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## Deploying a Multi-Tier Website Using AWS EC2

### Description:

Amazon Elastic Compute Cloud (Amazon EC2) provides scalable computing capacity in the Amazon Web Services (AWS) cloud. Using Amazon EC2 eliminates your need to invest in hardware upfront so you can develop and deploy applications faster. You can use Amazon EC2 to launch as many or as few virtual servers as you need, configure security and networking, and manage storage. Amazon EC2 enables you to scale up or down to handle changes in requirements or spikes in popularity, reducing your need to forecast traffic.

### Problem Statement:

Company ABC wants to move its product to AWS. They have the following things set up right now:

1. MySQL DB
2. Website (PHP)

The company wants high availability of this product, therefore, it wants Auto Scaling to be enabled on this website.

### Steps To Solve:

1. Launch an EC2 Instance
2. Enable Auto Scaling on these instances (minimum 2)
3. Create an RDS Instance
4. Create Database & Table in RDS instance:
  - a. Database name: intel
  - b. Table name: data
- c. Database password: intel123
5. Change the hostname on the website
6. Allow traffic from EC2 to the RDS instance
7. Allow all traffic to the EC2 instance

### Answer

Login to the AWS Web Console and go to EC2 Service

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Create a Security Group or use an existing subnet with the below services/ports allowed.

- HTTP – 80
- MySQL – 3306
- SSH – 22

The screenshot shows the 'Inbound rules' section of an AWS Security Group. It lists four rules:

Security group rule ID	Type	Protocol	Port range	Source	Description - optional
sg-09d8e5218270913f8	All traffic	All	All	Custom	Q, sg-002101bc8b3395383 X
sg-0812db580a08a0eb0	MySQL/Aurora	TCP	3306	Custom	Q, 172.31.0.0/16 X
sg-0b5743dae2757d92c	SSH	TCP	22	Custom	Q, 0.0.0.0/0 X
-	HTTP	TCP	80	Anywhere...	Q, 0.0.0.0/0 X

At the bottom, there is a warning: 'Rules with source of 0.0.0.0/0 or ::/0 allow all IP addresses to access your instance. We recommend setting security group rules to allow access from known IP addresses only.'

172.31.0.0/16 is my VPC CIDR value.

## Save Rules

## Create Launch Templates



The screenshot shows the 'Create launch template' form with the following fields:

- Launch template name and description**
- Launch template name - required**: WebServer
- Template version description**: v1
- Auto Scaling guidance**: ☐ Provide guidance to help me set up a template that I can use with EC2 Auto Scaling
- Template tags**
- Source template**

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Don't include in launch template

Amazon Linux  
aws

macOS  
Mac

Ubuntu  
ubuntu

Windows  
Microsoft

Red H  
Red

Browse more AMIs  
Including AMIs from AWS, Marketplace and the Community

**Amazon Machine Image (AMI)**

Ubuntu Server 20.04 LTS (HVM), SSD Volume Type  
ami-06aa3f7caf3a30282 (64-bit (x86)) / ami-0a75bd84854bc95c9 (64-bit (Arm))  
Virtualization: hvm ENA enabled: true Root device type: ebs

Free tier eligible

**Description**  
Canonical, Ubuntu, 20.04 LTS, amd64 focal image build on 2023-10-25

Architecture  
64-bit (x86)

AMI ID  
ami-06aa3f7caf3a30282  
Verified provider

**▼ Instance type** Info Advanced

Instance type  
t2.micro  
Family: t2 1 vCPU 1 GiB Memory Current generation: true  
On-Demand Windows base pricing: 0.0162 USD per Hour  
On-Demand SUSE base pricing: 0.0116 USD per Hour  
On-Demand RHEL base pricing: 0.0716 USD per Hour  
On-Demand Linux base pricing: 0.0116 USD per Hour

Free tier eligible

☒ All generations  
[Compare instance types](#)

Additional costs apply for AMIs with pre-installed software

Select Ubuntu, 20.04 LTS, and instance type t2.micro.



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### ▼ 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

MyKeyPair-Ravi

Create new key pair

### ▼ Network settings Info

Subnet Info

Don't include in launch template

Create new subnet

When you specify a subnet, a network interface is automatically added to your template.

### 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.

Select existing security group

Create security group

Security groups Info

Select security groups

default sg-002101bc8b3395383  
VPC: vpc-075375a9d0bf3861f

Compare security group rules

► Advanced network configuration

### User data - optional Info

Upload a file with your user data or enter it in the field.

Choose file

```
#!/bin/bash
sudo apt-get update -y
sudo apt-get install apache2 -y
sudo systemctl enable apache2
sudo systemctl start apache2
sudo apt-get install git
git clone https://github.com/awsvishwas/awsproject1.git project1
cd project1/
sudo mv * /var/www/html/
cd /var/www/html/
sudo rm -rf index.html
sudo add-apt-repository -y ppa:ondrej/php
sudo apt install php5.6 mysql-client php5.6-mysql -y
```

☐ User data has already been base64 encoded

default

Storage (volumes)

1 volume(s) - 8 GiB

**Free tier:** In your first year includes 750 hours of t2.micro (or t3.micro in the Regions in which t2.micro is unavailable) instance usage on free tier AMIs per month, 30 GiB of EBS storage, 2 million I/Os, 1 GB of snapshots, and 100 GB of bandwidth to the internet.

Cancel

Create launch template

```
#!/bin/bash
```

```
sudo apt-get update -y
```

```
sudo apt-get install apache2 -y
```

```
sudo systemctl enable apache2
```

```
sudo systemctl start apache2
```

```
sudo apt-get install git
```

```
git clone https://github.com/awsvishwas/awsproject1.git project1
```

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```
cd project1/  
sudo mv * /var/www/html/  
cd /var/www/html/  
sudo rm -rf index.html  
sudo add-apt-repository -y ppa:ondrej/php  
sudo apt install php5.6 mysql-client php5.6-mysqli -y
```

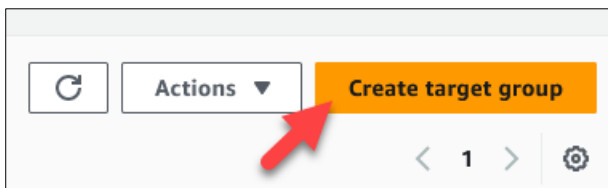
[EC2](#) > [Launch templates](#) > Create launch template

✓ Success

Successfully created [WebServer\(lt-09daa6745268a5e83\)](#).

▶ Actions log

## Create Target Groups



### Specify group details

Your load balancer routes requests to the targets in a target group and performs health checks on the targets.

#### Basic configuration

Settings in this section can't be changed after the target group is created.

Choose a target type

☒ Instances

- Supports load balancing to instances within a specific VPC.
- Facilitates the use of [Amazon EC2 Auto Scaling](#) to manage and scale your EC2 capacity.



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### Target group name

webapp

A maximum of 32 alphanumeric characters including hyphens are allowed, but the name must not begin or end with a hyphen.

### Protocol : Port

HTTP

80

1-65535

### IP address type

Only targets with the indicated IP address type can be registered to this target group.

#### ☒ IPv4

Each instance has a default network interface (eth0) that is assigned the primary private IPv4 address. The instance's primary private IPv4 address is the one that will be applied to the target.

#### ☐ IPv6

Each instance you register must have an assigned primary IPv6 address. This is configured on the instance's default network interface (eth0). [Learn more](#)

### VPC

Select the VPC with the instances that you want to include in the target group. Only VPCs that support the IP address type selected above are available in this list.

vpc-075375a9d0bf3861f  
IPv4: 172.31.0.0/16

### Protocol version

#### ☒ HTTP1

Send requests to targets using HTTP/1.1. Supported when the request protocol is HTTP/1.1 or HTTP/2.

### Health checks

The associated load balancer periodically sends requests, per the settings below, to the registered targets to test their status.

### Health check protocol

HTTP

### Health check path

Use the default path of "/" to ping the root, or specify a custom path if preferred.

/

Up to 1024 characters allowed.

### ► Advanced health check settings

### ► Tags - optional

Consider adding tags to your target group. Tags enable you to categorize your AWS resources so you can more easily manage them.

Cancel

Next

Click **Next**

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0 selected

Ports for the selected instances  
Ports for routing traffic to the selected instances.

80

1-65535 (separate multiple ports with commas)

Include as pending below

### Review targets

Targets (0)

Filter targets

Show only pending

Remove all pending

Remove	Health status	Instance ID	Name	Port	State	Security groups	Zone	Private IPv4 address	Subnet ID
No instances added yet									

Specify instances above, or leave the group empty if you prefer to add targets later.

0 pending

Cancel Previous **Create target group**

Click on **Create Target Group**

Now let's go ahead and create a Load Balancer for High availability and required for Auto Scaling

Actions

**Create load balancer**

< 1 >

### Basic configuration

**Load balancer name**  
Name must be unique within your AWS account and can't be changed after the load balancer is created.

mywebserver

A maximum of 32 alphanumeric characters including hyphens are allowed, but the name must not begin or end with a hyphen.

**Scheme** [Info](#)  
Scheme can't be changed after the load balancer is created.

☒ **Internet-facing**  
An Internet-facing load balancer routes requests from clients over the Internet to targets. Requires a public subnet. [Learn more](#)

☐ **Internal**  
An internal load balancer routes requests from clients to targets using private IP addresses.

**IP address type** [Info](#)  
Select the type of IP addresses that your subnets use.

☒ **IPv4**  
Recommended for internal load balancers.

☐ **Dualstack**  
Includes IPv4 and IPv6 addresses.

Select the VPC, Subnets and Security Groups

### Listeners and routing

A listener is a process that checks for connection requests using the port and protocol you configure. The rules that you define for a listener determine how the load balancer routes requests to its registered targets.

▼ Listener HTTP:80 [Remove](#)

Protocol	Port	Default action
HTTP	80	Forward to webapp

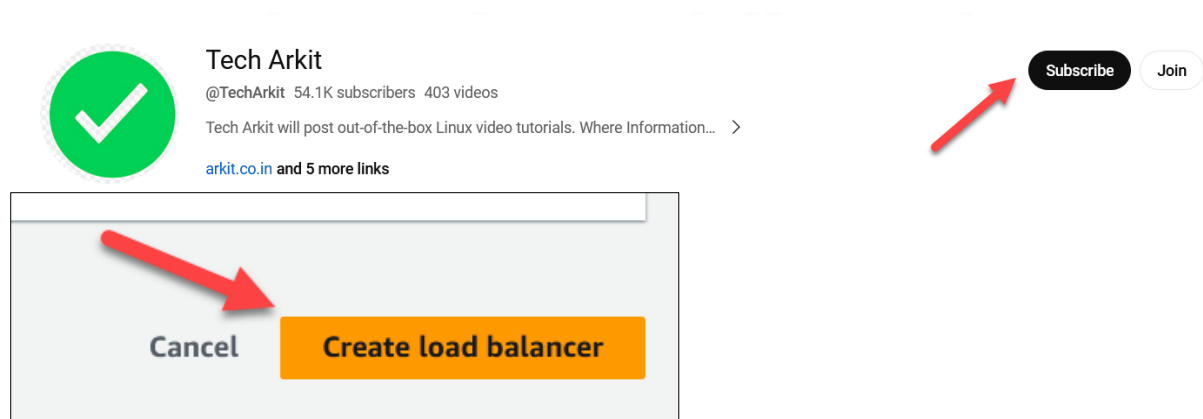
1-65535

Target type: Instance, IPv4

[Create target group](#)

Select Listeners and routing, Select the Target Group which we have created at the step 1

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Click on **Create load balancer**

☑ **Successfully created load balancer: mywebserver**  
Note: It might take a few minutes for your load balancer to be fully set up and ready to route traffic. Targets will also take a few minutes to complete the registration process and pass initial health checks.

## Create Auto Scaling Groups

### Choose launch template or configuration [Info](#)

Specify a launch template that contains settings common to all EC2 instances that are launched by this Auto Scaling group. If you currently use launch configurations, you might consider migrating to launch templates.

#### Name

Auto Scaling group name  
Enter a name to identify the group.

Must be unique to this account in the current Region and no more than 255 characters.

#### Launch template [Info](#)

[Switch to launch configuration](#)

Launch template  
Choose a launch template that contains the instance-level settings, such as the Amazon Machine Image (AMI), instance type, key pair, and security groups.

▼ ↺

[Create a launch template](#) [🔗](#)

Click **Next**

Select VPC settings and Subnets

Click **Next**





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## Load balancing [Info](#)

Use the options below to attach your Auto Scaling group to an existing load balancer, or to a new load balancer that you define.

☐ No load balancer

Traffic to your Auto Scaling group will not be fronted by a load balancer.

☒ Attach to an existing load balancer

Choose from your existing load balancers.

☐ Attach to a new load balancer

Quickly create a basic load balancer to attach to your Auto Scaling group.

### Attach to an existing load balancer

Select the load balancers that you want to attach to your Auto Scaling group.

☒ Choose from your load balancer target groups

This option allows you to attach Application, Network, or Gateway Load Balancers.

☐ Choose from Classic Load Balancers

#### Existing load balancer target groups

Only instance target groups that belong to the same VPC as your Auto Scaling group are available for selection.

Select target groups

webapp | HTTP

Application Load Balancer: mywebserver

Now select the load balancing since we already created the load balancer in the previous step.

## Additional settings

### Monitoring [Info](#)

☐ Enable group metrics collection within CloudWatch

### Default instance warmup [Info](#)

The amount of time that CloudWatch metrics for new instances do not contribute to the group's aggregated instance metrics, as their usage data is not reliable yet.

☐ Enable default instance warmup

Cancel

Skip to review

Previous

Next

Click **Next**

## Configure group size and scaling policies - optional [Info](#)

Set the desired, minimum, and maximum capacity of your Auto Scaling group. You can optionally add a scaling policy to dynamically scale the number of instances in the group.

### Group size - optional [Info](#)

Specify the size of the Auto Scaling group by changing the desired capacity. You can also specify minimum and maximum capacity limits. Your desired capacity must be within the limit range.

Desired capacity

2

Minimum capacity

2

Maximum capacity

3

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### Scaling policies - *optional*

Choose whether to use a scaling policy to dynamically resize your Auto Scaling group to meet changes in demand. [Info](#)

#### ☒ Target tracking scaling policy

Choose a desired outcome and leave it to the scaling policy to add and remove capacity as needed to achieve that outcome.

☐ None

Scaling policy name

Target Tracking Policy

Metric type [Info](#)

Monitored metric that determines if resource utilization is too low or high. If using EC2 metrics, consider enabling detailed monitoring for better scaling performance.

Average CPU utilization

Target value

50

Instance warmup [Info](#)

300

seconds

☐ Disable scale in to create only a scale-out policy

### Instance scale-in protection - *optional*

#### Instance scale-in protection

If protect from scale in is enabled, newly launched instances will be protected from scale in by default.

☐ Enable instance scale-in protection

Cancel

Skip to review

Previous

Next

Click **Next**

### Add notifications - *optional* [Info](#)

Send notifications to SNS topics whenever Amazon EC2 Auto Scaling launches or terminates the EC2 instances in your Auto Scaling group.

Add notification

Cancel

Skip to review

Previous

Next

Click **Next**

Add tags if required



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### Add tags - optional [Info](#)

Add tags to help you search, filter, and track your Auto Scaling group across AWS. You can also choose to automatically add these tags to instances when they are launched.

**i** You can optionally choose to add tags to instances (and their attached EBS volumes) by specifying tags in your launch template. We recommend caution, however, because the tag values for instances from your launch template will be overridden if there are any duplicate keys specified for the Auto Scaling group. **X**

Tags (0)

Add tag

50 remaining

Cancel

Previous

Next

Click **Next**

### Step 5: Add notifications [Edit](#)

Notifications

No notifications

### Step 6: Add tags [Edit](#)

Tags (0)

Key	Value	Tag new instances
No tags		

Cancel

Previous

Create Auto Scaling group

Verify the details and Click on “**Create Auto Scaling group**”

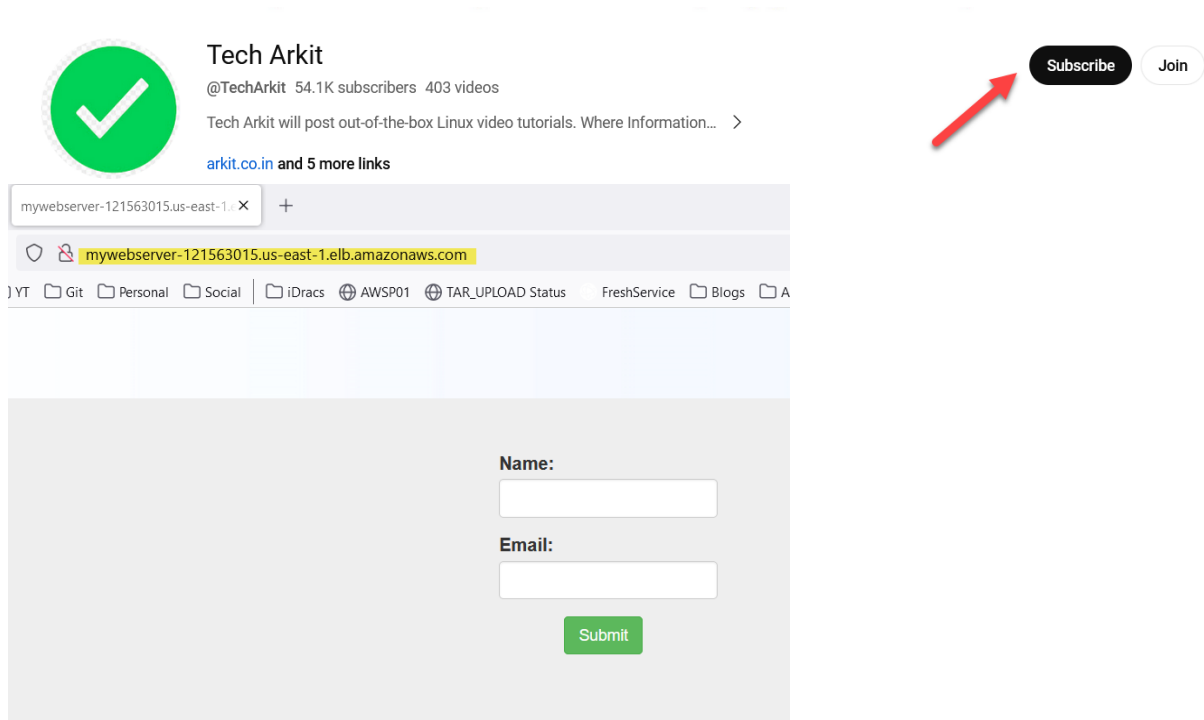
After the successful creation of the Auto Scaling Group, it will auto-provision the Instances required.

Instances (1) <a href="#">Info</a>									
<input type="text" value="Find Instance by attribute or tag (case-sensitive)"/>									
<input type="checkbox"/>	Name <a href="#">↕</a>	Instance ID	Instance state <a href="#">↕</a>	Instance type <a href="#">↕</a>	Status check	Alarm status	Availability Zone <a href="#">↕</a>	Public IPv4 DNS <a href="#">↕</a>	Public IPv4 ... <a href="#">↕</a>
<input type="checkbox"/>		i-0a55a3d1567cb1e26	Running <a href="#">🔍</a>	t2.micro	Initializing <a href="#">🔍</a>	No alarms <a href="#">+</a>	us-east-1d	ec2-52-202-144-128.co...	52.202.144.128
									Elastic IP
									-

Now try to access the Load Balancer URL

<http://mywebserver-121563015.us-east-1.elb.amazonaws.com>

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Now Let's spin up the RDS instance, to resolve the Database error.

The image shows the 'Create database' console in the AWS RDS console. The 'Choose a database creation method' section has two options: 'Standard create' (selected) and 'Easy create'. The 'Engine options' section has three options: 'Aurora (MySQL Compatible)', 'Aurora (PostgreSQL Compatible)', and 'MySQL' (selected). The 'MySQL' option is highlighted with a yellow border and a green checkmark.

Select Standard Create and MySQL

The image shows the 'Engine Version' and 'Templates' sections of the AWS RDS console. The 'Engine Version' dropdown menu is set to 'MySQL 8.0.33'. The 'Templates' section has three options: 'Production', 'Dev/Test', and 'Free tier' (selected). The 'Free tier' option is highlighted with a yellow border and a green checkmark.

Select engine version as MySQL 8.0.33 for compatibility and Free Tier

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### 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.

database-1

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. The first character must be a letter.

#### ☒ Burstable classes (includes t classes)

db.t3.micro

2 vCPUs 1 GiB RAM Network: 2,085 Mbps

#### 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

#### Existing VPC security groups

Choose one or more options

default X

#### Availability Zone [Info](#)

us-east-1d

#### 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)

Expiry: Aug 22, 2024

If you don't select a certificate authority, RDS chooses one for you.

#### ► Additional configuration

Select Security Group, Availability Zone as us-east-1d (My EC2 instance is in the same AZ)

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### Database authentication

Database authentication options [Info](#)

- ☒ Password authentication  
Authenticates using database passwords.
- ☐ Password and IAM database authentication  
Authenticates using the database password and user credentials through AWS IAM users and roles.
- ☐ Password and Kerberos authentication  
Choose a directory in which you want to allow authorized users to authenticate with this DB instance using Kerberos Authentication.

### Select Password Authentication

#### Estimated monthly costs

The Amazon RDS Free Tier is available to you for 12 months. Each calendar month, the free tier will allow you to use the Amazon RDS resources listed below for free:

- 750 hrs of Amazon RDS in a Single-AZ db.t2.micro, db.t3.micro or db.t4g.micro Instance.
- 20 GB of General Purpose Storage (SSD).
- 20 GB for automated backup storage and any user-initiated DB Snapshots.

[Learn more about AWS Free Tier.](#)

When your free usage expires or if your application use exceeds the free usage tiers, you simply pay standard, pay-as-you-go service rates as described in the [Amazon RDS Pricing page.](#)

**i** You are responsible for ensuring that you have all of the necessary rights for any third-party products or services that you use with AWS services.

Cancel

Create database

### Click "Create database"

Databases (1)										
<input type="text" value="Filter by databases"/>										
<input type="checkbox"/>	DB identifier	Status	Role	Engine	Region & AZ	Size	Actions	CPU	Current activity	Maintenance
<input type="radio"/>	<a href="#">database-1</a>	Creating	Instance	MySQL Community	us-east-1d	db.t2.micro	-	-	none	vpc-075375a9d0bf3861f

#### ✓ Successfully created database [database-1](#)

You can use settings from database-1 to simplify configuration of [suggested database add-ons](#) while we finish creating your DB for you.



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Summary			
DB identifier database-1	CPU <div><div></div>3.83%</div>	Status <span>Available</span>	Class db.t2.micro
Role Instance	Current activity <div><div></div>0 Connections</div>	Engine MySQL Community	Region & AZ us-east-1d
Connectivity & security			
Endpoint & port Endpoint <b>database-1.cpi4xkvf34nj.us-east-1.rds.amazonaws.com</b> Port 3306	Networking Availability Zone us-east-1d VPC vpc-075375a9d0bf3861f	Security VPC security groups default (sg-002101bc8b3395383) <span>Active</span> Publicly accessible No	

Connect to the RDS instance using MySQL client and create the database.

```
ubuntu@ip-172-31-43-251:~$ mysql -h database-1.cpi4xkvf34nj.us-east-1.rds.amazonaws.com -u admin -p
Enter password:
Welcome to the MySQL monitor.  Commands end with ; or \g.
Your MySQL connection id is 16
Server version: 8.0.33 Source distribution

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affiliates. Other names may be trademarks of their respective
owners.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

mysql> create database intel;
Query OK, 1 row affected (0.00 sec)

mysql> use intel;
Database changed
mysql> create table data(firstname varchar(21),email varchar(21));
Query OK, 0 rows affected (0.02 sec)

mysql> exit;
Bye
```

```
CREATE USER 'intel'@'database-1.cpi4xkvf34nj.us-east-1.rds.amazonaws.com' IDENTIFIED BY 'intel123';
```

```
GRANT CREATE, ALTER, DROP, INSERT, UPDATE, DELETE, SELECT,
REFERENCES, RELOAD on *.* TO 'intel'@'database-1.cpi4xkvf34nj.us-
east-1.rds.amazonaws.com' WITH GRANT OPTION;
```

```
mysql> CREATE USER 'intel'@'database-1.cpi4xkvf34nj.us-east-1.rds.amazonaws.com' IDENTIFIED BY 'intel123';
Query OK, 0 rows affected (0.01 sec)

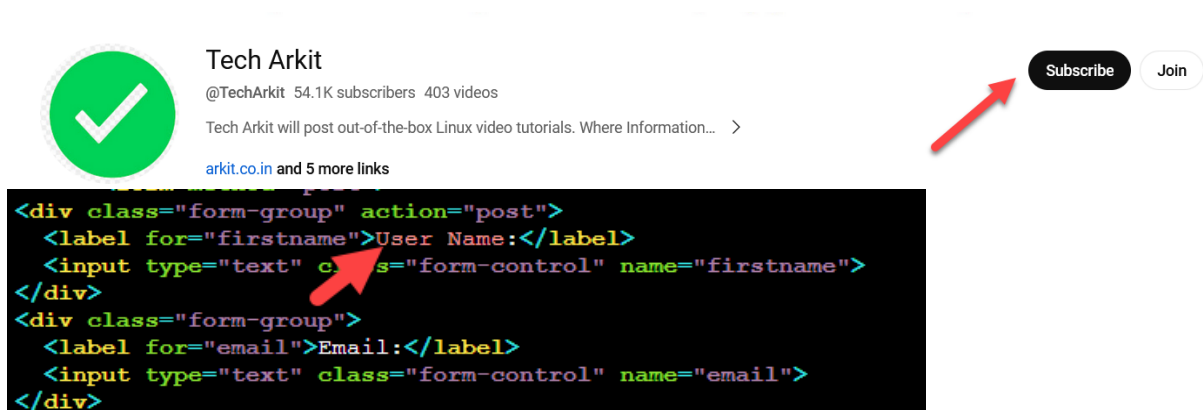
mysql> GRANT CREATE, ALTER, DROP, INSERT, UPDATE, DELETE, SELECT, REFERENCES, RELOAD on *.* TO 'intel'@'database-1.cpi4xkvf34nj.us-east-1.rds.amazonaws.com' WITH GRANT OPTION;
Query OK, 0 rows affected (0.00 sec)
```

## Update the Git Code

Now edit the GitHub Repository code and update the Instance details.

```
<?php
$firstname=$_POST['firstname'];
$email=$_POST['email'];
$servername = "database-1.cpi4xkvf34nj.us-east-1.rds.amazonaws.com";
$username = "intel";
$password = "intel123";
$db = "intel";
// Create connection
$conn = new mysqli($servername, $username, $password, $db);
```

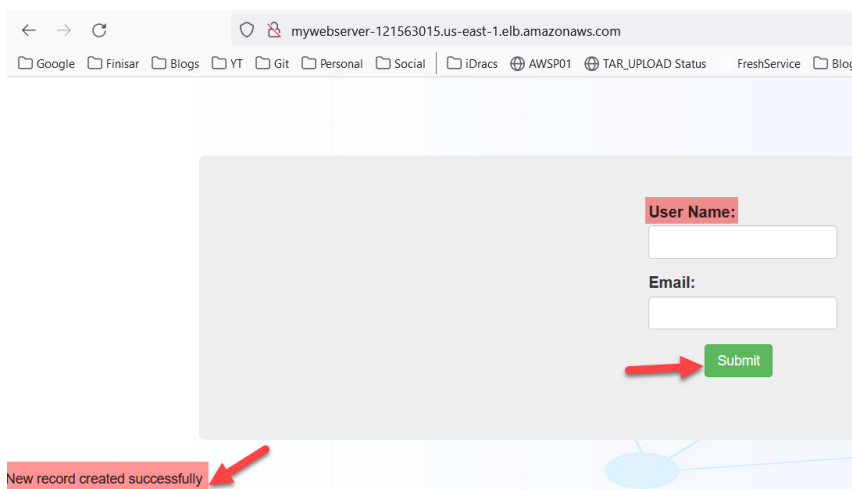
<https://www.youtube.com/techarkit> and <https://arkit.co.in>



Commit the repository.

Terminate the existing EC2 instance Autoscaling group will deploy the new instances with the correct authentication details.

Updated the Website details



Submitted the details it can write successfully.

That concludes the project.