

*Draft Prospectus*

CLEAR Consortium - Cyberinfrastructure-Enabled Learning, Engagement and Research

## **Cyberinfrastructure and the future of the World Research University**

### **Introduction**

Great research universities are faced with profound shifts in the global environment they inhabit: the emerging knowledge economy, globalization, technological innovation and worldwide social and political concerns. These forces present a set of dangers and opportunities to which universities must adapt. They also suggest the notion that great research universities should – and perhaps must – play a new and more deeply engaged role in the world.

The relationship between societal change and the institutional and pedagogical footing of research universities is clear. The knowledge economy is demanding new types of learners and creators. Globalization requires thoughtful, interdependent and globally identified citizens. New technologies are changing modes of learning, collaboration and expression. And widespread social and political unrest compels educational institutions to think more concertedly about their role in promoting individual and civic development. Institutional and pedagogical innovations are needed to confront these dynamics and insure that the canonical activities of universities – research, teaching and engagement – remain rich, relevant and accessible.

New technologies – cyberinfrastructure, in particular - afford a suite of opportunities to meet that challenge. Cyberinfrastructure enables new communication structures independent of distance and time, resulting in novel environments for research, teaching and engagement. These new environments can augment what universities do exceptionally well – creating residential learning communities – to build, explore and apply knowledge in pioneering ways to meet changing societal needs and realities.

### **The CLEAR Consortium**

The CLEAR Consortium will focus explicitly on the major challenges impinging on great research universities and the role cyberinfrastructure can play in addressing them. It will serve as a vehicle for exploring the space of opportunity afforded by cyberinfrastructure, in all of its complexity and dynamism. CLEAR Consortium members will jointly investigate and catalyze emerging technological and social infrastructures to research, engage and learn in new ways. CLEAR will also explore institutional design strategies to respond to the restructuring of higher education and new models of delivering education. It will facilitate coordination and cooperation around the use of cyberinfrastructure. CLEAR may launch and evaluate pilot projects and develop a research agenda to inform its activities. It may also serve a clearinghouse function to assemble and distribute key resources and documents.

CLEAR will investigate the need for and promise of cyberinfrastructure as it relates to learning, engagement and research. Examples of cyberinfrastructure's applications to all three areas are elucidated below. While learning, engagement and research are described separately, there is

abundant complementarity between those activities that will be a central theme of CLEAR discussions.

## Cyberinfrastructure and the Future of Learning

The emergence of cyberinfrastructure presents an unprecedented opportunity for universities to enhance student learning in dynamic, powerful ways. Combined with pedagogical innovations and appropriate social infrastructure, cyberinfrastructure affords new forms of knowledge creation and active learning experiences. Rather than replacing traditional same-time/same-place approaches to education, new technologies can enrich how, what, when and where students learn. Such pedagogical innovation is crucial as universities are challenged to both respond to and influence the learning styles and educational needs of a new generation of learners shaped by digital technologies.

Cyberinfrastructure presents opportunities to enhance learning in the following ways:

- **How students learn.** The realities of the digital age require universities to concentrate on the learning process as much as on the content that is being delivered. The emergence of cyberinfrastructure has coincided with a growing recognition that conventional forms of teaching are out of step with both the learning styles and learning needs of new generations of students. Constructivist theories of learning demonstrate that deep, authentic learning happens best in student-centered, social, and reflective educational environments. Constructivist principles are especially important in understanding the learning styles of new generations for whom digital technologies are at the heart of communication, discovery and play. John Seeley Brown has used the term “bricolage” to describe digital age shifts in student learning, reasoning and action.<sup>1</sup> Knowledge is constructed through experimentation, tinkering, and sharing – through meaningful *participation* in a learning experience.

Cyberinfrastructure creates opportunities for lively, intense forms of participation that augment conventional instruction. Science and engineering departments are modeling such hybrid approaches to courses. Studio teaching, for example, combines lecture and lab formats in a technology enhanced learning environment that supports group work and extensive faculty-student interaction. The result is a more flexible, learner-centered experience. Cyberinfrastructure also facilitates remote access to sophisticated scientific instruments that allow students to learn by doing in fields such as astronomy and physics.

- **What students learn.** Higher education institutions have long positioned themselves as gateways to knowledge. Yet we now inhabit a market environment in which knowledge “gateways” are ubiquitous, in the form of web portals, for-profit and franchised universities,

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<sup>1</sup> **John Seeley Brown**, “Learning in the Digital Age,” in Maureen Devlin, Richard Larson, and Joel Meyerson, eds., *The Internet and the University: Forum 2001* (Boulder, Colo.: EDUCAUSE and The Forum for the Future of Higher Education, 2002), 71–72, <<http://www.educause.edu/forum/ffpiu01w.asp>> (retrieved May 18, 2004).

libraries, and NGOs. Promising access to knowledge alone is no longer a defensible position for universities, nor is it a sufficient strategy for creating informed, innovative citizens. Leaders and participants in the new global economy must be collaborative, resourceful, improvisational and analytic. They must know not only how to access and retain information, but how to evaluate, synthesize and explicate its meaning. They must also have the intellectual skills and social framework to engage thoughtfully in a complex, interconnected world.

Cyberinfrastructure is opening up more experiences to help students develop these skills. In environmental science, for example, advanced computational simulations and climate modeling bring to life abstract knowledge and make raw data immediately relevant to our daily lives and decisions. Powerful web-based collaboration platforms allow students and scholars from universities across the world to be participants in one classroom, bringing to bear new perspectives and experiences that reflect – and encourage students to be accountable to – our changing global reality. Multimedia tools provide an opportunity for students develop new forms of literacy and express themselves in hypertextual mediums.

- **When and where student learn.** Universities are committed to being holistic learning communities – settings in which as much learning takes place outside the classroom as within. We seek to make our campuses and residence halls rife with opportunities to illuminate in-class learning. We also provide opportunities for students to develop social and cultural horizons to serve them in their careers and as citizens of a complex world. The community-learning dimension of universities has as much value as the academic.

Cyberinfrastructure supports experiential, spontaneous learning that takes place outside the classroom and makes a campus a true learning community. Online chats with peers down the hall or across campus enrich social relations and prompt spur-of-the-moment collaboration. Wireless networks that span classrooms, libraries, student housing and social spaces extend learning to all corners of campus. And web-based course management systems allow access to course materials, online discussions, and collateral learning material day and night.

- **From whom students – and faculty – learn.** The flexible, dynamic learning opportunities made possible by cyberinfrastructure also support students, faculty, researchers and others to contribute in new roles. New technologies present faculty with an exciting intellectual undertaking: designing learning *environments* that augment conventional classroom instruction. Technologies that support group-based work give students a chance to learn directly from each other. And collaboratories and Grid science allow students to contribute to research activities in authentic, powerful ways, often while being mentored by researchers or practitioners at other institutions.

Cyberinfrastructure also makes more permeable our institutional barriers and in turn, introduces new, diverse sources of expertise and knowledge to our university community. The same technologies that facilitate communication across campus relax constraints on barriers of time and distance to individuals and institutions across the globe. On an individual level, technology allows students and instructors from multiple, distributed universities to be

co-participants in the same course. On an institutional level, cyberinfrastructure creates multiple linkages between institutions, faculty and students in which local learning is enriched by global interactions.

## **Cyberinfrastructure and the Future of Engagement**

The emergence of cyberinfrastructure also poses new opportunities for universities to fulfill their missions of engagement to address complex social problems. New technologies allow new forms of collaboration and networking that impact the design, deployment and sustainability of university-community partnerships. And just as cyberinfrastructure has the capacity to make permeable our institutional barriers, it can diversify the communities we serve and with which we identify. It can also amplify the educational impact of universities by providing broader access to fundamental resources such as classes, libraries, research and technical resources.

Cyberinfrastructure presents opportunities to deepen engagement in the following ways:

- **Designing, building and sustaining community collaborations.** Successful collaborations acknowledge that community building happens through networks of individual relationships. The centrality of these personal relationships will never be replaced, but communication technologies can transform the process by which those relationships are developed and the resources needed to cultivate them. This is crucial for collaborations beyond a university's local geographic area. Technologies can support a long-term vision for geographically distributed partnerships - building from distant, small forms of collaboration to larger, more trusting engagements over time. As the engagements evolve and the social infrastructure of the partnership matures, technologies such as email, web conferencing and collaboration tools provide an alternative to costly same-time, same-place visits. These technologies help create multiple linkages, points of contact and synergies between partners - key characteristics of sustainable engagements.

Similar technologies can also support a participatory design processes in distributed partnerships. Coupled with adequate social leadership and facilitation, participatory design laboratories can help harmonize the interests of stakeholders and define mutually beneficial outcomes.

Some forms of engagement may not require long-term, incremental relationship-building or sustainability strategies. Cyberinfrastructure strengthens these engagements in other ways. In the case of a humanitarian health crisis, for example, cyberinfrastructure enables teams of university experts to be rapidly formed and deployed. It also supports their work in the field, facilitating access to resources and know-how in distant settings.

- **Amplifying educational impact.** Cyberinfrastructure can also bring educational opportunities to new communities locally and around the world that do not have access to high quality learning. But technology-mediated distance education must be coupled with modifications to teaching styles to extend meaningful, dynamic learning experiences – not just content delivery – to new communities of learners. A studio-like environment with

appropriate instructor support in both locales, robust collaboration platforms, and access to rich information resources can greatly enhance distributed classroom initiatives. Unlike conventional delivery of distance education, these technologies and teacher supports help to bring people together rather than enforce distance.

Expanding access to high quality education must be coupled with other deep forms of engagement that build communities capacity where there is a paucity of public wealth. Again, cyberinfrastructure is a key resource. It can play a role in establishing and maintaining broad distributed alliances. It can also tap local and distant expertise, knowledge, and resources in service of community development in a cost-effective way.

- **Harmonizing research activities with community needs.** New technologies hold promise in helping university-based thought and knowledge centers sense emerging problems to which they should be attuned. They can also help transfer new knowledge into communities, in the form of curricula, course materials, tutorials or software. Similarly, cyberinfrastructure can create a tighter, more efficient feedback loop between researchers and practitioners. Policy collaboratories are a compelling example of cyberinfrastructure supporting Pasteur Quadrant-type research, with direct participation by and short-term dividends to practitioners.

## **Cyberinfrastructure and the Future of Research** [Copy to be generated by Dan or Liz]

### **The Spectrum of Opportunity and Challenge**

Cyberinfrastructure has the potential to propel great research universities toward new horizons in teaching, engagement and research in service of individual and community development. Yet the promise of enriched, diversified participation and collaboration in the act of knowledge creation is beset with important and challenging questions. Explorations of new horizons must be tempered with concern for the design and character of learning institutions. The CLEAR Consortium will explore salient questions of educational and institutional design, including:

- Can we empower university and community partners – particularly those in developing countries - to have the infrastructure to participate?
- What is the competitive/market impact of the restructuring of higher education and new models of education delivery (virtual universities, corporate universities, consortia, etc.)?
- How can cyberinfrastructure link and leverage not only individuals, but institutions?
- What are the socio-economic impacts of deep, global engagement and the de-elitizing of higher education on developing countries? How will new structures and technologies impact demographics?
- How can cyberinfrastructure build local advantage and respond directly where the need is?

- Are engagement activities at odds with the economic imperatives of a fierce global competition?
- What are the tradeoffs between commercial and intellectual interests?
- What are institutional barriers to a new species of world research university? (e.g. transfer credit hours, bundled tuition, oversight and credentialing.)
- Should/can universities scale out traditional educational models or new models?
- How can cyberinfrastructure mitigate the tension between teaching, engagement and research by elucidating and leveraging complementarities?
- How can new technologies support improved teaching, as well as improved learning?
- What are the security implications of vastly interconnected cyberinfrastructures?
- How can the academy mobilize around these shifts?

### End draft ###

Other potential sections:

CLEAR Consortium Organizational Structure

Membership Benefits

Membership Levels