

RAJALAKSHMI ENGINEERING COLLEGE
AN AUTONOMOUS INSTITUTION
Affiliated to ANNA UNIVERSITY
Rajalakshmi Nagar, Thandalam,
Chennai-602105



RAJALAKSHMI
ENGINEERING COLLEGE
An AUTONOMOUS Institution
Affiliated to ANNA UNIVERSITY, Chennai

**DEPARTMENT OF COMPUTER SCIENCE
AND ENGINEERING**

CS19741 CLOUD COMPUTING LABORATORY
ACADEMIC YEAR:2024-2025 (ODD)

INDEX

Reg. No : 210701288

Name : M.Thamizh Bharathi

Branch : CSE

Year/Section : IV-E

Ex.No	List of Experiments	PageNo.	Signature
	VIRTUALIZATION		
1	Create and run a virtual machine in your system using VMWare Workstation pro		
2	Virtualize a machine and check how many virtual machines can be utilized at a particular time		
3	Create a VM clone and attach a virtual block to the cloned VM		
	PUBLIC CLOUD		
4	Develop a simple email automation service using Salesforce		
5	Launch a cloud instance using a public IaaS cloud service like the IBM cloud		
6	Work with a public cloud service such as the ServiceNow/MS Azure		
	CLOUD SIMULATION		
7	Model a cloud environment using CloudSim		
8	Implement RoundRobin task scheduling in both TimeShared and SpaceShared CPU assignment		
	HADOOP – MAP REDUCE		
9	Setup a single node Hadoop cluster and show the process using WEB UI		
10	Demonstrate the MapReduce programming model by counting the number of words in a file		
11	Implement the MaxTemperature MapReduce program to identify the year wise maximum temperature from sensor data		

Exp No: 1

Date:

VIRTUALIZATION

CONFIGURATION AND CREATION OF VIRTUAL MACHINE

AIM:

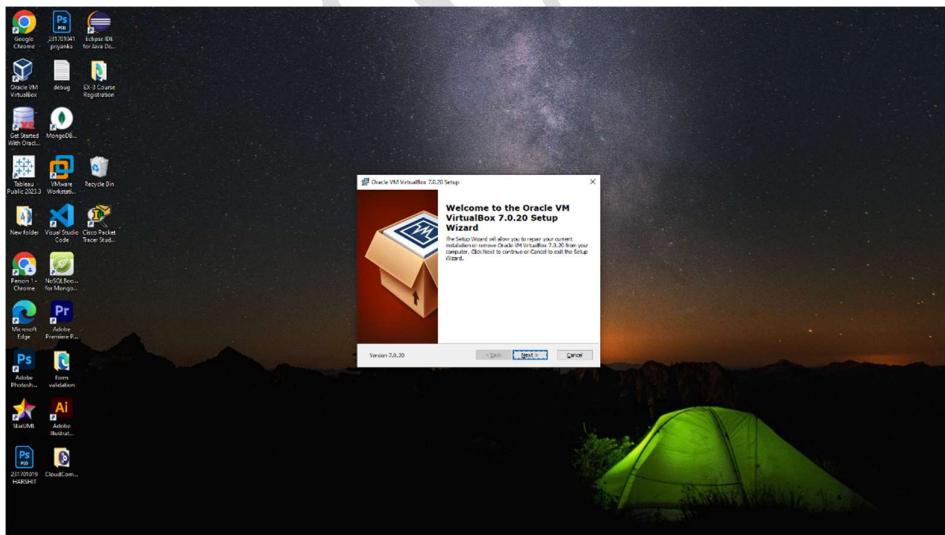
To configure a Virtual Machine using VM ware and Launch the VM and execute a simple program using C/PYTHON/JAVA.

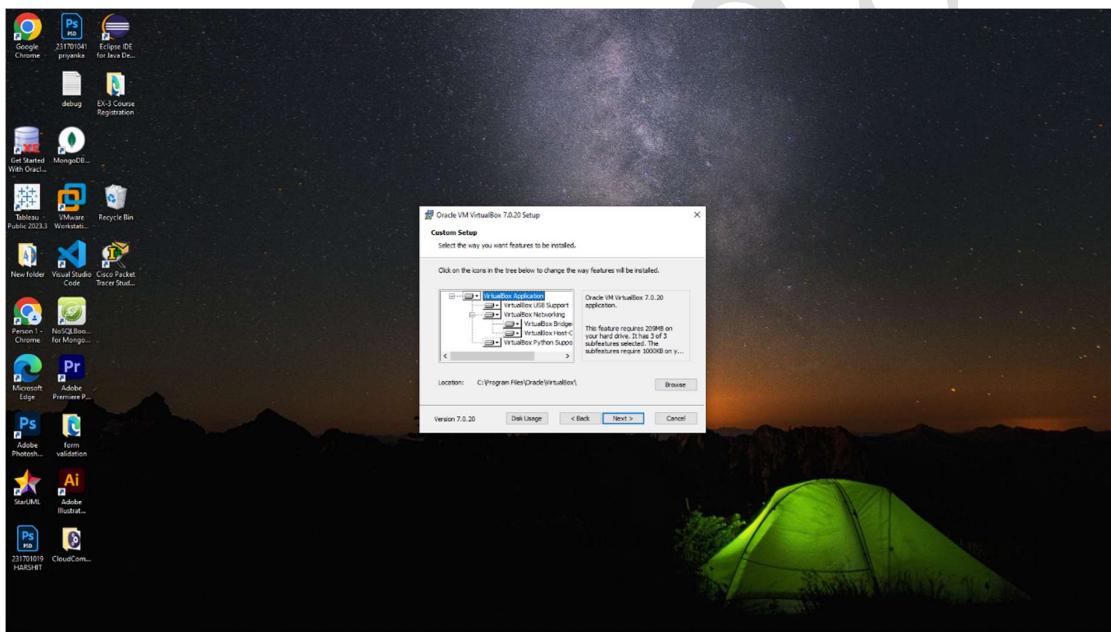
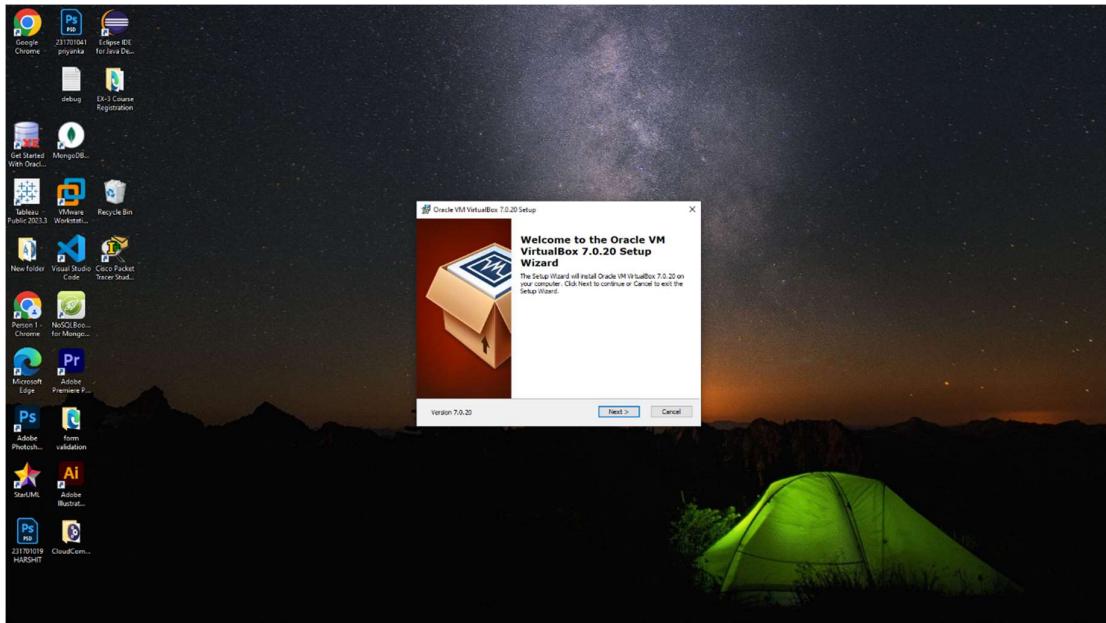
PROCEDURE:

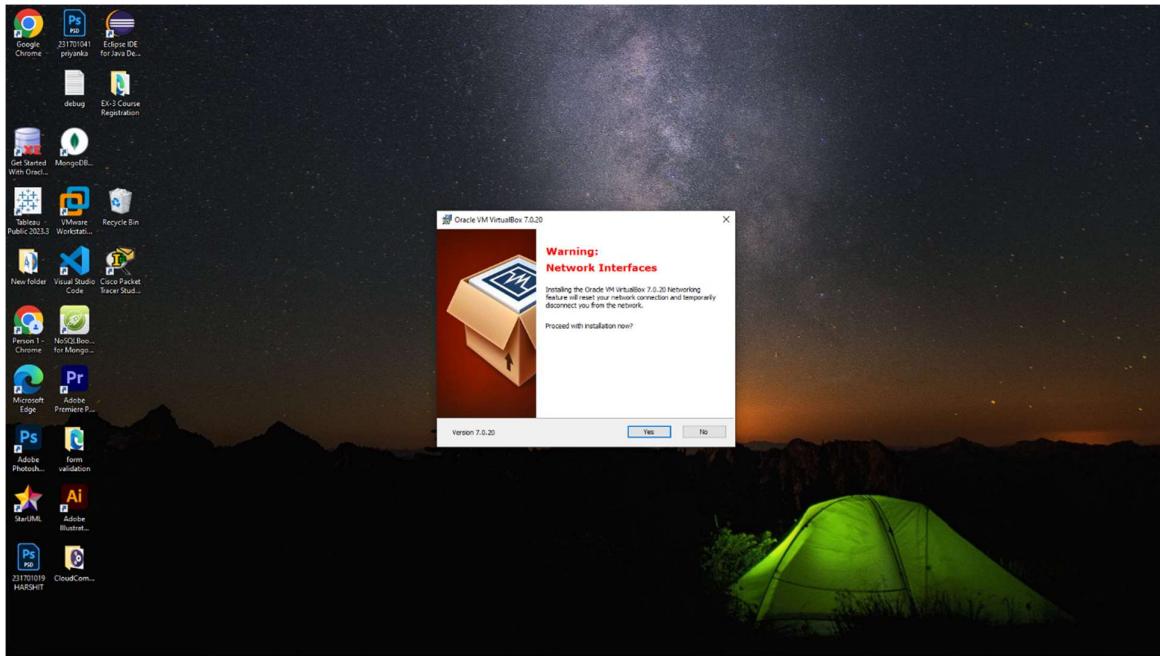
1. Launch a VM ware
2. Create new virtual machine
3. Customize the set-up
4. Set username and password
5. Browse for .iso file of an operating system
6. Configure the hardware capacity
7. Finish and power on the VM
8. Install C or PYTHON OR JAVA Compiler and execute a simple program

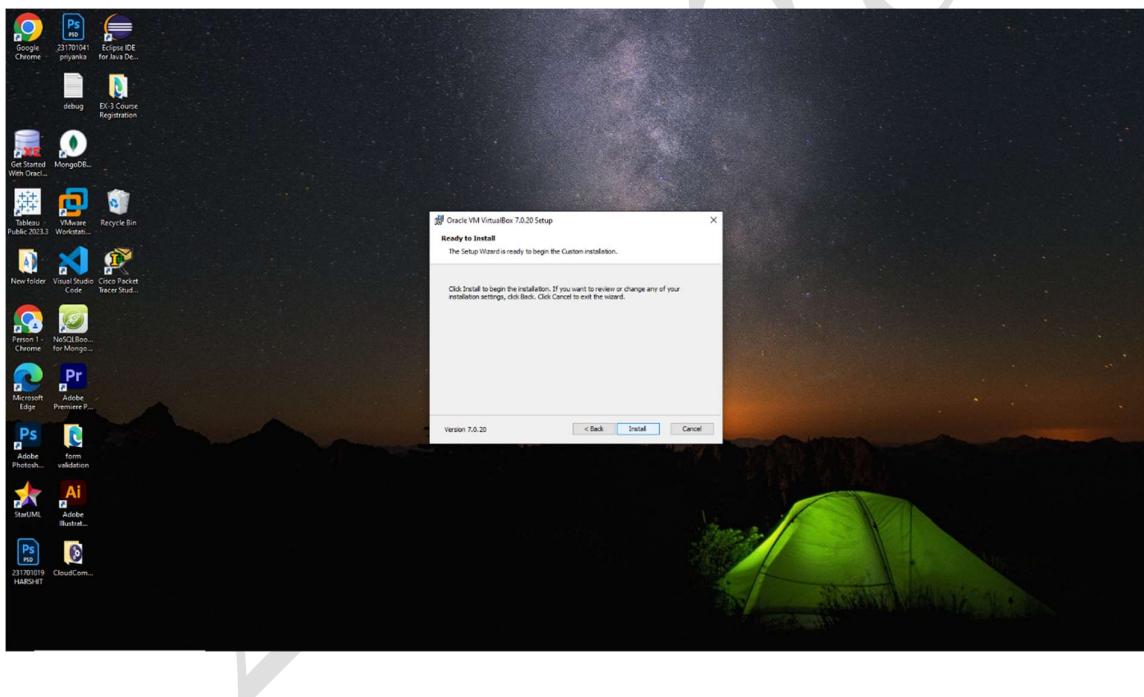
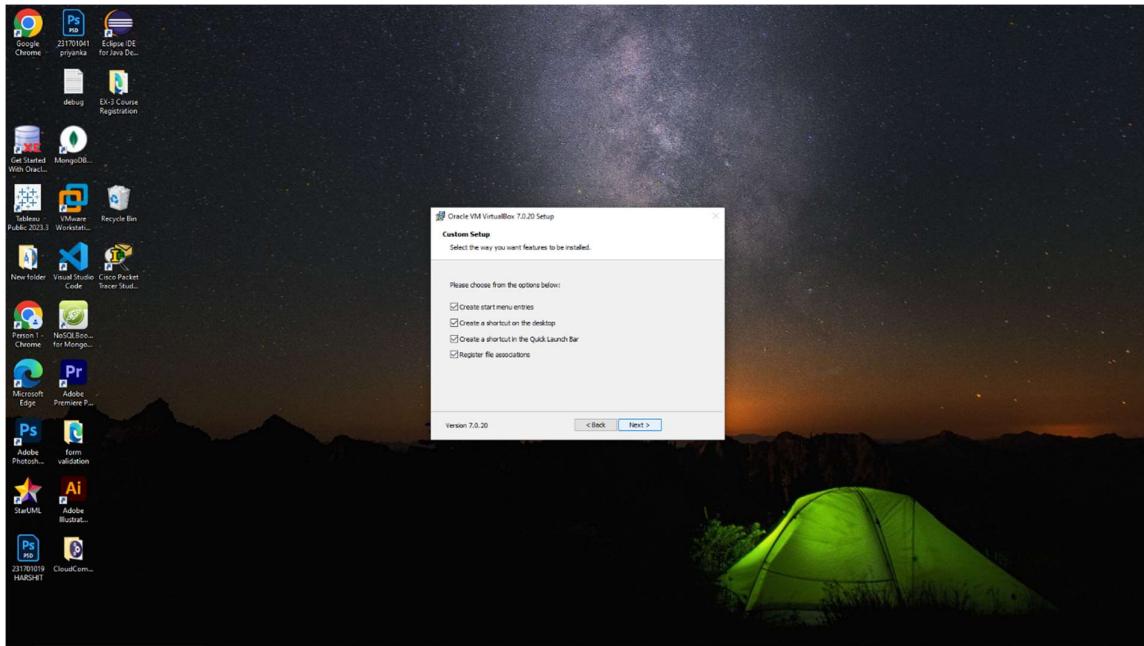
OUTPUT:

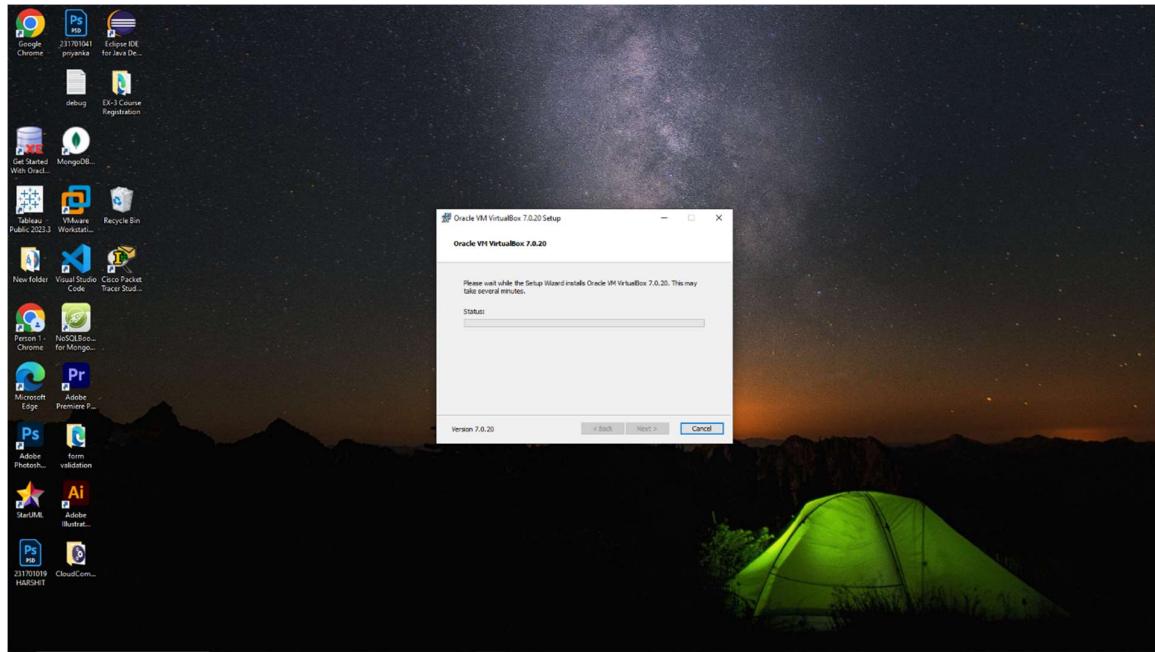
Typical Configuration



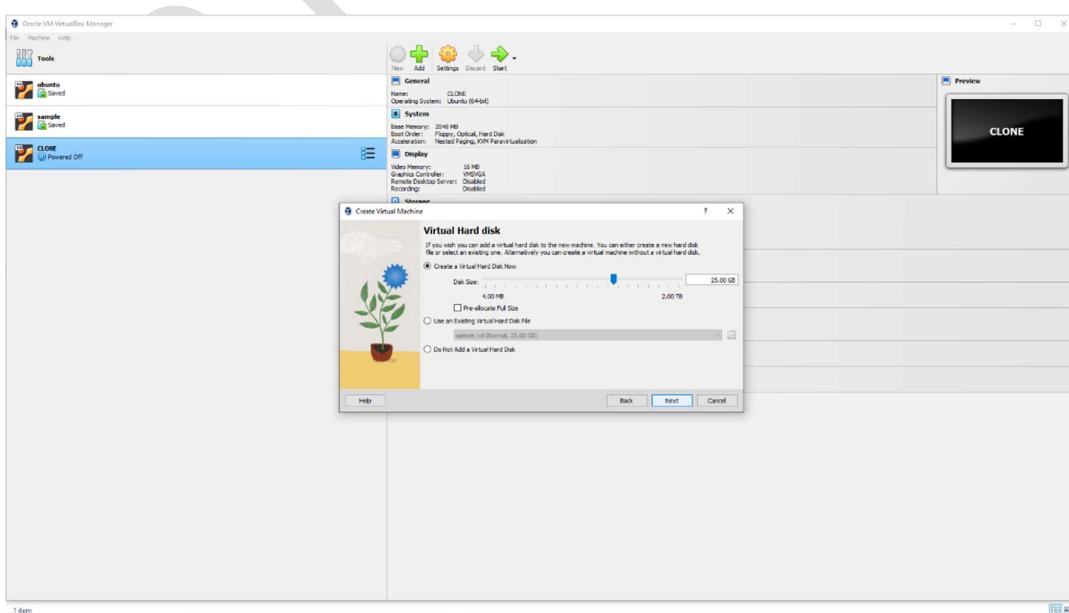
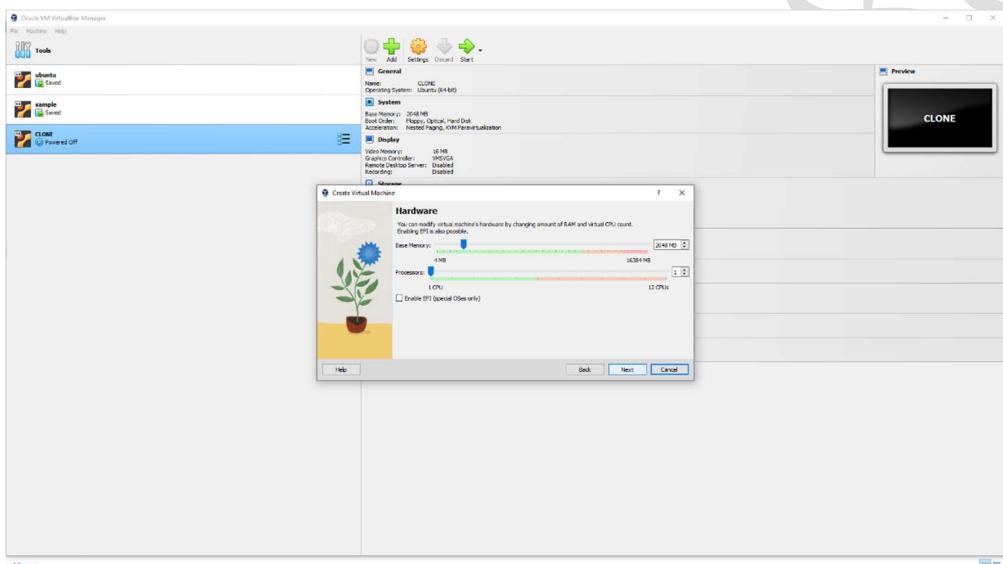
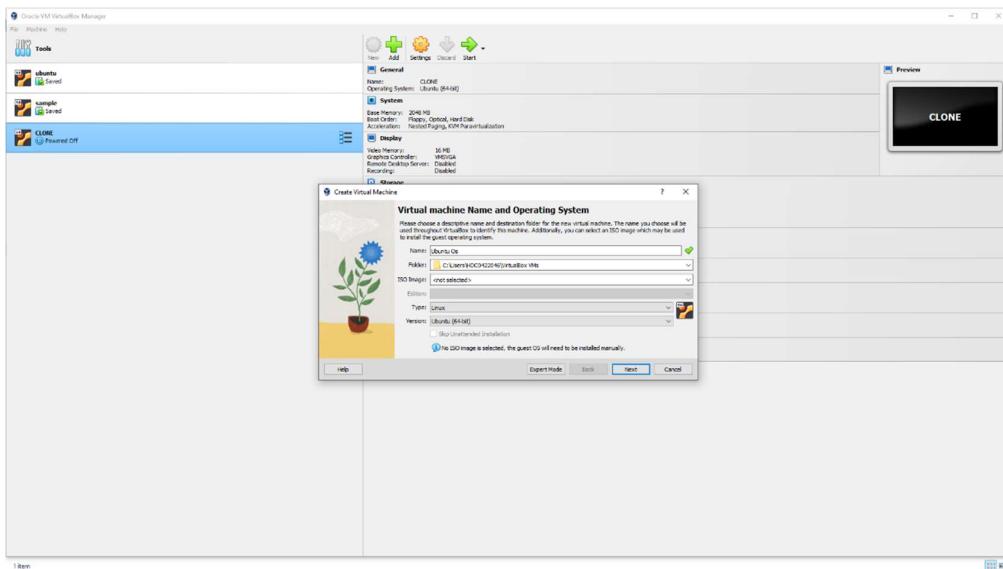


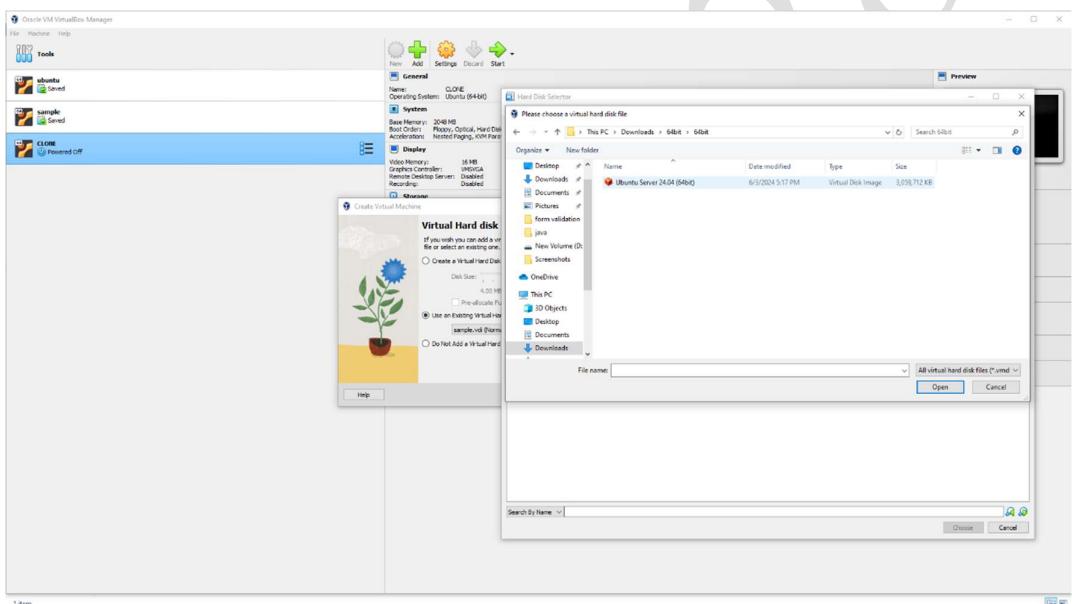
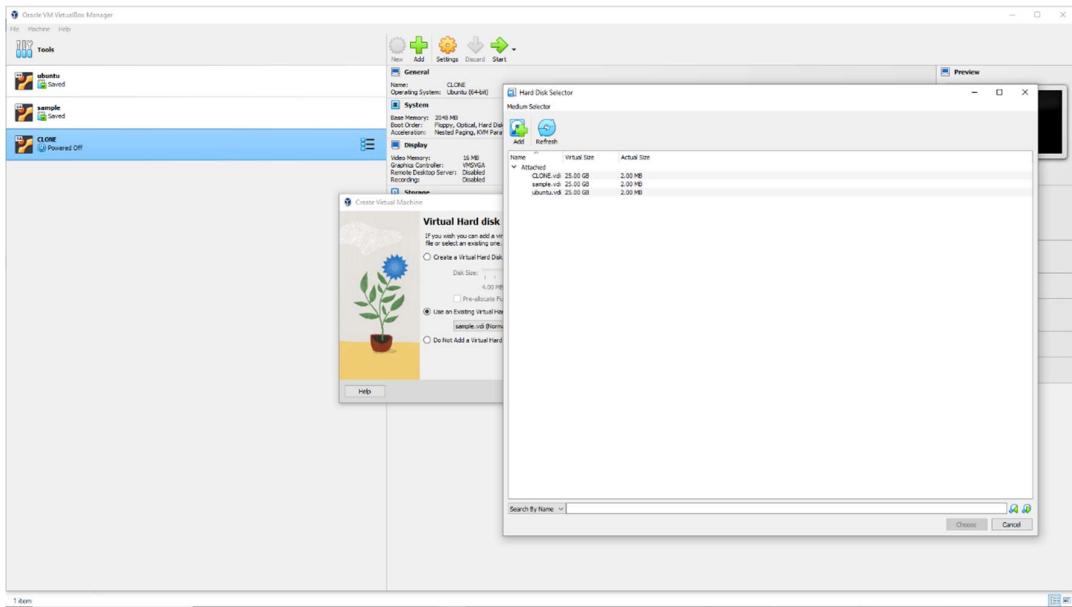


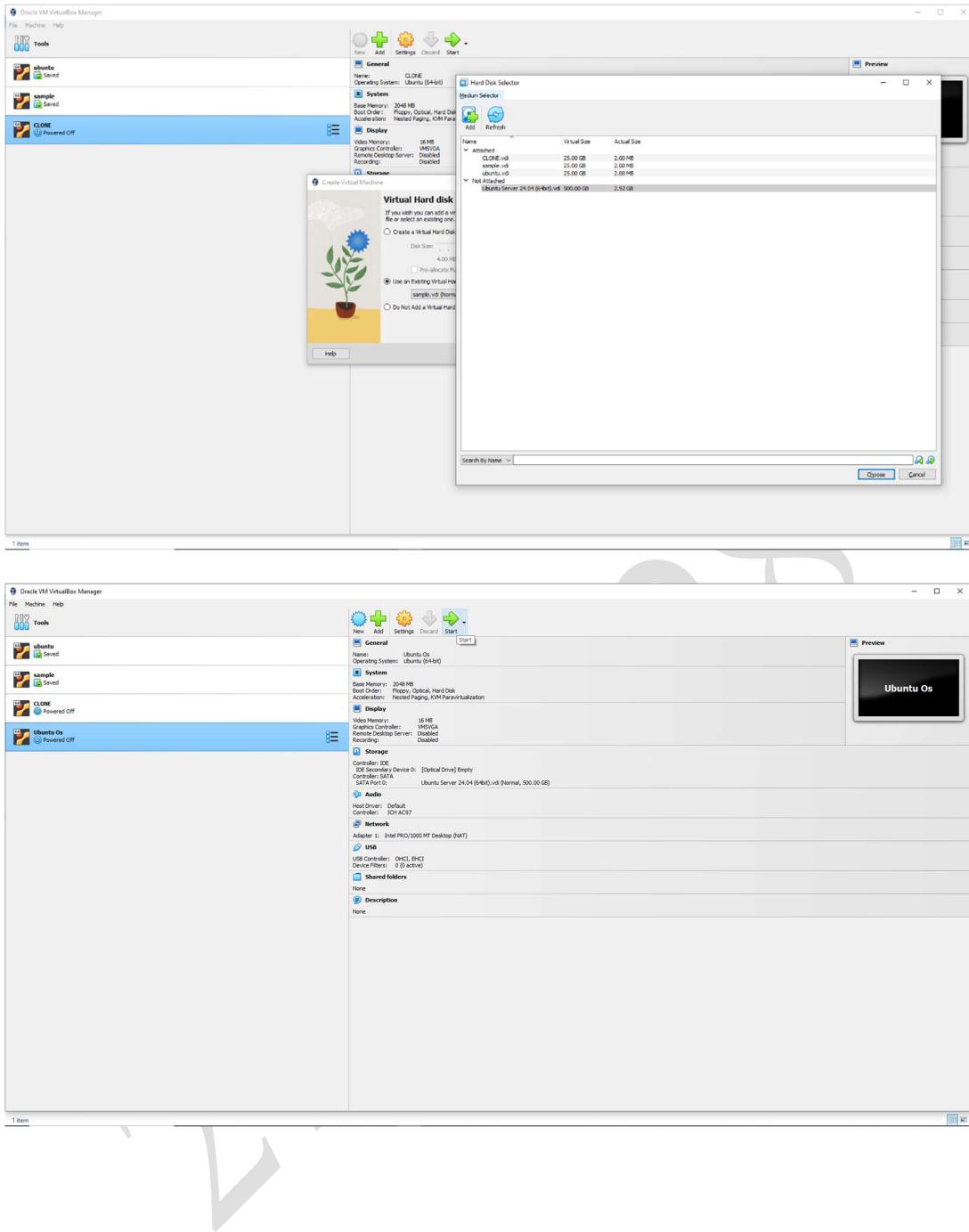




Custom configuration:







RESULT:

Thus, a Virtual Machine using VM ware and Launch the VM is configured.

Exp No: 2

Date:

VIRTUALIZATION

VIRTUAL BLOCK, VM CLONE & VM SNAPSHOT

AIM:

To configure a Virtual Block for a VM and then create a copy of VM through Cloning and perform a snapshot of VM.

PROCEDURE FOR VIRTUAL DISK:

1. Open the virtual machine settings editor (VM > Settings) and click Add
2. Click Hard Disk, then click Next.
3. Select Create a new virtual disk, then click Next.
4. Choose whether you want the virtual disk to be an IDE disk or a SCSI disk.
5. Set the capacity for the new virtual disk.
6. Accept the default filename and location for the virtual disk file
7. The wizard creates the new virtual disk. It appears to your guest operating system as a new, blank hard disk. Use the guest operating system's tools to partition and format the new drive for use.

PROCEDURE FOR VM CLONE:

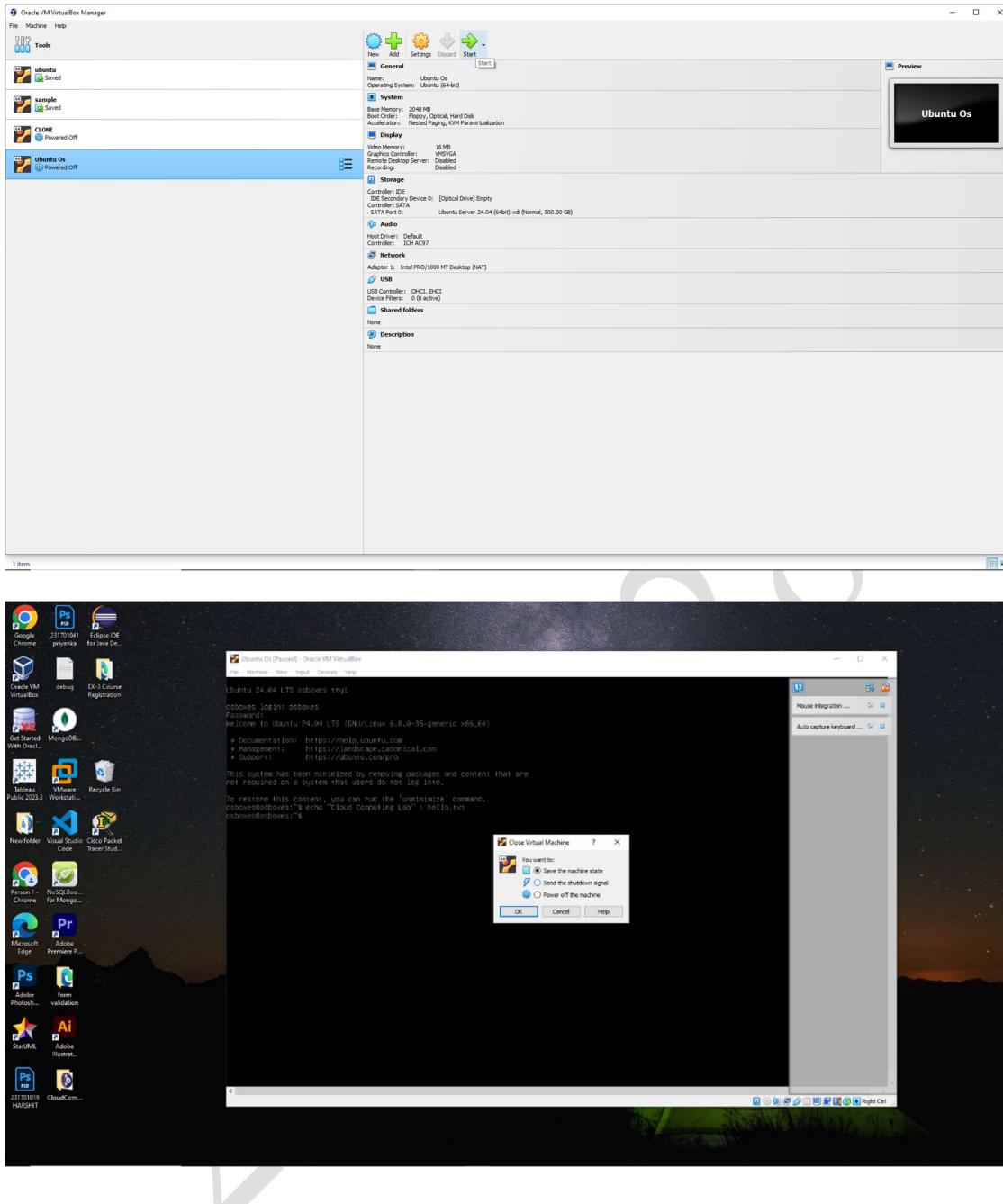
1. Select the virtual machine you want to clone.
2. Open the Clone Virtual Machine Wizard (VM > Manage > Clone) and click Next.
3. Select the state of the parent from which you want to create a clone, and click Next.
4. Select the type of clone you want to create and click Next.
5. Type a name and a path for the cloned virtual machine, and click Finish.

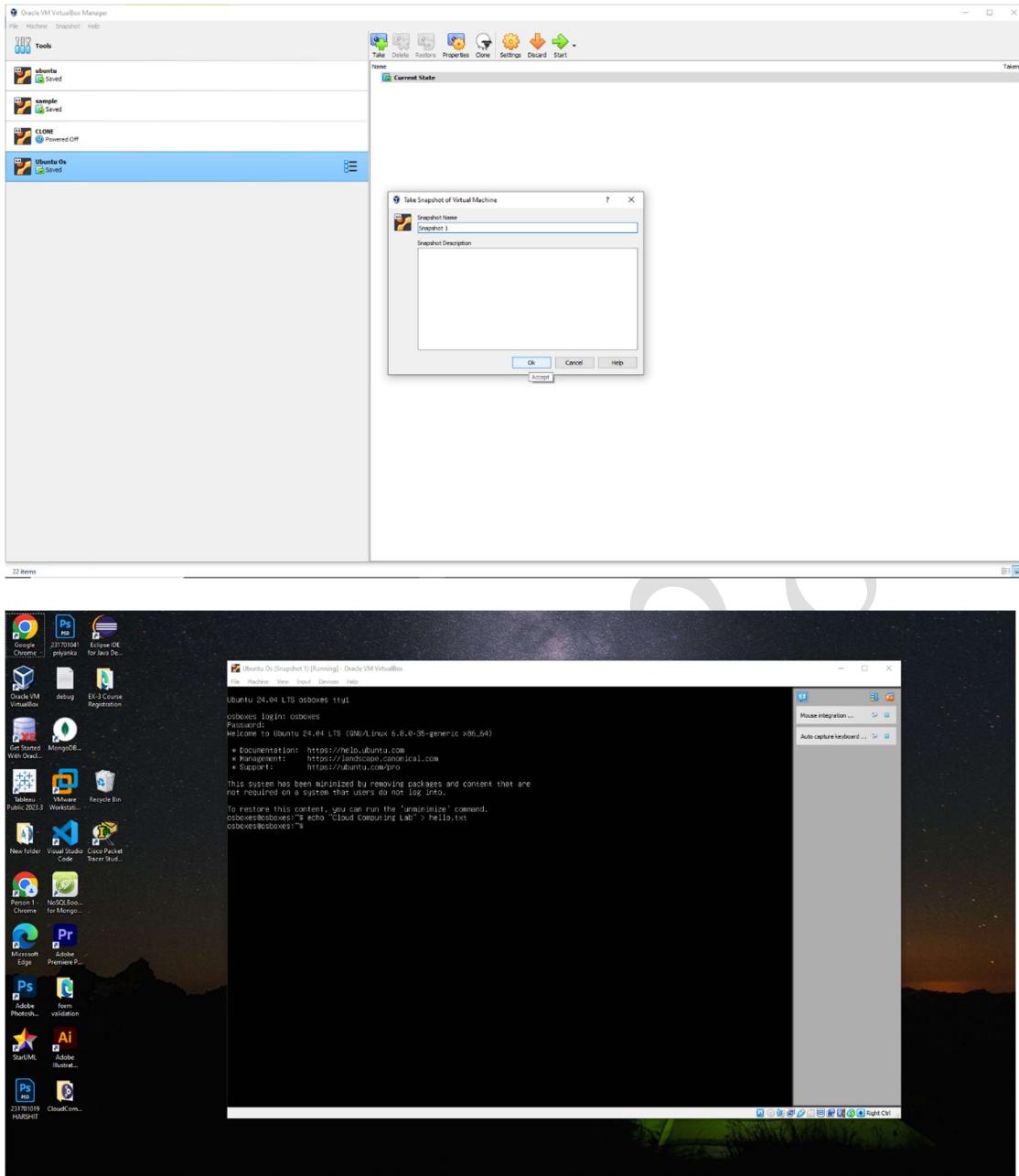
NOTE: You must power off a virtual machine before you can make a clone.

PROCEDURE FOR VM SNAPSHOT:

1. Choose VM > Snapshot > Take Snapshot

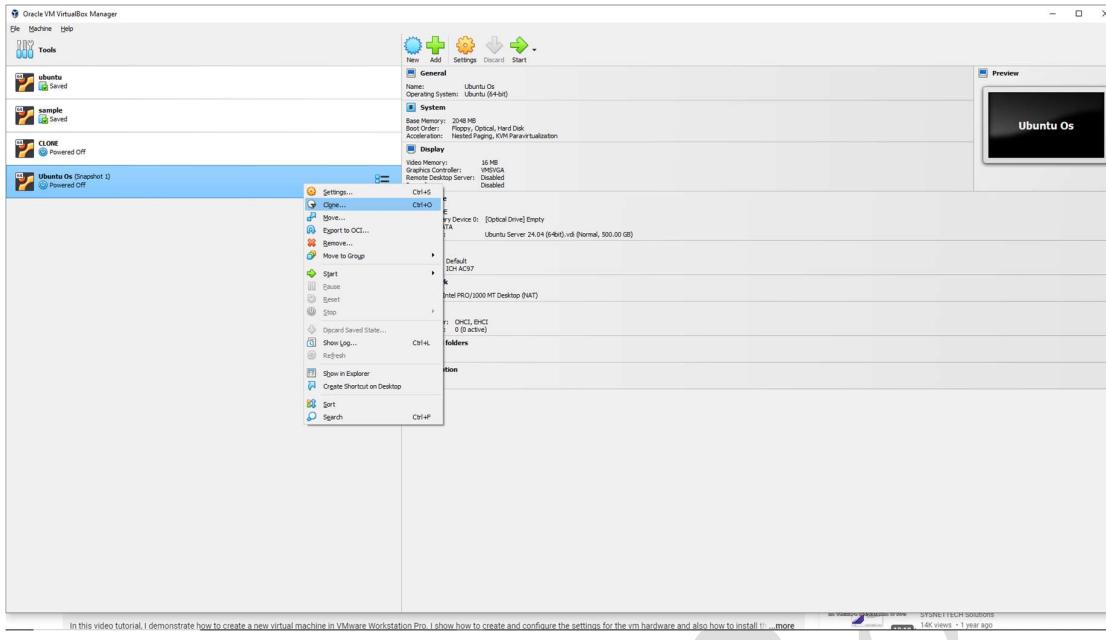
OUTPUT:



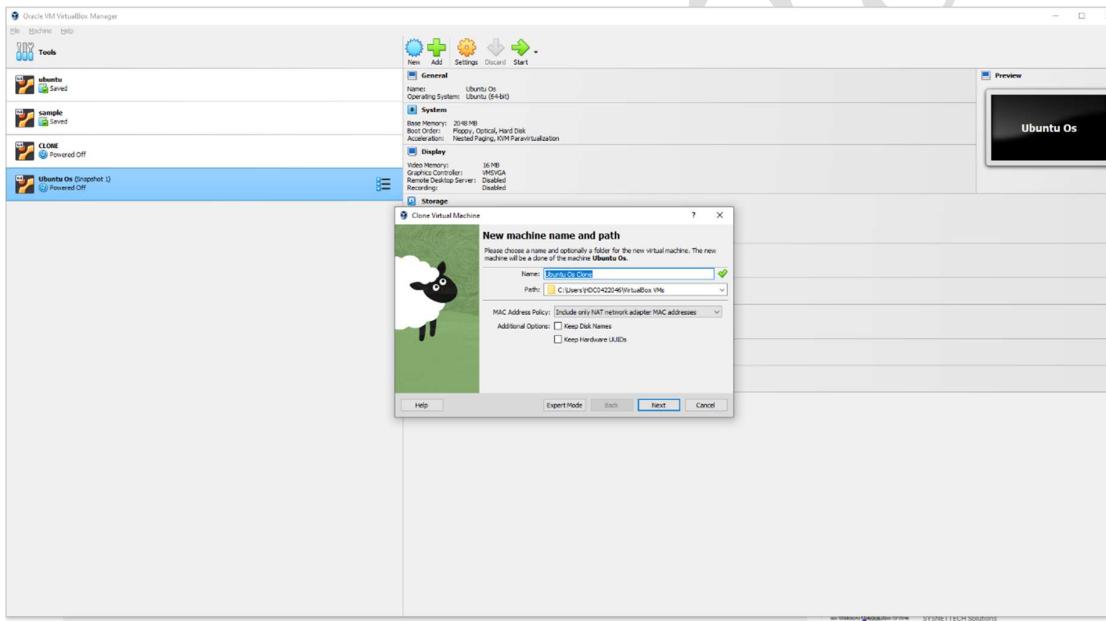


A Virtual block, Clone and Snapshot are created.

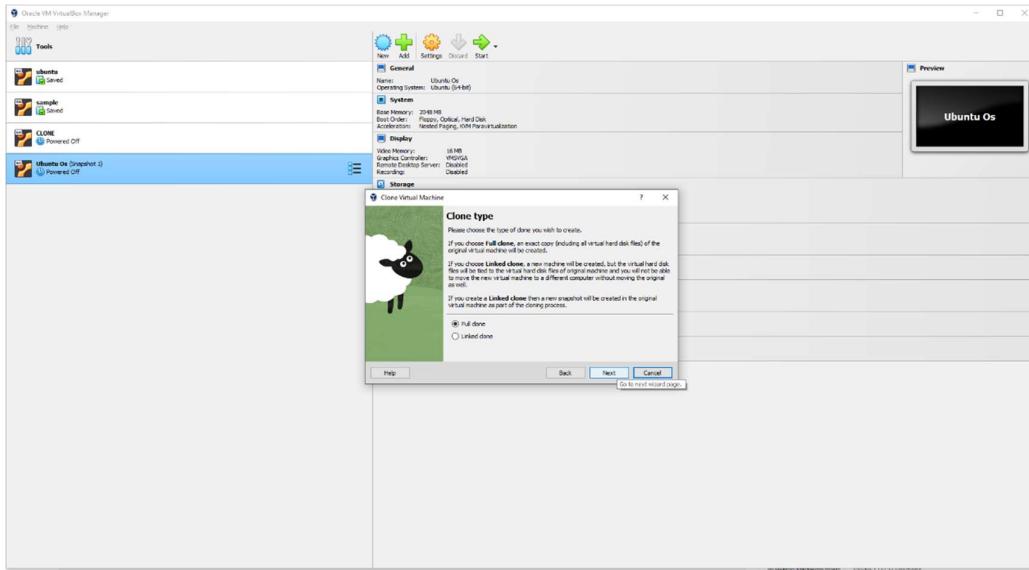
Cloning:



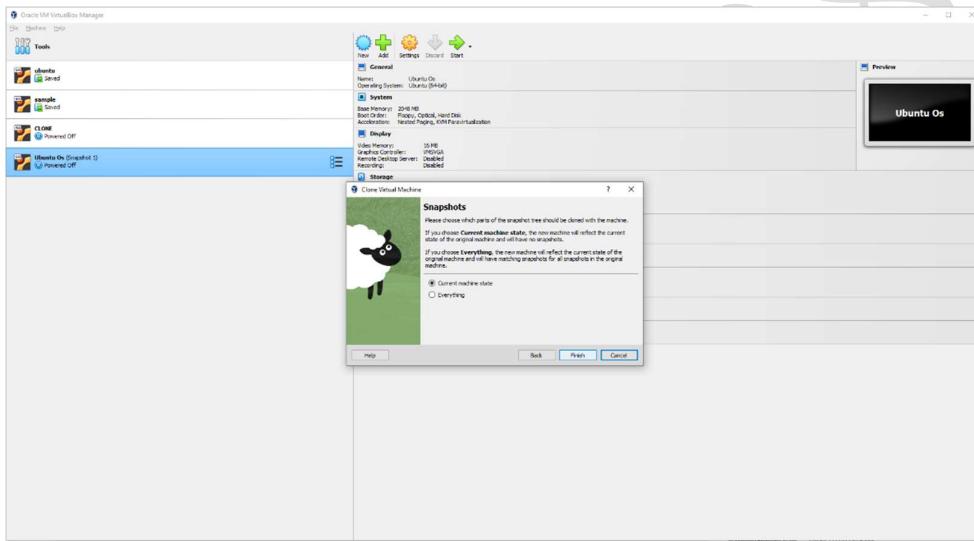
In this video tutorial, I demonstrate how to create a new virtual machine in VMware Workstation Pro. I show how to create and configure the settings for the vm hardware and also how to install it! ... more



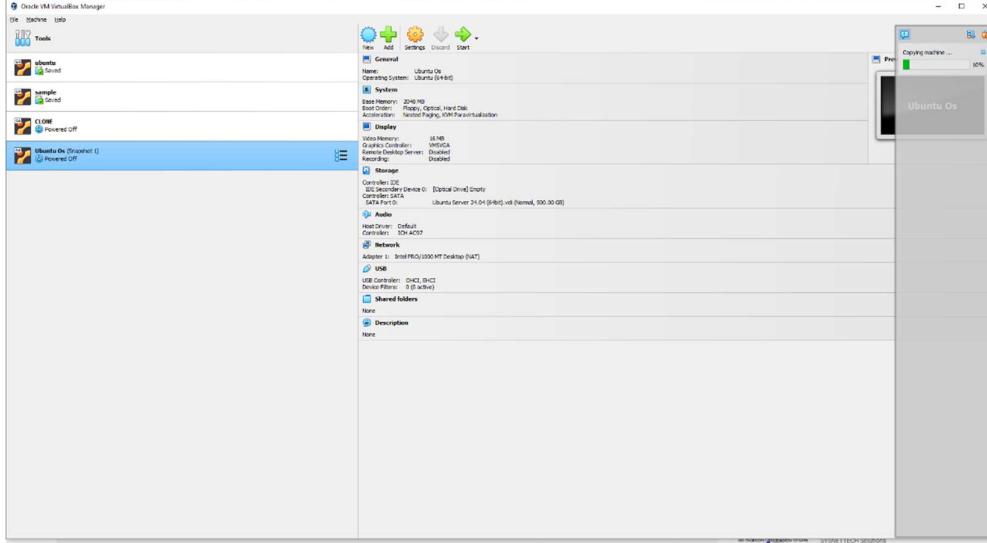
In this video tutorial, I demonstrate how to create a new virtual machine in VMware Workstation Pro. I show how to create and configure the settings for the vm hardware and also how to install it! ... more

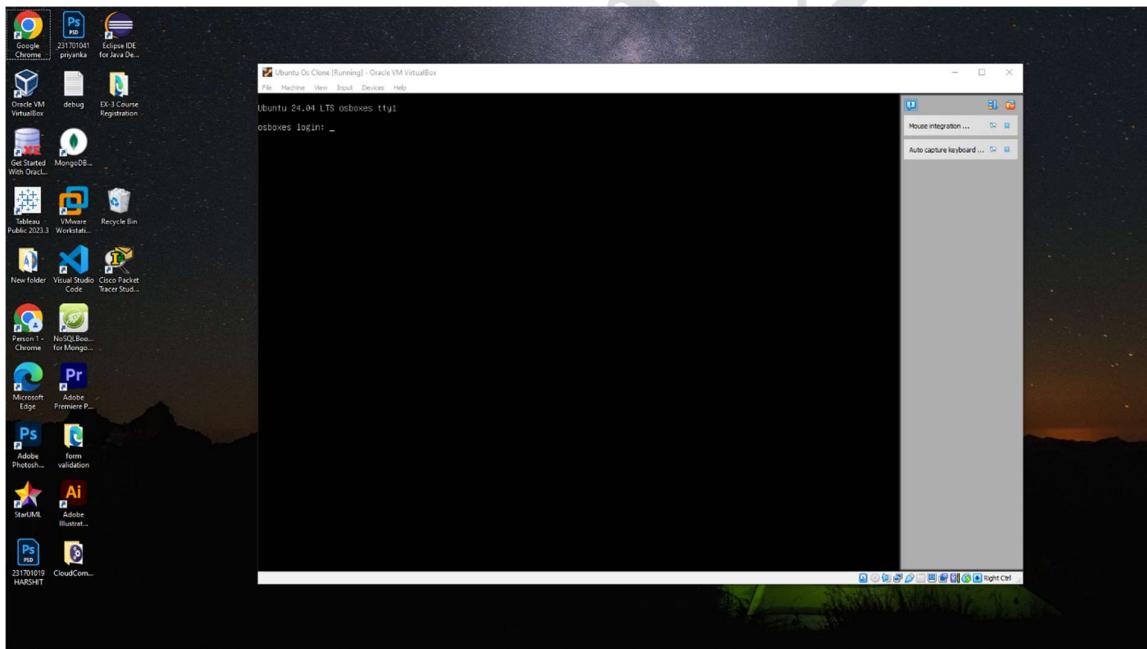
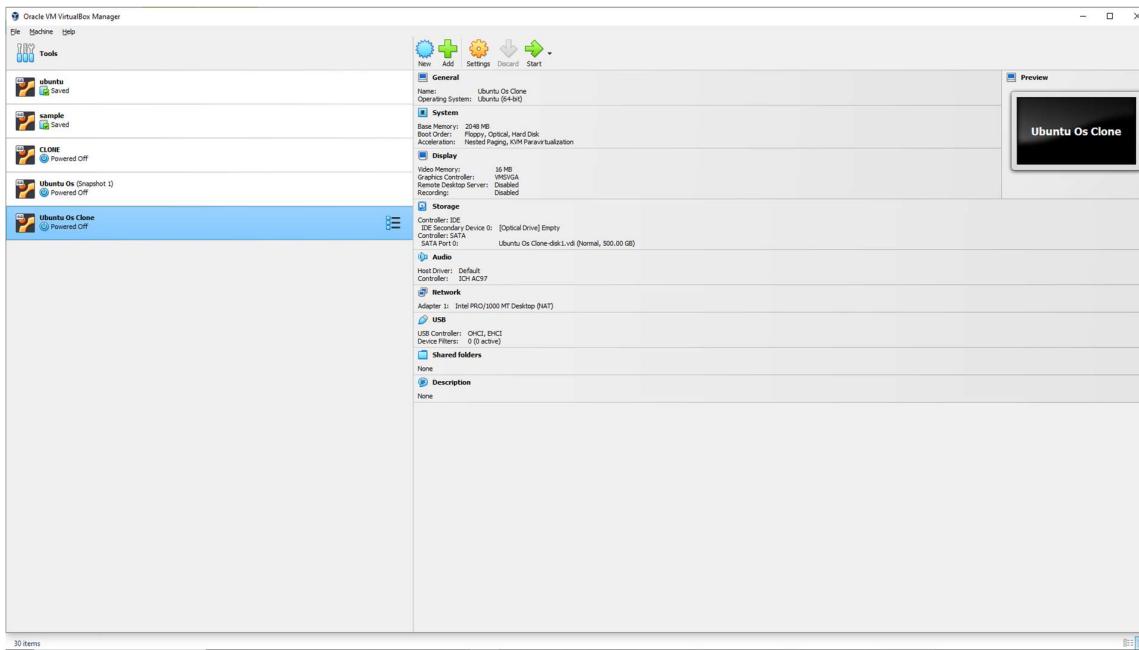


In this video tutorial, I demonstrate how to create a new virtual machine in VMware Workstation Pro. I show how to create and configure the settings for the vm hardware and also how to install ... more



In this video tutorial, I demonstrate how to create a new virtual machine in VMware Workstation Pro. I show how to create and configure the settings for the vm hardware and also how to install ... more





RESULT:

Thus a Virtual Block for a VM is configured, a copy of VM through Cloning is created and a snapshot of VM is performed.

Exp No: 3

Date:

VIRTUALIZATION INSTALLATION OF VIRTUAL MACHINE IN VIRTUAL BOX

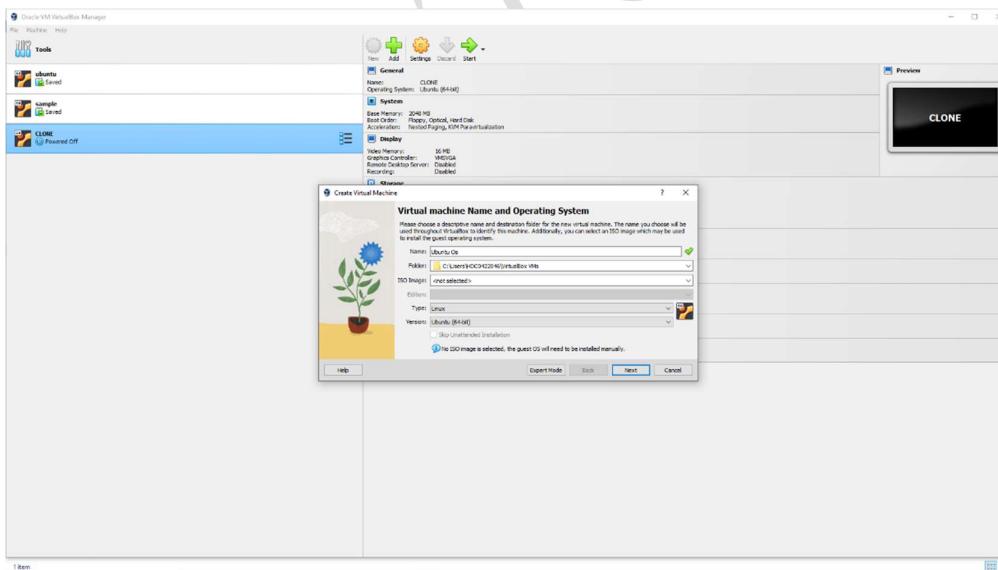
AIM:

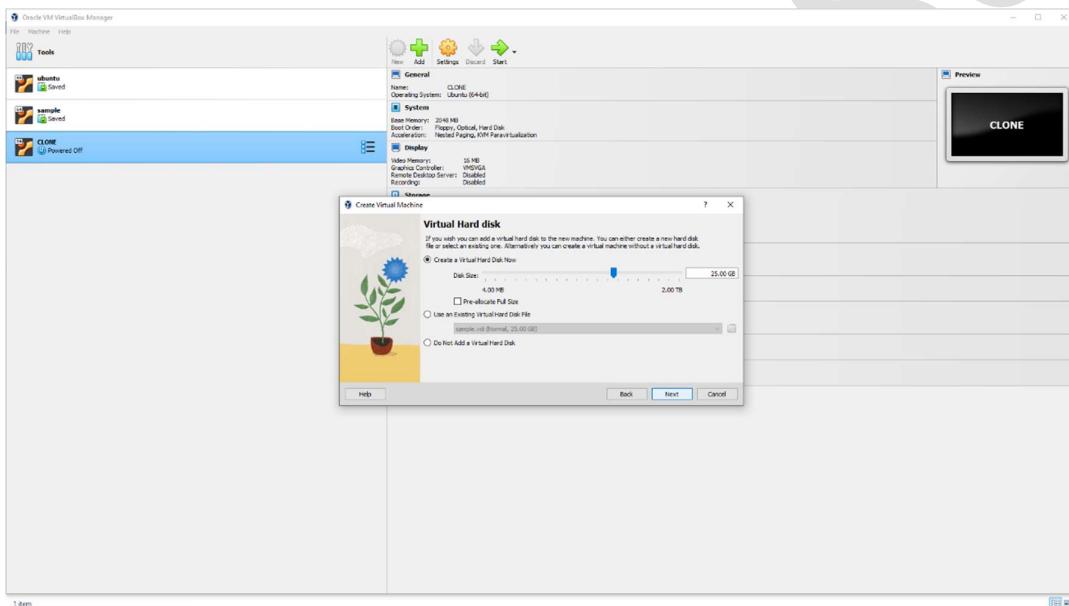
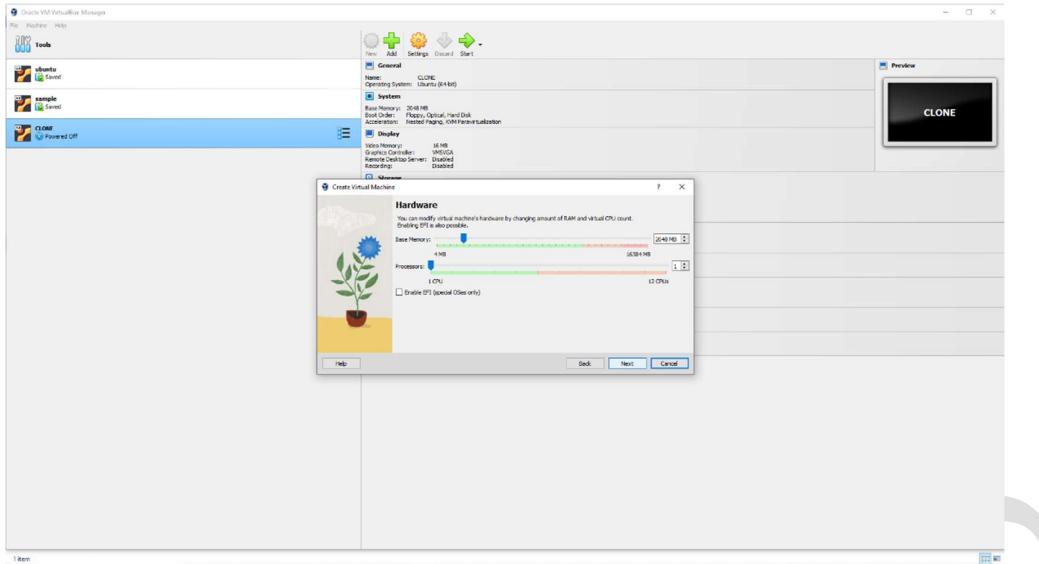
To configure a Virtual Machine using Virtual Box and Launch to execute a simple program using PYTHON.

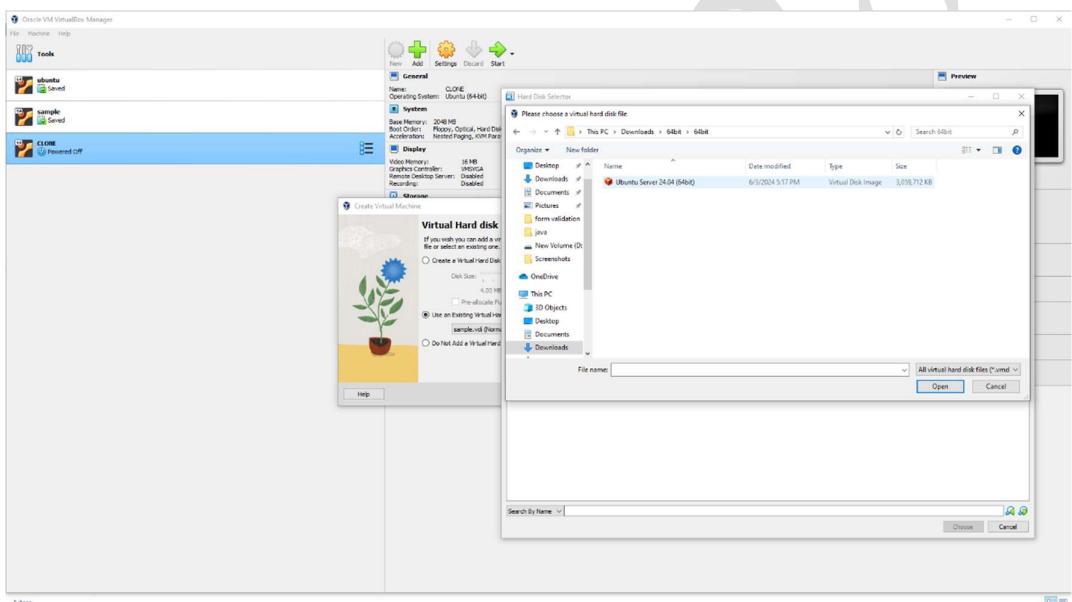
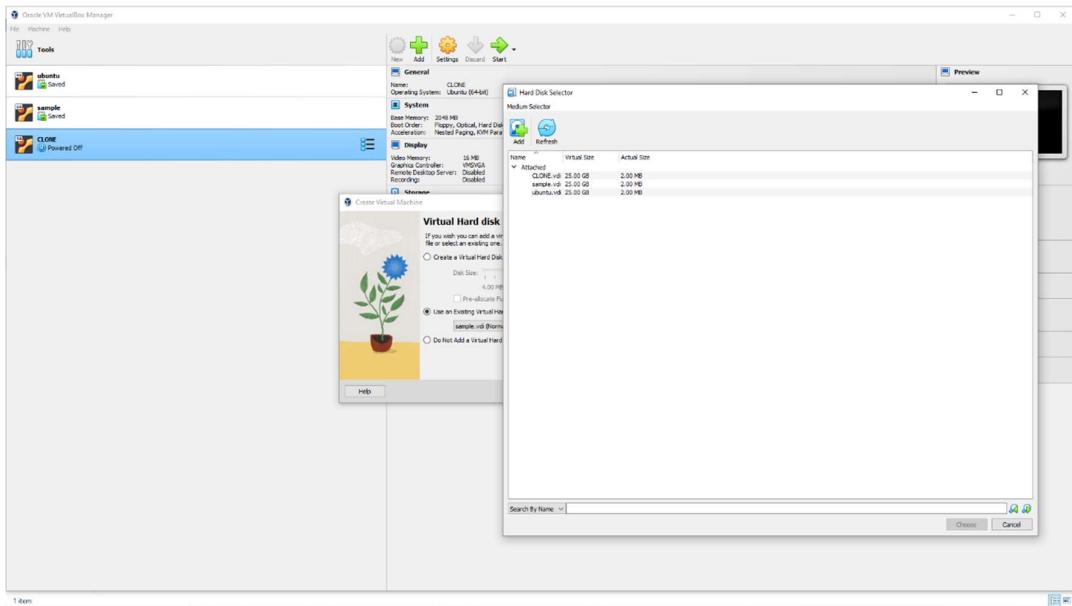
PROCEDURE:

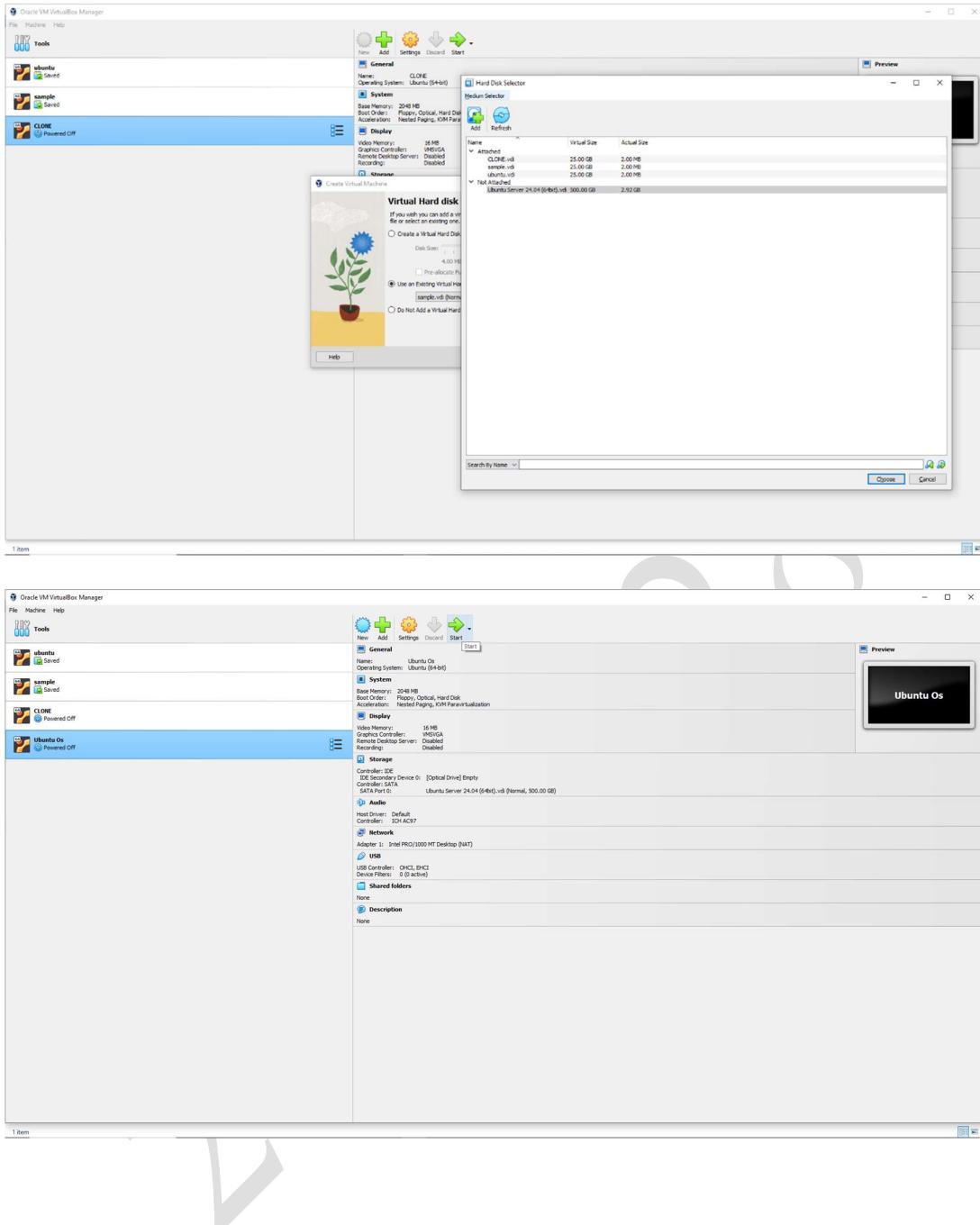
1. Launch a Virtual Box
2. Create new virtual machine
3. Customize the set-up
4. Set username and password
5. Browse for .iso file of an operating system
6. Configure the hardware capacity
7. Finish and power on the VM
8. Install C or PYTHON OR JAVA Compiler and execute a simple program

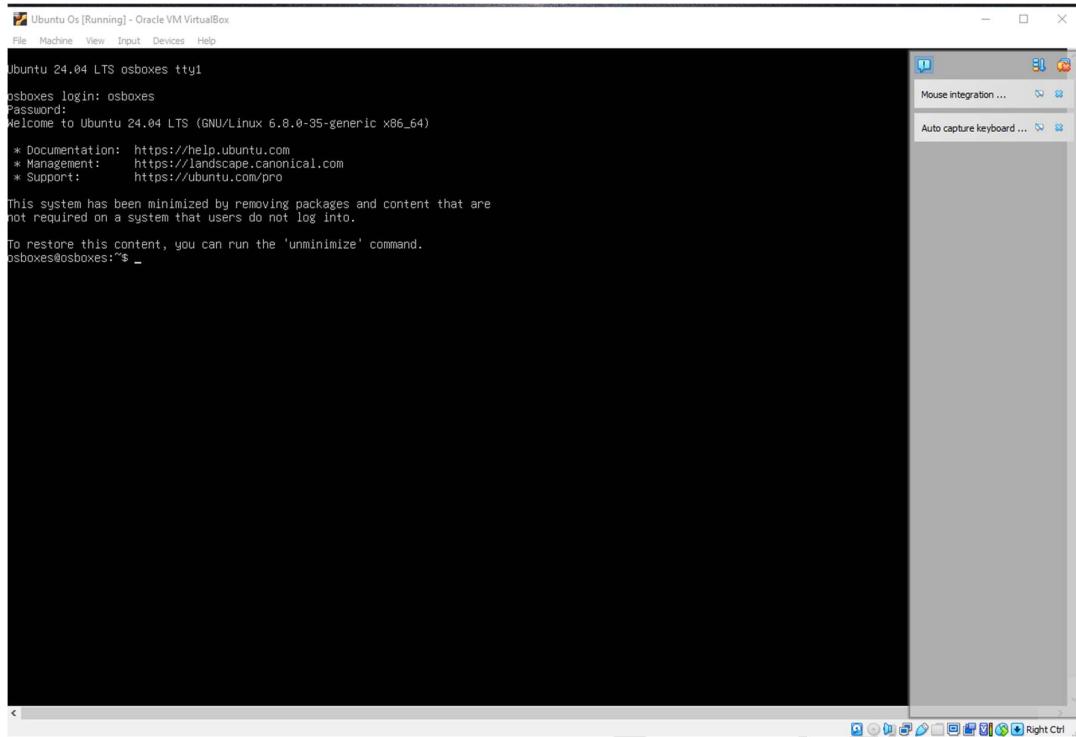
OUTPUT:











RESULT:

Thus a Virtual Machine using Virtual Box is configured.

EX. NO: 4

DATE:

PUBLIC CLOUD

CREATING AN INSTANCE IN SALESFORCE

AIM:

Develop a simple application to understand the concept of PAAS using Sales force

PROCEDURE:

1. Log in to your Salesforce account.
2. Click Setup at the upper-right corner.
3. Under the Build section, click Create and select Objects.
4. To create a custom object, click New Custom Object.
5. Enter the name of the Custom Object in Label, Plural Label, and Object Name.
6. Choose the custom apps for which the new Custom tab is required and click Save.
7. Select whether you want to define a custom app or a Salesforce console.
8. Give the app a name and description. An app name can have a maximum of 40 characters, including spaces. Click Save.

OUTPUT:

Salesforce: The Customer Comp... | Personal Information | Salesforce | New Custom Object | Salesforce | Rajalakshmi Engineering College | +

platform-force-4234.lightning.force.com/lightning/setup/ObjectManager/new

Check your email to verify your account. Just so you know, you can only log back in once you confirm your email.

Days left in Starter trial: 30 Buy Now

New Custom Object

Custom Object Definition Edit

Custom Object Information

The singular and plural labels are used in tabs, page layouts, and reports.

Label	Book	Example:	Account
Plural Label	Books	Example:	Accounts
Starts with vowel sound	<input type="checkbox"/>		

The Object Name is used when referencing the object via the API.

Object Name	Book_c	Example:	Account
-------------	--------	----------	---------

Description

Help for this Page

95°F Mostly sunny

ENG IN 02:19 PM 03-10-2024

Salesforce: The Customer Comp... | Personal Info... | New Custom... | Rajalakshmi... | Home | Sales... | Personal Info... | Home | Sales... | Object Manager | Object creat... | +

platform-force-4234.lightning.force.com/lightning/setup/ObjectManager/home

Days left in Starter trial: 30 Buy Now

Object Manager

52+ items. Sorted by Label

Activity	Activity	Standard Object
Alternative Payment Method	AlternativePaymentMethod	Standard Object
Asset	Asset	Standard Object
Asset Relationship	AssetRelationship	Standard Object
Authorization Form	AuthorizationForm	Standard Object
Authorization Form Consent	AuthorizationFormConsent	Standard Object
Authorization Form Data Use	AuthorizationFormDataUse	Standard Object
Authorization Form Text	AuthorizationFormText	Standard Object
Book	Book_c_kav	Custom Object
Business Brand	BusinessBrand	Standard Object
Cadence	ActionCadence	Standard Object
Calculated Insight Range Bound	CalculatedInsightRangeBound	Standard Object

USD/GBP +1.17%

ENG IN 02:33 PM 03-10-2024

The screenshot shows the Salesforce Setup interface with the 'Tabs' tab selected. The left sidebar includes links for Home, Contacts, Accounts, Sales, Service, Outreach, Commerce, and 'Your Acco...'. Under 'Setup', there are sections for Global Actions, Lightning App Builder, Lightning Extension, Loaded Console Tab Limit, Path Settings, Quick Text Settings, Record Page Settings, Rename Tabs and Labels, Sites and Domains, and Tabs. The 'Tabs' section is expanded, showing sub-options like Themes and Branding, Translation Workbench, User Interface, Custom Code, Development, Environments, User Engagement, Integrations, and Notification Builder. The main content area displays tabs categorized into Custom Object Tabs, Web Tabs, Visualforce Tabs, and Lightning Component Tabs. A single entry for 'Books' is listed under Custom Object Tabs. The status bar at the bottom indicates it's 03-10-2024, 02:35 PM, ENG IN.

The screenshot shows the Salesforce Setup interface with the 'Navigation Menus' page selected. The left sidebar is identical to the previous screenshot. The main content area is titled 'New Lightning App' and contains sections for 'App Details & Branding' and 'Org Theme Options'. In the 'App Details' section, fields for 'App Name' (Name your app...), 'Developer Name' (Enter a developer name...), and 'Description' (Enter a description...) are present. In the 'App Branding' section, there is a placeholder for an 'Image' with a 'Upload' button, and a color picker set to '#0070D2'. A checkbox for 'Org Theme Options' is available. At the bottom, a progress bar shows steps 10 through 12, with step 11 currently active. Step 11 details are: Platform, Platform, The fundamental Lightning Platform, 03/10/2024, 12:59 pm, Classic. Step 12 details are: Sales, Sales, The world's most popular sales force automation (SFA) solution, 03/10/2024, 12:59 pm, Classic. A 'Next' button is visible in the bottom right corner. The status bar at the bottom indicates it's 03-10-2024, 02:37 PM, ENG IN.

Salesforce | Personal Info | New Cust... | Rajalakshmi | App Manager | Home | Sales | Object creation | Home | Sales | Personal Info | Home | Sales | + Days left in Starter trial: 30 Buy Now

platform-force-4234.lightning.force.com/lightning/setup/NavigationMenus/home

New Lightning App

Available Profiles

- Contract Manager
- Marketing User
- Minimum Access - Salesforce
- Sales Insights Integration User
- SalesforceIQ Integration User
- Solution Manager

Selected Profiles

- System Administrator
- External Apps Login User
- Standard User

Save & Finish

Back

User Engagement Platform Sales

10 Outreach 11 Platform 12 Sales

For Starter Orgs, zero implemented emails to lists of prospective customers 03/10/2024, 12:59 pm Lightning

03/10/2024, 12:59 pm Classic 03/10/2024, 12:59 pm Classic

Upcoming Earnings Search ENG IN 02:40 PM 03-10-2024

Home | Salesforce | Object Manager | Salesforce

Check your email to verify your account. Just so you know, you can only log back in once you confirm your email.

Your Recommended Tours ▾

Leave Feedback | 30 Days left in trial | Buy Now

SETUP Object Manager

48 items. Sorted by Label

Search Setup

Quick Find Schema Builder Create

Custom Object
Custom Object from Spreadsheet

LABEL	API NAME	TYPE	DESCRIPTION	LAST MODIFIED
Account	Account	Standard Object		
Account Contact Relationship	AccountContactRelation	Standard Object		
Activity	Activity	Standard Object		
Asset	Asset	Standard Object		
Asset Relationship	AssetRelationship	Standard Object		
Campaign	Campaign	Standard Object		
Campaign Influence	CampaignInfluence	Standard Object		
Campaign Member	CampaignMember	Standard Object		
Case	Case	Standard Object		
Contact	Contact	Standard Object		
Contact Request	ContactRequest	Standard Object		

https://ruby-computing-1407.lightning.force.com/lightning/setup/ObjectManager/new

89°F Partly sunny

The screenshot shows the Salesforce Object Manager interface. The top navigation bar has tabs for 'Home | Salesforce' and 'Cup | Salesforce'. The URL is <https://ruby-computing-1407.lightning.force.com/lightning/setup/ObjectManager/01IdN0000014WqL/Details/view>. A banner at the top says 'Check your email to verify your account. Just so you know, you can only log back in once you confirm your email.' The main area is titled 'Cup' under 'SETUP > OBJECT MANAGER'. On the left, a sidebar lists various object settings like Fields & Relationships, Page Layouts, and Triggers. The right panel shows the 'Details' section for the 'Cup' object, including fields for API Name (Cup_O__c), Singular Label (Cup), Plural Label (Cups), and other configuration options like Enable Reports and Track Activities.

The screenshot shows the Salesforce Custom Tabs setup page. The top navigation bar has tabs for 'Home | Salesforce' and 'Tabs | Salesforce'. The URL is <https://ruby-computing-1407.lightning.force.com/lightning/setup/CustomTabs/home>. A banner at the top says 'Check your email to verify your account. Just so you know, you can only log back in once you confirm your email.' The main area is titled 'Custom Tabs' under 'SETUP > TABS'. On the left, a sidebar shows 'User Interface' settings, with 'Tabs' selected. The right panel provides information about creating custom tabs and lists sections for 'Custom Object Tabs', 'Web Tabs', 'Visualforce Tabs', and 'Lightning Component Tabs', each with a 'New' button and 'What Is This?' link.

Screenshot 1: New Custom Object Tab - Step 2, Add to Profiles

The screenshot shows the Salesforce Setup interface for creating a new custom object tab. The page title is "New Custom Object Tab" and the sub-section is "Step 2, Add to Profiles". It asks to choose user profiles for visibility. A radio button is selected for "Apply one tab visibility to all profiles [Default On]". Below this, a table lists profiles with their corresponding tab visibility settings. Most profiles have "Default On" selected.

Profile	Tab Visibility
Analytics Cloud Integration User	Default On
Analytics Cloud Security User	Default On
Contract Manager	Default On
CPQ Integration User	Default On
End User	Default On
Executive Sponsor	Default On
Identity User	Default On
Marketing User	Default On

Screenshot 2: Lightning Experience App Manager

The screenshot shows the Salesforce Setup interface for managing apps. The page title is "Lightning Experience App Manager". It displays a list of 18 items sorted by app name. The columns include App Name, Developer Name, Description, Last Modified, App Type, and Vi... (View). The "App Type" column shows various categories like Classic, Lightning, and Connected.

App Name	Developer Name	Description	Last Modified	App Type
All Tabs	AllTabSet		05/10/2024, 10:28 am	Classic
Automation	FlowsApp	Automate business processes and repetitive tasks.	05/10/2024, 10:29 am	Lightning
Community	Community	Salesforce CRM Communities	05/10/2024, 10:28 am	Classic
CPQ Integration User Connected A...	CPQIntegrationUserApp		05/10/2024, 10:28 am	Connected
Digital Experiences	SalesforceCMS	Manage content and media for all of your sites.	05/10/2024, 10:28 am	Lightning
Inside Sales	Inside_Sales	Generate leads faster, and qualify and nurture prospects using best practices.	05/10/2024, 10:28 am	Lightning
Marketing CRM Classic	Marketing	Track sales and marketing efforts with CRM objects.	05/10/2024, 10:28 am	Classic
Platform	Platform	The fundamental Lightning Platform	05/10/2024, 10:28 am	Classic
Sales	Sales	The world's most popular sales force automation (SFA) solution	05/10/2024, 10:28 am	Classic
Sales Console	LightningSalesConsole	(Lightning Experience) Lets sales reps work with multiple records on one scre...	05/10/2024, 10:30 am	Lightning
Sales Leader	Sales_Leader	Monitor sales activity, and guide your team to help them meet and exceed sa...	05/10/2024, 10:28 am	Lightning

New Lightning App

User Type
Analytics Cloud Integration User
Analytics Cloud Security User
Contract Manager
CPQ Integration User
Executive Sponsor
Identity User
Minimum Access - Salesforce
Solution Manager
Standard User
System Administrator
Marketing User
Read Only

Setup

Lightning Experience App Manager

App Name	Developer Name	Description	Last Modified	Type
AllTabs	AllTabSet		05/10/2024, 10:28 am	Classic
Automation	FlowsApp	Automate business processes and repetitive tasks.	05/10/2024, 10:29 am	Lightning
Community	Community	Salesforce CRM Communities	05/10/2024, 10:28 am	Classic
CPQ Integration User Connected A...	CPQIntegrationUserApp		05/10/2024, 10:28 am	Connected
CUP_APP	CUP_APP		05/10/2024, 11:48 am	Lightning
Digital Experiences	SalesforceCMS	Manage content and media for all of your sites.	05/10/2024, 10:28 am	Lightning
Inside_Sales	Inside_Sales	Generate leads faster, and qualify and nurture prospects using best practices.	05/10/2024, 10:28 am	Lightning
Marketing CRM Classic	Marketing	Track sales and marketing efforts with CRM objects.	05/10/2024, 10:28 am	Classic
Platform	Platform	The fundamental Lightning Platform	05/10/2024, 10:28 am	Classic
Sales	Sales	The world's most popular sales force automation (SFA) solution	05/10/2024, 10:28 am	Classic
LightningSales	LightningSales	Sell smarter and faster with the world's #1 CRM solution.	05/10/2024, 10:30 am	Lightning
Sales Console	LightningSalesConsole	(Lightning Experience) Lets sales reps work with multiple records on one screen.	05/10/2024, 10:28 am	Lightning

RESULT:

Thus a simple application to understand concept of PAAS using Salesforce is implemented.

PUBLIC CLOUD

CREATING AN INSTANCE IN IBM CLOUD

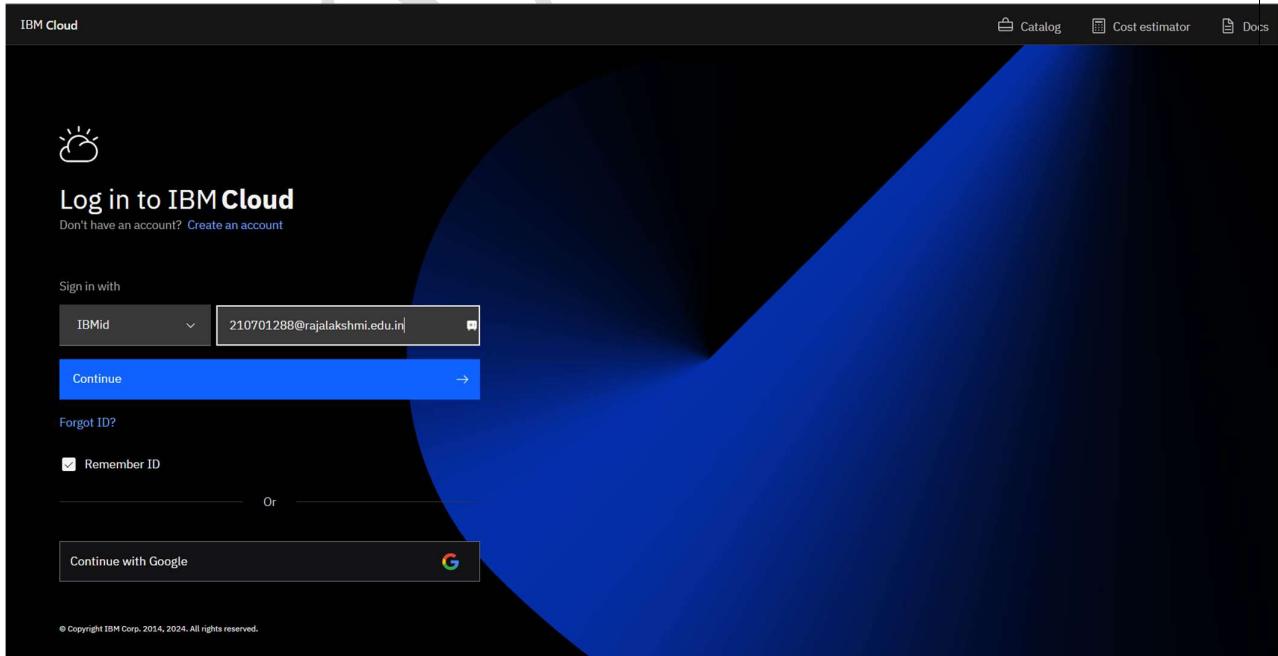
AIM:

Develop a simple application to understand the concept of PAAS using IBM CLOUD

PROCEDURE:

1. In the IBM Cloud console, go to Menu icon > VPC Infrastructure > Compute > Virtual server instances.
2. Click Create and enter the information required.
3. Click Create virtual server instance when you are ready to provision

OUTPUT:



The screenshot shows the IBM Cloud Catalog interface. At the top, there's a search bar and navigation links for Catalog, Manage, and account settings. Below the header is a 3D isometric illustration of a cityscape with people interacting with cloud components. The main area is titled "Catalog" and includes a dropdown for "IBM Cloud catalog" and a search bar. A navigation bar below the title has tabs for "All products" (which is selected), Deployable architectures, Cloud essentials, IBM products, Partner products, and Professional services. A dropdown menu for "Relevance" is open. On the left, a sidebar titled "Category" lists Compute, Containers, Networking, Storage, Converged infrastructure, and Enterprise applications. The main content area displays several service cards:

- Cloud Object Storage on VPC for SAP HANA Backup** (By IBM): Deploy the capability to backup an SAP HANA database to IBM Cloud Object Storage in a single step. Tags: Deployable architecture, SAP Certified.
- DevSecOps Application Lifecycle Management** (By IBM): DevSecOps provides a set of predefined continuous integration, continuous deployment and continuous compliance toolchain templates. Tags: Deployable architecture, Terraform IBM Modules (TIM).
- IBM Cloud Essential Security and Observability Services** (By IBM): Deploy core security and other supporting services to get set up to manage the security compliance of the resources in your account. Tags: Deployable architecture, Terraform IBM Modules (TIM).

The screenshot shows the IBM Cloud Dashboard. At the top, there's a search bar and navigation links for Catalog, Manage, and account settings. A "Create resource" button is also present. The main area is titled "Dashboard" and includes a sidebar with icons for various services. The dashboard itself has sections for "For you", "News", "Recent support cases", "Planned maintenance", and "IBM Cloud status".

For you:

- Build**: Explore IBM Cloud with this selection of easy starter tutorials and services. Status: Getting started, 15 min.
- Build a web app with Watson Speech to Text**: Deploy a conversational interface compatible with any application, device, or channel. Status: Popular, 2 hr.
- Get Started with Watson Studio**: Get started with using AI and Cloud Object Storage in 15 minutes. Status: Getting started, 7 min.
- Build a Virtual Private Cloud (VPC)**: Upgrade to a paid account to create your own protected space in the IBM Cloud. Status: Recommended, 5 min.
- Learn about IAM Roles**: Learn about roles in IBM Cloud and how they work to control access. Status: Getting started.
- Build a virtual machine**: Lift and shift your VM workloads to the IBM Cloud. Status: Getting started.

News:

- IBM Tech Now: November 21, 2022
- Introducing Badges to IBM Cloud Certification
- Announcing IBM SevOne Network Performance Management Version 6.4
- IBM Named a Leader in Gartner Magic Quadrant for Full Life Cycle API Management

Recent support cases, **Planned maintenance**, and **IBM Cloud status** sections are also visible.

NAME	EMAIL	PASSWORD	GI
Varun	fdhjdf@gmail.com	1234	M
Sujan	sujan.g.2019.cse@rajalakshmi.edu.in	\$2b\$12\$Tm9rhwJ.oV8tHXVMamhkqeoGPaG7XjVN/g/7TqwAfKMAR.ON3DNHu	M
thuhin@gmail.com	thuhin@gmail.com	\$2b\$12\$Ja6EnNS21k646qZ8duh5VuIBpEglqsAaJ4Xtx8kkI5w3xKkBjJuJ6	M
admin	admin@gmail.com	\$2b\$12\$HS9zQHsfmbVJHI.dWs9FeO3QlfqHFFmlL7l.1O/b0Llc/Xa511AF6	M
guest	sujanraju4000@gmail.com	\$2b\$12\$2AcCVS25w.Gc0ep4JWc3Ozy/Gp5SUgnf.thqOqUr3aMPjtYaoCy	M

RESULT:

Thus, a simple application to understand the concept of PAAS using IBM CLOUD is implemented.

PUBLIC CLOUD

CREATING AN INSTANCE IN MICROSOFT AZURE

AIM:

Develop a simple application to understand the concept of PAAS using Microsoft Azure

PROCEDURE:

1. Sign in to the Azure portal
2. Select Azure SQL on the left menu of the Azure portal.
3. Select +Add to open the Select SQL deployment option page.
4. Select Create.

OUTPUT:

The screenshot shows the Microsoft Azure portal homepage. At the top, there's a search bar and a user profile with the email 'thamizhbharathi22@outlook.com' and 'RESTRICTED TENANT'. Below the header, a 'Welcome to Azure!' message is displayed, along with options for a free trial, managing Microsoft Entra ID, and access student benefits. The main area is titled 'Azure services' and shows icons for various services like Create a resource, Quickstart Center, Azure AI services, Kubernetes services, Virtual machines, App Services, Storage accounts, SQL databases, Azure Cosmos DB, and More services. At the bottom, there are tabs for 'Recent' and 'Favorite' resources.

Welcome to Azure!

Don't have a subscription? Check out the following options.

SQL databases

Description
Utilize a fully managed relational database service, perfect for accelerating application development and simplifying management tasks.

Free training from Microsoft

- Provision an Azure SQL database to store a... 5 units - 50 min
- Secure your Azure SQL Database 8 units - 1 hr 7 min
- Scale multiple Azure SQL Databases with SQ... 7 units - 39 min

Useful links

- Overview
- Get started
- Documentation

Manage Microsoft Entra ID
Manage access, set smart policies, and enhance security with Microsoft Entra ID.

Access student benefits
Get free software, Azure credit, or access Azure Dev Tools for Teaching after you verify your academic status.

Kubernetes services **Virtual machines** **App Services** **Storage accounts** **SQL databases** **Azure Cosmos DB** **More services**

<https://portal.azure.com/#blade/HubsExtension/BrowseResourceBlade/resourceType/Microsoft.Sql%2Fservers%2fdatabases>

Microsoft Azure

All services > **Free services** ...

Services that include monthly free amounts for 12 months

For 12 months after signup, new customers can use up to the specified monthly free amount of each of these services without getting charged. **Service usage is billed at the pay-as-you-go rate after you reach the monthly limit.** To learn more, see the [Azure free account FAQ](#).

Give feedback

Windows Virtual Machine <small>COMPUTE</small>	Linux Virtual Machine <small>COMPUTE</small>	Azure Managed Disks <small>STORAGE</small>	Azure Blob Storage <small>STORAGE</small>
750 hours each of B1s and B2sats v2 (AMD-based) burstable VMs. Create Windows virtual machines (VMs) in seconds to meet your workload and budget needs. Learn more	750 hours each of B1s and B2sats v2 (AMD-based) burstable VMs. Create Linux virtual machines (VMs) in seconds to meet your workload and budget needs. Learn more	64 GB x 2 (P6) solid state drives SSD storage, plus 1 GB snapshot and 2 million I/O operations Get high performance, durable block storage for Azure Virtual Machines with simplified management. Learn more	5 GB locally redundant storage (LRS) hot block with 20,000 read and 10,000 write operations Use massively-scalable object storage for any type of unstructured data. Learn more
Create	Create	Create	Create
Azure Files <small>STORAGE</small>	Key Vault <small>SECURITY</small>	Azure Media Services Encoding <small>MEDIA</small>	Azure Database for MySQL <small>DATABASES</small>
100GB of LRS transaction optimized, hot, and cool files, 2 million read, list, and other file operations Migrate to simple, distributed, cross-platform file storage without changing	10,000 transactions RSA 2048-bit keys or secret operations, Standard tier. Safeguard and maintain control of keys and other secrets. Learn more	20 output minutes Standard encoder video or audio source file encoding. Index, package, protect, and stream video and audio at scale. Learn more	750 hours of Flexible Server—Burstable B1MS Instance, 32 GB storage, and 32 GB backup storage Host a fully managed, scalable MySQL database in Azure. Learn more
Create	Create	Create	Create

Microsoft Azure

All services > Free services >

Flexible server

Microsoft

Select one subscription to manage deployed resources and costs. Use resource groups like folders to organize and manage all your resources.

Subscription * Resource group * Create new

Server details

Enter required settings for this server, including picking a location and configuring the compute and storage resources.

Server name * ✓

Region * ✓

Availability zone * ✓

Authentication

Admin username * ✓

Password * ✓

Confirm password * ✓

Workload details (Compare workload type)

Workload type *

Choose one of these workload types to quickly configure the server based on your needs. You can modify the configuration after creation.

Estimated total INR 1705.91/month

Prices reflect an estimates only. View Azure pricing calculator. Final charges will appear in your local currency in cost analysis and billing views.

Storage INR 217.97/month

Storage selected 20 GiB (INR 10.898503 per GiB) 20 x 10.898503

Auto scale IOPS

Auto scale IOPS is billed on usage in per million request increments. Learn more

Backup Retention

Backup retention is billed based on additional storage used for retaining backups. Learn more

Bandwidth

For outbound data transfer across services in different regions will incur additional charges. Any inbound data transfer is free. Learn more

Review + create **Next : Tags >**

Microsoft Azure

All services > Free services >

Flexible server

Microsoft

Server name cannot be changed after server is created. Review these options carefully before provisioning.

Basics **Tags** **Review**

Creation time

Estimated Server Creation Time (in minutes) 5

Product details

Azure Database for MySQL
by Microsoft
[Terms of use](#) | [Privacy policy](#)

Basics

Subscription	Azure for Students
Resource group	CC_Lab
Server name	check
Server admin login name	admin
Location	South India
Availability zone	No preference
High availability	Disabled
MySQL version	8.0
Workload type	Dev/Test

Estimated costs

Compute Sku INR 1487.94/month

Standard_B1ms 1487.94

Storage INR 217.97/month

Storage selected 20 GiB (INR 10.898503 per GiB) 20 x 10.898503

Auto scale IOPS

Auto scale IOPS is billed on usage in per million request increments. Learn more

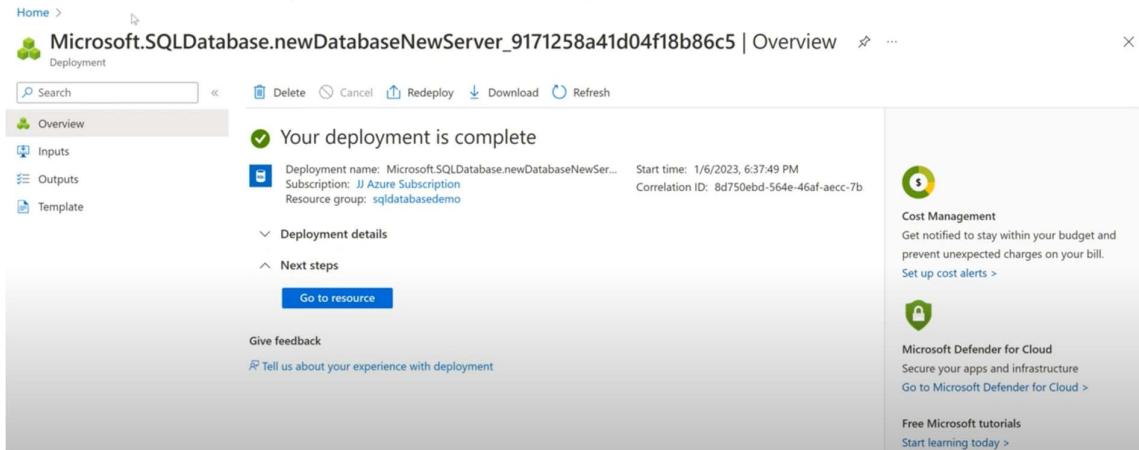
Backup Retention

Backup retention is billed based on additional storage used for retaining backups. Learn more

Bandwidth

For outbound data transfer across services in different regions will incur additional charges. Any inbound data transfer is free. Learn more

Create **< Previous : Tags** **Download a template for automation**



RESULT:

Thus a simple application to understand the concept of PAAS using Microsoft Azure is developed.

Exp No: 7

Date :

CLOUD SIMULATION **MODEL CLOUD ENVIRONMENT USING CLOUD SIM**

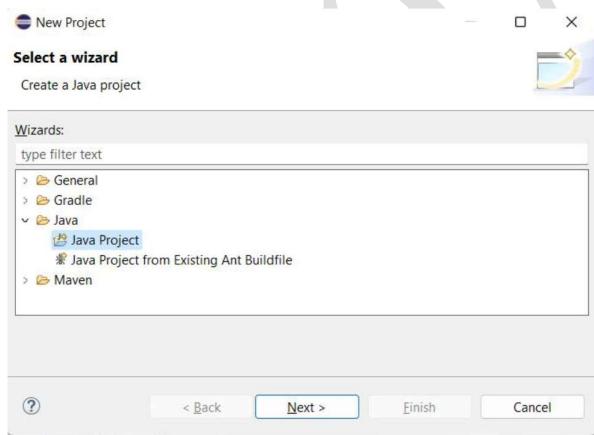
AIM:

To model the cloud environment using cloud sim tools.

PROCEDURE:

1. Now within the Eclipse window navigate the menu: File -> New -> Project, to open the new project wizard.
2. Select the ‘Java Project’ from the window popup and click Next.
3. Unselect the ‘Use default location’ option and then click on ‘Browse’ to open the path where you have unzipped the Cloudsim project and finally click Next to set project settings.
4. Now select the example program from folder examples from the unzipped folder.
5. Run the sample program

OUTPUT:



The screenshot shows the Eclipse IDE interface. The top window is the Package Explorer, displaying the project structure of 'Cloud_sim_project'. It includes source packages like 'org.cloudbus.cloudsim' and 'org.cloudbus.cloudsim.core', and various Java files such as 'CloudSimExample1.java', 'CloudSimExample2.java', and 'CloudSimExample3.java'. Below the Package Explorer is the CloudSimExample1.java code editor. The code is as follows:

```

1 package org.cloudbus.cloudsim.examples;
2
4 * * Title: CloudSim Toolkit
11
12*import java.text.DecimalFormat;
36
37 /**
38 * A simple example showing how to create a datacenter with one host and run one
39 * cloudlet on it.
40 */
41 public class CloudSimExample1 {
42
43     /** The cloudlet list. */
44     private static List<Cloudlet> cloudletlist;
45
46     /** The vmlist. */
47     private static List<Vm> vmlist;
48
49     /**
50      * Creates main() to run this example.
51      *
52      * @param args the args
53      */
54     public static void main(String[] args) {
55
56         Log.println("Starting CloudSimExample1...");
57
58         try {
59             // First step: Initialize the CloudSim package. It should be called
60             // before creating any entities.
61             int num_user = 1; // number of cloud users
62             Calendar calendar = Calendar.getInstance();
63             boolean trace_flag = false; // mean trace events
64
65             // Initialize the CloudSim library
66             CloudSim.init(num_user, calendar, trace_flag);
67
68             // Second step: Create Datacenters
69             // Datacenters are the resource providers in CloudSim. We need at
70             // least one of them to run a CloudSim simulation
71             Datacenter datacenter0 = createDatacenter("Datacenter_0");
72
73             // Third step: Create Broker

```

Screenshot of Eclipse IDE showing CloudSimExample1.java code and its execution output.

```

CloudSimExample1.java
1 package org.cloudbus.cloudsim.examples;
2
3 * Title:      CloudSim Toolkit
4
5 import java.text.DecimalFormat;
6
7 /**
8  * A simple example showing how to create a da
9  * cloudlet on it.
10 */
11 public class CloudSimExample1 {
12     /** The cloudlet list. */
13     private static List<Cloudlet> cloudletList;
14
15     /** The vmlist. */
16     private static List<Vm> vmlist;
17
18     /**
19      * Creates main() to run this example.
20      * @param args the args
21      */
22     public static void main(String[] args) {
23
24         Log.println("Starting CloudSimExample1...");
25
26         try {
27             // First step: Initialize the CloudSim package. It should be called
28             // before creating any entities.
29             int numUser = 1; // number of cloud users
30             Calendar calendar = Calendar.getInstance();
31             boolean trace_flag = false; // mean trace events
32
33             // Initialize the CloudSim library
34             CloudSim.init(numUser, calendar, trace_flag);
35
36             // Second step: Create Datacenters
37             // Datacenters are the resource providers in CloudSim. We need at
38             // least one of them to run a CloudSim simulation
39             Datacenter datacenter0 = createDatacenter("Datacenter_0");
40
41             // Third step: Create Broker

```

Console Output:

```

Simulation: No more future events
CloudInformationService: Notify all CloudSim entities for shutting down.
Datacenter_0 is shutting down...
Broker is shutting down...
Simulation completed.
Simulation completed.

=====
Cloudlet ID STATUS Data center ID VM ID Time Start Time Finish Time
0 SUCCESS 2 0 400 0.1 400.1
****Datacenter: Datacenter_0****
User id Debt
3 35.6
*****
CloudSimExample1 finished!

```

RESULT:

Thus, the cloud environment using cloud sim tools has been modelled.

CLOUD SIMULATION

IMPLEMENT ROUND ROBIN TASK SCHEDULING IN BOTH TIME SHARED AND SPACE SHARED CPU ASSIGNMENT

AIM:

Implement RoundRobin task scheduling in both TimeShared and SpaceShared CPU assignments.

PROCEDURE:

1. Create a new project by selecting java console line application template and JDK 18.
2. Open project settings from the file menu of the options window.
3. Navigate to project dependencies and select on add external jars and then click on 'Browse' to open the path where you have unzipped the Cloudsim Jars and click on apply.
4. Create a java file with the cloudsim code to implement the Round robin scheduling algorithm.
5. Run the application as a java file to see the output in the console below.

OUTPUT:

```

File Edit View Navigate Code Refactor Build Run Tools Git Window Help RoundRobinTaskSchedulingWithCloudsim - RoundRobinTaskScheduling.java
RoundRobinTaskSchedulingWithCloudsim | RoundRobinTaskScheduling.java
Project | RoundRobinTaskSchedulingWithCloudsim org.cloudbus.cloudsim
  > .idea
  > out
  > README.md
  > RoundRobinTaskScheduling
    > RoundRobinTaskSchedulingWithCloudsim.iml
  External Libraries
  Scratches and Consoles

1 package org.cloudbus.cloudsim.examples;
2
3 import ...
4
5 public class RoundRobinTaskScheduling {
6     private static float vmsSize = (float) 8;
7     private static List<Cloudlets> cloudletList;
8
9     private static List<Vm> vmlist;
10
11     private static List<Vm> createVM(int userId, int vms) {
12         LinkedList<Vm> list = new LinkedList<Vm>();
13         long size = 10000;
14         int ram = 512;
15         int mips = 1000;
16         long bw = 1000;
17         int pesNumber = 1;
18         String vnm = "Vm";
19         Vm[] vms = new Vm[vms];
20
21         for (int i = 0; i < vms; i++) {
22             vms[i] = new Vm(vnm + i);
23             vms[i].setVmSize(size);
24             vms[i].setRam(ram);
25             vms[i].setMips(mips);
26             vms[i].setBw(bw);
27             vms[i].setPesNumber(pesNumber);
28             list.add(vms[i]);
29         }
30
31         return list;
32     }
33
34     public static void main(String[] args) {
35         List<Vm> vms = createVM(1, 5);
36         CloudletScheduler scheduler = new RoundRobinScheduler(vms);
37         CloudletScheduler.setScheduler(scheduler);
38         CloudletScheduler.setVmList(vmlist);
39         CloudletScheduler.setCloudletList(cloudletList);
40
41         CloudletScheduler.start();
42     }
43 }

```

Run: RoundRobinTaskScheduling

- ▶ Initialising...
- Starting CloudSim version 3.0
- Datacenter_0 is starting...
- Datacenter_1 is starting...
- Broker is starting...
- Entities started.
- 0.0: Broker: Cloud Resource List received with 2 resource(s)
- 0.0: Broker: Trying to Create VM #0 in Datacenter_0
- 0.0: Broker: Trying to Create VM #1 in Datacenter_0
- 0.0: Broker: Trying to Create VM #2 in Datacenter_0
- 0.0: Broker: Trying to Create VM #3 in Datacenter_0
- 0.0: Broker: Trying to Create VM #4 in Datacenter_0

File Git Run TODO Problems Terminal Build Event Log 241:36 CRLF UTF-8 Tabs master

Build completed successfully in 4 sec, 398 ms (moments ago)

RESULT:

Thus Round Robin take scheduling is implemented using cloud simulator.

Exp No: 9

Date:

HADOOP

SET UP A SINGLE HADOOP CLUSTER AND SHOW THE PROCESS USING WEB UI

AIM:

To set-up one node Hadoop cluster.

PROCEDURE:

1. System Update
2. Install Java
3. Add a dedicated Hadoop user
4. Install SSH and setup SSH certificates
5. Check if SSH works
6. Install Hadoop
7. Modify Hadoop config files
8. Format Hadoop filesystem
9. Start Hadoop
10. Check Hadoop through web UI
11. Stop Hadoop

THEORY

Hadoop is an Apache open source framework written in java that allows distributed processing of large datasets across clusters of computers using simple programming models. A Hadoop frame-worked application works in an environment that provides distributed storage and computation across clusters of computers. Hadoop is designed to scale up from a single server to thousands of machines, each offering local computation and storage.

HADOOP ARCHITECTURE

Hadoop framework includes following four modules:

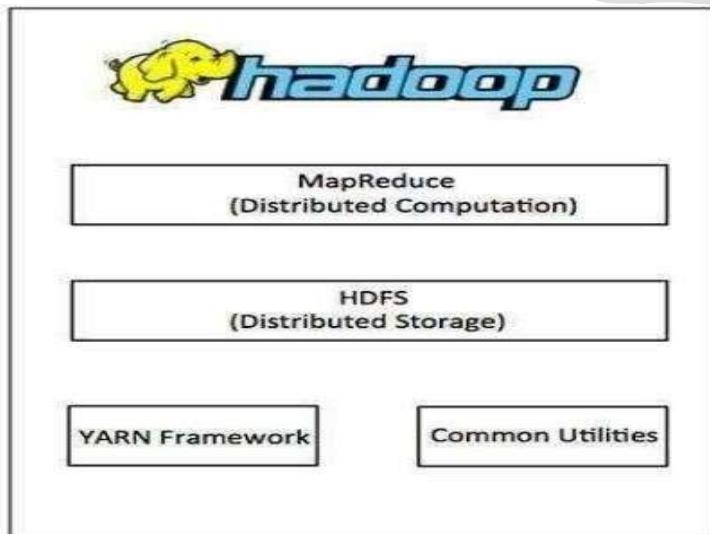
Hadoop Common: These are Java libraries and utilities required by other Hadoop modules. These libraries provide filesystem and OS level abstractions and contain the necessary Java files and scripts required to start Hadoop.

Hadoop YARN: This is a framework for job scheduling and cluster resource management.

Hadoop Distributed File System (HDFS): A distributed file system that provides high-throughput access to application data.

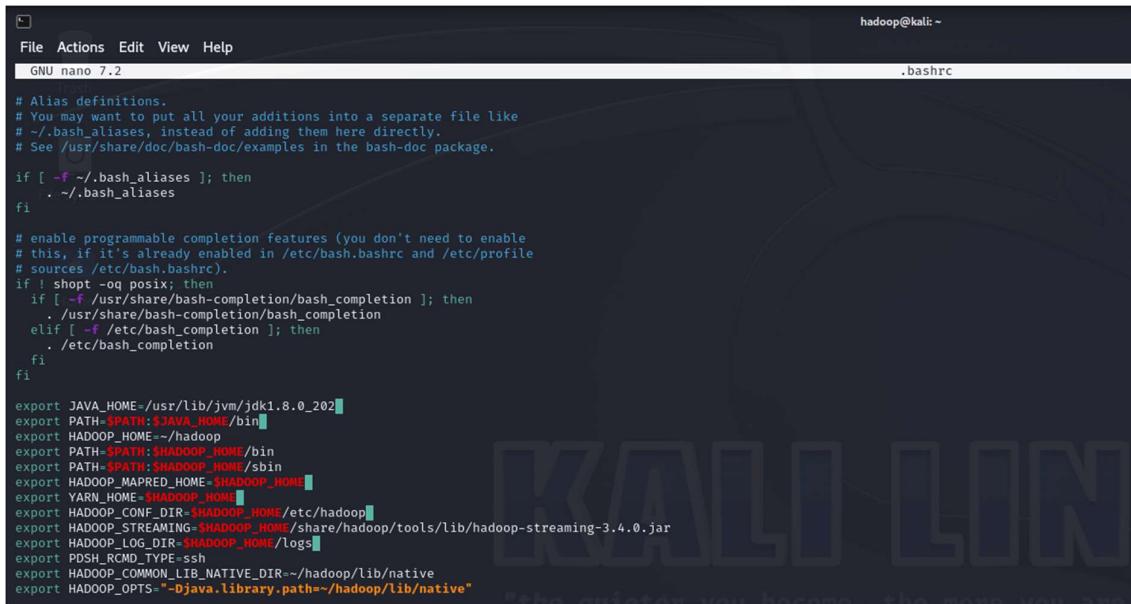
Hadoop MapReduce: This is a YARN-based system for parallel processing of large data sets.

We can use following diagram to depict these four components available in Hadoop framework.



PROCEDURE

\$ nano ~/.bashrc



```
hadoop@kali: ~
File Actions Edit View Help
GNU nano 7.2
.bashrc

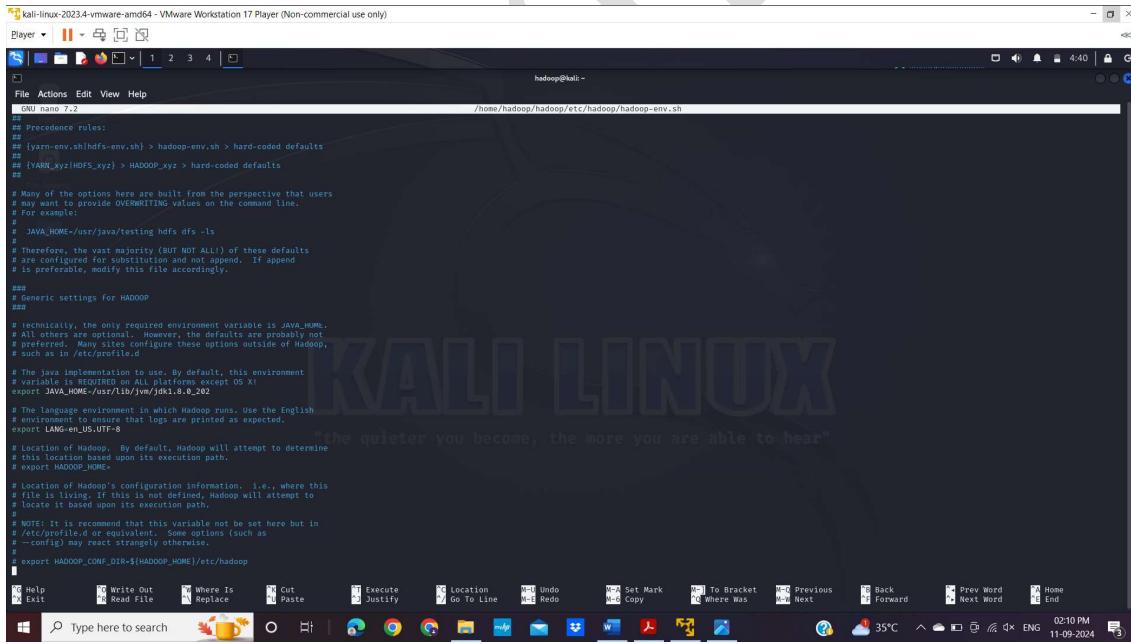
# Alias definitions.
# You may want to put all your additions into a separate file like
# ~/.bash_aliases, instead of adding them here directly.
# See /usr/share/doc/bash-doc/examples in the bash-doc package.

if [ -f ~/.bash_aliases ]; then
  . ~/.bash_aliases
fi

# enable programmable completion features (you don't need to enable
# this, if it's already enabled in /etc/bash.bashrc and /etc/profile
# sources /etc/bash.bashrc.
if ! shopt -q posix; then
  if [ -f /usr/share/bash-completion/bash_completion ]; then
    . /usr/share/bash-completion/bash_completion
  elif [ -f /etc/bash_completion ]; then
    . /etc/bash_completion
  fi
fi

export JAVA_HOME=/usr/lib/jvm/jdk1.8.0_202
export PATH=$PATH:$JAVA_HOME/bin
export HADOOP_HOME=/hadoop
export PATH=$PATH:$HADOOP_HOME/bin
export PATH=$PATH:$HADOOP_HOME/sbin
export HADOOP_MAPRED_HOME=$HADOOP_HOME
export YARN_HOME=$HADOOP_HOME
export HADOOP_CONF_DIR=$HADOOP_HOME/etc/hadoop
export HADOOP_STREAMING=$HADOOP_HOME/share/hadoop/tools/lib/hadoop-streaming-3.4.0.jar
export HADOOP_LOG_DIR=$HADOOP_HOME/logs
export PDSH_RCMD_TYPE=ssh
export HADOOP_COMMON_LIB_NATIVE_DIR=/hadoop/lib/native
export HADOOP_OPTS="-Djava.library.path=~/.hadoop/lib/native"
```

\$ nano \$HADOOP_HOME/etc/hadoop/hadoop-env.sh



```
kali-linux-2023.4-vmware-amd64 - VMware Workstation 17 Player (Non-commercial use only)
Player | 1 2 3 4 | File Actions Edit View Help
hadoop@kali: ~
File Actions Edit View Help
GNU nano 7.2
/home/hadoop/hadoop/etc/hadoop/hadoop-env.sh

## Precedence rules:
## (yarn-env.sh|hdfs-env.sh) > hadoop-env.sh > hard-coded defaults
## {YARN_XYZ|HDFS_XYZ} > HADOOP_XYZ > hard-coded defaults
## 

## Many of the options here are built from the perspective that users
## may want to provide OVERRIDING values on the command line,
## For example:
## 
## JAVA_HOME=/usr/java/testing hdfs dfs -ls
## 
## Therefore, the vast majority (BUT NOT ALL!) of these defaults
## are configured for substitution and not append. If append
## is preferable, modify this file accordingly.

## Generic settings for HADOOP
## 
## Technically, the only required environment variable is JAVA_HOME.
## All others are optional. However, the defaults are probably not
## preferred. Many sites configure these options outside of Hadoop,
## such as in /etc/profile.d

## The Java implementation to use. By default, this environment
## variable is REQUIRED on ALL platforms except OS X!
## export JAVA_HOME=/usr/lib/jvm/jdk1.8.0_202
## 
## The language environment used when Hadoop runs. Use the English
## encoding so that logs are printed as expected.
## export LANG=en_US.UTF-8

## Location of Hadoop. By default, Hadoop will attempt to determine
## this location based upon its execution path.
## export HADOOP_HOME=

## Location of Hadoop's configuration information. i.e., where this
## file is living. If this is not defined, Hadoop will attempt to
## locate it based upon its execution path.
## 
## NOTE: It is recommended that this variable not be set here but in
## $HADOOP_HOME/conf or equivalent. Configuration options (such as
## -config) may react strangely otherwise.
## export HADOOP_CONF_DIR=${HADOOP_HOME}/etc/hadoop
```

\$nano \$HADOOP_HOME/etc/hadoop/core-site.xml



```
File Actions Edit View Help
GNU nano 7.2 /home/hadoop
<?xml version="1.0" encoding="UTF-8"?>
<?xml-stylesheet type="text/xsl" href="configuration.xsl"?>
<!--
Licensed under the Apache License, Version 2.0 (the "License");
you may not use this file except in compliance with the License.
You may obtain a copy of the License at
http://www.apache.org/licenses/LICENSE-2.0

Unless required by applicable law or agreed to in writing, software
distributed under the License is distributed on an "AS IS" BASIS,
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
See the License for the specific language governing permissions and
limitations under the License. See accompanying LICENSE file.
--> Home
<!-- Put site-specific property overrides in this file. -->

<configuration>
<property>
<name>fs.defaultFS</name>
<value>hdfs://localhost:9000</value> </property>
<property>
<name>hadoop.proxyuser.dataflair.groups</name> <value>*</value>
</property>
<property>
<name>hadoop.proxyuser.dataflair.hosts</name> <value>*</value>
</property>
<property>
<name>hadoop.proxyuser.server.hosts</name> <value>*</value>
</property>
<property>
<name>hadoop.proxyuser.server.groups</name> <value>*</value>
</property>
</configuration>
```

\$nano \$HADOOP_HOME/etc/hadoop/hdfs-site.xml

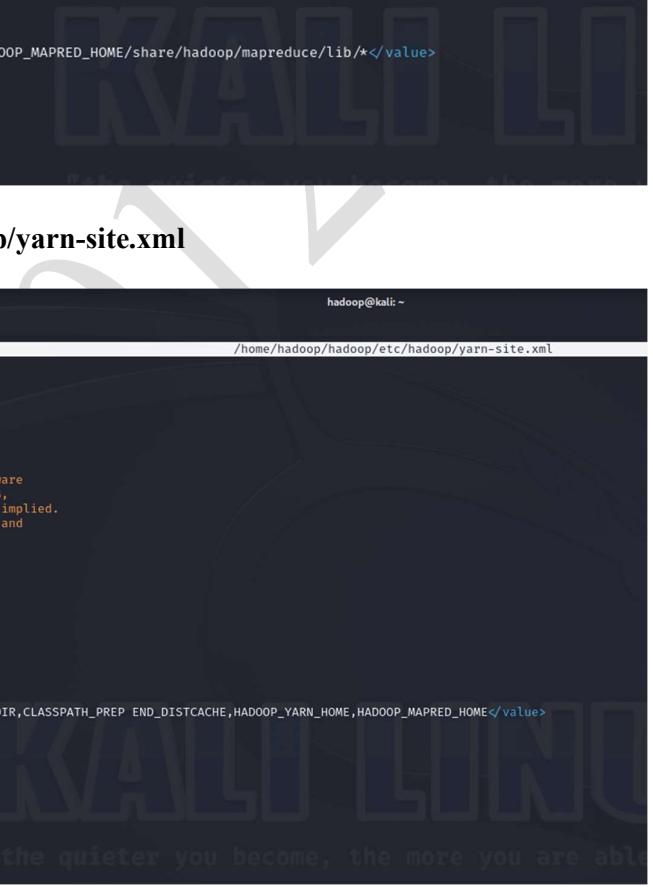


```
File Actions Edit View Help
hadoop@kali: ~ /home/hadoop/hadoop/etc/hadoop
GNU nano 7.2
<?xml version="1.0" encoding="UTF-8"?>
<?xml-stylesheet type="text/xsl" href="configuration.xsl"?>
<!--
Licensed under the Apache License, Version 2.0 (the "License");
you may not use this file except in compliance with the License.
You may obtain a copy of the License at
http://www.apache.org/licenses/LICENSE-2.0

Unless required by applicable law or agreed to in writing, software
distributed under the License is distributed on an "AS IS" BASIS,
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
See the License for the specific language governing permissions and
limitations under the License. See accompanying LICENSE file.
--> Home
<!-- Put site-specific property overrides in this file. -->

<configuration>
<property>
<name>dfs.replication</name>
<value>1</value>
</property>
<property>
<name>dfs.name.dir</name>
<value>file:///home/hadoop/hadoopdata/hdfs/namenode</value>
</property>
<property>
<name>dfs.datanode.data.dir</name>
<value>file:///home/hadoop/hadoopdata/hdfs/datanode</value>
</property>
</configuration>
```

\$nano \$HADOOP_HOME/etc/hadoop/mapred-site.xml



```

hadoop@kali: ~
File Actions Edit View Help
GNU nano 7.2
/home/hadoop/hadoop/etc/hadoop/mapred-site.xml
<?xml version="1.0"?>
<xm...lstylesheet type="text/xsl" href="configuration.xsl"?>
<!--
Licensed under the Apache License, Version 2.0 (the "License");
you may not use this file except in compliance with the License.
You may obtain a copy of the License at
  File System
    http://www.apache.org/licenses/LICENSE-2.0

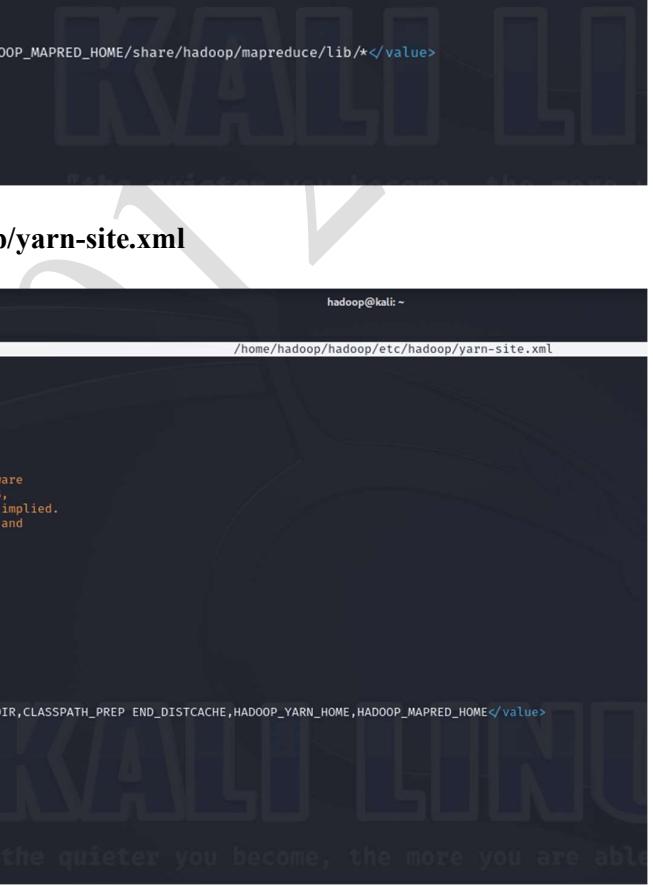
Unless required by applicable law or agreed to in writing, software
distributed under the License is distributed on an "AS IS" BASIS,
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
See the License for the specific language governing permissions and
limitations under the License. See accompanying LICENSE file.
-->

<!-- Put site-specific property overrides in this file. -->

<configuration>
<property>
<name>mapreduce.framework.name</name> <value>yarn</value>
</property>
<property>
<name>mapreduce.application.classpath</name>
<value>$HADOOP_MAPRED_HOME/share/hadoop/mapreduce/*:$HADOOP_MAPRED_HOME/share/hadoop/mapreduce/lib/*</value>
</property>
</configuration>

```

\$nano \$HADOOP_HOME/etc/hadoop/yarn-site.xml



```

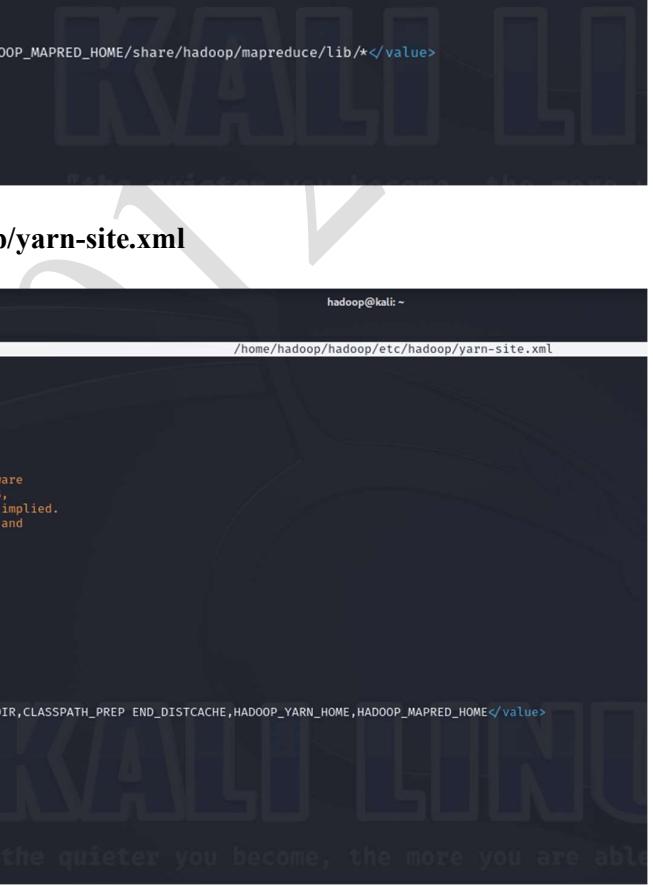
hadoop@kali: ~
File Actions Edit View Help
GNU nano 7.2
/home/hadoop/hadoop/etc/hadoop/yarn-site.xml
<?xml version="1.0"?>
<!--
Licensed under the Apache License, Version 2.0 (the "License");
you may not use this file except in compliance with the License.
You may obtain a copy of the License at
  File System
    http://www.apache.org/licenses/LICENSE-2.0

Unless required by applicable law or agreed to in writing, software
distributed under the License is distributed on an "AS IS" BASIS,
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
See the License for the specific language governing permissions and
limitations under the License. See accompanying LICENSE file.
-->

<configuration>
<!-- Site specific YARN configuration properties -->
<property>
<name>yarn.nodemanager.aux-services</name>
<value>mapreduce_shuffle</value>
</property>
<property>
<name>yarn.nodemanager.env-whitelist</name>
<value>JAVA_HOME,HADOOP_COMMON_HOME,HADOOP_HDFS_HOME,HADOOP_CONF_DIR,CLASSPATH_PREP_END_DISTCACHE,HADOOP_YARN_HOME,HADOOP_MAPRED_HOME</value>
</property>
</configuration>

```

\$ start-all.sh



```

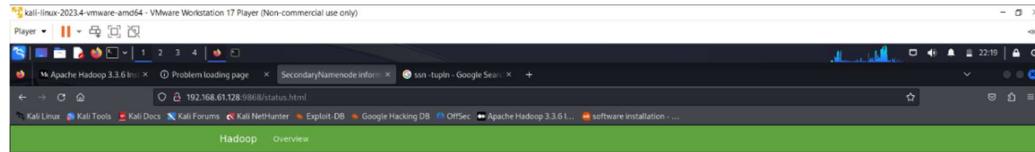
hadoop@kali: ~
File Actions Edit View Help
(hadoop@kali: [~])
└─$ start-all.sh
WARNING: Attempting to start all Apache Hadoop daemons as hadoop in 10 seconds.
WARNING: This is not a recommended production deployment configuration.
WARNING: Use CTRL-C to abort.
Starting namenodes on [localhost]
Starting datanodes
Starting secondary namenodes [kali]
Picked up JAVA_OPTIONS: -Dawt.useSystemAAFontSettings=on -Dswing.aatext=true
2024-09-11 04:59:16,429 WARN util.NativeCodeLoader: Unable to load native-hadoop library for your platform... using builtin-java classes where applicable
Starting resourcemanager
Starting nodemanagers

```

```
$ jps
```

```
[hadoop@kali) -[~]
└─$ jps
Picked up _JAVA_OPTIONS: -Dawt.useSystemAAFontSettings=on -Dswing.aatext=true
14436 NodeManager
16772 Jps
13830 SecondaryNameNode
14311 ResourceManager
13597 DataNode
13471 NameNode
```

localhost:9870



Overview

Version	3.3.6
Compiled	2023-06-18T08:22Z by ubuntu from (HEAD detached at release-3.3.6-RC1)
NameNode Address	localhost:9000
Started	Wed Aug 14 21:51:32 -0400 2024
Last Checkpoint	Never
Checkpoint Period	3600 seconds
Checkpoint Transactions	1000000

Checkpoint Image URI

- file:///tmp/hadoop-kali/dfs/namesecondary

Checkpoint Editlog URI

- file:///tmp/hadoop-kali/dfs/namesecondary

Hadoop, 2023.

localhost:8088

ID	User	Name	Application Type	Application Tags	Queue	Application Priority	StartTime	LaunchTime	FinishTime	State	FinalStatus	Running Containers	Allocated CPU Vcores	Allocated Memory MB	Allocated GPUs
Showing 0 to 0 of 0 entries															

No data available in table

RESULT:

Thus, Hadoop has been successfully installed.

Exp No: 10

Date:

HADOOP

DEMONSTRATE THE MAP REDUCE PROGRAMMING MODEL BY COUNTING THE NUMBER OF WORDS IN A FILE

AIM:

To demonstrate the MAP REDUCE programming model for counting the number of words in a file.

PROCEDURE

Step 1 - Open Terminal

```
$ su hduser
```

Password:

Step 2 - Start dfs and mapreduce services

```
$ cd /usr/local/hadoop/hadoop-2.7.2/sbin
```

```
$ start-dfs.sh
```

```
$ start-yarn.sh
```

```
$ jps
```

Step 3 - Check Hadoop through web UI

// Go to browser type <http://localhost:8088> – All Applications Hadoop Cluster

// Go to browser type <http://localhost:50070> – Hadoop Namenode

Step 4 – Open New Terminal

```
$ cd Desktop/
```

```
$ mkdir inputdata
```

```
$ cd inputdata/  
  
$ echo "Hai, Hello, How are you? How is your health?" >> hello.txt  
  
$ cat>> hello.txt
```

Step 5 – Go back to old Terminal

```
$ hadoop fs –copyFromLocal /home/hduser/Desktop/inputdata/hello.txt  
/folder/hduser // Check in hello.txt in Namenode using Web UI
```

Step 6 – Download and open eclipse by creating workspace

Create a new java project.

Step 7 – Add jar to the project

You need to remove dependencies by adding jar files in the hadoop source folder. Now Click on Project tab and go to Properties.Under Libraries tab, click Add External JARs and select all the jars in the folder (click on 1st jar, and Press Shift and Click on last jar to select all jars in between and click ok)

```
/usr/local/hadoop/hadoop-2.7.2/share/hadoop/common  
/usr/local/hadoop/hadoop-2.7.2/share/hadoop/mapreduce folders.
```

Step -8 – WordCount Program

Create 3 java files named

- WordCount.java
- WordCountMapper.java
- WordCountReducer.java

WordCount.java

```
import org.apache.hadoop.conf.Configuration;  
  
import org.apache.hadoop.fs.Path;  
  
import org.apache.hadoop.io.IntWritable;  
  
import org.apache.hadoop.mapred.FileInputFormat;
```

```
import org.apache.hadoop.mapred.FileOutputFormat;  
  
import org.apache.hadoop.mapred.JobClient; import  
org.apache.hadoop.mapred.JobConf;  
  
import org.apache.hadoop.util.Tool;  
  
import org.apache.hadoop.util.ToolRunner;  
  
import org.apache.hadoop.io.Text;  
  
public class WordCount extends Configured implements Tool {  
  
    @Override  
    public int run(String[] arg0) throws Exception {  
        // TODO Auto-generated method stub  
        if(arg0.length<2)  
        {  
            System.out.println("check the command line arguments");  
        }  
        JobConf conf=new JobConf(WordCount.class);  
        FileInputFormat.setInputPaths(conf, new Path(arg0[0]));  
        FileOutputFormat.setOutputPath(conf, new  
Path(arg0[1]));  
        conf.setMapperClass(WordMapper.class);  
        conf.setReducerClass(WordReducer.class);  
  
        conf.setOutputKeyClass(Text.class);  
        conf.setOutputValueClass(IntWritable.class);  
        conf.setOutputKeyClass(Text.class);
```

```
        conf.setOutputValueClass(IntWritable.class);

        JobClient.runJob(conf);

    }

    return 0;
}

public static void main(String args[]) throws Exception
{
    int exitcode=ToolRunner.run(new WordCount(),
        args); System.exit(exitcode);

}
}
```

WordCountMapper.java

```
import java.io.IOException;
import org.apache.hadoop.io.IntWritable;
import org.apache.hadoop.io.LongWritable;
import org.apache.hadoop.mapred.MapReduceBase;
import org.apache.hadoop.mapred.OutputCollector;
import org.apache.hadoop.mapred.Reporter;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapred.Mapper;

public class WordCountMapper extends MapReduceBase implements
```

```
Mapper<LongWritable,Text,Text,IntWritable>

{
    @Override

    public void map(LongWritable arg0, Text arg1, OutputCollector<Text,
IntWritable> arg2, Reporter arg3)

        throws IOException {

        // TODO Auto-generated method stub


        String s=arg1.toString();

        for(String word:s.split(" "))

        {

            arg2.collect(new Text(word),new IntWritable(1));

        }

    }

}
```

WordCountReducer.java

```
import java.io.IOException;

import java.util.Iterator;

import org.apache.hadoop.io.IntWritable;

import org.apache.hadoop.mapred.JobConf;

import org.apache.hadoop.mapred.OutputCollector;

import org.apache.hadoop.mapred.Reducer;

import org.apache.hadoop.mapred.Reporter;

import org.apache.hadoop.io.Text;
```

```

public class WordCountReducer implements
    Reducer<Text,IntWritable,Text,IntWritable> { @Override

    public void configure(JobConf arg0) {

        // TODO Auto-generated method stub

    }

    @Override

    public void close() throws IOException {

        // TODO Auto-generated method stub

    }

    @Override
    public void reduce(Text arg0, Iterator<IntWritable> arg1,
                      OutputCollector<Text, IntWritable> arg2, Reporter arg3)
                      throws IOException {

        // TODO Auto-generated method

        stub int count=0;

        while(arg1.hasNext())

        {

            IntWritable i=arg1.next();

            count+=i.get();

        }

        arg2.collect(arg0,new IntWritable(count));

    }

}

```

Step 9 - Create JAR file

Now Click on the Run tab and click Run-Configurations. Click on New Configuration button on the left top side and Apply after filling the following properties.

Step 10 - Export JAR file

Now click on File tab and select Export. under Java, select Runnable Jar.

In Launch Config – select the config fie you created in Step 9 (WordCountConfig).

- Select an export destination (let's say desktop.)
- Under Library handling, select Extract Required Libraries into generated JAR and click Finish.
- Right-Click the jar file, go to Properties and under Permissions tab, Check Allow executing file as a program. and give Read and Write access to all the users

Step 11 – Go back to old Terminal for Execution of WordCount Program \$hadoop jar wordcount.jar/usr/local/hadoop/input/usr/local/hadoop/output

Step 12 – To view results in old Terminal

\$hdfs dfs -cat /usr/local/hadoop/output/part-r-00000

Step 13 - To Remove folders created using hdfs

\$ hdfs dfs -rm -R /usr/local/hadoop/output

OUTPUT:

```
harithaah@fedora:~/CC/exp2$ ls
Mapper1.java Reducer1.java Runner1.java s.txt
harithaah@fedora:~/CC/exp2$ hdfs dfs -ls /
Found 7 items
drwxr-xr-x  - harithaah supergroup          0 2024-10-23 19:57 /cc
drwxr-xr-x  - harithaah supergroup          0 2024-10-10 20:38 /exp1
drwxr-xr-x  - harithaah supergroup          0 2024-10-10 20:47 /exp2
drwxr-xr-x  - harithaah supergroup          0 2024-10-10 21:02 /exp4
drwxr-xr-x  - harithaah supergroup          0 2024-10-10 21:13 /exp6
drwxr-xr-x  - harithaah supergroup          0 2024-10-10 21:13 /home
drwxr-xr-x  - harithaah supergroup          0 2024-10-10 21:08 /tmp
harithaah@fedora:~/CC/exp2$ hdfs dfs -mkdir /cc
harithaah@fedora:~/CC/exp2$ hdfs dfs -put s.txt /CC
```

```

harithaa@fedora:~/CC/exp$ javac -classpath SHADOOP_HOME/share/hadoop/common/*:$SHADOOP_HOME/share/hadoop/mapreduce/*:. -d . Mapper1.java Reducer1.java Runner1.java
harithaa@fedora:~/CC/exp$ jar -cvf wordcount.jar -C .
added manifest
adding: Mapper1.java(in = 1036) (out= 369)(deflated 64%)
adding: Reducer1.java(in = 871) (out= 368)(deflated 57%)
adding: Runner1.java(in = 1433) (out= 487)(deflated 66%)
adding: s.txt(in = 158) (out= 114)(deflated 27%)
adding: Mapper1.class(in = 1858) (out= 759)(deflated 59%)
adding: Reducer1.class(in = 1527) (out= 604)(deflated 66%)
adding: Runner1.class(in = 1432) (out= 709)(deflated 50%)
harithaa@fedora:~/CC/exp$ hadoop jar wordcount.jar Runner1 /CC/s.txt /CC/output
2024-10-26 14:00:08,752 INFO client.DefaultNoHARMFailoverProxyProvider: Connecting to ResourceManager at /0.0.0.0:8032
2024-10-26 14:00:09,469 INFO client.DefaultNoHARMFailoverProxyProvider: Connecting to ResourceManager at /0.0.0.0:8032
2024-10-26 14:00:11,224 WARN mapreduce.JobResourceUploader: Hadoop command-line option parsing not performed. Implement the Tool interface and execute your application with ToolRunner to remedy this.
2024-10-26 14:00:11,493 INFO mapreduce.JobResourceUploader: Disabling Erasure Coding for path: /tmp/hadoop-yarn/staging/harithaa/.staging/job_1729930878688_0001
2024-10-26 14:00:13,797 INFO mapred.FileInputFormat: Total input files to process : 1
2024-10-26 14:00:15,965 INFO mapreduce.JobSubmitter: number of splits:2
2024-10-26 14:00:18,724 INFO mapreduce.JobSubmitter: Submitting tokens for job: job_1729930878688_0001
2024-10-26 14:00:18,875 INFO mapreduce.JobSubmitter: Executing with tokens: []
2024-10-26 14:00:19,491 INFO conf.Configuration: resource-types.xml not found
2024-10-26 14:00:19,495 INFO resource.ResourceUtils: Unable to find 'resource-types.xml'.
2024-10-26 14:00:21,006 INFO impl.YarnClientImpl: Submitted application application_1729930878688_0001
2024-10-26 14:00:21,385 INFO mapreduce.Job: The url to track the job: http://fedora:8088/proxy/application_1729930878688_0001/
2024-10-26 14:00:21,396 INFO mapreduce.Job: Running job: job_1729930878688_0001
2024-10-26 14:00:59,125 INFO mapreduce.Job: Job job_1729930878688_0001 running in uber mode : false
2024-10-26 14:00:59,138 INFO mapreduce.Job: map 0% reduce 0%
2024-10-26 14:01:26,297 INFO mapreduce.Job: map 100% reduce 0%
2024-10-26 14:01:46,586 INFO mapreduce.Job: map 100% reduce 100%
2024-10-26 14:01:48,821 INFO mapreduce.Job: Job job_1729930878688_0001 completed successfully
2024-10-26 14:01:49,756 INFO mapreduce.Job: Counters: 54

```

```

harithaa@fedora:~/CC/exp2$ hdfs dfs -cat /CC/output/part-00000

```

B	1
CSE	1
From	1
Hello	1
Hey	1
We	1
a	1
an	1
are	1
awesome	1
be	1
ever	1
found	1
get	1
girl	2
happy	1
have	2
her	2
here	1
i	3
if	1
is	1
like	1
never	1

RESULT

Thus a word count program in java is implemented using Map Reduce.

Exp No: 11

Date:

HADOOP

IMPLEMENT THE MAX TEMPERATURE MAPREDUCE PROGRAM TO IDENTIFY THE YEAR WISE MAXIMUM TEMPERATURE FROM SENSOR DATA

AIM

To implement the Max temperature MapReduce program to identify the year-wise maximum temperature from the sensor data.

Description

Sensors sense weather data in big text format containing station ID, year, date, time, temperature, quality etc. from each sensor and store it in a single line. Suppose thousands of data sensors are there, then we have thousands of records with no particular order. We require only a year and maximum temperature of particular quality in that year.

For example:

Input string from sensor:

002902907099999 1902010720004+64333+023450

FM-12+

000599999V0202501N027819999999N0000001N9-*00331*+

99999098351ADDGF10299199999999999999999999

Here: 1902 is year

0033 is temperature

1 is measurement quality (Range between 0 or 1 or 4 or 5 or 9)

Here each mapper takes the input **key** as "byte offset of line" and **value** as "one weather sensor read i.e one line". and parse each line and produce an intermediate **key** "year" and **intermediate value** as "temperature of certain measurement qualities" for that year.

The combiner will form set values of temperature. Year and set of values of temperatures is given as input \langle key, value \rangle to reducer and Reducer will produce year and maximum temperature for that year from the set of temperature values.

PROGRAM

* /

```

import org.apache.hadoop.fs.Path;
import org.apache.hadoop.io.IntWritable;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapreduce.Job;
import org.apache.hadoop.mapreduce.lib.input.FileInputFormat;
import org.apache.hadoop.mapreduce.lib.output.FileOutputFormat;
import java.io.IOException;
import org.apache.hadoop.io.IntWritable;
import org.apache.hadoop.io.LongWritable;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapreduce.Mapper;
import org.apache.hadoop.mapreduce.Reducer;

//Mapper class

class MaxTemperatureMapper
extends Mapper<LongWritable, Text, Text, IntWritable> { private static final int MISSING
= 9999;

@Override
public void map(LongWritable key, Text value, Context context) throws IOException,
InterruptedException {

String line = value.toString(); String year = line.substring(15, 19); int airTemperature;
if (line.charAt(87) == '+') { // parseInt doesn't like leading plus signs airTemperature =
Integer.parseInt(line.substring(88, 92));
} else {
airTemperature = Integer.parseInt(line.substring(87, 92));
}
String quality = line.substring(92, 93);
if (airTemperature != MISSING && quality.matches("[01459]")) { context.write(new
Text(year), new IntWritable(airTemperature));
}
}
}

//Reducer class
class MaxTemperatureReducer
extends Reducer<Text, IntWritable, Text, IntWritable> {

@Override
public void reduce(Text key, Iterable<IntWritable> values, Context context)
throws IOException, InterruptedException {

```

```

int maxValue = Integer.MIN_VALUE; for (IntWritable value : values) {
maxValue = Math.max(maxValue, value.get());
}
context.write(key, new IntWritable(maxValue));
}
}
//Driver Class

public class MaxTemperature {

public static void main(String[] args) throws Exception { if (args.length != 2) {
System.err.println("Usage: MaxTemperature <input path="> <output path>"); System.exit(-1);
}

Job job = Job.getInstance(new Configuration()); job.setJarByClass(MaxTemperature.class);
job.setJobName("Max temperature");

FileInputFormat.addInputPath(job, new Path(args[0])); FileOutputFormat.setOutputPath(job,
new Path(args[1]));

job.setMapperClass(MaxTemperatureMapper.class);
job.setReducerClass(MaxTemperatureReducer.class);

job.setOutputKeyClass(Text.class); job.setOutputValueClass(IntWritable.class);

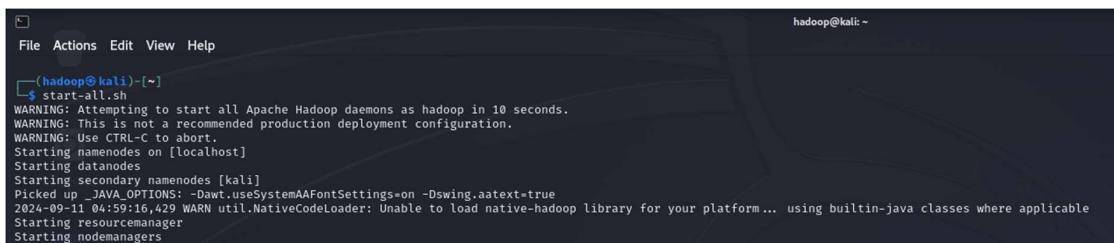
job.submit();
}
}

```

OUTPUT:

Input for String :

002902907099999 1902010720004+64333+023450FM-12+
 000599999V0202501N027819999999N0000001N9- 00331+
 99999098351ADDGF102991999999999999999'



```

File Actions Edit View Help
(hadoop@kali)-[~]
$ start-all.sh
WARNING: Attempting to start all Apache Hadoop daemons as hadoop in 10 seconds.
WARNING: This is not a recommended production deployment configuration.
WARNING: Use CTRL-C to abort.
Starting namenodes on [localhost]
Starting datanodes
Starting secondary namenodes [kali]
Picked up _JAVA_OPTIONS: -Dawt.useSystemAAFontSettings=on -Dswing.aatext=true
2024-09-11 04:59:16,429 WARN util.NativeCodeLoader: Unable to load native-hadoop library for your platform... using builtin-java classes where applicable
Starting resourcemanager
Starting nodemanagers

```

```
(hadoop@kali)-[~]
└─$ jps
Picked up _JAVA_OPTIONS: -Dawt.useSystemAAFontSettings=on -Dswing.aatext=true
14436 NodeManager
16772 Jps
13830 SecondaryNameNode
14311 ResourceManager
13597 DataNode
13471 NameNode
```

```
(hadoop@kali)-[~/hadoop/bin]
└─$ ./hdfs dfs -ls /exp3
Picked up _JAVA_OPTIONS: -Dawt.useSystemAAFontSettings=on -Dswing.aatext=true
2024-09-21 00:11:13,818 WARN util.NativeCodeLoader: Unable to load native-hadoop library for your platform ...
Found 3 items
-rw-r--r-- 1 hadoop supergroup 79205 2024-08-29 10:50 /exp3/dataset.txt
drwxr-xr-x - hadoop supergroup 0 2024-08-29 10:52 /exp3/new_output
drwxr-xr-x - hadoop supergroup 0 2024-09-13 01:00 /exp3/output
```

```
(hadoop@kali)-[~/hadoop/bin]
└─$ hadoop jar $HADOOP_STREAMING -input /exp3/dataset.txt -output /exp3/output -mapper ~/DA-Lab/exp3/mapper.py -reducer ~/DA-Lab/exp3/reducer.py
Picked up _JAVA_OPTIONS: -Dawt.useSystemAAFontSettings=on -Dswing.aatext=true
2024-09-21 00:13:19,993 WARN util.NativeCodeLoader: Unable to load native-hadoop library for your platform... using builtin-java classes where applicable
packageJobJar: [/tmp/hadoop-unjar3830594044787382099/] []
/tmp/streamjob2158010624070613243.jar tmpDir=null
2024-09-21 00:13:20,918 INFO client.DefaultNoharmFailoverProxyProvider: Connecting to ResourceManager at /0.0.0.0:8032
2024-09-21 00:13:21,223 INFO client.DefaultNoharmFailoverProxyProvider: Connecting to ResourceManager at /0.0.0.0:8032
2024-09-21 00:13:27,216 INFO mapreduce.JobResourceUploader: Disabling Erasure Coding for path: /tmp/hadoop-yarn/staging/hadoop/.staging/job_1726891437845_0001
2024-09-21 00:13:28,262 INFO mapred.FileInputFormat: Total input files to process : 1
2024-09-21 00:13:28,365 INFO mapreduce.JobSubmitter: number of splits:2
2024-09-21 00:13:28,610 INFO mapreduce.JobSubmitter: Submitting application for job: job_1726891437845_0001
2024-09-21 00:13:28,613 INFO mapreduce.JobSubmitter: Number of的心子任务: []
2024-09-21 00:13:29,230 INFO conf.Configuration: resource-types.xml not found
2024-09-21 00:13:29,230 INFO resource.ResourceUtils: Unable to find 'resource-types.xml'.
2024-09-21 00:13:29,895 INFO impl.YarnClientImpl: Submitted application application_1726891437845_0001
2024-09-21 00:13:29,993 INFO mapreduce.Job: The url to track the job: http://kali:8088/proxy/application_1726891437845_0001/
2024-09-21 00:13:29,998 INFO mapreduce.Job: Running job: job_1726891437845_0001
2024-09-21 00:13:43,554 INFO mapreduce.Job: Job job_1726891437845_0001 running in uber mode : false
2024-09-21 00:13:43,560 INFO mapreduce.Job: map 0% reduce 0%
2024-09-21 00:13:43,918 INFO mapreduce.Job: map 100% reduce 0%
2024-09-21 00:14:00,992 INFO mapreduce.Job: map 100% reduce 100%
2024-09-21 00:14:01,012 INFO mapreduce.Job: Job job_1726891437845_0001 completed successfully
2024-09-21 00:14:01,189 INFO mapreduce.Job: Counters: 54
File System Counters
  FILE: Number of bytes read=102094
  FILE: Number of bytes written=1138411
  FILE: Number of read operations=0
  FILE: Number of large read operations=0
  FILE: Number of write operations=0
  HDFS: Number of bytes read=83481
  HDFS: Number of bytes written=96
  HDFS: Number of read operations=11
  HDFS: Number of large read operations=0
  HDFS: Number of write operations=2
  HDFS: Number of bytes read erasure-coded=0
Job Counters
  Launched map tasks=2
  Launched reduce tasks=1
  Data-local map tasks=2
  Total time spent by all maps in occupied slots (ms)=14691
  Total time spent by all reduces in occupied slots (ms)=4696
  Total time spent by all map tasks (ms)=14691
  Total time spent by all map tasks (ms)=14691
  Total time spent by all reduce tasks (ms)=4696
  Total vcore-milliseconds taken by all map tasks=14691
  Total vcore-milliseconds taken by all reduce tasks=4696
  Total megabyte-milliseconds taken by all map tasks=15043584
  Total megabyte-milliseconds taken by all reduce tasks=4808704
Map-Reduce Framework
  Map input records=365
  Map output records=10220
  Map output bytes=81648
  Map output materialized bytes=102100
  Input split bytes=180
```

```
(hadoop@kali)-[~/hadoop/bin]
└─$ ./hdfs dfs -cat /exp3/output/*
Picked up _JAVA_OPTIONS: -Dawt.useSystemAAFontSettings=on -Dswing.aatext=true
2024-09-21 00:15:38,966 WARN util.NativeCodeLoader: Unable to load native-hadoop library for your platform...
01    26.5
02    26.6
03    29.1
04    30.8
05    31.1
06    33.6
07    38.5
08    40.2
09    36.5
10    36.9
11    27.6
12    25.9
```

RESULT

Thus a java program has been implemented to identify the year-wise maximum temperature from the sensor data.

Sample Questions

BASIC UNDERSTANDING: Exp 1

1. What is virtualization?

Ans. Virtualization is an abstraction layer that decouples physical hardware from operating system to deliver greater IT resource utilization and flexibility.

2. What is the Difference between Full Virtualization and Para Virtualization?

Ans. Full virtualization & Para virtualization both comes under the Hardware virtualization. Some of the differences between them are listed below:

Full Virtualization: In full virtualization guest VMs (Virtual Machines) are not aware that they are in virtualized environment there-fore the guest os issues command to what it thinks as actual hardware but actually are just simulated devices created by the hosts.

Para Virtualization : In para virtualization the guest vm is aware that it is in a virtualized environment . If guest vm requires resources , it issues commands to host operating system instead of directly communicating with simulated hardware.

3. What is Hyper-vvisor ?

A **hypervisor** or virtual machine monitor (VMM) is computer software, firmware or hardware that creates and runs virtual machines. A computer on which a **hypervisor** runs one or more virtual machines is called a host machine, and each virtual machine is called a guest machine.

4. What are the difference between Type 1 and Type 2 Hypervisor ?

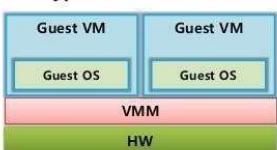
Ans. Type 1: When the Hypervisor is installed on bare metal / Physical hardware it is known as Type 1 Hypervisor . Examples are VM ware ESXi, Oracle VM, Microsoft Hyper V.

Type 2: When the Hypervisor is installed on top of an operating system it is known as Type 2 Hypervisor . Examples are Microsoft Virtual Server, VM Ware Server and workstation.

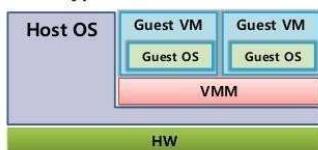
Type-1 vs. Type-2

- Depending on what sits right on HW

Type-1: VMM on HW



Type-2: Host OS on HW



- Xen, VMware ESX server, Hyper-V
- Mostly for server, but not limited
- VMM by default
- OS-independent VMM

- KVM, VMware Workstation, VirtualBox
- Mostly for client devices, but not limited
- VMM on demand
- OS-dependent VMM

BASIC UNDERSTANDING: Exp 2

1. What is a virtual block?

A virtual block device is an interface with applications that appears to the applications as a memory device, such as a standard block device.

2. What is a virtual disk?

Virtual disks are stored as files on the host computer or on a network file server. It does not matter whether the physical disk that holds the files is IDE or SCSI.

IDE (Integrated Drive Electronics) SCSI(Small Computer System Interface) SATA(Serial Advanced Technology Attachment)

3. What is a VM clone?

A clone is a copy of an existing virtual machine.

4. What is a Snapshot and a Template?

A snapshot is a copy of the virtual machine's disk file at a given point in time.

Snapshots provide a change log for the virtual disk and are used to restore a VM to a particular point in time when a failure or system error occurs.

A **template** is a master copy of a virtual machine that can be used to create many clones.