Hyperlinking Journal Articles by their References

Linking references is one promise of the electronic publishing of scholarly journals that is just starting to be fulfilled. This is perhaps one of the most profound ways research journals will change and some of the major issues are only starting to be addressed. Eventually, there will be a dynamic, global web of information where users can easily follow many different types of linked references. Before that happens, many problems need to be solved.

For journal articles there is a hierarchy of linking, and as one moves up, things get more complicated. References can be linked:

    -within an article - to and from the text
    -within a journal - forward and back in time
    -to other journals by the same publisher
    -to other journals in the discipline
    -to bibliographic databases of abstracts that lead back to full text
    -to data (multimedia)
    -to any type of data or database

In electronic articles, it is becoming standard to link references within an article. A mention of the reference in the text is linked to the reference list and back - this is straightforward. The next level is linking within a journal, which is a little more difficult, especially if you include forward citations (eg when an article in 1997 references an article in 1996, the older article will have a link to the later article). Expanding to link to other journals by the same publisher is easy after the initial linking is set up. However, things start to get interesting when links outside one publisher's content are considered.

The main areas of concern with linking multiple publishers are:

    Naming - Unique Object Identifier
    Metadata - knowing what an object's name is
    Name Resolution - getting to the named object
    Permanence - will you always be able to find it?
    Access Rights - can you get full text, or just abstracts?

A project that answers some of these questions is the Digital Object Identifier (DOI) (www.doi.org) being developed by the Association of American Publishers (AAP), CNRI, Academic Press and other publishers and information providers.

The DOI is a system that allows content to be given a unique number - the DOI. DOIs are stored in a Registry along with a URL that points to wherever the content owner chooses. When a user submits a DOI to the Registry they are immediately redirected to the URL registered for the DOI. To a certain extent, this solves the problems of Naming, Resolution and Permanence. The content owners must choose a naming scheme to give their content DOIs. The DOI system handles resolution and there is permanence because publishers change the URLs associated with the DOIs without having to change the DOI.

Unfortunately, the DOI system doesn't address how people will find DOIs. One approach is to use something for the DOI that is derivable from a standard bibliographic reference. Another approach is to have a metadata database of DOIs and associated information - abstract, authors, titles, keywords, etc in the case of journal articles.

Academic Press is working on using SICIs as DOIs for its journal content. We have found that a full SICI CSI 2.0 cannot be generated from the information in a standard reference, so something else is needed.

Unless everyone agrees on what to use for the DOI, a DOI lookup or matching facility will be necessary. People will have long lists of references for which they need DOIs. Academic Press and others in the DOI project have been looking at using the Dublin Core Metadata recommendations as the basis for building a DOI database. Also, Academic Press has created a prototype DOI Finder, which allows people to find DOIs using minimal bibliographic information.

This Project Briefing will give an overview of the current state of linking references and discuss the DOI and other aspects of linking references and try to see where things are headed.

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Academic Press - http://www.apnet.com/
IDEAL - http://www.idealibrary.com/
AP DOI Page - http://www.doi.org/
DOI - http://www.doi.org/