



# School of ICT

## Capstone Project

### Solution Design Document

<b>Project Title:</b>	Virtual Coffee Shop
<b>Project Team:</b>	Tech ProJENY
<b>Supervising Instructor:</b>	Andrew Campbell
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## DOCUMENT HISTORY

Document Revision	Date DD/MM/YY	Revised By	Changes/Notes	Corresponding Document
1.0.0	2022.3.7	Dean Alexander	Start to first draft	
1.1.0	2022.4.06	All Tech ProJENY team members	Initial full draft	
1.2.0	2022.4.08	Blythe Brown	Misc. edits and formatting	
1.2.0	2022.4.08	Dean Alexander	Some editing and formatting	
1.3.0	2022.5.31	Blythe Brown	Changing Visio Diagram	PROJ 354 - network map.vsd
1.4.0	2022.6.22	ALL Tech ProJENY	Edited High level diagram	

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## 2 INTRODUCTION

### 2.1 DESIGN OVERVIEW

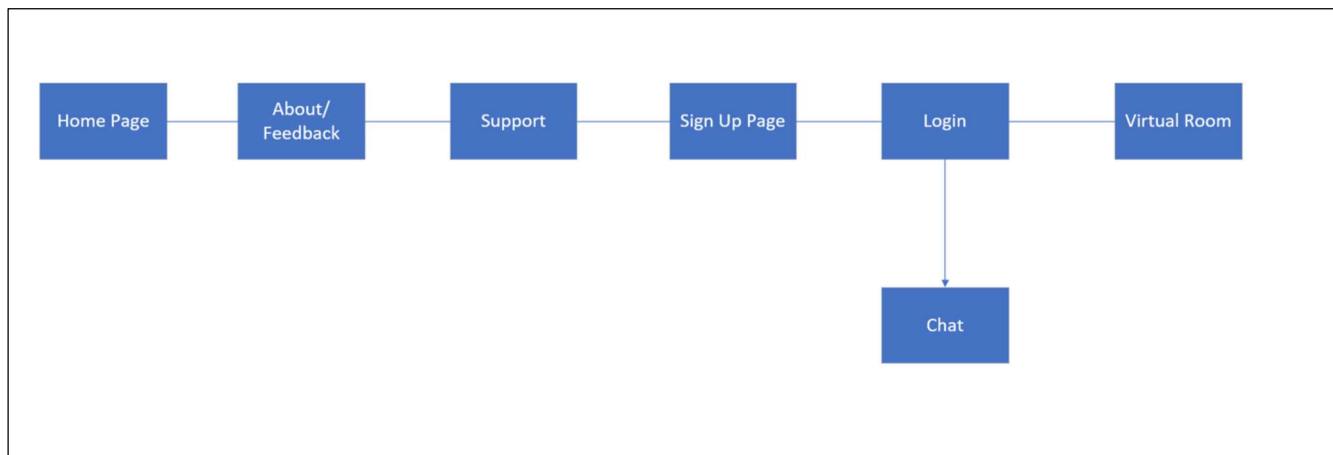
#### Operating Environment

All operating systems will run within a virtual environment through the use of VMware. Different operating systems and services will be used for the project. They are listed as follows:

- Ubuntu 20.04 – Webserver and MySQL server
- Windows 10 – Client systems
- pfSense – Firewall and router
- Windows Server Datacenter 2016 – DNS

#### High Level-Design

The site map below displays the basic organization of the website. The site will have users sign up and log in to experience the virtual tour and chat features. Once logged in, users can explore the virtual room to their liking. They can also go to a “table” in the room and select the chat option. Once the chat is selected the users will be moved to the chat page where they can message other users currently “sitting” at the table.



## 2.2 PURPOSE AND SCOPE

### **Purpose:**

This document will outline components, constraints, planning and overall design implementation for the virtual chat site. While some detail has been provided in the document the project remains a work-in-progress, with final details to be determined later.

### **Scope:**

The whole project will be virtualized on a local network. Till the final capstone presentation almost all of the features will be same, but few changes can be made at the spot. For example, adding an extra layer of security or adding a dark mode etc. to the website. Adding to it user will be limited to traversing through a physical space (using a virtual tour). Physical space will be limited to a single site for now but moving forward new sites can also be included.

## 2.3 PROJECT EXECUTIVE SUMMARY

This project is intended to provide users with a virtual hangout coffee space. Users are required to sign up to access the chat rooms. As soon as they are logged in, a simple but interactive chat interface will appear on the webpage that they can use to communicate with other users on the website. Upon entering the chat section of the website, users will have the ability to choose a virtual table located inside the coffee shop for web chat.

The client will connect through the internet to a web server running Apache2. On this server the web pages are stored and served to the client machines. The pages allow for navigation via a web browser. The user must first sign up for an account if they do not have one already. The user will need to provide a username and password. When the data has been entered, it is sent to the SQL server. The traffic is routed via pfSense. If the user already has an account, the user can enter their credentials for authentication. Authentication is done by sending the data to the SQL server and checking the data entered against entries in the database.

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### 2.3.1 SYSTEM OVERVIEW

Please see other sections of this document for system overview information.

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### 2.3.2 DESIGN CONSTRAINTS

Design constraints for the project include the following:

- Building virtual tour
- Programming the chat: getting messages sent and received between users

- Making virtual tour for mobile
- Using DNS
- User is using a laptop or desktop computer
- Browser is compatible
- Users are willing to use virtual chat vs talking in real life
- A business is willing to implement a system

### 2.3.3 CONTINGENCIES AND MITIGATION PLAN

One of the most impactful contingencies is the potential for one or more team members to be unable to attend capstone. To reduce the likelihood of this affecting project outcome, we have ensured a team size of six – the maximum permitted number. This ensures there will be an adequate number of group members for the capstone course, even if one or two group members are unable to attend the class next semester. Complying with other courses schedule can also be another constraint and in order to mitigate the same a proper academic planning will be required.

Creating the “virtual tour” aspect of the coffee shop may also be problematic. It might be difficult to make more of a 3D immersive experience with a lot of coffee shop details in the background. A possible workaround is simplifying this by setting up a page displaying “tables” and linking them to the different chatrooms when users click on each one.

## 2.4 SOLUTION SCOPE

This project includes a functioning website, including pages such as *Home, About Us, Sign-up, Login, Tour, and Chat*). The pages include the following functionality:

- *Home* – Gives a simple overview of the service.
- *About Us* – Informs the reader about the service, including its purpose.
- *Signup* – allows users to sign up with a custom username, name, email, and password
- *Login* – allows the user to enter their identification and authentication (per the backend SQL database), providing access to the chat functionality of the website.
- *Support* – helps customers find help with the website quickly and intuitively.
- *Tour* – The tour page will allow users to traverse a room or place and select a table to join a chat. The chat will have a live message stream with all users at the designated table able to send and receive messages. All systems will be held in an isolated network and will not be accessible by the public.

There are several relevant examples of out-of-scope components for the project, including:

- Having public users and a webserver is out-of-scope for the project solution.
- Business plan (including monetization strategy).
- A scalable back end.
- Partnership with a specific company.

## 2.5 PROJECT POTENTIALS

The objective of this project is to create an online social environment that allows people to socially distance while interacting with others. It provides an immersive experience by displaying a virtual tour inside of web browsers where users can select tables to enter them into different chat rooms. Because it does not require users to download any external applications, it is very versatile for multiple types of devices and more secure. It provides an opportunity for individuals to socialize with new people in a local coffee shop space without having to physically be there. This idea combines chatroom and virtual tour features within a website platform for ease of access.

## 2.6 REFERENCES

- [https://www.youtube.com/watch?v=yFWAOzwovrQ&ab\\_channel=BrianDesign](https://www.youtube.com/watch?v=yFWAOzwovrQ&ab_channel=BrianDesign)
- [https://www.youtube.com/watch?v=5WoQm7tR6EA&t=4s&ab\\_channel=BrianDesign](https://www.youtube.com/watch?v=5WoQm7tR6EA&t=4s&ab_channel=BrianDesign)
- <https://www.pexels.com/search/brewed%20coffee/>
- <https://acegif.com/coffee-gifs/>
- <https://www.bkacontent.com/12-types-of-editors-and-what-they-do/>
- [www.w3schools.com](http://www.w3schools.com)
- <https://www.myrecipes.com/how-to/make-your-home-feel-like-your-favorite-coffee-shop>
- <https://www.tutorialspoint.com/How-to-set-font-color-in-HTML#:~:text=To%20set%20the%20font%20color,used%20to%20add%20font%20color>
- <https://www.pexels.com/search/brewed%20coffee/>
- <https://www.youtube.com/watch?v=TOliuuOTLzg>
- <https://www.ibm.com/cloud/learn/lamp-stack-explained>
- <sup>1</sup>[https://en.wikipedia.org/wiki/Client\\_\(computing\)#:~:text=In%20computing%2C%20a%20client%20is,by%20way%20of%20a%20network.](https://en.wikipedia.org/wiki/Client_(computing)#:~:text=In%20computing%2C%20a%20client%20is,by%20way%20of%20a%20network.)

## 2.7 GLOSSARY

- **Client** – A piece of computer hardware or software that accesses a service made available by a server as part of the client-server model of computer networks.
- **DNS Server** – (Domain Name System) System that holds records that identify computers, services and other resources with the systems respective address.
- **FQDN** – (Fully Qualified Domain Name) is the complete domain name for a particular system or service.
- **Firewall** – software or hardware that holds a set of rules that can allow or block certain systems and networks from having access to a service or system.
- **pfSense** – Open-source software that provides both firewall and routing
- **SQL Server** – Open-source database software that will store and retrieve data for other



systems or software.

## 3 HIGH LEVEL DESIGN

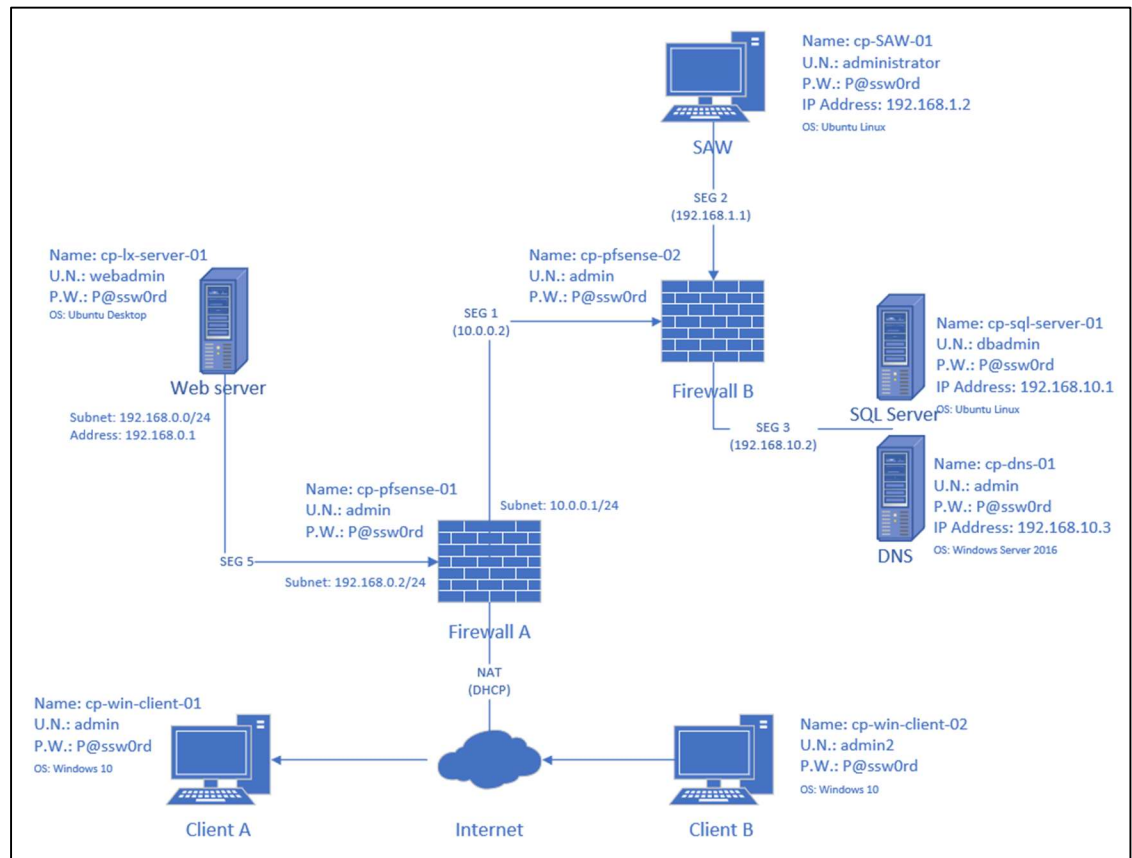
### 3.1 DESIGN CHOICES

The web application that will be produced in this project will run on LAMP. This web stack is widely used and runs some of the most widely used web applications. The group decided to go with this for the server side of the web application since it is open source and has a very good reputation when it comes to developing new custom web apps. The LAMP stack is composed of Linux, Apache, MySQL, and PHP.

The operating system that we selected is Linux. It is a free and open-source operating system that is widely used in developing web apps. Linux is very popular due to it being flexible, easily configured, and secure. For the web server, we decided to go with Apache2. It is a free and open-source web server that is one of the most preferred HTTP clients on the web. Apache is great to use when dealing with large amounts of traffic and it only requires minimal configuration. For the database, the group decided to go with MySQL which is the third component of the LAMP web stack. Similar to the other two components, MySQL is also open source. MySQL is one of the most popular database since it is very simple to set up and very easy to configure. For the scripting language, we selected PHP since it is easy to incorporate with the web server and the database. PHP has a lot of features that makes it one of the popular choices for web development which includes speed, flexibility and simplicity. In terms of firewall and routing, the group decided to use pfSense. PfSense is an open-source firewall/router which is easy to configure and provides services that are found on business-grade networking devices.

## 3.2 DESIGN FUNCTIONAL VIEW

The design functional schematic of the solution is as follows:



## 4 HIGH LEVEL DESIGN

### 4.1 HARDWARE DETAIL DESIGN

Following are the hardware components and specifications.

Components	Specifications
<b>Web Server</b>	CPU: Quad Core CPU RAM: 4 GB HARD DISK: 20GB NETWORK ADAPTER: Interface 1: WAN Interface 2: LAN Segment
<b>Database Server</b>	CPU: Quad Core CPU RAM: 4 GB HARD DISK: 40GB NETWORK ADAPTER: Interface: LAN Segment
<b>PfSense (two instances)</b>	CPU: Dual Core CPU RAM: 4 GB HARD DISK: 12GB NETWORK ADAPTER: Interface 1: LAN Segment Interface 2: LAN Segment
<b>Admin Machine</b>	CPU: Dual Core CPU RAM: 4 GB HARD DISK: 20 GB NETWORK ADAPTER: Interface: LAN Segment
<b>DNS Server</b>	CPU: Quad Core CPU RAM: 4 GB HARD DISK: 40 GB NETWORK ADAPTER Interface: LAN Segment

## 4.2 SOFTWARE DETAIL DESIGN

Components	Software
Client Side	HTML, CSS, Javascript
Server Side	Linux, Apache2, MySQL, PHP

The project will produce a working web application which will have two major components: the client and server side. All webpages will be created using HTML, CSS, and Javascript. For the server side, signup and login will be handled by PHP. All user information will be stored in a MySQL database. The Web Server that will be used in the project will be Apache2 and the operating system (OS) will be Linux since PHP, MySQL and Apache2 are easily integrated in this OS.

## 4.3 NETWORKING DETAIL DESIGN

Source	Permit/Deny	Protocol	Destination	Source Port	Destination Port	Service
User client	Permit	TCP	Apache webserver	any	443	HTTPS
Admin system	Permit	TCP	Apache Web Server	any	22	SSH
Admin system	Permit	TCP	PfSense			TCP
Apache Webserver	Permit	TCP	pfSense			TCP
PfSense	Permit	TCP	MySQL Server		3306	TCP
MySQL Server	Permit	TCP	PfSense			TCP
PfSense	Permit	TCP	Apache Web Server			TCP

User systems will be able to establish a connection with the Apache webserver on port 443. The webserver and admin system will be the only machines able to connect to the database. To access either the SQL server or the DNS server systems will need to go through the pfSense and have a specific IP address.

## 4.4 SECURITY DETAIL DESIGN

The website will be in its own network where users can access it. It will also have a firewall in place. So, users will only be able to establish a connection to ports 80, 443. Once users sign up, login or send any information the webserver will connect to a pfSense router to upload or retrieve data from the database server that resides in its own isolated network. The website will also be configured to use SSL certificates to encrypt data being sent and received.

## 4.5 SERVICES DETAIL DESIGN

### Web server

- Hosts all web pages
- Embedded virtual tour
- Chat page that sends and receives messages with the use of PHP

### SQL server

- Holds all user information and chat messages

### DNS

- Hold FDQN records for Web server, SQL server

## 5 OPERATIONAL REQUIREMENT

For this project to be completed, it will need the following functional features:

- Chat messages can be sent and received
- Users can login/logout and sign up
- Network connectivity
- Firewall implemented
- Web/DNS/SQL server deployed
- Functioning web pages
- PfSense routing implemented