Information Technology and the Future of the University

The Age of Knowledge

Educated people and ideas →

Prosperity

Security

Social well-being

Educated people are the most valuable resource for 21st societies and their institutions!!!

A Social Transformation

The 20th Century	The 21st Century
Transportation	Communications
Cars, planes, trains	Computers, networks
Energy, materials	Knowledge, bits
Prosperity, security	Prosperity, security
Social structures	Social structures

Forces of Change

A Changing World

Age of Knowledge

Demographic Change

Globalization

Post-Cold War World

Spaceship Earth

Forces on the University

Economics

Societal Needs

Technology

Markets

Brave New World?

Society of Learning?

Some quotes...

"Thirty years from now the big university campuses will be relics. Universities won't survive. It is as large a change as when we first got the printed book."

– *Peter Drucker*

"If you believe that an institution that has survived for a millennium cannot disappear in just a few decades, just ask yourself what has happened to the family farm."

– *William Wulf*

"I wonder at times if we are not like the dinosaurs, looking up at the sky at the approaching comet and wondering whether it has an implication for our future."

– *Frank Rhodes*

NAS/NAE/IOM/NRC Study

The Impact of Information Technology on the Future of the Research University

Information Technology and the Future of the Research University

Premise: Rapidly evolving information technology poses great challenges and opportunities to higher education in general and the research university in particular. Yet many of the key issues do not yet seem to be on the radar scope of either university leaders or federal research agencies.

Objectives

- To identify those information technologies likely to evolve in the near term (a decade or less) that could ultimately have major impact on the research university.
- To examine the possible implications of these technologies for the research university: its activities (teaching, research, service, outreach); its organization, management, and financing; and the impact on the broader higher education enterprise.
- To determine what role, if any, there was for the federal government and other stakeholders in the development of policies, programs, and investments to protect the valuable role and contributions of the research university during this period of change.

ITFRU Panel

- James Duderstadt (Chair), President Emeritus, Univesity of Michigan
- Daniel Atkins, Professor of Information and Computer Science, University of Michigan
- John Seely Brown, Chief Scientist, Xerox PARC
- Marye Anne Fox, Chancellor, North Carolina State University
- Ralph Gomory, President, Alfred P. Sloan Foundation
- Nils Hasselmo, President, Association of American Universities
- Paul Horn, Senior Vice President for Research, IBM
- Shirley Ann Jackson, President, Rensselaer Polytechnic Institute
- Frank Rhodes, President Emeritus, Cornell University
- Marshall Smith, Professor of Education, Stanford; Program Officer, Hewlett Foundation
- Lee Sproull, Professor of Business Administration, NYU
- Doug Van Houweling, President and CEO, UCAIC/Internet2
- Robert Weisbuch, President, Woodrow Wilson National Fellowship Foundation
- William Wulf, President, National Academy of Engineering
- Joe B. Wyatt, Chancellor Emeritus, Vanderbilt University
- Raymond E. Fornes (Study staff), Professor of Physics, North Carolina State University

Phase 1

- Meetings of study panel
- Site visits (Bell Labs, IBM Research Labs)
- National workshop at NAS (100 leaders from industry, higher education, foundations, government)
  - Available on the Research Channel
  - http://www.research.channel.com/programs/na/itfru.html

Phase 1: Conclusions

- There was a consensus that **the extraordinary evolutionary pace of information technology is likely to continue for the next several decades** and even could accelerate on a superexponential slope. Photonic technology is evolving at twice the rate of silicon chip technology (e.g., Moore's Law), with miniaturization and wireless technology advancing even faster, implying that the rate of growth of network appliances will be incredible. For planning purposes, we can assume that within the decade we will have infinite computer power, infinite bandwidth, and ubiquitous connectivity (at least compared to current capabilities).
- The event horizons for disruptive change are moving ever closer. There are **likely to be major technology surprises**, comparable in significance to the appearance of the personal computer in the 1970s and the Internet browser in 1994, but at more frequent intervals. The future is becoming less certain.

A Detour:
The Evolution of Computers

Mainframes (Big Iron)
…IBM, CDC, Amdahl
…Proprietary software
…FORTRAN, COBOL
…Batch, time-sharing

Minicomputers
…DEC, Data Gen, HP
…PDP, Vax
…C, Unix

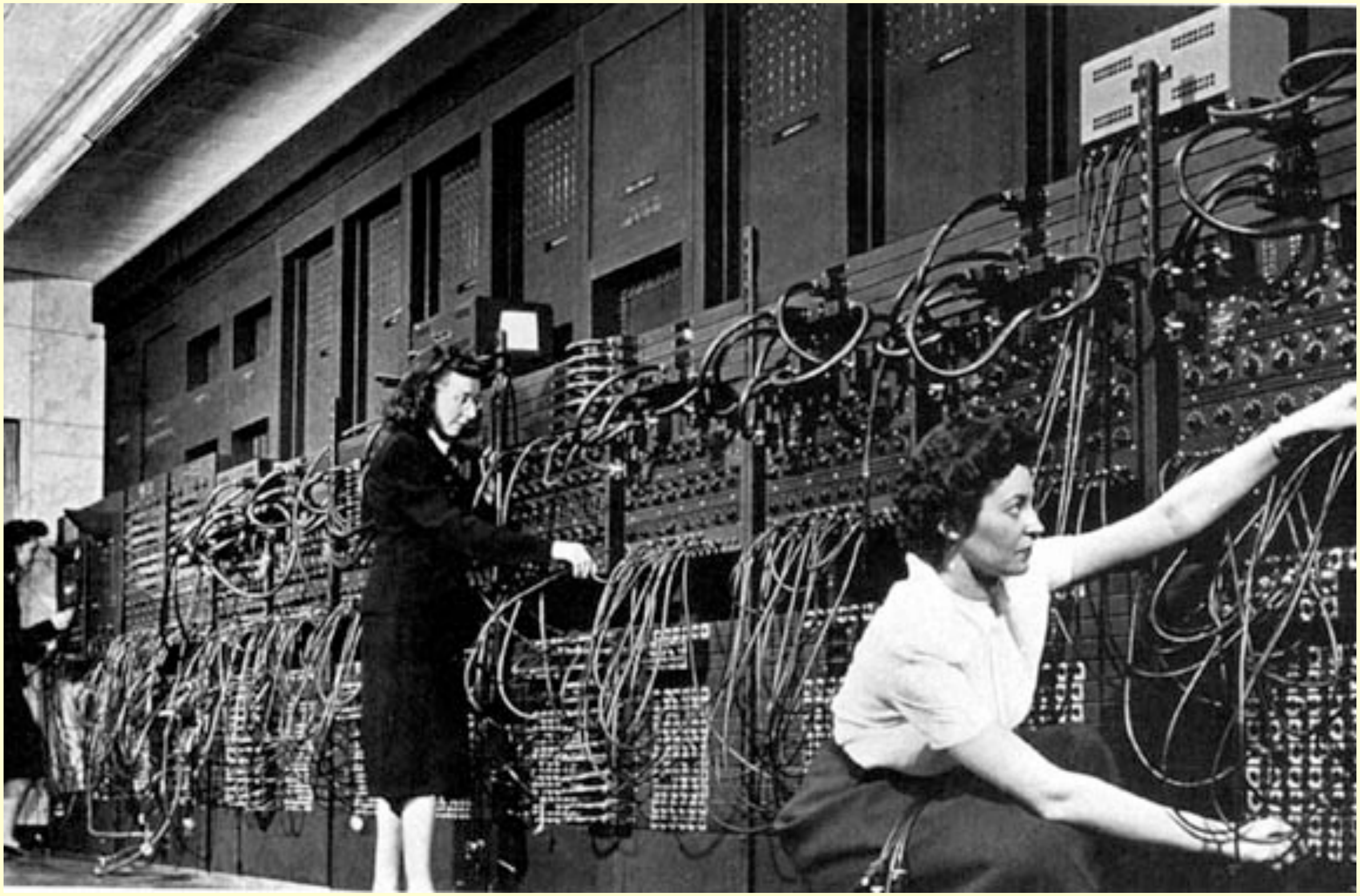
Microcomputers
…Hand calculators
…TRS, Apple, IBM
…Hobby kits -> PCs

Supercomputers
…Vector processors
…Cray, IBM, Fujitsu
…Parallel processors
…Massively parallel

Networking
…LANs, Ethernet
…Client-server systems
…Arpanet, NSFnet, Internet

Batch → Time-sharing → Personal → Collaborative

From Eniac

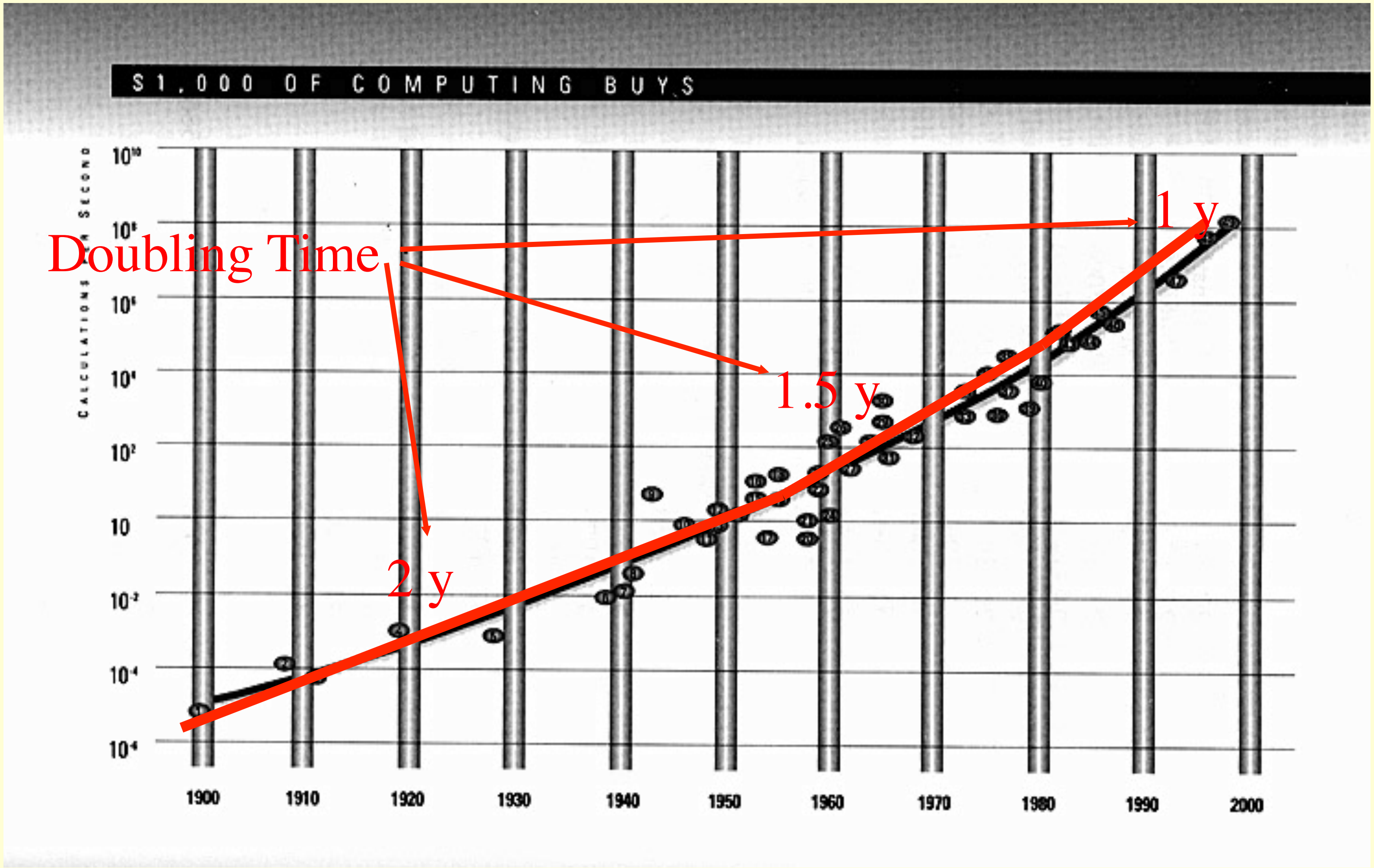


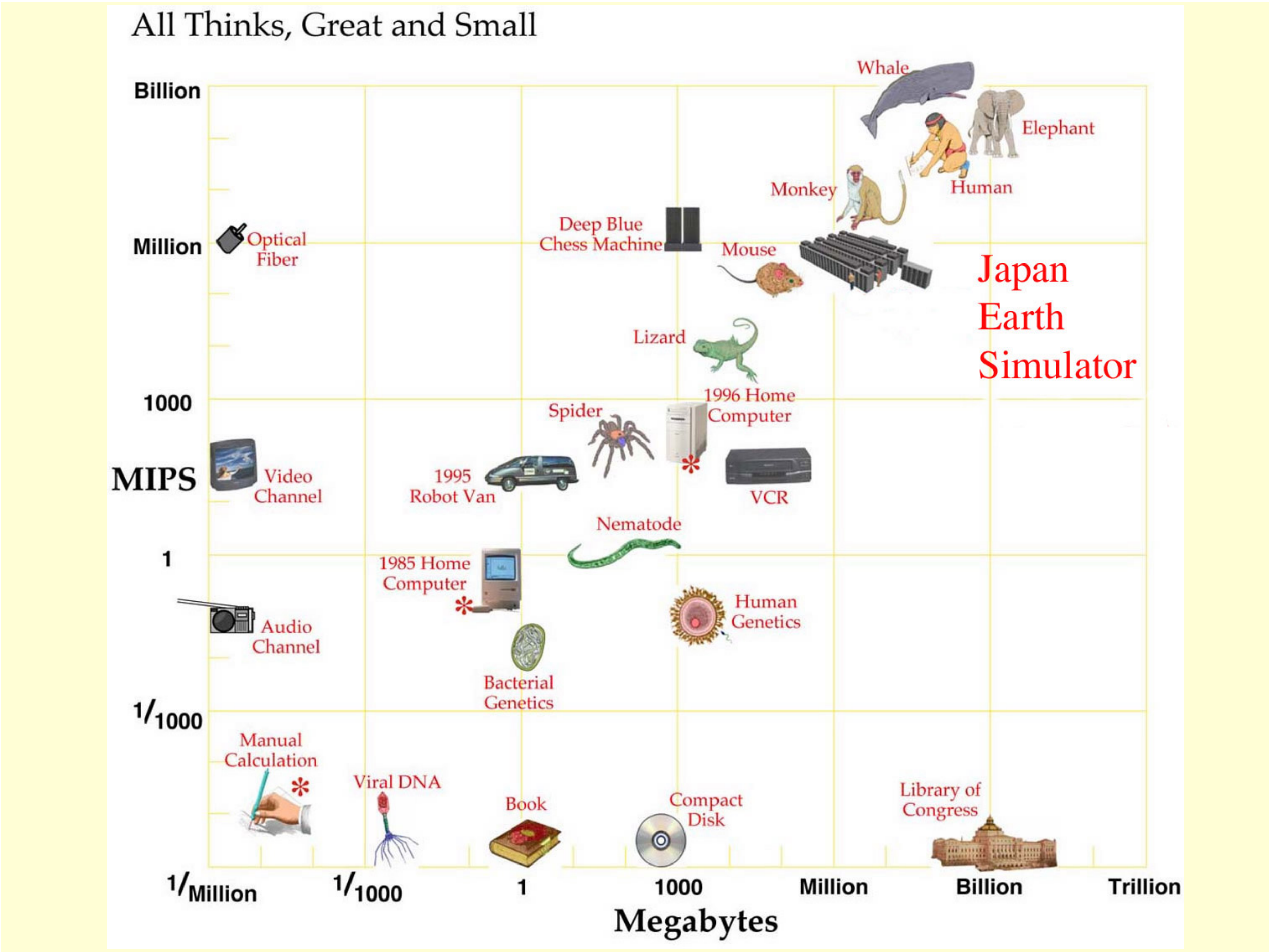
To ASCI "Q" … and beyond


Japan Earth Simulator


PN-07-12/13
PN-08-08/09
PN-09-14/15

The Evolution of Computing




All Thinks, Great and Small
Billion
Million
1000
1
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MIPS
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Trillion
Megabytes
Whale
Elephant
Human
Monkey
Deep Blue Chess Machine
Mouse
Optical Fiber
Japan Earth Simulator
Lizard
1996 Home Computer
Spider
Video Channel
1995 Robot Van
VCR
Nematode
1985 Home Computer
Human Genetics
Audio Channel
Bacterial Genetics
Manual Calculation
Viral DNA
Book
Compact Disk
Library of Congress

ASCI Purple RFP

Privacy & Legal Notice

The Purple RFP was issued on February 22, 2002

RFP RESPONSES ARE DUE 4:00 P.M. PDT APRIL 29, 2002

ASCI Purple (2004):

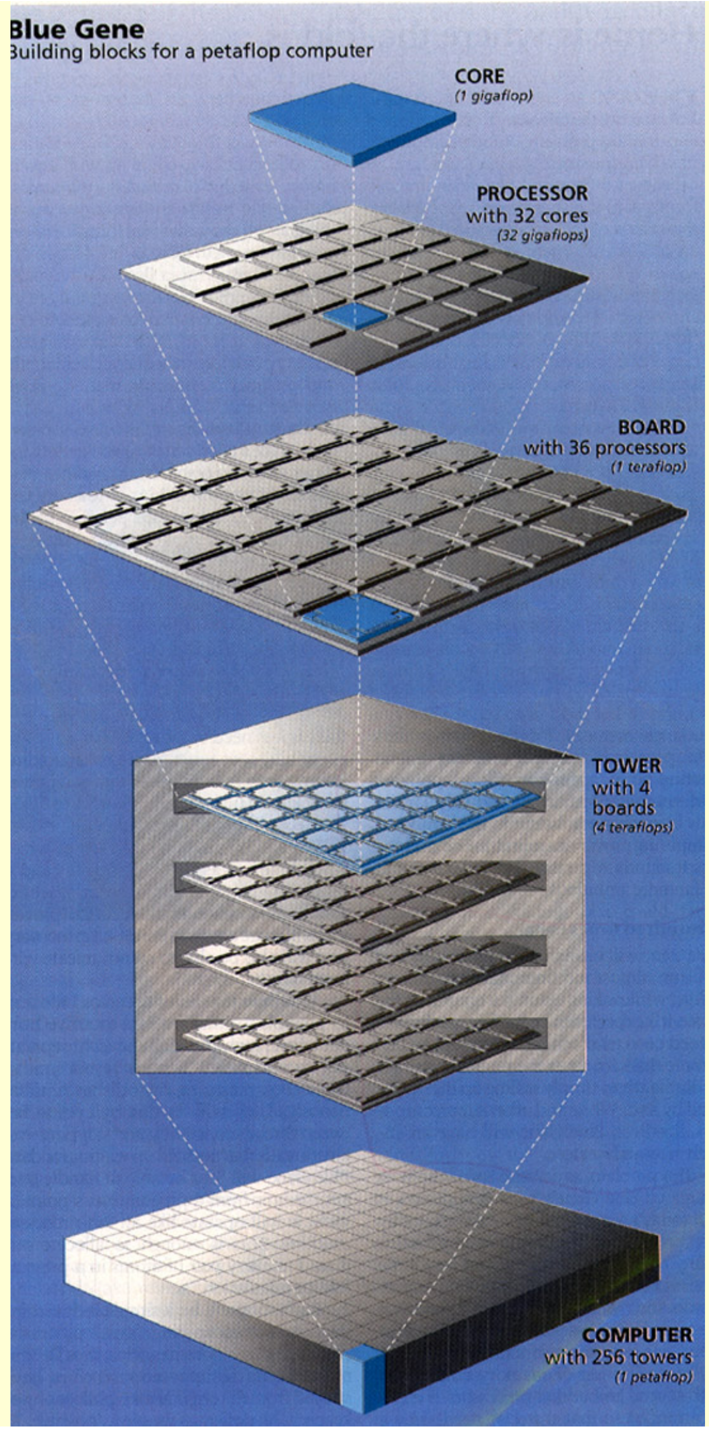
100 TeraFlops

IBM Blue Gene L (2004):

360 TeraFlops

IBM Blue Gene P (2006):

"Several" PetaFlops




No Stopping Parking Loading Or Unloading Along Curve Or Roadway
P.D.Q.
53'

Some Extrapolation of the PC

	2000	2010	2020
Speed	10^9	10^{12}	10^{15}
RAM	10^8	10^{11}	10^{14}
Disk	10^9	10^{12}	10^{15}
LAN	10^8	10^{12}	10^{15}
Wireless	10^6	10^9	10^{12}

Hardware Technology Trends

- Processing (Moore's Law) (increasing 40% per year)
  - Current speed record: 150 GHz chips
- Disk storage (increasing 60% to 100% per year)
  - 3.5 disk can hold 320 Gb
  - Far cheaper than paper or microfilm
- Bandwidth
  - Lab demo on single fiber: 11 Tb/s
  - Real communication at 40 Gb/s
- Mobility
  - 802.11 (a, b, g, I) at 55 Mb/s and beyond
- Displays
  - Full wall projections
  - Resolution must better than paper

Software and System Trends

- Algorithm improvements
- Embodiment of techniques and processes into software
  - Formalization and standardization
  - People are the exception rather than the main line
- Distribution of computing, data, applications, and services
- Grid interconnection of resources
- Services as unit of IT, rather than bare-bones data and processing

Some Examples

- **Speed**
  - MHz to GHz to THz to Peta Hz
- **Memory**
  - MB (RAM) to GB (CD,DVD) to TB (holographic)
- **Bandwidth**
  - Kb/s (modem) to Mb/s (Ethernet) to Gb/s
  - Internet2 (Project Abilene): 10 Gb/s
- **Networks**
  - Copper to fiber to wireless to photonics
  - “Fiber to the forehead…”

Computer-Mediated Human Interaction

- **1-D (words)**
  - Text, e-mail, chatrooms, telephony
- **2-D (images)**
  - Graphics, video, WWW, multimedia
- **3-D (environments)**
  - Virtual reality, distributed virtual environments
  - Immersive simulations, avatars
  - Virtual communities and organizations
- **And beyond… (experiences, “sim-stim”)**
  - Telepresence
  - Neural implants

Evolution of the Net

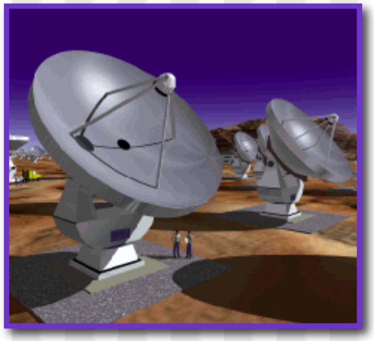
- Already beyond human comprehension
- Incorporates ideas and mediates interactions among millions of people
- 400 million today; more than 1 billion in 2005
- Internet II, Project Abilene
- Semantic Web, Executable Internet, Web Services, Cyberinfrastructure

Cyberinfrastructure

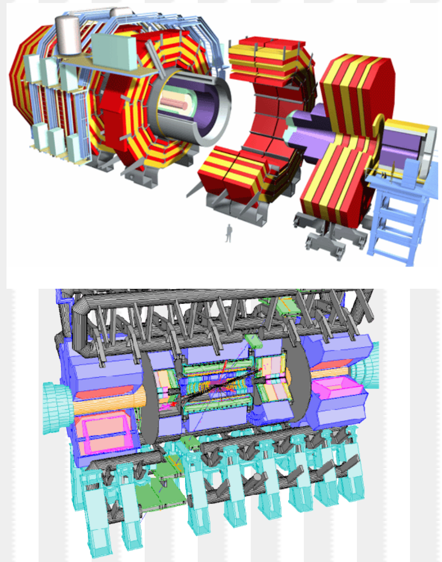
(Cyber) infrastructure

- The term *infrastructure* has been used since the 1920's to refer collectively to the roads, bridges, rail lines, and similar public works that are required for an industrial economy to function.
- The recent term *cyberinfrastructure* refers to an infrastructure based upon computer, information and communication technology (increasingly) required for discovery, dissemination, and preservation of knowledge.
- Traditional infrastructure is required for an industrial economy. Cyberinfrastructure is required for an information economy.

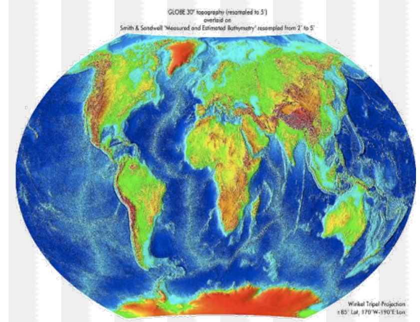
Cyberinfrastructure Enabled Science



NVO and ALMA



ATLAS and CMS



Climate Change

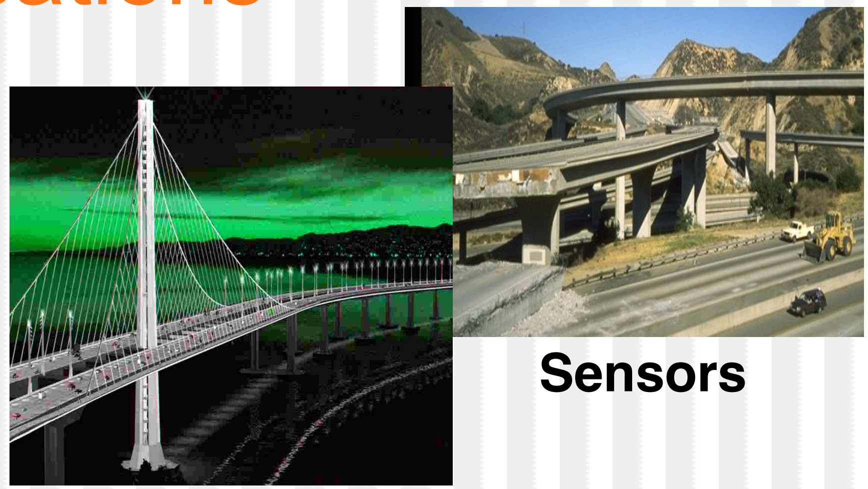
United States virtual observatory

LIGO

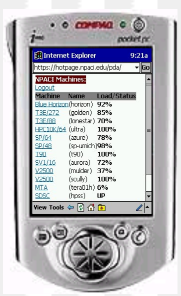
The number of nation-scale projects is growing rapidly!

More Diversity, New Devices, New Applications

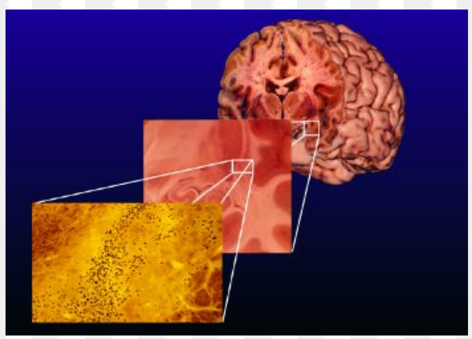
Personalized Medicine



Sensors



Wireless networks

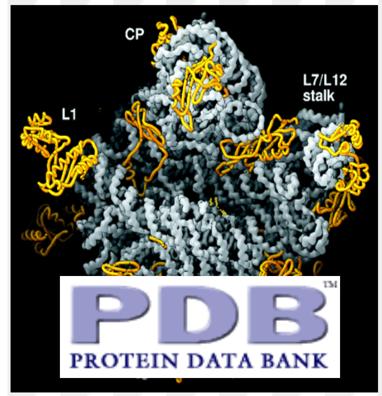


Knowledge from Data

Instruments

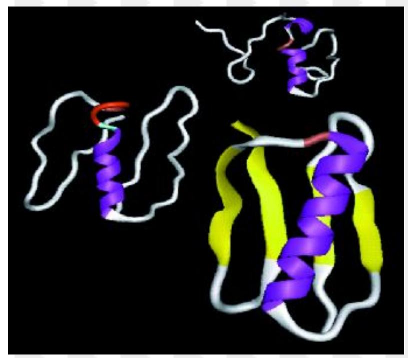
Cyberinfrastructure is a First-Class Tool for Science

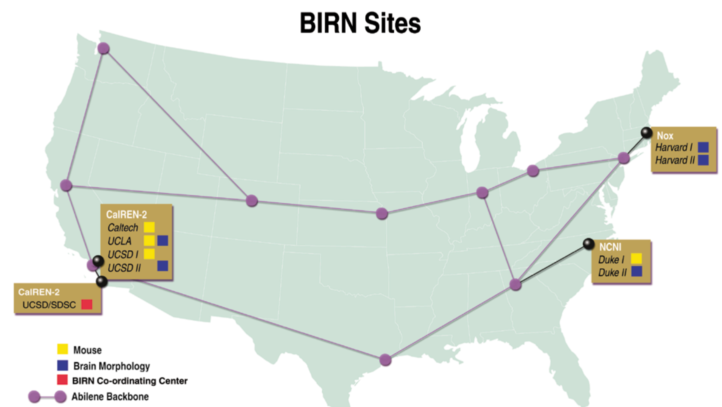
NSF
NEESgrid

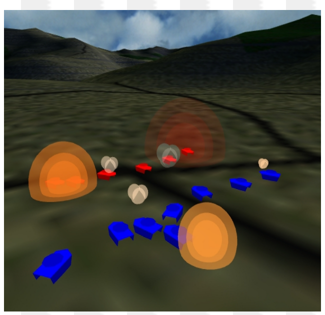


GriPhyN
Data Intensive Science

iVDgL

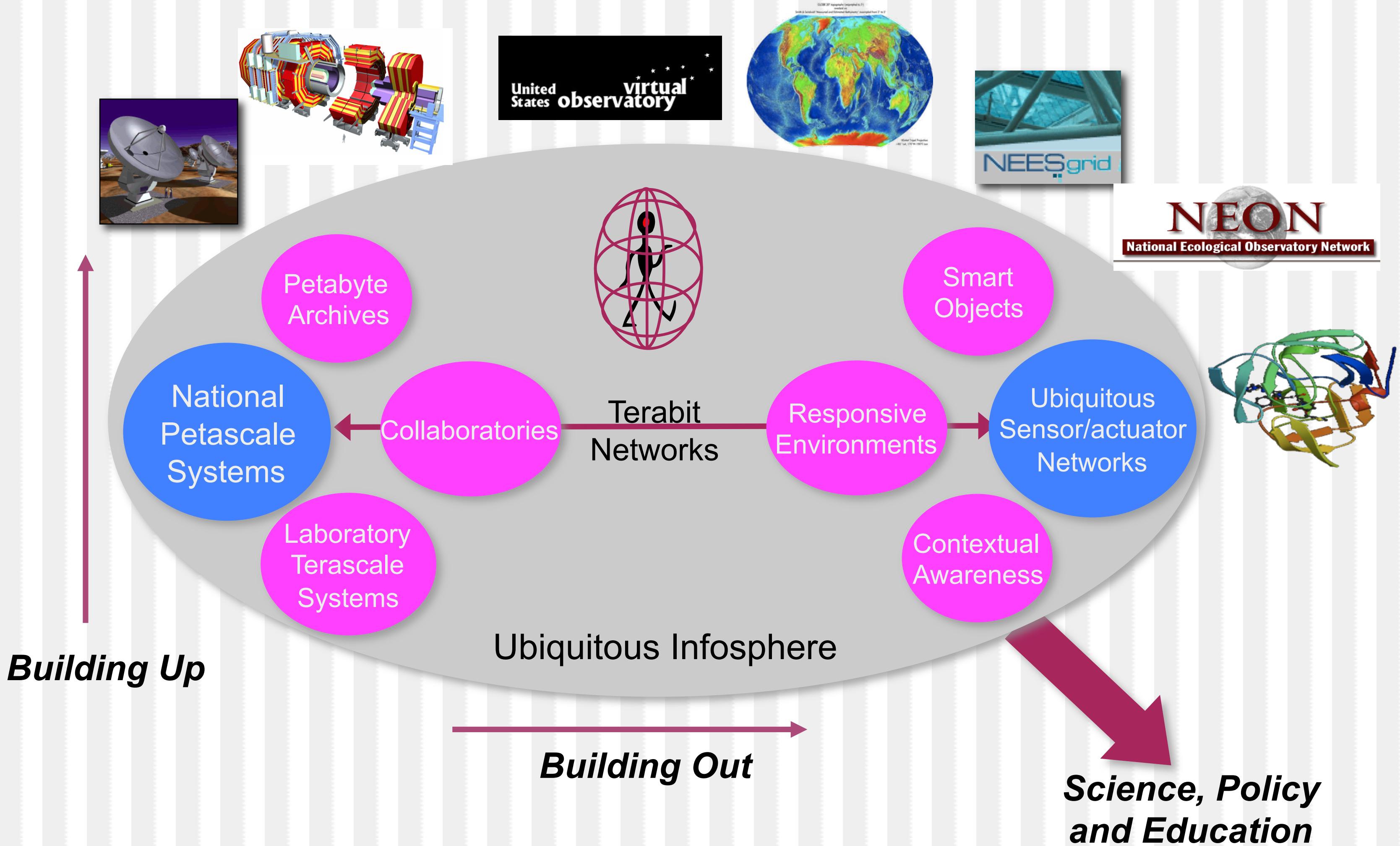






United States virtual observatory

Futures: The Computing Continuum



Two leading U.S. initiatives

- Next Generation Abilene
  - Advanced Internet **backbone**
    - connects entire campus networks of the research universities
  - 10 Gbps nationally
- TeraGrid
  - **Virtual machine room** for distributed computing (Grid)
  - Connecting 4 HPC centers initially
    - Illinois: NCSA, Argonne
    - California: SDSC, Caltech
  - 4x10 Gbps: Chicago ↔ Los Angeles
- Ongoing collaboration between both projects

Chef
CompreHensive collaborativE Framework

About Internet2®

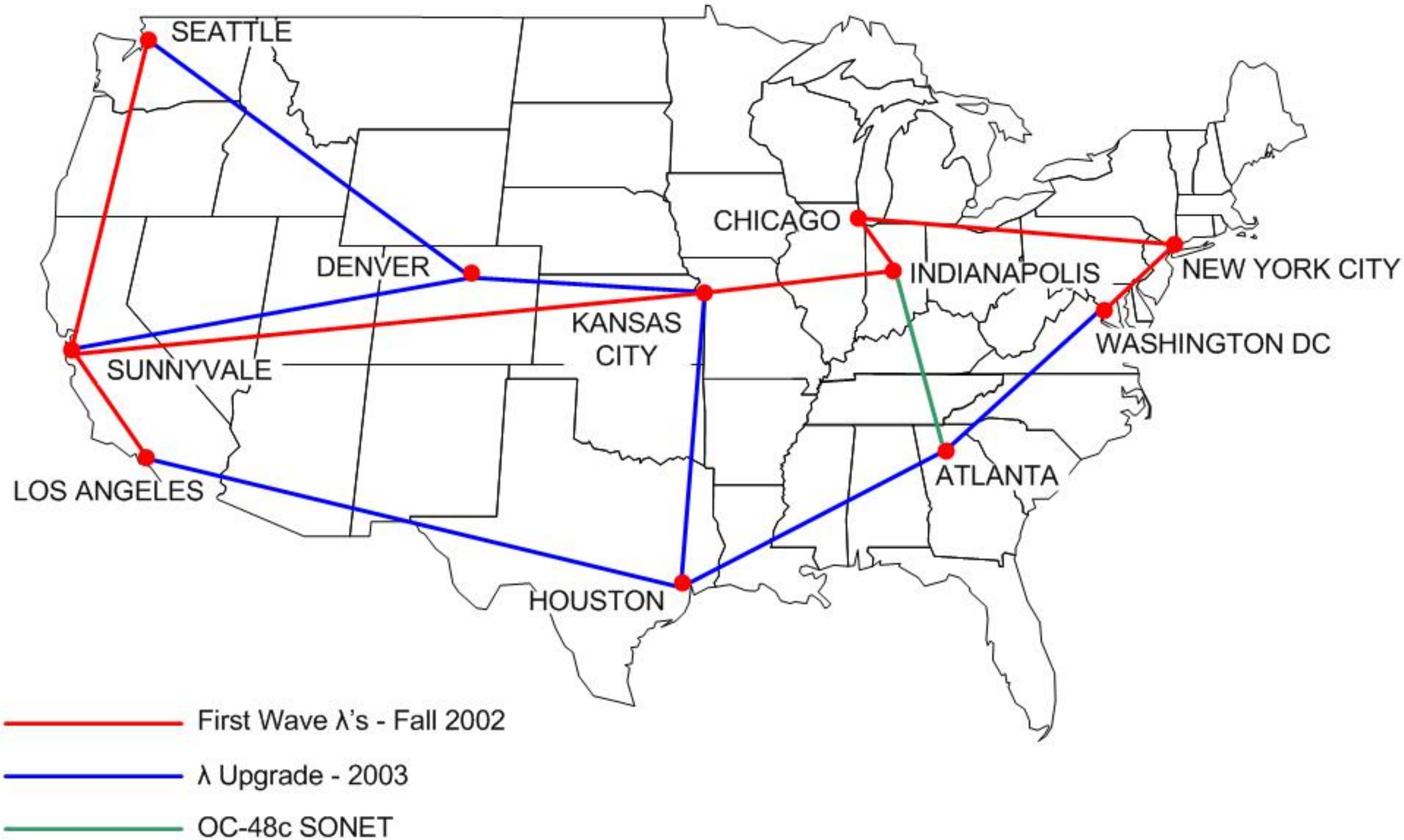
Internet2 is a consortium being led by over 200 universities working in partnership with industry and government to develop and deploy advanced network applications and technologies, accelerating the creation of tomorrow's Internet. Internet2 is recreating the partnership among academia, industry and government that fostered today´s Internet in its infancy. The primary goals of Internet2 are to:

- Create a leading edge network capability for the national research community
- Enable revolutionary Internet applications
- Ensure the rapid transfer of new network services and applications to the broader Internet community.

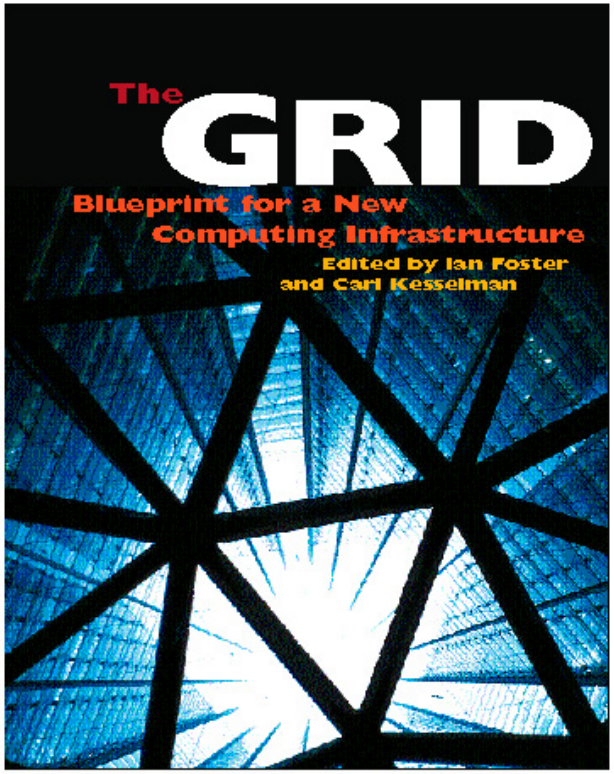
Through Internet2 Working Groups and initiatives, Internet2 members are collaborating on:

- Advanced Applications
- Middleware
- New Networking Capabilities
- Advanced Network Infrastructure
- Partnerships and alliances
- Initiatives

ABILENE NETWORK 10-Gbps OPTICAL UPGRADE - 2002-2003

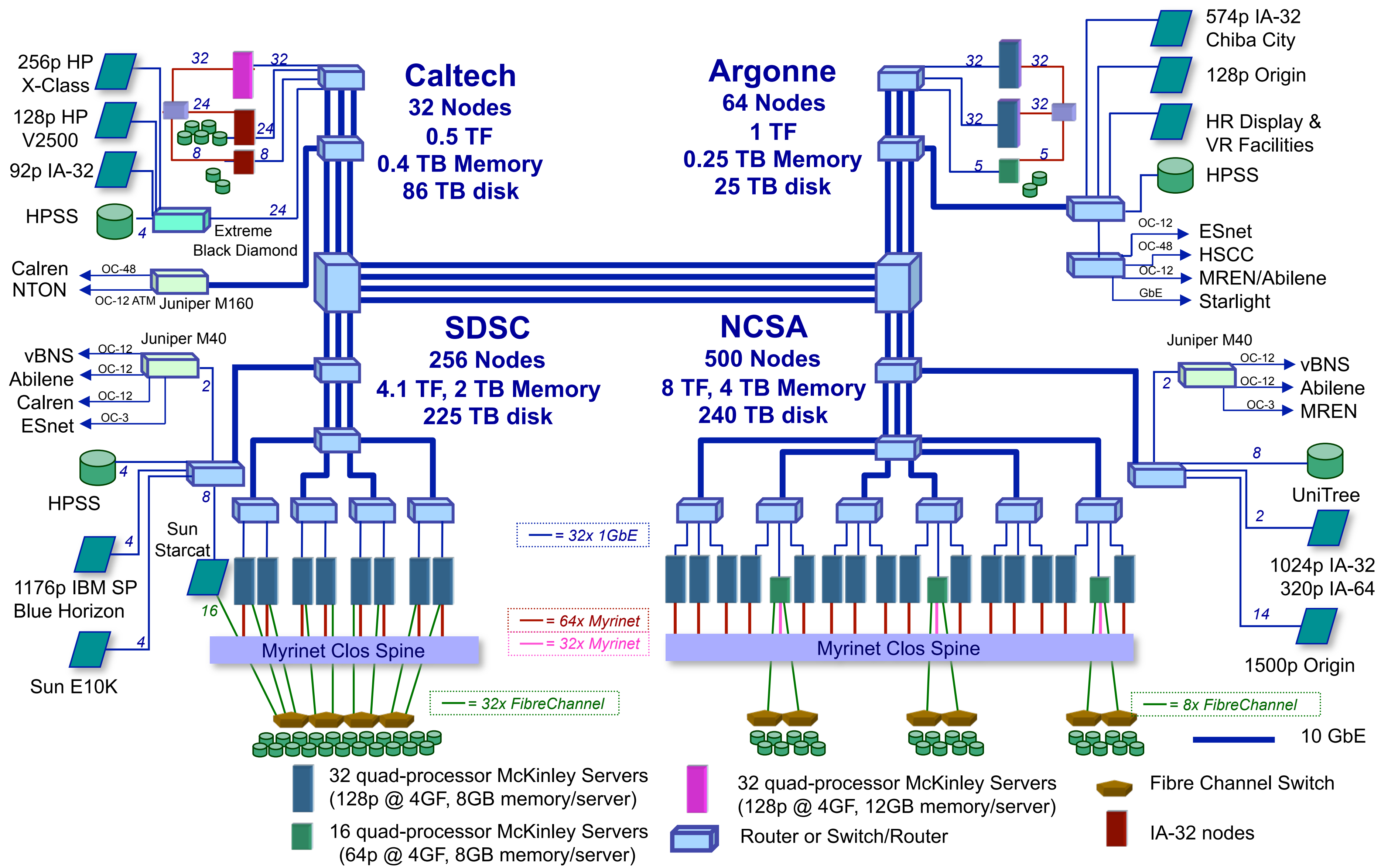


The Grid

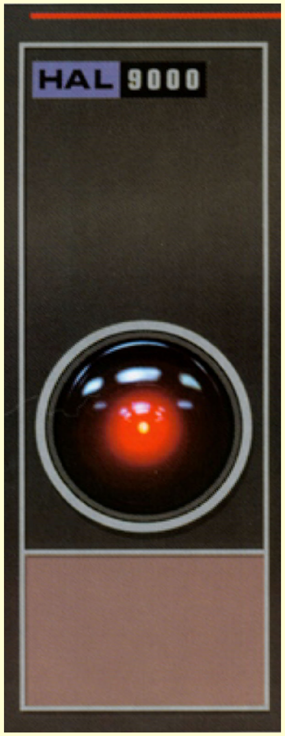


Ian Foster and Carl Kesselman, editors, "The Grid: Blueprint for a New Computing Infrastructure," Morgan Kaufmann, 1999, http://www.mkp.com/grids

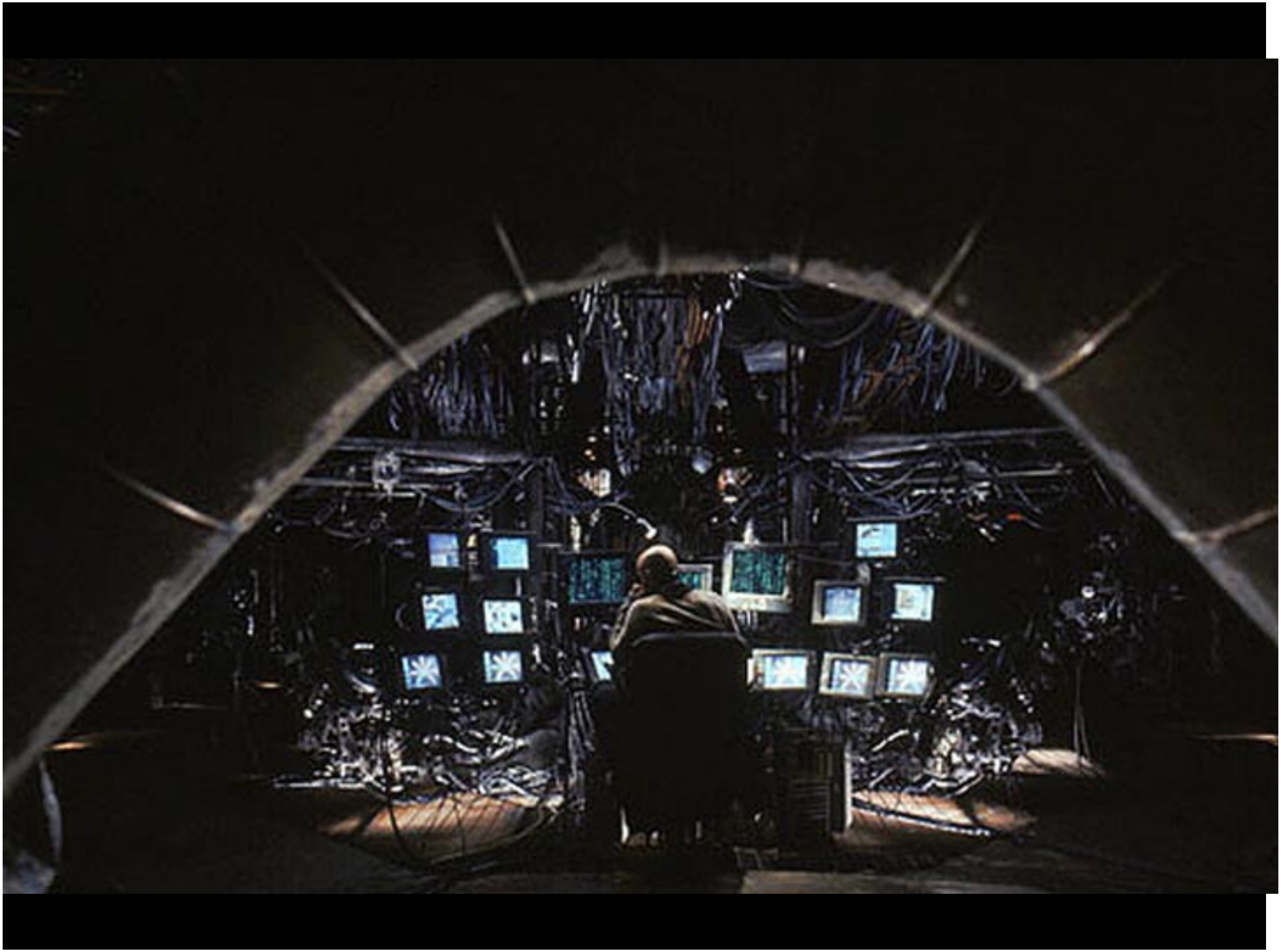
TeraGrid Architecture – 13.6 TF



Some Other Possibilities



- **Ubiquitous computing?**
  - Computers disappear (just as electricity)
  - Calm technology, bodynets
- **Agents and avatars?**
  - Fusing together physical space and cyberspace
  - Plugging the nervous system into the Net
- **Emergent behavior?**
  - … Self organization
  - … Learning capacity
  - … Consciousness (HAL 9000)



Conclusions (continued)

- The **impact of information technology on the university will likely be profound, rapid, and discontinuous**–just as it has been and will continue to be for the economy, our society, and our social institutions (e.g., corporations, governments, and learning institutions). It will affect our activities (teaching, research, outreach), our organization (academic structure, faculty culture, financing and management), and the broader higher education enterprise as it evolves into a global knowledge and learning industry.

IT and the University

Missions: teaching, research, service?

Alternative: Creating, preserving, integrating, transferring, and applying knowledge.

The University: A "knowledge server", providing knowledge services in whatever form is needed by society.

Note: The fundamental knowledge roles of the university have not changed over time, but their realizations certainly have.

Research

- Simulating reality
- Collaboratories: the virtual laboratory
- Changing nature of research
  - Disciplinary to interdisciplinary
  - Individual to team
  - “Small think” to “big think”
- Analysis to creativity
  - Tools: materials, lifeforms, intelligences
  - Law, business, medicine to art, architecture, engineering

Libraries

- Books to bytes (atoms to bits)
- Acquiring knowledge to navigating knowledge
- What is a book?
  - A portal to the knowledge of the world.

Teaching to Learning

- Pedagogy
  - Lecture hall to environment for interactive, collaborative learning
  - Faculty to designer, coach
- Classroom
  - Handicraft to commodity
  - Learning communities
  - Virtual, distributed environments
- Open learning
  - Teacher-centered to learner-centered
- Passive Student to Active Learner to Demanding Consumer
  - Unleashing the power of the marketplace

The Media Union

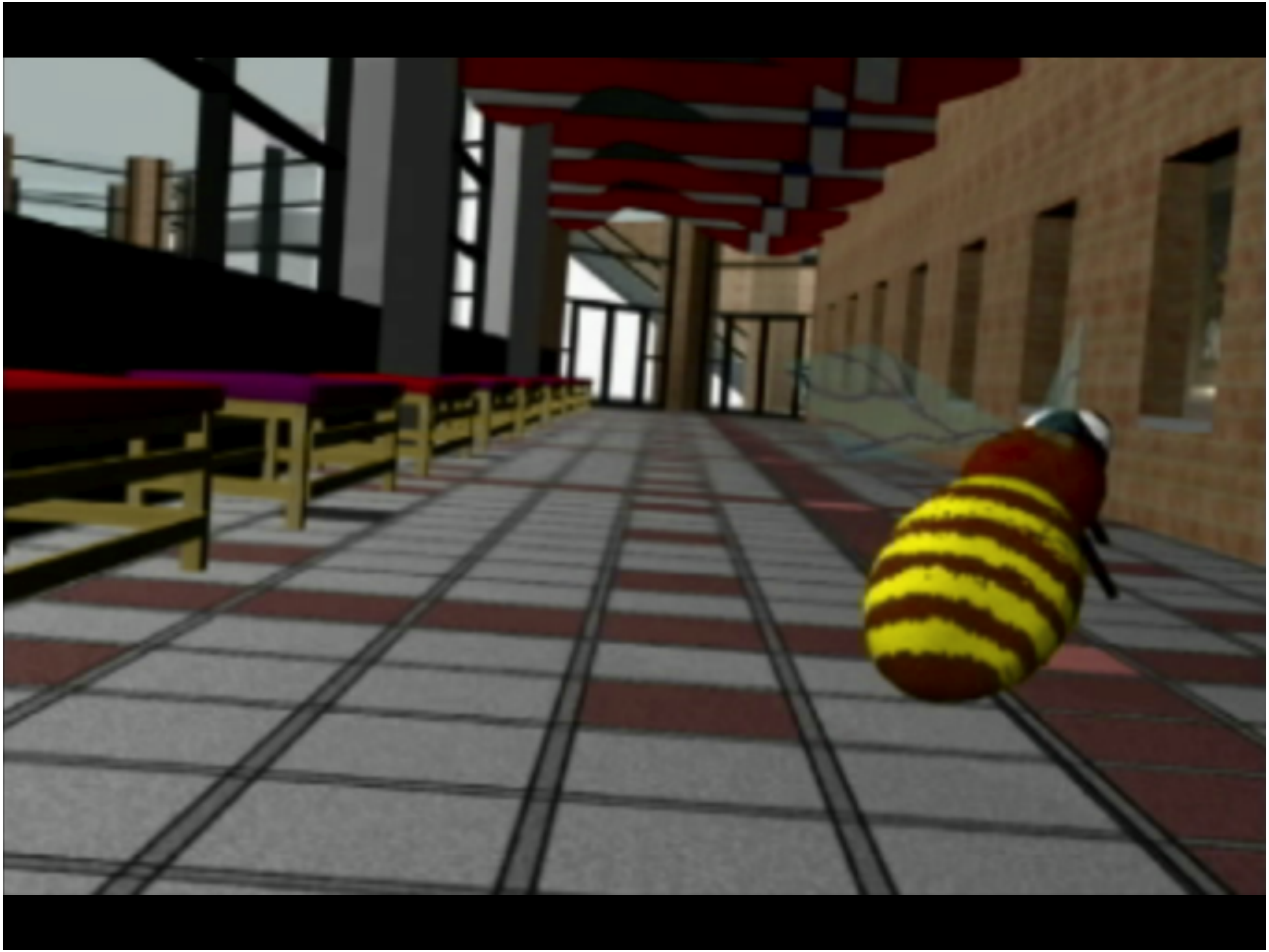

PATENTS AND
TRADEMARKS
INDEXES AND
ABSTRACTS
WASTE


GROUP SPACE


helen c. lee
mfa thesis exhibition
facet


coffee
pastries
soups
snacks
Mujo


2




James and Anne
Duderstadt Center


THE
DUDE
Celebrating 100 Years
RESERVES


DUDE


The Midnight
Engineering Society
Welcomes You To:
THE
DUDE

The Old Paradigm

- Linear, sequential college curriculum
- Based on lectures to passive students
- Students discouraged from interacting with one another (particularly on exams …)
- Student learning activities include reading, writing, and taking exams

The Plug and Play Generation

- Raised in a media-rich environment
  - Sesame Street, Nintendo, MTV,
  - Home computers, WWW, MOOs, virtual reality
- Learn through participation and experimentation
- Learn through collaboration and interaction
- Nonlinear thinking, parallel processing

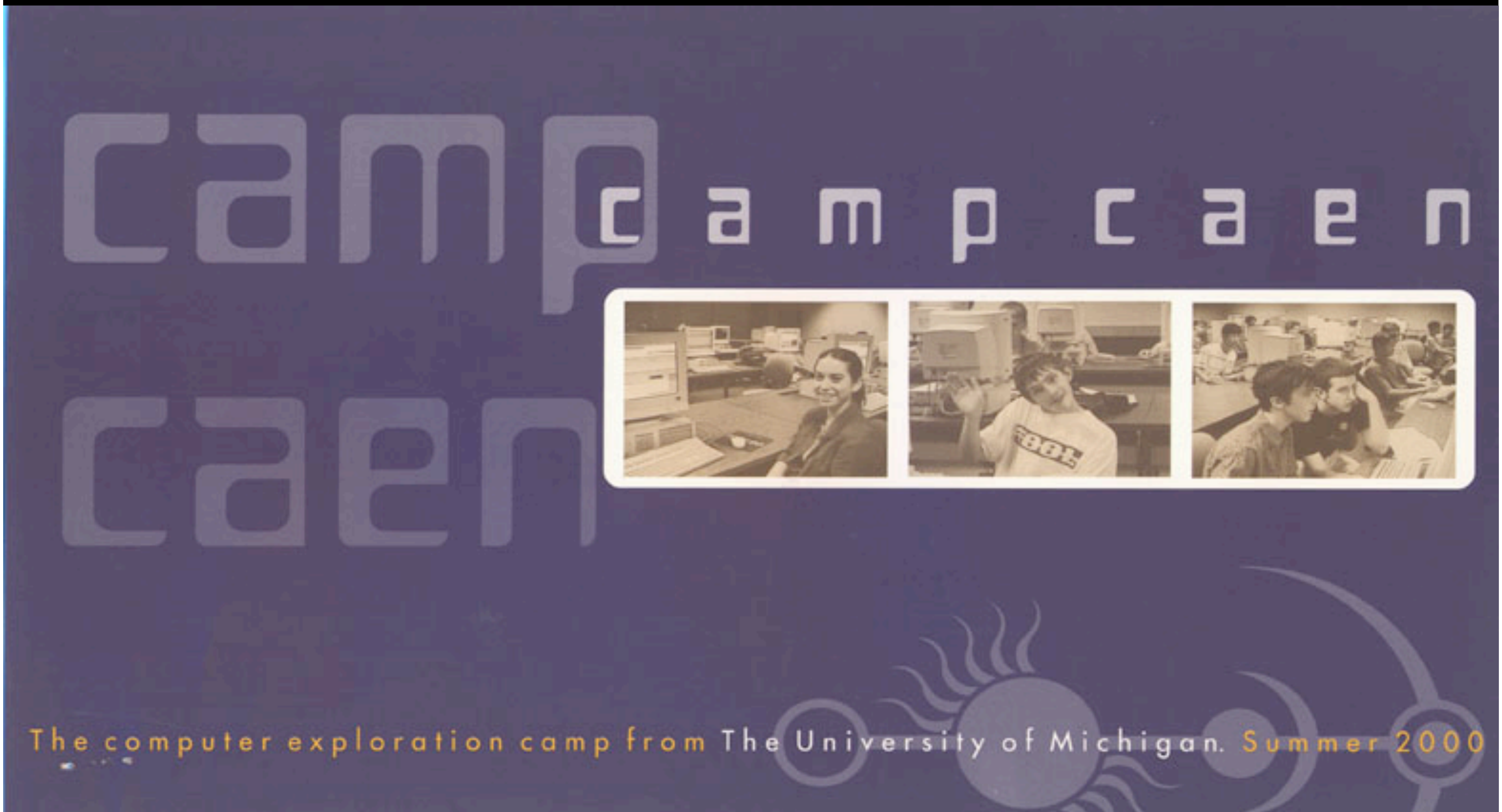
Some Learning Characteristics of the Digital Generation*

- Multiprocessing
- Multimedia literacy
- Knowledge navigators
- Discovery-based learning that merges with play
- Bricolage
- A bias toward action

*John Seely Brown, Xerox PARC

The New Students

- Active learners, building their own knowledge structures and learning through action and collaboration
- Use nonlinear learning (“hyperlearning”)
- Develop peer groups of learning and build sophisticated learning environments
- Faculty will be challenged to shift from development and presentation of content to designing learning environments and mentoring (coaching) active learners


camp caen
camp caen
The computer exploration camp from The University of Michigan. Summer 2000


WASTE
JBS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SIGN-IN Sheet
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Thank you!


SUPER SPORTS


SIGN-IN
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Lifelong Learning

- Students increasingly accept that in an era in which knowledge in most fields doubles every few years, lifetime learning will be necessary for survival.
- Today's graduates expect to change not simply jobs but careers many times during their lives. At each stage further learning will be necessary.
- A shift from "just in case" to "just in time" to "just for you" learning.

IT-Mediated Distance Learning

The Sloan Foundation has invested over $30 million in the development of Asynchronous Learning Networks. Their conclusions from over 100,000 sponsored course units in thousands of courses:

I) **This stuff works.** You can reproduce the classroom over the Internet with no apparent loss of educational quality (as measured by test scores, etc.).

2) **It is not expensive** to convert a course into ALN format (about $10,000 per course), if the aim is interactive rather than automated teaching.

The key: Don't automate the classroom, but break it free from the constraints of space and time!

The Digital Divide

Concern: The "digital divide" between those who have access to information and those who do not.

Another View: The real divide is not access to technology but rather between those who have access to educational opportunity and those who do not because of economic means, family responsibilities, or job constraints.

As access to IT appliances becomes more ubiquitous (e.g., PDAs) and IT breaks learning free from constraints of space and time, technology may actually narrow the stratification in our society by opening up access to education.

Conclusions (continued)

- Yet, **for at least the near term**, meaning a decade or less, **the university will continue to exist in much its present form**, although meeting the challenge of emerging competitors in the marketplace will demand significant changes in how we teach, how we conduct scholarship, and how our institutions are financed. Universities must anticipate these forces, develop appropriate strategies, and make adequate investments if they are to prosper during this period.
- **Over the longer term, the basic character and structure of the university may be challenged** by the IT-driven forces of aggregation (e.g., new alliances, restructuring of the academic marketplace into a global learning and knowledge industry) and disaggregation (e.g., restructuring of the academic disciplines, detachment of faculty and students from particular universities, decoupling of research and education).

Implications for Colleges and Universities

Activities: teaching, research, outreach

Organization and structure: disciplinary structure, faculty roles, financing, leadership

Enterprise: markets, competitors, role in evolving national research enterprise, globalization

Some Examples

- The digital generation will demand interactive, collaborative, nonlinear learning experiences.
- Faculty members will be challenged to become designers of learning experiences, motivators of active learning.
- We are experiencing a transition to open learning environments in which strong market forces will challenge the traditional university monopolies.

Conclusions (continued)

- Although information technology will present many complex challenges and opportunities to university leaders, we suggest that **procrastination and inaction are the most dangerous courses of all during a time of rapid technological change**. Just as it has in earlier times, the university will have to transform itself once again to serve a radically changing world if it is to sustain these important values and roles.
- Although we feel confident that information technology will continue its rapid evolution for the foreseeable future, it is far more **difficult to predict the impact of this technology on human behavior and upon social institutions** such as the university. It is important that higher education develop mechanisms to sense the changes that are being driven by information technology and to understand where these forces may drive the university.

Conclusions (continued)

- Because of the profound yet unpredictable impact of this technology, it is important that institutional strategies include: 1) the opportunity for **experimentation**, 2) the formation of **alliances** both with other academic institutions as well as with for-profit and government organizations, and 3) the development of sufficient **in-house expertise** among the faculty and staff to track technological trends and assess various courses of action.

Phase Two:
The IT Forum

2003 Activities

- IT Forum - Washington (2/22/03)
- AAU Presidents Summit (4/15/03)
- AAU Provosts Workshop (9/9/03)
- IT Forum - Carnegie Mellon (9/5/03)
- NSF Leadership “Tutorial” (10/29/03)
- IT Forum- Institute for Creativity Technologies (3/11/04)
- Executive Leadership Core Workshops

AAU Presidents' Summit

- First, the 2x4 (Lou Gerstner)
- Panel 1: Today's Issues
  - ("And, oh, by the way, all under control …)
- Discussion 2: Tomorrow's Challenges
  - ("But have you thought about …)
- Discussion 3: Where do you need help?

Looking at the In-Out Box

- How do we meet the demand for IT?
- How do we pay for it?
- What about security and privacy issues?
- (We just delegate these issues to our CIOs to handle, and they tell assure us that everything is under control …)

But what happens if …?

- Someone hands you a device the size of a football containing the entire Library of Congress ...?
- Your faculty members become nomads in cyberspace with the rapid evolution of "cyberinfrastructure" as a functionally complete environment for scholarship and scholarly communities …?
- What if students use IT to take control of their learning environments?

And what about …?

- The “technological” generation gap among students and faculty
- The disruptive force of the marketplace brought onto the campus by IT
- The disaggregation (disintegration) and reaggregation of functions and roles

Wait a second …?

- How can presidents possibly provide leadership with the future so uncertain?
- We need help!!!
- At last some progress: From denial to acceptance to seeking help …

Next, the AAU provosts

- What bothers you today?
- What do you see coming down the road?
- What are you going to do about it?
- How can we help?

The Near Term

- Network and bandwidth management
- How do we pay for this technology?
- How do we protect security and privacy?
- Data management and preservation issues

The Longer Term

- The digital generation
- Cyberinfrastructure
- Competition vs. cooperation
- Instability of university paradigm
- Survival of research university
  - (At least as we know it today)
  - (A subject that NO university president would allow on the table!!!)

Cooperation vs Competition

- Concern: Being victimized by monopolies: PeopleSoft, Blackboard, Oracle, Microsoft
- Urgent Need: To form university alliances to develop open-source technologies to support instruction, research, and administrative needs

An interesting comparison: 1865-1900

- From colonial colleges to Humboltian universities
- Empowerment of faculty
- Emergence of public land-grant universities
- Early massification of higher education

Every that could change, in fact, did change!

Is the 2000 - 2035 period similar?

How does learning occur?

- Faculty believe they know … but in reality, they haven’t a clue (they are of the “pre-digital” generation).
- Need sophisticated understanding of learning and cognition in technology-rich environments


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Faculty Visitors
Researchers
General Visitors
Corporate Visitors
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Current Students
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Academic Depts.
Administrative Depts.
West Coast Campus
Qatar Campus
Libraries
Job Postings
Calendar
News
Carnegie Mellon
Keynote Speaker
L'Oréal Executive and Carnegie Mellon alumna and trustee Candace Sheffield Matthews will be the featured speaker at commencement, May 16.
More...
Honorary Doctorates
C.D. Mote Jr., William D. Ruckelshaus and Richard A. Tapia (l-r) will receive honorary degrees for their contributions in science, technology and public policy.
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Commencement 2004

IT Forum - Carnegie Mellon

- Today’s students are “electrified”; they are a transformative force.
- Example: instant messaging, WiKi’s, Blog’s, always on-always connected
- Peer-to-peer learning
- Faculty has concluded that best approach is to turn the kids loose, letting them define their own learning environments.

The New Literacy

- Not just from verbal to multimedia, but from “read only, listening, viewing” to composition in all media
- From analysis to synthesis: creativity!!!
- Dewey to Piaget to Papert: constructionist learning
- “I hear and I forget; I see and I remember; I do and I understand; I teach and I master!!!”

Perhaps it is time…

- To integrate the educational missions of the university with its research and service roles …
- To rip instruction out of the classroom (or at least the lecture hall) and place it instead in the discovery environment of the laboratory or studio or the experiential environment of professional practice.

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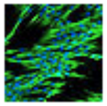
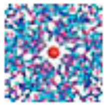
HIGHLIGHTS



University of Colorado Tissue Engineer to Receive NSF's Coveted Waterman Award



United States Still Leads in Science and Engineering, But Uncertainties Complicate Outlook

Oldest Hemoglobin Ancestors Offer Clues to Earliest Oxygen-Based Life

President Bush Honors Excellence in Science, Mathematics and Engineering Mentoring

Specialized Info for: GO

NSF Staff & Organizations: GO

Program Areas

Overview of Programs
Biology
Computer, Information Sciences
Crosscutting
Education
Engineering
Environmental Research & Education
Geosciences
International
Math, Physical Sciences
Polar Research
Social, Behavioral, Economic Sciences

Guide to Programs
Grant Proposal Guide
Grant Policy Manual
GPRA/Strategic Plan

NSF Leadership Tutorial

- NSF’s role in technology and learning?
- Recognize that NSF is MOST of the action in education research (80% or greater)
- BUT, NSF programs tend to be overly constrained by tradition, by practice, and by Congress.
- Not known for innovative or significant work, at least in this area.

Urgency of the Moment

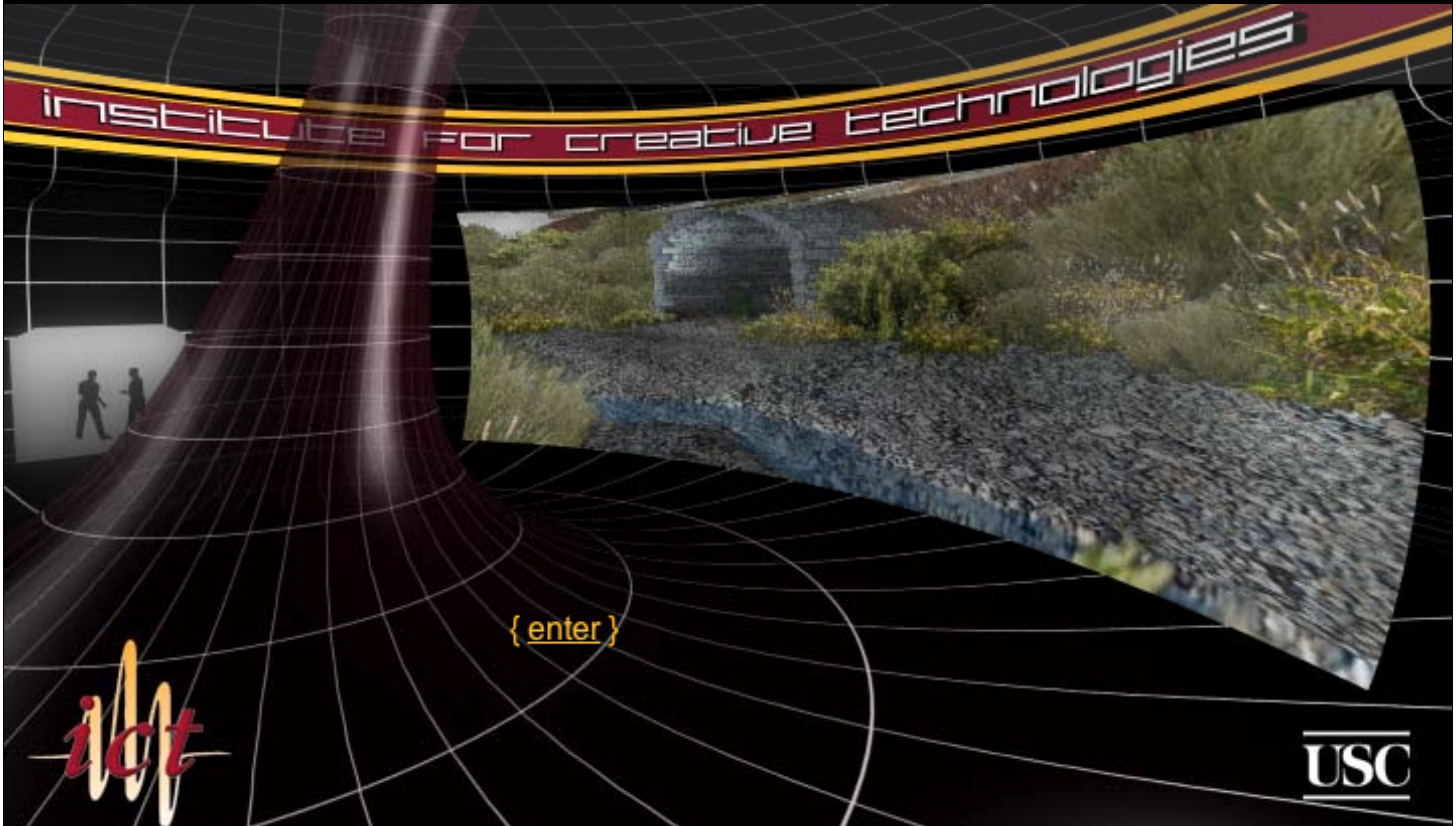
- Not just the disruptive impact of exponentially evolving technology on world
- But pending turnover in nation’s K-12 teacher cadre (over next 5-7 years)
- Impact of 9-11 and Iraq on STEM pipeline of foreign nationals
- Human resource implications of a global, knowledge-driven economy

What to do?

- First, need to observe and understand what is actually happening (with individuals and institutions)
- Importance of assessment
- NSF needs to be far more activist, searching for tipping points
- Linkages with scientific community
- A possible DARPA-like model???

Most important …

- NSF needs to become an learning organization!!!
- For that matter, so do most universities.
- (Only the University of Phoenix seems to understand this …)


institute for creative technologies
{ enter }
USC

Institute for Creative Techologies

- Goal: Use Hollywood and gaming technologies to build the Army a "holodeck"
- How can technology be used to create an emotional connection between knowledge and learning?
- Can you improve learning and decision making using virtual environments

institute for creative technologies

Advanced Leadership Training Simulation

printer friendly version

USC / Paramount Pictures

The Advanced Leadership Training Simulation project explored the role of storytelling for training teams of US Army soldiers for crisis management and leadership skills.
ALTSIM participants assumed various roles in an US Army tactical operations center, working as a team to address situations that were presented to the team through a web-based interface. ALTSIM presented these situations using media of high production value, including graphical maps, video-based news broadcast feeds, audio-based radio communications from soldiers in the field, and text-based intelligence reports, among others.

The ALTSIM project was a partnership between the Institute for Creative Technologies and Paramount Pictures. The research focus of the ALTSIM project was on the creation of highly interactive storylines for use in training applications. A central problem in the field of interactive drama is to enable a high degree of interactivity in virtual environments while preserving a degree level of narrative control necessary to achieve both pedagogical and entertainment goals. The solution explored in the ALTSIM project, called Experience Management, was to formally represent pre-authored storylines as a description of the expected user experience, and then employ storyline adaptation strategies to move the experience back on track in the face of unexpected user behavior.

The ALTSIM project ended in March of 2003, and led to the start of the ongoing "Leaders" project at ICT.

Research reports:

Gordon, Andrew S. and Iuppa, Nicholas V. (2003) Experience Management Using Storyline Adaptation Strategies. Proceedings of the First International Conference on Technologies for Digital Storytelling and Entertainment, Darmstadt, Germany, March 24-26, 2003 institute for creative technologies

FlatWorld: The Mixed Reality Simulation Space

printer friendly version

The FlatWorld project is a mixed reality simulation environment merging cinematic stagecraft techniques with immersive media technology. FlatWorld is a joint effort between the University of Southern California's Institute for Creative Technologies (ICT) and Integrated Media Systems Center (IMSC).

Current virtual environments have severe limitations that have restricted their use. For example, users are often required to wear bulky head mounted displays that restrict a person's freedom to physically move as they would in the real world. Furthermore, a person cannot touch or feel objects in the virtual world.

This project addresses these issues by developing an approach to virtual reality simulation which allows individuals to walk and run freely among simulated rooms, buildings, and streets.

Click here for the Flatworld Photo Gallery

In film and theatrical productions, sets are constructed as modular components called "flats". Using flats, set designers produce physical, tangible structures that convey a sense of place or activity. FlatWorld utilizes a "digital flat" system. A digital flat is effectively a large screen display. A single digital flat has the ability to appear as an interior room wall or an exterior building face. When physical props are used in conjunction with digital flats, doors and windows can be simulated Users can touch and open these portals to view an exterior virtual world. Because of their modular characteristics, several digital flats can be rapidly assembled in any open space to simulate multiple situations in a variety of geographic locations. The immersive experience is heightened through the use of immersive audio, tracked stereoscopic graphics, and "4D" sensory effects such as blowing wind and vibrating floors. This approach of using physical props within a virtual environment can create a "mixed reality" world where the physical and the virtual seamlessly coexist.

Observation 1

- Hollywood (and gaming industry) have figured out how to engage large numbers of people with quite primitive technologies.
- Everquest: hundreds of thousands of participants, many living their lives now in “virtual worlds” (work as well as play)

Observation 2

- Students are beginning to form communities capable of learning on their own.
- These communities involve teams and challenge the one faculty member-one course paradigm.

Observation 3

- CIOs are reaching a consensus on what the IT infrastructure for the university will be for the next 5 years or so.
- Based on open-source standards (I2, SAKAI, Grid, Cyberinfrastucture)
- Will challenge monopolies (Microsoft, PeopleSoft, Blackboard, WebCT)

Obsevation 4

- Good news: This stuff really works!
- Bad news: Our most hypothetical speculations will become real VERY soon.
- Example: Next generation Playstation and X-Box gaming consoles will have more power than faculty have ever seen in their lifetimes.

Phase 2

- **NAS IT Forum Activities (expanded)**
  - Monitoring technology evolution
  - IT Strategy Roadmapping Effort
  - Policy Development
- **National Workshops (2002-2003)**
  - University Presidents and Board Chairs
  - Foundation Presidents and Technology Officers
- **National Workshops (2003-2004)**
  - Presidents, Provosts, Deans, Faculty Governance
  - Impact on education, research, service
- **Regional Workshops (2004-2005)**
- **Campus Workshops (2003-2005)**

Institutional Strategies

Some Assumptions

- Information and communications technology will continue to evolve exponentially (Moore’s Law) for the foreseeable future.
- Ubiquitous, high speed, and economically accessible network capacity will exist nationally and to a great extent globally.
- Affordable, multimedia-capable computers (including network appliances) will be commonplace and most college will expect student ownership of such devices.
- Most colleges will deliver some portion of their instructional missions both on campus and beyond via the Internet.
- Nontraditional sources of university-caliber instruction such as software developers and publishers are likely to become increasingly important suppliers of course content and materials.

Some Recommendations

1. University leaders should recognize that the rapid evolution of information and communications technologies will stimulate–indeed, demand–a process of strategic transformation in their institutions.
2. It is our belief that universities should begin the development of their strategies for technology-driven change with a firm understanding of those key values, missions, and roles that should be protected and preserved during a time of transformation.
3. It is essential to develop an integrated, coordinated strategy for the institution in a systemic and ecological fashion.
4. Universities need to understand the unique features of digital technologies and how these affect people and their activities.

Recommendations (cont)

5. Universities should aim to build layered organizational and management structures, based upon broadly accepted values, strategies, heuristics,a nd protocols at the highest levels, but encouraging diversity, flexibility, and innovation at the level of execution.

6. One should recognize that the investment in technology infrastructure necessary for higher education in the digital age will not only be compatible in expense to physical and human capital, but it will be pervasive and continually evolving throughout the institution.

7. Getting from here to there requires a well-defined set of operational strategies and tactics at institutional transformation.

Some Conclusions

For the Near Term

For the near term, meaning a decade or less, it is likely that most colleges and universities will retain their current form, albeit with some evolution and pedagogical and scholarly activities and in organization and financing.

While change will occur, and while it is likely to be both profound and unpredictable, it will be at least be comprehensible.

For the Longer Term

If the past dictated by Moore's Law continues to characterize the evolution of information technology, over the next several decades we would see the power of this technology (and related technologies such as biotechnology and nanotechnology) increase by factors of one-thousand, one-million, one-billion, and so on, likely reshaping our society and most social institutions into unrecognizable forms.

Another Perspective …

The impact of information technology will be even more radical than the harnessing of steam and electricity in the 19th century. Rather it will be more akin to the discovery of fire by early ancestors, since it will prepare the way for a revolutionary leap into a new age that will profoundly transform human culture.

–Jacques Attali, *Millennium*