

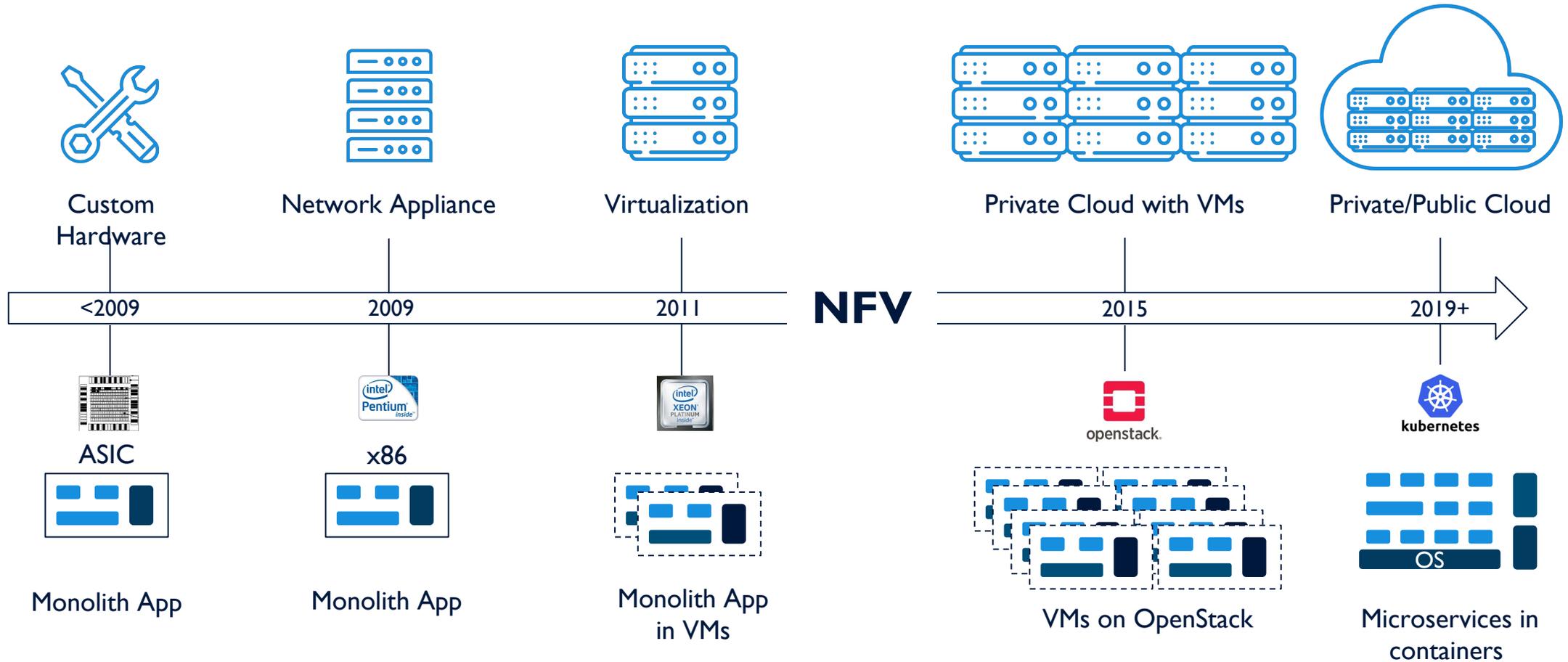
# E2E 5G Cloud Native Network

Heather Kirksey, VP, Community & Ecosystem, *Linux Foundation*

Azhar Sayeed, Chief Architect, *Red Hat*

Fu Qiao, Technical Lead, *China Mobile*

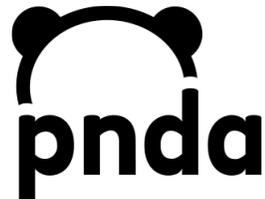
# NFV Cloud Journey



# LF Networking Leads Modern Networking Innovation



**70% of the world's mobile subscribers represented by LFN membership**



# Ecosystem Partners



**OPNFV**

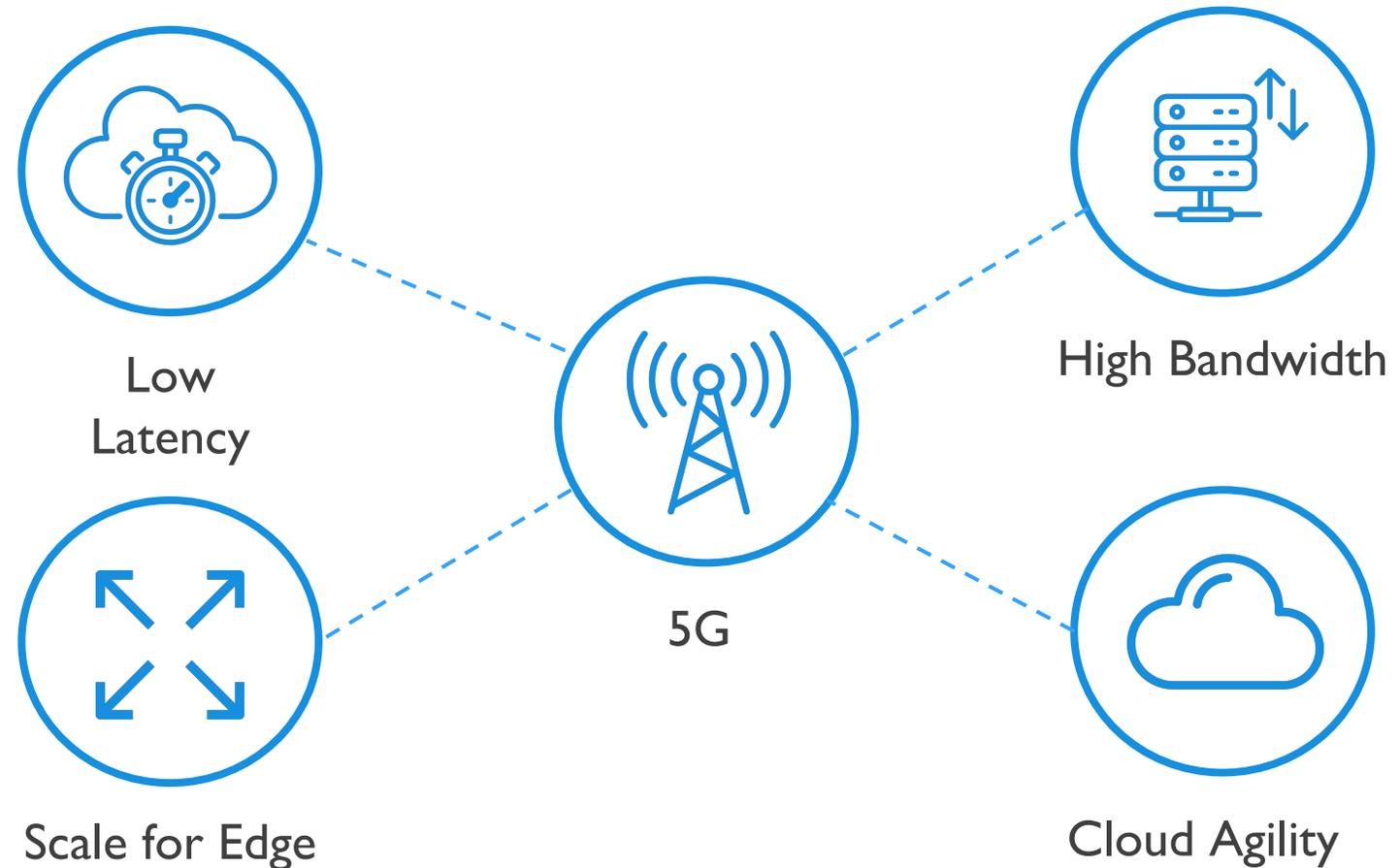


# What is 5G?

- › 50 5G commercial networks in 27 countries\*
- › Global market for 5G technology will reach \$667.90 billion by 2026\*\*

\*5G - 50 5G Commercial Networks – November Snapshot, GSA)

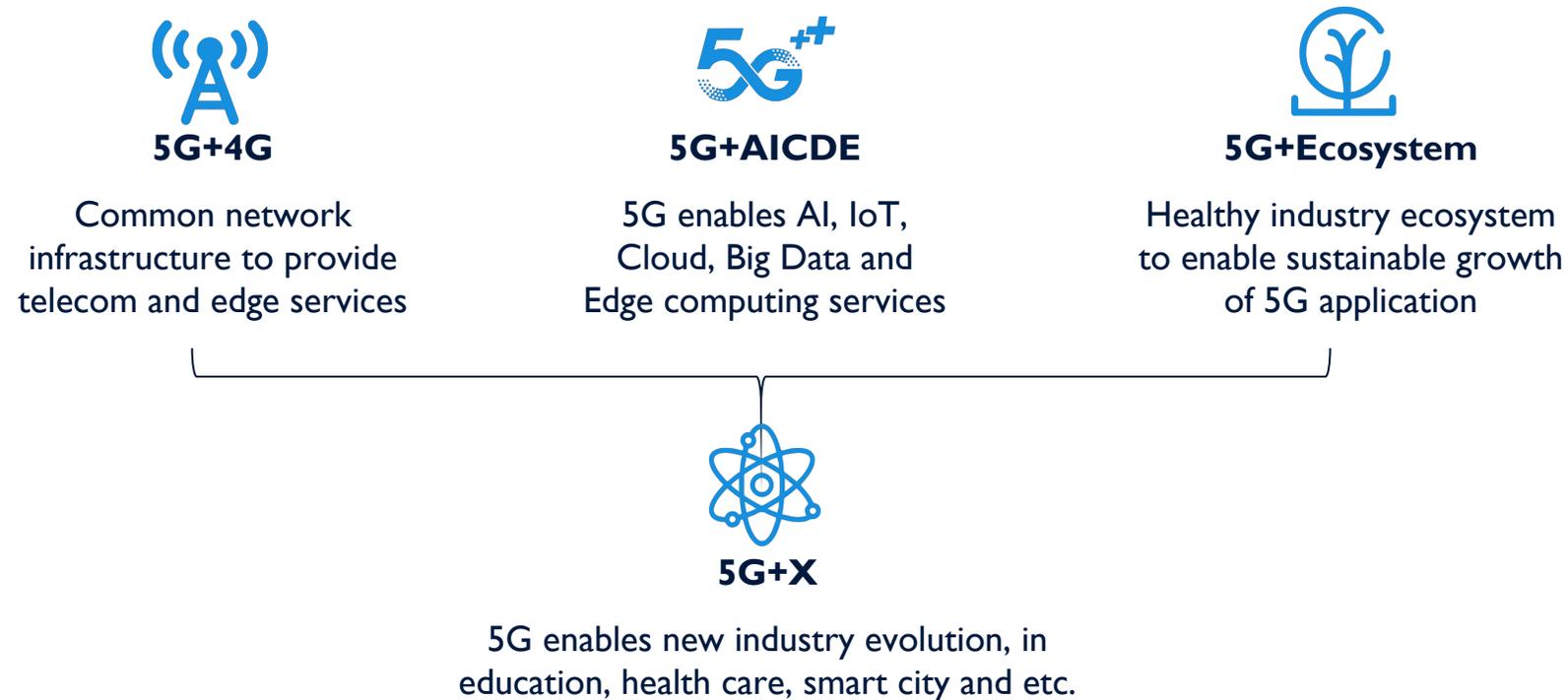
\*\*Big Market Research



# Use Case: 5G and Cloud in China Mobile

China Mobile began 5G commercial service on Oct. 31 in 50 cities

5G is not only a new generation of communication, but also innovation and transformation of Telco technology



# 5G Architecture Based on Cloud Native

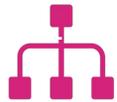
**Globally Scheduled**  
Resource



**Biggest NFV Cloud**



**SBA/Cloud Native/Slicing**



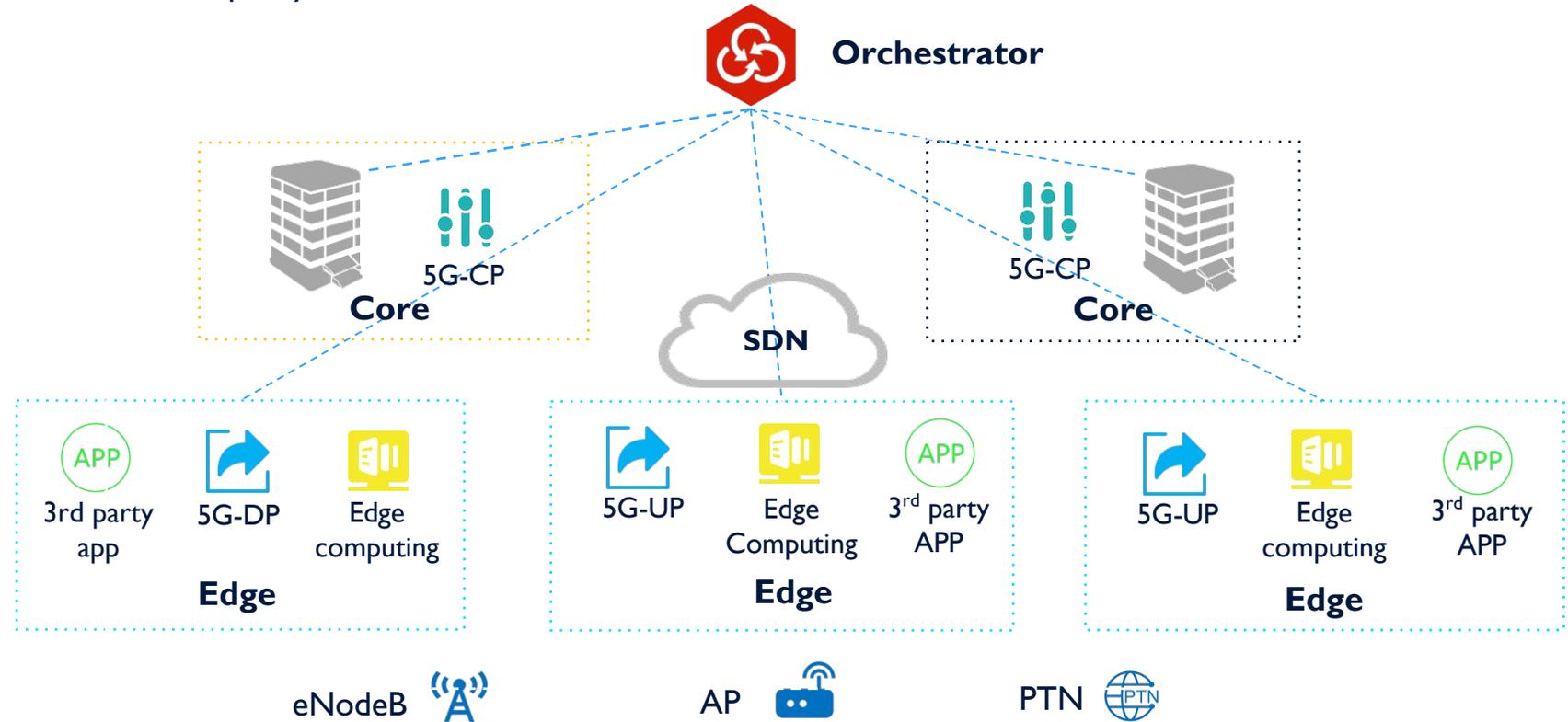
**Orchestration based on ONAP**

**Elastically scalable**  
Capacity

**Flexible Tuning**  
Structure

**Fast deployed**  
Services

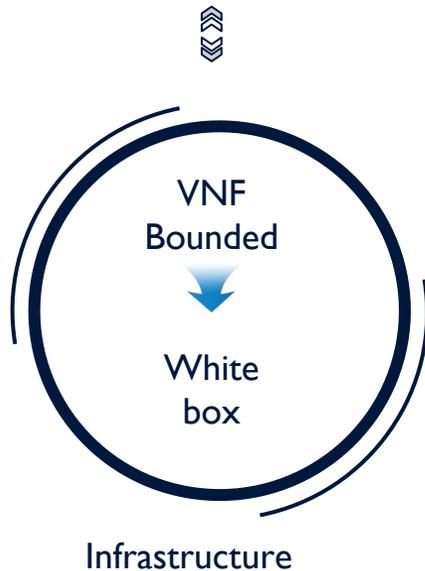
**Fully open**  
PaaS



# Major Challenges for 5G

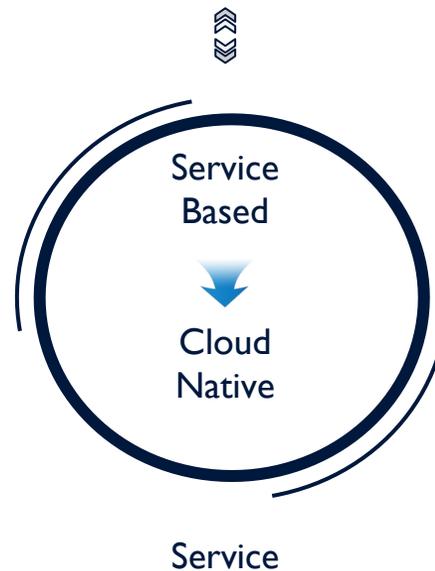
## Insufficient Decoupling

New soft 'silo' for Vendors



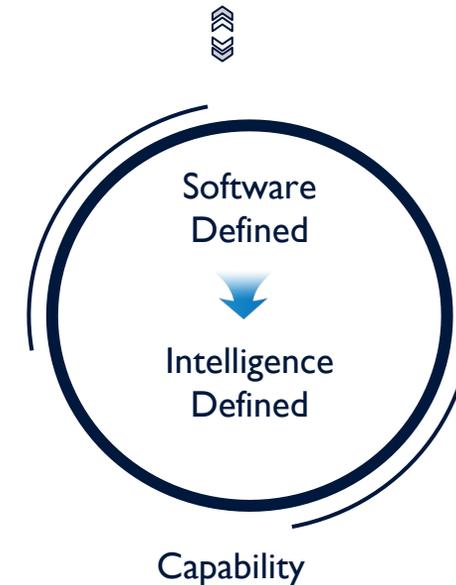
## Insufficient SBA

Lack of common service at the PaaS level



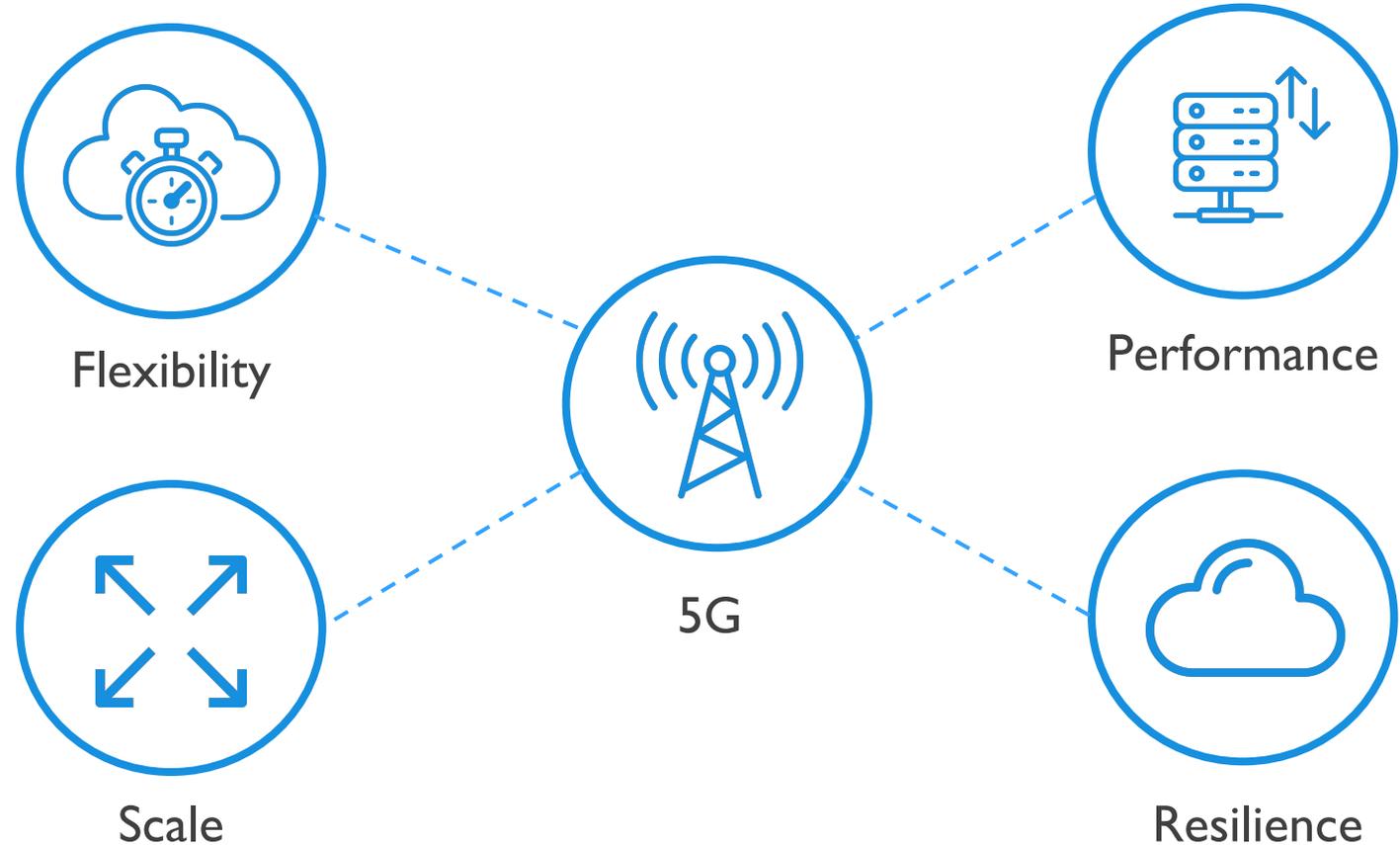
## Insufficient Operation

Lack of automatic and intelligent operation with the increase of complexity of network



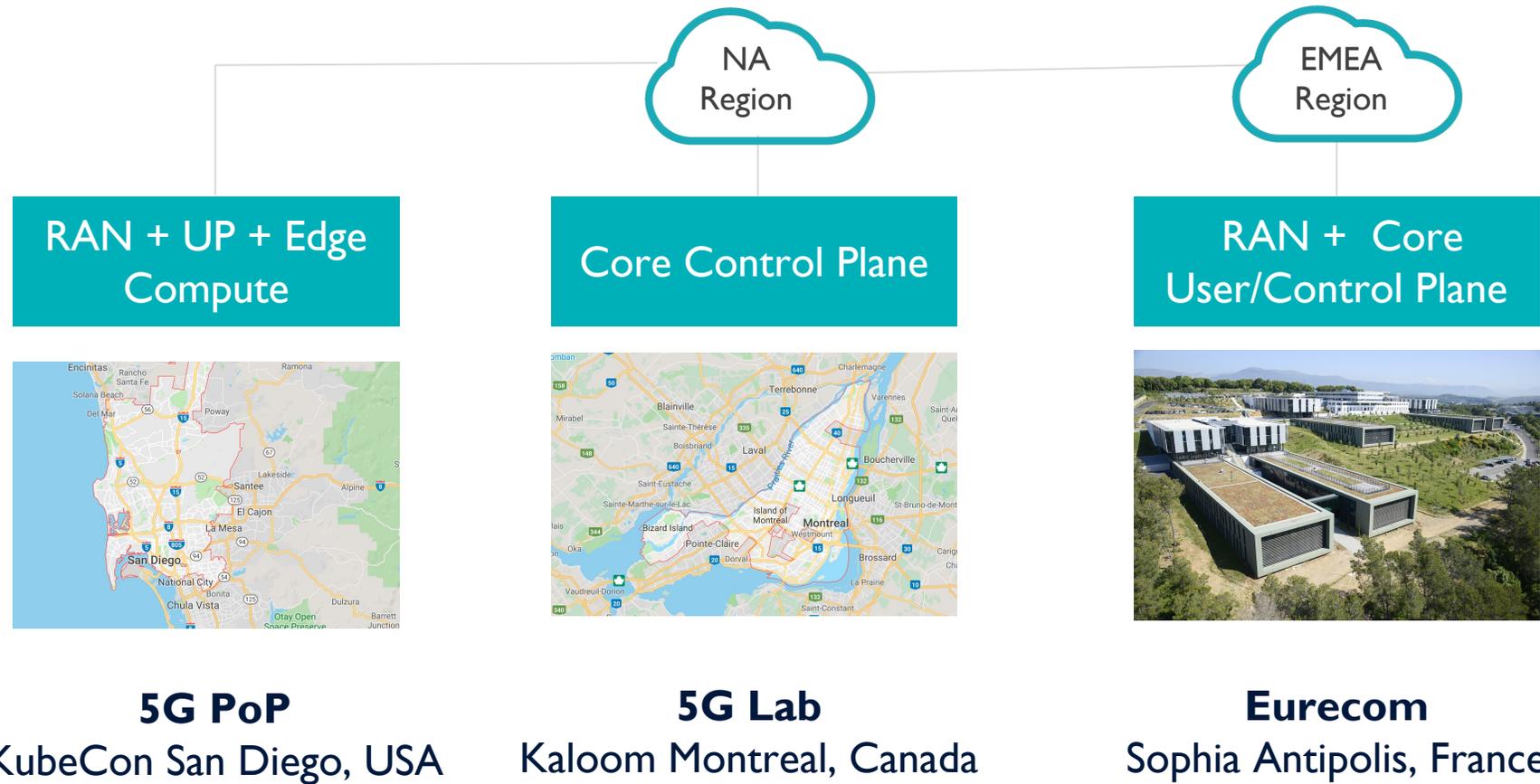
# Why Cloud Native for 5G?

- › Common Infrastructure for applications and the network
- › Lifecycle management and cloud operational models
- › Ecosystem of applications and vendors for new services

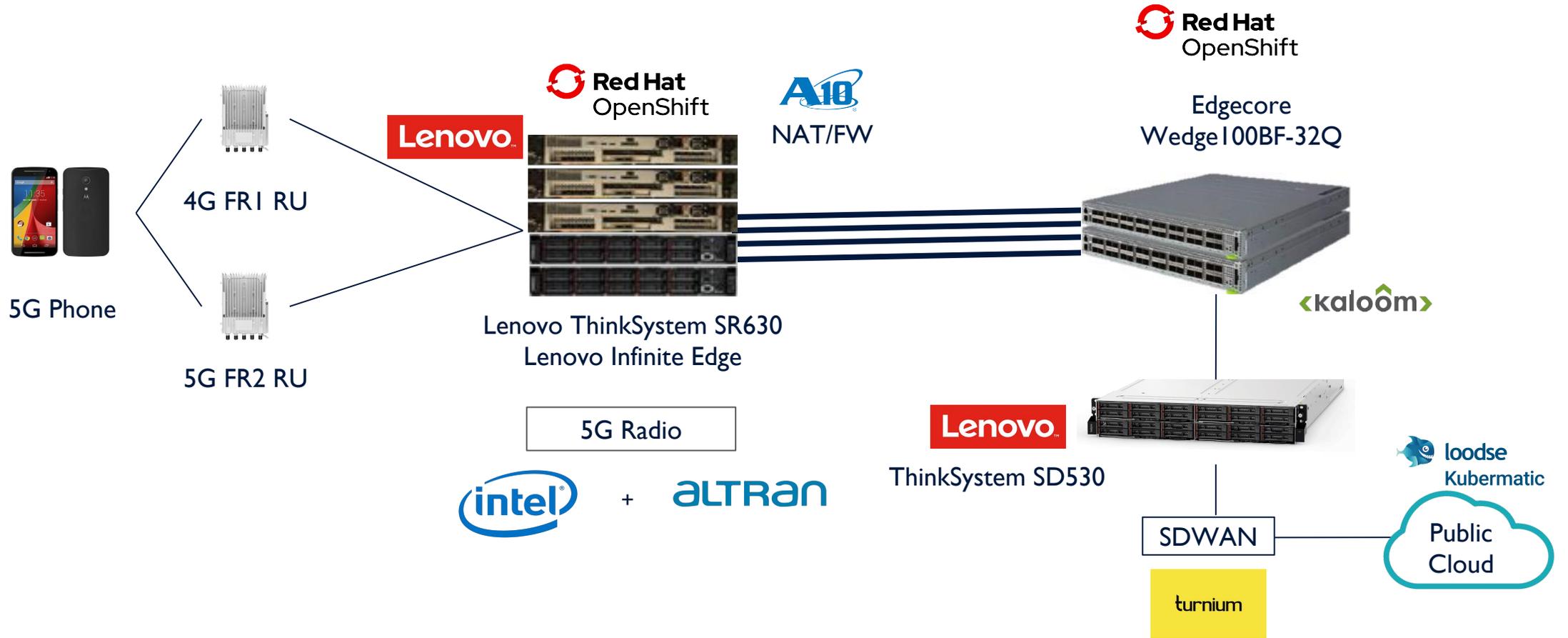


# High Level POC Network

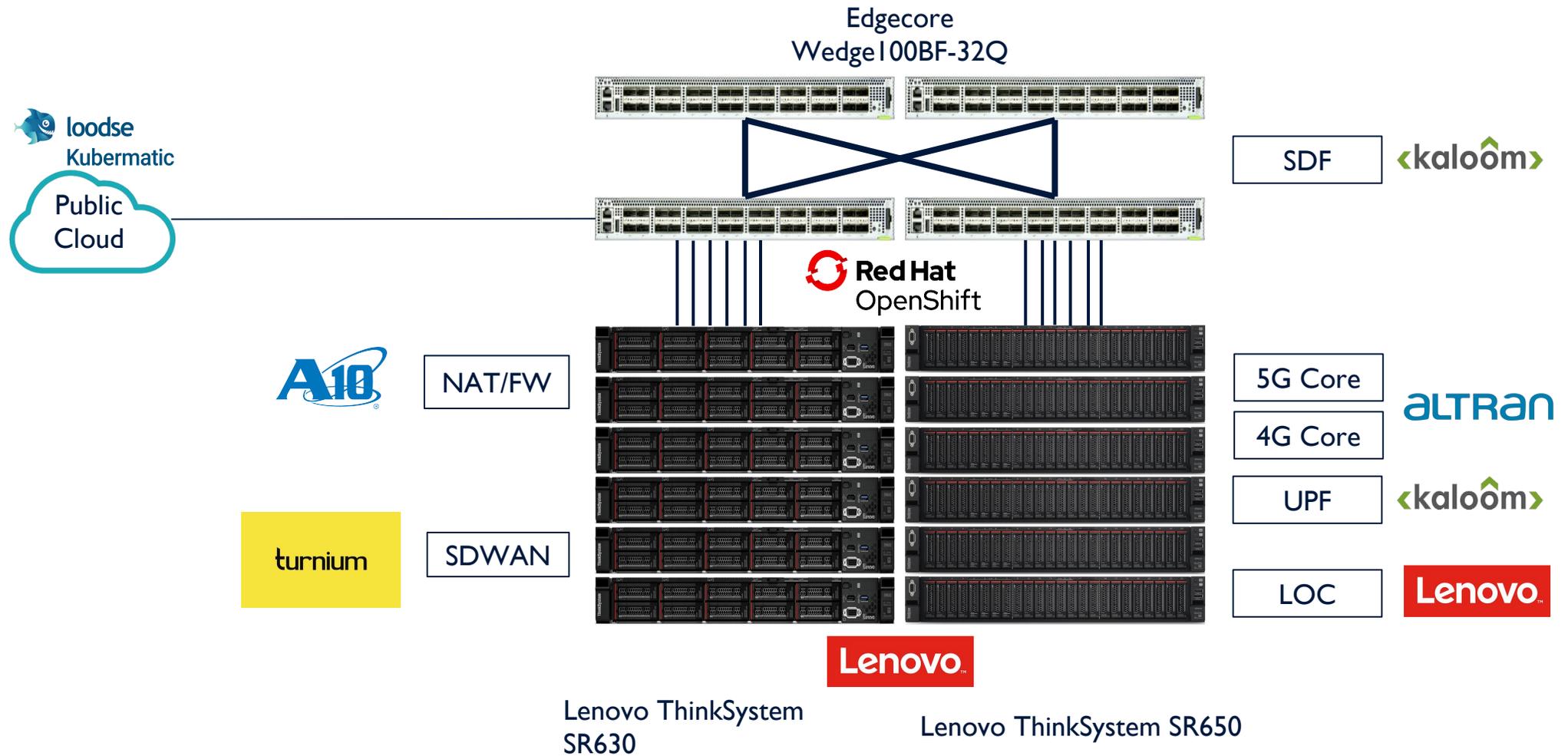
## End to End Setup



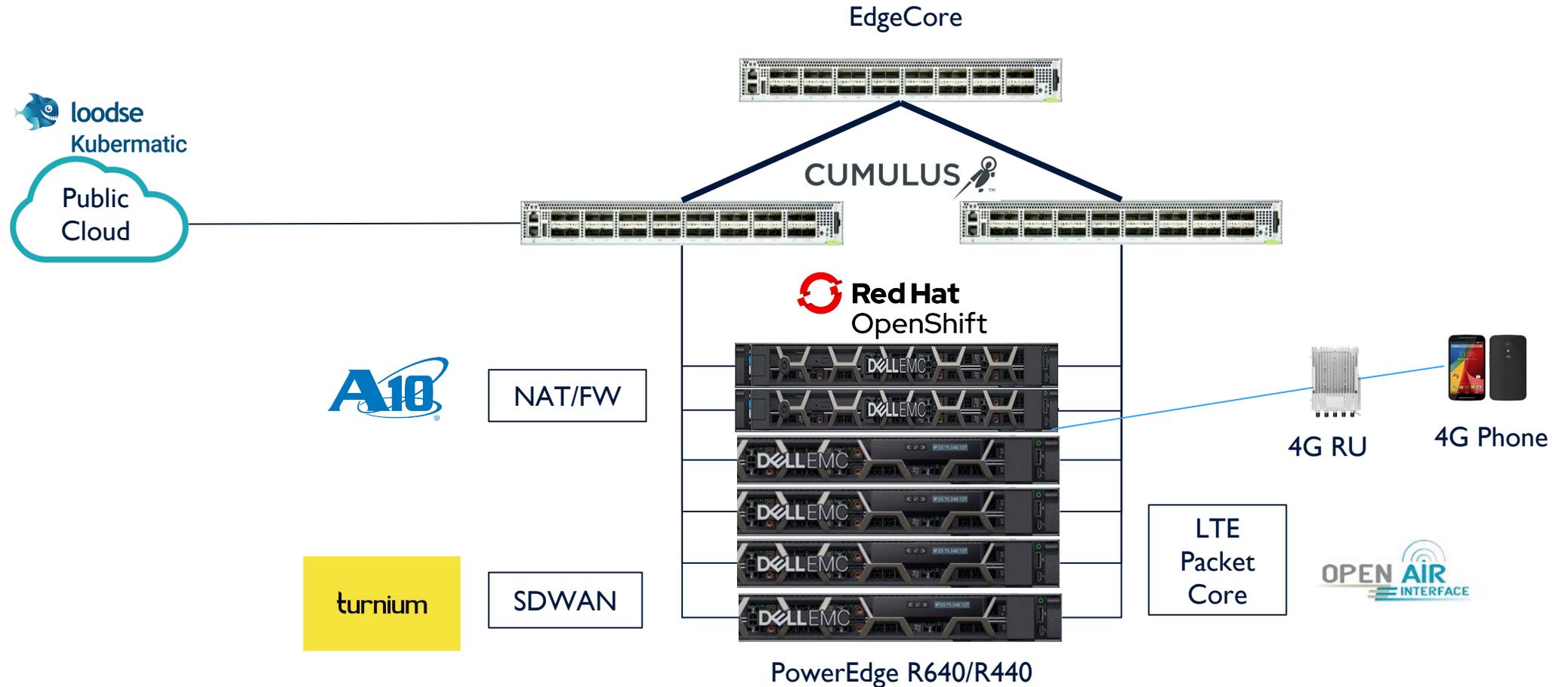
# 5G RAN + Edge Compute - San Diego



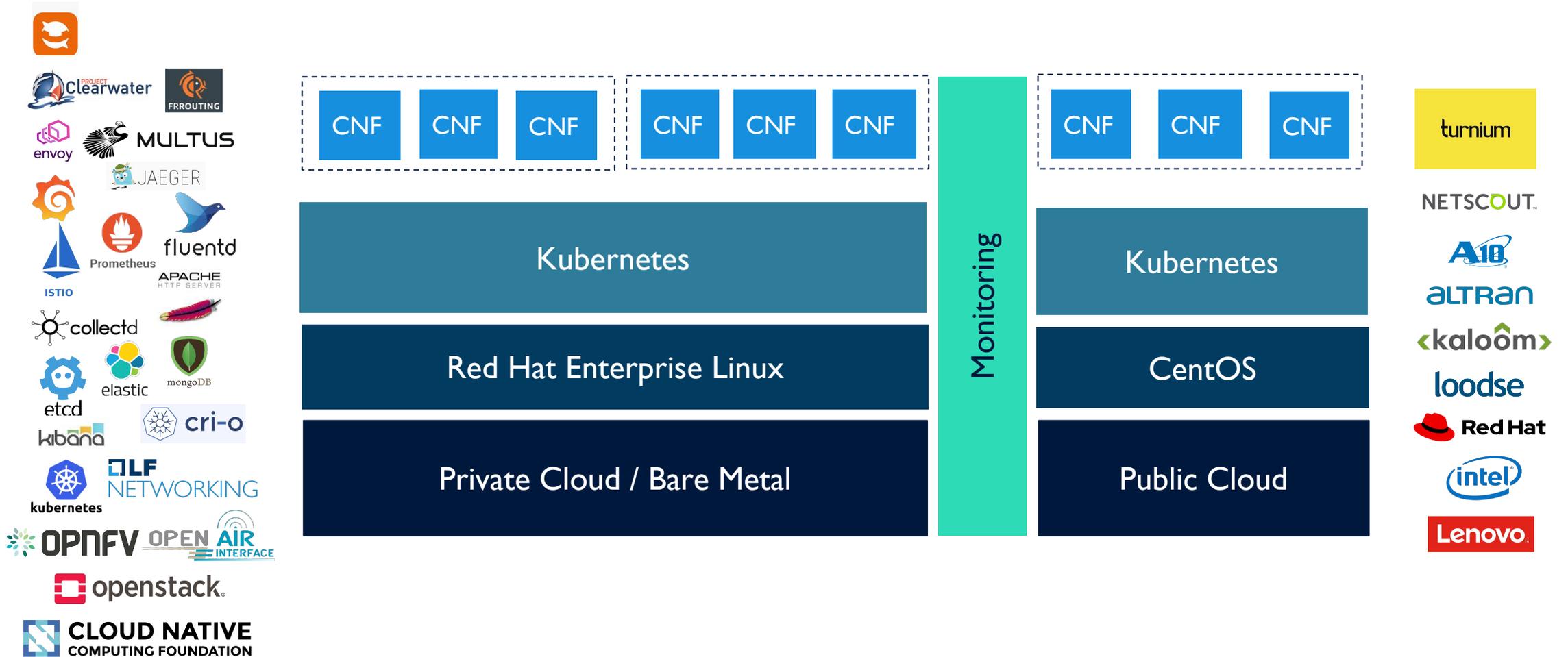
# 5G Core - NSA - Montreal



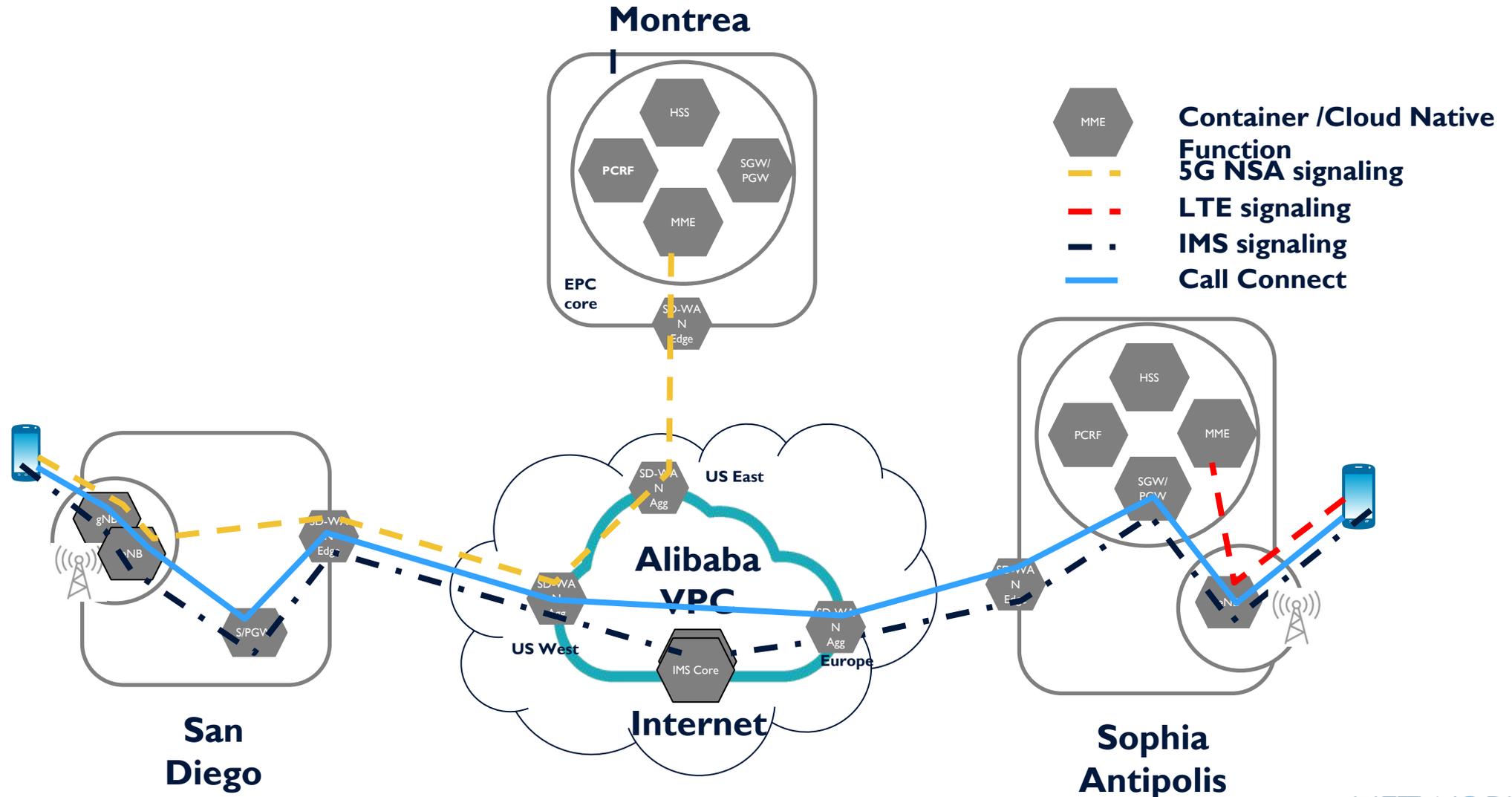
# 5G RAN & EPC - NSA - Sophia Antipolis, France



# Software Stack



# Cloud Native Mobile Network



# Lessons Learned & Gaps

## › **Kubernetes and Cloud Native 5G Components**

- › Standard Interfaces: CNF Descriptors
- › HW performance and acceleration: exposing FPGA, GPU and other capabilities
- › Networking IPv6 for everything
- › Networking: Protocol support for SCTP, PTP, sub-us-time synchronization
- › Networking: Exposing secondary network interfaces
- › k8s Operators: Best practices and Lifecycle Management
- › CNF Design: Network Function refactoring guidelines with regard to state management

## › **Operations**

- › Radiating frequencies
- › Special configurations
- › Multi Cloud Managers

## › **Technology Readiness for Cloud Native 5G**

- › Handsets
- › Radio Technology - Frequency Bands

## › **5G Code Maturity**

- › 5G RAN
- › 5G Core implementations

# LFN & Cloud Native 5G

- › OPNFV and CNTT
  - › Testing and integration project “the place to collaborate and test new initiatives”
  - › Compliance and Verification Programs for Infra and applications
  - › Barometer project providing platform metrics (telemetry)
  - › **Next Phase: Cloud Native Reference Architecture**
  - › **Next Phase: CNF Compliance Testing**
- › ONAP
  - › ONAP 5G use case blueprint shows how to automate 5G, and the ONAP4K8s profile shows how to use ONAP with CNFs/Kubernetes
  - › **Next Phase: Full 5G automation with network slicing anticipated and full CNF/Kubernetes support**
- › ORAN
  - › WG6 and WG8 - Cloud Native Reference Implementations in ORAN-SC
- › FD.io
  - › **Next Phase: 5G UPF implementation**
- › LFN + CNCF TUG Collaboration
  - › CNF Testbed
  - › CI/CD and tooling automation

# How to Get Involved

- › Participate in LFN projects to advance cloud native capabilities: <https://wiki.lfnetworking.org/>
- › Join the CNNT Cloud Native Reference Architecture Work:  
<https://wiki.lfnetworking.org/display/LN/Common+NFVI+Telco+Task+Force+-+CNNT>
- › Define CNF Compliance and Verification Testing:  
<https://wiki.lfnetworking.org/pages/viewpage.action?pageId=25362538>
- › Engage with telecom networking requirements in k8s and CNCF networking projects
- › Drive future networking proofs of concept:  
<https://wiki.opnfv.org/display/OSDD/OPNFV+VCO+Demo+Discussion+Home>
- › Attend LF Networking Developer & Testing Forum:  
<https://events.linuxfoundation.org/events/lf-networking-ddf-plugfest-2020/>

# Learn More at KubeCon + CloudNativeCon NA

- › On the floor - Visit participant booths:
  - › A10 (S69)
  - › Red Hat (D1)
  - › Intel (D2)
  - › Lenovo (S100)
  - › Loodse (SE27)
- › Attend session about OAI open source RAN/core implementation:
  - › “Build Your Own Private 5G Network on Kubernetes”, Frank Zdarsky, Red Hat & Raymond Knopp, Eurecom, Wednesday, November 20 • 11:50am - 12:25pm, <https://sched.co/UaWZ>
- › Visit the E2E 5G Cloud Native Network Meeting Space (Sponsored by Red Hat)
  - › The Westin San Diego Gaslamp Quarter, Plaza Meeting Room, 2nd floor
  - › Today and tomorrow: 10:00 - 12:00 AM & 2:00 - 4:00 PM
  - › Email: [hgarciag@redhat.com](mailto:hgarciag@redhat.com)
- › Attend Common NFVI Telecom Taskforce (CNTT) Telecom User Group Meeting
  - › Today: 4:00-6:00 PM Meeting Room 2, Upper Level

# Proof Of Concept Partners



# Community Volunteers

Sara Alkokhon, *Bell Canada*

Saeid Hashemi, *Bell Canada*

Dan Bernier, *Bell Canada*

Fu Qiao, *China Mobile*

Sebastian Scheele, *Loodse*

Hareh Kheskani, *Loodse*

Tobias Hintze, *Loodse*

Bill Mulligan, *Loodse*

Moath Qasin, *Loodse*

Jonathan Harris, *Lenovo*

Chadie Ghadie, *Lenovo*

Hal Humrickhouse, *Lenovo*

Ahmed Murad, *Lenovo*

Chris Gu, *Lenovo*

Anand Gorti, *Lenovo*

Bin Zhou, *Lenovo*

Eric Chen, *Lenovo*

Jay Bryant, *Lenovo*

Dave Cain, *Red Hat*

William Caban, *Red Hat*

Hanen Garcia, *Red Hat*

Tom Nadeau, *Red Hat*

Ricardo Noriega, *Red Hat*

Yolanda Robla, *Red Hat*

Azhar Sayeed, *Red Hat*

Aaron Smith, *Red Hat*

Pasi Vaananen, *Red Hat*

Frank Zdarsky, *Red Hat*

Luis Aparicio, *Red Hat*

Francisco Mallado, *Red Hat*

Ajay Simha, *Red Hat*

Andrew Bays, *Red Hat*

Per Andersson, *Kaloom*

Adrian Stroila, *Kaloom*

Angelo Coluni, *Kaloom*

Martin Gignac, *Kaloom*

Rohit Mahadevan, *Kaloom*

James Oakley, *Turnium*

Josh Hicks, *Turnium*

Geoff Hultin, *Turnium*

Sandeep Panesar, *Turnium*

Ben Tremblay, *Turnium*

Brandon Cazander, *Turnium*

Sam Diep, *Intel*

Bryan Madden, *Intel*

Sunku Ranganath, *Intel*

Emma Collins, *Intel*

Dana Nehama, *Intel*

Damien Power, *Intel*

Michael Beadle, *Intel*

Aibhne Breathnach, *Intel*

Zhi Bin, *Alibaba*

Xuan Min, *Alibaba*

Chris Qiao, *Alibaba*

Rajat Gupta, *Altran*

Rajiv Gupta, *Altran*

Nilanjan Samajdar, *Altran*

Masood Amin, *Altran*

Abhishek Kumar, *Altran*

Mohammed A Khan, *Altran*

R. Ezhirpavai, *Altran*

Bhudev Sharma, *Altran*

Ravikanth Pasumarthy, *Altran*

Saurabh Kumar, *Altran*

Konstantin Dunaev, *A10*

Jim Capobianco, *A10*

Praveen Chandel, *NetScout*

Vikram Saksena, *NetScout*

Irfan Ghauri, *OAI*

Raymond Knopp, *OAI/EURECOM*

Valerie Chaubard, *EURECOM*

Florian Kaltenberger, *OAI/EURECOM*

Lionel Gauthier, *EURECOM*

Cedric Roux, *EURECOM*

Jean-Christophe Delaye, *EURECOM*

Raphael Defosseux, *OAI*

Rohan Kharade, *EURECOM*

Kai Xe, *Foxconn*

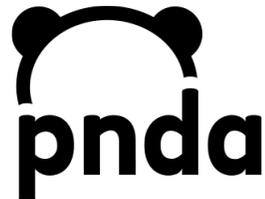
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THANK YOU

 THE **LINUX** FOUNDATION