LINKING INITIATIVES

Although Z39.50 has provided libraries with the mechanism to integrate front-end resource discovery into its services, it does not provide a solution that allows users to link to similar services and resources from another specific resource. This idea of context-sensitive, extended linking services is a relatively new area of interest within information organizations. It gives librarians and other information providers control of how to interlink their resources.

The idea of interlinking resources is not a new concept. In 1945 Vannevar Bush (an electrical engineer at Tufts University and the Massachusetts Institute of Technology) first mentioned the importance of related items found by users being available through actionable links (Bush, 1945). This concept is often referred to as associative indexing. The Web has made this type of interlinking easy. The user should eventually be able to control this type of interactive association.

Although citation reference linking has been around a long time, and today's Internet tends to mimic the paper paradigm in its linking to electronic versions of cited articles in bibliographies, linking to data has tended to be unidirectional (back and forth from reference to article). Wider and deeper navigation through the information universe needs to go beyond one level and become bi-directional, cross-directional, and even inter-directional.

Two types of solutions are helping the marketplace move toward user-directed linking systems. Static linking uses batch processes to compute links in advance of search strategies. SilverPlatter's SilverLinker service provides ongoing updates to its links, and CrossRef provides associated metadata and unique identifiers in a central database along with a search facility. Dynamic linking initiatives compute links for an information entity instantaneously with the user's request to the database. The success of this type of service depends on the quality of the metadata in the source document. EBSCO's SoftLinks and Dialog@Site!™ GOLD eDOCs both use algorithms to dynamically generate URLs.

Both of these solutions are based on the importance and context of metadata in relation to the information accessed. Not only is metadata needed to provide this type of context-sensitive extended linking service, but the quality of the metadata is even more important. Who will provide this high-quality metadata? Although metadata harvesting can and probably will provide the bulk of the information contained in digital documents, the authenticity and accuracy of metadata will always be a concern in the digital environment.

Major concerns exist about how to address the *appropriate copy* problem. Given that many manifestations of a cited article may exist that a user wishes to retrieve, how do information organizations link users to the appropriate copy of the information they need? In other words, when a user wishes to retrieve a specific copy of a linked article, how can a library ensure the user receives the copy of the article the library has already paid for through its electronic subscriptions, rather than being linked to a service where they or the library has to repay for something they already provide access to?

Other issues such as operational performance (how *close* is the item to the user in network terms—that is, in the library OPAC as opposed to linked

EBSCO'S SoftLinks, www.epnet.com/academic/linking.asp

Dialog@Site! GOLD eDOCs, www.dialog.com/products/atsite

Appropriate copy: the copy the library or information organization actually owns or has access to.

through an aggregator service), different vendor service models for the same content, and archiving of digital content also must be considered.

Herbert Van de Sompel of Cornell University has written many articles related to this issue (see Part 1-3 of the article "Reference Linking in a Hybrid Library Environment" in vol. 5, no. 4 and no. 10, 1999, of *D-Lib Magazine*). He focuses on the importance of bibliographic metadata, and how linking from metadata should be to a wide range of services and links, all taking into account the context of the user. An appropriate copy for a user, for instance, may be to a print subscription on the shelf rather than an electronic version of an article the library does not subscribe to. A link to the local OPAC, therefore, may be of great importance as one of many relevant local information repositories in this service.

Two major initiatives, CrossRef and OpenURL, are attempting to provide the context-sensitive extended linking service that will enable users to interlink among information entities and will allow libraries to connect into their local services to provide a solution to the appropriate copy issue. Both of these initiatives are based on work that Van de Sompel and his colleagues are doing in relation to the Open Archives Initiative (OAI) metadata standard elaborated in the previous chapter (low-barrier metadata harvesting specifications).

CrossRef

CrossRef is a consortium of more than 122 publishers that have agreed to contribute article metadata and links to a common database, which contains more than 4.8 million article records for more than 6,300 journals. The CrossRef system creates a mechanism for members to obtain digital object identifiers (DOIs) by looking up metadata for the object, and to obtain metadata by looking up DOIs.

The basic building blocks of a linking system are reference databases, resolvers, and identifiers. Although many ways exist to approach the unique identification of a digital object, no single accepted or official method exists. Since no single identifier can meet the needs of this problem today, CrossRef has decided to incorporate a network of identifiers surrounded by supporting metadata for each information entity. The DOI provides this type of structure and also is widely accepted and favored by most publishers. Since the DOI is a "dumb" identifier (similar to an ISBN number), the reference database can provide the mechanism to perform the search for the identifier, the metadata, or both. This mechanism becomes important in solving the appropriate copy problem, as well as in providing extended linking services (beyond just links to full text).

The beginning of an extensive and effective linking system is under construction. From the journal publishers' point of view, each CrossRef participant is assigned a unique DOI publisher prefix, which publishers assign to each article they publish. This DOI and its accompanying metadata are then deposited in the CrossRef reference database, and the DOI resolver is notified of the location of the article. As part of the publication process, the metadata for each reference in the article is queried in the CrossRef database. If a match is found, that DOI is retrieved and inserted as a CrossRef link in the article bibliography.

To support localization of linking, institutions must use a resolver that has knowledge about the local institution's collection. One of the first of these

local resolvers, or link servers, to be marketed was the SFX link server from Ex Libris. SFX was developed by Van de Sompel and purchased by Ex Libris in February 2000. SFX, and similar link servers being developed by other vendors, can control the types of link services that are offered to users at any time and where these links are resolved. In this way, instead of a static or hard-coded link, a hook (or URL) is inserted dynamically when the user views the link source, which provides the mechanism for appropriate copy. This hook leads to the other initiative currently under development.

OpenURL

To address the interoperability problems inherent in linking heterogeneous information resources, Van de Sompel and his colleagues have developed the OpenURL framework. A working model can be described this way: a resource introduces the OpenURL to the user at the time of a search, the user clicks on the OpenURL, and the target of the OpenURL is a service component of the user's choice. The OpenURL provides the mechanism to transport the metadata from the information resource to the user's chosen service component. If correctly tailored, the user's service component can deliver context-sensitive services.

Through the creation of overlay linking services (substitution of one URL for another more appropriate URL) and the OpenURL, information organizations can fully integrate their resources into their users' overall information services by creating the hooks that link back to local resources and services. The OpenURL has been submitted to National Information Standards Organization (NISO) for accreditation as an ANSI Standard and has been accepted as a FastTrack work item.

Although some concern existed early on that the CrossRef and OpenURL initiatives were at odds with each other in attempting to solve the problem of context-sensitive extended linking services, that concern has vanished as Ex Libris and others involved in these initiatives are working together to incorporate the best of both tools. CrossRef has begun to implement the OpenURL standard into its DOI environment.

Metadata provide the mechanism to enable the extended and open linking services that are needed in the information universe. Information organizations can assist in this endeavor by providing authenticated metadata to their local information resources and services, so that when standards such as OpenURL and services such as CrossRef are integrated into local environments, organizations have already put into place the mechanism for the successful resolution of links and identifiers for their local users to find their appropriate copy.

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