Information Services & Use 14 (1994) 255–265
IOS Press

Xanadu: document interconnection enabling re-use with automatic author credit and royalty accounting*

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1. The tragedy of closed media

The great idea of electronic media, interactive and universal, seems to promise great freedom and possibility. Yet it also harbors many sinister restrictions. I am very concerned with the restrictive and even repressive directions of electronic media, which threaten to create a Balkanized, imprisoning world just when we thought we were being freed.

They are closed and cannot be used together. Books and journals are compatible, they can share the same desktop. But there is no way to make marginal notes in a CD-ROM, and there is no way to quote from it or link to it.

The alleged standards go in the wrong directions. Current "multimedia standards" are built on a closed-unit philosophy; no one else may connect data to them. Multimedia objects are closed encapsulations that do not allow interconnection between documents. This is a dead-end world.

The central issue is interconnection and re-use of material. Systems currently being designed do not address this problem (although some exciting exceptions, such as World Wide Web, are beginning to appear on the Internet).

Even on networks, in "conferences" and "forums", alleged boundaries of subjects are sternly administered according to the whim of whoever runs them.

Great headlines and hoopla presently attend the new media activities of large corporations. The Full Service Network in which Time-Warner claims to be investing five billion dollars, for instance, appears to be predicated on our believing that they understand interactive media. Yet in the publicity they stress "video on demand" (being able to start looking at an existing movie at any time), "near video on demand" (being able to start looking at an existing movie at *almost* any time), and being able to switch points of view in a baseball game. These are scarcely the interactive media some of us foresee and want.

*From the proceedings of the National Convergence Symposium '94, Sydney, Australia, April 13, 1994.

0167-5265/94/$06.00

At another level, industry initiatives to track copyright are also limited in thinking. For instance, the "SMPTE header initiative", by the Society of Motion Picture and Television Engineers, will be placing copyright notices in the headers of files. This assumes that entire files will be accessed by users.

Many allegedly far-seeing computer applications are ways of simulating paper. Macintosh "WYSIWYG" applications ("What You See Is What You Get"), such as word processing and spreadsheet, usually simulate paper. And a program called Adobe Acrobat – a way of transmitting documents between computers – mimics paper, and its documents cannot be linked into from outside.

All these approaches fail to see the great possibilities.

2. What we need

We get most of our information in small amounts, echoed and borrowed: quotes, clips, summaries, digests, reviews. This flexibility is available in the world of paper, but we are losing it in digital media. We have more and more types of media, but no good ways of using them together.

What we need is *unbounded on-line media with compatible connections* – for scholarship, controversy, anthologizing, understanding, the reworking of ideas, and freedom. We need interconnection without boundaries and the ability to re-use in new contexts.

The problem is how to allow everything to be combined, while still keeping ownership and context sorted out. We believe we have found a way.

Let us talk about the unified, generalized hypermedia world that I foresee for users of all ages, skills and interests.

The typical user of the twenty-first century sits at a screen, making choices in unpredictable directions, drawing material out forever.

There is no telling where the user will go next. He or she sends for the content implicitly, by pointing and clicking, or by whatever interface gestures become popular at a given time. The actual purchase of the materials is formally ordered by the user's screen machine.

The user does not have to buy whole documents. Instead, she or he simply selects (and purchases) *the next fragment desired.* These may add up to whole documents, or not. The user will only draw out a small, unpredictable part of each document at a time, jump from document to document like a squirrel from branch to branch, passing through one document on the way to another, purchasing just that moment's portion.

This does not imply that we will use our ability to think, concentrate, or study deeply. Rather, this quick perusal will be a vital form of search, the principal access method by which we find the materials we most need to master.

The reader need not master computerish styles of interactions; she or he need only start on one document and click across the universe from there. It will be unnecessary to learn commands. The reader will be able to point and click to travel inside a document, or to travel between documents on bridges of interconnection. Even a child should be able to find her or his way around.

The user points at the desired link on the screen; the user's screen machine – that is, the underlying computer – automatically purchases the linked material from its publisher and brings that material to the screen. Thus anyone, with whatever skill, can go from document to document within this universe.

The typical document will include text, graphics, audio, video, etc. All borderlines between media will be eliminated. Everything will be interactive; "Everything is a movie".

No assumptions can be made about the viewing machine or program: there is no way to tell what kind of viewing machine the user has, or compel the use of a specific viewing machine or program, only to recommend them.

Many different points of view, including unpopular and eccentric ones, will be freely publishable, linked to the materials they agree and disagree with.

In today's world, we are exposed only to those viewpoints held by those with access to media. Open controversy and argument are not well represented by existing systems. This is not the democratic ideal. For the vitality and viability of tomorrow's world, this must be changed.

3. Generalist, no boundaries of subject

This is a medium for publishing in all areas. Indeed, since there are no real boundaries between different areas, all publishing methods that restrict themselves to given areas are hobbled. There will be no boundaries to categories; you are not restricted to the way that someone else sees the world. A document may be of any size, spread across many disks in many places. Anyone may publish connections to the document. The network is a seamless whole, and all its contents a unified docuverse.

The universe connects in all directions. There are no really sharp lines between subjects, and generalists are those people who pursue their interests without regard to artificial boundary lines. There are more and more brilliant generalists throughout the world, but the existing publication media subdivide the world of ideas and information artificially. Tomorrow's world will not.

This cannot just be for the wireheads, early adopters, elite; it must be accessible to all. Because it will be equally available to everyone at low cost, and open to all points of view, we believe this will be a populist medium.

4. Freedom: open hypermedia publishing

These matters are not merely technical. They are moral issues about freedom that affect our entire future.

Moral precept: people must be free to read anything.

Correlate: we must be free to jump into a document at any place, and use it according to our own preferences. (This is contrary to some people's accustomed prerogatives. Many authors like to imprison the reader, and "computer-assisted instruction" is largely based on such imprisonment.) We believe the reader must always be free to go back, turn the page or fast-forward. The author must be free to suggest but not to

impose. Our model is turning the page of a book: the author has put the pages in order, but the reader is free to skip.

Moral precept: all hypertext jumps should be reversible. (In many interactive media now on the market, the reader cannot go back to previous places, but is swept along. This is a form of imprisonment.)

Moral precept: everyone must be free and equal to publish, to comment, to publish links, to quote.

Moral precept: the system must not keep records of who sends for what; otherwise reading becomes a political act.

5. Stability and copyright

"Literature" is what remains after all is said and done. Tomorrow's media may arrive faster, but they must not go away faster; we must have the same certainty of re-use that we have known in the paper world. We need to know the material will be addressable in the same form and the same way, decades from now.

Many computer people naively think that copyright will go away. But it cannot. Copyright is not an imposition; it is the compromise under which things are made available. Thus the new system must extend it inconspicuously and innocuously. Pragmatically, it is necessary to entice rightsholders to participate, or materials will be available only under the gravest restrictions. Our point-and-click universe must work in a world of copyright law; but we must make copyright and royalty innocuous and smooth.

6. Xanadu

Xanadu has long been a software design, an ideal, and an action plan for a worldwide linked electronic publishing system.

We believe the Xanadu system offers unique solutions to issues of royalty, rights and re-use.

Our electronic publishing model has been unique: a scheme for open, integrated universal electronic publishing with freedom for anyone to publish. Anyone may publish any form of data, and anyone may publish links to already-published material. Perhaps most important, anyone may re-publish material already on the network without restriction, excerpted at will and presented in any new context. A few simple rules operate automatically to maintain ownership, authorial credit and accounting.

Xanadu is a business model to achieve this openness and freedom. It is a method for the sale of copyrighted material on networks. All parties agree by contract to a standard form of sale and re-use. This is a highly-integrated business model based on an exact delineation of parties, contracts, and arrangements. Rather than being restrictive, however, this system defines an extremely broad playing field for publication, communication, education, scholarship, business communication, entertainment, multimedia, other art forms, and general use. The type of implementation is secondary. Different implementations and protocols may coexist and operate together under this framework.

The system is defined so that all parts of a published document may be purchased à la carte in pieces. Anything already published within the system may also be re-used and re-published with ease within the system. Thus text, graphics, audio, animations, simulations may be recombined on a mix-and-match basis. This is true for links as well.

All parties agree by contract that materials may be re-used freely, but only by virtual inclusion in new Xanadu documents. Thus everyone is free to use previous materials in new ways, but royalty and credit automatically go to the rightsholder.

Links and markers are local applicative substructures, and not embedded in any way. This better facilitates re-use of the material.

Each time a customer buys a fragment of any data – text, graphics, audio, 3D models, whatever – a proportional royalty payment automatically goes from the customer to the publisher. Anything may be bought in small portions.

The plan has also been to license, or franchise, service providers, who will set up computers and data storage using our software, and make the service available to customers locally and internationally. Customers may modem in to their local service providers. The service providers, in turn, will be able to send for materials they do not have locally.

7. An implementation suitable for the Internet

7.1. Interaction in Xanadu

The user perceives a point-and-click universe. In actuality, each click makes another small purchase of content bytes or links from the network (Figure 1).

A receipt will be sent with each portion. This will assist the user, or the user's system, in filing the portion, if the user chooses to keep it. The receipt will also authenticate, by means of a hash code, the user's legitimate purchase of this portion.

Basic purchase will be simple, allowing a minimal interface for purchasing portions. A higher-performance interface will be point-and-click with material appearing in separate Mac-style windows.

There have been various complex arrangements (especially SGML) for the framing and presentation of text, especially local assignment of layouts to paragraph types. We will have such an arrangement, but within the framework of local applicative substructures.

A very high-performance interface will also be specified at a later time.

8. Document connection

A document consists of contents bytes (text, graphics, etc., *originating in this document*), and connections both in and out of the document. The structure of document connections is *applicative*, meaning that no codes are embedded. Structure is managed within the database system (Figure 2). In relation of other documents, these connections create a symmetrical structure of connections (Figure 3). It is important

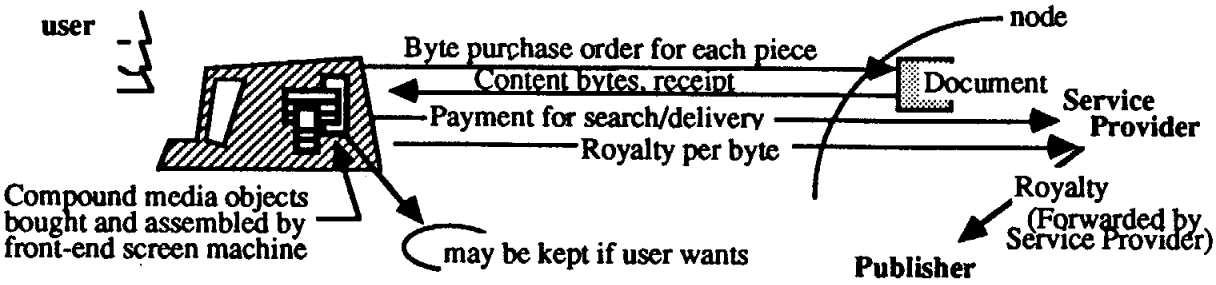

Figure 1.

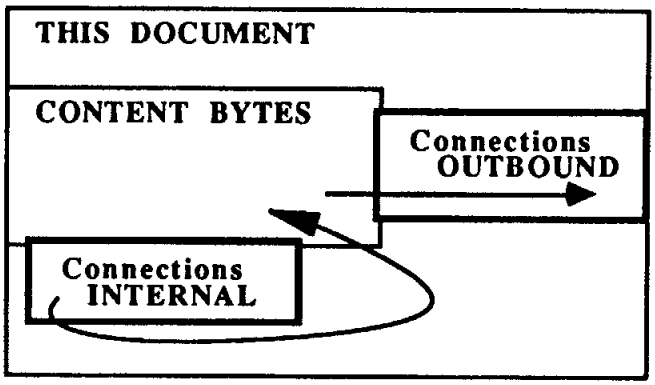

Figure 2.

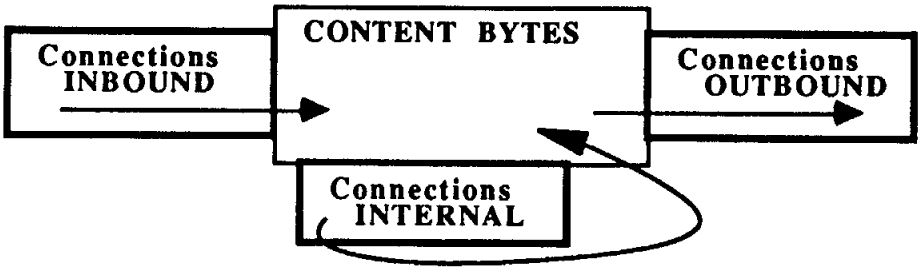

Figure 3.

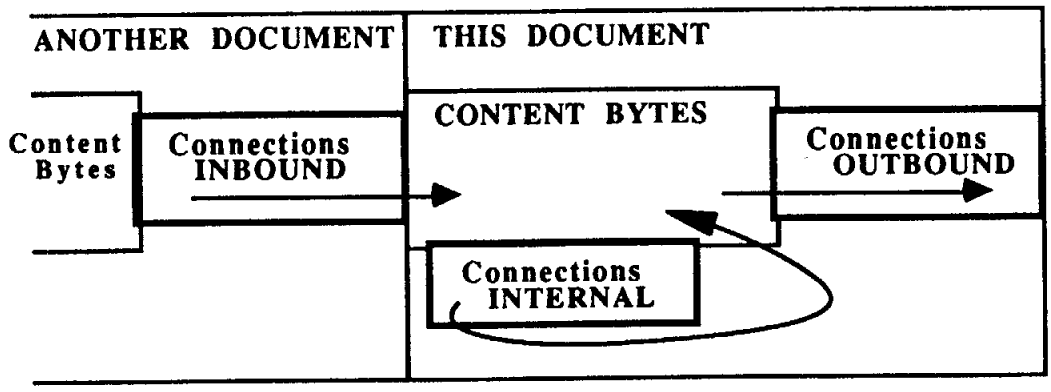

Figure 4.

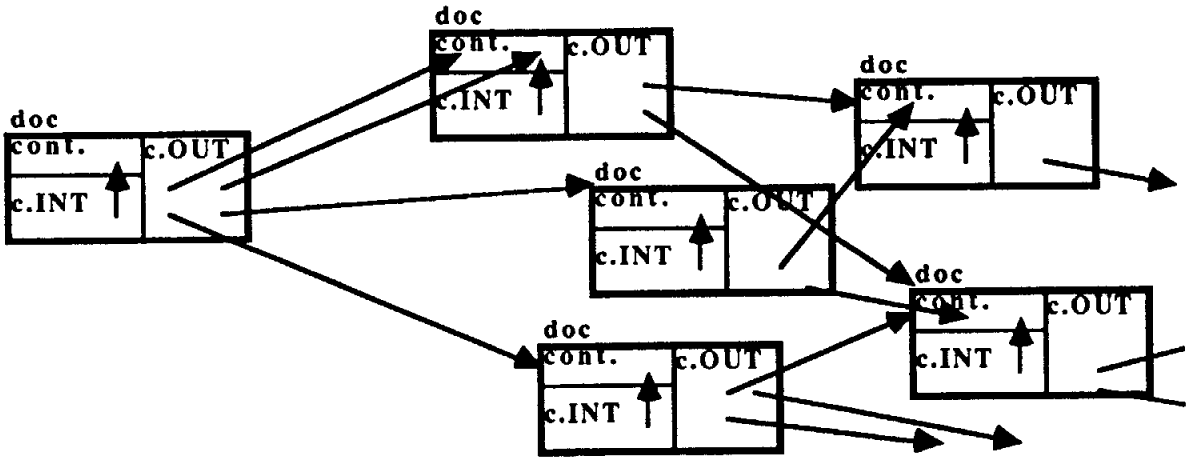

Figure 5.

to understand this symmetry, which we will discuss later.

All connections are owned. One document's inbound connection is another document's outbound connection (Figure 4). *Connections into a document are owned by other documents where they originate.* Taken all together, these connected documents make up a docuverse (Figure 5). No other parts are needed.

8.1. Types of connections

There are two types of connections: links and transclusions (Figure 6). A link is an arbitrary connection of any type. A link is a connector, of arbitrary extensible type, between part of a document and another part of a document. The link may be within or between documents. A transclusion means a new instance: "bring in this material here", even though the place of origin is different.

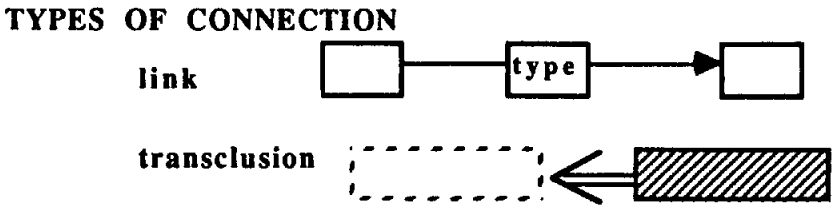

Figure 6.

8.1.1. Types of links

There can be many types of link, in an ever-extensible list. A short beginning list:

- Subject (what commentator thinks this is about);
- Comment;
- Disagreement;
- Endorsement;
- Evidence;
- Example;
- Graphical illustration.

8.1.2. Link endsets

The endset is the material a link is attached to at either end (e.g., text, graphic, "hot button"). In Xanadu, there will be many types of endsets. These types will simply tell the system where the link is considered to be attached.

8.1.3. Endset coupling type

The endset coupling specifies how it is attached: to a point, to a span of bytes, an area of picture, etc. Various different coordinate-spaces may be defined for this coupling. Couplings can also be Deep or Surface. Deep couplings reach to the data structure, whereas surface couplings reach the result of projecting the data structure. Example: a deep coupling to a PostScript document would couple to text bytes inside the original PostScript code, a surface coupling would couple merely to an area of the output surface generated by the PostScript program.

8.1.4. Link directionality, visibility, followability

All Xanadu links can be seen from either end and followed from either end. Some people call this "bidirectional". This is incorrect. All our links are *bivisible* (can be seen from both ends) and *bifollowable* (can be followed from both ends). Links are usually *directional*, that is, asymmetrical in meaning. Very few link types are symmetrical ("is related to" would be one possible example).

8.1.5. Transclusions

A transclusion means "bring this material in here". The formal definition: virtual inclusion across a document boundary. The material is not copied into the new docu-

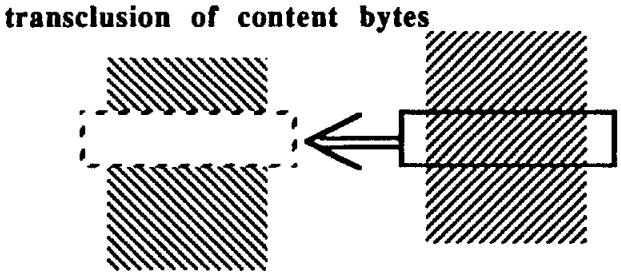

Figure 7.

Figure 8.

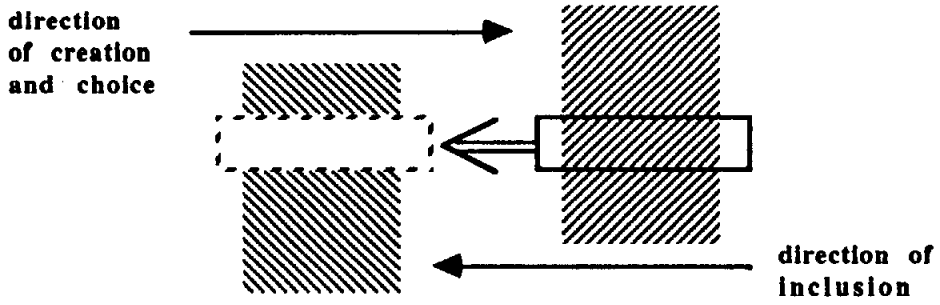

Figure 9.

ment, but always newly-purchased from the original, or a functioning instance of the original.

- Content bytes, such as text and graphics, may be transcluded (Figure 7).
- Links themselves may be transcluded (Figure 8). In practice this means that a connector of a certain type, and either its from-set or its to-set is transcluded.

8.1.6. Directions of a transclusion

Transclusions, like links, are bivisible, bifollowable and directional. To simplify things we say that a transclusion that brings in material is an outbound connection.

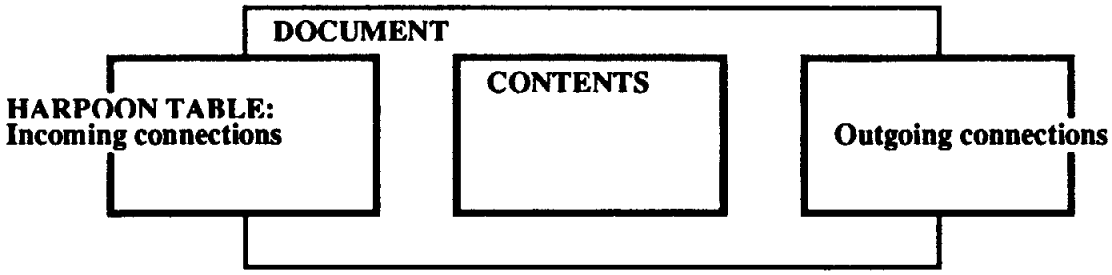

Figure 10.

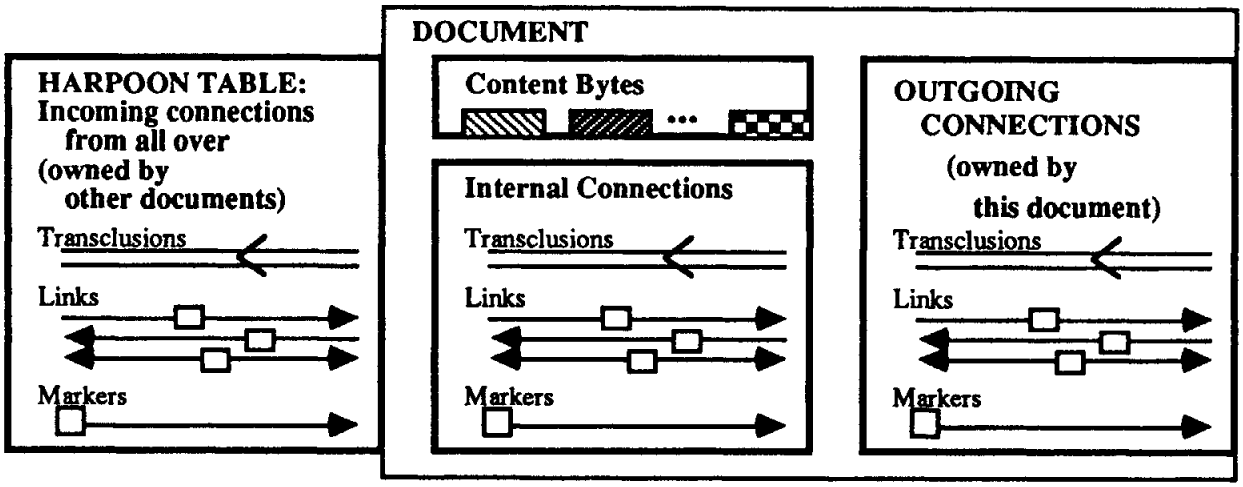

Figure 11.

But there are of course two directions: the direction in which the material has been chosen and the transclusion has been created (the *direction of creation and choice*), and the direction in which the material flows to be included (the *direction of inclusion*) (Figure 9).

9. Overview of a document in detail

Recall the symmetry of a document, mentioned earlier. We will be storing a document's incoming connections with it in what we will call a Harpoon Table (Figure 10).

Let us add to this overview the different parts we have discussed. The symmetry is still there, but with details showing the parts and their ownership (Figure 11).

10. Royalty server and payment system

The Xanadu Royalty Server has been designed as a new way of selling copy-

righted materials on the networks, especially World Wide Web. It is intended for convenient small purchases of arbitrary portions of text, graphics and other data. The different Xanadu royalty servers, suitably attached to the Internet, make one virtual distributed repository.

Xanadu-published materials may be virtually included in any World Wide Web document, without special permission, simply by placing the appropriate Xanadu citation (xanaddress) in the document. The purchase of the material can be carried out automatically by a client program such as Mosaic.

The sale model embodies the win-win synthesis of Xanadu publishing: all published material may be used as on-line boilerplate and clip art, but the publisher gets credit and royalty for every use.

The server and payment system are intended for licensing to small bulletin board operators, as well as corporations, universities and other larger organizations. A complete accounting and payment system is part of the anticipated package. Each operator may extend credit terms on any basis, and a user with a Xanadu account may purchase documentary material from anywhere on the net.

The user and publisher contracts are intrinsic to the system. Since the copyright laws were originally intended to cover the publication of physical objects, especially those of paper, we extend these rules by contract into the new realm of on-line demand publishing. In particular, the publisher agrees to relinquish context control of the material, and the purchaser agrees not to republish except by a citation, which others may follow by an independent purchase of the same material.