## Objective:

The main objective of this document is to demonstrate the implementation of a database application on a public cloud using docker.

## Background:

Farmeasy is the name of our database application. The name has been kept keeping in mind the users of this application; Farmers and Researchers. Basically, Farmers upload data regarding themselves and the crops which they want to sell. This data is stored in a database which is then accessed for displaying available products to buyers. Besides we also have useful links for farmers in the homepage, a scroller image widget, a clock, a link to videos and miscellaneous. We have used JavaScript, HTML and CSS for the front end and PHP for the back-end connectivity. MariaDB(MySQL) is used as back-end database.

| first_name | last_name | gender | city | district | state | aadhar | phone | crop |
|---|---|---|---|---|---|---|---|---|
| Rajesh | hiremath | male | bengalore | bengalore | karnataka | 476474787989 | 7876477899 | 1,3,apple,mango,nuts |
| Arsha | ranade | male | chikkamangalore | chikkamangalore | karnataka | 796587789654 | 9786588965 | 2,tomato,radish |
| Ranadhir | sharm | male | gadag | gadag | karnataka | 789749789788 | 9886890806 | 2,tomato,brinjal |
| Ghambhir | shetty | male | kodagu | kodagu | karnataka | 565788939399 | 8985988958 | 2,tomato,brinjal |
| Ganesh | karma | male | gadag | gadag | karnataka | 789579745934 | 9098589505 | 2,3,tomato,gram |
| Anusha | kantar | female | uttarkannada | uttarkannada | karnataka | 894794778489 | 9745454544 | 4,corn,ragi,jowar |
| Radhika | singe | female | udapi | udapi | karnataka | 893797903080 | 7662388823 | 2,3,radish,dal |
| Raman | ankani | male | koppal | koppal | karnataka | 767348934999 | 9959044459 | 3,4,nuts,dal,wheat |
| Ramya | sharm | female | bengalore | bengalore | karnataka | 676287388378 | 9699096566 | 1,2,3,mango,orange,tomato,dal |
| Gangadhar | kohli | male | bagalakote | bagalakote | karnataka | 874783889900 | 6888968906 | 4,wheat,ragi |
| Krishna | rathode | male | raichur | raichur | karnataka | 587658676858 | 9905695690 | 1,4,apple,wheat |
| karna | karte | male | udapi | udapi | karnataka | 648768763499 | 7889457979 | 1,2,apple,tomato |
| anita | choudary | female | ramanagar | ramanagar | karnataka | 664687899999 | 8789893499 | 2,tomato |
| bharat | chouhan | male | gulbarga | gulbarga | karnataka | 848884984888 | 7492399090 | 1,4,apple,ragi |

Fig. 1: Sample Of the Data In Database


Fig. 2: The homepage of our website

## Docker:

Our database application is executed using XAMPP server, which loads PHP scripts using Apache web server and MySQL server. This works fine for our local computers. The aim is to make our application platform independent. There are varieties of operating systems or runtime environments in which we may have to run our application and there is no guarantee that it will work there. Docker is treated as the solution for such situation. It is similar to virtual

machines, the difference being that it virtualizes the operating system, while Virtual Machine virtualizes hardware. Using Docker containers, we can run a container in virtually any platform.

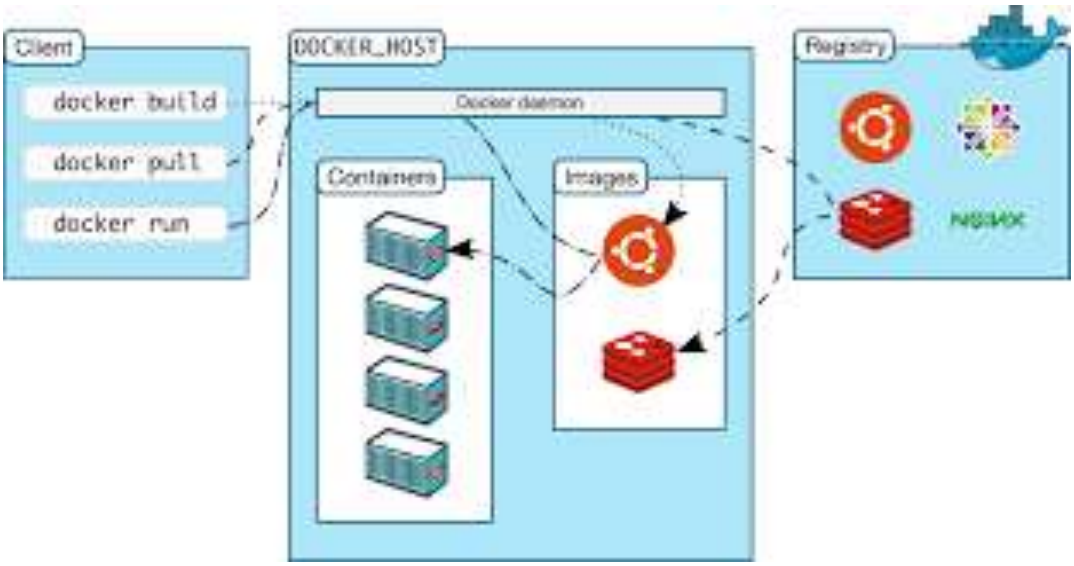



Fig. 3: Docker

## Azure:

Azure is a popular public cloud, managed by the Microsoft Corporation. We chose Azure because of its ease of usage compared to other cloud platforms. It provides several free services for the first 12 months and also offers $200 credit to be used in the first twelve months. Azure offers a broad variety of services like Web Apps, Virtual Machines, SQL storage and so on. For our project, we use the Web App service of Azure.

Fig. 5: Azure Cloud

## Deploying Container To Azure:

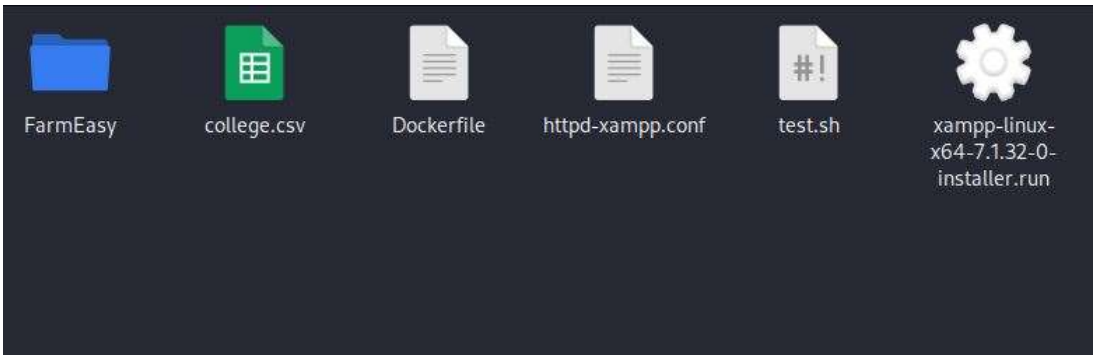
The first part of the deployment was to create a **Dockerfile**. It is a standard way of dynamically creating images. To explain this, Dockerfile is a file containing a set of instructions that tells docker how to produce an image. For our project, I prepared the Dockerfile as given below:

```
FROM ubuntu:bionic
COPY xampp-linux-x64-7.1.32-0-installer.run /opt
COPY test.sh /opt
WORKDIR /opt
RUN apt update
RUN apt-get update
RUN apt-get install net-tools
RUN chmod +x xampp-linux-x64-7.1.32-0-installer.run
RUN chmod +x test.sh
RUN ./xampp-linux-x64-7.1.32-0-installer.run
WORKDIR lampp/htdocs
RUN mkdir FarmEasy
COPY FarmEasy /opt/lampp/htdocs/FarmEasy
WORKDIR /opt
RUN rm lampp/etc/extra/httpd-xampp.conf
COPY httpd-xampp.conf /opt/lampp/etc/extra
EXPOSE 80
COPY test.sh /usr/local/bin/
RUN chmod u+x /usr/local/bin/test.sh
ENTRYPOINT ["test.sh"]
```

The httpd-conf is used to configure phpmyadmin for public access.

The test.sh has a very important function to perform. The XAMPP server, unlike other servers like nginx, does not run in the foreground. To keep the server running in foreground(otherwise the container exits immediately after run), we need something that runs forever. test.sh does exactly this. It runs an infinite while loop.

To build an image using the dockerfile, we must have a directory in a Linux system with docker installed like the one shown below. Note that college.csv is optional. It is required only for filling data in our database. One of my classmates contributed this file.




Then, within that directory, open a terminal and issue the following command

***docker build .***

It takes a while to build the image. A message showing successful completion will be displayed.

Then I used ***docker tag*** command to give a name and tag to the created image. In my case, it was:

***docker tag <image-id> dockercoolexp/osproject:latest***

Basically, I will push my image to my Docker Hub registry named dockercoolexp (username) for further steps.

To run the container, we can issue the following command:

***docker run -p 8000:80 --name test dockercoolexp/osproject:latest***

To see the container in action, open a browser and type localhost:8000. You should be able to see the XAMPP welcome page. This shows the successful configuration of the container. Note that this would not be possible without the test.sh script that I mentioned before. I simply mapped port 8000 on the host to port 80 on the container where our XAMPP server is listening.

To push the image to DockerHub, I used the following commands:

***docker login***

***docker push dockercoolexp/osproject:latest***

After these commands, I have a docker image in my docker registry for public use. To pull the image simply use ***docker pull dockercoolexp/osproject:latest.***

Now lets come to Azure.

First, I open a cloud shell and then, I clone my Github repository containing all the required files using: ***git clone https://github.com/txh2020/DockerProject***.

Then issue ***cd DockerProject.***

Note that I haven't included the xampp installation file in my GitHub repo because it is too large (152MB) to fit in a normal GitHub repository. In Azure I dealt with the problem using wget:

***wget*** ***https://sourceforge.net/projects/xampp/files/XAMPP%20Linux/7.1.32/xampp-linux-x64-7.1.32-0-installer.run/download***

and then I renamed the file as xampp-linux-x64-7.1.32-0-installer.run using:

***mv download xampp-linux-x64-7.1.32-0-installer.run*** .

Basically, our project folder contents should be as follows:


I decided to use **docker conpose** to deploy to the image to Azure. After a lot of unsuccessful attempts, I found out that it was not possible to implement **VOLUME** using Dockerfile. A volume is used to persist the data stored in the database. The problem lies in the fact that we can create a volume in Dockerfile, but we cannot dynamically initialize it for storage. I also tried other techniques such as **Azure File Share** but was not successful. Then I came across Docker compose. We can build a docker image using a file known as **docker-compose.yml** using the following command:

**docker compose up**

The command automatically searches for the docker-compose.yml file and builds the image. For the deployment to Azure, my docker-compose.yml file, which is present as dc.yml in my GitHub repo is as follows:

```
version: '3.3'

services:

  db:

    image: dockercoolexp/osproject:latest

    volumes:

      - db_data:/opt/lampp/var/mysql

volumes:

   db_data:
```

This is where the image that I pushed to the DockerHub helps. I am pulling that image here since Azure cannot build it from scratch using **build .** option in the dc.yml file to itself build the file from scratch.

The goal is to deploy our dockerized web application as a web application in the cloud. In the cloud terminal, issue the following commands. Note that you can give any name to the resource group, service plan and webapp:

```
az group create --name myResourceGroup --location "South Central US"

az appservice plan create --name myAppServicePlan --resource-group myResourceGroup --sku F1 --is-linux

az webapp create --resource-group myResourceGroup --plan myAppServicePlan --name styapp2--multicontainer-config-type compose --multicontainer-config-file dc.yml
```

Once these steps are successfully completed, then issue the following command.

***az webapp config appsettings set --resource-group myResourceGroup --name styapp2 --settings WEBSITES_ENABLE_APP_SERVICE_STORAGE=TRUE***

This step is crucial because it gives persistency to the database.

Once all these steps are done, go to the Azure Portal. Search for styapp2. Click on the app. Then in the dashboard, we have the link to our webapp. Click on it. Initially, the application takes a lot of time to load. It may gateway timeout or application error. Do not heed these errors. Reload the browser as and when these errors appear. Finally, you will find the XAMPP welcome page appearing. Our web application is running successfully.

Then I just created the required database using phpMyAdmin and populated it using college.csv.

And there we go. The web application is finally ready.

In my case the link to the application is as follows:

https://styapp2.azurewebsites.net/FarmEasy/proj.php

## References: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