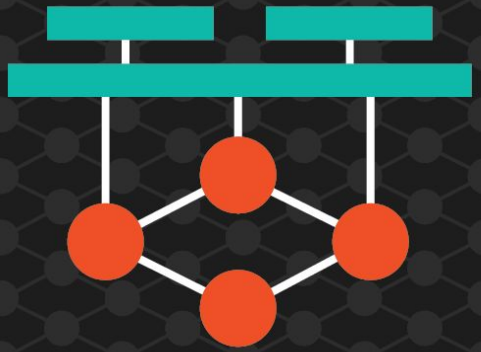
September 25 - 27, 2018
Amsterdam, The Netherlands



ons

EUROPE

OPEN NETWORKING //
Integrate, Automate, Accelerate

ons
EUROPE
OPEN NETWORKING //
Integrate, Automate, Accelerate

September 25 - 27, 2018
Amsterdam, The Netherlands

How to Bring your Virtual Machine VNF to Container World?

Tomofumi Hayashi, Red Hat

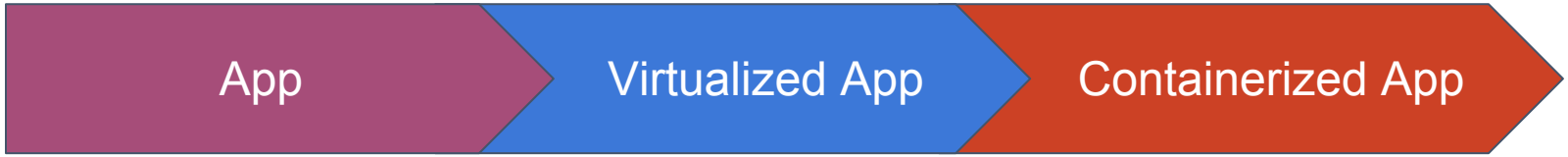
ons
EUROPE
OPEN NETWORKING //
Integrate, Automate, Accelerate

Disclaimer

The content set forth herein is Red Hat confidential information and does not constitute in any way a binding or legal agreement or impose any legal obligation or duty on Red Hat.

This information is provided for discussion purposes only and is subject to change for any or no reason.

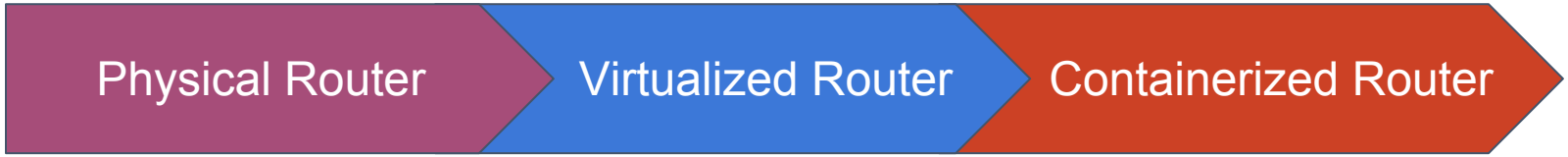
The Motivation is...



Containerized app brings more agility/efficiency/flexibility than virtualized app...

So what about NFV?

Is It Easy to Make a VNF Container?



- Console
- Mgmt Interface
- Kernel (modified)

- Console
- Mgmt Interface
- Kernel (modified)

- ~~Console~~
- ~~Mgmt Interface~~
- **Generic** Kernel

CNF = Container Network Function? or Cloud Native Network Function?

From https://www.cncf.io/about/charter/, cloud native systems should be:

(a) **Container packaged**.

(b) Dynamically managed.

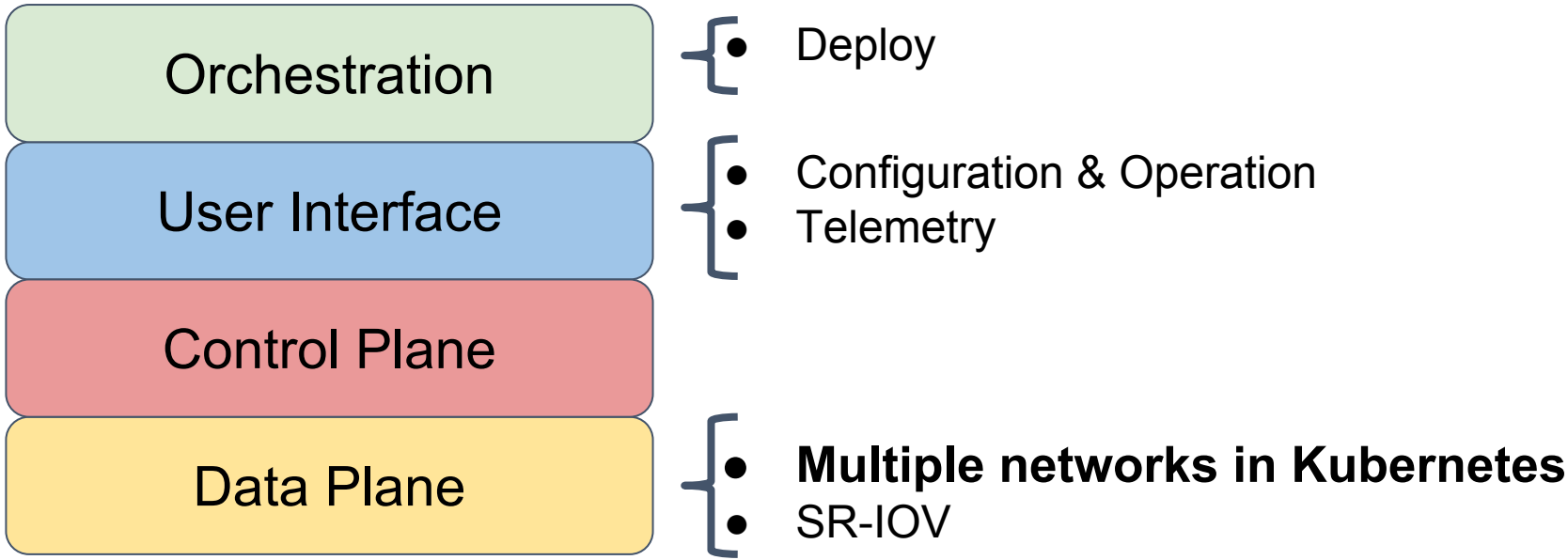
(c) Micro-services oriented.

ons
EUROPE
OPEN NETWORKING //
Integrate, Automate, Accelerate

Agenda:

- Network Device Functions for Containers
  - Data Plane
  - User Interface
  - Orchestration
- Open Source Projects for Container Network Functions

Network Device Functions for Containers VNF?



ons
EUROPE
OPEN NETWORKING //
Integrate, Automate, Accelerate

Data Plane (Multiple Networks in Kubernetes)

The Kubernetes Pod always have **one** interface to connect Kubernetes networks.

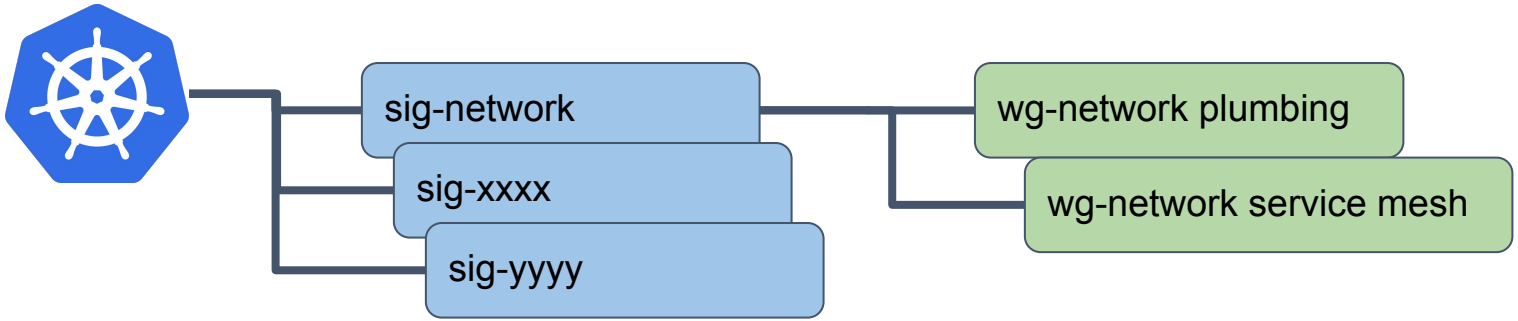
But sometimes VNFs want to use multiple interfaces

- To serve L2 network functions (e.g. vCPE use-case)
- To isolate networks from other Pod/Users

Data Plane (Multiple Networks in Kubernetes)

There are two working groups in K8s community, under network-SIG:

- Network Plumbing WG (meeting agenda/info)
- Network Service Mesh WG (meeting agenda/info)



ons
EUROPE
OPEN NETWORKING //
Integrate, Automate, Accelerate

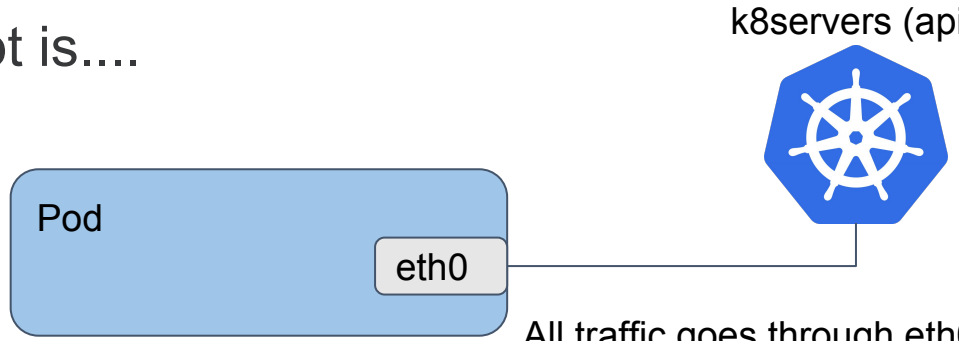
Data Plane (Multiple Networks in Kubernetes)

<<<<< They have talk/tutorial in ONS!!! >>>>>>

- Network Plumbing WG
  - Tutorial: Tutorial: NFV features in Kubernetes" at G102 (**right now!**)
- Network Service Mesh WG
  - Talk: "Network Service Mesh: An Attempt to Reimagine NFV in a Cloud-Native Fashion" Tomorrow (Sep 26, 14:30 - 15:00, G106/7)

Multiple Interface in Kubernetes

The Core Concept is....

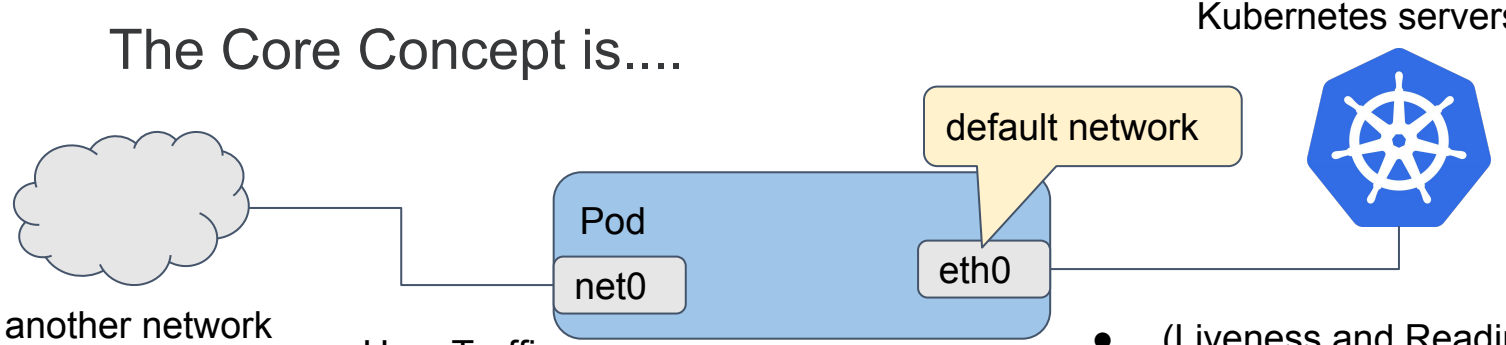


All traffic goes through eth0

- (Liveness and Readiness) Probes
- Communication between API and Pod
- User Traffic

Multiple Interface in Kubernetes (cont'd)

The Core Concept is....



- User Traffic

- (Liveness and Readiness) Probes
- Communication between API and Pod

ons
EUROPE
OPEN NETWORKING //
Integrate, Automate, Accelerate

Data Plane (Multiple Networks in Kubernetes)

There are two working groups in K8s community, under network-SIG:

- **Network Plumbing WG**
- Network Service Mesh WG

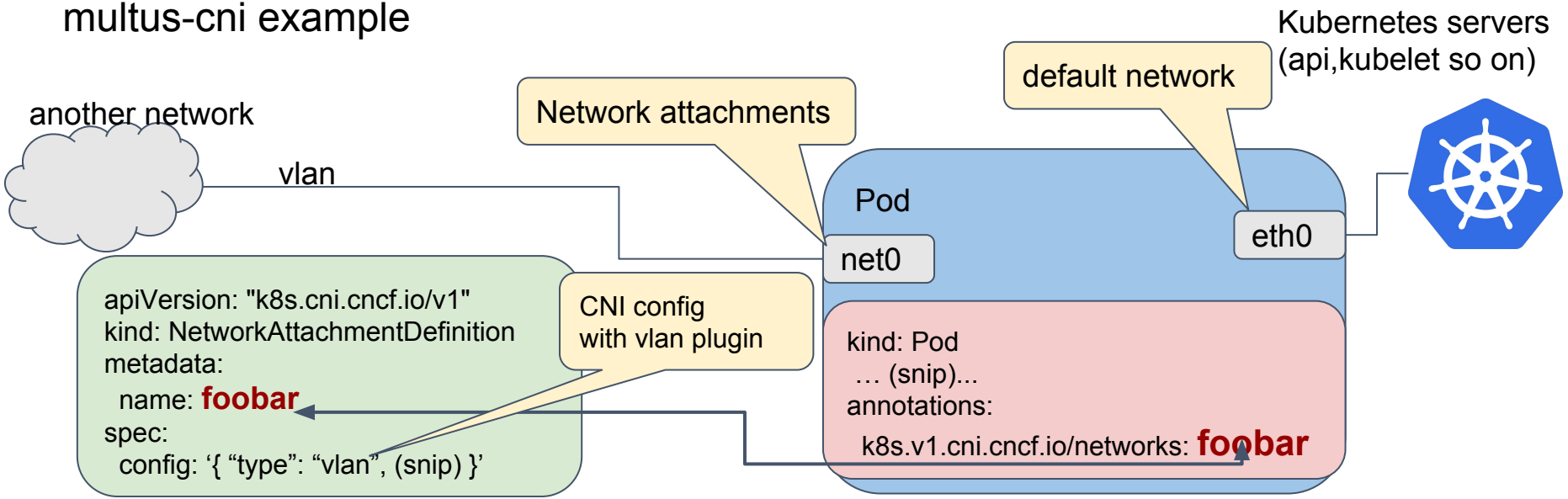
Data Plane (Multiple networks in Kubernetes)

Network Plumbing WG

- Making de-facto standard document/specs
  - Kubernetes Network Custom Resource Definition De-facto Standard Version 1
  - V2 currently under development…
- Implement multus-cni as its reference implementation
  - meta-plugin to multiplex network CNI plugins

Multiple Interface in Kubernetes (cont'd)

multus-cni example



ons
EUROPE
OPEN NETWORKING //
Integrate, Automate, Accelerate

Data Plane (Multiple Networks in Kubernetes)

There are two working groups in K8s community, under network-SIG:

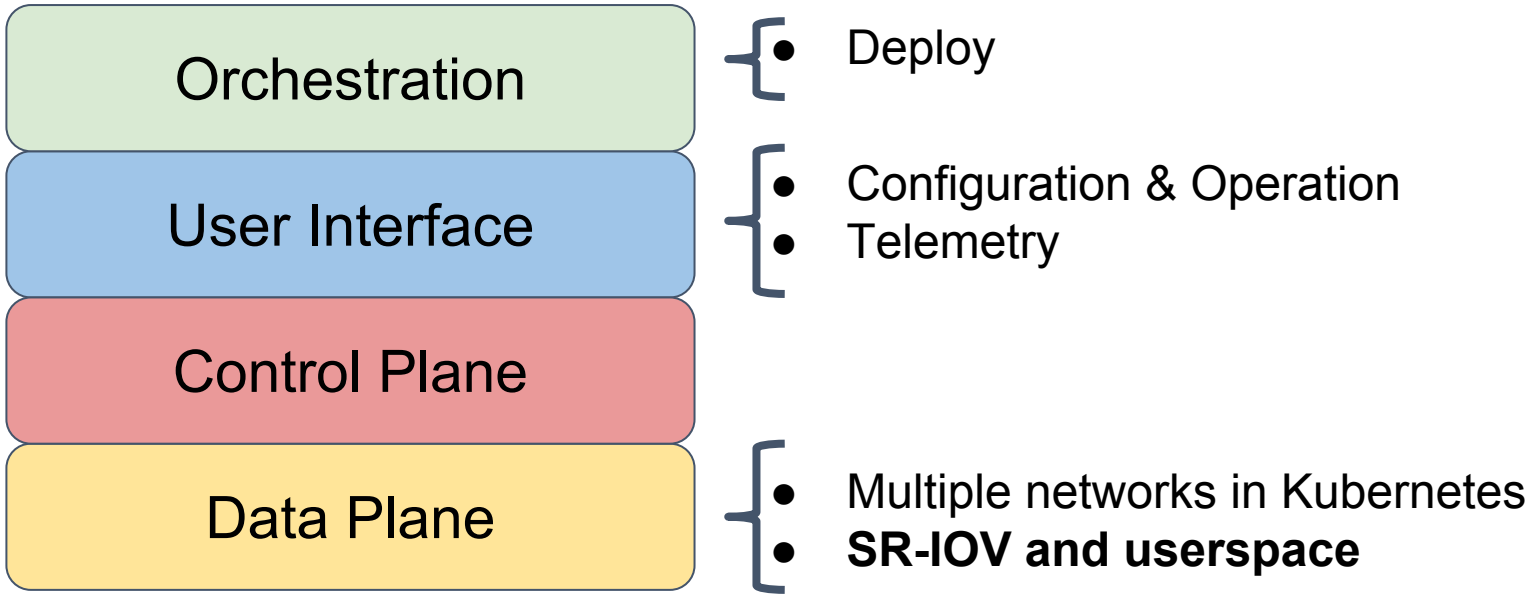
- Network Plumbing WG
- **Network Service Mesh WG**

Data Plane (Multiple networks in Kubernetes)

Network Service Mesh WG

- Provide network service (L2, L3 and others) into Kubernetes from scratch
- Interacts with Device Plugin API(DPAPI) without CNI
  - Provide a brand new network framework in Kubernetes
- Implementation: github.com/ligato/networkservicemesh

Network Device Functions for Containers VNF?



ons
EUROPE
OPEN NETWORKING //
Integrate, Automate, Accelerate

SR-IOV

- https://github.com/hustcat/sriov-cni
  - without any resource management...
- https://github.com/intel/sriov-network-device-plugin
  - CNI plugin + device plugin for resource management
- Network Service Mesh
  - device plugin only

SR-IOV

- https://github.com/intel/sriov-network-device-plugin
  - resource management with Device Plugin API (DPAPI)
    - Step 1) Before the pod launch, Device Plugin allocates VFs
    - Step 2) Its CNI plugin configures VF, given from Device Plugin
  - Mainly discuss at
    - k8s/resource-management working group
    - network plumbing working group

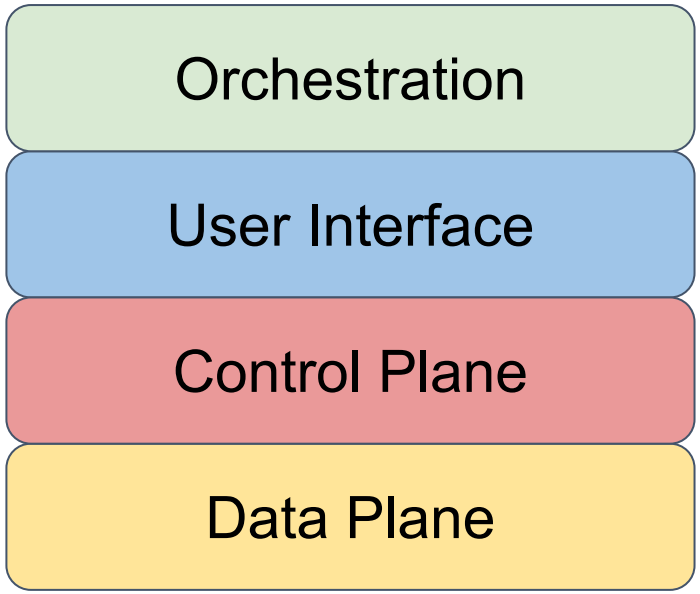
Note: https://github.com/zshi-redhat/virt-network-device-plugin provides SR-IOV emulation with virtio_net for PoC/Demo

Userspace

https://github.com/intel/userspace-cni-network-plugin (active)

- In very early development phase
- Create virtual interface (other than veth)
- Connect to virtual switch
  - OvS-DPDK
    - vhostuser interface
  - VPP
    - memif interface

Network Device Functions for Containers VNF?



- Deploy

- **Configuration & Operation**
- Telemetry

- Multiple networks in Kubernetes
- SR-IOV and userspace

Configuration and Operation: Gap

Strongly related to its lifecycle:

- Container
  - Stateless
  - Read once, no changed (delete and launch again if config change)
- Network device
  - STATEFUL!
  - Changed on-demand

Configuration and Operation (cont'd)

Infra in Kubernetes:

- Custom Resources
- Admission Controllers/Dynamic Admission Control
- (skipped: Overlay Mount Filesystem, provide ARG in Pod...)

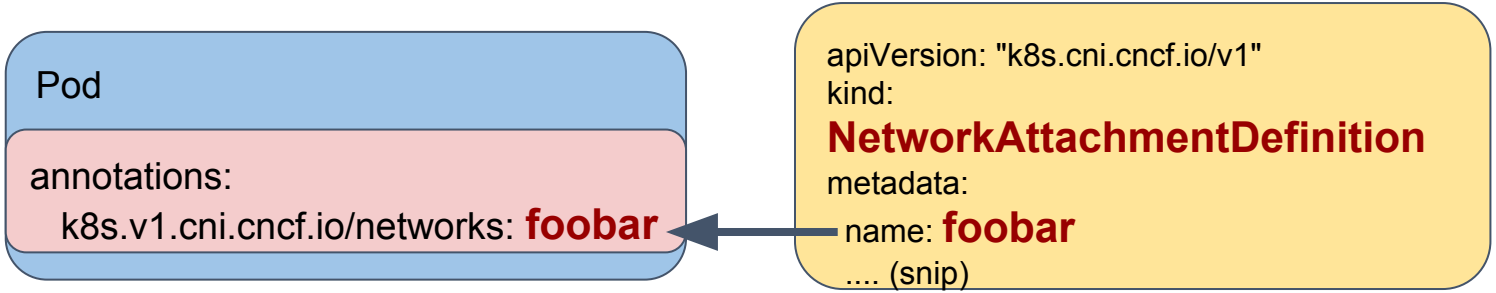
Infra in Networking:

- RESTCONF/NETCONF/YANG for modeling
- gRPC/ssh/http for transport

Configuration ... (cont'd) - Infra in Kubernetes

Custom Resources:

- Create Original 'Resource' object in Kubernetes
- User can create/modify through k8s API
- multus-cni uses custom resources as following:



Configuration... (cont'd) - Infra in Kubernetes

Admission Controllers/Dynamic Admission Control:

- Intercepts requests for Kubernetes API (to create custom resource, for example) after auth, before its persisted
- ValidatingAdmissionWebhook is used to hook the request and do validation

Configuration and Operation (cont'd)

Infra in Kubernetes:

- Custom Resources
- Admission Controllers/Dynamic Admission Control
- (skipped: Overlay Mount Filesystem, provide ARG in Pod...)

Infra in Networking:

- RESTCONF/NETCONF/YANG for modeling
- gRPC/ssh/http for transport

Configuration... in Networking

- IETF netmod WG: NETCONF,RESTCONF/YANG
  - IETF netmod WG provides data models in YANG
  - NETCONF/RESTCONF uses ssh/http(s)/TLS/SOAP/TLS for transport
- OpenConfig: NETCONF,RESTCONF,gRPC/YANG
  - OpenConfig provides common data models in YANG
  - OpenConfig also defines gNMI (gRPC Network Management Interface)

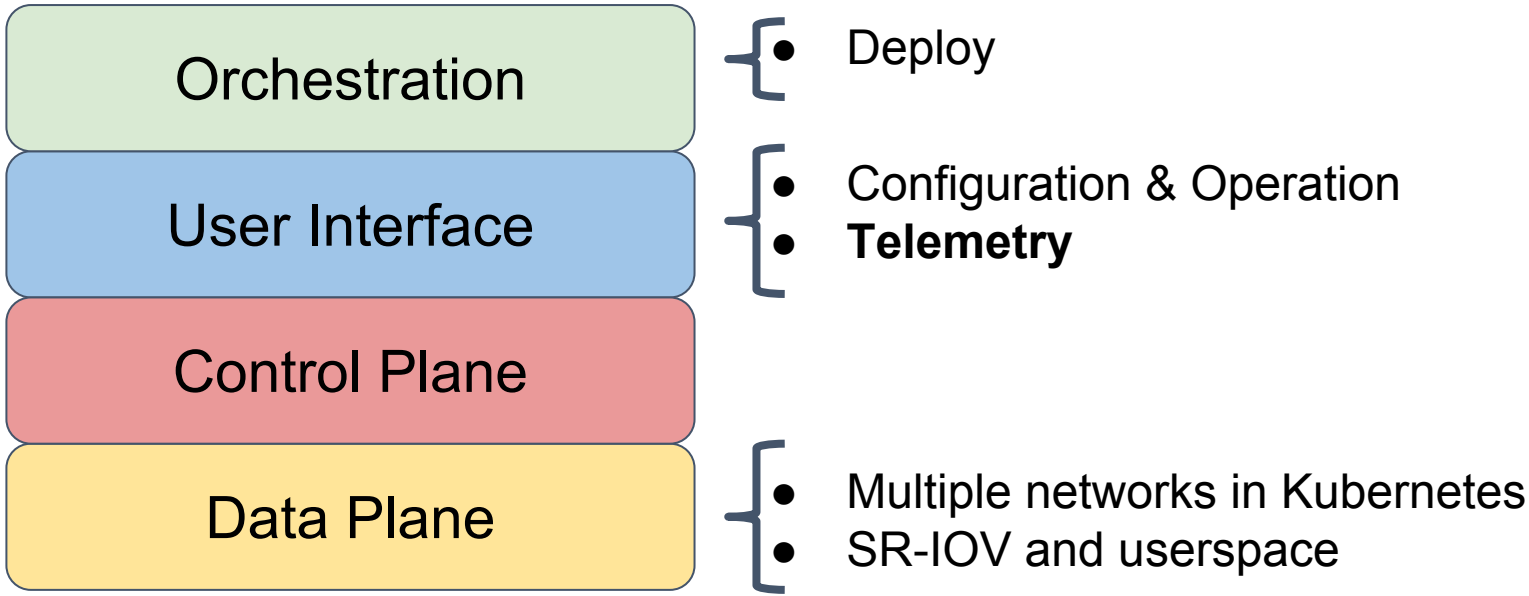
ons
EUROPE
OPEN NETWORKING //
Integrate, Automate, Accelerate

Configuration and Operation (cont'd)

Talk: Beyond the Command Line: Programming Network Devices with gRPC and OpenConfig

(Day3, September 27, 16:45 - 17:15, G106/107)

Network Device Functions for Containers VNF?



Telemetry

Infra in Container:

- http/https (for Prometheus)

Infra in Networking:

- YANG-PUSH in IETF netconf wg
- gNMI, Streaming Telemetry in OpenConfig
- VES(VNF Event Stream) in OPNFV
- and so on (vendor specific way and yeah, we have SNMP!)

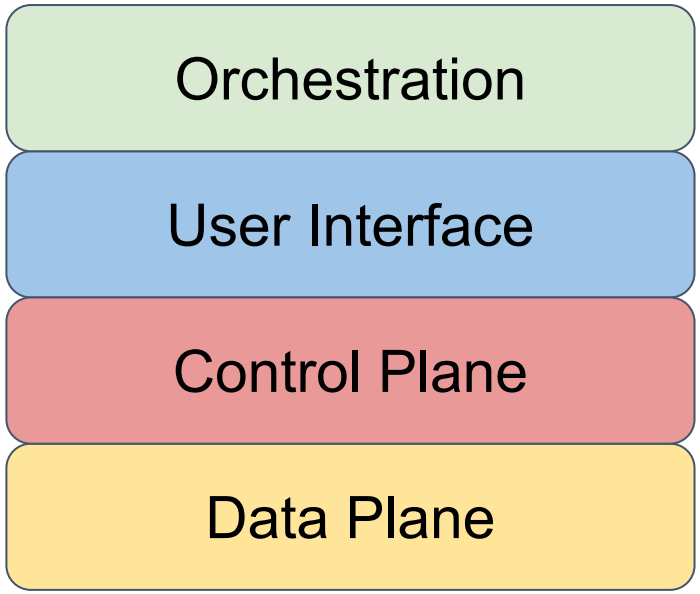
ons
EUROPE
OPEN NETWORKING //
Integrate, Automate, Accelerate

Telemetry

Additional consideration in case of container environment:

- Should we provide all information for each container?
  - Some info is host specific, not container specific.
- Is container telemetry suitable for Telco?
  - Prometheus exporter (TLS with nginx)
  - Prometheus exporter consumes TCP ports....

Network Device Functions for Containers VNF?



- **Deploy**

- Configuration & Operation
- Telemetry

- Multiple networks in Kubernetes
- SR-IOV and userspace

ons
EUROPE
OPEN NETWORKING //
Integrate, Automate, Accelerate

Deploy

Kubernetes and its community provide following tools:

- Helm
- Operator Framework

Deploy

Helm

- Package manager for Kubernetes
- Package, 'charts', provides several Kubernetes resources
  - Pod
  - Configmap
  - Service
  - Deployment

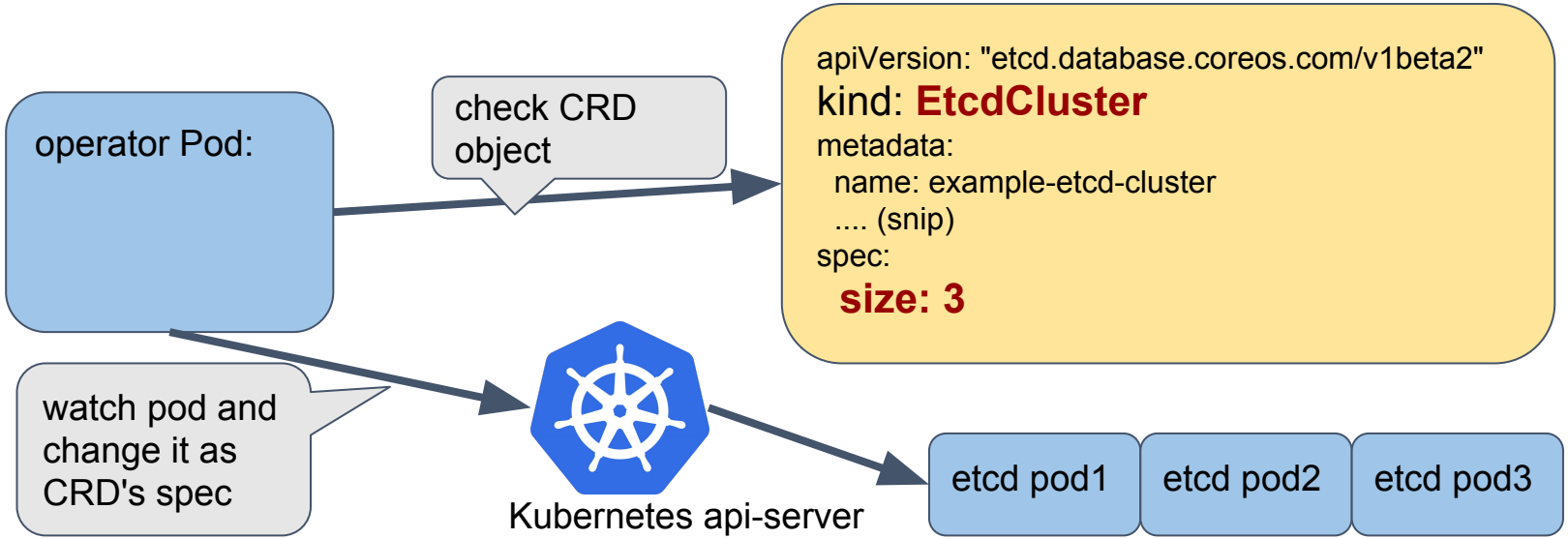
Deploy

Operator Framework

- Framework to manage Kubernetes native applications
  - can be used for deployment as well as automation automation
  - e.g: etcd-operators, prometheus-operators
- Operator creates custom resource to manage applications
- Each operators has associated 'operator pod'
  - to watch custom resource objects and
  - to keep apps based on its custom resources (e.g. # of replica)

Deploy

Operator Framework (in case of etcd-operator)



Open Source Projects for Container VNF

Container VNF:

- Container4NFV project in OPNFV
- Metaswitch's Clearwarter docker integration
- Metaswitch's Clearwater Kubernetes integration by Intel

Cloud native VNF:

- Clover in OPNFV

ons
EUROPE
OPEN NETWORKING //
Integrate, Automate, Accelerate

Wrap-up:

- Network Device Functions for Containers
  - Data Plane
  - User Interface
  - Orchestration
- Open Source Projects for Container Network Functions

ons
EUROPE
OPEN NETWORKING //
Integrate, Automate, Accelerate

Thank you! Questions?

Slides available at https://onseu18.sched.com/

@s1061123

ons
EUROPE
OPEN NETWORKING //
Integrate, Automate, Accelerate

Click to add Title

- Click to add Text