東京大学
THE UNIVERSITY OF TOKYO

Introduction of 5G!Pagoda Project

2016/10/6
Yoshiaki Kiriha
The University of Tokyo

5G! PAGODA

Agenda

- 5G Activity in Japan (5GMF)
- 5G! Pagoda Overview
- Technical Contributions from Japan
- 5G! Pagoda Roadmaps

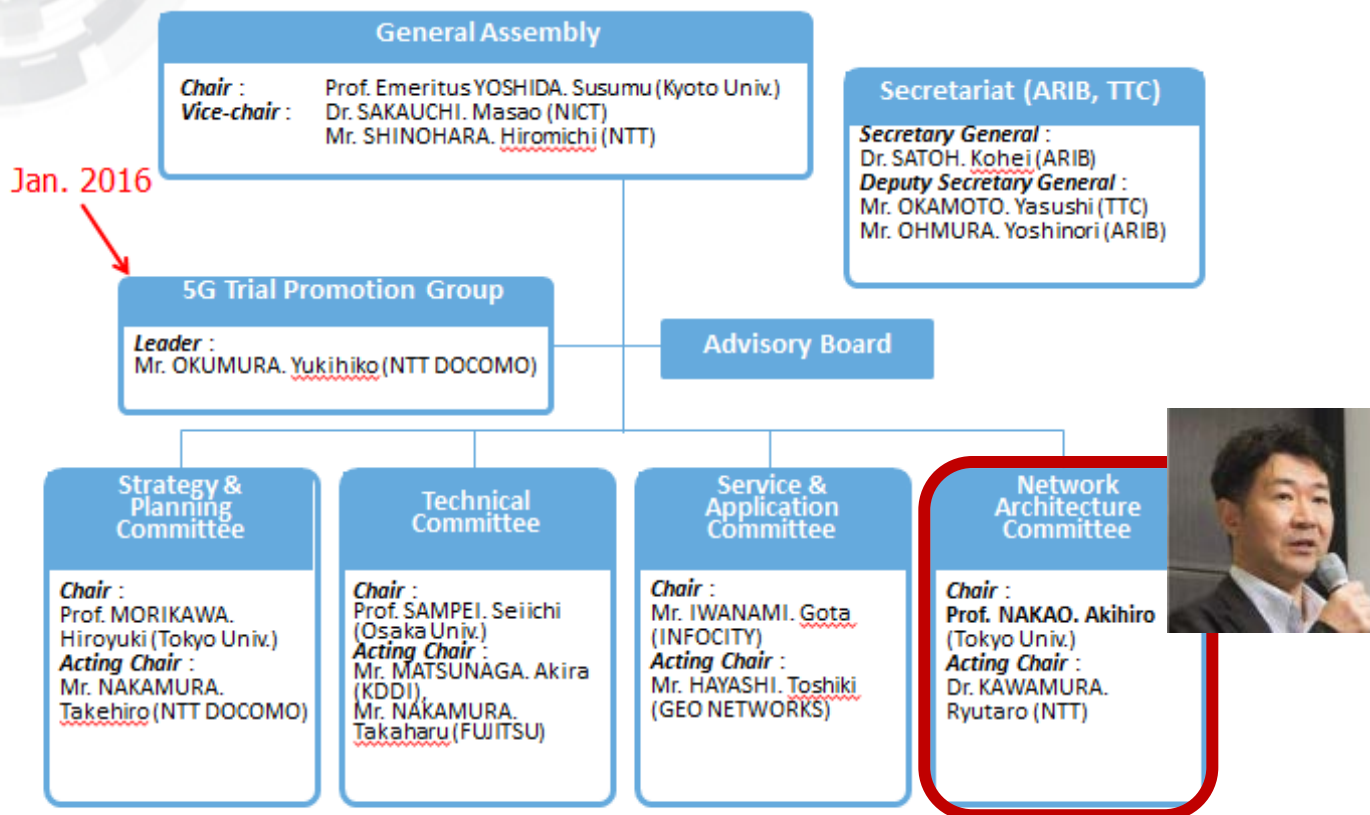# *5G Activity in Japan*

◆ 5GMF White Paper(219pages) have been published on 2016/May!

Download from http://5gmf.jp/news/20160705160541/

Organizational Structure of 5GMF

General Assembly

Chair :   Prof. Emeritus YOSHIDA. Susumu (Kyoto Univ.)
Vice-chair :   Dr. SAKAUCHI. Masao (NICT)
               Mr. SHINOHARA. Hiromichi (NTT)

Secretariat (ARIB, TTC)

Secretary General :
Dr. SATOH. Kohei (ARIB)
Deputy Secretary General :
Mr. OKAMOTO. Yasushi (TTC)
Mr. OHMURA. Yoshinori (ARIB)

Jan. 2016

5G Trial Promotion Group

Leader :
Mr. OKUMURA. Yukihiko (NTT DOCOMO)

Advisory Board

Strategy & Planning Committee

Chair :
Prof. MORIKAWA. Hiroyuki (Tokyo Univ.)
Acting Chair :
Mr. NAKAMURA. Takehiro (NTT DOCOMO)

Technical Committee

Chair :
Prof. SAMPEI. Seiichi (Osaka Univ.)
Acting Chair :
Mr. MATSUNAGA. Akira (KDDI)
Mr. NAKAMURA. Takaharu (FUJITSU)

Service & Application Committee

Chair :
Mr. IWANAMI. Gota (INFOCITY)
Acting Chair :
Mr. HAYASHI. Toshiki (GEO NETWORKS)

Network Architecture Committee

Chair :
Prof. NAKAO. Akihiro (Tokyo Univ.)
Acting Chair :
Dr. KAWAMURA. Ryutaro (NTT)

..cont.

◆ As of Sept. 2016, 105 members are participated

Members:93 (as of 12 May 2016)   Ordinary members:74, Individual members:14,
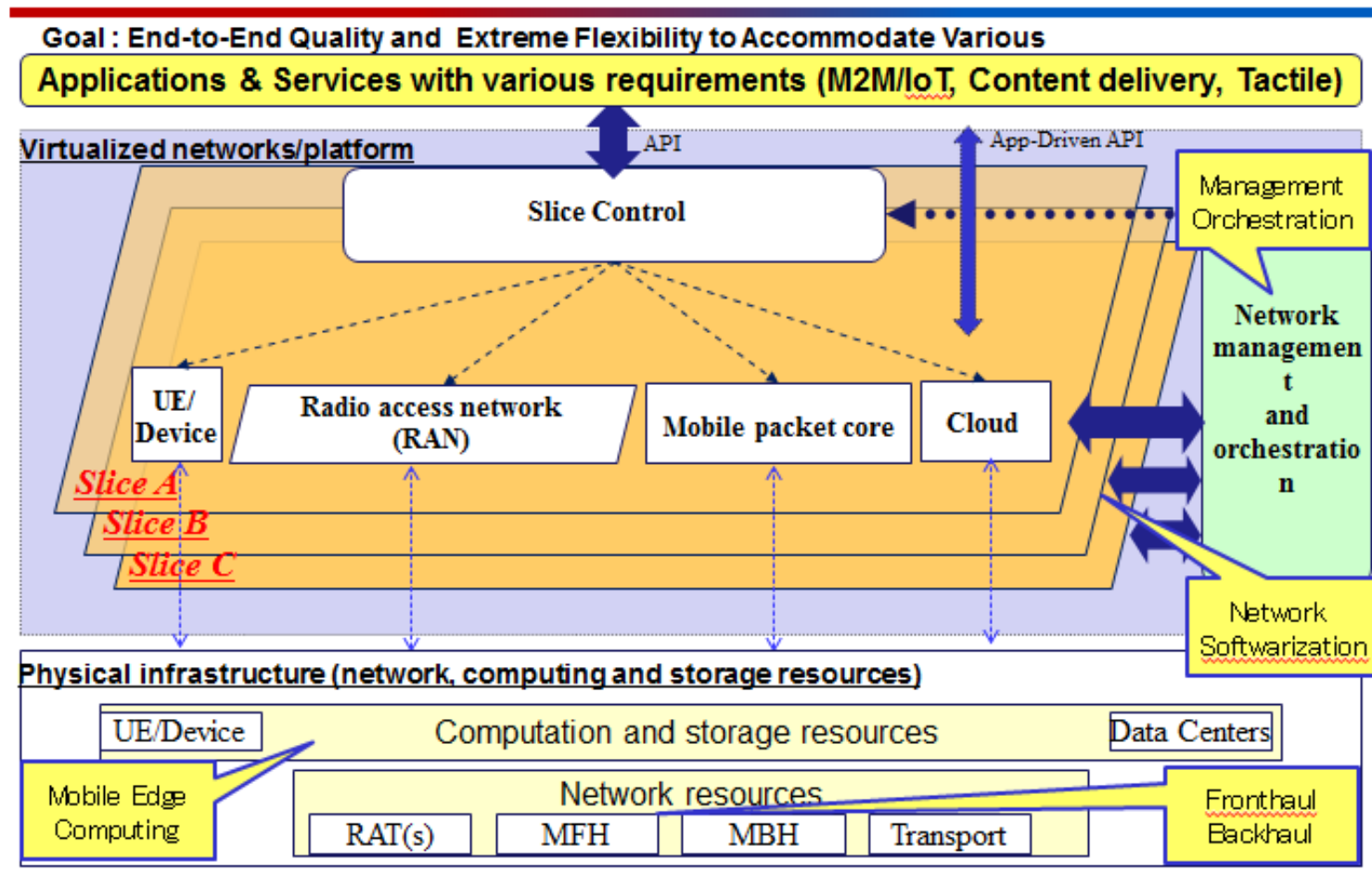Special members: 3 (MIC, ARIB, TTC)

5G Network Softwarization

◆ **Network Softwarization is a key enabler for 5G/IoT services**

This architecture has contributed to ITU-T FG IMT2020 discussion

EU-Japan Collaboration Project Proposal

5G!Pagoda
"A network slice for every service"

5G! PAGODA

Federating Japanese and European 5G Testbeds to Explore Relevant Standards and Align Views on 5G Mobile Network Infrastructure Supporting Dynamic Creation and Management of Network Slices for Different Mobile Services.

サービスに応じたスライス動的生成・管理機能の実証と標準化を目的とする日欧連携5G移動通信基盤テストベッド

Call:	EUJ1-2016 - 5G - Next Generation Communication Networks
Coordinators:	Tarik Taleb and Akihiro Nakao
E-mails:	tarik.taleb@aalto.fi and nakao@nakao-lab.org
Phone:	+358-50-435-2325 and +81-3-5841-2384

R&D Partners

5G!Pagoda Project Scope

◆ Softwarized Network Realization w/ NFV, SDN and 5G
◆ Research-Innovation (experimentation)-Standardization
◆ The Top Objectives are

i) the development of a scalable 5G slicing architecture towards supporting specialized network slices composed on multi-vendor network functions, through the development of
ii) a scalable network slice management and orchestration framework for distributed, edge dominated network infrastructures, and convergent software functionality for
iii) lightweight control plane and
iv) data plane programmability and their integration, customization, composition and run-time management towards different markets.

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5G!Pagoda Basic Architecture

◆ **Customized Software Functions on EU/J Federated Testbed**

5G playground, FLARE Project, O3 project, etc.
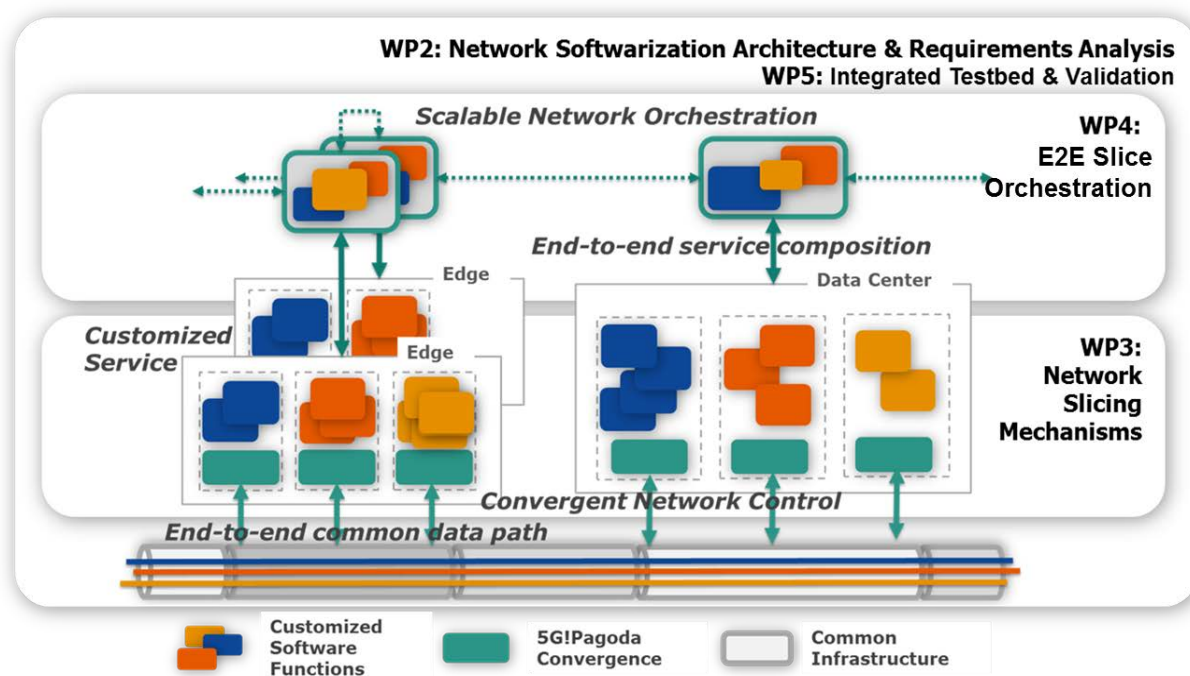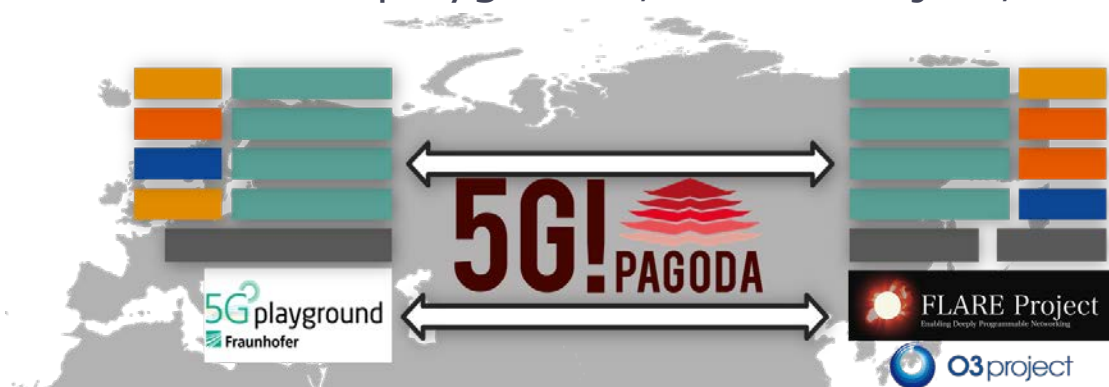
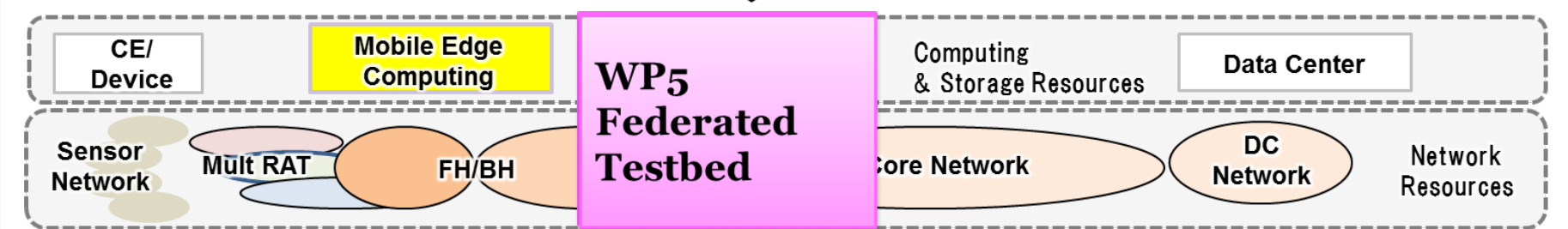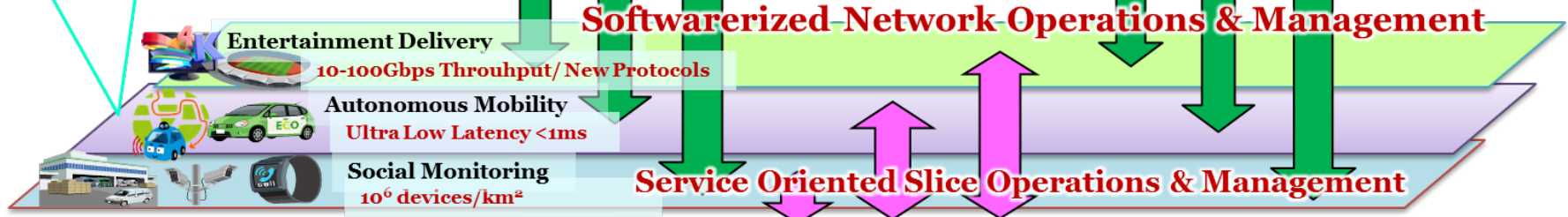# *Working Items and Goals*
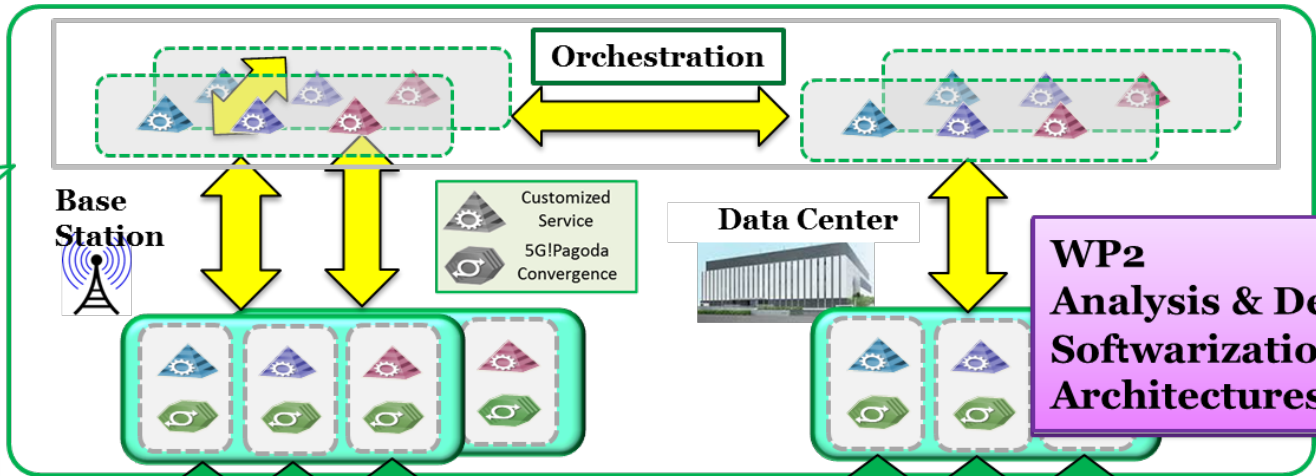
5G!Pagoda Organization

◆ Tight & Close Collaboration will be executed
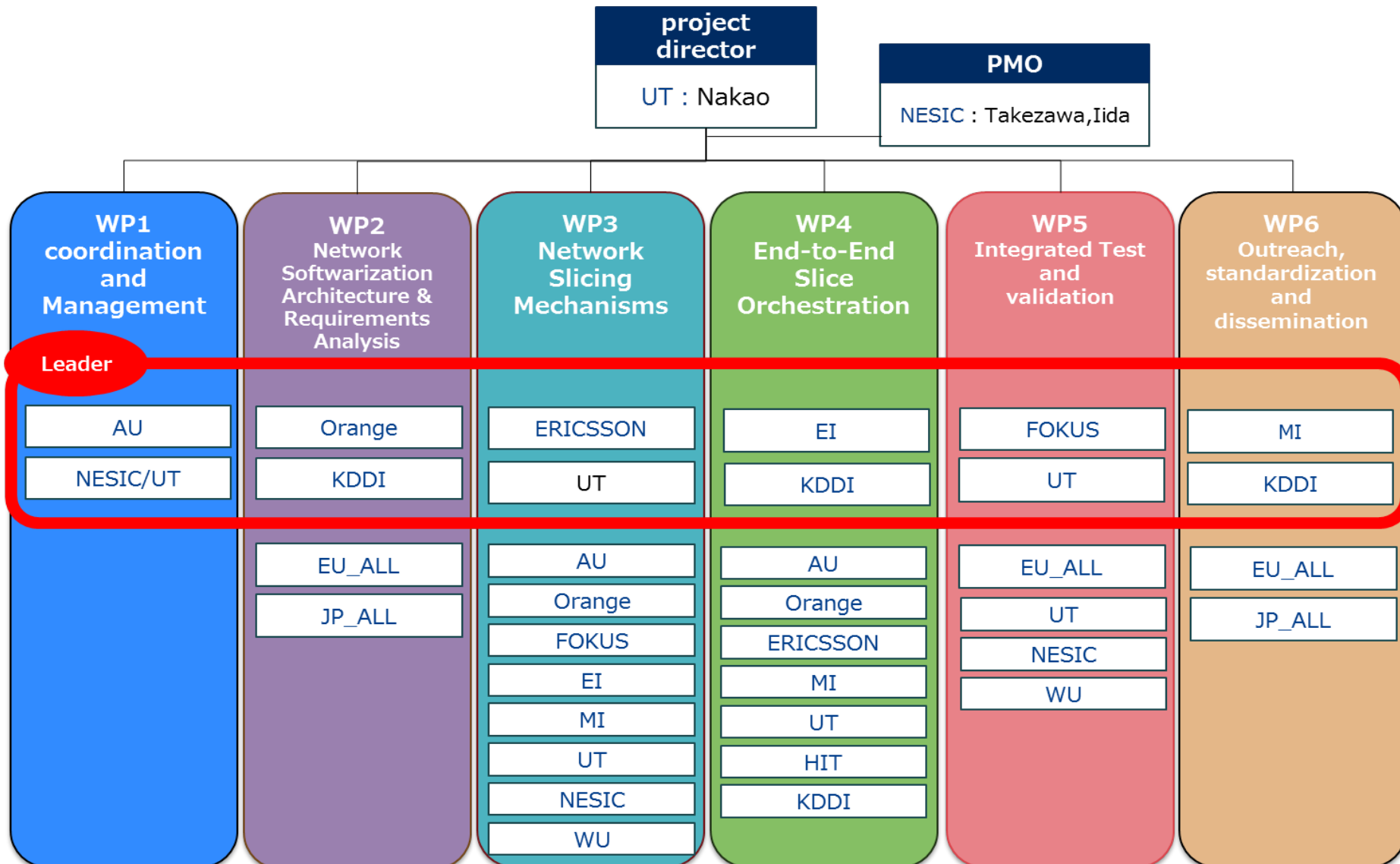
Contribution from U-Tokyo

◆ *Open Source based Network Softwarization Platform*

| Open Source |
| Optimization |
| **TILERA** SDK |

Network Functions Software Defined Data Plane

Toy-Block Networking GUI

Resource Management Center
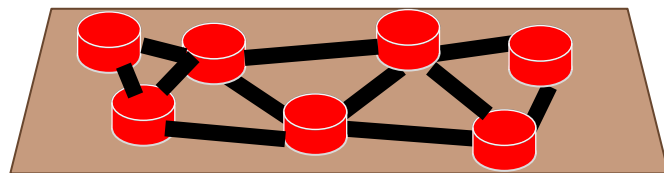
Slice (Logical NW View)
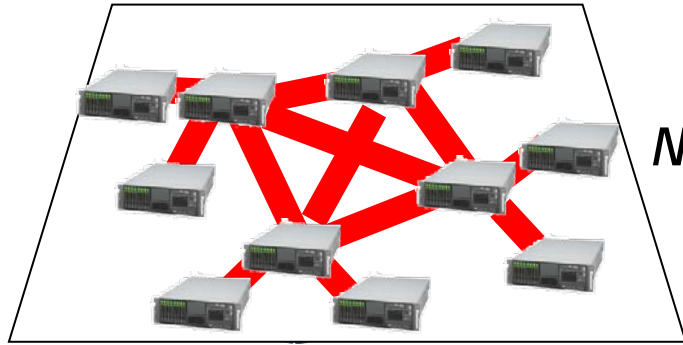
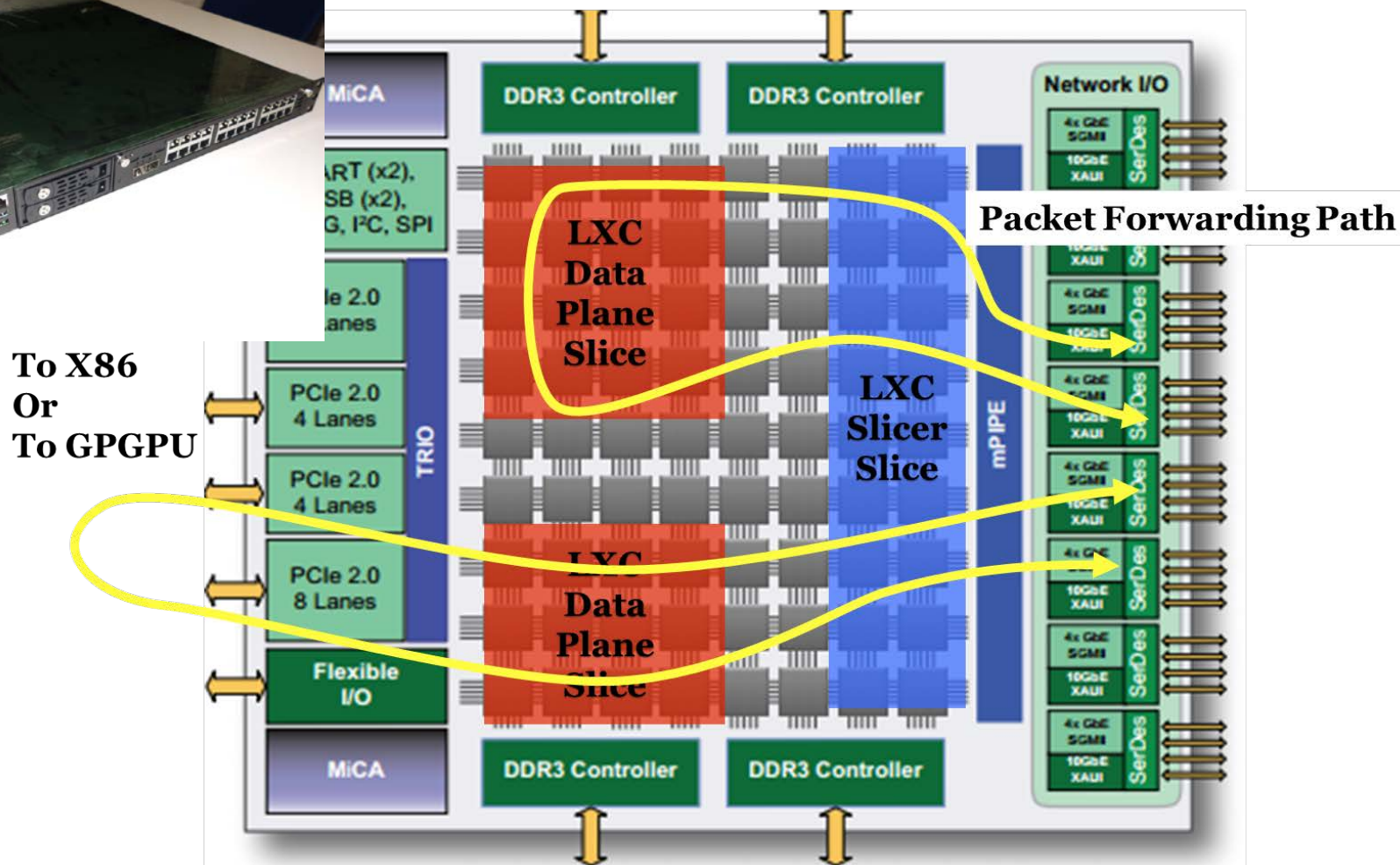*Network of FLARE nodes (Physical NW View)*

Contribution from U-Tokyo

◆ *FLARE Platform will be enhanced towards 5G Slicing*

Current Spec: 72 core EZ-Chip Network processor, GbE: 24 ports and 10GbE
SFP+: 2 ports, Up to 128GB memory / 1TB SSD, Redundant Power supply

LXC: Linux Container on Zero Overhead Linux (ZOL)

Contribution from KDDI Research

KDDI Research

◆ Developing a platform allowing Automatic Implementation of Comm. Systems from architecture.

- ✓ **Common features as software libraries: database, and control- and data-planes**
- ✓ **Common Orchestrator to control and mange multiple comm. systems**

Platform **automatically generates** and evaluates the state machine from the given architecture, and implement **the execution codes** without the fatal failure of the system

System designer provide architecture of comm. System to Platform

Platform automatically implementing comm. system

Softwarized mobile core

Architecture

HSS   PCRF
MME
eNB   SGW   PGW

MME   HSS   SGW   PGW   PCRF

Redundancy

Database layer

Control plane

Data plane

Status statistics

Admission Ctrl.

Comm. Sys. 1   Comm. Sys. 2   Comm. Sys. 3

Database layer

MME_1 SGW_1 PGW_1 MME_2 SGW_2 PGW_2 MME_3 SGW_3 PGW_3

Orchestrator: service oriented service infra.

Common orchestrator rapidly sensing state change by distributed OSS included
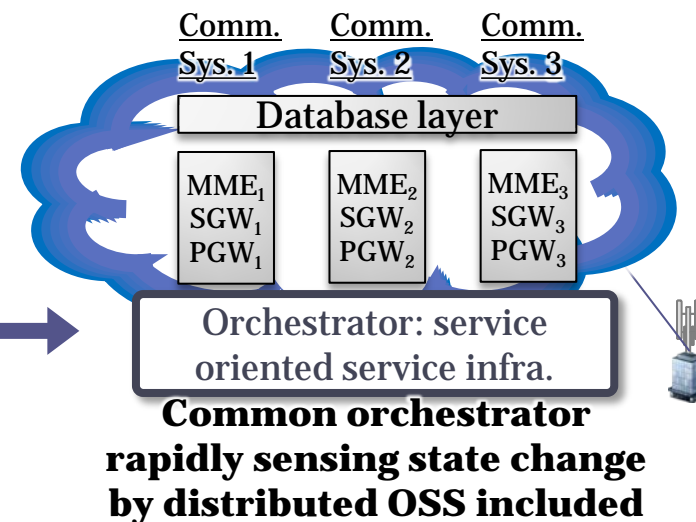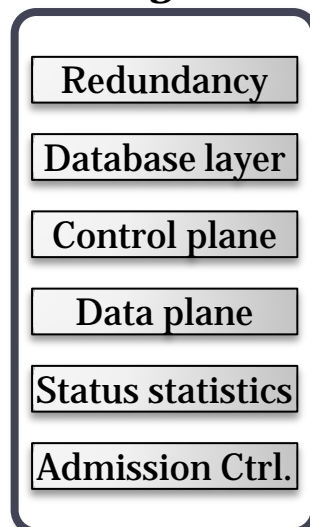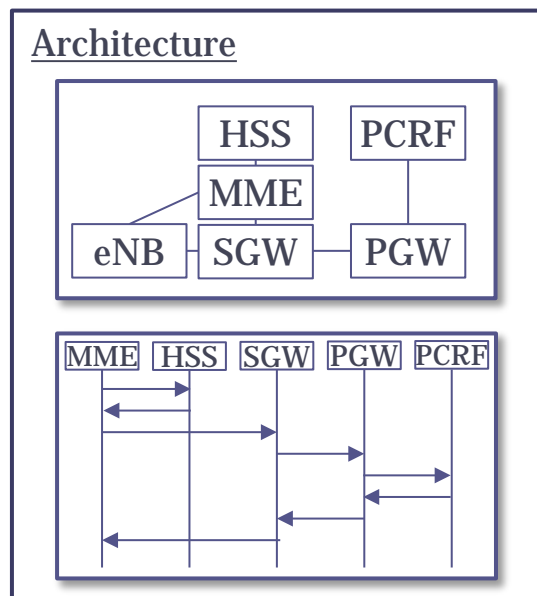
Contribution from Waseda University

◆ *ICN(an Emerging Network Architecture) slice*

   realization on 5GPagoda frame work

   ✓ **Smooth connection mechanism with RAN**

   ✓ **New protocol set for automatic FIB configuration**

   ✓ **Name structure, Node naming, Mobility**

◆ *Demonstration of an application service on ICN*

   ✓ **Candidate will be IoT related**

◆ *Standardization activities*

   ✓ **Mainly in ITU-T(FG IMT-2020 etc.)**

   ✓ **Already contributed one document to FG IMT-2020**

Contribution from NESIC

NEC
NEC Networks & System Integration Corporation

Performance

- Network Slicing R&D
- Slice Deployment in our MVNO

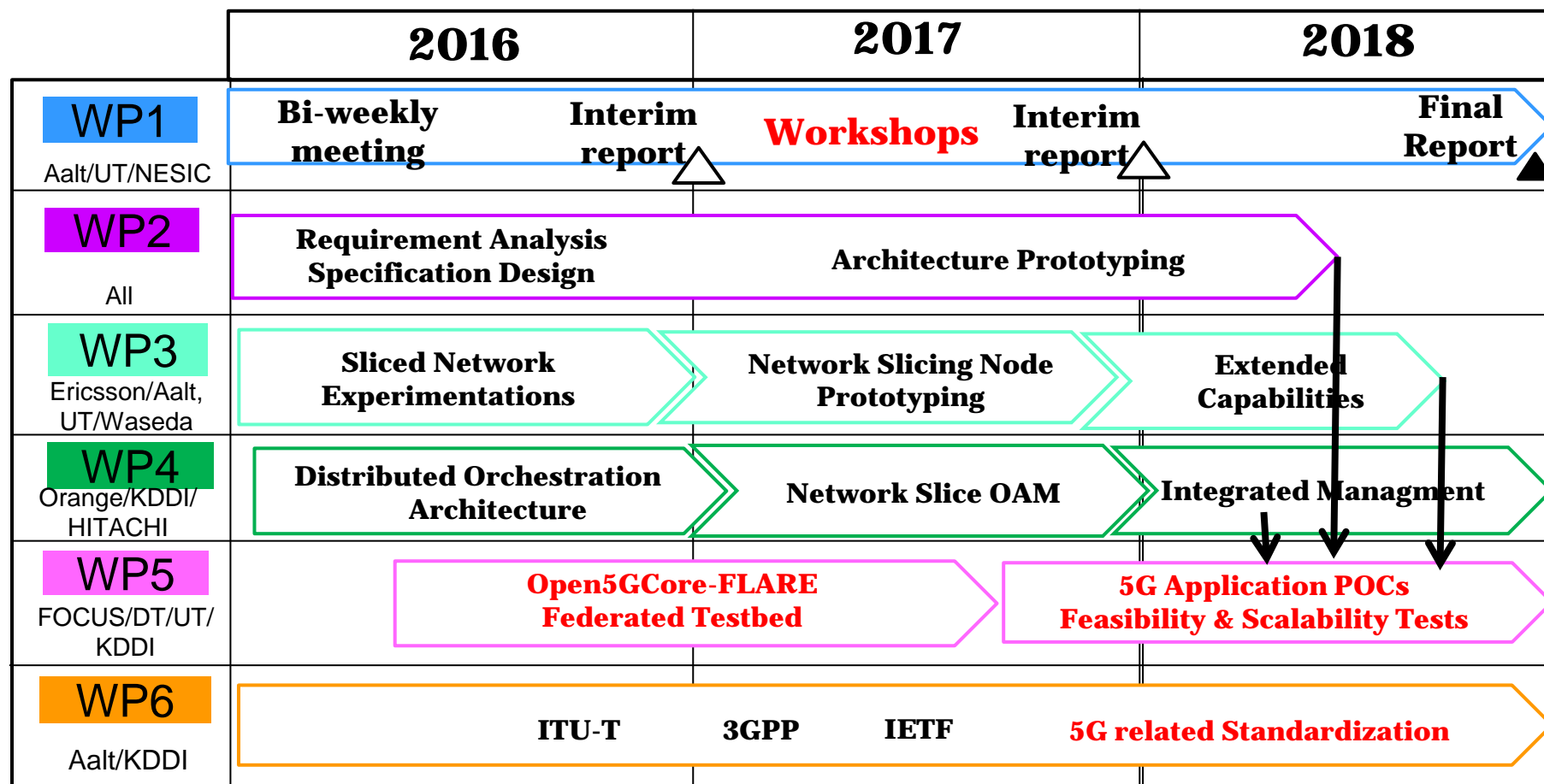- Lots of Experiences on carrier NFV & SDN PoC

Know-how

- **MVNO Operations & Management**
- **IoT service Experience**
- SI skills on reliable Carrier NW
- Collaborative FLARE R&D since 2014

① Contribute to a specification of network slice operations w/ edge computing functions, a prototype development, and field trials
② Verifies on "Time To Market" and "E2E Quality Satisfaction" capability

5G!Pagoda Roadmap

◆ First 5G!Pagoda paper has been submitted to IEEE Communications Magazine
   "PERMIT: Network Slicing for Personalized 5G Mobile Telecommunications"

	2016	2017	2018
WP1 Aalt/UT/NESIC	Bi-weekly meeting — Interim report △	**Workshops** — Interim report △	**Final Report** ▲
WP2 All	Requirement Analysis Specification Design	Architecture Prototyping	
WP3 Ericsson/Aalt, UT/Waseda	Sliced Network Experimentations	Network Slicing Node Prototyping	Extended Capabilities
WP4 Orange/KDDI/ HITACHI	Distributed Orchestration Architecture	Network Slice OAM	Integrated Managment
WP5 FOCUS/DT/UT/ KDDI		Open5GCore-FLARE Federated Testbed	5G Application POCs Feasibility & Scalability Tests
WP6 Aalt/KDDI	ITU-T	3GPP IETF	5G related Standardization

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Questions ?

List of Japanese R&D Partners

The main partners who executes and promotes European and Japanese collaborative "5G! Pagoda" project, contribute to international technology progress and deployment.