IEEE NetSoft 2016 Keynote

SK telecom

Software Defined RAN (SDRAN) Evolution

- Challenges & Opportunities

June 7, 2016

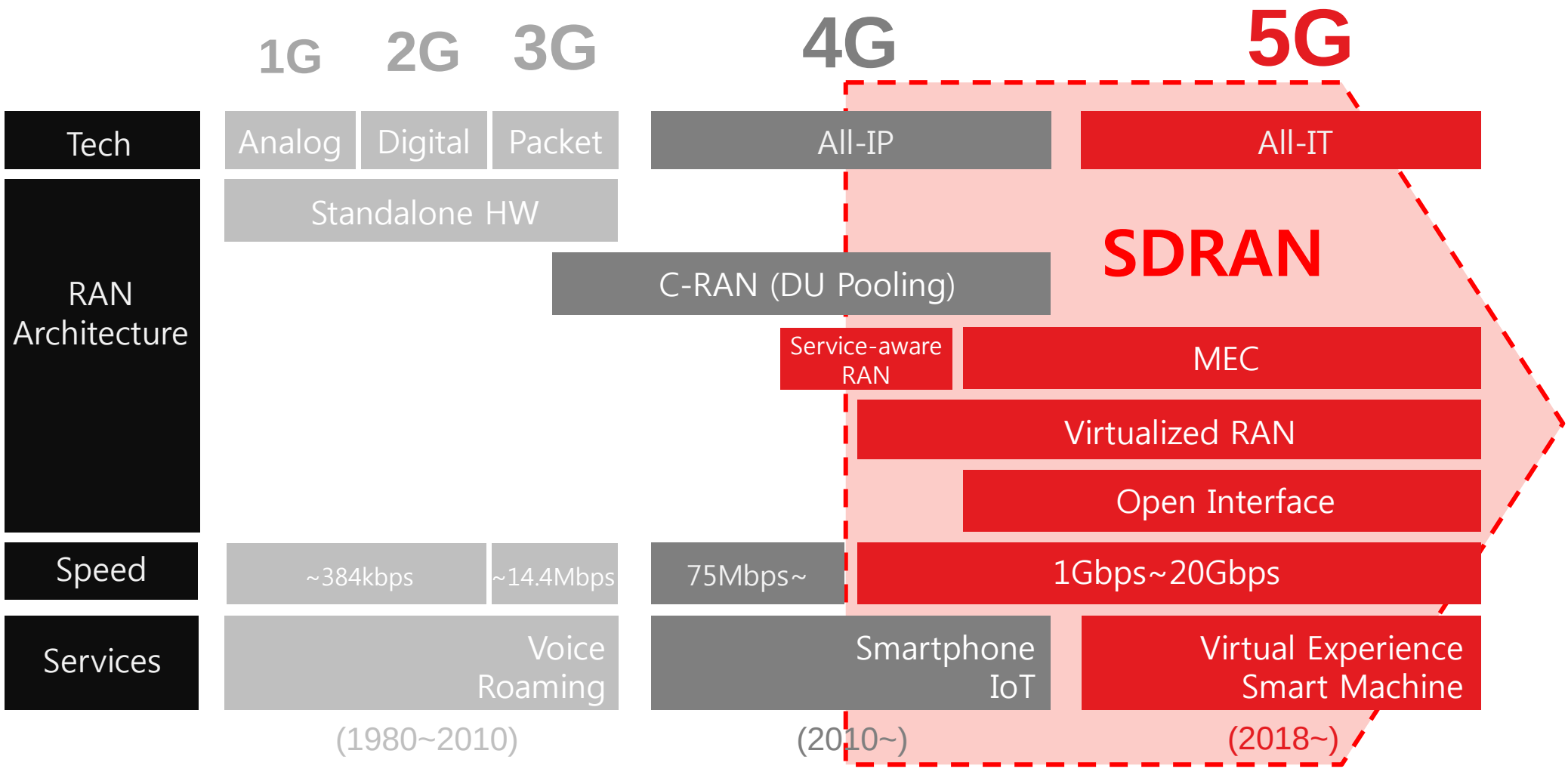
Alex Jinsung Choi

CTO & EVP, Corporate R&D Center

Contents

History of Mobile Network Evolution

RAN Evolution Direction



Operator Challenges

Current HW-centric mobile infrastructure leads to inefficiency when
- Re-allocating radio resources dynamically to cope with the change of traffic
- Introducing and providing customized/innovative services
- Upgrading Telco functionalities

Inefficient utilization of radio resources

Inability to customize for various customers

High upgrade costs

Mobile infrastructure needs re-architecting

Re-architecting the RAN

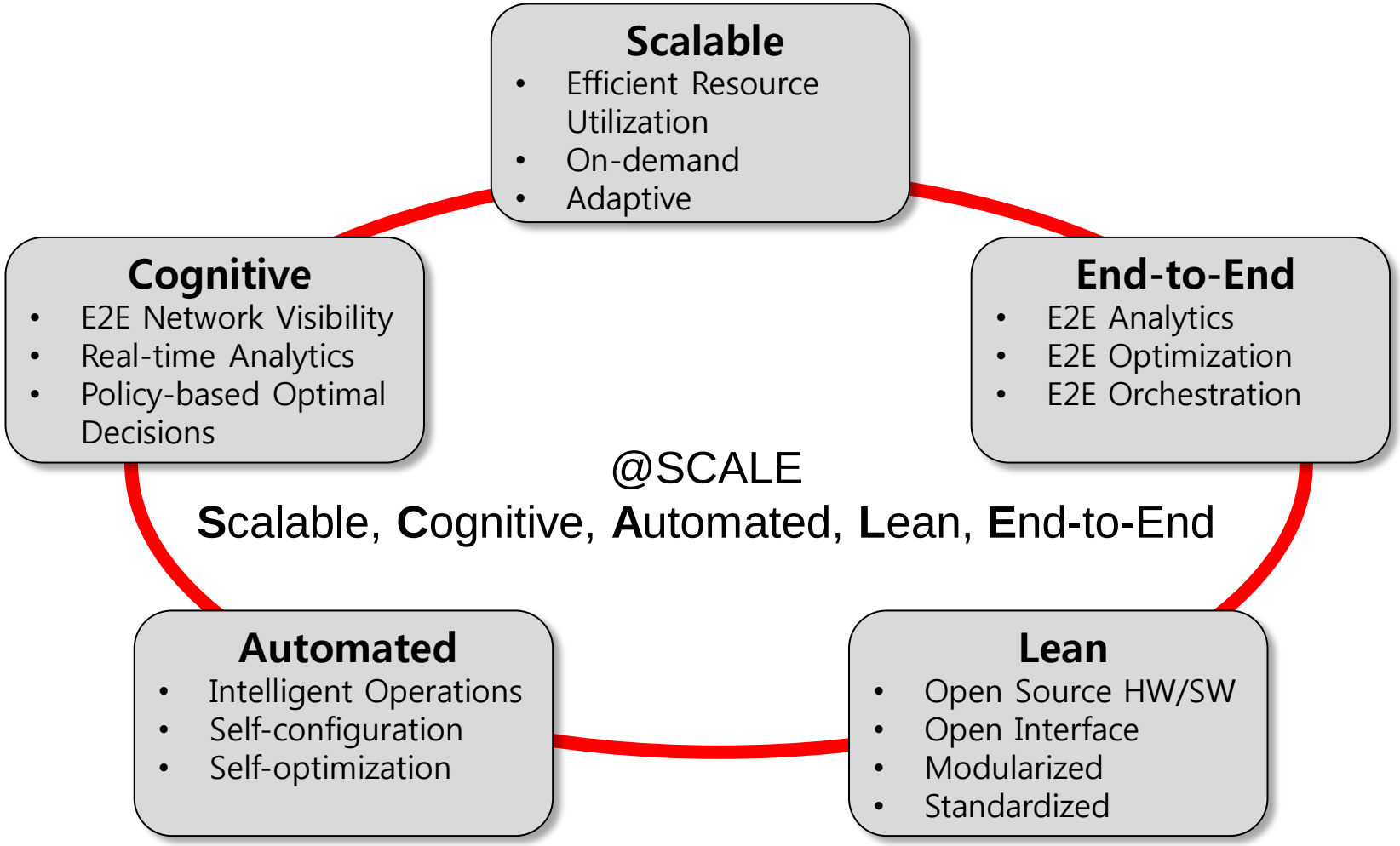
Direction of SKT's Future RAN Architecture

- Network that fulfills diverse requirements/services **at-scale**
- @SCALE: **S**calable, **C**ognitive, and **A**utomated, **L**ean, **E**nd-to-end

Past & Present		Future Telco @SCALE
Fixed	Inefficient Resource Utilization	**Scalable**
Unaware	Massive Data Risk Management	**Cognitive**
Manual	Human Efforts and Errors	**Automated**
Fat & Monolithic	High Complexity (Closed API)	**Lean**
Domain-Specific	Separate Management	**End-to-end**

Re-architecting the RAN

SKT's future RAN will be
"Scalable", "Cognitive", "Automated", "Lean", and "End-to-End"



Re-architecting the RAN : How?

SK telecom

4 Basic Principles

"Unbundling"

- Software/Hardware Decoupling
- Unbundled Function Blocks
- Control-/User-plane Separation

"Open"

- Open Source Software (OpenStack, ONOS)
- Open Hardware (OCP, TIP)
- Open Interface (Fronthaul, API)

"Softwarization"

- NFV (Network Functions Virtualization)
- SDN (Software Defined Networking)
- Orchestration & Network Slicing (XaaS)

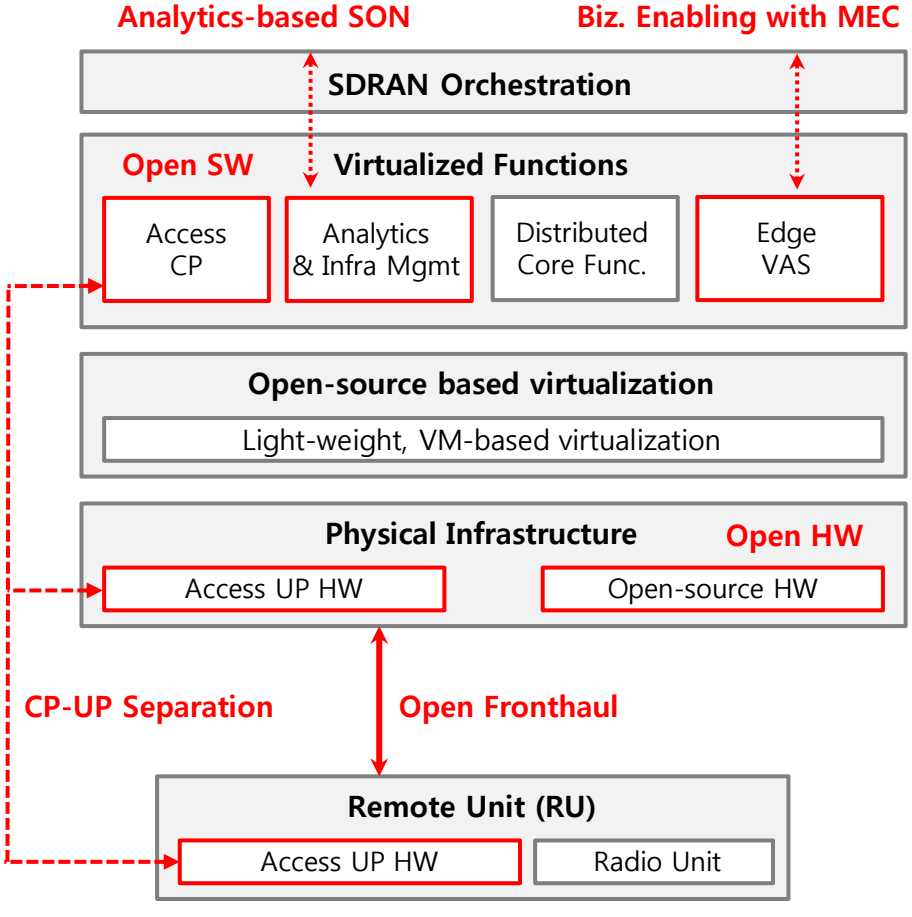
"Cloudification"

- Cloud-based "All IT" Infra
- SDN-enabled Fabric
- Re-architecting as a Data Center

SDRAN (Software-defined RAN)

Software-based "All-IT" network infrastructure with open RAN innovations

SDRAN Architecture



Key Values

1 Open Architecture

- Network function virtualization
- Open interface (fronthaul, service API)
- CP-UP separation
- Open HW and SW

2 Operational Intelligence

- SW-based risk management
- Auto Recovery
- Reconfiguration without service interruption
- Automated operation and optimization with real-time analytics

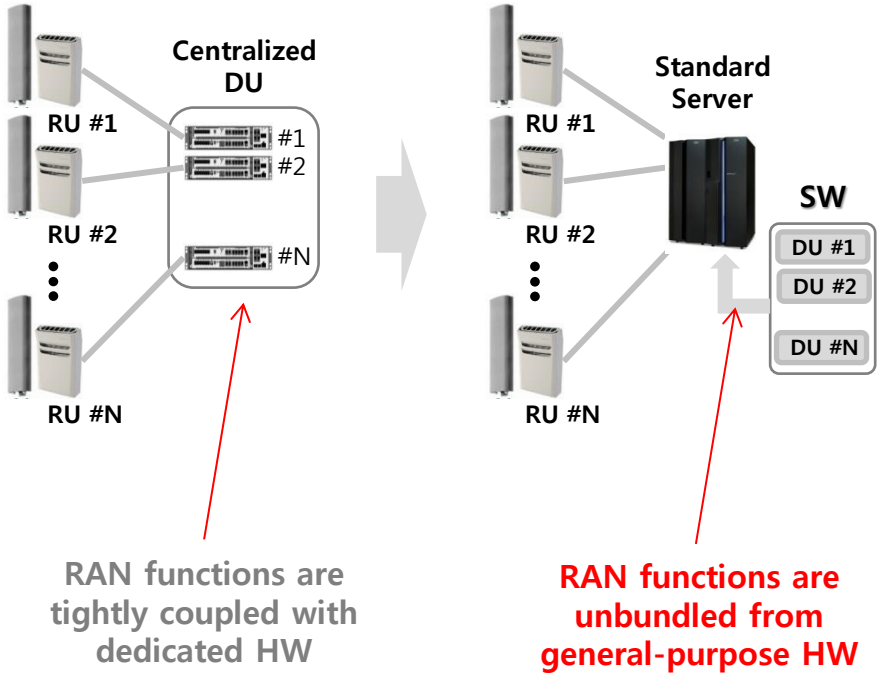
3 Biz. Enabling Platform

- 3rd party services
- Rapid Creation of Innovative Services
- Edge service slicing

SDRAN - Enabling Features (1/5)

Network Function Virtualization

- Apply IT virtualization technologies to Telco infrastructure



Requirements

- RAN functions are virtualized on any COTS (standard servers) on the market
- Meet carrier-grade performance requirements, such as real-time processing and availability

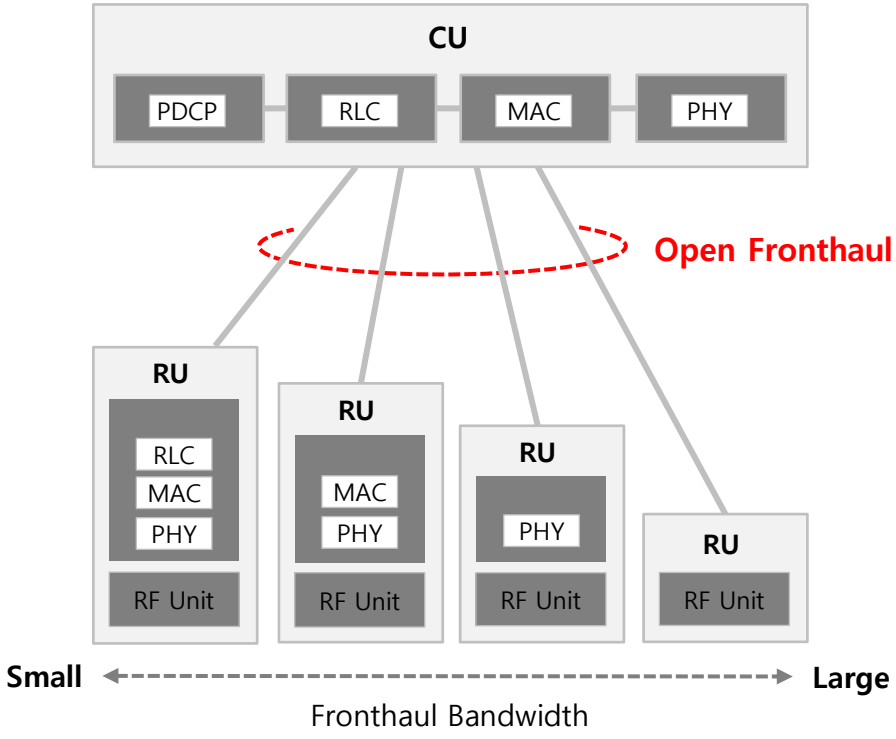
Benefits

- Open source solution, e.g., OpenStack, is already widely used in the industry
- Brings pooling gains, i.e., enables efficient use of hardware resources
- Cost-efficiency by using general purpose computing platforms

SDRAN - Enabling Features (2/5)

Open Fronthaul with Function Split

- Unbundling central unit (CU) and remote unit (RU)



Requirements

- Support flexible function split between CU and RU
- Define open interface for fronthaul, especially O&M related specifications
- Show multi-vendor interoperability with compliance testing

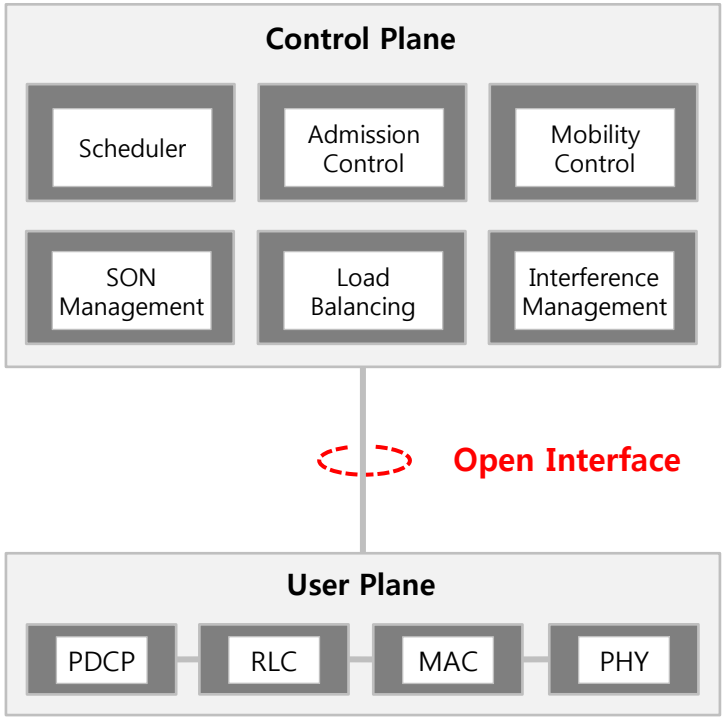
Benefits

- Select best combination of CU and RU in terms of costs, fronthaul bandwidth, and coordination
- Cost-efficiency by leveraging wide ecosystem

SDRAN - Enabling Features (3/5)

CP-UP Separation

- Unbundling control plane (CP) and user plane (UP)



Requirements

- Define CP functions which can be differentiated by each operator (scheduler, admission control, handoff control, SON management, load balancing, interference management, link aggregation, multi-RAT management, etc.)
- Define open interface between CP and UP
- CP run as virtualized function
- UP run on standardized and dedicated hardware

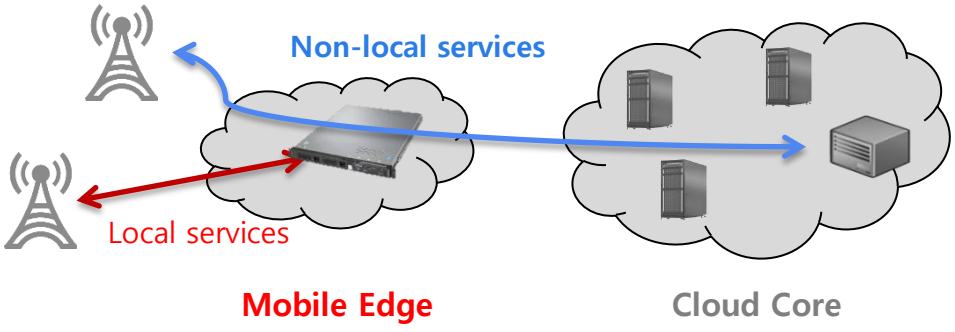
Benefits

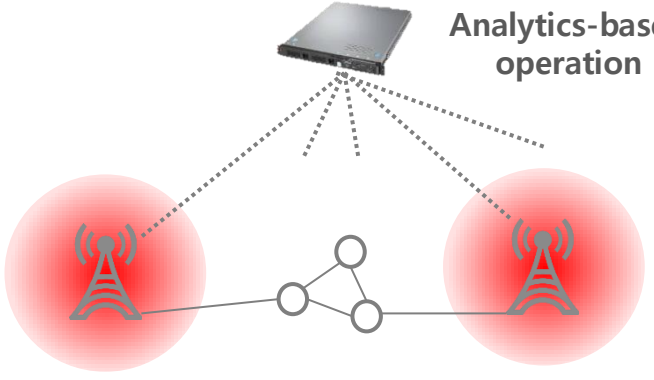
- Separate HW expansion of CP and UP
- Enables RAN slicing
- Operators can introduce differentiated CP
- Cost-efficiency by using GPP and/or commoditized UP hardware

SDRAN - Enabling Features (4/5)

Open API for MEC & Analytics

- Provides additional information for non-telco applications





Requirements

- Define open API for
  - 3rd party applications
  - Analytics functions
- Need to provide necessary information, for example, radio condition, user information, resource allocation, etc.

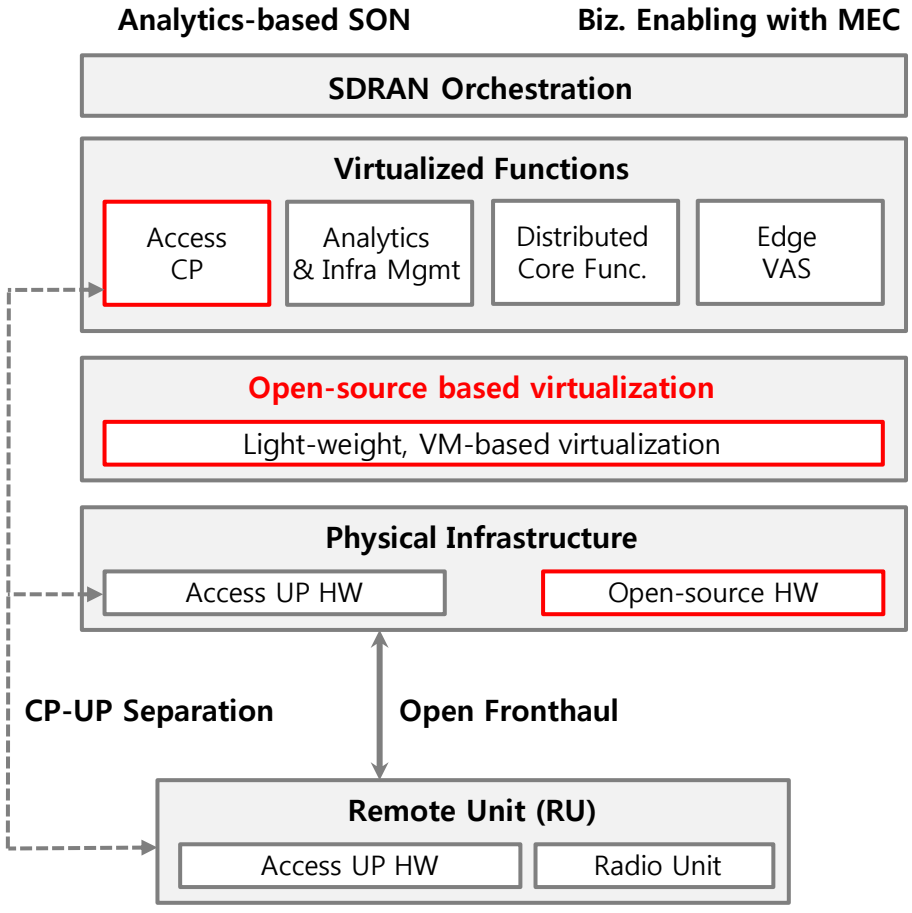
Benefits

- Brings operational intelligence (risk management, automated operations, and optimization) to operators using real-time analytics
- Brings new business opportunities with mobile edge computing platform

SDRAN - Enabling Features (5/5)

Open HW/SW

- Standardize HW components and modularize SW components



Requirements

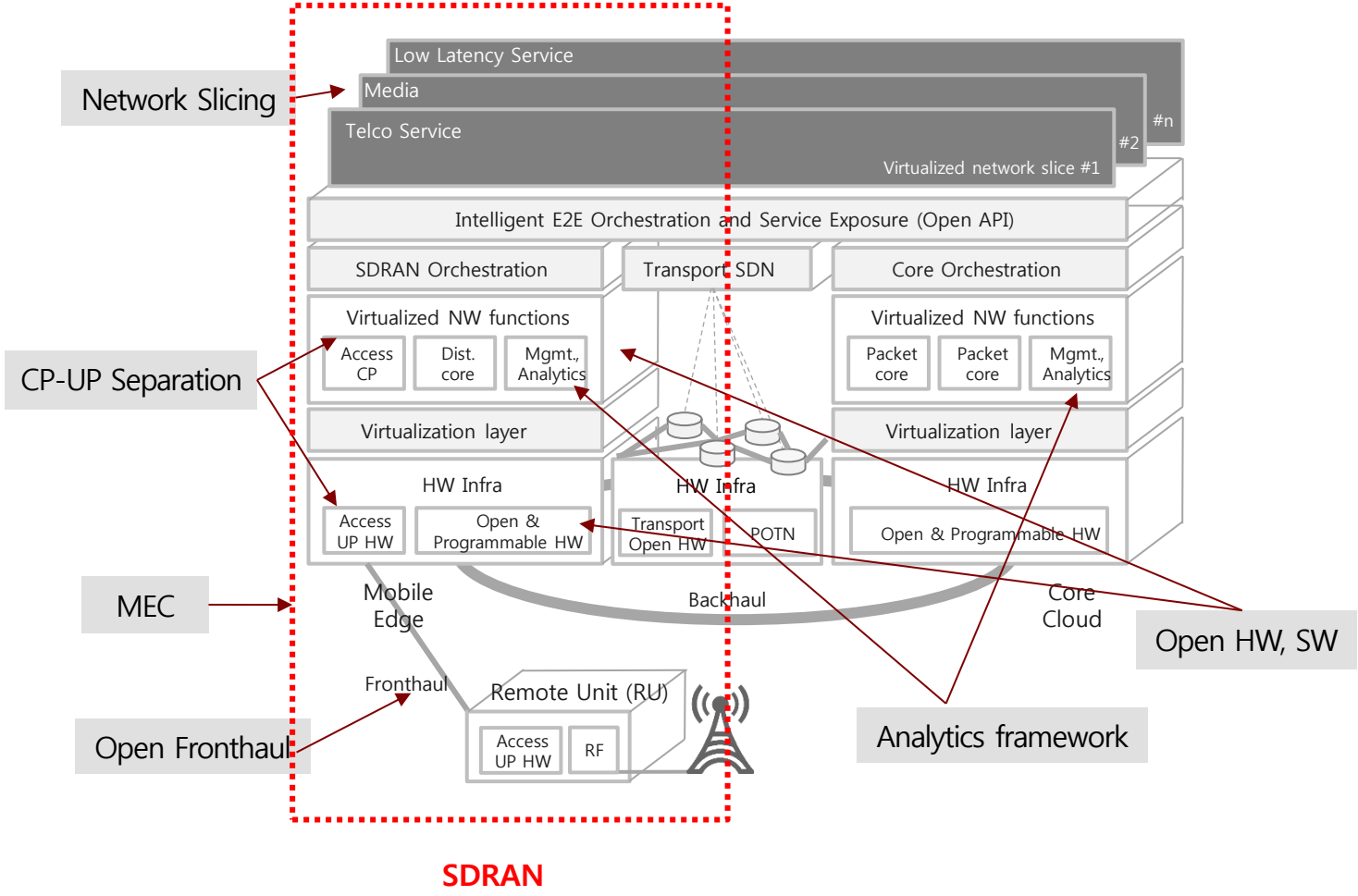
- Define common specifications for HW components such as server, switch, storage, rack, etc.
- Define open interface between SW components (L1, L2, L3)

Benefits

- OCP has proven that openness and collaboration can successfully drive innovations on HW technologies for data centers
- Provides power efficiency, flexibility, and scalability
- Cost-efficiency with standardized HW components

SDRAN – Extension to E2E Architecture

SDRAN will complete the end-to-end "AtSCALE" network infrastructure



- Each area (access, transport, and core) is now being virtualized using technologies like NFV and SDN
- E2E orchestrator connects access, transport, and core networks, and provides managements of services in the aspect of the end-to-end connection

SDRAN Opportunities

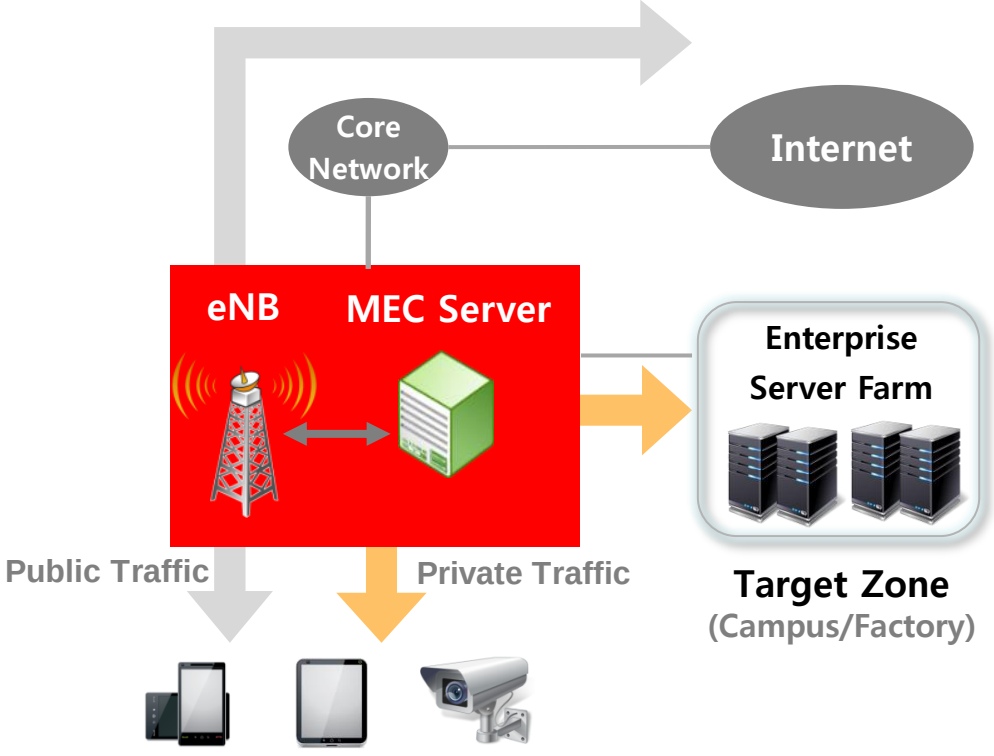
Operator Opportunities provided by SDRAN

Operational Intelligence	New Business	Customer Experience	Cost-efficiency
			
Real-time Big Data Analytics Automated Operations Zero-touch Network	Edge Service Platform Innovative Services	Real-time Optimization Service Agility	Unbundled RAN Components Multi-vendor Interoperability

SDRAN Opportunities

New Business

- "Proximity to end users" brought by mobile edge computing platform brings new opportunities to operators to *create new business models*
- Example: **Private Network**
  - Local routing and traffic control for enabling the smart work service with high security



Customer Experience

- Low latency enabled by mobile edge service platform will *enhance the customer experience* in certain applications like **AR** and **VR**
- Low latency will *create new services* like **self-driving car** and **robotic surgery** which have been impossible in existing networks

SDRAN Challenges

IT World vs. Telco World

Simplicity & Flexibility

Programmability
Easy-to-reconfigure
Open

99.999% Reliability & Availability

Stability
Deterministic performance
Standard

SDRAN Challenges

Challenges SDRAN needs to deal with

Mission Critical	Real-time Processing	System Integration	Reliability
			
RAN Slicing CP-UP Separation	Distributed System with Function Split HW Accelerator	Open Interface Compliance Testing	Operational Intelligence

Global Collaboration

SK telecom is committed to open source and standards-based solutions
We are carrying out various R&D projects to verify the SDRAN concept & performance in collaboration with global telco/IT companies

OPEN Compute Project

Gold Member
OCP Telco Project

SDRAN

TELECOM INFRA PROJECT

Founding Member
Board Chair

ON.LAB

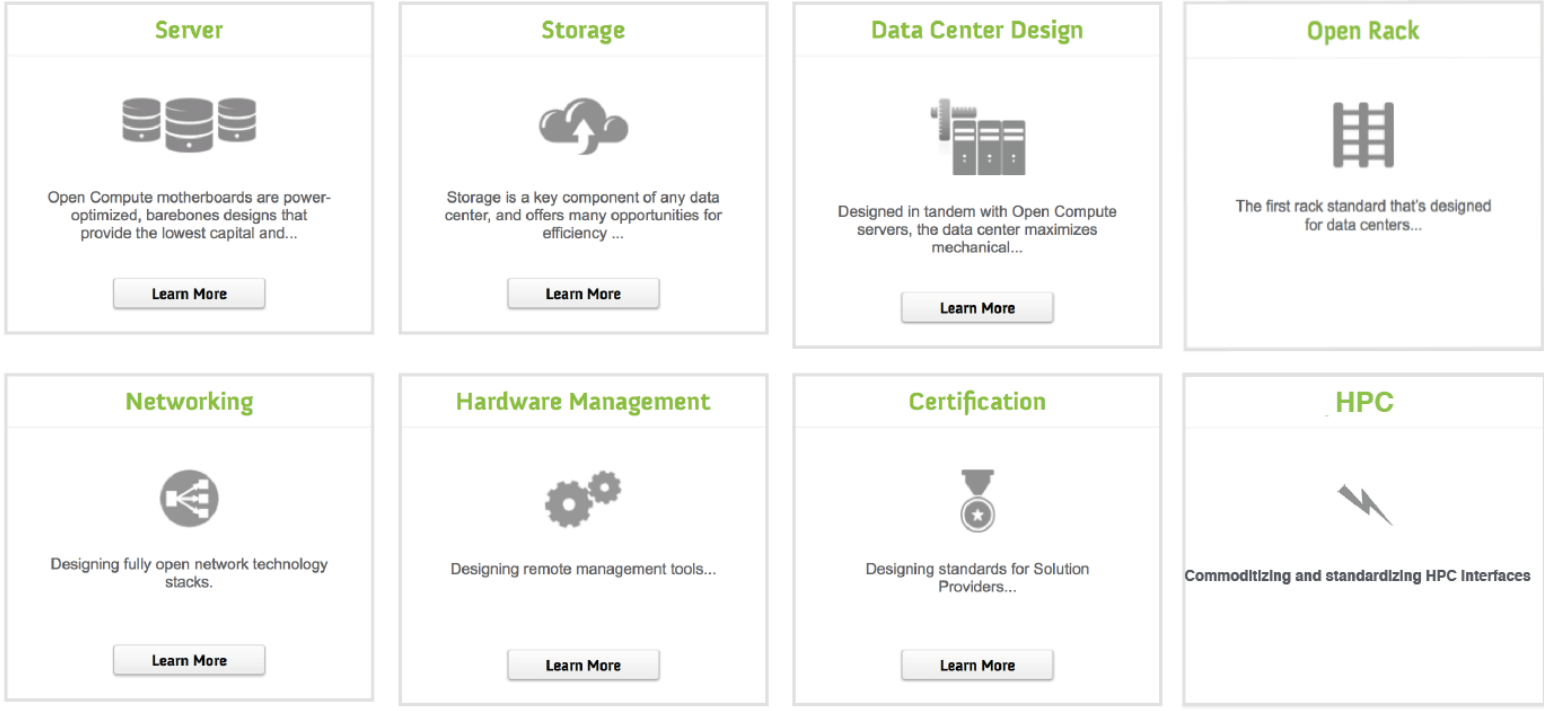
Member and Collaborator
CORD and ONOS Partner

CORD

ONOS
Open Network Operating System

Global Collaboration

- **Open Compute Project (OCP)**
  - *Redesigning hardware* to efficiently support the growing demands on IT infrastructure
  - Break and open the black box of proprietary infrastructure, making it more *efficient*, *flexible*, and *scalable*
- **8 Projects + Telco Project (created on Jan. 2016)**
  - *OCP Telco Project*: Focus on data center technologies for *telecom companies*

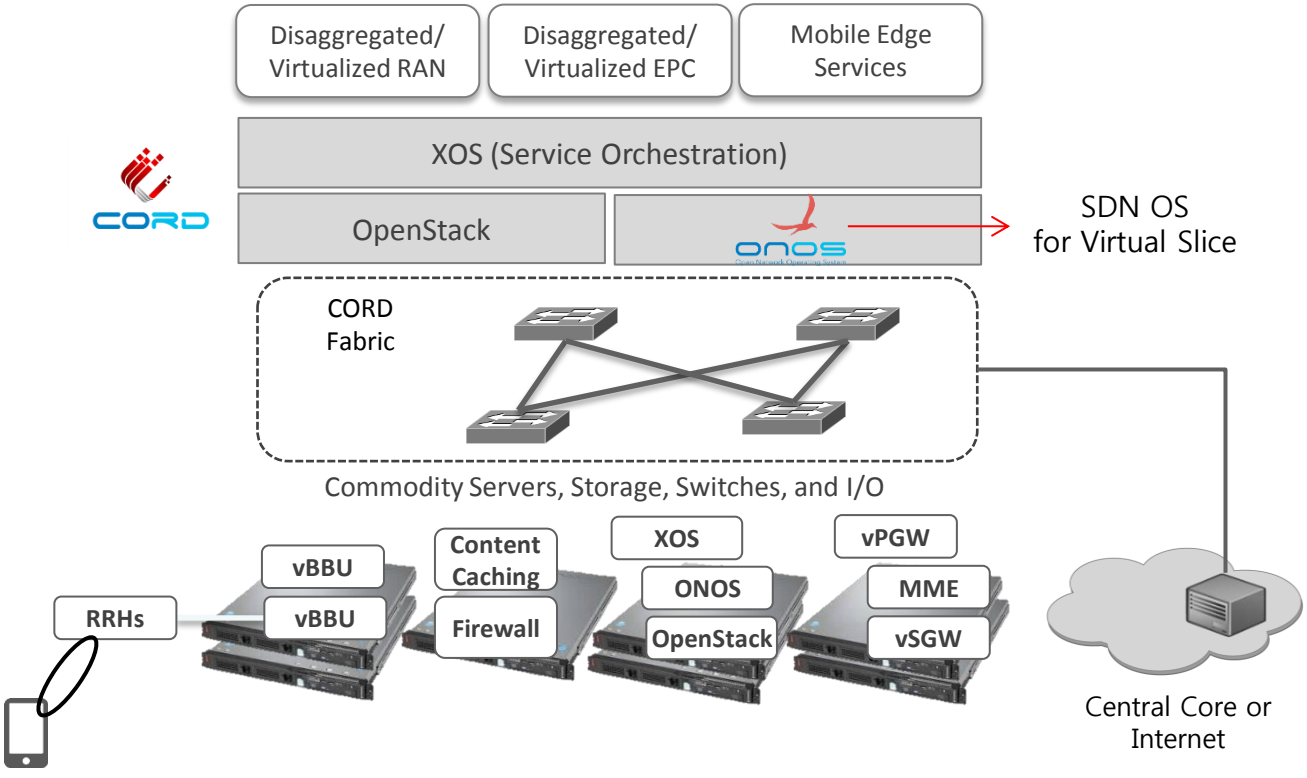


Global Collaboration ON.LAB

SK telecom

- **Mobile CORD (M-CORD)**
  - CORD (Central Office Re-architected as a DataCenter) extended to mobile network
- **M-CORD Vision**
  - Enable virtualized/disaggregated RAN and Core
  - Deploy network functions as services
  - Leverage best practices of SDN, NFV and Cloud

M-CORD



PoC Activities

- Real-time Analytics (SON)
- PGW C-/D-plane separation
- Low-latency Video
- Network Slicing
- Connectionless Service

Summary

- SDRAN is RAN softwarization based on open architecture and open interfaces

- SDRAN transformation will be the key technology to
  - Simplify the network and enable cost-efficiency
  - Bring operational intelligence for network managements
  - Create new revenue streams with edge service platform

- Final goal is to develop a software-based “All-IT” telecom network infrastructure from the end-to-end perspective

- SKT is collaborating with best partners to implement the modular functions and integrate those blocks efficiently

SK telecom


thank you
danke
рахмат
謝謝
ngiyabonga
teşekkür ederim
gracias
merci
obrigado
dziękuję
bedankt
спасибо
Баярлалаа
mersi
barka
welalin
tack
spas
dank je
misaotra
matondo
paldies
grazzi
mahalo
tapadh leat
хвала
asante
manana
obrigada
tenki
murakoze
mochchakkeram
djiere dieuf
mamnun
chokrane
go raibh maith agat
trugarez
dakujem
takk
arigatô
мерси
shukriya
dhanyavadagalu
diolch
merci
ευχαριστώ
xiexie
grazie
tanemirt
rahmet
taiku
sulpay
gracies
gratias ago
chnorakaloutioun
kop khun krap
sukriya
ありがとう
terima kasih
감사합니다
najis tuke
sagolun
kam sah hamnida
rahmat
didi madloba
mesi
dekuji
sobodi
enkosi
bayarlalaa
gracie
hvala
maururu
koszonom
dhanyavad
kiitos
dankie
nanni
nandri
faafetai lava
vinaka
спасибі
blagodaram
kia ora
akun
dankon
aciu
дякую
lau