

Ubiquitous Networking and JGN for Future e-Japan

Tadao SAITO
Professor Emeritus, The University of Tokyo
Professor, Chuo University
Chairman, Ubiquitous Networking Forum
Jan. 29th 2004
SAINT 2004

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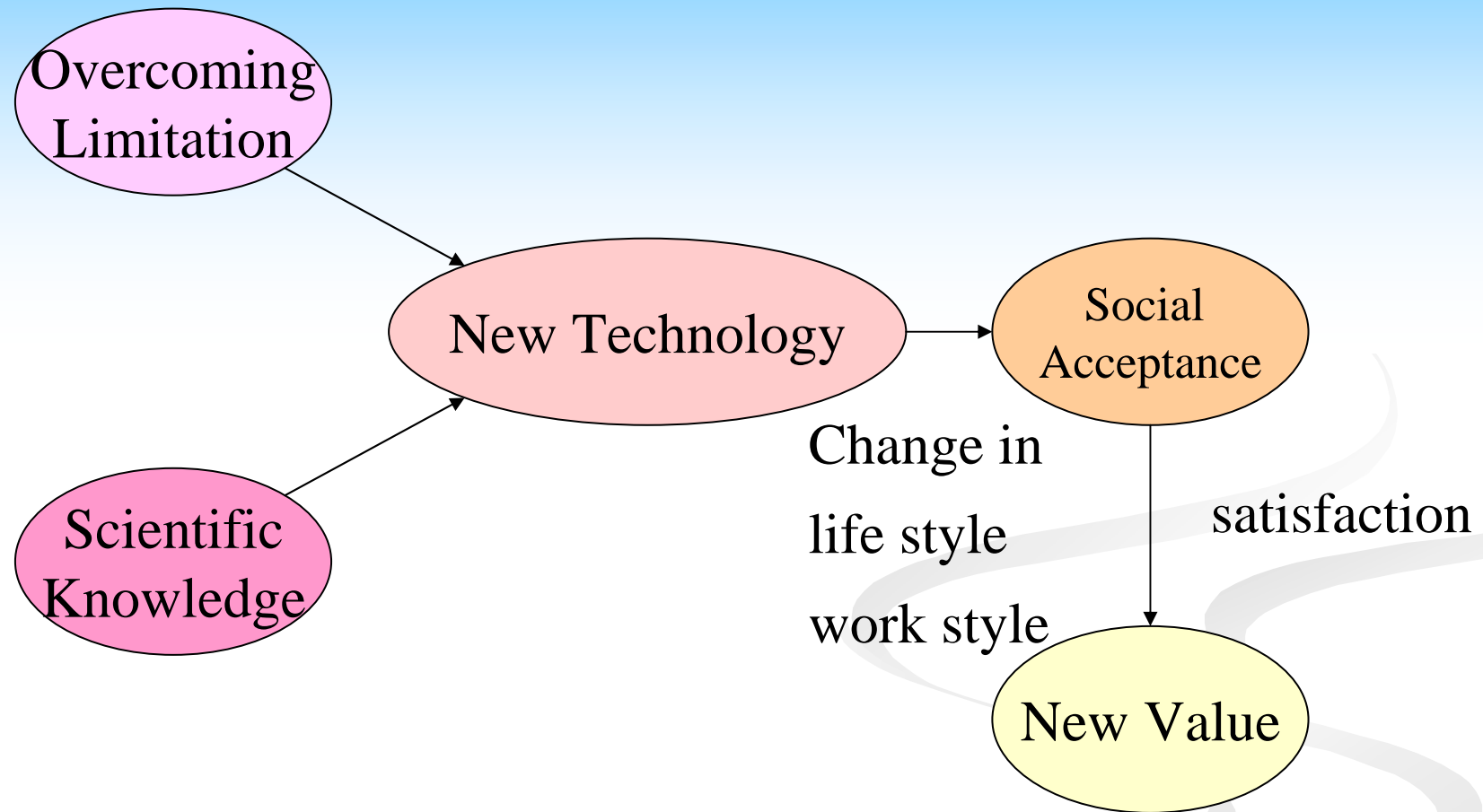
Cost Performance Improvement after 1960

	1960	1990	2000	2010
LSI	10^6	10^8	10^{10}	
Computer	10^3	10^5	10^7	
Data Communication	10^1	10^3	10^5	
Broadcasting	10^3	10^3	10^4	

Near Future of Electronics

	Design Rule	Clock	Transistor Density
	nm	GHz	M/cm ²
2001	150	1.7	90
2004	90	4	180
2007	55	6.7	360
2013	45	11.5	700
2016	22	29	2800

ITRS roadmap 2001



Condition for Growth

Market Expansion

Value Addition to Attract People

Application

Services

Contents

Broader Use of Electronics

Number should exceed human population.

e-Japan Strategy 2001

Main objective: “To make Japan the world's most advanced IT nation by 2005”

- ◆ 5-year urgent concentrated implementation by 2005
- ◆ Four priority policy areas
 - Infrastructure: Principle of private-sector initiatives, Creation of the world's most advanced environment for the Internet
 - e-commerce: Ex-post-facto check rule, Building confidence in participants, International harmonization
 - e-governments: Reform of administrative work, Social infrastructures for use of IT
 - Human resources: Improvement in IT literacy, Recruiting of IT instructors, Fostering of IT engineers/experts

Constant access environment by 2005
High-speed: 30 million households
Ultra-high-speed: 10 million households

Targets

Achieved Targets for “e-Japan Strategy” (Establishment of Infrastructure)

Targets

**Constant access
environment by 2005**

High-speed: 30 million households

Ultra-high-speed: 10 million households

Versus

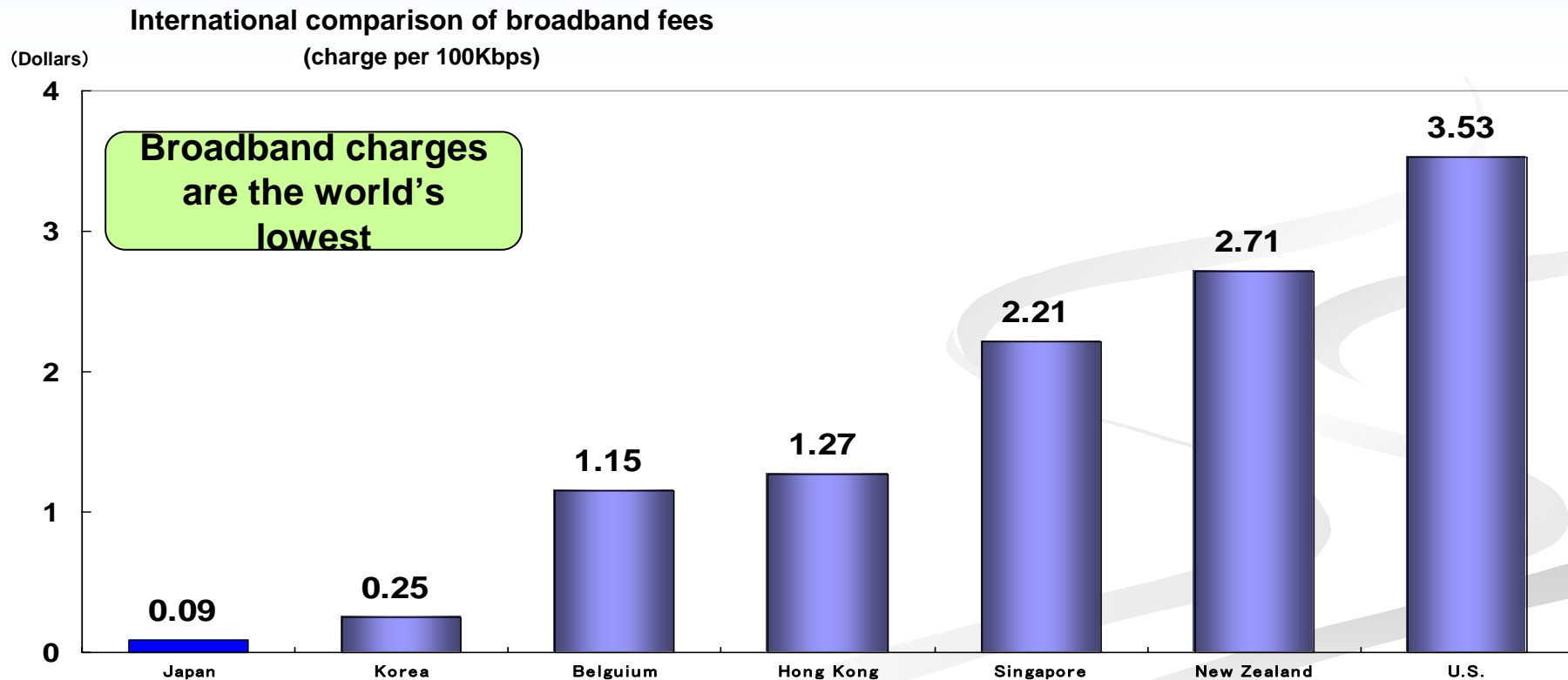
Actual Results

**Constant access
environment by 2003**

High-speed (DSL): 35 million households
High-speed (cable TV): 23 million households
Ultra-high-speed (FTTH): 17.7 million households

Improved Broadband Environment with Increased Use and More Diversity

- ◇ Broadband fees are the lowest in the world.
- ◇ The number of subscribers has broken through the 10 million subscriber mark, and is fast approaching Korea's second-place world ranking.
(as of the end of 2002: US-18.7M, Korea 9.86M, Japan 7.81M)
- ◇ Apace with DSL, we are also seeing a rapid increase in the use of fiber optics.



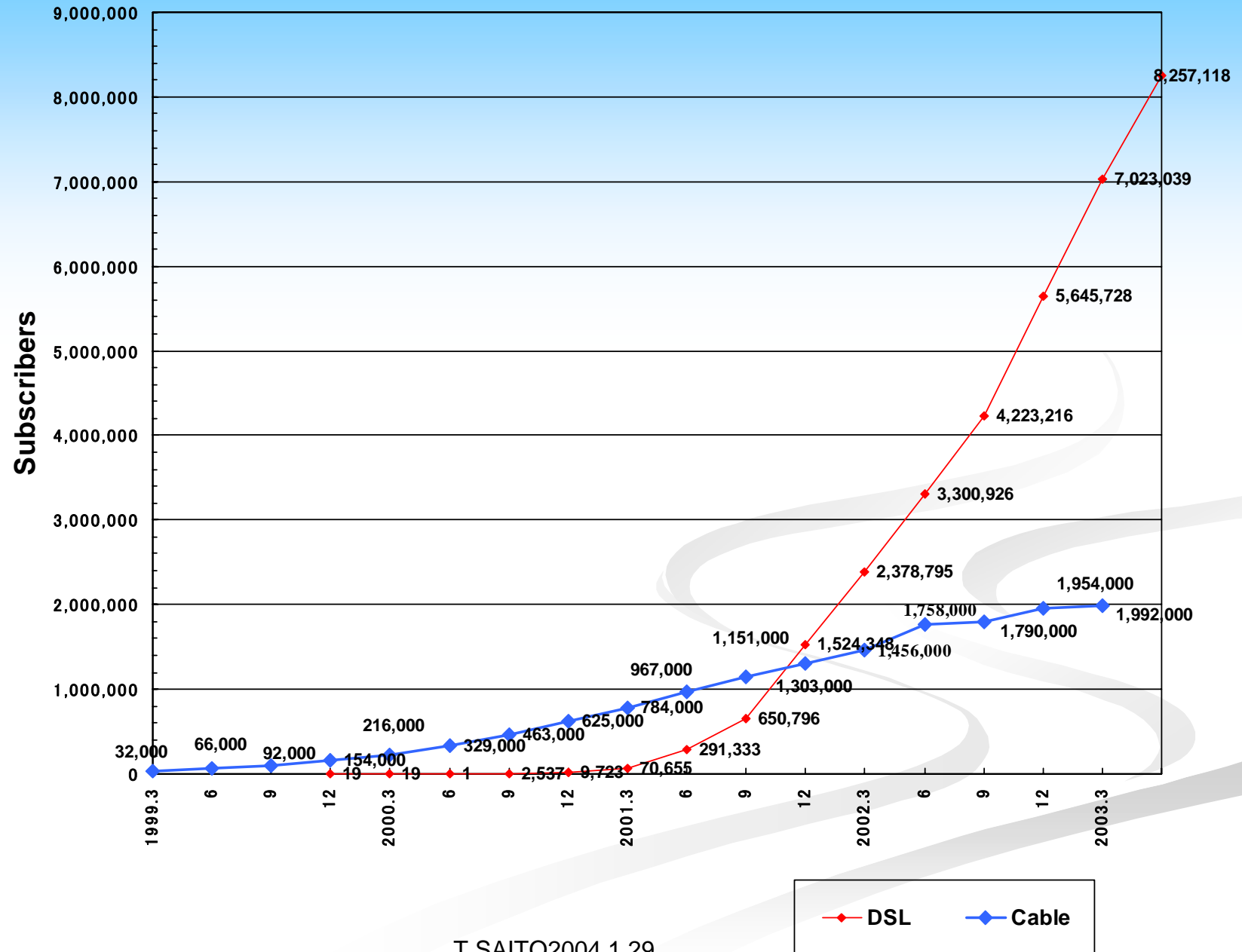
(Note) Comparison calculating fees per 100kbps, based on speed provided and fees charged for DSL or Cable Internet in each country and region.

(Source: Created from ITU documentation)

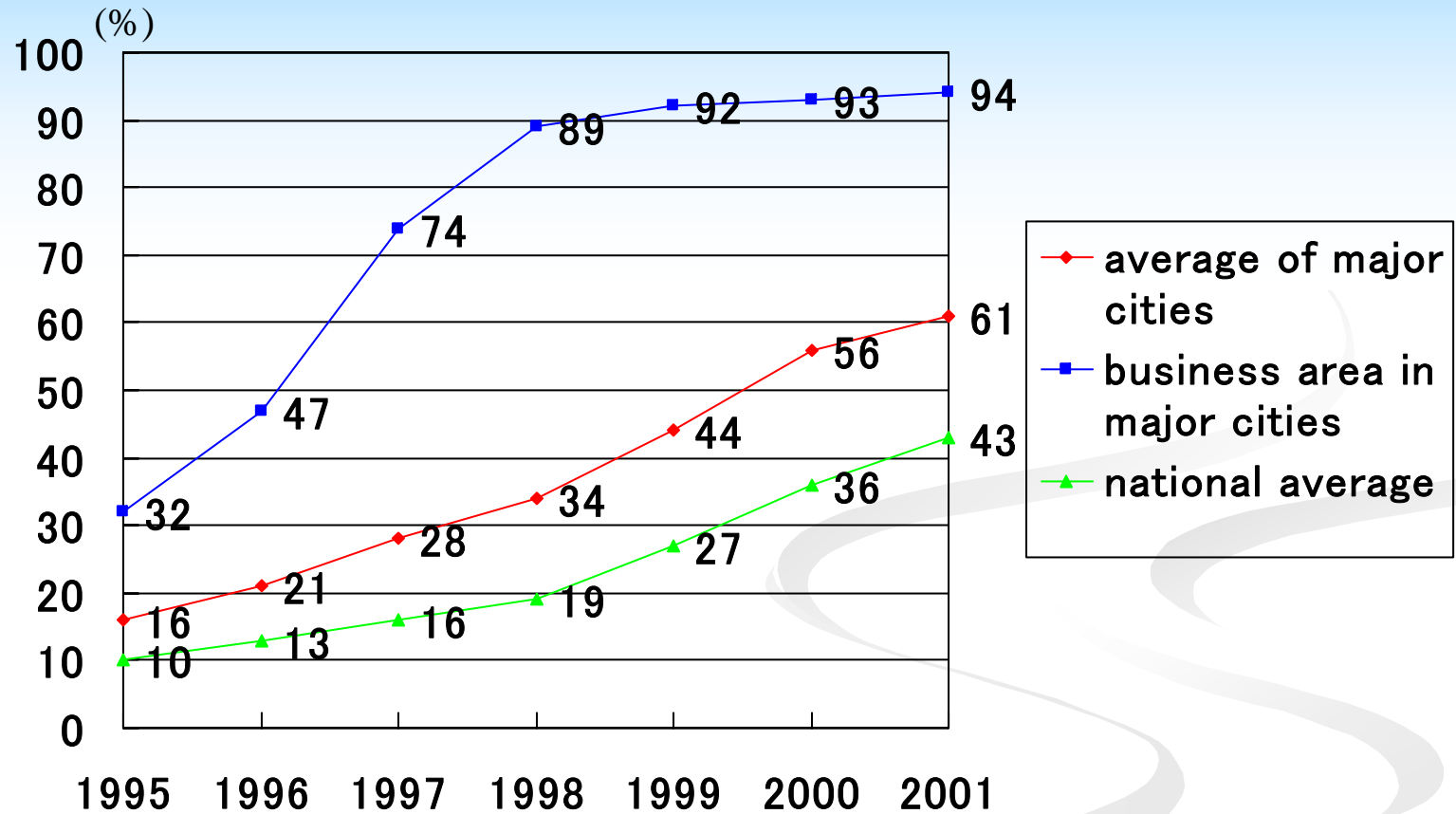
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Survey by
MPHPT

Cable and DSL users



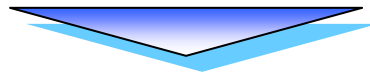
Optical Fiber Penetration in Japan



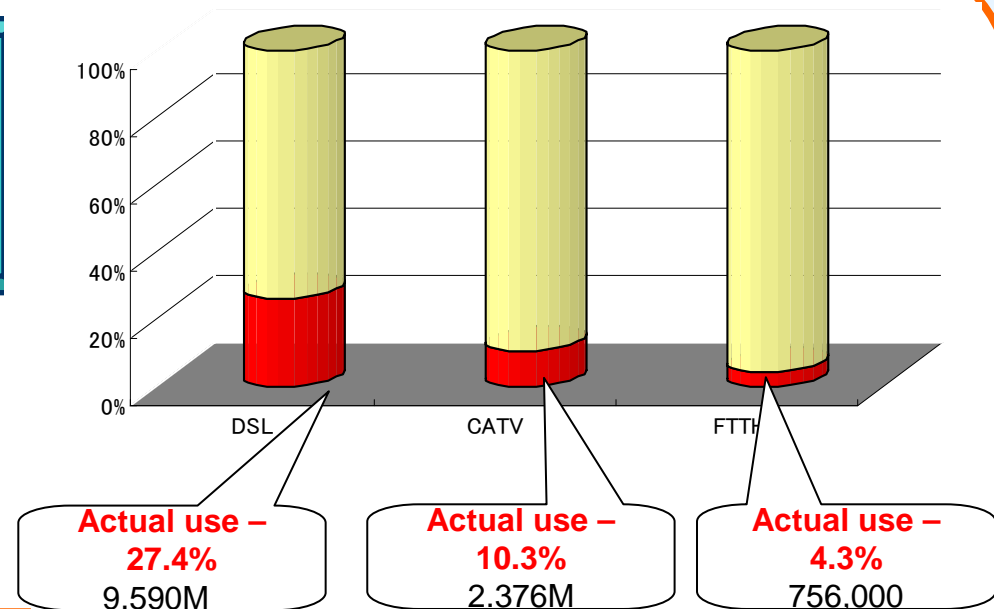
Transition to New IT Strategy

The first phase was successful but.....

**Actual use is still low
(Able to connect but do not)**



**Advancement of IT strategy to
the second phase is urgently required
(expansion in actual use)**

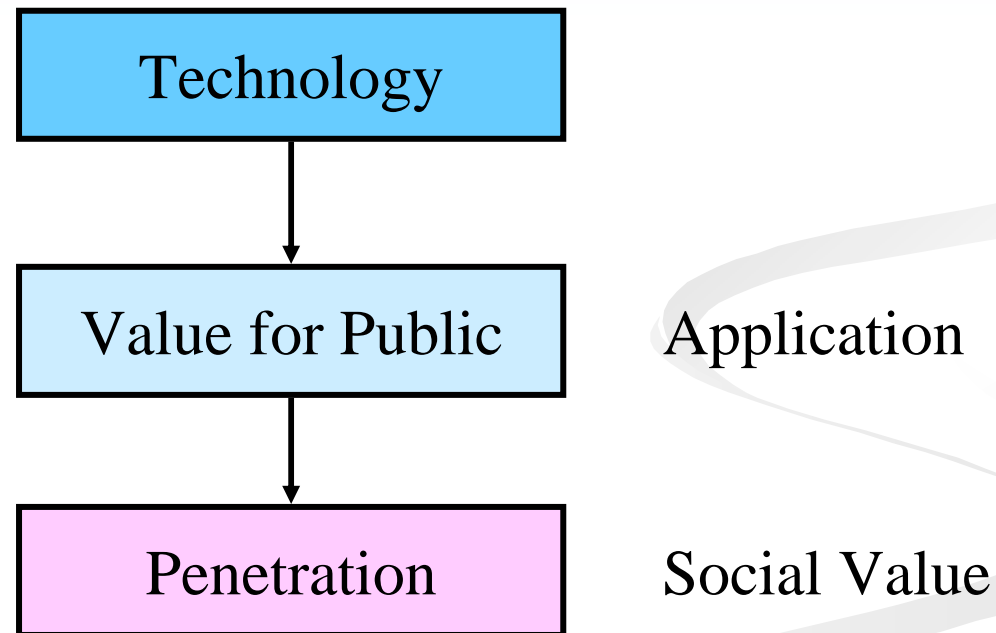


(Source) MPHPT (as of end of October 2003)
(Note) Percentages refer to the share of actual users compared with the number of potential users.

Transition of Communication Network

Telephone → Internet

Narrowband → Broadband expected to be Gbps in 15 years



- Gigabit-Class Links between ATM switches
- Links between ATM Switches and ATM Connecting Nodes

Access Points: 66 locations (● ○ :IPv6 Connecting Nodes)

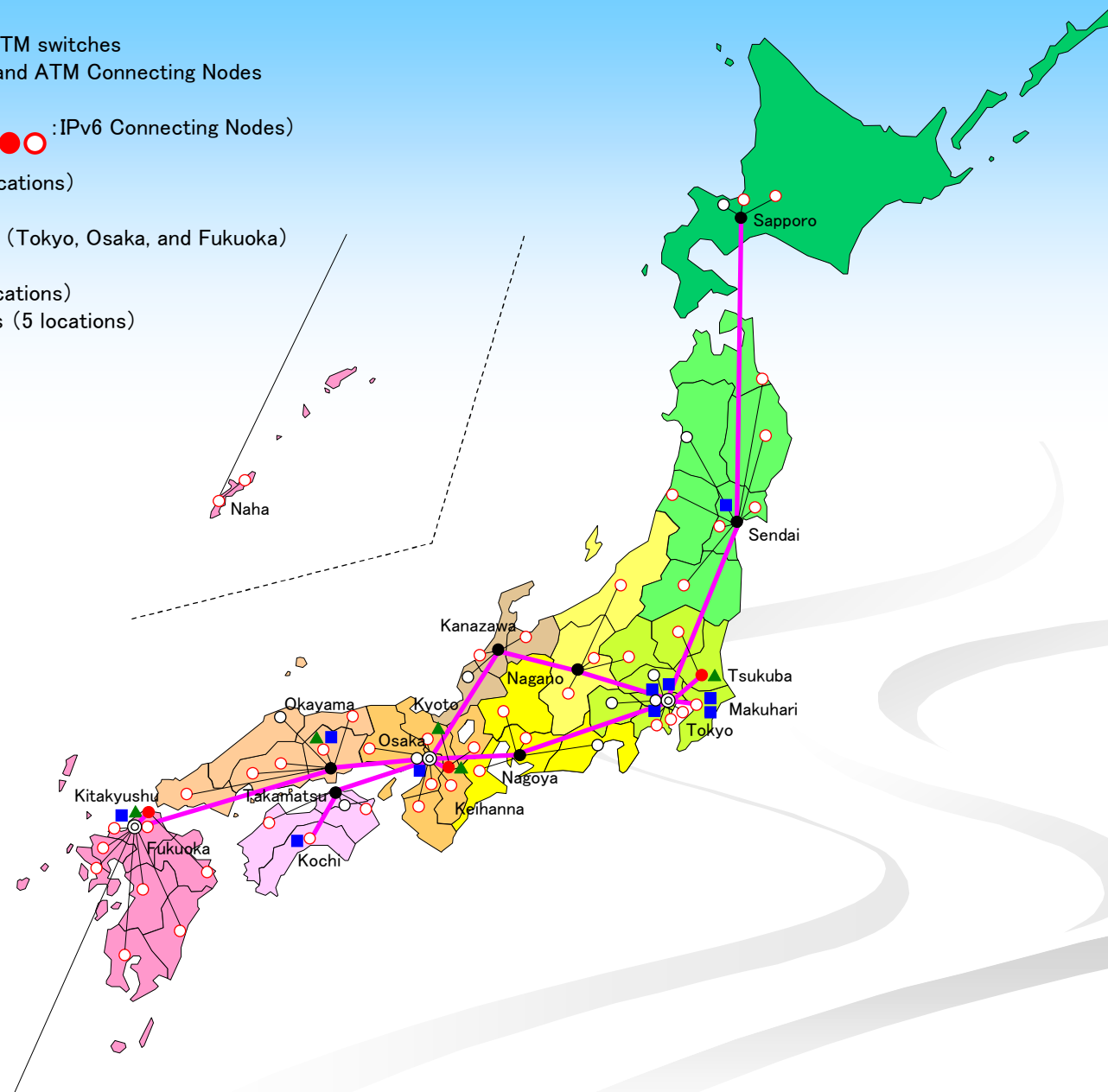
● ● ATM Switches (10 locations)

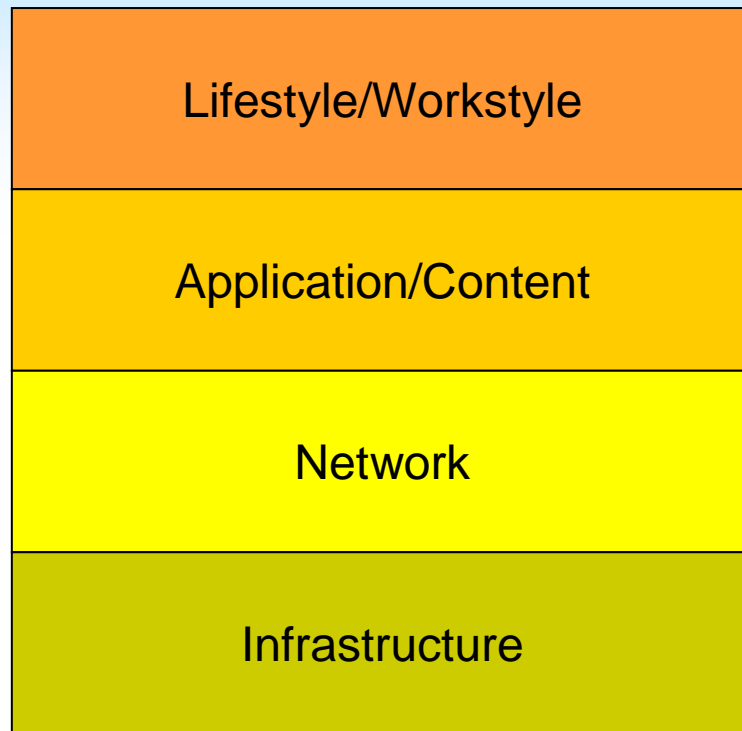
○ ○ ATM Connecting Nodes (56 locations)

○ ○ ATM Relay Switching Function (Tokyo, Osaka, and Fukuoka)

⊙ TAO Research Centers (10 locations)

■ Shared Use Research Facilities (5 locations)





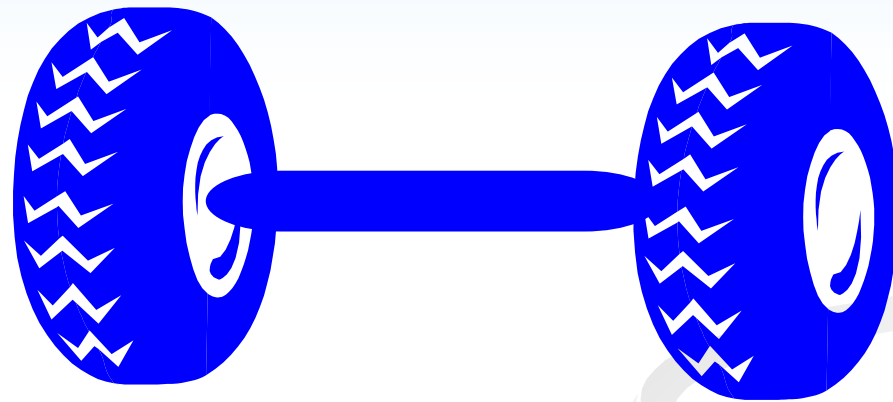
Comfort Secure Life

Value Addition for Human
Life

Stable Management

Broadband

Two Wheels



Technology

Life Style

Gigabit Network Project

- April 1999 ~ March 2004
- Nationwide Network
- Free Use for Research
 - Network Operation
 - Application
 - 193 subjects
 - 103 events
 - 543 organizations

Achievements by JGN

Technology Development mainly in Network,
Application/Contents

Experimental New Workstyle/Lifestyle

Education/Museum

Medical Application

Remote Collaboration

Disaster Recovery

High Definition Picture Application

Contents Creation Collaboration

Effects of R&D Gigabit Network (JGN: Japan Gigabit Network)

Economic Ripple Effects

● Direct economic effect

Direct economic effect: ¥158.6 to 168.3 billion (multiplier: 2.37 to 2.38)

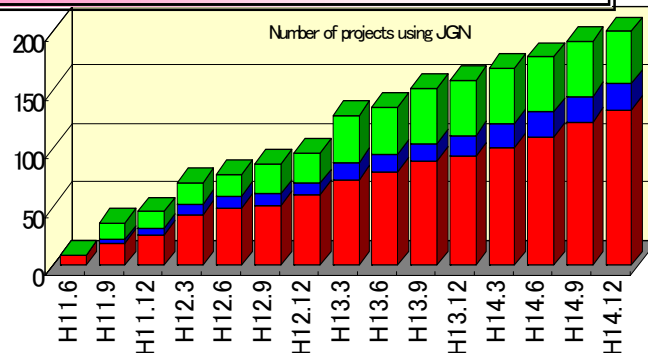
* The general multiplier for public investments is about 2.37 to 2.38

● Market creation effect

R&D achievements will create markets of about ¥2.2 to 2.8 trillion yen in total.

(Network markets)	Network equipment, CDN market, etc.	¥1,691.9 billion
(Application markets)	Digital contents distribution market, etc.	¥509.4 to 1,065.6 billion

R&D Induction and Acceleration Effects



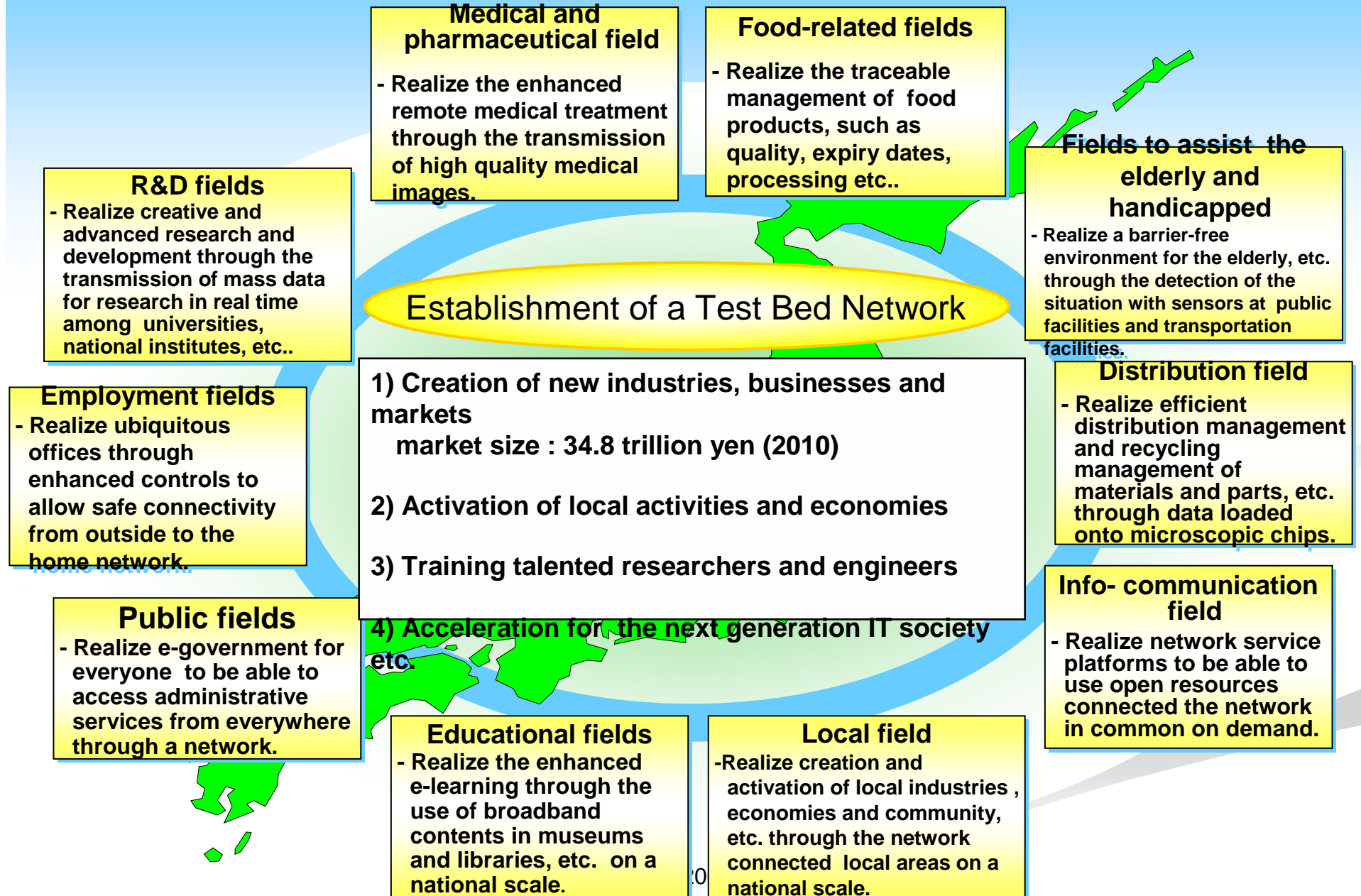
Total: 202
Public: 47
Direct: 22
General: 133

(As of December 2002)

- About 40% of the projects were planned by taking the opportunity of JGN.
- JGN accelerated about 50% of the R&D projects already planned.
- Effectively accelerating the following R&D fields in particular:
 - ◆ IPv6, network measurement, and interconnection
 - ◆ Communication technology and distributed system
 - ◆ e-learning, digital contents distribution, and remote image analysis and diagnosis system

■ Public: R&D through "Gigabit Network Application Research and Development System"
■ Direct: R&D by TAO through Research Center
■ Private: R&D by research institutes of private companies and universities

Various ripple effects



Further Development

Innovations in Surrounding Technologies

Broader Use of Information Technology

→ Ubiquitous Networking

Developments of Applications

Adaptation of Society for New IT

Use of High Speed Connection

	Wired	Wireless	
1X	100kb/s	10kb/s	
			2000
10X	1Mb/s	100kb/s	
			2005
100X	10Mb/s	1Mb/s	
			2010
1000X	100Mb/s	10Mb/s	

In addition to making Japan the world's most advanced IT nation by 2005, we must aim to continue leading the world after 2006.

IT Strategy – Phase I:

To positively tackle the establishment of IT foundational infrastructure → significant level of progress.



IT Strategy – Phase II:

To realize a “*vigorous, safe, impressive and convenient society*” through the practical use of Information Technology

Priority Policies

Leading 7 fields making practical use of IT

Medical / Foods / Life / Finance for SMEs / Intellectual / Employment and Labor / Governmental Services



Develop results in these 7 fields to other fields.

Construction of New Society

1. Construction of next generation IT environment
2. Safe and secure use environment
3. R&D to promote the intellectual resources of the next generation
4. Develop IT-HR and promote learning
5. New international relationships focusing on IT

R&D Test Bed Network in e-Japan Strategy

The e-Japan Strategy II

Infrastructure Development for the New IT Society

Promotion of Technology R&D to Create Next Generation Knowledge

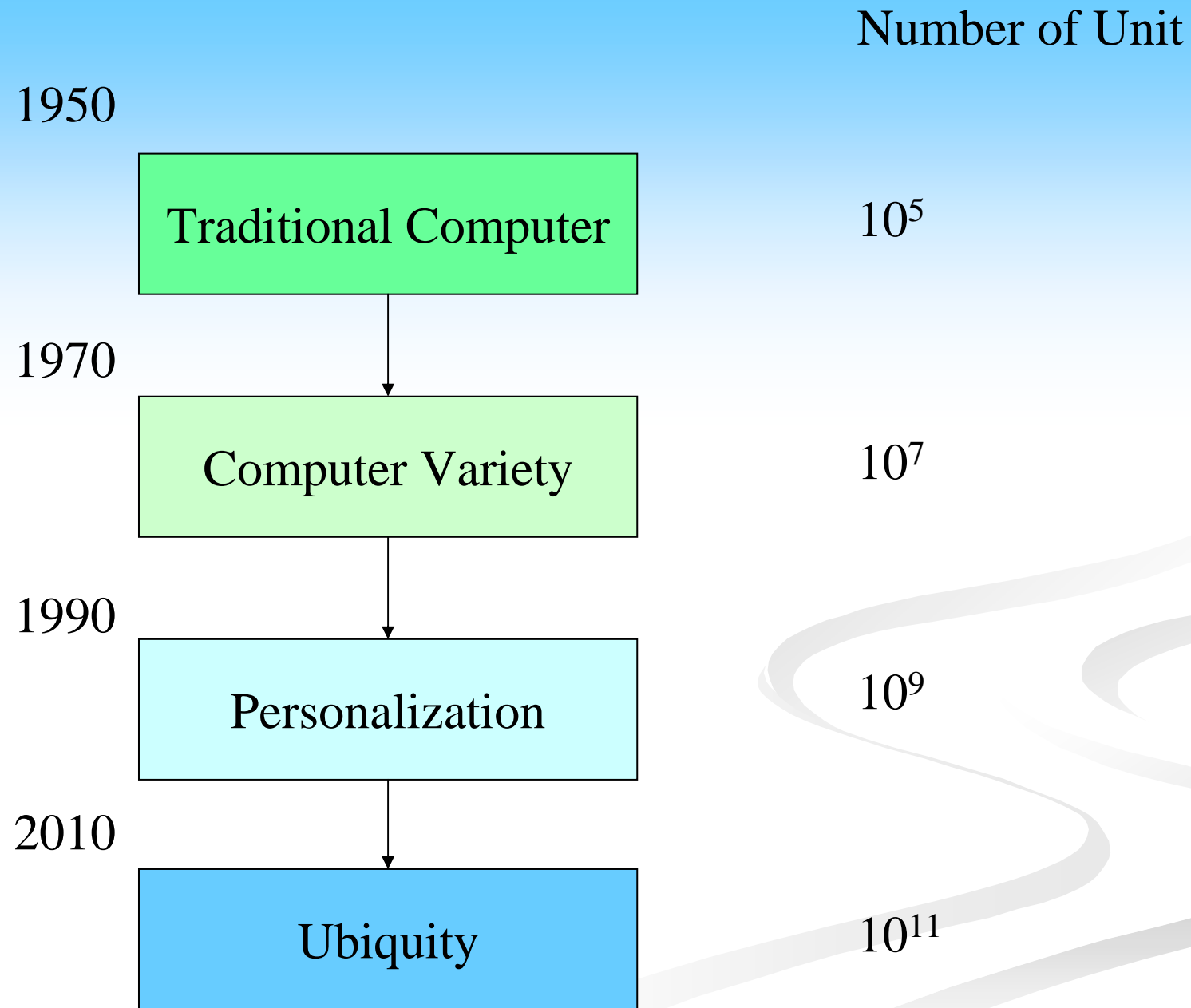
Policy Objectives

- 1) Reinforce and substantiate the technological R&D in the following crucial fields : software technology, information security technology, and human interface(interface between humans and equipment).
- 2) Continue the R&D for more advanced basic technology to enhance the high-speed networks for the next generation, in addition to working on the further development of the **Test Bed(feasibility testing) Network.**
- 3) Promote the R&D on applied technology that utilizes the above.

Policies

- 3) The basic development of Internet technologies will be promoted from the scope of transmission speeds of 100 Gbps to Tbps. With the aim of moving toward the ubiquitous network era, the R&D on **Test Bed Networks will be promoted on a nationwide scale.** The R&D for applied technology that utilizes ultra high-speed networks, will also be promoted with the findings incorporated into basic development.
The international test bed network will be promoted to develop the joint international projects.

Test Bed Network is the basic environment for IT R&D



Personalization was the keyword for market growth during 1990~2010

Home Appliance

TV, Audio

Mobile Communication

Telephone, Data

Personal Computer

Personal Digital Aids

Digital Camera

ID Card / Debit Card

Requests for Network Services

Network Everywhere

office environment everywhere

information sharing

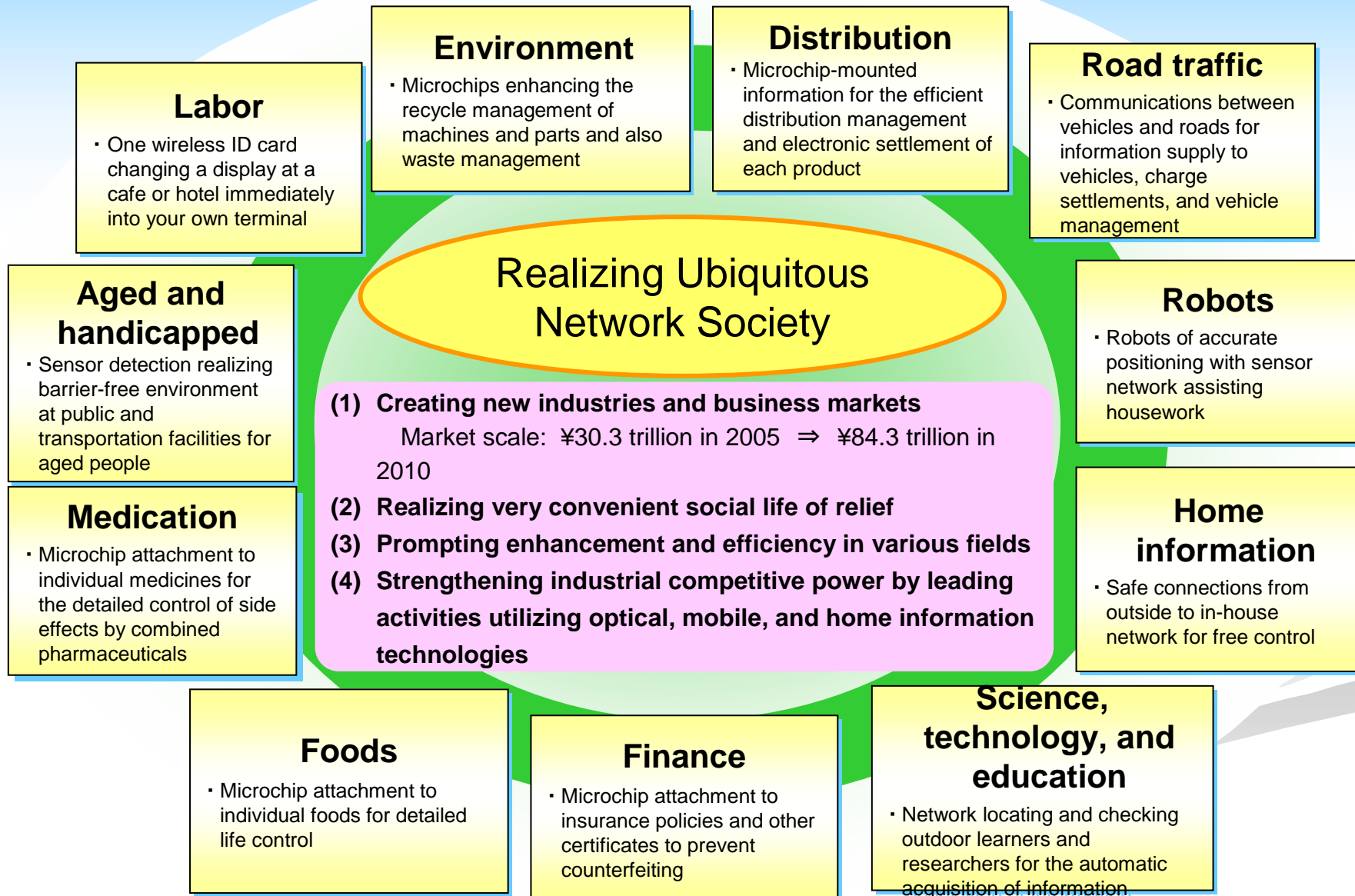
My Computer Everywhere

customized environment without carrying equipment

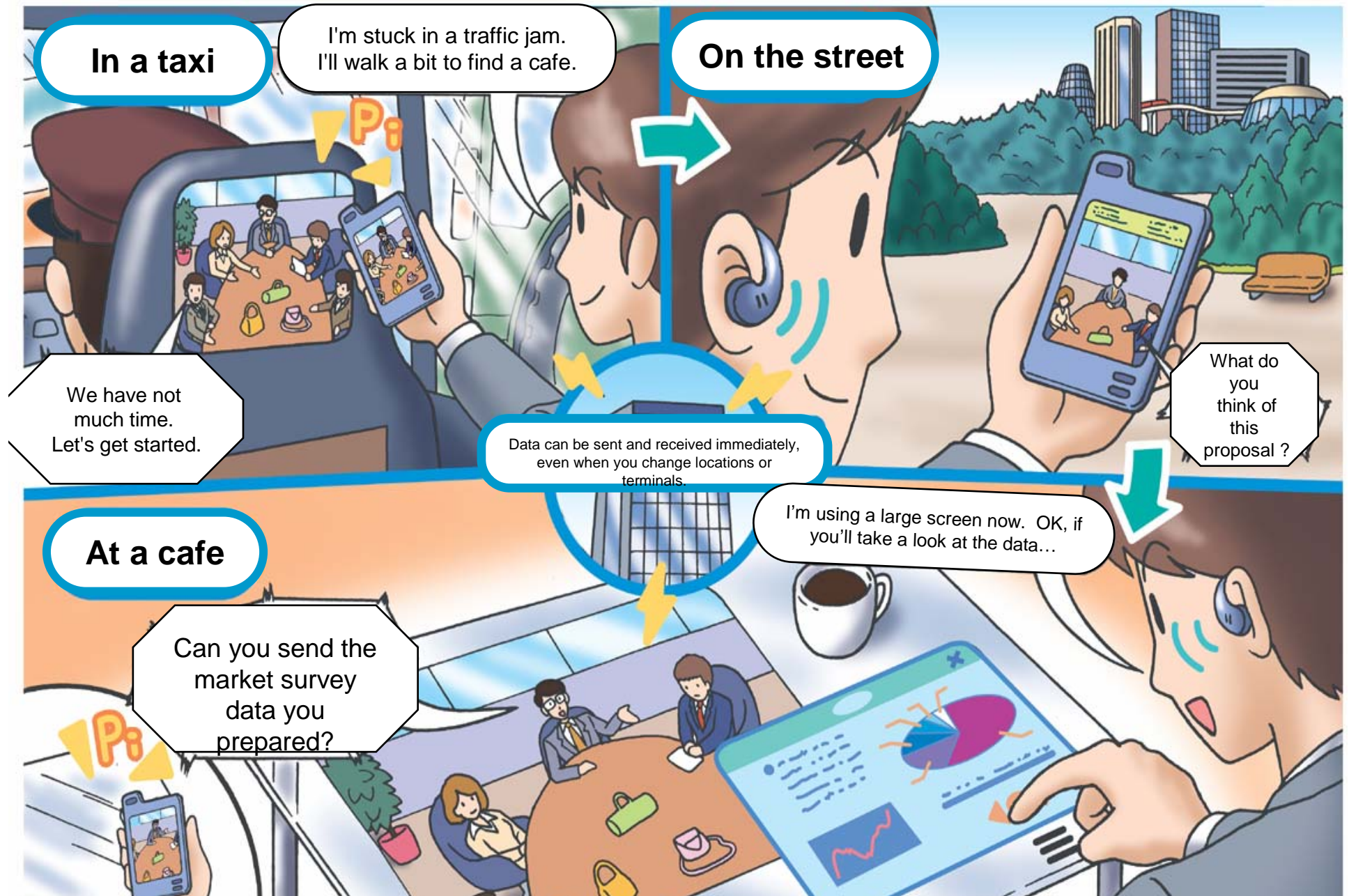
customized interface everywhere

Ubiquitous network application fields

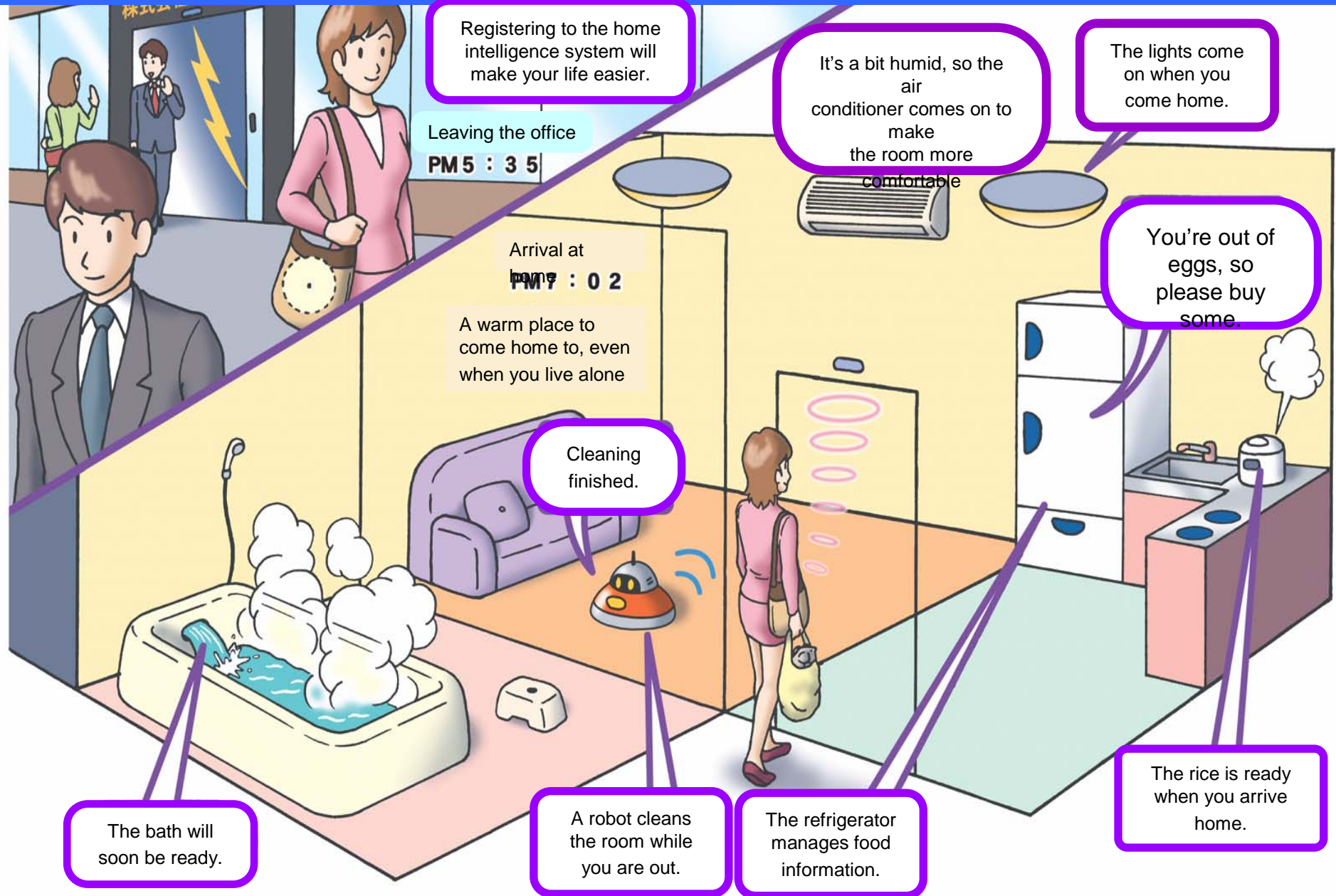
※ Ubiquitous network: Information and communications network for the free and comfortable use of network terminals and contents at any time and any place Ubiquitous originated from a Latin term meaning “existing everywhere.”



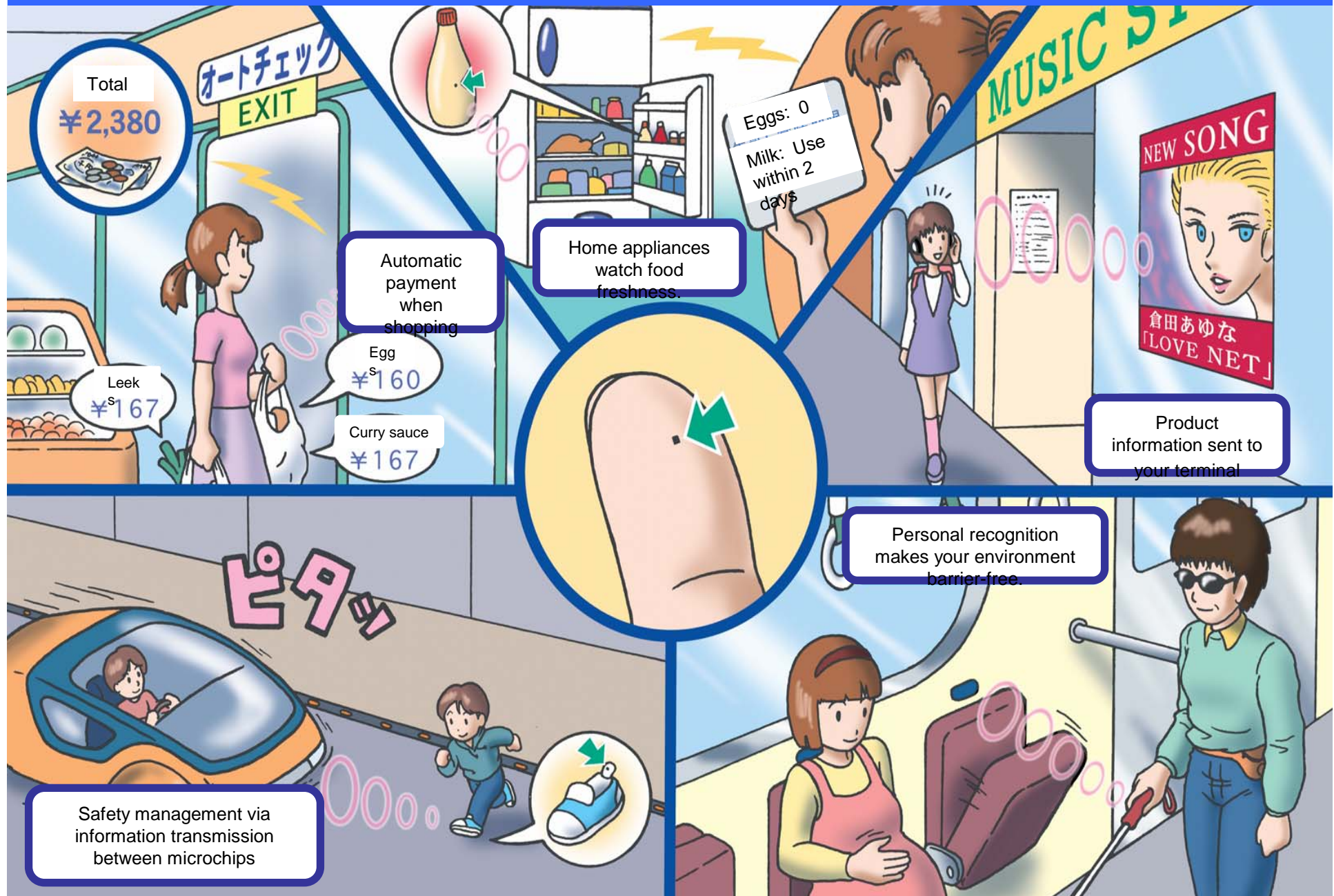
Scene of Use ①



Scene of Use ②



Scene of Use ③



Scene of Use ④

Paris



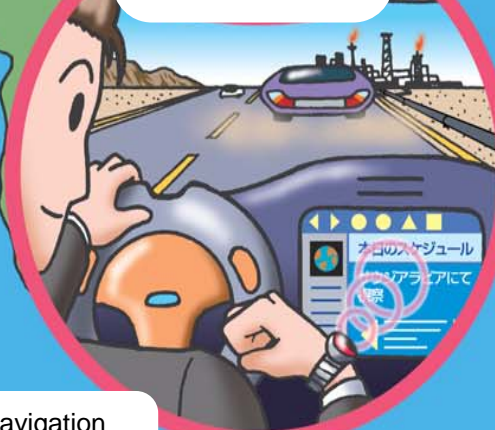
Terminal built into
a cafe table

New York



Permanent
terminal in a
conference room

Saudi Arabia



Car navigation
system in a rental
car

Hong
Kong



Electronic
paper

Hawaii



Window pane of a
resort hotel

Having a means of personal recognition
means you can use any terminal in the
world as your own.

Scene of Use ⑤



Significance of Realizing Ubiquitous Network

1 Creating new industries and business markets

- Realizing a ubiquitous world utilizing Japan's leading photonic, mobile, and home information technologies
 - ⇒ Creating new distribution business, mobile commerce market, network terminal market, and contents distribution and transmission business (Market scale: ¥30.3 trillion in 2005, ¥84.3 trillion in 2010)
- Promoting local activation by enhancing the productivity and efficiency of local industry

2 Realizing a social life of relief

- Microchip-based network for the intelligent life control of pharmaceuticals and foods
- Personal authentication using fingerprints, iris, and other biometrics for safe and easy high-price orders and settlements
- Network automatically keeping the optimum conditions by locating and sensing people at home and in office

3 Promoting participation of the handicapped and aged in the society

- Barrier-free environment where the visually or aurally handicapped can obtain positional and peripheral information from road and home sensor networks
- Barrier-free environment where the aged can use public and transportation facilities by the transmission and verification of personal information through sensor networks

4 Solving environmental problems

- Network access anywhere for telework, SOHO, and other working environments to reduce human migration
- ID tags and information mounted chips for efficient distribution management to reduce environmental loads



Solving various social problems from the 20th century

Broader Use of Processor

98% of total production of processor is non PC use

Expansion of concept of computer

Redesign human computer interface

GUI is too complex

Ambient human interface

Analogue like human interface

Ubiquity

Pantheism in Primitive Religion is Global

Catholic Theory in 17th Century

Barush de Spinoza (1632-1677)

Computer Everywhere by Prof. K. Sakumura(1984)

Mark Wiser (1988)

- Invisible Computer
- Calm Computer
- Pervasive Computing

Ubiquitous Network

Japanese Government Vision (2002)

Current Use of Computers

1. Embedded
Home Appliances
Automobiles, Aircrafts
Weapons
Machining Tools
2. Audio-Visual Human Interface
Calculator - PC – Mainframe
3. Usually Isolated Chip (do not include power and communication connections)
Tag
ID card

Extension of Computer Capability

Flexible Communication

Machine-Machine

Finally to Human

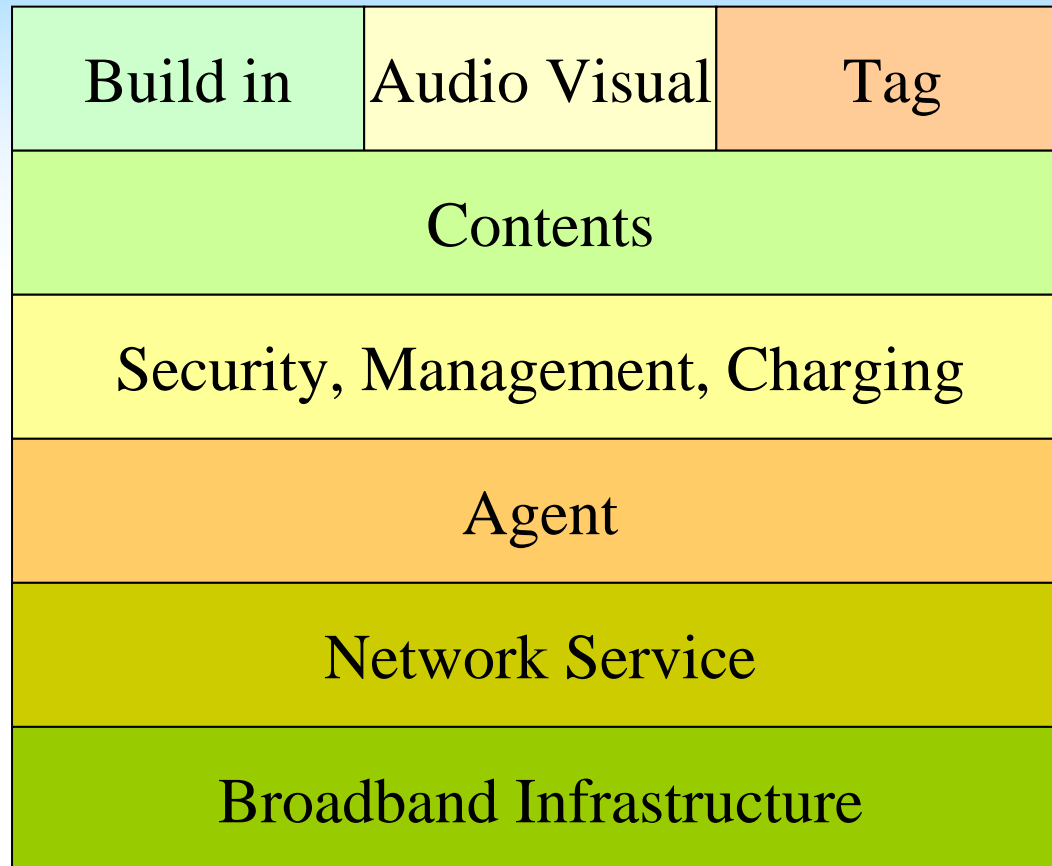
Real World Computer Interface

Networks having Enough Capacity

Rich Contents required by Application

Agent Capability adaptive to each Individual

Security, Reliability, Dependability



Current Interests by Business

Extension of Cellular Telephone

Next Generation Home Appliances

High Tech Housing

Improvement of Commercial Distribution System

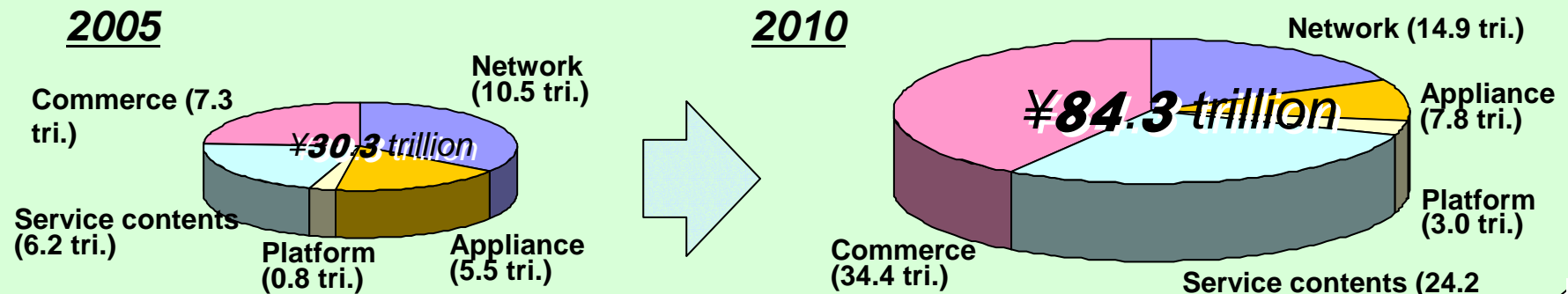
Secure ID card

Ripple Effects of Ubiquitous Network

Images of Use

Social life	<ul style="list-style-type: none"> ■ Microchip-based network for the intelligent life control of pharmaceuticals and foods ■ Automatic control of home and office air conditioning and lighting at good timings according to settings or by sensing positions and behaviors ■ Home system to start air conditioning, cooking, bath preparation with positional information for welcoming when Home mode is set from outside ■ Vehicle system using chips on children and pets and nearby networks to detect a child or pet rushing out and stop the vehicle automaticall 	Environment	<ul style="list-style-type: none"> ■ Network access anywhere for telework, SOHO, and other working environments to reduce human migration ■ ID tags and chip-mounted information for efficient distribution management to reduce environmental loads
Consumption	<ul style="list-style-type: none"> ■ Constructing a personal authentication system from verification systems using microchip-mounted cards, terminals, and biometrics such as fingerprints and iris for safe and easy high-price orders and settlements ■ Customer IC cards and merchandize ID tags allowing customers to pay money merely by picking up what they need and pass through counters 	Labor	<ul style="list-style-type: none"> ■ Calling your own working environment instantaneously only by network authentication from office, outside, or home ■ Changing a display at a cafe table, taxi seat, airplane seat, or hotel room in and outside Japan immediately into your own terminal only by authentication ■ Advanced contents distribution technology to realize optimum display according to the terminal and access network capacity to make your own information available instantaneously
Social participation	<ul style="list-style-type: none"> ■ Barrier-free environment where the visually or aurally handicapped can obtain positional and peripheral information from road and home sensor networks ■ Barrier-free environment where the aged can use public and transportation facilities by the transmission and verification of personal information through sensor networks ■ Chips in mobile terminals or cards transmitting handicap or injury information to automatically activate chairs, toilets, and escalators at stations or department stores and on trains 	Education	<ul style="list-style-type: none"> ■ Outdoor activities where members can exchange visual images and notes freely or have a group session by real time through network terminals while moving without being aware of a network ■ World researchers observing the natural environment with microsensors and making field experimentation using artificial structures ■ Several laboratories exchanging research data interactively as very realistic 3D information by real time for creative studies

Market Scale



Ubiquitous Network Promotion Strategy

Realizing Ubiquitous Network First in the World



① Promotion of R&D project

- Promoting R&D on networking using microchips and others by gathering mobile, optical, and home information technologies

② Next-generation R&D network for ubiquitous network age

- Creating new services in the distribution, foods, medicine, environment, and education fields
- Establishing an R&D network as the testbed for demonstration to put R&D results to practice

③ Promotion of international development

- Promoting global linkage for global standardization with cooperation from Asia

④ Promotion of ubiquitous network by industry, academia, and government

- **Promoting international development through global information transmission and strengthening linkage with college research institutes and academic societies**

Tide toward Ubiquitous Network Society

Tide toward ubiquitous network

- Release from spatial and geographical restrictions
- Release from restrictions of communication objects
- Release from restrictions of network, terminal, and contents selection
- Release from restrictions of communication performance
- Release from network risks

Changes of background social structure

- Industrial structure
- Employment and labor
- Electronic economic activities
- Life and society
- Crimes and harms
- Hobbies and leisure
- Social participation of the aged and handicapped
- Solutions to environmental problems
- Efficient production activities for low environmental load

Network technology

- IPv6 technology (supporting address increase, two-way communication, and multicast)
- Photonic network technology (WDM)
- Information distribution and centralized management

Device technology

- Photonic crystal fiber
- Small recording device for long-time recording
- Large-screen, ultrahigh-definition display
- Wearable computing device

Security and authentication technology

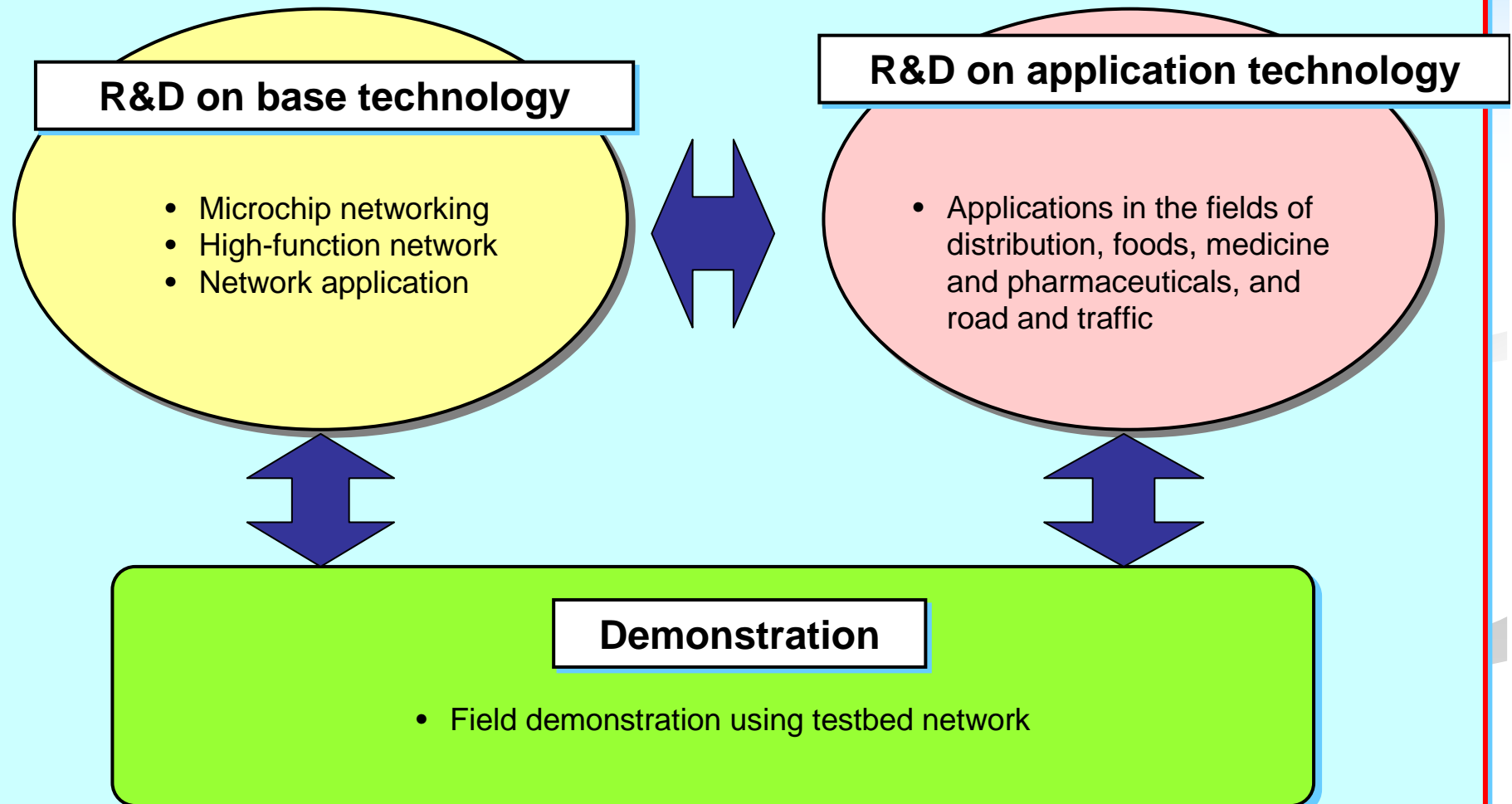
- General-purpose security base architecture
- Contents (moving picture etc.) protection technology for safe ubiquitous commerce
- Bionic verification (finger vein pattern etc.)

Software application technology

- Open platform easy to use by real time
- Expressive contents production

Technical Development by Spiral Research and Development

- Promoting “R&D on base technology,” “R&D on application technology,” and “Demonstration together
- Feeding back application technology and demonstration results to R&D on base technology to raise the general R&D level



R&D of Ubiquitous Network Technology

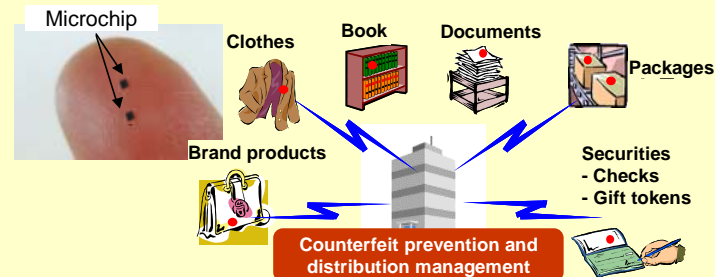
Promoting R&D on microchip-based networking with Japan's excellent power in mobile, optical, and home information technologies, on ultrahigh-speed authentication, and on control and management for network access at any place and time

R&D on Base Technology of Ubiquitous Network

○ Establishing elemental technology by fiscal 2005 and practical network in fiscal 2007 after total demonstration

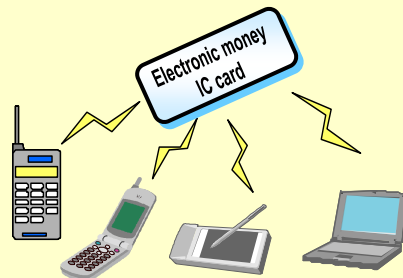
Microchip networking

Free network configuration from various items with microchips



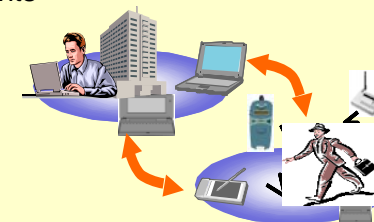
Ubiquitous network authentication and agent

Non-contact card changing any terminal to your own



Ubiquitous network control and management

Network access at any place and time to create the same communication service environment as that in office to enjoy various contents



Technical Challenges

Short range broadband radio

Low power electronics

Wireless power supply

Security

Low Cost

Radio bandwidth usage

Network Management Issues

Presence management

QoS management

Routing

Node management

Secure communication

Address management

extension of current business



new application



new life style



creation of new value

improved cost performance



expansion of demand to
overcome price reduction



growth in GDP in information age

Agricultural Society ~ 1750

Industrial Society 1870 ~ 1970

Information Society 2010 ~

Change of Major Source of Wealth

Production Means Change Society

Work Style, Education, Demography, Family Style