

*Collaboration, Open Mind/Innovation,  
and Challenger's Spirit  
- Innovation from our future daily life! -*

@NICT: National Institutes of  
Information and Communications Technology

November, 2017

Fumihiko “Tom” Tomita, Dr. Sci.  
Chief Research & Strategy Officer,  
Vice President, NICT, Japan

# ***Collaboration, Open Mind/Innovation, and Challenger's Spirit***

***-Innovation from our future daily life!-***

***NICT: National Institutes of Information and Communications Technology***

***As a National Institute of Opportunity***

***November, 2017***

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Vice President, NICT, Japan**



# Welcome address from NICT Fumihiko "Tom" Tomita, CRSO

The sole national research institute in the field of ICT in Japan

- Promoting its own research and development
- Cooperating with and supporting industry and academia
- + Education and training of cybersecurity experts

Industry/Academia/Government  
**Innovation Platform**

Public Services

- Japan Standard Time
- Space Weather Forecast...

**Budget :**

**~ 27 Billion Yen +  $\alpha$  (~11)**  
**(~\$400 Million in Total)**

NICT President  
Prof. Tokuda

**Personnel: ~1000**  
**(Researchers: ~520,**  
**PhDs: ~460)**

**as of Apr. 2017**

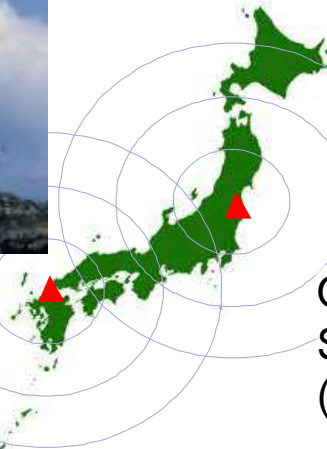
**Collaboration**  
**Open Mind/Innovation**  
**Challenger's Spirit**

# Public Services

## Frequency Standard and Japan Standard Time



Hagane-yama Station  
(60 kHz)



Ohtakadoya-yama Station  
(40 kHz)

- **>100M** Radio controlled clocks & watches
- **>300M** Access/day Internet Standard Time / NTP Service

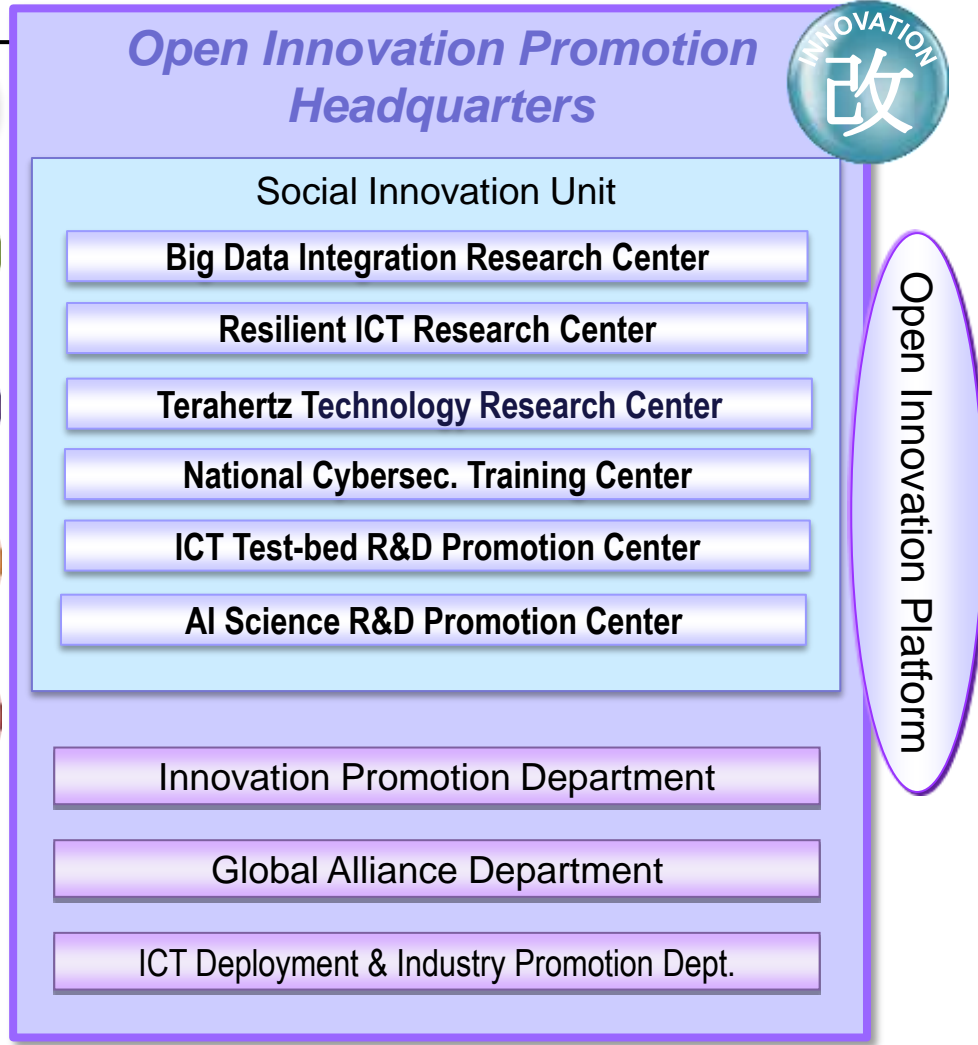
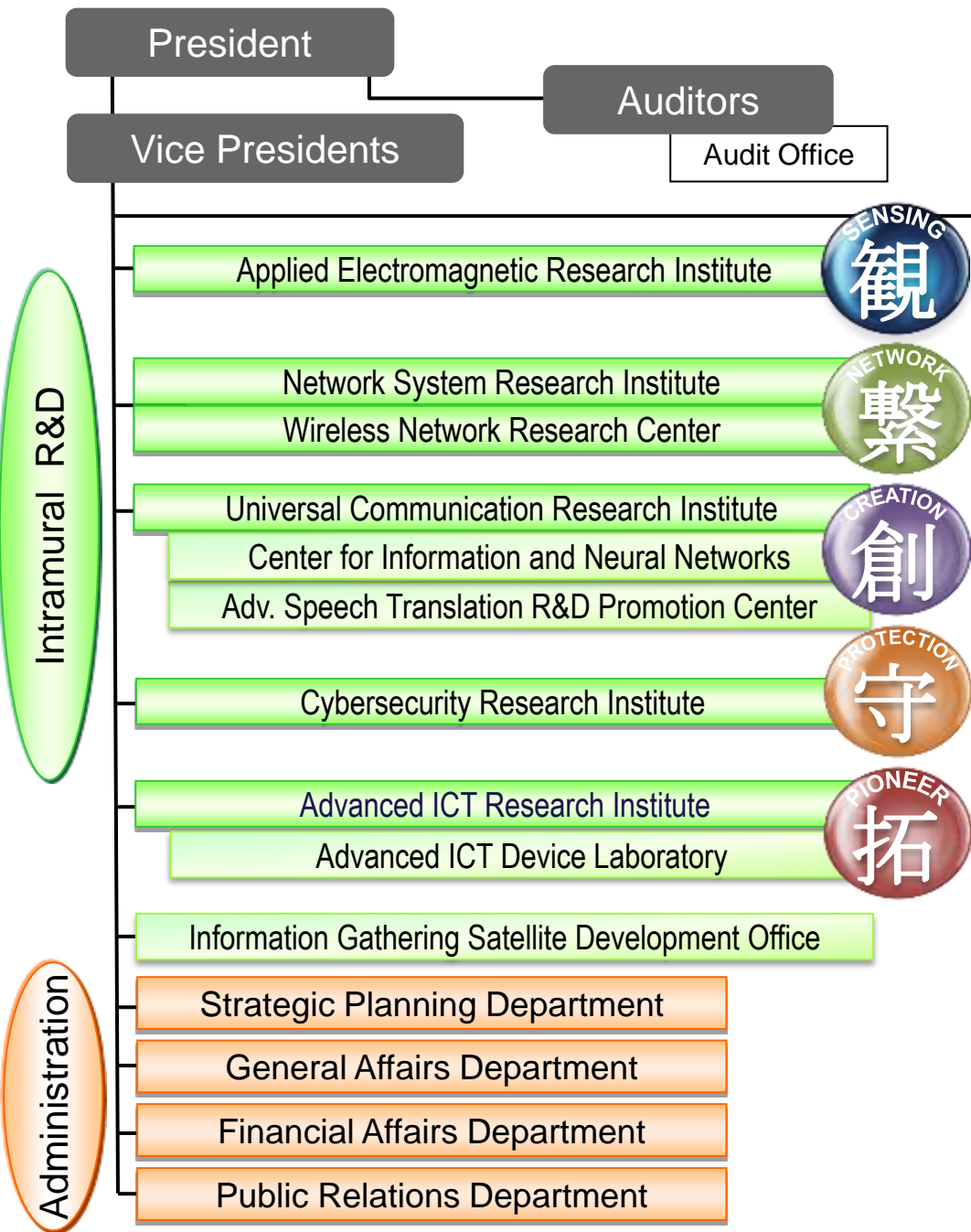
## Space Weather Forecasts



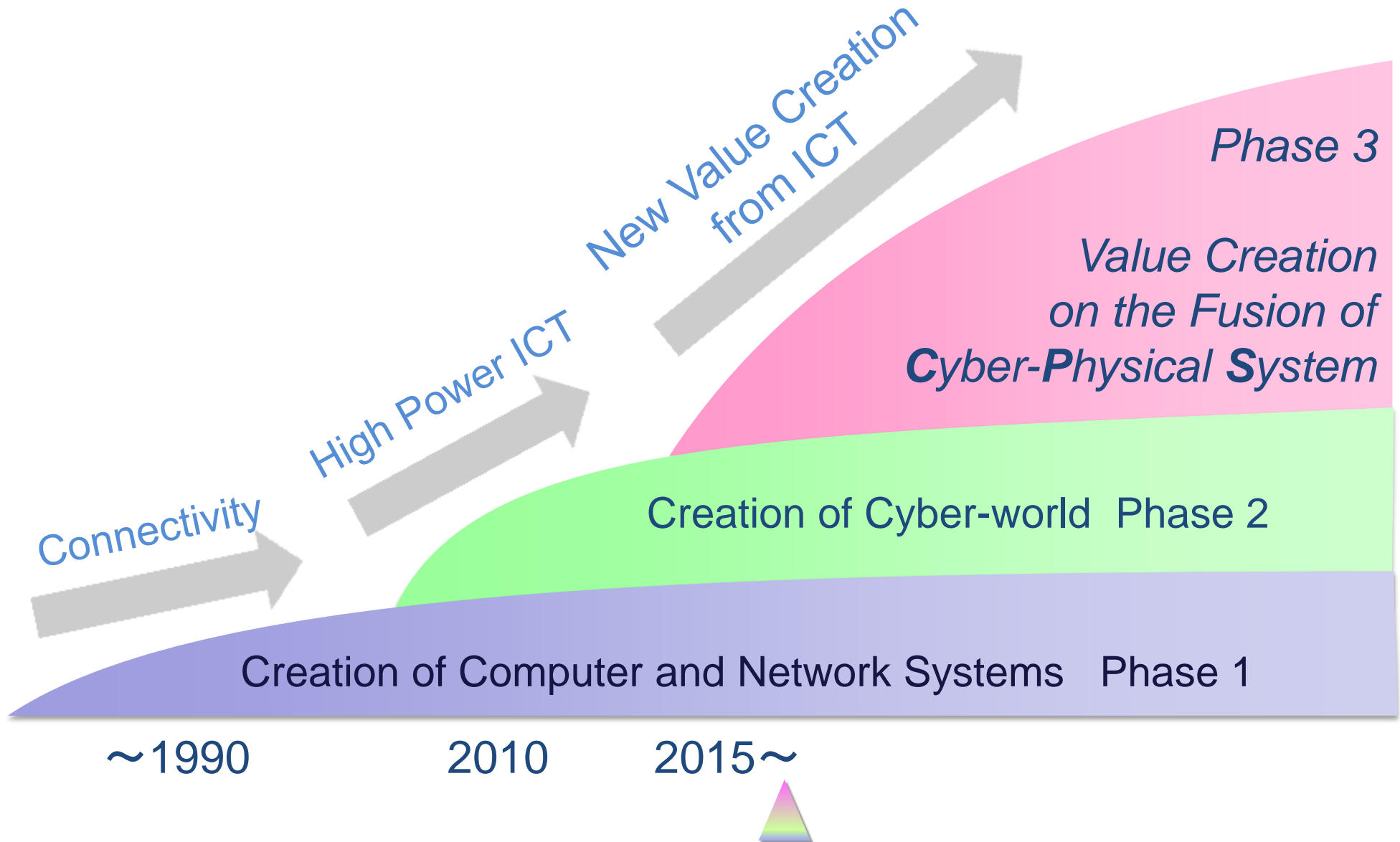
## Test & Calibration of Wireless Equipment



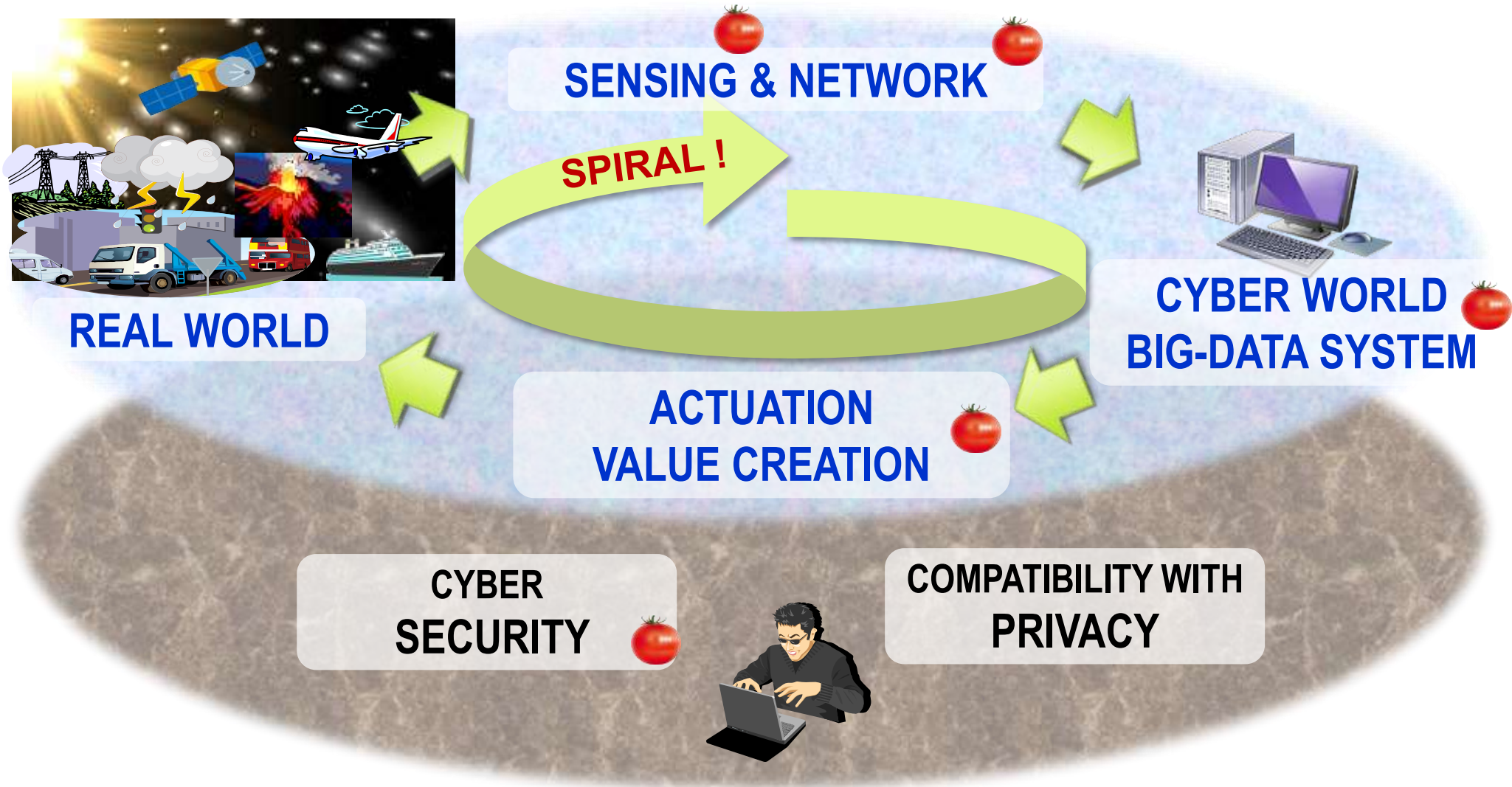
# Organization



# History and 3rd Paradigm of ICT

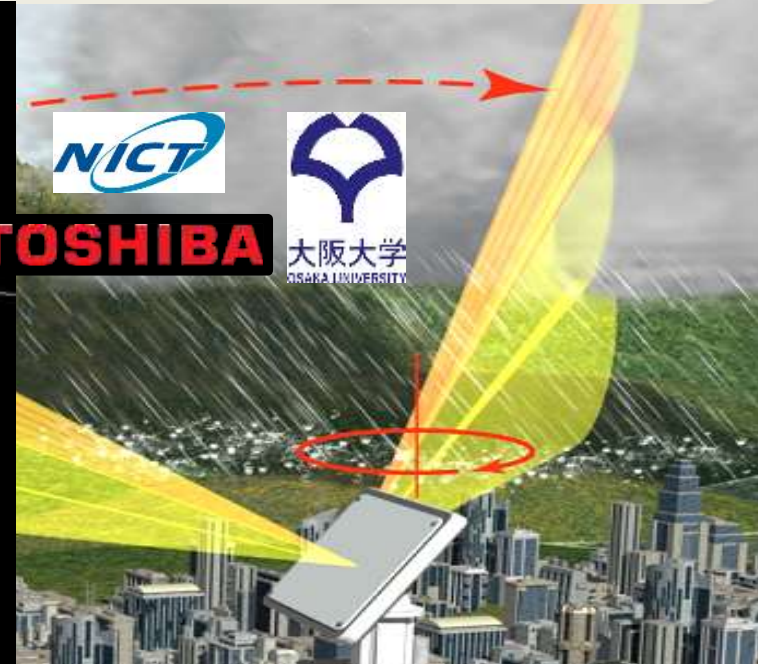
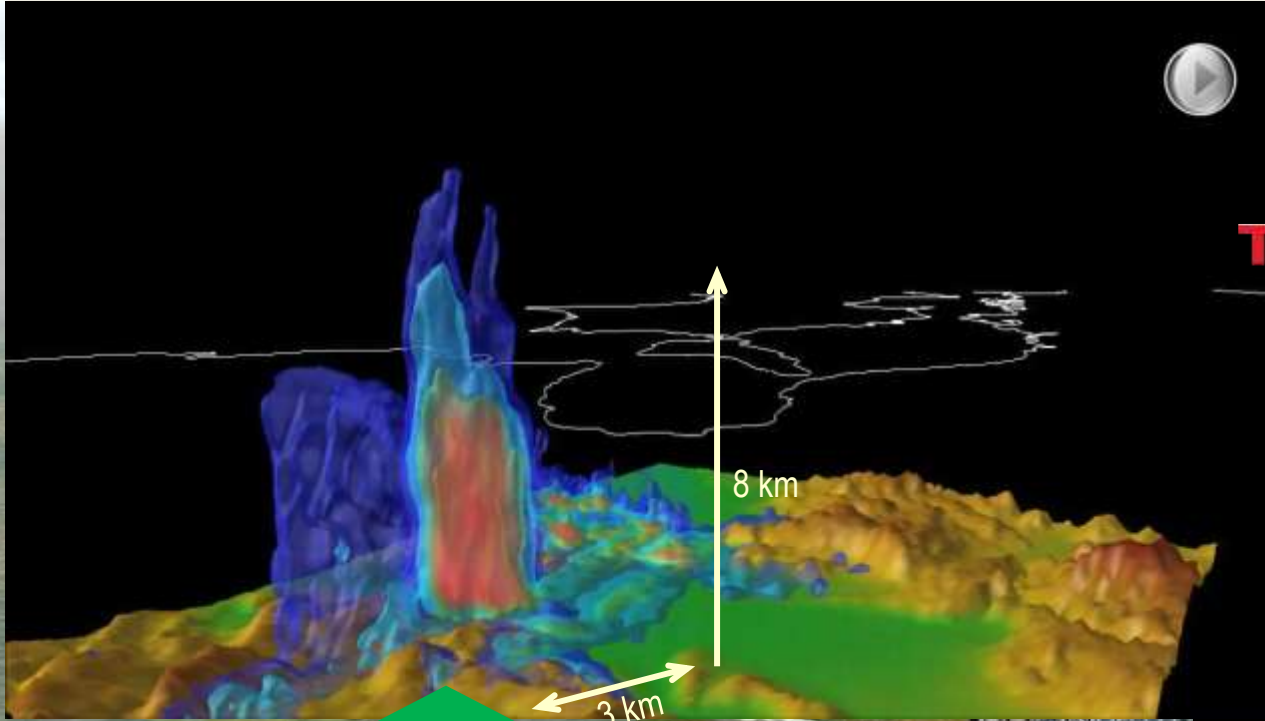


# Data Driven Innovation for Quality of Social Life

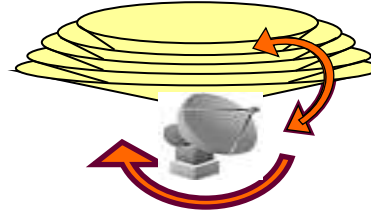


# Next-Generation Phased Array Weather Radar

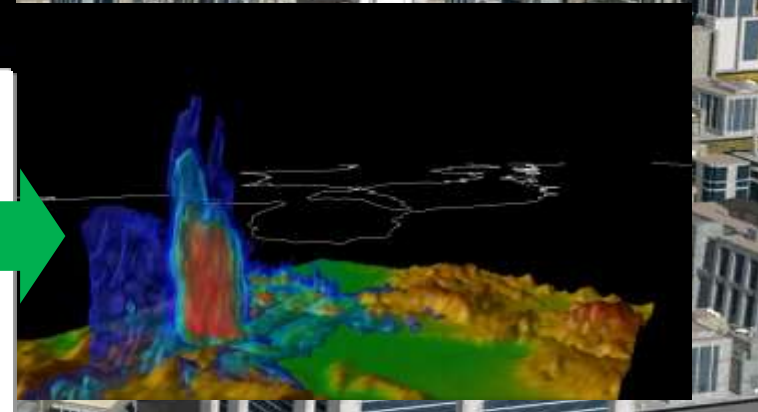
- 3D heavy rainfall and tornadoes at a spatial resolution of 100m **within 30 secs.**
- Prediction of sudden and localized meteorological phenomena



Phased Array Radar:  
**10-30 sec.**



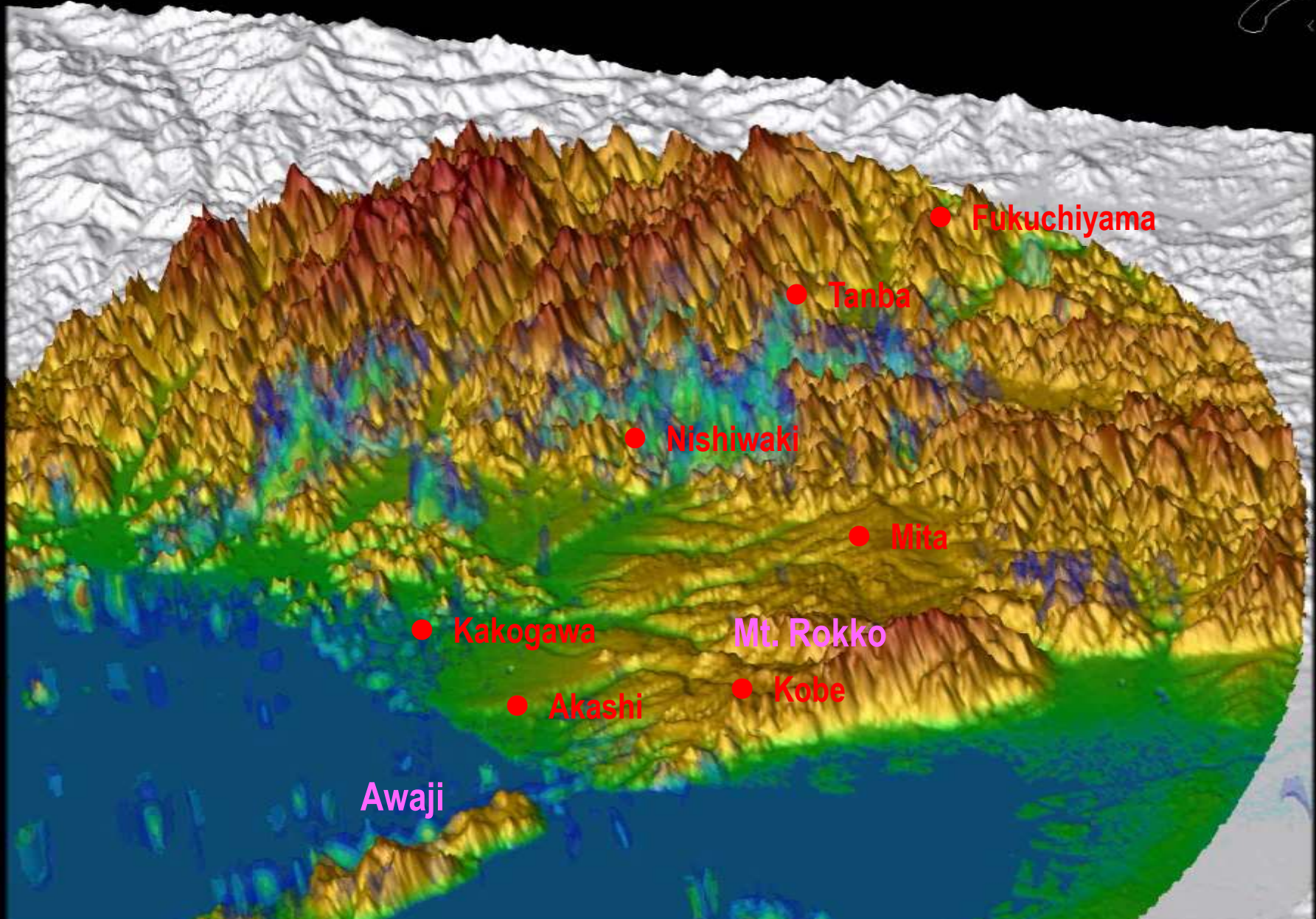
Parabolic antenna:  
**5-10 min.**







# Unexpectedly Localized Heavy Rain: 2014 Aug.16,21:00 - 17,05:00 (300x speed)





# Space-borne Cloud & Precipitation Radar

GPM (Global Precipitation Observation)/DPR (Dual-frequency Precipitation Radar)

**JAXA, NICT and NASA Collaboration Project**

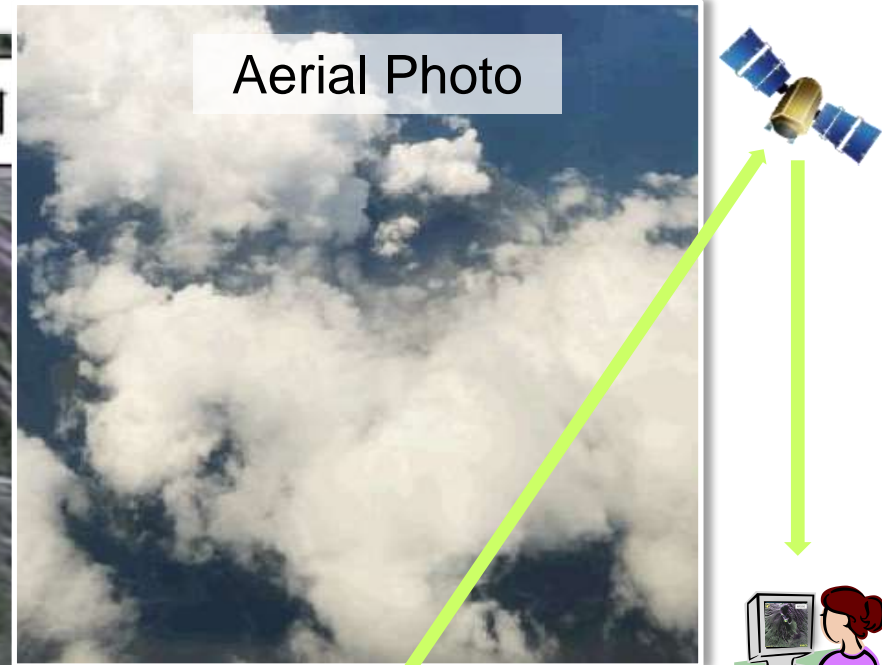
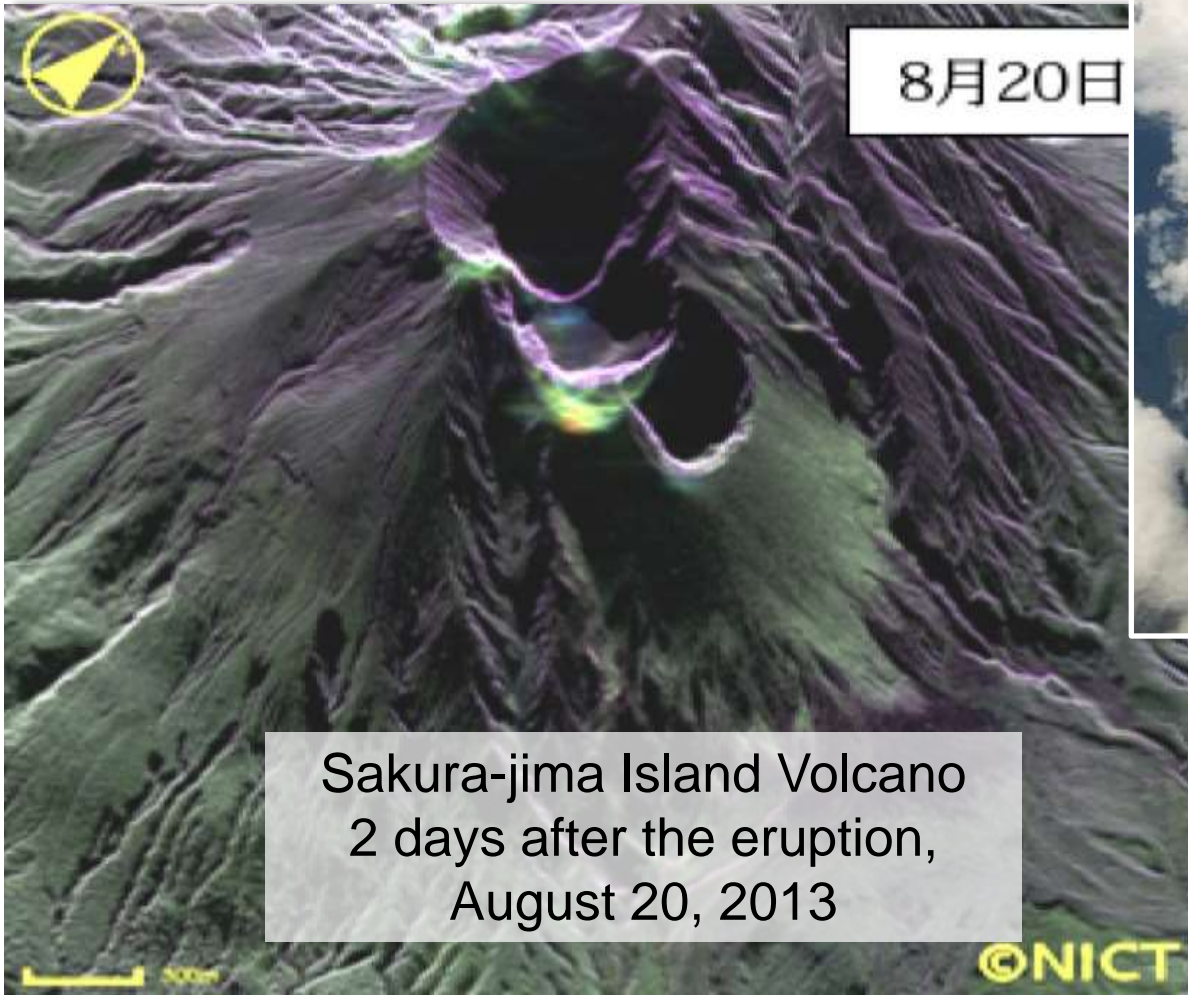


GPM/DPRが捉えた日本海海上の筋状の降雪  
(2014年12月2日18時54分頃[日本時間])

Snow streaks over the Sea of Japan observed by GPM/DPR  
around 09:54Z on December 2, 2014

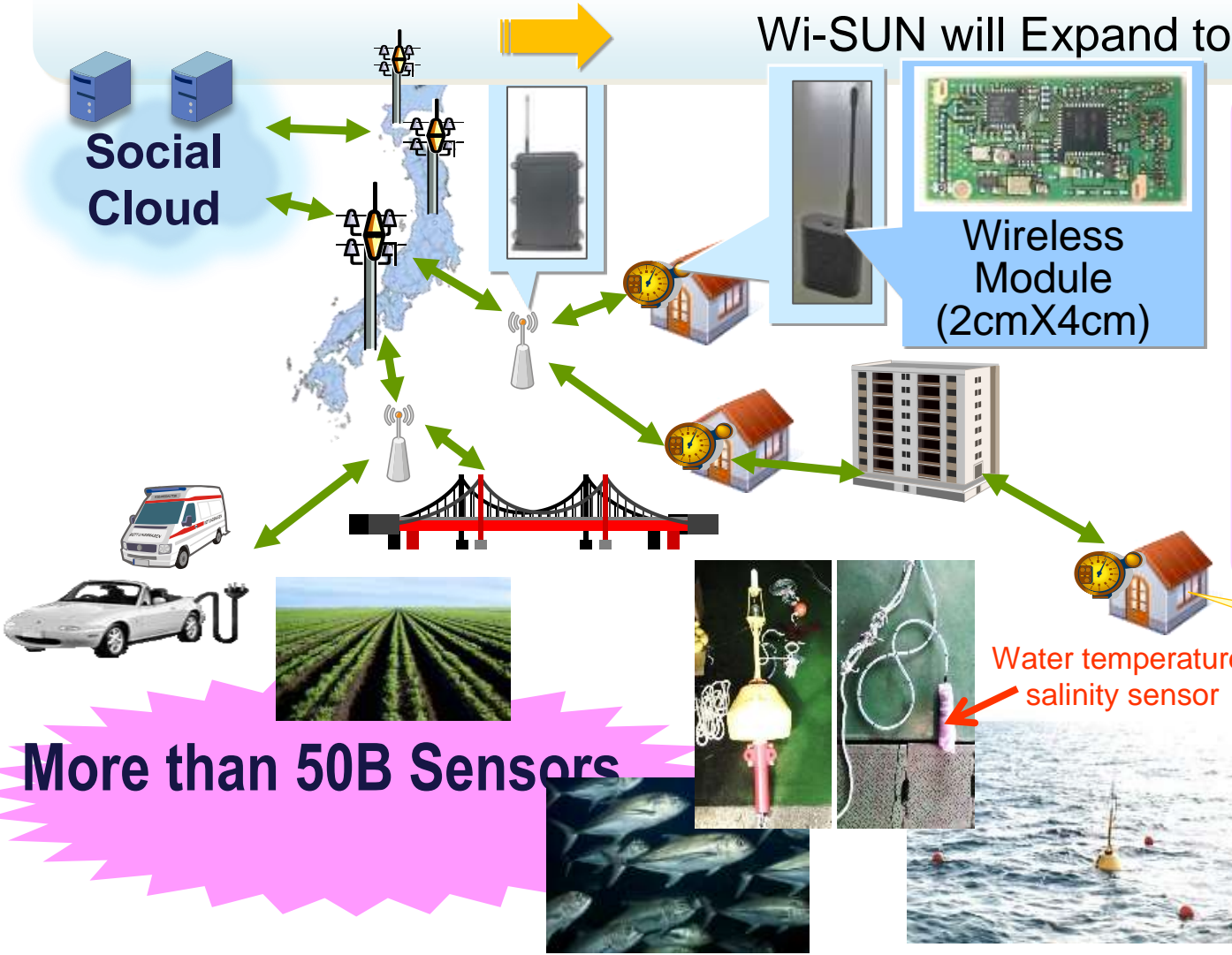
# Volcano Eruption Observation by Pi-SAR2

Precise (**30cm**) polarimetric color image (through clouds, day and night) can be transferred to the ground in near real-time (**10 mins.**)



World's First Small-Sized and Low-Power "Radio Device" Compliant with Smart-Meter Standards of "ECHONET Lite" and "Wi-SUN"

Wi-SUN will Expand to the Sensor Network World



**More than 10-year operation driven by an AA battery**

**Communication range is automatically expanded by multi-hop transmission**

**More than 50B Sensors**

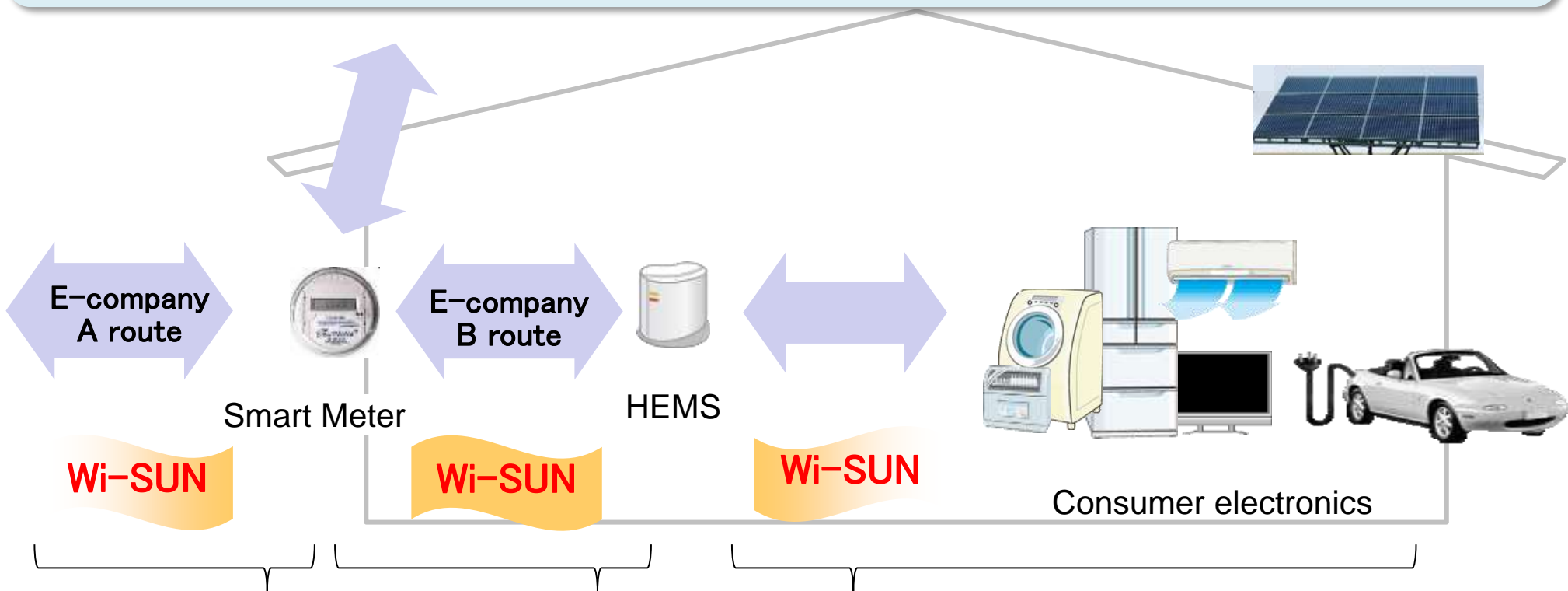
Water temperature salinity sensor



# Wi-SUN will expand to Sensor Network World

Wi-SUN has been accepted **all (10) major Electric companies and Gas companies in Japan (over 80M houses)**.

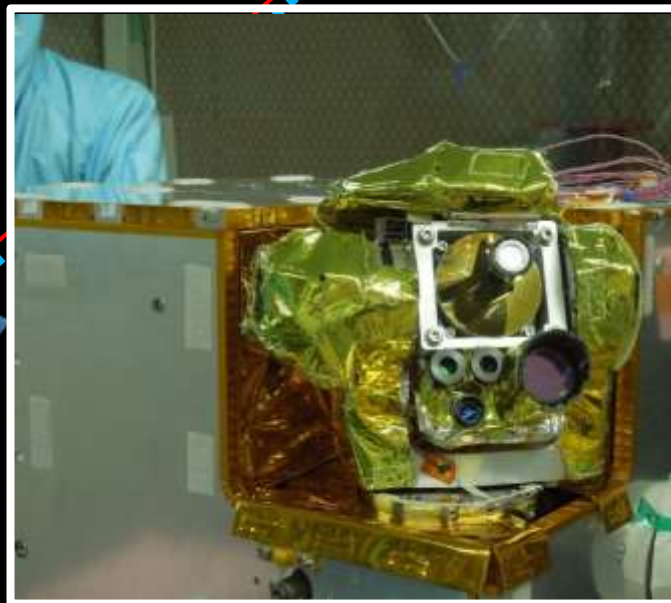
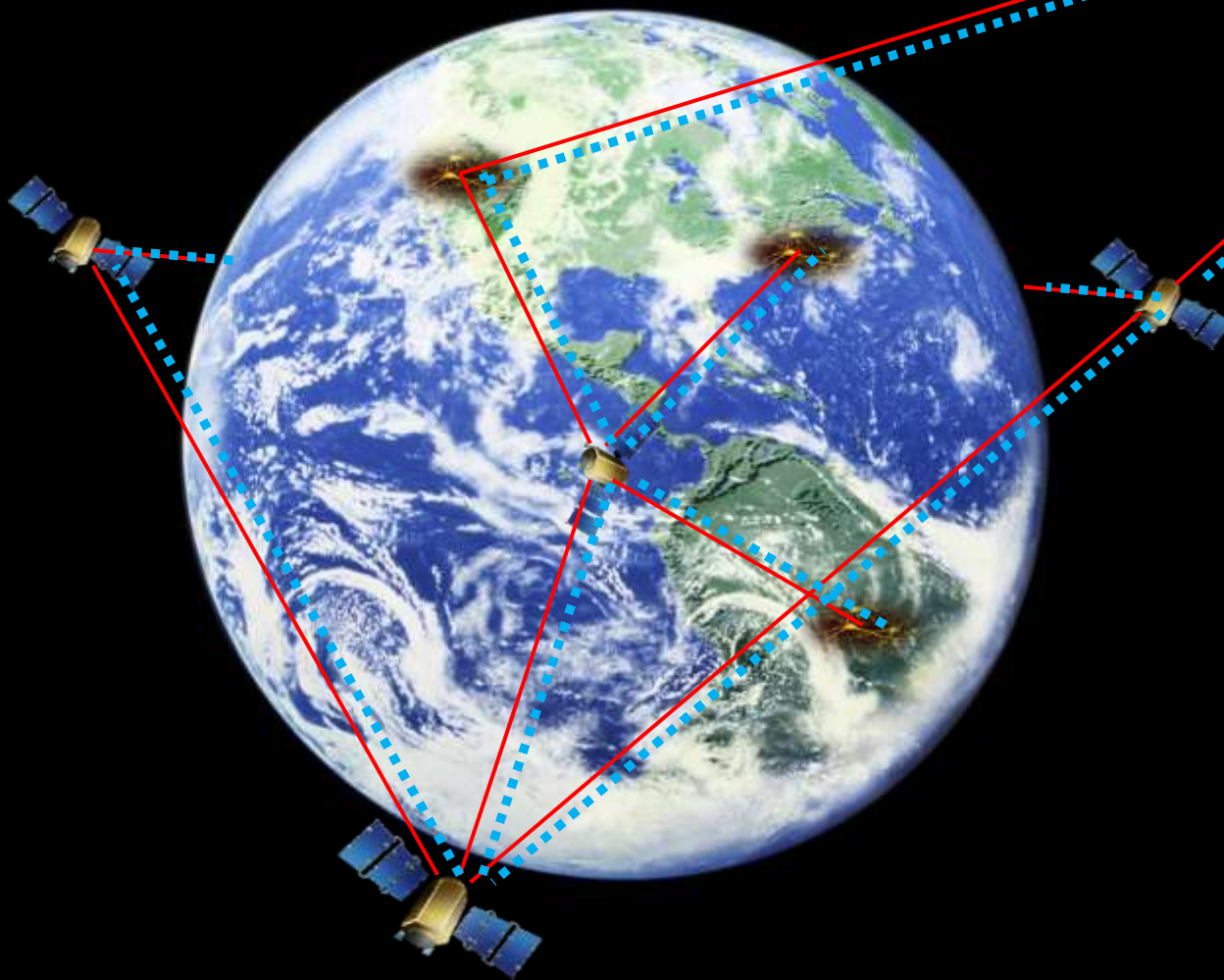
Now expanding to the **Home Area Network** and will expand to the other **SENSOR NETWORK** world.



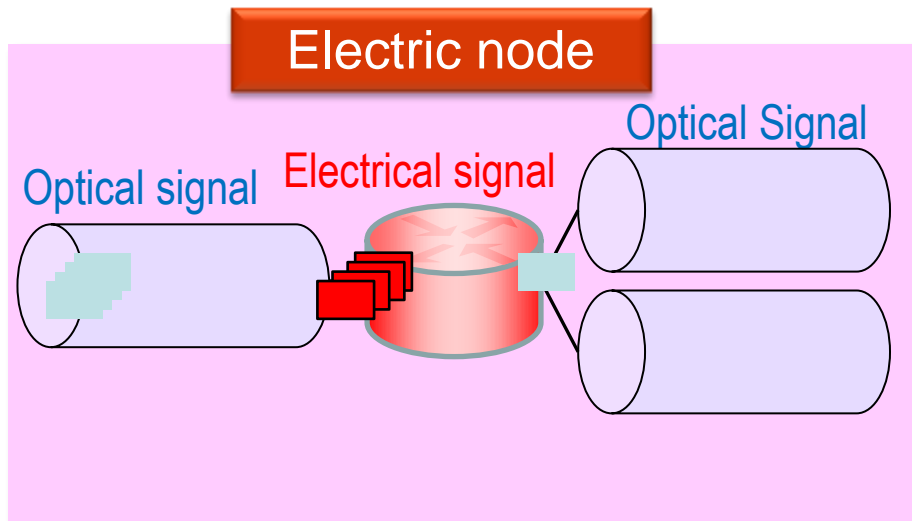
Interoperability among multi vendors (Wi-SUN Alliance)



# Hybrid (**Laser** and Radiowave) Space Communication System is an Inevitable Future !

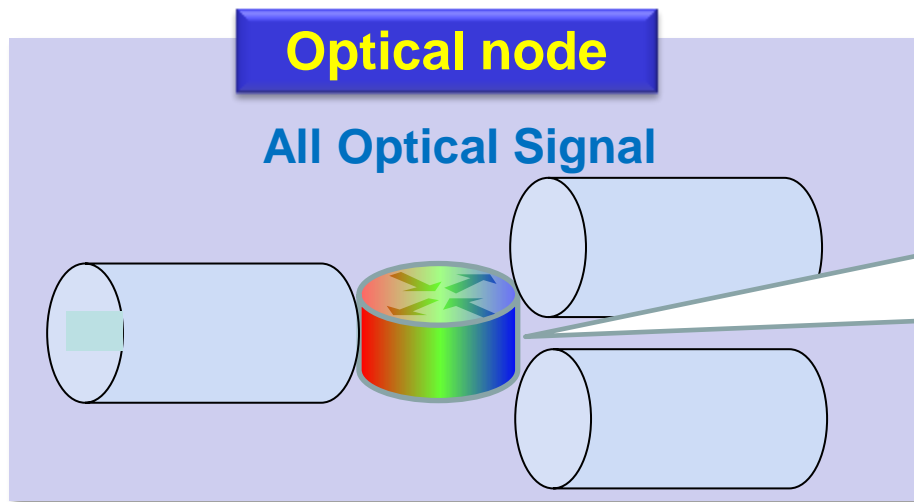
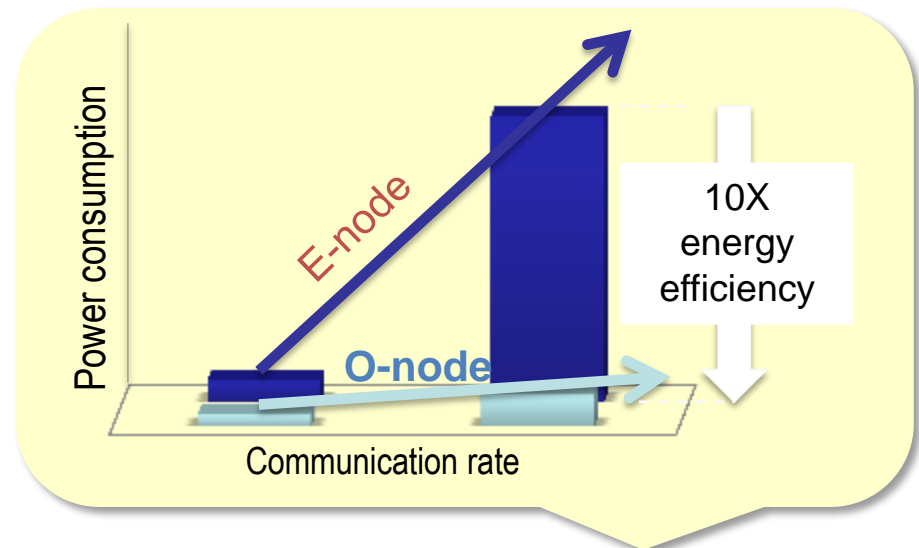


# All Photonic Network; Power-saving and Low-latency Node



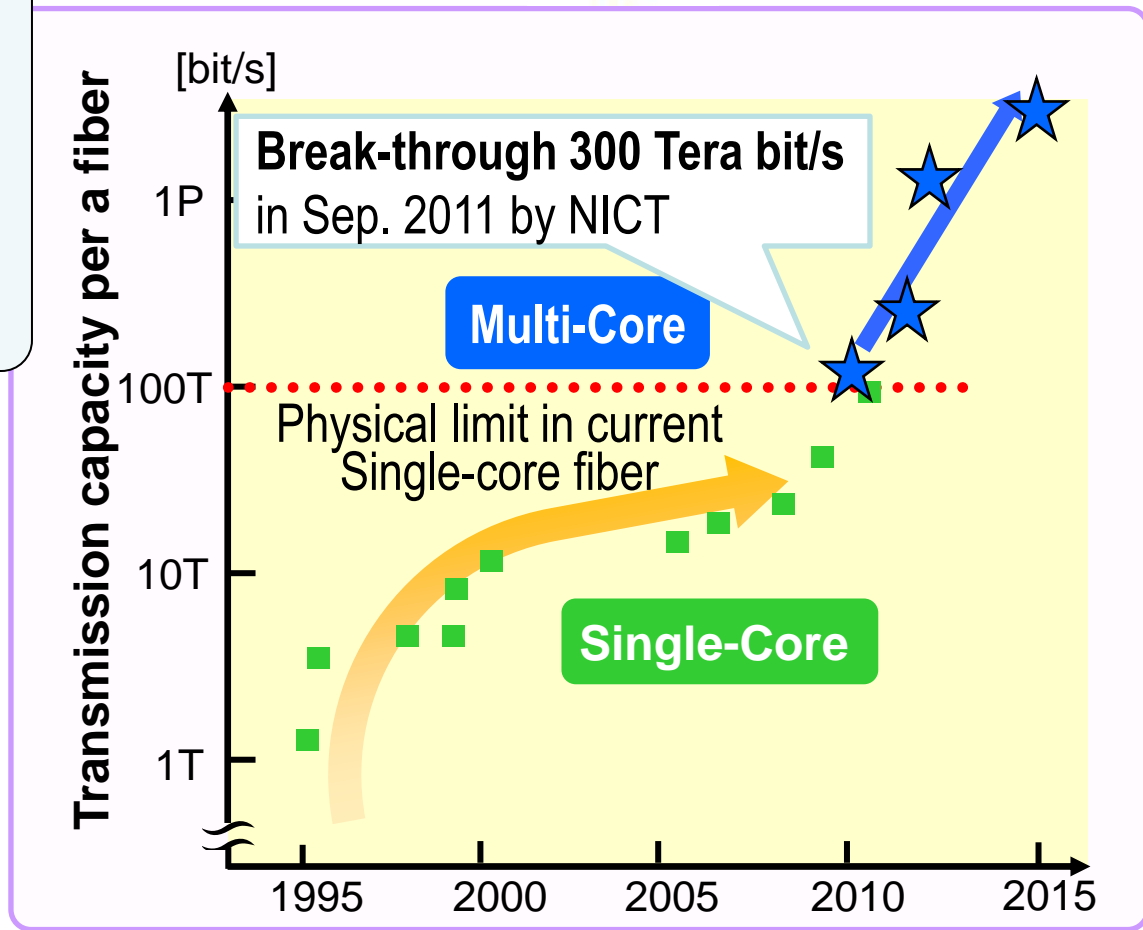
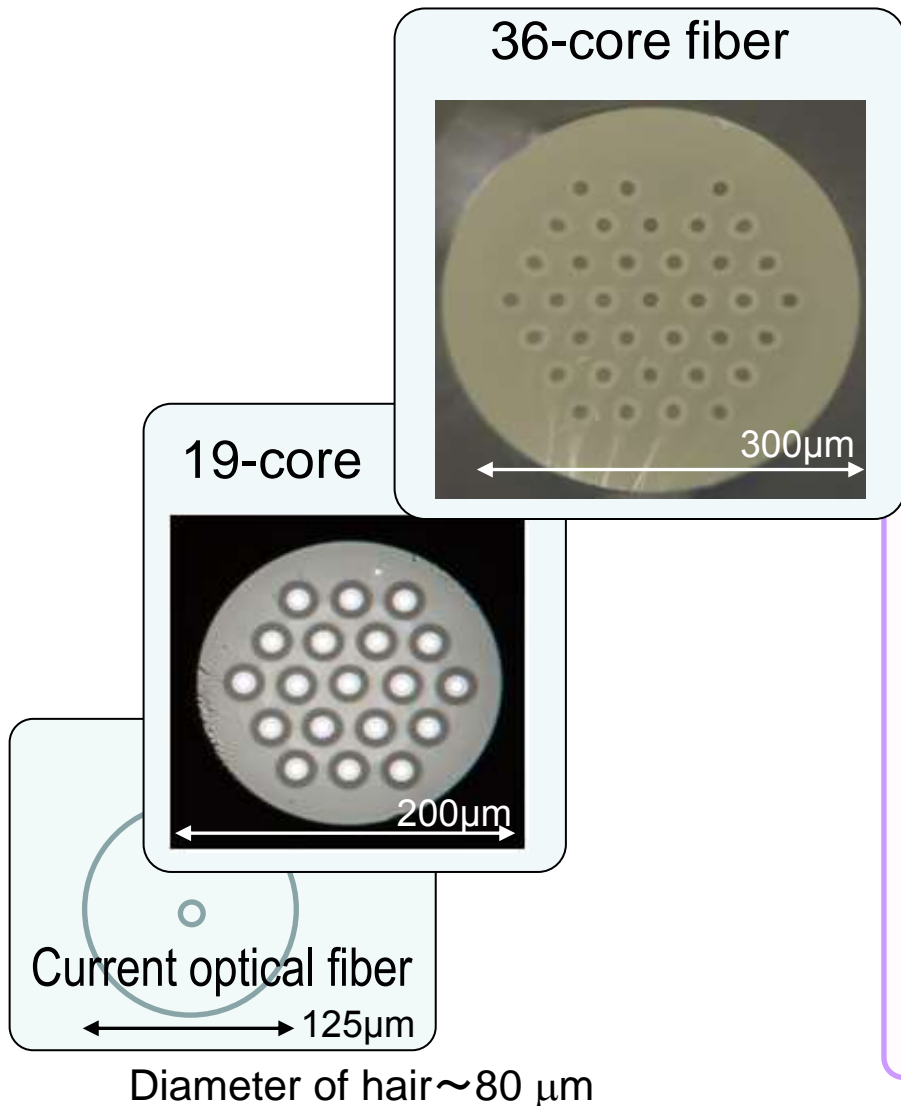
**World Record ! High-speed optical node**

- Large capacity : 12.8 Tbit/1 terminal
- Power consumption: 1.4kW



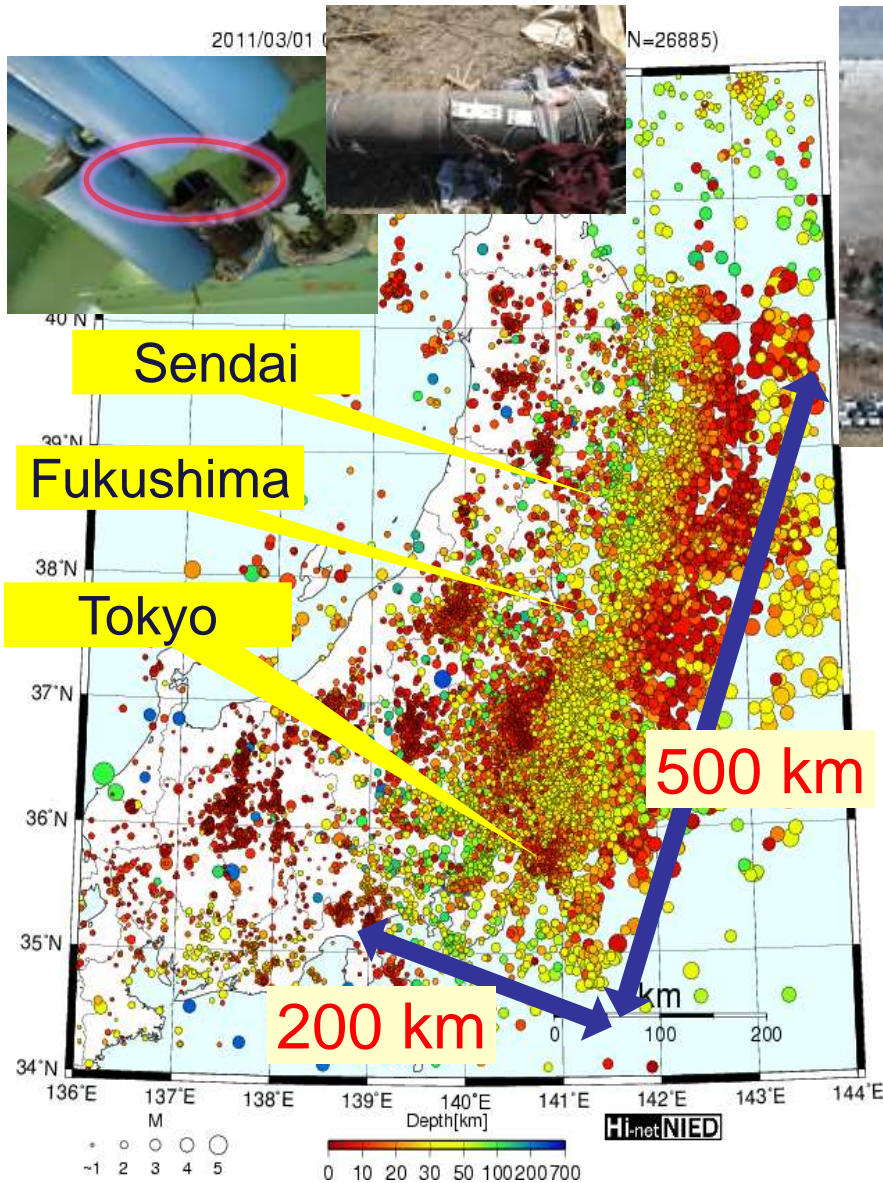
# Multi-core fiber transmission -Challenge for "Exa bps" transmission-

NICT leads fiber competition by multi-core optical fiber transmission technology



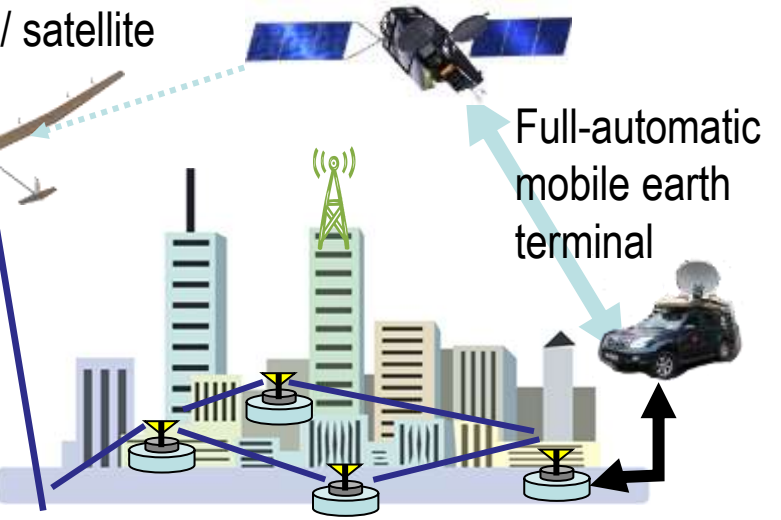
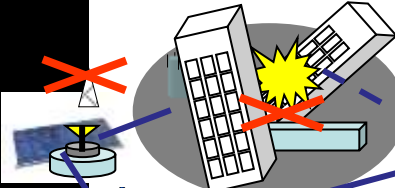
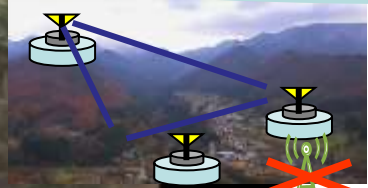


# 2011 Disaster and Endurable ICT

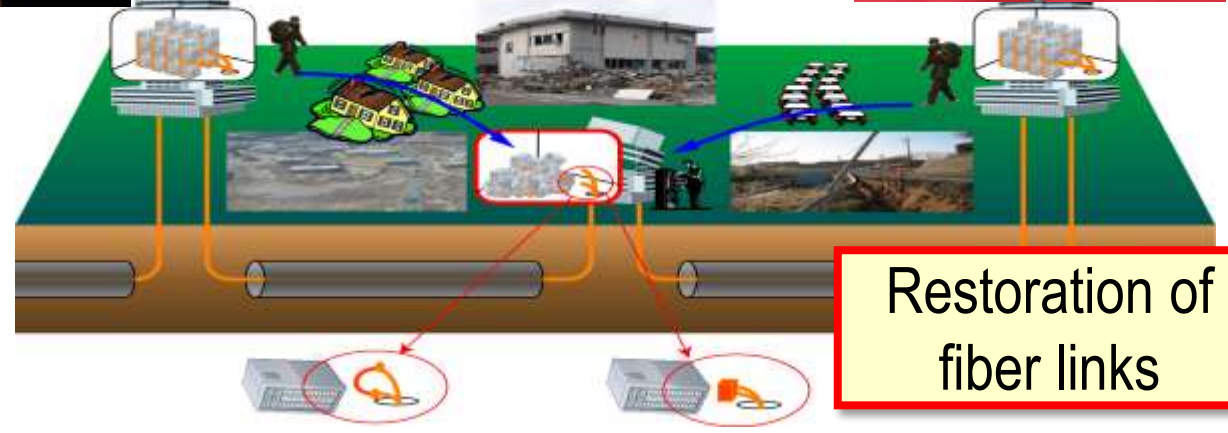
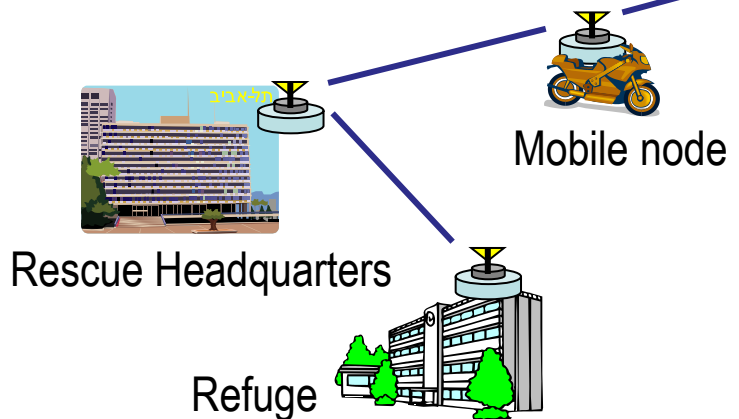


Connecting isolated areas

Flexible bridging networks by UAV / satellite



Portable Optical Amplifier (EDFA)



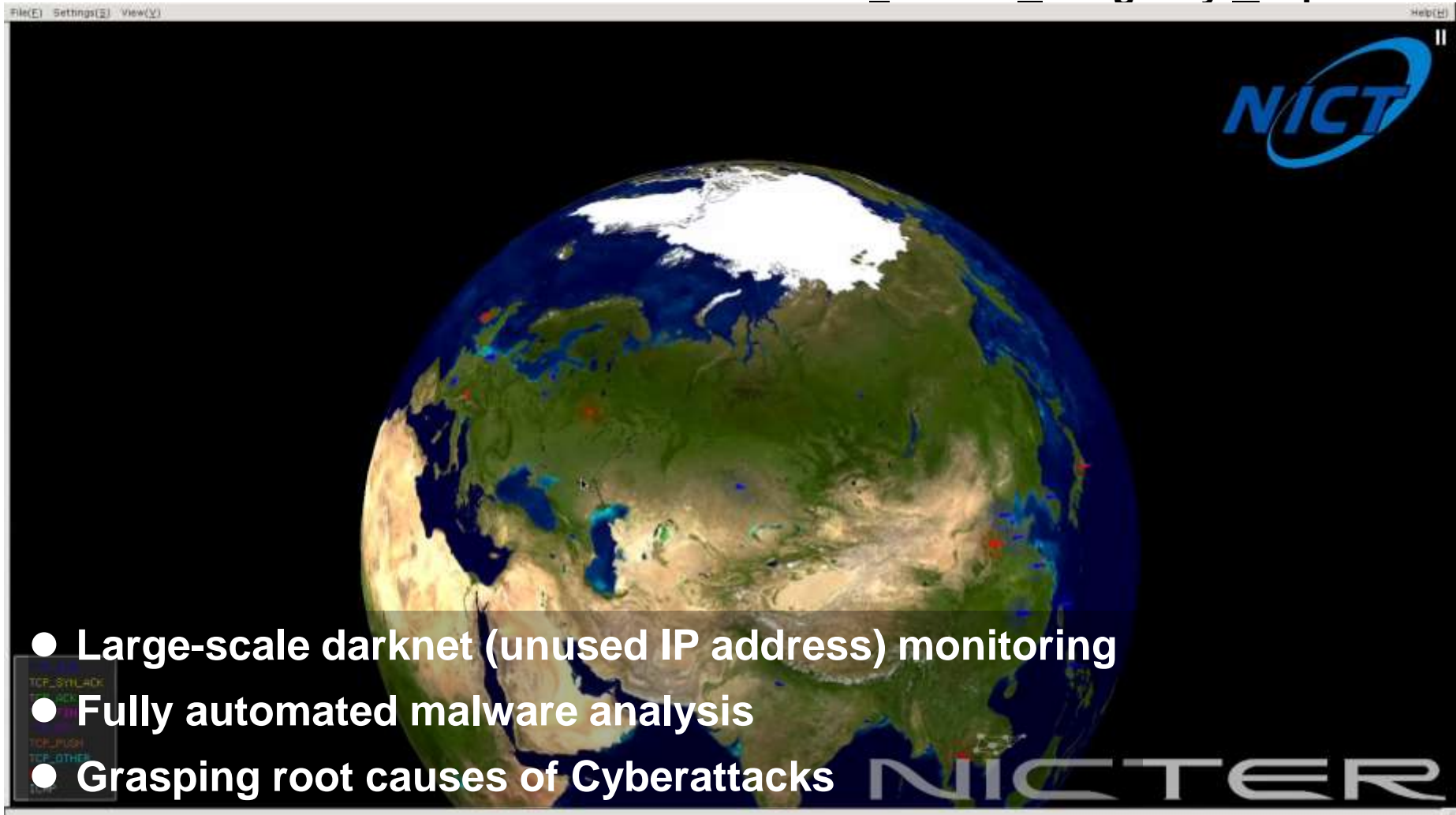
Restoration of fiber links



# Cybersecurity

**NICTER**

**Network Incident analysis Center  
for Tactical Emergency Response**



The screenshot shows a computer window titled "File(E) Settings(S) View(V) Help(H)". The main content is a globe with various colored dots (red, blue, green) indicating network activity. In the top right corner, there is a blue "NICT" logo. In the bottom right corner, the word "NICTER" is written in a large, stylized font. In the bottom left corner, there is a terminal window with the following text:

```
TCP_SYN_ACK  
TCP_RST  
TCP_PUSH  
TCP_OTHER  
TCP
```

- Large-scale darknet (unused IP address) monitoring
- Fully automated malware analysis
- Grasping root causes of Cyberattacks



# Cybersecurity

## DAEDALUS

Direct Alert Environment for  
Darknet And Livenet Unified Security

- Darknet-based real-time alert system
- Detecting internal malware infections by darknet
- Sending alert to infected organizations



# Cyber-security Collaborations in NICT

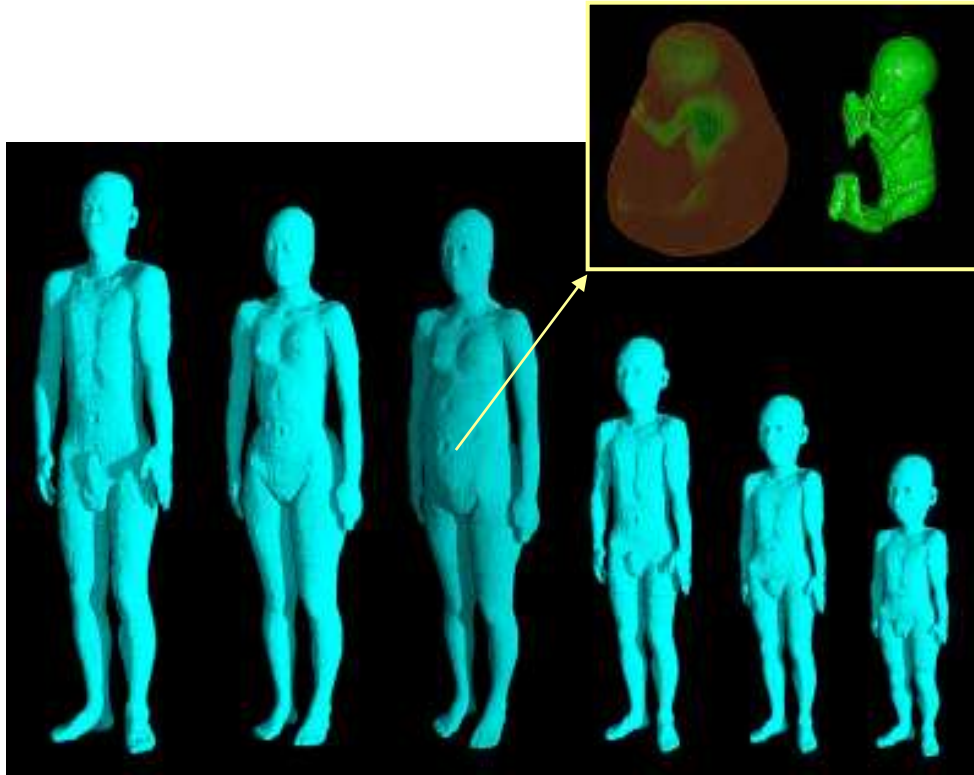
## ● Domestic Collaborations

- ✓ **Global darknet monitoring environment** (>300K addresses) with Japanese universities and enterprises
- ✓ **Over 600 Japanese local governments** (total;1700) joined DAEDALUS
- ✓ Information sharing with **security related organizations** (e.g., NISC, JPCERT/CC, IPA, etc.)

## ● International Collaborations

- ✓ In **JASPER** (Japan ASEAN Security PartnERship) project, DAEDALUS sends alerts to ASEAN countries
- ✓ **Overseas deployment of darknet sensor** for Asia, Oceania and European countries with mutual data exchange
- ✓ **R&D collaborations** and researcher exchange

- Numerical human-body models with the aim of evaluating the safety of radio waves with respect to the human body
- This voxel human **model databases are available to the public**  
[http://emc.nict.go.jp/bio/model/index\\_e.html](http://emc.nict.go.jp/bio/model/index_e.html)



## Review of Computational Anthropomorphic Anatomical and Physiological Models

History, latest advances, current challenges and future prospects for computer models of anatomy and physiological functions are addressed in this review.

By HABIB ZAIDI, Senior Member IEEE, and BENJAMIN M. W. TSUI, Fellow IEEE

**ABSTRACT** | The widespread availability of high-performance computing and accurate and realistic computer simulation techniques has stimulated the development of computational anthropomorphic models of both the anatomy and physiological functions of humans and laboratory animals. These simulation tools have been applied to different medical imaging modalities including ultrasound, single photon emission computed tomography, positron emission tomography, X-ray computed tomography, magnetic resonance imaging, optical imaging, and multimodality imaging with various combinations of the above. This paper reviews the fundamental and technical challenges and future directions of developing computational models of anatomy and physiological functions and their applications to biometry calculations. The computer-generated models represent radiation sources and detectors through biological systems and physics of accurate and realistic anatomy and physiology data obtained from clinical studies. These simulations are increasingly important in biomedical imaging and

### 1. INTRODUCTION

The development of advanced methods for the design of computational models that represent the human and laboratory animal anatomy and physiology has been one of the most active areas of research in molecular imaging and radiation dosimetry [1]. Such computational models are used extensively to derive dose conversion parameters in



Fig. 4. Variable posture model development from a statistically realistic voxel model with upright standing posture (© courtesy of T. Nagasaki, National Institute of Information and Communications Technology, Japan).

Translation between 31 languages. Download and use for free. Main targets are sightseeing, medical, and shopping services.

Speech recognition

Translation results

Result confirmation

週末は予定がありますか?  
(Do you have any plans for this weekend?)

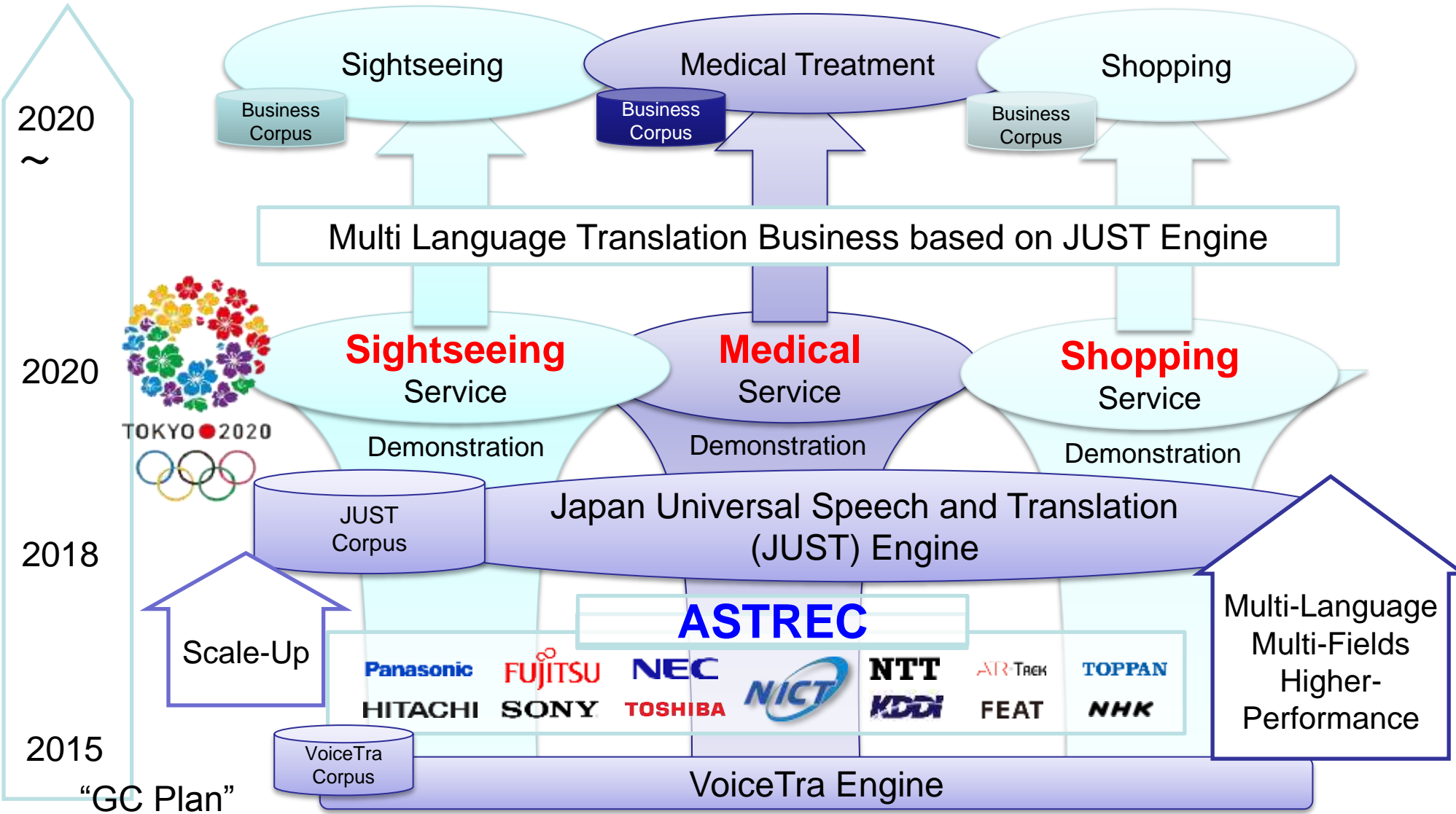
# Universal Speech Translation Adv. Res. Consortium (U-STAR)

AI and Network-based speech-to-speech translation with the aim of breaking language barriers around the world. Over 30 research Institutes in 23 countries





Overcome the Boundaries of Language  
Speech-to-Speech Translation for 2020 Tokyo Olympic Paralympic





# High-function measurement system in CiNet Academic Alliance; Brain Science



Center for Information and Neural Networks (Suita; Osaka Univ.)



NICT Advanced ICT Institute (Kobe)

Suita

Kobe



7T-MRI



3T-MRI



MEG



3T-MRI



1.5T-MRI



MEG

MRI: Magnetic Resonance Imaging  
MEG: Magneto Encephalo Graphy

Other: Near Infra- Red Spectro-scropy (NIRS)、Electroencephalograph (EEG)、  
Trans-cranial magnetic stimulation (TMS)

Presented clip

Brain activity by f-MRI



Future : Decoding imagination in brain to help communications  
One of the solutions for **Aging society problems**.

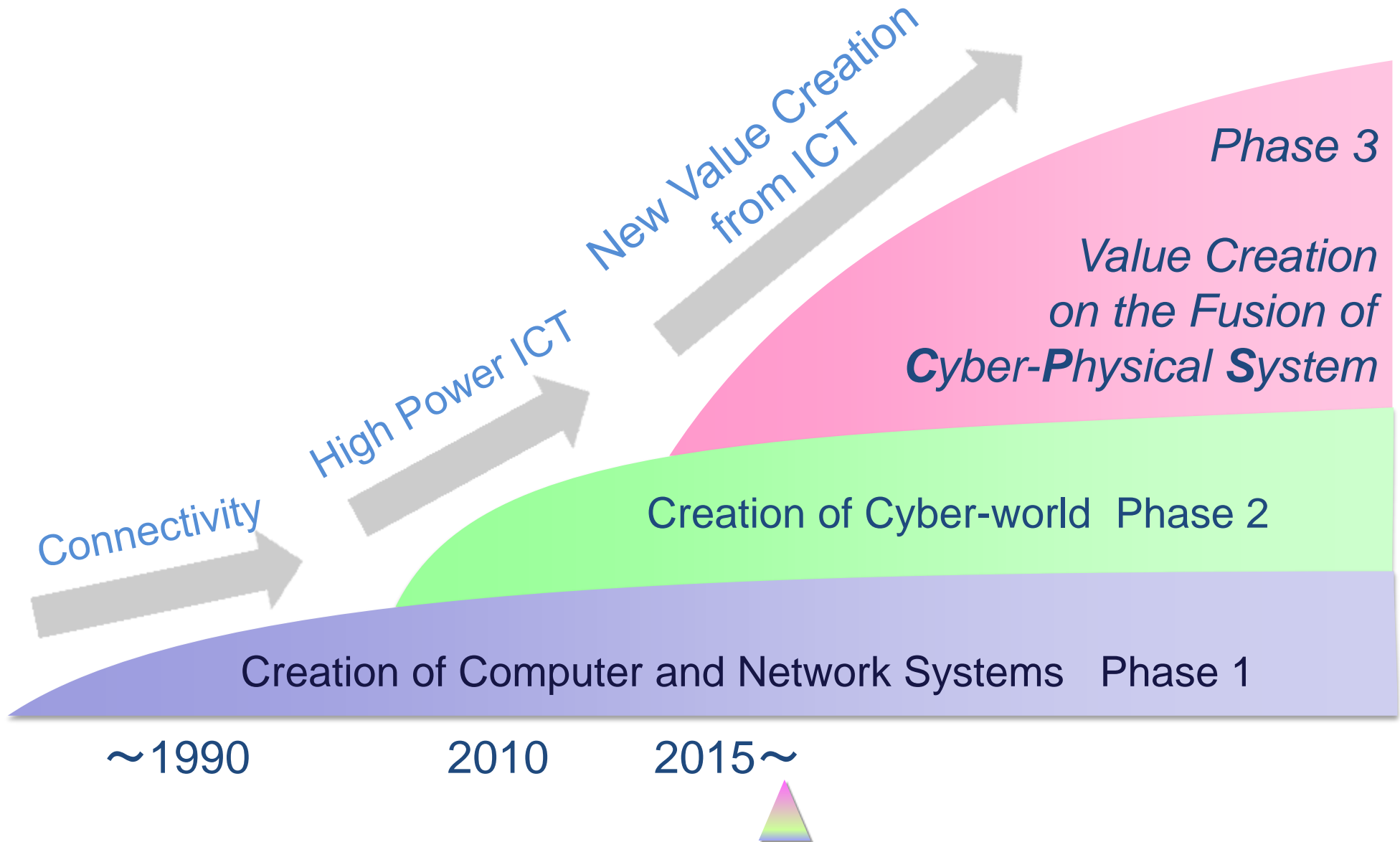
Presented clip



Clip reconstructed from brain activity



# History and 3rd Paradigm of ICT



# Phase 1; ICT Innovation Prestige from Technology

**Good technology attracts mass users**

R & D



New Products & Service



Society

**Good chef attracts  
good guests**

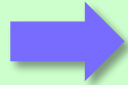
**Quality Restaurant  
Style Innovation**

**Paradise of S&T !**

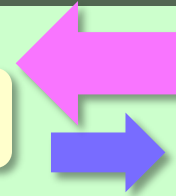
## Phase 2; Another Innovation Prestige from Internet

**Users select the good Services**

R & D



New Products & Service



Society

**Guests select  
good foods**

**Food-Court or  
Home-Party Style  
Innovation**

**Users Selection**

Phase 3; Cyber-Physical System, M2M, e-..., Smart ..., IoT, etc.



- *Social issues have **d**irectly connected to R&D*
- *Field oriented and Personal Service dominant innovation*

Wide variety of guests in Asian market

Sushi-Counter Style Innovation





# Open ICT Innovation Platform by NICT *The Institute of Opportunity*



**REAL WORLD**

**SENSING & NETWORK**

**SPIRAL!**

**VALUE CREATION, ACTUATION**

**SECURITY PRIVACY**



**CYBER WORLD  
BIG-DATA SYSTEM**



**New ICT Services by the Sushi-counter style innovation**

Chef  
President  
Prof. Tokuda

**Social Issues  
Potential Needs  
Feedback to  
R&D**

**Future Possible  
World**

Collaboration  
Open Mind/Innovation  
Challenger's Spirit

**GLOBAL / DOMESTIC**



**Academia**

Ingredients / foodstuffs  
Technologies / Big Data



**Small Business**

**Big Business**

**Government**

# Social ICT R&D and Global Collaboration

【□】 Funding / Collaboration

- 【Disaster Prevention】
- 【Medical / Health Care】
- 【Smart City】
- 【Preservation】
- 【Education】
- 【Agriculture / Food】

【○】 Mobile Wireless Test Bed

- 【Disaster Prevention】
- 【New Business】
- 【Preservation】
- 【Agriculture / Food】

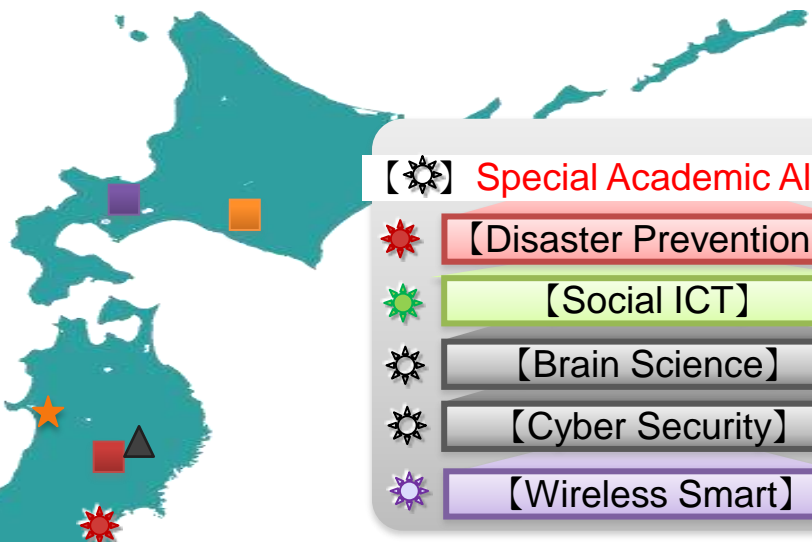
【☀】 Special Academic Alliance

- ☀ 【Disaster Prevention】
- ☀ 【Social ICT】
- ☀ 【Brain Science】
- ☀ 【Cyber Security】
- ☀ 【Wireless Smart】

【☆】 G-Space Platform

- ★ 【Disaster Prevention】
- ★ 【Agriculture / Food】

【△】 Local Government Collaboration



- EU R&D co-funding Cooperation
- US NSF co-funding Joint Research Program
- ASEAN ICT Virtual Organization



# ASEAN IVO and Social ICT



【Social ICT】

【Smart City / Home】

【Smart Wireless】

【Cyber Security】

【New Business】

【Education】

【Medical / Health Care】

【Agriculture / Food】

【Preservation】

【Disaster Prevention】

【Tourism】

【Environment Protection】





# ASEAN IVO Members as of Nov., 2017

## Myanmar

UCSY



## Laos

NUOL



## Japan

NICT



## Thailand

CHE, Chulalongkorn U., CMU, KMITL, NECTEC, NIMT, TNI



## Philippines

Mapua University



## Malaysia

MIMOS, UTM, UPM



## Cambodia

NIPTICT



## Vietnam

DUT, HUST, IOIT, PTIT, UIT-HCM, VNU-IFI, VNU-UET, VNU-ITI



## Singapore

I²R, NTU, NUS, SingAREN, SUTD



## Indonesia

BPPT, ITB, LIPI, Tel-U, MCIT



## Brunei

UBD, UTB



We are now in front of “Social Big Data”  
未知遭遇

*Unknown Future Society and  
Natural Phenomena*

**Charming ICT**  
**+ Open & Challenging Innovation**

***For World Human Happiness  
and Endurable ICT***

***Let's Start  
Friendly Communication for  
Cooperative Innovation***

**Thank you very much  
For your kind attention**

ご静聴感謝いたします

**<http://www.nict.go.jp/en/>**

