2009-01

SI 640 - Digital Libraries and Archives, Winter 2009

Conway, Paul

<http://hdl.handle.net/2027.42/64936>
http://hdl.handle.net/2027.42/64936
SI 640 Digital Libraries and Archives

Week 8 – Cyberinfrastructure
Dan Atkins and Paul Conway, contributors
“a new age has dawned in scientific and engineering research, pushed by continuing progress in computing, information, and communication technology, and pulled by the expanding complexity, scope, and scale of today’s challenges. The capacity of this technology has crossed thresholds that now make possible a comprehensive “cyberinfrastructure” on which to build new types of scientific and engineering knowledge environments and organizations and to pursue research in new ways and with increased efficacy.”

http://www.cise.nsf.gov/sci/reports/toc.cfm
Terms

• Cyberinfrastructure
  • infrastructure
  • cyber
• Cyberinfrastructure-enabled
  • knowledge communities (CKCs)
  • learning, research, engagement
Converging Streams of Activity

Collaboratories

Home Land Security
http://web.calit2.net/RiskReduction/index.html

Cyberscience

ACLS Panel

GRIDS (broadly defined)

2nd Edition
www.mkp.com/grid2

Science-driven pilots (not using above labels)

Removed logo of e-Science
http://www.nesc.ac.uk/

IT & Future of Higher Education
Cyberinfrastructure Goals

• More applications, capabilities, efficiency
• Reuse and multiple-use of designs; capture of commonality
• Spread of best practice
• Achieving interoperability
• Provision of tools and services
• Shared facilities
• Assistance and expertise
Networked Information (Knowledge) Society

Cyberinfrastructure-Enabled Knowledge Communities (CKCs)

Global Cyberinfrastructure

Global Information Infrastructure

R&D, Deployment of Digital Libraries

Institutions:
Libraries
Archives
Museums

Visions & Needs of Individuals, Communities

Application of Distributed Computing

Digital Information & Communication Technology (electro-optical-magnetic)
Some Names for CKCs

• Co-laboratory, Collaboratory
• Grid Community
• e-X Community (as in e-science)
• Cyber-X Community (as in cyberscience)
• Community Gateways or Portals
• Virtual Community, Virtual Organizations, e.g. (Inter) National Virtual Observatory
Cyberinfrastructure

<table>
<thead>
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<th>Community-Specific Knowledge Environments for Research and Education</th>
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Base Technology: computation, storage, communication

\(\text{cyberinfrastructure: hardware, software, services, personnel, organizations}\)
Core Middleware

- **Identity and Identifiers** – namespaces, identifier crosswalks, real world levels of assurance, etc.
- **Authentication** – campus technologies and policies, interrealm interoperability via PKI, Kerberos, etc.
- **Directories** – enterprise directory services architectures and tools, standard objectclasses, interrealm and registry services
- **Authorization** – permissions and access controls, delegation, privacy management, etc.
- **Integration Activities** – open management tools, application of virtual, federated and hierarchical trust, enabling common applications with core middleware
## Cyberinfrastructure

Community-Specific Knowledge Environments for Research and Education  
(*collaboratory, co-laboratory, grid community, e-science community, virtual community*)

Customization for discipline- and project-specific applications

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Base Technology: computation, storage, communication

= cyberinfrastructure: hardware, software, services, personnel, organizations
Japanese Earth Simulation Center

Removed images produced by the Japanese Earth Simulation Center
Virginia Tech Terascale Cluster
(1,100 Mac G5s)

Removed images of the computer cluster at Virginia Tech

http://computing.vt.edu/research_computing/terascale/
## Cyberinfrastructure

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Base Technology: computation, storage, communication

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NEESgrid
Earthquake Engineering Collaboratory

Removed image that represented the structure of the grid.
Embedded Sensors: R&D and Use

Ocean Research Interactive Observatory Networks


National Ecological Observatory Network (NEON)

http://www.cens.ucla.edu/index.html

Removed trademarked logos


Removed trademarked logos
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**Networking, Operating Systems, Middleware**

**Base Technology: computation, storage, communication**

= cyberinfrastructure: hardware, software, services, personnel, organizations
Electronic Visualization Lab

Removed [http://www.evl.uic.edu](http://www.evl.uic.edu) banner.

Tele-Immersive Collaboration in the CAVE Research Network

Removed photographs of the Lab.
Cyberinfrastructure

Community-Specific Knowledge Environments for Research and Education
*(collaboratory, co-laboratory, grid community, e-science community, virtual community)*

Customization for discipline- and project-specific applications

- High performance computation services
- Data, information, knowledge management services
- Observation, measurement, fabrication services
- Interfaces, visualization services
- Collaboration services

Networking, Operating Systems, Middleware

Base Technology: computation, storage, communication

= cyberinfrastructure: hardware, software, services, personnel, organizations
Time-Space Collaboration

Time

Same

Physically together...

Drop in lab, physical library, museum

Different

Audio, chat, video conference, group applications

Email, threaded-discussions, shared files...

Place

Same

Different

distance matters  beyond being there
# Cyberinfrastructure

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Networks, Operating Systems, Middleware

Base Technology: computation, storage, communication

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Information Services for CKCs

• Online access to complete credentialled, archival literature.
• Stewardship and curation services for enormous collections of scientific data.
• Digital repositories for diverse digital objects as instructional material and works in progress.
• Digitized special collections.
• More continuous (vs. batch) and open forms of scholarly communication.
• Individual and community customization information services.
Cyberinfrastructure is a First-Class Tool for Science
Our Cultural Commonwealth, 2006
Problems of Scholarly Publishing, 1959
Scholarly Communication, 1979
Commission Members

Paul Courant  
Provost, Economics  
University of Michigan

Sarah Fraser  
Art History  
Northwestern University

Mike Goodchild  
Geography  
UC Santa Barbara

Margaret Hedstrom  
School of Information  
University of Michigan

Charles Henry  
VP & CIO  
Rice University

Peter B. Kaufman  
VP, Innodata-Isogen  
President, Intelligent Television

Jerome McGann  
English  
University of Virginia

Roy Rosenzweig  
History  
George Mason University

John Unsworth (Chair)  
Library and Information Science  
University of Illinois, Urbana-Champaign

Bruce Zuckerman  
Religion  
University of Southern California
Potential of Cyberinfrastructure

“New information technologies empower research on traditional objects of study.”

ACLS Report, p. ii
What is Cyberinfrastructure?

- Discipline-specific software
- Expertise
- Best Practices
- Tools
- Collections
- Policies
- Collaborative environments

ACLS Report, p. 6
Necessary Characteristics

• Accessible as a public good
• Sustainable
• Interoperable
• Facilitate collaboration
• Support experimentation
Recommendations

1. Invest in cyberinfrastructure as a strategic priority.

2. Develop public and institutional policies that foster openness and access.

3. Promote cooperation between the public and private sectors.
Recommendations (cont’d)

4. Cultivate leadership.

5. Encourage digital scholarship.

6. Establish national centers to support scholarship that contributes to and exploits cyberinfrastructure.
Recommendations (cont’d)

7. Develop and maintain open standards and robust tools.

8. Create extensive and reusable digital collections.