KubeCon | CloudNativeCon

North America 2018

CNCF Cross-cloud CI Deep Dive:

Using Cross-cloud with Cloud-native Network Functions (CNFs)

Taylor Carpenter & Denver Williams, Vulk.coop

CNCF Cross-cloud CI + CNF

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

The CNF project provides reference code and test comparisons of Cloud-native Network Functions.

Agenda - 35 Minutes

- Intro to CNCF Cross-cloud CI Project
  - Cross-cloud Kubernetes provisioner
- Intro to CNCF Cloud-native Network Functions (CNFs) Project
  - Reproducible CI for NFV testing
  - Using cross-cloud with CNFs
- Lessons learned / Challenges
- What's next
- How to collaborate
- Q/A

cross-cloud ci

Quick Intro to CNCF Cross-cloud CI

CLOUD NATIVE
COMPUTING FOUNDATION

cross-cloud ci

https://github.com/crosscloudci/crosscloudci

What is CNCF Cross-cloud CI?

What? The CNCF 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 stages (build pipeline per project, cloud provisioning with cross-cloud, app deployments with 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

Graduated

kubernetes
Orchestration

Prometheus
Monitoring

envoy
Service Mesh

Incubating

OPENTRACING
Distributed Tracing API

fluentd
Logging

GRPC
Remote Procedure Call

containerd
Container Runtime

rkt
Container Runtime

CNI
Networking API

envoy
Service Mesh

JAEGER
Distributed Tracing

TUF
Software Update Spec

Notary
Security

Vitess
Storage

CoreDNS
Service Discovery

NATS
Messaging

LINKERD
Service Mesh

HELM
Package Management

ROOK
Storage

HARBOR
Registry

SANDBOX

spiffe
Identity Spec

SPIRE
Identity

Open Policy Agent
Policy

cloudevents
Serverless

TELEPRESENCE
Tooling

OPENMETRICS
Metrics Spec

KV
Distributed K/V

cortex
Monitoring

Buildpacks.io
Packaging Spec

Falco
Container Security

Dragonfly
Image Distribution

Virtual Kubelet
Nodeless

Goal: to Target Non-CNCF Projects

Implemented

ONAP
OPEN NETWORK AUTOMATION PLATFORM

Goal: to Target Public, Bare Metal & Private Clouds

aws

Microsoft Azure

Google Cloud

IBM Cloud

openstack.

ORACLE®

packet

+arm

vmware®

HUAWEI

Alibaba Cloud

CNCF CI Platform Timeline

CLOUD NATIVE
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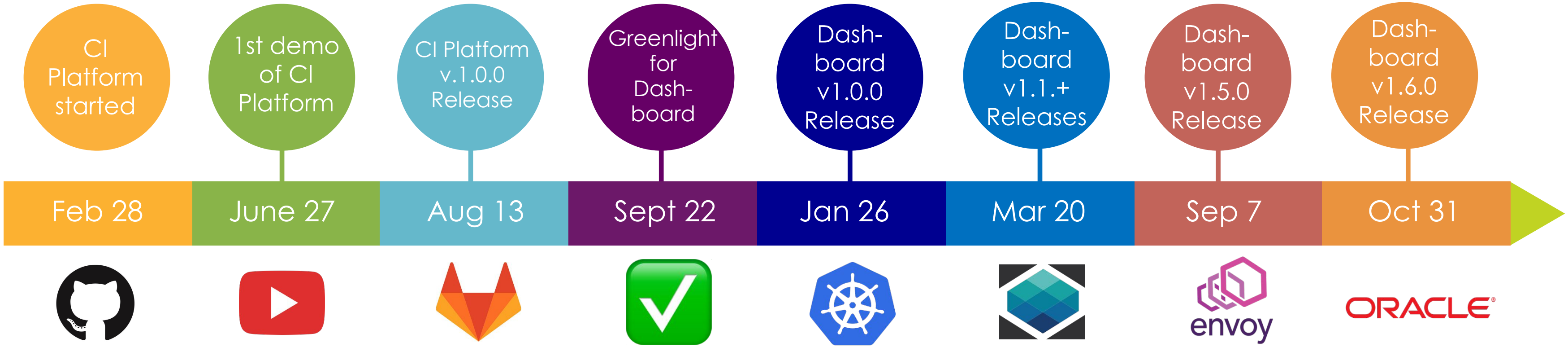
- Feb 28, 2017: CI Platform started
- Jan 26, 2018: v.1.0.0 Dashboard released
- Mar 20, 2018: v1.2.0 included ONAP
- Sept 7, 2018: v1.5.0 included Envoy
- Oct 31, 2018: v1.6.0 included OCI



CI Platform started — Feb 28

1st demo of CI Platform — June 27

CI Platform v.1.0.0 Release — Aug 13

Greenlight for Dashboard — Sept 22

Dashboard v1.0.0 Release — Jan 26

Dashboard v1.1.+ Releases — Mar 20

Dashboard v1.5.0 Release — Sep 7

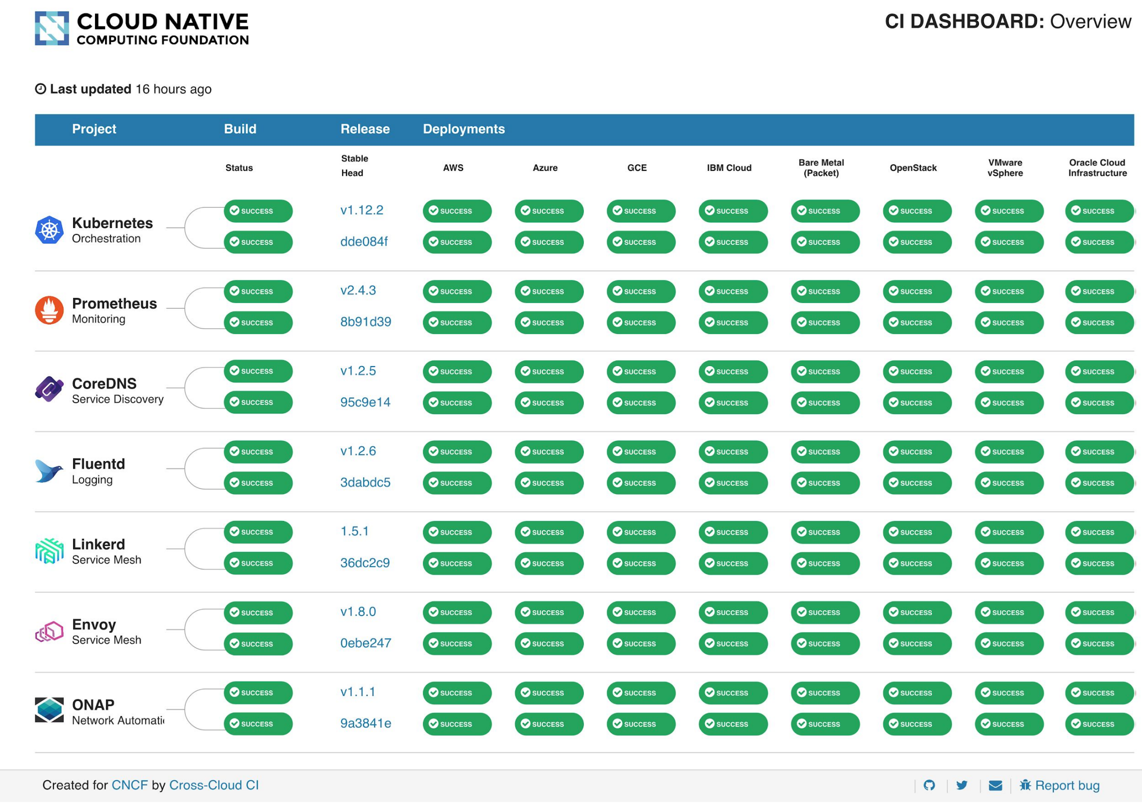
Dashboard v1.6.0 Release — Oct 31

CI Status Dashboard Overview

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

CI Dashboard at cncf.ci



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Last updated 16 hours ago

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	✓ 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
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Report bug

Testing System Overview

- **Build pipeline per project** (optional, can use project’s build artifacts)
- **Kubernetes provisioning pipeline** (cross-cloud)
- **App deployment pipeline** (cross-project)

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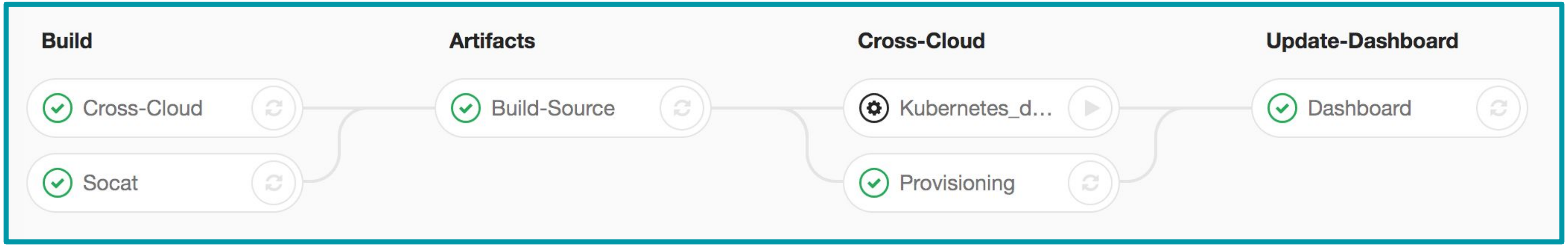
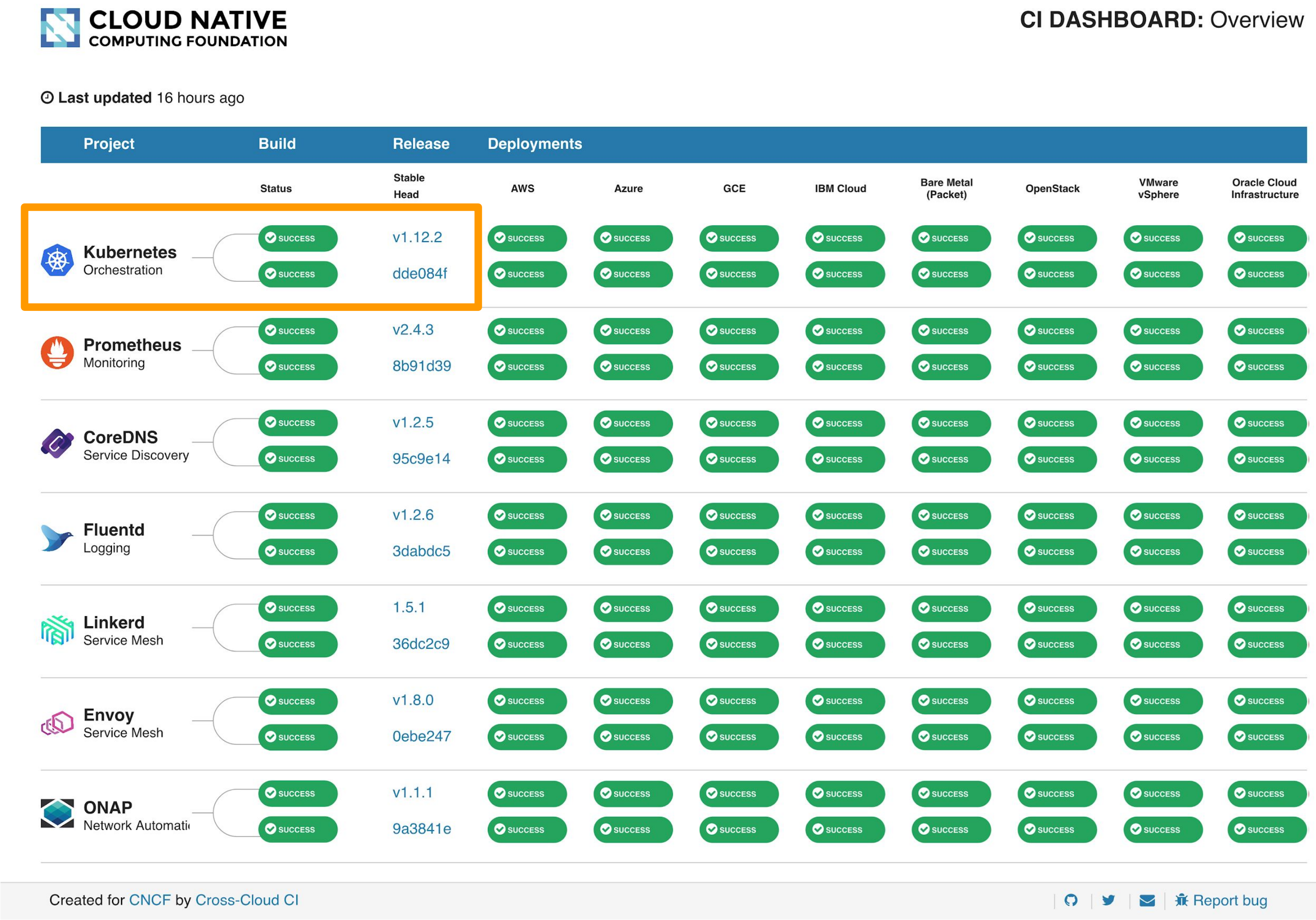
K8s Provisioning Pipeline Stage

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





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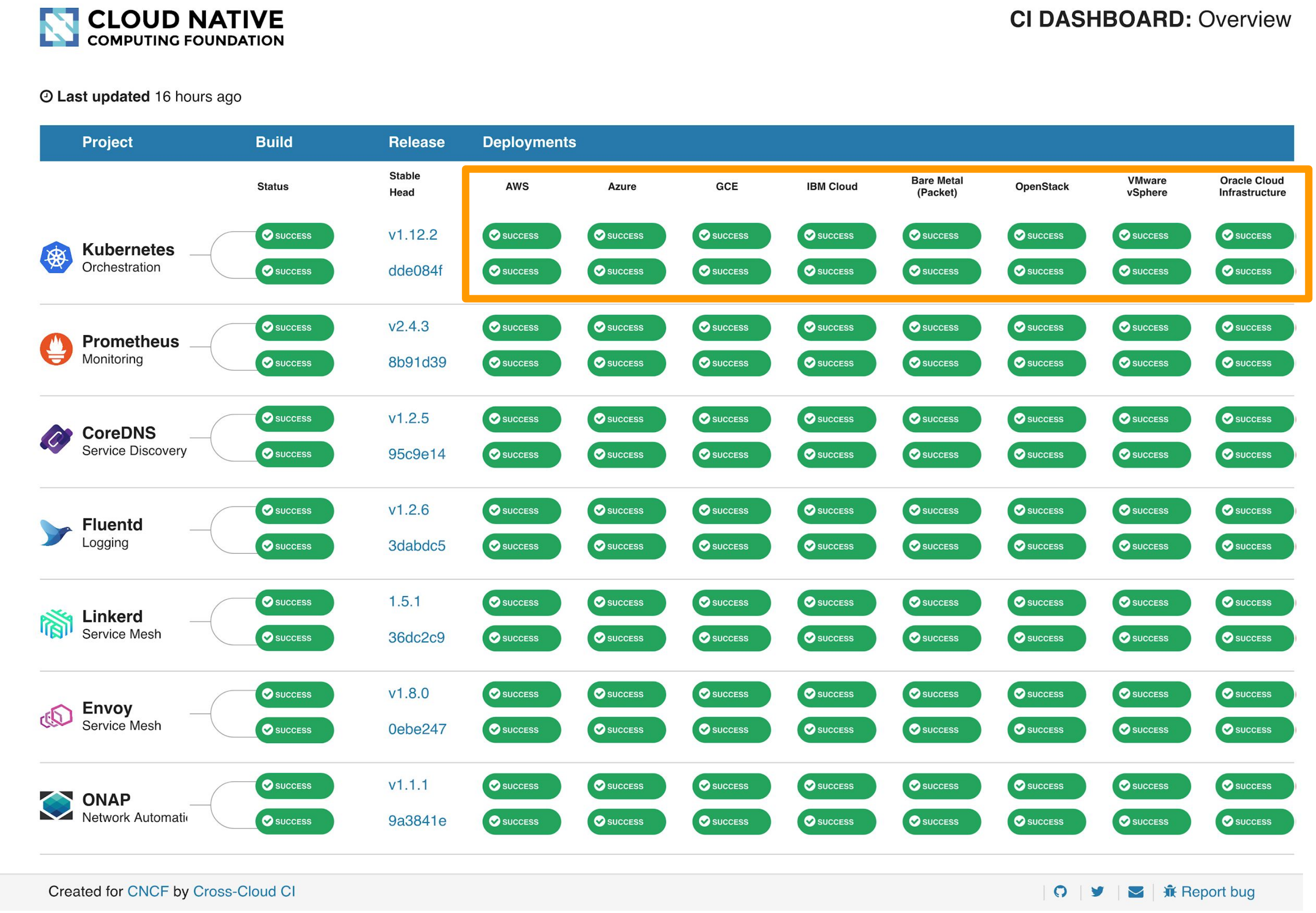
1. Testing K8s stable and head



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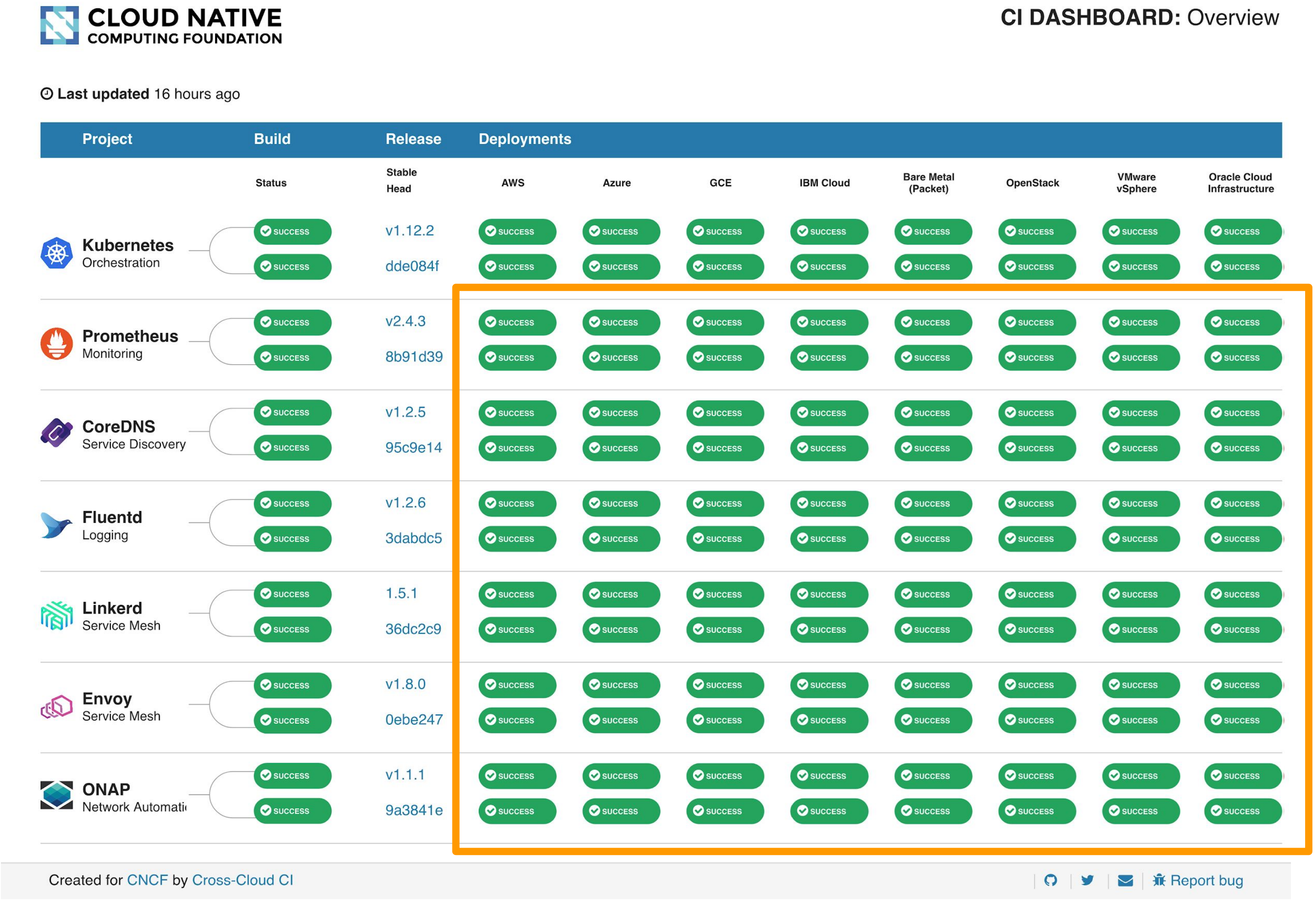
2. Provision w/ cross-cloud



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3. Deploy w/ cross-project

CI System Technology Overview

- **Unified CI/CD platform:** GitLab
- **App deployments and e2e tests:** K8s manifest management with Helm
- **Cross-cloud provisioning:** Terraform, Cloud-init and per cloud K8s configuration
- **Automated builds and deployments:** Git + per project yaml configuration

Quick Intro to CNCF Cloud-native Network Functions (CNFs)

https://github.com/cncf/cnfs

CNF Project Intro

CNCF is ushering the evolution of Virtualized Network Functions (VNFs) to Cloud-native Network Functions (CNFs) running on Kubernetes in public, private, or hybrid clouds.

The transition to CNFs will provide 3 major benefits to service providers:

1. Cost savings (capex/opex)
2. Improved resiliency
3. Higher development velocity

CNF Project Intro

The CNF project facilitates open collaboration on the development and use of Cloud-native Network Functions for real world use cases. The project provides reference code and test comparisons of CNFs.

https://github.com/cncf/cnfs

CNF Project Goals

The ideal outcome of the CNF project is that a third party developer can run the provided CNF reference code/benchmarking tests with an API key and a couple of CLI commands.

Note: the CNF project is still in the prototype stage. Additional reference code and benchmarking tests will be added incrementally.

Reproducible CI for NFV testing

Creating a Neutral Test Environment

Hardware

Public:

- Packet Cloud
- FD.io CSIT lab

Software

Open:

- 100% open source
- Vanilla Kubernetes
- Helm

Community

Collaboration:

- Cross-group
- Multi-vendor

Reproducible Infrastructure

Machines

Networking

Provisioning Physical Machines

The machines running the network functions use commodity hardware and all configuration is documented.

Specs at a glance:

- CPU: Dual socket Xeon Gold 5120 (2.2Ghz)
- Cores: 24 per CPU (48 total)
- Memory: 384 GB of DDR4 ECC
- Storage: 3.2 TB of NVMe Flash
- NIC: Quad port Intel x710

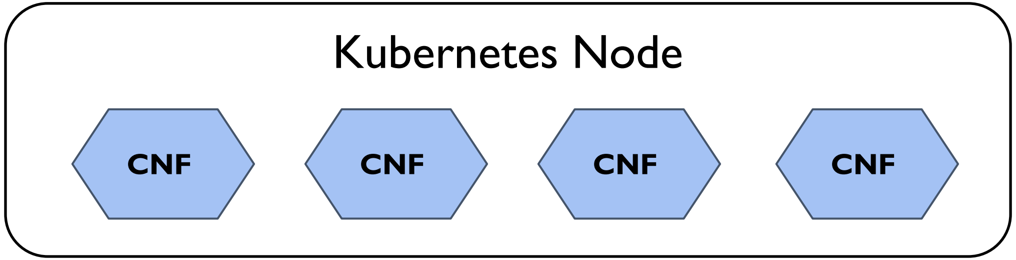
The system hardware configuration is based on the Packet m2.xlarge.x86.

Using either the default dual port Mellanox ConnectX-4 NIC or a quad port Intel x710 NIC. The NIC ports are connected to 10GbE ports on the top-of-rack switches.

Vanilla K8s Clusters

Kubernetes test environment:

- Deployment of Kubernetes with cross-cloud
- Kubernetes services running on bare metal



Kubernetes Node

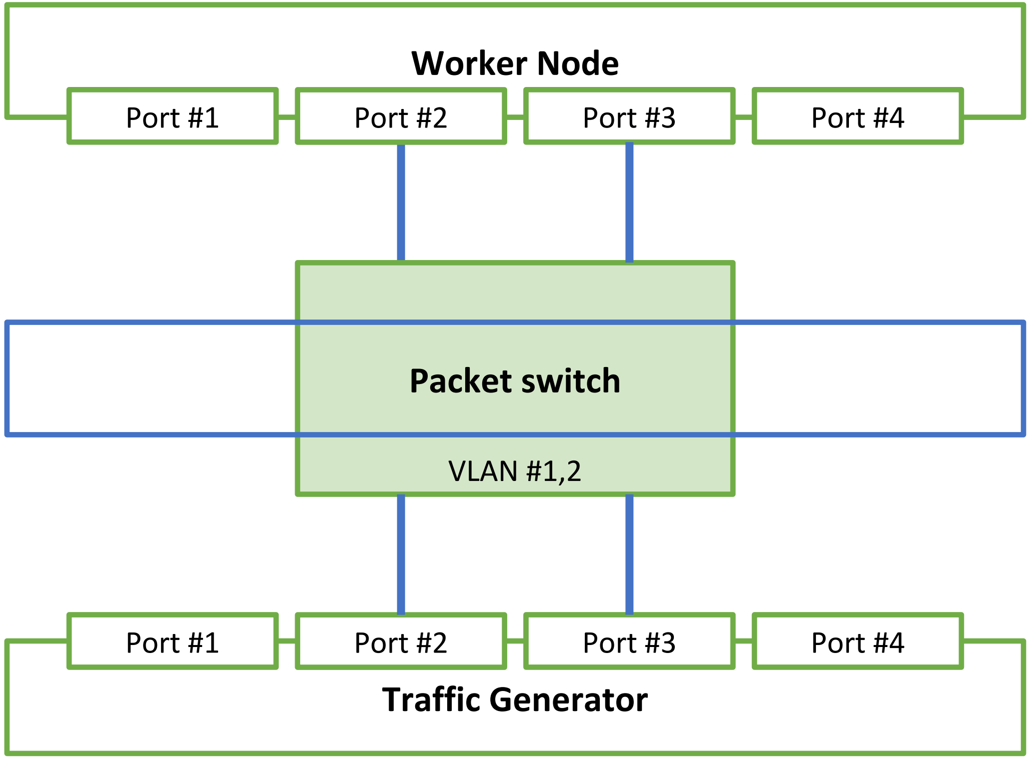
CNF

CNF

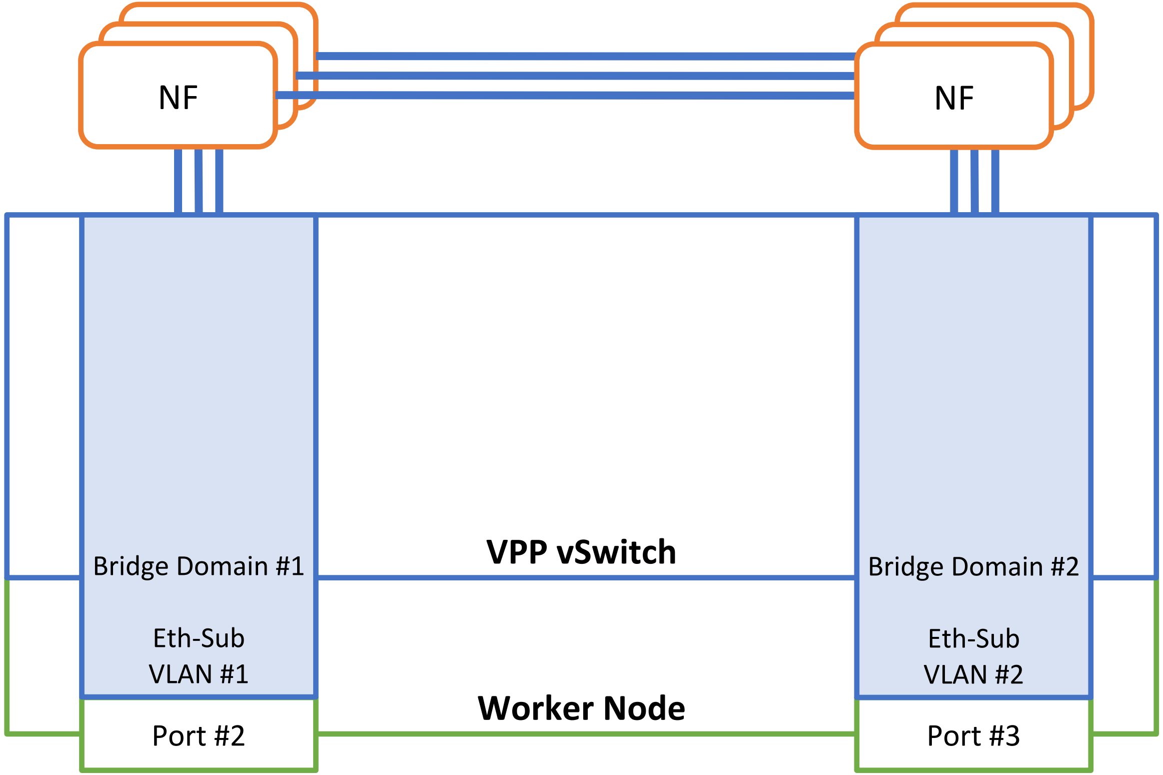
CNF

CNF

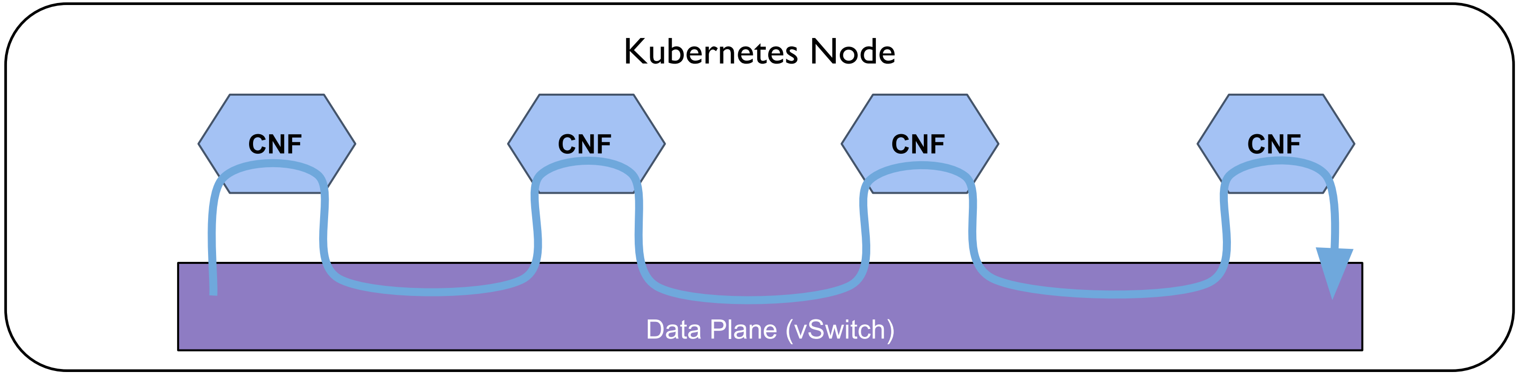
Layer-2 Network Wiring

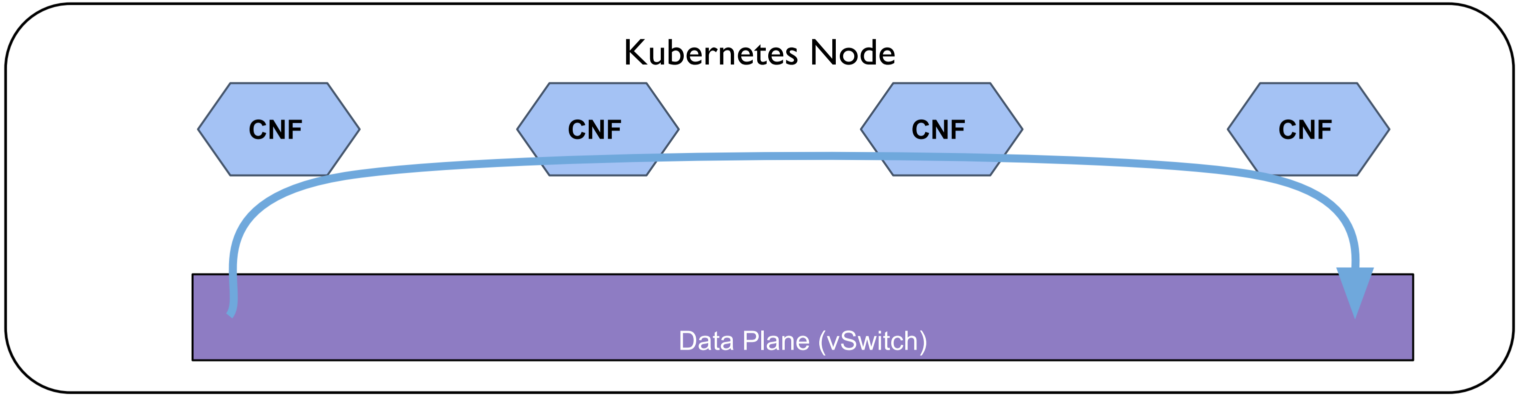


Layer-2 Host Configuration



Layer 2 CNF Connections





Deploying K8s w/Layer-2 Support!

Kubernetes test clusters:

- Deployment of Kubernetes with cross-cloud
    - + Ansible + cpu management policies
- Kubernetes services running on bare metal
- High-performance Layer-2 networking w/VPP for CNFs and host vSwitch
- Connecting CNFs over memif sockets

Using Cross-cloud with CNF Project

Cross-cloud Enhanced for CNFs

New features:

- Added support for Ubuntu 18.04 as a host OS
- Support reserved Packet instances
- Enable support for cpu-management-policies
- Support worker node reboots for kernel config (eg. grub) updates

Lessons Learned / Challenges

Lessons Learned / Challenges

Creating neutral and easily reproducible test comparisons has its obstacles, including:

- General challenges transitioning from VNFs to CNFs
- Reproducible infrastructure provisioning
- Reproducible clusters with high-performance data planes

Transitioning from VNFs to CNFs

- Moving from network functionality from physical hardware to encapsulating the software in a virtual machine (P2V) is generally easier than containerizing the software (P2C or V2C)
- Many network function virtualization VMs rely on kernel hacks or otherwise do not restrict themselves to just the stable Linux kernel userspace ABI
  - They also often need to use DPDK or SR-IOV to achieve sufficient performance
- Containers provide nearly direct access to the hardware with little or no virtualization overhead
  - But they expect containerized applications to use the stable userspace Linux kernel ABI, not to bypass it

Reproducible Infrastructure Provisioning

- Just because it’s in the API does not mean it works
- Access to the switch configuration does not mean you can set it up as expected
- Limits in provider facilities and between customer projects

Reproducible Clusters

- OpenStack
- Host OS - builds, packages, defaults
- Standard plugins vs source builds

What’s Next?

What’s Next for Cross-cloud?

Cross-Group Collaboration:

- Network Service Mesh (NSM) collaboration
- Merge enhancements from forks/pull requests (eg. VMWare)
- Gathering feedback from End Users, CNCF Projects and K8s Community
- Planning next iteration of project

What’s Next for Cross-cloud?

Features:

- Supporting Network Service Mesh
- Layer-2 for different providers
- Supporting kubeadm
- Supporting offline services like DNS

What’s Next for CNCF CNFs?

Events and presentations:

- KubeCon CNFs BoF on Wed, Dec 12 at 2:35pm PT
  - https://sched.co/JCLS
- Mobile World Congress, Barcelona, February 25-28, 2019
  - https://www.mwcbarcelona.com
- Open Networking Summit, San Jose, California, April 3 - 5, 2019
  - https://events.linuxfoundation.org/events/open-networking-summit-north-america-2019/

What’s Next for CNCF CNFs?

Enhancements:

- Comparisons with OpenStack, Firecracker, Singularity
- Supporting more environments (eg. Amazon bare metal)
- Adding more use cases

How to collaborate

How to Collaborate with Cross-cloud

- **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/cross-cloud/issues

- **Review KubeCon Cross-cloud CI Intro Slides:**
  - https://kccna18.sched.com/event/Grci

Connect with Cross-cloud CI

cross-cloud ci

@crosscloudci

@crosscloudci

#cncf-ci slack channel

crosscloudci@vulk.coop

Connect with CNF Project

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@cncf/cnfs

@vulkcoop

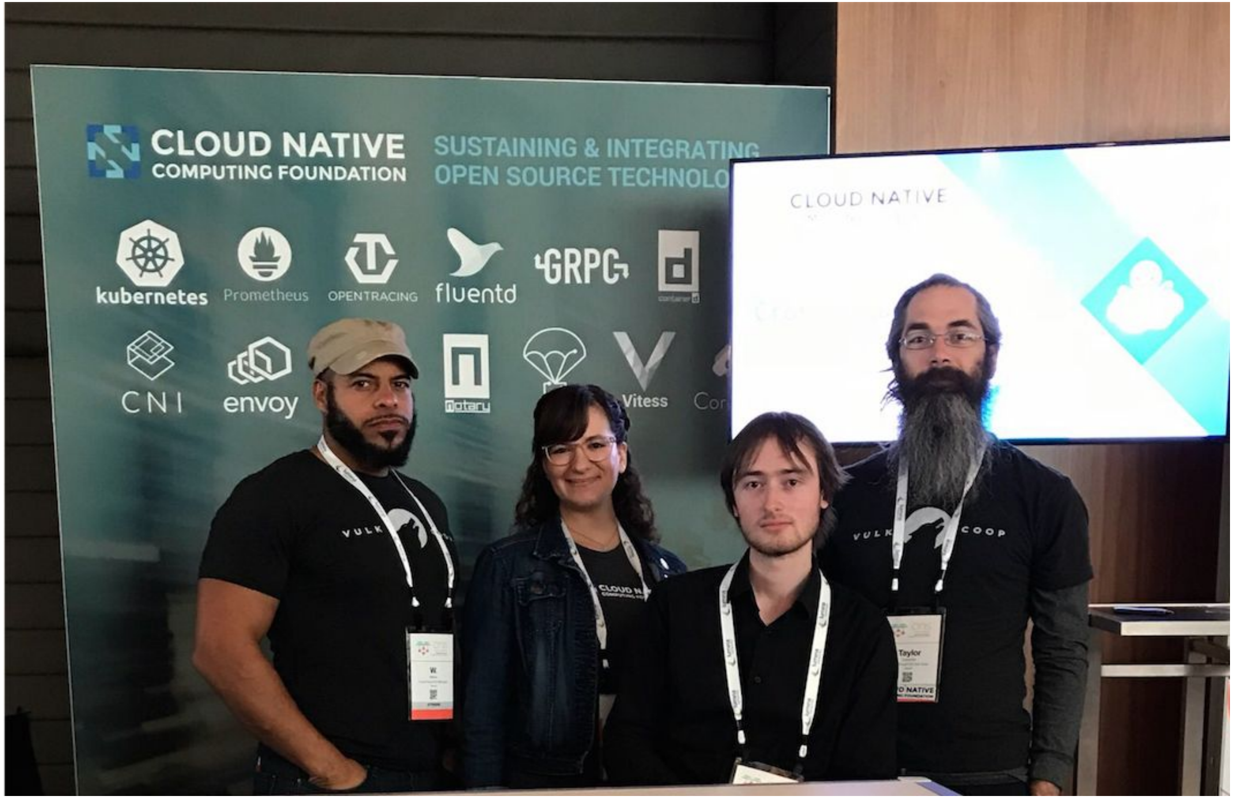
#cnf slack channel

cncfcnfs@vulk.coop

Q&A

Thank you for your participation!

- **W. Watson**
  @wavell
- **Lucina Stricko**
  @lixuna
- **Denver Williams**
  @denverwilliams
- **Taylor Carpenter**
  @taylor



Thank you!

cross-cloud ci

Today’s Demo Prepared by:

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lucina@vulk.coop
watson@vulk.coop
denver@debian.nz

VULK
COOP

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North America 2018