Effective Communication and Scientific Cyberinfrastructure

Geoffrey C. Bowker, University of California, Irvine
introduction
“History and Theory of Infrastructure: Lessons for New Scientific Cyberinfrastructures” (University of Michigan, Sept 2006; NSF Grant #0630263)

*Understanding Infrastructure: Dynamics, Tensions, and Design* (January 2007)
Knowledge Infrastructures: Intellectual Frameworks and Research Challenges

Report of a workshop sponsored by the National Science Foundation and the Sloan Foundation

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Cyberinfrastructure (our working def’n) –

“the set of organizational practices, technical infrastructures, and social norms that collectively provide for the smooth operation of scientific work at a distance”
Knowledge infrastructures are robust internetworks of people, artifacts, and institutions which generate, share, and maintain specific knowledge about the human and natural worlds. Like all infrastructures, they are composed of many systems and networks, each with its own unique dynamics. Because shared, reliable knowledge is among human society’s most precious resources, the institutional elements of knowledge infrastructures – such as universities, libraries, and scientific societies – have typically adopted conservative, slow-changing forms. Yet recently key elements of knowledge infrastructures, especially information technologies and communication practices, have changed very rapidly, creating a growing sense of disarray and disjuncture between established forms and new and exciting, but unproven, possibilities. We argue for the need to consider knowledge infrastructures as wholes, rather than focusing only on their most rapidly evolving elements.
speaking truth to power
AN ESSAY
ON THE
PRINCIPLE OF POPULATION;
OR,
A VIEW OF ITS PAST AND PRESENT EFFECTS
ON
HUMAN HAPPINESS;
WITH
AN INQUIRY INTO OUR PROSPECTS RESPECTING THE FUTURE REMOVAL OR MITIGATION OF THE EVILS WHICH IT OCCASIONS.

BY
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VOL. I.

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JOHN MURRAY, ALBEMARLE STREET.
MDCCCLXXVI.
Caribou in Canada
• Despite recent estimates that the Earth’s ecological systems are worth about $33 trillion annually, the comparatively low cost of maintaining the biological diversity that underpins these services is ignored. (Williams, Gaston et al. 1994)

• In common with all agricultural crops, the productivity of modern wheat and corn is sustained through constant infusions of fresh germplasm with its hereditary characteristics ... . Thanks to this regular ‘topping up’ of the genetic or hereditary constitution of the United States’ main crops, the Department of Agriculture estimates that germplasm contributions lead to increases in productivity that average around 1 percent annually, with a farm-gate value that now tops $1 billion... (Myers 1997)
However, there are great difficulties in predicting future patterns of diversification ... in patchy and changing environments, particularly as projected human-driven changes are unlikely to reflect simply those of the past. Following Erwin and Brooks et al.’s arguments, the perverse result of extrapolating future diversification ‘potential’ from recent history is that it leads to favoring conservation of species that are particularly similar to another (e.g. faunas with large numbers of rodents), in preference to biotas with more dissimilar and diverse species. (Williams, Gaston et al. 1994)
For example, a dandelion and a giant redwood can be seen to represent a richer collection of characters in total, and so greater diversity value, than another pair of more similar species, a dandelion and a daisy ... . This shows how the phenotypic characters (or the genes that code for them) could provide a 'currency' of value for biodiversity. Pursuing this idea, we will then need to maximize richness in the character currency within the conservationists' 'bank' of managed or protected areas (History 2002).
Concepts like stability and ecosystem are ambiguous and defined in contradictory ways. In fact there is no such thing as an integrated, equilibrial, homeostatic ecosystem: It is a myth...! (O'Neill 2001)
GEON: GEOsciences Network

Physical model

Portal (login, myGEON)
- Registration
- GEONsearch
- GEONworkbench
  - Community Modeling Environment

Core Grid Services
- Authentication, monitoring, scheduling, catalog, data transfer, replication, collection management, databases

Physical Grid
- RedHat Linux, ROCKS, Internet, I2, OptIPuter (planned)

Modeling Environment

HPCC

Data

Model results
Participatory Urban Sensing: Vision Video
We are pleased to announce our new video piece that envisions how communities can use everyday mobile phones to gather data about things that are important to them. This vision is being made into reality right now by the center’s researchers, who are working on projects such as the Personal Environmental Impact Report (PEIR).

- YouTube Video
- Urban Sensing Website
- Press Release, [PDF]

"We envision a world where researchers, students, industry and government routinely use distributed sensor and actuator networks to understand and control both natural and artificial systems."

- What is ENSS
- Imagine if...
- Latest Reports

CENS 7th Annual Research Review
October 28, 2009 -- 8:30 AM - 2:30 PM
Location: Covel Commons - Grand Horizon Room
More event info... | RSVP

MORE UPCOMING EVENTS
CENS Technical Seminar Series: Andreas Krause
Optimizing Sensing from Water to the Web
OCTOBER 16, 2009 -- 1:00 PM - 2:00 PM
Location: BH 4760
Read More

CENS SRC URO Scholars Program
24-SEP-09
Apply today to become a CENS SRC URO Scholar! CENS is accepting applications for UCLA undergraduates to apply to the 2009-2010 CENS SRC URO Scholars Program. Deadline: October 16, 2009
Read More

Deborah Estrin awarded 2009 ACM Sigmobile Outstanding Contribution Award
11-SEP-09
Congratulating to CENS’s Director, Deborah Estrin for being this year’s winner of the ACM Sigmobile Outstanding Contribution Award! Sigmobile is the Association of Computing Machinery’s special interest group on wireless and mobile communications.

Recent Events

CENS Technical Seminar Series: Peter Capone-Newton
Addressing Health Disparities with Participatory and Personal Mobile Sensing
OCTOBER 9, 2009 -- 1:00 PM - 2:00 PM
Location: BH 4760
Read More

Slashdot.org - Your Rights Online: Privacy, Mobile Phones, Ubiquitous Data Collection
03-SEP-09
CENS’ Katie Shilton’s article is featured on slashdot. Read More
Imagine if...

Buildings could detect their own structural faults and respond in real time to seismic events.

Institutions and individuals could reliably measure toxic levels at very low concentrations, and trace contamination back to its source.

Buoys along the coast could alert surfers, swimmers, and fishermen to dangerous bacterial levels in the water.

We could infuse complex and endangered ecosystems with chemical, physical, acoustic, and image sensors to continuously track global change.

Dangerous bacterial and contaminant levels could be detected on the farm through dense sampling, instead of “in the field” through sparse sampling.
LTER Network

- The Long Term Ecological Research (LTER) Network is a collaborative effort involving more than 1000 scientists and students investigating ecological processes over long temporal and broad spatial scales.
- The Network promotes synthesis and comparative research across sites and ecosystems and among other related national and international research programs.
- The National Science Foundation established the LTER program in 1980 to support research on long-term ecological phenomena in the United States.
- The 26 LTER Sites represent diverse ecosystems and research emphases.
- The LTER Network Office coordinates communication, network publications, and research-planning activities.

Featured Site: Luquillo LTER

Other Featured Sites

Featured Site Homepage: http://luq.ornl.gov
LTER Site Profile: http://www.ornl.edu/inter/LTER

Luquillo LTER studying recent environmental changes

Tropical environments are changing fast due to deforestation and regrowth, urbanization, climate change, and other forces. The consequences are immense for the whole array of ecosystem services that people require. The Luquillo Long Term Ecological Research Program (LUQ) is tackling these issues in Puerto Rico. LUQ began in 1988 and focused on natural disturbances (hurricanes, landslides, droughts, floods) and ecosystem responses to them. That work revealed patterns of resistance and resilience to cycles of natural disturbance. But how will the tropics respond to directional changes in land use and climate?

The LUQ study region is well-suited to answering this question. First, urbanization has been rapid, and there is a strong gradient of land use from El Yunque National Forest to the city of San Juan with 1.5 million people. Along this gradient, for example, LUQ is studying how urbanization affects stream chemistry and organisms. Second, there is also a strong gradient in climate, from the coast to the peaks of the Luquillo Mountains at 1076 meters. Along this gradient, for example, LUQ is studying how climate appears to affect the distribution of tree species. Understanding these stream and forest changes in space helps us predict changes in time.

LUQ takes four approaches to understanding environmental change: long-term
Welcome to the Online Canon of Greek Authors and Works

The TLG® Canon of Authors and Works is a searchable database and a bibliographic guide to the authors and works included in the TLG® Digital Library. It provides biographical information about each author (i.e., date by century and epithets that identify the place of birth or literary activity and the genre each author is associated with). Each author is identified by a four-digit number; each work is identified by a three-digit number. For example, Homer is author 0012. Homer’s Iliad is identified as 0012.001. The structure of each text is further identified by its particular citation. To use the same example, line 1 in book 1 in Homer’s Iliad is 0012.001.1.1. The TLG Canon is a well-established standard used by all digital projects across the globe.

The Canon represents many years of research conducted by TLG staff members. A printed version of the Canon (Luci Berckowiz and Karl A. Squier, Thesaurus Linguae Graecae: Canon of Greek Authors and Works, 3rd edition, Oxford University Press) was published in 1999. The Online Canon, now edited by Project Director, Maria Panteli, has grown substantially since the early 1990s, especially as the TLG expanded into the Byzantine period. The Online Canon database currently contains over 12,000 bibliographical records and is regularly updated to include new entries as they are added to the TLG® Digital Library. For information or suggestions, please contact Maria Panteli (mpanteli@uci.edu).

To view titles in Greek, a polytonic Greek font must be installed on your computer.

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the design space
Infrastructural dynamics: tracks & trajectories

• Momentum and path dependencies
• Systems, networks, and internetworks

• What are the break points in CI development? When, and by what mechanisms, does CI get ‘locked in’?
Infrastructural dynamics: transfer, travel & interconnection

• Growing to scale.
• What’s in a standard?
• The power of gateways

• What / who are the gateway technologies, organizations, and people in CI development? What steps can be taken to support / extend such bridging work?
Infrastructural tensions: interest & exclusion

• The *insides* and *outsides* of infrastructure

• Infrastructural orphans

• *Who gains and who loses through CI development? What are the available mechanisms for inclusion and redistribution?*
Infrastructural tensions: innovation & incumbency

- Infrastructure and entitlement
- Problems of ‘capture’
- *Who are the ‘incumbents’ of CI development? How can the interests of existing constituencies be balanced against those of innovation and ‘new entrants’?*
Infrastructural tensions: data & working epistemologies of the sciences

• What’s data?
• Whose data?
• Who to trust?
• The problem of metadata.

• What existing data cultures / practices characterize the various CI domain sciences? How can CI be grown to accommodate, reflect, and support these?
Designing (cyber)infrastructure?

From *design* to *strategic action*...

From *blueprints* or *maps* to *principles of navigation*...
Boundaries between social and technical work can often be shifted in either direction.
conclusion
<table>
<thead>
<tr>
<th>Mode-1 science</th>
<th>Mode-2 science</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic</td>
<td>Academic and social</td>
</tr>
<tr>
<td>Mono-disciplinary</td>
<td>Trans- and disciplinary</td>
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<tr>
<td>Technocratic</td>
<td>Participative</td>
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<td>Certain</td>
<td>Uncertain</td>
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<tr>
<td>Predictive</td>
<td>Exploratory</td>
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</tbody>
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- interdisciplinary
- communication
- natural science
- experiment
- biodiversity
- hands on
- lab
- biology
- fun
- field
- fun
- 1st century
- lab
- 21st century
- species
- ecosystems
- inquiry
- experiential
- investigation
- migration
- science
- education
- problem solving
- environmental science
- conservation biology
- distance learning
- habitat
- exploration
- questions
- migration
- creativity
- inquiry
- examine
- natural science
- biodiversity