

# RDP 2018 - 2019

## GCU Cloud Platform

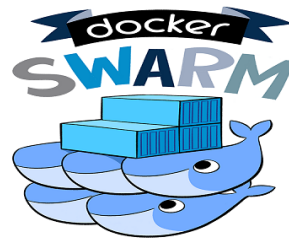
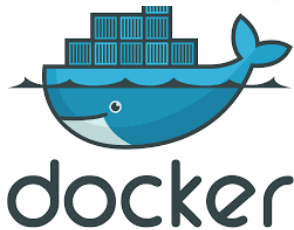
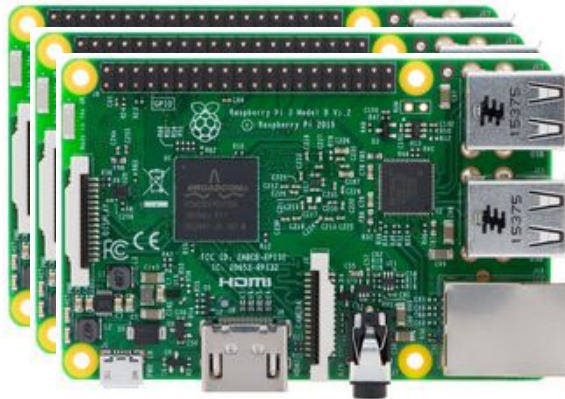
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# Research Question

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



## Mentor an Lead:

- Professor Mark Reha

## Students:

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- Trevor Moore
- Tyler McCarthy
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# GCU Private Cloud Platform

## Cloud Portal Application

Login and  
Registration

Product  
Catalog

Applications

Monitoring  
and Debug

Configuration

Java API Client for Docker

Docker REST API

## GCU Raspberry Pi Cluster

Docker Hub

Docker  
Image Library



Docker Swarm  
Masters



**Management**  
Responsive Web  
Application  
written using the  
Spring  
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
- Leverage Docker for Containers
- Leverage Docker Swarm for Orchestration





# Cloud Portal Application

- Implemented using the Java Spring 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

- Setup OS Images and VNC on new Raspberry Pi's
- Setup Docker on new Raspberry Pi's
- Setup Docker Repository with GCU Customized Images
- Setup Docker Swarm on Raspberry Pi's
- Prototype 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 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



docker



kubernetes

# 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
- 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?
- How does the current Pi Cluster networking technology work and will this either be needed or work alongside Kubernetes or Docker Swarm?
- How can Docker Swarm be used to orchestrate the Cloud Container Provisioning and manage the Pi Compute Resources, such as CPU, Memory, and Storage?
- What will the performance be with on a Pi if we allocate 0.5 to 1.0 CPU and 240Mb - 500Mb RAM? We have to prove this can be adjusted Docker Swarm.