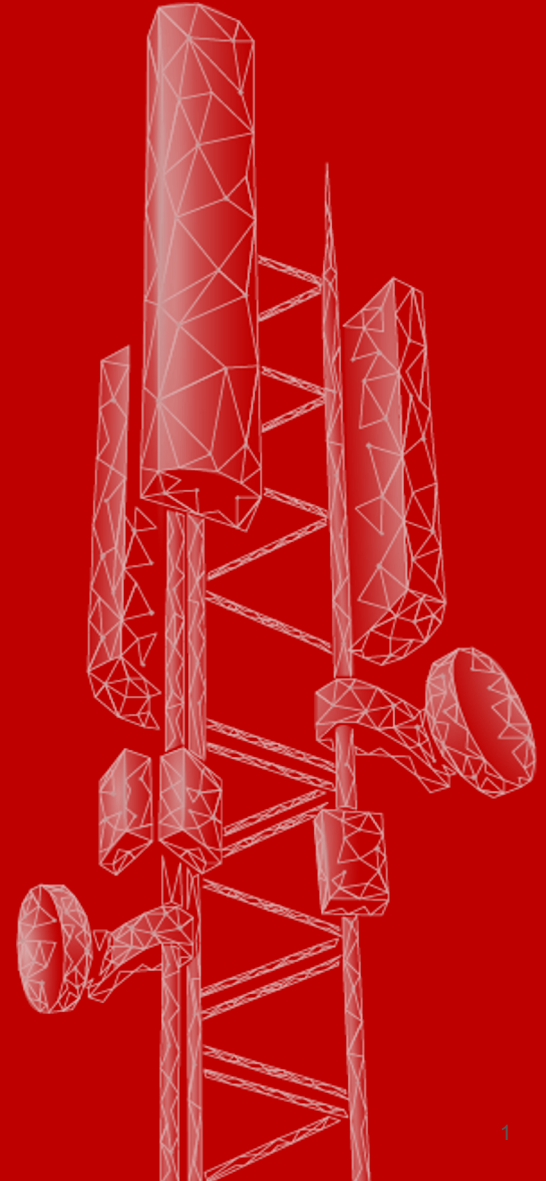# Rakuten Mobile

Rakuten Communications Platform: Battle-tested Open RAN and Cloud Native Solution for Operator Deployments

Azita Arvani
General Manager
Rakuten Mobile, Americas

Rakuten Group at a glance

Rakuten is an internet and technology-powered group operating since 1997 with 70+ businesses and 20k+ employees across the globe

~$210B — Global gross transaction volume in 2020

~$14B — Total annual revenue (2020)

1.4B+ — Members globally

20k+ — Employees across the globe

70+ — Services and businesses

35+ — Countries/areas around the world

Rakuten Advertising — United States

Rakuten kobo — Canada

Rakuten — United States

Rakuten VIKI — United States

Rakuten SUPER LOGISTICS — United States

Rakuten Aquafadas — France

Rakuten — Germany

Rakuten — France

Rakuten Viber — Luxembourg

Rakuten TV — Spain

Rakuten — Japan

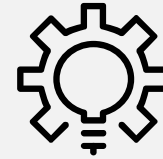Rakuten — Taiwan

Innovation on Four Strategic Levels

Disaggregated Radio

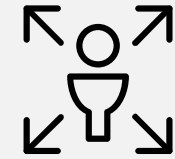Radically Lower Site Capital Expenditure

Unified Cloud

Elastic Architecture for Greater Scalability

Massive Automation

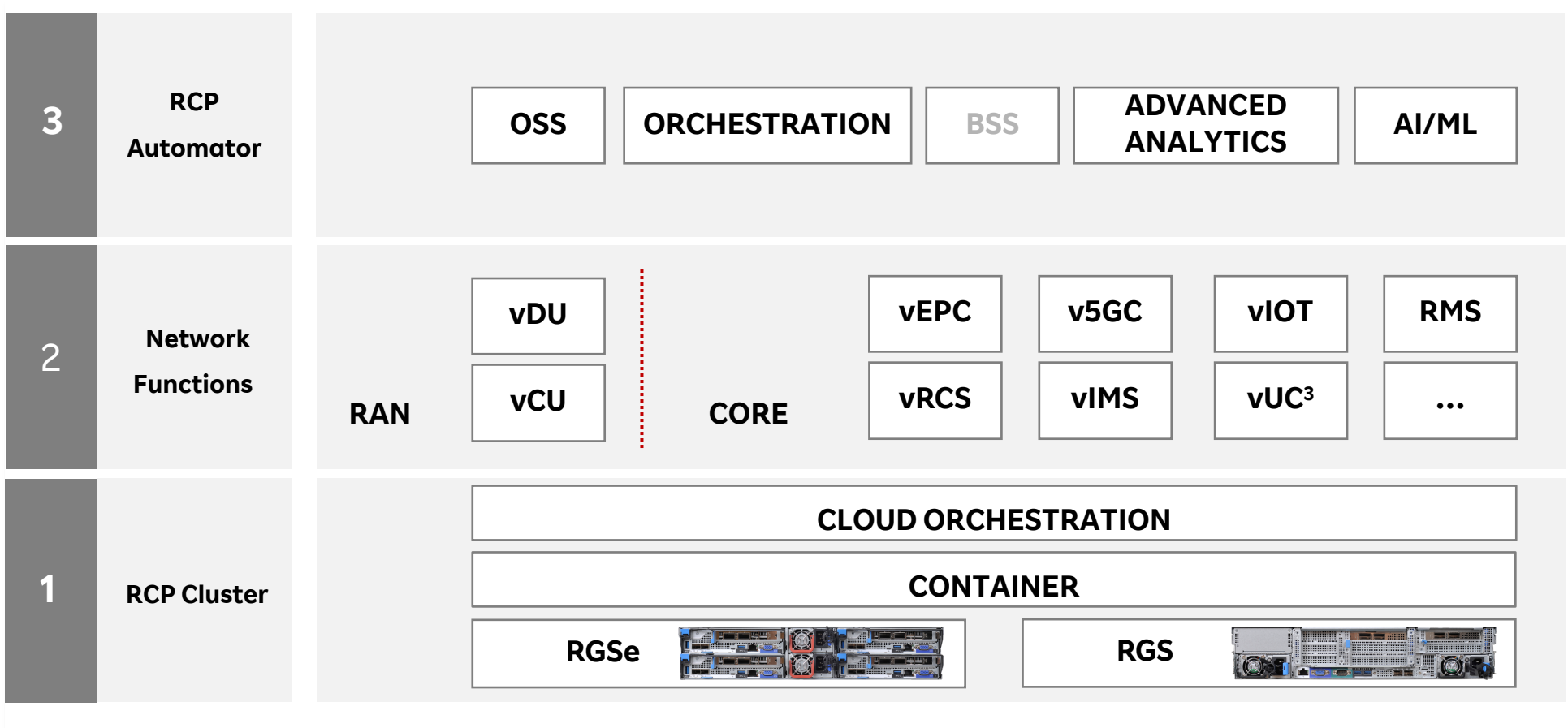Relentless End-to-End Automation of Everything

Platform Organization

Modern Organization for Next-Gen Business

Rakuten Communications Platform

We have built our network based on KEY DESIGN PRINCIPLES allowing us to disrupt the telecom market in Japan

RCP

KEY DESIGN PRINCIPLES

3	RCP Automator	OSS	ORCHESTRATION	BSS	ADVANCED ANALYTICS	AI/ML

- **ADVANCED AUTOMATION FOR TOUCHLESS OPERATIONS**

2	Network Functions	RAN	vDU / vCU	CORE	vEPC	v5GC	vIOT	RMS
					vRCS	vIMS	vUC^3	...

- **100% DISAGGREGATION FROM HARDWARE**
- **OPEN ARCHITECTURE**

1	RCP Cluster	CLOUD ORCHESTRATION
		CONTAINER
		RGSe RGS

- **100% COTS HARDWARE**
- **ELASTICITY WITH CONTAINERS TO SCALE AT LOW COST**

Rakuten Communications Platform

The Rakuten Ecosystem is uniquely positioned to build an entirely new digital platform with Rakuten Mobile

RCP

Rakuten Mobile

telco platform
world's first fully virtualized,
cloud-native, end-to-end

Enables **telcos and enterprises**
easily build secure and open networks

Global

mobile operator
world's first fully virtualized,
cloud native
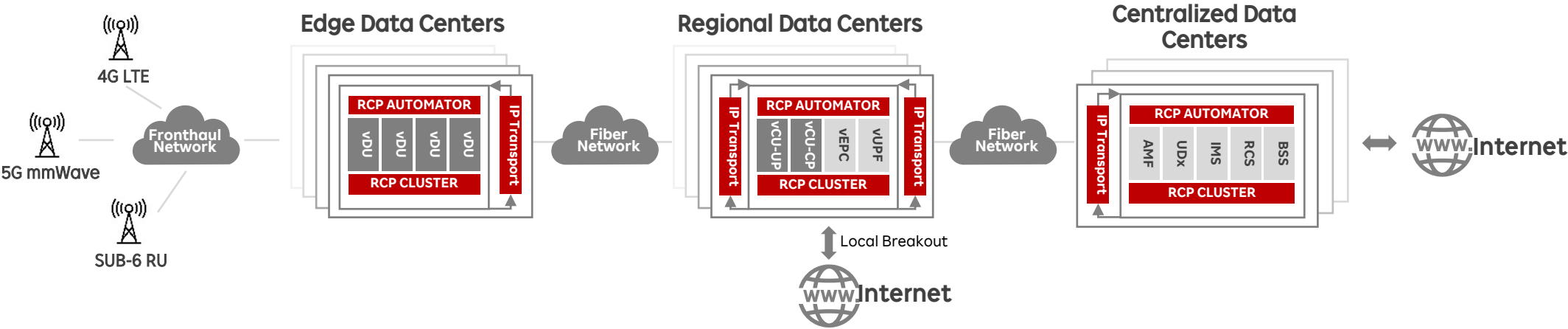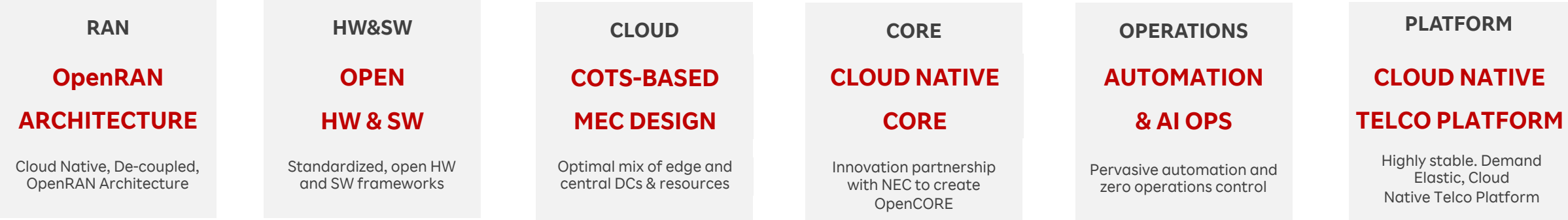
Best mobile experience
for **consumers**

Japan

Rakuten Mobile is the first customer of RCP

Rakuten Mobile architecture

Rakuten architecture is designed around open networks

RAN	HW&SW	CLOUD	CORE	OPERATIONS	PLATFORM
OpenRAN ARCHITECTURE	**OPEN HW & SW**	**COTS-BASED MEC DESIGN**	**CLOUD NATIVE CORE**	**AUTOMATION & AI OPS**	**CLOUD NATIVE TELCO PLATFORM**
Cloud Native, De-coupled, OpenRAN Architecture	Standardized, open HW and SW frameworks	Optimal mix of edge and central DCs & resources	Innovation partnership with NEC to create OpenCORE	Pervasive automation and zero operations control	Highly stable. Demand Elastic, Cloud Native Telco Platform

* Edge Data Centres and Regional Data centers are currently being deployed.

6

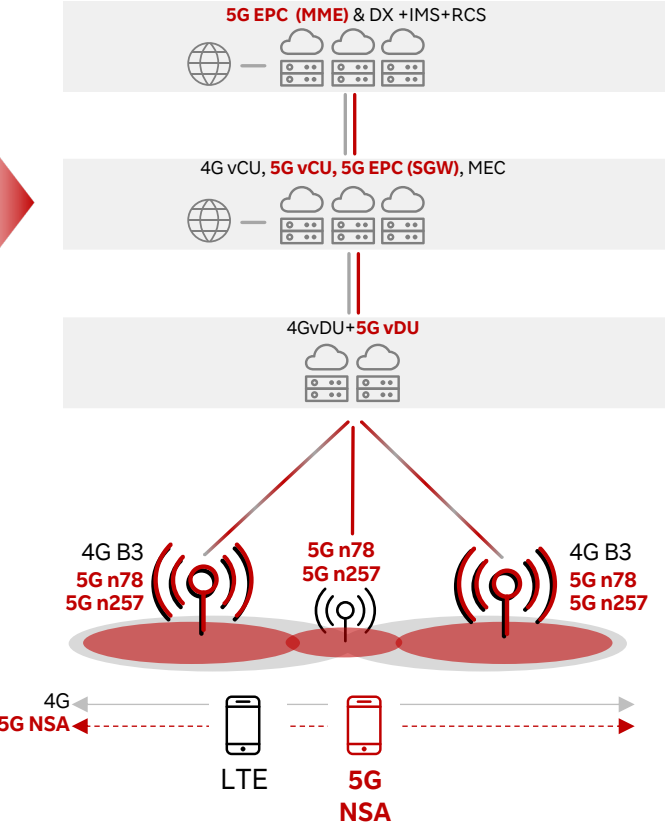# Our journey towards to World's First Cloud Native 5G SA Network

April 2020
Launched World's 1st Fully Virtualized 4G Network
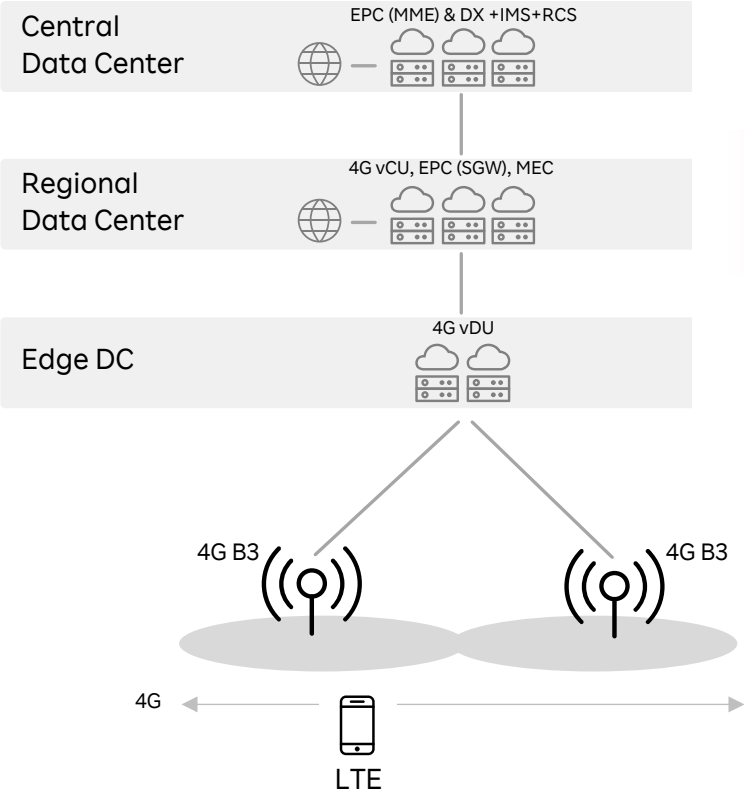
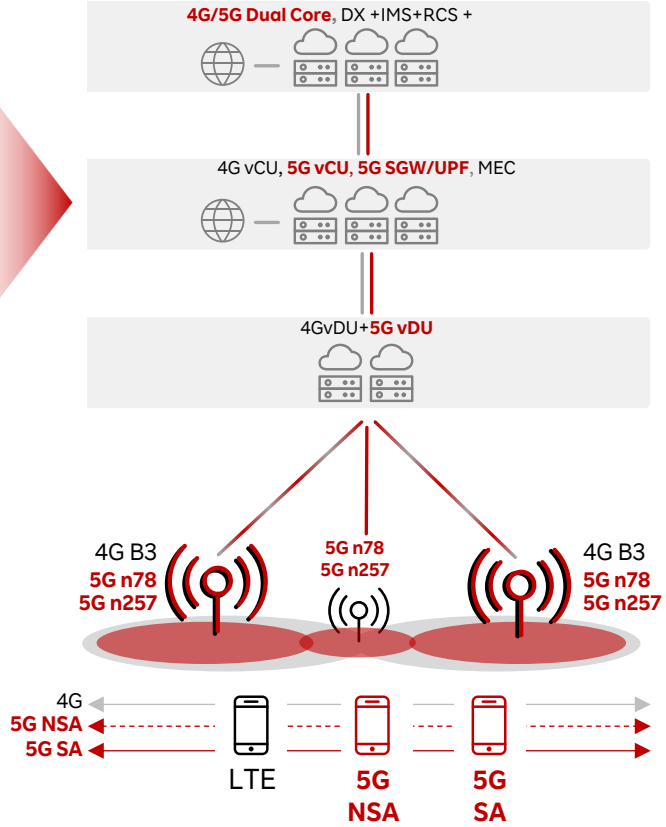**September 2020**
Launched World's 1st Fully Virtualized 5G NSA Network

Summer 2021
Will Launch World's 1st Cloud Native 5G SA Network

Central Data Center

EPC (MME) & DX +IMS+RCS

5G EPC (MME) & DX +IMS+RCS

4G/5G Dual Core, DX +IMS+RCS +

Regional Data Center

4G vCU, EPC (SGW), MEC

4G vCU, **5G vCU, 5G EPC (SGW)**, MEC

4G vCU, **5G vCU, 5G SGW/UPF**, MEC

Edge DC

4G vDU

4GvDU+**5G vDU**

4GvDU+**5G vDU**

4G B3

4G B3

4G B3 **5G n78 5G n257**

5G n78 5G n257

4G B3 **5G n78 5G n257**

4G B3 **5G n78 5G n257**

5G n78 5G n257

4G B3 **5G n78 5G n257**

4G

4G
5G NSA

4G
5G NSA
5G SA

LTE

LTE

5G NSA

LTE

5G NSA

5G SA

New customer behavior

Rakuten Mobile goes beyond by delivering exceptional experience for data hungry customers
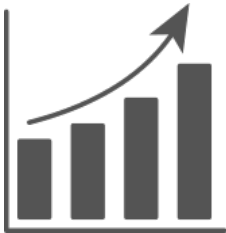
Customers	Data volume/sub	Video performance	RCS calls ratio
> 4m	**0.5 GB/ Day**	**2m videos**	**70%**
Onboarded within 12 months	2X More Compared to Other Operators	50% Of Traffic is Video and Streaming	2.5X More RCS Calls than VoLTE

New way to operate

Rakuten Mobile operates like no other existing telco in the world

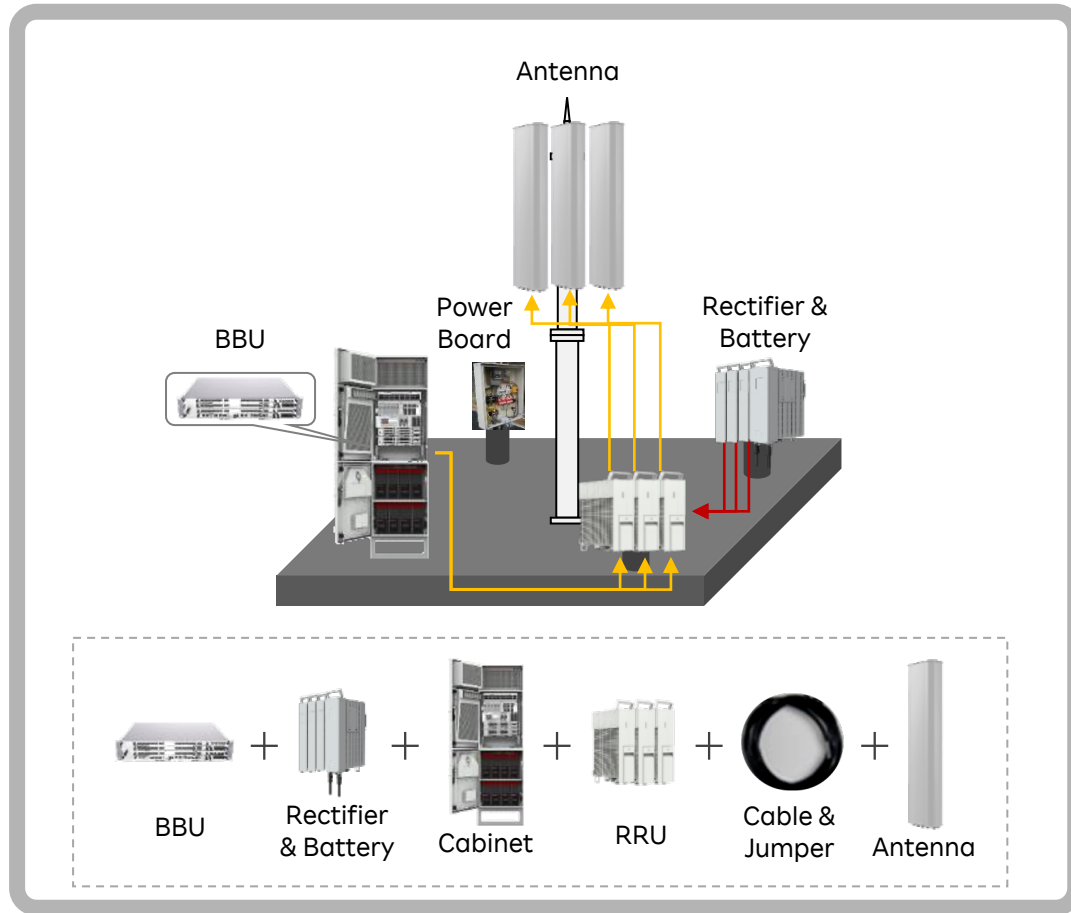| Customer Activation	Cell Site deployment	New NW Feature Deployed	Engineer : Subscriber Ratio	NW availability
3 Mins	**4 Mins** (for 5G) **8.5 Mins** (for 4G)	**6 Days**	**1 : 20,000**	**No 9s Resilience**
Instead of 3 hours	Instead of days or months	Instead of 6 months	Instead of 1 : 1,000	Old thinking: Telco-Grade (99.99999%)
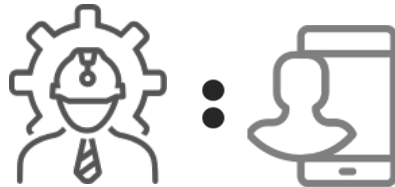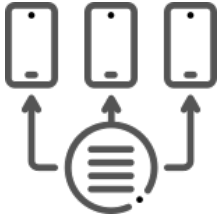
Simplified Radio Site Construction with innovative solutions

Traditional Radio Site Deployment

Antenna

BBU

Power Board

Rectifier & Battery

BBU + Rectifier & Battery + Cabinet + RRU + Cable & Jumper + Antenna

VS

Rakuten Simplified Site Deployment

Integrated RRH + Antenna

GC

Power Board

Rectifier & Battery & RIU

DU

Rectifier & Battery & RIU   AAU
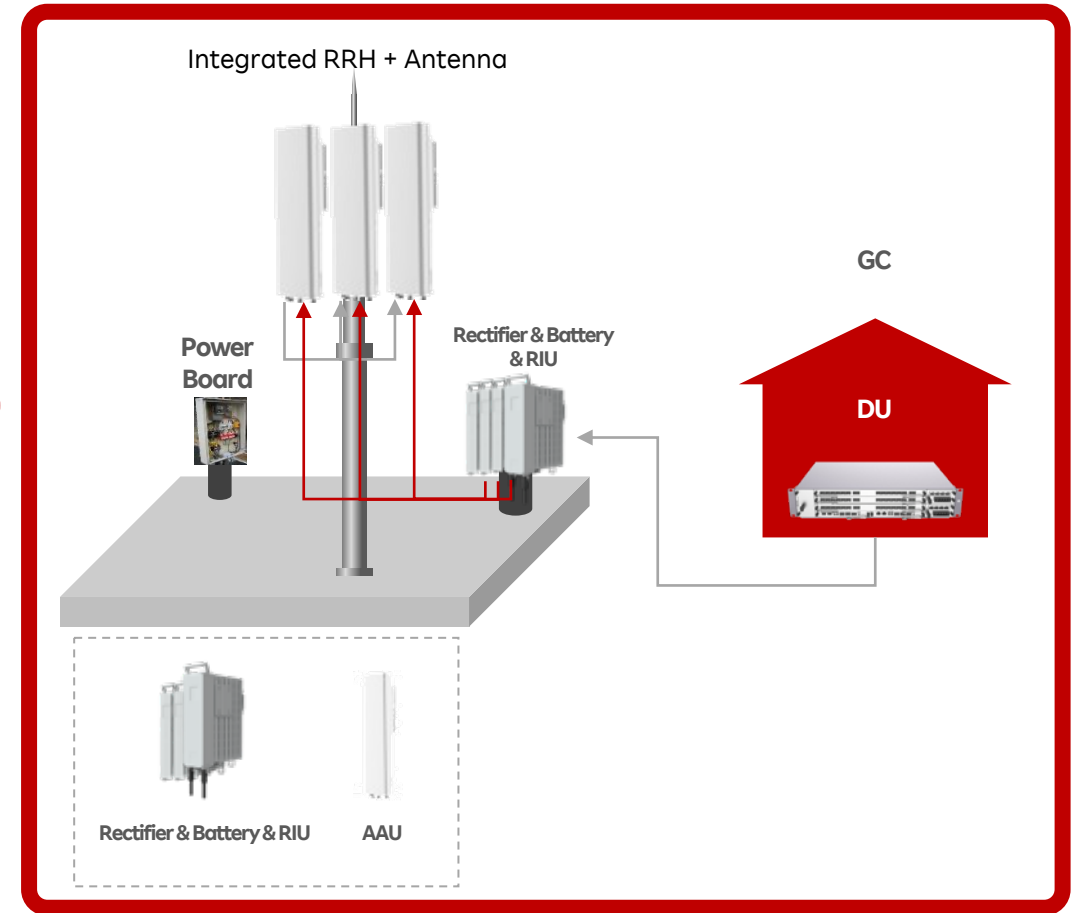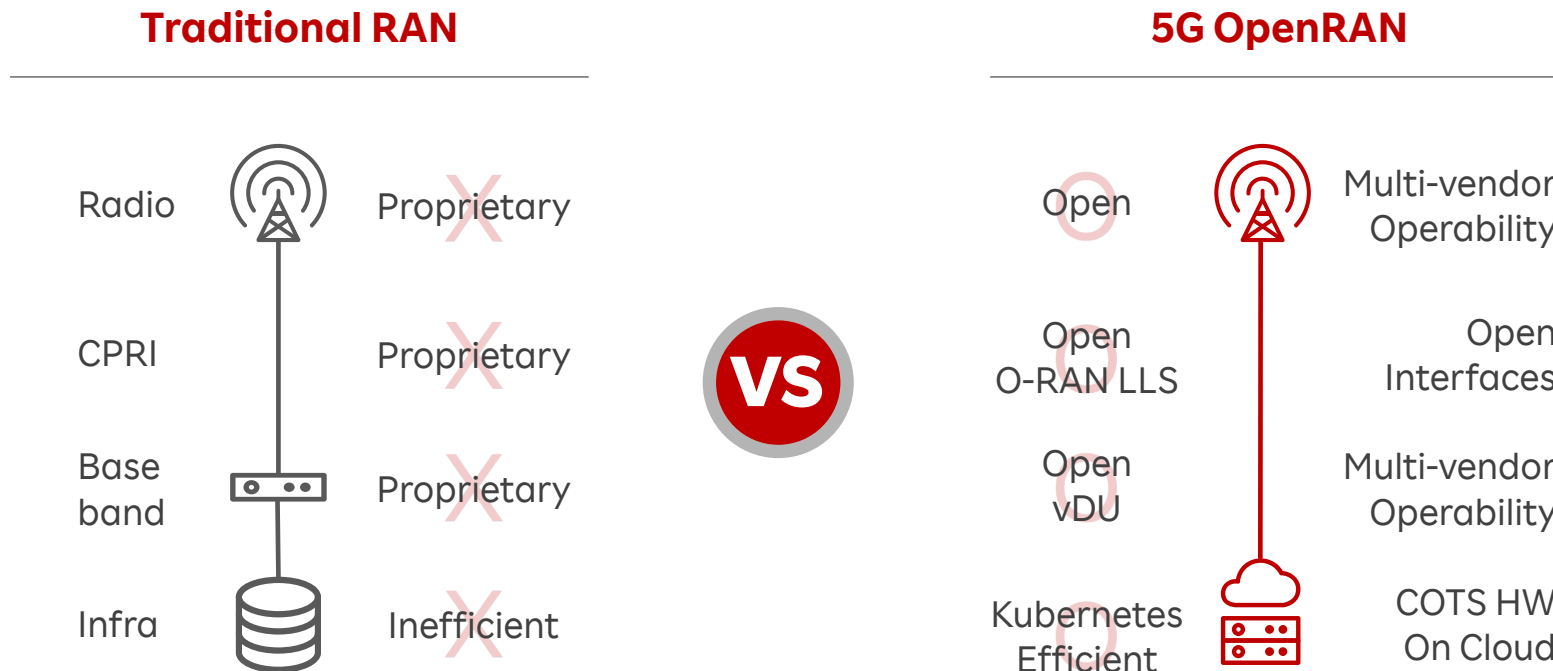
OpenRAN is about having a choice vs. tradition

Our Network is world's first OpenRAN based large scale deployment

Traditional RAN

Radio — Proprietary ✗

CPRI — Proprietary ✗

Base band — Proprietary ✗

Infra — Inefficient ✗

VS

5G OpenRAN

Open — Multi-vendor Operability

Open O-RAN LLS — Open Interfaces

Open vDU — Multi-vendor Operability

Kubernetes Efficient — COTS HW On Cloud

This approach enables us to select any vendor for our network and prevent lock-in

Unique Modular Concrete Poles that are Simple and Cost Effective

Cost Effective

40%

40% less cost compared to building top macro

Concrete Pole

Ease of Installation

Deploy maximum no. of poles nationwide

Complete Control

Ease of Access

To site maintenance

Modular

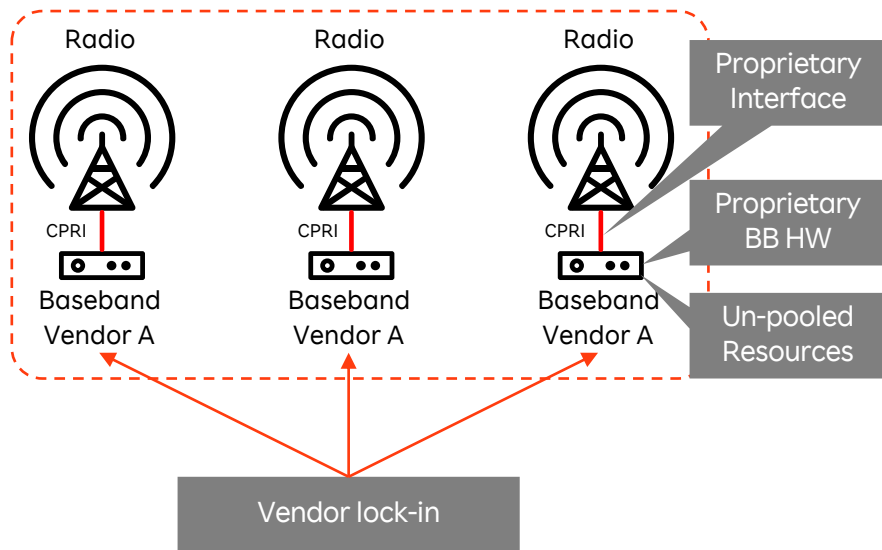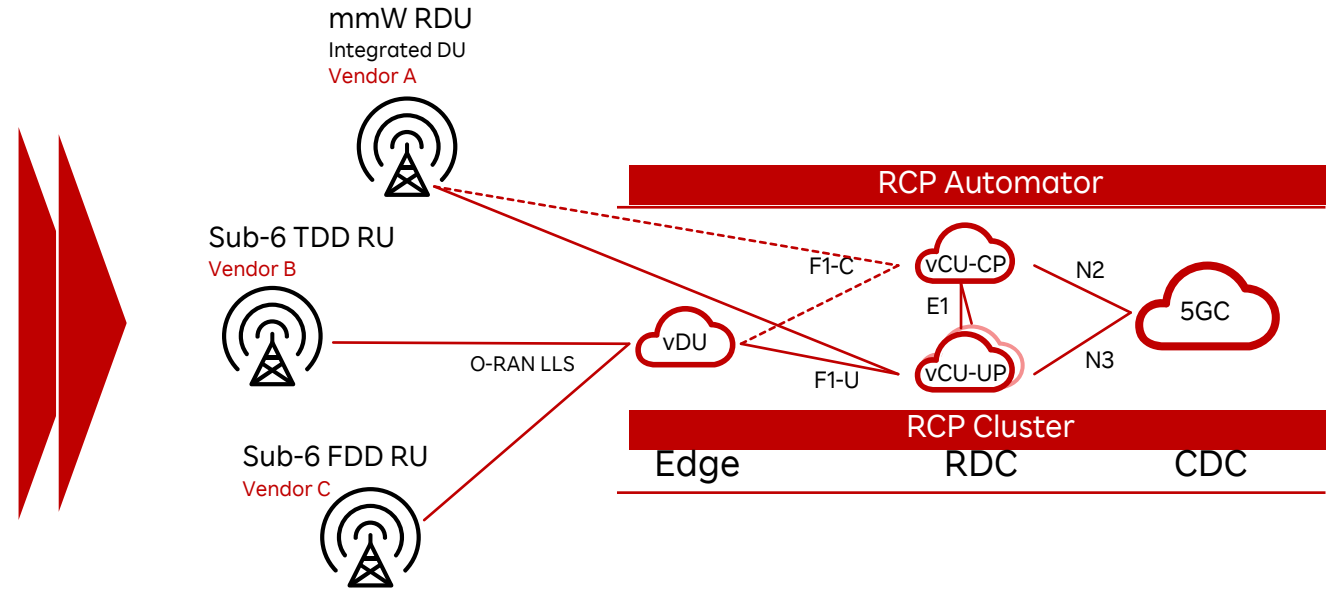## 5G Ready

Minimum required space

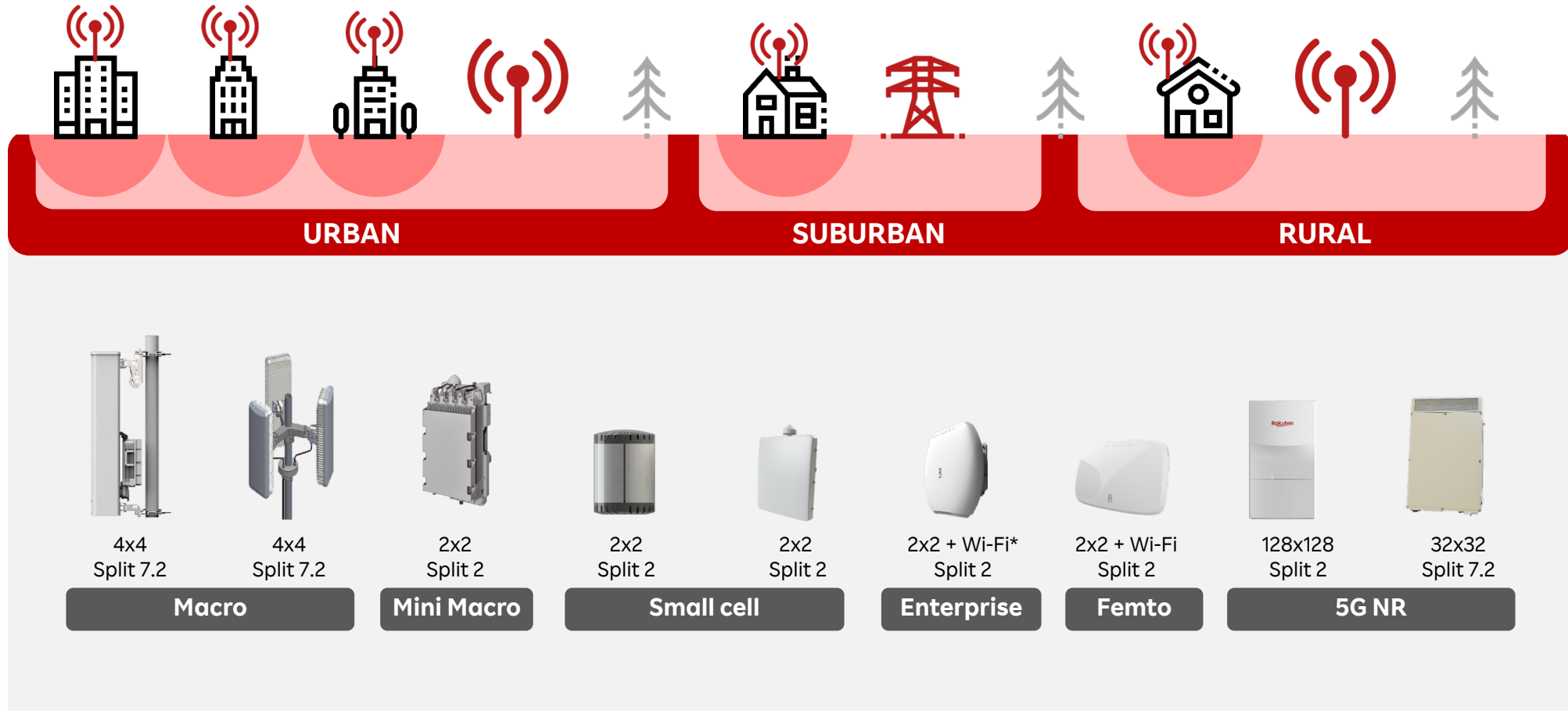# vRAN architecture - fully open, multi-vendor, innovative and future proof

From Legacy RAN Architecture

To Fully Open, Multi-vendor, built-upon scalable automated platform, supporting different use-cases and deployment scenarios, Innovative Future-Proof Access Architecture

One of the World's Largest HetNet OpenRAN Deployment

| URBAN | | | SUBURBAN | | | RURAL | |

4x4 Split 7.2	4x4 Split 7.2	2x2 Split 2	2x2 Split 2	2x2 Split 2	2x2 + Wi-Fi* Split 2	2x2 + Wi-Fi Split 2	128x128 Split 2	32x32 Split 7.2

Macro — **Mini Macro** — **Small cell** — **Enterprise** — **Femto** — **5G NR**
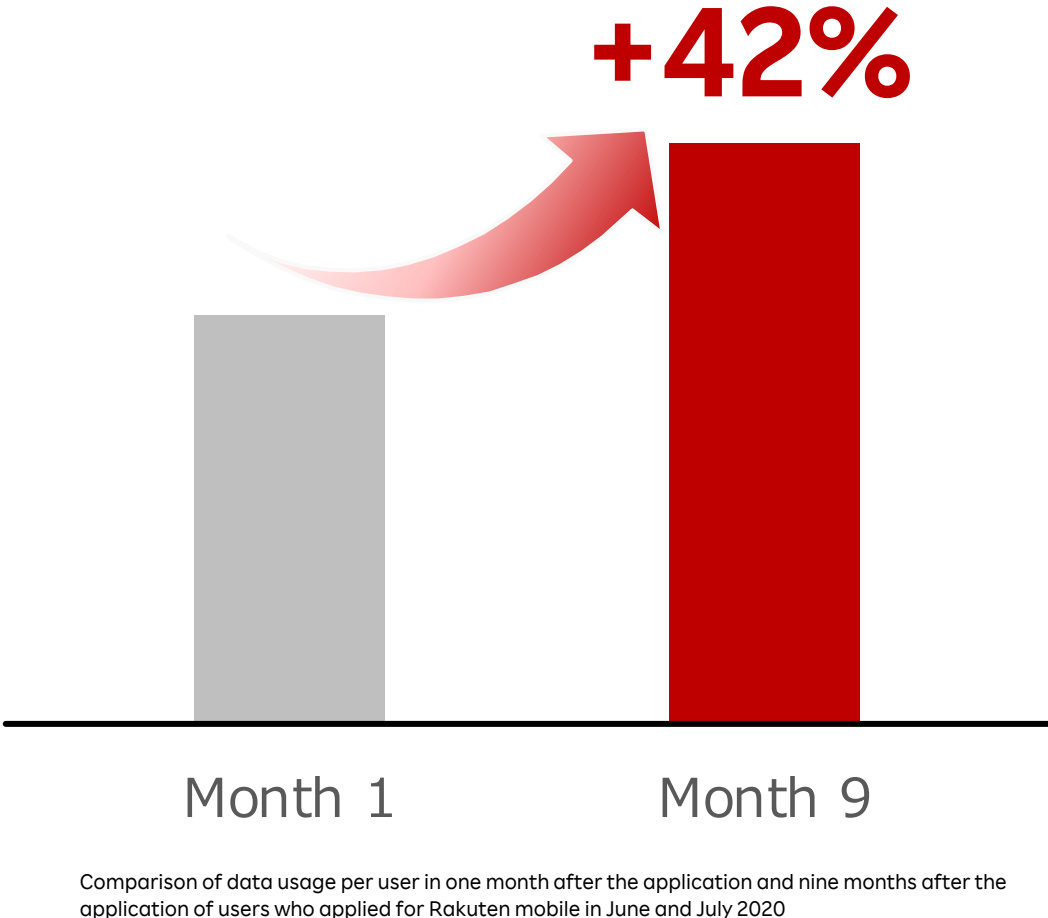
Integrated HetNet Approach allows us to manage existing spectrum better

The longer subscribers use the service, the more data they consume

Rakuten Mobile Network Data Traffic

**2020
Apr**
Commercial
4G NW Launch

**2021
Jan**

**2021
June**

Weekly In-Network Traffic data from April 2020 to June 2021
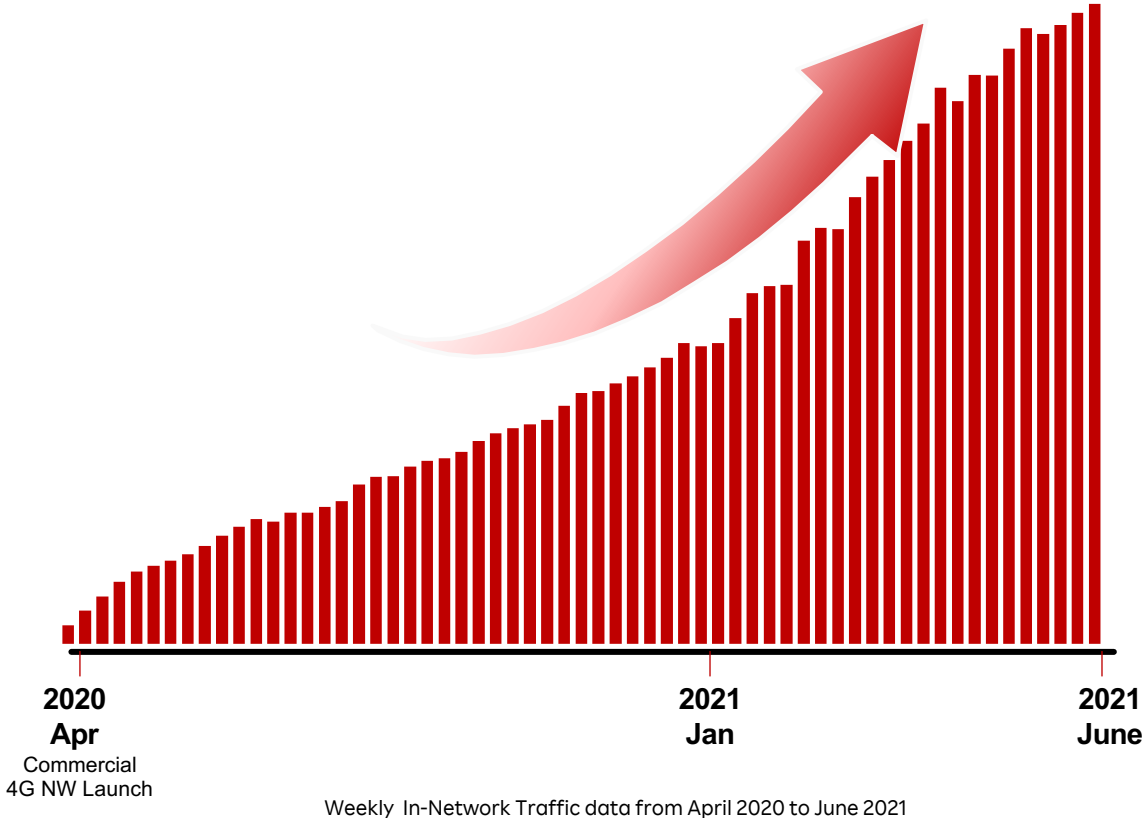
Data traffic per Rakuten Mobile subscriber

+42%

Month 1

Month 9

Comparison of data usage per user in one month after the application and nine months after the application of users who applied for Rakuten mobile in June and July 2020

Recognized for best Voice App Experience and Upload Speed Experience in Japan

Oct 2020[1]

Mobile Experience Awards, Japan

OPENSIGNAL
October 2020, Japan Report

	NTT DoCoMo	SoftBank	au	R
Video Experience		WINNER		
Games Experience		WINNER		
Voice App Experience		WINNER		
Download Speed Experience	WINNER			
Upload Speed Experience				WINNER
4G Availability			WINNER	

Apr 2021[2]

Mobile Experience Awards, Japan

OPENSIGNAL
April 2021, Japan Report

	au	NTT DoCoMo	R	SoftBank
Video Experience				WINNER
Games Experience				WINNER
Voice App Experience			WINNER	
Download Speed Experience		WINNER		
Upload Speed Experience			WINNER	
4G Availability	WINNER			

16

Globally Recognized O-RAN based NW Performance

Score comparison — Overall
Selected international cities

Total Score 1000 Dots

Cities	Total Score (highest)	Total Score (lowest)
Tokyo	920	
Atlanta	914	807
Berlin	916	889
Johannesburg	918	773
London	911	834
Mexico City	854	711
Milan	939	823
New York	922	790
Riyadh	858	697
Rome	898	850
São Paulo	906	610
Seattle	936	803
Sydney	940	911
Zürich	936	901

● Rakuten Mobile network   ● highest score / operator   ● lowest score / operator
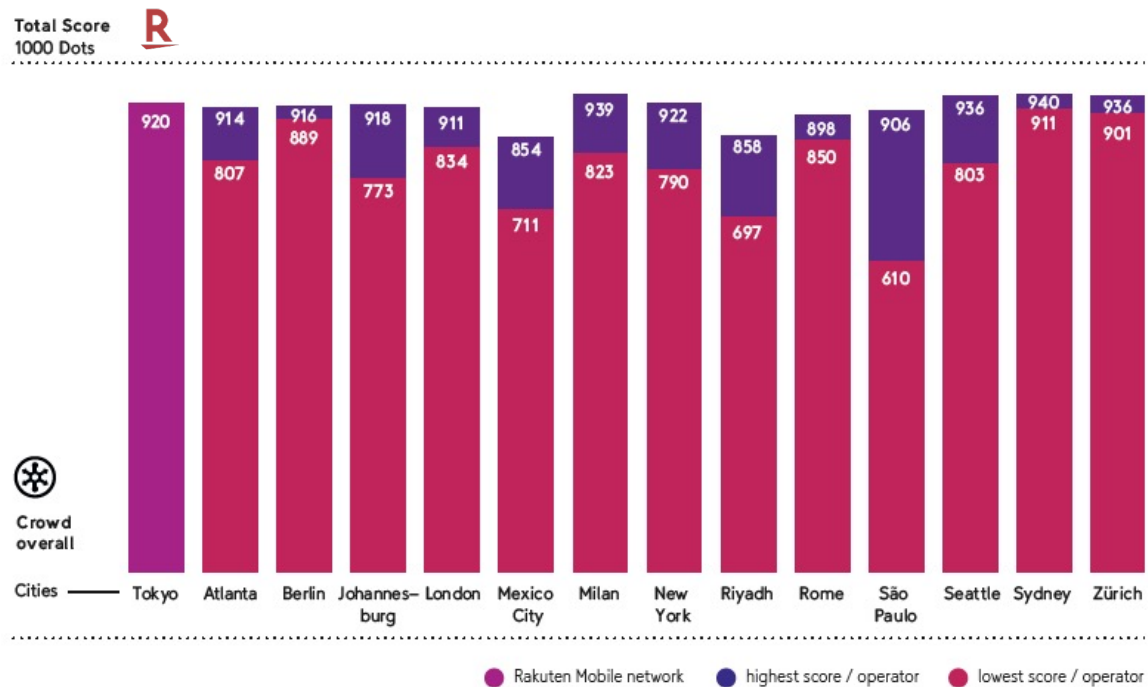
Nationwide Score comparison
Nationwide Rakuten Mobile network in global comparison

outstanding · very good · good · satisfactory · sufficient

● umlaut Score Rakuten Mobile Japan   ● umlaut Scores of operators published in 2020/2021

Rakuten Mobile is globally recognized

Rakuten Mobile's fully virtualized, end to end cloud-native mobile network has been highly evaluated across the world and has been recognized as the upcoming network of the new generation.

Smart Solutions: Mobile Network
MM Research Institute Award

Most Innovative Mobile/ Wireless Product or Service
Leading Lights Awards 2020

The Best Automated Network 2021
Layer 123 Europe 2021

Ground-breaking Virtualization Initiative
Glotel Awards 2020

Market Development Award
GTI Awards 2021

Best Mobile Technology Breakthrough & CTO Choice: Outstanding Mobile Technology
Glomo Awards 2021

Our key secure operations principles

RCP is built on key secure operations principles enabling us to embed security at every layer of the communications stack

Trusted Transparency

Working with a **trusted supply chain** and continuously **verifying the trust level** of the system – all physical, virtual, hardware and software components

Zero Trust

Conducting **Trust Assessment,** applying **Trust Level Policy** for each network zone, and **enforcing the Policy** through automated updates

NIST Framework

Adopting **the Cybersecurity Framework** to enhance our capability to identify, prevent, detect, respond to cyber attacks and recover

Clean Network

Providing secure **end-to-end cloud-native network** infrastructure with trusted partners and **establishing** processes to safeguard customer privacy and sensitive information

Recognized by the U.S. Department of State as a **5G Clean** Telecommunications company in 2020
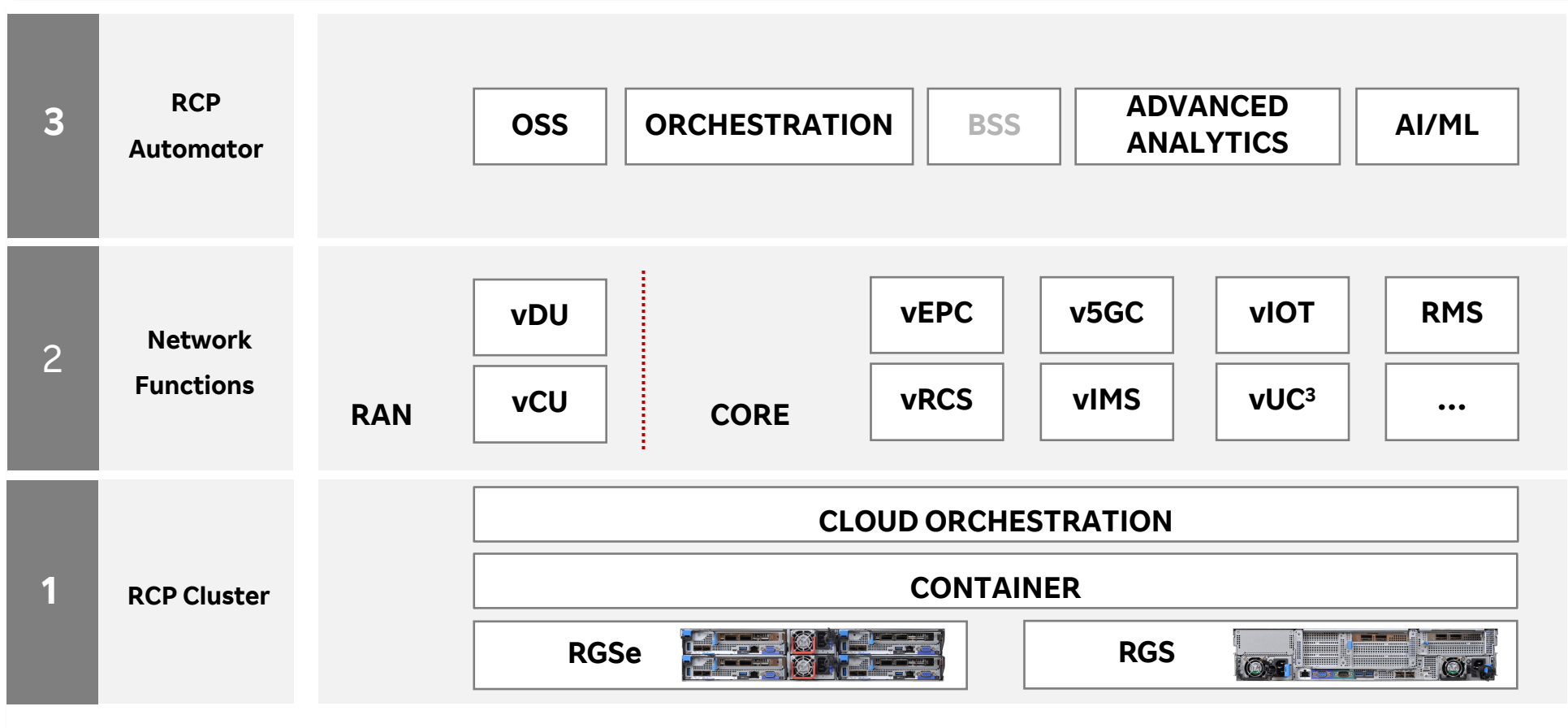
Rakuten Communications Platform: Flexible Engagement Model

While RCP remains the essential part of the model, we acknowledge that each telecom has unique needs

RCP

KEY DESIGN PRINCIPLES

3	RCP Automator		OSS	ORCHESTRATION	BSS	ADVANCED ANALYTICS	AI/ML

- **ADVANCED AUTOMATION FOR TOUCHLESS OPERATIONS**

2	Network Functions	RAN	vDU		CORE	vEPC	v5GC	vIOT	RMS
			vCU			vRCS	vIMS	vUC[3]	...

- **100% DISAGGREGATION FROM HARDWARE**
- **OPEN ARCHITECTURE**

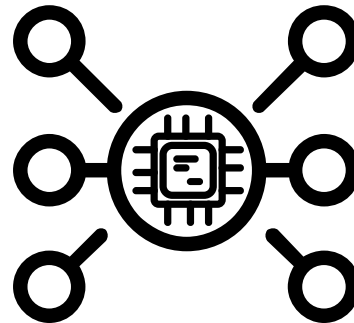| 1	RCP Cluster	CLOUD ORCHESTRATION
		CONTAINER
		RGSe · · · RGS

- **100% COTS HARDWARE**
- **ELASTICITY WITH CONTAINERS TO SCALE AT LOW COST**
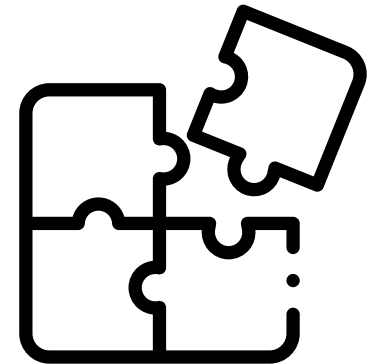
Continuing to Innovate

We are focusing on a **business Eco-System**
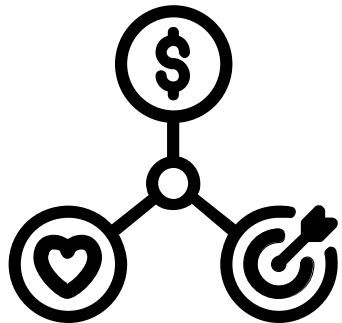
We are creating a **Technology Eco-System**

We are driving innovation on how to **design, deploy and operate** telco networks