

Network Disaggregation

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自己紹介

1997～2001 NTT/NTTコムウェア

2001～2008 シスコシステムズ

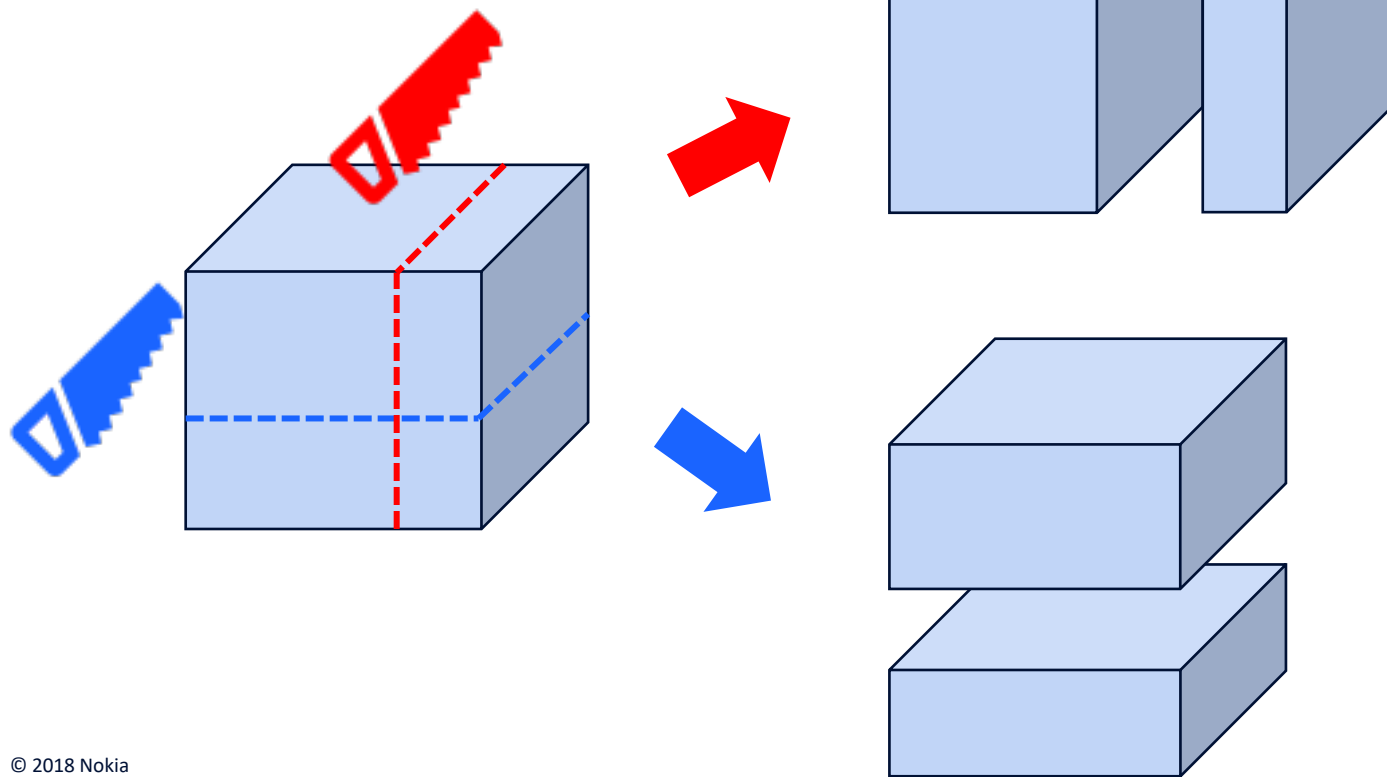
2008～2016 アルカテル・ルーセント

サービスプロバイダ向けルーター・スイッチ、EPC、SDN等の製品事業部

2016～ Nokiaにより買収され一夜で会社の看板が変わる。

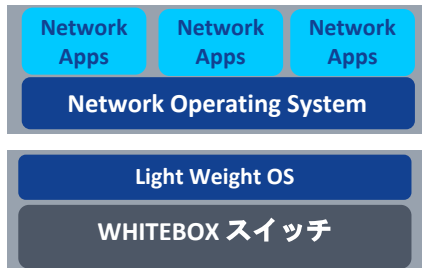
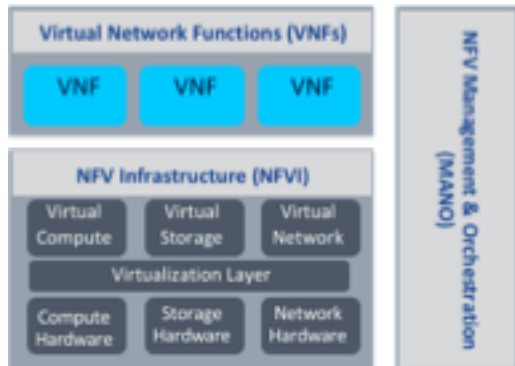
NokiaのIP&Optical Networks製品事業部責任者

様々なDisaggregationのアプローチ

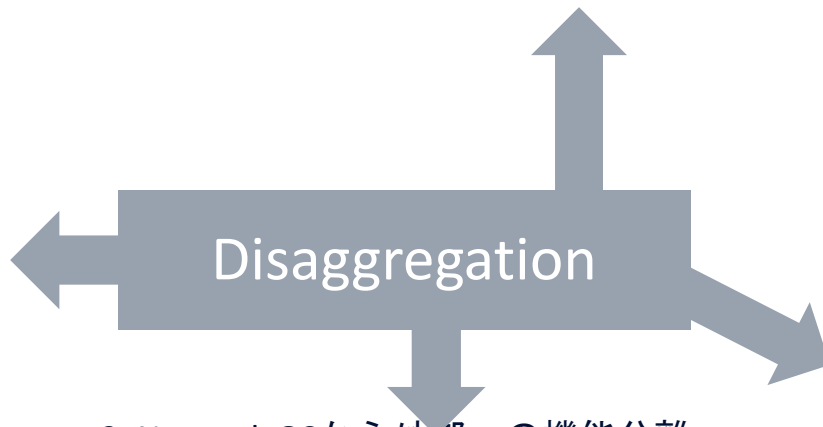
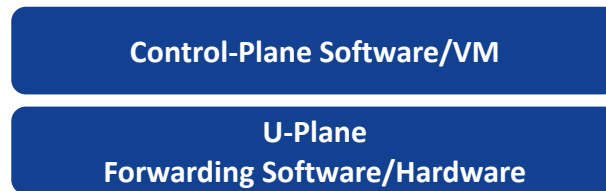


様々なDisaggregationの例

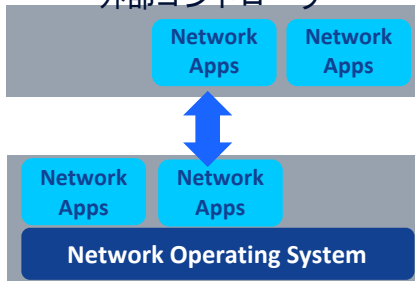
1. Generic Hardware + Software



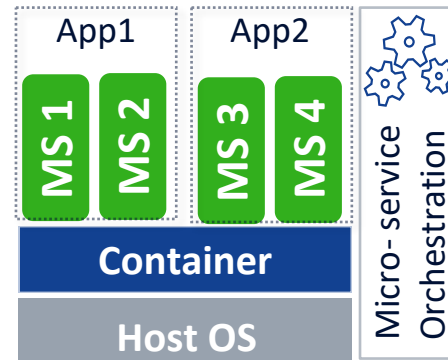
3. NFのC-plane/U-Plane分離



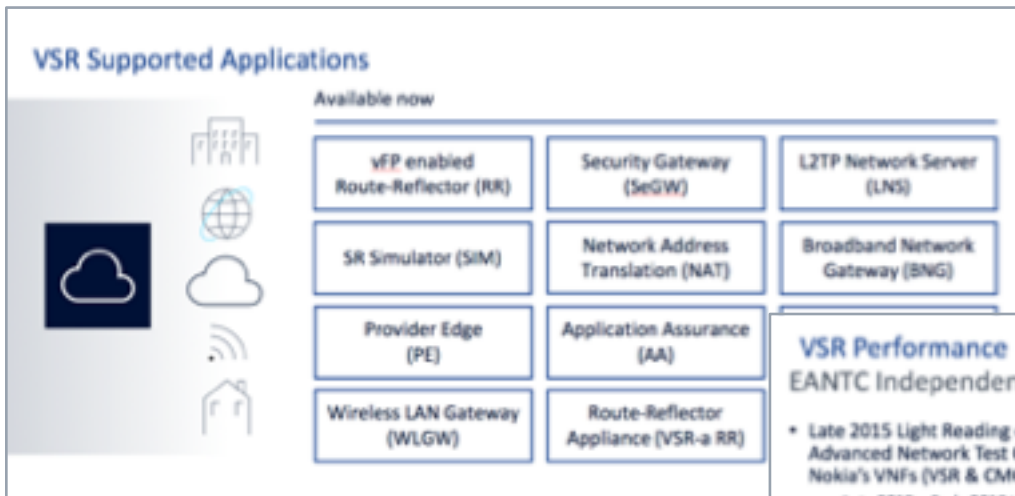
2. Network OSから外部への機能分離 外部コントローラー



4. NFのMicro Service化



1. Generic Hardware + Software (Router系)



VSR Performance EANTC Independent Test Results



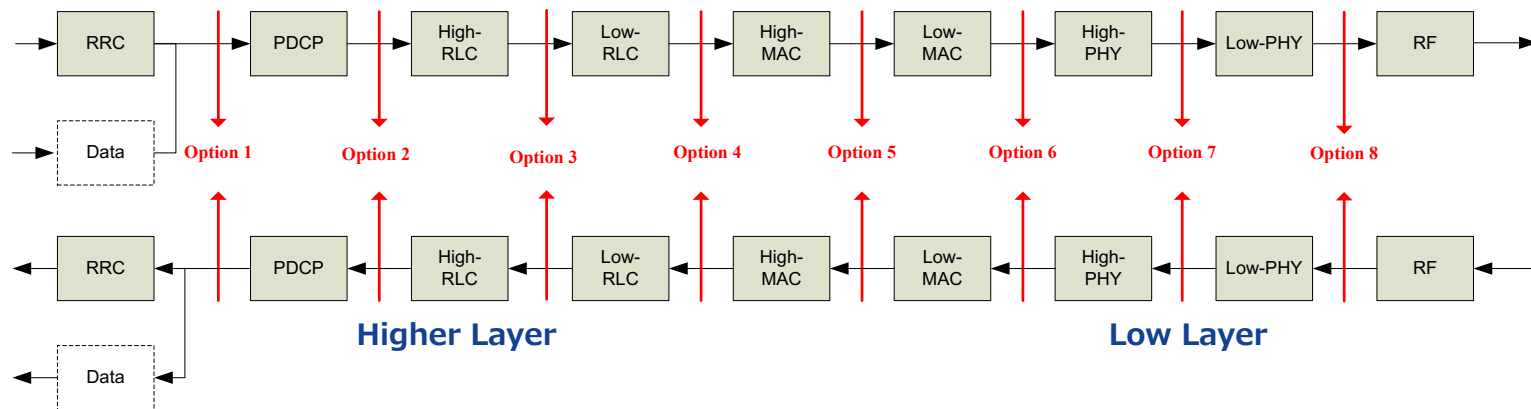
- Late 2015 Light Reading commissioned European Advanced Network Test Centre (EANTC) to test Nokia's VNFs (VSR & CMG*)
 - Late 2015 – Early 2016 testing occurred in Nokia's Mountain View (US) labs
- Tested VSR as a PE, RR, BNG and AA device
- Single VSR tested with 8 x 10GE interfaces, @ single socket 18 cores CPU (E5-2699v3)
- VSR as a PE
 - Line-rate 80Gbps RFC2544 at >=256byte packets (57.5Mpps)
 - Line-rate with IMIX packets with 2500 concurrent L2 and L3 services configured including QoS (54k lines of config) (50Mpps)
- VSR as a BNG
 - 79.2Gbps throughput with 16k subscribers, 48k hosts, 48k queues and 48k policers
- VSR as a Route-Reflector
 - 3.2-3.5M route updates per second
 - Linear scale/performance (same with 100 peers as with 1000 peers)
- VSR performing Application Assurance
 - 36Gbps throughput with 64k clients and 5.3M concurrent TCP sessions
 - Scales to 11.4M sessions today

"The independent EANTC tests of Nokia VSR-PE, VSR-RR and VMG validated state of the art performance, resource efficiency and migration paths for virtual routers and mobile core gateways."

- Carsten Rosenhoevel, Managing Director, EANTC AG (March 2016)

1. Generic Hardware + Software (Radio系)

無線基地局の内部機能分離

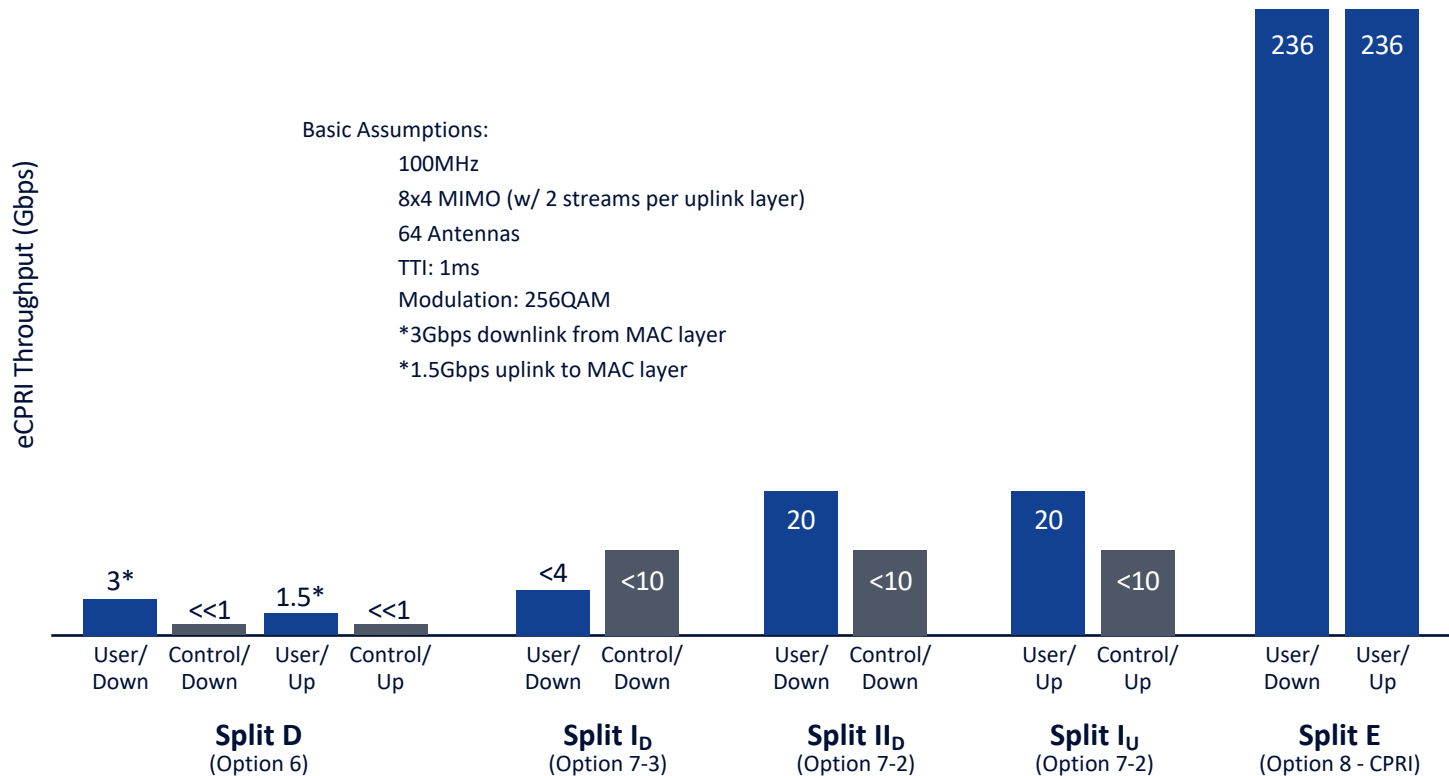


遅延要件

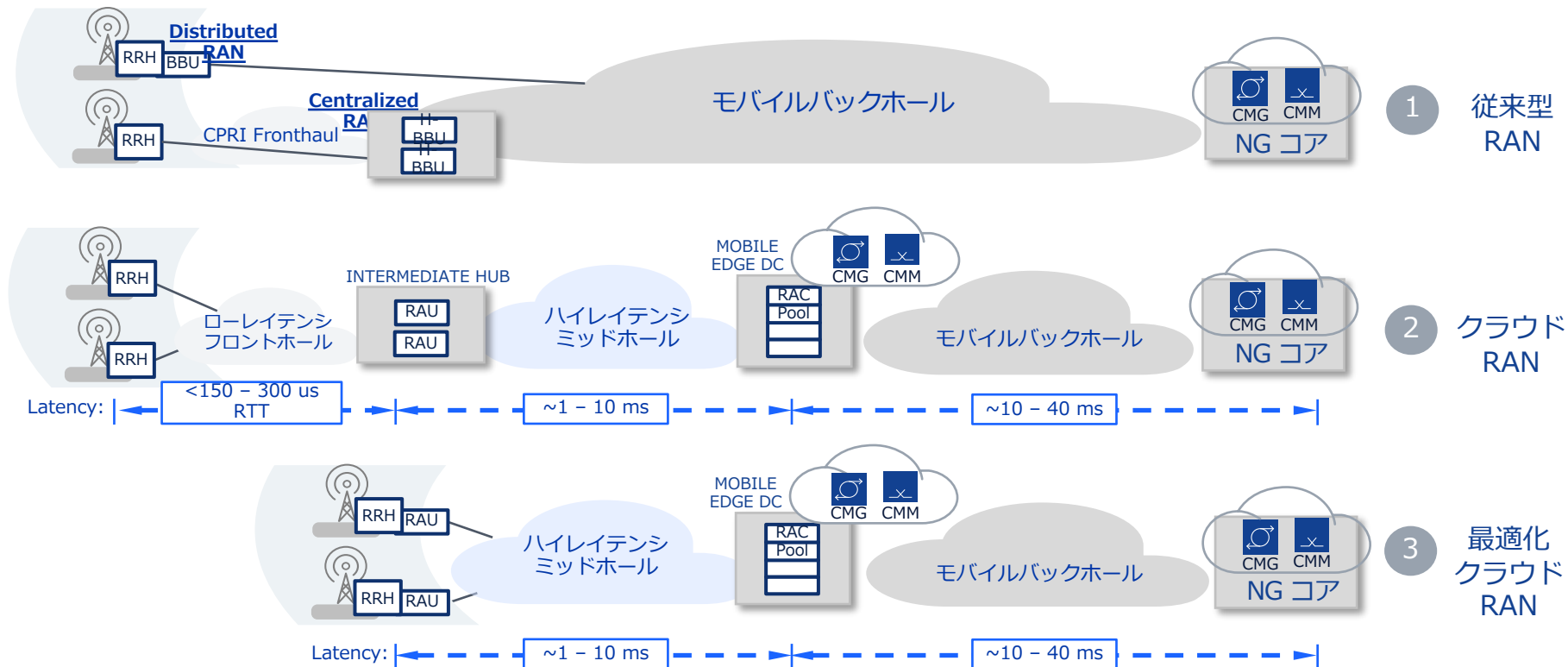
帯域幅要件

コーディネーション

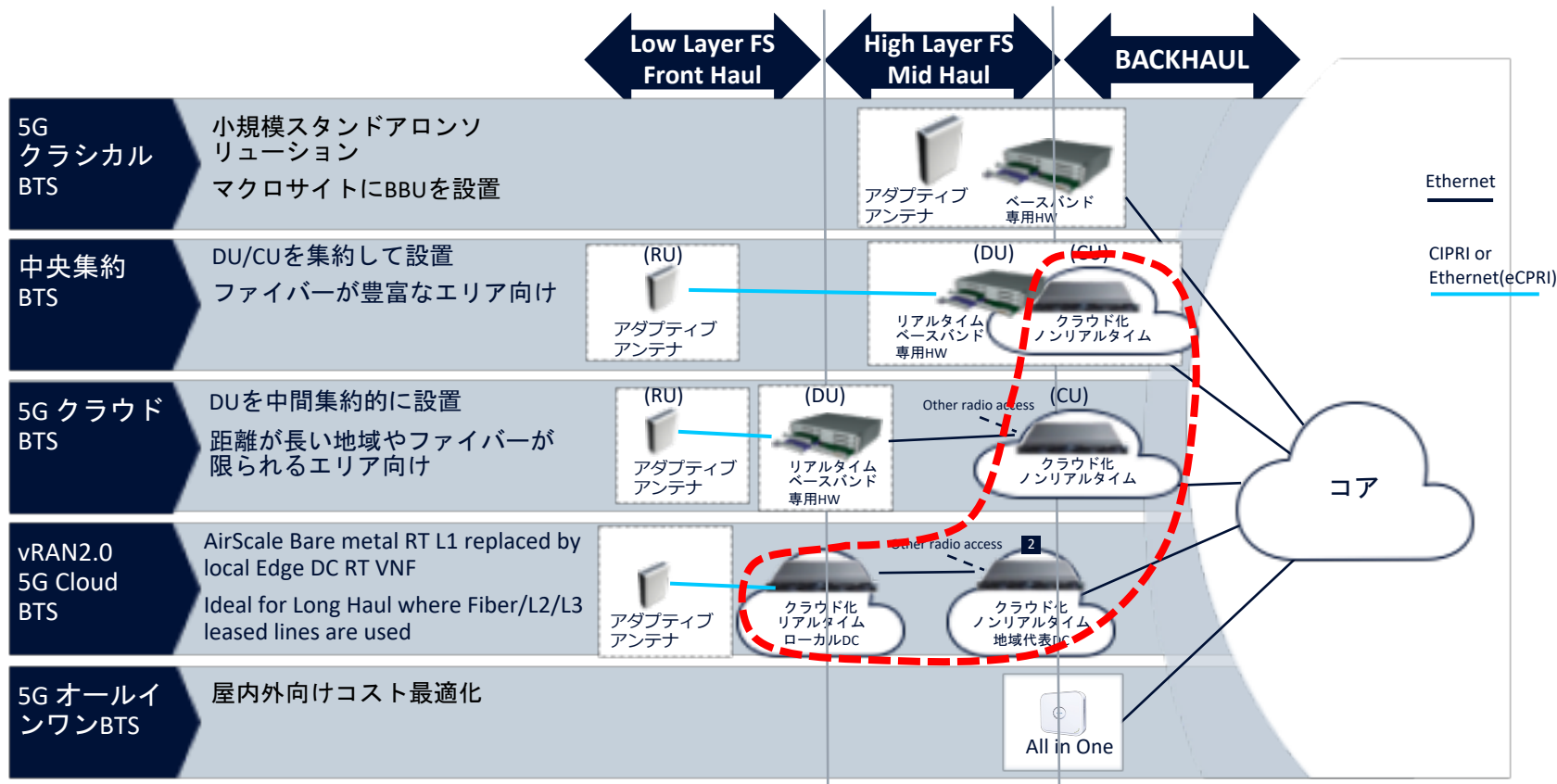
機能分離レイヤによるネットワークへの帯域要件の違い



機能分離レイヤによるネットワークへの遅延要件の違い



1. Generic Hardware + Software (Radio系)



RANのオープン化への動き (1)

ORAN(Open Radio Access Network) Alliance



AT&T	ASOCS	Netsia
Deutsche Telekom	Blue Danube,	Nokia
NTT/DOCOMO	Ciena	Radisys
SK Telecom	Cisco	Samsung
Telstra	Commscope	Stanford University
Verizon	Fujitsu	Texas Instruments
AltioStar	Intel	University of Sydney
Amdocs	Mavenir	
Aricent	NEC	

C-RAN Alliance

China Mobile Research Institute
Huawei Technologies
ZTE Corporation
Nokia Solutions and Networks System Technology (Beijing)
Datang Mobile
Intel Corporation
Broadcom Limited
Xilinx
Wind River Systems
RedHat Software (Beijing)
Spirent Communications Technology (Beijing)

ORAN Alliance



Will continue to be an operator led initiative

Board made up of the 5 founding operators:
AT&T, DT, China Mobile, Orange and NTT
DOCOMO

Completion of the first open
front haul specification

Working group set-up
Governance settled
The legal formation of the new entity completed
Updated By-law and IPR policy

New use cases
New working groups operational
Merger completed
New interface spec. released

PoC at MWC 2019

1Q/2018

2Q/2018

3Q/2018

4Q/2018

1Q/2019

RANのオープン化への動き (2)

TIP(Telecom Infra Project)

- **Announced in MWC 2016**
- **Sponsor members: FB, Intel, Nokia, SKT, DTAG**
- **Originally focus on connecting the unconnected.**
- **Telecom Infra Project, Inc. (Delaware)**

Mission

The Telecom Infra Project (TIP) is an innovation-focused initiative driven by operators, infrastructure providers, system integrators, and other technology companies that aim to reimagine the traditional approach to building and deploying telecom network infrastructure.

Project Groups

Access Projects

Edge Computing

Power and Connectivity

System Integration and Site Optimization

OpenCellular – Wireless Access Platform Design

Solutions Integration

OpenRAN

CrowdCell

vRAN Fronthaul

Backhaul Projects

Millimeter Wave (mmWave) Networks

Open Optical & Packet Transport

Core & Management Projects

Artificial Intelligence and Applied Machine Learning

End-to-End Network Slicing (E2E-NS)

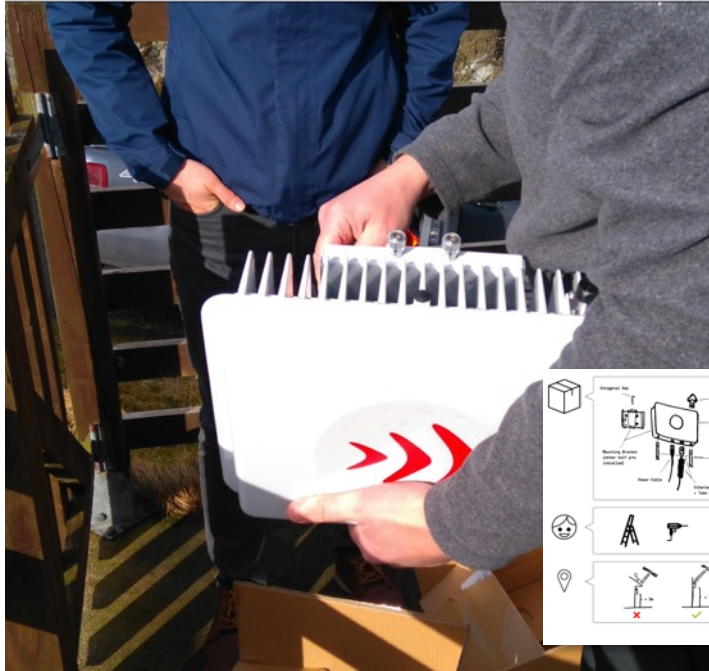
People and Process

TIP Community Labs

TEAC

RANのオープン化への動き (2)

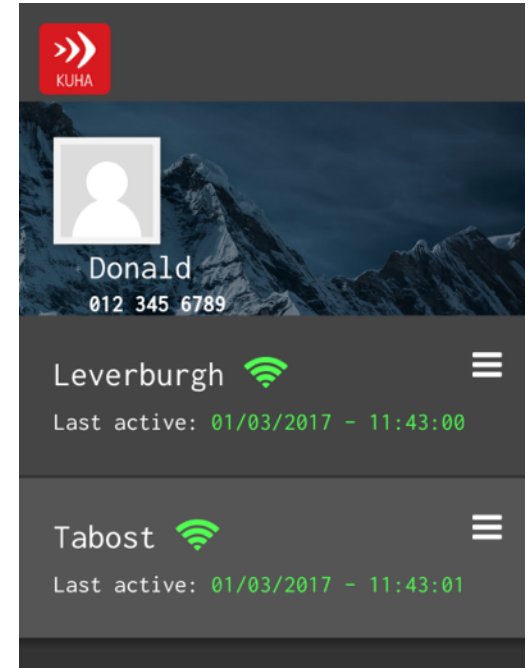
TIPのRadioトライアル@スコットランド



Local residents set up the Kuha base station using Ikea-like instructions



Completed installation



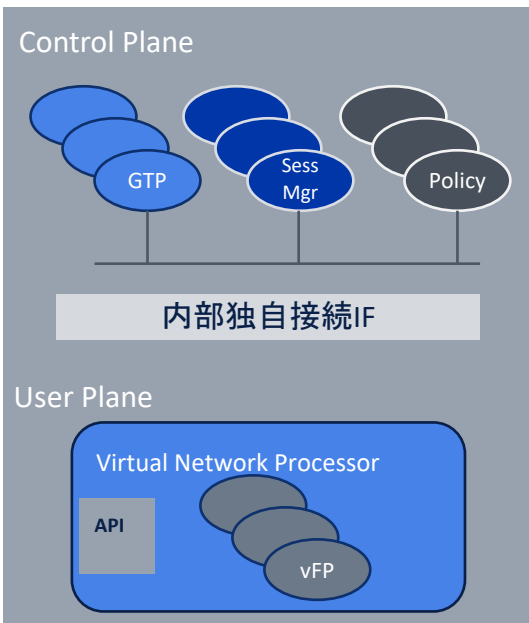
Kuha Cloud OSS UI shows the base station status and assists the local users.

3. NFのC-plane/U-Plane分離

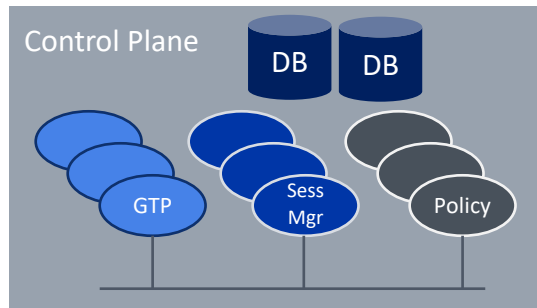
4. NFのMicro Service化

モバイルパケットコア、BNG向けに実装

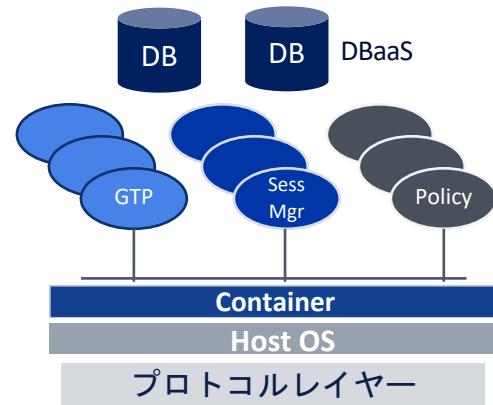
CP / UP 一体型VNF



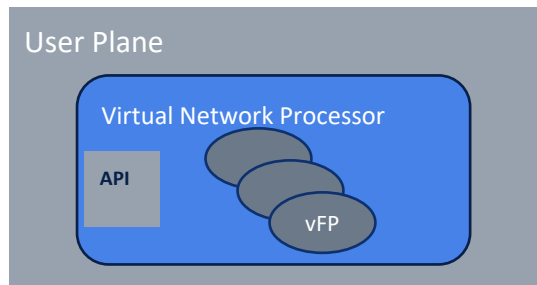
Control Plane VNF



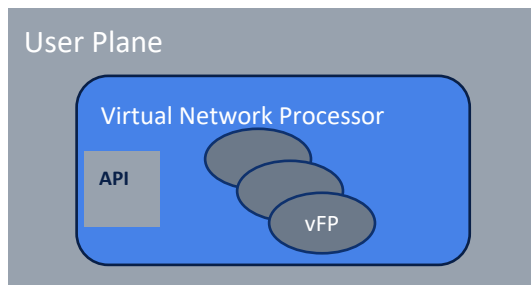
Control Plane マイクロサービス



User Plane VNF



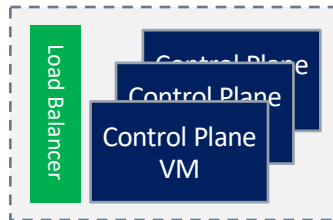
User Plane VNF



3. NFのC-plane/U-Plane分離 U-Planeの選択肢

Control Plane:

(SMF, PGW-C, SGW-C,
combo SMF/PGW-C for
4G-5G IWK)



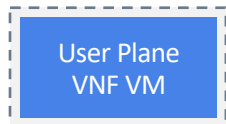
CMG (Control Plane)

- State efficient control plane
- Single IP address architecture
- Dynamic scale-in/out

Sx (4G), N4 (5G)

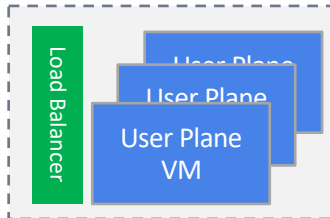
User Plane:

(UPF, PGW-U, SGW-U,
combo UPF/PGW-U for
4G-5G IWK)



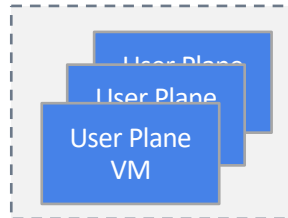
Single VM CMG

- Scale: 4M PDU
- Throughput: up to 120Gbps



Multi-VM CMG with LB

- Scale: 32M+ PDU
- Throughput: up to 960Gbps



Multi-VM CMG without LB

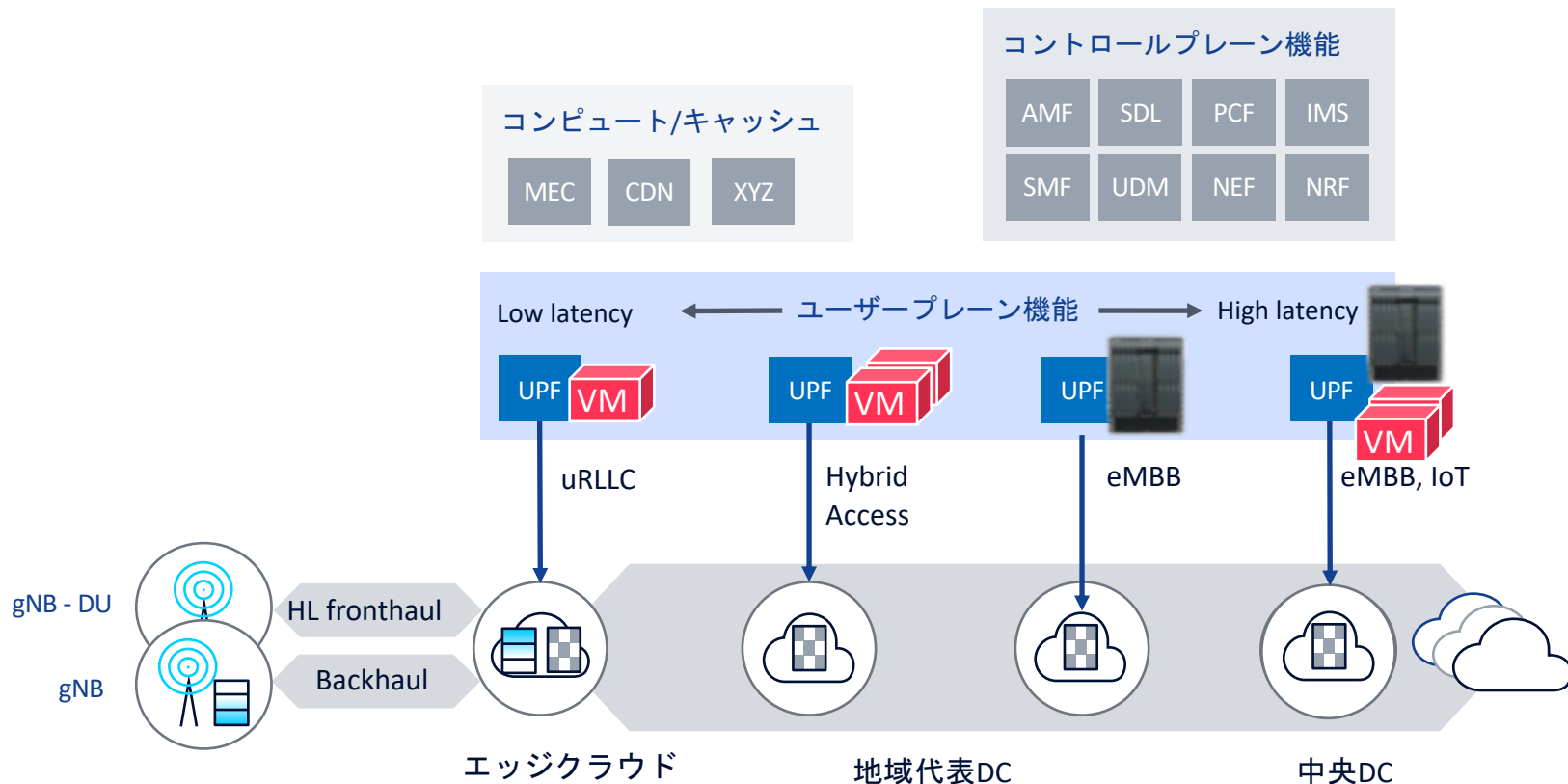
- Scale: 32M+ PDU
- Throughput: up to 960Gbps



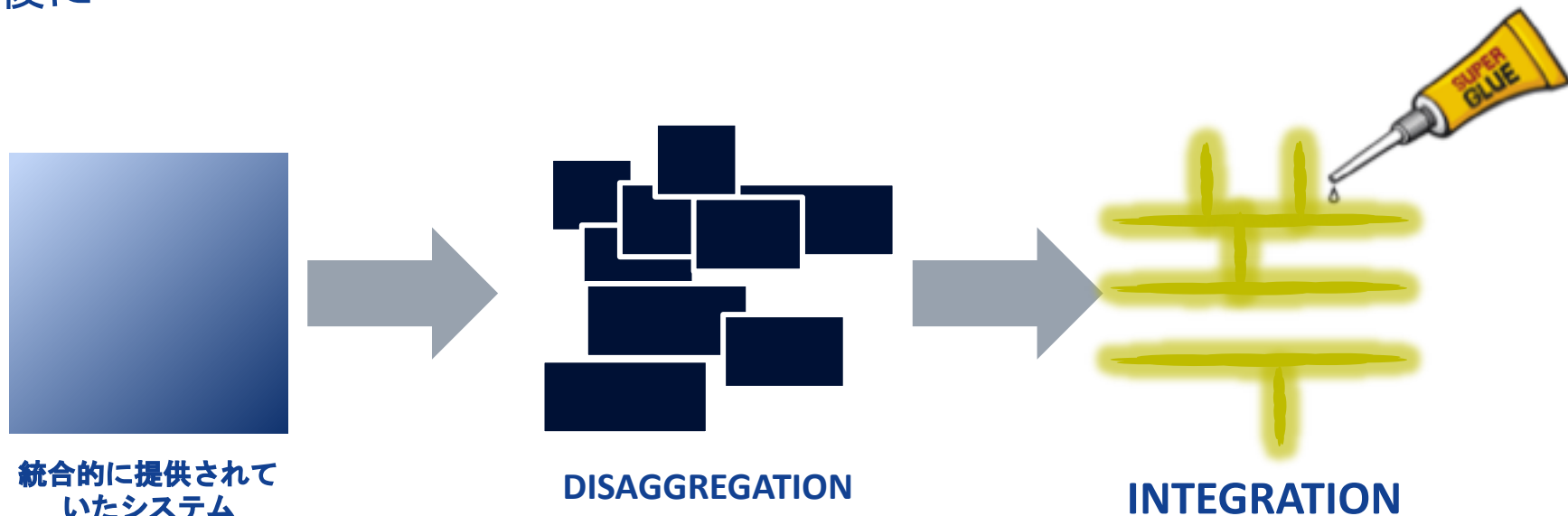
7750

- Scale: 16M+ PDU
- Throughput: Multi terabit

3. NFのC-plane/U-Plane分離 用途に応じたUPF設置場所とプラットフォームの選択



最後に



DisaggregateしたものはIntegrateする必要がある。
Integrationには労力とコストがかかる。また責任の所在をどこにおくか。
何を目的としてDisaggregationを適用するか深い考慮が必要。



NOKIA