Internet2 Health Sciences

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Internet2 Health Sciences Program Manager
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CUDI meeting in Manzanillo, Colima

Agenda

- Brief background on Internet2
- Structure and process of Health Science Initiative
- Bridging the Gap
  - Government, Industry, Academia
  - Health care providers, educators, researchers
- Translational Research Strategies

Internet2

- Mission: develop and deploy advanced network applications and technologies, accelerating the creation of tomorrow's Internet
  - Membership organization of US universities
  - Key partnerships with government and industry
- Goals
  - Enable advanced network applications
  - Ensure leading edge R&E network environment
  - Transfer experiences/capability

Internet2 Universities

206 University Members, March 2004

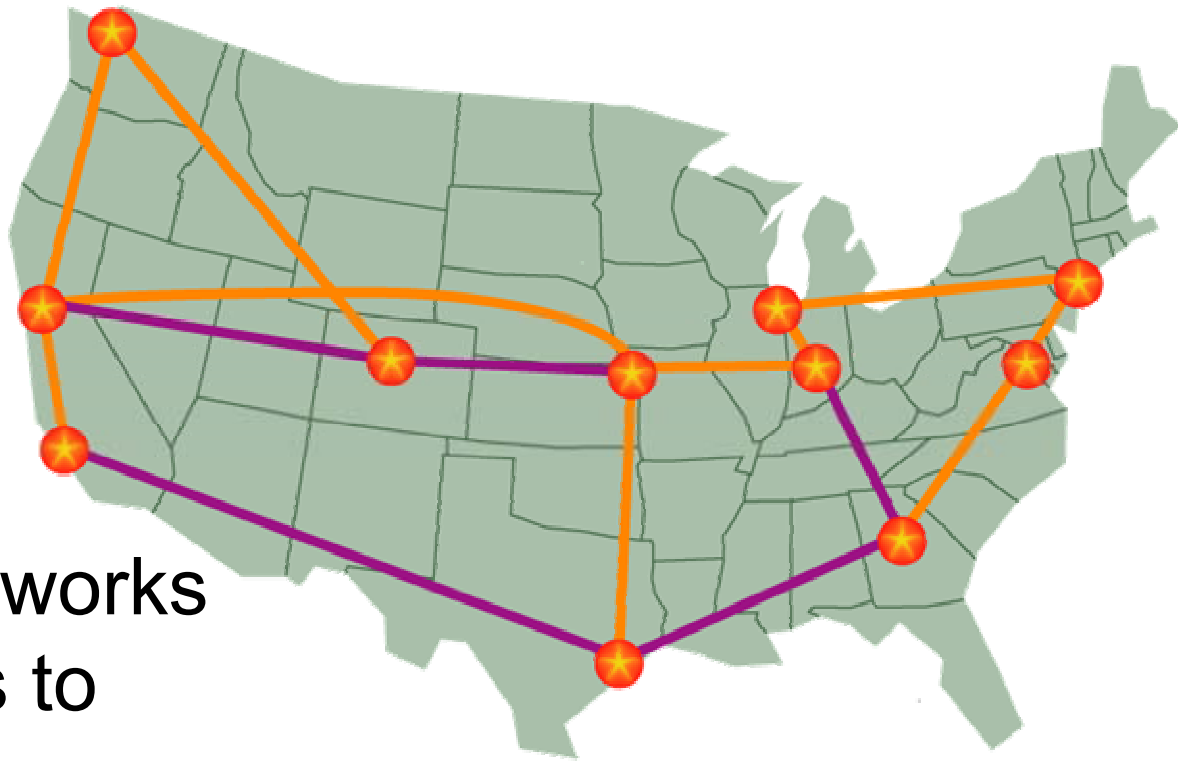
Strategic Foci

- Address the advanced networking needs and interests of the **research & education** community
- Implement a systems approach towards a **scalable advanced networking** infrastructure
- Provide **leadership** in the evolution of the Internet
- Leverage **strategic relationships** among academia, industry and government
- Catalyze activities that **cannot be accomplished by individual** organizations
- Focus on **financially feasible**, affordable, and deployable technologies and solutions

Production Infrastructure: Abilene

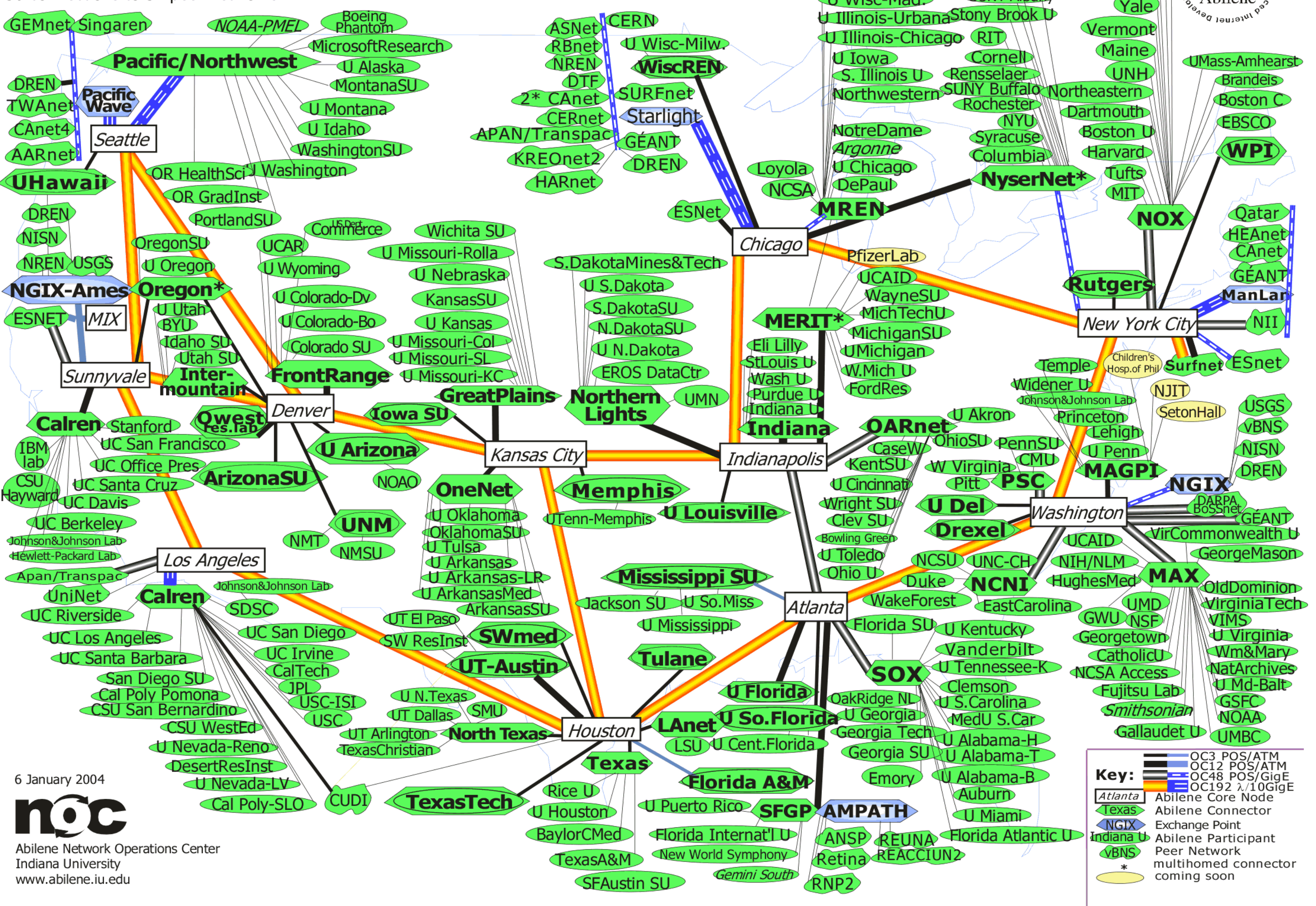
Core Map, March 2004

- Backbone operates at 10 Gbps (OC192)
- 11 core nodes
- 47 GigaPoPs Regional high-performance aggregation sites
- Local campus networks provide 100 Mbps to the desktop

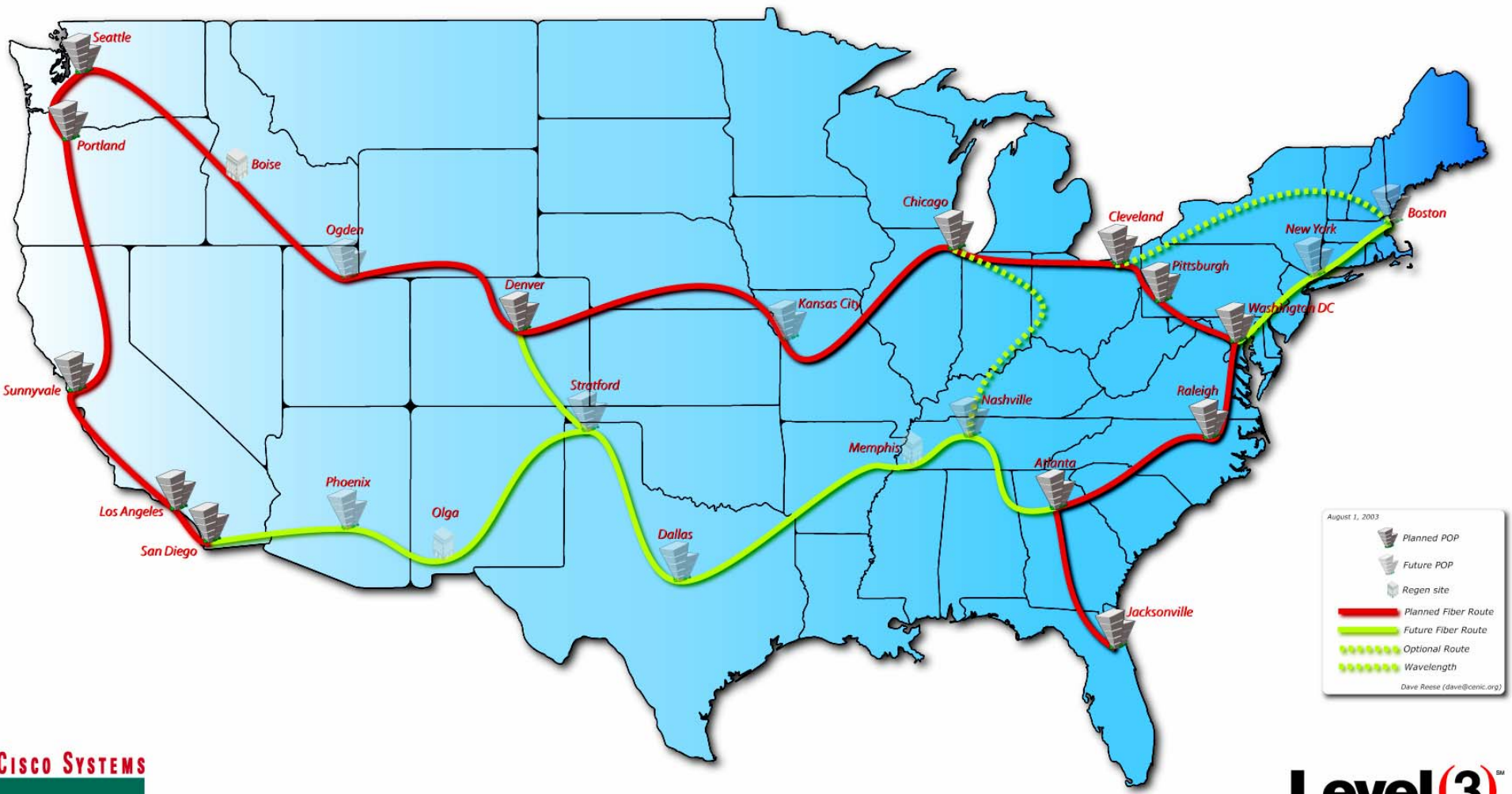


The Abilene Network

completed connections:
238 participants
49 connectors + 2 NGIXs + StarLight, AMPATH, PacificWave, ManLan IXs
50 connections to 32 peer networks



NLR National Fiber Network



Initial Coordinating Participants

Cisco Systems

Level (3) Communications

cenic Corporation for Education Network Initiatives in California

FLR

Georgia Institute of Technology

Internet2

IWIRE

NCAR

Pacific Northwest GigaPop

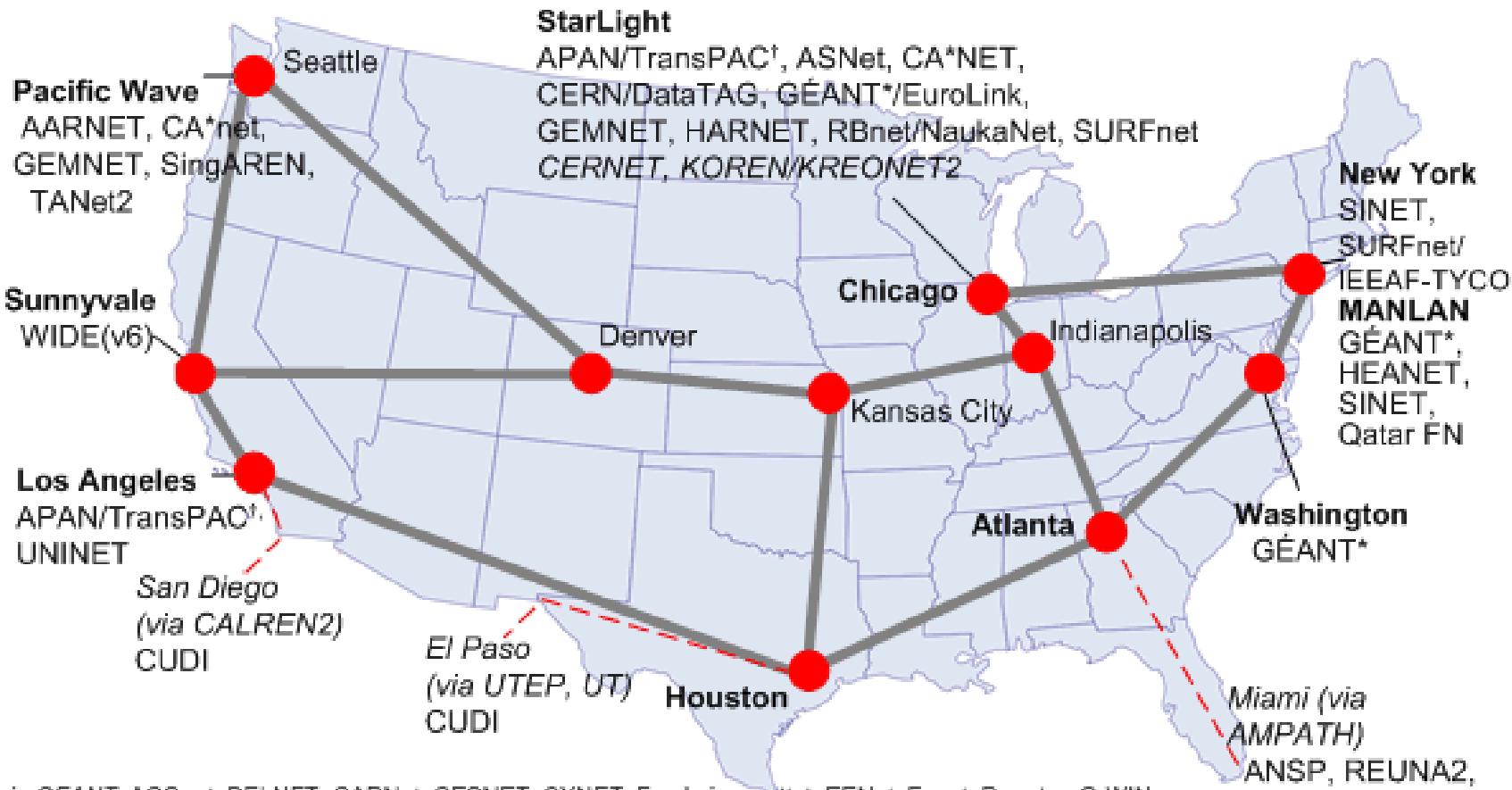
Pittsburgh Supercomputing Center

Texas Consortium

Virginia Tech

Abilene International Peering

Abilene International Network Peers



* *via GÉANT:* ACOnet, BELNET, CARNet, CESNET, CYNET, Forskningsnettet, EENet, Funet, Renater, G-WIN, GRNET, HUNGARNET, Rhnet, HEAnet, IUCC, GARR, LANET, LITNET, RESTENA, Univ. Malta, SURFnet, UNINETT, POL34, RCTS2, RoEduNet, RBnet, SANET, ARNES, RedIRIS, SUNET, SWITCH, JANET, ULAKBYM, CERN

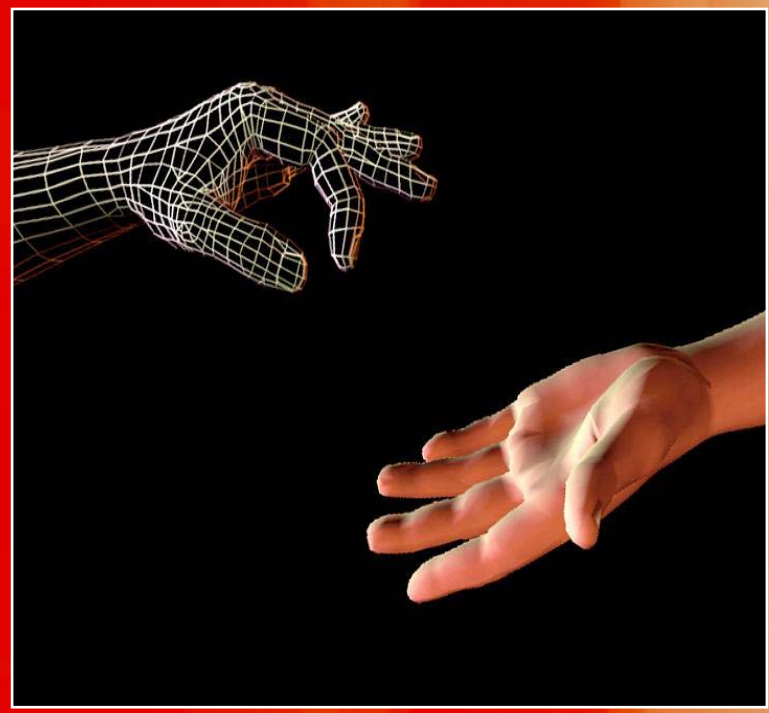
† *via APAN/TransPAC:* WIDE/JGN, IMnet, CERNet/CSTnet/NSFCNET, KOREN/KREONET2, PREGINET, SingAREN, TANET2, ThaiSARN

Americas

- Canada, Mexico, US cross-border connectivity
- Chile, Venezuela, Brazil, Argentina connected to Miami via 45Mpbs (AMPATH)
- Cable infrastructure around the region
- CLARA backbone network emerging

Healthcare in the Information Age

The scope of the Internet2 Health Science Workgroup includes clinical practice, medical and related biological research, education, and medical awareness in the public.



Health Science Members

- 86 Academic Medical Centers (AAMC)
- 130 Health Science related colleges
  - Public Health, Nursing, Dentistry, Pharmacy
- Affiliate Members
  - NIH, FDA, NSF, NASA, NOAA
  - Howard Hughes Medical Institute
- Pharmaceutical Companies (Big Rx)
  - Johnson&Johnson, Pfizer, Eli Lilly
- TeleHealth
  - Prous Science, Cisco, IBM, Microsoft, SUN, Polycom, Ford Motor Company

Health Sciences Initiative

- Health Science Advisory Group
- Working Groups/SIG/BoF
- Medical Professional .Org
- Driven by the needs of the medical discipline
  - Health care providers
  - Educators
  - Researchers

CLINICAL:
Why Physicians Participate in Internet2

- Extend the provision of better healthcare
  - TeleHealth (eHealth)
  - Develop Clinical Skills and Assessment
- Distributed data sharing
  - Electronic Health Record
  - Presence and Integrated Communications (VoIP, RFID)
  - Advanced visualization: Computer Assisted Surgery
  - Computer Aided Diagnosis
- Collaboration independent of boundaries
  - Geography
  - Time
  - Cognition: Knowledge Management

Educators:
Why Faculty Participate in Internet2

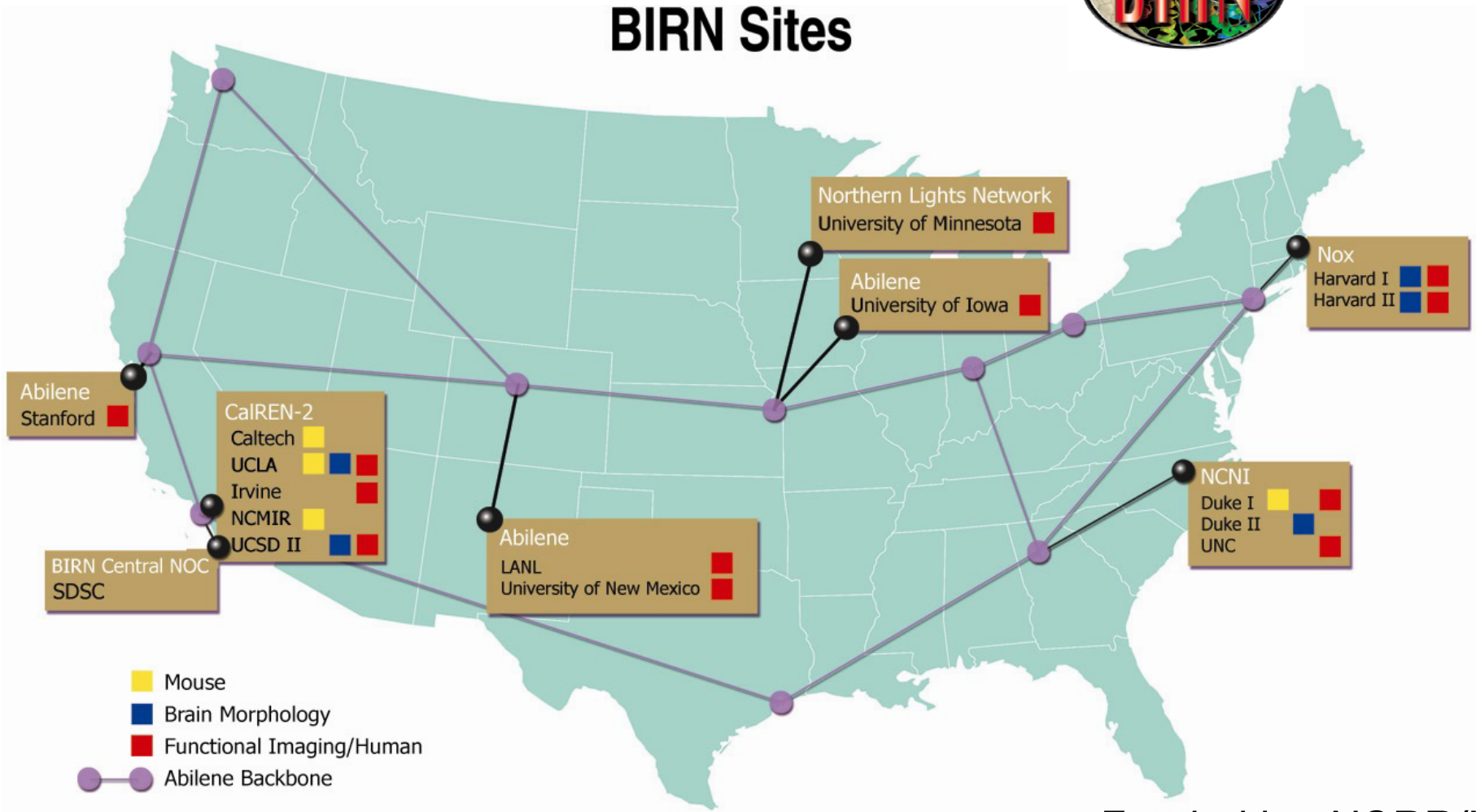
- Rich resources from student endpoints to centralized powerful computation and large storage
- Students absorb multiple channels of information

RESEARCHERS:
Why Scientists Participate in Internet2

Internet2 doesn't only **save time**, it allows **interactivity** in places where that was not possible before. I'd call it a **quantum leap**, if I didn't know that physics defines that as the smallest change a system is capable of... *Timothy Poston, Bangladesh*

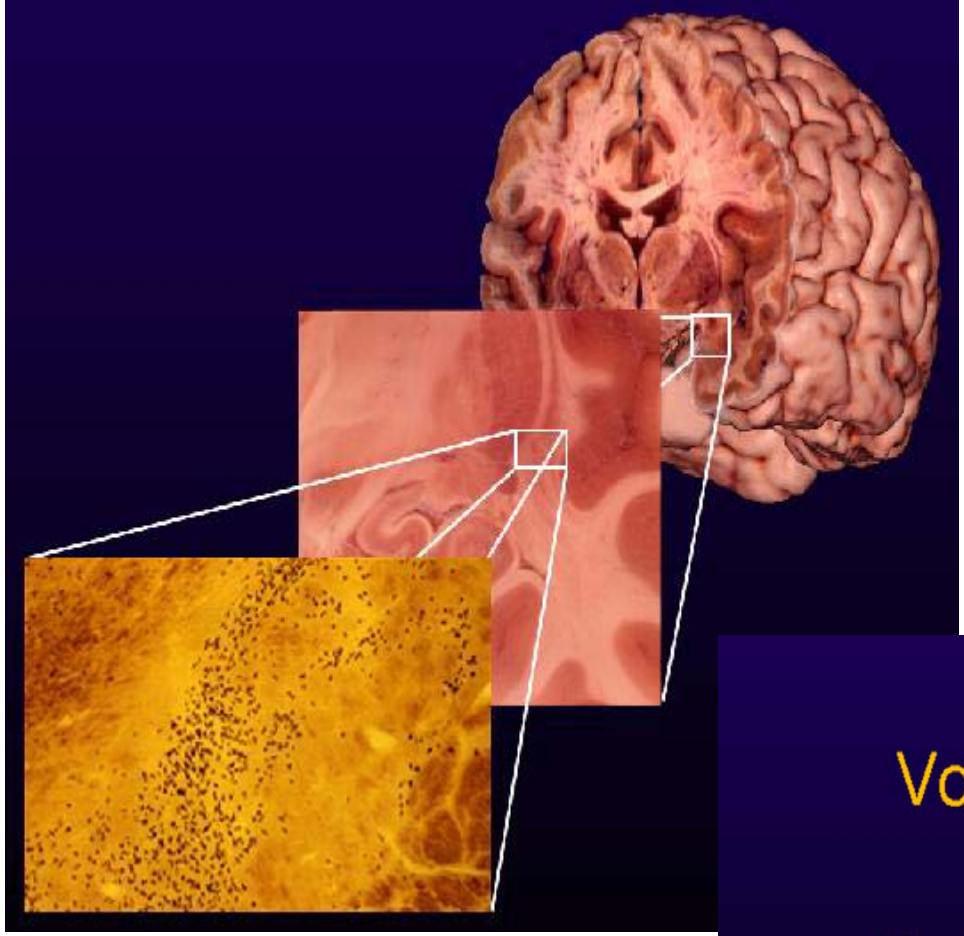
Biomedical Informatics Research Network

http://www.nbirn.net/



Funded by: NCRR/NIH

Mark Ellisman, PhD,Univ. California San Diego, SDSC

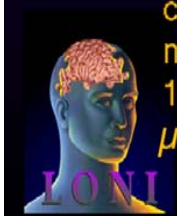


EACH BRAIN REPRESENTS A LOT OF DATA

Volume sizes by resolution - brain = 1500 cm^3

GB = Gigabyte = 10^9
TB = Terabyte = 10^{12}
PB = Petabyte = 10^{15}

Voxel size	B&W (1 B/p)	High res (2 B/p)	Color (3 B/p)
cm	1.5 KB	3 KB	4.5 KB
mm	1.5 MB	3 MB	4.5 MB
10 μm	1.5 TB	3 TB	4.5 TB
μm	1.5 PB	3 PB	4.5 PB

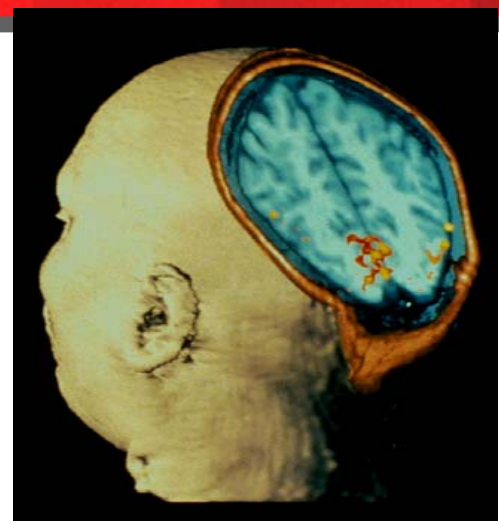


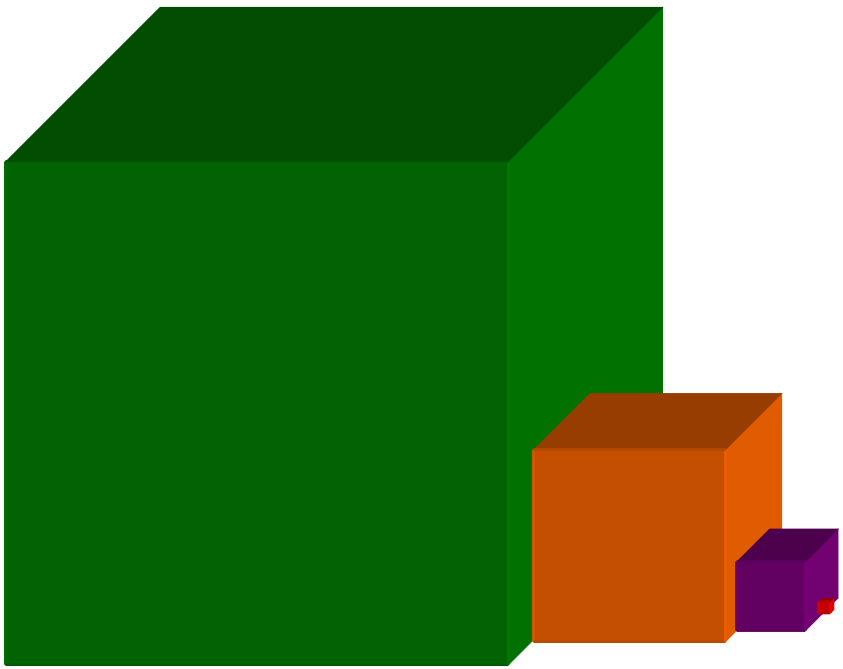
AND COMPARISONS MUST BE MADE BETWEEN MANY (fMRI)

Slide courtesy of Arthur Toga (UCLA)

Time Needed to Move Brain Images Across the Internet

Voxel size: 1 mm
Imaging Technology: Current color MRI
Data generated: 4.5 Megabytes

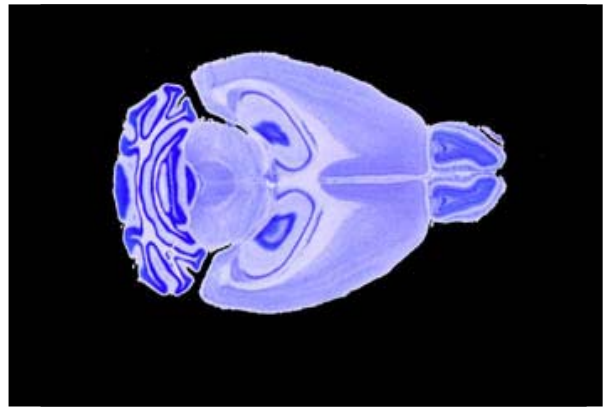


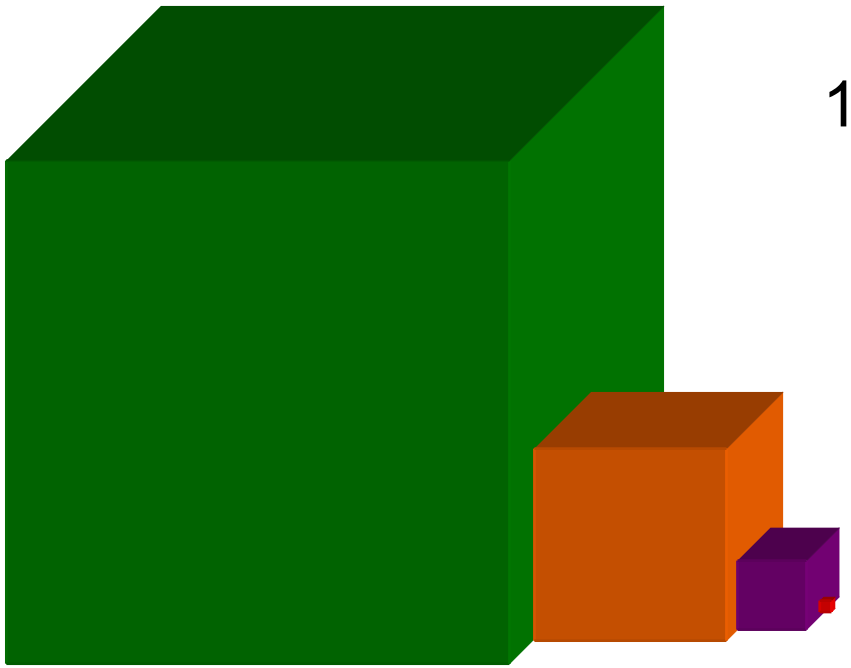


643 seconds	56 Kbps Modem
36 seconds	Broadband Internet
0.4 seconds	Typical LAN
0.006 seconds	Current Internet2 Record (5.6 Gbps)

Time Needed to Move Brain Images Across the Internet

Voxel size: 10 µm
Imaging Technology: Current color fMRI
Data generated: 4.5 Terabytes

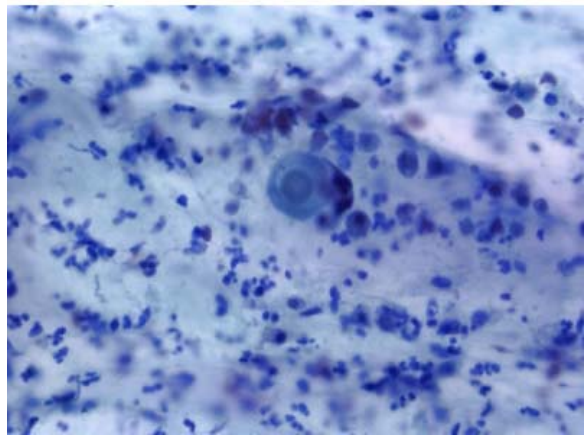


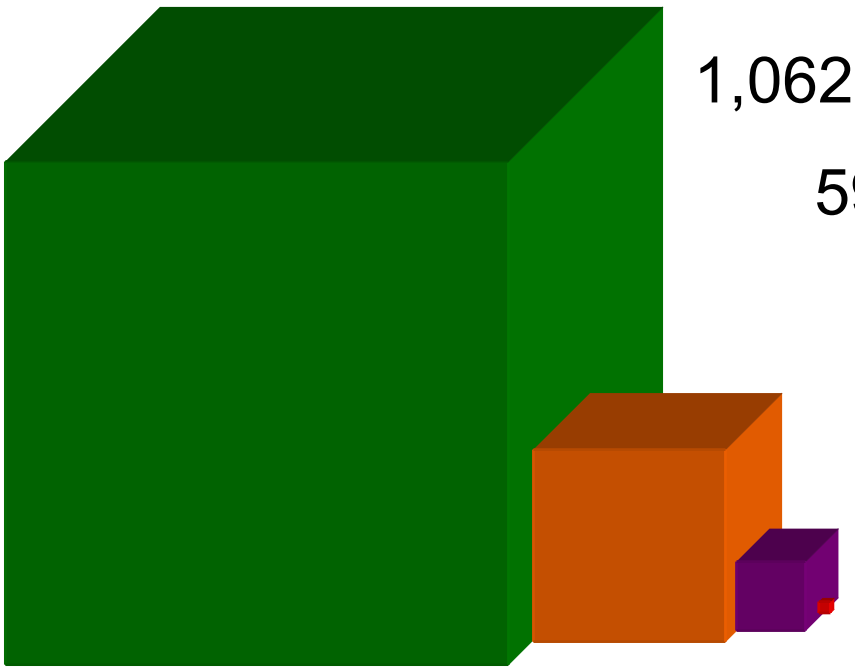


178,571 hours	56 Kbps Modem
10,000 hours	Broadband Internet
100 hours	Typical LAN
1.8 hours	Current Internet2 Record (5.6 Gbps)

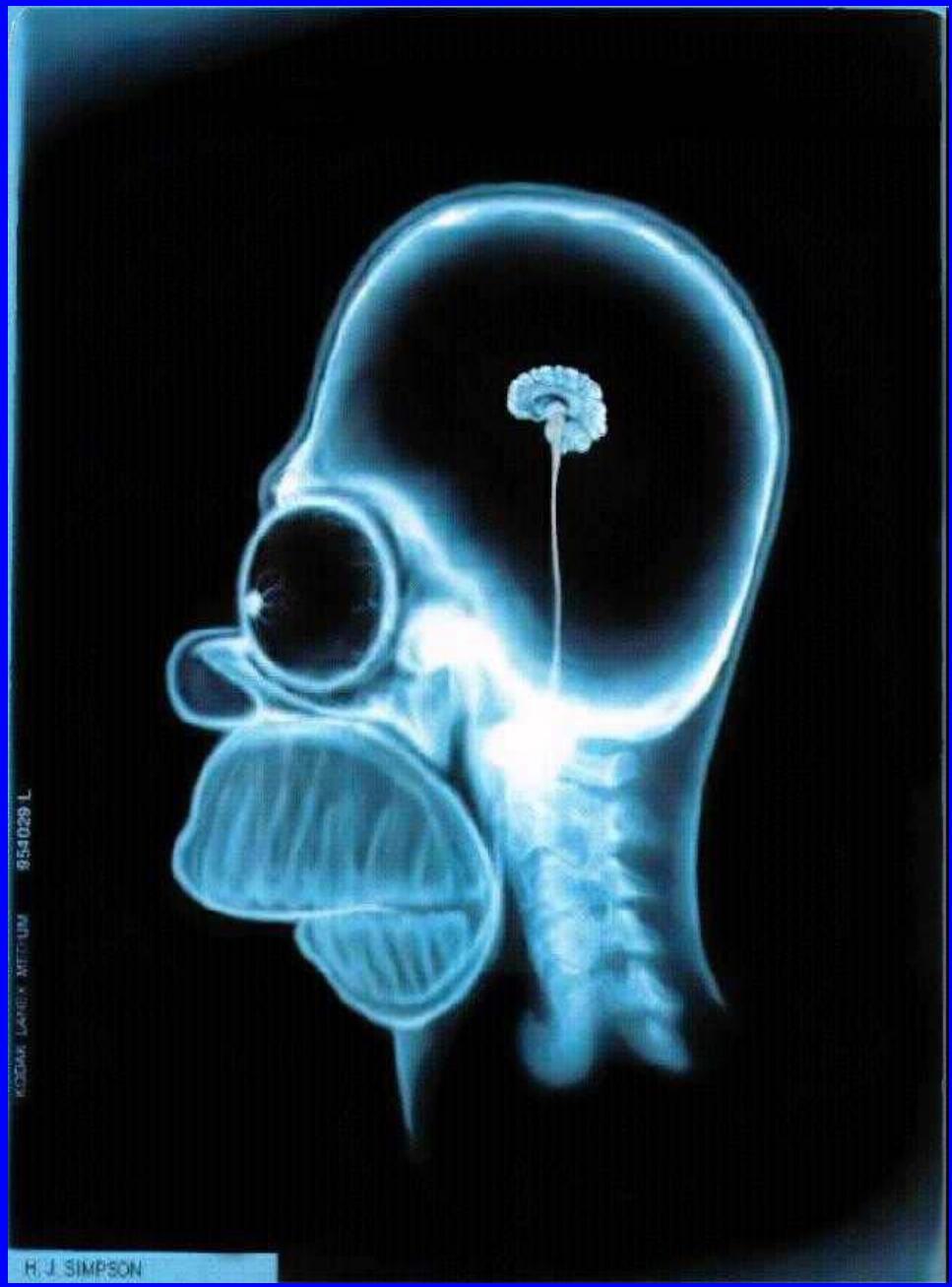
Time Needed to Move Brain Images Across the Internet

Voxel size: 1 µm
Imaging Technology: Near-future color fMRI
Data generated: 4.5 Petabytes





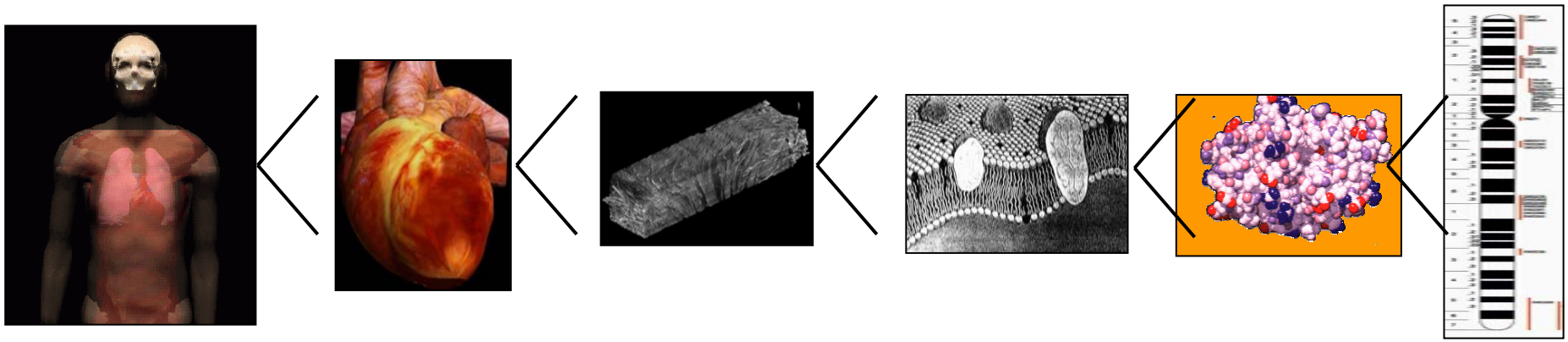
1,062,925.17 weeks	56 Kbps Modem
59,523.8 weeks	Broadband Internet
181.7 weeks	Typical LAN
10.6 weeks	Current Internet2 Record (5.6 Gbps)



Slide Courtesy of BIRN

Health Science Grand Challenge

<Person-----Organ-----Tissue-----Cell-----Protein-----Atom>



Courtesy: Peter Hunter, University of Auckland

The Wizard GAP: Translational Research

Discipline Community

CS, Math, CSE

Network of Research

Healthcare Life Sciences

CS, Math, CSE

Discipline Community

Slide courtesy Chris Johnson, SCI

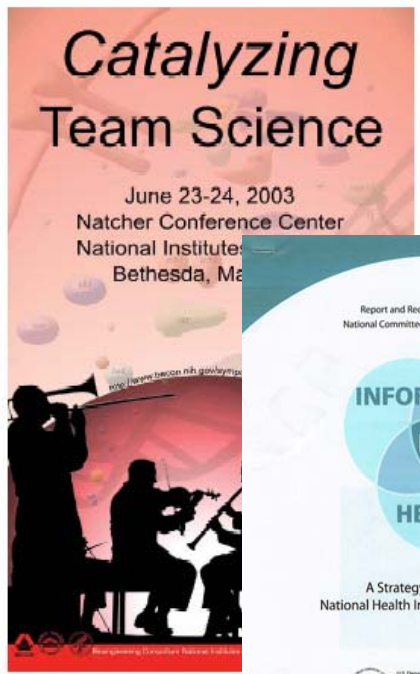
NIH Roadmap: http://nihroadmap.nih.gov/

E. Zerhouni, M.D.
Director, National Institutes of Health

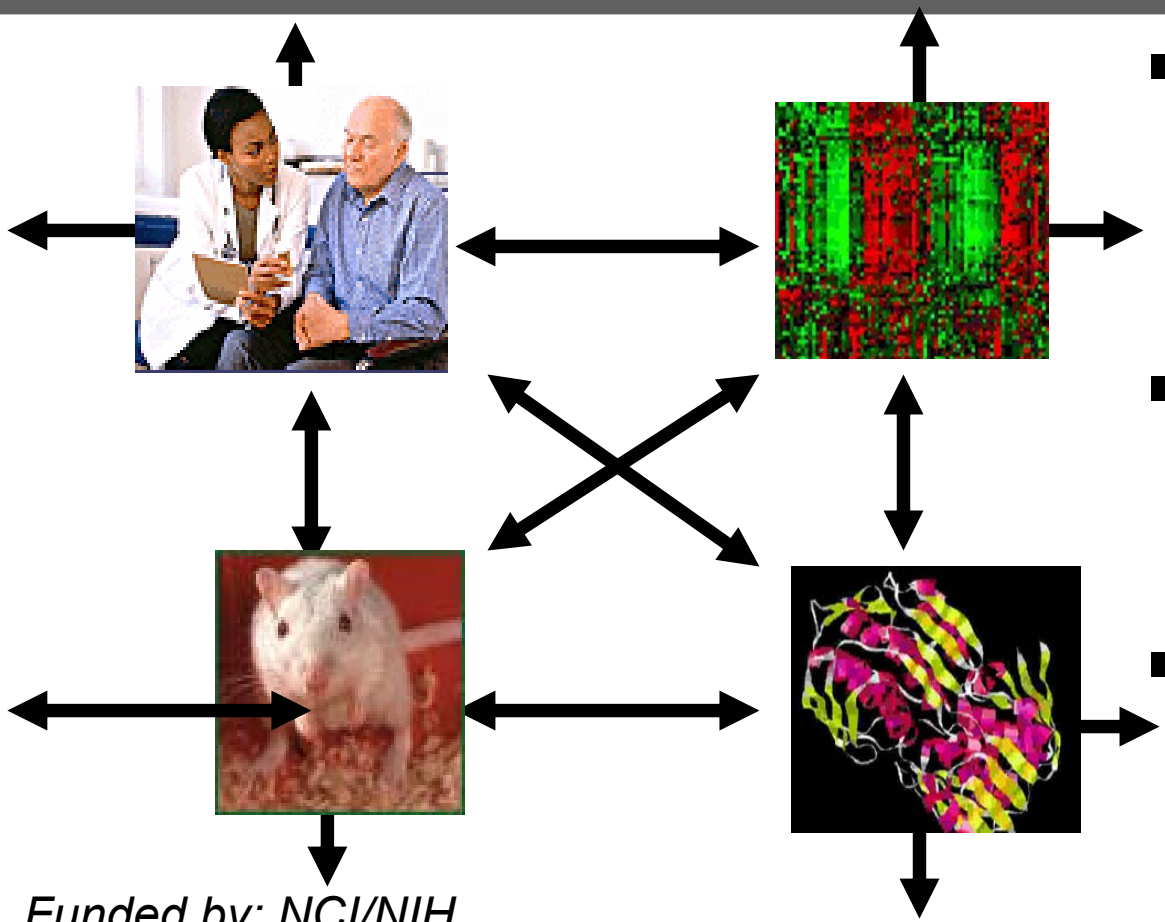
- What are today's most pressing scientific challenges?
- What are the roadblocks to progress and what must be done to overcome them?
- Which efforts are beyond the mandate of one or a few…but are the responsibility of (NIH as) a whole?

NIH Roadmap: Implementation Themes

- New Pathways to Discovery
  - National Technology Centers
  - Bioinformatics
  - Nanotechnology
- Research Teams of the Future
- Reengineering the Clinical Research Enterprise
  - Integration/Interoperability
  - Clinical Trials/Elect. Health Records
  - Translational Research



Research Team of the Future:
Cancer Biomedical Informatics Grid



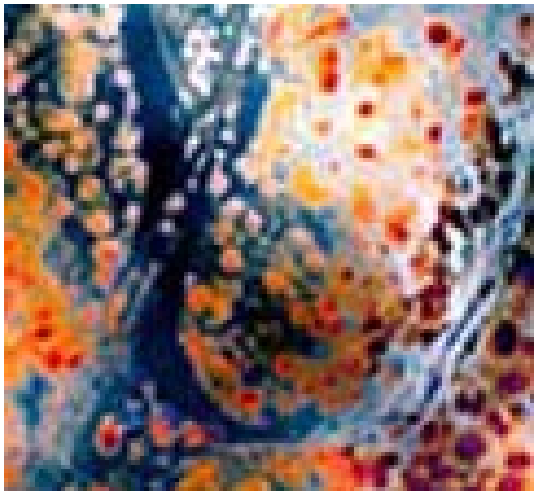
- Global Cancer Research Community
- Grid deployment to Cancer Centers
- Bioinformatics infrastructure
- Public data sources

Funded by: NCI/NIH

http://cabig.nci.nih.gov/

David States, MD, PhD

ONCOMINE



- Cancer Microarray Database containing close to 50 million datapoints
- Data mining tools to efficiently query genes and datasets of interest
- Meta-analyze groups of studies

http://141.214.6.14:8080/Array1/

Funded by: Univ of Michigan Pathology, Pew Scholars Program, American Cancer Society, and V Foundation

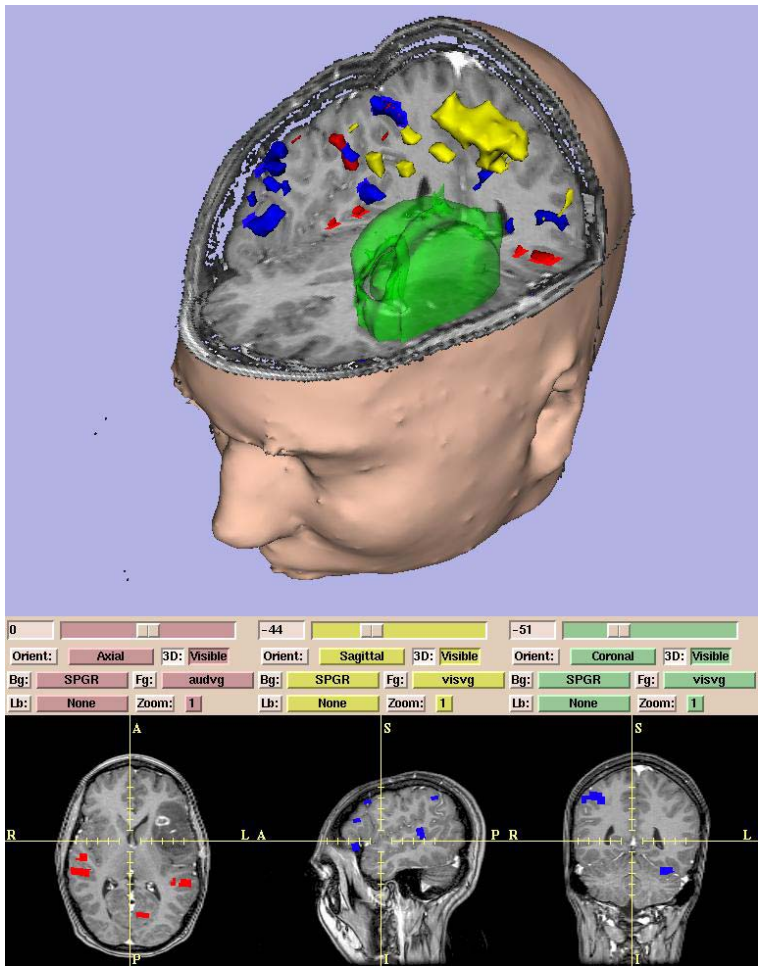
Arul M. Chinnaiyan, MD, PhD

Remote, Real-time Simulation for Teaching Human Anatomy and Surgery

- Demonstrate remote, real-time teaching of human anatomy and surgery
- Deliver real-time simulation and visualization technologies
- Network-based architecture allows for multiple high-resolution stereo-graphic displays and haptic devices

Stanford University
School of Medicine
Stanford, CA

Surgical Planning



- Pipelines for Morphometric Analysis
- Surgical Planning
- Interoperative segmentation
- Brain atlas
- fMRI

Funded by NCRR/NIH

Ron Kikinis, M.D., Steve Pieper, Ph.D., Simon Warfield, Ph.D.

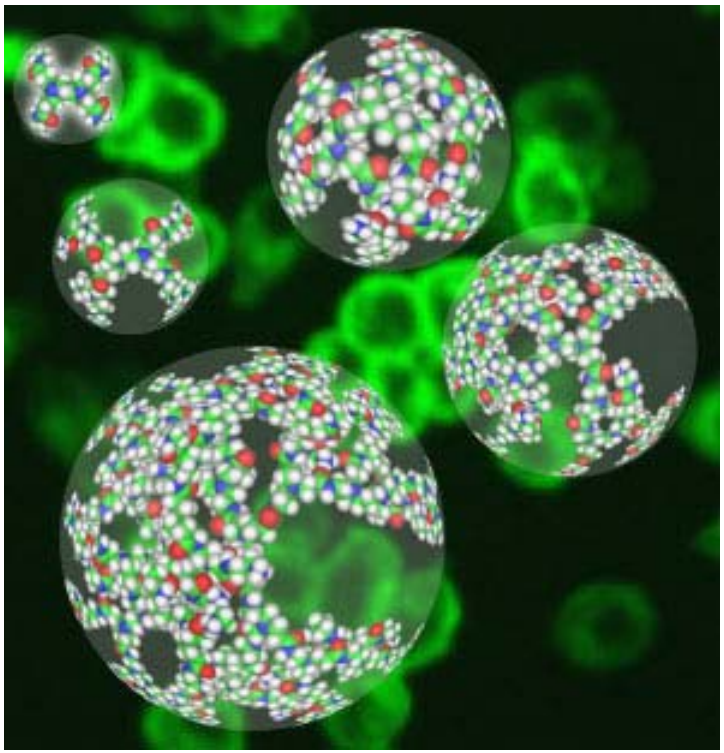
Brigham and Women's Hospital, Harvard Medical School

Telemammography: National Digital Mammography Archive

- Storage and retrieval of complete clinical record
  - Mammographic Radiology images (DICOM)
  - Pathology reports and related patient information
- Standard formats using standard protocols
- Multi-layered security
- Input and retrieval from multiple locations
- Measurement Criteria: Saving lives!

University of Pennsylvania, Philadelphia, PA
Y12 National Security Complex in Oak Ridge, Oak Ridge, TN
University of Chicago, Chicago, IL
University of North Carolina at Chapel Hill, Chapel Hill, NC
University of Toronto, Toronto, Canada

Center for Biologic Nanotechnology



http://nano.med.umich.edu/

Funding: NIH, DOE, NSF, DARPA

James Baker, MD

- Bring together the multiple disciplines to develop nanotechnology from conception to human trials.
- Nanotechnology will impact communications, information storage, materials sciences and other non-biologic applications offering limitless opportunities for miniaturization.

Pathway to Progress: The Patient

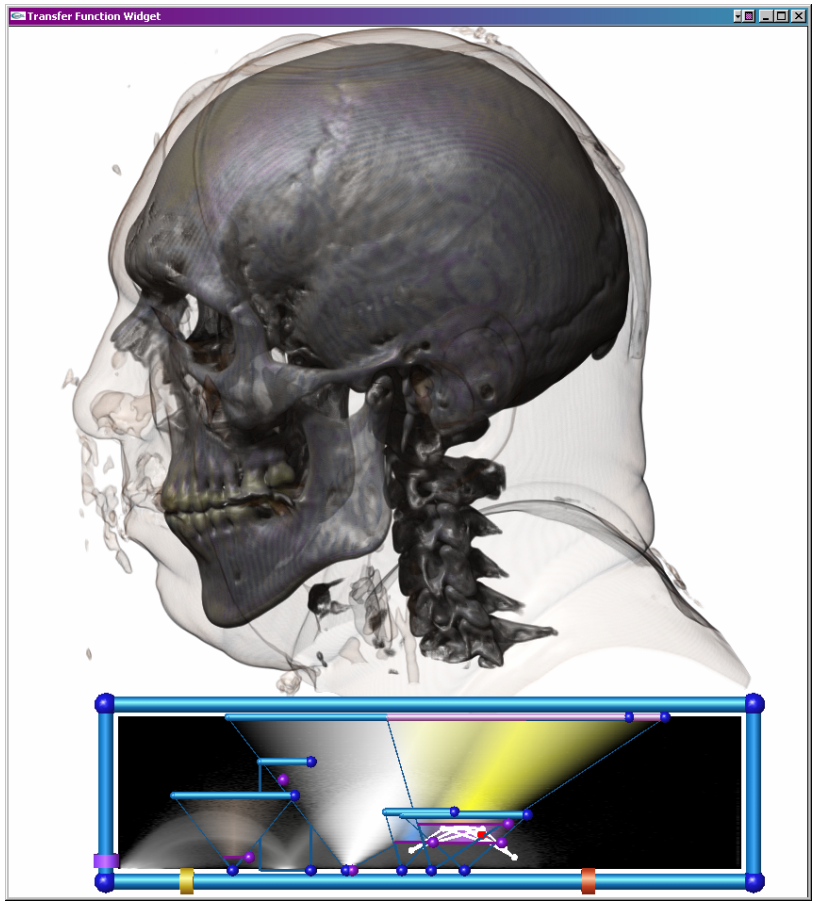
- CUDI and Internet2 Translational research collaboration basis
  - Scientific discovery
  - Product development
  - Clinical trials
- Patient care
  - Access to services
  - Efficiencies of production
  - Improve quality of care

Core Functions for Electronic Medical Networks

- Support ongoing and future management decisions
- Broadband electronic communication and connectivity
- Population health monitoring and reporting

More Information

- On the Web
  - www.internet2.edu
  - Health.internet2.edu
- Email
  - *info@internet2.edu*
  - Ana Preston
  - *Apreston@internet2.edu*
  - Mary Kratz
  - *Mkratz@internet2.edu*

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