Universidade de Aveiro

Departamento de Eletrónica, Telecomunicações e Informática

Arquitetura de Redes Avançadas

2020/2021

Virtualization Support Guide

(under construction)

Prof. Dr. Daniel Corujo

dcorujo@ua.pt

V0.1

November 2020

INDEX

Contents

Version Summary

26/11/2020 – v0.1 – Basic information needed for the CDN practical work

1 Introduction

Virtualization is a flexible tool allowing users to deploy virtual machines over the same infrastructure. This not only exists in cloud-based datacenters, but also at user terminals with many tools such as VirtuaBox, VMWare or Parallels. Nonetheless, such virtual machines acting alone (e.g., unconnected) have limited use, so virtual computing goes hand-in-hand with virtual networking. This allows several options for connecting the virtual machines to physical and virtual networks themselves.

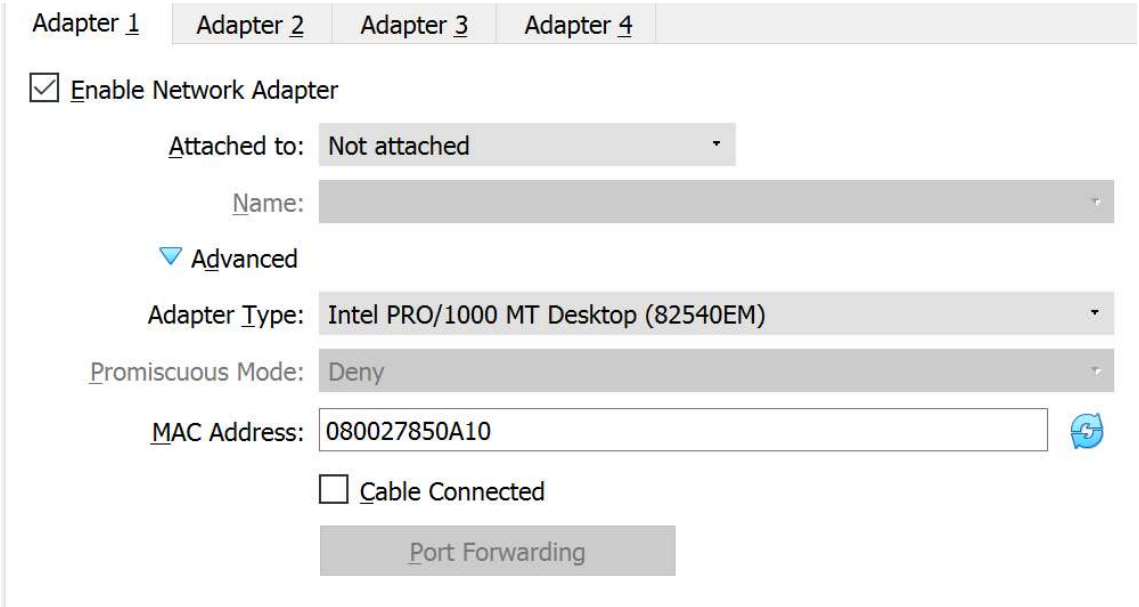
Additionally, this can be leveraged by other tools, such as GNS3, which allows virtual machines to be integrated into a networking topology project along with routers, switches and VPCs. The net result is the ability to test out high-level services (e.g., DNS, SIP servers) which are not present in VPC's or Cisco routers.

This document acts as a collection of informational items on the virtualization tools needed for the execution of practical guides for the "Arquiteturas de Redes Avançadas", and in integration with GNS3.

2 VirtualBox

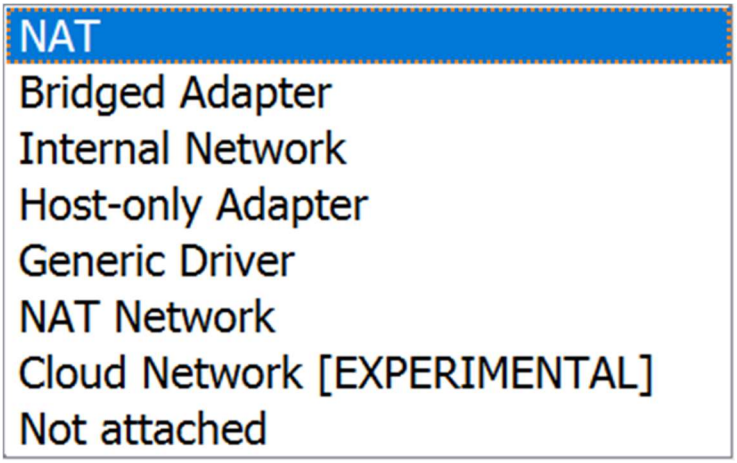
The best source for learning about how VirtualBox handles virtualized networking is from VirtualBox itself. Most of the information on this section comes right from their manual's Networking section, which can be found in https://www.virtualbox.org/manual/ch06.html . Students are seriously advised to spend some time going through the manual.

You have probably noticed in VirtualBox that your virtual machines can have several network adapters. You can right click on a virtual machine, select "Settings" and go into the Network section, which will look like below:



2.1 VirtualBox Network Attachment Options

As you can see, ou can either enable or disable the network interfaces. Additionally, you can select where each interface is connected to, according to the following options list:



What follows is a direct extraction of VirtualBox's Networking chapter on it's manual. Some considerations are added in *italic underlined text.*

Not attached. In this mode, Oracle VM VirtualBox reports to the guest that a network card is present, but that there is no connection. This is as if no Ethernet cable was plugged into the card. Using this mode, it is possible to pull the virtual Ethernet cable and disrupt the connection, which can be useful to inform a guest operating system that no network connection is available and enforce a reconfiguration.

Network Address Translation (NAT). If all you want is to browse the Web, download files, and view email inside the guest, then this default mode should be sufficient for you, and you can skip the rest of this section. Please note that there are certain limitations when using Windows file sharing. See Section 6.3.3[1], "NAT Limitations". *What this section point's out in VirtualBox's manual, is that there are limitations with ICMP support using this options. The manual points out that **ping** should work, but other tools might not (e.g., **traceroute**).*

NAT Network. A NAT network is a type of internal network that allows outbound connections. See Section 6.4[2], "Network Address Translation Service".

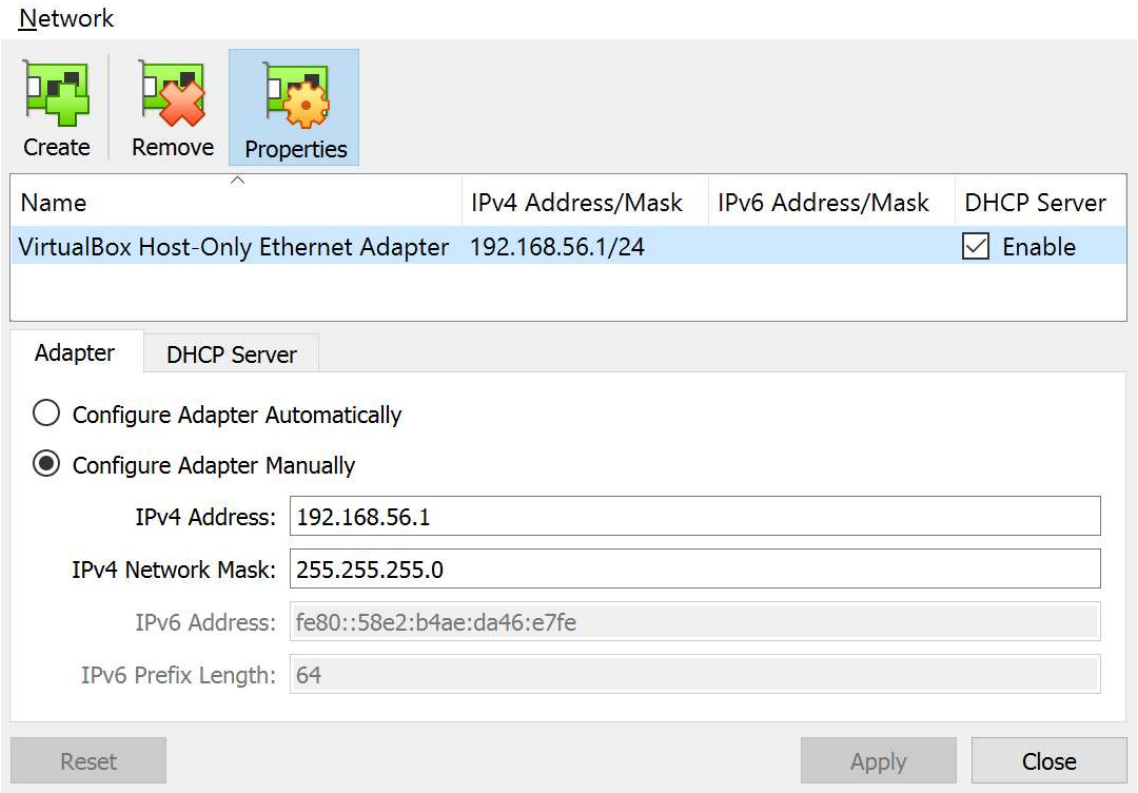
[1] https://www.virtualbox.org/manual/ch06.html#nat-limitations
[2] https://www.virtualbox.org/manual/ch06.html#network_nat_service

Bridged networking. This is for more advanced networking needs, such as network simulations and running servers in a guest. When enabled, Oracle VM VirtualBox connects to one of your installed network cards and exchanges network packets directly, circumventing your host operating system's network stack. *This is a very interesting option, which allows your machine to look like it is an independent node connected to the same network that your physical host device (e.g., your laptop) connects too. For example, if you have your laptop connected to a network with DHCP active, your virtual machine will acquire it's own IP address via DHCP, independently of the IP address received by the host computer. However, there are known limitations with some **Wi-Fi cards**, when you select this option, which can produce erratic behavior.*

Internal networking. This can be used to create a different kind of software-based network which is visible to selected virtual machines, but not to applications running on the host or to the outside world. *This is useful for creating an internal network, which is visible to the VirtualBox virtual machines, and can be used to interconnect them. To use this you just need to select "Internal Network" as the attachment option, and select an existing Internal network, or create a new one by writing a new name.*

Host-only networking. This can be used to create a network containing the host and a set of virtual machines, without the need for the host's physical network interface. Instead, a virtual network interface, similar to a loopback interface, is created on the host, providing connectivity among virtual machines and the host. *This basically allows you to create an internal network that connects virtual machines and the host machine, **without having to attach a physical interface** (unlike bridged networking). In order to use this, you need to previously create VirtualBox Host-Only adapter. By default, one is already created. For you to create new ones or edit existing ones, you need to go into VirtualBox's main menu, select File -> Host Network Manager, which will show you the following window:*

,



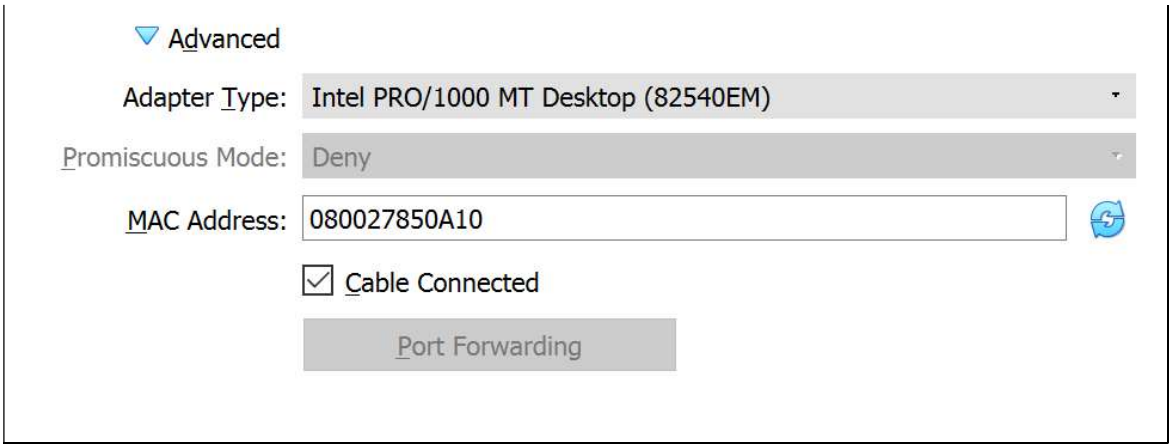
Here you can configure the virtual host-only ethernet adapter, where you can define the used subnet by pointing out the IP address that the physical host device (e.g., your laptop) will have in this host-only network. You can also activate DHCP, pointing out the IP pool range for the virtual machines' IP addresses that you connect to this host-only adapter.

Generic networking. Rarely used modes which share the same generic network interface, by allowing the user to select a driver which can be included with Oracle VM VirtualBox or be distributed in an extension pack.

The following sub-modes are available:

> **UDP Tunnel:** Used to interconnect virtual machines running on different hosts directly, easily, and transparently, over an existing network infrastructure. *This is what GNS3 will automatically change for you in VirtualBox settings, when you allow it to take over the networking connection of your virtual machine.*
>
> **VDE (Virtual Distributed Ethernet) networking:** Used to connect to a Virtual Distributed Ethernet switch on a Linux or a FreeBSD host. At the moment this option requires compilation of Oracle VM VirtualBox from sources, as the Oracle packages do not include it.

It is important that you activate the "Cable Connected" option in the "Advanced" tab.



It is also important that you install the VirtualBox Extension Pack, which you can find here: https://www.virtualbox.org/wiki/Downloads

3 Importing Virtual Machines into VirtualBox

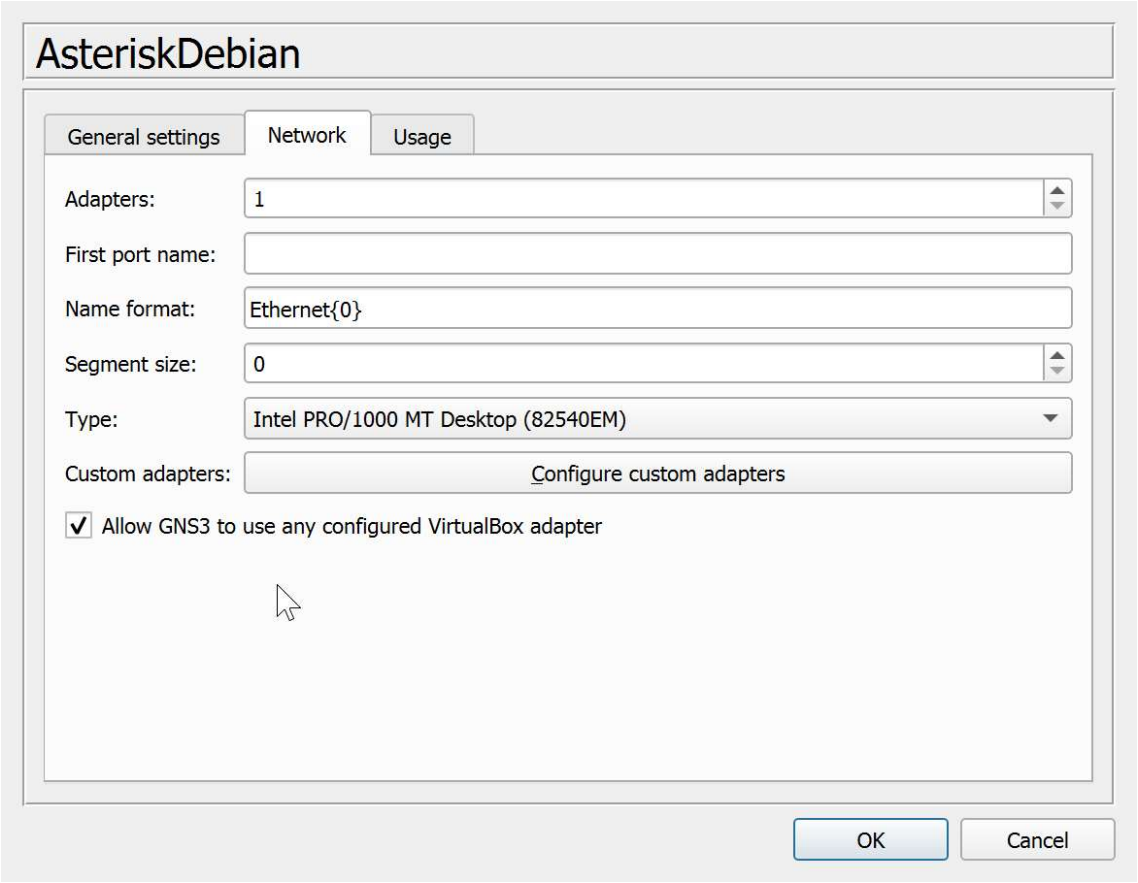
This is a very basic procedure. If you have virtualbox installed, you just need to double-lick on the ".ova" file (virtualbox associates this extension with the tool), and it will automatically import the virtual machine. Alternatively, you can go into File -> "Import Applicance" and select the file manually. After this, you are ready to start the virtual machine and test it.

4 GNS3 Interconnection with VirtualBox

For the CDN practical guide, you will need to download a virtual machine from the e-learning section of the course, and add it as a node into the topology. One important aspect is that you need to download it and import it into VirtualBox **BEFORE** trying to add it into GNS3. **In fact, in order to help detect any issues, make sure that you test the virtual machine before using it in GNS3, making sure that everything is correct (e.g., trying a NAT link attached, and see if you can access some outside service).**

When you have the virtual machine imported and verified in VirtualBox, you need to add it into GNS3's appliances catalogue (similarly as you did for the Cisco Router images). You do this by going into GNS3's main menu "Edit" -> "Preferences" and going into the "VirtualBox VMs" option. There, you can select "New" at the bottom, and go through the configuration options (the virtual machine will be selectable from a drop-down list, which is populated with the already-imported virtual machines existing in VirtualBox).

After you have imported this, you can **Edit** the properties of the virtual machine. Concretely, ***you need to go into the "Network" tab, and activate the "Allow GNS3 to use any configured VirtualBox adapter"*** *as shown below:*



This will allow GNS3 to "take over" your virtual adapter (configured in VirtualBox) and use it with the remainder nodes in your GNS3 topology. While running GNS3 with the virtual machine active, you will notice in the VirtualBox virtual machine Network Settings, that GNS3 will automatically change the type of attachment to "Generic Driver" and "UDPTunnel". This is expected and working as intended, as GNS3 will encapsulate the traffic used within it's topology and the integrated virtual machines.