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# Internet2 and Network Research

Columbia University

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October 29<sup>th</sup>, 2001

## *Elevator Explanation*

- *Internet2's mission is to develop and deploy advanced network applications and technologies, accelerating the creation of tomorrow's Internet*

## *What are we really?*

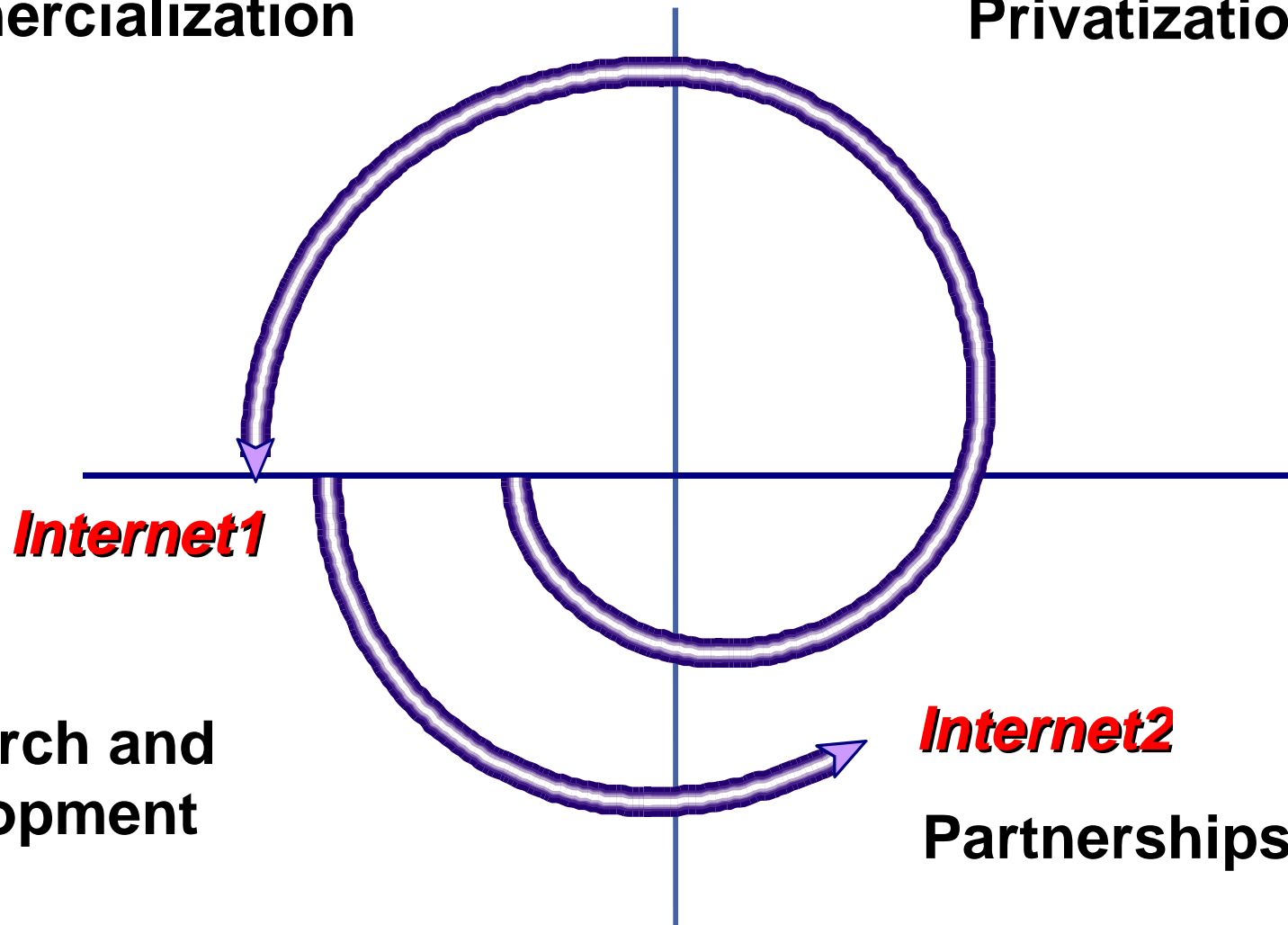
- Membership organization of US research universities
- Parent 501.3c (UCAID) has board of university presidents
- Project supported by numerous partnerships (government, industry, international)

## *Goals*

- Enable new generation of advanced applications
- Re-create leading edge R&E network capability
- Transfer capability to global production internet

**Commercialization**

**Privatization**



**Research and  
Development**

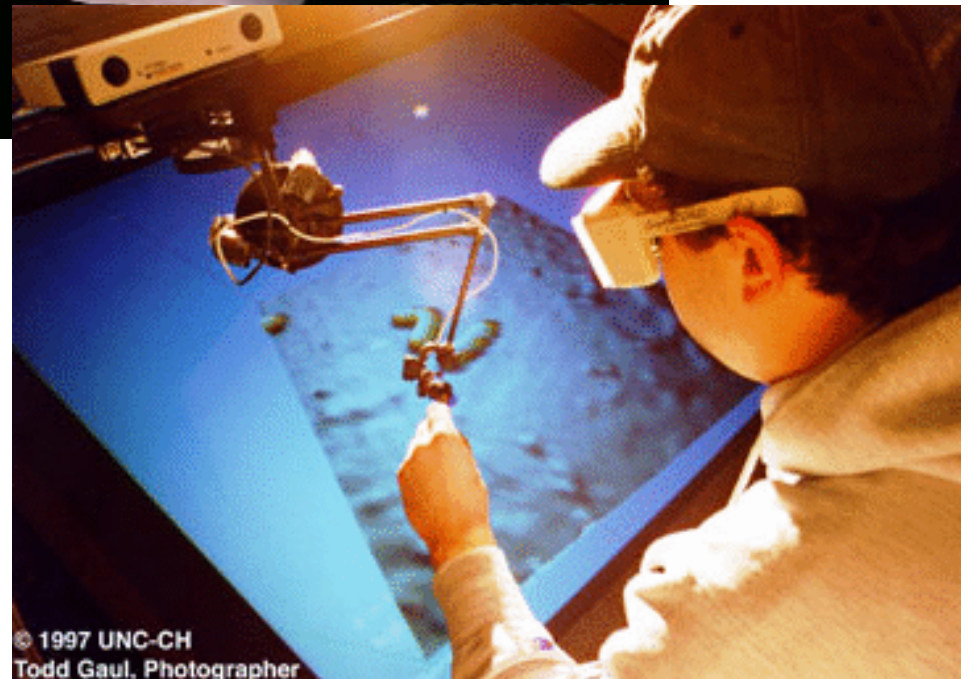
***Internet2***

**Partnerships**

*Real-time access to remote instruments*

3-D Brain Mapping  
(Pitt, PSC)

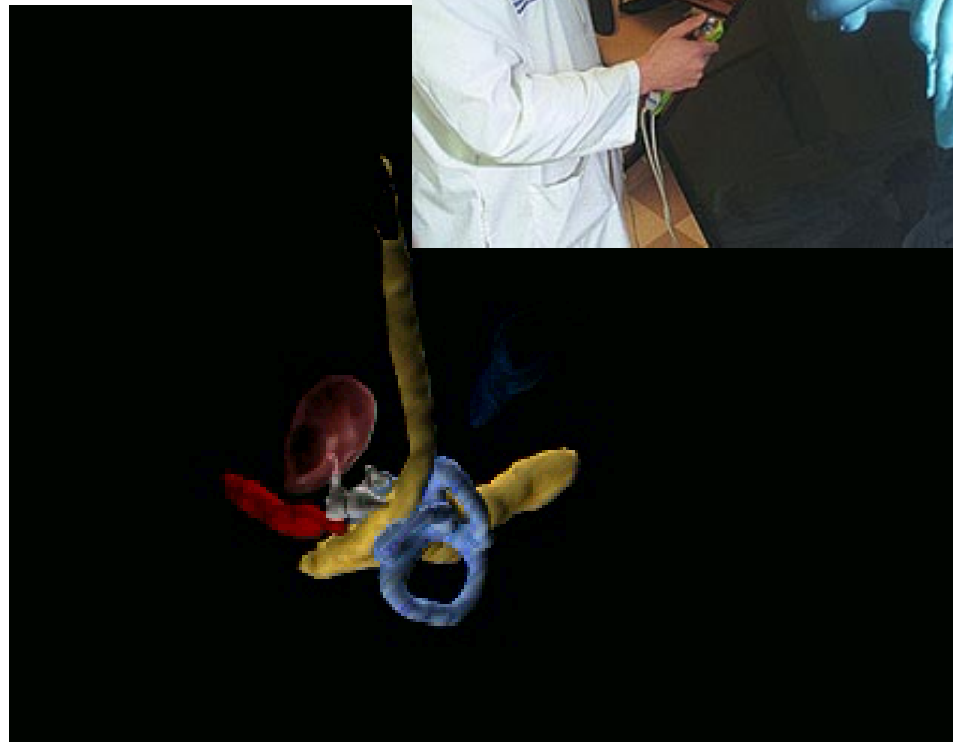
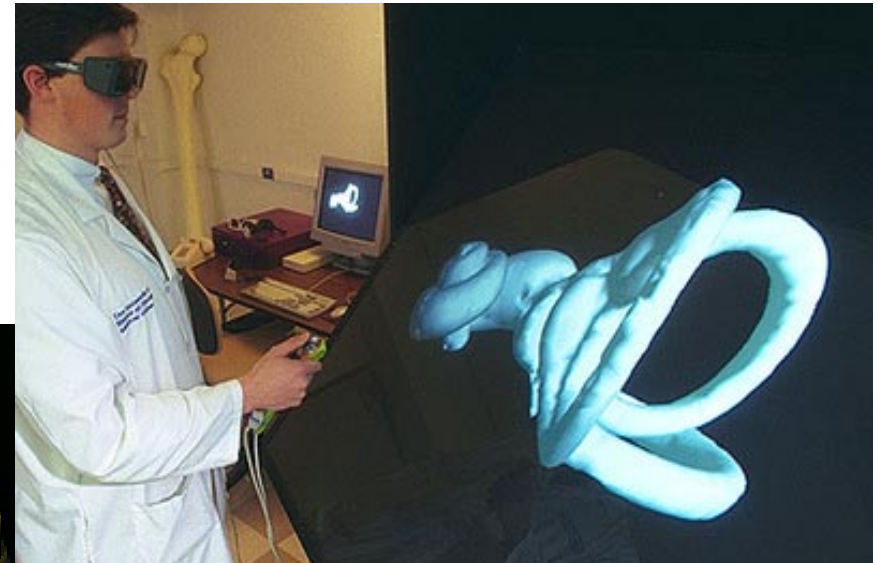
Distributed nanoManipulator  
(UNC-CH)



*Shared virtual environments*

*University of Illinois at Chicago*

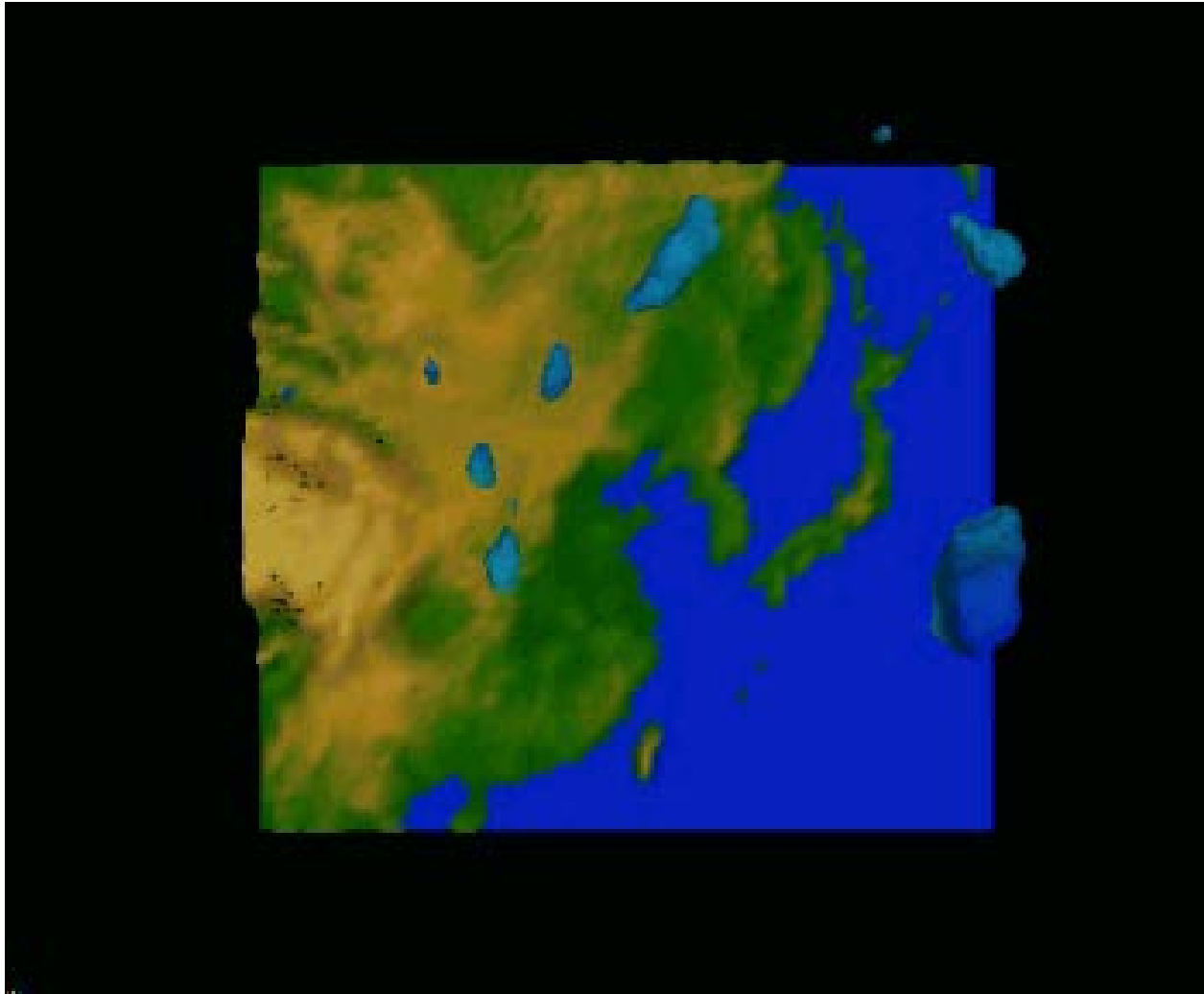
Virtual  
Temporal  
Bone





Source:  
University of Illinois–Chicago





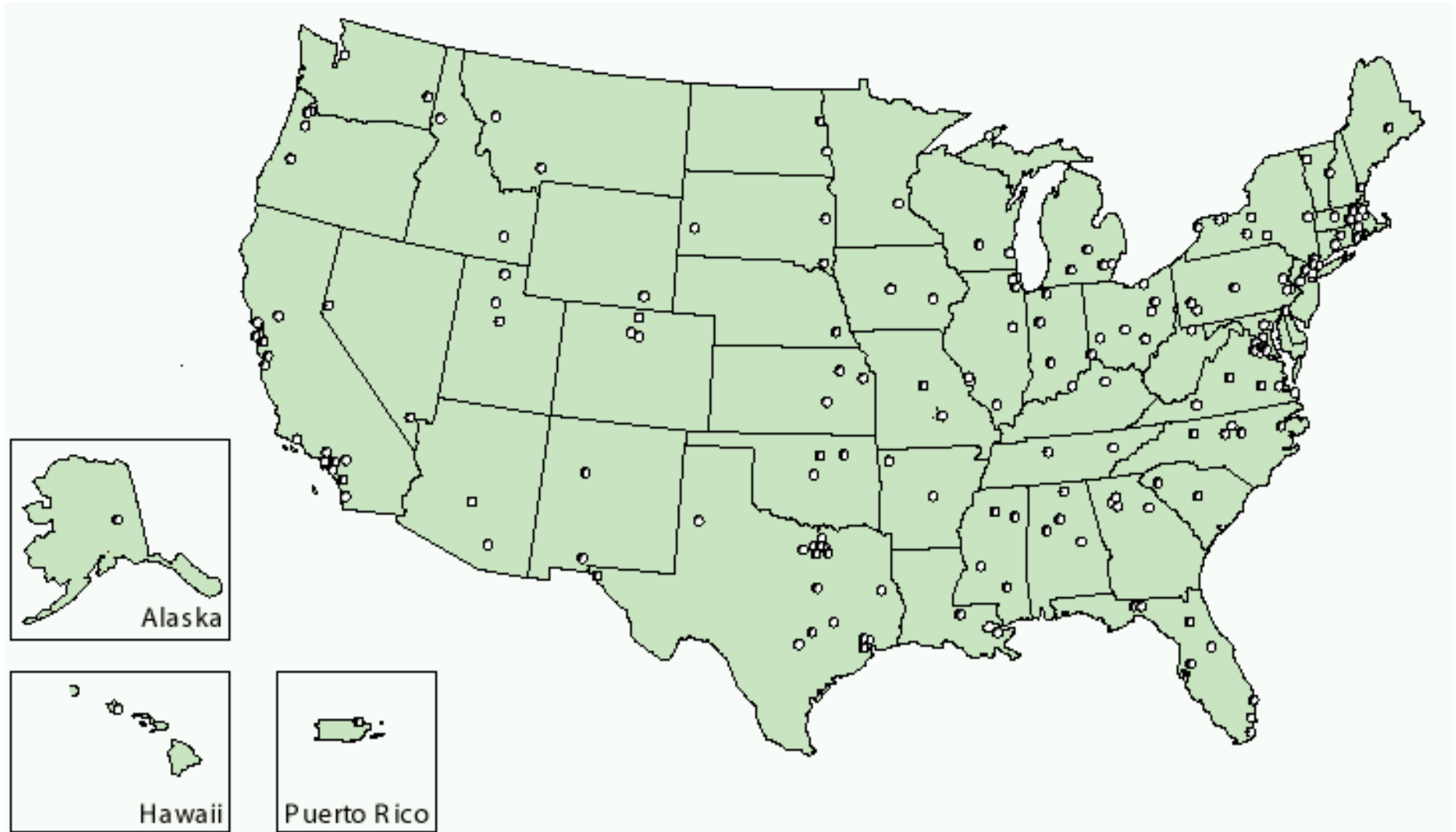
*Large-scale  
computation*

*University  
Corporation for  
Atmospheric  
Research*



# Internet2 Universities

187 Universities as of October, 2001



+ over 35 affiliate members

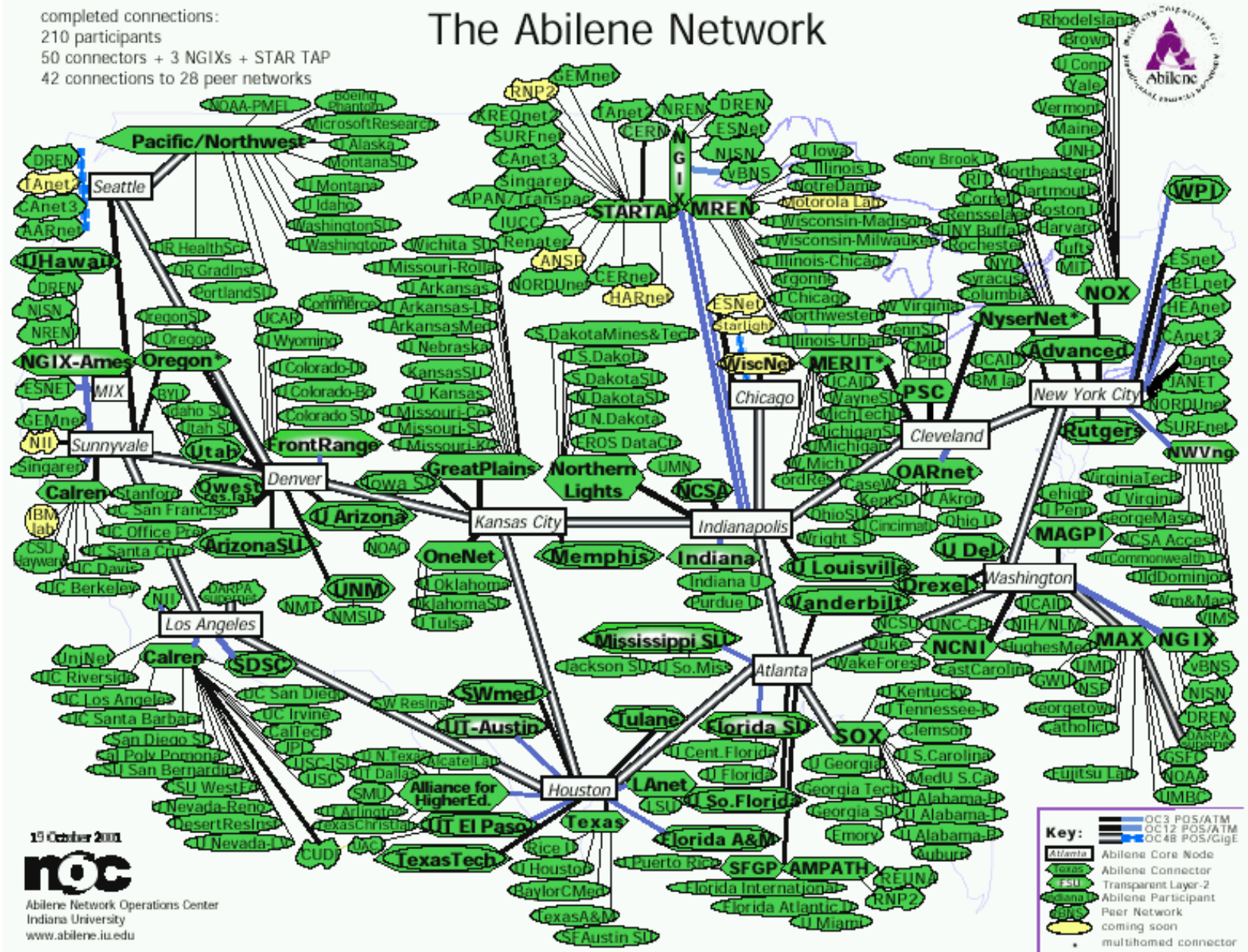


# Abilene Topology

October, 2001

completed connections:  
 210 participants  
 50 connectors + 3 NGIXs + STAR TAP  
 42 connections to 28 peer networks

## The Abilene Network



19 October 2001  
**noc**  
 Abilene Network Operations Center  
 Indiana University  
 www.abilene.iu.edu



# Internet2 Corporate Partners



Microsoft



*+ over 70 corporate members*



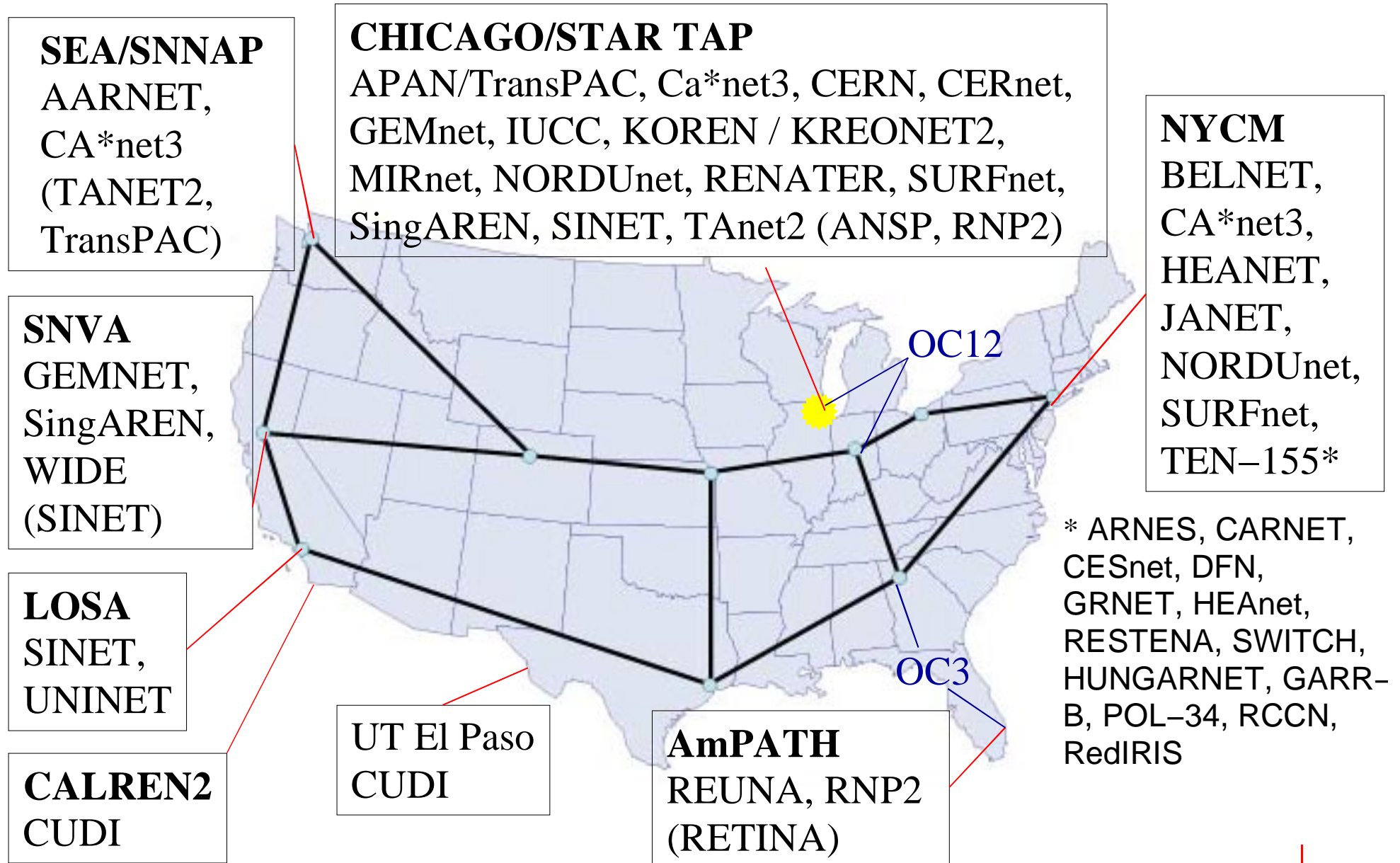
# International MoU Partners

## October, 2001

*AAIREP (Australia)*  
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*APAN (Asia-Pacific)*  
*APAN-KR (Korea)*  
*ARNES (Slovenia)*  
*BELNET (Belgium)*  
*CANARIE (Canada)*  
*CARNET (Croatia)*  
*CESnet (Czech Republic)*  
*CERNET, CSTNET, NSFCNET (China)*  
*CUDI (Mexico)*  
*DANTE (Europe)*  
*DFN-Verein (Germany)*  
*GIP RENATER (France)*  
*GRNET (Greece)*  
*HEAnet (Ireland)*  
*HUNGARNET (Hungary)*  
*INFN-GARR (Italy)*  
*Israel-IUCC (Israel)*

*JAIRC (Japan)*  
*JUCC (Hong Kong)*  
*NECTEC/UNINET (Thailand)*  
*NORDUnet (Nordic countries)*  
*POL-34 (Poland)*  
*RCCN (Portugal)*  
*RedIRIS (Spain)*  
*RESTENA (Luxembourg)*  
*RETINA (Argentina)*  
*REUNA (Chile)*  
*RNP2 (Brazil)*  
*SingAREN (Singapore)*  
*Stichting SURF (Netherlands)*  
*SWITCH (Switzerland)*  
*TAnet2 (Taiwan)*  
*TERENA (Europe)*  
*JISC/UKERNA (UK)*

# Abilene International Peering



## *Quality of Service*

- <http://www.internet2.edu/qos/>

## *Multicast*

- <http://www.internet2.edu/multicast/>

## *IPv6*

- <http://www.internet2.edu/ipv6/>

## *Measurement*

- <http://www.internet2.edu/measurement/>

## *Middleware*

- [www.internet2.edu/middleware/](http://www.internet2.edu/middleware/)

# Internet2 & Network Research...

*Internet2 largely a creation of CIOs*

*Because of emphasis on applications and production communication, specific support is not provided for CS network research*

***However... Internet2 advanced network technologies and applications are available to all, including computer scientists!***

## *Goals*

- Engage CS faculty and students from the beginning
- Increase awareness of Internet2's capabilities
- Facilitate access to existing and (where required) **new network facilities and capabilities**
- Build a highly instrumented network infrastructure with open access to measurement data
- *Recreate the culture of playfulness and experimentation that existed when the net was new, small, and non-commercial*



*Initiative is under auspices of Network Research Liaison Council (NRLC)*

- Larry Landweber – UW–Madison (chair)

*NRLC is liaison between Internet2 and CS researchers*

*Two workshops held*

- June, 2000 & April, 2001
- Presentations by 22 researchers
- Identification of resources to support their research
- Position papers and planning meeting with faculty from Columbia, Delaware, and RPI

## *Distributed account infrastructure*

- 20 to 25 systems in U.S. and other countries
- Located outside firewalls at gigaPoPs, universities, and corporate partner sites
- Connectivity to Internet1 and Internet2 to enable experiments over either
- Managed by Internet2 and university staff
- IPv6, multicast, & co-located network measurement

## *Routing overlay service*

- **Idea:** large, well-connected overlay testbed for new protocol research (e.g. new routing protocols)

*Identify and engage CS researchers*

*Identify international researchers and I2 partners*

*Obtain funding*

*Specify functionality*

*Design and implement system architecture and operational tools*

*Obtain and deploy systems*

# Critical Success Criteria

*Accepted SIGCOMM or INFOCOM papers  
report on use within 18 months*

*Systems deployed and being used by  
critical mass of CS network researchers  
within 12 months*