NTT Communications
Transform. Transcend.

Technology Development Challenges for Wide-area SDx Services in the Cloud Native Era

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VP of SDN/NFV technology development,
NTT Communications

Board member of ONF

Transform your business, transcend expectations with our technologically advanced solutions.

Introduction

- NTT Communications is transforming our service development style/process/environment through “Softwarization” to meet our customers’ requirements in the cloud-native era.
- We are tackling “Softwarization challenges” including in-house software development to provide value-added SDx services in shorter time-to-market cycle.

Agenda

- Softwarization History of NTT Communications' Network Services
- Tech-vision on the wide-area SDx Services and Active Projects
- Next Technology Development Challenges

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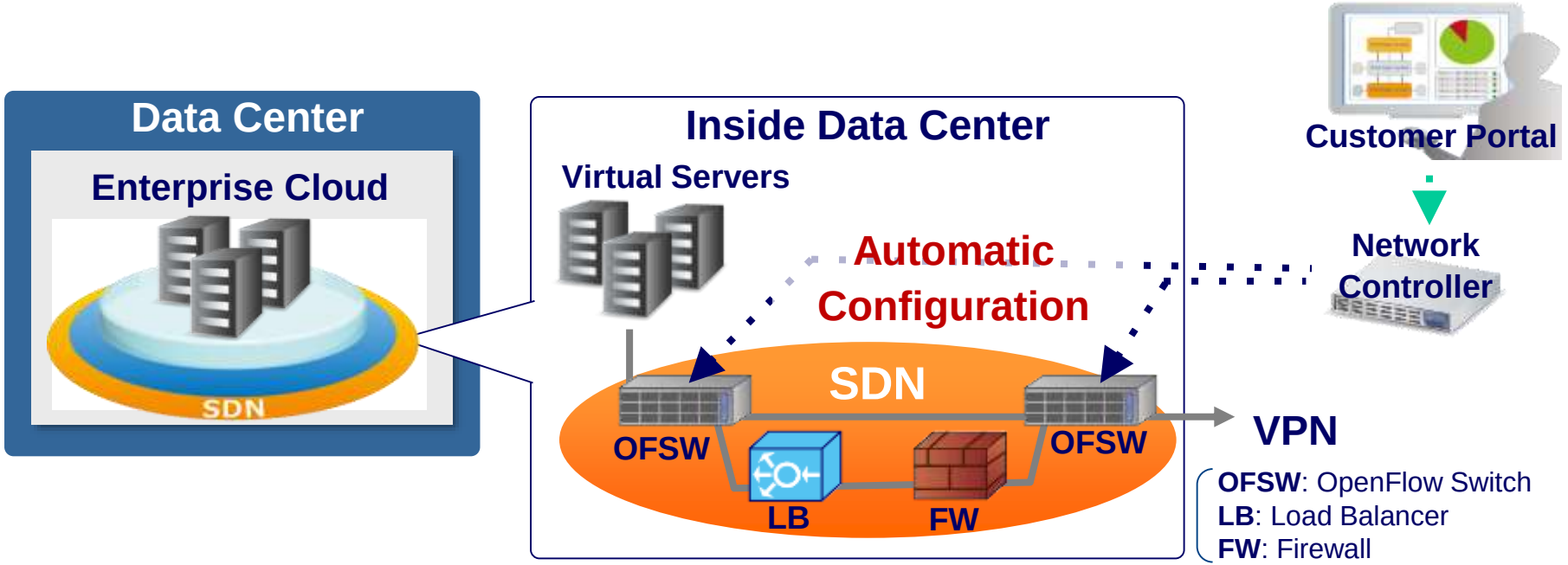
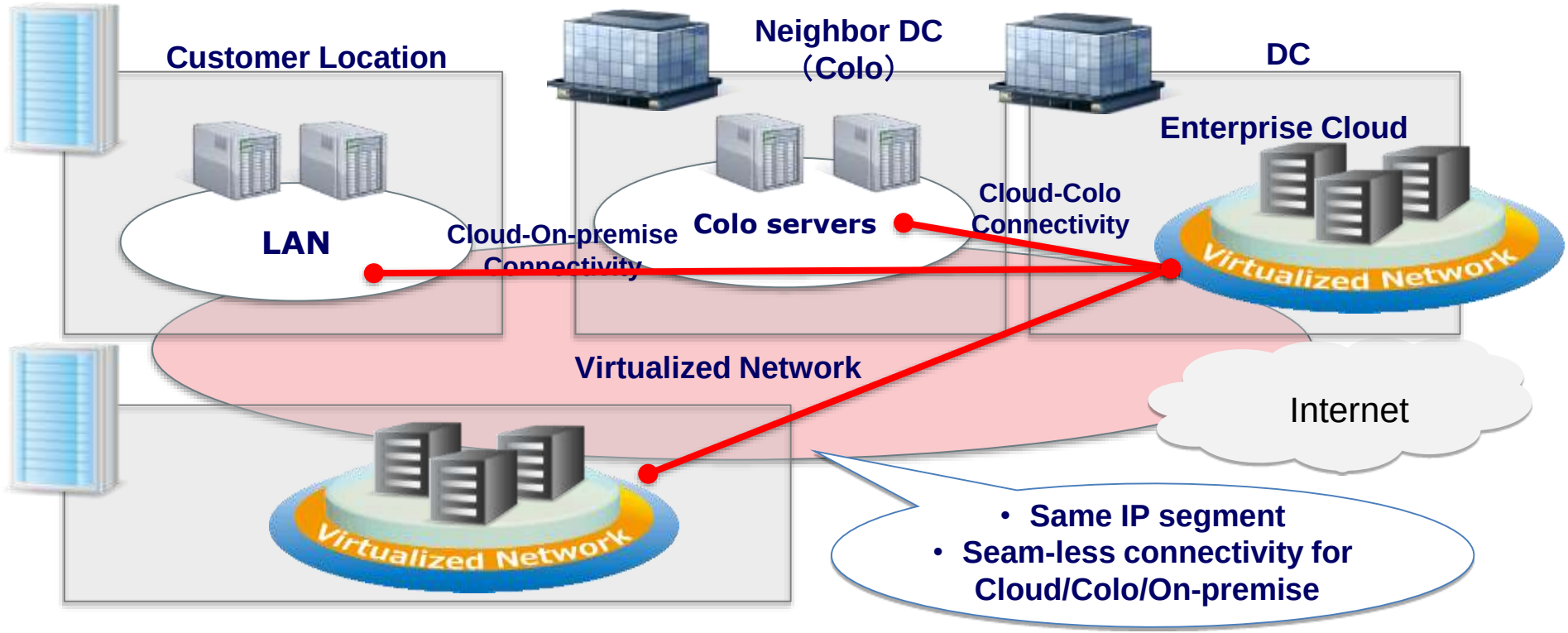
“SDN”-lization Step1: Inside DC(Data Center)

- ✓ Automation of network configuration
- ✓ Dynamic network management by customer portal

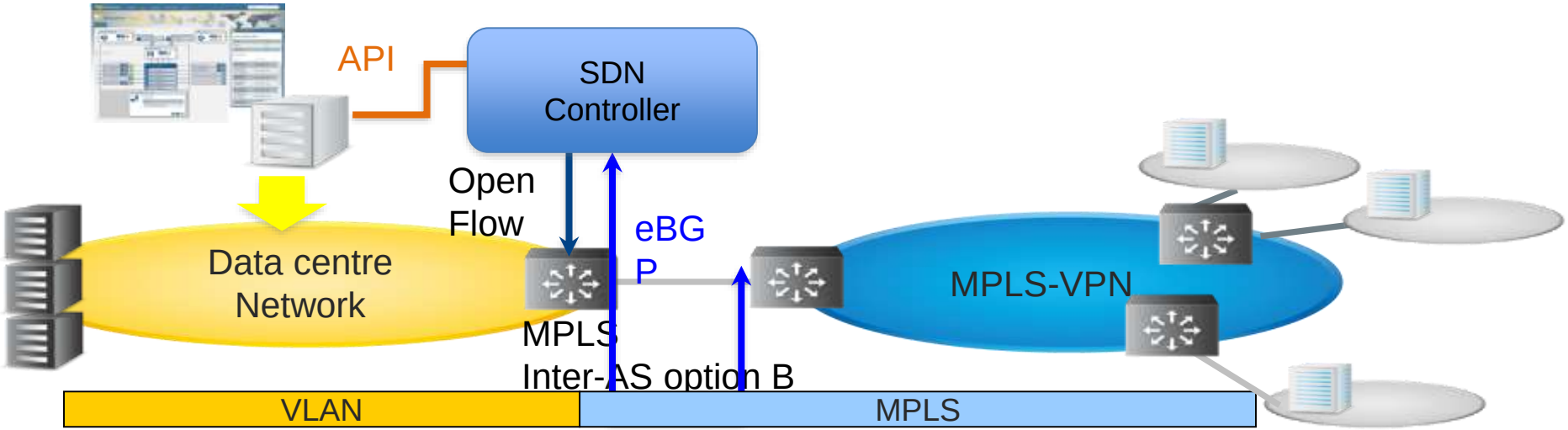


“SDN”-lization Step2: Between DCs

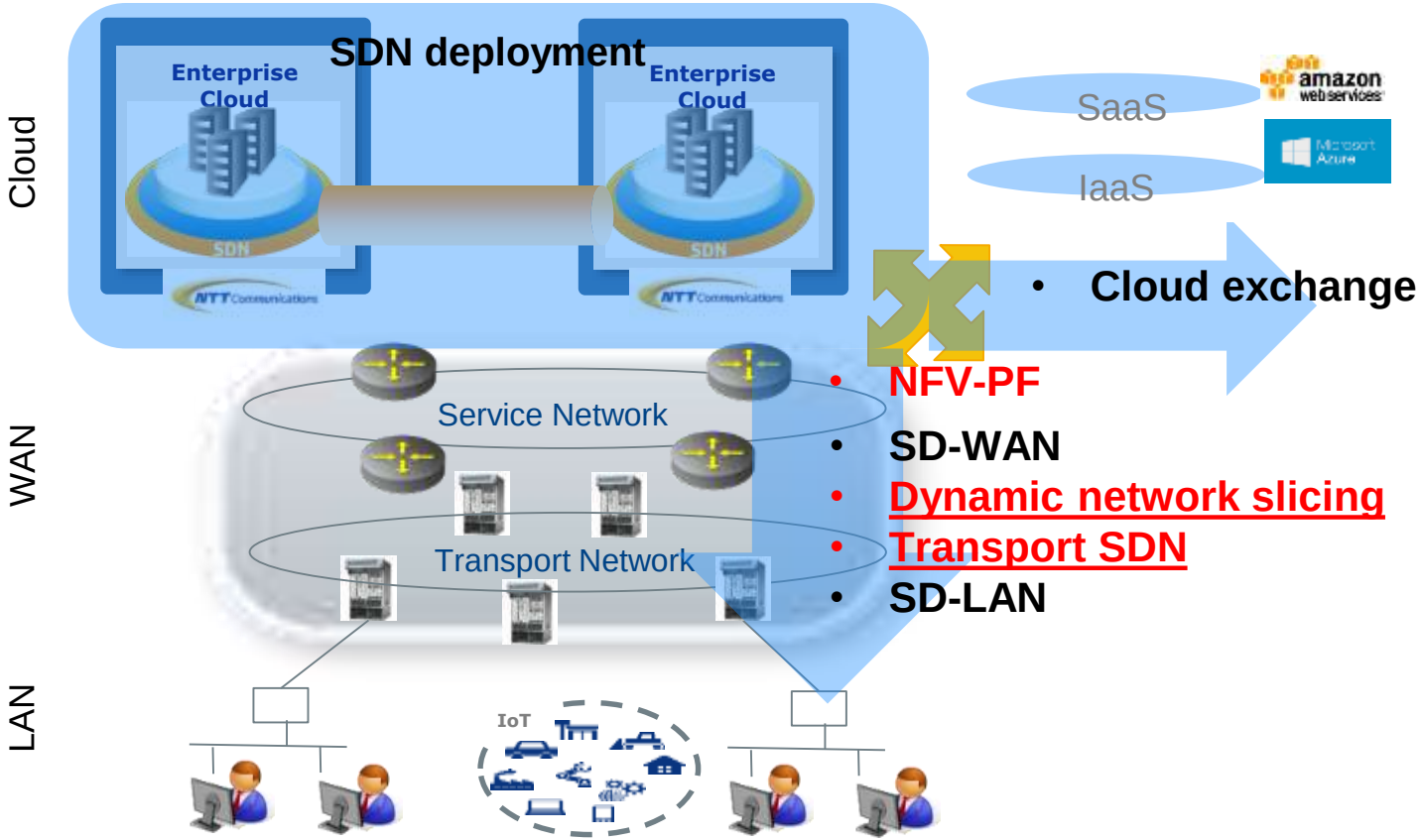


“SDN”-lization Step2: DC～WAN

✓ **Automated connection settings between our network services (e.g. VPN) with our cloud services**



Softwarization Deployment Expansion



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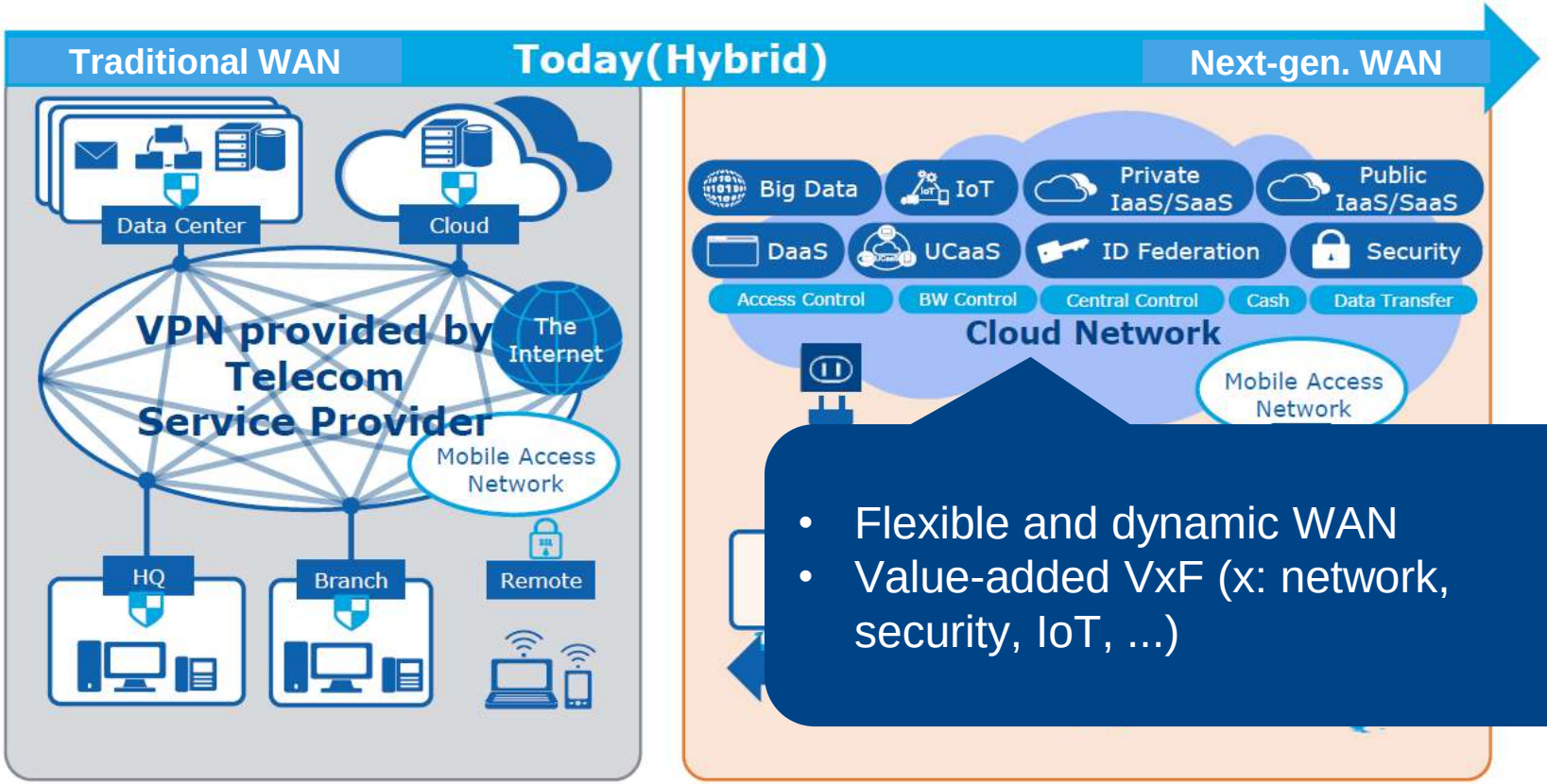
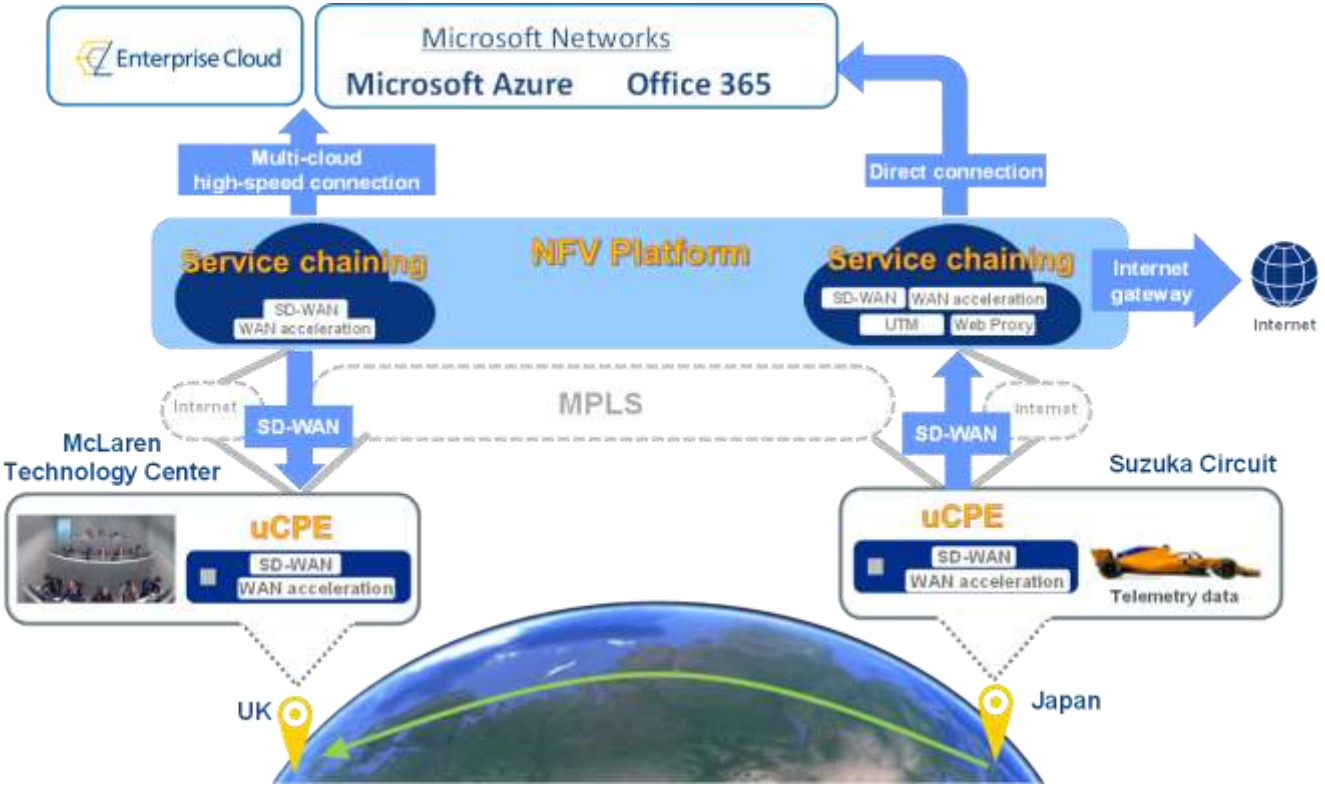
Customers' Expectations for Wide-area SDx Services

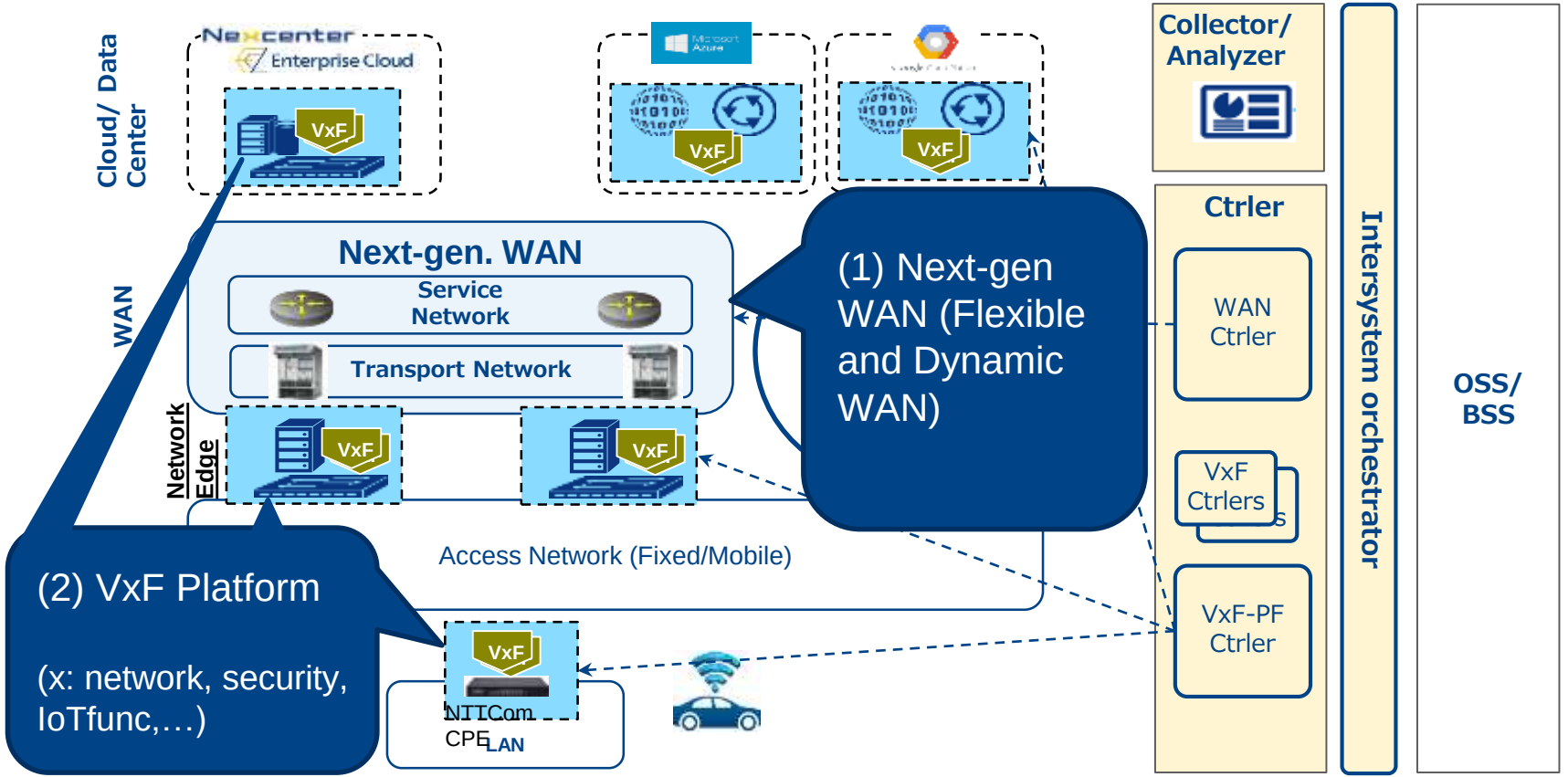


Advanced Use Case (as an example)



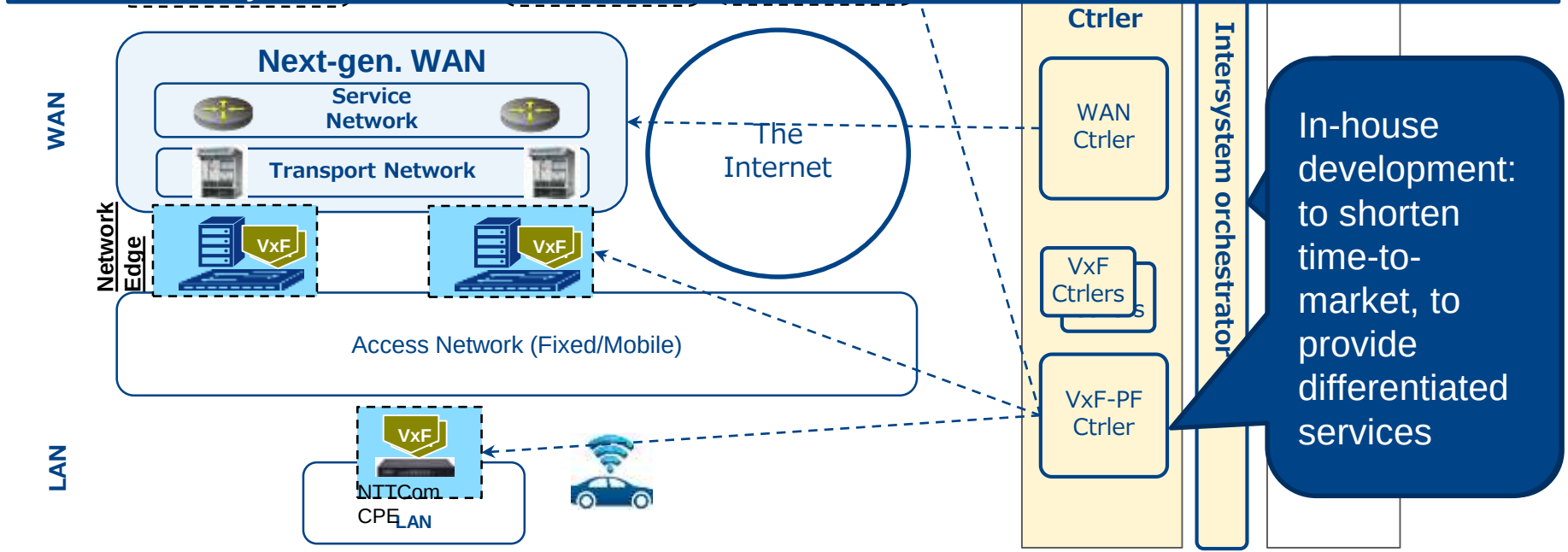
https://www.ntt.com/about-us/press-releases/news/article/2018/1004_3.html

SDx Services Architecture



SDx Services Architecture

- Micro service architecture: to achieve agility, to easily adopt technology innovation, and to achieve distributed parallel development
- API first: to achieve easier provision of various composite services and to increase extensibility



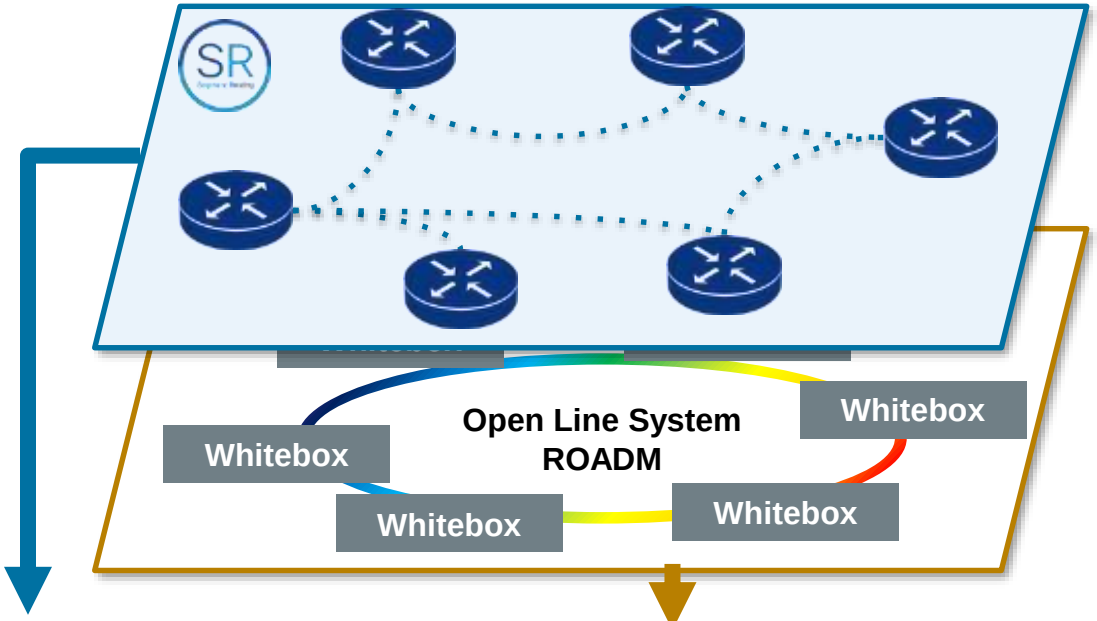
Next-gen. WAN ~ Requirements

Traditional WAN → **Today(Hybrid)** → **Next-gen. WAN**

- **Minimal traffic engineering**
- **Simple L2/L3 pipe**
- **Static control**

- **Fine-grained application – centric slicing and traffic engineering**
- **Simple L2/L3 pipe + Service Functions Chaining**
- **Dynamic control**

Next-gen. WAN ~ Basic Design



Standard IF

Configuration Management

NETCONF / OpenConfig

Traffic Engineering Controller

PCE P

Orchestrator

Intelligent service networks

Slicing, SFC, Distribution
Scalability in traffic flows
Soft-isolation

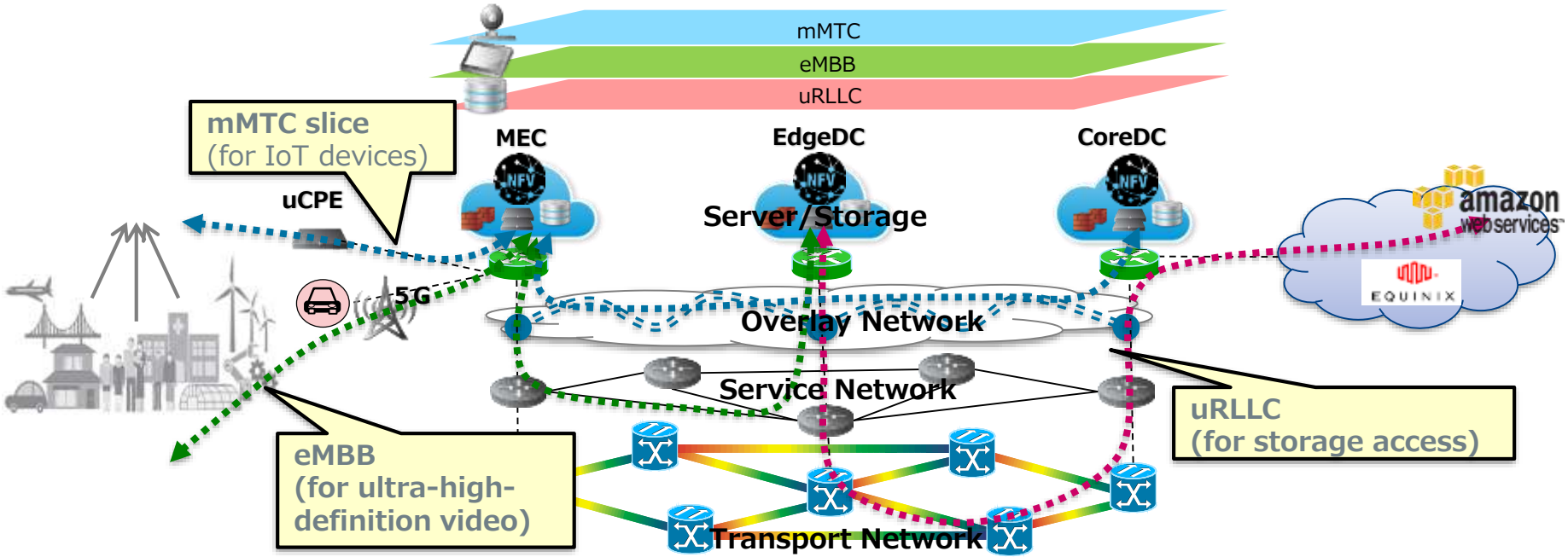
Simple&fast transport networks

Openness for multi-vendors/whiteboxs
Scalability in bandwidth
Hard-isolation

Flexible ctrler/orchestrator

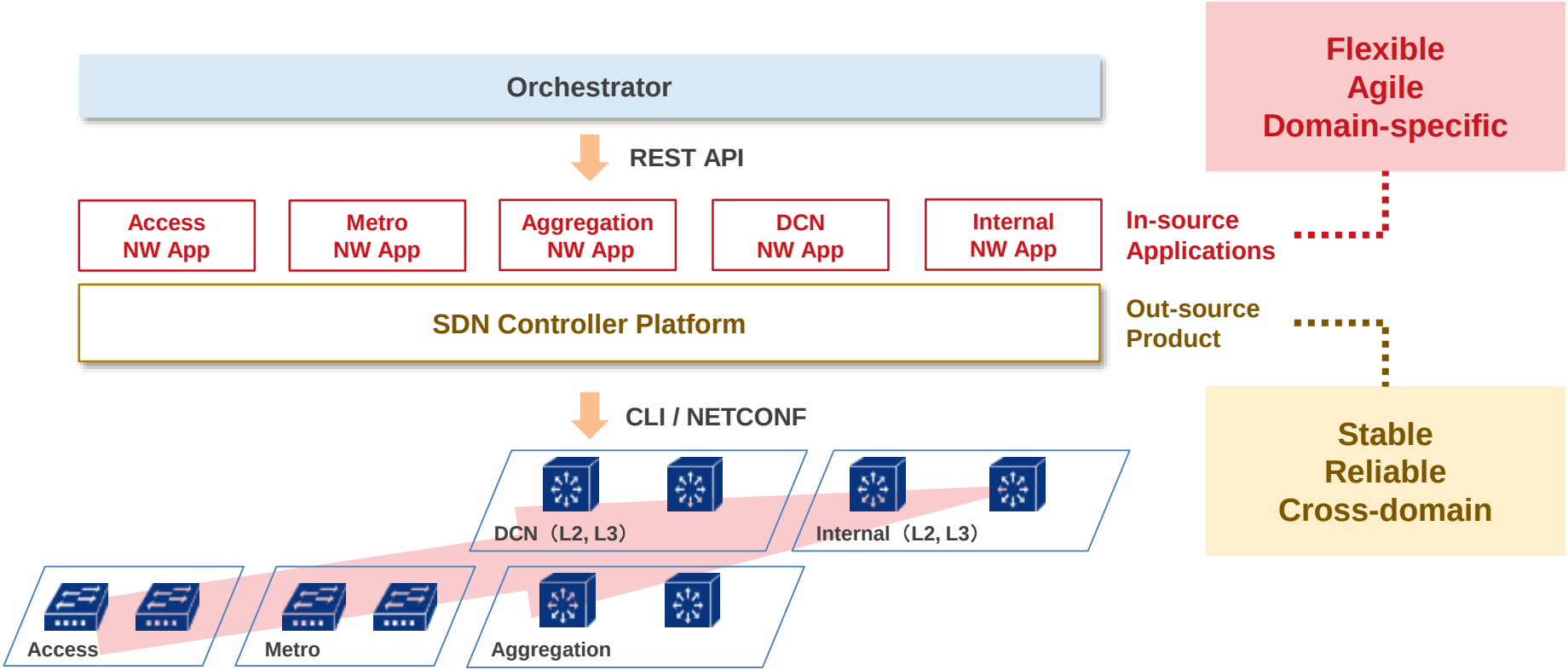
Software-defined approach
Automation, Centralization

Next-gen. WAN ~ Network Slicing



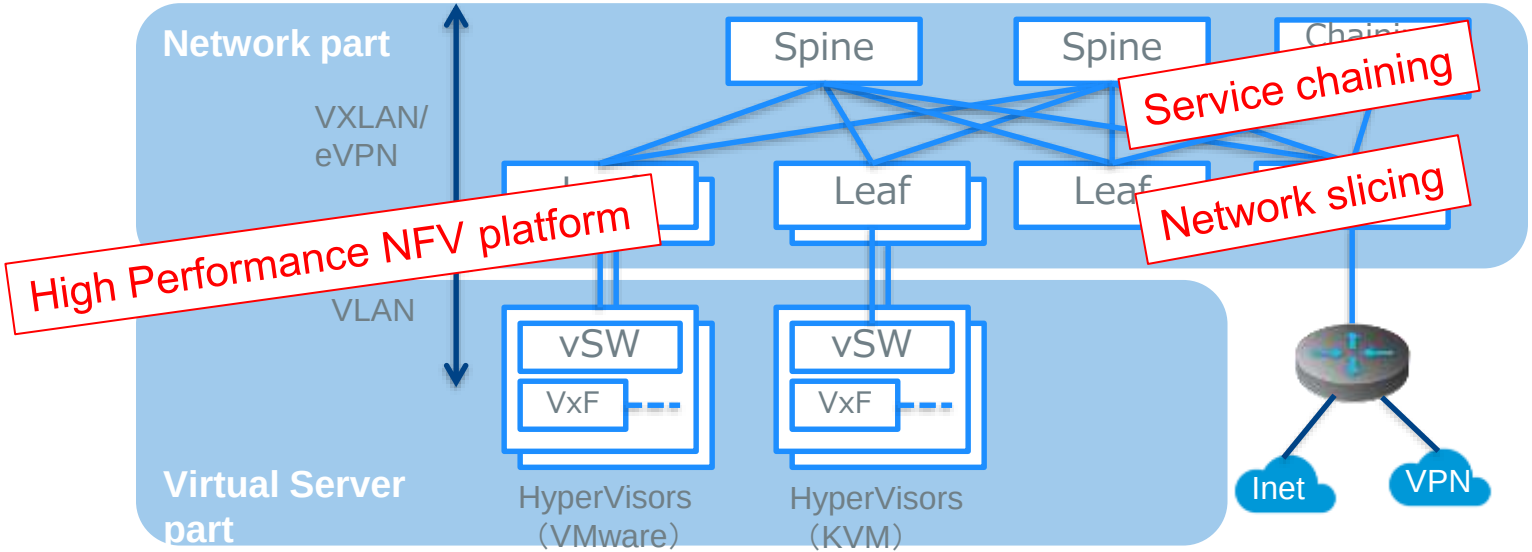
uRLLC: Ultra-Reliable and Low Latency Communications
eMBB: enhanced Mobile Broadband
mMTC: massive Machine Type Communication

Next-gen. WAN ~ WAN (SDN) Controller Basic Design

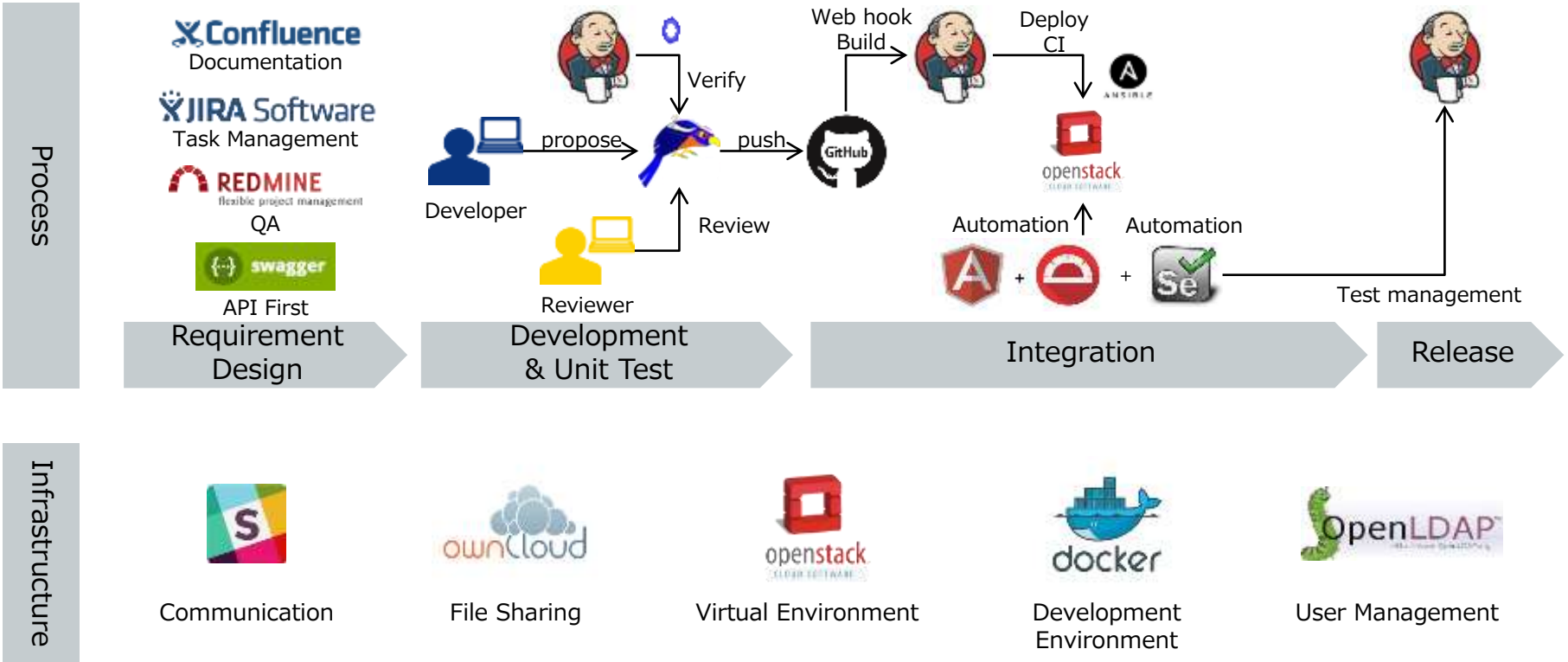


VxF Platform (Network edge) Architecture

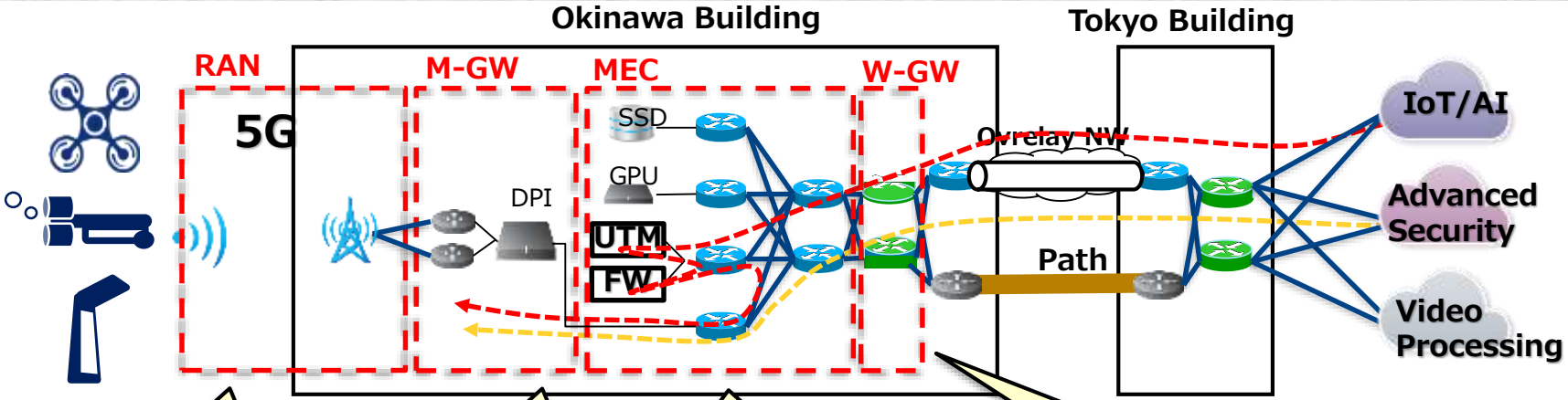
- Decoupling control of network part and virtual server part and connecting them using matured technologies.
  - Network -> Using standardized network protocols(VXLAN/eVPN…)
  - Virtual Server -> Accommodating various kind of hypervisors (VM/ Containers, …)



Examples of In-house Development Environments



OOL (Okinawa Open Lab) Trial



RAN

<Functions>
Authorization, Slicing, Location mgt)
<Technology>
Open Air Interface

MultiAccess GW

<Functions>
Packet manipulation
<Technology>
DPI, P4

MEC

<Functions>
Packet filtering, Image proceccing, Image processing, compression
<Functions>
FPGA,GPU,kubernetes

■WAN GW

<Functions>
Slice mapping, Resource
<Functions>
SR/SRv6, Traffic engineering, Telemetry

Practical Issues to be Resolved

- Highly hierarchical and distributed component management
  - Robust and highly automated operation scheme assuming that faults must occur in some components
  - Non-stop service provisioning against software updates
  - Reasonable quality assurance (SLA / SLO) method / mechanism including the concept of error budget
- Service monitoring and QoE/QoS management
  - Effective end-to-end service monitoring mechanism for users / operators
  - Components relationship management that enables operators to analyze fault causes
  - Proactive operation based on the QoE/QoS
- Productive and sustainable software development system
  - SRE (Site Reliability Engineering) team to improve credibility/availability/performance
  - Active utilization of cloud native software development

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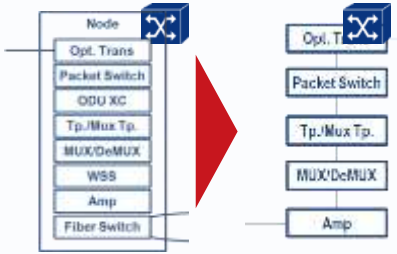
Softwarization Challenges

1 OSS/Standard APIs adoption

- Customizability
- Faster time to market
- Interoperability
- CAPEX/OPEX reduction

2 Disaggregation

- Speeding up technical innovation
- Inventory optimization



3 DevOps & Automation

- Fully and advanced automation & Visualization
  - Telemetry
  - AI / Deep learning

Micro Services Architectures

In-house Development

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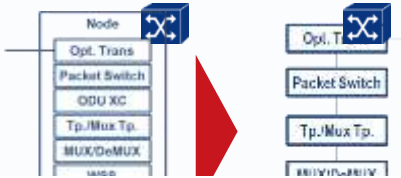

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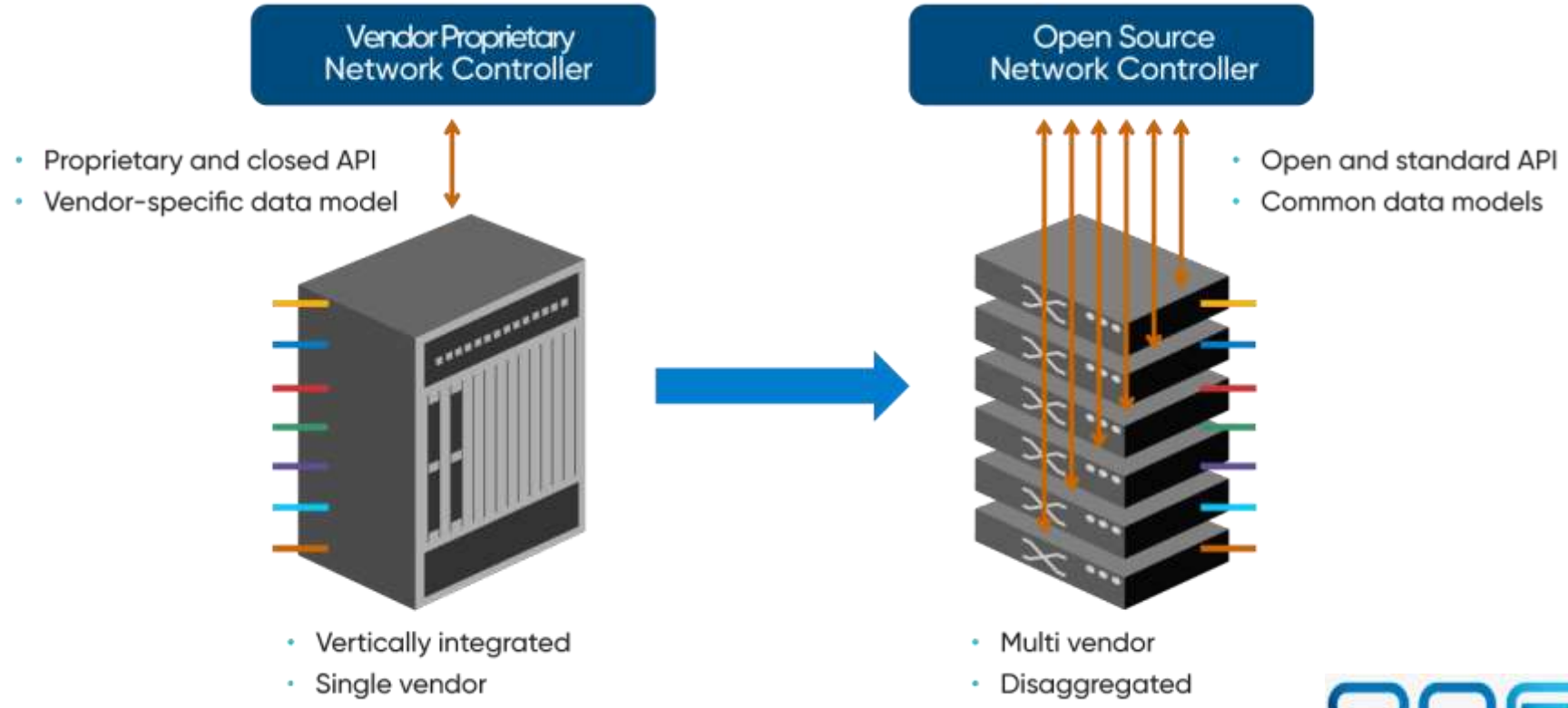
Transport Networks Transformation Challenge: ODTN with ONF

Micro Services Architectures

In-house Development

ODTN (Open Disaggregated Transport Networks)



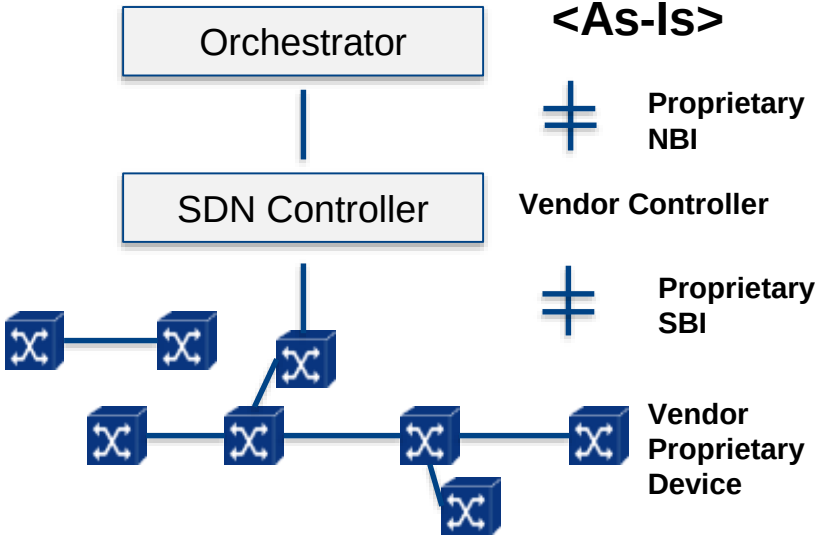
ODTN Members

odtn@opennetworking.org

Towards Full Open Architecture

- Existing communities are focused on each specific target
- No “Integrated Solution” in open source community

→ Build a reference implementation by using those communities outputs



<To-Be>

Open NBI

Open Ctrl

Open SBI

Open Device

Transport API

ONOS

OPENCONFIG

Open ROADM

Open Line System

ONF

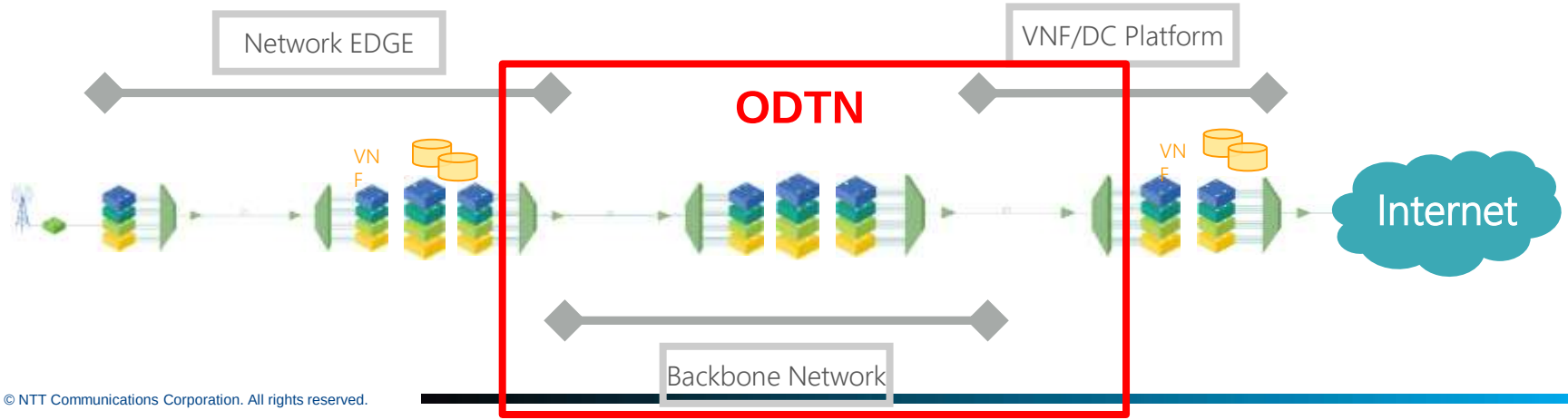
Collaboration with TIP

CONVERGED ARCHITECTURES FOR NETWORK DISAGGREGATION & INTEGRATION
NTT & Telefonica

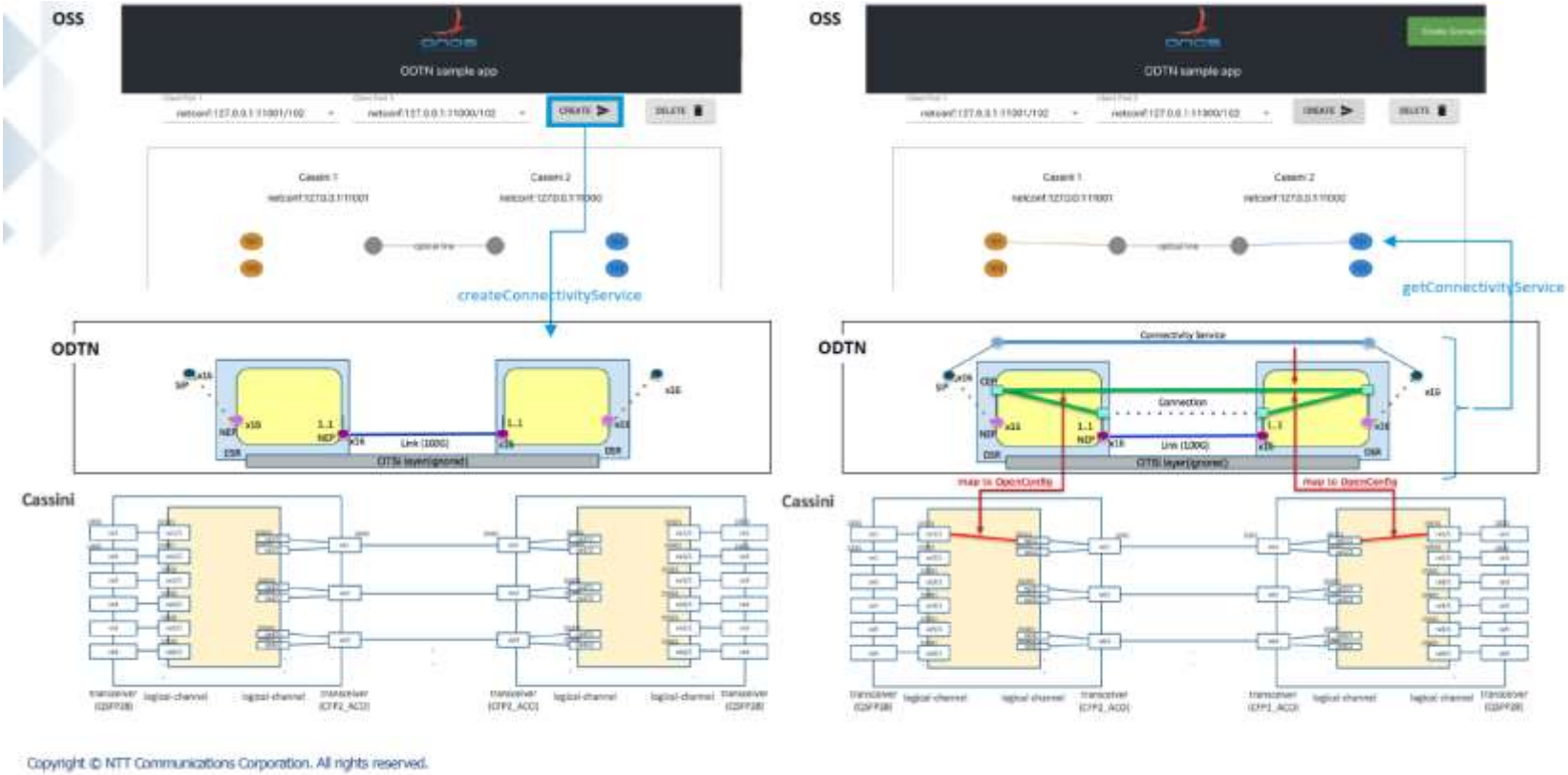
PURPOSE

- Define **operator use cases** in open converged packet and optical networks.
- Prove that use cases can be met with **architectures based on open technologies**
- Leverage the opportunity provided by TIP to involve different players to **accelerate technical developments** and help operators in real-world scenarios.

The target areas expand from the edge of the network up to the VNF or Datacenter platform going through the backbone network



ODTN / TIP Collaboration Demo



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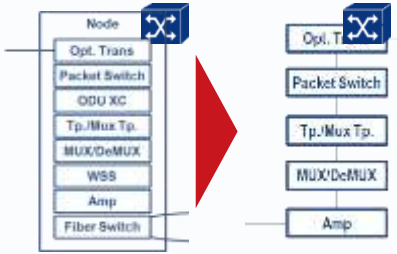
Multi Domain Inter-connect Challenge with

2 Disaggregation

ation

nization



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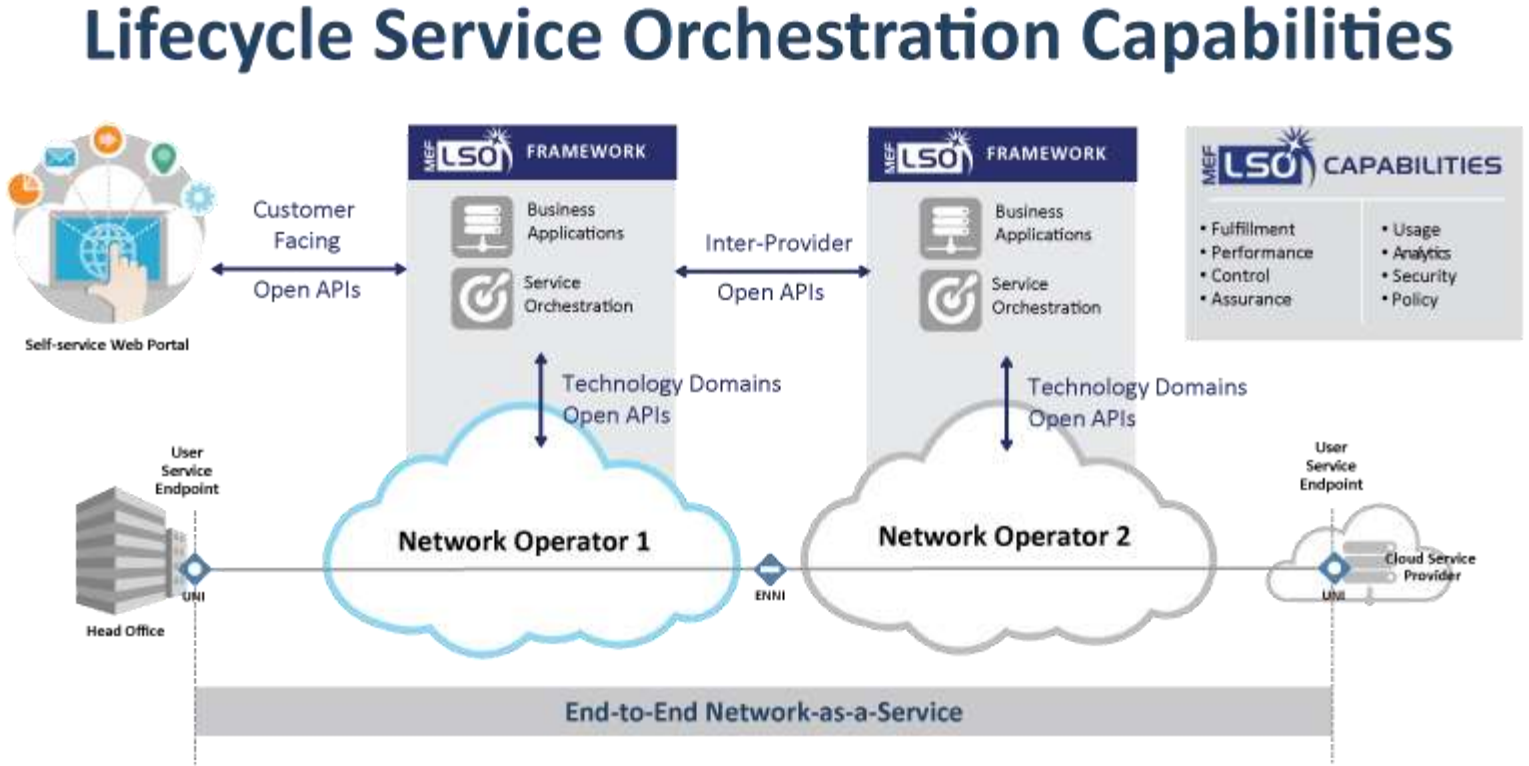
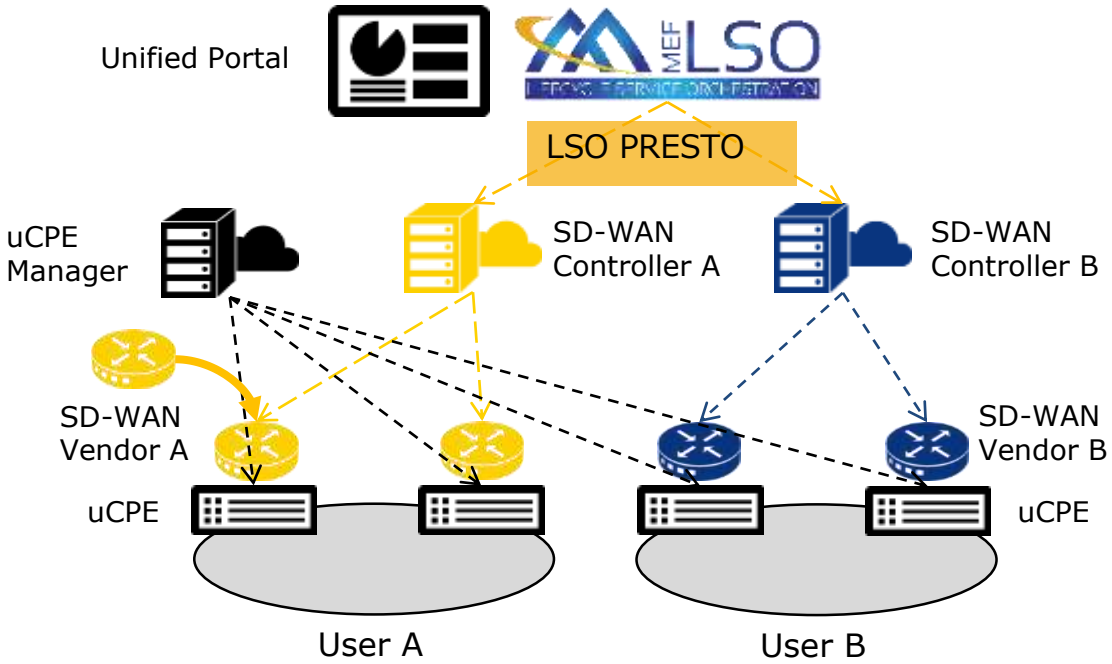
MEF Overview



http://www.mef.net/lso/lifecycle-service-orchestration

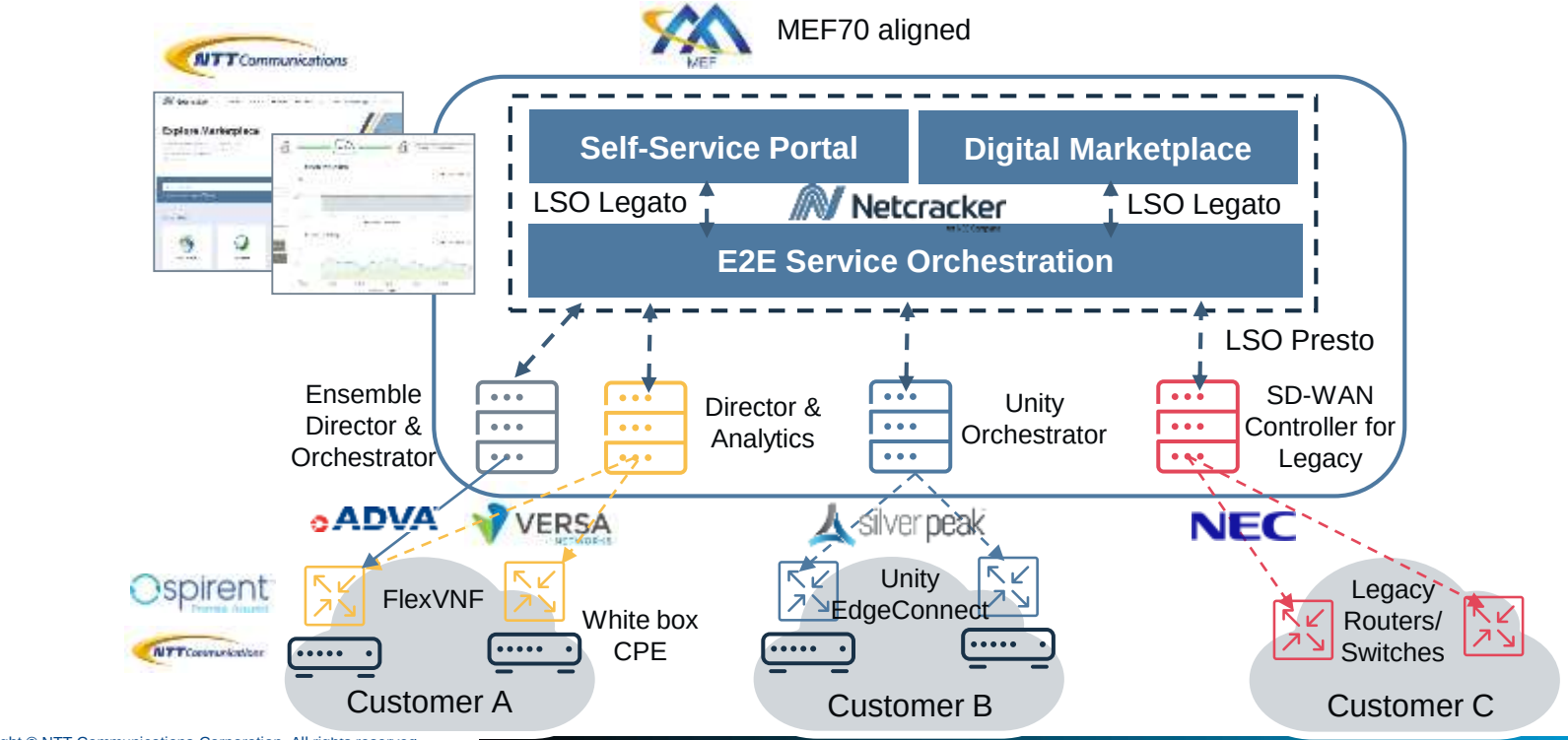
MEF Collaboration Usecase (1): Multi-Vendor SD-WAN

Integrated and flexible multi-vendor SD-WAN offering using white box CPEs.
(We have been providing multiple SD-WAN services based on different vendors' solutions)



MEF3.0 Proof of Concept (To appear in Nov. @MEF19)

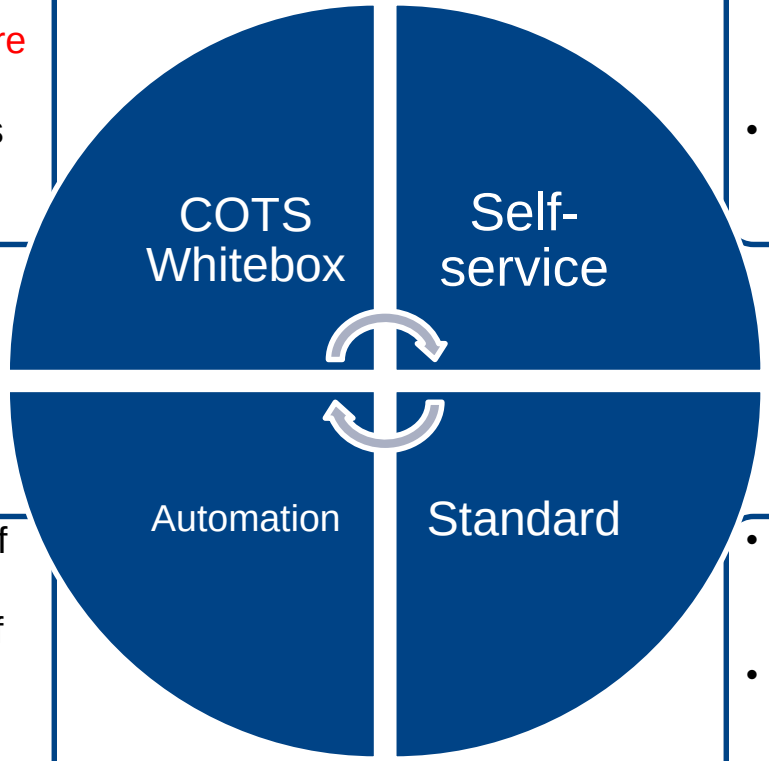
To prove an innovative concept which enables an automated uCPE based multi-vendor SD-WAN service



PoC Highlights

- Software (SD-WAN applications) and hardware (CPEs) separation by utilizing white box servers
- Open NFVI uCPE operating system

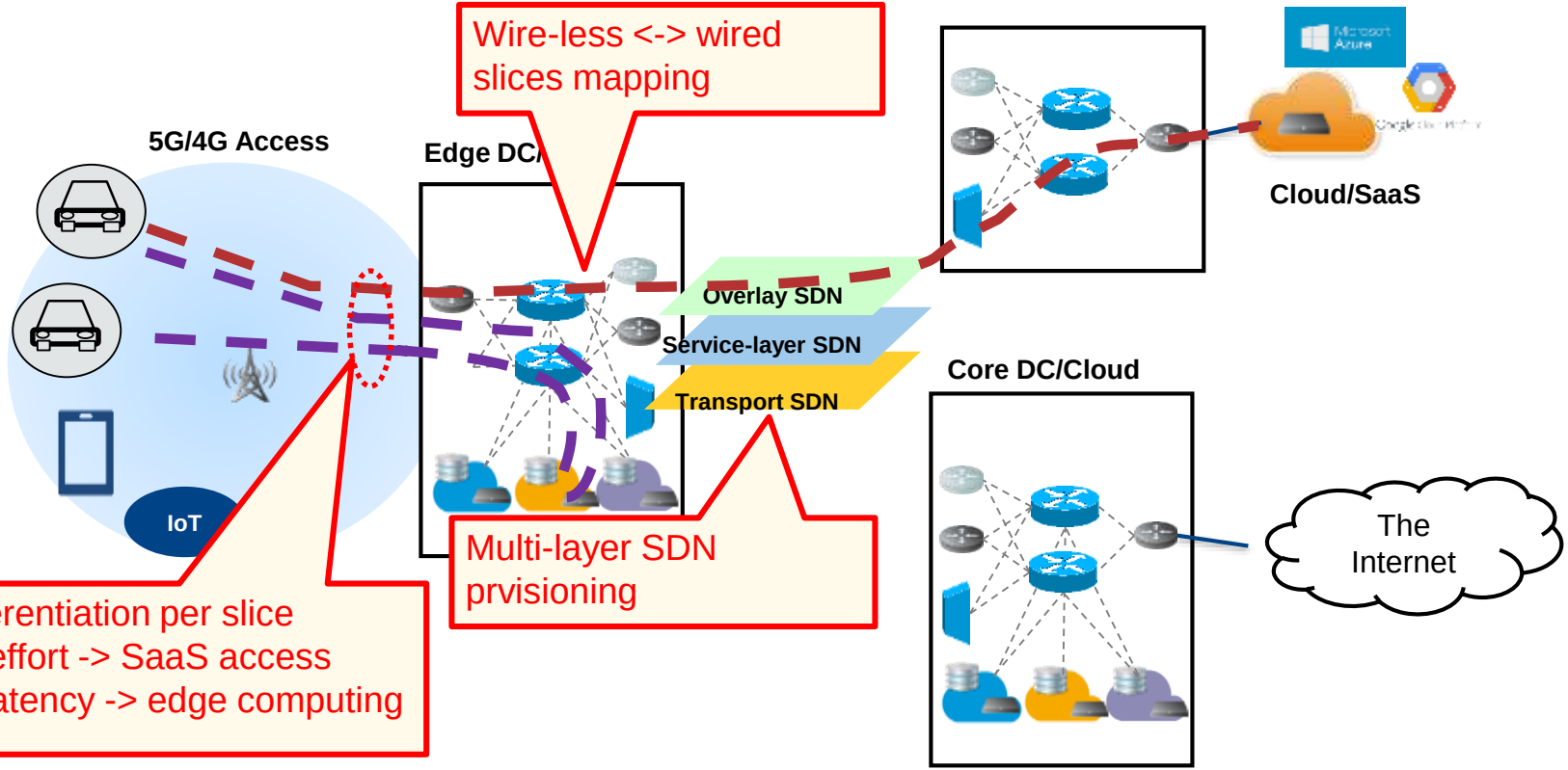
- Procurement of SD-WAN services via an online marketplace
- Unified operations of multiple SD-WAN solutions in a self-service portal



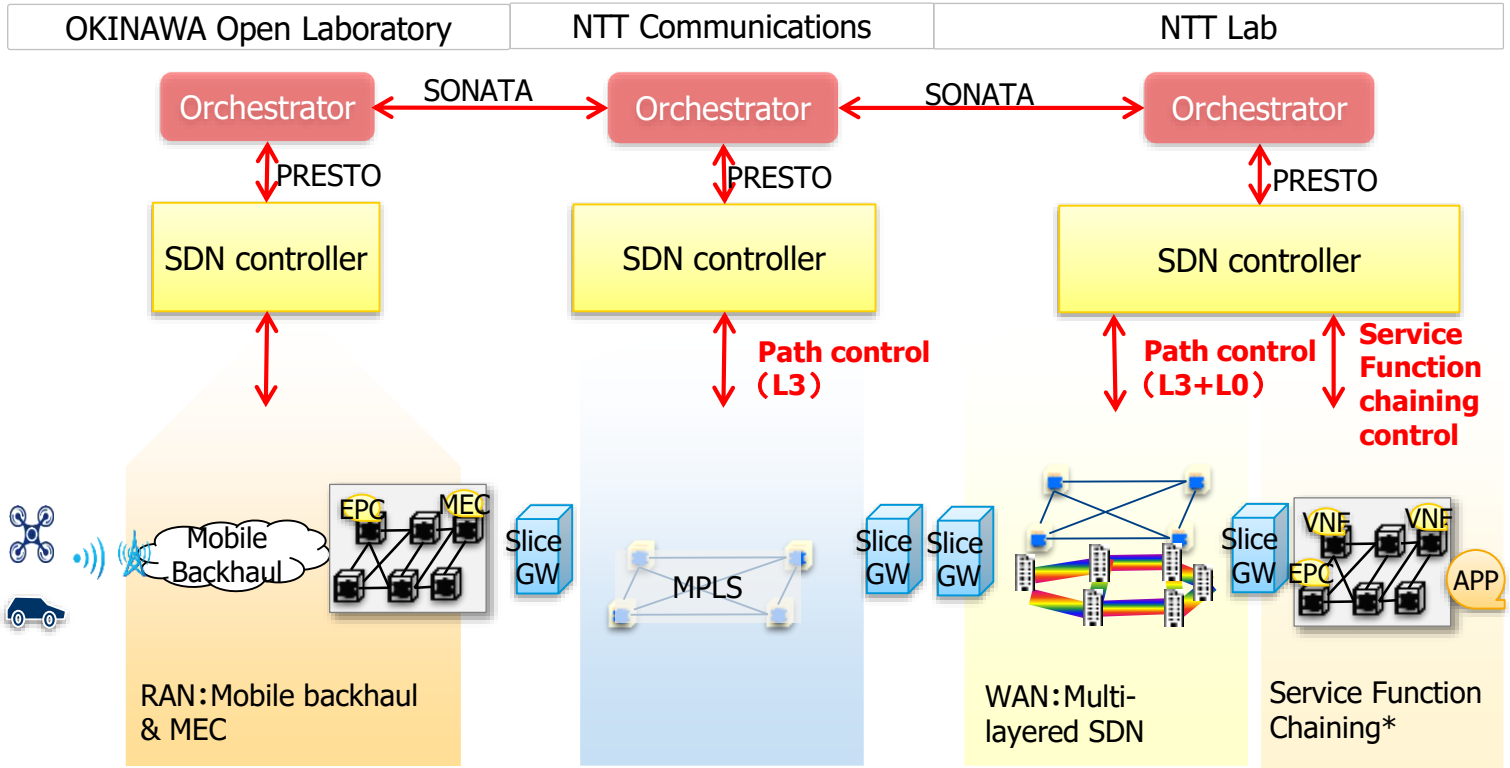
- Zero touch provisioning of uCPE platform
- Life cycle management of SD-WAN applications
- Catalogue-driven service orchestration

- Align with Industry-first SD-WAN service specification (MEF70)
- Use of Legato & Presto API for unified management of multiple SD-WAN solutions

MEF Collaboration Usecase (2): Mobile<->Fixed Networks Interconnect



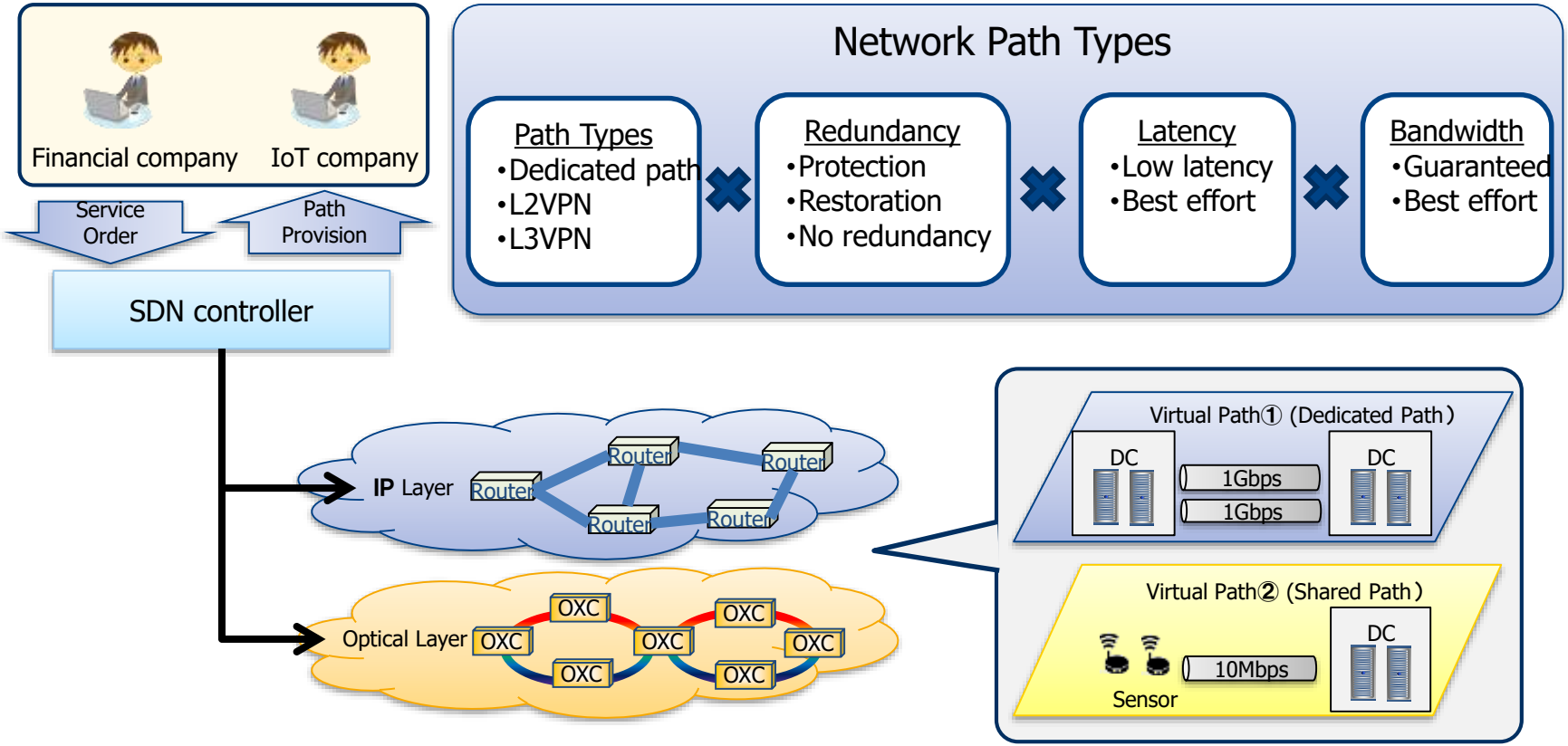
Architecture Overview



* Multi-Service Fabric (NTT laboratories product)

Intent-based Multi-layer SDN Provisioning

NTT Lab's Demo
@NetSoft2018



Multi-grade Reliability for Network Slice

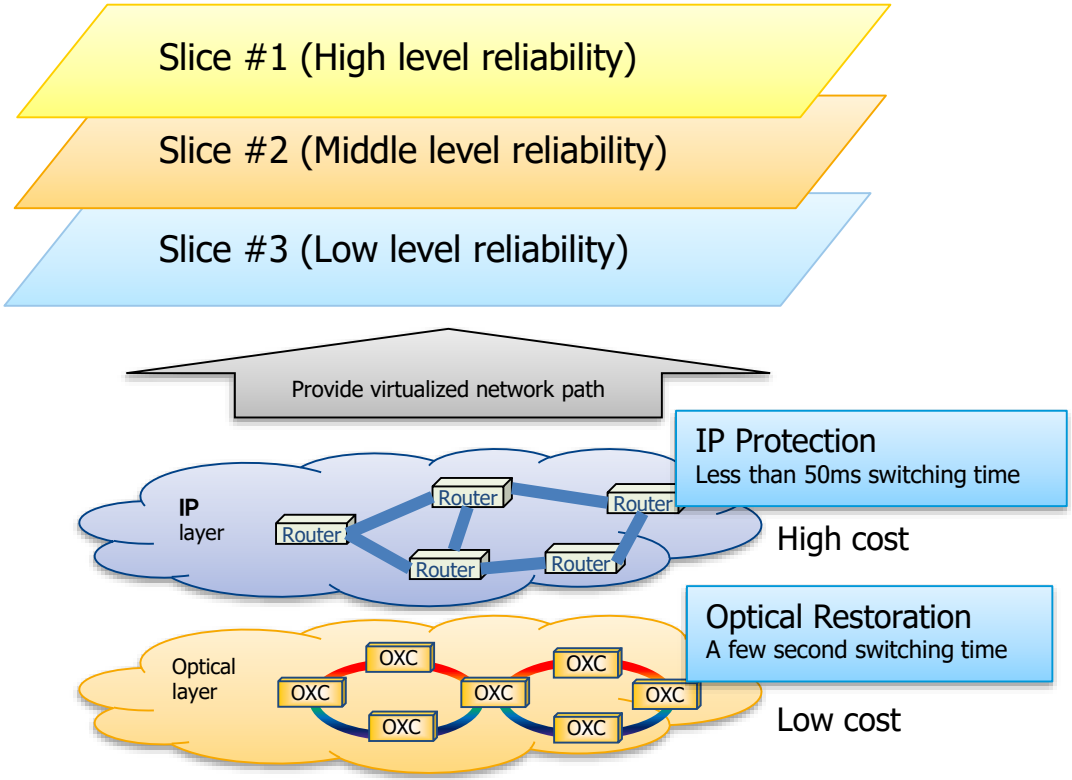
NTT Lab's Demo
@NetSoft2018

Steps of Network Slice Evolution

Isolation from other slices

QoS differentiation
(e.g. ultra low latency)

Reliability differentiation
(e.g. ultra reliability)



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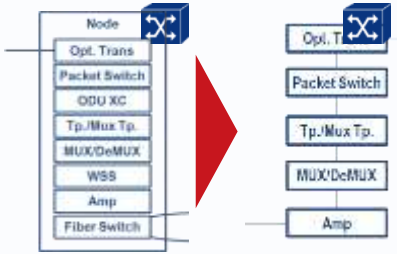

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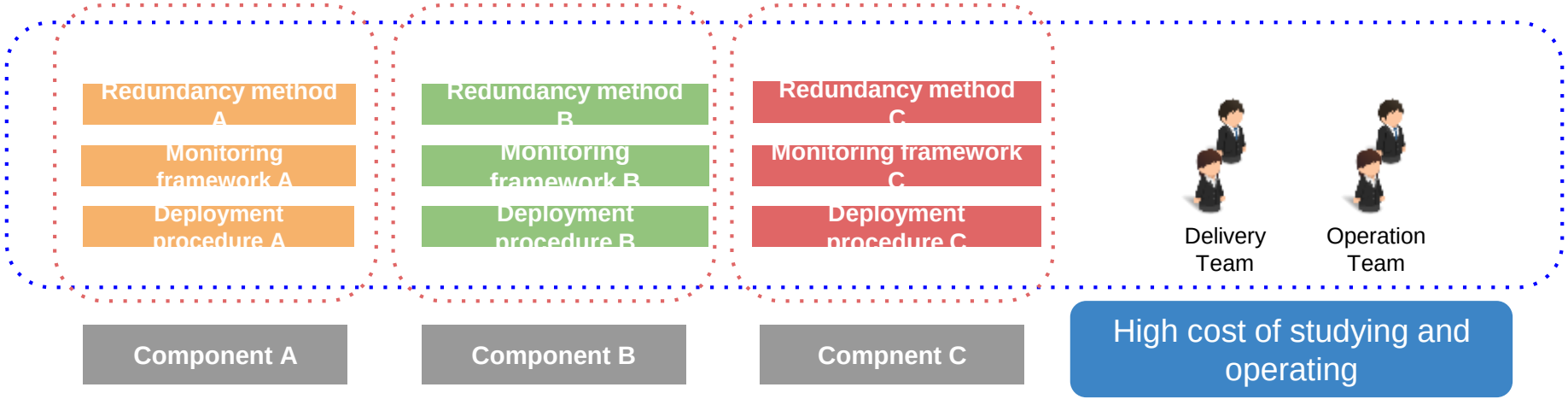
Micro Services Architectures

In-house Development

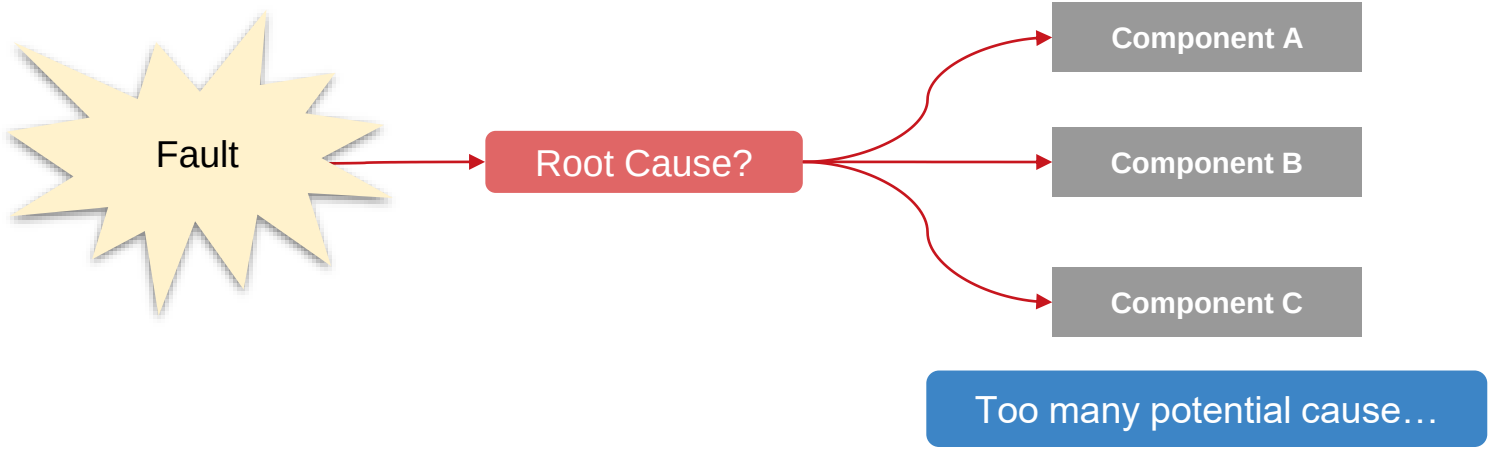
Experienced Issues of Micro Service Implementation (1)

Distributed development teams caused diversity of implementation method / framework / procedure



Experienced Issues of Micro Service Implementation (2)

Hardness of root cause analysis when any fault occur

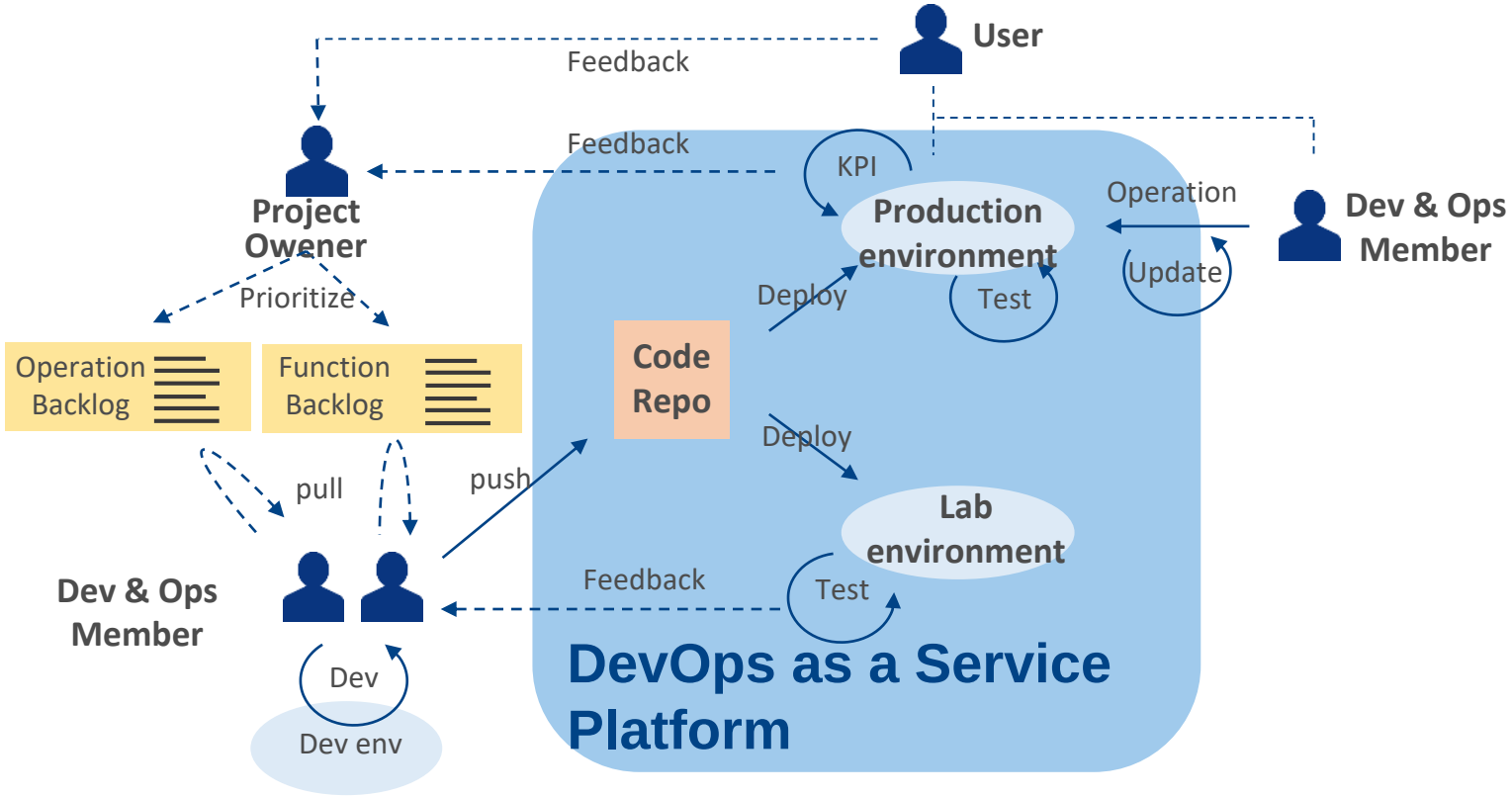


Approach 1: Commonization

- Application execution framework (->Container framework)
  - Making software developers free from infrastructure operation
  - Cutting CAPEX/OPEX by software portability
- CI/CD framework
- Deployment procedure

SRE team

Approach 2: DevOps as a Service Environment



Operation Automation Feedback Loop

Provisioning

NETCONF/YANG

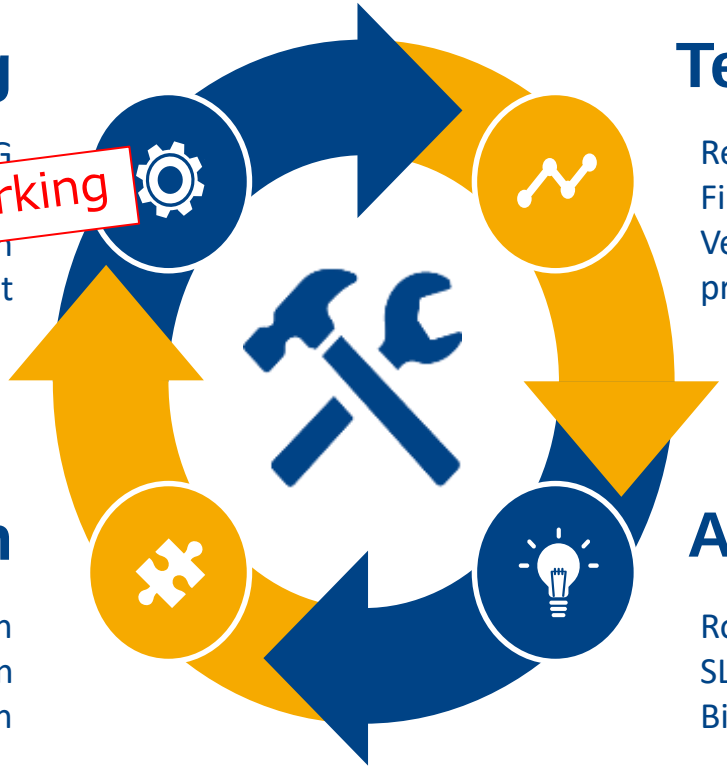
Intent-based networking

In-source development

Telemetry

Real-time, high-resolution
Fine-grained data
Vendor-neu
protocol

Telemetry



Plan

Path computation
Resource Optimization
Cooperative configuration

Analysis

Root Cause A
SLA As
Big Data analysis

AI-based analysis

Bigdata analysis

Summary and Future Works

- NTT Communications' "Softwarization challenges" to provide value-added SDx services in shorter time-to-market cycle.
- Next Challenges and future works
  - ✓ OSS/Standard API adoption -> from PoC level to production, reasonable collaboration with open communities that compete each other
  - ✓ Disaggregation -> Wider adoption into production environments, Difficulties in scalable management
  - ✓ DevOps & Automation -> Scalable framework for highly distributed software components, Advanced operation using AI/ Big-data?

---> Hope we can move forward collaborating with audiences!