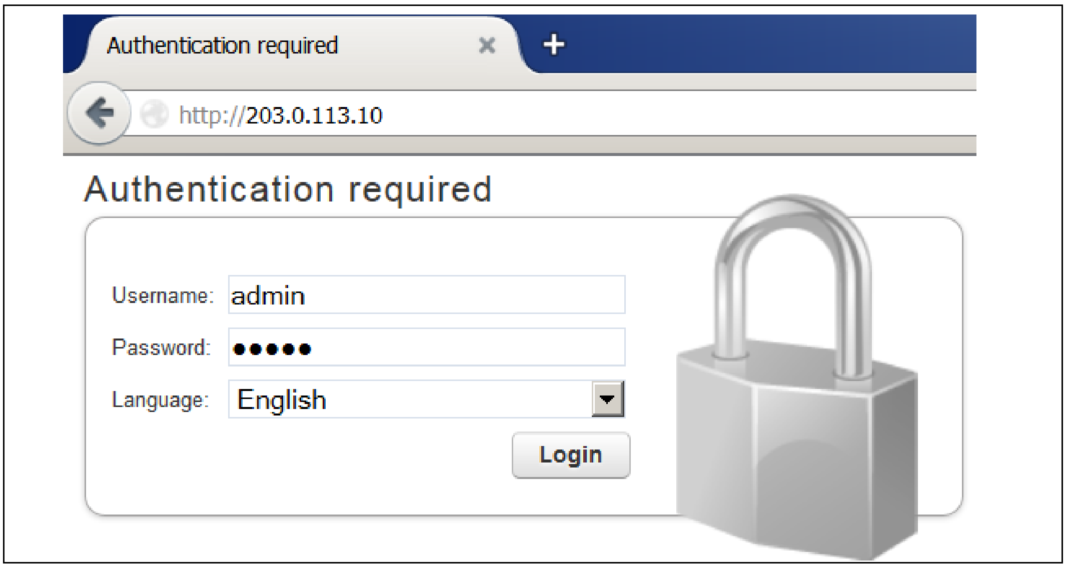
Following activation, the changes must be committed permanently within 30 seconds otherwise the configuration will revert back to the original configuration and the changes will be lost. This is a check by cOS Core that the administrator has not been locked out by the changes:

```
Device:/> commit
```

6. Finally, open a web browser and surf to the IP address of the **If1** interface. The cOS Core login dialog should appear and the default administrator credentials of username *admin* with password *admin* can be used to log in. By default, only the *HTTPS* protocol can be used so the connection will be encrypted. With *HTTPS*, cOS Core will send a self-signed certificate and the browser will prompt for that certificate to be accepted.

   Ít is possible to enable unencrypted HTTP for the management connection but this is not recommended.

   When connecting through the Web Interface for the first time, the *cOS Core Setup Wizard* will automatically try to start as a browser popup window. Browser popups may be disallowed so the browser will ask if the wizard popup should be allowed. For this section, the wizard is not used and its popup window can be dismissed. Using the wizard is described in *Section 6.2, "Web Interface and Wizard Setup"*.



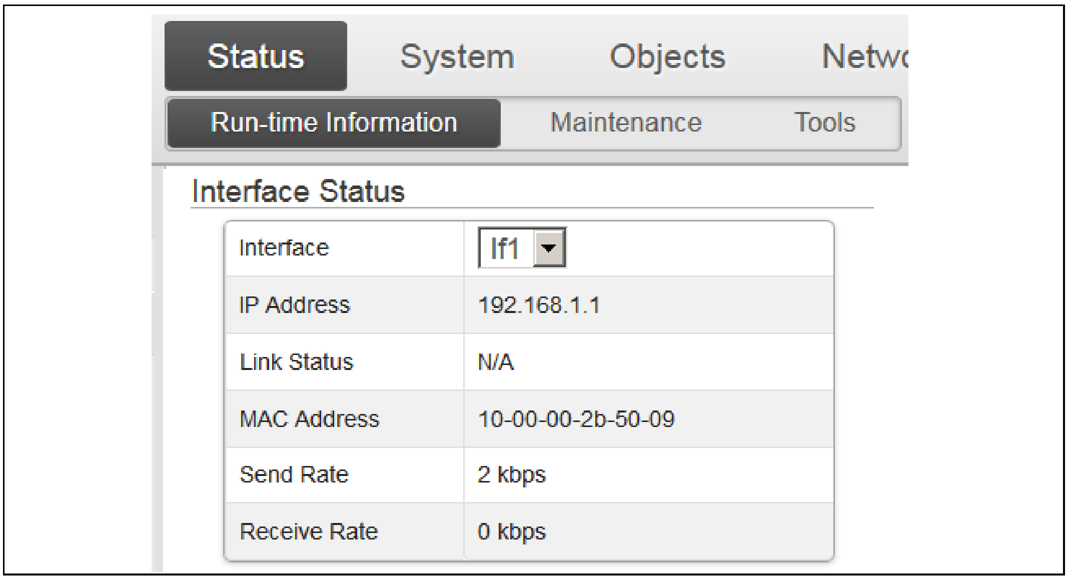
Username: admin
Password: ●●●●●
Language: English

D. Register a License and Bind it to cOS Core

1. A cOS Core license for VMware must be associated with a MAC address on the virtual machine. To get a MAC address, open the cOS Core Web Interface and go to **Status > Run-time Information > Interfaces** and make a note of the MAC address for the **If1** interface.

   Alternatively, the following CLI command can be used to obtain the MAC address:

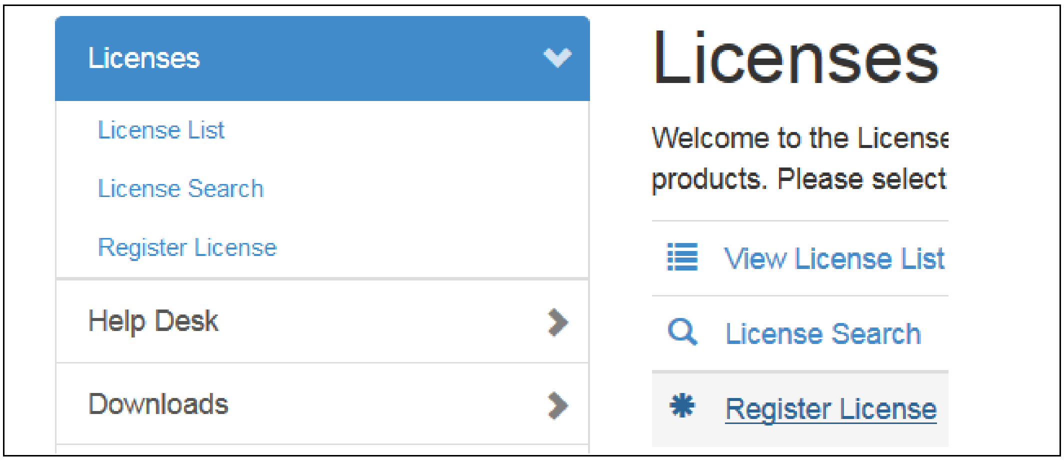
   ```
   Device:/> ifstat If1
   ```



Interface Status

Interface	If1
IP Address	192.168.1.1
Link Status	N/A
MAC Address	10-00-00-2b-50-09
Send Rate	2 kbps
Receive Rate	0 kbps

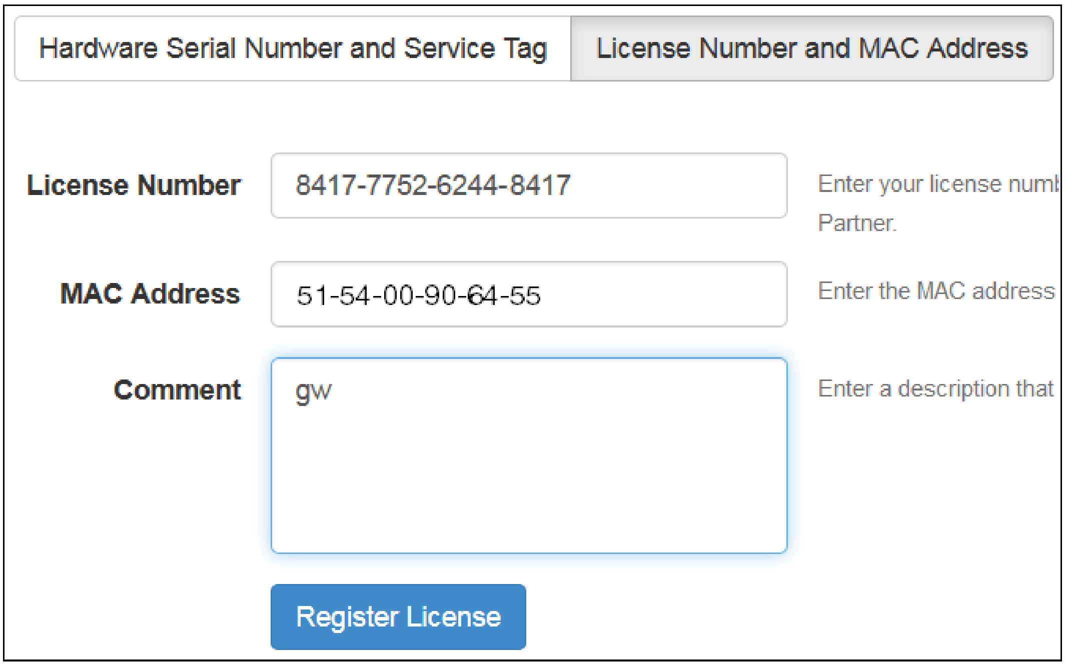
2. Now, log in to the Clavister website and select **Register License**.



Licenses

Welcome to the License
products. Please select

3. The registration page is displayed. Select the option **License Number and MAC address** then enter the MAC address noted earlier with the license number and click **Register License**. The license number will be given to you by your Clavister reseller.

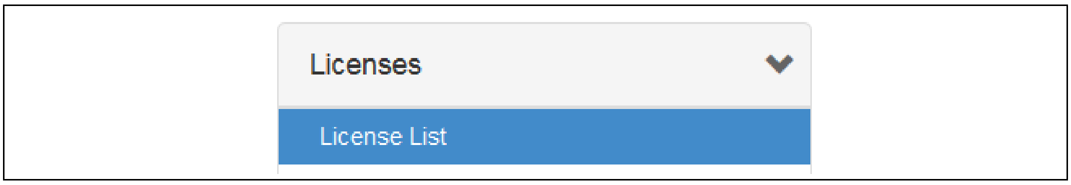

Hardware Serial Number and Service Tag
License Number and MAC Address
Register License

License Number: 8417-7752-6244-8417 — Enter your license numb
Partner.

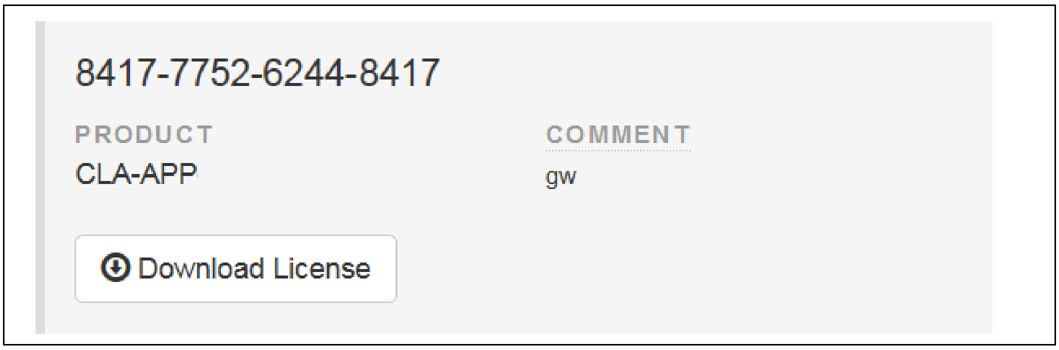
MAC Address: 51-54-00-90-64-55 — Enter the MAC address

Comment: gw — Enter a description that

4. After the license is registered and associated with the MAC address, select **Licenses**, then **License List** and select the newly registered license from the displayed list.



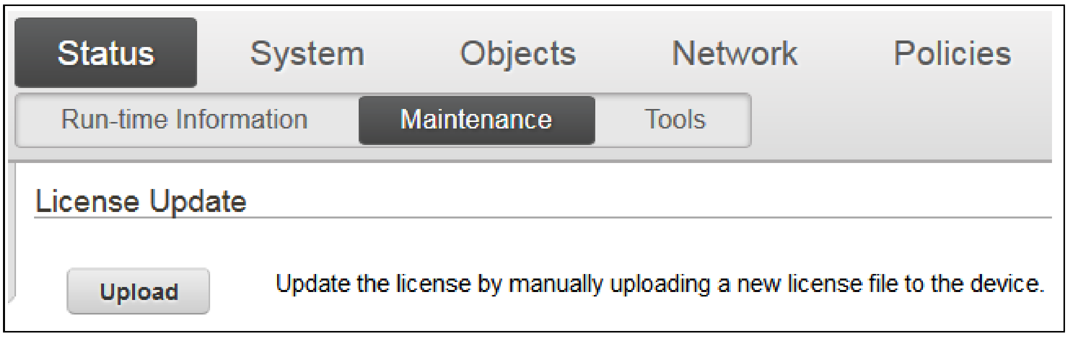
5. Now, select the **Download** option to download a license file to the local disk.


8417-7752-6244-8417

PRODUCT: CLA-APP

COMMENT: gw

6. Finally, go back to the cOS Core Web Interface and go to **Status > Maintenance > License**. Select *Upload* to upload the license file from the management computer to cOS Core.



Update the license by manually uploading a new license file to the device.

The 2 hour evaluation time limit will now be removed and cOS Core will only be restricted by the capabilities defined by the license.

Chapter 3: Importing Virtual Machines

This chapter describes importing a disk image distribution of a virtual machine running cOS Core. It is assumed that KVM software with QEMU has been installed and is running in the appropriate environment and the relevant software tools have also been installed. This initial setup has been described previously in *Chapter 1, Overview & Requirements*.

Virtual machine creation can be done in one of the following ways:

- **Manually** using virtual machine manager. This is described next in *Section 3.1, "Manual Setup"*.
- **Automatically** using a script. An example script is supplied by Clavister and this is described next in *Section 3.2, "Script Setup"*.

cOS Core Memory Requirements

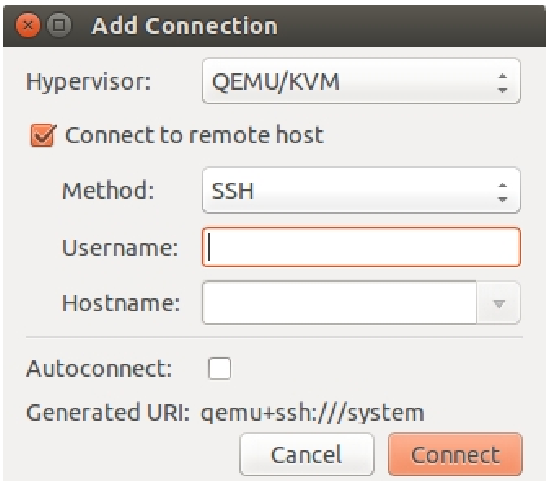
The minimum amount of memory required for cOS Core to run is 128 Mbytes and memory should not be reduced below this level. However, certain memory demanding features cannot run in this ammount of memory so a minimum of 512 Mbytes is recommended. This allocation may need to be increased depending on the cOS Core license available and the number of connections/tunnels that will be open simultaneously. The maximum memory allocation possible for cOS Core is 4096 Mbytes. Anything available above this will not be used.

If the allocated memory is insufficient during operation, cOS Core will output console messages indicating this while trying to reduce the number of open connections/tunnels. Eventually, cOS Core will enter *safe mode* where only management access is possible.

3.1. Manual Setup

This section describes using *Virtual Machine Manager* to manually create a cOS Core virtual machine.

1. Start *Virtual Machine Manager* and select the menu options **File > Add Connection**.



Add Connection

Hypervisor: QEMU/KVM

☑ Connect to remote host

Method: SSH

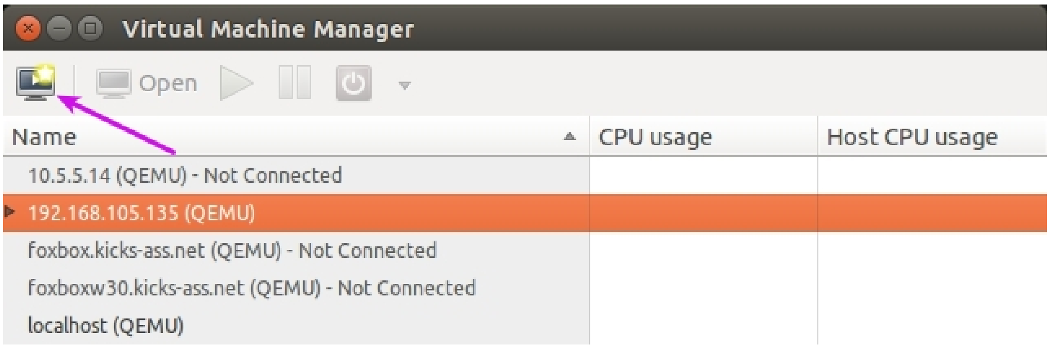
Username:

Hostname:

Autoconnect: □

Generated URI: qemu+ssh:///system

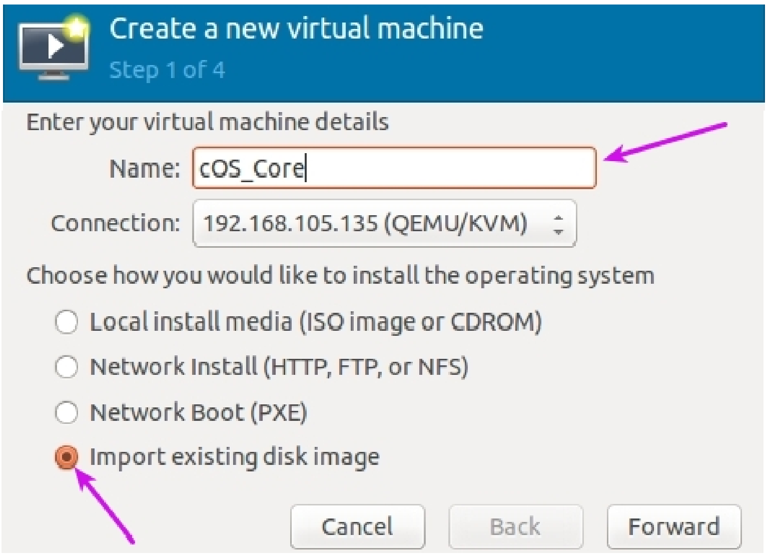
2. Double click on the new host to open it. You will be prompted for the password.



Virtual Machine Manager

Name	CPU usage	Host CPU usage
10.5.5.14 (QEMU) - Not Connected		
192.168.105.135 (QEMU)		
foxbox.kicks-ass.net (QEMU) - Not Connected		
foxboxw30.kicks-ass.net (QEMU) - Not Connected		
localhost (QEMU)		

3. Select **Create new virtual machine** to start the new VM wizard. Give the new virtual machine a name and select *Import existing disk image* then **Forward**.



Create a new virtual machine

Step 1 of 4

Enter your virtual machine details

Name: cOS_Core

Connection: 192.168.105.135 (QEMU/KVM)

Choose how you would like to install the operating system

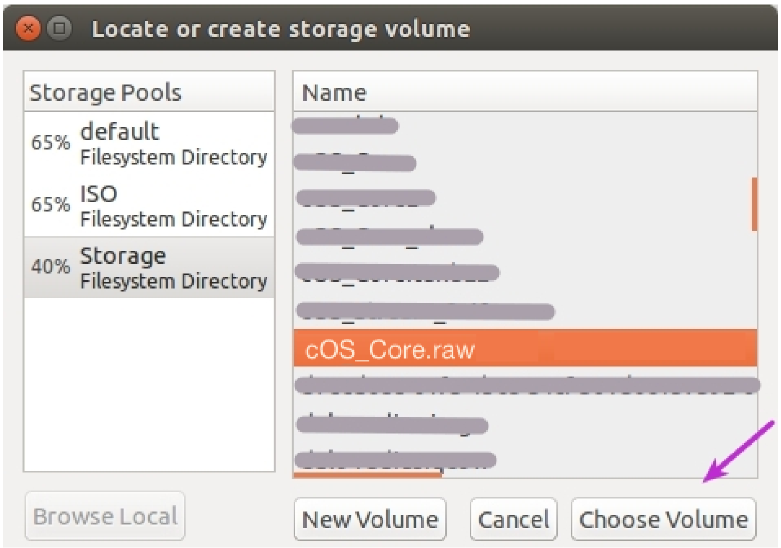
○ Local install media (ISO image or CDROM)

○ Network Install (HTTP, FTP, or NFS)

○ Network Boot (PXE)

● Import existing disk image

4. Select the cOS Core image file and select **Choose Volume**. For this description, it is assumed that the image file has the name *cOS_Core.qcow2* but the actual filename will include a version number.



Locate or create storage volume

Storage Pools	
65%	default Filesystem Directory
65%	ISO Filesystem Directory
40%	Storage Filesystem Directory

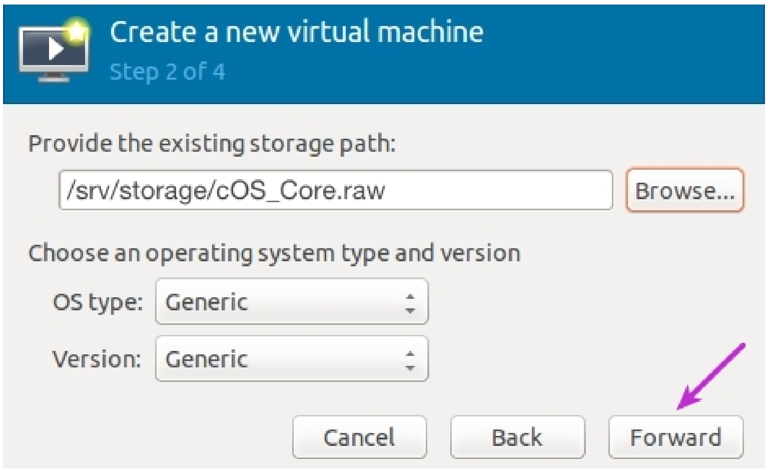
Name

[redacted]

cOS_Core.raw

[redacted]

5. In the next step, leave the **OS type** and **Version** as *Generic* and select **Forward**.



Create a new virtual machine

Step 2 of 4

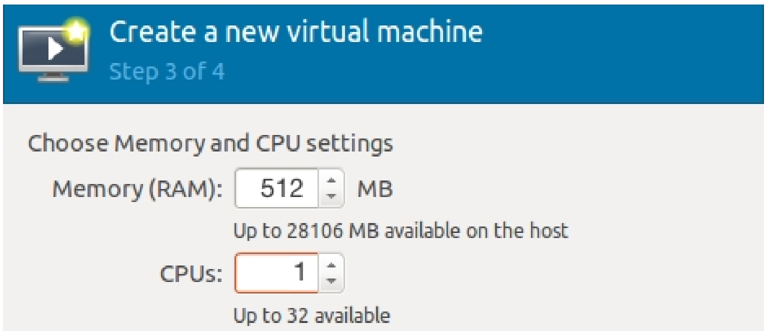
Provide the existing storage path: /srv/storage/cOS_Core.raw

Choose an operating system type and version

OS type: Generic

Version: Generic

6. Set the amount of RAM and the number of CPUs that are required. Only one CPU is required. cOS Core requires 128 Mbytes of memory as an absolute minimum. However, some memory demanding cOS Core features such as Anti-Virus scanning, IDP and Application Control will not be able to function in 128 Mbytes. For this reason, 512 Mbytes is recommended. The maximum possible is 4096 Mbytes. such as



Choose Memory and CPU settings

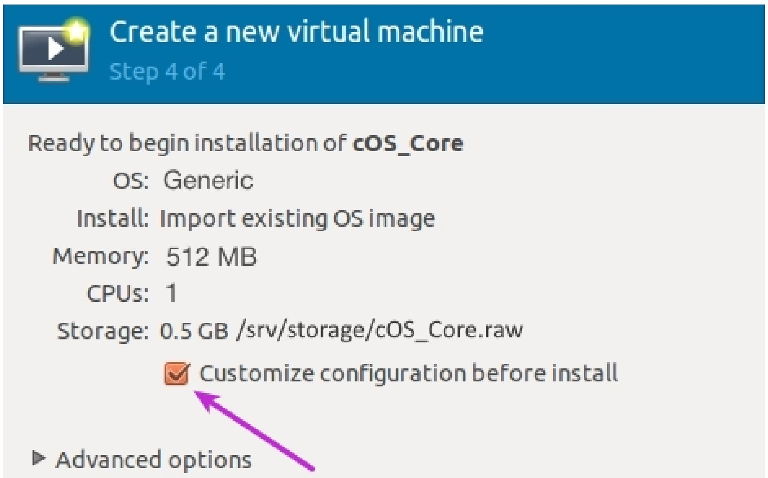
Memory (RAM): 512 MB

Up to 28106 MB available on the host

CPUs: 1

Up to 32 available

7. Check the option **Customize configuration before install** and then select **Finish** to exit the wizard.



Ready to begin installation of **cOS_Core**

OS: Generic

Install: Import existing OS image

Memory: 512 MB

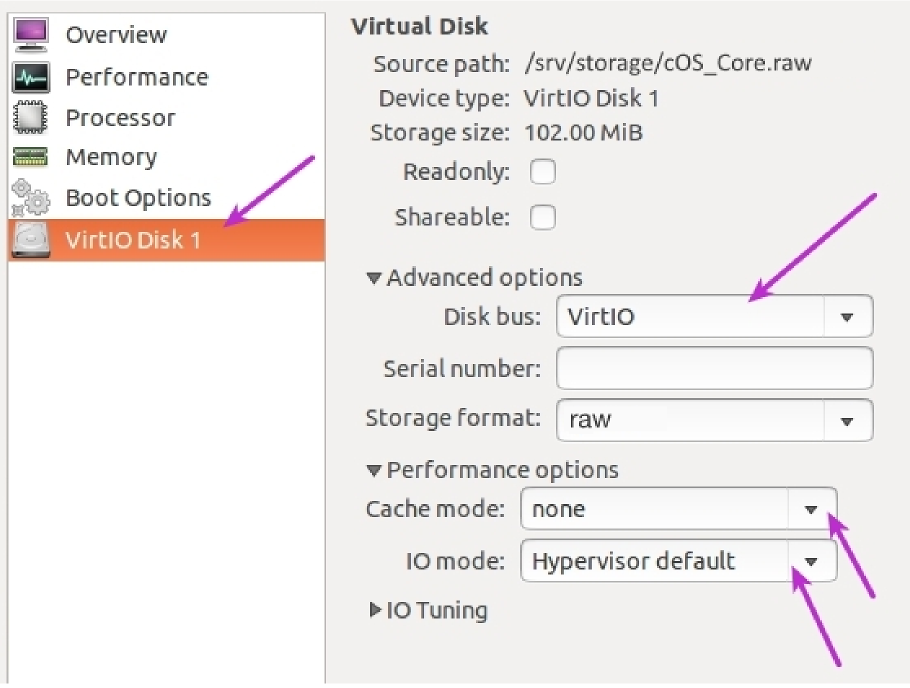
CPUs: 1

Storage: 0.5 GB /srv/storage/cOS_Core.raw

☑ Customize configuration before install

8. Select the disk from the navigation menu and make sure the following values are entered for the disk driver:

    - **Disk bus:** VirtIO
    - **Cach mode:** none
    - **IO mode:** Hypervisor default



Virtual Disk

Source path: /srv/storage/cOS_Core.raw

Device type: VirtIO Disk 1

Storage size: 102.00 MiB

Readonly: □

Shareable: □

▼ Advanced options

Disk bus: VirtIO

Serial number:

Storage format: raw

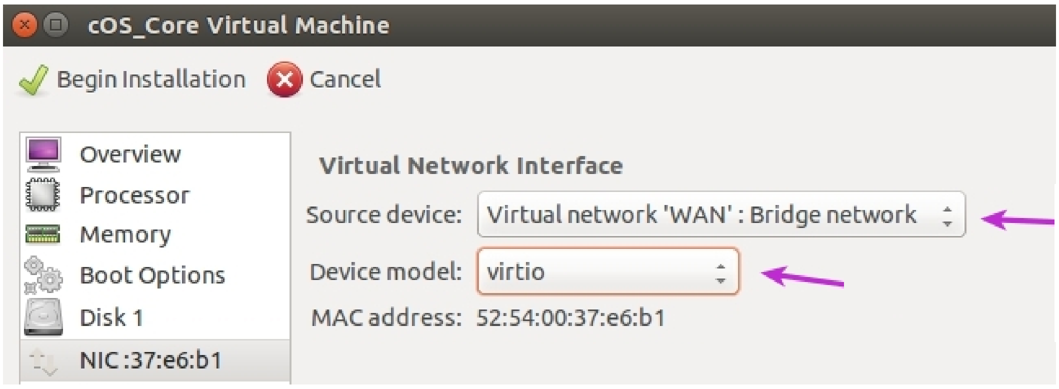
▼ Performance options

Cache mode: none

IO mode: Hypervisor default

▶ IO Tuning

9. Set the **Source device** to the defined WAN bridge and set the **Device model** to *virtio*. Select **Apply**, then select **Add Hardware**.



Virtual Network Interface

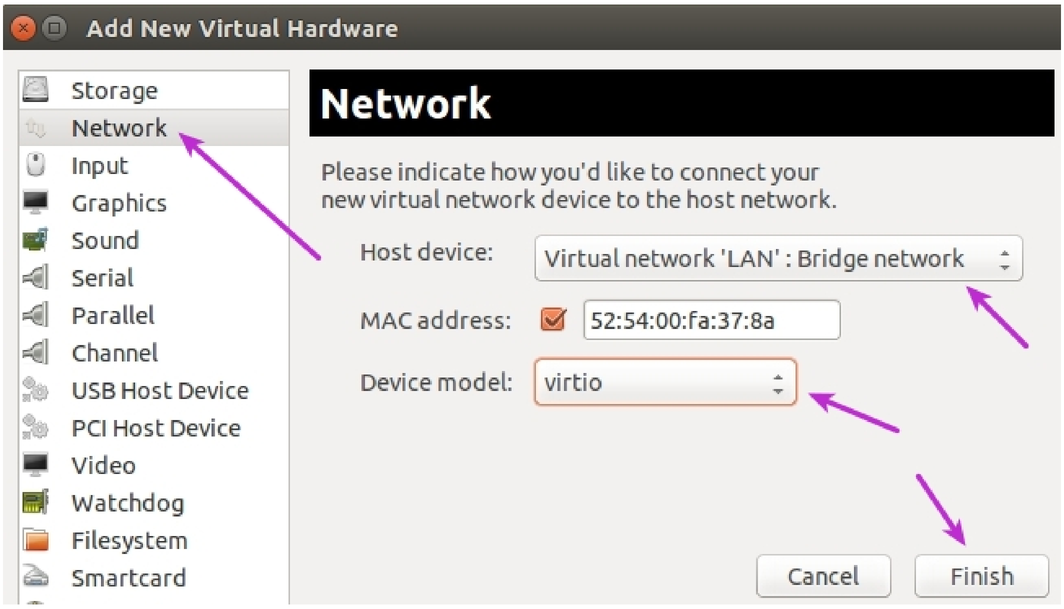
Source device: Virtual network 'WAN' : Bridge network

Device model: virtio

MAC address: 52:54:00:37:e6:b1

10. Select **Network** in the navigation menu and then set **Host device** to the defined LAN bridge and **Device model** to *virtio*.

    Repeat this process for the third interface.



Network

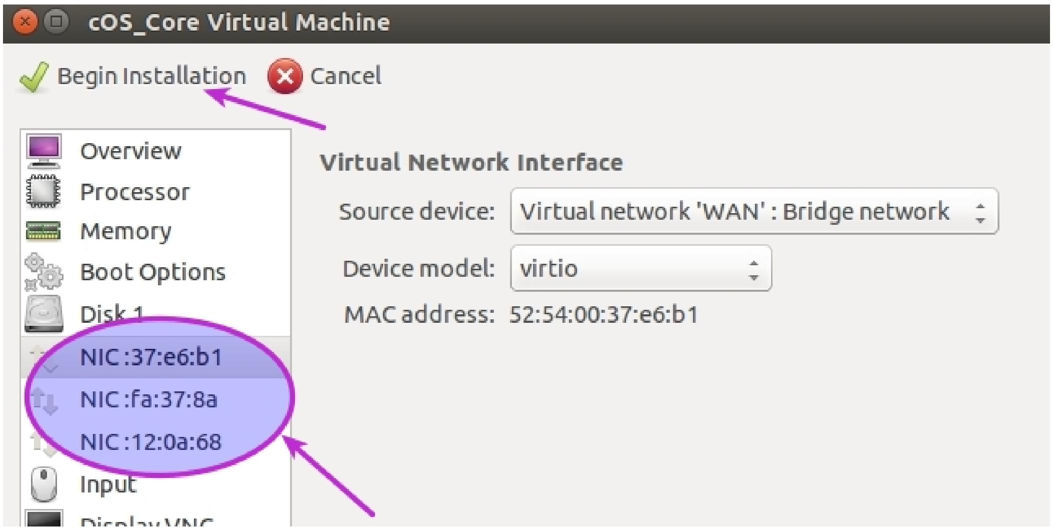
Please indicate how you'd like to connect your new virtual network device to the host network.

Host device: Virtual network 'LAN' : Bridge network

MAC address: ☑ 52:54:00:fa:37:8a

Device model: virtio

11. There are now three network interfaces attached to the virtual machine so **Begin installation** can now be selected. This will also boot up the virtual machine.



Virtual Network Interface

Source device: Virtual network 'WAN' : Bridge network

Device model: virtio

MAC address: 52:54:00:37:e6:b1

3.2. Script Setup

An example script for this setup called **prepare.sh** can be downloaded from:

http://github.com/Clavister

This script is written in *bash* and is not supported by Clavister. It is provided only as a reference script for cOS Core setup under KVM and it can be freely used, modified or redistributed under the GPL open source license. As far as Clavister is aware, the script is suitable for KVM running under most Linux distributions.

The process for creating the virtual machine with the script can be summarized as follows:

- Run the script *prepare.sh*. This go through a series of questions to create an XML file for initial configuration of the virtual machine. The script will optionally create the virtual machine using this file. One of the key tasks performed by the script is to map cOS Core's virtual Ethernet interfaces to networking bridges.

- Use the *virsh define* command to create the virtual machine using the created XML file as input if the administrator chose not to do it with the script.

Install *bridge-utils* or *Open vSwitch*

Either *bridge-utils* or *Open vSwitch* must be installed for networking functions. Both cannot be installed at the same time. If the virtual security gateway is going to be part of a cOS Core HA cluster then *Open vSwitch* must be installed. However, Open vSwitch can also be used for standalone virtual security gateways.

The *prepare.sh* script will ask which of the two is installed and configure the networking accordingly.

Detailed Steps for Virtual Machine Definition

Once the Linux system has been set up with the required software installed, the series of steps for creating a cOS Core virtual machine are as follows:

1. Download the cOS Core distribution package file from the Clavister *Customer Web* to a local workstation computer. The Clavister website will require customer login credentials.

2. Upload the following files to the Linux computer's disk using the *Secure Copy* (SCP) protocol and make a note of their location.

    i. The cOS Core image file for KVM which can be downloaded by logging in to the Clavister website.

    ii. The script *prepare.sh* or a modified version of it.

    Many SCP clients can be used for this. For example, open source *puTTY.*

3. Open a console to access Linux. Note that the script **must** be run as root and the script will check that this is the case.

4. Change the working directory to be the location of the uploaded files then run the script *prepare.sh* using the command:

```
[root@linux]# ./prepare.sh
```

Optionally, the filename of the cOS Core virtual machine image can also be specified in the command line:

```
[root@linux]# ./prepare.sh <vm_image_filename>
```

When it runs, the script will prompt for the following:

i. **The Clavister product:** The script can be used with all Clavister's security products. Select *cOS Core* for this question.

ii. **The security gateway name:** The name of the virtual machine and also the name of the XML generated by the script. This is the name that will be displayed when using Virtual Machine Manager.

iii. **Networking**: The administrator must tell the script if *bridge-utils* or *Open vSwitch* is being used for networking. If the selected networking package is not detected, the script will terminate.

iv. **The interface mapping**: A default mapping of cOS Core virtual Ethernet interfaces to networking bridges will be performed by the script and displayed. The script will ask if this mapping should be changed, allowing the administrator to select an alternative mapping.

v. **Creating the virtual security gateway**: A virtual machine running cOS Core can be created by the script. If the administrator chooses not to do this, it must be done manually using the *virsh* utility as described later. A reason not to let the script create the virtual machine is if the XML configuration file is to be checked and possibly altered manually.

6. After the script completes and if the administrator chose not to create the virtual machine, an XML file will have been created which is then used to create it manually. Assume that the name chosen for the gateway is *my_security_gateway*. The XML configuration file created by the script will be *my_security_gateway.xml*. The following Linux command will create the virtual machine:

   ```
   [root@linux]# virsh define my_security_gateway.xml
   ```

   The XML file can be examined and edited manually before this step but it is recommended to make changes later.

Changing the Virtual Machine Configuration

The initial configuration parameters of the virtual machine created will be those specified in the configuration XML file created by the script but these can be changed later as required. For example, the amount of RAM memory allocated may need to be increased. Making these changes on an existing virtual machine is described in *Chapter 4, Configuring Virtual Machines*.

3.3. The Management Interface

The KVM Console

When cOS Core starts, KVM will display a console which represents the console that is normally directly connected to the local console port of a physical Clavister Security Gateway. This console is accessed by using VNC to connect to the IP address and port previously specified when running the script *prepare.sh*.

This console displays output from cOS Core exactly as it would be displayed with a non-virtual Clavister Security Gateway. It will show the initial startup sequence output and this can be interrupted, if required, by key presses in order to enter the boot menu. After startup, the KVM console can be used to issue CLI commands to configure cOS Core further and this is described in *Section 6.4, "CLI Setup"*.

Tip: Changing focus back from the KVM console

*KVM will keep focus in the console window after clicking it. Use the key combination **Ctrl-Alt** to release this focus.*

The Default Virtual Ethernet Interfaces

By default, the standard cOS Core installation provides three virtual Ethernet interfaces. To function, these virtual NICs **must be mapped** to the correct bridge or physical Ethernet interface by changing the *Source device* property for the interface using Virtual Machine Manager (*virt-manager*). Doing this is described in *Chapter 4, Configuring Virtual Machines*. The *Device model* property will remain as the default value of *virtio*

cOS Core assigns the following default logical names to the virtual interfaces:

- Interface names: *Ifn*. For example, the first interface is *If1*.
- IP address objects: *Ifn_ip*. For example, the first address object is *If1_ip*.
- Netmask IP objects: *Ifn_net*. For example, the first netmask is *If1_net*.

Connecting to the Virtual Clavister Security Gateway

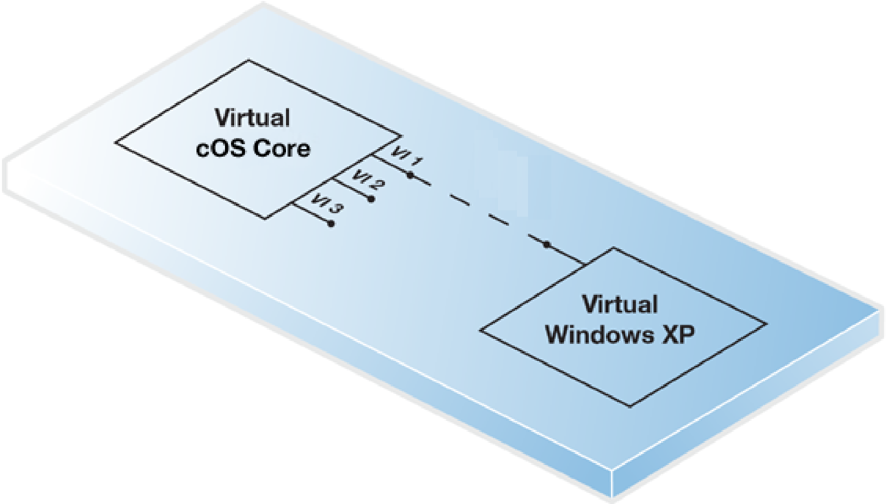
The first virtual Ethernet interface, *If1*, will be assigned the IP address **192.168.1.1** by cOS Core. This is the default cOS Core management interface and connection to it can be done from a web browser (using the cOS Core Web Interface) or SSH client (using the cOS Core CLI) just as it is done with a non-KVM installation.

The workstation running the web browser or SSH client can be one of the following:

- **A virtual workstation running under the same KVM host.**

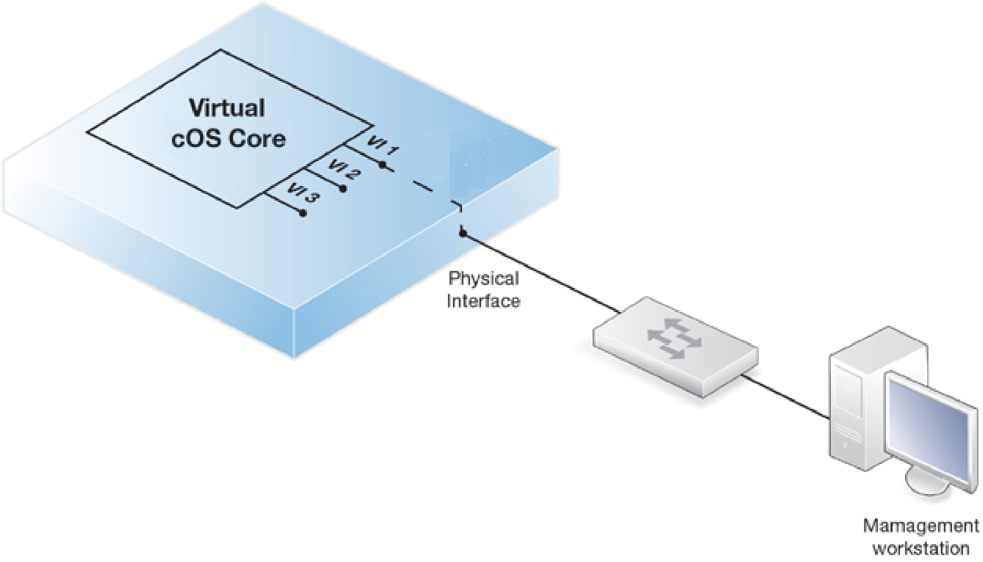
  In this case, a Linux or Open vSwitch bridge can be used to connect the virtual Ethernet interface with a virtual Ethernet interface on the virtual workstation. The virtual workstation might be, for example, a Windows XP installation as shown below.

  For this option to function, KVM must be configured so that the virtual Ethernet interface on both cOS Core and the workstation are on the same bridge.



- **A physically separate workstation computer.**

  In this case, a *macvtap* adapter can be configured to connect the virtual Ethernet interface to a physical interface. Physical connection is then made between that physical interface and an interface on a physically separate workstation computer.



In both the above cases, the real or virtual workstation PC needs its connecting Ethernet interface configured with an IP address on the same network as the cOS Core interface. Once this is done, the management workstation and the Clavister Security Gateway can communicate and initial cOS Core setup can then be performed in exactly the same way as a non-virtual security gateway. This is described next in *Chapter 6, Configuring cOS Core*.

Setup with Multiple Virtual Clavister Security Gateways

When there are multiple virtual machines running cOS Core under one KVM host, the IP address of the management virtual Ethernet interface must be different for the different virtual machines if administration is to be done through the Web Interface or SSL client.

The recommended way to change the management interface IP address is to enter CLI commands into the cOS Core console which is displayed by KVM after cOS Core starts. The commands to do this are as follows:

1. Set the IP address of the default management interface *If1_ip*. In this example, it will be set to *10.0.0.1*:

   ```
   Device:/> set Address IP4Address If1_ip Address=10.0.0.1
   ```

2. Now set the network of the interface. This object has the name *If1_net*.

   ```
   Device:/> set Address IP4Address If1_net Address=10.0.0.0/24
   ```

3. As a check, the current management rule for HTTP access can be displayed:

   ```
   Device:/> show RemoteManagement RemoteMgmtHTTP
   ```

These steps should then be followed by an *activate* and then a *commit* command to deploy the changes.

These same steps could be performed through the Web Interface but as soon as the changes are committed, the administrator has 30 seconds to log back in to cOS Core before the changes are undone and cOS Core reverts to the previous configuration.

Chapter 4: Configuring Virtual Machines

Once the cOS Core virtual machine disk image is imported (this is described in the previous chapter), the KVM virtual machine environment will have a set of default parameters. For example, the virtual interfaces available to cOS Core. This section describes how these parameters should be configured.

Important: Read the previous chapter first

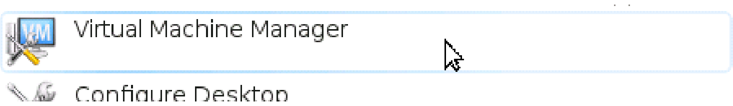
This chapter deals with changing the default virtual machine configuration ***after*** *it has been imported. Importing is described in* ***Chapter 3, Importing Virtual Machines*** *and that should be read first.*

Displaying the Current Configuration

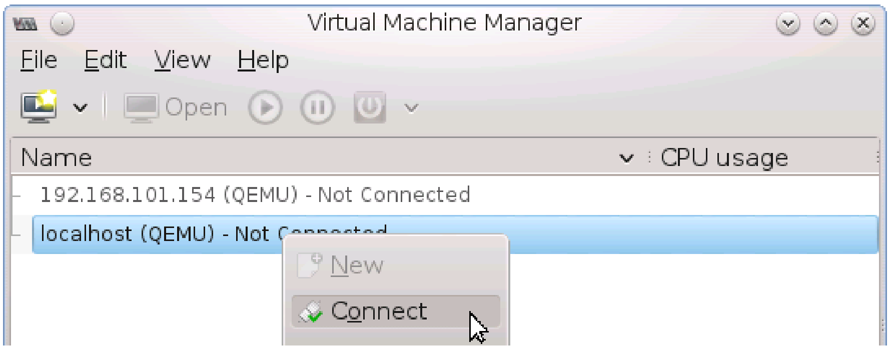
The current KVM configuration of a virtual machine can be displayed with the following steps:

1. Use a client console to access Linux and start the *virt-manager* software.

2. Start the *virt-manager* software. The *virt-manager* virtual machine manager software will be used throughout this guide but alternative virtual management software may be used.



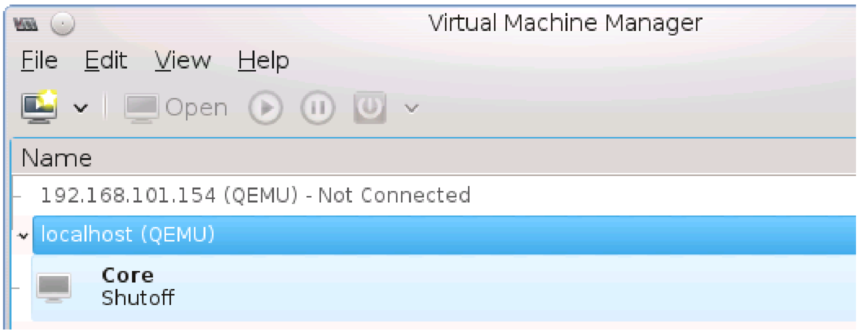
3. Connect to KVM by right-clicking on *localhost (QEMU)* and selecting the *Connect* menu option (or double-click on the *localhost* line).



192.168.101.154 (QEMU) - Not Connected

localhost (QEMU) - Not Connected

4. A list of currently defined virtual machines will be shown.



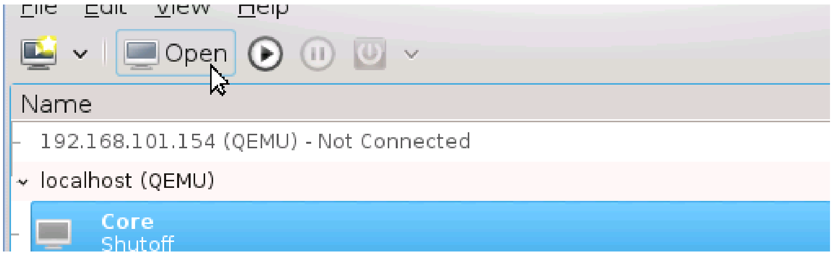
192.168.101.154 (QEMU) - Not Connected

localhost (QEMU)

Core
Shutoff

Changing the Configuration

1. To display and edit the currently selected virtual machine's configuration, first press the *Open* button in the toolbar.

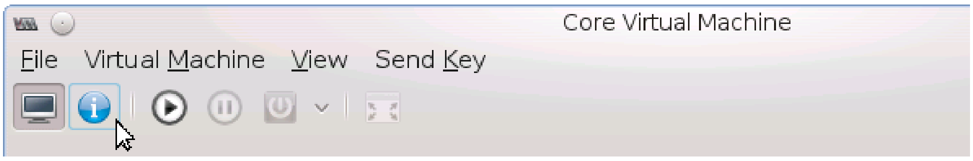


192.168.101.154 (QEMU) - Not Connected

localhost (QEMU)

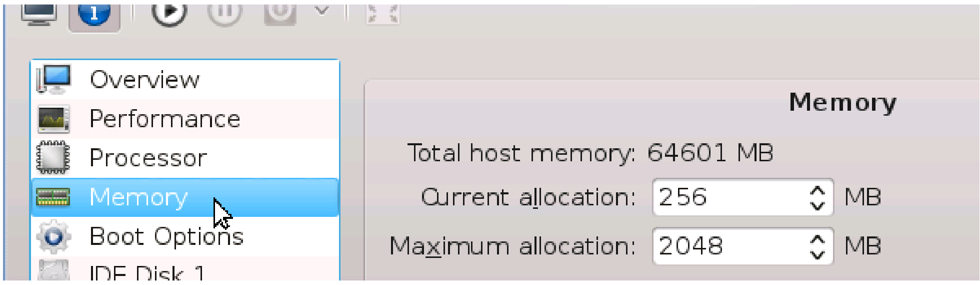
Core
Shutoff

2. The status dialog for this virtual machine will display. Press the information button in the toolbar.



3. The configuration of the virtual machine will now be displayed.

4. To change a configuration parameter, select it in the left hand navigation list and then alter the displayed values. For example, changing the default RAM memory allocation is shown below.



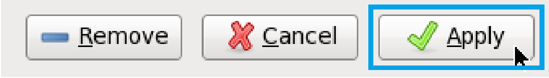
Memory

Total host memory: 64601 MB

Current allocation: 256 MB

Maximum allocation: 2048 MB

5. Save any configuration changes by pressing the *Apply* button.



Chapter 5: Adding Extra Interfaces

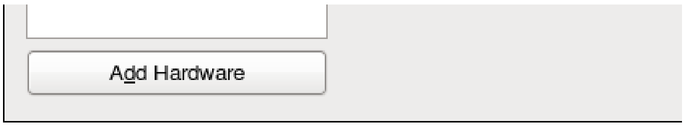
The default virtual machine created by the script *prepare.sh* has three virtual interfaces configured for cOS Core. These have logical cOS Core names **If1**, **If2** and **If3**.

If more virtual interfaces are required, these can be added later but must be manually configured. This chapter explains how extra interfaces can be added so they are correctly configured.

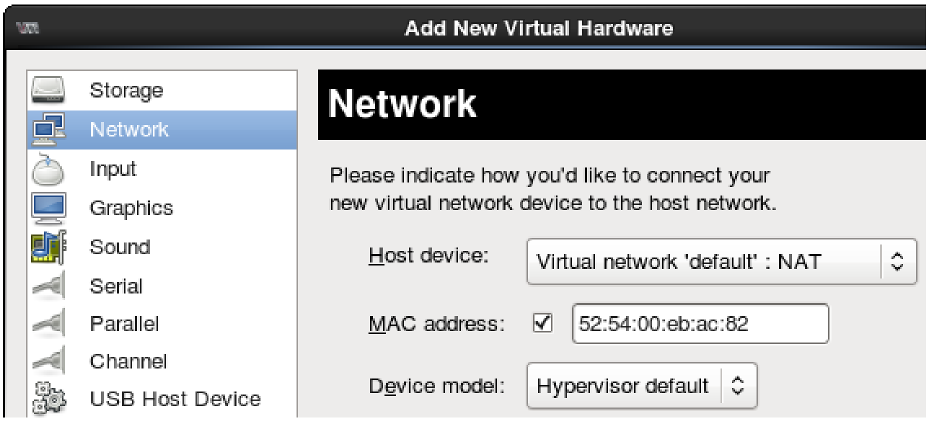
The steps are as follows:

1. Open *virt-manager* and open the configuration dialog for the virtual machine. Doing this is described previously in *Chapter 4, Configuring Virtual Machines*.

2. Press the *Add Hardware* button at the bottom of the configuration dialog.



3. The *Add New Virtual Hardware* dialog will be displayed. Select *Network* from the options on the left.



Network

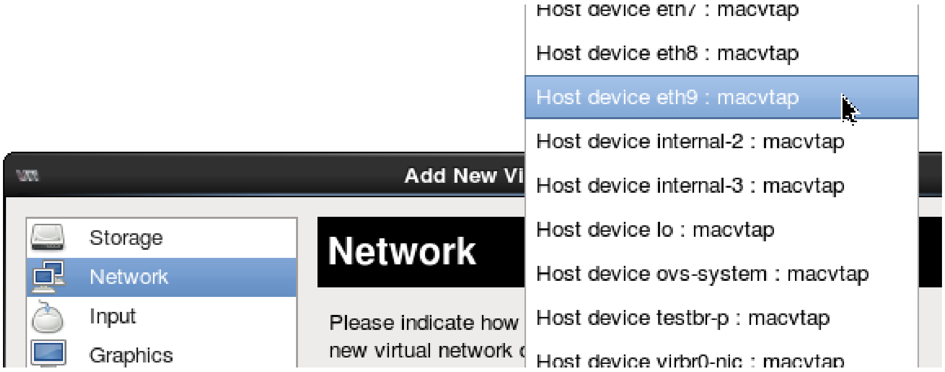
Please indicate how you'd like to connect your new virtual network device to the host network.

Host device: Virtual network 'default' : NAT

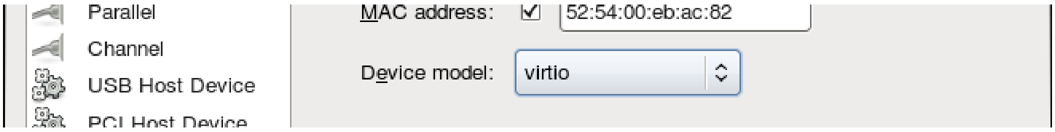
MAC address: ☑ 52:54:00:eb:ac:82

Device model: Hypervisor default

4. Now select the *Host Device* which will be the physical interface or bridge to be mapped to this virtual interface. In the screenshot below, a physical Ethernet interface called **eth9** will be selected for the mapping.


Add New Vi
Storage
Network
Input
Graphics
Network
Please indicate how
new virtual network
Host device eth7 : macvtap
Host device eth8 : macvtap
Host device eth9 : macvtap
Host device internal-2 : macvtap
Host device internal-3 : macvtap
Host device lo : macvtap
Host device ovs-system : macvtap
Host device testbr-p : macvtap
Host device virbr0-nic : macvtap

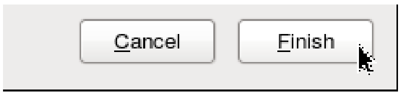
5. Next, select the *Device Model* to have the value *Virtio*.



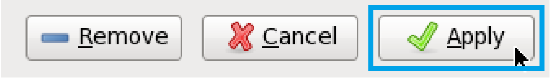
MAC address: ☑ 52:54:00:eb:ac:82

Device model: virtio

6. Close the new hardware dialog by pressing the *Finish* button.



7. The new interface will now appear in the list at the left of the configuration dialog. Press the *Apply* button to save the changed configuration.



8. Although the virtual interface has now been added to the virtual machine, cOS Core will not automatically add it to the current configuration. To add the interface, run the following cOS Core CLI command:

```
Device:/> pciscan -cfgupdate
```

The output from this command will confirm that a new interface has been added. If it is the first added and no previous ones have been deleted it should have the logical name **If4**.

Follow the *pciscan* command with the *activate* and *commit* CLI commands to save the configuration changes.

Caution: Adding and deleting cOS Core interfaces

*cOS Core allows logical interfaces to be deleted. If this is done the ordering of subsequently added logical interfaces can become unpredictable and may not necessarily have the first logical name that is available. For example, if cOS Core interface **If2** is deleted from the configuration, the next interface added using **pciscan** may not become **If2**.*

Chapter 6: Configuring cOS Core

6.1. Management Workstation Connection

The Default Management Interface

After first time startup, cOS Core scans the available Ethernet interfaces and makes management access available on the first interface found and assigns the IPv4 address **192.168.1.1** to it.

With installation under KVM, the default management interface is the cOS Core **If1** interface.

Alternative cOS Core Setup Methods

Initial cOS Core software configuration can be done in one of the following ways:

- **Through a web browser.**

  A standard web browser running on a standalone computer (also referred to as the *management workstation*) can be used to access the cOS Core *Web Interface*. This provides an intuitive graphical interface for cOS Core management. When this interface is accessed for the first time, a *setup wizard* runs automatically to guide a new user through key setup steps. The wizard can be closed if the administrator wishes to go directly to the Web Interface to perform setup manually.

  The wizard is recommended for its simplification of initial setup and is described in detail in *Section 6.2, "Web Interface and Wizard Setup"*.

- **Through a terminal console using CLI commands.**

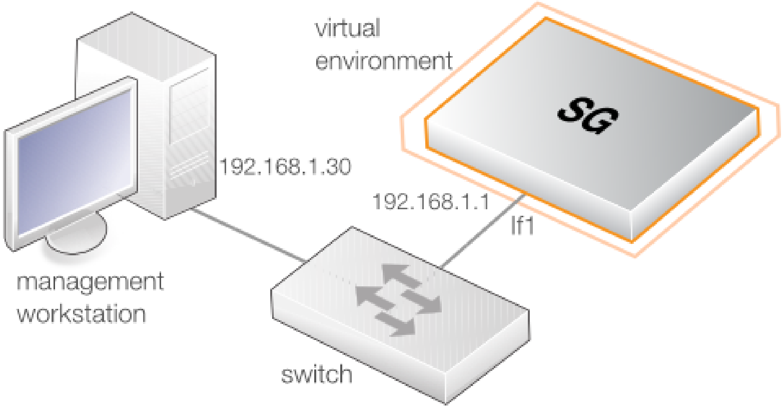
  The setup process can alternatively be performed using console CLI commands and this is described in *Section 6.4, "CLI Setup"*. The CLI allows step by step control of setup and should be used by administrators who fully understand both the CLI and setup process.

  CLI access can be remote, across a network to a cOS Core interface using a similar connection to that used with the Web Interface. Alternatively, CLI access can be direct, through the KVM console window.

Network Connection Setup

For setup using the Web Interface or using remote CLI, a management workstation computer must be first physically connected to cOS Core across a network. This connection is described previously in *Chapter 3, Importing Virtual Machines*.

The logical cOS Core management interface with KVM is **If1** and the corresponding physical Ethernet port associated with this should be connected to the same network as the management workstation (or a network accessible from the workstation via one or more routers). Typically the connection is made via a switch or hub in the network using a regular straight-through Ethernet cable as illustrated below.



For connection to the public Internet, one of the other interfaces should be connected to an ISP and this interface is sometimes referred to below and in the setup wizard as the *WAN* interface.

Workstation Ethernet Interface Setup

Traffic is able to flow between the designated workstation interface and the Clavister Security Gateway interface because they are on the same IP network. This means the workstation interface must be first assigned the following static IPv4 addresses:

- **IP address:** *192.168.1.30*
- **Subnet mask:** *255.255.255.0*
- **Default gateway:** *192.168.1.1*

Tip: Using another workstation interface IP address

*The IPv4 address assigned to the management workstation's Ethernet interface, could be any address from the **192.168.1.0/24** network. However, the IP chosen must be different from **192.168.1.1** which is used by cOS Core's default management interface.*

The following appendices at the end of this guide describe how to set up the management workstation IP with different platforms:

- ***Appendix A, Windows XP IP Setup***.
- ***Appendix B, Vista IP Setup***.
- ***Appendix C, Windows 7 IP Setup***.
- ***Appendix D, Windows 8/8.1/10 IP Setup***.
- ***Appendix E, Apple Mac IP Setup***.

6.2. Web Interface and Wizard Setup

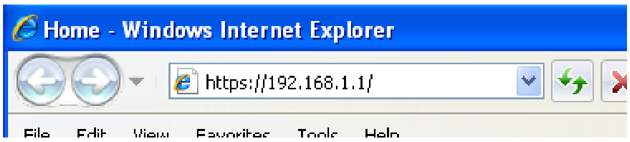
This chapter describes the setup when accessing cOS Core for the first time through a web browser. The user interface accessed in this way is called the Web Interface (also known as the WebUI).

Note

Many of the screenshots in this chapter have had whitespace removed from the original image to improve the readability. However, all of the informational content in the images has been preserved.

Connect By Surfing to *https://192.168.1.1*

Using a web browser, enter the address *https://192.168.1.1* into the navigation window as shown below.


Home - Windows Internet Explorer
https://192.168.1.1/
File Edit View Favorites Tools Help

Check for a proxy server and turn off popup blocking.

Make sure the web browser doesn't have a proxy server configured.

Any popup blocking in the browser should also be temporarily turned off to allow the setup wizard to run.

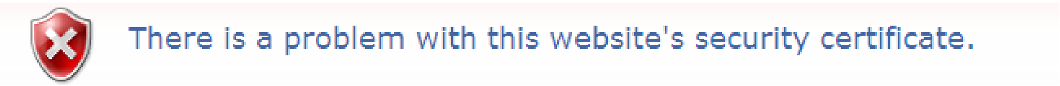
If there is no response from cOS Core and the reason is not clear, refer to the help checklist in *Section 6.6, “Setup Troubleshooting ”*.

Note: HTTP access is disabled for cOS Core 11.01 and later

For cOS Core version 11.01 and later, HTTP management access is disabled in the default configuration and HTTPS must be used. HTTP access can be enabled by the administrator but this is not recommended.

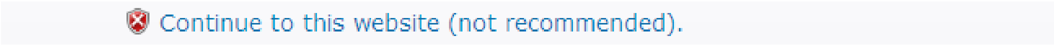
The cOS Core Self-signed Certificate

When responding to an *https://* request, cOS Core sends a self-signed certificate which will not be initially recognized so it will be necessary to tell the browser to accept the certificate for this and future sessions. Different browsers handle this in slightly different ways. In Microsoft Internet Explorer the following error message will be displayed in the browser window.



There is a problem with this website's security certificate.

To continue, tell IE to accept the certificate by clicking the following link which appears near the bottom of the browser window.



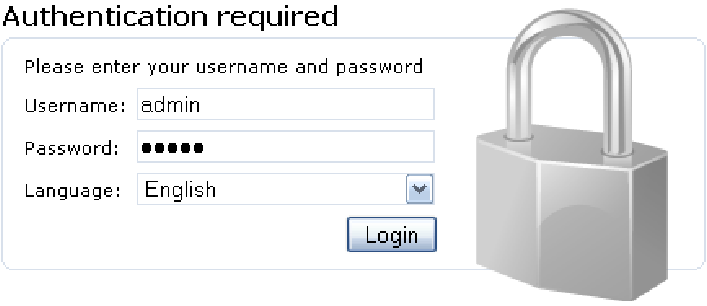
Continue to this website (not recommended).

In Firefox, this procedure is called "*Add a security exception*".

It is possible to configure cOS Core to use a CA signed certificate instead of self-signed certificate for the management login and doing this is described in the *cOS Core Administration Guide*.

The Login Dialog

cOS Core will next respond like a web server with the initial login dialog page as shown below.



Authentication required

Please enter your username and password

Username: admin

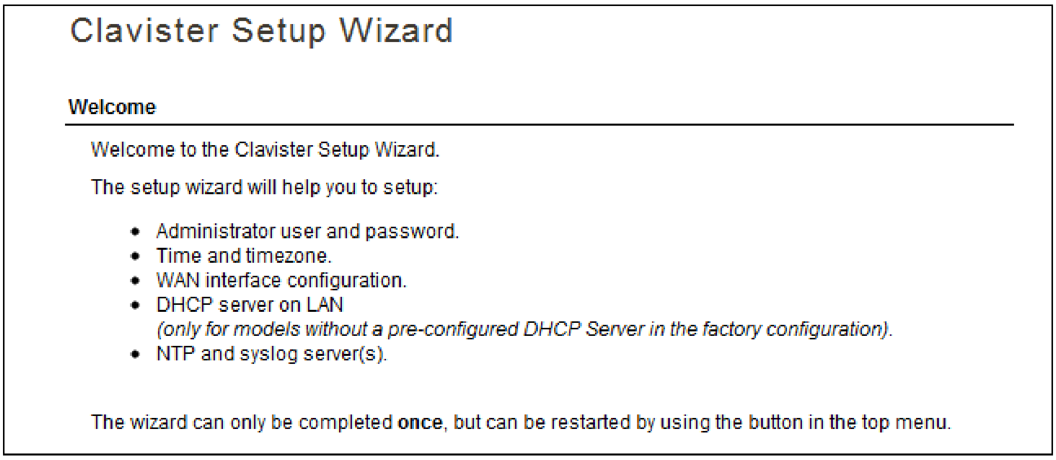
Password: ●●●●●

Language: English

The available Web Interface language options are selectable at the bottom of this dialog. This defaults to the language set for the browser if cOS Core supports that language.

Logging In and the Setup Wizard

Now login with the username *admin* and the password *admin*. The Web Interface will appear and the cOS Core setup wizard should begin automatically. The first wizard dialog is the wizard welcome screen which should appear as shown below.



Clavister Setup Wizard

Welcome

Welcome to the Clavister Setup Wizard.

The setup wizard will help you to setup:

- Administrator user and password.
- Time and timezone.
- WAN interface configuration.
- DHCP server on LAN
  (only for models without a pre-configured DHCP Server in the factory configuration).
- NTP and syslog server(s).

The wizard can only be completed **once**, but can be restarted by using the button in the top menu.

Cancelling the Wizard

The setup wizard can be cancelled at any point before the final *Activate* screen and run again by choosing the *Setup Wizard* option from the Web Interface toolbar. Once any configuration changes have been made and activated, either through the wizard, Web Interface or CLI, then the wizard cannot be run since the wizard requires that cOS Core has the factory defaults.

The Wizard Assumes Internet Access will be Configured

The wizard assumes that Internet access will be configured. If this is not the case, for example if the Clavister Security Gateway is being used in *Transparent Mode* between two internal networks, then the configuration setup is best done with individual Web Interface steps or through the CLI instead of through the wizard.

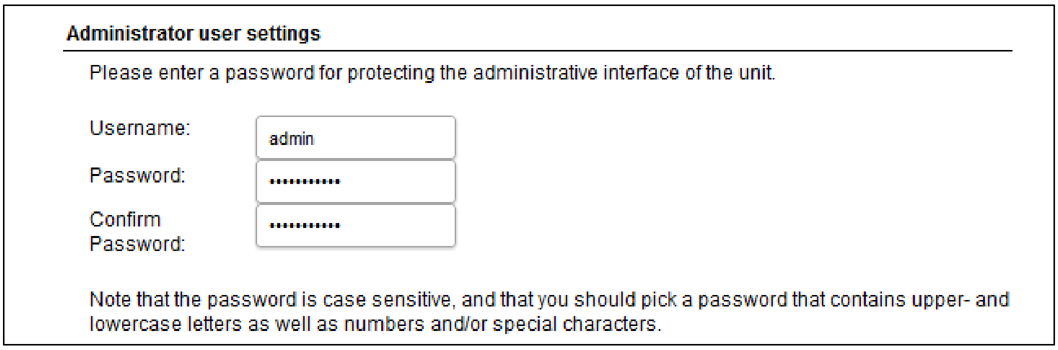
Advantages of the Wizard

The wizard makes setup easier because it automates what would otherwise be a more complex set of individual setup steps. It also reminds you to perform important tasks such as setting the date and time and configuring a log server.

The steps that the wizard goes through after the welcome screen are listed next.

Wizard step 1: Enter a new username and password

You will be prompted to enter a new administration username and password as shown below. It is recommended that this is always done and the new username/password is remembered (if these are forgotten, restoring to factory defaults will restore the original *admin/admin* combination). The password should be composed in a way which makes it difficult to guess.



Administrator user settings

Please enter a password for protecting the administrative interface of the unit.

Username: admin

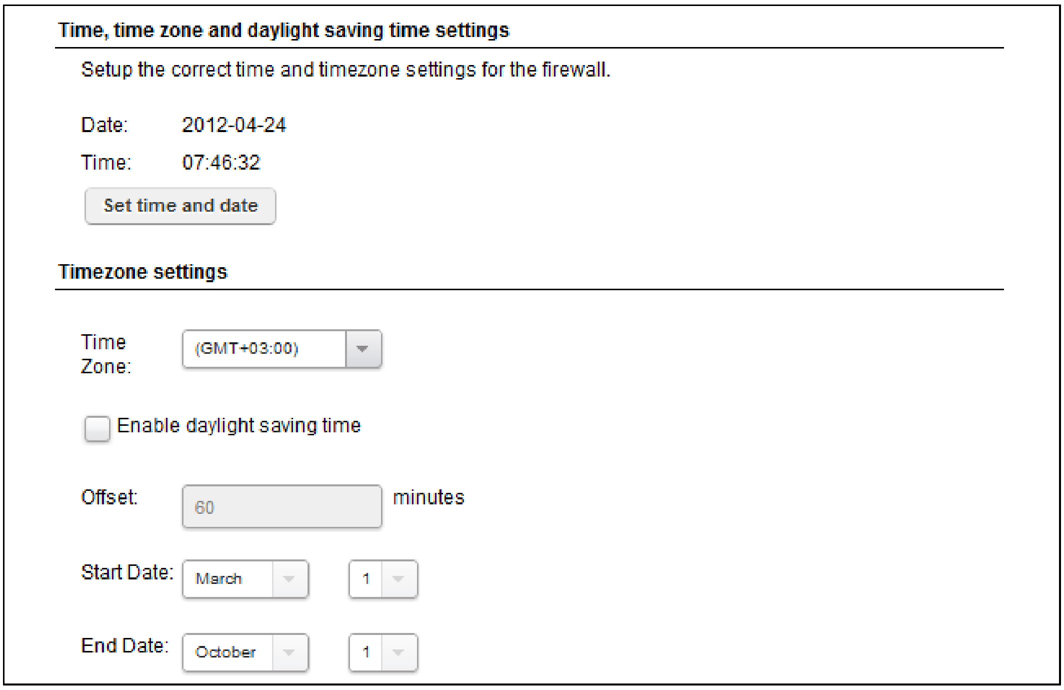
Password: •••••••••••

Confirm Password: •••••••••••

Note that the password is case sensitive, and that you should pick a password that contains upper- and lowercase letters as well as numbers and/or special characters.

Wizard step 2: Set the date and time

Many cOS Core functions rely on an accurate date and time, so it is important that this is set correctly in the fields shown below.



Time, time zone and daylight saving time settings

Setup the correct time and timezone settings for the firewall.

Date: 2012-04-24

Time: 07:46:32

Timezone settings

Time Zone: (GMT+03:00)

□ Enable daylight saving time

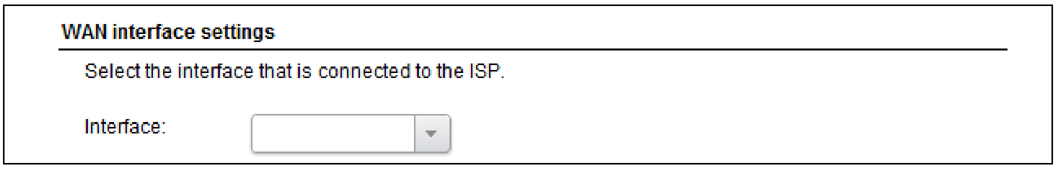
Offset: 60 minutes

Start Date: March 1

End Date: October 1

Wizard step 3: Select the *WAN* interface

Next, you will be asked for the *WAN* interface that will be used to connect to your ISP for Internet access.



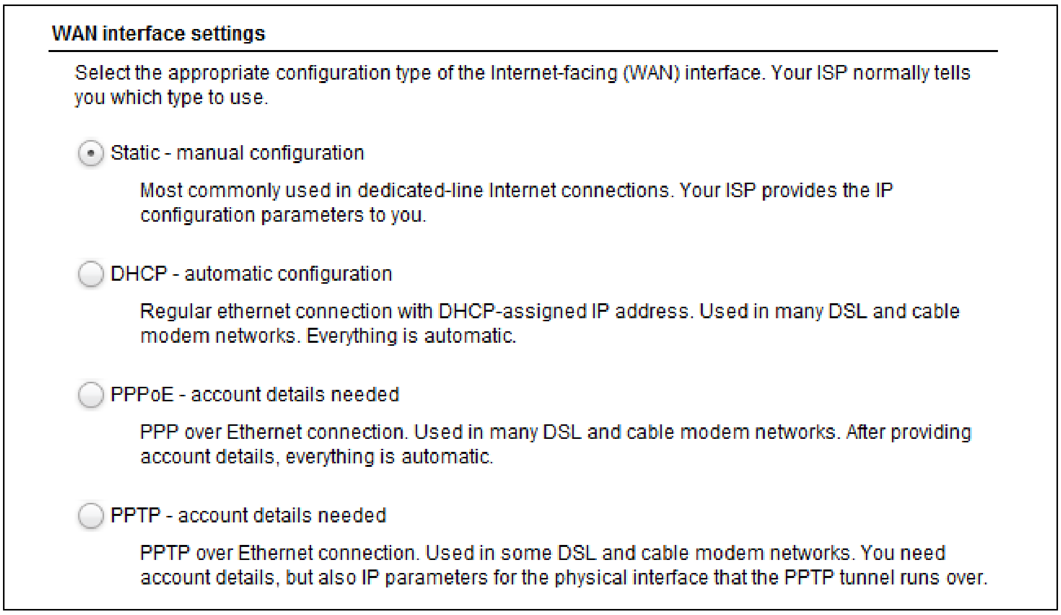
WAN interface settings

Select the interface that is connected to the ISP.

Interface:

Wizard step 4: Select the *WAN* interface settings

This step selects how the WAN connection to the Internet will function. It can be one of *Manual configuration*, *DHCP*, *PPPoE* or *PPTP* as shown below.



WAN interface settings

Select the appropriate configuration type of the Internet-facing (WAN) interface. Your ISP normally tells you which type to use.

● Static - manual configuration

Most commonly used in dedicated-line Internet connections. Your ISP provides the IP configuration parameters to you.

○ DHCP - automatic configuration

Regular ethernet connection with DHCP-assigned IP address. Used in many DSL and cable modem networks. Everything is automatic.

○ PPPoE - account details needed

PPP over Ethernet connection. Used in many DSL and cable modem networks. After providing account details, everything is automatic.

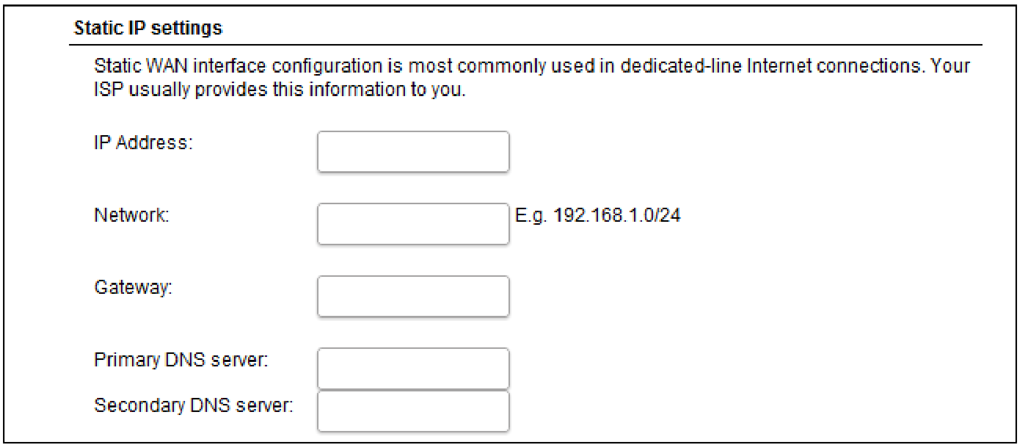
○ PPTP - account details needed

PPTP over Ethernet connection. Used in some DSL and cable modem networks. You need account details, but also IP parameters for the physical interface that the PPTP tunnel runs over.

These four different connection options are discussed next in the following subsections **4A** to **4D**.

- **4A. Static - manual configuration**

  Information supplied by the ISP should be entered in the next wizard screen. All fields need to be entered except for the *Secondary DNS server* field.



Static IP settings

Static WAN interface configuration is most commonly used in dedicated-line Internet connections. Your ISP usually provides this information to you.

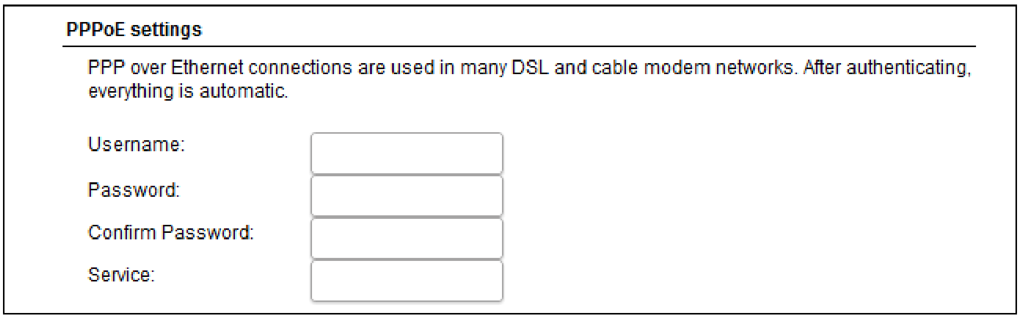
IP Address:		
Network:		E.g. 192.168.1.0/24
Gateway:		
Primary DNS server:		
Secondary DNS server:		

- **4B. DHCP - automatic configuration**

  All required IP addresses will automatically be retrieved from the ISP's DHCP server with this option. No further configuration is required for this so it does not have its own wizard screen.

- **4C. PPPoE settings**

  The username and password supplied by your ISP for PPPoE connection should be entered. The *Service* field should be left blank unless the ISP supplies a value for it.



PPPoE settings

PPP over Ethernet connections are used in many DSL and cable modem networks. After authenticating, everything is automatic.

Username:

Password:

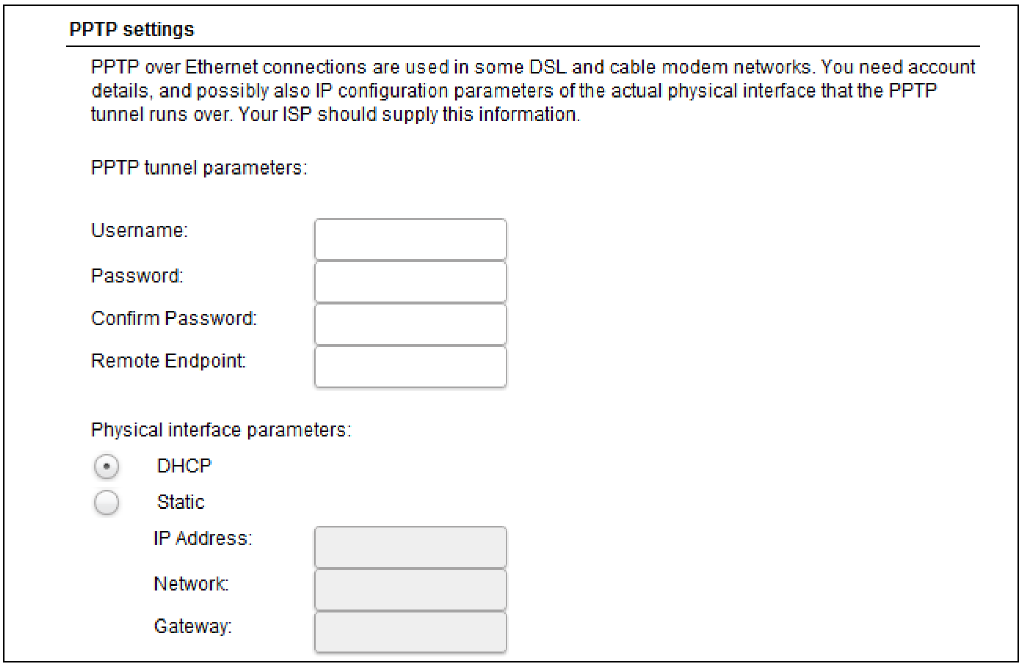
Confirm Password:

Service:

DNS servers are set automatically after connection with PPPoE.

- **4D. PPTP settings**

  The username and password supplied by your ISP for PPTP connection should be entered. If DHCP is to be used with the ISP then this should be selected, otherwise *Static* should be selected followed by entering the static IP address supplied by the ISP.



PPTP settings

PPTP over Ethernet connections are used in some DSL and cable modem networks. You need account details, and possibly also IP configuration parameters of the actual physical interface that the PPTP tunnel runs over. Your ISP should supply this information.

PPTP tunnel parameters:

Username:

Password:

Confirm Password:

Remote Endpoint:

Physical interface parameters:

● DHCP

○ Static

IP Address:

Network:

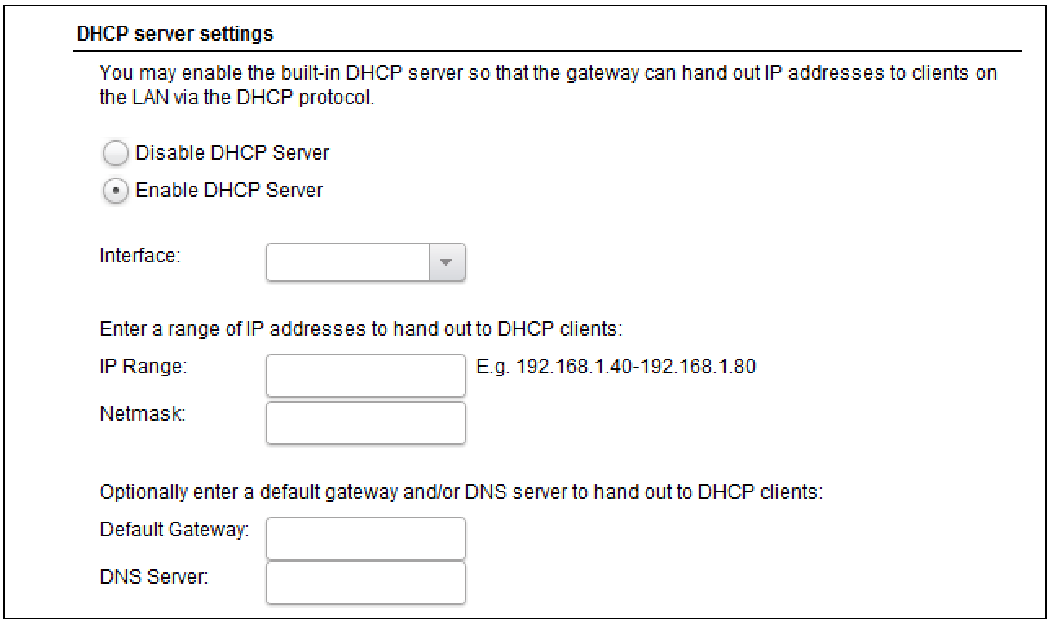
Gateway:

DNS servers are set automatically after connection with PPTP.

Wizard step 5: DHCP server settings

If the Clavister Security Gateway is to function as a DHCP server, it can be enabled here in the wizard on a particular interface or configured later.

For example, the private IPv4 address range might be specified as *192.168.1.50 - 192.168.1.150* with a netmask of *255.255.255.0*.



DHCP server settings

You may enable the built-in DHCP server so that the gateway can hand out IP addresses to clients on the LAN via the DHCP protocol.

○ Disable DHCP Server
● Enable DHCP Server

Interface:

Enter a range of IP addresses to hand out to DHCP clients:

IP Range: E.g. 192.168.1.40-192.168.1.80

Netmask:

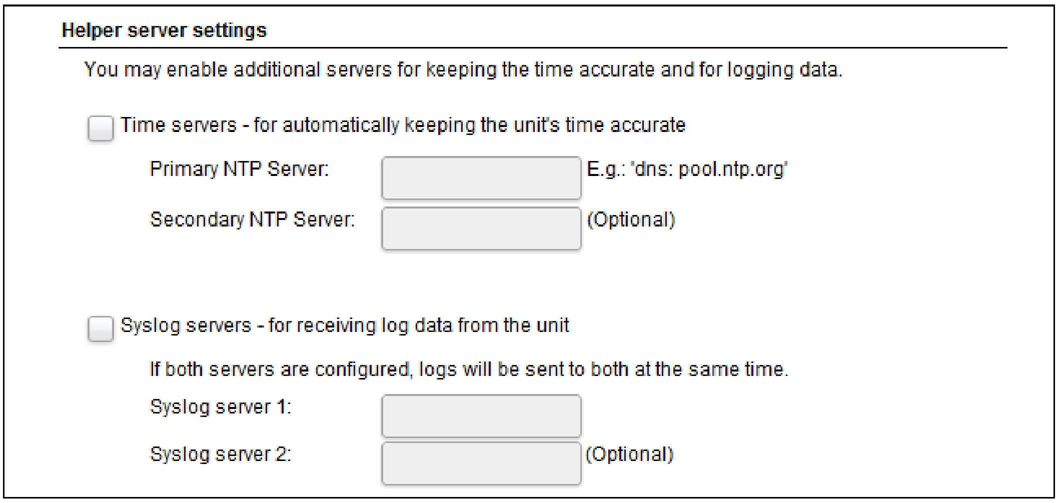
Optionally enter a default gateway and/or DNS server to hand out to DHCP clients:

Default Gateway:

DNS Server:

Wizard step 6: Helper server settings

Optional NTP and Syslog servers can be enabled here in the wizard or configured later. *Network Time Protocol* servers keep the system date and time accurate. Syslog servers can be used to receive and store log messages sent by cOS Core.



Helper server settings

You may enable additional servers for keeping the time accurate and for logging data.

□ Time servers - for automatically keeping the unit's time accurate

Primary NTP Server: E.g.: 'dns: pool.ntp.org'

Secondary NTP Server: (Optional)

□ Syslog servers - for receiving log data from the unit

If both servers are configured, logs will be sent to both at the same time.

Syslog server 1:

Syslog server 2: (Optional)

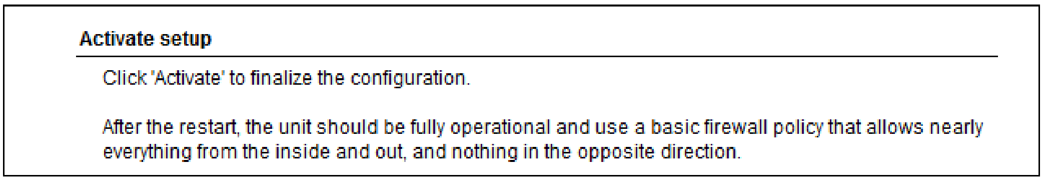
For the default gateway, it is recommended to specify the IP address *192.168.1.1* and the DNS server specified should be the DNS supplied by your ISP.

When specifying a hostname as a server instead of an IP address, the hostname should be prefixed with the string *dns:*. For example, the hostname *host1.company.com* should be entered as *dns:host1.company.com*.

Wizard step 7: Activate setup

The final step is to activate the setup by pressing the *Activate* button. After this step the Web

Interface returns to its normal appearance and the administrator can continue to configure the system.



Activate setup

Click 'Activate' to finalize the configuration.

After the restart, the unit should be fully operational and use a basic firewall policy that allows nearly everything from the inside and out, and nothing in the opposite direction.

Running the Wizard Again

Once the wizard has been successfully finished and activated, it cannot be run again. The exception to this is if the Clavister Security Gateway has its factory defaults restored in which case the unit will behave as though it were being started for the first time.

Uploading a License

Without a valid license installed, cOS Core operates in *demo mode* (demonstration mode) and will cease operations 2 hours after startup. To remove this restriction, a valid license must be uploaded to cOS Core. Doing this is described in *Section 6.5, "Installing a License"*

6.3. Manual Web Interface Setup

This section describes initial cOS Core configuration performed directly through the Web Interface, without using the setup wizard. Configuration is done as a series of individual steps, giving the administrator more direct control over the process. Even if the wizard is used, this section can also be read as a good introduction to using the Web Interface for configuring key aspects of cOS Core.

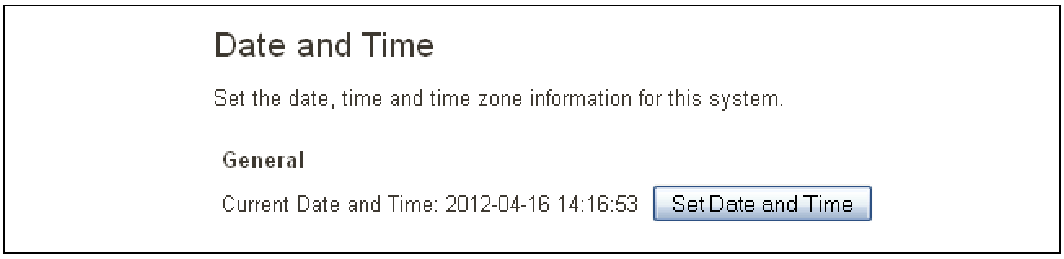
Ethernet Interfaces

The physical connection of external networks to the Clavister Security Gateway is through the various *Ethernet interfaces* which are provided by the hardware platform. In a virtual environment, these are the *virtual interfaces* provided by the hypervisor. On first-time startup, cOS Core scans for these interfaces and determines which are available and allocates their names. The first interface detected in the scan always becomes the initial default management interface and this cannot be changed beforehand.

All cOS Core interfaces are logically equal for cOS Core and although their physical capabilities may be different, any interface can perform any logical function. With cOS Core under KVM, the virtual *If1* interface is always the management interface. Assuming the normal KVM total of 3 virtual interfaces, the other two virtual interfaces will automatically be given the names *If2* and *If3* by cOS Core. For this section, we will assume that the *If2* interface will be used for connection to the public Internet and the *If3* interface will be used for connection to a protected, local network.

Setting the Date and Time

Many cOS Core functions rely on an accurate date and time, so it is important that this is set correctly. Even when running in a virtual environment, each virtual security gateway maintains its own date and time and it is still important that this is set correctly for each gateway. To do this, select **System > Device > Date and Time**.



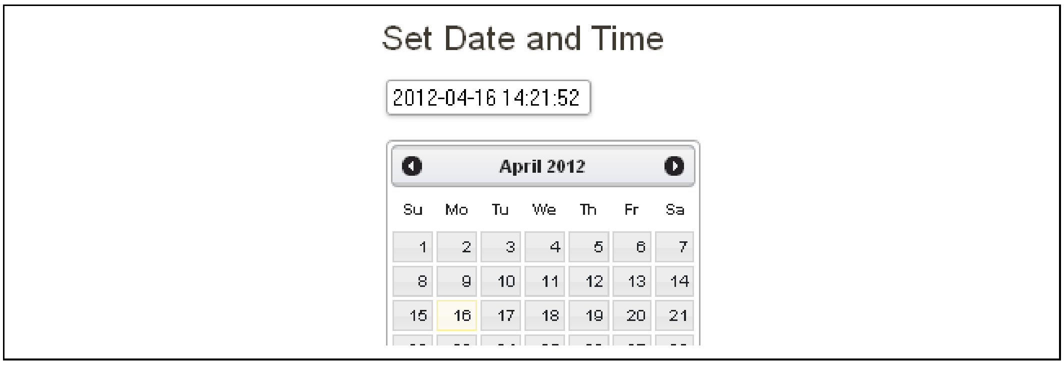
Date and Time

Set the date, time and time zone information for this system.

General

Current Date and Time: 2012-04-16 14:16:53

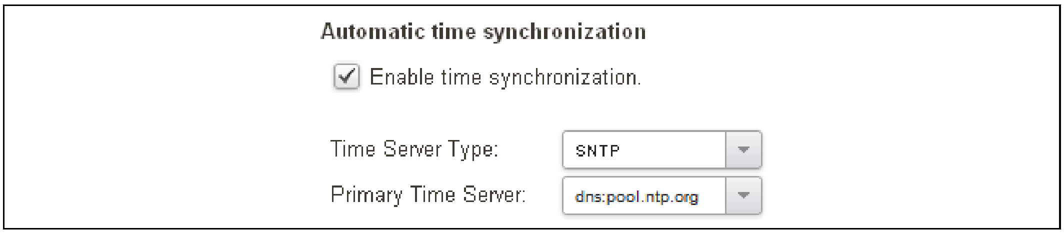
By pressing the **Set Date and Time** button, a dialog appears that allows the exact time to be set.



Set Date and Time

2012-04-16 14:21:52

A **Network Time Protocol** (NTP) servers can optionally be configured to maintain the accuracy of the system date and time and this will require public Internet access. Enabling this option is strongly recommended since it ensures the accuracy of the date and time. A typical NTP setup is shown below.



Automatic time synchronization

☑ Enable time synchronization.

Time Server Type: SNTP

Primary Time Server: dns:pool.ntp.org

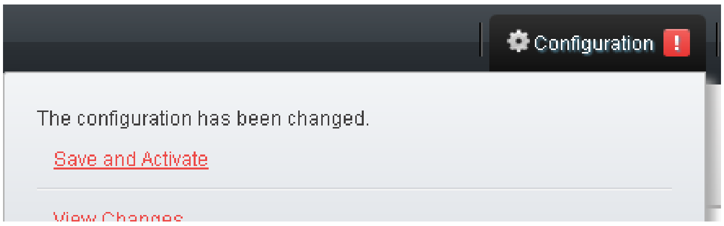
Note: The time server URL requires the "dns:" prefix

*When specifying a URL in cOS Core for the time server, the URL must have the prefix "**dns:**".*

Once the values are set correctly, we can press the **OK** button to save the values while we move on to more steps in cOS Core configuration. Although changed values like this are saved by cOS Core, they do not become active until the entire saved configuration becomes the current and active configuration. We will look at how to do this next.

Activating Configuration Changes

To activate any cOS Core configuration changes made so far, we need to select the **Save and Activate** option from the **Configuration** menu (this process is also sometimes referred to as *deploying* a configuration).

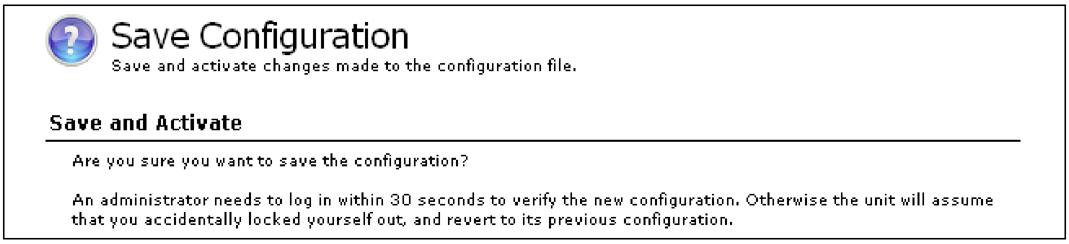


The configuration has been changed.

Save and Activate

View Changes

A dialog is then presented to confirm that the new configuration is to become the running configuration.



Save Configuration

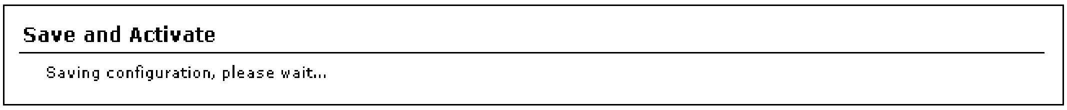
Save and activate changes made to the configuration file.

Save and Activate

Are you sure you want to save the configuration?

An administrator needs to log in within 30 seconds to verify the new configuration. Otherwise the unit will assume that you accidentally locked yourself out, and revert to its previous configuration.

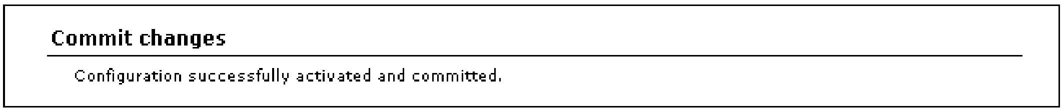
After clicking **OK**, cOS Core *reconfiguration* will take place and, after a short delay, the Web Interface will try and connect again to the security gateway.



Save and Activate

Saving configuration, please wait...

If no reconnection is detected by cOS Core within 30 seconds (this length of time is a setting that can be changed) then cOS Core will revert back to the original configuration. This is to ensure that the new configuration does not accidentally lock out the administrator. After reconfiguration and successful reconnection, a success message is displayed indicating successful reconfiguration.



Commit changes

Configuration successfully activated and committed.

Reconfiguration is a process that the cOS Core administrator may initiate often. Normally, reconfiguration takes a brief amount of time and causes only a slight delay in traffic throughput. Active user connections through the Clavister Security Gateway should rarely be lost.

Tip: How frequently to commit changes

It is up to the administrator to decide how many changes to make before activating a new configuration. Sometimes, activating configuration changes in small batches can be appropriate in order to check that a small set of changes work as planned. It is, however, not advisable to leave changes uncommitted for long periods of time, such as overnight, since any system outage will result in these edits being lost.

Automatic Logout

If there is no activity through the Web Interface for a period of time (the default is 15 minutes), cOS Core will automatically log the user out. If they log back in through the same web browser session then they will return to the point they were at before the logout occurred and no saved (but not yet activated) changes are lost.

Setting Up Internet Access

Next, we shall look at how to set up public Internet access. The setup wizard described in the previous chapter, provides the following four options:

A. Static - manual configuration.

B. DHCP - automatic configuration.

C. PPPoE setup

D. PPTP setup

The individual manual steps to configure these connection alternatives with the Web Interface are discussed next.

A. Static - manual configuration

Manual configuration means that there will be a direct connection to the ISP and all the relevant IP addresses for the connecting interface are fixed values provided by the ISP which are entered into cOS Core manually.

Note: The interface DHCP option should be disabled

For static configuration of the Internet connection, the DHCP option must be disabled (the default) in the properties of the interface that will connect to the ISP.

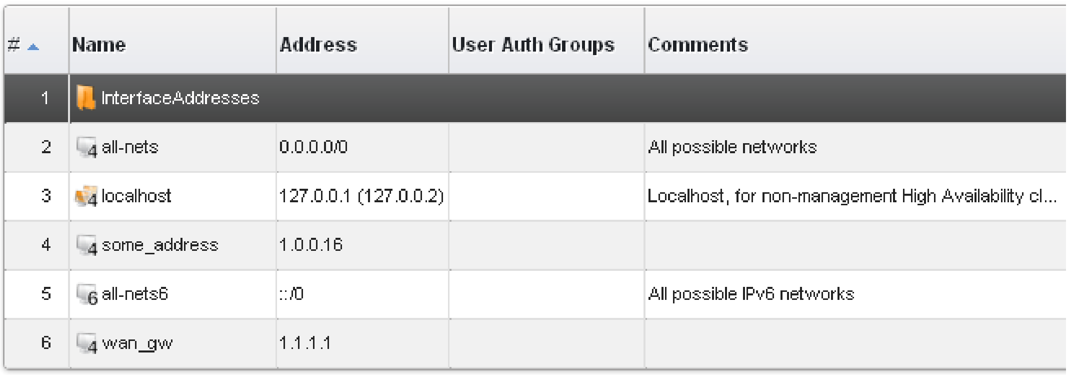
The initial step is to set up a number of IP address objects in the cOS Core *Address Book*. Let us assume for this section that the physical interface used for Internet connection is *If2* the static IP address for this interface is to be *10.5.4.35*, the ISP's gateway IP address is *10.5.4.1*, and the network to which they both belong is *10.5.4.0/24*.

Note: Private IP addresses are used for example only

Each installation's IP addresses will be different from these IP addresses but they are used here only to illustrate how setup is done. Also, these addresses are private IP addresses and in reality an ISP would use public IP addresses instead.

Let's now add the gateway *IP4 Address* object which we will call *wan_gw* and assign it the IP address *10.5.4.1*. The ISP's gateway is the first router hop towards the public Internet from the Clavister Security Gateway. Go to **Objects > Address Book** in the Web Interface.

The current contents of the address book will be listed and will contain a number of predefined objects automatically created by cOS Core after it scans the interfaces for the first time. The screenshot below shows the initial address book for the KVM.

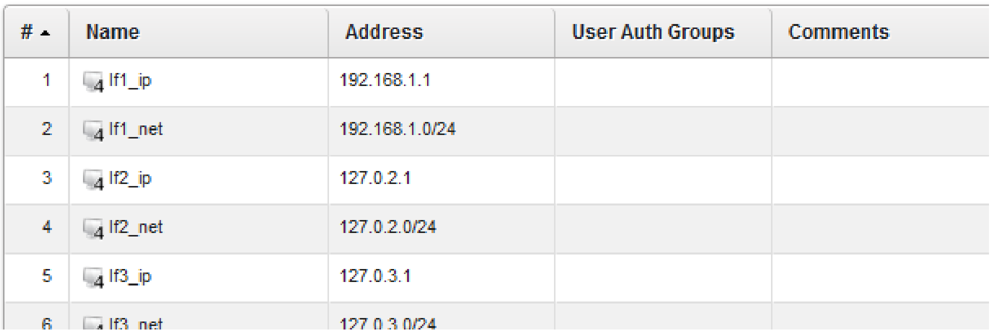


# ▲	Name	Address	User Auth Groups	Comments
1	InterfaceAddresses			
2	all-nets	0.0.0.0/0		All possible networks
3	localhost	127.0.0.1 (127.0.0.2)		Localhost, for non-management High Availability cl...
4	some_address	1.0.0.16		
5	all-nets6	::/0		All possible IPv6 networks
6	wan_gw	1.1.1.1		

Note: The all-nets address object represents any address

*The IPv4 address object **all-nets** (0.0.0.0/0) is an object that should never be changed and can be used in many types of cOS Core rules to refer to any IPv4 address or network range. The address object **all-net6** (::/0) is the IPv6 equivalent and represents any IPv6 address or network range.*

For the KVM, all the Ethernet interface related address objects are gathered together in an *address book folder* called *InterfaceAddresses*. By clicking on this folder, it will be opened and the individual address objects it contains can be viewed. The first few addresses automatically added to the folder are shown below.



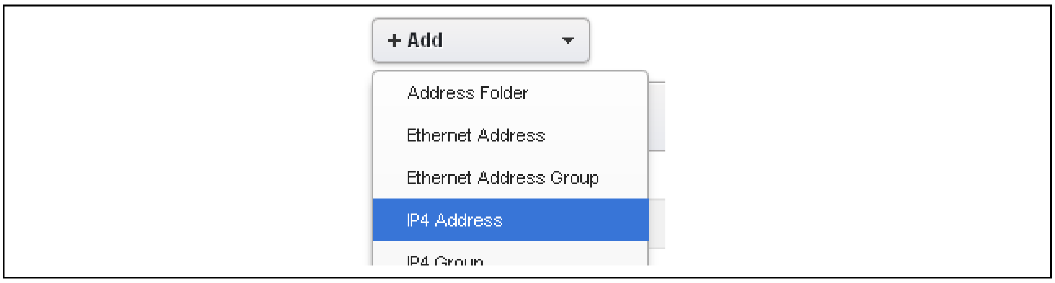
# ▲	Name	Address	User Auth Groups	Comments
1	If1_ip	192.168.1.1		
2	If1_net	192.168.1.0/24		
3	If2_ip	127.0.2.1		
4	If2_net	127.0.2.0/24		
5	If3_ip	127.0.3.1		
6	If3_net	127.0.3.0/24		

On initial startup, two IP address objects are create automatically for each interface detected by cOS Core. The first IP address object is named by combining the physical interface name with the suffix *_ip* and this is used for the IP address assigned to that interface. The other address object is named by combining the interface name with the suffix *_net* and this is the network to which the interface belongs.

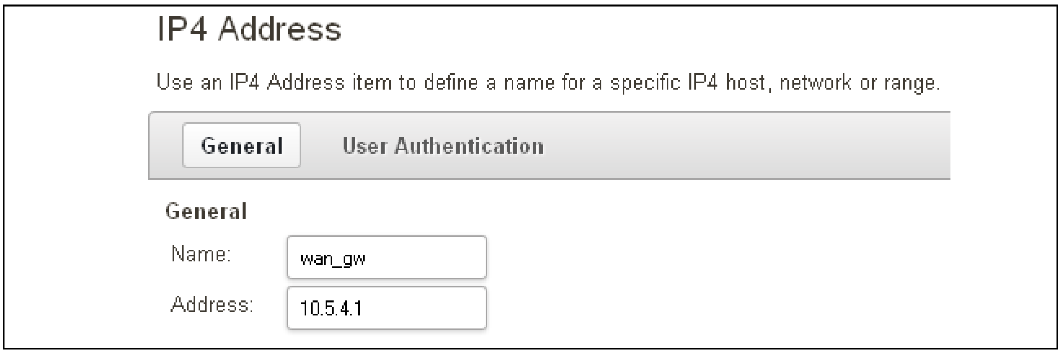
Tip: Creating address book folders

New folders can be created when needed and provide a convenient way to group together related IP address objects. The folder name can be chosen to indicate the folder's contents.

Now click the **Add** button at the top left of the list and choose the *IP4 Address* option to add a new address to the folder.



Enter the details of the object into the properties fields for the IP4 Address. Below, we have entered the IP address *10.5.4.1* for the address object called *wan_gw*. This is the IP of the ISP's router which acts as the gateway to the Internet.



IP4 Address

Use an IP4 Address item to define a name for a specific IP4 host, network or range.

General | User Authentication

General

Name: wan_gw

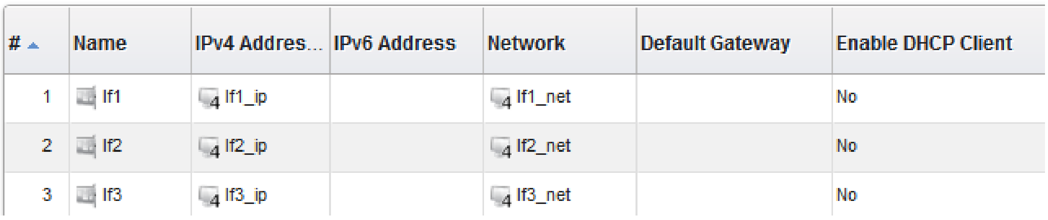
Address: 10.5.4.1

Click the **OK** button to save the values entered.

Then set up *If2_ip* to be *10.5.4.35*. This is the IP address of the *If2* interface which will connect to the ISP's gateway.

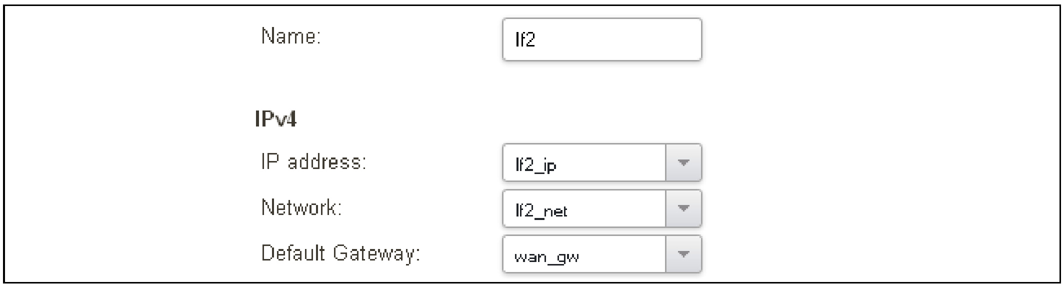
Lastly, set the IP4 Address object *If2_net* to be *10.5.4.0/24*. Both *If2_ip* and *wan_gw* must belong to this network in order for the interface to communicate with the ISP.

Together, these 3 IP address objects will be used to configure the interface connected to the Internet which in this example is *If2*. Select **Network > Interfaces and VPN > Ethernet** to display a list of the physical interfaces.



# ▲	Name	IPv4 Addres...	IPv6 Address	Network	Default Gateway	Enable DHCP Client
1	If1	If1_ip		If1_net		No
2	If2	If2_ip		If2_net		No
3	If3	If3_ip		If3_net		No

Click on the interface in the list which is to be connected to the Internet. The properties for this interface will now appear and the relevant settings can be entered or changed.



Name: If2

IPv4

IP address: If2_ip

Network: If2_net

Default Gateway: wan_gw

Press **OK** to save the changes. Although changes are remembered by cOS Core, the changed configuration is not yet activated and won't be activated until cOS Core is told to activate the changed configuration.

Remember that DHCP should **not** be enabled when using static IP addresses and also that the IP address of the *Default Gateway* (which is the ISP's router) **must** be specified. As explained in more detail later, specifying the *Default Gateway* also has the additional effect of automatically adding a route for the gateway in the cOS Core routing table.

At this point, the connection to the Internet is configured but no traffic can flow to or from the Internet since all traffic needs a minimum of the following two cOS Core configuration objects to exist before it can flow through the Clavister Security Gateway:

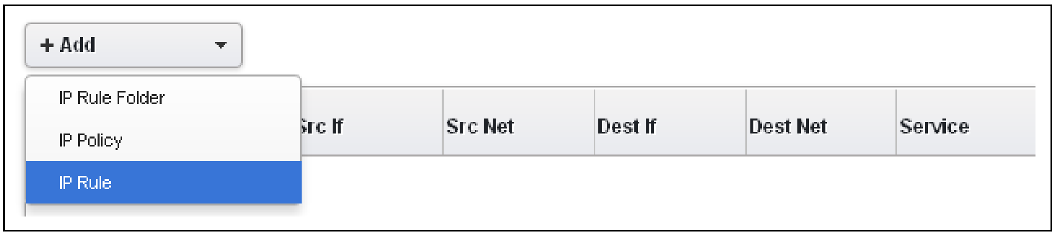
- An *IP rule* defined in a cOS Core *IP rule set* that explicitly allows traffic to flow from a given source network and source interface to a given destination network and destination interface.
- A *route* defined in a cOS Core routing table which specifies on which interface cOS Core can find the traffic's destination IP address.

  If multiple matching routes are found, cOS Core uses the route that has the smallest (in other words, the narrowest) IP range.

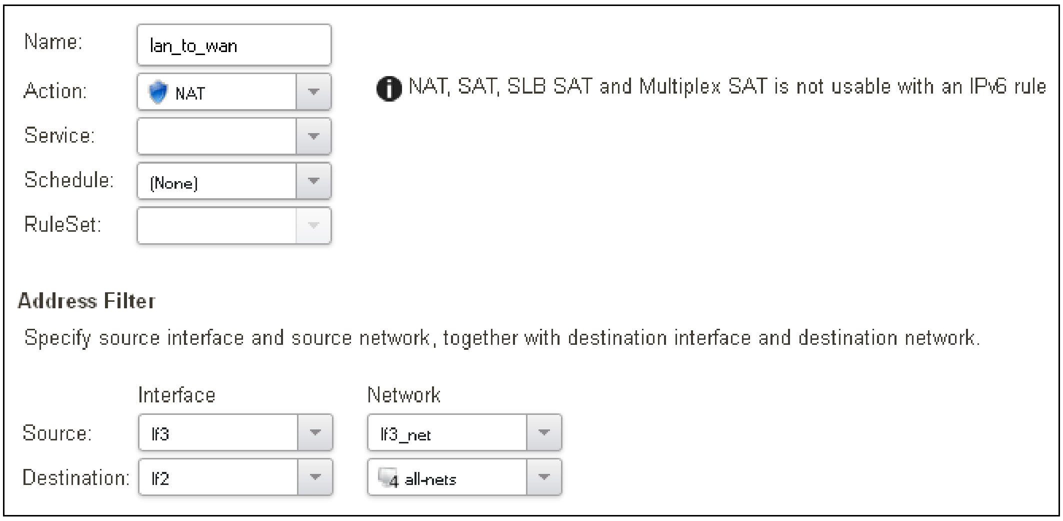
We must therefore first define an IP rule that will allow traffic from a designated source interface and source network. In this case let us assume we want to allow web surfers on the internal network *If3_net* connected to the interface *If3* to be able to access the public Internet.

To do this, we first go to **Policies > Firewalling > Main IP Rules**.

The empty *main* IP rule set will now appear. Press the **Add** button at the top left and select **IP Rule** from the menu.



The properties for the new IP rule will appear. In this example, we will call the rule *lan_to_wan*. The rule *Action* is set to *NAT* (this is explained further below) and the *Service* is set to *http-all* which is suitable for most web surfing (it allows both HTTP and HTTPS connections). The interface and network for the source and destinations are defined in the *Address Filter* section of the rule.



Name: lan_to_wan

Action: NAT

Service:

Schedule: (None)

RuleSet:

NAT, SAT, SLB SAT and Multiplex SAT is not usable with an IPv6 rule

Address Filter

Specify source interface and source network, together with destination interface and destination network.

	Interface	Network
Source:	If3	If3_net
Destination:	If2	all-nets

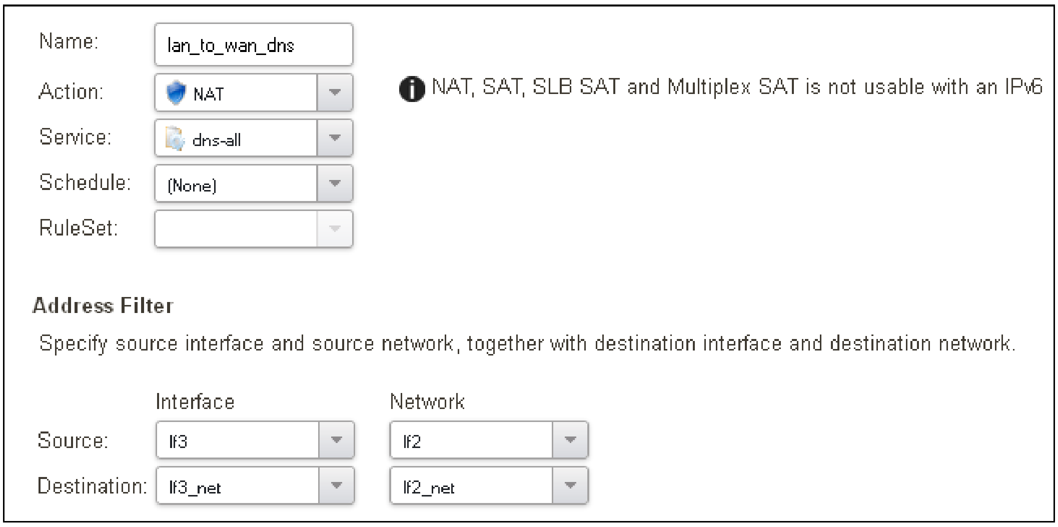
The destination network in the IP rule is specified as the predefined IP4 Address object *all-nets*. This is used since we don't know to which IP address the web surfing will be done and this allows surfing to any IP address. IP rules are processed in a top down fashion, with the first matching rule being obeyed. An *all-nets* rule like this should be placed towards the bottom of the rule set since other rules with narrower destination addresses should trigger before it does.

Only one rule is needed since any traffic controlled by a *NAT* rule will be controlled by the cOS Core *state engine*. This means that the rule will allow *connections* that originate from the source network/destination and also implicitly allow any returning traffic that results from those connections.

In the above, we selected the service called *http_all* which is already defined in cOS Core. It is advisable to make the service in an IP rule as restrictive as possible to provide the best security possible. Custom service objects can be created and new service objects can be created which are combinations of existing services.

We could have specified the rule *Action* to be *Allow*, but only if all the hosts on the protected local network have public IP addresses. By using *NAT*, cOS Core will use the destination interface's IP address as the source IP. This means that external hosts will send their responses back to the interface IP and cOS Core will automatically direct the traffic back to the originating local host. Only the outgoing interface therefore needs to have a public IP address and the internal network topology is hidden.

To allow web surfing, DNS lookup also needs to be allowed in order to resolve URLs into IP addresses. The service *http_all* does not include the *DNS* protocol so we need a similar IP rule that allows this. This could be done with one IP rule that uses a custom service which combines the *HTTP* and *DNS* protocols but the recommended method is to create an entirely new IP rule that mirrors the above rule but specifies the service as *dns-all*. This method provides the most clarity when the configuration is examined for any problems. The screenshot below shows a new rule called *lan_to_wan_dns* being created to allow DNS.



Name:	lan_to_wan_dns
Action:	NAT
Service:	dns-all
Schedule:	(None)
RuleSet:	

NAT, SAT, SLB SAT and Multiplex SAT is not usable with an IPv6

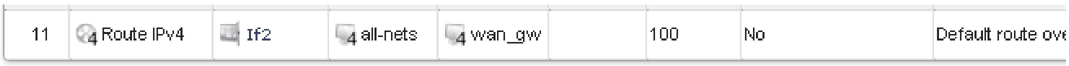
Address Filter

Specify source interface and source network, together with destination interface and destination network.

	Interface	Network
Source:	If3	If2
Destination:	If3_net	If2_net

This IP rule also specifies that the action for DNS requests is *NAT* so all DNS request traffic is sent out by cOS Core with the outgoing interface's IP address as the source IP.

For the Internet connection to work, a *route* also needs to be defined so that cOS Core knows on which interface the web browsing traffic should leave the Clavister Security Gateway. This route will define the interface where the network *all-nets* (in other words, any network) will be found. If we open the default *main* routing table by going to **Network > Routing > Routing Tables > main**, the route needed should appear as shown below.



11	Route IPv4	If2	all-nets	wan_gw		100	No	Default route ove

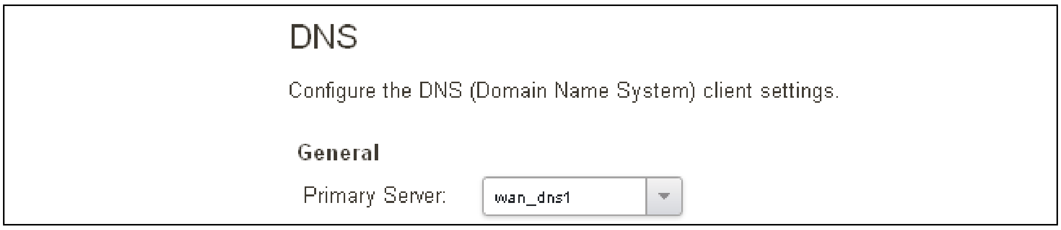
This required *all-nets* route is, in fact, added automatically after specifying the *Default Gateway* for a particular Ethernet interface which we did earlier after setting up the required IP4 Address objects.

Note: Disabling automatic route generation

*Automatic route generation is enabled and disabled with the setting "**Automatically add a default route for this interface using the given default gateway**" which can be found in the properties of the interface.*

As part of the setup, it is also recommended that at least one DNS server is also defined in cOS Core. This DSN server or servers (a maximum of three can be configured) will be used when cOS Core itself needs to resolve URLs which is the case when a URL is specified in a configuration instead of an IP address.

Let's assume an IP address object called *wan_dns1* has already been defined in the address book which is the IP address for the first DNS server. By choosing **System > Device > DNS**, the DNS server dialog will open and this object from the address book can be assigned as the first server.



DNS

Configure the DNS (Domain Name System) client settings.

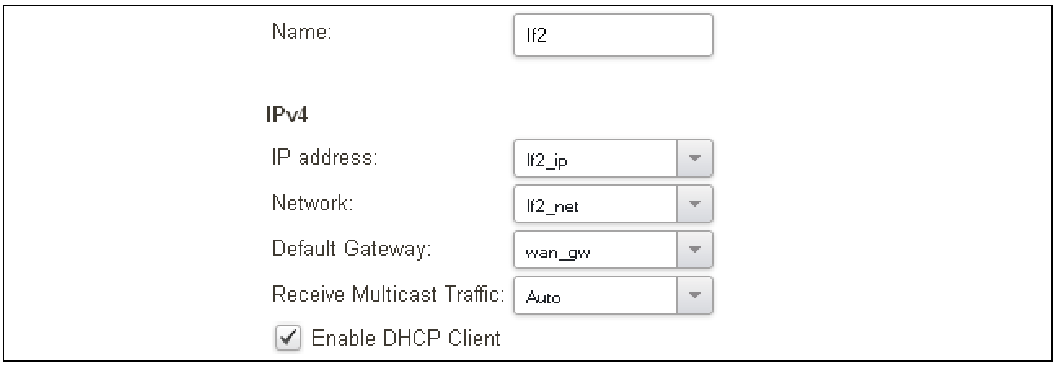
General

Primary Server: wan_dns1

B. DHCP - automatic configuration

All the required IP addresses for Internet connection can, alternatively, be automatically retrieved from an ISP's DHCP server by enabling the **DHCP Client** option for the interface connected to the ISP. We enable this option by first selecting **Network > Interfaces and VPN > Ethernet** to display a list of all the interfaces.

Click the *If2* interface in the list to display its properties.



Name: If2

IPv4

IP address: If2_ip

Network: If2_net

Default Gateway: wan_gw

Receive Multicast Traffic: Auto

☑ Enable DHCP Client

In the above screenshot, DHCP is enabled for this interface and this is the required setting if IP addresses are to be retrieved automatically. Usually, a DHCP *Host Name* does not need to be specified but can sometimes be used by an ISP to uniquely identify this Clavister Security Gateway as a particular DHCP client to the ISP's DHCP server.

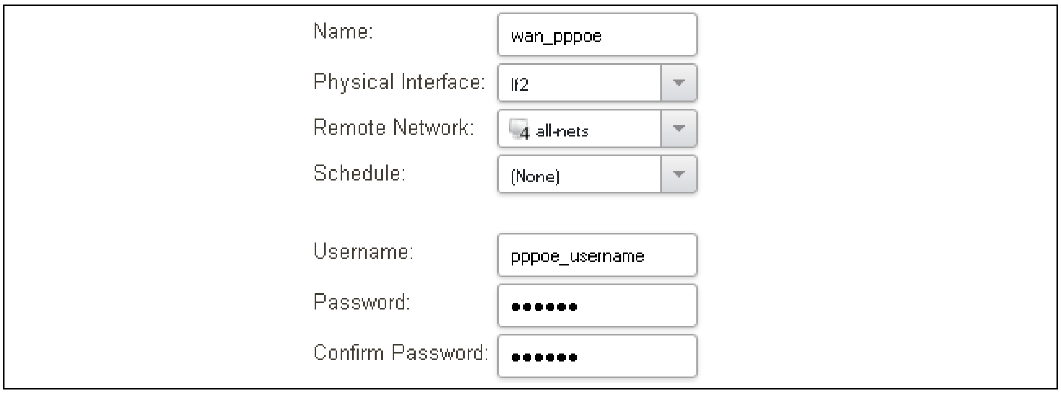
On connection to the ISP, all required IP addresses are retrieved automatically from the ISP via DHCP and cOS Core automatically sets the relevant address objects in the address book with this information.

For cOS Core to know on which interface to find the public Internet, a *route* has to be added to the *main* cOS Core routing table which specifies that the network *all-nets* can be found on the interface connected to the ISP and this route must also have the correct *Default Gateway* IP address specified. This *all-nets* route is added automatically by cOS Core during the DHCP address retrieval process.

After all IP addresses are set via DHCP and an *all-nets* route is added, the connection to the Internet is configured but no traffic can flow to or from the Internet since there is no IP rule defined that allows it. As was done in the previous option (**A**) above, we must therefore define an IP rule that will allow traffic from a designated source interface and source network. (in this example, the network *If3_net* and interface *If3*) to flow to the destination network *all-nets* and the destination interface *If2*.

C. PPPoE setup

For PPPoE connection, we must create a PPPoE tunnel interface associated with the physical Ethernet interface. Assume that the physical interface is *If2* and the PPPoE tunnel object created is called *wan_pppoe*. Go to **Network > Interfaces and VPN > PPPoE** and select **Add > PPPoE Tunnel**. These values can now be entered into the PPPoE Tunnel properties dialog.



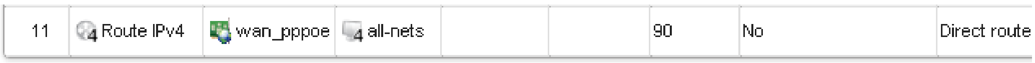
Name: wan_pppoe
Physical Interface: If2
Remote Network: all-nets
Schedule: (None)

Username: pppoe_username
Password: ••••••
Confirm Password: ••••••

Your ISP will supply the correct values for *pppoe_username* and *pppoe_password* in the dialog above.

The PPPoE tunnel interface can now be treated exactly like a physical interface by the policies defined in cOS Core rule sets.

There also has to be a route associated with the PPPoE tunnel to allow traffic to flow through it, and this is automatically created in the *main* routing table when the tunnel is defined. If we go to **Network > Routing > Routing Tables > main** we can see this route.



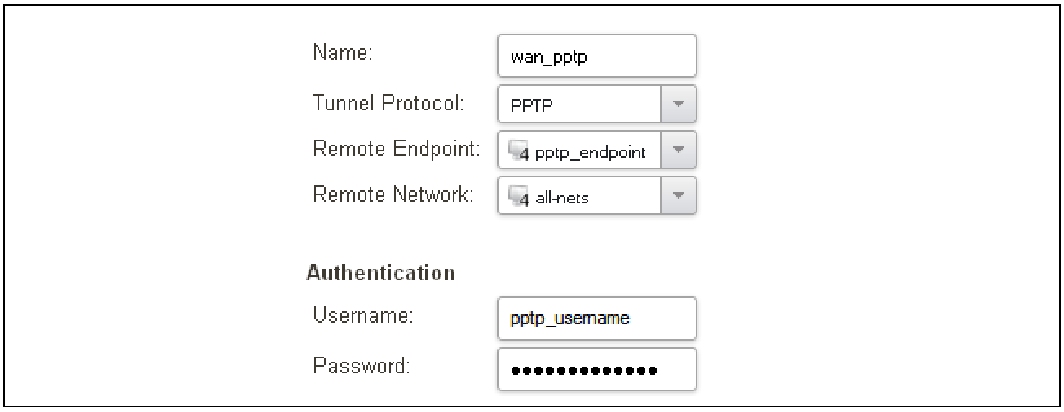
11	Route IPv4	wan_pppoe	all-nets			90	No	Direct route

If the PPPoE tunnel object is deleted, this route is also automatically deleted.

At this point, no traffic can flow through the tunnel since there is no IP rule defined that allows it. As was done in option **A** above, we must define an IP rule that will allow traffic from a designated source interface and source network (in this example, the network *If3_net* and interface *If3*) to flow to the destination network *all-nets* and the destination interface which is the PPPoE tunnel we have defined.

D. PPTP setup

For PPTP connections, a PPTP client tunnel interface object needs to be created. Let us assume that the PPTP tunnel will be called *wan_pptp* with a remote endpoint *10.5.4.1* which has been defined as the IP4 Address object *pptp_endpoint*. Go to **Network > Interfaces and VPN > PPTP/L2TP Clients** and select **Add > PPTP/L2TP Client**. The values can now be entered into the properties dialog and the *PPTP* option should be selected.



Name:	wan_pptp
Tunnel Protocol:	PPTP
Remote Endpoint:	pptp_endpoint
Remote Network:	all-nets

Authentication

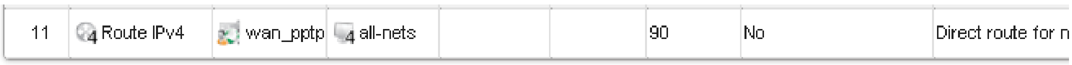
Username:	pptp_username
Password:	••••••••••••••

Your ISP will supply the correct values for *pptp_username*, *pptp_password* and the remote endpoint. An interface is not specified when defining the tunnel because this is determined by cOS Core looking up the *Remote Endpoint* IP address in its routing tables.

The PPTP client tunnel interface can now be treated exactly like a physical interface by the policies defined in cOS Core rule sets.

There also has to be an associated route with the PPTP tunnel to allow traffic to flow through it, and this is automatically created in the *main* routing table when the tunnel is defined. The destination network for this route is the *Remote Network* specified for the tunnel and for the public Internet this should be *all-nets*.

If we go to **Network > Routing > Routing Tables > main** we can see this route.



11	Route IPv4	wan_pptp	all-nets			90	No	Direct route for n

If the PPTP tunnel object is deleted, this route is also automatically deleted.

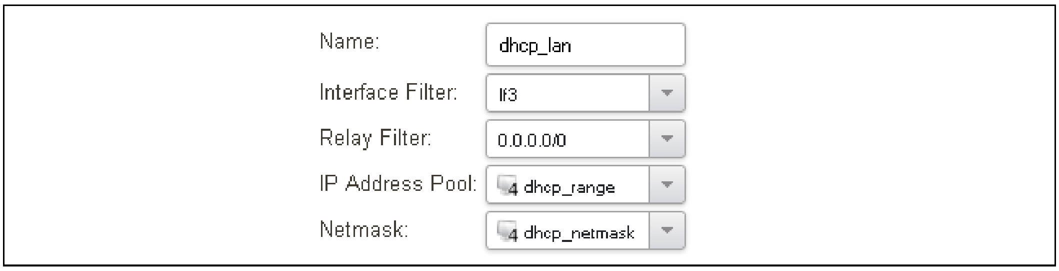
At this point, no traffic can flow through the tunnel since there is no IP rule defined that allows it. As was done in option **A** above, we must define an IP rule that will allow traffic from a designated source network and source interface (in this example, the network *If3_net* and interface *If3*) to flow to the destination network *all-nets* and the destination interface which is the PPTP tunnel that we have defined.

DHCP Server Setup

If the Clavister Security Gateway is to act as a DHCP server then this can be set up in the following way:

First, create an IP4 Address object which defines the address range to be handed out. Here, we will assume this is called *dhcp_range*. We will also assume that an IP4 Address object *dhcp_netmask* has been created which specifies the netmask.

We now create a DHCP server object called *dhcp_lan* which will only be available only on the *If3* interface. To do this, go to **Network > Network Services > DHCP Servers** and select **Add > DHCP Server**. We can now specify the server properties.



Name: dhcp_lan

Interface Filter: If3

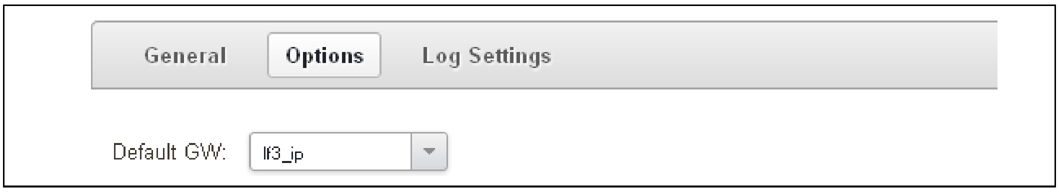
Relay Filter: 0.0.0.0/0

IP Address Pool: dhcp_range

Netmask: dhcp_netmask

An example IP pool range might be *196.168.1.10 - 192.168.1.20* with a netmask of *255.255.0.0*.

In addition, it is important to specify the *Default gateway* for the server. This will be handed out to DHCP clients on the internal networks so that they know where to find the public Internet. The default gateway is always the IP address of the interface on which the DHCP server is configured. In this case, *If3_ip*



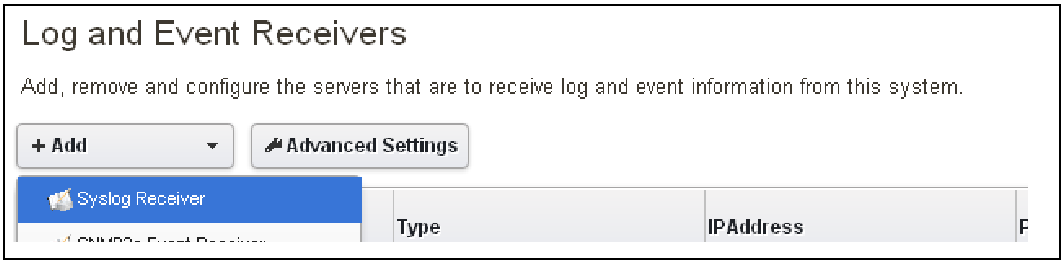
Default GW: If3_ip

Also in the **Options** tab, we should specify the DNS address which is handed out with DHCP leases. This could be set, for example, to be the IP address object *dns1_address*.

Syslog Server Setup

Although logging may be enabled, no log messages are captured unless at least one log server is set up to receive them and this is configured in cOS Core. *Syslog* is one of the most common server types.

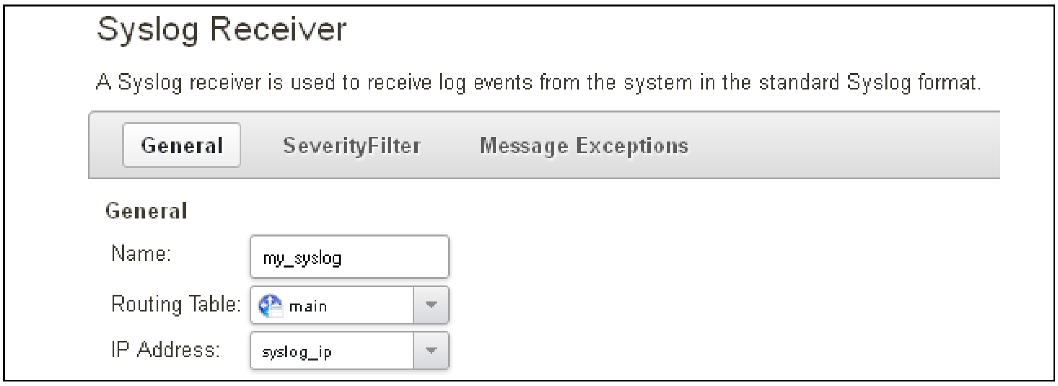
First we create an IP4 Address object called, for example, *syslog_ip* which is set to the IP address of the server. We then configure the sending of log messages to a Syslog server from cOS Core by selecting **System > Device > Log and Event Receivers** and then choosing **Add > Syslog Receiver**.



Log and Event Receivers

Add, remove and configure the servers that are to receive log and event information from this system.

The syslog server properties dialog will now appear. We give the server a name, for example *my_syslog*, and specify its IP address as the *syslog_ip* object.



Syslog Receiver

A Syslog receiver is used to receive log events from the system in the standard Syslog format.

General

Name: my_syslog

Routing Table: main

IP Address: syslog_ip

Tip: Address book object naming

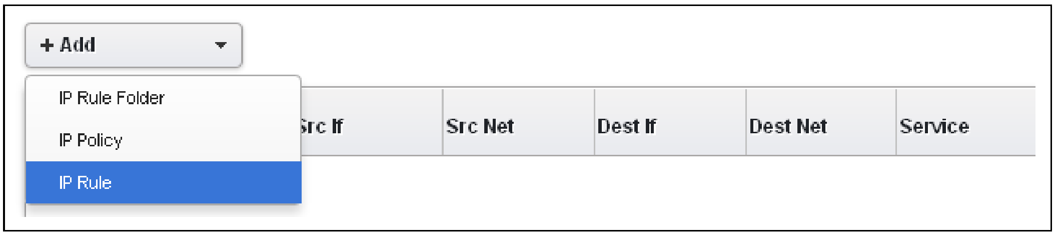
*The cOS Core address book is organized alphabetically so when choosing names for IP address objects it is best to have the descriptive part of the name first. In this case, use **syslog_ip** as the name and not **ip_syslog**.*

Allowing ICMP *Ping* Requests

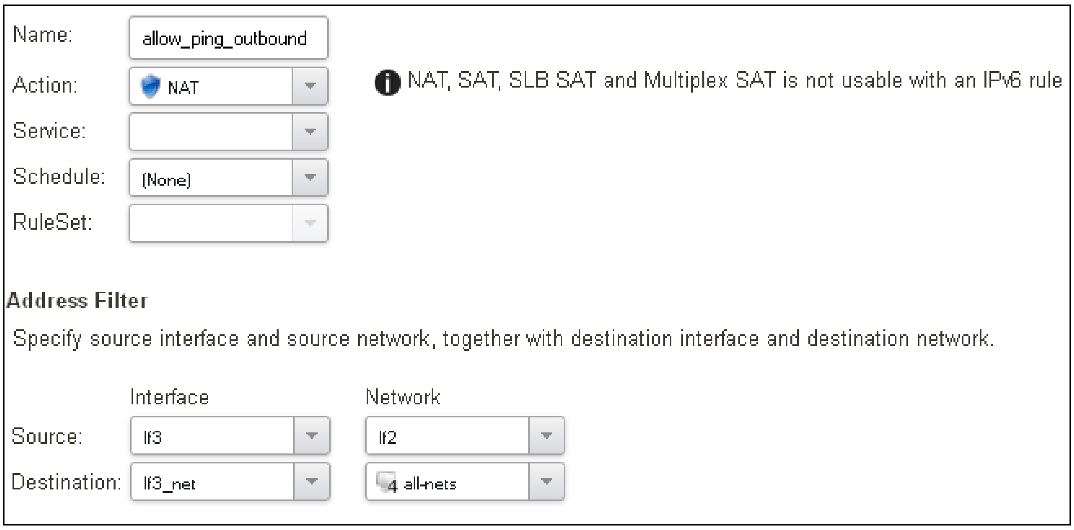
As a further example of setting up IP rules, it can be very useful to allow ICMP *Ping* requests to flow through the Clavister Security Gateway. As discussed earlier, the cOS Core will drop any traffic unless an IP rule explicitly allows it. Let us suppose that we wish to allow the pinging of external hosts with the ICMP protocol by computers on the internal *If3_net* network.

There can be several rule sets defined in cOS Core but there is only one rule set defined by default and this is called *main*. To add a rule to it, first select **Policies > Firewalling > Main IP Rules**.

The *main* rule set list contents are now displayed. Press the **Add** button and select **IP Rule**.



The properties for a new IP rule will appear and we can add a rule, in this case called *allow_ping_outbound*.



Name: allow_ping_outbound

Action: NAT

Service:

Schedule: (None)

RuleSet:

NAT, SAT, SLB SAT and Multiplex SAT is not usable with an IPv6 rule

Address Filter

Specify source interface and source network, together with destination interface and destination network.

	Interface	Network
Source:	If3	If2
Destination:	If3_net	all-nets

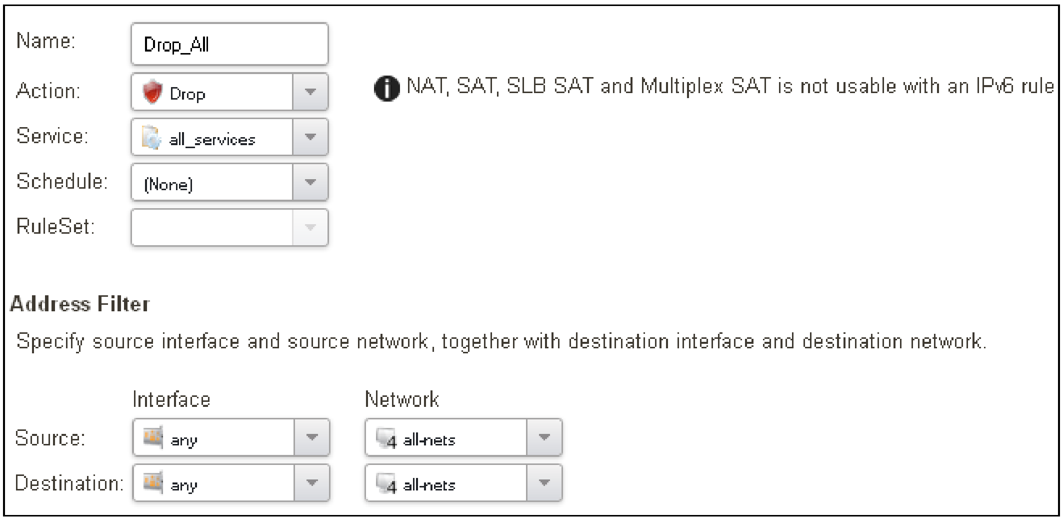
The IP rule again has the *NAT* action and this is necessary if the protected local hosts have private IP addresses. The ICMP requests will be sent out from the Clavister Security Gateway with the IP address of the interface connected to the ISP as the source interface. Responding hosts will send back ICMP responses to this single IP and cOS Core will then forward the response to the correct private IP address.

Adding a Drop All Rule

The top-down nature of the IP rule set scanning has already been discussed earlier. If **no** matching IP rule is found for a new connection then the *default rule* is triggered. This rule is hidden and cannot be changed and its action is to drop all such traffic as well as generate a log message for the drop.

In order to gain control over the logging of dropped traffic, it is recommended to create a drop all rule as the last rule in the *main* IP rule set. This rule has an *Action* of *Drop* with the source and destination network set to *all-nets* and the source and destination interface set to *any*.

The service for this rule must also be specified and this should be set to *all_services* in order to capture all types of traffic.



Name: Drop_All

Action: Drop

Service: all_services

Schedule: (None)

RuleSet:

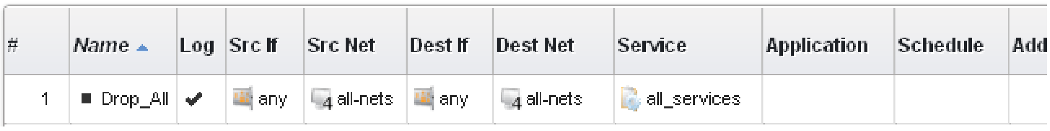
NAT, SAT, SLB SAT and Multiplex SAT is not usable with an IPv6 rule

Address Filter

Specify source interface and source network, together with destination interface and destination network.

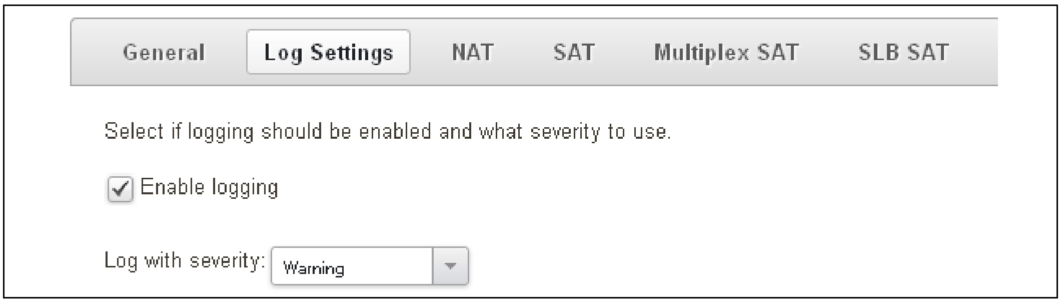
	Interface	Network
Source:	any	all-nets
Destination:	any	all-nets

If the this rule us the only one defined, displaying the *main* IP rule set will be as shown below.



#	Name ▲	Log	Src If	Src Net	Dest If	Dest Net	Service	Application	Schedule	Add
1	■ Drop_All	✓	any	all-nets	any	all-nets	all_services			

Logging can now be enabled on this rule with the desired severity. Click the **Log Settings** tab, and click the **Enable logging** box. All log messages generated by this rule will be given the selected severity and which will appear in the text of the log messages. It is up to the administrator to choose the severity and depends on how they would like to classify the messages.



Select if logging should be enabled and what severity to use.

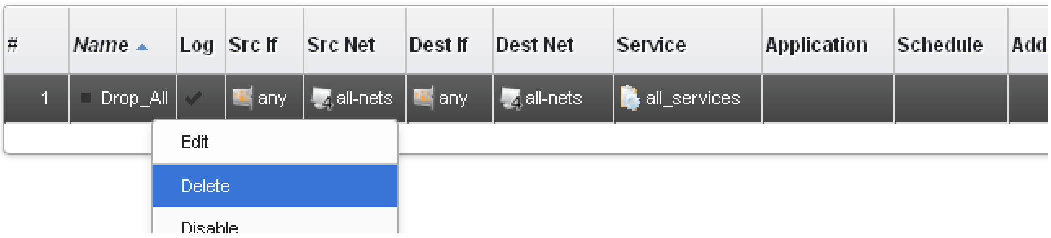
☑ Enable logging

Log with severity: Warning

Deleting Configuration Objects

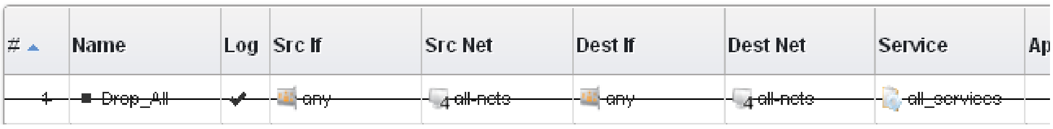
If information is deleted from a configuration during editing then these deletes are indicated by a line scored through the list entry while the configuration is still not yet activated. The deleted entry only disappears completely when the changes are activated.

For example, we can delete the drop all IP rule created in the previous paragraph by right clicking the rule and selecting *Delete* in the context menu.



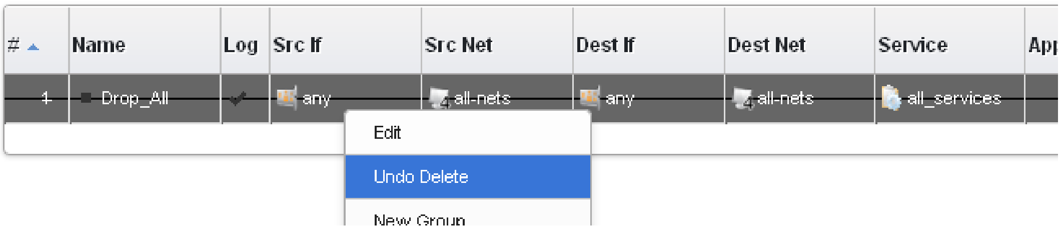
#	Name ▲	Log	Src If	Src Net	Dest If	Dest Net	Service	Application	Schedule	Add
1	■ Drop_All	✓	any	all-nets	any	all-nets	all_services			

The rule now appears with a line scored through it.



# ▲	Name	Log	Src If	Src Net	Dest If	Dest Net	Service	Ap
~~1~~	~~■ Drop_All~~	~~✓~~	~~any~~	~~all-nets~~	~~any~~	~~all-nets~~	~~all_services~~	

We can reverse the delete by right clicking the rule again and choosing *Undo Delete*.



# ▲	Name	Log	Src If	Src Net	Dest If	Dest Net	Service	App
~~1~~	~~■ Drop_All~~	~~✓~~	~~any~~	~~all-nets~~	~~any~~	~~all-nets~~	~~all_services~~	

Uploading a License

Without a valid license installed, cOS Core operates in *demo mode* (demonstration mode) and will cease operations 2 hours after startup. To remove this restriction, a valid license must be uploaded to cOS Core. Doing this is described in *Section 6.5, “Installing a License”*

6.4. CLI Setup

This chapter describes the setup steps using CLI commands instead of the setup wizard.

The CLI is accessible in two ways:

- Across the local network at default IP address *192.168.1.1* using an SSH (Secure Shell) client. The network connection setup is the same as that described in *Section 6.2, "Web Interface and Wizard Setup"* as is the way the workstation interface's static IP address must be set up so it is on the same network as the Clavister Security Gateway's interface.

  If there is a problem with workstation connection, a help checklist can be found in *Section 6.6, "Setup Troubleshooting "*.

- Via the local cOS Core console. In a virtual environment, the cOS Core console is the same as the virtual machine console.

The CLI commands listed below are grouped so that they mirror the options available in the setup wizard.

Confirming the Connection

Once connection is made to the CLI, pressing the **Enter** key will cause cOS Core to respond. The response will be a normal CLI prompt if you are using the local console of the virtual machine and a username/password combination will not be required (a password for this console can be set later).

```
Device:/>
```

If connecting remotely through an SSH (Secure Shell) client, an administration username/password must first be entered and the initial default values for these are username *admin* and password *admin*. When these are accepted by cOS Core, a normal CLI prompt will appear and CLI commands can be entered.

Changing the Password

To change the administration username or password, use the *set* command to change the current CLI object category (sometimes referred to as the *object context*) to be the *LocalUserDatabase* called *AdminUsers*.

```
Device:/> cc LocalUserDatabase AdminUsers
Device:/AdminUsers>
```

Tip: Using tab completion with the CLI

The tab key can be pressed at any time so that cOS Core gives a list of possible options in a command.

Now set the username/password, which are case sensitive, to be the new chosen values for the user called *admin*. In the example below, we change to the username *new_name* and password *new_pass*.

```
Device:/AdminUsers> set User Admin Name=new_name Password=new_pass
```

The new username/password combination should be remembered and the password should be composed in a way which makes it difficult to guess. The next step is to return the CLI to the default top level of object categories.

```
Device:/AdminUsers> cc
Device:/>
```

Setting the Date and Time

Many cOS Core functions rely on an accurate date and time, so it is important that this is set correctly using the *time* command. A typical usage might be:

```
Device:/> time -set 2008-06-24 14:43:00
```

Notice that the date is entered in *yyyy-mm-dd* format and the time is stated in 24 hour *hh:mm:ss* format.

Ethernet Interfaces

The connection of external networks to the Clavister Security Gateway is via the various *Ethernet interfaces* which are provided by the hardware platform. In a virtual environment, connection is made via the *virtual interfaces* provided by the hypervisor. On first-time startup, cOS Core scans for these interfaces and determines which are available and allocates their logical configuration names. The first interface detected in the scan always becomes the initial default management interface and this cannot be changed beforehand.

All cOS Core interfaces are logically equal for cOS Core and although their physical capabilities may be different, any interface can perform any logical function. With cOS Core in a virtual environment, the virtual *If1* interface is always the management interface. Assuming that a total of 3 virtual interfaces is configured, the other two interfaces will be given the names *If2* and *If3* by cOS Core. For the sake of example, we will assume that the *If2* interface will be used for connection to the public Internet and the *If3* interface will be used for connection to a protected, local network.

Setting Up Internet Access

Next, we shall look at how to set up public Internet access with the CLI. The setup wizard described previously, provides the following four options:

A. Static - manual configuration.

B. DHCP - automatic configuration.

C. PPPoE setup

D. PPTP setup

The individual manual steps to configure these connection alternatives with the CLI are discussed next.

A. Static - manual configuration

We first must set or create a number of IP address objects. It's assumed here that the interface used for Internet connection is *If2*, the ISP gateway IP address is *10.5.4.1*, the IP address for the connecting interface will be *10.5.4.35* and the network to which they belong is *10.5.4.0/24*.

Note: Private IP addresses are used for example only

Each installation's IP addresses will be different from these IP addresses but they are used here only to illustrate how setup is done. Also, these addresses are private IP addresses and in reality an ISP would use public IP addresses instead.

We first add the gateway IP address object which we will call *wan_gw*:

```
Device:/> add Address IP4Address wan_gw Address=10.5.4.1
```

This is the address of the ISP's gateway which is the first router hop towards the public Internet. If this IP object already exists, it can be given the IP address with the command:

```
Device:/> set Address IP4Address wan_gw Address=10.5.4.1
```

Now use this object to set the gateway on the *If2* interface which is connected to the ISP:

```
Device:/> set Interface Ethernet If2 DefaultGateway=wan_gw
```

Next, set the IP object *If2_ip* which will be the IP address of the interface connected to the ISP:

```
Device:/> set IP4Address InterfaceAddresses/If2_ip Address=10.5.4.35
```

Note: Qualifying the names of IP objects in folders

*On initial startup of the KVM, cOS Core automatically creates and fills the **InterfaceAddresses** folder in the cOS Core address book with the interface related IP address objects.*

*When we specify an IP address object which is located in a folder, we must qualify the object's name with the name of the folder. For example, when we specify the address **If2_ip**, we must qualify it with the folder name **InterfaceAddresses** so the qualified name becomes **InterfaceAddresses/If2_ip**.*

If an object is not contained in a folder and is therefore at the top level of the address book then no qualifying folder name is needed.

Now set the IP object *If2_net* which will be the IP network of the connecting interface:

```
Device:/> set IP4Address InterfaceAddresses/If2_net Address=10.5.4.0/24
```

It is recommended to verify the properties of the *If2* interface with the command:

```
Device:/> show Interface Ethernet If2
```

The typical output from this will be similar to the following:

```
                  Property  Value
 --------------------------  --------------------------
                      Name:  If2
                        IP:  InterfaceAddresses/If2_ip
                   Network:  InterfaceAddresses/If2_net
            DefaultGateway:  wan_gw
                 Broadcast:  10.5.4.255
                 PrivateIP:  <empty>
                     NOCHB:  <empty>
                       MTU:  1500
                    Metric:  100
               DHCPEnabled:  No
            EthernetDevice:  0:If2  1:<empty>
           AutoSwitchRoute:  No
 AutoInterfaceNetworkRoute:  Yes
   AutoDefaultGatewayRoute:  Yes
   ReceiveMulticastTraffic:  Auto
      MemberOfRoutingTable:  All
                  Comments:  <empty>
```

Setting the default gateway on the interface has the additional effect that cOS Core automatically creates a route in the default *main* routing table that has the network *all-nets* routed on the interface. This means that we do not need to explicitly create this route.

Even though an *all-nets* route is automatically added, no traffic can flow without the addition of an *IP rule* which explicitly allows traffic to flow. Let us assume we want to allow web surfing from the protected network *If3_net*. on the interface *If3*. A simple rule to do this would have an *Action* of *Allow* and would be defined with the following commands.

Firstly, we must change the current CLI context to be the default *IPRuleSet* called *main* using the command:

```
Device:/> cc IPRuleSet main
```

Additional IP rule sets can be defined which is why we do this, with the rule set *main* existing by default. Notice that the CLI prompt changes to reflect the current context:

```
Device:/main>
```

Now add an IP rule called *lan_to_wan* to allow the traffic through to the public Internet:

```
Device:/main> add IPRule
                Action=Allow
                SourceInterface=If3
                SourceNetwork=If3_net
                DestinationInterface=InterfaceAddresses/If2
                DestinationNetwork=all-nets
                Service=http-all
                Name=lan_to_wan
```

This IP rule would be correct if the internal network hosts have public IP addresses but in most scenarios this will not be true and internal hosts will have private IP addresses. In that case, we must use NAT to send out traffic so that the apparent source IP address is the IP of the interface connected to the ISP. To do this we simply change the *Action* of the above command from *Allow* to *NAT*:

```
Device:/main> add IPRule
                Action=NAT
                SourceInterface=If3
                SourceNetwork=InterfaceAddresses/If3_net
                DestinationInterface=If2
                DestinationNetwork=all-nets
                Service=http-all
                Name=lan_to_wan
```

The service used in the IP rule is *http-all* which will allow most web surfing but does not include the DNS protocol to resolve URLs into IP addresses. To solve this problem, a custom service could be used in the above rule which combines *http-all* with the *dns-all* service. However, the recommended method which provides the most clarity to a configuration is to create a separate IP rule for DNS:

```
Device:/main> add IPRule
                Action=NAT
                SourceInterface=If3
                SourceNetwork=InterfaceAddresses/If3_net
                DestinationInterface=If2
                DestinationNetwork=all-nets
                Service=dns-all
                Name=lan_to_wan_dns
```

It is recommended that at least one DNS server is also defined in cOS Core. This DSN server or servers (a maximum of three can be configured) will be used when cOS Core itself needs to resolve URLs which is the case when a URL is specified in a configuration instead of an IP address. If we assume an IP address object called *dns1_address* has already been defined for the first DNS server, the command to specify the first DNS server is:

```
Device:/> set DNS DNSServer1=dns1_address
```

Assuming a second IP object called *dns2_address* has been defined, the second DNS server is specified with:

```
Device:/> set DNS DNSServer2=dns2_address
```

B. DHCP - automatic configuration

All required IP addresses can alternatively be automatically retrieved from the ISP's DHCP server by enabling DHCP on the interface connected to the ISP. If the interface on which DHCP is to be enabled is *If2* then the command is:

```
Device:/> set Interface Ethernet If2 DHCPEnabled=Yes
```

Once the required IP addresses are retrieved with DHCP, cOS Core automatically sets the relevant address objects in the address book with this information.

For cOS Core to know on which interface to find the public Internet, a *route* has to be added to the *main* cOS Core routing table which specifies that the network *all-nets* can be found on the interface connected to the ISP and this route must also have the correct *Default Gateway* IP address specified. This *all-nets* route is added automatically by cOS Core during the DHCP address retrieval process. Automatic route generation is a setting for each interface that can be manually enabled and disabled.

After all IP addresses are set via DHCP and an *all-nets* route is added, the connection to the Internet is configured but no traffic can flow to or from the Internet since there is no IP rule defined that allows it. As was done in the previous option (**A**) above, we must therefore manually define an IP rule that will allow traffic from a designated source interface and source network. (in this example, the network *If3_net* and interface *If3*) to flow to the destination network *all-nets* and the destination interface *If2*.

C. PPPoE setup

For PPPoE connection, create the PPPoE tunnel interface on the interface connected to the ISP. The interface *If2* is assumed to be connected to the ISP in the command shown below which creates a PPPoE tunnel object called *wan_ppoe*:

```
Device:/> add Interface PPPoETunnel wan_ppoe
                EthernetInterface=If2
                username=pppoe_username
                Password=pppoe_password
                Network=all-nets
```

Your ISP will supply the correct values for *pppoe_username* and *pppoe_password*.

The PPPoE tunnel interface can now be treated exactly like a physical interface by the policies defined in cOS Core rule sets.

There also has to be a route associated with the PPPoE tunnel to allow traffic to flow through it, and this is automatically created in the *main* routing table when the tunnel is defined. If the PPPoE tunnel object is deleted, this route is also automatically deleted.

At this point, no traffic can flow through the tunnel since there is no IP rule defined that allows it. As was done in option **A** above, we must define an IP rule that will allow traffic from a designated source interface and source network (in this example, the network *If3_net* and interface *If3*) to flow to the destination network *all-nets* and the destination interface which is the PPPoE tunnel that we have defined.

D. PPTP setup

For PPTP connection, first create the PPTP tunnel interface. It is assumed below that we will create a PPTP tunnel object called *wan_pptp* with the remote endpoint *10.5.4.1*:

```
Device:/> add Interface L2TPClient wan_pptp
                Network=all-nets
                username=pptp_username
                Password=pptp_password
                RemoteEndpoint=10.5.4.1
                TunnelProtocol=PPTP
```

Your ISP will supply the correct values for *pptp_username*, *pptp_password* and the remote endpoint.

Your ISP will supply the correct values for *pptp_username*, *pptp_password* and the remote endpoint. An interface is not specified when defining the tunnel because this is determined by cOS Core looking up the *Remote Endpoint* IP address in its routing tables.

The PPTP client tunnel interface can now be treated exactly like a physical interface by the policies defined in cOS Core rule sets.

There also has to be an associated route with the PPTP tunnel to allow traffic to flow through it, and this is automatically created in the *main* routing table when the tunnel is defined. The destination network for this route is the *Remote Network* specified for the tunnel and for the public Internet this should be *all-nets*.

As with all automatically added routes, if the PPTP tunnel object is deleted then this route is also automatically deleted.

At this point, no traffic can flow through the tunnel since there is no IP rule defined that allows it. As was done in option **A** above, we must define an IP rule that will allow traffic from a designated source interface and source network (in this example, the network *If3_net* and interface *If3*) to flow to the destination network *all-nets* and the destination interface which is the PPTP tunnel that we have defined.

Activating and Committing Changes

After any changes are made to a cOS Core configuration, they will be saved as a new configuration but will not yet be activated. To activate all the configuration changes made since the last activation of a new configuration, the following command must be issued:

```
Device:/> activate
```

Although the new configuration is now activated, it does not become permanently activated until the following command is issued within 30 seconds following the *activate*:

```
Device:/> commit
```

The reason for two commands is to prevent a configuration accidentally locking out the administrator. If a lock-out occurs then the second command will not be received and cOS Core will revert back to the original configuration after the 30 second time period (this time period is a setting that can be changed).

DHCP Server Setup

If the Clavister Security Gateway is to act as a DHCP server then this can be set up in the following way:

First define an IP address object which has the address range that can be handed out. Here, we will use the IP range *192.168.1.10-192.168.1.20* as an example and this will be available on the *If3* interface which is connected to the protected internal network *If3_net*:

```
Device:/> add Address IP4Address dhcp_range
                Address=192.168.1.10-192.168.1.20
```

The DHCP server is then configured with this IP address object on the appropriate interface. In this case we will call the created DHCP server object *dhcp_lan* and assume the DHCP server will be available on the *If3* interface:

```
Device:/> add DHCPServer dhcp_lan
                IPAddressPool=dhcp_range
                Interface=If3
                Netmask=255.255.255.0
                DefaultGateway=InterfaceAddresses/If3_ip
                DNS1=dns1_address
```

In addition, it is important to specify the *Default gateway* for the DHCP server since this will be handed out to DHCP clients on the internal network so that they know where to find the public Internet. The default gateway is always the IP address of the interface on which the DHCP server is configured. In this case, *If3_ip*.

NTP Server Setup

Network Time Protocol (NTP) servers can optionally be configured to maintain the accuracy of the system date and time. The command below sets up synchronization with the two NTP servers at hostname *pool.ntp.org* and IP address *10.5.4.76*:

```
Device:/> set DateTime
                TimeSyncEnable=Yes
                TimeSyncServer1=dns:pool.ntp.org
                TimeSyncServer2=10.5.4.76
```

The prefix *dns:* is added to the hostname to identify that it must resolved to an IP address by a DNS server (this is a convention used in the CLI with some commands).

Syslog Server Setup

Although logging may be enabled, no log messages are captured unless a server is set up to receive them and *Syslog* is the most common server type. If the Syslog server's address is *195.11.22.55* then the command to create a log receiver object called *my_syslog* which enables logging is:

```
Device:/> add LogReceiverSyslog my_syslog IPAddress=195.11.22.55
```

Allowing ICMP *Ping* Requests

As a further example of setting up IP rules, it can be useful to allow ICMP *Ping* requests to flow through the Clavister Security Gateway. As discussed earlier, the cOS Core will drop any traffic unless an IP rule explicitly allows it. Let us suppose that we wish to allow the pinging of external hosts with the ICMP protocol by computers on the internal *If3_net* network. The commands to allow this are as follows.

First, we must change the current CLI context to be the *IPRuleSet* called *main* using the command:

```
Device:/> cc IPRuleSet main
```

Now, add an IP rule called *allow_ping_outbound* to allow ICMP pings to pass:

```
Device:/main> add IPRule
                Action=NAT
                SourceInterface=If3
                SourceNetwork=InterfaceAddresses/If3_net
                DestinationInterface=If2
                DestinationNetwork=all-nets
                Service=ping-outbound
                Name=allow_ping_outbound
```

The IP rule again has the *NAT* action and this is necessary if the protected local hosts have private IP addresses. The ICMP requests will be sent out from the Clavister Security Gateway with the IP address of the interface connected to the ISP as the source interface. Responding hosts will send back ICMP responses to this single IP and cOS Core will then forward the response to the correct private IP address.

Adding a Drop All Rule

Scanning of the IP rule set is done in a top-down fashion. If **no** matching IP rule is found for a new connection then the *default rule* is triggered. This rule is hidden and cannot be changed and its action is to drop all such traffic as well as generate a log message for the drop.

In order to gain control over the logging of dropped traffic, it is recommended to create a drop all rule as the last rule in the *main* IP rule set. This rule has an *Action* of *Drop* with the source and destination network set to *all-nets* and the source and destination interface set to *any*.

The service for this rule must also be specified and this should be set to *all_services* in order to capture all types of traffic. The command for creating this rule is:

```
Device:/main> add IPRule
                Action=Drop
                SourceInterface=any
                SourceNetwork=any
                DestinationInterface=any
                DestinationNetwork=all-nets
                Service=all_services
                Name=drop_all
```

Uploading a License

Without a valid license installed, cOS Core operates in *demo mode* (demonstration mode) and will cease operations 2 hours after startup. To remove this restriction, a valid license must be uploaded to cOS Core. Doing this is described in *Section 6.5, "Installing a License"*

6.5. Installing a License

Each virtual copy of cOS Core running under KVM requires a unique license file to be installed. Without a license, cOS Core will function for only 2 hours from startup in *demo mode* (demonstration mode). To end demo mode, a license file must be downloaded to a local disk from the Clavister website and then uploaded to cOS Core through the Web Interface or using SCP.

Installing a cOS Core License

To install a license, perform the following steps:

1. Obtain a *license code* from a cOS Core reseller for a virtual environment license.

2. Create a cOS Core virtual machine in the virtual environment.

3. Make a note of the MAC address of one of the cOS Core virtual Ethernet interfaces. A MAC address can be found through the Web Interface or with the following CLI command:

   ```
   Device:/> ifstat If1
   ```

   Note that this MAC address will be associated with the license and cannot be changed later.

4. If not already done, register as a user and enter your organization details, by choosing the *Login* link at *https://www.clavister.com*.

5. Log in to the Clavister website and go to **Licenses > Register License** then select the registration option **License Number and MAC Address**.

6. Enter the license code and MAC address. This will cause a new license to be generated and stored on the website. This license will appear in the user's license list on the site.

7. Download the created license from the website to the local disk of the management computer by clicking on the entry in the license list.

8. Upload the license from the management computer to cOS Core using the Web Interface or SCP. In virtual environments, cOS Core cannot automatically fetch the license. In the Web Interface, go to **Status > Maintenance > License** and press the **Upload** button to select the license file on disk.

9. After upload, perform a restart or reconfigure on cOS Core to complete installation of the license. A restart is recommended in case memory requirements have changed.

10. Following a restart, the 2 hour demo mode will end and the cOS Core capabilities will only be restricted by the installed license.

Examining the License Contents

The contents of a Clavister license (*.lic*) file can be examined by opening it in a standard text editor. cOS Core licenses for virtual environments contain the line:

```
Virtual Hardware: Yes
```

The license contents also specifies how many virtual interfaces are available on one virtual machine. The default value can be upgraded by purchasing the appropriate license.

KVM and cOS Core Lockdown Mode

When cOS Core is run in demo mode (that is to say, without a valid license), it will operate for two hours before it enters *lockdown mode*.

When cOS Core enters *lockdown mode* under KVM, it will consume all KVM resources. When this happens it is necessary to shut down the cOS Core virtual machine instance since nothing further can be done with cOS Core itself until it is restarted. In other words, restarting cOS Core should **only** be done via the KVM management interface once *lockdown mode* is entered.

General information about cOS Core licensing can be found in the *cOS Core Administration Guide*.

6.6. Setup Troubleshooting

This appendix deals with connection problems that might occur when connecting a management workstation to a Clavister Security Gateway.

If the management interface does not respond after the Clavister Security Gateway has powered up and cOS Core has started, there are a number of simple steps to troubleshoot basic connection problems:

1. Check that the correct interface is being used.

The most obvious problem is that the wrong interface has been used for the initial connection to the management workstation. Only the first interface found by cOS Core is activated for the initial connection from a browser after cOS Core starts for the first time.

2. Check that the workstation IP is configured correctly.

The second most obvious problem is if the IP address of the management workstation running the web browser is not configured correctly.

3. Using the *ifstat* CLI command.

To investigate a connection problem further, use the KVM console after cOS Core starts. When you press the enter key with the console, cOS Core should respond with the a standard CLI prompt. Now enter the following command once for each interface:

```
Device:/> ifstat <if-name>
```

Where *<if-name>* is the name of the cOS Core management interface. By default this is the KVM *If1* interface. This command will display a number of counters for that interface. The *ifstat* command on its own can list the names of all the KVM interfaces.

If the *Input* counters in the hardware section of the output are not increasing then the error is likely to be in the cabling. However, it may simply be that the packets are not getting to the Clavister Security Gateway in the first place. This can be confirmed with a packet sniffer if it is available.

If the *Input* counters are increasing, the management interface may not be attached to the correct physical network. There may also be a problem with the routing information in any connected hosts or routers.

4. Using the *arpsnoop* CLI command.

A final diagnostic test is to try using the console command:

```
Device:/> arpsnoop -all
```

This will show the *ARP* packets being received on the different interfaces and confirm that the correct connections have been made to the correct interfaces.

6.7. System Management

Upgrades Under KVM

When running under KVM, upgrades of cOS Core are done just as they are on a non-virtualized cOS Core installation, by installing upgrade packages through the normal cOS Core user interfaces. It is not necessary to create a new virtual machine for a new version.

Increasing IPsec Performance with AES-NI

If the underlying hardware platform supports *AES-NI* acceleration, this can be made use of by cOS Core to significantly accelerate IPsec throughput when AES encryption is used. This acceleration is enabled by default.

If disabled, this feature can be enabled in the Web Interface by going to **Network > Interfaces and VPN > Advanced Settings** and clicking the checkbox **Enable AES-NI acceleration**. In the CLI, use the command:

```
Device:/> set Settings IPsecTunnelSettings AESNIEnable=Yes
```

After enabling, cOS Core must be rebooted for this option to take effect.

To check if the underlying platform supports AES-NI, use the CLI command:

```
Device:/> cpuid
```

If AES-NI is supported, *aes* will appear in the *Feature flags* list in the output from the command.

Chapter 7: High Availability Setup

This section provides the extra information needed to correctly set up a cOS Core high availability (HA) cluster under KVM. A cOS Core cluster consists of two Clavister Security Gateways, one is the *master*, the other the *slave*. Each of these security gateways will run its own separate virtual machine. The interfaces of the two gateways in a cluster need to be connected together in matching pairs through switches. It is the creation and connection of virtual switches for the cluster that is described in this section.

Important: Interface pairs should have matching bus, slot, port

In an HA cluster made up of two virtual Clavister Security Gateways, the bus, slot and port numbers of the two virtual interfaces in each HA interface pairing should be the same. If they are not, unexpected behavior could occur.

Open vSwitch Installation

HA setup with KVM requires that *Open vSwitch* is installed on the Linux system. Open vSwitch will be used to provide virtual switches so that matching interfaces of the master and slave in the cluster can be connected together. The installation of Open vSwitch itself will not be discussed further here. Refer to the software's own documentation for help with installation.

Open vSwitch is open source software that can be used in situations other than high availability to implement various networking solutions with KVM.

Note: The bridge-utils package must be removed

*Before installing Open vSwitch, the package **bridge-utils** must be removed from the Linux system.*

A Single Physical Server is Assumed

This section assumes that both the virtual security gateways in the HA cluster are installed on the same hardware server. In practice, two servers will probably be used for hardware redundancy and both will have KVM and Open vSwitch installed on them.

The configuration of the connections between two separate servers will not be discussed in this section and it is up to the administrator to choose the most appropriate way of doing this. One approach is to use *VLAN tagging* with Open vSwitch so internal bridge traffic can pass between the physical servers that make up the HA cluster.

Setup of cOS Core

The initial setup of the two separate virtual security gateways is done as normal so they are initially working as separate gateways. Before running the *HA Setup Wizard* on each unit to create the HA cluster, it is necessary to first correctly configure the virtual networking to emulate the hardware connections that would normally be present between the master and slave units.

Configuring Open vSwitch for HA

Assuming Open vSwitch has been installed, it is necessary to create KVM separate *virtual switches* so that the pairs of matching interfaces from the security gateways in the cluster are connected together on each switch.

This is done with the following steps:

> ***A.*** *Define an Open vSwitch* bridge *for each interface pair.*
>
> ***B.*** *Configure the HA master and slave virtual machines to connect the cOS Core interfaces to the relevant bridge.*

These two steps are described next.

A. Define an Open vSwitch bridge for each interface pair.

Assuming that all of the three default virtual interfaces (*If1*, *If2* and *If3*) on each security gateway are to be connected together, three Open vSwitch *bridges* must be created:

- **br1-internal** - Connecting together the *If1* interfaces. This is created using the Linux command:

  ```
  [root@linux]# ovs-vsctl add-br br1-internal
  ```

- **br2-external** - Connecting together the *If2* interfaces **and** also connected to the public Internet via a physical interface called *eth0* (this name will vary between configurations). This is created using the Linux commands:

  ```
  [root@linux]# ovs-vsctl add-br br2-external
  [root@linux]# ovs-vsctl add-port br2-external eth0
  ```

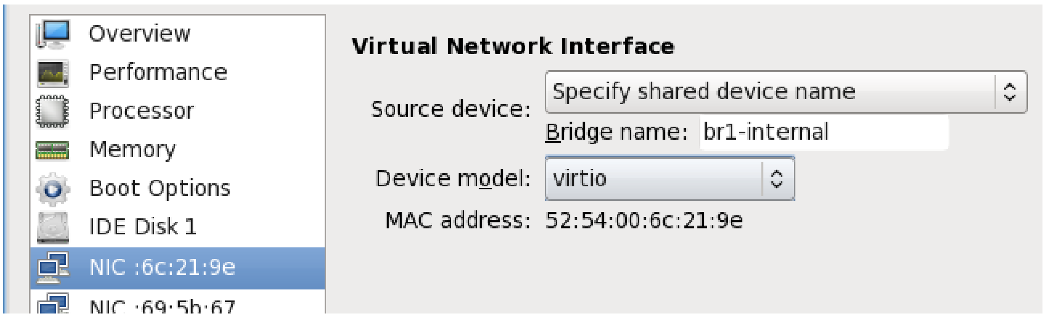
- **br3-internal** - Connecting together the *If3* interfaces. This is created using the Linux command:

  ```
  [root@linux]# ovs-vsctl add-br br3-internal
  ```

B. Connect interface pairs to the relevant bridge.

It is assumed that *virt-manager* will be used to configure each of the two virtual machines in the HA cluster.

Assume that the interface *If1* is to be associated with Open vSwitch bridge *br1-internal* on both master and slave gateways. The intuitive approach is to select the NIC entry in the navigation menu that corresponds to the *If1* interface and enter the *Bridge name*:



Virtual Network Interface

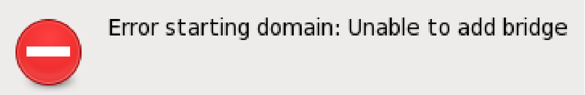
Source device: Specify shared device name

Bridge name: br1-internal

Device model: virtio

MAC address: 52:54:00:6c:21:9e

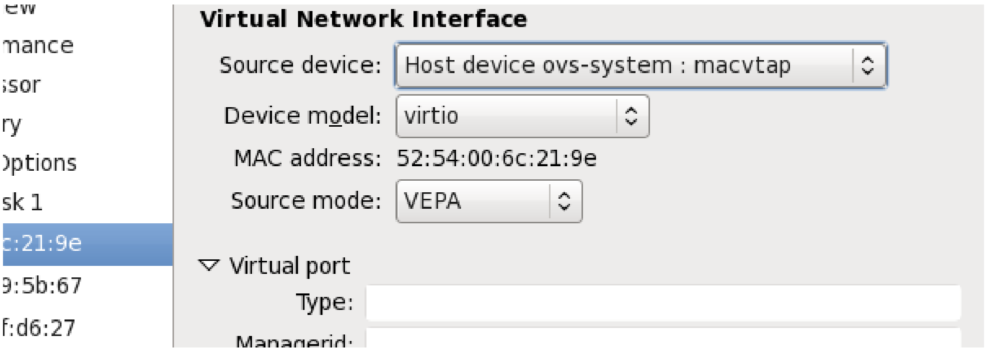
However, if this is now applied and the virtual machine started, it will give an error message:



Error starting domain: Unable to add bridge

To get around this issue, allocate the Open vSwitch bridge using the following steps:

1. Open the properties of the HA cluster's master security gateway in *virt-manager*. Change the *Source device* to be something using *macvtap* so that the *Type* of the *Virtual port* can be set:



Virtual Network Interface

Source device: Host device ovs-system : macvtap

Device model: virtio

MAC address: 52:54:00:6c:21:9e

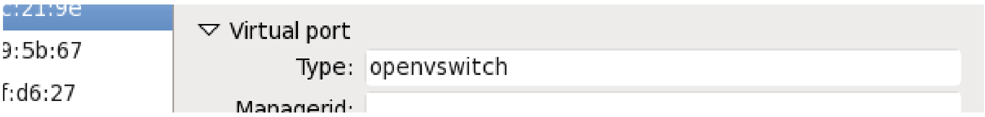
Source mode: VEPA

Virtual port

Type:

Managerid:

2. Set the *Type* to be *openvswitch*.

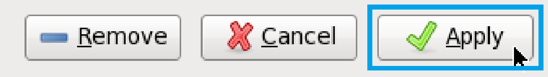


Virtual port

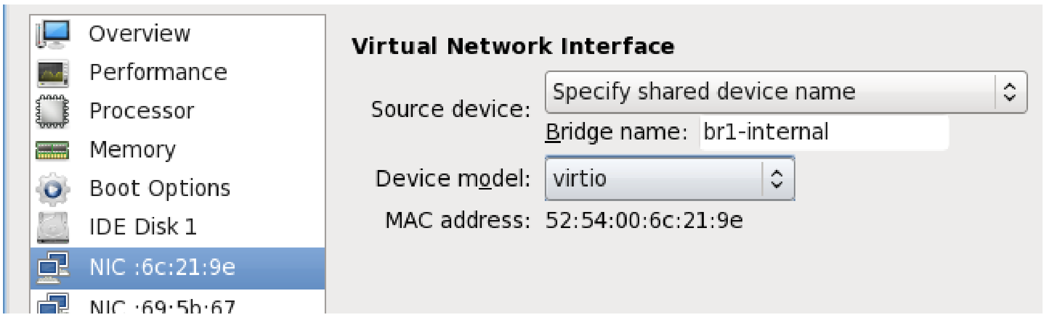
Type: openvswitch

Managerid:

3. Save this setting by selecting the **Apply** button.



4. Now, change the *Source device* setting back to *Specify shared device name* and set it to be the Open vSwitch bridge connected to the interface. In this case, *br1-internal*.



Virtual Network Interface

Source device: Specify shared device name

Bridge name: br1-internal

Device model: virtio

MAC address: 52:54:00:6c:21:9e

5. Now select the **Apply** button and repeat the process with the remaining interfaces *If2* and *If3*, connecting them to the bridges *br2-external* and *br3-internal*.

6. Repeat the process for the slave security gateway.

The networking for an HA cluster on a single hardware server is now complete. When the security gateways are on different servers, the procedure is similar. However, the administrator should then decide how they want to connect the Open vSwitch bridges on each server together. *VLAN tagging* can be used to separate the internal bridges on each server. Each pair of cluster interfaces uses a different VLAN ID to separate its traffic from the other pairs of interfaces.

Chapter 8: SR-IOV Setup

Overview

Single Root I/O Virtualization (SR-IOV) is a specification that can allow direct access to an external PCI Ethernet interface by cOS Core running under KVM. It is only available on Intel based hardware.

The direct access provided by SR-IOV can give dramatically higher traffic throughput capability for a virtual Clavister Security Gateway since it circumvents the overhead involved with normal virtual interfaces. A disadvantage of using SR-IOV is the static nature of configurations that use it.

> ***Important: SR-IOV consumes an entire core***
> *When SR-IOV is enabled, cOS Core will consume* ***virtually all*** *the resources of the processor core on which it runs. This is true even if cOS Core has no traffic load. The reason for this is that SR-IOV uses continuous interface polling to check for new traffic.*

SR-IOV Interfaces for cOS Core

By default, cOS Core provides three virtual Ethernet ports with the logical cOS Core names **I1**, **I2** and **I3**. The setup procedure described in this section adds hardware PCI Ethernet ports as additional interfaces with logical cOS Core names **I4**, **I5** and so on.

Once the setup is complete, only traffic routed through these additional ports will benefit from the throughput increases provided by SR-IOV.

Prerequisites for SR-IOV

In order to make use of SR-IOV with cOS Core under KVM, the following is required:

- Support for IOMMU with IOMMU enabled in the BIOS.

- Hardware support for SR-IOV with Intel™ VT-d or AMD-Vi.

- Support for SR-IOV enabled in the BIOS.

- Available slots supporting PCI Express v2.0 (5.0GT/s) x8 Lanes with ARI and ACS.

- An Intel Ethernet Converged Network Adapter x520/X540 with Intel 82599 chipsets (10 Gb) or an Intel i350 adapter (1 Gb).

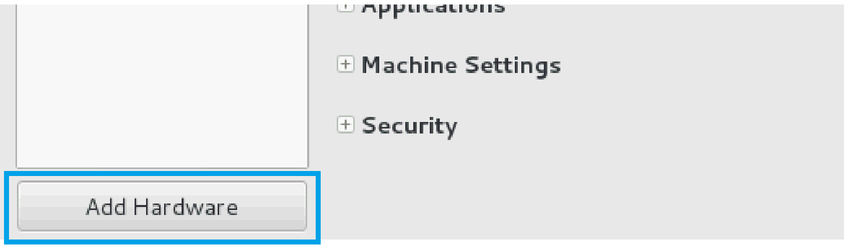
Set up of the hardware platform for virtualization is not discussed further here. For details on this subject refer to the Intel document entitled: ***Using Intel Ethernet and the PCI-SIG Single Root I/O Virtualization (SR-IOV) and Sharing Specification on Red Hat Enterprise Linux*** .

Adding SR-IOV Interfaces

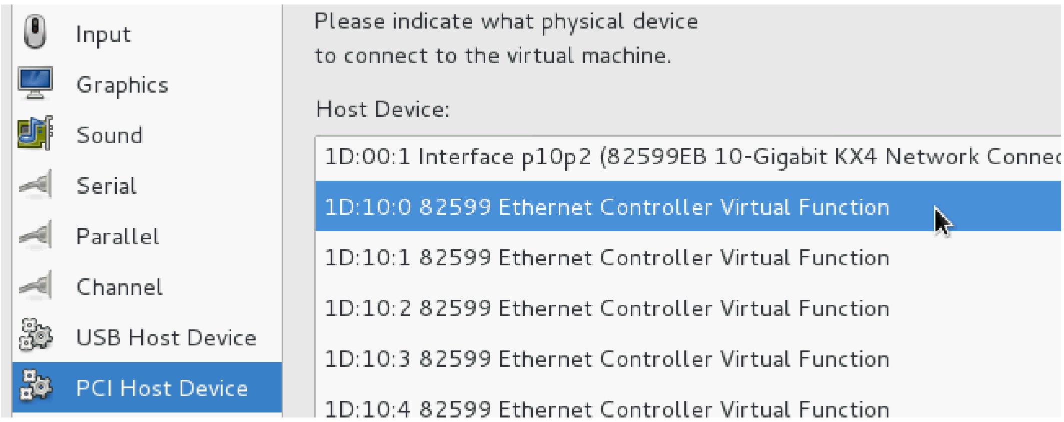
The following are the steps for SR-IOV interface setup with cOS Core:

1. If it is running, stop the cOS Core virtual machine.

2. In *virt-manager*, select **Add Hardware**.



3. Select **PCI Host Device** and the correct virtual function. For the first PCI device, the final digit in the numeric designation on the left should be even (below it is **1D:10:0**). Press **Finish** to add the device.

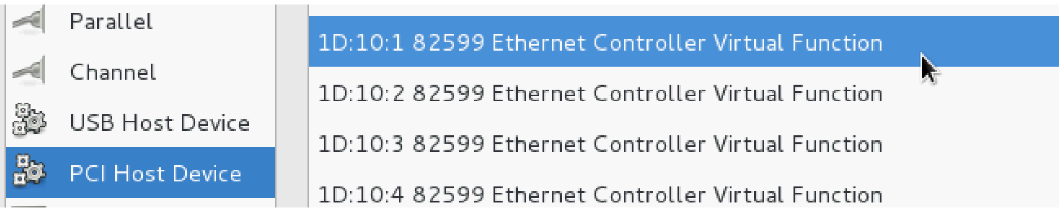


Please indicate what physical device to connect to the virtual machine.

Host Device:

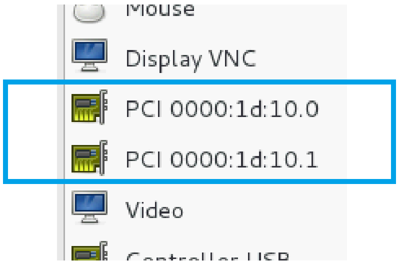
1D:00:1 Interface p10p2 (82599EB 10-Gigabit KX4 Network Connec
1D:10:0 82599 Ethernet Controller Virtual Function
1D:10:1 82599 Ethernet Controller Virtual Function
1D:10:2 82599 Ethernet Controller Virtual Function
1D:10:3 82599 Ethernet Controller Virtual Function
1D:10:4 82599 Ethernet Controller Virtual Function

4. The same is repeated if a second PCI device is added but the final digit of the selected virtual function should be odd.



1D:10:1 82599 Ethernet Controller Virtual Function
1D:10:2 82599 Ethernet Controller Virtual Function
1D:10:3 82599 Ethernet Controller Virtual Function
1D:10:4 82599 Ethernet Controller Virtual Function

5. The new adapters are now listed in *virt-manager*.



6. Start the cOS Core virtual machine.

7. Start cOS Core again and issue the following console CLI command:

```
Device:/> pciscan -cfgupdate
```

   cOS Core will scan the available interfaces and include the added PCI interfaces into the configuration. Some example output is shown below.

8. Finally, save the configuration changes using the following commands:

```
Device:/> activate

Device:/> commit
```

Note: Do not pre-assign the SR-IOV MAC address

For any usage of SR-IOV interfaces with cOS Core, the MAC address should not be preassigned by the hypervisor so that it is fixed. This will prevent cOS Core from controlling the MAC address which can be needed in certain circumstances.

Achieving Maximum Throughput

Once the SR-IOV interfaces exist as logical interfaces in cOS Core they can used for both receiving and sending in traffic as well as being part of rule sets and other cOS Core objects.

On order to reach much higher throughput speeds, traffic must both enter and leave the security gateway via SR-IOV interfaces. Having the traffic enter or leave on a normal interface will create a bottleneck, reducing throughput back to non-SR-IOV speeds.

Features Not Supported by SR-IOV Interfaces

The following cOS Core features are not supported by SR-IOV interfaces:

- Proxy ARP/ND using XPUBLISH is not supported.
- Multicast is not supported.

Chapter 9: FAQ

This appendix collects together answers to a selection of *Frequently Asked Questions* that can be helpful in solving various issues with cOS Core running under KVM.

Question Summary

1. The 2 hour cOS Core demo mode time limit has expired. What do I do?
2. Are upgrades of cOS Core done differently under KVM?
3. How do I release the focus from the KVM console window?
4. Do all virtual interfaces have to be configured as virtio NICs?
5. How do I manage multiple virtual security gateways?
6. How much increase in throughput can SR-IOV provide?

Questions and Answers

1. The 2 hour cOS Core demo mode time limit has expired. What do I do?

cOS Core will not respond after it enters *lockdown mode* after 2 hours and will consume all the KVM resources. In this situation, the KVM virtual machine must be stopped and then restarted so that cOS Core restarts and enters a new 2 hour evaluation period.

2. Are upgrades of cOS Core done differently under KVM?

No. cOS Core upgrades are performed under KVM just as they would be in non-KVM environments.

3. How do I release the focus from the KVM console window?

KVM keeps focus in the console window. To click outside the console window, press the key combination **Ctrl-Alt** .

4. Do all virtual interfaces have to be configured as virtio NICs?

Yes. cOS Core will not work with virtual interfaces that are not configured to use the virtio driver. Any added interfaces must have the *Device model* property set to *virtio*.

5. How do I manage multiple virtual security gateways?

The IP address of the management virtual Ethernet interface for cOS Core must be different for the different virtual security gateways running under a single hypervisor.

6. How much increase in throughput can SR-IOV provide?

The performance increase provided by SR-IOV can be dramatic if traffic both enters and leaves via SR-IOV interfaces. A quadrupling of maximum throughput is possible.

Appendix A: Windows XP IP Setup

If a PC running Microsoft XP™ is being used as the cOS Core management workstation, the computer's Ethernet interface connected to the Clavister Security Gateway must be configured with an IPv4 address which belongs to the network *192.168.1.0/24* and is different from the security gateway's address of *192.168.1.1*.

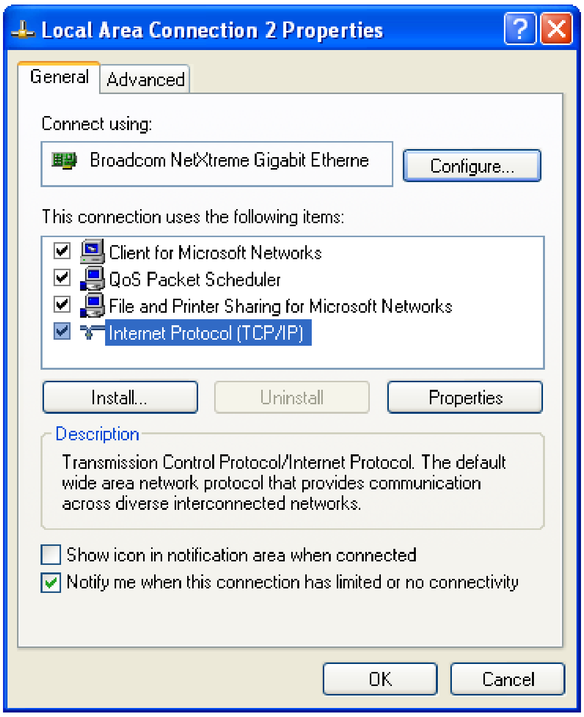
The IPv4 address *192.168.1.30* will be used for this purpose and the steps to set this up with Windows XP are as follows:

1. Click the **Start** button.

2. Right click on **My Network Places** and select **Properties**.

3. Right click the chosen Ethernet interface and select **Properties**.

4. Select **Internet Protocol (TCP/IP)** and click **Properties**.



Connect using:

Broadcom NetXtreme Gigabit Etherne

This connection uses the following items:

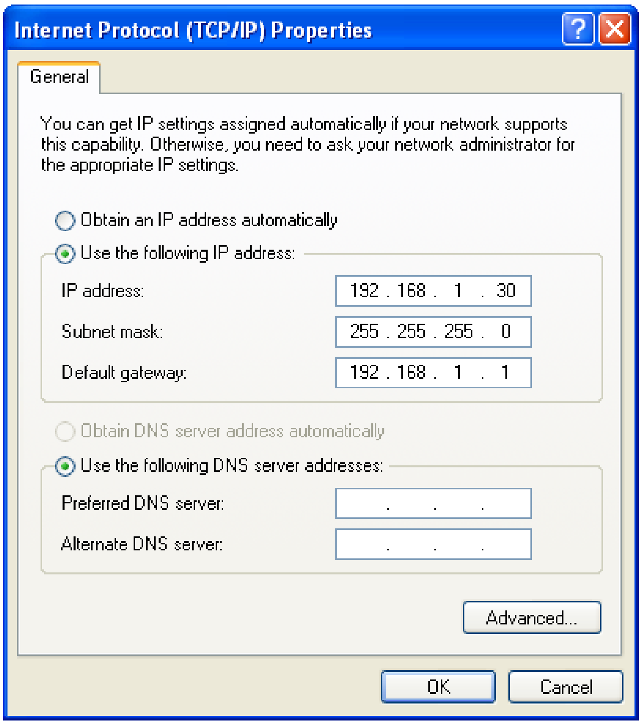
☑ Client for Microsoft Networks
☑ QoS Packet Scheduler
☑ File and Printer Sharing for Microsoft Networks
☑ Internet Protocol (TCP/IP)

Description

Transmission Control Protocol/Internet Protocol. The default wide area network protocol that provides communication across diverse interconnected networks.

□ Show icon in notification area when connected
☑ Notify me when this connection has limited or no connectivity

5. Enter the IPv4 addresses given above and click **OK**.



You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.

○ Obtain an IP address automatically

● Use the following IP address:

IP address: 192 . 168 . 1 . 30

Subnet mask: 255 . 255 . 255 . 0

Default gateway: 192 . 168 . 1 . 1

○ Obtain DNS server address automatically

● Use the following DNS server addresses:

Preferred DNS server: . . .

Alternate DNS server: . . .

Note: DNS addresses can be entered later

To browse the Internet from the management workstation via the security gateway, it is possible to go back to the last step's properties dialog later and enter DNS server IP addresses. For now, they are not required.

Appendix B: Vista IP Setup

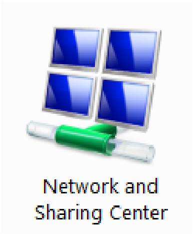
If a PC running Microsoft Vista is being used as the cOS Core management workstation, the computer's Ethernet interface connected to the Clavister Security Gateway must be configured with an IP address which belongs to the network *192.168.1.0/24* and is different from the security gateway's address of *192.168.1.1*.

The IP address *192.168.1.30* will be used for this purpose and the steps to set this up with Vista are as follows:

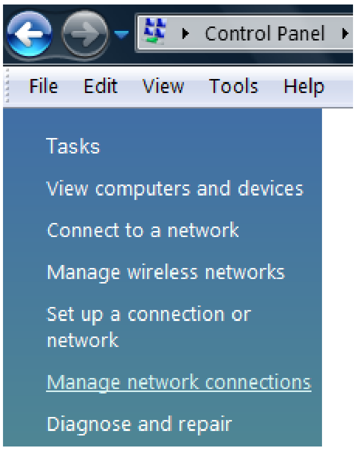
1. Press the Windows **Start** button.

2. Select the **Control Panel** from the start menu.

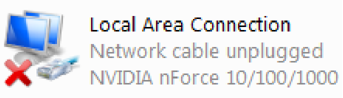
3. Select **Network & Sharing Center** from the control panel.



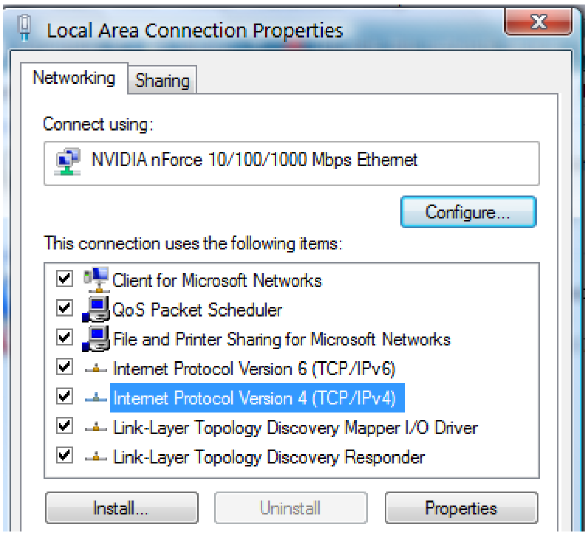
4. Select the **Manage network connections** option.



5. A list of the Ethernet interface connections will appear. Select the interface that will connect to the security gateway.



6. The properties for the selected interface will appear.



Local Area Connection Properties

Networking | Sharing

Connect using:

NVIDIA nForce 10/100/1000 Mbps Ethernet

Configure...

This connection uses the following items:

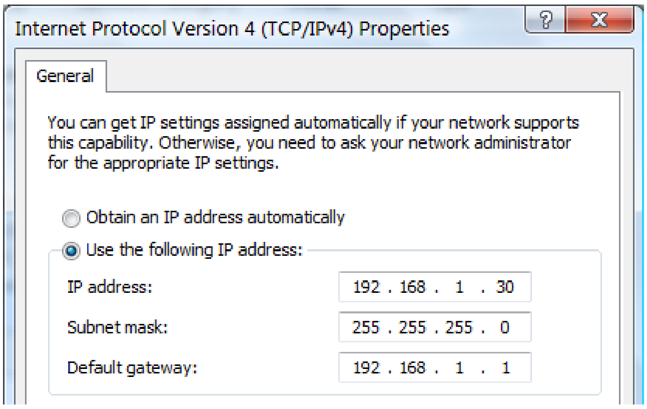
- ☑ Client for Microsoft Networks
- ☑ QoS Packet Scheduler
- ☑ File and Printer Sharing for Microsoft Networks
- ☑ Internet Protocol Version 6 (TCP/IPv6)
- ☑ Internet Protocol Version 4 (TCP/IPv4)
- ☑ Link-Layer Topology Discovery Mapper I/O Driver
- ☑ Link-Layer Topology Discovery Responder

Install... | Uninstall | Properties

Select and display the properties for *Internet Protocol Version 4 (TCP/IPv4).*

7. In the properties dialog, select the option **Use the following IP address** and enter the following values:

   - **IP Address:** *192.168.1.30*
   - **Subnet mask:** *255.255.255.0*
   - **Default gateway:** *192.168.1.1*



Internet Protocol Version 4 (TCP/IPv4) Properties

General

You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.

○ Obtain an IP address automatically

● Use the following IP address:

IP address:	192 . 168 . 1 . 30
Subnet mask:	255 . 255 . 255 . 0
Default gateway:	192 . 168 . 1 . 1

DNS addresses can be entered later once Internet access is established.

8. Click **OK** to close this dialog and close all the other dialogs opened since step **(1)**.

Appendix C: Windows 7 IP Setup

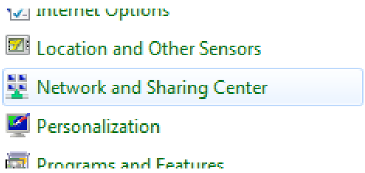
If a PC running Microsoft Windows 7 is being used as the cOS Core management workstation, the computer's Ethernet interface connected to the Clavister Security Gateway must be configured with an IP address which belongs to the network *192.168.1.0/24* and is different from the security gateway's address of *192.168.1.1*.

The IP address *192.168.1.30* will be used for this purpose and the steps to set this up with Windows 7 are as follows:

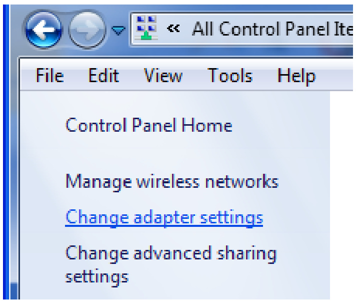
1. Press the Windows **Start** button.

2. Select the **Control Panel** from the start menu.

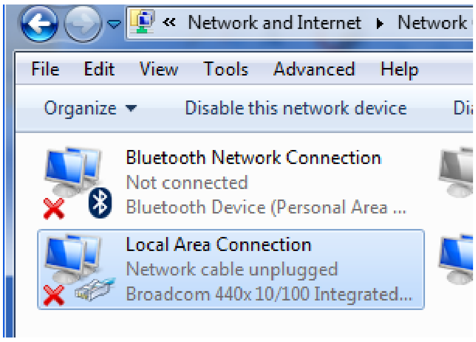
3. Select **Network & Sharing Center** from the control panel.



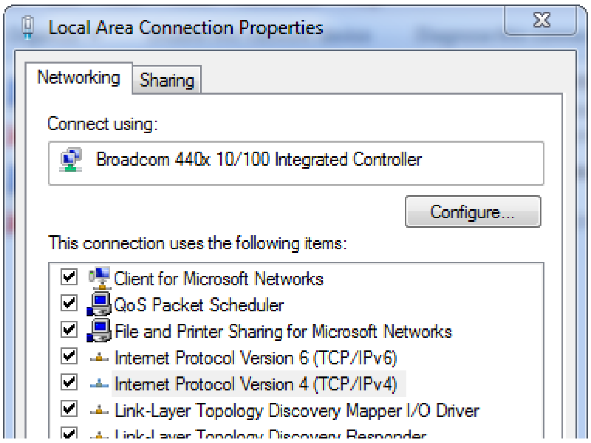
4. Select the **Change adapter settings** option.



5. A list of adapters will appear and will include the Ethernet interfaces. Select the interface that will connect to the security gateway.


« Network and Internet ▸ Network
File Edit View Tools Advanced Help
Organize ▾ Disable this network device Di
Bluetooth Network Connection
Not connected
Bluetooth Device (Personal Area ...
Local Area Connection
Network cable unplugged
Broadcom 440x 10/100 Integrated...

6. The properties for the selected interface will appear.



Local Area Connection Properties

Networking | Sharing

Connect using:

Broadcom 440x 10/100 Integrated Controller

Configure...

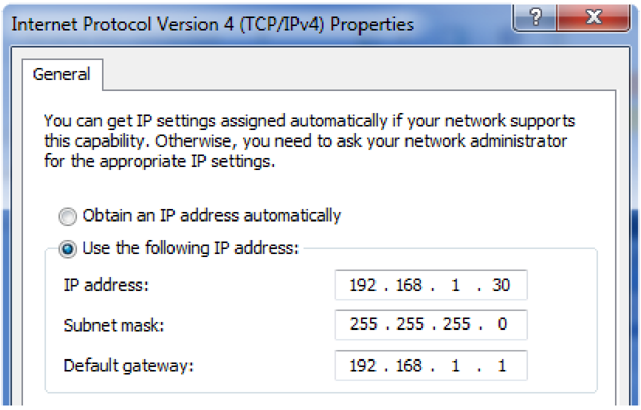
This connection uses the following items:

- ☑ Client for Microsoft Networks
- ☑ QoS Packet Scheduler
- ☑ File and Printer Sharing for Microsoft Networks
- ☑ Internet Protocol Version 6 (TCP/IPv6)
- ☑ Internet Protocol Version 4 (TCP/IPv4)
- ☑ Link-Layer Topology Discovery Mapper I/O Driver
- ☑ Link-Layer Topology Discovery Responder

Select and display the properties for *Internet Protocol Version 4 (TCP/IPv4).*

7. In the properties dialog, select the option **Use the following IP address** and enter the following values:

   - **IP Address:** *192.168.1.30*
   - **Subnet mask:** *255.255.255.0*
   - **Default gateway:** *192.168.1.1*



Internet Protocol Version 4 (TCP/IPv4) Properties

General

You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.

○ Obtain an IP address automatically

● Use the following IP address:

IP address: 192 . 168 . 1 . 30

Subnet mask: 255 . 255 . 255 . 0

Default gateway: 192 . 168 . 1 . 1

DNS addresses can be entered later once Internet access is established.

8. Click **OK** to close this dialog and close all the other dialogs opened since step **(1)**.

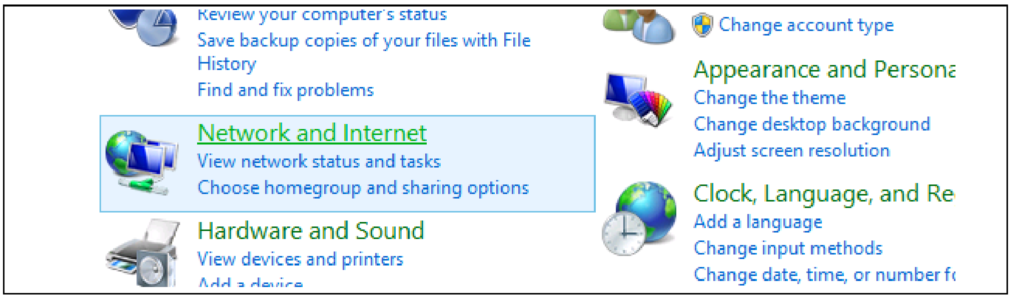
Appendix D: Windows 8/8.1/10 IP Setup

If a computer running Windows is being used as the cOS Core management workstation and a DHCP server is not enabled on the cOS Core management interface, the management computer's Ethernet interface connected to the Clavister Security Gateway should be configured with an IPv4 address which belongs to the network *192.168.1.0/24*. That address must be different from the security gateway's default management interface address of *192.168.1.1*.

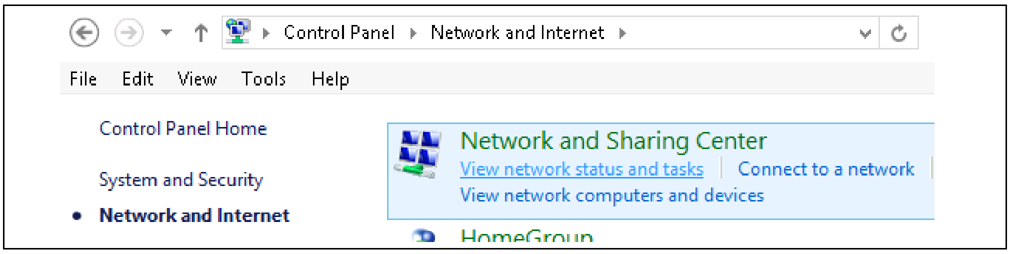
The IPv4 address *192.168.1.30* will be used for this purpose and the steps to set this up with Windows 8, 8.1 or 10 are as follows:

1. Open the Windows **Control Panel** (the *Category* view is assumed here).

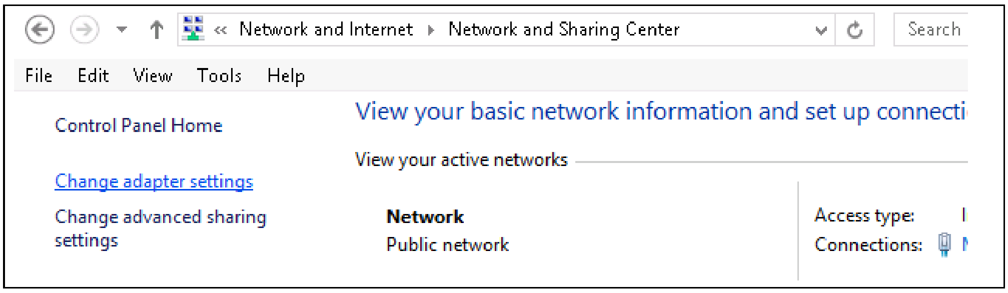
2. Select **Network & Internet** from the control panel.


Review your computer's status
Save backup copies of your files with File History
Find and fix problems
Network and Internet
View network status and tasks
Choose homegroup and sharing options
Hardware and Sound
View devices and printers
Add a device
Change account type
Appearance and Persona
Change the theme
Change desktop background
Adjust screen resolution
Clock, Language, and Re
Add a language
Change input methods
Change date, time, or number f

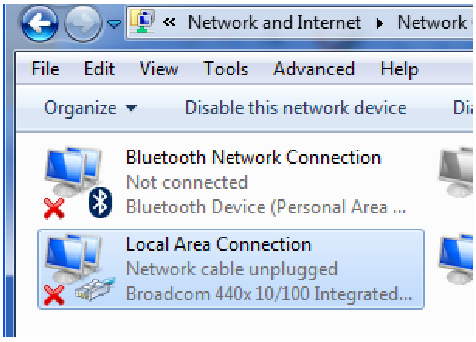
3. Then, select the **Network & Sharing Center** option.



4. Now, select the **Change adapter settings** option.


Network and Internet
Network and Sharing Center
Search
File
Edit
View
Tools
Help
Control Panel Home
Change adapter settings
Change advanced sharing settings
View your basic network information and set up connecti
View your active networks
Network
Public network
Access type:
Connections:

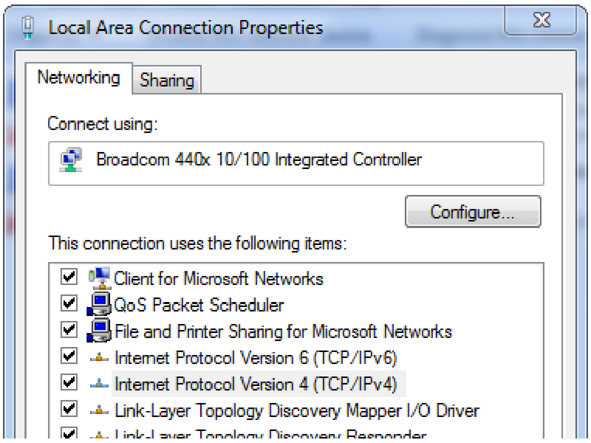
5. A list of adapters will appear and will include the Ethernet interfaces. Select the interface that will connect to the security gateway.


« Network and Internet ▸ Network
File Edit View Tools Advanced Help
Organize ▾ Disable this network device Di

Bluetooth Network Connection
Not connected
Bluetooth Device (Personal Area ...

Local Area Connection
Network cable unplugged
Broadcom 440x 10/100 Integrated...

6. The properties for the selected interface will appear.



Connect using:

Broadcom 440x 10/100 Integrated Controller

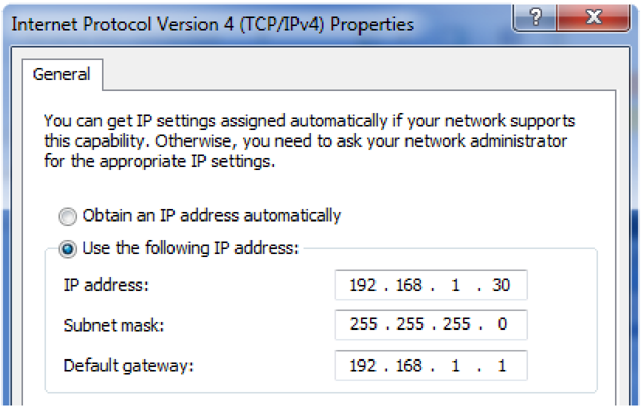
This connection uses the following items:

- ☑ Client for Microsoft Networks
- ☑ QoS Packet Scheduler
- ☑ File and Printer Sharing for Microsoft Networks
- ☑ Internet Protocol Version 6 (TCP/IPv6)
- ☑ Internet Protocol Version 4 (TCP/IPv4)
- ☑ Link-Layer Topology Discovery Mapper I/O Driver
- ☑ Link-Layer Topology Discovery Responder

Select and display the properties for *Internet Protocol Version 4 (TCP/IPv4)*.

7. In the properties dialog, select the option **Use the following IP address** and enter the following values:

- **IP Address:** *192.168.1.30*
- **Subnet mask:** *255.255.255.0*
- **Default gateway:** *192.168.1.1*



You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.

○ Obtain an IP address automatically

● Use the following IP address:

IP address: 192 . 168 . 1 . 30

Subnet mask: 255 . 255 . 255 . 0

Default gateway: 192 . 168 . 1 . 1

DNS addresses can be entered later once Internet access is established.

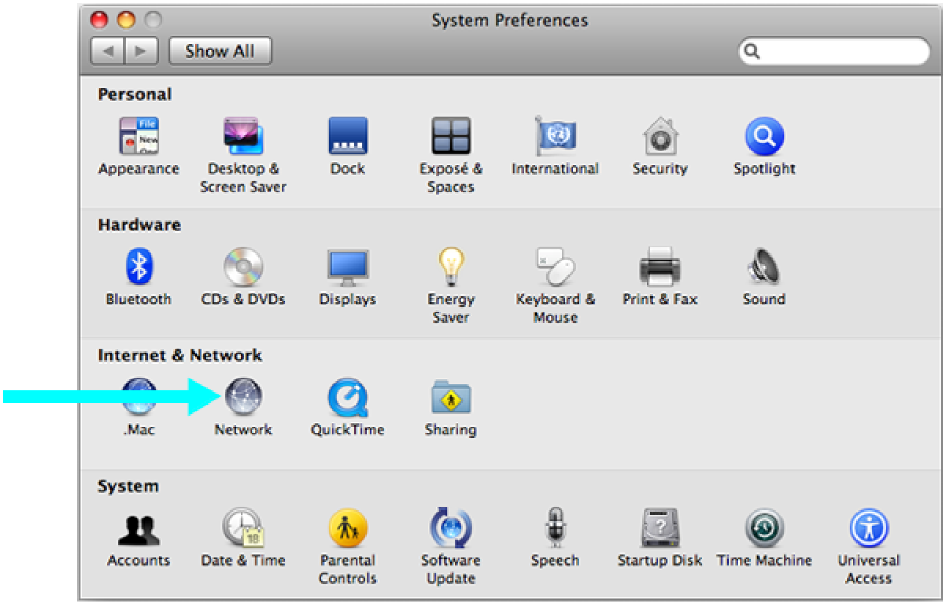
8. Click **OK** to close this dialog and close all the other dialogs opened since step **(1)**.

Appendix E: Apple Mac IP Setup

An Apple Mac can be used as the management workstation for initial setup of a Clavister Security Gateway. To do this, a selected Ethernet interface on the Mac must be configured correctly with a static IP. The setup steps for this with Mac OS X are:

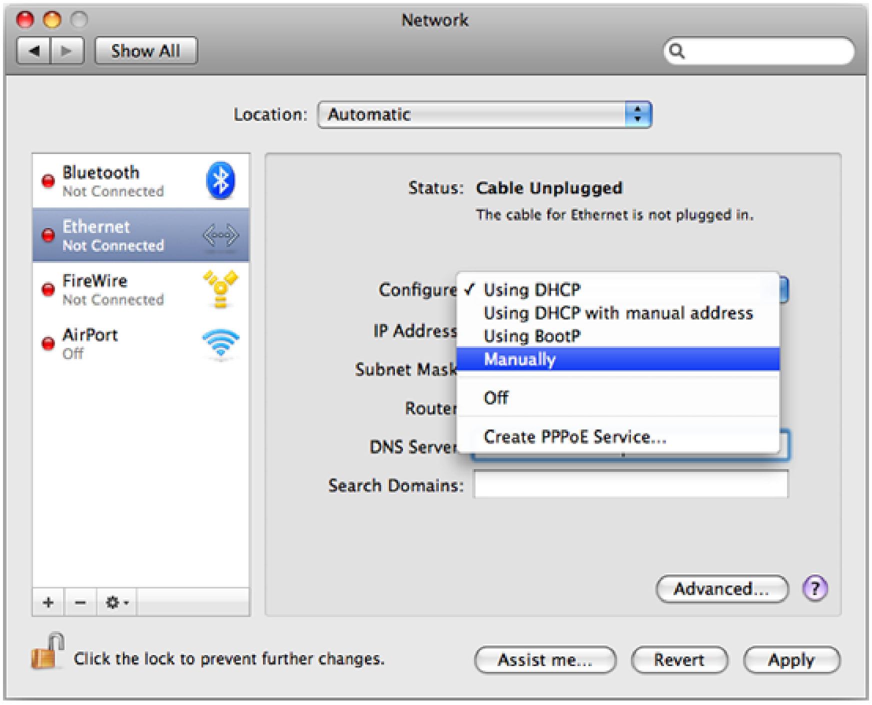
1. Go to the **Apple Menu** and select **System Preferences**.

2. Click on **Network**.



3. Select **Ethernet** from the left sidebar menu.

4. Select **Manually** in the **Configure** pull down menu.



Location: Automatic

Status: **Cable Unplugged**

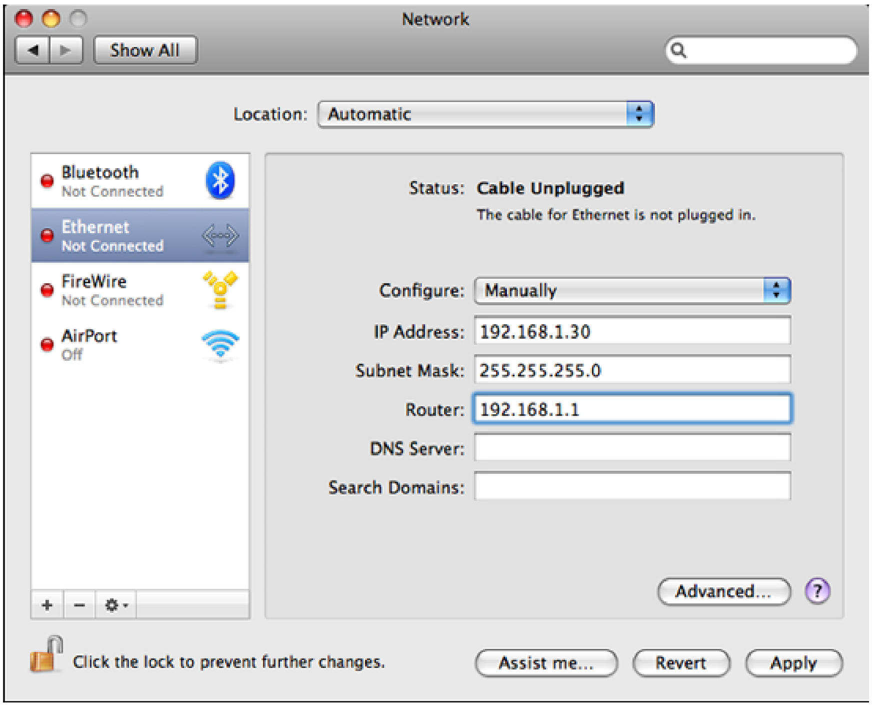
The cable for Ethernet is not plugged in.

Configure: Manually

Search Domains:

Click the lock to prevent further changes.

5. Now set the following values:
   - **IP Address:** *192.168.1.30*
   - **Subnet Mask:** *255.255.255.0*
   - **Router:** *192.168.1.1*



Location: Automatic

Status: Cable Unplugged
The cable for Ethernet is not plugged in.

Configure: Manually
IP Address: 192.168.1.30
Subnet Mask: 255.255.255.0
Router: 192.168.1.1
DNS Server:
Search Domains:

Click the lock to prevent further changes.

6. Click **Apply** to complete the static IP setup.

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