

Enterprise Content Management

Enterprise content management

Enterprise content management (ECM) is a set of technologies used to capture, store, preserve and deliver content and documents and content related to organizational processes. ECM tools and strategies allow the management of an organization's unstructured information, wherever that information exists.

Definition

The "official" definition of enterprise content management was created by AIIM (Association for Information and Image Management) International, the worldwide association for enterprise content management in the year 2000. The abbreviation ECM has been reinterpreted and redefined many times.

In autumn 2005 AIIM defined ECM as follows:

Enterprise Content Management is the technologies used to Capture, Manage, Store, Preserve, and Deliver content and documents related to organizational processes.

In winter 2006 AIIM added the following paragraph to the definition:

ECM tools and strategies allow the management of an organization's unstructured information, wherever that information exists.

This new term is intended to completely encompass the legacy problem domains that have traditionally been addressed by records management and document management. It also includes all of the additional problems involved in converting to and from digital content, to and from the traditional media of those problem domains (such as physical and computerized filing and retrieval systems, often involving paper and microforms). Finally ECM is a new problem domain in its own right, as it has employed the technologies and strategies of (digital) content management to address business process issues, such as records and auditing, knowledge sharing, personalization and standardization of content, and so on.

History

New product suites have arisen from the combination of capture, search and networking capabilities with technologies of the content management field, which have traditionally addressed digital archiving, document management and workflow. Generally speaking, this is when content management becomes enterprise content management. The different nomenclature is intended to encompass all of the problem areas related to the use and preservation of information within an organization, in all of its forms — not just its web-oriented face to the outside world. Therefore, most solutions focus on "business to employee" (B2E) systems. However, as the solutions have evolved, new components to content management have arisen. For example, as unstructured content is checked in and out of an ECM system, each use can potentially enrich the content's profile, to some extent automatically, so that the system might gradually acquire or "learn" new filtering, routing and search pathways, corporate taxonomies and semantic networks, which in turn assist in making better retention-rule decisions, determining which records or documents to keep, and which to discard, and when. Such issues become all the more important, as email and instant messaging are increasingly employed in the decision-making processes in an organization.

Thus, the term enterprise content management refers to solutions that concentrate on providing in-house information, usually using internet technologies. The solutions tend to provide intranet services to employees (B2E), but also include enterprise portals for "business to business" (B2B), "business to government" (B2G), or "government to business" (G2B), etc. This category includes most of the former document management groupware and workflow solutions that have not yet fully converted their architecture, but provide a web interface to their applications. Digital Asset Management (DAM)

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is as well a form of ECM that is concerned with content stored using digital electronic technology.

The technology components that comprise ECM today are the descendants of the electronic document management systems (EDMS) software products that were first released in the late 1980s and early 1990s. The original EDMS products were developed as stand-alone technologies, and these products provided functionality in one of four areas: imaging, workflow, document management, or COLD/ERM (see #Components of an enterprise content management system below).

For the software companies, it made sense to develop different products for each of these distinct EDMS functions. At that time, most organizations that were candidates for EDMS generally wanted a solution to address just one overriding business need or application. They were looking for stand-alone solutions to address narrow application needs, many of them at the departmental level – such as imaging for forms processing, workflow for insurance claims processing, document management for engineering documentation, or COLD/ERM for distributing and archiving monthly financial reports.

The typical "early adopter" of these new technologies was an organization that deployed a small-scale imaging and workflow system, possibly to just a single department, in order to improve the efficiency of a repetitive, paper-intensive business process and migrate towards the Paperless office. Even in these early years, when the market for these software products was still relatively immature, it was clear that each of the major technologies within EDMS offered tremendous value to specific organizational processes or applications, at a time when business processes were overwhelmingly paper-based. The primary benefits that the first stand-alone EDMS technologies brought to organizations revolved around saving time or improving accessibility to information. Among the specific benefits were the following:

- Reduction of paper handling and error-prone manual processes.
- Reduction of paper storage
- Reduction of lost documents
- Faster access to information
- Online access to information that was formerly available only on paper, microfilm, or microfiche
- Improved control over documents and document-oriented processes
- Streamlining of time-consuming business processes
- Security over document access and modification
- Provide reliable and accurate audit trail
- Improved tracking and monitoring, with the ability to identify bottlenecks and modify the system to improve efficiency.

Through the late 1990s, the various segments of the EDMS industry continued to grow steadily, if not spectacularly. The technologies appealed to organizations with clear problems, and which needed targeted, tactical solutions to address those problems.

As time passed, and more organizations had achieved "pockets" of productivity with the use of these technologies, it became clear that the various EDMS product categories were in fact complementary for many businesses. Organizations increasingly wanted to be able to leverage the capabilities of multiple EDMS products. Consider, for example, the needs of a customer service department, where imaging, document management, and workflow functionality could be brought together to allow agents to access any information needed to resolve a customer inquiry. Likewise, an accounting department could access supplier invoices from a COLD/ERM system, purchase orders from an imaging system, and contracts from a document management system as part of an approval workflow. And as more and more organizations established an Internet presence, they wanted to present certain portions of this information via the web, which required the capabilities to manage web content. Furthermore, organizations that had installed the software in individual departments now began to envision wider benefits, if they were to deploy it across the enterprise. Consider the fact that many business documents cross multiple departments and multiple business processes. Why not improve the management of electronic documents throughout the organization, and gain the same business benefits at an enterprise

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level?

Both the market and the software providers began to understand the strategic potential of software products that integrated the individual EDMS technology components into a single, integrated solution, capable of addressing an organization's complete information management needs. In fact, the movement toward integrated EDMS solutions merely reflected a common trend in the history of the software industry: the obsolescence of certain types of products and the convergence of technologies, as vendors melded them into new packages.

Consider office suites, for instance. In the 1970s and early 1980s, word processing, spreadsheet, and presentation software products were standalone products. Within an organization, however, the same users were likely to need all three products. The software vendors responded, and started packaging them as integrated office suites – a strategy that also helped address consumer demand for tighter interoperability among desktop applications.

The situation was similar in the EDMS world. Just about any company that needed document management also needed imaging, workflow, web content management, and COLD/ERM. Organizations began to demand multiple EDMS services and ways to leverage them for broad-based applications. Thus, the EDMS vendors took steps to deliver on truly integrated solutions incorporating the EDMS component technologies.

The leaders tended to be those vendors that already offered multiple stand-alone EDMS technologies. For these vendors, the early steps toward consolidation were small ones. The first phase was to offer multiple systems as a single, packaged "suite." Early suites were little more than multiple products being sold together at a reduced price, and there was a perception in the market that such suites were a strategy on the part of the vendors to capture additional seats within a customer account. Not surprisingly, market acceptance was limited – at least initially.

But in the late 1990s, these software vendors began a major surge of software development and acquisition activity, adding capabilities to their software products or buying the software companies whose products offered the functional capabilities they needed. Integrating the products into a single solution has proven to be an ongoing challenge for many of these vendors. Scalability – that is, the ability of a software product to continue to function well when it is deployed on a wide scale – also presented some significant problems, as organizations demanded solutions that could be deployed not just to multiple geographic locations, but on a global scale, to tens of thousands of users.

In response to these market demands, the major software providers put considerable development effort into addressing these issues, and they continue to enhance the capabilities of their products and to expand the types of content those products can manage. Beginning in approximately 2001, the industry began to use the term "enterprise content management" to refer to those software solutions that provide the full complement of EDMS technologies, reflecting the truly "enterprise" nature of their products.

More recently, the ECM market has seen the entry of Microsoft and Oracle Corporation, two of the largest and most pervasive providers of software, at the value end of the market. These companies have each taken steps to develop solutions for content management – Microsoft with its various offerings in the SharePoint product family in recent years, and Oracle in 2006 with its Oracle Content Management product. These two software companies look to provide software solutions with the basic ECM functionality that will address the functional requirements commonly required by the majority of organizations. The result is likely to be a stratification of the current ECM market, based on the level of content services that different organizations require.

Independently of Microsoft and Oracle, open source enterprise content management systems have emerged. These include Alfresco, eZ Publish, KnowledgeTree, Nuxeo, Plone and freedom. Similarly to the operating system, application server and database markets, these entrants hope to apply the open source distribution model of freely available and downloadable software to compete against the traditional enterprise software sales model of the incumbent ECM vendors and commoditize the ECM market.

The need for scalability and scanning facilities for hundreds of millions of documents requiring Terabyte, Petabyte or Exabyte filestores that are in compliance with existing and emerging standards such as HIPAA, SAS 70, BS 7799 and

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ISO/IEC 27001 may make outsourcing to certified end to end service providers a viable alternative.

Characteristics

Content management has many facets including enterprise content management, Web content management (WCM), content syndication and digital or media asset management. Enterprise content management is a vision, a strategy, or even a new industry, but it is not a closed system solution or a distinct product. Therefore, along with DRT (Document Related Technologies) or DLM (Document Lifecycle Management), ECM can be considered as just one possible catch-all term for a wide range of technologies and vendors.

A comparison of the definitions of the different application fields of ECM and WCM makes it clear that the existing system category distinctions cannot last long, whether for products and technical platforms or for usage models. Solutions that are used as pure in-house solutions today will be made accessible to partners or customers tomorrow. The content and structure of today's outward-directed web portal will be the platform for tomorrow's internal information system. In his article in ComputerWoche, Ulrich Kampffmeyer concentrated the claimed benefit of an enterprise content management system to three key ideas that distinguish such solutions from Web content management:

"Enterprise Content Management as integrative middleware

ECM is used to overcome the restrictions of former vertical applications and island architectures. The user is basically unaware of using an ECM solution. ECM offers the requisite infrastructure for the new world of web-based IT, which is establishing itself as a kind of third platform alongside conventional host and client/server systems. Therefore, EAI Enterprise Application Integration and SOA Service Oriented Architecture will play an important role in the implementation and use of ECM.

Enterprise Content Management components as independent services

ECM is used to manage Information without regard to the source or the required use. The functionality is provided as a service that can be used from all kinds of applications. The advantage of a service concept is that for any given functionality only one general service is available, thus avoiding redundant, expensive and difficult to maintain parallel functions. Therefore, standards for interfaces connecting different services will play an important role in the implementation of ECM.

Enterprise Content Management as a uniform repository for all types of information

ECM is used as a content warehouse (both data warehouse and document warehouse) that combines company information in a repository with a uniform structure. Expensive redundancies and associated problems with information consistency are eliminated. All applications deliver their content to a single repository, which in turn provides needed information to all applications. Therefore, Content Integration and ILM Information Lifecycle Management will play an important role in the implementation and use of ECM.

Enterprise Content Management is working properly when it is effectively "invisible" to users. ECM technologies are infrastructures that support specialized applications as subordinate services. ECM thus is a collection of infrastructure components that fit into a multi-layer model and include all Document Related Technologies (DRT) for handling, delivering, and managing structured data and unstructured information jointly. As such, Enterprise Content Management is one of the necessary basic components of the overarching E-Business application area. ECM also sets out to manage all the information of a WCM and covers archiving needs as a universal repository."

Components of an enterprise content management system

Enterprise content management systems combine a wide variety of technologies and components, some of which can also be used as stand-alone systems without being incorporated into an enterprise-wide system.

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The five ECM components and technologies of the ECM model were first defined by AIIM as follows:

- Capture
- Manage
- Store
- Preserve
- Deliver

The model includes in the "Manage" category five traditional application areas:

- Document management (DM),
- Collaboration (or collaborative software, groupware),
- Web content management (WCM) (including web portals),
- Records management (RM) (archive and filing management systems on long-term storage media) and
- Workflow / Business process management (BPM)

These "Manage" components connect Capture, Store, and Deliver and Preserve and can be used in combination or separately. While Document Management, Web Content Management, Collaboration, Workflow and Business Process Management are more for the dynamic part of the life cycle of information, Records Management takes care of information which will no longer be changed. The utilization of the information is paramount throughout, whether through independent clients of the ECM system components, or by enabling existing applications that access the functionality of ECM services and the stored information. The integration of existing technologies makes it clear that ECM is not a new product category, but an integrative force.

The individual categories and their components will be examined in the following.

Capture

The "Capture" category contains functionalities and components for generating, capturing, preparing and processing analog and electronic information. There are several levels and technologies, from simple information capture to complex information preparation using automatic classification. Capture components are often also called "Input" components.

Manually generated and captured information

Manual capture can involve all forms of information, from paper documents to electronic office documents, e-mails, forms, multimedia objects, digitized speech and video, and microfilm.

Automatic or semi-automatic capture can use EDI or XML documents, business and ERP applications or existing specialist application systems as sources.

Technologies for processing captured information

Various recognition technologies are used to process scanned documents and digital faxes, among them:

Optical character recognition (OCR)

This converts image information into machine-readable characters. OCR is used for type.

Handprint Character Recognition (HCR)

This refinement of OCR converts handwriting or lettering into machine characters, but does not yet gives satisfactory results for running text. However, for defined field content, it has become very reliable.

Intelligent Character Recognition (ICR)

ICR is a further development of OCR and HCR that uses comparison, logical connections, and checks against reference lists and existing master data to improve results.

Optical Mark Recognition (OMR)

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OMR, as used for checkboxes for example, reads special markings in predefined fields with very high accuracy. It has proven its value in questionnaires and other forms.

Barcode

Barcodes on mailed forms allow for the automatic recognition and filing of returns.

Document Imaging

Document imaging processing techniques are used to show scanned images, and also allow legibility enhancement for capture. Functions like "despeckling," which removes isolated pixels, or "adjustment," which straightens images from sheets that feed in at an angle, improve the results of recognition technologies. Document imaging functions are used in capture quality control.

Forms processing

In forms capture, there are two groups of technologies, although the information content and character of the documents may be identical.

Paper Forms

Forms processing means the capture of industrially or individually printed forms via scanning. Recognition technologies are often used here, since well-designed forms enable largely automatic processing.

E-Forms / Web-Forms

Automatic processing can be used to capture electronic forms as long as the layout, structure, logic and contents are known to the capture system.

COLD

COLD/ERM are technologies for the automatic processing of structured entry data. COLD stands for Computer Output to Laser Disk and is still in use although laser disks have not been on the market for years. The acronym ERM here stands for Enterprise Report Management. In both, supplied output data is processed based on existing structure information in such a way that it can be indexed independently of the origination system, and transferred to a storage component that can be dynamic (Store) or an archive (Preserve).

Aggregation

Is a process of combining data entries from different creation, capture, and delivery applications? The goal is to combine and unify data from different sources, in order to pass them on to storage and processing systems with a uniform structure and format.

Components for subject indexing of captured information

Systems incorporate further components for subject indexing and getting captured digital information to the appropriate recipients. These include:

Indexing (manual)

In English parlance, indexing refers to the manual assignment of index attributes used in the database of a "manage" component for administration and access.

Input Designs (profiles)

Both automatic and manual attributing can be made easier and better with preset profiles. These can describe document

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classes that limit the number of possible index values, or automatically assign certain criteria. Input designs also include entry masks and their logic in manual indexing.

Categorization (automatic classification or categorizing)

Based on the information contained in electronic information objects, whether OCR-converted faxes, office files or output files, automatic classification programs can extract index, category, and transfer data autonomously. These systems can evaluate information based on predefined criteria or in a self-learning process.

The objective of all "Capture" components is the provision of information to the "Manage" components for further processing or archiving.

Manage

The Manage components are for the management, processing, and use of information. They incorporate:

- Databases for administration and retrieval, and
- Access authorization systems.

The goal of a closed ECM system is to provide these two components just once as services for all "Manage" solutions such as Document Management, Collaboration, Web Content Management, Records Management and Workflow / Business Process Management. To link the various "Manage" components, they should have standardized interfaces and secure transaction processes for inter-component communication.

DM – Document Management

Document management in this context does not refer to the industry known in Europe as DMS, but to document management systems in the narrower "classical" sense. These systems control documents from their creation through to long-term archiving. Document management includes functions like:

- Check in/Check out for checking stored information for consistency
- Version management to keep track of different versions of the same information with their revisions and renditions (same information in a different format)
- Search and navigation for finding information and its associated contexts
- Visualizing for showing information in structures like virtual files, folders, and overviews.

However, the functions of Document Management increasingly overlap with those of the other "Manage" components, the ever-expanding functionalities of office applications like Outlook/Exchange or Notes/Domino, and the characteristics of "Library Services" for administering information storage.

Collaboration (collaborative systems, groupware)

Collaboration simply means "working together." However, these solutions, which developed from conventional groupware, now go much further and include elements of Knowledge Management. Collaboration includes the following functions:

- Jointly usable information databases
- Joint, simultaneous, controlled information processing
- Knowledge based on skills, resources and background data for joint information processing
- Administration components such as whiteboards for brainstorming, appointment scheduling, project management etc.
- Communication application such as video conferencing

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- Integration of information from other applications in the context of joint information processing

WCM – Web Content Management

Enterprise Content Management claims to integrate Web Content Management. However, information presented on the Internet and Extranet or on a portal should only be data that is already present in the company, whose delivery is controlled by access authorization and storage. Web Content Management includes the following functions, among others:

- Creation of new or editing of existing information in a controlled generation and publishing process
- Delivery and administration of information for the web presentation
- Automatic conversion for various display formats, personalized display and versions.
- Secure separation of access to public and non-public information
- Visualization for Internet presentation (browser, HTML, XML etc.)

It is however worth noting that many in the industry do not consider WCM as an integral component to an ECM system. There are very few examples of successful implementations whereby a shared repository for documents (the core purpose of ECM) and web content are managed together. Indeed very different techniques and philosophies to structure and organize content are utilized for external facing web content than for internal facing document content.

RM – Records Management (file and archive management)

Unlike with traditional electronic archival systems, Records Management (RM; Electronic Records Management or ERM) refers to the pure administration of records, important information and data that companies are required to archive. Records Management is independent of storage media, and can also manage information stored otherwise than in electronic systems. Among the functions of Records Management are:

- Visualisation of file plans and other structured indexes for the orderly storage of information.
- Unambiguous indexing of information supported by thesauri or controlled wordlists.
- Management of record retention schedules and deletion schedules.
- Protection of information in accordance with its characteristics, sometimes down to individual content components in documents.
- Use of international, industry-specific or at least company-wide standardized meta-data for the unambiguous identification and description of stored information.

Wf – Workflow / BPM – Business Process Management

Workflow and Business Process Management differ substantially.

There are different types of Workflow, for example:

- "Production Workflow" which uses predefined sequences to guide and control processes
- "Ad-Hoc Workflow" in which the user determines the process sequence on the fly.

Workflow solutions can be implemented as:

- "Workflow solutions" with autonomous clients which users mostly work with, or as
- "Workflow Engines" which act as a background service controlling the information and data flow, without requiring an own client for this.

Workflow Management includes the following functions, among others:

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- Visualisation of process and organization structures.
- Capture, administration, visualization, and delivery of grouped information with its associated documents or data.
- Incorporation of data processing tools (such as specific applications) and documents (such as office products)
- Parallel and sequential processing of procedures including simultaneous saving
- Reminders, deadlines, delegation and other administration functionalities
- Monitoring and documentation of process status, routing, and outcomes
- Tools for designing and displaying process.

Resources

BPM or Business Process Management goes a step further than Workflow. Although the words are often used interchangeably. BPM aims at the complete integration of all affected applications within an enterprise, with monitoring of processes and assembling of all required information. Among BPM's functions are:

- Complete workflow functionality
- Process and data monitoring at the server level
- EAI or Enterprise Application Integration, to link different applications
- BI or Business Intelligence, with rule structures, integration of information warehouses, and utilities that assist users in their work.

Today, "Manage" components are offered individually or integrated as suites. In many cases they already include the "Store" components.

Store

"Store" components are used for the temporary storage of information which it is not required or desired to archive. Even if it uses media that are suitable for long-term archiving, "Store" is still separate from "Preserve."

The "Store" components listed by AIIM can be divided into three categories: "Repositories" as storage locations, "Library Services" as administration components for repositories, and storage "Technologies." These infrastructure components are sometimes held at the operating system level like the file system, and also include security technologies which will be discussed farther below in the "Deliver" section. However, security technologies including access control are superordinated components of an ECM solution.

Repositories

Different kinds of ECM repositories can be used in combination. Among the possible kinds are:

File Systems

File systems are used primarily for temporary storage, as input and output caches. The goal of ECM is to reduce the data burden on the file system and make the information generally available through "Manage," "Store" and "Preserve" technologies.

Content Management Systems

This is the actual storage and repository system for content, which can be a database or a specialized storage system.

Databases

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Databases administer access information, but can also be used for the direct storage of documents, content, or media assets.

Data Warehouses

These are complex storage systems based on databases, which reference or provide information from all kinds of sources. They can also be designed with more global functions such as Document or Information Warehouses.

Library Services

Library Services have to do with libraries only in a metaphorical way. They are the administrative components close to the system that handle access to information. The Library Service is responsible for taking in and storing information from the Capture and Manage components. It also manages the storage locations in dynamic storage, the actual "Store," and in the long-term "Preserve" archive. The storage location is determined only by the characteristics and classification of the information. The Library Service works in concert with the database of the "Manage" components. This serves the necessary functions of

- Search, and
- Retrieval

While the database does not "know" the physical location of a stored object, the Library Service manages the

- Online storage (direct access to data and documents)
- Nearline storage (data and documents on a medium that the drive can access, but for which robotics or something similar must first be set up)
- Offline storage (data and documents on a medium that is removed from system access).

If there is not a superordinated document management system to provide the functionality, the Library Service must have

- Version management to control the status of information.
- Check -in/Check-out, for controlled information provision.

Storage technologies

A wide variety of technologies can be used to store information, depending on the application and system environment:

Read and Write Magnetic Online Media

This includes hard drives as RAID (Redundant Array of Independent Disks) server drive subsystems, Storage Area Networks (SANs) as storage infrastructures and Network-attached storage (NAS) as directly accessible network storage areas.

Magnetic Tape

In automated storage units like "Libraries" or "Silos" with robotics for access, used like DAT in smaller environments for backup but not online access.

Digital Optical Media

CD (CD-R for write-once, read-only Compact Disk, CD/RW for read-and-write Compact Disk), Digital Versatile Disk (DVD)), MO (Magneto Optical), and other formats can be used for storage and distribution, or in jukeboxes for online

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storage.

Preserve

The "Preserve" components of ECM handle the long-term, safe storage and backup of static, unchanging information, as well as temporary storage of information that it is not desired or required to archive. This is sometimes called "electronic archiving," but that has substantially broader functionality than that of "Preserve." Electronic archiving systems today generally consist of a combination of administration software like Records Management, Imaging or Document Management, Library Services (IRS — Information Retrieval System) and storage subsystems.

But it is not just electronic media that are suitable for long-term archiving. For purely securing information, microfilm is still viable, and is now offered in hybrid systems with electronic media and database-supported access. The decisive factor for all long-term storage systems is the timely planning and regular performance of migrations, in order to keep information available in the changing technical landscape. This ongoing process is called Continuous Migration. The "Preserve" components contain special viewers, conversion and migration tools, and long term storage media:

Long term storage media

WORM optical disk

Write Once Read Many (WORM) rotating digital optical storage media, which include the classic 5 ¼" in or 3 ½" WORM disc in protective sleeve, as well as CD-R and DVD-R. Recording methods vary for these media, which are held in jukeboxes for online and automated nearline access.

WORM tape

Magnetic tapes with WORM characteristics are used in special drives that can be as secure as a traditional WORM medium if used properly with specially secured tapes.

WORM hard disk

Magnetic disk storage with special software protection against overwriting, erasure, and editing, delivers similar security like a traditional WORM medium. An example is CAS Content Addressed Storage.

Storage networks

Storage networks like NAS Network Attached Storage and SAN Storage Area Networks can also be used if they meet the requirements of edit-proof auditing acceptability with unchangeable storage, protection against manipulation and erasure, etc.

Microfilm

Microforms like microfilm, aperture cards; a jacket a.s.o. can be used to back up information that is no longer in use and does not require machine processing.

Paper

Paper still has applications as a long-term storage medium, since it does not require migration, and can be read without any technical aids. However, like microfilm it is used only to double secure originally electronic information.

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Long term preservation strategies

To secure the long term availability of information different strategies are used for electronic archives.

Migration

Continuous migration of applications, index data, meta data and objects from older systems to new ones generates a lot of work but secures the accessibility and usability of information, and allows during this process the deletion of information which is no longer relevant. Conversion technologies are used to update the formats of the stored information.

Emulation

Emulation of older software allows us to run and access the original data and objects. As well as special viewer software which can identify the formats of the preserved objects and can display the objects in the new software environment.

Standards for interfaces, meta data, data structures and object formats are important to secure the availability of information.

Deliver

The "Deliver" components of ECM are used to present information from the "Manage," "Store," and "Preserve" components. They also contain functions used to enter information in systems (such as information transfer to media or generation of formatted output files) or for readying (for example converting or compressing) information for the "Store" and "Preserve" components. Since the AIIM component model is function-based and not to be regarded as architecture, we can assign these and other components here. The functionality in the "Deliver" category is also known as "output" and summarized under the term "Output Management."

The "Deliver" components comprise three groups of functions and media: Transformation Technologies, Security Technologies, and Distribution. Transformation and Security as services belong at the middleware level and should be available to all ECM components equally. For Output two functions are of primary importance:

Layout/Design

With tools for laying out and formatting output, and

Publishing

With Applications for presenting Information for distribution and publication.

Transformation technologies

Transformations should always be controlled and trackable. This is done by background services which the end user generally does not see. Among the transformation technologies are:
COLD / ERM (Computer Output to Laser Disc)

As distinct from "Capture" components, it prepares output data for distribution and transfer to the archive. Typical applications are lists and formatted output, for example individualized customer letters. These technologies also include journals and logs generated by the ECM components. Unlike most imaging media COLD records are indexed not in a database table but by absolute positions within the document itself (i.e. page 1 line 82, position 12). As a result COLD index fields are uneditable after submission unless they are converted into a standard database.

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Personalization

This is no longer just a function of web-based portals, but applies to all ECM components. Personalization gives the user just those functions and information that he needs.

XML (Extensible Markup Language)

A description language that allows description of interfaces, structures, metadata, and documents. XML is becoming the universal technology for describing information.

PDF (Portable Document Format)

An intelligent print and distribution format that enables the platform-independent presentation of information. Unlike pure image formats like TIFFs, PDFs permit content searches, the addition of metadata, and the embedding of electronic signatures.

XPS (XML Paper Specification)

A XML specification developed by Microsoft describing the formats and rules for distributing, archiving, rendering, and processing XPS documents.

Converters and Viewers

Serve to reformat information to generate uniform formats, and also to display and output information from different formats.

Compression

Used to reduce the storage space needed for pictorial information. The ITU process (CCITT) is mainly used for b/w for TIFFs, and JPEG2000 for color images. ZIP applications allow the compression of any kind of data for transfer.

Syndication

Used for presenting content in different formats, selections and forms in the context of Content Management. Syndication allows the same content to be used multiple times in different forms for different purposes.

Security Technologies

Security technologies are cross-section functions that are available to all ECM components. For example, electronic signatures are used not only when documents are sent, but also in data capture via scanning, in order to document the completeness of the capture. PKI (Public/Private Key Infrastructure) is a basic technology for electronic signatures. It manages keys and certificates, and checks the authenticity of signatures. Other electronic signatures demonstrate the identity of the sender and the integrity of the sent data, i.e. that it is complete and unchanged. In Europe there are three forms of electronic signatures, of different quality and security: simple, advanced, and qualified. In most European states the qualified electronic signature is legally admissible in legal documents and contracts. Finally, there is Digital Rights Management and Watermarking. This is used in Content Syndication and in MAM (Media Asset Management) for managing and securing intellectual property rights and copyrights. It works with techniques like electronic watermarks that are integrated directly into the file, and seeks to protect usage rights and protect content that is published on the Internet.

Distribution

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All of the above technologies basically serve to provide the various contents of an ECM to target users by various routes, in a controlled and user-oriented manner. These can be active components such as e-mail, data media, memos, and passive publication on websites and portals where users can get the information themselves. Possible output and distribution media are:

- Internet, extranet and intranet
- E-business portals
- Employee Portals
- E-mail and fax
- Data transfer by EDI, XML or other formats
- Mobile devices like mobile phones, PDAs, and others
- Data media like CDs and DVDs
- Digital TV and other multimedia services
- Paper

The task of the various "Deliver" components is to provide information to users in the best way for the given application, while controlling its use as far as possible.

Outlook

The former member of the board of directors of AIIM international, Ulrich Kampffmeyer, states in his whitepaper on ECM in 2004:

"Document technologies like Enterprise Content Management make traditional data processing complete. They bring together structured, weakly structured and unstructured information. Every company, every government agency, and every organization must confront the subject. Even if there are no immediate plans to implement such a system, it sneaks into the organization of its own accord – with the next server licence update, with the next office software suite, with the next database or ERP upgrade. In many companies with heterogeneous IT landscapes, the question of which redundant functionalities of existing products are unused is already more important than whether to invest in a new software system. The most important job is to keep in-house information under control. The questions add up: where to put the thousands and thousands of e-mails, what to do with the electronically signed business correspondence, where to put taxation-relevant data, how to transfer information from the disorganized file system, how to consolidate information in a repository that everybody can use, how to get a single login for all the systems, how to create a uniform in-basket for all incoming information, how to make sure that no information is lost or ignored, etc. etc. Document technologies play an important role in all these questions. ECM solutions are necessary basic components for many applications.

Every potential user will naturally consider his own individual needs before deciding on a system. However, putting off decisions does not make them less necessary. Every year something supposedly better and easier to use will come along, but waiting will just mean never installing anything. Every time the decision is put off, the mountain of uncontrolled and unused information gets bigger, and known problems get larger. A sensible long-term migration strategy removes the fear of fast technology change. The basic functions of document technology are mature, and most products are reliable, stable, secure, and increasingly affordable. In many industries, the use of document technology makes the difference in staying competitive. ECM — Enterprise Content Management — should be a part of every modern IT infrastructure."

ECM market development

Prior to 2003, the ECM market was dominated by a number of medium-sized independent vendors that fell into two categories. Those who had originated as Document Management companies (Documentum, FileNet, OpenText) and had begun adding on management of other enterprise content and those who had started as Web Content Management providers (Interwoven, Vignette, Stellent) and begun trying to branch out into managing other types of content such as business documents and rich media. Larger vendors such as IBM and Oracle also had offerings in this space and the

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market share remained largely fragmented.

In 2002, Documentum had added collaboration capabilities with its acquisition of eRoom while Interwoven and Vignette countered with their respective acquisitions of iManage and Intraspect. Similarly, Documentum purchased Bulldog for its Digital Asset Management (DAM) capabilities while Interwoven and OpenText countered with acquisitions of MediaBin and Artesia. OpenText also acquired European companies IXOS and Red Dot to shore up its software portfolio.

In October 2003, EMC began a period of market consolidation that continues today with a \$1.5B USD acquisition of Documentum. This acquisition led to the creation of a new category, Information Lifecycle Management (ILM) that looked at the management and storage of content holistically from end user to software to middleware, to database with a particular focus on IT governance and management; change control processes; requirements for system availability and recovery times; and service level agreements. Soon EMC's primary competitors in the database space responded as IBM purchased FileNet and Oracle purchased Stellent in 2006. OpenText also purchased Hummingbird in 2006.

Today, OpenText, Interwoven, and Vignette remain the three primary independent ECM vendors with OpenText far outpacing Interwoven and Vignette in terms of revenue and customer base. According to CMS Watch, other ECM vendors include IBM's FileNet, EMC's Documentum, Laserfiche, Microsoft Office Sharepoint Server 2007, Hyland Software, Xerox's DocuShare, and Saperion. Ever-Team, SunGard EXP, WAVE Corporation, Objective Corporation, ColumbiaSoft and Xythos Software have been added in the Gartner Magic Quadrant for ECM 2006.

In early 2007, independent analyst firm CMS Watch cited substantial turbulence among many ECM vendors, suggesting that even some of the biggest players in the market were undergoing significant changes. In addition 2007 has seen the emergence of Open Source options for ECM supplied by Nuxeo, Knowledge Tree and Alfresco, along with S-a-a-S (Software as a Service) from Spring CM.

According to Gartner, as of 2007, the ECM market leaders were Open Text Corporation, EMC (Documentum), IBM and Oracle Corporation.

Hewlett-Packard (HP) entered the ECM space with its acquisition of Australian company Tower Software in 2008.

The Web 2.0 wave has brought new players to the market with strength in web-based delivery. Koral and EchoSign, both available on the Salesforce.com AppExchange platform, are representative of this trend.

Gartner, estimates that the ECM market is worth approximately \$2.9 billion in 2007; this is expected to grow at a CAGR of 12.9% through 2011. After a plethora of industry consolidation, only three or four major companies are left in this space and the industry as a whole is undergoing a significant transformation as Microsoft commoditizes content management components...

According to Gartner, by 2008, 75 percent of Global 2000 companies will have a desktop-focused and a process-focused content management implementation (0.9 probability) and ECM will continue to absorb other technologies, such as digital asset management and e-mail management. Gartner also predicted that there will be further market consolidation, acquisition and separation of vendors into platform and solution providers.

Currently, Enterprise information management is taking a growing interest from organizations who are trying to approach Information Management (whether structured or unstructured) from an Enterprise perspective. EIM combines ECM and Business Intelligence.