Orchestrating a brighter world

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ICT consolidation in 5G
The role of Software Networks

EUCNC Conference, Athens, June 2016

Xavier Costa Perez
Head of 5G Networks R&D

NEC Laboratories Europe
Heidelberg. Germany

Global Market Disruptive Trends – SDN/NFV
The End of the Traditional Telecom Business Model?

Telecom Operators fighting for survival

- Increasing costs/decreasing profits
- SDN/NFV to provide substantial CAPEX/OPEX savings
- Looking for new revenue sources – Industry Verticals & Data monetization

OTTs, Cloud providers and Startups entering the market

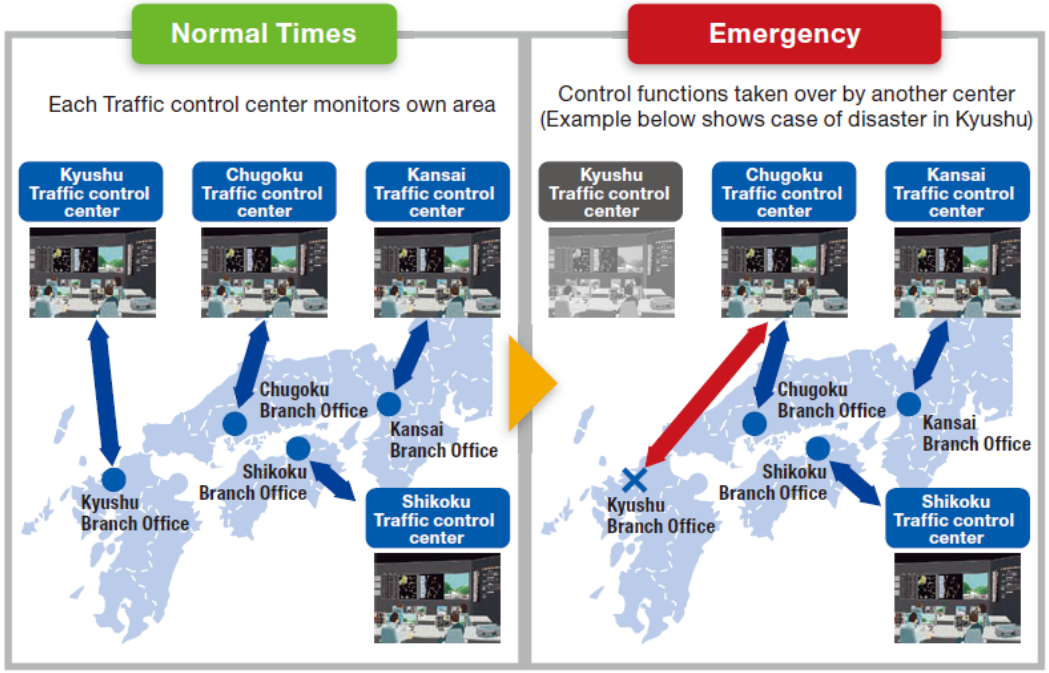
- 3000+ Startups *Funded* in the Telecom space
- Google, Facebook, Amazon, Microsoft, … heavily investing on
  - Services
  - Infrastructure

Traditional Telecom Business Model Transformation

- Multi-vendor 5G PoCs increasing -> NFV/SDN to facilitate multi-vendor 5G deployments
- Freemium mobile data model -> 15+ countries rolling out internet.org
- OTTs infrastructure deployment
  - Google – Fiber, Loon, Project Fi
  - Facebook - Telecom Infra project
- Industry Verticals
  - Connected cars equipment
  - Connected cars platforms

SDN/NFV for Verticals - Transportation

- NEXCO-West responsible for a transportation system that can deliver the personnel and materials required for rescue, restoration and reconstruction in the event of a disaster

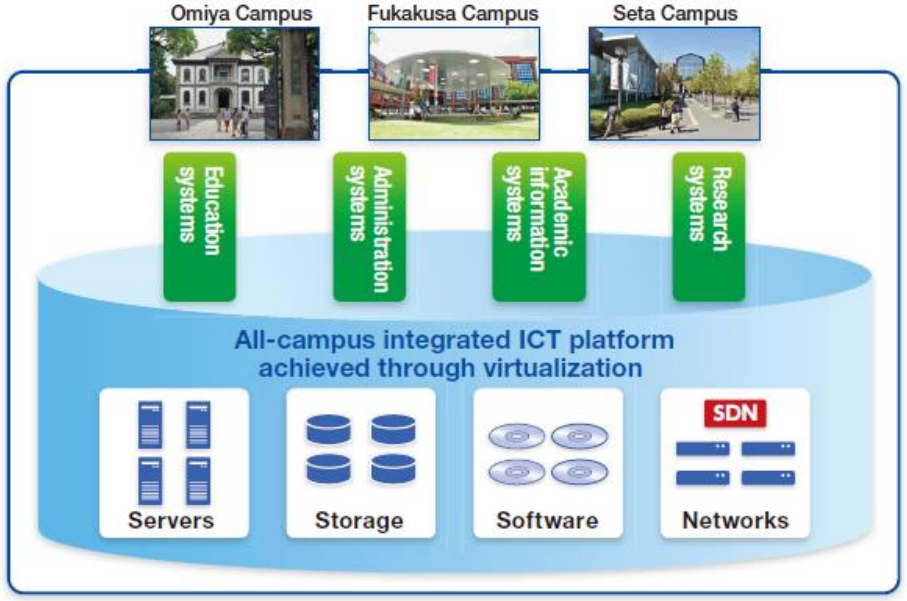


Example of an SDN backup traffic control-framework for traffic control centers

- SDN network linking multiple routes between 45 traffic control centers and expressway offices within a 4,000km-wide area
- The centrally-controlled, software-driven SDN network has greatly enhanced the stability of its expressway traffic control ensuring minimum disruptions

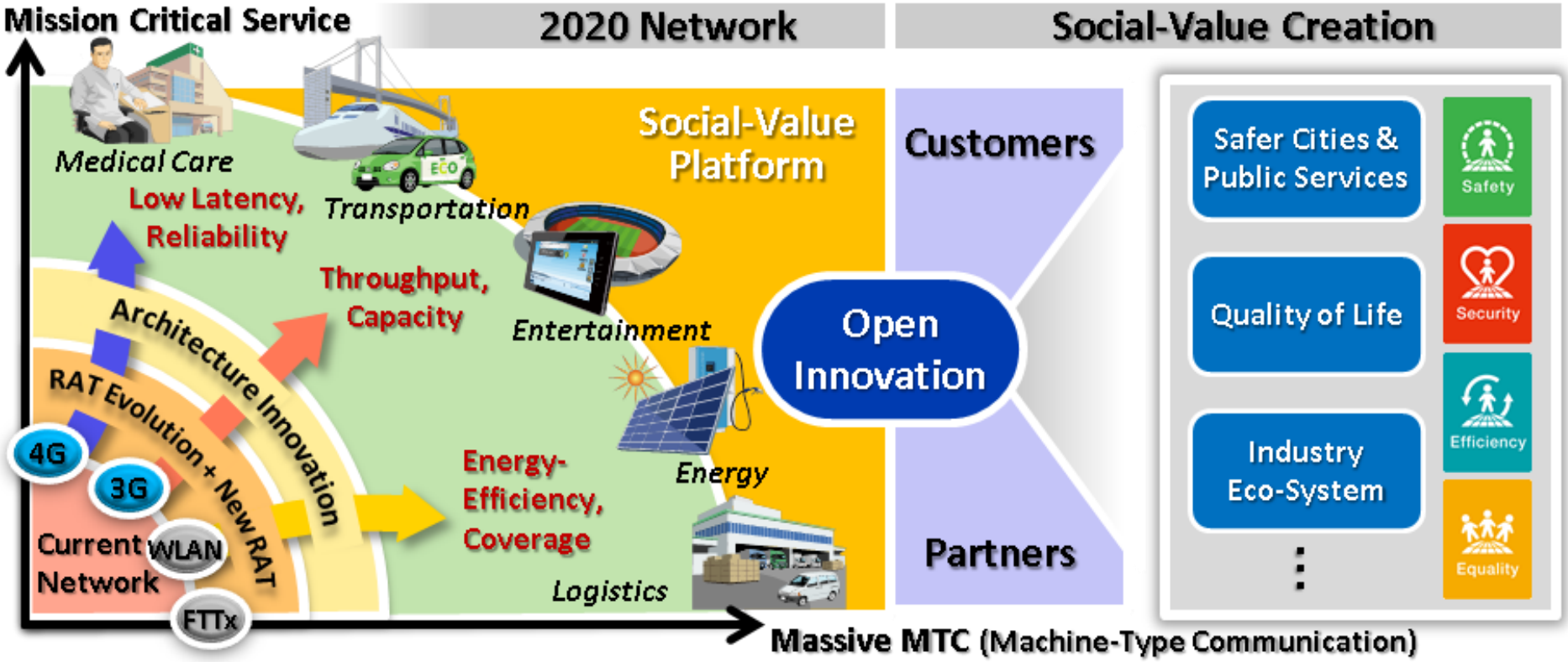
SDN/NFV for Verticals - Education

- Integration of Ryukoku University ICT systems to improve educational ability and quality of education
- 10 faculties, one junior college and 10 graduate schools



- SDN deployed gradually in conjunction with the existing network equipment to provide upgrade flexibility
- First step towards a common system platform integrating and virtualizing all ICT infrastructure resources such as servers, storage, and networks

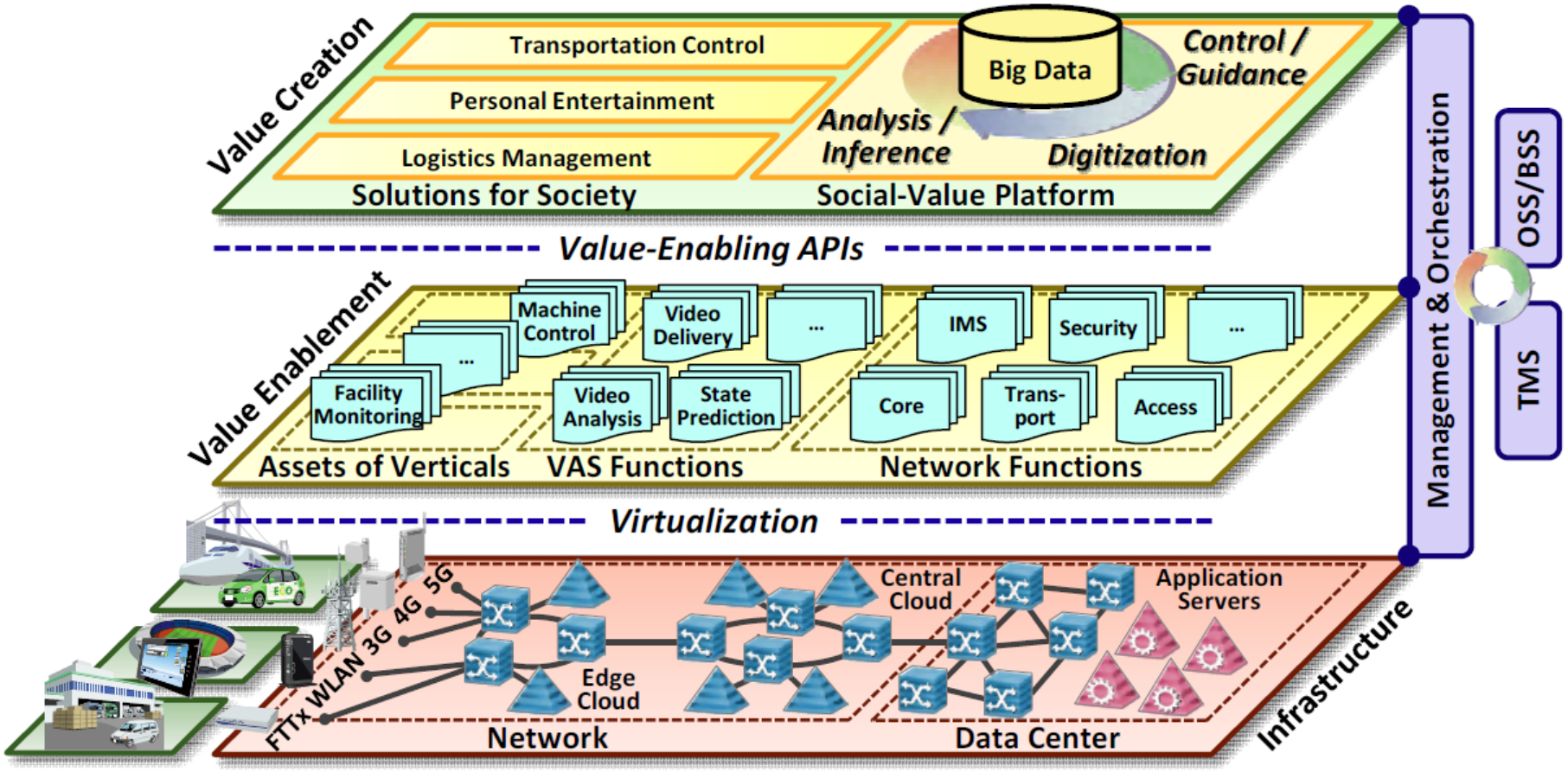
NEC's 2020 Network Vision Toward 5G



5G Architecture Overview

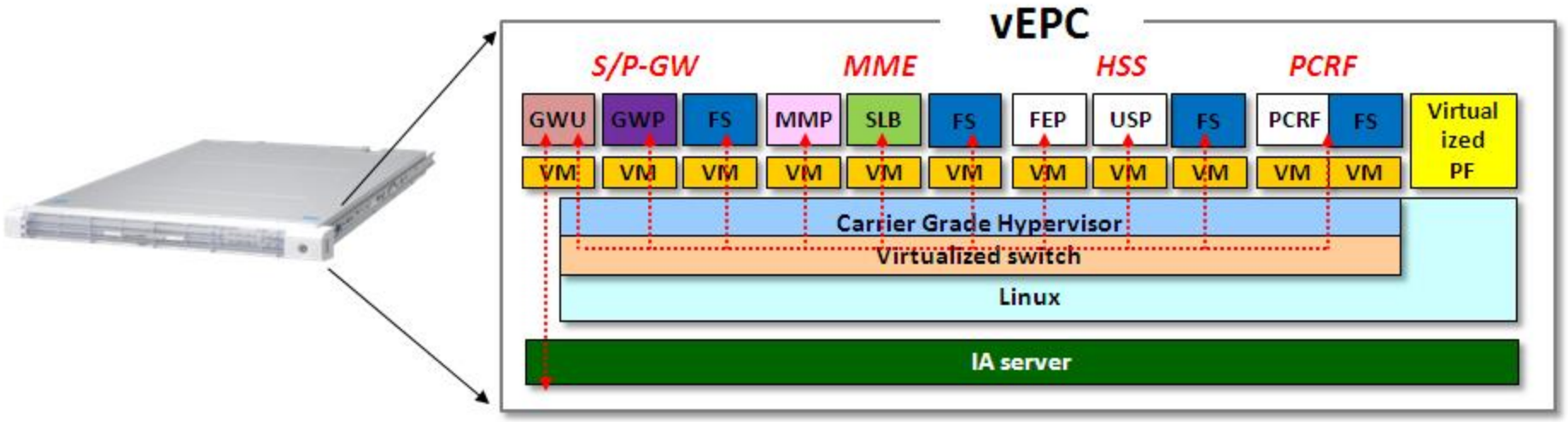
Network platform to fulfill the requirements for 5G networks

- High flexibility and rich functional. based on advanced network virtualization & programmability
- Independency between HW and SW that enables high expandability of the network functions



SDN/NFV for Mobile Networks - vEPC

- vEPC and VNF Manager already deployed in a major operator network



- The vEPC virtualizes
  - Mobility Management Entity (MME)
  - Serving Gateway (S-GW)
  - Packet Data Network-Gateway (P-GW)

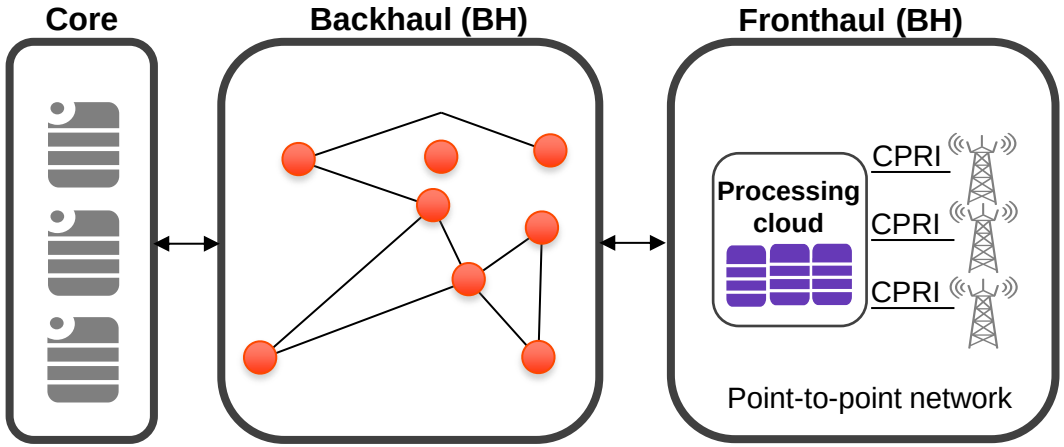
- The VNF Manager handles lifecycle events, such as creation, activation, termination and update of virtualized Network Functions (VNF)

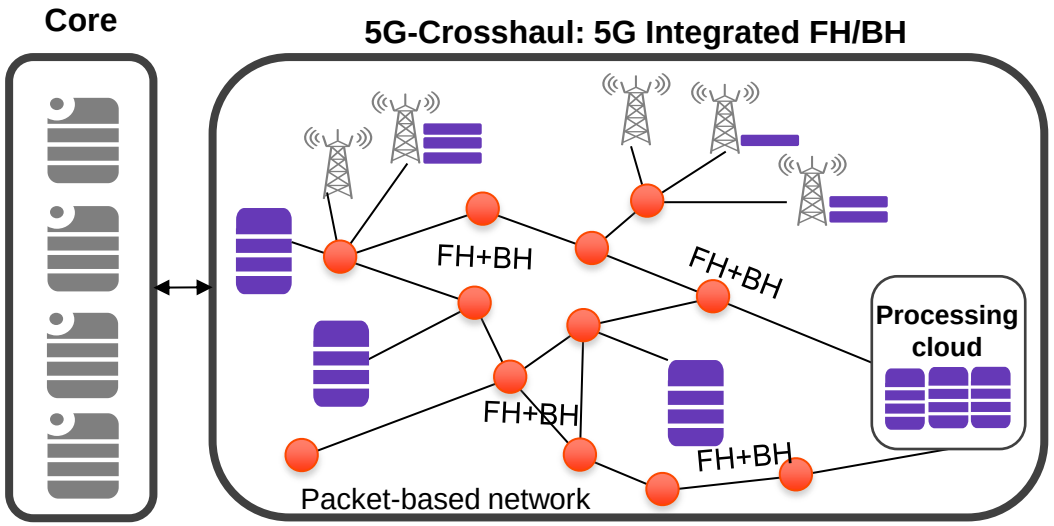
5G-Crosshaul: Fronthaul & Backhaul Integration for 5G

Today' s C-RAN Mobile Transport Network

CPRI transports IQ data via point-to-point optical links in a fronthaul (FH) network. Pain points:

- BW usage is independent on user's load
  - Highly inefficient
- No path diversity
  - Low fault tolerance
- Separated management platforms (FH - BH)
  - Management complexity and cost
- C-RAN Functional split and placement
  - Fixed and Static





5G-Crosshaul: 5G Mobile Transport Network

5G C-RAN will be transformed to a packet-based network (NGFI/IEEE/CPRI). FH and BH will converge to an integrated transport network (Crosshaul):

- BW usage dependent on user's load
  - Higher efficiency
- Enables path diversity – Packet-based Routing
  - Higher fault tolerance/Load balancing
- Unified management platform (FH + BH)
  - Lower management complexity and cost
- C-RAN Functional split and placement
  - Variable – Support of different functional splits
  - Dynamic – NFV-based 5G networks

5G-Crosshaul SDN/NFV-based Architecture

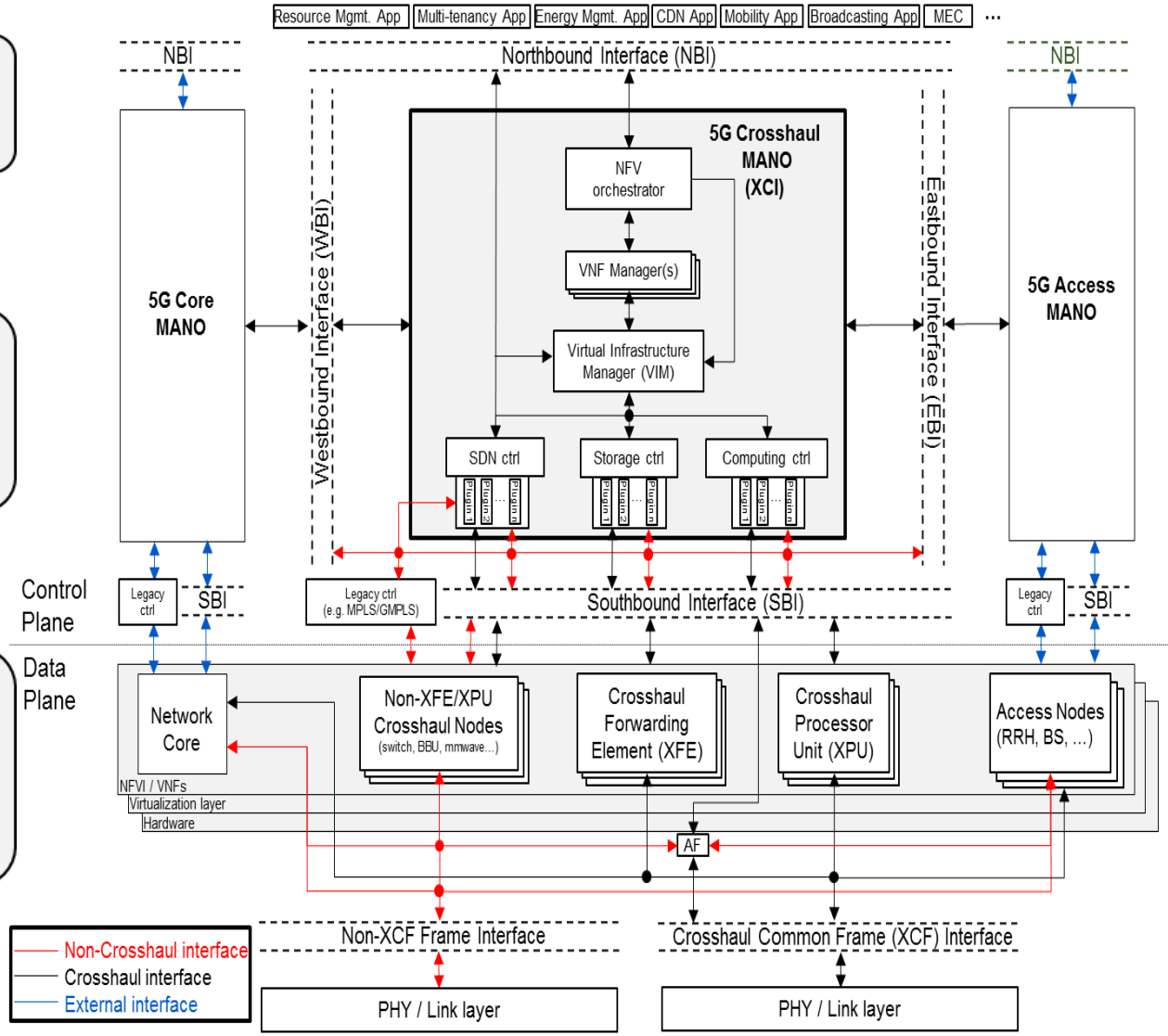
Innovative Network Applications
e.g. Multi-tenancy, MEC, Mobility

North Bound Interface

SDN/NFV-based Control plane
Compatible with ODL/ONOS and ETSI NFV architecture frameworks

South Bound Interface

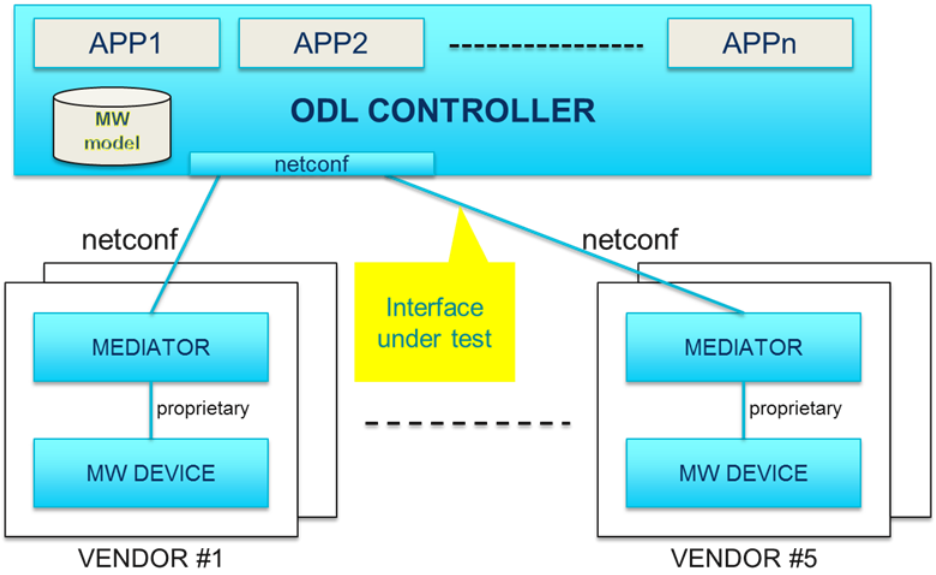
Data plane: Unified across heterogenous technologies
Support Fronthaul (with flexible functional split) and Backhaul traffic multiplexing

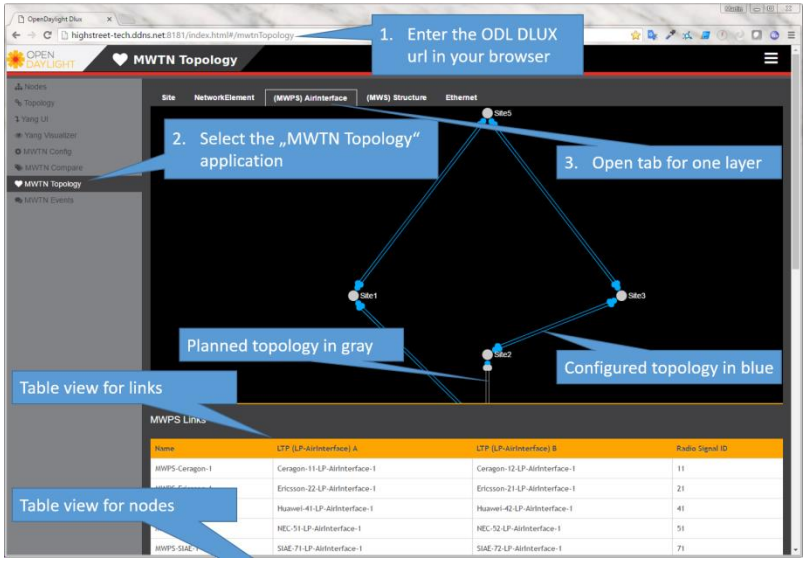


5GXCrosshaul

Multi-vendor Wireless Transport SDN Proof of Concept

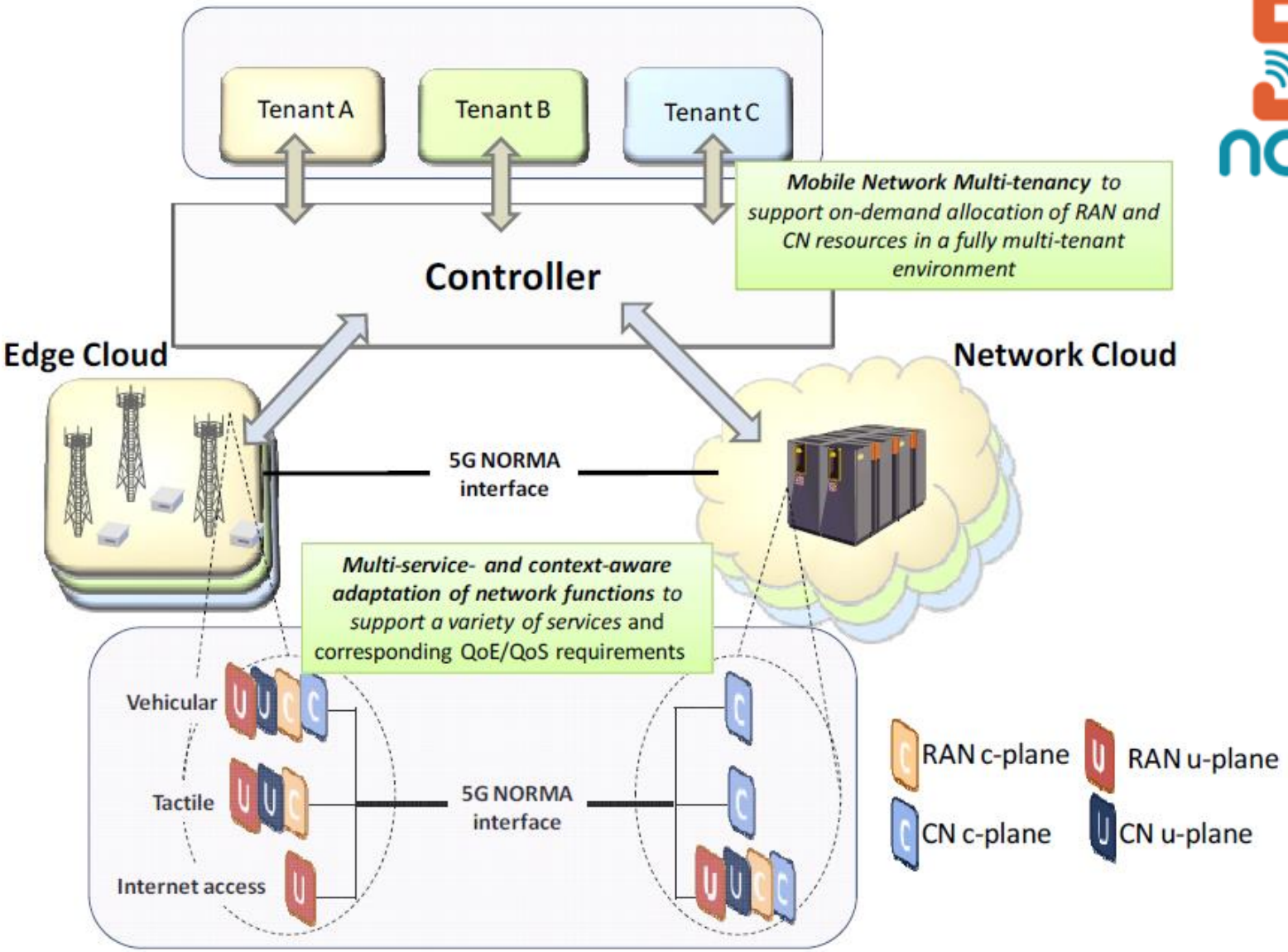
- PoC of a common information model for SDN-enabled wireless transport environments - 12 companies took part
- Simplification of operations, management and control of transport NW





- The PoC demonstrated
  - Dynamic network view
  - Configuration
  - Discrepancy monitoring and detection
  - Event handling

5G-NORMA – Network Slicing – Multi-Service/Tenancy



Towards Network Slicing

Resource sharing already available

- Configurable shares per tenant
- Customization per tenant

Radio Resource Sharing

✓Efficient RAN sharing schedule by NVS Scheduler

Fully Reservation(FR) Mode: 1
(Guaranteed Allocation)

Guarantee | Guarantee

Partial Reservation(PR) Mode: 2
(Minimum Guaranteed Allocation)

Guarantee ⟷ Guarantee

Complete Sharing(CS) Mode 3
(Flexible Allocation)

Sharing

MVNO #1 MVNO #2

RAN Sharing

Core sharing

Transport Sharing

Multi-IP

NEC

Security
✓VLAN
✓IPSec

-Each MVNO setting
-Flexible RAN Sharing

MOCN
MVNO #1
MVNO #N

GWCN
MVNO #1
MVNO #N

O&M sharing

Multi-PM/KPI

✓Centralized O&M with separated PM data collection per MVNO

Key Takeaways

- SDN/NFV transforming the traditional Telecom Business Model
- Software Networks already delivering on some ICT areas
- Evolution taking place for mobile networks from Core to RAN
- SDN/NFV facilitating multi-vendor deployments
- Open-source to play an increasing role in mobile networks

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