



Cloud Research

Quantum TLC

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Glossary

Term	Definition
Cloud Computing	Cloud computing is the on-demand access of computing resources—physical servers or virtual servers, data storage, networking capabilities, application development tools, software, AI-powered analytic tools, and more—over the internet with pay-per-use pricing.
SLA	A service level agreement (SLA) is an outsourcing and technology vendor contract that outlines a level of service that a supplier promises to deliver to the customer.

Introduction

This document will go over why Cloud can add value to this project. We will go over the importance of having cloud, how it can benefit this tournament system, and what services will be used, and why this will make sense. The decision on the cloud service with an extra look at the costs can be found in (TLC Quantum, 2024, Cost Analysis).

Cloud

The cloud can be described as using servers that are used on the internet, with the software and the data storage in databases that can be run on the servers. This will allow Quantum TLC can put services of the system into servers and do not have to manage their physical servers themselves or run them on our machines. (What is the cloud? | Cloud definition, n.d.)

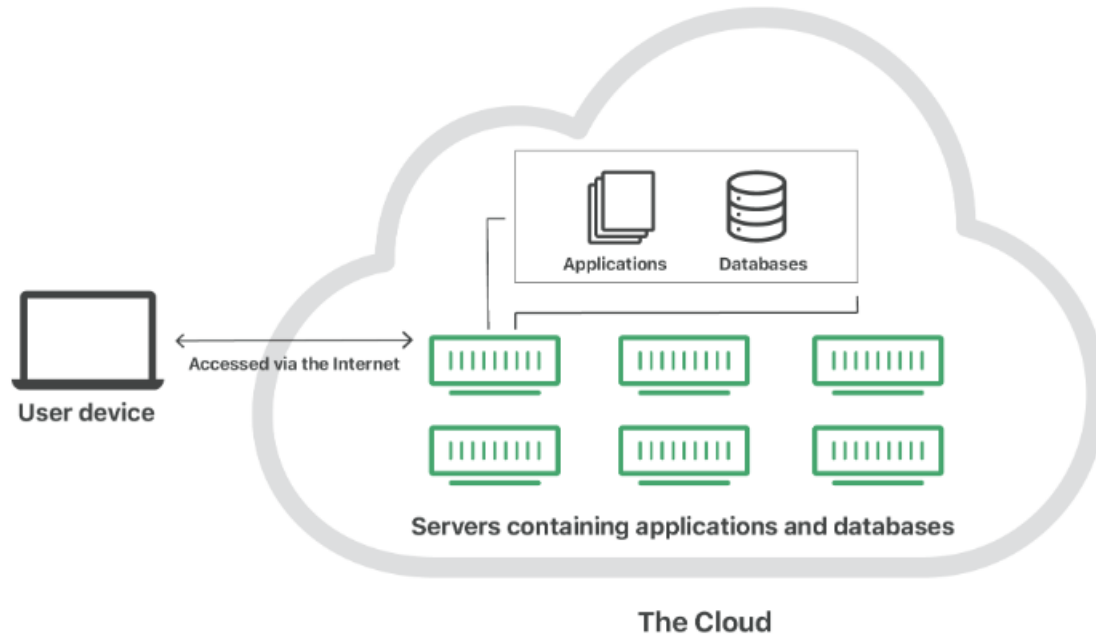


Figure 1: Overview Of How Cloud Works (What is the cloud? | Cloud definition, n.d.)

Cloud will allow users to access their sources on all devices since the computing and storage take place in servers in a data center. (What is the cloud? | Cloud definition, n.d.)

Cloud Services

The resources that are available to be used inside of the cloud are called “services”. There are several services such as database storage, infrastructure of the system, and other products. This is categorized as different service models. To list the most important ones.

- **Software-as-a-Service (SaaS):** The application will be hosted on the cloud servers. Where users can access it over the internet. A example, think of food, as a dine-out where you are just going to order something and everything will be handled for you.
- **Platform-as-a-Service (PaaS):** Instead of hosting the whole application, you will pay for the things you need to build your application. This includes tools, infrastructure, etc. happening all over the internet. To compare it with food, this can be seen as Ordering food to your house.
- **Infrastructure-as-a-Service (IaaS):** This is for the company to rent servers in order to store things on the cloud. With this infrastructure, they will then start working on the application. An example regarding food is, that you will order a package of pre-selected ingredients and combine them in your way to make your food.

(What is the cloud? | Cloud definition, n.d.)

See the following picture to clarify it even more.

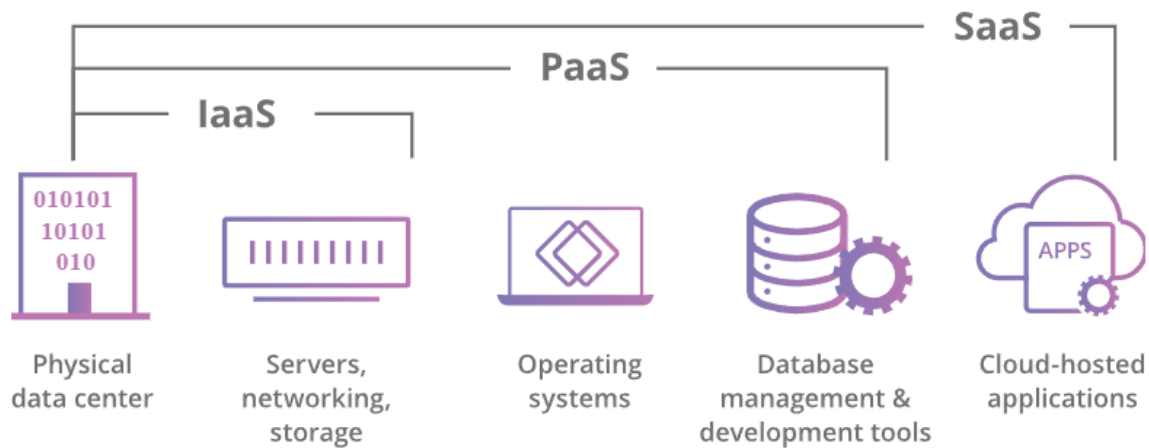


Figure 2: Different Cloud Services (What is the cloud? | Cloud definition, n.d.)

Cloud Platforms

It is a solution to have a scalable, flexible, and cost-effective way for TLC Quantum to access computing resources when you need them with pay-as-you-go pricing. A platform will create a virtual pool that provides computing, network services, and data storage. Whether you use it for analyzing data, developing and deploying your application, or delivering software, the cloud offers a lot of possibilities for the need for Quantum TLC. (What Is a Cloud Platform?, n.d.)

There are three types of cloud platforms:

- **Public Cloud:** These are third-party platforms that provide the benefits of cloud over the internet. Examples are Amazon Web Services, Microsoft Azure, and Google Cloud Platforms.
- **Private Cloud:** This is a cloud platform exclusive to an organization. It is either hosted on-site or by a third-party company.
- **Hybrid Cloud:** This is a mix of public and private cloud. The data can be moved between the two, which will offer more flexibility, and optimize security and compliance.

(What Is A Cloud Platform?, n.d.)

Quantum TLC will be making use of the public cloud. The three platforms mentioned above both provide a pay-as-you-go and offer different discounts differently. When looking at the three platforms:

- **AWS:**
 - Mature server that provides a wide range of services and features.
 - A lot of documentation and a mature ecosystem.
 - High in performance and scalability, based on different pricing.

- Azure (Microsoft Azure)
 - Easy to integrate with the Microsoft technologies.
 - Storing security and compliance features.
- GCP
 - High-performance global network infrastructure.
 - Developer-friendly environment.

(Comparing AWS, Azure, GCP, n.d.)

All and all the service can be used by Quantum TLC. Due to the compliance with Microsoft technologies and the easy-to-use interface, with also a lot of services that they offer, Microsoft Azure can be great as a cloud platform. When thinking of the system, Azure can in regards to performance offer Azure SQL Database, or with Scalability have Kubernetes Services to help containerized workload to scale horizontally, which can help with the peak loads in the festival periods. They also have great security with the identity management of the Azure Active Directory. They also have compliance with the GDPR/Privacy when it comes to features like Azure Key Vault managing to store sensitive data. (Security services and technologies available on Azure, 2023)

Relevant Cloud Services

To begin with, to look at the architecture of Quantum TLC, there are incoming requests from the front-end to the API gateway which will load balance to certain services based on configurations. These services will have a database that will store needed information. The database and load balancer are single points of entries, this means they are also single points of failure, meaning that when the service fails the system will fail. Therefore, the cloud can offer to put the API gateway and Database into the cloud, offering backups when a service fails.

DBaaS

When using a cloud database, comes with several benefits.

- **Improved Agility:** A cloud database is easy to set up. It will facilitate faster testing, and improving the overall development of the team. When you decide to do something different, it can be easily removed and move to the next solution.
- **Faster market:** with cloud databases, you don't need extra hardware to run the databases. Also, it will make the database up and running within minutes.
- **Reduced Risks:** Cloud providers such as Azure and Google will use automation to improve security with the use of the best practices, lowering the risks compared to when humans do maintenance. Furthermore, they provide SLA and certain features that are automated to limit the loss of cost due to downtimes.
- **Lower costs:** With the automated features, this can also be applied to usage and need for resources in the database. When Quantum TLC has peak usage, it will accordingly adjust to its need, same to when there is less usage.

For Azure, there are a lot of choices for databases, such as MySQL, PostgreSQL, and much more. Databases on the cloud also come with the needed challenges. Even with the automatic auto-scaling to usage, the size limitations can still be a struggle. (Cloud Database: Top 5 Solutions and Why You Need Them, 2022)

API Gateway

By deploying the API Gateway on the cloud it can create a secure and easy-to-monitor environment, that also provides cloud functions. Moreover, it will come in with built-in functions that will easily let you implement authentication and key validation. (API Gateway, n.d.)

Kubernetes-services

With Kubernetes, you can have container orchestration that automates the deployment, scaling and management of this containerized application. Azure Kubernetes Service (AKS) has brought the benefits of the cloud together with Kubernetes to have a fully managed cluster. It bring benefits to it such as efficient resource utilization with providing resources to self-manage the Kubernetes infrastructure. Also, it is faster application development by providing auto-upgrades, and self-healing when a container is not working. Moreover, AKS integrates with Aure Active Directory, which will reduce the risks.

The pricing can be estimated with the use of the Container Services calculator of Microsoft Azure to estimate the cost of the needed resources. (Azure Kubernetes Service (AKS): What Is It and Why Do We Use It?, 2020)

Security

Cloud platforms also offer cloud services regarding security. Azure provides the following that can be used inside Quantum TLC:

- **Azure Key Vault:** Store passwords, keys, tokens, etc.

The key vault will mainly be used for storing the secrets for the database and connecting to third-party applications such as RabbitMQ keys, to remove the sensitive data from the code.

This will look the following for FestivalConnect:

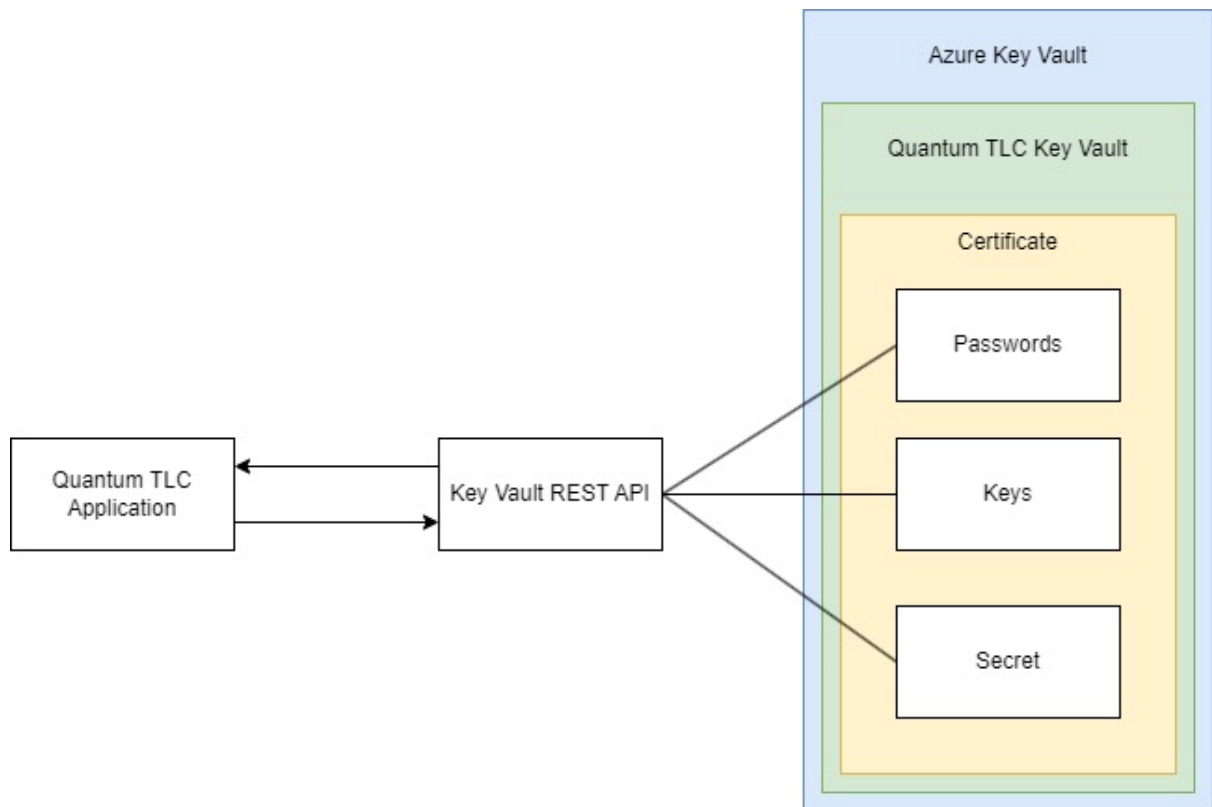


Figure 3: Key Vault Integration With Quantum TLC

So inside the cloud platform Azure, Quantum TLC created a key vault, which stores passwords, keys, and secrets, and the FestivalConnect APIs will interact with the Azure key vault API to retrieve the information.

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