

# Climb HPC Mountain: OpenFlightHPC

## How Open-Source is Scaling Up HPC Stacks in Hardware, Cloud, and Hybrid Computing

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### Overview

OpenFlightHPC is an open-source community developing a flexible, functional and stable HPC stack that can be launched on any platform. With an aim to develop separate, modular tools that cover the entire cluster building process, OpenFlightHPC's intention is to cover each part of the process both from a best practice and technical perspective. From designing, deploying, to managing the cluster architecture our current running model revolves around the visual concept of climbing up 'HPC Mountain.'

### How does OpenFlightHPC work?

Broken into three components OpenFlightHPC starts at the bottom of HPC Mountain and works it's way to the top. These are:

- **Community:** Covering documentation, best practice, technical papers, forums and bootcamps
- **Stack:** The images, templates and configurations to launch an OpenFlightHPC environment across platforms
- **User Suite:** Non-intrusive toolsets for streamlining the management of the research environments.

To see how each component current fits within our project check out each level of the HPC mountain.

### Workflow

The workflow stage is the combination of the previous stages.

At the workflow stage the User Suite tools help streamline the process. Here's a list of what OS systems are currently supported:

	CentOS 7	CentOS 8	Ubuntu 18.04	Ubuntu 20.02
Planned	✓	✓	✓	✓
Tested	✓	✓	✓	⌚
Packaged				
↳x86/amd64	✓	✓	✓	⌚
↳aarch64	✓	⌚	⌚	⌚
Documented	✓	✓	✓	⌚

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#### Diagram Key

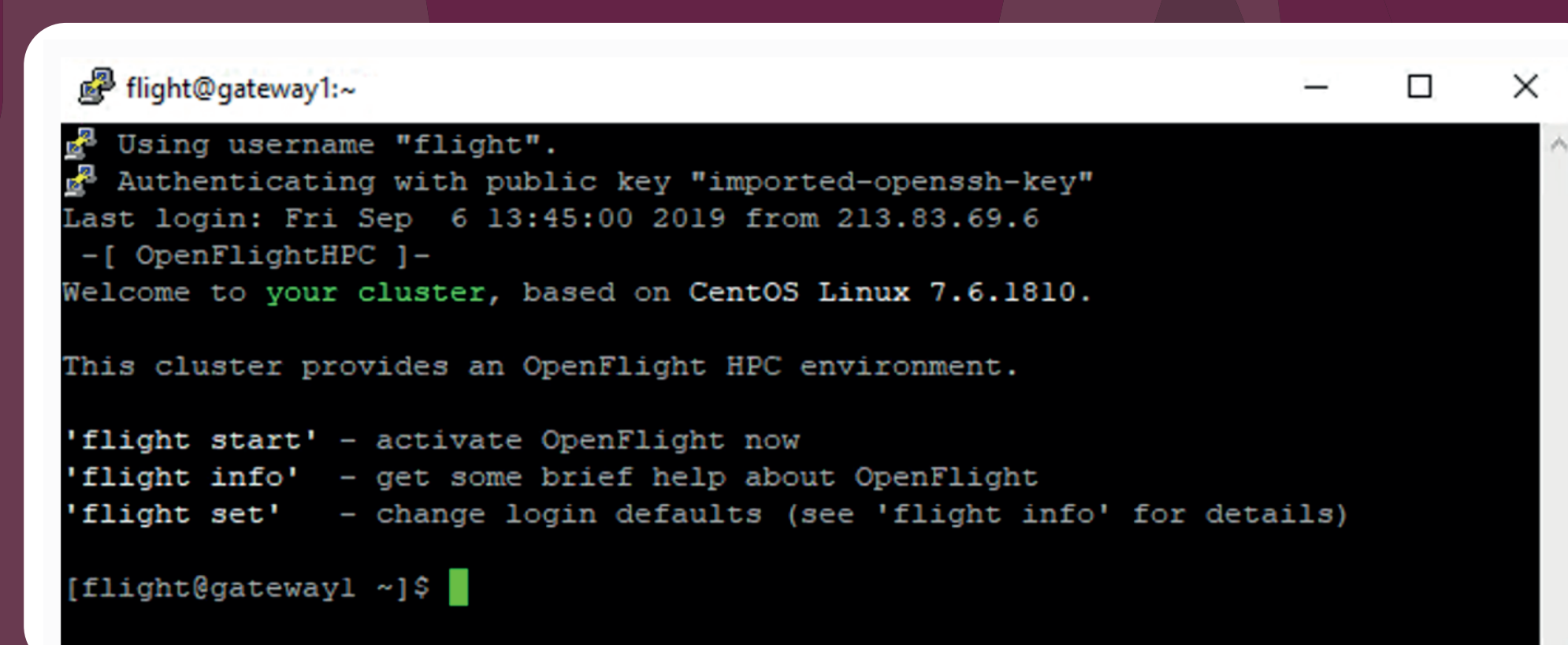
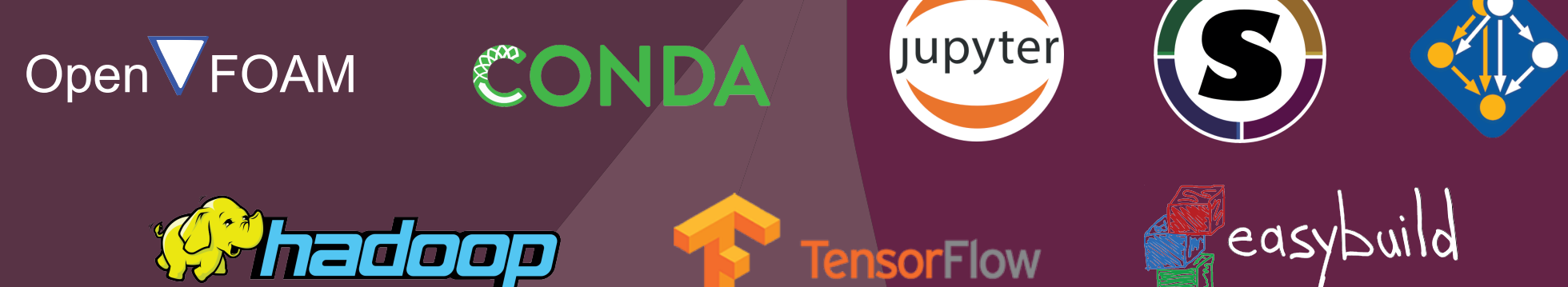
⌚ In progress    ✓ Complete

### Environment

The Environment stage involves installing and managing the software, applications and resource usage of the cluster.

Both Stack and Community components apply at the Environment stage - focused primarily on creating consistency in use. Here's an example start page where users can gain knowledge of 'flight' commands:

We also have a list of applications tested for use in an OpenFlightHPC environment. These include:



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### Platform

The Platform stage consists of the deployment and management of resources on the cluster platform. This largely involves configuring the base level of resources. Currently, OpenFlightHPC can be configured across cloud, metal, and virtual platforms.

Both Stack and Community components apply at the Platform stage. Here's an example of OpenFlightHPC enacting a basic AWS deployment:

#### 1. Download Template

```
$ curl -o cluster.yaml https://raw.githubusercontent.com/openflightHPC/openflight-compute-c
```

#### 2. Generate base64 customdata string

```
$ DATA=$(cat << EOF
#Cloud-config
system_info:
  default_user:
    name: flight
  runcmd:
    - echo "ssh-rsa MySSHpublicKeyHere user@host" >> /home/flight/.ssh/authorized_keys
EOF
)
$ echo "$DATA" | base64 -w 0
I2Nkb3VxLmVob2p2eXpzeXN0ZW1faW5mbWogIGRlZmF1bHRfdXN1cjoKICAgIGShbmU6IGZsaW00dDpA
```

#### 3. Deploy a cluster

```
$ aws cloudformation deploy --template-file cluster.yaml --stack-name mycluster \
--parameter-overrides sourceimage="AMI_ID_HERE" \
clustername="mycluster" \
customdata="I2Nkb3VxLmVob2p2eXpzeXN0ZW1faW5mbWogIGRlZmF1bHRfdXN1cjoKICAgIGShbmU6IGZsaW00dDpA
```

#### 4. Configure gateway and nodes

```
$ cat << EOF >> /etc/hosts
10.10.3.57 gateway1
10.10.8.10 node01
10.10.4.54 node02
EOF
```

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### Architecture

The first stage of HPC Mountain, Architecture, consists of the initial cluster design and choices related to what, where and how resources will be deployed.

Architecture design is the first, the longest, and most critical step of cluster creation. It determines the platforms, tools and configuration of hardware and software. This step currently is covered within Community Documentation and Best Practice.

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