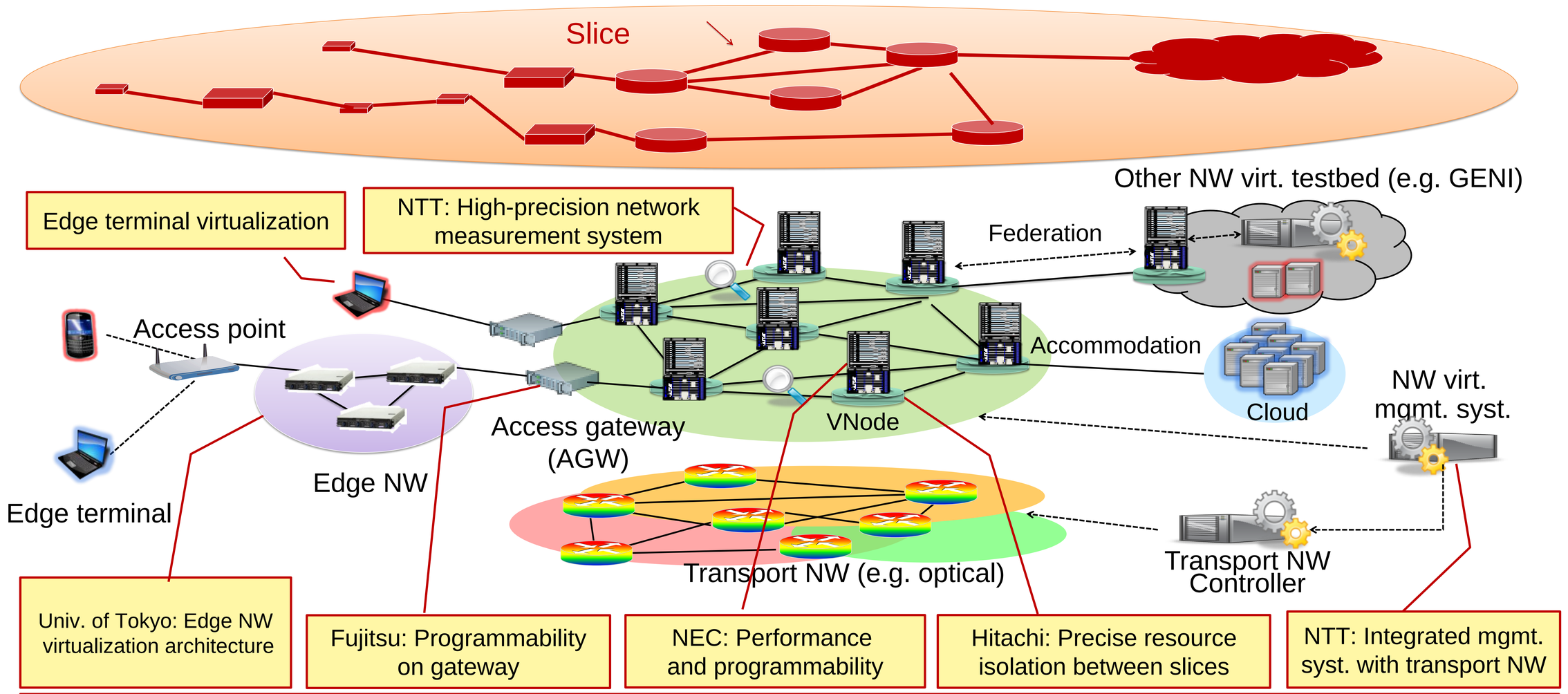
# VNode: Deeply Programmable Network Testbed

【Goals】 Deployment of advanced network virtualization infrastructure, which requires (a) “abstraction” of resources, (b) “isolation” of resources, (c) “elasticity” of resources, (d) “programmability”, (e) “authenticated, authorized and account (AAA)”

## Architecture

- Features
  - –Programmable virtual network by VNode. Virtual network has virtualized transporting and computing resources.
  - –Constructing virtual network from edge network to core network, cooperating with transport network
- Advantage
  - –Offering private networks that have various performance, security, protocol, etc.
  - –Offering economical network by constructing virtual networks on one physical network




Univ. of Tokyo: Overall deeply programmable network architecture

## Enhancing Network Applications on VNode and GENI

・Effective application use cases using programmable network such as VNode and GENI

・Showing how to improve the service quality of experience with in-network and edge area computing resources

## Demos:

・Enhanced video application via a federation slice between VNode and GENI

・User-aware data deployment using AGW-VNode

・Communicating by using a non-IP protocol on VNode

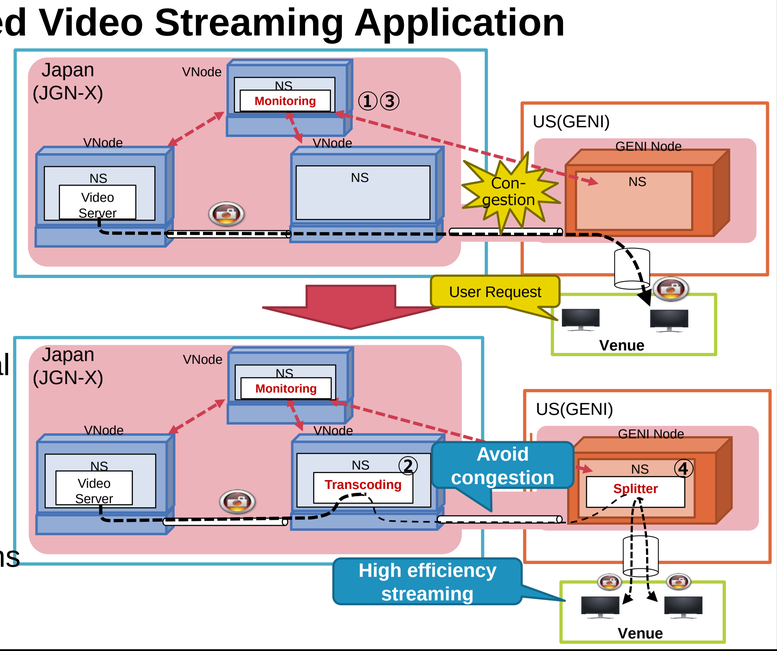
### Enhanced Video Streaming Application

**Demo Scenario**

Traffic Congestion
①Detect congestion
②Put transcoder and decrease traffic volume
Join New User
③Detect user request
④Put splitter and multi-casting without additional core network traffic

**Merit**

Realize low cost and high performance service by deploying software functions on programmable network




*Application Utilizing AGW-VNode*

## Users’ location aware data deployment beforehand for better QoE

### ■Target of this technology

- ■Avoiding performance degradation because of the large latency and instability of WAN.
- ■Utilizing the programmability near users provided by AGW-VNode

### ■Details of this demonstration

***(A) With user-aware data deployment***

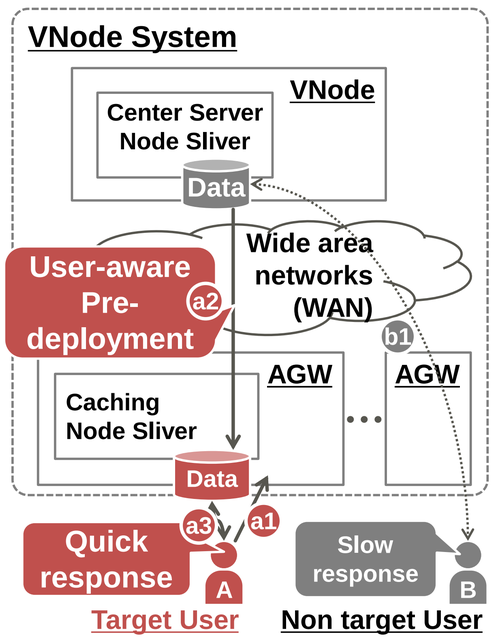
(a1) Users’ locations are detected

(a2) Data is deployed in advance near users

(a3) Users get quick responses

***(B) Without user-aware data deployment***

(b1) Data is located far from users and users get only slow response




## IPON: Switching by IP Addresses

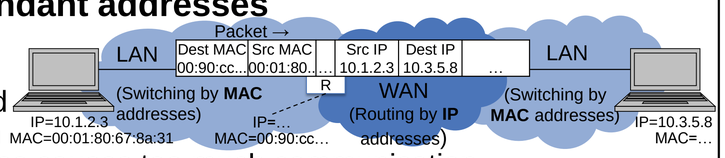
### 1. Problems to be solved

**Address redundancy in IP/Ethernet networks**

- Each node has an IP and a MAC addresses – both can be software-defined.
- Each packet contains four addresses: source&destination MAC&IP addresses.

**Problems caused by redundant addresses**

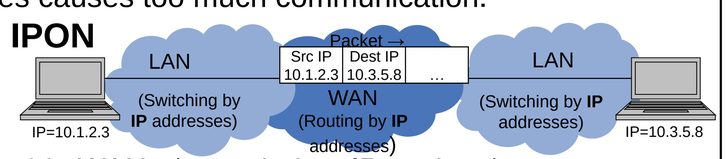
- Packet sizes become larger.
- Correspondence of MAC and IP addresses must be managed by using the address resolution protocol (ARP) – ARP sometimes causes too much communication.




### 2. A simple solution using IPON

**Method**

- The header format of IPON (IP/null) is the same as IPv4.
- IPON packets are routed by IPv4 in WANs (regarded as IP packets).
- IPON packets are switched by IP addresses in LANs.




**Solution**

Packet sizes become smaller, and ARP is not required – no overhead.

**This research has been executed under the Commissioned Research of National Institute of Information and Communications Technology (NICT).**