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CNCF Cross-cloud CI Project Intro

Taylor Carpenter & Denver Williams, [Vulk.coop](https://vulk.coop)



Project Intro



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CNCF Cross-Cloud CI tests Kubernetes (K8s) and projects running on K8s across multiple cloud providers.

Project Intro - 35 minutes



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- History of the Project
- Why and What
- Project Overview
- Technology Overview
- Lessons Learned
- What's Next
- Q&A

Cross-cloud CI Intro: History



History and why the project exists:

The project started from as an idea in early 2016 to test the compatibility of Kubernetes versions on cloud providers along with applications running on those clusters.

This was before the K8s Conformance Group, Cluster API project and well before a GA version of kubeadm existed. At that time there were very few cloud providers offering K8s as a service, such as Google Kubernetes Engine (GKE).

Cross-cloud CI Intro: What is it?



What? The Cross-cloud CI project consists of a composable base CI system, a status repository server and a dashboard.

The underlying CI testing system has 3 components (build pipeline, multi-cloud provisioner cross-cloud, cross-project) that continually **validate the interoperability of each CNCF project for any commit on stable and head across all supported cloud providers.**

The testing system can reuse artifacts from a project's existing CI system or generate new build artifacts. The status repository server collects the test results and the dashboard displays them.

Goal: to target CNCF projects



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Graduated



Incubating



SANDBOX



Cross-cloud CI Intro: cncf.ci



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Sean Kerner @ #Kubecon @TechJournalist · 6h

How @CloudNativeFdn Is Growing the Cloud Landscape at #KubeCon
#CloudNativeCon
eweek.com/cloud/how-cncf...

CNCF started with one project (@kubernetesio) it now has 31 &
@cra tells me that by 2020 there could be 60 projects!

Goal: to target non-CNCF projects



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Implemented



↻ VULK COOP @KubeCon | Seattle, WA and 1 other Retweeted



cross-cloud ci @crosscloudci · Mar 14

Attending @OpenNetSummit this month? Join us at the #CNCF booth #22 to experience @ONAP and @kubernetesio demoed together on cncf.ci. There's still time to register 🐙

Goal: to target public, bare metal & private clouds



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aws

Microsoft Azure



Google Cloud



IBM Cloud

openstack.

ORACLE®

packet

+ arm

vmware®

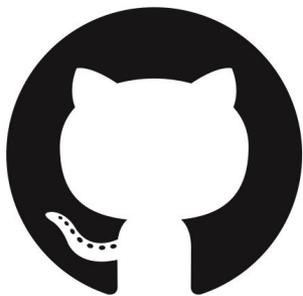


HUAWEI



Alibaba Cloud

CNCF CI Platform started (Feb 28, 2017)



- Feb 1st, 2017: CNCF CI Goals posted to mailing list
- Feb 28, 2017: CI Platform started



CI Dashboard Greenlight (Sept 22nd, 2017)



- Greenlight to start implementation of CI Dashboard
- Granted during Open Source Summit in Los Angeles



Cncf.ci v1.0.0 Release (Jan 26th, 2018)



- Cncf.ci v1.0.0 released to production
- Included the Dashboard, Status API server, 4 active projects and 5 active clouds
- Projects: K8s, Prometheus, CoreDNS, Linkerd
- Clouds: AWS, Azure, GCE, GKE, Packet



Cncf.ci v1.1+ Releases (March, 2018)



- Cncf.ci v1.1.0 released
 - Added Fluentd and IBM Cloud
- Cncf.ci v1.2.0 released
 - Added ONAP SO project
- Cncf.ci v1.3.0 released
 - Added OpenStack



Cncf.ci v1.5.0 Release (Sept 7, 2018)



- Cncf.ci v1.5.0 released to production
- Added Envoy to projects



Cncf.ci v1.6.0 Release (Oct 31, 2018)



- Cncf.ci v1.6.0 released to production
- Added OCI to deployments



CI Status Dashboard Overview



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CI Dashboard Overview:

- Overview of cncf.ci
 - Shows status of 3 pipeline stages: Build, Provision and App Deployments
 - Refreshes at 3:00am Eastern Time every day
 - Supports dynamically adding/removing active clouds and projects
 - Clicking on Build status badge opens CI system build job URL
 - Clicking on Release Name opens project's GitHub commit URL
 - Clicking on Deployment status badge opens “provisioning/app-deploy” job URL

Last updated 16 hours ago

Project	Build	Release	Deployments							
	Status	Stable Head	AWS	Azure	GCE	IBM Cloud	Bare Metal (Packet)	OpenStack	VMware vSphere	Oracle Cloud Infrastructure
 Kubernetes Orchestration	 SUCCESS	v1.12.2	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS
	 SUCCESS	dde084f	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS
 Prometheus Monitoring	 SUCCESS	v2.4.3	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS
	 SUCCESS	8b91d39	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS
 CoreDNS Service Discovery	 SUCCESS	v1.2.5	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS
	 SUCCESS	95c9e14	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS
 Fluentd Logging	 SUCCESS	v1.2.6	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS
	 SUCCESS	3dabdc5	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS
 Linkerd Service Mesh	 SUCCESS	1.5.1	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS
	 SUCCESS	36dc2c9	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS
 Envoy Service Mesh	 SUCCESS	v1.8.0	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS
	 SUCCESS	0ebe247	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS
 ONAP Network Automati	 SUCCESS	v1.1.1	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS
	 SUCCESS	9a3841e	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS	 SUCCESS

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1. Build projects from source

Last updated 16 hours ago

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2. Provision w/ cross-cloud

Last updated 16 hours ago

Project	Build	Release	Deployments							
	Status	Stable Head	AWS	Azure	GCE	IBM Cloud	Bare Metal (Packet)	OpenStack	VMware vSphere	Oracle Cloud Infrastructure
 Kubernetes Orchestration	✓ SUCCESS	v1.12.2	✓ SUCCESS							
	✓ SUCCESS	dde084f	✓ SUCCESS							
 Prometheus Monitoring	✓ SUCCESS	v2.4.3	✓ SUCCESS							
	✓ SUCCESS	8b91d39	✓ SUCCESS							
 CoreDNS Service Discovery	✓ SUCCESS	v1.2.5	✓ SUCCESS							
	✓ SUCCESS	95c9e14	✓ SUCCESS							
 Fluentd Logging	✓ SUCCESS	v1.2.6	✓ SUCCESS							
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 Linkerd Service Mesh	✓ SUCCESS	1.5.1	✓ SUCCESS							
	✓ SUCCESS	36dc2c9	✓ SUCCESS							
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	✓ SUCCESS	0ebe247	✓ SUCCESS							
 ONAP Network Automati	✓ SUCCESS	v1.1.1	✓ SUCCESS							
	✓ SUCCESS	9a3841e	✓ SUCCESS							

3. Deploy w/ cross-project

CI Status: Sometimes things fail



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- See dashboard snapshot
 - From Monday, December 10, 2018

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Project	Build		Release	Deployments							
	Status		Stable Head	AWS	Azure	GCE	IBM Cloud	Bare Metal (Packet)	OpenStack	VMware vSphere	Oracle Cloud Infrastructure
 Kubernetes Orchestration	✓ SUCCESS		v1.12.2	✓ SUCCESS	✓ SUCCESS	❌ FAILED	✓ SUCCESS	❌ FAILED	✓ SUCCESS	✓ SUCCESS	❌ FAILED
	✓ SUCCESS		27fca55	✓ SUCCESS	❌ FAILED	✓ SUCCESS	✓ SUCCESS	❌ FAILED	✓ SUCCESS	✓ SUCCESS	❌ FAILED
 Prometheus Monitoring	✓ SUCCESS		v2.4.3	✓ SUCCESS	✓ SUCCESS	✓ SUCCESS	✓ SUCCESS	❌ FAILED	❌ FAILED	✓ SUCCESS	❌ FAILED
	❌ FAILED		56cda56	⊘ N/A	⊘ N/A	⊘ N/A	⊘ N/A	⊘ N/A	⊘ N/A	⊘ N/A	⊘ N/A
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 Fluentd Logging	❌ FAILED		v1.2.6	✓ SUCCESS	✓ SUCCESS	✓ SUCCESS	✓ SUCCESS	❌ FAILED	❌ FAILED	✓ SUCCESS	❌ FAILED
	❌ FAILED		c037e41	✓ SUCCESS	❌ FAILED	✓ SUCCESS	✓ SUCCESS	❌ FAILED	❌ FAILED	✓ SUCCESS	❌ FAILED
 Linkerd Service Mesh	✓ SUCCESS		1.5.1	✓ SUCCESS	✓ SUCCESS	✓ SUCCESS	✓ SUCCESS	❌ FAILED	❌ FAILED	❌ FAILED	❌ FAILED
	❌ FAILED		68b200b	⊘ N/A	⊘ N/A	⊘ N/A	⊘ N/A	⊘ N/A	⊘ N/A	⊘ N/A	⊘ N/A

Cloud Configuration



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```
[tmux: 0]@dev.vulk.co: vim
15     - "container"
16     - "compile"
17
18 clouds:
19   aws:
20     active: true
21     display_name: AWS
22     order: 1
23   azure:
24     active: true
25     display_name: Azure
26     order: 2
27   gce:
28     active: true
29     display_name: GCE
30     order: 3
31   gke:
32     active: false
33     display_name: GKE
34     order: 4
35   ibmcloud:
36     active: true
37     display_name: IBM Cloud
38     order: 6
39   packet:
40     active: true
41     display_name: Bare Metal (Packet)
42     order: 8
NORMAL ↵ ← integration ↵ ↵ cross-cloud.yml ↵ ↵
unix ↵ ↵ utf-8 ↵ ↵ yaml ↵ ↵ 10% ↵ ↵ 19:1
```

Refresh triggered



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```
=====
= Cross-Cloud CI Trigger Client"
=====
```

```
*Quick start => type default_connect*
```

```
To use defaults and get a client run: default_connect
```

```
- @tc is the trigger client.
```

```
- @c is the ciservice client (also @tc.ciservice)
```

```
=> Use @c as outlined in docs/usage_from_irb.mkd
```

```
## Manual setup
```

```
To change the data store, set the @store_file variable to use a differnt store file (default: db/datastore-<CR
CI_ENV>.yaml)
```

```
Trigger client can be created with @tc = CrossCloudCi::TriggerClient.new({store_file: @store_file})
```

```
Ci service client is available as @tc.ciservice and @c
```

```
Set debugging level with @tc.logger.level and @tc.ciservice.logger.level
```

```
## Type trigger_help for more
```

```
Environment: prod
```

```
2.1.7 :001 > default_connect
```

```
I, [2018-10-19T14:35:08.332855 #21176] INFO -- : [CiService] Loading active projects
```

```
I, [2018-10-19T14:35:08.332985 #21176] INFO -- : [CiService] Loading GitLab project data
```

```
I, [2018-10-19T14:35:11.130718 #21176] INFO -- : [CiService] Creating data mappings
```

```
I, [2018-10-19T14:35:11.131012 #21176] INFO -- : [TriggerClient] Dashboard API: devapi.cncf.ci
```

Testing System Overview



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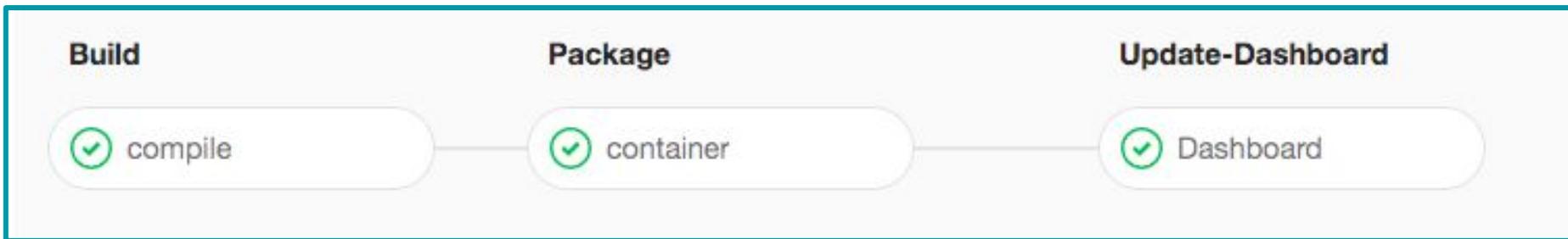
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- **Build Pipeline per project** (optional, can use project's build artifacts)
- **Cloud Provisioning Pipeline** (cross-cloud)
- **App Deployment Pipeline** (cross-project)

Build Pipeline Stage

1. **Build:** Compile binaries and e2e tests
2. **Package:** Create containers, create artifact pinning config and push to registry
3. **Update-Dashboard:** Update build status badges



Cloud Provisioning Pipeline Stage



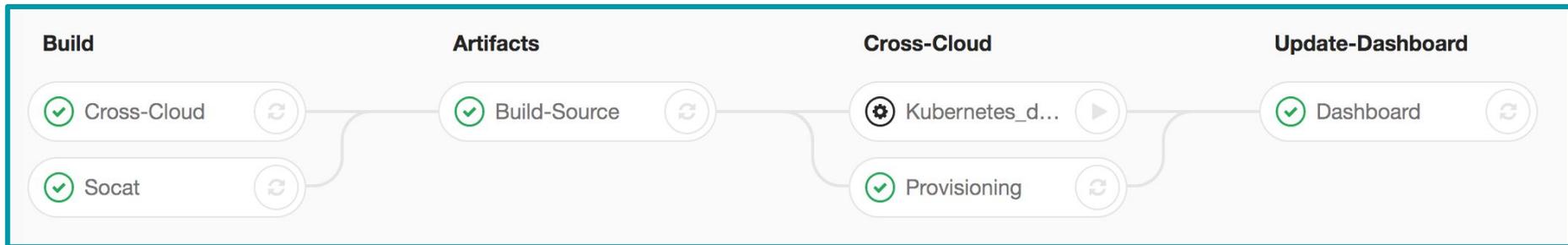
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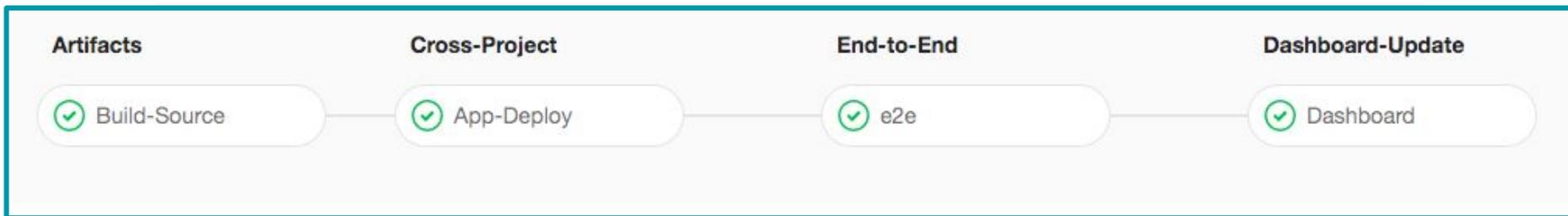
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1. **Build:** Prepare provisioning software from the cross-cloud project
2. **Artifacts:** Collect K8s artifact pinings from the previous K8s builds
3. **Cross-Cloud:** Deploy K8s onto each cloud using cross-cloud provisioner
4. **Update-Dashboard:** Update deployment badges



App Deployment Pipeline Stage

1. **Artifacts:** Collect project artifact pinnings from the previous build stages
2. **Cross-Project:** Use Helm charts to deploy each project
3. **End-to-End:** Run e2e tests for each project
4. **Dashboard-Update:** Update deployment status badges





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Technology Overview

CI System Technology Overview

- **Unified CI/CD platform:** GitLab
- **Cross-cloud provisioning:** Terraform, Cloud-init, and per cloud K8s configuration
- **App deployments:** K8s manifest management with Helm
- **E2e tests:** Custom containers + Helm
- **Automated builds and deployments:** Git + per project yaml configuration

Dashboard Technology Overview



- **Frontend:** Vue.js
- **Status repository:** Elixir and Erlang
- **Automated builds and deployments:** Git + per project yaml configuration



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Lessons Learned

Lessons Learned



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Starting with the end-user interface is advised

- Serve one audience as your focus
- Simplify what you are communicating
- Graceful failures in the Web UI

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Lessons Learned



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Don't start tightly coupled to an existing CI platform

- API, pipeline, event hooks
- Mixing CI for the software components with implementation
- Supporting existing project CI systems

Lessons Learned



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Design for projects and cloud providers to help from the start

- The entire system should be reproducible by others
- Support composable portions from the start (eg. kubeadm)



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What's Next?

What's next for Cross-cloud CI?



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Cross-Group Collaboration:

- OpenCI community
- OPNfv collaboration
- Network Service Mesh collaboration
- Gathering feedback from End Users, CNCF Projects and K8s Community on next iteration of `cncf.ci` Status Dashboard

What's next for Cross-cloud CI?



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Adding More CNCF Projects:

- Jaeger
- Notary
- Vitess
- etc

What's next for Cross-cloud CI?



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Adding New Features:

- **Automate** project release updates
- **API** for history of builds, deployments and end-to-end tests
- **Rollback** to previous working release
- **Integrate** with other test platforms
- **New screens TBD:** Per Project, Per Deployment, etc

Upcoming Events

CNCF Cross-cloud CI Deep Dive at KubeCon North America 2018

- Day: Wednesday, December 12
- Time: 10:50am - 11:25am Pacific Time
- Location: Tahoma 5 @ TCC *The Conference Center (TCC)*

CI WG Public Meetings

- Day: 4th Tuesday of month
- Time: 11:00am Pacific Time (US and Canada)
- Location: <https://zoom.us>

How to Collaborate



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- **Attend CI WG meetings:**
 - <https://github.com/cncf/wg-ci>
- **Subscribe to the CNCF CI public mailing list:**
 - <https://lists.cncf.io/g/cncf-ci-public>
- **Create issues on GitHub:**
 - <https://github.com/crosscloudci/crosscloudci/issues>

Connect with the team



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@crosscloudci



@crosscloudci



#cncf-ci slack channel



crosscloudci@vulk.coop

Q&A



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Thank you for your feedback!



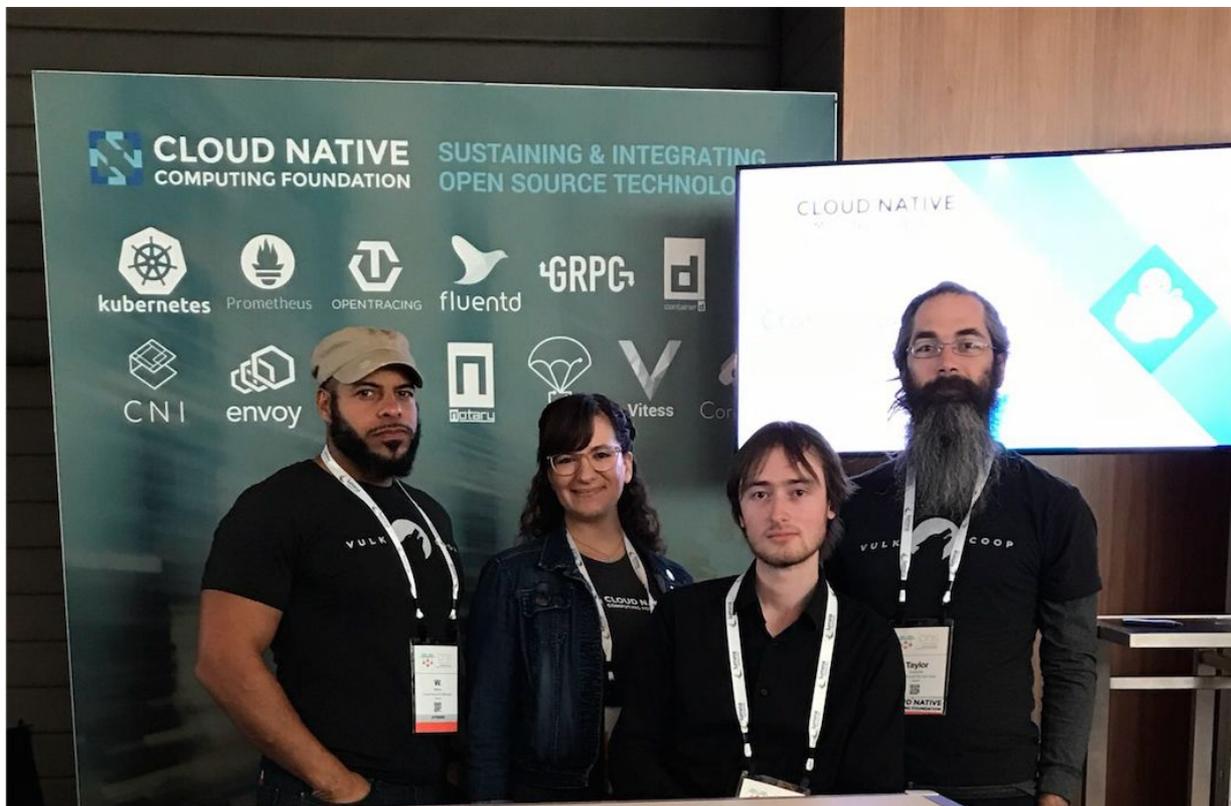
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- **W. Watson**
[@wavell](#)
- **Lucina Stricko**
[@lixuna](#)
- **Denver Williams**
[@denverwilliams](#)
- **Taylor Carpenter**
[@taylor](#)





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