

U-World: The Future of e-Community Centers

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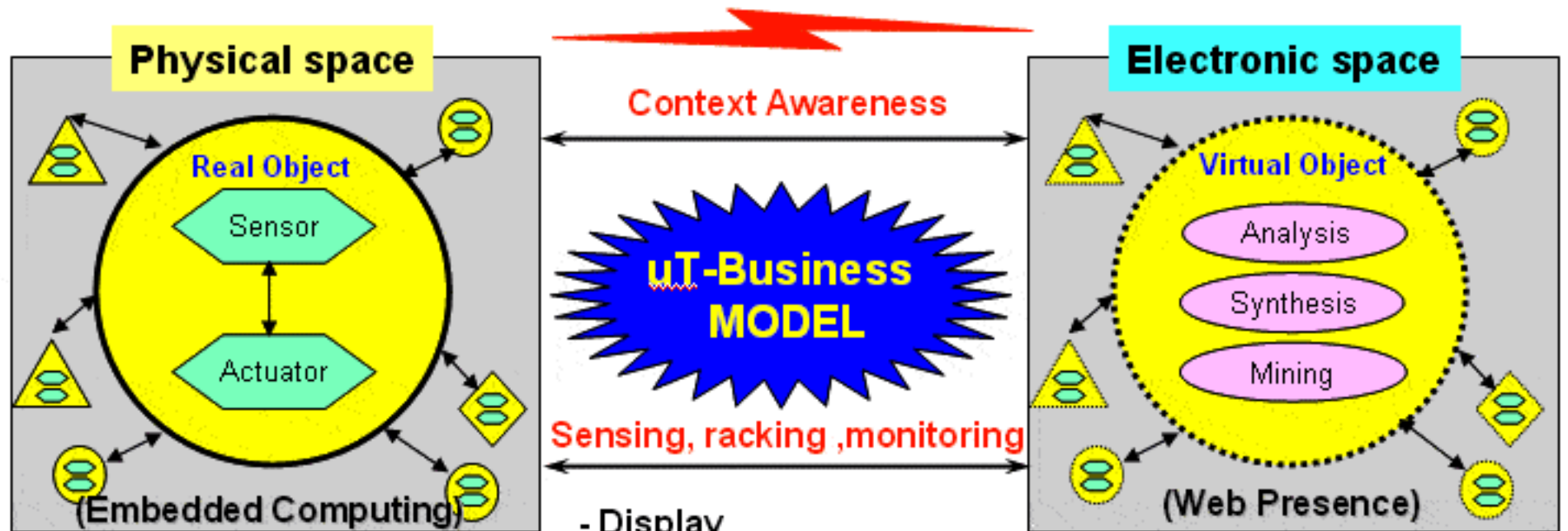
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0. Background

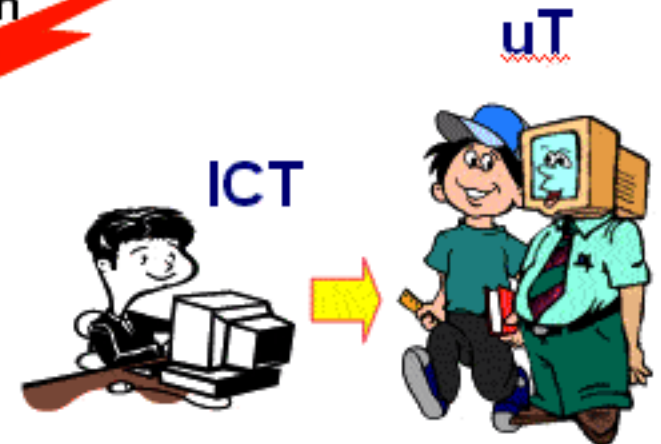
Ubiquitous Computing in Our Life



From ICT to uT



- Display
- Fresh information services
- Suggestion, Recommendation
- Control & Working

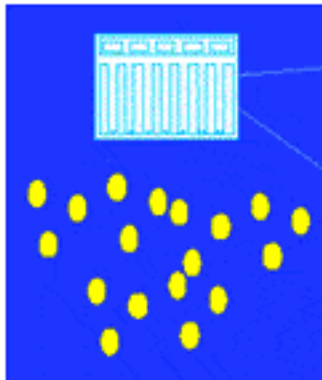


Space-Object-Computer-Human/Mobile Phone

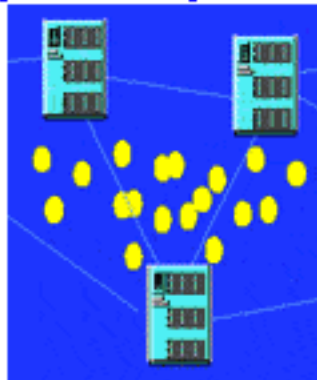
ICT has changed many things around

People → Appliances + Objects
Locally → Remotely
Fixed → Mobile
Wired → Wireless

Many persons,
one computer



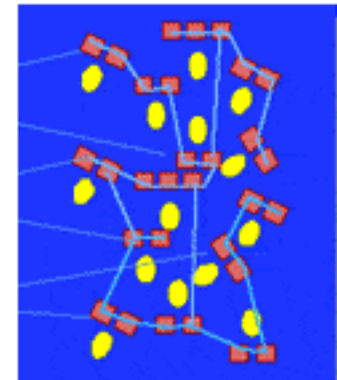
Fewer persons
per computer



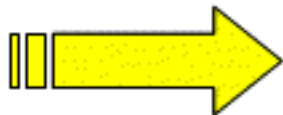
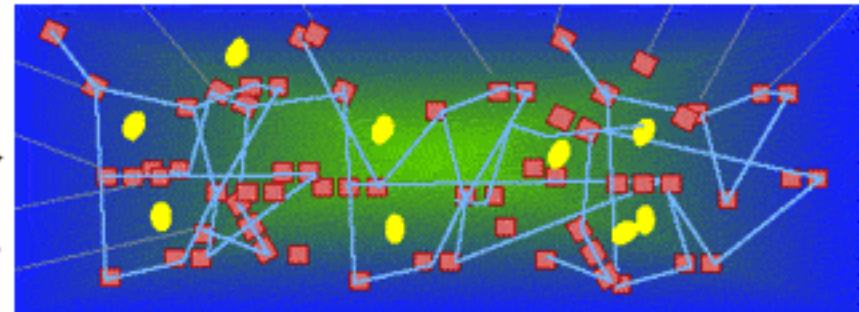
One person
per computer



One person,
few computer



One person,
many computer!!



Era of Ubiquitous

New Environmental Changes

- ❑ **Space:** Real Space (Physical)
 - ➔ Cyber Space (Electronic)
 - ➔ Ubiquitous Space (Cross Space)
- ❑ **(Communication) Speed:**
 - Mbps ➔ Gbps ➔ Tbps (Tera: 10^{12})
 - ➔ Pbps (Peta: 10^{15}) (➔ Velocity of Light)
- ❑ **Media:** Analog ➔ Digital ➔ Hybrid
- ❑ **System:** Centralized ➔ Distributed ➔ Integrated



Contents

0. Background

1. The 4th Wave of Environmental Changes

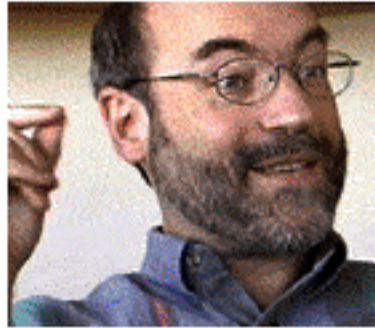
2. Ubiquitous Computing with Convergence of ICT

3. UT from Ubiquitous Home to Ubiquitous World

4. The Advent of Cross Space and Space Divide Problem in Ubiquitous World

5. Conclusion

1. The 4th Wave of Environmental Changes



... "a new way of thinking about computers in the world, one that takes into account the natural human environment," **Mark Weiser** (1952-99, Palo Alto Research Center of Xerox Co.) hoped to create a new world in which people interacted with and used computers without thinking about them....

1st Wave

Primitive Society

2nd Wave

Agricultural Society

3rd Wave

Industrial Society

4th Wave

Information Society

Ubiquitous Society



Agricultural Revolution
(During Several
Thousands Years)



Industrial Revolution
(During Several
Hundreds



Information Revolution
(During Several
Decades)



Integrated Space Revolution
(During Several
Years)



Intelligent Integration of Physical Space and Cyber Space by Ubiquitous Technology

2. Ubiquitous Computing with Convergence of ICT

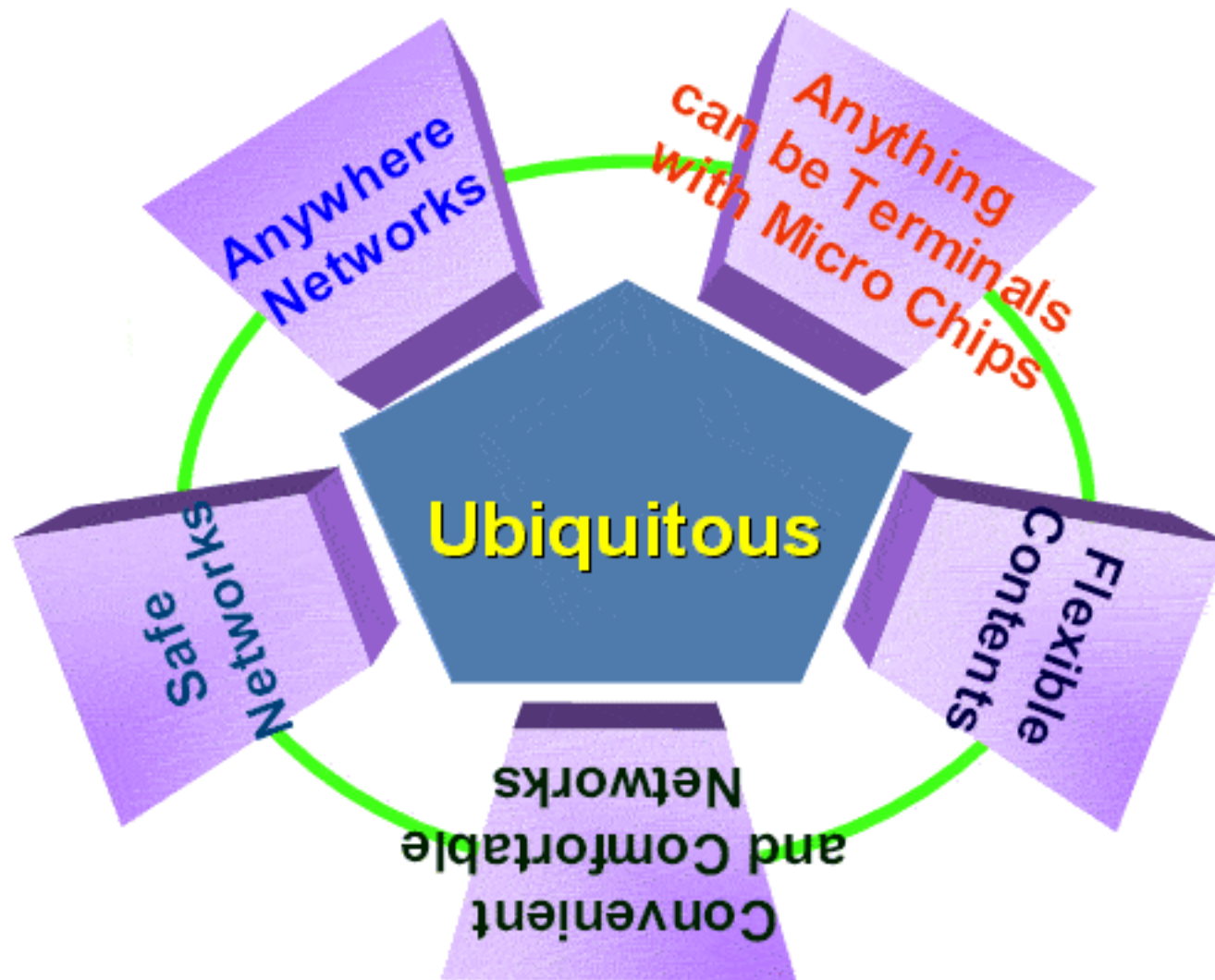
Comprehensive Meaning

- ❑ **“Ubiquitous”** (Latin)
 - ➔ Being or seeming to be everywhere at the same time; omnipresent:
- ❑ **“Ubiquitous Computing”** Computing environment that access will be anywhere and anytime:
 - ➔ Wherever we go! Whenever we want to use it!
 - ➔ We can access the computing network and acquire the necessary information.

Practical Meaning

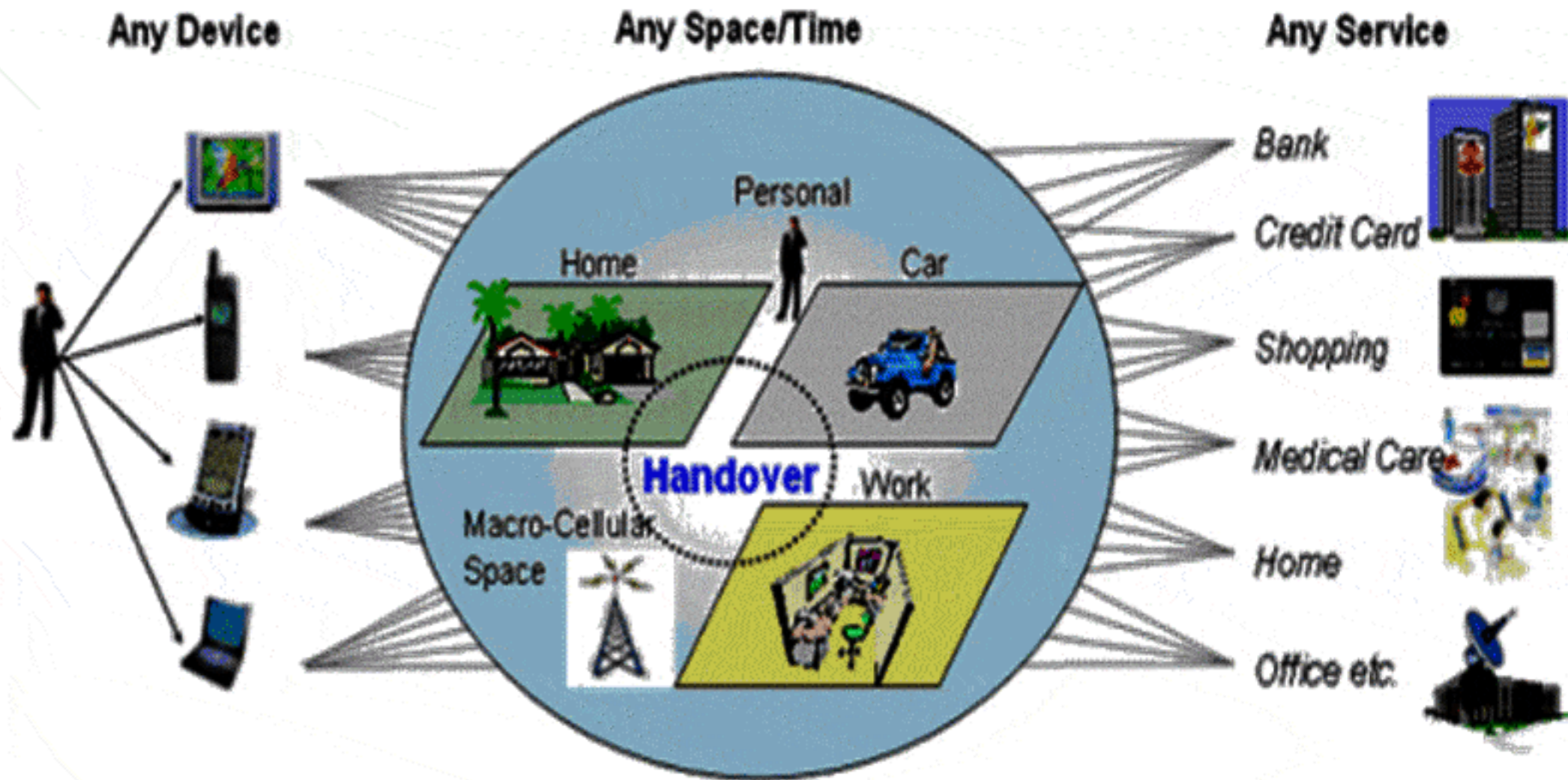
Ubiquitous computing is the method of enhancing computer use intellectually by making many computers available throughout the physical environment (with invisible Micro-Chips in Products, Roads, Bridges, Tunnels, Buildings, and others in connection with Mobile Networking Systems), but making them effectively invisible to the user.

Ubiquitous Computing



Conceptual Diagram

Ubiquitous Computing Environment



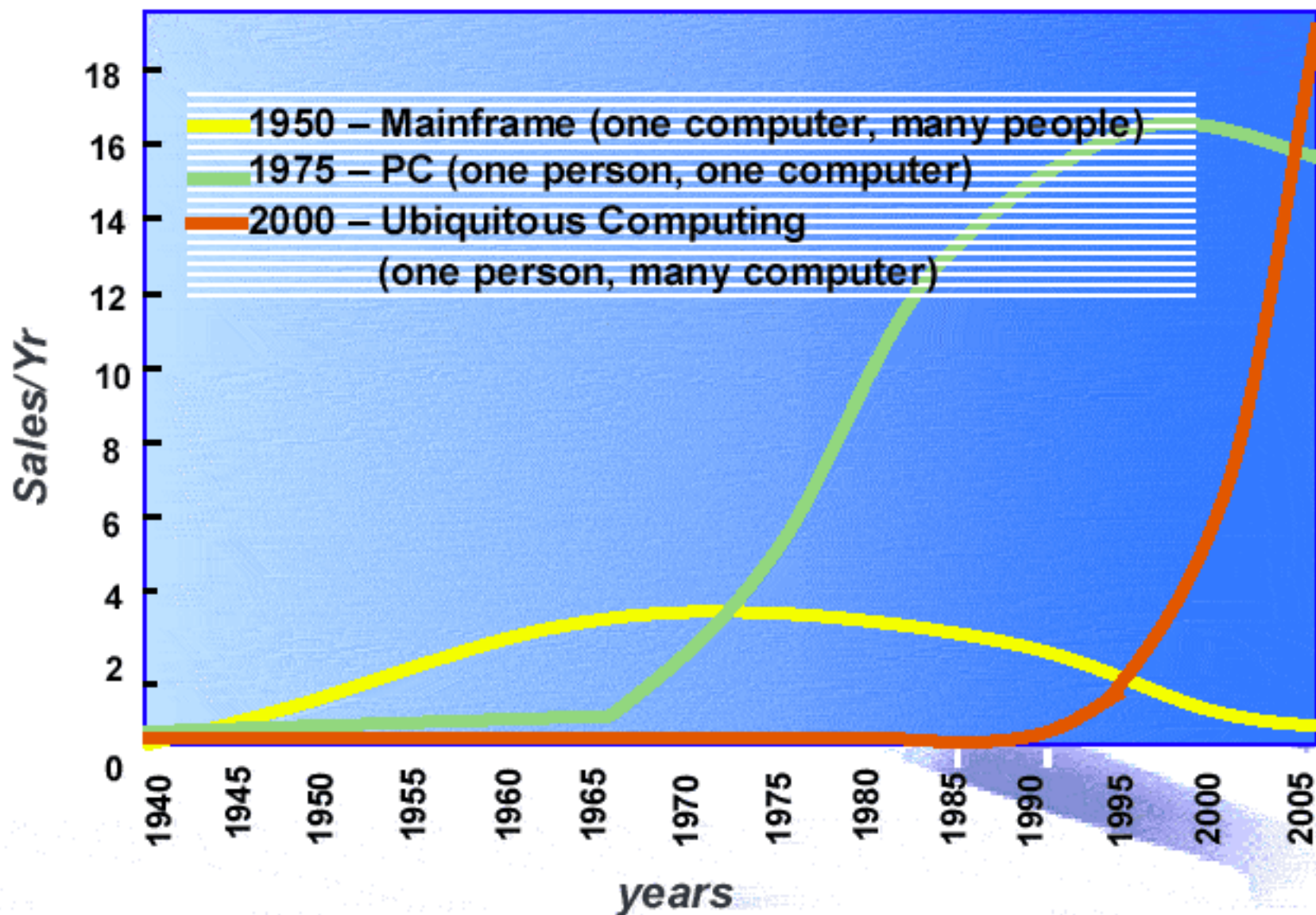
Trends of Computing Systems

Era	Trend	Description
First (1950-1975)	Mainframe Computer	Many/Few People One Computer
Second (1975-2000)	Personal Computer	One/Few people one Computer
Third (2000-2020)	Ubiquitous Computing	Many Computers One Person

Core Technologies of Ubiquitous Computing

Core Technologies		Contents
Basic Technologies	Sensor Technology	<ul style="list-style-type: none"> <input type="checkbox"/> RFID(Radio Frequency Identification), Bio Chip, MEMS (Micro Electro Mechanical System), Temperature Sensor Devices
	Semiconductor Technology	<ul style="list-style-type: none"> <input type="checkbox"/> Lower Power Micro Processor, Memory Devices <input type="checkbox"/> OS Design technology
	Network Technology	<ul style="list-style-type: none"> <input type="checkbox"/> Sensor Network <input type="checkbox"/> High-Speed LAN, Wireless Personal Area Network (WPAN)
Application Technologies	Status Recognition Technology	<ul style="list-style-type: none"> <input type="checkbox"/> Voice, Characters, Motion Recognition Technology <input type="checkbox"/> Geographical Position and Status Recognition technology
	Intelligent Intention Recognition Technology	<ul style="list-style-type: none"> <input type="checkbox"/> User Intention and Status Recognition Technology with Interaction under Intelligence Environment
	Response Creation Technology	<ul style="list-style-type: none"> <input type="checkbox"/> Environment Change Technology and Information Announce Technology by User Instruction
	Integration Technology	<ul style="list-style-type: none"> <input type="checkbox"/> User-Friendly Computing Technology <input type="checkbox"/> Invisible Internal Integration technology

Trends of Computing Systems



Characteristics of Ubiquitous Computing.

- ❑ The computer which is not connected to network is not Ubiquitous Computing
- ❑ As a calm technology, It should be invisible
- ❑ Wherever in real world not virtual space, we can use the computer interface
- ❑ According to the user's conditions(place, ID, equipment, time, temperature, brightness, weather etc.), The service should be changed

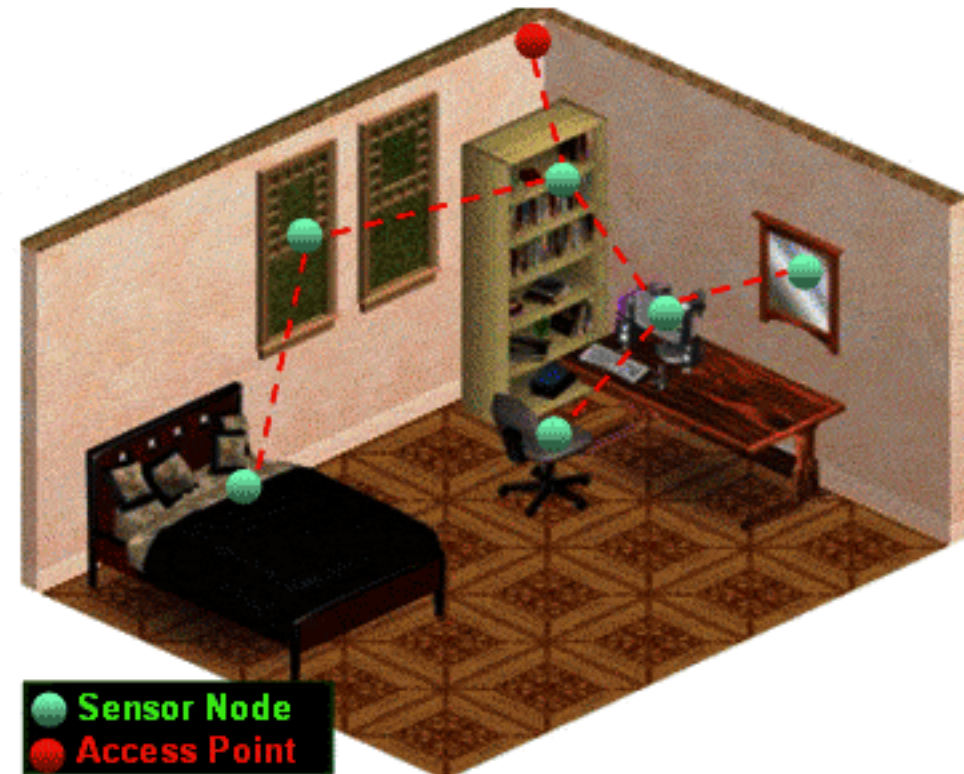
*Tags Developed by T-Engine
Project of UID, Japan*



Ubiquitous Environment [Bed Room]

□ Components

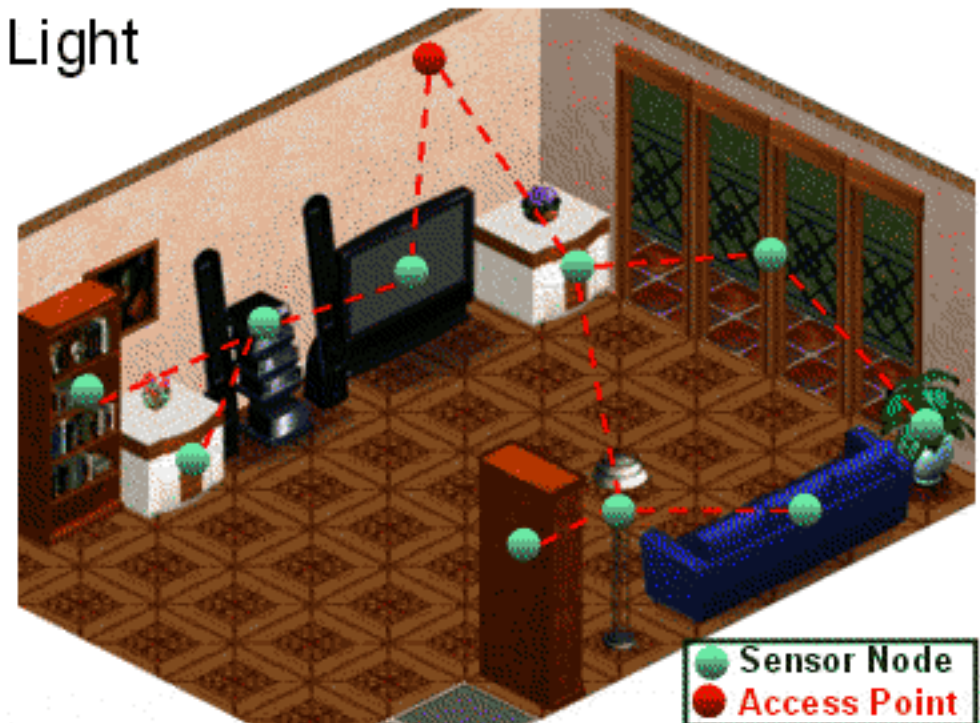
- ➔ Bed Controlling by the Sleeping status
- ➔ Automatic Lamping and Adjusting Light
- ➔ Computer and Display Screen Announcing Schedule and Notices
- ➔ Shelves Managing Position Information of Books with RFID
- ➔ Chair Checking Health Status of Users
- ➔ Automatic Curtain and Windows
- ➔ Sensor for Measuring Temperature in the Room



Ubiquitous Environment [Living Room]

□ Components

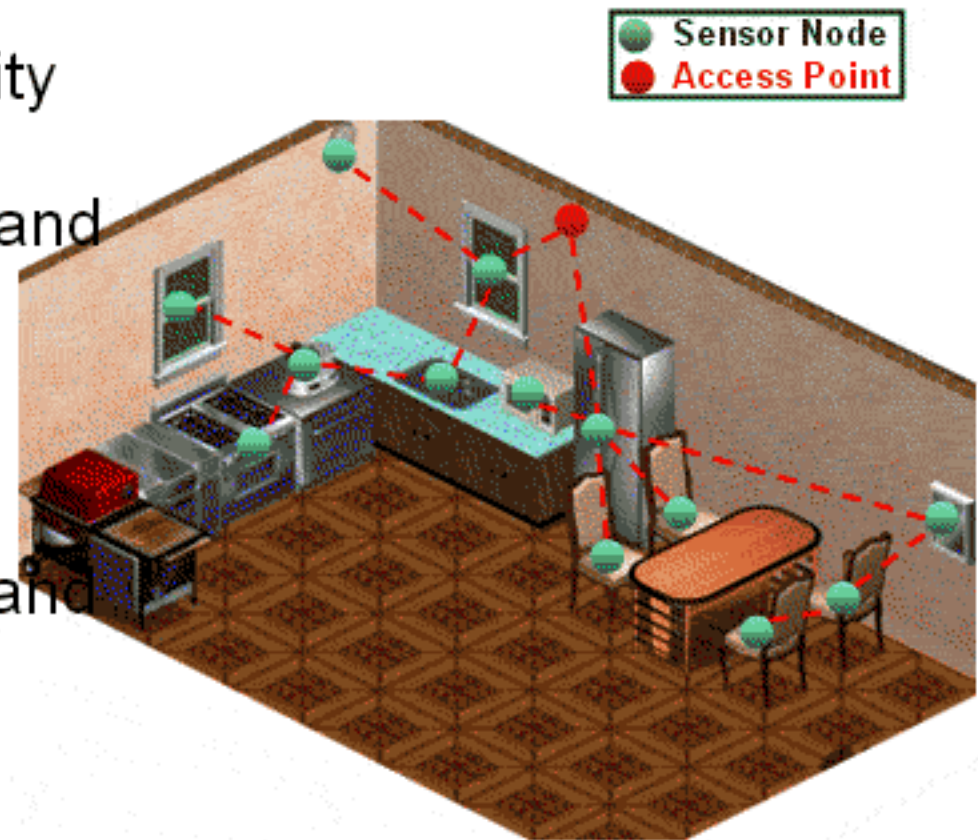
- ➔ Flowerpot Identifying Management Status
- ➔ Entrance Gate Monitoring the Persons who Enter
- ➔ Multi-vision Monitoring all Information in Connection with Home Server Systems
- ➔ Sensor Measuring Temperature and Moisture Status in the Living Room
- ➔ Automatic Lamping and Adjusting Light
- ➔ Sofa Checking Health Status of Users
- ➔ Displaying Shelves and Drawer Tracing Location of Things
- ➔ Audio System Recognizing Users
- ➔ Automatic Curtain and Windows
- ➔ Sensor Measuring External Temperature



Ubiquitous Environment [Kitchen]

□ Components

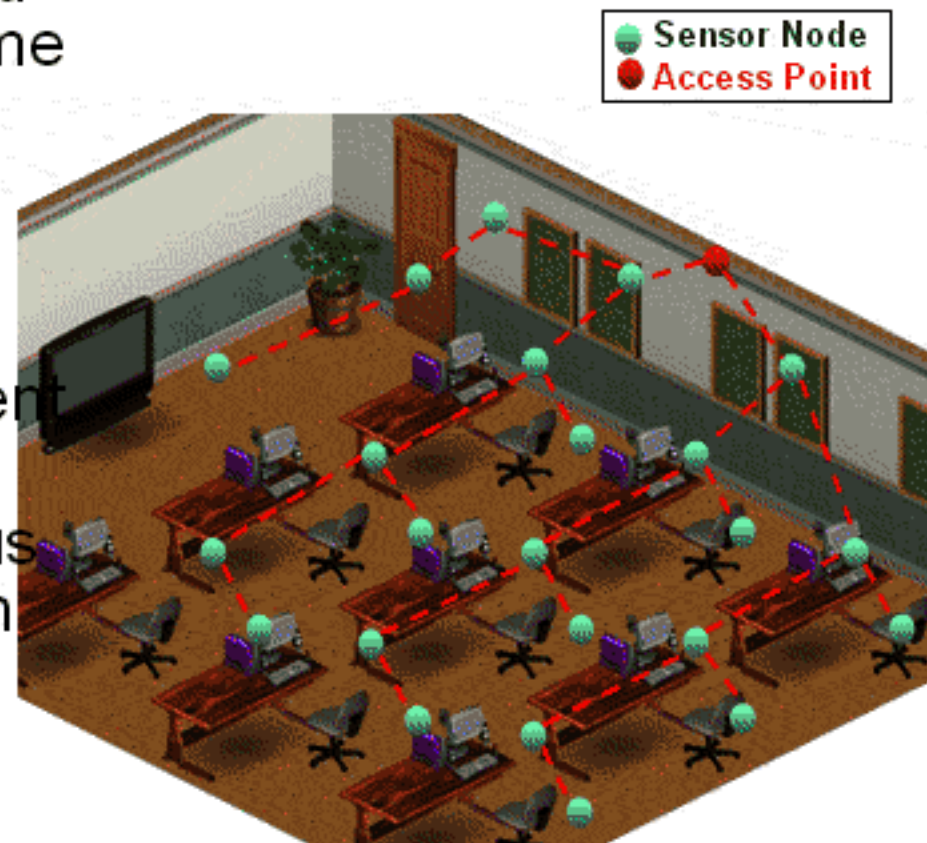
- ➔ Ventilator Checking & Ventilating Air
- ➔ Chair Checking Health Status of Users
- ➔ Refrigerator Monitoring Quantity and Condition of Foods
- ➔ Sink Controlling Temperature and Capacity of Water
- ➔ Cooking Machines by Recipe Information provided
- ➔ Automatic Windows
- ➔ Automatic Oven with Heating and Safety Control
- ➔ Monitor Checking Menu and Amounts of Food Materials



Ubiquitous Environment [Classroom]

□ Components

- ➔ Automatic Lamping and Adjusting Light
- ➔ Automatic Windows
- ➔ Door Identifying Attendances and Monitoring the Persons who Come in and Go out
- ➔ Computer Identifying Users and Setting User-Environment in Connection with School Servers
- ➔ Flowerpot Identifying Management Status
- ➔ Chairs Recognizing Health Status and Linking the Server for Health Care
- ➔ Multi-Vision Helping Classes in Connection with School Server



A ubiquitous World in Our Life

Urban areas

1. Routing support to permit seamless roaming among networks and media types by maintaining active TCP/UDP connections.
2. Provide location-aware and personalized advice for vehicle drivers.

Multimedia conference, DMB

Office

1. Collaboration with other group within a company and with suppliers and customers can reduce cost from fluctuating supply and demand.
2. Create new business from real-time and location-based commerce.

Location Aware
Personalized Advice

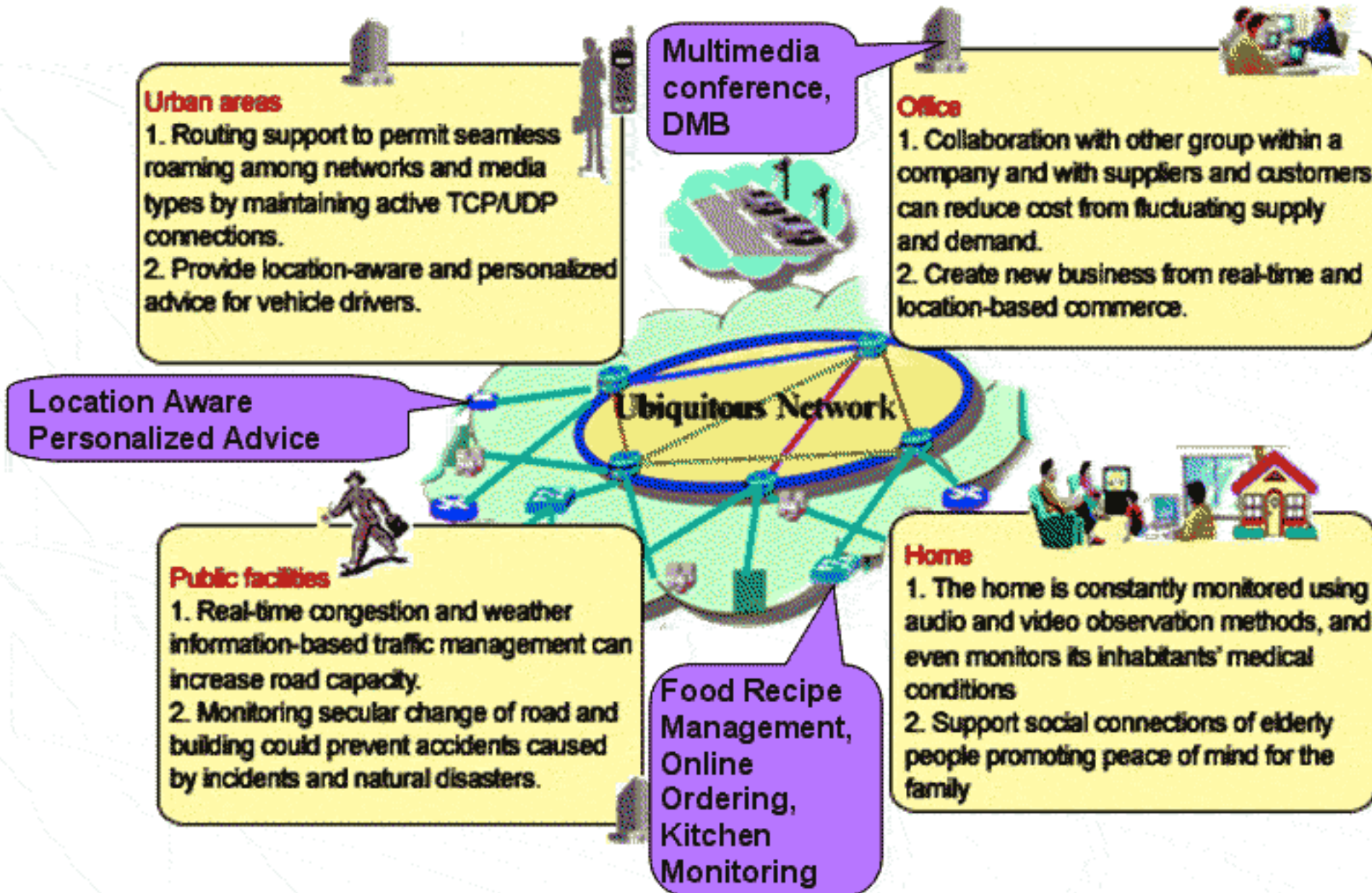
Public facilities

1. Real-time congestion and weather information-based traffic management can increase road capacity.
2. Monitoring secular change of road and building could prevent accidents caused by incidents and natural disasters.

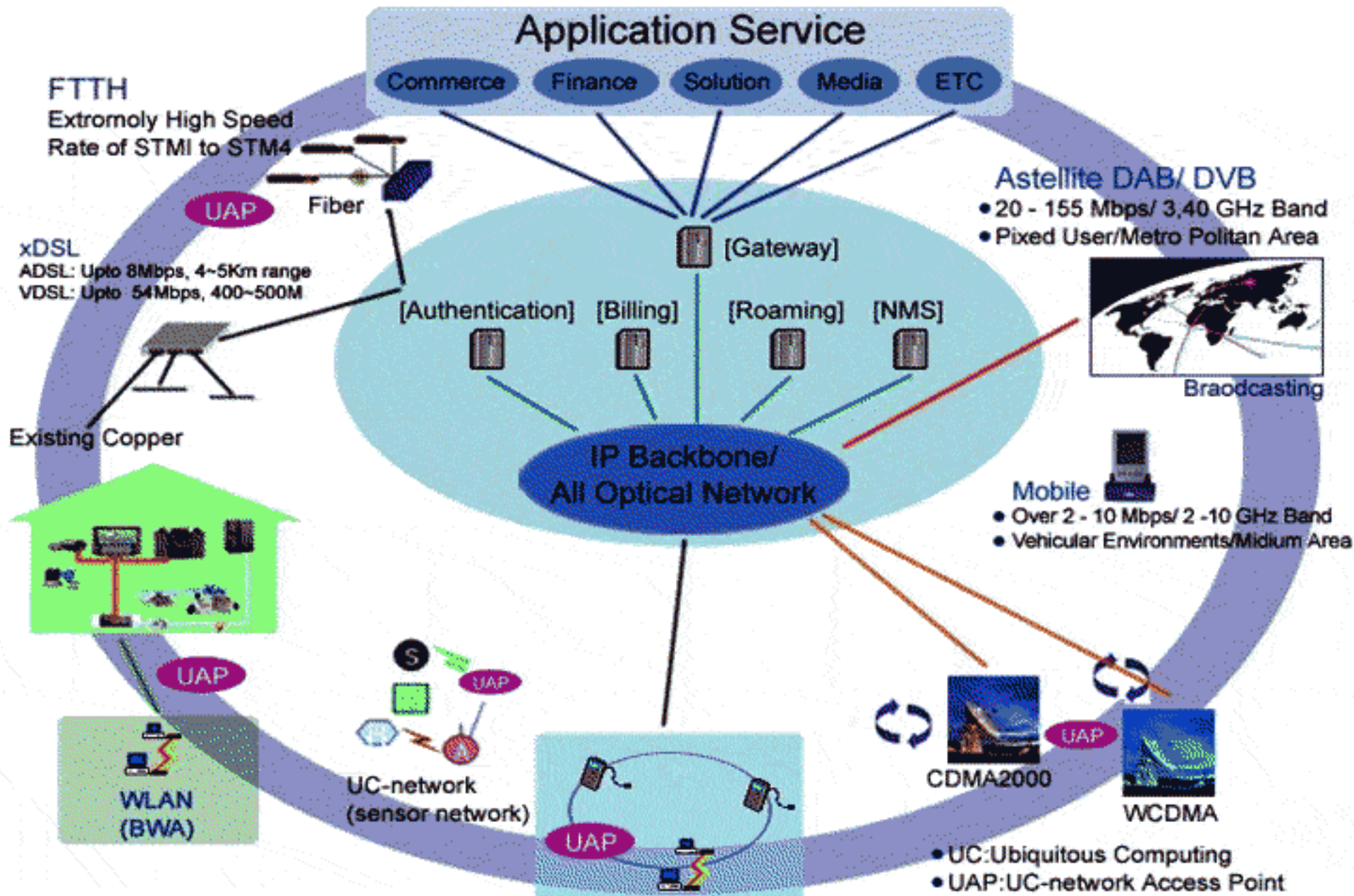
Food Recipe Management, Online Ordering, Kitchen Monitoring

Home

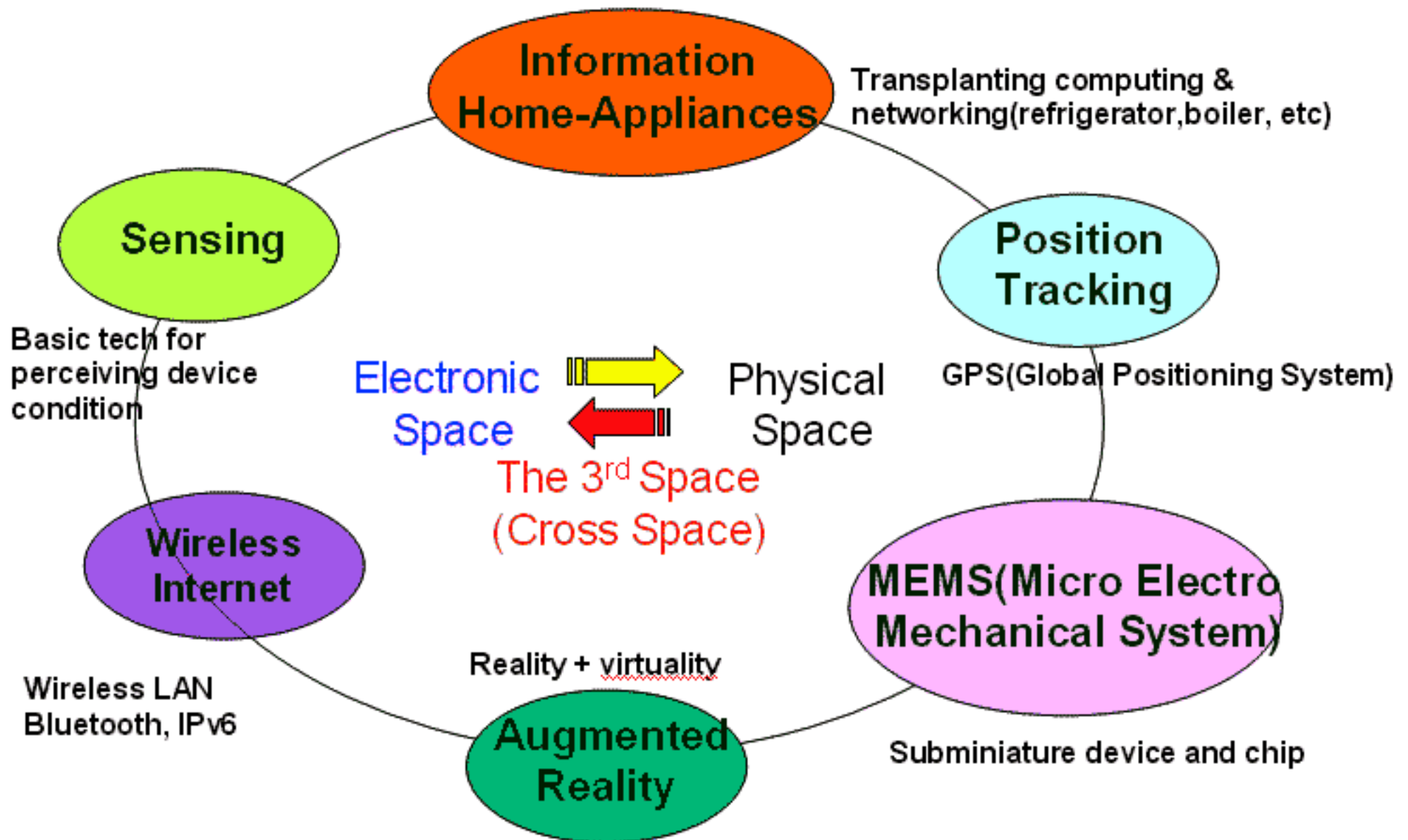
1. The home is constantly monitored using audio and video observation methods, and even monitors its inhabitants' medical conditions
2. Support social connections of elderly people promoting peace of mind for the family



A Ubiquitous Network

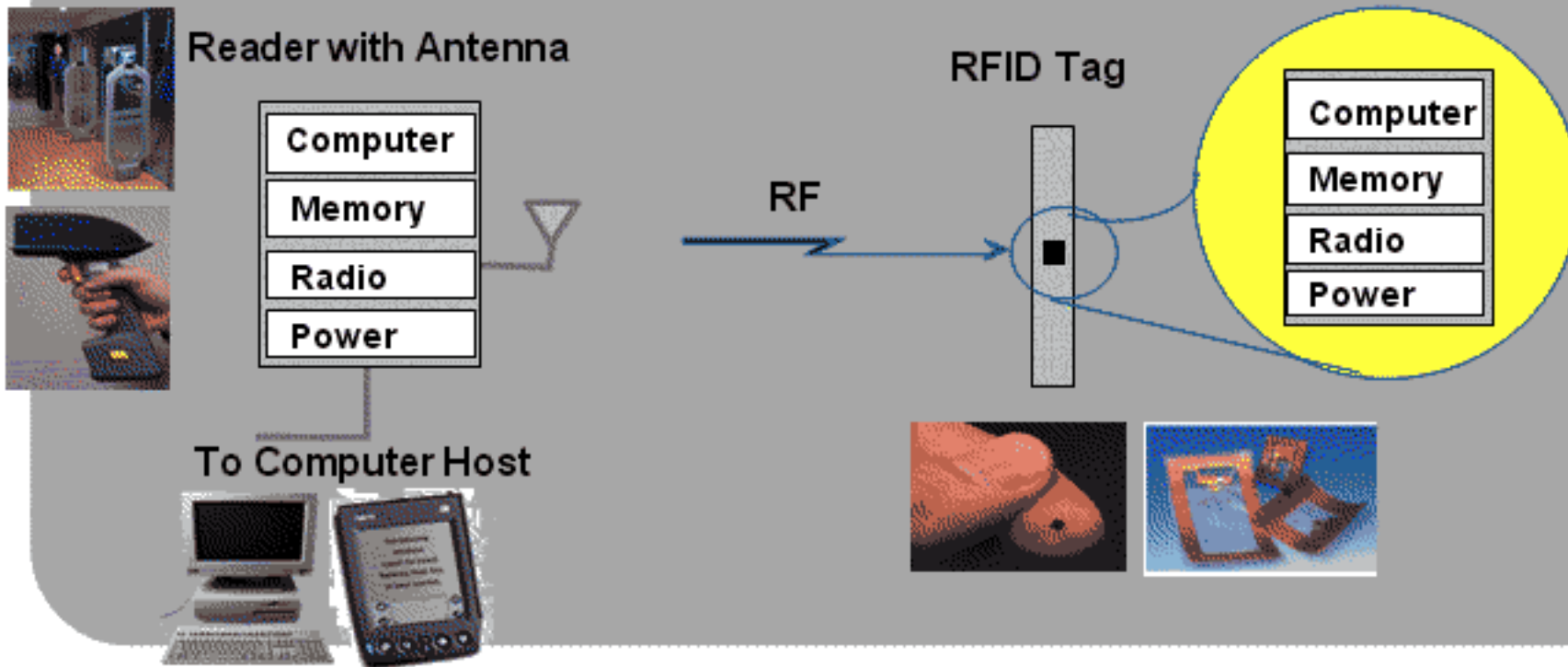


The 3rd Space with uT

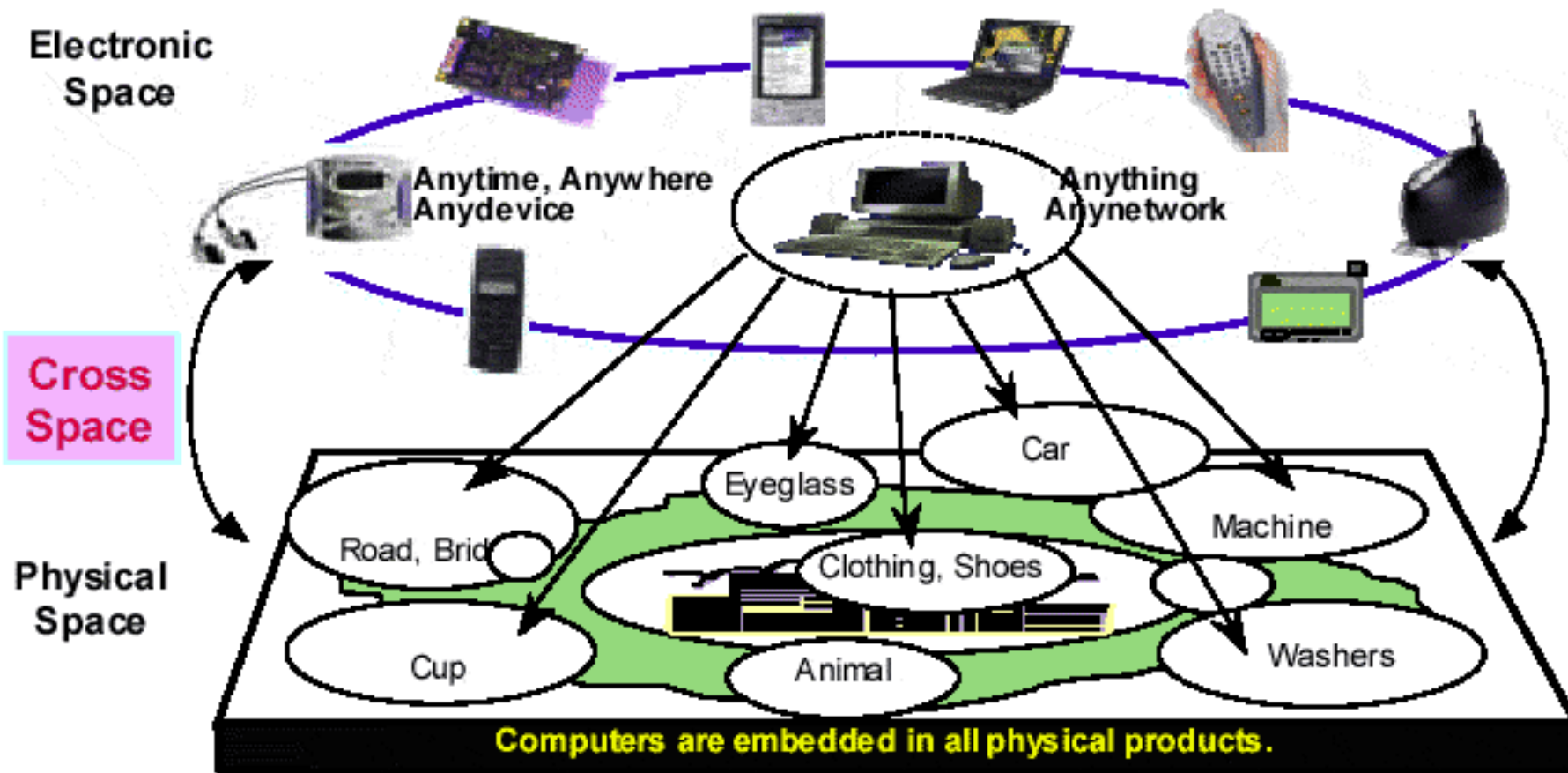


Example: RFID Tag

RFID is transmitting and receiving Radio Frequency signal and composed of tag(transponder), antenna, reader, host computer, etc.



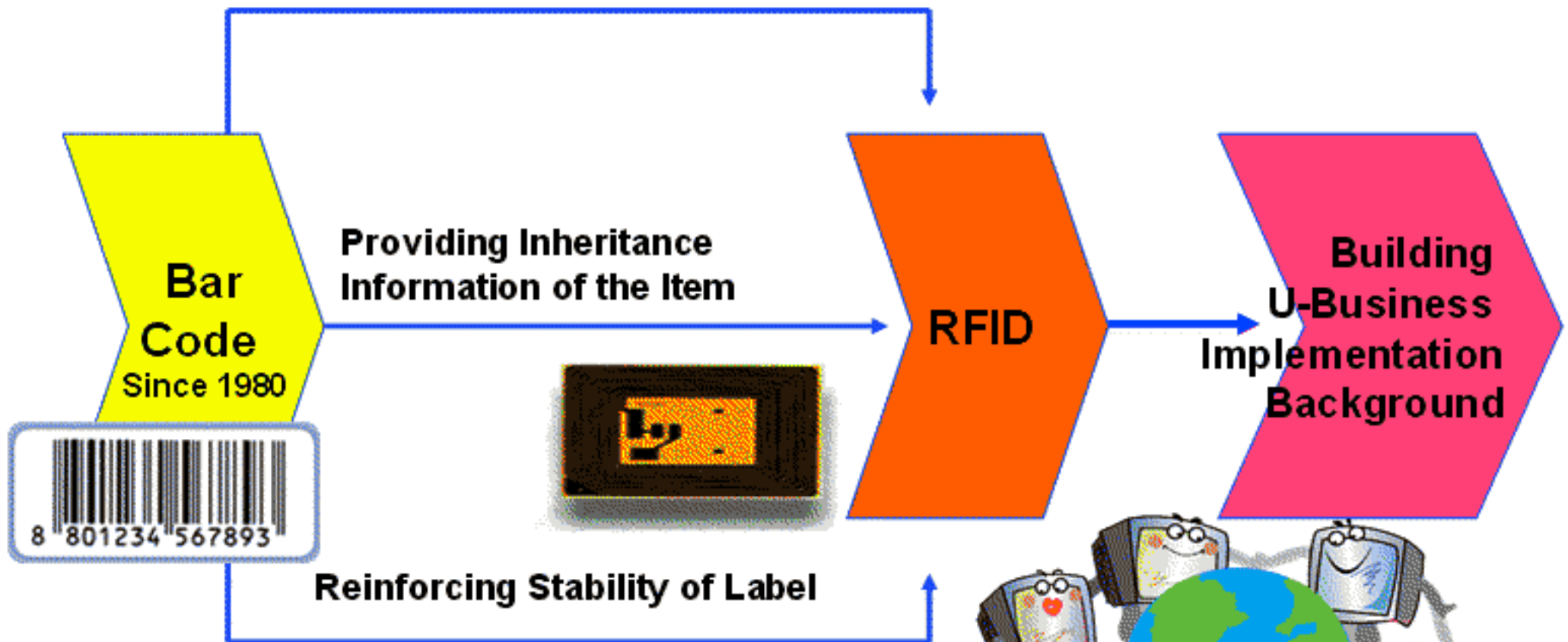
4. The Advent of Cross Space and Space Divide Problem in Ubiquitous World



Cross Space between Electronic Space and Physical Space

RFID Evolution and Sensor Networks

Extension of Control Area and Mobility

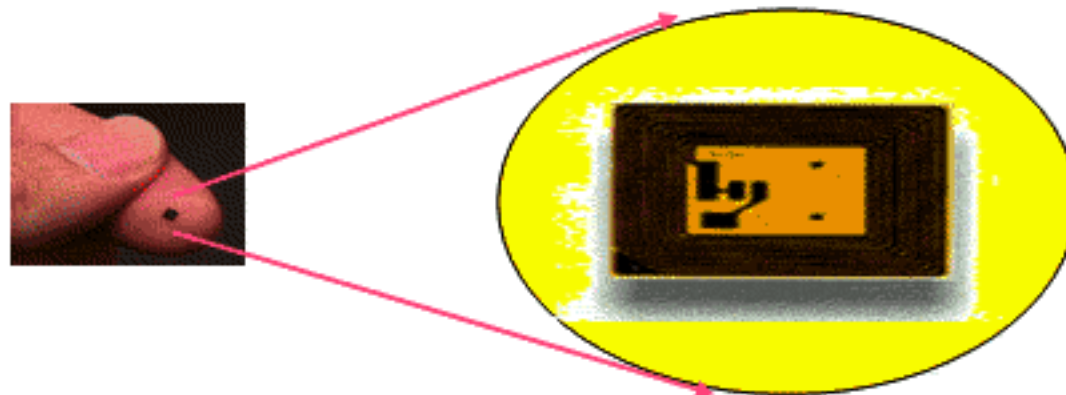


RFID Background

Definition of RFID

❑ Radio Frequency IDentification

- ➔ One of Innovative U-Business based on Ubiquitous Chip
- ➔ Automatic Item Identification Technology by use of Radio Wave and Micro-Chip during The 2nd War
- ➔ Near-Perfect Supply Chain Visibility in Applications



Composition of RFID– RFID Tag

RFID Tag

➔ Micro Chip with Electronic Product Code and Small Antenna

EPC Type (96bits)			
8bits	28bits	24bits	36bits
Header	Produced Company	Type of Product	Inheritance Number



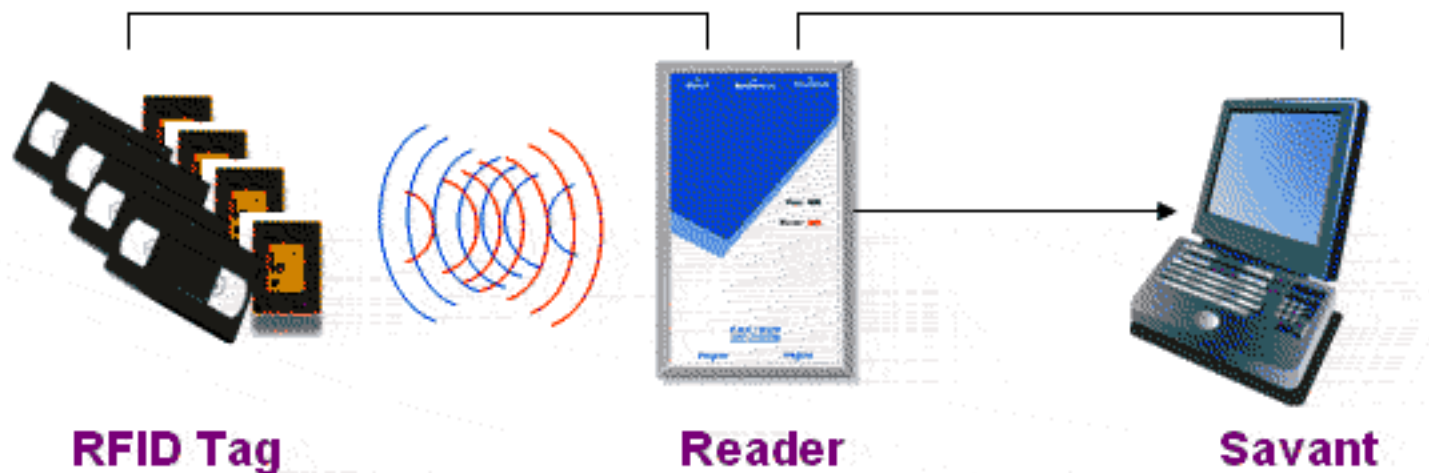
Composition of RFID– Reader

❑ Reader

- ➔ EPC Information Collection through Tag and Radio Wave Communication
- ➔ Transmit Collected EPC Information to “Savant”

Collecting EPC Information

Transmitting Collected EPC Information



Composition of RFID– Savant

□ Savant

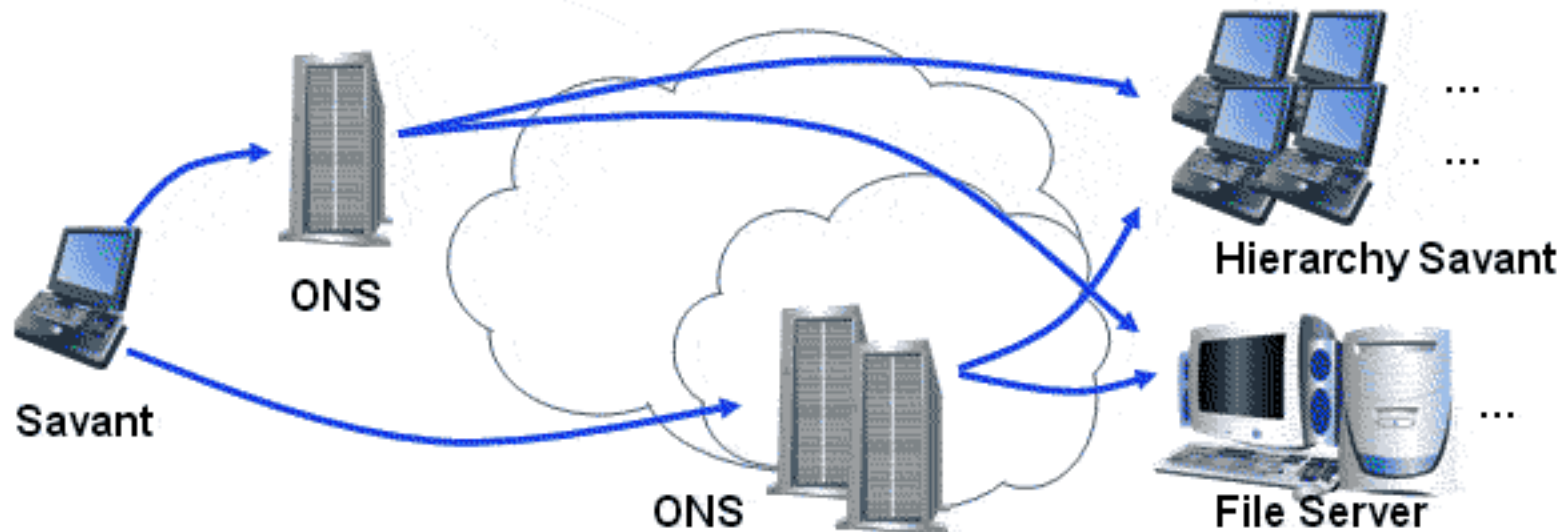
- ➔ Hierarchy Network System for Information Acquisition, Storing and Interaction with other Savants



Composition of RFID- ONS

❑ Object Name Service

- ➔ Similar Service of DNS providing site address requested by Communication Equipments
- ➔ Provision of Information Service to Savant regard on assigned Items



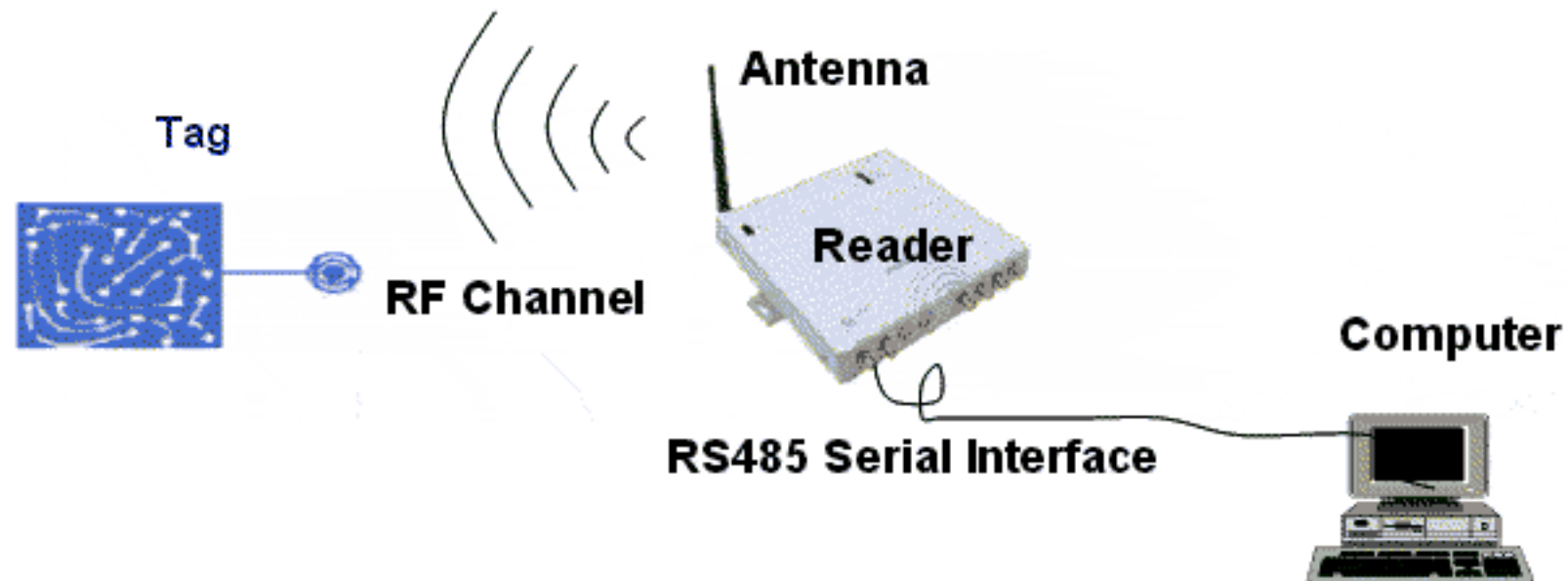
Composition of RFID– PML

❑ Physical Markup Language

- ➡ General Method describing Physical Objects in Hierarchy
- ➡ To be stored Dynamic and Temporary Data by PML Server
- ➡ PML Servers are operated by Products Manufacturers

RFID Evolution

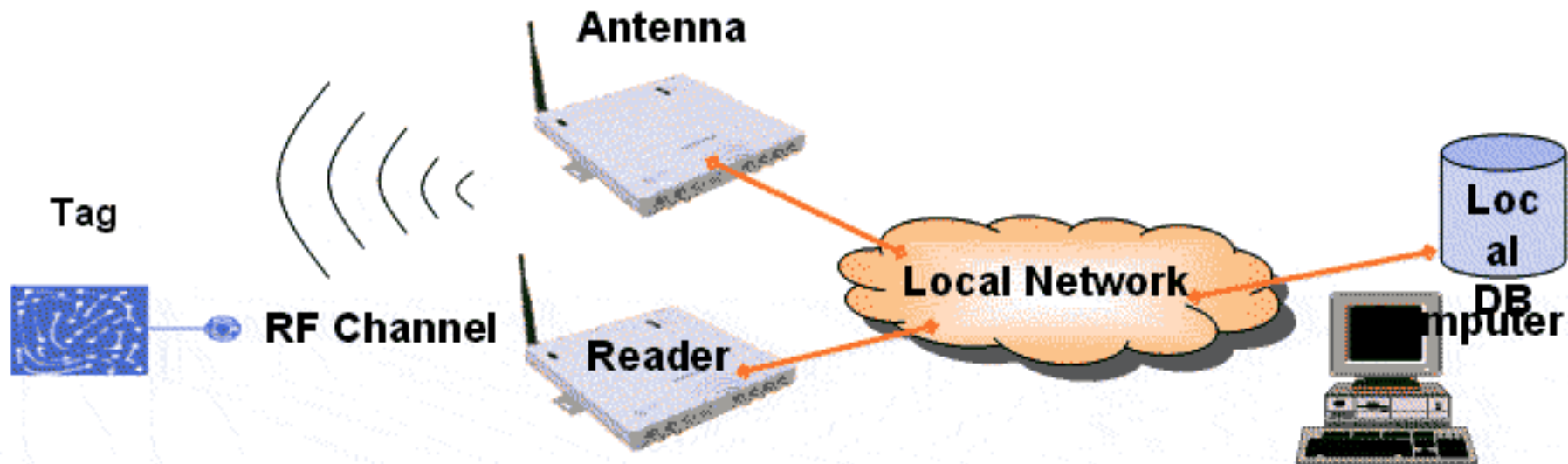
1 Stand-alone RFID



Tag ID	➔	Private Code
Connectivity	➔	Separated
Application	➔	Extremely restricted

RFID Evolution

2 Networked Private RFID



Tag ID



Private Code

Connectivity



Locally Connected and centralized processing

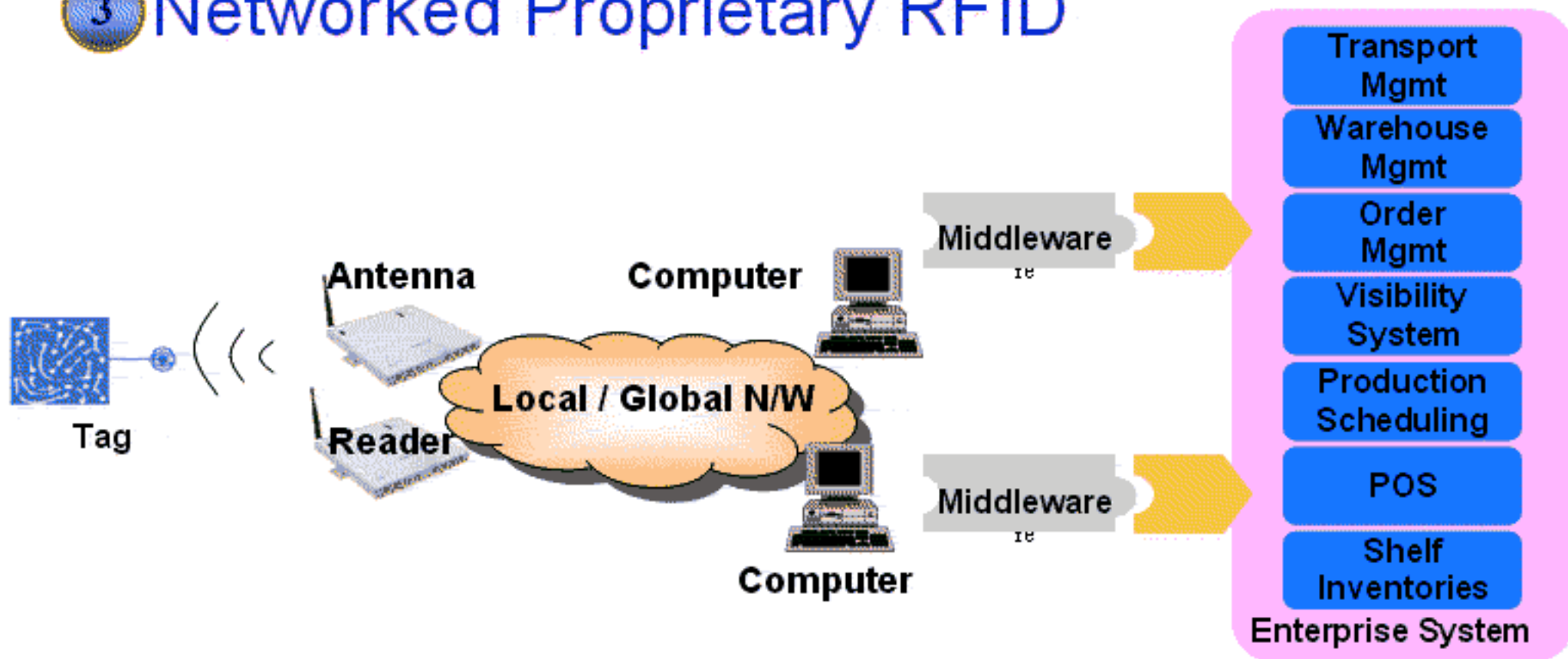
Application



Small scale applications (ex: library)

RFID Evolution

3 Networked Proprietary RFID



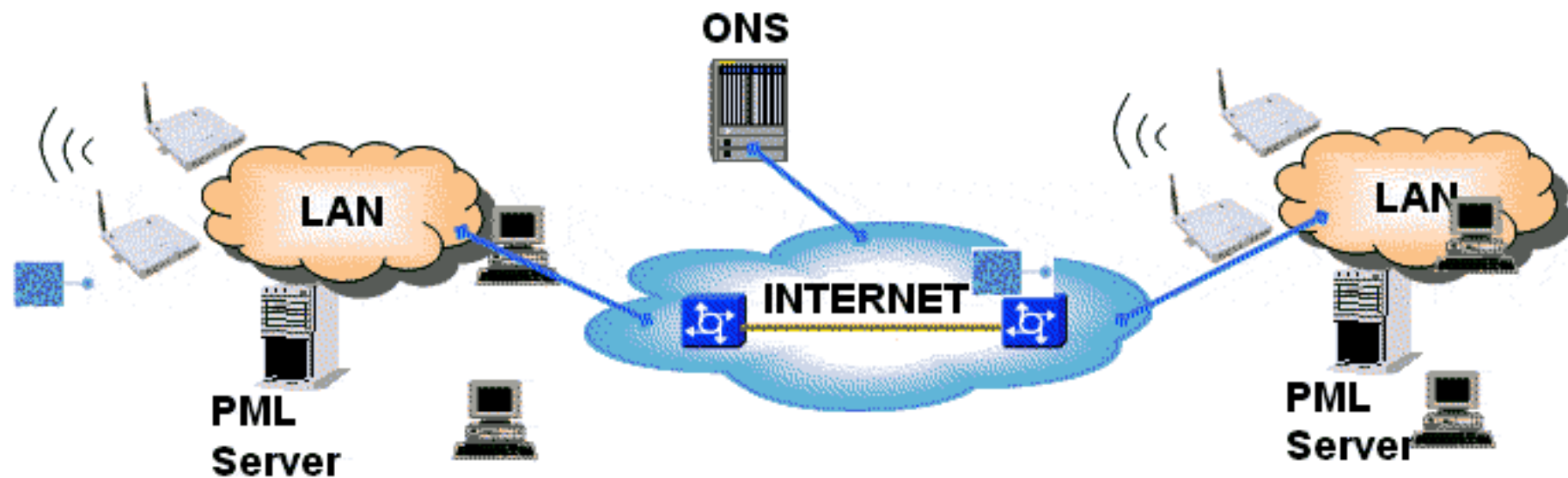
Tag ID
Connectivity
Application



Proprietary Code
Large scale and distributed processing
Enterprise level applications

RFID Evolution

- 4 Globally Networked RFID: Primitive
Physical Product Items are entangled with
Virtual world.

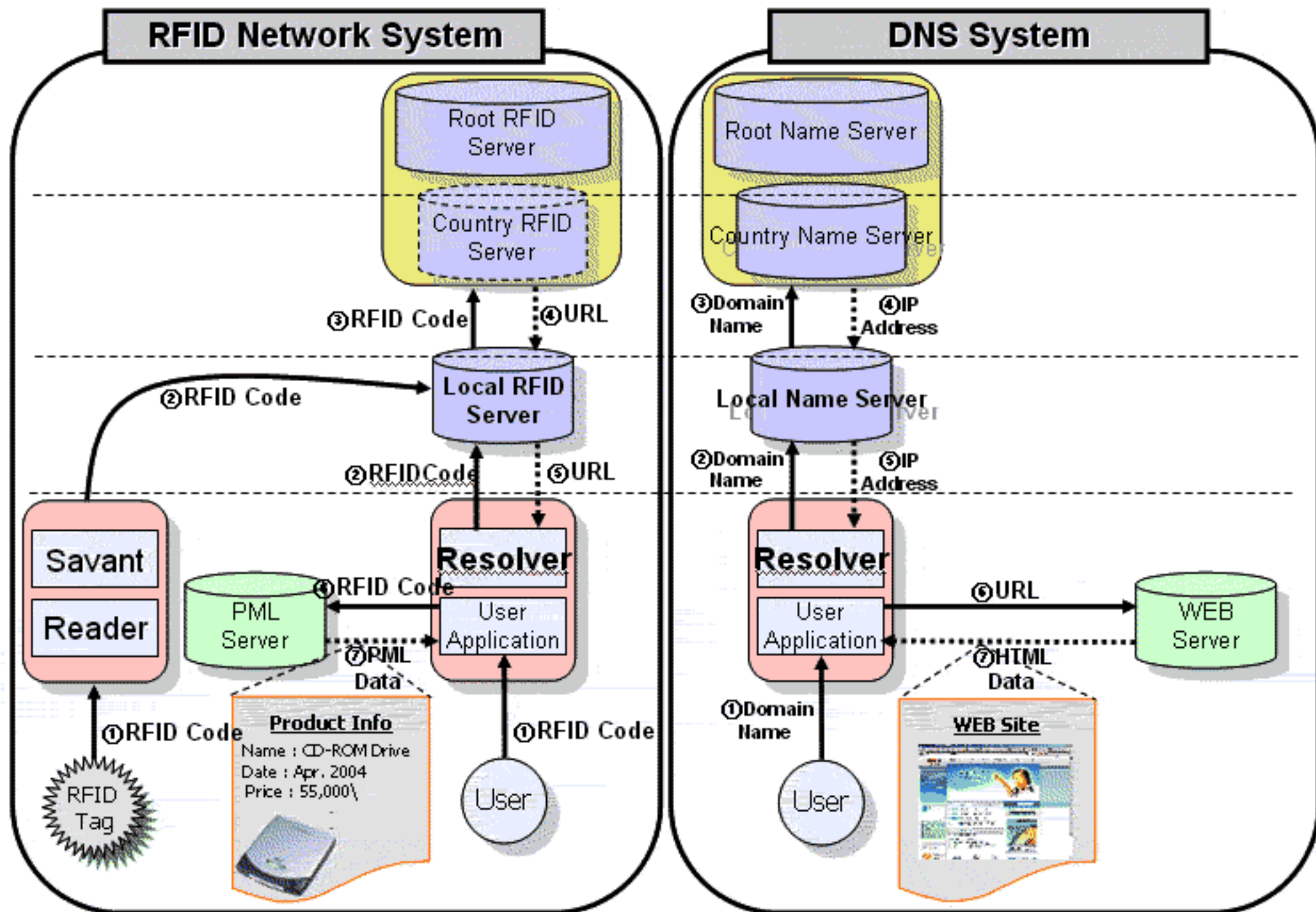


Tag ID
Connectivity
Application



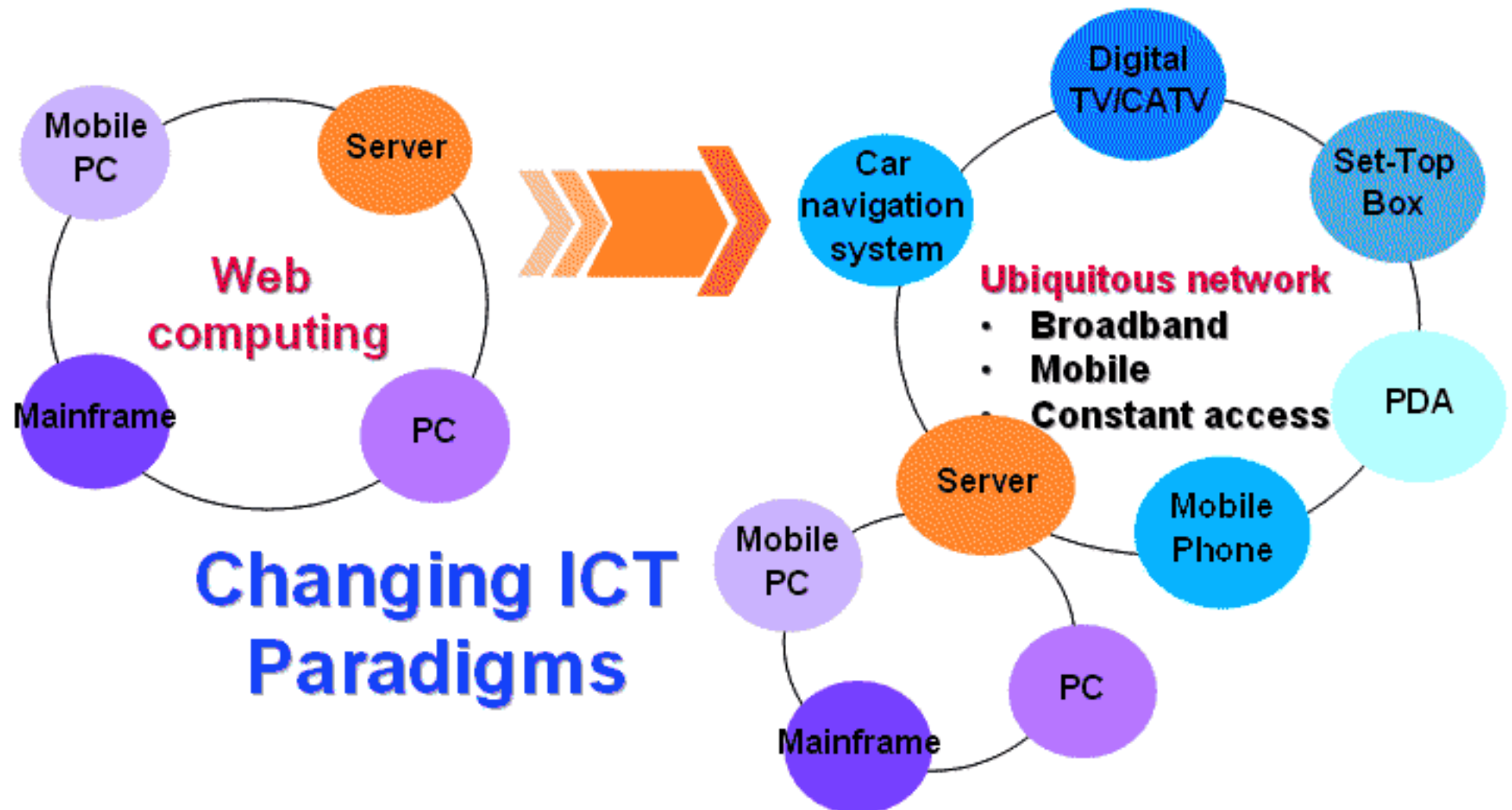
Universal Code (EPC)
Internet-level
Global scale applications

Comparison of RFID ONS & DNS



5. Conclusion

Needs of Corresponding Strategies against the Emerging Paradigm Shifts in the Technological Environmental Changes through ICT for Asia and the Pacific Region



Emerging Technologies

❑ “The Quest for the Next Big Thing”,

Business Week, Aug. 2003

- ① Utility Computing
- ② The Sensor Revolution
- ③ Plastic Electronics
- ④ Bionic Bodies



❑ “10 Emerging Technologies that will Change the World”,

MIT ENTERPRISE TECHNOLOGY REVIEW, Feb. 2003

- ① Brain-Wireless Sensor Networks
- ② Grid computing
- ③ Software Assurance
- ④ and more



Change of the Economic system

- ❑ **The space is goods itself in the ubiquitous network which have physical, information and space goods**
 - 1st Space : Physical goods (object of possession)
 - 2nd Space: Information goods (object of access)
 - 3rd Space: Space goods (object of living)
- ❑ **Economy of 3rd space enlarge Network to the Community**
 - e.g. Ubiquitous Apartment, U-City, and so on
 - The economy of 3rd space is not the economic behavior but similar to political behavior
- ❑ **Each people in the same community can be a maker and consumer simultaneously**

Change of the Management Strategy

□ 1st space

- Price competition is important

□ 2nd space

- Information distribution
- Network externality
- Increasing Returns to Scale in the information society

□ New management strategy in the 3rd space

- Inter-space

the core strategy is that converge electronic space and physical space

- Hyper-space

It is required that new management easily able to access and manage in electronic space and physical space

Pressing Problems in the 3rd Space

❑ **The Problem of Information Capability**

- ➔ Information gap, the poor ability for using internet cause the lower payment relatively
- ➔ It is more serious problem that there is huge information gap between Countries

❑ **Change from information divided to space divided**

- ➔ Addict in the 3rd space similar to the addict by internet
- ➔ Transparency of space can delete the corruption, however the scale of individual privacy may be reduced
- ➔ Alienation in the 3rd space

Serious Digital Divide : schools, gender, race, workplace, Countries



The gap of information and communication technologies among Asia and the Pacific countries are increasingly serious as a digital divide. Digital divide has been occurred technological gaps in human resource development throughout our society. Digital divide exists in various levels. It exists among countries with different levels of developments, between cities and rural areas, the rich and the poor, men and women, and the young and the old even in the same country.

Space Divide in U-World

More important matter is that the digital divide of e-community might be more seriously expanded to **space divide** in the ubiquitous world by the advent of cross space among different socio-economic groups in Asia and the Pacific region.

Benefits and Convenience in U-World

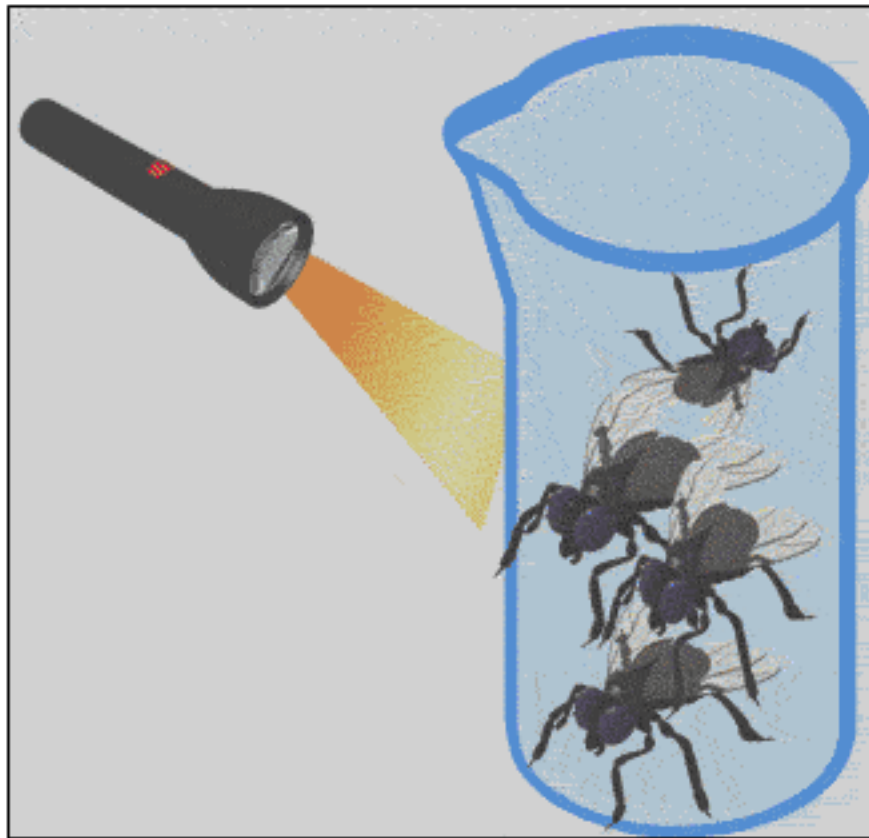
- ❑ **Ubiquitous Networks will provide various kinds of benefits and convenience to human life. Good examples can be found in public services such as disaster programs, traffic control, or health care monitoring.**
- ❑ **These ubiquitous applications have not only generic public values but also important implications promoting further development of related technologies, industries and markets in new 3rd space.**

Boiled Frog Phenomenon

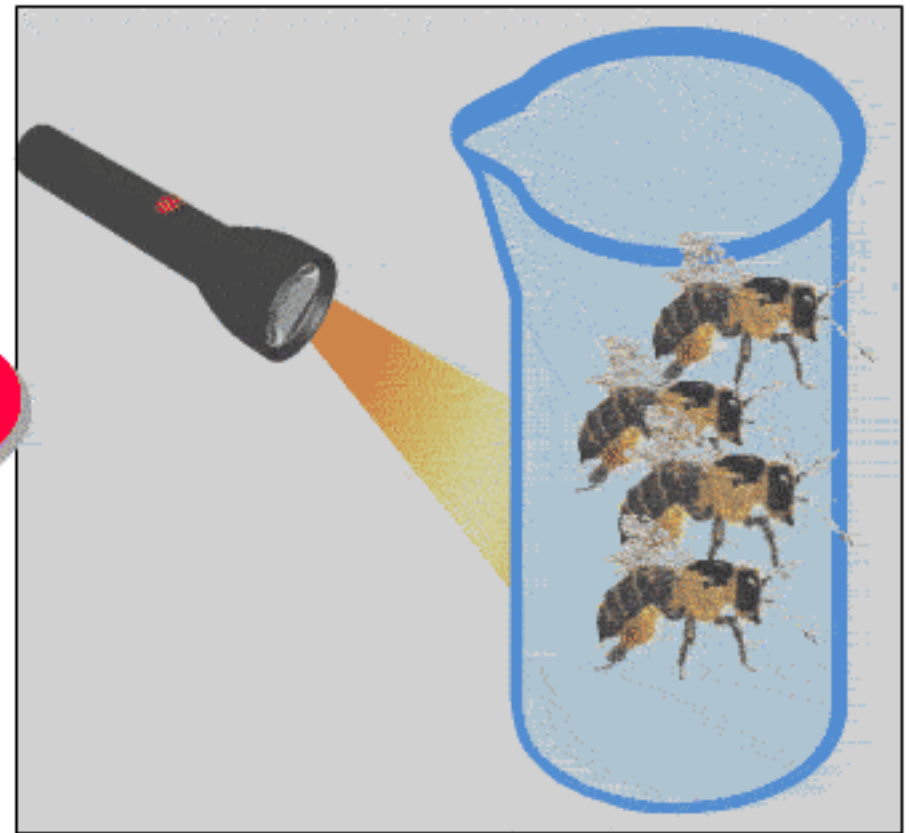


- ❑ If we boil a frog in cold water adding a slight degree of flame slowly, then the frog will die from unawareness of boiling water.
- ❑ Even though the frog felt the change of environment, it could not properly act to survive.

Adaptation from Environmental Change : Bees and Flies Experiment



Critical/Unexpected Action



Logical/Traditional Action

Why all Flies escaped and all Bees died in the beakers ?
Which group's nature is more closer to Administrators and Educators?