# Factors Influencing the Use of Technical Standards in a Nationwide Library and Information Service Network

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THE APRIL 1970 ISSUE of *Library Trends* contains an article by Wigington and Wood describing the standardization requirements of a national program for information transfer. In their article, the authors drew an analogy between the national telephone network and a conceptualized national information transfer system. In doing so, they identified a significant distinction between the two. For the "national telephone system there existed a single management-planning and decision-making authority for most of the system involved." For a national information transfer system there will be "many centers of influence."[1]

A review of national library and information service activities that have taken place during the twelve years since that article was published discloses that attention has continued to be focused on the need for a national information transfer system, and emphasis has continued to be placed on the standardization requirements. There has also been an increasing awareness of the socioeconomic issues which are influencing the use or lack of use of the technical standards needed to support network development.

## Acknowledging the Importance of Standards

In April 1974 the National Science Foundation (NSF) and the Council on Library Resources (CLR) sponsored a four-day meeting of representatives of the library and information services communities to

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establish a framework of objectives for the bibliographic control com-
ponent of a national program for information transfer. The meeting
attendees recommend the establishment of a "mechanism to monitor
and facilitate the attainment of national bibliographic control."[2] The
National Commission on Libraries and Information Science (NCLIS),
NSF and CLR responded to that recommendation by establishing an
Advisory Group on National Bibliographic Control which was
renamed the Committee for the Coordination of National Bibliograph-
ic Control (CCNBC). The CCNBC members were charged with "such
tasks as developing national strategies, identifying areas for standardi-
zation, protecting systems integrity, providing national direction for
international participation, and assigning responsibility to accomplish
specific tasks."[3] The group first met in February 1975 and continued to
serve as a forum for discussion and studies relating to bibliographic
control and standardization until 1979, when its members concluded
that more formal mechanisms for national-level planning had come
into existence.

In 1975 NCLIS issued *Toward a National Program for Library and
Information Services: Goals for Action* which set forth "the Commis-
sion's conclusions and goals for action which can be taken toward the
formulation of a national policy."[4] In delineating the nationwide net-
work concept, NCLIS identified a major responsibility of the federal
government to be the encouragement and promulgation of standards.
Their program document stated:

> Without doubt, an essential function, to be performed by the agency
> responsible for implementing the nationwide network, will be that of
> encouraging and guiding the development and adoption of common
> standards and common practices, adherence to which is implicit in
> system design and implementation of a nationwide information net-
> work....Careful attention to standards problems and requirements at
> the design stage can significantly reduce the incompatibilities and
> interconnection problems that arise when independently developed
> systems are integrated into a coherent operating network.[5]

The NCLIS program document also outlined areas for which the
Library of Congress should be responsible. Central to many of these was
a corpus of reliable technical standards.[6] To identify its responsibilities
more specifically, the Library of Congress commissioned a study by
Inforonics, Inc. The resulting 1978 report, entitled *The Role of the
Library of Congress in the Evolving National Network*, again focused
on the need for technical standards by recommending that "the Library
of Congress should assume leadership of network development activi-
ties by performing the major coordinating role in applying technology

and acquiring funding for the technical and standards-related tasks required to link federal, multistate, state, and local systems into the national network."[7]

During 1976 the Deputy Librarian of Congress invited senior representatives of several major library networks to form a Network Advisory Group to advise the Library of Congress (LC) Network Development Office on the development of an initial blueprint for nationwide library network planning. In 1977 the Network Advisory Group disseminated the results of its deliberations in a report entitled *Toward a National Library and Information Service Network: The Library Bibliographic Component.* Again the role of LC in the development and promulgation of technical standards was stressed.[8] Also in 1977 the Network Advisory Group became the Library of Congress Network Advisory Committee, with an expanded membership to include nonlibrary organizations, and with the charge to advise LC on matters related to nationwide network planning. During the process of addressing the technical aspects of library networking, the Network Advisory Committee encountered issues even more basic to networking, the issues of network governance[9] and bibliographic data ownership and distribution.[10]

As a separate issue the NCLIS program document also recommended making unique and major resource collections available nationwide.[11] In support of this recommendation, NCLIS established the Task Force on a National Periodicals System in November 1975. The task force, consisting of eighteen persons selected for their stature, experience and position in the library and information communities, met during 1976. Their report, *Effective Access to the Periodical Literature: A National Program,*[12] proposed a program with a National Periodicals Center (NPC), highly dependent upon accepted technical standards, to be under the management of the Library of Congress.

In the fall of 1977 the Library of Congress requested the Council on Library Resources to undertake the preparation of a technical development plan for the NPC. This was done, and in August 1978 CLR published *A National Periodicals Center: Technical Development Plan.* The plan brought into sharp focus the need for a considerable amount of compromise on the part of the library community insofar as the adoption of technical standards was concerned. In that section of the plan dealing with the identification of serials within the NPC, the designers wrote:

> The NPC will require libraries to use the ISSN [International Standard Serial Number] on all orders as a means of uniquely identifying a

specific title. Since the emerging national bibliographic system for serials in the U.S. will approximate the ISDS [International Serials Data System] in many important ways, it will be to the NPC's advantage to also use other ISDS data elements from the beginning. While this method of control is not consistent with past cataloging practices in American libraries, it is fairly consistent with existing and proposed practices. It also is similar to the treatment of periodicals by abstracting and indexing services. Any system of control selected— and ISDS is no exception—will create some problems for libraries because of their inconsistent application of standards. The use of the ISDS will, however, capitalize on its international acceptance as a powerful force for standardization and cement it more firmly into the foundation upon which the U.S. will build a strong system of national bibliographic control.[13]

In its continuing effort to encourage the development of an emerging national library and information system, CLR in 1979 began the Bibliographic Services Development Program (BSDP). This five-year (1979-84) program includes as a key issue the promulgation of standards to facilitate information interchange. The program principals reiterated this in November 1980 by their recognition that "Standards underpin any effort to share bibliographic records and products, particularly if they are in machine-readable form,"[14] and in August 1981, when they wrote, "Pressures by libraries and users to reduce barriers that impede the flow of bibliographic information also will influence the development of standards."[15]

*Information for the 1980's*, the final report of the 1979 White House Conference on Library and Information Services, contains further evidence of the recognition of the need for technical standards. In her testimony at the open hearing, Henriette Avram stated:

With the proliferation of information systems nationally and internationally, the need for increased information sharing becomes apparent as the worldwide economic situation becomes increasingly difficult. Present technology, and the marriage of the computer with telecommunications, increase the potential for information sharing while, at the same time, increasing the need for standardization. Effective and economic use of the technology and compatibility through standardization become more and more urgent. It can be said that standards are the sine qua non of information systems.[16]

Three important resolutions were approved by the conference delegates in support of technical standards. Resolution C-1, Technology and Uniform Standards, calls on the federal government to:

Direct all federally supported libraries and information services and other appropriate Federal agencies to support the development, review, and adoption of national and international standards for

> publishing, producing, organizing, storing, and transmitting infor-
> mation, using established and recognized procedures and institu-
> tions, and...that high priority be given to establishing or extending
> standards which address hardware and software compatibility, com-
> puter and communications network protocols, and machine-readable
> information; and...that the private sector be encouraged to participate
> and to support the development of such standards.[17]

Resolution C-8, Technology Standards Research, stipulates "that the
private and the public sectors join in furthering research directed
toward the development of technological standards."[18] Resolution C-
14, Cooperative Standards and Networking, calls for "uniform stan-
dards for national bibliographic records universally adopted [to] be
implemented."[19]

## Current Circumstances

Much has been written and said during the past twelve years about
the need for technical standards. Indeed, the number of such standards
available today is much larger than in 1970 when Wigington and Wood
outlined the standardization requirements (thirty-seven ANSI Z39
standards as of November 1981 versus only five in April 1970). Yet the
task of inventorying and developing the needed new standards remains
largely undone and the adoption of existing standards by the existing
information agencies has been spotty at best. Libraries and information
services have demonstrated a willingness to devote both time and money
to the development and promulgation of standards,[20] yet uniform adop-
tion and use of standards remains an elusive goal. Little compatibility
exists among the bibliographic records produced by information ser-
vices or information services and libraries. Two activities in particular
have served to exemplify these disparities. The first revealed differences
in bibliographic practices among members of the abstracting and
indexing (A&I) community, and the second, the differences between A&I
and library community practices.

In 1978 a survey was conducted by the National Federation of
Abstracting and Indexing Services (NFAIS) Common Practices and
Standards Committee. For this survey each NFAIS member service was
asked to provide information on the standards used in its production of
the printed and machine-readable bibliographic descriptions it distrib-
utes. The unpublished findings of the survey indicated very little com-
monality in practice, an uneven adherence to national and
international standards, and virtually no compliance with the *UNI-*

*SIST Reference Manual,*[21] which had been developed by the international A&I community for the purpose of fostering standardization.

Also in 1978, Unesco convened an ad hoc group of experts to establish a common communication format derived from the *UNISIST Reference Manual* and *UNIMARC.*[22] The members of the group represented the International Federation of Library Associations and Institutions (IFLA), International Organization for Standardization (ISO), International MARC Network Study (IMNS), UNISIST International Centre for Bibliographic Descriptions (UNIBID), Inter-Organization Board for Information Systems (IOB), International Centre for Scientific and Technical Information (ICSTI), International Serials Data System (ISDS), International Development Research Centre (IDRC), and International Council of Scientific Unions—Abstracting Board (ICSU-AB). The group, after four meetings during 1979 and 1980, was unable to reconcile the differences in bibliographic data handling practices and requirements between the library and A&I communities except by devising a completely new set of conventions for both communities to use.[23]

Both the NFAIS survey and the Unesco Common Communication Format (CCF) endeavor served as catalysts to intiate a subsequent examination of factors that influence and control the use, misuse and lack of use of technical standards. The NFAIS survey clearly pointed out the fact that the bibliographic records prepared by the A&I services were totally incompatible for all practical networking purposes. The Unesco CCF work determined that the needs served by the bibliographic records generated by libraries and A&I services were so varied that any attempt to reconcile them was virtually impossible. Even records produced by national libraries and national bibliographies are different because they serve different needs.[24]

Such revelations have not been welcome to those who believed that having technical standards would somehow ensure bibliographic control, enable the interlinking of bibliographic databases, and provide the basis for the envisioned nationwide library and information services network. Having standards and using standards are two separate issues.

Because the practicality of the Unesco CCF was being questioned, four members of the ad hoc group, the representatives of IFLA, ICSU-AB, ISO, and the International MARC Network Study, turned their attention to an attempt to understand and articulate the similarities and differences between the library and A&I communities.

Their analysis found that, fundamentally, both communities are alike in that both are concerned with the representation of document

descriptions in a brief record form which can then be used to identify documents relevant to the needs of users of the service. A major difference has been that the library community expects to provide the user with the actual documents that are identified, while most A&I services generally only identify documents to the user, who is expected to go to another source, usually a library, to obtain the actual items.

Another basic difference between the two communities is the degree of motivation to adopt standards and common practices. In the library community the overlap of collections has always served as an impetus to share catalog records in order to avoid costly duplication of cataloging and record creation. Consequently, a great deal of standardization of record content and record formatting has taken place. Within the library community, efforts to standardize have resulted in near worldwide acceptance of MARC- and ISBD-based conventions for the generation of computer-readable bibliographic records. The high motivation for sharing is what led to the development of UNIMARC, and the plans to use it for international exchange by national bibliographic agencies.

In the A&I community, there has not been this same motivation to adopt standards across agencies. There has been no concerted effort on the part of the A&I database producers to standardize their distribution files. The main reason for this is that there has been no widespread customer demand for the A&I community to standardize their bibliographic record creation practices. Recipients of the A&I services' information files have been willing to develop reformatting programs for each file subscribed to, in order to derive the benefits of having access to the information contained in the various source files. Without the external demand for standardized handling, the A&I services have not been willing to expend the funds needed to change what they are doing. Also, the A&I services' customers seem reluctant to ask the services to change. Such changes, they believe, would be expensive for them, as additional programming effort would be required.

In addition, the A&I agencies have not been much interested in sharing data among themselves. Most major A&I services are discipline-oriented, and their attitudes toward comprehensiveness, timeliness and record content vary widely. Since the users of these services are discipline-oriented as well, they are unlikely to demand that the source data distributed by numerous A&I agencies be interchanged or merged. Thus the interchange of computer-readable bibliographic records among A&I services is generally not viewed as a viable economic option. Where one service does obtain records from another, the involved services generally have bilateral agreements on the format conventions.

Usually the service producing the records has adopted the conventions of the service purchasing the records.

Another significant difference between libraries and A&I services in regard to record interchange has to do with coyright restrictions which apply to the data. Libraries that provide computer-readable bibliographic records generally do not place restrictions on how and where those records may be used. Indeed, third-party use is often actively encouraged. However, A&I services either limit or discourage third-party use without special contractual agreements.

Another factor which influences how libraries and A&I services view interchange deals with pricing policies. The prices one library charges another for computer-readable bibliographic records are generally not based on the cost of producing the records. In fact, the revenues a library derives from the sale of such records are usually much less than the production cost. Interchanges among national libraries and bibliographies are rarely accompanied by an associated transfer of funds. Such interchanges are usually on a quid pro quo basis. A&I services, on the other hand, attempt to recover costs and often include a margin of profit in their pricing policies.

## Factors Which Influence Use

Although this review of similarities and differences presented no new findings, it did help to bring into focus some of the reasons why more and more useful technical standards by themselves will not assure the uniformity a nationwide library and information services network requires. Issues such as governance, economics, culture, and perceived value exert greater influence on decisions to adopt and use technical standards than mere availability. Promulgators of technical standards have in the past frequently failed to take this into account.

The LC Network Advisory Committee (NAC) envisaged the evolution of a nationwide network as a result of linkages of bibliographic services; negotiated relationships among services and state, regional and federal groups; and similar connectings of special interest groups, with the negotiations extending to technical standards and the standards-setting processes. NAC members also envisaged the governance of the nationwide network evolving as the network itself evolved.[25]

### Governance

In the United States, as in many other countries, the adoption and use of technical standards is largely voluntary. There is no practical mechanism available to force the adoption and use of standards. When-

ever the decisions to develop and promulgate standards intended for use by many communities are vested in a single community, the resulting standards may find limited acceptance. Governance issues, e.g., control of programs of work of standards committees, determination of the scopes of standards, and selection of the individuals that will actually draft the standards, are important and need more attention than afforded in the past. Dynamic standards such as the ISSN, International Standard Book Number (ISBN), title word abbreviations, and country codes require continued maintenance. The selection and oversight of agencies responsible for such maintenance activities also involves issues of governance. If some segments of the library or information service communities believe they have little or no control over either the development or maintenance of standards, they may feel little if any obligation to use those standards.

One early example of an issue of governance is to be found in the history of the development of the Z39 standard for periodical title abbreviations. In 1962 the chair of the Z39 subcommittee responsible for developing that standard passed from the library community to the A&I community. Members of the library community voiced concern over that action. It was feared that the needs of libraries would not be adequately considered. The officers of Z39 at that time recognized this as a potential obstacle to achieving approval of a proposed standard. To overcome this, they instructed the new chairperson to ensure equal representation of both communities on the reconstituted subcommittee.

Another example of the relationship of governance and use is to be found in the development of codes for serial titles, namely CODEN[26] and ISSN.[27] CODEN emanated from the A&I community with little early participation in its development by librarians. Consequently, the level of bibliographic control required for such code assignment was initially inadequate, and the early CODEN files contained numerous duplicate assignments. Also, the initial four-character CODEN, which had no check character, did not provide for a sufficient number of codes for the full range of serials of interest to librarians and once used, CODEN could not be computer-checked. Had the development of CODEN been shared by both communities of potential users, the need for a standard serial number as a national code[28] might have never arisen. Consequently, two serial title code standards, one from ANSI, the other from the American Society for Testing and Materials, are in use. CODEN is used primarily by the subject access database producers (A&I services), and ISSN by the library community as well as some A&I services.

Still another example of standards developed under the control of one community, applicable in principle to (but not used by) both, is the MARC family of formats. These formats were developed with little input from the A&I services. Since the A&I services were not involved, few follow the MARC conventions. Had the A&I services been more involved, the MARC formats might have been made more specifically applicable to A&I needs and would probably have been adopted by more of the A&I services.

Control of the implementation of standards is also a governance issue. The administration of the assignment of codes such as ISSN, ISBN and codes for institutional addresses and country names is performed by maintenance agencies, not the standards-setting bodies. Genuine attempts are made to align the actual implementation of a standard with the intent of its developers, but the implementation group or maintenance agency may nevertheless apply the standard in a manner not fully consistent with the intentions of the developers. When this occurs, the question of who controls the implementation arises. A case in point was the machine assignment of ISSNs to entries in *New Serial Titles* (NST).[29] The ISSN standard specifies only one ISSN per serial.[30] However, the company that assigned ISSNs to NST failed to follow that rule. Because the 21-year cumulation of NST contained multiple entries for some serials, those serials were assigned more than a single ISSN as specified in the standard. Subsequent cancellation of the duplicate ISSN resolved this problem, but at an added expense to the organizations involved.

It is the maintenance agencies that are incurring the expenses of implementing them. Because of this, the agencies are inclined to handle the implementation by methods most cost effective for themselves. Whenever there are differences in interpretation of the intent of a standard between the standard-setting body and the maintenance agency, there is an issue of governance. Because of this, the ANSC Z39 Executive Council prepared a position paper covering its relationship and interactions with maintenance agencies. The position paper calls for formal agreements between Z39 and the agencies which implement Z39 standards for the continuous monitoring of these agencies.[31]

Issues of governance need to be recognized and reconciled in advance to expedite the development of the standards. Potential conflicts that might arise as the result of questions of participation, ownership, control, and distribution need to be understood and minimized so that the resulting standard will have the widest possible applicability and acceptance.

*Economics*

The economic issues that influence the development and use of standards are exceptionally difficult to deal with. Many of the components of a nationwide library and information service network are already in place. Changing established practices at these institutions to accommodate the use of standards may be very costly. Regardless of the value of any given standard to the network as a whole, the decision-makers at the component institutions will have to be presented clear economic justifications to change their established practices. In 1981, when Online Computer Library Center, Inc. (OCLC) converted name headings and uniform titles in its online union catalog to conform with the second edition of *Anglo-American Cataloging Rules* (AACR2),[32] it did so to reduce library costs, which might have increased dramatically as users attempted to resolve conflicts created under various cataloging guidelines.[33] While this constituted a short-term economic loss for OCLC, the decision to take this loss was based on a projected long-term economic gain. By implementing AACR2, OCLC provided a great benefit to its member libraries, significantly speeding up their cataloging operations.[34] The decisions made at the Library of Congress to use compatible headings in lieu of following AACR2 were not arbitrary. They were based on cost factors.[35]

Considerable attention has been paid over the years to the funding of standards development. Much of the effort of the Z39 Executive Council during 1978-80 was devoted to establishing a funding mechanism that would permit a viable standards program. The concern for adequate funding of Z39 will continue as additional standards required for a nationwide network are identified. However, somewhat less attention has been given to the expenses inherent in the adoption and use of technical standards. As resources are committed to developing standards, it would seem prudent to consider how their implementation and use is to be financed. For example, were a group of A&I services to adopt the full range of standards and conventions needed to achieve compatibility with the record structure, content and content designation of the LC MARC formats, a major investment would be required. In all probability, the costs would be passed through to the subscribers of the services. Since a large number of these subscribers are service providers (e.g., Bibliographic Retrieval Service and Dialog Informaton Retrieval Service), they too would incur new expenses adapting their systems and user aids to the changed formats. Would these service providers absorb these costs or pass them along to their users? Probably the latter.

The Universal System for Information in Science and Technology (UNISIST) Ad Hoc Group to Develop a Common Communication

Format proposed that ISO Technical Committee 46, Documentation (TC 46) standardize the use and content of character positions six through nine of the record leader of the international standard for bibliographic information interchange on magnetic tape.[36] ISO TC 46 spent two years working on this item before deciding such a standard was not needed. However, had this effort resulted in new ISO and, subsequently, ANSI standards, would the Library of Congres have been able to justify its adoption economically? Would the bibliographic services have converted the millions of records in their databases? How would they have recovered their costs? It seems highly unlikely that adoption of such a standard could be economically justified.

The economic issues associated with the use of technical standards in a networking environment are without question the most serious that network planners have to face.[37] The use of standards cannot place unbearable economic burdens on network components.

*Culture*
Organizational culture, that "synergistic set of shared ideas and beliefs that are associated with a way of life in an organization,"[38] influences decisions relating to the adoption of technical standards. Each organization associated with a nationwide library and information service network will have its own unique organizational culture. Since few, if any, network standards will be applicable to a single node or subset of a nationwide network, the utility and need for a given standard may be viewed quite differently by various network components. Organizational cultures are difficult to change. Frequently those who are proponents of standardization are not the decision-makers who can commit the resources needed to make the changes network standardization will require.

To minimize the degree or level of change at their own institutions, members of standards-setting groups will often seek to write standards containing alternative specifications. This leads to standards that are subject to various interpretations and, while providing for the retention of local practices, are not satisfactory in a network environment. An example of such a standard is the ANSI Z39 standard for the abbreviation of titles of periodicals,[39] which permits word abbreviation by truncation or contraction and the retention or deletion of diacritical marks. The developers of this standard came from very different organizational cultures, none of whom could compromise local practice, so alternatives were included. Such cultural or environmental differences need to be recognized as potential hindrances to producing standards of high specificity.

*Perceived Value*

Network planners need to be able to articulate and demonstrate the value of technical standards in order to assure their use. The value of technical standards is not equally perceived or shared across the full range of potential users. Some may view standards as detrimental to competition, as illustrated by the development of bar code technology, which the Planning Committee on Automated Identification Systems of the CCNBC described as "the competitive scramble for a piece of the market, resulting in a multitude of diverse formats and accompanying hardware, and competing technologies...."[40] Others may believe that a given standard impedes progress, as was the case with the ANSI standard for bibliographic information interchange on magnetic tape.[41] This standard was viewed as not being applicable to the distribution of bibliographic data through online telecommunications, so that some other record structure would be needed. The Library of Congress Network Development Office sponsored a study conducted by the Mitre Corporation in order to determine whether this was a valid concern. Mitre found that "current MARC format structure is functionally valid for the online transmission of bibliographic data."[42]

The perceived value of existing technical standards may also be diminished by the lack of standards needed in related network applications. Where no official (i.e., ISO or ANSI) standards exist, local practices are employed. As use of a local practice spreads, it becomes a *de facto* standard, such as the MARC language codes[43] have become within the library community where no official language code standard exists. Not having ANSC Z39 or ISO TC 46 standard codes for languages—one of the most frequently used elements of bibliographic data—perpetuates the use of local practices and can even discourage adoption of existing Z39 or TC 46 standards.

## Conclusions

The nationwide library and information service network is developing. Technological advances and economic pressures are changing its overall design. The design will continue to evolve as linkages, programs and concepts are tested and adopted or abandoned. The questions of governance and support and bibliographic data ownership and distribution are being addressed both within and outside the library community.[44] The role of and need for technical standards in the evolving network is appropriately recognized by responsible individuals. The difficulties imposed by the widespread use of common practices by

diverse groups, each with its own interests, are beginning to be understood. Shaw summarized this when he wrote:

> Public and private sector libraries, telecommunication vendors, hardware manufacturers, legislative agencies, various utilities, existing and planned network organizations, and others must have a stake in a national network, not to mention end users, who have the largest stake of all. Each group will have different goals and each will promote its own interest. Each group, as a component of a national network, will have to modify its immediate interest to some degree for the benefit of the whole.[45]

The important work of developing technical standards for the nationwide library and information services network continues. ANSC Z39 subcommittees are developing standards for computer-to-computer protocols; terminal commands; library, patron and item identification; and character sets, to list but a few. The composition of these subcommittees illustrates how librarians, information specialists, computer scientists, and publishers are working collectively to develop networking-oriented technical standards.

Concurrent with the recognition of the importance of technical standards to library and information service networking, and the increased awareness of the factors influencing their development and use, has come the further realization that the nationwide network configuration will involve much more than pairs of twisted wires strung between existing bibliographic services. Avram and McCallum have noted: "While technology in the early 1970s pushed the community toward centralized automated systems, it is now pulling toward decentralization."[46] Indeed, the network may be many networks providing various services and converging only at the users' terminals.

The standardization requirements of a nationwide network of networks will be different, but no smaller in scope than envisioned twelve years ago. There will be increased emphasis placed on standard methods to bridge among functions, databases, and host computers, and increased needs for standardized accounting practices and funds transfer. Improving the economics of information creation, transfer and use will be the motivating force behind the standardization efforts of the next decade.

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