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So You Want to Build a Network

WARNING: BUILDING A NETWORK may be hazardous to your health. Depending on network philosophy and guidelines, networking may demand unparalleled cooperation and communication among libraries. If cooperation within a region is "unnatural," dissension and frustration are likely to discourage any efforts to develop a network promoting such ideas as resource-sharing and coordinated purchasing. Success depends on selecting objectives acceptable to the expected participants.

When designing a network it must be clearly understood from the beginning which capabilities will eventually be provided, so that the basic design is compatible with the long-term evolution of the system. Many problems stem from differing interpretations of network direction and philosophy. Network participants may be shocked or unhappy to discover either that their desires run counter to those of the network, or that the architecture of the computer system precludes certain capabilities. A common understanding from the very beginning will alleviate many subsequent confrontations.

This paper reviews some of the problems associated with selecting system characteristics, establishing a governance structure and managing the project, financing, and computer technology. Each section is headed by questions indicating the type of issues which must be solved. Examples are based on experiences with the Washington Library Network (WLN).

System Characteristics

What functional capabilities will be provided (single-function or multi-function)? Will the system be designed for a particular area of the library, such as technical services, or for a particular function, such as cataloging, or will several functions be integrated? If several functions are to be integrated, how many? Possibilities include acquisitions, accounting, cataloging, authority control, shelflist, reference, circulation, serials control, union catalog, interlibrary loan, and microform alternatives to the card catalog.

What types of libraries will be served (single-institution or multi-institution)? Will the system support the activities of one institution or several concurrently? If several, to what extent will one library be able to access information about another library's activities? Will the autonomy of any one library be usurped by the system under certain conditions? What types of libraries and related requirements will be accommodated?

What standards will be enforced (national standards)? Will the cataloging portion of the system utilize all of the appropriate indicators and subfield codes defined in the MARC format, or will a subset or other variation be employed? If MARC is adopted, how will compliance be enforced? The possibilities include "honor system," computer editing and human review. How will conflicts between local practice or choice of entry and the Library of Congress's (LC) practice be resolved?

What authority control will be needed? Will the choice and form of entry be subject to established authorities? If so, how will compliance be enforced? If several institutions participate in the network, will each have its own set of authority files? Will libraries be allowed to share a common set of authorities? Will sharing a common authority be required?

What aspects will be mandatory and what will be optional? What co-operative agreements beyond use of the computer system will be required?

The computer system will cost less to develop and operate if it is a single-function/single-institution system which does not utilize the MARC format and relies on the "honor system" for quality control. At the other extreme is the WLN computer system, which integrates all of the above-listed functions for an indeterminate number of institutions and is in strict compliance with the MARC format and LC practice (as required for all current cataloging performed by Washington librar-

ies). Extensive programming edits bibliographic entries for proper use of the MARC format and routes them to a bibliographic center for on-line human review to ensure quality. Only one record is allowed in the data base for each unique item. Each authority group may have its own reviewers to ensure compliance with its established authorities. Multiple sets of authority files are allowed, with one or more institutions using a common set of authorities. Washington libraries have agreed to share one such set, making the union catalog consistent for the state.

Participants in WLN are expected to enter all new holdings into the data base. Therefore, use of the cataloging and authority control modules is required. All other subsystems or modules are optional; each library decides for itself the extent to which automation will be introduced. In addition, participants agree to share their resources with other members under reasonable conditions.

Unfortunately, when the previously developed systems and networks were surveyed in 1974, none were found to contain the desired combination of characteristics. At that time it was decided to develop a system based on many of the concepts embodied in the "quadraplanar" design planned for the University of Chicago's system. Financial implications of these design decisions will be discussed later; suffice it to say that selecting system characteristics has enormous impact on individual library procedures and organization, in addition to facilitating expanded programs in resource-sharing.

Governance and Project Management

Who governs the network?
Who signs the contracts and approves expenditures?
To what extent will participants be involved in decision-making?
Who sets development/enhancement priorities?
Who sets the prices for services offered?
What support staff will be required?

In 1973 independent requests to the legislature by three large state-supported institutions for monies to develop differing library computer systems provided the springboard for organizing WLN. While reviewing the requests, the Washington State Data Processing Authority concluded that one integrated system should be developed which would serve all libraries in the state. With the concurrence of the State Library, the first chartered organization, the Library Automation Committee (LAC), was established to serve as an advisory body to the data processing authority. Membership consisted predominantly

of representatives from the three requesting institutions, with additional members from other types of libraries invited to ensure that the resultant system would meet the needs of all the state's libraries. LAC then decided what type of system to develop and established numerous subcommittees to collect and draft the detailed specifications for each subsystem. The committees functioned with little opposition until the likelihood of substantial funding added considerable credibility to the endeavor. At this time the jockeying for money and positions of influence began. LAC was attacked for not providing equal representation to all power groups, e.g., public, academic and community college libraries. Each constituency wanted its representatives seated on the committee. Some pressure was relieved by requiring equal representation on all subcommittees but in the end a few new seats had to be added.

Three years is not much time to develop a large on-line computer system and to spend over $2 million. Since the State Library had previously employed an outside contractor to develop a batch resource-directory system and had had excellent results, the decision was made to extend the contract and build upon that experience base. The advantage of that decision was immediate productivity on the part of the technical staff. The long-term disadvantage of the decision was that intimate knowledge of the system's internal aspects resided with the outside staff, not with WLN staff. Two full-time persons, a librarian and a computer system designer, were hired by WLN to coordinate system development and oversee the work of the contractors. Numerous staff members at the State Library combined with LAC subcommittee members to provide input on system requirements and to review system progress.

A major consequence of having only two full-time persons assigned to the project was inadequate communication between involved parties. Staff members were continually occupied and internal communications were thus too infrequent to keep everyone abreast of the current situation. Librarians throughout the state received insufficient information. It was not uncommon to be in a meeting where many attendees lacked the background to discuss the issues at hand. Frequent repetition of information known to some but not all was necessary to bring the group to a common terminology and understanding. An occasional group even operated on outdated information.

Midway through the development, about one and one-half years into the project, the state librarian retired. This event caused some loss of momentum while the new state librarian became familiar with previous directions, sifted through controversial statements on project

status, and decided which past commitments were to continue to be honored. The arrival of a new top administrator also opened the possibility for reassignment of responsibilities. During the transition period, internal power struggles and uncertainty slowed decision-making and invited review of previous controversial issues. Previous decisions of the project leader were occasionally the subject of great dissension. Two-thirds of the way through development, the project leader left and the task of management fell increasingly on various committees. The main reason these turnovers failed to destroy the project was the relative stability of the staff employed by the outside contractors. Since the majority of the technical work such as programming was done by these outside groups, the project survived the periods of ambiguous responsibility.

Data processing groups unfamiliar with libraries frequently underestimate the size of the job by one order of magnitude or so. Also, on-line systems are more complex than batch systems. The estimating techniques which had worked well for projecting milestones during the previous batch resource-directory system proved inadequate for the on-line system, causing several major changes in the implementation schedule. Uncertainty as to when the system would really be ready caused some lack of confidence in the whole project, especially among those who, for whatever motives, privately hoped the network would never succeed. Due to schedule slippage and related cost overruns, the once-amicable relationshp with one contractor deteriorated into one of rigidity and legality. Toward the end it seemed the struggle had raged interminably. Despite the problems, however, the system was finally delivered, and contrary to predictions by the skeptics, it is working well.

In anticipation of the software delivery, the process of support staff recruitment began. Programmers with adequate backgrounds were located without great difficulty, but procedures estabished by the state's Department of Personnel caused more than six months' delay in the actual hiring of most employees. Recently, eight months elapsed before a planned promotion could be finalized. Inadequate staffing and the related lack of support in reducing hiring delays to less than one month remain very critical problems. That the system was developed and implemented by a small handful of people has to stand as one of today's modern miracles. It speaks well of the dedication of a lot of staff members and librarians throughout the state.

Complaints and general concern by librarians about LAC being attached to the Data Processing Authority caused the State Library to avoid bringing decision topics to LAC, and added incentive to efforts

already underway to create WLN formally through special legislation as a permanent responsibility of the Washington Library Commission. Following extensive statewide hearings, legislation acceptable to the majority was drafted, presented to the legislature and passed. WLN as established by law is a self-sustaining agency of the state of Washington with the state librarian as executive director. Through this legislation the state is divided into service areas which elect representatives to a representative assembly. The assembly then elects an executive council, which in turn forms various committees to fulfill its advisory responsibilities to the commission. Governance of WLN is now participatory and democratic. Functions previously designated to LAC are divided between the executive council and its newly-formed committees. Membership in WLN is established through signing one of three types of contracts: (1) basic membership, in which the parties agree to participate in resource-sharing without using the computer system; (2) principal membership, stipulating agreement to share resources, use the computer system, and comply with established system guidelines; and (3) cooperative membership, in which the parties agree to resource-sharing while obtaining computer system services indirectly through a principal member.

Financing

How much will the system cost to develop?
What will transitional costs be?
Where will the money come from?
How many participants are needed to be self-sustaining?
How much can the network afford to lose during initial start-up?
Will development money have to be repaid?

Building a network of the scope and character of WLN is a costly endeavor. Raising over $3 million for system development over a 6-year period was a project requiring years of preparatory activity with the state legislature in order to create an awareness of library community needs. This was especially necessary since not all libraries participated actively in the process, and some even quietly worked for the demise of the whole effort. In spite of all the preparatory lobbying, funding was forthcoming only with the endorsement and active support of the Washington Data Processing Authority, an agency established to regulate the mushrooming expenditure of tax monies on computerization at a time when anticomputerization sentiment was strong in the legislature. This joint support, while successful in gaining the necessary development money, created an administrative awkward-

ness, i.e., joint responsibility for expenditures. In the early phases this awkwardness seemed a small price to pay for the apparent system of checks and balances which encouraged participation in the project. Occasionally, however, libraries got differing commitments from each agency which subsequently had to be reconciled. Fortunately, the money for development was allocated to a central fund, reducing the likelihood that a library would embark on a deviant course because of financial independence, and encouraging libraries to assemble and discuss ways to divide the wealth. Having the money in a common fund was a great stimulus to cooperation.

By far the greatest financial problem, second only to gaining the funding, was managing the budget. As mentioned before, data processors not familiar with library automation commonly underestimated both time and cost, and although the estimates in question here were made by personnel with considerable library system experience, the figures were repeatedly too low. Unfortunately, the overruns were rarely below $20,000, necessitating periodic high-level meetings to redo the budget. Throughout the whole project, energy had to be devoted to satisfying skeptics that there were no major scandals to be "exposed." In the end, more than $200,000 in unanticipated expenses had to be incorporated into the budget by delaying implementation and deferring certain capabilities, the later addition of which would not compromise the basic design.

Implementing the system required more money than development did. With continued support in the legislature it was hoped that money would be appropriated to cover: (1) the initial operating loss of the network, (2) the one-time start-up costs for participating libraries, and (3) the added transitional costs incurred by libraries switching over to the computer system. In an effort to encourage libraries to lower their operating budgets to pay for automation, the legislature granted appropriations only to the first two areas. This has created a dilemma for many state-supported libraries. Their options are (1) to spend the new equipment money in the hope that automation will pay for itself in cost savings, or (2) to return the equipment money to the state unspent and decline to participate in the network—at the risk of having to fund the full cost later. With one year remaining, there is still time for libraries to decide; however, at this time, the libraries are split on the question of participation without additional money for transition.

With over $3 million invested in development and implementation of the network, and a base monthly operating cost in the neighborhood of $75,000, one might question whether the return on that investment will ever be sufficient to justify the expenditure. While it might be convenient to justify the network as a research or pioneering effort

paving the way for a new generation of automated library services, support for the system was gathered on the basis that participating libraries would be able to achieve a lower overall cost of operation. Several examples seem to indicate that the WLN system design will maximize the return on a library's investment in automation. For instance, the effort to establish and maintain a current publishers' name and address file to support ordering, claiming and paying functions in acquisitions will also support claiming in serials control and, if keyed by the publisher's prefix inherent in each ISBN, in reference assistance. The indexes for author, title and subject access to catalog information can also support the same types of access to on-order, holdings/location and circulation data. Through common access points, reference librarians can obtain information for all branches within a library and for all participating libraries in the region. Eliminating most manual files within a library will maximize the return on investment in computer filing. While a library may justify the use of the computer system for cataloging support alone, this system was developed to encourage much larger economic savings. Indeed, the investment is great because the system was designed to provide more economical library service throughout an entire region. The option is now available for libraries to make extensive use of automation in all areas of operation.

The degree of participation by each library will determine the total number of network participants needed by WLN to succeed financially. Fortunately, the legislature will not require repayment of the development monies, and having $1.2 million of initial capital has eliminated the need to recover all operating expenses when only a few libraries are participating. The challenge has been to establish a schedule of fees which will remain constant as the number of participants grows but will generate enough income for WLN to be self-sustaining when the initial capital runs out. Only time will tell if the WLN prices have been properly selected.

Computer Technology

What type and size of computers should be chosen?
Whose computers should be used?
What type of terminals should be used?
What design trade-offs can be made?
What data base protection is necessary?

Policy within the state of Washington requires all state agencies to obtain computer services from designated data processing service centers. The only decision WLN had to make was which service center

to utilize. The initial decision was to continue with the same center used during previous development projects and which was also involved in ongoing operations. When that center became overcommitted and new equipment was not forthcoming, development was assigned to another computing center, while the first retained responsibility for ongoing operations. Finally, a comparison of rates charged by all service centers resulted in the decision to move all computing to a third service center located 300 miles away. The problems of development being done at three different centers, as well as the disruption of moving, obviously delayed implementation and added to the cost of the project. The establishment of a branch office for the computer system support staff 300 miles across the state has provided desirable isolation from frequent interruptions, but has also greatly hindered interstaff communications.

The state of Washington also negotiates master contracts for the purchase of computer equipment. Consequently, the first terminals used by WLN were custom terminals supplied by the designated contractor. The terminals worked well and were very satisfactory except for their inability to share a communication line to the computing center. Competitive price quotes for supplying custom terminals with the needed "multidrop" support resulted in a change of vendor which delayed implementation somewhat and required the changing of existing modems. Since the new terminals are programmable, considerable time was spent "debugging" the programs during their first year in the field.

Contrary to the situation ten years ago, existing computer technology was more than adequate to solve system design problems. The only real problems were errors of decision and constraints imposed by the use of commercially available software products, e.g., CICS and ADABAS. Errors of decision include installation of modems incompatible with the CRT terminals initially used by WLN, and failure to draft exhaustive specifications for custom CRT terminals. Software constraints imposed by CICS and ADABAS affected both system performance and functional capabilities implemented in the first version of the system. The performance-related problem, on-line response time, can be solved, given adequate time to work on it, but some of the unimplemented functional capabilities will require some ingenuity to reinstate. For instance, the bibliographic data base serves as: (1) a resource directory for all institutions participating in the network, (2) a union catalog for all libraries sharing the same set of authorities, and (3) an individual institution's catalog if its card catalog is closed. Searching the data base therefore requires an indication of scope.

There may be many items, perhaps millions, encompassed by any one such scope. Unfortunately, ADABAS cannot restrict a search to such a large set of records efficiently, so the scope option had to be temporarily removed pending development of an alternative.

As is the case with all new programming, numerous "bugs" were uncovered during the first year of operation. A few were costly to remedy (over $5000 in processing), but most were solved in a few days. The possibility of a catastrophic programming error always exists, although that likelihood diminishes the longer the system is in operation. To reduce the possibility that an error might be undetected, "snooper" programs were written to sample the data base randomly and periodically in order to verify accuracy of the relationships. In addition, duplicate copies of the data base are frequently made, and all updates to the files are logged to avoid being unable to recover from a major disaster.

Summary

Developing computer software for on-line library networks is very expensive, especially if the computer system is intended to support all functional units of each library and also to serve as a union catalog for the region. WLN has spent over $3 million developing its system. These monies were granted by the state legislature to develop a computer system which would curtail the growing costs of library operation. Recognizing that considerable research and "pioneering" were involved, and that an investment in new library technology was worthwhile, the legislature appropriated the money without any requirement for repayment.

Implementing the new computer system required formalization of a governance structure, and operating funds for the first two years until the system becomes self-sustaining. In both cases, the state legislature was again involved—first to create WLN through law, and second to appropriate $1.2 million of initial capital to be repaid later. Without the support of the legislature, it is doubtful that WLN could have found sufficient funding for such an ambitious undertaking. Ultimately, however, it was cooperation among libraries which convinced the legislature of the merits of a regional network and enabled development of a system to promote resource-sharing.

All the health hazards, disagreement, contention, anger, frustration, exhaustion, despair, and poor decisions which await courageous people who want to build a network are worth the risk if success will bring needed information to people and enhance the ability of libraries to make that information available.