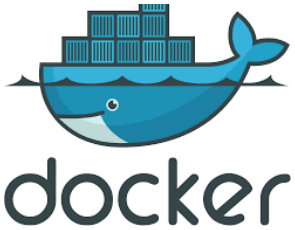
RDP 2018 - 2019

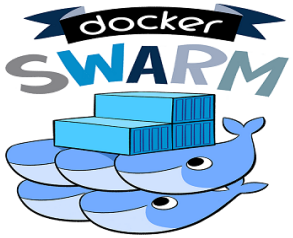
GCU Cloud Platform

v0.3

Research Question

Can we design and build a fully functioning Private Cloud Platform using a cluster of Raspberry PI's using current Cloud Technologies?





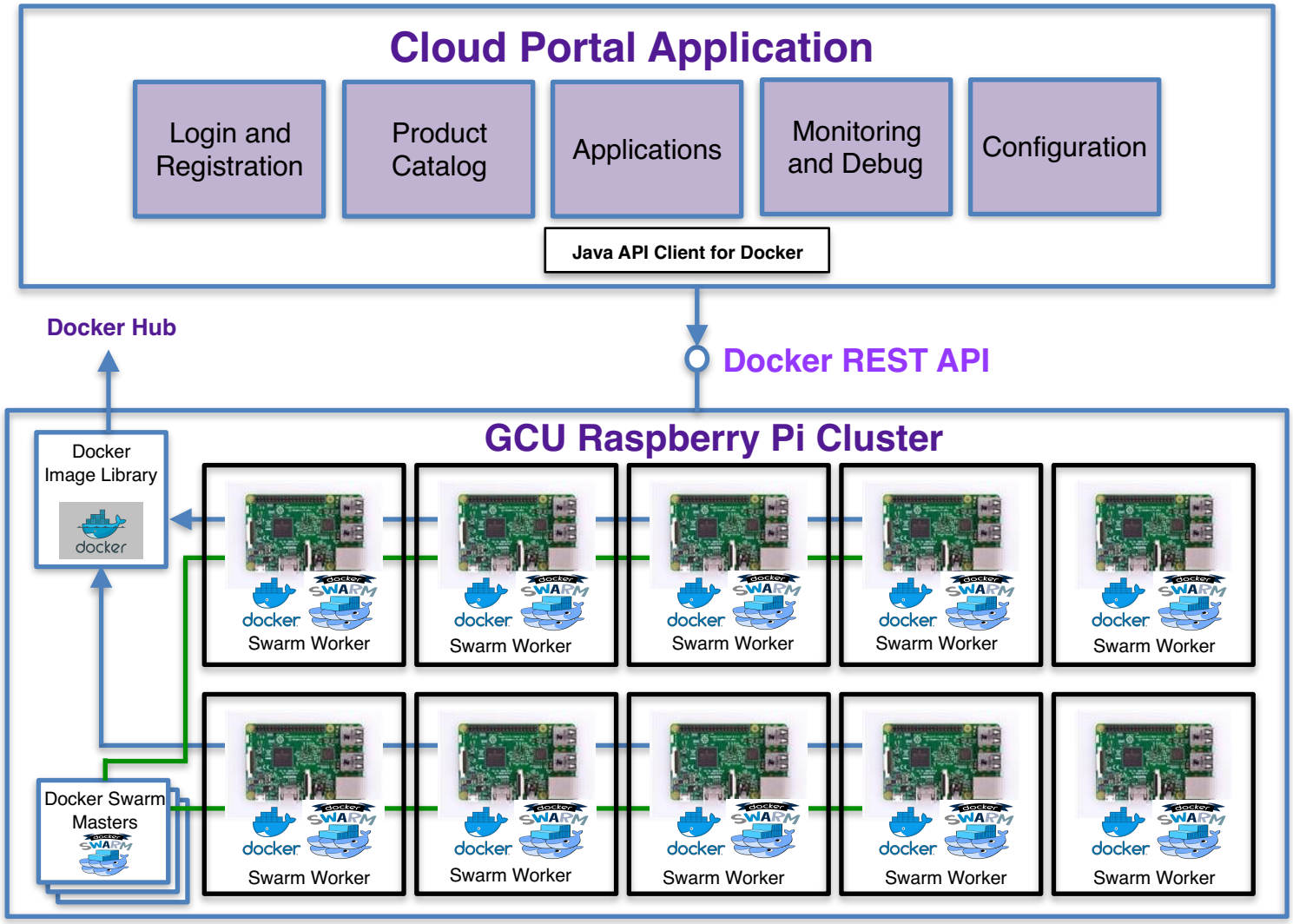
Mentor and Lead:

- Professor Mark Reha

Students:

- Aaron Ross
- Athena Plascencia
- Brendan Brooks
- Chuong Nguyen
- Mark Mott
- Trevor Moore
- Tyler McCarthy
- William Bierer

GCU Private Cloud Platform



Management

Responsive Web Application written using the Spring Boot Framework

Docker API's

Use Docker-Java

Cloud Compute

Expandable cluster of Raspberry Pi's all running Docker in a Docker Swarm

Raspberry Pi Cluster

- Cluster of Raspberry Pi's for Compute Services
  - Initially built using 20 Pi's and being expanded to 60
- Easily expandable to add more Compute Services
- Docker Library to include the following Images:
  - Application Stacks:
    - JBoss, TomEE, Tomcat, Apache PHP, Python, Python AI, NodeJS, .NET Core
  - Databases:
    - MySQL, PostgreSQL, CloudBase (future)
- Leverage Docker for Containers
- Leverage Docker Swarm for Orchestration

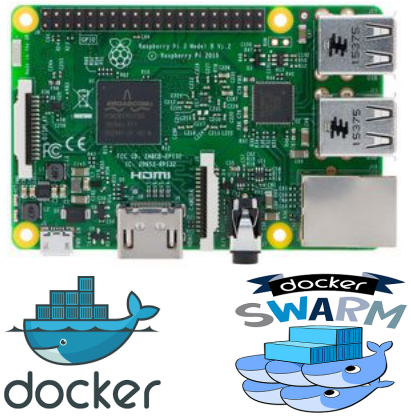
Cloud Portal Application

- Implemented using the Java Spring Boot Framework
- Implemented using Bootstrap for responsive design
- User registration to access Cloud Platform
- Browse a Cloud Product Catalog
- Setup and configure a Cloud Application:
  - Provision an Application Stack
  - Provision a Database (with a Stack)
  - Configure an Application (CPU / RAM)
  - Deploy Application Code
  - Start/Stop/Restart Application
  - Monitor and Debug Application

SPRING Framework

RDP Team Activities

- OS Images and VNC on new Raspberry Pi's
- Setup Docker on new Raspberry Pi's
- Setup And Test GCU Customized Images
- Setup Docker Swarm on Raspberry Pi's
- Implement Java API Client for Docker Library
- Create a script or utility to easily replicate a new Raspberry Pi
- Setup a POC with a small Cluster of 4-5 Pi's
- GCU Raspberry Pi Cluster:
  - Design and built as part of Isac's RDP
  - Integrate this RDP
- Cloud Portal Application:
  - Design and built app
  - Integration of Java API Client for Docker library



RDP Student Learning Opportunities

- Raspberry Pi
- Cloud Computing:
  - Docker Images and Containers
  - Docker Swarm Orchestration
  - Java API Client for Docker Library
  - General Cloud Computing Concepts
  - General Linux and Networking Concepts
- Knowledge recall from prior BSCP classes:
  - CST-221: Linux, bash shell scripting, networking
  - CST-323: Cloud PaaS, Docker, DevOps
  - CST-341: Open Source Technologies using the Spring Framework
  - CST-341: Open Source Technologies using Bootstrap
  - CST-361: Java Design Patterns

Outstanding Issues

- Do we need a common storage solution? Yes, use NAS
- How does the current Pi Cluster networking technology work and will this either needed or work along side Kubernetes or Docker Swarm? Will likely conflict
- How can use Docker Swarm be used to orchestrate the Cloud Container Provisioning and manage the Pi Compute Resources, such as CPU, Memory, and Storage? Yes, all configurable
- What will the performance be with on a Pi if we allocate 0.5 to 1.0 CPU and 240Mb - 500Mb RAM? Can be adjusted in Docker and need to measure