



EQUINIX

# Where the Edges Meet, Infra Forms and Apps Land

*How DevOps driven optimally deployed infrastructure and software will make 5G a reality*

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Akraino Technical Event Spring 2022

# Outline



- 5G and Edge
- DevOps Multi-domain Infra Orchestration
- Who Is Equinix?



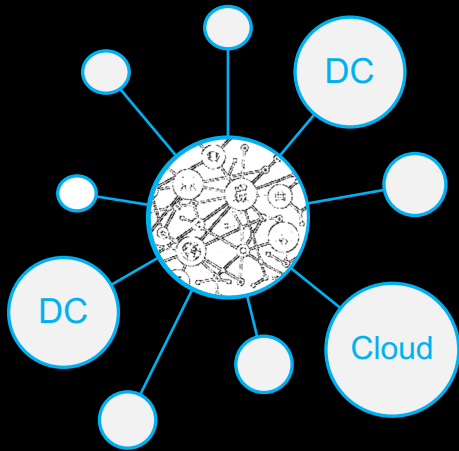
# 5G and Edge

# New applications drive expansion to the edge and densification of networks



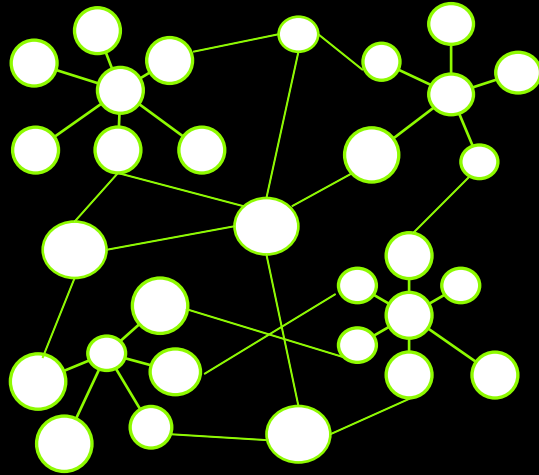
**Legacy**

Centralized



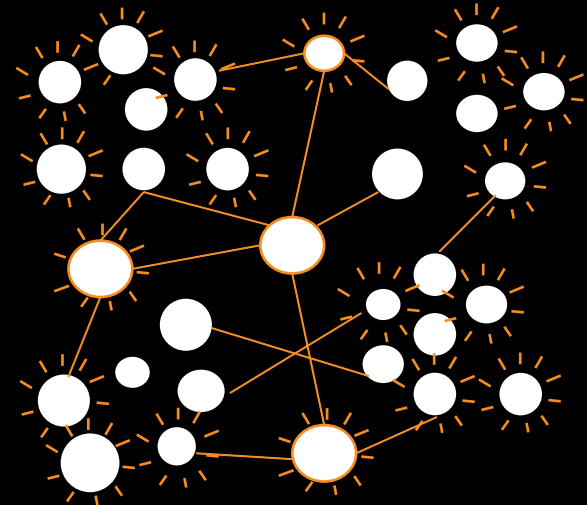
**Existing**

Distributed



**Forming**

Edge



User to App  
Distance

$\sim 10^3$  km  
 $\sim 10^0$  sec

$\sim 10^2$  km  
 $\sim 10^{-1}$  sec

$\sim 10^1$  km  
 $\sim 10^{-2}$  sec

# Ubiquitous Edge

*present, appearing, or found everywhere*

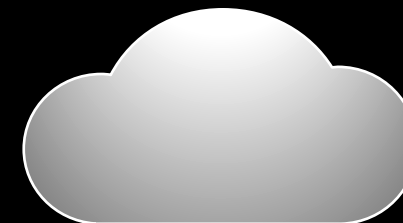
Devices

Fiber Aggregation  
Tower Sites  
Premise

Traffic Aggregation  
Central Office  
Edge Data Center  
Cloud Edge Zones

Interconnection Hubs / Peering  
Mobile Switching Centers  
Multi-Tenant Data Centers  
Cloud Local Zones

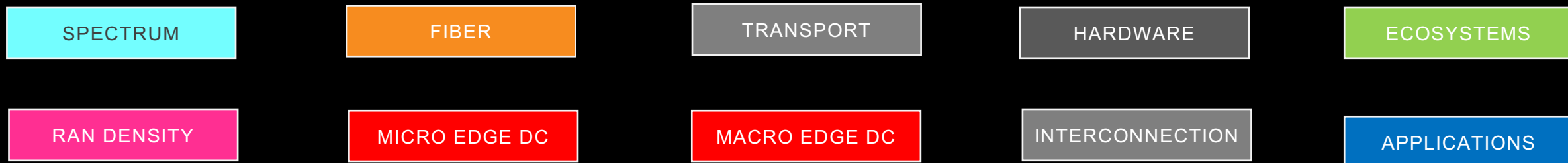
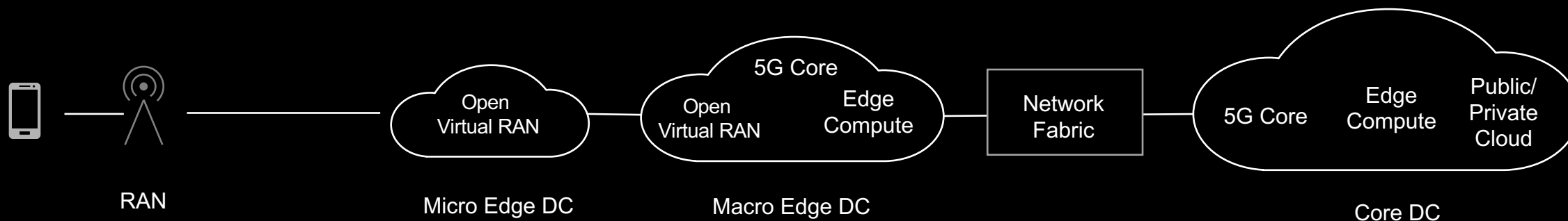
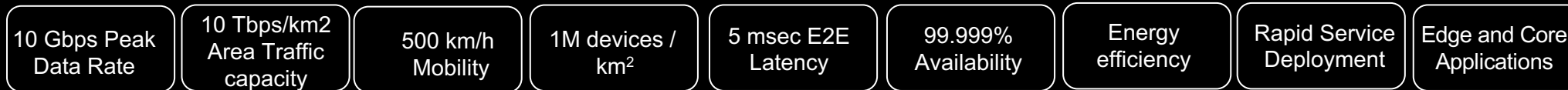
Cloud AZ  
Telco Core



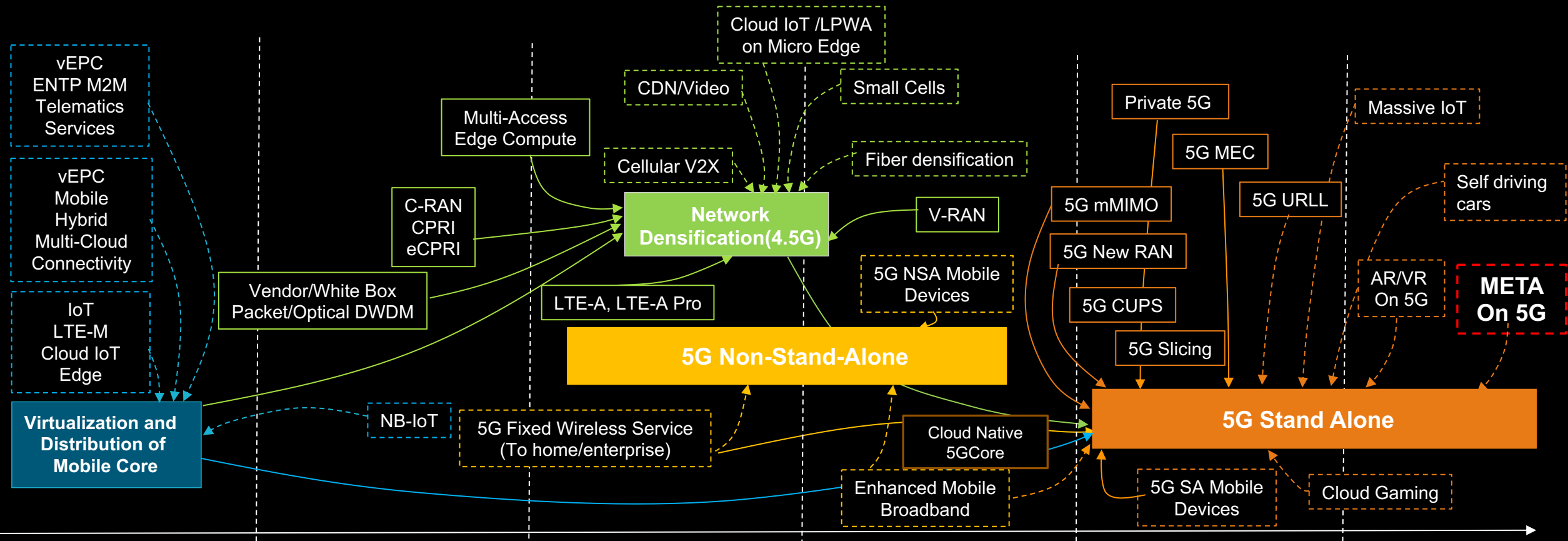
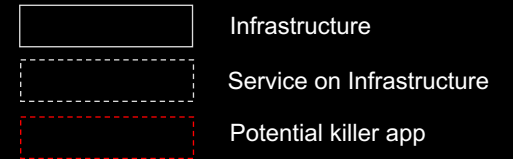


# 5G: Major Technological Inflection Point for Digital Infrastructure

New thinking required to optimize an evolving multi-variable function



# Transformation of 4G/5G infrastructure and use cases



2016 - 2019

2019 - 2022

2022 - 2025+

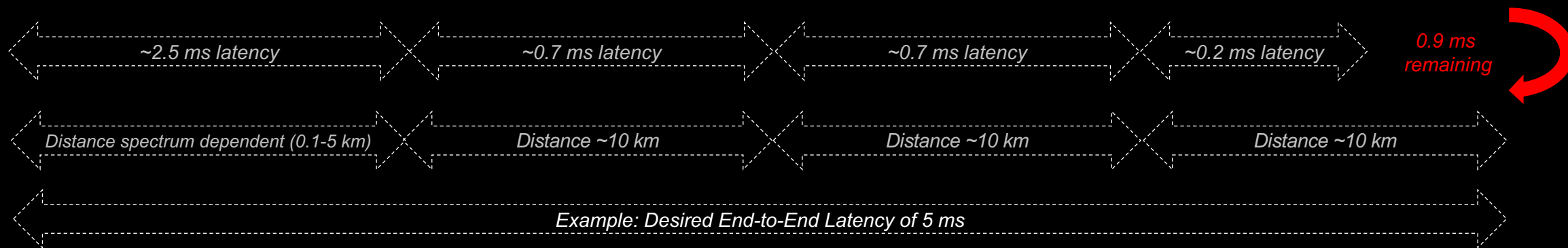
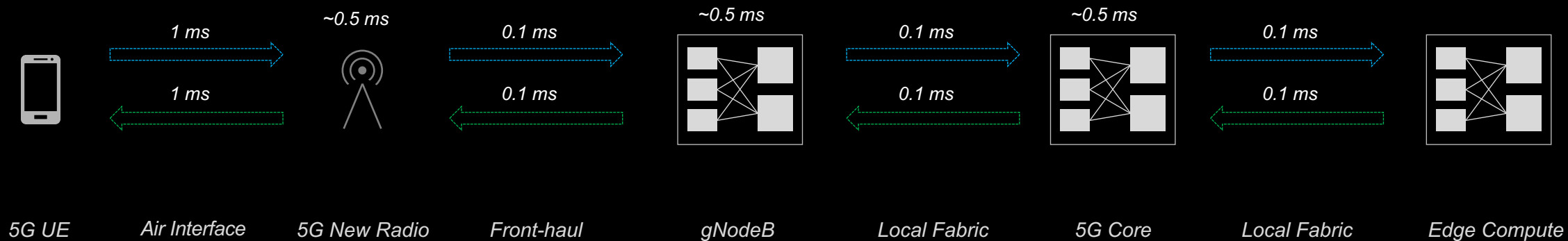
Virtualization Mature

Densification Evolving

Next Generation Long-term

# Making 5G a Reality: Optimally-Distributed Architecture

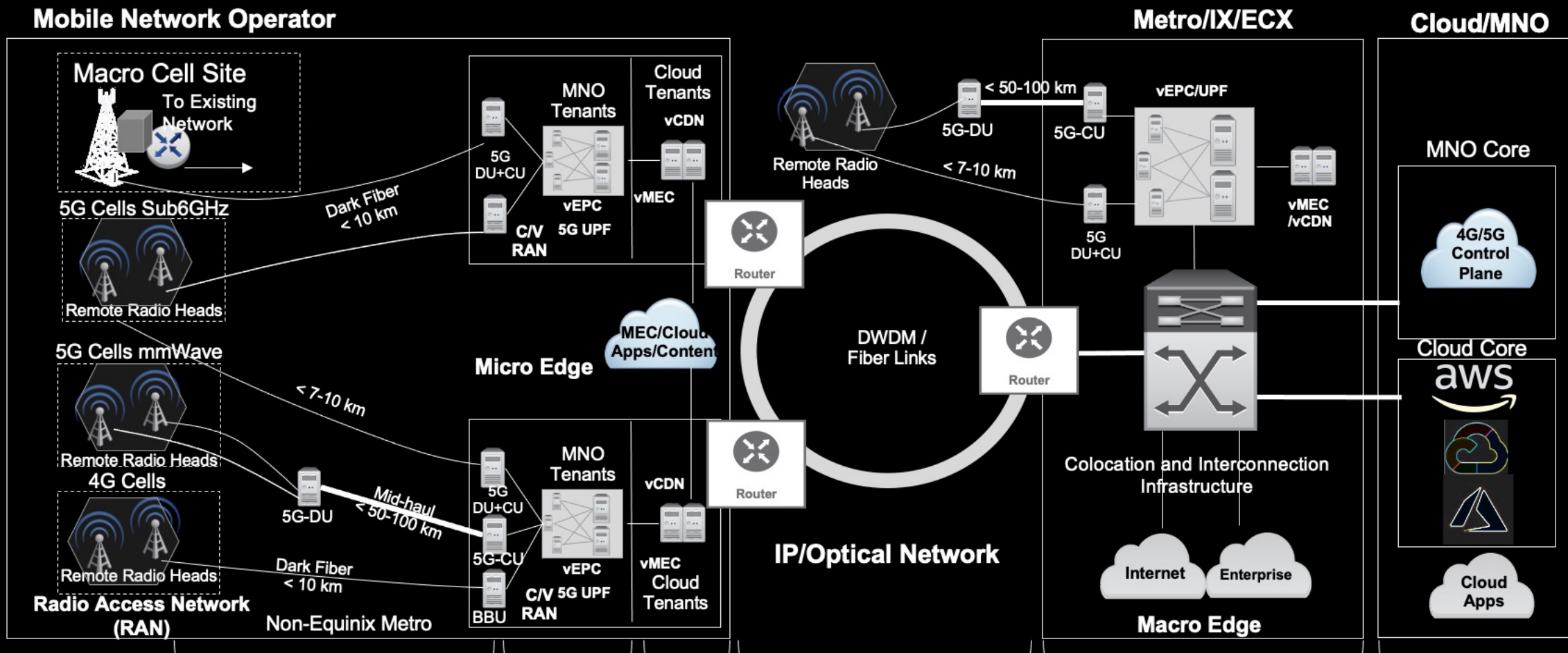
Optimally-placed & interconnected infrastructure required to deliver on 5G performance promises



Latencies and distances are estimates



# Ubiquitous Metro Edge Architecture



**Network Latency (RTT)**

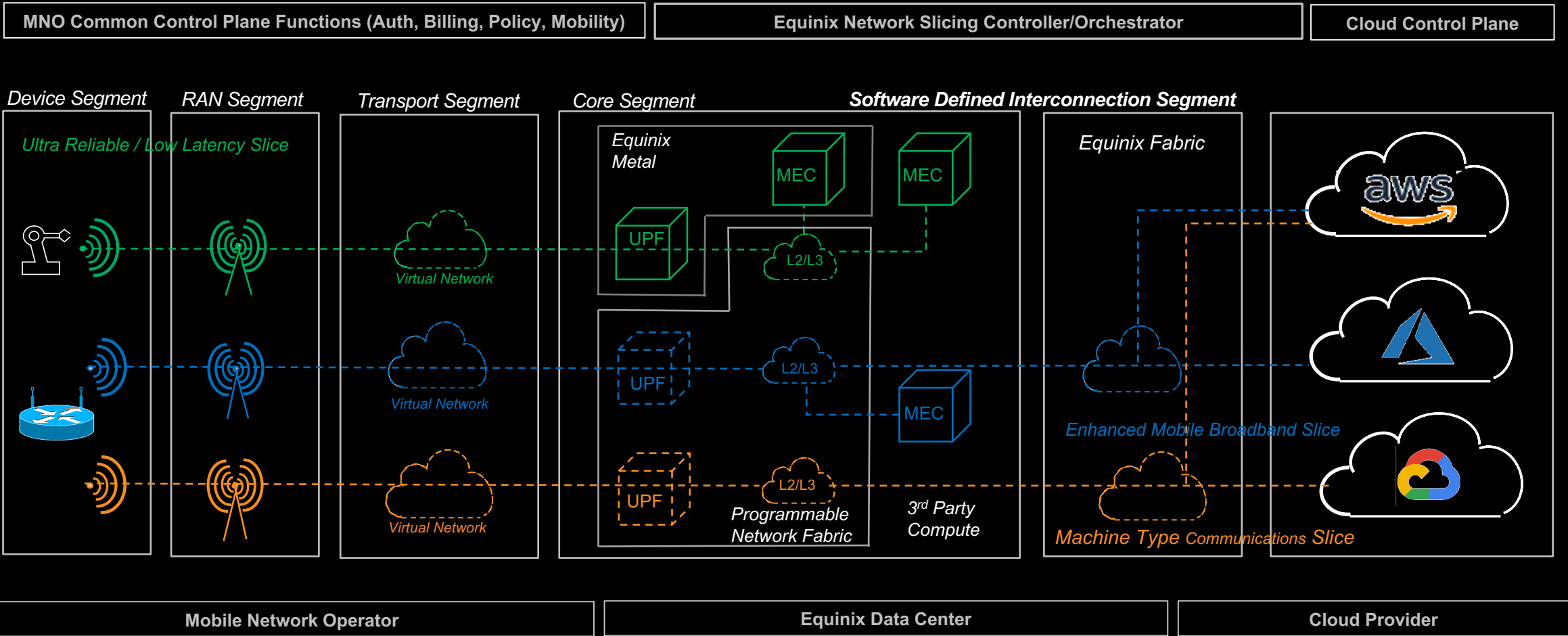
- 3 – 5 msec (5G); 15 – 20 msec (4G) – critical data path for URLL
- 10 – 15 msec (5G); 25 – 30 msec (4G) – regular data and management path



# Network Slicing for Interconnection of Core and Edge – Multi-MEC, Multi-Cloud



The Slicing Must Go On

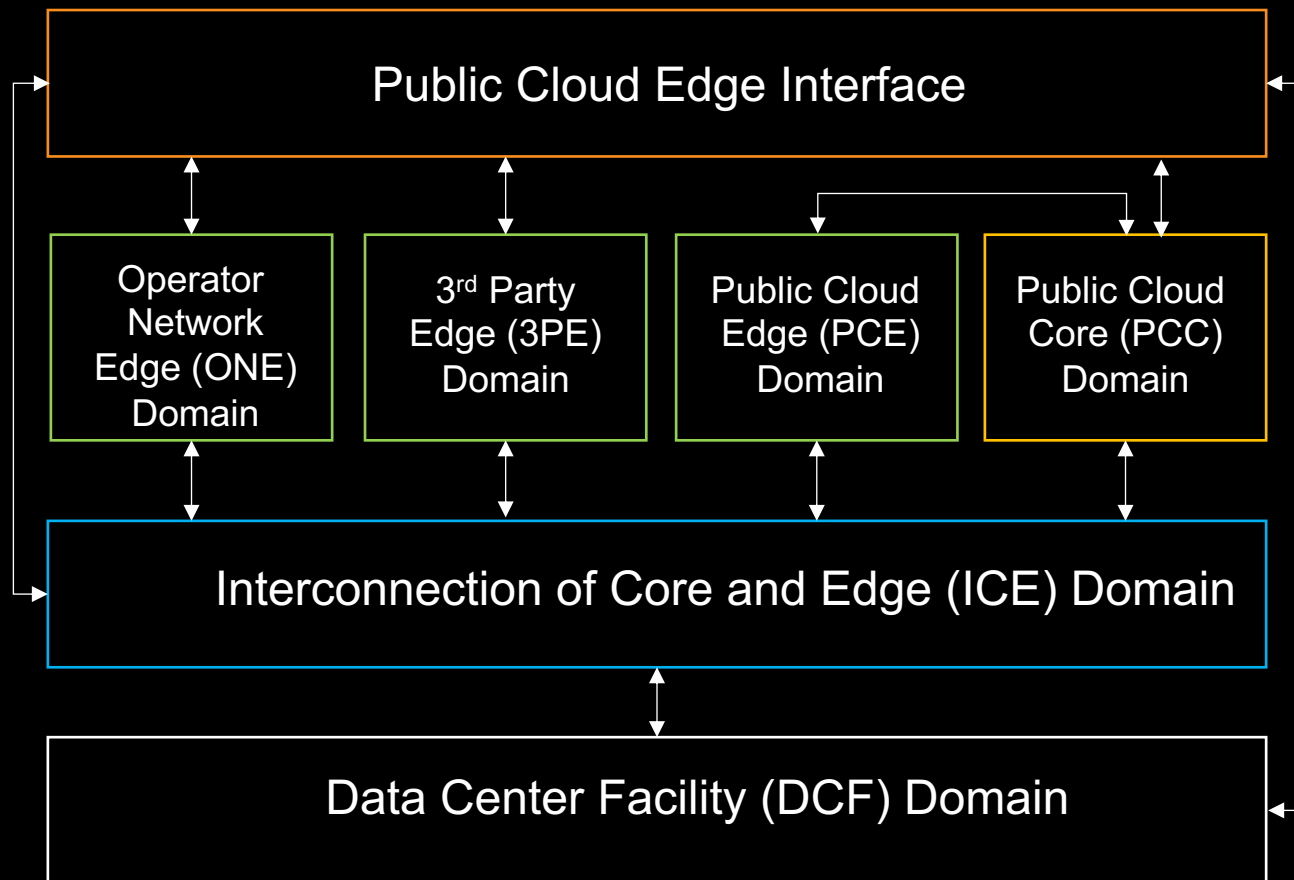




DevOps Multi-domain Infra Orchestration

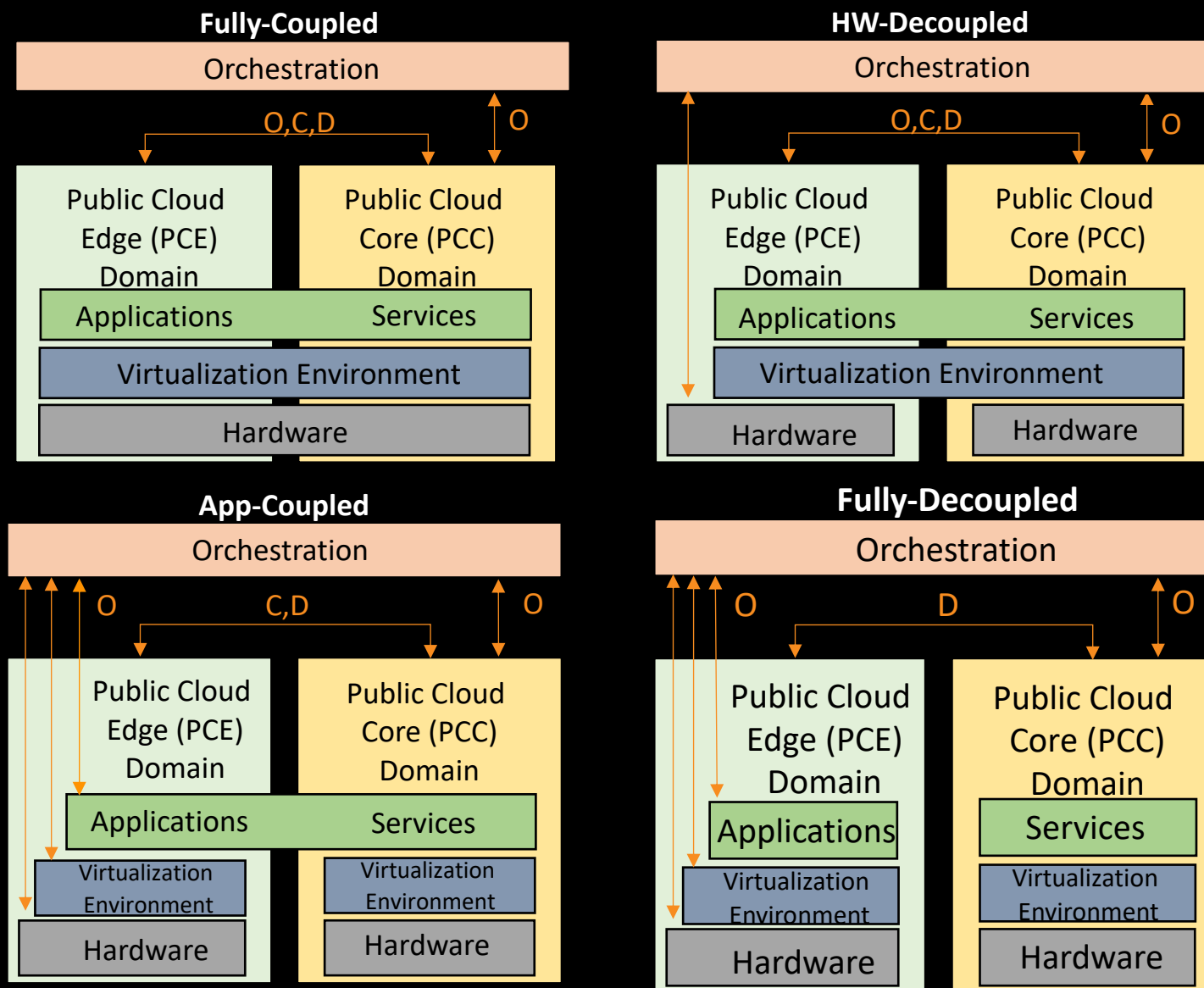
# Akraio Public Cloud Edge Interface (PCEI) Blueprint

## Overview



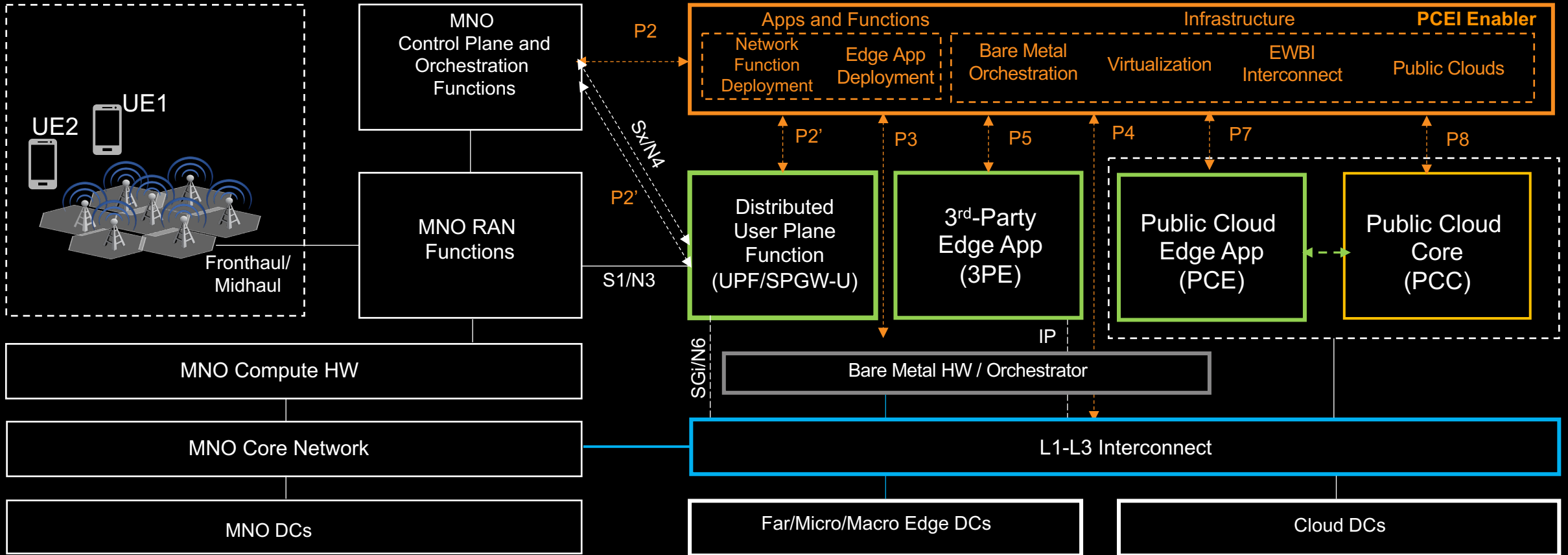
The purpose of Public Cloud Edge Interface (PCEI) Blueprint is to develop a **set of open APIs, orchestration functionalities** and **edge capabilities** for enabling Multi-Domain Interworking across the Operator Network Edge, the Public Cloud Core and Edge, the 3rd-Party Edge as well as the underlying infrastructure such as Data Centers, Compute Hardware and Networks.

# Public Cloud Driven Edge Computing: PCC-PCE Interactions

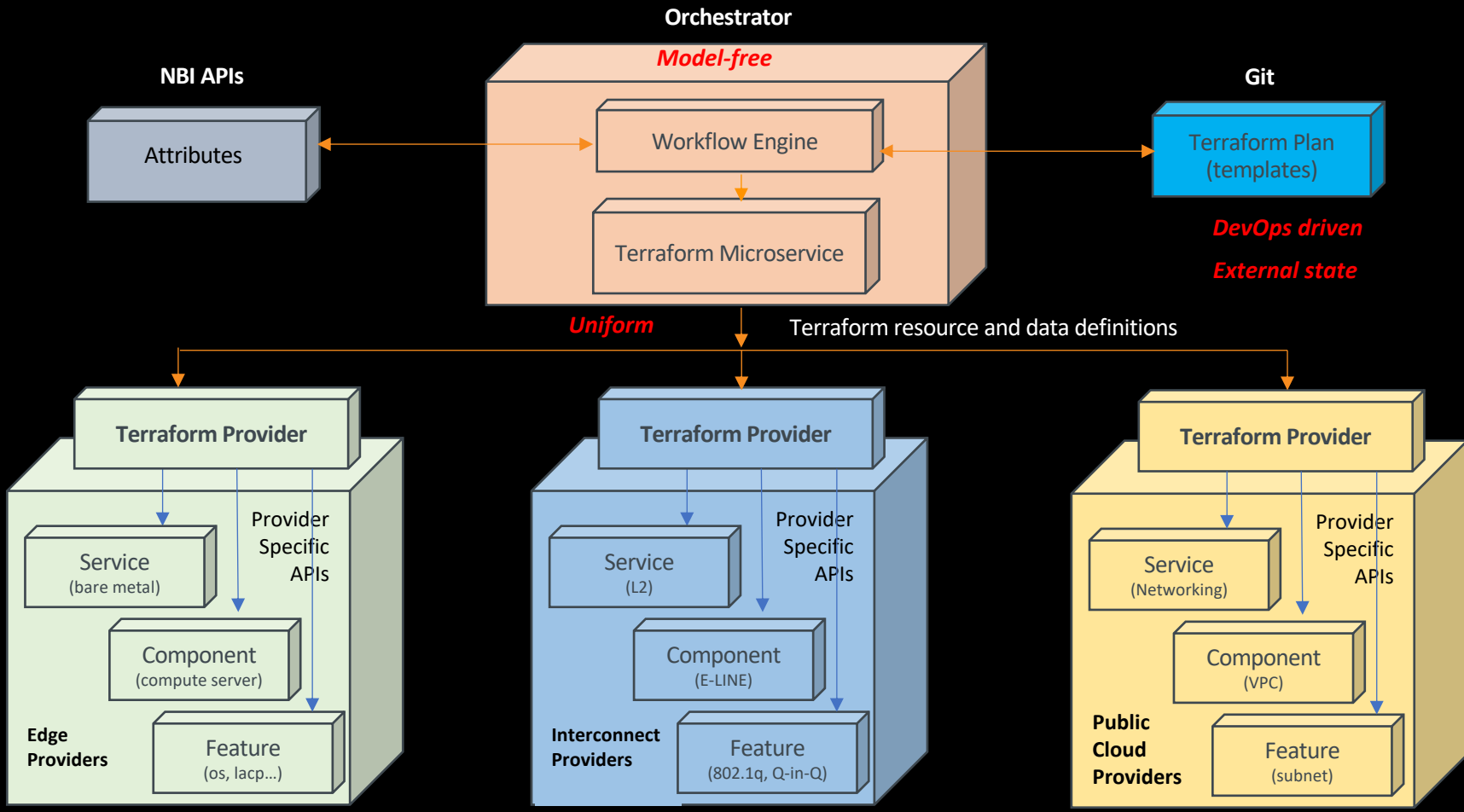


- **Orchestration (O):** Automation and sequencing of deployment and/or provisioning steps. Orchestration may take place between the PCC service and PCE components and/or between an Orchestrator such as the PCEI Enabler and PCC or PCE.
- **Control (C):** Control Plane messaging and/or management interactions between the PCC service and PCE components.
- **Data (D):** Data Plane messaging/traffic between the PCC service and the PCE application.

# High-Level PCEI Architecture

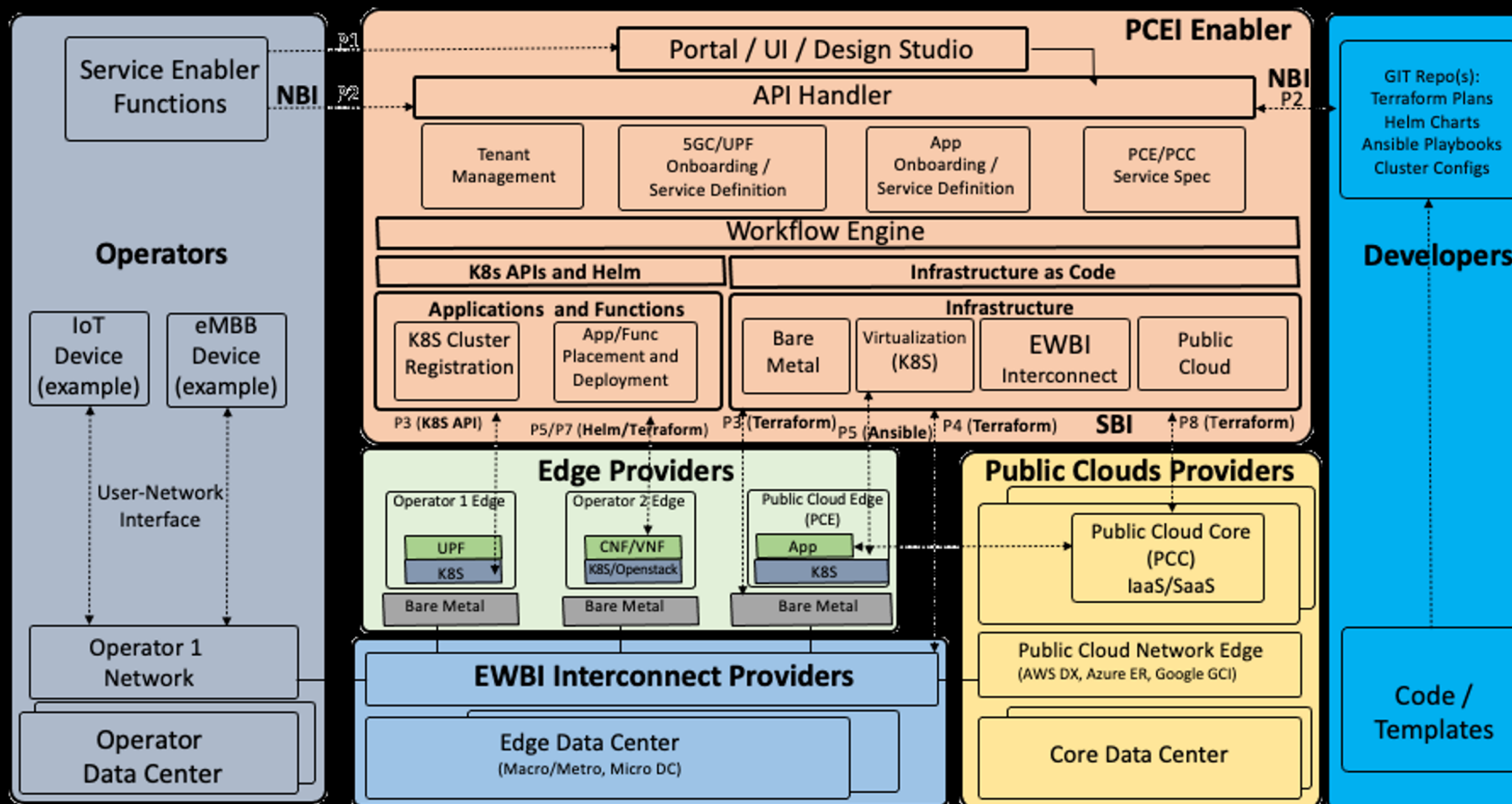


# Orchestration with Infra-as-Code



- **Uniform** - use of the same infrastructure orchestration methods across public clouds, edge clouds and interconnection domains.
- **Model-free** – the orchestrator does not need to understand the details of the individual infrastructure domains (i.e., implement their models). It only needs to know where to retrieve the Terraform plans for the domain in question and execute the plans using the specified provider.
- **External state** – the state of infrastructure resources created by the orchestrator is stored outside of the orchestrator itself, making it stateless with respect to the infrastructure
- **DevOps driven** – the Terraform plans can be developed and evolved using DvOps tools and processes.

# PCEI Release 5(+) Overview



## ❑ NBI APIs

- ❑ GIT Integration
- ❑ Dynamic Edge Cluster Registration
- ❑ Dynamic App Helm Chart Onboarding
- ❑ Automatic creation of Service Instance in EMCO and deployment of Apps
- ❑ Automatic Terraform Plan Execution

## ❑ Workflow Engine

- ❑ Camunda

## ❑ Integrated Terraform Plan Executor

- ❑ Azure (PCC)
- ❑ AWS (PCC)
- ❑ Equinix Fabric (Interconnect)
- ❑ Equinix Metal (Bare Metal Cloud)
- ❑ Openstack (3PE)

## ❑ Equinix Fabric Interconnect

## ❑ Multi-Public Cloud Core (PCC) Orchestration

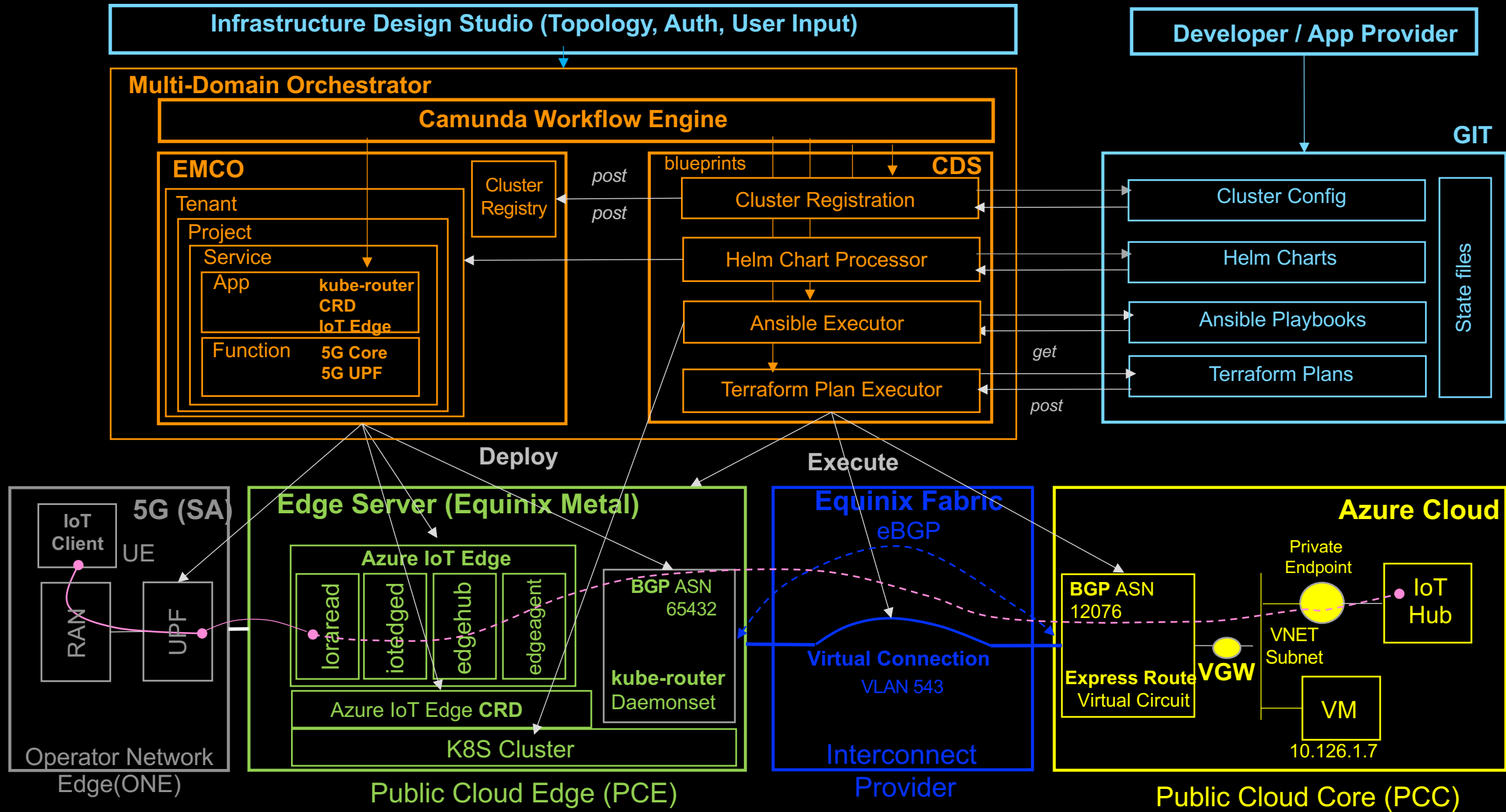
## ❑ Kubernetes Edge

## ❑ Openstack Edge

## ❑ Cloud Native 5GC and UPF Deployment



# DevOps Multi-domain Infra Orchestration: PCIe demo





Who Is Equinix?

# Who Is Equinix

Equal access, neutrality and interconnection



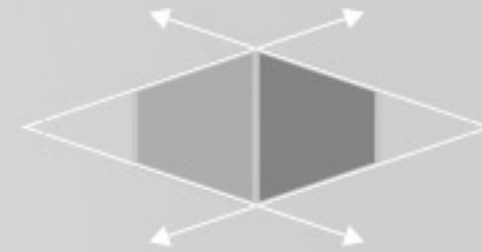
DESTINATION

STRENGTH

FORTRESS

PERSPECTIVE

CONNECTION



# History of Equinix

At the center of digital transformation for over 20 years

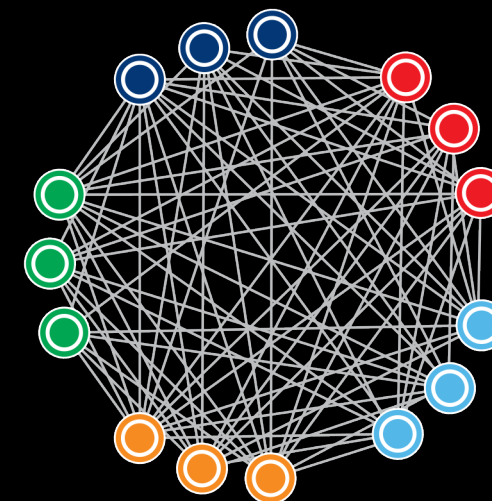
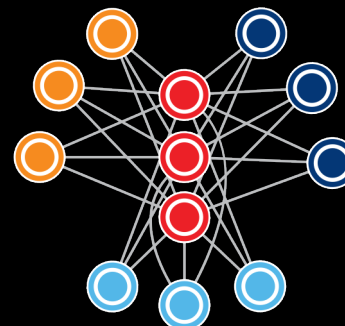
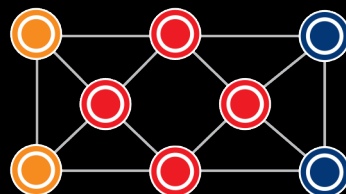
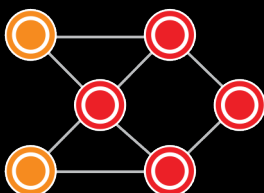
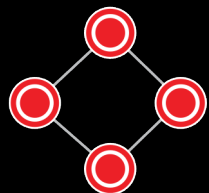
Networks

E-commerce and content

Exchanges

Clouds

Enterprises



INTERNET

WEB

ELECTRONIC TRADING

CLOUD

DIGITAL ECOSYSTEMS



# Equinix by the Numbers

Global infrastructure and exchange platform for digital business

**240+**  
Data Centers

**68**  
Metros

**25**  
Countries

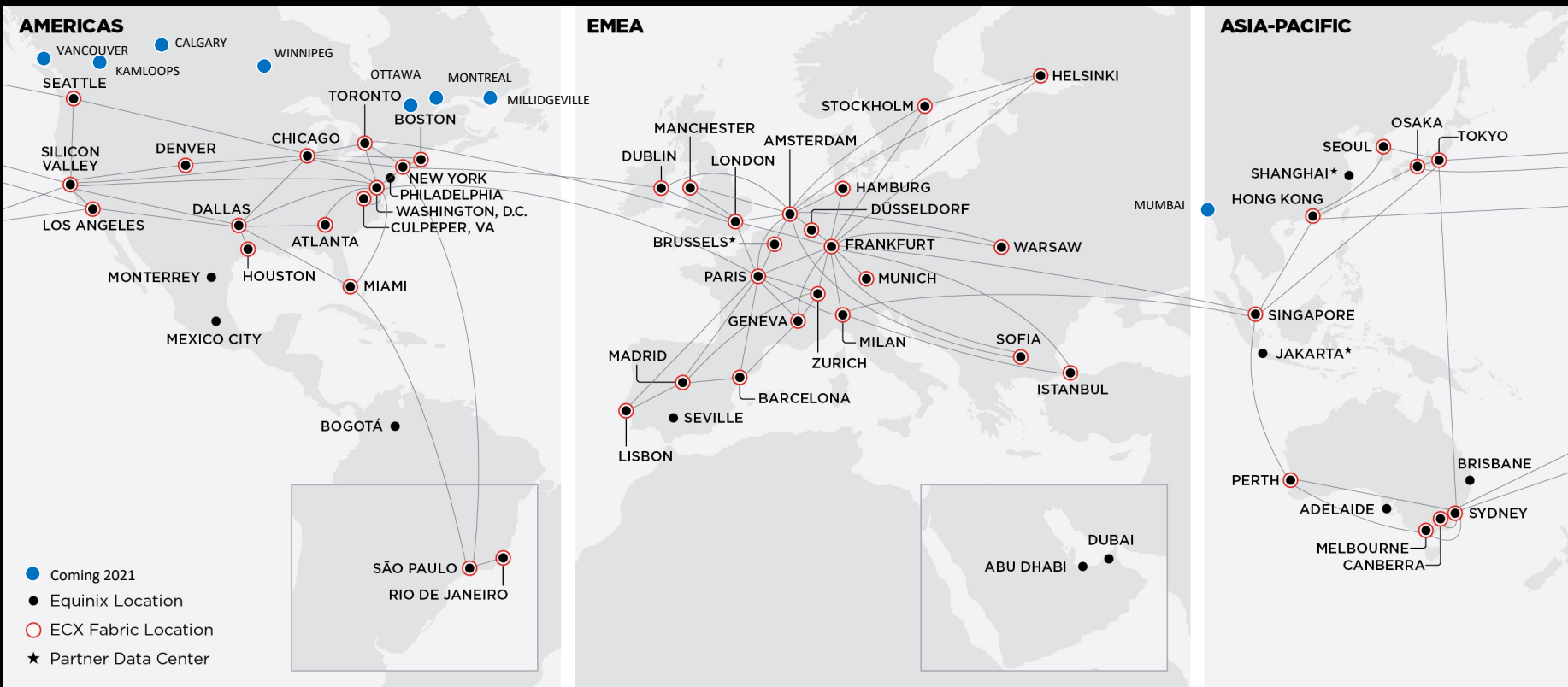
**5**  
Continents

**10,000+**  
Companies

**419,000+**  
Interconnections

**99.9999%**  
IBX Uptime

IBX: International Business Exchange (DC)



## Ecosystems

- 1,800+ Networks
- 650+ Media & Entertainment
- 1,250+ Financial Services
- 2,900+ Cloud & IT
- 3,000+ Enterprises

## Edge Services

- Network Edge (NFV)
- Bare Metal (BMaaS)

## Interconnection

- Equinix Fabric (SDN-enabled)
- Internet Exchange (12.6+ Tbps)

## Strategic Locations

# Building Ubiquitous Edge with Platform Equinix



## Infra Orchestration



APIs



Terraform



Portals



## Edge Services



Network  
Edge



Bare  
Metal



Precision  
Time



## Interconnection Services



Cross  
Connects



Equinix Internet  
Exchange™



Equinix  
Connect



Equinix  
Fabric™



## Data Center Services



Edge  
Data Centers



IBX®  
Data Centers

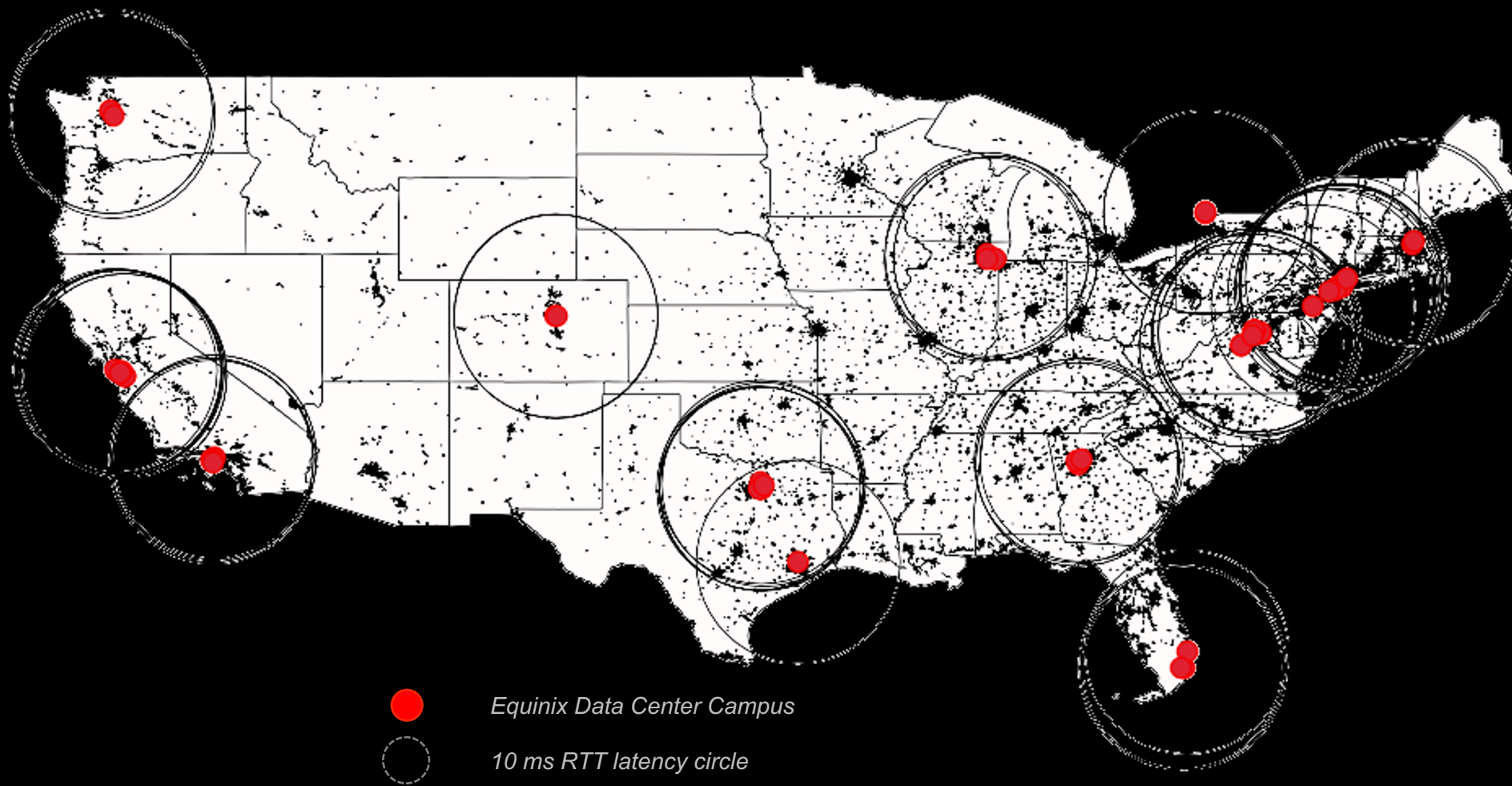


xScale™  
Data Centers



# We Can Start Making 5G Real Now

80% of U.S. urban/metropolitan population is within 10 ms RTT from Equinix data centers



● Equinix Data Center Campus  
○ 10 ms RTT latency circle

DEVICE EDGE

FAR EDGE

MICRO EDGE

MACRO EDGE

CORE CLOUD

Latency 0 – 1 ms

1 – 5 ms

5 – 10 ms

10 – 50 ms

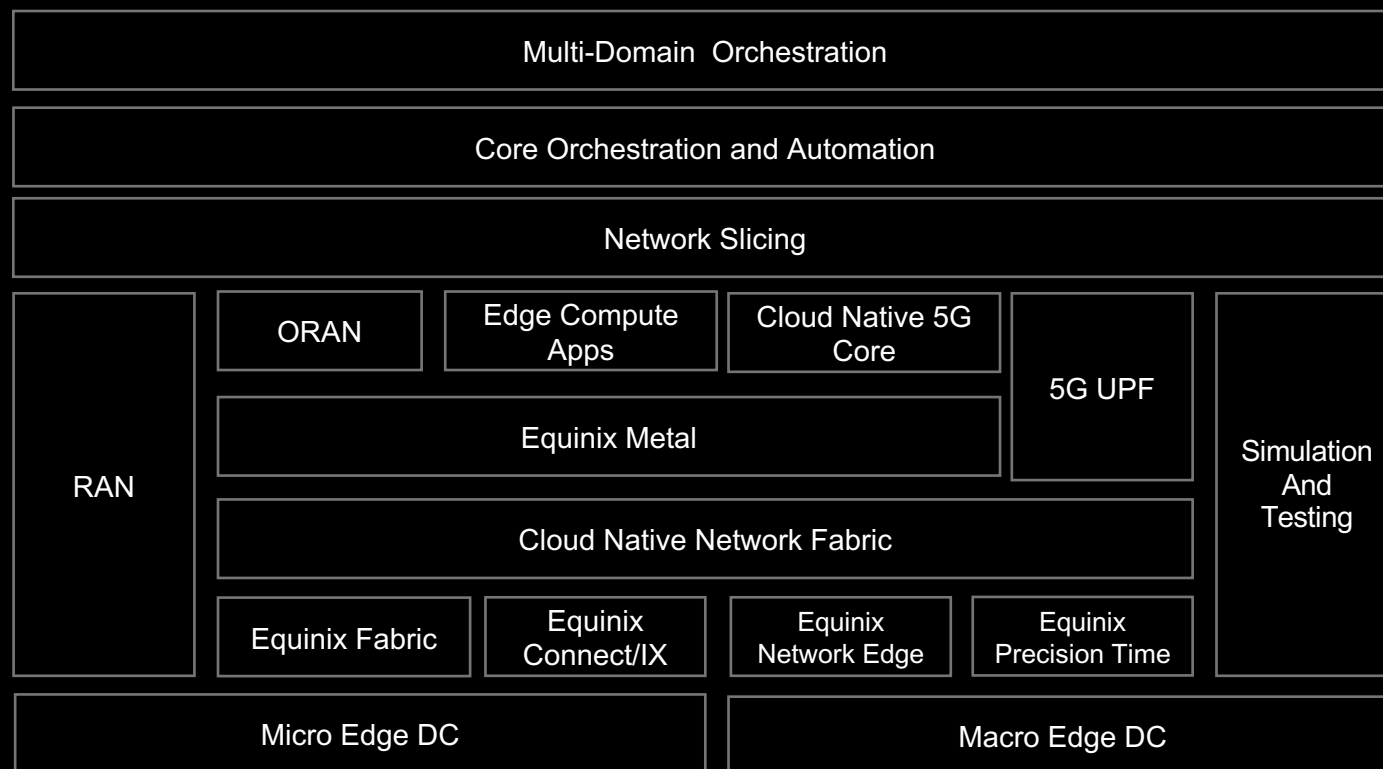
50 – 100 ms

# Call for Collaboration (Better Together)

Industry engagements – 5G and edge

- **Equinix 5G and Edge Technology Development Center**

- Develop 5G and edge architectures leveraging ecosystems already in place at Equinix
- Explore hybrid multicloud interconnectivity scenarios between MNOs, public clouds and private infrastructures
- Develop multiparty business models, partnering strategies and go-to-market motions for 5G and edge market







# Call for Collaboration (Better Together)

Industry engagements – open-source & developer community

- **LF Edge** – The Linux Foundation
  - Premier member (top-level membership)
  - Governing Board member
  - Technical Steering Committee Co-Chair of Akraino project
  - Technical lead for Public Cloud Edge Interface blueprint
- **LF Networking** – The Linux Foundation
  - Silver member (standard membership)
- **CNCF** (Cloud Native Computing Foundation) – The Linux Foundation
  - Gold member (2<sup>nd</sup>-top-level membership)
  - Governing Board member





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