

Decisions and Timing, a Practical Guide

Dr. Ulrich Kampffmeyer



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Dr. Ulrich Kampffmeyer

PROJECT CONSULT Unternehmensberatung Dr. Ulrich Kampffmeyer GmbH, Geschäftsführer
VOI, Verband Optische Informationssysteme e.V., Vorsitzender des Vorstandes
IMC, International Information Management Congress, Member of the Board of Directors

Abstract

Both the technology and the market for document management and imaging systems are moving fast. New players are entering the marketplace: the big vendors of standard office, groupware and PC-LAN operating software like Microsoft, Novell or Lotus have started to attack the market with standard products. This will change the whole situation by creating new user awareness, impacting the business of smaller specialized system houses and opening a new large market for integration, services and consulting. This puts the user in a difficult spot: should he trust in low-cost standard products, or should he stick to specialized high end solutions? Especially in the field of long term archival on WORM disks one has to decide to enter a permanent process of change with standard programs, or to take risk that his specialized solution will vanish from the market by the pressure of the big players. This presentation not only describes the situation but shows the chances and risks for end users, systemhouses, software manufacturers and integrators.

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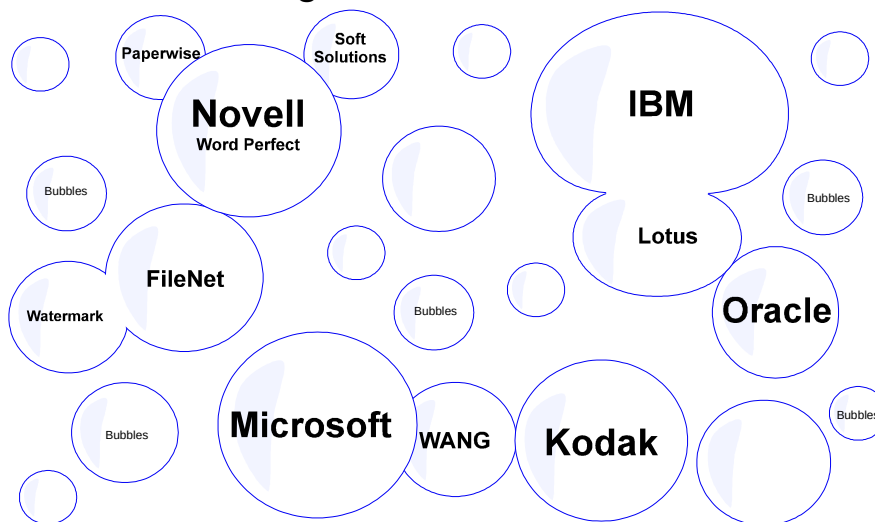


1 Changing Markets

The computer industry is very fast-paced. Each year new hardware, operating-system versions, and application packages hit the market, each claiming to be better, faster, and more full-featured than ever before. At the receiving end is the user, who needs to be able to store data for many years, and access it efficiently with retrieval software. This is a fundamental conflict of interest - rapid development and turnover of hardware, applications, and operating systems versus the need for long-term data availability and edit-proof, legally admissible archiving.

By now all software vendors have recognized the importance of the document management market. New alliances, takeovers, and cooperative agreements are changing the vendor landscape. What once was a niche market for specialist vendors is going mainstream, and a large part of the future software and service turnover in the IT industry will be made in document management.

New Players and Alliances in the Document Management Market



A survey of the most important events in the document management industry during the last few months:

- Wang/Microsoft alliance - Microsoft will bundle Wang's Imaging Clients with Windows '95. This will result in a great spread of imaging technology, although Microsoft is not in a position to offer a complete filing/archiving solution. The idea is to let Wang and Partners take care of this. Work is underway on a modular "Components" concept for this purpose.



- Wang/Kodak alliance - Kodak will handle distribution of Wang Imaging Software. The Microsoft/Wang and Wang/Kodak combination will result in considerable market power, and makes Wang once again one of the key players in the document management market.
- FileNet purchases Watermark for \$61 million. With around 180,000 licenses sold, Watermark is the US market leader. This should give FileNet the world's largest installed base of workflow and imaging systems.
- Novell and FileNet sign distribution agreement (alliance directed against Microsoft/Wang and IBM/Lotus). FileNet will create three versions for Novell, from a simple groupware-imaging product to a full-featured workflow system. Novell already offers document-imaging products with Softsolutions and Paperwise.
- IBM buys Lotus. Via the Lotus LN:DI interface IBM now has the largest market not only for groupware but also for document management and archiving systems connected to Lotus Notes.
- Late last year Lotus had agreed on a cooperation with ORACLE to solve the problem of replicating Notes databases in large systems with the ORACLE MultiMedia-Server. It is an open question whether this cooperation is still operative after the marriage to IBM.
- SAP offers its own Workflow component as an extra component for R3. With the IXOS archive system this gives SAP a complete module set for archiving, document management and workflow within the framework of its commercial applications.
- Unisys can extend its market position, and not just with its own Informage product. Garmhausen & Partner together with Unisys win the world's largest workflow contract at Deutsche Telekom with some 90,000 workstations. C.S.E workflow software will be used. 20,000 workstations will be installed during the next two years to start with. Garmhausen & Partner, a subsidiary of Informix, is relatively new in the business as an integrator, but with a distribution agreement with C.S.E. they were able to secure the German rights to one of the leading workflow products.
- Workflow Management Coalition - a standard for workflow products is formed through the efforts of the WfMC. Adherence to this standard was a decisive factor in Deutsche Telekom's decision in favor of C.S.E.
- IBM, Microsoft, Rank Xerox, Lotus and Novell give up their own efforts to create proprietary filing and document management systems, and form the DMA - Document Management Alliance - under the umbrella of the AIIM. This standardizes protocols and standards such as DFR, Shamrock and DEN, which hopefully will soon be reflected in products.



- BancTec acquires Recognition - their Plexus workflow management software is considered professional and is widely installed around the world. This puts BancTec squarely in the trend of market consolidation through mergers and alliances.

New Players and Alliances in the Document Management Market

Novell	+ PaperWise + Soft Solutions + FileNet FileNet + Watermark	Co-operation Strategy? What about this Zoo, Which will be the Novell product of the future? Hey FileNet, what about a product strategy ?
IBM	+ Lotus Lotus + Oracle	Buying Strategy? SAA is gone, AIX, OS400, OS/2, Windows, WinNT... Which kind of products will develop out of this quarry of options?
Microsoft	+ WANG WANG + Kodak	Distribution & Component Strategy? The Exchange Server is no DMS platform, an Imaging Client is not enough, so who knows how to handle all the "Components"? Hey WANG & Kodak, is the Distribution of Products via the channel of the Partner the key to Success?

The big standard software vendors are following varying strategies. Some are opting for cooperative efforts and product bundling, while others are simply acquiring firms with interesting solutions. Time will tell which strategy is the more effective. All vendors face the problem of generating new solutions for the market from their existing products. Document management, workgroup and workflow systems have far-reaching effects on users' organizations. The decisive factors will be the availability of tools for simple adaptation, standard interfaces for integration in existing solutions, and an open platform of modules and services. Since the new groupings were only formed this year, we won't be seeing the first products from them before mid-1996. Exhibitors at CeBIT '96, the most important computer fair in Europe and beyond, will restrict themselves to announcements and prototypes.



Future Products Mainstream Perspectives - a Draft

	1995	1996	1997	1998
Document Imaging	many specialized Solutions	Standard Products	Part of Operating Systems	
Document Management	some specialized solutions	first DMA Products	Part of Operating Systems	
Groupware	specialized Solutions	more Solutions beside NOTES	Bypack to Office Packages	
Workflow	specialized Solutions	WfMC conform Standard Products	Seperation in low-end / high-end	low-end: Bypack to Office Solutions high-end: specialized Solutions
Electronic long-term Archival (WORM)	specialized Solutions, standard Modules	Standard Modules	Part of DMA-Products (plug & play)	

But the trend is towards standard components that add document management and imaging capabilities to office packages, the operating system, and special application solutions. Time will tell whether the Document Management Alliance and the Workflow Management Coalition will establish themselves fast enough to get really compatible and interchangeable standard products. The chances for this are quite good, and at the latest by 1998 the products that today are still marketed as specialist solutions will become common.

These changes will be at the expense of smaller software houses and system integrators with their own DMS solutions. Many of them will probably end up as mere integrators for the big vendors.

2 User Needs

This means that in order to make the right decision in long-term planning for a workflow or archiving system with optical storage the user must keep the market under close observation. The basic question at the heart of the matter is, is it better to wait, trusting that the big vendors will come out with standard products soon, or is it better to opt for a solution that is available immediately, in order to benefit from a document management system as soon as possible? Users don't want to have to deal with technologies and future strategies, users want cost-effective, run-capable, and safe solutions.



Users Need

The option of electronic document management, document imaging, groupware and workflow as integrated solutions:

- **Cost reduction**
- **Efficiency improvement**
- **Business advantage**

User requirements for document management, imaging, workgroup and workflow are clear - solutions need to be available now and they have to be economical. And here lies the opportunity for the specialist vendors who already have products on-line. The entry of the key software industry players has made the technology "respectable", and customers are now ready to invest in system solutions. And the more sales small-to-medium sized vendors make during the next 12 months, the greater will be their products' chances for survival.

Users Demand

The use of electronic document management, document imaging, groupware and workflow:

- **Solving of organizational and process problems**
- **Long-term availability of information**
- **Easy-to-use, implement and maintain**
- **Short-term implementation at fixed costs**
- **Up-to-date, competitive solutions**
- **Short-term Return on Investment**
- **Long-term security of investment**
- **Integration in existing infrastructure, hardware and software environments**
- **Compatibility with organizational and business goals**

The risks to the user today are not restricted merely to the right strategic decision or the right product choice. For one thing, many applications have been developed with everything except the user in mind, or represent isolated islands cut off from the outside world. For another, the user's organization is



often not sufficiently prepared to really use such a system effectively and efficiently. Often, the risks involved in adapting the organization and implementing the system are greater than the technological risks. Users routinely underestimate the time and effort required to first prepare the organization and then operate a document management system with client-server architecture.

The Users' Risks

The implementation of electronic document management, document imaging, groupware and workflow:

- **The user's organization is not prepared for the use of these systems**
- **User's needs and solutions answers differ**
- **Over-dimensioned projects cost too much and come too late**
- **Running and maintaining a system may eat up all potential gains**
- **Individual solutions may be cut off from the mainstream development**
- **Closed-shop solutions might not serve companies' overall needs**

For these reasons, today many questions are still open for future customers. Standards, long-term availability, security and compatibility are an important part of this. The realization is slowly sinking in that it is the archived information that is the most important and valuable element, not only of a system but for the entire firm, and this realization is causing choice, purchase, and implementation decisions to be made slowly and with all due deliberation.

3 Problems of document standards

Today, the media of choice for edit-proof archiving is the WORM (Write Once Read Many) optical disk. WORM is available in a number of formats - 14", 12", 5¼", and CD-WORM. Although this technology is mature and offers plenty of storage space for constantly expanding volumes of information, it is by no means as widely used as it could be. This is in part due to its basic incompatibility with traditional magnetic-disk-oriented operating systems. Such operating systems are accustomed to reorganizing, deleting, and making changes on hard disks. This is not possible with WORMs. Furthermore, the large data volumes that such disks are capable of holding create inherent difficulties for operating systems.



A Conflict of Interest

- **Rapid turnover and constant development of new hardware, applications, and operating systems**
- **Long-term information availability and edit-proof archiving**

If we look at the conflict of interests from this standpoint, we see that there are a number of problems standing in the way of more widespread use of optical storage media.

A Conflict of Interest

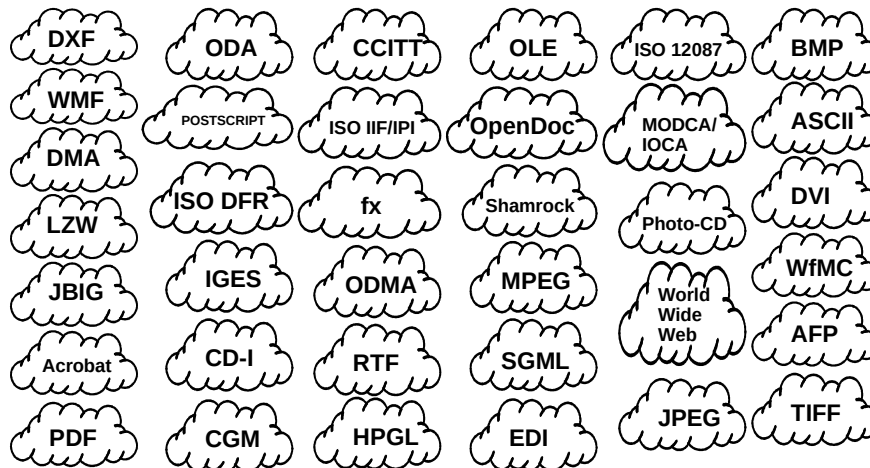
Problems:

- **Lack of document standards**
- **Proprietary interfaces and formats**
- **WORM optical storage media incompatible with magnetic-disk-oriented operating systems**
- **Networks and databases become bottlenecks**
- **Unresolved problems with data privacy and security in information exchange**

These include a lack of document standards, a multitude of proprietary interfaces and formats, and an as yet not completely clarified legal basis for archiving. Furthermore, databases and networks are increasingly serious bottlenecks in systems using optical storage media. In large applications even professional databases often reach the limits of their capacity. The situation is particularly critical when many users frequently and simultaneously access optical storage media by traditional networks.



The Standards Problem



However, the major hindrance standing in the way of implementation of optical storage has been the lack of clear standards. There is the TIFF standard for scanned facsimiles, but TIFF exists in many different versions. One US vendor advertises a TIFF converter that can handle 149 TIFF formats! The TIFF format most widespread in Europe is Aldus 3, which when converted per CCITT/4 is the standard image-archiving format. However, new standards are now also gaining in importance, such as LZW compression or the JBIG format. The market here is being driven less by archiving than by document interchange over the InterNet and other communication services.

Document Types and Their Implications for Long-Term Archiving

Elementary objects	One image (TIFF) One unstructured textfile (how to store ?) One structured data set (how to store ?)
Complex objects (compound documents)	One file with mixed (how to store ?) text, images, spreadsheet tables, graphics, layouts etc.
Container objects	One structured object (how to store ?) containing many struc- tured, unstructured, com- plex and elementary objects with internal & external references, version management and access information

The file-archiving situation is much more complex and confused. Every user will have noticed how insecure, difficult, and tricky it is to work with large file



volumes using traditional file managers. More and more products are coming to market promising to improve this situation, like the document-management systems from Sharper, Saros, and others. Microsoft has also entered the ring with its Exchange Server. As files increasingly take on the dimensions of images - 25 to 30 Kb - the distinction between the two is becoming more and more academic. However, if you want to archive files, you are faced with the problem that every word processor, every spreadsheet, every application has its own format. Worse, these formats are constantly changing.

Problems in Presentation & Reproduction of Long-Term Archived Objects

Use for:

- **Retrieval**
- **Access**
- **Viewing**
- **Processing (copies)**
- **Printing**

Problem areas:

- **Source program no longer available**
- **Complex and container objects no longer interpretable (missing viewers and converters)**
- **Access to referenced parts of complex and container objects not available**
- **Print formats changed**
- **Layout formats changed**

File formats change with almost every new release of a program. If you try to access a file after several years, you will frequently get nothing but the laconic message that the system cannot find the associated program. A standard format, ODA/ODIF, has long been offered that could solve this problem, but hardly any vendor uses it. Microsoft has had an ODA converter for years, but does not include it with the standard MS Windows package, for example. Obviously, vendors consider it to be in their interest to maintain proprietary formats, in order to maintain their market positions.

There are several programs from the US that solve this problem by offering viewers capable of accessing files without calling (spawning) the source program. However, the user quickly finds him - or herself confronted with the need for a great variety of viewers in many different versions which must be administered over a long period of time.

Complex objects, such as a file assembled from text, tables, and images with OLE, make the situation more complicated still. Non-incorporated linkages lead to nowhere in document imaging and archiving systems. Thus, vendors, consultants, and users often face the question of how to store information in such a way as to still be readable in the year 2000 and beyond.



One Question - No Answer

Dear consultant, vendor or system integrator!

**What do you tell your customers now on retrieving,
accessing, viewing, processing and printing
documents archived today**

in the year 2000 ?

There is often a solution of sorts for elementary objects. We have looked at the problems with complex objects. The situation gets completely out of hand when we turn our attention to container objects, i.e., complete dossiers or procedures made up of various documents, structured and unstructured data, elementary and complex objects with internal and external references, and access information. The technology does not exist that would enable an open exchange of information, as suggested by the term "Open Systems". The current lack of intelligent document-interchange formats with authentication, version management, access security etc. represents a risk for the user.

4 Problems of Document Management System Architecture

Many of the archiving systems widely used today simply do not have the architecture to meet the needs for filing and management of temporary as well as static, long-term-archived information. Most of these are closed applications, in which the archive is directly connected to an administration application and the client software.



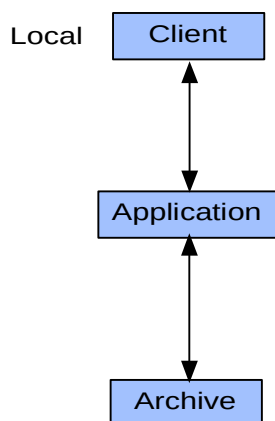
Today

- Closed filing, archive, workgroup and workflow applications are superimposed on the operating system
- Operating systems are magnetic-disk-oriented and do not support direct linkage to WORM storage media
- Proprietary formats, non-existent document standards, and different interface types discourage wider use
- Traditional networks are poorly suited to large-scale information interchange
- Standard databases are bottlenecks for large document management applications
- The lack of intelligent data-interchange formats for documents including authentication, version management, access protection etc. represents a risk

Self-contained applications for filing, archiving, workgroup, and workflow are superimposed on the operating system. But as stated at the beginning, operating systems are magnetic-disk-oriented and do not support the direct connection of WORM storage media. Proprietary formats, the lack of document standards, and different interface types further hinder more extensive use.

Information Interchange Today

Closed Applications

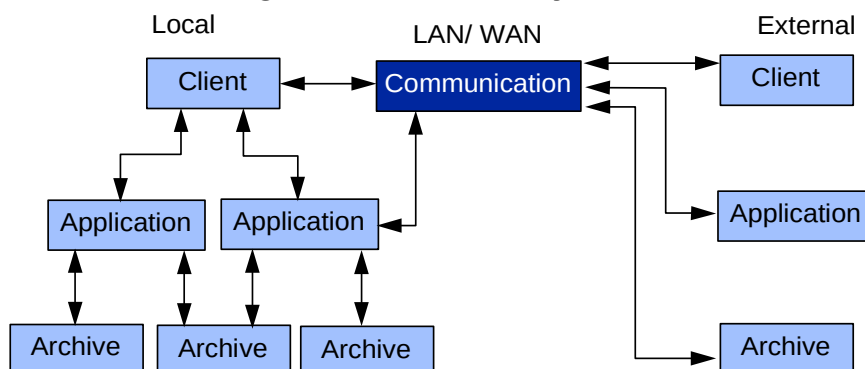


The information processing of the future will place new requirements on filing and archiving systems. A defining characteristic will be that instead of closed applications, separately usable services will be required. These services will perform new tasks. Future archives will be put together from all types of media, support different formats, and provide information from a variety of applications. Users will have access from many different applications to information from local, central, or remote archives.



Information Interchange in the Future

Data Interchange in Distributed Systems



A particular problem arises from communication via networks which are no longer under the control of a central system. Documents leave applications' control domain in terms of formats, access authorization, history, and version management. The problems of whole or partial replication of databases and volume transport of images and other large files have not yet been satisfactorily solved.

Future

- **Operating systems will perform document-management functions:**
 - Fax sending and receiving
 - Database-supported administration instead of file systems
 - Integration platform
 - Incorporation of office communication
- **Special characteristics of document management systems will be integrated in operating systems:**
 - Imaging
 - Scanning
 - Distributing
 - Retrieval
 - Archiving (?)

Most archiving systems presently work with reference databases, i.e. images and files are referenced to a database by pointers. In a search, the associated document or documents are found via the database and provided to the user.



Risks and Problems

- **Documents leave the control domain of the application**
 - Formats
 - Authorization
 - Version management
 - History
 - Conversion / Viewing
- **Replication of portions of archives in groupware and data-warehouse systems**
- **Mass data-transport performance**
- **The necessity of long-term information availability conflicts with the rapid pace of product development**

Problems in long-term optical media storage will arise from new requirements of information access and distribution, such as self-contained objects, which have their own reference information and do not use a reference database, fulltext, hypertext and knowledge-based systems, repositories, libraries and other object-based systems, and especially distributed systems such as groupware products.

Document Storage & Retrieval - An Unsolved Challenge

- **Reference databases - the traditional way**

But how to deal with:

- **"Self contained objects" containing their own reference information**
- **Fulltext, hypertext and knowledge-based systems with integrated objects**
- **Repositories, libraries and other types of object storage**
- **New databases or repositories integrated in operating systems**
- **Distributed systems such as groupware and data warehouse products**

In the future, operating systems will perform document-management functions themselves. Special functions like document display through integrated fax software will be standard in the future. Traditional file managers will be replaced by databases, and operating systems will more and more become integration platforms. This is particularly the case for integration in office-communication products. Special features of document-management systems, like imaging, scanning, distribution, retrieval, and at least the filing of dynamic information will



thus become integral parts of operating systems. Archiving on WORM optical media, on the other hand, will become a "wallflower".

Avenues for Possible Problem Solutions

- **New file management / archive architectures**
- **Standard document formats**
- **Viewers**
- **Converters**
- **Migration**

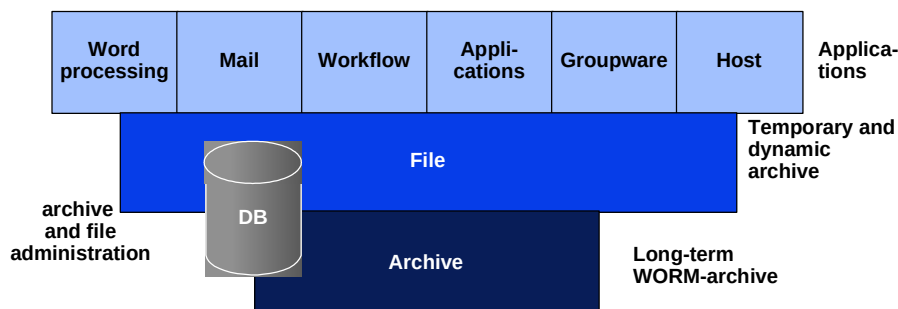
There are basically five different avenues of approach for solving these problems:

- New filing/archiving architectures
- Standardized document formats
- Viewers
- Converters
- Migration

New filing/archiving architectures separate the static long-term archiving on WORM from a level at which temporary, dynamic filing and archiving take place. Both levels are administered by the same database, which references the objects in filing and archiving. At the filing level are modules such as navigation, for sending information in distributed environments, localization, for administering different filing and archiving locations, and converters, for generating facsimiles from text, for example, or generating another standard archive format for long-term archiving. Version management is also included, for managing the different versions of source applications, layouts, converters, and viewers. The dynamic level can be subject to constant change. The important thing is that the long-term archive can remain unchanged for a period of years. This decoupling allows the interface to and formats of the applications using the filing and archiving system to be constantly changed and updated, without compromising the integrity, consistency, or edit-security of the long-term archive.



Interplay of Applications and Archive Systems



Standard document formats could be another part of the solution. However, as previously noted the market is in a state of flux at the moment, so that viewers at the client level will be an indispensable part of future archive systems. They are considerably faster than loading the source program, and in addition they ensure that the information remains unchanged, which is one of the requirements for legal admissibility. Converters work in similar fashion, with the difference that they generate a new, uniform file format. Thus, input and output formats differ. Users can employ two different strategies - either store information in the original format as generated and use various viewers to prepare the information during runtime for screen display and printout, or use a converter to convert data from different sources into a single standard archive format.

Avenues for Possible Problem Solutions

Viewers:

- Convert data during runtime for screen viewing and printing
- Original format remains unchanged

Problems:

- Numerous viewers required
- Loading performance
- Lack of version management
- Lack of intelligent objects which call the appropriate viewer
- Recovery and migration of old data

However, the use of viewers and converters is not without its difficulties. For example, version management is a problem with both. Furthermore, at present there are not yet intelligent objects which call the appropriate viewer or control the converter appropriately. And with viewers, recovery and migration of old



data are critical. Additionally, the need to use a great many different viewers can compromise performance. Converters, for their part, require constant maintenance and upgrading, and the definition of a long-lived archiving format is a very difficult matter.

Avenues for Possible Problem Solutions

Converters:

- **Convert the entry format into an archive format before archiving**
- **Generate a new, uniform format**

Problems:

- **Constant maintenance of the converter or converters**
- **Definition of long-term archive format**
- **Version management**
- **Lack of intelligent objects which can control the converter appropriately**

5 Migration - Chance for Technology Change

Despite the use of standard document formats, viewers, and converters, the user will sooner or later be faced with the need to migrate his or her archive. Migration is the timely transfer of information objects, which can be necessitated by a switch to a higher system or release, a switch to a new system type, or a switch to a new vendor.

Avenues for Possible Problem Solutions

Migration:

- **Timely switch to new technology**

Problems:

- **Copying or conversion of old data**
- **Inclusion in cost/benefit analysis**
- **Time-intensive**

Long-term planning to ensure operability, data security, and availability is naturally of the essence in any long-term information object archiving operation. Continued fast-paced developments in hard- and software must be taken into



account. The WORM digital optical storage systems that currently predominate in long-term archiving are static and cannot be reformatted.

Migration

Strategy A migration concept must ensure

- Operability,
- Data availability,
- Upgradability, and
- System change

extending beyond the initial implementation phase.

The migration concept should be part of the specification profile in any tender for bids and should be included in any resulting contract.

With this in mind, it can be worthwhile to make strategic use of technological changes by migrating to another system at a well-chosen time. This time has arrived when:

- Drives and media prices drop;
- Drive and media capacity increases;
- New storage strategies offer faster access.

Migration

Questions about long-term digital optical storage

Drives	How long available, how secure, how expensive to maintain, hard- and software compatibility, application compatibility, when to change?
Media	How long available, how secure, how much data, usability in the next drive generation, how long does copying take, are new higher-capacity media available?
Operating software	How long available? Upwards compatible? Cost for changeover to newer, faster platforms?
Data and document formats	How long read/writable, format-conversion software, standardized document formats, format-conversion cost, compatibility with applications in use?
Information life	How long must stored data remain accessible? How is data disposed of when no longer needed?

The frequent new version releases in the software industry cannot be predicted, and information objects generated under one software standard may not be



readable by a later software package. Therefore, conversion routines are needed which ensure the conditions stated above.

Migration

Operating-system version change	Adaptation costs Driver compatibility Basic software compatibility Application compatibility
Operating-system or hardware platform change	Adaptation costs New hard- and software Availability of existing data Application compatibility
Application or application-module change	Interfaces Document formats Basic software
Storage-system change	Change to larger-format archive media, driver software Basic software compatibility Hardware compatibility Document formats

In planning a document management system, it must be determined at an early stage when and what kind of migration will be necessary. A migration strategy must guarantee operability, information availability, upgradability, and the ability to change systems over the long term.

Requirements for Manufacturers of Application Programs

- **Ensure that applications are able to read formats for at least 5 years or 4 generations.**
- **Ensure that applications are able to write formats for at least 3 years or 2 generations.**

The copying and conversion of older data is a particular problem. The user must reach an agreement with the manufacturer on the estimated costs for migration, as migration is extremely time-consuming and can be very costly in other ways as well. The manufacturer should also be required to reveal all formats of database, archived information objects, and transfer to other applications. A possible vendor switch should also be considered.



Requirements for Storage-System Manufacturers

- Ensure that media can be read over at least 2 drive generations.
- Ensure that media can be written for at least 1 generation in new drives.
- Ensure operability of drives for at least 7 years or 2 generations after installation, through spare-parts availability, maintenance, and operating-software upgrading.
- Ensure that the vendor provides conversion software for migration (copying, reformatting, storage-space optimizing).
- Contractual definition of costs for migration in media change (time, cost estimate).
The time expenditure should be demonstrated by testing.
- Manufacturer's recommendation as to when migration is advisable and when it is absolutely necessary.

Storage-media manufacturers often claim that the next media generation will be able to read old media as well, but in the real world this compatibility is hardly ever possible over more than one or at the most two generations. Manufacturers should be required to provide the following for their products:

- Assured readability of media over at least two drive generations;
- Assured writability of media over at least one generation in new drives;
- Assured operability of drives, meaning spare parts, maintenance, and operating software upgrading, over at least 7 years or two generations after installation;
- Assured provision by the vendor of conversion software for migration (copying, reformatting, storage-space optimization);
- Contractual definition of costs for migration upon media change (time, cost estimate), with test demonstration of the time required;
- Manufacturer's recommendation of when migration is advisable and when it is vital.

The switch to a new operating-system generation is particularly critical, since applications of the new operating system must be able to read and write the formats of old applications. Applications should always be able to read the formats of five years or four release generations and write the formats of three years or two generations.



Requirements for Manufacturers in General

- **Uniform, object-oriented document standards**
- **Vendor-independent, uniform interfaces among applications, as between workgroup and workflow and operating system and between operating system and file, archive, and jukebox management system**
- **Plug & Play solutions for WORM-archives with a standard interface, uniform recording formats and operating-system-independence**

In summary, the conflict of interest between technological advances, with the need to keep up with new products and convert to new technologies in time, and the need to archive information for the long term, shows that new developments such as the Information Highway, worldwide information sharing, and the linkage of computers, television, and telecommunications will bring new challenges and problems for document management. Keep in mind that there is a trend to really open platforms, although the details of interfaces, document formats, and other matters have not yet been worked out.

The change from file-oriented operating systems to library repositories, i.e. database-supported operating systems, will be very important for the future direction of document-management development. It will lead to document-management systems, groupware, and workflow becoming components of standard, off-the-shelf products.

6 New Standards on the Horizon

The need for uniform standards for documents, interfaces and functions has become obvious even to vendors who have heretofore followed proprietary strategies. While the various ISO groups have worked out standards, they have only seldom found their way into products. The ISO has been often seen as too slow and too removed from the real world of the marketplace. Instead, high expectations are being placed in two standardization bodies formed by the leading manufacturers, vendors, and system integrators.

6.1 DMA Document Management Alliance

The inadequacy of hierarchical file systems in large network applications and the lack of version management, a worldwide standard for information interchange document IDs, and database-supported document management systems led in the past to proprietary semi-solutions and products. IBM and Saros relied on the Shamrock Coalition, which further developed the Standard for Document Filing and Retrieval DFR described in ISO 10166, Novell had



placed the first modules of its Document Enabled Networking middleware product on the market, and Lotus countered with its replicating database concept. At the AIIM Conference in San Francisco in April 1995 these vendors agreed to develop a joint standard for document management, DMA. Since then Microsoft and many other vendors have joined this alliance. As of September 1995 the DMA counts some 70 members and rising.

Document management allows simple access to all unstructured data (documents) within an organization, regardless of where and in what format the documents are stored. Document management also includes the ensuring of accuracy, performance, security and reliability in document handling. Firms that are looking for a suitable document management system to handle exploding document repositories will have an easier time in the future if the Document Management Alliance (DMA) established in April 1995 achieves its goal of creating a uniform set of standards.

The DMA, which was organized as a project group of the Association for Information and Image Management (AIIM), is the result of a merger of two leading document management initiatives:

- Document Enabled Networking (DEN), set up by Novell and Xerox in May 1994, and
- Shamrock Document Management Coalition, established by IBM and Saros in February 1994.

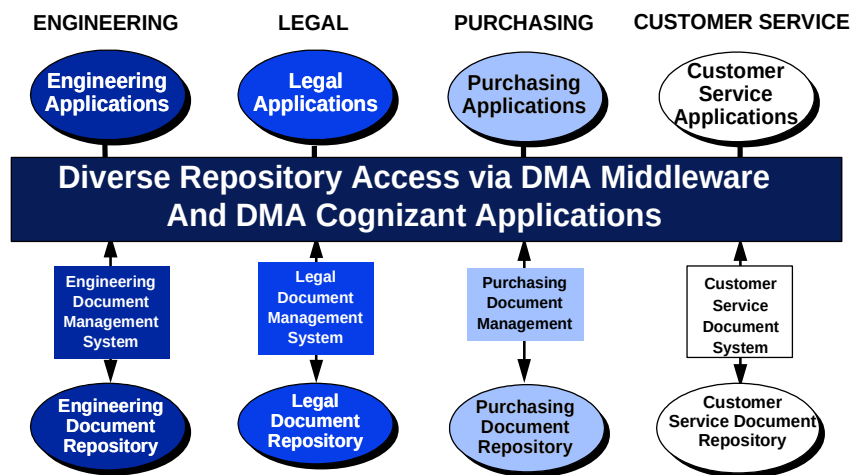
AIIM project groups tackle special problems that arise in the development of document management technologies. They are intended to enable fast decisions which meet the needs of manufacturers and users alike. While DEN developed standards for access to electronic documents regardless of where they are located and what their file type is, Shamrock's goal was to ensure the interoperability and consistency between document repositories administered by different document management systems on different platforms. The DMA combines these objectives and will try to present the first specifications enabling interoperability of document management applications, services and repositories by September 1995. The DMA specifications will be available on all familiar platforms and should allow uniform access to documents - direct access to library services and middleware access to different data repositories.



Goals of the DMA Specifications

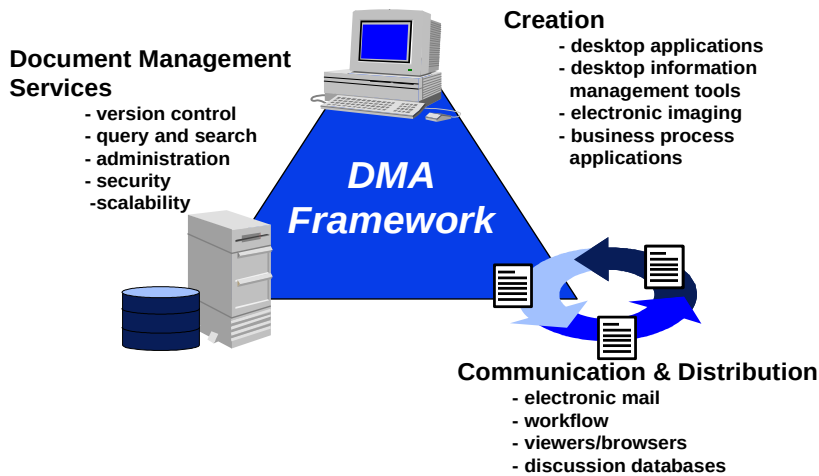
- A common, non-proprietary interface (version control, security aspects, scalability) for applications accessing company-wide library services
- Access to a document management system from multiple desktop applications
- Consistent access to different document management systems from a single desktop application
- Simplified interface between document management systems and existing legacy systems, desktop applications, E-mail and workflow systems

Bridging All of Your Islands





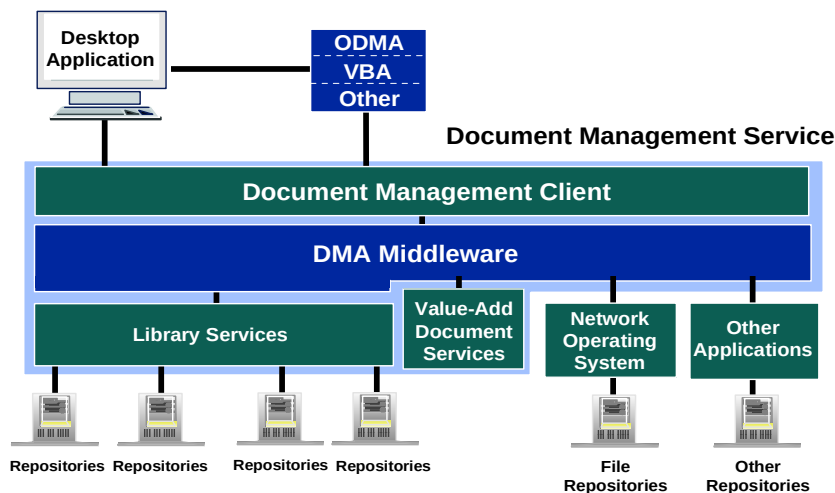
Enterprise Document Management



To permit company-wide specifications for library services and for the middleware-level which allow the user to access documents from different systems, flat-file repositories and file servers as well as to search for the corresponding document, the DMA will define three core elements:

- A common interface for integrating the access and search methods of individual library services
- A uniform application interface (API) for access and searches across more than one document management service
- An object-based data model for standardizing access to company-wide library services. The model will support modular integration of library services, enabling manufacturers to implement individual components of the entire model.

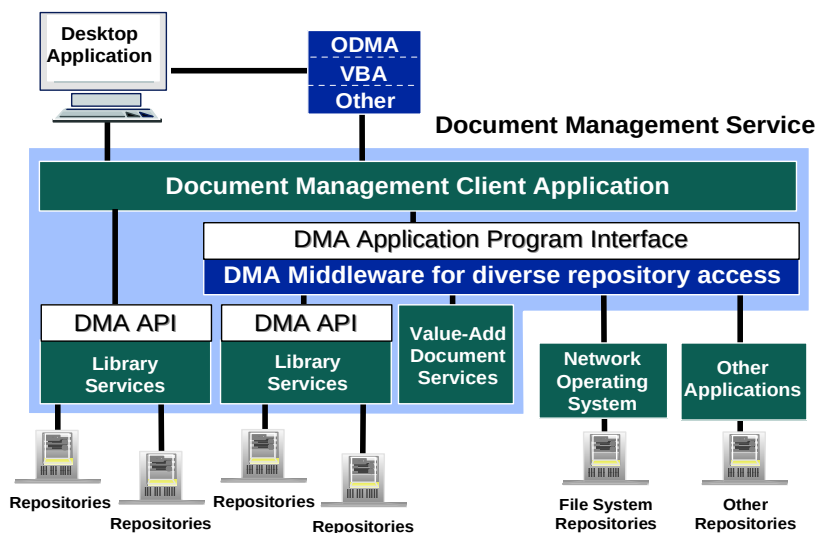
DMA System Framework





The DMA specifications are based on a vendor-independent C-language API. They are flexible with regard to access to an individual library service or to a number of different library services. Services and applications operating via DMA will give users transparent, reliable, and uniform access to information in electronic documents regardless of where and in what format they are stored. By means of various application and user interfaces, documents from most office applications can be located by their attributes or contents.

DMA Interface Framework



The object-based DMA-architecture will protect existing investments and at the same time give companies the freedom to create new documents in many different applications. Additionally, with the aid of DMA the user can integrate new documents into most of the common data formats and migrate them for future applications as well. DMA's comprehensive scalability means that small workgroup environments can be upscaled to large company-wide environments. A working group within DMA is also working on the definition and coordination of interfaces to the Workflow Management Coalition.

6.2 WfMC Workflow Management Coalition

Like other software technologies, workflow products come from various sources. While some of them were conceived from the start as workflow solutions, others started as imaging, document management or E-mail systems or as relational or object-based database systems. The development of pure workflow solutions often involved new terms, interfaces, and user interfaces, while products developed on the basis of other technologies used the existing terminology and user interfaces. Both approaches have their own strengths and weaknesses, which the user can combine into an integrated solution to meet his needs in the event of standardization.

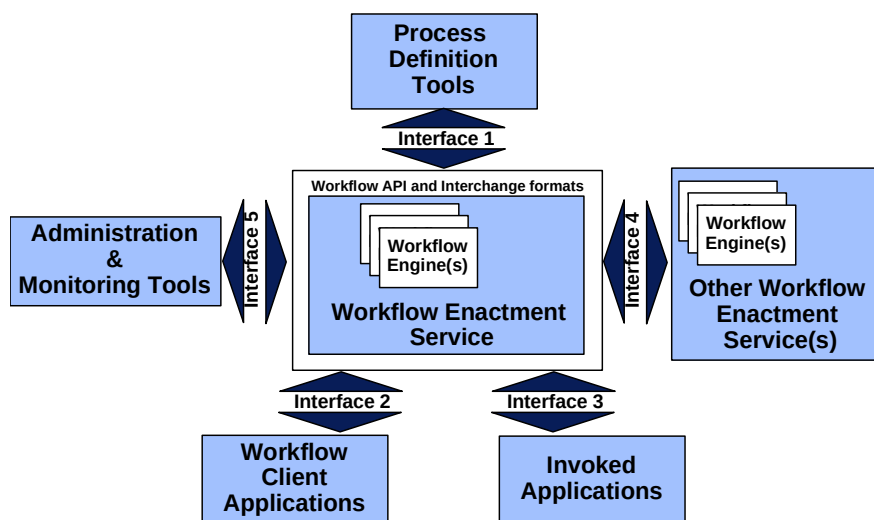


The Workflow Management Coalition established in August 1993 is an international group of over 100 workflow vendors, users and consultants and is the primary standardization body in this very fast-developing field. Membership is open to all interested parties involved in the development, analysis or installation of workflow systems. The Coalition's goal is the development of software specifications and standards in order to create the prerequisites for the interoperability of different workflow products and components in differing environments. This increases the investment value of workflow products and reduces the risk involved. A further objective is the broadening of the workflow market through increased awareness of workflow. To help propagate standards, the Coalition intends to expand its cooperation with other industries.

Workflow Reference Model

The Workflow Management Coalition is divided into a technical and a control committee, each with several working groups. One Coalition working group is involved with the development of a reference model for workflow management systems, describing the general characteristics, functions and interfaces of workflow systems. The model contains five categories of standards which are intended to ensure interoperability and communication between different workflow products and components, and forms the basis for the other working groups.

Workflow Reference Model



Process Definition Tools

Various tools can be used to analyze, model and describe business processes. The process definition tools are generally designed for a specific workflow



management software. A Workflow Management Coalition interface will give greater flexibility in this area. This so-called "process definition import/export interface" provides a general interchange format for the following types of information:

- Process starting and ending conditions
- Process activities with associated applications and data
- Identification of data types and access paths
- Definition of conditions and rules
- Resource allocation

Process Definition and User

Workflow Process Definition	Workflow Process Instance	Worklist
Workflow Process Definition 	1st Instance 	User 1 Work Item 1 Work Item 2 Work Item 3 ... Work Item N
	2nd Instance 	Work Item 1 Work Item 2 Work Item 3 ... Work Item N
Workflow Process Definition 	1st Instance 	User 2 Work Item 1 Work Item 2 Work Item 3 ... Work Item N

Workflow Enactment Service

The workflow enactment service, which can contain one or more workflow engines, provides the runtime environment for carrying out processes. The enactment service differs from the applications and end-user tools used to perform the actual work steps. It is often necessary to integrate a number of standard or application-specific tools in the enactment service to provide a complete workflow management system. This integration can take two forms:

- Invoked application interface, with the aid of which the workflow engine can activate certain applications. This integration is typically server-based and without user interaction, for example the transfer of data to a host system.
- Workflow client application interface, through which the workflow engine cooperates with the applications which support the user in his or her work.

Workflow Client Applications

The workflow client application presents the end user with a worklist of activities to carry out. It can automatically call programs to support the user upon transfer of the associated data, before returning everything to the enactment service. A workflow client application can be part of a workflow management system, a se-



parate product (such as an E-mail component) or an individual application. Flexible communication is necessary between the enactment service and the client applications which provide the various functions for the linkage to the service and to perform work steps.

Invoked Applications

Workflow systems must be connected with various services (such as fax, document management or E-mail services (like X.400)) or other existing applications. The Coalition provides "tool agents" for interfacing to such applications. It could also be useful to design a number of APIs which enable the development of applications which can be called directly from the workflow engine.

Workflow Interoperability

Workflow products come in different models, each with its specific strengths. The products available range from ad-hoc to production workflow, in which processes are exactly predictable and clearly definable by rules. One of the Coalition's major objectives is the definition of standards that allow the exchange of work items among the workflow systems of different vendors. This interoperability can extend from simple task transfer all the way to workflow management systems with the complete exchange of process definitions and all workflow-related data. The highest degree of integration will remain unattainable, as it would require manufacturers to cooperate and reveal all formats and interfaces. The Coalition distinguishes among the following interoperability levels:

- Level 1 **Coexistence:** Different workflow products based on the same hard- and software platform.
- Level 2 **Unique Gateways:** Special workflow systems can exchange work.
- Level 2A **Common Gateway API:** Extension of Unique Gateways.
- Level 3 **Limited Common API:** A subset of workflow functions is assembled in an open API.
- Level 4 **Complete Workflow API:** All aspects of a workflow system are contained in an open API.
- Level 5 **Shared Definition Format:** Workflow products can use the same process definitions during runtime.
- Level 6 **Protocol Compatibility:** All APIs containing the exchange of definitions, work items, and recovery are standardized.
- Level 7 **Common Look and Feel:** Workflow system components can be combined in any way desired.

Administration & Monitoring Tools

A Workflow Management Coalition interface will allow a given manufacturer's administration and monitoring tools to cooperate with the workflow enactment

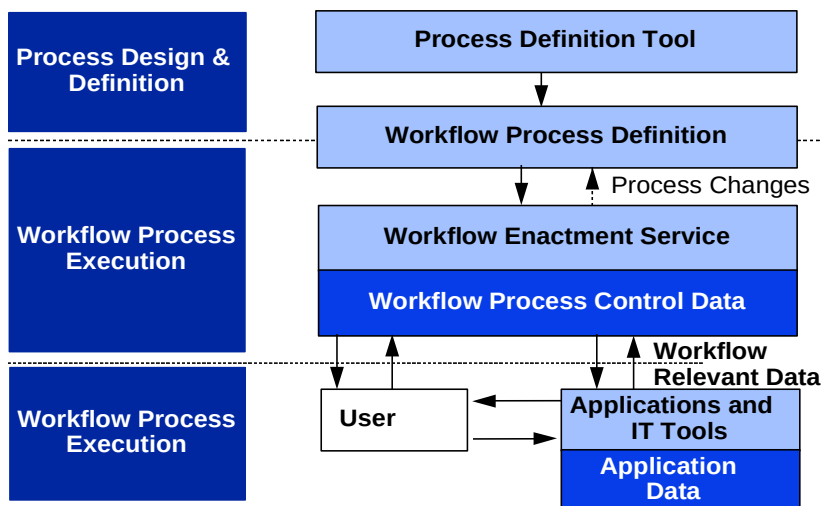


service engine of one or more other manufacturer(s). A standardized interface would permit the complete recording of the flow of work through the entire organization, regardless of what systems were used for that work. Furthermore, users could choose the workflow administration and monitoring tools best suited to their requirements.

Terminology

The Coalition has formed a separate working group specifically for developing a glossary of standard terminology for describing workflow systems and their environments.

Data Types in Workflow Systems



7 Decisions and Timing

In view of the market situation described and the problems involved in long-term document management, the question for the potential customer is, "should I wait, or buy a solution now and take the risk that it won't be on the market in another one or two years?" The situation is made even more fraught by the constant talk of worldwide document interchange on the information highway, multimedia, and telework, and is further aggravated by the fact that many of the technical and legal problems have yet to be resolved.



New Ideas • New Platforms • New Problems

New ideas

- Information Highway & Multimedia Communication
- Worldwide information sharing
- Computers, television and telecommunication unite

New platforms

- Open platforms with hardware & software independence
- New operating systems quit file oriented structures and offer database supported document libraries
- Document-Imaging, groupware and workflow become part of standard office packages

New problems

- Nobody's really looking after write once read many archiving media
- Nobody's really looking after document-interchange in open system environments
- Nobody's really looking after standard information access and retrieval
- Nobody's really looking after storage and transportation of mass data
- Nobody's really looking after security and protection of information

Therefore, the user must be clear about the effects such a system will have on his or her organization before deciding to implement it.

User requirements can be summarized in three major points. The first is the need for uniform, object-oriented document standards, so that documents can be sent from one system to another while maintaining confidentiality, data protection, and data security. Another is the need for non-proprietary, uniform interfaces among high-level applications, like work group and workflow, operating systems and the true filing and archiving systems.

The Strategy

①

The right solution?

- **The right solution is always the one that solves your problem most efficiently now**
- **Choose the right vendor and product**
the key questions are:
 - how much does he care for your problem?
 - is he experienced?
 - is his product modular and open?
 - will he survive both, market development and the lifetime of your solution?
- **If you will be using WORM-Media be aware that this is a long-term decision**

The right solution is always the one that meets the needs of the specific user. This alone is one reason not to wait for low-cost standard products, since as a rule such products do not satisfactorily meet organizational requirements. The user then always has to decide between purchasing the low-cost standard



solution and adapting the organization to fit it, or having a custom software solution tailor-made to fit the organization. The second alternative in particular requires the right choice of a system integrator. This will often depend on the availability of sufficiently qualified personnel on the part of the vendor, since the enormous boom in documents management systems has swept the market clean of system consultants and qualified programmers. Often the "second best" basic product will be the better choice if the vendor chosen can provide the necessary specialist personnel. Also, due to its physical characteristics, the use of WORM memory requires long-term planning. Thus, the selection criteria for document management, workgroup and workflow products are increasingly affected by factors external to the products themselves. For this reason, for large-scale individual solutions firms are more and more looking to neutral specialist document management consultants.

The Strategy

2

The right time?

- **Prepare yourself now for the challenge of the introduction of an Electronical Document Management, Document Imaging Groupware and Workflow System in your company**
- **Buy now - don't wait for the "more advanced", "more modern" system at the next fair**
- **Find the right path using as many standard components as possible and streamlining your organization - but avoid long lasting, huge projects - the technological development and your competition will outrun them**

The potential user should start thinking now about when and which product to implement, since soon small base-level solutions will creep into his organization via operating systems or office software packages whether he likes it or not. To ensure an orderly implementation that fits in with the long-term IT strategy of the organization, the basic decisions and groundwork should be in place before the first products come in and take on a life of their own.

But the vendors still have some homework to do themselves - the market for electronic archiving and document management will only really get into high gear when there is a logical separation of dynamic and static systems. This will make possible plug & play WORM archive solutions that can be linked to standard applications. Only when vendors and system integrators meet these needs will the economic expectations placed in these technologies begin to be realized.

Über den Autor



Dr. Ulrich Kampffmeyer ist seit über 35 Jahren im Thema Informationsmanagement zu Hause. Als Geschäftsführer und Unternehmensberater seines Beratungsunternehmens PROJECT CONSULT (<http://PROJECT-CONSULT.de>) berät er Unternehmen bei der Strategie, Konzeption, Einführung, Ausbau und Migration von Information Management-Lösungen.

Er gründete und leitete Fachverbände, arbeitete bei internationalen Standardisierungen mit und gilt als Mentor der Information-Management-Branche in Europa.

Dr. Kampffmeyer ist international anerkannter Autor, Kongressleiter, Referent und Moderator zu Themen wie Information Management, Information

Governance, elektronische Archivierung, Records Management, ECM Enterprise Content Management, Dokumentenmanagement, Workflow, Rechtsfragen, Wissensmanagement, Digitalisierung und Collaboration. Auf zahlreichen nationalen und internationalen Kongressen und Konferenzen wirkte er als Keynote-Sprecher mit. Er engagiert sich besonders für die Rolle und Ausbildung des Information Professional der Zukunft.

Von Fachzeitschriften wurde zweimal unter die 100 wichtigsten IT Macher Deutschlands gewählt. Sein Curriculum Vitae findet sich auf Wikipedia http://bit.ly/WP_DrUKff

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Geschäftsleitung und V. i. S. d. P.: Dr. Ulrich Kampffmeyer
Anschrift der Redaktion:

PROJECT CONSULT Unternehmensberatung
Dr. Ulrich Kampffmeyer GmbH
Isestraße 63, 20149 Hamburg
Telefon: +49 40 412856 53
E-Mail: presse@project-consult.com
<http://www.project-consult.de>