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Coalition for Networked Information

Introduction &
Program Plan
2014-2015

CNI STEERING COMMITTEE, 2014-2015

John P. Barden, University of Rochester, representing EDUCAUSE, 2015-2016

Daniel Cohen, Digital Public Library of America, at large member, 2014-2015

Joseph D. Combs, Vanderbilt University, representing EDUCAUSE, 2014-2017

Rebecca A. Graham, University of Guelph, representing ARL, 2013-2016

Geneva L. Henry, George Washington University, representing ARL, 2014-2017

Thomas C. Leonard, University of California, Berkeley, representing ARL, 2012-2015

Clifford A. Lynch, Coalition for Networked Information, *ex officio* member

Glenda Morgan, University of Illinois at Urbana-Champaign, representing EDUCAUSE, 2013-2015

Diana G. Oblinger, EDUCAUSE, *ex officio* member

Elliott Shore, ARL, *ex officio* member

John Unsworth, Brandeis University, representing EDUCAUSE 2012-2015

Donald J. Waters, The Andrew W. Mellon Foundation, at large member, 2014-2015

CALENDAR OF KEY MEETINGS

Designing Libraries III, Calgary, Alberta, Canada – September 28-30, 2014

ARL Forum: *Wanted Dead or Alive: The Scholarly Monograph,* Washington, DC - October 9, 2014

2014 Fall Membership Meeting, Washington, DC – December 8-9, 2014

10th International Digital Curation Conference: *Ten Years Back, Ten Years Forward: Achievements, Lessons and the Future for Digital Curation,* London, England – February 9-12, 2015

2015 Spring Membership Meeting, Seattle, WA – April 13-14, 2015

2015 Fall Membership Meeting, Washington, DC – December 14-15, 2015

2016 Spring Membership Meeting, San Antonio, TX – April 4-5, 2016

2016 Fall Membership Meeting, Washington, DC – December 12-13, 2016

CNI STAFF

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Coalition for Networked Information

An Introduction &
Program Plan 2014-2015

Mission

The Coalition for Networked Information (CNI) promotes the transformative promise of networked information technology for the advancement of scholarly communication and the enrichment of intellectual productivity.

ABOUT CNI

Background and Leadership

The Coalition for Networked Information (CNI), a joint initiative of the Association of Research Libraries (ARL) and EDUCAUSE, promotes the use of digital information technology to advance scholarship and education. In establishing the Coalition under the leadership of founding Executive Director Paul Evan Peters, our sponsor organizations recognized the need to broaden the community's thinking beyond issues of network connectivity and bandwidth to encompass digital content and advanced applications to create, share, disseminate, and analyze such content in the service of research and education. Reaping the benefits of the Internet for scholarship, research, and education demanded–and continues to demand–new partnerships, new institutional roles, and new technologies and infrastructure. CNI seeks to advance these collaborations, to explore these new roles, and to catalyze the development and deployment of the necessary technology base.

Since its founding in 1990, CNI has addressed a broad and diverse array of issues related to the development and use of digital information in research and education environments. As the premier organization fostering connections and collaboration between library and information technology communities, we represent the interests of a wide range of member organizations from higher education, publishing, networking and telecommunications, information technology, government agencies, foundations, museums, libraries, and library organizations.

CNI is supported entirely from dues paid by its over 200 member institutions. Membership in the Coalition is open to all organizations–both for-profit and not-for-profit–that share CNI's commitment to furthering the development of digital information in the networked environment. We view our members as partners in advancing the Coalition's mission. Fall and spring membership meetings are CNI's flagship events, bringing together hundreds of representatives for a comprehensive update on critical issues.

CNI's program is guided by a Steering Committee to which sponsor organizations ARL and EDUCAUSE each appoint three representatives drawn from their member leadership; the current roster of Steering Committee members appears on the inside front cover of the printed Program Plan and on our website. Three "at large" representatives on the Steering Committee contribute additional perspectives. The chief executives of ARL, EDUCAUSE, and CNI serve as *ex officio* members of the committee.

CNI Executive Director Clifford Lynch has led the organization since 1997. Joan Lippincott, CNI's Associate Executive Director, has served since fall 1990. For more information about the Coalition's history and contributions, see the CNI website, www.cni.org.

Program Themes

CNI's work is structured around three central themes that we believe are the essential foundations of the vision of advancing scholarship and intellectual productivity:

Developing and Managing Networked Information Content

The Coalition has played a central role in ensuring that the network richly engages the needs of scholarship, teaching and learning. We bring together many diverse groups that create and manage content, and work with these communities to advance the deployment and stewardship of digital information resources. Changes in scholarly practices (particularly those shorthanded by "e-science" or "e-research") and the development of large-scale digitized collections require a close and continuing examination of information creation, aggregation, exchange, reuse, and preservation throughout the research and education community and society broadly; these developments, and the evolving roles of higher education institutions and cultural memory organizations in facilitating

and supporting them, are a central part of the CNI agenda. Working within these contexts and others, CNI furthers the development of economic, policy, social and legal frameworks to sustain the creation and management of digital information and to facilitate its access.

Transforming Organizations, Professions, and Individuals

The pervasiveness of ubiquitously accessible digital information is transforming institutions, professions, and the practices of learning and scholarship. CNI focuses on the unprecedented need for collaboration among libraries, information technology and instructional technology groups, faculty, museums, archives, university presses, and other units in order to achieve success in this environment. In addition, we promote new alliances and partnerships with publishers, information technology and network service providers, scholarly societies, government, and other sectors. Organizations must understand their constituencies and adapt their services and facilities to current needs; they must develop and share new strategies, policies, and best practices. Professions need to develop new competencies and enter into new dialogues that cross traditional disciplinary boundaries. CNI seeks to facilitate these collaborations and dialogues and to help professions and institutions work together in program strategy formulation.

Building Technology, Standards, and Infrastructure

The networked information environment relies on the development and deployment of standards and infrastructure components in order to enable the creation, discovery, use, and management of digital information on the Internet. The ability to use collections of resources in a unified, consistent fashion is essential and requires a continuing focus on interoperability of services. At the same time, promising new technologies need to be explored, assessed and tested, and sometimes adapted to the needs of the CNI community. No one institution acting alone can build the needed infrastructure or explore the full range of new technologies as they become available; it requires a coordinated, community-wide effort that also reaches out to other communities, such as the world of e-research. CNI seeks to highlight links between technology and policies at all levels, to offer a context for collaborative experiments and test beds, and to serve as a focal point for sharing knowledge about new technologies.

The specific program initiatives that further CNI's themes evolve from year to year. The initiatives and strategies planned for 2014-2015 are described in the Program Plan portion of this publication; most build upon and continue efforts already underway. Many of the initiatives seek to make strategic progress relevant to more than one theme.

It is important to recognize that the digital information environment is still changing rapidly. CNI is continually adapting its activities in response to new developments and opportunities. Indeed, CNI believes agility is essential in the current environment and invites a continuous dialogue with its members on the need for additional program initiatives. Because of this, the 2014-2015 Program Plan should be viewed as a snapshot of our thinking about priorities and opportunities as of late 2014 that will inevitably develop further during the coming program year.

Policy & Consultative Activities

CNI acts as an important and respected voice on behalf of our community in a wide range of national and international policy venues. This is accomplished through our participation in the ongoing scholarly dialogue; through collaboration with key funding agencies, such as the National Science Foundation (NSF), the Institute of Museum and Library Services, the National Endowment for the Humanities, The Andrew W. Mellon Foundation, the Alfred P. Sloan Foundation, and Jisc; through work on advisory groups of organizations such as ITHAKA, OCLC, the American Library Association (ALA), and Microsoft Research; through service on numerous visiting and advisory committees for our member institutions; through contributions to standards efforts and standards organizations such as the National Information Standards Organization (NISO); and through participation in organizations such as the Networked Digital Library of Theses and Dissertations (NDLTD) and the Library Publishing Coalition.

Of particular note in this area are our recent contributions to the Library of Congress's National Digital Information Infrastructure and Preservation Program (NDIIPP) and the National Digital Stewardship Alliance, to various studies and programs conducted by the US National Research Council, particularly in conjunction with the Board on Research Data and Information (BRDI), the National Academies Developing a 21st Century Global Library for Mathematics Research study, the Campus Bridging Task Force of the NSF Advisory Committee on Cyberinfrastructure, the Blue Ribbon Task Force on Sustainable Digital Preservation and Access, the NSF-funded study on software sustainability, the Research Data Alliance (RDA), the Council on Library and Information Resources (CLIR) Committee on Coherence at Scale, the New Media Consortium's first *Horizon Report – Library Edition*, the Association of College & Research Libraries' Information Literacy Competency Standards for Higher Education Task Force, and the ALA Working Group on Libraries and Digital Content.

As a contributor and participant within a complex and dynamic ecosystem of organizations that share common interests, CNI works with Internet2 on advanced networking applications and standards; with CLIR on scholarly communication, cyberinfrastructure, and preservation issues; with the New Media Consortium on the exploration and use of new media and new technologies in higher education; with the Learning Spaces Collaboratory on development of principles for technology-enabled spaces that enhance learning; and with ALA on policy and professional development activities. We are deeply involved with some of the programs of our sponsor organizations, notably the EDUCAUSE Learning Initiative (ELI) and the EDUCAUSE Campus Cyberinfrastructure Initiative, and the recent SHared Access Research Ecosystem (SHARE) effort that ARL is leading in partnership with the Association of American Universities (AAU) and the Association of Public and Land-grant Universities (APLU).

In addition to specific initiatives to address CNI's overarching program themes, the Coalition actively conducts an ongoing program of collaboration and advocacy to advance the development of digital information and its role in transforming organizations and scholarly activities. To this end, CNI works with scholarly societies, government agencies, publishers, and others. CNI is also committed to leadership development within the community and contributes regularly to the CLIR Postdoctoral Fellows program and the ARL Research Library Leadership Fellows (RLLF) program.

On an international level, we collaborate with other organizations concerned with networked information, including the Digital Curation Centre (DCC) and Jisc in the UK, the German Initiative for Networked Information (DINI), the German Research Foundation (DFG), Denmark's Electronic Research Library (DEFF), the SURF Foundation (the Dutch higher education and research partnership organization for network services and information and communications technology), and the Confederation of Open Access Repositories (COAR).

CNI works to provide our community with frameworks for understanding key networked information issues so that institutions can develop strategies to address these issues on the local, regional, or national level. We write white papers, reports, and articles, we present talks at conferences, and we make institutional visits that may involve meetings with campus leaders and presentations at public events and seminars.

CNI alerts its community to our organizational activities, significant new publications, and important developments in the field via the CNI website, the CNI-ANNOUNCE e-mail list, and the CNI News RSS. Additional information about CNI's activities and interests is available through Twitter (twitter.com/ cni_org), which serves as a complement to other communication channels. We also make video of selected sessions from our membership meetings publicly available from our YouTube and Vimeo channels (www.youtube.com/cnivideo, vimeo.com/channels/cni).

Meetings

The Coalition's semiannual membership meetings, scheduled for December 8-9, 2014, in Washington, DC, and April 13-14, 2015, in Seattle, WA, highlight activities related to CNI's program themes, focus attention on significant new thinking and technology developments, and provide opportunities for members to showcase and discuss a wide range of emerging issues and developments in networked information. Some participants have developed knowledge communities within CNI and use the meetings as an opportunity to share ideas on a particular aspect of networked information and to incubate new initiatives. Each member organization is invited to send two delegates, typically a senior information technologist and a senior librarian. Meeting participants are introduced to new developments that may reshape institutional plans in a forum that encourages collaborations and dialogues with others who share common interests.

CNI has a long history of being the first to offer discussion of major networked information developments, including the early Web browser Mosaic, the NSF Digital Libraries Program, the Google Books Scanning program, and NSF's DataNet initiative. CNI regularly co-sponsors an event in partnership with Jisc as part of our ongoing collaboration with our UK colleagues; the most recent event, the conference *Opening Up Scholarly Communications,* took place in Bristol, England in July 2014. CNI occasionally convenes invitational or public workshops to advance specific elements of its program plan, most recently the *Digital Scholarship Centers Workshop* held April 2014 in St. Louis, MO.

We also serve as an active co-sponsor for other meetings relevant to the CNI agenda. This year these events include the North Carolina State University Libraries, CNI, and University of Calgary co-sponsored conference "Designing Libraries for the 21st Century III," on September 28-30, 2014 in Calgary, Canada, the ARL Fall Forum: *Wanted Dead or Alive – The Scholarly Monograph,* on October 9, 2014, in Washington, DC, and the 10th International Digital Curation Conference, "Ten Years Back, Ten Years Forward: Achievements, Lessons and the Future for Digital Curation," to be held February 9-12, 2015, in London, England.

Additionally, CNI is serving as a cooperating organization for several other conferences, including: the Personal Digital Archiving Conference in New York City on April 24-26, 2015; the Society for Imaging Science and Technology (IS&T) Archiving Conference on May 19-22, 2015 in Los Angeles, CA; the Open Repositories 2015 meeting in Indianapolis, Indiana on June 8-11, 2015; and the Joint Conference on Digital Libraries (JCDL) 2015 in Knoxville, TN on June 22-26, 2015.

Developing & Managing Networked Information Content

The Coalition has broad interests across all forms of digital content that can be used to support research and education. We provide a forum for information on leading projects in this arena, including a showcase at CNI membership meetings for innovative faculty projects from our member institutions. In addition, we track developments and promote strategies for the creation, management, and preservation of digital collections, digital libraries, and federated services in support of digital content. Further, because digital content cannot be divorced from the processes of teaching, learning, and scholarship that both create and rely upon that content, CNI is deeply involved in issues related to the changing practices of scholarship, the restructuring of scholarly publishing, the increasing focus on the value of data underlying research, and the broader transformation of scholarly communication, as well as innovation in teaching and learning. Through our membership meetings, specialized conferences and workshops, collaborative initiatives with other organizations, and publications, we provide leadership on digital content policy and new directions in scholarly communication.

Institutional and Disciplinary Implications of E-Research

For over a decade, the Coalition has led programs to chart, understand, and facilitate the transformation of scholarly practice through the use of digital content and advanced information technology. These endeavors have come to be shorthanded as *e-research* (or, in the sciences, *e-science,* and in the humanities, *digital humanities*). In the sciences and engineering, CNI has been heavily involved in helping the higher education and library communities understand and frame emerging issues in cyberinfrastructure and e-science, with a primary focus on data sharing and data curation issues, and the interrelationships between data, software and more traditional publications. In the arts and humanities, CNI, working with a wide range of partners, has a long record of leadership in computing and the humanities, and in efforts to build collaborations that span the museum, archival and library communities. The need to continue to understand evolving scholarly practice in the sciences, social sciences, and humanities is vital in informing future planning by CNI's members. We will continue to feature humanities projects such as those supported through the National Endowment for the Humanities Office of Digital Humanities, the Institute of Museum and Library Services (IMLS), The Andrew W. Mellon Foundation, and the multi-sponsor, international Digging into Data initiative, emphasizing computationally intensive research enabled by a robust infrastructure.

In the 2014-2015 program year, CNI will continue to engage data-related e-research developments in both the sciences and the humanities, but more selectively than in past years. A wide range of organizations, including EDUCAUSE and the Association of Research Libraries (ARL), now have aspects of data stewardship issues prominently on their agendas; there are immediate challenges for higher education institutions driven by funder mandates for data management plans, data sharing policies, and public access. In the near future, a wide range of federal agencies will be issuing policies to implement the goal of public access to federally funded research outcomes (publications and data) as directed by the 2013 US Office of Science and Technology Policy directive; these will require further action by higher education institutions, both locally and collectively. It is our intention to support and collaborate with these efforts but not to duplicate them. For example, CNI is substantially involved in supporting the effort led by ARL, the Association of American Universities (AAU), and the Association of Public and Land-grant Universities (APLU) called SHARE (SHared Access Research Ecosystem), which among other things should result in a system to track and facilitate the management of research outcomes (publications, software and data) across US higher education. Many of the key developments here are international as well as national. Scholarship is a global enterprise. We co-sponsored a conference and invitational workshop in Bristol, England in July 2014 with our UK colleagues at Jisc, *Opening Up Scholarly Communications*, in which we examined trends and challenges for new modes of research dissemination in a multi-national context, and issued a report.

There are specific challenging frontier areas where CNI expects to continue to provide direct leadership, including efforts to understand criteria for retention and re-assessment, re-use practices, issues related to data involving human subjects, aspects of large-scale infrastructure, reproducibility of results, long-term sustainability and the evaluation of the effectiveness of funder and institutional policies. We also hope to help clarify some of the tangled issues of software sustainability and software preservation, and the relation of both of these to data stewardship, reproducibility of results, and other challenges.

Faculty investigators need guidance from their funders and their home institutions on how best to meet these requirements, and they will be demanding new services at both disciplinary and institutional levels; CNI member institutions are leading the development of a wide variety of such services. We have seen the launch of other potentially important community based efforts like the Digital Preservation Network (DPN), the Digital Public Library of America (DPLA), and the Research Data Alliance (RDA); we will be highlighting developments from these programs in our membership meetings, and seeking to facilitate coordination among these developments through participation in groups like the Committee on Coherence at Scale.

CNI continues to be concerned with the question of the availability of data related to scholarly work, and we have engaged in a number of discussions around open access, open science, and open data as they relate to this question, as well as discussions about disciplinary norms for data sharing and practices for data citation. We will also continue to explore and document the ways in which data and computationally intensive scholarship are altering the nature of scholarly communication; the issues here include the legal and technical barriers to large-scale text and data mining; appropriate organizational, policy and technical strategies for linking articles and underlying data; and ways to construct scholarly works that are amenable to various combinations of human and machine use. Critical new developments here include the emergence of virtual research environments as arenas for the interoperation of data and tools from multiple sources, and the need to better understand the complex architectural questions about the relationships among repositories, operational storage systems, e-research workflows, high performance network connectivity and powerful computational resources.

Connecting our work in e-research directly to our program focus on institutional content resources, CNI will continue to examine institutional policy and planning implications of campus cyberinfrastructure initiatives in both the sciences and humanities, and consider how these can complement national or international cyberinfrastructure investments and strategies at disciplinary and cross-disciplinary levels.

Digital Preservation

Closely related to, and supporting the programmatic focus on stewardship of institutional content resources, is the Coalition's ongoing work on preservation of a wide variety of digital content. This is a central issue not only in the shift to network-based scholarly communication, but also in ensuring the continuity of the broad cultural and intellectual record in the digital age and the continued availability of evidence to support future scholarly inquiry. The issues here are not simply technical, but they represent a fundamental social and public policy challenge with wide-reaching implications; we are particularly interested in trying to define and characterize the ever growing range of materials that should constitute parts of our cultural and intellectual record, including new areas such as social media in the broadest sense, and to find ways to measure progress in preserving them. CNI works closely with organizations such as ARL, the Council on Library and Information Resources (CLIR), The Andrew W. Mellon Foundation, the Library of Congress, the National Science Foundation (NSF), ITHAKA, the UK Digital Curation Centre (DCC), and OCLC on the full range of technical, economic, and strategy issues surrounding digital preservation.

We will co-sponsor and co-chair the DCC's 10th International Digital Curation Conference, which will take place in London, England on February 9-12, 2015, and we will also act as a cooperating organization for several other conferences involved in digital archiving. Digital preservation progress will continue to receive extensive coverage at CNI membership meetings.

The wide-scale adoption of networked information services and the shift to digital content raises a set of new questions about risk management and business continuity planning for libraries and higher education institutions. CNI continues to track these risk management issues, exploring developments and experiences with so-called "cloud" storage systems and their implications for robust storage and digital preservation, as well as some of the thinking emerging from the exascale computing and massive storage communities on the development of resilient systems, and the ways in which these ideas can be applied to very large scale digital preservation.

Another area in which CNI has maintained a strong interest is in the changing nature of personal information storage and personal archiving, and the social and scholarly implications of these developments. A specific case in point is the institutional response to the acquisition of large, personal digital archives from scholars and researchers, as well as the personal archives of prominent intellectual, artistic, literary, political and similar figures. CNI will be involved again in the Personal Digital Archiving Conference, which will be hosted in New York City on April 24-26, 2015.

The digital records of organizations are also poorly explored. A particular area of CNI interest is the changing nature of the academic record caused by the deployment of learning management systems, institutional repositories (IRs), large-scale lecture and event capture, and long-lived, collaborative resources jointly developed by faculty and students, and most recently massively open online courses (MOOCs). These emerging methods and systems will have lasting policy implications for special collections and institutional archives.

A new area of investigation is the character and structure of stewardship transitions, where responsibility for preserving and managing collections of content need to migrate from one organization to another. Issues in this area are emerging in a wide range of contexts: escrow agreements for commercial digital content; the disposition of research data after some initial funder-underwritten retention period; organizational failures; succession rights in the context of efforts like DPN.

Institutional Content Resources and Repositories

A centerpiece of CNI's work on networked information is built around the broad theme of the stewardship of institutional content resources: materials created by members of the institutional community, or that document the work, processes, or intellectual and cultural life of an institution. The practice of such stewardship, which includes management, preservation, and access, is a central role for higher education and cultural memory organizations in the digital age. Our work here has two major components. One is to advance and structure the wealth of new digital content. The program includes our continuing efforts to understand and highlight experiments in the creation of new types of scholarly works for the digital medium, such as successors to the scholarly print monograph or the development of electronic theses and dissertations; the disposition of materials collected through lecture capture systems; the implications of mass digitization of materials to support scholarship; and the availability of digital representations for existing collections of physical materials held in libraries, archives, museums, and audio/visual and public broadcasting groups. The second major effort focuses on approaches to managing the wealth of new content through the development of strategies such as the deployment of IRs. Here CNI is addressing the full range of issues from policy and strategic planning through system architecture and standards for the management of complex digital objects.

We will continue to explore ways in which institutional strategies and systems need to connect to national and disciplinary-level data management and curation activities (such as those developing through the e-research initiatives described above), and some of the inter-institutional issues that arise from large-scale research collaborations and virtual organizations.

A continuing priority is a focused, ongoing re-examination and re-assessment of IR services. The concept of the IR is in its second decade; CNI was deeply involved in the initial conceptualization of IR services and in the development of implementation strategies for them. Platform alternatives have multiplied and matured, and understandings about costs, as well as barriers to successful deployment, have become much clearer. Indeed, we are seeing significantly different deployment trajectories in different nations, particularly in the context of subject repositories and other disciplinary or funder-defined data management frameworks, and these are leading to new policy issues and requirements for various kinds of interoperability standards. It is an appropriate time to document these developments. The SHARE program (and parallel developments in other nations), relying heavily on repositories of all types as infrastructure, is creating a new set of demands for various forms of interoperability.

We are particularly interested in ways in which the impact of IRs might be measured, and the ways in which IRs interact with virtual organizations, faculty movement from one institution to another, and with stewardship of scholarly work associated with faculty retirements.

Transforming Organizations, Professions, & Individuals

The pervasive nature of digital content and networks has led to transformations in the way the research and education community does its work. In this program area, we focus on the impact of changing technologies, new modes of communication and content creation, and the pervasiveness of digital content on organizations, including the changing nature of teaching and learning, the need for new services and skills in professions, and the pressure on physical facilities to accommodate the changing needs of user communities.

CNI has a longstanding commitment to highlighting and advancing organizational initiatives that facilitate cooperation across institutional units and professional cultures, with particular emphasis on collaboration between librarians and information technologists. We have also tried to extend the core library-information technology collaboration to encompass instructional technologists, faculty, publishers, electronic records managers, archivists, research managers and others. Our work on organizational and institutional issues includes a focus on evaluation and assessment strategies, recognizing the continuing need to understand the effects and contributions of advanced information technology and digital content.

We are monitoring a number of new developments in this area, including some of the implications of MOOCs, new models for e-book development and acquisition, multi-pronged institutional publishing and dissemination programs that strategically span and coordinate activities involving the libraries and university presses, and sometimes other units, and the growing importance of building and maintaining high-quality institutional databases of geo-referencing information. A number of institutions are experimenting with the use of mobile devices in teaching and learning, and researchers use mobile devices for data collection and communication in the field. New applications involve sophisticated geo-tagged information and augmented reality, or the use of portable devices as distributed "sensors." Institutions are at widely varying stages of readiness in developing policies, services, and strategies for mobile devices. In the last few years our Executive Roundtable program has been a particularly useful vehicle for mapping emerging thinking in these areas.

Today's Learners and Digital Environments

Digital technologies and the global nature of higher education today are accelerating changes in colleges and universities in a variety of ways. There are increasing calls to make higher education more affordable and more accountable for student outcomes. One response has been the growing use of analytics software to track student behavior related to learning; this is used to improve student performance and outcomes, and to inform faculty members. We are following some new technologies that enable universities to reach new and huge audiences (e.g. MOOCs), and how some result in significant gains in learning (e.g. the "flipped classroom"). We help institutions understand the need to reconfigure some of their services and their physical and virtual spaces to reflect the ways in which our students work with technology and information today. Another programmatic emphasis is to assist our members in thinking about the content issues related to the use of educational resources in this environment, whether making digital content available in MOOCs or instituting a campus e-textbook pilot program.

As both students and faculty increasingly produce new digital information, sometimes incorporating parts of others' work, and often in complex social software contexts, they have a pressing need to understand a wide range of issues including intellectual property, privacy, preservation, format standards, and metadata creation. A variety of literacies (information, technology, and visual) are converging as students, faculty, and others produce innovative digital content.

Spaces and Services that Support Technology-Enhanced Research and Learning

Campuses are building or renovating physical, technology-enabled spaces to support research and learning. CNI continues to have a strong focus on spaces that enhance new modes of teaching and learning; for example, spaces configured to support collaborative student projects employing technology and a range of information resources. Our interest stresses aligning new services and new technologies within the spaces that have been built to enhance the teaching and learning mission of the institution. Spaces that promote the integration of content and technologies into student-produced work in a way that engages students in the academic enterprise (whether media labs, studios, information/learning commons, or specialized classrooms) are a particular focus, highlighted in an article on innovative ways that library spaces, technologies, and services are enabling pedagogical and curricular change published in October, 2014. We are following developments in the emergence of MakerSpaces, which may offer capabilities such as 3-D printing on campus.

Our work also emphasizes how these spaces can provide mechanisms for various professional collaborations to offer student-centered services. Librarians, instructional technologists, multi-media specialists, information technologists, and writing center staff are some of the partners who may work together to offer joint services in these types of spaces. CNI co-sponsored a major conference, Designing Libraries for the 21st Century, at the Taylor Family Digital Library at the University of Calgary in October 2014, and we

are planning a similar conference for next year. We are working to take some lessons learned to a broader community through webinars and sessions at conferences sponsored by the EDUCAUSE Learning Initiative (ELI) and the Learning Spaces Collaboratory.

Many institutions are interested in understanding the learning spaces of other campuses when they are planning renovations or new buildings. They seek data, photos, floor plans, and service models for new learning spaces, including classrooms, media studios, learning or information commons, and small group collaborative spaces. We are working with the ARL Task Force on Facilities, the FLEXSpace project, and the North Carolina State University Learning Space Toolkit's Space Browser to provide a variety of useful information about campus spaces.

The assessment of learning spaces has garnered increasing attention, and we will continue to work with our partners to explore principles and practices in this area, offering a session describing outcomes of a workshop combined with webinars under the auspices of the EDUCAUSE Learning Initiative (ELI). We are working with the ELI's Seeking Evidence of Impact program to examine the link between learning and use of technology-enabled informal learning spaces such as libraries, learning commons, and media labs. We also partner with the Learning Spaces Collaboratory (LSC), which is exploring the intersection of research and practice in the planning of 21st century learning spaces.

Supporting Emerging Scholarly Research Practices at Scale

Changes in research practices and scholarly communication are creating new faculty needs for help, advice and training in technologies such as visualization and research data management, the best use of new publication and dissemination venues for their scholarship, and intellectual property issues. The source of these demands is shifting from early adopters to the faculty at large. Libraries and IT organizations are hiring or training new types of staff with the skills to support faculty in their digital scholarship and e-research activities. Many institutional programs are still in early or pilot stages and may reach a limited number of faculty and departments. Institutions are experimenting with new organizational structures as well. Assisting institutions in understanding how to develop services at scale will be a programmatic focus in the coming year.

For several years, we have been highlighting digital scholarship centers as an emerging area of interest in both research and college libraries. Typically, these centers provide a suite of spaces, high-end technologies, and in-depth consultation for faculty, graduate students, and upper-level undergraduates working on capstone projects. They represent an institutional response to the need for services to support new kinds of scholarship. In spring 2014 we hosted a specialized workshop that explored digital scholarship centers in the humanities and other disciplinary areas. CNI issued a report encouraging better understanding of the rationale and mission for a center, suggestions for good practice, and models of staffing, funding, and provision of services and supplemented the report with related materials on our website. One of the topics that engendered the most spirited discussion during the workshop was drawing distinctions between centers supporting digital scholarship in libraries or other units serving the entire campus versus centers which are faculty-sponsored and limited to specific research activities of digital scholarship. During the 2014-15 program year, we will convene a workshop to further discuss the continuum of types of institutes, centers, labs, and similar organizations that provide mechanisms to support digital scholarship to help provide clarity on what the purposes of various types of centers are and their configurations of expertise, programs, and support. In addition, we plan to offer a conference, co-sponsored by ARL, to assist those institutions that want to develop a digital scholarship center with their planning; the agenda would include information on such topics as staff expertise, physical space and technologies, funding models, and partnering with faculty on research, teaching, and learning.

Executive Roundtable

CNI's Executive Roundtable series assembles executive teams (usually the chief librarian and chief information technology officer, but varying depending on the topic) from about 10 member organizations for a focused discussion on a topic of interest on the morning of the first day of each membership meeting. Launched in 2003, the Executive Roundtables build on the theme of collaboration between librarians and information technologists that has been at CNI's foundation. Past topics have included institutional repositories, campus open access policies, learning management system strategies, identity management, learning spaces, funding innovation, the university's role in the dissemination of research and scholarship,

lecture and performance capture, infrastructure to support research, risk management and disaster planning, institutional strategies for multiple devices and platforms, institutional publishing strategies, scholarly identity management, institutional e-book strategies, and software as a service and cloud-based applications. For recent roundtables, we have placed summaries on the CNI website.

The fall 2014 Executive Roundtable will address supporting digital humanities at institutional scale; the spring 2015 Roundtable is currently planned to focus on privacy in the context of research, education, and communication.

Building Technology, Standards, & Infrastructure

CNI continues to be engaged in key areas of standards and infrastructure development. The Coalition is particularly concerned with facilitating the difficult and delicate transition of standards and technologies into operational infrastructure for the research, higher education and library communities. For example, federated identity management is becoming a key infrastructure component to support research using resources beyond a single campus. Another example: while there has been good work recently on linked data and on annotation, there are practical deployment questions regarding where data is actually hosted, and where computation occurs, that still need to be fully explored.

In addition to the specific program initiatives described here, CNI participates in and tracks a wide range of developments in areas as diverse as identifiers, digital books, metadata standards, distributed and federated network services, harvesting technologies, recommender systems, and personalization technologies. As we look at an evolving landscape that includes commercial Web search engines, traditional library automation tools such as online catalogs, stand-alone abstracting and indexing databases, systems deployed by scholarly publishers, museums, and other content providers, and learning management systems, the Coalition is concerned with architectural and standards frameworks that can facilitate integration and interoperation. This perspective has motivated much of our work over the last few years on cyberinfrastructure, IRs, the various components of the Open Archives Initiative (including the protocol for metadata harvesting, the object reuse and exchange protocol, and, most recently, the Open Annotation work), and learning management systems. One of our most important contributions is the ability to promote discussions across project and technology silos that help to reduce redundancy, increase coherence, and facilitate scalability.

Currently, we see a number of trends that we believe will drive a renewed focus on standards and infrastructure, including the proliferation of mobile devices (smart phones, tablets, e-book readers, etc.), the move towards data resources as part of the infrastructure (changes in identity management, bibliographic control, etc.), and the move towards cross-institutional systems (Web-scale discovery and resource sharing, cloud computing, and distributed storage). Many of the latest developments couple technical issues with policy challenges in novel ways. We have been exploring the issues in these areas through articles and presentations, executive roundtables and other programming at our membership meetings, and participation in a range of committees and advisory boards.

We also continue to track and inform our members about developments in technologies that promise to change the way we can capture or document objects and events digitally (for example, through developments in computational digital photography and image capture), and the way we can share or reproduce them (for example, through 3-D printing technologies).

Institutional Infrastructure to Support Research

There is a renewed focus on campus infrastructure to support research programs. Developments include: policy, technical, and economic influences that are leading to a partial re-centralization of computing functions; radically new high performance network and distributed computing technologies; a rethinking of storage functionality and economics; requirements for long-term data management, curation and preservation; and growing faculty demands for informatics support services. An additional dimension of these needs involves information and technology intensive collaborations among groups at multiple campuses (sometimes characterized as collaboratories or virtual organizations) and virtual research environments that enable such collaborations. Complementing the organizationally oriented work on e-research already described, CNI is also concerned with the institutional and cross-institutional

development of technical infrastructure, with a particular focus on large-scale storage and data management (discussed in more detail earlier), and on collaboration tools and environments. Of particular concern is the persistently difficult integration of investment in national level research infrastructure and campus-level investments and approaches; we participated in the recent NSF Task Force on Campus Bridging, and helped advise a recent NSF-funded effort to explore sustainability of infrastructural software, as well as working closely with efforts such as the EDUCAUSE Center for Analysis and Research (ECAR) working group on campus cyberinfrastructure and relevant work within the Common Solutions Group. These issues are also central to strategies for research data management stewardship discussed earlier.

Security, Privacy, Identity and Access Management

CNI takes a broad view of security, integrity, privacy and access management issues as they relate to the management of licensed resources and the stewardship and preservation of digital content. New technological capabilities (notably the ability for users to amass and maintain massive personal digital libraries which include large amounts of copyrighted material drawn from licensed databases or large collections of digital books on proprietary reading platforms) continue to raise complex questions with both technological and policy dimensions. CNI believes that we must continue to explore new behaviors and practices such as the building of workgroup or personal collections combining public and private materials, or large scale text or data mining that spans published literature and databases and unreleased research results, or the emerging commerce in information about reader behaviors in various contexts.

In early 2015 CNI will convene a one-day workshop that will focus on a high-level re-assessment of technology to support privacy for users of networked information services, and also of technology that can help to make the evolving networked information infrastructure more robust and secure. Our intent is that this will contribute to updates to best practices for libraries, for vendors that support library and related marketplaces, and also point out places where standards developers within our community will want to revisit their work.

Authentication and authorization are now established as essential infrastructure components for network-based services and have become a particularly critical need as institutions increasingly rely on site license agreements with information providers, implement online and distance education initiatives, and form consortia for resource sharing or educational initiatives. They are an essential underpinning for data sharing and data reuse. The Coalition has been supporting partners such as Internet2, EDUCAUSE, and InCommon in pursuing a program to define technology approaches, standards, best practices, and policy and business issues for such inter-organizational authentication and authorization infrastructures.

The Coming Convergence Of Identity Management, Biography, Bibliography and Social Discovery

We will continue the exploration of the potential future convergence, or at least linkage, between identities as established by campus-based identity management systems on one hand, and personal names as used in the context of scholarly communication, citation, and bibliographic control name authority on the other. Historically, these worlds have been almost completely separate and highly insular, but the emergence of sophisticated author rights retention strategies, institutional and disciplinary repositories, advanced bibliometrics and webmetrics, faculty activity tracking and research management systems, and directories and social discovery systems in academic settings, are clearly bringing them into closer alignment. Connections to public history, genealogy, and prosopography or large-scale biography are also fast emerging, essentially recognizing potential continuity between forward-looking infrastructure and historical documentation. We are also seeing bridges being established between resources of a primarily academic nature and tools used by the broad public (including Wikipedia). A very important development that CNI is helping to advance is the work towards a National (and ultimately international) Archival Authorities Infrastructure.

Numerous systems, databases, and initiatives that are relevant to parts of this program, such as the Open Researcher and Contributor ID (ORCID), the International Standard Name Identifier (ISNI), the Virtual International Authority File (VIAF), VIVO, and new developments within Web of Science, Microsoft Academic Search, Google Scholar, and other platforms, are making this an extraordinarily dynamic area.

Selected Recent Publications by CNI Staff

Clifford A. Lynch. "Cloud Architectures and Cultural Memory" (edited transcript of a keynote address given on September 4, 2013). *Proceedings of the 4th International Symposium on Information Management in a Changing World (IMCW)*, to appear.

Keith Kintigh, et al. "Cultural Dynamics, Deep Time, and Data: Planning Cyberinfrastructure Investments for Archaeology." *Advances in Archaeological Practice,* to appear February 2015.

Joan K. Lippincott, Kim Duckett, and Anu Vedantham. "Libraries as Enablers of Pedagogical and Curricular Change," *EDUCAUSE Review Online* (October 2014).

Joan K. Lippincott and Kim Duckett. "Library Space Assessment: Focusing on Learning," *Research Library Issues*, no. 284 (2014).

Clifford A. Lynch. "The Need for Research Data Inventories and the Vision for SHARE," *Information Standards Quarterly* (Summer 2014).

Jim Pitman and Clifford A. Lynch. "Planning a 21st Century Global Library for Mathematics Research," *Notices of the American Mathematical Society* (August 2014).

Clifford A. Lynch, "The 'Digital' Scholarship Disconnect," *EDUCAUSE Review* (May/June 2014).

Joan K. Lippincott, Harriette Hemmasi and Vivian Lewis, "Trends in Digital Scholarship Centers," *EDUCAUSE Review* (May/June 2014).

Clifford A. Lynch. "The Next Generation of Challenges in the Curation of Scholarly Data," in *Research Data Management: Practical Strategies for Information Professionals*, edited by Joyce M. Ray, 395-408. West Lafayette, IL: Purdue University Press, 2013.

Clifford A. Lynch. "The Future of Personal Digital Archiving: Defining the Research Agendas," in *Personal Archiving: Preserving Our Digital Heritage*, edited by Donald T. Hawkins, 259-278. Information Today, 2013.

Clifford A. Lynch. "The Public Library in 2020," in Library 2020: *Today's Leading Visionaries Describe Tomorrow's Library*, edited by Joseph Janes, 25-32. Scarecrow Press, 2013.

Clifford A. Lynch. "Foreword," in *Access and Identity Management for Libraries: Controlling Access to Online Information*, edited by Miriam Garibyan, Simon McLeish and John Paschoud. London, UK: FACET Publishing, 2013.

Clifford A. Lynch. "Defining a National Library in a Digital World: Dame Lynne Brindley at the British Library," *Alexandria: The Journal of National and International Library and Information Issues* 23, no. 3 (August 16, 2013): 57-63.

Clifford A. Lynch. "Ebooks in 2013: Promises Broken, Promises Kept, and Faustian Bargains," *Digital Content: What's Next*, e-content supplement to American Libraries (June 2013): 12-16.

Reports of CNI Executive Roundtables and Workshops

Digital Scholarship Centers. Report of the CNI workshop, April 2014. Forthcoming.

Software as a Service and Cloud-Based Applications. Report of the Executive Roundtable, Spring 2014 CNI Membership Meeting (April 2014).

E-Book Strategies. Report of the Executive Roundtable, Fall 2013 CNI Membership Meeting (December 2013).

Institutional Strategies and Platforms for Scholarly Publishing. Report of the Executive Roundtable, Fall 2012 CNI Membership Meeting (December 2012).

Multiple Devices and Platforms: Institutional Strategies. Report of the Executive Roundtable, Spring 2012 CNI Membership Meeting (April 2012).

CNI Staff Contributed to these Selected Recent Reports:

Scholarly Communication: *The Journey Towards Openness.* Conference report, Jisc/CNI meeting 2014: Opening Up Scholarly Communications. July 10-11, 2014, Bristol, UK. Forthcoming.

Committee on Planning a Global Library of the Mathematical Sciences; Board on Mathematical Sciences and Their Applications; Division on Engineering and Physical Sciences; National Research Council of the National Academies. *Developing a 21st Century Global Library for Mathematics Research.* Washington, DC: National Academies Press (2014).

L. Johnson, S. Adams Becker, V. Estrada, and A. Freeman. *NMC Horizon Report: 2014 Library Edition.* Austin, Texas: The New Media Consortium (2014).

Guy T. Almes, Curtis W. Hillegas, et al. *Big Data: Laying the Groundwork.* ECAR Campus Cyberinfrastructure (ECAR-CCI) Working Group (September 2014).

Michael Russell, Joan Lippincott, Joan Getman. *Connected Teaching and Personalized Learning: Implications of the National Education Technology Plan (NETP) for Adult Education – DRAFT for Public Comment.* Washington, DC: American Institutes for Research (May 2013).

Most staff publications, as well as selected presentations and interviews, are available online at www.cni.org/publications.

Alfred P. Sloan Foundation

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and Research Libraries in Illinois)

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Louisiana State University, Libraries

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Microsoft Corporation

Mississippi State University

Montana State University

National Archives and Records Administration

National Institute of Environmental
  Health Sciences

National Institutes of Health Library

National Library of Medicine

NCAR (National Center for Atmospheric Research)

New Media Consortium

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New York University

North Carolina State University

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IMAGE CREDITS*

Front (left to right; top to bottom):

Composition I, 1916
Patrick Henry Bruce, American, 1881-1936
Yale University Art Gallery, American Paintings and Sculpture (http://artgallery.yale.edu)
Courtesy: Artstor Collection (http://www.artstor.org), Images for Academic Publishing (IAP)

Scalable Visualization Using Grids (Image 2)
A simulation showing ground wave action as shock waves travel under the ocean while passing Catalina Island. This simulation, known as TeraShake, used the 10 teraflop DataStar supercomputer and large-scale data resources of the San Diego Supercomputer Center (SDSC) at the University of California, San Diego. The warmer red and yellow colors indicate regions of compression, while the cooler blue and green colors show regions of dilation. Faint yellow (faults), red (roads) and blue (coastline) lines add geographical context. (Date of Image: July 2006)
Courtesy: Marcus Thiebaux (Information Sciences Institute, University of Southern California) and NSF

Colonies of Bacteria Do Battle (Image 4) (background)
Researchers from University of California, San Diego's Center for Theoretical Biological Physics, Tel Aviv University and the University of Texas, Austin, found that rival colonies of the bacteria *Paenibacillus dendritiformis* can produce a lethal chemical that keeps competitors at bay. By halting the growth of nearby colonies and even killing some of the cells, groups of bacteria preserve scarce resources for themselves, even when the encroaching colony is closely related. (Date of Image: 2009)
Courtesy: Eshel Ben-Jacob and NSF

Statuette of a Kouros
Etruria, ca. 490 B.C.
The J. Paul Getty Museum (http://www.getty.edu/museum/)
Object Number: 85.AB.104
Courtesy: Getty's Open Content Program

Perkins Library, Duke University
Courtesy: Mark Zupan, Duke University Libraries

Back (left to right):

Lagoon Nebula, Messier 8
The Very Large Telescope (VLT) at the European Southern Observatory's (ESO) Paranal Observatory in Chile has captured this richly detailed new image of the Lagoon Nebula. This giant cloud of gas and dust is creating intensely bright young stars, and is home to young stellar clusters. This image is a tiny part of just one of eleven public surveys of the sky now in progress using ESO telescopes. Together these are providing a vast legacy of publicly available data for the global astronomical community. Release date: January 22, 2014
Courtesy: ESO/VPHAS+ team

Cross-cut Bone in Interference Contrast
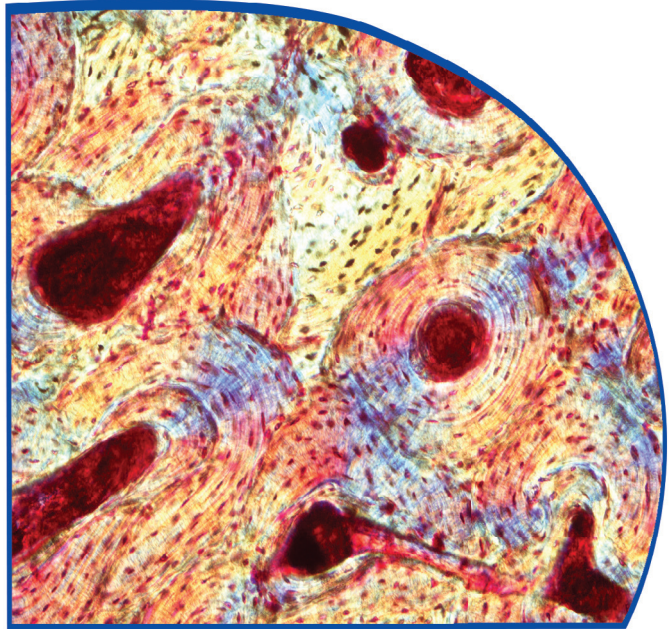By Josef Reischig
Date: 2008
This image comes from the archive of Josef Reischig and is part of the 384 pictures kindly donated by the authorship heirs under CC BY SA 3.0 license as a part of Wikimedia Czech Republic's GLAM initiative.
Courtesy: Wikimedia Commons

*Descriptions are from image sources unless otherwise noted.

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