Enhancing ONAP to orchestrate container VNFs using container orchestration as VIMs

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links

- https://wiki.onap.org/display/DW/September+26-28+Topics#September26-28Topics-M8
  - Enhancing ONAP to orchestrate container VNFs using container orchestration as VIMs
- https://zoom.us/j/162599919
- This slide: https://docs.google.com/presentation/d/18lh8g-GpN8fJi2MYOKNx-s-LyhIc6bkLrMR0mndWgjQ/edit?usp=sharing
- Meeting minutes: https://wiki.onap.org/display/DW/2017-09-26+Meeting+notes%3A+Enhancing+ONAP+to+orchestrate+container+VNFs+using+container+orchestration+as+VIMs?flashId=-674792111
- https://etherpad.opnfv.org/p/paris-2017-onap-container-vim
- Irc freenode #onap-meeting

Session goal

Enhancing ONAP to orchestrate container VNFs using container orchestration as VIMs

Description: Release 1 ONAP instantiates VNFs as VMs in compute farm using VIMs such as Openstack which manages VM. Increasing VNF density on each node, need for multiple networks/slices, Services using SFC and reduced bringup & network latency requirements in market such as 5G and vCPE are driving container based VNFs. This project proposal is to enhance ONAP to support VNFs as containers in addition to VNFs as VMs by container orchestration as VIM instead of VM manager like openstack.

Session goals: Objective/Outcome desired

- Get consensus on crawl/walk/run direction.
- Get agreement on K8S as container VIM in R2
- Get feedback on proposed architecture and changes to various ONAP projects.
- Get an understanding that VNFs as container is needed for ONAP R-2 use cases(5G-RAN and vCPE)

Next steps...

Tech discussion

- Is this proposal good idea?
    - Are there VNFs that uses container?
- plan for R-2
    - First target: Kubernetes/Docker/CNI plugin
- Under existing projects or new project?
- timeframe
- Alignment with Use cases
- Architecture

For technical details we can continue discussion.
Let's schedule room...

If it's go,

Next steps?

- TBD...

Project logistics

- Wiki pages
- Source code repo
    - multi-VIM
    - SO
- jira/irc/zoom/slack/whatever
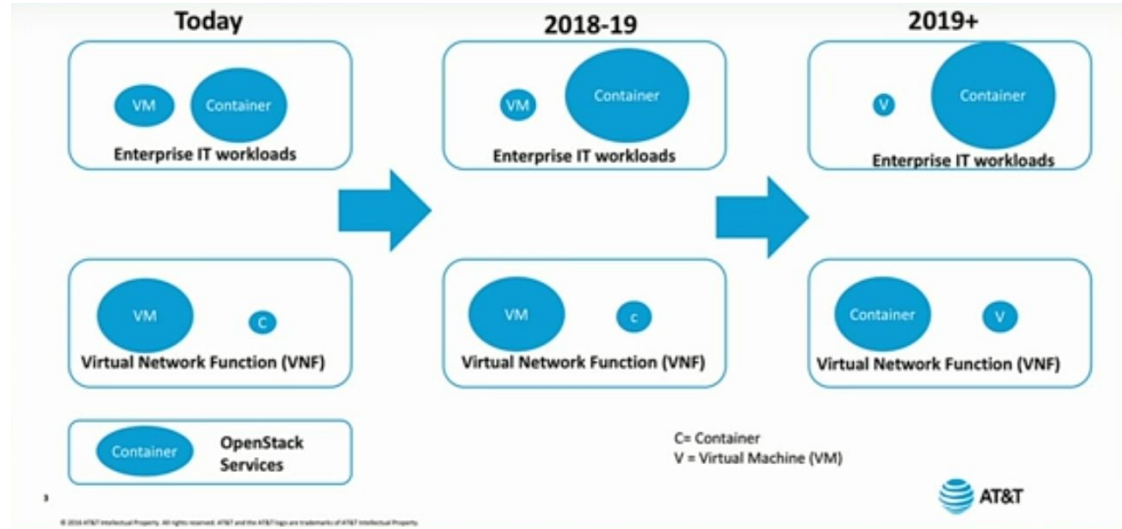- Weekly meeting?
- Volunteers

overview

Background

- The trend is to shift from VM world to container world. Can't be pushed back
- Deliver them up through ONAP to users
- There are many container related technologies which can be utilized at ONAP layer
  - OPNFV container4nfv
  - K8s feature node

Demands for container technology

- Many telco operators are interested in container instead of VM
- https://www.openstack.org/videos/boston-2017/at-and-t-container-strategy-and-openstacks-role-in-it

Goal and Scope

- Investigate/understand how container will be integrated into ONAP orchestration
- Container managed by ONAP as VIM
- Figuring out necessary enhancements/changes etc
  - How interface
  - How features are exposed to user eventually
- And then (jointly) propose for Release2

Non goal/out-of-scope

- Not installer. ONAP running over container
  - ONAP on kubernetes
  - https://wiki.onap.org/pages/viewpage.action?pageId=3247305
  - Self hosting might be possible. But it would be further phase.

- kubernetes/container deployment
- On-demand Installing docker/kubernetes on VMs/baremetal as VIM
  - This is also out of scope for now.
  - For ease of use/deployment, this will be further phase.

architecture

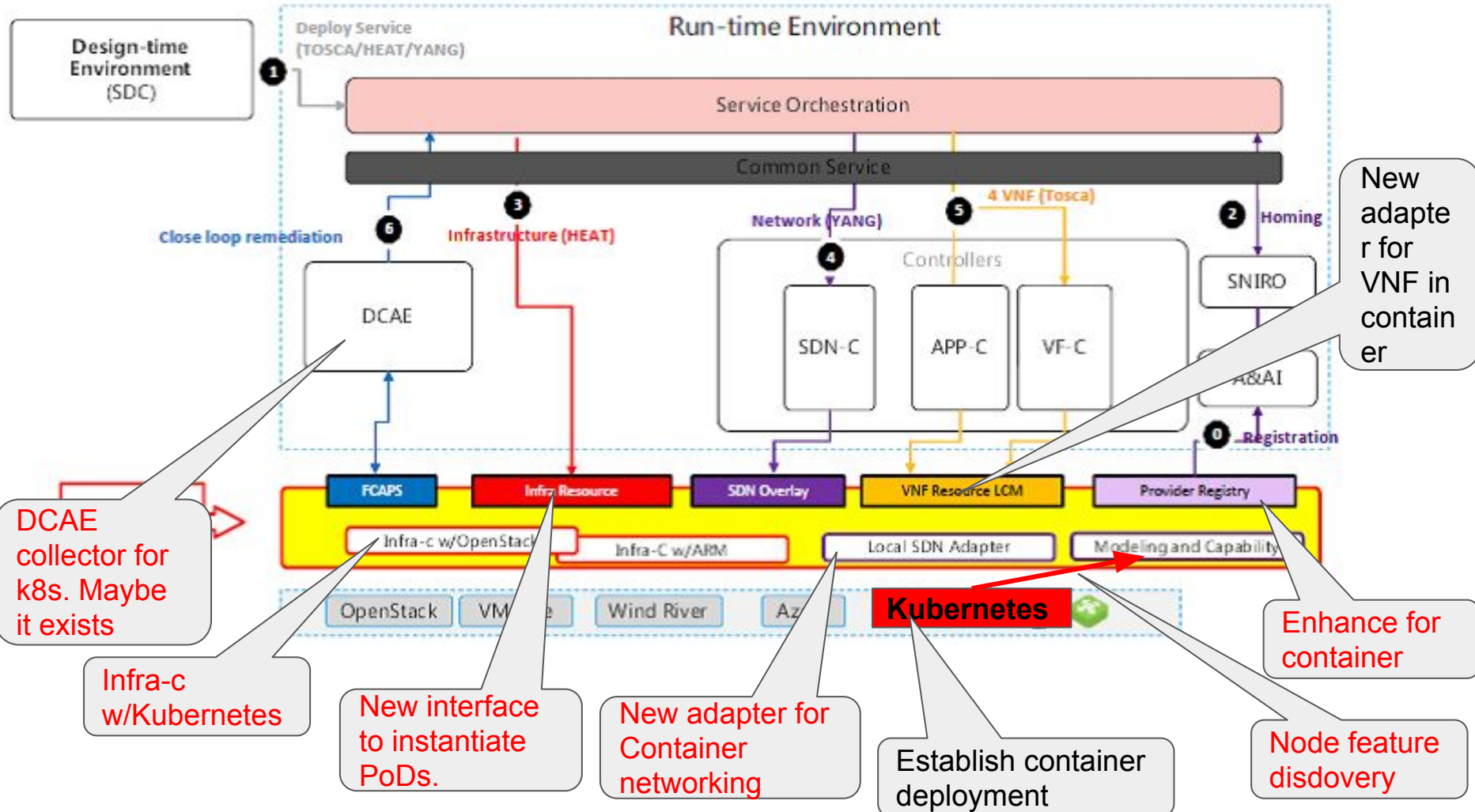**OpenECOMP Portal**

Design Functions

Operations Functions

Service Design & Creation
- Design Studio
- Resource Onboarding
- Certification Studio

Catalog
- Product
- Service
- Resource
- Process
- Recipes & Eng. Rules

Policy Creation
- Policy Editor
- Policy Rules
- Conflict Identification

Policy Storage
- Library
- Templates

Workflow/Engineering Rules & Policy Distribution
(metadata artifacts/recipes)

OpenECOMP Controller

Dashboard
- Manual Action
- Reporting
- Topology Visualization
- OpenECOMP OA&M

E-Services | Big Data | BSS | OSS
(Dispatch, Ticketing, Fundamental Planning etc.)

External Data Movement & APIs

AAI
- Inventory Management
- Active / Available
- Entitlements
- Resource / Service Topology

MSO
- API Request Handler
- Request Decomp. & Recipe Selection
- Orchestration Engine
- Adapters (J2EE)

Common Services: Logging, Data Movement, Access Control & Internal APIs

Operational Management Framework (OMF)

DCAE
- Analytic Applications
- Streaming Framework
- Events Pub/Sub
- APIs
- Real-Time Collector
- Batch Collector

Controllers
- *Engineering Rules & Inventory*
- Service Logic Interpreter
- Network Adapters
- Application Adapters

Container/openretriever (Kubernetes)

Yet Another Managed Environment

Legend:
- Design-time Framework
- Run-time Execution

Managed Environment
- Storage
- Compute
- Networking
- VNFs / Applications

Design-time Environment (SDC)

Run-time Environment

Deploy Service (TOSCA/HEAT/YANG)

Service Orchestration

Common Service

Close loop remediation

Infrastructure (HEAT)

Network (YANG)

4 VNF (Tosca)

Homing

DCAE

Controllers

SDN-C

APP-C

VF-C

SNIRO

A&AI

Registration

FCAPS

Infra Resource

SDN Overlay

VNF Resource LCM

Provider Registry

Infra-c w/OpenStack

Infra-C w/ARM

Local SDN Adapter

Modeling and Capability

OpenStack

VMware

Wind River

Azure

Kubernetes

New adapter for VNF in container

DCAE collector for k8s. Maybe it exists

Infra-c w/Kubernetes

New interface to instantiate PoDs.

New adapter for Container networking
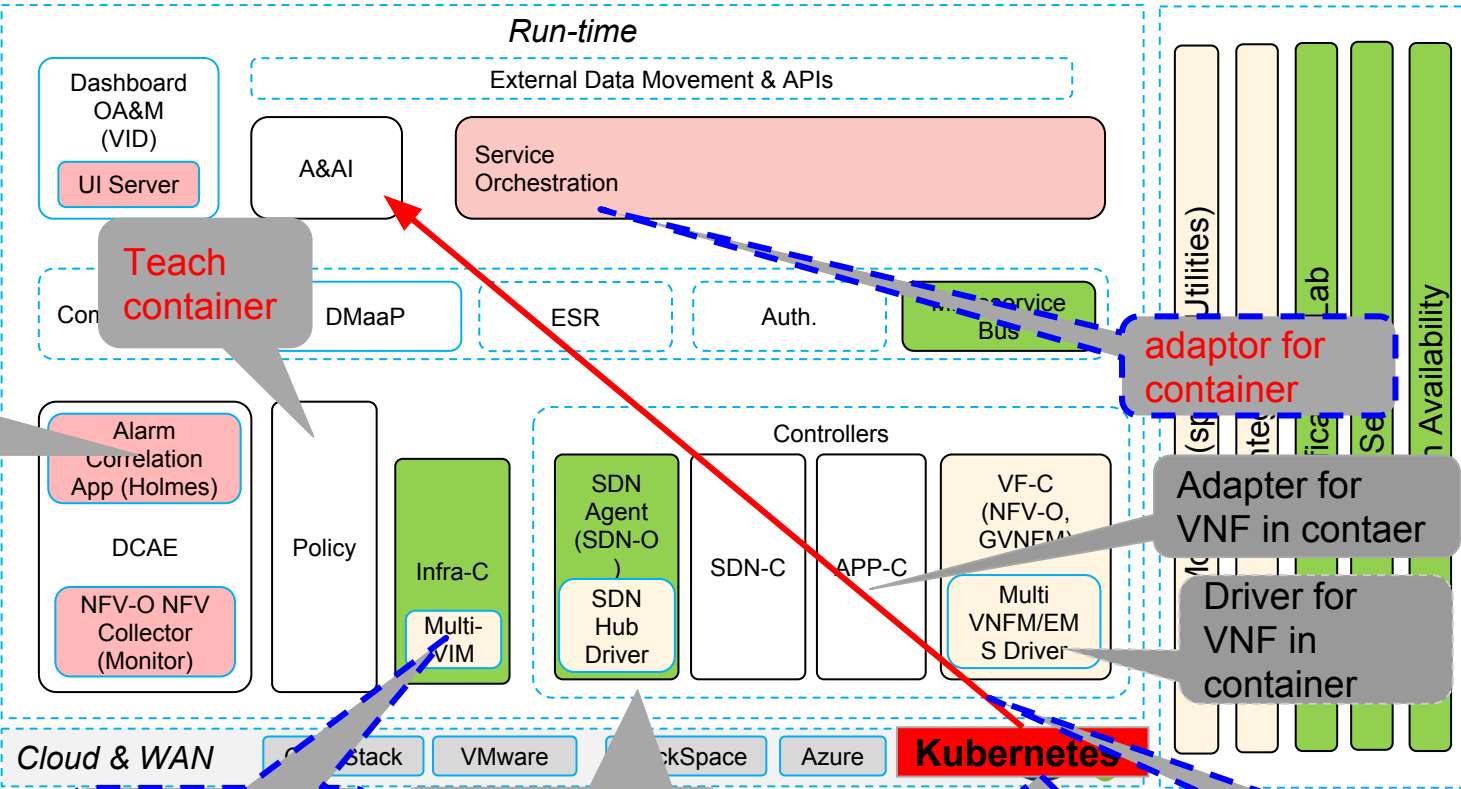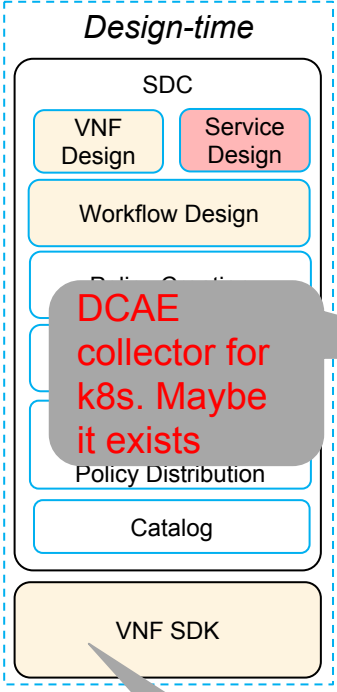
Establish container deployment

Enhance for container

Node feature disdovery

First target R-2

E-Services | BSS/OSS | Big Data

Portal — OPEN-O UI (GUI/CLI)

Design-time

SDC
- VNF Design
- Service Design
- Workflow Design
- Policy Distribution
- Catalog

VNF SDK

Run-time

Dashboard OA&M (VID)
- UI Server

External Data Movement & APIs

A&AI

Service Orchestration

Con... | DMaaP | ESR | Auth. | Microservice Bus

Alarm Correlation App (Holmes)

DCAE

NFV-O NFV Collector (Monitor)

Policy

Infra-C
- Multi-VIM

Controllers
- SDN Agent (SDN-O)
  - SDN Hub Driver
- SDN-C
- APP-C
- VF-C (NFV-O, GVNFM)
  - Multi VNFM/EMS Driver

Cloud & WAN   OpenStack | VMware | RackSpace | Azure | **Kubernetes**

Teach container

DCAE collector for k8s. Maybe it exists

adaptor for container
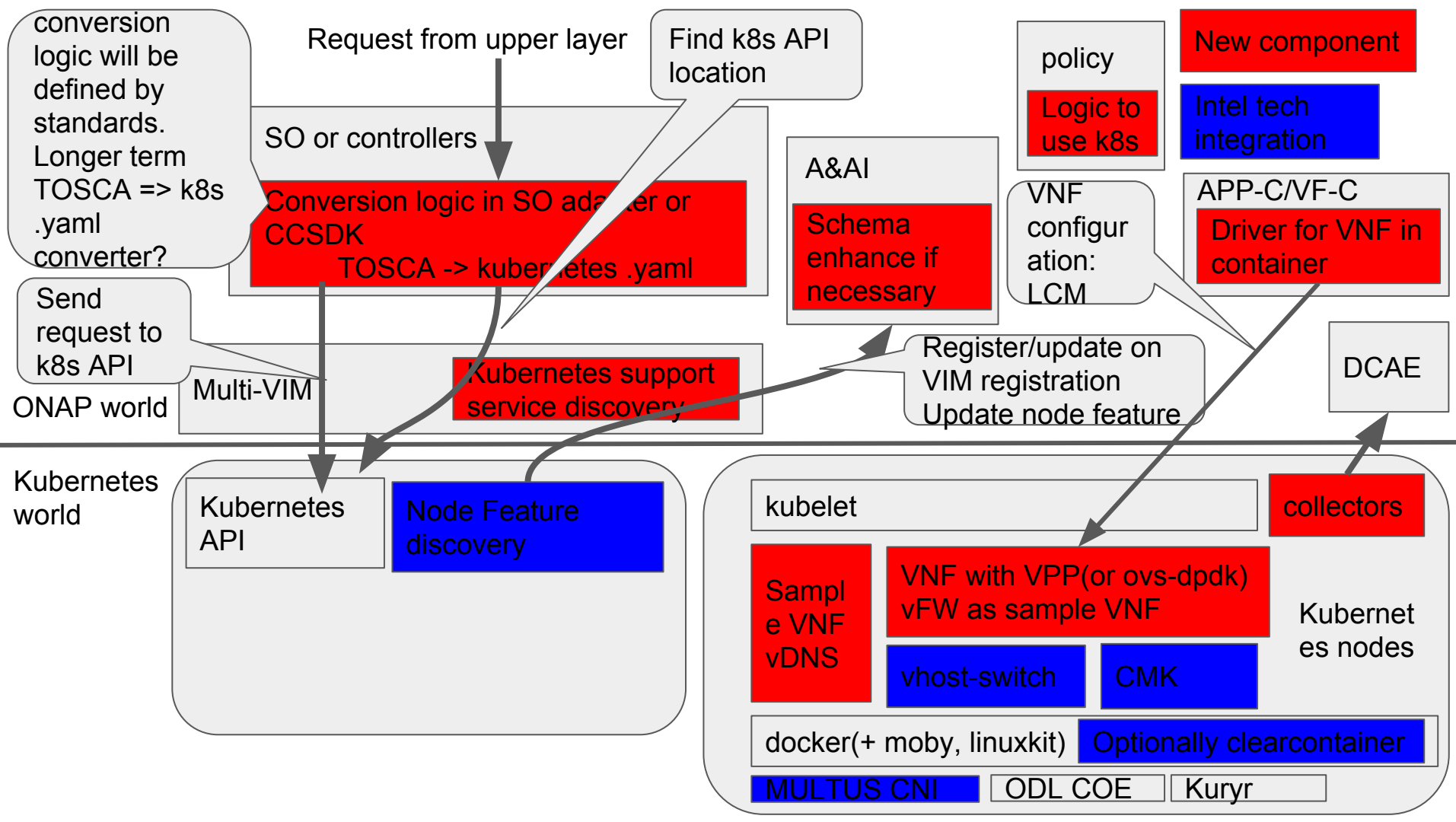
Adapter for VNF in contaer

Driver for VNF in container

container image

New interface to instantiate PoDs.

New adapter for Container networking

Establish container deployment

Node feature disdovery

conversion logic will be defined by standards. Longer term TOSCA => k8s .yaml converter?

Request from upper layer

Find k8s API location

policy

New component

Logic to use k8s

Intel tech integration

SO or controllers

Conversion logic in SO adapter or CCSDK

TOSCA -> kubernetes .yaml

A&AI

Schema enhance if necessary

VNF configuration: LCM

APP-C/VF-C

Driver for VNF in container

Send request to k8s API

ONAP world

Multi-VIM

Kubernetes support service discovery

Register/update on VIM registration
Update node feature

DCAE

Kubernetes world

Kubernetes API

Node Feature discovery

kubelet

collectors

Sample VNF vDNS

VNF with VPP(or ovs-dpdk) vFW as sample VNF

Kubernetes nodes

vhost-switch

CMK

docker(+ moby, linuxkit)

Optionally clearcontainer

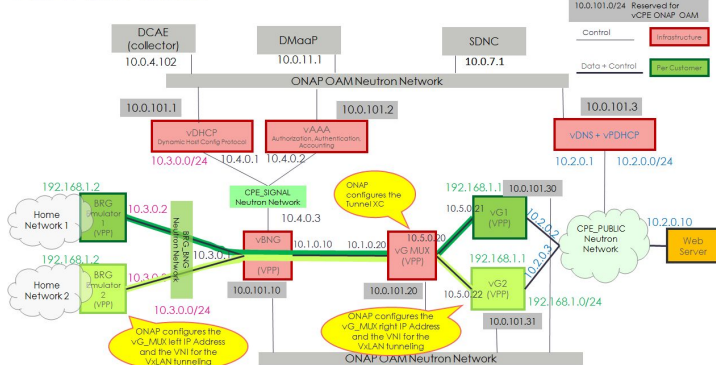MULTUS CNI

ODL COE

Kuryr

Stretched goal: containerize approved usecases

- Containerize more approved use cases
- From R-1 use cases
  - vCPE, VoLTE
- From R-2 use cases
  - 5G-RAN, vCPE, SD-WAN, ONAP change management
- Open Source VNF is needed to create container image
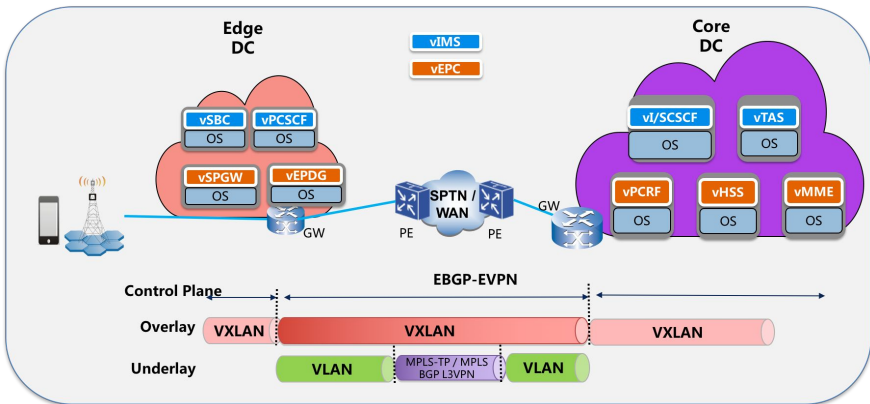
vCPE Use Case

Relationship to ONAP components/API

- Model
  - TOSCA:
  - Need to align with ETSI VNF model strategy
- Adapters and its API for SO
  - Adapter in SO
- APP-C/VF-C and CCSDK as g-VNFM
  - VNF life cycle management, VNFM/EMS driver
- AAI and multi-VIM
  - To report container features/capabilities
  - Enhance northbound API of multi-vim to accept requests for containers
- Policy enforcement
  - Placement policy
  - Operational policy
- DCAE: collectors for k8s
- VNF-SDK
  - VNF packaging. Maybe container specific?
  - How to describe VNF requirement would/should be VIM-agnostic

Use Cases alignment

R-1 use cases: https://wiki.onap.org/display/DW/Release+1+Use+Cases

- Sample VNF
- vCPE
- VoLTE

R-2 use cases: https://wiki.onap.org/display/DW/Release+2+Use+Cases

- Use case proposal: 5G- RAN deployment, Slicing, SON
- Use Case:Enterprise vCPE --potential R1 use cases' extension
- Use Case proposal: ONAP Change Management
- Use Case: SD-WAN

Random Considerations

- Transition from VM to container
  - Run VM inside container so that VM based VNF can be managed as container.
    - Only for transition. Unify deployment interface with container.
- Cloud portability
  - All the major cloud players joined CNCF.
  - Container technology:
    - Docker Moby and linuxkit: this allows to deploy docker on all the major cloud environment
  - Container orchestrator:
    - Kubernetes is winning in this space
    - Kubernetes has various support for container runtime
- Orchestrator
  - Kubernetes and docker swarm
  - Kubernetes pod api
- Container scheduling?
  - Pod level scheduling
  - Valet: host level scheduling

Open questions

- Container deployment: the first target is k8s on baremetal for simplicity
  - K8s over openstack
  - K8s on baremetal
- Container technology: The first target is k8s as it's winning in container space
  - Kubetentes
  - Docker
  - CNI plugin
  - Follow CNCF direction: all the major player of cloud space have joined CNCF.
- Scheduling at the level container orchestration layer
  - Equivalent to Vallet?

discussion...