

Implementation of Inter-Networking with Host Internet in Oracle VM VirtualBox Guest Virtual Machines

Polished technical report
with lab walkthrough

Implementation of Inter-Networking with Host Internet in Oracle VM VirtualBox Guest Virtual Machines

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Abstract

This report examines the use of Oracle VM VirtualBox to implement inter-networking with host internet access in a controlled virtual laboratory environment. The study uses three guest virtual machines, assigns static IP addresses within a private host-only network, and evaluates communication among the host and guests through ping testing. It also compares common VirtualBox networking modes, including NAT, Host-only, and Bridged networking, to support practical network planning and virtualization deployment.

Introduction

Oracle VM VirtualBox is a powerful x86 and AMD64/Intel64 virtualization product for enterprise and home use.

It is a feature-rich, high-performance solution that is also available freely as Open Source Software.

Virtualization enables multiple operating systems to run on a single physical machine while sharing underlying hardware resources efficiently.

This approach improves resource utilization and makes it possible to test isolated system and network configurations without affecting production environments.

As a result, virtualized platforms are widely used for controlled experimentation, software validation, and network lab development.

Main Features of VirtualBox

VirtualBox offers an extensive range of features designed to support a variety of use cases.

Its main features include practical tools for managing guest systems, sharing files, preserving system states, and duplicating virtual machines for testing and deployment.

- Modularity
- Guest additions
- Shared folders
- Seamless windows
- Snapshots
- Cloning
- Multiple frontends

VirtualBox Components and Kernel Modules

VirtualBox uses a small set of core components to manage virtual machines and their interaction with the host system. VBoxSVC, the GUI process, and the hypervisor process work together to provide the user interface, service management, and virtual machine execution.

The main kernel modules are vboxdrv, vboxnetadp, vboxnetflt, and vboxpci.

These modules support device access, networking, filtering, and PCI-related functionality for guest virtual machines.

Networking Modes and Literature Survey

The literature survey compares existing virtualization approaches and networking methods used to connect guest systems with external networks.

VirtualBox provides several networking modes for guest communication and host connectivity.

NAT allows a guest to access external networks through the host without being directly reachable from outside, which is suitable for basic Internet access.

Host-only networking creates a private communication channel between the host and guest systems, while Bridged networking places the guest on the same physical network as the host.

Host-only networking is particularly useful in a private lab environment where the host and guests must communicate with one another without exposing the virtual machines to the external network.

Mode	Purpose
NAT	Allows the guest to reach external networks through the host while keeping the guest isolated from inbound access.
Host-only networking	Creates a private network between the host and the guest virtual machines.
Bridged networking	Connects the guest directly to the physical network through the host network interface.

How to Install Oracle VM VirtualBox

1. Oracle VM VirtualBox is a free application used to create and run virtual machines on your computer.
2. Confirm the prerequisites: a supported operating system, an active internet connection, permission to install software, and enough free disk space.
3. Open a web browser and go to the official Oracle VirtualBox website.
4. Choose the correct version for your operating system and save the installer in an easy-to-find folder such as Downloads.
5. Open the downloaded installer file to begin the setup process.
6. Follow the on-screen prompts, accept the default options unless different settings are needed, review the settings, and continue until installation begins.
7. Allow any requested permissions so the installation can continue without interruption.
8. Wait for the installation to finish and complete the setup when prompted.
9. Open Oracle VM VirtualBox from the applications menu, desktop, or Start menu, then wait for the main window to load.
10. Verify that VirtualBox opens without errors and that the main window appears responsive.
11. In the lab, perform a ping test from Command Prompt or Terminal to confirm that the host or virtual network is responding correctly.
12. Successful replies, including four replies and 0% packet loss, confirm that the installation and basic network verification were completed successfully.

Lab Demonstration

The lab demonstration was performed in Oracle VM VirtualBox using Host-Only networking to verify communication

between the host and the guest machines.

A dedicated test machine was used for all three guest systems, and the exercise was practiced only in the lab environment so the networking demonstration remained isolated and controlled.

The host-only configuration included one Kali Linux guest, one Windows 10 guest, and one Windows Server 2019 guest.

Static IP addresses were assigned in the 172.16.1.x range, with 172.16.1.1 used as the host address.

1. Prepare the host machine and three virtual machines, consisting of one Linux client and two Windows clients.
2. Set the network adapter of each virtual machine to Host-Only so the lab remains isolated.
3. Assign static IP addresses in the 172.16.1.x range and use 172.16.1.1 as the host address.
4. Start each machine and confirm that the adapter is connected.
5. Open Command Prompt or Terminal and use ping commands to test communication between the host and each virtual machine, and between the virtual machines themselves.
6. Successful replies confirm that the inter-networking configuration is working correctly.

These commands confirmed successful connectivity between the host and all virtual machines during the demonstration.

Figure 33: Successful ping test to 172.16.1.1 from the command prompt, showing four replies, 0% packet loss, and a 0 ms average round-trip time, confirming that the network connection is working correctly in the lab environment.

CIDR Subnet Masks and Network Planning

Research Question: What would be our recommendations for configuring the virtual networks in the data center for clients numbering no more than 10,000?

Table 5: CIDR subnet masks.

CIDR	Convert to 1s and right pad	Subnet mask
/8	11111111.00000000.00000000.00000000	255.0.0.0
/9	11111111.10000000.00000000.00000000	255.128.0.0
/10	11111111.11000000.00000000.00000000	255.192.0.0
/11	11111111.11100000.00000000.00000000	255.224.0.0
/12	11111111.11110000.00000000.00000000	255.240.0.0
/13	11111111.11111000.00000000.00000000	255.248.0.0
/14	11111111.11111100.00000000.00000000	255.252.0.0
/15	11111111.11111110.00000000.00000000	255.254.0.0
/16	11111111.11111111.00000000.00000000	255.255.0.0
/17	11111111.11111111.10000000.00000000	255.255.128.0
/18	11111111.11111111.11000000.00000000	255.255.192.0
/19	11111111.11111111.11100000.00000000	255.255.224.0
/20	11111111.11111111.11110000.00000000	255.255.240.0
/21	11111111.11111111.11111000.00000000	255.255.248.0
/22	11111111.11111111.11111100.00000000	255.255.252.0
/23	11111111.11111111.11111110.00000000	255.255.254.0
/24	11111111.11111111.11111111.00000000	255.255.255.0
/25	11111111.11111111.11111111.10000000	255.255.255.128

/26	11111111.11111111.11111111.11000000	255.255.255.192
/27	11111111.11111111.11111111.11100000	255.255.255.224
/28	11111111.11111111.11111111.11110000	255.255.255.240
/29	11111111.11111111.11111111.11111000	255.255.255.248
/30	11111111.11111111.11111111.11111100	255.255.255.252

The minimum host address is 172.31.0.1, the maximum host address is 172.31.63.254, the broadcast address is 172.31.63.255, and this network has 16,382 available hosts, which is suitable for the virtual network design of a data center with not more than 10,000 hosts.

Figure 43: CIDR subnet masks screenshot.

This figure shows the binary and dotted-decimal subnet mask conversion used to select the /18 network for the virtual network design.

Conclusion

In our evaluation, we successfully tested Internet connectivity within all virtual machines through the host. We also verified communication among the virtual machines and between the virtual machines and the host.

References

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How to Install Oracle VM VirtualBox

Step-by-step installation manual

Tech Guide

Version: Latest

Level: Beginner

How to Install Oracle VM VirtualBox

Version: Latest | Level: Beginner

1. Introduction

Oracle VM VirtualBox is a free application used to create and run virtual machines on your computer. This guide shows the installation process for beginners in a simple, step-by-step format.

2. Prerequisites

- ☐ Supported operating system such as Windows, macOS, or Linux
 - ☐ Active internet connection
 - ☐ Permission to install software
 - ☐ Enough free disk space
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3. Download the Installer

Open a web browser and go to the official Oracle VirtualBox website. Choose the correct version for your operating system, then save the installer in an easy-to-find folder such as Downloads.

4. Start the Installation

Open the downloaded installer file to begin the setup process.

5. Follow the Setup Prompts

Follow the on-screen prompts, accept the default options unless you need something different, review the settings, and continue until installation begins.

6. Allow Permissions if Requested

Note: If your computer asks for permission during setup, approve the request so installation can continue.

7. Wait for Installation to Finish

Allow the setup to finish and complete the installation when prompted.

8. First Launch

Open Oracle VM VirtualBox from the applications menu, desktop, or Start menu, then wait for the main window to load.

9. Basic Verification

Confirm that VirtualBox opens without errors and that the main window appears responsive.

10. Practical Lab Verification

In the lab, you can verify the installation by running a ping test from the command prompt to confirm that the host or virtual network is responding correctly. The screenshot shows a successful ping with four replies and 0% packet loss.

11. Conclusion

VirtualBox is now installed and ready to use.