P4 and Stratum Use Case for New Edge Cloud

NTT EAST
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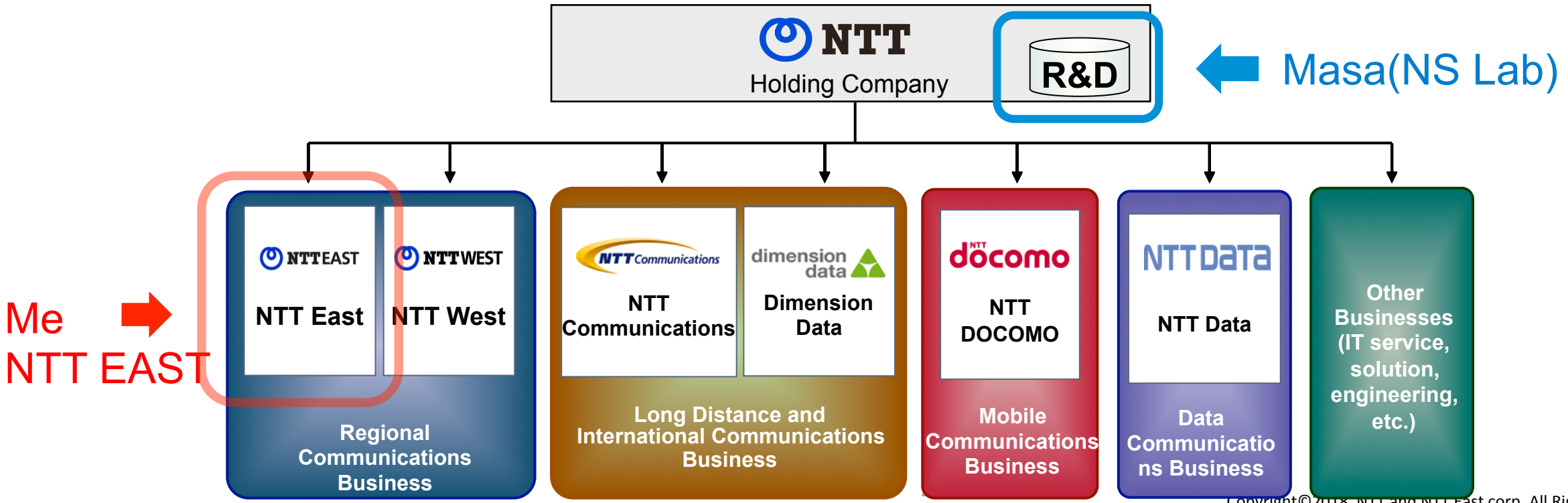
About NTT and NTT Group

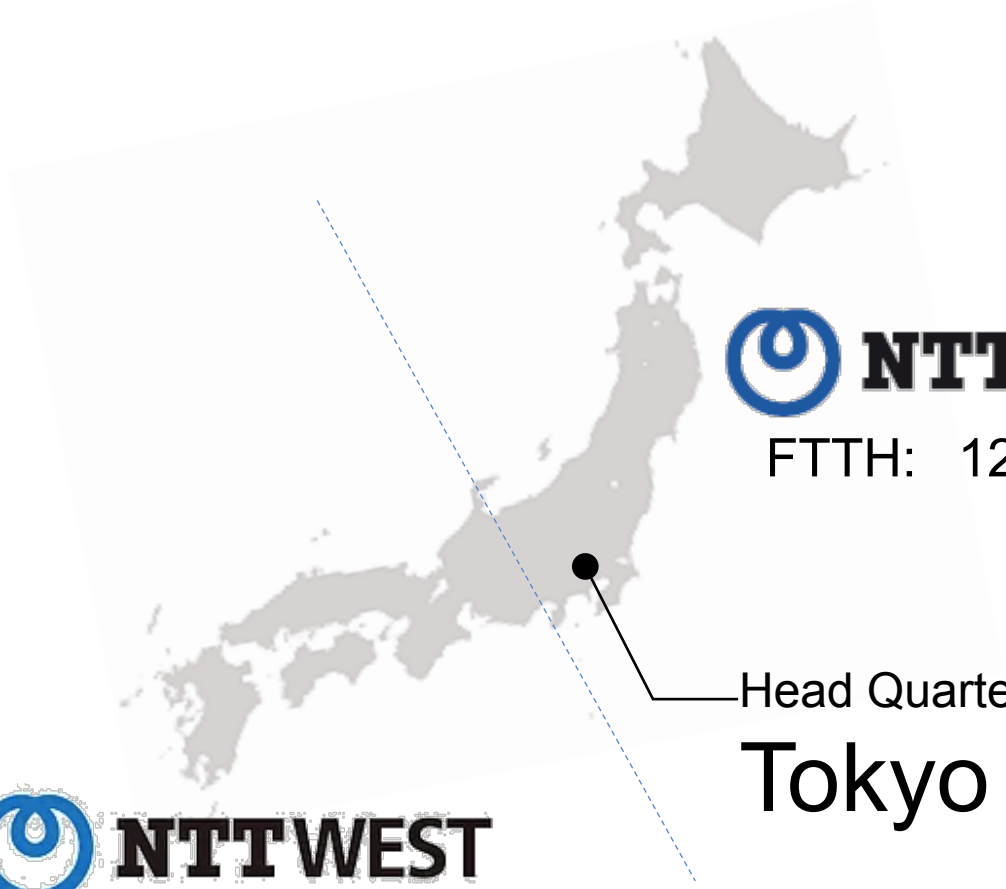
NTT (as a holding company) and several operational companies.

- ✓ NTT ・・・ group management and basic research
- ✓ NTT East/West ・・・ Residential Network operator
- ✓ NTT Communications ・・・ global cloud and network operator
- ✓ NTT DoCoMo ・・・ mobile network operator



Japanese Market

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



NTT EAST

FTTH: 12 million

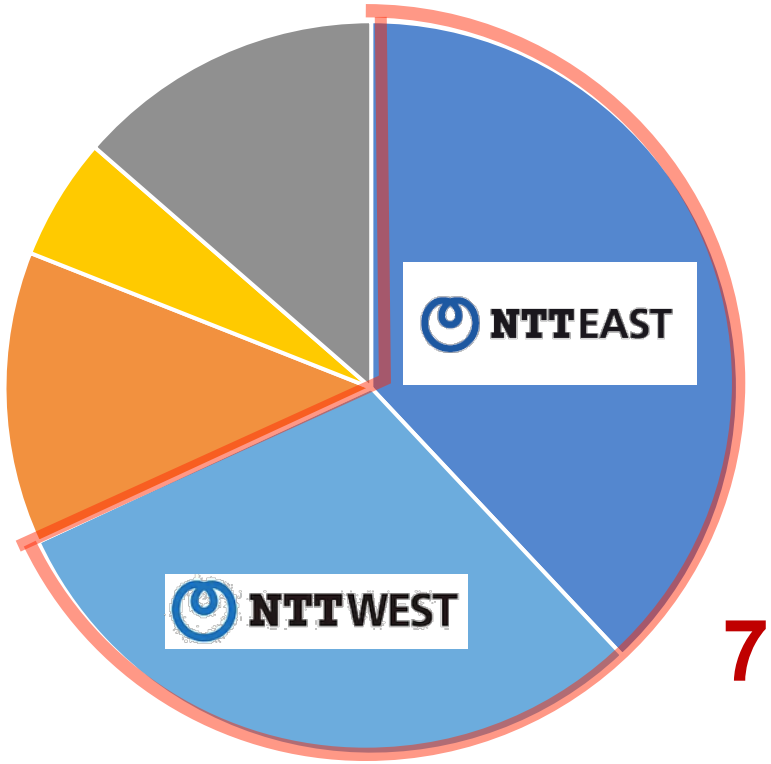
Head Quarter

Tokyo

NTT WEST

FTTH: 9 million

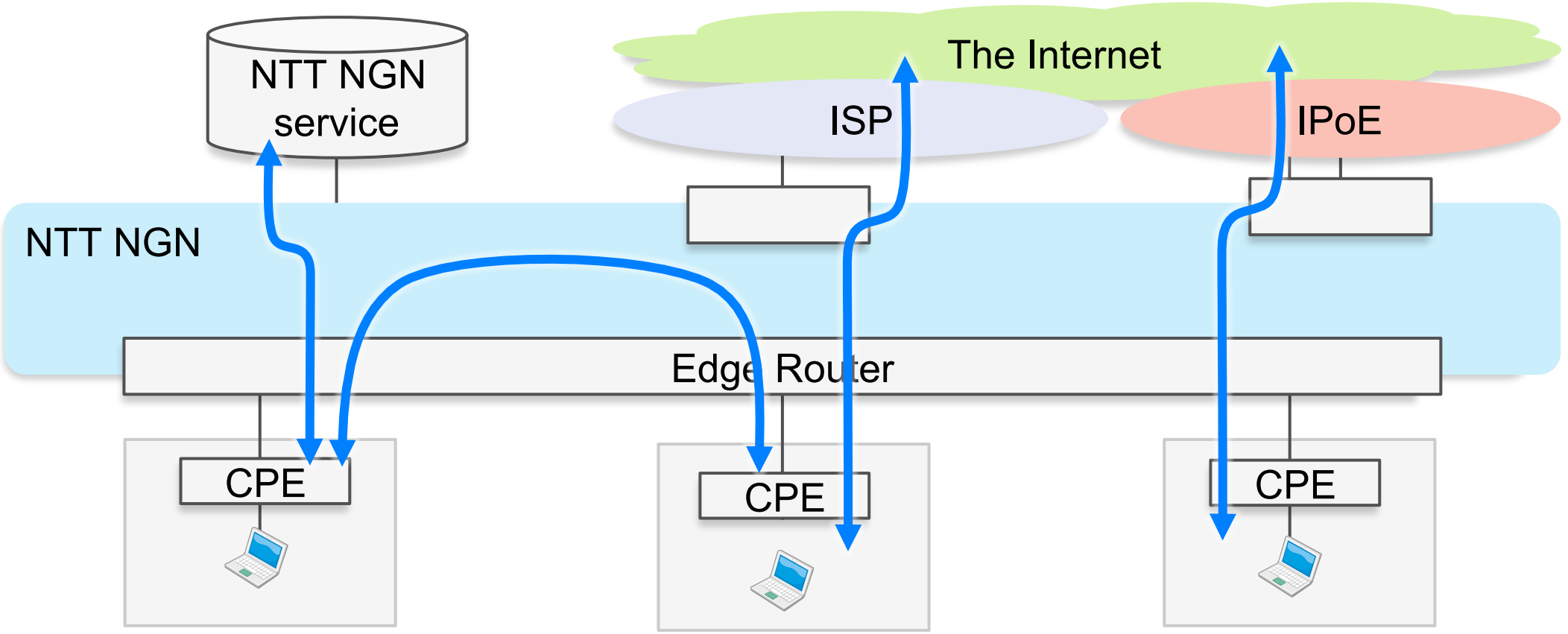
FTTH Share



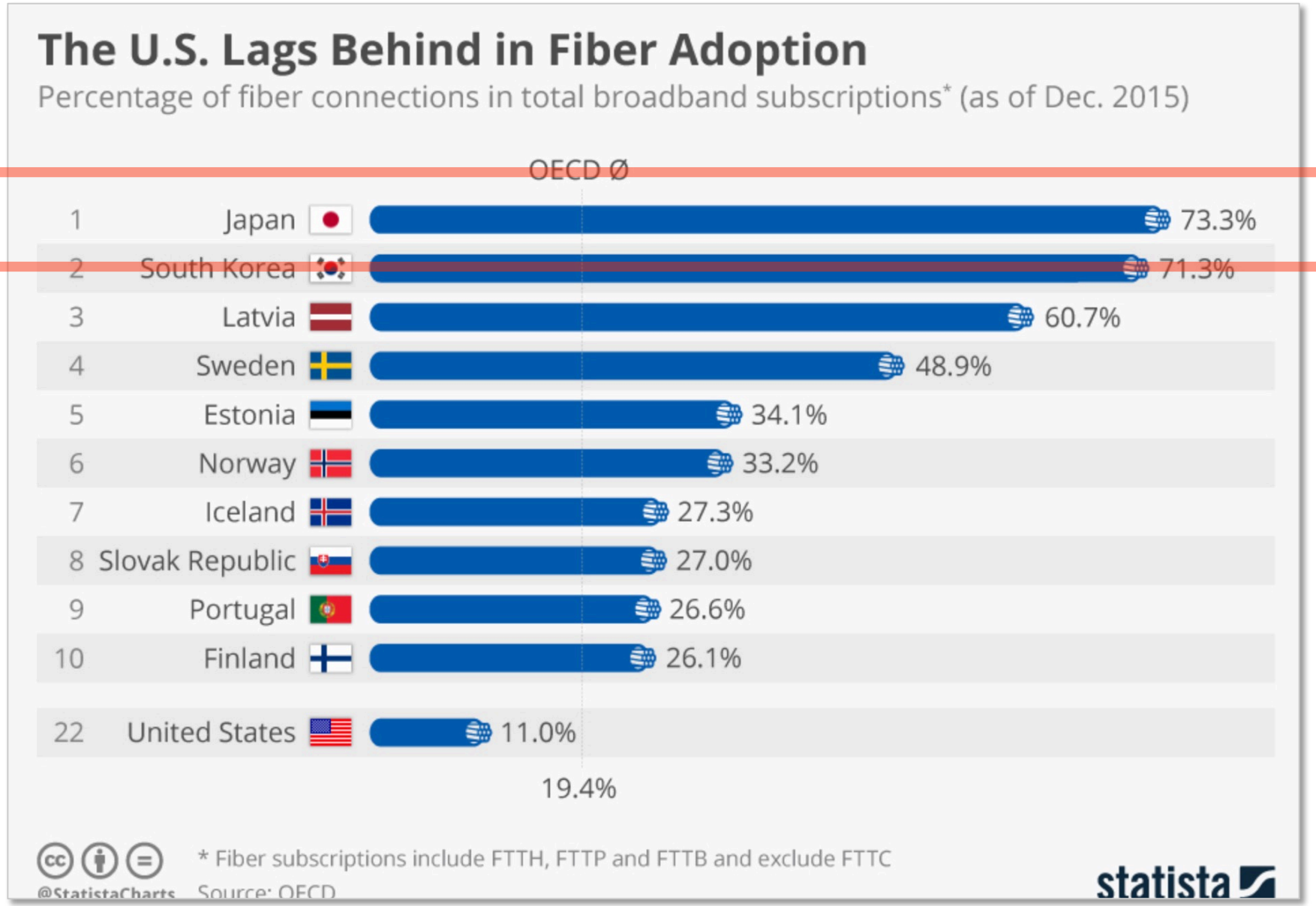
70%

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.

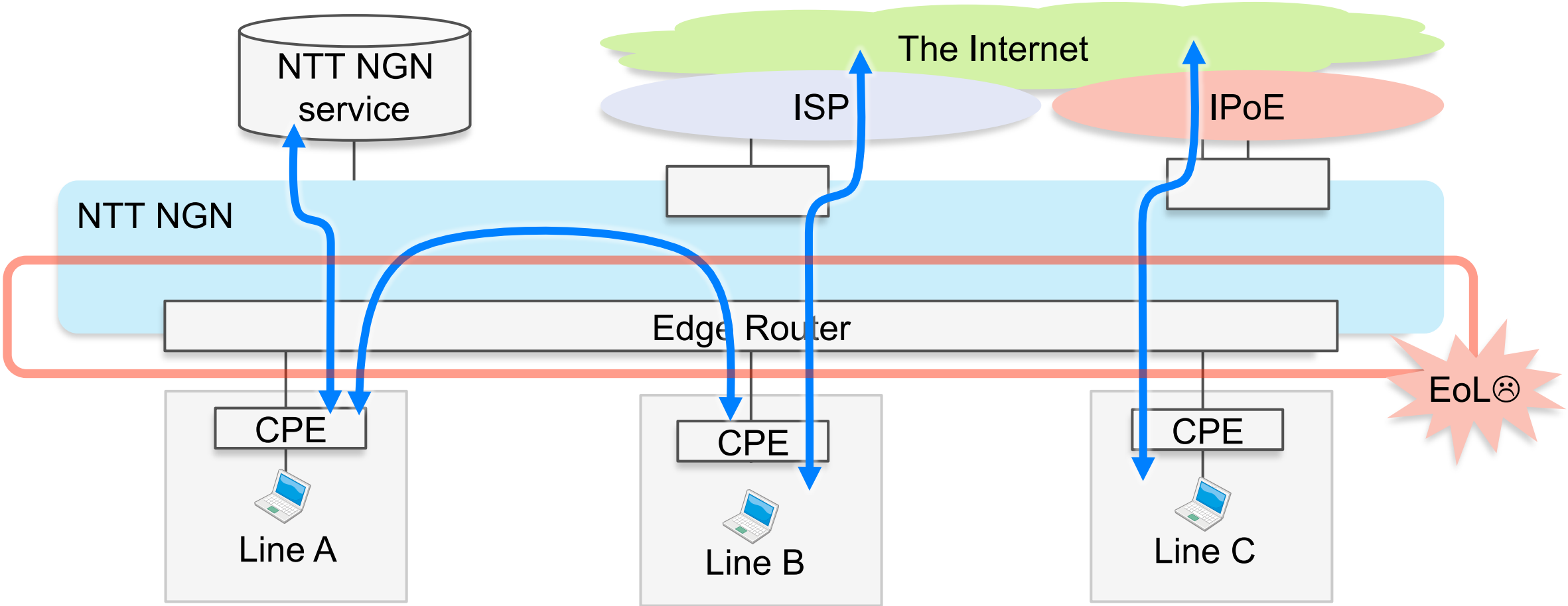


Maturity in providing FTTH service



Opportunity to Evolve Everything

- This network is already 10 years old. Network devices are reaching EoL.
- One of the barrier to deploy new architecture into existing network will be getting easier because of large amount of equipments' End of Life.



Anticipation for NEW network

- Whole eco-system will be unhappy pursuing pure cost reduction.
- New business must be created!
  to **avoid reinventing another dumb pipe** ☹
- Co-operation among operators and laboratories will be beneficial path.

COST REDUCTION

NEW SERVICE

Anticipation for New network

1. Service add-on
2. Reliability
3. Replacement
4. Scale in / out
5. Service Migration
6. Simple topology and chaining
7. Open Source
8. Cost Reduction

A) Scalability
- Service

B) Reliability
- N + M redundancy

C) Reduce Replacement TIME
- Simple management
- Simple Topology

D) REDUCE Development TIME
- Develop, Implement, Release
- Leveraging in-market technology
- Disaggregation

(Network) Requirement in Japan...

Japanese Rail Operator Says Sorry For 'Inexcusable' Departure 25 Seconds Early

May 17, 2018 · 3:18 AM ET

SCOTT NEUMAN

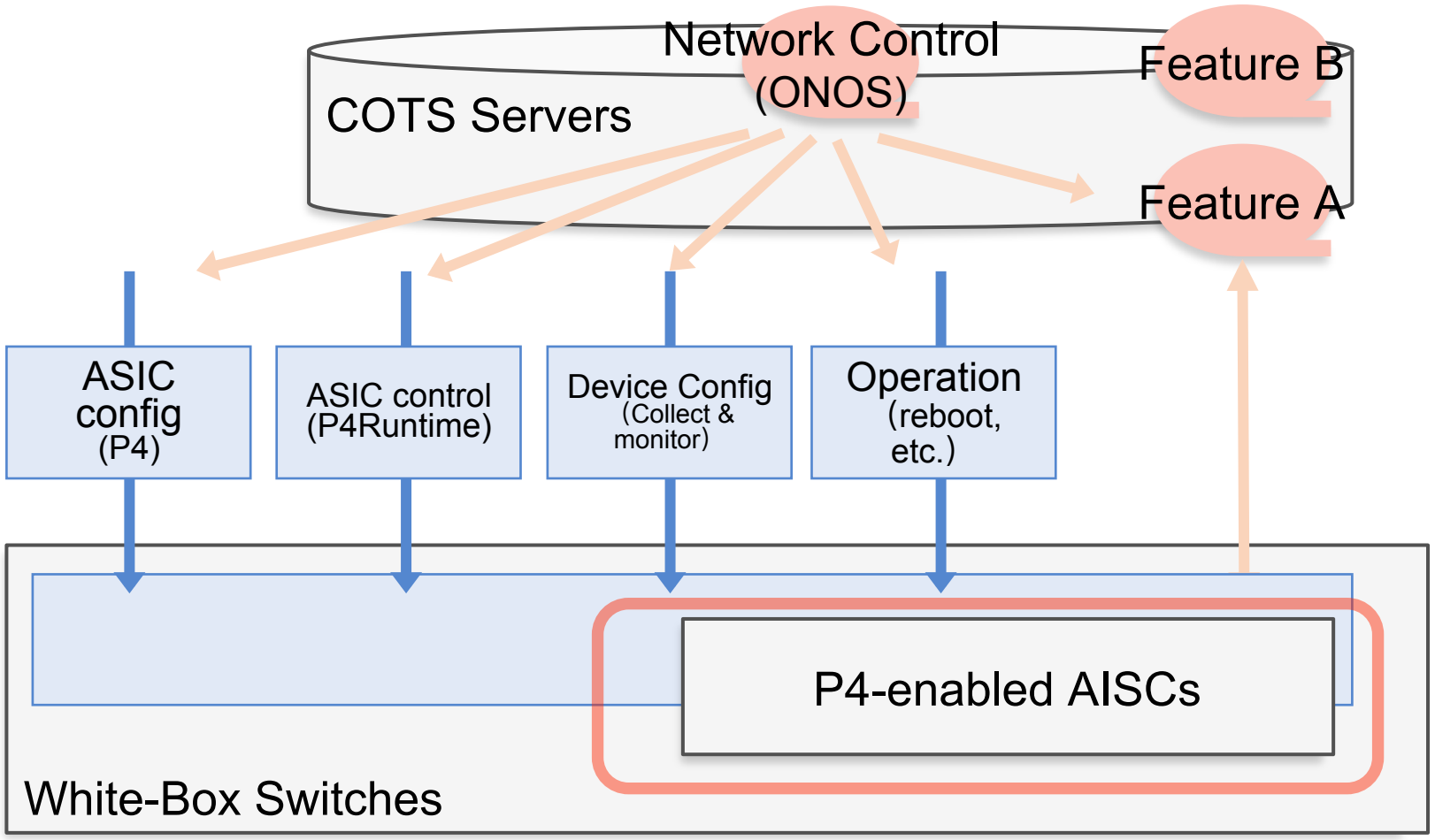
In the U.S., you might expect a passenger rail operator to apologize for being late. However, in Japan — where sleek, high-speed trains are famous for arrivals and departures that you could set your watch by — **leaving a station just 25 seconds early** is nothing short of a disgrace.

That is what happened earlier this month at Notogawa Station in the central Shiga Prefecture, when a train mistakenly pulled away from the platform almost a half-minute ahead of schedule – at 7:11:35 a.m. instead of 7:12.

"The great inconvenience we placed upon our customers was truly inexcusable," Japan Railways said in a statement about the May 11 incident involving a Shinkansen bullet train.

P4, Stratum, and UPAN Overview

- P4 is ASIC independent programming language to describe forwarding behavior
- Stratum acts as NOS agent to communicate with control plane and deal with management operations
- UPAN is a solution project leveraging multiple class of devices and NFVI infrastructures



UPAN

Overarching solution project managing entire network and individual network elements. Inculedes P4 dataplane & Stratum

Stratum

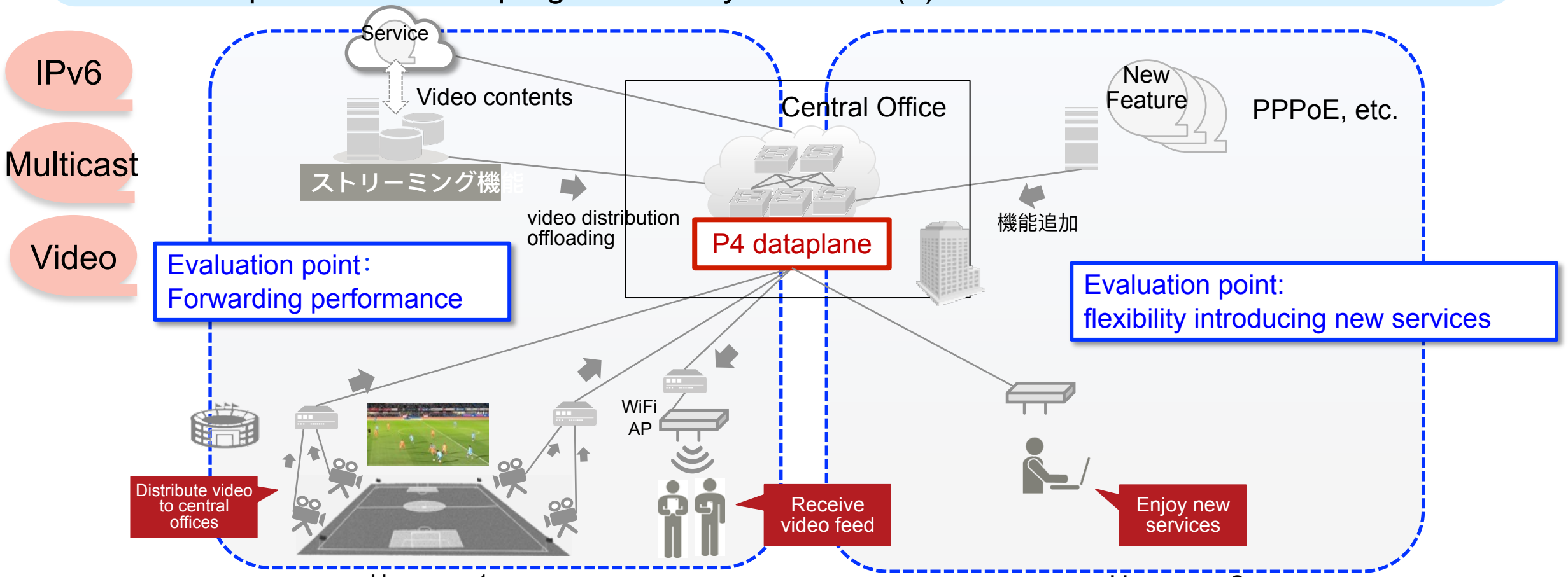
On device NOS designed for programmable dataplane such as P4

P4

ASIC independent language for dataplane programming

P4 use-cases

- NTT East intend to evaluate following use cases using P4 data plane switches to explore services benefits and business oportunities
  - ✓ Video streaming use case (1)
  - ✓ Data plane feature re-programmability use case (2)



Use case 1

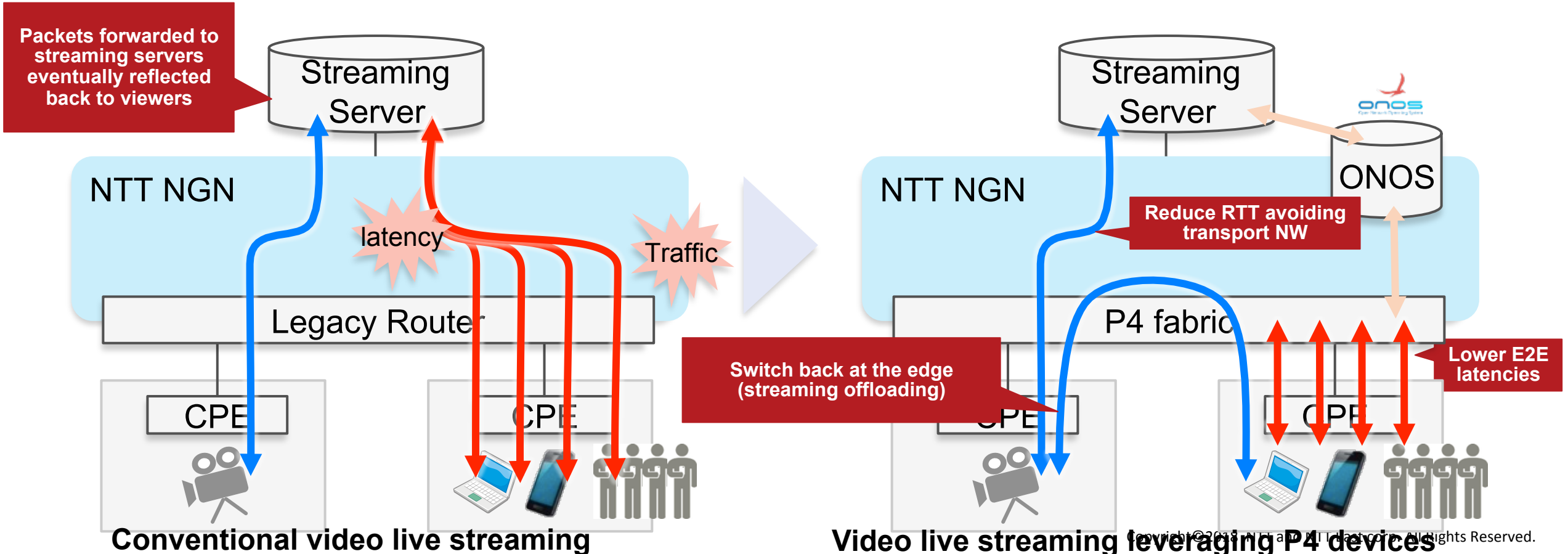
Offloading video distributionfunctionalities to P4 switches

Use case 2

Introduction of new service as software upgrade

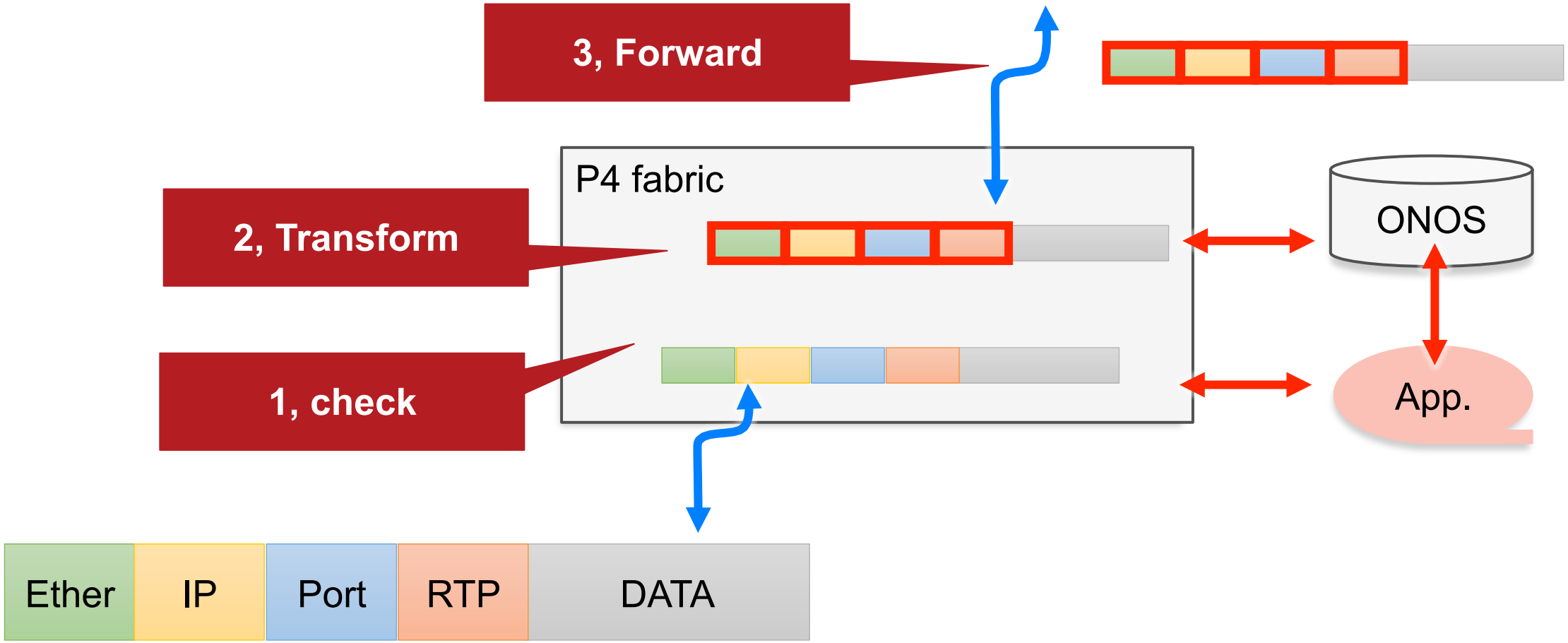
P4 use-case 1

- Using P4 switches as edge router to offload video live streaming protocol handling to improve viewer experience
- Programmable ASICs enables some of streaming protocol handling typically handled bystreaming server side to be offloaded to the network at the edge, which enables improved viewer experience reducing E2E delays and reducing traffic in the transport network.



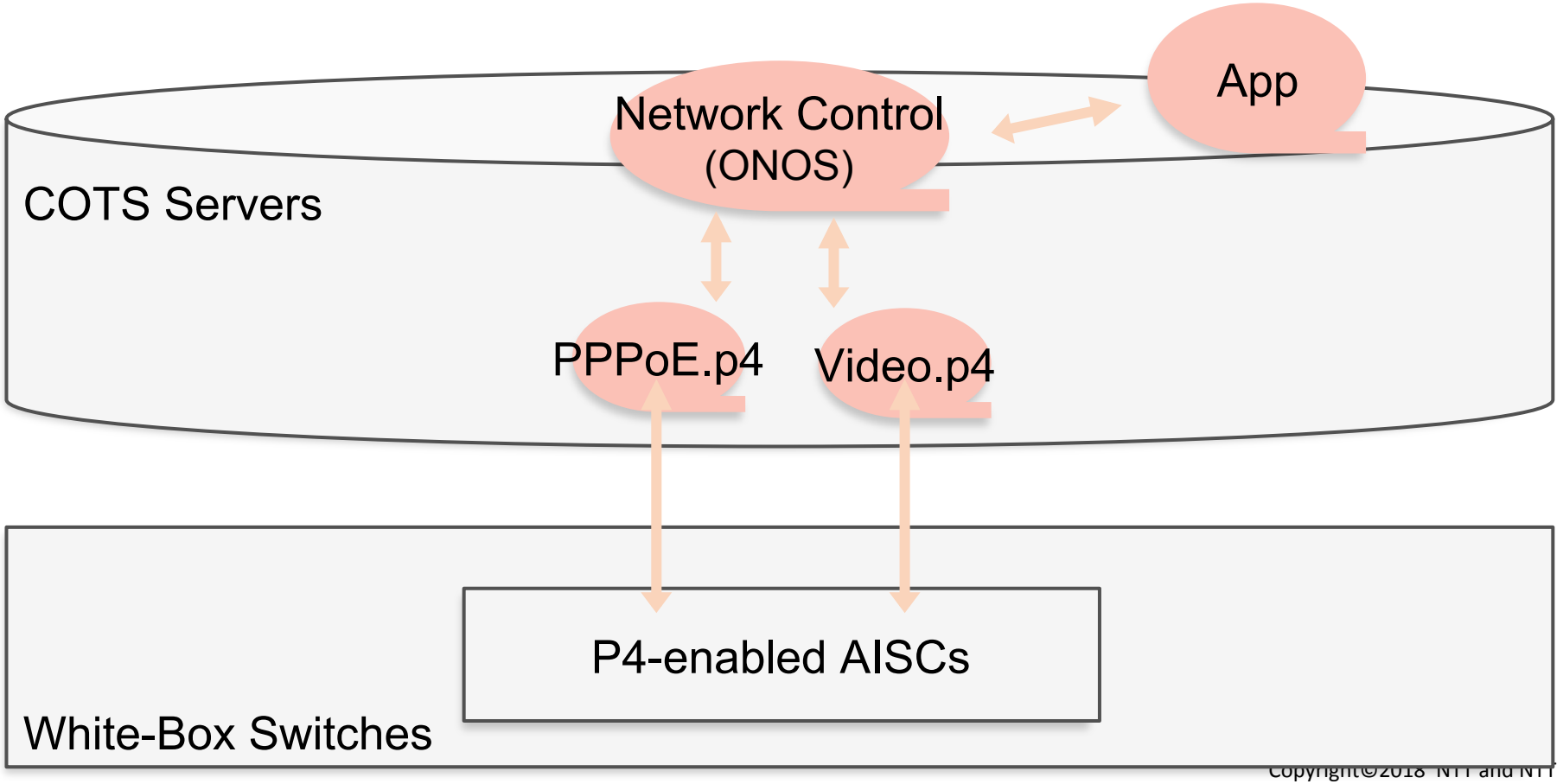
P4 use-case 1

- P4 switch runs with ONOS and use-case sample Apps.
- The switch check the packet header depending on the signal from Apps, transform the headers, and forward it.
- In this case, Unicast packet to multicast packet transform has been generated.



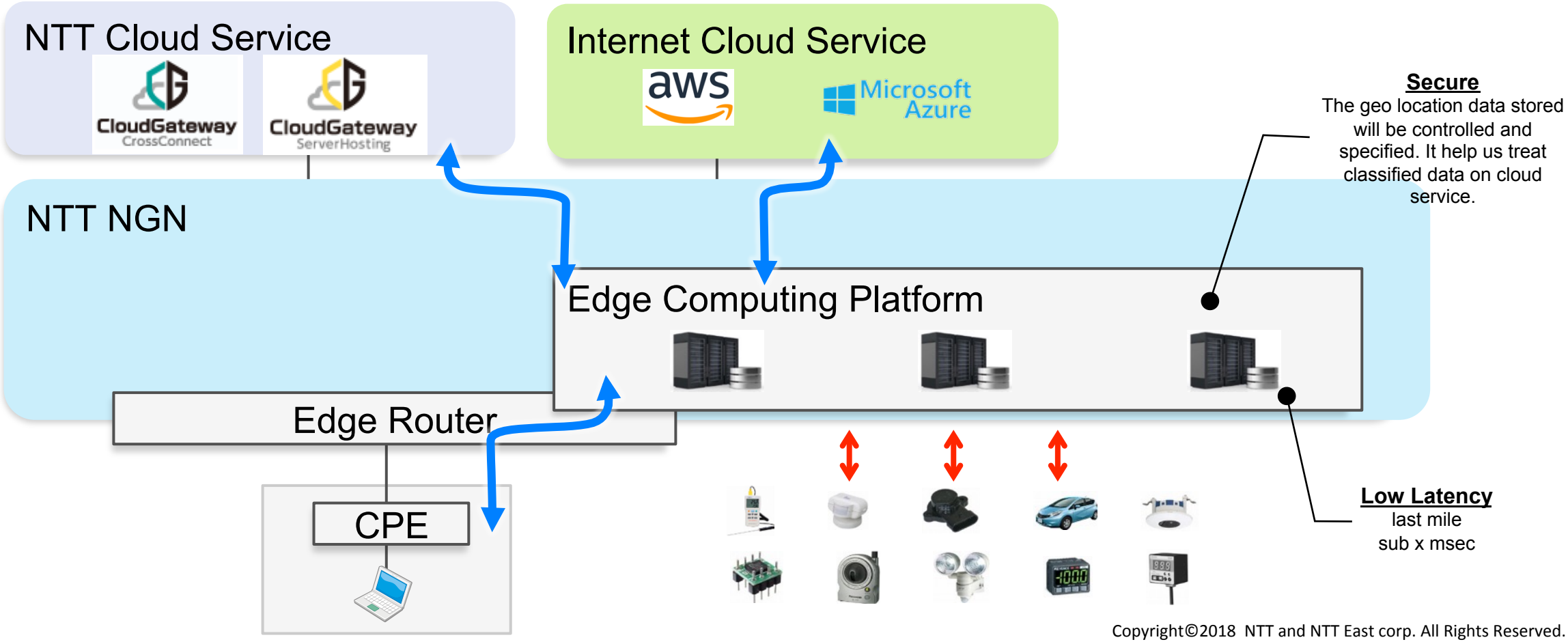
P4 use-case 2 -dynamic add/remove features-

- Using P4 switches as edge router to enable flexibly adding and removing various data plane features as software life cycle management
- Adapt to various network service demands using same set of programmable hardware to **reduce complexities in hardware investment planning and field deployments**



NTT EAST Edge Cloud Computing

NTT EAST plans to start providing edge cloud computing platform and brings the expertise of NTT innovators into a collaborative environment with industry technology providers, developers and startups to move ideas to market faster.



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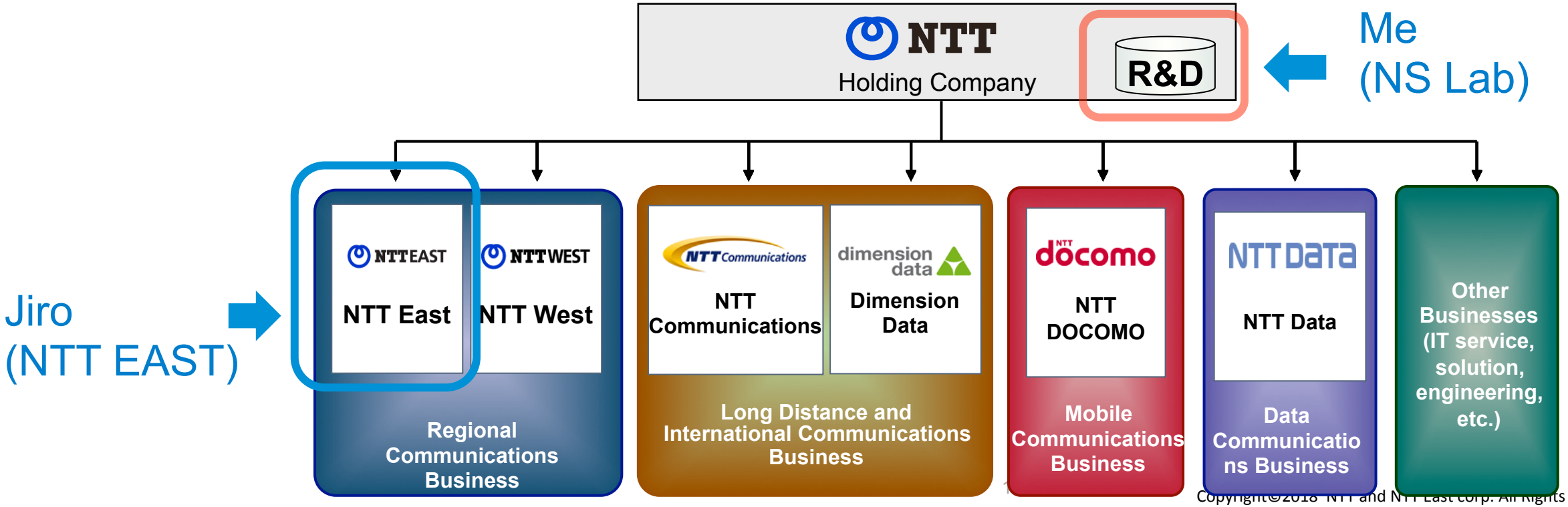
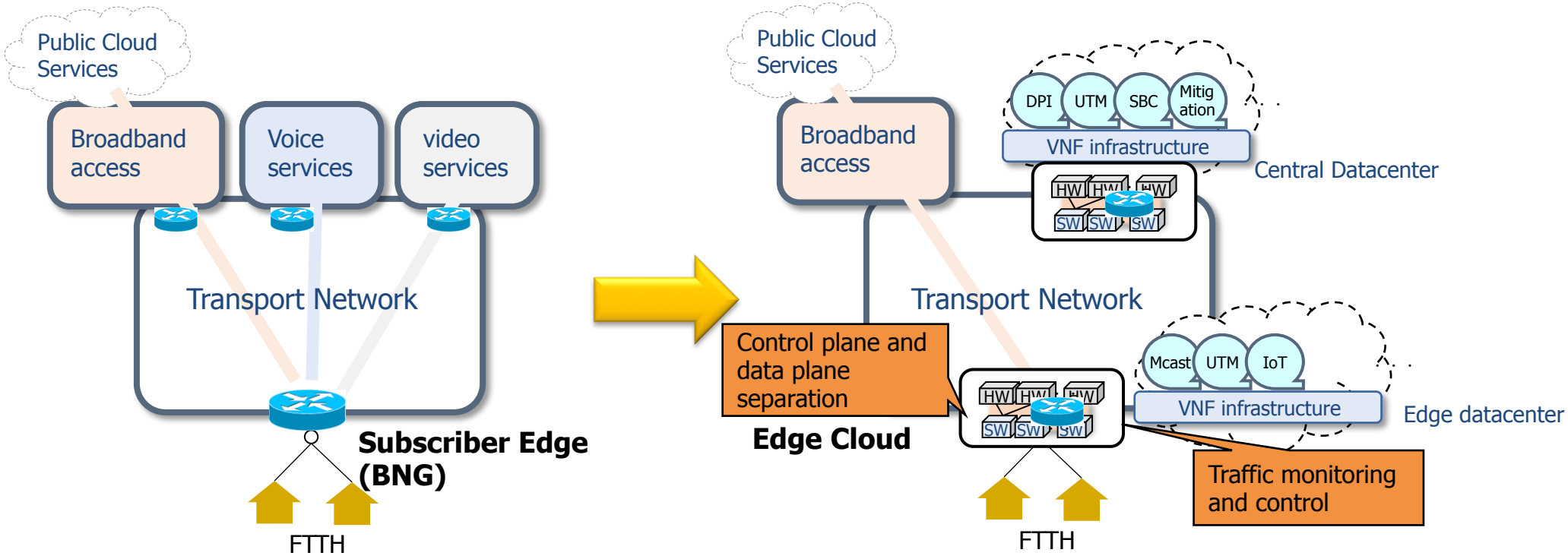


Our Edge concept and architecture

- Service Edge and cloud platform is going to be converged as Edge Cloud.
- Edge platform is expected to support more flexibility and scalability.

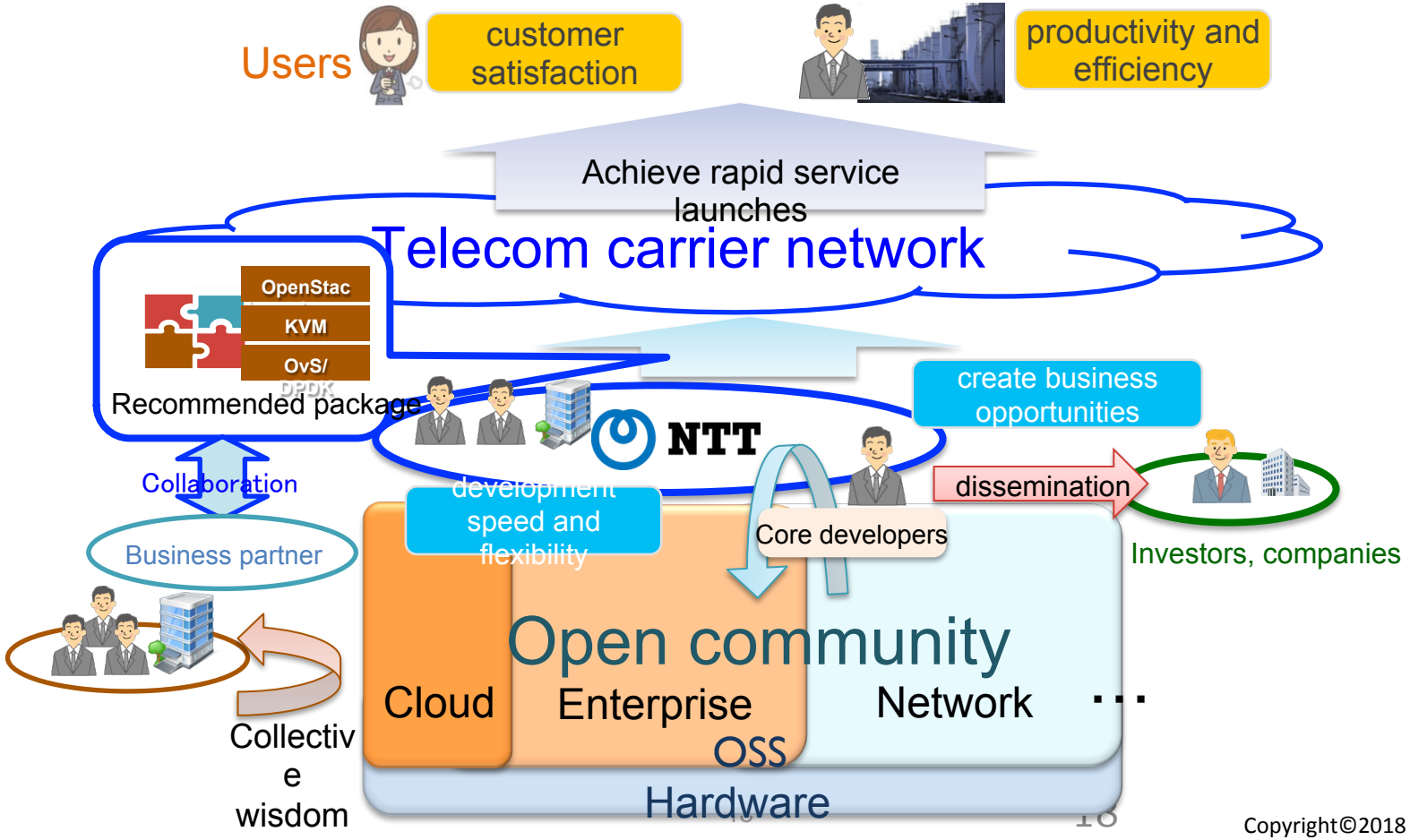


- Offering triple play Services
- Basically optimized for consumer

- Various Services with rapidly provided
- Suitable for Business partner and their customers

NTT R&D with open community

- Open source community is getting a key driver to promote innovation.
- To collaborate open community is getting more important for us.

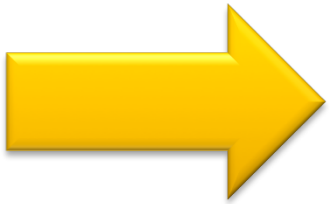


How we compose BNG ?

- To make our network more simple, scalable and flexible,
  we challenge to realize service edge with VNF and common hardware.

There is no alternatives but to choose...

Dedicated Edge Router



What we need for next-gen service edge are...

COTS +VNF

+

Common hardware

Expectation for Network Programmability

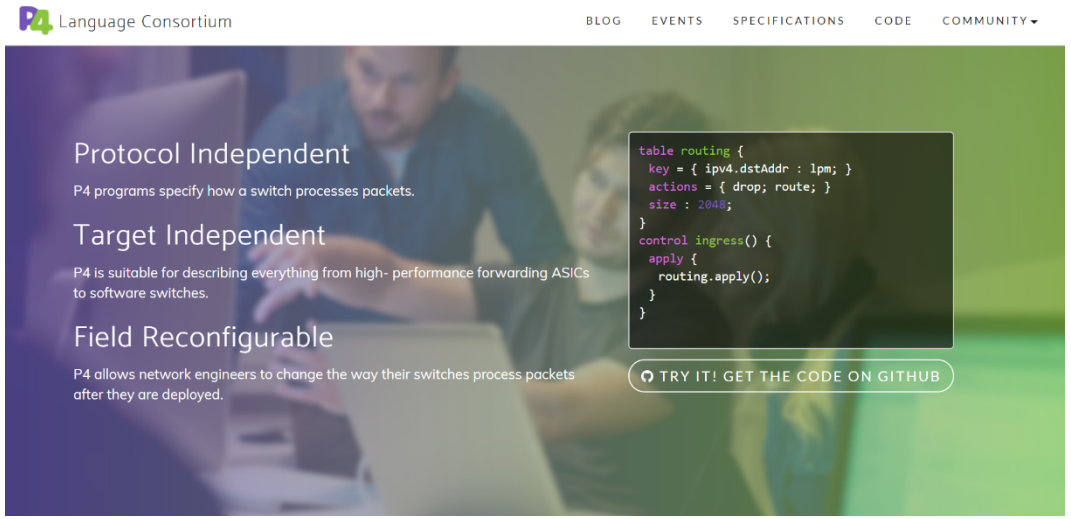
- There are many kinds of network functions in BNG, so it is difficult to disaggregate by simply adopting COTS and white box switches.

- Virtualization makes our network more flexible, but it also makes it difficult to keep performance and makes our network invisible.

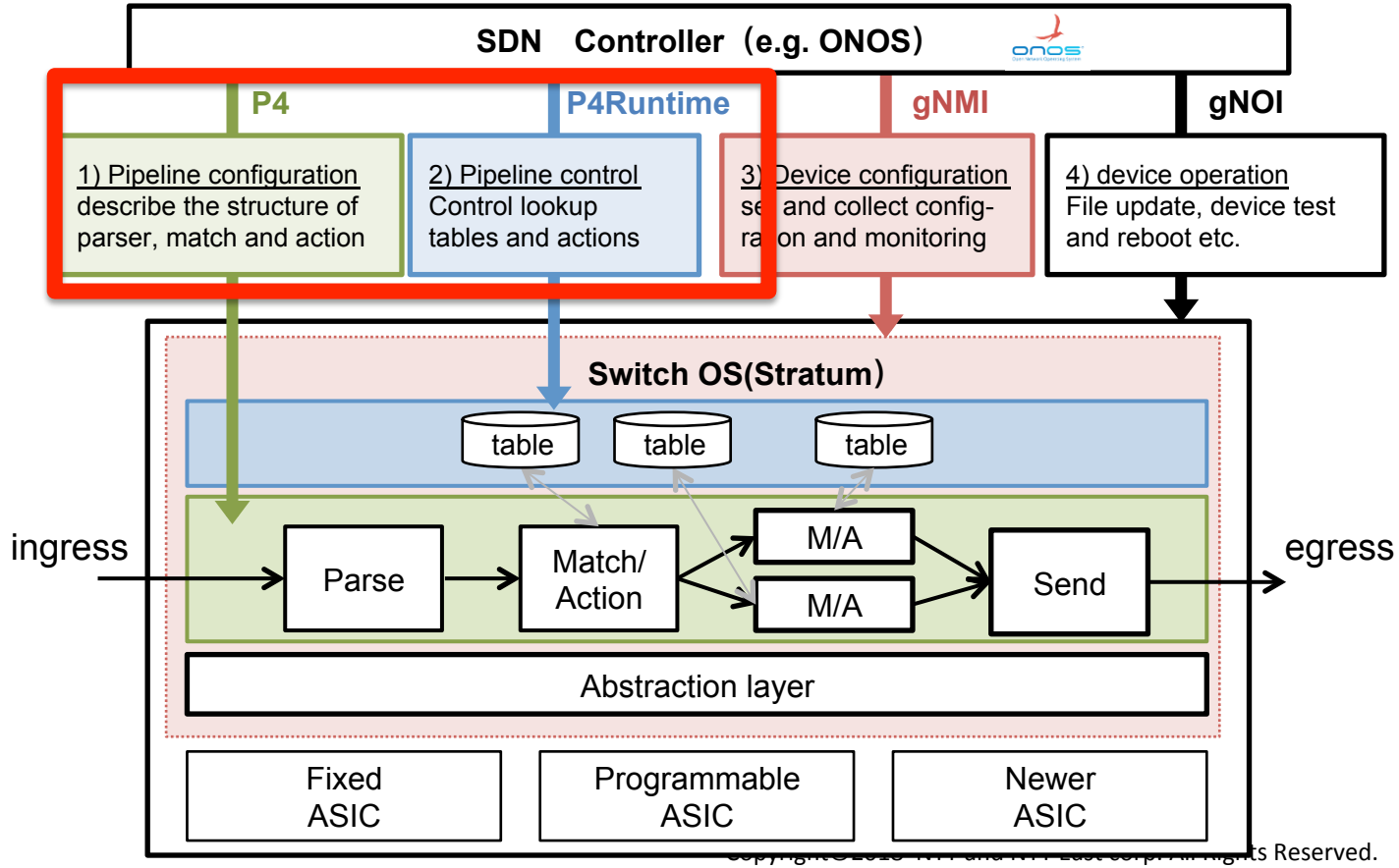
We suppose that network programmability might become a key component to disaggregate BNG

P4 and Stratum

- P4 enables us to program what and whenever we want on hardware
- Stratum provide us a simple unified interface to control switches including P4.



https://p4.org/



Use cases and lab trials

Expectation to Network Programmability

Use case for programmable Edge cloud

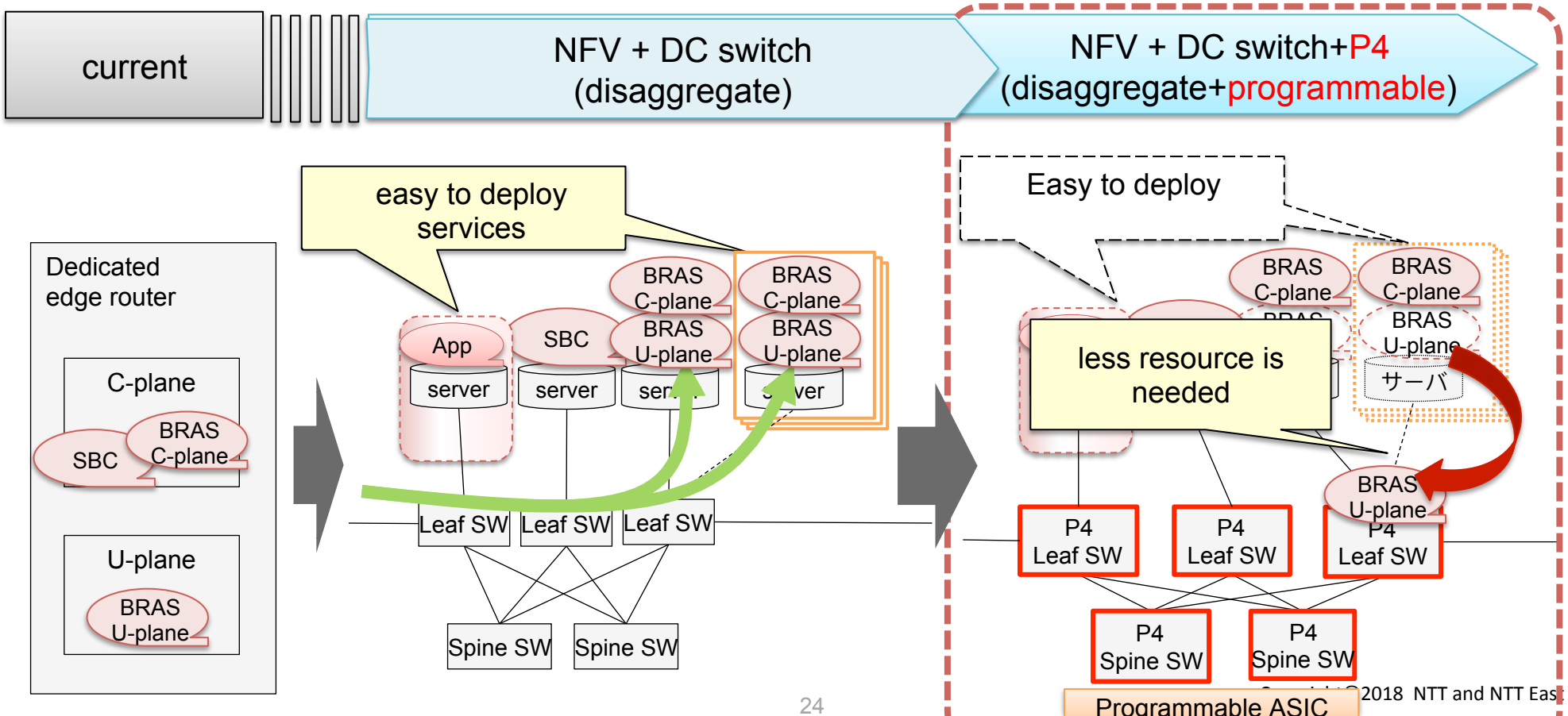
- We focus on two different types of use case which could support cost effective and value add network.

#	Cost effective network	Value add network
issue	In the current virtualized network, we need much more COTS server to perform as fast as dedicated router.	in the current network, it is difficult to manage strict traffic quality such as low latency services.
Use case	Disaggregate BNG c/u-plane function	Platform for ultra low latency service

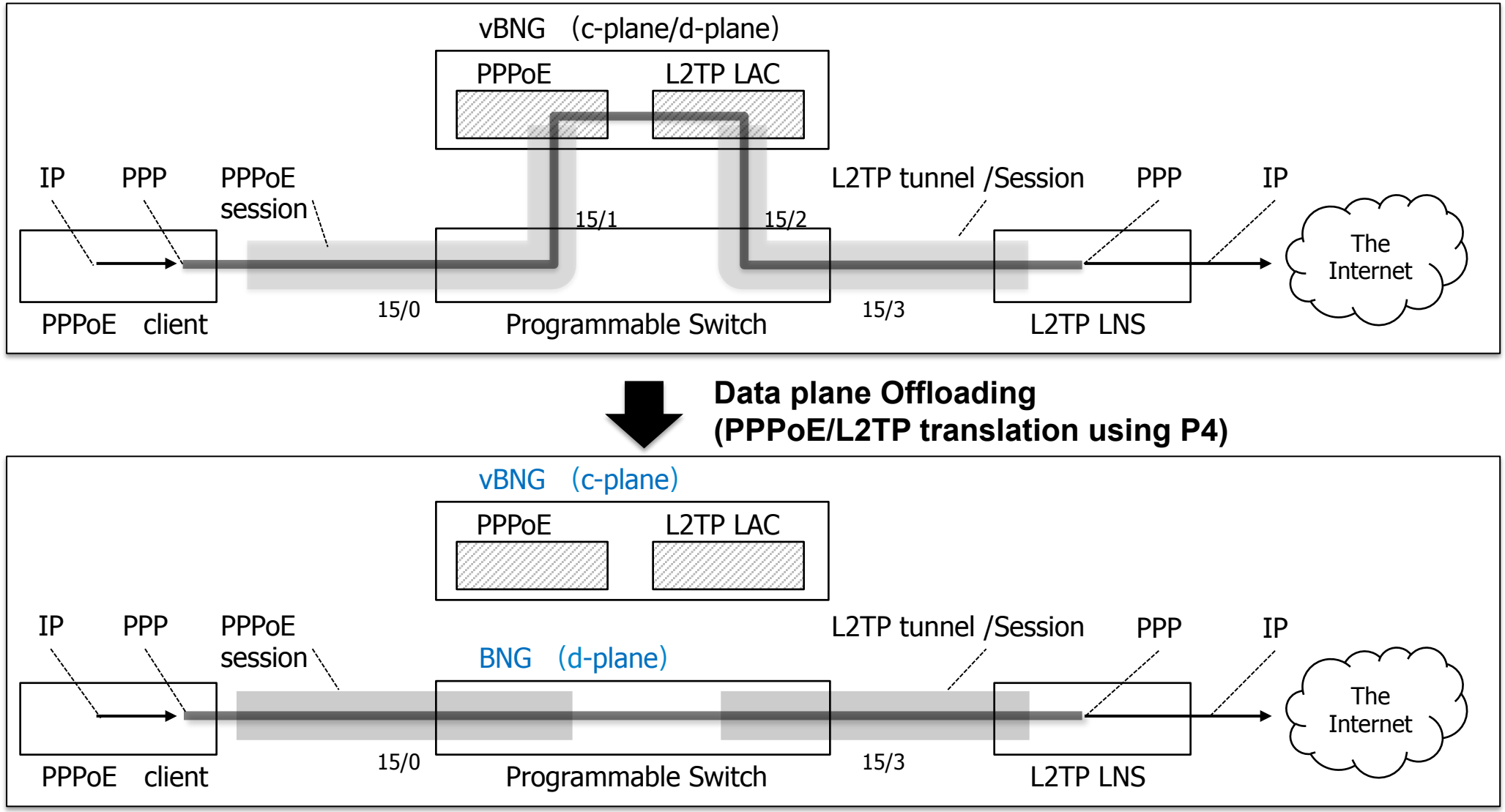
VNF offloading use case

Disaggregate BNG with programmable Switches

- Disaggregated BNG enables us to fit proper resources as we just need.
- With programmability, we can improve resource efficiency and implement value-add function.

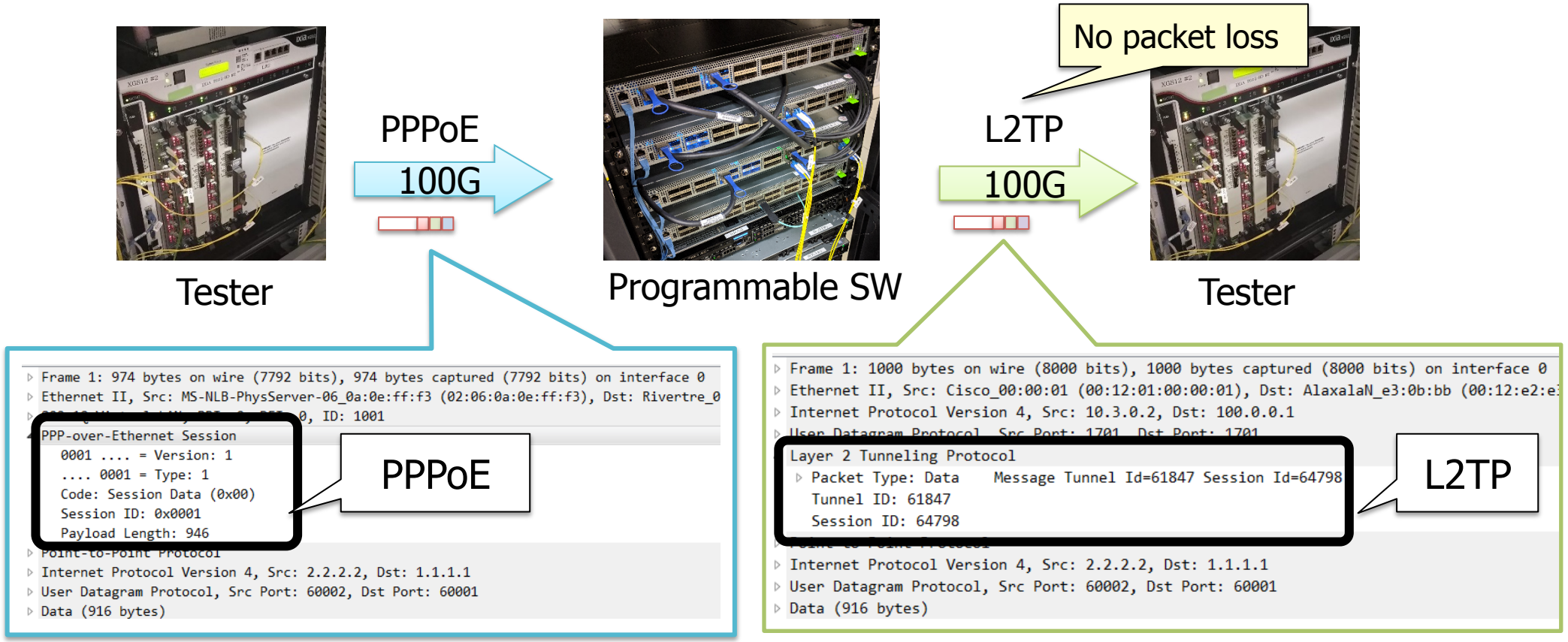


Diagram



Test Result

- PPPoE and L2TP translation works well on 100Gbps traffic.

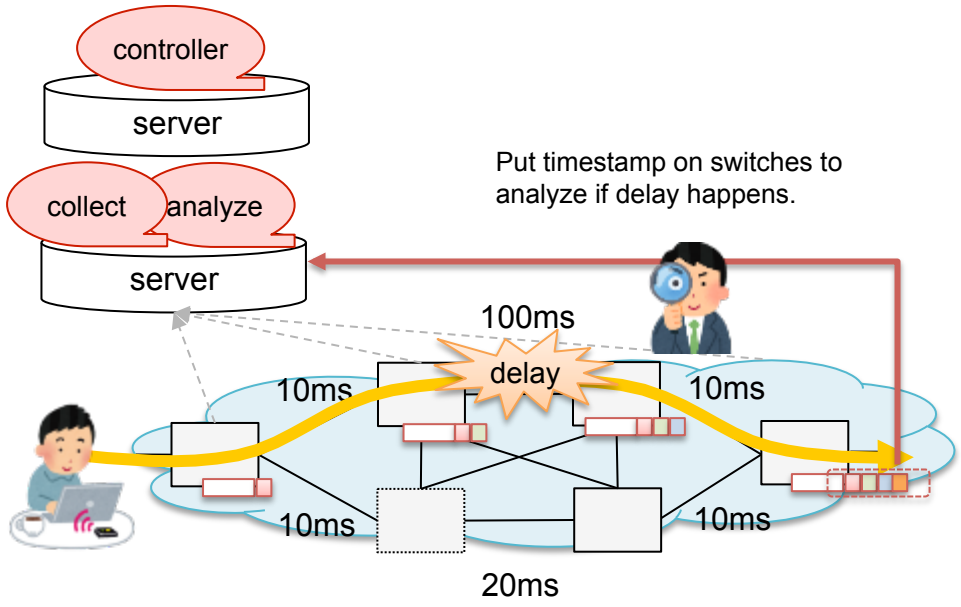


Network visibility use case

Platform for ultra low latency services with INT

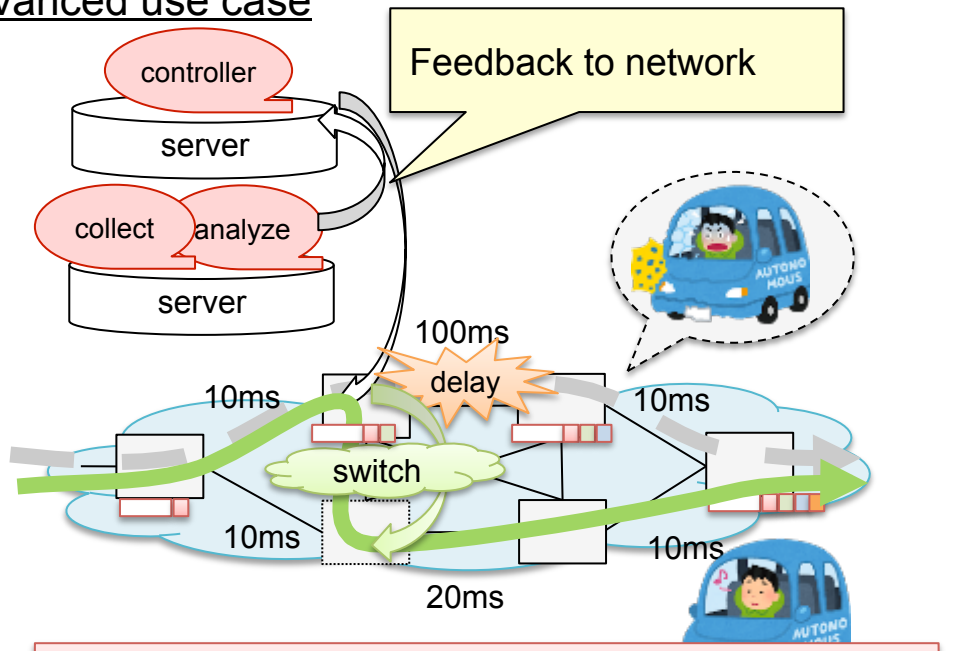
- Make network quality more visible by collecting packet by packet granularity status.
- Enable operator to control traffic according to the analysis result.

basic use case



Make it visible if delay might increase or not for ultra low latency services

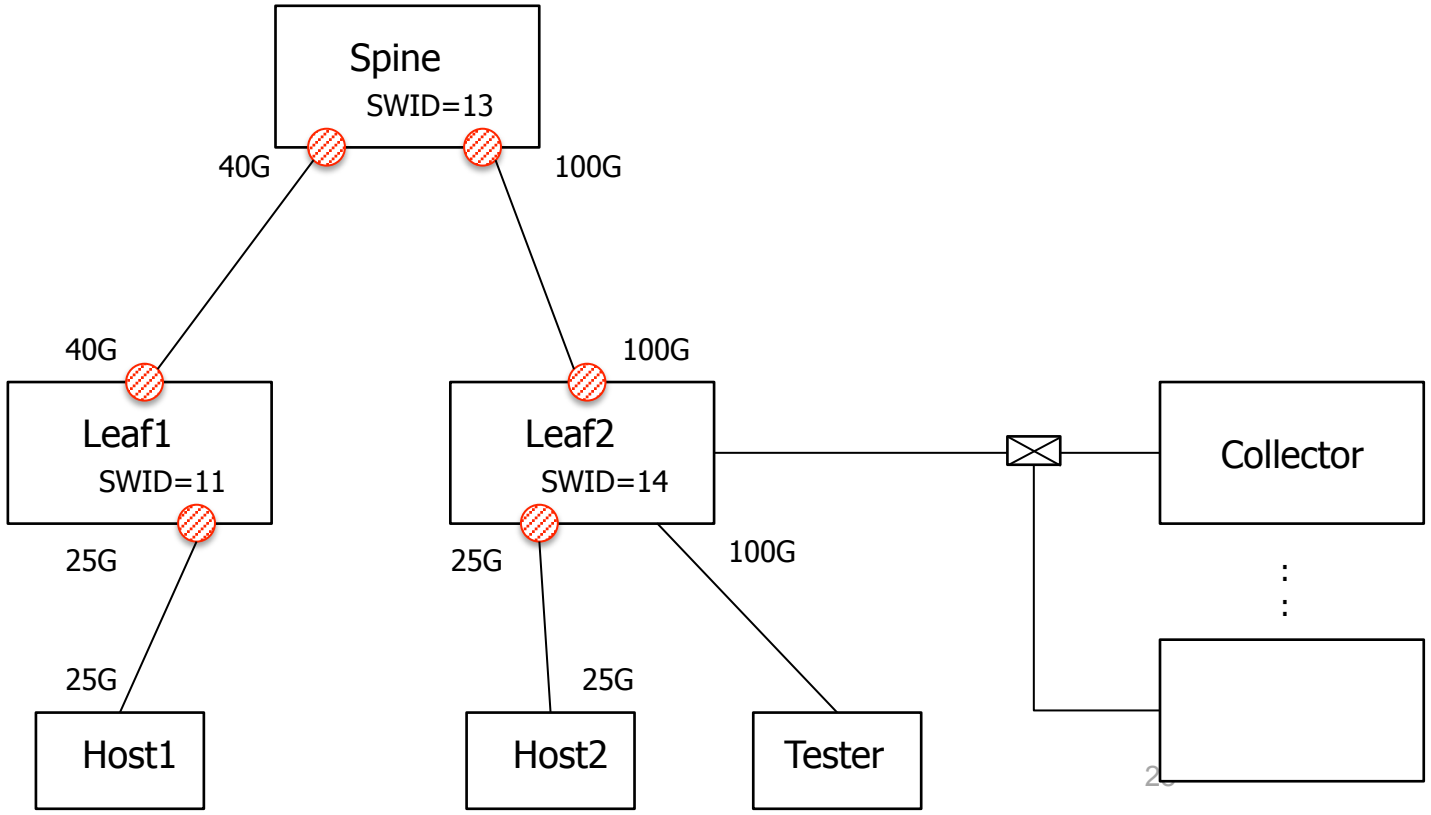
advanced use case



reroute in advance by predicting the possibility of delay

Diagram and Result

- We can detect over-threshold of end-to-end latency in real time (Fig.1)
- We can also confirm that hop-by-hop latency in each switches could be figured out (Fig. 2)



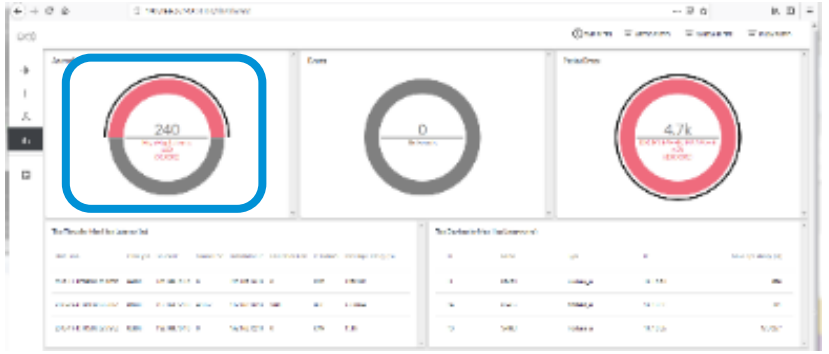


Fig.1

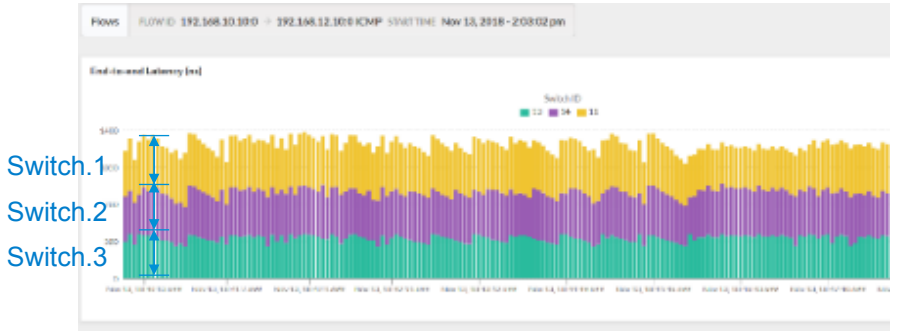
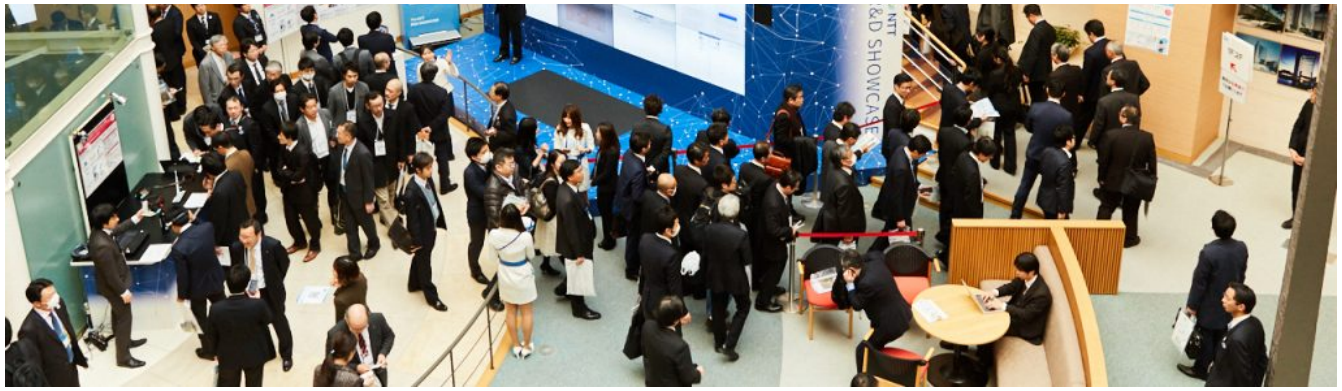


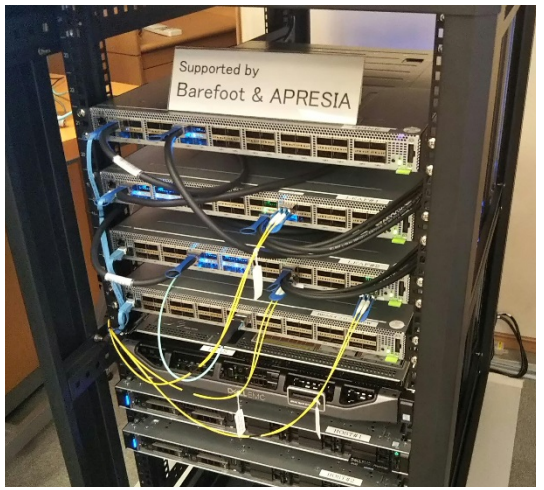
Fig.2

NTT R&D Forum 2018 Autumn

“Transforming Your Digital Visions into Reality,”

- NTT held annual exhibition in Nov.29 and 30,2018.
- We demonstrate our VNF offloading and INT trials at the exhibition.





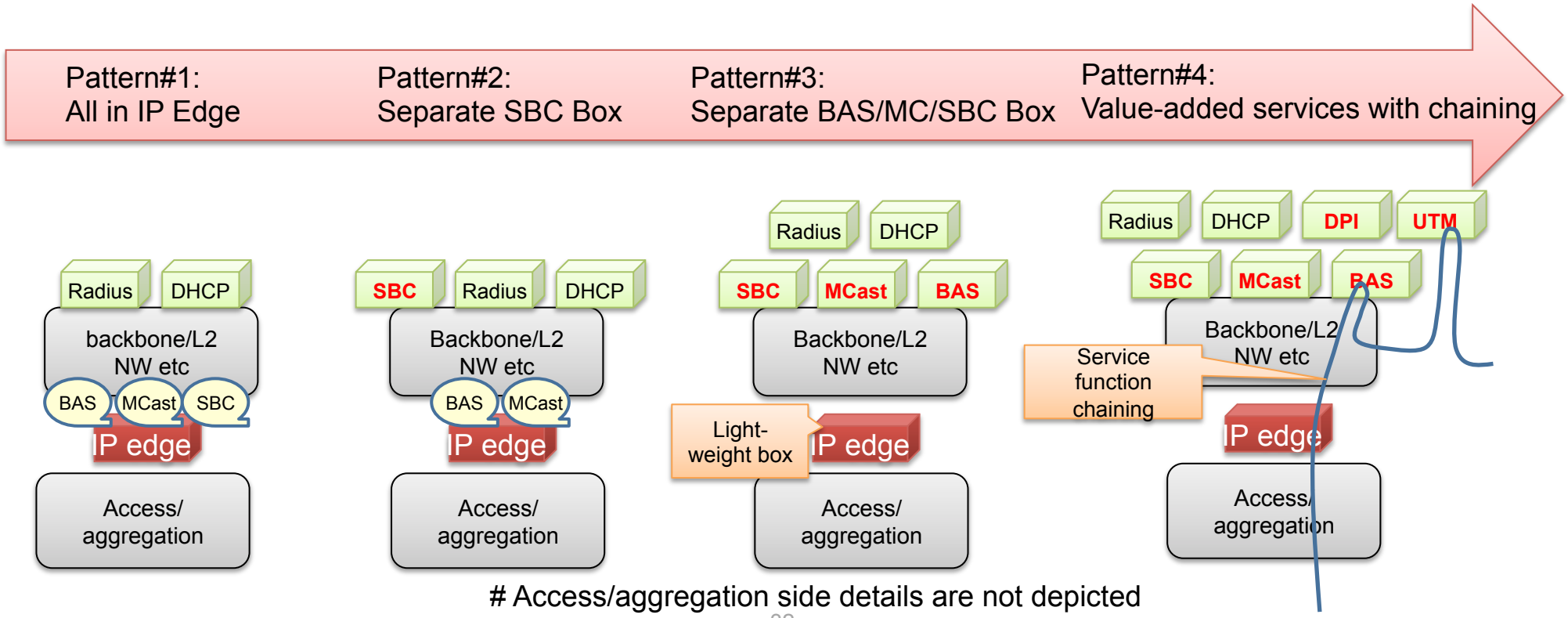
Conclusion

- Network programmability would be a key component to realize the edge cloud platform.
- We confirmed that P4 has a strong possibility to support our use cases through our lab test.
- To make these use case more feasible, it would be important how we can integrate data-plane function with control plane.
- For the next step, we are going to consider how we can adopt P4 and Stratum to our network.

Backup slide

Assumed Steps for BNG disaggregation

- There are some hurdles to overcome to fully disaggregate BNG.
  - Feasible architecture, VNF performance, interoperability
  - Guarantee service level, implementation quality of each hardware and software etc



Access/aggregation side details are not depicted

Lab Testing Timeline (under planning)

- **Evaluate P4 Use cases for BNG**
  - ✓ Plan to demonstrate NTT R&D Forum in Nov. 2018
- **Apply P4/stratum for BNG**
  - ✓ In addition to 1st STEP challenges, integrate ONOS/Stratum in Jan. 2019