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Department of Computer Science and Engineering

**B.TECH. (CSE)**  
**VI SEMESTER**

**UE20CS351 – Cloud Computing**  
**Mini-Project Report**  
**on**  
**Project – 3**  
**Deployment of Web App Using AWS Cloud**  
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## **Short Description and Scope of the Project**

- The aim of this project is to develop a web application, connect it to a database hosted on AWS RDS, and deploy it on an AWS EC2 instance using GitHub actions and Nginx.
- Prior knowledge regarding web development with React, Git/GitHub, AWS, and database fundamentals in SQL was helpful while doing the project.
- The web application should have a basic CRUD (Create, Read, Update and Delete) functionality, and a proper database schema.
- AWS Budgets should be set up to ensure usage within the free tier. This is ensured by using RDS instances like db.t2.micro, db.t3.micro, or db.t4g.
- The deployment should include integration with GitHub actions and be deployed with Nginx.
- We have developed a simple single-page To-Do list Web Application. This was developed using:
  1. Frontend - ReactJS
  2. Backend Routing - NodeJS and ExpressJS
  3. Database - AWS RDS - MySQL
  4. Hosted using - EC2 instances.
- The Web Application has the following functionality:
  1. Users can create tasks.
  2. Users can view the created tasks.
  3. Users can update tasks as completed.
  4. Users can delete tasks.



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## Methodology

**The methodology used to host the to-do list web app was:**

- Creation of front end using ReactJs. Using bootstrap CSS in Reactjs a working front end was developed.
- An EC2 instance was created with nginx installation to host the webpage. For the EC2 instance to render the webpage the code was pushed to the GitHub repository where a GitHub/workflows/blank.yaml file exists which has an auto-trigger on commit enabled.
- Any commit causes the workflow to run again, deleting and rebuilding the WebApp completely.
- The backend is built using NodeJs and is also pushed to the same GitHub.
- We run the front end and back end on the same instance.
- As the backend needs to be running simultaneously with the frontend we run the front end on port 3000 and redirect it to port 80 of the EC2 instance, while the backend is redirected to port 81 from 3001 of the EC2 instance.
- An SQL database is hosted on AWS RDS. A user profile is created and the host and credentials are added to the NodeJs to allow it to connect to the RDS.
- CRUD operations such as adding a todo, updating a todo and deleting a todo, all will now work with the database. The database 'CCdatabase' has a table called todolist which contains the parameters id, listname and completion. Listname is added upon the user adding a todo, upon marking complete completion should turn to 1 from the default 0 value and an auto-assigned id should also be provided to the todo.



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### **The methodology to run the todo-list web app:**

- Store the key file (cc-key-pair.pem) which is needed for establishing a connection with the EC2 instance.
- Establish connection on 2 separate terminals using -
  - `ssh -i <path_to_key_file> ubuntu@ec2-35-92-36-213.us-west-2.compute.amazonaws.com`
  - `ssh -i "cc-key-pair.pem" ubuntu@ec2-35-92-36-213.us-west-2.compute.amazonaws.com`
- Once the connection is successfully established, we navigate to the folder containing the files to run the frontend and backend respectively.
  - For frontend - `cd /var/www/todo/frontend`
  - For backend - `cd /var/www/todo/backend`
- Start the servers
  - Frontend - `serve -s build`
  - Backend - `npm start`
- Open browser and type -
  - `http://34.218.250.140/`



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## Testing

Some of the key observations that we made during testing are-

1. Updating multiple users at quick succession takes time due to the 3-tier architecture that is used to develop this application. There is a very visible lag that is observed in this situation. The website renders the tasks as completed however it takes time for the changes to appear in the database.
2. The timeout for this reverse proxy connection is set to 240 seconds and hence, in cases like updating or deleting multiple tasks in quick succession may result in overloading the system and the result are not updated before timeout.
3. While adding tasks to the database, a task\_id is auto-incremented. The task\_id numbers persist and retain their order until the table is truncated.
4. The connection to the database at the AWS RDS instance is established using MySQL Workbench. This fails to connect unless the IP address of the system is a part of the inbound rules of the RDS database instance.



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## Results and Conclusions

The result of this project can be seen here.

### AWS – RDS

The screenshot shows the AWS Management Console for Amazon RDS. The browser address bar indicates the URL is https://us-west-2.console.aws.amazon.com/rds/home?region=us-west-2. The console page title is "Database Details - RDS Manager". The breadcrumb navigation shows "RDS > Databases > ccdatabase". The main content area displays the details for the database instance "ccdatabase".  
  
**Summary**  

DB Identifier	CPU	Status	Class
ccdatabase	2.09%	Available	db.t3.micro
Role	Current activity	Engine	Region & AZ
Instance	2 Connections	MySQL Community	us-west-2d

  
**Connectivity & security**  

Endpoint & port	Networking	Security
Endpoint ccdatabase.c95irdynjpc.us-west-2.rds.amazonaws.com	Availability Zone us-west-2d	VPC security groups cc (sg-0401e92c409bc2b7d) Active
Port 3306	VPC vpc-058d54b8083c46115	Publicly accessible Yes
	Subnet group default-vpc-058d54b8083c46115	Certificate authority Info rds-ca-2019
	Subnets subnet-09d0be97449e1a72e subnet-0857c549f8710b02c subnet-0b0be1989bb91566af subnet-02836b802df905baf	Certificate authority date August 22, 2024, 22:38 (UTC+05:30)
	Network type IPv4	DB instance certificate expiration date August 22, 2024, 22:38 (UTC+05:30)



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## AWS – EC2

Instance details | EC2 Management console

Successfully stopped i-00784b240545f0bc1

EC2 > Instances > i-028678ef958596db9

**Instance summary for i-028678ef958596db9** Info

Updated less than a minute ago

Instance ID i-028678ef958596db9	Public IPv4 address 35.92.36.213   <a href="#">open address</a>	Private IPv4 addresses 172.31.18.196
IPv6 address -	Instance state Running	Public IPv4 DNS ec2-35-92-36-213.us-west-2.compute.amazonaws.com   <a href="#">open address</a>
Hostname type IP name: ip-172-31-18-196.us-west-2.compute.internal	Private IP DNS name (IPv4 only) ip-172-31-18-196.us-west-2.compute.internal	Elastic IP addresses -
Answer private resource DNS name IPv4 (A)	Instance type t2.micro	AWS Compute Optimizer finding Opt-in to AWS Compute Optimizer for recommendations.   <a href="#">Learn more</a>
Auto-assigned IP address 35.92.36.213 [Public IP]	VPC ID vpc-058d54b8083c46115	Auto Scaling Group name -
IAM Role -	Subnet ID subnet-0bbe1989bb91566af	

Instance details | EC2 Management console

Details Security Networking Storage Status checks Monitoring Tags

**Instance details** Info

Platform Ubuntu (Inferred)	AMI ID ami-0db245b76e5c21ca1	Monitoring disabled
Platform details Linux/UNIX	AMI name ubuntu/images/hvm-ssd/ubuntu-focal-20.04-amd64-server-20230328	Termination protection Disabled
Stop protection Disabled	Launch time Thu Apr 20 2023 20:06:32 GMT+0530 (India Standard Time) (about 3 hours)	AMI location amazon/ubuntu/images/hvm-ssd/ubuntu-focal-20.04-amd64-server-20230328
Instance auto-recovery Default	Lifecycle normal	Stop-hibernate behavior disabled
AMI Launch index 0	Key pair assigned at launch cc-key-pair	State transition reason -
Credit specification standard	Kernel ID -	State transition message -
Usage operation RunInstances	RAM disk ID -	Owner 967833717096
ClassicLink -	Enclaves Support -	Boot mode -
Current instance boot mode legacy-bios	Allow tags in instance metadata Disabled	Use RBN as guest OS hostname Disabled
Answer RBN DNS hostname IPv4 Enabled		
<b>Host and placement group</b> Info		
Host ID	Affinity	Placement group



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## Terminal

```
ubuntu@ip-172-31-18-196: ~  
peslug20cs477@LAPTOP-UMRGJK0E: ~$ cd CC  
peslug20cs477@LAPTOP-UMRGJK0E: ~$ ssh -i "cc-key-pair.pem" ubuntu@ec2-35-92-36-213.us-west-2.compute.amazonaws.com  
Welcome to Ubuntu 20.04.6 LTS (GNU/Linux 5.15.0-1033-aws x86_64)  
  
* Documentation:  https://help.ubuntu.com  
* Management:    https://landscape.canonical.com  
* Support:       https://ubuntu.com/advantage  
  
System information as of Thu Apr 20 16:49:48 UTC 2023  
  
System load:  0.0          Processes:      115  
Usage of /:   37.9% of 7.57GB Users logged in: 1  
Memory usage: 33%         IPv4 address for eth0: 172.31.18.196  
Swap usage:   0%  
  
* Ubuntu Pro delivers the most comprehensive open source security and compliance features.  
  
https://ubuntu.com/aws/pro  
  
* Introducing Expanded Security Maintenance for Applications.  
Receive updates to over 25,000 software packages with your Ubuntu Pro subscription. Free for personal use.  
  
https://ubuntu.com/aws/pro  
  
Expanded Security Maintenance for Applications is not enabled.  
  
31 updates can be applied immediately.  
18 of these updates are standard security updates.  
To see these additional updates run: apt list --upgradable  
  
Enable ESM Apps to receive additional future security updates.
```

## Frontend

```
ubuntu@ip-172-31-18-196:/var/www/todo/frontend$ serve -s build  
ERROR: Cannot copy server address to clipboard: Couldn't find the 'xsel' binary and fallback didn't work. On Debian/Ubuntu you can install xsel with: sudo apt install xsel.
```

```
Serving!
```

```
- Local:    http://localhost:3000  
- Network:  http://172.31.18.196:3000
```

## Backend

```
ubuntu@ip-172-31-18-196:/var/www/todo/backend$ npm start
```

```
> backend@1.0.0 start /var/www/todo/backend  
> node index.js
```

```
Server started on port 3001
```





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## Before Creating new task

Not secure | 35.92.36.213

### Todo List

**Add Todo**

  
  

This is a sample todo  
☒ ☐

## Adding Task

Not secure | 35.92.36.213

### Todo List

**Add Todo**

  
  

This is a sample todo  
☒ ☐

Not secure | 35.92.36.213

### Todo List

**Add Todo**

  
  

This is a sample todo  
☒ ☐

Results and Conclusion  
☒ ☐

## Marking Task as Completed

Not secure | 35.92.36.213

### Todo List

**Add Todo**

  
  

This is a sample todo  
☒ ☐

Results and Conclusion  
☒ ☐



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## Removing Task

Not secure | 35.92.36.213

### Todo List

**Add Todo**

Add new todo

Submit

This is a sample todo

✓ ✗

## Database Before Adding Task

Query 1 x

Limit to 1000 rows

```
1 • use CCdatabase;
2 • select * from todolist;
```

Result Grid | Filter Rows: | Edit: | Export/Import: | Wrap Cell Content: |

id	listname	completion
NULL	NULL	NULL

todolist1 x

Output

Action Output

#	Time	Action	Message
✓ 1	22:37:36	use CCdatabase	0 row(s) affected
✓ 2	22:37:37	select * from todolist LIMIT 0, 1000	0 row(s) returned

## Task Created

Query 1 x

Limit to 1000 rows

```
1 • use CCdatabase;
2 • select * from todolist;
```

Result Grid | Filter Rows: | Edit: | Export/Import: | Wrap Cell Content: |

id	listname	completion
1	Results and Conclusion	0

todolist3 x

Output

Action Output

#	Time	Action	Message
✓ 1	22:37:36	use CCdatabase	0 row(s) affected
✓ 2	22:37:37	select * from todolist LIMIT 0, 1000	0 row(s) returned
✓ 3	22:38:25	use CCdatabase	0 row(s) affected
✓ 4	22:38:25	select * from todolist LIMIT 0, 1000	0 row(s) returned
✓ 5	22:38:43	use CCdatabase	0 row(s) affected
✓ 6	22:38:44	select * from todolist LIMIT 0, 1000	1 row(s) returned



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Task Updated as completed.

Query 1 x

```
1 • use CCdatabase;  
2 • select * from todo1ist;
```

Limit to 1000 rows

Result Grid

id	listname	completion
1	Results and Conclusion	1

Output

Action Output

#	Time	Action	Message
1	22:37:36	use CCdatabase	0 row(s) affected
2	22:37:37	select * from todo1ist LIMIT 0, 1000	0 row(s) returned
3	22:38:25	use CCdatabase	0 row(s) affected
4	22:38:26	select * from todo1ist LIMIT 0, 1000	0 row(s) returned
5	22:38:43	use CCdatabase	0 row(s) affected
6	22:38:44	select * from todo1ist LIMIT 0, 1000	1 row(s) returned
7	22:39:23	use CCdatabase	0 row(s) affected
8	22:39:24	select * from todo1ist LIMIT 0, 1000	1 row(s) returned

Task Deleted

Query 1 x

```
1 • use CCdatabase;  
2 • select * from todo1ist;
```

Limit to 1000 rows

Result Grid

id	listname	completion
----	----------	------------

Output

Action Output

#	Time	Action	Message
1	22:37:36	use CCdatabase	0 row(s) affected
2	22:37:37	select * from todo1ist LIMIT 0, 1000	0 row(s) returned
3	22:38:25	use CCdatabase	0 row(s) affected
4	22:38:26	select * from todo1ist LIMIT 0, 1000	0 row(s) returned
5	22:38:43	use CCdatabase	0 row(s) affected
6	22:38:44	select * from todo1ist LIMIT 0, 1000	1 row(s) returned
7	22:39:23	use CCdatabase	0 row(s) affected
8	22:39:24	select * from todo1ist LIMIT 0, 1000	1 row(s) returned
9	22:39:44	use CCdatabase	0 row(s) affected
10	22:39:44	select * from todo1ist LIMIT 0, 1000	0 row(s) returned



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Through this project, we improved our understanding of developing and hosting a complete web application using AWS. We also learnt how to build a deployment pipeline using deployment tools like GitHub Actions.