IT3010

Network Design & Management

3rd Year, 1st Semester

Lab Report 02

Virtualization Providers

Submitted to

Sri Lanka Institute of Information Technology

In partial fulfillment of the requirements for the

Bachelor of Science Special Honors Degree in Information Technology

03.03.2019

Declaration

I certify that this report does not incorporate without acknowledgement, any material previously submitted for a degree or diploma in any university, and to the best of my knowledge and belief it does not contain any material previously published or written by another person, except where due reference is made in text.

Registration Number: IT17134972

IT17076326

IT17139854

Name: Jayasena K. L. K. U. D.

Hemachandra M. A. J. C.

Nagarawaththa N. W. C. R.

Contents

1. Virtualization providers

When we are in industry, we should work with different kind of Operating Systems (OS). If we use only two operating systems, we can dual boot our machine. But most of the times, we must work with more than 2 operating systems. So, in such a case we can use a Virtual Machine which is an emulation of a computer system. In there, we can work with different operating systems at same time. There are so many virtualization providers in industry. In here, we are discussing about three providers only. They are,

1. VMware
2. Virtual Box
3. Parallels Workstation

1.1. VMware

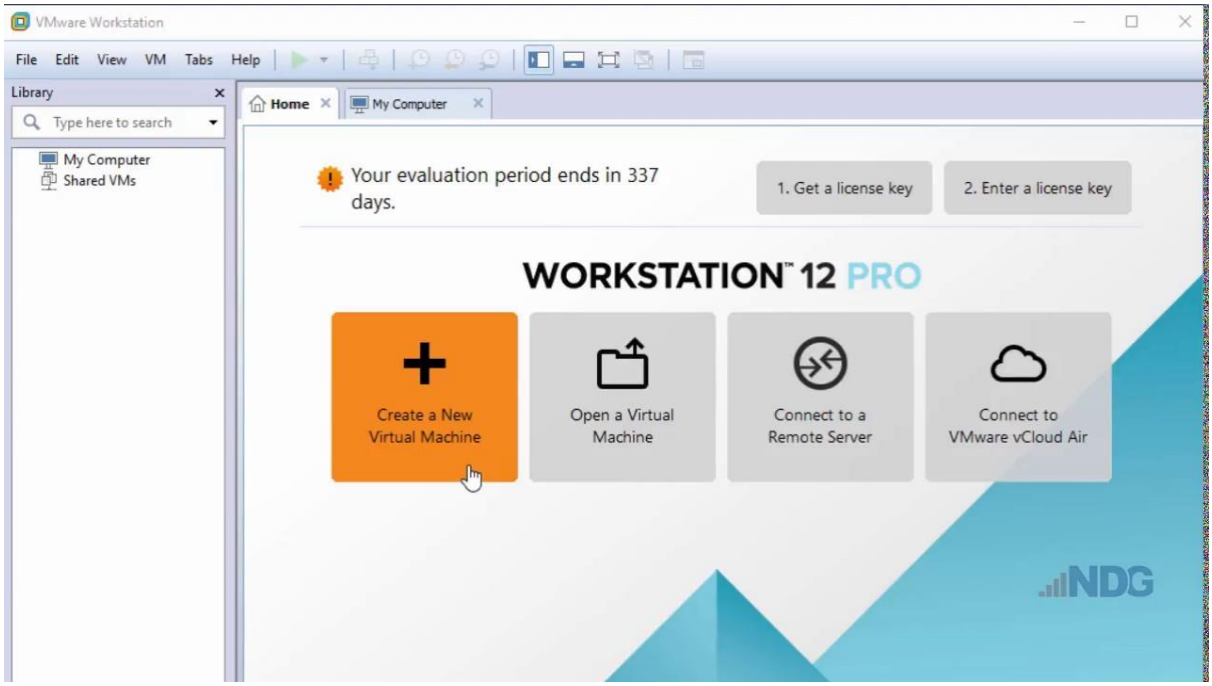

Figure 1.1: VMware Workstation

The different types of network adapter in VMware workstation are,

- Bridged Networking
- NAT
- Host-only Networking
- Custom Networking

There are three types of networking available to virtual machines. Each type has its own uses, behaviors and features:

Bridged networking

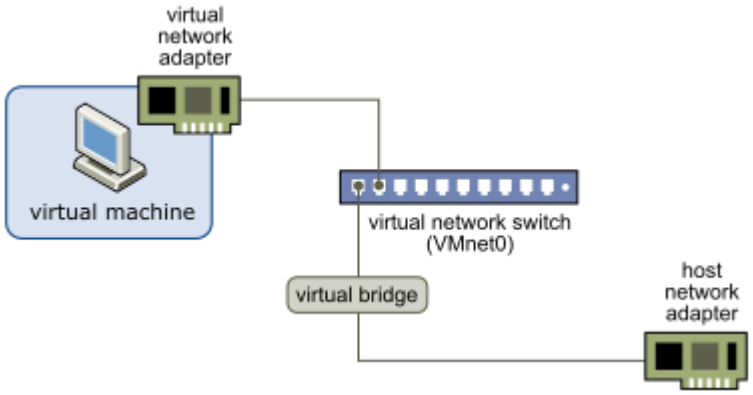

Figure 1.2: Bridged Network Configurations

Bridged networking connects virtual machines to the Local Area Network (LAN) of their host machine and allows them to connect to any other host or virtual machines (if they are also bridged) on the network. Establish additional virtual bridges to use in custom configurations that require connections to more than one physical Ethernet adapter on the host computer.

Host-only Networking

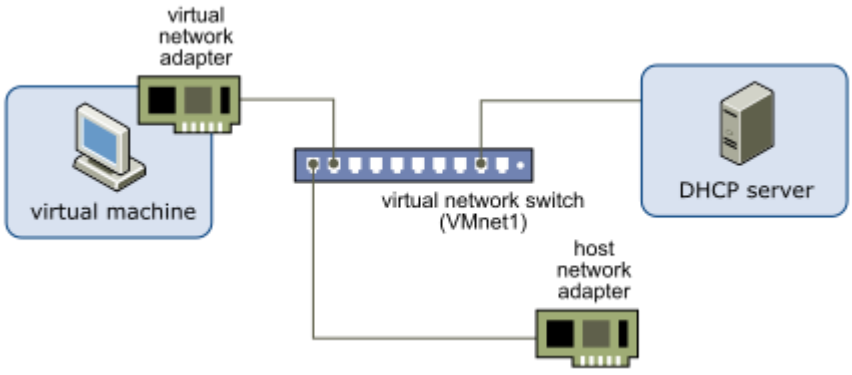

Figure 1.3: Host-Only Networking Configuration

Host-only networking connects virtual machines to a private LAN shared only by their host machine and any other virtual machines using host-only networking.

Network Address Translation (NAT)

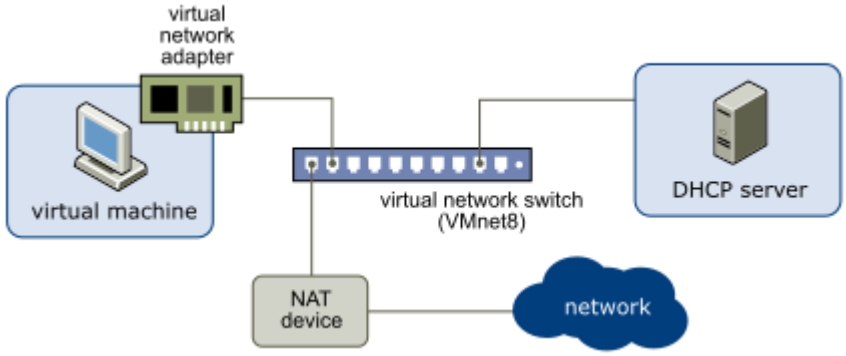

Figure 1.4: NAT Configuration

NAT networking connects virtual machines to an external network, using the host machines IP address for external communication. And it connects virtual machine to non-Ethernet using Token Ring or ATM. And can establish private LAN between your host machine and any other virtual machines on your computer.

Custom Networking

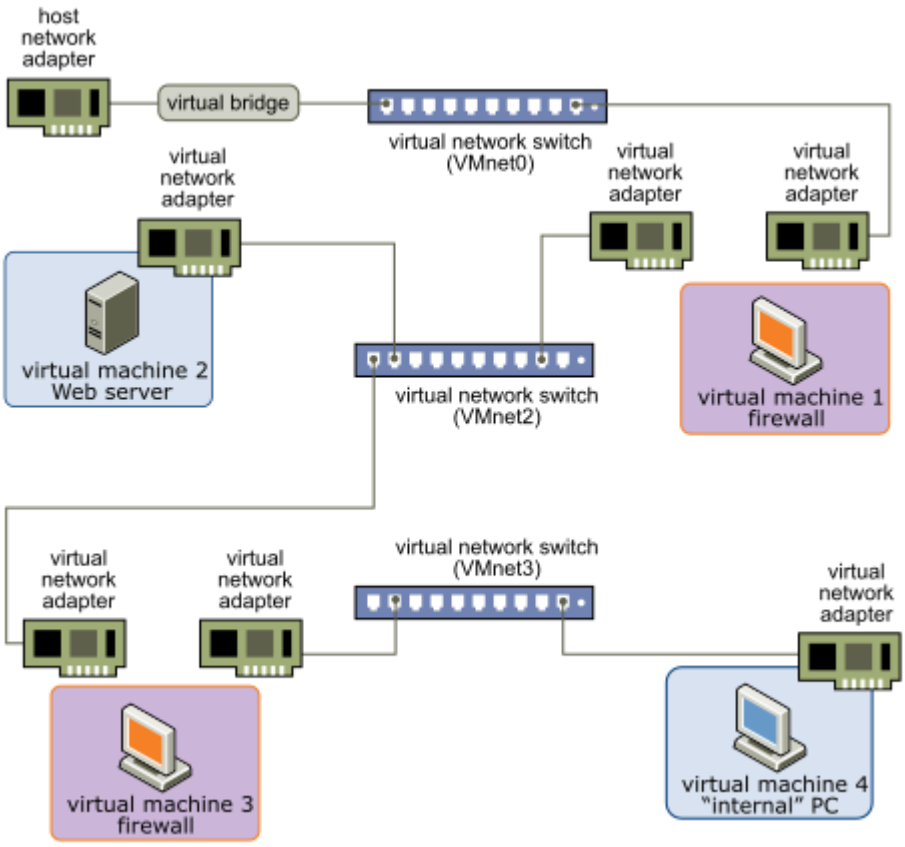

Figure 1.5: Custom Configuration with Two Firewalls

This example shows server connections through multiple firewalls. You can combine devices on a virtual network in many ways. In this example, a Web server connects through a firewall to an external network and an administrator's computer connects to the Web server through a second firewall.

Bridged networking	Host-only Networking	Network Address Translation (NAT) networking
Used in environments where virtual machines provide services in a real network.	Used in isolated test environments where virtual machines do not need to communicate with other environments	Used in environments where virtual machines do not provide services but still need to access a network
Connects the virtual network adapter in a virtual machine to the physical Ethernet adapter in its host machine.	Other host machines on the host LAN cannot communicate with the virtual machines	Other host machines on the host LAN can communicate with the virtual machines, however external host machines cannot initiate communication with virtual machines unless NAT port forwarding is also in use.
Default network adapter interface is vmnet0.	Default network adapter interface is vmnet1.	Default network adapter interface is vmnet8.

Scenario

This scenario is based on practical usage of one of the interface cards of the VMware workstation. Network adapter choices depend on the version number and the guest operating system running on the virtual machine. There are network adapters that are appropriate for the virtual machine.

- **Vlance**: This is an emulated version of the AMD 79C970 PCnet32- LANCE NIC. And, it is an older 10 Mbps NIC with drivers available in most 32-bit guest operating systems except Windows Vista and later. A virtual machine configured with this network adapter can use its network immediately.

- **VMXNET**: The VMXNET virtual network adapter has no physical counterpart. VMXNET is optimized for performance in a virtual machine. Because operating system vendors do not provide built-in drivers for this card, you must install VMware Tools to have a driver for the VMXNET network adapter available. VMXNET driver is only supported on kernels earlier than 3.3

- **Flexible**: The Flexible network adapter identifies itself as a Vlance adapter when a virtual machine boots but initializes itself and functions as either a Vlance or a VMXNET adapter, depending on which driver initializes it. With VMware Tools installed, the VMXNET driver changes the Vlance adapter to the higher performance VMXNET adapter.

- **E1000**: An emulated version of the Intel 82545EM Gigabit Ethernet NIC. A driver for this NIC is not included with all guest operating systems. Typically, Linux versions 2.4.19 and later, Windows XP Professional x64 Edition and later, and Windows Server 2003 (32-bit) and later include the E1000 driver. E1000 does not support jumbo frames prior to ESXi/ESX 4.1.

- **E1000e**: This feature emulates a newer model of Intel Gigabit NIC (number 82574) in the virtual hardware. This is known as the "e1000e" vNIC. e1000e is available only on hardware version 8 (and newer) virtual machines in vSphere 5. It is the default vNIC for Windows 8 and newer (Windows) guest operating systems. For Linux guests, e1000e is not available from the UI (e1000, flexible vmxnet, enhanced vmxnet, and vmxnet3 are available for Linux).

- **VMXNET 2 (Enhanced)**: The VMXNET 2 adapter is based on the VMXNET adapter but provides some high-performance features commonly used on modern networks, such as jumbo frames and hardware offloads. This virtual network adapter is available only for

some guest operating systems on ESXi/ESX 3.5 and later. Because operating system vendors do not provide built-in drivers for this card, you must install VMware Tools to have a driver for the VMXNET 2 network adapter available.

VMXnet2(Enhanced)	VmXnet3
Support TSO, jumbo frames, TCP/IP Checksum offload	Support TSO, jumbo frames, TCP/IP Checksum offload
No support to MSI/MSI-X. (to guest operating system kernel support)	No support to MSI/MSI-X. (to guest operating system kernel support)
Do not receive side scaling	Receive side scaling
No IPv6 TCP Segmentation offloading	Have Ipv6 TCP Segmentation offloading

1.2. Virtual Box

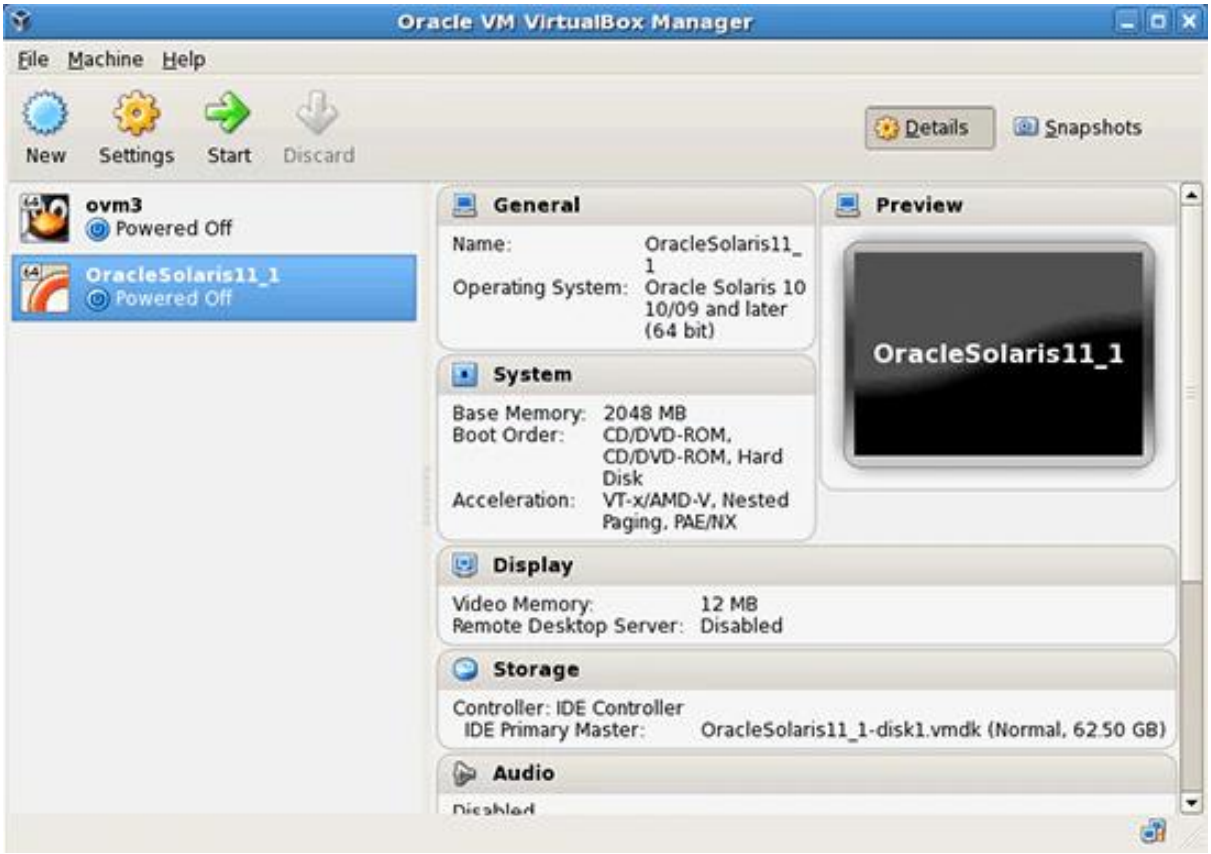

Figure 1.6: Oracle Virtual Box

There are different types of virtual interface cards in Virtual box.

- **AMD PCNet PCI II (Am79C970A)**

  This has in built support for CRC checks. This can pad short packets to the minimum length. This can operate in both 32 bit and 16 bits. Can access to registers through IO port space or memory which mapped to IO.

- **AMD PCNet FAST III (Am79C973, the default)** – This is supported by most of the systems. Unfortunately, such as MS Vista does not come up with the drivers for this device itself, so we must install it manually.

- **Intel PRO/1000 MT Desktop (82540EM)** – This has a PCI interface. Supports gigabit ethernet. This device has an internal memory of 64 kb.

- **Intel PRO/1000 T Server (82543GC)** – This card is recognized by windows xp guests without additional driver software installation.

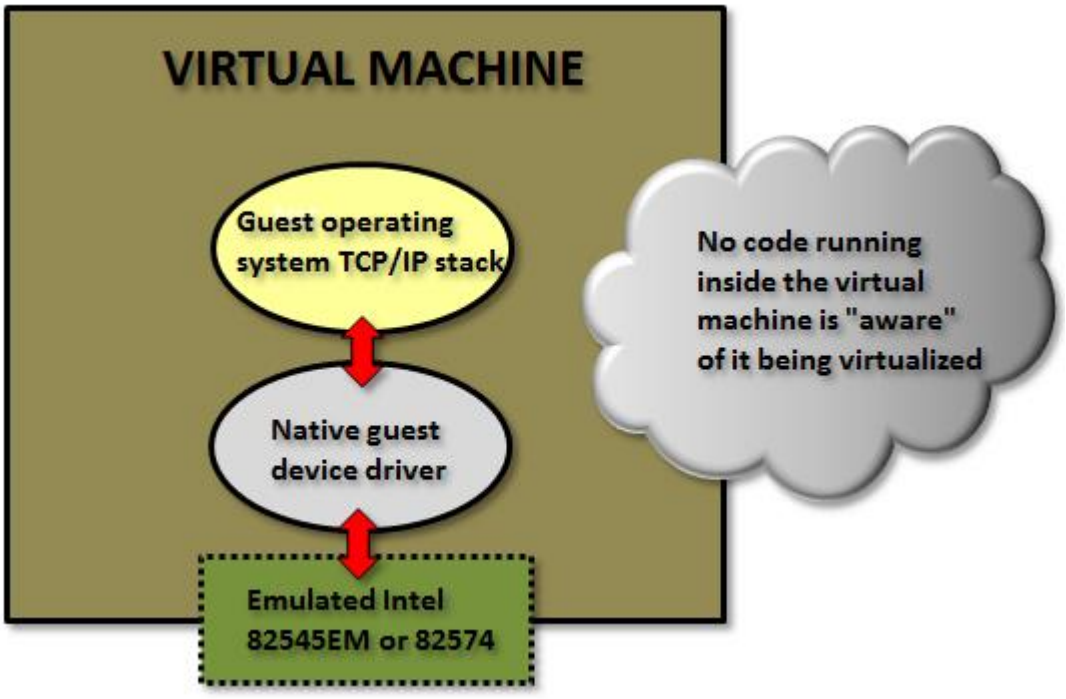

Figure 1.7: 82545EM

- **Intel PRO/1000 MT Server (82545EM)** – This device works with windows vista and later versions.

- **Paravirtualized network adapter (virtio-net)** – If we select this thing Virtual box does not virtualize hardware but then it expects a special software interface for VE to be provide by us. This method can avoid the complexity of emulating networking hardware.

Mode	Connection between VM and host	Connection between VMachines	Connection VM to Internet	Connection Internet to VM	Connection between hosts
Not attached mode	Not available	Not available	Not available	Not available	Not available
NAT	Not available	Not available	Available	Port Forwarding	Not available
Nat Network	Not available	Available	Available	Port Forwarding	Not available
Bridged Networking	Available	Available	Available	Available	Not Available
Internal Networking	Not available	Available	Not available	Not available	Not available
Host-only networking	Available	Available	Not available	Not available	Not available
UDP Tunnel networking	Not available	Available	Not available	Not available	Not available
Virtual Distributed Ethernet networking	Not available	Not available	Not available	Not available	Available

Scenario

I have 2 VMs that one is a client computer and one is a server computer. Server and computers should able to communicate with each other but if they want to connect internet, they have connected through the server to develop this server has one network adapter as NAT configured and one as internal network configured and the Client's NIC also configure

1.3. Parallels Workstation

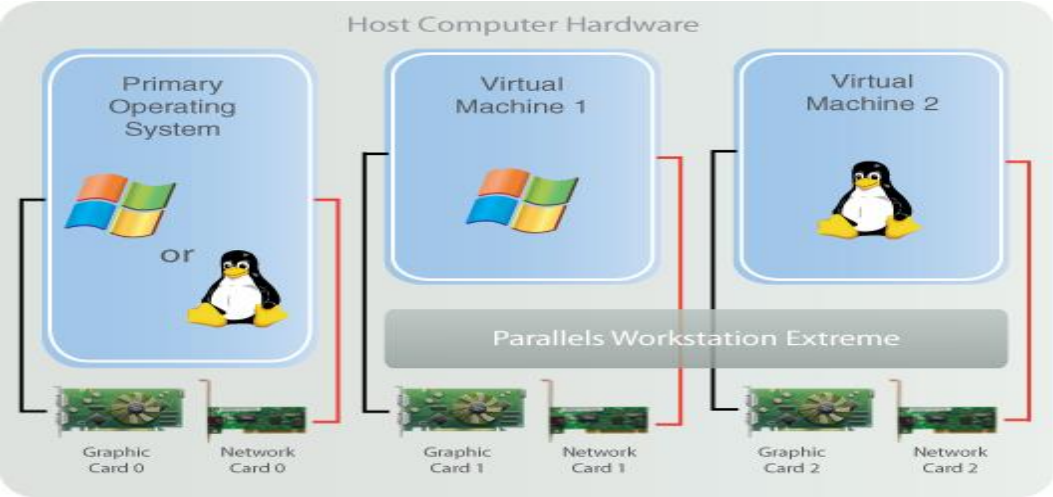

Figure 1.8: Parallels Workstation

Parallels workstation is a virtual machine suite for intel ×86-compatible computers that operate on Microsoft Windows, Linux, and Mac Operating systems × platforms. Like other virtualization software programs, it uses type 2 hypervisor technology allowing for the simultaneous creation and execution multiple ×86 virtual computers

There are different types of virtual interface cards in parallels workstation are,

Virtio Network Adapter

Intel® PRO/1000 MT

Intel® Gigabit CT (82574L)

Realtek RTL8029AS

- **Virtio Network Adapter** is the Fastest Network Card Comparing to Others. It is the default adapter for Linux based operating systems. It works only in Linux and BSD guest operating systems.

- **Intel® PRO/1000 MT** is default network adapter for Windows and Mac OS X virtual machines. It works in all operating systems. In this adapter, it counts a checksum and splits packages. Therefore, it will increase the network performance.

- **Intel® Gigabit CT (82574L)** supports for this network interface card wa**s** added in Parallel Desktop 11 for Mac. This is Intel's e1000e Ethernet driver.

- **Realtek RTL8029AS** is the simplest adapter among these. It does not count a checksum or split packages like others. This adapter can be used only if you have installed a parallels tool in virtual machine Without Parallel tools, it will work very slow or even will not work at all. It works especially good with Windows XP virtual machines.

Scenario

When a situation like you need to transfer files between your host computer and Virtual machine. (The host machine run Windows Operating System and Mac OS is run inside the VM).
Then, we can four network adapters,

Virtio Network Adapter
Intel® PRO/1000 MT
Intel® Gigabit CT (82574L)
Realtek RTL8029AS

In this case Virtio Network Adapter is not suitable because it compatible in Linux based Platforms even it is the fastest adapter. Then, Realtek RTL8029AS is also can be suitable for this case. Without parallel tools, Realtek RTL8029AS cannot be used. Intel® Gigabit CT (82574L) is suit, if the host machine run Mac OS. Intel® PRO/1000 MT is capable to work with both windows and mac OS platforms as well as all OSes. It is not like Realtek RTL8029AS, it counts a checksum and splits packages.

References

[1] http://www.virtualbox.org/manual/ch06.html

[2] https://kb.vmware.com/s/article/1001805

[3] https://unix.stackexchange.com/questions/114294/the-different-types-of-network-adapter-in-virtual-machines

[4] https://kb.parallels.com/en/4948

[5] http://download.parallels.com/workstation/v4/extreme/en_us/parallels/docs/Parallels_Workstation_Users_Guide/22969.htm

[6] https://books.google.lk/books?id=QXF1kKX2za8C&pg=PA45&lpg=PA45&dq=parallels+workstation+adapters&source=bl&ots=GHWs8_ohB1&sig=ACfU3U10Rmta6KNP63yZH1NXRd52dN8IDA&hl=en&sa=X&ved=2ahUKEwisgc7ElOXgAhUO148KHbEbA0UQ6AEwDHoECAwQAQ#v=onepage&q=parallels%20workstation%20adapters&f=false