

2008 EU-Japan Cooperation Forum on ICT Research
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Technology Innovations Toward Green IT Society

Yasuhiko Arakawa

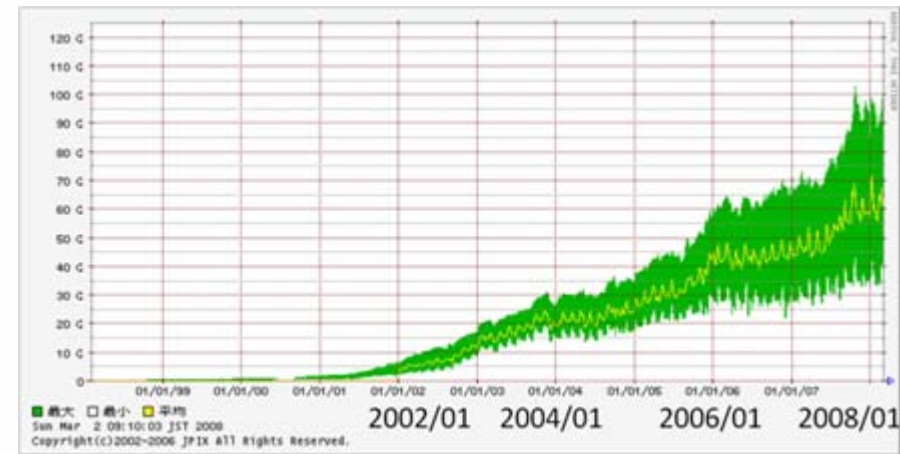
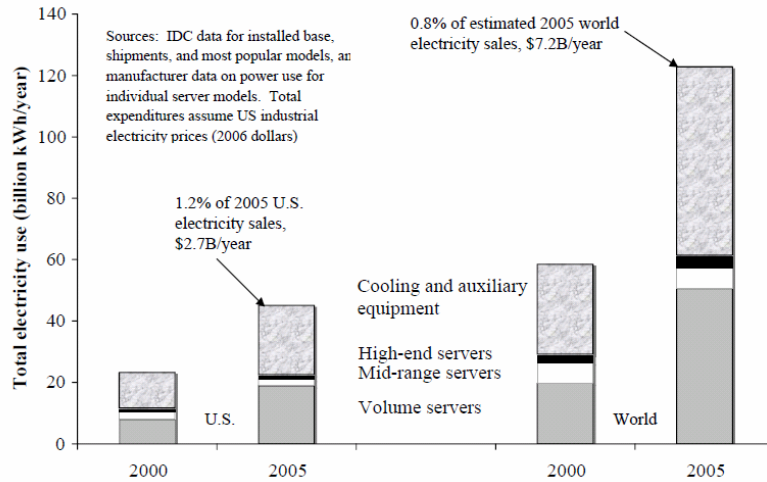
Institute for Nano Quantum Information Electronics

The University of Tokyo

Outline

- Introduction
- Innovation toward green IT society by virtual mobility technology
- University-industry collaboration
- Summary

Server electricity and internet traffic



Summary results for server electricity

http://www.energystar.gov/ia/products/downloads/UKEnergy_Summit_Slides.pdf

JPIX traffic 2008.3.1

Future trends of ICT

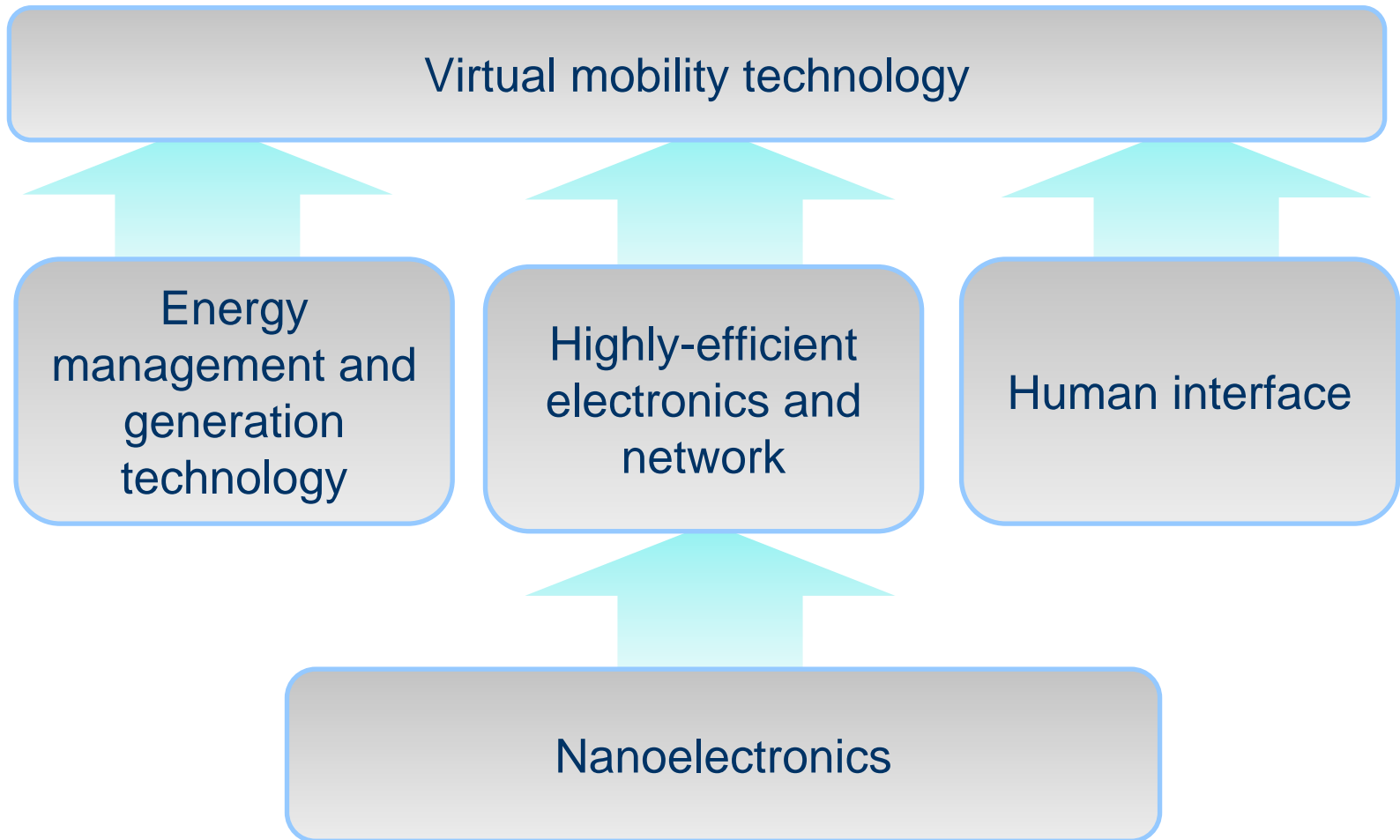
- Dramatic increase of information flow and total global energy consumption
 - Information flow @2025 > 200 x Information flow @2006
 - Target of 50% reduction of CO₂ exhaust
 - Advanced network systems and devices
 - Ultra-low power electronics and Ultra-broadband network
- Demands to user interface
 - Development of ore user-friendly interface
 - Advanced display and sensors
 - High resolution, large area, flexible and Various sensors

Virtual mobility technology* (I)

- Virtual mobility technology is defined as realizing social and economic activities by human and data communication through information network without physical movement of human and things.
- Virtual mobility technology reduces the total sum of the following energy consumption.
 - The energy consumed by information flow in global network
 - The energy consumed by the physical movement of human and things.

•The technology concept of “Virtual mobility” has been proposed by Technology-Strategy WG at Japan Electronics and Information Technology Industries Association

Virtual mobility technology (II)



Highly-efficient electronics and network

- High performance and Low power CMOS-LSI
 - Scale-down
 - High- and low-k material for insulating layers
 - 3D LSI
- Integrated energy management of equipment and devices
 - Low power consumption by multi- or many core technology of CPU
 - Dynamic power and clock management
 - Optical interconnection
- Highly-efficient power supply systems
 - High performance power devices
 - Power monitoring and eco-management
- Highly efficient photonic network
 - Core- and edge router
 - Broadband all optical repeater systems
- Low power and large area display

Energy management and generation

- Highly efficient air conditioner management
 - Distributed power management systems
 - Highly efficient power generation
- Solar cell technology
 - Silicon-based solar cells
 - Non silicon-based solar cells
 - Nanostructure-based solar cells
 - Printable solar cell technology

Human interface

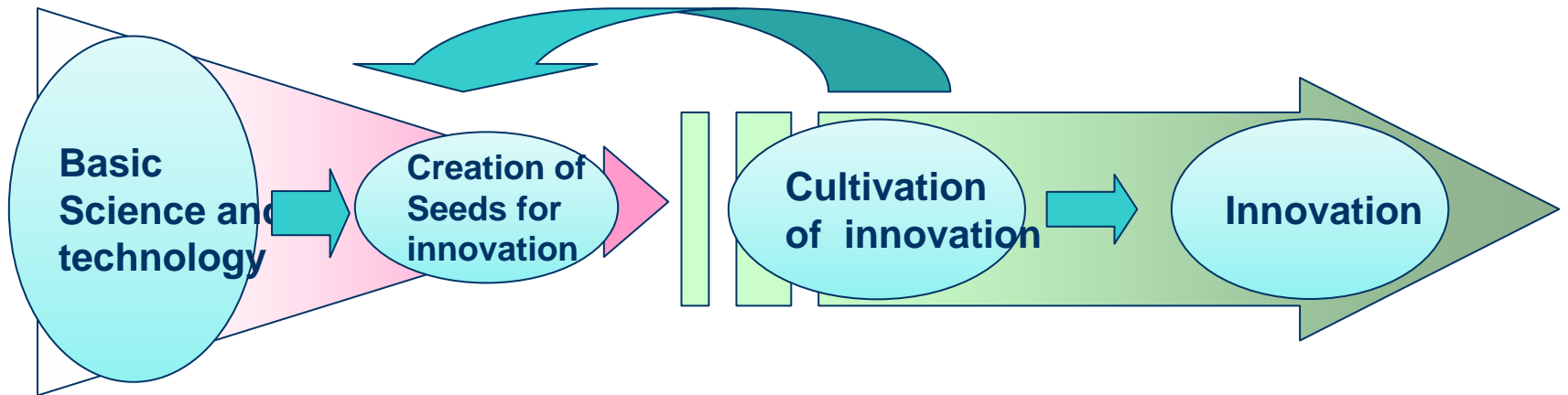
- Interface for human communication
 - Voice and image recognition
 - Automatic translation
- Display technologies for high-level reality
 - Large area and high resolution display
 - Flexible display, 3D display
- Security technology
 - Privacy
 - Cryptography communication
- Network technology
 - Wireless network
 - Sensor network
- Advanced sensor technology

Nanoelectronics

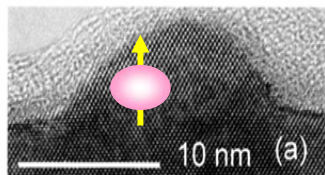
- Nano-CMOS materials
 - Carbon nanotube, Magnetic material for spintronics, Organic semiconductors, Metal-oxide material
- Silicon photonics
 - Optical and electronic integrated circuit, Optical interconnection devices
- Highly-efficient power devices
 - SiC, GaN
- Innovative quantum devices
 - Quantum dot devices, Quantum computing devices, Quantum cryptography communication devices, Superconducting devices

University-industry collaboration

- For realizing innovations, university-industry collaboration is indispensable.
- Sharing visions and locations



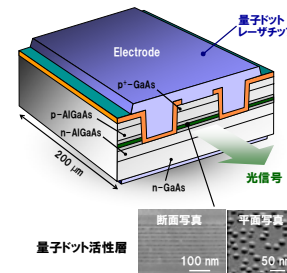
Phase I



Quantum dots proposed by Arakawa (1982)

25 years

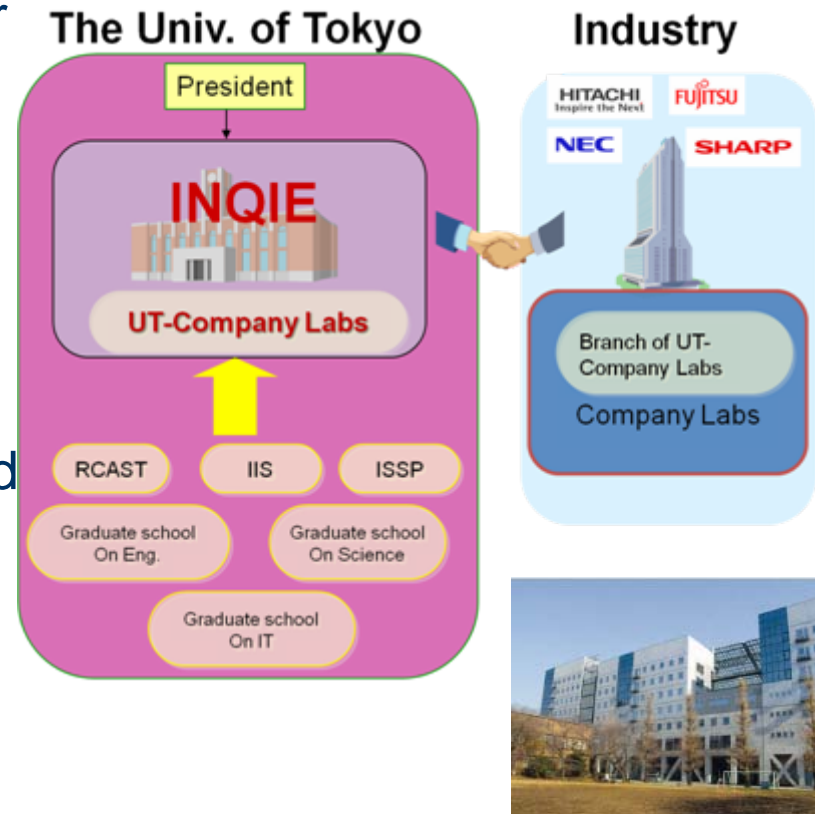
Phase II



A curve-out company "QD laser corp." (2006)

Example of university-industry collaboration

- The University of Tokyo started a new research institute “Institute for Nano Quantum Information Electronics “ (INQIE) in October 2006
- Joint collaboration with industries.
 - Four major companies, NEC, Sharp, Hitachi and Fujitsu, participate in this project. Four UT-company labs were opened on the Komaba campus.
 - Sharing visions and scientific and technological knowledge.
 - Development of quantum engineering



Summary

- Development of cutting-edge and the most advanced technology realizes the virtual mobility for highly efficient green IT society.
- University-industry collaboration and international collaboration are important for the green IT society.