Editor's Note

In the summer of 2024, Clifford Lynch announced his retirement as executive director of the Coalition for Networked Information (CNI) after 28 years at its helm. CNI quietly launched a project to create this Festschrift to document and honor his legacy. Authors began contributing articles in early 2025, with a planned publication date of July 2025. Since the final membership meeting of Cliff's tenure was April 7–8 in Milwaukee, the plan was to surprise him, surrounded by colleagues and friends, with a presentation of the table of contents of this special issue. However, just two weeks prior to the meeting, Cliff's health worsened; he was told about the Festschrift and received project details and articles. Though unable to attend in person, he participated in the CNI membership meeting via Zoom and also virtually joined his retirement reception, which included readings of excerpts from each article in this volume. Sadly, on April 10, 2025, Clifford Lynch passed away. Festschrift contributors wrote their articles prior to his passing, and we have chosen not to alter their original language.

Clifford Lynch at Berkeley

Michael K. Buckland

abstract: Clifford Lynch is known for his long tenure as executive director of the Coalition for Networked Information (CNI). Here, two other achievements are summarized. From 1979 until he moved to CNI in 1997, Clifford was responsible for developing and implementing library infrastructure for the multicampus University of California system, including MELVYL, a highly innovative, user-oriented online replacement for card catalogs and its extension to provide access to medical and other bibliographical resources. To support it and other applications, he and others built an intercampus network that evolved into the university's Internet node. In addition, for more than three decades he also team-taught the Friday Afternoon Seminar, a weekly Berkeley campus colloquium series featuring a wide range of research reports.

The factors that have made Clifford an effective executive director of CNI include a prodigious familiarity with a wide range of developments, exceptionally lucid explanations, and willingness to assist. His influence has been mostly informal or indirect. Informal through conference presentations, advisory committee assignments, and consultation. Indirect in being advisory. These contributions are described elsewhere. Here we briefly summarize two contributions at the University of California that have been both formal and direct. First, the design and operational deployment of library and bibliographical infrastructure for the university of california: the MELVYL online union catalog and its associated telecommunications network. Second, over three decades as a university instructor cochairing the Friday Afternoon Seminar on Information Access.

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portal: Libraries and the Academy, Vol. 25, No. 3 Supplement (2025), pp. 59–67.

Library Automation, MELVYL, and Networks

Clifford's first formal role in library automation was when, as an undergraduate at Columbia University majoring in mathematics and computer science, he was employed as a systems programmer in the Bobst Library of New York University in 1974. After completing his MA in computer science at Columbia in 1976, he became a senior systems programmer at the New York University Computer Center.

Meanwhile, in California, a scathing audit by the state Department of Finance of the use of library funds on the (then) nine campuses of the University of California was completed in 1972. Its effect was to freeze increases in state funding for the university's library services, despite steadily increasing costs and space needs, until the university could show that it had a single, coherent plan for library development across its nine campuses instead of nine campuses separately seeking duplicative comprehensive collections and independently installing local computer systems.

Eventually in 1976 the university administration appointed Stephen R. Salmon to head a new Office for Universitywide Library Planning and two years later an ambitious plan for the development of the University of California Libraries was adopted by the university and accepted by state authorities.[1] The price for generous renewed state funding for the university's libraries was a single coherent plan for one university instead of campus separatism. The plan was based on two key foundations: (1) inexpensive shared off-campus book storage for little-used materials; and (2) a union catalog enabling anyone on any campus to discover and locate all copies of all the titles held in all the hundred libraries of all the nine campuses.

Salmon's unit was soon renamed as the Office for Library Plans and Policies in the Office of the President, the central systemwide administration, which was then located next to the Berkeley campus. He recruited Edwin Brownrigg from New York University to lead the automation effort, and Brownrigg persuaded Clifford Lynch to join him. That is how Clifford came to be in Berkeley in April 1979 as manager of computing resources in what was by then called the Division of Library Automation.

The campus libraries had been adopting computer-based procedures for cataloging and there was a plan to generate computer-onto-microfiche (COM) catalogs supported by a computer-based index, but, instead, a bolder decision was made to design and build from scratch an online, remotely accessible shared library catalog, a union catalog for the entire system. There was reasonable doubt that the University's central bureaucracy could or should be entrusted to do this, but the need was imperative. Brownrigg and Lynch assembled a talented and loyal staff and launched MELVYL, a pioneering online public access catalog even though funding for it proved to be severely inadequate. It needs to be stressed that the late 1970s and early 1980s were a crucially pivotal period for library service in the gradual but Copernican revolution from building excellent local paper collections for readers to use, to enabling online access to collections anywhere and, implicitly, from anywhere.

This shift was accompanied by a second significant change. Library service had always been a campus responsibility with little role for the central administration beyond supplying funds. The directors of campus libraries reported to and were dependent on campus chancellors, not a central library coordinator. But the powerful new reality was

that technological developments were increasingly capital-intensive and this brought a compelling economic, and so political, imperative for centralization that was mostly resisted by campuses, especially the larger campuses with their centrifugal tendencies and preferences for home-brew designs. There had been a small multicampus research unit, the Institute for Library Research, which had been used for some applied research and, within it, a Universitywide Library Automation Program had experimented with the development of computer-generated printed union catalogs. But it had had limited impact. The program was transferred to Salmon's office, and the institute was closed in 1978.

There was also a third source of conflict. A union catalog would require a central computing facility and dramatic development of intercampus telecommunications. The library catalog was the first university application to depend on reliable, nonstop telecommunications service on an entirely new scale. As with banks' ATM machines, service could not be provided without it. The need for telecommunications support had been grossly underappreciated. But, impressed by a demonstration of the MELVYL prototype, state officials had recognized its importance, approved a new recurrent budget line item of a million dollars a year earmarked for this purpose and even asked whether this would be enough. This was good news, of course, but it led directly to another major conflict over jurisdiction. Within the central administration, Salmon, the Office for Library Plans and Policies, and its Division of Library Automation (DLA) reported to the senior vice president for academic affairs. IT support and telecommunications services, however, were the assigned responsibility of the senior vice president for administration. This created a fundamental organizational, financial, and technical conflict. Clifford was working within an environment wracked by multiple, sometimes bitter, conflicts.

MELVYL

The new multicampus union catalog was named MELVYL. This was not an acronym but an insider joke based on the WYLBUR software being used and it seemed aptly ironic given Melvil Dewey's passion for spelling reform.

A biography of MELVYL would be an interesting and exciting read, but it has yet to be written. However, the development of MELVYL and the telecommunications built to support it are documented in several special sections of the journal *Information Technology and Libraries*.[2]

The first attempts at online library catalogs had been relatively simple, sometimes a creative extension of online circulation systems. MELVYL, however, was a careful and thorough attempt to replace the functionality of a standard library card catalog on an exceptionally large scale and to add advanced features that the transition from card to computer allowed. It was recognized as being generationally different from earlier online library catalogs. In particular, it soon exceeded card catalog functionality by supporting, in addition to search on titles (or, rather, "title begins with"), also search for individual words

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within titles. Similarly, it supported search for words within subject headings as well as the subject heading itself. Functionality was further extended to searches by (or for searches to be qualified by) language, date of publication, and the date when a record was loaded into MELVYL. This last could be used to qualify a search query and so provide a personalized updating service on new acquisitions.

Good design practice and the sensitive relationships with the campuses combined to encourage close consultation with campus librarians. This was buttressed by extensive use of transaction logs for monitoring and diagnostic analysis, on which at least two doctoral dissertations were based.

A robust, powerful Boolean command language allowed complex searches combining multiple catalog fields and, initially, a simpler "Look up" menu mode was offered. There was a choice of display options. The first demonstration was in March 1981, and a prototype was made available to library staff in April and more widely in August. A production version of MELVYL was provided in November 1983.

Cataloging was a campus library responsibility. The Division of Library Automation did no cataloging. It loaded records supplied by the campus libraries that were mainly derived from OCLC (the Online Computer Library Center), RLIN (the Research Libraries Information Network), and the Library of Congress, with local acquisition and call number details added. The one-time cost of the retrospective conversion of older records was a campus responsibility which was addressed opportunistically after some limited central support. By May 1984, 1 million catalog records had been loaded.

Initially, only a very few hard-wired terminals at each campus could be supported, but as telecommunications support developed, dedicated access reached all libraries. Two further radical departures from the card catalog era followed: distributed terminals allowed catalog access throughout a library, including inside the stacks, without the need to return to the catalog hall; and, an even more dramatic development, access from offices, laboratories, and from home was supported.

Medline on MELVYL

By the early 1980s, the nine University of California campuses, with five medical schools and many departments with varied health and medicine interests, were spending a great deal of money on searching the medical literature mainly using the DIALOG Medline service with its challenging search commands. In addition, the dial-up telephone-based telecommunications access was costly, so DIALOG and comparable services were primarily used by researchers fortunate enough to have extramural grant funding.

At that time and for several decades, libraries had been structured in two main divisions: public services and technical services. Searching bibliographies was done by reference librarians in the public services division. Catalogs were the responsibility of technical services personnel who worked backstage. The two roles were organizationally, professionally, and even physically distant from each other even though they were concerned with similar bibliographical records and were increasingly using the same kind of hardware and comparable software. In their early days, OCLC and RLIN supplied their own special "smart" terminals and software, completely different from the dumb terminals that were later replaced by IBM PCs and Macs.

In consultation with librarians in the medical libraries, a daring proposal was hatched. Why not make Medline records, which were bibliographical and similar to catalog records, accessible and searchable through the MELVYL service with its friendly interface instead of paying for DIALOG service and, even better, why not avoid dial-up telephone charges by providing access over the network built for the catalog? This was a radical change of professional culture, but the case was compelling. When asked to supply a single set of Medline records, the National Library of Medicine responded that their pricing policy was to charge per campus. Eventually, a compromise was reached. The university paid five times the usual price (not nine times) on the grounds that it had five medical schools. Licensing conditions, some differences between Medline records and catalog records, and operational efficiency led to Medline being served as a separate MELVYL service and restricted to university-affiliated users.[3]

The Medline on MELVYL service was immediately hugely popular and it was especially appreciated by scholars without grants. Since the university libraries held the great majority of the journals indexed in Medline, links could be added to show university library holdings records for most retrieved Medline records. Access to the California Academic Libraries List of Serials (CALLS) augmented information on holdings within the state.

It is hard now to appreciate how revolutionary Medline on MELVYL seemed at the time. It quickly led the way to similar provision of access to other popular bibliographical services. *Current Contents* soon followed and it was recognized that a record within one bibliography could be linked to records in other bibliographies and to catalog holding records. In effect, bibliographies and the catalog were beginning to be integrated.

Telecommunications

The telecommunications required to support the use of a union catalog serving a research-oriented nine-campus university with some 125,000 students and over 200,000 faculty and staff had not been adequately appreciated in the university's library plan. The university's existing data telecommunications supported mainly infrequent batch-mode transmissions of administrative data. These could be sent again later if transmission failed. In contrast, a union catalog, like with an ATM network, simply cannot operate during any lapse in service, even if the failure of any individual transaction was not that serious. With the testing of the prototype MELVYL, the magnitude of this problem became apparent. Drastic action was essential. The regional telephone company, Pacific Bell, quoted $250,000 a month for service. Fortunately, state officials were so impressed by a demonstration of the MELVYL prototype that a recurrent million dollars of additional state funding earmarked for library use was promptly added to the university's budget.

Edwin Brownrigg, the director of the Division of Library Automation, and Clifford Lynch and their staff, set out to urgently build a library telecommunications network with consulting firm Bolt Beranek and Newman (BBN) which had been developing the packet-switched ARPANET that served as a prototype for our modern Internet. For resilience and efficiency, different media were used including a satellite link between north and south, leased lines, direct line-of-sight radio, and spare capacity on the State Highway Patrol's lines were all used. For resilience, each campus had at least two network connections using different transmission media.

In the days before modern Wi-Fi, Brownrigg, a packet radio enthusiast, saw wireless as a much-needed alternative to running cables across marble floors. As proof of concept, a grant-funded "MELVYLmobile" was designed and demonstrated. A dedicated terminal was used for searching while being pushed around on a book truck with no wired connection. Clifford and Brownrigg then authored *Packet Radio Networks: Architectures, Protocols, Technologies and Applications*, apparently the first published book on the topic.[4]

The Challenges of Success

Success brought increasing technical pressures, especially on Clifford. The popularity of the service made it difficult to keep up with demand, given the inadequate funding and bureaucratic difficulties. There were at various times inadequate disk storage capacity for loading new records, insufficient chilled computer room space for additional disk drives, inadequate processing capacity on the two 1 MIP IBM clone machines, and continued use of the no longer supported OS/360 MVT IBM operating system because it was free. When MELVYL's response time lengthened, a policy decision was made to restrict access to MELVYL when demand peaked rather than degrade service. A degraded service is a bad service; limited service indicates inadequate funding.

It was gradually recognized that more was involved than access to a single application (MELVYL); the university needed a shared general-purpose network for many different purposes. Eventually the political and fiscal tensions led to organizational changes. In 1986, MELVYL, the intercampus network supporting it, and the rest of the Division of Library Automation was transferred from the Academic Affairs Division to the senior vice president for administration and physically relocated to Oakland. Clifford went with it and assumed steadily increasing responsibility until in July 1997 he left for CNI. The position of assistant vice president for library plans and policy, held first by Stephen Salmon and then by me, was abolished in 1987, and I had returned to the Berkeley campus. But since the role was needed, it was soon reinvented and eventually in 1997 formed the basis for the current California Digital Library.

The sheer complexity of the MELVYL software proved a burden. Eventually economies were made by using simpler software even though the name MELVYL was retained. The quality of service suffered as a result, and it was not until the introduction of UC Search in 2021 that a successor comparable to the original MELVYL was introduced.

The Berkeley Campus and the Friday Afternoon Seminar

From 1973 to 1975, as an undergraduate at Columbia University, Clifford had tutored mathematics in the School of General Studies and also taught noncredit courses in computer programming in the School of Library Service under the direction of Theodore Hines.

When he moved to California in April 1979, Clifford's office in the university-wide central administration was in Berkeley next to the campus. Despite his demanding workload, Clifford took advantage of this proximity to complete a PhD in computer science in 1987. His dissertation was titled "Extending Relational Database Management Systems for Information Retrieval Applications." In it, he explained why existing

systems were inadequate for bibliographical applications and suggested how that lack might be remedied.[5] In the fall 1987 semester, he taught an advanced graduate course in the Department of Electrical Engineering and Computer Science on database systems and information retrieval.

There was interest in his teaching in the School of Library and Information Studies, now named the School of Information. He wanted to, but his already fabled travel schedule made committing to a fixed weekly schedule implausible. The problem was resolved through a collaboration. He would teach whenever he was available, and I would assume responsibility when he was not. We started rather informally with a design seminar for doctoral students in the spring 1991 semester. The theme was designing a bibliographical robot: If you could build a robotic bibliographical assistant, what, actually, would you want it to do? The official course description read:

> The seminar will explore capabilities that would seem desirable in the next generation of online library catalogs and online bibliographic databases using a functional approach: each student will pick a desirable functional capability, e.g., filtering/ranking to deal with excessive retrieval; restating a subject search in more general or more specific terms; extending searches from one database to other, different databases . . . The task will be to define the need, specify how this could be done more or less automatically with one or more existing databases, demonstrate that it would in principle be feasible, and make recommendations. Intended for advanced students.

I had used this approach in a graduate seminar at the University of New South Wales in Australia as a deliberate antidote to the pervasive, but understandable, preoccupation with working within the limitations of available technology. Our class at Berkeley was a seminar in the traditional sense of a group with shared interests meeting regularly to present and discuss their latest ideas. Seven doctoral students enrolled. Faculty member Ray Larson, whose doctoral research had studied the balancing of workload between MELVYL and its users, joined us. He later cochaired the seminar from 2004 until his untimely death in 2017. As of this writing, Clifford and I are now in our 69th and consecutive semester cochairing the seminar. Two of the original seven students still regularly participate.

In time, the seminar became more open. On three occasions in fall 1991, we invited guest speakers to share their work in progress. By fall 1993, we had invited speakers most weeks. Students who were not registered for the seminar and others from across the campus and beyond were welcome to participate whenever the topic or the speaker was of interest. A weekly emailed announcement was sent to anyone who wanted it and was reflected widely.

To accommodate Clifford's work schedule, sessions were held on Fridays from 3 to 5 p.m. This might seem an unpopular time for a class, but employed individuals found it a good time because organizations tend not to schedule meetings late on Friday afternoons. We retained that time slot and used the nickname "Friday Afternoon Seminar." Officially, the course is a section of 296A Seminar with each section having a distinguishing subtitle. Various subtitles were used at first. The scope was loosely defined as being concerned with network accessible resources. We settled for some years on "Extended Retrieval," then later simply "Information Access." We interpreted our anchorage in

access to network accessible resources as having a very long anchor chain. We did not find it to be a constraint.

The result has the form of a colloquium series, but the research seminar intent has been retained. Completed research can be reported at conferences or published in papers. We preferred to discuss work still in progress. The seminar is used as an opportunity to do a "dry run" for conference presentations, to critique potential grant proposals, and to improve tentative dissertation proposals. Students who registered for credit have to propose and undertake a project and report on it in addition to attendance and participation. We like to describe it as an individual study in a supportive environment.

One consequence of the openness of the seminar, its scope, and its timing that we should have anticipated but did not, is that it generated goodwill toward the school. Researchers and professionals in the area appreciated that they were welcome to attend even if they did not.

Clifford and I used the seminar regularly to air our own ideas and to rehearse conference presentations. It is, after all, part of his role as director of CNI to be up-to-date across a wide range of current developments. Clifford's up-to-dateness, combined with his wide-ranging knowledge and his unusual ability to make complex topics intelligible, were ideal for the seminar. He became the most frequent speaker, typically presenting material three times a semester, as well as a steady flow of news announcements. In recent years, he has made use of the seminar to discuss his evolving ideas concerning the stewardship of cultural heritage resources and for a rehearsal of his magisterial plenary overviews at CNI membership meetings. I was also a frequent speaker, averaging twice a semester, mainly trying out intended project proposals or draft papers on historical and theoretical work.

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Two principles guided the choice of speakers and topics. First, we chose speakers and topics that Clifford and I thought would interest us personally, whether or not students and others would also find them interesting. Second, in the spirit of a seminar, we preferred to hear about work still in progress. That made unresolved issues more likely and also meant that discussion at the seminar was more likely to be found helpful by the speaker.[6] The relatively few students taking the seminar for credit each had to make a couple of brief progress reports and then a "final progress report" toward the end of the semester. Occasionally the seminar was combined with other school events, in particular the school's hundredth and subsequent birthday events and a celebration of the life and academic work of Ray Larson.

With COVID-19 we simply continued, using Zoom, and with the campus mandate to return to in-person instruction we have continued in a hybrid format with most but not all participating remotely.

With Clifford's appointment to CNI as executive director in July 1997 and his subsequent relocation to the East Coast, the seminar might reasonably have ended. However, with considerable ingenuity he frequently managed to arrange his travel schedule to

enable brief Friday visits to Berkeley, and we continued. On the very rare occasions when neither of us was available, we would arrange for someone else to moderate rather than cancel the session.

Conclusion

Clifford Lynch is known for his nearly three decades leading the Coalition for Networked Information, for his wide-ranging expertise, and for his clear explanations of complex matters. Less well known is his prior 18 years designing and implementing the innovative library systems and a telecommunications network to support them at the nine-campus University of California. With others, the innovative MELVYL online library union catalog was built and further services added, notably "Medline on MELVYL." Also, an early packet-switched intercampus network was built. It should be noted that these eighteen years, from 1979 to 1997, were a pivotal period in libraries' transition from cards to fully networked online service. This experience positioned him ideally for CNI. Meanwhile, his exceptional knowledge and talent for explaining enriched the lives of students and professionals through 35 years of teaching on the Berkeley campus in the weekly Friday Afternoon Seminar from 1991 to 2025.

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Notes

1. University of California, Office of the Executive Director of Universitywide Library Planning, *The University of California Libraries: A Plan for Development, 1978–1988* (Berkeley, CA: Office of the Executive Director of Universitywide Library Planning, 1977), https://archive.org/details/universityofcali0000univ.
2. "In-Depth: University of California MELVYL," *Information Technology and Libraries* 1, 4 (December 1982): 350–380; *Information Technology and Libraries* 2, 1 (1983): 58–115; *Information Technology and Libraries* 11, 2 (1992): 146–81; *Information Technology and Libraries* 11, 3 (1992): 271–304; *Information Technology and Libraries* 11, 4 (1992): 405–19. Note the detailed chronology of developments in 11, 2 (June 1992): 178–79.
3. M. M. Horres, S. S. Starr, and B. L. Renford, "MELVYL MEDLINE: A Library Services Perspective," *Bulletin of the Medical Library Association* 79, 3 (July 1991): 309–20, https://pmc.ncbi.nlm.nih.gov/articles/PMC225558/.
4. Clifford Lynch and Edwin B. Brownrigg, *Packet Radio Networks: Architectures, Protocols, Technologies, and Applications* (Oxford, UK: Pergamon, 1987).
5. Clifford A. Lynch, "Extending Relational Database Management Systems for Information Retrieval Applications," (Ph.D. diss., University of California, Berkeley, 1987).
6. The program—speaker, title and summary—for each week starting with Spring 2000 and less completely for earlier semesters is available at https://courses.ischool.berkeley.edu/i296a-ia/s25/history.html.