

Research Activities on Broadband Mobile and Wireless Communications in the Center of Excellence Program at Keio University

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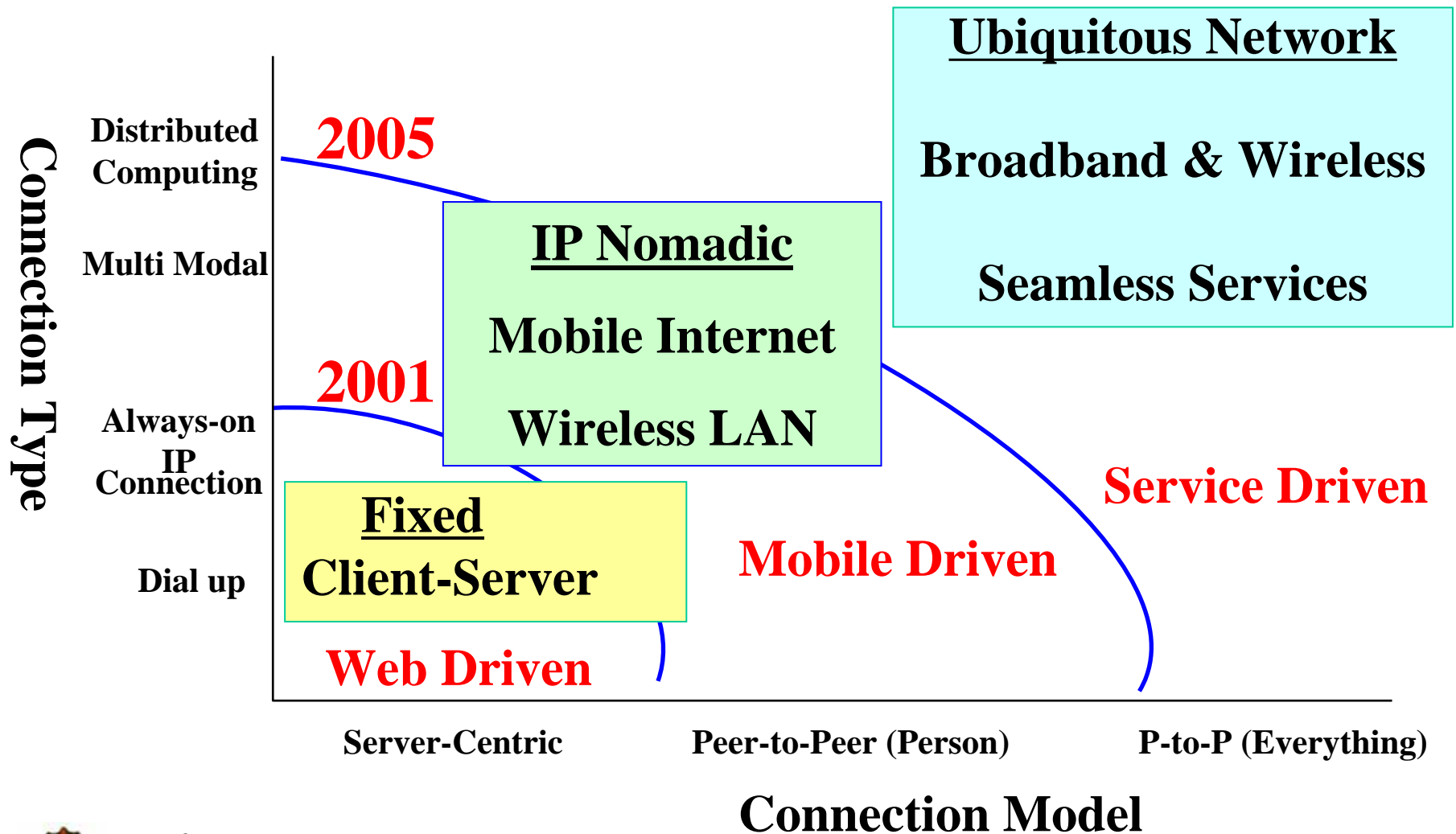
K² Campus, Keio University
Kawasaki, Japan

<http://www.k2.keio.ac.jp/index.htm>



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Paradigm Shift in Networking



What is Ubiquitous Network ?

Ubiquitous: Omnipresence [Latin]

- **Computing Everywhere**
- **Content Everywhere**
- **Connectivity Everywhere**

Seamless Connection and Service

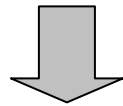
Location, Context & Preference-Aware

Service



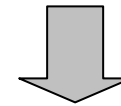
Is Japan Strong in Ubiquitous Era ?

Conventional IT Society



Hardware & Software
(OS , Applications)
Network Technology
Applications

Ubiquitous Network Society



Cellular Phones, PDAs,
Appliances, AV Equipment,
Automobiles
+ Applications, Services,

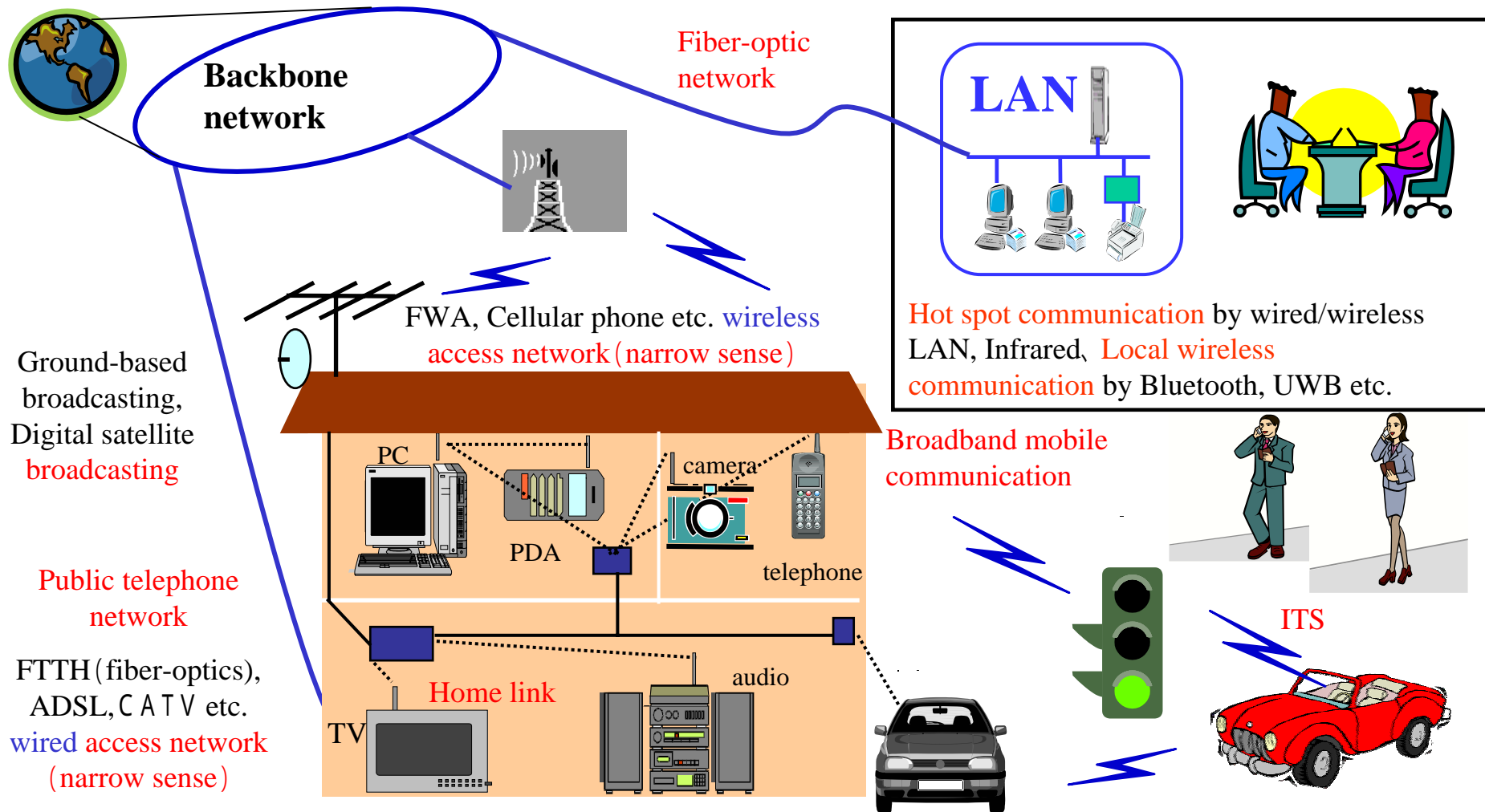
The Ubiquitous Field Holds the Key to the Japanese Economy's Revival.

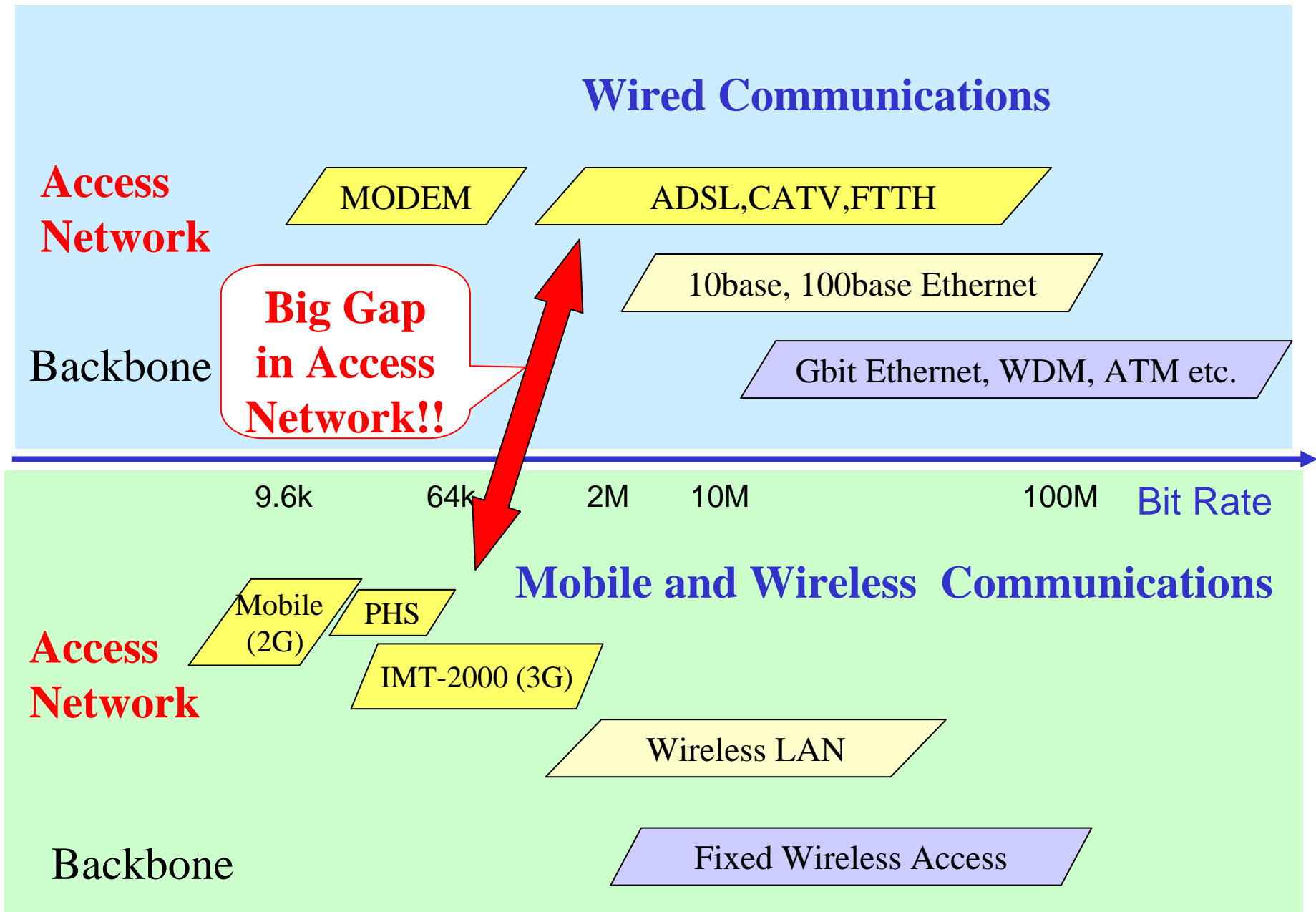
Keio University Takes the Leadership to Push the Frontier of Broadband Mobile and Wireless Communications in Ubiquitous Network Society.



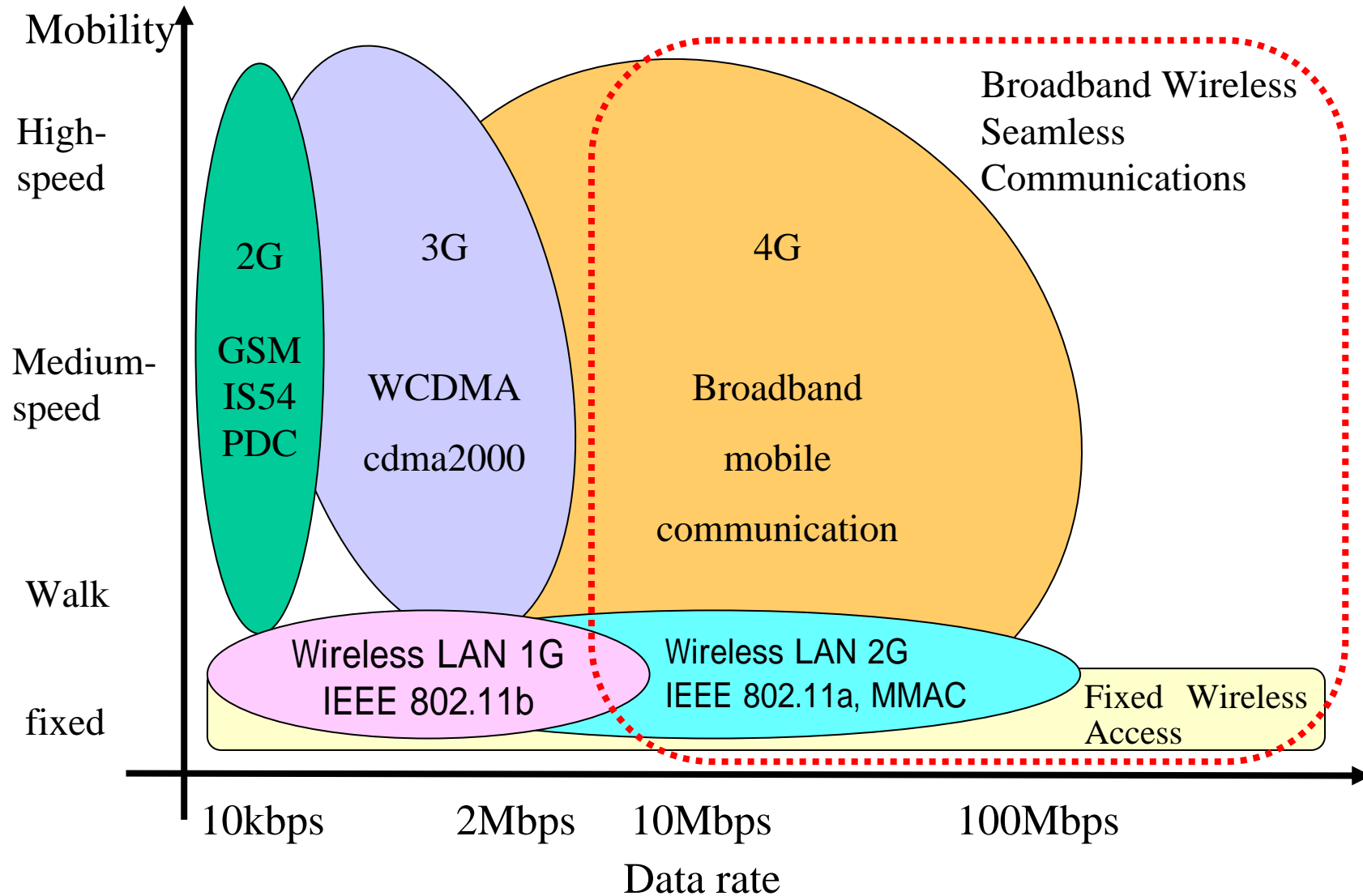
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Variety of Access Networks





Development of Broadband Wireless Communications



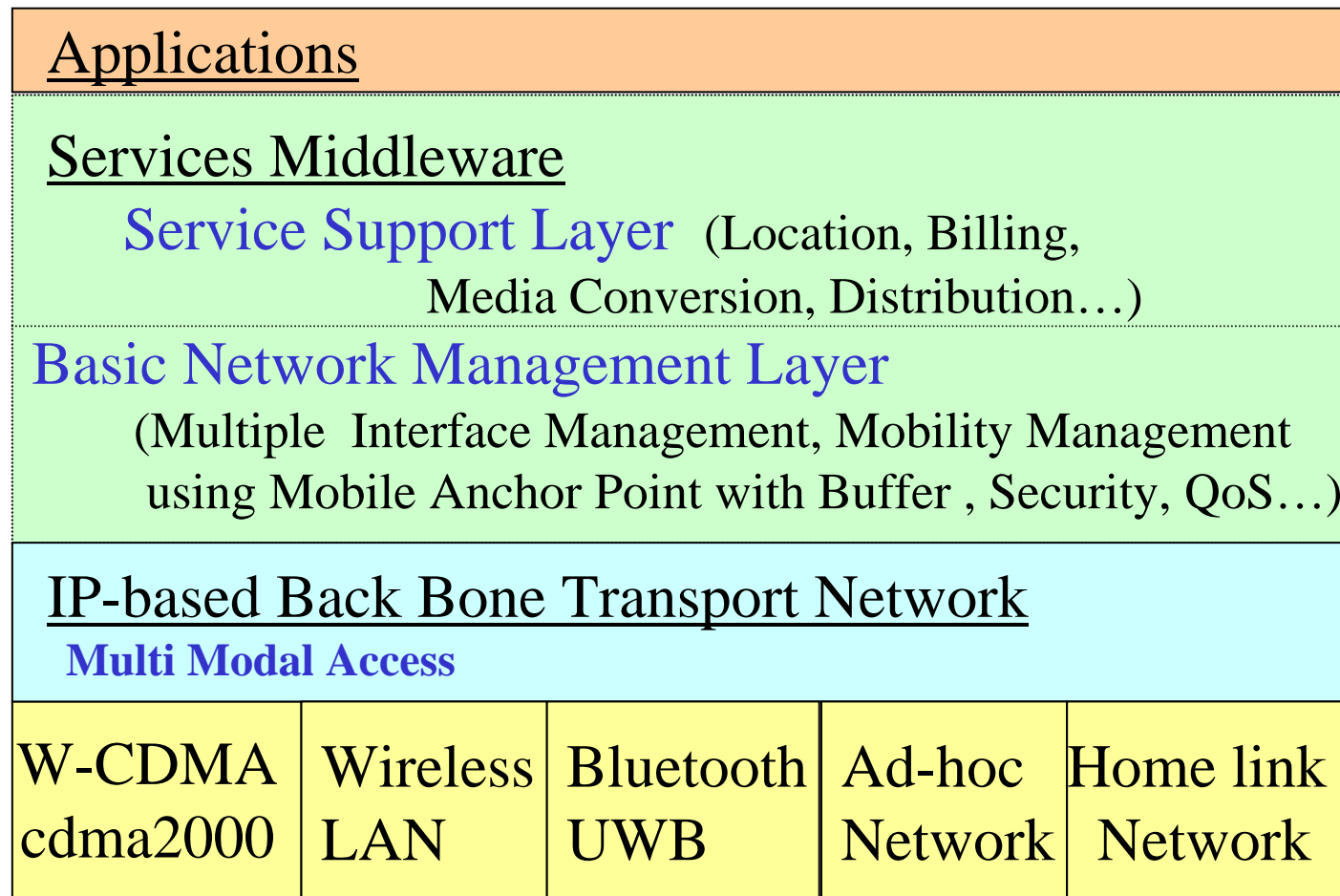
Our View of 4G Mobile and Wireless Communications

Significant Paradigm Shift Should be Considered to Set the Targets !

- Higher Transmission Rate up to 100Mbps
- Flexible to Advanced Internet, QoS Control
- Enhanced Security
- Seamless Operation across Networks
- Multiple Broadband Access Options in Combined Public and Private Networks
(Including Wireless LAN, Wireless Home link and Ad-Hoc Network)

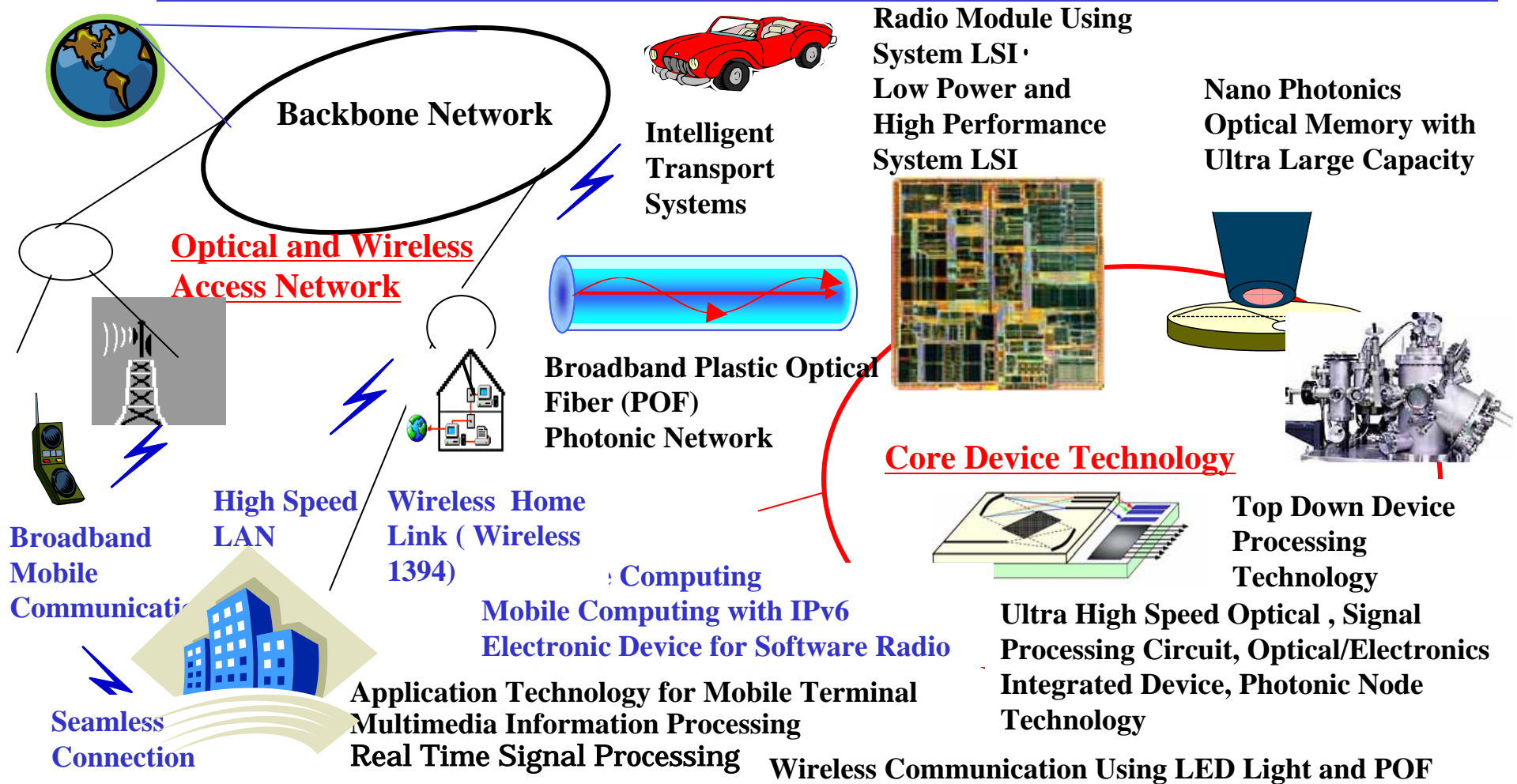


Our View of IP-Based 4G Mobile and Wireless Network Architecture





Keio University 21st Century COE Program
Optical and Electronic Device Technology for Access Network
Leader : Prof. Toshiaki Makabe



Prof. Iwao Sasase, Keio University

<http://www.coe.keio.ac.jp/>

Our COE Research Programs Related to Mobile and Wireless Communications

1. Broadband mobile communications
2. Wireless homelink and wireless ad-hoc networks
3. IPv6-based next generation mobile and ubiquitous Environment
4. Visible-light communications
5. Reconfigurable RF MEMS

10 professors and more than 100 graduate students are working hard in these research programs.



Our On-Going Research on Broadband Mobile Communications

The mission is to achieve high-speed transmission and flexible QoS control in broadband mobile communications by utilizing adaptive modulation, space-time coding, adaptive array antenna, and MIMO (multi-input multi-output).

1. High Speed OFDM/CDMA with MIMO
2. Interference Reduction Techniques
3. High Speed Packet Scheduling Algorithm
4. Seamless Networking by Handover and Mobile IP

Joint Project with NTT DoCoMo



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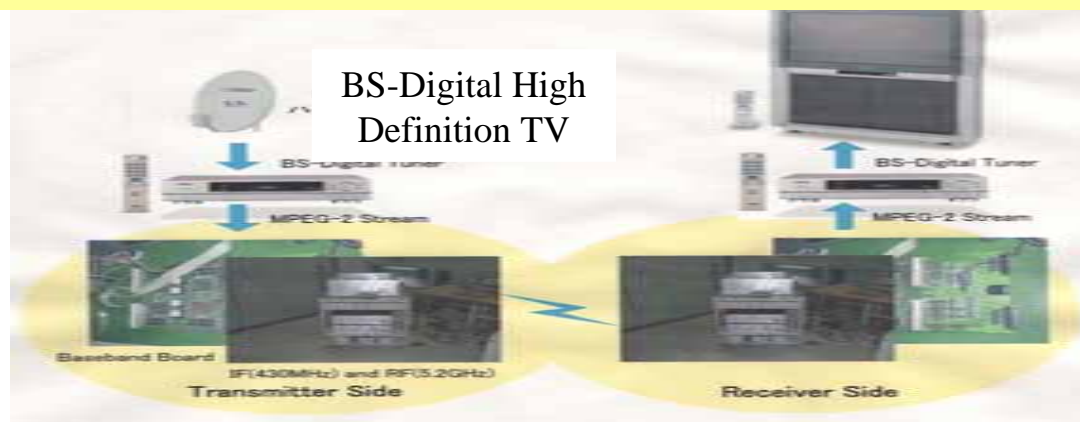
Wireless 1394 Home Link System

Wireless 1394 is the standardized wireless home Link which assures video streaming transmission.

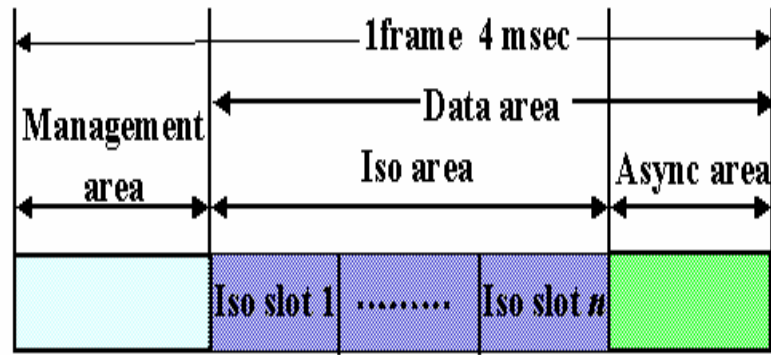
Wireless 1394 was proposed as a first wireless home link scheme in the world by TAO Shin-Kawasaki Research Center (Project leader: Prof. M. Nakagawa, Keio Univ.) in 1997, and was standardized by ARIB in 2001.



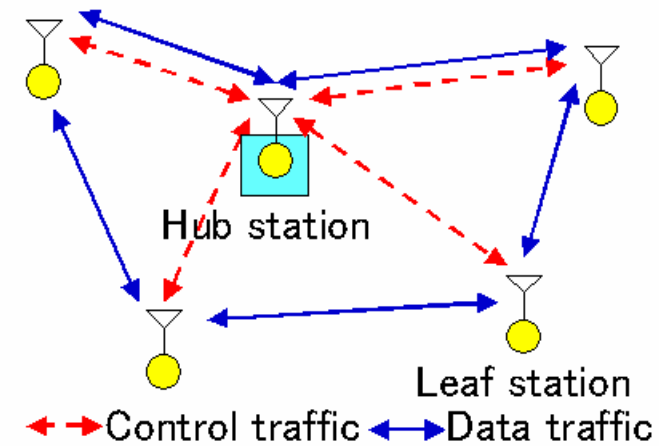
ARIB Standard T72 (40Mbps, Isochronous)



Our On-Going Research on Wireless Home link (Wireless 1394)



Frame structure consisting Iso slots for real-time video and Async slots for data



Star topology for control traffic

1. Improvement of channel Utilization and video transmission quality in multipath fading environment
2. Reduction of shadowing effect due to human body



Our On-Going Researches on Ad-hoc Networks

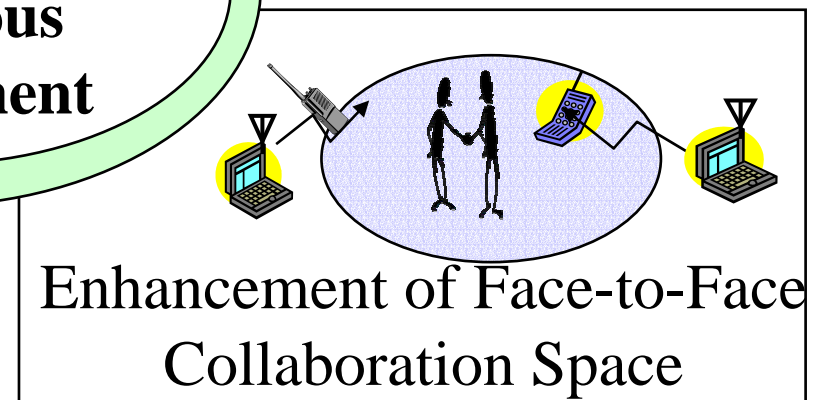
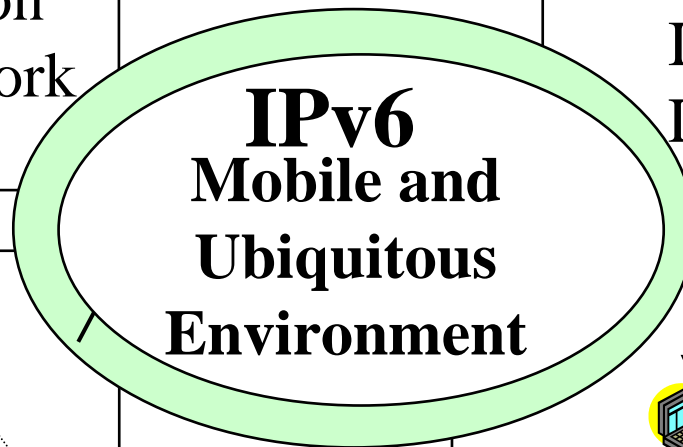
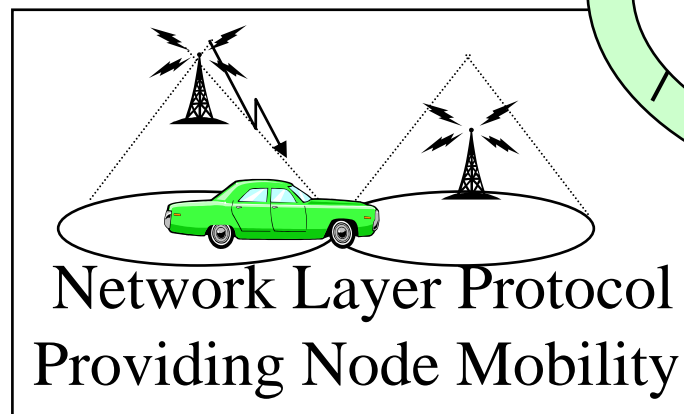
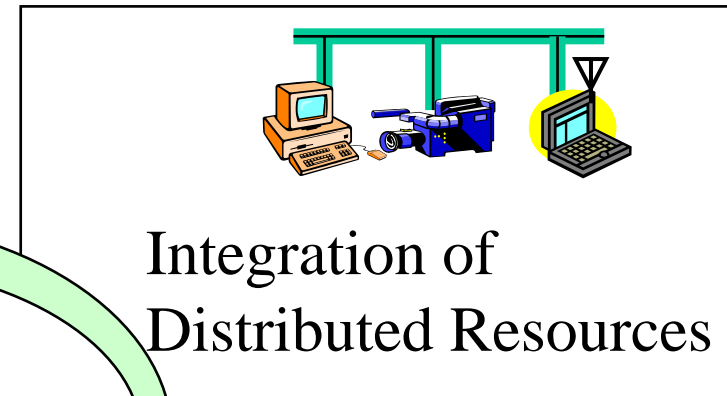
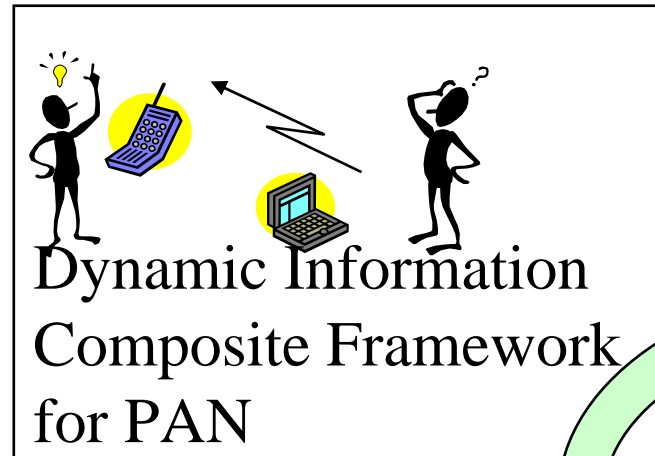
1. MAC protocols for broadcasting to improve throughput performance while keeping highly reliable broadcasting
2. Multi-level zone-based hierarchical link state routing with the new location search technique for mobile ad-hoc networks
3. An effective multicast routing protocol in ad-hoc network with asymmetric link
4. A low latency handoff scheme using positional information for mobile IP based networks

The consortium on ad hoc wireless networks started in Japan in December 2004 aiming at promotion of R&D on ad hoc networks.



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Our On-Going Research on IPv6-Based Next Generation Mobile and Ubiquitous Environment



Main Research Topics at Sasase Lab.

- Broadband Mobile Communications
- Ad-Hoc Wireless Communications
- Wireless Home Link (Wireless 1394)
- Optical CDMA and WDMA
- Photonic Networks and Multicast Switches
- Network Security

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Research Areas at Sasase Lab.

Mobile and Wireless Communications

Mobile Comm., Personal Comm.,
W-CDMA, Ad-hoc Comm., Infrared,
Smart Antenna, MIMO, OFDM,
Wireless 1394...

Communication Networks

Optical Burst Switching, Optical CDMA,
WDMA, Photonic Networking,
Multicast Switch, ADSL,

Communication Systems / Information Theory

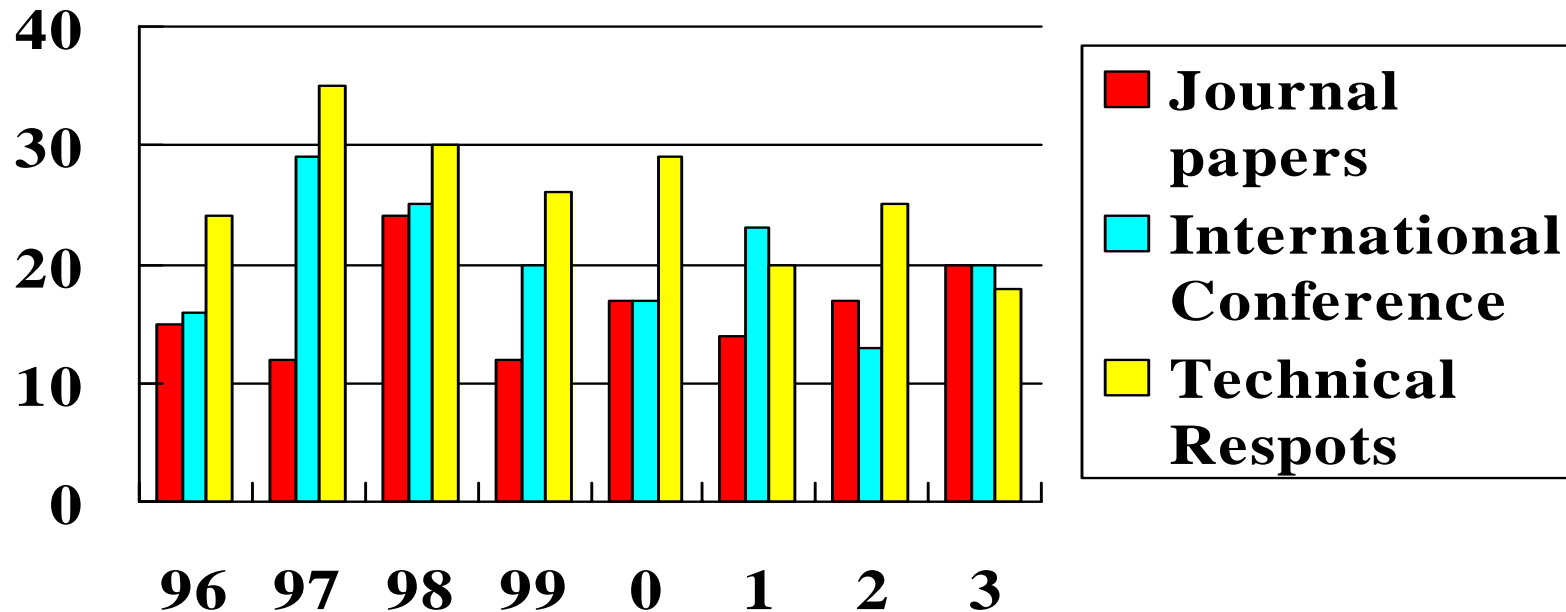
Digital Modulation & Demodulation,
Com. Protocols, Interference Canceller,
Trellis Coded Modulation, Queuing
Theory, Coding theory, Optical Com.
Theory...

Network Security/ Signal Processing

Individual Authentication, Intrusion
Detection System, Radar Signal
Processing.



Achievement in Recent 8 Years



209 Journal Papers, 297 International Conference papers

All the post graduate students have presented their papers at international conferences.
More than 90% of the post graduate students have published journal papers.



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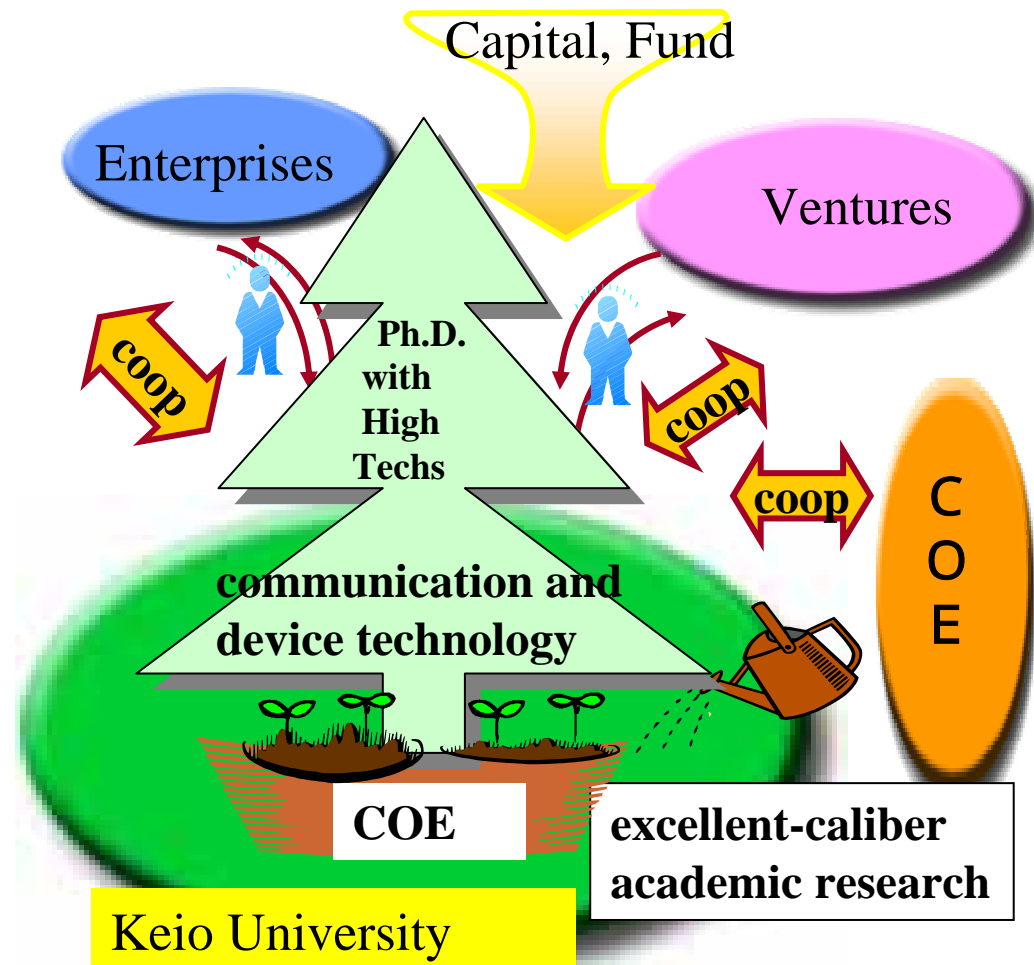


Keio University 21st Century COE Program
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Leader : Prof. Toshiaki Makabe

Network of Excellence

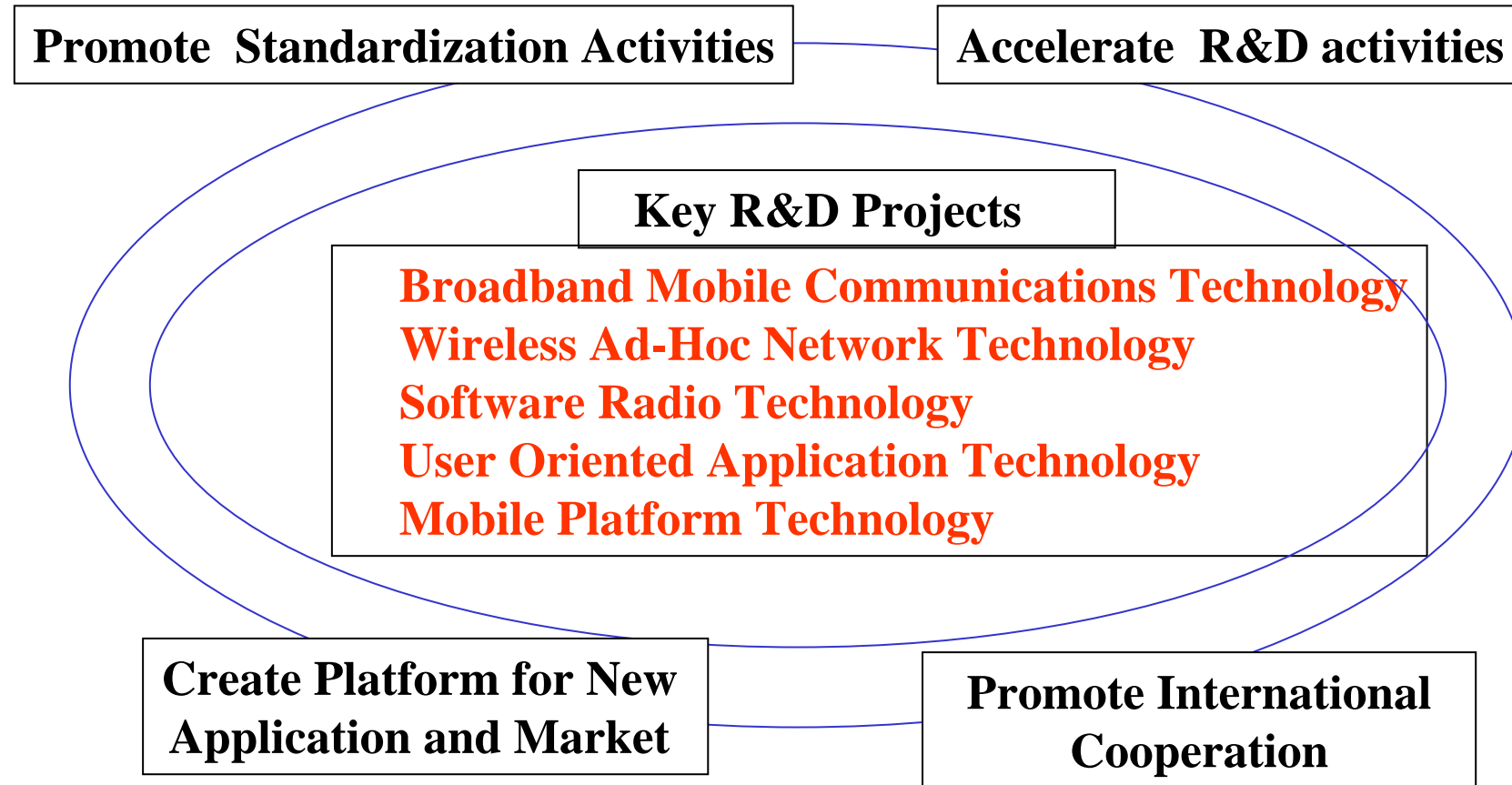
**Promote International
Cooperation and
Standardization
Activities**

**Accelerate R&D
Activities**



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Strategy for New Mobile Communication System



To Produce Break-Through Technology

- Encourage to Make New Idea with Originality
- Creative Research Environment
- Education on Information Technology
- Produce Globally Active Human Resources
- National Strategic Project and Policy
- Flexible and Open Interchange of Personnel
- Fair Evaluation for Achievement



Way of Thinking

Japanese

- Stability-oriented
- Cooperative
- Equal Treatment
- Consultation
- All-round
- No.1
- Steady, Punctual



Americans

- Challenging Spirit
- Individual
- Equal Opportunity
- Clear Decision Making
- Unique and Special
- Only One
- Strategic, Aggressive

