INTRODUCTION TO CLOUD COMPUTING COURSE PROJECT

TECHNICAL REPORT

West Chester University of Pennsylvania

February 2022

Prepared by

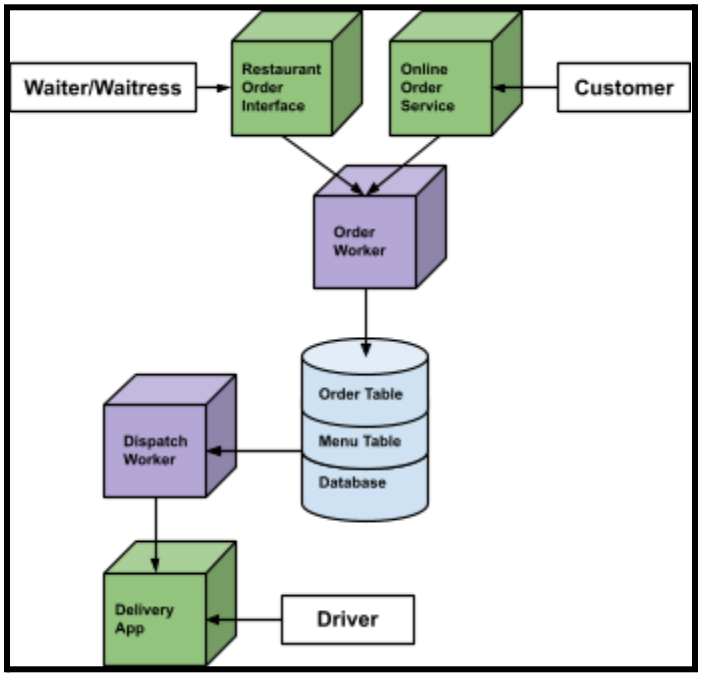
Nassirdine Djibo
Emma Loch
Joseph McDowell
Evan Older
Kieran Petrosky

SUMMARY
Project Description

Cloud Cooked is a cloud-based restaurant order interface and delivery management service targeted at restaurants who employ their own drivers. The service can accept orders in two ways through an optimized UI for cashiers and a customer facing online website. Additionally, the service provides a delivery driver application for delivery drivers, providing them with available delivery orders and optimal routes for multiple order drives. Cloud Cooked is deployed and maintained by Kubernetes, and also includes CI/CD services, allowing for automatic and seamless updates to the service.

CHAPTER 1
Team Vision and Design

Our team's vision is to create a cloud-based service for restaurant ordering and delivery. The service will be capable of taking both in-person orders by cashier input and online orders by customers. The system will also feature a mobile delivery app, which provides drivers optimal routes for multiple order deliveries. The service will utilize two databases: a menu database for storing item prices, and an order database for storing all orders.



Frontend components

- Restaurant order interface (waiter/waitress)
    - Take in-person orders, input customers cashiers
- Online order service (customer)
    - Online orders, input from customers
- Delivery app (delivery driver)
    - Used by delivery driver, provides optimal driving routes

Backend components

- Order worker
    - Handles placed orders, gets pricing through menu database, stores orders into order database
- Dispatch worker
    - Provides open delivery orders to delivery app, finds optimal google maps driving route

Databases

- Menu database
    - Stores restaurant menu item prices
- Order database
    - Stores and categorizes orders

CHAPTER 2
Addressing Technical Requirements

In order to address and meet the technical requirements of the project, we will first finalize the concept of each component of the service. This includes finalizing each action all frontend and backend components will take, and all the detailed information that each database will contain.

After finalizing the service conceptually, we will look into implementing each component of the service. For the two beginning front-end services, the restaurant order interface and the online service, we will utilize JavaScript, to make the GUIs and websites needed for front-end interactions. Back-end workers will be coded with Python. For databases, we will use MySQL database services.

We will also develop an independent mobile delivery application which will interact with services through our delivery worker. We will also implement Google Maps API to be used by our delivery worker to provide optimal routes for our mobile application.

After producing working software, the application will successfully run within a single CloudLab profile and instantiate/collect results of at least 20 runs. The service will be able to automatically process customer orders and store them in the order database. The delivery driver application will automatically update with new delivery orders, and will provide an optimized route to drivers orders based on time of order and location. The service will demonstrate a high level of system complexity running on cloud services.

CHAPTER 3
Intermediate Milestones

Up to this point, our team has successfully built the cloud structure of our project. Our project currently builds and deploys two containers: a Python Flask (backend) container, and a MySQL container. The images for the containers are built through docker-compose, and deployed and maintained through Kubernetes. Our group has also successfully built the CI/CD pipeline for our project on Jenkins, automatically building and deploying updates from our repository. Succeeding with Kubernetes deployment and CI/CD implementation have been our group's greatest accomplishments up to this point.

Our Python Flask container contains a python application which deploys a web application. We intend on this application to be our cashier UI once completed. The application is currently not fully developed and functional. As of now, it only takes in input and redisplays the input. We intend to revise the web application format and structure, and also have that input instead be posted to our database.

Our MySQL database container contains three database tables: menu, customers, and orders. Once completed, the menu database will contain restaurant food and prices, while orders will contain inputted order information, and customers will contain customer information, including addresses (which will be used for our delivery driver application).

Currently, our team's greatest challenge is having our backend application writing to and retrieving information from our databases. We've looked at multiple options to connect our application to the database server and methods to take submitted information and posting to the proper tables. Our group also needs to implement a frontend container that will contain javascript and run our web servers. Lastly, we need to finalize configurations for our MySQL database tables.

At this point, our team believes most of our initial vision for the project is still feasible. Succeeding with Kubernetes Deployment and CI/CD implementation were massive boosts to our team's capabilities for finishing the process. Having already gone through the steps towards deploying our own containers on Kubernetes will allow any future additions and revisions to be much easier than our initial attempts. The Jenkins pipeline will allow our team to work much more effectively. With automated building and deployment of changes we push to our repository, our team can save a lot of time when testing and making changes to our project. Currently, the majority of what is left involves coding and database configurations, both of which we are more familiar with. The only component of our team's vision which we do not think is longer feasible is making our delivery driver application mobile. Instead, we will host the application on a website just like our other frontend components.

CHAPTER 4
Final Deliverable

By our final submission, our team successfully deployed our application on the Cloud. One of the greatest accomplishments of our project was building the fully functional Cloud infrastructure and incorporating our Jenkins pipeline. Our containers are successfully built and deployed onto a Kubernetes pod and maintained by Kubernetes. We built pipelines for both our MySQL and Python Flask containers, allowing us to effortlessly apply edits and incorporate CI/CD services into our project.

Another accomplishment by our team was building the basic functionalities of our project. We mostly were able to achieve the two ends (website for ordering and a delivery service) of our project we originally intended to create for this project, although not completely in the form that we had originally envisioned. We also succeeded in our implementation of the MySQL databases, which was discussed as a goal in the previous chapter, and functions exactly how we envisioned it. Our applications pull up menu information from flask, and post and fetch order information from our MySQL databases when submitting orders and selecting delivery orders, respectively.

However, our final project had some challenges along the way and there were some components that didn't turn out the way we intended. The biggest issue we had was with the delivery application, which came down to a matter of not having enough time to complete it. The functionality of the application works, where a driver can select multiple orders and generate a google maps route for those stops. However, we intended for our application to utilize a route optimization algorithm while generating the route, which never was implemented. Our application is also hosted on the same website as the rest of our project, and lacks any sort of authentication, so it isn't truly a "stand-alone" application, which it would have been if we had more time to complete it.

Another challenge we faced was with the web server as a whole. While we felt like we accomplished the functionality, our website does not visually look professional. We would have been more likely to have a professional looking website if we had time to incorporate JavaScript into our project, which was a goal of our last chapter. Instead, we hosted a very barebones website on our Python Flask application itself, since we didn't have the time to work on connecting a JS webserver to a Python application. Lastly, we weren't able to incorporate GrubHub and Doordash APIs into our project, as we found out there are no publicly available APIs for those services. However, we saw that as a farfetched goal going into this project.

In hindsight, our group was not able to accomplish everything we laid out when we first conceptualized our project. However, we were successfully able to implement the basic and essential functionalities of our intended service, achieving our goal of providing a functioning restaurant and delivery service. In addition, we were able to put our product on the Cloud with CI/CD services, which is what we felt like would be our greatest hurdle coming into the project. Despite the challenges, our group was able to deliver on the fundamentals of our project and met our final deliverable.

Personal Info:

Nassirdine Djibo
Contact information: nassourdine.djibo@gmail.com
300 N front St, Apt c1, Darby, PA 19023
201-736-8920
https://www.linkedin.com/in/nassirdine-djibo-1820ba1a7/

Job experience:

Company	Job title	year
Amazon	Stower	2016-2017
Uber	Driver	2018-2022

Education:

Community College of Philadelphia
Graduation year: (2020)
Major: Computer Science (Associate degree)

West Chester University of Pennsylvania
Graduation year: (2020 - present)
Major: Computer Science (Bachelor)

Skills / Certifications:

Languages:
French, Arabic, English
Tech skills:
Java, Python, MySQL, Microsoft word, Excel, PowerPoint

Emma I. Loch emmailoch@gmail.com

560 Gralan Drive | Lancaster | PA | 17601 | tel: 717.471.3850

EDUCATION: WEST CHESTER UNIVERSITY, College of Science and Technology, West Chester, PA

Bachelor of Science, Graduation: May 2023
Major: Computer Science, concentration in Cyber Security (certification awarded)
Minor: Digital Marketing
Cum. GPA: 3.401, cum laude
| Honor's College Scholarship, Fall 2019 – Spring 2023 |
Selected Courses:

Computer Security & Ethics	Data Structures & Algorithms
Foundations of Computer Science	Computer Systems
Computer Science I, II & III	
Spring 2022:	
Introduction to Cloud Computing	Modern Malware Analysis
Programming Lang. Concepts & Paradigms	

ACTIVITIES & AWARDS:

Honors Student Association (HSA), member – (Fall 2019 - Present)
HAS Choir, member – (Fall 2019 – Present)
Computer Science Club, member – (Spring 2021 - Present)
Irish Dance Club, member – (Fall 2019 - Present)

WORK EXPERIENCE:

West Chester University, West Chester, PA January 2022 – May 2022
Research Scholars Program under the direction of Dr. Linh B Ngo MS, PH.D.

- Analyze subreddit communities to elucidate current issues confronting computer programmers along with potential solutions
- Refine research skills and coding skills

West Chester University, West Chester, PA Academic year 2021-2022
West Chester University Resident Assistant

- Enforce university rules and regulations
- Counsel students, residents, and fellow resident assistants
- Assist students in the dorm

Sheetz, Lancaster, PA June 2019 – June 2021
Team Member, Kitchen and Register

- Completed kitchen tasks and prepared food
- Interacted with and assisted customers

SKILLS & LANGUAGES:

- Java
- C
- Python
- Microsoft Word
- Microsoft Excel
- Microsoft PowerPoi

References available upon request
U.S. citizen (*yes*)

Joseph McDowell

About me:

Email: josephrmcdowell@gmail.com | Phone Number: 215-435-7065

Websites: LinkedIn | GitHub | Awards: Eagle Scout

Goal:

Seeking a position in the field of Computer Science where I can utilize my skills to further work towards personal and professional development and contribute towards the prosperity of the organization.

Skills:

Self-starter | Self-regular | Critical thinking | Problem solving | Leader | Reading Documentation | Strong Communicator | Time Management | Positive Attitude | Forward thinking | Learning new tools | Python | C/C# | Java | Spark | Git | New languages

Education:

West Chester University of Pennsylvania | 2018 to 2022

Major: Computer Science B.S. | GPA: 3.7 | Organizations: Sigma Chi

Key Courses:

Data Structures | Algorithms | Big Data | Computer Security | Software Engineering | Cloud Computing | Artificial Intelligence | Modern Malware Analysis | Network Administration

Work Experience:

Employer: Kulicke & Soffa

Positions: Software Engineer Intern | Employment during Summer 2021

Description:

- Created automatic testing utilizing the Robot Framework to ensure consistency between release updates.
- Managed communication for the team assigned to the project via running meetings and gathering important information from other employees.

Projects:

Bee Careful

- A video game developed in Unity 3D game engine, programmed in C#
- I utilized git for version control and managed tasks using agile methods and Jira software.

Evan Older

Email: evanmolder@gmail.com
Mobile: 267-280-3365
Github: https://github.com/eolder
LinkedIn: https://www.linkedin.com/in/evan-older-1646721a1/

Education

West Chester University of Pennsylvania

- B.Sc. in Computer Science with a minor in Physics - December 2022
- M.Sc. in Computer Science - December 2023

Work Experience

Software Engineer, Intern - Rajant Corporation - June 2020 to Present

- BCCLI - Implemented/Designed a command line interface management application for Rajant Breadcrumbs™, in **Go/Rust**.
- Maintained and built **Linux** firmware for Rajant Breadcrumbs™.
- Automated aspects of development pipelines using **Bash**.

Rajant Corporation, 200 Chesterfield Pkwy, Malvern, PA 19355, (484) 595-0233

Front End Associate - Giant Food Stores - Summer 2017 to Spring 2020

- Maintained a safe and clean store environment, while keeping guests satisfied with their shopping experience.

Giant Food Stores, 1824 Ridge Pike, Royersford, PA 19468, (610) 831-5450

Skills and Knowledge

Languages:

Rust, **Go**, **Java**, **C**, Python, NodeJS, **Bash**, Ocaml

Software:

CAD, **Linux**, **OpenCV**, VMware ESXi, Proxmox Virtualization Environment, **Google Protocol Buffers**, Verilog/SystemVerilog, NGINX/Apache reverse proxy, Google Cloud APIs, Amazon Web Services Elastic Compute, OpenVPN, OpenCA.

Hardware:

3D FDM Printers, Espressif Microcontrollers, Arduinos, Particle MCUs, Rack Mount Server Maintenance.

Noteworthy Personal Projects

- Full-Stack Over the Air firmware management platform for Espressif Microcontrollers, written in **Rust**, **Bash**, and **C++**.
- Computer Vision tracking platform/gimbal, using **Java** and **OpenCV**.
- Custom RESTful API/solution for managing lighting/fans, using **C++** and **Java**.
- (WIP) CAN/OBDII Development Board, based on the Espressif ESP32 SOC.
- Custom Antenna design - Quadrifilar Helix Antenna tuned to 127MHz, to capture NOAA satellite signals.
- Custom rack mount **Linux** server, for hosting various projects including bullet #1.

Kieran Petrosky
8 Endslow Lane, Perkasie, PA18944
KP933775@wcupa.edu
267-424-0402

EDUCATION

- **West Chester University of Pennsylvania, College of Science and Mathematics**
  - West Chester Honors College, Class XXI
  - Major: Computer Science B.S.
  - Minor: Civic and Professional Leadership
  - Cumulative GPA: 3.733 *magna cum laude*
    - Dean's List for the College of Science and Mathematics
  - Intended Graduation: Fall 2022
- **Related Courses**
  - Fall 2019 – Spring 2020: Computer Science I, Computer Science II
  - Fall 2020 – Spring 2021: Computer Science III, Foundations of CSC, Computer Security & Ethics, Computer Systems, Data Structures & Algorithms
  - Fall 2021 – Spring 2022: Software Engineering, Programming Language Concepts & Paradigms, Data Communications & Networking, Intro to Cloud Computing, Modern Malware Analysis, Computer Security

ACTIVITIES

- **Honors Student Association (HSA)**
  - Fall 2019 - Present
  - University-associated organization dedicated to providing volunteerism and service within the local community.
- **West Chester University Incomparable Golden Rams Marching Band**
  - Fall 2019 – Fall 2021
  - Performs in exhibition at football games, local competitions, and regional and national events
  - Recipient of the 2019 Sudler Trophy, awarded to the college marching band which demonstrates the highest musical standards in the nation.

EXPERIENCE

- **Research Scholar's Program (West Chester University of Pennsylvania)**
  - Spring 2022, under the direction of Dr. Linh B Ngo

- Analyze subreddit communities to elucidate current issues confronting computer programmers along with potential solutions

SKILLS

- **Programming Languages**
  - Java, C, Python, OCaml
- **Operating Systems**
  - Windows, Linux