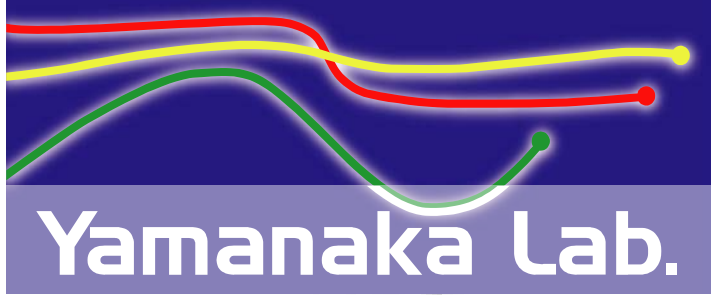


SDN/NFV Based Disaster Recovery Method in Elastic Lambda Aggregation Network

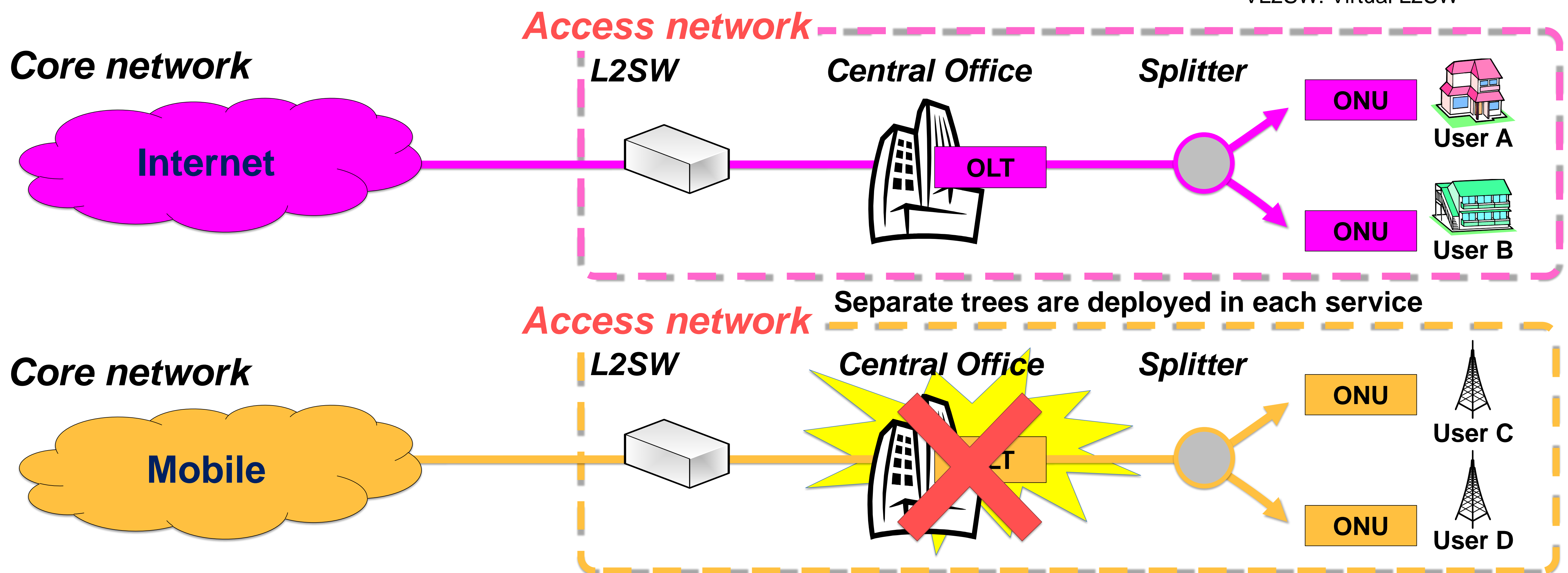
~Outline~

Keio University



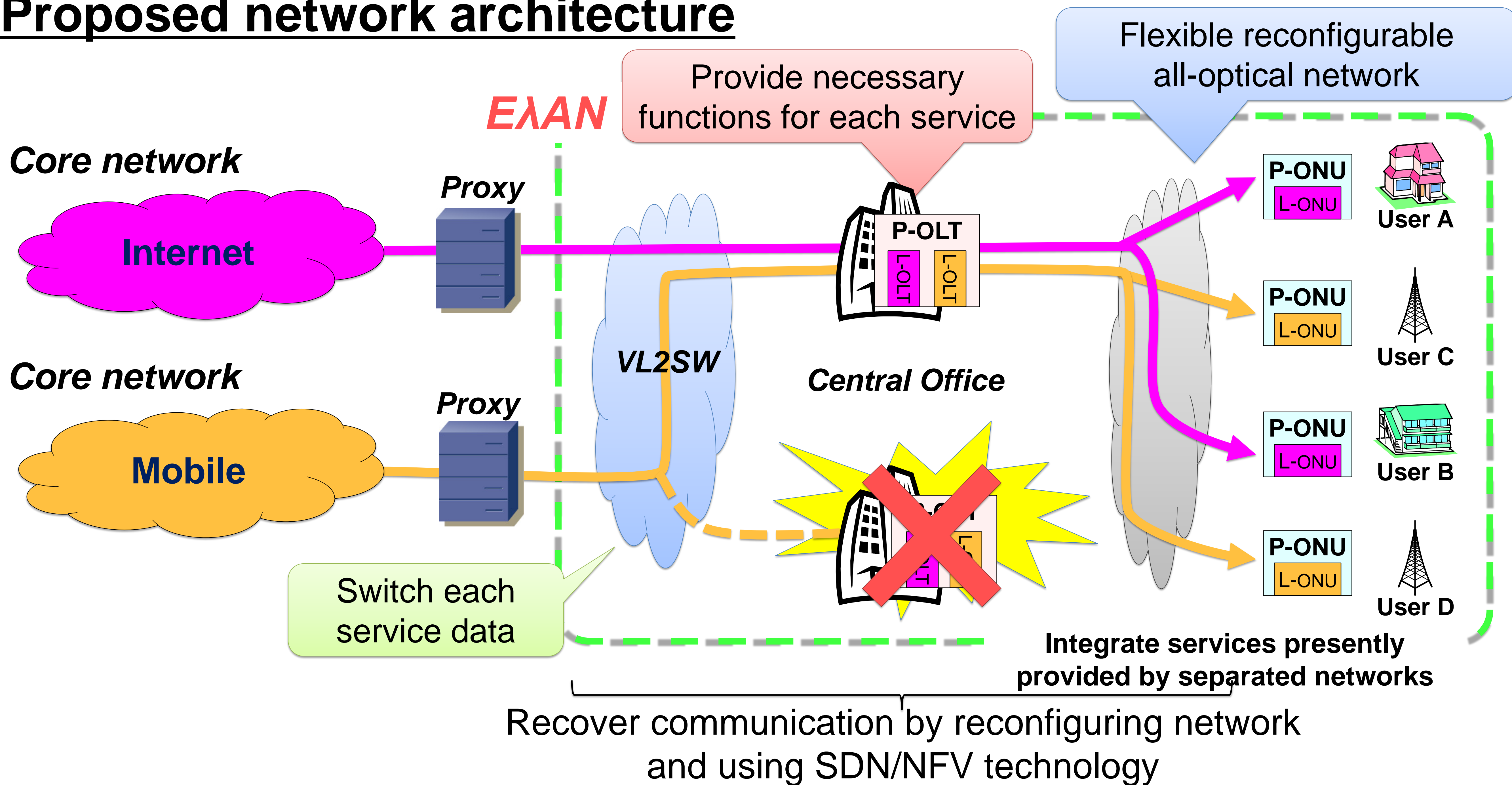
OLT: Optical Line Terminal
ONU: Optical Network Unit
L2SW: Layer 2 SWitch
L-OLT: Logical OLT
L-ONU: Logical ONU
P-OLT: Programmable OLT
P-ONU: Programmable ONU
VL2SW: Virtual L2SW

Today's network architecture



Difficult to provide service in disaster

Proposed network architecture

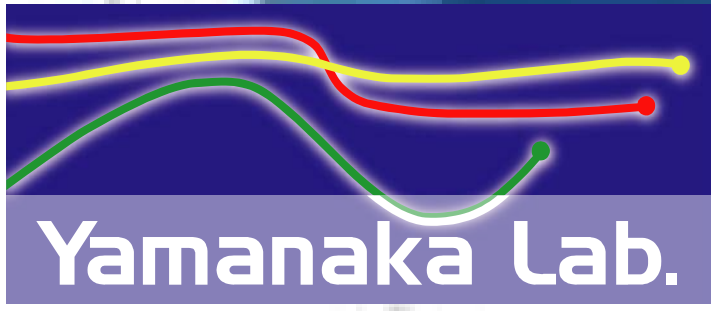


**Accommodate many subscribers
and maintain service providing in disaster**

This work is supported by “R&D for Elastic Lambda Aggregation Network”, contract research of National Institute of Information and Communications Technology (NICT) of Japan.

SDN/NFV Based Disaster Recovery Method in Elastic Lambda Aggregation Network

~ Demonstration ~



OLT: Optical Line Terminal
ONU: Optical Network Unit
L2SW: Layer 2 Switch
L-OLT: Logical OLT
L-ONU: Logical ONU
CO: Central Office

Improvement of disaster tolerance

- Reconfigure network with available devices
- Ensure connectivity to many subscribers

L-OLT generation

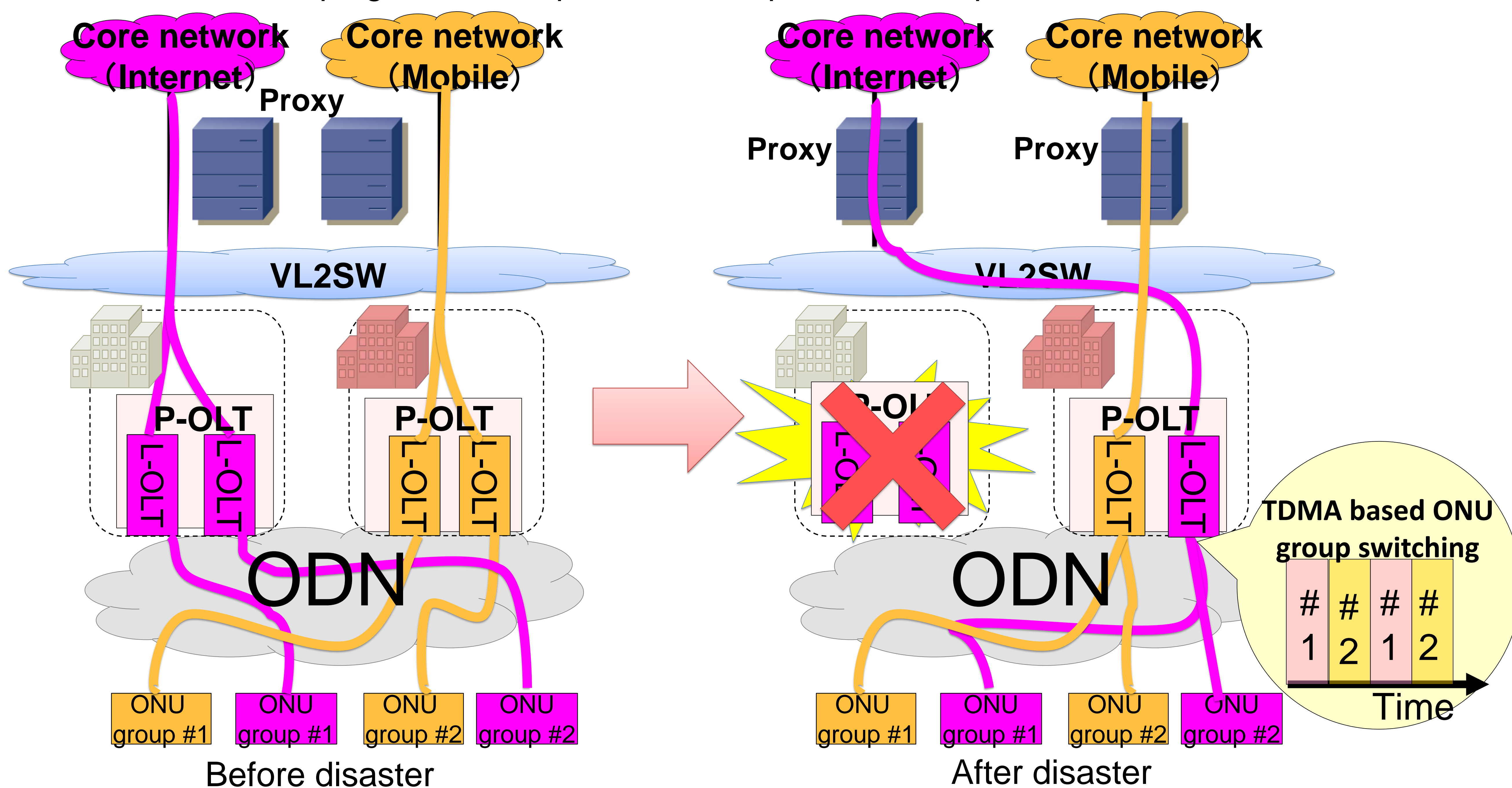
- Generate L-OLT in another CO when functions in the CO are stopped
- Provide services from accommodating CO by reconfiguring ODN and VL2SW

TDMA-based ONU group switching

- Single ONU group consists of smaller than 256 L-ONUs
- Recover more than 256L-ONUs

Stabilize communication by Proxy

- Buffer data in order to prevent the packet loss
- Use traffic shaping in order to prevent voice packet interruption



Virtual Layer 2 SWitch (VL2SW)

- Switch each service data to appropriate P-OLT

Programmable OLT (P-OLT)

- Generate L-OLT which provides necessary functions to each service

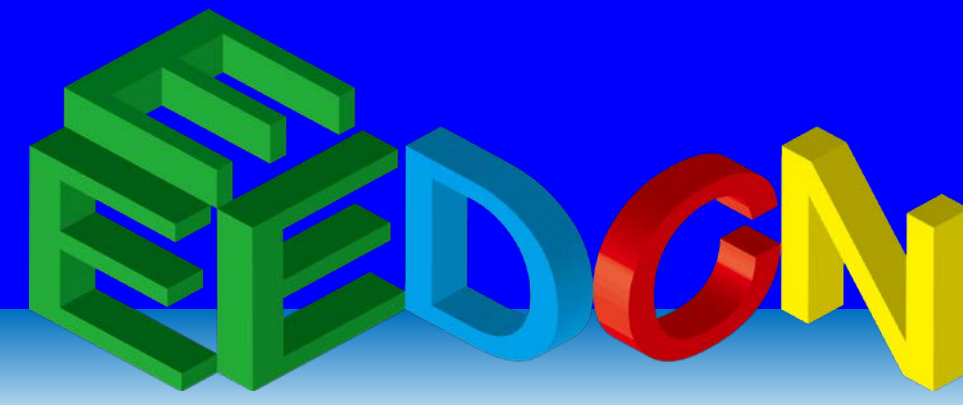
Optical Distribution Network (ODN)

- Configure optical paths/trees which have flexible bandwidth for each service

Programmable ONU (P-ONU)

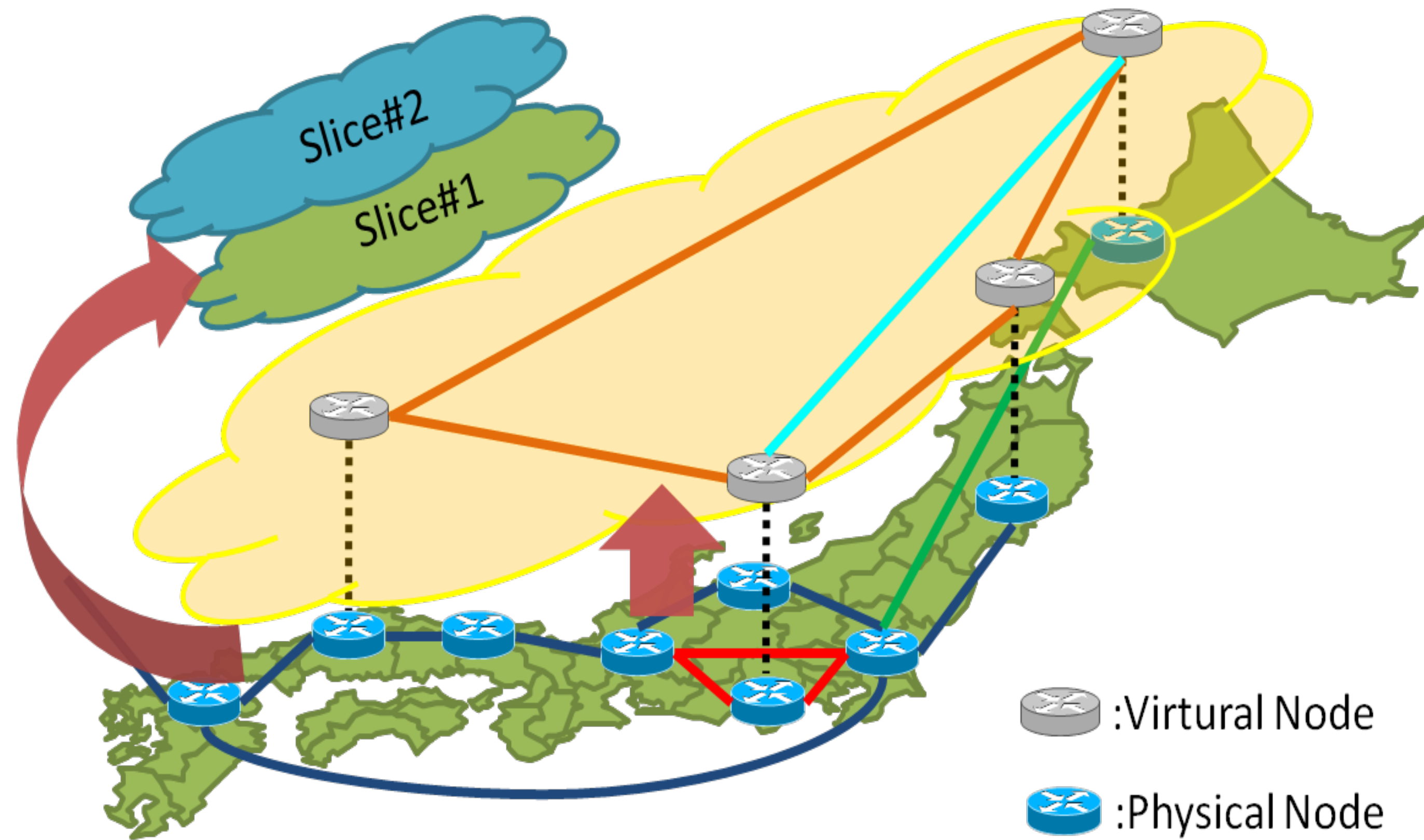
- Generate L-ONU which provides necessary functions to each service

Traffic Engineering on Virtual Network by Network API



Virtual Network on NWGN (NeW Generation Network)

NWGN is the project to solve drastically many problems of Internet.



- In NWGN, V_NW MGs will be able to have original virtual network called "Slice"
- QoS, independence, bandwidth, etc. are guaranteed on slice.

*1V_NW MG: Virtual Network Manager

If V_NW MGs obtain some of the information of physical network, they can provide more useful service.

We propose the New Generation Network API*1 for a new service on a slice.

*2API:Application Programming Interface

Demonstration of Energy-aware routing

<V_NW MG*2>

- provide the original services.
 - Energy-aware routing
 - Minimum-delay Routing
- Calculate the metric of virtual links.

<Network API>

- Interface between virtual and physical network.
- Using API, V_NW MG can get some of the information of physical network

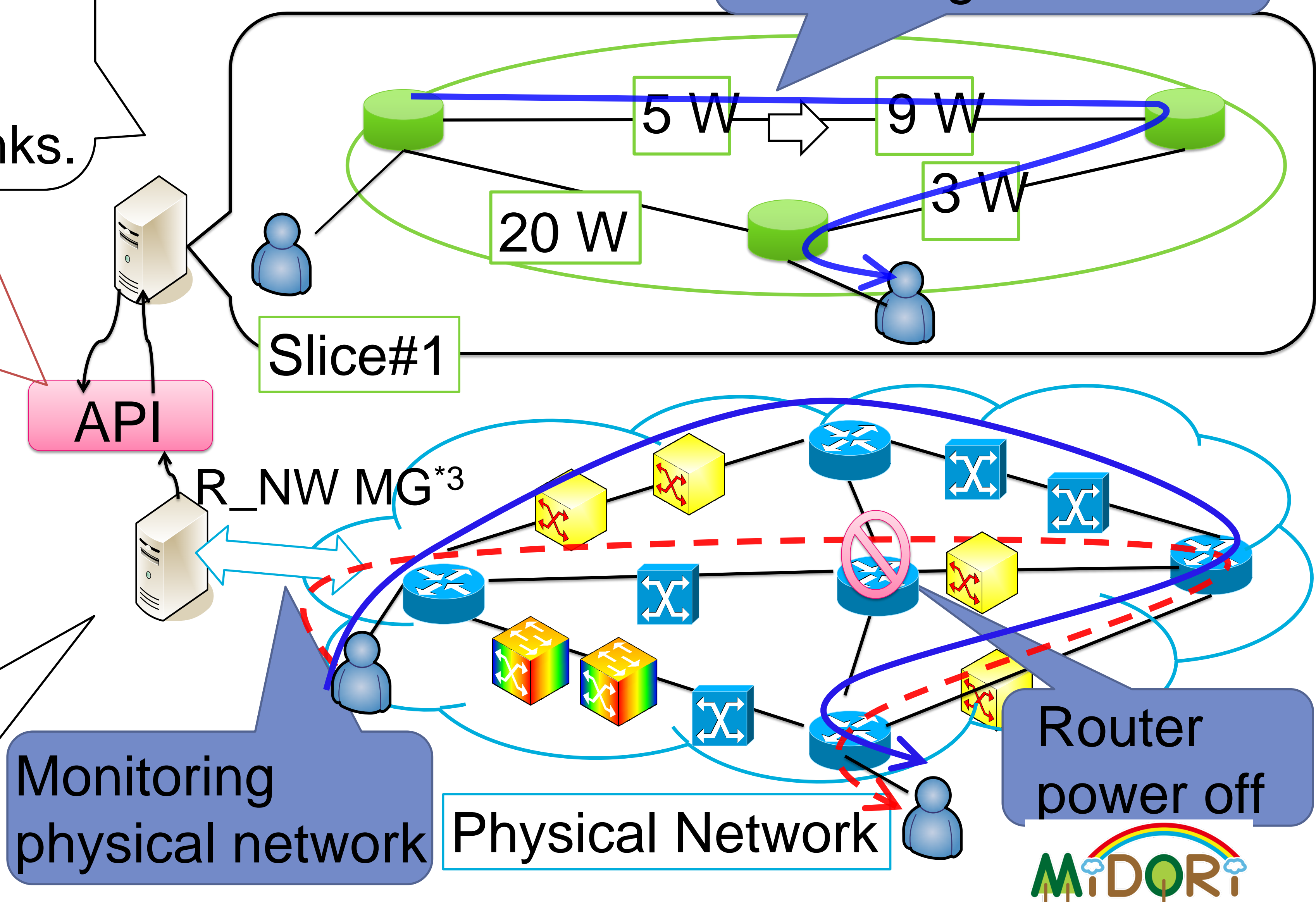
*3P_NW MG:

Physical Network Manager

Change the metric according to R_NW

<R_NW MG*3>

- Monitor the physical Network.
- change the topology to optimize energy consumption.



V_NW MG can provide Energy aware routing considering Real Network.

This work is partly supported by "Energy Efficient and Enhanced-type Date-centric Network" Project funded by National Institute of Information and Communication Technology (NICT).