5G Transformation with Open Source

A study of Data Plane Function Acceleration in Local 5G Using Open Networking Technology

Hidetaka Nishihara, NTT EAST

2020

Agenda

1. Introduction
2. New business utilizing Local 5G
3. New solution utilizing open networking technology
4. Requirements of telecom carriers in Local 5G
5. Future work & conclusion

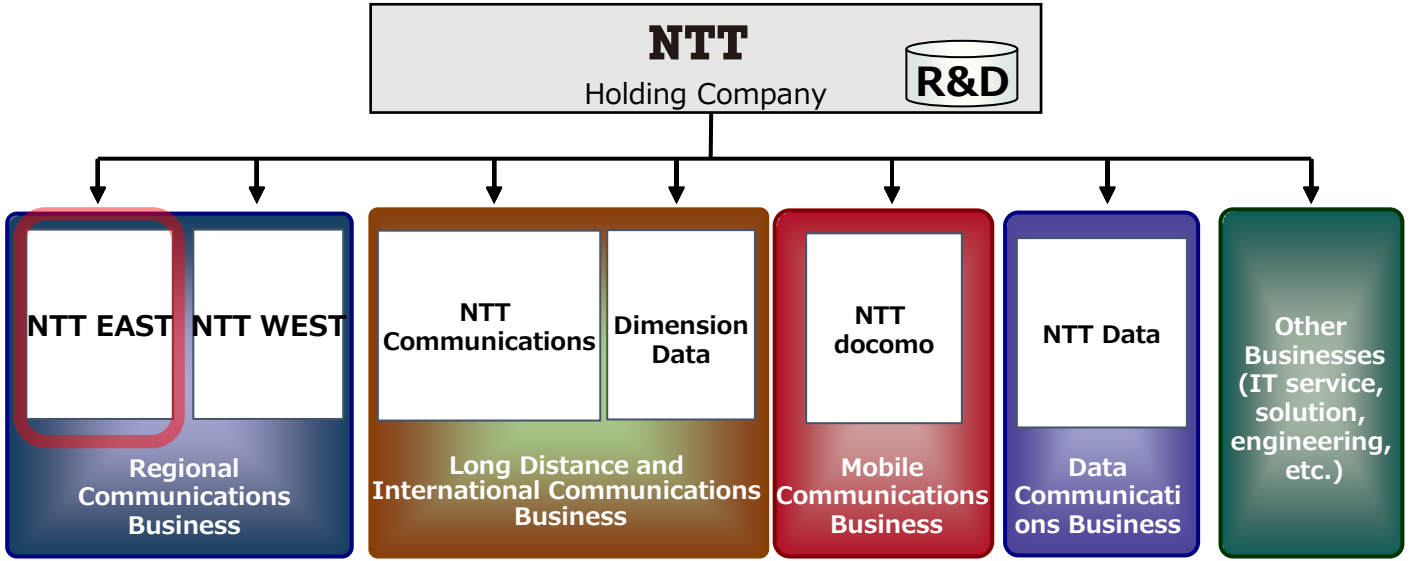
1.Introduction

About NTT and NTT Group

NTT (as a holding company) and several operational companies.

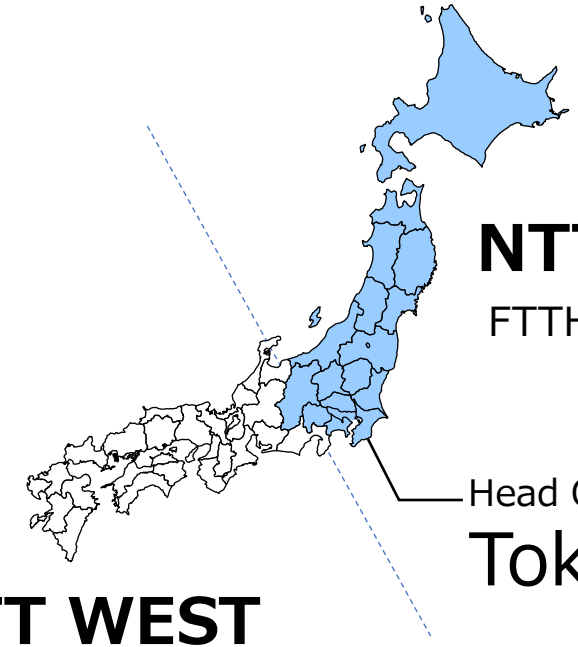
- ✓ NTT ・・・ group management and basic research
- ✓ NTT EAST/WEST ・・・ Residential Network operator
- ✓ NTT Communications ・・・ global cloud and network operator
- ✓ NTT docomo ・・・ mobile network operator

Me ➡
NTT EAST



Japanese Market

NTT EAST is providing “Regional fixed access service (last mile)”.



NTT EAST

FTTH: 12 million

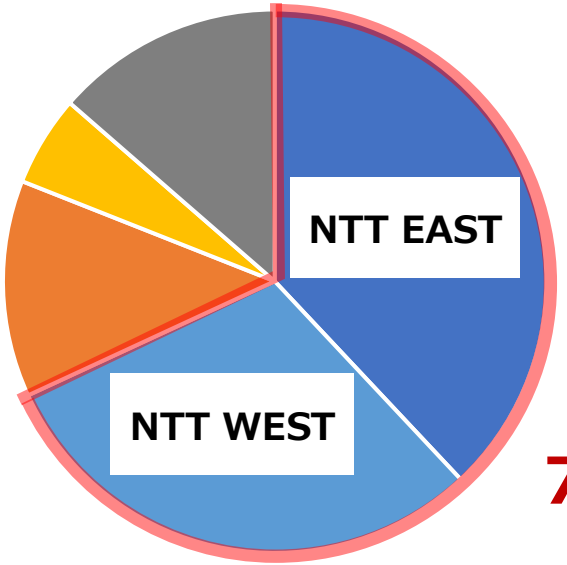
Head Quarter

Tokyo

NTT WEST

FTTH: 9 million

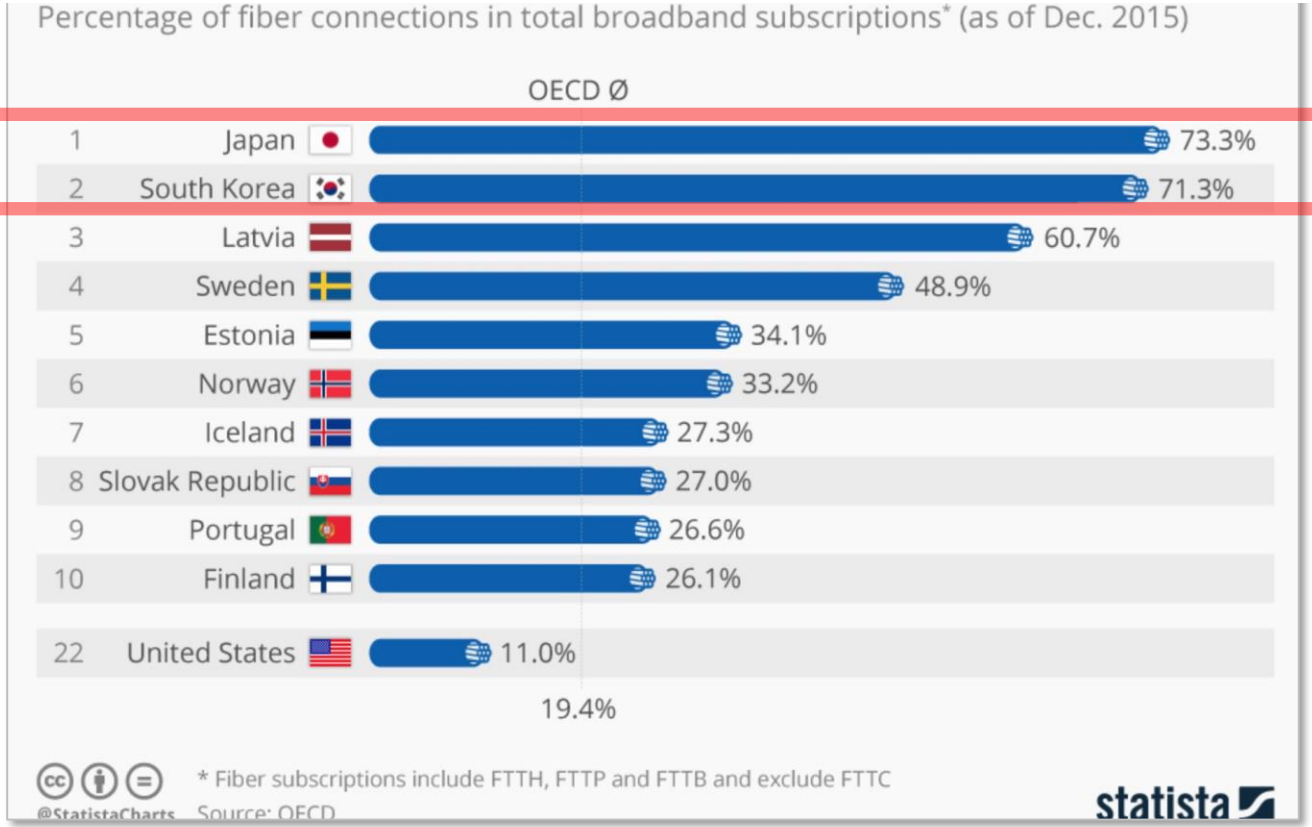
FTTH Share



70%

Maturity in providing FTTH service

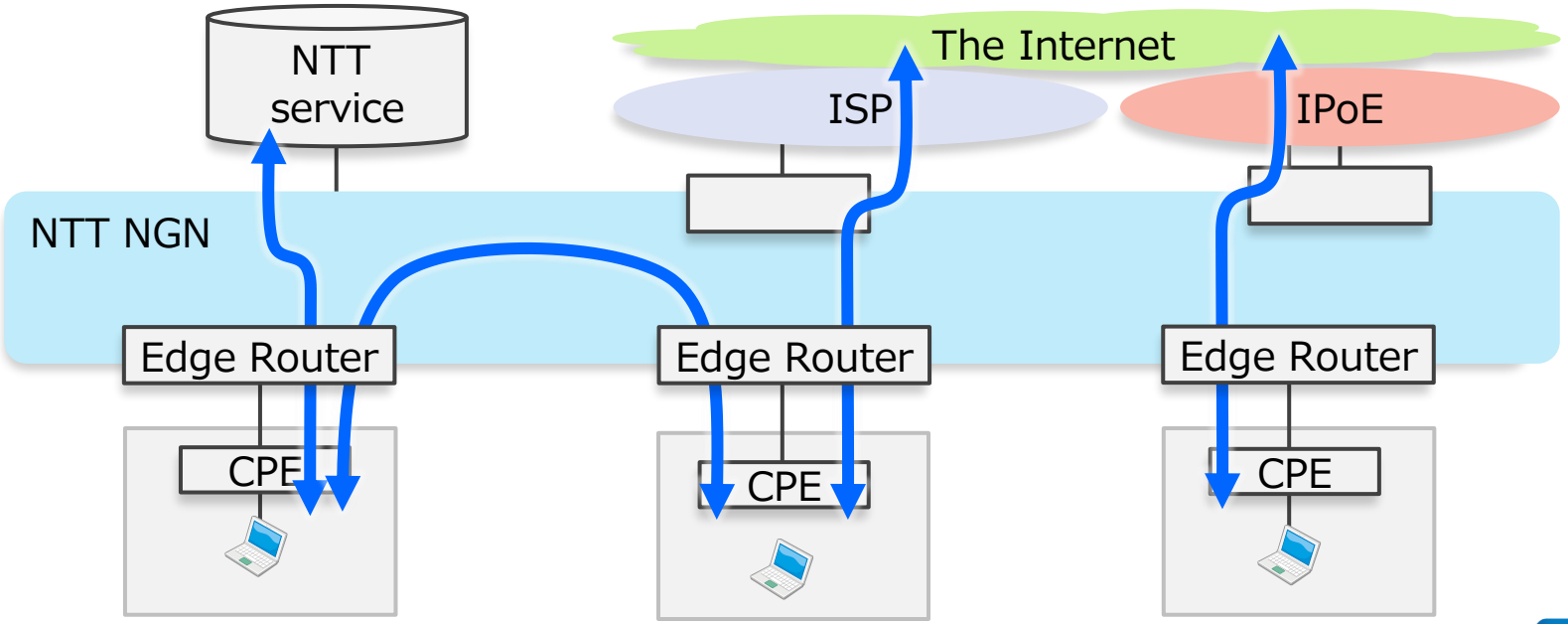
Fiber infrastructure has already been widely deployed in Japanese market



https://www.statista.com/chart/4392/fiber-adoption-in-oecd-countries/

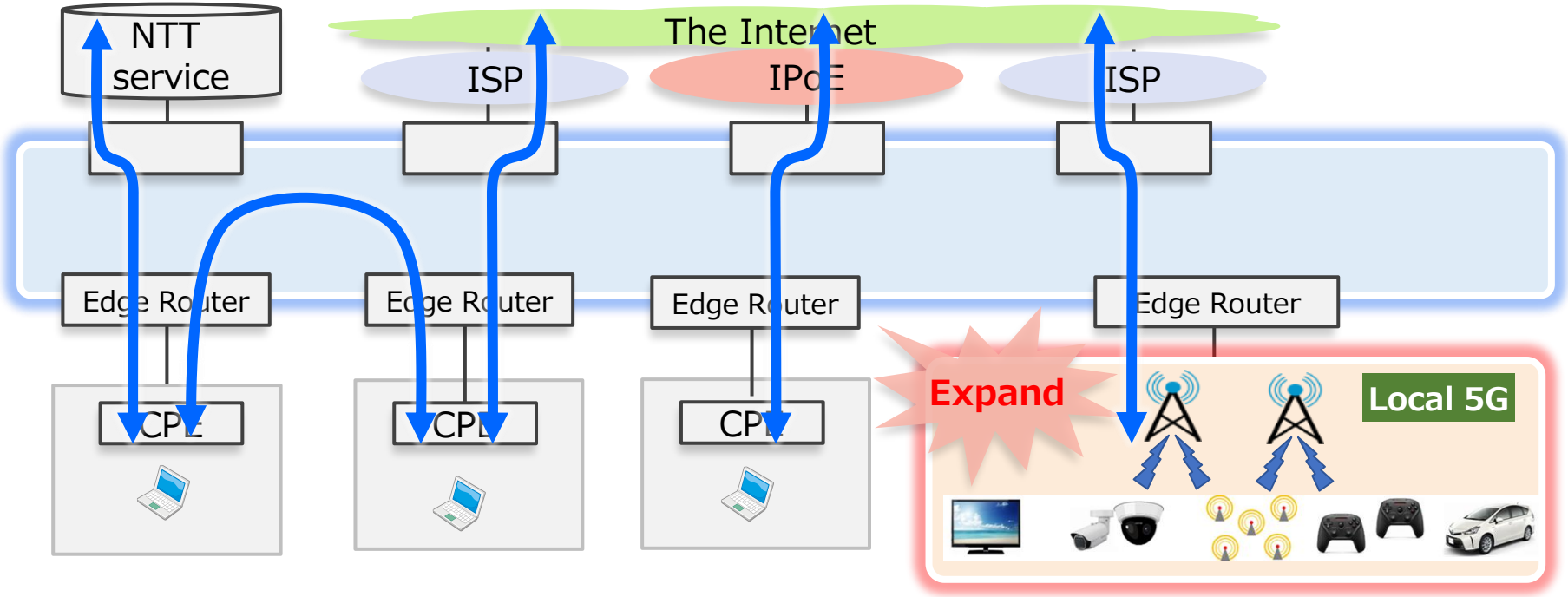
NTT EAST Existing Network (NGN)

- A couple of thousands of “Legacy” edge router is in operation.
- SDN has been partially deployed on a part of NFV service.
- FTTH coverage has already been over 99% for couple years.



Our challenge for new access network.

- Diversification of services and devices.
- Expansion to new access networks such as **Non-Public 5G (Local 5G).**



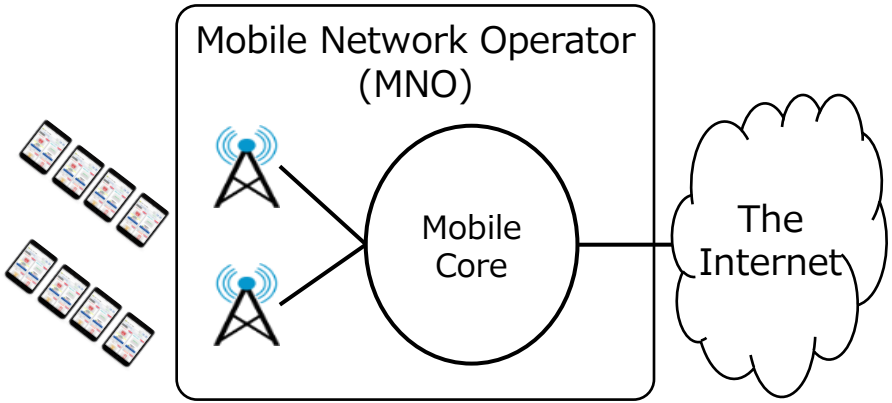
2. New business utilizing Local 5G

What's Local 5G ?

Various entities other than telecom carriers (regional companies, etc.) can deploy 5G systems by themselves.

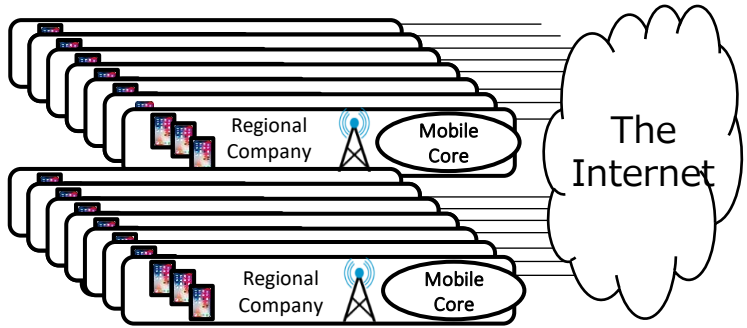
Public 5G

Deploy and operate of large-scale facilities nationwide



Local 5G

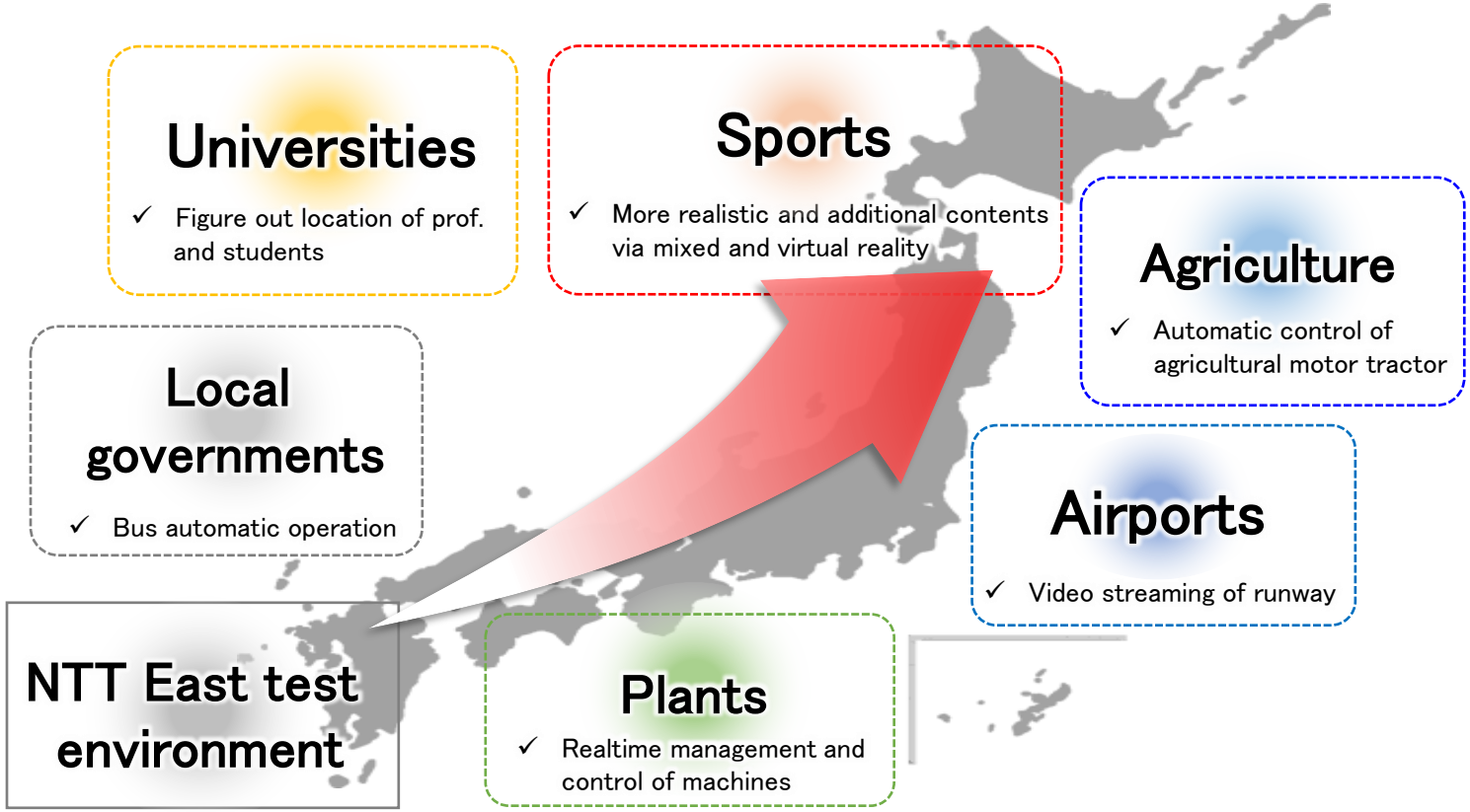
Deploy and operate dedicated facilities for each regional companies.



※ Mobile Core = EPC / 5GC

Developing new business utilizing Local 5G

Considering concrete business models leveraging advantage of Local 5G.



Local 5G OpenLab with Tokyo University

- Tokyo University and NTT East established test fields for institutions to co-create use cases with Local 5G.

- Explore way to **create new services adding values to customers.**

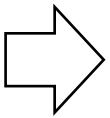
3. New solution utilizing open networking technology

The issue of conventional mobile core.

- The Conventional mobile : high functionality, high performance and expensive.
- Regional companies provide services to users within a limited range.

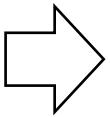
⇒ Not necessary to require such high functionality, high performance and expensive.

Issue①Lightweight
(Implement only required functions)



- U-Plane function need to be distributed.
- C-Plane function need to be aggregated.

Issue②Cost reduction

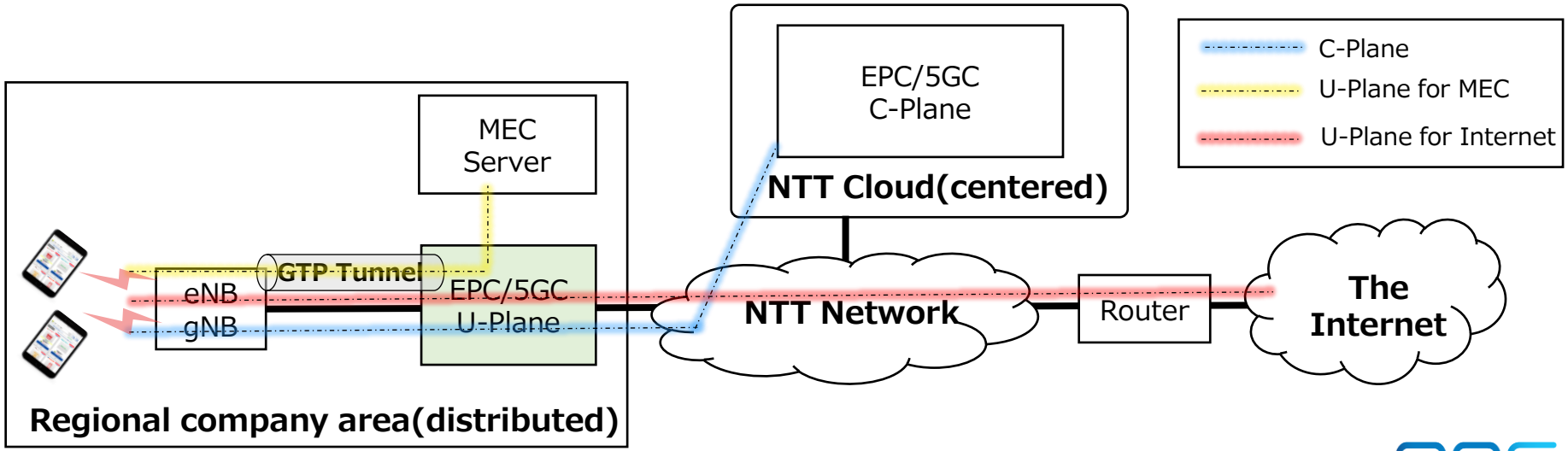


- Using Generic hardware (e.g. white box switch)
- Using Open Source Software

Concept of our solution.

- Only the lightweight U-Plane function of mobile core is deployed at the edge of regional companies.
- Utilizing programmable switch (P4*1 SW) to develop lightweight U-Plane function.
- Since the C-Plane function of mobile core is a common function, it is collectively deployed on the NTT cloud.

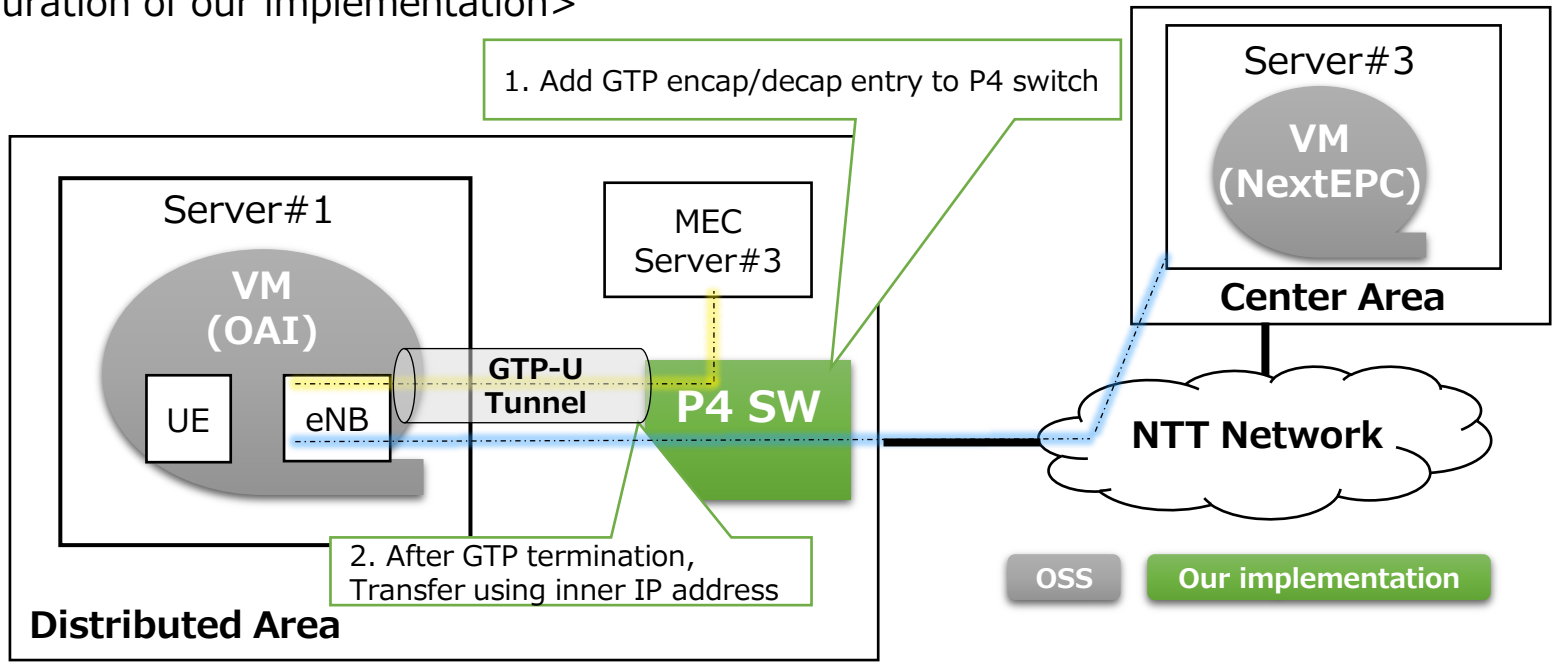
*1 : High-level Language for. Programming Protocol-independent Packet Processors



U-Plane function Implementation

- We deploy U-Plane function which can encap and decap GTP header.
- By this function, we can transfer packets to MEC server after GTP termination.

<Configuration of our implementation>

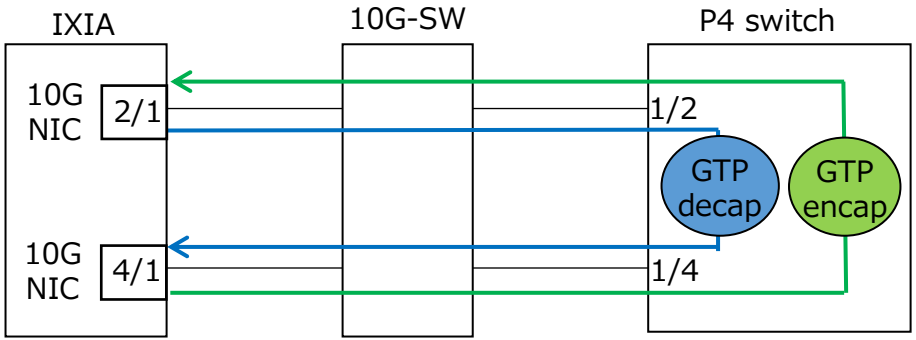


OAI : Open Air Interface

Experimental Results of our implementation

- With our implementation, we were able to confirm the throughput of wire rate (10Gbps).
- Responding to abnormal systems is a remaining issue.

Configuration of our experiment.



Experimental result

[1] IXIA ⇒ P4 switch (GTP encap)

Transmission and Reception rate	Long Packet (1464Byte)
10Gbps	9.6Gbps

[2] IXIA ⇒ P4 switch (GTP decap)

Transmission and Reception rate	Long Packet (1464Byte)
10Gbps	9.5Gbps

4. Requirements of telecom carriers in Local 5G.

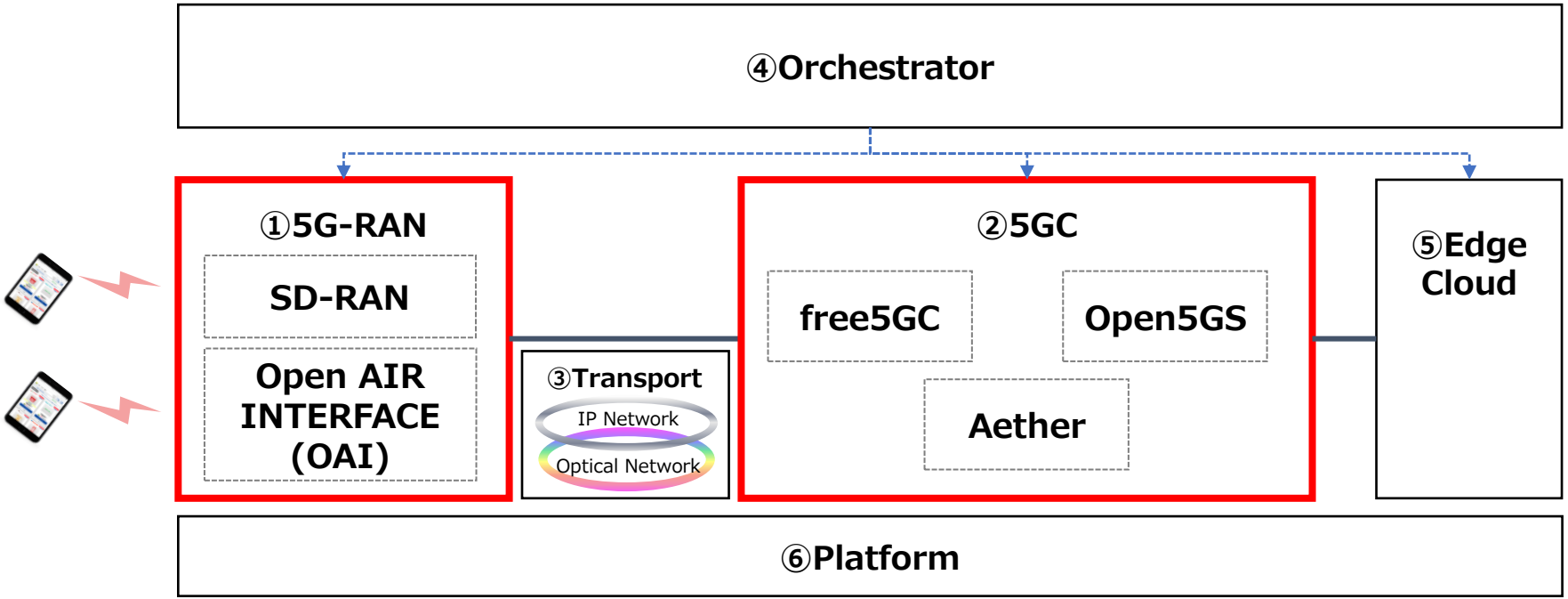
In Local 5G, many regional companies will deploy smaller mobile infrastructures compared to Public 5G.

1. **Lightweight and Low cost.**
   - Need generic hardware and softwareization of 5G-RAN/5GC.
   - Utilizing Open Source Software.
   - Control and User Plane separation.
2. **Center-managed mechanism.**
   - On behalf of deploying and operating each regional company.
3. **Customization for individual requests.**
   - Change RAN parameter (e.g. Uplink heavy) .

5. Future work & Conclusion

Applying open source software to Local 5G.

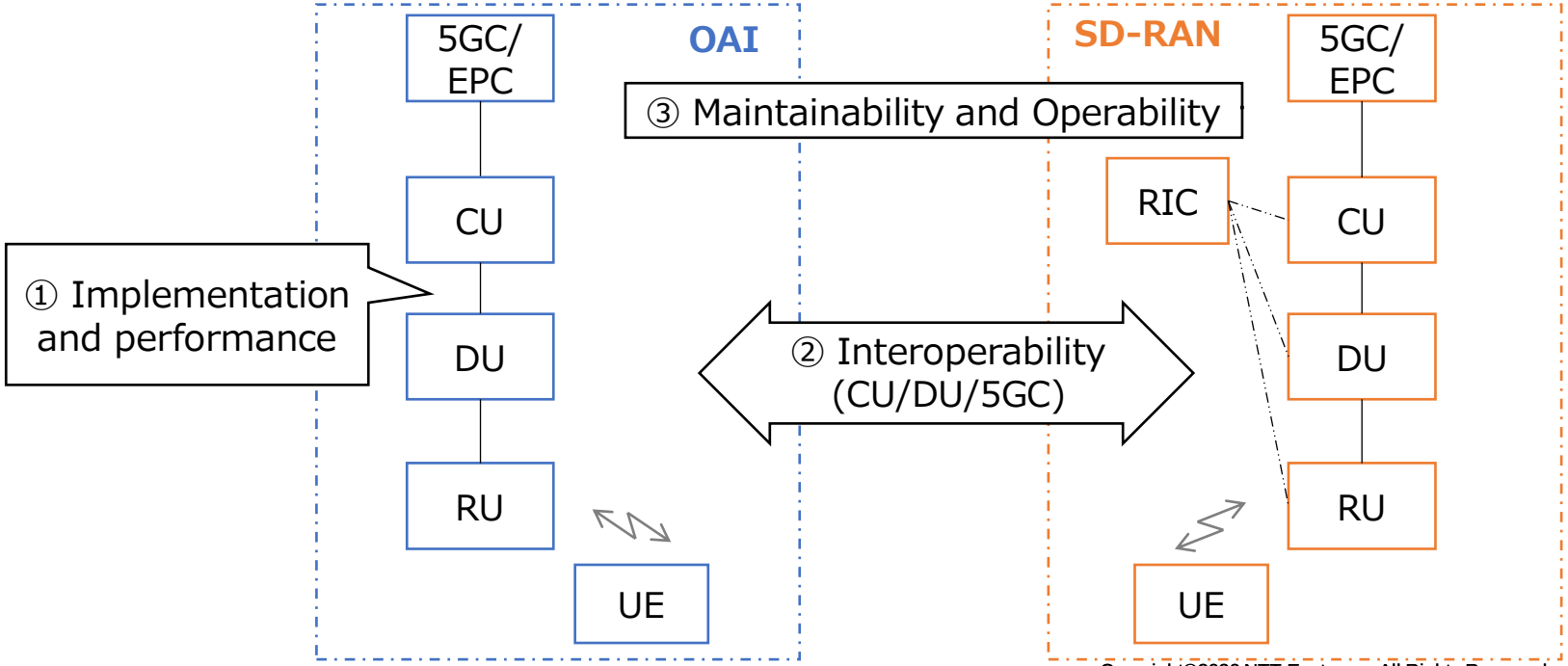
For cost reduction of Local 5G, we will deploy and evaluate open source software of ①5G-RAN and ②5GC.



① Plan of Evaluating 5G-RAN.

Evaluation target : OpenAirInterface(OAI) and SD-RAN.

Evaluation point : ①Implementation and performance,
②Interoperability, ③Maintainability and Operability.



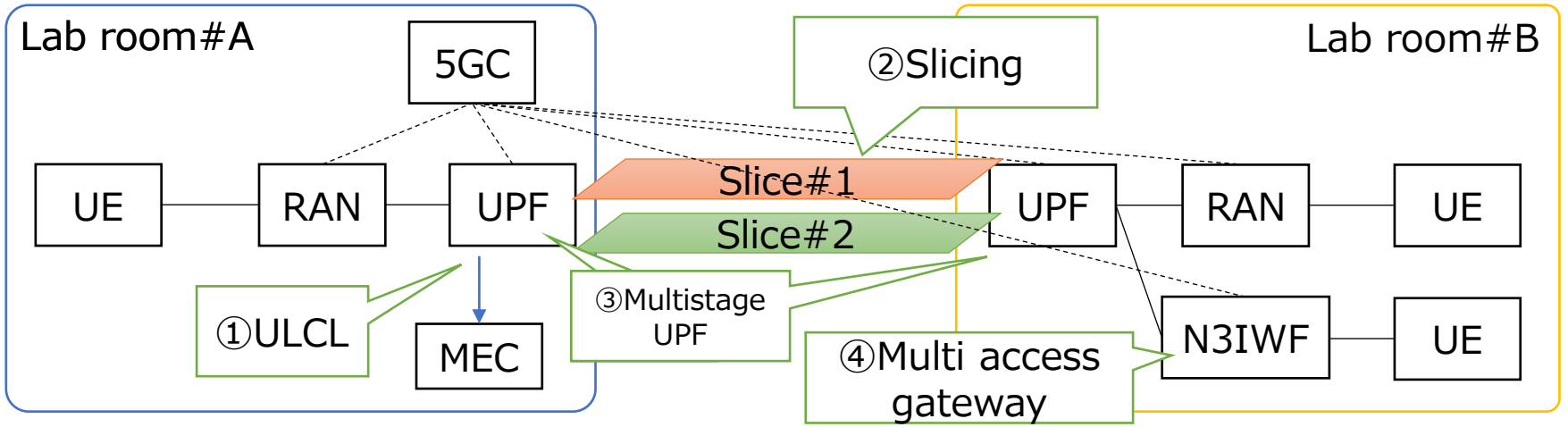
② Plan of Evaluating 5GC.

Evaluation target : Aether, free5GC and Open5GS.

Evaluation point :

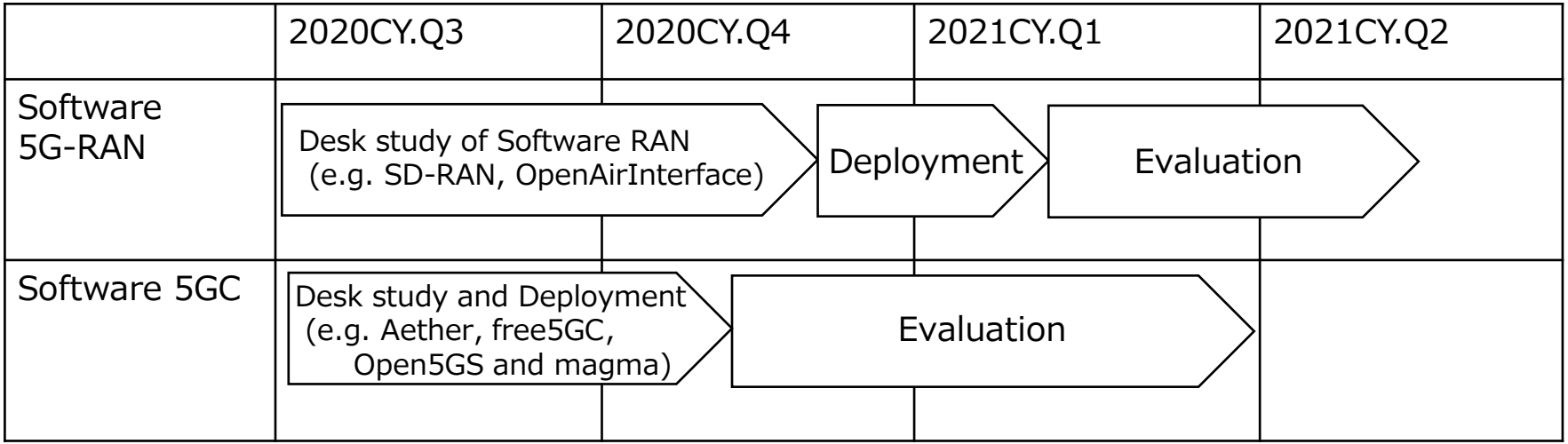
① Route control function to MEC* by ULCL(Uplink Classifier).
② Quality control by slicing function.
③ Multistage structure of UPF.
④ Multi Access Gateway by N3IWF.

* Multi-access Edge Computing



Schedule

- Plan to deploy Aether in our Lab　(2020CY.Q4).
- Plan to deploy SD-RAN in our Lab (2021CY.Q1~Q2).



ONF cooperation is necessary, and we would like to continue to cooperate and discuss.

Conclusion

- Developing new business utilizing Local 5G.
- Investigating Local 5G utilizing open networking technology for cost reduction and customization.
- If you are interested in, please contact us.

<Contact>
Hidetaka Nishihara, NTT EAST
hidetaka.nishihara.nt@east.ntt.co.jp

5G Transformation with Open Source

Thank You

2020