**EXERCISE ONE**

**Services Pricing Comparison Table**

|  |  |  |  |
| --- | --- | --- | --- |
| Component name | Azure | Google Cloud | AWS |
| Compute(3 VMs Frontend application) | $367.92/month (D2s v3) | $245.03/month (e2-standard-2) | $311.76/month (t3.large) |
| Compute(3 3VMs Backend Application) | $367.92/month (D2s v3) | $245.03/month (e2-standard-2) | $311.76/month (t3.large) |
| Load Balancer for applications | $27.38/month (Standard LB) | $25.55/month (Cloud Load Balancing) | $32.85/month (ALB) |
| Storage (3\*2VMs \* 250GB) | $187.20/month (Premium SSD) | $156.00/month (SSD) | $150.00/month (gp3 SSD) |
| Support across Multiple regions | $78.84/month (Traffic Manager) | $75.00/month (Cloud DNS) | $89.28/month (Route 53) |
| PostgreSQL DB | $380.77/month (Azure DB) | $353.40/month (Cloud SQL) | $416.38/month (RDS Multi-AZ) |
| Support | $100.00/month (Standard) | $100.00/month (Standard) | $100.00/month (Developer) |
| Monthly Total | **$1,510.03** | **$1,200.01** | **$1,412.03** |

**Functional Table Differences.**

|  |  |  |  |
| --- | --- | --- | --- |
| Feature | Azure | Google Cloud | AWS |
| Load Balancing | Standard Load Balancer with basic traffic distribution | Cloud Load Balancing with global/regional options | Application Load Balancer with advanced routing |
| Multi-Region Failover | Traffic Manager with multiple routing methods | Cloud DNS with health checks and failover capability | Route 53 with health checks and failover routing |
| Auto-scaling | VM Scale Sets with integration to Azure Monitor | Managed Instance Groups with auto scaling policies | EC2 Auto Scaling, fine-grained control |
| Database Redundancy | Azure DB with geo-redundant backups | Cloud SQL with high availability and read replicas | RDS Multi-AZ with synchronous replication |
| Support SLA | Professional: 1 hour response | Enhanced: 1 hour response | Business: 1 hour |
| Virtual Network | VNET with NSGs and service endpoints | VPC with global routing and firewall rules | VPC with fine-grained subnet control |
| Monitoring | Azure Monitor with 1-minute metrics | Cloud Monitoring with 1-minute metrics | CloudWatch with 1-minute metrics |

**Observations and Recommendations for best hosting.**

Our requirements will find the best cost efficiency through Google Cloud followed by AWS and then Azure.

The infrastructure deployment across multiple regions is available from all providers though their redundancy approaches vary. AWS Route 53 delivers maximum health check capabilities but Azure Traffic Manager provides additional routing methods.

The three options comprise PostgreSQL-compatible database solutions that ensure high availability through their services. AWS RDS Multi-AZ replicates data synchronously across multiple availability zones within a single region and Azure DB back up data across multiple geographic areas and Google Cloud SQL enables high availability settings.

Basic production-level assistance is included in the price tier. Faster response times and technical account managers are accessible by purchasing higher pricing tiers.

**EXERCISE TWO**

**Environmental Setup**

**Installing Google Cloud CLI**

The following screenshot shows how the Google Cloud CLI was installed in my system. First, I downloaded the executable from Google Cloud Servers, installed it and started the CLI via terminal.

The following command shows how I created a new project and enabled the iam service.

**Python Script.**

The next step is to create and test a deployment script. The script does the following.

* Creates a VM instance with 2 vCPUs and 8GB RAM (e2-standard-2), 250GB storage, Ubuntu 20.04 image
* Sets up an external static IP address for the VM
* Configures firewall rules to allow both HTTP and SSH access
* Installs Nginx and sets up a simple "Hello World" webpage

The following screenshots shows the script source code.

The following screenshots shows the deployment logs for our script.

From the screenshot, we can see the script:

* Retrieving the project ID.
* Creating or reusing the static IP.
* Creating firewall rules for HTTP and SSH.
* Creating the VM instance.
* Displaying the static IP and SSH access command.

**The VM Running in the Compute Engine Console**

From the google console with our created project started, we can see that our vm is running.

**Testing SSH**

We can as well use ssh against our created vm. The following screenshots shows that I am successfully connected to the vm using the ssh and I am able to run the hostname to get the hostname and the ls commands to get the list of files and directories on the current working directory.

**Hosting a website.**

Now that the vm is up and running and we have also setup firewall rules, I used the following commands to deploy a simple static Hello world webpage. The following screenshot shows the outputs of every command.

When we visit the static ip that was given to use by the script after restarting nginx server, we get the following on our browser demonstrating that the webpage is hosted successfully.

**Documentation and Github.**

The script is deployed to a github repository and can be accessed via the link <https://github.com/hemarastylepeke/google-cloud.git>. The README.md file has also been created within the same repository to help in running the script.

The following screenshots shows the contents of README.md.

**REFERENCES**

Sukhdeve, D.S.R. and Sukhdeve, S.S., 2023. Google Cloud Platform for Data Science. *Google Cloud Platform for Data Science*.

Borra, P., 2024. A Survey of Google Cloud Platform (GCP): Features, Services, and Applications. *International Journal of Advanced Research in Science, Communication and Technology (IJARSCT) Volume*, *4*.

Kingsley, M.S., 2023. Cloud Platform. In *Cloud Technologies and Services: Theoretical Concepts and Practical Applications* (pp. 143-156). Cham: Springer International Publishing.

Megino, F.B., De, K., Elmsheuser, J., Klimentov, A., Lassnig, M., Euell, M., Hartmann, N., Maeno, T., Outschoorn, V.M., Sandesara, J.A. and Sell, D., 2024. Operational experience and R&D results using the Google Cloud for High-Energy Physics in the ATLAS experiment. *International Journal of Modern Physics A*, *39*(13n14), p.2450054.

Rehan, H., 2024. Revolutionizing America's Cloud Computing the Pivotal Role of AI in Driving Innovation and Security. *Journal of Artificial Intelligence General science (JAIGS) ISSN: 3006-4023*, *2*(1), pp.239-240.

Manthiramoorthy, C. and Khan, K.M.S., 2024. Comparing several encrypted cloud storage platforms. *International Journal of Mathematics, Statistics, and Computer Science*, *2*, pp.44-62.