KubeCon
CloudNativeCon
North America 2019

Intro + Deep Dive: Cloud Native Network Function (CNF) Testbed

Taylor Carpenter & Denver Williams,
Vulk Cooperative

Agenda - 90 Minutes

- Team
- Intro to CNF Testbed
- Overview of components + stages
- Pre-reqs + setup workstations
- Stage 1: Hardware provisioning
- Stage 2: Cluster provisioning
- Use cases + examples
- Q/A

CNF Testbed

CNF Testbed Intro + Deep Dive Goals

- To gain a shared understanding of:
  - How to set up a CNF Testbed workstation,
  - How to provision Packet machines,
  - How to create Kubernetes clusters,
  - How to deploy examples and use cases,
  - How to stay connected with the CNF Testbed initiative

CNF Testbed

Get These Slides

https://sched.co/UakA

CNF Testbed

Meet Vulk Cooperative

vulk.coop

- Worker-owned software cooperative
- Since 2013
- Meetups in Austin, TX
  - Austin Software Co-operatives
  - Open Source Axes
- twitter.com/cnftestbed
- twitter.com/vulkcoop
- twitter.com/opensourceaxes

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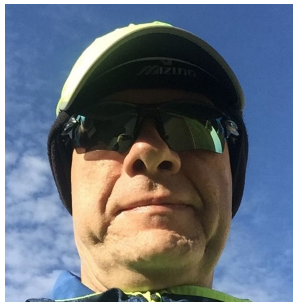

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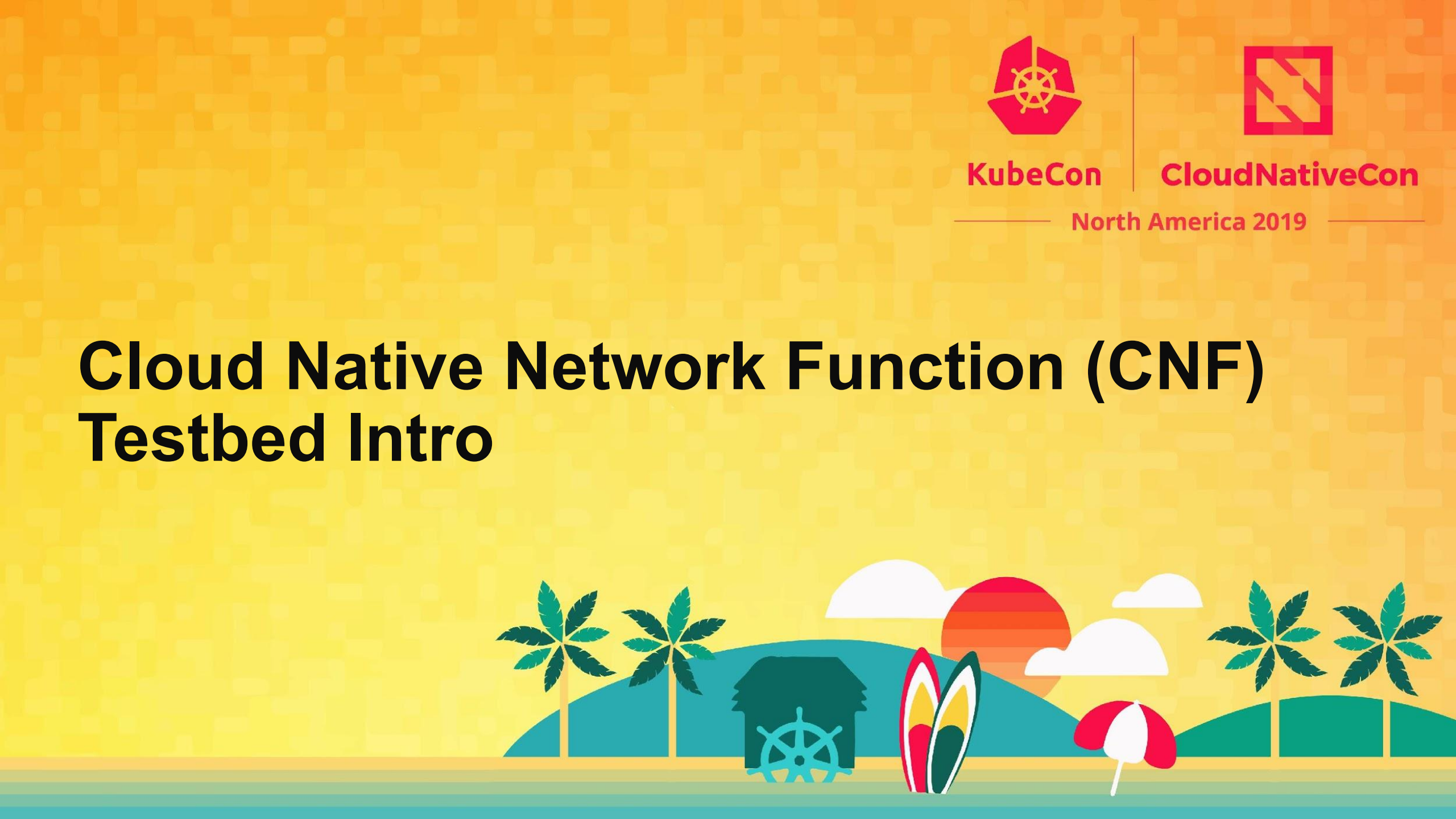
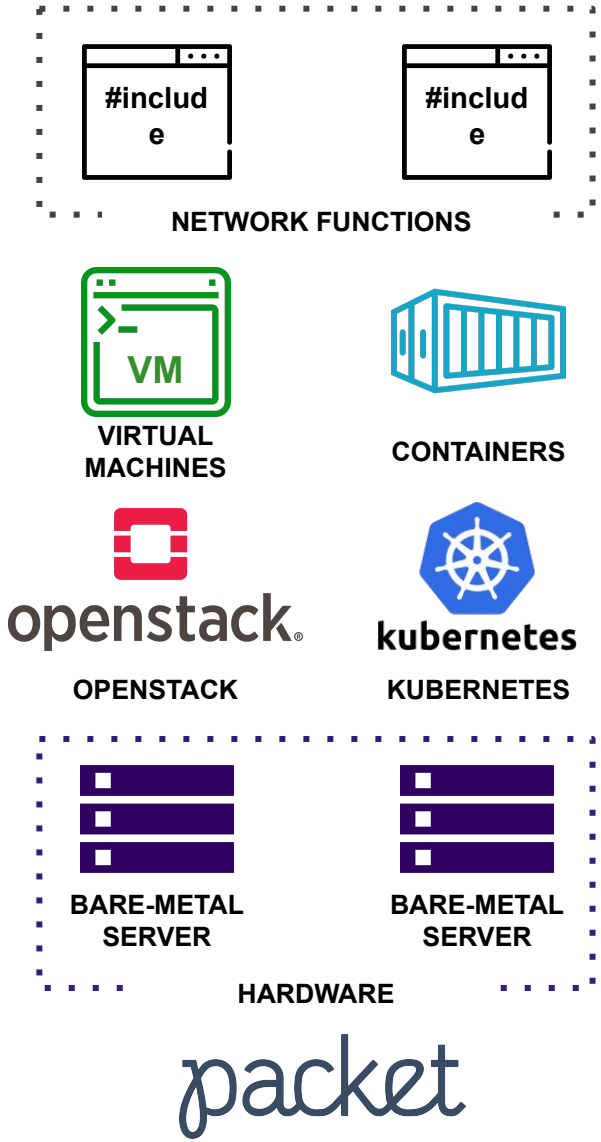
Network Service Mesh



Cloud Native Network Function (CNF) Testbed Intro

CNF Testbed

- Open source initiative from CNCF
- Collaborating with CNCF Telecom User Group
- Testing and reviewing emerging cloud native technologies in the Telecom domain
- Funneling the new technology to early adopters
- Providing fully reproducible use cases and examples
- Running on top of on-demand hardware from the bare metal hosting company, Packet



CNF Testbed

We Welcome Your Participation

- Replicate our results from github.com/cncf/cnf-testbed with an API key from packet.com/cnf

- Package your internal network functions in containers (ideally following cloud native principles) and run on your instance of the testbed
  - We don't need to see the code but would love to see the results

- Create pull requests to have the CNF Testbed run on your bare metal servers or other cloud bare metal servers like AWS i3.metal

CNF Testbed

Contribute Use Cases and Enhancements

- Contribute new use cases to the CNF Testbed (issues or spec board)

- Create pull requests to improve Kubernetes or OpenStack deployments

Get Connected with the CNF Testbed

- Join the #cnf-testbed channel on CNCF slack
  - slack.cncf.io

- Subscribe to the CNCF Telecom User Group mailing list:
  - telecom-user-group@lists.cncf.io

- Attend CNCF Telecom User Group meetings:
  - https://github.com/cncf/telecom-user-group
  - 1st Mondays at 5pm CET / 8am Pacific Time (US & Canada)
  - 3rd Mondays at 1pm CET / 7pm China Standard Time

CNF Testbed

Review & Roadmap

Review of CNF Testbed v1 - It Begins

- Initiative started at ONS NA 2018 in Los Angeles
  - Apples-to-apples comparison of CNFs and VNFs
  - What can we re-use from ONAP and other projects?
  - What gaps are missing on the path to cloud native?
  - What is a POC to assist with discussions?

ONAP Demo to Ansible-based v1 CNF Testbed

- Started with onap-demo
- Pivot to building blocks: Docker + Vagrant first
- Next: OpenStack and K8s workload platforms
- VPP based vSwitch for both platforms
- Ansible for additional hardware, host and network provisioning
- Custom use cases with Ansible, scripts and HEAT templates

CNF Testbed

Review of July to October 2019

July 2019	❑ Deutsche Telekom reproduced CNF Testbed ❑ Successfully tested the Intel container kit on Packet ❑ WIP Adding NSM (eg. PF)
Aug 2019	❑ NSM Packet filter use case ❑ WIP NSM Physical NIC Gateway use case ❑ Containerized VPP vSwitch on Mellanox ❑ Maintenance: Fix OpenStack deploy, updates, bug fixes
Sept 2019	❑ New helm-based use cases: IPsec single node, IPFwd Performance Snake and Pipeline ❑ NSM physical NIC gateway use case ❑ Tutorial + walkthrough using the CNF Testbed at ONS EU
Oct 2019	❑ NSM IPSec single-node use case ❑ NSM IPFwd Service Chain benchmark test ❑ GW-Routers service chain using NSM and Kubernetes

General Goals - Technology Innovation Review Tool

- Support changing and trying different technology options
- Keep things as simple as reasonable
- Use upstream community tooling
- Use cloud native principles where possible

Use Cloud Native Principles

- Where possible use cloud native principles for all levels (hardware to use case)
  - Immutable hardware
  - Version control all configuration including underlay networking
  - Workload bootstrapping repeatable by automation/pipeline
- Highlight where gaps are missing and out-of-band procedures are used
- Bring focus to technology which is attempting to provide solutions to meet cloud native principles

Key Features of CNF Testbed v2

- Using more in-band components
  - refactor using Helm or kubectl for K8s use cases
  - replace cross-cloud provisioner with Terraform + Kubespray
  - more K8s-native replacements for out-of-band host setup
- Adding support for emerging technology including NSM, DANM, SRIOV device plugins
- Adding new examples:
  - SR-IOV
  - Hybrid K8s + OpenStack service chains
  - workload configs (eg. Nokia CPU Pooler + NSM)

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CNF Testbed Roadmap | Nov 2019 to Jan 2020

Nov 2019	❑ Clients using different external gateways ❑ NSM SR-IOV Use Case ❑ Separate hardware and workload provisioning stages + Kubespray for K8s	NSMCon, KubeCon NA (Nov 18-21)
Dec 2019	❑ DANM SR-IOV use case ❑ NSM multi-cluster IPsec use case ❑ Intel Multus + CPU Manager use case	[TBD]
Jan 2020	❑ NSM 5G use case ❑ NSM Hybrid K8s+Openstack use case ❑ TBD: Kolla/Openstack-helm (TBD)	[TBD]

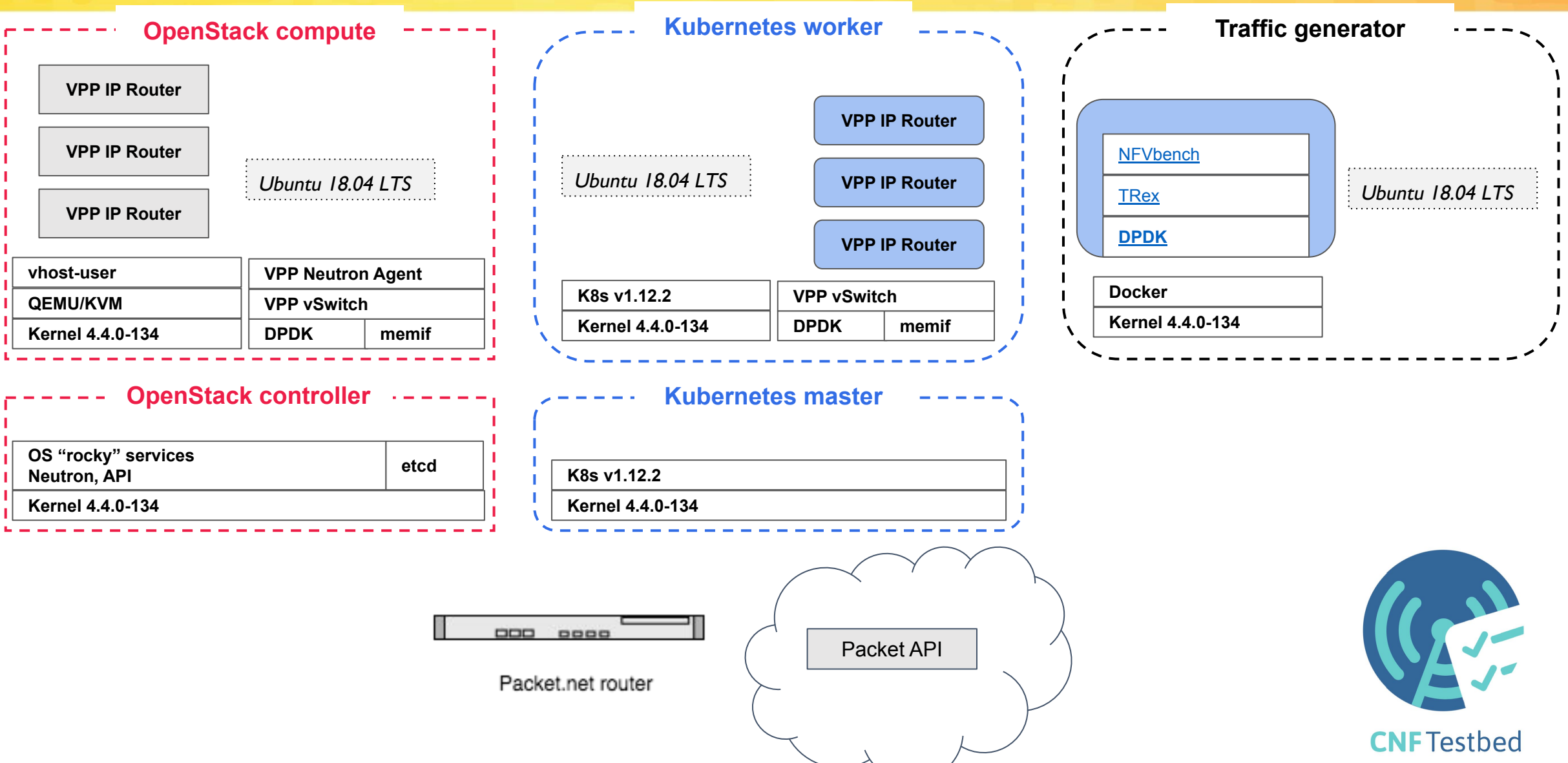
CNF Testbed

Overview of Components and Stages

Components of the CNF Testbed

- Hardware provisioning
- Workload provisioning (eg. K8s or OpenStack)
- Use Cases and Examples
- Network Functions (eg. Packet Filter, NIC Gateway)
- Testing tools (eg. NFVbench)

CNF Testbed Software Components



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Workstation Set-up

Pre-reqs to Setting up the Workstation

- Access to a project on Packet
  - Note the **PROJECT_NAME** and **PROJECT_ID**, both found through the Packet web portal, as these will be used throughout the deployment for provisioning servers and configuring the network.

- An available keypair for SSH access
  - Add your public key to the project on Packet through the web portal, which ensures that you will have passwordless SSH access to all servers used for deploying the CNF Testbed.

[current docs]

CNF Testbed

Set-up a Workstation

- Install the initial dependencies
  - Install base tools such as git, curl
  - Install Docker
  - Install Kubectl
- Clone CNF Testbed
- Create a keypair on the workstation and upload to Packet

[current docs]

CNF Testbed

Steps to Deploy the CNF Testbed

Steps to Deploy the CNF Testbed

- Current v1 vs future v2
- Tutorial workstations
- How to set up a CNF Testbed environment:
  - https://github.com/cncf/cnf-testbed/blob/master/docs/Deploy_K8s_CNF_Testbed.md#steps-to-deploy-cnf-testbed

- Deployed on servers hosted by:

packet

CNF Testbed

Deploy Ansible Environment

- Certain parts of the CNF Testbed are done directly using Ansible playbooks. The easiest way to run these is to set up an interactive container on the workstation server using "cnfdeploytools", which has been built previously.

- This container environment is not used for deploying the K8s clusters. When the environment is needed it will be mentioned (deploying packet generator and CNFs).

ANSIBLE

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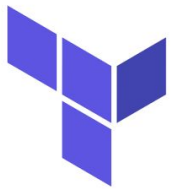
Hardware and Cluster Provisioning

Changing How to Provision Hardware and Clusters

- Moving off **“cross-cloud”** custom provisioner, one stage for:
  - Hardware
  - Kubernetes clusters

- Moving to a two-stage process, using:



Terraform **and**

KUBESPRAY

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Stage 1: Hardware Provisioning

Overview of Hardware Provisioning Stage

- Terraform is used to provision the Packet machines
  - Reserved and on-demand instances supported

- Ansible is used for additional host configuration and network underlay provisioning

Terraform

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Stage 2: Workload or Cluster Provisioning

Overview of K8s Workload Provisioning

- K8s-infra provisioner
  - Minimal declarative configuration
  - Simple and easy to use CLI
  - Kubespray integration for deployment
- Ansible for out-of-band host provisioning including underlay networking
- Additional configuration and services through normal K8s process

KUBESPRAY

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OpenStack Workload Provisioning

- OpenStack Chef (normally started by Terraform Ansible plugin)
- Ansible for additional host provisioning including underlay networking
- VPP-networking or OVS for vSwitch

Future:

- Move to Kolla or OpenStack-helm

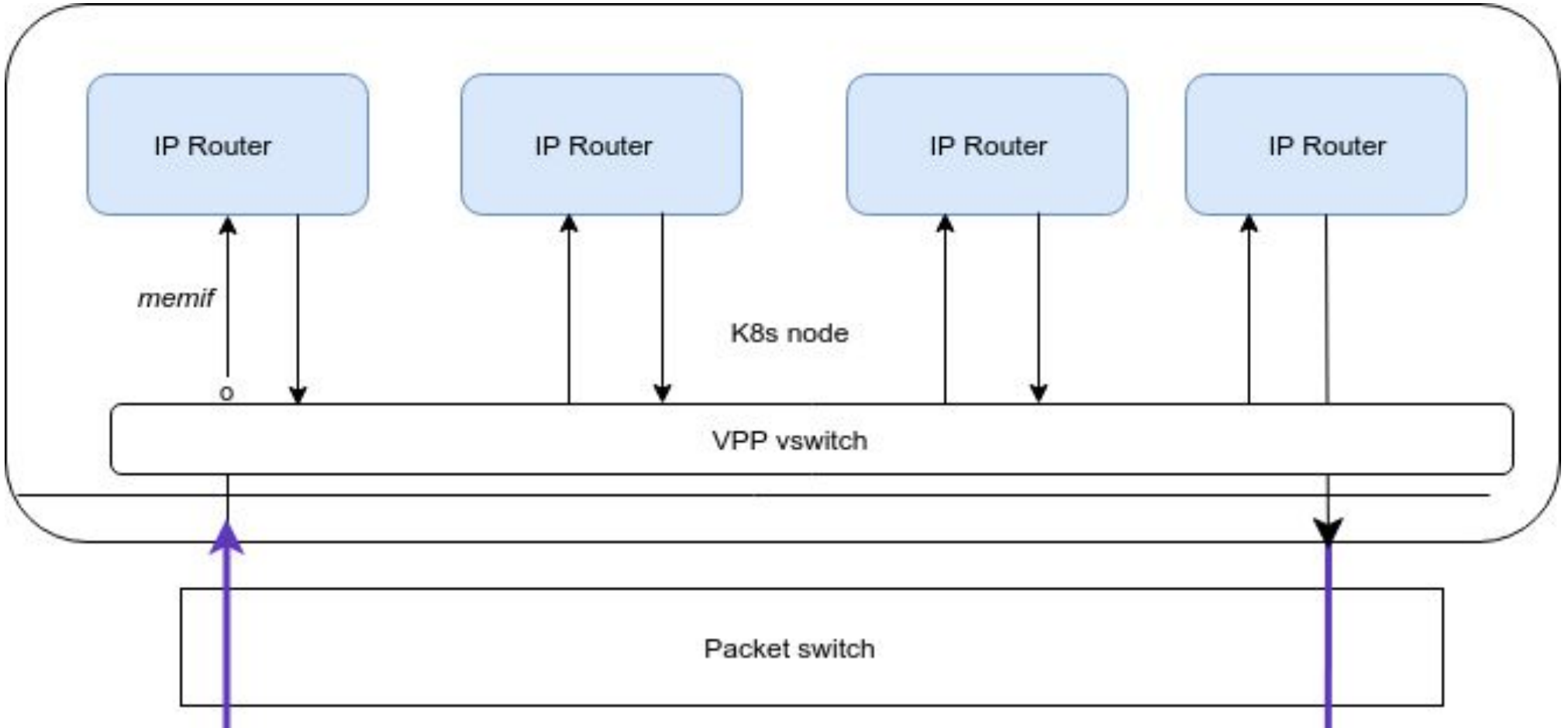
Use Cases & Examples

Overview of Use Cases

- Structure
- Purpose
- Different / multiple examples
- Different implementations
  - Out of band
  - Multus (https://github.com/intel/multus-cni)
  - DANM (https://github.com/nokia/danm)
  - Network Service Mesh (https://networkservicemesh.io)

Example #1 - Snake Service Chain Example

- Github cncf/cnf-testbed/tree/master/examples/use_case/3c2n-csc
- Connecting container NFs through a vSwitch to create a service chain



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Deploying Example #1

- Pre-reqs
  -
- Deployment of example
  -
- Run tests for use case / example
  -

Example #2 - SRIOV Device Plugin

- Github
  - K8s workload infra setup
  - SRIOV example pod
- Uses Intel's SRIOV K8s device plugin
- Kubectl

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Deploying Example #2

- Pre-reqs
  - Kubectl
- Deployment of example
  - Workload infra
  - Example pod

Example #3 - Multiple Network Paths for Clients

- Github [use_case/external-packet-filtering-on-k8s-nsm-on-packet]
- 2 client containers, packet filtering NF, 2 gateway NFs
- Each GW has dedicated access to a single physical network port
- Multiple service chains with private networks
- DPDK + VPP-based access to Packet's Intel x710 NIC
  - n2.xlarge machine type
  - host provisioning required
  - privileged GW container
- Helm and NSM

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Deploying Example #3

- Pre-reqs
  - Helm, Network Service Mesh, External end-point
- Deployment of example
  -
- Run tests for use case / example
  -

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Connect with the Team

cncf/cnf-testbed

@cnftestbed

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Q/A

Questions? Concerns?

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Thank you for your participation!

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