Emerging Role of Z39.50 for Library Consortia in India

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Abstract

Interoperability is a key issue for resource discovery in a library consortia environment. Interoperability is a concept that addresses the extend to which different types of computers, networks, operating systems and applications work together effectively to exchange information in a useful and meaningful manner. The technology enabled library consortia environment is heterogeneous, it hosts many different technologies, various data, multiple applications and other networked resources. There are several emerging standards, which have been developed to facilitate the interchange of data in a distributed environment. Such standards make it possible to perform seamless searches across several distributed resources, which have been implemented on different platforms. Z39.50 standard is becoming an important strategic tool for libraries and other information organizations. The use of Z39.50 can enhance resource sharing by providing a single interface to search multiple information resources. This paper discusses about the z39.50 standard, various components of z39.50 system and its applications in the library consortia environment.

Keywords : Library consortia; India; Standards; Protocol; Information retrieval; z39.50; Interoperability

0. Introduction

Need of resource sharing was realised by libraries a long back. Inter-library loan has been practised as one of the most popular resource sharing activity amongst libraries. For resource sharing, the participating libraries need to come together and cooperate in two broad areas: (a) Developing the collection on shared basis, and (b) Developing services for exploiting such collection. Over the last five years information technology has had a profound effect on resource sharing activities. A collection is no longer bound by the structure of four walls. This creates the opportunity and an environment for new services unlike we had before. The collection function, however, is expanding to include a connection function. Selection is moving to an environment in which a multiplicity of media is available. Niche knowledge of users is increasingly important in the academic environment. Groups of local users will have an ongoing need for the proximate location of heavily used data, but the library should also provide access to less frequently used resources. Besides, the user not just wants access to the global resource of information in a reliable and cost-effective way. (S)he wants this access from wherever her/his workplace is located and with a minimum of effort and a maximum of transparency. Libraries and other information providers are trying to meet these demands by critically looking at their services, concentrating on content and reliability. The three major components of resource sharing are: bibliographic access, interlibrary lending, and co-operative collection development. A new facet of resource sharing is the development of joint licensing agreements that permit consortia of libraries to share responsibilities and costs of providing access to electronic resources.

1. Library Consortia

Consortia are commonly formed to increase the purchasing power of the collaborating institutions, to expand resource availability (in the past, print materials, increasingly today, digital data, and in the future, possibly human resources), and to develop and/or offer automated services. In her 1972 study of academic library consortia Ruth Patrick identified six activities engaged in by at least a third of the

cooperative organizations surveyed: reciprocal borrowing privileges, expanded interlibrary loan service, making available union catalogs or lists of resources, photocopying, reference, and delivery services. Each of these functions remains relevant to the purposes of most consortia today, although technology has changed the way they are carried out and a new service— joint licensing of electronic resources — has emerged as a major complementary activity. Indeed, "membership in a consortium is increasingly seen as the ante for participation in the game of competitive and cost-effective database licensing". With vendors continuously experimenting with different business plans for offering digital data and seeking to protect and expand profit margins of the print era, libraries almost are required to join forces to protect the interests of their clienteles. Affecting the future of "how information will be created, marketed and purchased," is viewed as one of the primary reasons for the development of today's consortia, but "consortia have the potential of serving their member libraries in many ways. Chief among these are collective buying power, collective technical expertise, resource sharing (digital and traditional media), staff development, consolidation of services and collections, risk sharing, exploitation of a pseudonymous identity for grant seeking and lobbying purposes, and the intangible benefits of collaboration". Dannelly in his writing on resource sharing partly explained how time has helped promote the growth of library consortia when he wrote "We are entering a Golden Age of Cooperation because (1) the technology to link libraries and to make the users of one library aware of the collections of others is available and getting better all the time, and (2) economics are forcing us to cooperate.". Libraries have gone from print indexes to librarian-mediated online searching, from CD-ROM user-friendly systems to highly powered Web-based systems that provide index entries, abstracts, and the full text and image of the article. Technology and its recent advancements have enabled the library resource sharing more effective than ever before.

2. Library Consortia Activities in India

Several library consortia have been set up in India over the last few years, to obtain site licenses and enable desktop Internet access to scholarly e-resources like e-journals and databases. Prime examples include the Department of Atomic Energy(DAE) Consortium, INDEST consortium under the MHRD (Ministry of Human Resources) initiative covering leading academic institutions like IISc (Indian Institute of Science), IITs (Indian Institutes of Technology), IIMs (Indian Institutes of Management) and NITs (National Institutes of Technology); and CSIR (Council for Scientific and Industrial Research) consortia covering about 40 national laboratories. INFLIBNET, with UGC (University Grants Commission) support, is another major initiative covering Universities.

These consortia efforts have enabled reducing the information gap between the resource rich and resource deficient among the participating libraries by providing equal access to information. The information resource base is being expanded to include more such resources. However, the activities of these library consortia at present are limited to negotiating with the publishers to obtain site licenses to make the online journals and databases accessible to the participating libraries.

The ways these library consortia operate are as follows:

- Identification of information resources of common interest (online journals, databases etc)
- Negotiating with the publishers for site licensing
- Participating libraries are informed of the resources subscribed to and the access details

Individual library may provide the necessary access links to the resources in the library web site. These links are established directly with the publishers web site or through the consortium web site.

The scope and activity of Library consortia are not limited to licensing electronic resources. It is much beyond. It will eventually empower the users accessing more information in the least possible time. Technology plays a major role in achieving this. In an ideal technology enabled library consortia environment, the entry point to the patrons of each member library is through a single web enabled window system that is user-oriented and provide access to the entire collection of the consortium member libraries. The system at the user end should offer services like patron identification and authentication, a comprehensive resource discovery system (encompassing the entire OPAC of member libraries and their holdings), access to the entire e-journals collection and databases. All these should be done through a single search and that should facilitate locating all the resources that are available across the member libraries. No matter where the search results comes from. The system should be capable of patron-initiated online requests of resources and Inter Library loan facilities. In other words, the technology enabled library consortia must provide:

- a single point of access
- unified login (including one user ID)
- one common user interface, i.e. one presentation structure
- one uniform,user-friendly retrieval system
- direct access to electronic media and a unified request service.

In a technology enabled library consortia environment, the information is inherently a sharable resource as they are electronic. But the library automation systems, standards and protocols that the participating libraries may have adopted may not be the same. This may cause serious compatibility problems. So, the challenge is to find ways to link the diverse systems and resources provided by individual participating libraries. Interoperability is the key to this as it allows organisations and communities to retain their specialist practices, while putting high-level standards and protocols in place for sharing of information. The interdependence of libraries in library consortia for access to the information makes mandatory the adoption of standards. The use of automated systems to manage libraries, and the need for inter-operability of these systems to support resource discovery, lending, and increasingly electronic document delivery requires that data elements, content rules, data formats, interconnection protocols be observed. It is important to have standardisation on all levels of communication in order to get good results from the end-users' point of view. "All levels" include for instance:

- network protocol
- character set
- data format
- profile which defines set of search terms, structure of search terms etc.
- cataloguing
- use of index terms and classification schemes

3. Interoperability

Interoperability is a key issue for resource discovery in a library consortia environment. Interoperability is a concept that addresses the extend to which different types of computers, networks, operating systems and applications work together effectively to exchange information in a useful and meaningful manner. The technology enabled library consortia environment is heterogeneous, it hosts many different technologies, various data, multiple applications and other networked resources. A functional goal is to hide this heterogeneity from users so they may effectively search for information, communicate and perform other tasks.

In a technology enabled library consortia context, interoperability generally means one of two things:

- being able to search, browse and retrieve information from distributed libraries based on (broadly) the same technologies, protocols and metadata formats
- being able to search, browse and retrieve information from distributed libraries based on a variety of software solutions, search and retrieve protocols and metadata format
- Ensuring that systems and resources at the participating libraries are interoperable will generally require the consistent application of available standards. There are four main 'standards-based' factors affecting interoperability among distributed libraries:
- the use of different library automation systems
- the use of different search and retrieve (or indexing) protocols
- the use of different metadata formats
- differences in cataloguing standards
- differences in subject indexing schemes

Even the libraries use the same automation systems and cataloging standards, there need to be a system to interconnect these automation systems. In any situation, interoperability is the key issue for a library consortia environment.

Interoperability requires standards on several levels. It is necessary to standardize what is being exchanged (data elements), how to structure it for exchange (record schemas and record syntaxes) and how to actually exchange it (protocol transactions and messages and profiles). Examples:

- Protocol standards e.g. Z39.50, ISO 10160/10161, X500, LDAP, HTTP, FTP, XQL - messages exchanged between client and server
- Protocol profiles – e.g. Bath, UCP, CIMI, IPIG - limiting options to ensure interoperability
- Data element standards – e.g. ISO 8459 - defines the elements that are part of messages. These may or may not be grouped into data structures or records
- Record structure standards – e.g. MARC (ISO 2709), GRS-1, SGML, XML, HTML
- Record content standards - Z39.50 Holdings schema, RDF, EAD,

4. Standards and Protocols for Library Consortia

Of the above, the standards and protocols that concern the librarians most in a library consortia environment, which is beyond licensing electronic resources, are:

- Metadata Standards or Resource Description Standards - AACR2 and Dublin Core;
- Resource Exchange Standards - MARC , CCF;
- Protocol standards for Resource Discovery – Z39.50; and
- Standards for Interlibrary loan – ISO10160/10161

There are several emerging standards, which have been developed to facilitate the interchange of data in a distributed environment. Such standards make it possible to perform seamless searches across several distributed resources, which have been implemented on different platforms. This capability could be used :

- in collaborative projects to make data from several organizations accessible in a single search
- within single organizations to make their data available to a wider audience that may be operating in other platforms and with other interfaces.

5. Z39.50

Most of us have heard of Z39.50. The term appears frequently in library literature throughout the last ten years, especially concerning library information systems and data sharing. Some librarians may have detailed knowledge of Z39.50: what it is, how it is used, and why it is important. However, for many of us it remains a slightly mysterious buzzword (or buzz number) that we only vaguely comprehend.

5.1 What is Z39.50 ?

Z39.50 is an international standard protocol used by networked computer systems for information retrieval. It enables information seekers to search different systems on a network or the Internet through the use of a single user interface. Software and system vendors offer access to information from a diversity of unique systems with different hardware, software, interfaces, and database search commands. Compounding matters for the information seeker, the Internet provides access to a mind-boggling array of databases that grows daily. The challenge for users becomes how to find the right information painlessly amidst this vast array. The goal of Z39.50 is to reduce the complexity and difficulties of searching and retrieving information.

Since the Z39.50 standard enables communication between computers, it can be used in several important ways in libraries. Most libraries now offer access to dozens if not hundreds of databases from library networks and/or from Internet sources. Because the access software for databases varies widely, searchers now must learn many different approaches to search and retrieve information. Search screens present the user with extremely different approaches for searching. Some offer a simple search box in which to type a search. Others offer many options that must be reviewed and understood for a successful search. Symbols used for searching may vary greatly from database to database. For example, the Boolean search “and” may be achieved in different databases by use of the following words or characters: “and”, “AND” (in some WAIS databases capitals must be used), “+”, a simple space, or “&.” Also, multiple databases cannot be searched simultaneously, so the user must search the first database, then log out of it before searching the next database. With Z39.50 software installed on computers, searchers have the distinct advantage of using one familiar interface to search many different databases individually or at the same time. This allows searchers to become proficient with repeated use of that familiar software.

The Z39.50 standard was developed to overcome the problems associated with multiple database searching such as having to know the unique menus, command language, and search procedures of each system accessed. Z39.50 simplifies the search process by making it possible for a searcher to use the familiar user interface of the local system to search both the local library catalogue as well as any remote database system that support the standard.

The latest edition of Z39.50 was approved in 1995 by the National Information Standards Organization (NISO), the only organization accredited by the American National Standards Institute (ANSI) to approve and maintain standards for information services, libraries and publishers.

Z39.50 makes it easier to use the wealth of information resources on the Internet. When using Z**39.50** enabled systems, a user in one system can search for electronic information in another system without having to know how that system works. Z39.50 gives different networks the ability to act like one network. By allowing different networks to act like one Z39.50 gives the user the ability to search different databases

using one interface. Z39.50 protocol does this by separating the user interface from all of the information servers, databases, and search engines it uses (Moen, ND). This is crucial because it can eliminate the user having to learn many different systems and database protocols for searching. Being able to search from the comfort of one's own interface is a big positive, otherwise "a simple reference query could involve logging in and out of a dozen databases, from the local catalog, to a regional system, and on to a variety of databases…", and a more difficult question could lead to "Interface Shock", the feeling one gets having to deal with multiple interfaces in a short period of time (Schneider, 1996, p.86).

The Z39.50 standard was originally proposed in 1984 to provide a standard way of interrogating bibliographic databases. Since then, it has gone through 3 versions - in 1988 (v1),1992(v2) and 1995(v3). Version 2 in 1992 also incorporated and became compatible with an ISO standard (10162/3) called Search and Retrieve. Version 3 in 1995 extended the features of the protocol - it is this version that most suppliers are now implementing. It is maintained by the Z39.50 Maintenance Agency - administered by the Library of Congress.

5.2 How does Z39.50 work ?

Z39.50 operates in a client/server environment, acting as a common language that all Z39.50 enabled systems can understand.

A library user interacts with "client" software installed on a computer workstation to formulate and send a search to the "server" software. The server software resides on a server containing the database that the library user wishes to search. When the searcher sends a request from the client workstation, the Z39.50 software installed there translates the request into the communication protocol defined by the Z39.50 standard and forwards the request to the server on which the database resides. Next, the Z39.50 server software receives the request and understands the communications protocol defined by the Z39.50 standard. It then translates the request into the language understood by the server and the search is performed. To return the requested information to the library user, the communication proceeds in reverse. A library user, performing a search at a workstation with the Z39.50 client software installed, sends a search request to one server or simultaneously to many servers with the Z39.50 server software installed. All servers should respond to the request for information by returning the requested data, and the client software builds a list of the items retrieved from all the servers searched and presents it to the user. Some may find that experiencing a search using a Z39.50 client software assists with understanding this concept.

When executing a Z39.50 search, the user specifies search terms that will be used to match against access points in the database. The user's query identifies information, or **attributes**, about those search terms that specify how that term is to be treated when used in the search. There are several different types of attributes:

- **Use** attributes indicate database access points— searchable fields or indexes that can be specified in the search. For example, a search for an author's name or a publication title would be specified by use attributes.
- **Relation** attributes are descriptors that specify characteristics such as less than, greater than, or equal to. A search for books published during or later than 1996 would use relation attributes in the query. Other attributes that control queries include truncation or omitting of characters in search terms and the structure of the query itself. In Z39.50 implementations, attributes belong to published attribute sets, which define characteristics of searches for given types of information. An example is the registered "bib-1" attribute set, which specifies a standard way that searches for bibliographic information will be executed.

The Present Facility allows the user to request that some or all of the records identified as meeting the search criteria be transmitted from the server to the client. This facility also supports selection of data elements to include and format for transferring the records.

Other Z39.50 Facility protocols exist to support such features as:

- Sort the results as specified by the user.
- Delete search results, either entirely or for specified records.
- Scan (browse) through index lists of items such as subject terms, titles, author names,and other database fields.
- Access Control through authentication and passwords.
- Resource Control and termination of Z39.50 search sessions by the client or server.

Two newer facilities, not readily available yet in many implementations are:

- Explain, which allows the client to exchange information with the server about what type of server the client is querying and what the client must do to communicate successfully with that server in a Z39.50 session, and
- Extended Services, which define operations the client may request of the server, such as saving a search for later re-use or running a search query on a periodic schedule.

The typical search process involved in a Z39.50 session is as follows:

- OPAC user selects Target library (Z-server) from an OPAC menu.
- OPAC user enters search terms
- OPAC software sends search terms and Target library details to a “Z-client” a piece of software usually running as part of the library system.
- Z-client translates the search terms into “Z-speak” and contacts the Target library’s Z-server software.
- There is a preliminary negotiation between the Z-client and Z-server to establish the rules for the “Z-Association” between the two systems.
- Z-server translates the “Z-speak” into a search request for the Target library’s database and receives a response about numbers of matches etc.
- Z-client receives records
- Records are presented to the OPAC interface for the user.

Originally Z39.50 was designed to help with searching very large bibliographic databases like those of OCLC and the Library of Congress. Today Z39.50 is used for a wide range of library functions that involve database searching, from cataloging to interlibrary loan to reference. With the rapid growth of the Internet, the Z39.50 standard has become widely accepted as a solution to the challenge of retrieving multimedia information including text, images, and digitized documents. Z39.50 is being used to access, for example, museum data, government information, and geospatial data. It can also be used to search the online databases and CD-ROMs that vendors develop according to a variety of design schemes. Without having to learn each system, users can search those databases with a single Z39.50 client, even though each uses a different hardware and software configuration, stores different types of data, and has different internal search logic.

This seamless access to multiple, diverse databases through a single interface is Z39.50's greatest benefit. Adding Z39.50 standard operability to an information system allows information systems to retain their uniqueness while providing a uniform interface to information seekers. Libraries can adopt a single standardized interface for their patrons to access the library's catalog, purchased CDROMs, subscriptions to online databases, and Internet resources. Data from a variety of sources can be extracted to a common format for offline use or import into a local database.

Z39.50 can encourage resource sharing on a broad scale. In the library community, for example, Z39.50 supports:

- broadcast searching of library catalogs located on the Internet anywhere in the world,
- interlibrary loan through Z39.50's standardized approach for delivering holdings information, and online item ordering and document delivery.

A primary goal of Z39.50 has been to enable separate information retrieval systems to interoperate, and thus provide a mechanism for a user to search one or more databases in a uniform and transparent manner. In addition, Z39.50 enables the user to retrieve data from one or more databases in a uniform manner. Interoperability is a complex challenge. Problems with interoperability result in users finding themselves unable to conduct meaningful and consistent information retrieval transactions across multiple implementations. There are many reasons for this, and it is important to identify several spheres that impact interoperability, and more generally, Z39.50 usability. There appear to be three such spheres: the standard itself; Z39.50 implementations; and local information retrieval system functionality.

The Standard: When thinking about Z39.50, it is important to understand the functionality supported by the features in the standard. It is an information retrieval protocol that enables one system to connect to another, express queries in a standard format, and retrieve results from the databases in one or more standard formats. In addition, the standard supports other important functions. Usability problems can occur at the level of the standard when Z39.50 does not support functions desired by users.

Implementations of Z39.50: Although Z39.50 is a standard, it is a standard that contains many options and choices from which implementors can choose. Two implementors that build Z39.50 implementations may find problems in interoperability between their systems because of the separate choices from the standards each implementor made. This is especially true with implementations based on Version 3 of the standard. Version 3 has a number of features that not all implementors support. Thus, if one implementor builds support for features A, B, and C and another implementor builds support for features B, D, and E, the two implementations will not interoperate on features A, C, D, and E. For basic library catalog searching, all Z39.50 implementations should support three core features: Init, Search, and Present. Yet major interoperability problems arise even for basic searching of library catalogs because of differences in attribute types and values supported and the record syntaxes supported in separate implementations.

Local Information Retrieval Systems: In this sphere of influences, there are differences in the functionality supported for information retrieval (IR) by the local systems. Z39.50 cannot add functionality to local systems. The standard simply defines a standard way of exchanging protocol messages that support existing functions of local IR systems. Thus, if a local system provides a feature to allow sorting of result sets and another system does not support sorting, a protocol request to have the latter server sort results sets will be impossible to execute. More problematic for interoperable search and retrieval are the access points and indexes provided by local systems and the types of searching supported. For example, if one IR system for bibliographic records supports Personal Author searching (i.e., there is an index for Personal Author names from the MARC records) and another system only supports searching on Names (e.g., as both subjects and authors), there will be interoperability impact. Similarly with systems that do or don't support truncation, proximity searching, and Boolean searching.

6. Z39.50 System for Library Consortia

Though numerous literature available on Z39.50, it may still not be very clear as to what all form part of Z39.50. It is an information retrieval protocol that enables one system to connect to another, express queries in a standard format, and retrieve results from the databases in one or more standard formats. Because of its many benefits, many libraries are interested in implementing a Z39.50 system. However, to implement a Z39.50 system in a library, two important concepts should be understood. First, any library may install a Z39.50 system regardless of the current integrated library system, because Z39.50 is hardware/software-independent. It will operate with all systems. Second, the "client/server model" is the basis of the Z39.50 system and understanding this model facilitates decision making for a library. We may describe the z39.50 system that comprises:

- Z39.50 Servers/Targets
- Z39.50 clients
- Z39.50 web clients
- Bath profiles

Understanding the role played by Z39.50 client and server software helps answer questions about whether a library should purchase the client or the server software or both. Purchasing the client software enables librarians and other users to search and retrieve information from servers with the Z39.50 software installed. Purchasing the server software allows a library to share the contents of databases residing on the library's servers with users elsewhere who have a Z39.50 client. Therefore, each library must decide if access to information at other sites benefits local users, and, also, if sharing local databases with distant users benefits the world of libraries and information access.

The rich functionality offered by the Z39.50 standard presents challenges for independently developed Z39.50 systems to interoperate. Simple claims by vendors that they "conform" to the standard do not yet ensure that their products will automatically interoperate with products from other vendors. The implementations take on very different faces depending on which Z39.50 facilities and services are included, as well as what local practices libraries follow in applying cataloging rules and authority control. The differences can result in interoperability failures between Z39.50 systems and have added to the complexity of Z39.50 implementation. Solutions to these challenges take the form of Z39.50 profiles. A profile is a detailed specification of Z39.50 features and functions that an implementation will support, improving interoperability by:

- assisting customers in specifying requirements for Z39.50 products,
- defining a core set of Z39.50 features to assist vendors in configuring their products,
- improving users' success in information retrieval, and
- leveraging local investment in Z39.50 by providing global access to resources.

Profiles are a useful approach to solving interoperability problems between Z39.50 implementations. Profiles are auxiliary standards mechanisms that reflect agreements between users and implementors on a set of requirements and Z39.50 specifications to address those requirements. Profiles can be considered a subset of Z39.50 features and specifications from the standard. Profiles detail specifications and choices among options that implementations will support including:

- Version of the standard (e.g., Version 2 or Version 3 or both)
- Facilities and services of the standard (e.g., Init, Search, Present, Access Control, Scan, and Explain)
- Attribute sets supported including specific attribute types and values supported, and combinations of attributes

- Record syntax(es) supported
- Levels of conformance.

A profile initiative that has broad implications for libraries is the Bath Profile: An International Z39.50 Specification for Library Applications and Resource Discovery. This profile reflects international agreement on a core set of features including search and retrieval of bibliographic records and retrieval of holdings information.

Most of the library consortia operate on a centralized acquisition and decentralized utilization mode. Access to information is provided in a decentralized mode except union catalogs. Even union catalogs are replaced by virtual union catalogs. There needs to be a centralized server for resources of common interest with Z39.50 server and client compliant at the server end. The user/participating library end will have z39.50 client system. This holds good for a consortia with centralized union catalog environment. Consortia with Virtual union catalogs will need to have both z39.50 server and client installed in every participating library which will be very expensive.

7. Conclusion

It is important for all library consortia to consider interoperability issues. Success of library consortia will depend upon successful interoperability and in the consistent application of standards regarding such matters as protocols, metadata formats, cataloguing rules and subject classification schemes. Library consortia can make immediate use of existing tools that promote interoperability and to improve these tools as needed. Z39.50 is one such protocol designed to be used in library environment.

For an optimum implementation of z39.50 kind of systems there needs to be:

- National infrastructure – building a common portal as single point access to the electronic resources, catalogues and subject gateways and as well as consensus on the use of standards, user dministration etc.
- Library infrastructure – upgrading of IT systems as well as standardisation of library systems, coordination and co-operation
- Digital resources – license agreements at national level, digitisation of collections and retro-conversion of catalogue cards
- User facilities – development projects, i.a. including user training, competence development, user

Of course, there are drawbacks to the use of Z39.50; it requires special software that needs to be installed, configured, and maintained, and cost can be prohibitive. In addition to the technology and cost factors, there are other limitations; although Z39.50 addresses requirements for search and retrieval, it does not address data exchange. These issues have yet to be solved. Z39.50 has not gained widespread acceptance; there are newer technologies such as RDF and XML that may be more effective. Although the development of Z39.50 has been underway for nearly 20 years, only in the past five to six years have library automation vendors and other Z39.50 developers produced stable and robust Z39.50 implementations. During this period, a wide range of commercial Z39.50 products have become available. The origins of Z39.50 are solidly in the library community, but since the early 1990s other information communities have seen the potential of an standard information retrieval protocol for providing access to a wide variety of distributed, networked resources. With the increased use of Z39.50 across different types of information resources and different developers' implementations, new problems in interoperability have surfaced.

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