Open vSwitch

Open vSwitch and OVN 2021

Fall conference - Dec 7th & 8th 2021

NODUS

Service Function Chaining Using OVN in Kubernetes

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Agenda

- What is Kubernetes Network?
- Nodus Deep Dive
- Service Function chaining model

What is Kubernetes Networking ?

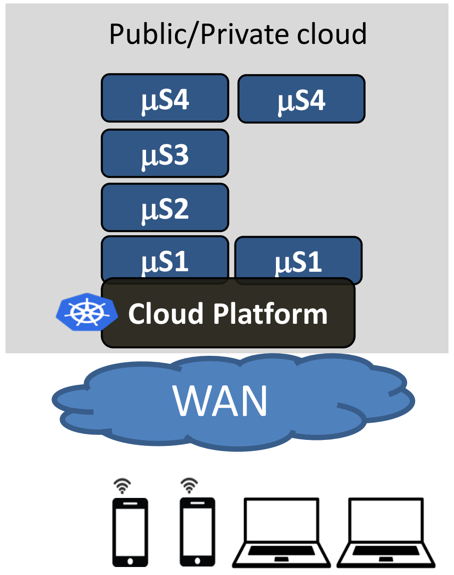
- Kubernetes Network doesn’t handle network at the first place, it call CNI plugin to handle the network.
- CNI stands for Container Networking interfaces. This community works on the CNI spec. The standard way to communicate to a container Network namespaces
- Networking in Kubernetes remains as the out-of-scope components
- Kubernetes Networking doesn’t address Multiple network Interfaces, Multiple Network managements and identities network as entity, we must depend on the CNI plugins to do heavy lifting here.
- Things not yet discussed are more in Kubernetes – Edge Networking, Network as an entity to be configured by Kubernetes, Virtual and Provider Networks, SDN, Service Function chaining

What is Nodus ?

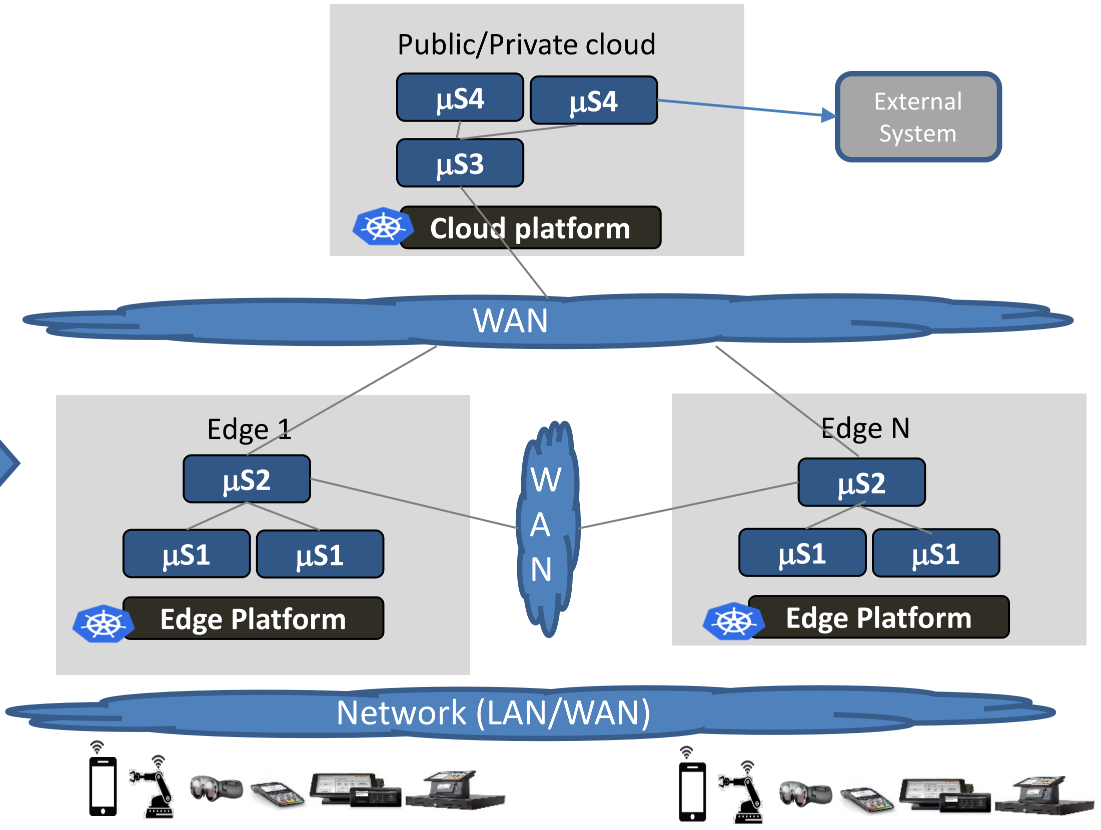
- Nodus is Latin word for “a Knot”.
- As the name suggested, the Nodus is the network controller in Kubernetes
- It act like a knot that perfectly converge the NFV networking concept and uses the Kubernetes labels to implement the Service Function Chaining.
- Nodus is answer for Software Defined Networking in Kubernetes, it take care of Edge networking solutions, support containers and VMs Service Function chaining

Application and Network Transformation in Edges

(AR/VR apps, Gaming, Analytics and Even traditional applications due to sovereignty and context)



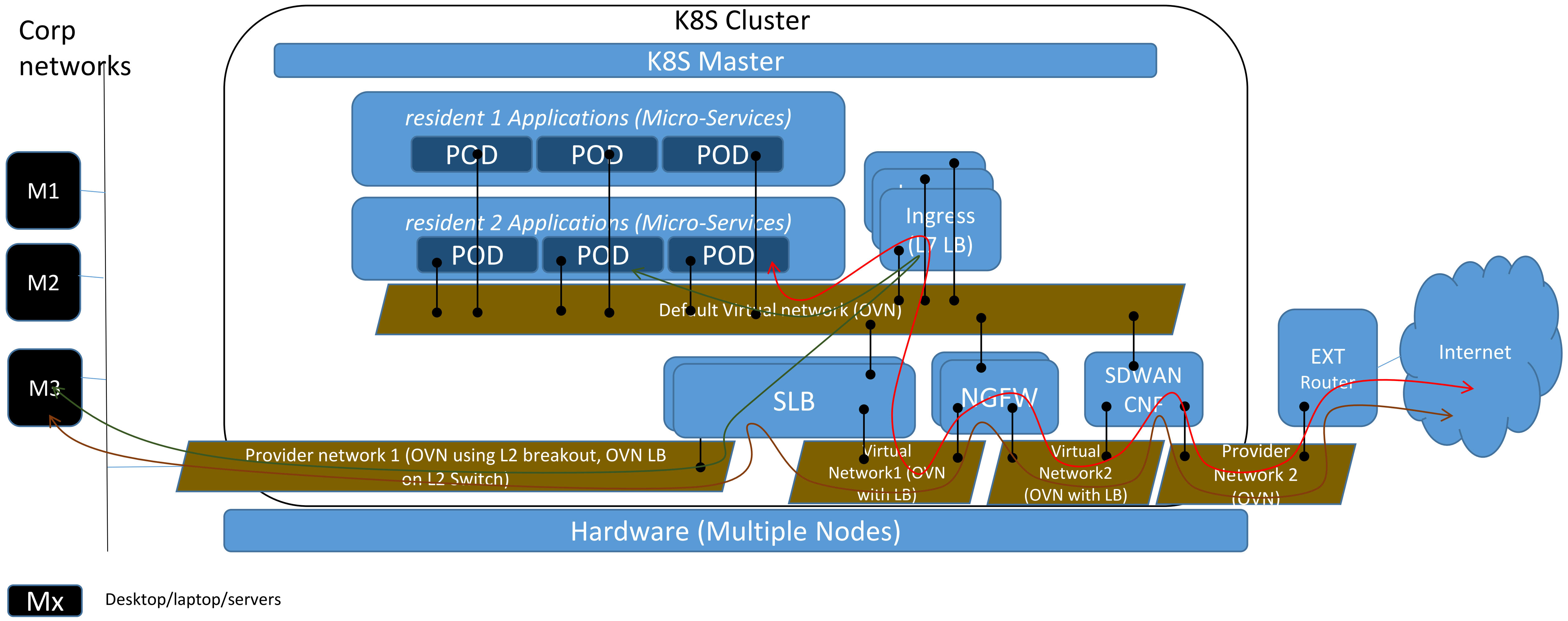
- Proximity
- Data sovereignty
- Economics
- Context



Centralized computing to Geo distributed computing

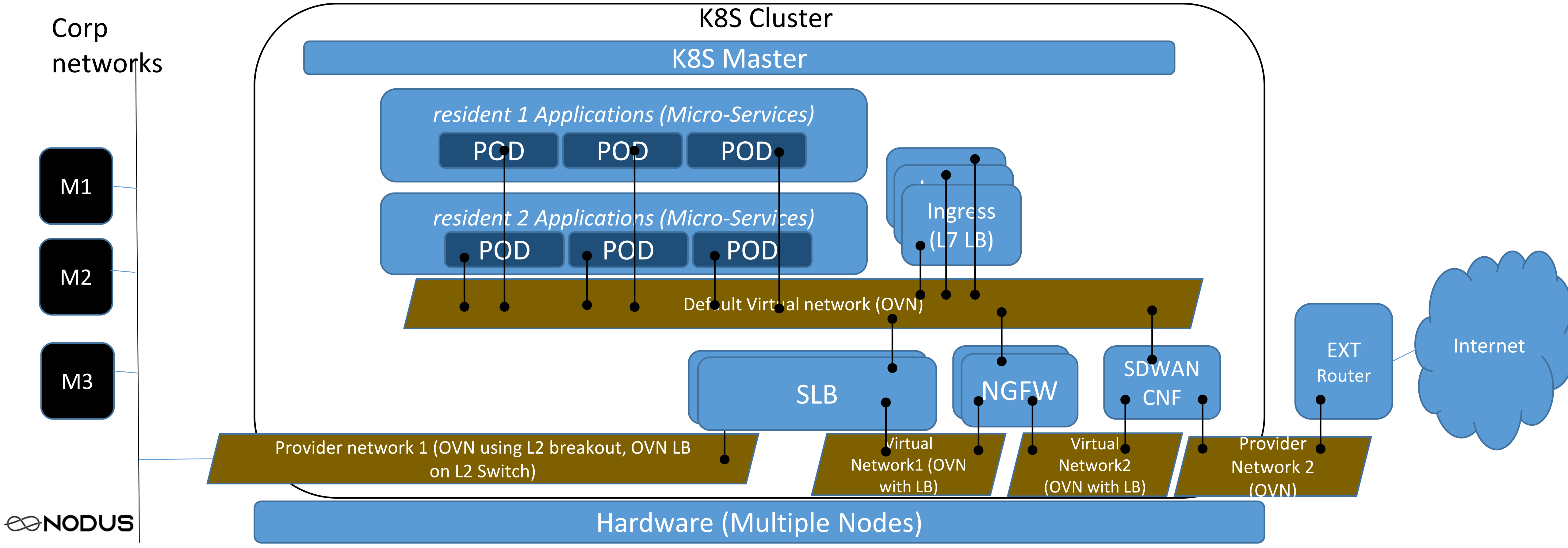
An App consisting of four Micro-services
ms1 talks to ms2, ms2 to ms3 and ms3 to ms4
ms1" is user facing service
"ms1", "ms2" are expected to be there together
"ms2" is stateful and hence need to talk to each other

How does NFV based deployment with Cloud-native applications look like (Taking SDWAN with security NFs as an example)



Corp networks
M1
M2
M3
K8S Cluster
K8S Master
resident 1 Applications (Micro-Services)
POD
POD
POD
resident 2 Applications (Micro-Services)
POD
POD
POD
Ingress (L7 LB)
Default Virtual network (OVN)
SLB
NGFW
SDWAN CNF
EXT Router
Internet
Provider network 1 (OVN using L2 breakout, OVN LB on L2 Switch)
Virtual Network1 (OVN with LB)
Virtual Network2 (OVN with LB)
Provider Network 2 (OVN)
Hardware (Multiple Nodes)
Mx
Desktop/laptop/servers

Nodus Features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NODUS
Hardware (Multiple Nodes)

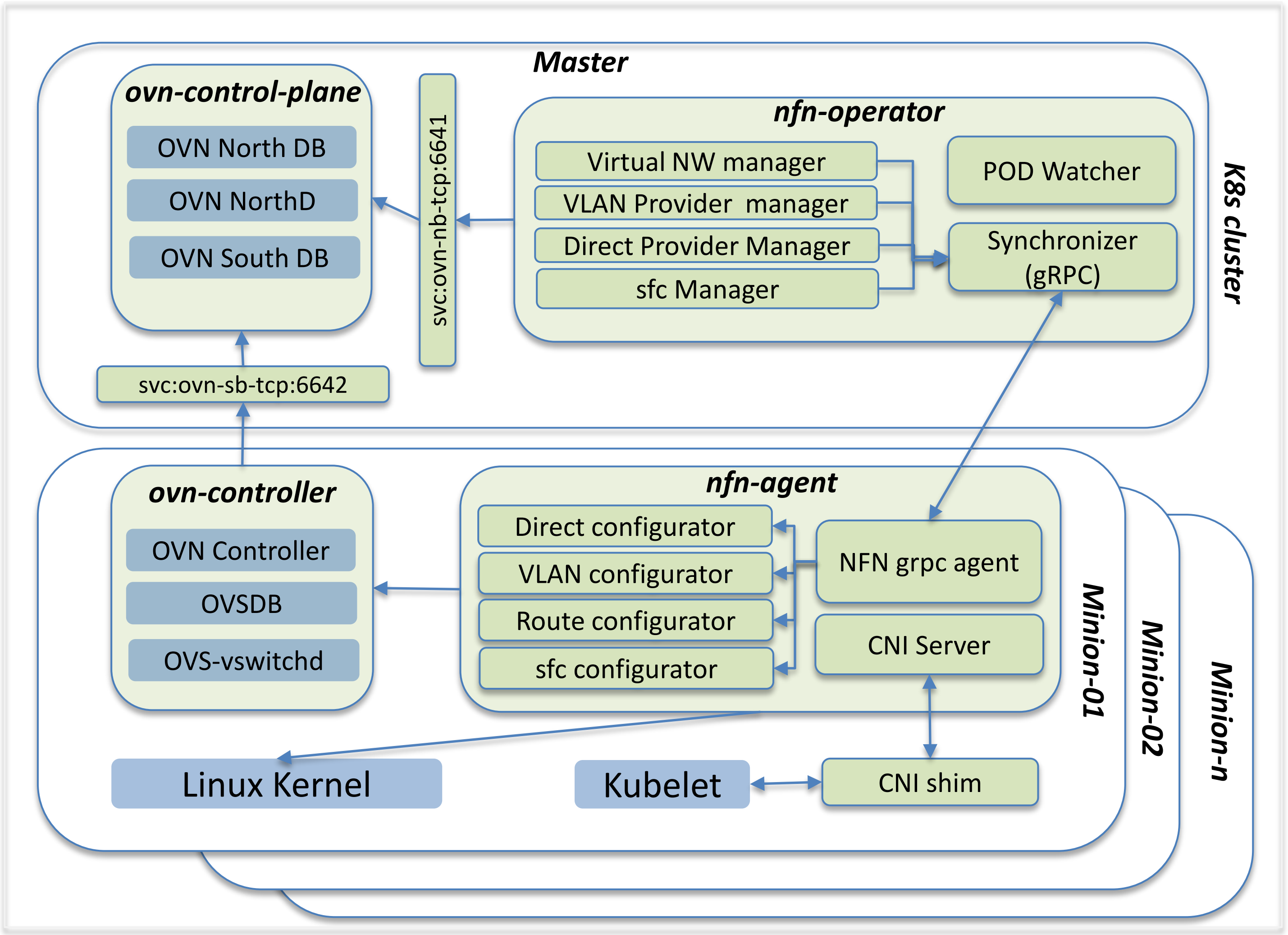
Feature Reqmts

Dynamic virtual Networks	Provider networks	Multiple interfaces	Network function chaining	Network function load balancing
No changes to NFs	No changes to Apps	Configuration via operators	Finite network SRIOV Overlay networking	Smart NIC friendly & AF_XDP for packet processing NFs

Why did we choose OVN for Nodus?

- One of the best programmable controller
- Hides OVS complexity
- Broader eco-system
- L2 CNI – Support for unicast, multicast, broadcast applications
- One site level IPAM – No IP address restriction with number of nodes
- Possible to implement critical features with table-based pipeline
  (Firewall, Routing, Switching, Load balancing, Network Policy)
- SmartNIC friendly

Nodus Architecture blocks



NFN Operator:

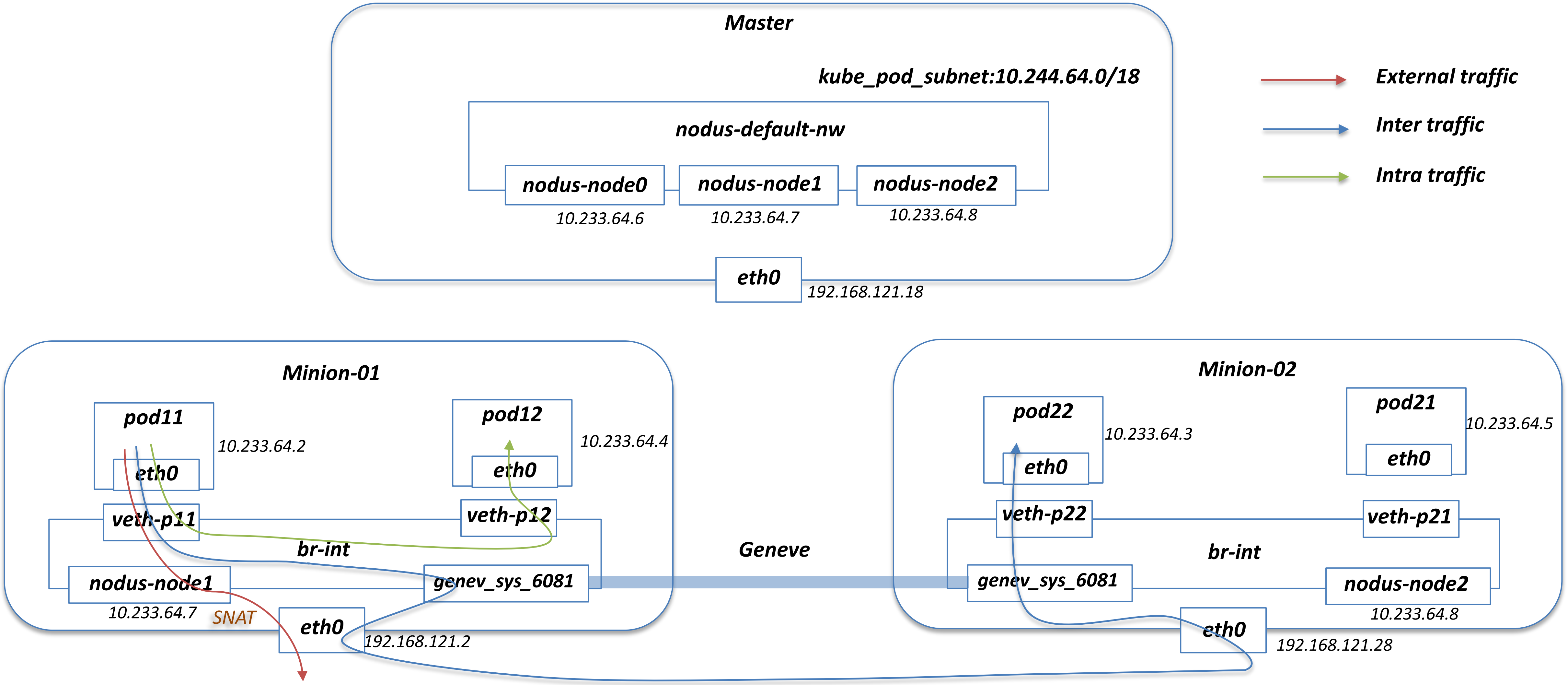
- Exposes virtual, provider, chaining CRDs to external world.
- Programs OVN to create L2 switches.
- Watches for PODs being coming up
  - Assigns IP addresses for every network of the deployment.
  - Looks for replicas and auto create routes for chaining to work.
  - Create LBs for distributing the load across CNF replicas.

NFN agent:

- Performs CNI operations.
- Configures VLAN and Routes in Linux kernel (in case of routes, it could do it in both root and network namespaces)
- Communicates with OVSDB to inform of provider interfaces. (creates ovs bridge and creates external-ids:ovn-bridge-mappings)

https://github.com/akraino-edge-stack/icn-nodus

Nodus - Network traffic between pods

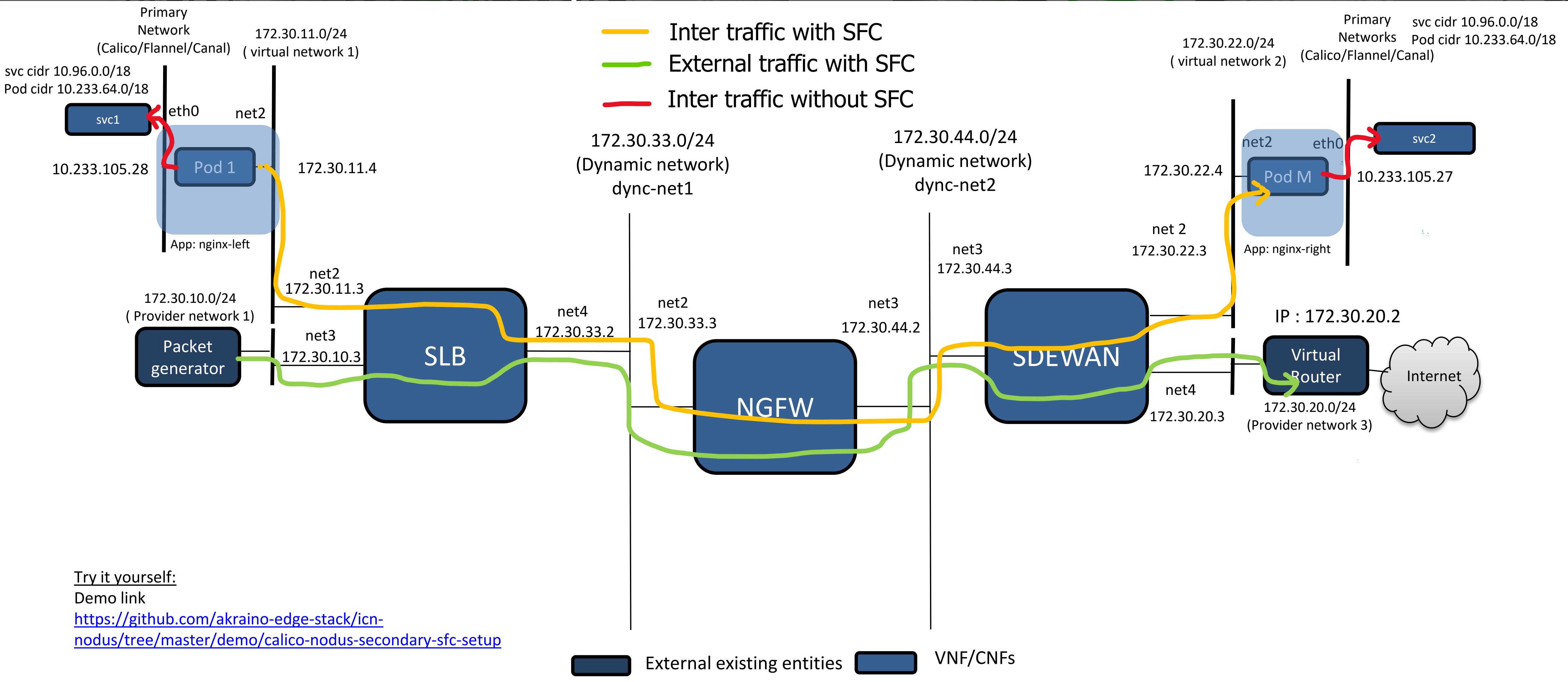


Network Chaining CR

```
apiVersion: k8s.plugin.opnfv.org/v1alpha1
kind: NetworkChaining
metadata:
  name: example-networkchaining
spec:
  # Add fields here
  chainType: "Routing"
  routingSpec:
    namespace: "default"
    networkChain: "net=virutal-net1,app=slb,net=dync-net1,app=ngfw,net=dync-net2,app=sdewan,net=virutal-net2"
    left:
    - networkName: "left-pnetwork"
      gatewayIp: "172.30.10.2"
      subnet: "172.30.10.0/24"
      podSelector:
        matchLabels:
          sfc: head
      namespaceSelector:
        matchLabels:
          sfc: head
    right:
    - networkName: "right-pnetwork"
      gatewayIp: "172.30.20.2"
      subnet: "172.30.20.0/24"
      podSelector:
        matchLabels:
          sfc: tail
      namespaceSelector:
        matchLabels:
          sfc: tail
```

Revisited standards -
Draft_Kubernetes_Software_defined_Network_Custom_Resource_Definition_De-facto_Standard_out_of_CNI_scope

Nodus Advanced SFC - using provider networks & one Virtual networks with pod labels



Try it yourself:
Demo link
https://github.com/akraino-edge-stack/icn-nodus/tree/master/demo/calico-nodus-secondary-sfc-setup

Nodus Status

Current

- Dynamic Network Creation
- VLAN Provider Network Support – Controller and Agent
- Direct Provider Network Support – Controller and Agent
- SFC feature – Controller and Agent
- Kubespray default primary network plugin
- Tested with sdewan CNFs and SDEWAN Controller
- Multiple SFC Network chaining – Working on 4 SFC models
- Kubernetes Network policy based on OVN ACLs

Link to Repo:
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Network Innovation continues….

Work In Progress

- VM SFC in Kubernetes
- SRIOV NIC as primary network interfaces
- Using OVN Load balancer for Kubernetes service(without kube-proxy)
- SFC support with OVN load balancer support for NF Elasticity
- Proxy less service mesh with OVN & Ipsec in network namespace
- IPv6 support
- Traffic interception method with 5G UPF
- Kubespray Centos CI/CD, SFC advance testing
- Standard Software Defined Network Defacto standard in Kubernetes – Google Docs

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SFC Model Demo in Kubernetes

Goal: Labels eliminates Pod annotations

Overview

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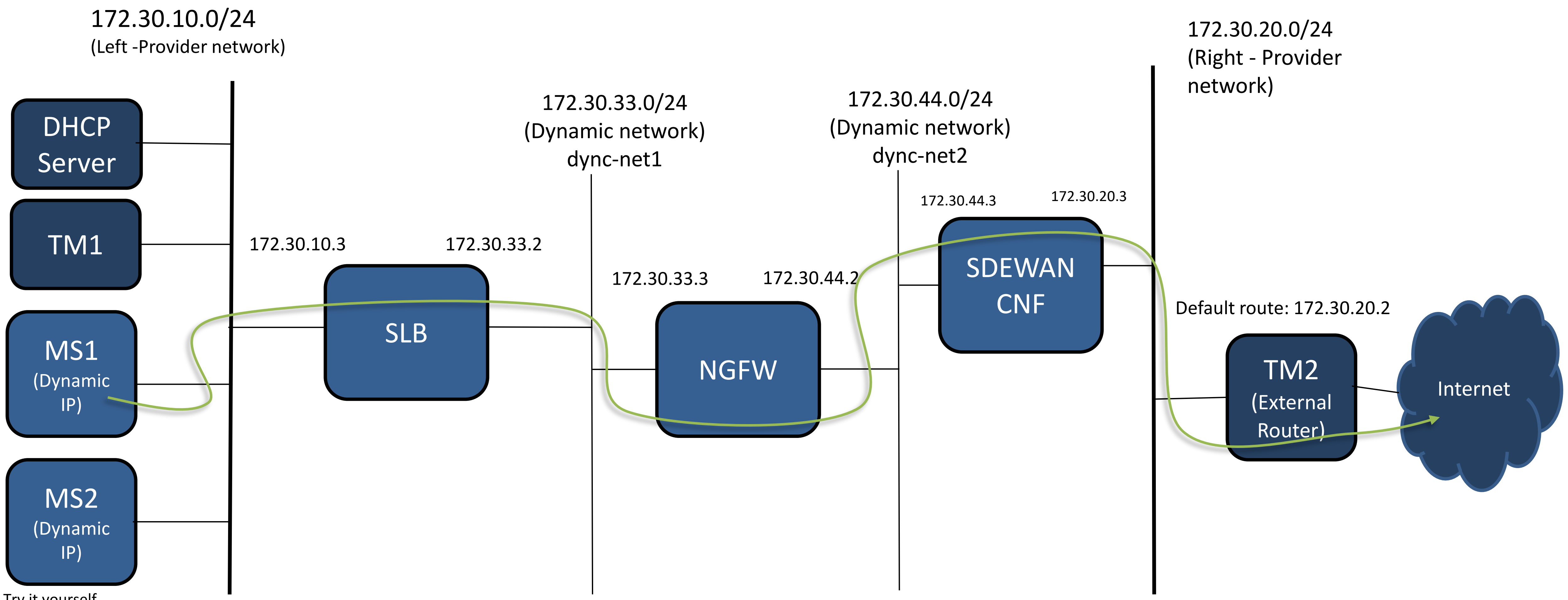
Nodus Demo - Traffic from pod within the cluster with sfc



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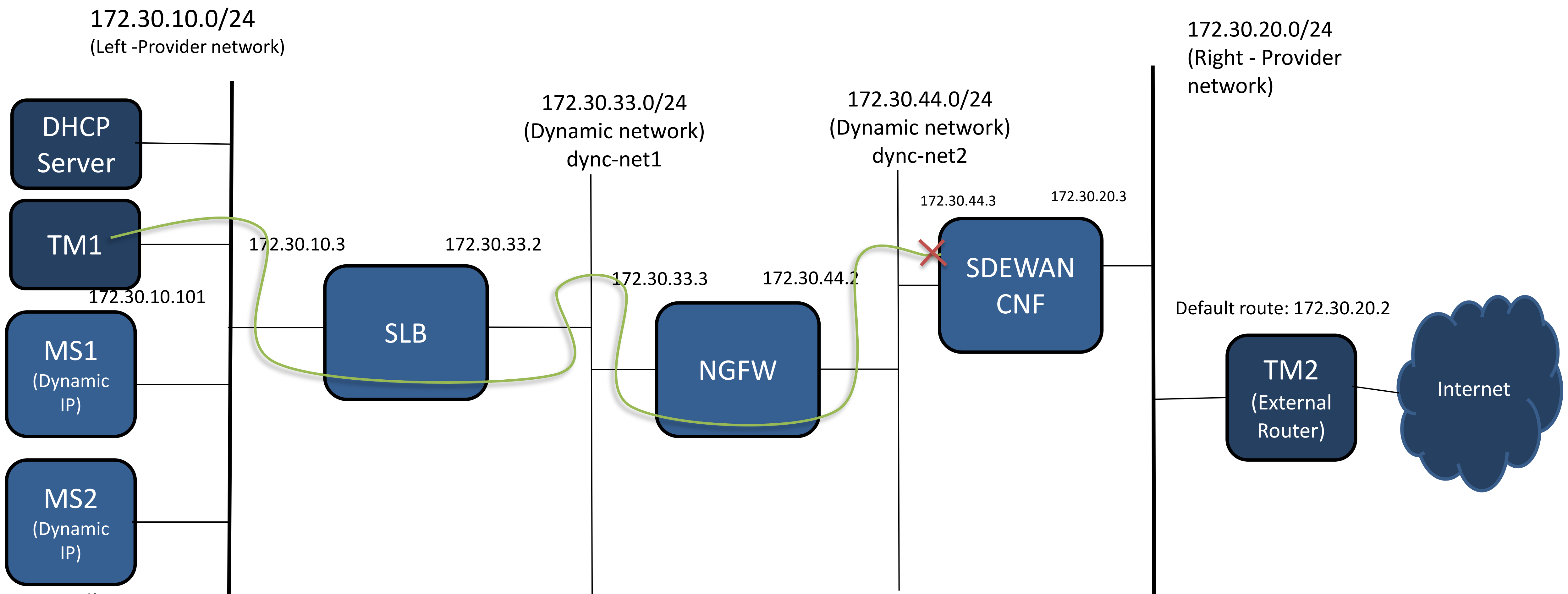
■	External existing entities
■	VNF/CNFs

Nodus Demo - Traffic from external entities – Firewall icmp reject



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▆ External existing entities ▆ VNF/CNFs

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Q & A Session