M-CORD: Mobile CORD

- Enable 5G on CORD

ONOS Partnership

http://cord.onosproject.org/

CORD
Central Office Re-architected as a Datacenter

CORD Aims to Deliver to Service Providers

Economies of a datacenter

Infrastructure built with a few commodity building blocks using open source software and white boxes

Agility of a cloud provider

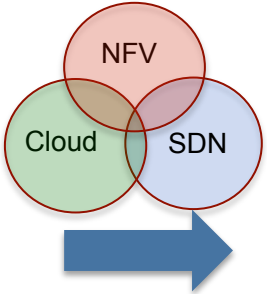
Software platforms that enable rapid creation of new services

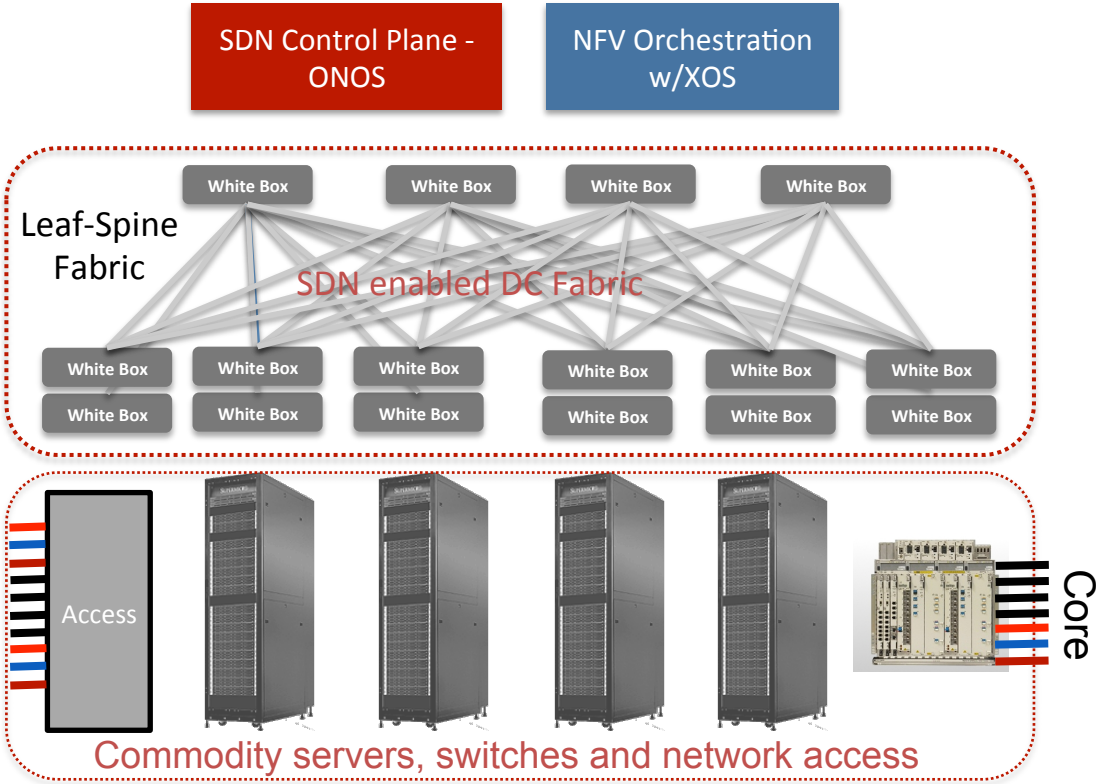
CORD: Central Office Re-architected as Datacenter

Large number of COs

Evolved over 40-50 years

300+ Types of equipment
Huge source of CAPEX/OPEX





M-CORD Drivers = Operator Challenges

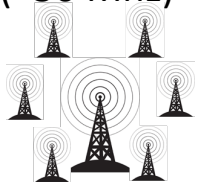
In the last 5 years

100,000%

Increase in Wireless Data Traffic

$50 Billion

Spectrum investment (~50 Mhz)



$5 Billion

LTE System investment (RAN, EPC)

Slowing revenue growth

M-CORD Drivers: Operator Challenges

State of the infrastructure: Built with closed proprietary boxes

- Inefficient utilization including sub-optimal use of precious radio resources
- Inability to customize for various customers
- Slow in creating innovative services
- Cannot support industry-specific IoT scenarios

Mobile infrastructure needs re-architecting – To Enable 5G

M-CORD Objectives

✓ Enhance resource utilization, especially spectrum

- Real-time resource management
- Exploit multiple RATs
- Monitoring & Analytics framework

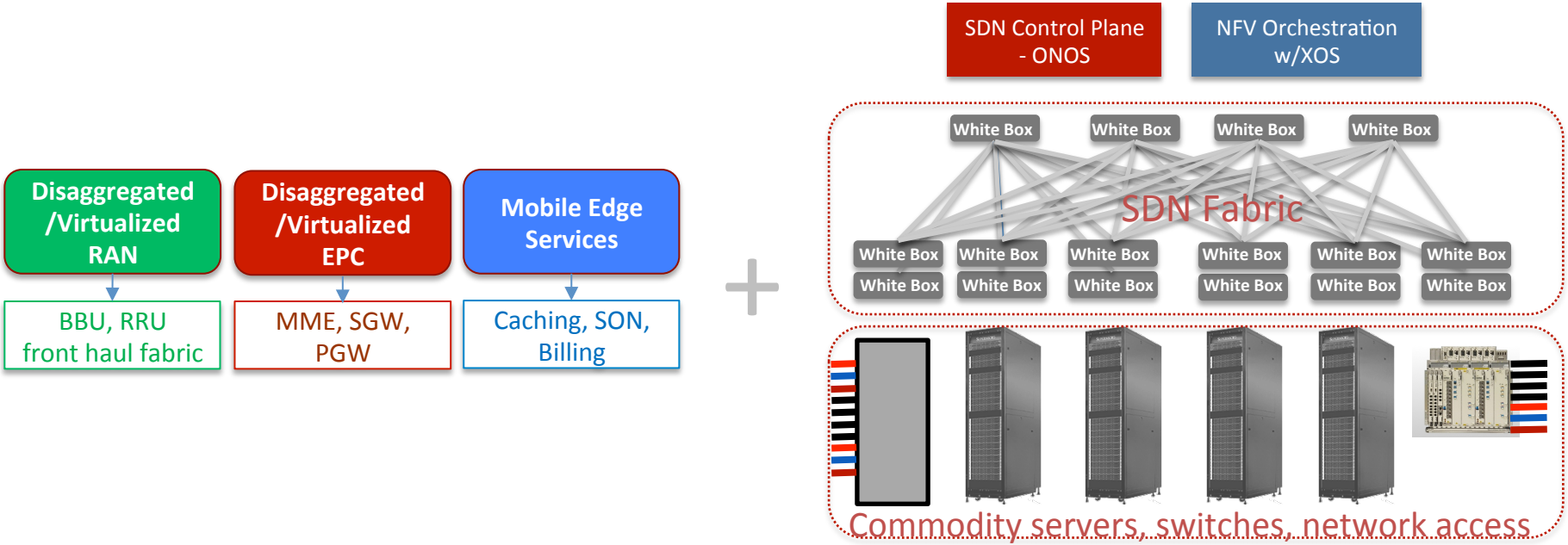
✓ Provide customized services and better QoE to customers

- Customized service composition
- Reduced latency and increased throughput
- Differentiated QoE based on service requirements

✓ Agile and cost-efficient deployment

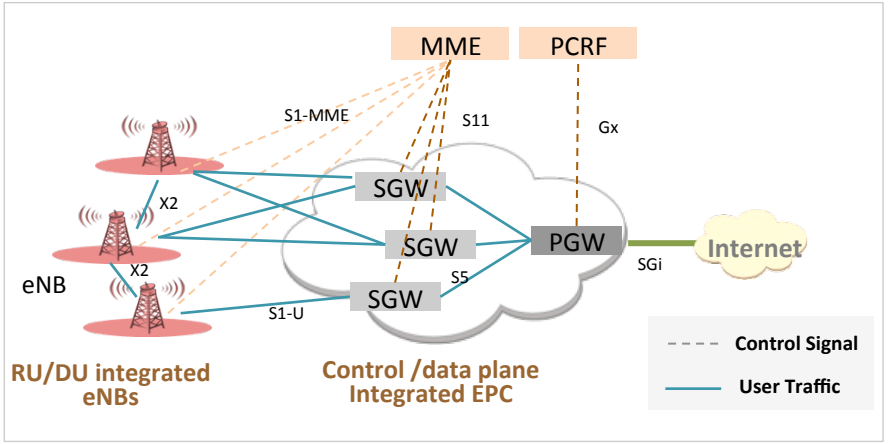
- On-demand deployment
- Virtualized /disaggregated RAN and EPC
- Commodity H/W and open source

M-CORD = Best of Mobile + CORD



Disaggregated/Virtualized RAN and EPC

Traditional Architecture



with proprietary boxes & solutions

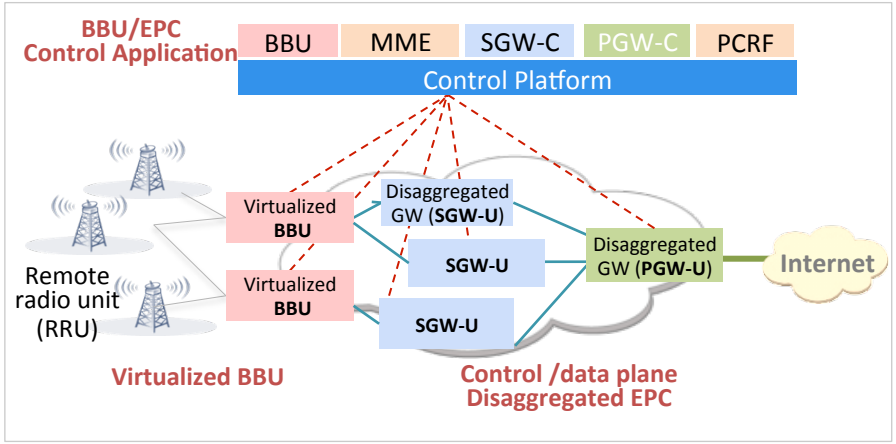
RU/DU integrated RAN

- Limited Scalability
- Inefficient coordination
- Sub-optimal spectrum usage
- High Cost

Control/data plane integrated EPC

- Limited scalability
- Discrete control
- Proprietary H/W for all-purpose
- High Cost

Target Architecture



with commodity H/W & open source/open API

Disaggregated & Virtualized RAN

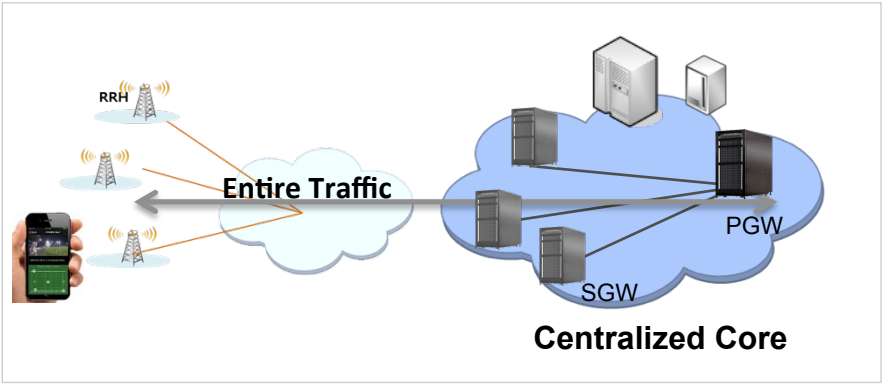
- High Flexibility & Scalability
- Centralized Coordination
- Spectrum usage optimization
- Reduced Cost

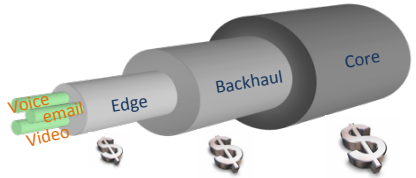
Disaggregated EPC

- Independent Scalability
- Centralized Control
- Choice of H/W best fits the SLA
- Reduced Cost

Mobile Edge

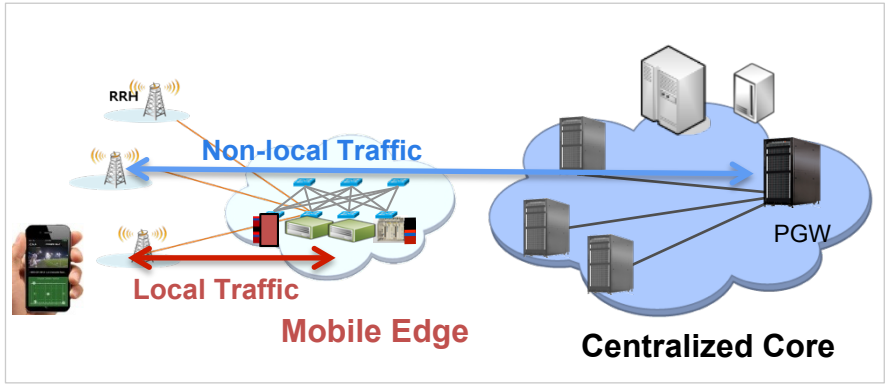
Traditional Mobile Service Processing





- Overload on backhaul, transport and core EPC
- Inefficient use of network resources
- Deterioration on QoE of the users
- Overprovisioning to handle peak traffic

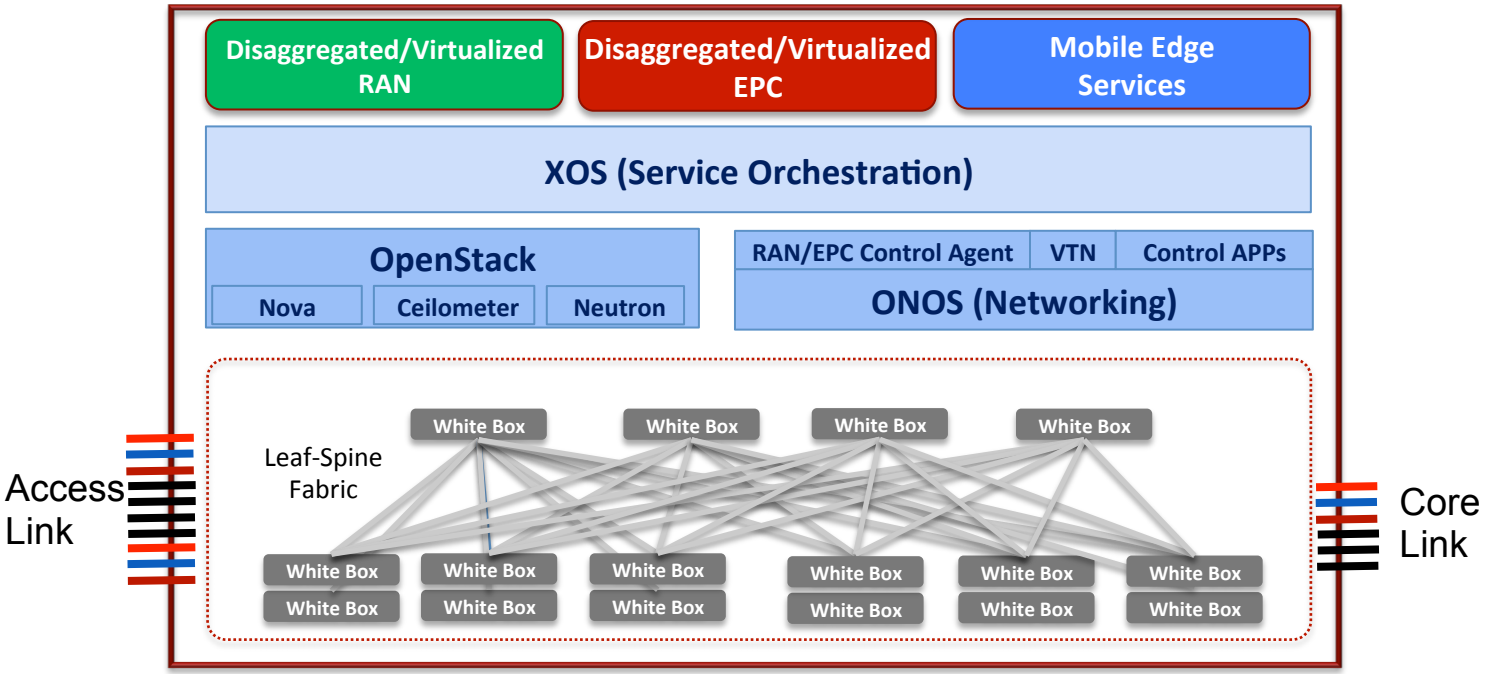
Mobile Edge Service Processing



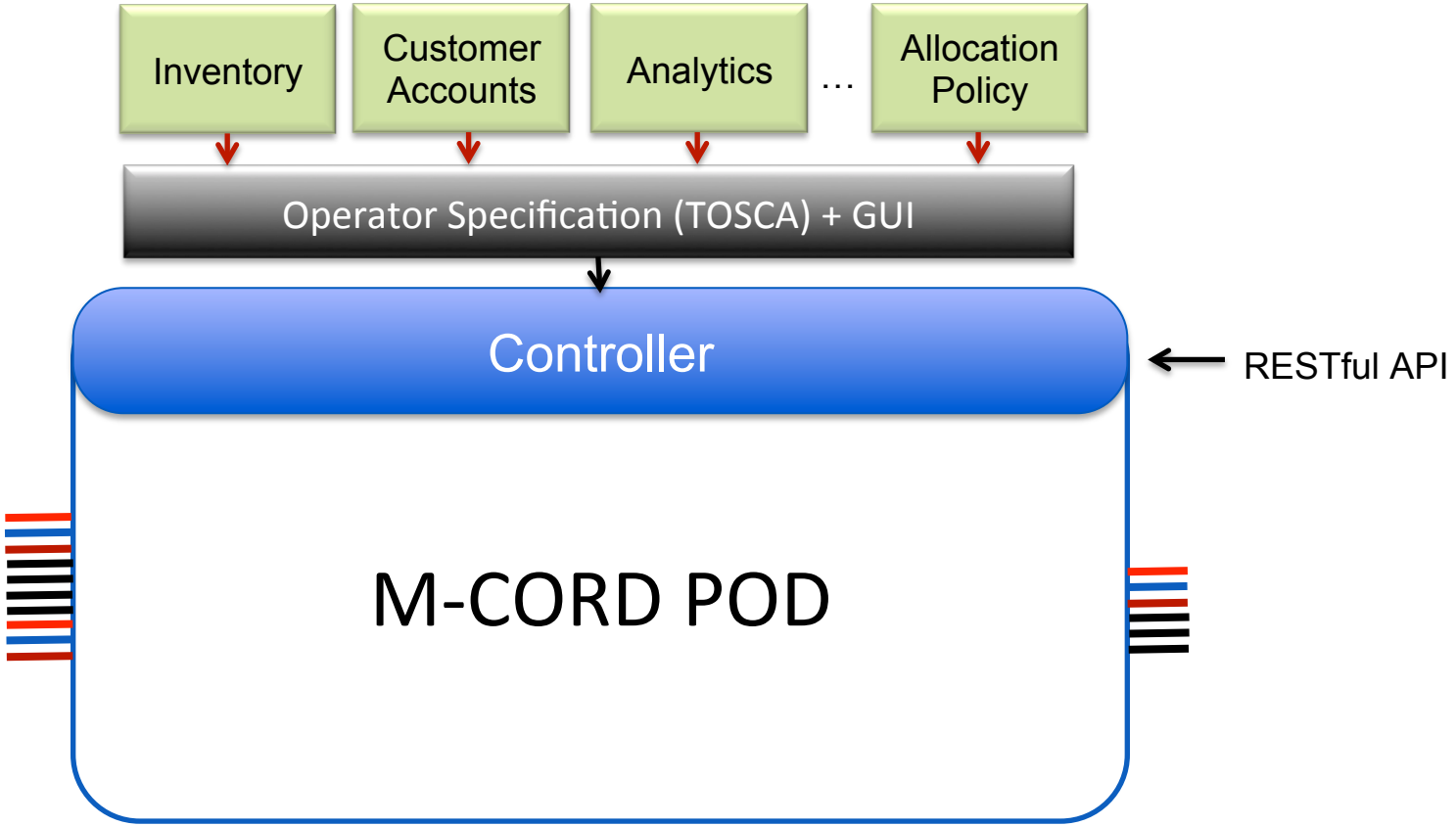
"Mobile edge, where operators can leverage their core competencies to overcome their limitations"

- Mobile edge's best advantage is 'Proximity to End Users'
- Services can be processed at mobile edge
- Suitable for customized services to target customers
- Net Result: Better efficiencies for operators and better QoE for users

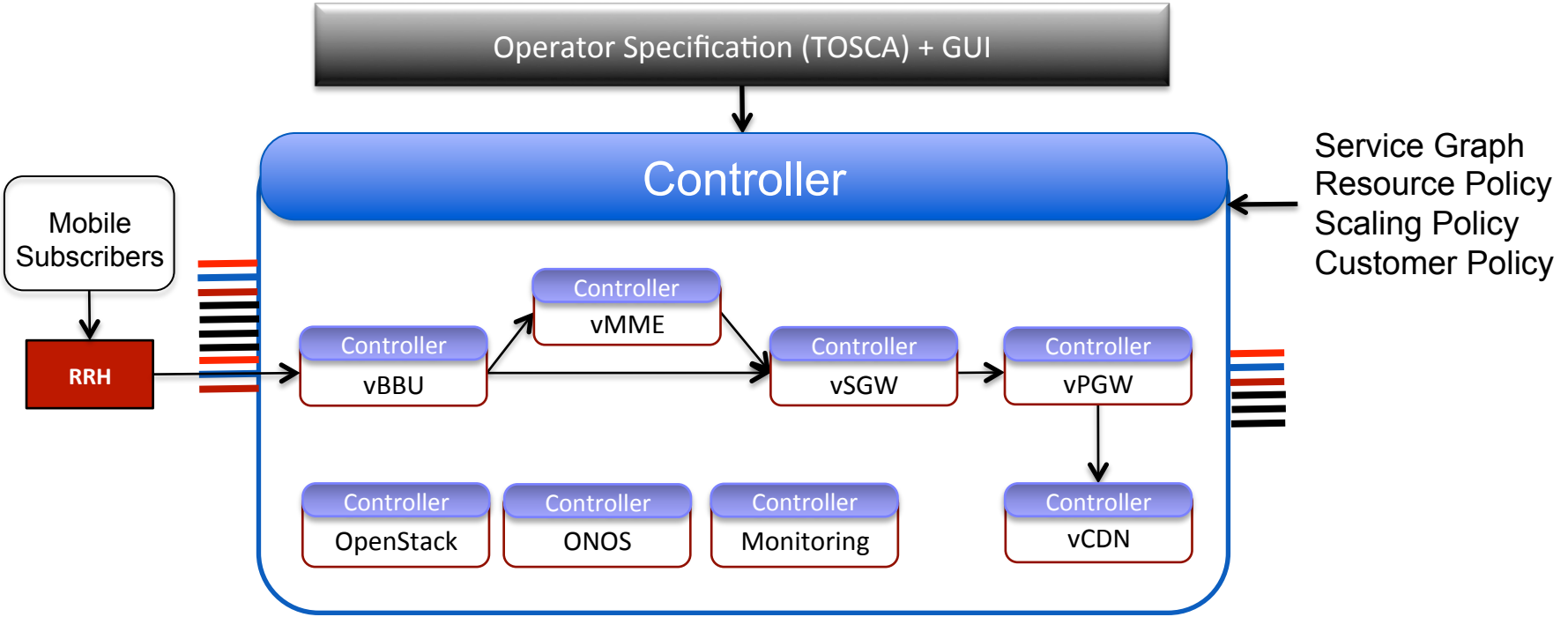
M-CORD Architecture Framework



M-CORD – External view

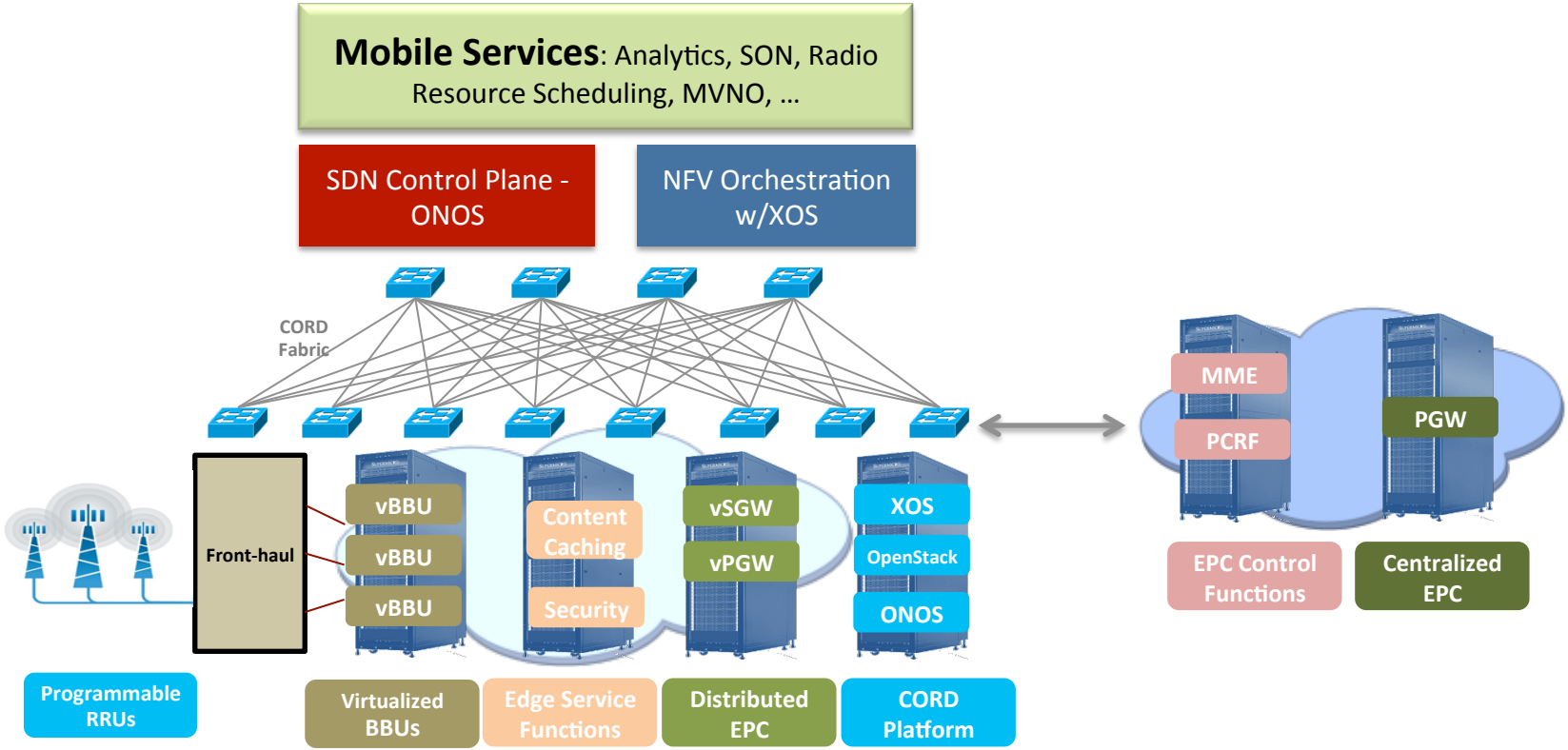


M-CORD – Internal View



Everything-as-a-Service (XaaS) / Micro-Services Architecture

M-CORD Implementation



Mobile CORD POC (March 2016)

- Disaggregated and virtualized RAN
  - Simple programmable Remote Radio Heads
  - vBBU on commodity servers
- Disaggregated and virtualized EPC
  - Data plane management by ONOS
  - P-GW, S-GW, MME as “VNFs as a Service”
- Mobile edge service
  - Select EPC processing at the edge + eSON/A-CORD
  - Caching and other services from the edge
  - Customized for enterprises and applications

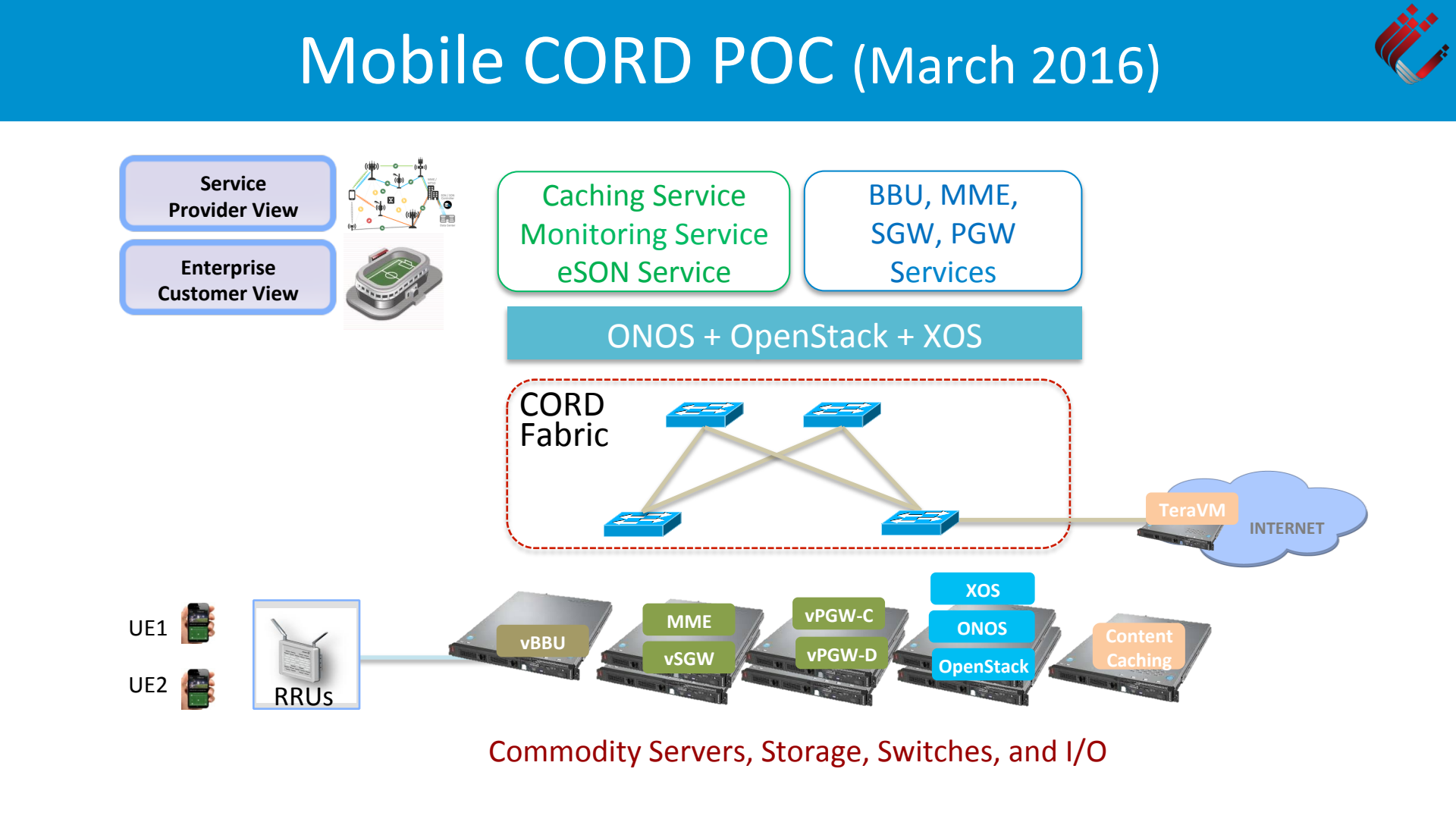
On-demand RAN/EPC deployment

Better user QoE

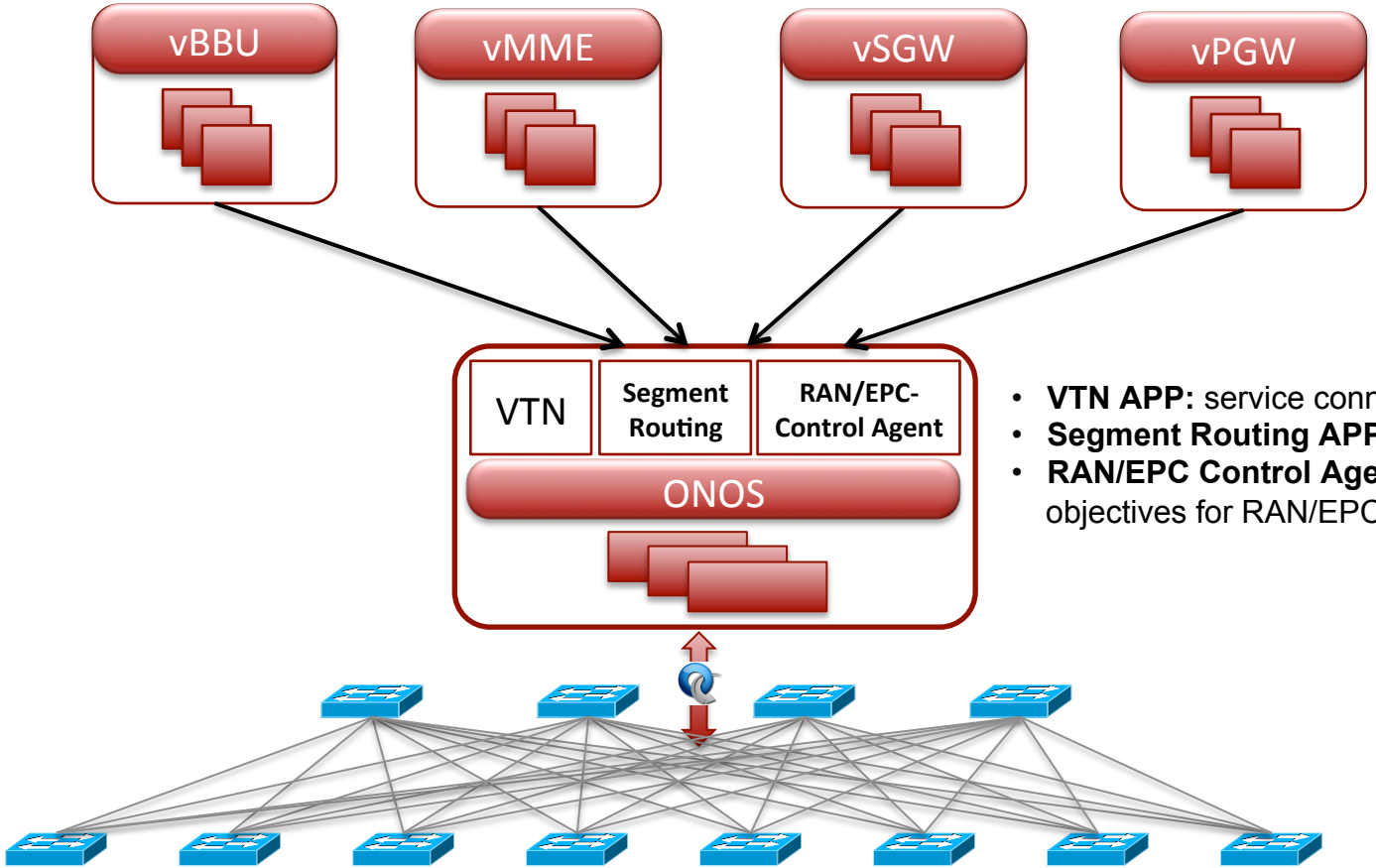
Efficient Resource Utilization

Programmable Infrastructure:
White Boxes + Open Source

Mobile CORD POC (March 2016)

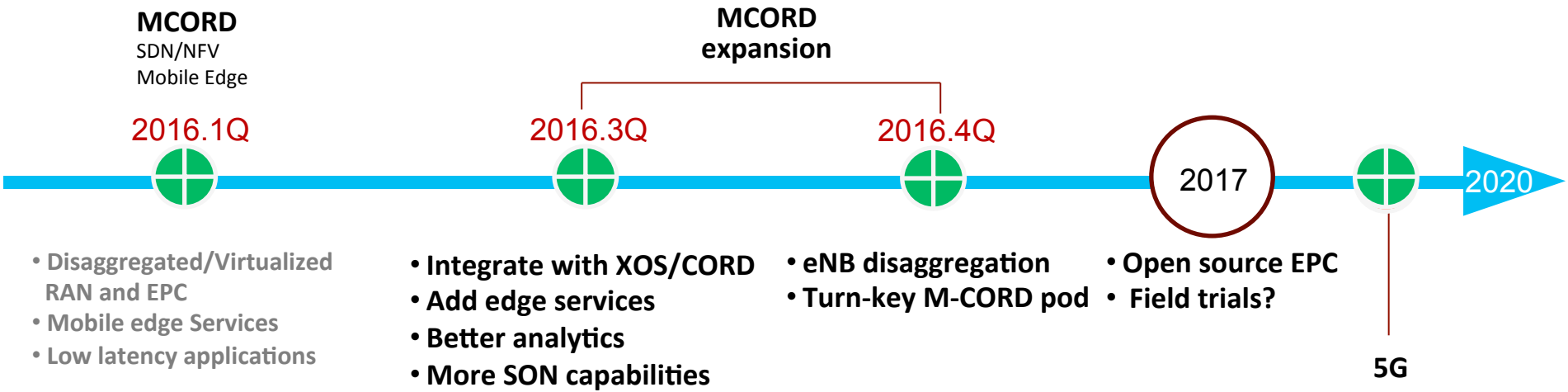


Role of ONOS



- **VTN APP:** service connectivity
- **Segment Routing APP:** fabric management
- **RAN/EPC Control Agent APP**: compose flow objectives for RAN/EPC data plane inside OVS

M-CORD Roadmap



Summary

- **CORD has emerged as a very important service provider solutions platform**
  - Brings economy of a datacenter and agility of a cloud
- **ON.Lab & partners offer an open reference implementation of CORD platform**
  - Hardware blue print (OCP compliant)
  - Software distribution: ONOS + OpenStack + XOS + a set of services
- **M-CORD integrates disaggregated/virtualized RAN and EPC with mobile edge services into CORD**
  - M-CORD POC at ONS 2016
- **M-CORD roadmap includes**
  - Integration of disaggregated eNB
  - Connectionless service for IoT use cases
  - Field trials

ONOS Partnership and Community

ON.LAB	SERVICE PROVIDER PARTNERS	VENDOR PARTNERS	COLLABORATORS	VOLUNTEERS
ON.LAB	at&t, China unicom中国联通, NTT Communications, SK telecom, verizon	ciena, CISCO, ERICSSON, FUJITSU, intel, HUAWEI, NEC, NOKIA	10+ Companies	

- All ONOS partners are also partners of the CORD project
- CORD community includes all stakeholders of the value chain: service providers and vendors: OEM, merchant silicon, white box, disaggregated functions, system integrators, …
- CORD plans to collaborate with key industry organizations such as MEF and BBF

M-CORD Collaborators

- **M-CORD Collaborators**

radisys

CAVIUM

NEC Netcracker

airhop communications

COBHAM

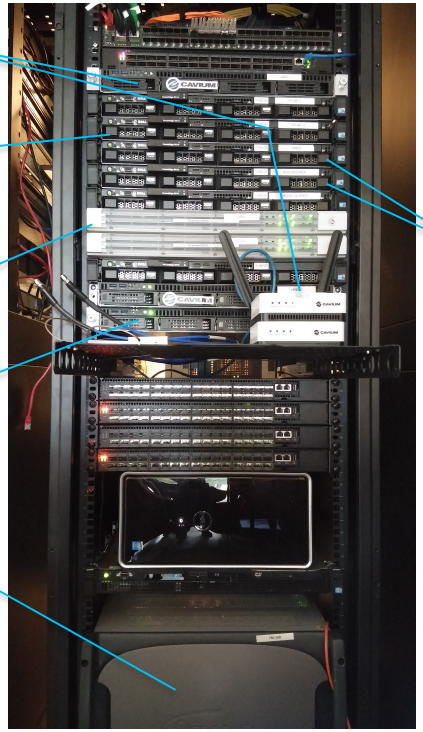
CAVIUM vBBU RRU

radisys vPGW-C vPGW-U

NEC Netcracker vMME vSGW

airhop communications eSON

COBHAM UE, App Emulator



ON.LAB ONOS XOS