CMPE 282 - Project

University: San Jose State University (SJSU)

Course: Cloud Services

Professor: Andrew Bond

Team: ***Techno Spartan***

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TECHNO SPARTAN	VERSION: 2.0
PROJECT PLAN	DATE: 05/14/2021

Revision History

Date	Version	Description	Author
02/03/2021	0.1	Initial Draft	Shreya Ghotankar
02/10/2021	0.2	Kubernetes Architecture and workflow	Parvathi Pai Sania Gonsalves
02/14/2021	1.0	Minor edits and published	Shreya Ghotankar Parvathi Pai Sania Gonsalves
05/05/2021	1.1	Architecture Diagram updated	Parvathi Pai
04/15/2021	1.2	Implemented CRUD operations backend	Sania Gonsalves
05/10/2021	1.3	Updated Implementation, Deployment, CI/CD Information	Parvathi Pai Shreya Ghotankar
05/14/2021	2.0	Peer Review and Final publish	

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Introduction

Purpose of this document

The purpose of this document is to provide a detailed project description of the application called "Smart Salary", which will have three different roles: HR, Manager and Employee. Through this application, the employee can tweet his salary raise; Manager can list their reportee, update, view their salaries; and HR can visualize the salary change and predict the growth of both employee and manager. This document includes details about the application idea, development, deployment, and deliverables.

Scope:

This document defines the project plan of the "Smart Salary" application. This includes project idea, individual contribution, development process, deployment process and deliverables.

Project Idea

We have used the default project database and created application called **Smart Salary** where the employees can view their information like salary and reporting manager on a dashboard. Managers can see employees reporting to them. HR can see the list of all employees and HR department specific dashboard that provides insights into each employee's growth over the years. This project majorly focuses on data analysis and data visualization to generate salary insights. We have used Amazon Elastic Container Service for our application deployment.

Our responsive web application can be used by any enterprise organization and can be extended to any levels. Initially we are creating a three-tier application. This can be extended to multiple tiers depending on the depth of the organization.

3 roles: Employee, Manager and HR.
Our application has following features –

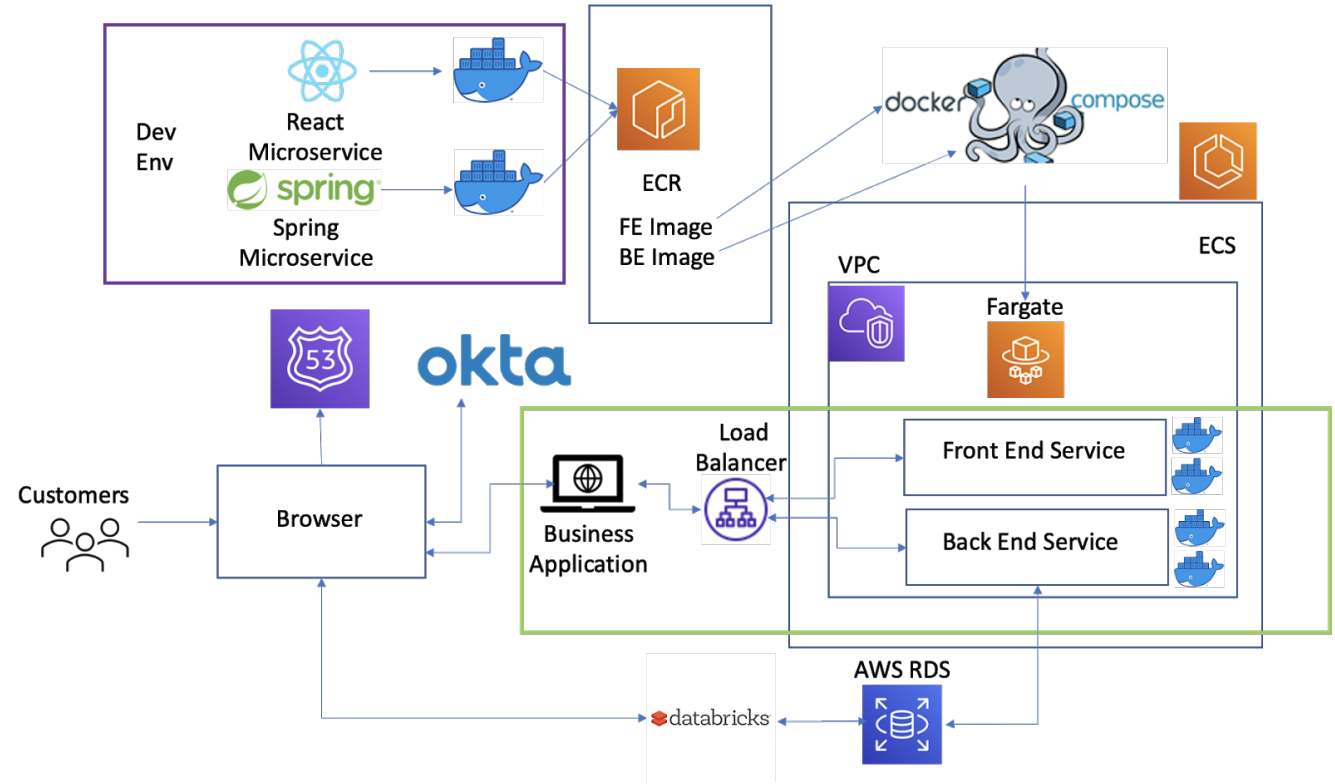
- Employee Dashboard – Employee information like name, salary, reporting manager
- Manager Dashboard – Own Information, List of employees reporting to her/him.
- HR Dashboard- List of all Employees, perform actions like update, delete and add employees, HR department specific dashboard to view Employee Trends – insights into employee demographics based on gender, age and salary difference by age.

Presentation and Demo

Presentation Slides -
https://drive.google.com/file/d/1CyfWanUG60JKxU6DU8v4uYsFyqU60lDd/view?usp=sharing

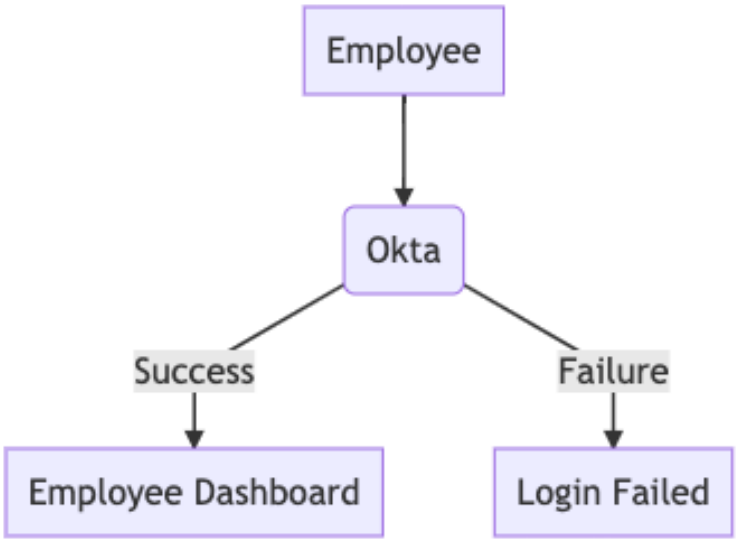
Demo -
https://drive.google.com/file/d/1VClkp9VRymb8yTUKTCLD4FyIA2mEpK8I/view?usp=sharing

Architecture Diagram

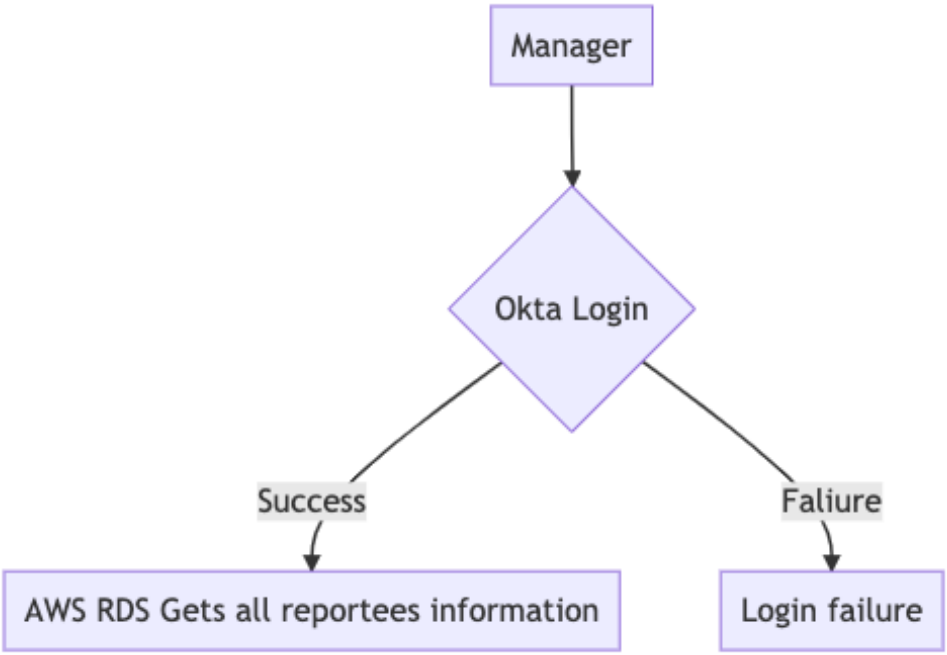


High Level Design

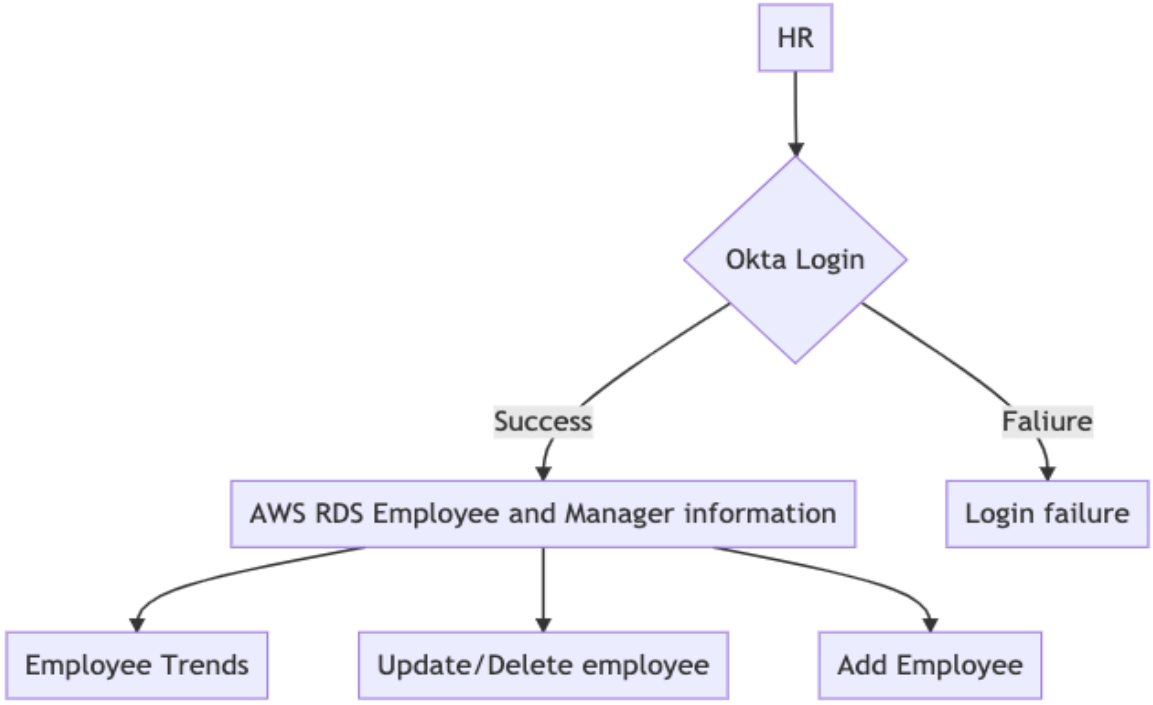
Use Case 1: Employee login and lands on Dashboard



Use Case 2: Manager can see list of employees reporting to him/her.



Use Case 3: Add, update and delete employees.
Data visualization for Employee Trends.



Technology and Services Stack

- Front-end – CSS, JavaScript, REACT JS, Material Design
- Spring Boot
- Authentication and Authorization – Okta
- Database - AWS RDS MYSQL
- Data Insights– Python, Databricks
- Deployment – Docker, Docker Compose, Amazon ECS, Amazon ECR, AWS Fargate

Project Group

Name	Responsibility
Shreya Ghotankar	Authentication and Authorization, Role-based access, UI, Documentation Add, Update, Delete Employee - Frontend
Parvathi Pai	UI, Employee Trends using Databricks, Deployment of frontend and backend microservices using Docker, Docker compose, Amazon ECS.
Sania Gonsalves	Implemented Add, Update, Delete Employee -Backend

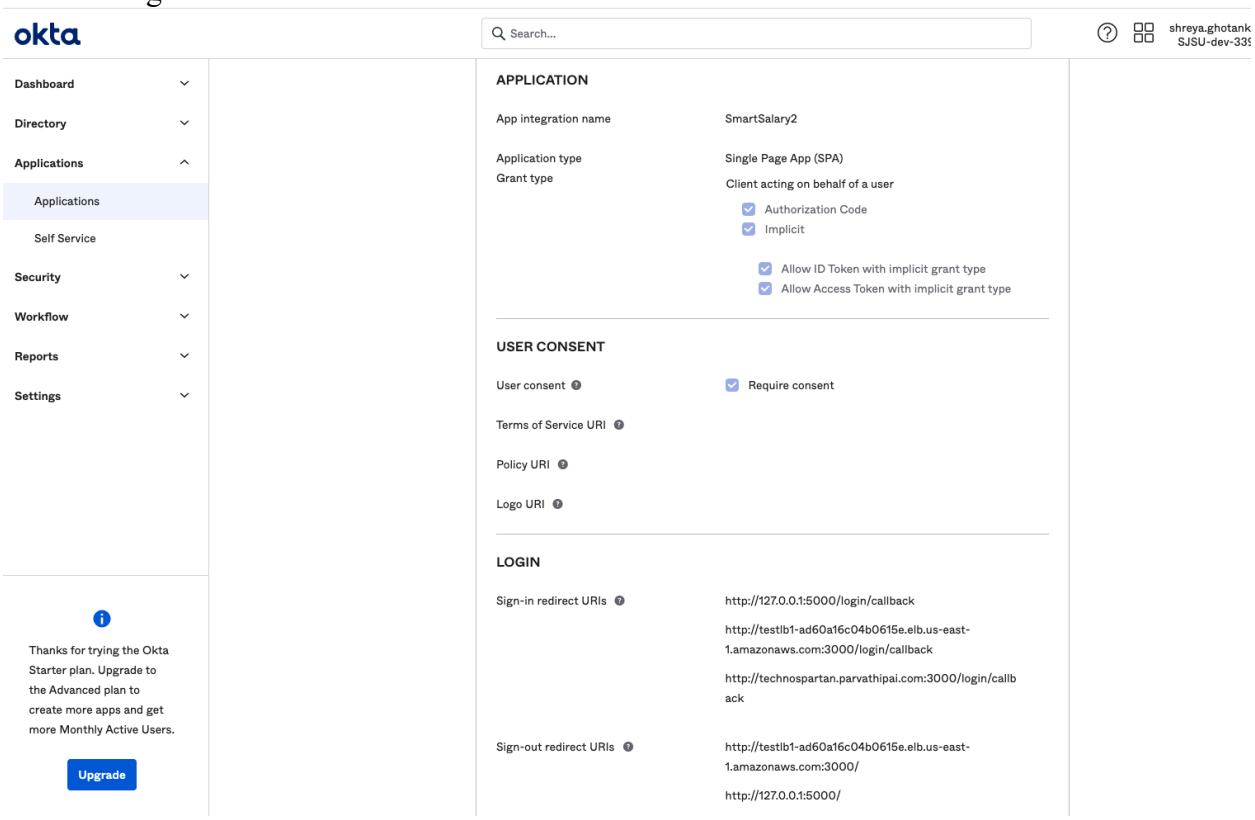
Implementation

GitHub URL: **https://github.com/ParvathiRPai/Cloud_Services**

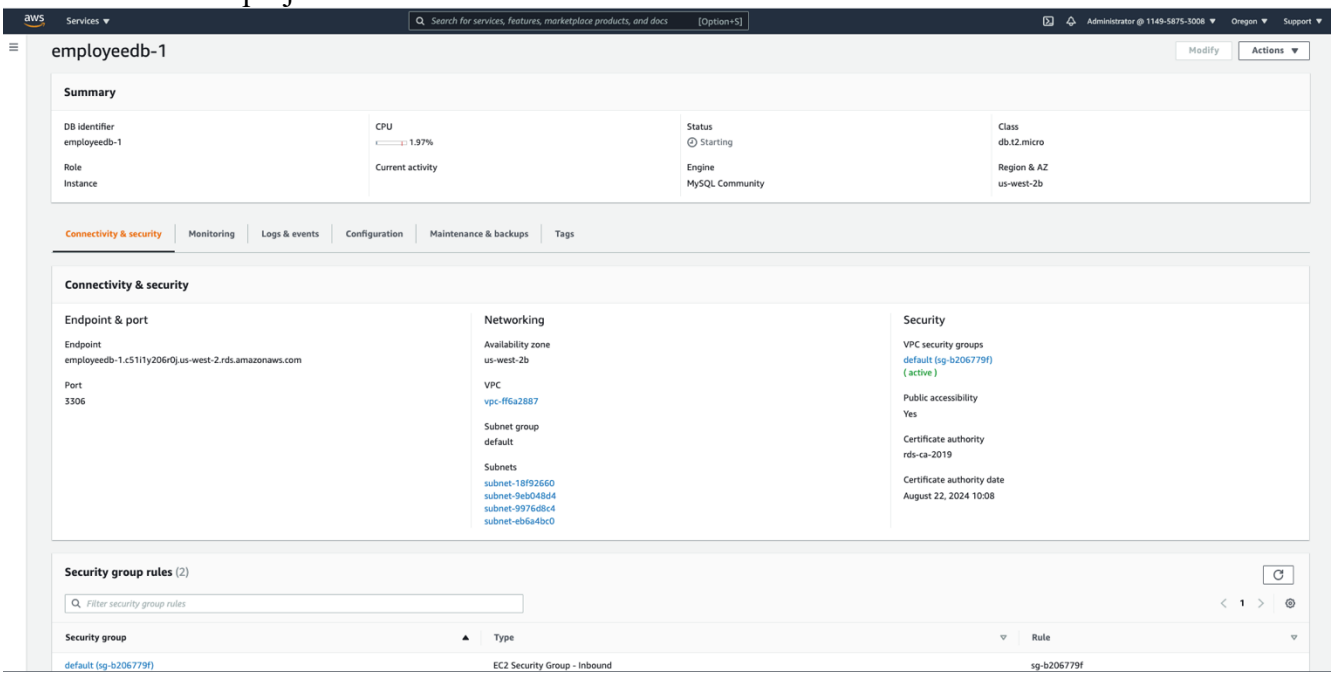
1. Authentication and Authorization

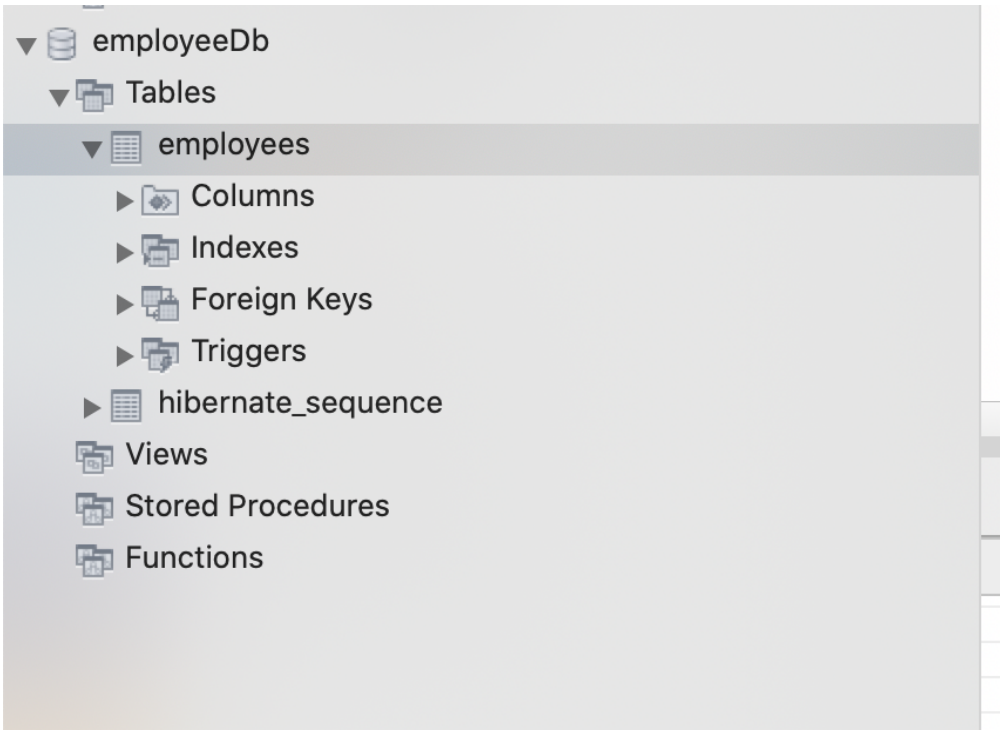
   We have used OKTA for our authentication and authorization feature. User can Login or Sign Up using the Okta Sign-in Widget integrated in our React JS application. We have also implemented role-based access feature. There are 3 roles – Employee, Manager and HR. Based on the role the specific dashboard is made available to the user.

Okta Configuration:



2. We have used AWS RDS – MYSQL as our database, where we imported the data from the default project database.





3. Using DB to fetch employee information to display on the dashboard. Everyone is an employee including Manager and HR. So, they also see the employee dashboard.
4. Manager has a manager specific dashboard which shows manager the list of employees reporting to them.
5. HR has access to perform actions like Add, update and delete employees which are implemented as CRUD operations.
6. HR has a specific dashboard to view the Employee Trends. These trends are generated using the test data. We have made use of Databricks community edition for data analysis. We are using Python with libraries like NumPy, Pandas and Matplotlib.

Databricks Screenshots

Cloud_services (Python)

test | File | Edit | View: Standard | Permissions | Run All | Clear | Publish | Comments | Experiment | Revision history

Cmd 1

```
def CreateSchemaToPandas(file_location):   file_type = "csv"   # CSV options   i ...
```

Show cell

Cmd 2

```
file_location_salaries = "/FileStore/tables/salaries.csv" file_location_dept_man ...
```

Show cell

Cmd 3

```
df_salaries=CreateSchemaToPandas(file_location_salaries) display(df_salaries) df ...
```

Show cell

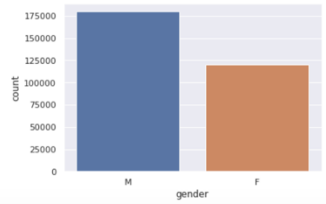
Cmd 4

```
import seaborn as sns import matplotlib.pyplot as plt ...
```

Show cell

Cmd 5

```
1  sns.set(style="darkgrid")
2  ax = sns.countplot(x="gender", data=df_employees[df_employees.gender != 28791])
3  #  Through this analysis we can conclude that there are more male employees.
```



Cloud_services (Python)

test | File | Edit | View: Standard | Permissions | Run All | Clear | Publish | Comments | Experiment | Revision history

```
1  import pandas as pd
2  import numpy as np
3  #  Type casting object type to string type
4  df_employees['hire_date']=pd.to_datetime(df_employees.hire_date)
5  df_employees['birth_date']=pd.to_datetime(df_employees.birth_date)
6  df_employees['age_when_hired'] = (df_employees['hire_date'] - df_employees['birth_date'])/np.timedelta64(1, 'Y')
7  df_employees['age_when_hired'] = df_employees.age_when_hired.astype(int)
```

Command took 0.22 seconds -- by parvathi.pai@sjsu.edu at 3/29/2021, 1:50:56 PM on cloud_services

Cmd 7

```
1  df_employees.head()
```

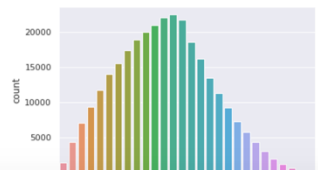
Out[7]:

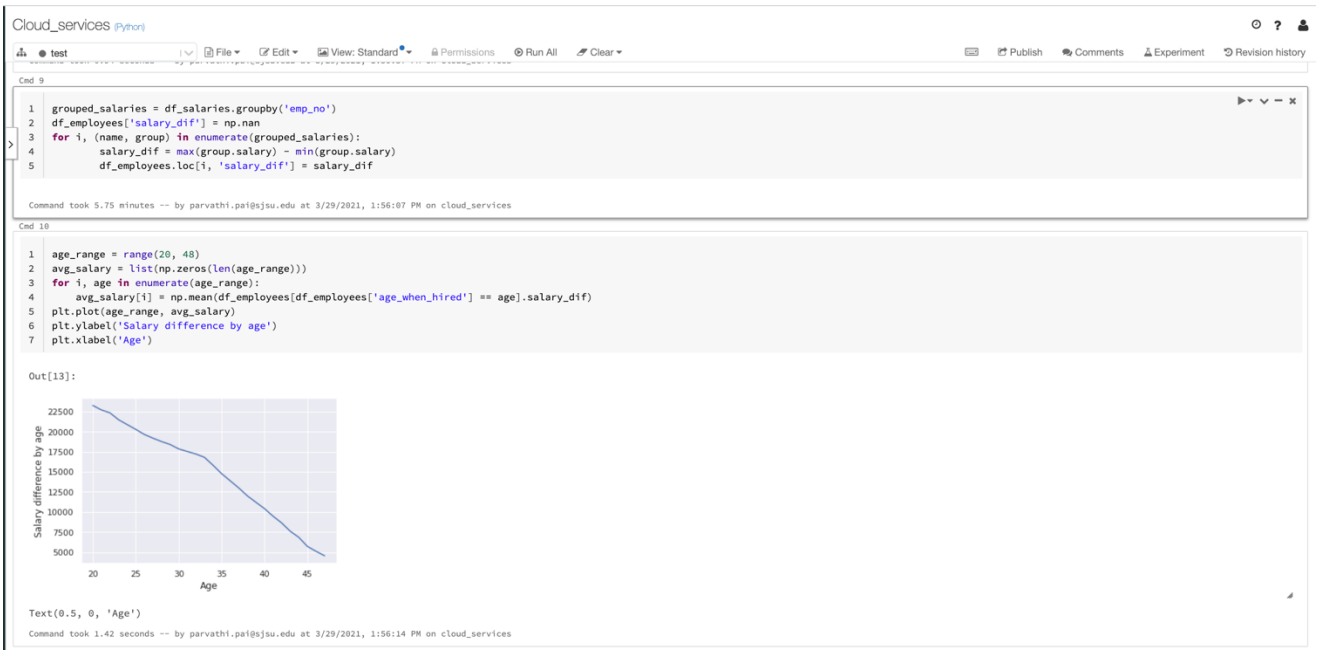
	emp_no	birth_date	first_name	last_name	gender	hire_date	age_when_hired
0	10001	1953-09-02	Georgi	Facello	M	1986-06-26	32
1	10002	1964-06-02	Bezalel	Simmel	F	1985-11-21	21
2	10003	1959-12-03	Parto	Bamford	M	1986-08-28	26
3	10004	1954-05-01	Chirstian	Koblick	M	1986-12-01	32
4	10005	1955-01-21	Kyoichi	Maliniak	M	1989-09-12	34

Command took 0.07 seconds -- by parvathi.pai@sjsu.edu at 3/29/2021, 1:50:57 PM on cloud_services

Cmd 8

```
1  yx = sns.countplot(x='age_when_hired', data=df_employees)
```





7. We have added a JUnit test case.

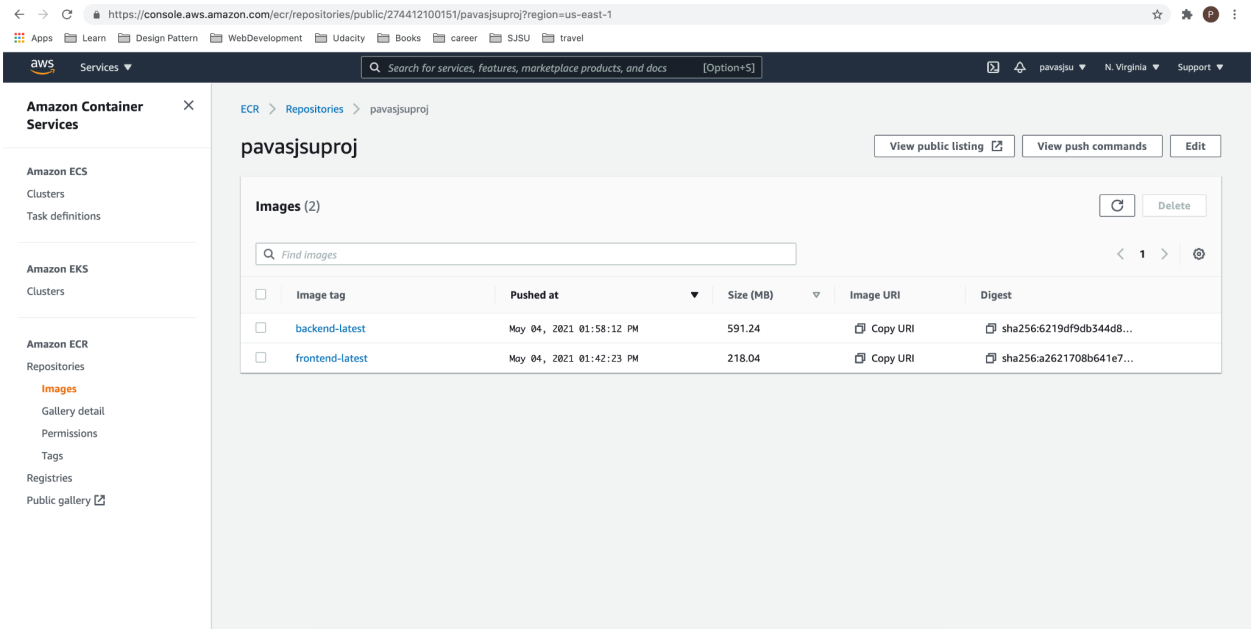
```
package com.example.smartsalary.backend;

import ...

@SpringBootTest
class BackendApplicationTests {
    @Autowired
    private EmployeeController controller;
    @Test
    void contextLoads() { assertThat(controller).isNotNull(); }
}
```

Deployment

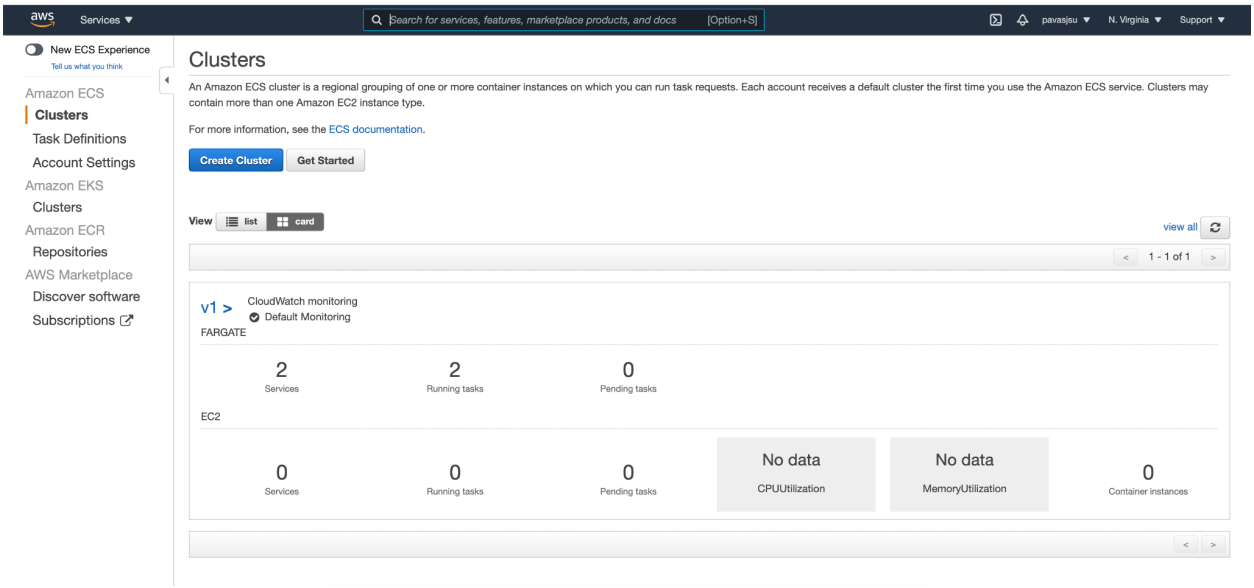
- We are making use of two microservices - Front end using react and back end using spring.
- Locally we are creating two images one for front end and another for back end using docker as shown

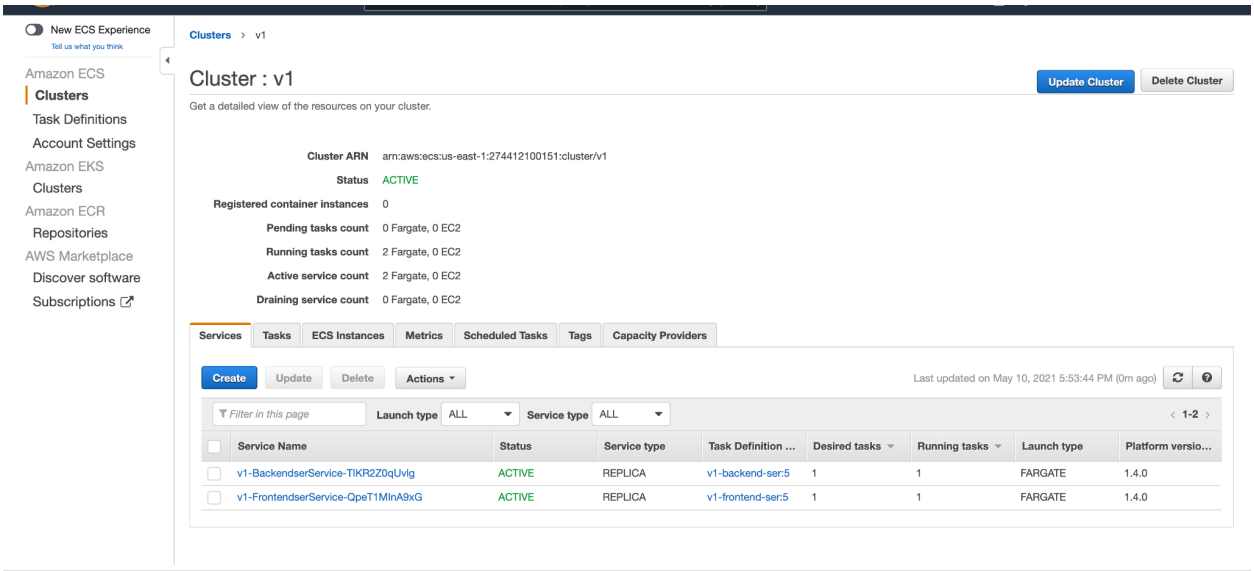
```
v1_frontend-ser                          latest           6faa70985b1c   6 days ago     720MB
public.ecr.aws/x4y9x2u7/pavasjsuproj     frontend-latest  6faa70985b1c   6 days ago     720MB
public.ecr.aws/x4y9x2u7/pavasjsuproj     backend-latest   324c3211144c   6 days ago     912MB
v1_backend-ser                           latest           324c3211144c   6 days ago     912MB
```

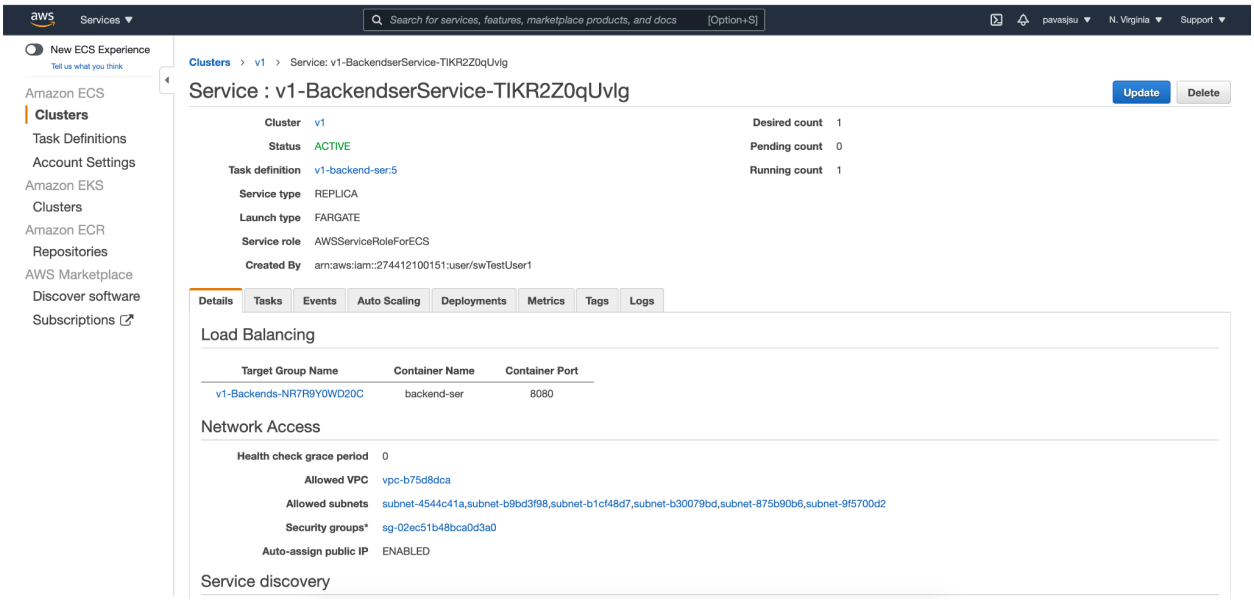
- The local docker images are registered in ECR as shown. We are making use of public repositories as it is almost free of cost, whereas the private repositories are charged after 750MB.

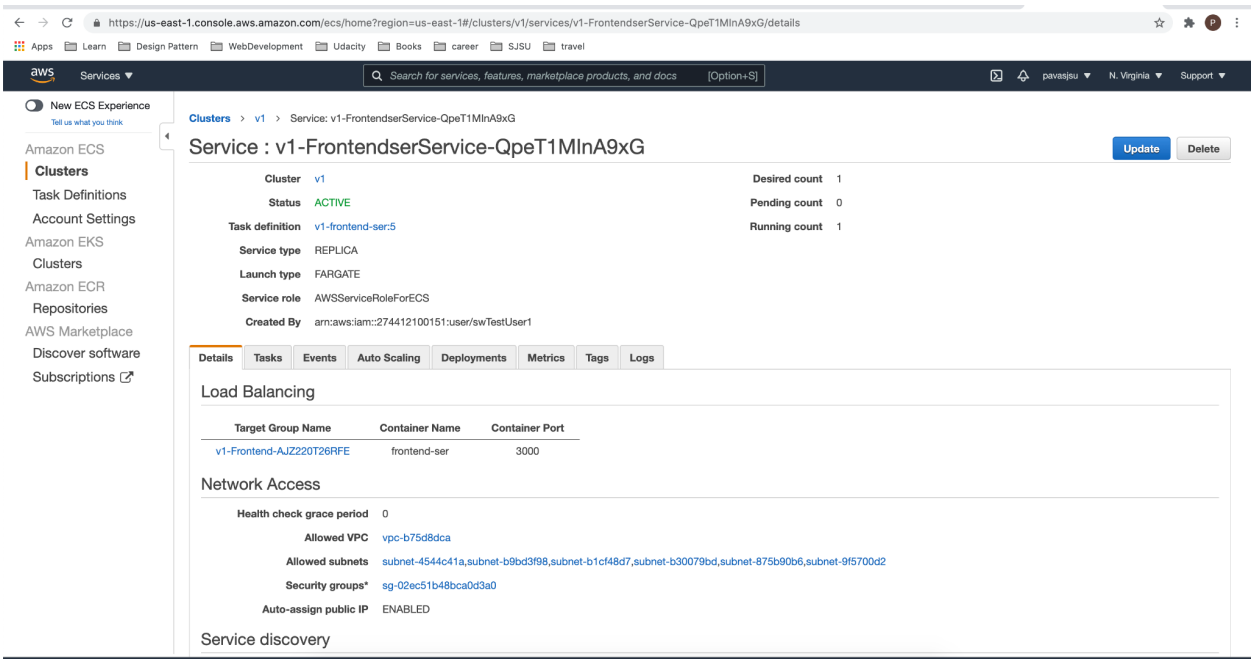


- The two microservices are the deployed using fargate as shown in the figure

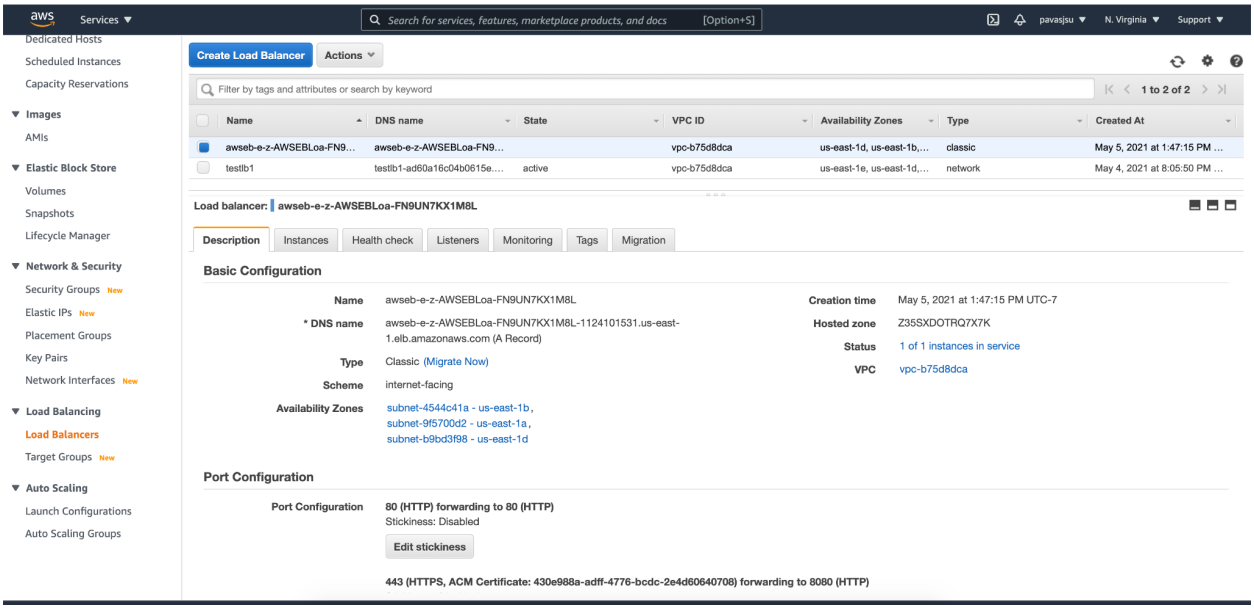



New ECS Experience
Tell us what you think
Amazon ECS
Clusters
Task Definitions
Account Settings
Amazon EKS
Clusters
Amazon ECR
Repositories
AWS Marketplace
Discover software
Subscriptions
Clusters > v1
Cluster : v1
Update Cluster
Delete Cluster
Get a detailed view of the resources on your cluster.
Cluster ARN arn:aws:ecs:us-east-1:274412100151:cluster/v1
Status ACTIVE
Registered container instances 0
Pending tasks count 0 Fargate, 0 EC2
Running tasks count 2 Fargate, 0 EC2
Active service count 2 Fargate, 0 EC2
Draining service count 0 Fargate, 0 EC2
Services Tasks ECS Instances Metrics Scheduled Tasks Tags Capacity Providers
Create Update Delete Actions
Last updated on May 10, 2021 5:53:44 PM (0m ago)
Filter in this page
Launch type ALL
Service type ALL
1-2
Service Name Status Service type Task Definition ... Desired tasks Running tasks Launch type Platform versio...
v1-BackendserService-TIKR2Z0qUvlg ACTIVE REPLICA v1-backend-ser:5 1 1 FARGATE 1.4.0
v1-FrontendserService-QpeT1MInA9xG ACTIVE REPLICA v1-frontend-ser:5 1 1 FARGATE 1.4.0

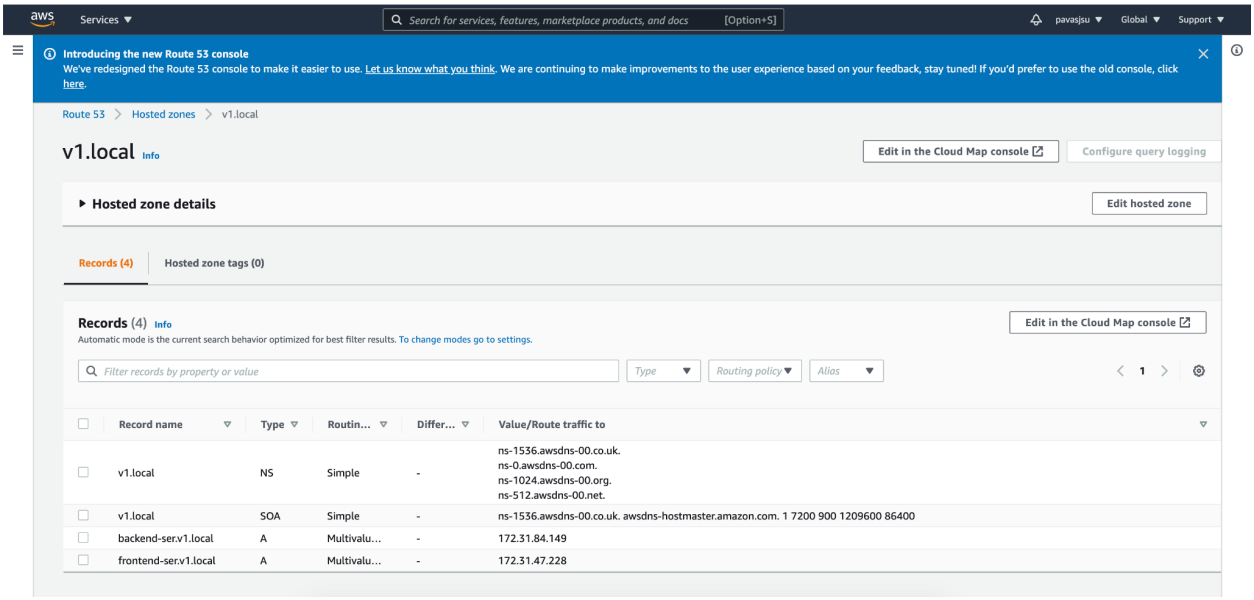

aws
Services
Search for services, features, marketplace products, and docs [Option+S]
pavasjsu
N. Virginia
Support
New ECS Experience
Tell us what you think
Amazon ECS
Clusters
Task Definitions
Account Settings
Amazon EKS
Clusters
Amazon ECR
Repositories
AWS Marketplace
Discover software
Subscriptions
Clusters > v1 > Service: v1-BackendserService-TIKR2Z0qUvlg
Service : v1-BackendserService-TIKR2Z0qUvlg
Update
Delete
Cluster v1
Status ACTIVE
Task definition v1-backend-ser:5
Service type REPLICA
Launch type FARGATE
Service role AWSServiceRoleForECS
Created By arn:aws:iam::274412100151:user/swTestUser1
Desired count 1
Pending count 0
Running count 1
Details Tasks Events Auto Scaling Deployments Metrics Tags Logs
Load Balancing
Target Group Name Container Name Container Port
v1-Backends-NR7R9Y0WD20C backend-ser 8080
Network Access
Health check grace period 0
Allowed VPC vpc-b75d8dca
Allowed subnets subnet-4544c41a,subnet-b9bd3f98,subnet-b1cf48d7,subnet-b30079bd,subnet-875b90b6,subnet-9f5700d2
Security groups* sg-02ec51b48bca0d3a0
Auto-assign public IP ENABLED
Service discovery



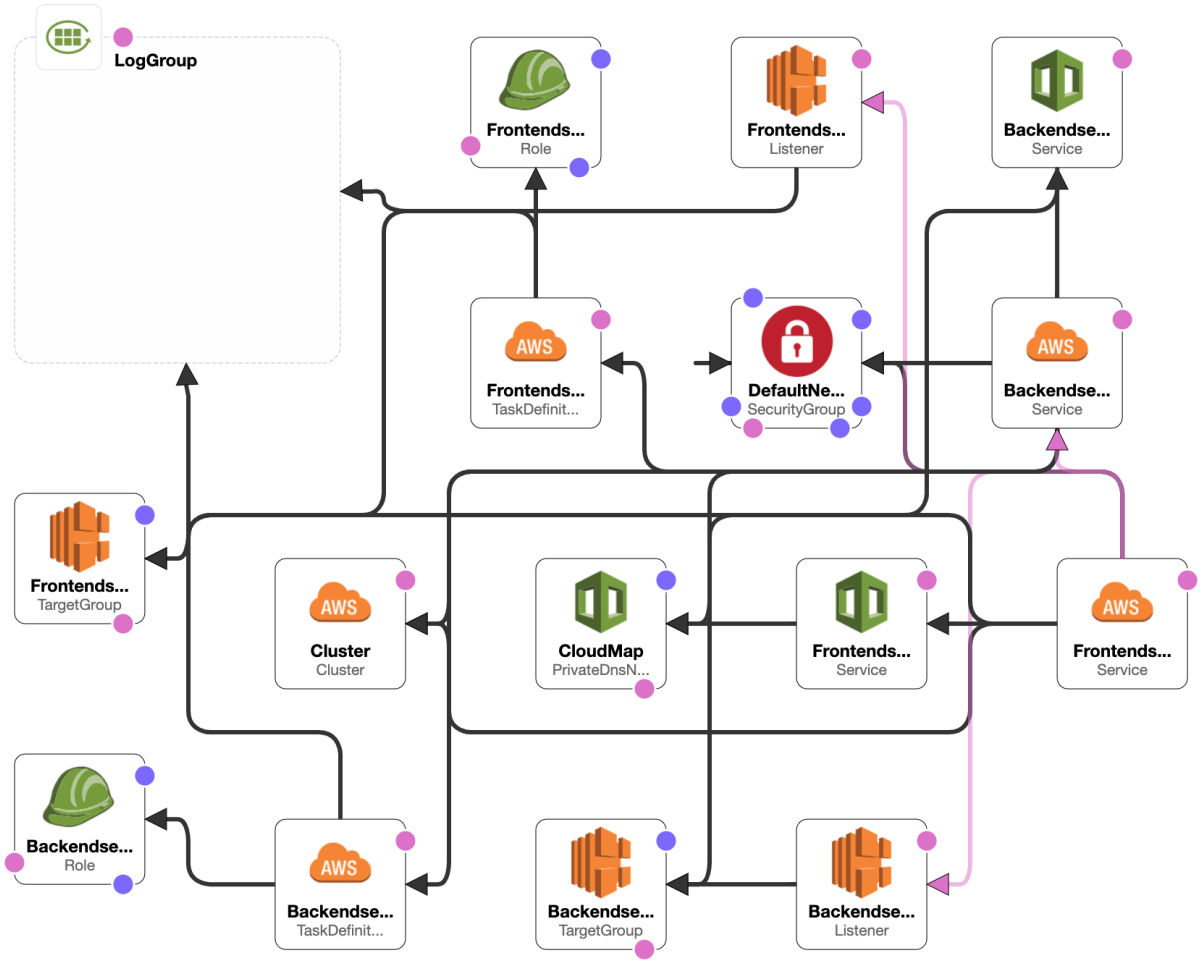
- The application load balancer is configured as shown in the figure.

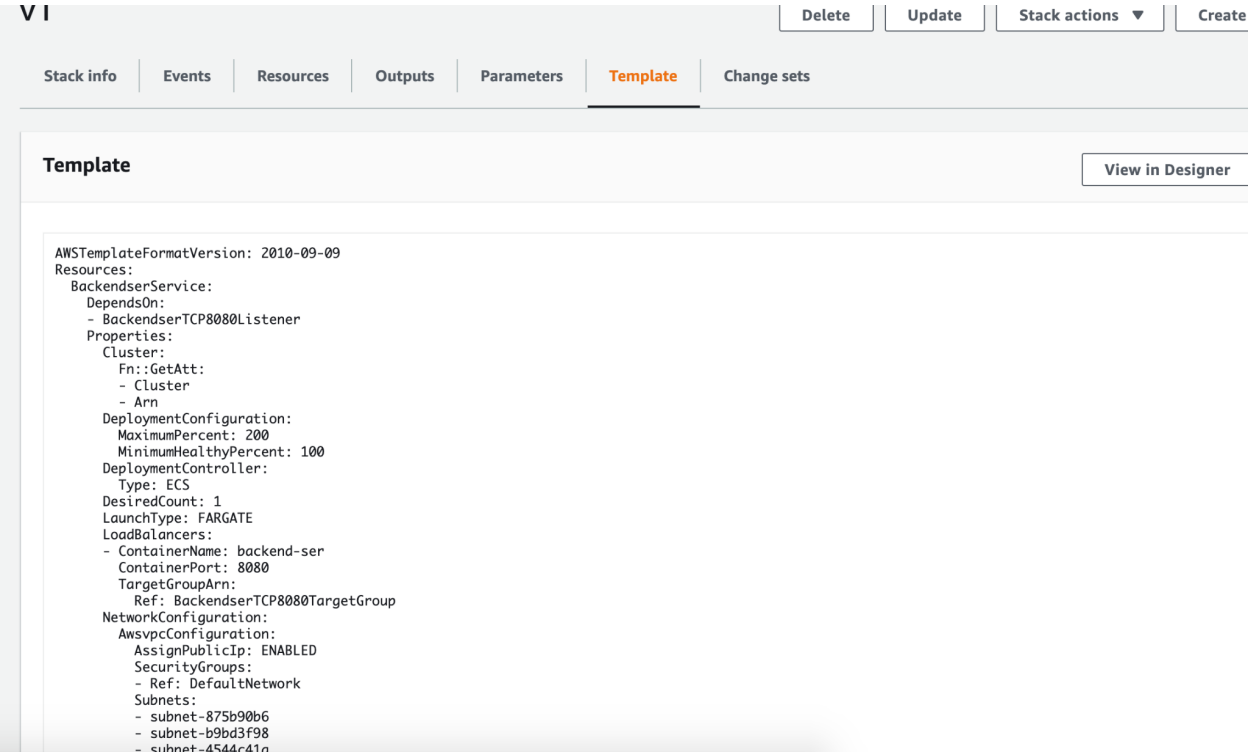


- Route 53 is configured as shown in the figure



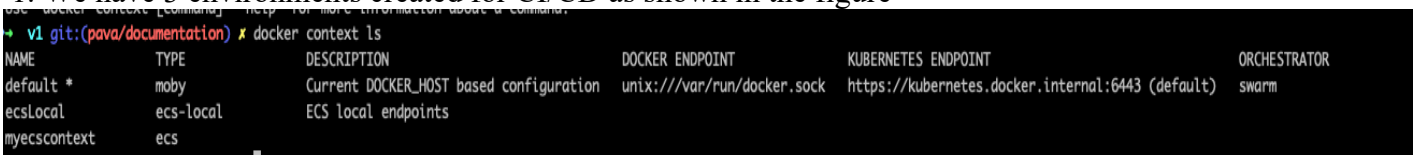
- Cloud formation template for Fargate is shown in the figure



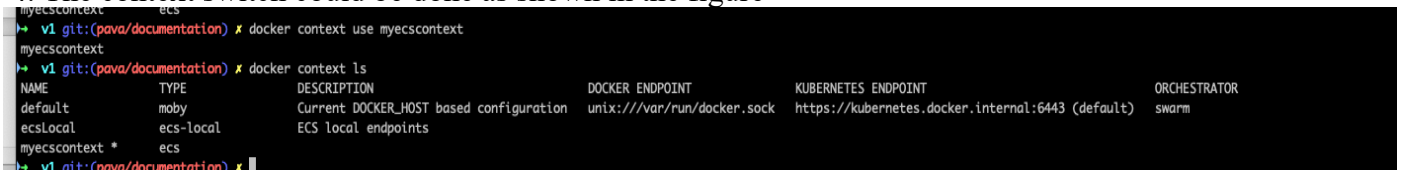


CI/CD

1. We have 3 environments created for CI/CD as shown in the figure



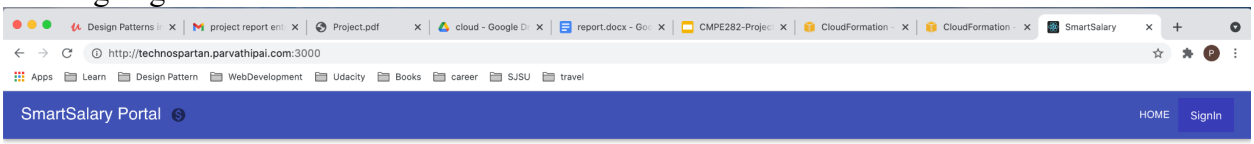
2. The *ecslocal* environment is for local ECS CI/CD setup
3. *myecscontext* is for registering our service to ECR then to ECS.
4. The context switch could be done as shown in the figure



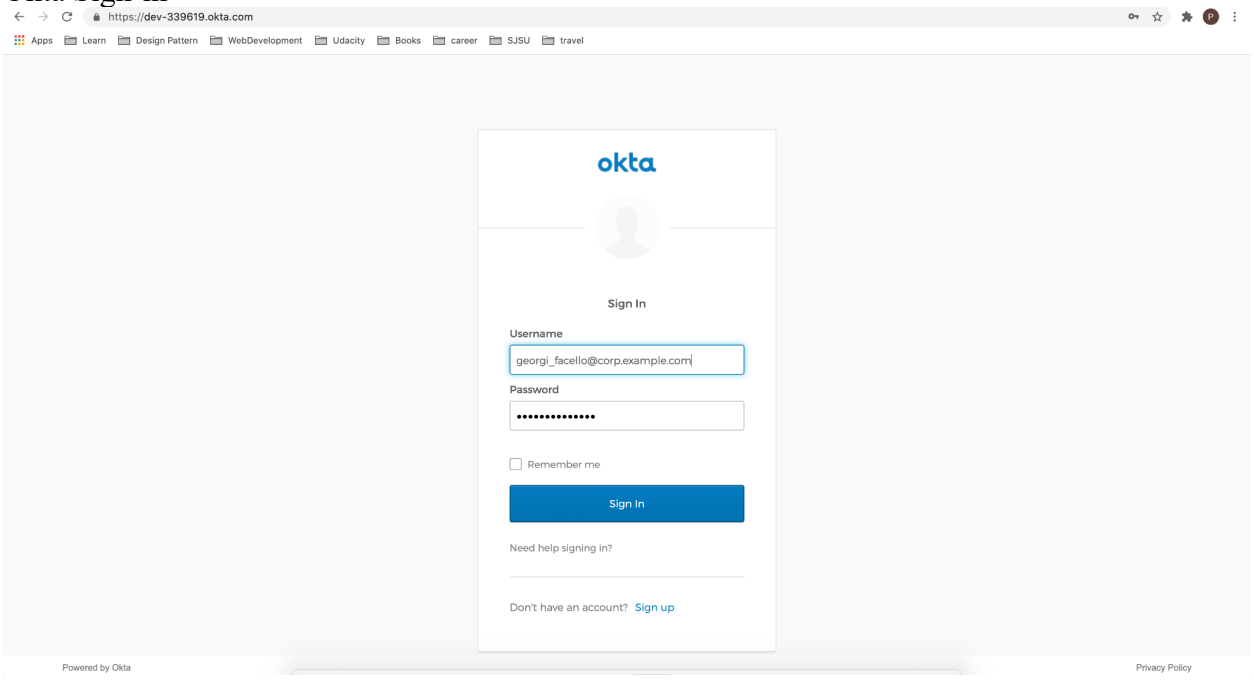
5. Docker push pushes the images to ECR and ECS as shown in the figure

Application Screenshots

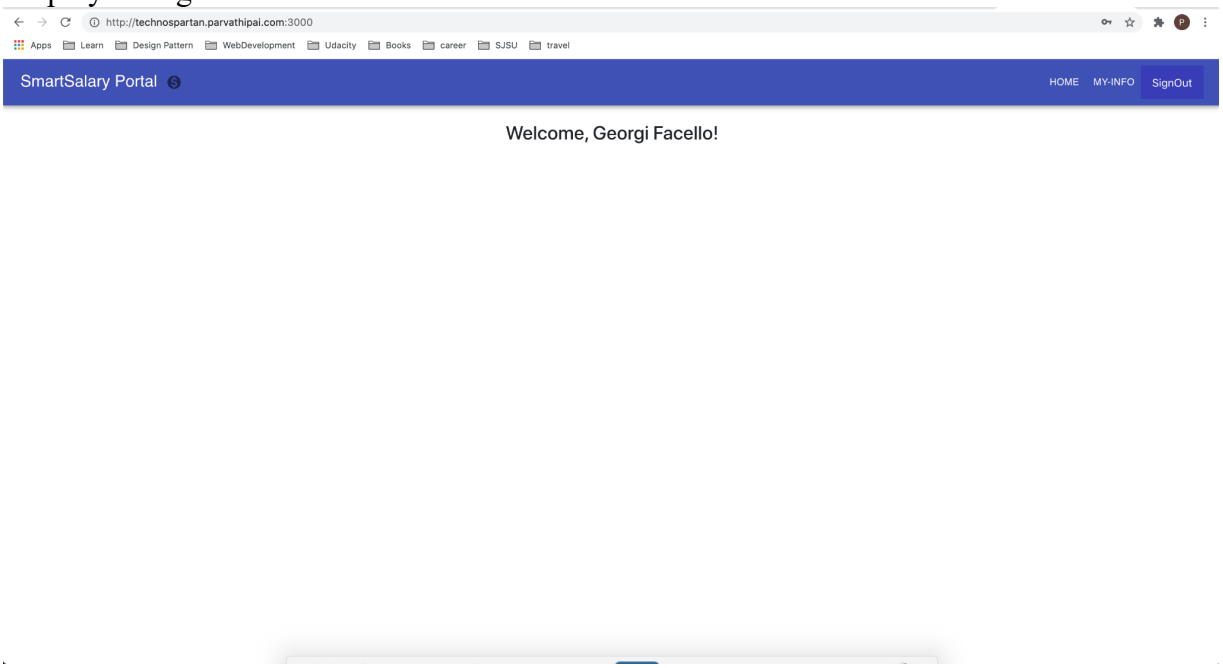
Landing Page



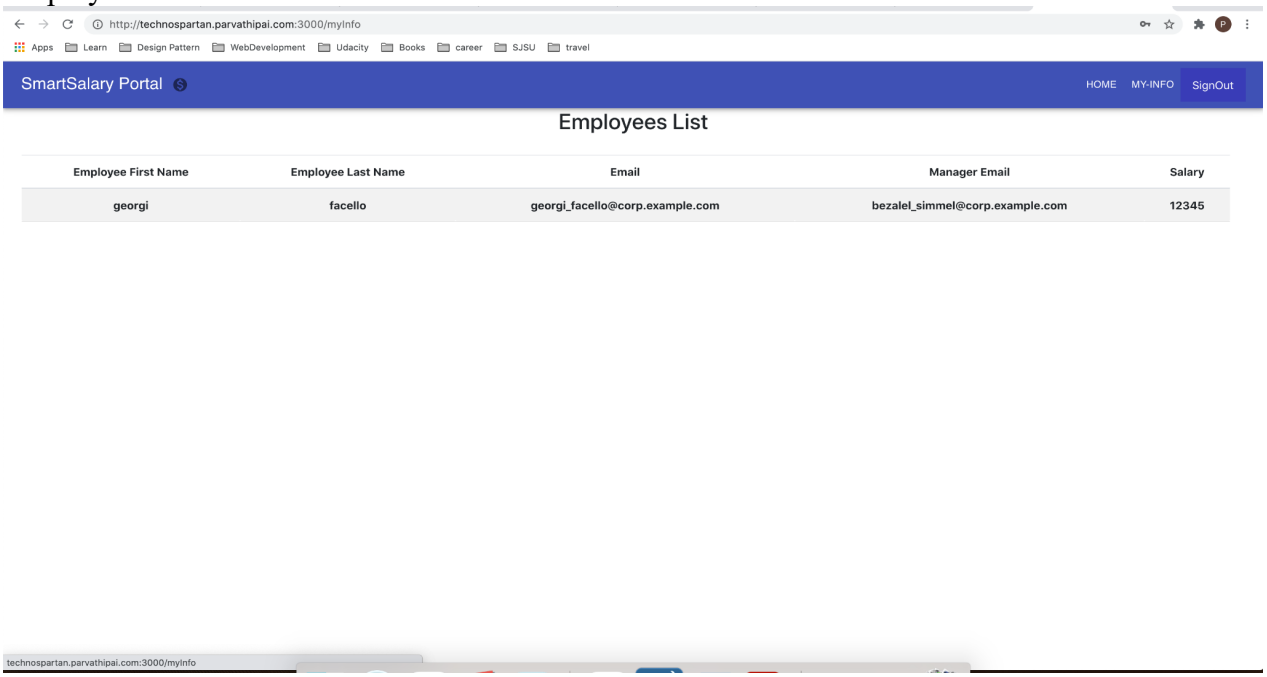
Okta Sign-in



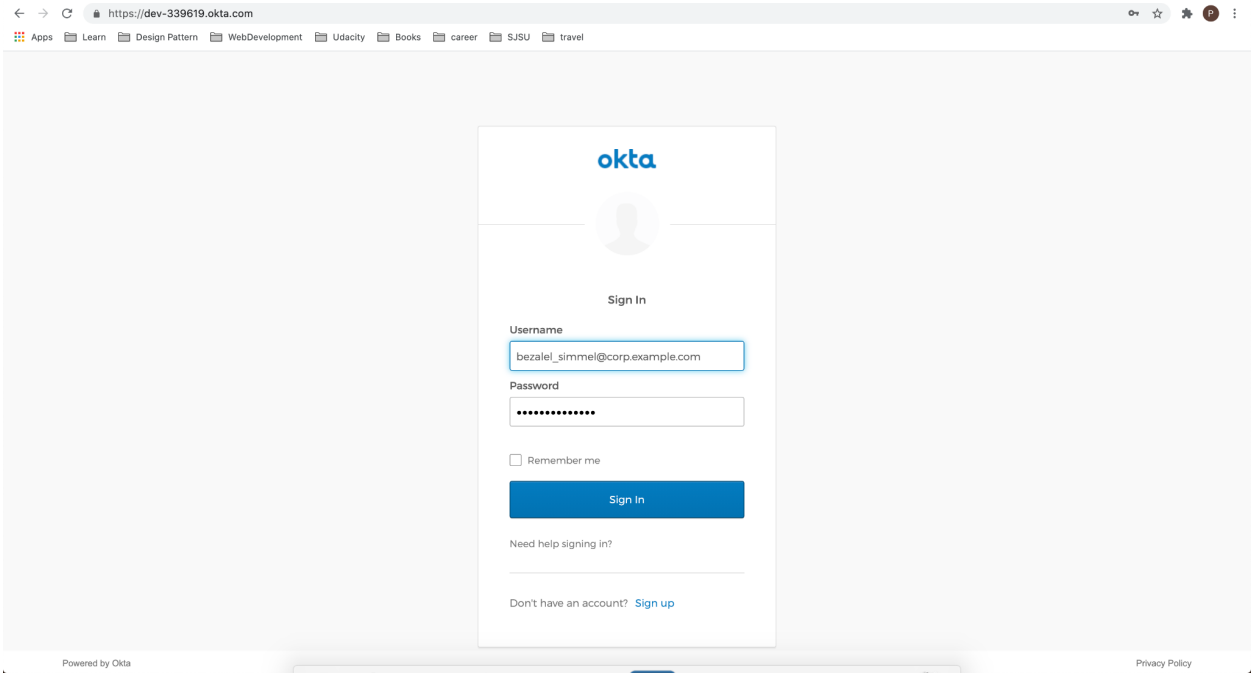
Employee Login



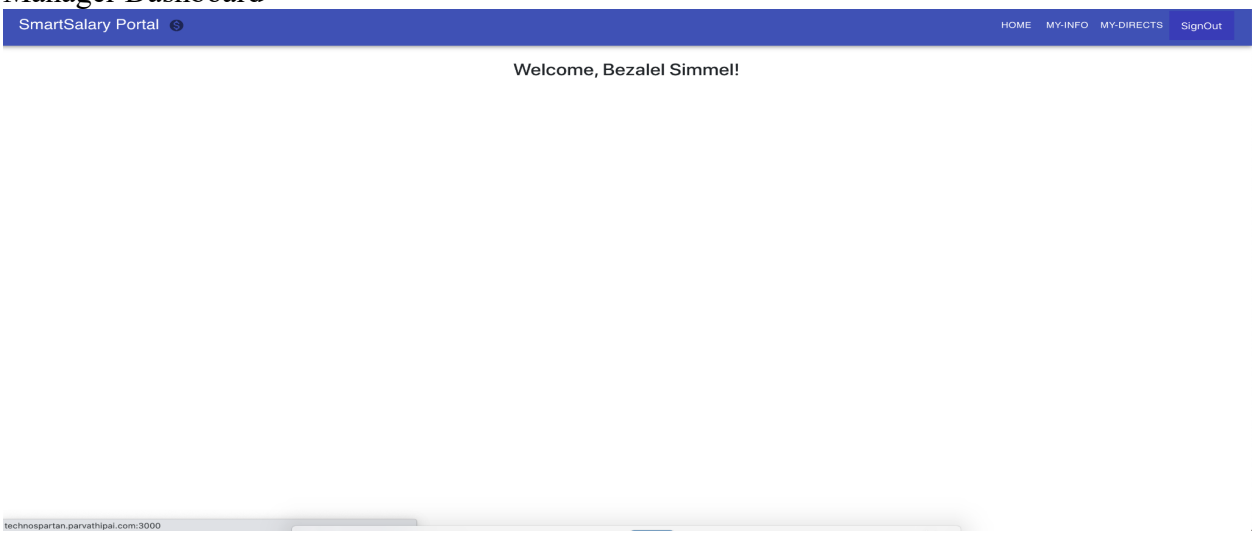
Employee Dashboard

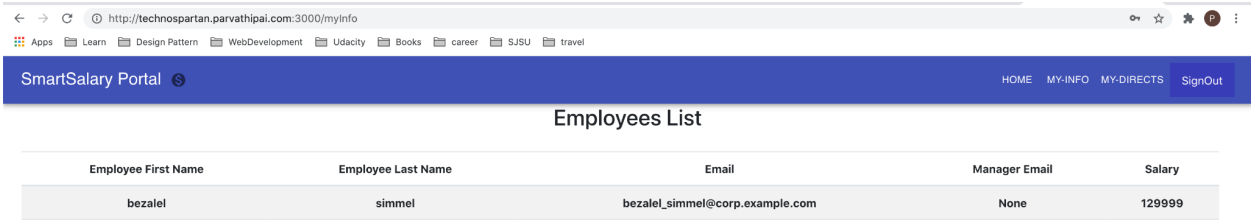


Manager Login



Manager Dashboard





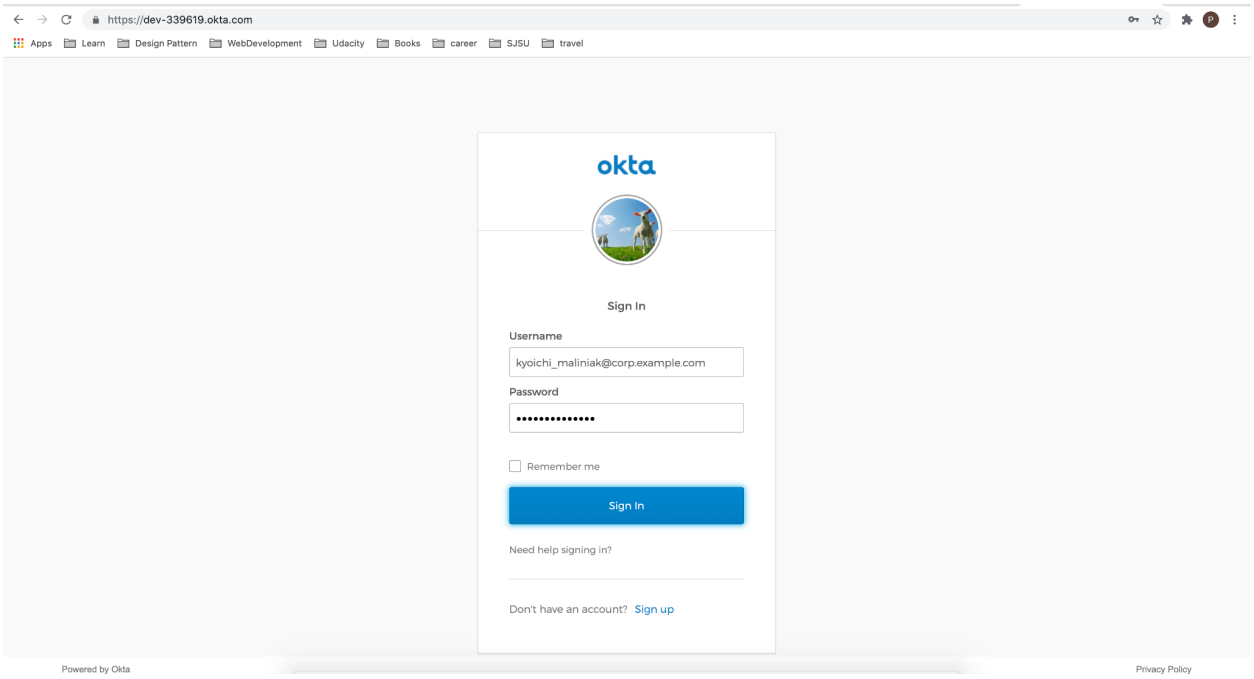
Employees List

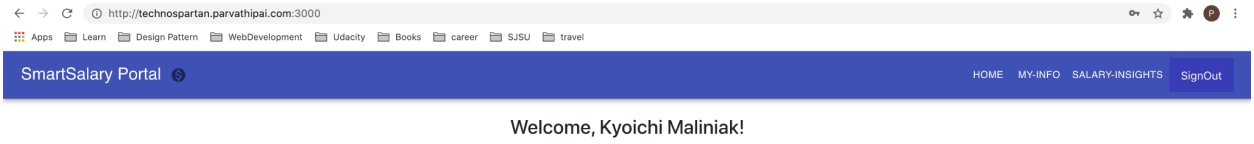
Employee First Name	Employee Last Name	Email	Manager Email	Salary
bezalel	simmel	bezalel_simmel@corp.example.com	None	129999

Employees List

Employee First Name	Employee Last Name	Email	Manager Email	Salary
georgi	facello	georgi_facello@corp.example.com	bezalel_simmel@corp.example.com	12345
kyoichi	maliniak	kyoichi_maliniak@corp.example.com	bezalel_simmel@corp.example.com	1250
Mary	Sluis	Mary_Sluis@corp.example.com	bezalel_simmel@corp.example.com	123666
Anneke	Preusig	Anneke_Preusig@corp.example.com	bezalel_simmel@corp.example.com	12400
Kazuhide	Peha	Kazuhide_Peha@corp.example.com	bezalel_simmel@corp.example.com	30000
Chirstian	Koblick	Chirstian_Koblick@corp.example.com	bezalel_simmel@corp.example.com	50000

HR login


https://dev-339619.okta.com
Apps Learn Design Pattern WebDevelopment Udacity Books career SJSU travel
okta
Sign In
Username
kyoichi_maliniak@corp.example.com
Password
Remember me
Sign In
Need help signing in?
Don't have an account? Sign up
Powered by Okta
Privacy Policy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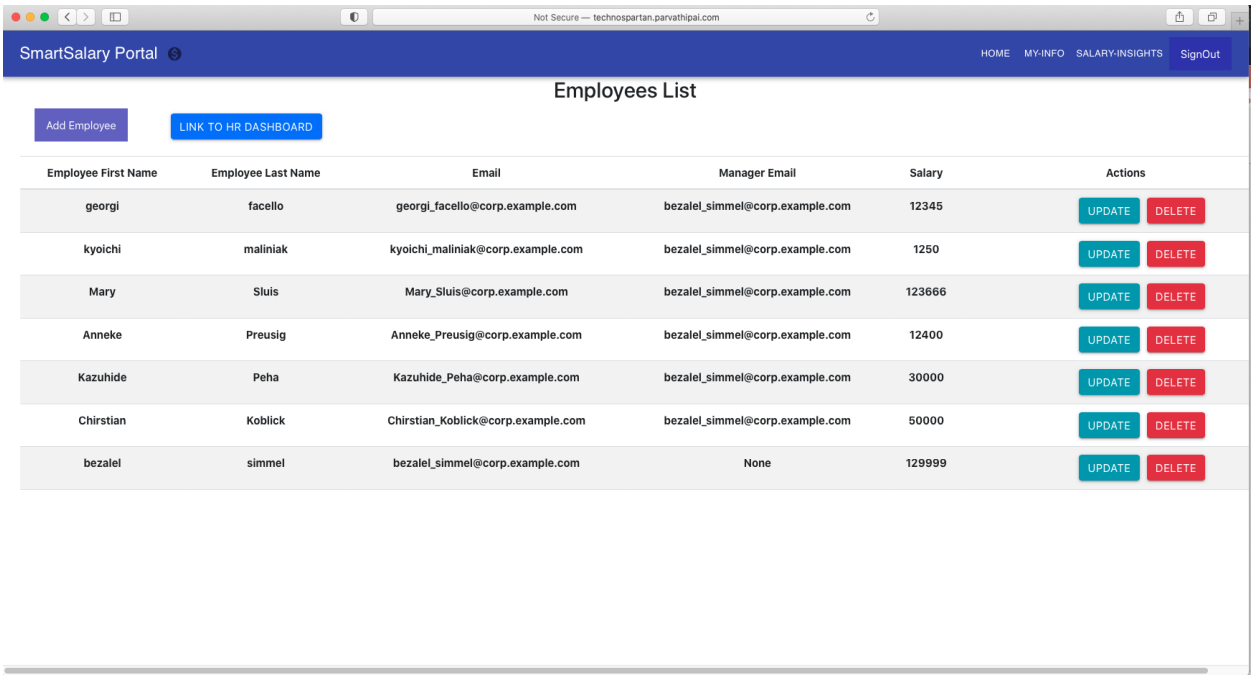
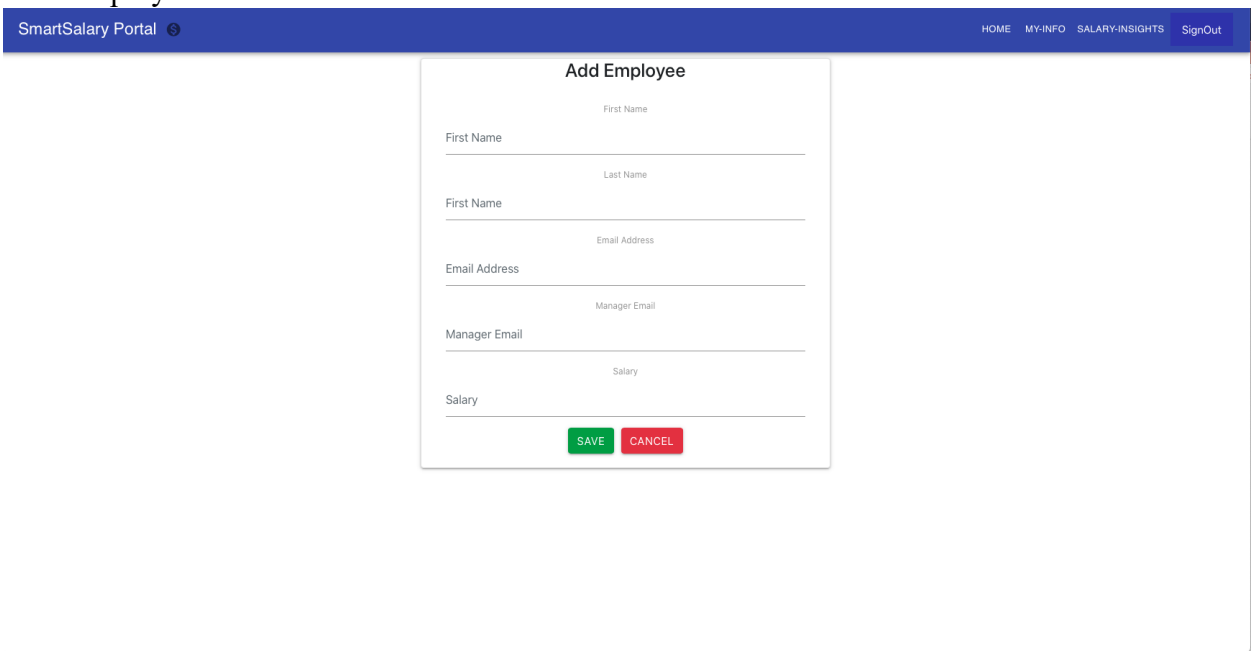
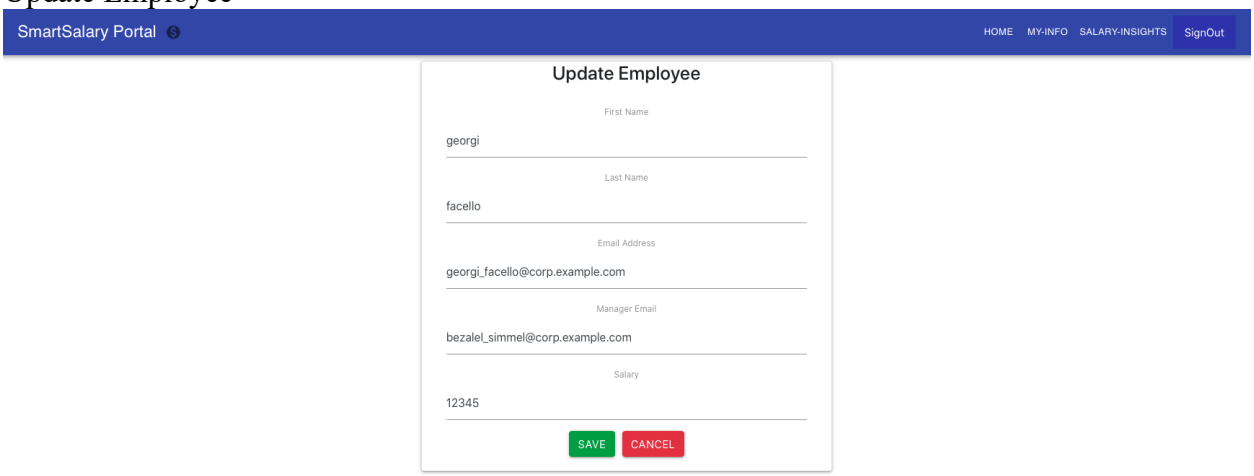
Apps Learn Design Pattern WebDevelopment Udacity Books career SJSU travel
SmartSalary Portal
HOME MY-INFO SALARY-INSIGHTS SignOut
Welcome, Kyoichi Maliniak!



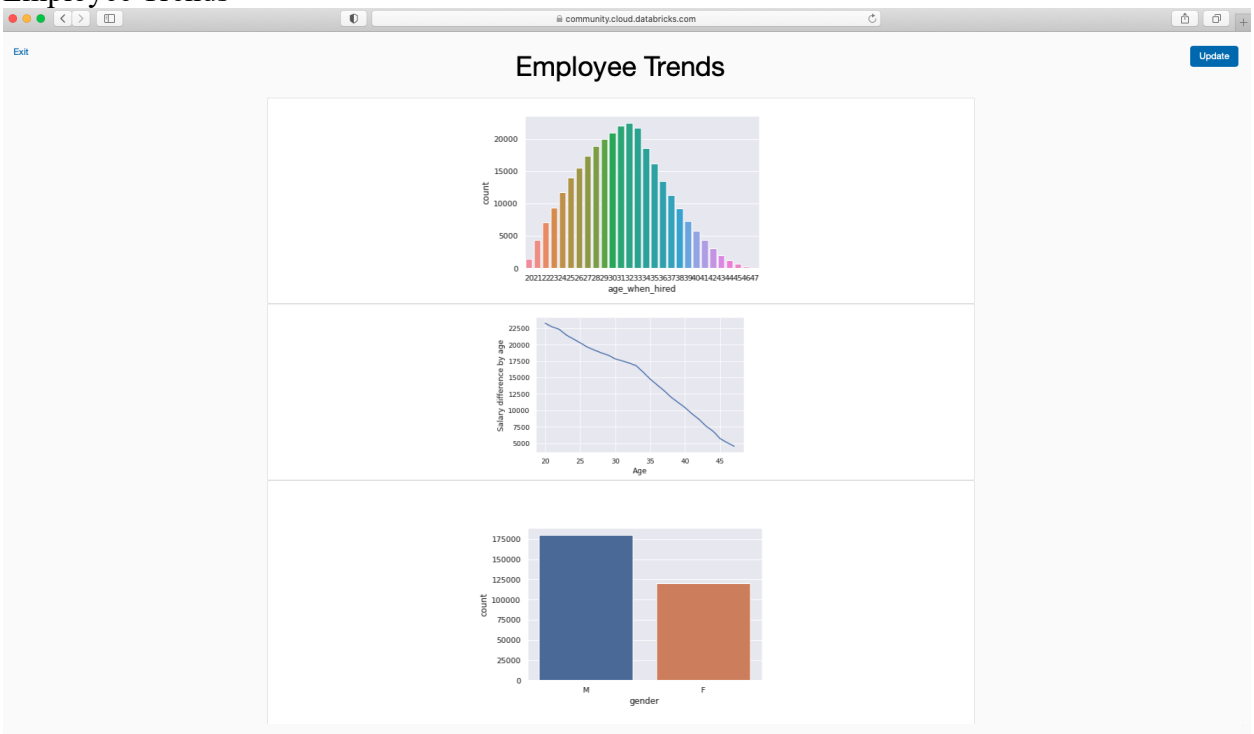
Add Employee



Update Employee



Employee Trends



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