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Building the Cloud Native Telco with Network Service Mesh

Ivana Atanasova & Radoslav Dimitrov

Open Source Engineers, VMware

 @VMWopensource

blogs.vmware.com/opensource

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How things changed?



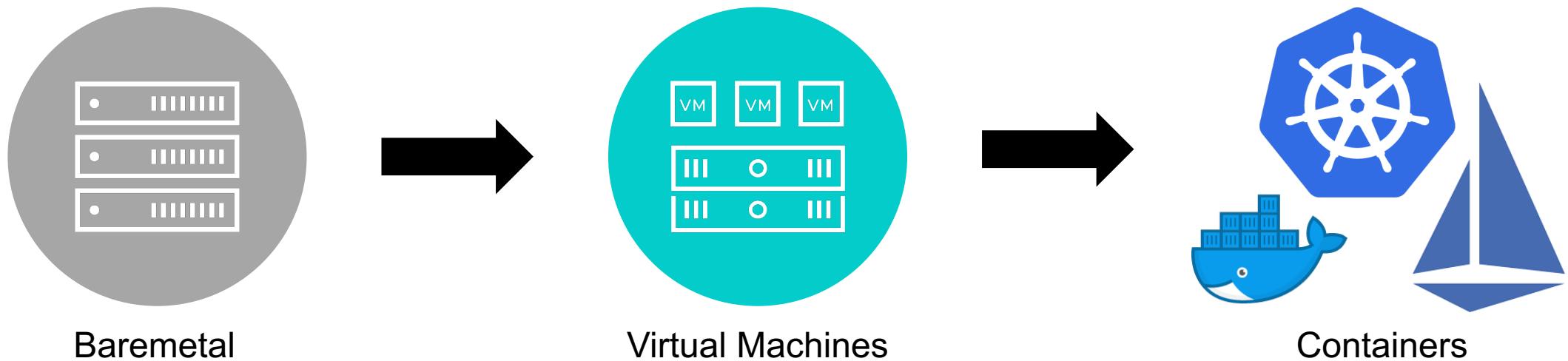
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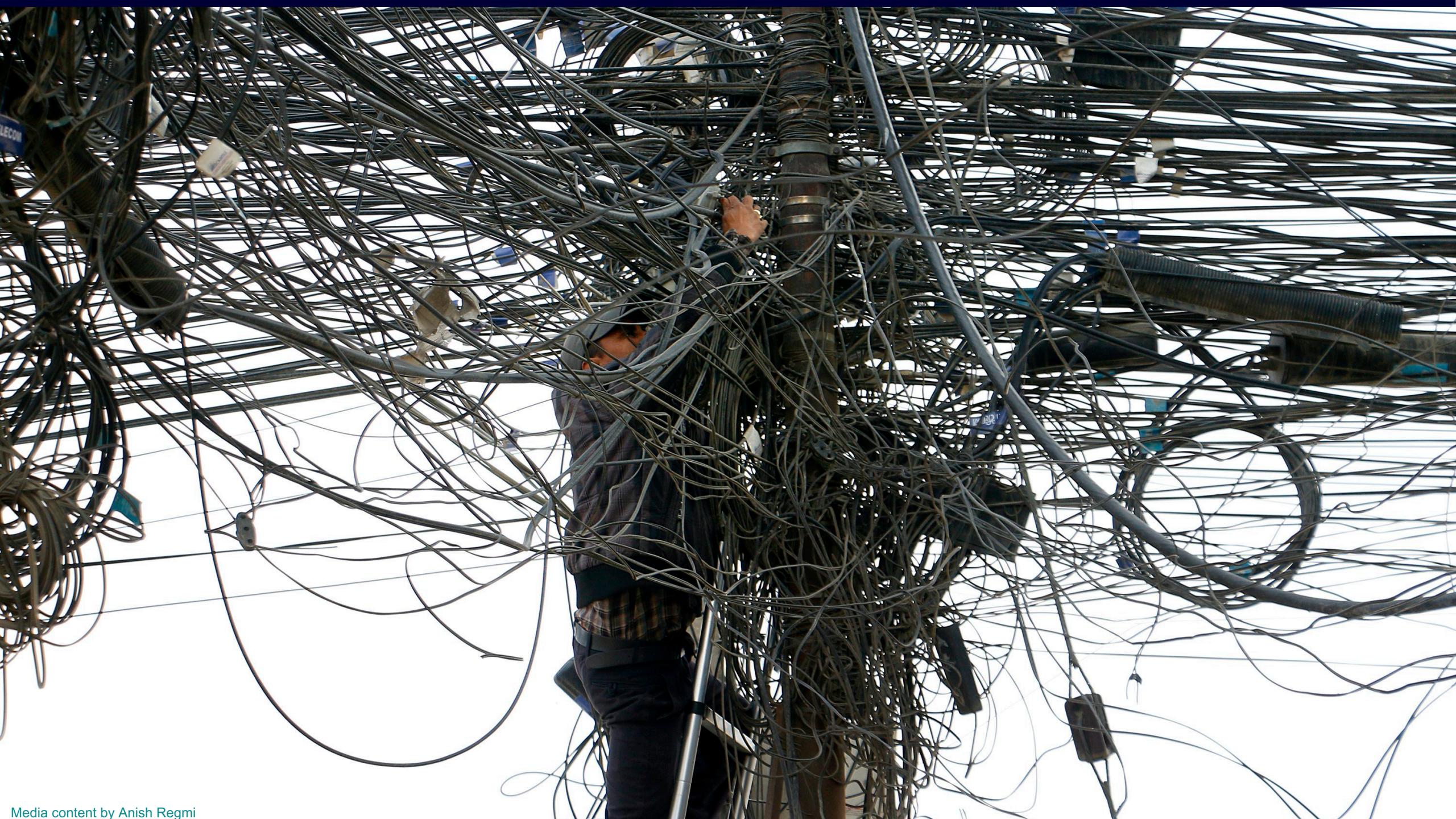


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Evolution in the Telco



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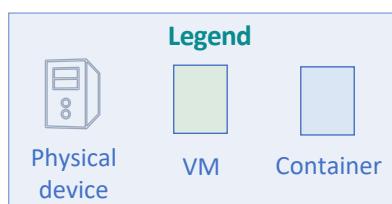
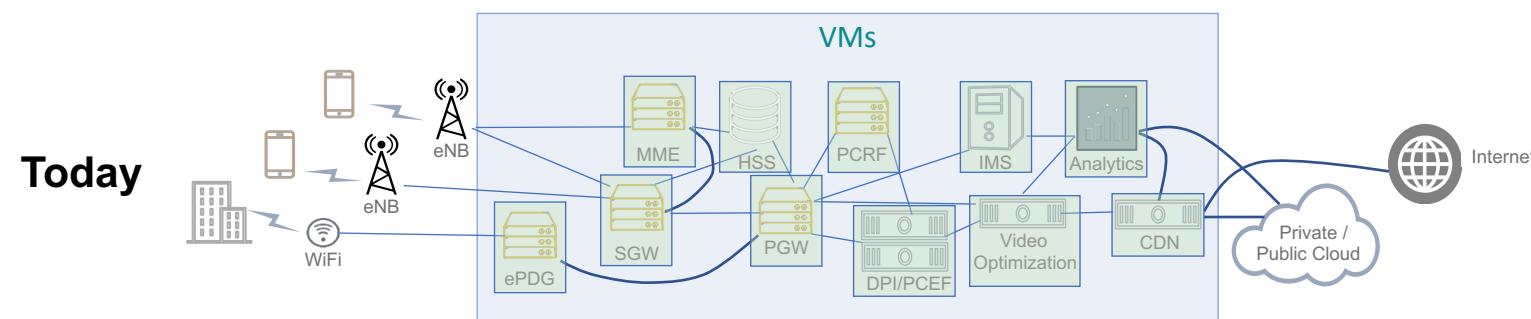
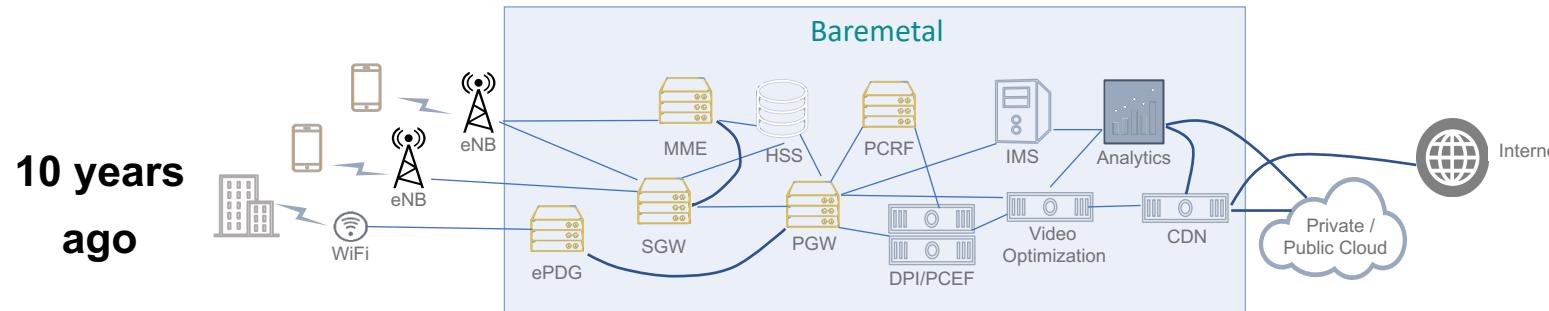


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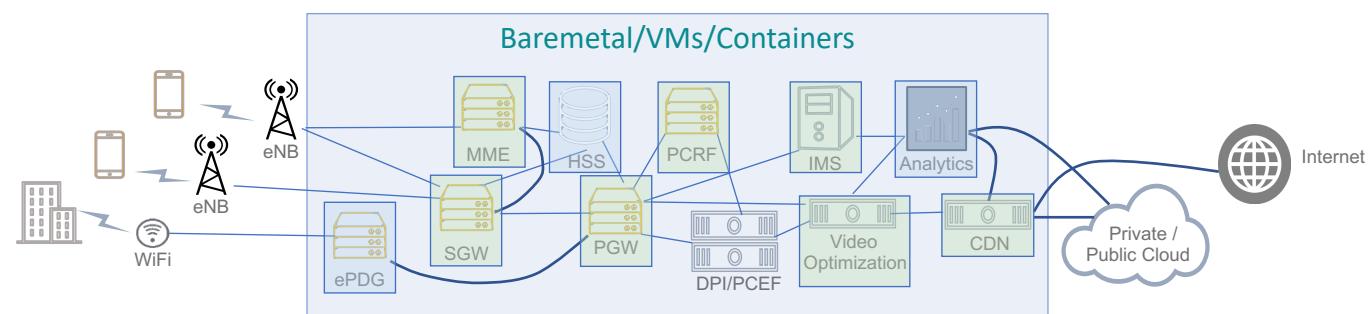
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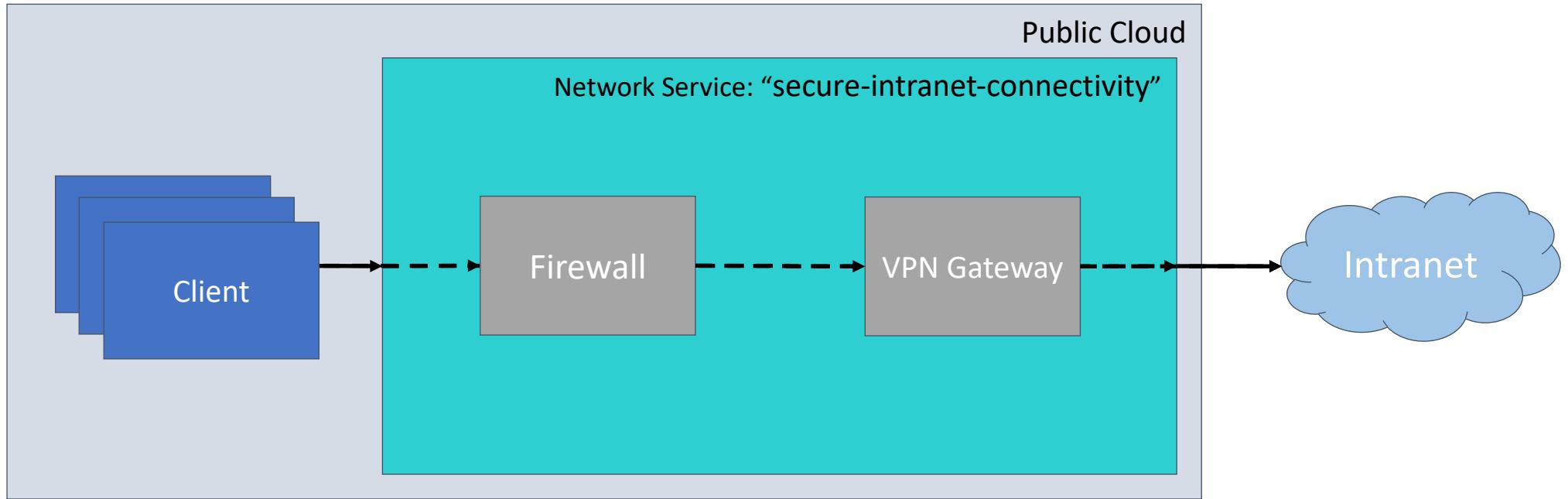
Networking Function Virtualization (NFV)



What's next?



What is a Network Service?



- **Clients** – consume Network Services
- **Endpoints** – implement Network Services
- **Wires** – responsible for the connections, payload agnostic

What is Network Service Mesh?



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- CNCF Sandbox project
- Service mesh for L2/L3 payloads
- On-demand, dynamic, negotiated connections
- Workload-To-Workload granular level of connectivity
- Loosely coupled heterogeneous network configurations
- gRPC API to publish and consume Network Services
- Without changes to Kubernetes
- Works with any CNI



Network Service Mesh

Describing a Network Service

- Specify type of payload
- Source and destination selection
- Service composition

```
apiVersion: networkservicemesh.io/v1
kind: NetworkService
metadata:
  name: secure-intranet-connectivity
spec:
  payload: IP
  matches:
    - match:
        sourceSelector:
          app: firewall
        route:
          - destination:
              destinationSelector:
                app: vpn-gateway
    - match:
        route:
          - destination:
              destinationSelector:
                app: firewall
```

What happens under the hood?



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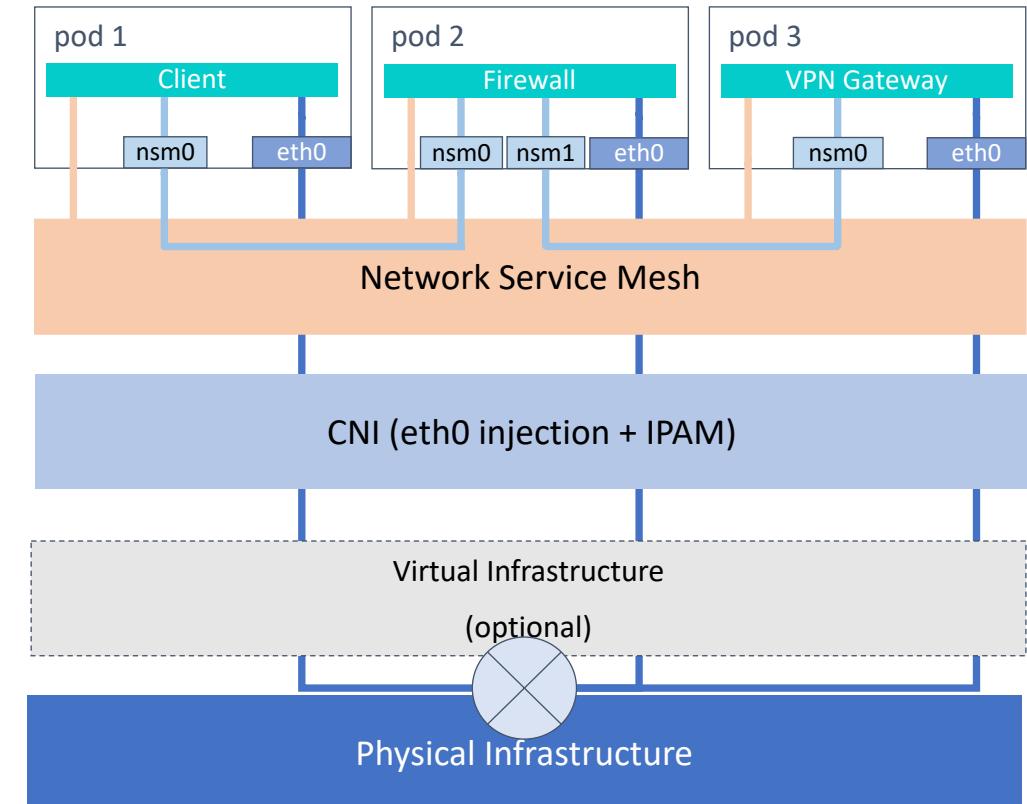


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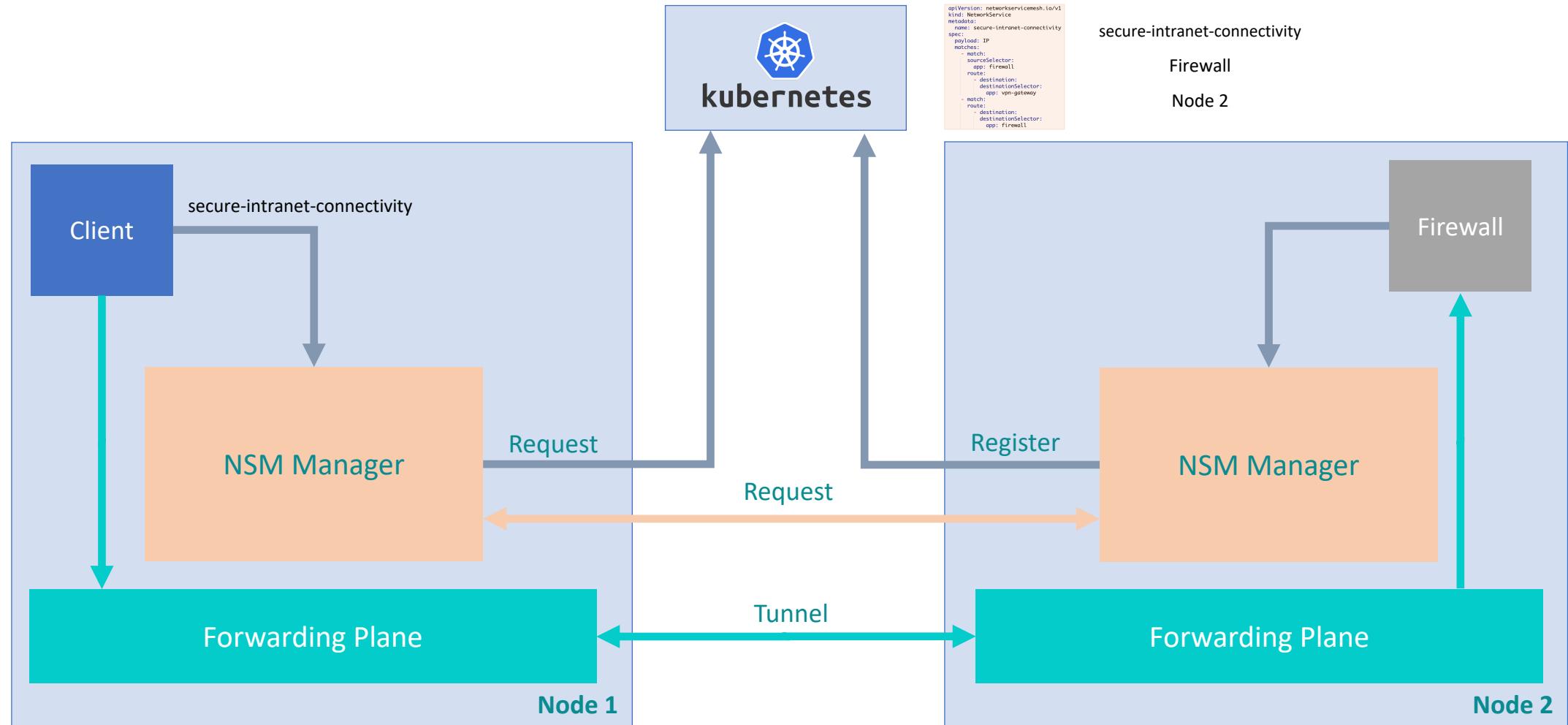
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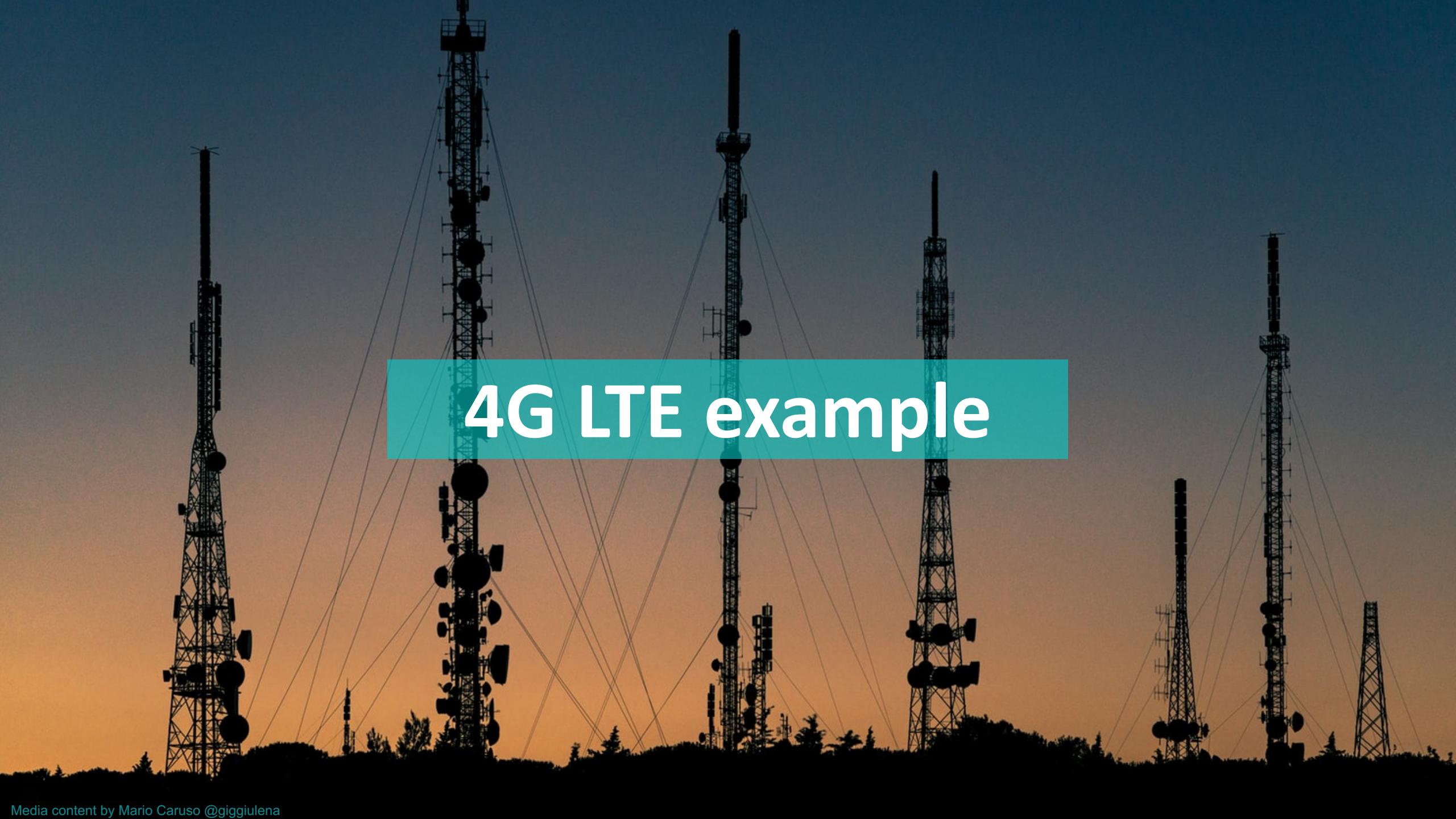
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- Endpoints announce themselves to NSM
- Client requests a Network Service
- NSM takes care of creating the necessary connections
- NSM lives peacefully with the existing CNI network (eth0)



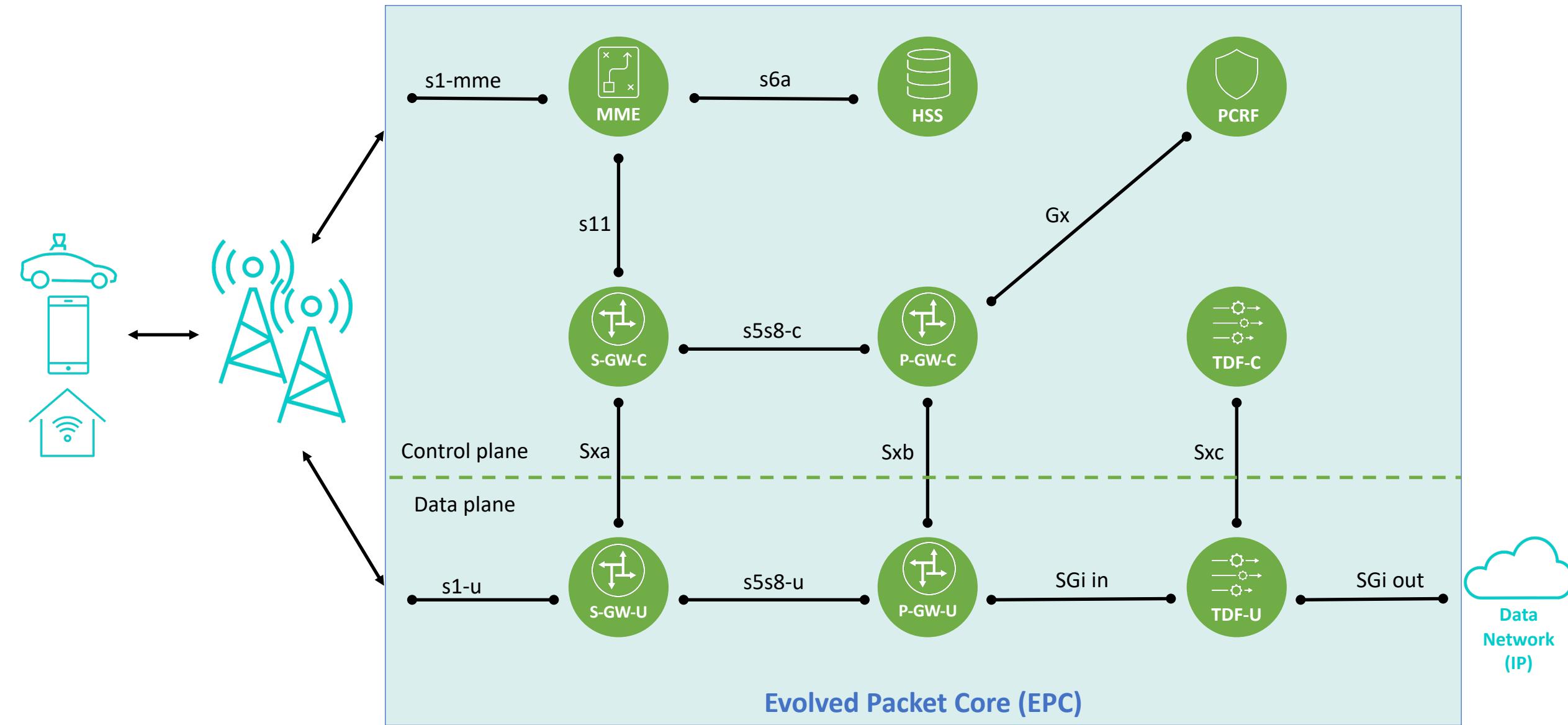
How it works?



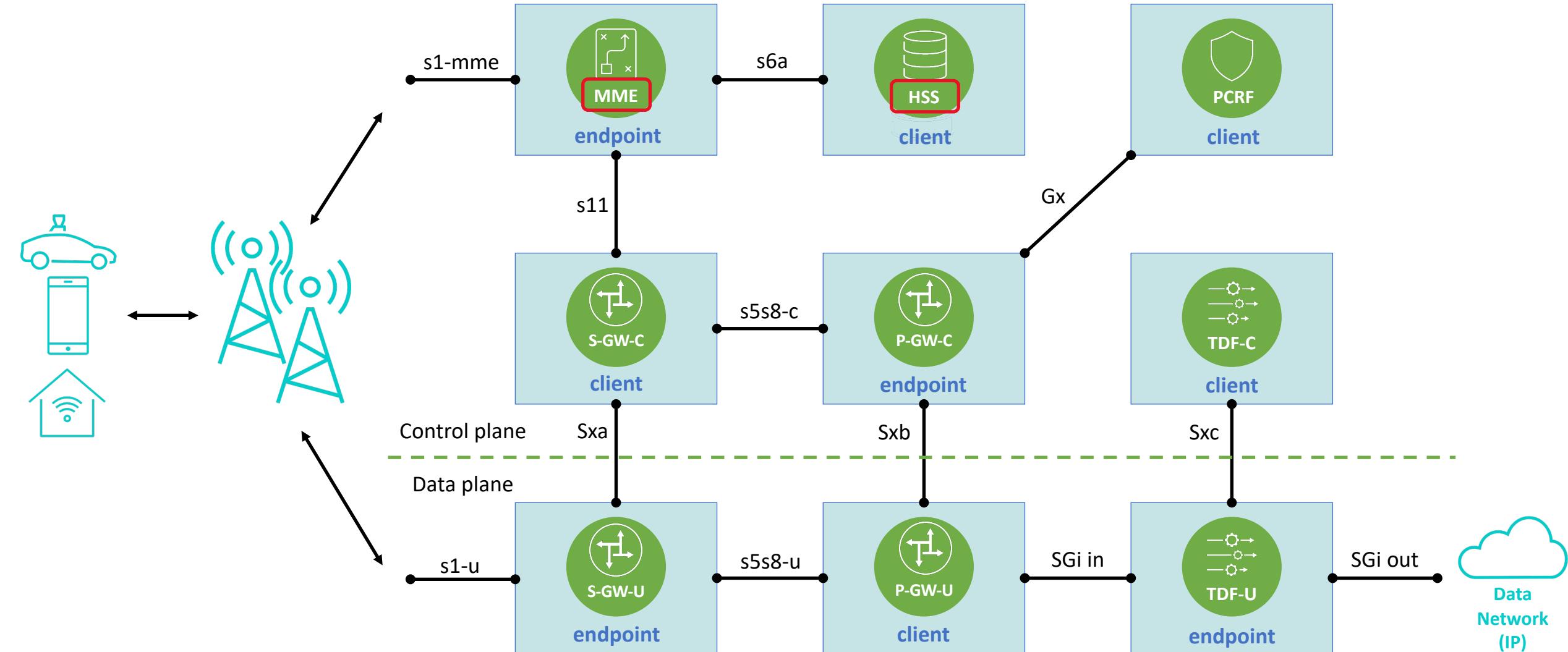
The background of the image shows several tall, dark silhouettes of telecommunications towers or antennas against a gradient sky transitioning from dark blue at the top to orange and yellow near the horizon. The towers are interconnected by a network of thin white lines, suggesting a mesh or cellular network.

4G LTE example

4G LTE Network

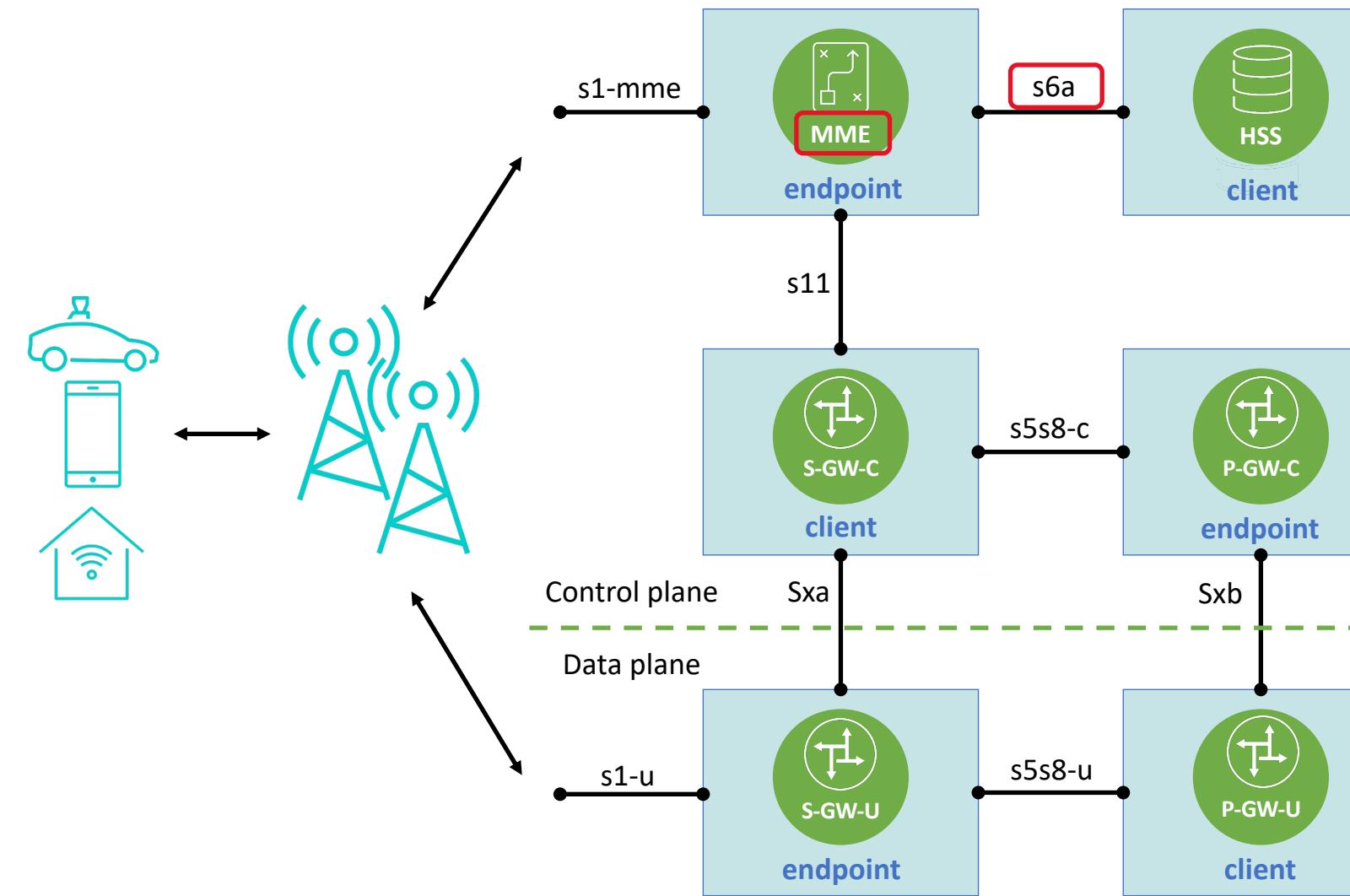


4G LTE Network and NSM



4G LTE Network – Network Service

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```
apiVersion: networkservicemesh.io/v1alpha1
kind: NetworkService
metadata:
  name: 4g-network
spec:
  payload: IP
  matches:
  - match:
    sourceSelector:
      app: s1-mme
    route:
      - destination:
        destinationSelector:
          app: mme
  - match:
    sourceSelector:
      app: s6a
    route:
      - destination:
        destinationSelector:
          app: mme
```

Endpoints and Clients



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```
---
```

Endpoint
apiVersion: apps/v1 kind: Deployment spec: replicas: 1 selector: matchLabels: network servicemesh.io/app: "mme" template: metadata: labels: network servicemesh.io/app: "mme" network servicemesh.io/impl: "4g-network" spec: containers: - name: sidecar-nse image: network servicemesh/4g-network-sidecar-nse:latest imagePullPolicy: IfNotPresent env: - name: ADVERTISE_NSE_NAME value: "4g-network" - name: ADVERTISE_NSE_LABELS value: "app=mme"

```
---
```

Client
apiVersion: apps/v1 kind: Deployment spec: selector: matchLabels: network servicemesh.io/app: "hss" replicas: 1 template: metadata: labels: network servicemesh.io/app: "hss" spec: containers: - name: hss image: alpine:latest command: ['tail', '-f', '/dev/null'] metadata: name: "hss" namespace: default annotations: ns.network servicemesh.io: 4g-network:app=s6a



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Demo

x bash

dimitrovr-a01:examples dimitrovr\$

x watch

Every 2.0s: kubectl get pods --all-namespaces

NAMESPACE	NAME	READY	STATUS	RESTARTS	AGE
kube-system	coredns-5644d7b6d9-gx4kq	1/1	Running	0	40m
kube-system	coredns-5644d7b6d9-lbrk7	1/1	Running	0	40m
kube-system	etcd-kube-master	1/1	Running	0	40m
kube-system	kube-apiserver-kube-master	1/1	Running	0	40m
kube-system	kube-controller-manager-kube-master	1/1	Running	0	40m
kube-system	kube-proxy-dt8pt	1/1	Running	0	40m
kube-system	kube-proxy-nxbgt	1/1	Running	0	37m
kube-system	kube-scheduler-kube-master	1/1	Running	0	40m
kube-system	tiller-deploy-79c578486f-v7jq4	1/1	Running	0	32m
kube-system	weave-net-q8t2k	2/2	Running	0	40m
kube-system	weave-net-w7vrs	2/2	Running	1	37m

x bash

dimitrovr-a01:examples dimitrovr\$

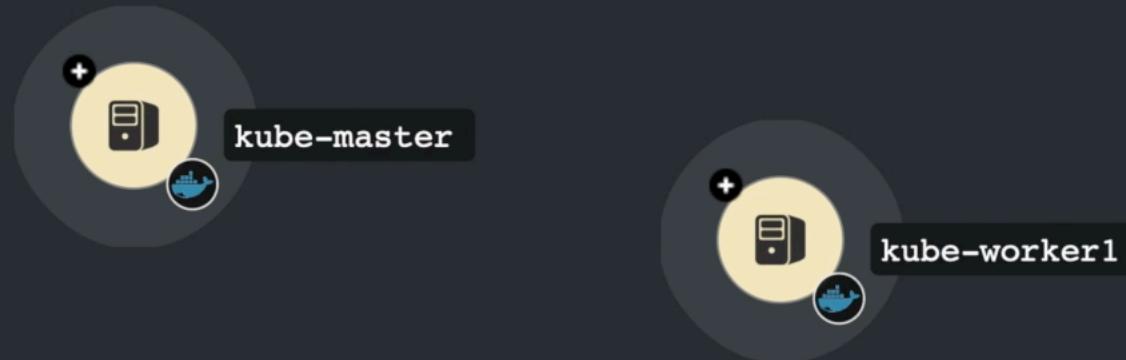
x watch

Every 2.0s: kubectl get pods --all-namespaces

NAMESPACE	NAME	READY	STATUS	RESTARTS	AGE
kube-system	coredns-5644d7b6d9-gx4kq	1/1	Running	0	54m
kube-system	coredns-5644d7b6d9-lbrk7	1/1	Running	0	54m
kube-system	etcd-kube-master	1/1	Running	0	55m
kube-system	kube-apiserver-kube-master	1/1	Running	0	55m
kube-system	kube-controller-manager-kube-master	1/1	Running	0	55m
kube-system	kube-proxy-dt8pt	1/1	Running	0	54m
kube-system	kube-proxy-nxbgt	1/1	Running	0	52m
kube-system	kube-scheduler-kube-master	1/1	Running	0	55m
kube-system	tiller-deploy-79c578486f-v7jq4	1/1	Running	0	47m
kube-system	weave-net-q8t2k	2/2	Running	0	54m
kube-system	weave-net-w7vrs	2/2	Running	1	52m
nsm-system	nsm-admission-webhook-786fd976ff-m247g	1/1	Running	0	14m
nsm-system	nsm-kernel-forwarder-dc7rq	1/1	Running	0	14m
nsm-system	nsm-kernel-forwarder-gwgcx	1/1	Running	0	14m
nsm-system	nsmgr-7tfhv	3/3	Running	0	14m
nsm-system	nsmgr-nwjv9	3/3	Running	0	14m

× bash

dimitrov-a01:examples dimitrov\$ █



Topology view
G.V().Has('Type', 'container', 'Docker.Labels.i...
Live

Captures Generator Flows Alerts Workflows

Topology rules Gremlin console

Create

Metadata ID: 587a01f1-c0cf-4d50-752b-5f339aec4a6c <

Features <

Metrics <

Routing tables <

Flows <

Outro

- Dynamically defined infrastructure
- CNCF CNF Testbed involvement
 - NSM-based use-cases already present
 - Ongoing work for network separation use-case
- Multi-repo design
- NSM Operator
- Forwarding plane
 - Multiple simultaneous forwarders
 - SmartNIC
 - SR-IOV
- NSM seminar on 5G and CNF Testbed



CNF Testbed



Takeaway



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Thank You



<https://github.com/networkservicemesh>



@vmwopensource



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KEEP CLOUD NATIVE CONNECTED

