

HCAR Client Database System's Cloud Database Provider Report

Project Title	HCAR Client Database
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1. Introduction

This document serves as a result of the findings of a study into the two proposed options for the Cloud Database server that will be utilized for the HCAR Client Database System (to be referred as “The System”). The two options in consideration are Microsoft’s *Azure Database for MySQL* (to be referred as “Microsoft’s Database”), or Google’s *Cloud SQL for MySQL* (to be referred as “Google’s Database”). The Microsoft solution would be brokered by Nylex.net (Nylex) while the Google solution would be invoiced directly to a Google Account. Regardless of the ultimate design decision, we (The Team) have decided upon using Google’s *Cloud Run* to host the web server that runs the website and application logic for The System.

2. Background Information

2.1. Key Vocabulary

2.1.1. Database and Database Management System

As defined by Oracle: “A database is an organized collection of structured information, or data, typically stored electronically in a computer system. A database is usually controlled by a database management system

(DBMS). Together, the data and the DBMS, along with the applications that are associated with them, are referred to as a database system, often shortened to just database” (Source: [What Is a Database? | Oracle](#)). A common misconception is to visualize a database being like Microsoft Excel, but databases are much more powerful.

In regards to The System, the database will hold the raw data, such as names, addresses, doctors, etc., in a structured collection that is controlled by the Database Management Software. This software “serves as an interface between the database and its end users or programs” and also “facilitates oversight and control of databases, enabling a variety of administrative operations such as performance monitoring, tuning, and backup and recovery” (Source: [What Is a Database? | Oracle](#)). In our scenario, the DBMS will do the heavy lifting in actually organizing the data in order to best meet the queries we send.

An analogy is to compare the Database and Database Management Software to a library. The Client data can be thought of as books in a library. The Database itself is the physical library where the books are stored. The Database Management Software is the librarian who goes around organizing and retrieving books that visitors request.

2.1.2. MySQL

MySQL is a free Database Management Software that is widely used and trusted by countless web applications. Some notable examples purported by MySQL are Facebook and Verizon (Source: [MySQL :: Why MySQL?](#)). The software has been around for almost 30 years and is now owned by Oracle Corporation.

2.1.3. Cloud Storage

Not to be confused with a Cloud Database, which is a database that is stored remotely and accessed over the Internet, Cloud Storage is a service that allows one to remotely store files and folders that can be accessed over the Internet. Users are responsible for organizing their own files in their own folders, but some Cloud Storage providers may offer additional services to organize it for them. Popular Cloud Storage solutions include Microsoft OneDrive, GoogleDrive, Dropbox, among others. This storage can be thought of as a traditional file cabinet, but with the added benefit of users not needing to be “in the office” in order to pull out or add files. Unlike a traditional Database, there is no automatic organization to better

structure stored data. In the context of The System we are developing, data that would go on the Cloud Storage are files such as PDFs, client photos, and other documents that do not have a tabular structure akin to Client data.

2.2. Current Details on the Planned Implementation

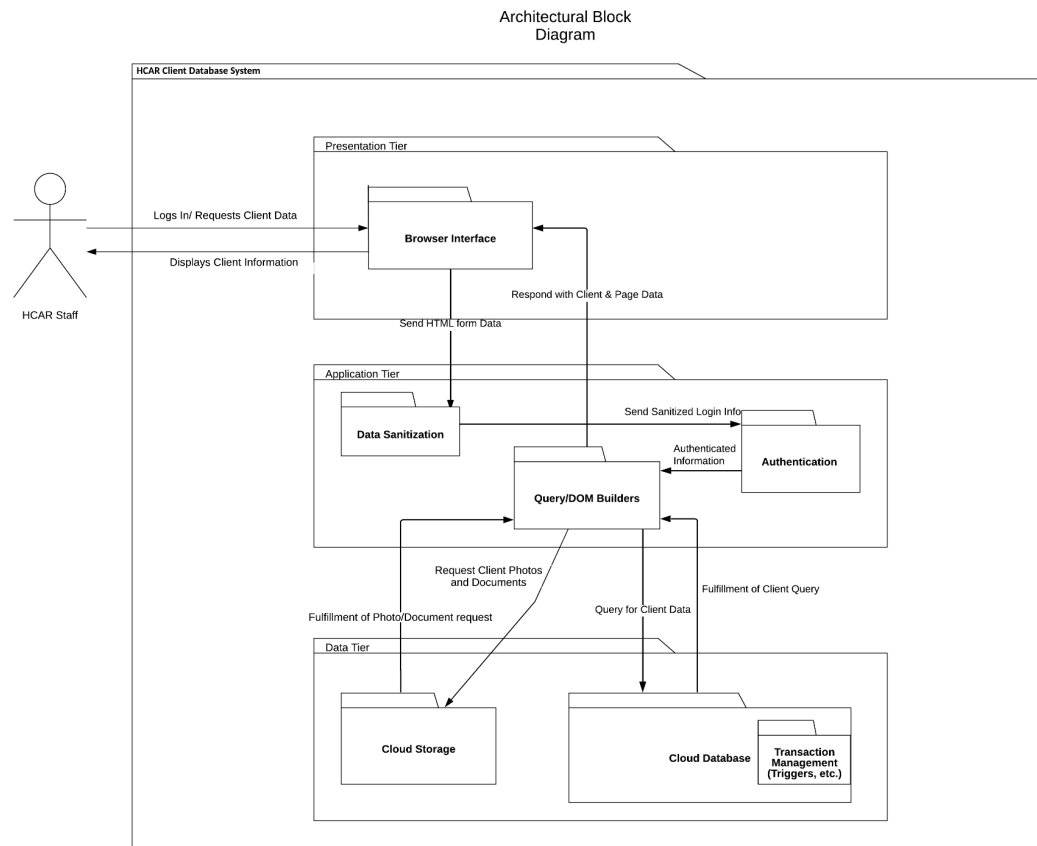


Fig. 1: HCAR Client Database System Architecture Block Diagram

Regardless of the final decision regarding the provider for the Cloud Database, we plan on using Google's *Cloud Run* to host the web server that will generate the web application for the system. Connectivity with either Microsoft (via Nylex) or Google are both possible from the Google web server. In theory and according to prior research, integration between the web server and the Cloud Database would be easier if Google was the provider of choice. Regarding Cloud Storage, Nylex could provide a directory for our system to store documents or we could integrate with Google's Cloud Storage instead. There are no significant technical impacts with either option and price difference is likely insignificant considering HCAR already contracts storage with Nylex as of date.

3. Comparison of Product Quotes

3.1. Price Comparison

3.1.1. Microsoft's Database (Brokered by Nylex)

According to correspondence with Nylex received on the 25th of February, the plans for Microsoft's Database that Nylex could provide start around **\$0.20 per hour** (Source: Joel Stephens from Nylex). As of the writing of this document, we are expecting more details on how much a general basic configuration would cost based on a specification we estimate would be sufficient. After some research into pricing listed by Microsoft themselves, the \$0.20 per hour estimate corresponds to a configuration of a General Purpose tier configuration with 2 "vCores" that would amount to an actual **\$0.171 per hour price** (Source: [Flexible Server Pricing - Azure Database for MySQL | Microsoft Azure](#)). For reference, a "vCore" is the unit of computational power that Microsoft uses. Considering that the average month is 730 hours long, that equates to an **average of \$124.83 a month**. If Nylex could theoretically acquire a 1 "vCore" configuration, it may possibly reduce the rate to \$0.0855 per hour, which equates to a monthly average of \$62.415. It is unclear if that would be feasible since Microsoft's pricing page does not publicly list said pricing option, instead they increment by 2 "vCores." Although not mentioned as of yet by Nylex, Microsoft offers 40% and 60% discounts for prepaying for 1 or 3 years of service in advance, respectively. It is currently unknown if Nylex would also offer that deal, if so that would reduce the monthly cost to about \$74.898 a month with a 1 year discount.

Our research has also uncovered that Microsoft's Database has a more economical tier that does sell individual "vCore" units, starting at **\$0.017** per hour for a single shared "vCore" that is only ever fully utilized upon meeting system demand. However, Microsoft gives a disclaimer that this tier is not intended for production use with constant database usage. The impacts of this performance limitation are unknown due to our inexperience with their product. This tier is also disqualified from the previously mentioned long term commitment discount.

3.1.2. Google's Database

According to Google's pricing page, their pricing for a "vCPU" has the rate of **\$0.0413 per hour per "vCPU."** For reference, a "vCPU" is the unit of computational power that Google uses. This rate equates to an

average cost of **\$30.149 per month for the computational power alone, plus a few more dollars** for memory and storage. Assuming a 1:1 correspondence between Microsoft “vCores” and Google “vCPUs”, a comparable Google configuration that includes 2 vCPUs would cost on average about **\$102.71 a month**. Google’s cheapest “Standard” configuration that includes 1 “vCPU” would instead be on average about **\$50.84 a month**. Similar to Microsoft, Google offers 25% and 52% discounts for prepaying for 1 or 3 years of service in advance, respectively. With a 1 year commitment, the 2 vCPU configuration would reduce to about \$77.0325 each month.

Like with the Microsoft Database offered by Nylex, Google’s Database has cheaper tiers that are intended for systems that do not continuously need to use their computational units. They have **two** tiers with single shared “vCPU” configurations that cost **\$0.0105** and **\$0.035** per hour, respectively. This comes out to about **\$7.665** and **\$25.55** a month. However, these estimates do not include the storage costs, so an additional \$1-\$2 dollars would be added on top of the monthly price. Once again like with Microsoft’s cheaper tier, we are unaware of any performance impacts of using these cheaper tiers due to our inexperience with their product. Also, these two tiers are disqualified from Google’s commitment discount.

3.2. Comparison in Functionality and Integration

Fundamentally, both solutions for the Cloud Database would meet the requirements of the software system. The main distinctions between both options is the price and the ease of integration. Regarding price, Google’s offerings are cheaper for almost all tiers besides the cheapest tier. However, said cheapest tier is not recommended by both companies due to the potential for low performance. If one compares the roughly \$124 cost for Microsoft via Nylex and Google’s \$102 comparable configurations, proceeding with Google would roughly save HCAR \$264 every year. In the event that HCAR prepays for a year of service, Microsoft’s Database via Nylex would be roughly 2 dollars cheaper per month. In that event, price is a non-deciding factor.

Regarding integration, it would, as expected, be a smoother process to integrate Google’s Database with their own web server compared to integration with a Microsoft Database provided through Nylex. Integration with the database purchased though Nylex would still be possible, however there will not be as much built in default connectivity. Furthermore, unless Nylex provides our team with full administrative control over the database configuration during

development, requesting actions or selective permissions could delay development. One potential benefit from proceeding with Nylex would be that they would never accidentally lose access to the account that pays for the cloud database. However, due to the overall system relying on a website that would be hosted by Google we lose that potential advantage. Unless Nylex can also offer reasonably priced web hosting, then there is no way to regain that advantage. For reference, Google's Cloud Run is our current option for deploying the web application and they quote rates starting at \$0.16 a month to \$4.78 a month in the unlikely event that the system received 10 million requests in that month.

4. Our Recommendation

After looking at our options, the CPH Team would like to propose moving forward with Google Cloud as the tool for our cloud-run database.

Using Google Cloud also allows us the ability to self-assign privileges to different service accounts, going through Nylex for any admin features seems inconvenient and unnecessary when this tool is generally cheaper, and gives more room for our team to customize and configure the database to HCAR's liking. Service accounts using Google Cloud can also be pre-configured to set specific instances for users of the database, making it easier to separate the tiers of privilege in our product. If we were to set up a database using Google Cloud, we will still be able to connect to the documents currently stored in HCAR's cloud storage with Nylex, but must be authorized and allowed to connect by Nylex staff via their storage's programmer interface.

5. References

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