eSangathan Project

Collaborative Working Environment State of the Art

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WHAT YOU WILL FIND IN THIS DOCUMENT

In this State of the Art about Collaborative Working Environments, focus is done on the different kind of solutions available on the market, for the past 20 years and still in use, and for the next 5 years with the new generation of collaborative tools emerging from the Web 2.0 new paradigm.

The first chapter is dedicated to classify the different types of collaborative applications.

The second chapter shows how the collaborative tools and usages have evolved this last years and how they are used today.

The third chapter illustrates some recent surveys about different usages expected by large companies worldwide.

The fourth chapter is a description of what could be the ideal collaborative working environment if it could contain all the necessary features to work efficiently

The fifth chapter is about how to start a collaborative workspace. It is important to deliver some messages about the fact that even with the emergent generation of products, it is not sufficient to install the technology, it is also necessary to structure and organize the data and the work.

The sixth chapter will describe the main usages of collaborative working environments today.

We'll finish this state of the art by a perspective about the new concept of Enterprise 2.0 formalized few months ago, which could generate a major shift within organizations and revolutionize their information systems and the way people work.

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A FEW WORDS OF INTRODUCTION

Collaborative software is one of the oldest applications of the computer science field. Since the beginning of the network connections, the computer science community tried to interconnect humans and help them to collaborate through the network.

Doug Engelbart was the first to initiate the virtual communities in its research laboratory in the 60's and collaboration was one of the first applications. Very soon, the scientific community was the first to want to use collaborative tools, essentially for communications. BBS, Chat sessions, Newsgroups, and so on, ancestors of our new web sites were created between 1978 and 1988. The e-mail system was created in 1966. And, the first version of a complete integrated collaborative platform was put onto the market by Lotus more than 20 years ago. The success of this kind of applications was great within large corporations.

DG Information Society and Media from the European Commission has also been investing in research thanks to the framework program. The last two reports dedicated to these topics must be read to have a global overview on the impact of Collaborative Working Environments for our societies, our industries and our environment:

- "Collaboration@Work, The 2006 report on new working environment and practices" [CW-06]
- "New Collaborative Working Environments 2020, Report on industry-led FP7 consultations and 3rd Report of the Experts Group on Collaboration@Work" [NCWE-06]

The first CWE conference held in Brussels, May 10-11, 2006, and its proceedings are available: "1st Conference on Collaborative Working Environments for Business and Industry", Conference Report [CWE'06-06]

All the collaborative aspects of our lives are covered in these reports and the vision and perspectives for the coming 15 years are developed. It is why we will not cover again those aspects; they are wonderfully described in these reports.

This current "start of the art" study will only focus on the very concrete situation about the different features and tools used by CWE solutions since their creation, and try to give a perspective about their usage in the next few years. In this very complex context where the collaboration concept could be integrated in each part of our systems, our objective is to help our readers to have a very pragmatic and detailed vision of the different sets and features provided by CWE, to better understand how to use them in their daily work (and leisure) live.

Initially the usage for collaboration was inside the companies, but the Internet revolution allowed the usage of collaborative tools also outside companies. The Internet provided also new web-based solutions of collaboration, allowing optimizations and a much more easy way to exchange and share information than in the initial solutions.

Collaborative working environments are composed of a set of different features starting with the electronic messaging system and going to the videoconference, through the workflow or the document management systems. These different solutions can be benchmarked through their functional richness or thanks to the different levels of interaction they provide to their users.

Upon these considerations, we can divide these different solutions of collaboration in three main categories:

- The **specialized collaboration tools**: they are the historic actors of the market. These tools are composed of rich features, and can manage complex collaborative contexts like groupware, knowledge management or electronic document management. More often, these solutions offer strong development platforms to build new applications upon. These applications are generally developed as part of complex software development projects. Existing for more than 15 years, this category of tools was the first to be used in the enterprises, but only within special business applications. These tools are complex to manipulate, to install, to deploy, and are only allowing exchange of information within their functional perimeter inside the company, with no possibilities of interconnection with other external systems. The cost of such projects is very expensive. The projects are also difficult and need a lot of qualified people to manage them. Only huge companies can invest in such systems, not small and medium companies.
- The **generic collaboration tools**: they are the new generation of collaboration tools, inspired from groupware applications of the previous category, and most of the time defined as web-based collaborative workspaces. End users can directly administer and work with these tools, without any computer skill. There is no necessity to build complex development projects, and the IT department is just responsible of the reliability 24/7 of the platform.
- The **integrated collaborative tools**: they are not true collaborative tools, but include some collaborative features. These integrated tools are for instance Enterprise Portals, ERPs[1], CRMs[2], and so on. More and more software companies are integrating collaborative features to their software because it is a user request.

This state of the art will be focused on the two first categories of collaboration tools: specialized and generic.

[1] Enterprise Resource Planning
[2] Customer Relation Management

A CLASSIFICATION FOR COLLABORATIVE SOLUTIONS

Collaborative work solutions can be classified depending on their finality. We can distinguish height major type of solutions: groupware, collaborative workspaces, communication, document management, knowledge management, content management, coordination and peer-to-peer solutions. We will describe below the different features available in most of these solutions.

1. GROUPWARE SOLUTIONS

Groupware solutions are most often used within collaborative intranets (Lotus Notes/Domino, Novell Groupwise, Microsoft Exchange, etc.). They are used now for more than 15 years in the most important companies. The features proposed by these solutions allow companies to build strong collaborative processes and improve drastically specific tasks and human processes. Until these last years, these tools were the most spread over companies.

They are deployed like any other software project within the information system, forcing people to go through the IT department to build projects; end-users cannot manage directly any part of the system. For any modification not previously anticipated during the specification phase, new requirements must be given to the IT department, generating long delays to benefit from new features. Usually the end-users are connected to these groupware solutions from their internet network, from remote secured lines, or from secured IP lines.

2. COLLABORATIVE WORKSPACES SOLUTIONS

Collaborative workspaces are the new generation of collaborative working environments. Based on the usage of web-based collaborative workspaces, they are a true alternative to groupware solutions internal to a corporation, and they are accessible to small and medium businesses, even to individual or independent teams. 80% of the features of a traditional groupware solution are covered in a generic way, allowing end-users to be fully autonomous. The other 20% features are only necessary for complex applications needing specific developments. They can be sub-contracted to the groupware tools.

It is important to separate two kinds of features:

- the “synchronous” features, meaning that the two (or more) users exchanging a data through the synchronous solutions must be present at the same time (like during a phone call)
- the “asynchronous” features meaning that the two (or more) users exchanging a data through asynchronous solutions are not present at the same time of the action (like within an e-mail exchange)

The best collaboration workspace solutions can provide both set of features in the same product, with a strong integration of the synchronous part in the asynchronous one. We will detail these features in the next chapters.

3. COMMUNICATION ORIENTED SOLUTIONS

They are the foundation of the collaborative working tools. Without these communication solutions, it is impossible to collaborate or cooperate efficiently. All the collaborative working environments must integrate these features, or be interconnected with such tools. Among this communication tools, we have:

- **The electronic messaging system** (e-mail): it is the most common tool used by the companies and organizations. It has become in a few years the main communication tool used worldwide, replacing a huge part of phone communications and fax exchanges. We can divide into three main categories the e-mail providers companies:
    - the software companies providing messaging servers like IBM or Microsoft with Domino and Exchange;
    - the internet pure players providing free or premium online messaging services, like Yahoo or Google;
    - the application service providers providing hosted messaging systems for companies.
- **Mailing lists**: This rudimentary tool is always used in a lot of companies, because it allows new information to circulate very quickly, using the electronic messaging system.
- **Chat rooms**: these systems are reproducing oral conversations on writing basis. They are not really used within companies, but are used most often within communities, like developers or interest groups. Participants are redirected to common rooms where everybody can participate to the current conversations. History of these conversations can be stored. These applications are based on a client/server model and they allow multiple chat channels. IRC is one the most known applications, but there is a lot more.
- **Instant messaging**: These new application is a well-known application in the consumer area. Little by little, companies are adopting it. It is a perfect companion of the messaging system, allowing both real time and non real time communication, and offering a more informal way to communicate. It allows also to visualize the presence status of the contacts. This presence status is called *awareness*. It can also be embedded within other non real time applications, like messaging systems or virtual workspaces, as a companion of a person name displayed.
- **Audio or video conference**: This application allows a group of people to communicate in real-time. This communication is multi-directional, allowing the use of voice over IP, video over IP, from any point to any other point. Some applications allow only one-to-one meetings; others allow many-to-many. It is possible to use software solutions expandable on

current PCs, or to use dedicated solutions using specific hardware to improve sound and video quality and resolution.

4. Document Oriented Solutions

Document management solutions are designed to allow members of a community, a team, a company or any other group of people, to store, share and validate, documents, files, texts, medias, in a asynchronous way. They are one of the essential components of a collaborative working environment, allowing capitalization. They are an answer to our increasing volume of electronic documents produced, our new organizations giving preference to management by project methods, and our new "extended enterprises" (the enterprise collaborating with partners and subcontractors in a very close manner).

People can work in two ways when they need to produce a document collaboratively:

- Each employee works successively on the document, and the final delay of realization is proportional to the number of people working on it.
- Employees can work simultaneously on different parts of the document, allowing working much more quickly than in the sequential way.

Having a centralized repository for the documents prevents also to have multiple copies of the documents spread over the network, for instance in each mailbox of the employees.

These collaborative working environments are designed to outshine time and location constraints, providing more efficiency to individuals, teams, and globally to the enterprise or the organization.

5. Knowledge Oriented Solutions

We have different applications covered by these more knowledge-oriented tools, like expertise cartography, knowledge repositories or search engines. These tools are necessary to capitalize, search and retrieve the vast amounts of knowledge and skills stored in the information system of the companies.

For instance, within organizations having thousands of employees, distributed over different locations around the world, it is very difficult to find the right skills and the required knowledge when they are looked for.

These knowledge management solutions are dedicated to help people to find these resources and to gain time and money, reusing the knowledge or allowing the correct experts to work on the project.

- **Search engines and document repositories**: these tools allow organizations to store and to find the good information among the vast amount of electronic information produced each day by the employees. Different techniques exist to index documents, like keyword indexation, full text indexation, semantic indexation, etc.
- **Knowledge repositories**: they are built on structured databases to capitalize a structured knowledge extracted from projects, feedbacks, knowledge workers, etc. The goal for the company and the teams is to be able to reuse the knowledge capitalized over the years, and to keep track of the knowledge of the expert leaving the company.
- **Expertise cartography**: these cartographies allow the company to have a map of the skills and expertise of their employees or partners. It can be represented as a network of expertise within the company, and linked to the different document repositories.
- **Skills management**: in addition to the expertise cartography, skills management solutions are more based today on directories of skills, filled by the people, but often difficult to update. This area will evolve quickly with the emergence of the next generation of business social networks representations built for the companies.
- **Business social networks**: a new concept in the information system area. Today, companies are in the paradoxical situation that the skills of their employees are much better known outside the company through professional social networks like LinkedIn or Xing than within the company. The arrival of business social networks for companies is already changing this situation.

6. Content Oriented Solutions

- **Bulletin boards**: the ancestor of the web-based publication solutions. Bulletin boards were a way to publish information directly over a virtual place, and to pick up feedback from the users. Less and less used, replaced by blogs and wikis, some solutions are very well known and used around the world.
- **Content management solutions**: these solutions can be composed by a lot of different tools, like electronic document management systems, document image processing solutions, and enterprise portals. They can archive e-mails, files, and all the dynamic content produced by the information system. Collaborative features are implemented to allow the management of validation processes within the system.
- **Blogs**: originally based on the personal paradigm of the journal publication, they are evolving within the companies as a communication channel, from one to many, or from a team to many. Individual blogs will contribute also to the *digital identity* of a person within the company.
- **Wikis**: Wikis are becoming the most used tools to publish and structure information within departments and teams. In a wiki, each person can publish his/her own data, and modify the data of somebody else. At the same time, every modification is controlled and stored in a

[3]. t is possible to roll-back to a previous version of a page at any time, allowing to control the quality of the information. Because the tool is very easy to use, it is spreading very efficiently within companies and becoming the most used collaborative tool after the e-mail.

7. COORDINATION ORIENTED SOLUTIONS

In this area, we have shared calendar and task solutions, and workflow management systems. These solutions are designed to optimize and rationalize information processes. They allow gaining a lot of time and consequently money.

- **Shared calendar and tasks:** these applications allow people to share their calendar, and to delegate also their management. Group meetings can automatically be scheduled, finding the available time schedules and even the available rooms or projectors. They can be used for virtual or face-to-face meetings. Privacy options are also available.
- **Discussion Forums**: Forums were used very early in the companies to create the first flows of virtual discussions. It was one of the first application template distributed by Lotus Notes. Feedback is that only 20% of the people are able to be involved in discussion forums within companies. The obligation to animate and the separation from the other content tools necessary to really manage virtually its project are a hindrance to their uses.
- **Workflow solutions:** The main functionality of workflow systems is to circulate forms and documents within the company, following pre-defined simple or complex processes. These solutions take charge of the different actors and the data of the company processes, allowing to compute automatically which step must be applied after the executed one. Three main components are necessary:
    - the workflow designer to allow organizational people to pre-define processes between actors, roles and data;
    - the workflow basket to distribute and/or affect the work between the different actors or roles for a specific step;
    - the workflow dashboard to know at any time the status of a live process and who is the next actor of the process.

  Many automatic actions can be taken by the workflow engine, in case of delay, in case of absence, in case of status selection, etc.

  Two kinds of workflow solutions exist:

    - The “administrative workflow”, oriented to the management of administrative processes like vacation forms validation processes. They are essentially built around

[3] A *feed* is a list of information accessible through different interfaces. The most recent example are RSS (Real Simple Syndication) Feeds, used within the blogs.

form management systems, and very often, they are integrated with the electronic messaging system to circulate the data.

- The "production workflow" managing processes directly attached to the business processes of the company, like an insurance company in care of medical care reimbursements. In this case, document image processing solutions are also used to manage mails received from subscribers and integrate them in the live workflow process. These workflow solutions are much more complex to deploy than the administrative ones.

8. Peer to Peer Solutions

Some peer-to-peer solutions exist in the collaborative working environments. They are not popular because they need to install client softwares on the PCs, and the trend is to be fully web-based architectured now. It works fine within small groups, but not at a larger scale.

In P2P architecture, each user is connected to the other users, without any server link. In fact, each client is at the same time client and server. The data is duplicated on each client. It is not a low cost solution if it is necessary to manage large amounts of data.

P2P for asynchronous information (like documents) is less and less used. However, some important vendors (like Skype) use P2P as an efficient architecture for synchronous exchanges.

THE LATEST EVOLUTIONS OF CWE

In this chapter, we focus on the latest evolutions of CWE. They are important to note, because they are conditioning the new ways of working for our future organizations. Nowadays, this trend must be integrated in any information system related decision. Even if today some of these tendencies are not obvious, they can suddenly appear and be used by a majority of people.

1. From Groupware to Web-Based Collaboration

The term "groupware" generally brings to mind the pioneers in the field: Lotus Notes and a few others. Although these platforms delivered with a few built-in applications such as email or discussion forums, they are essentially development platforms. As such, they require extensive project and IT work prior to deployment.

Web-based collaborative workspaces offer a new paradigm, based on the following requirements:

- **Self-service –** Any authorized user with no *computer knowledge*[4] should be able to create a collaborative workspace in a matter of minutes. A project team should be able to create a workspace on-the-fly, without the help of IT personnel. Following a few simple steps, any project manager should be able to create a workspace and invite his team members into that workspace. End-users should be empowered to become the creators and administrators of their own workspaces, while IT personnel could focus on more strategic tasks such as insuring the quality of service, 24x7 availability, etc.
- **Ready-to-use –** Once it is created, a workspace should provide all the collaboration tools that users need to collaborate efficiently. Users should not be required to have specific computer skills in order to use these tools. Collaborative workspaces should be ready-to-use.
- **100% Web-based Access –** Collaborative workspaces should enable any user (both employees and external users) to collaborate easily, without being bothered by incompatible systems or applications (one of the key shortcomings of legacy groupware solutions). Workspaces should therefore be fully web-based and accessible through a web browser.
- **Offline Access –** A collaborative workspace is the main repository for all the information related to a project. It should therefore be available offline, on the user's computer, so that a user may always have access to the information stored on his/her computer.
- **Information and document sharing platform** – A collaborative workspace should allow its users to store, validate, retrieve, share, manage versions, publish, print, lock, send, notify and so on, any information or document/file which is implied in a collaborative process of the company. This level of management replaces file system repositories and the usage of the email to send and share documents involved in the projects. The email becomes again a communication tool, and all the information and the documents of a project are stored within the collaborative platform.

We surveyed multiple companies equipped with only classical groupware tools and concluded that **collaborative workspaces would meet 80% of their needs**. Only the remaining 20% would require specific applications developed with traditional groupware platforms.

It is clear that businesses that switch from traditional groupware tools to collaborative workspace platforms will gain on several fronts, by providing their users with enhanced collaborative functionalities and by significantly lowering their costs.

2. From e-Mail Collaboration to Collaborative Workspaces

Although email is essentially a communication tool, it is often used as a de-facto corporate collaboration tool. Users generally use their email to store office documents, project files, and

[4] By "computer knowledge" we mean the necessary knowledge to write HTML pages, to code specific applications, to write programs, etc. We are not speaking about the regular computer-usage knowledge, which could be also a problem for some people. We are presupposing that these computer-usage skills are assimilated.

other items in their personal folders. Consequently, files are duplicated among users and storage space is wasted. Email is inadequate as a collaborative tool for many other reasons; for example, information stored in personal folders is not centralized. Therefore, when a new member joins a project team, there is no easy way to provide him with the latest version of the project documents or history of the project.

The new generation collaborative tools are "generic", like email or word processors. Today, there are few differences between email or office applications: 95%+ of the most commonly used functionalities are identical. The main differences lie in the user interfaces, integration capabilities with other systems, or pricing.

By providing a set of generic collaborative functionalities, the new generation of collaborative platforms can reach the same level of seamlessness. Once users are comfortable with the main tools and practices of one collaboration platform, they can quite easily use other similar platforms easily.

These changes have important implications. Now that collaboration tools are generic and users are able to create and manage their own workspaces, collaborative workspaces offer a compelling IT investment and should rapidly gain in popularity.

Here are a few examples of these generic functionalities: Document management (creation, modification, deletion, publication), version management (history of changes), co-edition, restriction of rights, management of workflow processes, creation of private and secure sub-spaces, granular rights management, creation of custom forms, etc.

Once these generic collaborative tools are deployed, email is used efficiently as a communication tool, to notify users of events occurring in the collaborative layer. When a user posts or modifies a document in a collaborative workspace, he/she can notify his/her co-workers by sending an email containing a short comment and the URL to the document itself. This approach has many benefits: for example if a document is modified while a team member is away, he/she will have access easily to the latest version when he/she returns. This removes a potential source of error.

3. From File-Centric Collaboration to Publication

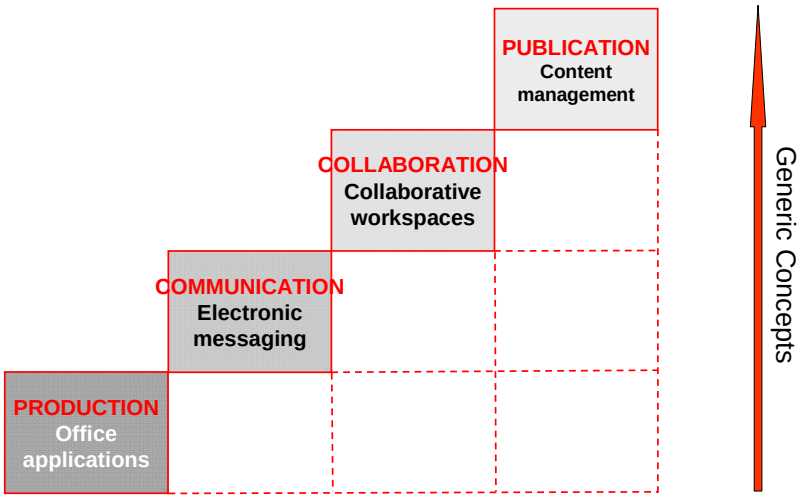

Figure 1

As shown in Fig: 1, collaborative tools interface both with email and office applications. The office application layer is used to produce the information and the email layer is used for notification purposes.

Issues of compatibility between application and document formats are also a frequent source of problems. For example, it is often difficult to share documents created with Microsoft Visio[5].

To meet their goal, collaborative workspaces must therefore support and provide generic, universal publication formats, on top of generic collaborative functionalities.

There are two main categories of dynamic publication functionalities:

- **Dynamic Publication of Information** – Dynamic publication of information must be available from within the workspace. Requiring users to leave their workspace to create and publish documents would hinder their productivity and be less consistent with a fully collaborative

[5] A diagram management software from Microsoft

approach. Collaborative workspaces should therefore provide an environment that lets user publish their information easily, regardless of the application used.

- **Generic information viewing –** Users should be able to view a published document even if they do not have the document's source application. No collaborative workspace can be said to be "universal" without this functionality. On-the-fly conversion to HTML/XML or independent-application viewers like Acrobat is universal or de facto solutions.

4. From Web-Based Collaboration to Participation

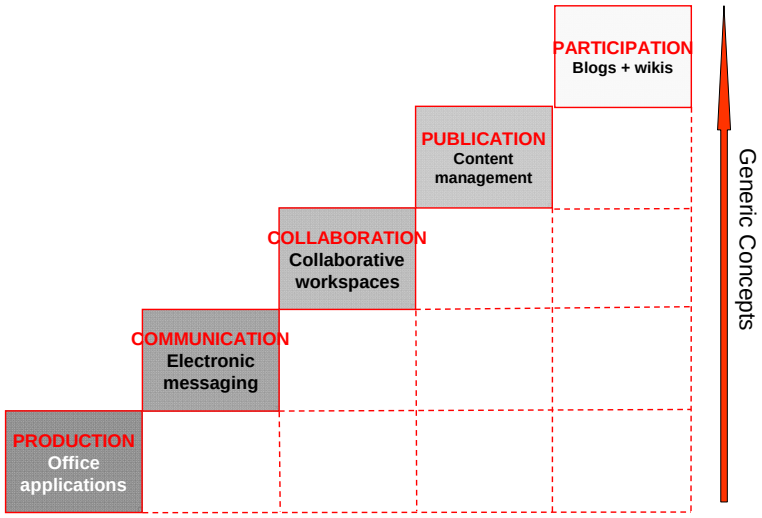

Figure 2

With the Web 2.0 paradigm, we are entering in the participation era

What is the difference between participation and collaboration? Collaborate is more about "working together", meanwhile participation if "to take part of", "to join in", "to involve oneself". These definitions show that the participation action doesn't need a strong relation between the actors of the action, but need only to be involved in a global action. It is easier for a majority of people. In the other way, "working together" can be done without any reflection on the nature of the work, but participating induce involvement, and it is what people want, to be involved in the decision, to take part on it, even if they are not fully collaborating to achieve the work.

The blogs are the best example of this new participation era. The origin of the blog is egocentric, it is the ability for a human being to publish his own thoughts to be red by his family, his friends, and perhaps some other unknown internet users. But thanks to the possibility to comment and to trackback on the others' posts, a huge network of links is created day after day, and the most important is not the URL links, but the human links created between all the bloggers thanks to this two trivial mechanisms. Little by little, a collective intelligence emerges from this pile of blogs, without any real collaboration, just through a self-organization of active participation! Participative mechanisms unleash the human will to be actively involved in his environment.

The consequences for enterprises and hierarchies are great. It is the rise of the Enterprise 2.0 concept, with the end of the enterprise hierarchical management. Participation is a disruptive change for the enterprise and the irruption of “heterarchies”.

Participative technologies are for everybody, each employee can use them, publish, comment, interact, share, exchange, validate, interrogate, freely, without any constraint, just following the rules and conventions of good usage decided by the company.

It is the reason why introducing today CWE in an organization should by implementing immediately participative technologies, at least blogs and wikis, in all the departments, for all the teams, in all the divisions, and allow people to express themselves, to interact through comments, to start building participative interactions and create little by little a participative ecosystem. Like this, it is not only an improved information system that will gain the enterprise, it will be a deeply involvement of all the enterprise's actors to reach the same goal, improve their collective results and their mutual collaboration.

ENTERPRISE DEMAND EVOLUTION

Collaborative solutions exist for a long time, but the user maturity necessary to adopt them is growing very slowly and has not yet reached the end of the learning curve. The market is not yet fully mature. However, for the first time in many years, things are changing, thanks to the new Web 2.0 paradigm. This last year, the unique consumer audience of web 2.0 services has demonstrated to the enterprises that it is now the time to improve the enterprise organization thanks to this new paradigm. It is the birth of the Enterprise 2.0 concept. For instance, Gartner Group is expecting that 50% of the companies by 2009 will use wikis. We will conclude our state of the art describing precisely this new phenomenon.

It is interesting to have a prospective view about the changes in the enterprise needs this last years, thanks to two surveys. The first one is a French survey, the second one a US survey. Of course, cultural differences interfere in these surveys, but the differences are so important that they obviously show the global trend.

This is the first survey, done in 2002:

Table 1

Functionalities	% of companies requested
Document sharing	88%
Collaborative workspaces Shared directories Form management E-mail notifications Seach engines Forums	82%
Workflows Shared calendars Information categorization and classification News	76 %
Online feedbacks and best practices Task management	71 %
Knowledge sharing and capitalization	59 %
Project management, time management	53 %

Source: Markess International, 2002

We can see that the prominent expected features at that time were features related to file management and structured data (forms, workflow, categorization, etc.)

The second survey, done in February 2007 by InformationWeek on a basis of 250 US companies, show that the new trend is about non structured data (instant messaging and unified communications), and about easy content production tools (content management, wikis and blogs):

Table 2

Solutions	% of companies requested
Instant messaging	69 %
Collaborative content tools	61 %
Integrated search tools	56 %
Unified communications[6]	49 %
Wikis	47 %
Mashups[7]	43 %
Ajax[8]-powered Web portals	39 %

[6] Applications that embed in one single package phone (and answering machine), fax (send and receive) and e-mail system, delivered to the desk of each employee.

[7] A mashup is the ability to integrate in one web page (or web application) various data and services coming from other web applications. The integration is done thanks to APIs (Application Programming Interface) and web services. Many new Web 2.0 projects are based on mashups.

[8] A new web programming language; allowing web applications to have rich client behaviors on a single web page. It is the future of the web-based application interfaces.

RSS feeds	38 %
Blogs with partners or customers	31 %
Presence awareness	31 %
Business social networks	30 %
Click-to-call communication	27 %
Blogs among employees	26 %

Source: InformationWeek, 2007

Blogs among employees is a very low proportion of the needs. We suggest that it is because the blogging action is considered by most of the users (and managers) as a "personal" activity, and not in its dimension of collective intelligence creator. Nevertheless, the feedback about 3 years of active blogging by more than 78 million people around the world is that little by little, open communities of bloggers are being created, allowing its members to interact and think together thanks to the network of comments, links and trackbacks created.

This phenomenon, once understood by companies' knowledge officers, will spread all over the corporations if, and only if, intermediate management levels are not afraid about the transparency given to the organization. However, a lot of studies are now showing that corporate transparency (inside and outside) is an advantage for the company that can be used in CSR reporting, and not a disadvantage.

THE PERFECT CWE

By perfection, we do not want to specify that a single CWE must have all these features, but that all these features are useful for company workers, and if the information system could provide them, users, teams and organizations should be much more efficient and productive. Of course, as we already explained it, it is not sufficient to deploy this kind of CWE to succeed in this mission, it is necessary also to accompany people helping them to learn, assimilate, adopt and change their ways of working.

1. Main Features of Collaborative Workspaces

The features of a Collaborative Working Environment are built around workspaces, and divided in two major categories: asynchronous and synchronous functionalities.

We now proceed to a detailed review all these features.

1.1 Asynchronous Functionalities

Asynchronous functionalities enable users to collaborate even when they are not online simultaneously.

- **Self-service workspace creation** – Any user can create a collaborative workspace at any time, through a simple web form. By default, the creator of a workspace is the workspace manager. Some companies have added approval mechanisms that must be completed before a workspace can be created.
- **100 % Web interface –** This is mandatory for timely, universal access to the information.
- **Member and access rights –** When a user is invited to join a workspace, he can be granted reader, author, or manager rights. Access rights can be applied at every level of the workspace, from the workspace itself to the document level. It is possible to add a « public» account to the access control list of a workspace and applied to specific areas, granting public access to non-registered users. This enables the workspace to act as a website.
- **Online creation of documents –** Most documents can be created directly from within the workspace, without using the operating system file manager.
- **Online edition or deletion of documents –** It is possible to edit or delete documents from within the workspace.
- **Documents Management –** Documents can be stored and organized in folders.
- **Private inner-spaces –** Restricted areas can be created in a workspace, to map the organization of a project.
- **File sharing –** Any existing file can be imported and made available to authorized users.
- **HTML conversion and publication of Microsoft Office documents –** Thanks to this key feature, a workspace can be used as a comprehensive publication space. HTML conversion occurs on the fly during the saving process of a document. Concurrently, the document is stored in its original format to be easily downloadable and modifiable.
- **Any corporate application is accessible in Acrobat format -** Acrobat documents can be viewed from within the workspace.
- **Shared calendar and task list -** One (or more) shared calendar(s) and task lists are available in the workspaces. Their purpose is not to replace the user's private or group calendars. They are the workspace's calendar. They can nevertheless be synchronized with PIM[9] devices. Tasks can be assigned to group members or to entire groups.
- **Email notifications –** This feature is critical for the usability of collaborative workspaces. Users are often registered with several workspaces and could not track all the changes occurring within these spaces without a notification mechanism. Automated daily or weekly notifications and manual notification can be sent to users or groups of users (when a document is posted, modified, etc.).

  These notifications contain a URL pointing to the document itself. Comments can be added to these notifications. These notification mechanisms provide two key advantages:

[9] Personal Information Manager

- Changes are notified by email.
- Once a notification is read, it can be deleted.

The actual document is stored in the workspace. Consequently, users will stop using their email as a document repository. This greatly improves the overall usability of email and solves the perennial archiving problems.

- **Import of HTML files (html, flash, videos, audios, etc**.) – HTML files or web objects (flash, jpeg, gif, etc.) can be imported directly into a page. They are encapsulated in the workplace and are rendered accurately. Dynamic behaviors can also be associated with these pages. Users can therefore create information pages with specific behaviors, with no javascript skills.
- **Document versions management** – When a document is updated, there is an option to keep the previous version(s) of this document. Each version has a unique identifier.
- **Forms management** – This tool enables the creation of structured pages containing specific fields defined by the workspace manager. These forms are useful whenever data must be entered in a specific format, and can be used with approval mechanisms.
- **Approval management (workflow)** – Workflows can be created and are extremely useful for the management of specific data. These workflows can have several levels and enable the automated routing of the documents to specific folders, based on the state of the document.
- **Polls** – gather the opinions of workspace members on a specific subject in a matter of hours.
- **Statistics** – As with any highly interactive system, managers need to know in real time how their workspaces are used, which pages, folders or rooms are most or least viewed, who are accessing them, etc.
- **Search engine** – The information stored in a workspace, whether in pages or in attached files, can be found by searching on keywords.
- **Site Map** – Provides a fast and detailed view of the content of folders and/or the structure of inner spaces. Also used as a navigation tool, it is extremely useful for navigating large workspaces.
- **Offline Access** – Users can work in their workspace even when disconnected from the network. Synchronization between the online and offline workspaces occurs as soon as the user is again connected.
- **Information channels** - information feeds[10] can be added and viewed directly from within a workspace. Workspaces can therefore be used as context-specific portals and contribute to improve corporate-wide information dissemination.

[10] A *feed* is a succession of information pieces

- **Blogs** – The most easy and standard way today, to animate a community and to bring news inside or outside a project team. A blog by project, a blog by people, a blog by department, all the news must be written using the blog system.
- **Wikis** – Wiki itself or pages that work like wikis. The most important thing is to have the wiki-spirit: allow anybody in the team to modify the content of a page, and keep a version of the page for each modification done. Like this, it is possible to rollback at any time.
- **Comments** – This ability to comment is essential in a modern CWE. Comments must be available at each level. Of course, it must also be possible to disable them in some specific cases, but the default must be the possibility to comment on a published page, a file, a folder and so on. Why it is so important? Because otherwise people need to use the e-mail to send and receive their comments, or use another object (a forum for instance) to comment on the relevant object. In such cases, the comment thread is disconnected from the commented object, and the efficiency and the relevance of the CWE are greatly diminished.
- **Rating** – A rating system is also essential in a CWE, because it is the best way to establish the quality of the information and the documents pushed in the CWE. Three levels of objects can be rated[11]: the information itself; the author publishing within the CWE; the comments written by the members of the CWE. This rating mechanism is the first step to establish a reputation environment in the company and improve the overall quality and motivation to contribute to the CWE and the knowledge capitalization.
- **Tags –** Tags are replacing keywords to index documents and informations. A keyword is traditionally associated to an object by a professional or an author itself, but in a closed way. Most of the time people must use only keywords from the official list of keywords. Tags are the opposite way, matching the new web 2.0 paradigm. Each people, author or reader, must be able to associate freely a "tag" (a free keyword) to a document or information. A huge informal set of tags will then exist, and from this set a tag cloud will be drawn, presenting in a graphical way what are the most important tags selected by the users. Some advanced systems allow also to combine keywords and tags to create a contextual navigation by tags. A tagging taxonomy is called a "folksonomy".
- **RSS Feeds** – The best way today to be alerted of what is new or modified in the CWE. People can subscribe to specific RSS feeds, bringing news about the modifications of a single page or the comments done, or modifications of a room or folder, or modifications and news about a CWE. Web-based RSS readers must be deployed independently of the CWE or integrated within their customizable home page. They are supplementary to the e-mail notifications that will be used only for urgent purposes.
- **Customizable home page** – It is the dashboard of the CWE. The best customizable home pages allow today to bring a lot of internal or external information in one single page, with a "portlet" approach, and the possibility for the user to contextualize his home page.

[11] It is not an obligation to implement all of them. It could depend of the policy of the company relating to the ability to rate people or not. At the first step, the minimum level is to rate documents. With the objective to implement the other levels step by step.

- **Integration with corporate portals** – Workspace platforms can be integrated with existing portals. Workspace-specific information (list of the user's workspaces and newly published documents, etc.) will be displayed when the user logs on to the corporate portal.
- **Integration with single authentication mechanisms –** Users must be able to navigate freely between the different components of the corporate information system. Collaborative workspaces support SSO (Single Sign-On) can therefore meet this critical goal.
- **Development Platform –** Although the main purpose of collaborative platforms is to be ready-to-use and available to end-users with no computer background, it must be possible to extend their functionalities through custom developments for those who have such needs.

1.2 SYNCHRONOUS FUNCTIONALITIES

Synchronous functionalities enable users to exchange information through the system in real time.

- **Instant Messaging –** Although many companies are reluctant to deploy instant messaging solutions, instant messaging is critically important because it provides the engine behind other synchronous functionalities. Highly successful with individual users worldwide, instant messaging is a fantastic communication tool. It can also be a valuable corporate tool that gives users more freedom and enables telecommuters to feel less isolated from their colleagues. Two main synchronous functions are available:
  - Chat – real-time discussion via text-based messages.
  - Real-time awareness – Indicates whether a remote user is online and available. Awareness can also be used directly with certain applications by indicating whether the author of a document being read is online and available. If the author is available, a conversation can be initiated immediately.
- **White board**: This is an application allowing people to share in real time, over the network or the Internet, a virtual window where they can write and draw simultaneously. Very useful, this tool can be used alone or integrated inside other applications like videoconference solutions. Schemes, flow charts, organization charts, and so on can be drawn, allowing people to interact through a virtual communication.
- **Online poll –** This module enables the real time creation of polls providing instant poll results
- **Application sharing –**This popular collaborative feature comes only right after instant messaging. It enables users to share a window, or their entire desktop with other members of the group. Users can grant control of their applications to other remote users, which can jointly edit documents, debug computer applications, and more.
- **Voice –** Voice-based network communication (VOIP) is becoming a mainstream tool. Quality will vary depending on the number of users and the available network bandwidth.

- **Video –** Because of bandwidth limitations, web-based video-conferencing has not gained the same level of popularity. In addition, experience shows that participants prefer to focus on the content presented by the speaker rather than on the speaker himself. This is particularly through when the people do know each other.
- **Virtual meetings –** Organizing virtual meetings is akin to book a room and inviting participants into that room. When the meeting is set to begin, participants simply join by logging on to the system. Latecomers can join without disrupting the meeting.
- **Recording –** A synchronous meeting can be fully recorded and archived for later on demand access. Everything is recorded (chat, voice, application sharing, and video). This great tool can help users write accurate minutes, absentees see a meeting they have missed, and decision makers review information in details.

These features are the best examples of what today's self-service, ready-to-use collaborative tools have to offer. However, very few products on the market can provide all these features in a single package. Buyers should therefore do the necessary research to find the product that will best meet their needs.

HOW TO START A WORKSPACE

1. CREATE A WORKSPACE

The self-service model enables any user to create his/her workspace(s). There are two main approaches:

- Any corporate users can create a workspace
- Only specific users can create a workspace.

The first scenario generally applies in cases where collaborative workspaces are used occasionally, for narrowly defined projects that involve small teams and entail little interaction with the rest of the company. The lifespan of these spaces is generally quite short. The second scenario applies in cases where collaborative workspaces are widely deployed and made available. In such cases, it is often necessary to control the creation of workspaces and restrict this ability to a specific category of users: project managers, system administrators, etc. The goal is to control and rationalize how workspaces are created. Workflow mechanisms are often implemented. To create a workspace, a user must fill in a request through a web form. The workspace will be effectively created only once the request has been approved. These validation mechanisms are also useful to control the accuracy of the information provided by the user and/or to verify that a workspace with the same purpose does not already exist.

Companies often prefer to create workspace templates that can be applied when a workspace is created. This enables users to create pre-arranged workspaces. Managers should define what

types of users they wish to invite and create appropriate user groups. These groups should be created before individual member accounts. They will be used to assign rights to specific documents or inner rooms: it is important to always proceed in that way. If groups are not properly planned and created ahead of time, user management and rights management can become quite cumbersome.

2. CREATE THE WORKSPACE STRUCTURE

The workspace creator should then focus on his first content-related task. The workspace must be structured in a way that will help its future members to start their own work, because experience shows that people are not able to start on a "blank page", even if it can be a good idea to let emerge the final structure of the workspace by the users themselves, little by little during the workspace life.

This design phase should not be driven by the workspace creator's preferences, but by looking concretely at what users of the workspace will need. This is not an easy task. Workspace managers have a natural tendency to organize things "their way" rather than to think from the user's perspective. The structure of a workspace should therefore be implemented after a phase of careful planning: the success of the workspace will largely depend on this preparation phase.

Once the structure of a workspace is created, it can always be modified, and workspace managers should be willing to do so whenever necessary. A few additional tasks must be completed:

- Creation of a home page that clearly states the purpose of the workspace, its rules and membership. Add a static map if necessary and a quick reminder of the main functionalities available. This home page can be made contextual: the manager can create several home pages that will be displayed selectively based on the user's rights or other factors.
- Creating folders that will enable users to store and classify documents appropriately.
- Creation of inner-spaces with their own user rights. For example, those who intend to use a workspace as an extranet can create a private inner-space for their company where they will store private documents. Non-authorized users (customers, for example) will not see this inner space and have no access to it. Remember that it is always preferable to assign rights to groups rather than to individual users.

2.1 PUBLISH REFERENCE DOCUMENTS

Each space can contain specific reference documents, or point to reference documents stored in other workspaces to avoid document redundancy. Document templates, such as reporting or quality-control templates or any other type of document can also be created and shared.

2.2 INVITE MEMBERS AND GRANT RIGHTS

Once the structure of the workspace is created, members can be invited into the workspace, and start publishing and sharing documents. Membership can be granted to co-workers as well as external users. Users can have specific access rights, ranging from reader to co-manager. Each user should be added to one of the groups created previously, giving them predefined access rights to specific areas of the workspace. Other powerful features include the ability to give users read-only rights at the root of the workspace, and manager rights in an inner space. Alternatively, the ability to hide inner spaces from unauthorized users is important. Such powerful and comprehensive rights management functionalities are managed directly by the workspace manager(s) and do not require any specific computer knowledge. Every user newly invited to a workspace will receive an email notification with a link to the workspace, and gain immediate access.

2.3 DAILY ADMINISTRATION

Once this process is completed, a workspace is ready for production. Throughout the lifetime of the workspace, the manager should monitor it frequently to ensure that documents are published in the proper location, and that its structure remains adequate (for example, it may be necessary to split a folder in two when documents need to be classified according to finer criteria), etc.

WHAT ARE THE USES

As it is often the case with new technologies, specifications alone are not sufficient. It helps to see practical applications of these technologies. Software packages are too often deployed only to be under-utilized. It is therefore important to understand what can be done with collaborative workspaces and how they should be used and integrated into the end user's work environment. Based on how mayeticVillage is used in corporate environments, we will list a few common applications of collaborative workspaces.

After several years of corporate deployment and daily use of mayeticVillage workspaces, we have identified five main categories of workspaces that serve specific purposes:

- Project Workspaces
- Publication Workspaces
- Temporary Workspaces
- Knowledge Workspaces
- Training Workspaces

Collaborative workspaces are used in intranet and extranet modes, and can even be used as optional services added to existing web site. The five categories of workspaces we are about to describe can be used in all three ways.

The intranet use is quite natural, and corresponds to the initial purpose for which collaborative tools were developed. On the other hand, extranet use is a novelty: because of the limitations we discussed earlier legacy groupware applications were rarely used as extranet solutions. On the other hand, collaborative workspaces are fully adapted to the requirements of an extranet: rapid deployment, no specific computer skills required, easy and flexible administration of users and access rights, etc. They are an ideal tool to build sophisticated and highly secure extranets.

Collaborative workspaces have been very successful when used to build sophisticated extranet infrastructures in a few days. Another less common application is for existing web sites to offer collaborative workspaces as an additional service. Generally, these web sites are dedicated to specific fields. The purpose of these workspaces was to facilitate the exchange of information between users, or to simply increase the global awareness of these new technologies. Collaborative workspaces offer endless possibilities. In every situation where information must be shared, exchanged, archived, sorted, etc, workspaces provide a unique and pragmatic solution.

1. Project Workspaces

Typically, collaborative workspaces can be used by project teams to share and manage all their project-related information. This information is stored in a single workspace and can be shared among all participants, employees, contractors, vendors, customers and partners.

Collaborative workspaces can be scaled to meet the requirements of any projects. Some will create workspaces for 2-members teams, others will use multiple workspaces for a single project with 250+ participants (a major insurance company is currently using mayeticVillage to plan, manage and implement a complete overhaul of its global information system). In the case of large projects, it is critical to be able to segment a workspace into inner spaces, where different users will be granted access to specific areas.

For example, in cases where multiple contractors work on the same project, they can post restricted information in their private inner-spaces and public information in common areas. This is a unique feature of collaborative workspaces that can be implemented by users with no specific computer knowledge.

Collaborative workspaces can be used for all kinds of projects: IT, HR, marketing, R&D. Event management (exhibits, seminars, congress, etc.) projects can strongly benefit from these universal worktools, accessible universally and highly secure.

Recently, NGOs have become dedicated users of collaborative workspaces, which they use to manage worldwide teams and projects.

2. PUBLICATION WORKSPACES

The second most frequent use of collaborative workspaces is for publication purposes, thanks to features such as on-the-fly HTML conversion of Office documents, the direct publication of any type of enterprise document through Acrobat. Currently, only IBM Team Workplace, Mayetic's mayeticVillage, and blogs and wikis solutions offer such powerful features. Publication workspaces are extremely successful. Businesses and users constantly need to publish or create online information, and being able to do it easily, without any specific computer knowledge, is a key advantage.

One good example of a publication space is available at http://www.e3work.com, a workspace used for a European project, with public and private areas. This workspace was built based on a standard mayeticVillage workspace and simple Microsoft Word files.

No specific computer knowledge (HTML, FTP or others) was required. Information can be published and modified instantly, and made available universally. Creating this workspace, with its public and private areas took only a few days. Many corporate intranets can be streamlined by creating "micro sites". These micro sites are managed directly by the content providers, without the assistance of a corporate webmaster or a web publisher. Workspaces can be used for both publication and collaboration.

Today there is more and more websites built and manage with second generation wiki engines, like Curriki (http://www.curriki.org) developped using the XWiki open source solution, with a content directly written online by the users.

Example of applications:

- Virtual exhibits, HR, Marketing
- Product sheets
- Corporate information
- Sports clubs, associations, schools
- Etc.

2.1 TEMPORARY WORKSPACES

Users often need to exchange information more informally, to share a few documents occasionally with a few people. Most email providers limit the size of file attachments to a few MB. Using FTP (which requires specific software and computer knowledge) is not always an option. Here again, collaborative workspaces provide a much better adapted solution. A workspace can be created (and deleted) in less than a minute. Uploading a file is simple and

fast, and notifying users by email with a link to the uploaded file can be done in a few mouse-clicks. Here again, no computer knowledge is required. These "Temporary Workspaces" (as we have named them) provide quick solutions beyond the scope of formal projects, and have a short lifespan. This type of use is increasing steadily: once users understand the power of collaborative workspaces, they tend to use them every day, like their email. This generally creates a chain reaction where friends and colleagues soon become active worskpace users and creators.

2.2 KNOWLEDGE WORKSPACES

The field of knowledge management (KM) is more formal. Although collaborative workspaces are not KM tools per-say, a lot of companies have used them very efficiently as the software infrastructure underpinning their KM processes. Although workspaces provide built-in management functionalities, they are often coupled with other specialized tools when used as KM Tools.

2.3 TRAINING WORKSPACES

Workspaces are often used as "Training workspaces", for training purposes, e-learning or more classical education.

Collaborative workspaces are not training or e-learning tools per-say, but they can become a compelling work tool for all types of training projects. About 23% of all workspaces created on mayeticVillage.net are used for education-related purposes (schools, colleges, training centers, etc.). This is significant of the impact of these tools on education. They are not only essential for online training, but they are also an perfect support for regular classes. Based on our concrete experiences with many public and private universities (HEC, ESSEC, etc.) there are 3 main categories of education-oriented workspaces:

Trainee – Trainer
For online classes:

- Schedule of online courses, latest information…
- Online pedagogical resources (courseware, evaluations, case studies, summaries, cards, etc.)
- Detailed notes on the courseware posted by the teacher
- Discussion forum between learners and teachers
- Online quizzes
- Test results
- Workshops
- Remedial classes

For regular classes:

- Posting of courseware

- Answers to exercises
- Information archive (web articles, book-marks, book summaries, etc)
- Practical introduction to e-collaboration

Trainer - Trainer

- Collaborative creation of courseware
- Mutualization of teacher resources (methodologies, discussions, etc)
- Coordination between teachers and their assistants
- Coordination among teachers through better knowledge of other teacher's courseware
- Creation of additional courseware by students.
- Year-end curriculum evaluation

Learner - Learner

- Discussion forum
- Sharing internet bookmarks
- Group work (projects, research workshops, interaction with other students, etc.)
- Posting student notes
- Private "student-only" inner-spaces
- Creation of additional courseware by students

These are just a few examples of how workspaces can drastically enhance the teaching and learning experience in the age of the internet.

New collaborative technologies are an exciting opportunity for all users, regardless of their computer skills. This revolution reaches far beyond the collaborative world and represents a major evolution for any information system. Collaborative workspaces are being deployed at an increasing pace in all types of enterprises and organizations. In the coming years, they will become as ubiquitous and universal as office or email applications. It is therefore important to understand these technologies and their multiple applications in order to be prepared to use them fully.

PERSPECTIVES – THE ENTERPRISE 2.0

What are today the perspectives of the CWE environments? It is not only a new generation of solutions or tools. It is a paradigm shift, not only technical, but also sociological and organizational.

This paradigm shift is called "*Enterprise 2.0*" since the first article published by Andrew McAfee [AMC-06] on this topic (read also Don Tapscott's report [DT-06]).

New tools, first massively adopted by the users of the Web 2.0, are changing essentially the way we work, collaborate, participate, interact and exchange with others. These tools are not based

on the hierarchical vision of a corporation, used to manage scarcity and opacity within its organization, but on the heterarchical vision delivering abundance and transparency.

The shift will be hard to take for most of the companies and the managers. But the 20 last years of collaboration tools deployment within companies have demonstrated that the structured way to impose collaboration tools to a company and its employees is not helping this company to better organize its work outside the already existing processes (refer to the eSangathan second newsletter for a more detailed analysis: "from collaboration to participation" [NL2-07]).

Only the participative tools or the "mass collaboration" [DT-07] ones will allow the organizations to access the next level of creativity, efficiency and productivity. It will be done by changing the way companies are managed and organized; leaving the categorized and structured information to emerge by itself.

It is no more a dream; it is now a reality. Tools are here, and their extremely fast adoption by the consumers demonstrates that people are ready for it, because these solutions unleash the energy and participation will of the individuals.

Millions of people are collaborating like this in the consumer area for 2 years. Thousands of companies around the world are already shifting to these models and deploying pilots to collaborate and manage their content and their knowledge in this way.

The key factors are **participation** and **openness**:

- Participation: because everybody in the company must be "part of". Human beings want to participate to their environment as the success of the blogosphere or wikipedia demonstrate us.
- Openness: because it is a mind shift. This change is already done in part within the software industry, with the now unimpeachable success of the open-source softwares, and within the consumer area with the user generated content (UGC) success of the Web 2.0.

CWE will radically change in the next years and will be part of the new Enterprise 2.0 paradigm.

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