CLOUD COMPUTING

LABORARTORY MANUALS

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

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INDEX

PRACTICAL-1

Aim: Introduction to Cloud Vendors: Amazon, Microsoft, IBM

Cloud Service providers (CSP) offers various services such as **Software as a Service**, **Platform as a service**, **Infrastructure as a service**, **network services**, **business applications**, **mobile applications**, and **infrastructure** in the cloud. The cloud service providers host these services in a data center, and users can access these services through cloud provider companies using an Internet connection.

Amazon Web Services (AWS)

AWS (Amazon Web Services) is a **secure cloud service platform** provided by **Amazon**. It offers various services such as database storage, computing power, content delivery, Relational Database, Simple Email, Simple Queue, and other functionality to increase the organization's growth.

Features of AWS

AWS provides various powerful features for building scalable, cost-effective, enterprise applications. Some important features of AWS is given below-

- AWS is **scalable** because it has an ability to scale the computing resources up or down according to the organization's demand.
- AWS is **cost-effective** as it works on a **pay-as-you-go** pricing model.
- It provides various flexible storage options.
- It offers various **security services** such as infrastructure security, data encryption, monitoring & logging, identity & access control, penetration testing, and DDoS attacks.
- It can efficiently manage and secure Windows workloads.

2. Microsoft Azure

Microsoft Azure is also known as **Windows Azure**. It supports various operating systems, databases, programming languages, frameworks that allow IT professionals to easily build, deploy, and manage applications through a worldwide network. It also allows users to create different groups for related utilities.

Features of Microsoft Azure

- Microsoft Azure provides **scalable**, **flexible**, and **cost-effective**
- It allows developers to quickly manage applications and websites.
- It managed each resource individually.
- Its IaaS infrastructure allows us to launch a general-purpose virtual machine in different platforms such as Windows and Linux.
- It offers a **Content Delivery System (CDS)** for delivering the Images, videos, audios, and applications.

3. Google Cloud Platform

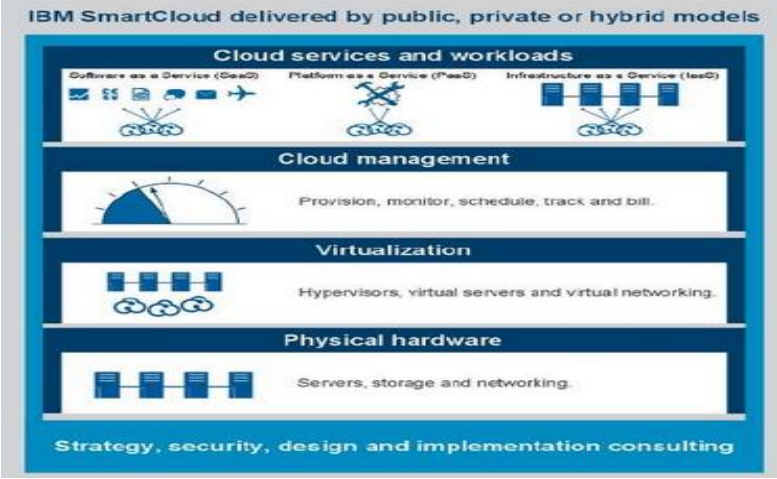
Google cloud platform is a product of **Google**. It consists of a set of physical devices, such as computers, hard disk drives, and virtual machines. It also helps organizations to simplify the migration process.

Features of Google Cloud

- Google cloud includes various **big data services** such as Google BigQuery, Google CloudDataproc, Google CloudDatalab, and Google Cloud Pub/Sub.
- It provides various services related to **networking**, including Google Virtual Private Cloud (VPC), Content Delivery Network, Google Cloud Load Balancing, Google Cloud Interconnect, and Google Cloud DNS.
- It offers various **scalable** and **high-performance**
- GCP provides various **serverless services** such as Messaging, Data Warehouse, Database, Compute, Storage, Data Processing, and Machine learning (ML)
- It provides a free cloud shell environment with Boost Mode.

4. IBM Cloud Services

IBM Cloud is an open-source, faster, and more reliable platform. It is built with a suite of advanced data and AI tools. It offers various services such as Infrastructure as a service, Software as a service, and platform as a service. You can access its services like compute power, cloud data & Analytics, cloud use cases, and storage networking using internet connection.



Feature of IBM Cloud

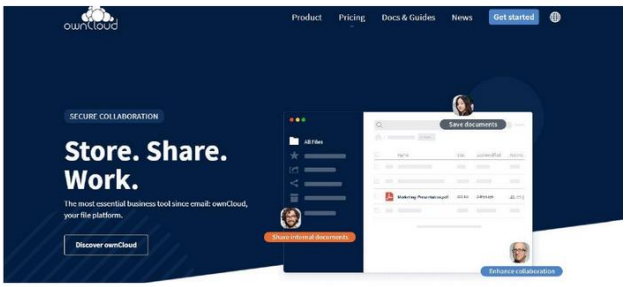
- IBM cloud improves operational efficiency.
- Its speed and agility improve the customer's satisfaction.
- It offers Infrastructure as a Service (IaaS), Platform as a Service (PaaS), as well as Software as a Service (SaaS)
- It offers various cloud communications services to our IT environment.

PRACTICAL-2

Aim: Setting up Virtualization using VirtualBox/VMWare Hypervisor

OwnCloud is an open source file sync and share software for everyone from individuals operating the free ownCloud Server edition, to large enterprises and service providers operating the ownCloud Enterprise Subscription. ownCloud provides a safe, secure, and compliant file synchronization and sharing solution on servers that you control.

You can share one or more files and folders on your computer, and synchronize them with your ownCloud server. Place files in your local shared directories, and those files are immediately synchronized to the server and to other devices using the ownCloud Desktop Sync Client, Android app, or iOS app. To learn more about the ownCloud desktop and mobile clients



Design

For desktop machines to synchronize files with their ownCloud server, desktop clients are available for PCs running Windows, macOS, FreeBSD or Linux. Mobile clients exist for iOS and Android devices. Files and other data (such as calendars, contacts or bookmarks) can also be accessed, managed, and uploaded using a web browser without any additional software. Any updates to the file system are pushed to all computers and mobile devices connected to a user's account. Encryption of files may be enforced by the server administrator.

The ownCloud server is written in the PHP and JavaScript scripting languages. For remote

access, it employs sabre/dav, an open-source WebDAV server. ownCloud is designed to work with several database management systems, including SQLite, MariaDB, MySQL, Oracle Database, and PostgreSQL.

Features

Owncloud is a software only product. owncloud does not offer off-premises storage capacity. This is in contrast to the likes of Dropbox that offers both software and off-premises storage capacity. owncloud storage capacity has to be provided on user owned devices.

OwnCloud files are stored in conventional directory structures, and can be accessed via WebDAV if necessary. User files are encrypted both at rest and during transit. ownCloud can synchronise with local clients running Windows (Windows XP, Vista, 7 and 8), macOS (10.6 or later), or various Linux distributions.

ownCloud users can manage calendars (CalDAV), contacts (CardDAV) scheduled tasks and streaming media (Ampache) from within the platform.

Enterprise Features

For Enterprise customers, ownCloud GmbH offers apps with additional functionality. They are mainly useful for large organizations with more than 500 users. An Enterprise subscription includes support services.

Commercial features include End-to-end encryption, Ransomware and Antivirus protection, Branding, Document Classification, Single-Sign-On via Shibboleth/SAML

PRACTICAL-3

AIM:- Setting up Virtualization using Virtual Box/VMware

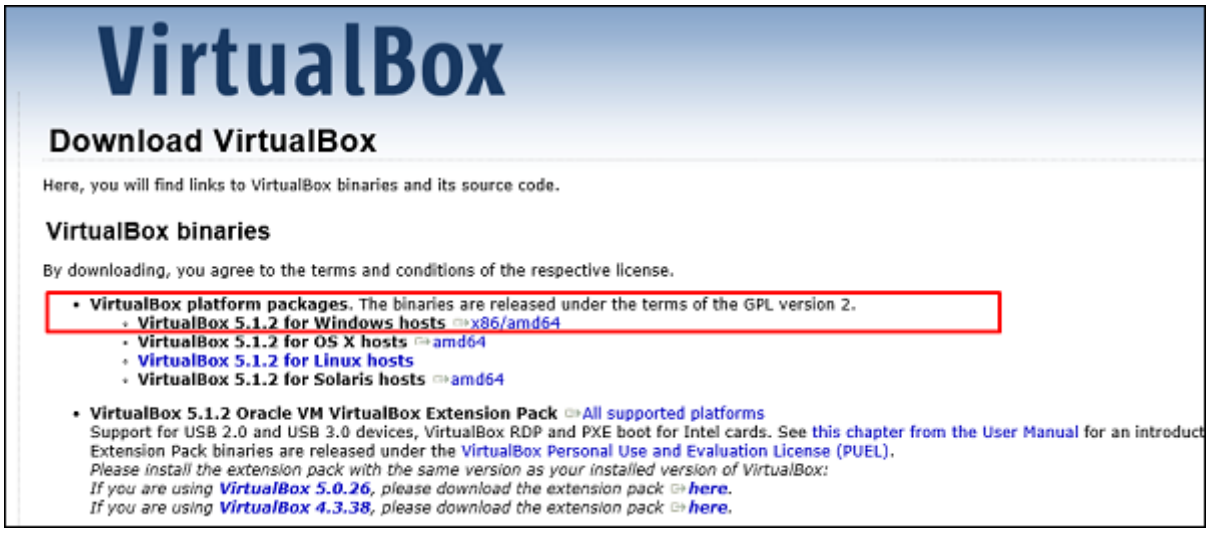
Hypervisor.

Run VirtualBox and create a new virtual machine. Name it ESXi , select Linux as its type, and Other Linux (64-bit) as the version

Installing VirtualBox

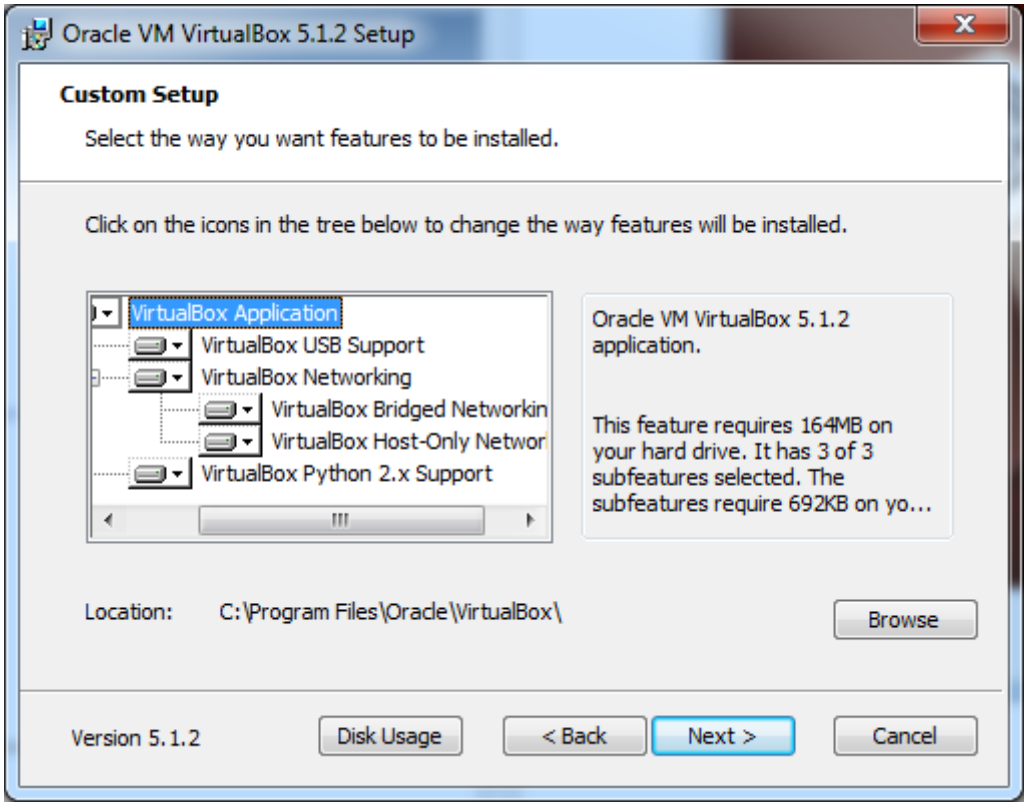
To start with, we will download VirtualBox and install it. We should follow the steps given below for the installation.

Step 1 − To download VirtualBox, click on the following link https://www.virtualbox.org/wiki/Downloads Now, depending on your OS, select which version to install. In our case, it will be the first one (Windows host).

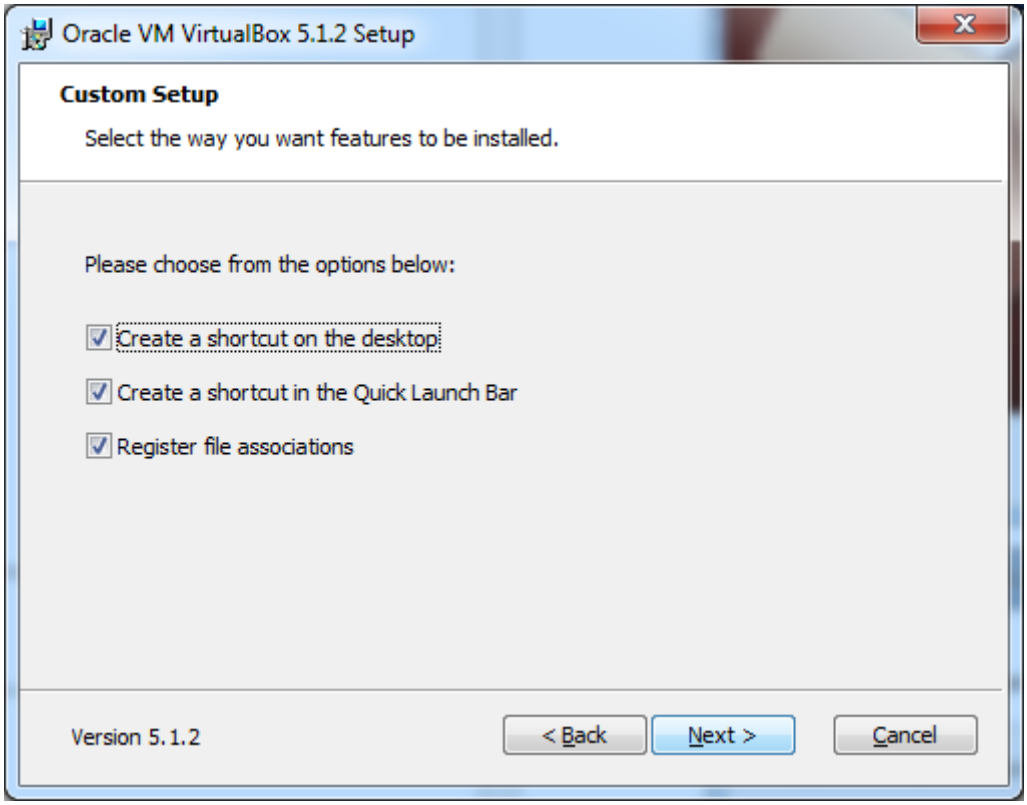


Step 2 − Once the option is selected, click on “Next”.

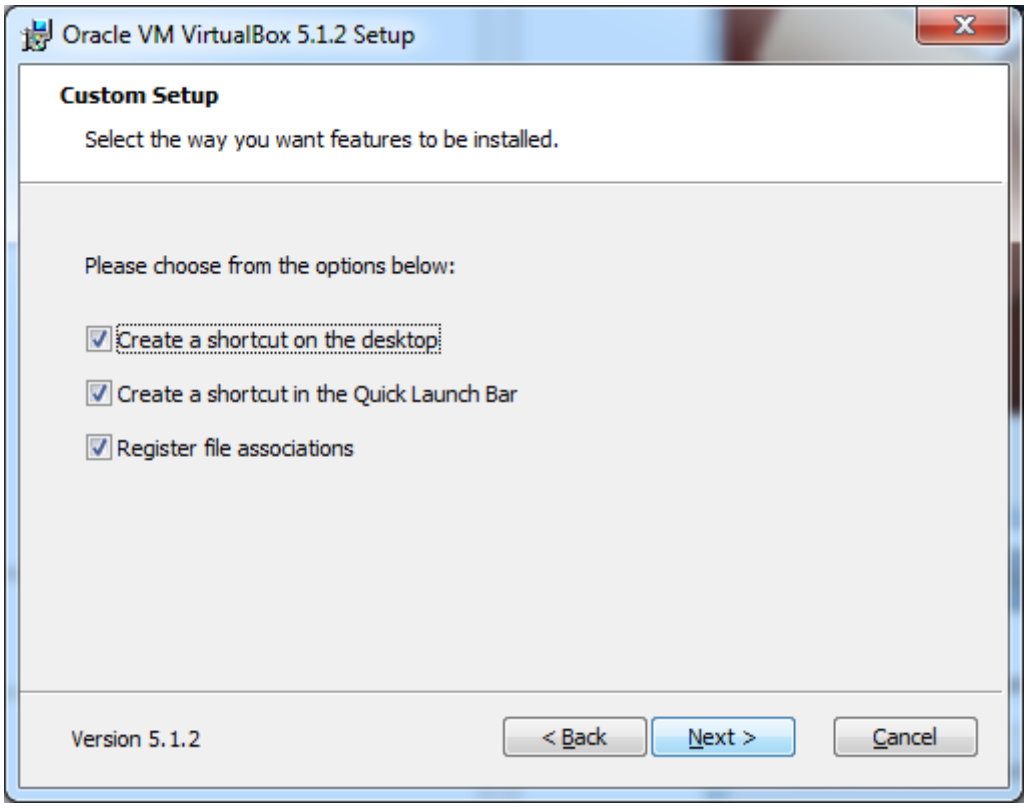
Step 3 − You have the option asking where to install the application. We can leave it as default and click on "Next".



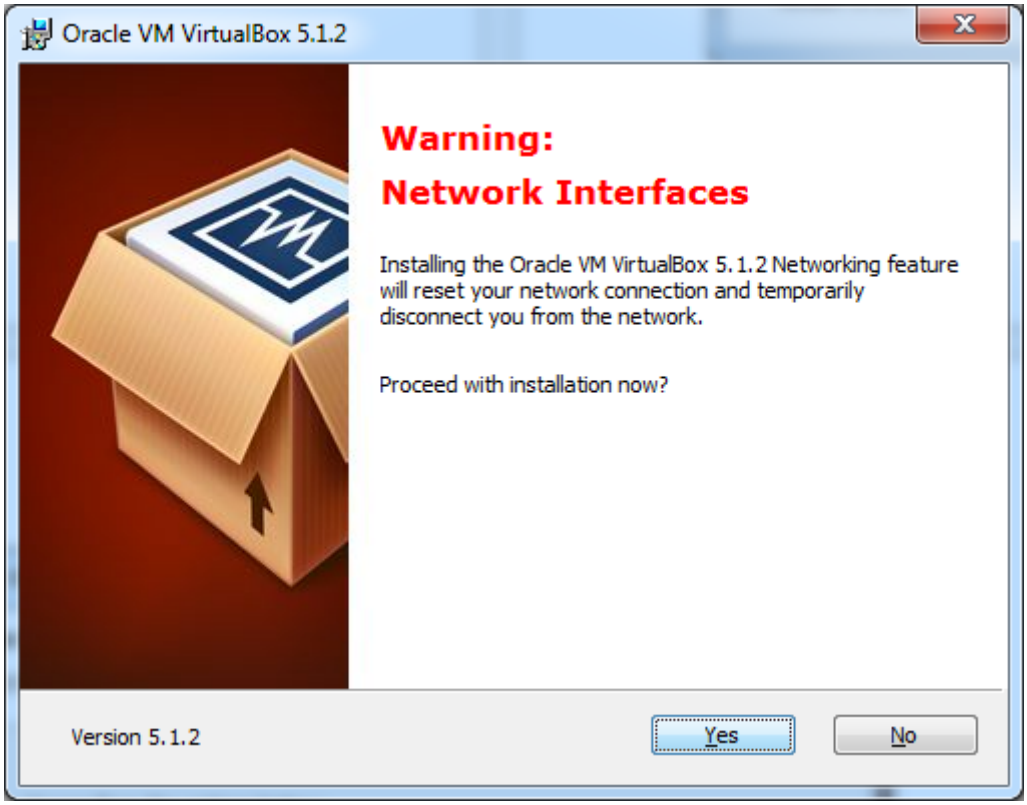
Step 4 − Once the options are selected as shown in the following screenshot, click on Next.



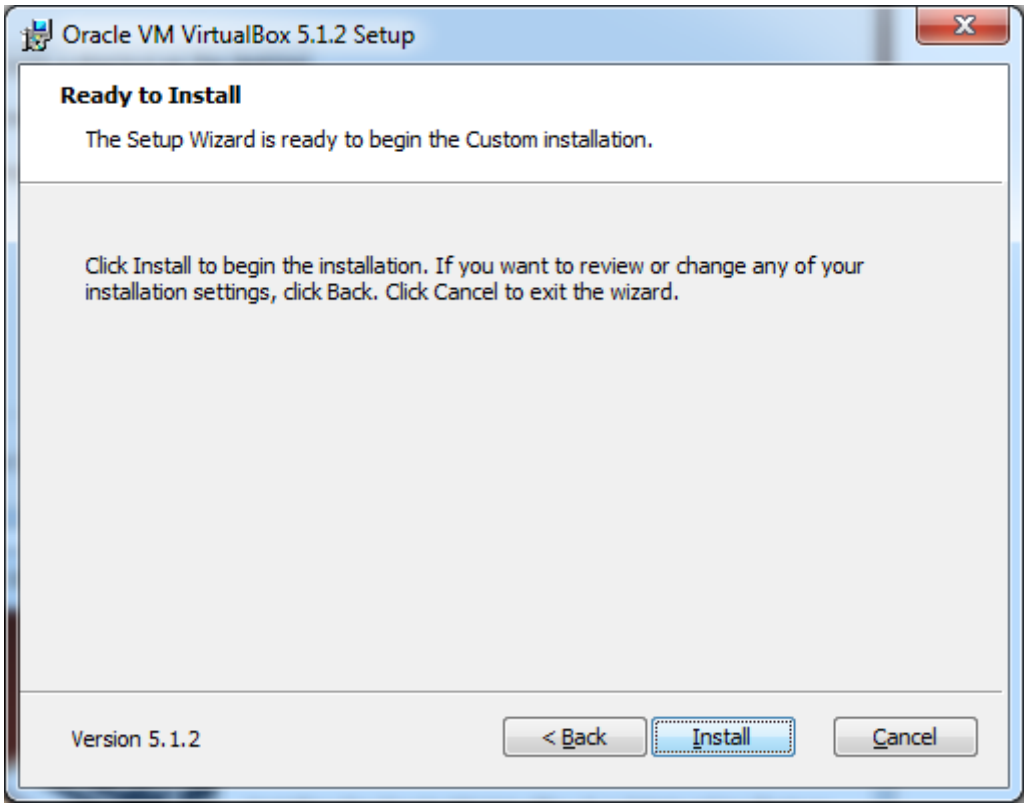
ext.



Step 5 − A dialog box will come up asking whether to proceed with the installation. Click "Yes".

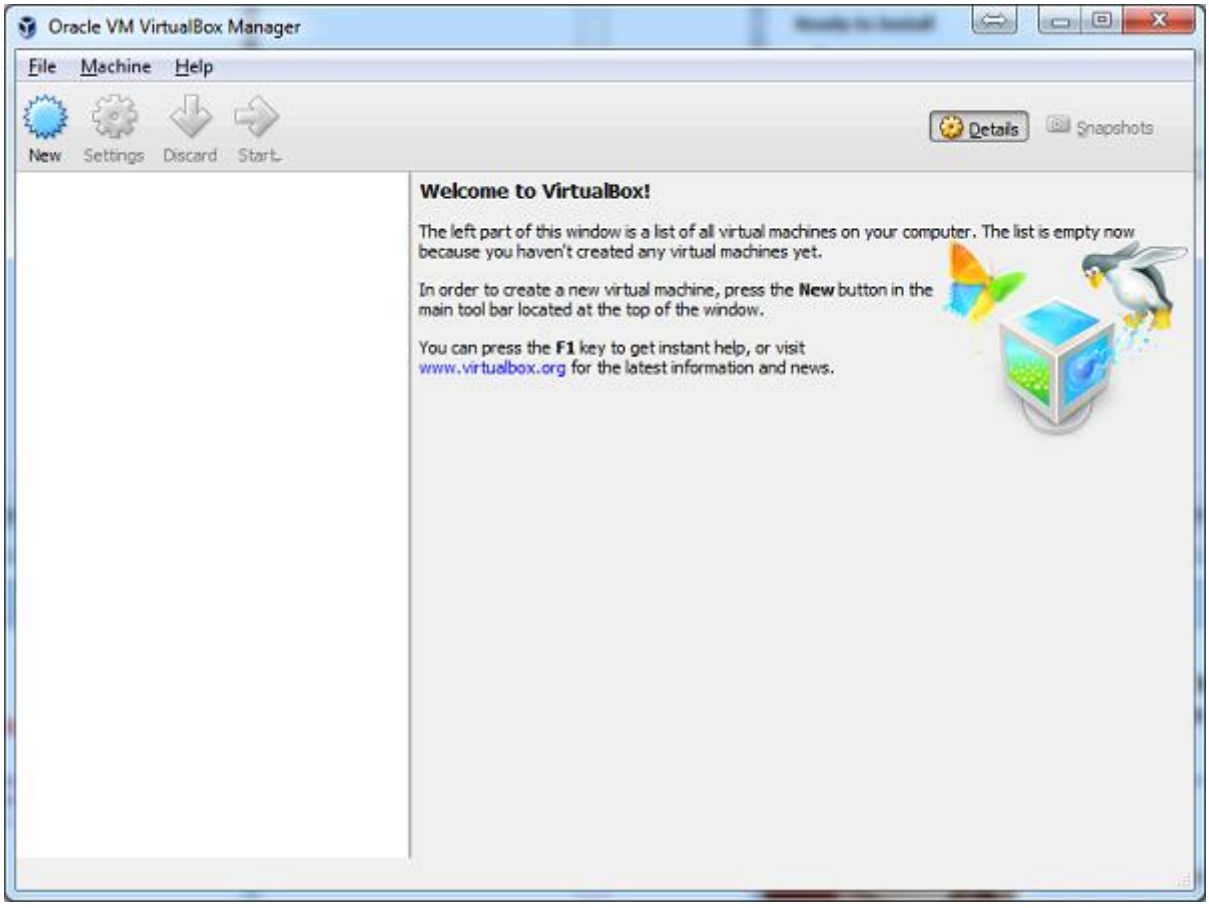


Step 6 − In the next step, click on “Install”.



Step 7 − Tick the start VirtualBox check box and click on “Finish”.

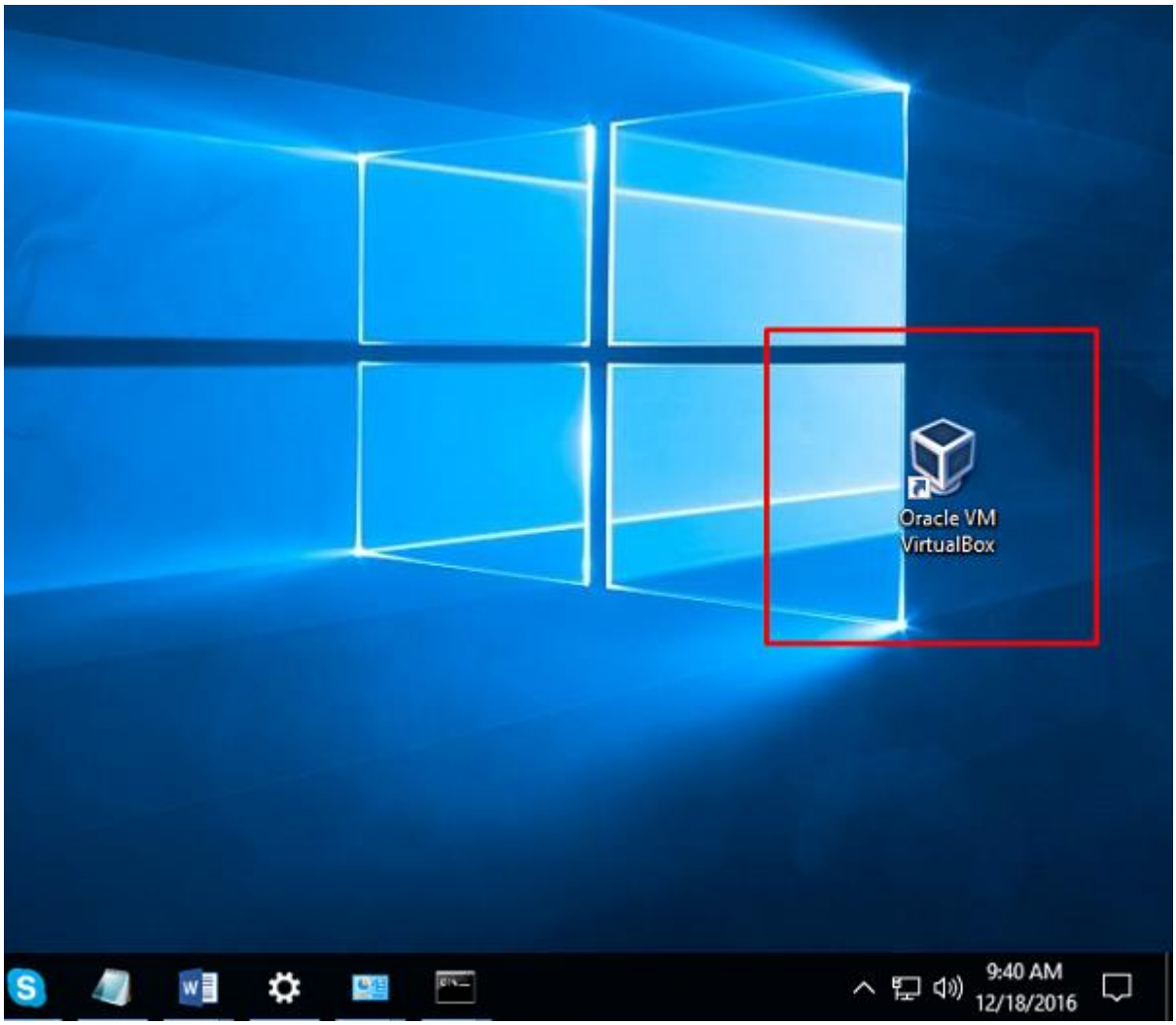
Step 8 − VirtualBox application will now open as shown in the following screenshot. Now, we are ready to install the virtual machines.



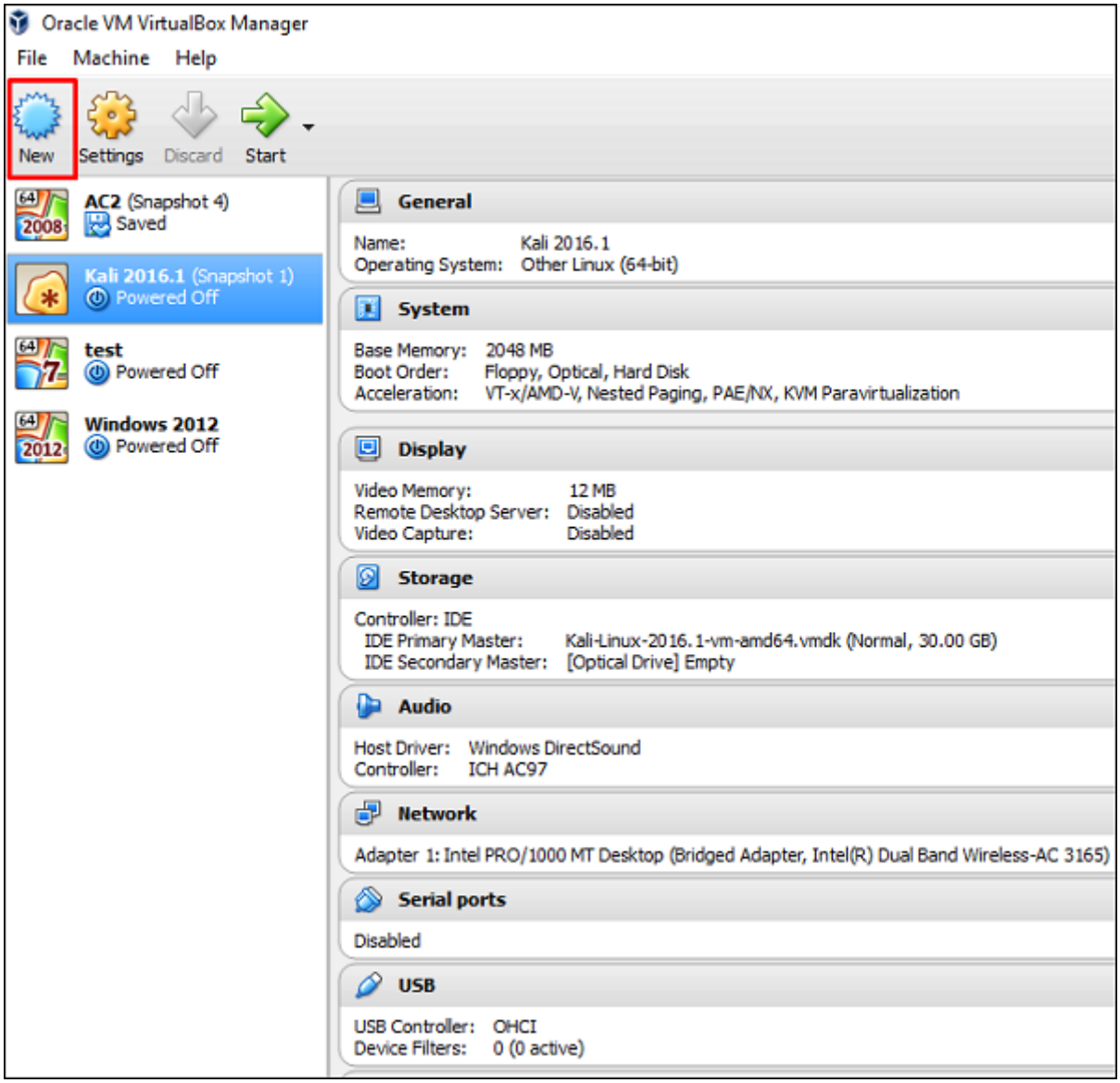
Creating a VM with VirtualBox

To create a virtual machine with Oracle VirtualBox, we should follow the steps given below.

Step 1 − To begin with, click on the "Oracle VM VirtualBox" icon on the desktop as shown in the screenshot below.



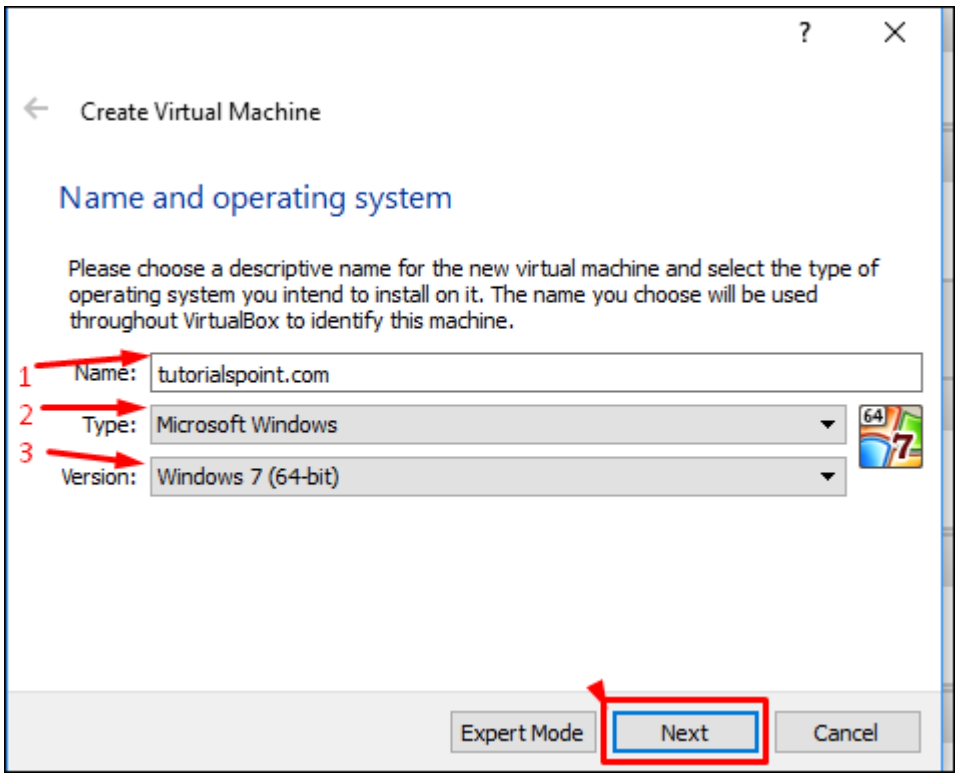
Step 2 − The next step is to click on "New" button, which is in the top left hand side of the screen.



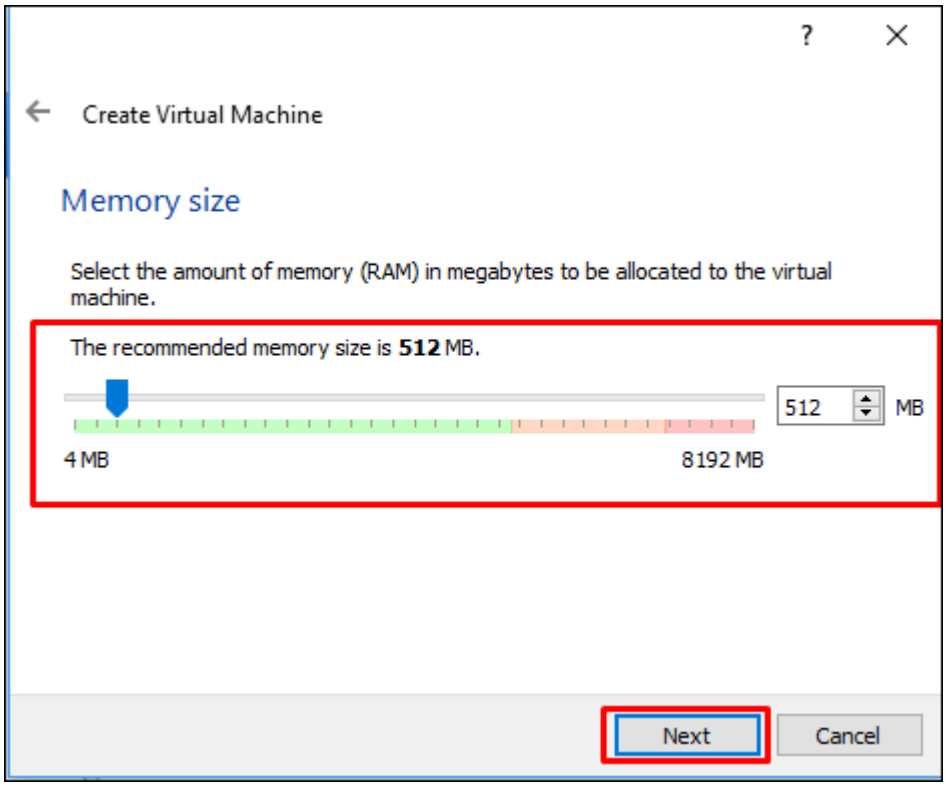
Step 3 − A table will pop-up requesting you the parameters for the virtual machine. These will be −

- **Name** − We have to put a friendly name for this Virtual Machine.
- **Type** − Enter the OS that is going to be installed on it.
- **Version** − Enter the specific version for that OS, which we have selected earlier.

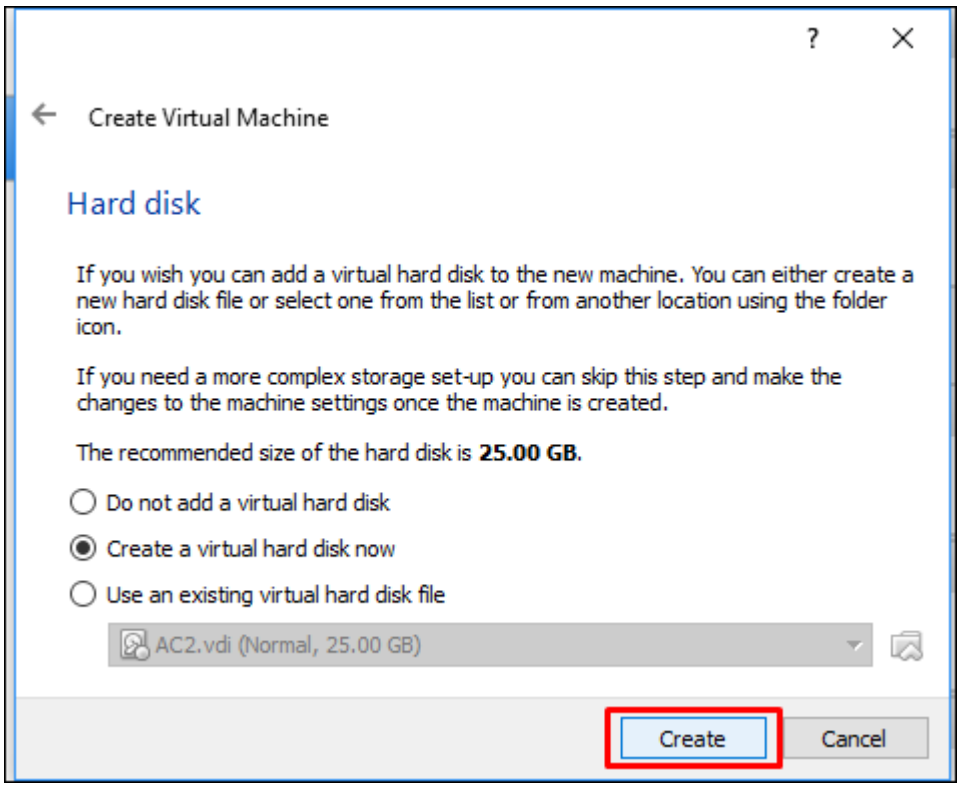
Once all the above parameters are filled, click on “Next”.



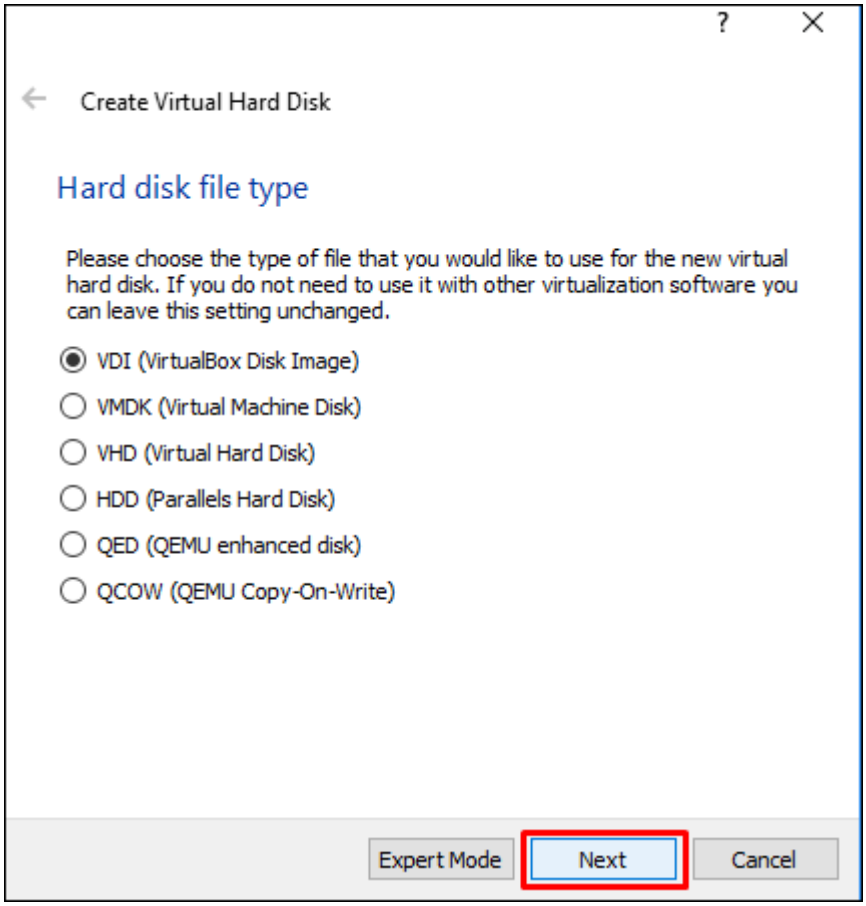
Step 4 − Select the amount of memory that you need to allocate in this VM → Click on "Next".



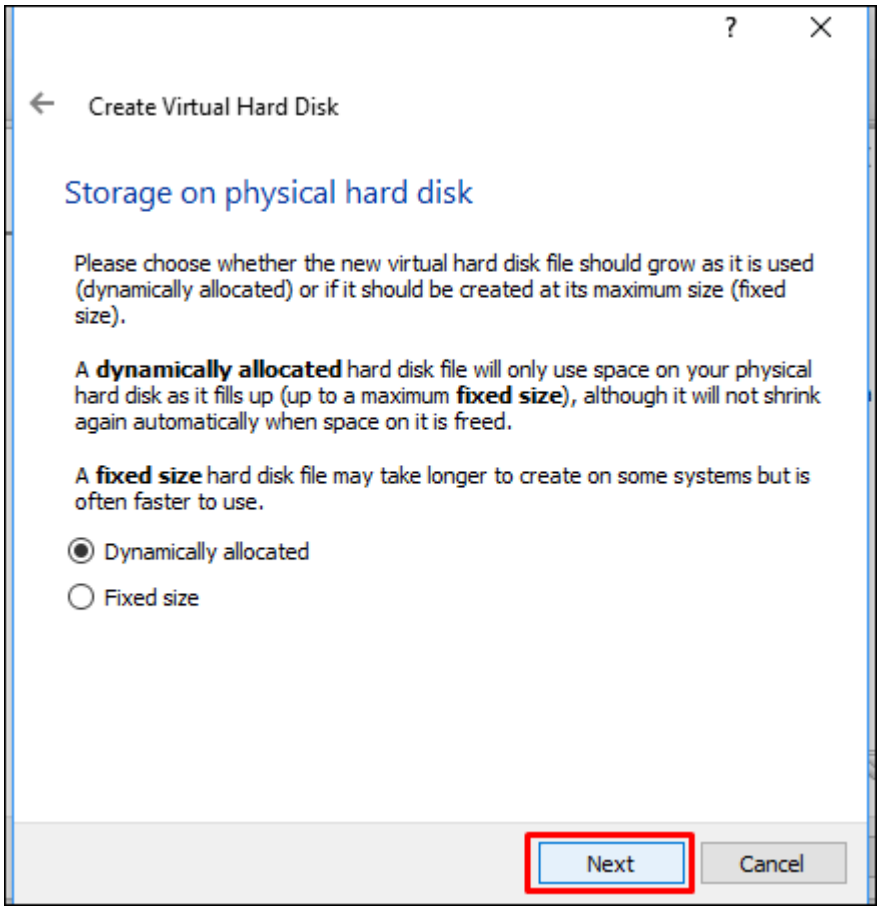
Step 5 − Check one of the three options for the HDD and click on "Create".



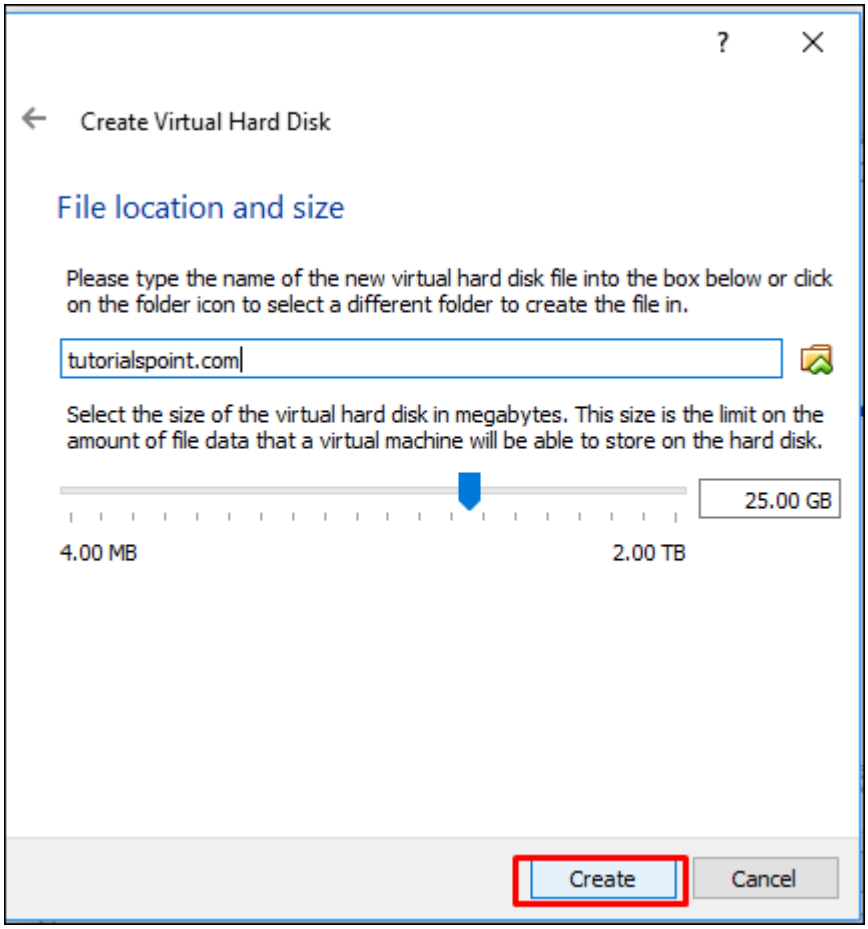
Step 6 − Select a file extension for your virtual HDD (It is recommended to use a common file extension that most of the hypervisors use like VHD) → click on "Next".



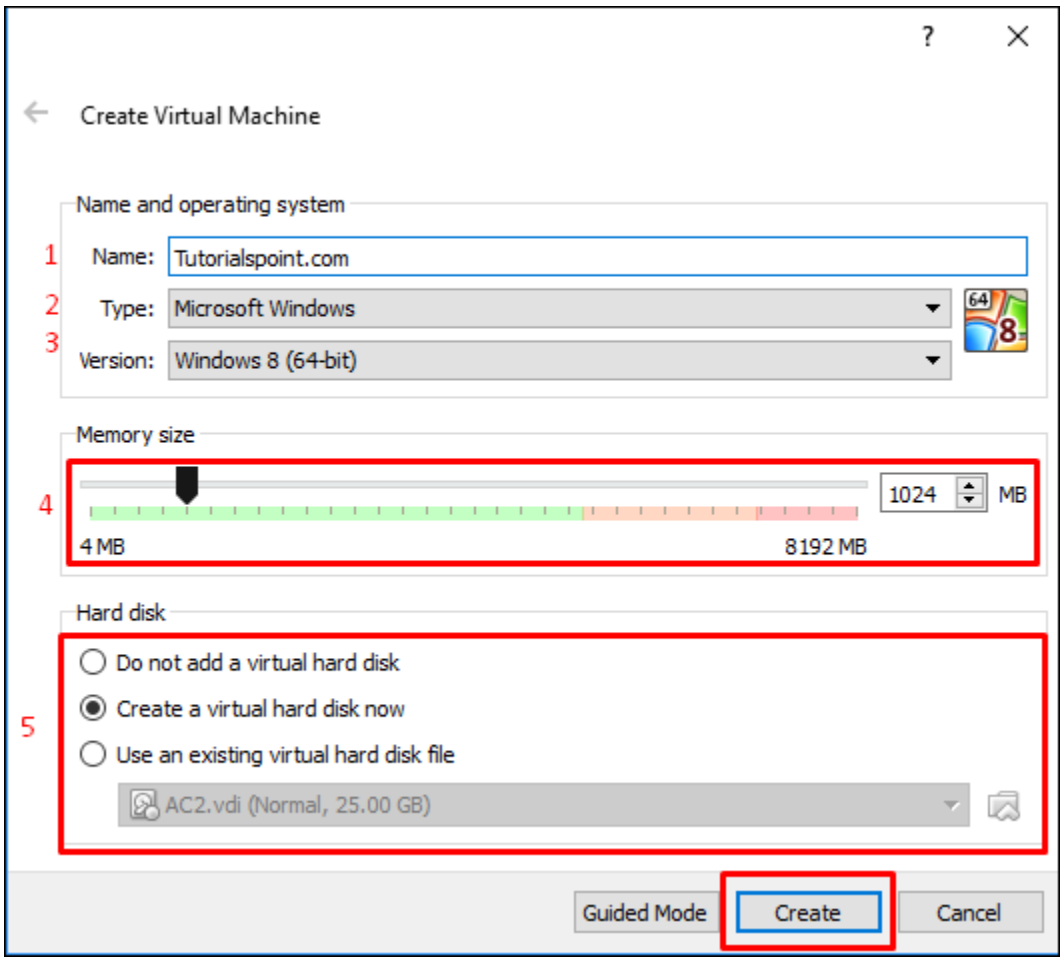
Step 7 − Choose whether you want the Virtual HDD as dynamic or fixed. This is based on your needs → Click on “Next”.



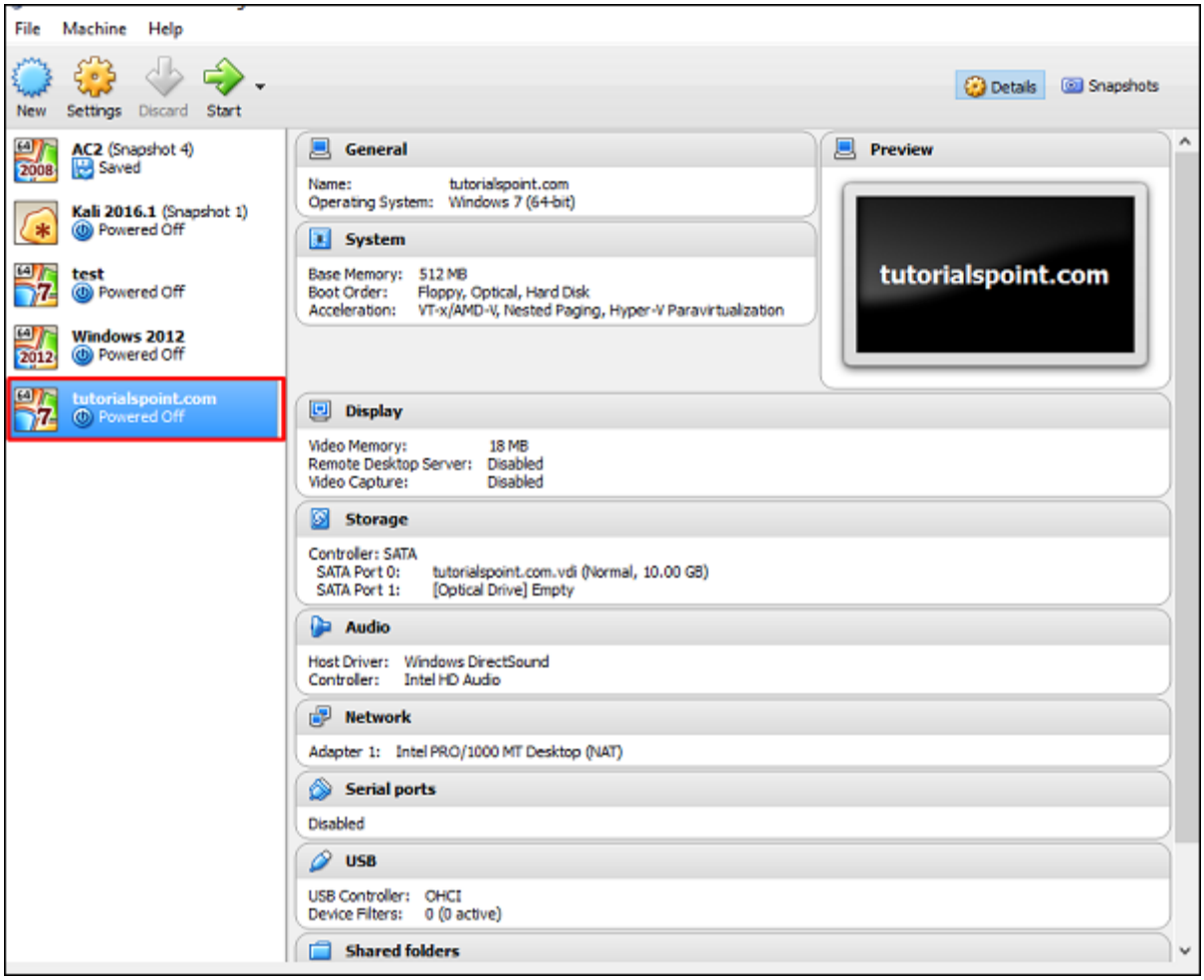
Step 8 − Put a name for your virtual HDD file and select the disk size for your VM → Click on “Create”.



All the above steps can be done in one shot by selecting the “Expert mode”.



The virtual machine created will be as shown in the screenshot below.



Setting up Networking with VirtualBox

There are two types of networking modes in VirtualBox, which are −

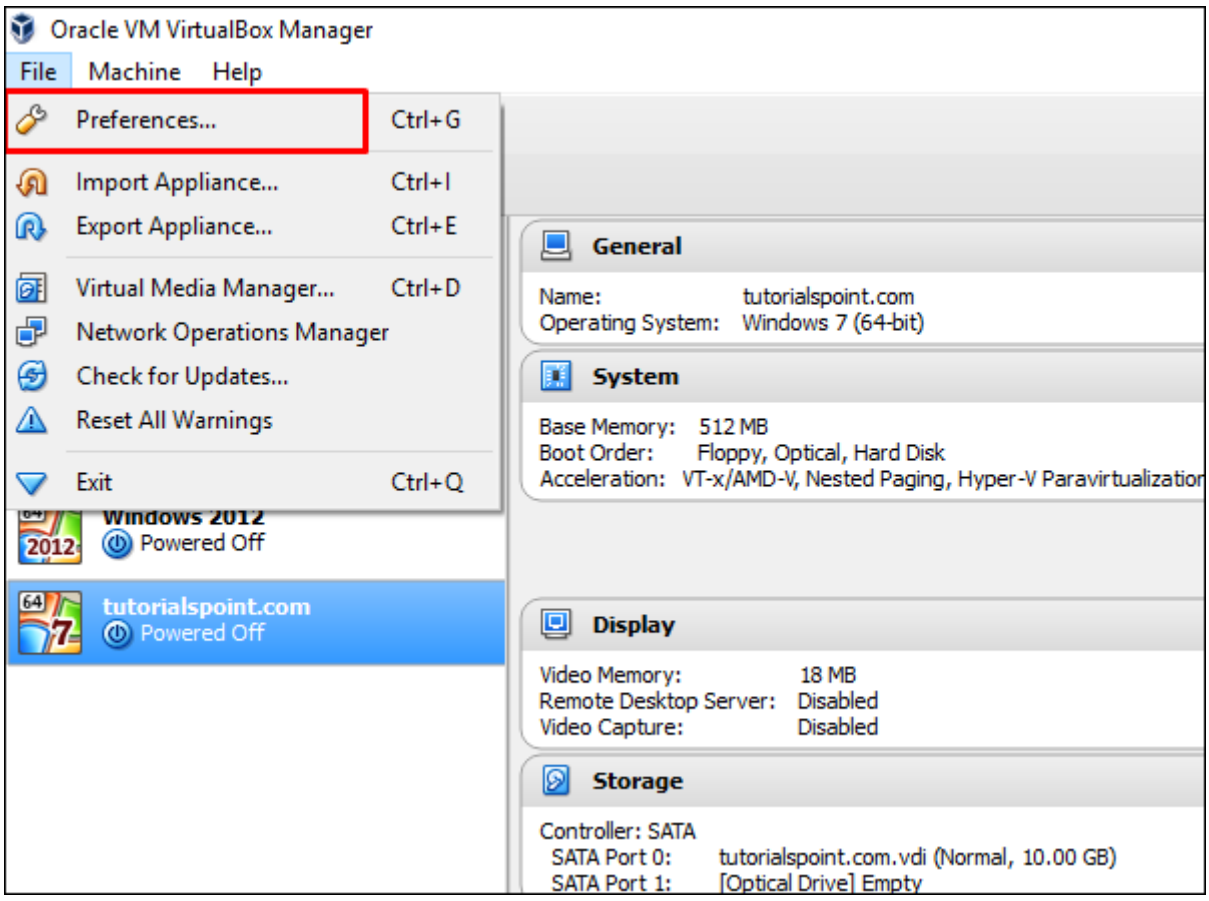
- Nat Networks and
- Host-only Networks.

Both of these are explained in detail below.

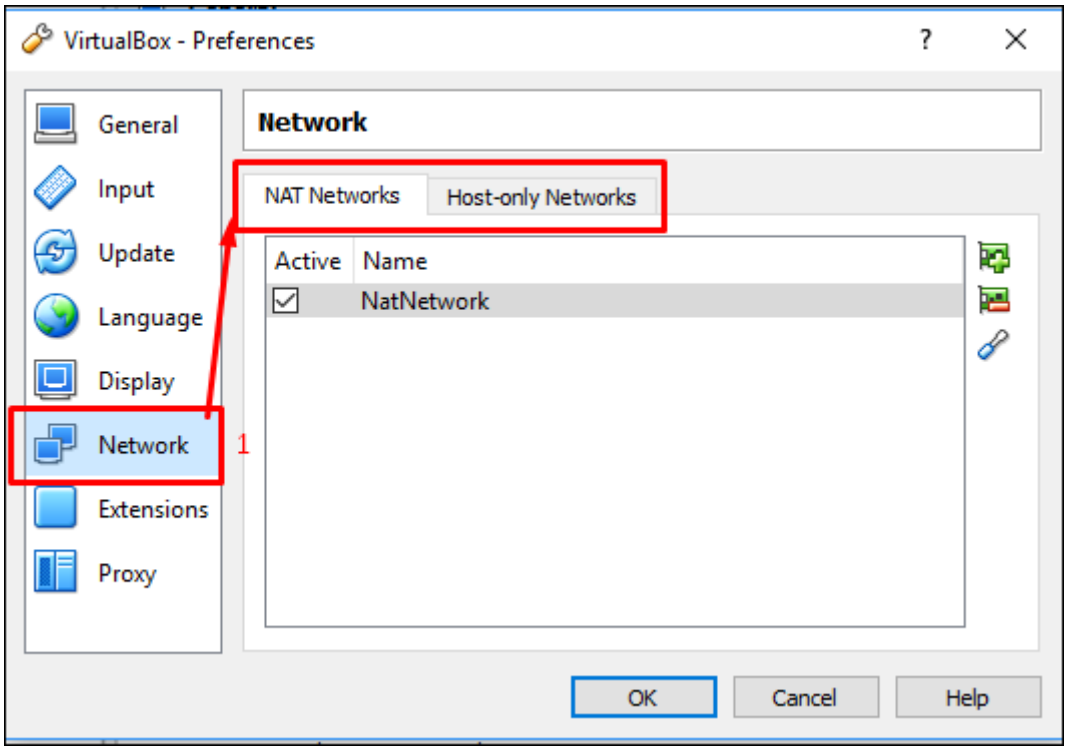
Nat Networks

For setting up Nat Networks, we should follow the steps given below.

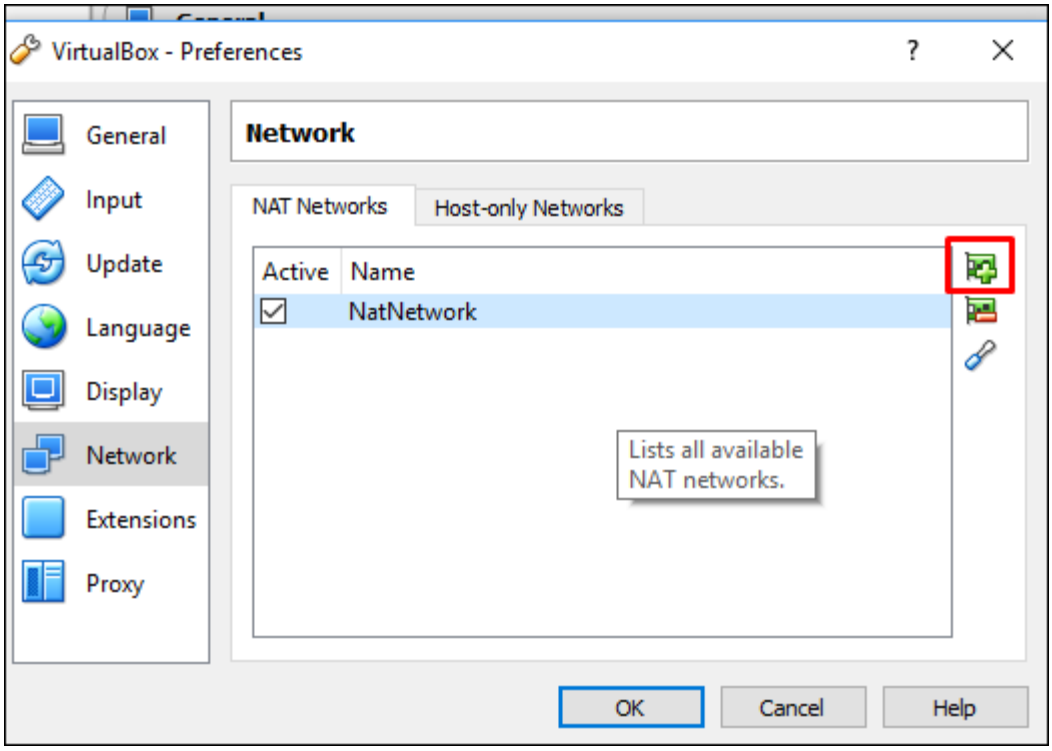
Step 1 − Go to Oracle VM VirtualBox Manager → Click on “Preferences…”



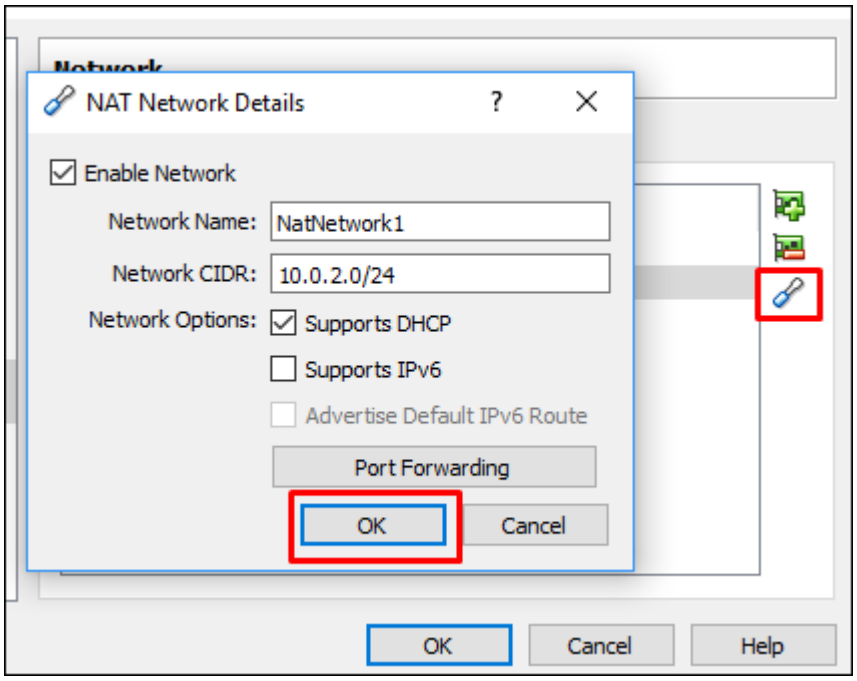
Step 2 − Click on “Network” and then on the left panel click on the “NAT Networks” tab.



Step 3 − Click on the “+” button, which is highlighted in the screenshot below.



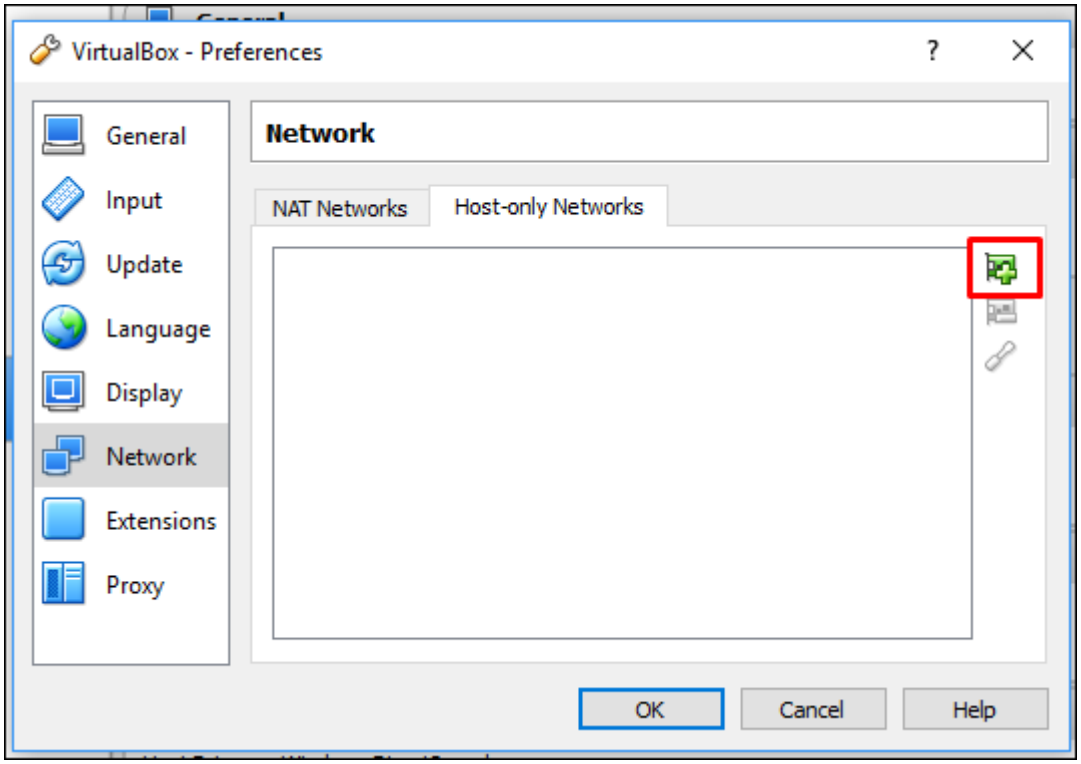
Step 4 − Here, we have to put the "Network Name" and the IP range for this network that will be NAT-ed, in order to have access to internet and to other networks.



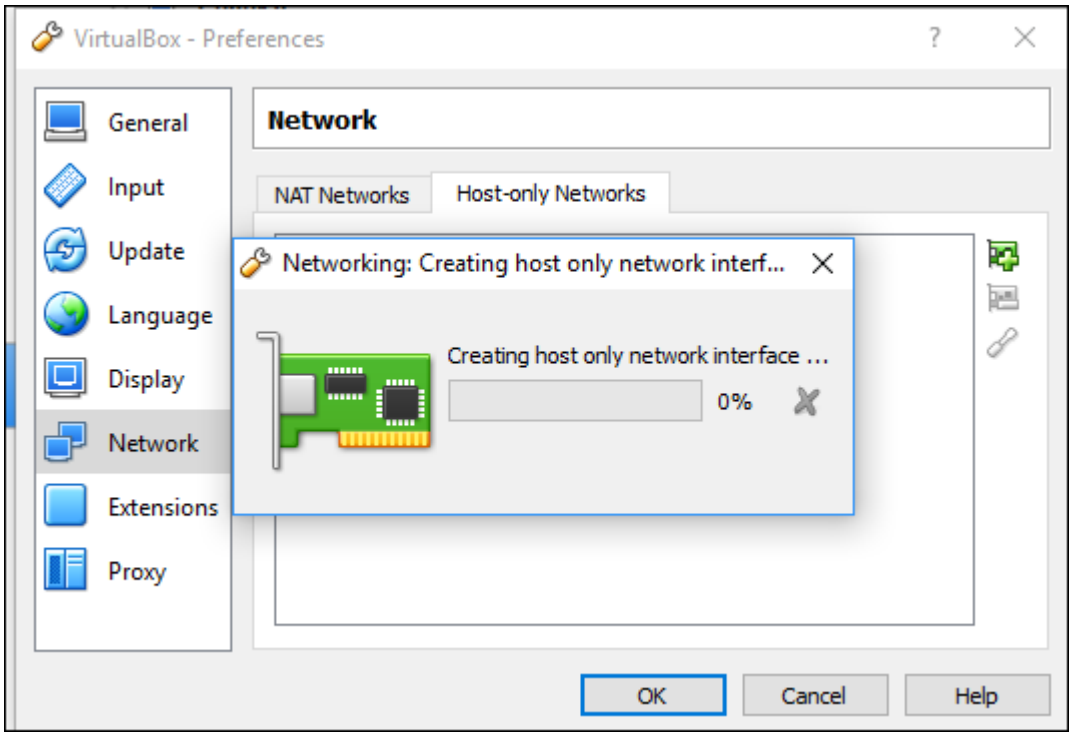
Host-only Networks

For setting up Host-only Networks, we should follow the steps given below.

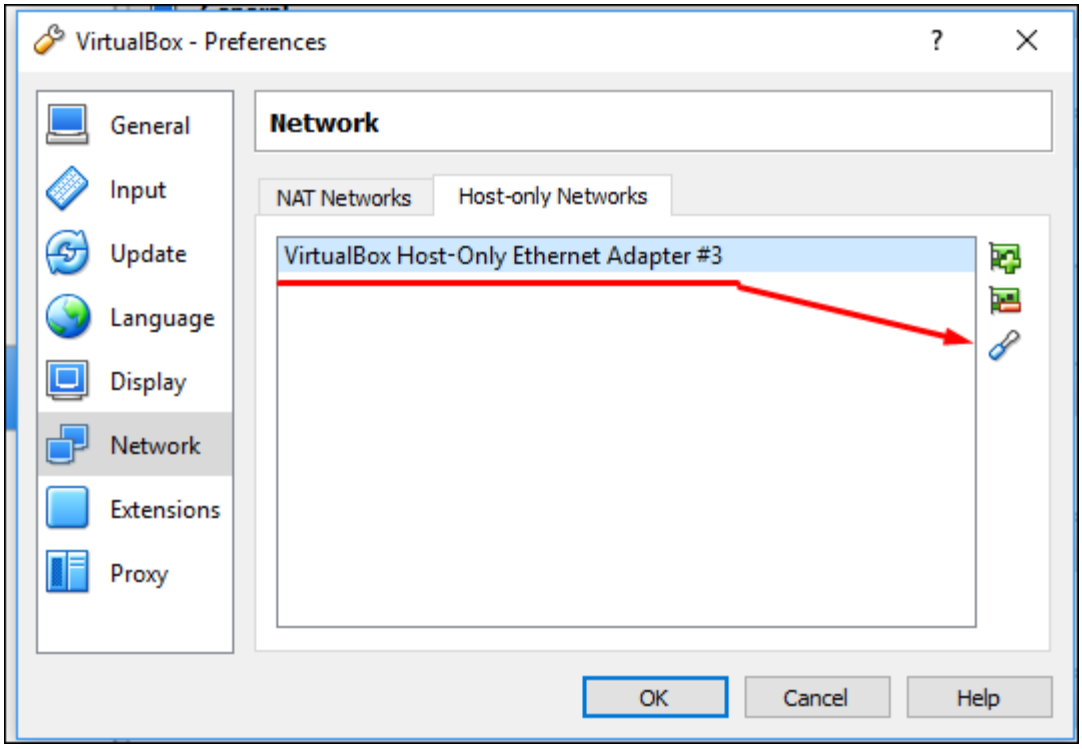
Step 1 − If you click on the "Host-only Networks" tab, you can create networks that are isolated from the other networks. However, VM hosts communicate with each other and the Hypervisor machine. Click on the "+" sign.



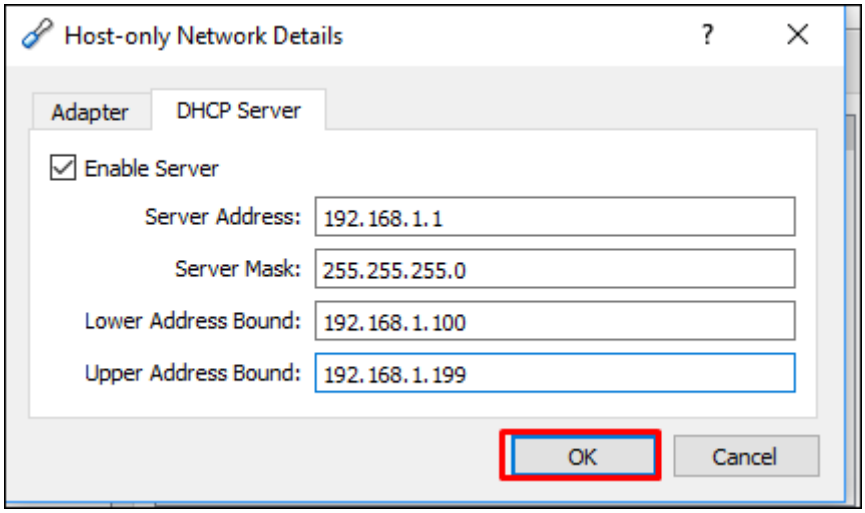
Step 2 − The host interface will continue to be created as shown in the screenshot below.



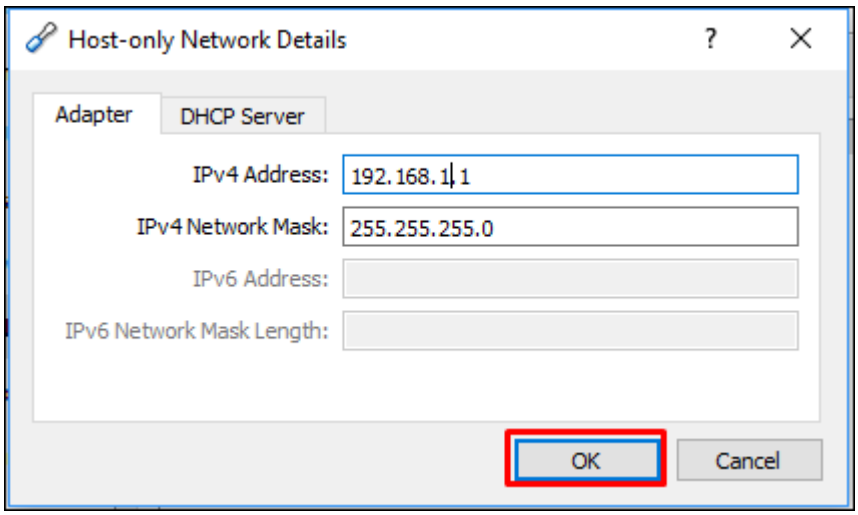
Step 3 − If you click on  button, you can edit the settings.



Step 4 − If you want your host machines to take "DHCP IP", click on the "DHCP Server" tab and check the box "Enable Server" → Click "OK".

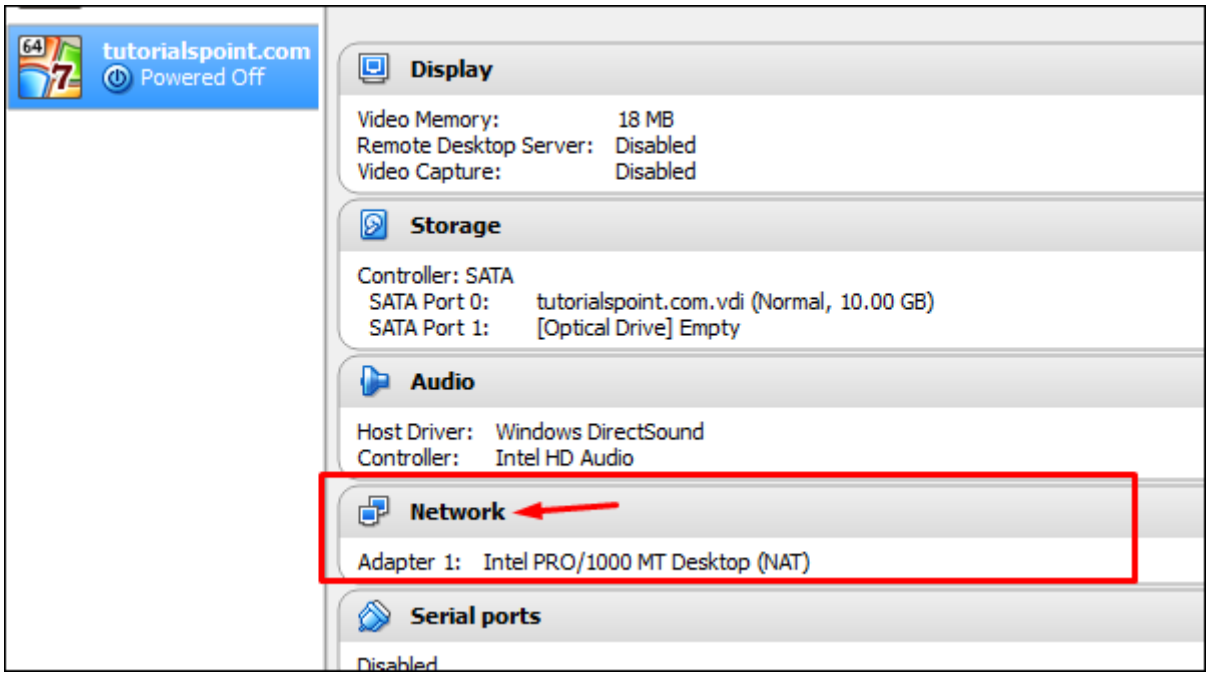


Step 5 − In the "Adapter" tab, put the IP of the hypervisor.



After all these preparations for setting up the network modes is complete. It is now time to assign a network to our VMs.

To do this, Click on the VMs on the left side of the panel, then right click on the "Network" option and a table will be open.

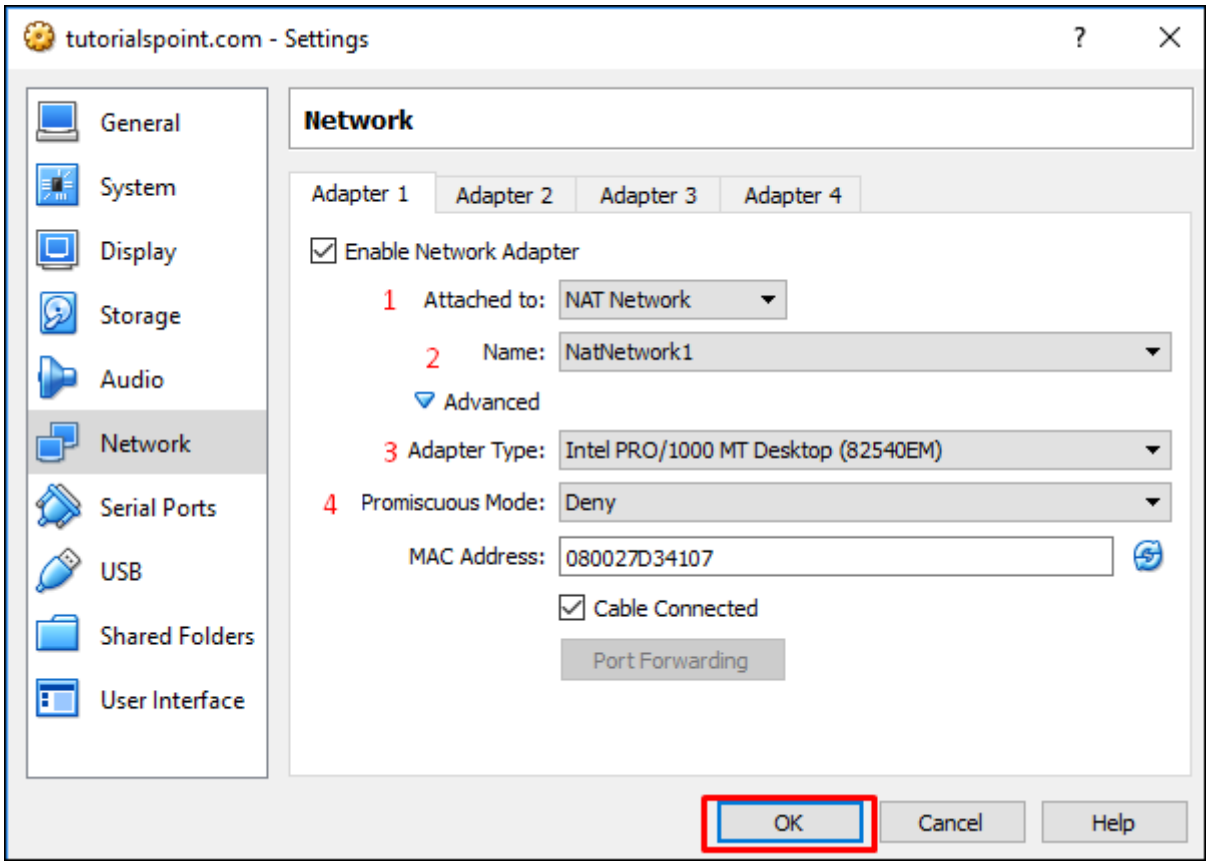


You can have up to four Ethernet adaptors per machine. The following image has four sections highlighted, which are explained below.

- Check the box "Enable Network Adapter" to enable the vNIC on the VM and attach it to one network.
- You can have many networks created, so we have to select one of them in the "Name" dropdown box.
- In the adapter type dropdown-box, we have to select a physical NIC that the hypervisor has.

- Promiscuous Mode: Here, we can select “Deny”, if we do not want the VMs to communicate with each other.

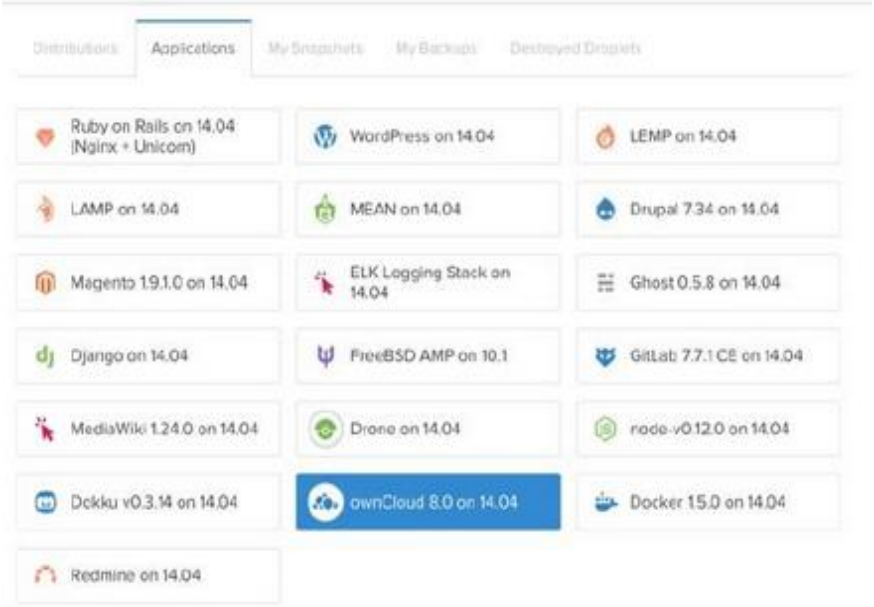
Once all the above parameters are completed. Click on “OK”.



PRACTICAL-4

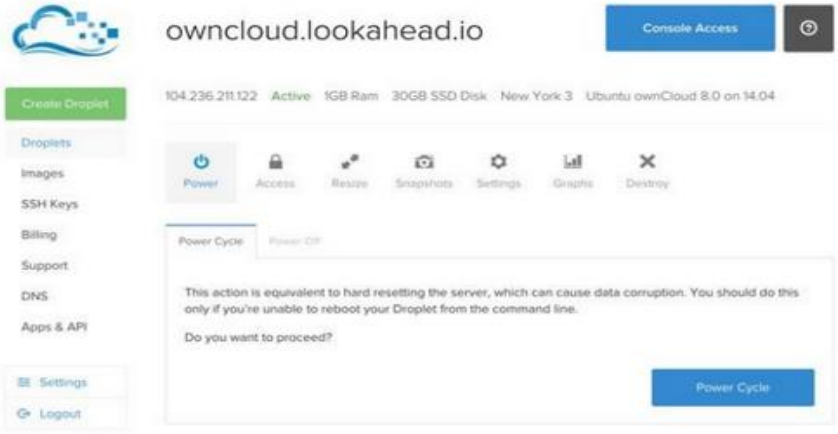
AIM:- Installation and configuration of OwnCloud software for SaaS.

Click on the Applications tab and click the ownCloud 8.x image button

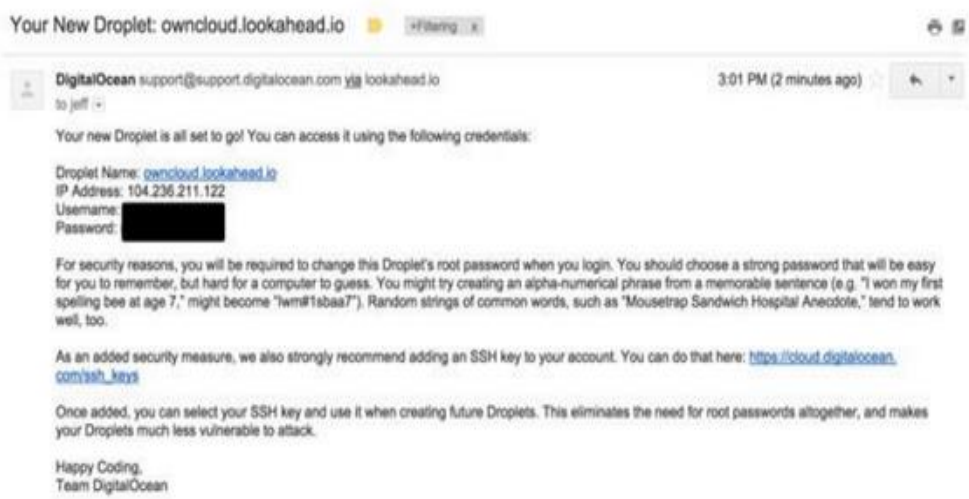


Submit the form and create droplet progress screen:

When it's complete, see droplet on the dashboard:



Now, configure domain name DNS to point to the droplet, i.e. set an A record for the subdomain or domain name to the IP address



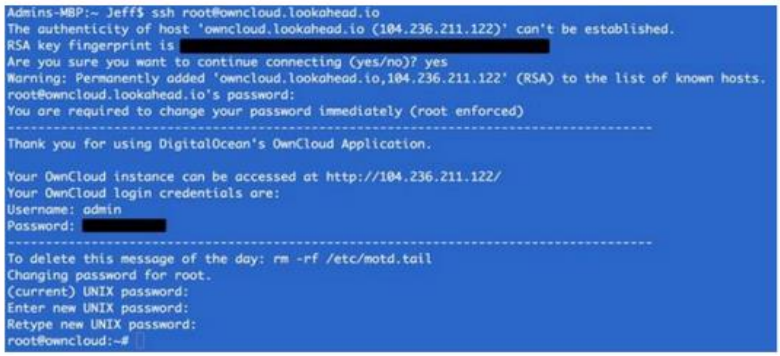
Once your DNS changes propagate visit your site—but you'll get this warning. OwnCloud requires you to add this domain to its listed of trusted domains.

When you click the grey button, you should see the general login screen:

Log In to Your OwnCloud Dashboard

However, you may have noticed we don't have our dashboard credentials yet:

To obtain them, use the SSH login credentials and a terminal application to log in to your droplet server



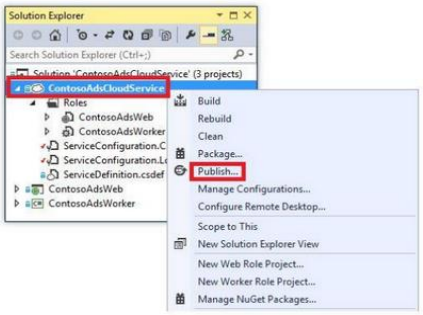
Then, return to the browser and log in to your OwnCloud.


104.236.211.122/index.php/apps/files/
Files
admin
All files
Favorites
Shared with you
Shared with others
Shared by link
New
Name
Size
Modified
32 minutes ago
32 minutes ago
32 minutes ago
Welcome to ownCloud
Your personal web services. All your files, contacts, calendar and more, in one place.
Get the apps to sync your files
Desktop app
Windows, OS X, Linux
ANDROID APP ON
Google play
Available on the
App Store
Connect your desktop apps to ownCloud
Connect your Calendar
Connect your Contacts
Access files via WebDAV
There's more information in the documentation and on our website.
If you like ownCloud, recommend it to your friends and spread the word!

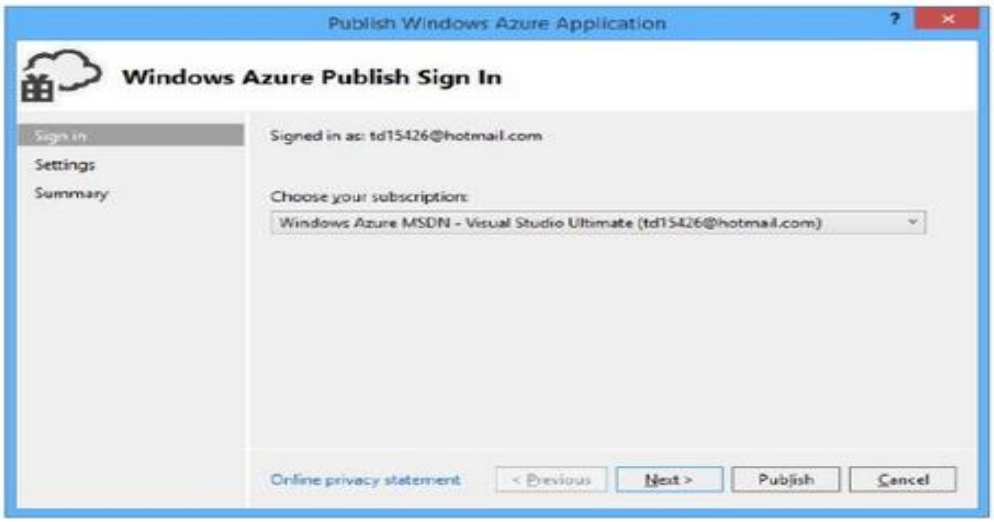
PRACTICAL-5

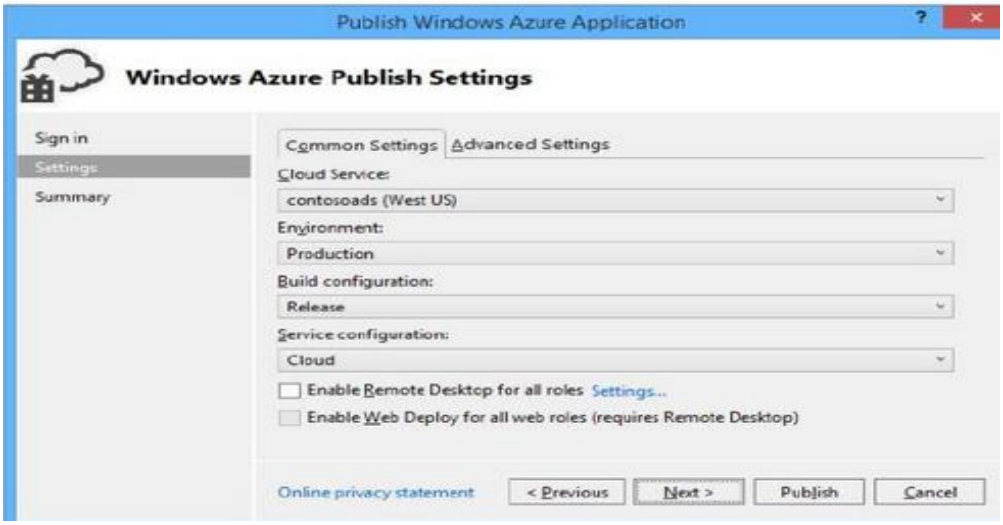
AIM:- Accessing Microsoft AZURE cloud-services.

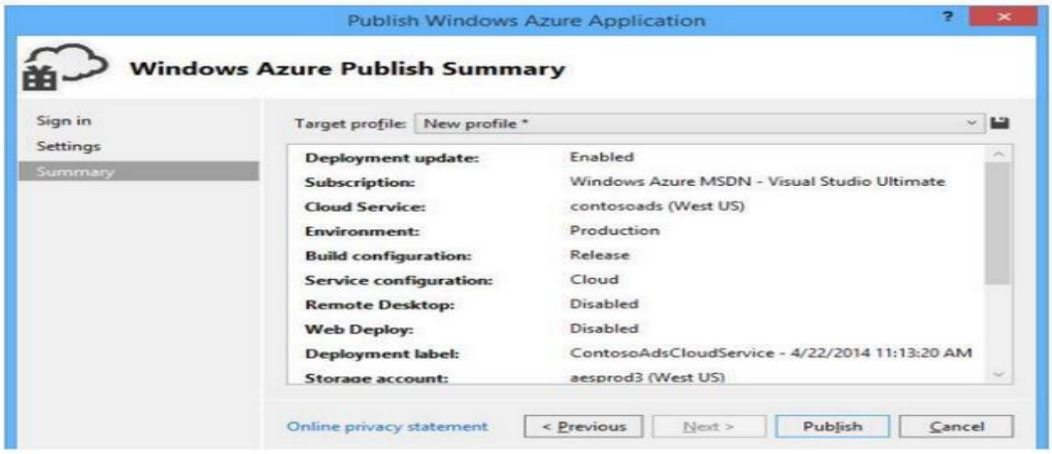
In Solution Explorer, right-click the ContosoAdsCloudService cloud project and then select Publish.



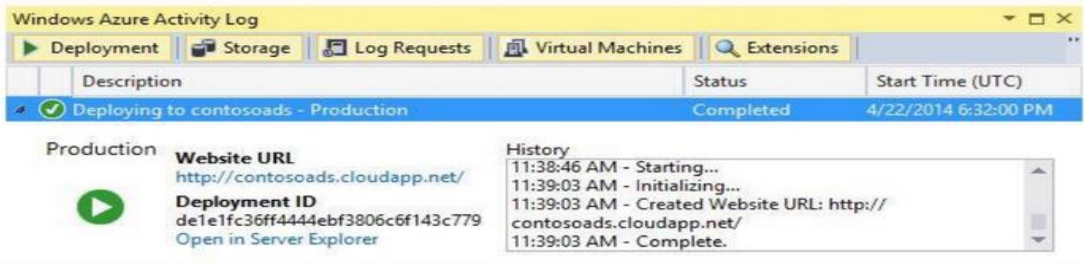
In the Sign in step of the Publish Azure Application wizard, click Next







When the deployment status is complete, click the Web app URL to start the application.



PRACTICAL-6

AIM:- Cloud Simulation Software Introduction: CloudSim.

CloudSim is a simulation toolkit that supports the modeling and simulation of the core functionality of cloud, like job/task queue, processing of events, creation of cloud entities(datacenter, datacenter brokers, etc), communication between different entities, implementation of broker policies, etc. This toolkit allows to:

- Test application services in a repeatable and controllable environment.
- Tune the system bottlenecks before deploying apps in an actual cloud.
- Experiment with different workload mix and resource performance scenarios on simulated infrastructure for developing and testing adaptive application provisioning techniques

Core features of CloudSim are:

- The Support of modeling and simulation of large scale computing environment as federated cloud data centers, virtualized server hosts, with customizable policies for provisioning host resources to virtual machines and energy-aware computational resources
- It is a self-contained platform for modeling cloud's service brokers, provisioning, and allocation policies.
- It supports the simulation of network connections among simulated system elements.
- Support for simulation of federated cloud environment, that inter-networks resources from both private and public domains.
- Availability of a virtualization engine that aids in the creation and management of multiple independent and co-hosted virtual services on a data center node.
- Flexibility to switch between space shared and time shared allocation of processing cores to virtualized services.

PRACTICAL-7

Aim : Create a cluster with AWS

Step 1: Create a cluster

If you already have a cluster that you want to use, you can skip this step.

For the exercises in this tutorial, use a four-node cluster.

To create a cluster

1. Sign in to the AWS Management Console and open the Amazon Redshift console at https://console.aws.amazon.com/redshift/

.

Using the navigation menu, choose the **Provisioned clusters dashboard**.

• *Important*

Make sure that you have the necessary permissions to perform the cluster operations. For information on granting the necessary permissions, see Authorizing Amazon Redshift to access AWS services.

- At top right, choose the AWS Region in which you want to create the cluster. For the purposes of this tutorial, choose **US West (Oregon)**.

- On the navigation menu, choose **Clusters**, then choose **Create cluster**. The **Create cluster** page appears.

- On the **Create cluster** page enter parameters for your cluster. Choose your own values for the parameters, except change the following values:

    - Choose `dc2.large` for the node type.
    - Choose `4` for the **Number of nodes**.
    - In the **Cluster permissions** section, choose an IAM role from **Available IAM roles**. This role should be one that you previously created and that has access to Amazon S3. Then choose **Associate IAM role** to add it to the list of **Associated IAM roles** for the cluster.

- Choose **Create cluster**.

Step 2: Download the data files

In this step, you download a set of sample data files to your computer. In the next step, you upload the files to an Amazon S3 bucket.

To download the data files

1. Download the zipped file: LoadingDataSampleFiles.zip.
2. Extract the files to a folder on your computer.
3. Verify that your folder contains the following files.

```
customer-fw-manifest
customer-fw.tbl-000
customer-fw.tbl-000.bak
customer-fw.tbl-001
customer-fw.tbl-002
customer-fw.tbl-003
customer-fw.tbl-004
customer-fw.tbl-005
customer-fw.tbl-006
customer-fw.tbl-007
customer-fw.tbl.log
dwdate-tab.tbl-000
dwdate-tab.tbl-001
dwdate-tab.tbl-002
dwdate-tab.tbl-003
dwdate-tab.tbl-004
dwdate-tab.tbl-005
dwdate-tab.tbl-006
dwdate-tab.tbl-007
part-csv.tbl-000
part-csv.tbl-001
part-csv.tbl-002
part-csv.tbl-003
part-csv.tbl-004
part-csv.tbl-005
part-csv.tbl-006
part-csv.tbl-007
```

Step 3: Upload the files to an Amazon S3 bucket

In this step, you create an Amazon S3 bucket and upload the data files to the bucket.

To upload the files to an Amazon S3 bucket

1. Create a bucket in Amazon S3.
    1. Sign in to the AWS Management Console and open the Amazon S3 console at https://console.aws.amazon.com/s3/

    .

1. Click **Create Bucket**.
2. In the **Bucket Name** box of the **Create a Bucket** dialog box, type a bucket name.

The bucket name you choose must be unique among all existing bucket names in Amazon S3. One way to help ensure uniqueness is to prefix your bucket names with the name of your organization. Bucket names must comply with certain rules. For more information, go to Bucket restrictions and limitations in the *Amazon Simple Storage Service User Guide.*

3. Select a Region.

   Create the bucket in the same Region as your cluster. If your cluster is in the US West (Oregon) Region, choose **US West (Oregon) Region (us-west-2)**.

4. Choose **Create**.

   When Amazon S3 successfully creates your bucket, the console displays your empty bucket in the **Buckets** panel.

- Create a folder.

  1. Choose the name of the new bucket.
  2. Choose the **Actions** button, and click **Create Folder** in the drop-down list.
  3. Name the new folder `load`.
  4. Upload the data files to the new Amazon S3 bucket.
     1. Choose the name of the data folder.
     2. In the Upload - Select Files wizard, choose **Add Files**.

        Follow the Amazon S3 console instructions to upload all of the files you downloaded and extracted,

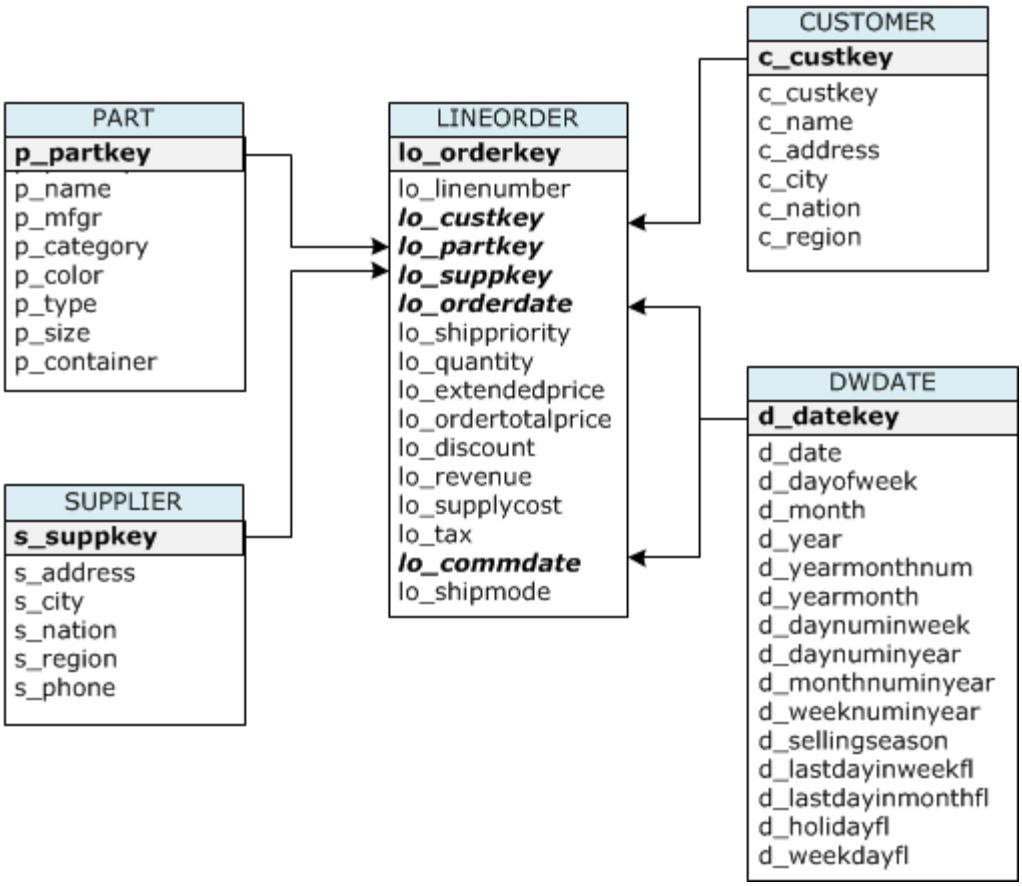
     3. Choose **Start Upload**.

User Credentials

The Amazon Redshift COPY command must have access to read the file objects in the Amazon S3 bucket. If you use the same user credentials to create the Amazon S3 bucket and to run the Amazon Redshift COPY command, the COPY command has all necessary permissions. If you want to use different user credentials, you can grant access by using the Amazon S3 access controls. The Amazon Redshift COPY command requires at least ListBucket and GetObject permissions to access the file objects in the Amazon S3 bucket. For more information about controlling access to Amazon S3 resources, go to Managing access permissions to your Amazon S3 resources.

Step 4: Create the sample tables

For this tutorial, you use a set of five tables based on the Star Schema Benchmark (SSB) schema. The following diagram shows the SSB data model.



The SSB tables might already exist in the current database. If so, drop the tables to remove them from the database before you create them using the CREATE TABLE commands in the next step. The tables used in this tutorial might have different attributes than the existing tables.

To create the sample tables

1. To drop the SSB tables, run the following commands in your SQL client.

```
• drop table part cascade;
drop table supplier;
drop table customer;
drop table dwdate;
drop table lineorder;
```

- Run the following CREATE TABLE commands in your SQL client.

```
CREATE TABLE part
(
  p_partkey     INTEGER NOT NULL,
  p_name        VARCHAR(22) NOT NULL,
  p_mfgr        VARCHAR(6),
  p_category    VARCHAR(7) NOT NULL,
  p_brand1      VARCHAR(9) NOT NULL,
  p_color       VARCHAR(11) NOT NULL,
  p_type        VARCHAR(25) NOT NULL,
  p_size        INTEGER NOT NULL,
  p_container   VARCHAR(10) NOT NULL
```

```
);

CREATE TABLE supplier
(
  s_suppkey   INTEGER NOT NULL,
  s_name      VARCHAR(25) NOT NULL,
  s_address   VARCHAR(25) NOT NULL,
  s_city      VARCHAR(10) NOT NULL,
  s_nation    VARCHAR(15) NOT NULL,
  s_region    VARCHAR(12) NOT NULL,
  s_phone     VARCHAR(15) NOT NULL
);

CREATE TABLE customer
(
  c_custkey      INTEGER NOT NULL,
  c_name         VARCHAR(25) NOT NULL,
  c_address      VARCHAR(25) NOT NULL,
  c_city         VARCHAR(10) NOT NULL,
  c_nation       VARCHAR(15) NOT NULL,
  c_region       VARCHAR(12) NOT NULL,
  c_phone        VARCHAR(15) NOT NULL,
  c_mktsegment   VARCHAR(10) NOT NULL
);

CREATE TABLE dwdate
(
  d_datekey            INTEGER NOT NULL,
  d_date               VARCHAR(19) NOT NULL,
  d_dayofweek          VARCHAR(10) NOT NULL,
  d_month              VARCHAR(10) NOT NULL,
  d_year               INTEGER NOT NULL,
  d_yearmonthnum       INTEGER NOT NULL,
  d_yearmonth          VARCHAR(8) NOT NULL,
  d_daynuminweek       INTEGER NOT NULL,
  d_daynuminmonth      INTEGER NOT NULL,
  d_daynuminyear       INTEGER NOT NULL,
  d_monthnuminyear     INTEGER NOT NULL,
  d_weeknuminyear      INTEGER NOT NULL,
  d_sellingseason      VARCHAR(13) NOT NULL,
  d_lastdayinweekfl    VARCHAR(1) NOT NULL,
  d_lastdayinmonthfl   VARCHAR(1) NOT NULL,
  d_holidayfl          VARCHAR(1) NOT NULL,
  d_weekdayfl          VARCHAR(1) NOT NULL
);
CREATE TABLE lineorder
(
  lo_orderkey          INTEGER NOT NULL,
  lo_linenumber        INTEGER NOT NULL,
  lo_custkey           INTEGER NOT NULL,
  lo_partkey           INTEGER NOT NULL,
  lo_suppkey           INTEGER NOT NULL,
  lo_orderdate         INTEGER NOT NULL,
  lo_orderpriority     VARCHAR(15) NOT NULL,
  lo_shippriority      VARCHAR(1) NOT NULL,
  lo_quantity          INTEGER NOT NULL,
  lo_extendedprice     INTEGER NOT NULL,
  lo_ordertotalprice   INTEGER NOT NULL,
  lo_discount          INTEGER NOT NULL,
  lo_revenue           INTEGER NOT NULL,
  lo_supplycost        INTEGER NOT NULL,
```

```
  lo_tax                INTEGER NOT NULL,
  lo_commitdate         INTEGER NOT NULL,
  lo_shipmode           VARCHAR(10) NOT NULL
);
```

Step 5: Run the COPY commands

You run COPY commands to load each of the tables in the SSB schema. The COPY command examples demonstrate loading from different file formats, using several COPY command options, and troubleshooting load errors.