Infrastructure Recommendation for CLOUDTECH SOLUTIONS

BY

Group 1:

1. Pranjal Pathak (20020701)
2. Akhil Ajithkumar (20017759)
3. Pratiksha Bhalerao (20034866)
4. Yashaswini Nagraj (20086302)

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Link to our GitHub Shared Repository -> https://github.com/20034866/TechSolutions-Inc

Introduction:

In recent years, cloud computing has become an indispensable part of the modern technological landscape, transforming how businesses and individuals access, store, and manage data. Its ability to provide on-demand computing resources, scalability, and cost efficiency has driven its widespread adoption across various industries **(Xu, X. 2012)**. Cloud computing has revolutionized the way organizations manage and utilize IT services and has transformed how resources are used from using a traditional on-premises infrastructure to more flexible, scalable, and cost-efficient computing models. The **National Institute of Standards and Technology (NIST)** defines cloud computing as "a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction" **(Mell & Grance, 2011).** At its core, cloud computing enables users to access a wide range of services and applications over the Internet, eliminating the need for substantial investments in physical hardware and providing the agility to adapt to changing business needs **(Armbrust et al., 2010)**.

Cloud Computing can be classified either by the deployment type or the service type it uses, as seen in Figure 1. Based on the deployment type, it can be categorized into three kinds.

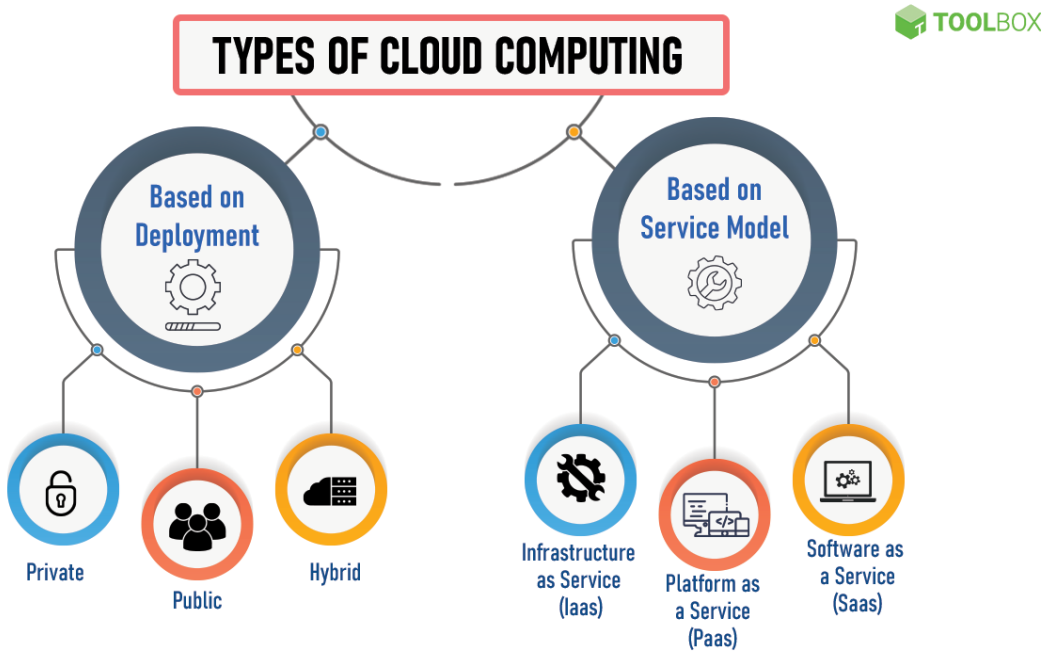


Fig. 1 Types of Cloud Computing

Private Cloud: Microsoft defines a private cloud as "a cloud computing model where the IT services are provided over private IT infrastructure for the dedicated use of a single organization" **(Microsoft Azure, n.d.)**. It offers all the benefits of the public cloud with enhanced security and control, as it is being hosted for a single organization. Unlike the public cloud, the private cloud needs to be managed in-house or can be outsourced to a third party which can be quite tedious and resource intensive. Additional protection can be added by using company firewalls and internal hosting to secure its susceptible data.

Public Cloud: According to Amazon Web Services **(Amazon Web Services, n.d.)**, a public cloud refers to "cloud services offered over the public internet and available to anyone who wants to purchase them. It is free for all to use and is typically provided by third-party providers over the Internet. The platform or company providing this type of services are also the ones who are managing the whole infrastructure and maintenance, and the user has limited control over it. The user only needs to develop its requirements and usually uses the pay-as-you-go model, which simply means that the user only pays for the services whenever they are running and not for the whole time it is hosted. It allows multiple users to use the infrastructure at the same time, without having to worry about the privacy and security of their systems. The key characteristics include broad network access, resource pooling, rapid elasticity, and measured service

Hybrid Cloud: IBM defines the hybrid cloud as "a combination of private and public cloud resources, designed to allow data and applications to be shared between them" **(IBM Cloud, n.d.)**. It is also called bets of both worlds as depending on the requirements, one has the flexibility to shift between both public and private cloud. This allows businesses flexibility and more deployment options while also enabling data and application portability. Businesses using this type generally pay for resources temporarily instead of buying them.

Based on the service model, it can be majorly categorized into three services.

Infrastructure as a Service (IaaS): This service contains the basic building blocks for the IT cloud and provides access to networking features, computers (both virtual or dedicated hardware), and data storage spaces **(Amazon Web Services, n.d.)**. It offers a lot of flexibility to users as they can manage any computer in any part of the world and can be scaled up or down based on requirements. It also gives more control to the administrators and developers over their infrastructure, including managing operating systems, storage, and applications deployed on it. Using this service, allows organizations to curb their costs by reducing the hardware costs and management of servers and offers benefits like scalability, cost efficiency, and reduced hardware. Common examples include web hosting, data storage, and disaster recovery.

Platform as a Service (PaaS): PaaS offers a cloud-based environment that enables developers to build, deploy, and manage applications without the complexity of managing

underlying infrastructure. It provides a platform with pre-configured development tools, database management systems, and other resources necessary for application development **(Microsoft Azure, n.d.)**. This service gives the users an option to quickly develop applications without having to worry about physical dependencies like servers, storage or network, patching, and software maintenance which in turn increases efficiency, reduces development time, and can be easily scaled. Common examples include Microsoft Azure App Services and Google App Engine.

Software as a Service (SaaS): This service is used to host web applications. By using this service, the user only needs to use the software instead of managing and developing the service. Software applications are delivered and developed over the internet where cloud providers where it is managed and hosted, which makes it a lot easier to use anywhere using any machine provided it's connected to the cloud and has a web browser. It reduces the need for IT staff and infrastructure and increases the ease of use, scalability, and automatic updates. Common examples include Microsoft Office 365, Google Workspace, and Salesforce.

Impact of cloud computing on SME's

Small and Medium-sized Enterprises are businesses having fewer employees up to a certain limit which differ country and industry-wise. According to the **European Commission (2020, p. 10),** SMEs are categorized as follows: micro enterprises have fewer than 10 employees and a turnover or balance sheet total of €2 million or less; small enterprises have fewer than 50 employees and a turnover or balance sheet total of €10 million or less; and medium-sized enterprises have fewer than 250 employees and a turnover of €50 million or less, or a balance sheet total of €43 million or less. SMEs play a crucial role in the economy, representing over 99% of businesses in the European Union and employing around 100 million people, accounting for more than half of Europe's GDP.

Cloud computing has had a significant impact on SMEs by providing them with new technologies and services which has helped them to become more efficient, reduce costs, and offer scalable solutions without having to manage the infrastructure and hardware. Findings by **Sultan (2011)** cloud-based technology can help SMEs gain insights into customer behavior and market trends, allowing them to make data-driven decisions and enhance their competitiveness. It offers SMEs the flexibility to scale up or down depending on the requirements which is crucial to any business as they experience regular fluctuations. Cloud helps them by handling this aspect allowing them to look for and grab opportunities around them without having to worry about their infrastructure. With technological advancements and the addition of services like Artificial Intelligence (AI), Internet of Things (IoT), and data analysis, SMEs can detect new consumer behaviour, forecast trends, improve efficiency, and can focus on innovation and other aspects of their business side. It has also helped in increasing collaboration amongst employees, by using shared resources and providing seamless connections across the world just by using the internet. Cloud-based tools like Microsoft 365 and Google Workspace facilitate document sharing, communication, and project management, fostering a more connected and agile workforce **(Buyya et al., 2009).** Cloud computing has also helped SMEs in business continuity and disaster recovery while providing enhanced security and compliance. By using cloud services, they are benefiting from high availability aiding them in their data security and applications which can be quickly restored in case of failure or a disaster. This capability is essential for minimizing downtime and maintaining business operations in the face of unforeseen events, such as natural disasters or cyberattacks **(Sultan, 2011)**.

Background of the Enterprise

For our cloud assignment, we have chosen an SME known as **CloudTech Solutions** which was founded by John Wick and Tony Stark along with Natasha Romanoff just after the pandemic in 2020 and has amassed 21 small clients spread throughout Ireland in a short time. It has a small team of just 16 people headed by Tony Stark who acts as the CEO, while John and Natasha are CFO and CMO respectively. They started with only three people and now are one of the most influential SMEs working for the upliftment and betterment of other SMEs by leveraging the cloud services to upscale them.

Their details are as follows:

Tagline – Private Cloud, Delivered Locally
Business Type – Small & Medium sized Enterprise (SME)
Industry – Cloud Computing
Headquarters – Cork, Ireland

Mission Statement - CloudTech Solutions is a small and dedicated enterprise, providing cloud services to the upcoming and newly formed organization using on-premises data centers, ensuring privacy, control, and performance to its clients tailored specifically to their needs.

Business Idea – CloudTech Solutions is a small enterprise providing local support to up-and-coming newly formed companies, catering to their personal needs and requirements. With their on-premises data centers and servers, they can handle and deliver public, private, and hybrid cloud while focusing on Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS).

CloudTech Solutions offers a lot of services, which can be broadly categorized into three branches namely:

- **On-Premises Private Cloud Solutions**

  They have their custom-built private cloud which is hosted in their backyard on data centres which enhances their security and control.

  Virtual Machines: Scalable VMs for their workloads.

  Private Storage Solutions: Secure and compliant storage solution.

  Custom Networking: Networks that suit their requirements including LANs (Local Area Networks) and VPNs (Virtual Private Networks).

- **Hybrid Cloud Integration**

Solutions that can be integrated with their on-premises systems with the public cloud to create a hybrid cloud.

Data Replication: Secure client's data by replicating their databases on different servers to avoid loss/corruption of data and maintaining backup.

Integration Services: Use APIs (Application Programming Interface) to seamlessly integrate with cloud services.

- **Managed Hosting Services**

To manage and host data for business applications and websites.
Disaster Recovery: The company uses its servers for data replication and to provide backups in case of data loss or corruption of data.

Dedicated Hosting: They have exclusive servers for their clients for critical applications and sensitive data.

- **Custom IT Infrastructure Solutions**

The company also provides custom IT support to its clients to meet individual business needs.

Server Management: Setup, maintenance, and monitoring of servers.

Network Infrastructure: Desing, maintaining, and managing network infrastructure for a robust network.

- **Consulting and Support Services**

Expert consulting and support team to handle adverse situations, optimization of services, and transition to different services.

Technical Support: They have a dedicated person whose sole responsibility is to provide support to their clients throughout the day.

Training Programs: They also provide training simulations to their clients for easy-to-fix issues and small difficulties.

- **Target Market**

Small to Medium Enterprise (SMEs): Small companies that require robust IT infrastructure have no expertise in managing and deploying servers but require cloud services for scalability and data protection.

Manufacturing Companies: Companies that require help in managing and storing inventory, bookkeeping, and other critical operations.

Small Healthcare Clinics: Small and medium healthcare clinics store patients’ sensitive data and healthcare compliance codes.

Schools: Schools and universities which required to store students' information and manage digital classes and resources post covid.

Small Firms: Small firms need to store sensitive data and resources and strictly control due to regulatory reasons.

Current IT Setup

The SME operates all its computing processes on an on-premises server located within the organization's premises. This robust architecture can handle a significant network load. The system's components are as follows:

1. Server Hardware:

The server framework, besides the fundamental brackets, includes many elements such as a CPU, RAM, hard or solid-state drives, NICs, a stable power source, and a cooling system to avoid heat-related issues.

2. Network Components:

These components monitor the throughput of the system’s traffic by setting up various network protocols and other aspects such as different ports. They make sure that several appliances in the network are linked and the messages in the system are promptly transmitted inside the internal network.

3. Operating System:

The company uses Ubuntu Linux as its primary operating system.

4. Server Software:

The server contains the software environment to support any kind of application. It features a Nginx HTTP server as a Web server for hosting those Web applications, an application server, and a PostgreSQL Database Management System for Create, Read, Update, and Delete operations. Also, it has applications that can be used in storing and sharing files and backing up software in cases of data loss.

5. Security Components:

To shield the whole infrastructure from malicious programs, the company has it installed with a robust anti-virus system, and an intrusion detection system to monitor for possible activities. They also maintain an authentication control and a delegation control system to control the access rights of each member properly.

6. Management and Monitoring Tools:

Monitoring tools are also highlighted as an essential component that the company should implement. Some of the tools they use include Nagios for monitoring and alerting services for servers, switches, applications, and services. Also, they use Puppet to manage and automate the server picture.

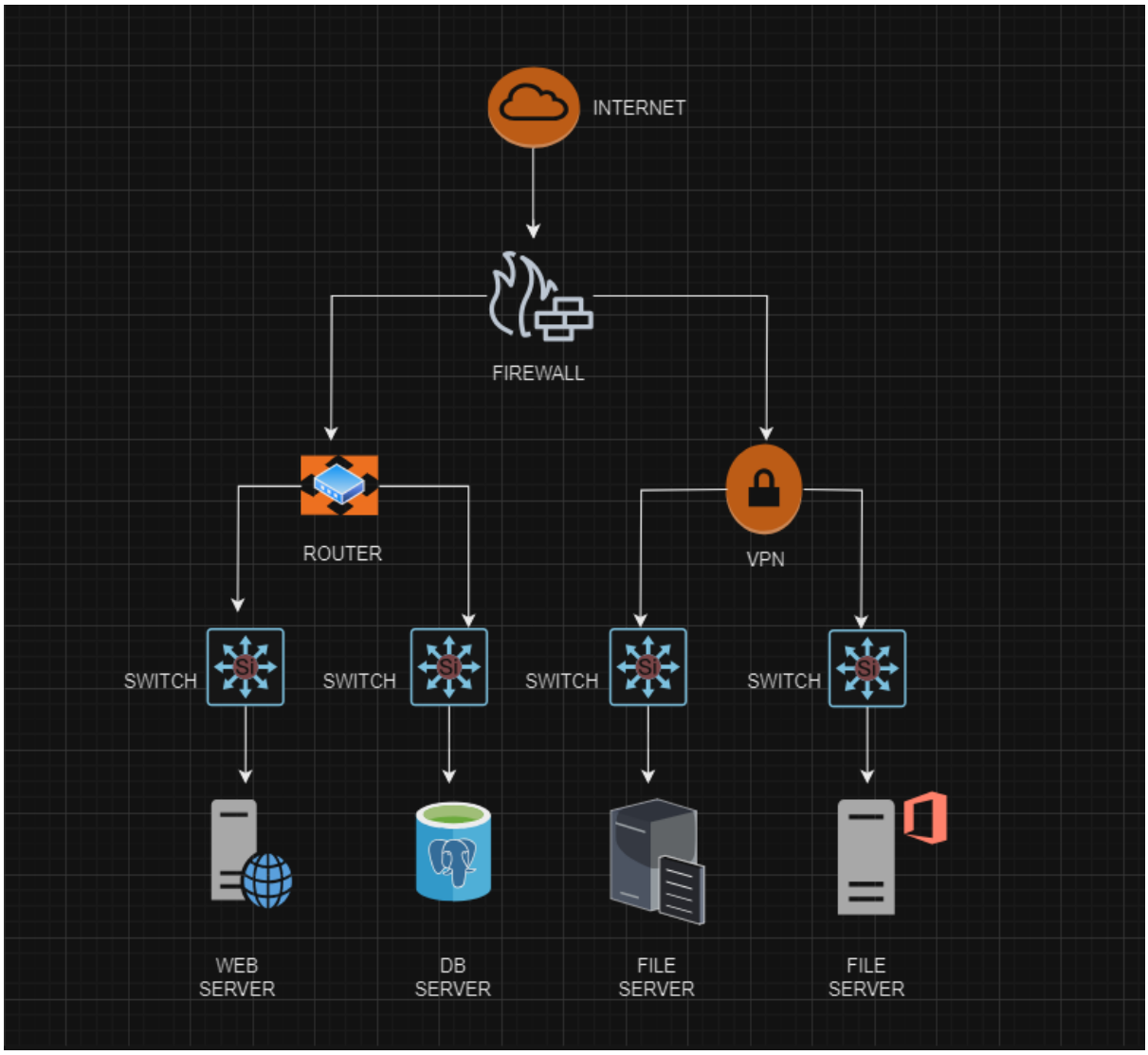


Fig 2 – On-Prem Architecture

The skeletal view of the company's current IT setup can be observed from the diagram provided above. As can be seen, all components needed for the company's customers are available; however, the company is focusing on expanding its consulting service and acquiring bigger contracts. Although on-premises servers offer benefits like greater control over data and better hardware customization, the current setup presents several challenges.

Scalability Issues

- **Increased Demand:**

When there is an increase in demand for the company's software solutions, the current on-premises infrastructure struggles to handle the increased load, leading to performance degradation and longer deployment times.

- **New Projects:**

Onboarding new projects or clients may sometimes demand more computing capability to meet the needs of the clients. The current setup faces difficulty when it comes to quickly growing the resource allocation to meet these new needs.

- **Remote Access:**

It is challenging for employers to allow their employees to have remote access to important documents and other resources, and this results in several drawbacks such as when there is a need to complete tasks in minimum time, or when there are certain conditions that require high numbers of employees who may work from home.

Disaster Recovery and Backup

The most important aspect that must be pushed in terms of implementation and management is backups since their absence can lead to catastrophic data loss. However, the establishment of an efficient backup management program is quite a challenge, and procedures involve considerable use of resources.

- **Energy Consumption and Cost:**

The servers deployed in large on-premises infrastructure environments are power hogs, and high energy costs lead to even higher project expenses.

- **Vendor Lock-In:**

The organization could find itself tied to certain vendors for equipment, systems, and assistance, which is a disadvantage. In general, customization can be possible, but it can even prove to be very time-consuming and demands a certain level of expertise.

Moving to Cloud-Based Infrastructure

Considering these challenges, moving to a cloud-based infrastructure offers numerous benefits:

Increased Scalability:

In cloud services, the company has the flexibility of expanding and even diminishing resources that are needed to perform their jobs based on the organization’s load with little capital outlay.

Cost Efficiency:

Switching to the more flexible cloud pay-as-you-go system also allows the company to minimize capital investment on hardware and direct costs for their maintenance.

Improved Accessibility:

Cloud infrastructure has accessibility as one of the marked strengths since employees can easily work from any location with an internet connection; this comes in handy with flexibility and productivity.

Enhanced Disaster Recovery:

Disaster recoveries are typically built into the cloud through their platform, thus minimizing the prospects of data loss and the potential for operation disruption.

Recommended Architecture

Organizations can easily migrate to any of the popular clouds like AWS, GCP, Azure, or any other of their choice to avail the benefits for the customers We **recommend AWS**, and thus all comparisons will be based on AWS services.

For the **IaaS** the company can take **advantage of AWS Elastic Compute Cloud (EC2**) which is based on virtual machines that offer a selection of operating systems and storage and RAM configurations. **Load balancing can be added to EC2 instances** so that it can assist in balancing traffic flow in and out of the server. An **API Gateway and Route 53** can be used to provide specific domain names for customers according to their requirements. **AWS CloudWatch** alarms can be configured to prevent the creation of charges/fees in AWS accounts.

In the scope of database hosting, an excellent relational database service is provided by AWS which is called **RDS** (Relational Database Service). **AWS S3** can be used for secure data storage, ensuring data does not leave their environment. AWS Secrets Manager can secure the storage of environment variables and secret keys. For Continuous Integration/Continuous Deployment (**CI/CD**) processes, Platform as a Service **(PaaS) AWS Elastic Beanstalk** can be used without the need to handle underlying infrastructure, **AWS ECR** can store container images, which can be deployed on **EC2** instances for each version release.

In terms of the **Software as a Service (SaaS) model**, the company may create a cloud security management division to supervise the infrastructure. They can then make use of observability tools such as Prometheus for dealings with the monitor and alert dashboards. For email automation, they can use **AWS SNS** i.e., Simple Notification Service.

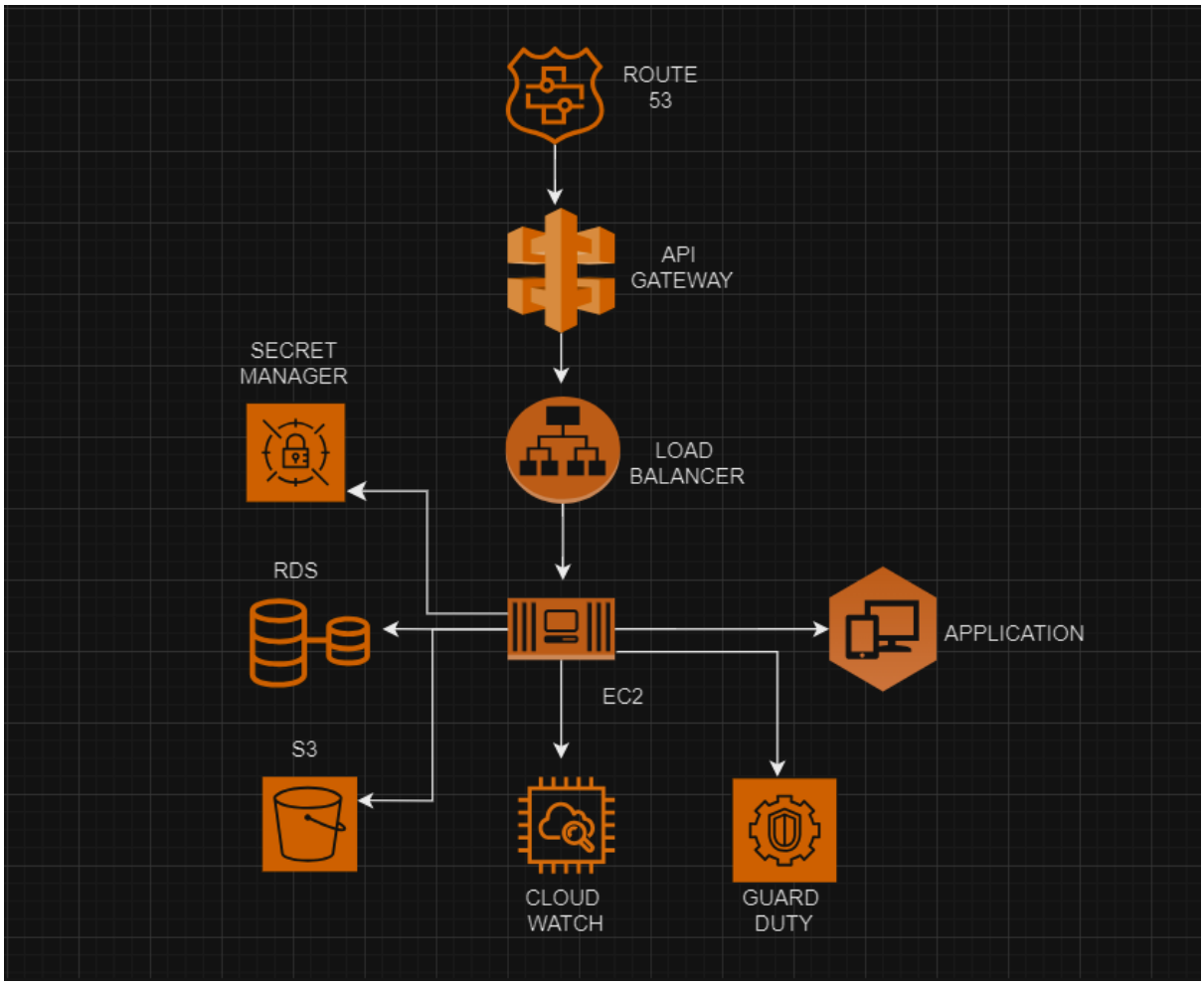


Fig 3 – Cloud Architecture

Using all the above-mentioned AWS services, any potential client that the company may come across will not experience what previous clients faced. Here's how the new architecture addresses each problem:

Cost Efficiency:

There are possible solutions to avoid overspending or micromanaging expenses, such as using **AWS CloudWatch** to identify and track costs and cost management tools like **AWS Cost Explo**rer to calculate clients' budgets in advance based on possible project costs. Another difficulty that arises with on-premises servers is in making such precise cost predictions. As for the costs in the cloud, we can consider utilizing Optional instances or committed use discounts for predictable workloads. Monitoring our resources' consumption and adjusting the resource capacity helps avoid the wastage of resources that were purchased in bulk or procured and were not used to their full potential.

Scaling:

With **AWS Load Balancer attached to EC2 instances**, traffic can be efficiently distributed among available instances, reducing latency. Auto-scaling maximally makes changes

dynamically to the available resources to improve the application's performance to meet the user's demand. On the other hand, vertical scaling of on-premises servers is a more complicated process and can often fall short of horizontal scaling's ideal results. Establishing physical diminishing is also possible when scaling vertically by adding more RAM is easier in the cloud. Also, it can be easily cloned for new projects, and it will not be time-consuming at all.

Security and Backup:

To enable a strong network security, AWS keeps the entire network within a single VPC. The information is protected in transit and when stored in the database. Unauthorized physical access is prevented through access controls, and authentication key mechanisms forestall potential attacks. The security monitoring is done on a continuous basis with **AWS GuardDuty** providing notifications to CloudWatch about any behavioural detections. While on-premises security systems have the disadvantage of physical security threat such as natural disasters which can easily compromise the security of data, on-cloud security data can be backed up in other datacentres or availability zones to avoid exposure.

Vendor Lock-In and Accessibility:

This can be in the form of accommodating multiple operating systems, multiple CPU architectures, or supporting multiple hardware vendors without any long-term obligations. **VDI** enables employees to access virtual desktops from anywhere making it an added advantage in the File and Remote working. The overall administration of the desktop is also made easier in a centralized VDI, and the management of updates, security, and user settings or software is also made easier by the VDI.

Details of the cost

Key Considerations for Cost Estimation:

Since CloudTech Solutions is a small company with only 16 employees and a clientele of 21 even smaller companies, they don't need a lot of computing power, storage, and resources. Moderate computing power and storage are sufficient for their work. We have also assumed the workload includes web hosting, databases, application servers, and file storage. We also must ensure high availability and regular backups for business continuity.

The estimated cost of migrating from on-premises infrastructure to cloud services, CloudTech Solutions must pay the following amounts as discussed below:

EC2 Instances:

Amazon Elastic Compute Cloud is a web service that provides secure, resizable compute capacity in the cloud. AWS offers the broadest and deepest compute platform, with over 750 instances and a choice of the latest processor, storage, networking, operating system, and purchase model to help match the needs of its users (**Amazon Web Services, n.d.).**

EC2 instances can be broken down for different requirements

Web Servers: The instance type for web servers should be 2 instances running on t3.medium to handle web traffic for client websites. Its monthly cost is around USD 60.74, and its yearly cost is USD 728.88, as seen in Figure 4.

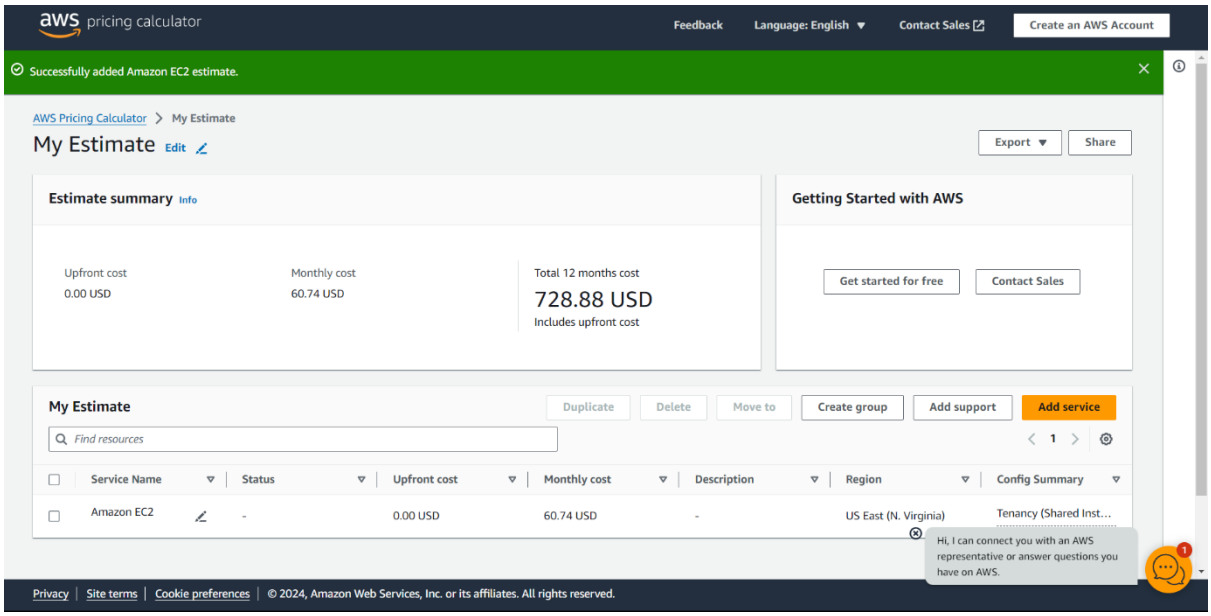


Figure 4: EC2 cost for web servers

Application Servers: The instance type for web servers should be 2 instances running on t3.large to run applications and backend services. Its monthly cost is around USD 60.30, and its yearly cost is USD 723.60, as seen in Figure 5.

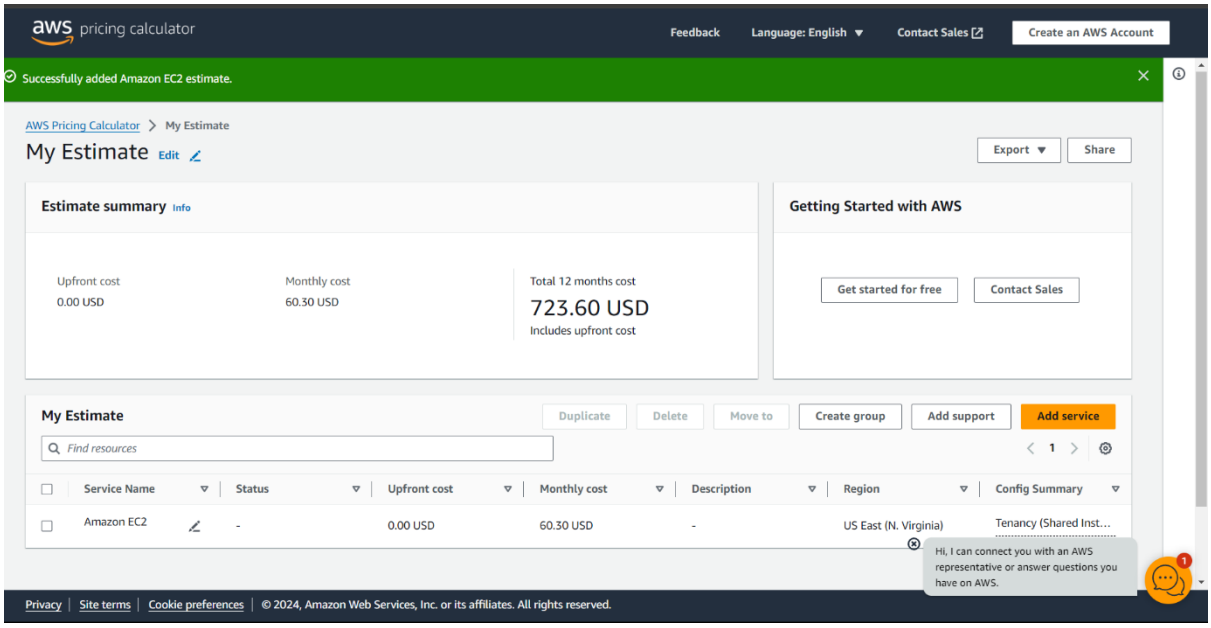


Figure 5: EC2 cost for application servers

Database Servers: The instance type for database servers should be 2 instances, one for primary and one for failure, running on t3.medium to store and manage client-sensitive data. Its monthly cost is around USD 30.08, and its yearly cost is USD 360.96 as seen in Figure 6.

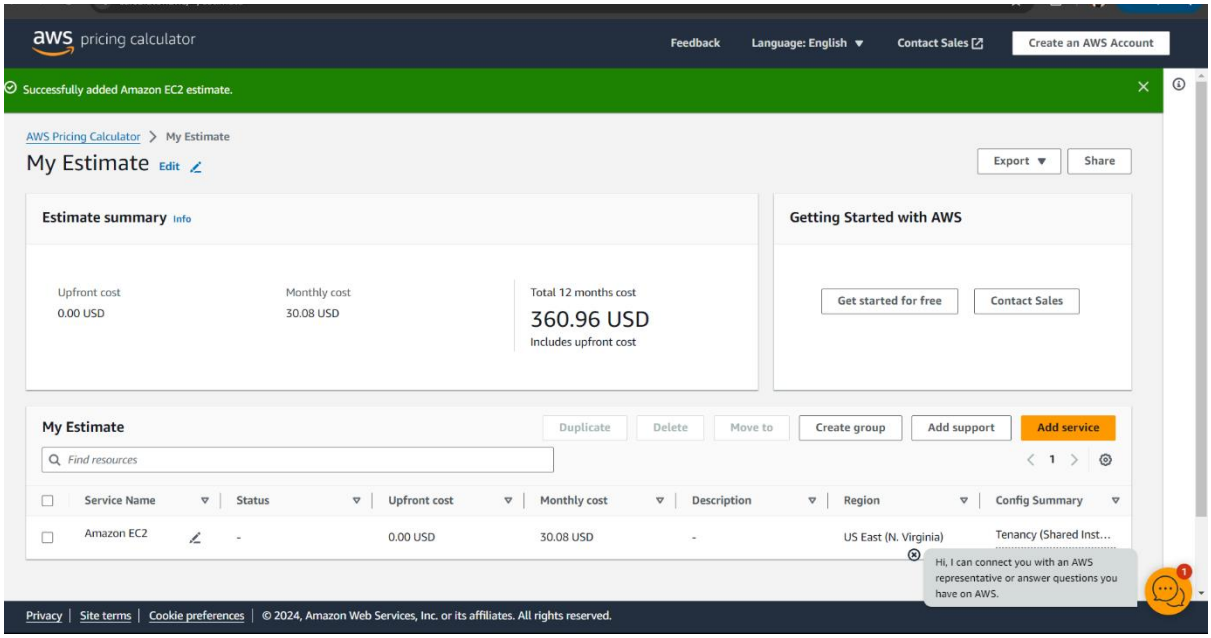


Figure 6: EC2 cost for database servers

File Storage: The instance type for file storage should be 1 instance running on t3.medium to store files, media, and backups. Its monthly cost is around USD 15.04, and its yearly cost is USD 180.48, as seen in Figure 7.

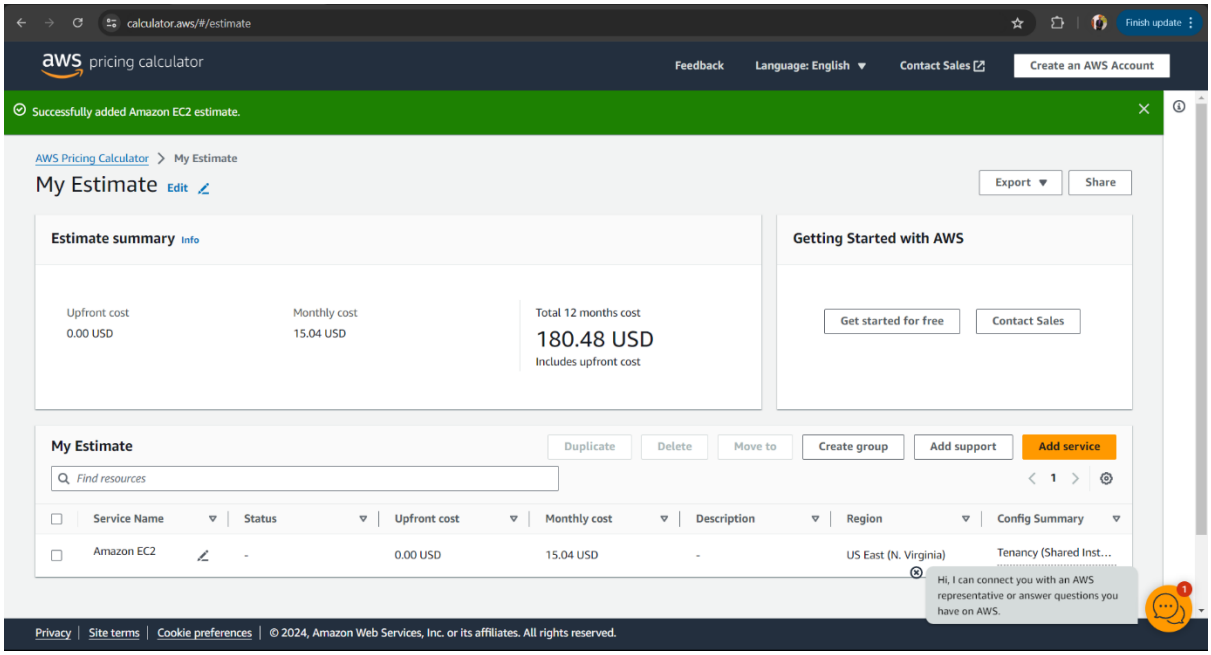


Figure 7: EC2 cost for file storage

Development and Testing: The instance type for code development and testing should be 2 instances running on t3.small for development, testing, staging, and production environments. Its monthly cost is around USD 15.04, and its yearly cost is USD 180.48, as seen in Figure 8.

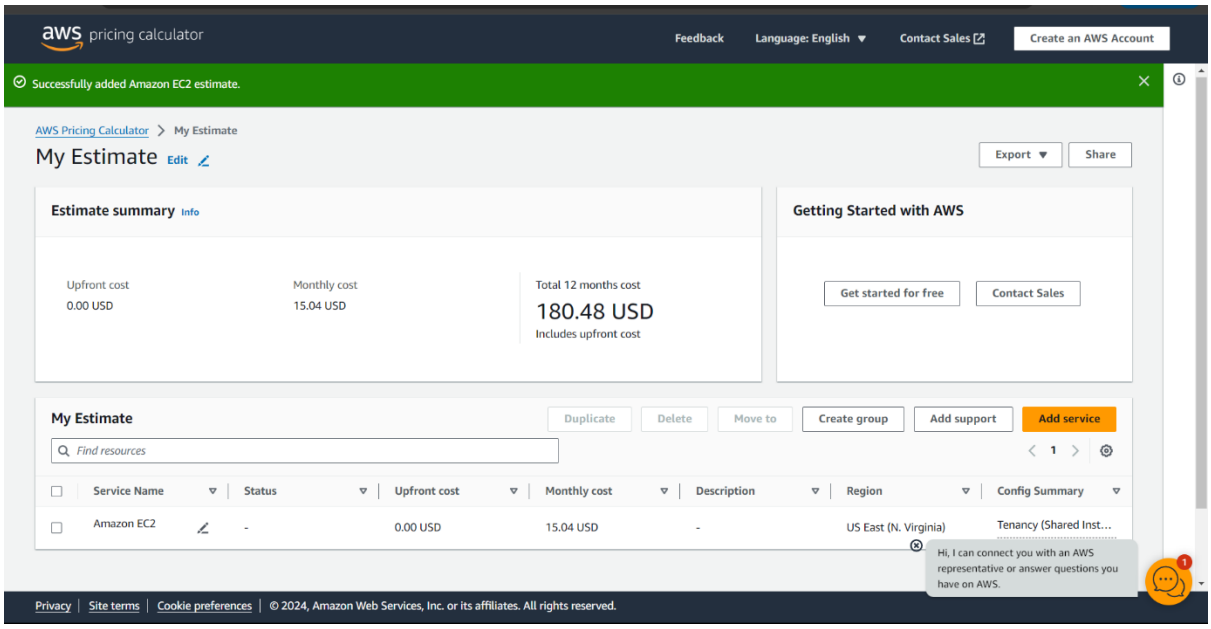


Figure 8: EC2 cost for development and testing

Backup & Maintenance: The instance type for backup & maintenance should be 1 instance running on t3.small for handling backups and maintenance tasks. Its monthly cost is around USD 7.52, and its yearly cost is USD 90.24, as seen in Figure 9.

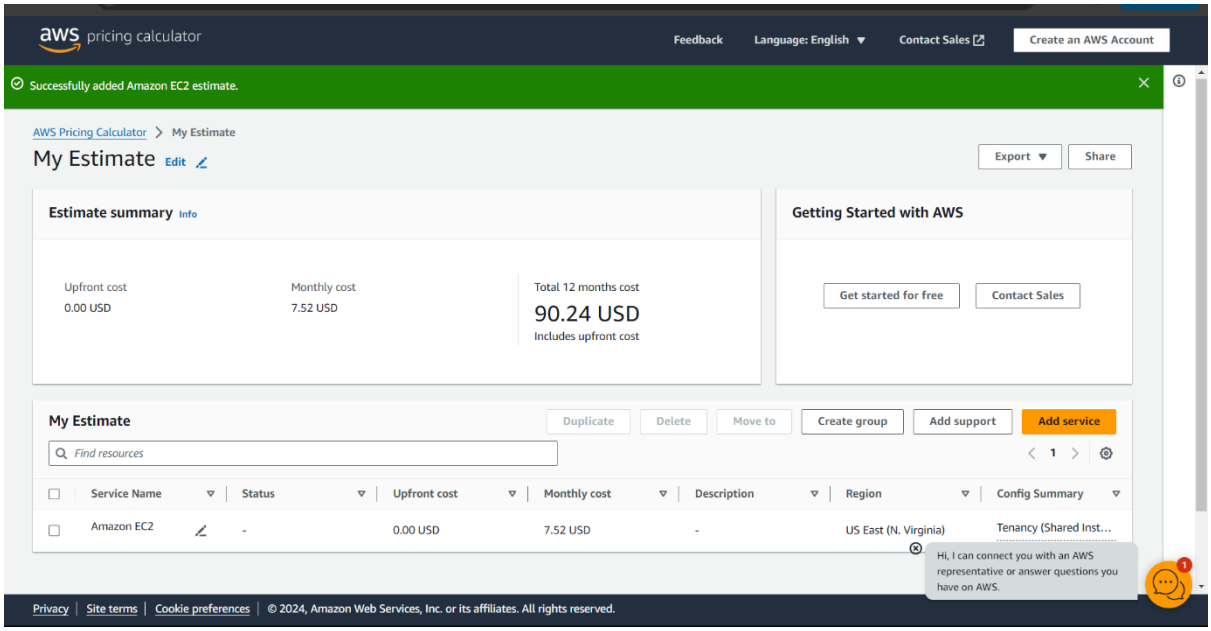


Figure 9: EC2 cost for backup & maintenance

Elastic Load Balancer: The elastic load balancer is used to distribute the traffic across web servers and applications. Its monthly cost is around USD 74.83, and its yearly cost is USD 897.96, as seen in Figure 10.

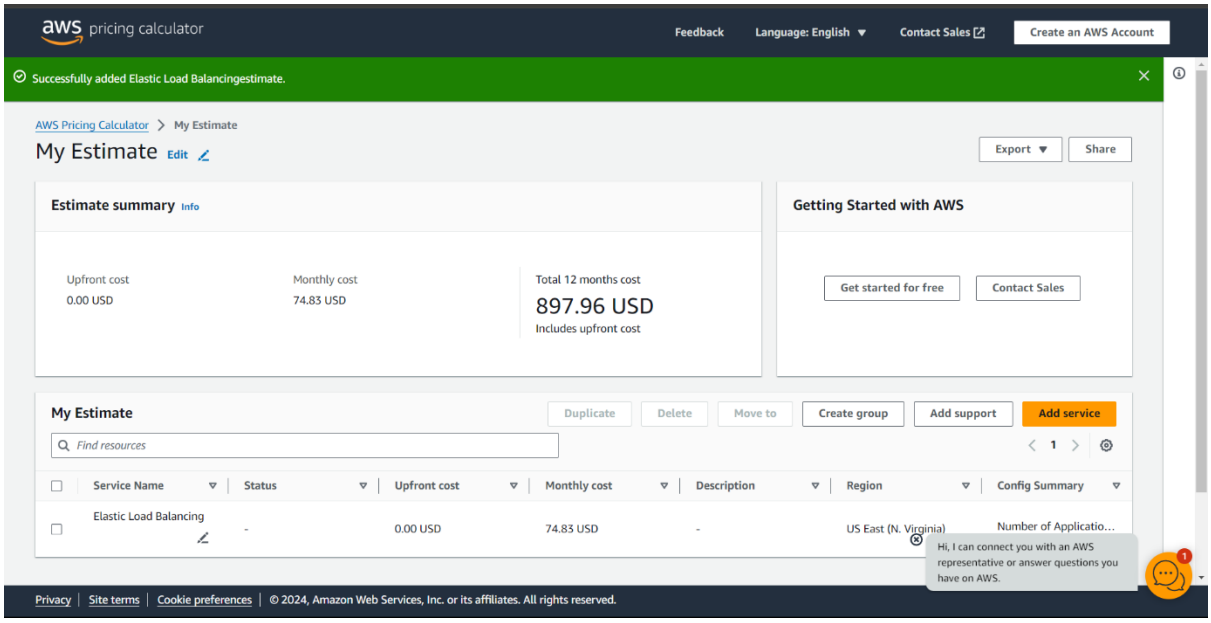


Figure 10: Elastic Load Balancer cost for distributing traffic

AWS RDS (Relational Database Service):

Amazon Relational Database Service is a collection of managed services that makes it simple to set up, operate, and scale databases in the cloud (**Amazon Web Services, n.d.).**

RDS can be broken down for different requirements:

Production Database: We are using 2 instances running on db.m5.large which can handle both general workloads and intensive applications at the same time and to ensure high availability. Its monthly cost is around USD 2420.32, and its yearly cost is USD 29043.84 as seen in Figure 11.

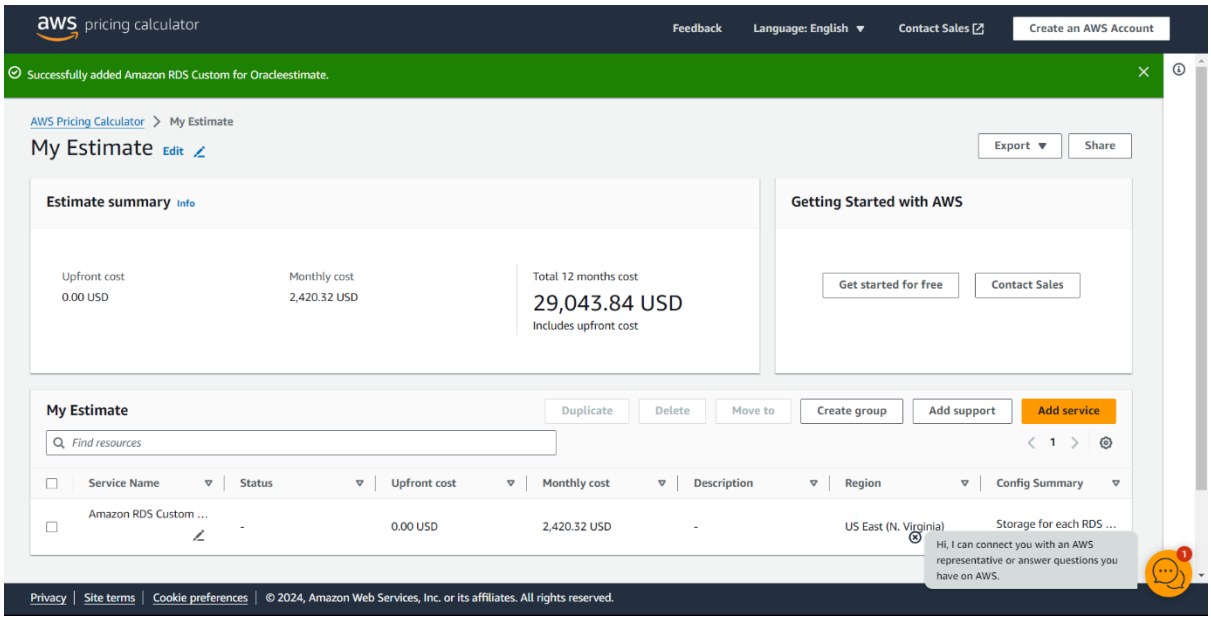


Figure 11: RDS cost for production database

Development and testing Databases: We are using 1 instance running on db.t3.medium for lightweight development and testing purposes. Its monthly cost is around USD 61.14, and its yearly cost is USD 733.68 as seen in Figure 12.

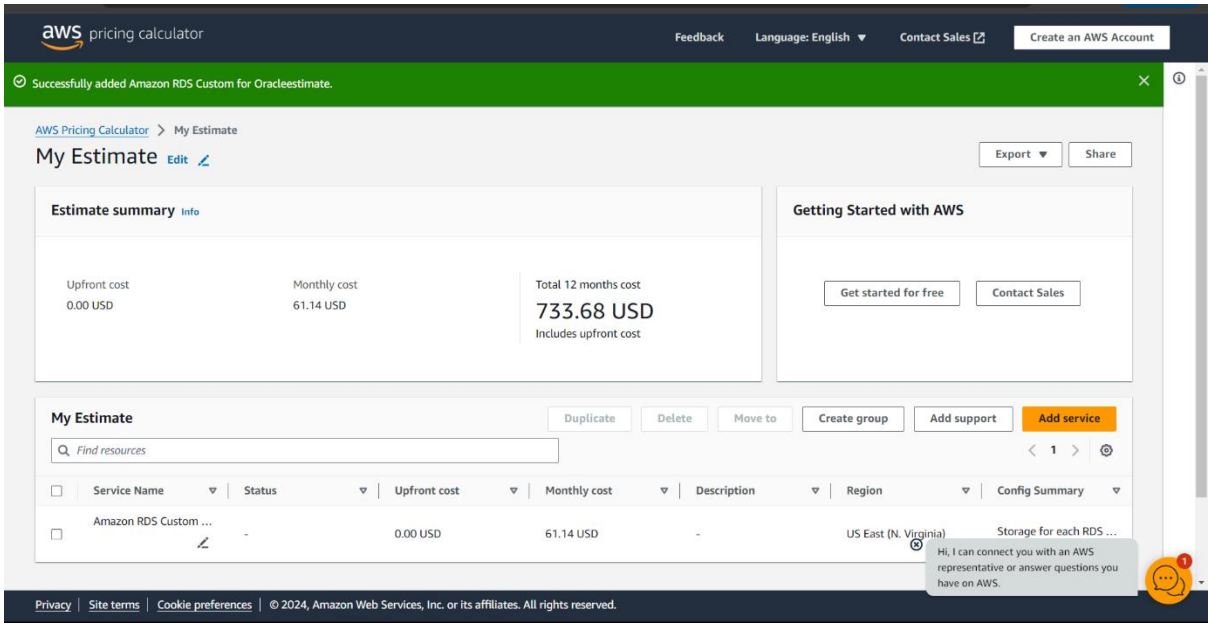


Figure 12: RDS cost for Development and Testing database

Backup and Maintenance: We are using 1 instance running on db.t3.medium for lightweight development and testing purposes. Its monthly cost is around USD 61.14, and its yearly cost is USD 733.68 as seen in Figure 13.

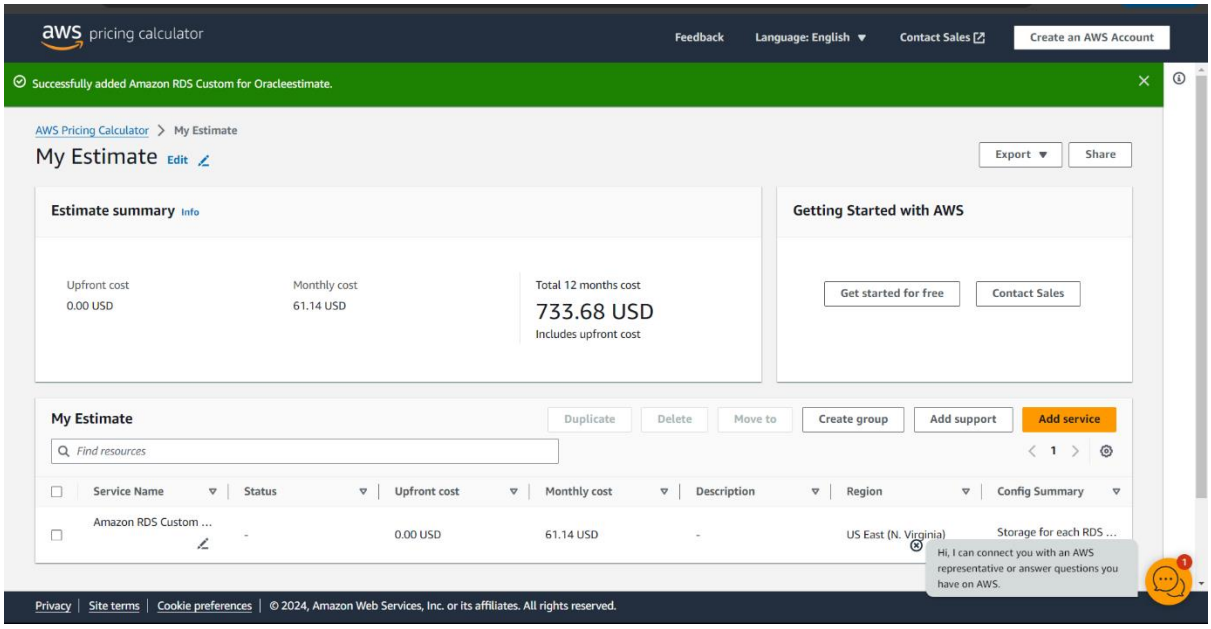


Figure 12: RDS cost for Backup and Maintenance

After going through the above two services, the monthly cost comes to **USD 2806.15,** and the yearly cost comes to **USD 33673.80.**

Sample Cloud Infrastructure Deployment

This sample deployment or Proof of Concept (POC) will demonstrate how we have set up an EC2 instance with a pre-defined IAM role, which is connected to a MySQL database hosted on RDS (Relational Database Service) and we are using CloudWatch to monitor both the instance and database. CloudWatch will send me a notification on my mail whenever an alarm is triggered.

Step By Step Deployment Procedure

Step 1: Create an IAM role.

Login to the AWS management console.
Navigate to IAM from the search bar.
Create a new role by clicking on the right-hand upper corner as shown in Figure 13.

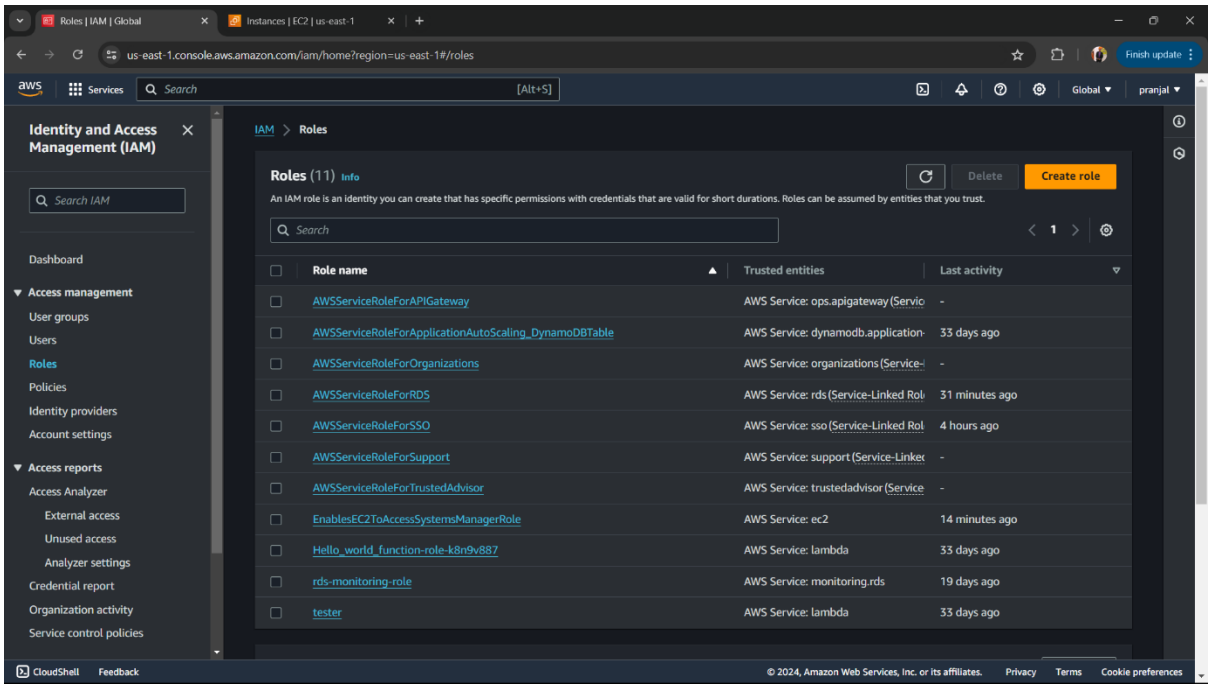


Figure 13: Creating a new IAM Role

In the Trusted entity choose ‘AWS Service’ and in use cases choose ‘EC2’ then click on next as shown in Figures 14 and 15.

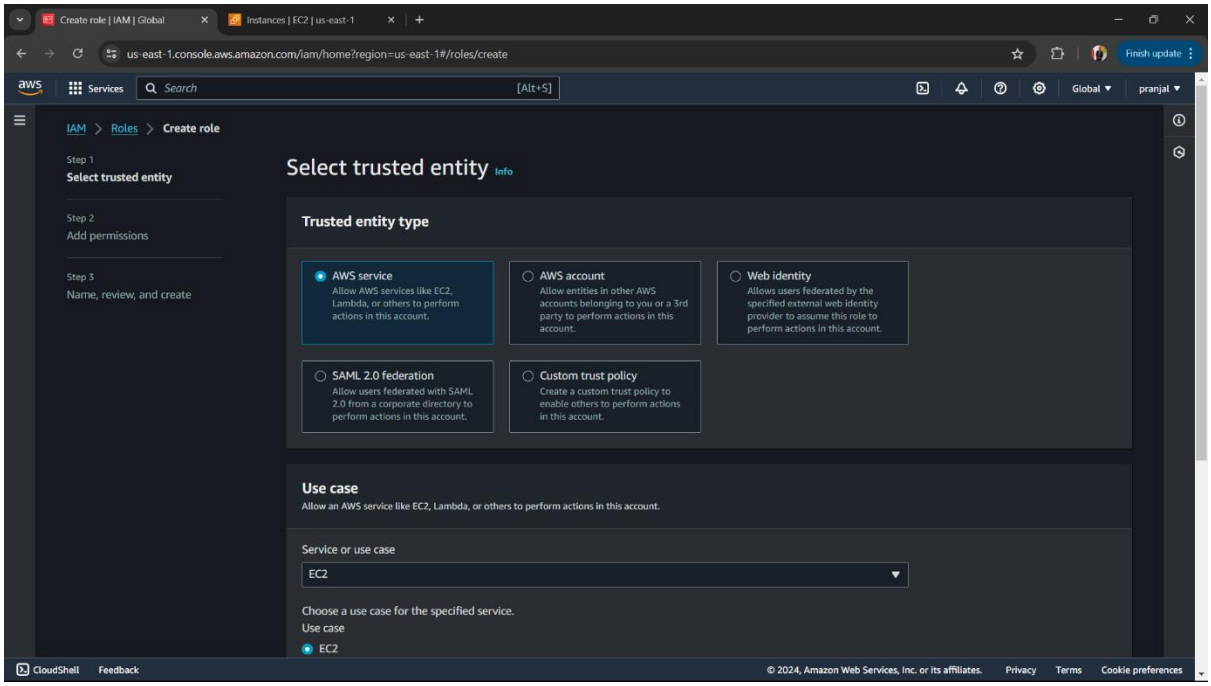


Figure 14: Choosing trusted entity

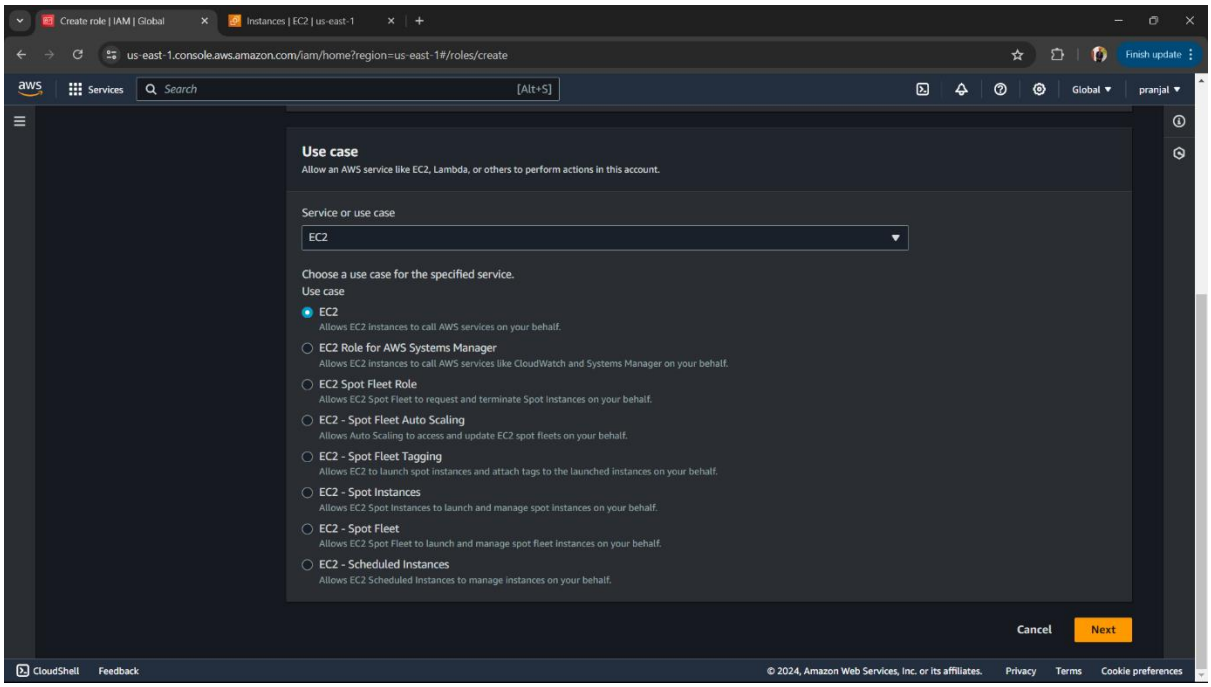


Figure 15: Click Next

Now, we must add permissions to it. Search for AmazonSSMManagedEC2InstanceDefaultPolicy and AmazonEC2Rolefor SSM and click on ‘Next’ as shown in Figure 16.

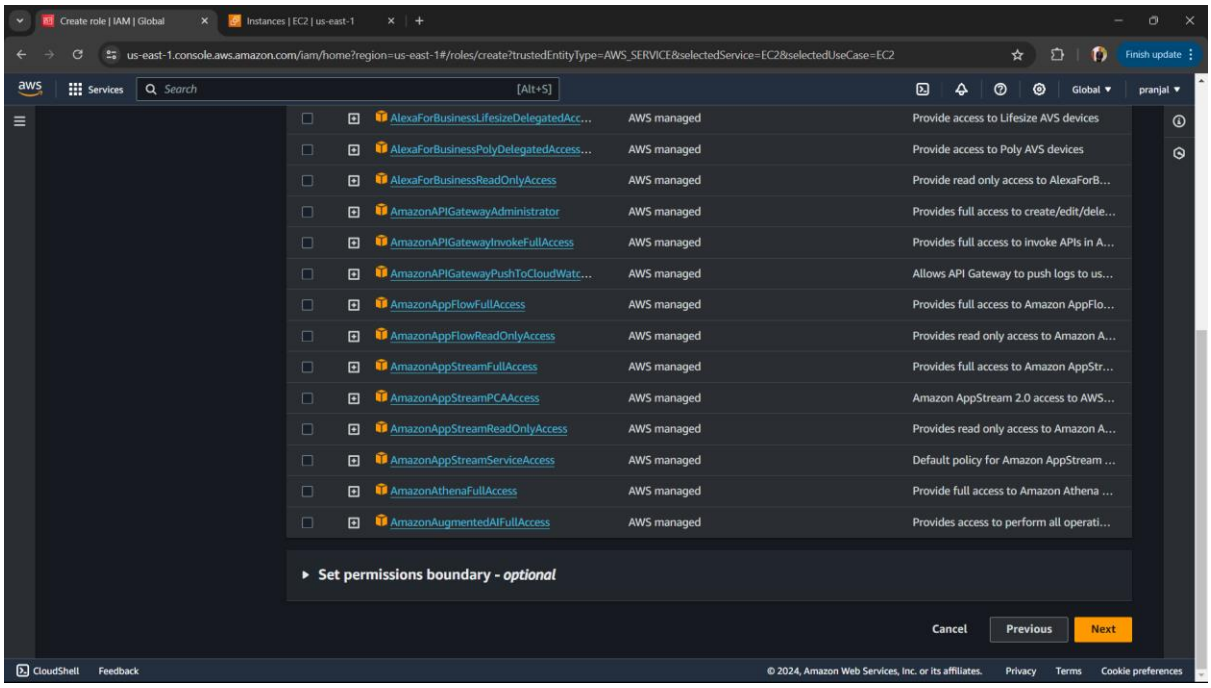


Figure 16: Adding permissions to IAM role.

Now add a role name and a description of what the role is about as seen in Figure 17 and after reviewing it click on ‘Create Role’ as shown in Figure 18.

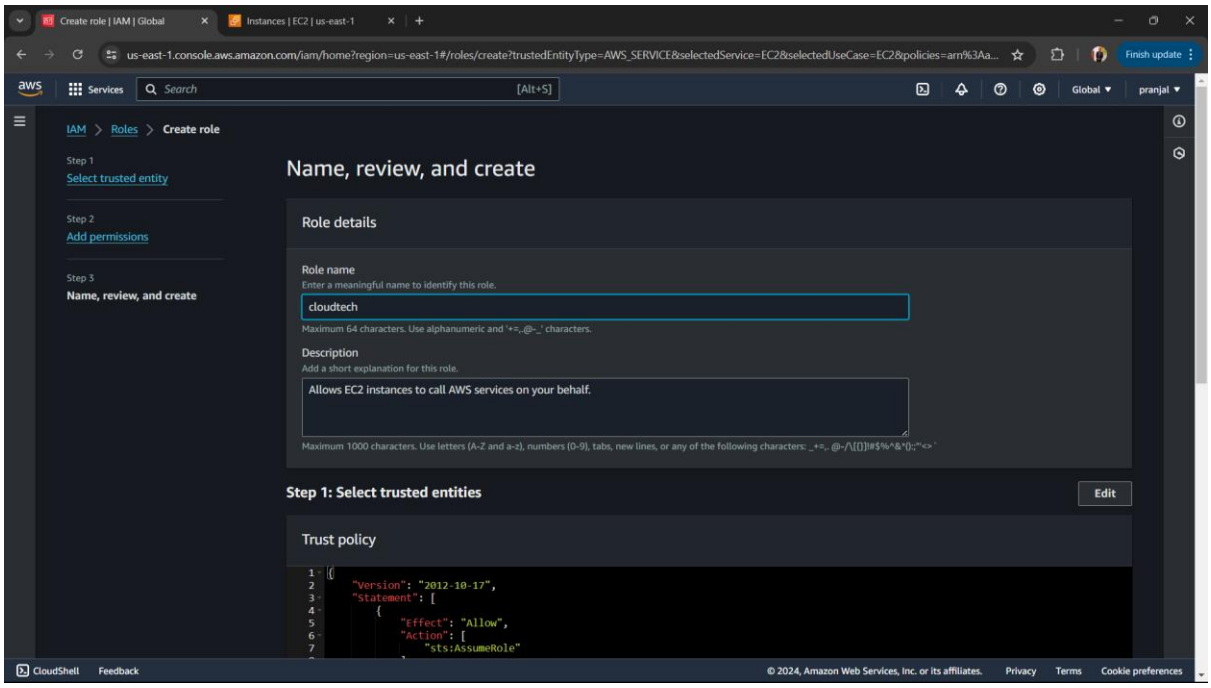


Figure 17: Adding name and description

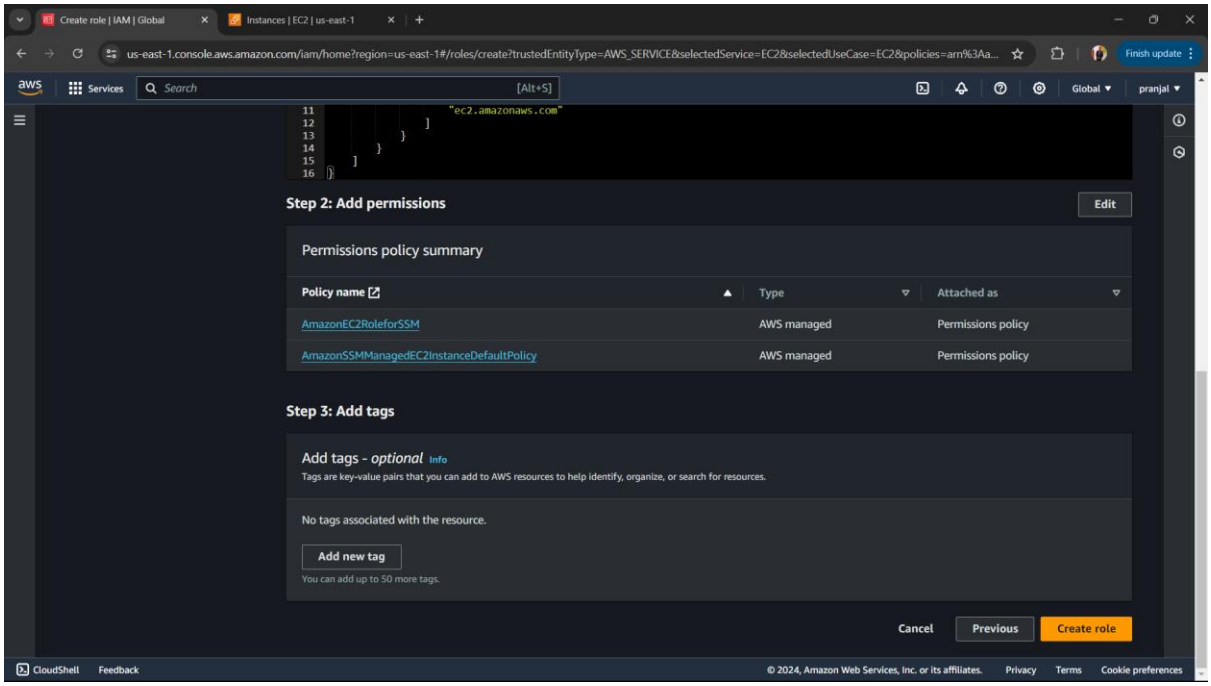


Figure 18: Reviewing details and creating role.

You will be able to see the role created in the IAM dashboard as seen in Figure 19.

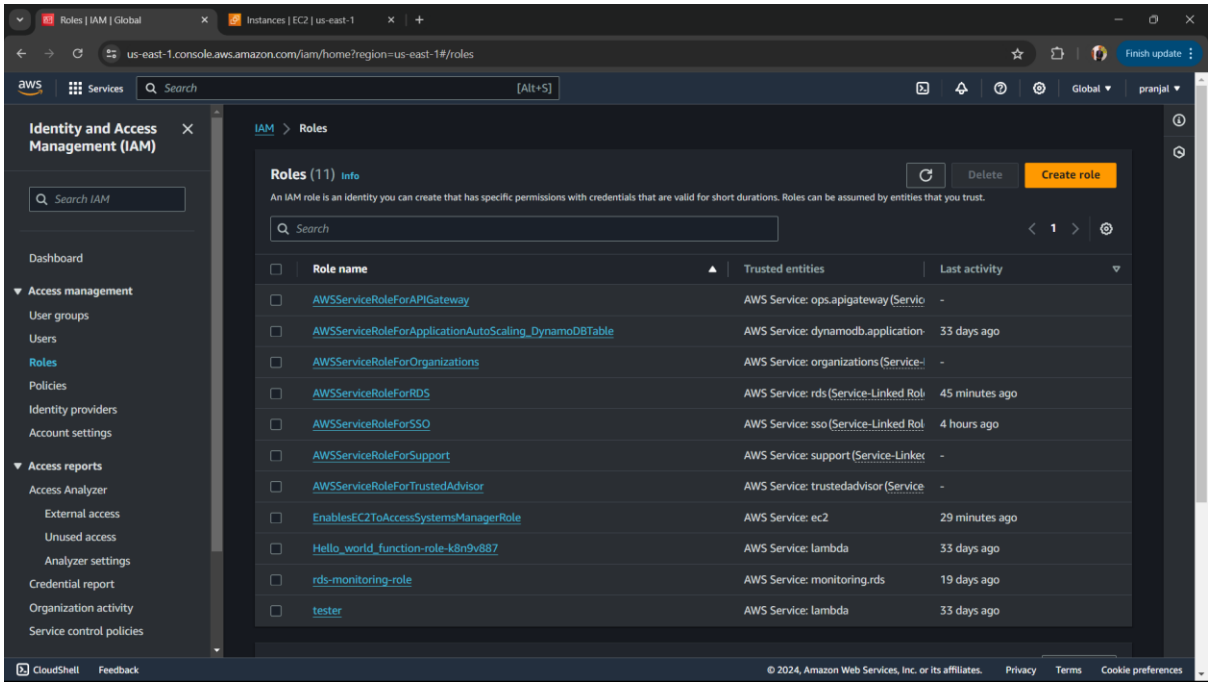
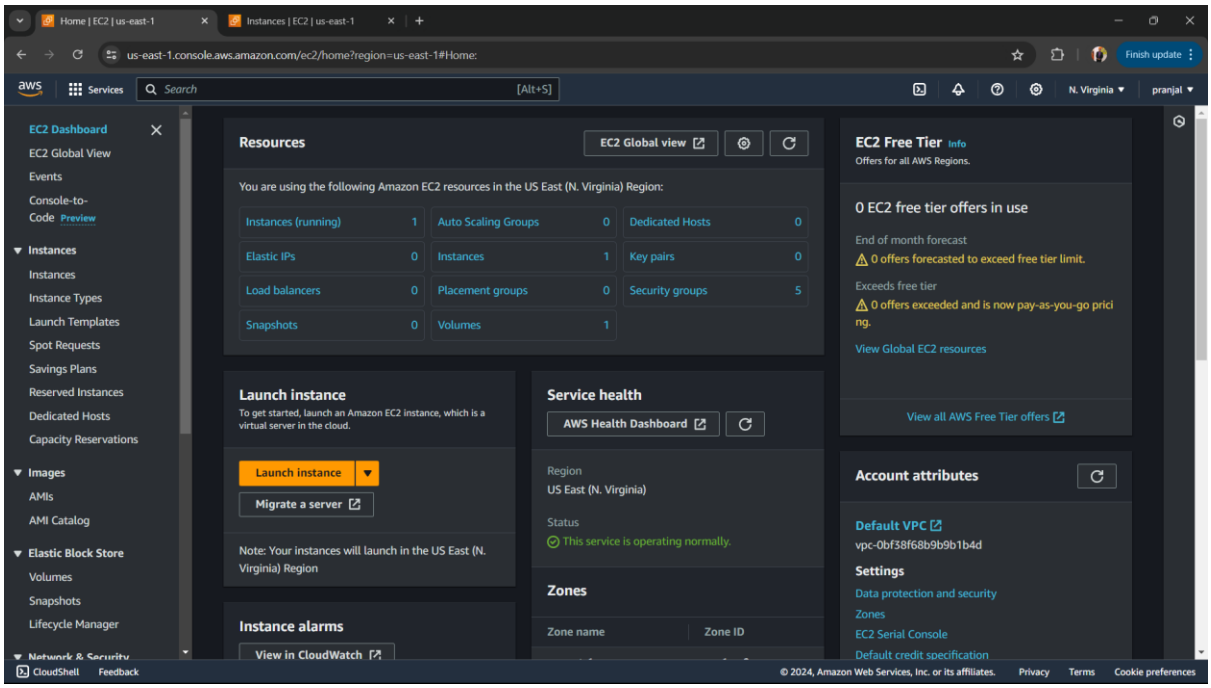


Figure 19: IAM Dashboard

Step 2: Creating an EC2 instance

Navigate to the EC2 dashboard and click on launch instance as shown in Figure 20.



Give a name to the instance and in the application and OS images select ‘Ubuntu’ as shown in Figure 21.

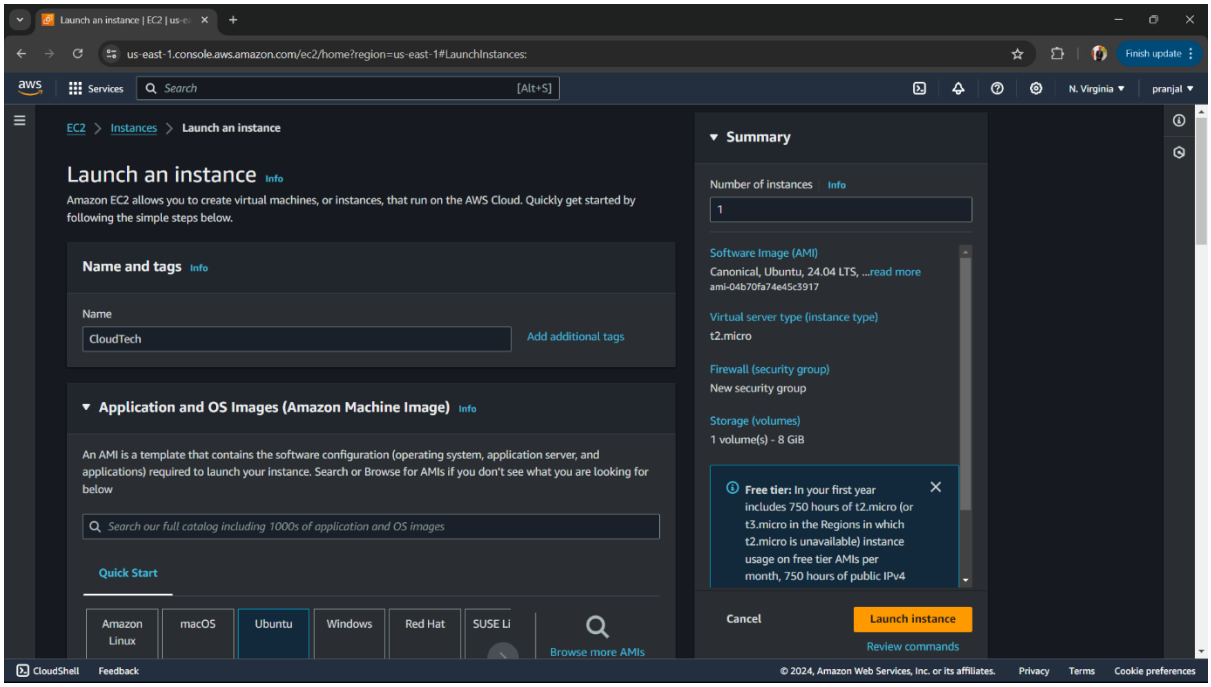


Figure 21: Launching an instance

In the AMI (Amazon Machine Image) choose the free tier and architecture as shown in Figure 22.

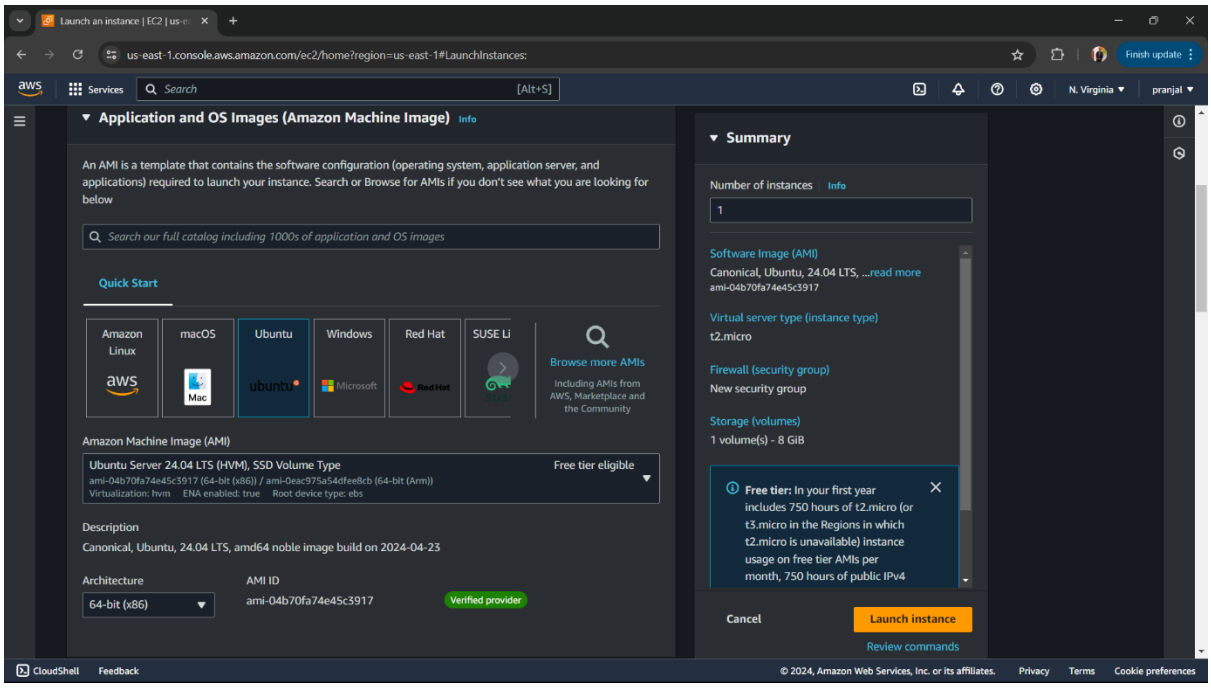


Figure 22: Choosing OS image

In the instance type choose t2.micro (free tier) and proceed without using a key-pair as shown in Figure 23.

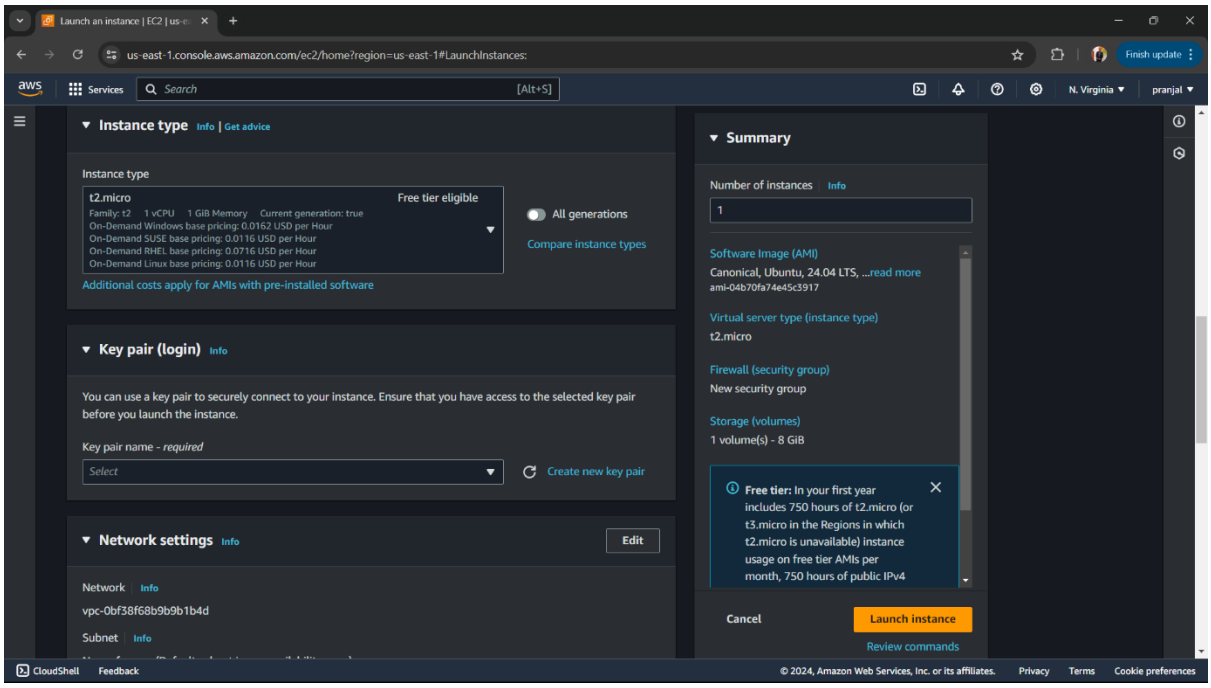


Figure 23: Choosing instance type

Now, in the Network Settings leave all the settings as default, no changes are to be made in it as shown in Figure 24.

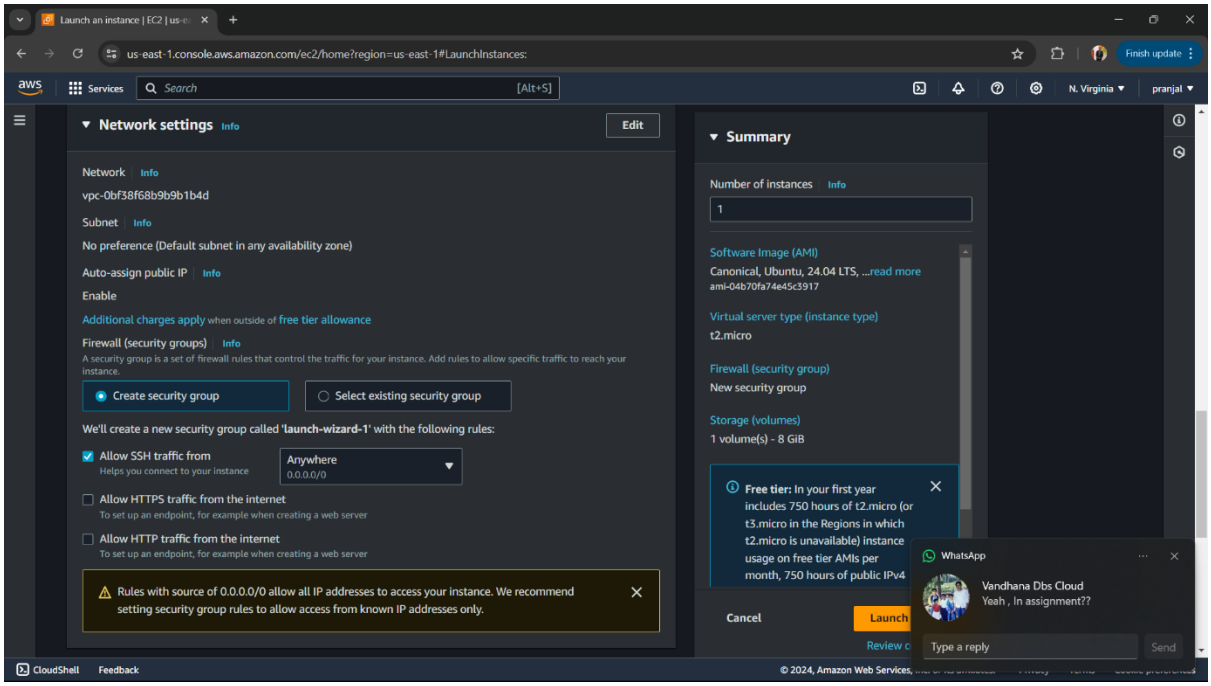


Figure 24: Choose the default in Network Settings

In the advanced settings, choose the IAM role we have created in Step 1, in the IAM Instance profile. This will attach the created role to our EC2 instance as shown in Figure 25 and click on 'Launch Instance' to launch the instance.

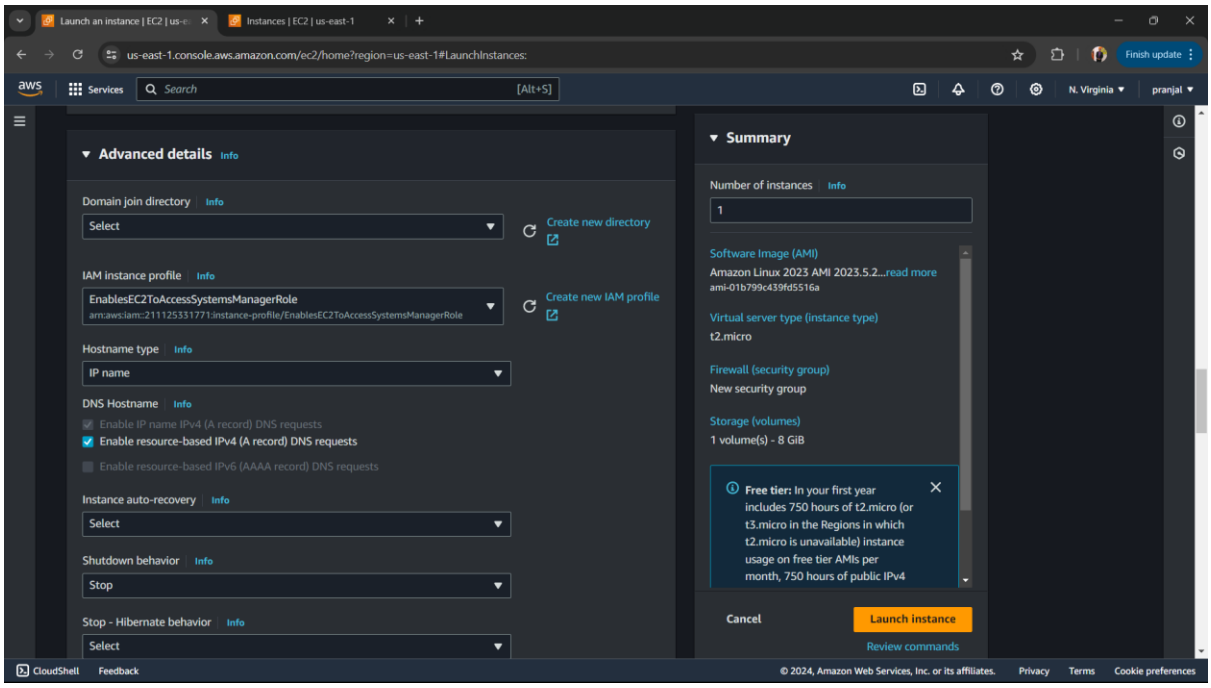


Figure 25: Connecting IAM role to EC2 instance and Launch instance

Step 3: Creating RDS and attaching it to our EC2 instance

Search for the service RDS in the console and open the service. Click on ‘Create Database’ and choose a ‘standard create’ and in the engine options choose ‘MySQL’ as shown in Figure 26.

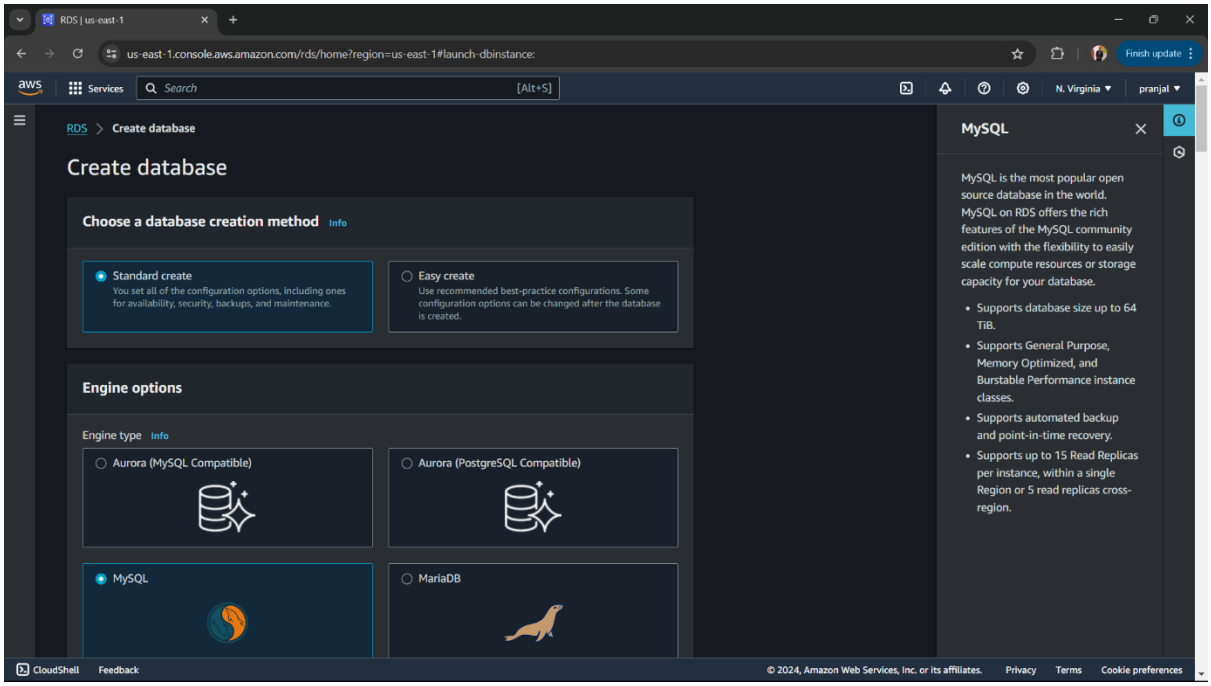


Figure 26: Creating a database

In the templates, choose ‘Free Tier’ and leave the Availability and durability as default as shown in Figure 27.

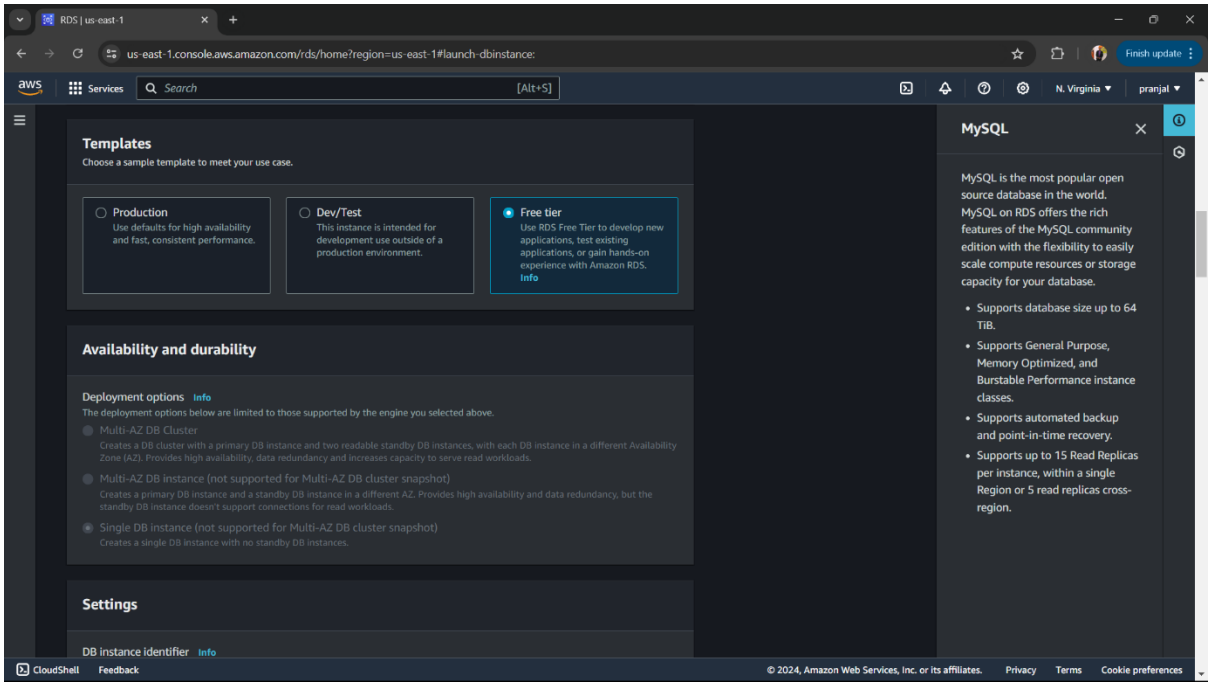


Figure 27: Choosing a template

In settings, give a name in the DB Instance identifier. We must create credentials for restricting access to it and create a username and password as shown in Figure 28.

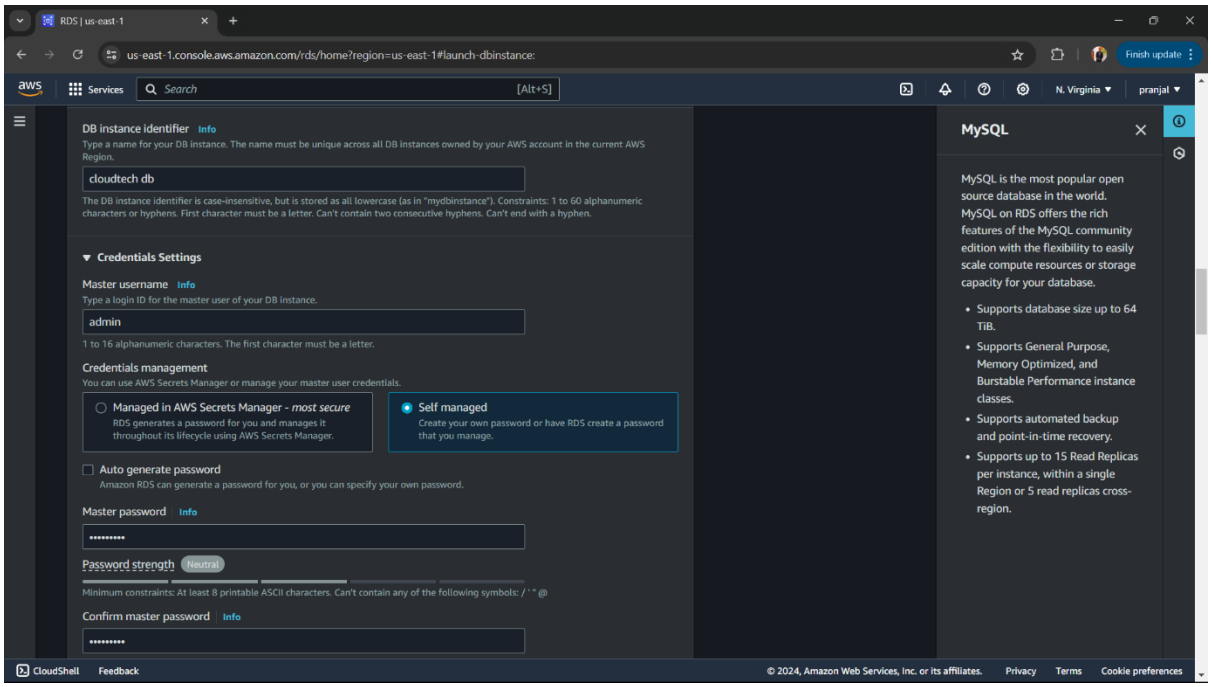


Figure 28: Creating credentials for access

In the instance configuration, choose ‘burstable classes’ as shown in Figure 29.

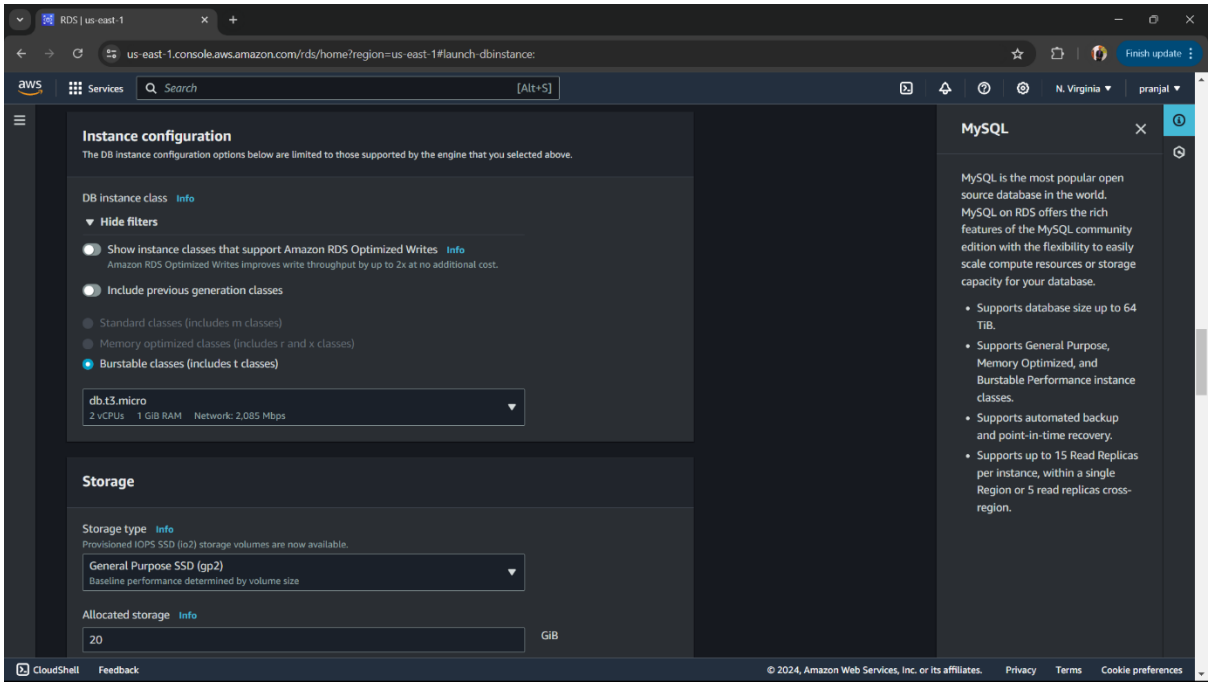


Figure 29: Instance Configuration settings

In the storage settings, enable storage autoscaling to dynamically increase the storage if the threshold is crossed as shown in Figure 30.

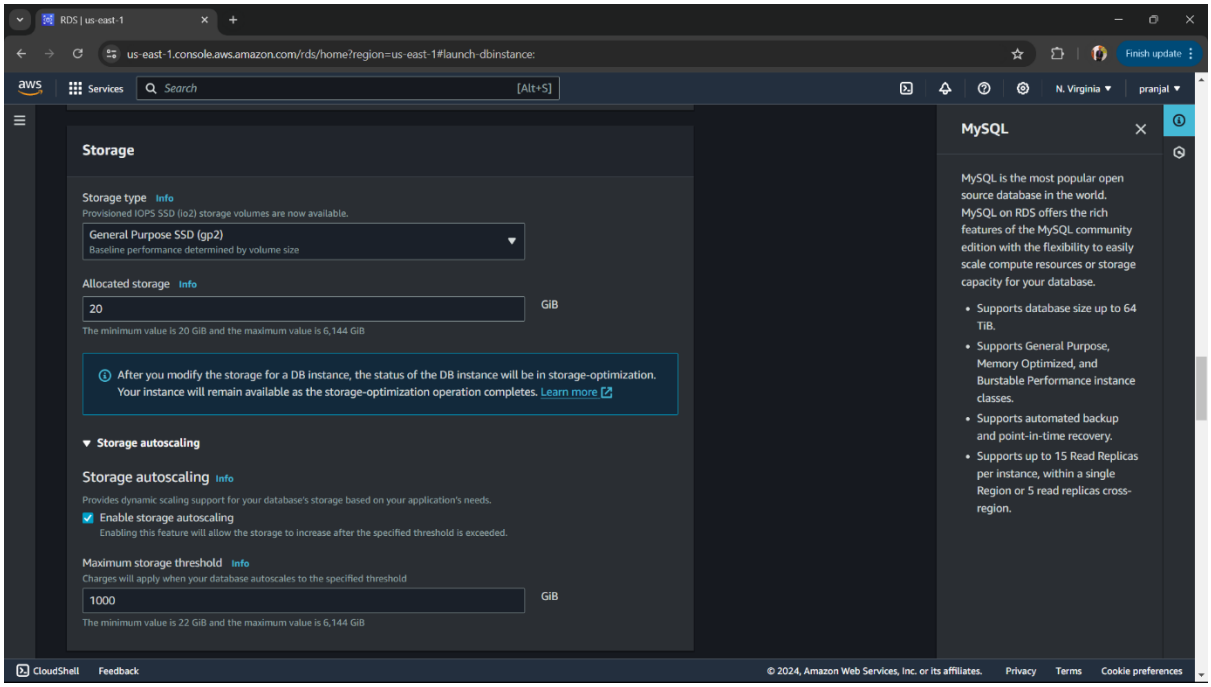


Figure 30: Storage settings

In connectivity, choose ‘connect to an EC2 instance’ and choose the instance we created in the previous step as shown in Figure 31.

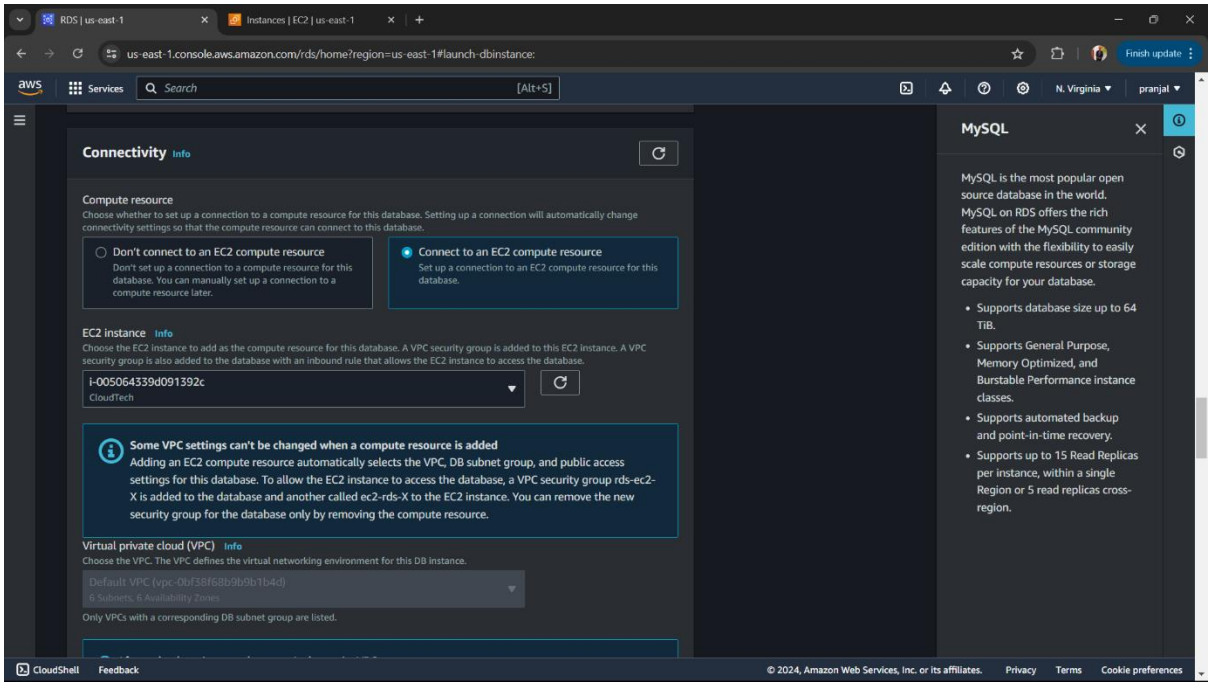


Figure 31: Connecting to EC2 instance.

In the DB subnet group, choose ‘automatic setup’, and do not give public access as shown in Figure 32.

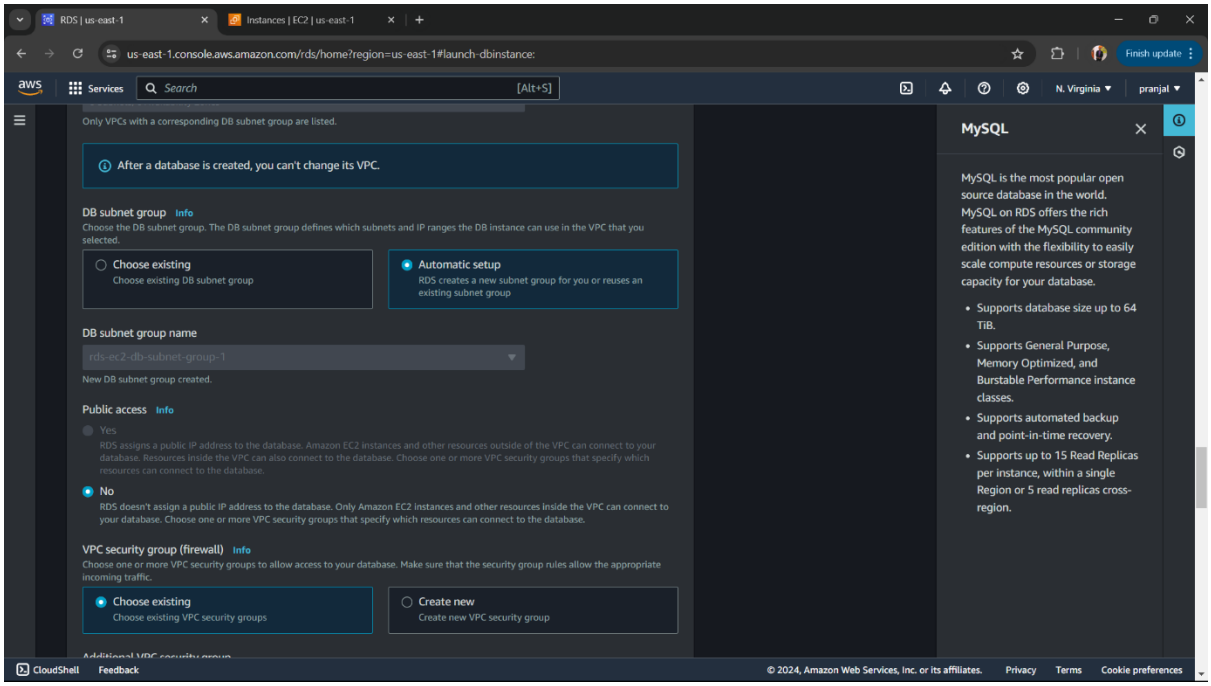


Figure 32: Choosing DB subnet group

In the VPC (Virtual Private Cloud), create a new VPC and give it a name as shown in Figure 33 and 34.

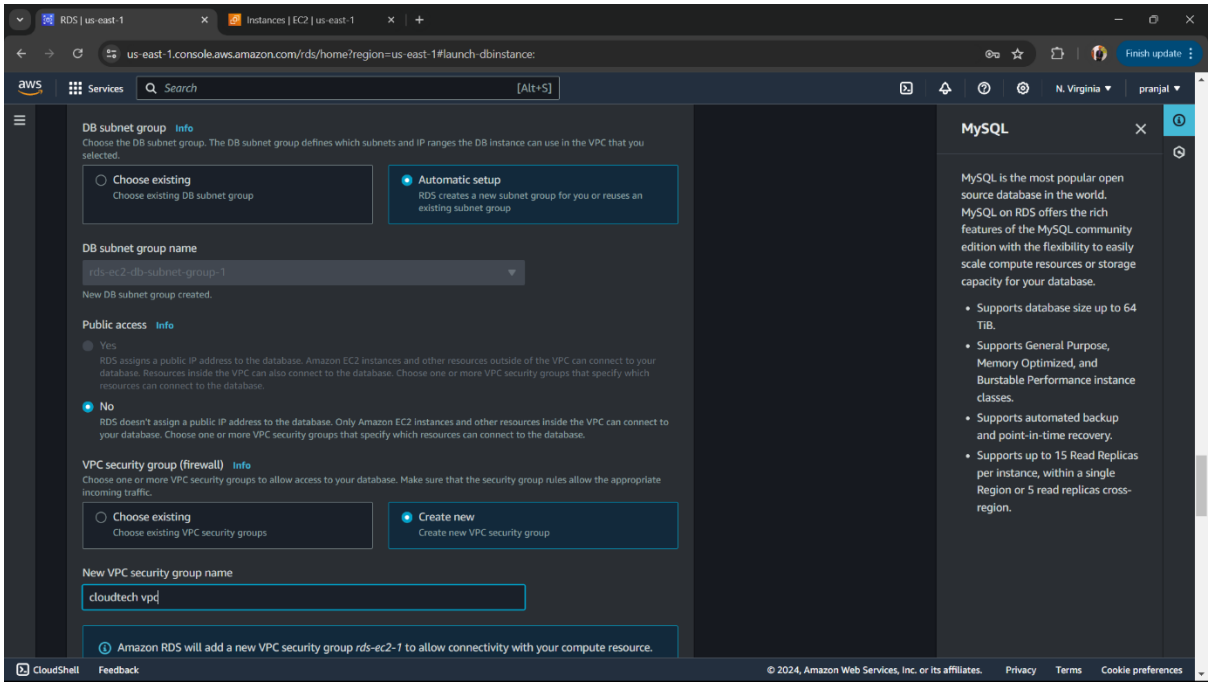


Figure 33: Creating VPC

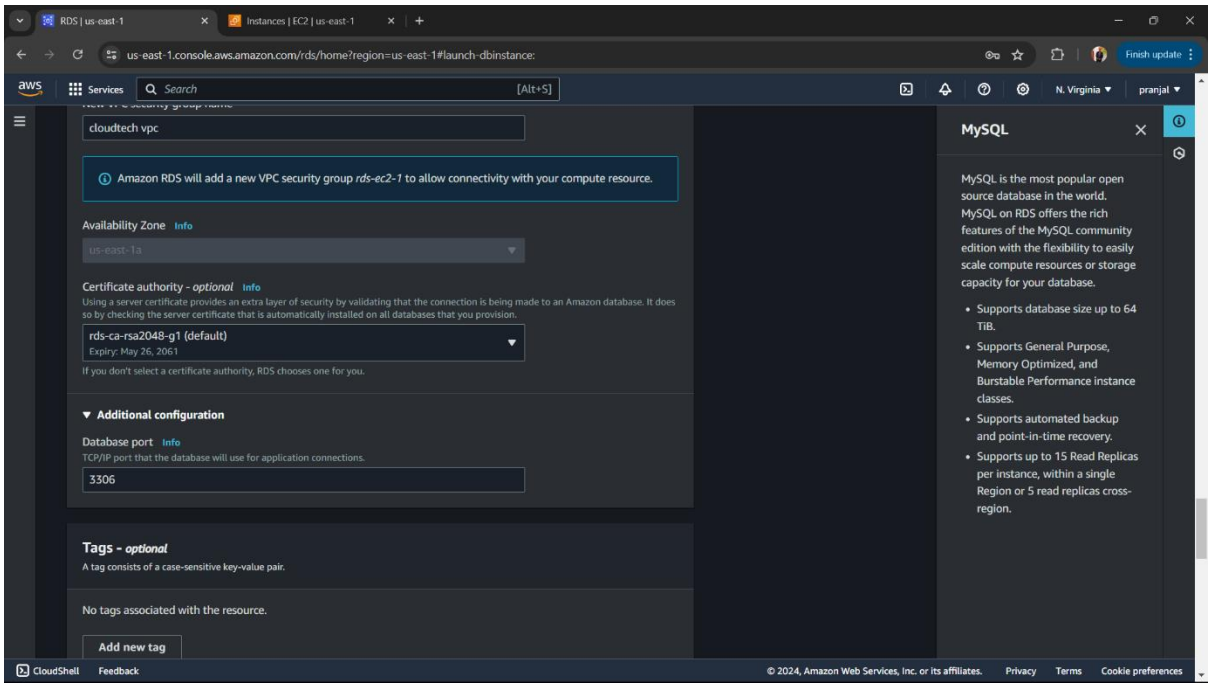


Figure 34: Creating VPC

Enable encryption, then note down the KMS (Key Management System) ID and click on ‘create’ to finish setting up RDS which is connected to EC2 as shown in Figure 35.

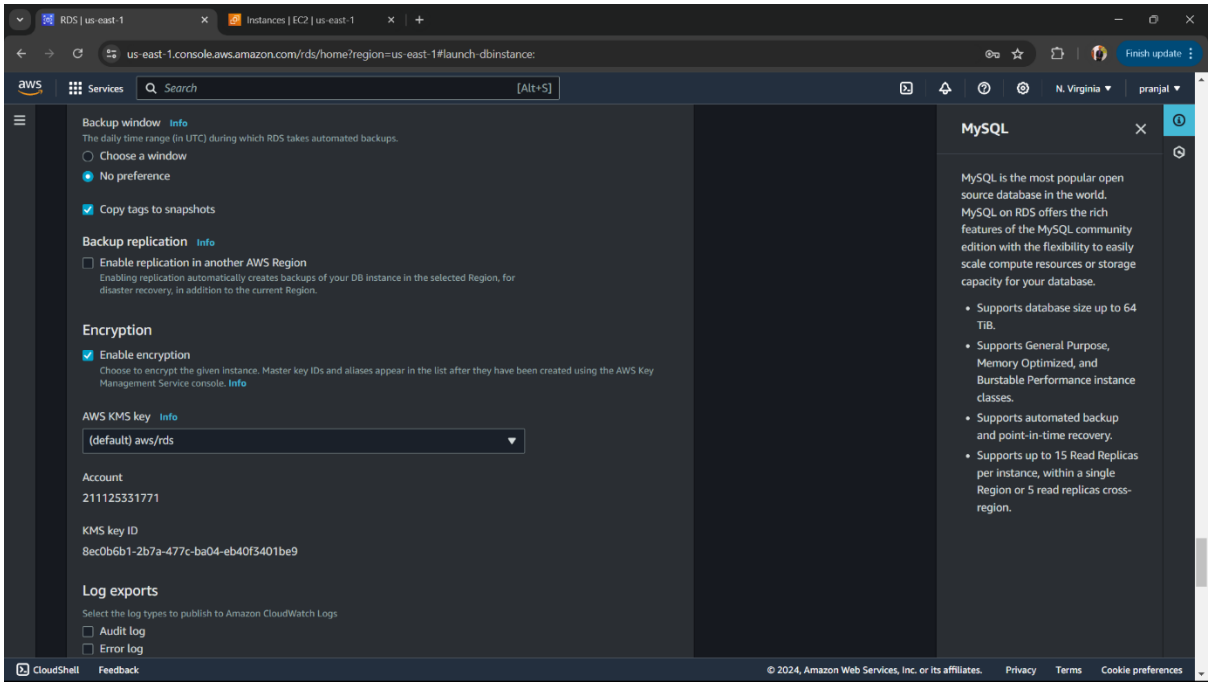


Figure 35: Encryption and finalizing creation

Step 4: Enabling CloudWatch to view logs

Search for CloudWatch in the console, then go to alarms and click on ‘create alarm’ as shown in Figure 36.

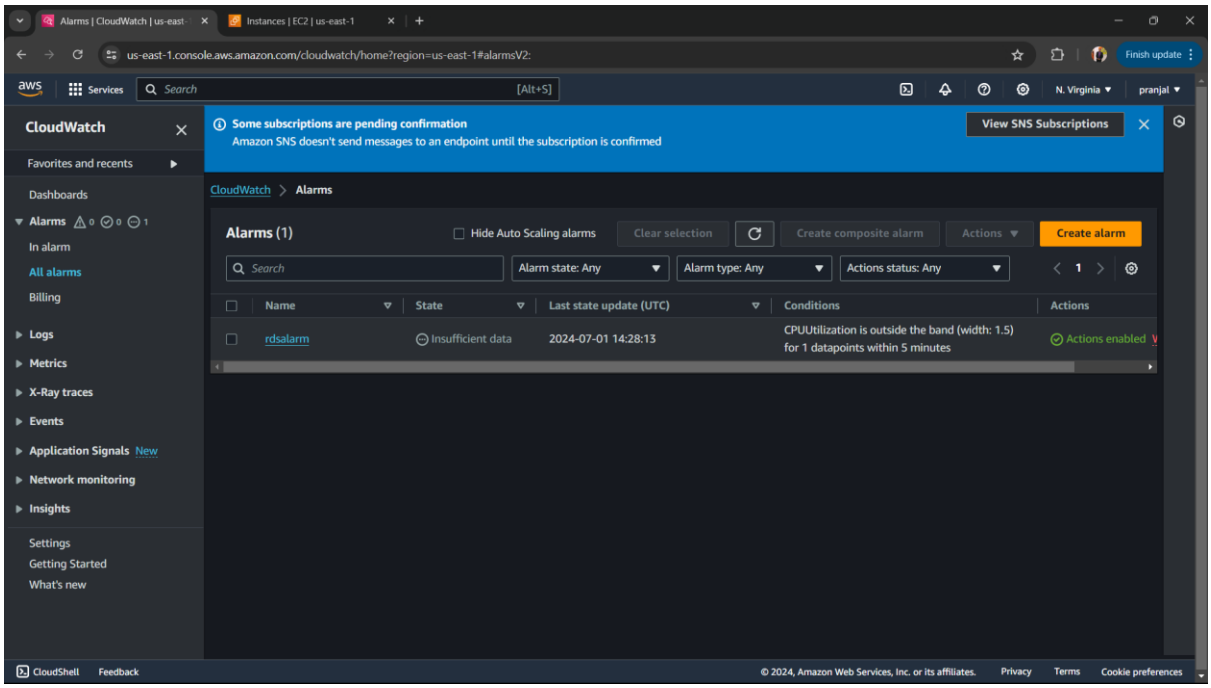


Figure 36: Creating alarm using CloudWatch

Now, we must choose which service we need alerts on. Click on EC2 and you will find several services that can be monitored, choose any service that needs to be monitored and click on 'Select Metric' as shown in Figure 37.

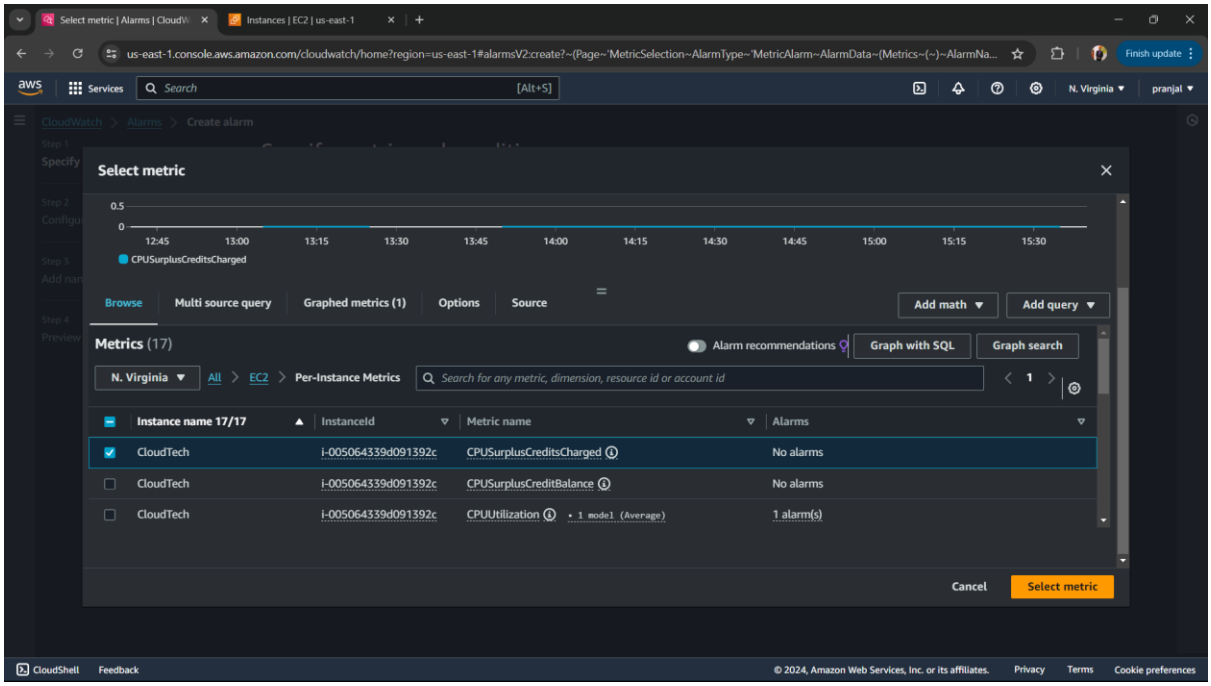


Figure 37: Choosing Metric

You will see a graph displaying the chosen metric as seen in Figure 38.

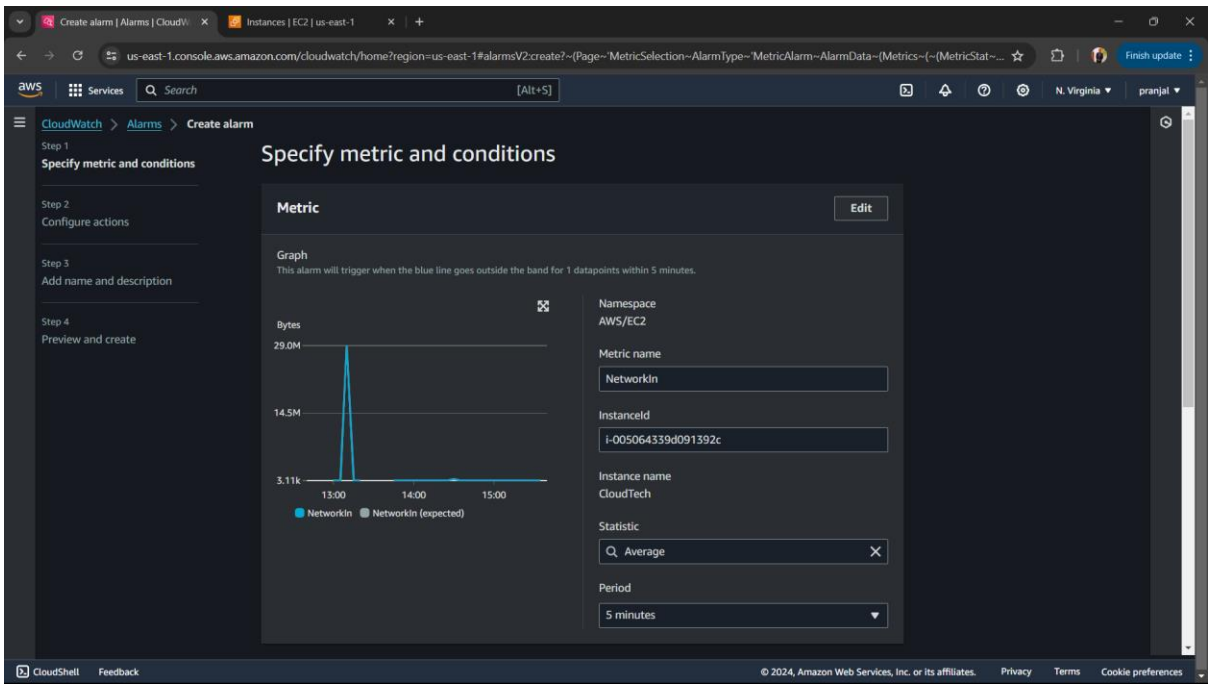


Figure 38: Specifying metric and conditions.

Now, in the conditions, choose ‘Anomaly Detection’ then specify the threshold and click on Next as shown in Figure 39.

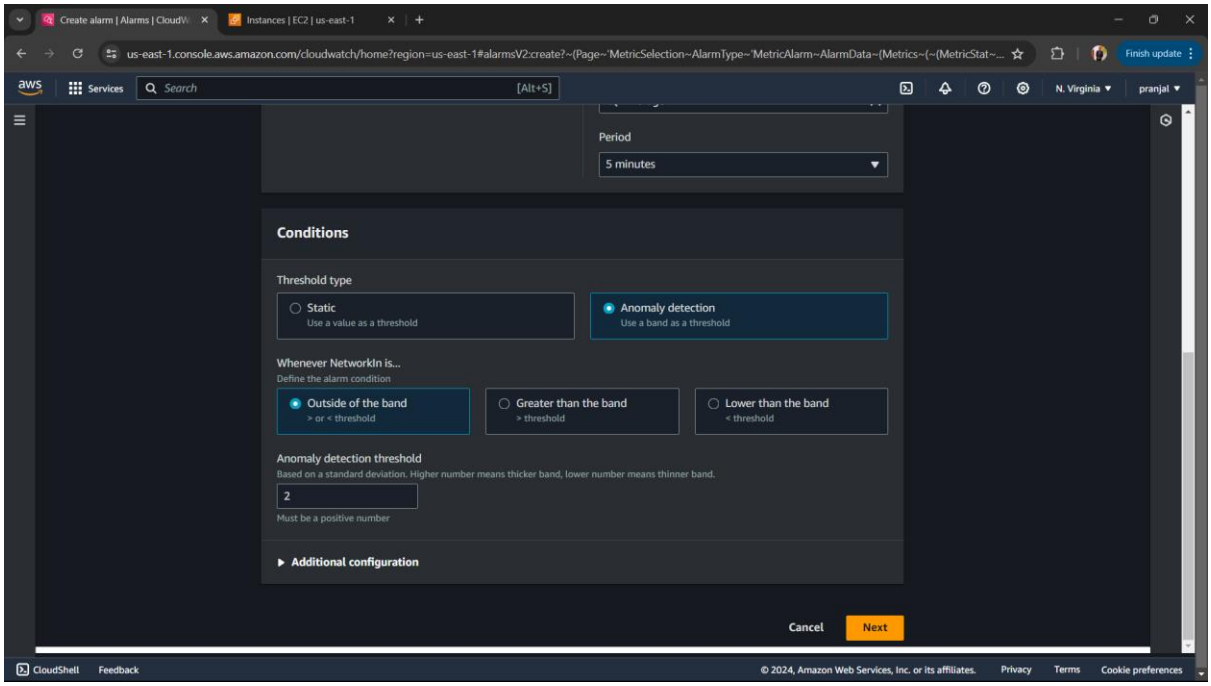


Figure 39: Choosing conditions

In the notifications section, choose the trigger you want, create a new topic, and add the mail of the person who wants to be notified when this alarm is triggered as shown in Figure 40.

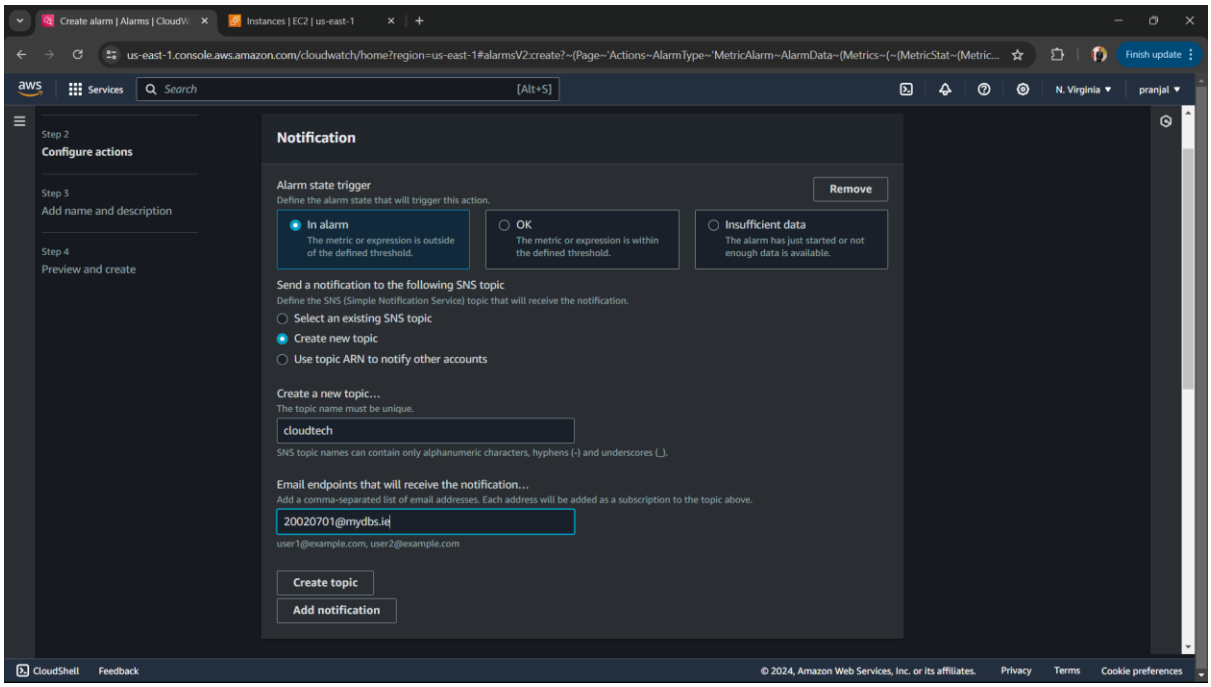


Figure 40: Creating topic and selecting alarm state trigger

Add a name and description for the trigger, review all the details, and click on create, as seen in Figure 41.

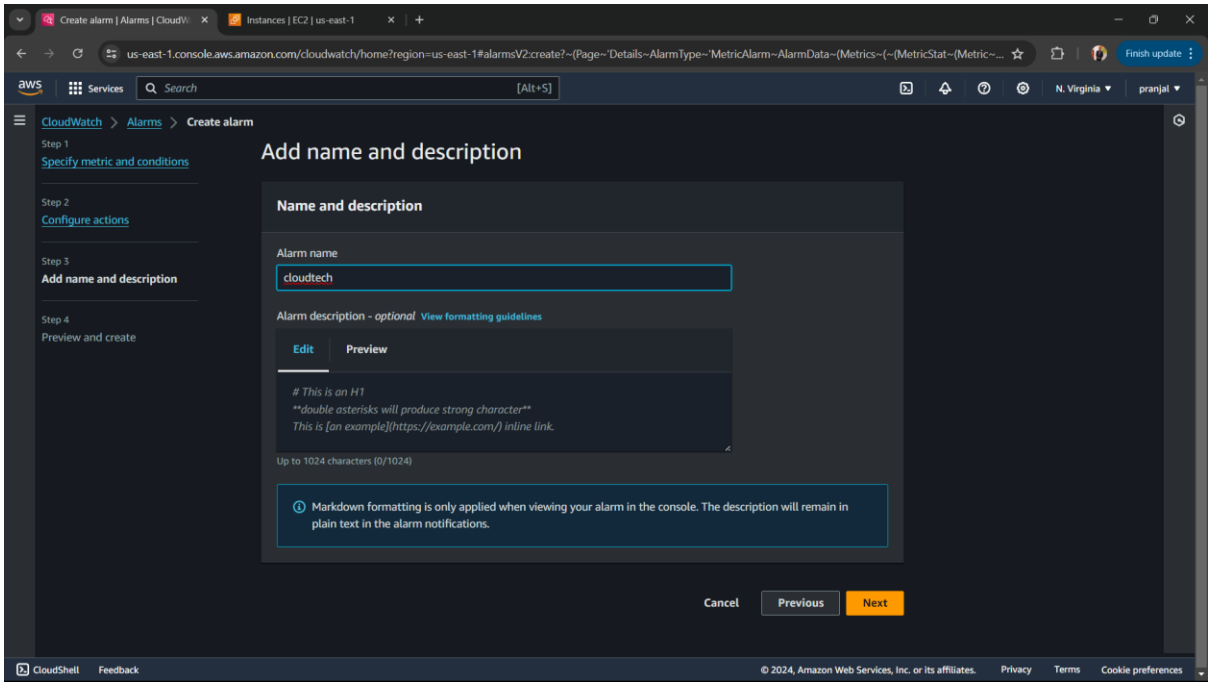


Figure 41: Adding name, and description to the trigger.

Now, review all the details and click on 'create alarm' to finish creating an alarm for the instance as shown in Figures 42 and 43.

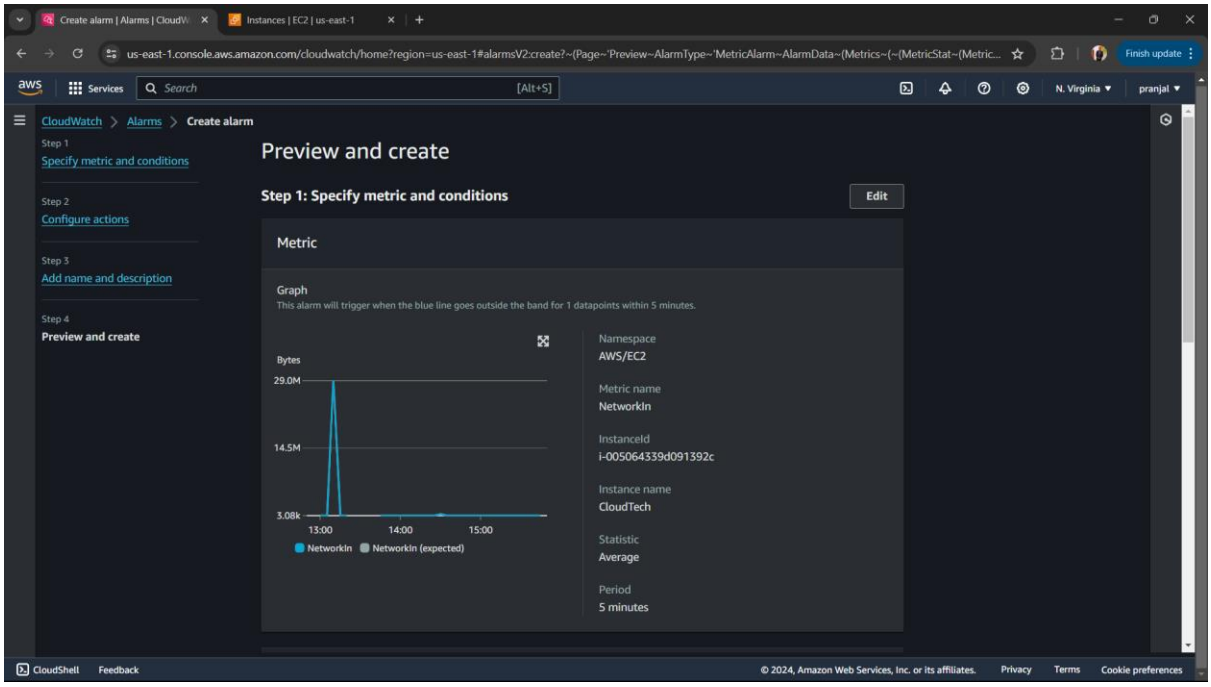


Figure 42: Reviewing the metric and conditions

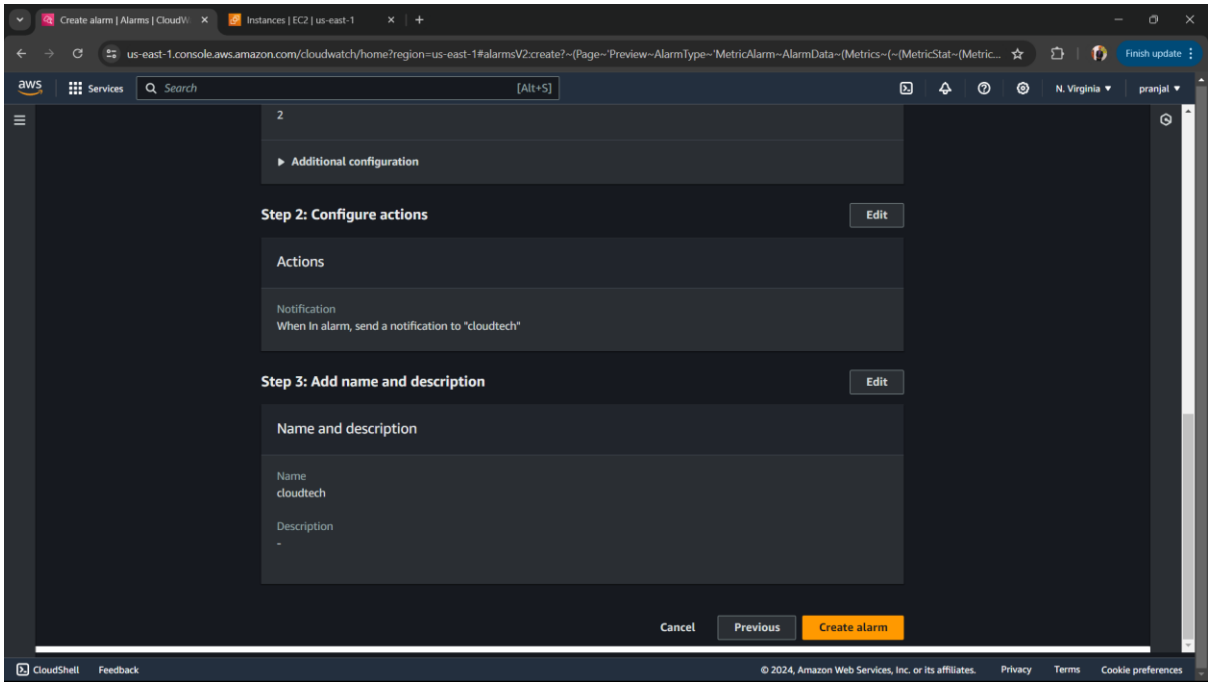


Figure 43: Create Alarm

Now search for the EC2 instance in the console and go to it to view all the services attached to the newly created instance as shown in the following Figures.

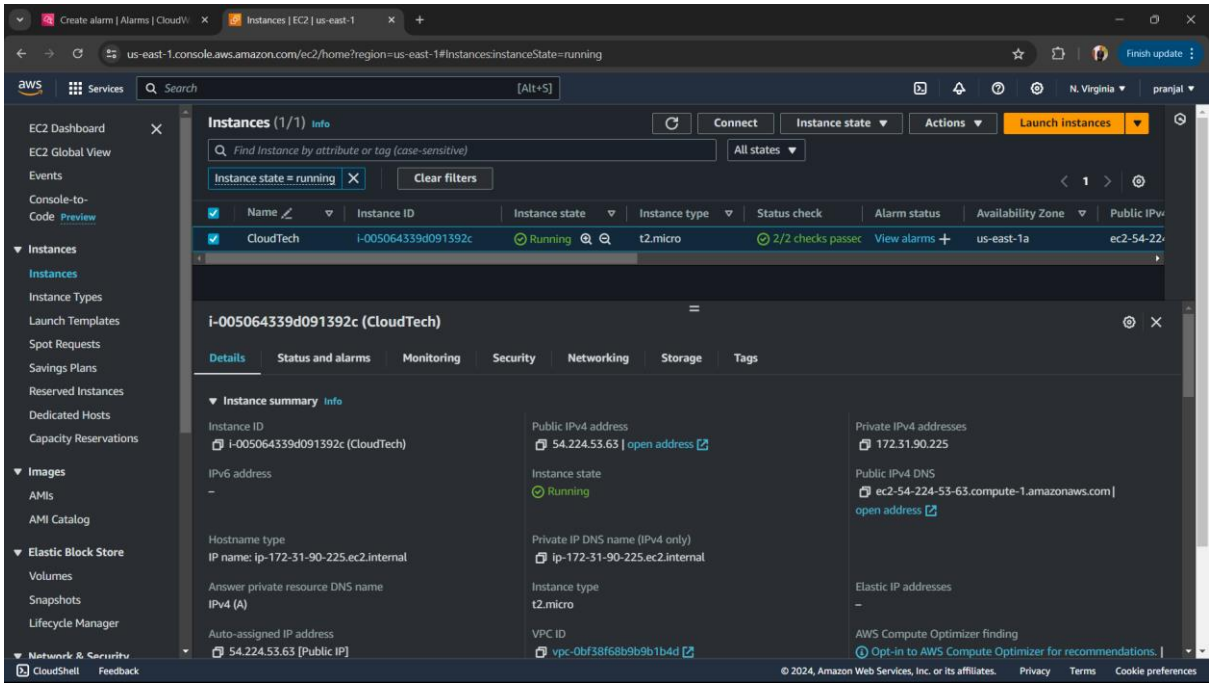


Figure 44:Details of the newly created EC2 instance

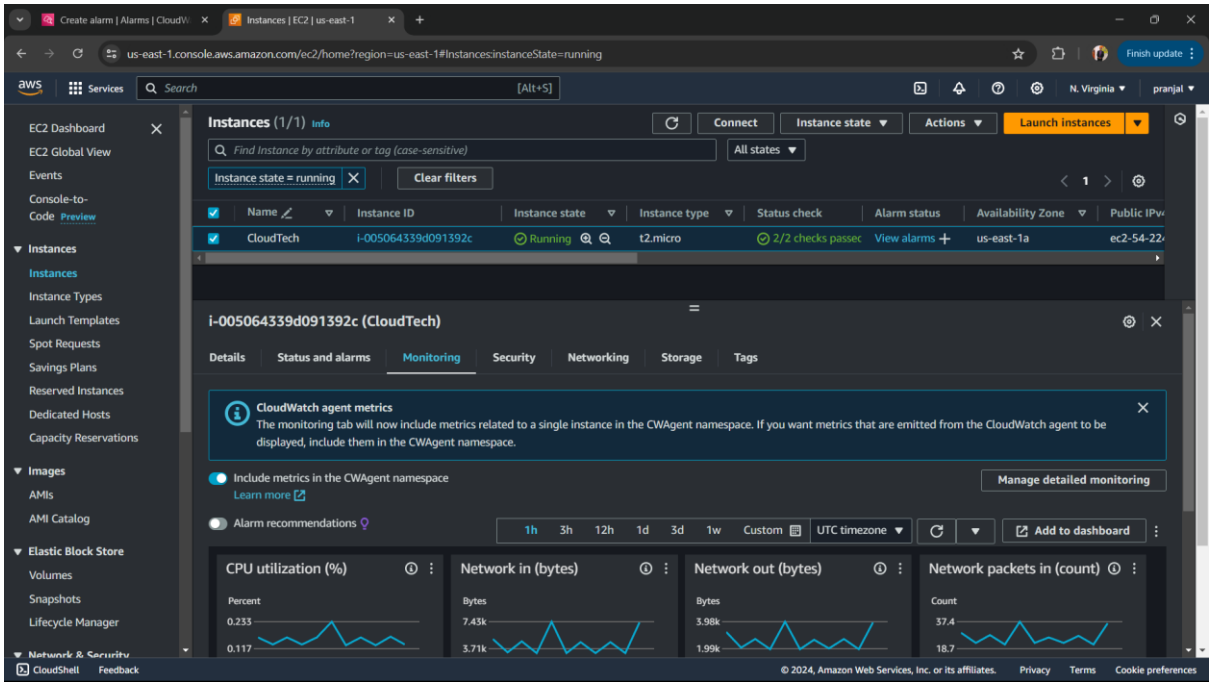


Figure 45: EC2 instance with CloudWatch Monitoring

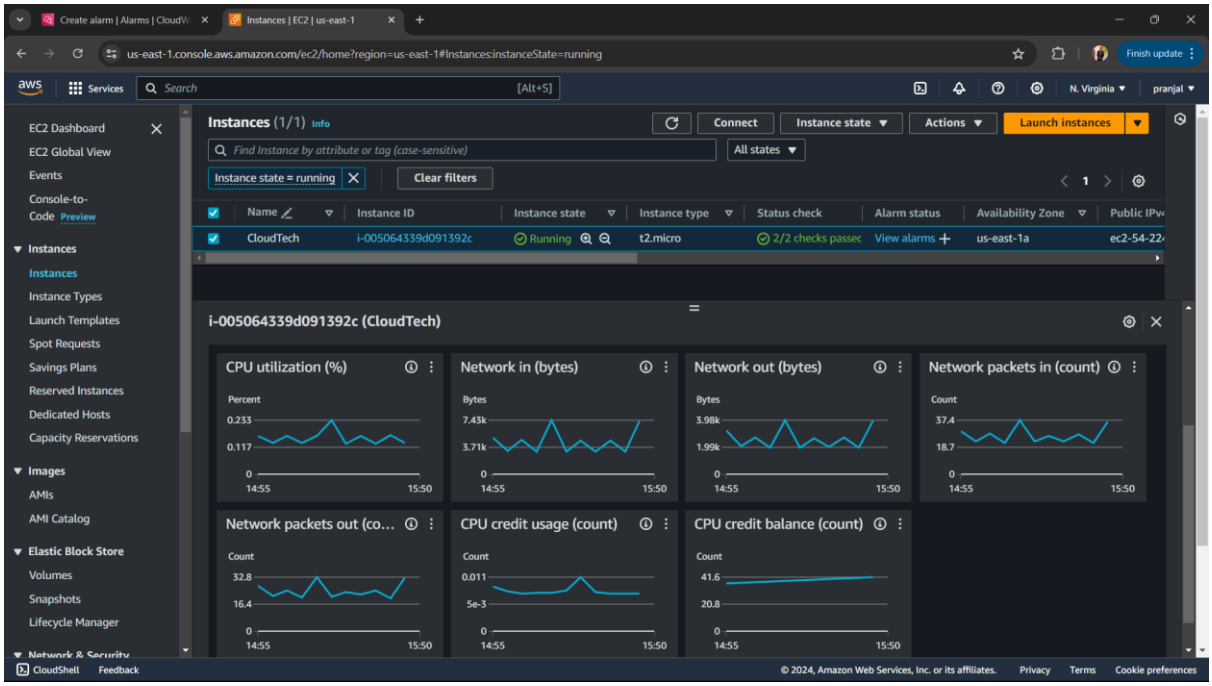


Figure 46: EC2 instance with CloudWatch Monitoring

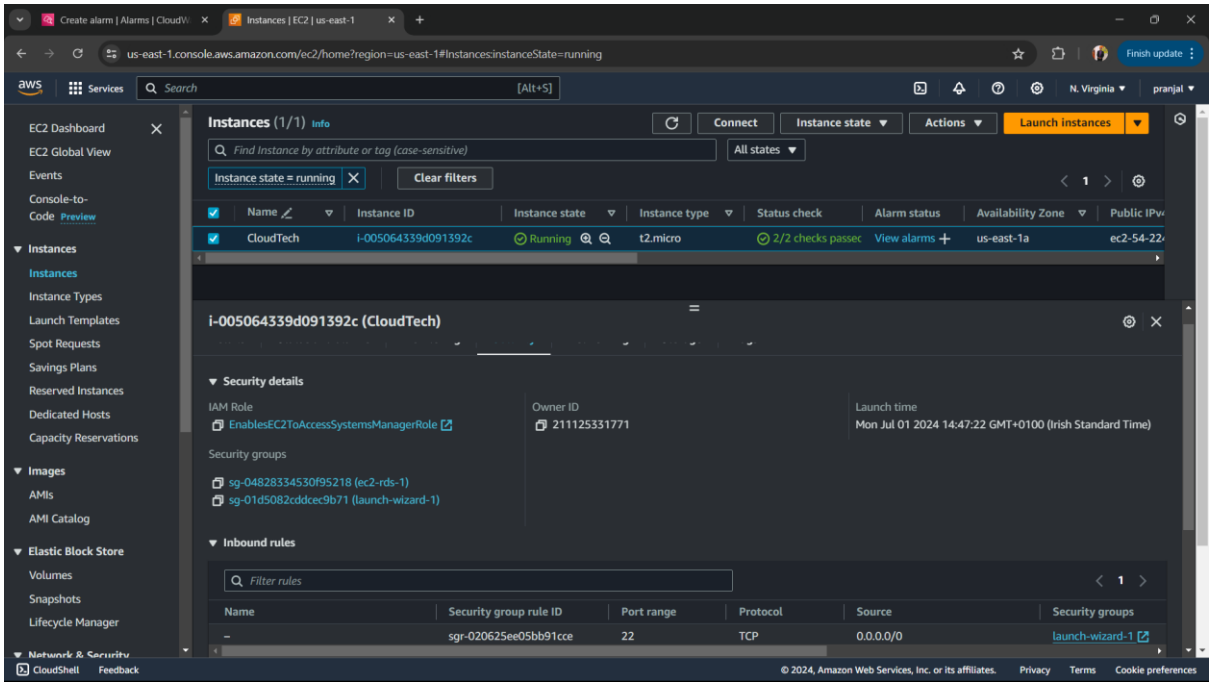


Figure 47: EC2 instance with Security groups

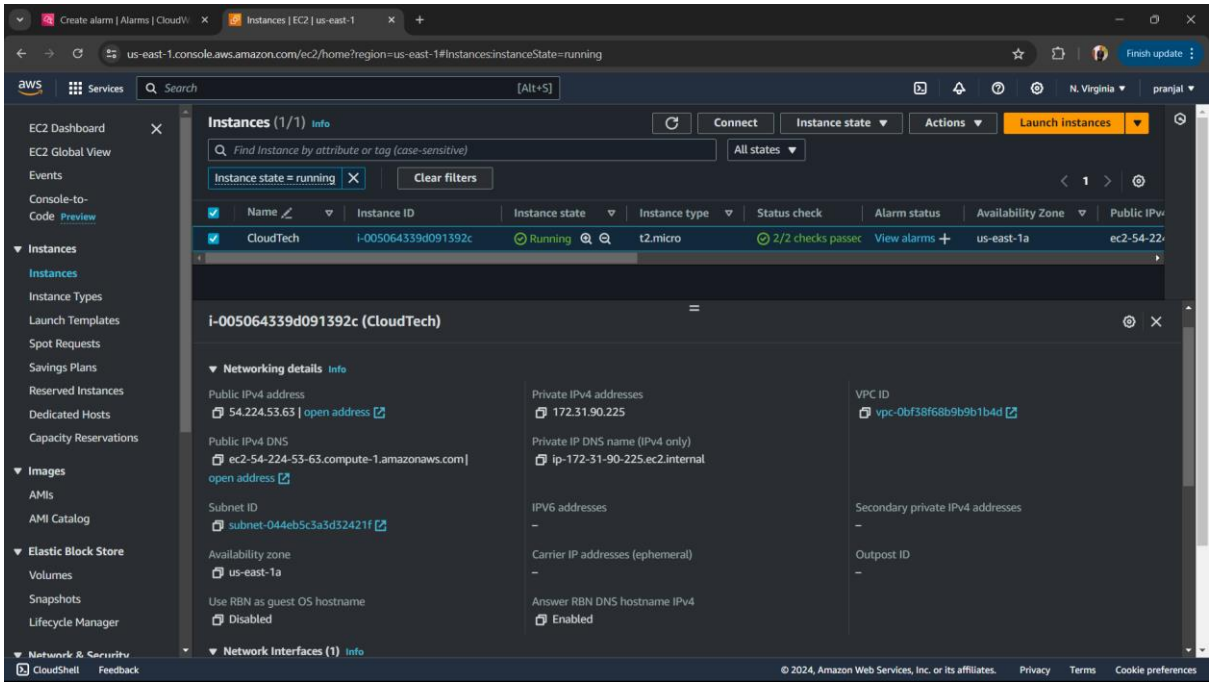


Figure 48: EC2 instance with networking details

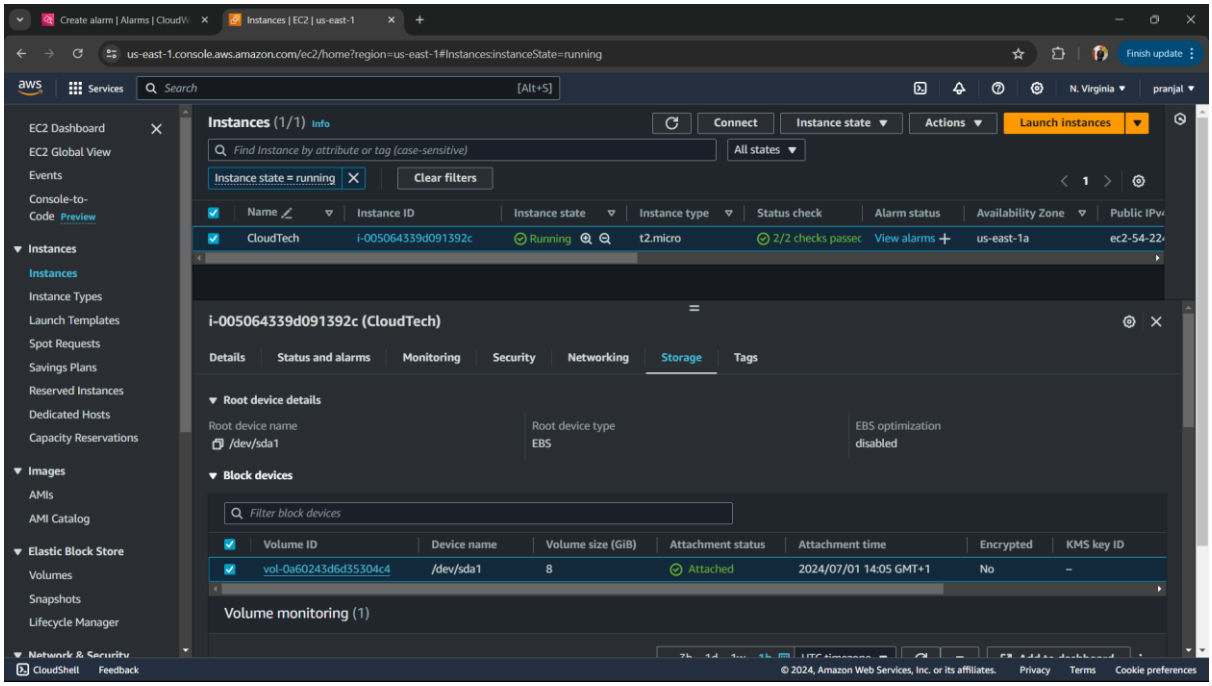


Figure 49: EC2 instance with RDS storage attached to it.

Conclusion

Migrating from on-premises architecture to a cloud-based infrastructure signifies a major shift in CloudTech Solutions, and this transition is driven by their need for scalability, cost reduction, security, and architectural advancements to better serve their existing clients and to attract new clients. CloudTech is currently dependent on hardware and struggles to meet the growing demands of its clients. The setup they use is hard to maintain and not budget-friendly and struggle with the flexibility required to meet the rapid development of the market. This setup not only can be susceptible to downtimes but also is inefficient, impacting the ability to deliver reliable services.

The proposed migration to AWS cloud services offers a robust solution to these challenges. AWS EC2 provides scalable compute resources, allowing CloudTech to dynamically adjust its infrastructure based on real-time. The shift to AWS RDS for their database management ensures high availability, automatic backups, and easy scalability, significantly reducing the administrative burden and operational risks. Additionally, integrating AWS CloudWatch facilitates proactive monitoring and management of our cloud resources, enabling quick identification and resolution of potential issues.

Based on our evaluation, the company needs to slowly migrate its data in phases so as not to impact its business. They should invest some time and money to get their employees trained on using cloud services of their preference and leverage security features like IAM to comply with industry standards. They should use monitoring tools like CloudWatch, Prometheus, Grafana, and Site24x7 to ensure they get alerted each time a pipeline fails, or faults in their production servers or for similar issues.

Our Proof-of-Concept (POC) has shown that cloud services can easily manage their work. The EC2 instance can effectively handle compute tasks, while RDS allows them to effectively manage and scale their data needs while ensuring reliability and CloudWatch helps them to easily monitor their costs and other monitoring activities.

To conclude, moving to AWS presents CloudTech with a transformative opportunity. It addresses the limitations they have and helps them to reach even greater heights and to continue providing relief for even smaller SMEs so they can focus on their problems instead of worrying about their technology needs. The cloud environment not only enhances their productivity and scalability but also ensures they are a worthy competitor in their field. By adopting a well well-planned and phased approach, they can achieve a seamless transition to the cloud, unlocking new possibilities for their business and clients.

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