

## **COLLECTeR Europe 2006**

Proceedings edited by  
Petra Schubert and Daniel Risch

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# **Collaborative Electronic Commerce Technology and Research**

## **Background of COLLECTeR Europe 2006 in Basel, Switzerland**

The COLLECTeR series of conferences (<http://www.collector.org/>) was established to link research centres at universities to form a basis for collaborative research in Electronic Commerce.

### **Conference Topic 2006: Collaborative Business**

The “networked economy” challenges organizations to consider the use of Collaborative Business, namely the combined deployment of groupware and e-business infrastructures. Mobile computing technology and collaboration support have reached a level that makes a seamless integration of communications and data processing economically feasible. This constitutes our notion of Collaborative Business: the timely bundling of communication, coordination, and collaboration activities.

The focus of COLLECTeR Europe 2006 is on new forms of Customer Relationship Management (CRM) – including mobile CRM – that cover the whole value chain and use new working modes. This concerns questions related to the optimisation of channels, the improvement of customer acquisition and retention, and after-sales contacts and services.

### **Aim**

COLLECTeR Europe 2006 is a forum for researchers to present and discuss their current and ongoing work. In order to stimulate a lively discussion the number of participants is limited to approx. 30 people. The aim of the event is to bring together researchers and practitioners to discuss foundations and industry potentials of Collaborative Business. This includes the exploration of the effective deployment of novel technologies and services.

### **Contributions are grouped into sessions covering the following topics:**

- Digital archiving, privacy and property rights
- Personalization
- Markets and business processes
- Mobile and ambient business
- Communities and Work Group Collaboration
- Social systems
- Security devices and secure communication

All paper submissions to COLLECTeR Europe 2006 represent the original work of the authors. There were no rigid guidelines regarding paper size for the final research papers. We asked to submit between 6 and 8 pages.

The social event, the conference dinner, lunches and breaks were sponsored by Ecademy, the National Network of Excellence of the Swiss Universities of Applied Sciences for E-Business and E-Government.

Basel, June 2006

Petra Schubert and Daniel Risch

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# Digital archiving, knowledge management and the persistence of digital data: managing access to digital resources as technologies change: A Discussion Paper.

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## Abstract

*As electronic resources displace independent media such as paper, digitally stored information becomes vulnerable in ways that may defy solution. Indeed, these resources are vulnerable to the very changes embodied in the new technologies. This discussion paper suggests that if new standards are not established for the storage and maintenance of resource collections, the advantages of electronic delivery will be lost. However, focus on storage alone is not sufficient. It is essential that the issue of long term access be addressed at the point of creation of the digital resource. Changing technologies, hardware and software will continue to present problems for long term access unless appropriate procedures are put in place to ensure that essential digital resources are preserved and continued access assured. The methods suggested to date: archiving the technology, migration of data, and emulation, all present problems of cost, practicality and loss of data. Today, our ability to store information is unparalleled. The wealth these stores contain is essential to our economic and social wellbeing. This wealth is of little use, however, if we lose the key.*

## 1 Introduction

Assuring the longevity of essential digital resources is a critical element in effective knowledge management systems. While emerging technologies promise greater access to information, there is an obverse side to this prospect. As electronic resources displace independent media such as paper, digitally stored information becomes vulnerable in ways that may defy solution. Indeed, these resources are vulnerable to the very changes embodied in the new technologies. This discussion paper suggests that if new standards are not established for the storage and maintenance of resource collec-

tions, the advantages of electronic delivery will be lost. While the initial debate has come from government public records agencies and libraries, this problem is not unique to those sectors. It is one which must be addressed by all sectors: government, business and industry.

## **2 The problem**

Changes in technologies, which affect delivery and the ease with which records can be copied and changed, mean that, for some records, permanence can no longer be guaranteed. However, this is not the main reason for concern. Changes in software and hardware are occurring so rapidly that some records may not make the transition from one system to the next. While, for the more ephemeral records this may not be important, there are many areas, in business, industry and research, where it will be essential to retain access to electronic resources stored on media only accessible through older systems. Access might depend not only on retaining the records themselves, in whatever storage media, but also multiple versions of software and even hardware. If standards are not in place for the migration of records, the advantage of electronic storage will be lost.

In his discussion of approaches to information management, Bentley [1998] emphasised the importance of completeness and correctness of information, the prevention of deterioration and avoidance of accidental loss and corruption. One of the advantages of today's technology is that we expect that digital copies will not be degraded, that they will be the exact same as the original. While this may be so initially, with the passage of time, changes in software, hardware, and systems, degeneration may occur in digital copies, too. Bentley also pointed to the risk of dependency on Information Systems. Witness the panic over the Y2K problem. This demonstrated society's dependence and the interdependencies of organisations on computer systems. One of the positive aspects of this crisis was that it forced businesses to undertake inventories of critical systems [Manion & Evan: 379] and to recognise the importance of IT systems and resources to strategic decision-making. If access to resources is lost or corrupted, business will suffer.

The Y2K experience also made businesses aware of their interdependencies both within and outside organisations and across national borders. Ohmae emphasises this importance of the flow of information among countries and the change that has occurred. Information once monopolised by governments is now accessible to individual citizens [Ohmae: 18-19]. He speaks of global citizens who have their own sources of information and are no longer dependent on government sources. While dependency may have shifted away from governments, access to information itself will remain essential to well functioning businesses and societies. Indeed, without the guarantee of protection and safeguards that governments can provide it is even more important to ensure the longevity of those resources essential to continuing development.

One of the most significant issues is that of technological obsolescence. This issue is one which should be of great concern. An example, which illustrates this point is that of the 1960 US census which was stored on magnetic tape [Parkes:362]. By 1976, the equipment needed to read this tape was no longer available at the Census Bureau, and only two such machines survived: one in Japan and another in a US museum [Parkes:362]. The information the tapes contained was of significant historical value to the National Archives. Fortunately, a copy was able to be made which did allow long term preservation [Parkes:362]. This is just one example but it illustrates the problem.

While much focus has been on the physical storage media itself, the problem of technological obsolescence should be of far greater concern. This view is strongly emphasised by researchers in this area [Parkes:363].

### **3 Who is affected? (Business, Archives, Libraries)**

Efficient record storage and retrieval is essential to business success. To meet commercial and statutory requirements, information has traditionally been stored in hard-copy media such as paper or microform. To maximise the benefits accruing from the exponential growth forecast in electronic trading, organisations will become increasingly dependent on electronic forms of transaction records. Archiving of these records in a manner that ensures access for the future thus becomes a matter of serious concern.

The external resources that business use have been affected. Denison's and Stewart's *Electronic sources of information for business in Australia and New Zealand: (3rd ed: 1998-1999)*, presented a comprehensive list of electronic sources for business including a mix of 'stand alone' media like CDROMs as well as web and traditional online database resources [Denison and Stewart]. This is a rapidly changing field with many of the traditional electronic resource providers experiencing considerable pressure to keep up with the demand from business to provide more flexible, accessible and affordable electronic resources in line with the heightened expectations that Internet access has produced. Many of these services existed in some form before Web access was generally available and have had to adapt to the new technologies in order to maintain their business market.

Most people are familiar with some aspect of these problems of archiving, if only on a small scale. System software upgrades, hardware changes, moves to a different e-mail system, all can cause problems where access to files are concerned. In the business sector, such changes may cause problems which have legal and financial ramifications for the company.

The difficulty of access to large collections of information resources is not new. Negotiating today's web of digital information has been compared with the labyrinthine stacks of the monastic library described in Umberto Eco's *Name of the Rose* [Alexander: 23]. Access was not the only concern of that period. Previous to the advent of the printed book, the degeneration of content, both text and pictorial, of hand-copied manuscripts was a common problem to the extent that classical authors warned against relying completely on their content [Eisenstein: 194-195]. Errors were inevitable. One of the perceived advantages of today's technology is the expectation that digital copies will not be degraded, that they will be the exact same as the original. While this may be so initially, with the passage of time, changes in software, hardware, and systems, degeneration may occur in digital copies, too.

### **4 What is being done?**

Governments are moving towards greater dependence on electronic data storage and hence are already engaged in digital archiving projects. While their requirements may differ from those of the business sector, there are still benefits to be gained from a study of current digital archiving projects to establish where there is overlap and to establish the extent to which these projects have dealt with the problem of changing technologies and changing format requirements.

Some research into digital archiving is well established in the field of government and in libraries. The Victorian Government in Australia, for example, embarked on a whole of government approach to electronic records keeping. The Victorian Electronic Records Strategy (VERS) Project was aimed at enabling Victorian Government agencies to implement satisfactory electronic archiving systems and strategies which would facilitate long term accessibility. Other studies have been conducted. For example, the US National Historical Publications and Records Office funded a project at the University of Pittsburgh in 1995. Another study, *Preserving Digital Information* was conducted by the US Commission on Preservation and Access and the Research Libraries Group (1996).

A project of interest at the UK Public Records Office at Kew was EROS: Electronic Records in Office Systems (UK: Cabinet Office. Central Information Technology Unit's Government Directive Initiative: Digital Records. August 1998). The role of the Public Records Office (PRO) includes the electronic preservation of government records. The EROS Web site [see bibliography] gives information on this project. Some examples of the records kept on this system included:

(i) Committee proceedings, notes and attendees; and, (ii) Drafts of a Green Paper. The latter was presented in pdf format. Dates allowed movement back and forward to various versions of document (dates indicated changes made).

Large scale data storage functions have been undertaken by Oxford University Computing Service which Archives electronic assets of University of Oxford [Feeney: 34-35]. The University of London Computing Centre provided a databank for a variety of depositors including the Public Records Office. Work was undertaken on a contract basis, with management of data at the bit stream, on a 'cost for quantity' economic model. The Computing Centre's core service was as a 'Safety Deposit Box' [Feeney: 37-38]. Clearly, for governments and the library sector this could be matter of serious concern. For the business sector, where access to records is a matter of financial survival, tackling this problem is essential.

Businesses are attempting new ways of dealing with the expanding need for digital storage. One example is the Media Asset Management (MAM) systems which aim to provide faster retrieval of digital assets (graphics, illustrations, page layouts, and compound documents which may include movies and sound, etc.) and create metadata characterising the particular asset [Anon.: 1998]. In order to get the most out of these systems it is recommended that digital assets first be organised in folders or binders in much the same way as for paper documents like letters and faxes. It is suggested that not doing anything about media asset management isn't an option as the problem will only get worse [Anon.: 1998]. While this is an example of the concern over digital assets which focuses on access, the need for organisation of resources and for appropriate metadata, the compounding problem of changing software will still need to be addressed.

Storage is another area where changes are occurring. Annual growth rates for storage provision have been reported to be more than 60%. Storage management costs were rising by 25% p.a. Hence the growth in outsourcing to Storage Service Providers (SSPs). These could be viewed as information utilities allowing faster rollouts of new applications, improved security, backup and data archiving[Moore:1,24].

Enterprise Storage connects to, stores and retrieves data from all major computing platforms in both mainframe and open systems environments. It also allows connection

to networks, file servers, Web servers and management interfaces. Consolidation of data is facilitated and managers are able to leverage information from throughout the enterprise. Enterprise Storage Network (ESN) [Rich, 2000] provides a single infrastructure which exploits the power of information. It is independent of location, cost effective, flexible and provides easy scalability (up or down). Other aspects include: cross-platform connectivity, transparent and non-intrusive data migration and data-centric storage architectures. ESN presents particular advantages in merging organisations [Rich, 2000].

It is clear from the above examples that there is some overlap in the concerns of the public and private sector organisations in their focus on data migration and data storage. Indeed, some have pointed to the idea of the web as a distribution system for content and suggested the prospect of its developing into a distributed system to enable migration of content [Evans: 1999]. While approaches may differ, there are surely benefits to be gained from both contributions.

## **5 Proposed solutions (Migration, archiving the technology, emulation, standards)**

Proposed solutions to ensure access include: archiving the technology, migrating content as systems and software change, saving data at the bit stream and using emulation software as required [Rothenberg, 1995: 24-29]. Archiving the technology is unrealistic although it is conceivable that there may be a role for this to some degree. In the summary provided in Parkes, solutions focus was around three areas: migration of data; emulation; and standardisation.

Migration involves not only transferring the data to the new media but ensuring that the necessary modifications have been undertaken to maintain compatibility with the new technology [Parkes: 369]. Exact copies can not be guaranteed, however and the task may involve some complexity [Parkes: 369]. Most regular users of word processing and presentation softwares would be familiar with the problems involved in migrating basic documents as software packages are upgraded! Indeed, the US Task Force on Archiving Digital Information (1996) noted that migration is 'time consuming, costly and much more complex than simply refreshing' and did not favour this method [Parkes: 370].

Emulation: Rothenberg's proposal to provide software which emulates the original hardware and software environment is discussed [Parkes: 370]. While this method has received some favourable reviews, it is suggested that many of the same problems are evident here as for migration, among them the economic feasibility of continually producing emulation software given the speed of technological change.

Standardisation: Again, Rothenberg's work is referred to [Parkes: 371]. While preservation in a computer system independent format may be suitable for some content, problems arise if structure is an important element [Parkes: 371]. This may be one reason why pdf format documents have been favoured by some digital preservation projects.

Victorian Electronic Records Strategy (VERS) was a joint project of the Public Records Office of Victoria and the CSIRO [PROV:1998]. Its aim was to provide good record keeping for government business with a focus on long term storage requirements. A successful prototype was developed with potential financial benefits. All government departments would be involved. Electronic records would be produced in long term format, captured at point of production. Information is preserved within metadata and includes data formats and descriptions of content [Waugh,2000]. Standards estab-

lished included: Use of XML; PDF; digital signatures to ensure integrity; standardised metadata [PROV: 1998]. Interest had been expressed from the business sector.

From discussions with researchers involved in some of the projects listed above and in others in the UK and Australia, it might be concluded that none of the solutions offered a final answer. More recent proposals such as Genomic storage, while interesting, seem impractical at present [Wong, 2003]. Problems with all of these proposals include: practicality, costliness and loss of information.

## **6 Standards (XML, PDF, etc.)**

In his discussion of the importance of XML, Berners-Lee [p.173] points out that it 'stems the tide of information loss' because it allows anyone to create their own tags as they deem necessary. Hence, 'An XML document is typically richer: the information it contains is more well defined.' [Berners-Lee: 173]. XML is favoured for these reasons by influential groups internationally (W3C) and has gained widespread acceptance.

Other potential standards have been indicated above, among them pdf, digital signatures and standards in metadata. The usefulness of pdf was noted in 4 above: Drafts of a Green Paper were presented in pdf format. Dates allowed movement back and forward to various versions of document (dates indicated changes made). Although pdf relies on proprietary software, its broad availability and popularity and the popularity of XML certainly hold some promise for their being adopted as standards in the short term. The VERS project above included these among the favoured list of standards.

## **7 Recommendations (Procedures, the process)**

While discussion of standards tends to consider the global context, local needs must also be considered. Joseph Stiglitz - Chief Economist with the World Bank, when discussing to the Global Development Network emphasised the importance of locally based research institutions which possess a knowledge of local conditions and needs. For this reason, global 'technological fixes' may never be adequate to meet the digital archiving needs of individual businesses. To some degree, the focus will need to be on procedures and processes which take into account local conditions.

For most organisations, the integrity and accessibility of electronic records is essential to the success of their enterprise. As has been suggested, the rapid changes to technology, changes in hardware and software for example, present difficulties where long term preservation is concerned. How to ensure the migration to a new system, of all records essential to the conduct of their business, is a perennial concern with no quick solution. What is needed along side the technical solutions is a set of policies and procedures which will guarantee that all essential records are indeed retained and are accessible and secure.

It will be important to develop a standard approach to dealing with record storage and retrieval within an environment of continuing technological change - for both software and hardware. One step should be the design of a process methodology which defines a uniform set of standards for adoption by the organisation, to enable the storage and retrieval of strategically important information.

The organisation will be well aware of the importance of guaranteeing that client records are not lost as records migrate for one system to the next and of the need to ensure efficient and effective access over the long term. A preliminary study of specific

needs which covers areas such as commercial transactions, client information, financial record keeping, legal requirements and focuses also on the enabling technologies will aid identification of the essential procedural elements.

International standards are being developed as regards the use of metadata in providing access links between electronic media. It is important that these standards, especially as they relate to the specific needs of the organisation concerned, be considered when establishing procedures.

## **8 The Future (merging software, Data mining, Data warehousing, Knowledge Management Tools, Digital Archiving)**

*“... after only a few generations of computer hardware, software and Web content, there is little in the way of an enduring cultural heritage to build upon.”* (Bergeron, 2002:258)

Bergeron has suggested that Cyberspace culture is based on a loss of data: programs, operating systems, databases, application specific files, all are disappearing. What is preserved is a matter of choice. What is remembered or revived depends on the priorities and values of a given group at a given time. Indeed, what has come down to us as classics from past centuries, as O'Donnell suggests, have been influenced by artificial imperatives. He illustrates this by pointing to the revival of the reading and copying of Latin classics at the time when Christianity became the official religion of the Roman state [O'Donnell: 109-110]. Undoubtedly, this selectivity was continued during the periods where expensive and time consuming manuscript copies were made in medieval libraries, usually in monasteries. Today, too, choices will be made as to what is to be preserved. The likelihood that much will be lost that, perhaps should have been preserved is real. Clearly, the changing technologies make that inevitable unless some simpler means for the digital preservation of resources is found.

Established technologies such as data warehousing and data mining present a reactive approach often dealing with legacy systems. Newer Knowledge Management (KM) Technologies focus on current business needs. Much of the discussion around digital storage and digital archiving on the other hand, tends to be proactive and concerned with both current and future access. This is important. Descriptions of current developments in all of these, suggests a merging of technologies to a degree. A more radical approach may appear: Internet scale operating system, storage and applications could provide a partial answer (Anderson and Kubiatoiwicz,2002). However, assuring long term access to content through global agreements on standards may continue to be difficult to achieve.

## **9 Conclusion**

Efficient storage of digital resources is an urgent concern for both private and public sector organisations. However, focus on storage alone is not sufficient. It is essential that the issue of long term access be addressed at the point of creation of the digital resource. Changing technologies, hardware and software will continue to present problems for long term access unless appropriate procedures are put in place to ensure that essential digital resources are preserved and continued access assured. The methods suggested to date: archiving the technology, migration of data, and emulation, all present problems of cost, practicality and loss of data. Today, our ability to store in-

formation is unparalleled. The wealth these stores contain is essential to our economic and social well being. This wealth is of little use, however, if we lose the key.

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