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ABSTRACT

This paper presents the results of a three-year project of the 22 libraries of the California State University (CSU) system to create an entirely new approach to information access. The Unified Information Access System (UIAS) is designed to provide integrated, single-search access to the full range of library information resources. In addition to creating a powerful information access tool, it incorporates customized guidance in navigating the information environment, making it a valuable educational resource as well as an effective access management tool for librarians. The name "Pharos" was selected as the new name for the system in its public manifestation. The scope and complexity of the UIAS project has entailed an array of challenges, both in its conception and execution as Pharos. Through close collaboration with Ameritech Library Services, CSU has succeeded in creating a service to students and faculty that has enormous potential for delivery of information and educational resources tailored to the needs of the individual. Pharos in its present manifestation as a gateway to knowledge is far from perfect or complete, but it offers a framework that can be built upon and adapted to the information and educational environments of the 21st century. (AEF)

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UNIFIED INFORMATION ACCESS FOR THE 21ST CENTURY:
A PROJECT OF THE CALIFORNIA STATE UNIVERSITY

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Abstract

This paper presents the results of a three year project of the twenty-two libraries of the California State University system to create an entirely new approach to information access. The Unified Information Access System (UIAS) is designed to provide integrated, single-search access to the full range of library information resources. In addition to creating a powerful information access tool, it incorporates customized guidance in navigating the information environment, making it a valuable educational resource as well as an effective access management tool for librarians.

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Background

In 1994 the twenty-two libraries of the California State University produced a comprehensive strategic plan to prepare for the educational and information environments anticipated for the 21st Century. That plan, titled *Transforming CSU Libraries for the 21st Century*, identified, as its first and foremost strategy, a system of linking and integrating for easy access the full range of information resources available in all the CSU and other libraries as well as resources of the Internet.¹ CSU libraries were facing frozen or declining budgets combined with prodigious increases in the rate of publication and in access methods to the expanding information cosmos. A new and innovative use of technology was seen as necessary to leverage the size of the CSU information resources in order to continue to meet the needs of students and faculty.

The Unified Information Access System (UIAS) initiative that arose from this strategic planning responds to a vision for the 21st Century that assumes that CSU students and faculty will interact with each other and with information using an Internet environment that enables every student and every faculty member to access, retrieve, display, and manipulate a vast array of recorded knowledge and information. The barriers of space--physical location of student, faculty member, or information--are expected to disappear, as well as the barrier of time.

Conceptualizing the UIAS

While our vision for UIAS was well developed in general terms, a great deal of work lay ahead in defining unified information access and determining its feasibility given the state of available technology in CSU libraries and the library automation industry. We formed a systemwide project team composed of representatives of CSU libraries, multimedia centers, computer centers and the systemwide

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Chancellor's Office. The firm of RMG Consultants, Inc. was hired to assist in conceptualizing the UIAS and to serve as our intermediary with the library automation vendor community. At project start-up in the spring of 1995 the team held two meetings of the entire group in which the basic UIAS system was envisioned.

In envisioning the UIAS interface the project team focused on the end-user's point of view, particularly that of the emerging university student. We knew that the students of the near future would have grown up using a computer. Their experience using the Web and at least a vague understanding of the Internet and how it provided anytime anywhere access to vast information resources was also considered a given. We assumed they would want everything and want it now. On the other hand, we realized as professional librarians, that the majority of the content of the Web was not reliable scholarly information. We considered it vital that higher education students use a variety of databases that index numerous formats of recorded knowledge to get the best sources of scholarly information for any given topic. The challenge became how to create an interface that would give them just that. That is, let them do a single search in a Web interface and retrieve relevant books, journals in print or online format, Web resources and multimedia. We established this goal as a realistic one in terms of our general expectations as to how information technology would develop over the next several years.

Having set the general goal, we saw it as essential that we establish a dialog with leading library automation vendors to determine if they shared our vision. The development of UIAS would require vendors to share our vision for the project and be willing to develop the necessary software to implement it. RMG arranged an extensive series of meetings for the project team with about a dozen library automation vendors at ALA conferences in January and June 1995 and January 1996. Many vendors agreed strongly with the concept of UIAS. They tended to support open standards for its development and respected the fact that CSU libraries currently used several vendors for their integrated library systems. There was a mixed reaction to our position that this sort of advanced functionality should be developed in a Web browser rather than a proprietary client, as vendors were putting considerable effort into such clients at the time. Still, we were convinced that a Web interface was essential since Web browsers were widely available for free, already handled full text and multimedia, and would continue to develop rapidly. As the meetings progressed, vendors came to agree with us on this point and also assured us that they were developing suitable Z39.50 server and client software. Standards for ILL, intercampus circulation and authentication were more uncertain, but vendors stated they were willing to develop software for standards in these areas when they were adopted.

Overall, the vendor discussions affirmed wide interest and support for the UIAS concept and were very positive. RMG Consultants submitted their report concluding, based on discussions with vendors and examination of CSU library automated systems, that UIAS was indeed feasible and attainable within technical and budgetary constraints.² The report contained a proposed architecture for the UIAS and outlined a Request for Proposals (RFP) process as an implementation strategy.

By this time the project team had conceptualized the elements of a UIAS system in some detail. A user would make a single search from a standard Web browser to obtain information resources in books, periodicals, reference works, and online sources including Web sites and government publications. A bibliographic search that would have taken most of a day in printed indexes a decade ago, or a few hours in several online databases, is completed in about a minute. The search results feature optimized retrieval tools for each type of resource. Online sources are accessible by hypertext links to the full document file. Local books and periodical sources have call numbers and easy print options. The union catalog's combined holdings of the CSU libraries are obtained by direct end-user borrowing, and other materials not in the local library are attainable with interlibrary loan or document delivery request forms.

UIAS system response to a search request by the end-user is summarized as follows. The search is submitted from a Web browser on a form sent to a unified access gateway server (UGS). The UGS converts the search into a Z39.50 client request for broadcast to multiple Z39.50 servers. These servers can be a local library's OPAC; union catalog servers, including the project's union catalog server; commercial index, abstract or full text database servers; government document servers; or a Web search index. The UGS will be a campus-based server and will permit each CSU library to select, by multiple profiles, the database servers to which each user's search request is broadcast in Z39.50 protocol. The

UGS then receives the results in Z39.50 protocol, formats them for effective utilization by the end-user using CGI/JAVA scripts, and transmits the results to the end-user's workstation.

The CSU Council of Library Directors (COLD) analyzed the project concept in September 1995 and decided that an RFP should be developed for providing each CSU library with a UGS and establishing a CSU Union catalog with a Z39.50 server. The development of the RFP was assigned to task forces to write functional requirements for the UGS server including user authorization, broadcast searching and document delivery features, and for the union catalog server including cataloging and mutual borrowing capabilities. Developing the option for Z39.50 server access in a wide range of existing and potential systemwide licensing agreements for bibliographic, abstract and full text databases was also seen as essential. The existing CSU Electronic Access to Resources Committee (EAR) was given this assignment by COLD.

The task forces were constituted as subgroups the UIAS project team; they were charged with reviewing the results of the initial request for information from vendors and do other fact finding as needed to draft their documents. They were to develop functional requirements, an evaluation process and an implementation schedule for the procurement of twenty-two campus-based gateway servers and the central union catalog system. Their work was concluded by mid-December 1995.

The UGS task force developed functional requirements with many key features for the UGS server. The UGS will support users with a single easy to use search interface accessible via Web clients for which it is an HTTP server. The UGS is also a Z39.50 V3.0 client for access to multiple databases mounted on Z39.50 servers. Return of uniform search results from certain non-Z39.50 database servers such as a Web search engine should be considered. It must be capable of searching both predetermined and user-selected groups of databases based on a single user request. The UGS must also support user authorization, end-user ILL and interlibrary borrowing requests, and unmediated document delivery. Ease of use of all its features by end-users must be considered. The UGS must use open standards to the maximum feasible degree for interoperability.

In parallel the functional requirements were developed for the Z39.50 union catalog database server (UC) containing the combined holdings of the CSU libraries. The UC was required to have a Z39.50 V3.0 database server. At a minimum, this would permit it to respond to search requests with listings of which CSU campuses have a given title. The campus OPAC(s) will then be queried by Z39.50 regarding item availability and the request placed at a local campus showing availability. The database could be developed from existing CSU union catalog archive tapes, or by a merge of all campus OPAC databases. The database could be maintained by real time online updates, or by batch processing at frequent intervals of online updates to a transaction file. It will also handle inter-CSU library ILL requests. It may also be used as a common database for cataloging. All of these capabilities could mean its use would reduce other ongoing costs.

The UIAS project was made one of the first wave of CSU systemwide Integrated Technology Strategy initiatives and received funding in Spring 1996. In June of 1996 the chair of COLD and the UIAS project team met to discuss the next steps to be taken. The responsibilities of the project team devolved to three implementation teams: a management team to plan for ongoing operation of the UIAS, an evaluation team to select the vendor, and a contract negotiation team to oversee development of the contract with the UIAS vendor. COLD also appointed project liaisons at each campus.

Selecting the Development Partner

A Request for Proposal was issued with responses due August 23, 1996.³ Ten vendors responded to the RFP. The ten vendors were Ameritech Library Services, Auto-Graphics, CARL, Data Research Associates, Endeavor Information Systems, Geac, Innovative Interfaces, Library Corporation, OCLC and VTLS. The following month the evaluation team reviewed these proposals and made a selection of finalists. Finalists were Ameritech Library Services, CARL, Data Research Associates, Innovative Interfaces and OCLC. The finalists participated in confidential discussions with the evaluation team in October 1996 and provided demonstration servers for review by the campus liaisons whose comments were solicited by the evaluation team.

Each finalist was then asked to prepare a best and final offer (BFO). The evaluation team met in February 1997 and reviewed these documents. Present at the meeting was the newly hired full time UIAS project manager. The results of the two day meeting were presented in a report issued by the evaluation team. The report recommended that contract negotiations should begin with Ameritech based on the Ameritech BFO having the best overall rating as established by the agreed-upon evaluation criteria. This resulted in the contract negotiation team commencing talks with Ameritech.

The contract with Ameritech was in negotiation for about five months. Since it was for a developmental product, the timeline for its completion and the exact steps needed to combine and enhance a number of existing Ameritech products to make a functioning UIAS system was complex. The contract was signed in July 1997 and the name *Pharos* was selected as the new name for the system in its public manifestation.

The main CSU liaison to Ameritech has been the UIAS project manager. He has been in almost daily contact with Ameritech. In addition, several members of the UIAS management team have been in regular contact with the company. Ameritech has had many key people involved, including its president, its vice president for product development, and a number of other lead development personnel. In addition to regular phone calls, several meetings between the CSU project team and Ameritech personnel have occurred at three to six month intervals. They have been at either the CSU Chancellor's Office or Ameritech Library Systems headquarters in Provo, Utah.

As the project has progressed, it has become clear that this is a developmental partnership. Ameritech has worked hard to realize the complex objectives of UIAS in an open standards environment. Since the open standards for such functions as intercampus circulation and authentication are not yet finalized, this has proven a significant challenge. Ameritech has also had to port some components, notably its WebPAC product, from UNIX to NT so that the Pharos gateway could be on one server. The system requirements meant that their existing WebPAC and the under-development Resource Sharing System (RSS) had to be enhanced. In addition Ameritech had to develop a new module for Remote Patron Authentication (RPA). Specialized CSU task forces for database management, system design and implementation, user services and intercampus services have developed detailed requirements and reviewed developmental software and trial databases throughout the two-year period. Overall, it has been a unique opportunity for a vendor and a university to partner in development of a major new service for library users.

The Architecture of Pharos

Pharos is created by the interoperation of the following systems:

- twenty-two Pharos Gateway Servers -- one located at each of the twenty-two CSU libraries
- The Union Catalog/Z39.50 server -- located at the Chancellor's office
- 4CNET -- California State University's Wide Area Network
- The twenty-two CSU libraries' local integrated library system (ILS) Z39.50 servers
- Other California academic and public library Z39.50 servers
- The Internet
- Commercially operated Z39.50/HTTP servers providing access to indexing, abstracting, and full-text resources

The Pharos Gateway Server is comprised of:

- IBM IntelliStation
- MS NT 4.0 SP4
- Apache Server 1.3.2 (HTTP)
- Ameritech WebPAC 1.35 with bibengine 8.1 (Multi-threaded version 3, Z39.50 Client)
- Ameritech RSS (ISO 10161 Protocol Server)
- MS SQL Server 6.5
- Ameritech Remote Patron Authentication (RPA) Server

The Pharos Union Catalog is comprised of:

- IBM RS6000 -- S70
- AIX 4.3
- Sybase System 11
- Ameritech Horizon 5.x
- InfoSphere - ProIndex

Interoperation of Component Systems

Union Catalog

Because CSU libraries use integrated library systems from different vendors, the first step in developing Pharos was upgrading these local systems to include a Z39.50 V. 3 server. Building the union catalog was preceded by CSU's development of an algorithm that matches similar bibliographic records from the twenty-two library catalogs and then selects one of the matching records to be the *master record* retained in the union catalog. The program developed by Ameritech to implement this algorithm adds the local control number (LCN) to the master record from each of the matching CSU bibliographic records. The resulting MARC field in the Master Record is used to create a *Hook-to-Holdings*, which the Pharos Gateway Server resolves, using Z39.50, to dynamically retrieve the local call number and circulation status from each ILS. Holdings information is not stored in the Union Catalog. When fully operational, the union catalog will be updated on a daily basis with new, modified or deleted records from the twenty-two campus libraries.

The User's Perspective

To the user Pharos is a Web site, or part of a Web site, offered by the user's campus library. Pharos provides access to library information resources that can be obtained online, in the user's library, or requested from other libraries and/or document suppliers. The user is offered the opportunity to simultaneously search a number of catalogs and databases likely to contain the information desired by the user. Through the design of the screens generating the Pharos user interface, a novice user can begin with a general *Quick Search* that is intended to provide results that would lead the user to more specific information. Experienced users of the system can navigate quickly to topical screens that provide Quick Searches in subject domains. Expert users have access to more sophisticated searching options in specific databases or *native* interfaces offered by information providers that allow for more precise searching.

Authentication/Authorization

Integral to Pharos is an authentication/authorization system that provides a mechanism for controlling user access to impacted resources and services.

When using licensed resources or requesting materials not owned by the local library, the remote user is prompted to provide an I.D. number and last name by the Remote Patron Authentication (RPA) Server. The RPA submits this information to the library's ILS which then validates this user against its patron database. Assuming the user entered the correct information, the user is authorized to use licensed resources from the library or anywhere else on the Internet.

Inter-campus Circulation/Interlibrary Loan/Document Delivery

If a user has searched for information in Pharos and located a record or citation for an item that is not locally/currently available, he or she is prompted to request the item. The user generates a request for this item and is prompted by the RPA to enter his or her user I.D. and last name. Assuming the user entered the correct information, he or she is authorized to submit a request. The request will contain information about the user provided by RPA from the patron database, and bibliographic information provided by the database in which the user located the desired item.

Ameritech's Resource Sharing System (RSS) Web service submits the request to the MS SQL server database. Based on profiling decisions made by the local library, requests can be automatically routed to: 1) a short list of CSU libraries owning this item; 2) other libraries, which the requesting library may have reciprocal borrowing agreements; 3) a document supply service contracted by CSU; and 4) national and international interlibrary loan services.

Users are able to check the status of their requests on the Pharos Website; doing so requires authentication by the RPA. The user is notified by an e-mail message when requested items are available. If the library chooses, the requested item can be delivered directly to the user.

Library Customization

Because each CSU library has its own gateway server, Pharos can be customized for each library in a number of ways. The library can select what combination of catalogs and commercial databases to offer in a broadcast search and can decide how to integrate Pharos with existing library Web pages. The library can add a campus logo and other campus information sources and can create predefined searches and full-text hypertext links for faculty syllabi Web pages, and Web-based full-text course reserves.

The Pharos demonstration server can be reached through the project home page at <http://uias.calstate.edu>.

The Future of Pharos

Pharos is by design intended to be an expanding and evolving resource; as the educational, technological and information environments change, so will Pharos. The most significant area of refinement of Pharos planned for the immediate future is its customization for the user.

Pharos incorporates an important advance in library systems technology by linking the user interface to the patron database stored in each library's computer system. In addition to enabling authorization and authentication for resource sharing and access to licensed databases, this linkage permits the customization of Pharos to correspond to a variety of demographic characteristics of the user. The sequence of screens, branching options, help and guidance resources and search tools can be designed to accommodate the needs of faculty versus students, graduates versus undergraduates, residential versus distance learning students, and fine arts versus biology majors. Help screens, information competence tutorials, and pre-selected combinations of information resources can be packaged for lower division students, for example, while faculty can be presented with screens designed for more advanced searching. It is even possible to customize the Pharos interface to the level of the individual by creating and storing a user's own Pharos Web page that contains profile and search history information.

As the CSU continues to refine and expand Pharos, it will build on two related ongoing system-wide initiatives: the Academic Information Services Cooperative (AISC) and the Information Competence Project. The AISC provides the core content for Pharos. It combines the collective purchasing power of twenty-two libraries to acquire a core collection of electronic bibliographic and full text resources available across the system. It also encompasses a system-wide program of document delivery (books and articles) and agreements for expedited borrowing from University of California libraries. A new and innovative project within this initiative is the Journal Access Core Collection⁴ consisting of a customized electronic full-text database of selected journal titles most often subscribed to by CSU libraries.

The Information Competence Project⁵ addresses the problem of making sense of the increasingly complex information environment; it is a critical element in the success of Pharos. Twenty multi-campus projects have been completed or are presently underway and include both general education and major-specific instructional programs. Several are in the form of Web-based modules that will be incorporated into Pharos. An information competence fellowship program and faculty workshops have also been developed.

Conclusion

The scope and complexity of the UIAS project has entailed a daunting array of challenges, both in its conception and execution as Pharos. Through close collaboration with Ameritech Library Services, we have succeeded in creating a service to our students and faculty that has enormous potential for delivery of information and educational resources tailored the needs of the individual. Pharos in its present manifestation as a gateway to knowledge is far from perfect or complete, but it offers a framework we can build upon and adapt to the information and educational environments of the 21st Century.

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Abstract

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