



# Installing and Setting Up COMAC Exemplar Platform Release

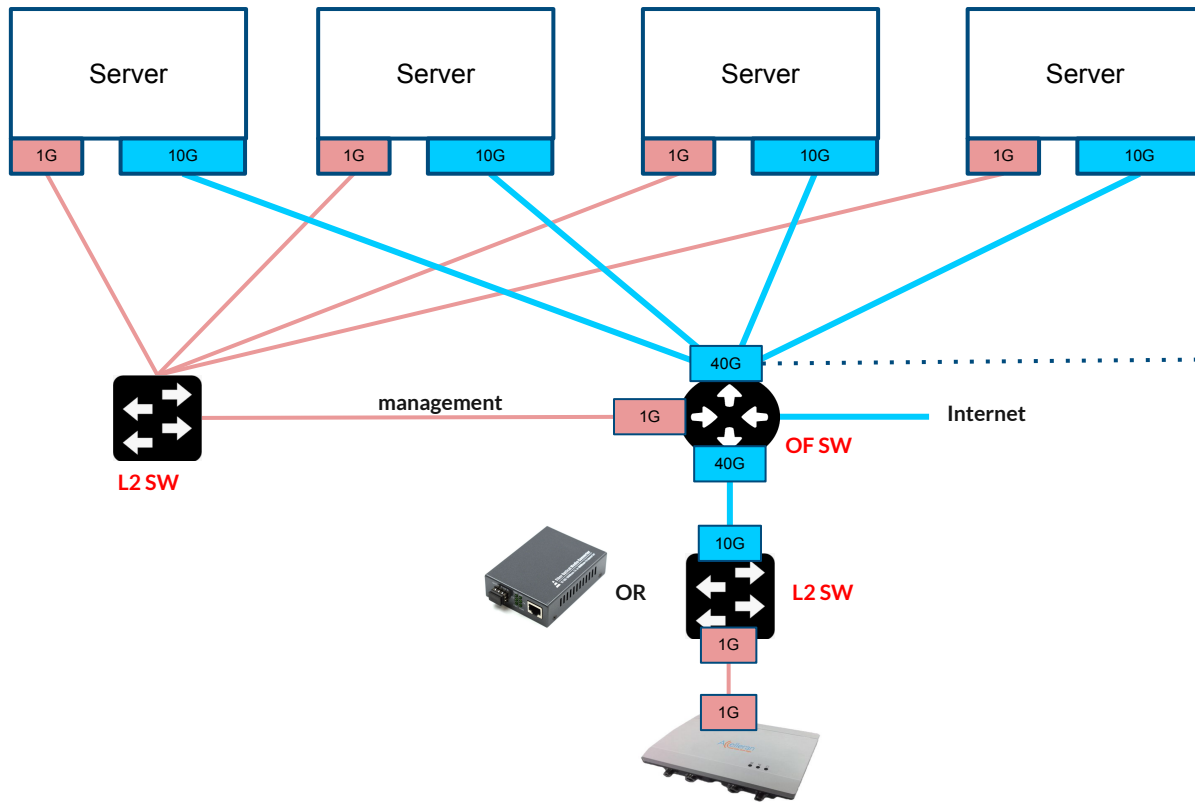
Pingping Lin, Doyoung Lee, Hyunsun Moon, Woojoong Kim  
ONF

# Contents

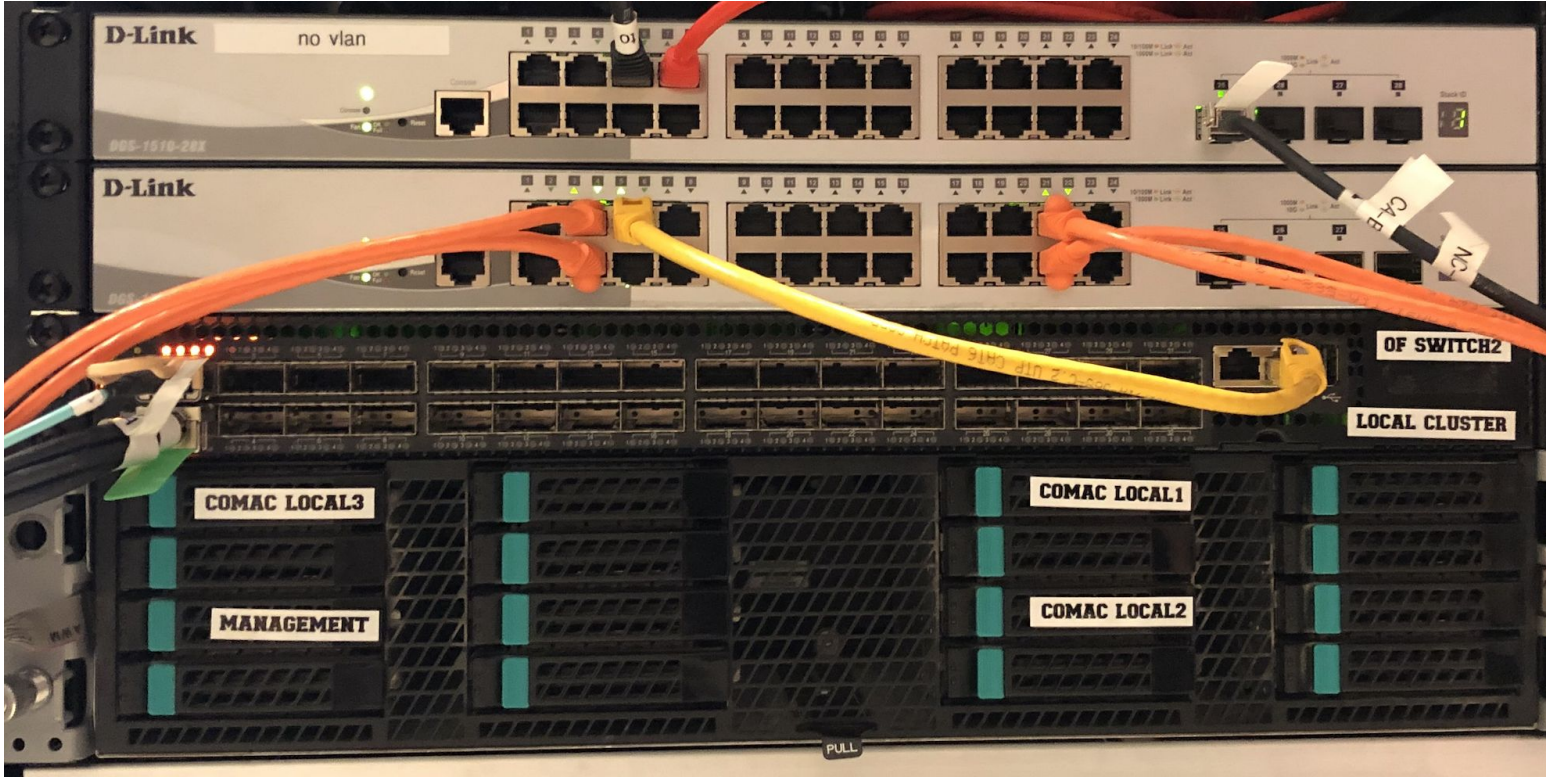
Full pod tutorial by record video, we will hands by COMAC in a box.

- **Part 1: “Physical Infrastructure” Pingping**
- Part 2: “K8S & CORD Platform” Doyoung
- Part 3: “OMEC” Hyunsun
- Part 4: “CDN and Video Test” Woojoong

# 1 Min to Setup Hardware Connectivity



# 1 Min to Setup Hardware Connectivity:Front



# 1 Min to Setup Hardware Connectivity : back



# Software Overview

- Kernel modules

- “nf\_conntrack\_proto\_sctp” for SCTP protocol
- “vfio-pci for” SR-IOV

- Software List

- `git clone https://github.com/kubernetes-incubator/kubespray.git-b release-2.11`
- `git clone https://gerrit.opencord.org/automation-tools`
- `git clone https://gerrit.opencord.org/pod-configs`
- `git clone https://gerrit.opencord.org/helm-charts`

- SR-IOV SETUP

- Specify SPGWU to run on edge 3, install “**VFIO driver**” userspace APP with dpdk
- Specify CDN to run on edge 2, install “**Netdevice driver**”



```
vf 16 MAC 0e:77:25:b4:27:12, spoof checking on, link-state auto, trust off
vf 17 MAC fa:27:69:54:32:3f, spoof checking on, link-state auto, trust off
vf 18 MAC fe:67:2b:a1:5f:d6, spoof checking on, link-state auto, trust off
vf 19 MAC de:45:26:fb:02:e5, spoof checking on, link-state auto, trust off
vf 20 MAC 62:91:a6:81:20:23, spoof checking on, link-state auto, trust off
vf 21 MAC 1e:90:ff:f1:a5:65, spoof checking on, link-state auto, trust off
vf 22 MAC 8e:f1:3a:70:39:b4, spoof checking on, link-state auto, trust off
vf 23 MAC e2:64:32:ce:d0:9e, spoof checking on, link-state auto, trust off
vf 24 MAC c2:4f:b2:92:21:3c, spoof checking on, link-state auto, trust off
vf 25 MAC ae:53:7c:cf:0a:15, spoof checking on, link-state auto, trust off
vf 26 MAC 6a:d5:1c:05:fe:cf, spoof checking on, link-state auto, trust off
vf 27 MAC fe:96:de:fb:6f:ae, spoof checking on, link-state auto, trust off
vf 28 MAC d6:f4:7d:96:e7:be, spoof checking on, link-state auto, trust off
vf 29 MAC 22:56:c0:8e:67:83, spoof checking on, link-state auto, trust off
vf 30 MAC 12:fa:62:dc:37:e3, spoof checking on, link-state auto, trust off
vf 31 MAC a6:2e:ec:b2:93:08, spoof checking on, link-state auto, trust off
vf 32 MAC 16:41:ce:b3:74:6e, spoof checking on, link-state auto, trust off
vf 33 MAC e6:4d:cd:82:26:26, spoof checking on, link-state auto, trust off
vf 34 MAC 1a:40:11:eb:5d:8c, spoof checking on, link-state auto, trust off
vf 35 MAC ee:b0:ec:f1:81:03, spoof checking on, link-state auto, trust off
vf 36 MAC 32:2a:f3:5c:c2:b5, spoof checking on, link-state auto, trust off
vf 37 MAC 2e:a4:5a:c3:c1:14, spoof checking on, link-state auto, trust off
vf 38 MAC ce:0f:a7:75:bb:ef, spoof checking on, link-state auto, trust off
vf 39 MAC 82:f6:28:5a:6a:db, spoof checking on, link-state auto, trust off
vf 40 MAC c6:46:a0:94:2c:2b, spoof checking on, link-state auto, trust off
vf 41 MAC ca:9f:6a:be:0a:6d, spoof checking on, link-state auto, trust off
vf 42 MAC 0e:88:d6:62:96:73, spoof checking on, link-state auto, trust off
vf 43 MAC 4a:63:b0:ec:84:1c, spoof checking on, link-state auto, trust off
vf 44 MAC f6:6c:5b:0c:c6:c9, spoof checking on, link-state auto, trust off
vf 45 MAC 3a:4d:8c:3e:3b:42, spoof checking on, link-state auto, trust off
vf 46 MAC 5a:03:cc:f9:95:f5, spoof checking on, link-state auto, trust off
vf 47 MAC ca:2c:92:a2:bd:9c, spoof checking on, link-state auto, trust off
vf 48 MAC 5e:a8:82:bf:fb:3c, spoof checking on, link-state auto, trust off
vf 49 MAC f2:b5:d6:d9:18:b6, spoof checking on, link-state auto, trust off
vf 50 MAC 86:e8:ad:ba:e0:7b, spoof checking on, link-state auto, trust off
vf 51 MAC ba:80:a0:2b:eb:7e, spoof checking on, link-state auto, trust off
vf 52 MAC 66:f3:55:98:ce:8c, spoof checking on, link-state auto, trust off
vf 53 MAC 56:08:ac:c7:03:52, spoof checking on, link-state auto, trust off
vf 54 MAC 9e:db:52:05:1a:9a, spoof checking on, link-state auto, trust off
vf 55 MAC 2a:12:7b:09:8e:c8, spoof checking on, link-state auto, trust off
vf 56 MAC 92:4b:c5:50:e4:f2, spoof checking on, link-state auto, trust off
vf 57 MAC c6:89:b5:70:b8:ed, spoof checking on, link-state auto, trust off
vf 58 MAC 66:c5:29:c1:c8:dc, spoof checking on, link-state auto, trust off
vf 59 MAC 52:9f:14:b3:49:f7, spoof checking on, link-state auto, trust off
vf 60 MAC ea:a0:0e:3d:90:f8, spoof checking on, link-state auto, trust off
```

```
cord@central1:~$ ls
automation-tools  bbu_images  helm-charts  kubescape  pod-configs
cord@central1:~$
cord@central1:~$
cord@central1:~$ for i in `seq 1 2`;do ssh central$i sudo modprobe nf_conntrack_proto_sctp;done
sudo: unable to resolve host central2
cord@central1:~$
cord@central1:~$ sudo lsmod | grep sctp
nf_conntrack_proto_sctp      20480  0
nf_conntrack                 106496  8 ip_vs,nf_nat,nf_nat_ipv4,xt_conntrack,nf_nat_masquerad
e_ipv4,nf_conntrack_proto_sctp,nf_conntrack_netlink,nf_conntrack_ipv4
cord@central1:~$
cord@central1:~$
```

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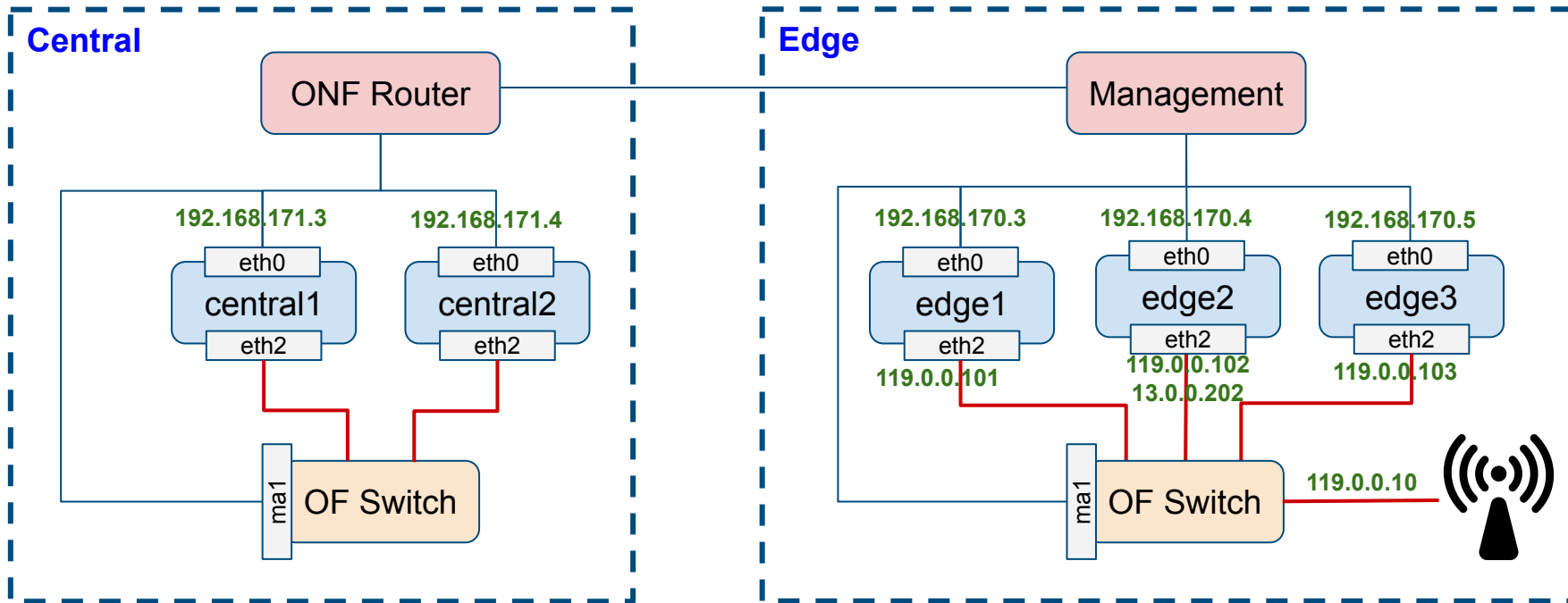


# K8S and CORD Platform

Doyoung Lee  
ONF/POSTECH

# Kubespray (1/3)

- Multi-clusters for COMAC



# Kubespray (2/3)

- Easy way to install Kubernetes cluster!
  - Use sample configuration files in automation-tools
  - automation-tools/comac/sample/central or edge or single

```
# K8S
kubeadm_enabled: true
kubelet_deployment_type: host
kubectl_localhost: true
kubeconfig_localhost: true

kube_feature_gates: [SCTPSupport=True]
kube_pods_subnet: 172.18.0.0/17
kube_service_addresses: 172.18.128.0/17
kube_apiserver_node_port_range: 2000-36767
kube_network_plugin: calico
kube_network_plugin_multus: true
multus_version: stable
ipip: false
```

extra-var.yaml

|

```
[all]
central1 ansible_host=10.90.0.131 etcd_member_name=etcd1
central2 ansible_host=10.90.0.132

[kube-master]
central1

[etcd]
central1

[kube-node]
central1
central2

[k8s-cluster:children]
kube-master
kube-node
|

[omec-cp]
central1
central2

[omec-cp:vars]
node_labels={"omec-cp":"enabled"}
```

hosts.ini

# Kubespray (3/3)

```
cord@edge1: ~
#
# Licensed under the Apache License, Version 2.0 (the "License");
# you may not use this file except in compliance with the License.
# You may obtain a copy of the License at
#
# http://www.apache.org/licenses/LICENSE-2.0
#
# Unless required by applicable law or agreed to in writing, software
# distributed under the License is distributed on an "AS IS" BASIS,
# WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
# See the License for the specific language governing permissions and
# limitations under the License.

[all]
edge1 ansible_host=192.168.170.3 etcd_member_name=etcd1
edge2 ansible_host=192.168.170.4 etcd_member_name=etcd2
edge3 ansible_host=192.168.170.5 etcd_member_name=etcd3

[kube-master]
edge1
edge2
edge3

[etcd]
edge1
edge2
edge3

[kube-node]
edge1
edge2
edge3

[k8s-cluster:children]
kube-master
kube-node

[omec-cp]
edge1
edge2

[omec-dp]
edge3
█
-- INSERT --
45,1 16%
```

```
cord@centr1: ~
# Copyright 2019-present Open Networking Foundation
#
# Licensed under the Apache License, Version 2.0 (the "License");
# you may not use this file except in compliance with the License.
# You may obtain a copy of the License at
#
# http://www.apache.org/licenses/LICENSE-2.0
#
# Unless required by applicable law or agreed to in writing, software
# distributed under the License is distributed on an "AS IS" BASIS,
# WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
# See the License for the specific language governing permissions and
# limitations under the License.

[all]
node1 ansible_host=10.0.0.240 etcd_member_name=etcd1
node2 ansible_host=10.0.0.241 etcd_member_name=etcd2
node3 ansible_host=10.0.0.242 etcd_member_name=etcd3

[kube-master]
node1
node2
node3

[etcd]
node1
node2
node3

[kube-node]
node1
node2
node3

[k8s-cluster:children]
kube-master
kube-node

[omec-cp]
node1
node2

[omec-dp]
node3
"kubespray/inventory/comac/hosts.ini" 50L, 1036C
11,1 Top
```

# CORD Platform & COMAC Profiles

- CORD Platform
  - NEM (Network Edge Mediator): XOS
  - Logging: Logstash, Elasticsearch, Kibana
  - Monitoring: Grafana, Prometheus
  - Message Broker: Kafka
  - Controller: ONOS
- COMAC Profiles
  - Service graph
  - COMAC profiles
- Using overriding values for configuration

```
# cord-platform values
etcd-operator:
  enabled: false
logging:
  enabled: false
nem-monitoring:
  enabled: true

# comac-profiles values
mcord-setup:
  enabled: false
etcd-cluster:
  enabled: false
```

# CORD Platform & COMAC Profiles

```
cord@edge1:~$ c-override-values-multi.yaml
NAME:      comac-platform
LAST DEPLOYED: Fri Aug 30 04:17:42 2019
NAMESPACE: default
STATUS:    DEPLOYED

RESOURCES:
==> v1/ConfigMap
NAME          DATA  AGE
base-kubernetes-tosca  3      0s
fabric        1      0s
kubernetes    1      0s
mcord-subscriber  1      0s
mcord-tosca    6      0s
onos-service  1      0s
vrouter       1      0s

==> v1/Job
NAME                               COMPLETIONS  DURATION  AGE
comac-platform-base-kubernetes-tosca-loader  0/1           0s        0s
comac-platform-mcord-subscriber             0/1           0s        0s
comac-platform-mcord-tosca-loader           0/1           0s        0s

==> v1/Pod(related)
NAME                                READY  STATUS             RESTARTS  AGE
comac-platform-base-kubernetes-tosca-loader-jtz78  0/1    ContainerCreating  0          0s
comac-platform-fabric-57c79f966d-bp6dt             0/1    ContainerCreating  0          0s
comac-platform-kubernetes-5844d4dd49-wsv98         0/1    ContainerCreating  0          0s
comac-platform-mcord-subscriber-ksww9             0/1    ContainerCreating  0          0s
comac-platform-mcord-tosca-loader-nlvgm            0/1    Pending            0          0s
comac-platform-onos-service-78855b85bf-rhsh8       0/1    ContainerCreating  0          0s
comac-platform-vrouter-5954675d74-zbjbz           0/1    ContainerCreating  0          0s

==> v1beta2/Deployment
NAME                                READY  UP-TO-DATE  AVAILABLE  AGE
comac-platform-fabric               0/1    1            0          0s
comac-platform-kubernetes           0/1    1            0          0s
comac-platform-onos-service         0/1    1            0          0s
comac-platform-vrouter              0/1    1            0          0s

cord@edge1:~$
cord@edge1:~$ watch kubectl get pods
cord@edge1:~$
cord@edge1:~$
```

```
cord@central1:~$ vim automation-tools/comac
cord@central1:~$
```



# CORD Platform

The screenshot shows the CORD Platform interface. At the top left is the CORD logo with the tagline "Your VNF orchestrator" and version "v.6.1.0". A search bar contains the text "Navigate routes (press 'f' to select)". In the top right corner, there is a "Service Status" dropdown menu. A left sidebar contains navigation links for "Home", "Core", "Slices", "Nodes", and "Instances". The main content area is titled "Service Graph" and contains a large empty space with a central icon of three vertical bars of increasing height. At the bottom, a "System summary" section displays three metrics: "0 Nodes", "0 Slices", and "0 Instances". In the bottom left corner, there is a "Logout" button.

CORD  
Your VNF orchestrator  
v.6.1.0

Navigate routes (press 'f' to select)

Service Status

Home  
Core  
Slices  
Nodes  
Instances

## Service Graph

System summary:

|            |             |                |
|------------|-------------|----------------|
| 0<br>Nodes | 0<br>Slices | 0<br>Instances |
|------------|-------------|----------------|

Logout

# COMAC Profiles

The screenshot displays the CORD v6.1.0 interface. The top navigation bar includes the CORD logo, a search bar with the text "Navigate routes (press 'f' to select)", and a "Service Status" dropdown. The left sidebar contains a menu with the following items: Home, Core, Slices, Nodes, Instances, Fabric (highlighted with a red box), Kubernetes, Mcord, Onos, and Vrouter. The main content area is titled "Service Graph" and shows a network diagram with the following components and connections:

- MCORD** is connected to **OMEC-CP** and **OMEC-UP**.
- OMEC-CP** is connected to **OMEC-UP**.
- OMEC-UP** is connected to **CDN-LOCAL** and **CDN-REMOTE**.
- CDN-LOCAL** is connected to **CDN-REMOTE**.
- ONOS** is connected to **FABRIC** and **VROUTER**.
- FABRIC** is connected to **VROUTER**.
- KUBERNETES** is shown as a separate component at the bottom.

The bottom navigation bar contains four buttons: Services, Service Instances, Instances, and Networks. The bottom right corner features the ONF CONNECT logo.

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# OMEC

```
resources: {}
#requests:
# memory: 4Gi
# cpu: 2
#limits:
# memory: 4Gi
# cpu: 2

config:
  hss:
    hssdb: cassandra
    s6a:
      nodePort:
        enabled: false
        port: 33868
    # Provide the peer whitelist extension
    # The peer name must be a fqdn. We allow also a special "*" character as the
    # first label of the fqdn, to allow all fqdn with the same domain name.
    # Example: *.example.net will allow host1.example.net and host2.example.net
    acl:
      oldTls: "*.cluster.local"
    #ipSec:
    bootstrap:
      enabled: true
    users:
      - imsi: "208014567891200"
        msisdn: "1122334455"
        apn: apn1
        key: "465b5ce8b199b49faa5f0a2ee238a6bc"
        opc: "d4416644f6154936193433dd20a0ace0"
      - imsi: "208014567891201"
        msisdn: "1122334455"
        apn: apn1
        key: "465b5ce8b199b49faa5f0a2ee238a6bc"
        opc: "d4416644f6154936193433dd20a0ace0"
    mmes:
      - id: 1
        isdn: "19136246000"
        unreachability: 1
    # See https://github.com/omec-project/c3po for details of config options
    cfgFiles:
      hss_json:
        common:
          fdcfg: conf/hss.conf
          # Origin host and realm will be set automatically if unset
          #originhost: ""
          #originrealm: ""
      hss:
        gtwHost: "*"
        gtwport: 9080
        restport: 9081
```

80,1

34%

```
config:
# omecontrol-plane override values
hss:
  bootstrap:
    enabled: true
  users:
    - imsi: "732111000000420"
      msisdn: "1122334455"
      apn: apn1
      key: "000102030405060708090a0b0c0d0e0f"
      opc: "69d5c2eb2e2e624750541d3bbc692ba5"
    - imsi: "732111000000421"
      msisdn: "1122334455"
      apn: apn1
      key: "000102030405060708090a0b0c0d0e0f"
      opc: "69d5c2eb2e2e624750541d3bbc692ba5"
  mmes:
    - id: 1
      isdn: "19136246000"
      unreachability: 1
  mme:
    cfgFiles:
      config_json:
        mme:
          mcc:
            dig1: 7
            dig2: 3
            dig3: 2
          mnc:
            dig1: 1
            dig2: 1
            dig3: 1
  spgwc:
    cpComm:
      nodePort:
        enabled: true
        port: 30021
    dpComm:
      addr: 192.168.170.3
      port: 30020
    cfgFiles:
      adc_rules_cfg: |
        [GLOBAL]
        NUM_ADC_RULES = 5

        [ADC_RULE_1]
        ADC_TYPE = 1
        IP = 13.1.1.111

        [ADC_RULE_2]
        ADC_TYPE = 2
```

71,1

5%

# OMEC

```
cord@edge1:~/helm-charts$ helm upgrade --install --namespace default omece-data-plane omece/omece-data-plane -f ~/automation-tools/comac/sample/omece-override-values-multi.yaml
Release "omece-data-plane" does not exist. Installing it now.
NAME:      omece-data-plane
LAST DEPLOYED: Fri Aug 30 04:22:07 2019
NAMESPACE: default
STATUS:    DEPLOYED

RESOURCES:
==> v1/ConfigMap
NAME      DATA      AGE
spgwu     4          0s
srlov-config 1         0s

==> v1/DaemonSet
NAME                DESIRED  CURRENT  READY  UP-TO-DATE  AVAILABLE  NODE SELE
CTOR AGE
srlov-device-plugin 3         3        0      3          0          <none>
0s

==> v1/NetworkAttachmentDefinition
NAME      AGE
s1u-net  0s
sg1-net  0s

==> v1/Pod(related)
NAME                READY  STATUS   RESTARTS  AGE
spgwu-0             0/1    Pending  0          0s
srlov-device-plugin-6wsg7 0/1    Init:0/1 0          0s
srlov-device-plugin-bmhzz 0/1    Init:0/1 0          0s
srlov-device-plugin-kbc8m 0/1    Init:0/1 0          0s

==> v1/Service
NAME      TYPE        CLUSTER-IP      EXTERNAL-IP  PORT(S)          AGE
spgwu-dp-comm  NodePort    172.18.153.118  <none>       20:30020/UDP    0s

==> v1/StatefulSet
NAME      READY  AGE
spgwu    0/1    0s

cord@edge1:~/helm-charts$
cord@edge1:~/helm-charts$ watch kubectl get pods
cord@edge1:~/helm-charts$
```

```
cord@central1:~/helm-charts$ helm dep up omece/omece-control-plane
Hang tight while we grab the latest from your chart repositories...
...Unable to get an update from the "local" chart repository (http://127.0.0.1:8879/charts):
  Get http://127.0.0.1:8879/charts/index.yaml: dial tcp 127.0.0.1:8879: connect: connect
ion refused
...Successfully got an update from the "cord" chart repository
...Successfully got an update from the "incubator" chart repository
...Successfully got an update from the "stable" chart repository
Update Complete.
Saving 1 charts
Downloading cassandra from repo https://kubernetes-charts-incubator.storage.googleapis.com/
```

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# CDN Installation

**Woojoong Kim**  
**Open Networking Foundation**

# How To Install CDN Local and Remote?

## Helm chart #1: CDN-Local

NGINX

Cached videos



CDN server

CDN-Local

## Helm chart #2: CDN-Remote

ffmpeg

Video files



Ant media

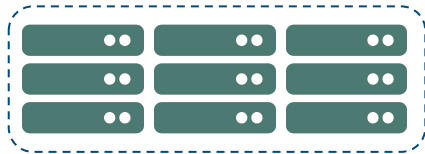


Media server

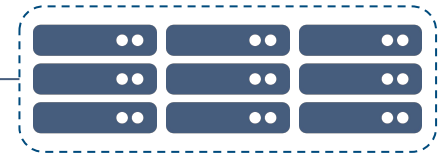


Video archive

CDN-Remote



Edge Cluster



Central Cluster

# CDN Configuration Variables

- File: omec-override-values-multi.yaml
  - **remote\_ip**: <IP address of any central cluster node>
  - **remote\_streaming**:
    - **antmedia\_ip**: <IP address of any central cluster node>
    - **video\_quality**: {360, 480, 720} # for CDN-Remote
  - **stream\_name**: <Name to access video stream → for URL>

# Video: CDN Deployment

```
cord@edge1: ~/helm-charts
Every 2.0s: kubectl get pods

NAME                                READY   STATUS    RESTARTS   AGE
comac-platform-fabric-57c79f966d-bp6dt    1/1     Running   0           39m
comac-platform-kubernetes-5844d4dd49-wsv98  1/1     Running   0           39m
comac-platform-mcord-subscriber-mjqj5     1/1     Running   0           9m50s
comac-platform-mcord-tosca-loader-nlvgn    0/1     Completed 3           39m
comac-platform-onos-service-78855b85bf-t2279  1/1     Running   0           9m50s
comac-platform-vrouter-5954675d74-zjbjz    1/1     Running   0           39m
cord-platform-grafana-846c6df66-xlr69     2/2     Running   0           42m
cord-platform-kafka-0                     1/1     Running   1           42m
cord-platform-onos-d4d6896f7-dwsdj        2/2     Running   0           42m
cord-platform-prometheus-alertmanager-c84bbf548-ctx9f  2/2     Running   0           42m
cord-platform-prometheus-kube-state-metrics-5bd49cbb6c-nf76k  1/1     Running   0           9m50s
cord-platform-prometheus-node-exporter-cqtvn  1/1     Running   0           42m
cord-platform-prometheus-node-exporter-jqfnd  1/1     Running   0           42m
cord-platform-prometheus-node-exporter-rmj6j  1/1     Running   1           42m
cord-platform-prometheus-pushgateway-6795f848dd-s8jv7  1/1     Running   0           9m50s
cord-platform-prometheus-server-86c7b5cc77-rrb48  2/2     Running   0           42m
cord-platform-zookeeper-0                 1/1     Running   0           5m9s
kpi-exporter-66f8698468-j9msw             1/1     Running   0           9m50s
kpi-exporter-66f8698468-kh49k            1/1     Running   3           42m
nginx-rtmp-0                               0/1     Init:0/1   0           3s
spgwu-0                                    1/1     Running   0           78s
sriov-device-plugin-kzjxt                 1/1     Running   0           78s
sriov-device-plugin-p4kcf                 1/1     Running   0           78s
sriov-device-plugin-w8rwm                 1/1     Running   0           78s
xos-chameleon-6754f7bcd8-7cl4c            1/1     Running   0           42m
xos-core-5d67b6dc49-v7ljh                 1/1     Running   0           9m50s
xos-db-66f95c59c7-vcsvl                   1/1     Running   0           42m
xos-gui-5fffb4b4474-plfz                   1/1     Running   0           42m
xos-tosca-f5468cc74-2nlmh                 1/1     Running   0           42m
xos-ws-7746c588d9-9cn9v                   1/1     Running   0           42m

cord@central1: ~/helm-charts
LAST DEPLOYED: Fri Aug 30 04:36:39 2019
NAMESPACE: default
STATUS: DEPLOYED

RESOURCES:
==> v1/ConfigMap
NAME      DATA   AGE
l3-config 1       0s

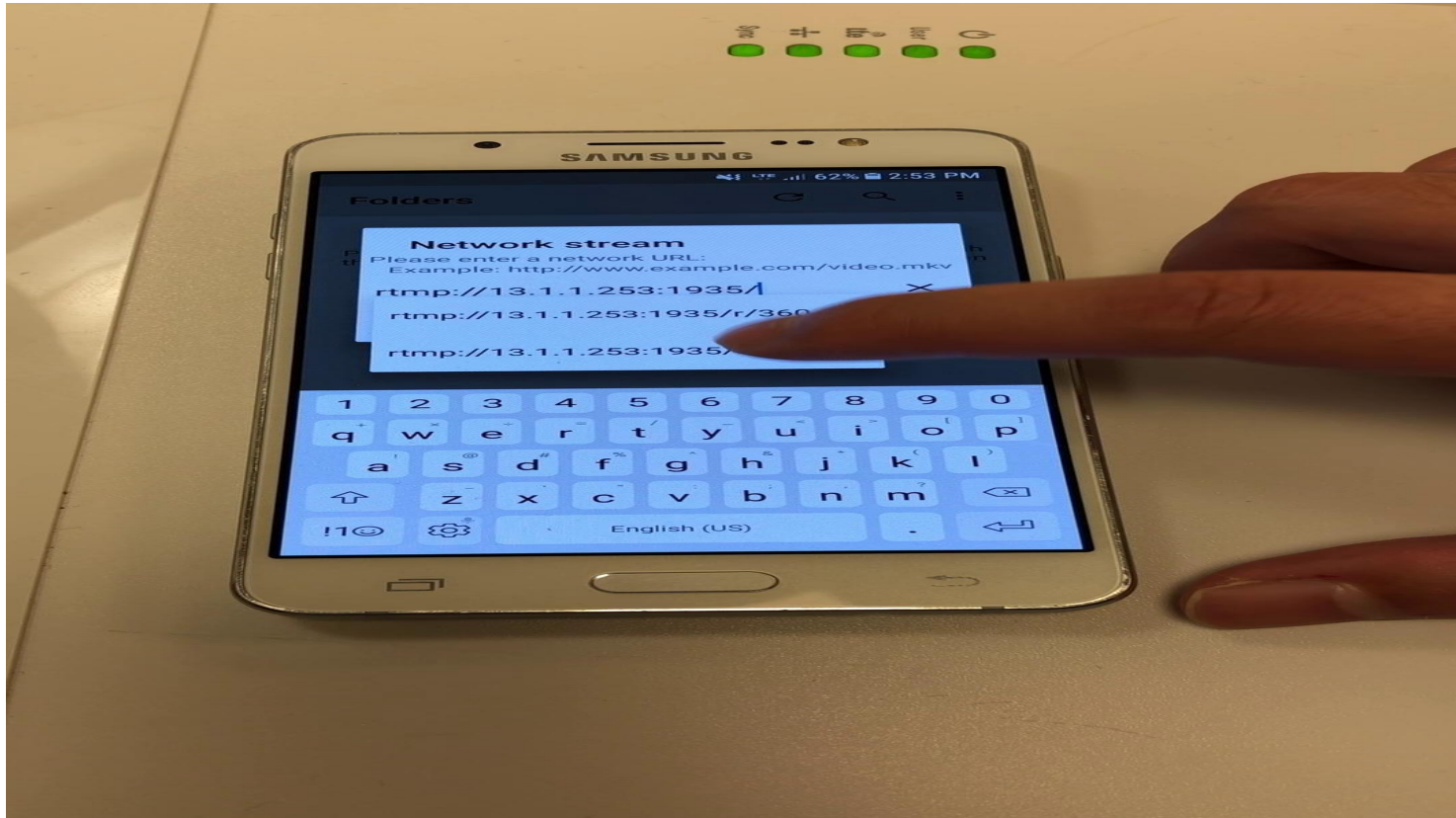
==> v1/Pod(related)
NAME      READY   STATUS    RESTARTS   AGE
acceleran-0  0/3     Init:0/1   0           0s

==> v1/Service
NAME      TYPE        CLUSTER-IP      EXTERNAL-IP
PORT(S)                                     AGE
acceleran      ClusterIP   None             <none>
36412/SCTP,4222/TCP,6379/TCP              0s
acceleran-external  NodePort    172.18.165.153  <none>
36412:31412/SCTP,4222:4222/TCP,6379:6379/TCP  0s

==> v1/StatefulSet
NAME      READY   AGE
acceleran 0/1     0s

cord@central1:~/helm-charts$ watch kubectl get pods
cord@central1:~/helm-charts$ █
```

# Video: Demo





Thank You

Follow Up Links:

<https://guide.opencord.org>