

# Workshop on Advanced Collaboration Environments

Rick Stevens

Argonne National Laboratory

University of Chicago

# Goals of the Workshop

---

- This workshop will address research, technological, and social issues of developing persistent collaboration infrastructure to address the needs of emerging scientific communities
- The goal of the workshop is to provide an open technical forum to promote the discussion of *high-end, high-value solutions* to the problem of supporting distributed scientific collaboration.

# Kudos and Thank You

---

- Big Thank You to Mary Fritsch for handling arrangements and meeting logistics
  - Please give a copy of your presentation to Mary..
- Mike Papka and the Organizing Committee.. Mike kept reminding me to get things done and then more often than not ended up doing them 😊
- Thanks to the Program Committee for helping to put together the program and in some cases agreeing to speak
- Thanks to all the contributors and participants for getting excited about this area of work and agreeing to participate
- Thanks to DOE for providing funding support for the meeting

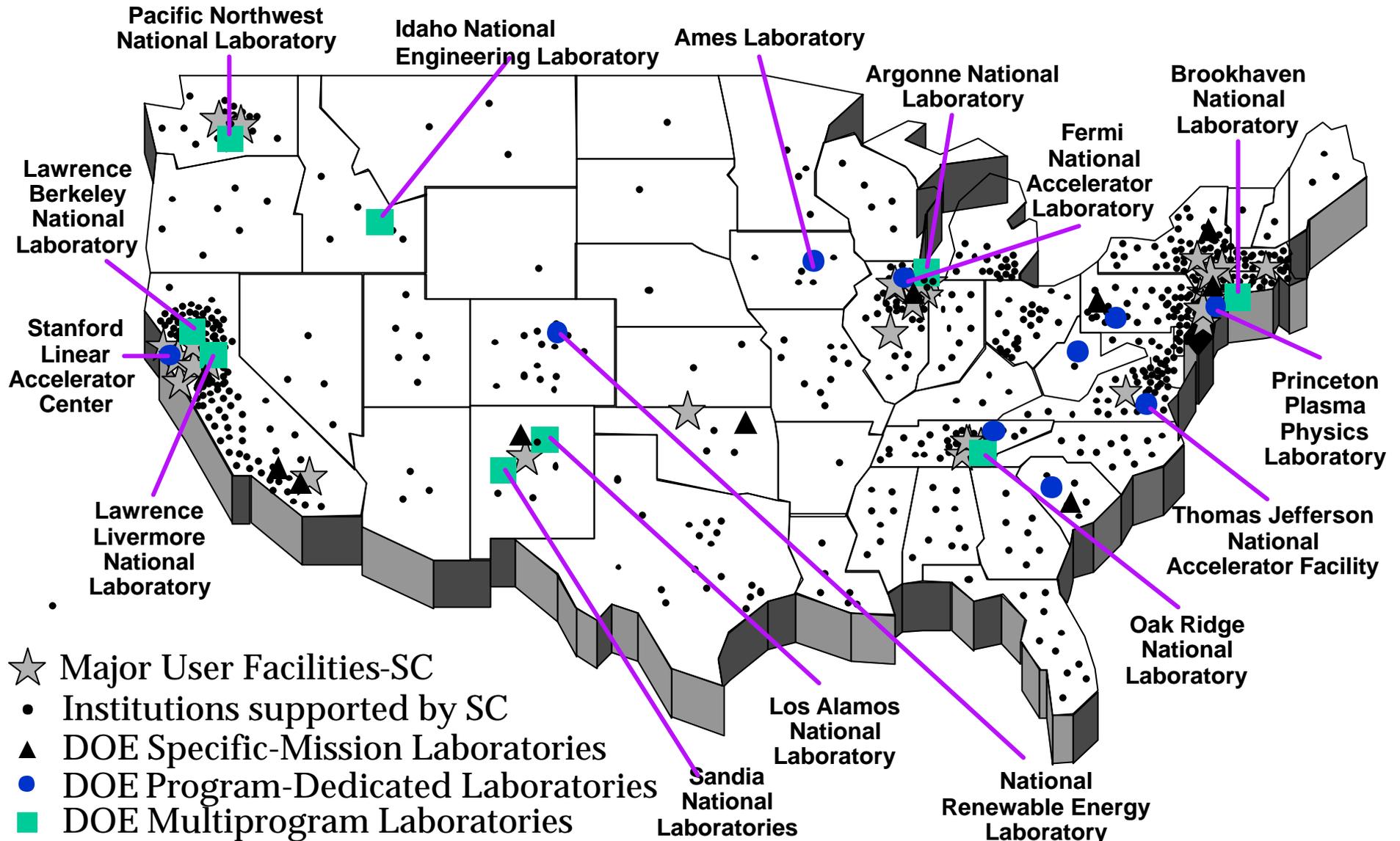
# Plan for the Day

---

- This is a Workshop So....
  - Please ask questions
  - Please feel free to raise new ideas and speculate
- Talks are unfortunately very short
  - Try to stay in your time limit
  - Leave time for questions
- Proceedings will be mailed in a few weeks
  - If you haven't registered and want a copy please make sure we have your contact information
- Roundtable discussion and summary at the end of the day..

# DOE Programs and Facilities

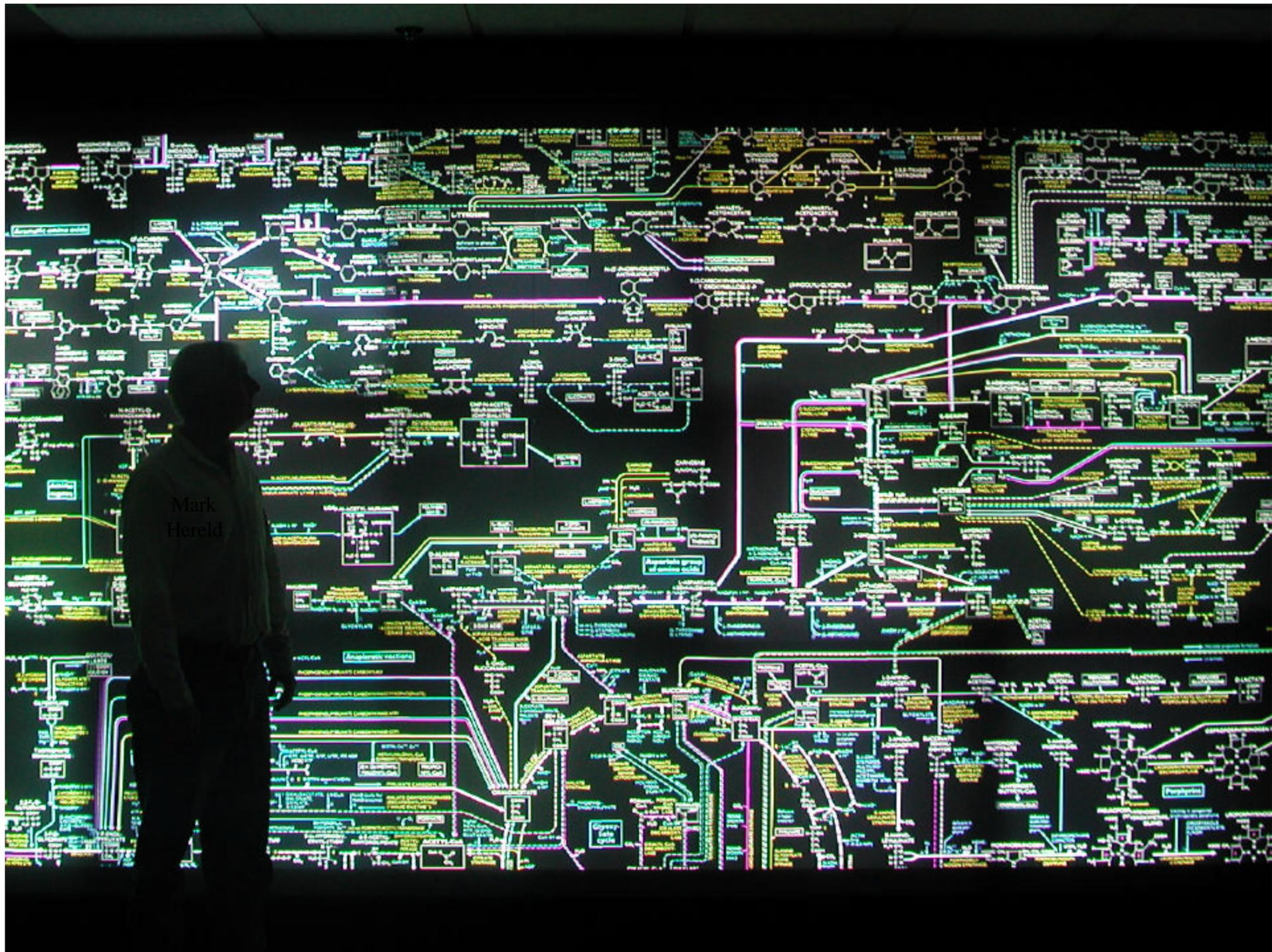
## Technical Challenges: Distributed Resources, Distributed Expertise



# Roadmaps: Future of Collaboration Environments

---

- What are Research and Development Roadmaps?
- Core technologies enabling/pacing ACE development
  - Networking
  - Distributed High-Quality Multimedia
  - Grid Middleware
  - Remote and Distributed Applications
  - Group Oriented, Multi-Site, Multi-user Applications
  - Emergence of Smart Space Technologies
  - Collaborative Virtual Environments



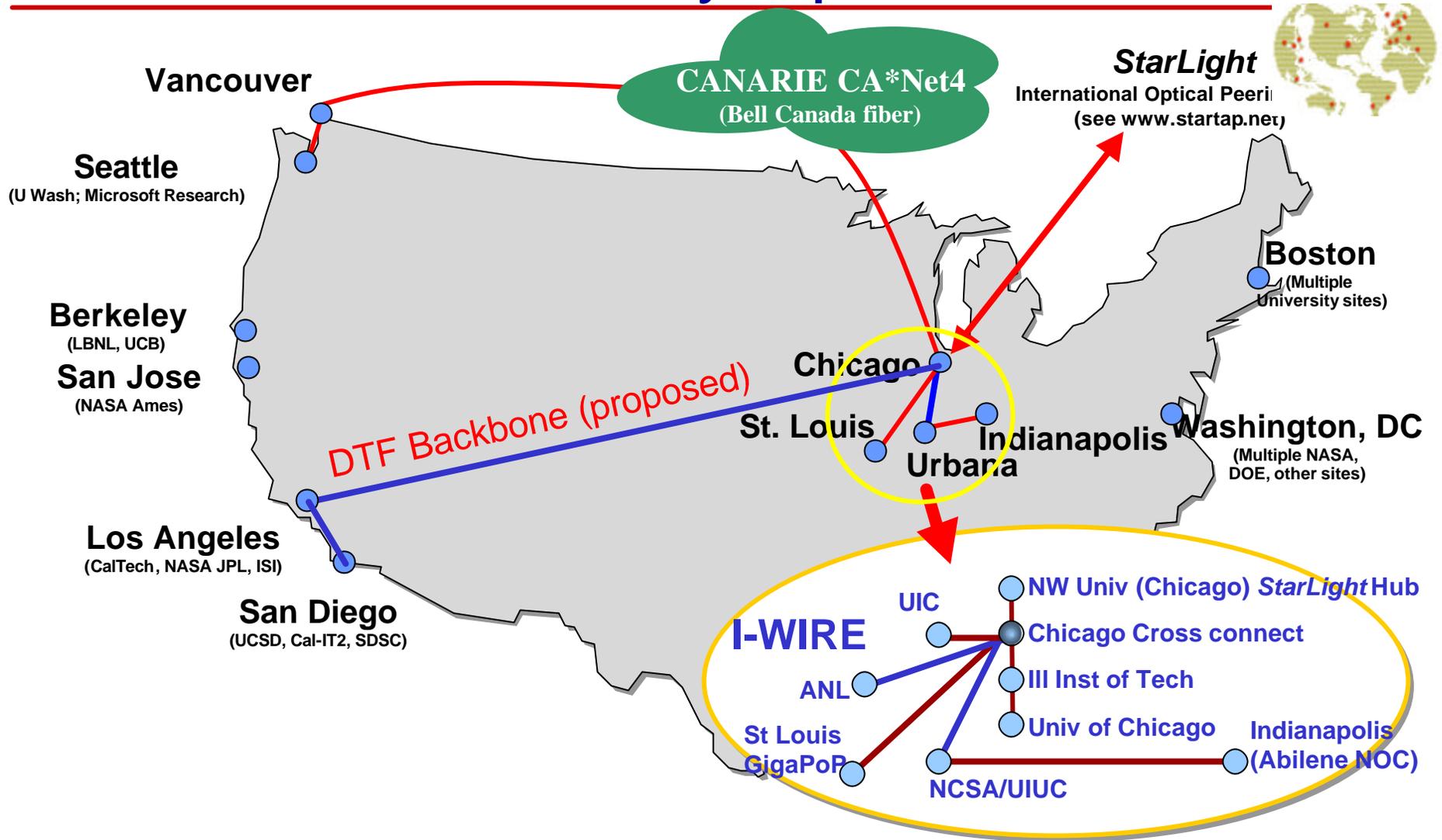
Mark  
Herold

# Networking Directions Major Trends 2001-2010

---

- Movement to all optical internet core  $\Rightarrow$  Terabits backbone
  - I-Wire, DTFnet, CallT<sup>2</sup>, BagNet, Canarie4, StarLight, etc.
- High-bandwidth Wireless [LAN, regional and MAN]
  - LEO based systems, regional > 100 Mbps services, building area
- Ubiquitous public bandwidth [802.11, etc.]
  - Networking mobility for meeting and workspaces
- Personal Networking [bluetooth, G3, IR, etc.]
  - Possibility of Integrating networking for personal devices
- IP v 6, native multicast, QoS, Caching, Beta Grids
  - Advanced networking services offer opportunity for new types of applications

# Research Community Optical Fiber



## PC Computing Technology in 2010 [\$1,000]

- Memory Capacity Continue quadrupling every 3 years
  - 256 MB today → 20 GB in 2010
  - GByte RAM chips [\$1MB today.. ~\$1GB in 2010]
- Disks 10 TB disks 1-2” form factor
  - 70 GB today → 1.5 TB in 2010
  - Personal Petabyte DBs become possible [100 disks]
- Microprocessor performance increase at 60% per year .
  - 4GF today → 160 GF in 2010
  - 1.4 GHz in 2000 → 30 GHz in 2010
- Networking [Ethernet]
  - 10 Gigabit Ethernet in 2000 → Terabit Ethernet in 2010

# IBM, Sony and Toshiba “Cell” Project

- \$400M investment towards Teraflop processor
- Targeted at PS3, broadband applications
  - Each company will produce products based on the core technology
- 100 nm feature size
- Design Center in Austin TX opening later this year
- Sony’s description of PS3 is 1000x performance of PS2
  - Will become the driver for all of Sony’s product lines
  - Video, Audio, Computer Games, PCs Etc.

# Distributed High-Quality Multimedia Systems

---

- Digital Video and Audio Processing
  - HDTV support PC, IP based cameras and audio, convergence on IP
- High-Performance Graphics Systems
  - Game market, billion polygon per sec, advanced lighting models, etc.
- Large-Scale Tiled Display Technologies
  - Exploit Commodity Technologies [projectors, clusters, software]
- Spatialized Audio and other Advanced Audio
  - Multichannel audio systems, beam forming, public/private channels, IP based
- True Stereo Displays, Ultra-high-resolution and Augmented Reality
  - Progress continues on alternatives to workstation displays

# Grid Middleware [toolkits for building Grids]

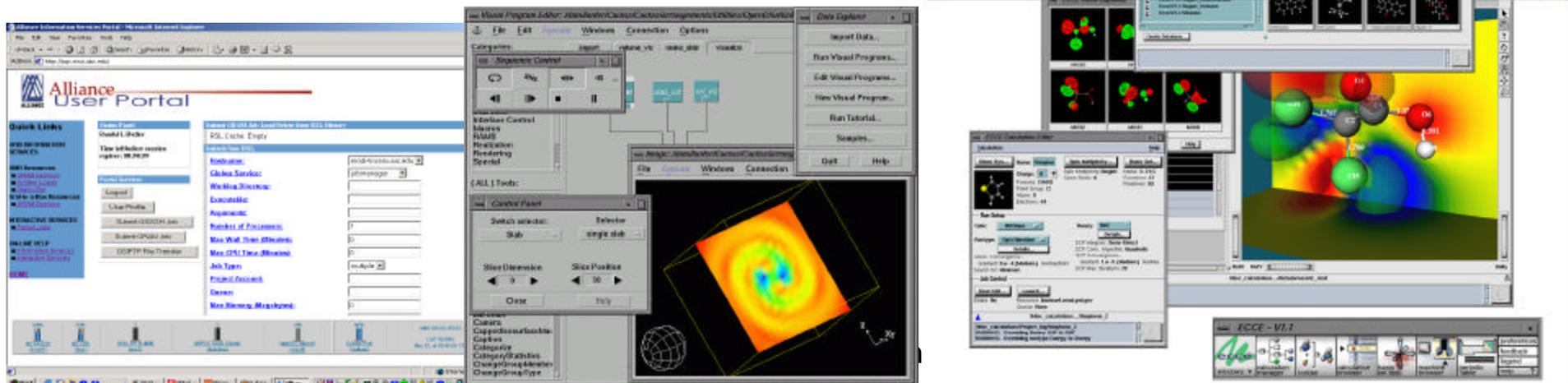
---

- PKI Based Security Infrastructure
- Distributed Directory Services
- Reservations Services
- Meta-Scheduling and Co-Scheduling
- Quality of Service Interfaces
- Grid Policy and Brokering Services
- Common I/O and Data Transport Services
- Meta-Accounting and Allocation Services



# Remote and Distributed Applications & Tools

- Tools for Building High-Performance Distributed Applications
  - MPICH-G2, Globus, Legion, etc
- Web Based [e.g. Java] tools
  - Portals, Java/COG, etc.
- Application Portals
  - ECCE', Hot-Page, BioWorkBen



# Group Oriented, Multi-Site, Multi-user Applications

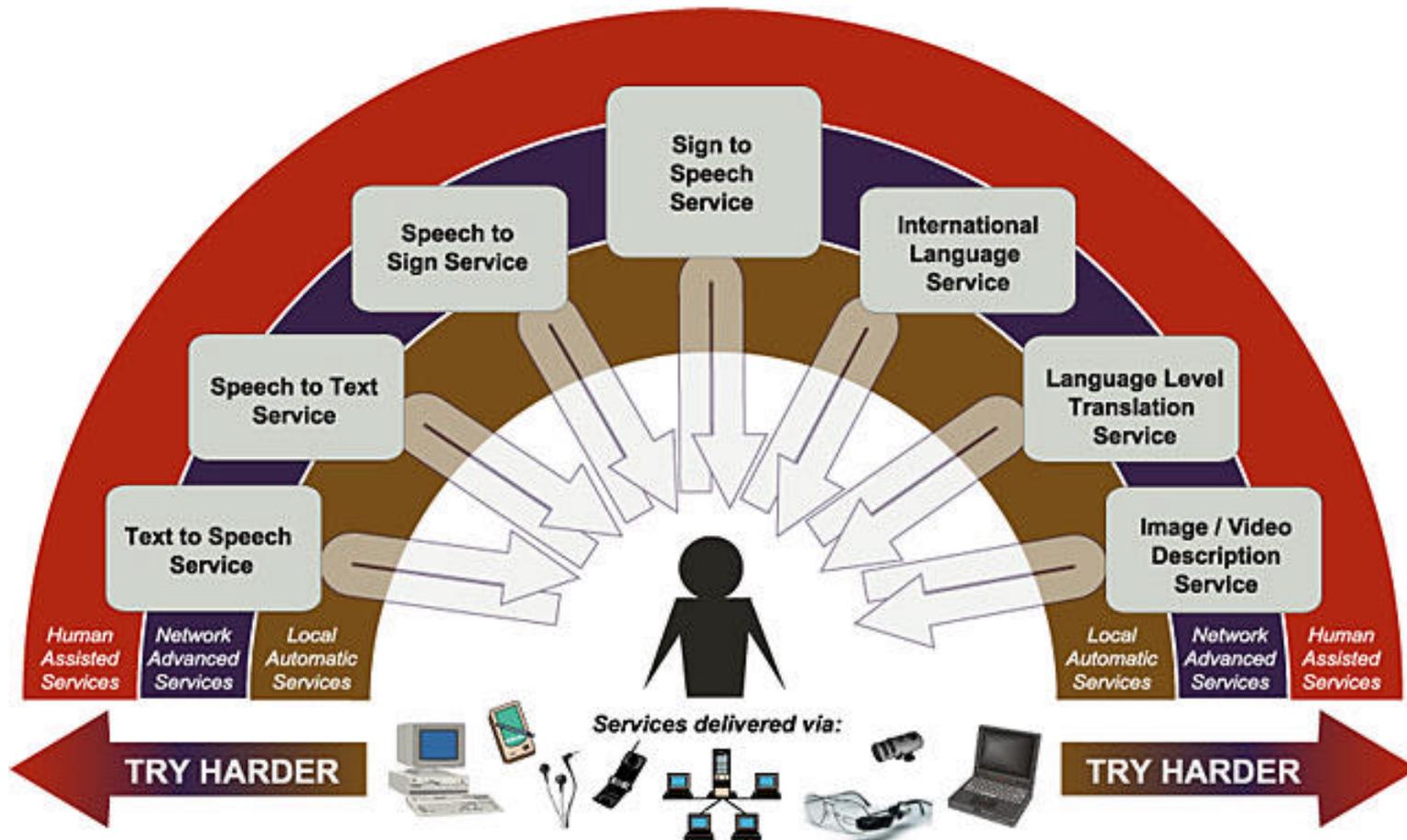
---

- New Class of Application Needed for Core ACE Development
- Start by Building Applications as General Services
  - Oracle database for example
- But, Need to provide not only one-to-many support of the application itself [server+multiple clients], but need to support awareness of the users, interactions and coordination of multiple users and support for sharing data and front-end interfaces
- A “User” in the future may be a small “group” of people
- Group oriented user interfaces are needed
- APIs are needed to bind these applications to collaborative sessions



# Modality Translation on the Grid

Background: [http://trace.wisc.edu/docs/modality\\_translation\\_poster2001/](http://trace.wisc.edu/docs/modality_translation_poster2001/)



# Emergence of Smart Space Technologies

---

- Platforms for applications development are expanding
  - PC  $\Rightarrow$  Laptop  $\Rightarrow$  PDA  $\Rightarrow$  Wearable  $\Rightarrow$  Ingestible  $\Rightarrow$  Implantable
  - PC  $\Rightarrow$  Cluster  $\Rightarrow$  App specific Cluster  $\Rightarrow$  Embedded Clusters
  - PC  $\Rightarrow$  Game Console  $\Rightarrow$  Clusters of Game Consoles
  - PC  $\Rightarrow$  Deskside  $\Rightarrow$  Room Oriented  $\Rightarrow$  Building Oriented
  - PC  $\Rightarrow$  Laptop  $\Rightarrow$  Application Appliance  $\Rightarrow$  Smart Tool Box
  - PC  $\Rightarrow$  Laptop  $\Rightarrow$  Embedded  $\Rightarrow$  Augmented Reality
- Edge devices in future ACES will not be PCs
- Rooms are becoming systems
- Spaces are becoming applications



# As Our Bodies Move On-Line

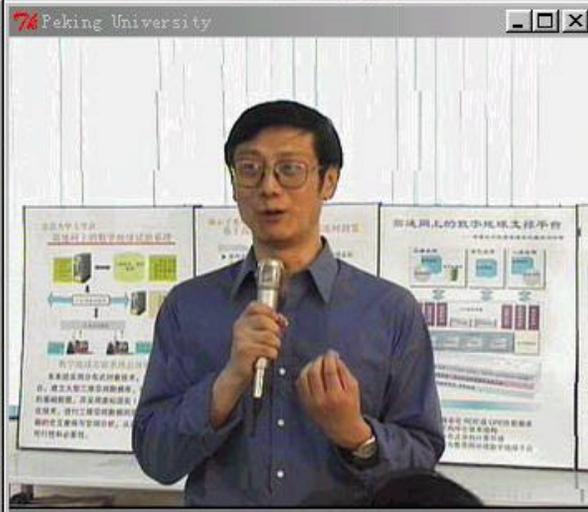


- New Sensors—Israeli Video Pill
  - Battery, Light, & Video Camera
  - Images Stored on Hip Mounted Device
- Next Step—Putting You On-Line!
  - Key Metabolic and Physical Variables
  - Wireless Internet Transmission
- Post-Genomic Individualized Medicine
  - Combine Your Genetic Code & Imaging, with Your Body's Data Flow
  - Use Powerful Data Mining Techniques

# Collaborative Virtual Environments

---

- Shared Virtual Reality
  - Synthetic Worlds with Real People
- Access Grids
  - Augmented Real Spaces with Groups of Real People
- Moos and Muds
  - Text Based Worlds with Real and Synthetic People
- Collaborative Games
  - Synthetic Worlds with Real and Synthetic People that Fight Back!



224.8.8.1/8000

	NSFCnet root@210.2 25 f/s 19 kt <input type="checkbox"/> 静止 <input type="checkbox"/> 窗		北京航空航 friend@210. 25 f/s 53 kb <input type="checkbox"/> 静止 <input type="checkbox"/> 窗		北京航空航 friend@210. 25 f/s 19 kt <input checked="" type="checkbox"/> 静止 <input type="checkbox"/> 窗		北京航空航 friend@210.25 25 f/s 128 kb/s <input checked="" type="checkbox"/> 静止 <input type="checkbox"/> 窗
	清华大学 Harry@210. 25 f/s .2 kt <input checked="" type="checkbox"/> 静止 <input type="checkbox"/> 窗		Peking Unive chenbin@21 23 f/s 7 Mb <input checked="" type="checkbox"/> 静止 <input type="checkbox"/> 窗				

VIC v2.8nlsde-2.1.0      菜单   帮助   退出

解码器... 大小... 模式... 关闭	解码器... 大小... 模式... 关闭

# New Communities

---

- Advanced Collaboration Technology is Working
  - Phenomenal growth of the Access Grid is but one example
  - Grids are starting to capture the corporate imagination [e.g. Microsoft and IBM]
  - End User companies are investing [e.g. Boeing, Ford, Johnson & Johnson, Motorola]
- New Communities are Discovering ACE Technologies
  - SciDAC Collaboratory Pilots [Some represented here]
  - NASA's Distributed Astrobiology Institute
  - Medical Research and Clinical Communities
  - Education, Outreach, Training Communities

# Applications Drivers [circa 2001]

- Today: data intensive science communities

- High energy physics
- Astronomy
- Earth science



- Emerging: human intensive science communities

- Engineering
- Biology
- Nanoscience
- Exploration



# Example New Application Domains

---

- Distributed Paleontology labs
- Real-time Collaborative Medical Consultations
- Financial Markets and Trading Floors
- Software Development Sweatshops
- Collaborative Visual Data Mining and Decision Support
- Distributed real-time crisis management
- Collaborative Genome Annotation Festivals

# Potential New AG Communities

---

- Computational Molecular/Cell biology
- Computational Nanotechnology
- Search for Extraterrestrial Intelligence/LITU
- Biological Field Stations
- Oceanography and Terrestrial Ecology Research Groups
- Scientific Computing Infrastructure Development
- Remote Visualization Research Testbeds
- Student Support Groups

# Global Grid Forum Working Group

---

- The Grid Forum was formed in 1999 to provide a common ground for Grid Development Worldwide
- Grid Forum has established a Working Group to focus on coordination of future ACE tools, APIs and Protocols
  - Foster development of common specifications, Interfaces and reference implementations of Grid-Based Collaboration Tools
  - Provide input to other Grid Forum working groups on requirements to support the AccessGrid
- For more Information on this see:
  - Jason Leigh
  - Mike Papka
  - Deb Agarwal

