Applied Distributed Systems
CSCI B649

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INDIANA UNIVERSITY

Presentation Link

https://iu.mediaspace.kaltura.com/media/t/1_7pp11gkf

*Note: Audio gets very low at 10:08 due to mic problems.

Introduction

Introduction

Our goals were:

1. Understand distributed architecture components, message queues, testing and deployment strategies, CICD, etc.

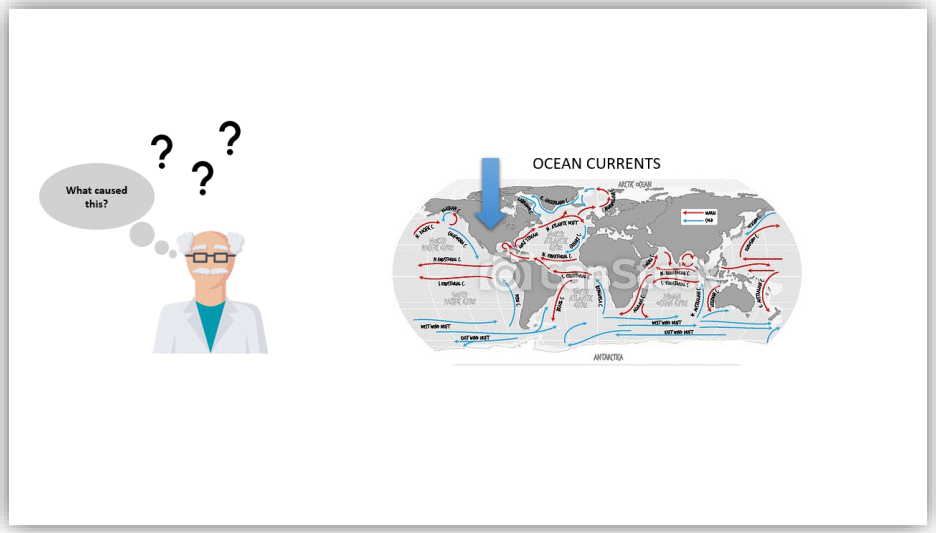
2. Build a full-stack weather analysis system that’s highly available and fault-tolerant, architected in 3 milestones.

3. Deploy and review an open-source project under the Apache foundation.

Introduction

Elevator Pitch:
Research scientists will understand how weather phenomena in a region, affect their research.

Features to view	**(Data Source):**
Reflectivity	(NEXRAD)
Spectrum width	(NEXRAD)
Radial Velocity	(NEXRAD)
ALBEDO	(MERRA)
LWGNTICE	(MERRA)



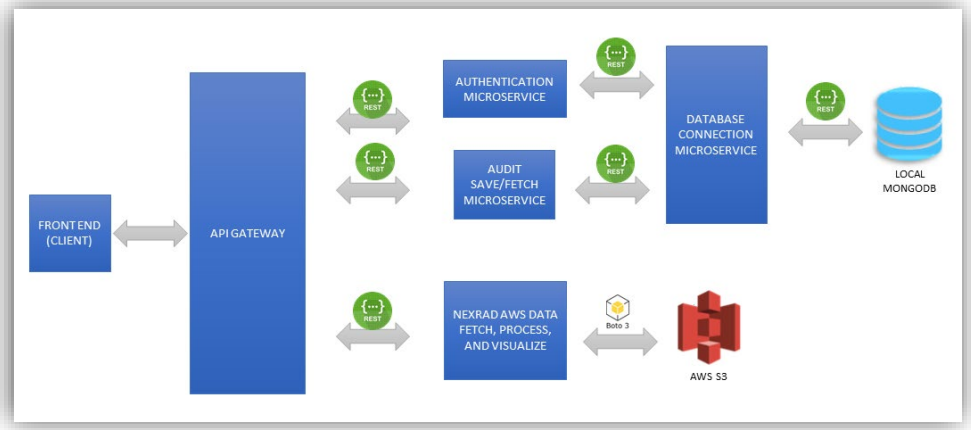
Experimental Testbed

Project 1

Experimental Testbed
Project 1

Architecture Decisions:

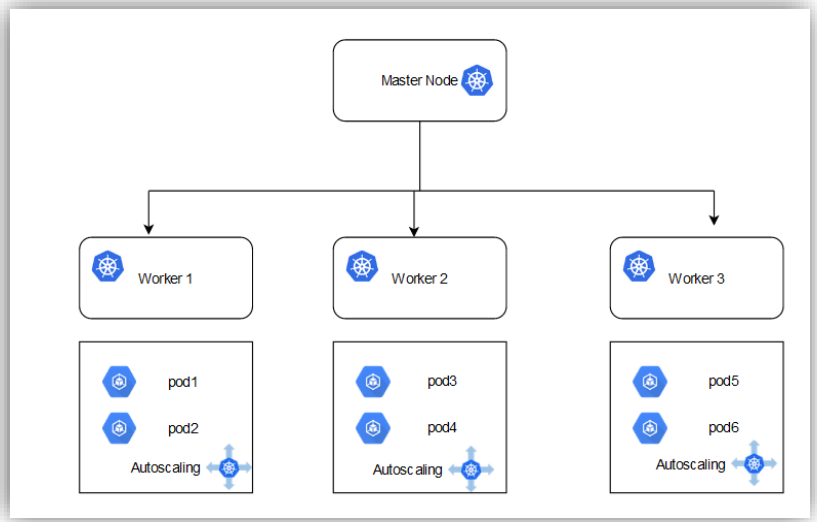
- 6 microservices
- Interservice communication in REST
- Gateway handles traffic routing
- User creds and audit trail in MongoDB
- Single service interacts with MongoDB
- Single service for NEXRAD data on S3
- Circle-CI for continuous integration



Experimental Testbed

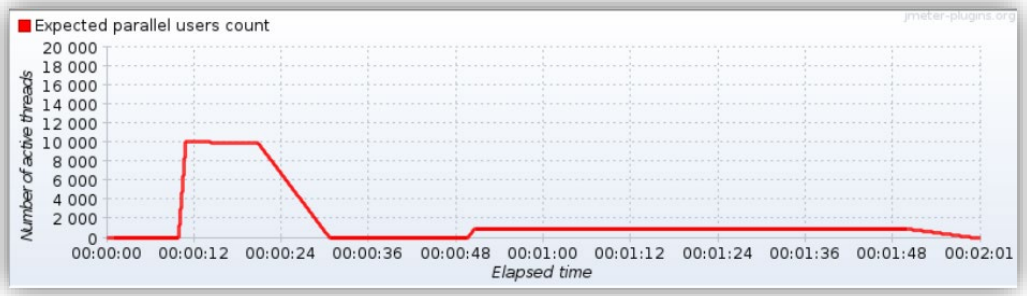
Project 2

Experimental Testbed
Project 2



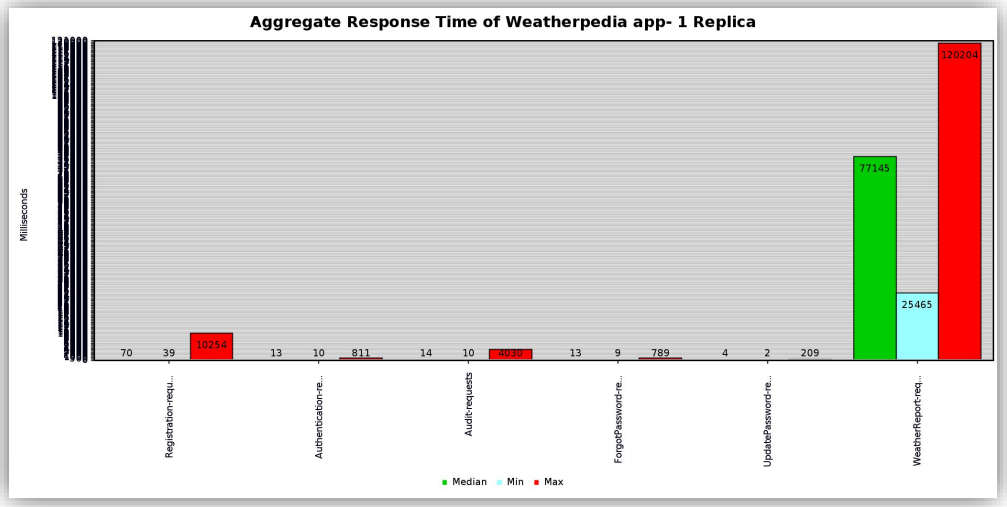
Performance Testing:

- Assess the system's maximum operating capacity.
- Baseline 3 worker nodes of 16GB each assigned on Jetstream.
- 1, 3, 5 replica-pods spawned for each microservice using kubeadm.
- Used Jmeter for both Load testing, and Spike testing.

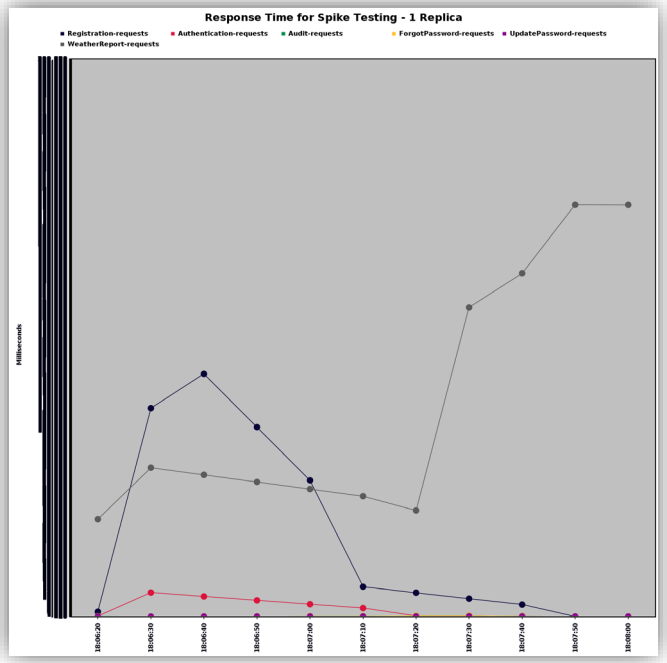


Experimental Testbed

Project 2

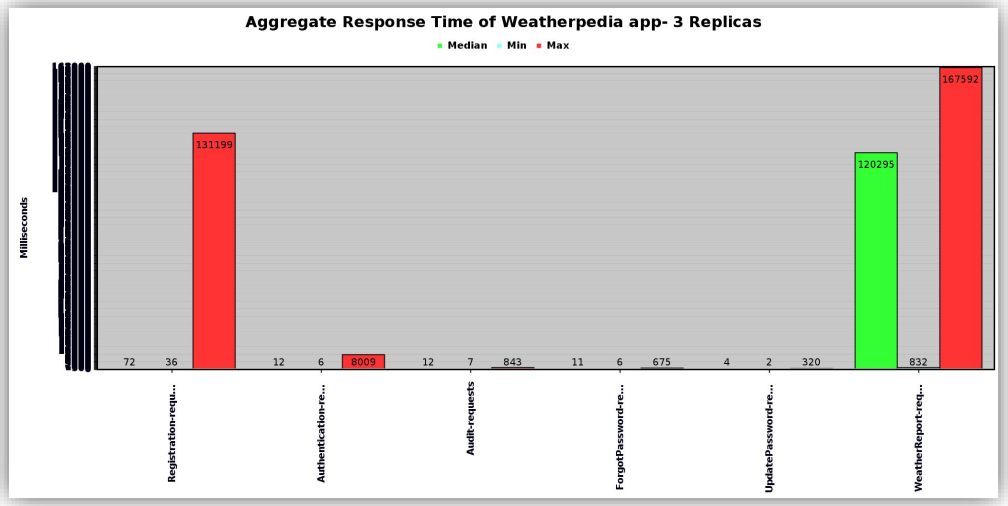


Performance under constant load

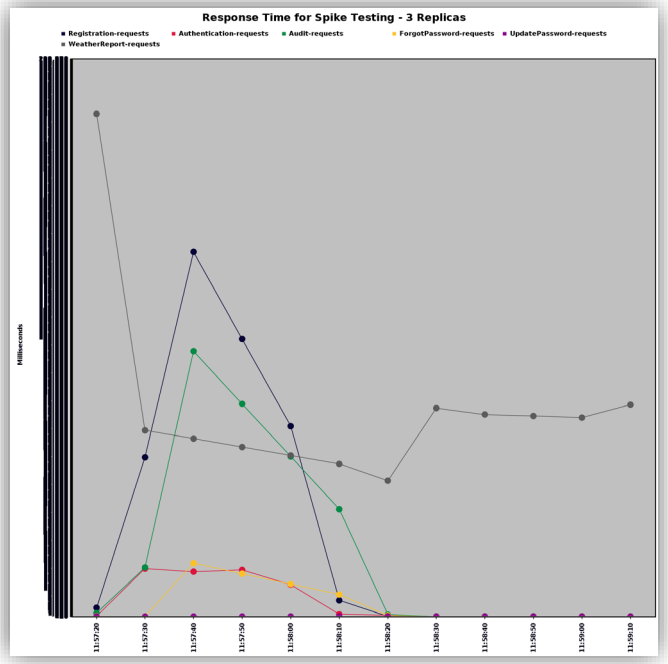


Performance under sudden load

Experimental Testbed
Project 2



Performance under constant load



Performance under sudden load

Experimental Testbed

Project 2

```
Every 2.0s: kubectl top pods                                    js-170-205.jetstream-cloud.org: Sat Mar  5 13:29:58 2022

NAME                                          CPU(cores)   MEMORY(bytes)
audit-deployment-7888f6bddb-89kch             22m          308Mi
audit-deployment-7888f6bddb-qmgdx             18m          308Mi
audit-deployment-7888f6bddb-scrcb             20m          317Mi
authentication-deployment-5555885cb4-9wwts    26m          321Mi
authentication-deployment-5555885cb4-cgxcf    20m          326Mi
authentication-deployment-5555885cb4-p56vp    36m          345Mi
database-connect-deployment-5465944748-68slv  13m          281Mi
database-connect-deployment-5465944748-6xh5n  39m          285Mi
database-connect-deployment-5465944748-x99w4  25m          290Mi
gateway-6b48d5bb7c-6bww6                      210m         38Mi
gateway-6b48d5bb7c-c2gbr                      150m         42Mi
gateway-6b48d5bb7c-mh7xf                      201m         43Mi
mongodb-deployment-789c9fd5b7-nhfwn           29m          198Mi
react-frontend-74787b9948-s6tq6               0m           5Mi
weather-reporter-deployment-7b45cbd79c-6z7qp  396m         960Mi
weather-reporter-deployment-7b45cbd79c-jxfmc  390m         967Mi
weather-reporter-deployment-7b45cbd79c-tvxk2  447m         1080Mi
```

Load Balancing in action

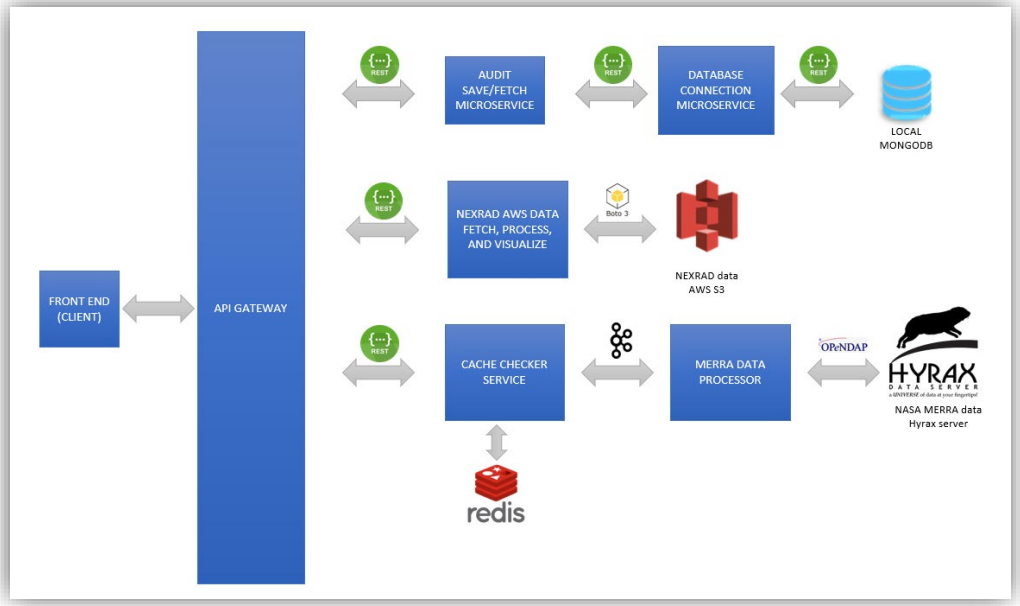
Experimental Testbed

Project 3

Experimental Testbed
Project 3

Architecture Evolution:

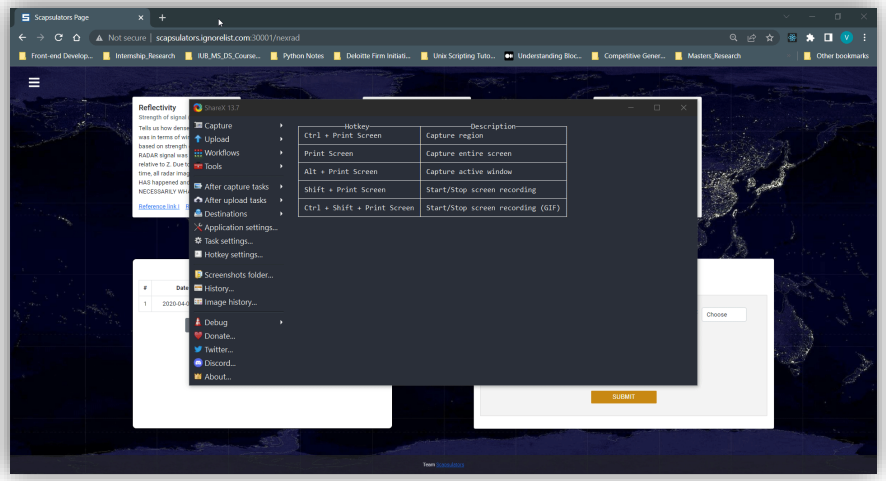
- 7 microservices
- OAUTH for session management
- Kafka to stream MERRA data report
- Caching of reports in Redis
- User creds and audit trail in MongoDB
- Circle-CI for entire CICD

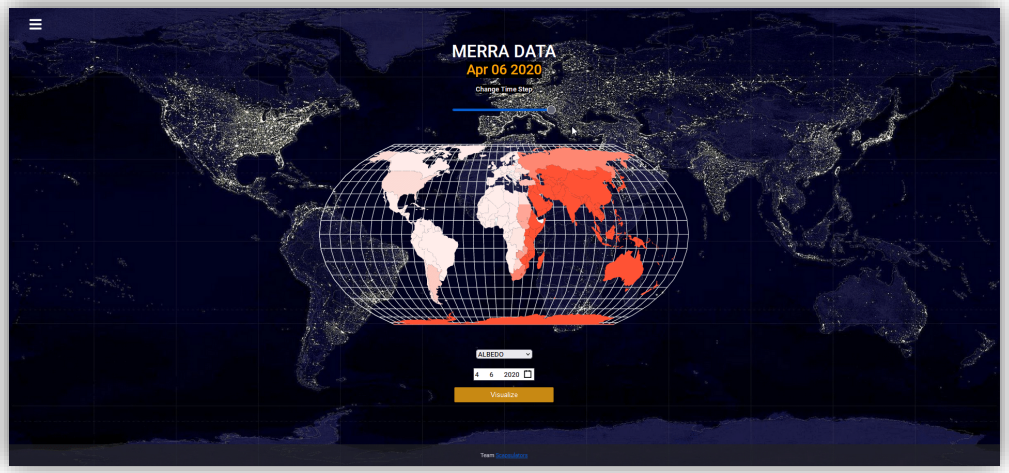


Experimental Testbed
Demo

Demonstration

http://scapsulators.ignorelist.com:30001/





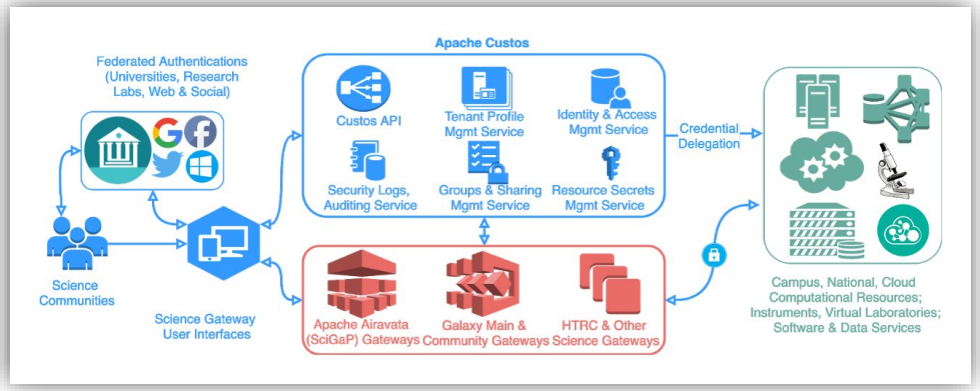
Case Study: Custos

Project 4

Case Study: Custos
Project 4

Highlights:

- Security Middleware for Gateways
- Key cloak for Identity Management
- Vault for Credential Management
- Cert-Manager for certificates of the cluster
- CI logon and federated authentication
- More than 30 microservices!



Case Study: Custos
Project 4

Open Issues identified and criticisms:

- Heavy Interdependency on Custos Configuration Microservice
- Key cloak and Vault are internal services which are available publicly
- Finer Breakdown of microservices required
- Messaging service keeps failing and restarting, should be excluded from current deployment
- Documentation needs improvement

Thank You! ☺

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