

The Deconstructed Journal Revisited – a review of developments

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Developments in net based academic publishing since 1999 are reviewed in light of the requirements of the Deconstructed Journal (DJ) academic publishing model. This model proposes that all the activities of traditional journal publishing could be carried out by a group of co-operating independent agents without the necessary requirement of a publisher to co-ordinate them. It is shown that most of the elements required for the DJ publishing model to operate are now available. The one major element missing is the independent Certification Agent (CA). The role of the CA in the DJ model is to provide quality control (refereeing, etc.) and to confirm this it should affix its ‘seal of approval’ to the document. Document integrity and authentication are described and the operation of Digital Signatures (DSs) reviewed including current usage problems. It is concluded that easy to use DSs or similar tools are needed to allow the emergence of truly independent CAs but the reward will be documents that are completely free.

Keywords: academic publishing, scholarly publishing, new publishing models, deconstructed journal model, document integrity, document authentication, digital signatures

Introduction

In earlier papers (Smith, 1997, Smith 1999a) a new academic publishing model was described entitled the Deconstructed Journal (DJ model)¹. This model proposed that all the roles of the academic journal could be fulfilled by a group of quasi-independent² co-operating agents each playing a part in the activity of academic publishing. It also proposed that these agencies did not need to be organised or co-ordinated by a central publisher. Between them these independent agents could fulfil all the needs presently fulfilled by the current academic publishing industry.

It was shown in those earlier papers that the academic publishing industry (which gives rise to the current form of the academic journal) plays certain clearly defined roles vis-à-vis the activity of academic research. The following main roles were identified along with the agencies that fulfilled these roles in the current and proposed (DJ) model.

| Role | Agency in current model | Agency in DJ model |
|-------------------------------------|---|--|
| Quality control (content) | Referees, organised by publisher | Independent ‘certification agents’ (called ‘evaluator organisations’ in Smith, 1999) |
| Conferring recognition of work done | Referees and journal editorial board | Independent ‘certification agents’ or (less directly) editorial boards of overlay journals ³ , (called ‘subject focal points’ in Smith, 1999) |
| Making available | Publisher – printing the article in an issue | Placing of material in local or centralised freely accessible electronic archives ⁴ |
| Making aware or marketing | Publisher – marketing of the journal to libraries and other customers | Overlay journals, general or specialised search engines, Web directories, subject portals, Weblogs. |

In order for the DJ model to operate fully there must be examples of all the required agencies that form it in existence.

Although the model would operate at its most flexible if all the agents were independent some agencies could be combined and the basic model would still operate. For example overlay journals could also be certification agents but they must not claim ‘ownership’ of the item certified or pointed to.

When the model was originally proposed some of these agencies existed in a proto-form, i.e., they had not been created to play a role within the DJ model but they already had the basic necessary functionality. For example there were freely accessible centralised archives like the Physics E-print archive. Also many search engines already existed to allow users to find items of interest on the Web thus performing the ‘Making aware’ role. However only a very few subjects had substantial archives and the ‘finding tools’ were rudimentary.

The Current Situation

This section considers what elements of the DJ model already exist in proto or fully realised form. We will look at each role and its required agency (within the DJ model) in turn and see if there are existing examples.

Quality control (content)

Independent certification agents

As yet there do not appear to be fully independent certification agents. By ‘independent’ I mean providing certification separately from publication or ‘making available’. There are journals that make articles they have published in e-form freely available. For example the journal *Learned Publishing* makes its papers freely available, as does the *New Journal of Physics*. BioMed Central (BMC) makes the research articles in all of its e-journals freely available (BMC is discussed in more detail in the section *Making available* below). Many journals allow authors to place copies of final papers (the version as published in the journal) in e-print archives and some authors do this even if the journal does not explicitly allow it. Finally there are many more journals that make a subset of their articles freely available (usually limited to issues over a certain age). This pool of already certified articles allows the possibility of ‘proto overlay journals’ that point to selections of these articles. This is discussed further below under *Making aware or marketing*.

Conferring recognition of work done

Independent ‘certification agents’

As noted above there are no examples of truly independent certification agents yet.

Editorial boards of Overlay Journals

Obviously, by choosing to link to an article the producers of an overlay journal are indicating they think the work ‘cited’ is of some value. However, using the current normal form of linking they can only point to an address (URL), they cannot guarantee that the item pointed to is the same one they originally chose. So the link is really saying, “This is a good article (assuming it is the one we read when we made this decision)”. This limits the extent to which they can confer recognition of work done. The problem of document integrity and authenticity in an electronic environment is discussed below in the section *The next steps*.

See *Making aware or marketing* below for a detailed discussion of the current status of overlay journals.

Making available

Placing of material in local or centralised freely accessible electronic archives

The growth in electronic archives for scientific and social science subjects has been enormous over the past few years. Some have followed the Physics ArXiv⁵ model and other subjects have invented their own, for example, CogPrints⁶ (for papers related to the study of cognition, e.g. psychology, neuroscience, linguistics, computer science, philosophy and biology), NCSTRL⁷ (computer science), and RePEc⁸ (economics).

Production of new e-print archives has been made easier by the provision of free software to build them. Already three different packages are available, CDSware⁹ from CERN, DSpace¹⁰ from MIT, and EPrints¹¹ from the University of Southampton. It is planned that a fully supported commercial version of the EPrints software will be available from Ingenta¹². All of these packages are OAI compliant (OAI is discussed in *Making aware or marketing* below).

Further impetus to the provision of e-print archives has been given by the Budapest Open Access Initiative (BOAI)¹³ from OSI¹⁴. This builds, in part, on the Open Archive Initiative and encourages the use of open archives and open journals to make the results of research freely available. BOAI have published two detailed guides to explain how to launch a new open access journal (Crow and Goldstein 2003a) and how to convert a subscription-based journal to open access (Crow and Goldstein 2003b). Another recent promotion of the idea of open access repositories is the recent report from SPARC¹⁵ (Crow, 2002) which strongly promotes the idea of institutional repositories. This case is reiterated for a European context in Buckholtz (2003).

In the area of commercial open publishing there is BioMed Central¹⁶ which publishes a range of e-journals in biomedicine. The papers are freely accessible. BioMed Central has an ‘article processing charge’ (paid by the author or author’s employer) which pays for the work in publishing the article, including “obtaining peer reviews and in preparing the article for publication”¹⁷, the inclusion of a reference in PubMed, and archiving the article in PubMed Central¹⁸.

Thus there is a growing (and the growth is accelerating) repository of freely available academic material either already quality certified or needing to be certified (or which would benefit for certification). This also provides the target material for overlay journals which are discussed next.

Making aware or marketing

Overlay Journals

The name overlay journal comes (I believe) from a comment in Ginsparg (1996) where he discusses the possibility of information services provided as an ‘overlay’ on the Physics e-print archive. Such a service already existed in 1996 according to Smith (2000). An excellent example of a new operational overlay journal is *Applications of Superconductivity*¹⁹. This title happily describes it self as a ‘virtual journal’ and it contains "a multijournal compilation of developments in superconducting electronics, materials and largescale systems". This journal shows exactly how an overlay journal can add value. In addition to links to relevant articles it provides e-mail alerting of new items, the ability to search across the virtual journal and links to article supply services if the text you want is not freely available. Although it is currently free one can see how it could charge a small fee and be worth the cost. *Applications of Superconductivity* is one of a series of virtual journals (Virtual Journals in Science and Technology²⁰) developed jointly by the American Physical Society and the American Institute of Physics. There is also an experimental overlay journal concerned with electronic publishing entitled *Perspectives in Electronic Publishing (PeP)*²¹. This is described as a “journal-centred portal” and is much more than a simple set of links. In Kritchel and Warner (2002) the journal *Geometry and Topology*²² is referred to as an overlay journal but it does not fit my definition as makes articles available on its own server and only uses the ArXiv service as an archive.

A major step forward in the area of ‘making aware’ has been the Open Archives Initiative (OAI)²³. This promotes interoperability between independent archives²⁴ by specifying a standardised form of metadata presentation (the OAI metadata harvesting protocol) which allows automated harvesting of metadata by external services to provide cross-archive search services and current-awareness services. Currently there are 86 OAI compliant archives²⁵. These are contributing records to a small range of service providers²⁶. A particularly interesting service is provided by DP9²⁷ from Old Dominion University. This service forms a link between traditional search engines and the contents of the OAI compliant archives allowing the search engines to index the contents.

Weblogs (Bloggs)

Although I see Weblogs as precursors to new overlay journals, or even new forms of journal, I have given them a separate section in this article as I want to describe them in detail.

At their most basic Weblogs are web pages containing lists of sites visited (hence ‘web logs’) with comments by the producer or editor. Their original form was like a diary recording interesting pages found. They are intended to be constantly updated with the latest addition being at the top of the list. There are variations on this format, for example, one might have a ‘thought for today’ approach with links on a theme embedded in a few lines or paragraphs of text then the next day another theme would be explored. Another Weblog might be devoted to a single theme with more and more links being added over an extended period. They have existed in their current form since 1997 (although some writers on their development claim the earliest Web site listings produced by Tim Berners-Lee and others in the early 1990s were proto Weblogs). More recent developments have added a list of related Weblogs (or other Web sites) that the editor of a Weblog regularly reads to the Weblog home page or a linked page. This helps place the editor and the content of that Weblog in a context. This list is known as a ‘blogrolling list’ (Paquet 2002). It is possible to build and maintain a Weblog site with conventional Web authoring tools (or just a plain text editor) but with the growth of interest in Weblogs dedicated production and maintenance tools have become available. Some take the form of a Web site where one can add a new item in a standard form and this is added automatically to your existing Weblog. An example of this approach is ‘blogger.com’²⁸. Another approach is to install a dedicated Weblog production package like Radio Userland²⁹ on your own PC. This enables the user to build and maintain a Weblog on their PC to be published on an external hosting service. The updating can be carried out on or off-line. Such is the interest in producing Weblogs there is now a site that offers comparisons of a range of Weblog production tools³⁰.

Some writers have discussed the possibilities of Weblogs for researchers (Paquet 2002, Mortensen and Walker 2002). Jill Walker also has a Web page entitled ‘Research Blogs’ which lists Weblogs maintained by researchers³¹.

There have been a few articles discussing Weblogs in the general library and information literature over the past few years (2001-2002) but these have mainly concentrated on their use in library and information work. No one appears to have spotted that Weblogs have all the basic attributes of full scale overlay journals. With very little (if any) modification one could take one of the Weblog production packages (online or locally installed) and build a passable overlay journal quite quickly. As was pointed out in Smith (1999b) almost all the genuine innovation in e-publishing has come from net users not from the commercial publishing world. Also, end users often use tools designed for one thing for something the designers didn’t envisage. When Tim Berners-Lee originally invented the Web he was thinking of hyperlinked technical documents not the Web as we see it today.

Finally, it is interesting that Weblogs started as online diaries or *journals* (in the original meaning of the word 'a record of the days activities') – it would be somehow poetic if these new journals replaced those old journals.

General or specialised search engines and Web directories/portals

Although we have all the new tools discussed above there is continuing need for the traditional search engines like Google³² and AltaVista³³. There are also more specialist services like Scirus³⁴ concentrating on specific areas of knowledge. In the future one can imagine specialist search engines so focussed that they border on being new overlay journals. There is also a continuing need for the general purpose directories like Yahoo³⁵ and the Open Directory Project³⁶ as starting points for less focussed searches. The specialist directories and subject portals like those that form the RDN (Resource Discovery Network)³⁷ will probably move towards becoming overlay journals over time.

The Next Steps

As can be seen from the previous section the main elements of the DJ model are beginning to form. This formation is not to satisfy the requirements of the DJ model but is happening simply as outcomes of other activities. It is interesting to note that there appears to be almost an inevitability about this process – many of the precursors of a revolution are becoming available even though the processes bringing about these changes do not have this as their specific goal.

Looking back to the *Introduction* above it was stated that in order for the DJ model to work all of the main agencies (or elements) that form it have to be extant. We already have the independent repositories in the form of institutional and central open archives and the software packages to build more. We have the beginnings of a mechanism to provide detailed search and retrieval services with the OAI metadata harvesting protocol and the services being built using this standard. Overlay journals already exist as such or in proto-form as Web directories or subject portals. We may find ourselves with a surfeit of overlay journals if Weblogs develop as I suspect they might. The only major element that is missing is 'independent certification agents' (and it is this critical element that most distinguishes the DJ model from other similar proposed models).

The need for independent Certification Agents (CAs)

Why is this element so critical to the DJ model? Because without the separation of quality control from making available (publishing) you still have remnants of the traditional journal model with articles only available from a specific source. It has to be admitted that the model adopted by BioMed Central almost escapes this criticism with the deposit of copies in PubMed Central but we still have a partly centralised model.

Who could be a CA?

Any person or organisation that can claim expertise in a subject and is respected for that knowledge could set up as a CA. Learned or professional societies have a head start in this new world. They already have the necessary reputation and their members have the expertise. Commercial organisations could do it by 'buying in' or otherwise organising such expertise. This is what commercial publishers already do. They persuade recognised academics to sit on editorial boards of journals or act as referees for papers. So existing publishers could just move to become CAs. It is clear there is no reason why independent CAs as required by the DJ model should not exist. There is one technical requirement that is not yet fully available – this is described and discussed below.

The 'Seal of Approval'

The ideal envisaged in the DJ model is that a document can be anywhere (including the possibility of multiple copies in more than one place) and the CA can be anywhere. What is needed is a mechanism whereby the CA can attach a 'seal of approval' to the document that guarantees this is a true copy and it was certified by this CA. Once we have such a mechanism the document can be placed anywhere on the net with no continuing connection to the CA. This leads us to the problems of 'document integrity' and 'document authentication'.

Document integrity and authentication

If you print out a page of an article and put it in a drawer for a year you can be reasonably sure that it will still be there and readable when you look again although the ink may fade and the paper become brittle. One thing you can be absolutely certain about is that the words will not move around the page or some of them disappear without trace or be replaced by others. This is not true with electronic documents. They are just computer files and computer files only exist physically as patterns of magnetism on a disc or even more ephemerally as patterns of charges in memory. They can easily be altered intentionally or unintentionally. Even

when the file exists as a relatively stable magnetic pattern on a disc it may not stay the same pattern for long even if the file is not being deliberately changed as utility programs move files around to de-fragment them or make better use of the space on the disc. The integrity of computer files (and hence electronic documents) has always been a problem. It is less of a problem as long as the document stays on the same computer because it is possible to track these moves and be sure that a file has remained unchanged in terms of content even if its physical representation has changed. However once the document is made available on the network and can be downloaded to other computers this basic certainty is lost.

Fortunately there are ways to ensure integrity of the contents of a computer file (and hence an electronic document). One of these is to use what is known as a 'one way hash function' to compute information about the file which can be used later to see if the file content has changed. Any hash function takes an input string of a variable length (like a file containing an electronic document) and returns a fixed length string usually much shorter. A one way hash function takes this a step further such that it is very hard to reconstruct the original string given the fixed length string and it is also very hard to construct another input string that hashes to the same output string. The output string is given a range of names, e.g., message digest, fingerprint, cryptographic checksum, or message integrity check. The most commonly used name seems to be 'message digest'. For a detailed description of this (and other related techniques) see Schneier (1996). Hash functions are not secret so given a file, the message digest and the name of the hash function used to produce the original message digest it is possible to re-calculated the message digest of the file you have and compare it with the one given with the file. If they are the same one can be sure the file you have is identical to the original.

So now we have a way of ensuring that the file is unchanged but how can we be sure the sender is who they claim or in our case that this is the file certified by the relevant CA? One way to do this is to use a Digital Signature (DS). The use of a hash function as described above to check the integrity of a file is the first half of a DS. A DS also uses public key cryptography (PKC) to ensure the authenticity of a message by ensuring the sender (or the person or organisation who 'signs' the message) is who they claim to be. PKC was originally invented to get around the key exchange problem of basic symmetric cryptography where the key that encrypts the message also decrypts it. With PKC there are two keys, a private key and a public key, a message encrypted with the one has to be decrypted with the other. This has the added advantage that only the sender knows the private key and the public key only decrypts messages encrypted with the matching private key. So you can be sure if someone's public key decrypts a message it must have been sent (or encrypted) by them. We could prove both the integrity and authenticity of a message (or document) by encrypting the whole thing but encryption and decryption are computationally expensive and so a DS combines the use of a hash function with PKC to make it easier. The procedure is as follows. A message digest is calculated for the document, this message digest is encrypted using the sender's private key, the two items (the document and the encrypted message digest) are bundled together (e.g. in an e-mail message). The recipient takes the document and calculates the message digest, then finds the public key for the sender and decrypts the accompanying message digest. If the two message digests are the same this is the document sent (or certified) and the sender (or certification agent) is who they claim to be.

Simple isn't it? Unfortunately, no it isn't. Although the elements that enable DSs to work are all known there appears to be no agreed standard for how they are put together. It is possible to buy DS programs that run on PCs which automatically do the calculations and encryption and package up the file ready to send or to be downloaded but the recipient has to have the same software for the unpacking and verification to be done automatically. It is as if it was agreed that all cars have to have a steering wheel and brakes (and also agreed how these things work) but there is no agreement on which side the steering should be on or whether the brake is the middle or left pedal. Any competent computer scientist could carry out the process described in the previous paragraph, I am assured it is not particularly difficult, but we are not all computer scientists. It is possible that in time commercial packages will converge on a common standard, at least to the extent that someone using one DS program will be able to accept and process a file processed and packaged by another. However there is no guarantee of this. Word processing programs have been around for many years but most still use their own proprietary file formats to store documents even though there is a generally accepted interchange format (RTF³⁸). There is work being done at NIST³⁹ to enable DS services to interwork⁴⁰. However, since the basic FIPS⁴¹ Digital Signature Standard⁴² was published in 1994 and we still don't have an agreed way for DS programs to interwork I am not expecting a solution soon. Maybe what we need is an initiative similar to the OAI that designs a simple standard sufficient for academic publishing needs.

There may also be simpler ways to achieve our goal. Since all we want is to be sure the document we have is the one originally certified we could just calculate the message digest, send this to the claimed certification agent (or a secure site that maintains a list of certified documents) and ask it to return the title (or bibliographic record) of the document. This may not be as secure as using a DS but we are not dealing with national secrets or sensitive personal information.

If we want to achieve the full flexibility of the DJ model we need an easy to use solution to the document integrity and authentication problem.

Conclusion

All the elements of the DJ model are available but one – the independent CA. In some ways they do exist – all publishers of reputable academic journals are CAs but in most cases there is still the ownership link between the CA and the item certified. Even if ownership is relinquished there is still a need for a guaranteed copy to be available on a server usually controlled by the CA. This limits the development of the distributed open archive or open repository model and prevents the emergence of truly independent CAs. As Kritchel and Warner (2002) point out:

“since these papers are in places where they can be modified by authors, it does not appear to be possible to base a certification system on these papers.”

With digital signatures or a similar mechanism to allow the paper to carry its certification with it we can escape this limitation. The phrase ‘freeing the journal literature’ is used almost like a battle-cry by those that advocate making all the journal literature freely available in open archives or repositories. This single step finally does this, the certified article can be anywhere on the net. It is not tied to any server or site, it is completely free.

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Notes and links to further information

¹ It is interesting to note that during that period (1997-1999) other similar (but less detailed) models were independently proposed. An example is Phelps, 1998.

² I prefer 'quasi-independent' to 'independent' because, although the agents do, or can, work independently of each other (and in fact must be mainly independent for the model to maintain its decentralised form) each does require the presence of the other agents to give to full value to its own work. The DJ model is definitely one where the whole is significantly greater than the sum of its parts.

³ The phrase 'overlay journals' has become the standard one used by other writers in this area to describe what were previously called 'virtual journals' (and I called Subject Focal Points in Smith, 1999). Overlay journal does describe well the way in which they operate although I still like the name virtual journal as I feel this best describes the nature of these agents.

⁴ The term 'archive' has become the normal one to refer to collections of e-prints although it is not meant in its normal sense of a reserve repository whose main aim is preservation rather than making available. I suspect this is due to the use of this term in the name of the original Physics E-print archive (or ArXiv), the precursor of all the e-print archives. The term 'repository' is gaining in use and may become the accepted name of these collections.

⁵ See <http://arxiv.org/>

⁶ See <http://cogprints.soton.ac.uk/>

⁷ See <http://www.ncstrl.org/>

⁸ See <http://netec.mcc.ac.uk/RePEc/>

⁹ See <http://cdsware.cern.ch/>

¹⁰ See <http://www.dspace.org/>

¹¹ See <http://software.eprints.org/>

¹² See http://www.ingenta.com/isis/general/Jsp/ingenta?target=/about_ingenta/press_releases/southampton.jsp

¹³ See <http://www.soros.org/openaccess/read.shtml>

¹⁴ See <http://www.soros.org/>

¹⁵ Scholarly Publishing and Academic Resources Coalition, see <http://www.arl.org/sparc/>

¹⁶ See <http://www.biomedcentral.com/>

¹⁷ See <http://www.biomedcentral.com/info/about/apcfaq>

¹⁸ See <http://www.pubmedcentral.nih.gov/>

¹⁹ See <http://www.vjsuper.org/>

²⁰ The current titles are *Applications of Superconductivity, Biological Physics Research, Nanoscale Science & Technology, Quantum Information, and Ultrafast Science*. See <http://www.virtualjournals.org/vjs/> for more information.

²¹ See <http://aims.ecs.soton.ac.uk/pep.nsf>

²² See <http://www.maths.warwick.ac.uk/gt/>

²³ See <http://www.openarchives.org/>

²⁴ Interestingly the OAI does not insist the achieves have to be open, i.e., freely available, only that the metadata that describes the contents is openly available.

²⁵ See <http://oaisrv.nsd.cornell.edu/Register/BrowseSites.pl> for the latest list

²⁶ See <http://www.openarchives.org/service/listproviders.html> for the latest list

²⁷ See <http://arc.cs.odu.edu:8080/dp9/about.jsp>

²⁸ See <http://www.blogger.com/>

²⁹ See <http://radio.userland.com/>

³⁰ See BlogComp, <http://www.urldir.com/bt/>

³¹ See <http://huminf.uib.no/~jill/txt/researchblogs.html>

³² See <http://www.google.com/>

³³ See <http://uk.altavista.com/>

³⁴ See <http://www.scirus.com/>

³⁵ See <http://www.yahoo.co.uk/>

³⁶ See <http://dmoz.org/>

³⁷ See <http://www.rdn.ac.uk/>

³⁸ Rich Text Format

³⁹ National Institute of Standards and Technology, see <http://www.nist.gov/>

⁴⁰ See http://csrc.nsl.nist.gov/pki/signed_info_format/welcome.htm

⁴¹ Federal Information Processing Standards

⁴² See <http://www.itl.nist.gov/fipspubs/fip186.htm>