# ***Assessment***

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## Docker

**Prerequisite:** Install docker on amazon ec2 and confirm that its working as expected.

Reference : [Installing Docker to use with the AWS SAM CLI - AWS Serverless Application Model](https://docs.aws.amazon.com/serverless-application-model/latest/developerguide/install-docker.html)

**Source code:** [**https://github.com/srikanthmalta/aws\_assessment/blob/main/docker/Dockerfile**](https://github.com/srikanthmalta/aws_assessment/blob/main/docker/Dockerfile)

Docker command to build the Docker image

* Docker build -t express-app .

Note: Make sure we have we have all the steps to build the image in file named Dockerfile

Docker command to run image in interactive mode.

* docker run -it -p 3000:3000 express-app

Note:

* You can open the ec2 machine in different terminal and make a curl command to validate the response.
* To access from the browser, make sure ec2 machine has public IP and port 3000 open.

URL to access the from the browser

* <http://localhost:3000>
* http://<ec2 public ip>:3000

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Command to run in detached mode

* docker run -d -p 3000:3000 express-app

Command to view the docker logs

* docker logs <container-id>

Command to run image in interactive mode while allowing to have access to source code.

* docker run -it -v /path/to/source/code:/usr/src/app -p 3000:3000 express-app

Note: By mounting source code directory of your repository (on your **host machine**) to a directory inside the Docker container. This allows you to make changes to the code on the host machine, and those changes will be immediately reflected in the container.

-it = Interactive mode

-v = mounts source code directory

-p = exposed the port

This approach is very useful for **development environments** because:

1. You don’t need to rebuild the Docker image after every code change.
2. You can test your changes in real time by refreshing your browser.

### Docker implementation validation:

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Open port on security group of ec2 to access the endpoint from the public internet via browser by using public IP of ec2 machine

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### Docker Compose

1.2.1 - What docker command would I use to set up this docker compose

configuration in interactive mode?

* Docker-compose up

• 1.2.2 - What docker command would I use to set up this docker compose

configuration in detached mode?

* Docker-compose up -d

• 1.2.2 - What docker command would I use to view and follow the logs

generate by this setup in detached mode?

* docker-compose logs -f <service name>

• 1.2.4 - Once I have set up this wordpress site, if I destroy the container

and recreate it, will I still be able to use the setup from my previous run?

If not, what changes would you do to the docker compose file in order to

make this possible?

* We have to use persistent storage, you will lose all data after destroying the containers. Adding Docker volumes ensures that your WordPress site and MySQL database persist across container runs.

• 1.2.3 - Can you make changes to this docker compose file in order to make

it possible for developers to be able to make code updates to the wordpress

site on their local code editor?

* to make code updates to the WordPress site from their local code editor, you can **bind mount the WordPress code directory** from their local machine into the WordPress container

#### Install docker compose on AWS ec2 linux machine

sudo curl -L https://github.com/docker/compose/releases/latest/download/docker-compose-$(uname -s)-$(uname -m) -o /usr/local/bin/docker-compose

**Fix permissions after download:**

sudo chmod +x /usr/local/bin/docker-compose

**Verify success:**

* docker-compose version

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* Create docker compose file
  + Location : <https://github.com/srikanthmalta/aws_assessment/blob/main/docker-compose/docker-compose.yml>
* Run docker compose file
  + Docker compose up -d ( in detached mode)

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* Open security group on the ec. ( word press compose yml file is configured to run on port 8081.

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* WordPress access form the browser

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## 3.1.0 Linux

You are currently experiencing issues with the services running on your Ubuntu server. Server performance is degrading and you need to investigate why. The services running on this server are nginx, php-fpm and some docker containers running a distributed micro service mesh with node, python and go runtimes.

3.1.1 - what method would you use to connect to server in order to troubleshoot the issue at the source?

• 3.1.2 - given that you still don’t know what the issue might be, list a number of commands you would execute to better understand what is wrong with this environment, stating what insights this command would provide to you in helping you pinpoint the issue.

• 3.1.3 - you suspect the issue might be from the nginx service. How would you figure out where the error log is located and how will you inspect this log?

• 3.1.4 - you suspect the issue might be from the php-fpm. How would you figure out where the error log is located and how will you inspect this log?

• 3.1.5 - you suspect the issue might be from a docker container. Assuming the docker container is writing logs to the default log driver, how would you inspect the logs generated by this container?

• 3.1.6 - you suspect the issue might lie somewhere else. Which logs would you investigate to try and find out what the issue is?

### Answers:

In order to connect to the server either use ssh command or use putty terminal

Ssh command : **ssh -i private.em ec2-user@<ip address>**

**Trouble shooting**

* Top command: Provides insights into CPU, memory usage, and running processes.
* df -h : To check for the disk storage
* free -h : To check for memory utilization
* ps -ef | grep <service > : to validate if the process are running
* docker commands to check if the docker containers are running fine
  + docker ps => list all running containers
  + docker logs <container id> => for container logs
* Nginix logs : look for nginx logs directly ( /var/log/nginx/\*.logs for nginx logs )
  + Tail -f to continuedly read the latest logs

## 3.2.0 Formatting the json response of a api response**.**

1. Installed httpd service on the ec2 machine.
2. Copied the content into /var/www/html/service.json
3. Curl command to fetch the data
   1. http://<your-server-ip>/servers.json (<http://localhost/servers.json> - when running inside the machine )
4. Script for conversion

[root@ip-10-0-1-75 ~]# cat script.sh

#!/bin/bash

# Fetch the JSON file

curl -s http://localhost/servers.json -o servers.json

# Convert JSON to the desired format

jq -r '.data[] | "Host \(.hostname)\nUser \(.username)\nHostname \(.ip)"' servers.json > servers\_formatted.txt

echo "Formatted output saved to servers\_formatted.txt"

Validated

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* Script for fetching servers which are in down state

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Output:  
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## 4.0.0 Scalable and highly available architecture

To design a scalable and highly available architecture for a service using EC2 as hosts, here is the proposed plan with a focus on multiple microservices.

### High availability:

* To achieve high availability for each microservice 2 ec2 machines are created under 2 different availability zone.
* Create Auto Scaling group: Min of 2 instances need to be configured to achieve high availability

Two public subnets are created under two availability zone (there fore two ec2 machines are present under two different subnets)

* Application Load balancer is AWS managed resource, and it scales automatically with the load and availability is managed by AWS as per the SLA

**Time to start:** We have to make use of launching template and use them with minimum *user-data configuration* which helps ec2 instances ready to server the request quickly.

### Scalability:

This architecture is highly scalable.

**Load balancer**: Scales as per the number of requests (managed by AWS)

**EC2**: New instances are created automatically as per the scaling policy. Machines are created randomly under the chosen **availability zone**, there by making it zone redundant.

**Security:** Security group can be configured to allow the http traffic from only load balancer by updating the security group of EC2 machines with security group of LB in the ingress rules.

**Load Balancing**: Target groups allow the traffic to be distributed among the machines inside the target groups

### Security & Scalability using cloud front service

**By using Use CloudFront we achieve the following:**

* **Static Content Delivery**: To deliver cached static content (e.g., images, JavaScript, CSS) from edge locations near the users.
* **Dynamic Content Optimization**: To speed up the delivery of dynamic content (e.g., APIs) by using optimized edge locations.
* **DDoS Mitigation**: To protect your application against DDoS attacks by leveraging AWS Shield.
* **Cost Efficiency**: To reduce costs by offloading traffic from your origin servers to CloudFront edge locations.
* **Scalability**: When expecting unpredictable spikes in traffic and need to serve content globally without latency issues.

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Figure 1 : Application Load Balancer design

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Figure 2: AWS high level arhitecture

Implementation:

***Following infra has been implemented to validate the design using terraform.***

### 1. Target Group for Each Microservice

- Create a dedicated target group for each microservice to isolate and manage traffic effectively.

### 2. Application Load Balancer (ALB)

- Deploy an Application Load Balancer with the following configurations:

a. Create a dedicated listener for each microservice.

b. Map each listener to its corresponding target group.

c. Configure health checks for each target group to ensure service availability.

d. Attach a security group to the ALB to allow traffic only on required ports (e.g., HTTP/HTTPS).

### 3. VPC Design

- Set up a robust VPC architecture with:

a. At least \*\*two public subnets\*\*, each in a different availability zone, to ensure high availability.

b. Security groups:

- Allow incoming traffic on required ports (e.g., 80, 443) and port 22 for SSH access.

- Allow traffic from the security group associated with the load balancer.

### 4. EC2 Configuration

- Create a \*\*Launch Template\*\* based on an existing and fully configured EC2 instance running the required microservice.

- Restrict http traffic from Security group of ALB for security

### 5. Auto Scaling Group

- Implement an Auto Scaling Group (ASG) with the following configurations:

a. Ensure the ASG spans a minimum of \*\*two availability zones\*\*.

b. Use the \*\*Launch Template\*\* created in Step 4.

c. Associate the target group created in Step 2 with the ASG, enabling the load balancer to dynamically register instances as backends and distribute traffic evenly.

d. Configure auto-scaling policies based on performance metrics, such as triggering a scale-out action when CPU utilization exceeds 80%.

### 6. Database Tier:

* Use **Amazon RDS (Relational Database Service)** with multi-AZ support for high availability.
* Enables automated backups, replication, and failover to a standby instance in case of failures.

### 7. Cache:

* Use **Amazon ElastiCache (Redis or Memcached)** to store session data and frequently accessed data.
* Reduces latency and database load by caching common queries.

### 8 Static Asset Storage:

* Store static assets in **Amazon S3**.S3 is very scalable and provides unlimited storage with max object size on 5TB
* S3 automatically scales to handle the growth of your data without any need for manual provisioning or capacity planning.
* We need to enable lifecycle policies for cost optimization

### 9. Cloud Front

* Use **Amazon CloudFront**, a CDN, to deliver these assets globally with low latency.
* Cloud front backend need to be configured with ALB as backend.
* ALB security group need to updated to allow traffic from cloud front alone

### 10. EBS snapshots:

Regular EBS snapshots to backup volumes. Snapshots are incremental and stores in S3 for higher durability

This architecture ensures scalability, fault tolerance, and high availability while maintaining an organized and professional approach to managing microservices.

**Note**:

ELB is completely managed by the AWS, and it scales as per the incoming traffic.

EC2 scaling should be managed by us with help of auto scaling group.

Redis is azure managed service

### Demo Screen shots implementing above design

Note: Below infra is create using terraform.

Summery:

The proposed solution leverages a combination of EC2 instances, a load balancer, and an auto-scaling group to ensure high availability, fault tolerance, and scalability. The load balancer distributes incoming traffic evenly across multiple EC2 instances, preventing overloading of any single instance and ensuring continuous availability even if one instance fails. The auto-scaling group dynamically adjusts the number of EC2 instances based on traffic demand, scaling up during peak loads and scaling down during low traffic to optimize cost-efficiency. This architecture addresses failure recovery by replacing unhealthy instances automatically and ensures scalability by adapting to varying traffic patterns, providing a reliable and resilient infrastructure for applications.

## 5.0.0 Terraform

Source code: [**https://github.com/srikanthmalta/aws\_assessment/tree/main/terraform**](https://github.com/srikanthmalta/aws_assessment/tree/main/terraform)

Ideally, we create a module for each service based on our design requirements and use modules to create infra. Due to time constraints i used resource blocks to create infra.

As shown in below image, configuration for reach resource is present in respective file starting with prefix “aws-“

**Launch configuration is no more supported on aws for auto scaling group. AWS supports only launch template on accounts created after May 31, 2023.**So i have create terraform code with **launch template**

**Terraform code is tested by applying the code. You can find the details in the state file for more details.**

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**Terraform plan to create Domain terraform-test in Route 53 and add the IP address of the ec2 as record under the domain has been commented.  
Did not apply as purchasing the domain costs us 15 USD/year. Commented the code in the terraform file.**

Following image is to show that the terraform plan works fine as per the code

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Validation screen shots:  
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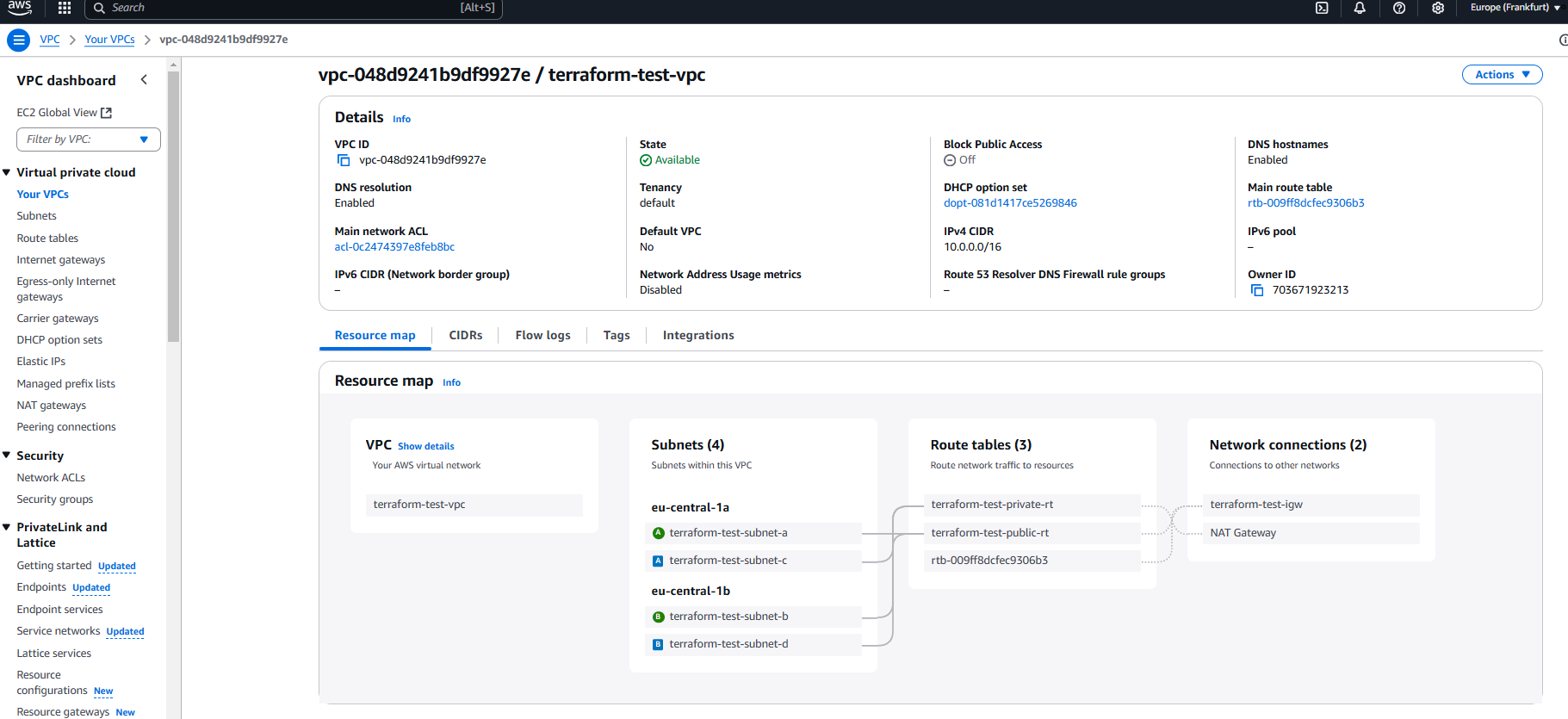
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