



Sprint 5 Demo

Building Cyber Infrastructure for Researchers

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Project Recap



Create Infrastructure for Earth Science Department at BU that allows researchers to submit code on large data sets and retrieve and display the results.

Last sprint:

- Created the Kubernetes cluster
- Simple OpenWhisk API request & response in the UI
- More UI enhancements; user hierarchy & joining new projects

What we learned this sprint



- Using Helm to enable Kubernetes cluster with OpenWhisk
- Working with Chameleon/GENI to add/remove worker nodes on a Kubernetes cluster
- Complex Request/Response with OpenWhisk on a cluster
- Working with Plotly & MongoDB for displaying results

Kubernetes Progress

```
ubuntu@cluster-test: ~$ kubectl get nodes --show-labels
```

| NAME | STATUS | ROLES | AGE | VERSION | LABELS |
|--------------------|--------|--------|------|---------|--|
| kind-control-plane | Ready | master | 4d2h | v1.17.0 | beta.kubernetes.io/arch=amd64,beta.kubernetes.io/os=linux,kubernetes.io/master= |
| kind-worker | Ready | <none> | 4d2h | v1.17.0 | beta.kubernetes.io/arch=amd64,beta.kubernetes.io/os=linux,kubernetes.io/core= |
| kind-worker2 | Ready | <none> | 4d2h | v1.17.0 | beta.kubernetes.io/arch=amd64,beta.kubernetes.io/os=linux,kubernetes.io/invoker= |

```
ubuntu@cluster-test: ~$
```

- Cluster created with: `kind create cluster --config kind-cluster.yaml`
- Openwhisk deployed on Kubernetes Cluster using `helm install`
- Wsk cli running on deployment
- Wsk property `apiHost` = IP of invoker node

Kubernetes Progress

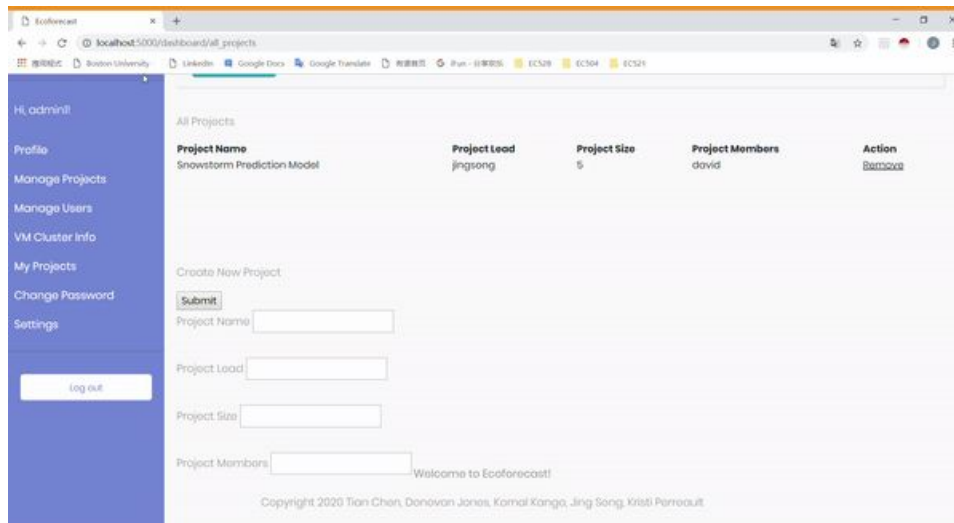
```
ubuntu@cluster-test:~$ wsk action invoke helloJS --blocking -i
mk: invoked /_/helloJS with id 92494b8332bc42af894b8332bcd2afb9
{
  "activationId": "92494b8332bc42af894b8332bcd2afb9",
  "annotations": [
    {
      "key": "path",
      "value": "guest/helloJS"
    },
    {
      "key": "waitTime",
      "value": 73
    },
    {
      "key": "kind",
      "value": "nodejs:10"
    },
    {
      "key": "timeout",
      "value": false
    },
    {
      "key": "limits",
      "value": {
        "concurrency": 1,
        "logs": 10,
        "memory": 256,
        "timeout": 60000
      }
    }
  ],
  "duration": 10,
  "end": 1586636681855,
  "logs": [],
  "name": "helloJS",
  "namespace": "guest",
  "publish": false,
  "response": {
    "result": {
      "payload": "Hello world"
    },
    "size": 25,
    "status": "success",
    "success": true
  },
  "start": 1586636681845
}
```



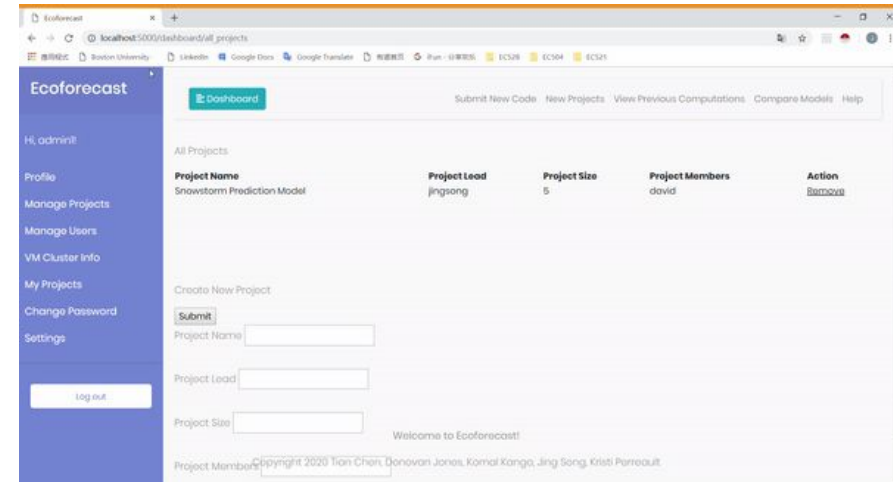
UI Progress

- User Hierarchy (Part II)
- Openwhisk Result Visualization

UI: User Hierarchy

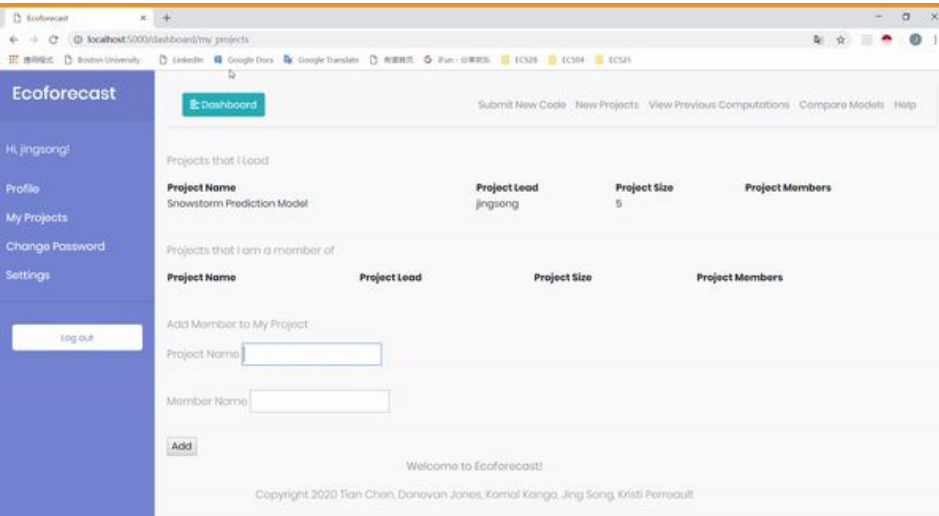


System Administrator: Manage Projects

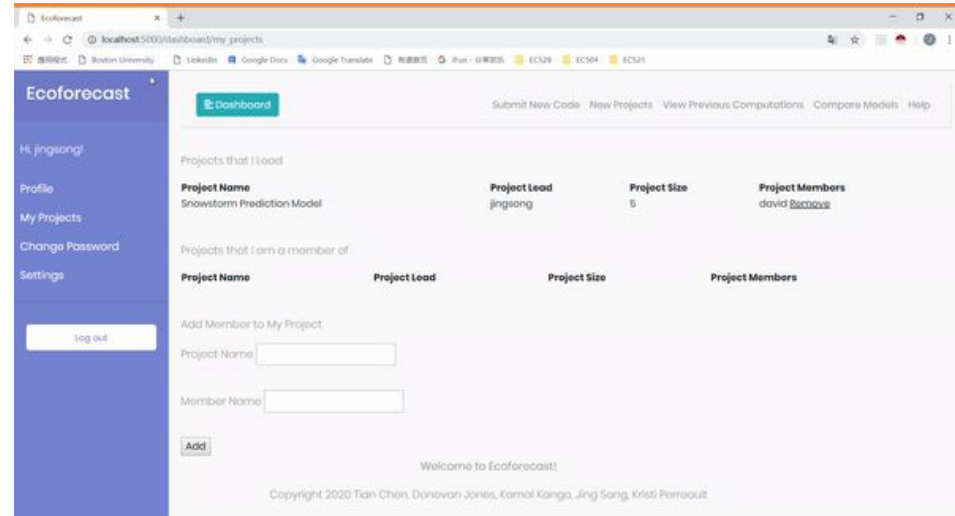


System Administrator: Manage Users

UI: User Hierarchy



Project Lead: Add Project Member



Project Lead: Remove Project Member

UI: Openwhisk Result Visualization

The screenshot shows a web browser window displaying the Ecoforecast application. The browser's address bar shows the URL `localhost:5000/dashboard/previous_computations`. The application has a blue sidebar on the left with the Ecoforecast logo and a list of navigation links: "Hi, admin!", "Profile", "Manage Projects", "Manage Users", "VM Cluster Info", "My Projects", "Change Password", and "Settings". At the bottom of the sidebar is a "log out" button. The main content area has a top navigation bar with a "Dashboard" button and links for "Submit New Code", "New Projects", "View Previous Computations", "Compare Models", and "Help". Below this, the "Previous Computations" section contains a table with the following data:

| Author | Computation Time | Code | Result |
|--------|----------------------------|----------------------|------------------------|
| admin! | 2020-04-09 21:25:46.238000 | Code | Result |
| admin! | 2020-04-10 00:53:42.445000 | Code | Result |
| admin! | 2020-04-10 01:10:41.294000 | Code | Result |

At the bottom of the page, there is a "Welcome to Ecoforecast!" message and a copyright notice: "Copyright 2020 Tian Chen, Donovan Jones, Kamal Kango, Jing Song, Kristi Porroout".

Plotly Javascript



UI Current Limitations

- Wait for access to BU Web Server <http://ecoforecast.bu.edu>
- Local Front-end
- Local MongoDB



If we could...

- Implement a Kubernetes Cluster info page for system administrators

Release Planning

Release #5 (due week 10) - DONE

- Call OpenWhisk through Kubernetes
- User Hierarchy Part II
- Join new project feature completed
- Data from OpenWhisk stored in MongoDB
- User can visualize and plot result data from code submission in UI

To Finish Up...

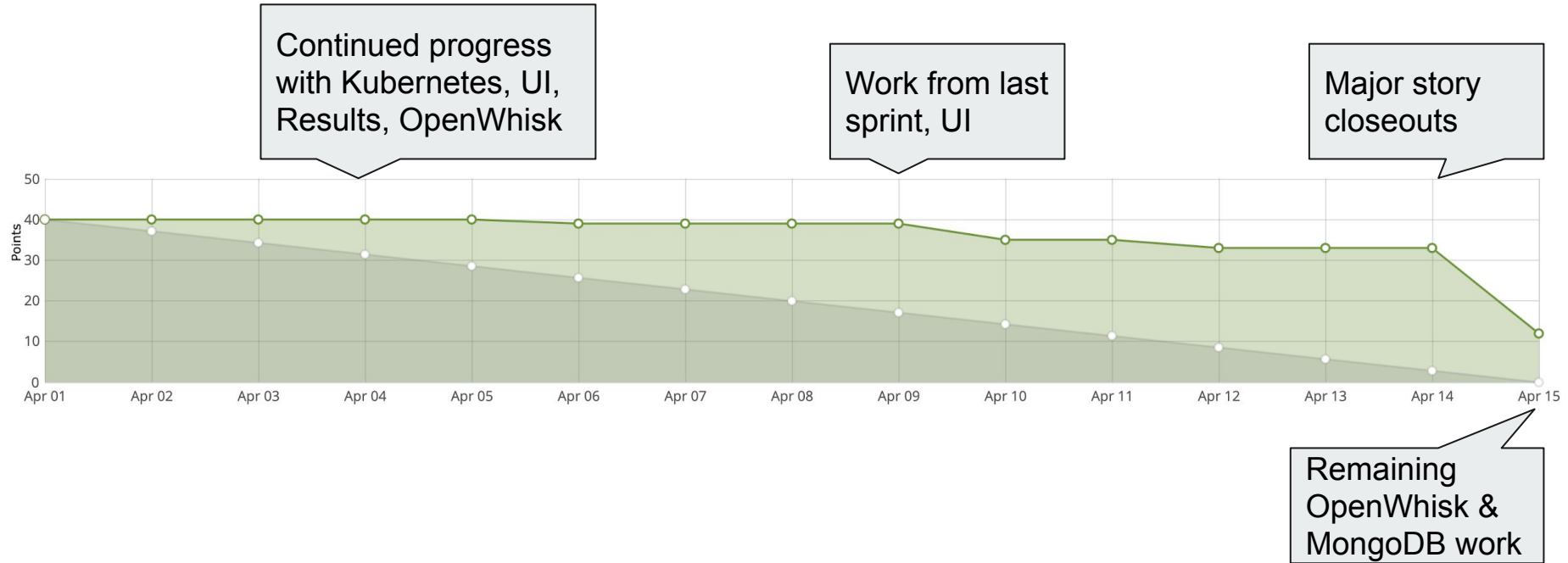
- Add/remove worker node on cluster
- Complex function with OpenWhisk and stored on MongoDB

Sprint 5 Problems



- Working with Helm to create Kubernetes cluster took some time
- Ran out of space on the Kubernetes cluster when trying to run OpenWhisk commands
- Waiting on mentors to deploy MongoDB & for server access

Sprint 5 Burndown Chart



Semester Summary



- Created a Kubernetes cluster on MOC to facilitate Chameleon & GENI worker nodes
- Installed OpenWhisk on cluster to run functions for researchers
- Created MongoDB databases for storing user data and computation results
- Created a new, cleaner UI featuring:
 - User login & registration
 - Dashboard
 - User hierarchy (admin, project leads, project members)
 - Code submission and results

Future Work



- Results comparison with other computations
- More plotting options to view data
- More Kubernetes clusters, worker nodes
- System Admin UI to monitor worker nodes
 - View which nodes are up or down
 - See geographic distribution of data & nodes



Questions?