Designing Smart Multi-party Collaboration System based on AG

December 12th, 2006

Grid @ Asia & GFK Joint WS ||

Access Grid WS @ Westin Chosun Hotel, Seoul

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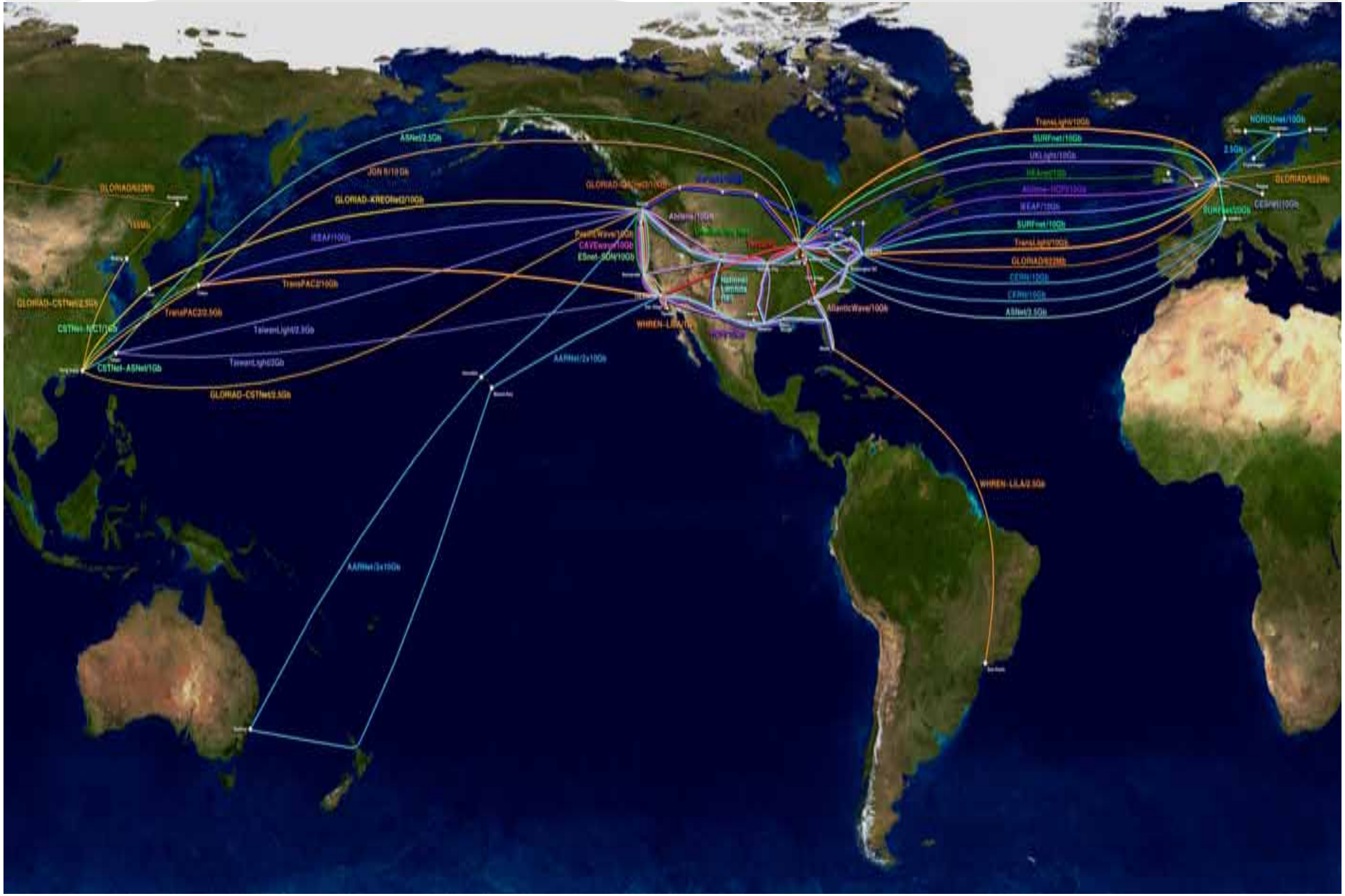
Contents

- Advanced Collaboration Environments - Approaches
- Designing Smart Interactive Collaboration Environments

Advanced Collaboration Environments

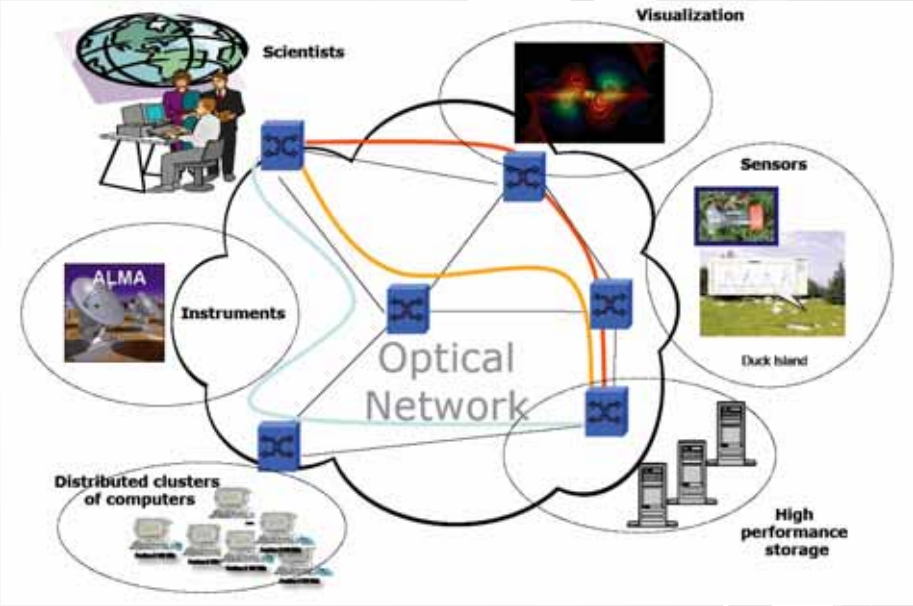
- Approaches -

GLIF: Global e-Infrastructure by linking the world with Light

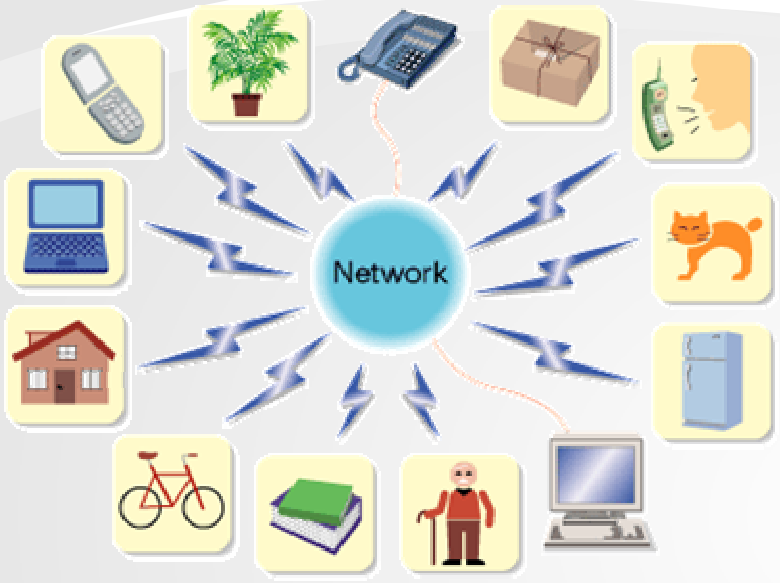


Cyber Infrastructure and Emerging Services

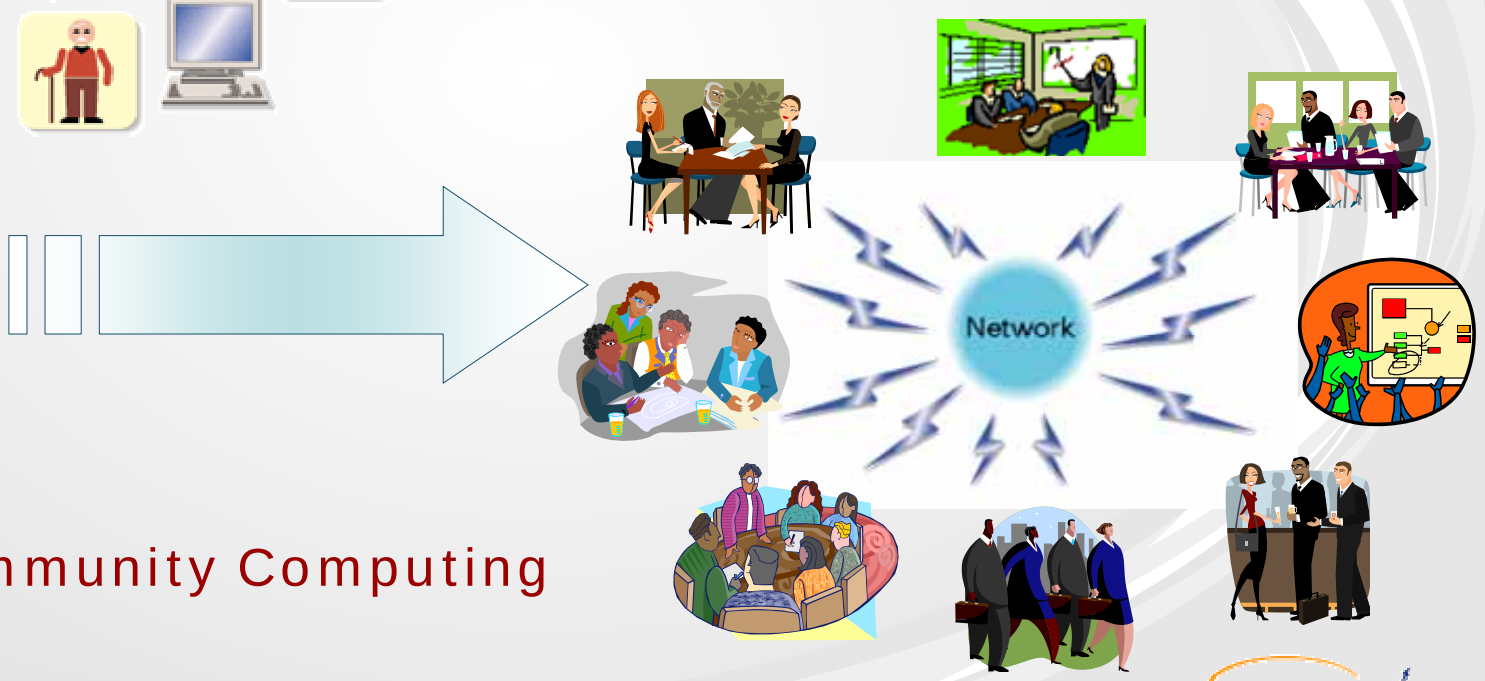
- Cyber Infrastructure for scientific (and ubiquitous community) computing and networking and beyond
  - Data and information repositories and access
  - Preserving data and artifacts
  - Support for distributed applications
  - **Support for collaboration**
  - Etc.
- Cyber Infrastructure = Network + Middleware + …



Collaboration Environment for Ubiquitous Community Computing

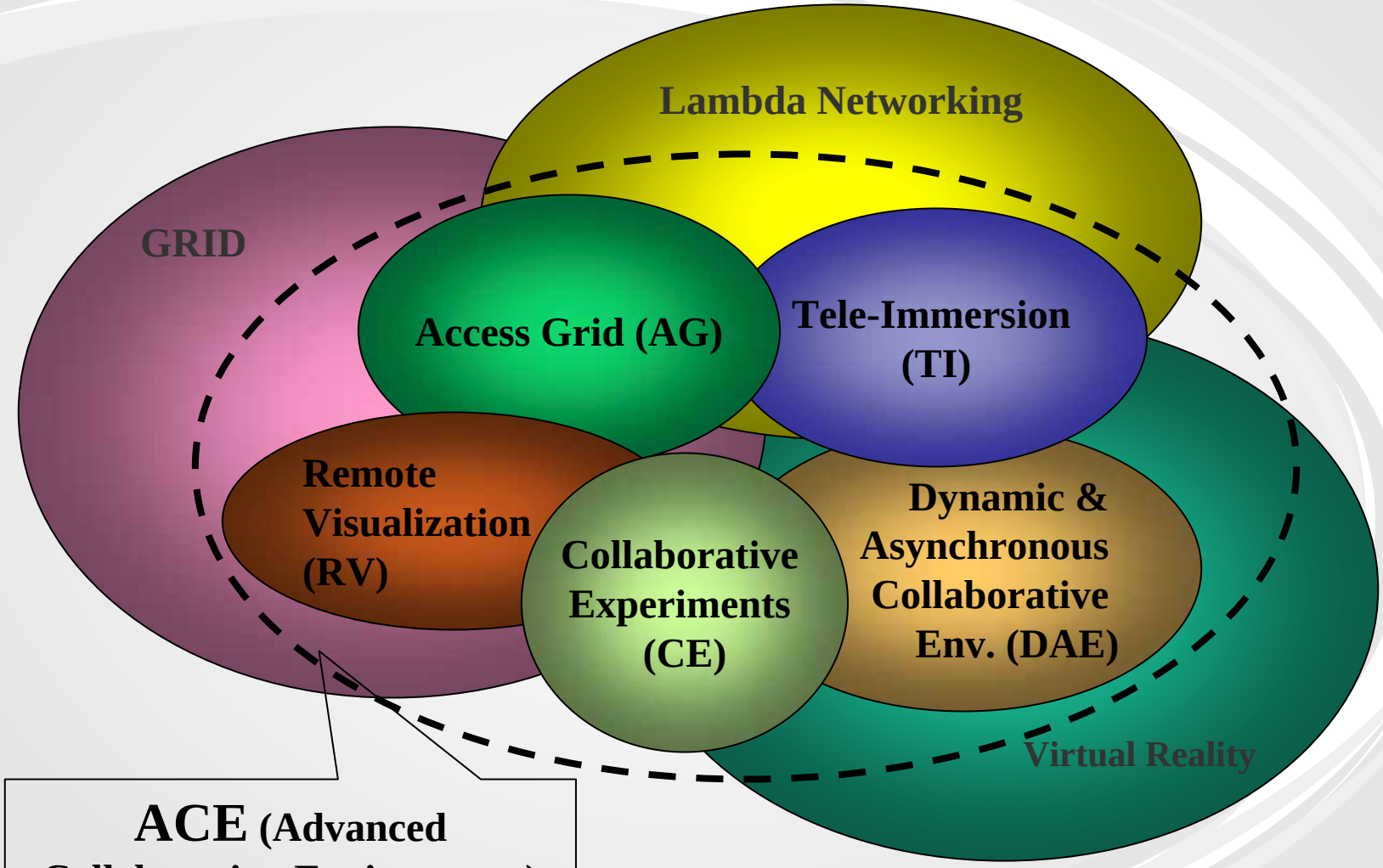


Ubiquitous Computing

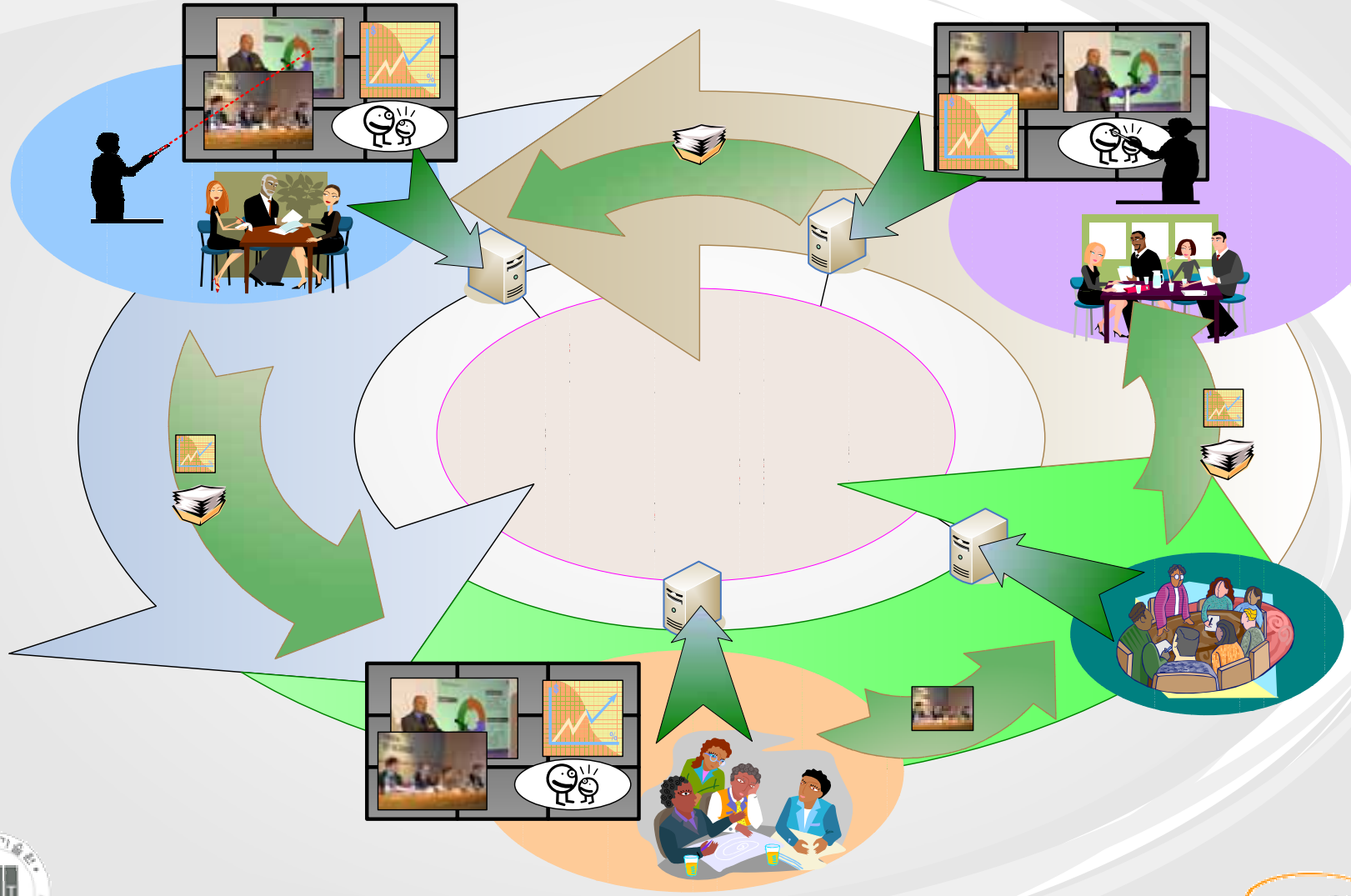


Community Computing

Advance Collaboration Environment: Usage Scenarios



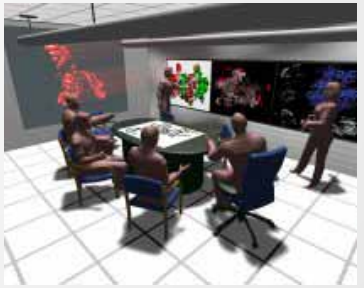
Toward Multi-party Interactive Collaboration Environment for Ubiquitous Community Environment

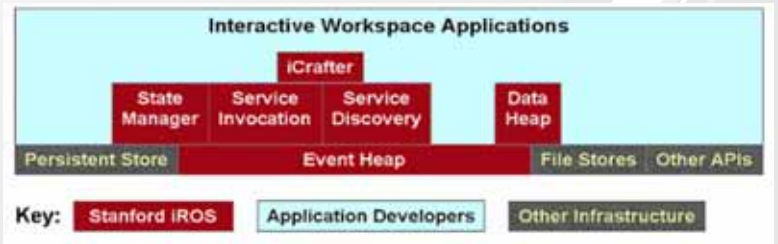


Collaboration Space Projects: Stanford iRoom (2000-2002)

Interactive workspaces
Stanford University Computer Science

- Explores new possibilities for people working together in technology-rich spaces by focusing on **augmenting a dedicated meeting space** with large displays, wireless or multimodal devices, and seamless mobile appliance integration.
- Research the intersection of HCI and systems problems that arise in deploying, operating and developing applications and human interfaces for an iRoom, including:
  - Multi-device, multi-user applications
  - Multimodal and fluid interaction
  - Reusable, robust, and extensible system software for deploying COTS-based ubiquitous computing environments like our own
  - integration of large (wall-sized) displays with advanced visualization capabilities into an iRoom
  - integration of computing "appliances" including PDA's, scanners, digital cameras, etc. into an iRoom

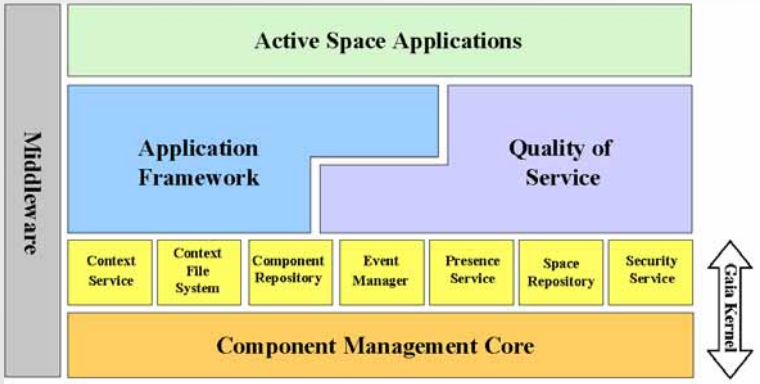


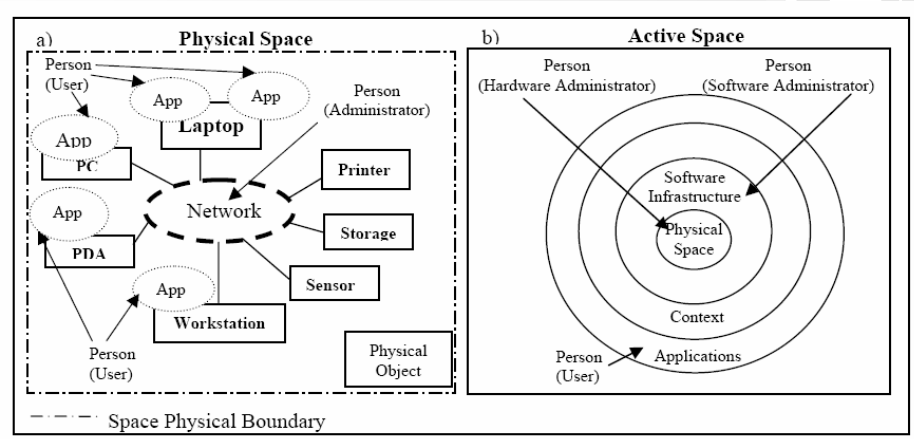


Collaboration Space Projects: UIUC Gaia (2001 ~)

Active Spaces for Ubiquitous Computing

- **An experimental middleware infrastructure for Active Space** used to prototype the resource management of and provide the user-oriented interfaces for such physical spaces populated with network-enabled computing resources.





Collaboration Space Projects: IBM BlueSpace (2002 ~)

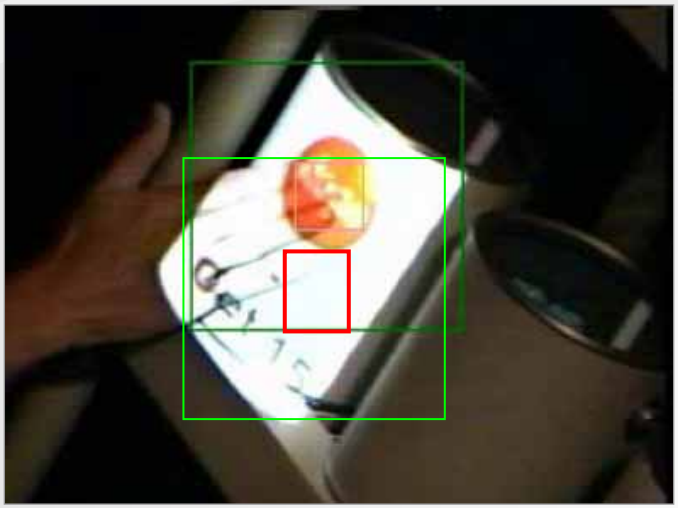
- IBM TJ Watson Research (joint work with Steelcase)
- Goal: construction of two prototypes of a future workplace (cubicle) integrated with technology

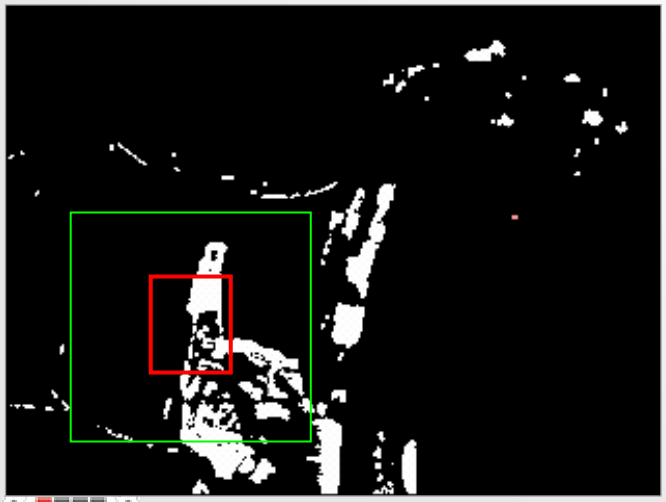
- To change/adapt workspace from/to:
  - a very open and collaborative setting to
  - a private and insulated one space
- Use of conference rooms to do some types of work that can't be done in the current office:
  - majority of meetings are with 2 or 3 other people
  - managers need privacy (auditory and visual)
  - hesitate to use speaker phones because of impact on others

Remote collaborative work

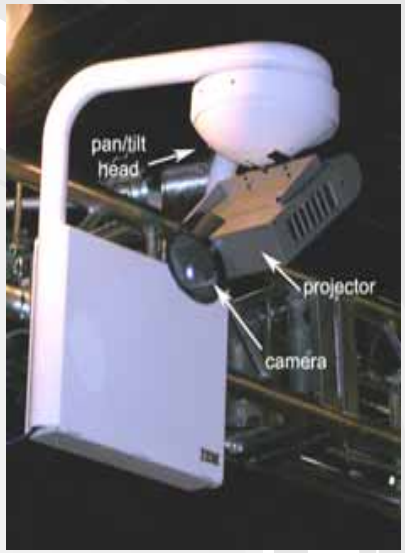
Changing display surface

BlueSpace: Operations (Cont.)





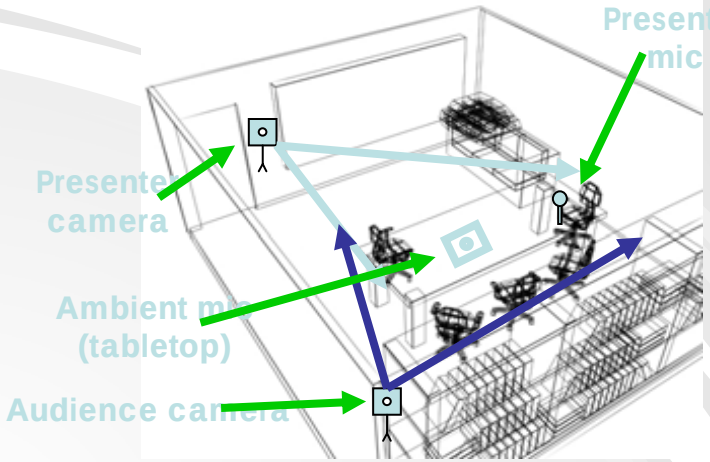
- Motion-based Interaction
  - Analyze video stream from the camera looking for motion
  - Detect motion towards target widget from any direction using *polar motion maps*
  - Distinguishes between "touch" and "flyover"
  - Supports: Multiple buttons; Grids of buttons

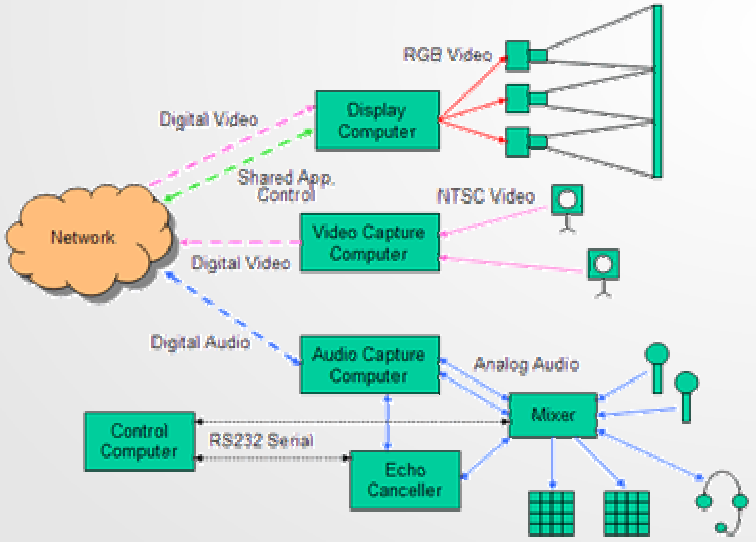


Everywhere interactive displays

Collaboration Space Projects: Access Grid (1999-) (led by ANL)

- Access Grid in the beginning
  - Group-to-group interaction
  - High-quality audio
  - Real-time video
  - Shared data & applications



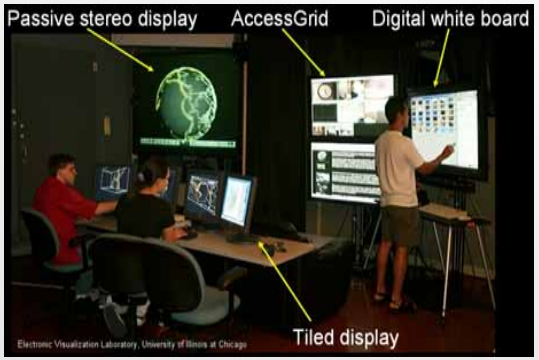


Access Grid: Usage Areas

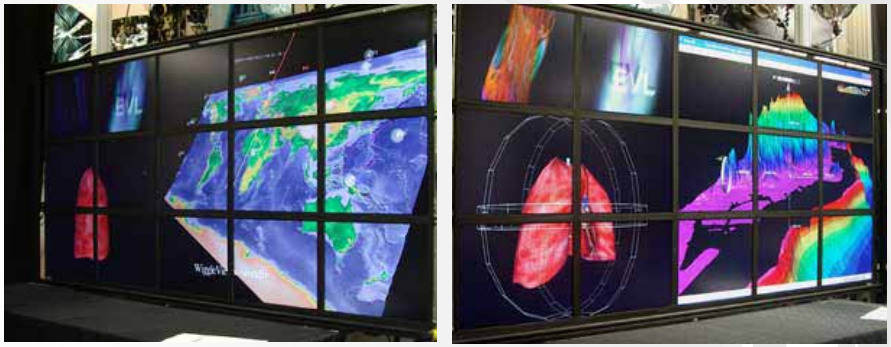
- The Academic and Research, Government, Private Sectors
- Making Remote Collaborations Work across Boundaries: e-Science
- Check “Multi-Sector Collaboration over the Access Grid” by J. T. von Hoffman (Boston Univ)”

Collaboration Space Projects: UIC EVL (2000 ~)

- Continuum (2000-2003)
  - Develop integrated ubiquitous tools and environments and to study how these tools can be used to enhance collaboration amongst knowledge workers - such as scientists and engineers.
  - EVL: Collaborative Continuum environment (tiled displays with VC and shared digital annotation capabilities) to speed up collaborative work by providing greater awareness between distantly located collaborators.



- TeraVision (2002-2006)
  - hardware-assisted, network-enabled "PowerPoint" projector for the Access Grid



- SAGE (2004-)
  - SAGE (Scalable Adaptive Graphics Environment) is a graphics streaming architecture for supporting collaborative scientific visualization environments with potentially hundreds of mega-pixels of contiguous display resolution.

Collaboration Space Projects: GLVF

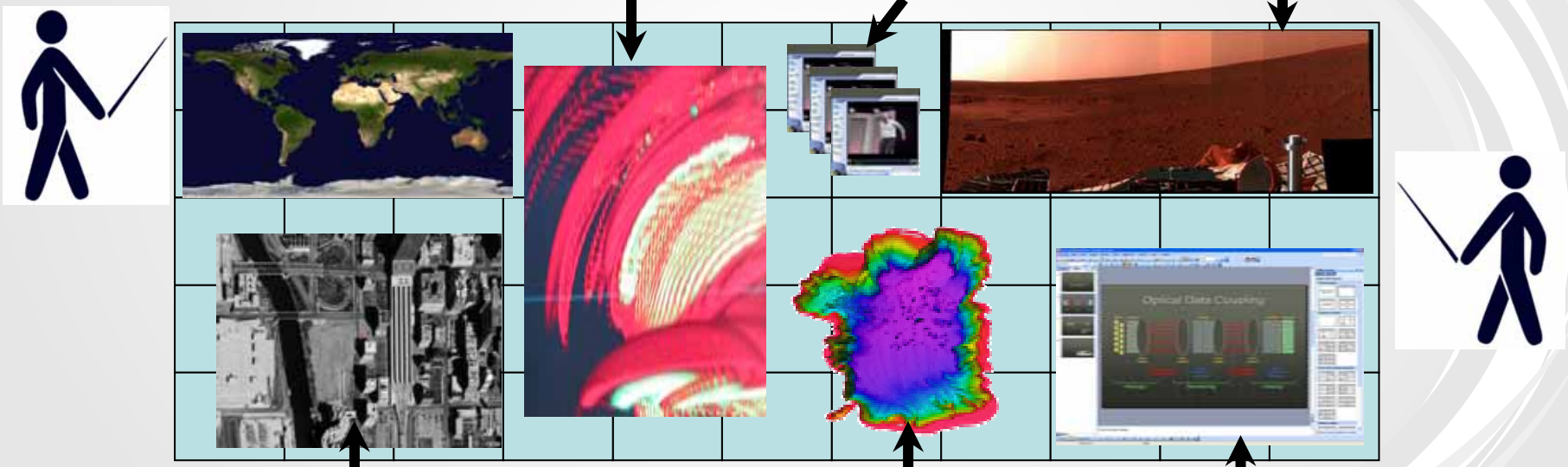
(led by UIC EVL)

The Global Lambda Visualization Facility (GLVF):
Technologies for Ultra-High-Definition Wide-Area Visualization and Collaboration

Remote sensing

Volume Rendering

Access Grid Live video feeds



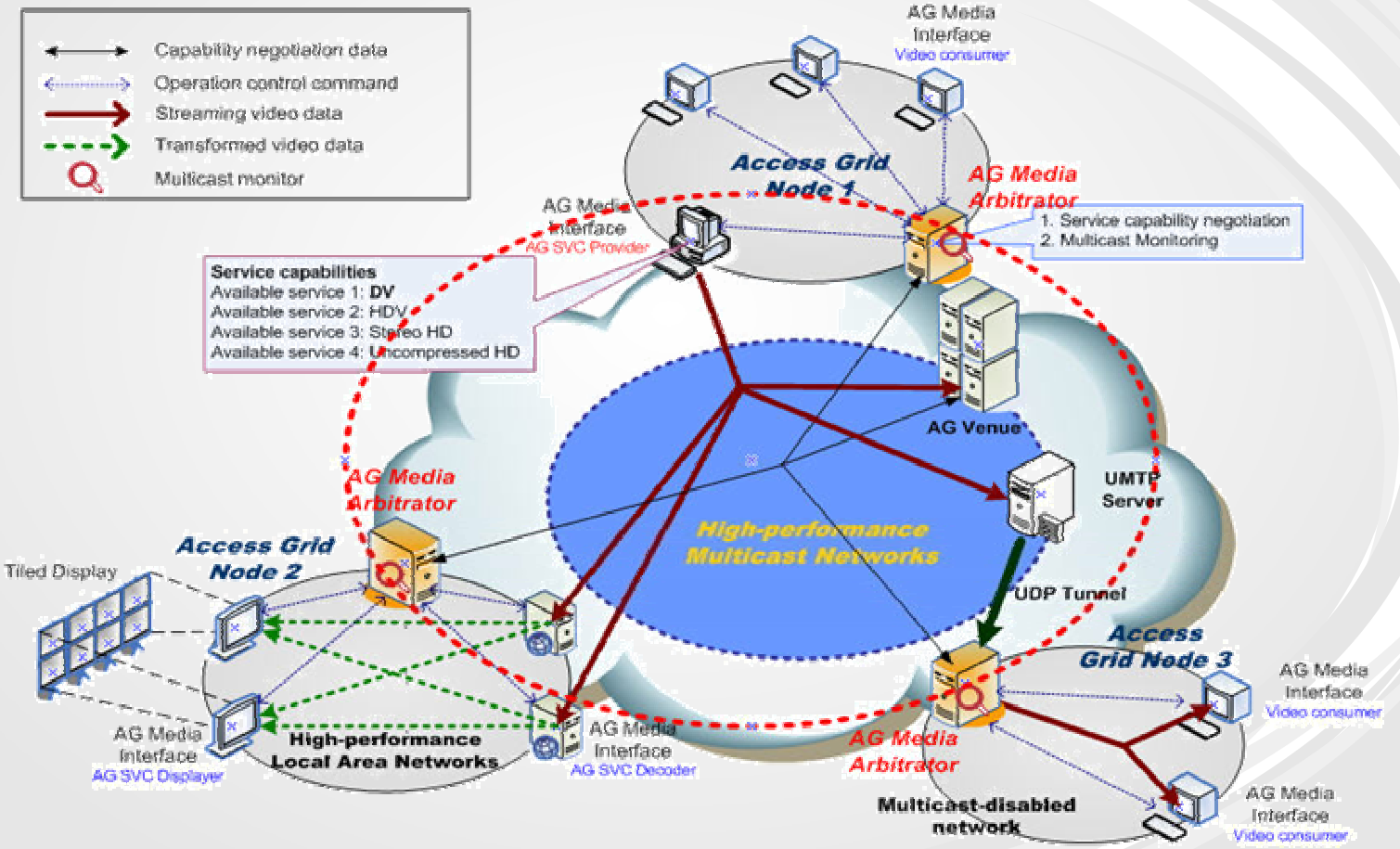
High-resolution maps

3D surface rendering

Remote laptop

Collaboration Space Projects: GIST AG Media Efforts (2002-) with KISTI

< AG Media + AG Connector + AG SVC >



High-quality Visualization Environment

Market: HALO Collaboration Studio (2005 Dec.-)

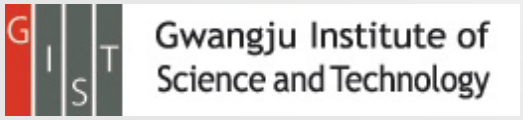
- HALO
  - $500,000 per room
  - 45 Mbps; Uses TCP/IP protocols
  - Developed with Dreamworks; Announced by HP Dec 2005
  - HP Plans 40 Internally by End of 2006
  - Dreamworks, AMD, PepsiCo are Customers

The Halo studios are designed to exact specifications, so that participants on the other side of the video conference appear to be in the same room

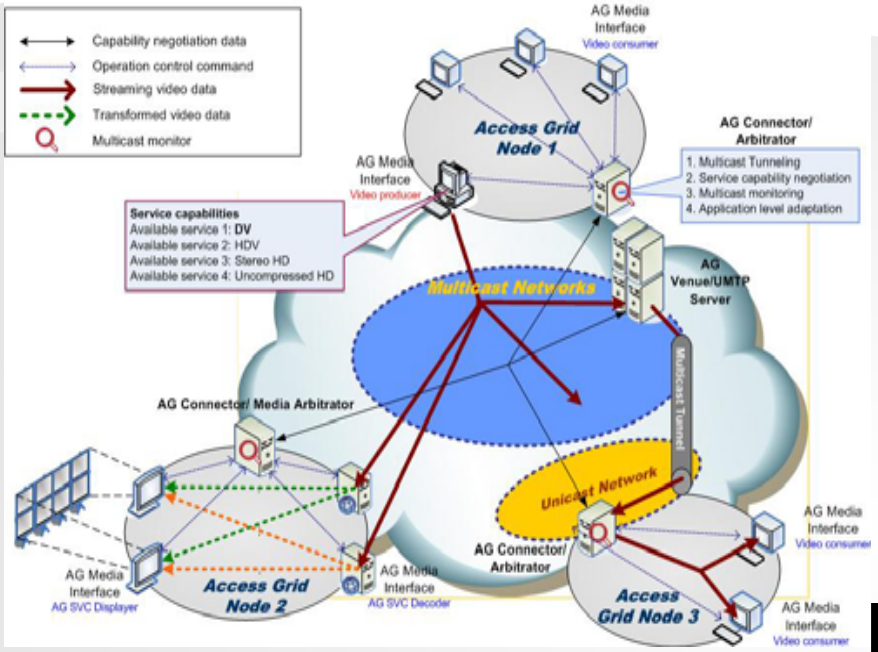
Market: Cisco Tele Presence (2006 Oct)

- **Audio/Visual Technology**
  - H.264 video codecs to offer the highest quality and lowest bit rate
  - Session Initiation Protocol
  - Native 720p and 1080p high-definition cameras; Native 720p and 1080p high-definition encoding/decoding
  - Low-latency architecture and low bandwidth utilization
  - Wideband advanced audio coding with low delay (AAC LD); Multichannel spatial audio with echo cancellation and interference filters to eliminate feedback from mobile devices
- **Network**
  - offer capabilities for ensuring quality of service (QoS), security, reliability, and high availability for high-bandwidth applications such as video, particularly high definition video, which can require 1Mbps to 5Mbps, depending upon the resolution.
- **Hardware-Optimized Environment**
  - Often include purpose-built office furniture, which incorporate cameras and displays, lighting, speakers, microphones, and projection capability into a specially designed table for larger rooms, or, in smaller configurations, with existing office furniture.

Designing Smart Interactive Collaboration Environments



Starting to build by combining …

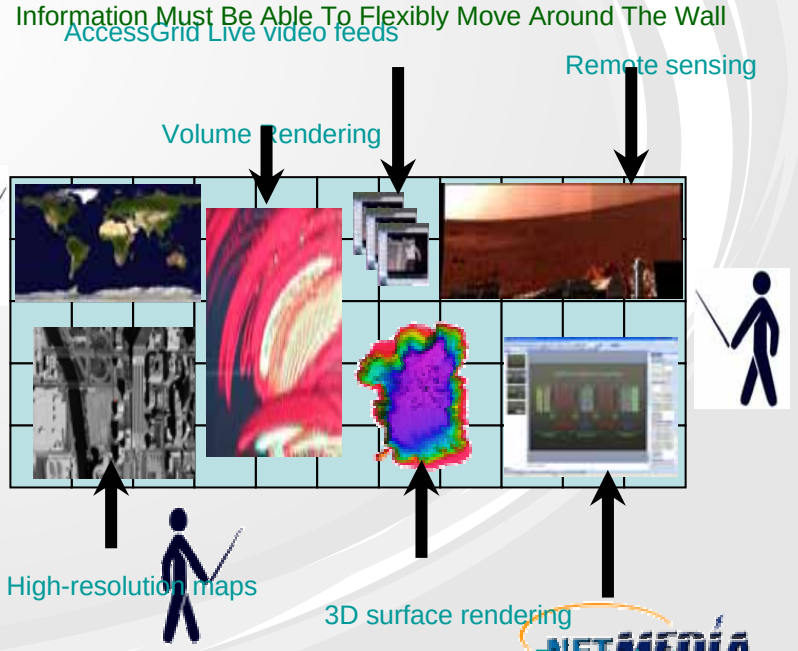


Optical (Lambda) Networking

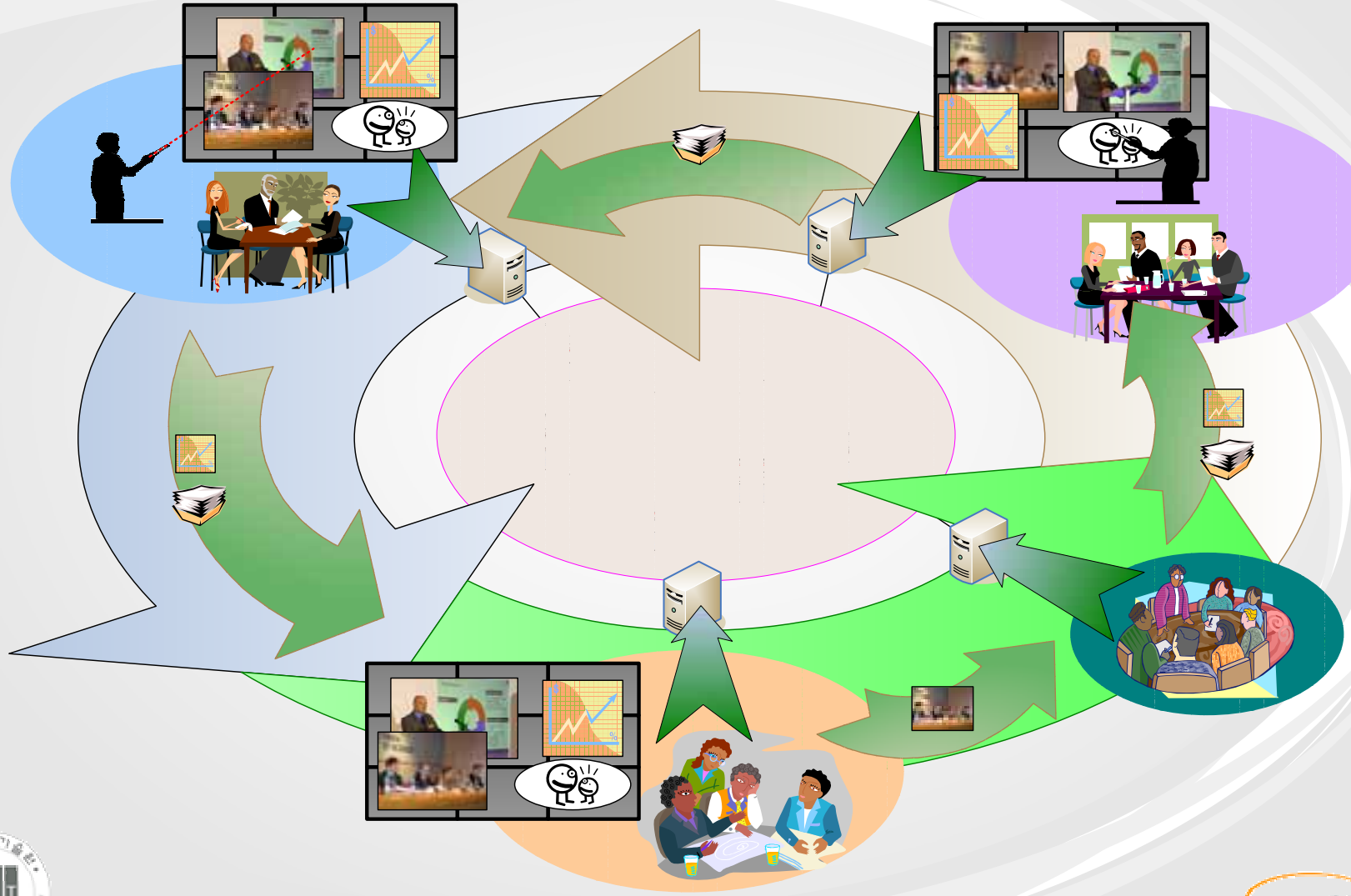
Immersive Media & Networked Virtual Environment

Wireless & Mobile

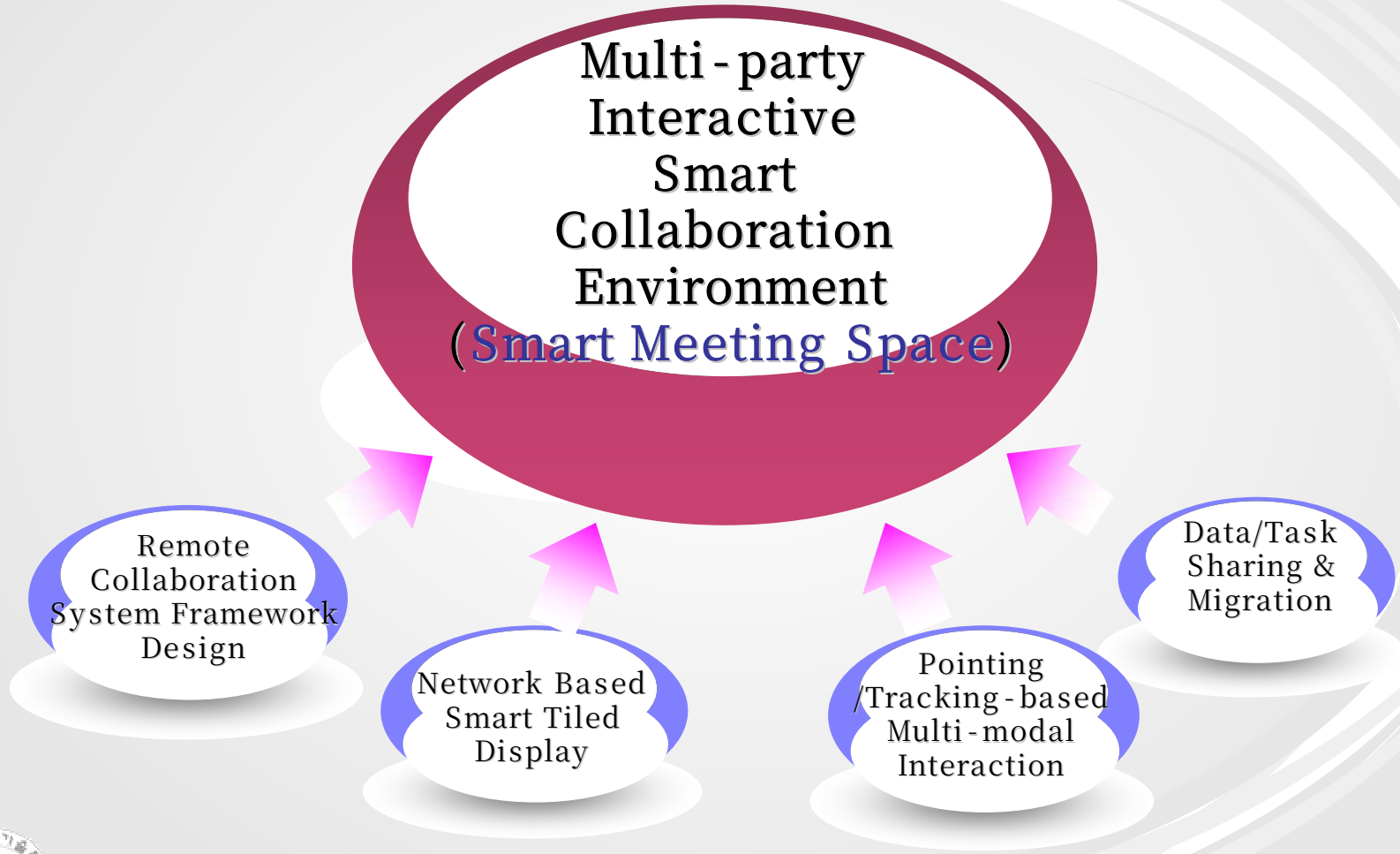
Peer-to-Peer & Home Networking



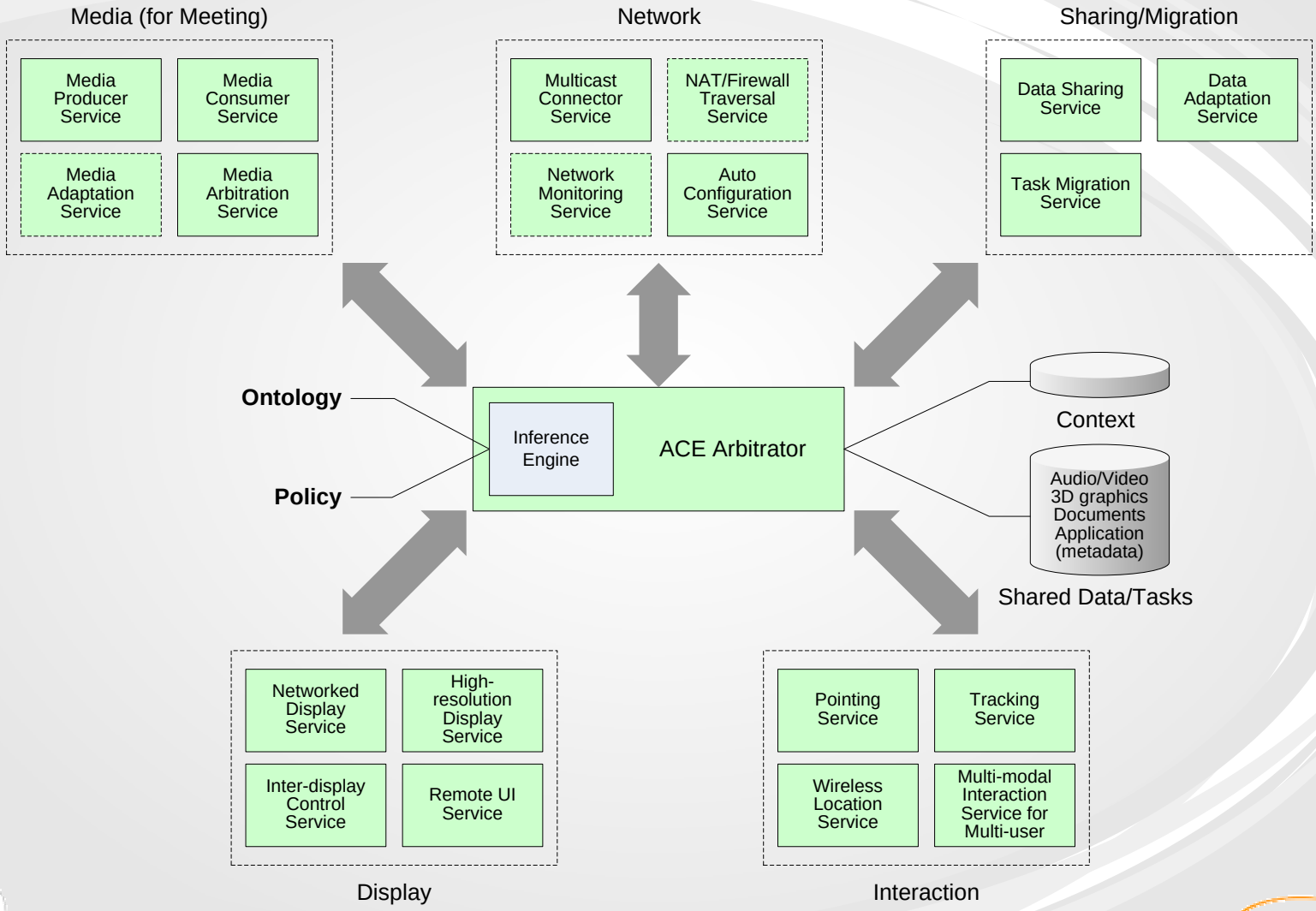
Toward Multi-party Interactive Collaboration Environment for Ubiquitous Community Environment



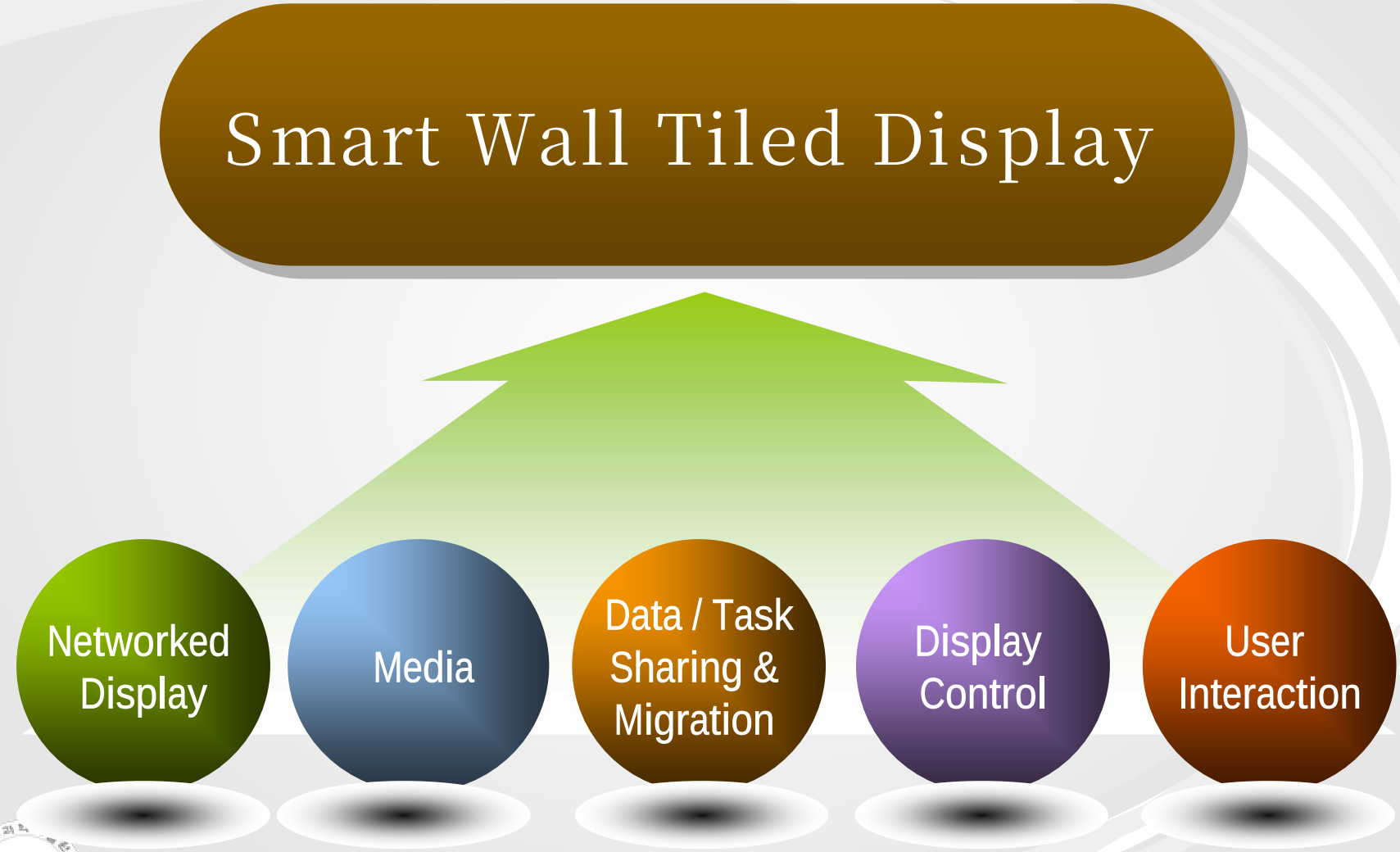
Smart Meeting Space Project Research Targets (2006-2009)



Software Architecture for Multi-party Interactive Smart Meeting Space

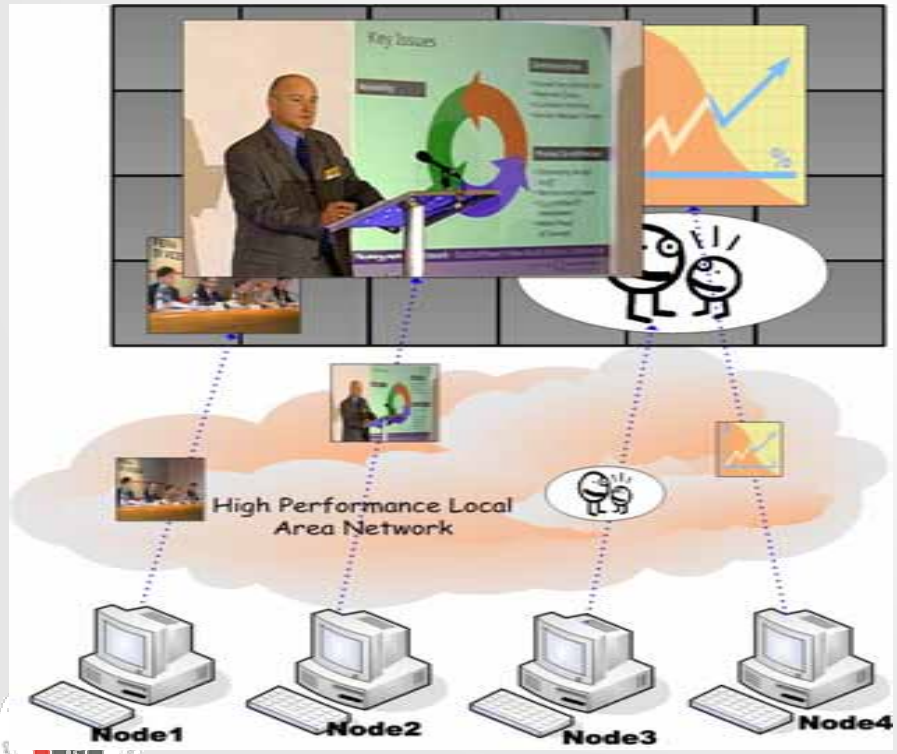


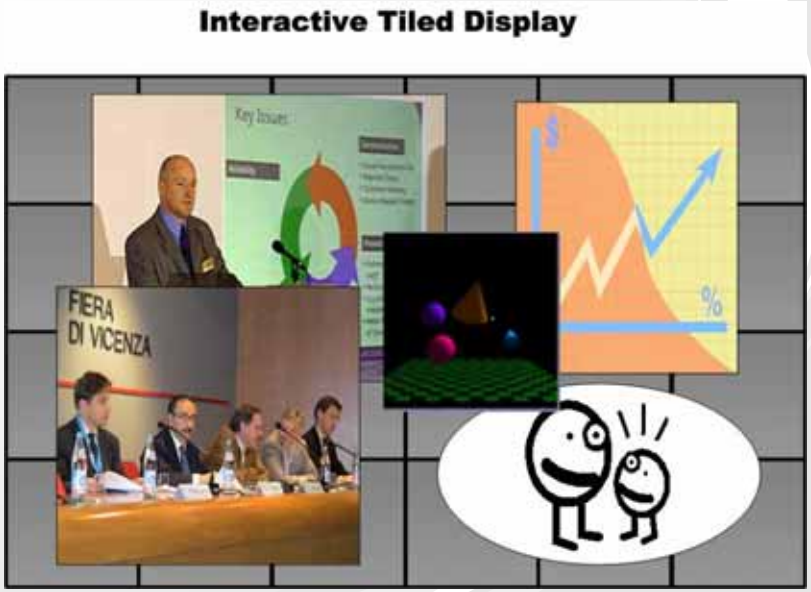
Smart Meeting Space System: From Display Viewpoint



Smart Wall Tiled Display - Networked Display & Media (for Meeting)

- Networked Display Support
  - Instead of DVI-like connectors, use network interfaces to feed rendering pixels
  - Allows us to share display among local and remote nodes
- Versatile Media Support
  - Simultaneous display of multiple media objects
  - Super high-resolution images, SD/HD videos, 3D graphics
  - Display resolution extension with tiling

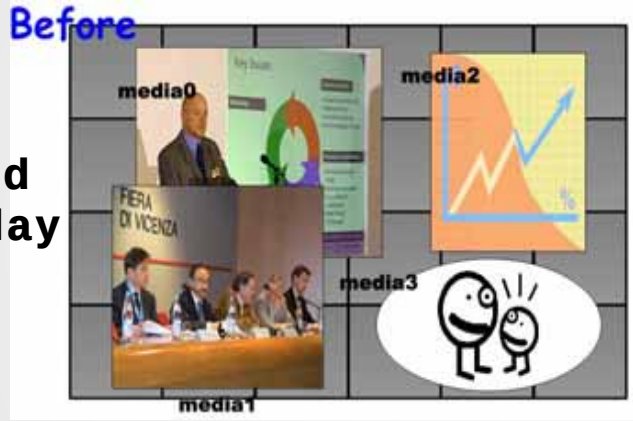




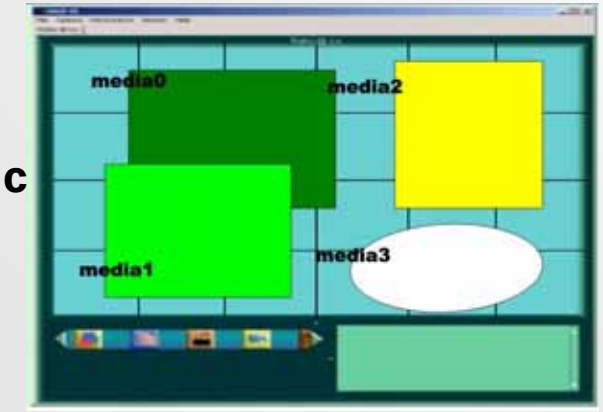
Smart Wall Tiled Display – Display Control & Sharing/Migration

- User Interfaces for Display Control
  - Display control UI (text-based & GUI-based)

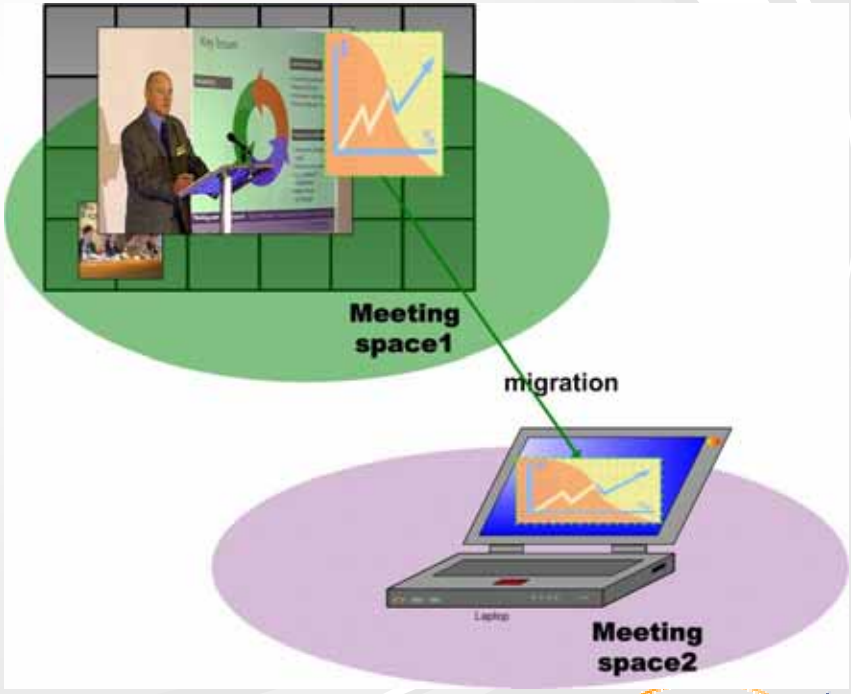
Tiled Display



Graphic UI

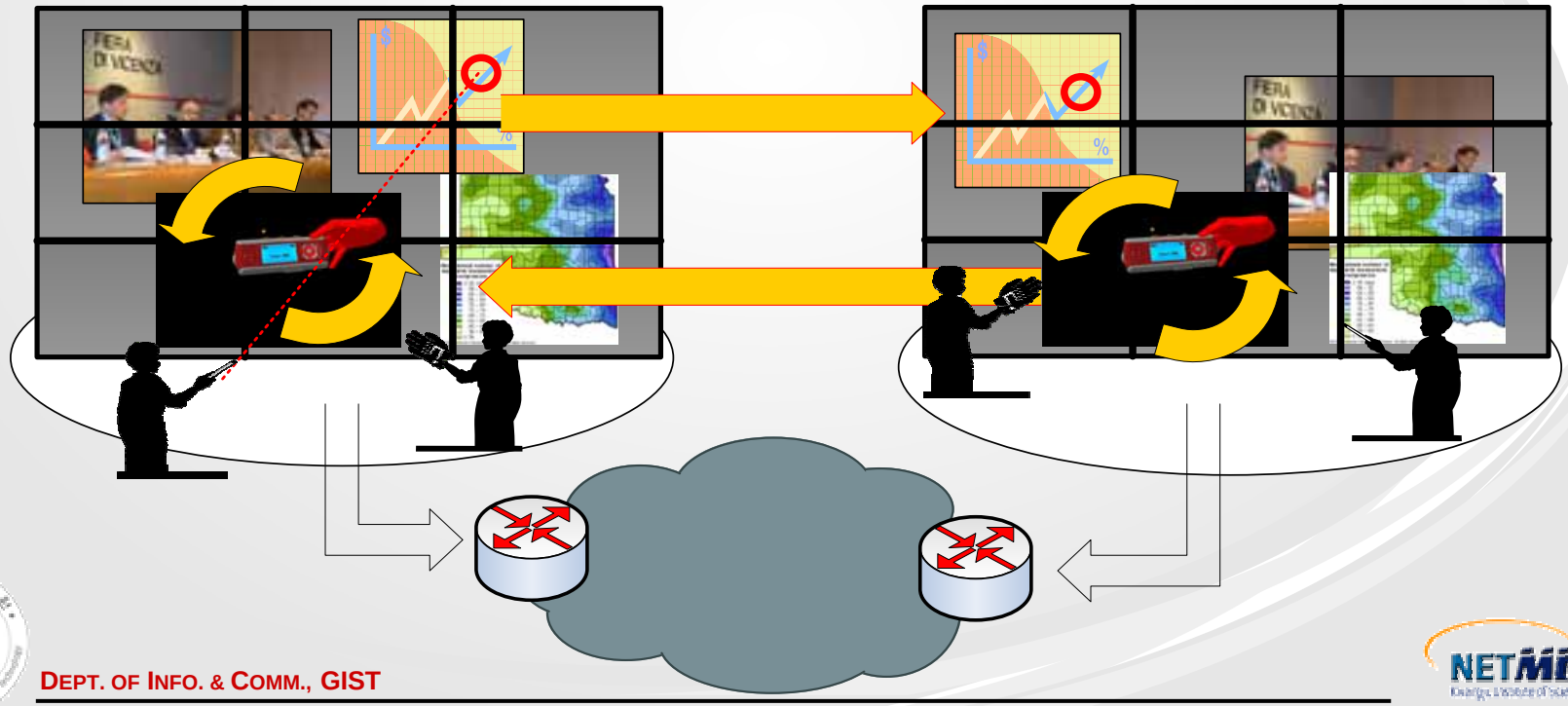


- Data/Task Sharing/Migration Support
  - Remote-UI oriented rendering to match migration space
  - Migration engine will decide the required translations, …

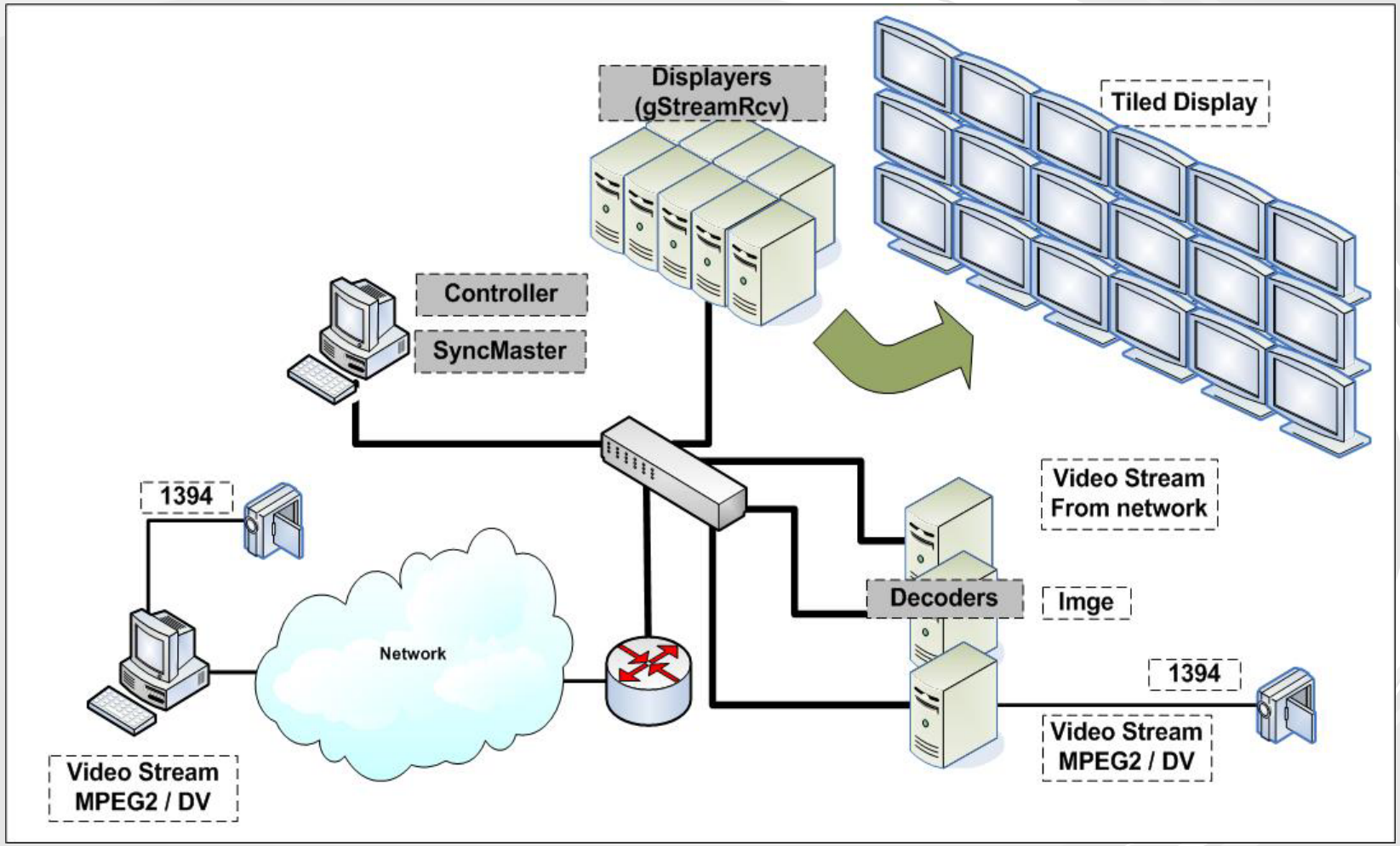


Smart Wall Tiled Display – User Interaction

- User Interaction
  - uT-pointing / (Glove-based) Hand tracking & related display (and application) control
  - Location-based user interaction employing wireless location devices (RFID or WLAN)
  - Merging the interactions of multiple users via networking

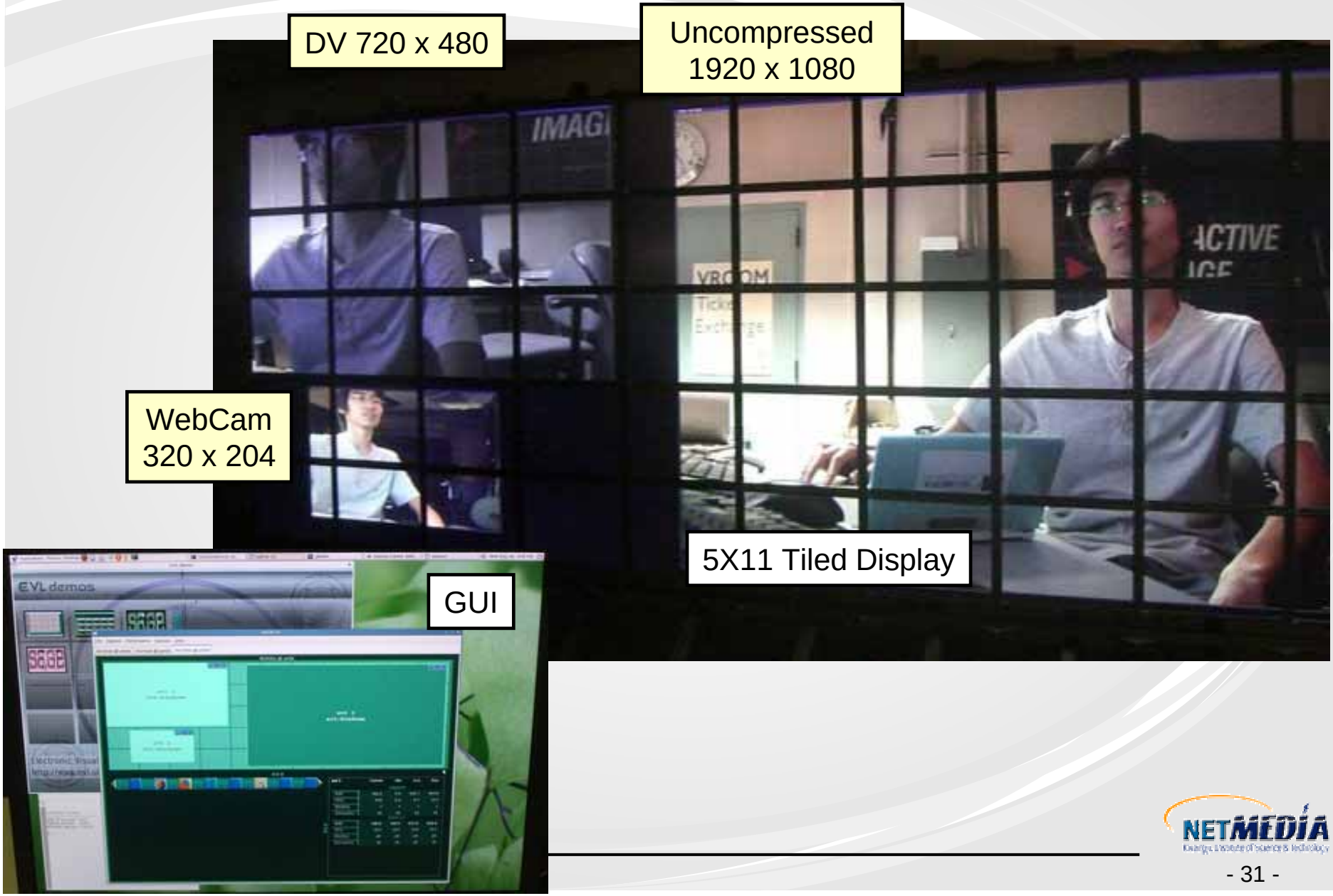


Prototype System: Integrating Media to Tiled Display System

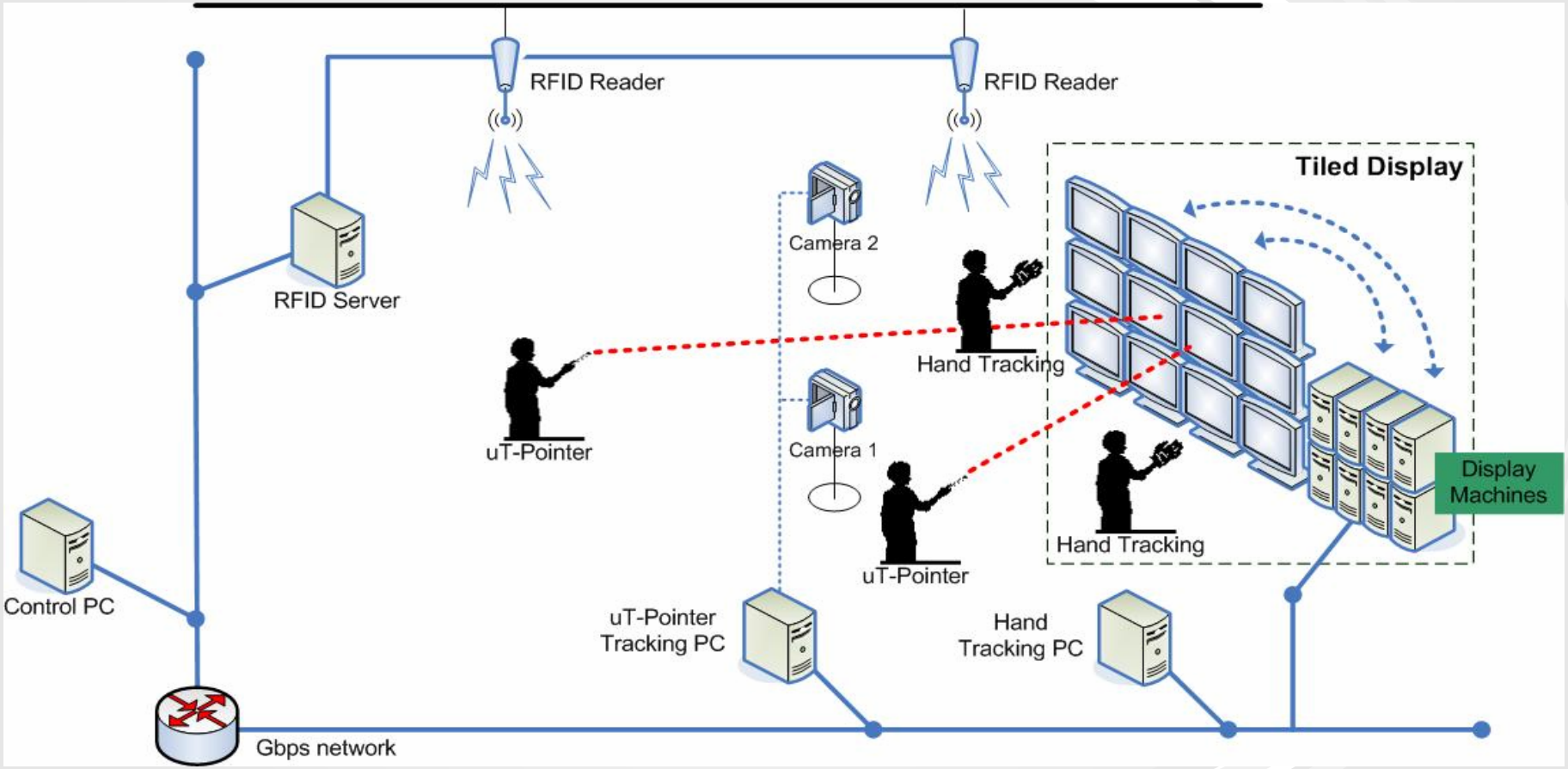


Tiled Display System @ GIST (2006/06)

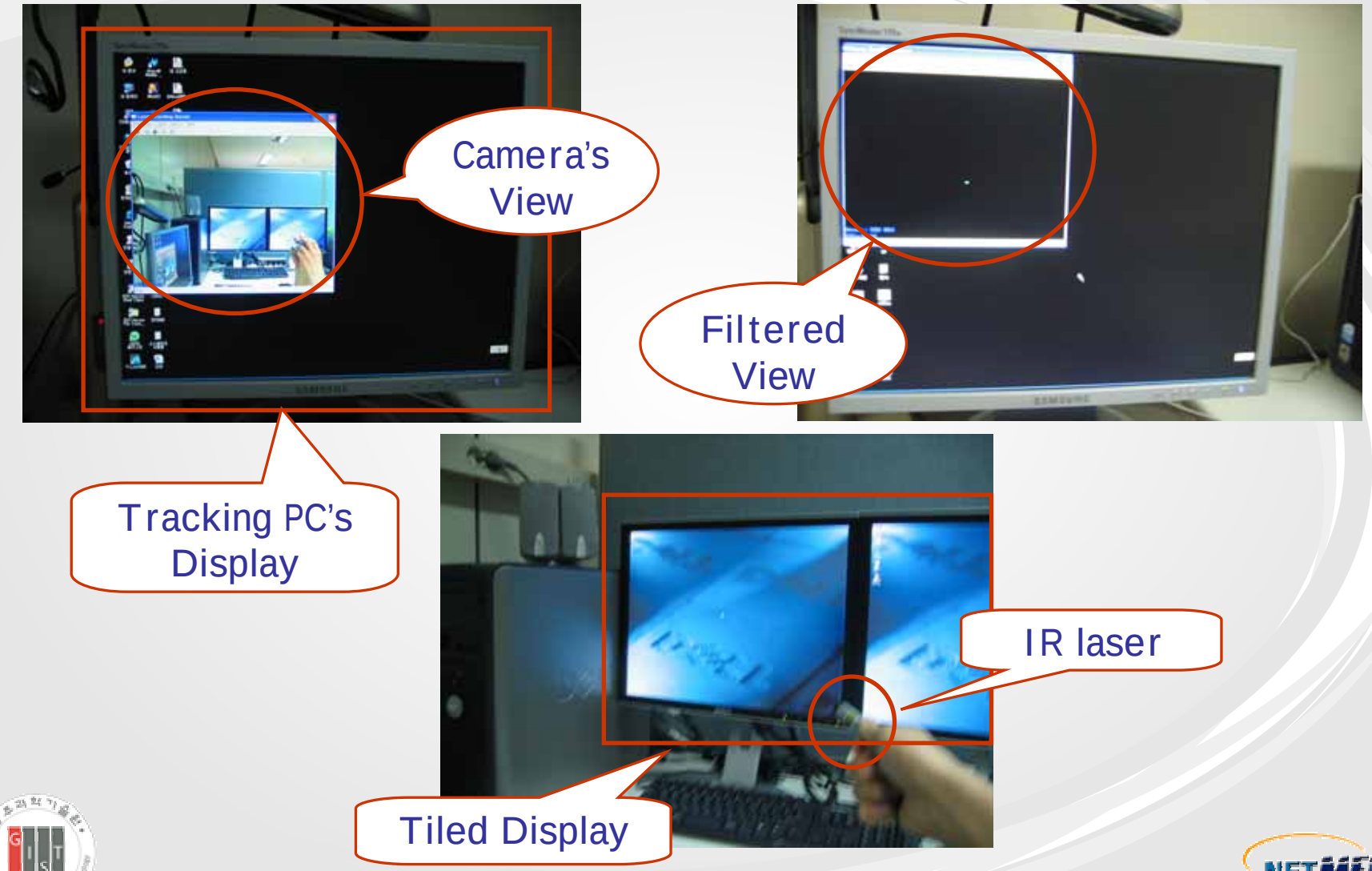
Versatile Media Support - SVT (2006. 08 with UIC/EVL)



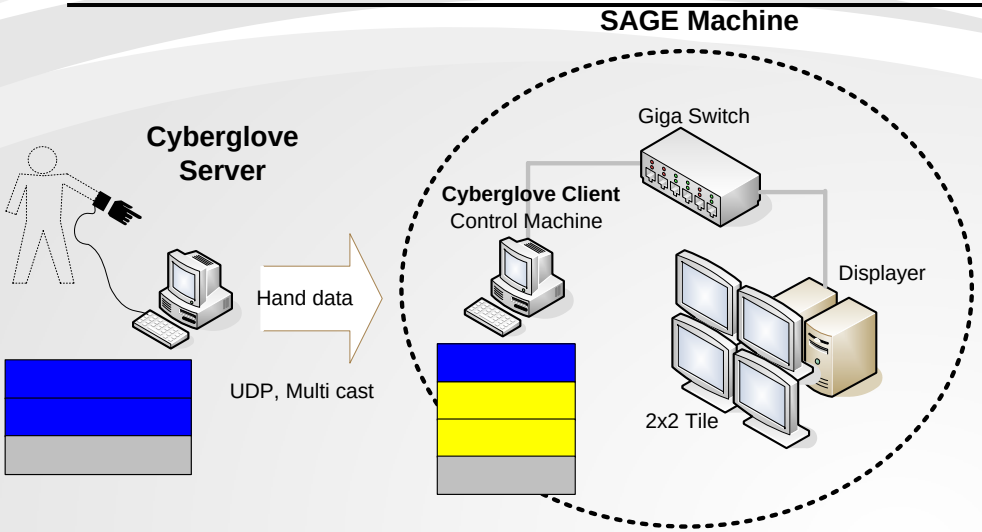
Prototype System: Multi-user Interaction with Display

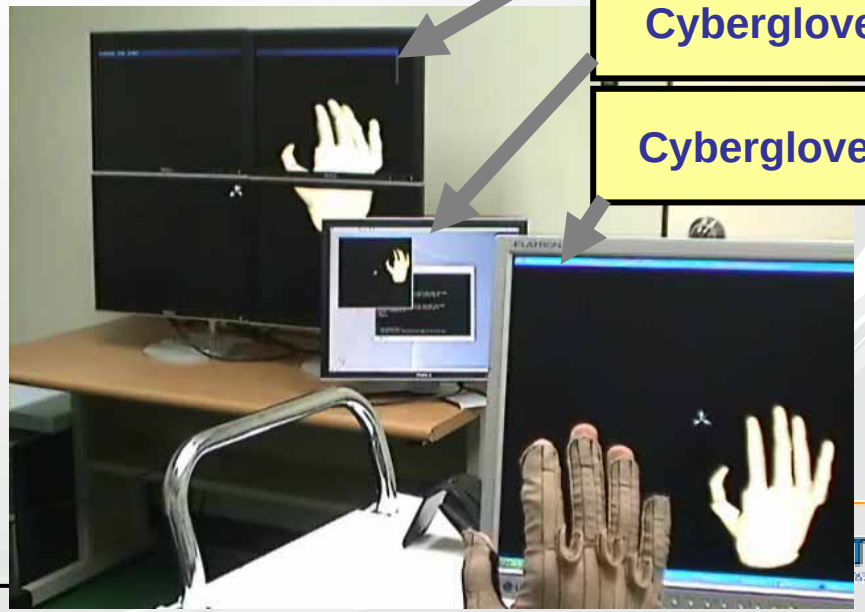


Interaction: InfraRed Laser Pointing (Current Progress)



Interaction: Glove-based Hand Tracking (Current Progress)



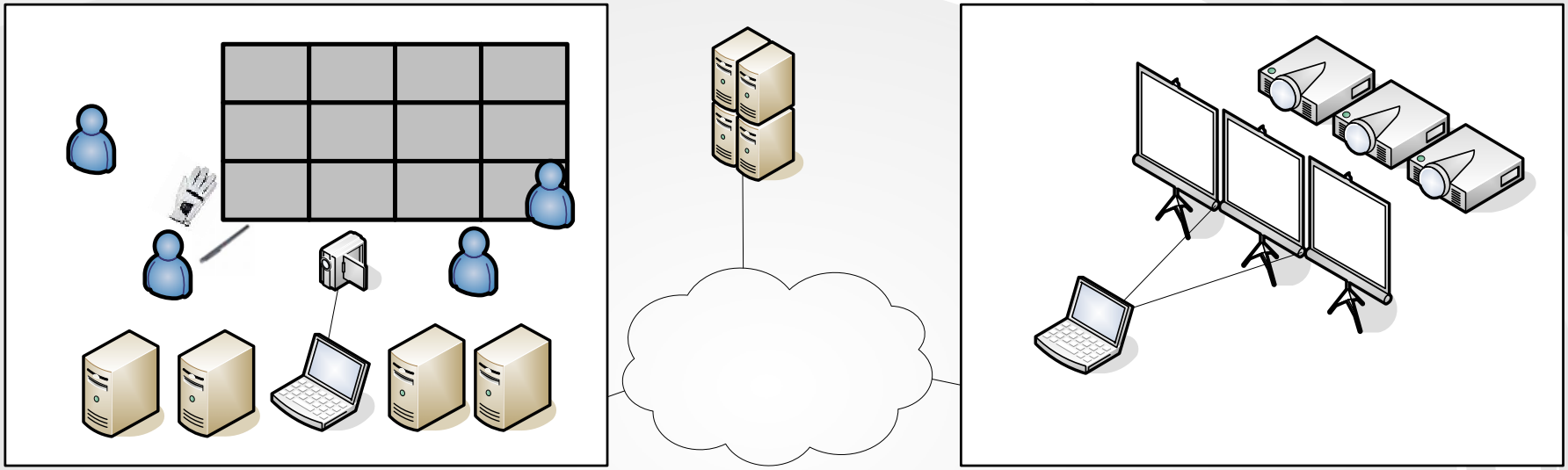


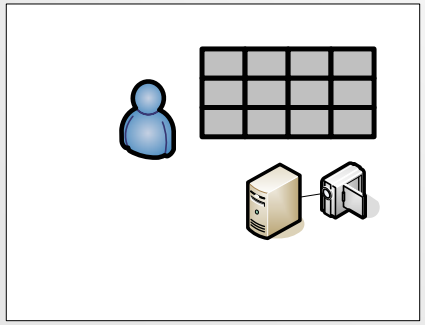
SAGE, Displayer

Cyberglove Client

Cyberglove Server

SC Global 2006: Sharing Interactive High-Resolution Media for Advanced Collaboration (2006/11)





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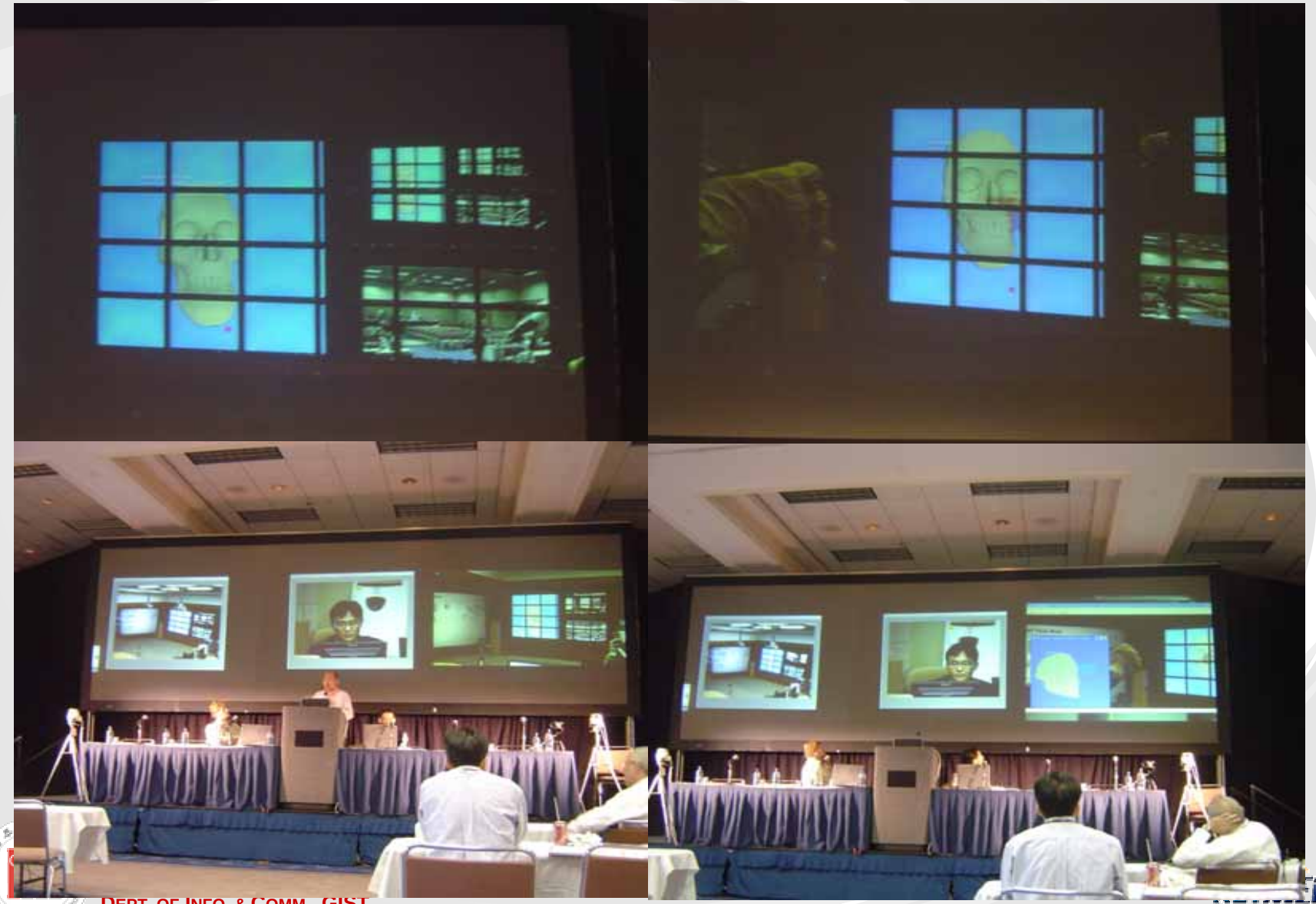
SC Global 2006 Demonstration (Cont.)



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Thank you!

Send Inquiry to jongwon@gist.ac.kr

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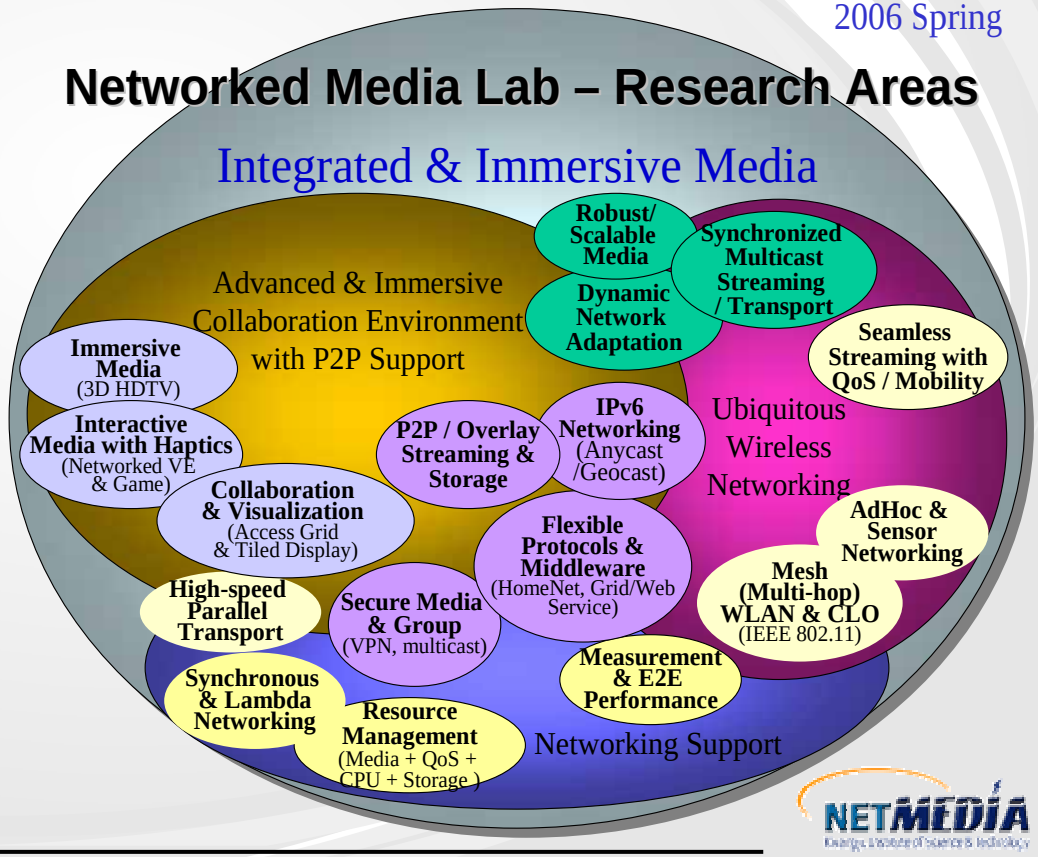
GIST Networked Media Lab.

- Networked Media Lab (Since Sept. 2001)
  - Faculty: JongWon Kim, Ph.D.
  - Members: 10 Ph.D/7M.S. candidates
  - http://nm.gist.ac.kr

Networked Media Systems and Protocols focusing "Reliable and Flexible Delivery System for Integrated Media over Wired/Wireless Networks"