CHARGING, PAYING AND COPYRIGHT - INFORMATION ACCESS ON OPEN NETWORKS

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The current commercialisation of the Internet is resulting in the rapid development of mechanisms and systems to support commercial transactions over open, public networks. There is also a growing requirement for publishers to make material available electronically while protecting their rights as copyright owners or licensers. Two European funded projects, COPINET and COPICAT, are investigating these two related areas

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Introduction

The rapid growth of the Internet and the increase in business use is resulting in the rapid development of mechanisms and systems to support commercial transactions over open, public networks. Publishers, especially in the STM area, wish to use the Internet as the means of delivery but have two principal concerns: how to maximise remuneration for electronically delivered material, and how to protect their rights as copyright owners or licensers. Two European funded projects, COPINET and COPICAT, respectively look at technical methods for meeting these, and other related, concerns.

The COPINET project (*CEC Libraries Project 3033*) is constructing and trialling a system to provide online access to commercially operated bibliographic information and full text document delivery services via the World Wide Web. The project does not aim to develop a definitive system but will produce implementation guidelines based on the experience gained in developing a representative system. Initial requirements analysis established the key needs of the three main actors: publishers, libraries and end-users, and provided information on the main issues related to charging and billing for information delivery as seen from each viewpoint. A parallel technology survey investigated the various World Wide Web (WWW) based financial transaction systems and considered how they may be included as part of a Web based text retrieval system. Based on the results of these two stages an initial design specification and test system were produced in a way which allows subsequent development to incorporate payment systems.

Copyright protection for electronically published material is addressed by the Commission of the European Communities (CEC) funded COPICAT project (*ESPRIT Project 8195*). The project is developing a copyright protection mechanism linked to a copyright management system and the final system will enable publishers to determine the level of protection appropriate to the value of the material while monitoring use and managing the chain of rights. COPICAT can be deployed to enable publishers to open up the market for electronically published material especially in open-access environments.

COPINET - charging and billing systems for document delivery

COPINET is examining the various technologies now emerging for secure financial transactions over the World Wide Web and is developing an experimental system that incorporates appropriate mechanisms for handling the commercial aspects of an online information service. The specific objectives are:

- to demonstrate how technologies for secure transactions and anonymous electronic payments can enable commercial publishing to be supported on the World Wide Web and thereby meet the identified requirements of the publishing and library communities.

- to demonstrate, to publishers and libraries, the feasibility of making valuable material commercially available to a potentially vast user community on the Internet, without incurring the overheads of registering every user.

- to implement a WWW server complex, able to support searching of the abstracts database with automatic linking to a full-text archive, and to develop modules for authentication, charging, billing and payment which can handle both registered and unregistered users

It is hoped that the results from the project will contribute to the improved availability over the Internet of well-organised, high-quality, authoritative information, with benefits both for the librarian who needs to provide access to such sources, and to users who increasingly expect to find and acquire the information he/she wants through the network.

The project has followed the normal format of requirements analysis (with a parallel technology survey), an initial design stage and pilot implementation. Further stages will include refinement of the design and the full scale system implementation scheduled for the first quarter of 1996.

COPINET requirements analysis

We looked at the requirements for online information systems from three viewpoints, corresponding to the three main actors: publishers, libraries and end-users

Requirements of users

Identification of end-user requirements is often the most difficult aspect of a requirements analysis as in many cases a clear picture is formed only *after* there is a pilot system in place for the users to relate to and information provided at an early stage tends to be more of a 'wish list'. Nonetheless, useful information has been gathered and analysed to provide at least a strong basis for the direction of the project. Some of the key requirements identified are:

- The end-user will pay for good quality material, successfully delivered but requires a usable means of redress if the delivered information is corrupted, only partially complete or of poor quality.

- The freedom of choice to conduct anonymous transactions for reasons of personal privacy, or the assurance that opportunities for industrial espionage are minimised, or because of national legislation.

- The ability to check that the information delivered is what was wanted before paying for it.

- Payment mechanisms offered are secure from any form of theft from the user's account.

- The ability to pay according to pages actually viewed with the possibility of 'first page free', thereby allowing the user to identify the work as previously unseen.

- The ability to negotiate or take advantage of special rates for special relationships between supplier and user.

- Knowledge of 'rights' with respect to the material - most users do *not* wish to behave illegally and so need to know what they can legally do with it.

- The service needs to be usable, use standard tools, minimise unnecessary presentation, and unnecessary acts of acquisition of detail.

Requirements of publishers

As library budgets fail to keep pace with user demand and the growth of publishing, publishers have seen journals subscriptions numbers declining every year over the last fifteen years, resulting in compensatory price rises above the

rate of inflation[1,4]. There has also been growth in interlibrary lending, library subscription resource sharing, and a greater allocation of library budgets to document delivery services[5,6,7,8]. Falling subscription numbers has more recently led to higher copyright fees for document delivery but the income generated has yet to compensate primary publishers for the loss in income from subscription cancellations[3].

Information consumers are also changing their habits in the way they 'consume' knowledge. They no longer need a whole book to get the information they want; they look for the 'information entity'. Instead of selling books which are made to be read from cover to cover, publishers are changing their products and only supplying the consumer with the wanted information entity — electronically or in print.

The key requirement of publishers is, of course, to continue to generate income from their publishing activities and therefore they need to establish new sources of revenue and to re-examine traditional ones. Subscription is still important but the increasing requirement for users to access 'information entities' means that pay-as-you go services, especially ones where the user has not had previous contact with the supplier, will grow in importance. Possible scenarios are:

- Licensing the use of abstracts[2], based on the view that the abstract can provide sufficient information to the user, such that they need not obtain a copy of the full article.

- Producing alternative subscription products, such as CD-ROMs and online delivery mechanisms. This might, however, replace several substantial print subscriptions in a large organisation.

- Relating subscription pricing level to organisation size or by limiting subscriptions to a fixed number of simultaneous accesses. A networked subscription allowing a single simultaneous access might be comparable to a single print subscription.

- Providing electronic information delivery systems which can accept casual users and charge them according to usage.

Requirements of librarians

Until now, information provided through books in libraries has almost always been free to the customer. Librarians purchase whole books and producers obtain payment through invoicing, and occasionally subscriptions. The movement of publishers towards selling information entities instead of books will change the librarians' role as intermediary in book distribution and emphasise the need for electronic charging and billing systems.

Librarians require:

- Free or inexpensive searching/browsing/identification

- Detailed table of contents page (such as available on the Investext database) or thumbnail previews; free or cheap

- Possibly a small fee for an abstract

- Full document delivery in the range of the equivalent of $15-$20 in local currency (so as not to impinge on existing markets)

- Individual page charges such that it's cheaper to request full document if, for example, 50% or more of pages are selected for viewing.

Charging, pricing and paying

Although much of the popularity of the Internet may be ascribed to the ready availability of 'free' information, it is becoming clear that information that has to be relied upon has to be paid for. Importantly, end-users recognise this and, subject to the requirements shown above, will be prepared to pay a realistic charge for obtaining information of the required quality.

The first question arising in the scenario where a user is able to search a bibliographic database via the Internet and to access directly the full text of the articles found, is how should the information be priced. The basic choice is between a subscription model and a transaction model, although these are not mutually exclusive.

Subscription and transaction charging

Subscription implies a need to authenticate the identity of the user as a subscriber, with less need to keep track of the use made of the information.

Charging is usually completely independent and separate from the access to the information. There is a precedent for variant subscription charges to individuals vs. organisations, with libraries being charged higher fees than individuals. The system developed in the COPINET project initially only handled subscribers to the service. That is, only registered users could use it (although mechanisms for registration exist). The system, in its first phase performed user authentication and logged transactions.

Transaction-based pricing however implies a direct link between usage and charging, with a need for a well-defined pricing model to enable charges to be calculated from the actual elements of usage. These usage elements can vary in granularity and nature, e.g. per-byte, per-minute, per-page, per-hit. The subsequent phases of the project (scheduled for completion fourth quarter 1995 and second quarter 1996) will progressively add support for registered users to be billed directly for use and finally for unregistered users to access the system and retrieve and pay for information on-line using an appropriate electronic cash system

While this paper is concerned with the broad findings and experience gained from the COPINET project, it is probably useful, in the context of the above scenario, to clarify the distinction between payment and the issues of pricing, charging, accounting and billing. The published price for an item of information (or service) may bear little resemblance to what a particular user is charged for it during a specific transaction. Furthermore, when a bill is issued, to whom, and who pays it, when and how, are all open questions. The following is offered as a way of clarifying the issues:

- Pricing provides a basis for charging.
- Charging is the process of applying a relevant pricing policy to a specific transaction context to determine the amount chargeable.
- Billing is the process of requesting payment.
- Payment is the transfer of monetary value from buyer to merchant.

Payment systems

There has recently been a phenomenal growth in both the demand and the provision of

technologies for electronic payment over the Internet. Electronic transfer of money between bank accounts is commonplace, but this takes place over secure dedicated networks. The electronic payment systems that are needed will have the same end result, but involving interactions between buyers, merchants and financial institutions over open, intrinsically insecure networks. The systems also need to be integrated seamlessly with the networked tools, applications and protocols that support the commercial activity over the Internet. Currently, it would appear that the World Wide Web is the platform of choice for this activity.

A number of schemes and systems have emerged over the last year or so, addressing the needs of open networked payment. In trying to compare and contrast the various schemes, the following attributes were found to be useful.

- **Access to trusted third party** - this may be *online*, where some secure server belonging to the TTP is accessed during a transaction, or *offline*, where the TTP service is used independently of the transactions (e.g. for key certification, and for funds transfer requests).

- **Nature of value representation** - this may be a payment *order*, which is a request to a third party to transfer a specified quantity of funds to a specified recipient (the electronic equivalent of cheques, credit cards, debit cards etc.), or a *token*, indistinguishable from cash but with potentially more complex behaviour than cash (e.g. the ability to impose restrictions on what it can be spent on).

- **Relationship to existing financial systems** - this may be *direct*, where existing accounts (e.g. with a credit card company) are used for each transaction, or *indirect*, where a new independent accounting entity is created to manage transactions (especially to aggregate small transactions and carry out transfers with the user's main account on a periodic basis).

- **Security mechanism** - this could be *intrinsic*, relying solely on cryptographic techniques in software, or *extrinsic* (and associated with token-based systems), using a tamper-

resistant device such as a smart card or PCMCIA device.

- **Degree of privacy** - this could be at several levels; from the situation where the seller knows who is buying and others can see who is buying what, to the situation where there is no way for anyone to trace the buyer

Examples of payment systems

Most of the payment systems available today include some or all of the attributes outlined above. Cryptographic techniques underpin most of them as they provide the only means of meeting the various requirements of the different systems with respect to security. The basic security requirements are:

- Authenticity: how to be sure that the other party in a transaction is who they are supposed to be.
- Integrity: how to be sure that the received message is exactly what was sent.
- Confidentiality: how to be sure that no unauthorised third party can read the message.
- Non-repudiability: how to ensure that the sender cannot deny sending the message, and that the receiver cannot deny receiving it.

Some examples of both payment order systems and token-based schemes are given below. The list is *not* exhaustive and given the pace of change in this area it is likely that new ones will have come into being, and possibly some of the older ones disappeared, since the time of writing.

Payment order systems

NetCheque and **NetChex** - essentially provide electronic analogues of conventional paper cheques, relying on digital signature techniques.

First Data - is an established credit card handling agency and allows users of the Netscape client/server combination (secured with Secure Sockets Layer[10]) to interact directly with the common card providers.

First Virtual (FV) - is based on credit cards, but avoids sending card details over the network by issuing the buyer with an ID, used in the buyer-seller transaction, which only FV can relate to the credit card details.

First Bank of Internet (FBOI) - is based on ATM cards procured by FBOI from Visa and makes use of the ATM (asynchronous transfer mode) network, making it easy for users to also withdraw real cash at any time.

NetBill[14], **Open Market** and **CyberCash** - are similar in that they rely on an online server handling user accounts and can aggregate small payments and hence reduce the transaction costs substantially. There are differences in the way that they handle actual payments.

Token-based schemes

NetCash[12] relies on having a close link to existing financial infrastructures to facilitate translation between anonymous electronic currency and non-anonymous electronic cheques.

DigiCash's ecash uses blind signature technology to provide anonymous cash tokens[9,10]. This system is being trialled on the Internet at present.

There are also some smart card schemes, linked to some of the major banks providing secure management of electronic cash as an extension of the user's normal account:

Mondex[13] from National Westminster, who are starting a major trial in Swindon.

Visa have announced a digital purse project.

The COPINET system

The system being developed (in three distinct phases) in COPINET provides a World Wide Web based search engine to interrogate an abstracts database. Linked to this is a separate server containing a database of full text articles (from the Institution of Electrical Engineers INSPEC database). Users can view abstracts and select full text articles for viewing. These are initially presented as 'thumbnail' images and the user is then able to view selected pages (or the full document), print them or download a Postscript file for higher quality printing.

Transactions are logged so that in the second and third phases of the project (as described in section Subscription and transaction charging) transaction based billing can be performed. A final decision on the electronic payment method has yet to be taken but it is possible that examples of both payment order and token based systems will be included. Obviously a 'production' system

would need to be able to handle all available methods of payment, or at least offer the user some choice.

COPINET will result in guidelines on the implementation of such systems being available to libraries. Considerable effort is likely to be needed to develop the basic system produced under the project into a satisfactory 'commercial' system but the results should provide very useful information for potential service providers.

COPICAT - copyright protection

One aspect of document delivery not covered in COPINET is that of copyright protection although it is clear that this is important in promoting the use of electronic document delivery. Information providers will wish to be assured that their rights as copyright holders are protected. To meet this need the CEC ESPRIT Project, COPICAT, has developed a copyright protection mechanism linked to a copyright management system. Publishers can determine an appropriate level of protection while monitoring use and managing the chain of rights.

One of the key elements of the COPICAT system is that it provides protection for digital material even after delivery to the user workstation unlike systems which provide authorisation management but then rely on tattooing or other form of marking to highlight unauthorised use (such as illegal copying) but still allow the action to occur. COPICAT physically prevents the copying of material in a subsequently reusable form. Legal copies may be authorised but the copies are only usable in a COPICAT environment.

The overall goal of COPICAT is to define and prototype a core basis for electronic copyright protection in a distributed environment. This will meet the need of the information providers who, currently, perceive a 'blocked market' as they cannot protect their rights sufficiently in the digital domain. The experimental site for the project is an educational enterprise providing open learning but the system is being developed to be as generic as possible and applicable to a wide range of publishing scenarios.

An Overview of COPICAT

The COPICAT model is based on the premise that in an ideal situation the provider of material subject to copyright would be able to trust the end-user to protect the rights of the copyright owner and they would share the wish to protect the information from intruding third parties. The diagram below illustrates a problem for which several commercial solutions exist, that of protecting information from theft in transit from a source to a destination. The transmission of the material, especially over the Internet, is definitely subject to risk and therefore for distribution over an open-access network, some form of protection is required. Encryption is the obvious mechanism, although some countries have particular restrictions on use.
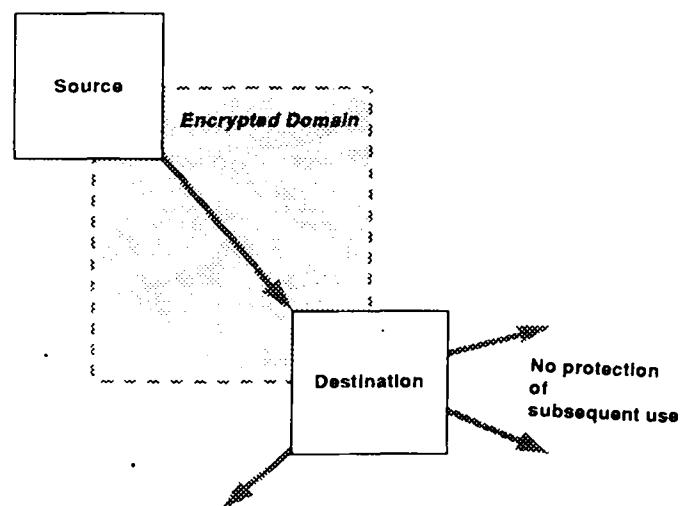

Figure 1 - Protection in transit only

In a digital environment, where replication is so easy, it seems appropriate to provide additional protection mechanisms which also revent subsequent misuse. The project has developed a system in which copyright material is 'wrapped' (by encryption) and only 'unwrapped' as a result of a specific authorisation handled by the CITED sub-system. Material is, in simplistic terms, only visible in the COPICAT 'environment'. The model ensures that any subsequent user actions, such as a 'save' or 'copy', result in the protected material, or material

derived from it, remaining in a protected state when outside the COPICAT environment.

Figure 2 shows the security problem which COPICAT faces. In addition to wishing protection in transit, the source does not trust the destination. Whilst permitting the information to be viewed by the destination user, the source wishes an assurance that the *destination user* cannot copy or otherwise allow unauthorised third parties some form of access to the information.
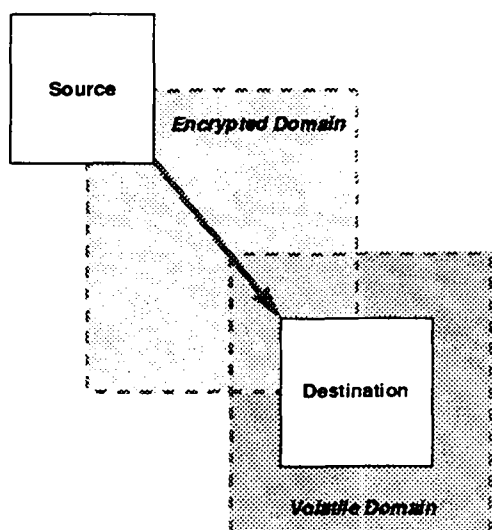

Figure 2 - Decryption into Volatile Space

While not fully solvable, if the source can have some assurance that the information cannot be sufficiently reconstructed and passed from the destination machine to elsewhere so as to be accessed by applications without the presence of access authorisation, this would address many of the concerns. What is required, according to the requirement characterised by the problem owners within COPICAT is that:

> The protection [of electronically-distributed copyright material] does not need to be absolute. The economic equation involved is to attempt to make it cheaper to behave legitimately than illegitimately'.[15]

The basic mechanisms in COPICAT are as follows:

- Material subject to copyright is 'wrapped' (encrypted) either by the publisher or a trusted third party.

- The end-user's workstation is appropriately configured for COPICAT use - i.e. a virtual filestore is set up and various protection activities are performed.

- When access to the material is required by an end user, an act of authorisation is required which results, on success, in either a real or virtual key being delivered.

- Wrapped material is delivered to the user's workstation and is then unwrapped (decrypted), using the key, into the virtual filestore.

- The material can then be used appropriately by the user's application.

- Material can be viewed, and in certain circumstances (subject to authorisation) copied, but it is not possible to save the unwrapped material to disk or to transmit it by any means

- As different levels of protection and authorisation can be included in the material, further authorisation may be required at the appropriate times (but only to access at a 'higher' level).

- The material *can* be saved, but only in a wrapped form such that subsequent viewing would require a similar COPICAT environment.

One important aspect of the COPICAT mechanism is that it puts the responsibility for determining the appropriate level of protection, and applying it, in the hands of the rightsholders. Ideally, a protection mechanism should be both consistent with the perceived value of a component and consistent with an acceptable access or other performance parameter. If this is impossible, then it is the rightsholder who must be free to consider the effect in the marketplace and decide what compromise is acceptable.

Current status....and the future

The COPICAT project is scheduled for completion in July 1996. The basic mechanisms have been developed and demonstrated in the form of a functional PC based demonstrator, with development of an Internet version well under way. The final stage of the project, commencing in January 1996, is to install a system on the University College Dublin campus network

where it will provide protection for CBT material. This is obviously a 'difficult' domain and 'hacking' will be encouraged in order to prove the security and integrity of the system.

A successful outcome will give information providers the confidence to deploy the system to protect their material for electronic distribution in all sorts of areas. The list of potential applications is huge, especially when one considers that the Internet is the most immediately obvious method of distributing such material. When combined with document delivery and online payment systems (being explored in COPINET), this technology should help provide the basis for the true online information market.

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