

DIT 637 Smart and Secure Systems
TT05 Experiencing DevSecOps - A Mobile App with Amazon EC2

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07/03/2024 Reviewed by Sam Chung

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We use the same application that we started in TT 04.

References

- GitHub Actions <https://docs.github.com/en/actions/learn-github-actions/understanding-github-actions#overview>
- Open Worldwide Application Security Project (OWASP) Zed Attack Proxy (ZAP) <https://github.com/marketplace/actions/zap-baseline-scan>
- Amazon Elastic Compute Cloud (EC2) <https://docs.aws.amazon.com/pdfs/AWSEC2/latest/UserGuide/ec2-ug.pdf#concepts>

Key Concepts and Tools for Cloud-based Full Stack Continuous Integration & Deployment (CI/CD)

Frontend

To create the visual part of a mobile app that users interact with

- **React Native:** To efficiently build dynamic and responsive user interfaces for mobile apps

Backend

The backend of a web application is responsible for the server-side logic, handling database interactions, user authentication, and application logic. It processes incoming requests, applies business rules, accesses databases, and sends responses back to the client.

- **ExpressJS:** A minimal and flexible Node.js web application framework that provides robust features for web and mobile applications. It is used to build the server-side logic of web applications.
- **Amazon EC2:** Provides scalable computing capacity in the Amazon Web Services (AWS) cloud. It is used for hosting and running backend servers.

Database

A database is an organized collection of data generally stored and accessed electronically from a computer system. It is essential for storing and managing large amounts of data efficiently. There are two types: SQL and NoSQL DB.

- **MongoDB Atlas:** A cloud-based NoSQL database service for modern applications, providing a fully managed and global cloud database with built-in automation for resource and workload management.

Development Environment

Codespaces: To provide a cloud-based development environment using containerization that is easy to set up and use from anywhere, similar to Google Docs, but for coding.

Version Control and Collaboration

GitHub as Repo: To store and manage code with version control, making collaboration more manageable, just like using Google Drive for sharing documents.

Continuous Integration (CI) and Deployment (CD)

GitHub Actions: To automate the testing and deployment process. When code is pushed to the repository, GitHub Actions can automatically run tests and deploy the application to Amazon EC2, saving you time and effort. It can also run a security scanner like ZAP.

- **Zed Attack Proxy (ZAP):** An open-source web application security scanner maintained by OWASP. It is used to find security vulnerabilities in web applications during development and testing phases.

Example: Movie Search Application

To practice and demonstrate the capabilities of React Native and Express in creating real-world applications, like searching for movies on Netflix.

Why are we moving our backend server from GitHub Codespaces to Amazon EC2?

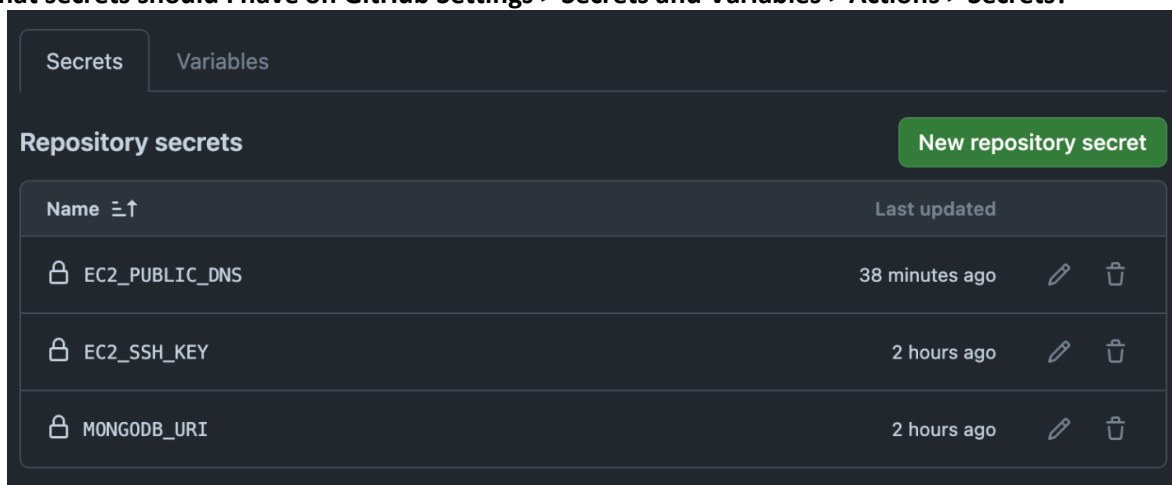
Moving our backend server from Codespaces to Amazon EC2 offers increased scalability, allowing us to handle higher traffic loads. It provides enhanced security features, better integration with AWS services, and cost-efficiency through flexible pricing models. EC2 also supports more powerful computing resources, giving us greater control over server configurations and performance optimizations, which is crucial for production environments.

Uploading three image files to your GitHub Repository generated from GitHub Classroom

1. The screenshot of your Amazon EC2 details with port 3000 allowed for access (0.0.0.0/0) as `'first_last_ec2_port_3000.png'` by using your first and last name.
2. The screenshot of your browser with endpoint `ec2_IPv4_url:3000/movies` as `'first_last_ec2_movies.png'` by using your first and last name.

FAQs

What secrets should I have on GitHub Settings > Secrets and Variables > Actions > Secrets?



What environment variables (.env) should I have for frontend? (Sample)

Note: make sure there's no `"/` at the end of the url.

Correct:

```
API_URL=http://34.215.57.88:3000
```

Wrong:

```
API_URL=http://34.25.57.88:3000/
```

How to run my frontend code?

Inside the frontend-reactnative folder

- npm install
- npx expo login
- npm expo start --tunnel
- Scan the QR code or manually open your Expo Go app

I can't access my Amazon EC2 endpoint in my browser?

- Security inbound rules should allow port 3000 with 0.0.0.0/0
- When accessing the IP, it should not have https. It should only have http.

1) User Case


As a movie enthusiast using a **mobile device**, I want to search and browse a list of movies with details such as title, genre, and year, so that I can easily find information about movies I am interested in **while on the go**.

Note: the user story didn't change. The question then is why we need MongoDB Atlas, ExpressJS, GitHub Actions, and Amazon EC2.

2) Deploying your backend application to the cloud

Deploying to Amazon EC2

1. Create an AWS account or sign-in if you have one already by accessing [Cloud Computing Services - Amazon Web Services \(AWS\)](#)



Sign in

☒ **Root user**

Account owner that performs tasks requiring unrestricted access. [Learn more](#)

☐ **IAM user**

User within an account that performs daily tasks. [Learn more](#)

Root user email address

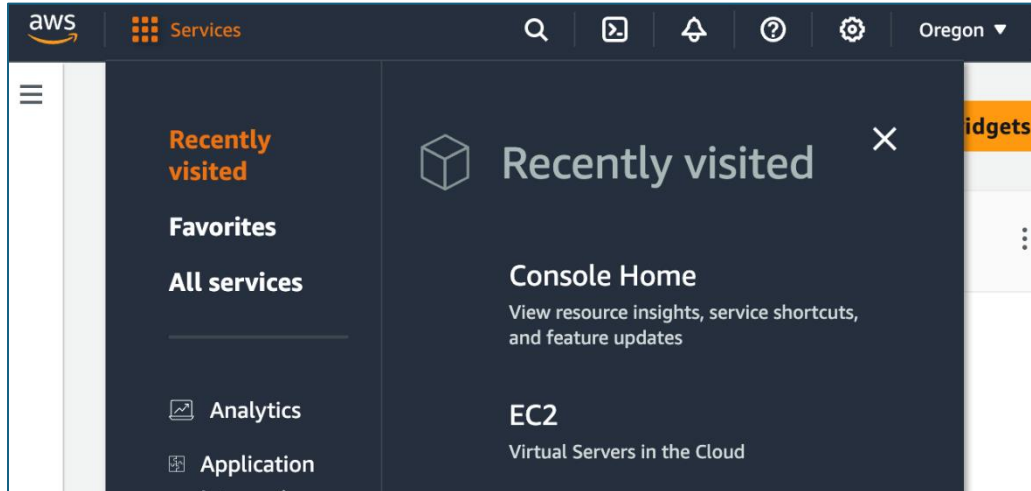
Next

By continuing, you agree to the [AWS Customer Agreement](#) or other agreement for AWS services, and the [Privacy Notice](#). This site uses essential cookies. See our [Cookie Notice](#) for more information.

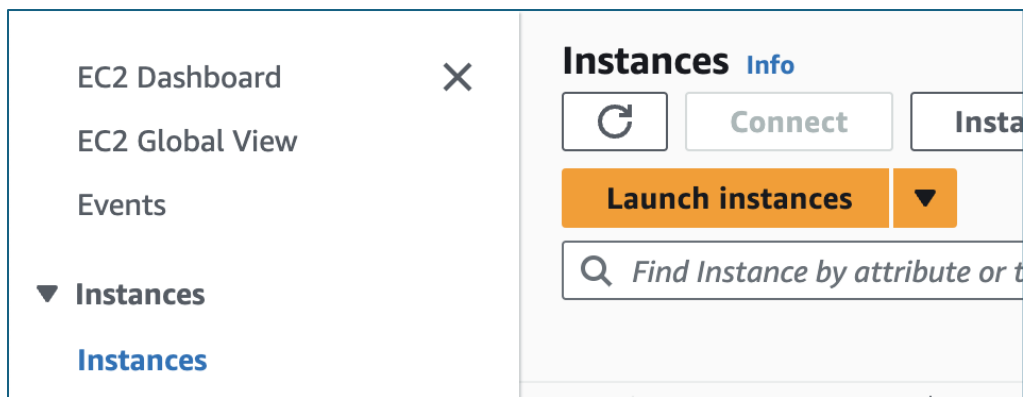
————— New to AWS? —————

Create a new AWS account

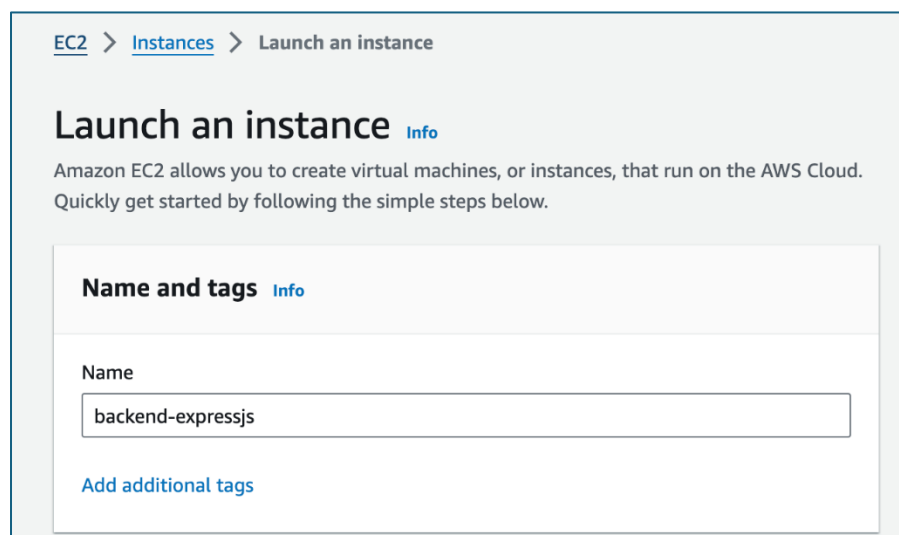
2. Click Services and find EC2. Alternatively, click the search icon to find EC2.



3. Click **Instances**, then **Launch instances**.



4. Add the name **backend-expressjs** for the instance name.



5. Choose **Ubuntu** and the default free tier.

▼ **Application and OS Images (Amazon Machine Image)** [Info](#)

An AMI is a template that contains the software configuration (operating system, application server, and applications) required to launch your instance. Search or Browse for AMIs if you don't see what you are looking for below

Q

Search our full catalog including 1000s of application and OS images

Quick Start

Amazon Linux

aws

macOS

Mac

Ubuntu

ubuntu

Window

Micros

Q

[Browse more AMIs](#)

Including AMIs from AWS, Marketplace and the Community

Amazon Machine Image (AMI)

Ubuntu Server 24.04 LTS (HVM), SSD Volume Type

Free tier eligible

ami-0cf2b4e024cdb6960 (64-bit (x86)) / ami-0c29a2c5cf69b5a9c (64-bit (Arm))

Virtualization: hvm ENA enabled: true Root device type: ebs

Description

Canonical, Ubuntu, 24.04 LTS, amd64 noble image build on 2024-04-23

Architecture

AMI ID

64-bit (x86) ▼

ami-0cf2b4e024cdb6960

Verified provider

7 | D I T 6 3 7

6. Choose **t2.micro** instance type.

▼ Instance type [Info](#) | [Get advice](#)

Instance type

t2.micro Free tier eligible

Family: t2 1 vCPU 1 GiB Memory

Current generation: true

On-Demand Linux base pricing: 0.0116 USD per Hour

On-Demand SUSE base pricing: 0.0116 USD per Hour

On-Demand Windows base pricing: 0.0162 USD per Hour

On-Demand RHEL base pricing: 0.0716 USD per Hour

▼

☐ All generations

[Compare instance types](#)

[Additional costs apply for AMLs with pre-installed software](#)

7. Create a new key pair.

▼ Key pair (login) [Info](#)

You can use a key pair to securely connect to your instance. Ensure that you have access to the selected key pair before you launch the instance.

Key pair name - *required*

Select ▼

[Create new key pair](#)

8. Use **backend-expressjs** as the key pair name.

Create key pair

Key pair name

Key pairs allow you to connect to your instance securely.

backend-expressjs

The name can include up to 255 ASCII characters. It can't include leading or trailing spaces.

Key pair type

☒ RSA
RSA encrypted private and public key pair

☐ ED25519
ED25519 encrypted private and public key pair

Private key file format

☒ .pem
For use with OpenSSH

☐ .ppk
For use with PuTTY

⚠ When prompted, store the private key in a secure and accessible location on your computer. **You will need it later to connect to your instance.** [Learn more](#)

Cancel

Create key pair

Privacy Enhanced Mail (PEM)

9. Optional: copy your pem file contents to your clipboard and paste in a notepad for now. Alternatively, you can open it with any text editor.

```
clark@clarks-air ~ % cat backend-expressjs.pem | pbcopy
```

10. Keep defaults for now.

▼ Network settings [Info](#)

Edit

Network [Info](#)

vpc-a062abd8

Subnet [Info](#)

No preference (Default subnet in any availability zone)

Auto-assign public IP [Info](#)

Enable

Additional charges apply when outside of free tier allowance

Firewall (security groups) [Info](#)

A security group is a set of firewall rules that control the traffic for your instance. Add rules to allow specific traffic to reach your instance.

☒ Create security group

☐ Select existing security group

We'll create a new security group called 'launch-wizard-4' with the following rules:

☒ Allow SSH traffic from

Helps you connect to your instance

Anywhere
0.0.0.0/0

☐ Allow HTTPS traffic from the internet

To set up an endpoint, for example when creating a web server

☐ Allow HTTP traffic from the internet

To set up an endpoint, for example when creating a web server

⚠ Rules with source of 0.0.0.0/0 allow all IP addresses to access your instance. We recommend setting security group rules to allow access from known IP addresses only.

×

▼ Configure storage [Info](#)

Advanced

1x 8 GiB gp3 Root volume

(Not encrypted)

ⓘ Free tier eligible customers can get up to 30 GB of EBS General Purpose (SSD) or Magnetic storage

×

Add new volume

The selected AMI contains more instance store volumes than the instance allows. Only the first 0 instance store volumes from the AMI will be accessible from the instance

🕒 Click refresh to view backup information

↻

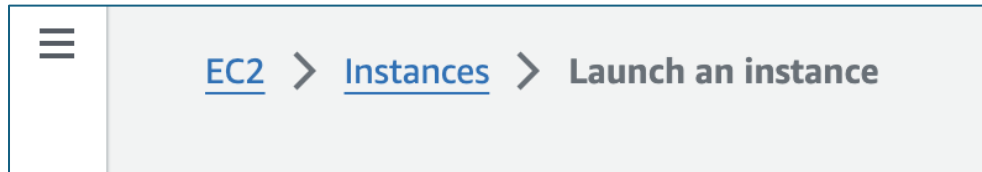
The tags that you assign determine whether the instance will be backed up by any Data Lifecycle Manager policies.

0 x File systems

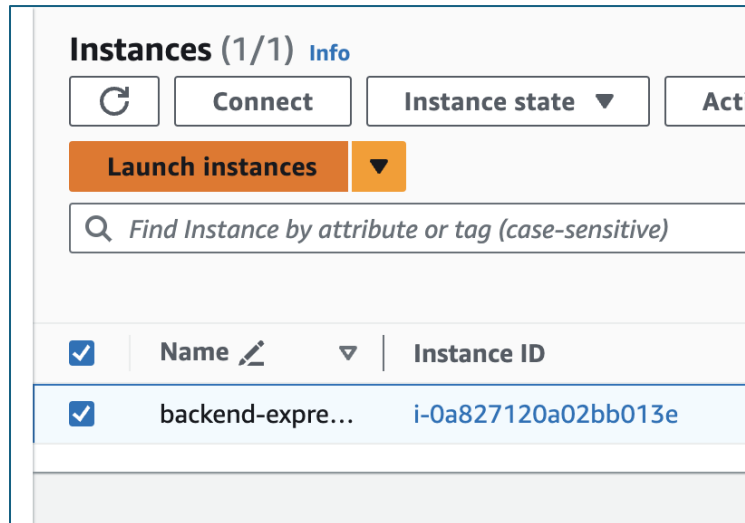
Edit

10 | D I T 6 3 7

11. Click Instances to go back to the overview of our created instance.

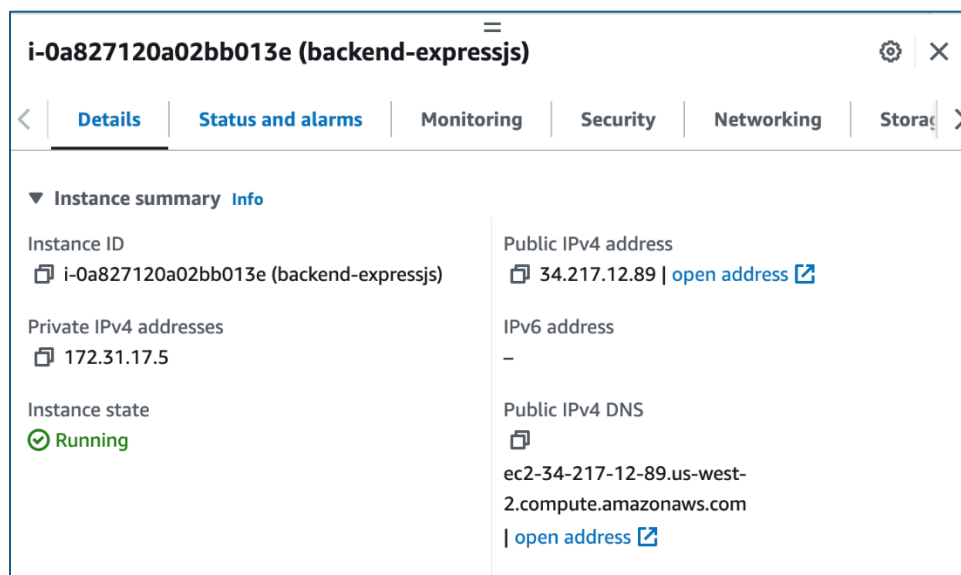


12. Click the row with the name 'backend-expressjs' and tick the checkbox.



13. Take note of the following:

- Public IPv4 address: we will use later as the backend url aka endpoint.
- Public IPv4 DNS: we will use this later to connect or auto deploy to the EC2 machine.
 - Optional: you can try to access this server from your terminal with:
 - `ssh -i backend-expressjs.pem ubuntu@<your-public-ipv4-dns>`



14. Click the **Security** tab.

Instances (1/1) Info

Refresh

Connect

Instance state ▼

Actions ▼

Launch instances ▼

Find Instance by attribute or tag (case-sensitive)

All states ▼

< 1 >

⚙

<input checked="" type="checkbox"/>	Name	Instance ID	Instance state	Instance type	Status check	Alarm
<input checked="" type="checkbox"/>	backend-expre...	i-0a827120a02bb013e	Running	t2.micro	2/2 checks passed	View

i-0a827120a02bb013e (backend-expressjs)

⚙

Details

Status and alarms

Monitoring

Security

Networking

Storage

Tags

▼ Security details

IAM Role

–

Owner ID

795901041651

Launch time

Thu Jun 20 2024 12:08:39 GMT-0700 (Pacific Daylight Time)

Security groups

[sg-04ed0d07c03e28c33 \(launch-wizard-4\)](#)

▼ Inbound rules

Filter rules

< 1 >

Range	Protocol	Source	Security groups	Description
	TCP	0.0.0.0/0	launch-wizard-4	–

15. Click the security group checkbox, edit inbound rules.

Security Groups (1/1) [Info](#)

Actions ▾

Export security groups to CSV ▾

Create security group

Find resources by attribute or tag

Security group name = launch-wizard-4

Clear filters

< 1 >

<input checked="" type="checkbox"/>	Name ▾	Security group ID ▾	Security group name ▾	VPC ID
<input checked="" type="checkbox"/>	-	sg-04ed0d07c03e28c33	launch-wizard-4	vpc-a06

sg-04ed0d07c03e28c33 - launch-wizard-4

Details

Inbound rules

Outbound rules

Tags

Inbound rules (1)

Manage tags

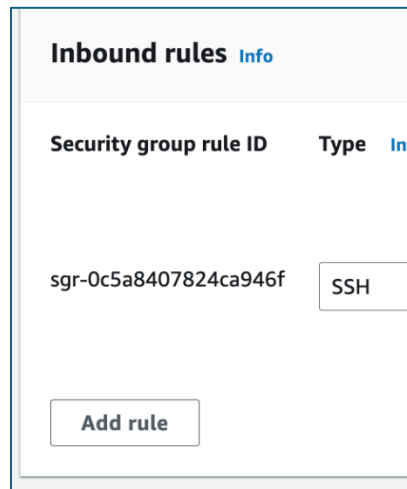
Edit inbound rules

Search

< 1 >

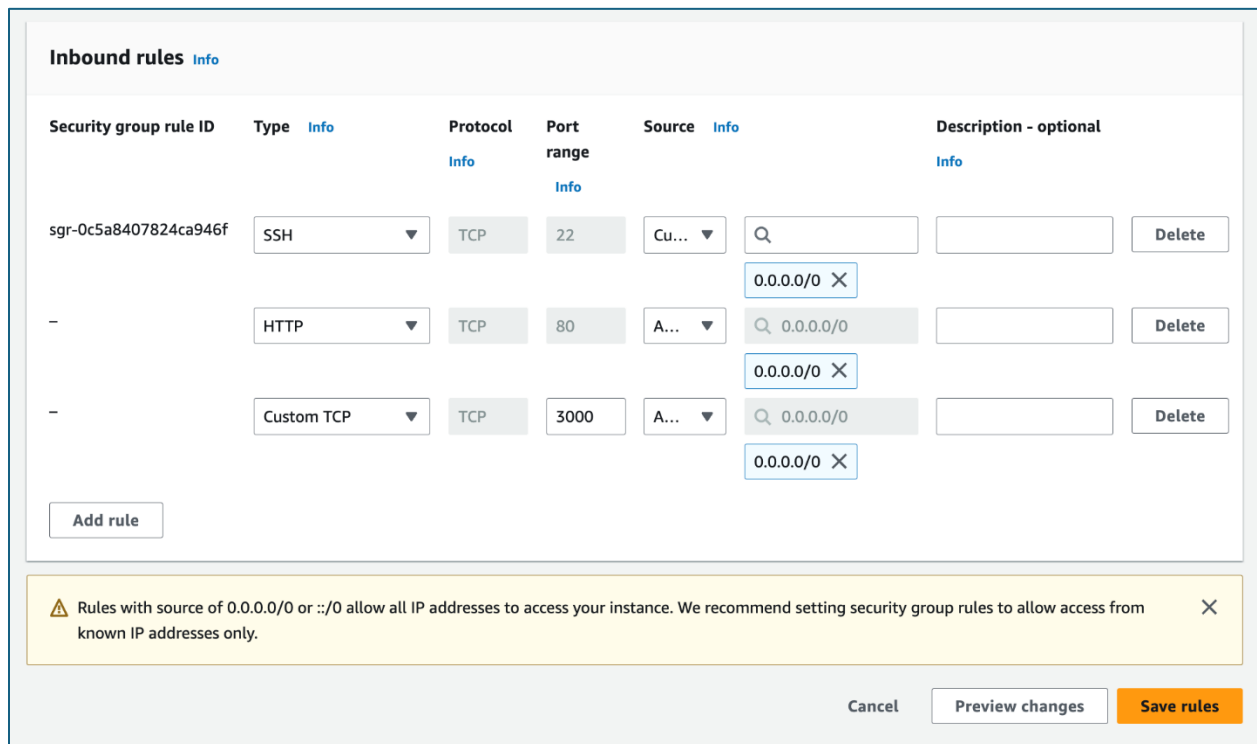
<input type="checkbox"/>	Name ▾	Security group rule... ▾	IP version ▾	Type ▾	Pre
<input type="checkbox"/>	-	sgr-0c5a8407824ca946f	IPv4	SSH	TCI

16. Click Add Rule.



17. Add the following:

- Type: HTTP, Port Range: 80, Source: Anywhere, 0.0.0.0/0
- Custom TCP: Port Range: 3000, Source: Anywhere, 0.0.0.0/0



18. Head back to your EC2 Instance Details and take a screenshot of your Amazon EC2 details with port 3000 allowed for access (0.0.0.0/0) as 'first_last_ec2_port_3000.png' by using your first and last name.

EC2 Dashboard

EC2 Global View

Events

Instances

Instances

Instance Types

Launch Templates

Spot Requests

Savings Plans

Reserved Instances

Dedicated Hosts

Capacity Reservations

Images

AMIs

AMI Catalog

Elastic Block Store

Volumes

Snapshots

Lifecycle Manager

Network & Security

Security Groups

Elastic IPs

Placement Groups

Key Pairs

Network Interfaces

Instances (1/1) Info

Find Instance by attribute or tag (case-sensitive)

All states

Connect

Instance state

Actions

Launch instances

< 1 >

☒

Name

☒

new-backendjs

☒

Instance ID

☒

i-0070b49b5e05e85df

☒

Instance state

☒

Running

☒

Instance type

☒

t2.micro

☒

Status check

☒

2/2 checks passed

☒

Alarm status

☒

View alarms

☒

Availability Zone

☒

us-west-2b

☒

Public IPv4 DNS

☒

ec2-35-90-244-212.us-...

☒

Public IPv4 ...

☒

35.90.244.212

☒

Elastic IP

☒

-

i-0070b49b5e05e85df (new-backendjs)

@

X

Details

Status and alarms

Monitoring

Security

Networking

Storage

Tags

▼ Security details

IAM Role

-

Owner ID

795901041651

Launch time

Mon Jul 15 2024 23:43:13 GMT-0700 (Pacific Daylight Time)

Security groups

sg-0c6b46739fa0e0b72 (launch-wizard-7)

▼ Inbound rules

Filter rules

< 1 >

Name	Security group rule ID	Port range	Protocol	Source	Security groups	Description
-	sgr-0c38cf445597bac84	3000	TCP	0.0.0.0/0	launch-wizard-7	-
-	sgr-0d03eb486f9e1de1f	443	TCP	0.0.0.0/0	launch-wizard-7	-
-	sgr-0fae6c263058fe943	80	TCP	0.0.0.0/0	launch-wizard-7	-
-	sgr-036876618c4ddef39	22	TCP	0.0.0.0/0	launch-wizard-7	-

15 | D I T 6 3 7

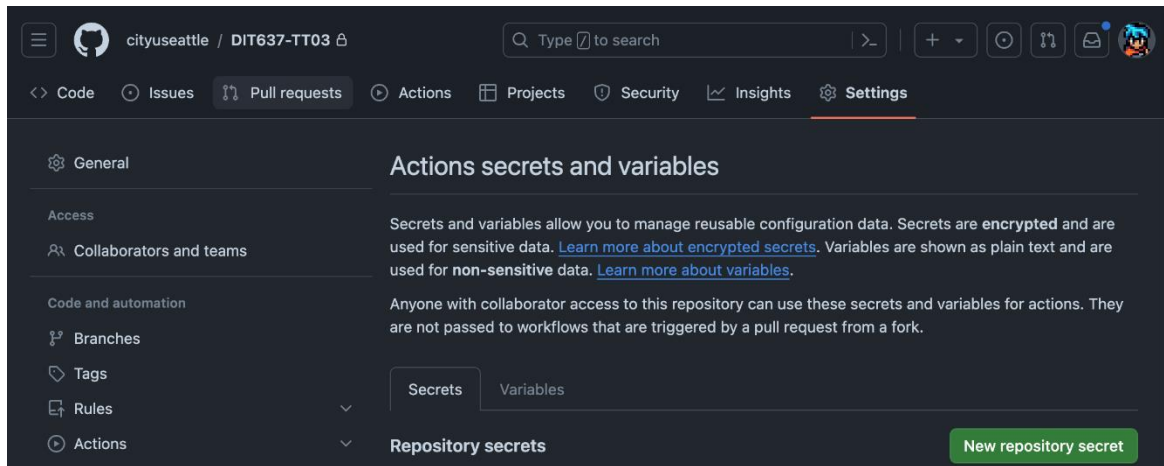
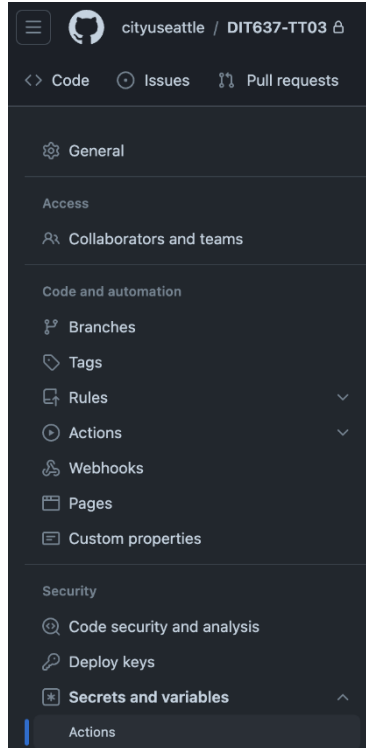
3) Update frontend React Native codebase to connect to the Amazon EC2 backend server.

1. Comment out the GitHub Codespaces URL (leave it there for references).
2. Copy the EC2 Public IPv4 Address in API_URL

```
frontend-reactnative > ⚙ .env
1  # we can choose which backend server to communicate with: GitHub Codespaces or Amazon EC2
2
3  ## update this with your own backend-expressjs forwarded address
4  # API_URL=https://probable-fishstick-77q6jrvpxrfwr7r-3000.app.github.dev
5
6  ## update this with your own EC2 Public IPv4 address with port 3000
7  API_URL=http://34.215.57.88:3000
```


4) Configuring environment variables for GitHub Actions

1. Create a Secret for MongoDB Atlas Connection
 - a. Go Settings > Secrets and Variables > Actions > Secrets > New repository secret.
 - i. Name: MONGODB_URI
 - ii. Value: (add the MongoDB connection string)



Actions secrets / Update secret

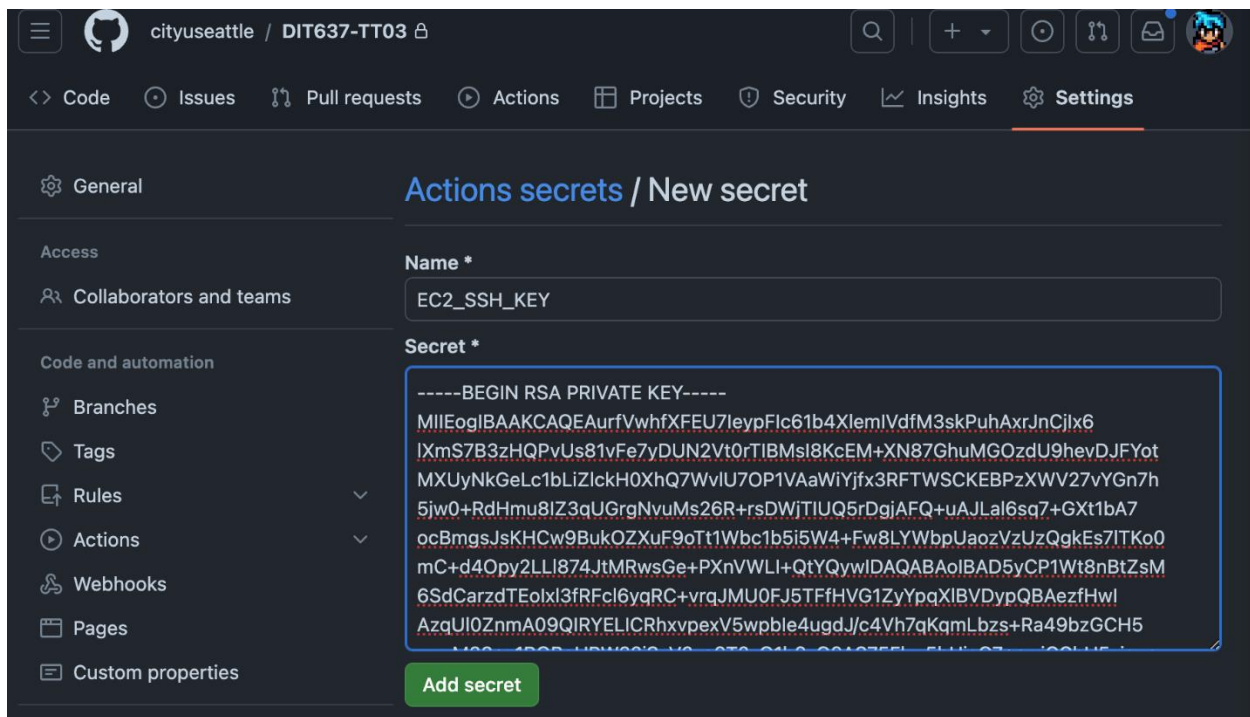
MONGODB_URI

Value

```
mongodb+srv://clarkngo:<password>@cluster0.rhkmsrr.mongodb.net/?  
retryWrites=true&w=majority&appName=Cluster0
```

Update secret

2. Create a Secret for EC2 SSH connection.
 - a. Name: EC2_SSH_KEY
 - b. Value: Copy paste the contents of backend-expressjs.pem file



The screenshot shows the GitHub Actions 'New secret' page. The left sidebar contains navigation links: General, Access, Collaborators and teams, and Code and automation. The 'Code and automation' section is expanded, showing links for Branches, Tags, Rules, Actions, Webhooks, Pages, and Custom properties. The main area is titled 'Actions secrets / New secret'. It has two input fields: 'Name *' with the value 'EC2_SSH_KEY' and 'Secret *' containing a long RSA private key. A green 'Add secret' button is at the bottom.

cityuseattle / DIT637-TT03

<> Code Issues Pull requests Actions Projects Security Insights Settings

General

Access

Collaborators and teams

Code and automation

Branches

Tags

Rules

Actions

Webhooks

Pages

Custom properties

Actions secrets / New secret

Name *

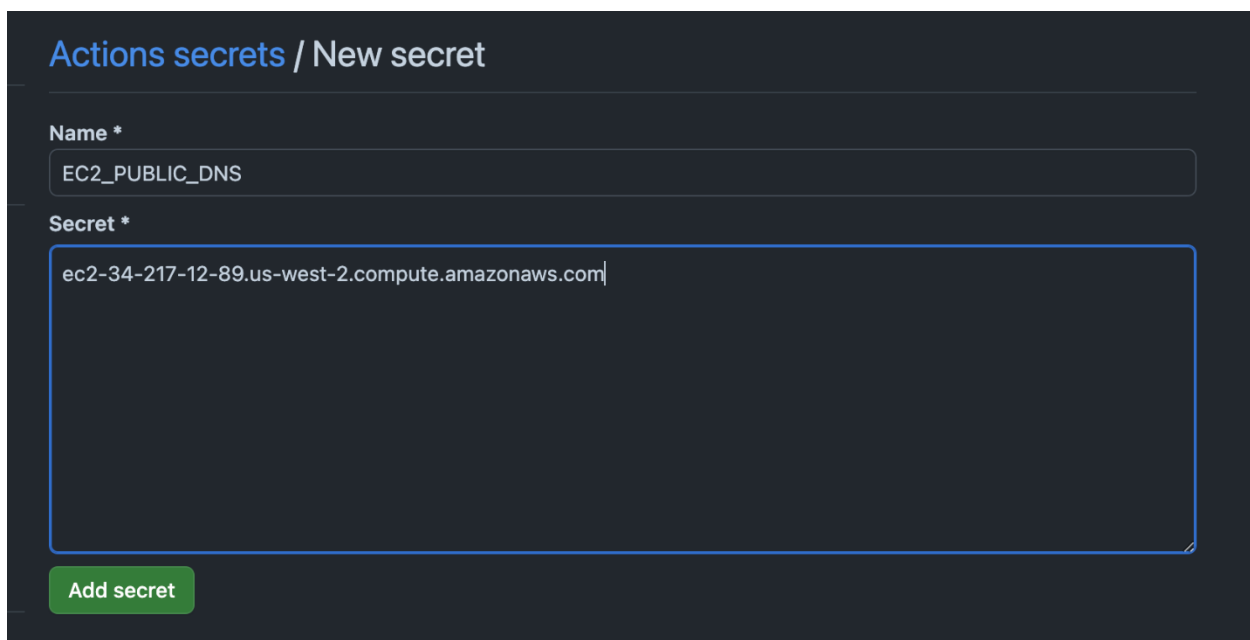
EC2_SSH_KEY

Secret *

-----BEGIN RSA PRIVATE KEY-----
MIIEoglBAAKCAQE AurfVwhfXFEU7leypFlc61b4XlemlVdfM3skPuhAxxrJnCjlx6
IXmS7B3zHQPvUs81vFe7yDUN2Vt0rTIBMsI8KcEM+XN87GhuMGOzdU9hevD.JFYot
MXUyNkGeLc1bLiZlckH0XhQ7WvIU7OP1VAaWiyjfx3RFTWSCKEBPzXWV27vYGn7h
5jw0+RdHmu8IZ3qUGrgNvuMs26R+rsDWjTIUQ5rDgjAFQ+uAJLa6sq7+Gxt1bA7
ocBmgsJsKHCw9BukOZXuF9oTt1Wbc1b5i5W4+Fw8LYWbpUaozVzUzQgkEs7ITKo0
mC+d4Opy2LLI874JtMRwsGe+PXnVWLI+QtYQywDAQABAoIBAD5yCP1Wt8nBtZsM
6SdCarzdTEolxI3fRFcl6yqRC+vrqJMU0FJ5TFfHVG1ZyYpqXIBVDypQBaezfHwI
AzqUI0ZnmA09QIRYELICRhvxpeXV5wpble4ugdJ/c4Vh7qKqmLbzS+Ra49bzGCH5

Add secret

3. Create a Secret for EC2 Public DNS
 - a. Name: EC2_PUBLIC_DNS
 - b. Value: Copy paste the Public IPv4 DNS in the Instance Details of your EC2



The screenshot shows the GitHub Actions 'New secret' page. The left sidebar is the same as the previous image. The main area is titled 'Actions secrets / New secret'. It has two input fields: 'Name *' with the value 'EC2_PUBLIC_DNS' and 'Secret *' containing the value 'ec2-34-217-12-89.us-west-2.compute.amazonaws.com'. A green 'Add secret' button is at the bottom.

Actions secrets / New secret

Name *

EC2_PUBLIC_DNS

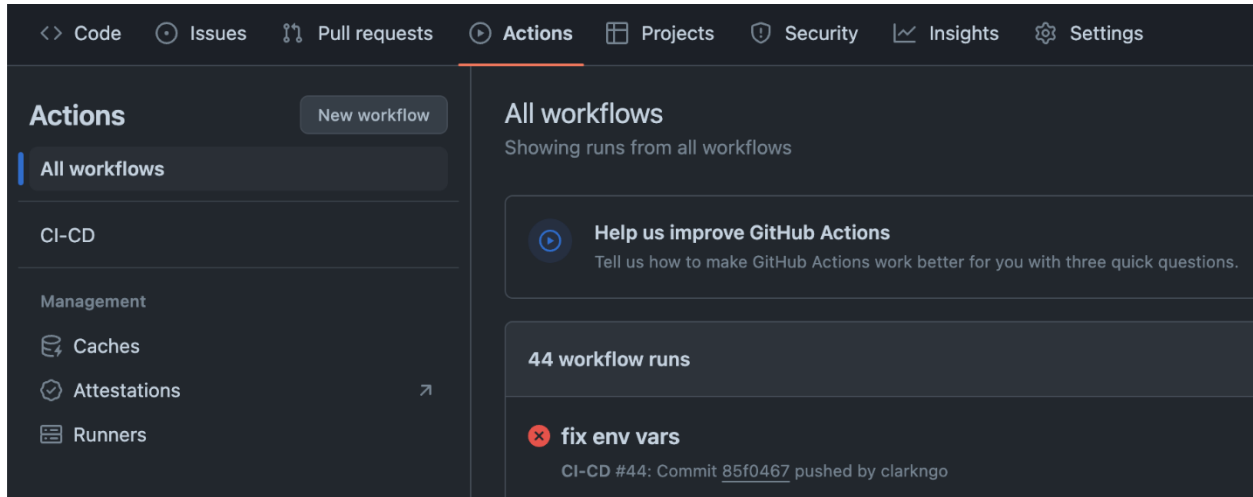
Secret *

ec2-34-217-12-89.us-west-2.compute.amazonaws.com

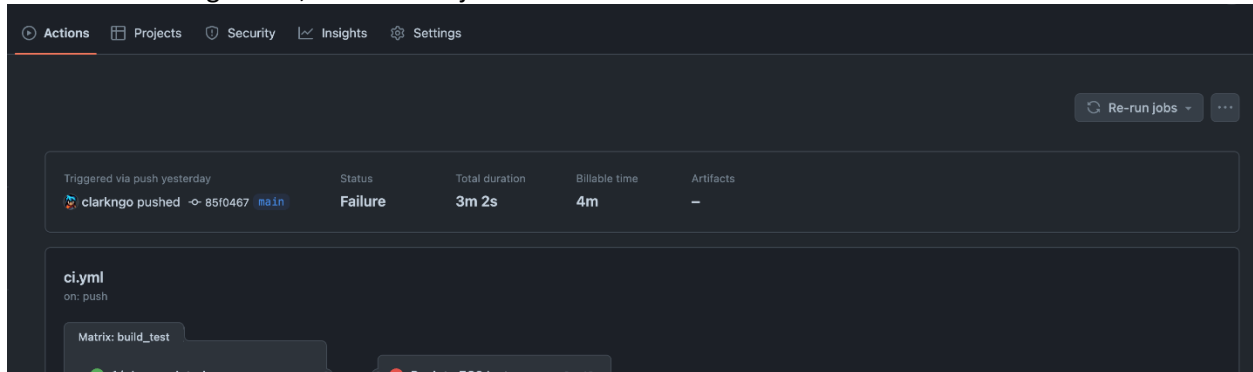
Add secret

5) Running test and deploy backend-expressjs to your EC2

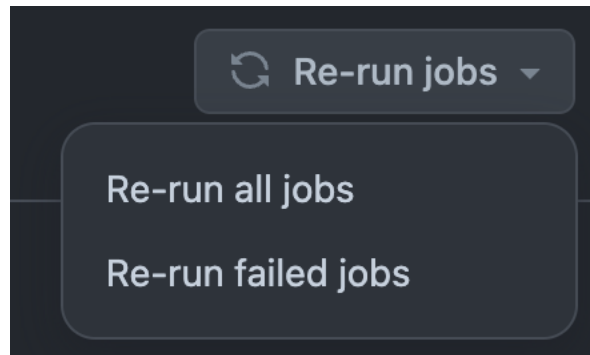
1. Find and click the most recent workflow



2. At the right side, click Re-run jobs.



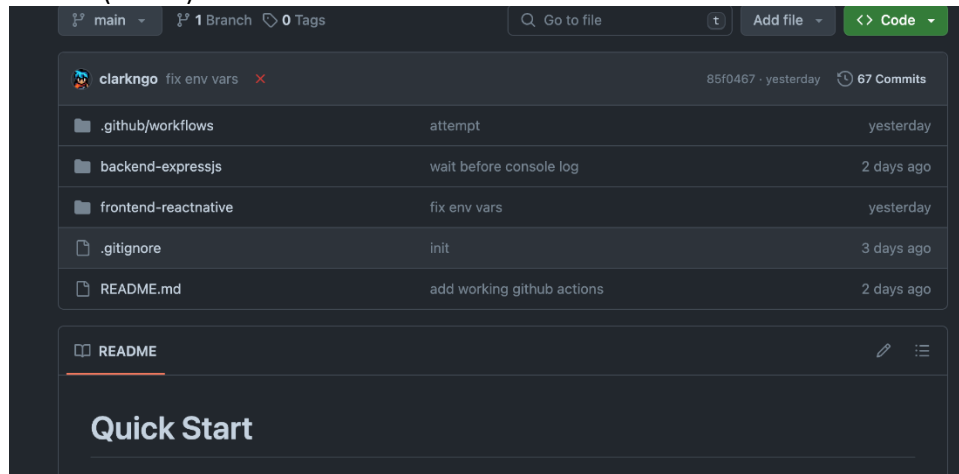
3. Click Re-run all jobs.



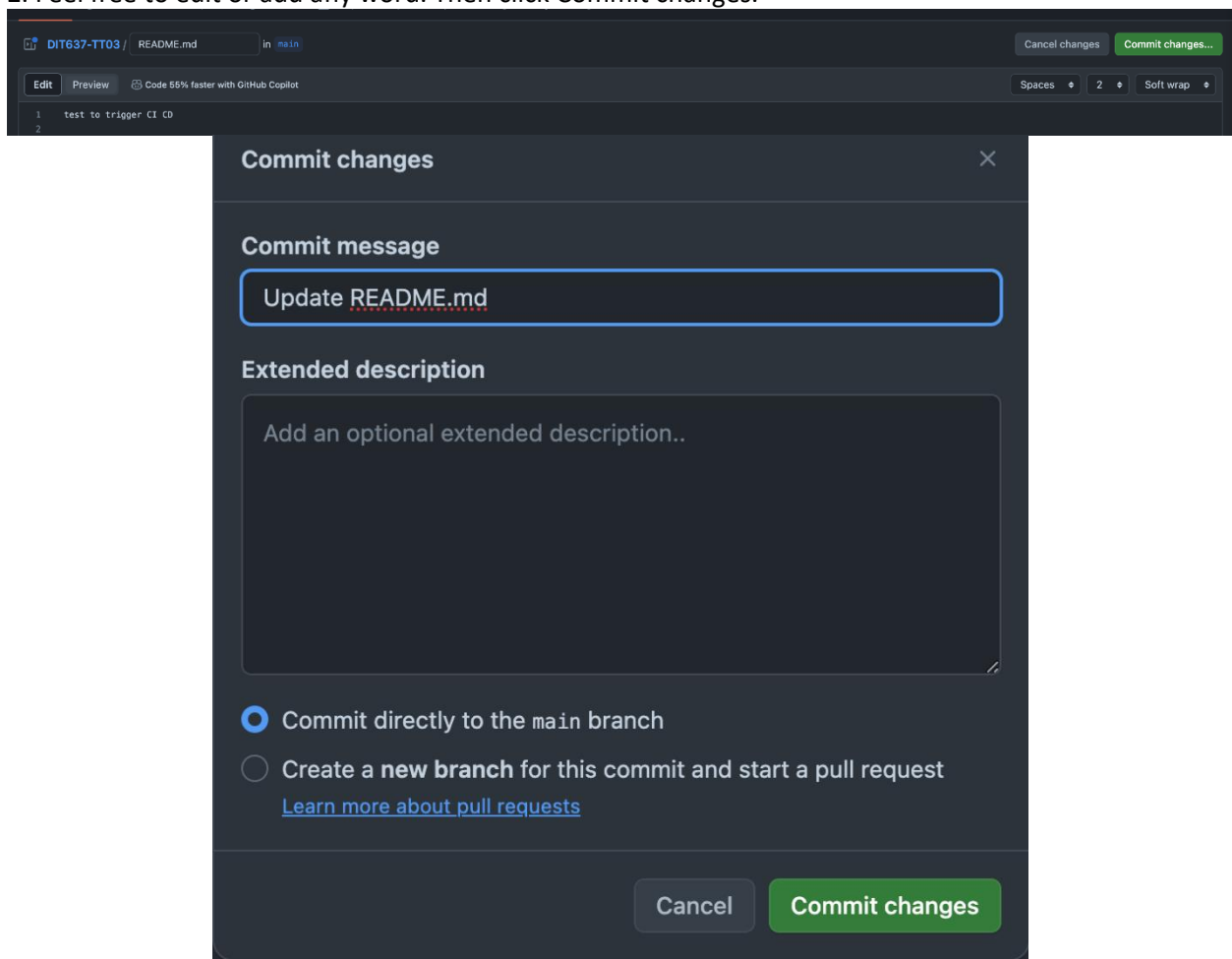
6) Test the CI/CD

1. Edit the README.md to quickly test if GitHub Actions (CI/CD) will pick up our changes. Hit the

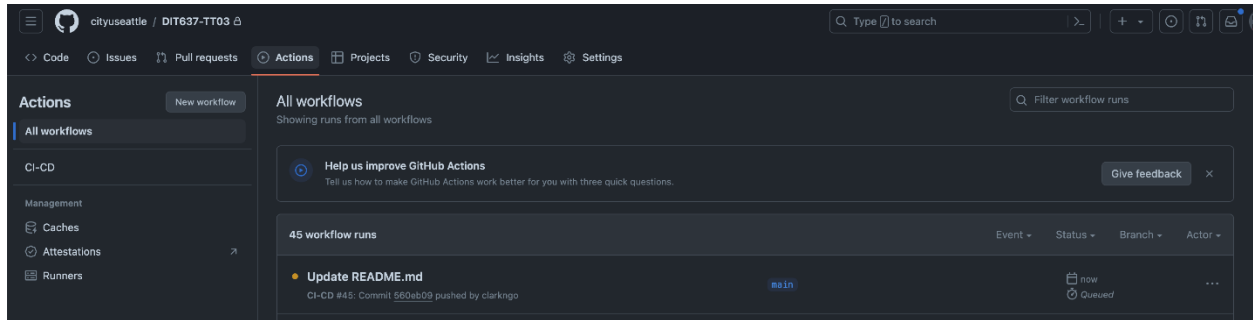
Edit button () beside the README.



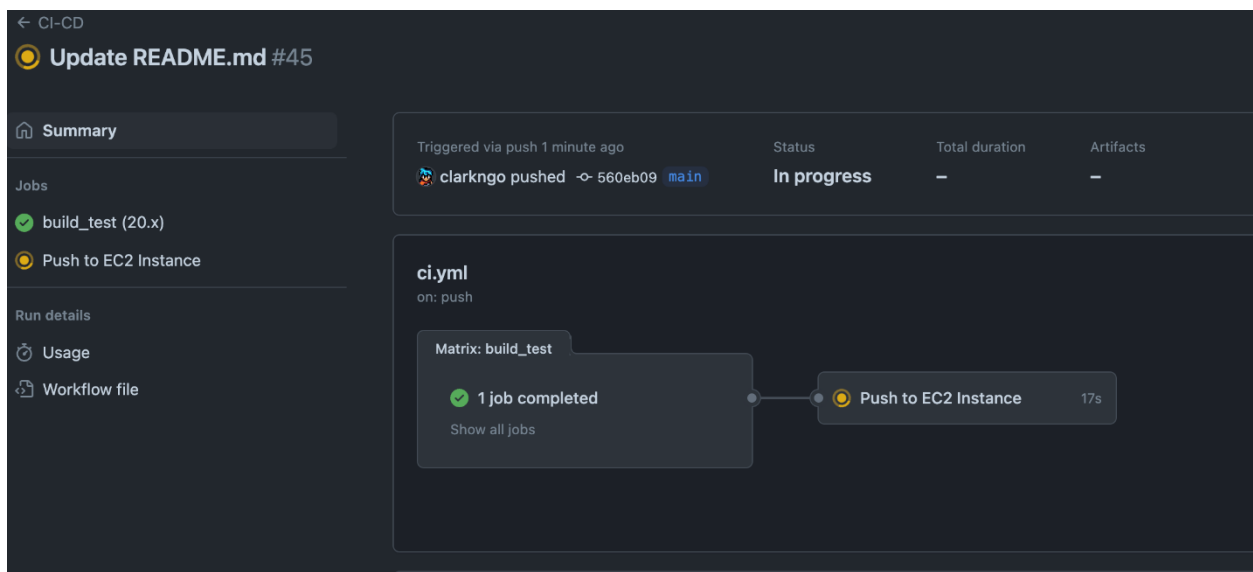
2. Feel free to edit or add any word. Then click Commit changes.



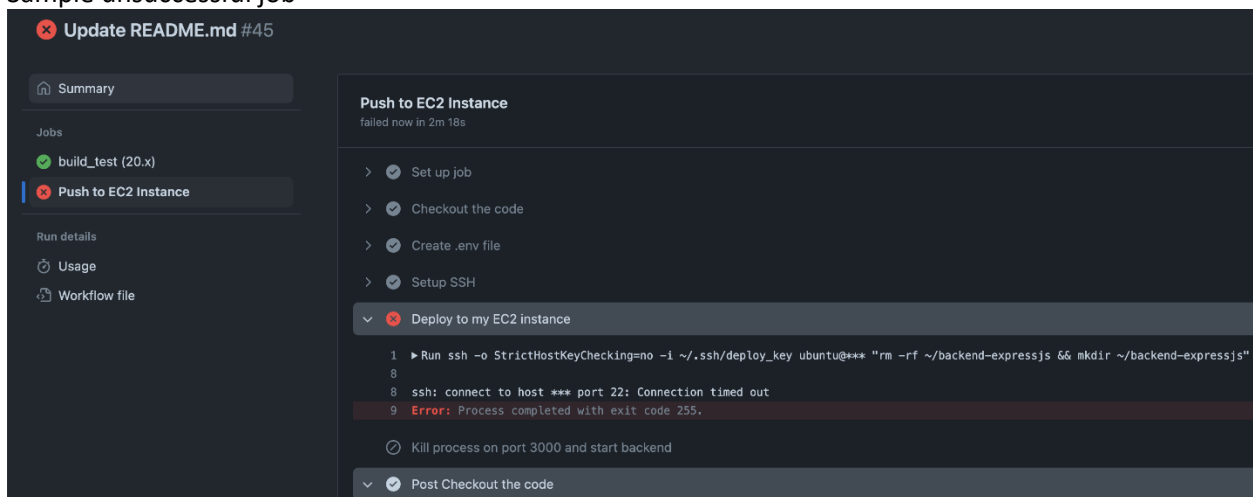
3. Go to your Actions tab and should see a running workflow



4. You can click the specific workflow to see more details.



5. You can click a specific job to see its details
Sample unsuccessful job



Sample successful job

The screenshot displays the GitHub Actions interface for a workflow named "Update README.md #45". The top navigation bar includes links for Code, Issues, Pull requests, Actions (selected), Projects, Security, Insights, and Settings. The left sidebar shows the workflow's history with two successful jobs: "build_test (20.x)" and "Push to EC2 Instance". The main content area shows the "Summary" tab for the selected job, which was triggered by a re-run 1 minute ago. A table provides job statistics: Status (Success), Total duration (42s), Billable time (9m), and Artifacts (none). Below this, the workflow file "ci.yml" is shown, triggered on push. A job matrix for "build_test" is displayed, showing one completed job. The workflow steps are visualized as a sequence: "1 job completed" followed by "Push to EC2 Instance" (29s).

← CI-CD

Update README.md #45

Summary

Jobs

- build_test (20.x)
- Push to EC2 Instance

Run details

- Usage
- Workflow file

Re-run triggered 1 minute ago

	Status	Total duration	Billable time	Artifacts
clarkngo 560eb09 main	Success	42s	9m	—

ci.yml
on: push

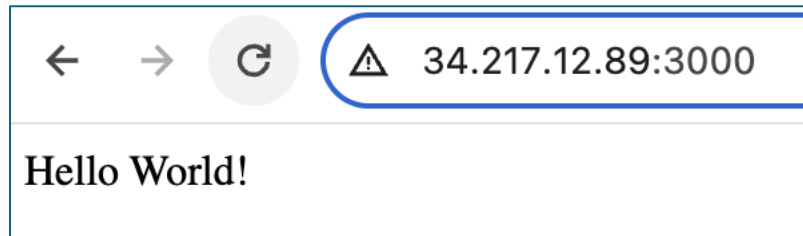
Matrix: build_test

- 1 job completed
Show all jobs

Push to EC2 Instance 29s

7) Test your backend server in EC2.

1. Copy and paste your Public IPv4 Address and add the port range **:3000** at the end.
 - a. Note: it should be **http** and not https when you copy and paste the url.



2. Copy and paste your Public IPv4 Address and add the port range **:3000** with **/movies** at the end.
 - a. Note: This might take a while because of large data
3. Take a screenshot of your browser with endpoint `ec2_IPv4_url:3000/movies` as 'first_last_ec2_movies.png' by using your first and last name.


```

<  →  ↻  ⚠ Not Secure  34.217.12.89:3000/movies
Pretty-print ☒
[
  {
    "_id": "573a1390f29313caabcd42e8",
    "plot": "A group of bandits stage a brazen train hold-up, only to find",
    "genres": [
      "Short",
      "Western"
    ],
    "runtime": 11,
    "cast": [
      "A.C. Abadie",
      "Gilbert M. 'Broncho Billy' Anderson",
      "George Barnes",
      "Justus D. Barnes"
    ],
    "poster": "https://m.media-
amazon.com/images/M/MV5BMTU3NjE5NzYtYTUyNS00MDVmLWIwYjgtMmYwYWl0ZDYyNzU2XkE
",
    "title": "The Great Train Robbery",
    "fullplot": "Among the earliest existing films in American cinema - not
tell - it depicts a group of cowboy outlaws who hold up a train and rob the
Several scenes have color included - all hand tinted.",
    "languages": [
      "English"
    ],
    "released": "1903-12-01T00:00:00.000Z",
    "directors": [
      "Edwin S. Porter"
    ],
    "rated": "TV-G",
    "awards": {
      "wins": 1,
      "nominations": 0,
      "text": "1 win."
    },
    "lastupdated": "2015-08-13 00:27:59.177000000",
    "year": 1903,
    "imdb": {
      "rating": 7.4,
      "votes": 9847,
      "id": 439
    },
    "countries": [
      "USA"
    ],
    "type": "movie",
    "tomatoes": {
      "viewer": {
        "rating": 3.7,
        "numReviews": 2559,
        "meter": 75
      },
      "fresh": 6,
      "critic": {
        "rating": 7.6,
        "numReviews": 6,
        "meter": 100
      },
      "rotten": 0,
      "lastUpdated": "2015-08-08T19:16:10.000Z"
    }
  }
]
```

8) Test your mobile app.

Recap on how to setup or start the frontend. In your codespaces:

1. `cd frontend-reactnative`
2. `npm install`
3. `npx expo login`
4. `npx expo start --tunnel`
5. Open via QR Code or manually in your Expo Go app in your phone.

We should see no changes and should have the same functionality.

Movie List

The Ace of Hearts

Year: 1921

Genres: Crime, Drama, Mystery

Cast: Lon Chaney, Leatrice Joy, John Bowers, Hardee Kirkland

Peter Pan

Year: 1924

Genres: Adventure, Fantasy, Family

Cast: George Ali, Esther Ralston, Cyril Chadwick, Mary Brian

The Thief of Bagdad

Year: 1924

Genres: Adventure, Family, Fantasy

Cast: Douglas Fairbanks, Snitz Edwards, Charles Belcher, Julianne Johnston

Lady Windermere's Fan

Year: 1925

Genres: Comedy

Cast: Ronald Colman, May McAvoy, Bert Lytell, Irene Rich

Disraeli

Year: 1929

Genres: Biography, Drama, History

Cast: George Arliss, Doris Lloyd, David Torrence, Joan Bennett

The Divorcee

Year: 1930

Genres: Romance, Drama

Cast: Norma Shearer, Chester Morris, Conrad Nagel, Robert Montgomery

King of Jazz

Year: 1930

Genres: Animation, Music

Cast: Paul Whiteman, John Boles, Laura La Plante, Jeanette Loff

Morocco

Year: 1930

9) Stopping or Terminating your Cloud Instance

Once you are done, feel free to stop the instance or terminate (permanently delete the server) it.

Note: AWS will generate a new Public IPv4 Address and Public IPv4 DNS when you stop/terminate the instance and start again. You will need to

1. Update your EC2_PUBLIC_DNS in GitHub Actions Secret
2. Update your EC2_SSH_KEY (if you have to generate a new key pair) in your GitHub Actions Secret
3. Update your API URL with Public IPv4 Address in your .env file in your frontend-reactnative project.

