

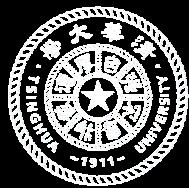
Building the Infrastructure for a Harmonious Information Society

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Tsinghua University

March 14, 2005

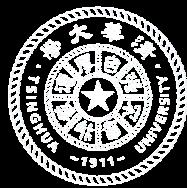




Outline

- **Changing Landscape in Computing**
- **Emerging Opportunities in Industry**
- **Harmonious Information Society**
 - A Smart Classroom Project as Example
- **Research at Tsinghua University**

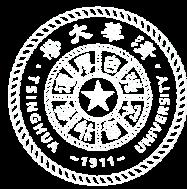




Quick Look Back (I)

- What has been done?
 - A. Turing: Turing Machine
 - J. von Neumann: von Neumann machines
 - C. Shannon, N. Wiener, L. von Bertalanffy
- Machine Computing
 - Binary stored data and program
 - Processor, memory, and I/O
 - Numerical and logical computation





Quick Look Back (II)

- **What is being done?**

- **Moore's Law:**

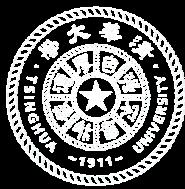
- In 1965, Gordon Moore stated, "The complexity for minimum component costs has increased at a rate of roughly a factor of two per year."

- Number of transistors on an integrated chip doubles every 18 months.

- **Network Bandwidth**

- **Network Efficiency**

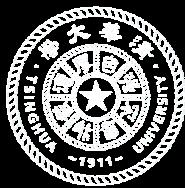




Quick Look Back (III)

- What has not been done or need to be done?
 - Binary data and Shannon's theory are all about coding, for storage, process and communication
 - How do we handle content?
 - Can or should knowledge be represented this way?
- Machine Intelligence
 - Failure of 5th Gen Computer
 - The old question: “Can machine think?”

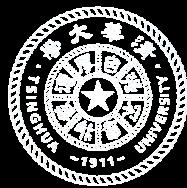




Brave Look Forward (I)

- Make Machine Thinking
 - Mimic Human Intelligence
 - Is our way of thinking the only best way?
 - Even people don't always “think” the same way!
 - In a harmonious society, we don't all think the same way, we communicate
 - Content-aware
 - Context-aware

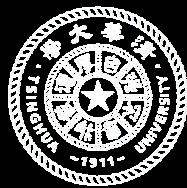




Brave Look Forward (II)

- Help People Thinking
 - Extend Human Intelligence
 - Global village
 - Massive/Multimedia data
 - Real-time/Instant communication
 - Yahoo, Google
 - Napster, Skype

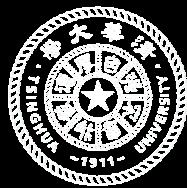




Lay Out Nerves

- Nerves form a network of pathways for conducting information throughout the body
- Converging network
 - Date, voice, and video
 - Internet, phone/cellular, and broadcasting

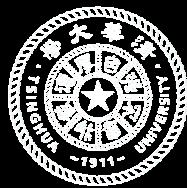




Seamless Mobility

- Why Do We Work Around Computers?
 - They are tethered
- How Can We Have Computers Work Around Us?
 - Make them wireless and embedded: mobile
 - Power
 - Bandwidth
 - Security
 - ...

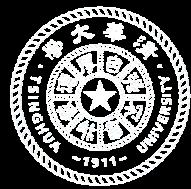




Smart Environment

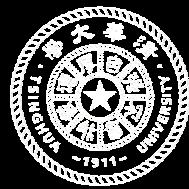
- Work environments allowing people to perform tasks efficiently by offering unprecedented levels of access to information and assistance from computers
 - Augmented Reality
 - Natural User Experience
 - Spontaneous Interoperation
 - ...





Augmented Reality

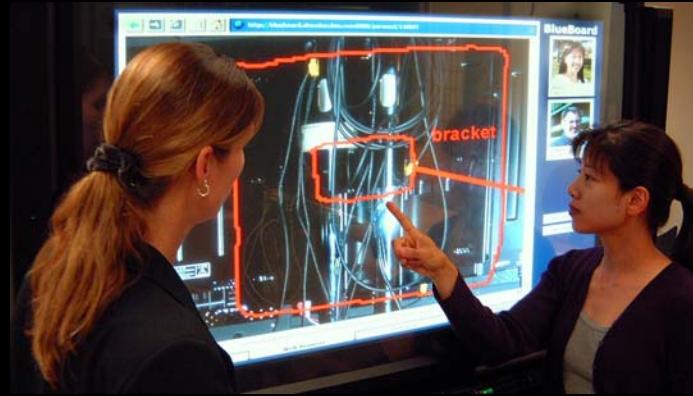




Natural User Experience



Voice Communication via MA



Pen/Touch Interaction

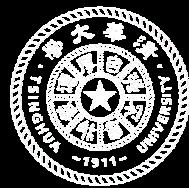


Laser Pointer
Interaction

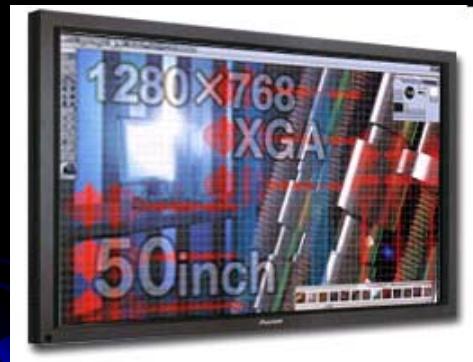
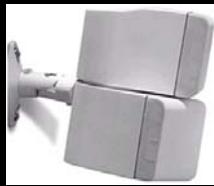


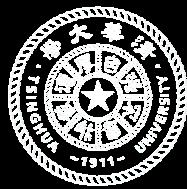
Context-aware
Interaction



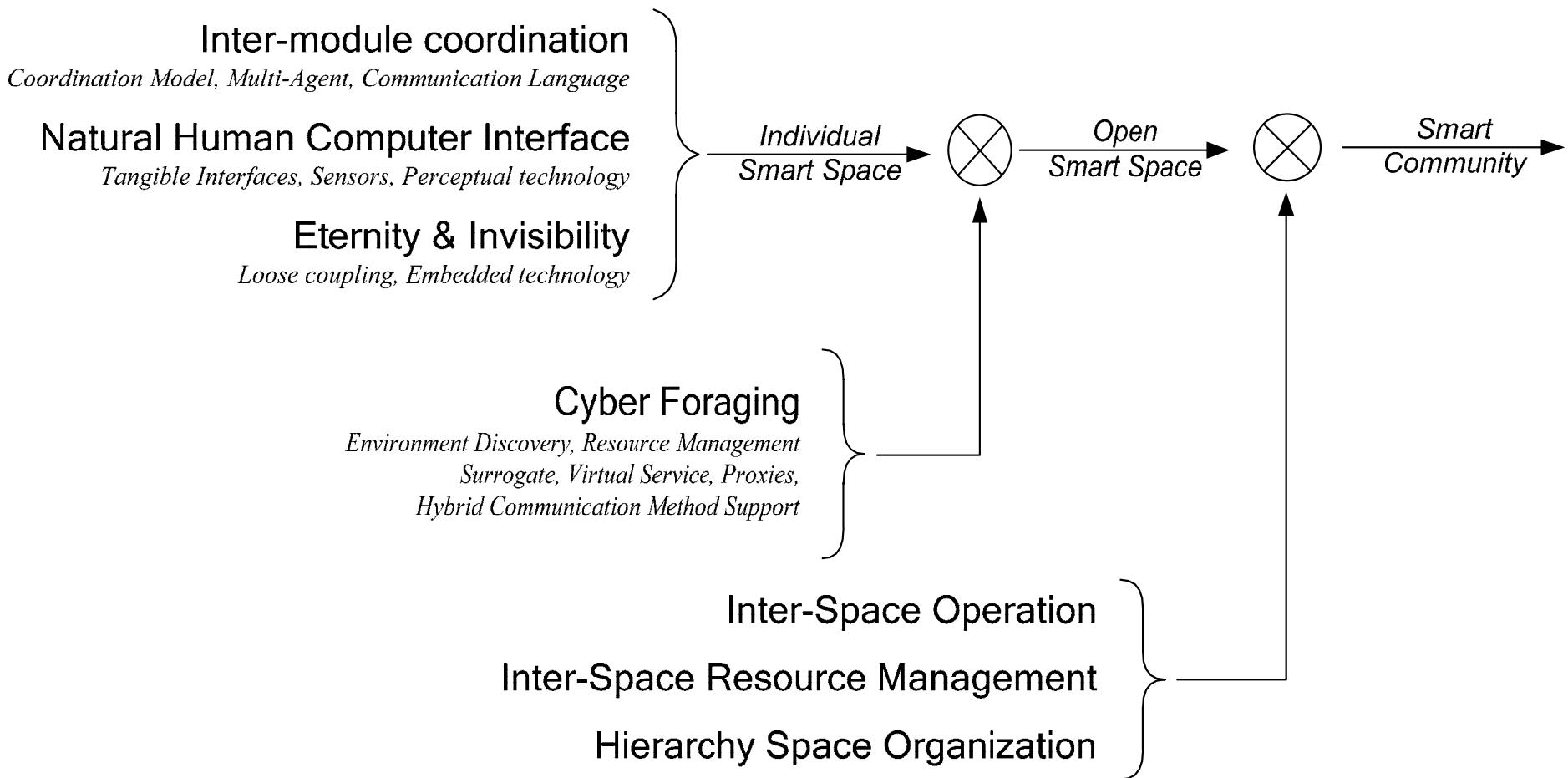


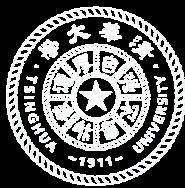
Spontaneous Interoperation



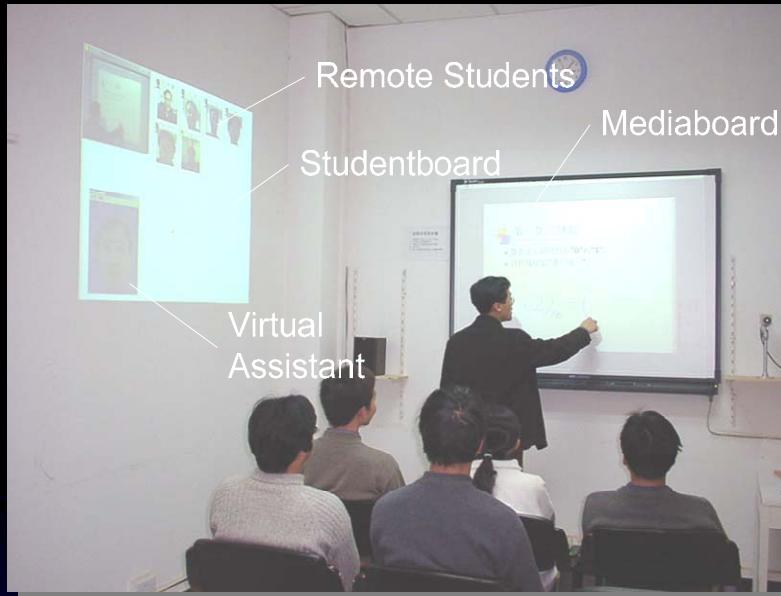


Smart Space Testbed



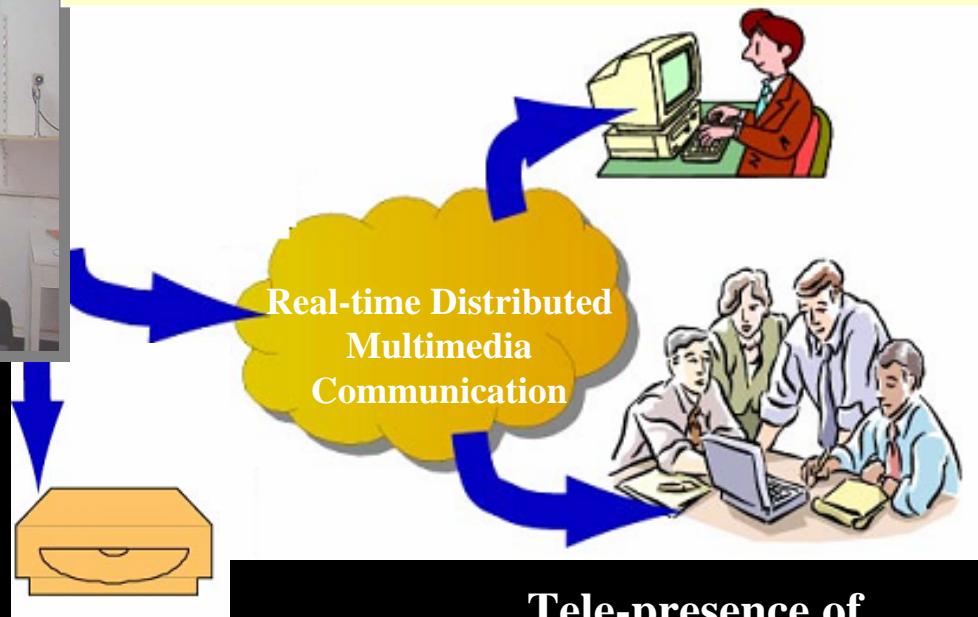


The Smart Classroom Project



Smart Classroom

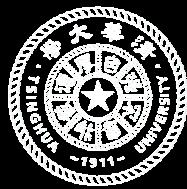
An augmented classroom where a teacher can instruct remote and local students at the same time and in a similar fashion.



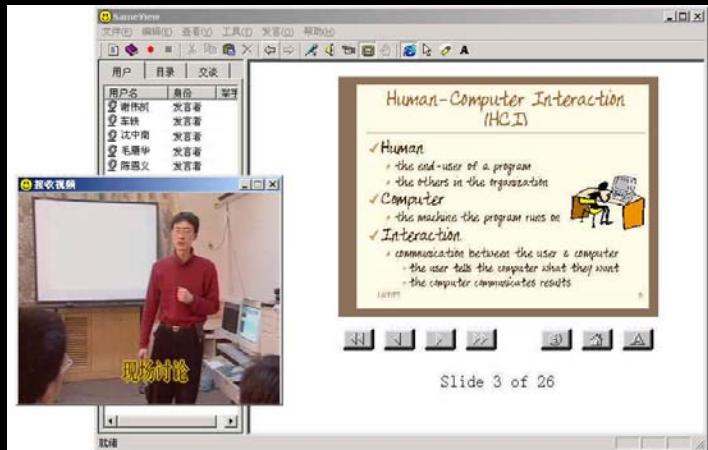
Experience Record
of the Classroom

Tele-presence of
Remote Students





Tele-presence



Interface of Remote Clients



Student Board in the Classroom

Smart Cameraman



Overview

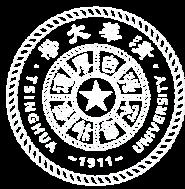


Writing on the Board

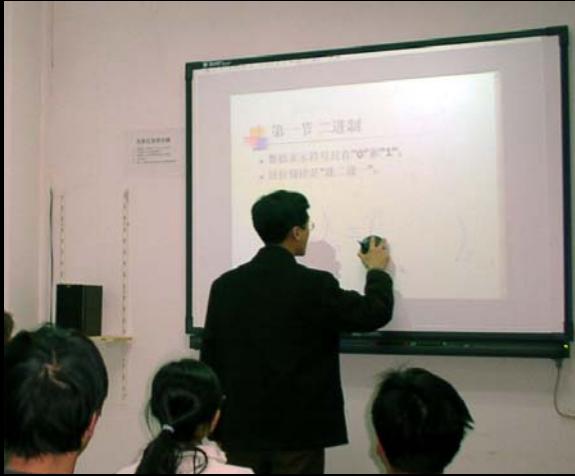


Showing a Model

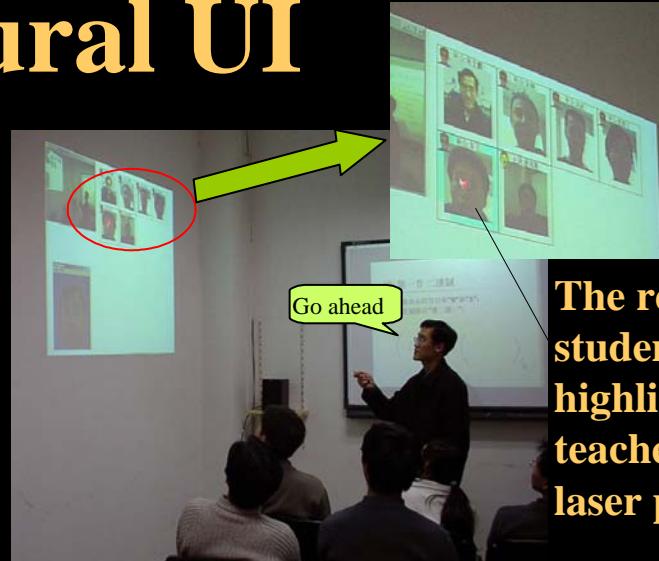




Invisibility: Natural UI



- Pen-based writing
- Speech-capable virtual assistant
- Biometrics-based login authentication

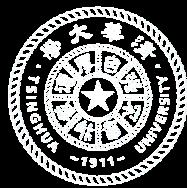


The remote student's image is highlighted as the teacher aims the laser pointer at it

- Highlight remote student by laser pointer and voice command

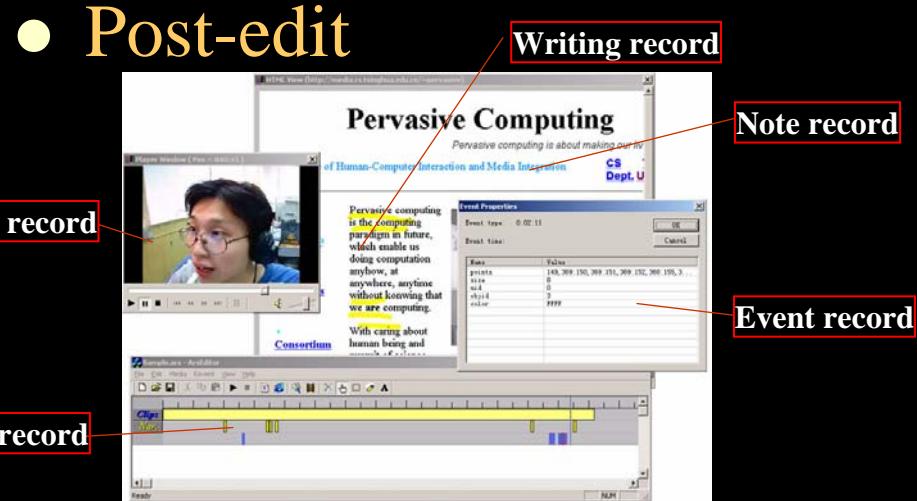


A camera for Face-Recognition is installed behind the mirror

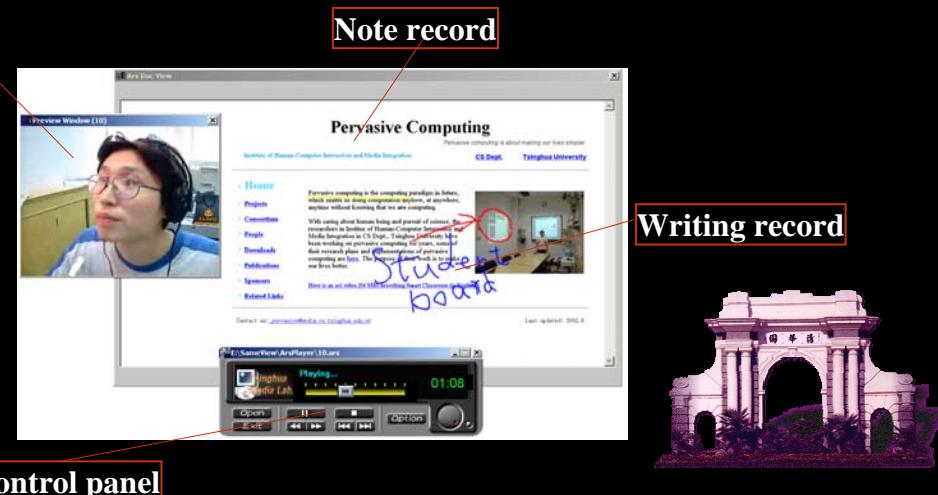


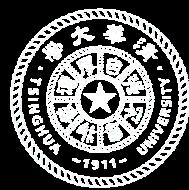
Experience Capture

- Auto-record the synchronized multiple data streams
 - Lecture on mediaboard and its presentation progress
 - Writing and pointing on the boards
 - Live audio/video
 - Interaction with remote students

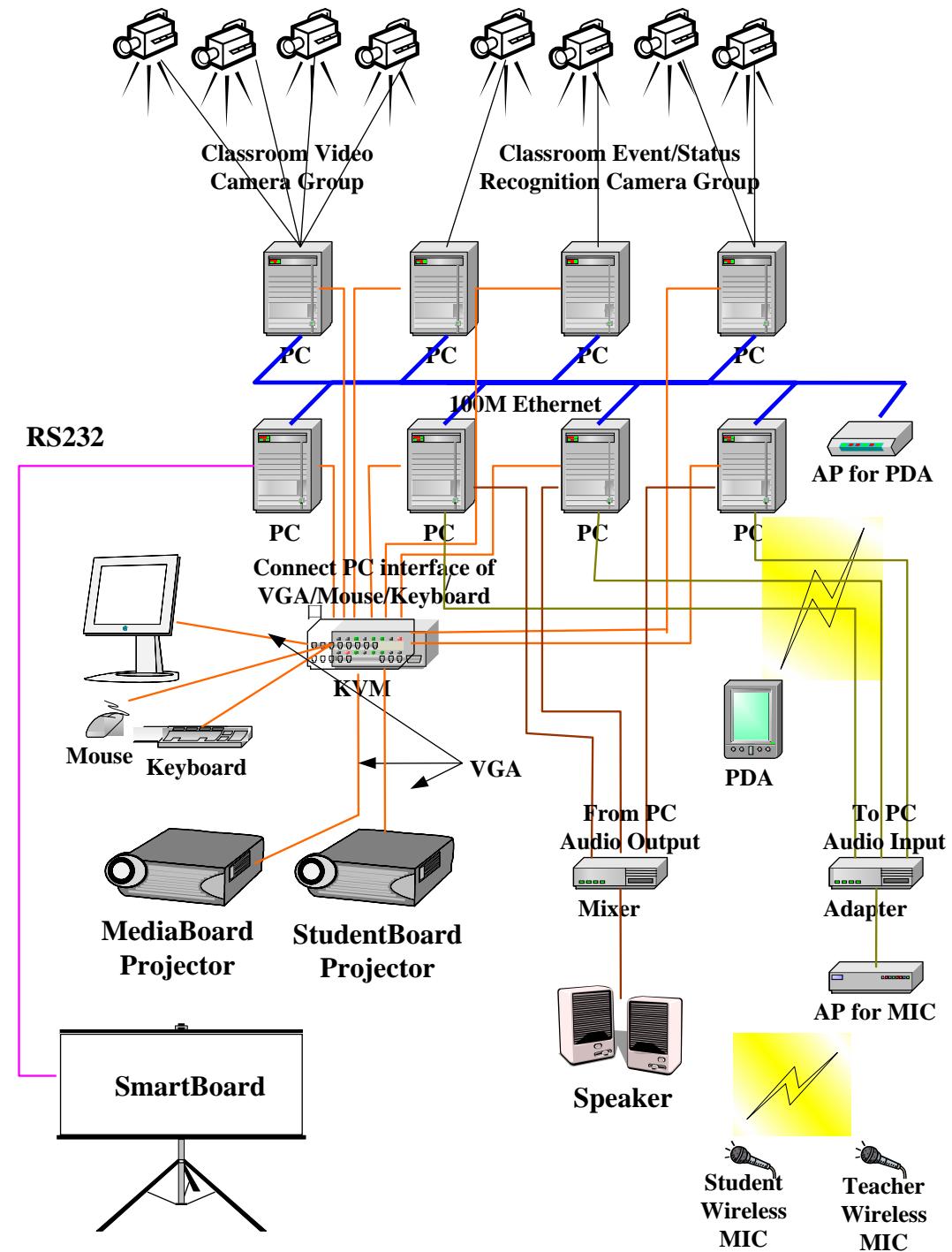


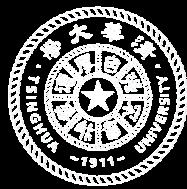
● Playback





Hardware Infrastructure for Smart Classroom

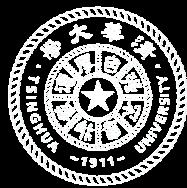




Ubiquitous or Pervasive

- **Seamless Mobility**
 - From stay in touch to seamless handover
- **Smart Environment**
 - From anytime, anywhere, any service to right time, right person, right service
- **Strengthen Human Intelligence**
 - Computer systems as human brain extension
 - Networked people with stronger thinking power

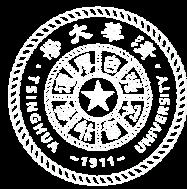




Related Effort (I)

- DTV
 - Broadcasting channel coding standard
 - UTI: “SIM” card for set-top boxes
 - DRM: Digital Right Management
 - CA: Conditional Access
 - EPG: Electronic Program Guide
 - GridMedia: IPTV broadcasting
 - Mobile and handheld DTV
 - SDR: Software defined radio DTV receiver





Digital TV Broadcasting

Content



Compressor / Multiplexer

Content



Compressor / Multiplexer

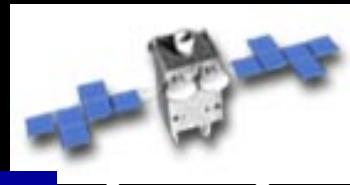
Content



Compressor / Multiplexer

Program Multiplexer

DTV Satellite Broadcasting



Setup Box/ Receiver



QPSK Mod

DTV Terrestrial Broadcasting



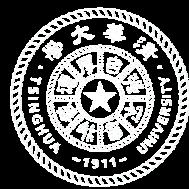
Receivers

DTV Cable Broadcasting

QAM Mod

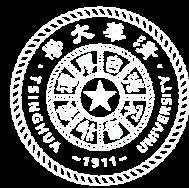
DMB-T Public Net





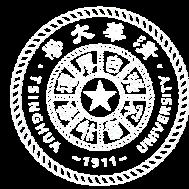
DMB-T



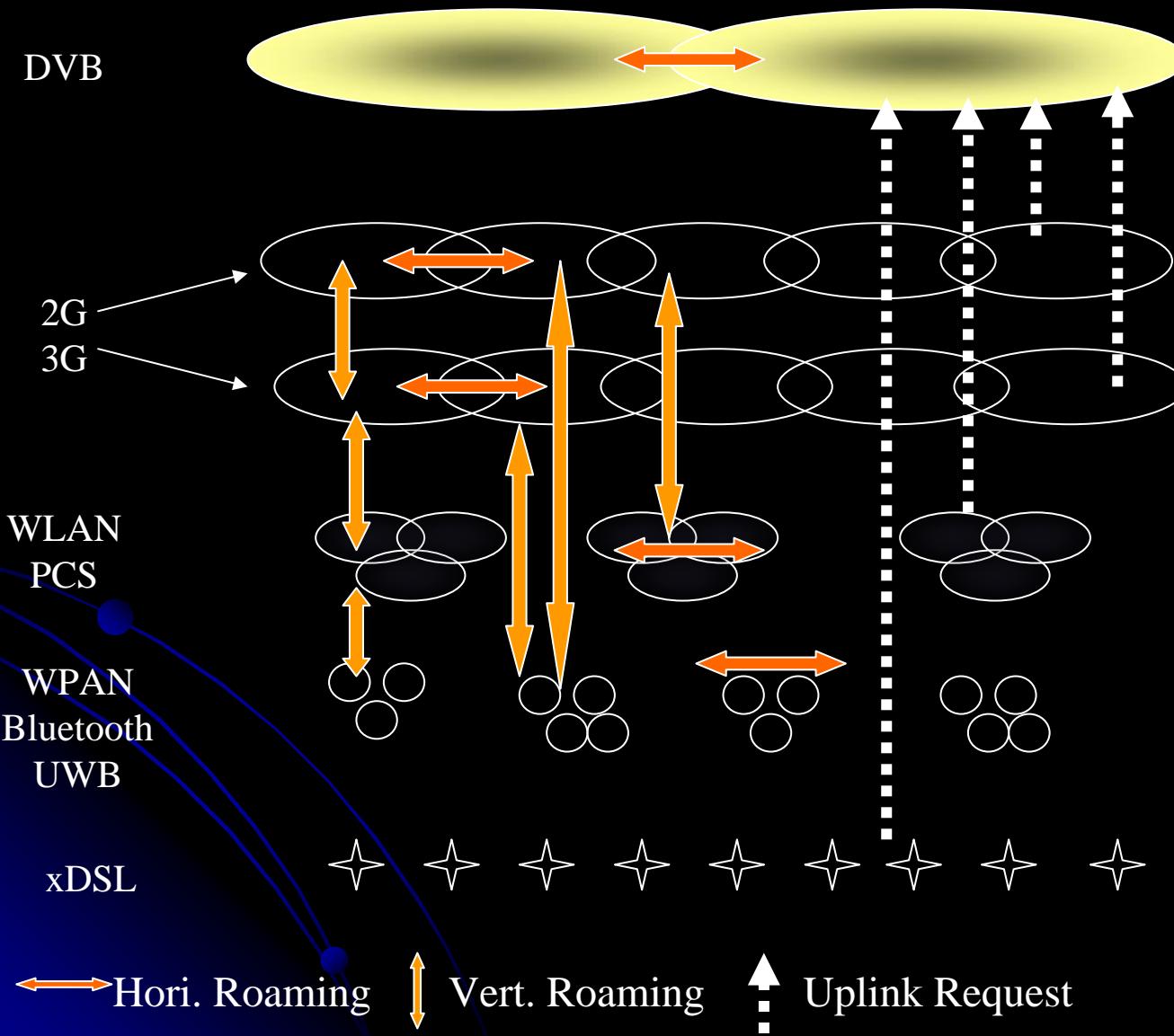
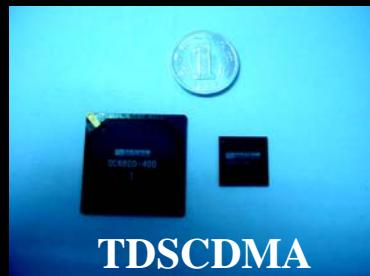


UTI

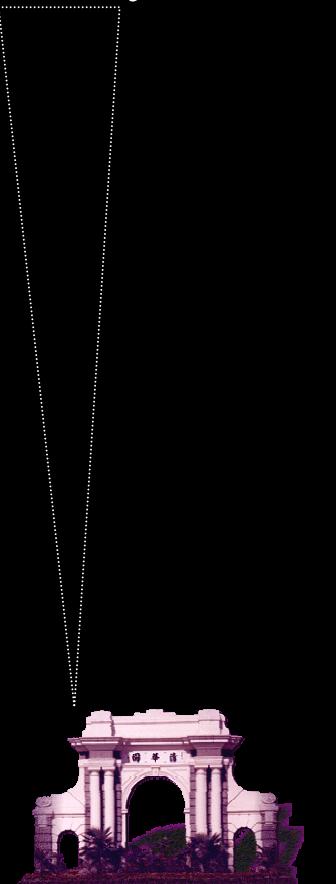


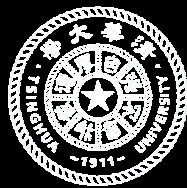


Wireless Overall



Mobility
Coverage
Security

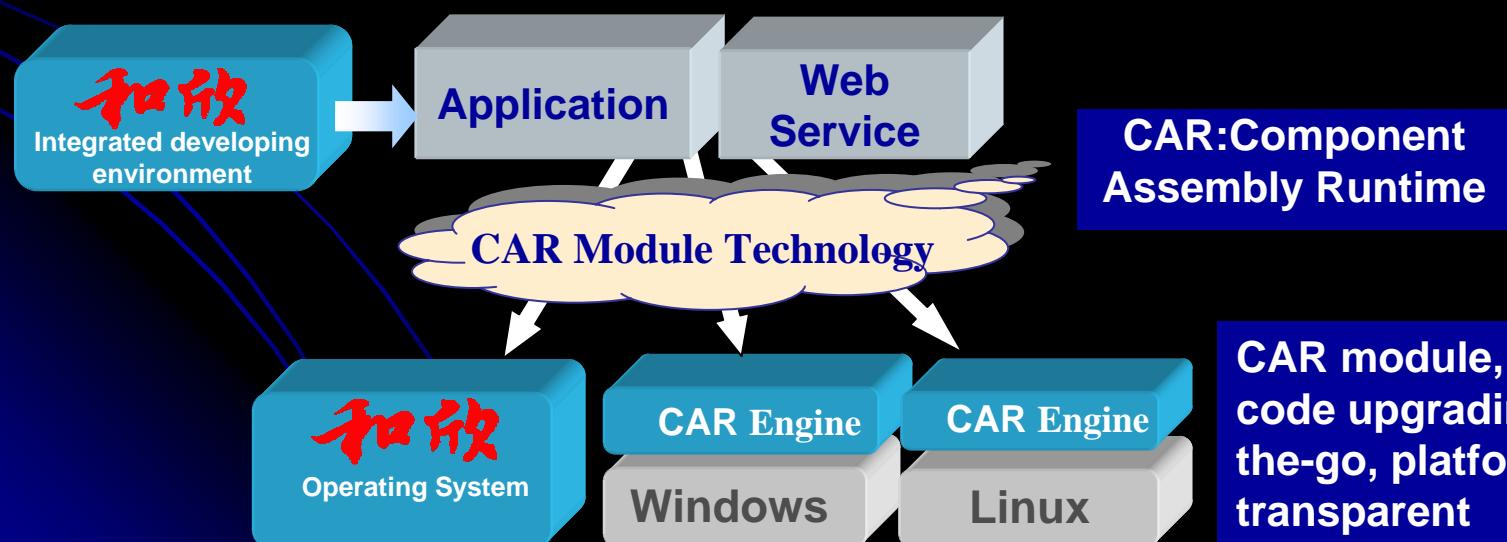


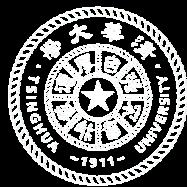


Related Effort (II)

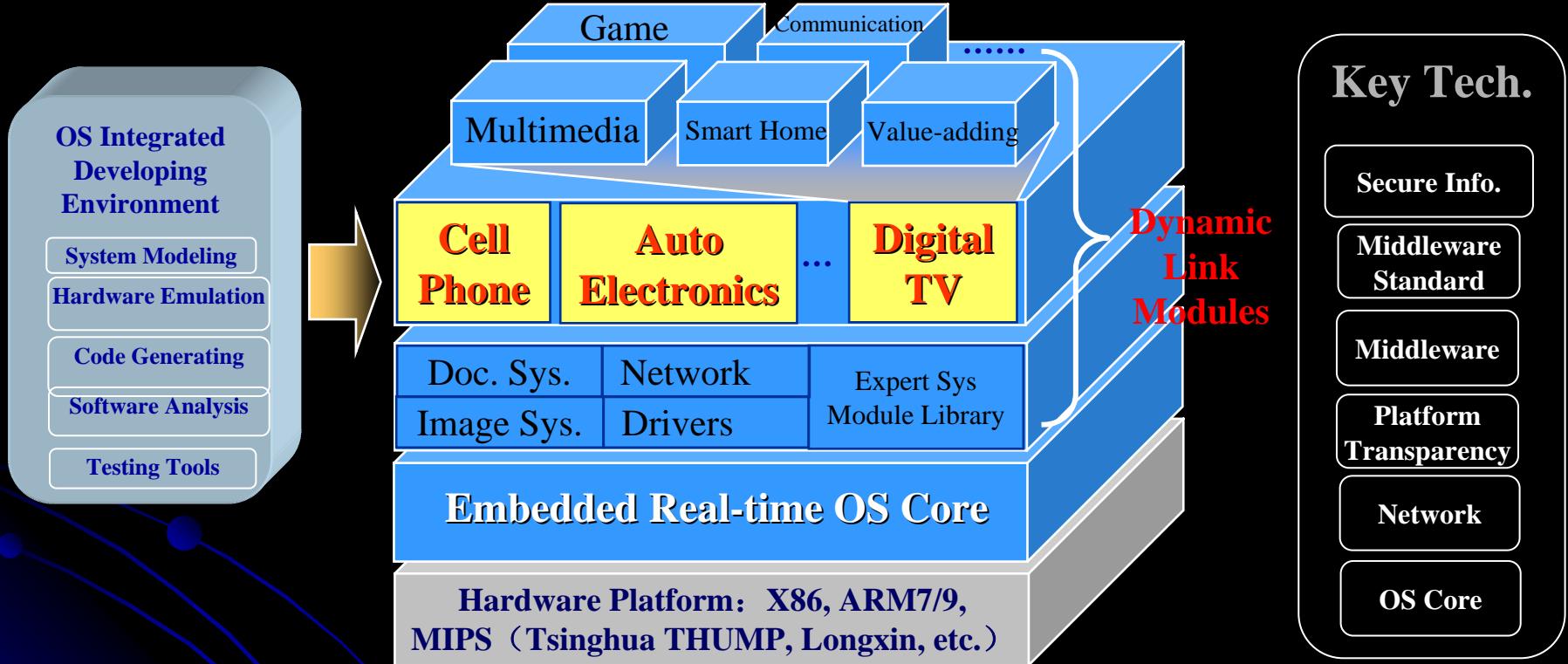
- OS and SoC

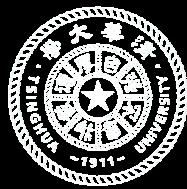
- Elastos
- THUMP
- NC: Network Computer
- \$100 laptop





Elastos

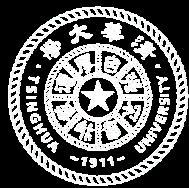




Related Effort (III)

- Security and Privacy
 - TCG & TNC
 - End-point security
 - Policy/compliance enforcement
 - SSO: Single Sign On
 - High-speed security algorithms
 - NPU based implementation

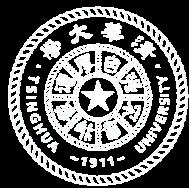




Conclusion

- On the way of revolution from machine computing to machine intelligence, we need symbiotic evolution
- A harmonious information society requires seamless mobility and smart environment
- Network convergence, natural interface, security and privacy are important research areas among others





Thank You

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