Dr. AMBEDKAR INSTITUTE OF TECHNOLOGY

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Cloud Computing Laboratory Report

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Cloud Computing Laboratory
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CONTENTS

Chapter No	Title	Page No
Part A		
Chapter 1	Salesforce	1
Chapter 2	CloudAnalyst Simulations	165
Chapter 3	Google App Engine	122
Chapter 4	Amazon Web Services - RDS	131
Chapter 5	VM Ware Workstation	101
	File Transfer in Virtual Machines	144
Part B		
Chapter 6	Mini Project	203
Chapter 7	Industry Certifications - Salesforce	227

SALESFORCE

Salesforce is an American cloud-based software company headquartered in San Francisco, California. It provides customer relationship management (CRM) service and also provides enterprise applications focused on customer service-marketing automation, analytics, and application development.

History

The company was founded on February 3, 1999 by former Oracle executive Marc Benioff, together with Parker Harris, Dave Hoelterhoff, and Frank Dominguez as a software as a service (SaaS) company, and was launched publicly between September and November 1999.

In June 2004, the company had its initial public offering on the New York Stock Exchange under the stock symbol CRM and raised US$110 million. Early investors include Larry Ellison, Magdalena Yesil, Halsey Minor, Stewart Henderson, Mark Iscaro, and Igor Sill, a founding member of Geneva Venture Partners.

In October 2014, Salesforce announced the development of its Customer Success Platform to tie together Salesforce's services, including sales, service, marketing, analytics, community, and mobile apps. In October 2017, Salesforce launched a Facebook Analytics tool for business-to-business marketers. In September 2018, Salesforce partnered with Apple intended on improving apps for businesses.

In February 2020, co-chief executive officer Keith Block stepped down from his position in the company. Marc Benioff remained as chairman and chief executive officer.

On December 1, 2020, it was announced that Salesforce would acquire Slack for $27.7 billion. The acquisition closed on July 21.

In February 2021, Salesforce announced that CFO Mark Hawkins would be retiring from his position after six years of working for the company; however, retaining a position as CFO emeritus until October. Amy Weaver was selected as his replacement.

Salesforce.com's customer relationship management (CRM) service comprises several broad categories: Commerce Cloud, Sales Cloud, Service Cloud, Data Cloud (including Jigsaw), Marketing Cloud, Community Cloud (including Chatter), Manufacturing Cloud, Analytics Cloud, App Cloud, Vaccine Cloud,IoT and Work.com with over 100,000 customers.

Main services

Salesforce's main services are tools for case, task and issue management. It also gives customers tracking abilities for their raised cases and conversation features for social networking Web sites, provides analytical tools and other services including email alert, Google search, and access to customers' entitlement and contracts. They also partner with companies like IBM, Accenture, and Saggezza to help integrate Salesforce's cloud-based services into their businesses.

Lightning Platform

Lightning Platform (also known as Force.com) is a platform as a service (PaaS) that allows developers to create add-on applications that integrate into the main Salesforce.com application. [failed verification] These third-party applications are hosted on Salesforce.com's infrastructure. Force.com applications are built using declarative tools, backed by Lightning [further explanation needed] and Apex, a proprietary Java-like programming language for Force.com, as well as Visualforce, a framework including an XMLsyntax typically used to generate HTML. The Force.com platform typically receives three complete releases a year. As the platform is provided as a service to its developers, every single development instance also receives all these updates. In 2015, a new framework for building user interfaces – Lightning Components – was introduced in beta. Lightning components are built using the open-source Aura Framework but with support for Apex as the server-side language instead of Aura's JavaScript dependency. This has been described as an alternative to, not necessarily a replacement for, Visualforce pages.

As of 2013, the Force.com platform has 1.4 million registered developers. Lightning Base Components is the component library built on top of Lightning Web Components.

Experience Cloud

Experience Cloud (formerly Community Cloud) provides Salesforce customers the ability to create online web properties for external collaboration, customer service, channel sales, and other custom portals in their instance of Salesforce.

Tightly integrated to Sales Cloud, Service Cloud, and App Cloud, Experience Cloud can be quickly customized to provide a wide variety of web properties. Experience Cloud combines the functionality of the former Salesforce Customer and Partner Portals with some additional features.

Work.com

Work.com, previously Rypple, is a social performance management platform for managers and employees. It allows continuous coaching, real-time feedback, and recognition. It is aimed at sales management, customer service, marketing, and can be utilised by human resource departments.

Work.com, then known as "Rypple", was founded by Daniel Debow and David Stein, to create a simple way of asking for feedback anonymously at work. The company was formed in May 2008 and their client list included Mozilla, Facebook, LinkedIn and the Gilt Groupe. Rypple aims to get employees to build and manage their own coaching networks.

In September 2011, Rypple announced that they had hired Bohdan Zabawskyj as its Chief Technology Officer. In 2011, Rypple developed a more formalized management methodology called OKR ("Objectives and Key Results") for Spotify. Rypple also partnered with Facebook to create "Loops", short for "feedback loops", which gathers feedback from co-workers, including praise, progress against goals, and coaching from supervisors into one channel.

In December 2011, Salesforce.com announced that they would acquire Rypple. The transaction was completed in 2012 and Rypple was rebranded as Work.com in September 2012.

AppExchange

Launched in 2005, the Salesforce AppExchange is an online application marketplace for third-party applications that run on the Force.com platform. Applications are available for free, as well as via yearly or monthly subscription models. Applications available range from integrations with SharePoint to mobile approval management.

As of June 2016, it features 2,948 applications which have driven 3+ million installs. The "AppExchange" is also a place customers can search for cloud consulting partners to help them implement the technology in their own organization. Cloud consulting partners for Salesforce include large companies like IBM's "Bluewolf" and Accenture as well as smaller ones like Cloudreach.

myTrailhead

Launched in 2019, Salesforce's myTrailhead is an online training platform that can be customized for the specific needs of its customers. The platform extends functionality to provide users with training content specific to their usage of Salesforce and enables them to create and publish their own training content and programs.

Technologies

Salesforce is powered by the Model–view–controller architecture.

Apex

Apex is a proprietary programming language provided by the Force.com platform to developers similar to Java and C#. It is a strongly typed, object-oriented, caseinsensitive programming language, following a dot-notation and curly-brackets syntax. Apex can be used to execute programmed functions during most processes on the Force.com platform including custom buttons and links, event handlers on record insertion, update, or deletion, via scheduling, or via the custom controllers of Visualforce or Lightning Experience pages.

Due to the multitenant nature of the platform, the language has strictly imposed governor limitations to guard against any code monopolizing shared resources. Salesforce provides a series of asynchronous processing methods for Apex to allow developers to produce longer-running and more complex Apex code.

Lightning

In 2014, Salesforce made public the front end of its platform, called Lightning. This component-based framework is what the Salesforce mobile app is built on. Salesforce built on this framework in 2015 by releasing the Lightning Design System, an HTML style framework with default CSS styling built in. This framework allows customers to build their own components to either use in their internal instances or sell on the AppExchange.

The Salesforce Lightning App Builder is a tool for rapid application development of responsive web interfaces. This interface allows for different screens to be put together based on Lightning components. This can be used as layouts for records or specific applications.

Lightning Experience, released in 2016, is the new redesigned interface in Salesforce for processes enhancement. Since then all the apps available on AppExchange need to be Lightning and those built on Classic have to migrate to Lightning as Classic is not to be updated any more by Salesforce. The platform offers an option for developers to employ migration techniques to enable the new user-friendly interface and switch to Lightning.

What is Salesforce used for?

- Engage customers with relevant, empathetic digital marketing from anywhere.
- Sell smarter and grow your business faster from anywhere.
- Quickly launch and scale ecommerce built around your customer — from anywhere.
- Provide great customer service from anywhere.
- Go digital fast and empower your teams to work from anywhere

SALESFORCE

1. Create a web application to enter student details like Name, USN, Semester, Section and CGPA to a database on Salesforce Cloud Platform

Steps:

1. Launch your Salesforce Trailhead Playground by opening any module and Switch to

Lightning Experience if you are currently in Salesforce Classic by clicking your picture in the

right top corner and then click on “Switch to Lightning Experience”.

2. Then go to Setup gear icon and click “Setup”.

3. Click on “Object Manager” and click “Create> Custom Object” to create new Custom

Object.

4. Name the object “Student”.

5. Allow Reports and Allow Search.

6. Check the box in front of “Launch New Custom Tab Wizard after saving this custom object”.

7. To create a Tab for the Object: Select any Tab Style for the object “Student”. Click Next, Next, leave the defaults and save.

8. To add fields to the Object: Go to “Fields & Relationships” option of Student object and Click “New”.

9. Add the following fields one after the other:

• Field Label: USN (Length 10), Data Type: Text, provide an example USN as Help Text, make it as Required Field and Don't allow Duplicate Values and make it as Case Insensitive.

• Field Label: Section (Length 1), Data Type: Text, make it as Required Field.

• Field Label: Semester (Length 1, Decimal Place 0), Data Type: Number, make it as Required Field.

• Field Label: CGPA (Length 2, Decimal Places 2), Data Type: Number, make it as Required Field.

Validation Rules:

1.Name validation:

To add a rule to the Student Name so that the name should only start with letter but not digit:

• Go to Validation Rule of Student Object and click “New”

• Name it as “Student Name Validation”

• Error Condition Formula: “NOT (REGEX (Name,"[a-z A-Z]+[a-z A-Z]+"))”

• Error Message: “Please Enter a valid name”.

• Error Location: Field –Student Name.

• Click Save.

2.Semester Validation:

To add a rule to the Semester so that it should always be greater than 0 and less than or equal to 8:

• Go to Validation Rule of Student Object and click “New”.

• Name it as “Semester validation”.

• Error Condition Formula: OR (Semester__c >8, Semester__c <=0).

• Error Message: Please Enter a Semester from 1-8.

• Error Location: Field – Semester.

• Click Save.

3.CGPA Validation:

To add a rule to the CGPA so that it should not take CGPA greater than 10:

• Go to Validation Rule of Student Object and click “New”

• Name it as “CGPA validation”.

• Error Condition Formula: CGPA__c > 10

• Error Message: Please Enter a Correct CGPA.

• Error Location: Field –CGPA

• Click Save

4.USN Validation:

To add a rule to the USN so that it should validate only student's serial number.

• Go to Validation Rule of Flight Object and click "New"

• Name it as "USN Validation".

• Error Condition Formula: NOT(REGEX(USN__c,"[1-5]{1} +[A-Z]{2} + [0-9]{2} +[A-Z]{2} + [0-9]{3}"))

• Error Message: Please enter a valid USN.

• Error Location: Field – USN

• Click Save.

10. To create an application: Go to “Setup” and type “App Manager” in Quick Find Box.

11. Click on “New Lightning App” to create a Lightning Application.

12. Name it as “Student Details”, give the description for your application.

13. Uploading Image and changing colours are optional, then click Next.

14. Navigation Style: Standard Navigation, click Next.

15. No need to add any Utility Bar, click Next.

16. Add the following Items: Students, Reports and Dashboards, click Next.

17. Assign it to System Administrator Profile by selecting System Administrator and pressing right arrow and then click Save & Finish.

18. Go to App Manager, select your application and select Students and click "New" to add some details to your application.

Make sure you will get error messages when you give invalid Name, USN, Semester and CGPA.

Reports and Dashboards:

To Create a Students Report:

- Go to “Reports tab” Click on “New Folder” And give it any name and Click Save.
- Click on “New Report” and from search bar Search for “Students” and then select it and then click continue.
- Add the required Columns to get the Completed Entered data.
- If you Want the report to be grouped by any specific Fields then Search for the field in “Add groups” otherwise it is optional.
- Click on save and name the report as “New Students Report” and then select the folder which you have created.
- Click Save and then Click Run

Hands-On Orgs
Lightning Experience | Salesforce
Reports | Salesforce
Student | Salesforce
resourceful-unicorn-jfs9bs-dev-ed.trailblaze.lightning.force.com/lightning/o/Report/home?queryScope=mru
Student Details
Students
Reports
Dashboards
Reports
Recent
1 item
Search recent reports...
New Report
New Report (Salesforce Classic)
New Folder
REPORTS
Recent
Created by Me
Private Reports
Public Reports
All Reports
FOLDERS
All Folders
Created by Me
Shared with Me
FAVORITES
All Favorites
Report Name
Description
Folder
Created By
Subscribed
New Students Report
Create folder
* Folder Label
report_2
* Folder Unique Name
report_2
Cancel
Save

Hands-On Orgs
Lightning Experience | Salesforce
Report Builder | Salesforce
Student | Salesforce
resourceful-unicorn-jfs9bs-dev-ed.trailblaze.lightning.force.com/one/one.app#eyJjb21wb25lbnREZWYiOiJyZXBvcnRzOnJlcG9ydEJ1aWxkZXIiLCJhdHRyaWJ1dGVzIjp7InJlY29yZEI...
Student Details
Students
Reports
Dashboards
Create Report
Category
Recently Used
All
Accounts & Contacts
Opportunities
Customer Support Reports
Leads
Campaigns
Activities
Contracts and Orders
Price Books, Products and Assets
Administrative Reports
Select a Report Type
Search Report Types...
Recently Used Report Types
Report Type Name
Category
Students
Standard
Details
Students
Standard Report Type
Start Report
Details
Fields (15)
Created By You
New Students Report
Last Used 1/26/2023
Created By Others
No Reports Yet
Objects Used in Report Type
Owner

To Create a Students Dashboard:

- Go to "Dashboard tab" and then click on "New Folder" and give it any Name.
- Click on "New Dashboard" and then name it as "Students Dashboard" and select folder that you have created Click on Create.
- Click on the report that you have created and click on that and click select.
- Select any style to represent the data in dashboard.
- Add any filter(s), otherwise it is optional.
- Click on Save and Click Run.

Hands-On Orgs
Lightning Experience | Salesforce
Dashboards | Salesforce
Student | Salesforce
resourceful-unicorn-jfs9bs-dev-ed.trailblaze.lightning.force.com/lightning/o/Dashboard/home?queryScope=mru
Student Details
Students
Reports
Dashboards
Dashboards
Recent
0 items
Search recent dashboards...
New Dashboard
New Folder
DASHBOARDS
Recent
Created by Me
Private Dashboards
All Dashboards
FOLDERS
All Folders
Created by Me
Shared with Me
FAVORITES
All Favorites
Create folder
* Folder Label
dashboard_1
* Folder Unique Name
dashboard_1
Cancel
Save
Nothing here yet
After you view a dashboard, it appears here.

Hands-On Orgs
Lightning Experience | Salesforce
New Dashboard | Salesforce
Student | Salesforce
Student Details
Students
Reports
Dashboards
Component
Filter
Save
Done
New Dashboard
* Name
dashboard_1
Description
Folder
dashboard_1
Select Folder
Cancel
Create

Hands-On Orgs
Lightning Experience | Salesforce
dashboard_1 | Salesforce
Student | Salesforce
Search...
Student Details
Students
Reports
Dashboards
dashboard_1
Component
Filter
Save
Done
New Students Report
Sum of CGPA: 17
8.4
8.6
Section
A
B
View Report (New Students Report)

2. Create a Web Application to implement an online cart for adding items to a shopping cart and deleting it.

STEPS:

1. Launch your Salesforce Trailhead Playground by opening any module and Switch to Lightning Experience if you are currently in Salesforce Classic by clicking your picture in the right top corner and then click on “Switch to Lightning Experience”.

2. Then go to Setup gear icon and click “Setup”.

3. Click on “Object Manager” and click “Create> Custom Object” to create new Custom Object.

4. Name the object “Cart”.

5. Allow Reports and Allow Search.

6. Check the box in front of “Launch New Custom Tab Wizard after saving this custom object”

7. To create a Tab for the Object: Select any Tab Style for the object “Cart”. Click Next, Next, leave the defaults and save.

8. To add fields to the Object: Go to “Fields & Relationships” option of cart object and Click “New”.

9. Add the following fields one after the other:

• Field Label: Item Name, Data Type: Text Area, make it as Required Field.

• Field Label: Category, Data Type: Picklist, click radio button in front of Enter values, with each value separated by a new line value are: Books, Electronics & Accessories, Furniture & Home Appliances, Fashion – Men, Fashion – Women, Fashion – Kids, Footwear and Others.

• Make it as Required Field and Restrict the values to the values in the picklist.

• Field Label: Quantity, Data Type: Number, make it as Required Field.

• Field Label: Price, Data Type: Currency (Length 16, Decimal Places 2), Make it as Required Field.

To create an application:

10. Go to “Setup” and type “App Manager” in Quick Find Box.

11. Click on “New Lightning App” to create a Lightning Application.

12. Name it as “Online Shopping Cart”, give the description for your application.

13. Uploading Image and changing colours are optional, then click Next.

14. Navigation Style: Standard Navigation, click Next.

15. No need to add any Utility Bar, click Next.

16. Add the following Items: Carts, Reports and Dashboards, click Next.

17. Assign it to System Administrator Profile by selecting System Administrator and pressing right arrow and then click Save & Finish.

18. Go to App Manager, select your application and select Carts and click “New” to add some details to your application.

Reports and Dashboards:

To Create a Carts Report:

• Go to “Reports tab” Click on “New Folder” And give it any name and then click Save.

• Click on “New Report” and from search bar Search for “Carts” and then select it and click Continue. • Add the required Columns to get the Completed Entered data.

• If you Want the report to be grouped by any specific Fields then Search for the field in “Add groups” otherwise it is optional.

• Click on save and name the report as “New Carts Report” and then select the folder which you have created.

• Click Save and then Click Run

To Create a Carts Dashboard:

• Go to “Dashboard tab” and then click on “New Folder” and give it any Name.

• Click on “New Dashboard” and then name it as “Shopping cart” and select folder that you have created Click on Create.

• Click on the report that you have created and click on that and click select.

• Select any style to represent the data in dashboard.

• Add any filter(s), otherwise it is optional.

• Click on Save and Click Run.

Hands-On Orgs
Lightning Experience | Salesforce
dashboard_1 | Salesforce
Online Shopping Cart
Cart
Reports
Dashboards
dashboard_1
+ Component
+ Filter
Save
Done
New Cart Report
140k
120k
100k
80k
60k
40k
20k
0
Sum of Price
Category
Electronics & Accessories
Sum of Price
123,990
(99.68% of 124k)
Books
Electronics & Accessories
Category
View Report (New Cart Report)

3. Create a web application to enter the faculty details like faculty ID, faculty name, and salary to a database and calculate the income tax to be paid by the faculty at the end of the financial year.

STEPS:

1. Launch your Salesforce Trailhead Playground by opening any module and Switch to Lightning Experience if you are currently in Salesforce Classic by clicking your picture in the right top corner and then click on "Switch to Lightning Experience".

2. Then go to Setup gear icon and click "Setup".

3. Click on "Object Manager" and click "Create> Custom Object" to create new Custom Object.

1. Name the object "Faculty"

2. Allow Reports and Allow Search.

3. Check the box in front of "Launch New Custom Tab Wizard after saving this custom object"

4. To create a Tab for the Object: Select any Tab Style for the object "Faculty". Click Next, Next, leave the defaults and save.

5. To add fields to the Object: Go to “Fields & Relationships” option of Student object and Click “New”

6. Add the following fields one after the other:

• Field Label: ID (Length 10), Data Type: Text, provide an example ID as Help Text, make it as Required Field, don’t allow Duplicate Values, make it as Case Insensitive and Set this field as the unique record identifier from an external system

• Field Label: Salary, Data Type: Currency (Length 16, Decimal Places 2), Make it as Required Field

To calculate Income Tax to be paid:

7. Go to “Buttons, Links and Actions” of Faculty Object and click “New Button or Link”

8. Name it as “Tax Calculation”

9. Select the radio button “Detail Page Link” as it is a website link.

10. Behaviour: Display in new window.

11. Content Source: URL.

12. Field Type: Faculty

13.In the empty space provided, type

https://www.incometaxindia.gov.in/Pages/tools/income-tax-calculator-234ABC.aspx

It is a link which redirects to the income tax calculation website.

14. Link Encoding: Unicode (UTF-8).

15. Click Save

16. Go to Page Layout, Click Faculty Layout.

17. Click Custom Links, Drag and drop the "Tax Calculation" link in the Custom Link area.

18. Click Save.

To add a rule to the faculty name so that it should take only valid names:

• Go to Validation Rule of Faculty object and click "New"

• Name it as "Name Validation".

• Error Condition Formula: NOT (REGEX (Name," [a-z] [A-Z] + [a-z] [A-Z] +")).

• Error Message: Please Enter a valid name.

• Error Location: Field – Faculty name.

• Click Save.

To create an application:

19. Go to "Setup" and type "App Manager" in Quick Find Box.

20. Click on "New Lightning App" to create a Lightning Application.

21. Name it as "Faculty Database", give the description for your application.

22. Uploading Image and changing colours are optional, then click Next.

23. Navigation Style: Standard Navigation, click Next.

24. No need to add any Utility Bar, click Next.

25. Add the following Items: Faculties, Reports and Dashboards, click Next.

26. Assign it to System Administrator Profile by selecting System Administrator and pressing right arrow and then click Save & Finish.

27. Go to App Manager, select your application and select Faculties and click "New" to add some details to your application.

28. Click the entry you added, go to details. Make sure you will get an error message when you enter an invalid name and invalid id.

29. Press the “Tax Calculation” link to calculate income tax.

30. Click OK so that it will redirect you to the income tax calculator website.

31. Enter the required Details and press “Calculate”.

Reports and Dashboards:

To Create a Faculty Report:

- Go to “Reports tab” Click on “New Folder” And give it any name and click on Save.
- Click on “New Report” and from search bar Search for “Faculty” and then select it then Click Continue.
- Add the required Columns to get the Complete Entered data.
- If you want the report to be grouped by any specific Fields then Search for the field in “Add groups” otherwise it is optional.
- Click on save and name the report as “New Faculties Report” and then select the folder which you have created.
- Click Save and then Click Run

To Create a Faculty Dashboard:

- Go to “Dashboard tab” and then click on “New Folder” and give it any Name.
- Click on “New Dashboard” and then name it as “Income Tax Dashboard” and select folder that you have created Click on Create.
- Click on the report that you have created and click on that and click select.
- Select any style to represent the data in dashboard.
- Add any filter(s), otherwise it is optional.
- Click on Save and Click Run

Hands-On Orgs
Income Tax Dashboard | Salesforc
playful-koala-ntbhby-dev-ed.trailblaze.lightning.force.com/one/one.app#eyJjb21wb25lbnREZWYiOiJkZXNrdG9wRGFzaGJvYXJkczpkYXNoYm9hcmQiL...
Search...
Faculty Database
Faculties
Reports
Dashboards
Dashboard
Income Tax Dashboard
As of Jan 4, 2023, 9:44 AM·Viewing as Keshav Regmi
Refresh
Edit
Subscribe
New Faculties Report
Record Count
3
2.5
2
1.5
1
0.5
0
$45,000.00
$50,000.00
$55,000.00
$60,000.00
Salary
View Report (New Faculties Report)

4. Create a web application to book a flight from a source to destination and store the status of flight, and departure timings on database.

STEPS:

1. Launch your Salesforce Trailhead Playground by opening any module and Switch to Lightning Experience if you are currently in Salesforce Classic by clicking your picture in the right top corner and then click on “Switch to Lightning Experience”

2. Then go to Setup gear icon and click “Setup”.

3. Click on “Object Manager” and click “Create > Custom Object” to create new Custom Object.

4. Name the object “Flight”.

5. Allow Reports and Allow Search.

6. Check the box in front of “Launch New Custom Tab Wizard after saving this custom object”.

7. To create a Tab for the Object: Select any Tab Style for the object “Flight”. Click Next, Next, leave the defaults and save.

8. To add fields to the Object: Go to “Fields & Relationships” option of Student object and Click “New”.

9. Add the following fields one after the other:

• Field Label: Source, Data Type: Text Area, make it as Required Field.

• Field Label: Destination, Data Type: Text Area, make it as Required Field.

• Field Label: Departure Timing, Data Type: Date/Time, make it as Required Field.

10.Validation Rules:

1.Date and time Validation:

To add a rule to the departure timing so that it is greater than today’s date and the present time:

• Go to Validation Rule of Flight Object and click “New”

• Name it as “Date Time should be in Range”

• Error Condition Formula: Departure_Timing__c<NOW ()

• Error Message: Departure Date/Time cannot be in past of present.

• Error Location: Field – Departure Timings.

• Click Save

2.Source and Destination Validation:

To add a rule to the Source and destination so that source and destination should not be equal:

• Go to Validation Rule of Flight Object and click "New"

• Name it as "Source and destination Checking"

• Error Condition Formula: Source__c = Destination__c

• Error Message: Source and destination can never be equal.

• Error Location: Top of the Page.

• Click Save.

Create one more object to provide status of the flight:

11. Name the Object "Status"

12. Allow Reports and Allow Search.

13. Check the box in front of "Launch New Custom Tab Wizard after saving this custom object"

14. Create a Tab for the Object.

15. To add fields to the Object: Go to "Fields & Relationships" option of Student object and Click "New".

16. Add the following fields one after the other:

• Field Label: Flight Name, Data Type: Master-Detail Relationship, Related to: Flight.

• Sharing Setting: Read-Only. Leave the defaults and save.

• Master – Detail relationship is provided to enter status only to the existing flights.

• Field Label: Flight Status, Data Type: Picklist, click radio button in front of Enter values, with each value separated by a new line.

• Values are: Arrived, Cancelled, Delayed and Departed.

• Make it as Required Field and Restrict the values to the values in the picklist.

17. To create an application:

18. Go to “Setup” and type “App Manager” in Quick Find Box.

19. Click on “New Lightning App” to create a Lightning Application.

20. Name it as “Flight Details”, give the description for your application.

21. Uploading Image and changing colours are optional, then click Next.

22. Navigation Style: Standard Navigation, click Next.

23. No need to add any Utility Bar, click Next.

24. Add the following Items: Flights, Statuses, Reports and Dashboards, click Next.

25. Assign it to System Administrator Profile by selecting System Administrator and pressing right arrow and then click Save & Finish.

26. Go to App Manager, select your application and select Flights and click “New” to add some details to your application.

Make sure you will get an error message when you try to give the Departure Timing less than the current time and today's date

Make sure you will get an error message when you give source and destination station names as same.

Reports and Dashboards:

To Create a Flights Report:

• Go to “Reports tab” Click on “New Folder” And give it any name and then click Save.

• Click on “New Report” and from search bar Search for “Flights” and then select it and Click Continue.

• Add the required Columns to get the Complete Entered data.

• If you want the report to be grouped by any specific Fields then Search for the field in “Add groups” otherwise it is optional.

• Click on save and name the report as “New Flights Report” and then select the folder which you have created.

• Click Save and then Click Run.

To Create a Status Report:

• Go to “Reports tab” Click on “New Folder” And give it any name and then click Save.

• Click on “New Report” and from search bar Search for “Flights with Status” and then select it and then click Continue.

• Add the required Columns to get the Complete Entered data.

• If you want the report to be grouped by any specific Fields then Search for the field in “Add groups” otherwise it is optional.

• Click on save and name the report as “New Flights with status Report” and then select the folder which you have created.

• Click Save and then Click Run

To Create a Status Dashboard:

•Go to “Dashboard tab” and then click on “New Folder” and give it any Name.

•Click on “New Dashboard” and then name it as “Status” and select folder that you have created Click on Create.

• Click on the report that you have created and click on that and click select.

• Select any style to represent the data in dashboard.

• Add any filter(s), otherwise it is optional.

• Click on Save and Click Run

New Status | Salesforce
Status | Salesforce
mindful-unicorn-5ma8su-dev-ed.trailblaze.lightning.force.com/one/one.app#eyJjb21wb25lbnREZWYiOiJkZXNrdG9wRGFzaGJvYXJkczpkYXNoY...
Search...
Flight Details
Flights
Status
Reports
Dashboards
Status
Component
Filter
Save
Done
New Flights with Status Report
Record Count
3
2.5
2
1.5
1
0.5
0
3
1
1
2
Arrival Status
Cancel Status
Delayed Flights
Departed Flights
Status: Status Name
View Report (New Flights with Status Report)

5. Create a collaborative learning environment for a particular learning topic using Google Apps. Google Drive, Google Docs and Google Slides must be used for hosting e-books, important articles and presentations.

STEPS:

1. Open http://drive.google.com/ and Sign In with your google account.

2. Create a new folder named "My Learning Environment" by clicking "New" button on the top left corner.

3. Right click on the folder created and tap "Share" then click on "Advanced".

4. Under the "Who has Access" section click on "Change" of the first option.

5. Now check on the "On- Public on the web" option & set the Access to "Can View Only" and Click Save. This will make your folder to be accessible by anyone on the internet to view its contents and download them

6. Copy the link and post it or share it to anyone you like.

Adding Learning Contents to your Environment:

7. Double click on the folder you just created and click “New” button again.

8. Add these items:

a. Folder: Named “E-Books” where you will open the folder and click “New” and “Upload a file” like a Book from your hard drive

b. Google Docs: Named “Important Quotes” where you will add some important links to the doc file. The file will keep saving hence you need to press save. click “Share” if you wish to share it

c. Google Slide: Named “Welcome Folks” make a few changes and add your content and choose your theme

d. You may also add many other items as necessary.

• At any point in future if you wish to share this environment right click on the folder and click share. Copy the link and share

https://drive.google.com/drive/folders/1pxcSeVFFS947T2cgZYm63LOGhNSCXA5O?usp=sharing

6. Develop Department events registration app with an object containing event name, date/time, venue as parent relationship, another object containing student name, branch, event name, date/time, venue as child relationship.

STEPS:

1. Launch your Salesforce Trailhead Playground by opening any module and Switch to Lightning Experience if you are currently in Salesforce Classic by clicking your picture in the right top corner and then click on "Switch to Lightning Experience".

2. Then go to Setup gear icon and click "Setup".

3. Click on "Object Manager" and click "Create > Custom Object" to create new Custom Object.

4. Name the object "Event".

5. Allow Reports and Allow Search.

6. Check the box in front of "Launch New Custom Tab Wizard after saving this custom object".

7. To create a Tab for the Object:

Select any Tab Style for the object "Event". Click Next, Next, leave the defaults and save.

8. To add fields to the Object:

- Go to "Fields & Relationships" option of Student object and Click "New".

9. Add the following fields one after the other:

- Field Label: Event Time, Data Type: Date/Time, make it as Required Field.

- Field Label: Event Venue, Data Type: Text Area, make it as Required Field.

10. To add a rule to the Event Date/Time so that it is greater than today's date and the present time: • Go to Validation Rule of Event Object and click "New".

• Name it as "Date and Time in Range".

• Error Condition Formula: Event_Time__c <NOW ()

• Error Message: Date or time less than the current one.

• Error Location: Field – Event Time.

• Click Save.

Create one more object to store student details:

11. Name the Object “Student1”.

12. Allow Reports and Allow Search.

13.Check the box in front of “Launch New Custom Tab Wizard after saving this custom object”.

14. Create a Tab for the Object.

15. To add fields to the Object:

- Go to “Fields & Relationships” option of Student object and Click “New”.

16. Add the following fields one after the other:

- Field Label: Event Name, Data Type: Text.

- Field Label: Event Time, Data Type: Master-Detail Relationship, Related to: Event.

Sharing Setting: Read-Only. Leave the defaults and save.

- Field Label: Event Venue, Data Type: Look up Relationship, Related to: Event.

- Field Label: Branch, Data Type: Text, Make it as a Required Field.

17. To create an application:

18. Go to “Setup” and type “App Manager” in Quick Find Box.

19. Click on “New Lightning App” to create a Lightning Application.

20. Name it as “Events’ Registrations”, give the description for your application.

21. Uploading Image and changing colours are optional, then click Next.

22. Navigation Style: Standard Navigation, click Next.

23. No need to add any Utility Bar, click Next.

24. Add the following Items: Events, Students, Reports and Dashboards, click Next.

25. Assign it to System Administrator Profile by selecting System Administrator and pressing right arrow and then click Save & Finish.

26. Go to App Manager, select your application and select Events and click “New” to add some details to your application.

27. Make sure you will get an error message when you try to give the Event Time less than the current time and today’s date and also you can’t select events which are not there in the list.

Reports and Dashboards:

To Create an Event Report:

• Go to “Reports tab” Click on “New Folder” And give it any name and Click Save.

• Click on “New Report” and from search bar Search for “Events” and then select it then Click Continue.

• Add the required Columns to get the Complete Entered data.

• If you want the report to be grouped by any specific Fields then Search for the field in “Add groups” otherwise it is optional.

• Click on save and name the report as “New Events Report” and then select the folder which you have created.

• Click Save and then Click Run

To Create a Students Report:

• Go to “Reports tab” Click on “New Folder” And give it any name and Click Save.

• Click on “New Report” and from search bar Search for “Students with Events” and then select it then Click Continue.

• Add the required Columns to get the Complete Entered data.

• If you want the report to be grouped by any specific Fields then Search for the field in “Add groups” otherwise it is optional.

• Click on save and name the report as “New Events with Students Report” and then select the folder which you have created

To Create an Event Dashboard:

• Go to “Dashboard tab” and then click on “New Folder” and give it any Name.

• Click on “New Dashboard” and then name it as “Event Dashboard” and select folder that you have created, Click on Create.

• Click on the report that you have created and click on that and click select.

• Select any style to represent the data in dashboard.

• Add any filter(s), otherwise it is optional.

• Click on Save and Click Run

To Create a Student1 Dashboard:

• Go to “Dashboard tab” and then click on “New Folder” and give it any Name.

• Click on “New Dashboard” and then name it as “Students with Events Dashboard” and select folder that you have created, Click on Create.

• Click on the report that you have created and click on that and click select.

• Select any style to represent the data in dashboard.

• Add any filter(s), otherwise it is optional.

• Click on Save and Click Run

7. Develop Blood Donation registration app with an object which records donors name, age and blood group as parent relationship and another object containing haemoglobin level, donated or not details.

STEPS:

1. Launch your Salesforce Trailhead Playground by opening any module and Switch to Lightning Experience if you are currently in Salesforce Classic by clicking your picture in the right top corner and then click on "Switch to Lightning Experience"

2. Then go to Setup gear icon and click "Setup".

3. Click on "Object Manager" and click "Create > Custom Object" to create new Custom Object.

4. Name the object "Donor"

5. Allow Reports and Allow Search.

6. Check the box in front of "Launch New Custom Tab Wizard after saving this custom object".

7. To create a Tab for the Object: Select any Tab Style for the object "Donor". Click Next, Next, leave the defaults and save.

8. To add fields to the Object:

Go to "Fields & Relationships" option of Student object and Click "New".

9. Add the following fields one after the other:

• Field Label: Age, Data Type: Number (3,0).

• Field Label: Blood Group, Data Type: Picklist, click radio button in front of Enter values, with each value separated by a new line.

• Values are: A+ve, B+ve, A-ve, B-ve, O+ve, O-ve, AB+ve, AB-ve.

• Make it as Required Field and Restrict the values to the values in the Picklist.

• Field Label: Gender, Data Type: Picklist, click radio button in front of Enter values, with each value separated by a new line.

• Values are: Male, Female, Others. • Field Label: Weight, Data Type: Number (3,2).

Create one more object to store Collection details:

10. Name the Object “Record”.

11. Allow Reports and Allow Search.

12. Check the box in front of “Launch New Custom Tab Wizard after saving this custom object”

13. Create a Tab for the Object.

14. To add fields to the Object:

- Go to “Fields & Relationships” option of Student object and Click “New”.

15. Add the following fields one after the other:

• Field Label: Haemoglobin level, Data Type: Number (2,2).

• Field Label: Donor Name, Data Type: Look up Relationship, Related to: Donor.

• Field Label: Blood Group, Data Type: Look up Relationship, Related to: Donor.

• Field Label: Age, Data Type: Master-Detail Relationship, Related to: Donor. Sharing Setting: Read-Only. Leave the defaults and save.

• Field Label: Status, Data Type: Picklist, Values: Donated, Not Donated, Make it as a Required Field

Validation Rules:

1. Age Validation: To add a rule to the Donor age so that it is greater than 18 years:

• Go to Validation Rule of Donor Object and click “New”

• Name it as “Age Validation”.

• Error Condition Formula: age__c < 18.

• Error Message: Age must be greater than 18.

• Error Location: Field – Age.

• Click Save

2.Weight Validation:

To add a rule to the Donor Weight so that it Should be greater than 50:

• Go to Validation Rule of Donor Object and click "New"

• Name it as "Weight Validation".

• Error Condition Formula: weight__c < 50.

• Error Message: Eat more and gain your weight to 50 kgs.

• Error Location: Field –weight.

• Click Save

16. To create an application:

17. Go to "Setup" and type "App Manager" in Quick Find Box.

18. Click on "New Lightning App" to create a Lightning Application.

19. Name it as "Blood Donation", give the description for your application.

20. Uploading Image and changing colours are optional, then click Next.

21. Navigation Style: Standard Navigation, click Next.

22. No need to add any Utility Bar, click Next.

23. Add the following Items: Donors, Records, Reports and Dashboards, click Next.

24. Assign it to System Administrator Profile by selecting System Administrator and pressing right arrow and then click Save & Finish.

25. Go to App Manager, select your application and select Donors and click "New" to add some details to your application.

26. Make sure you can't donate when your age is less than 18 years and when your weight is not 50 kgs.

Reports and Dashboards:

To Create a Donor Report:

• Go to “Reports tab” Click on “New Folder” And give it any name then click on Save.

• Click on “New Report” and from search bar Search for “Donors” and then select it and then click on Continue.

• Add the required Columns to get the Complete Entered data

• If you want the report to be grouped by any specific Fields then Search for the field in “Add groups” otherwise it is optional.

• Click on save and name the report as “New Donor Report” and then select the folder which you have created.

• Click Save and then Click Run.

To Create a Records Report:

• Go to “Reports tab” Click on “New Folder” And give it any name then click on Save.

• Click on “New Report” and from search bar Search for “Donors with records” and then select it and then click on Continue.

• Add the required Columns to get the Complete Entered data.

• If you want the report to be grouped by any specific Fields then Search for the field in “Add groups” otherwise it is optional.

• Click on save and name the report as “New Donors with record Report” and then select the folder which you have created.

• Click Save and then Click Run.

To Create a Donor Dashboard:

• Go to “Dashboard tab” and then click on “New Folder” and give it any Name.

• Click on “New Dashboard” and then name it as “Donors Dashboard” and select folder that you have created Click on Create.

• Click on the report that you have created and click on that and click select.

• Select any style to represent the data in dashboard.

• Add any filter(s), otherwise it is optional.

• Click on Save and Click Run

To Create a Records Dashboard:

• Go to “Dashboard tab” and then click on “New Folder” and give it any Name.

• Click on “New Dashboard” and then name it as “Donors with record Dashboard” and select folder that you have created Click on Create.

• Click on the report that you have created and click on that and click select.

• Select any style to represent the data in dashboard.

• Add any filter(s), otherwise it is optional.

• Click on Save and Click Run

8. Develop Attendance maintenance app with an object to record student details and attendance and a provide a link to college websites results webpage.

1. Launch your Salesforce Trailhead Playground by opening any module and Switch to Lightning Experience if you are currently in Salesforce Classic by clicking your picture in the right top corner and then click on "Switch to Lightning Experience"

2. Then go to Setup gear icon and click "Setup".

3. Click on "Object Manager" and click "Create > Custom Object" to create new Custom Object.

4. Name the object "Student".

5. Allow Reports and Allow Search.

6. Check the box in front of "Launch New Custom Tab Wizard after saving this custom object".

7. To create a Tab for the Object: Select any Tab Style for the object "Student". Click Next, Next, leave the defaults and save.

8. To add fields to the Object:

Go to "Fields & Relationships" option of Student object and Click "New".

9. Add the following fields one after the other:

• Field Label: USN (Length 10), Data Type: Text, provide an example USN as Help Text, make it as Required Field and Don't allow Duplicate Values and make it as Case Insensitive.

• Field Label: Technical Branches, Data Type: Picklist, click radio button in front of Enter values, with each value separated by a new line.

• Values are: CSE, ISE, TCE, EEE, EC etc.

• Make it as Required Field and Restrict the values to the values in the picklist.

• Field Label: Total Attendance %, Data Type: Percent (3,2).

• Field Label: Semester, Data Type: Number (2,0).

To include Custom Links:

10. Go to “Buttons, Links and Actions” of “Student” Object and click “New Button or Link”.

11. Name it as “Check Details”.

12. Select the radio button “Detail Page Link” as it is a website link.

13. Behaviour: Display in new window.

14. Content Source: URL.

15. Field Type: Student.

16. In the empty space provided, type http://www.drait.edu.in/ It is a link which redirects to the income tax calculation website.

17. Link Encoding: Unicode (UTF-8).

18. Click Save

19. Go to Page Layout, Click Student Layout.

20. Click Custom Links, Drag and drop the "Check Details" link in the Custom Link area.

21. Click save.

22. To create an application:

23. Go to "Setup" and type "App Manager" in Quick Find Box.

24. Click on "New Lightning App" to create a Lightning Application.

25. Name it as "Attendance Management", give the description for your application.

26. Uploading Image and changing colours are optional, then click Next.

27. Navigation Style: Standard Navigation, click Next.

28. No need to add any Utility Bar, click Next.

29. Add the following Items: Student, Records, Reports and Dashboards, click Next.

30. Assign it to System Administrator Profile by selecting System Administrator and pressing right arrow and then click Save & Finish.

31. Go to App Manager, select your application and select Student and click "New" to add some details to your application.

Make Sure you are redirected to the College Website When you click on the Check Details Link.

Reports and Dashboards:

To Create a Student Report:

• Go to “Reports tab” Click on “New Folder” And give it any name then click Save

• Click on “New Report” and from search bar Search for “Attendance Management” and then select it then click Continue.

• Add the required Columns to get the Complete Entered data.

• If you want the report to be grouped by any specific Fields then Search for the field in “Add groups” otherwise it is optional.

• Click on save and name the report as “New Students Report” and then select the folder which you have created.

• Click Save and then Click Run.

To Create a Student Dashboard:

• Go to “Dashboard tab” and then click on “New Folder” and give it any Name.

• Click on “New Dashboard” and then name it as “Attendance Management” and select folder that you have created Click on Create.

• Click on the report that you have created and click on that and click select.

• Select any style to represent the data in dashboard.

• Add any filter(s), otherwise it is optional.

• Click on Save and Click Run

Attendance Management | Salesf
curious-panda-q0if2b-dev-ed.trailblaze.lightning.force.com/lightning/r/Dashboard/01Z2w0000014RO3EAM/view?queryScope=userFolders
Search...
Attendance Manag...
Students
Reports
Dashboards
Dashboard
Attendance Management
As of Jan 13, 2023, 9:08 AM·Viewing as Keshav Regmi
Refresh
Edit
Subscribe
New Students Report
0%
41.4%
82.7%
124.1%
165.4%
206.8%
248.1%
289.5%
330.8%
372.2%
413.5%
413.5%
View Report (New Students Report)

9. Create a web application with objects to maintain database of an art gallery which contains objects like artists, arts, inventory and provide a link to any of the art gallery website.

STEPS:

1. Launch your Salesforce Trailhead Playground by opening any module and Switch to Lightning Experience if you are currently in Salesforce Classic by clicking your picture in the right top corner and then click on "Switch to Lightning Experience".

2. Then go to Setup gear icon and click "Setup".

3. Click on "Object Manager" and click "Create > Custom Object" to create new Custom Object.

4. Name the object "Artist".

5. Allow Reports and Allow Search.

6. Check the box in front of "Launch New Custom Tab Wizard after saving this custom object".

7. To create a Tab for the Object: Select any Tab Style for the object "Artist". Click Next, Next, leave the defaults and save.

8. To add fields to the Object: Go to "Fields & Relationships" option of Student object and Click "New".

9. Add the following fields one after the other:

- Field Label: ID (Length 10), Data Type: Text, provide an example ID as Help Text, make it as required Field, don't allow Duplicate Values, make it as Case Insensitive and Set this field as the unique record identifier from an external system.

- Field Label: Art Name and Details, Data Type: Text, Make it as a required field.

- Field Label: Style, Data Type: Picklist,

  - Values: Pencil Sketching, craft design, free hand, Human portrait, drawing, painting etc.
  - Make it as Required Field and restrict values to the values in the picklist

Create one more object to store Collection details:

10. Name the Object “Art”.

11. Allow Reports and Allow Search

12. Check the box in front of “Launch New Custom Tab Wizard after saving this custom object”.

13. Create a Tab for the Object.

14. To add fields to the Object: Go to “Fields & Relationships” option of Student object and Click “New”.

15. Add the following fields one after the other:

- Field Label: Art Name and Details, Data Type: Master-Detail Relationship, Related to: Artist. Sharing Setting: Read-Only. Leave the defaults and save.

- Field Label: ID (Length 10), Data Type: Text, provide an example ID as Help Text, make it as required Field, don’t allow Duplicate Values, make it as Case Insensitive and Set this field as the unique record identifier from an external system.

Create one more object to store inventory details:

16. Name the Object “Inventory”.

17. Allow Reports and Allow Search.

18. Check the box in front of “Launch New Custom Tab Wizard after saving this custom object”

19. Create a Tab for the Object.

20. To add fields to the Object: Go to “Fields & Relationships” option of Student object and Click “New”.

21. Add the following fields one after the other:

- Field Label: Quantity, Data Type: Number. Make it as a required field.

To give a link to any art gallery website:

22. Go to “Buttons, Links and Actions” of Art Object and click “New Button or Link”.

23. Name it as “Gallery”.

24. Select the radio button “Detail Page Link” as it is a website link.

25. Behaviour: Display in new window.

26. Content Source: URL 27. Field Type: Gallery.

28. In the empty space provided, type, http://www.aakritiartgallery.com/ Link

Encoding: Unicode (UTF-8).

30. Click Save.

31. Go to Page Layout, Click Art Layout.

32. Click Custom Links, Drag and drop the “Gallery” link in the Custom Link area.

33. Click save.

To add a rule to the Artist id so that it should take valid id:

• Go to Validation Rule of Artist Object and click "New".

• Name it as "Artist id validation".

• Error Condition Formula: NOT(BEGINS(ID__c,'ART')).

• Error Message: Please Enter a Valid id of an artist.

• Error Location: Field –id.

• Click Save

To create an application:

34. Go to "Setup" and type "App Manager" in Quick Find Box.

35. Click on "New Lightning App" to create a Lightning Application.

36. Name it as "Art Gallery Database", give the description for your application.

37. Uploading Image and changing colours are optional, then click Next.

38. Navigation Style: Standard Navigation, click Next.

39. No need to add any Utility Bar, click Next.

40. Add the following Items: Artists, Arts, Inventories, Reports and Dashboards, click Next.

41. Assign it to System Administrator Profile by selecting System Administrator and pressing right arrow and then click Save & Finish.

42. Go to App Manager, select your application and select Faculties and click "New" to add some details to your application.

43. Click the entry you added, go to details.

44. Press the "Gallery" link to check the details.

45. Click OK so that it will redirect you to the website. Make sure it should an error when an invalid id is given.

Reports and Dashboards:

To Create an Artists Report:

• Go to “Reports tab” Click on “New Folder” And give it any name and Click Save.

• Click on “New Report” and from search bar Search for “Artists” and then select it and then Click Continue.

• Add the required Columns to get the Complete Entered data.

• If you want the report to be grouped by any specific Fields then Search for the field in “Add groups” otherwise it is optional.

• Click on save and name the report as “New Artists Report” and then select the folder which you have created.

• Click Save and then Click Run

To Create an Arts Report:

• Go to “Reports tab” Click on “New Folder” And give it any name.

• Click on “New Report” and from search bar Search for “Artists with Arts” and then select it.

• Add the required Columns to get the Complete Entered data.

• If you want the report to be grouped by any specific Fields then Search for the field in “Add groups” otherwise it is optional.

• Click on save and name the report as “New Artists with Arts Report” and then select the folder which you have created.

• Click Save and then Click Run

To Create an Inventory Report:

• Go to “Reports tab” Click on “New Folder” And give it any name.

• Click on “New Report” and from search bar Search for “Inventories” and then select it.

• Add the required Columns to get the Complete Entered data.

• If you want the report to be grouped by any specific Fields then Search for the field in “Add groups” otherwise it is optional.

• Click on save and name the report as “New Inventories Report” and then select the folder which you have created.

• Click Save and then Click Run.

To Create an Artists Dashboard:

• Go to “Dashboard tab” and then click on “New Folder” and give it any Name.

• Click on “New Dashboard” and then name it as “Art Gallery Dashboard” and select folder that you have created Click on Create.

• Click on the report that you have created and click on that and click select.

• Select any style to represent the data in dashboard.

• Add any filter(s), otherwise it is optional. • Click on Save and Click Run

To Create an Arts Dashboard:

• Go to “Dashboard tab” and then click on “New Folder” and give it any Name.

• Click on “New Dashboard” and then name it as “Artists with art Dashboard” and select folder that you have created Click on Create.

• Click on the report that you have created and click on that and click select.

• Select any style to represent the data in dashboard.

• Add any filter(s), otherwise it is optional.

• Click on Save and Click Run

To Create an Inventory Dashboard:

• Go to “Dashboard tab” and then click on “New Folder” and give it any Name.

• Click on “New Dashboard” and then name it as “Inventory Dashboard” and select folder that you have created Click on Create.

• Click on the report that you have created and click on that and click select.

• Select any style to represent the data in dashboard.

• Add any filter(s), otherwise it is optional.

• Click on Save and Click Run

10. Create a web application with objects to record details about staff, syllabus and activities of a department and provide a link to college website from any of the objects.

STEPS:

1. Launch your Salesforce Trailhead Playground by opening any module and Switch to Lightning Experience if you are currently in Salesforce Classic by clicking your picture in the right top corner and then click on "Switch to Lightning Experience"

2. Then go to Setup gear icon and click "Setup".

3. Click on "Object Manager" and click "Create > Custom Object" to create new Custom Object.

4. Name the object "Staff".

5. Allow Reports and Allow Search.

6. Check the box in front of "Launch New Custom Tab Wizard after saving this custom object".

7. To create a Tab for the Object: Select any Tab Style for the object "Staff". Click Next, Next, leave the defaults and save.

8. To add fields to the Object: Go to "Fields & Relationships" option of Student object and Click "New".

9. Add the following fields one after the other:

- Field Label: ID (Length 10), Data Type: Text, provide an example ID as Help Text, make it as Required Field, don't allow Duplicate Values, make it as Case Insensitive and Set this field as the unique record identifier from an external system.

- Field Label: Branch, Data Type: Text, Make it as a required field.

Create one more object to store Syllabus details:

10. Name the Object “Syllabus”.

11. Allow Reports and Allow Search.

12. Check the box in front of “Launch New Custom Tab Wizard after saving this custom object”

13. Create a Tab for the Object.

14. To add fields to the Object:

Go to “Fields & Relationships” option of Student object and Click “New”.

15. Add the following fields one after the other:

- Field Label: Subject Code, Data Type: Text.
- Field Label: Credits, Data Type: Number.

Create one more object to store department activities’ details:

16. Name the Object “Activities”.

17. Allow Reports and Allow Search.

18. Check the box in front of “Launch New Custom Tab Wizard after saving this custom object”

19. Create a Tab for the Object.

20. To add fields to the Object:

Go to “Fields & Relationships” option of Student object and Click “New”.

21. Add the following fields one after the other:

- Field Label: Details, Data Type: Text. Make it as a required field

Validation Rules:

1.Staff id Validation:

To add a rule to the Staff is so that it should take only valid ids:

• Go to Validation Rule of Staff Object and click “New”

• Name it as “Staff id validation”.

• Error Condition Formula: NOT(BEGINS(ID__c,’STAFF’)).

• Error Message: Please enter a valid staff Id.

• Error Location: Field – ID.

• Click Save.

To add a rule to the Subject code so that it should not take invalid sub code:

• Go to Validation Rule of Syllabus Object and click “New”.

• Name it as “Sub code validation”

• Error Condition Formula: NOT (REGEX (Subject_Code__c, "[0-9]{2} +[a-z] [A-Z]{2} + [0-9]{2} +")).

• Error Message: Please Enter a valid Subject code.

• Error Location: Field – Subject Code.

• Click Save

To add a rule to the Credits so that it Should not take more than 4 credits:

• Go to Validation Rule of Syllabus Object and click “New”.

• Name it as “Credits validation”.

• Error Condition Formula: OR (credits__c >4, Credits__c <=0).

• Error Message: Please Enter the credits which is less than 4.

• Error Location: Field –Credit.

• Click Save.

To give a link to college website:

22. Go to “Buttons, Links and Actions” of Art Object and click “New Button or Link”.

23. Name it as “College”.

24. Select the radio button “Detail Page Link” as it is a website link.

25. Behaviour: Display in new window.

26. Content Source: URL.

27. Field Type: College.

28. In the empty space provided, type https://www.drait.edu.in/

29. Link Encoding: Unicode (UTF-8).

30. Click Save

31. Go to Page Layout, Click Activities Layout.

32. Click Custom Links, Drag and drop the "College" link in the Custom Link area.

33. Click Save.

To create an application:

34. Go to “Setup” and type “App Manager” in Quick Find Box.

35. Click on “New Lightning App” to create a Lightning Application.

36. Name it as “Department Details”, give the description for your application.

37. Uploading Image and changing colours are optional, then click Next.

38. Navigation Style: Standard Navigation, click Next.

39. No need to add any Utility Bar, click Next.

40. Add the following:

41. Items: Staff, Syllabuses, Activities, Reports and Dashboards, click Next.

42. Assign it to System Administrator Profile by selecting System Administrator and pressing right arrow and then click Save & Finish.

43. Go to App Manager, select your application and select Faculties and click “New” to add some details to your application.

44. Click the entry you added, go to details.

45. Press the “College” link to check the details.

46. Click OK so that it will redirect you to the website. Make Sure You will get an error when u give invalid staff id, credits and Subject code

Hands-On Orgs
New Staff | Salesforce
empathetic-wolf-w3g44e-dev-ed.trailblaze.lightning.force.com/lightning/o/Staff__c/new?count=1&nooverride=1&useRecordTypeCheck=1&navigati...
Department Details
Staffs
Syllabuses
Activites
Reports
Dashboards
Staffs
Recently Viewed
0 items • Updated a minute ago
Staff Name
New
Import
Change Owner
New Staff
Information
* Staff Name
Kushal Marahatta
* ID
074da
Please Enter a valid staff ID
* Branch
CSE
Owner
Keshav Regmi
Cancel
Save & New
Save

Hands-On Orgs
Praveena MV | Salesforce
empathetic-wolf-w3g44e-dev-ed.trailblaze.lightning.force.com/lightning/r/Staff__c/a002w00000VfYGNAA3/view
Department Details
Staffs
Syllabuses
Activites
Reports
Dashboards
Staff
Praveena MV
New Contact
Edit
New Opportunity
Related
Details
Staff Name
Praveena MV
ID
STAFF080
Branch
CSE
Created By
Keshav Regmi, 1/4/2023, 7:52 AM
Owner
Keshav Regmi
Last Modified By
Keshav Regmi, 1/4/2023, 7:53 AM

Hands-On Orgs
New Syllabus | Salesforce
empathetic-wolf-w3g44e-dev-ed.trailblaze.lightning.force.com/lightning/o/Syllabus__c/new?count=7&nooverride=1&useRecordTypeCheck=1&navi...
Department Details
Staffs
Syllabuses
Activites
Reports
Dashboards
Syllabuses
Recently Viewed
0 items • Updated a few seconds ago
Syllabus Name
New
Import
Change Owner
New Syllabus
Information
*Syllabus Name
Cloud Computing
*Subject Code
18CS
Please Enter a valid Subject Code
*Credits
5
Please Enter the credits which is less than 4
Owner
Keshav Regmi
Cancel
Save & New
Save

Hands-On Orgs
Cloud Computing | Salesforce
empathetic-wolf-w3g44e-dev-ed.trailblaze.lightning.force.com/lightning/r/Syllabus__c/a012w000013S2s1AAC/view
Department Details
Staffs
Syllabuses
Activites
Reports
Dashboards
Syllabus
Cloud Computing
New Contact
Edit
New Opportunity
Related
Details
Syllabus Name
Cloud Computing
Subject Code
18CS71
Credits
4
Owner
Keshav Regmi
Created By
Keshav Regmi, 1/4/2023, 8:01 AM
Last Modified By
Keshav Regmi, 1/4/2023, 8:01 AM

Reports and Dashboards:

To Create a Staff Report:

• Go to “Reports tab” Click on “New Folder” And give it any name then select Save.

• Click on “New Report” and from search bar Search for “Staffs” and then select it then select Continue.

• Add the required Columns to get the Complete Entered data.

• If you want the report to be grouped by any specific Fields then Search for the field in “Add groups” otherwise it is optional.

• Click on save and name the report as “New Staffs Report” and then select the folder which you have created.

• Click Save and then Click Run.

To Create a Syllabus Report:

• Go to “Reports tab” Click on “New Folder” And give it any name then select Save.

• Click on “New Report” and from search bar Search for “Syllabus” and then select it then select Continue.

• Add the required Columns to get the Complete Entered data.

• If you want the report to be grouped by any specific Fields then Search for the field in “Add groups” otherwise it is optional.

• Click on save and name the report as “New Syllabus Report” and then select the folder which you have created.

• Click Save and then Click Run

To Create an Activities Report:

• Go to “Reports tab” Click on “New Folder” And give it any name then select Save.

• Click on “New Report” and from search bar Search for “Activities” and then select it then select Continue.

• Add the required Columns to get the Complete Entered data.

• If you want the report to be grouped by any specific Fields then Search for the field in “Add groups” otherwise it is optional.

• Click on save and name the report as “New Activities Report” and then select the folder which you have created.

• Click Save and then Click Run

To Create a Staff Dashboard:

• Go to “Dashboard tab” and then click on “New Folder” and give it any Name.

• Click on “New Dashboard” and then name it as “Staff dashboard” and select folder that you have created Click on Create.

• Click on the report that you have created and click on that and click select.

• Select any style to represent the data in dashboard.

• Add any filter(s), otherwise it is optional.

• Click on Save and Click Run

To Create a Syllabus Dashboard:

• Go to “Dashboard tab” and then click on “New Folder” and give it any Name.

• Click on “New Dashboard” and then name it as “Syllabus dashboard” and select folder that you have created Click on Create.

• Click on the report that you have created and click on that and click select.

• Select any style to represent the data in dashboard.

• Add any filter(s), otherwise it is optional.

• Click on Save and Click Run.

To Create an Activities Dashboard:

• Go to “Dashboard tab” and then click on “New Folder” and give it any Name.

• Click on “New Dashboard” and then name it as “Activities dashboard” and select folder that you have created Click on Create.

• Click on the report that you have created and click on that and click select.

• Select any style to represent the data in dashboard.

• Add any filter(s), otherwise it is optional.

• Click on Save and Click Run

VM WARE, VIRTUAL BOX AND GUEST OS

Virtual Box

VirtualBox is a powerful x86 and AMD64/Intel64 virtualization product for enterprise as well as home use. Not only is VirtualBox an extremely feature rich, high-performance product for enterprise customers, it is also the only professional solution that is freely available as Open-Source Software under the terms of the GNU General Public License (GPL) version 2. See "About VirtualBox" for an introduction.

Presently, VirtualBox runs on Windows, Linux, Macintosh, and Solaris hosts and supports a large number of guest operating systems including but not limited to Windows (NT 4.0, 2000, XP, Server 2003, Vista, Windows 7, Windows 8, Windows 10), DOS/Windows 3.x, Linux (2.4, 2.6, 3.x and 4.x), Solaris and Open Solaris, OS/2, and OpenBSD.

VirtualBox is being actively developed with frequent releases and has an ever- growing list of features, supported guest operating systems and platforms it runs on. VirtualBox is a community effort backed by a dedicated company: everyone is encouraged to contribute while Oracle ensures the product always meets professional quality criteria.

History:

VirtualBox was first offered by Innotek GmbH from Weinstadt, Germany, under a proprietary software license, making one version of the product available at no cost for personal or evaluation use, subject to the VirtualBox Personal Use and Evaluation License (PUEL). In January 2007, based on counsel by LiSoG, Innotek GmbH released VirtualBox Open-Source Edition (OSE) as free and open-source software, subject to the requirements of the GNU General Public License (GPL), version 2. Innotek GmbH also contributed to the

development of OS/2 and Linux support in virtualization and OS/2 ports of products from Connectix which were later acquired by Microsoft. Specifically, Innotek developed the "additions" code in both Windows Virtual PC and Microsoft Virtual Server, which enables various host–guest OS interactions like shared clipboards or dynamic viewport resizing.

Sun Microsystems acquired Innotek in February 2008.Following the acquisition of Sun Microsystems by Oracle Corporation in January 2010, the product was re- branded as "Oracle VM VirtualBox". In December 2019, VirtualBox started supporting only hardware-assisted virtualization, dropping support for Software- based one.

Features:

- Snapshots of the RAM and storage that allow reverting to a prior state.
- Screenshots and screen video capture
- "Host key" for releasing the keyboard and mouse cursor to the host system if captured (coupled) to the guest system, and for keyboard shortcuts to features such as configuration, restarting, and screenshot. By default, it is the right-side CTRL key.
- Mouse pointer integration, meaning automatic coupling and uncoupling of mouse cursor when moved inside and outside the virtual screen, if supported by guest operating system.
- Seamless mode – the ability to run virtualized applications side by side with normal desktop applications
- Shared clipboard
- Shared folders through "guest additions" software
- Special drivers and utilities to facilitate switching between systems
- Ability to specify amount of shared RAM, video memory, and CPU execution cap
- Ability to emulate multiple screens
- Command line interaction (in addition to the GUI)
- Public API (Java, Python, SOAP, XPCOM) to control VM configuration and execution
- Nested paging for AMD-V and Intel VT (only for processors supporting SLAT and with SLAT enabled)
- Limited support for 3D graphics acceleration (including OpenGL up to (but not including) 3.0 and Direct3D 9.0c via Wine's Direct3D to OpenGL translation)
- SMP support (up to 32 virtual CPUs per virtual machine), since version 3.0
- Teleportation (aka Live Migration)

- 2D video output acceleration (not to be mistaken with video decoding acceleration), since version 3.1
- EFI has been supported since version 3.1 (Windows 7 guests are not supported).

VM Ware

VMware, Inc. is an American cloud computing and virtualization technology company with headquarters in California. VMware was the first commercially successful company to virtualize the x86 architecture. VMware's desktop software runs on Microsoft Windows, Linux, and macOS, while its enterprise software hypervisor for servers, VMware ESXi, is a bare-metal hypervisor that runs directly on server hardware without requiring an additional underlying operating system. VMware's most notable products are its hypervisors. VMware became well known for its first type 2 hypervisor known as GSX. This product has since evolved into two hypervisor product lines: VMware's type 1 hypervisors running directly on hardware and their hosted type 2 hypervisors. VMware software provides a completely virtualized set of hardware to the guest operating system. VMware software virtualizes the hardware for a video adapter, a network adapter, and hard disk adapters. The host provides pass-through drivers for guest USB, serial, and parallel devices. In this way, VMware virtual machines become highly portable between computers, because every host looks nearly identical to the guest. In practice, a system administrator can pause operations on a virtual machine guest, move or copy that guest to another physical computer, and their resume execution exactly at the point of suspension. Alternatively, for enterprise servers, a feature called vMotion allows the migration of operational guest virtual machines between similar but separate hardware hosts sharing the same storage (or, with vMotion Storage, separate storage can be used, too). Each of these transitions is completely transparent to any users on the virtual machine at the time it is being migrated.

VMware's products predate the virtualization extensions to the x86 instruction set, and do not require virtualization-enabled processors. On newer processors, the hypervisor is now designed to take advantage of the extensions. However, unlike many other hypervisors, VMware still supports older processors. In such cases, it uses the CPU to run code directly whenever possible (as, for example, when running user-mode and virtual 8086 mode code on x86). When direct execution cannot operate, such as with kernel-level and real-mode code, VMware products use binary translation (BT) to re-write the code dynamically. The

translated code gets stored in spare memory, typically at the end of the address space, which segmentation mechanisms can protect and make invisible. For these reasons, VMware operates dramatically faster than emulators, running at more than 80% of the speed that the virtual guest operating system would run directly on the same hardware. In one study VMware claims a slowdown over native ranging from 0–6 percent for the VMware ESX Server.

Products:

Desktop software

- VMware Workstation, introduced in 1999, was the first product launched by VMware. This software suite allows users to run multiple instances of x86 or x86-64 -compatible operating systems on a single physical personal computer. Workstation Pro version 15.5.1 was released in Nov 2019.
- VMware Fusion provides similar functionality for users of the Intel Mac platform, along with full compatibility with virtual machines created by other VMware products.
- VMware Workstation Player is freeware for non-commercial use, without requiring a license, and available for commercial use with permission. It is similar to VMware Workstation, with reduced functionality.

Server software

VMware ESXi, an enterprise software product, can deliver greater performance than the freeware VMware Server, due to lower system computational overhead. VMware ESXi, as a "bare-metal" product, runs directly on the server hardware, allowing virtual servers to also use hardware more or less directly. In addition, VMware ESXi integrates into VMware vCenter, which offers extra services.

Cloud management software

- VMware vRealize Suite – a cloud management platform purpose-built for a hybrid cloud.
- VMware Go is a web-based service to guide users of any expertise level through the installation and configuration of VMware vSphere Hypervisor.
- VMware Cloud Foundation – Cloud Foundation provides an easy way to deploy and operate a private cloud on an integrated SDDC system.
- VMware Horizon View is a virtual desktop infrastructure (VDI) product.

Application management

- The VMware Workspace Portal was a self-service app store for workspace management.

Storage and availability

VMware's storage and availability products are composed of two primary offerings:

- VMware vSAN (previously called VMware Virtual SAN) is software-defined storage that is embedded in VMware's ESXi hypervisor. The vSphere and vSAN software run on industry-standard x86 servers to form a hyper- converged infrastructure (or HCI). However, network operators need to have servers from HCL (Hardware Compatibility List) to put one into production. The first release, version 5.5, was released in March 2014. The 6th generation, version 6.6, was released in April 2017.New features available in VMware vSAN 6.6 include native data at rest encryption, local protection for stretched clusters, analytics, and optimized solid-state drive performance. The VMWare 6.7 version was released in April 2018, Users now have improved monitoring tools and new workflows, it is closer to feature parity. The vCenter Server Appliance architecture is moving around to an easy deployment method**.**
- VMware Site Recovery Manager (SRM) automates the failover and failback of virtual machines to and from a secondary site using policy-based management.

Networking and security products

VMware NSX is VMware's network virtualization product marketed using the term software-defined data centre (SDDC). The technology included some acquired from the 2012 purchase of Nicira. Software Defined Networking (SDN) allows the same policies that govern Identity and Access Management (IAM) to dictate levels of access to applications and data through a totally converged infrastructure not possible with legacy network and system access methods.

Other products

Workspace ONE allows mobile users to access apps and data.

- The VIX (Virtual Infrastructure eXtension) API allows automated or scripted management of a computer virtualized using either VMware's vSphere, Workstation, Player, or Fusion products. VIX provides bindings for the programming languages C, Perl, Visual Basic, VBscript and C#.

- Herald is an communications protocol from VMware for more reliable Bluetooth communication and range finding across for mobile devices. Herald code is available under an Open-source license and was implemented in the Australian Government's COVID Safe app for contact tracing on 19 December 2020.

Guest OS

A guest operating system (guest OS) is an operating system (OS) that is secondary to the OS originally installed on a computer, which is known as the host operating system. The guest OS is either part of a partitioned system or part of a virtual machine (VM) setup. A guest OS provides an alternative OS for a device.

In disk partitioning, a guest OS is simply another instance of the same operating system that can boot up for controlling a certain partitioned memory set. A virtual machine (VM) process is much different, in that a guest OS can be a different OS alternative. In VM setups, a guest OS is delivered through a virtual machine environment through a tool called a hypervisor. Again, the machine will typically have a host OS, where the guest OS will operate "within" the host OS. This can lead to limitations on file saving and other operations within the guest OS, depending on whether the guest OS is said to be "persistent."

Part of the emergence of guest operating systems in VM systems has to do with the benefits provided by virtualization. These revolutions in computing coincide with the more general concept of cloud computing, where resources are delivered, rather than hosted, in physical local hardware setups. In addition, a guest OS often takes advantage of a lean OS build, where

memory requirements are further alleviated. VM setups can help with licensing issues, system requirements and more, making these an attractive part of an outsourced computing service.

HOST OPERATING SYSTEM

VERSUS

GUEST OPERATING SYSTEM

HOST OPERATING SYSTEM	GUEST OPERATING SYSTEM
A software installed on a computer that interacts with the underlying hardware	A software installed in a virtual machine
Host OS interacts on the hardware	Guest OS runs on a virtual machine
There is a single host operating system	There can be a single or multiple guest operating systems

Visit www.PEDIAA.com

VM WARE

Install VirtualBox/VMware Workstation with different flavors of Linux and execute some C programs

Step 1: To download and install the VMware product visit the official website of VMware.

https://www.vmware.com/in/products/workstation-pro/workstationproevaluation.html

Step 2: Click on Download VM WorkStation for Windows.

The installation file gets downloaded in the specified location and is now ready for installation.

Step 3: Click on the download file to install the VMWare Workstation 16 Pro. Popup will appear

Step 4: Once the initialization gets completed, Click Next

Step 5: Accept the terms and click on Next

In the next screen, it will ask for some additional features, it is not mandatory to check this box. Click on Next.

Step 6: On the next screen, some checkboxes are populated, Check them as per your requirement. Click on Next.

Step 7: At this step, VMware Workstation is ready to install. Click on Install.

Step 8: Once the installation gets completed you will see the following dialogue box. Click on Finish. If you have purchased the product and have a license key, then you can click on License to enter the key.

Step 9: Upon Finish, the window will close, and You can see VMware Workstation installed icon on your Desktop. Double Click on the Icon to open the application.

Step 10: For the first time opening, if you have not entered the License key in the previous steps, then it will ask for a license key.

Finally, this will open a window of VMware Workstation Pro.

Step 11: Click on File → New Virtual Machine. A New Virtual Machine Wizard will appear. Click on Typical.

Step 12: Select the ISO File and click on Next

Step 13: Fill in the required details such as username, password and click on next.

Step 14: Name the virtual machines.

Step 15: Allocate the memory and select Split virtual disk into multiple files and click on next.

Click on Customize Hardware.

Set the memory size to 4GB

Step 16 : Click on Finish. You can see that Ubuntu gets installed in the VM Ware Workstation.

Step 17: Login and Open Terminal and Execute a simple C Program

Step 18: Using gedit write a simple C Code. Use the following commands on the terminal:

- To Open the Editor →**gedit sample.c**
- To Compile the code → **gcc sample.c**
- To Get the output →**./a.out**

Ubuntu 64-bit (2) - VMware Workstation
File Edit View VM Tabs Help
Library
Type here to search
My Computer
Ubuntu 64-bit (2)
Home
Ubuntu 64-bit (2)
Activities
Text Editor
Jan 4 07:44
apjlab@ubuntu: ~/Desktop
Open
*sample.c
~/Desktop
Save
// Simple C program to display "Hello World"
// Header file for input output functions
#include <stdio.h>
// main function -
// where the execution of program begins
int main()
// prints hello world
printf("Hello World");
return 0;
C
Tab Width: 8
Ln 16, Col 2
INS
To direct input to this VM, move the mouse pointer inside or press Ctrl+G.
ENG
IN
21:14
04-01-2022

Ubuntu 64-bit (2) - VMware Workstation
File Edit View VM Tabs Help
Library
Type here to search
My Computer
Ubuntu 64-bit (2)
Home
Ubuntu 64-bit (2)
Activities
Terminal
Jan 4 07:50
apjlab@ubuntu: ~/Desktop
apjlab@ubuntu:~/Desktop$ gedit sample.c
apjlab@ubuntu:~/Desktop$ gcc sample.c
apjlab@ubuntu:~/Desktop$ ./a.out
Hello Worldapjlab@ubuntu:~/Desktop$
To direct input to this VM, move the mouse pointer inside or press Ctrl+G.
ENG
IN
21:20
04-01-2022

GOOGLE APP ENGINE

Google App Engine (often referred to as GAE or simply App Engine is a cloud computing platform as a service for developing and hosting web applications in Google-managed data centers. Applications are sandboxed and run across multiple servers. App Engine offers automatic scaling for web applications—as the number of requests increases for an application, App Engine automatically allocates more resources for the web application to handle the additional demand. The service is free up to a certain level of consumed resources and only in standard environment but not in flexible environment. Fees are charged for additional storage, bandwidth, or instance hours required by the application. It was first released as a preview version in April 2008 and came out of preview in September 2011.

Google App Engine primarily supports Go, PHP, Java, Python, Node.js, .NET, and Ruby applications, although it can also support other languages via "custom runtimes". Python web frameworks that run on Google App Engine include Django, CherryPy, Pyramid, Flask, web2py and webapp2, as well as a custom Google-written webapp framework and several others designed specifically for the platform that emerged since the release. Any Python framework that supports the WSGI using the CGI adapter can be used to create an application; the framework can be uploaded with the developed application. Third-party libraries written in pure Python may also be uploaded.

Google App Engine supports many Java standards and frameworks. Core to this is the servlet 2.5 technology using the open-source Jetty Web Server, along with accompanying technologies such as JSP. Java Server Faces operates with some workarounds. A newer release of App Engine Standard Java in Beta supports Java8, Servlet 3.1 and Jetty9.Though the integrated database, Google Cloud Datastore, may be unfamiliar to programmers, it is accessed and supported with JPA, JDO, and by the simple low-level API. There are several alternative libraries and frameworks you can use to model and map the data to the database such as Objectify, Slim3 and Jello framework. The Spring Framework works with GAE. However, the Spring Security module (if used) requires workarounds. Apache Struts 1 is supported, and Struts 2 runs with workarounds. The Django web framework and applications running on it can be used on App Engine with modification. Django-nonrel aims to allow Django to work with non-relational databases and the project includes support for App Engine.

Reliability and support

- All billed App Engine applications have a 99.95% uptime SLA.
- App Engine is designed in such a way that it can sustain multiple datacentre outages without any downtime. This resilience to downtime is shown by the statistic that the High Replication Datastore saw 0% downtime over a period of a year.
- Paid support from Google engineers is offered as part of Premier Accounts.

Bulk downloading

SDK version 1.2.2 adds support for bulk downloads of data using Python. The open-source Python projects gaebar, approcket, and gawsh also allow users to download and back up App Engine data. No method for bulk downloading data from GAE using Java currently exists.

Restrictions

- Developers have read-only access to the filesystem on App Engine. Applications can use only virtual filesystems, like gae-filestore.
- App Engine can only execute code called from an HTTP request (scheduled background tasks allow for self-calling HTTP requests).
- Users may upload arbitrary Python modules, but only if they are pure-Python; C and Pyrex modules are not supported.
- Java applications may only use a subset (The JRE Class White List) of the classes from the JRE standard edition. This restriction does not exist with the App Engine Standard Java8 runtime.
- A process started on the server to answer a request can't last more than 60 seconds (with the 1.4.0 release, this restriction does not apply to background jobs anymore).
- Does not support sticky sessions (a.k.a. session affinity), only replicated sessions are supported including limitation of the amount of data being serialized and time for session serialization.

App Engine provides more infrastructure to make it easy to write scalable applications, but can only run a limited range of applications designed for that infrastructure. App Engine's infrastructure removes many of the system administration and development challenges of building applications to scale to hundreds of requests per second and beyond. Google handles deploying code to a cluster, monitoring, failover, and launching application instances as necessary. While other services let users install and configure nearly any *NIX compatible software, App Engine requires developers to use only its supported languages, APIs, and frameworks. Current APIs allow storing and retrieving data from the document-oriented Google Cloud Datastore database; making HTTP requests; sending e-mail; manipulating images; and caching. Google Cloud SQL can be used for App Engine applications requiring

a relational MySQL compatible database backend. Per-day and per-minute quotas restrict bandwidth and CPU use, number of requests served, number of concurrent requests, and calls to the various APIs, and individual requests are terminated if they take more than 60 seconds or return more than 32MB of data. Google App Engine's integrated Google Cloud Datastore database has a SQL-like syntax called "GQL" (Google Query Language). GQL does not support the Join statement. Instead, one-to-many and many-to-many relationships can be accomplished using ReferenceProperty (). Google Firestore is the successor to Google Cloud Datastore and replaces GQL with a document-based query method that treats stored objects as collections of documents.

Google App Engine Features

- Blob store for serving large data objects;
- GAE Cloud Storage for storing data objects;
- Page Speed Service for automatically speeding up webpage load times;
- URL Fetch Service to issue HTTP requests and receive responses for efficiency and scaling; and
- Memcache for a fully managed in-memory data store.

Benefits of GAE

- Ease of setup and use. GAE is fully managed, so users can write code without considering IT operations and back-end infrastructure. The built-in APIs enable users to build different types of applications. Access to application logs also facilitates debugging and monitoring in production.
- Pay-per-use pricing. GAE's billing scheme only charges users daily for the resources they use. Users can monitor their resource usage and bills on a dashboard.
- Scalability. Google App Engine automatically scales as workloads fluctuate, adding and removing application instances or application resources as needed.
- Security. GAE supports the ability to specify a range of acceptable Internet Protocol (IP) addresses. Users can allow list specific networks and services and blocklist specific IP addresses.

GAE challenges

- Lack of control. Although a managed infrastructure has advantages, if a problem occurs in the back-end infrastructure, the user is dependent on Google to fix it.
- Performance limits. CPU-intensive operations are slow and expensive to perform using GAE. This is because one physical server may be serving several separate, unrelated app engine users at once who need to share the CPU.
- Limited access. Developers have limited, read-only access to the GAE filesystem.
- Java limits. Java apps cannot create new threads and can only use a subset of the Java runtime environment standard edition classes.

Install Google App Engine. Create hello world app and other simple web applications using python/java

Step 1: Create an account on Google App Engine.

Step 2: Log in to your Google App Engine Account.

Step 3: Create a New Project and give a Project Name and click on create.

Step 4: Once the project is created click on **Activate Cloud Shell** on the top right corner.

Step 5: Once the cloud shell gets activated type the following command in the terminal and choose the region as South Asia

gcloud app create

Click on Open Editor.

Step 6: Click on File → New File.

Step 7: Name the File as **hello.py** and type the following code:

```
from flask import Flask
app = Flask(__name__)
@app.route('/')
def index():
        return 'Hello World'
app.run(host='127.0.0.1', port=80)
```

Step 8: Create a app.yaml file.

Step 9: Go to terminal and type the following command

python hello.py

Note: If Flask is not installed, please use the following command ***pip install flask***

Step 10: Open the https link

AMAZON WEB SERVICES

Amazon Web Services, Inc. (AWS) is a subsidiary of Amazon providing ondemand cloud computing platforms and APIs to individuals, companies, and governments, on a metered pay-as-you-go basis. These cloud computing web services provide a variety of basic abstract technical infrastructure and distributed computing building blocks and tools. One of these services is Amazon Elastic Compute Cloud (EC2), which allows users to have at their disposal a virtual cluster of computers, available all the time, through the Internet. AWS's virtual computers emulate most of the attributes of a real computer, including hardware central processing units (CPUs) and graphics processing units (GPUs) for processing; local/RAM memory; hard-disk/SSD storage; a choice of operating systems; networking; and pre-loaded application software such as web servers, databases, and customer relationship management (CRM).

The AWS technology is implemented at server farms throughout the world, and maintained by the Amazon subsidiary. Fees are based on a combination of usage (known as a "Pay-as-you-go" model), hardware, operating system, software, or networking features chosen by the subscriber required availability, redundancy, security, and service options. Subscribers can pay for a single virtual AWS computer, a dedicated physical computer, or clusters of either. As part of the subscription agreement, Amazon provides security for subscribers' systems. AWS operates from many global geographical regions including 6 in North America.

Amazon markets AWS to subscribers as a way of obtaining large scale computing capacity more quickly and cheaply than building an actual physical server farm. All services are billed based on usage, but each service measures usage in varying ways. As of 2017, AWS owns 33% of all cloud (IaaS, PaaS) while the next two competitors Microsoft Azure and Google Cloud have 18%, and 9% respectively, according to Synergy Group.

As of 2021, AWS comprises over 200 products and services including computing, storage, networking, database, analytics, application services, deployment, management, machine learning, mobile, developer tools, RobOps and tools for the Internet of Things. The most popular include Amazon Elastic Compute Cloud (EC2), Amazon Simple Storage Service (Amazon S3), Amazon Connect, and AWS Lambda (a serverless function enabling serverless ETL e.g., between instances of EC2 & S3).

Most services are not exposed directly to end users, but instead offer functionality through APIs for developers to use in their applications. Amazon Web Services' offerings are accessed over HTTP, using the REST architectural style and SOAP protocol for older APIs and exclusively JSON for newer ones.

Applications of AWS services

Amazon Web services are widely used for various computing purposes like:

- Web site hosting
- Application hosting/SaaS hosting
- Media Sharing (Image/ Video)
- Mobile and Social Applications
- Content delivery and Media Distribution
- Storage, backup, and disaster recovery
- Development and test environments
- Academic Computing
- Search Engines
- Social Networking

RELATIONAL DATABASES

Amazon Relational Database Service (Amazon RDS) makes it easy to set up, operate, and scale a relational database in the cloud. It provides cost-efficient and resizable capacity while automating time-consuming administration tasks, such as hardware provisioning, database setup, patching, and backups. It frees you to focus on your applications so you can give them the fast performance, high availability, security, and compatibility they need.

Amazon RDS is available on several database instance types - optimized for memory, performance, or I/O - and provides you with six familiar database engines to choose from, including Amazon Aurora, PostgreSQL, MySQL, MariaDB, Oracle Database, and SQL Server. You can use the AWS Database Migration Service to easily migrate or replicate your existing databases to Amazon RDS.

Benefits of Amazon RDS:

- Easy to Administer

  Amazon RDS makes it easy to go from project conception to deployment. Use the Amazon RDS Management Console, the AWS RDS Command-Line Interface, or simple API calls to access the capabilities of a production-ready relational database in minutes. No need for infrastructure provisioning, and no need for installing and maintaining database software.

- Highly Scalable

  You can scale your database's compute and storage resources with only a few mouse clicks or an API call, often with no downtime. Many Amazon RDS engine types allow

you to launch one or more Read Replicas to offload read traffic from your primary database instance.

- Available and Durable

  Amazon RDS runs on the same highly reliable infrastructure used by other Amazon Web Services. When you provision a Multi-AZ DB Instance, Amazon RDS synchronously replicates the data to a standby instance in a different Availability Zone (AZ). Amazon RDS has many other features that enhance reliability for critical production databases, including automated backups, database snapshots, and automatic host replacement.

- Fast

  Amazon RDS supports the most demanding database applications. You can choose between two SSD-backed storage options: one optimized for high- performance OLTP applications, and the other for cost-effective general-purpose use. In addition, Amazon Aurora provides performance on par with commercial databases at 1/10th the cost.

- Secure

  Amazon RDS makes it easy to control network access to your database. Amazon RDS also lets you run your database instances in Amazon Virtual Private Cloud (Amazon VPC), which enables you to isolate your database instances and to connect to your existing IT infrastructure through an industry-standard encrypted IPsec VPN. Many Amazon RDS engine types offer encryption at rest and encryption in transit.

- Inexpensive

  You pay very low rates and only for the resources you actually consume. In addition, you benefit from the option of On-Demand pricing with no up-front or long-term commitments or even lower hourly rates via our Reserved Instance pricing.

VPC

Amazon Virtual Private Cloud (Amazon VPC) enables you to launch AWS resources into a virtual network that you've defined. This virtual network closely resembles a traditional network that you'd operate in your own data center, with the benefits of using the scalable infrastructure of AWS. Amazon VPC is the networking layer for Amazon EC2.

The following are the key concepts for VPCs:

- Virtual private cloud (VPC) — A virtual network dedicated to your AWS account.
- Subnet — A range of IP addresses in your VPC.
- CIDR block —Classless Inter-Domain Routing. An internet protocol address allocation and route aggregation methodology. For more information, see Classless Inter-Domain Routing in Wikipedia.
- Route table — A set of rules, called routes, that are used to determine where network traffic is directed.
- DHCP options sets: Configuration information (such as domain name and domain name server) passed to EC2 instances when they are launched into VPC subnets.
- Internet gateway — A gateway that you attach to your VPC to enable communication between resources in your VPC and the internet.
- Egress-only internet gateways: A type of internet gateway that allows an EC2 instance in a subnet to access the internet but prevents resources on the internet from initiating communication with the instance.
- VPC endpoint — Enables you to privately connect your VPC to supported AWS services and VPC endpoint services powered by PrivateLink without requiring an internet gateway, NAT device, VPN connection, or AWS Direct Connect connection. Instances in your VPC do not require public IP addresses to communicate with resources in the service.
- NAT gateway: A managed AWS service that allows EC2 instances in private subnets to connect to the internet, other VPCs, or on-premises networks.
- NAT instance: An EC2 instance in a public subnet that allows instances in private subnets to connect to the internet, other VPCs, or on-premises networks.
- Carrier gateways: For subnets in Wavelength Zones, this type of gateway allows inbound traffic from a telecommunication carrier network in a specific location and outbound traffic to a telecommunication carrier network and the internet.
- Prefix lists: A collection of CIDR blocks that can be used to configure VPC security groups, VPC route tables, and AWS Transit Gateway route tables and can be shared with other AWS accounts using Resource Access Manager (RAM).
- Security groups: Acts as a virtual firewall to control inbound and outbound traffic for an AWS resource, such as an EC2 instance. Each VPC comes with a default

security group, and you can create additional security groups. A security group can be used only in the VPC for which it's created.

1. Create a RDS and launch in your custom VPC network.

Step 1: Open “AWS Management Console”. Click on “VPC” service.

Step 2: Click “Subnets” on the left panel.

Step 3: Now you can see there is one subnet group (Public Subnet) created in your VPC (Your VPC id/11.0.0.0/16). Now Click on “Create Subnet” button

Step 4: Give a Name to the subnet and select you own VPC from the “VPC drop down”. Select an “availability zone” (Which is not used by “Public Subnet” of your VPC). Give CIDR block range. Click on “Yes, Create” button.

Step 5: Now you can see the subnet is created in your VPC.

Step 6: Click on “Services”. Click on “RDS” service.

Step 7: Click on “Subnet Groups” on the left panel. (Note: Before creating the subnet groups you need to note down your VPC ID and subnets for that VPC).

Step 8: Click on “Create DB Subnet Group” button.

Step 9: Give a name to the “Subnet”. Select your own “VPC ID”. Select the “Availability Zone” and “subnet”. Click on “Add” button.

Step 10: Now select another “Availability Zone” and “Subnet”. Click on “Yes, Create” button. (Note: Before clicking on “Yes, create” check that two subnets are added or not)

Step 11: Now you can see that “DB subnet group” is created.

Step 12: Click on “RDS Dashboard” on the left panel. Click on “Get Started” button

Step 13: Select your desired “Database Engine” from the list and click on “Select” button.

Step 14: If you want multi-AZ Deployment, select the “first radio button” otherwise select the “second radio button”. Click on “Next” button.

Step 15: Select your desired DB instance from the “DB Instance Class” drop down. Select Multi-AZ option from the drop down. Select the storage type from the drop down and give 95 your desired storage space range. Enter the Details (DB instance Identifier, Master user name, password and confirm password). Click on “Next” button.

Step 16: Select your own VPC ID from the "VPC Dropdown". Select the "public accessibility" from the dropdown. Select your desired Availability Zone from the dropdown. Give a name to your Database and check the database port is and mention the "Backup retention period" as per your needs and if you want a Time frame for your backup, configure the time frame from "Backup Window" Dropdown. Click on "Launch DB Instance" button.

RDS Management Console
ap-south-1.console.aws.amazon.com/rds/home?region=ap-south-1#launch-dbinstance:gdb=false;isHermesCreate=true;s3-import=false
Services
Search
[Alt+S]
Mumbai
keshav @ kk-cclab
RDS > Create database
Create database
Choose a database creation method Info
Standard create
You set all of the configuration options, including ones for availability, security, backups, and maintenance.
Easy create
Use recommended best-practice configurations. Some configuration options can be changed after the database is created.
Engine options
Engine type Info
Amazon Aurora
MySQL
MariaDB
PostgreSQL
Oracle
Microsoft SQL Server
MySQL
MySQL is the most popular open source database in the world. MySQL on RDS offers the rich features of the MySQL community edition with the flexibility to easily scale compute resources or storage capacity for your database.
Supports database size up to 64 TiB.
Supports General Purpose, Memory Optimized, and Burstable Performance instance classes.
Supports automated backup and point-in-time recovery.
Supports up to 15 Read Replicas per instance, within a single Region or 5 read replicas cross-region.
Feedback
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Privacy
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Services
Search
[Alt+S]
Mumbai
keshav @ kk-cclab
Engine options
Engine type Info
Amazon Aurora
MySQL
MariaDB
PostgreSQL
Oracle
Microsoft SQL Server
Edition
MySQL Community
Known issues/limitations
Review the Known issues/limitations to learn about potential compatibility issues with specific database versions.
Show filters
Engine Version
MySQL 8.0.30
MySQL
MySQL is the most popular open source database in the world. MySQL on RDS offers the rich features of the MySQL community edition with the flexibility to easily scale compute resources or storage capacity for your database.
Supports database size up to 64 TiB.
Supports General Purpose, Memory Optimized, and Burstable Performance instance classes.
Supports automated backup and point-in-time recovery.
Supports up to 15 Read Replicas per instance, within a single Region or 5 read replicas cross-region.
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RDS Management Console
ap-south-1.console.aws.amazon.com/rds/home?region=ap-south-1#launch-dbinstance:gdb=false;s3-import=false
Services
Search
[Alt+S]
Mumbai
keshav @ kk-cclab
Settings
DB instance identifier Info
Type a name for your DB instance. The name must be unique across all DB instances owned by your AWS account in the current AWS Region.
keshav
The DB instance identifier is case-insensitive, but is stored as all lowercase (as in "mydbinstance"). Constraints: 1 to 60 alphanumeric characters or hyphens. First character must be a letter. Can't contain two consecutive hyphens. Can't end with a hyphen.
Credentials Settings
Master username Info
Type a login ID for the master user of your DB instance.
admin
1 to 16 alphanumeric characters. First character must be a letter.
Manage master credentials in AWS Secrets Manager
Manage master user credentials in Secrets Manager. RDS can generate a password for you and manage it throughout its lifecycle.
Auto generate a password
Amazon RDS can generate a password for you, or you can specify your own password.
Master password Info
Constraints: At least 8 printable ASCII characters. Can't contain any of the following: / (slash), '(single quote), "(double quote) and @ (at sign).
Confirm master password Info
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RDS Management Console

ap-south-1.console.aws.amazon.com/rds/home?region=ap-south-1#launch-dbinstance:gdb=false;s3-import=false

aws | Services | Search [Alt+S] | Mumbai | keshav @ kk-cclab

Instance configuration

The DB instance configuration options below are limited to those supported by the engine that you selected above.

Amazon RDS Optimized Writes - *new* Info

Show instance classes that support Amazon RDS Optimized Writes

DB instance class Info

- Standard classes (includes m classes)
- Memory optimized classes (includes r and x classes)
- Burstable classes (includes t classes)

db.t3.micro
2 vCPUs 1 GiB RAM Network: 2,085 Mbps

Include previous generation classes

Storage

Storage type Info

General Purpose SSD (gp2)
Baseline performance determined by volume size

Allocated storage Info

20 GiB

The minimum value is 20 GiB and the maximum value is 6,144 GiB

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RDS Management Console

ap-south-1.console.aws.amazon.com/rds/home?region=ap-south-1#launch-dbinstance:gdb=false;s3-import=false

aws | Services | Search [Alt+S] | Mumbai | keshav @ kk-cclab

Connectivity Info

Compute resource

Choose whether to set up a connection to a compute resource for this database. Setting up a connection will automatically change connectivity settings so that the compute resource can connect to this database.

- Don't connect to an EC2 compute resource — Don't set up a connection to a compute resource for this database. You can manually set up a connection to a compute resource later.
- Connect to an EC2 compute resource — Set up a connection to an EC2 compute resource for this database.

Network type Info

To use dual-stack mode, make sure that you associate an IPv6 CIDR block with a subnet in the VPC you specify.

- IPv4 — Your resources can communicate only over the IPv4 addressing protocol.
- Dual-stack mode — Your resources can communicate over IPv4, IPv6, or both.

Virtual private cloud (VPC) Info

Choose the VPC. The VPC defines the virtual networking environment for this DB instance.

my-vpc-01 (vpc-0c34ccc74a052e962)

Only VPCs with a corresponding DB subnet group are listed.

After a database is created, you can't change its VPC.

DB Subnet group Info

Choose the DB subnet group. The DB subnet group defines which subnets and IP ranges the DB instance can use in the VPC that you selected.

mydbsubnet-k-1

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RDS Management Console

ap-south-1.console.aws.amazon.com/rds/home?region=ap-south-1#launch-dbinstance:gdb=false;s3-import=false

aws | Services | Search [Alt+S] | Mumbai | keshav @ kk-cclab

- Yes — RDS assigns a public IP address to the database. Amazon EC2 instances and other resources outside of the VPC can connect to your database. Resources inside the VPC can also connect to the database. Choose one or more VPC security groups that specify which resources can connect to the database.
- No — RDS doesn't assign a public IP address to the database. Only Amazon EC2 instances and other resources inside the VPC can connect to your database. Choose one or more VPC security groups that specify which resources can connect to the database.

VPC security group (firewall) Info

Choose one or more VPC security groups to allow access to your database. Make sure that the security group rules allow the appropriate incoming traffic.

- Choose existing — Choose existing VPC security groups
- Create new — Create new VPC security group

Existing VPC security groups

Choose one or more options

default ×

Availability Zone Info

No preference

RDS Proxy

RDS Proxy is a fully managed, highly available database proxy that improves application scalability, resiliency, and security.

Create an RDS Proxy Info

RDS automatically creates an IAM role and a Secrets Manager secret for the proxy. RDS Proxy has additional costs. For more information, see Amazon RDS Proxy pricing.

Certificate authority - *optional* Info

Using a server certificate provides an extra layer of security by validating that the connection is being made to an Amazon database. It does so by checking the server certificate that is automatically installed on all databases that you provision.

rds-ca-2019 (default)

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Step 17: Click on “Close” button.

Step 18: Now you can see one DB instance is created. (It will take 5-10min to create the database instance). You will have the DB name, VPC ID, End Point (which is used to connect to the DB Instance from your EC2 instance) and etc.

Note: To connect to the Database from your Ec2 Instance, you need the following.

- RDS end point.
- Database Name.
- Master username.
- Master Password.
- Port Number.

VIRTUALIZATION AND FILE SHARING

Virtualization

Virtualization is the process of running a virtual instance of a computer system in a layer abstracted from the actual hardware. Most commonly, it refers to running multiple operating systems on a computer system simultaneously. To the applications running on top of the virtualized machine, it can appear as if they are on their own dedicated machine, where the operating system, libraries, and other programs are unique to the guest virtualized system and unconnected to the host operating system which sits below it.

There are many reasons why people utilize virtualization in computing. To desktop users, the most common use is to be able to run applications meant for a different operating system without having to switch computers or reboot into a different system. For administrators of servers, virtualization also offers the ability to run different operating systems, but perhaps, more importantly, it offers a way to segment a large system into many smaller parts, allowing the server to be used more efficiently by a number of different users or applications with different needs. It also allows for isolation, keeping programs running inside of a virtual machine safe from the processes taking place in another virtual machine on the same host.

Working of Virtualization:

Software called hypervisors separate the physical resources from the virtual environments—the things that need those resources. Hypervisors can sit on top of an operating system (like on a laptop) or be installed directly onto hardware (like a server), which is how most enterprises virtualize. Hypervisors take your physical resources and divide them up so that virtual environments can use them.

Resources are partitioned as needed from the physical environment to the many virtual environments. Users interact with and run computations within the virtual environment (typically called a guest machine or virtual machine). The virtual machine functions as a single data file. And like any digital file, it can be moved from one computer to another, opened in either one, and be expected to work the same.

When the virtual environment is running and a user or program issues an instruction that requires additional resources from the physical environment, the hypervisor relays the request to the physical system and caches the changes—which all happens at close to native speed (particularly if the request is sent through an open- source hypervisor based on KVM, the Kernel-based Virtual Machine).

FILE SHARING

Transferring Files to and from Virtual Machines can be done in the following ways:

- Creating a Shared Folder in VirtualBox
- Dragging and Dropping Files in VirtualBox
- Managing Files with NextCloud

Creating a Shared Folder in VirtualBox

A shared folder is a folder that makes its files available on both the guest machine and the host machine at the same time. Creating a shared folder between the guest and the host allows you to easily manage files that should be present on both machines. The course virtual machines are ready to use shared folders right away, but if you are using the virtual machine on your personal computer, then you will need to specify which folder to use as shared storage.

Shared Folders on SCS Lab Computers using Course VMs:

If you are using a course VM on a lab computer, it is likely that a shared folder has already been set up for you. On the desktop of your course VM, you should notice a folder titled Shared Folders. Inside this folder, you will find any folders that have been shared between the course VM and lab computers. You should see two folders that have already been configured for you: Z_DRIVE and Temp. Z_DRIVE gives you access to your Windows Account Z:\ drive. This is storage that is persistent to your SCS account and available as a network drive on the lab computers. Temp gives you access to the folder found at D:\temp on the lab computer. Files stored in this folder are local to the machine, meaning that they can be accessed faster but will delete from the system when you log out. If you are working with data that you will need to use again, use the Z_DRIVE for your shared folder. If you need a faster read/write speed, use the Temp folder, but remember to back up your files, or they will be deleted when you log off the computer.

Shared Folders on Personal Computers

If you are using your own personal machine, you will need to configure VirtualBox to look in the right place for your shared files. First, click on the guest machine you intend to share files with. From there, you can select the guest Settings and navigate to Shared Folders on the left side menu. To create a new shared folder, either click the New Folder icon on the right menu or right-click the empty list of shared folders and click Add Shared Folder. From here, there are six options:

Folder Path: The folder name on the host machine. Click the drop-down menu and navigate to the folder you would like to share.

Folder Name: This is the name of the folder as it will appear on the guest machine.

Read-Only: If you check read-only, the guest machine will be unable to write changes to the folder. This is valuable when you only want to send files to the virtual machine, but do not want to risk having the files modified by the guest.

Auto-Mount: When any external storage is connected to a computer, it must be mounted in order to be used. It is recommended that you turn on auto-mounting unless you are familiar with the process of mounting a drive yourself.

Mount Point: Unless you already know about mount points, leave this blank.

Make Permanent: If you check this, the shared folder will be a permanent machine folder. If it is not checked, the folder will not be shared after a shutdown.

On the course virtual machines, when you load into the desktop, you should see a folder labelled Shared Folders. In there, you will see any folders that are currently mounted and being shared.

Dragging and Dropping Files in VirtualBox

If you only need to transfer a few files quickly, you can simply drag and drop the files in. On the top bar of the running guest machine, click on Devices > Drag and Drop and make sure that Bidirectional is selected. This means that you will be able to drag files from the host to the guest and from the guest to the host. Once bidirectional drag and drop is checked, you should be able to begin dragging and dropping files.

NOTE: Sometimes when dragging files into the course VM, you may not be able to drag them into the file browser directly. If you encounter this issue, you should drag your files onto the Desktop and move the files around from there. You should see the cursor change when it is ready to drop files.

You can also drag files from the guest machine into the host. To do this, simply open the file browser on the host to where you would like to drop the files and drag the files from the virtual machine into the file browser of the host. File transfers should be pretty quick; if the virtual machine seems stuck when transferring, simply cancel the transfer and try again.

Managing Files with NextCloud

On any virtual machine, including VirtualBox, VMWare, or the virtual machines hosted on the SCS OpenStack, you can access the SCS NextCloud services to move files between multiple machines and your SCS Windows Account storage. NextCloud offers you all of your SCS storage in one remote location, similar to how you might use other file hosting services like Dropbox or Google Drive. Before trying to use NextCloud, you should check that you can access the service by logging in here. If you can access the NextCloud services, you can browse the various file storage services available to you:

Linux Home: These are the files from your SCS Linux Account

Windows Home: These are the files from your SCS Windows Account and your lab Z:\ drive.

NextCloud: In addition to the other storage accounts provided to you by the SCS, you can also upload up to 20GB of files directly to NextCloud.

With NextCloud, you can upload your files from any machine with an internet connection and download them onto any other machine with an internet connection. For example, you can move project files off of your virtual machine, onto the NextCloud storage, and then download them on your personal laptop. Alternatively, you can upload files from your personal PC onto the NextCloud storage, place them into the Windows home folder, and access those files from either the lab Z:\ drive or download them on a virtual machine like VirtualBox or OpenStack.

Uploading Files to NextCloud from a Lab Computer

If you would like to upload files from a lab computer, the easiest way to do this is to place the files you would like to transfer into your Z:\ drive. These files will be automatically backup into your NextCloud storage under the Windows home folder. After that, you can move them into the main NextCloud storage or choose to keep them in your Z:\drive.

Uploading Files to NextCloud from a VM or Other PC

If you would like to upload files from either a VM or any other computer, you can log in to the NextCloud service using any of the available interfaces, such as the web interface. Press the "+" icon in the top left of the file browser and select Upload File. From here, you can choose to keep it in the main NextCloud storage, move it into your Windows Account storage (the Windows home folder), or into your Linux Account storage (the Linux Home folder).

Downloading NextCloud Files to a VM or Other PC

Once your files are uploaded, you will be able to download those files onto any machine, which can connect to NextCloud. First, log in to your preferred NextCloud interface (e.g., the web interface). Navigate to the folder which contains the files you would like to download. Once you are in the target folder, click the checkbox next to each file you would like to download. Above the file listing, you should notice the context bar changing to tell you how many files you have selected and a button labelled Actions. Click Actions > Download.

If you selected a single file, it will prompt you to confirm the download. If you have chosen more than one file, NextCloud will place all of the selected files into a zip archive. Before you can use the files, you will need to extract them from the archive. Once you have downloaded your file or extracted your archive, you are ready to use your files on your machine.

Create a file in one virtual machine and share it on a host machine.

Step 1: Install VM Work Station Pro 16 by clicking on the application file.

A window appears as shown in the picture. Click on the Next and follow the installation steps.

Accept the terms to continue the installation.

Click on Next.

VMware Workstation Pro Setup
Custom Setup
Select the installation destination and any additional features.
Install to:
C:\Program Files (x86)\VMware\VMware Workstation\
Change...
Enhanced Keyboard Driver (a reboot will be required to use this feature)
This feature requires 10MB on your host drive.
Add VMware Workstation console tools into system PATH
Back
Next
Cancel

VMware Workstation Pro Setup
User Experience Settings
Edit default settings that can improve your user experience.
Check for product updates on startup
When VMware Workstation Pro starts, check for new versions of the application and installed software components.
Join the VMware Customer Experience Improvement Program
VMware's Customer Experience Improvement Program ("CEIP") provides VMware with information that enables VMware to improve its products and services, to fix problems, and to advise you on how best to deploy and use our products. As part of the CEIP, VMware collects technical
Learn More
Back
Next
Cancel

Click on Install

Wait for the installation to complete.

Click on Finish

Step 2: Enter the license key received and click on Enter.

Click on Finish.

Step 3: Click on File and Click on New Virtual Machine. A window appears as shown in the picture below. Select **Typical** and click on Next.

Step 4: Select the Ubuntu ISO file present in the hard disk of your computer. Click on Next.

Step 5: Set the Username and Password for your virtual machine and click on next.

Step 6: Name the virtual machine and click on next.

Step 7: Set the disk space to 40GB and click on Next.

Step 8: Click on Customize Hardware.

Step 9: Set the RAM Size to 4GB i.e., 4096 MB and click on **Close** and click on **Finish**.

Wait for the installation to complete.

Step 10: Open the terminal and type the following command:

sudo apt install samba

Wait for the installation to complete and close the terminal.

Step 11: Click on VM on top and click on Settings. A window appears. Click on Options and Enable **Shared Folders, Auto Protect, VNC Connections** and click on **OK**

Step 12: Create a new folder that has to be shared and right click on the folder and click on properties. Select **Share this folder, allow others to create and delete files in this folder and Guest access**

Step 13: Click on permissions and set Read and Write Permissions for Owner, Group and Others.

Step 14: Close all the windows and click on Settings

Step 15: Click on Wired Settings and window appears as shown in the below picture. Copy the IPv4 address.

Step 16: Open **RUN** on Windows and type the IP Address with the "\\". For example, if the IPv4 Address copied is 172.16.10.128 in the **Run** window enter **\\172.16.10.128**

Step 17: A window appears showing the folder that was shared. The user can now access the folder.

CLOUD ANALYST

Cloud Analyst

Cloud Analyst is a tool developed at the University of Melbourne whose goal is to support evaluation of social networks tools according to geographic distribution of users and data centers. In this tool, communities of users and data centers supporting the social networks are characterized and, based on their location; parameters such as user experience while using the social network application and load on the data centre are obtained/logged.

Cloud Analyst is developed by Bhathiya Wickremasinghe et al. at the CLOUDS Laboratory. It is built on top of CloudSim and separates the simulation experimentation from a programming task enabling one to concentrate on the simulation parameters rather than the technicalities of programming. Simulation in Cloud Analyst involves the following steps:

- Defining and configuration of User Bases.
- Defining and configuring Data Centers.
- Allocating of Virtual Machines in Data Centers.
- Review and Adjustment of various other parameters such as Packet size, Number of packets, Bandwidth, and Load balancing policies.

The Cloud Analyst enables us to model different scenarios of CSPs and User Bases, and provides a comprehensive output detailing the response time, Data Center processing time and total cost involved in the communication and computation.

Installing and Running Cloud Analyst:

- Download CloudAnalyst
- Extract the files from the zip file which will give following folder structure
- Click on run.bat file
- The user can then configure the simulation which includes :
  - Simulation Duration
  - Number of User Bases
  - Service broker policy
  - Data Center Configuration
  - Load Balancing Policy
- To run the simulation, click on Run Simulation

Cloud Analyst
Help
Configure Simulation
Define Internet Characteristics
Run Simulation
Exit
Configure Simulation
Main Configuration
Data Center Configuration
Advanced
Data Centers:
Name
Region
Arch
OS
VMM
Cost per VM $/Hr
Memory Cost $/s
Storage Cost $/s
Data Transfer Cost $/Gb
Physical HW Units
DC1
0
x86
Linux
Xen
0.1
0.05
0.1
0.1
2
Add New
Remove
Cancel
Load Configuration
Save Configuration
Done

Cloud Analyst
Help
Configure Simulation
Define Internet Characteristics
Run Simulation
Exit
Configure Simulation
Main Configuration
Data Center Configuration
Advanced
User grouping factor in User Bases: (Equivalent to number of simultaneous users from a single user base)
10
Request grouping factor in Data Centers: (Equivalent to number of simultaneous requests a single applicaiton server instance can support.)
10
Executable instruction length per request: (bytes)
100
Load balancing policy across VM's in a single Data Center:
Round Robin
Cancel
Load Configuration
Save Configuration
Done

Cloud Analyst Simulations

1 Use the following userbase configuration to simulate following scenarios for the given data centre and virtual machine configuration and answer to the following questions. **Scenario-1:** Nearest data centre with round robin policies.
Scenario-2: Optimize response time with round robin policies.

User Base	Region	Data Centre	Peak Hour Users	Off Peak Hour Users	Virtual Machines
UB1	North America		1000	500	DC1-50
UB2	South America		1200	800	
UB3	Europe	DC1	2000	1000	
UB4	Africa		500	300	
UB5	Asia		3000	300	
UB6	Oceania		1500	150	

i) Tabulate the overall response time of all the scenarios and plot a line graph.
ii) Plot a bar graph for the data processing time of all the scenarios.
iii) Compare average response time by regions of all scenarios by plotting the line graph.
iv) Using Pie Chart show the total cost spent for each scenario.

2 Simulate the following scenarios for the given userbase, data centre and virtual machine configuration and answer to the given questions.

Scenario	Scenario Description	Load balancing algorithm	Service Broker Policy
1	One data centre with virtual machines for UB1	Nearest Data Centre	Round Robin
2	Two data centers with 25 and 50 Virtual Machines respectively for UB1		
3	Three data centers with 100,75 and 25 Virtual Machines Respectively for UB1		

i) Tabulate the overall response time and data processing of all the scenarios and plot the bar graph
ii) Plot a line graph of data centre request servicing time of all the data centers for all the scenarios
iii) Compare average response time by regions of all scenarios by plotting line graph
iv) Mention the data centers used by the UB2, UB3, UB4 and UB5

3 Simulate the following scenarios for given data centre, data centre and virtual machine configuration and answer the following questions.
Scenario 1: Closest data centre and round robin policies
Scenario 2: Optimize response time and round robin policies Use the following userbase configuration for all the scenarios

User Base	Region	Data Center	Peak Hour Users	Off Peak Hour Users	Virtual Machines
UB1	North America	DC1, DC3	1000	500	DC1-50 DC3-100
UB2	South America	--	1200	800	
UB3	Europe	DC4	2000	1000	DC4-150
UB4	Africa	--	500	300	

i) Tabulate and compare the Average response time and data processing time of all the scenarios by plotting the line graph
ii) Tabulate the response time of user bases in all scenarios and compare these by plotting bar graph. Which user base is taking maximum time among three scenarios? Why?
iii) Calculate the data transmission time from DC1 to UB2
iv) Plot the bar graph for data centre cost of all scenarios

4 Analyse the various service broker policies for the following configuration and answer the following questions.

Parameter	Value Used
UB Name	UB1
Region	2
Request Per User Per Hour	60
Data Size Per Request	100
Peak Hour Start (GMT)	3
Peak Hour End (GMT)	9
Avg Peak Users	40000
Avg Off Peak Users	4000
DC1 – No of VM	75
DC2 – No of VM	50
DC3 – No of VM	25
VM Image Size	10000 MB
VM Memory	512 MB
VM Bandwidth	1000 bps
DC1 – No of Physical Machine	2
DC2 – No of Physical Machine	2
DC3 – No of Physical Machine	2
DC – Memory Per Machine	204800 Mb
DC – Storage Per Machine	100000000 Mb
DC – Available BW Per Machine	1000000
DC – No of Processors Per Machine	4
DC – Processor Speed	10000 MIPS
DC – VM Policy	Time Shared
User Grouping Factor	1000
Request Grouping Factor	100
Executable Instruction Length	500
Load Balancing Policy	Throttled

	a) Tabulate and compare the data processing time of service broker policies by plotting the line graph b) Tabulate and compare response time of service broker policies by plotting the bar graph c) Tabulate the cost for service broker policies and represent it using pie chart d) Which service broker policy is best and why?
5	Analyse the various load balancing algorithms for the given userbase, data centre and virtual machine configuration and answer the following questions. Consider the following userbase configuration for all load balancing algorithms.

Number of User Bases	06
Region for the User Bases	UB1-South America, UB2-Asia, UB3-North America, UB4-Europe, UB5- Africa, UB6-Ocenia
Average Peak Users for All the User Bases	10000
Average off Peak Users for all the user bases	100
Peak Hours' Time	Depends on the region
Data centers in each user base	UB1-1, UB2-2, UB3-1, UB4-3, UB5-2, UB6-1
Virtual Machines in each data centre	6
Simulation time	10 mins
Service Broker Policy	Nearest Data Center

a) Tabulate and compare the data processing time of load balancing algorithms by plotting the line graph

b) Tabulate the response time of load balancing algorithms by plotting the bar graph

c) Tabulate the response time by region for load balancing algorithms and plot bar graph

d) Which load balancing algorithm is best and why?

Results of the Simulation Completed at: 22/11/2022 10:44:25

Overall Response Time Summary

	Avg (ms)	Min (ms)	Max (ms)
Overall response time:	275.94	38.16	637.78
Data Center processing time:	0.40	0.02	1.04

Response Time by Region

Userbase	Avg (ms)	Min (ms)	Max (ms)
UB1	299.85	229.71	376.68
UB2	499.26	375.18	637.78
UB3	50.17	38.16	63.18
UB4	300.10	235.63	381.14
UB5	300.00	235.64	370.65
UB6	401.31	312.12	506.12

User Base Hourly Response Times

UB1

UB2

UB3

UB4

UB5

UB6

Data Center Request Servicing Times

Data Center	Avg (ms)	Min (ms)	Max (ms)
DC1	0.40	0.02	1.04

Data Center Hourly Average Processing Times

DC1

Data Center Hourly Loading

DC1

Cost

Total Virtual Machine Cost ($):	0.50
Total Data Transfer Cost ($):	1.91
Grand Total: ($)	2.41

Data Center	**VM Cost $**	**Data Transfer Cost $**	**Total $**
DC1	0.50	1.91	2.41

Results of the Simulation Completed at: 22/11/2022 10:49:08

Overall Response Time Summary

	Avg (ms)	Min (ms)	Max (ms)
Overall response time:	278.14	36.89	665.24
Data Center processing time:	0.40	0.02	1.00

Response Time by Region

Userbase	Avg (ms)	Min (ms)	Max (ms)
UB1	300.15	219.19	396.21
UB2	499.63	390.21	665.24
UB3	50.20	36.89	64.88
UB4	299.63	222.14	367.64
UB5	299.96	234.13	369.16
UB6	402.17	304.12	500.12

User Base Hourly Response Times

UB1

UB2

UB3

UB4

UB5

UB6

Data Center Request Servicing Times

Data Center	Avg (ms)	Min (ms)	Max (ms)
DC1	0.40	0.02	1.00

Data Center Hourly Average Processing Times

DC1

Data Center Hourly Loading

DC1

Cost

Total Virtual Machine Cost ($):	0.50
Total Data Transfer Cost ($):	1.94
Grand Total: ($)	2.44

Data Center	**VM Cost $**	**Data Transfer Cost $**	**Total $**
DC1	0.50	1.94	2.44

Results of the Simulation Completed at: 22/11/2022 10:53:52

Overall Response Time Summary

	Avg (ms)	Min (ms)	Max (ms)
Overall response time:	300.06	237.06	369.12
Data Center processing time:	0.34	0.02	0.61

Response Time by Region

Userbase	Avg (ms)	Min (ms)	Max (ms)
UB1	300.06	237.06	369.12

User Base Hourly Response Times

UB1

Data Center Request Servicing Times

Data Center	Avg (ms)	Min (ms)	Max (ms)
DC1	0.34	0.02	0.61

Data Center Hourly Average Processing Times

DC1

Data Center Hourly Loading

DC1

Cost

Total Virtual Machine Cost ($):	0.51
Total Data Transfer Cost ($):	0.06
Grand Total: ($)	0.57

Data Center	**VM Cost $**	**Data Transfer Cost $**	**Total $**
DC1	0.51	0.06	0.57

Results of the Simulation Completed at: 29/11/2022 09:36:24

Overall Response Time Summary

	Avg (ms)	Min (ms)	Max (ms)
Overall response time:	50.21	39.56	61.83
Data Center processing time:	0.59	0.04	1.08

Response Time by Region

Userbase	Avg (ms)	Min (ms)	Max (ms)
UB1	50.21	39.56	61.83

User Base Hourly Response Times

UB1

Data Center Request Servicing Times

Data Center	Avg (ms)	Min (ms)	Max (ms)
DC1	0.68	0.04	1.08
DC2	0.51	0.07	0.88

Data Center Hourly Average Processing Times

DC1

DC2

Data Center Hourly Loading

DC1

DC2

Cost

Total Virtual Machine Cost ($):	3.04
Total Data Transfer Cost ($):	0.06
Grand Total: ($)	3.11

Data Center	**VM Cost $**	**Data Transfer Cost $**	**Total $**
DC2	0.51	0.03	0.54
DC1	2.54	0.03	2.57

Results of the Simulation Completed at: 29/11/2022 09:33:29

Overall Response Time Summary

	Avg (ms)	Min (ms)	Max (ms)
Overall response time:	51.09	39.56	63.38
Data Center processing time:	1.48	0.02	2.63

Response Time by Region

Userbase	Avg (ms)	Min (ms)	Max (ms)
UB1	51.09	39.56	63.38

User Base Hourly Response Times

UB1

Data Center Request Servicing Times

Data Center	Avg (ms)	Min (ms)	Max (ms)
DC1	1.57	0.25	2.00
DC2	2.19	0.63	2.63
DC3	0.53	0.02	0.88

Data Center Hourly Average Processing Times

DC1

DC2

DC3

Data Center Hourly Loading

DC1

DC2

DC3

Cost

Total Virtual Machine Cost ($):	18.25
Total Data Transfer Cost ($):	0.06
Grand Total: ($)	18.32

Data Center	**VM Cost $**	**Data Transfer Cost $**	**Total $**
DC2	7.61	0.02	7.63
DC1	10.14	0.02	10.16
DC3	0.51	0.02	0.53

Results of the Simulation Completed at: 29/11/2022 09:46:05

Overall Response Time Summary

	Avg (ms)	Min (ms)	Max (ms)
Overall response time:	125.37	37.68	375.14
Data Center processing time:	1.24	0.00	3.28

Response Time by Region

Userbase	Avg (ms)	Min (ms)	Max (ms)
UB1	51.54	39.66	62.40
UB2	201.66	152.78	254.76
UB3	50.16	37.68	63.45
UB4	299.17	249.14	375.14

User Base Hourly Response Times

UB1

UB2

UB3

UB4

Data Center Request Servicing Times

Data Center	Avg (ms)	Min (ms)	Max (ms)
DC1	0.77	0.21	1.40
DC2	0.00	0.00	0.00
DC3	2.64	0.61	3.28
DC4	0.51	0.02	1.26

Data Center Hourly Average Processing Times

DC1

DC2

DC3

DC4

Data Center Hourly Loading

DC1

DC2

DC3

DC4

Cost

Total Virtual Machine Cost ($):	15.96
Total Data Transfer Cost ($):	1.78
Grand Total: ($)	17.74

Data Center	VM Cost $	Data Transfer Cost $	Total $
DC2	0.40	0.00	0.40
DC1	5.02	0.55	5.57
DC4	0.50	0.69	1.19
DC3	10.04	0.54	10.58

Results of the Simulation Completed at: 29/11/2022 09:48:57

Overall Response Time Summary

	Avg (ms)	Min (ms)	Max (ms)
Overall response time:	124.84	37.15	366.13
Data Center processing time:	0.52	0.00	1.41

Response Time by Region

Userbase	Avg (ms)	Min (ms)	Max (ms)
UB1	50.42	37.15	64.61
UB2	200.96	149.82	262.28
UB3	50.16	37.94	64.44
UB4	298.57	241.64	366.13

User Base Hourly Response Times

UB1

UB2

UB3

UB4

Data Center Request Servicing Times

Data Center	Avg (ms)	Min (ms)	Max (ms)
DC1	0.77	0.22	1.41
DC2	0.00	0.00	0.00
DC3	0.28	0.08	0.91
DC4	0.51	0.02	1.04

Data Center Hourly Average Processing Times

DC1

DC2

DC3

DC4

Data Center Hourly Loading

DC1

DC2

DC3

DC4

st

Total Virtual Machine Cost ($):	15.96
Total Data Transfer Cost ($):	1.78
Grand Total: ($)	17.74

Data Center	VM Cost $	Data Transfer Cost $	Total $
DC2	9.94	0.00	9.94
DC1	5.02	0.54	5.56
DC4	0.50	0.69	1.19
DC3	0.50	0.55	1.06

Results of the Simulation Completed at: 29/11/2022 10:05:19

Overall Response Time Summary

	Avg (ms)	Min (ms)	Max (ms)
Overall response time:	71.29	44.57	115.63
Data Center processing time:	21.61	0.07	62.00

Response Time by Region

Userbase	Avg (ms)	Min (ms)	Max (ms)
UB1	71.29	44.57	115.63

User Base Hourly Response Times

UB1

Data Center Request Servicing Times

Data Center	Avg (ms)	Min (ms)	Max (ms)
DC1	27.90	0.72	48.25
DC2	34.38	1.38	62.00
DC3	3.13	0.07	6.82

Data Center Hourly Average Processing Times

DC1

DC2

DC3

Data Center Hourly Loading

DC1

DC2

DC3

Cost

Total Virtual Machine Cost ($):	13.18
Total Data Transfer Cost ($):	0.06
Grand Total: ($)	13.24

Data Center	**VM Cost $**	**Data Transfer Cost $**	**Total $**
DC2	5.07	0.01	5.08
DC1	7.61	0.03	7.63
DC3	0.51	0.02	0.53

Results of the Simulation Completed at: 29/11/2022 10:26:55

Overall Response Time Summary

	Avg (ms)	Min (ms)	Max (ms)
Overall response time:	50.16	37.62	60.91
Data Center processing time:	0.50	0.02	0.92

Response Time by Region

Userbase	Avg (ms)	Min (ms)	Max (ms)
UB1	50.04	37.62	60.12
UB2	50.22	42.17	58.67
UB3	50.38	42.16	60.91
UB4	49.55	39.16	60.41
UB5	50.55	42.66	60.91
UB6	50.30	42.61	59.91

User Base Hourly Response Times

UB1

UB2

UB3

UB4

UB5

UB6

Data Center Request Servicing Times

Data Center	Avg (ms)	Min (ms)	Max (ms)
DC10	0.51	0.11	0.90
DC1	0.43	0.03	0.86
DC2	0.52	0.10	0.92
DC3	0.52	0.11	0.92
DC4	0.53	0.02	0.91
DC5	0.43	0.15	0.90
DC6	0.51	0.09	0.90
DC7	0.46	0.08	0.90
DC8	0.55	0.14	0.91

DC9	0.54	0.02	0.91

Data Center Hourly Average Processing Times

DC1

DC10

DC2

DC3

DC4

DC5

DC6

DC7

DC8

DC9

Data Center Hourly Loading

DC1

DC10

DC2

DC3

DC4

DC5

DC6

DC7

DC8

DC9

Cost

Total Virtual Machine Cost ($):	1.00
Total Data Transfer Cost ($):	0.07
Grand Total: ($)	1.07

Data Center	VM Cost $	Data Transfer Cost $	Total $
DC10	0.10	0.01	0.11
DC2	0.10	0.01	0.11
DC1	0.10	0.01	0.11
DC4	0.10	0.01	0.11
DC3	0.10	0.01	0.11
DC6	0.10	0.00	0.10
DC5	0.10	0.00	0.10
DC8	0.10	0.01	0.11
DC7	0.10	0.00	0.10
DC9	0.10	0.01	0.11

CHAPTER 1

INTRODUCTION

Super Mario is a classic 2D side-scrolling platform game that follows Mario's quest to rescue Princess Peach from the evil Bowser. Players navigate through various levels filled with obstacles and enemies, collecting coins and power-ups along the way. The game features colorful graphics, memorable sound effects and music, and intuitive controls. The goal of the project is to recreate the game's classic gameplay and mechanics, while incorporating modern elements and updating the graphics and sound design for a new generation of players.

Additionally, the project aims to add new levels and challenges to keep players engaged, as well as multiplayer functionality for players to compete or cooperate with each other. It will also feature an adaptive difficulty system, allowing players of different skill levels to enjoy the game at their own pace. The project will be developed for multiple platforms, including desktop and mobile devices, with cross-platform multiplayer support for a seamless gaming experience. Overall, the Super Mario game project aims to bring back the beloved classic for old fans and introduce it to new ones, while delivering a fresh and enjoyable gaming experience.

1.1 Background

This game is a fun and intuitive web-based game. Here, the player can tap the screen or press the spacebar to navigate a bird through a gap between pairs of vertical pipes. When the bird passes through the gap, each successful pass through a pair of pipes awards the player one point and when the bird hits the pipe game ends.

1.2 Objective

- To develop a web-based game for the user.
- The Super Mario Bros Game is designed as a 2D game with simplicity in mind.
- In game use the touch screen mode in mobile or press the spacebar when using computer.
- HTML, CSS and JavaScript is used to create a game deployed in website.

CHAPTER 2

LITERATURE REVIEW

2.1 HTML

The **HyperText Markup Language** or **HTML** is the standard markup language for documents designed to be displayed in a web browser. It can be assisted by technologies such as Cascading Style Sheets (CSS) and scripting languages such as JavaScript.

Web browsers receive HTML documents from a web server or from local storage and render the documents into multimedia web pages. HTML describes the structure of a web page semantically and originally included cues for the appearance of the document.

HTML elements are the building blocks of HTML pages. With HTML constructs, images and other objects such as interactive forms may be embedded into the rendered page. HTML provides a means to create structured documents by denoting structural semantics for text such as headings, paragraphs, lists, links, quotes, and other items. HTML elements are delineated by *tags*, written using angle brackets. Tags such as **<img />** and **<input />** directly introduce content into the page. Other tags such as **<p>** surround and provide information about document text and may include other tags as sub-elements. Browsers do not display the HTML tags but use them to interpret the content of the page.

HTML can embed programs written in a scripting language such as JavaScript, which affects the behavior and content of web pages. The inclusion of CSS defines the look and layout of content. The World Wide Web Consortium (W3C), former maintainer of the HTML and current maintainer of the CSS standards, has encouraged the use of CSS over explicit presentational HTML since 1997. A form of HTML, known as HTML5, is used to display video and audio, primarily using the **<canvas>** element, in collaboration with JavaScript.

2.2 CSS

Cascading Style Sheets (**CSS**) is a style sheet language used for describing the presentation of a document written in a markup language such as HTML or XML (including XML dialects such as SVG, MathML or XHTML). CSS is a cornerstone technology of the World Wide Web, alongside HTML and JavaScript.

CSS is designed to enable the separation of content and presentation, including layout, colors, and fonts. This separation can improve content accessibility; provide more flexibility and control in the specification of presentation characteristics; enable multiple web pages to share formatting by specifying the relevant CSS in a separate .css file, which reduces complexity and repetition in the structural content; and enable the .css file to be cached to improve the page load speed between the pages that share the file and its formatting.

Separation of formatting and content also makes it feasible to present the same markup page in different styles for different rendering methods, such as on-screen, in print, by voice (via speech-based browser or screen reader), and on Braille-based tactile devices. CSS also has rules for alternate formatting if the content is accessed on a mobile device.

The name *cascading* comes from the specified priority scheme to determine which style rule applies if more than one rule matches a particular element. This cascading priority scheme is predictable.

The CSS specifications are maintained by the World Wide Web Consortium (W3C). Internet media type (MIME type) text/css is registered for use with CSS by RFC 2318 (March 1998). The W3C operates a free CSS validation service for CSS documents.

2.3 JavaScript

JavaScript often abbreviated as **JS**, is a programming language that is one of the core technologies of the World Wide Web, alongside HTML and CSS. As of 2022, 98% of websites use JavaScript on the client side for webpage behavior, often incorporating third-party libraries. All major web browsers have a dedicated JavaScript engine to execute the code on users' devices.

JavaScript is a high-level, often just-in-time compiled language that conforms to the ECMAScript standard. It has dynamic typing, prototype-based object-orientation, and first-class functions. It is multi-paradigm, supporting event-driven, functional, and imperative programming styles. It has application programming interfaces (APIs) for working with text, dates, regular expressions, standard data structures, and the Document Object Model (DOM).

The ECMAScript standard does not include any input/output (I/O), such as networking, storage, or graphics facilities. In practice, the web browser or other runtime system provides JavaScript APIs for I/O.

JavaScript engines were originally used only in web browsers, but are now core components of some servers and a variety of applications. The most popular runtime system for this usage is Node.js.

Although Java and JavaScript are similar in name, syntax, and respective standard libraries, the two languages are distinct and differ greatly in design.

2.4 GOOGLE APP ENGINE

Google App Engine (often referred to as GAE or simply App Engine is a cloud computing platform as a service for developing and hosting web applications in Google-managed data centers. Applications are sandboxed and run across multiple servers. App Engine offers automatic scaling for web applications—as the number of requests increases for an application, App Engine automatically allocates more resources for the web application to handle the additional demand. The service is free up to a certain level of consumed resources and only in standard environment but not in flexible environment. Fees are charged for additional storage, bandwidth, or instance hours required by the application. It was first released as a preview version in April 2008 and came out of preview in September 2011.

Google App Engine primarily supports Go, PHP, Java, Python, Node.js, .NET, and Ruby applications, although it can also support other languages via "custom runtimes". Python web frameworks that run on Google App Engine include Django, CherryPy, Pyramid, Flask, web2py and webapp2, as well as a custom Google-written webapp framework and several others designed specifically for the platform that emerged since the release. Any Python framework that supports the WSGI using the CGI adapter can be used to create an application; the framework can be uploaded with the developed application. Third-party libraries written in pure Python may also be uploaded.

2.5 Visual Studio Code

Visual Studio Code, also commonly referred to as **VS Code**, is a source-code editor made by Microsoft with the Electron Framework, for Windows, Linux and macOS. Features include support for debugging, syntax highlighting, intelligent code completion, snippets, code refactoring, and embedded Git. Users can change the theme, keyboard shortcuts, preferences, and install extensions that add additional functionality.

In the Stack Overflow 2021 Developer Survey, Visual Studio Code was ranked the most popular developer environment tool among 82,000 respondents, with 70% reporting that they use it.

Visual Studio Code is a source-code editor that can be used with a variety of programming languages, including C#, Java, JavaScript, Go, Node.js, Python, C++, C, Rust and Fortran. It is based on the Electron framework, which is used to develop Node.js web applications that run on the Blink layout engine. Visual Studio Code employs the same editor component (codenamed "Monaco") used in Azure DevOps (formerly called Visual Studio Online and Visual Studio Team Services).

Out of the box, Visual Studio Code includes basic support for most common programming languages. This basic support includes syntax highlighting, bracket matching, code folding, and configurable snippets. Visual Studio Code also ships with IntelliSense for JavaScript, TypeScript, JSON, CSS, and HTML, as well as debugging support for Node.js. Support for additional languages can be provided by freely available extensions on the VS Code Marketplace.

CHAPTER 3

REQUIREMENT SPECIFICATION

The hardware and software components of a computer system that are required to install and use software efficiently are specified in the SRS. The minimum system requirements need to be met for the programs to run at all times on the system.

3.1 HARDWARE REQUIREMENTS

The hardware requirements specify the necessary hardware which provides us the platform to implement our programs.

- 2.2 GHz processor (Pentium).
- GB RAM (System Memory).
- 20 GB of hard-drive space.
- VGA capable of 1024 x 768 screen resolution.
- Necessary computer peripherals such as keyboard or touch-screen, etc.

3.2 SOFTWARE REQUIREMENTS

The software requirement specifies the pre-installed software needed to run the code being implemented in this project.

- Windows Operating System
- Google Cloud SDK
- HTML, CSS and JavaScript
- Web Browser
- Frames per second is 60
- Gravity is 30px per second

CHAPTER 4

DESIGN

4.1 Basic Module

4.2 Game Logic

Mario Mario.js is a clone of Super Mario Bros. for the Nintendo Entertainment System, implemented in Javascript. It implements a hand-built game engine using the HTML5 Canvas.

Game Flow The main loop tries to render at 60fps. Each frame, we go through a few steps to update the game, and then render.

First, we get the controls. Depending on what the player is pressing, we make some changes to the player object.

Then, we update each entity, and the general game state. Entities are game objects which have data about their position, movement, collision boxes, and sprite, as well as functions for updating that state, and rendering to the canvas.

Scrolling is implemented using a viewport position that increases as Mario travels to the right. We only render or do calculations on objects that are close enough to the left edge of the screen. As in the original game, enemies become active slightly before they appear on screen.

The update function contains all of the logic for mutating the object's state without data from other entities. Once each object has updated, we check collisions. Independent movement, such as coins popping out of blocks, or Mario grabbing the flag and running out of the stage, are controlled here.

Collision

For obstacles such as walls, the ground, and the various blocks, they are indexed by their position in the game, so each entity only needs to check the area around itself for collision with those.

Then, each entity iterates through the other active entities to determine collision with moving objects, calling functions to update positions and state as appropriate.

The player object only checks collision with terrain. Enemies and items check their collision with the player and tell it how to update.

Note that collision boxes are separate from the display position of the entity's sprite. This was the case in the original game as well. Generally speaking, making the collision slightly more generous improves game feel.

Rendering

Once everything is in its proper place, we call each object's render function. Since the canvas doesn't implement a z-axis, the layering effect is handled entirely by rendering the objects in this order:

1. Background

2. Props
3. Items
4. Enemies
5. Projectiles
6. Terrain
7. Player
8. Pipes

Each object in the game holds a reference to a sprite object. Sprites identify which slice of what image to use, and data about which other frames in the sheet are part of the current animation, and how fast it should animate.

Figure: Sprites Player on left and tiles on right

Sprites assume that the entire animation is contained on a single row of the sheet. For the few exceptions, we force the sprite into the correct frame in the entity's update function.

Similarly, entities which need to face left and right replace the image reference in their sprite object with a flipped counterpart.

Level Generation

Each level object is created with references to the sprites to use for each type of object in the game. In this case, there are only a few tile sets, so individual levels could inherit from level subclasses for overworld, underground, castle, etc.

The level is constructed using a series of calls to functions that populate the tables of objects in the game world.

Pipes work by setting up the animation, and then calling a function to load the new level. Exit pipes use the same code for moving Mario, but with another callback that puts the player into position after setting up the stage.

Scaling sprites makes them appear with awkward borders. Some fiddling helps this (as you can see in the live version), but they are still not quite perfect. -A rare case that causes invincibility from getting hit to never end. -Goombas don't animate in sync with each other. -Sometimes goombas can get stuck inside each other. I'm not entirely sure what causes this. -Some sounds might not work due to format compatibility, especially in IE. Yes, IE doesn't support Microsoft's own file format. Really.

All of the features to be implemented are the actual features of the game! Namely, a score counter, more types of enemies, and 1up mushrooms.

Also, it should be possible to scale the game to any size, although in order to preserve sprite dimensions changing the actual size of the play area will be necessary for widescreen. For now, the game is rendered in 768x720

Beyond that, it would be nice to recreate the original game in even more detail, including the precise replication of the 21-frame rule, and glitches such as well-ejection errors, alternate pipes, and various simultaneous left+right input shenanigans.

Display Screen

We also have several achievements as Trophies or the Score as the player keeps on crossing the hurdles, his score gets incremented and on the basis of the score. Digital trophies are given to the player. Also, the background is a .png file that is attached and it keeps on re-looping as the bird progresses throughout the game. Various other facades are there in the game that give a complete look of the dynamism of the game.

4.6 Deployment

Software deployment includes all of the steps, processes, and activities that are required to make a software system or update available to its intended users. Today, most IT organizations and software developers deploy software updates, patches and new applications with a combination of manual and automated processes. Some of the most common activities of software deployment include software release, installation, testing, deployment, and performance monitoring.

Cloud deployment is the process of deploying an application through one or more hosting models—software as a service (SaaS), platform as a service (PaaS) and/or infrastructure as a

service (IaaS)—that leverage the cloud. This includes architecting, planning, implementing and operating workloads on cloud.

CHAPTER 5

DEVELOPMENT

index.html

```
<!DOCTYPE html>
<html>
  <head>
    <meta charset="utf-8">
    <title>Super Mario Bros</title>
    <meta name="description" content="">
    <meta name="viewport" content="width=device-width">

    <link rel="stylesheet" href="css/game.css">
  </head>
  <body>
    <script type="text/javascript" src="js/util.js"></script>
    <script type="text/javascript" src="js/input.js"></script>
    <script type="text/javascript" src="js/resources.js"></script>
    <script type="text/javascript" src="js/sprite.js"></script>
    <script type="text/javascript" src="js/entity.js"></script>
    <script type="text/javascript" src="js/pipe.js"></script>
    <script type="text/javascript" src="js/mushroom.js"></script>
    <script type="text/javascript" src="js/fireflower.js"></script>
    <script type="text/javascript" src="js/star.js"></script>
    <script type="text/javascript" src="js/fireball.js"></script>
    <script type="text/javascript" src="js/coin.js"></script>
    <script type="text/javascript" src="js/bcoin.js"></script>
    <script type="text/javascript" src="js/goomba.js"></script>
    <script type="text/javascript" src="js/koopa.js"></script>
    <script type="text/javascript" src="js/floor.js"></script>
    <script type="text/javascript" src="js/block.js"></script>
    <script type="text/javascript" src="js/rubble.js"></script>
    <script type="text/javascript" src="js/prop.js"></script>
    <script type="text/javascript" src="js/player.js"></script>
    <script type="text/javascript" src="js/flag.js"></script>
    <script type="text/javascript" src="js/levels/level.js"></script>
    <script type="text/javascript" src="js/levels/11.js"></script>
    <script type="text/javascript" src="js/levels/11tunnel.js"></script>
    <script type="text/javascript" src="js/game.js"></script>
    <div class="info">
      <p class="controls">Move: Arrow Keys, Jump: X, Run: Z</p>
    </div>
  </body>
</html>
```

style.css

```
html, body, ul, li {
  margin: 0;
  border: 0;
  padding: 0;
}

canvas {
  display: block;
  width: 762;
  margin: 0 auto;
  background-color: blue;
}

p {
  text-align: center;
}

body {
  overflow: hidden;
  height: 100%;
}

html {
  overflow: hidden;
  height: 100%;
}

.info {
  position: absolute;
  top: 0;
  left: 0;
}
```

index.js

```
var requestAnimFrame = (function(){
  return window.requestAnimationFrame       ||
    window.webkitRequestAnimationFrame ||
    window.mozRequestAnimationFrame    ||
    window.oRequestAnimationFrame      ||
    window.msRequestAnimationFrame     ||
    function(callback){
      window.setTimeout(callback, 1000 / 60);
    };
})();

var canvas = document.createElement("canvas");
var ctx = canvas.getContext('2d');
var updateables = [];
var fireballs = [];
var player = new Mario.Player([0,0]);

canvas.width = 762;
canvas.height = 720;
ctx.scale(3,3);
```

```
document.body.appendChild(canvas);

//viewport
var vX = 0,
    vY = 0,
    vWidth = 256,
    vHeight = 240;

resources.load([
  'sprites/player.png',
  'sprites/enemy.png',
  'sprites/tiles.png',
  'sprites/playerl.png',
  'sprites/items.png',
  'sprites/enemyr.png',
]);

resources.onReady(init);
var level;
var sounds;
var music;

var lastTime;
function init() {
  music = {
    overworld: new Audio('sounds/aboveground_bgm.ogg'),
    underground: new Audio('sounds/underground_bgm.ogg'),
    clear: new Audio('sounds/stage_clear.wav'),
    death: new Audio('sounds/mariodie.wav')
  };
  sounds = {
    smallJump: new Audio('sounds/jump-small.wav'),
    bigJump: new Audio('sounds/jump-super.wav'),
    breakBlock: new Audio('sounds/breakblock.wav'),
    bump: new Audio('sounds/bump.wav'),
    coin: new Audio('sounds/coin.wav'),
    fireball: new Audio('sounds/fireball.wav'),
    flagpole: new Audio('sounds/flagpole.wav'),
    kick: new Audio('sounds/kick.wav'),
    pipe: new Audio('sounds/pipe.wav'),
    itemAppear: new Audio('sounds/itemAppear.wav'),
    powerup: new Audio('sounds/powerup.wav'),
    stomp: new Audio('sounds/stomp.wav')
  };
  Mario.oneone();
  lastTime = Date.now();
  main();
}

var gameTime = 0;

function main() {
  var now = Date.now();
  var dt = (now - lastTime) / 1000.0;

  update(dt);
  render();
```

```
  lastTime = now;
  requestAnimFrame(main);
}

function update(dt) {
  gameTime += dt;

  handleInput(dt);
  updateEntities(dt, gameTime);

  checkCollisions();
}

function handleInput(dt) {
  if (player.piping || player.dying || player.noInput) return;

  if (input.isDown('RUN')){
    player.run();
  } else {
    player.noRun();
  }
  if (input.isDown('JUMP')) {
    player.jump();
  } else {
    //we need this to handle the timing for how long you hold it
    player.noJump();
  }

  if (input.isDown('DOWN')) {
    player.crouch();
  } else {
    player.noCrouch();
  }

  if (input.isDown('LEFT')) {
    player.moveLeft();
  }
  else if (input.isDown('RIGHT')) {
    player.moveRight();
  } else {
    player.noWalk();
  }
}

function updateEntities(dt, gameTime) {
  player.update(dt, vX);
  updateables.forEach (function(ent) {
    ent.update(dt, gameTime);
  });

  if (player.exiting) {
    if (player.pos[0] > vX + 96)
      vX = player.pos[0] - 96
  }else if (level.scrolling && player.pos[0] > vX + 80) {
    vX = player.pos[0] - 80;
  }
```

```
  if (player.powering.length !== 0 || player.dying) { return; }
  level.items.forEach (function(ent) {
    ent.update(dt);
  });

  level.enemies.forEach (function(ent) {
    ent.update(dt, vX);
  });

  fireballs.forEach(function(fireball) {
    fireball.update(dt);
  });
  level.pipes.forEach (function(pipe) {
    pipe.update(dt);
  });
}

function checkCollisions() {
  if (player.powering.length !== 0 || player.dying) { return; }
  player.checkCollisions();

  level.items.forEach(function(item) {
    item.checkCollisions();
  });
  level.enemies.forEach (function(ent) {
    ent.checkCollisions();
  });
  fireballs.forEach(function(fireball){
    fireball.checkCollisions();
  });
  level.pipes.forEach (function(pipe) {
    pipe.checkCollisions();
  });
}

function render() {
  updateables = [];
  ctx.clearRect(0, 0, canvas.width, canvas.height);
  ctx.fillStyle = level.background;
  ctx.fillRect(0, 0, canvas.width, canvas.height);

  for(var i = 0; i < 15; i++) {
    for (var j = Math.floor(vX / 16) - 1; j < Math.floor(vX / 16) + 20; j++){
      if (level.scenery[i][j]) {
        renderEntity(level.scenery[i][j]);
      }
    }
  }

  level.items.forEach (function (item) {
    renderEntity(item);
  });

  level.enemies.forEach (function(enemy) {
    renderEntity(enemy);
  });
```

```
  fireballs.forEach(function(fireball) {
    renderEntity(fireball);
  })

  for(var i = 0; i < 15; i++) {
    for (var j = Math.floor(vX / 16) - 1; j < Math.floor(vX / 16) + 20; j++){
      if (level.statics[i][j]) {
        renderEntity(level.statics[i][j]);
      }
      if (level.blocks[i][j]) {
        renderEntity(level.blocks[i][j]);
        updateables.push(level.blocks[i][j]);
      }
    }
  }

  if (player.invincibility % 2 === 0) {
    renderEntity(player);
  }

  level.pipes.forEach (function(pipe) {
    renderEntity(pipe);
  });
}

function renderEntity(entity) {
  entity.render(ctx, vX, vY);
}
```

CHAPTER 6

RESULTS

The project's results are exceptional. Since it has no prerequisites, it can run in any system, including MacOS, Windows, or Linux. The output of the game is self-adjusting by nature, so it displays uniformly across all screen kinds. The game needs only about 13Mb of storage at most. As a result, it may also be incredibly space-efficient. Although the game depends on RAM to boot, since it is primarily an 8-bit game, it needs at least 1GB of RAM to function properly. We have integrated the following features into the game, which has seamless gameplay: Jump sound, killing sound, and ambient noise.

GAMEPLAY

Start the game or home page

Game over after colliding with the pipe

CHAPTER 7

DEOPLOYMENT

Software deployment includes all of the steps, processes, and activities that are required to make a software system or update available to its intended users. Today, most IT organizations and software developers deploy software updates, patches and new applications with a combination of manual and automated processes. Some of the most common activities of software deployment include software release, installation, testing, deployment, and performance monitoring.

Software development teams have innovated heavily over the past two decades, creating new paradigms and working methods for software delivery that are designed to meet the changing demands of consumers in an increasingly connected world. In particular, software developers have created workflows that enable faster and more frequent deployment of software updates to the production environment where they can be accessed by users.

7.1 CLOUD DEPLOYEMENT

Cloud deployment is the process of deploying an application through one or more hosting models—software as a service (SaaS), platform as a service (PaaS) and/or infrastructure as a service (IaaS)—that leverage the cloud. This includes architecting, planning, implementing and operating workloads on cloud.

Advantages of Cloud Deployment:

- Faster and simplified deployments. Automate builds that deploy code, databases and application releases, including resource provisioning.
- Cost savings. Control costs using consumption-based pricing and eliminate capex-heavy on-premises environments.
- Platform for growth. Leverage the global infrastructure provided by cloud service providers (CSPs) to seamlessly expand the business into other geographies.
- New digital business models. Exploit the continuous release of features and services by CSPs, incubate new technologies and innovate digital business models.
- Business resiliency. Architect for the availability and fault-tolerance CSPs offer and ensure disaster recovery and business continuity of applications to make the business resilient.
- Agility and scalability. Use autoscaling and scalability to meet peak demands of the business without provisioning for excess capacity.

- Geographic reach. Access applications from any location, on any device, leveraging the connectivity backbone of CSPs.
- Operational efficiency. Use the inherent automation enabled by cloud to increase operational efficiency and reduce human effort.
- A competitive edge. Leverage infrastructure as code and development, security and operations to reduce the time to market for new features and stay ahead of the competition.
- Empowered users. Increase productivity by empowering users with self-service options on cloud, such as portals, DevOps pipelines, and executive and operational dashboards.

For our application we will be using Google App Engine for deployment of the application which provides a platform as a service to host our applications.

Fig Deployment of the application on Google App Engine

7.2 Deploying on Google App Engine:

- Create a new Cloud Console project or retrieve the project ID of an existing project to use.
- Install and then initialize the Cloud SDK.
- Create an app.yaml file.
- Project Directory Structure:

```
project_name/
├── app.yaml
├── www/
    ├── index.html
    ├── css/style.css
    ├── js/script.js
    ├── img/
    ├── other dir
```

  - app. yaml: Configure the settings of your App Engine application.
  - www/: Directory to store all of your static files, such as HTML, CSS, images, and JavaScript.
  - css/: Directory to store stylesheets.
  - style.css: Basic stylesheet that formats the look and feel of your site.
  - images/: Optional directory to store images.
  - index.html: An HTML file that displays content for your website.
  - js/: Optional directory to store JavaScript files.
  - Other asset directories.

Creating the **app.yaml** file.

The app.yaml file is a configuration file that tells App Engine how to map URLs to your static files. In the following steps, you will add handlers that will load www/index.html when someone visits your website, and all static files will be stored in and called from the www directory.

  - Create the app.yaml file in your application's root directory:
  - Create a directory that has the same name as your project ID. You can find your project ID in the Console.
  - In directory that you just created, create a file named app. yaml.

- Edit the app.yaml file and add the following code to the file.

```
! app.yaml ×
D: > clg > cc > flappy > ! app.yaml
1  runtime: python27
2  api_version: 1
3  threadsafe: true
4
5  handlers:
6  - url: /
7    static_files: www/index.html
8    upload: www/index.html
9
10 - url: /(.*)
11   static_files: www/\1
12   upload: www/(.*)
```

Deploying your application file:

When you deploy your application files, your website will be uploaded to App Engine. To deploy your app, run the following command from within the root directory of your application where the app.yaml file is located:

gcloud app deploy

Optional flags:

- Include the --project flag to specify an alternate Cloud Console project ID to what you initialized as the default in the *gcloud tool*.
  Example: --project [YOUR_PROJECT_ID].
- Include the -v flag to specify a version ID, otherwise one is generated for you. Example: -v [YOUR_VERSION_ID]

Viewing your application:

To launch your browser and view the app at

https://PROJECT_ID.REGION_ID.r.appspot.com

run the following command:

gcloud app browse

CONCLUSION

In conclusion, creating a Super Mario game project is a challenging endeavor that requires a strong understanding of game development principles, programming languages, and tools. However, with hard work and determination, a high-quality game can be developed that captures the essence of the original Super Mario games while also incorporating unique elements. Overall, a Super Mario game project was a rewarding and enjoyable experience for both developers and players alike. The game is suitable for all age groups and is available on Desktop broadens the scope for its usage. The game is fairly simple and we have tried to add more features in the original classic game.

While a basic Super Mario game can be developed with a solid understanding of game development principles, there is always room for additional features and improvements. Adding multiple logins would allow for players to save their progress and return to the game at a later time. Making the game multi-player compatible would allow for players to play together, either locally or online. These additional features would add more depth and replayability to the game, making it even more enjoyable for players. However, it would also require more development time and resources, which should be considered when planning the project. The project will also give a wider perspective of how different elements like graphics, sound effects, and game mechanics come together to create a cohesive and entertaining experience for players.

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

A Cloud Computing Lab Mini-Project Report on

"Super Mario Game Using Google App Engine"

Submitted in partial fulfilment of the requirement for the award of the Degree of

Bachelor
In
Computer Science & Engineering

Submitted by

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

Certificate

Certified that the Cloud Computing lab Mini-Project work titled **"Super Mario Game Using Google App Engine"** carried out by **Keshav Raj** bearing the USN **1DA19CS073** , is bona-fide student of **Dr. Ambedkar Institute of Technology, Bengaluru,** in partial fulfilment for the award of **Degree in Bachelor of Engineering in Computer Science & Engineering** of Dr. Ambedkar Institute of Technology during the academic year 2022-23. It is certified that all corrections/suggestions indicated during Internal Assessment have been incorporated in the Mini- Project report deposited in the department. The Mini-Project report has been approved as it satisfies the academic requirements in respect of Mini-Project work prescribed for the said Degree.

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Examination

Name of the Examiners with Date — Signature

1.
2.

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Keshav Raj

ABSTRACT

Super Mario is a classic 2D side-scrolling platform game that follows Mario's quest to rescue Princess Peach from the evil Bowser. Players navigate through various levels filled with obstacles and enemies, collecting coins and power-ups along the way. The game features colorful graphics, memorable sound effects and music, and intuitive controls. The goal of the project is to recreate the game's classic gameplay and mechanics, while incorporating modern elements and updating the graphics and sound design for a new generation of players.

Additionally, the project aims to add new levels and challenges to keep players engaged, as well as multiplayer functionality for players to compete or cooperate with each other. It will also feature an adaptive difficulty system, allowing players of different skill levels to enjoy the game at their own pace. The project will be developed for multiple platforms, including desktop and mobile devices, with cross-platform multiplayer support for a seamless gaming experience. Overall, the Super Mario game project aims to bring back the beloved classic for old fans and introduce it to new ones, while delivering a fresh and enjoyable gaming experience.