# *Report on US-China JCM and Tomorrow's Cyberinfrastructure*

**William Y. B. Chang**

**Office of International Science and Engineering**

**National Science Foundation**

**November 30, 2004**

# The 11th U.S.-PRC Joint Commission on S&T Cooperation

- US Co-Chair - John Marburger, Director of OSTP, Office of the President
- Chinese Co-Chair – XU Guanhua, Minister of Science and Technology
- Held on October 12, 2004 in Washington, D.C.

# Discussion Topics

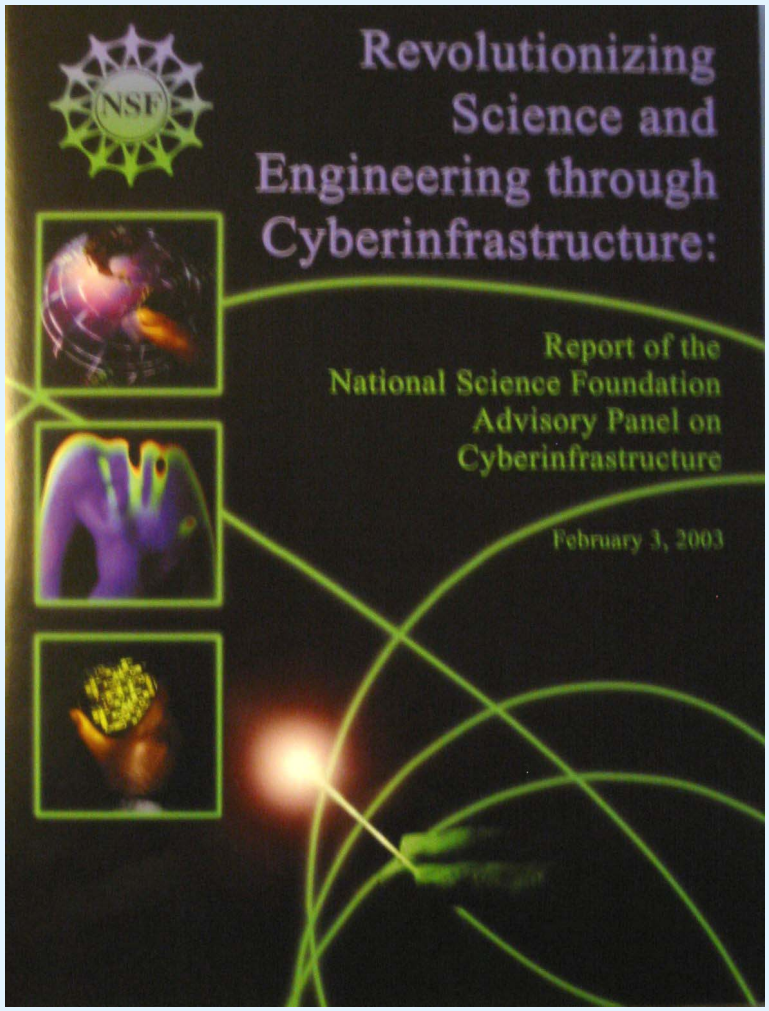
- Advanced Clean Energy Technologies
- Water Resource Management
- Agricultural Science and Technology
- Development of Young Scientists and Engineers
- Earth Observation/Global Change
- Physical Sciences
- Health Sciences

# NSF Involved Key US-China Collaborations

- Continue and expand the Summer Institute in China – Julia Dockery (Texas A&M) delivered a presentation
- China joined as an Associate Member in the Integrated Ocean Drilling Program (IODP)
- US and China continue to collaborate in ecological complexity and ecosystem services, in ocean observation, and in seismology
- Proposed new cooperation in high energy physics by focusing upgrade of Beijing Electron-Position Collider.
- Proposed cooperation in the neutrino experiment at Daya Bay
- Will host the 2nd Joint Workshop on Nano S&T

# Setting the Stage for Cyberinfrastructure

**Daniel E. Atkins, Chair,** University of Michigan
**Kelvin K. Droegemeier,** University of Oklahoma
**Stuart I. Feldman,** IBM
**Hector Garcia-Molina,** Stanford University
**Michael L. Klein,** University of Pennsylvania
**David G. Messerschmitt,** University of California at Berkeley
**Paul Messina,** California Institute of Technology
**Jeremiah P. Ostriker,** Princeton University
**Margaret H. Wright,**New York University




http://www.communitytechnology.org/nsf_ci_report/

# Cyberinfrastructure Promise

- Ubiquitous, digital knowledge environments that are both interactive and functionally complete…… (Atkins report)

- revolutionize the processes of discovery, learning and innovation across the science and engineering frontier.

# *What **IS** Cyberinfrastructure*

- Like electric utility grid
- “Grid computing” often used synonymously
- Harnesses entire system of interconnected elements
- Sometimes called “e-science”

# Cyberinfrastructure Characteristics

- Community-Focused
  - virtual organizations
  - distributed,
  - collaborative

- Scale and Scope
  - Multidisciplinary
  - International
  - Supporting data- and compute-intensive applications
  - High-end to desktop
  - Heterogeneous

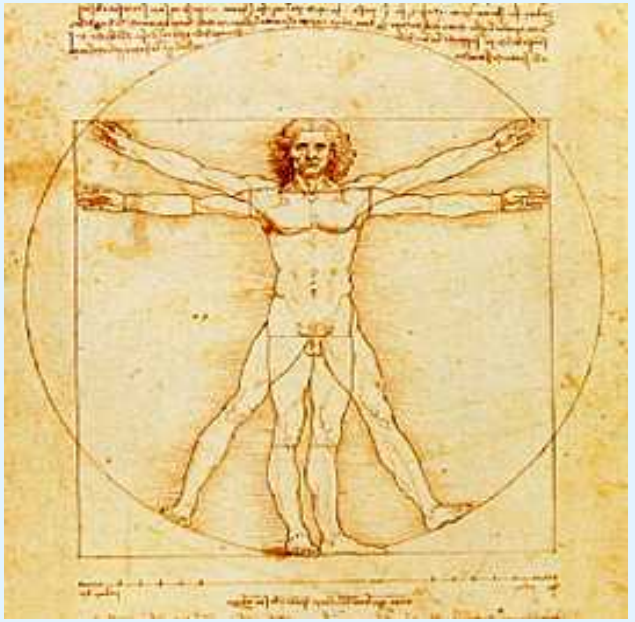
- Common Technology & Policy Platform(s)
  - Interoperability
  - Supports characteristics above

# Major Applications in Cyberinfrastructures

- Biomedical Informatics Research Network (BIRN)
- National Virtual Observatory
- Network for Earthquake Engineering Simulation (NEES)
- National Ecological Observatory Network (NEON)
- Tele-Science between U.S., Japan, Taiwan, and Korea

# *The Challenge of Genomic Sequencing*

*Homo sapiens*
(humans)

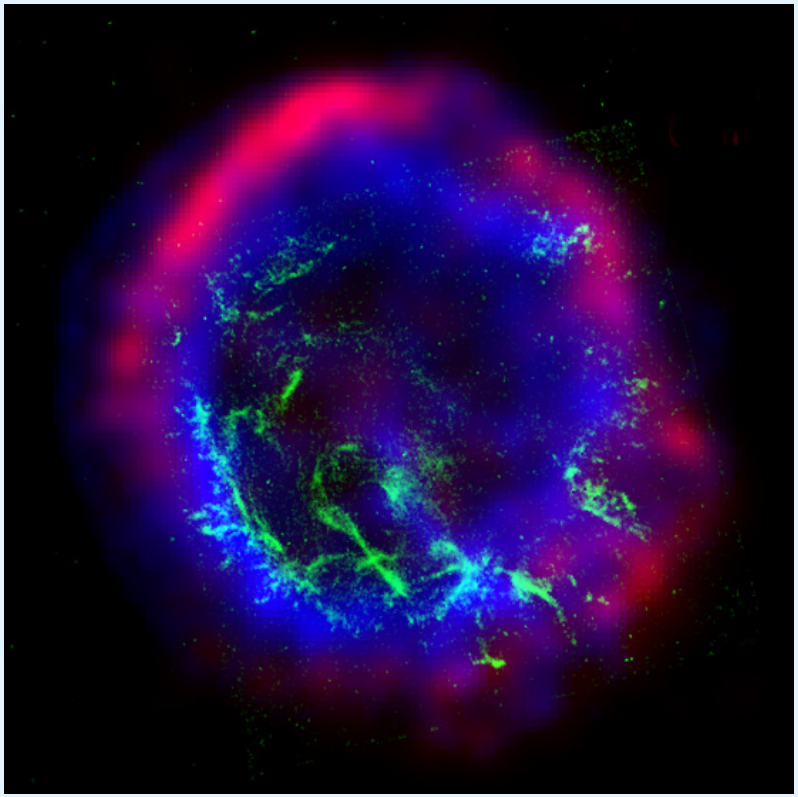



*Haemophilus influenzae*

# *Genomics*

- One of the great scientific revolutions in the 20th century and only beginning.
- Completing the Human Genome Project could have taken decades to accomplish without the power of today's computers and a suite of sophisticated software.
- The Age of Biotechnology lies before us—enabled by cyberinfrastructure.

# National Virtual Observatory (NVO)



**Composite image of the supernova remnant E0102-72, created from three separate data sources: radio (red), x-ray (blue), and optical (green).**

**Credits: x-ray: NASA/CXC/SAO, optical: NASA/HST,**

**radio: CSIRO/ATNF/ATCA.**


Photo: USGS / M. Ryzner

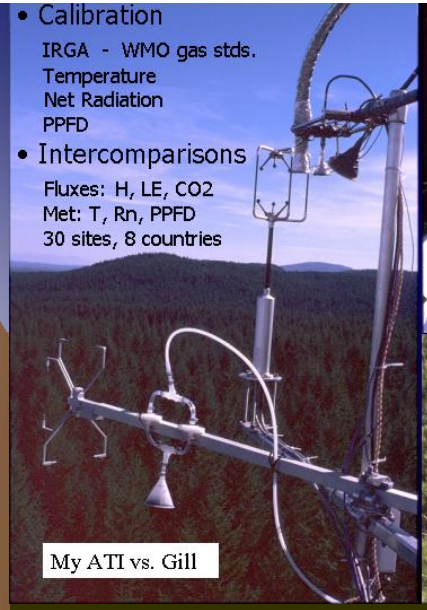

Photo: USGS/E.V. Leyendecker

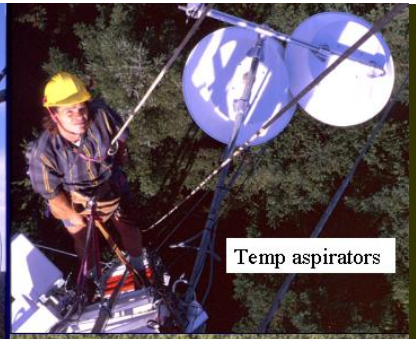
# *Network for Earthquake Engineering Simulation (NEES)*

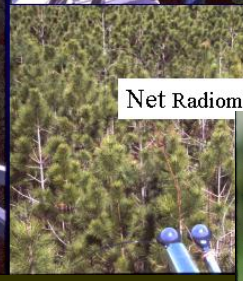
- **Researchers from across the US will be able to operate equipment and observe experiments anywhere on the net.**
- **Will study how building design, advanced materials, and other measures can minimize damage and loss of life.**
- **Researchers have just conducted first test of web-interface technology.**
  - **Shake table vibrated a model bridge with 100 sensors attached that streamed video and data to engineers**
  - **Engineers then analyzed the bridge's performance**
- **Potential for connection to sensor systems**
- **This is a new model for scientific research that will radically change earthquake engineering.**

National Ecological Observatory Network (NEON)

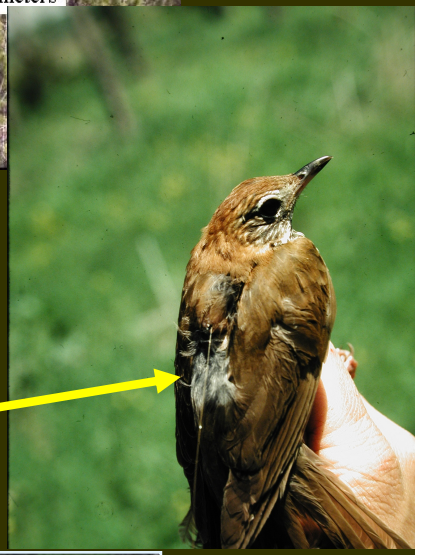

- Calibration
  - IRGA - WMO gas stds.
  - Temperature
  - Net Radiation
  - PPFD
- Intercomparisons
  - Fluxes: H, LE, CO2
  - Met: T, Rn, PPFD
  - 30 sites, 8 countries



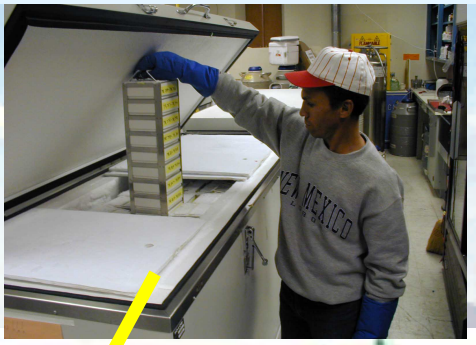




# Ecological Tools and Sensors

# NEON Infrastructure in Emerging Disease Ecology:Hanta virus

National Ecological Observatory Network (NEON)



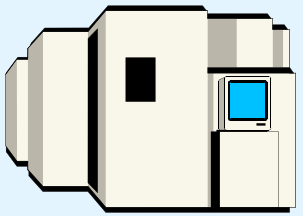
Source: Yates

National Ecological Observatory Network (NEON)

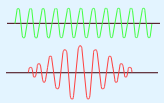
# NEON

## Leadership Governance

## IT, Collabortation Modeling, Visualization

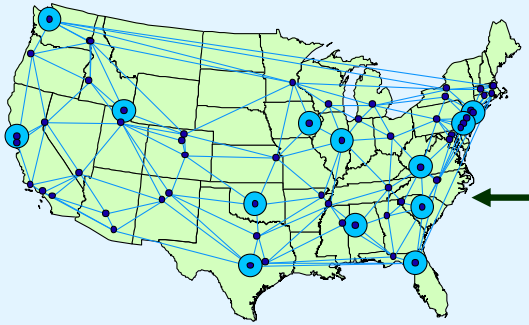


## Forecasting



Curated Data Repository

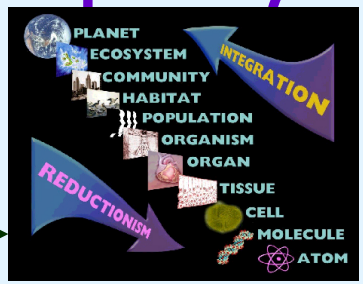
Time



## Networked

## Collaboration Synthesis

## Multi-disciplinary



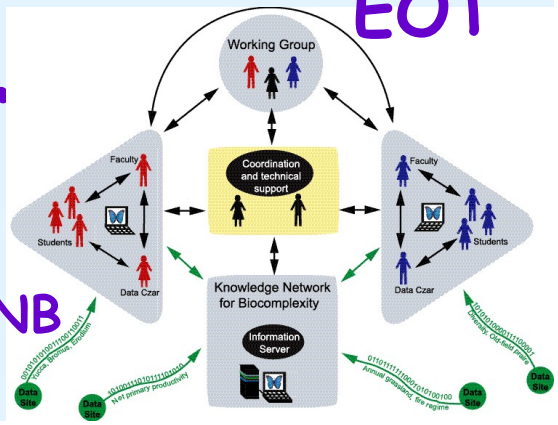

Space

Parameters

## Region to Continent

## Technology & Sensor

## EOT

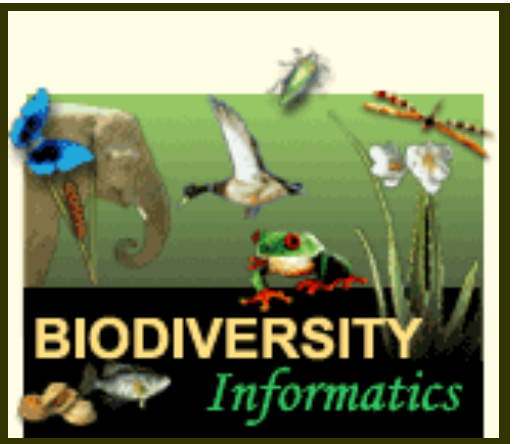



## KNB

National Ecological Observatory Network (NEON)

PARTNERSHIP for BIODIVERSITY INFORMATICS

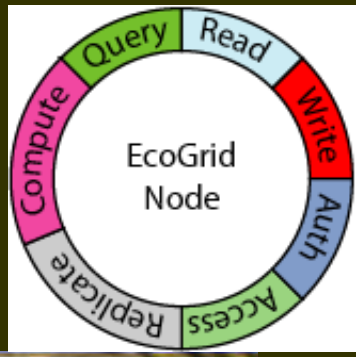
Science Environment for Ecological Knowledge




# Ecological Knowledge Systems Collaboratives, Cyberinfrastructure

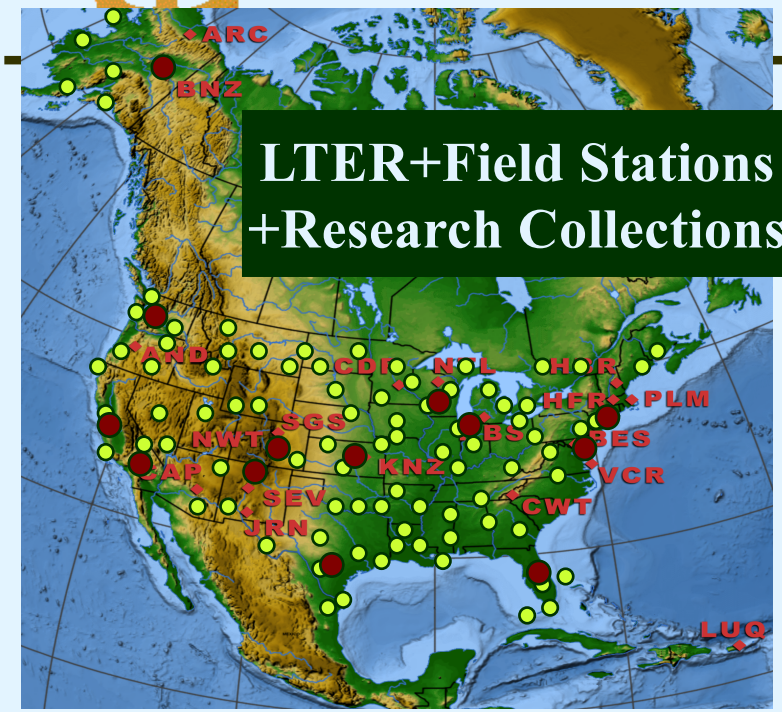
Discovery, Access, Interpretation, Integration, and Analysis of complex ecological data

ECOGRID

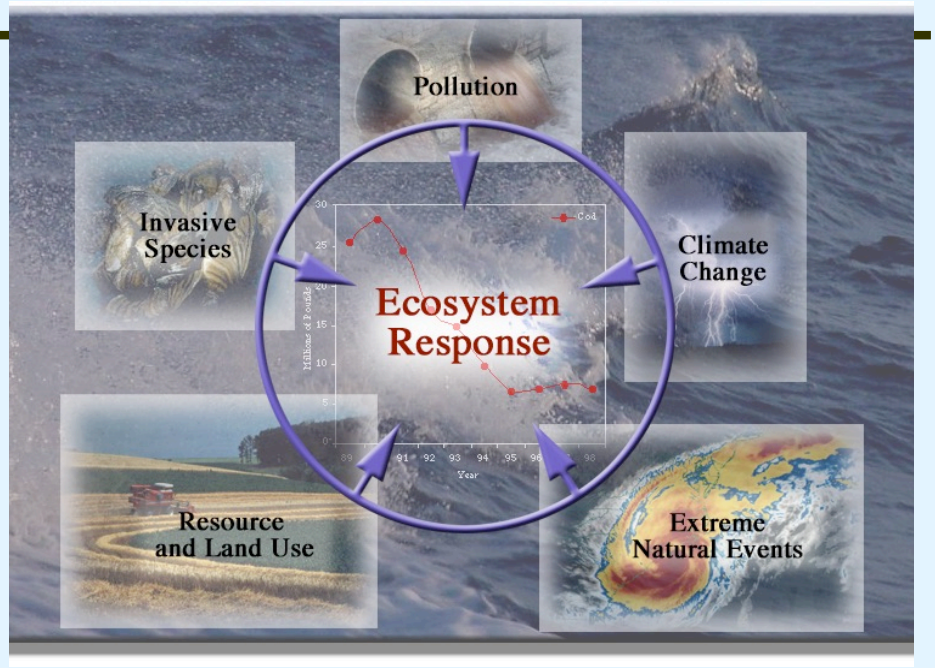



NSF

# Challenges




**LTER+Field Stations +Research Collections**




**Historically, ecological research has been driven by site based *measurements and experiments conducted* over short time scales**

**Complex regional drivers are affecting biodiversity and ecosystem function and services**

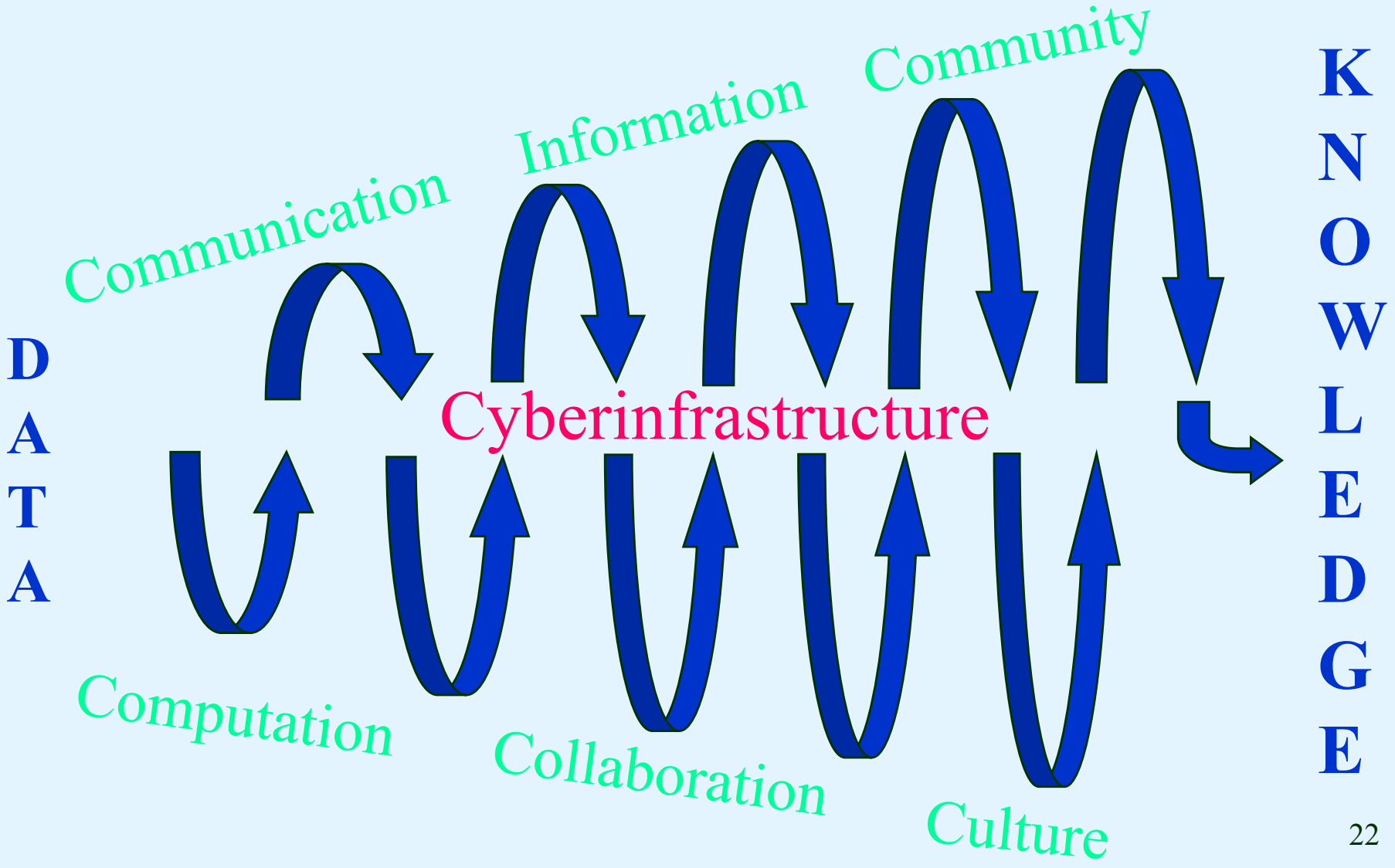
Liz Blood (BIO/DBI)
Dylan George (BIO/DBI)

# PRAGMA Telescience at iGRID 2002

# Areas Need More Enhancements, Research and Development

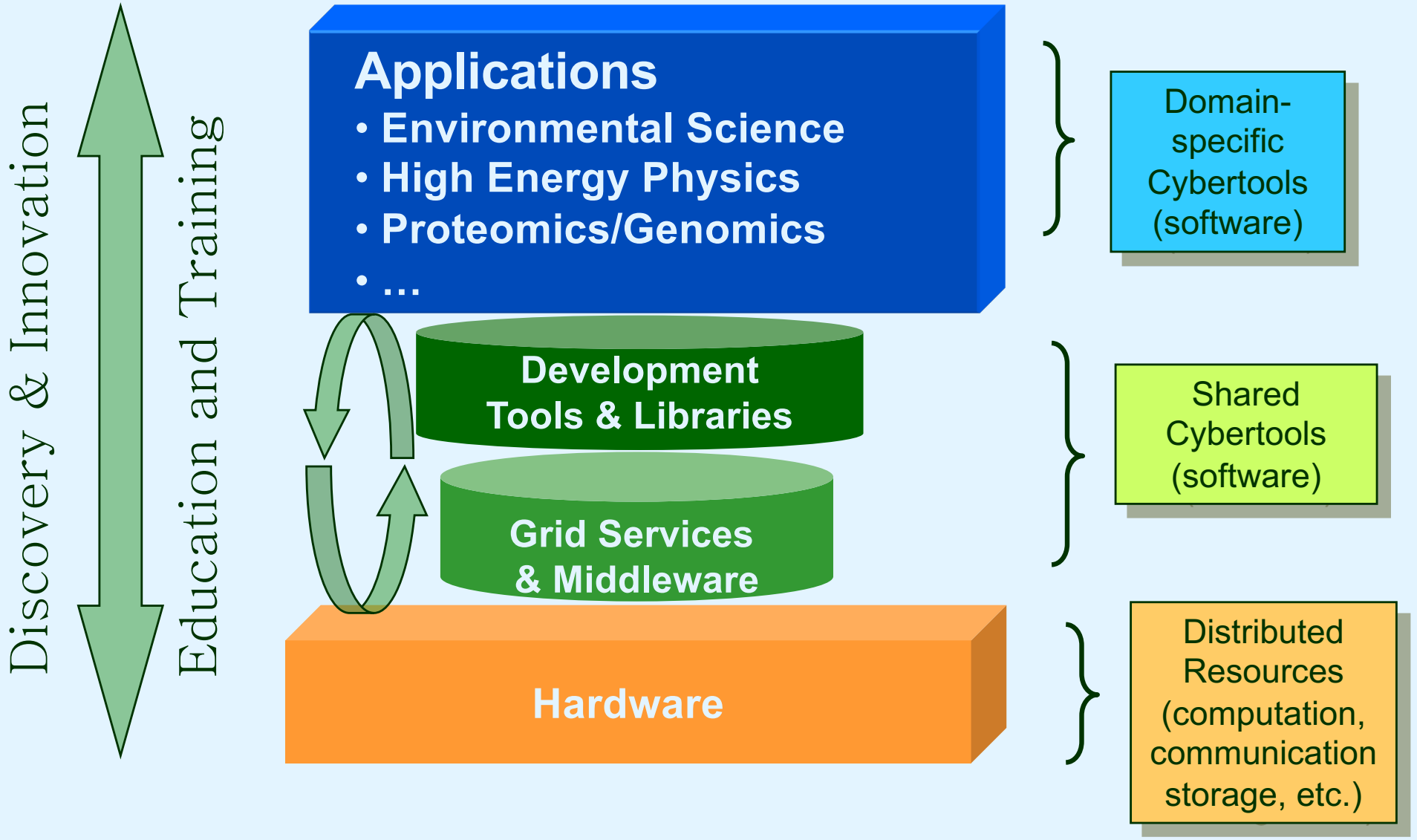
1. Archival repositories
2. Digital libraries
3. Data and information integration
4. Computational resources
5. Sensor networks
6. Optical networking

# On The Path to Knowledge



# Integrated CI System

*meeting the needs of a community of communities*



# Challenges

- Institutional & Infrastructural Ecology
  - Technological change more rapid than institutional change
- Broadening Participation
- Community-Building
- Seamless Integration of New and Old
  - Balancing upgrades of existing and creation of new resources
  - Legacy data/models
- Providing sustainable support

# *Please Send Us Your Next Bill Gates*

- We love Chinese students
- We know Chinese students are facing challenges in coming to the U.S. such as visa problems
- Please encourage your students to come to the U.S. universities
- Please continue send your best students to the U.S. for graduate and undergraduate study
- We need to create opportunities for next generation of U.S. and Chinese cyber-scientists to meet, train, educate and work together


# *Where to Go From Here*

- Continue and strengthen US-China coordination and collaboration in network, GRID research
- Identify technical areas for joint development
  - VOs, trust fabrics?
  - Monitoring/measurement, “total” performance?
  - Joint support for instruments and sensors
- Teach, Train, & Educate next generation of cyber developers and users
- Establish a global software (middleware) infrastructure to match the global network (fabric) infrastructure


Enabling the nation's future through discovery, learning and innovation