Cloud Service Approval Request

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Appendix

1 Introduction

"Hobby Project Generator" is a web application that will be suggested different projects to the users base on their preferences. Being a web application, it will need to be hosted on a backend server to provide consistent access to the users. In addition, it will also need to store the data of users who create an account with our web application. It will also need to store links to external projects that will be pulled from other websites as mentioned in our Project Proposal and Business Requirement Documentations. And it will also need to log information of events that are happening whether successful or unsuccessful for debugging and maintenance purposes. In order to satisfy the functionality above, a cloud relational database will be needed.

2 Analysis of available cloud services:

From our research, the main relational database cloud services providers include Amazon Relational Database Service (RDS), Google Cloud SQL, and Microsoft Azure SQL Database Service.

2.1 Amazon RDS Pros and Cons

Amazon is the largest cloud service provider with currently the most market share.

Pro:

- Supports multiple database engines includes:
  - Amazon Aurora
  - PostgreSQL
  - MySQL
  - MariaDB up to version 10.5.12, 10.4, 10.3, 10.2
  - Microsoft SQL Server Standard, web, and Express edition version 2012, 2014, 2016, 2017
  - Oracle database
- Provide micro instances with minimal resources at no cost to the users with hardware including 1 virtual CPU, 1GB RAM, and 30GB SSD storage
- Can communicate with our backend server which will be hosted on Amazon EC2 easier due to being in the same Cloud service provider as well as the same Virtual Private cloud
- More stable service with higher uptime compare to Google Cloud
- Great technical supports that provide responses within 24hr time frame.
- Provide encryption for data when being stored as well as when communicating with a back-end server.
- Can scale automatically if the need arises in the case of increase in usage from our users of "Hobby Project Generator", or manually scale vertically or horizontally by changing tiers or creating more instances.

- Low monthly cost to maintain and operate a relational database with their "micro" tier at $0.0016 / hour (MariaDB) [1]
- Monthly cost for operating database is $15.86 (MariaDB). [5]

Cons:

- Since RDS is a managed database service, root access to the server is not possible
- Only provide "micro" instances as a free service for up to 720 hours (1 month)

2.2 Microsoft Azure SQL Database Pros and Cons

Pro:

- Similar to Amazon RDS, Azures also provides many options in database engines including both relational and non-relational databases:
  - Microsoft SQL Database
  - PostgreSQL
  - MariaDB version 10.2 and 10.3
  - CosmosDB(non-relational)
- Fully-managed database servers reduce server maintenance responsibility on our team when developing "Hobby Project Generator" since database software are kept up to date by the service provider
- Storage available with Solid State Drives that is much better than magnetic drive when it comes to read and write speed.
- Supports manual vertical and horizontal scaling includes (CPU, Memory, IO, and storage)
- Azure pricing for MariaDB with 1 vCPU at the cost of $0.0340/ hour and a one time cost of $0.100 / GB
- The monthly cost for relational database operation per month is $27.82 (MariaDB)

Cons:

- Autoscale is not a built-in feature for Azure SQL Database and will require the user to create a script to adjust between the different hardware tiers.
- Managed relational database does not allow root access to the instance.

2.3 Google Cloud SQL Pros and Cons

Pros:

- Available database engine that is supported by Google Cloud Service includes:
  - MySQL version 8.0, 5.7, 5.6
  - PostgreSQL version 13, 12, 11, 10, 9.6
  - SQL Server
    - 2017 (Express, Web, Standard, Enterprise)
    - 2019 (Express, Web, Standard)

- Automate backup to prevent data loss
- Managed server relieve many administrative tasks from the development team
- Supports vertical and horizontal scaling for hardware
- At 1 virtual CPU, 3.75GB RAM (db-standard-1) instance, and running either MySQL or PostgreSQL, the pricing for Google service is 0.0483 / hours (1vCPU, 1GB RAM) and a 0.170 GB / month per GB of SSD

Cons:

- More unstable with lower availability compared to its competition Amazon RDS and Microsoft Azure SQL Database.
- Limited amount of database engine compare to its competitor
- Similar to Azure SQL Database, automatic scaling is not a built-in feature and will require the development team to provide script to automatically scale the database up or down.
- More pricey than its competitor with the smallest instance specification with the price of $54.41 / month.

Table 1: Analysis between Amazon RDS, Microsoft Azure SQL Database, Google Cloud SQL

Metric \ Language	Amazon RDS	MS Azure SQL Database	Google Cloud SQL
Relational Database (0.3)	5	5	5
Database Engine Availability (0.2)	5	4	3
Pricing (0.17) (higher is better)	5	4	3
Management (0.13)	4	4	4
Hardware Spec (0.07)	2	5	3
Hardware Scaling (0.06)	4	3	3
Encryption (0.04)	5	5	5
Data transfer cost (0.03)	4	5	3

	(higher is better)		
Total (weighted):	4.57	4.38	3.81

Legend:

Each metric is assess with a scale of 1 - 5.

Score given to each metric are not weighted until the total.

3 Discussion

3.1 Relational Database

The three cloud services share a lot in common when it comes to providing relational database servers. And "Hobby Project generator" will be needing a relational database because it helps organize users' data and projects with relationships. Since all of them provide the relational database option, they will all be receiving the same score.

3.2 Database Engine Availability

Amazon RDS comes in with the most amount of supported database engines with options ranging from MySQL, MS SQL Server, Oracle Database, Amazon Aurora, MariaDB and most of them supports relational database which will be the main model that "Hobby Project Generator" intends to store its user database including many external projects. Hence, Amazon RDS has a 5 for this metric. Compared to the Microsoft Azure SQL Database service, it is lacking MySQL engine. Google Cloud SQL with the least amount of supported database engine which is reflected through the table of analysis above. When assessing the availability of database engines, Amazon RDS service provides the most variety when it comes to database engines. In addition, Amazon RDS also contains MariaDB instances with a much newer supported version of 10.5.12 compared to Azure SQL Database Server with supported version 10.3. Unlike Microsoft SQL Server which will require a licensing fee for their usage which tends to come at a higher cost than it counters part MySQL and MariaDB. Unfortunately, Google Cloud SQL will provide "Hobby Project Generator" with the most disadvantage since it provides only three database engines with one of them being Microsoft SQL Server with a high operating fee due to licensing therefore it only receive a 3. Database engines variety and availability are important to "Hobby Project Generator" because in the case where our product requires a change in the database engine, it would be simpler to use the same cloud service provider and migrate over data instead of changing the service provider and having to deal with networking problems with Virtual Private Cloud.

3.3 Management

Database servers provided by RDS, Azure SQL Database, and Google Cloud SQL mostly are managed servers. The advantage of the managed servers is that it will reduce the administrative responsibilities and many overheads for team "Hobby" when developing the project. In addition, database software is kept up to date by the service providers. However, this also comes at the cost of being unable to have root access to the database server which is reflected by a score of 4 on our Table of Analysis.

3.4 Database Hardware

In terms of hardware, all three services provide many options for computing and storage in either the form of a package or custom for vCPU and memory. Storage options also include Solid State Drive (SSD), magnetic drive, and SSD IOPs for all three services to provide different options for different use cases.

Amazon RDS: (t2.micro)

- vCPU: 1
- RAM: 1GB
- Storage: 30GB SSD storage

Microsoft Azure SQL database: (standard Series gen 5)

- vCPU: 2
- RAM: 10.2 GB
- Storage: Separate storage options (SSD)

Google Cloud Service:

- vCPU: 1
- RAM: 3.75GB
- Storage: Separate storage options (SSD)

Listed above are the smallest instances available for each of the cloud service. Team Hobby only interested in the least resources instance that still perform well for budget reason. Amazon is the only that include the storage into their free tier instance. Microsoft Azure SQL Database receives a 5 for this metric since it provides the more hardware resources at this tier. Google would come in second with a score of 3 since it provides more RAM for computing compared to Amazon RDS. Amazon RDS provides the least resources for computing with their t2.micro instance.

3.5 Database Hardware Scaling

RDS, Azure SQL Database, and Google Cloud SQL also support scaling of database servers both horizontally and vertically. Although all three services support vertical manual scaling, out of the three, only Amazon RDS has built-in features that support vertically automatic scaling between the hardware tiers. In order to use automatic scaling with Azure SQL Database and Google Cloud SQL, team Hobby will need to develop a script that uses their API to enable vertical and horizontal scaling. This put Amazon RDS ahead of Azure SQL Database and Google Cloud SQL with a

score of 4 since it will reduce the amount of work for team Hobby when scaling the "Hobby Project Generator" to match with the demands of future users. Team Hobby will have more time to fix bugs as well as design and develop new features instead of managing the server resources.

3.6 Pricing

The cost of maintaining a relational database server on Amazon RDS is so far the cheapest given the hardware specification of 1 vCPU, 1GB RAM, and 30GB of storage per month at $15.86 USD / month running MariaDB. We are only comparing database servers running MariaDB and MySQL since they come at a lower cost than Microsoft SQL Server which requires licensing fees and is available at a higher cost than MariaDB and MySQL. Azure SQL Database with the same specification will cost $27.82 USD / month to operate. Google Cloud SQL is at the highest cost of the three with the cost of $40.359 USD / month running the same hardware configuration. From the afore mention price, Amazon RDS will be beneficial for "Hobby Project Generator" since users' amount will be less when our web application started, and having a lower operation cost will be very beneficial especially since most of our team members are students. Furthermore, since our resources can be scaled vertically, meeting our users' demand will be also simple but for the time being, running the lowest hardware specifications will be sufficient.

3.7 Encryption

Team Hobby also considered the security aspects for data that we keep. Amazon RDS provides storage encryption in order to protect data at rest. Similar to its counterparts, Azure SQL Database also provides data encryption both at rest and in transit using AES and 3DES. Similar to Azure SQL Database, Google Cloud SQL also uses AES encryption to protect data at rest. This put all three services on the same page when it comes to protecting "Hobby Project Generator" data. Since Amazon RDS, Microsoft Azure SQL and Google Cloud SQL all implement encryption algorithms that meets the industry standard for securely encrypt data, they will all have the same score for this metric.

3.8 Data Transfer cost

Last but not least would be data transfer cost from and to our "Hobby Project Generator". This metric weighted the least since we are not expecting a large influx of users for the first few months of operations. However, it is considered since traffic to our web application might increase in the future. On this aspect, Microsoft Azure SQL Database has the highest score since they allow up to 5GB of transferring data out to the internet for free monthly. With Amazon RDS receiving a score of 4 with 1GB of data transfer out to the internet free monthly. Both cloud service provide more than enough data transfer rate for "Hobby Project Generator" during our start up which reduce our cost to operate our back end server. Google Cloud SQL charged for transfering data to the internet regardless of the amount of data being transfer therefore only receive a

score of 3. Table 2 presents data transferring rate between the three cloud service provider.

4 Conclusion

In conclusion, Amazon RDS is the best option for "Hobby Project Generator" given the metrics discussed above. On the other hand, Microsoft Azure SQL Database is also a very promising alternative if a change in cloud service is required during the development of the product. Google would be Team Hobby least faborable option as a cloud service provider for our "Hobby Project Generator" web application.

Table 2: Data transfer rate for cloud service provided by Amazon, Microsoft, and Google.

Metric \ Cloud Service	Amazon RDS	MS Azure SQL Databse	Google Cloud SQL
Data transfer in from the internet	Free	Free	Free
Data transfer out to the internet	Free 1GB / month $0.09 USD / GB for next 10 TB	Free 5GB / month $0.0875 USD / GB next 10TB	$0.11 USD / GB for 0 -10GB

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