Massively parallel and fault tolerant photonic networks towards beyond 5G era

HERO-NET

Keio University

Yamanaka Lab.

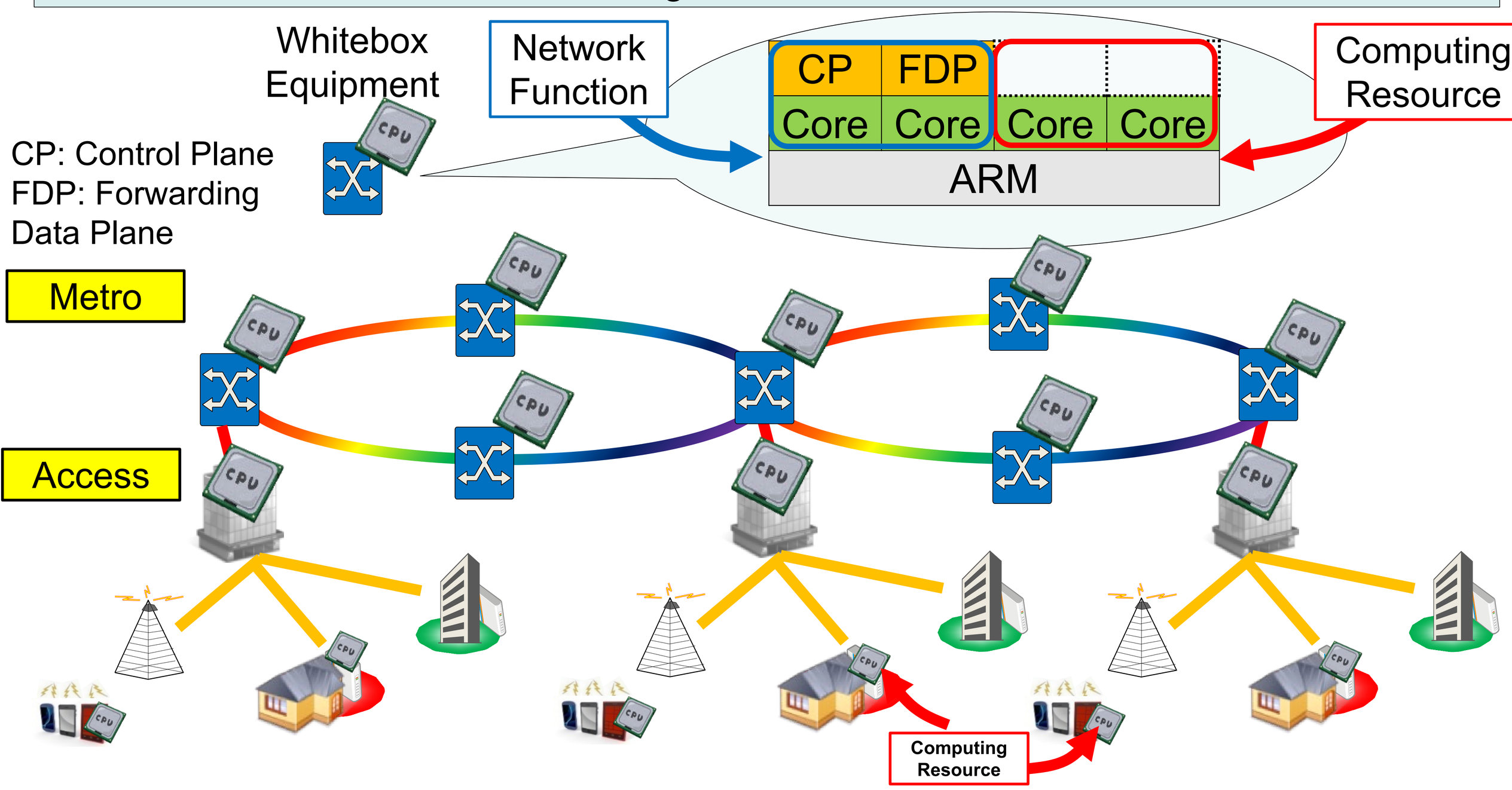
Yamanaka Laboratory, Keio University, Japan

Targets toward massively parallel and fault tolerant photonic networks

1. Efficient use of distributed computing resources in access/metro networks and flexible/dynamic prosessing allocation for viartual edge computing
2. Routing methods using failure rate estimation of the network
3. Paralle transmission over multi-route for over Tbit/s MAC signals

AMec: Access-Metro edge computing

AMec uses the processing modules of network devices, (IoT devices, and unused users devices) as resources for edge computing. It enables expansion of resource and flexible resource assignment.



Implementation of AMec testbed

AMec requires the management of resources through Pub/Sub communication and the coordinated processing of groups of resources. AMec testbed is implemented using ROS（Robot Operation System）, a middleware with providing these features.

Contact information

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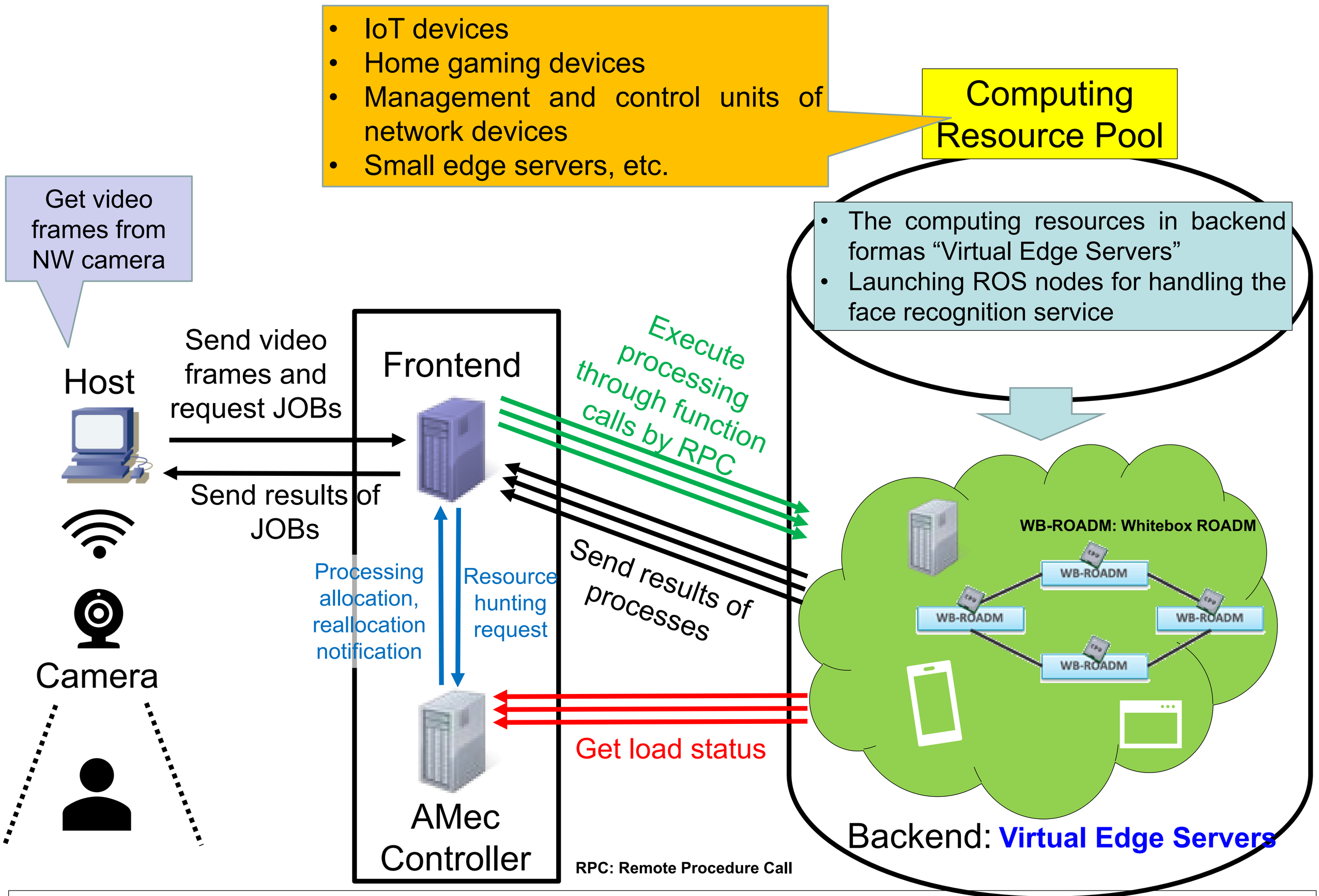
Service provided by the AMec testbed

The demo provides the face recognition service on the AMec testbed.

The face recognition service includes the following processes. They are assigned to many computing resources (i.e. ROS nodes).

1. Obtain video frames from the camera.
2. Grayscale transformation of the video frames as preprocessing.
3. Cut the face image from the grayed video frame.
4. Matching face images cut out from video frames with cascade files. The cascade file identifies individuals by their facial features.

Demo configuration in the iPOP 2021



This work is partly supported by the R&D of innovative optical network technologies for supporting new social infrastructure project (JMPI00316) funded by the Ministry of Internal Affairs and Communications Japan.

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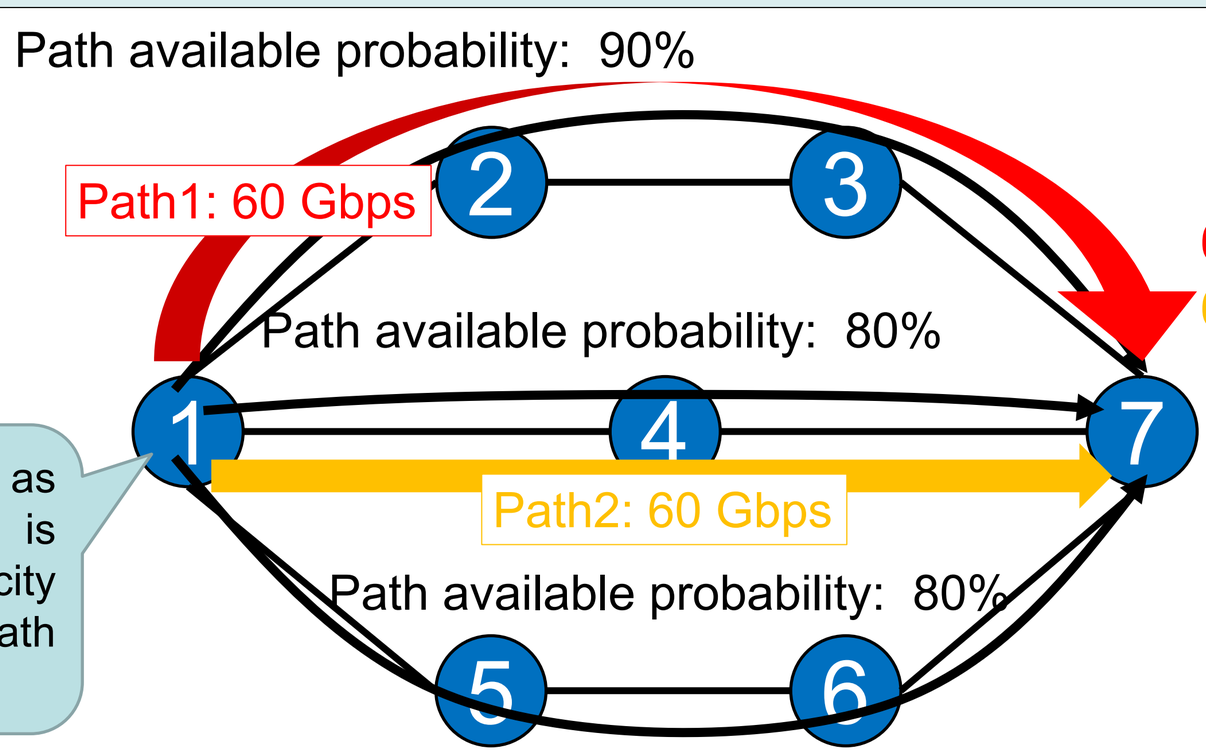
Expected capacity guaranteed routing (ECGR)

We have proposed expected capacity guaranteed routing (ECGR) for providing reliable services under high network failure environment. ECGR is a multi-path-based routing method based on failure prediction of equipment and links.

Request:
Node1→Node7
Capacity: 100 Gbps

Candidate paths
Selected path #1
Selected path #2

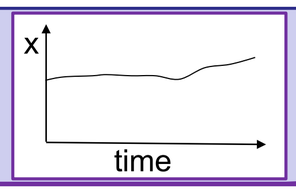
Required capacity is guaranteed as “expected capacity” which is obtained by multiplying the capacity to be set for the path by the path available probability.



ECGR on the fluctuating failure rate of network devices

Since the failure rate of equipment varies depending on the operating environment, it is necessary to estimate the failure rate of each device. If the failure rate is estimated to be higher than the planned failure rate, the transport paths can be changed as necessary.

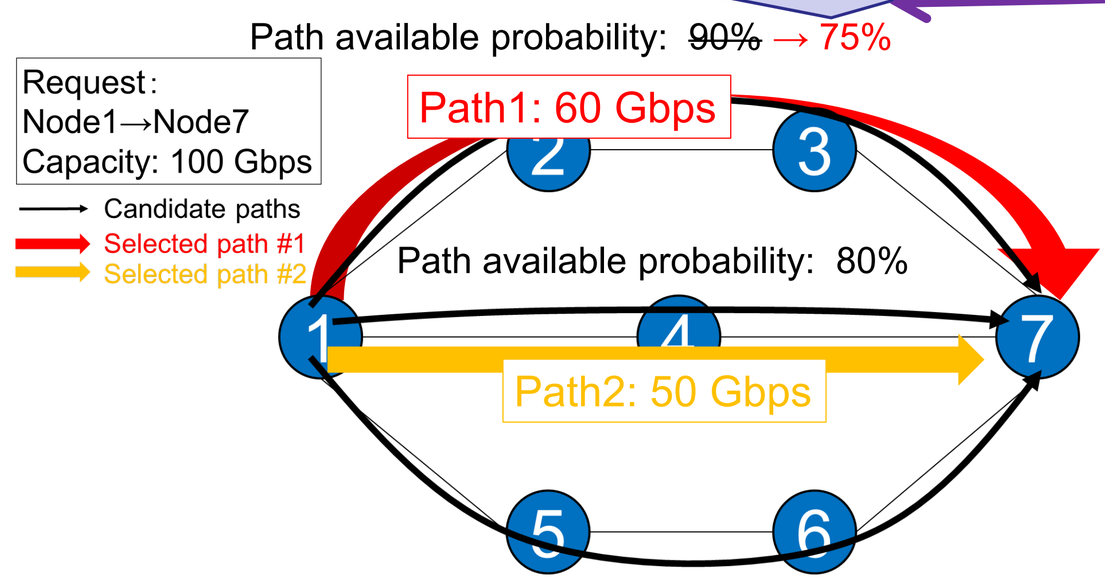
As an example of a network device, we are currently investigating the relationship between observation information and failures in EDFA.



Observation information of network device

Calculate failure rate

Update the probability of path availability



update

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MAPLE
Massively Parallel and Sliced Optical Network

Keio University
1858
CALAMVS GLADIO FORTIOR

Yamanaka Lab.

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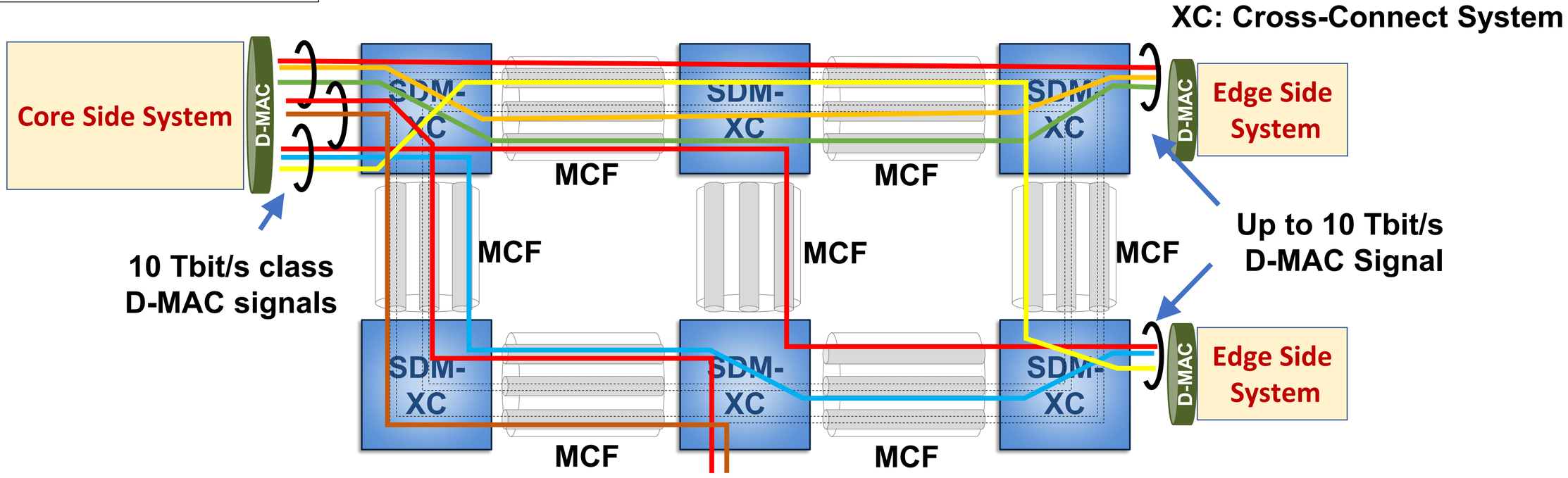
Dynamic-MAC

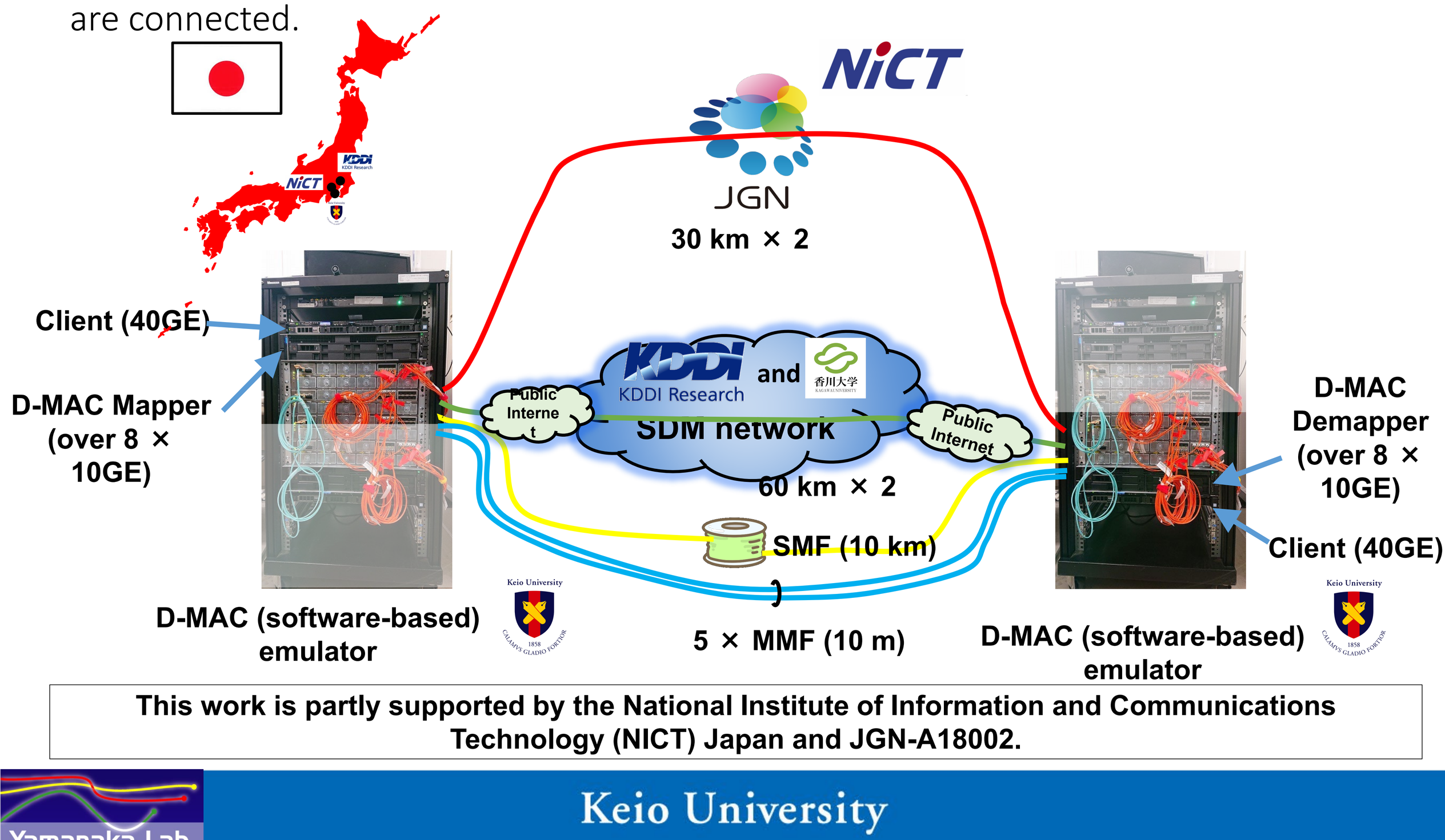
We have proposed the Dynamic-MAC as one of the methods for accommodating high-capacity services. Dynamic-MAC is a concept which will provide 100 Gbit/s class to 10 Tbit/s class variable capacity MAC with parallel transmission link over spatial division multiplexing (SDM) networks.

Dynamic-MAC application



Dynamic-MAC testbed with JGN

Keio Univ. (Kanagawa, Japan), NICT (Tokyo, Japan), and KDDI Research (Saitama, Japan) are connected.



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