**BAKU HIGHER OIL SCHOOL**

**PROCESS AUTOMATION**

**ENGINEERING DEPARTMENT**

Diagram, bubble chart

Description automatically generated**INFORMATION SECURITY**

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**Project Title:** Simple and Secure Storage Service

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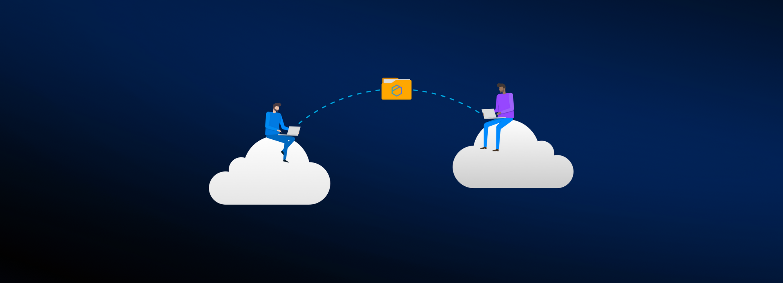
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# Introduction

Cloud computing is the on-demand, pay-as-you-go delivery of IT services over the Internet. Instead of purchasing, owning, and maintaining physical data centers and servers, renting computing power, storage, and databases from a cloud provider on an as-needed basis is possible. Cloud computing is in fact a mechanism or model for enabling convenient, easy, on demand network access to a shared pool of devices that are configurable. Another important feature of cloud computing is the minimum efforts and management cloud model provides rapid services.

People rely heavily on cloud services in their daily lives, e.g., for storing data, writing documents, managing businesses, and playing games online. Cloud computing also provides the infrastructure that has powered key digital trends such as mobile computing, the Internet of Things, big data, and artificial intelligence, thereby accelerating industry dynamics, disrupting existing business models, and fueling the digital transformation.

In regard to the benefits of cloud computing, some of them can be described as follows:

1. **Scalability**

The inherent scalability of cloud computing is one of its main advantages. Being able to simply (and quickly) scale an IT solution, for example, can have a significant and immediate impact on company. In the past, scaling an environment on-demand was impossible since businesses were limited by the size and processing capability of their hardware.

With the cloud, this constraint is no longer an issue. The cloud has completely transformed how businesses handle their technical resources.

1. **Innovation**

Business growth is inextricably linked to innovation. Using old technology might limit an organization's capacity to experiment with new solutions as well as deploy them on a large scale.

Combating back-end performance difficulties, particularly in the area of web applications, can be a serious challenge. Using the cloud as a foundation for innovation can result in better performance, reduced costs, and more agility. In the world of IoT product development, for example, companies are accelerating innovation at a rate that can only be achieved with cloud computing. The IoT industry has been able to develop, produce, and launch new products that are changing the world thanks to cloud computing – and this is true across the entire digital ecosystem.

1. **Cost-effective**

One of the key reasons why cloud computing is significant for businesses is its cost-effectiveness. While cloud migration can be costly, the best way to address the pricing issue isn't to consider how much money you'll save by migrating. Instead, consider how much your company is currently spending on IT services against how much it will be spending on the cloud.

Due to the wide range of project/solution requirements, calculating the true cost of ownership for a cloud solution can be tricky. For an approximate estimate, it's advisable to use a cloud partner.

1. **Flexibility**

One of the most frequently claimed reasons for cloud computing's importance in the business world is its flexibility. The cloud provides more flexibility in terms of infrastructure. However, cloud computing's intrinsic future-proofing architecture is often referred to as flexibility.

Technology is a constantly changing field where adaptation is not only necessary for survival but also for corporate growth. Business expansion used to be a costly process that required devoting a significant amount of people and financial resources to a single project. Now fast forward to today, and businesses have the technical ability to scale up and down as the market demands. The flexibility of cloud computing technology allows for this on-demand flexibility of growing capacities.

The operational flexibility of cloud computing can be achieved at a substantially lower cost.

Still, cloud computing not only provides a vast number of benefits and opportunities; it also comes with several challenges and concerns, e.g., regarding protecting customers’ data. Therefore, there is a dire need for more secure and low complexity cloud provision.

Shape, arrow

Description automatically generated**Simple and Secure Storage Service - S4** is a service to distribute user’s data among user-specified cloud providers in a secure fashion. The available cloud providers’ list depends on the project managers and is evolving. The cloud provided by S4 is one of the safest places on the internet. Sync, backup and share of files from anywhere, anytime – with military-grade encryption and zero-knowledge privacy are supposed to be some of the main benefits of the project to its users.

1. Logo of S4 Project

Now S4 released **version 2** which has brought significant improvements to the application. In the version 1, deleting database after its creation entails the increasing request duration, while that issue has been resolved in the new version.

This paper describes the main points regarding the features and development of S4 project.

# Technical Specification Report

A technical specification document defines the requirements for a project, product, or system. A specification is the information on technical design, development, and procedures related to the requirements it outlines. This document provides information to developers and other stakeholders on business requirements, internal standards, and best practices.

## List of Requirements

Requirements identify the product's business needs and purposes at a high level. They also clarify the features, functionality, behaviors and performance that stakeholders expect. Below you will find list of requirements.

1. Registration
2. Login
3. User Profile Settings
4. User System Settings
5. Dashboards
6. Subscription Plans
7. Request Forms
8. Cloud and on-premise support

## User and System Requirements

*1. Registration -* Users will be able to create personal accounts by following ways (UR):

a. By providing username, email and password (SR)

b. By using one of the oAuth options(e.g twitter, facebook, github) (SR)

* Username and passwords will be checked by predefined policies (FR)
* All sensitive data will be stored in hash format (NFR)

*2. Login -* User will be able to login to portal with credentials registered in registration stage. (UR):

a. User will be able to login with username/email and password (SR)

* User will be informed about successful / unsuccessful login attempts. (FR)
* User will be redirected to home page after successful login within 2 seconds (FR)
* User will be get notification emails about fraud attempts if there is more than 5 failed login attempts (FR)

*3. User Profile Settings* - User will be able to change all profile information stored. (UR)

a. New user profile details should be checked by proper policies in backend. (SR)

* User will be allowed to customize their profile and modify username, email and password. (FR)
* Option to upload profile picture (FR)
* Profile deletion, suspension, activation mechanism will be available in profile settings.(FR)

4. *User System Settings* - User will be able to manage billing and alert&notification settings (UR)

a. Proper billing mechanism will be configured to make transactions(SR)

* User will be able to add and remove credit cards for making purchases. (FR)
* Transaction process will be managed by third party providers (FR)
* User will be able to create notifications for budgeting, resource usage and instance state alerts. (FR)
* User can see user activity in system settings page. (FR)
* Option to export user activity information as well known media formats (csv, json) (NFR)

*5. Dashboards* - User will be able to monitor instance states, resource usage, billing statuses from dashboards. (UR)

a. Prometheus will export logs and Grafana will provide monitoring dashboards in UI. (SR)

* User will see hourly, daily, weekly, monthly monitoring logs in dashboards. (FR)
* Billing dashboards will provide clear understanding of current, past and possible future costs. (FR)
* Grafana dashboards will be exported from standalone server (NFR)

*6. Subscription Plans* - User can select one of the provided subscription plans. (UR)

a. Resource quotas will be measured by subscription plans in backend. (SR)

* User should choose one of the possible subscription plans. (FR)
* User can upgrade or downgrade plan whenever he/she wants. (FR)

*7. Request Forms* - User must fulfill request form in order to create new instance (UR)

a. Request form will be analyzed and proper resources will be allocated in storage providers (SR)

* Option to upload request form as a well known media formats (e.g. json, hcl, xml). (FR)
* Option to fulfill form in web UI as html form. (FR)
* Request form will be matched with chosen subscription plan. (FR)
* Request plans will be saved and prompted afterwards. (NFR)

*8. Cloud and on premise support* - User will be able to choose where to store data, whether in cloud or on premise infrastructure.

a. Chosen database solution will be provisioned in cloud or on premise. (SR)

b. Special security policies will be applied for better security principles in backend when provisioning new database instances. (SR)

* User should be able to provision new instance, suspend it and terminate it. (FR)
* User will be suggested about the most supported types of instances based on chosen availability zones (or provided hardware vendor in on premise infrastructure) (NFR)

### Use Case Diagram

User system use case diagram shows what the standard user can do on the platform. The standard user can register to the platform by filling the registration form. Then he/she can log in by using a valid username and password. After logging in, the standard user can use the functionalities of the platform

Here the use case diagram is presented.

Diagram

Description automatically generated

Figure - 1.

### Sequence Diagrams

Sequence diagrams show the steps done by the user after accessing the platform.

#### Login and Registration Sequence Diagram

A picture containing calendar

Description automatically generated

Figure - 2

#### Normal User Sequence Diagram

Timeline

Description automatically generated

Figure - 3

In the sequence diagram above the normal user is first supposed to login, after which the authorized user can manage his/her profile, can create instance in the dashboard (dashboard gives information about the instance states etc.), and from the dashboard the user-specified data is sent to the appropriate cloud provider which in turn provides the required resources.

# UML Diagrams

## Activity Diagrams

Diagram

Description automatically generated

Figure - 4

Diagram

Description automatically generated

Figure - 5

In the activity diagram above the registration process is depicted.

## Class Diagram

The class diagram above provides information about the classes and their attributes.

Diagram

Description automatically generated

Figure - 6

## ER Diagram

Diagram

Description automatically generated

Figure - 7

# Product Backlogs

Graphical user interface, application

Description automatically generated

Figure - 8

# Agile Methodology – Main Modules

The Agile methodology is a way to manage a project by breaking it up into several phases. It involves constant collaboration with stakeholders and continuous improvement at every stage. Once the work begins, teams cycle through a process of planning, executing, and evaluating. Continuous collaboration is vital, both with team members and project stakeholders.

## Registration

## Design

Graphical user interface, application, Teams

Description automatically generated

Figure - 9

For the creation of new account user is supposed to enter username, email, password.

## Development

Text

Description automatically generated

Figure - 10

## Testing

Text

Description automatically generated

Figure - 11

The script checks whether the website’s registration page is available or not through obtaining HTTP status code. Here is the script written in bash.

Text

Description automatically generated

Figure - 12

## Login

## Design

Two people standing next to a computer screen

Description automatically generated with low confidence

Figure - 13

## Development

Here is a snippet of login code.

Text

Description automatically generated

Figure - 14

## Testing

**Performance Testing**

Text

Description automatically generated

Figure - 15

**Penetration testing**

The following depicts the result of whatweb command which reveals the server information and IP address.

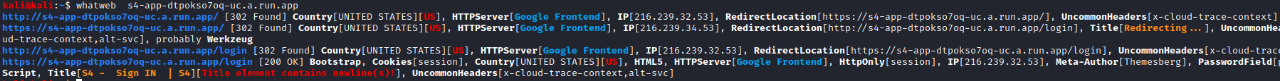


Figure - 16

The below dig command usage reveals the IP and ns records of the application which then can be used.

Text

Description automatically generated

Figure - 17

Text

Description automatically generated

Figure - 18

Blocking WHOIS info is of good security.

## Database Provision

## Design

Graphical user interface, text, application, email

Description automatically generated

Figure - 19

The process takes place in the background.

## Development

Text

Description automatically generated

Figure - 20

## Testing

Text

Description automatically generated

Figure - 21

Since there is no authentication while testing it gives 403 error - Forbidden message

## Database Instance Form

## Design

Graphical user interface, text, application, email

Description automatically generated

Figure - 22

Graphical user interface, application

Description automatically generated

Figure - 23

Currently, 9 database types are supported by S4. Storage size ranges between 10 and 65536 GB.

## Development

Text

Description automatically generated

Figure - 24

## Testing

Text

Description automatically generated

Figure - 25

## Database Monitoring and Control

## Design

Graphical user interface, text, application, website

Description automatically generated

Figure - 26

In the case of instance named testdbinstance the state is RUNNABLE and it has been given public IP address.

Graphical user interface, application, Word

Description automatically generated

Figure - 27

## Development

Text

Description automatically generated

Figure - 28

## Testing

Table

Description automatically generated

Figure - 29

This test has been conducted via Apache Jmeter which is believed to be one of the most effective performance testing tools.

# Implementation of Cryptography

In the website HTTPS is used instead of HTTP, which is much more secure – TLS is used.

Apart from this, SHA256 is used.

Text

Description automatically generated

Figure - 30

# Links

* <https://github.com/app-generator/flask-volt-dashboard>

# References

* <https://sam-solutions.us/why-cloud-computing-is-important-for-business/>
* <https://www.atlassian.com/agile>