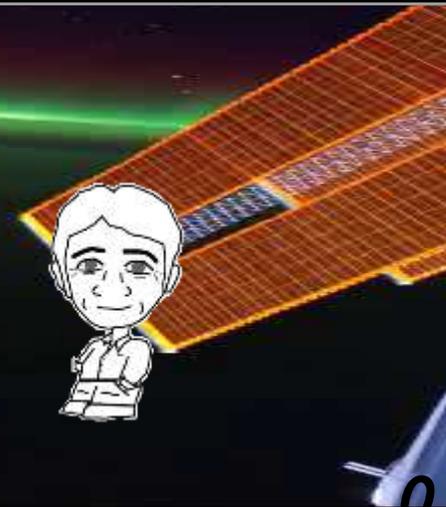# Open and Global ICT Innovation Platform for Future Smarter Communication World

@ NICT: National Institutes of Information and Communications Technology

February, 2015

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

Role of the National Institutes of ICT (NICT)

ICT for Sustainable World Human Happiness

The sole national research institute in the field of information and communications technologies (ICT) in Japan

5 min.

- Promoting its own research and development
- Cooperating with and supporting industry and academia

President Dr. Sakauchi

**Budget :
~ 29 Billion Yen + α
(~$250 Million + α)**

**Personnel: 984
（Researchers: 555,
PhDs: 459)**

as of Nov. 2014

**Industry/Academia/Government
Open Platform**

National ICT Policy

Public Services
- Japan Standard Time
- Space Weather Forecast
- Wireless Equipment Testing & Calibration

Phase 1 (- 1990):
Creation of Computer and Network Systems
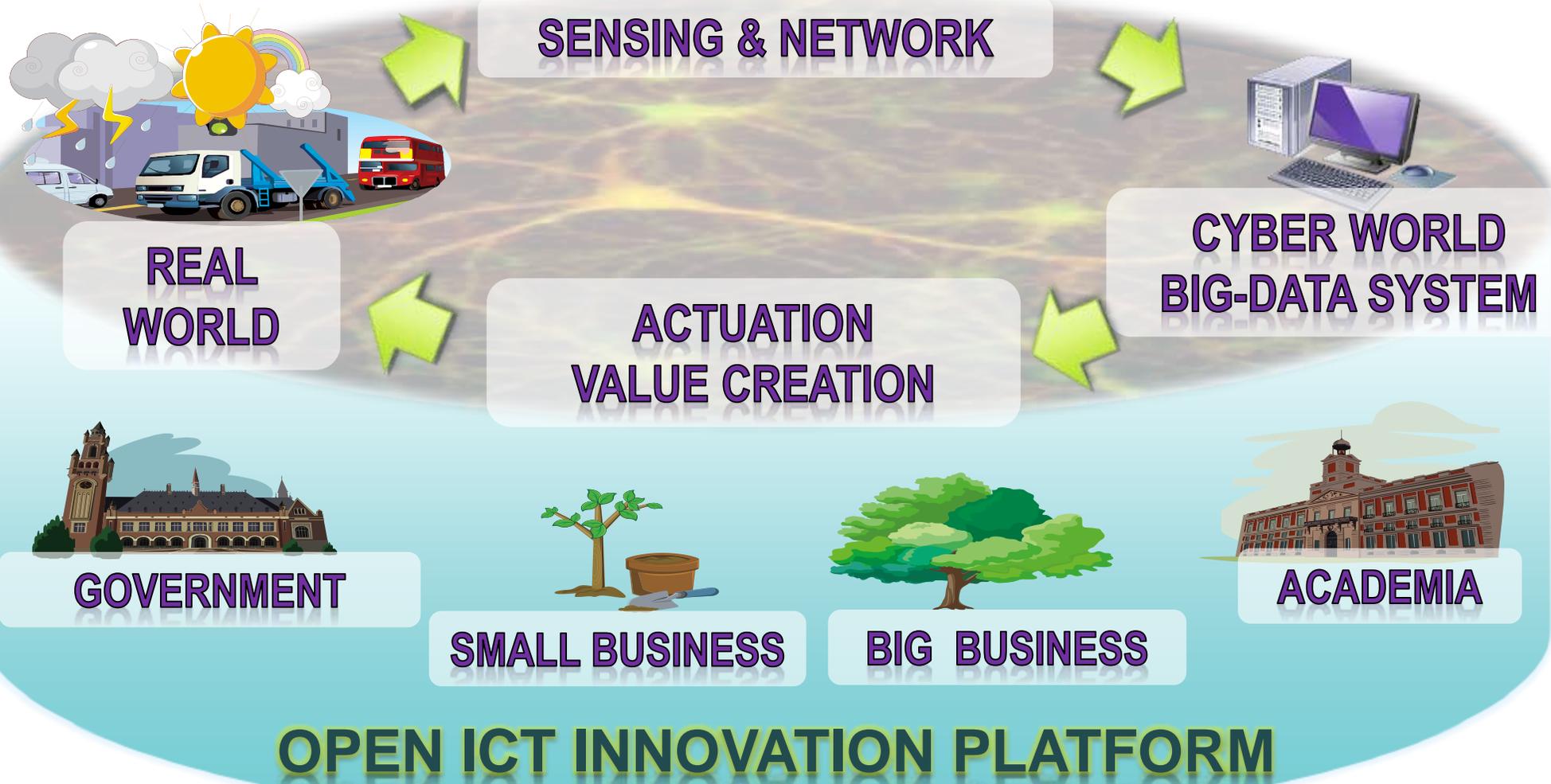
Phase 2 (1990 – 2010):
Creation of Cyber-world

Phase 3 (2010 -):
Value Creation on the Fusion of Real World & Cyber World

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

ICT for Sustainable World Human Happiness

R & D → New Products & Service → Society

- *Social issues have directly connected to R&D*
- *Field oriented innovation and wide variety of users*

ICT penetration into the society

Open ICT Innovation Platform
For Quality of Life

SENSING & NETWORK

REAL WORLD

ACTUATION VALUE CREATION

CYBER WORLD BIG-DATA SYSTEM

GOVERNMENT

SMALL BUSINESS

BIG BUSINESS

ACADEMIA

OPEN ICT INNOVATION PLATFORM

Social ICT Collaboration

ICT for Sustainable World Human Happiness

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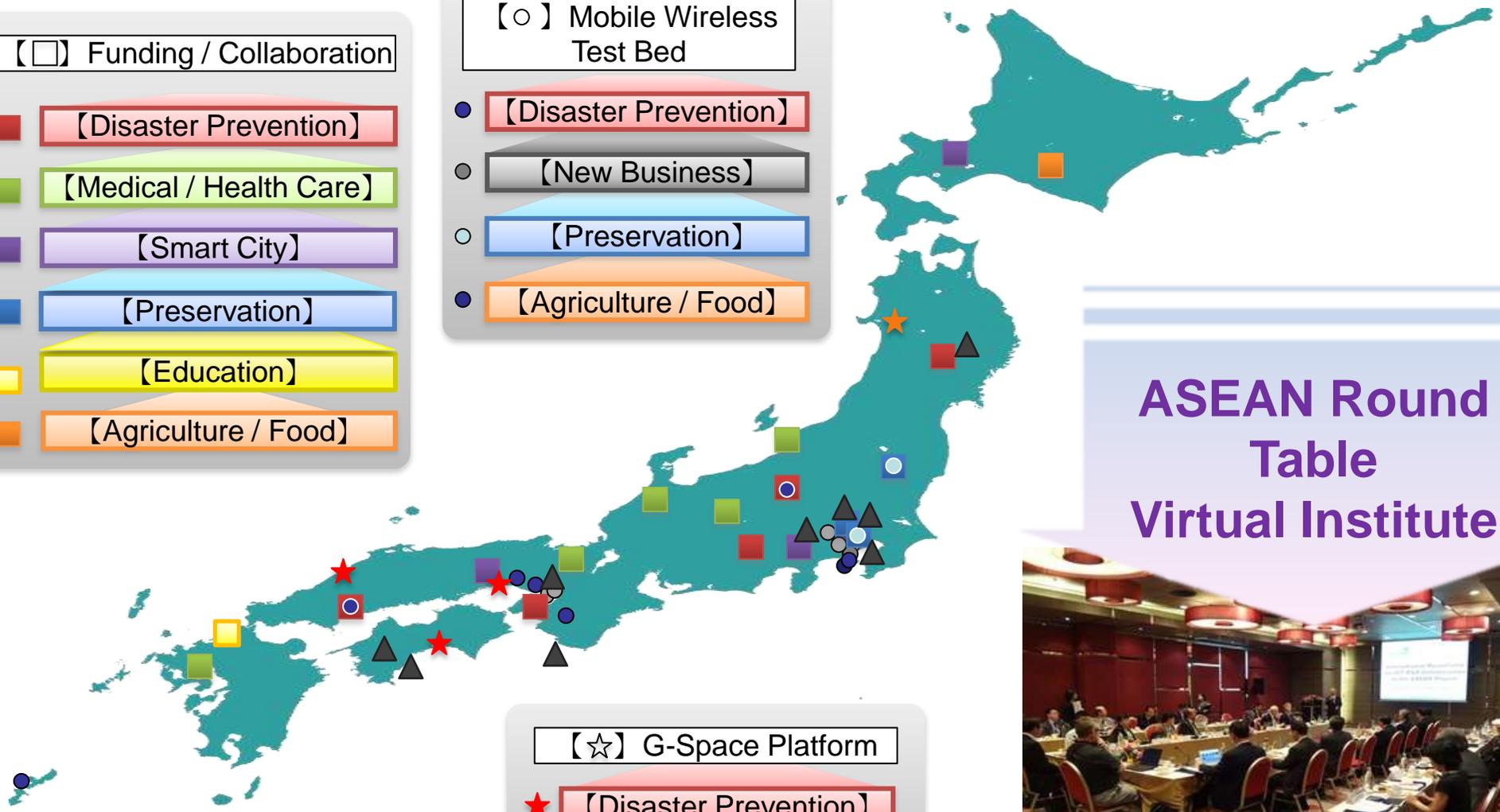- 【Preservation】
- 【Education】
- 【Agriculture / Food】

【○】 Mobile Wireless Test Bed
- 【Disaster Prevention】
- 【New Business】
- 【Preservation】
- 【Agriculture / Food】

【△】 Collaboration with Local Government

【☆】 G-Space Platform
- 【Disaster Prevention】
- 【Agriculture / Food】

ASEAN Round Table Virtual Institute

NICT

ICT for Sustainable World Human Happiness

Sensing and Network Technologies

Information Analysis Big data system
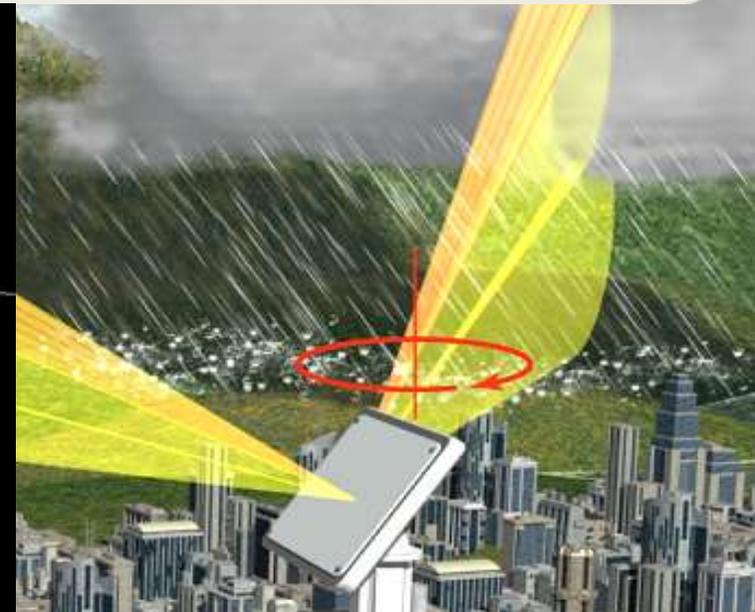
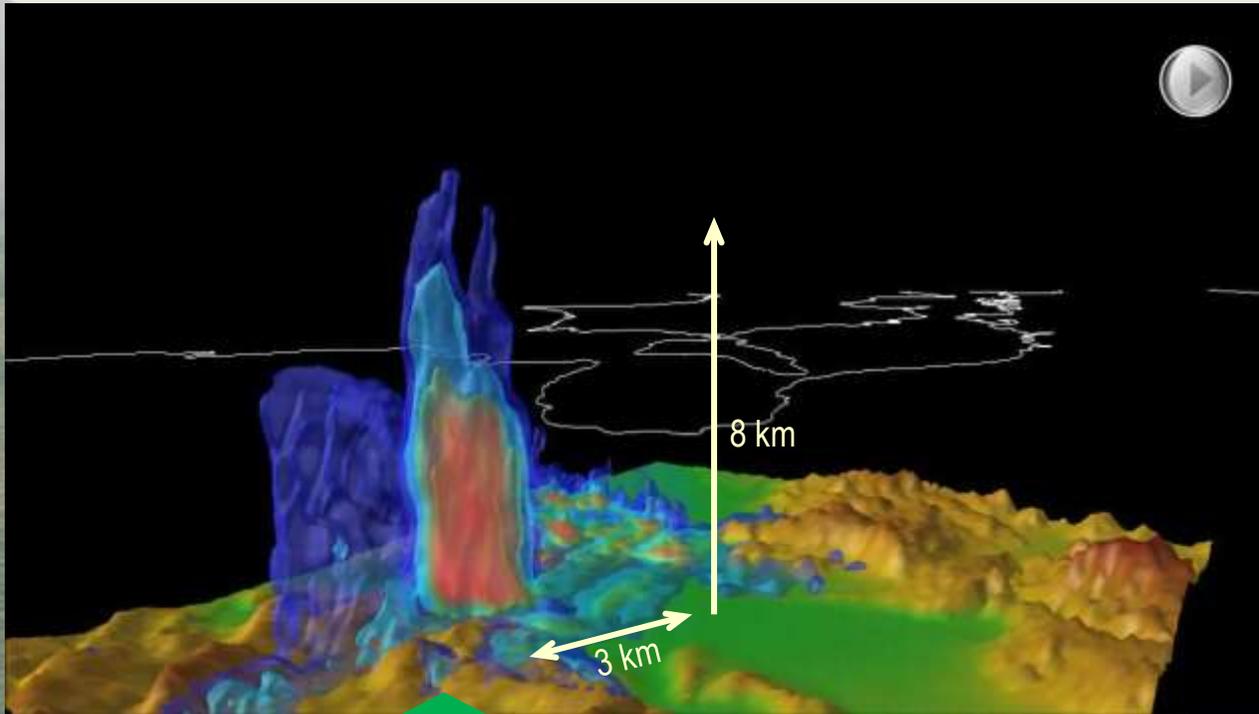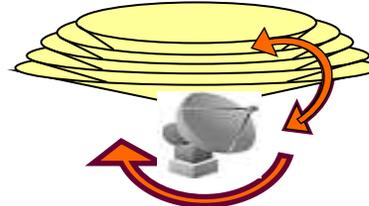**Security and Privacy**

Advanced ICT (Future ICT)
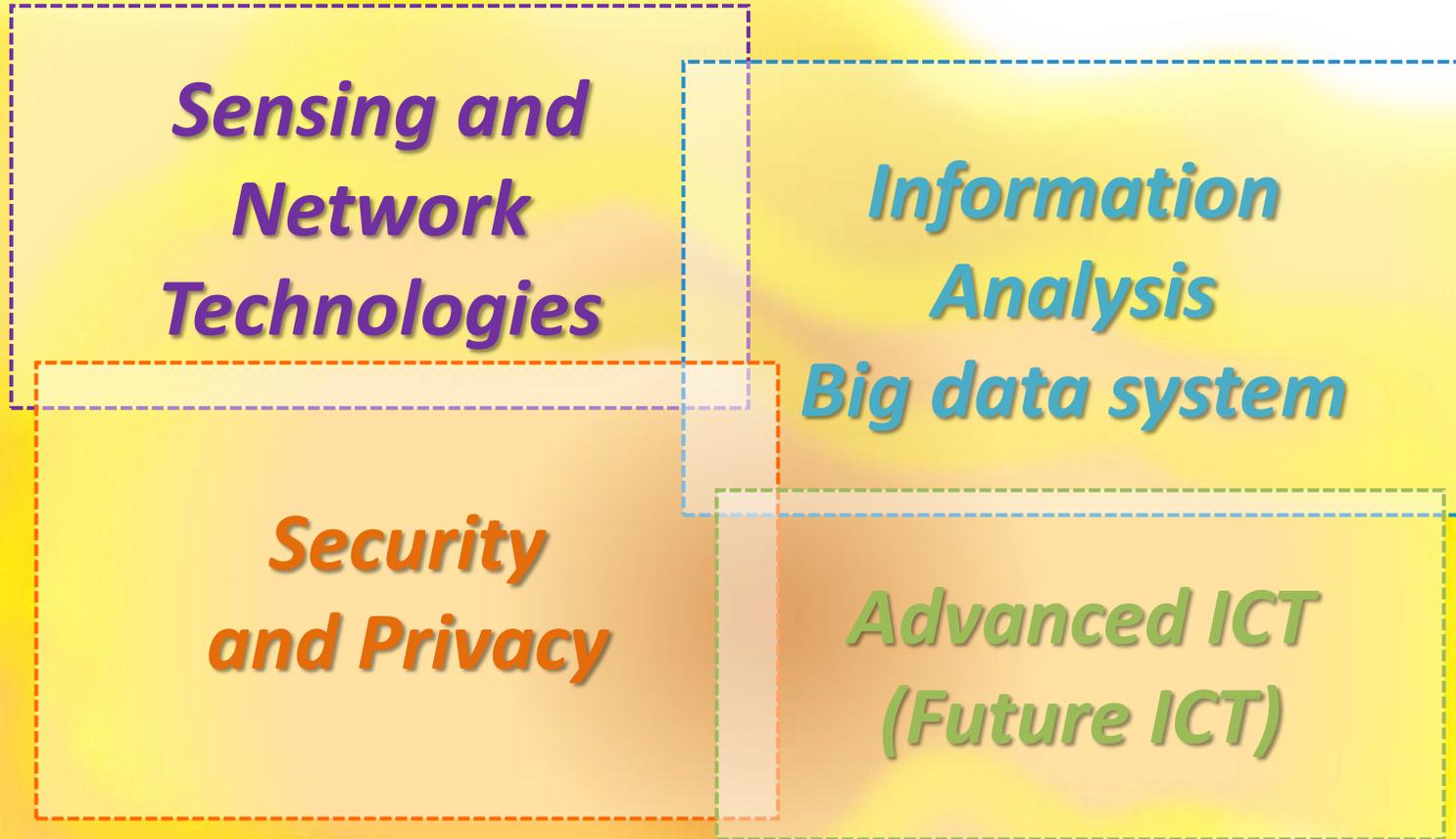
~ *Amoeba Model*

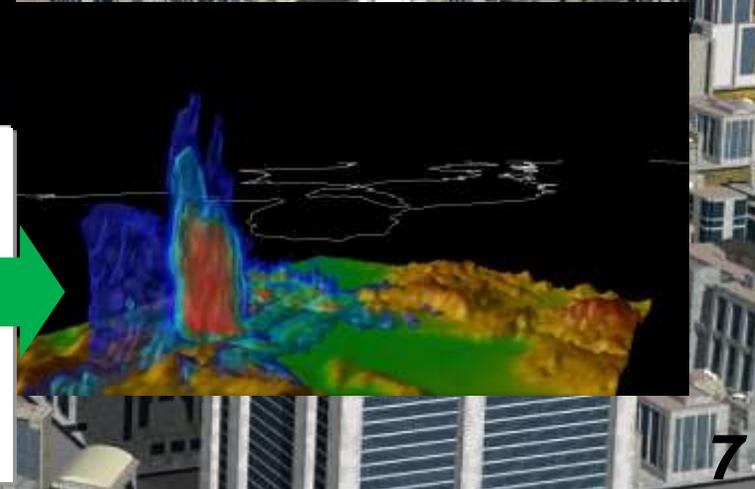# Next-Generation Phased Array Weather Radar

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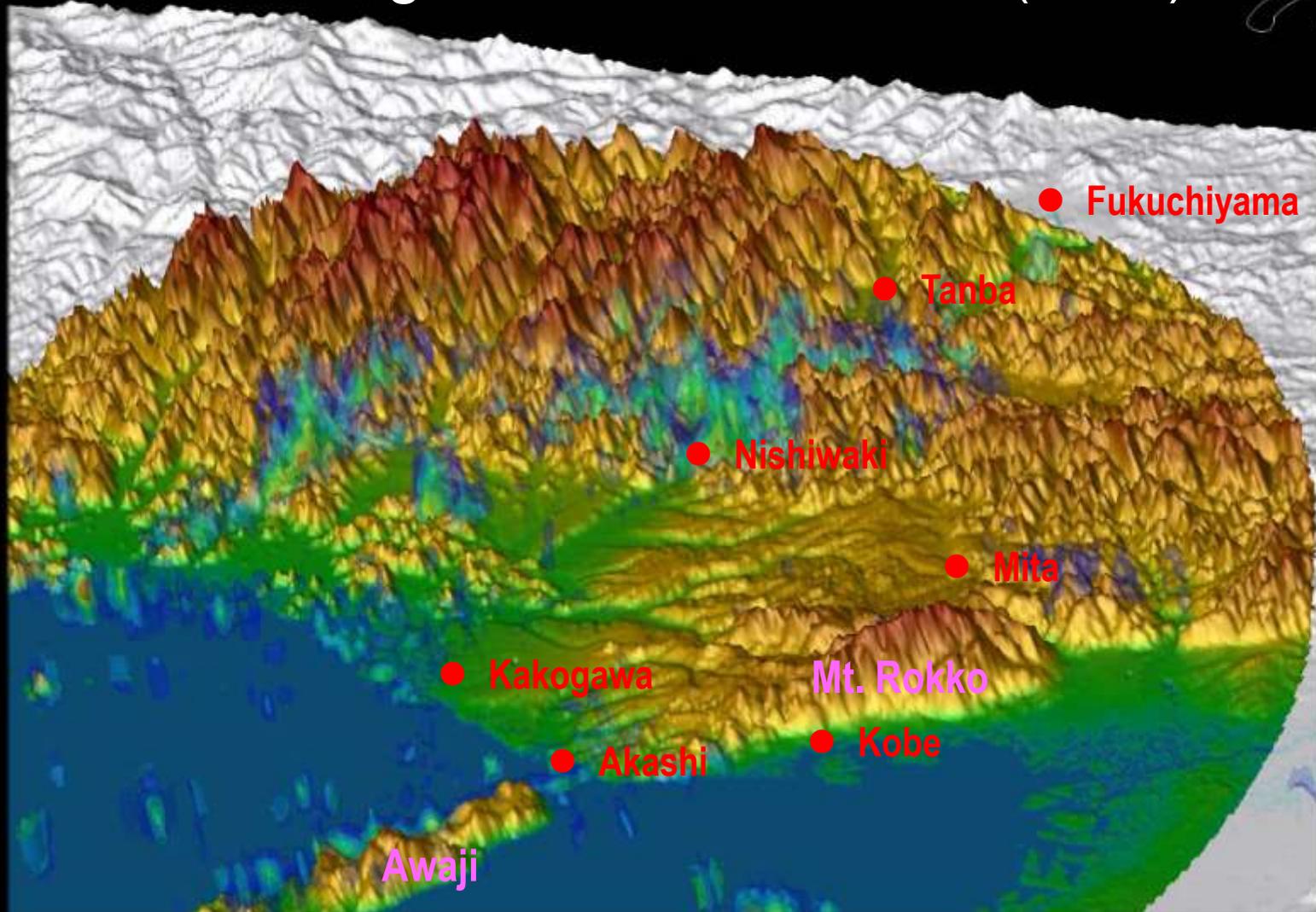- Prediction of sudden and localized meteorological phenomena

8 km

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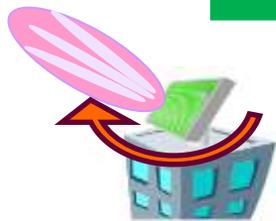
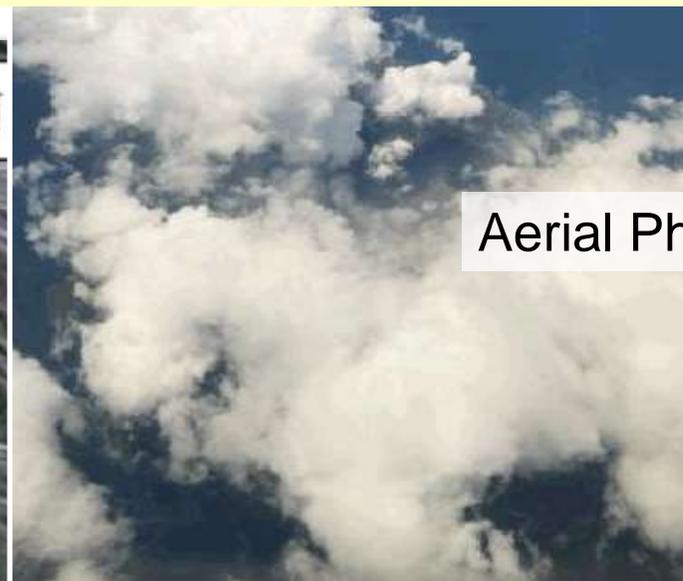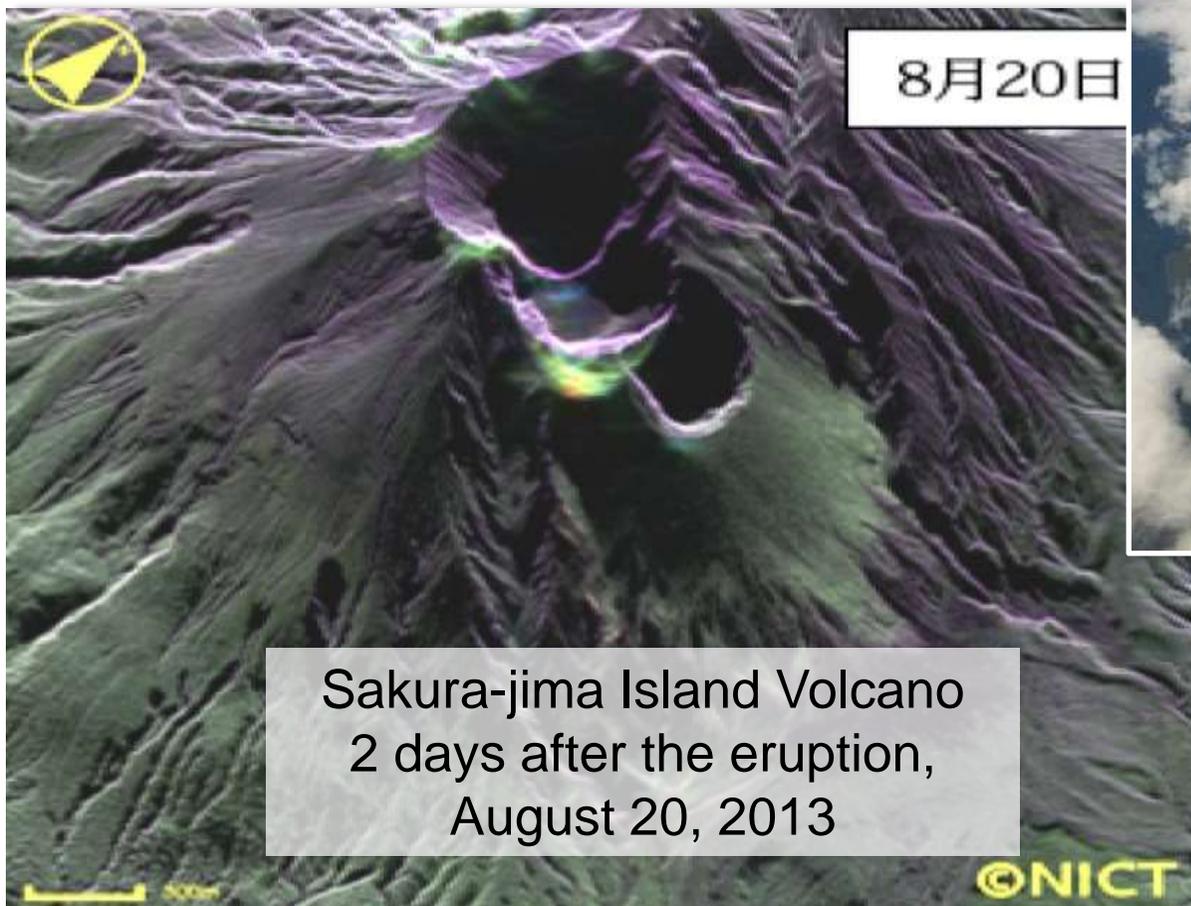Phased Array Radar: **10-30 sec**.

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

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

Volcano Observation by Pi-SAR2

Precise (30cm) polarimetric color image can be transferred to the ground facility in **10 mins.** with new onboard data processor and satellite data link for Pi-SAR2.

*It used to take **several hours** after the observation.*

8月20日

Aerial Photo

Sakura-jima Island Volcano
2 days after the eruption,
August 20, 2013

©NICT

Pi-SAR2

Ground Photo

Wireless Smart Utility Network (Wi-SUN)

ICT for Sustainable World Human Happiness

World's First Small-Sized and Low-Power "Radio Device" Compliant with Smart-Meter Standards of "ECHONET Lite" and "Wi-SUN"
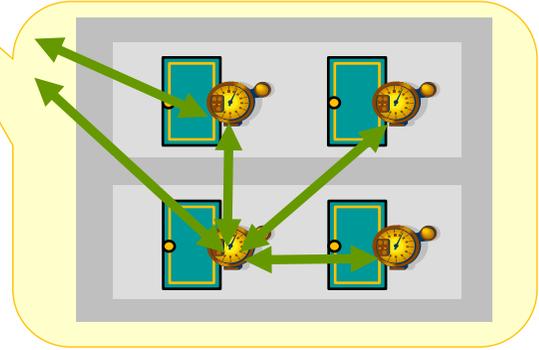
Wi-SUN will Expand to the Sensor Network World

Social Cloud

Wireless Module (2cmX4cm)
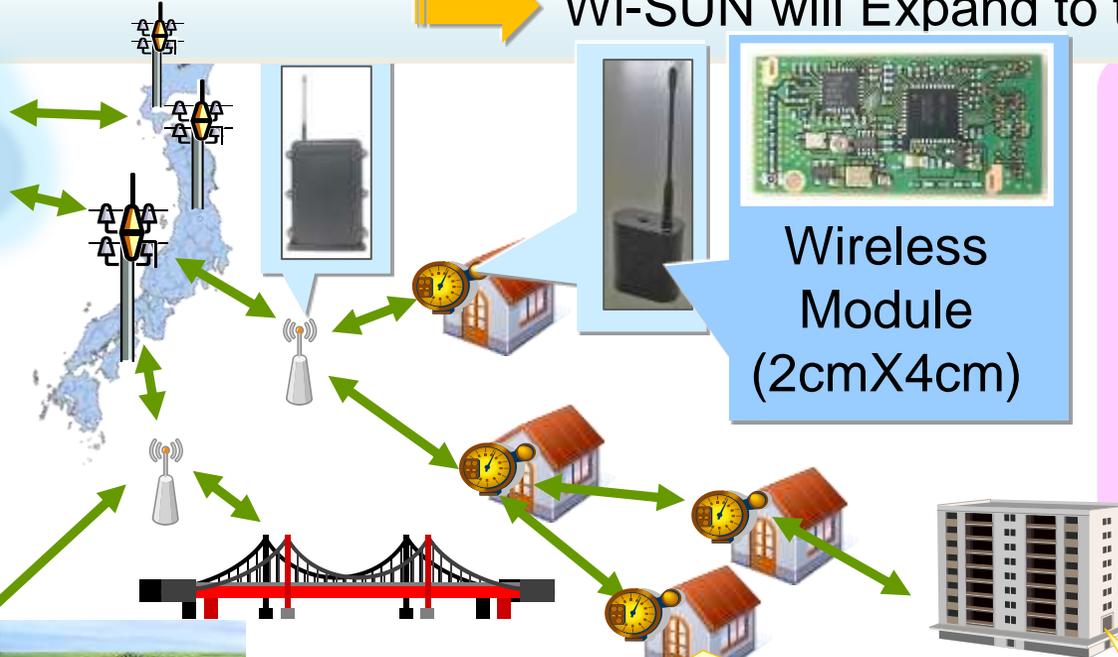
More than 10-year operation driven by an AA battery

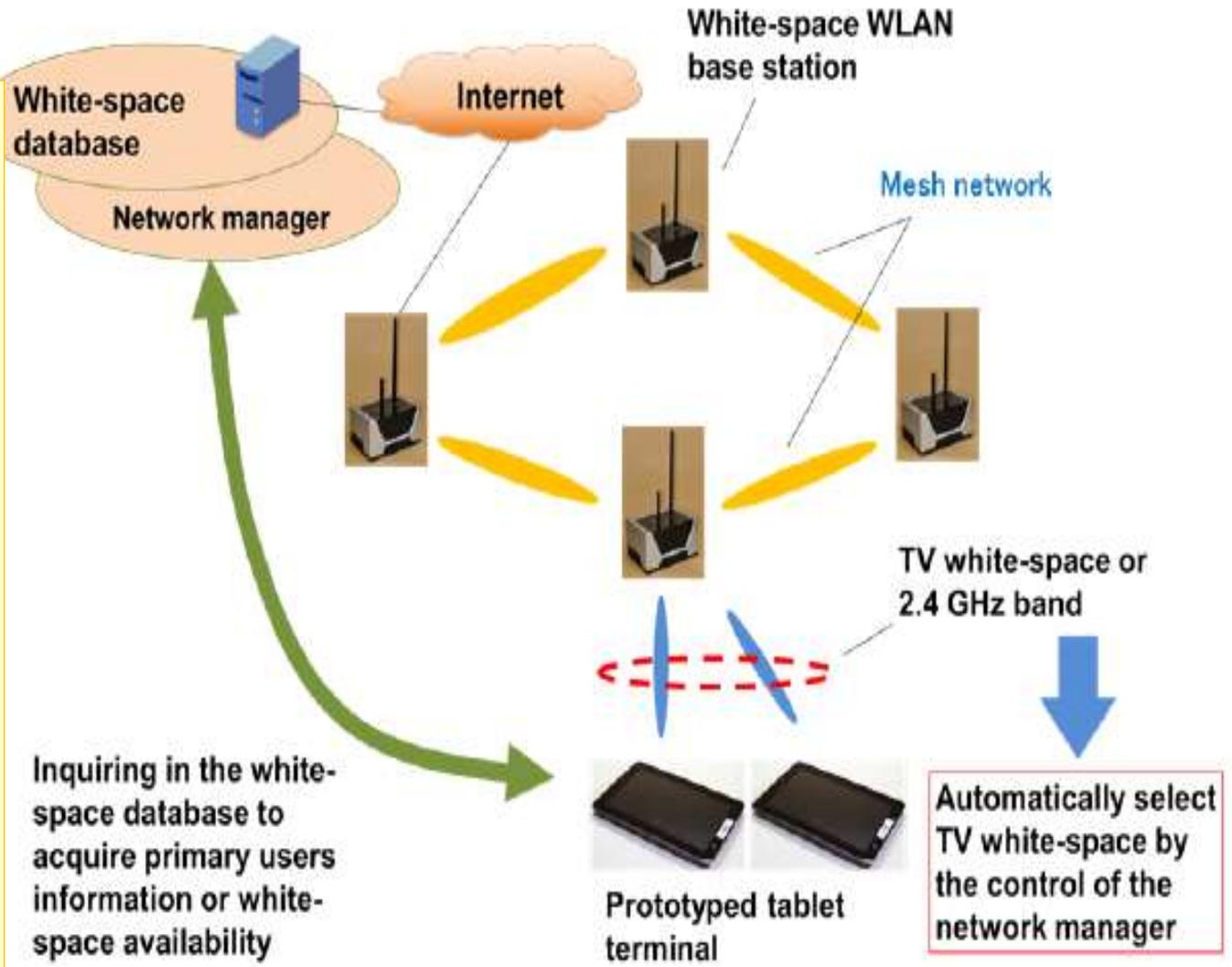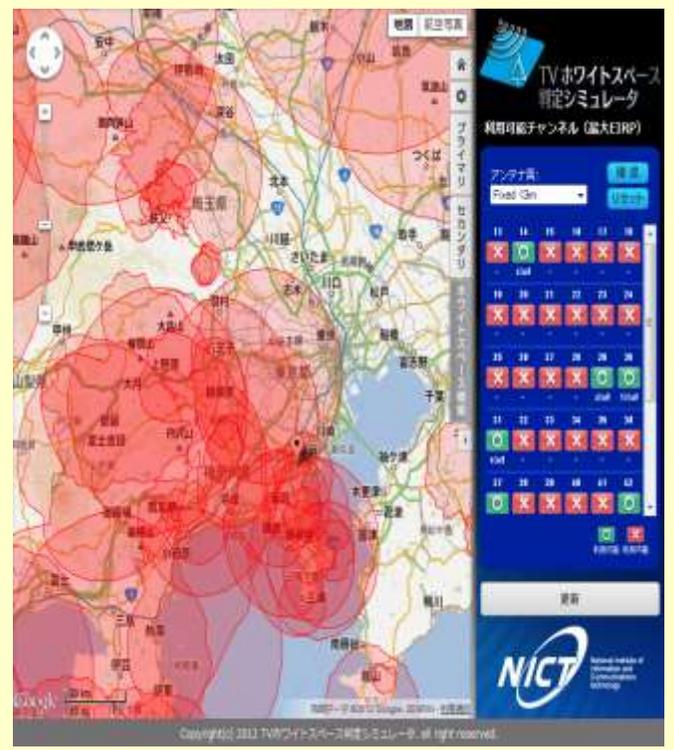**Communication range is expanded by multi-hop transmission**

**More than 50B Sensors**

Agricultural Wireless Sensor System

Cognitive
Wi-SUN router

Available channels or frequencies as white-spaces for secondary users. **Applicable to any countries' rule**.

White-space database
Network manager

Internet

White-space WLAN base station

Mesh network

TV white-space or 2.4 GHz band

Inquiring in the white-space database to acquire primary users information or white-space availability

Prototyped tablet terminal

Automatically select TV white-space by the control of the network manager

Space Broad-Band and Ocean Broad-Band

ICT for Sustainable World Human Happiness

Collaborative team of JAMSTEC and NICT succeeded ROV (Remotely Operated Vehicles) remotely operated test from land using high-speed satellite communication for the first time in the world.
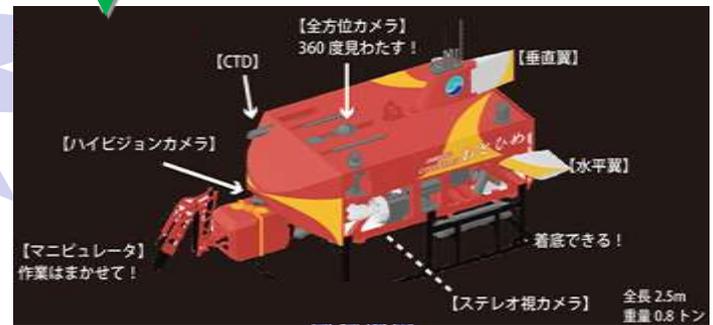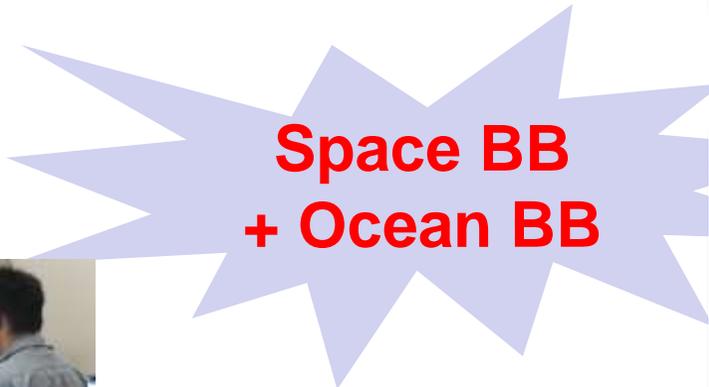
WINDS: High-Speed Internet Satellite ～1.2Gbps

Hi-Vision Real-time monitoring
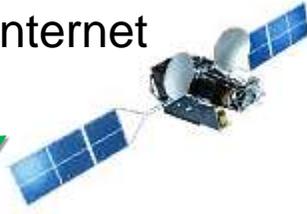
Underwater Operations Vessel "KAIYO" ©JAMSTEC

Space BB + Ocean BB

Real-time Operations

Deep sea remotely operated vehicle OTOHIME ©JAMSTEC

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Photonic Network Research

Network Architecture + Network System + Light-wave Devices Technology towards the realization of new-generation networks

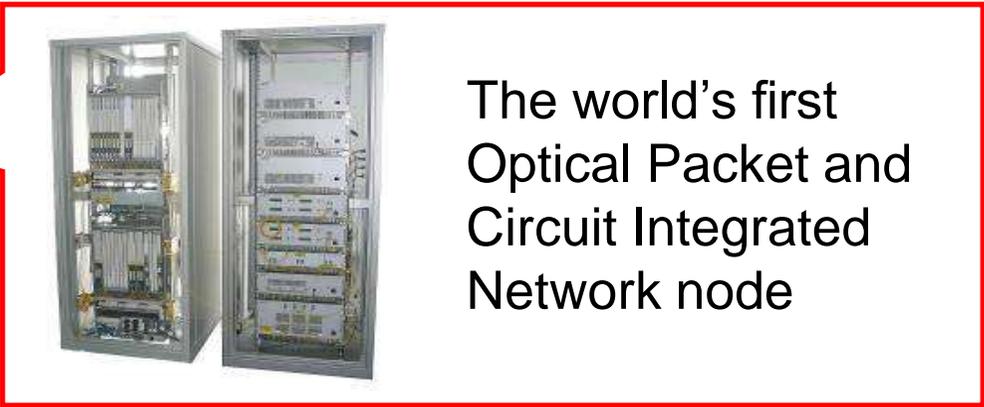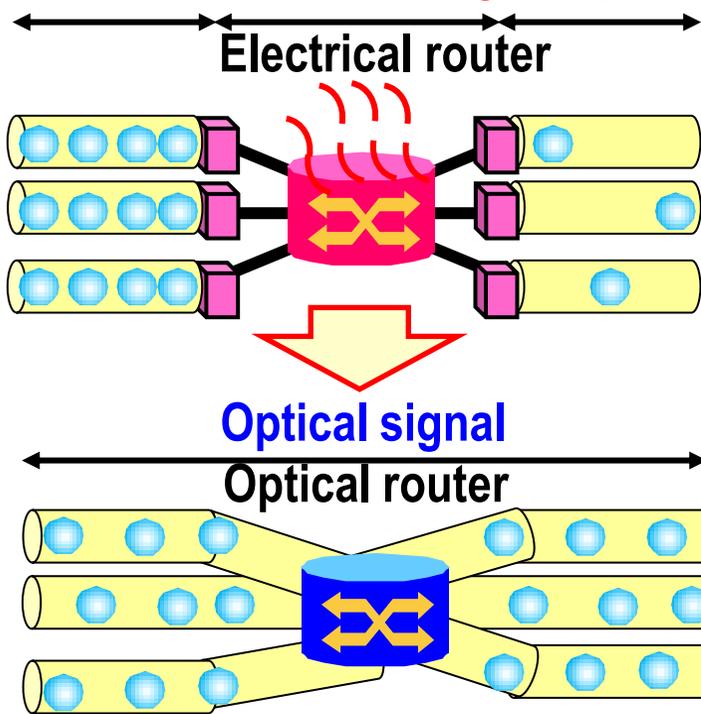large-capacity, power-saving, low-latency, highly reliable network

Optical signal **Electrical signal** **Optical signal**

Electrical router

Optical signal
Optical router

100Gbit/s DSP ➡ **400G DSP** ➡

Limit of SMF 100Tbit/s
➡ **1Pbit/s Multi Core F** ➡
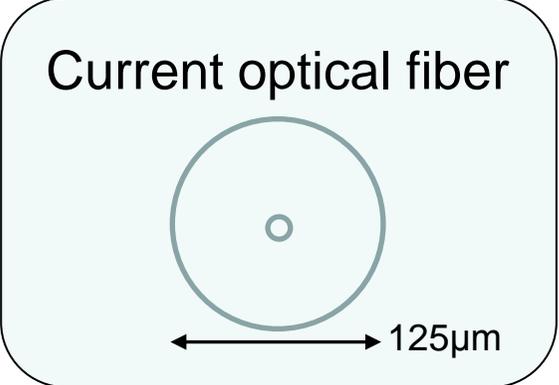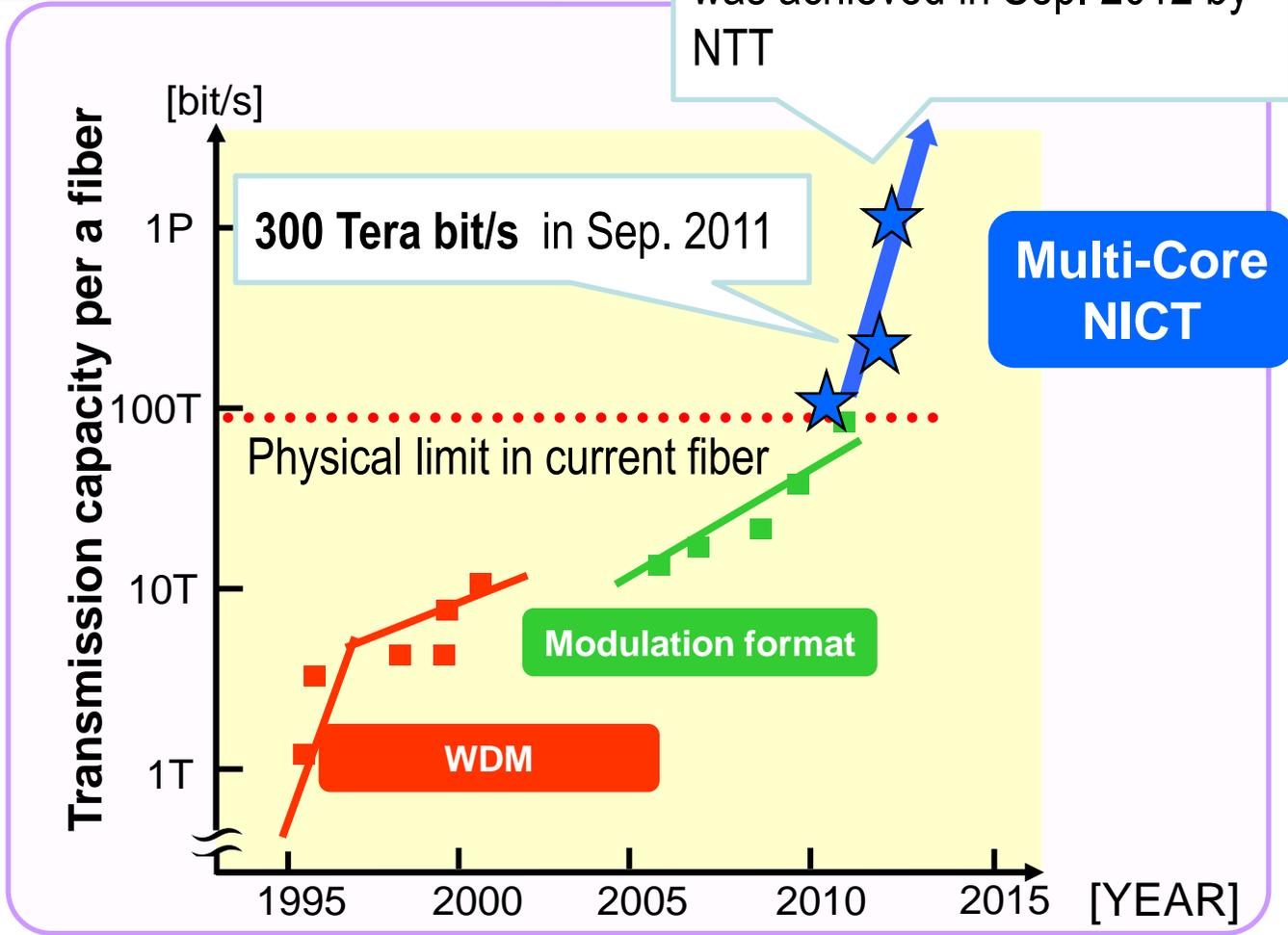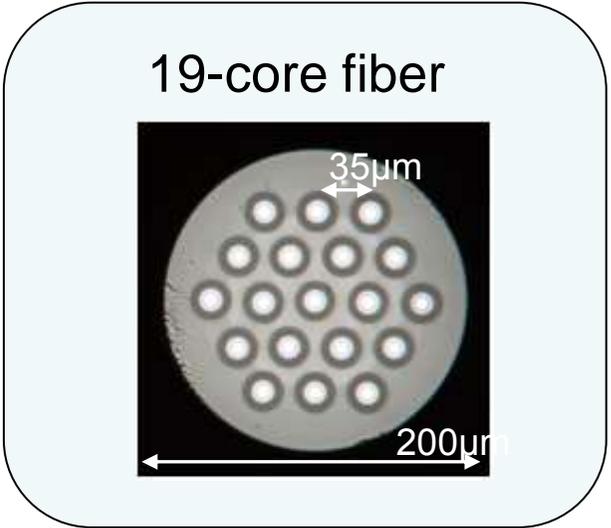
DSP: Digital Signal Processor
SMF: Single Mode Fiber

The world's first Optical Packet and Circuit Integrated Network node

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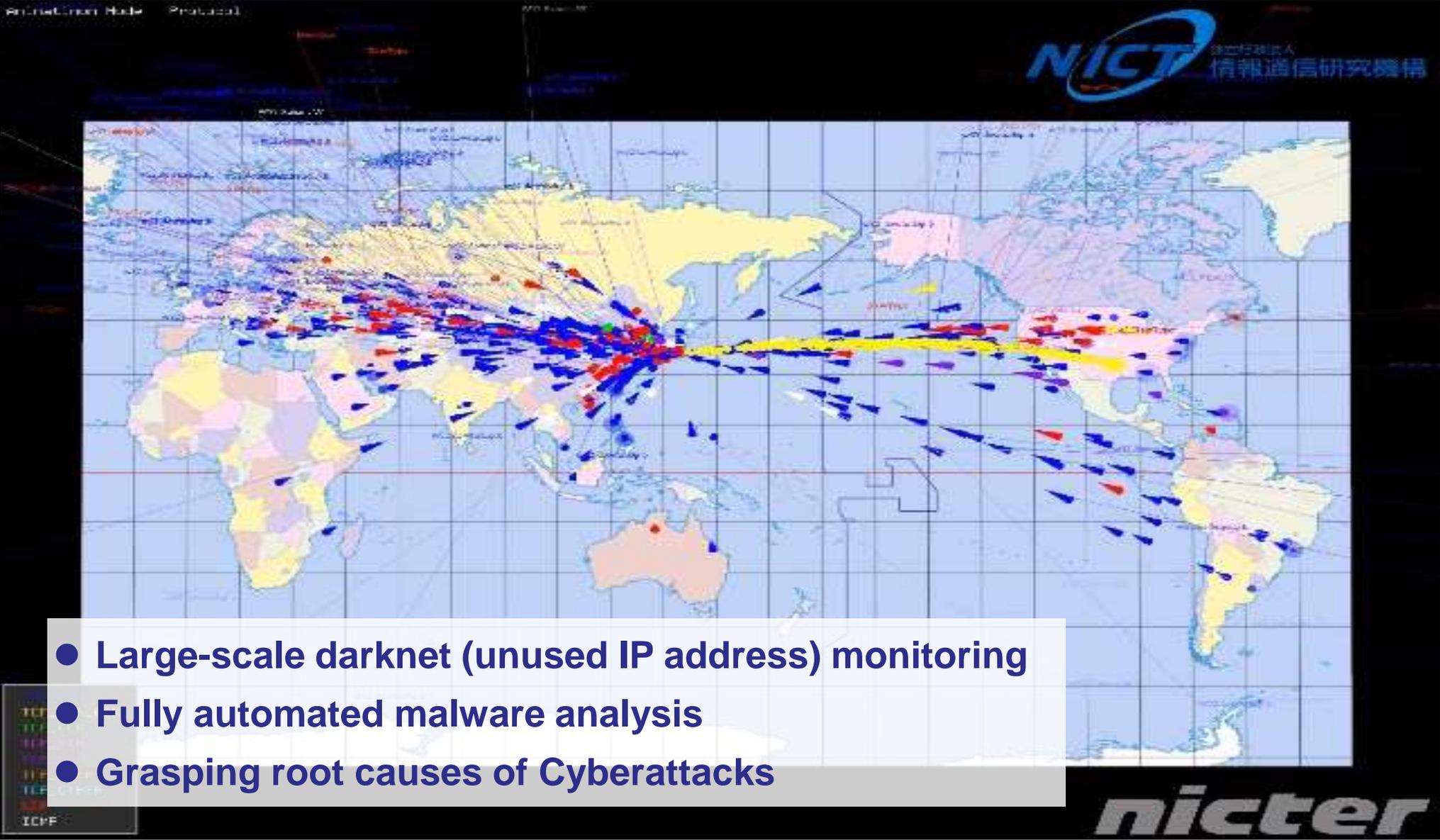## Challenge for "Exa bps" transmission

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

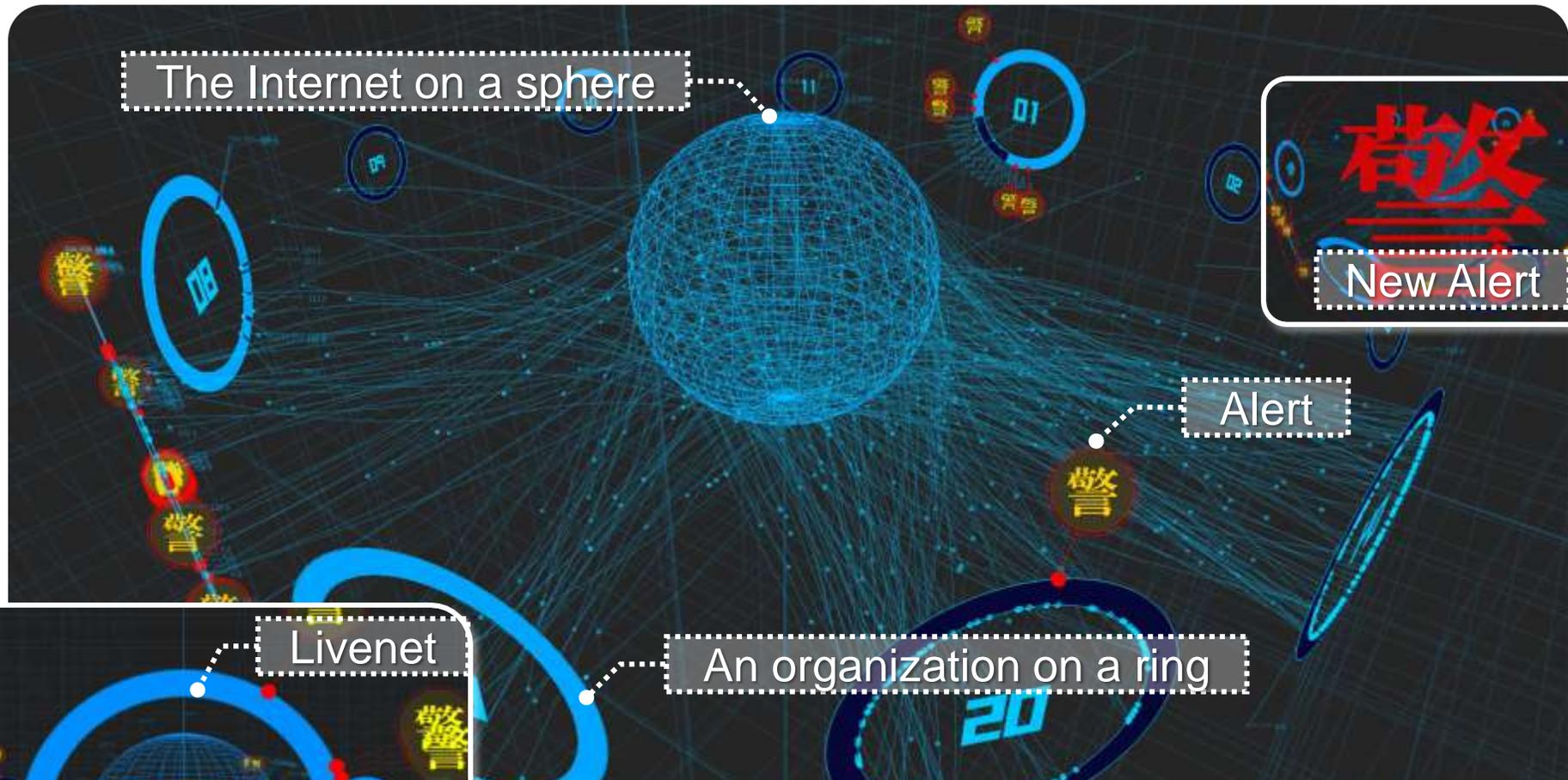Record breaking **1 Peta-bit/s** was achieved in Sep. 2012 by NTT

19-core fiber

35μm

200μm

Current optical fiber

125μm

Diameter of hair～80 μm

[bit/s]

Transmission capacity per a fiber

1P

300 Tera bit/s in Sep. 2011

Multi-Core NICT

100T

Physical limit in current fiber

10T

Modulation format

1T

WDM

1995   2000   2005   2010   2015   [YEAR]

P(Peta) : Quadrillion=1000 T (Trillion)

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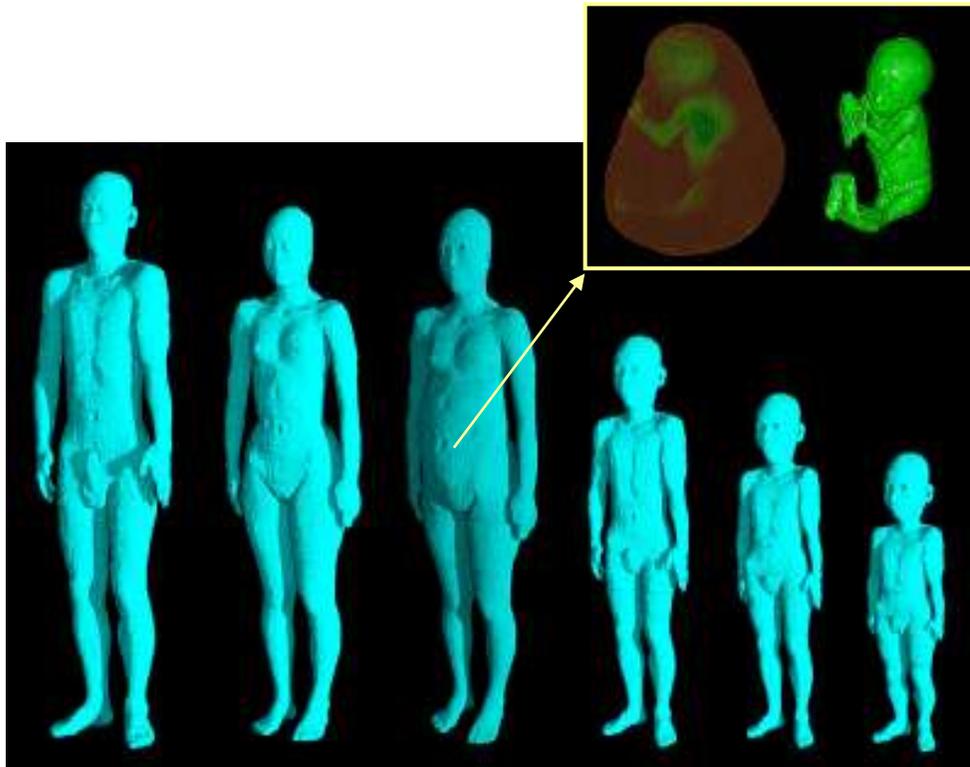
NICTER

ICT for Sustainable World Human Happiness

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

NICT DAEDALUS

Direct Alert Environment for
Darknet And Livenet Unified Security

ICT for Sustainable World Human Happiness

The Internet on a sphere

New Alert

Alert

Livenet

An organization on a ring

Infected host

Darknet

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

ICT for Sustainable World Human Happiness

- 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

NICT Disaster Information Distribution Platform

- Basically, a real-time QA system

- Provide big pictures of damages and rescue activities to rescue workers and victims, and also provides the list of answers to a question, mainly based on SNS and WEB

- 2014.4 twitter data award winner (6/1300)

- Available to the general public in 2014 > " **DISAANA** "

automatically lists the problems and requests in an area; makes rescue activity more efficient

answers on a map, on smartphones

Universal Speech Translation Advanced Res. Consortium (U-STAR)

BPPT Agency for the Assessment and Application of Technology (BPPT), Indonesia	Institute of Automation, Chinese Academy of Sciences (CASIA), China	**CDAC** Center for Development of Advanced Computing (CDAC), India	**ETRI** www.etri.re.kr Electronics and Telecommunications Research Institute (ETRI), Korea	Institute for Infocomm Research (I2R), Singapore
Institute of Information Technology (IOIT), Vietnam	**NECTEC** National Electronics and Computer Technology Center (NECTEC), Thailand	**NICT** National Institute of Information and Communications Technology (NICT), Japan	Department of Information Technology and Telecom (DITT), Bhutan	Al-Khawarizmi Institute of Computer Science, UET (KICS-UET), Pakistan
LTK Language Technology Kendra (LTK), Nepal	Mongolian University of Science and Technology (MUST), Mongolia	National University of Mongolia (NUM), Mongolia	**UCSC** University of Colombo School of Computing (UCSC), Sri Lanka	University of the Philippines Diliman (UPD), Philippines
Budapest University of Technology and Economics Dept. of Telecommunications and Media Informatics (BME-TMIT), Hungary	National Center of Scientific Research (CNRS-LIMSI), France	**inesc id lisboa** Institute of Systems and Computer Engineering - Research and Development in Lisbon, (INESC-ID), Portugal	Polish-Japanese Institute of Information Technology, (PJIIT), Poland	Pázmány Péter Catholic University, (PPKE), Hungary
University of Sheffield, Department of Computer Science, Speech and Hearing Group, (SpandH), UK	KU Leuven, Dept. Electrical Engineering, division PSI-Speech, (ESAT), Belgium	Technische Universität München, (TUM), Germany	**TRINITY COLLEGE DUBLIN** Trinity College Dublin, (TCD), Ireland	**BİLGEM** Center of Research for Advanced Technologies of Informatics and Information Security, (TUBITAK), Turkey

uulm Ulm University - Institute of Communications Engineering, (UUlm) Germany	"U-STAR" is an international research collaboration formed to develop a network-based speech-to-speech translation (S2ST) with the aim of breaking language barriers around the world and to implement vocal communication between different languages. Members: 26 research Institutes in 23 countries

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Decoding human visual experiences from brain activity

(Nishimoto et al., 2011 *Current Biology*)

- Decode natural perception in brain (with certain accuracy).
- Future : Decoding imagination in brain to help communication.
  One of the solutions for aging society problems.

Presented clip
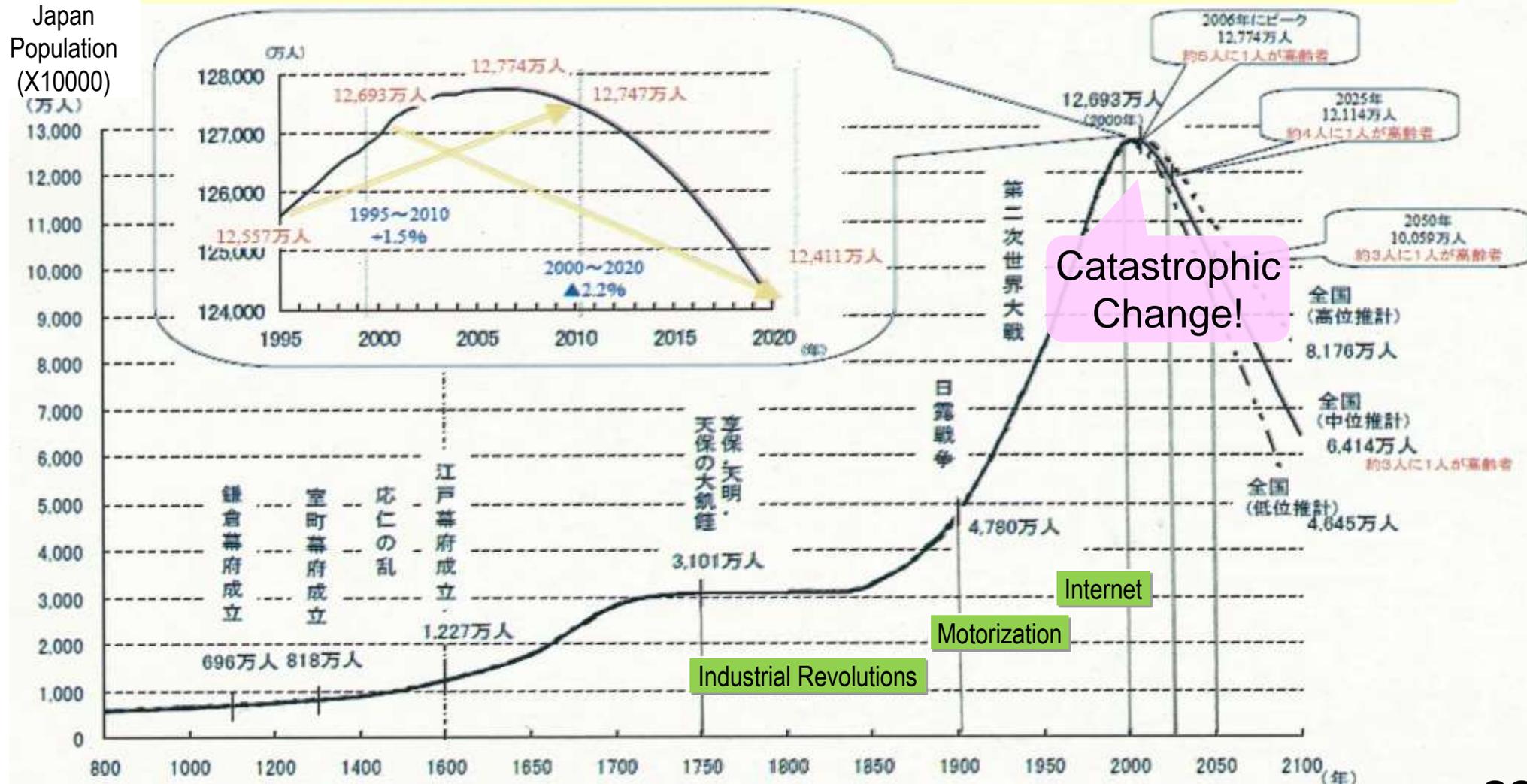
Clip reconstructed
from brain activity

ICT for Sustainable World Human Happiness

Social systems has been decently established, but
more healthy and sophisticated style must be renovated by ICT.

Japan
Population
(X10000)
（万人）

Catastrophic
Change!

Internet

Motorization

Industrial Revolutions

ICT for *Sustainable World Human Happiness*

Sendai

Fukushima

Tokyo

500 km

200 km
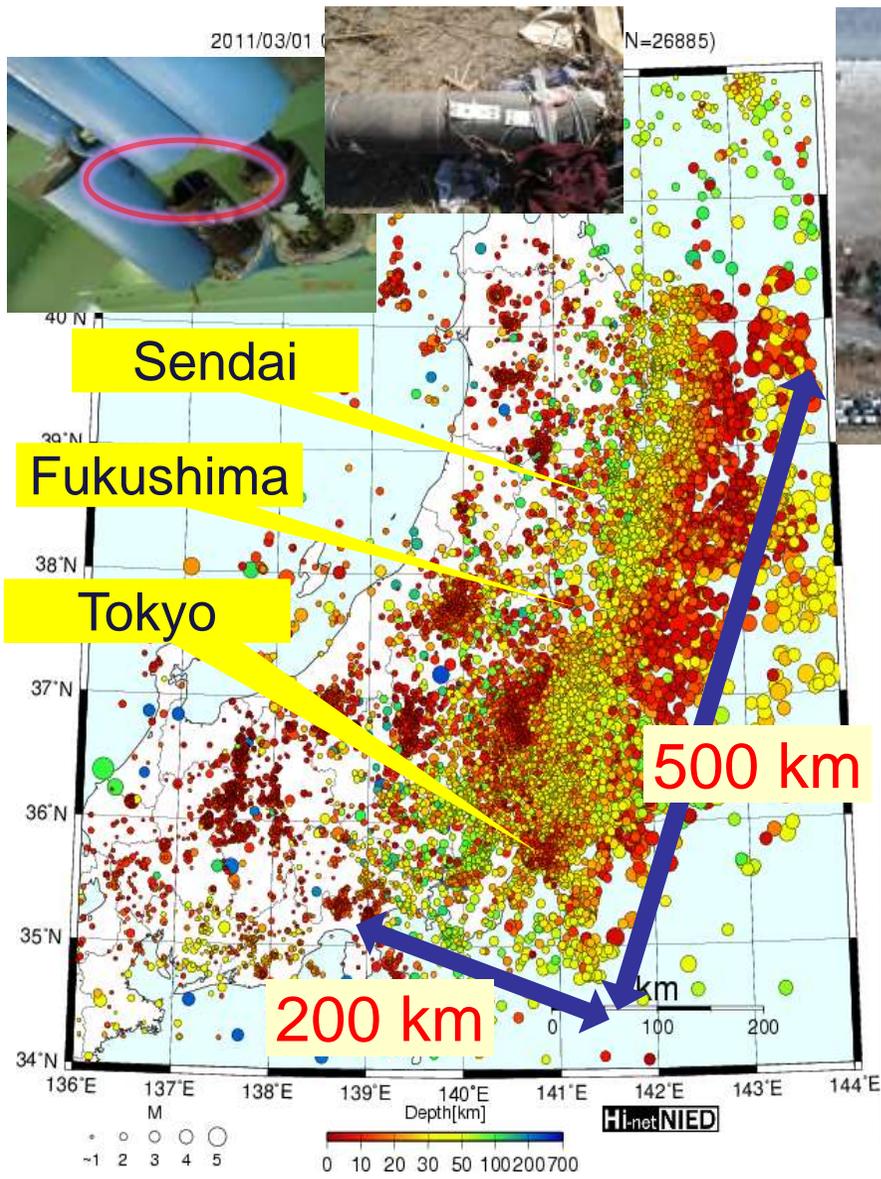
For Global Partnership

ICT is Borderless

Connecting the World
Information Society
Standardization

Global Issues to Tackle

Global Warming, Environments,
Food, Population Explosion, Energy,
Disasters, Digital Divide…

Bi-lateral Collaborations ➡ Global Alliance

Open ICT Innovation Platform
For Quality of Life

ACADEMIA

RESEARCH & DEVELOPMENT

BIG BUSINESS

SMALL BUSINESS

GOVERNMENT

SOCIETY

ASEAN ROUND TABLE   VIRTUAL INSTITUTE

Global Alliance among ASEAN and NICT

To solve social problems such as traffic, energy, agriculture, and more.
To share social benefit of ICT technologies in the borderless internet society.
To strengthen partnerships of global collaboration and cooperation.

ICT Open Innovation Platform

ICT Virtual Institute

ASEAN−NICT ICT Roundtable

	Country	Institution	Participant
1st	7	16	31
2nd	9	22	51

Proposal: Establish ICT Virtual Institute to construct the ICT Open Innovation Platform and to promote the Global Alliance

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/