Lab 1.1:   
VirtualBox – Tasks

The goal of this laboratory is to learn the fundamentals of hypervisor-virtualization and gain knowledge about the deployment of applications in a virtual environment. Therefore, this laboratory is tackling virtualization by usage of the hypervisor VirtualBox.

In this laboratory you are going to deploy the online store-ui from the case study onto your VirtualBox-VM and connect it to an already running online shop in the cloud (provided on internal servers). You can connect the store-ui on your VM with our internal servers via the FB4STUD WiFi at 172.22.145.110, in case you are outside the university you have to use FB4-VPN. *In case you face issue related to Internet on VM when using the Bridged Network Mode with Eduroam or FB4STUD, you need to use personal hotspot through which you can access the Internet on VM.*

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# Student Group Information

Enter your student group information in the following table and provide your group number.   
(This number will be important for later labs as well, please remember it!)

**GroupNumber** Group\_\_10

|  |  |
| --- | --- |
| **Member Name** | **Matriculation Number** |
| **Chowdhury Abida Anjum Era** | 7219089 |
| **Eraj Rizvi** | 7219193 |
| Nimisha Vilayatarani | 7219293 |

# Tasks

This section contains the questions you have to answer. Those answers are required to pass the lab acceptance session. Please make sure that you first install VirtualBox and set-up your VM (document “Lab 1.1 VirtualBox - Installation Instructions") before you tackle these tasks.

## VM Configuration

The tasks in this chapter do address the VM configuration and networking configuration.

### Connectivity

1. How can you get your VM’s IP-Address?  
     
   ifconfig

result: inet 10.0.2.15

1. How can you reach your Host from your VM?   
     
     
   by ping command

first we have to check the ip of host machine

1. Can you reach the internet from your VM?   
     
   yes .command ping google.com
2. Is your VM reachable from Clients in your host’s network?  
   NO
3. Is your VM reachable from your Host?  
     
   No

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1. How can you access your VM by using SSH and without starting a GUI? (**Hint**: Headless-Mode)  
     
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2. A screenshot of a computer

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3. Think of a way to make your VM accessible to clients from your Host’s network!  
     
   by changing the network mode of VM ,may be from NAT to Bridge
4. Is your VM suitable to be used as an internet server?

**Resources:**

Ensure that the VM has sufficient resources (CPU, RAM, storage) to handle the expected workload. Internet servers, depending on the services they provide, can have varying resource requirements.

**Network Configuration:**

Properly configure networking settings for the VM, including IP addressing, DNS, and firewall rules. The VM should have a reachable IP address, and network traffic should be appropriately directed to the VM.

**Security:**

Implement security best practices. This includes regularly applying security updates, configuring firewalls, securing remote access (e.g., SSH), and employing other security measures to protect the server from unauthorized access and attacks.

### Networking Modes

1. What network modes are available in VirtualBox and what are their characteristics? (Explain them)  
     
     
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Not attached: This mode simply disconnects the VM from the rest of your network, meaning it'll have no network and, by extension, internet connectivity with the host or any other virtual machines.

Generic Driver: This network mode lets you share the generic network interface of your host machine with the selected VM, meaning the particular VM gets its own network controller and is separated from the rest of the physical network. You can then install drivers for the generic network interface using an extension pack, but they're often included with VirtualBox anyway.

NAT: Network address translation (NAT) sets up a dedicated network between the host machine and the specific VM for which you select this mode. It's an isolated network, meaning no other machine other than the host and the specified VM can talk to each other. The VM can also use the host's internet connection in this network mode.

Bridged Adaptor: Under this setting, each VM is treated as a separate machine on your actual network, meaning the host machines, any VMs you might have and any other devices on your network can talk to each other without any hassles. Of course, this also means that your VMs get access to the internet.

Host-only Adapter: Under this setting, your VMs and the host machine are all connected but are physically cut off from the rest of your network. This provides the highest level of network security for your VMs, with the trade-off being rather limited networking capabilities. This setting might also be called Host-only Network on some older versions of VirtualBox.

Internal Network: This sets up an internal network between multiple VMs. In this mode, the VMs are separated even from the host machine and are on a network of their own. Keep in mind that this is the only network mode in VirtualBox where your VMs don't have internet access.

Cloud Network: This is an experimental VirtualBox network mode that launched with VirtualBox 7.0.6 in January 2023 that allows a local VM to connect to a subnet on a remote cloud service to make it accessible over the internet, among other enterprise use cases.

1. Switch from *NAT* to *bridged networking* mode.  
   Try to reach your VM from another device in the network.  
   What are the challenges of the *bridged networking* mode? (hint: bridged networking mode doesn’t work from FB4STUD or eduroam networks due to some Firewall limitations, what you need to do is to create a hotspot on your phone and connect to that hotspot network)  
     
   first I have to change the network settings to bridge adaptor and then have to set host device network. And then ipconfig in vm :get the ip and then ping in the host machine then we have to know the port of vm   
   cat /etc/apache2/ports.conf and then on host terminal , we have to type curl vm\_ip\_address:port\_number

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1. What is the difference between the *NAT* and *bridged networking* modes?  
     
   NAT mode is ideal if you want to keep your VM private and secure, or if you have limited IP addresses on your network. Bridge mode should be considered if you want to make your VM public and accessible, or if you need to run network-intensive applications or services
2. Does the bridged networking mode suite the requirements for an internet server? (Assumed the network is reachable from the internet)  
     
   Yes, the bridged networking mode is generally well-suited for hosting an internet server within a virtual machine (VM). In bridged mode, the VM is placed on the same network segment as the host machine, essentially making it behave like a separate physical machine on the local network. This mode is conducive to running services that need to be directly accessible from the internet.
3. How many VMs could you potentially host on your PC (ignore the hardware limitations) if your network would only contain your PC?  
     
     
   Technically, it depends on the hypervisor.I could run the VM based on the threads limits on our own computer. For example, If there are 12 threads in my pc ,then I can run 6 VMs
4. Are there downsides on the *bridged networking* mode?  
     
   One of the main drawbacks is that it exposes the guest VMs to the same risks and vulnerabilities as the host network. If the host network is compromised, the guest VMs could also be attacked or infected by malware. It needs to ensure that the guest VMs have unique IP and MAC addresses, and that they do not conflict with the host network's DHCP or DNS settings. Bridged networking also consumes more bandwidth and resources than other networking modes, as it requires a separate network interface card (NIC) for each guest VM.

## Case Study

In this chapter you are going to deploy the store-ui from the case-study (Online Shop) on your virtual machine. Continue if you read the instructions on this.

1. Is the store-ui accessible from your Host? (Use *bridged networking*)  
   Yes  
   +-
2. Switch back to the NAT mode  
   Is the store-ui still accessible from your Host?  
   (Why is/isn’t it accessible?)  
     
   No
3. What do you need to do, to enable your Host to access the website on your VM?  
     
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   Description automatically generated  
    1) Create Directory

sudo mkdir /var/www/store

2) go to the directory

cd /var/www/store

3) clone the repository

git clone https://git.inf.fh-dortmund.de/01/cloud-labs/e-commerce-microservices/store-ui

4) now go to the app folder

cd /var/www/store/store-ui

5)now install the depedencies

sudo npm install

sudo npm run build

6) Install and Configure NGINX (ngnx is a server)

sudo apt install nginx

7) Delete default files from nginx server

cd into /etc/nginx/sites-enabled/.

(There will be a template default file in nginx server, because we dont need default settings, it needs to be customized)

cd /etc/nginx/sites-enabled/

rm default

cd into /etc/nginx/sites-available/. Here also we have to delete the existing default file.

cd /etc/nginx/sites-available/

rm default

8) Create a new file default inside /etc/nginx/sites-available/. and configure it to serve your React App.

server {

listen 3000;

server\_name 192.168.178.63; (ip of the vm)

root /var/www/store/store-ui/build;

index index.html index.htm;

try\_files $uri /index.html;

# Static files

location / {

try\_files $uri /index.html;

}

}

9) Create a soft link for /etc/nginx/sites-available/default file in the dir/etc/nginx/sites-available

cd /etc/nginx/sites-available/

sudo ln -s default /etc/nginx/sites-enabled/.

10) Start-Up the NGINX Server!

sudo ufw allow 'Nginx Full'

sudo systemctl daemon-reload

sudo systemctl start nginx

sudo systemctl restart nginx

1. Why are the deals of the day pane empty?  
   (You probably need to check the Developer-Tools -> Networking and then reload the page)  
     
     
   because we are calling localhost:8002 and there is no API running on it
2. What do you need to do, to enable the store-ui to access the products- and cart-service?  
   (Check the .env-File in the repository and the endpoints configured in the remote ui)  
   

Have to set the ip 172.22.145.110  
  
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## Reflective Tasks

Based on the knowledge you gathered, there are some reflective questions to be asked. (Always keep in mind the case study while answering these questions)

1. Do you think the way the VM has been created in this laboratory is efficient and worth it?  
   **For Development**:  
     
     
   The VM creation process for development purposes may be considered efficient if it provides developers with a consistent and isolated environment to work on the projects.  
   As we are using bridge networking , it may create problem sometimes
2. **To be run as a server**:  
     
   Considerations include security, resource management, and the ability to handle server-specific workloads. For less heavy works we can use this approach  
     
     
   **To rent them to customers:**  
     
     
   For this case it needs more resources in the host machine to rent the vm to the customers
3. Is the used approach scalable? (vertically and horizontally)  
     
   A large and complex repository might introduce challenges in terms of cloning speed, synchronization, and resource usage. If the repository contains dependencies that are tightly coupled to specific VM instances, it might pose challenges for scalability.
4. How can you migrate your VM to the machine of one of your group members?  
     
   Copy the entire virtual machine folder, containing the .vdi and .vbox files
5. Would the capability to share a VM change your mind regarding Q1 and Q2?  
     
     
   Sometimes it will be efficient if one machine stops working
6. Scenario: You are running several VMs as servers in your production environment. Those VMs are mission-critical for your business and are not allowed to become inoperative.
   1. How could you detect failures in those VMs quickly to prevent outages?Think of a way to replace an inoperative VM with a new one.

**Monitoring Systems:** Implement robust monitoring systems that continuously check the health and performance of VMs. This includes monitoring resource utilization, network connectivity, and application-level metrics.

**Automated Alerts:** Set up automated alerts to notify administrators immediately when predefined thresholds are breached or when anomalies are detected.

**High Availability (HA) Solutions:** Consider deploying high availability solutions that provide failover capabilities. Clustering technologies or load balancers can redirect traffic to healthy VMs if one becomes inoperative.

**Regular Backups:** Regularly backup VM configurations and data so that, in the event of a failure, a new VM can be quickly provisioned and restored.

* 1. Will the new VM be available with the same configuration and Network-Identity as the old one?

**Configuration:** The configuration of the new VM can be streamlined by using infrastructure-as-code (IaC) tools such as Ansible, Terraform, or scripts. Storing the VM configuration as code allows for consistent replication.

**Network Identity:** To ensure the new VM has the same network identity, use static IP addresses or implement DHCP reservations. This ensures that when a new VM is provisioned, it can assume the same network identity as the old one

* 2. Does VirtualBox offer any assistance for this scenario?

**Snapshot and Clone Features:** VirtualBox provides snapshot and clone features that can aid in scenarios where VM replacement is needed. Snapshots capture the state of a VM at a specific point in time, and clones allow for duplication. These features can be utilized for backup and quick restoration purposes.

**Export/Import Appliances:** VirtualBox allows you to export VMs as appliances. This can be helpful for creating a standardized VM configuration that can be easily imported and deployed in case of a failure.

# Conclusion

This lab should teach you the basics of hypervisor virtualization and (some) pitfalls. You should be able to set up virtual machines, connect them to the internet and make them accessible for other clients.

Regarding Question 5c), there are some technologies to investigate.   
Feel free to have a look at Vagrant[[1]](#footnote-1) by HashiCorp.

# Outlook

With the limitations of hypervisor virtualization regarding scalability and resilience, we need to test further virtualization methods to get the case study in a deployable state.

Therefore, the next laboratory will focus on containerized virtualization.

1. https://developer.hashicorp.com/vagrant [↑](#footnote-ref-1)