# AKARI Project


## - Design for the New Generation Network -

KUBOTA Fumito
New Generation Network Research Center
National Institute of Information and Communications Technology
(kubota@nict.go.jp)

# Outline

1. Background

2. Limitation and problems on the current Internet

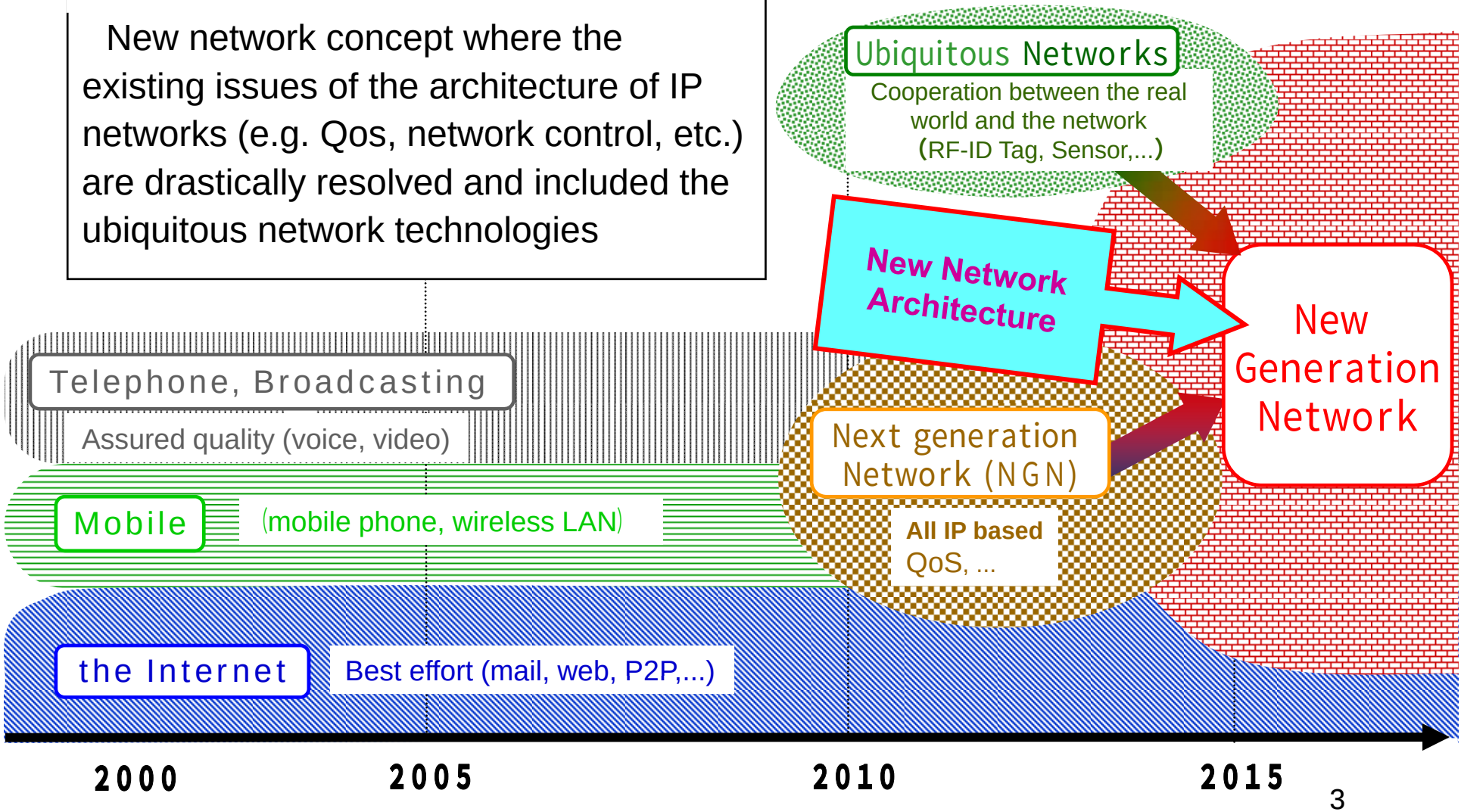
3. The AKARI Project
   - Challenge toward the New Generation Network

4. Conclusion

# Milestone on Advancement of Networks

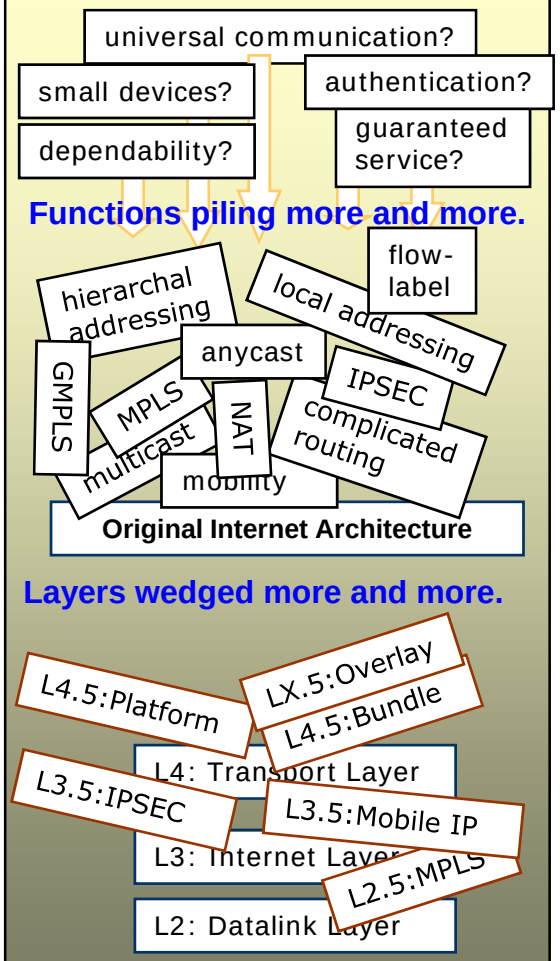
New Generation Network

New network concept where the existing issues of the architecture of IP networks (e.g. Qos, network control, etc.) are drastically resolved and included the ubiquitous network technologies



# Limitations and Problems of the Internet

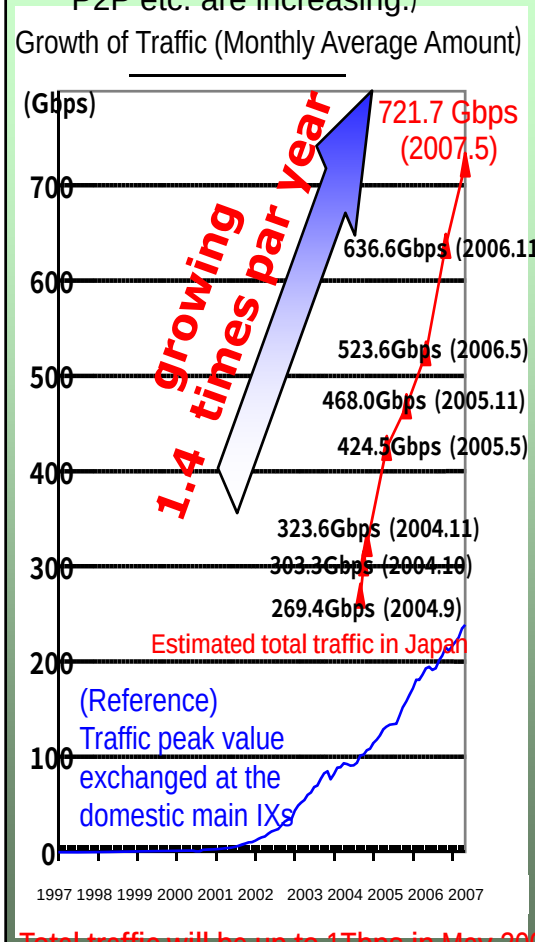
## (1) Too much Complicated




**There comes a time to redesign the network from a clean slate.**

## (2) Explosion of Traffic

(Major factors: video download, P2P etc. are increasing.)




Total traffic will be up to 1Tbps in May 2008.
It is expected to amount to 1 Peta bps in 2020s.

## (3) Security Issues

Threats to network security are getting malicious and sophisticated, like Bot.

- Victim Individuals who experienced some kind of damage: 54.7%
- Number of reported virus victims 85,700
- Victim corporations that experienced some kind of damage: 68.1%
- Market products related information security throughout service About U.S. $180 billion (estimated cost)

→ **Time is coming to re-creation from the origin!**

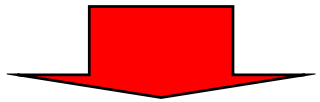
# Problems that Need to be Solved :
## Presently existing, What might happen in the Future, and the Unknown.

- **Large capacity** transmission/exchange
  – 1,000 times by 2020 (Peta bps)
- Core router **electric power consumption**
  – 1 atomic power generation per 100 devices
- Difficulty of **guarantee of bandwidth**
  – essential limitation of packet exchange
- Difficulty of **congestion control**
  – long fat pipe (bandwidth・delay product) problem, fairness of users
- Difficult to introduce **plural gateways**
  – explosion of routing table by multi-homing
- Avoidance of **break down**
  – several tens of seconds' order needed for rerouting in broad areas

# Objectives of the New Architecture

The “**New” Generation Network Architecture** which will satisfy demands of the Ubiquitous Network Society around 2015 – 2020, shall be studied by approaching from “**Clean-Slate**” design not by extension of the existing Internet or the “Next” Generation Network (NGN).

**NICT** plays the role of the **National Research Center** bringing up Japanese research community towards developing the “New” Generation Network Architecture (NWGN).



**AKARI Project** has been studying the New Generation Network Architecture

# AKARI Architecture Design Project

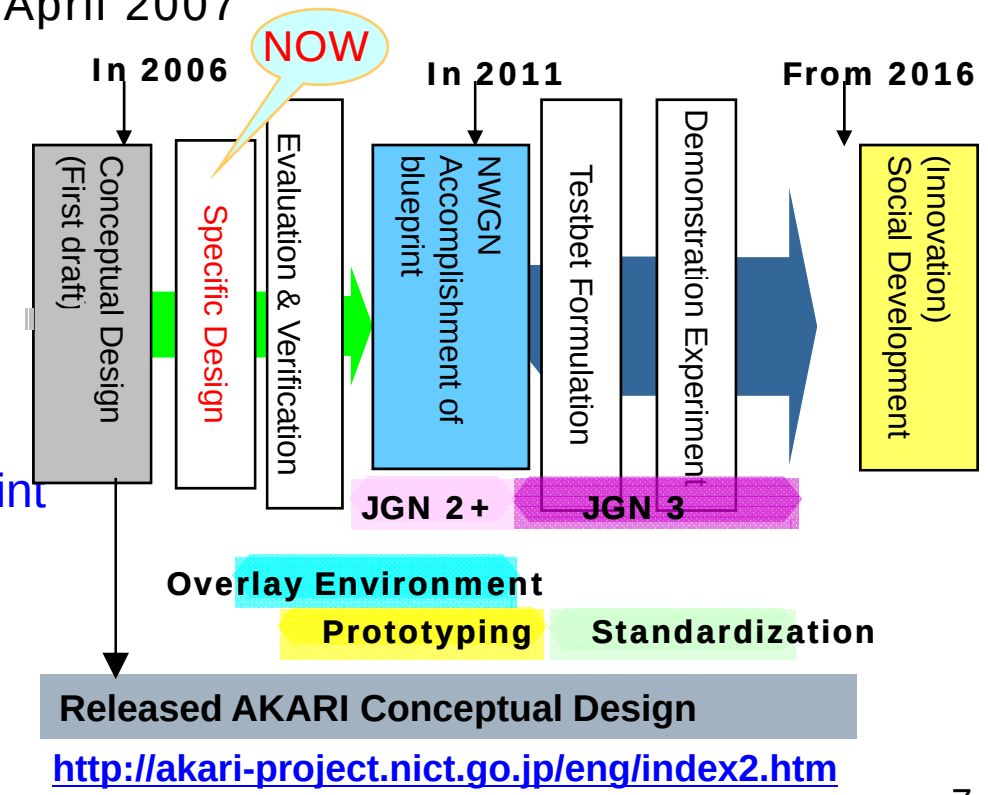
## – A small light in the dark pointing to the future –

The study began in April 2004 to seek after an ideal network from a **clean-slate** in response to the future needs, which won't be able to realize as an extension of the present network technology.

**AKARI Conceptual Design** (White paper 1st edition)
published on 30 April 2007

At present, a detailed design of NWGN is under discussion. Some ideas are going to be tried prototyping and experimental implementation over the testbed used JGN 2 plus.

Creation of a set of NWGN Blueprint is the next target for around 2011, and finally realizing sustainable network architecture and practical use should come after 2015.



# Principles of New generation Network Architecture

Designing the three fundamental principles and operating a grand design as an entire network as social infrastructure.

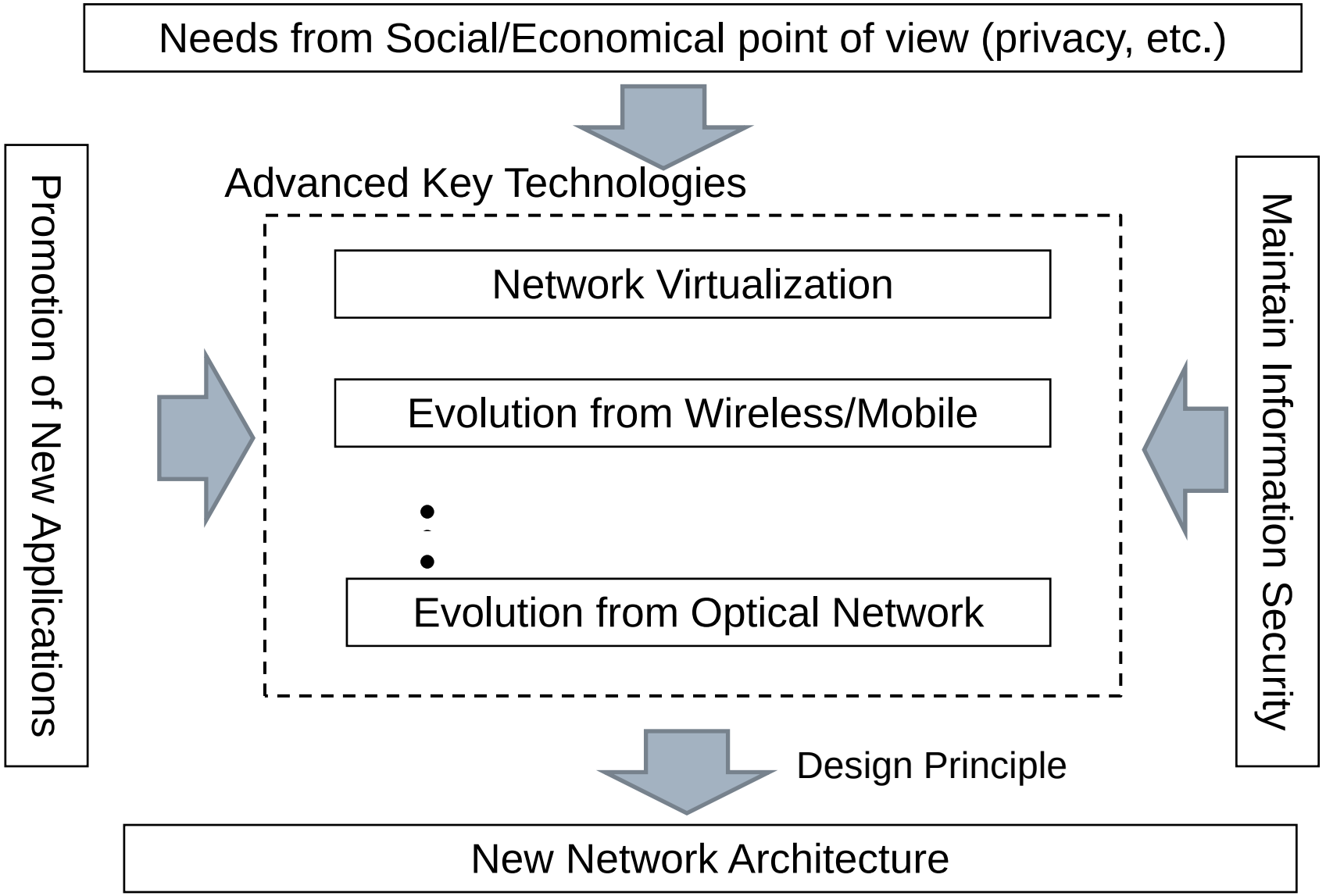
1. KISS (Keep It Simple, Stupid) principle
   - Crystal synthesis (selection, conversion, simplify)
   - Common layering (concatenation)
   - End-to-End (original Internet)

2. Sustainable & Evolutionary principle
   - Self-* properties
   - Robust large-scale network
   - Scalable, distributed control
   - Openness

3. Reality Connection principle
   - Separation of physical & logical addressing
   - Bi-direction authentication
   - Traceability

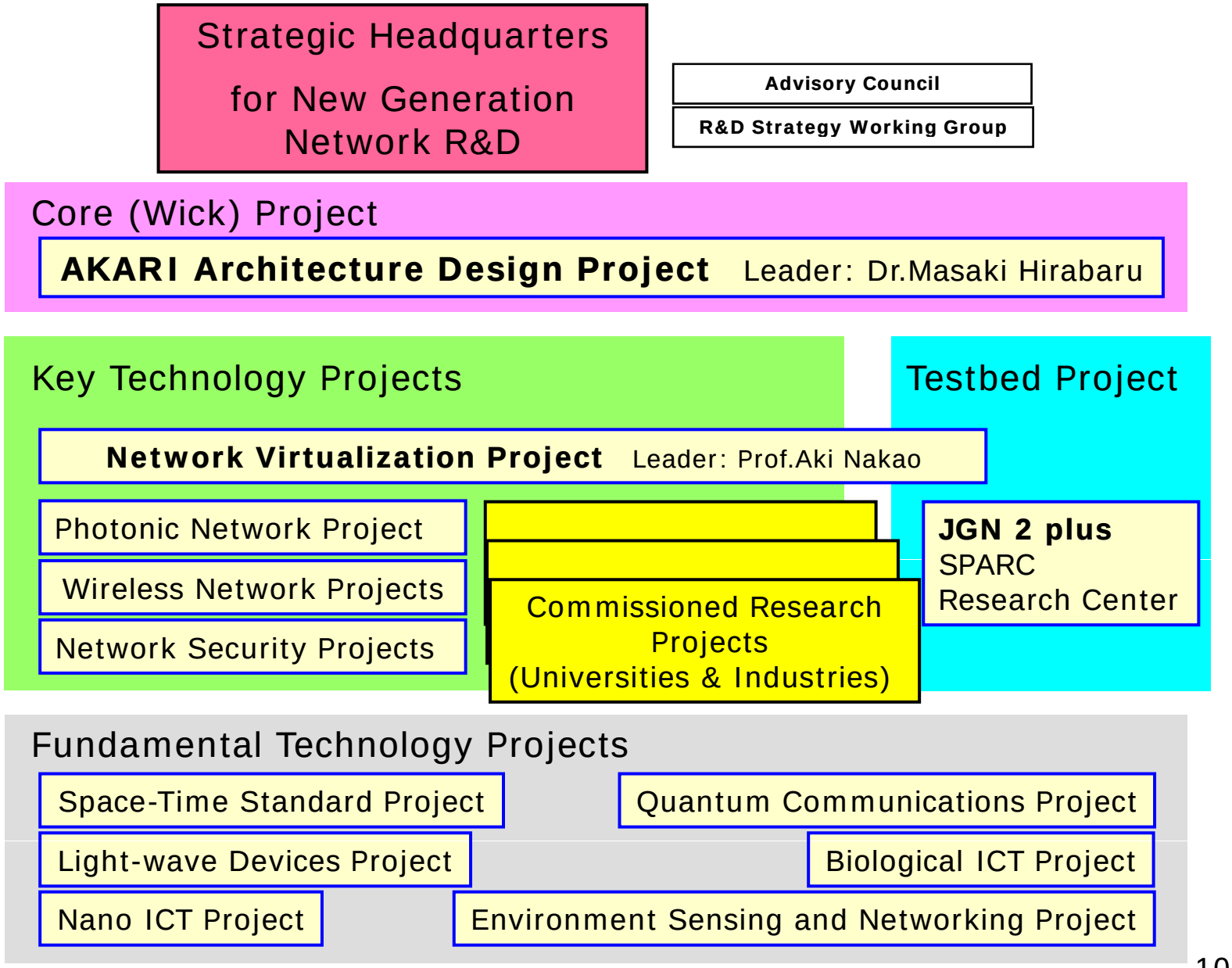
Designing the future, diverse, new generation network
- pick up techniques for the future under the principles
- integrate & simplify them with design methods

# Approaches to the New Architecture



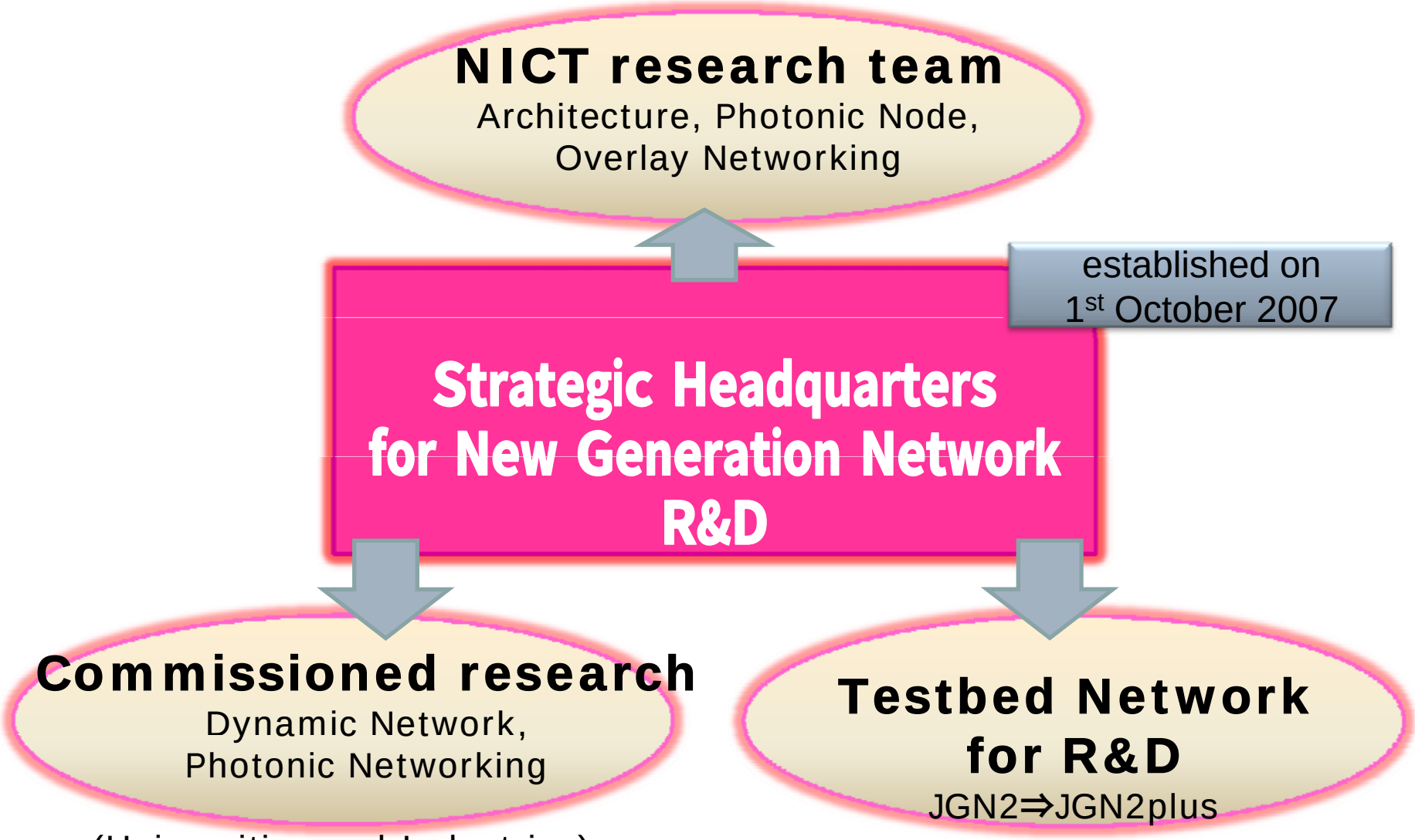
# AKARI Project (extended)

## – Overview of the related NICT Projects



# NICT R&D Schemes

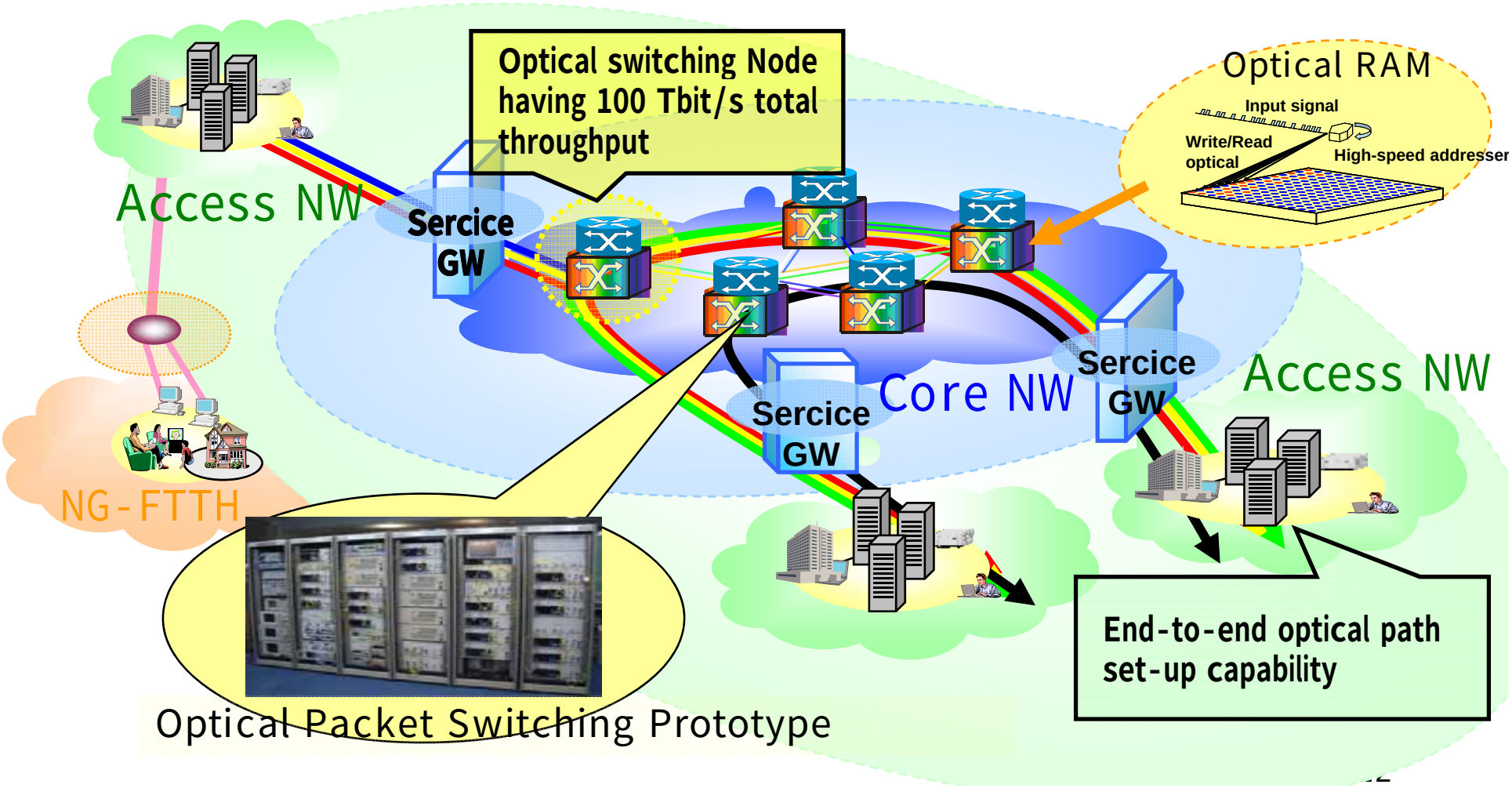
■ Combining with the variety of R&D schemes, collaborative research can be promoted effectively with Universities and Industries



# Examples of key technologies for NWGN (1)

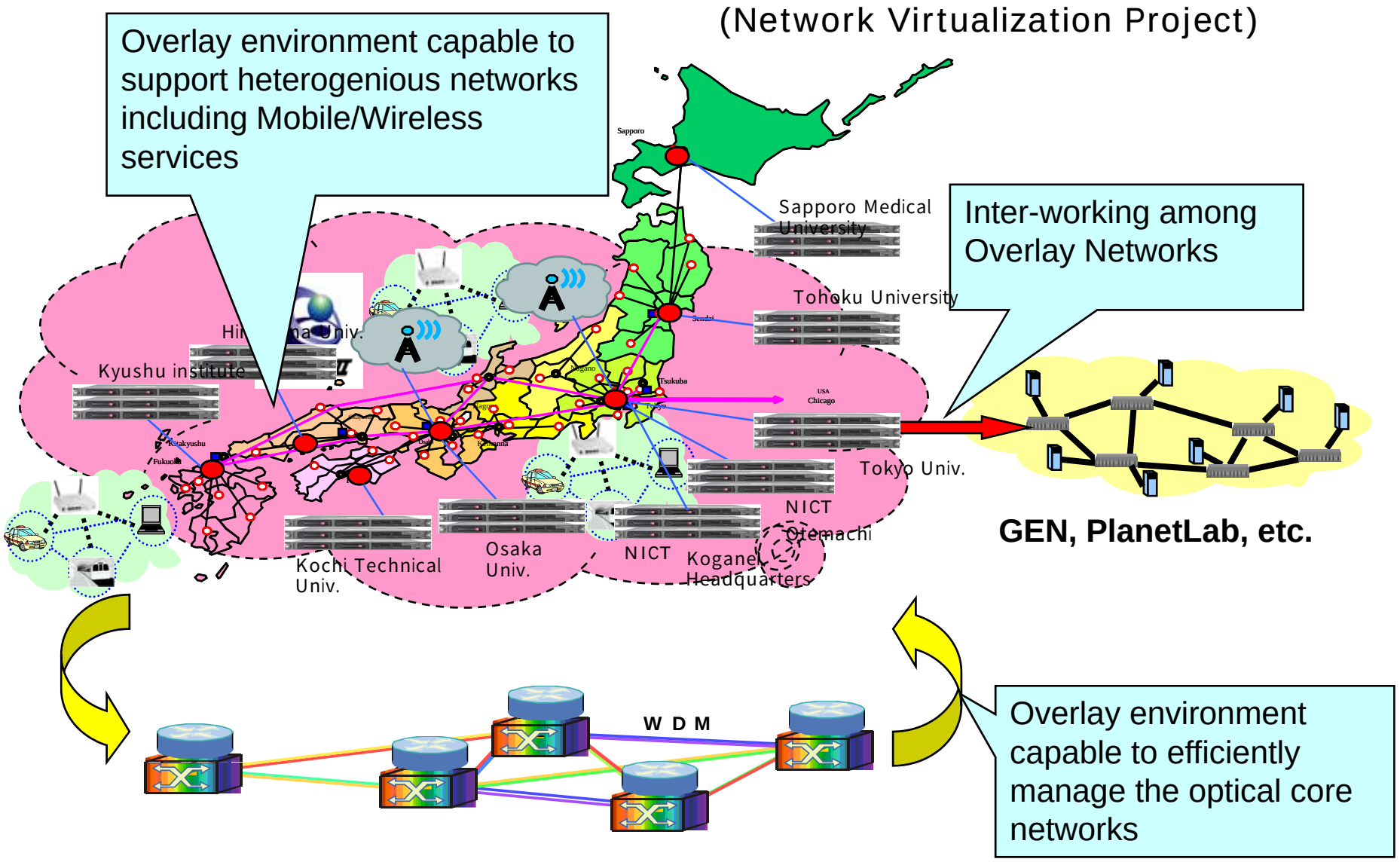
## (1) Photonic Network Projects

Key technologies and prototype systems are studied towards very high-speed and high capacity but very low power consumption all optical transport networks.



# Examples of key technologies for NWGN (2)

## (2) Overlay Network Research and Environment



# Examples of key technologies for NWGN (3)

## (3) Commissioned Research: Dynamic Network Projects

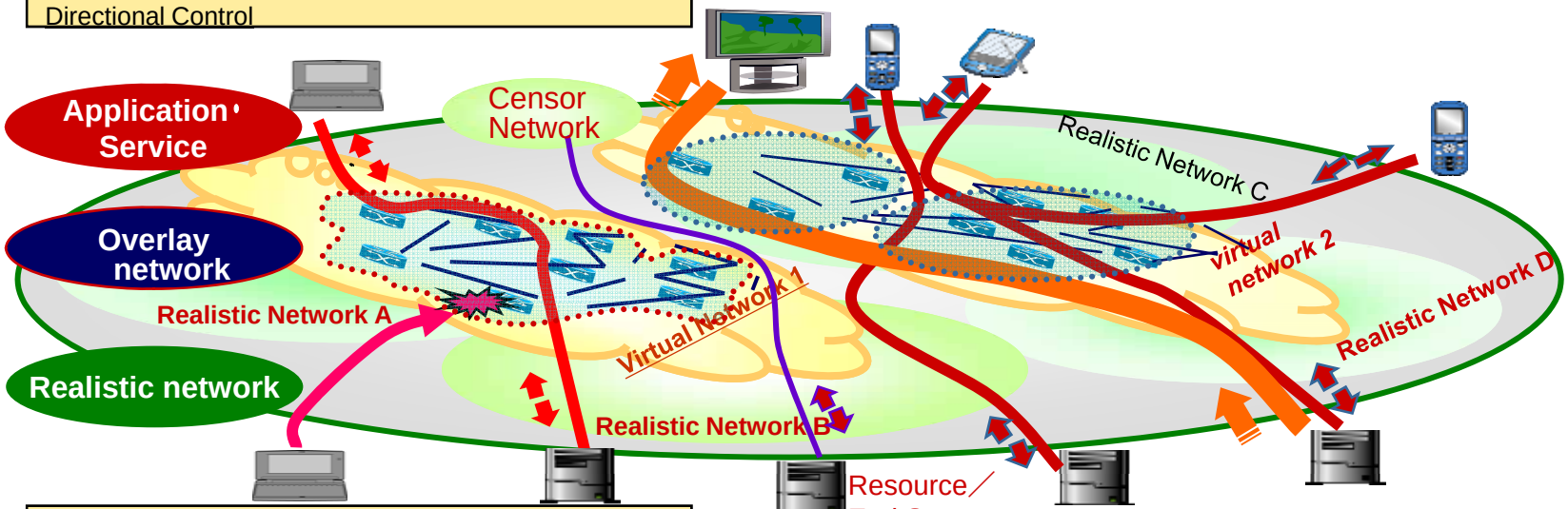
- Term from 2007 – to 2010
- Goal To realize network containing functions below
  - To provide dynamic and optimum service for communication environment and users' demands that are frequently changed
  - To provide high quality and high efficiency for heavy weight division, such as microscopic data of censor and high-definition videos
  - To ensure stability of lines in a situation when obstacles are detected

**Sub-Issue 1: Problems of structural design, structure, and control**

- Challenge A: Technology of Scalable Network Structure Optimization
- Challenge B: Technology of Real-Time Streaming Directional Control
- Challenge C: Technology of Users and Applications' Directional Control

**Sub-Issue 2 : Problem of Dependability for assuring**

- Challenge F: Technology of Network Quality's Adaptive Control and Disaster Tolerance
- Challenge G: Technology of Overlay Network Security




- Challenge D: Technology of Control for Large Resources
- Challenge E: Technology of Disparate Network Cooperation
- Challenge H: Technology of Service Platform Structure

# Japan's R&D Formation for New Generation Network (NWGN)

## New Generation Network Promotion Forum

- Proposed by the organizing committee on October 2, 2007, and to be launched in November 2007
- Open to people not only in the network area but also different areas
- Formation of a base for NWGN R&D activities with industry-academia-government collaboration

**Activities**

(1) Study of an "All Japan" NWGN R&D policy and roadmap

(2) Study of the NWGN from social and economical aspects

(3) Promotion of experiments for testbed network technology

(4) Sharing and dissemination of NWGN vision

(5) Promotion of international collaboration

**Contribution to the Forums Activities**

- Active participation in the review
- Communication of NWGN R&D Strategic Plans etc

**Reflect expertise into R&D Strategic Plans**

## NICT

### Research Departments

### NWGN R&D Strategic Headquarters

**Role of NICT Research Departments**

(1) NWGN architecture design

(2) R&D on elemental technologies and their evaluation in testbed networks

(3) Support of relevant R&D by means of extramural research contracts

# Structure of NWGN Promoting Forum

- Established in November 2007
- Members: 214 (December 4, 2007)

**Assembly**

President: Tadao Saito (Professor emeritus, the University of Tokyo)
Vice President: Tomonori Aoyama (Professor of Keio University)
Yasuhiko Ito (Vice President of KDDI)
Noritaka Uji (Vice President of NTT)

Organizer

**NXGN Promotion Committee**
Chairman: Tomonori Aoyama (Professor of Keio Univ)

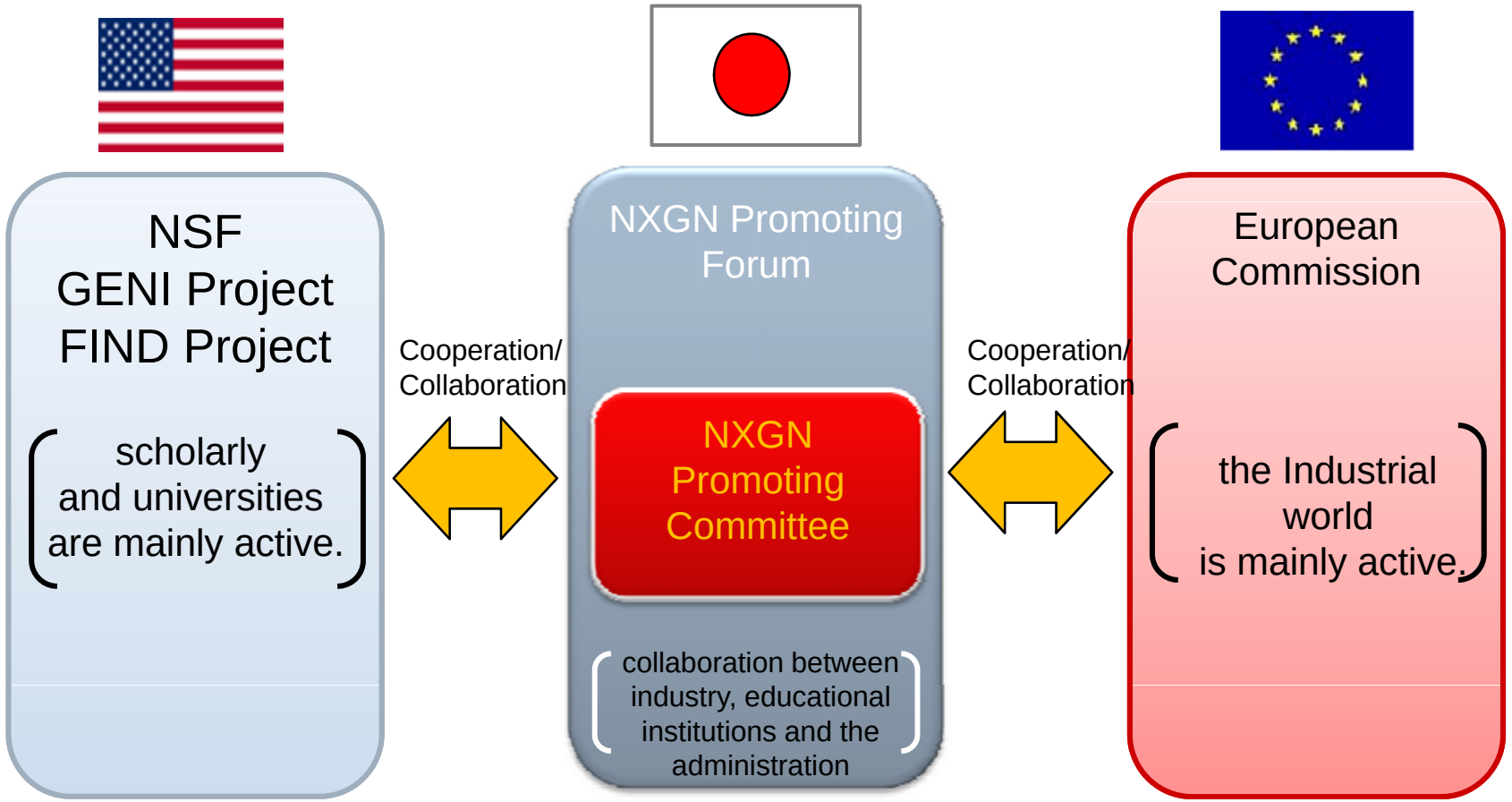
- Research Development Strategy Working Group
- Assessment Working Group
- Testbed Network Promotion Working Group
- Project Promotion Working Group

- Investigation of research development strategy from the fundamental to application researches
- Investigation of NXGN's social and economic aspects
- Promotion of testbed network and demonstration experiments
- Sharing, transmitting vision of NXGN and diffusion activities
- Promotion for international cooperation in the West and Asia.

Secretariat: MIC & NICT

# Cooperation and Collaboration with Other Countries

■The NXGN Promoting Committee will promote cooperation with other countries.
■ It is actively engaged in promoting joint international symposiums, academic exchanges, and people-to-people exchanges.



# Conclusion

- The New Generation Network is an emergent research target which will be introduced in around 2020.
- Its network architecture should be studied based on requirements for future ubiquitous network society, and on new networking key technologies such as advanced photonic, wireless and sensor network technologies.
- Prototype systems and a set of standard should be developed in 2015-2020 time frame.
- Network testbed are essential for R&D, and especially, large scale overlay network test environment will be provided.
- Global collaboration among universities, industries and governments is very important.

Thank you for your attention!