A collaborative prototype designed to support an organizational workplace

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Abstract: - In this paper we present a prototype of a collaborative tool that provides shared documents between users of a group, with the possibility of editing and comparing multiple drafts of the document. In order to prove its effectiveness, the collaboration must be associated with a proper software infrastructure. Our interest is to determine whether a collaborative tool must provide special features apart from any other kind of application, in order to be properly received by its future users. Organizations have always been concerned with detecting new opportunities and resources, but the economic and social realities now force them to keep the resources they already own under observation. Concepts like collaboration and knowledge management have rarely been integrated as an efficient resource of the organizational culture, mainly as a result of the fact that they have been launched as an image towards other organizations and less as a perspective for the organization's structure itself. It might be of course extremely difficult to determine what are the members of a community that adhere to such a conceptualized notion like collaboration, if they encounter the lack of support in understanding the benefits of implementing this kind of approach. There are a large number of organizations that claim strong values and principles as part of their culture, but it is our interest in this paper to find a middle point between the boundary an employee faces when embracing an ideology and the organization's position towards it.

Key-Words: - collaboration, collaborative environments, knowledge management, collaborative software

1 Introduction

The flow of dispersed information through various organizational channels represents the fundamental factor in determining the need of collaboration and structured knowledge; nevertheless, the concept of collaborative environments might raise difficulties when implementing the right architecture in leveraging information as the main organizational resource.

A virtual organization relies on linking its members and departments after a classical approach, but in terms of geographical differentiation and informational and communication support. Virtual communities provide information technology-based cyberspaces in which individual and collaborative learning is implemented by groups of geographically dispersed learners and knowledge is valued according to the organizational goals [11].

The concept of collaboration must be approached by the members of the organization, implemented by the company management and sustained by the informational framework within the organization. Therefore, considering these aspects, we face a new paradigm based on knowledge sharing and ubiquitous information. One member's stock of knowledge is being provided to other members in a shared informational network, pointing out in a detailed manner the abstract concept of proactive behaviour. The application of collaborative systems has been proposed for various industries (for example newspaper companies in [23]).

So that collaboration takes its role as a business strategy, it is vital that the environments characterized by this sort of approach must be aware of merging the efficiency of informatics systems, tools and technologies [7]. The goal of any process that involves the implementation of an advanced stage towards actual strategies is concerned not only with classical problem solving, but also maintaining collaborative work and achieving value [14].

The challenges in working with virtualized dispersed work groups are not completely isolated from the ones that are usually met in the classical organizational architecture, but they impose the immediate existence of a successfully deployed IT collaborative infrastructure. Virtual collaborative environments gather geographically distributed users that connect and collaborate with each other via a network. A fundamental requirement for the correct behavior of the community is that there

should always be enough available resources to allocate the services that are to be offered. The services must be available within the community, providing transparency and full functionality to their members and foreign users if desired, in order to entitle such kind of collaborative implementation as a successful one [8].

Collaboration is not necessarily a result of an immediate need of linking various segments of economic and social environments, as in this point, the existence of web infrastructure would be considered a sufficient strategy; therefore, collaboration is born as a progressive ramification towards the actual organizational strategies [22].

The paper is organized as follows:

- In Section 2 we describe the mechanism of a collaborative organization, by pointing out the importance of a proper collaboration concept within these environments.
- In Section 3 we present the architecture challenges of the collaborative tools, with the usual encountered limitations and facilities.
- In section 4 we are focused on describing a proposed prototype regarding the sharing process of written documents/notes among the members of a team.

2 The mechanism of collaborative organization

Regardless of the dimension of one enterprise, its members determine the need for accuracy in defining usually abstract concepts, so that the results of a future implementation might be evaluated and quantified. Synchronizing a concept with its practical use within a software application brings up problems not only in the evaluation of the results, but even in the exact establishment of those.

Large organizations often place their employees in situations where it might be difficult for them to distinguish the general assembly of aggregated actions from daily framework activities [13]. On the other hand, a similar process but in the opposite direction is met in small firms where usually the decision makers are overwhelmed by the pressure of a defined goal, without having a structured framework. Therefore, collaboration must not be taken into consideration only as a trend towards actual global economy, but as an indispensable tool that provides knowledge dissemination between members and reduces informational loses [14].

They facilitate better distribution of knowledge, improve planning and development cycles and

create more functional and productive relationships within intercultural teams (Fig. 1) [9].

According to various social theories, there have often been scenarios in which the accomplishment of individual interest eventually leads to o general accomplishment, mostly animated by an inductive effect.
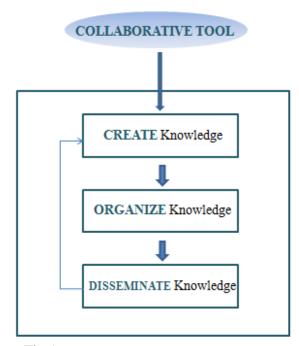

Fig.1 – Knowledge stages in collaborative environments (Source adaptation: [14])

The main purpose of communities is to offer services to their members exclusively (e.g. management information about the activities within the communities) or to foreign users (e.g. publishing information about the community and its activities). These services are related to web publishing, content management systems (CMS), forums, blogs, video and audio streaming, a shared agenda these services to be accessible, the system uses the resources of the community to keep them activated [8].

A distributed work environment represents a social and economic reality that cannot be ignored when establishing the significance of effective and efficient communication, regardless of the physical distances that separate the actors in the collaboration [15].The barriers regarding time and space between the members of an organization reveal the need for upgrading from the usual knowledge dissemination strategies to ones that apply in the collaborative communities layer, allowing faster feedbacks, more efficient brainstorming sessions and a smooth informational flow [9].

The matching of various related tasks in collaborative environments requires a certain structure that enables the interdependencies between processes; thus, the functionality of the collaborative mechanism is not altered by execution flaws or any other kind of full or partial inactivity. Interaction between members regards resources discovery, access, and sharing, as well as group communication and discussion, or simply any collaboration which has occurred as a valuable resource [11].

The coordination mechanism authorizes a task only when its realization does not violate any defined interdependency [3]. A new tool may earn an advantage by emulating an existing tool and building a loyal user base. These loyal users may then discover the potential of the tool to support new uses and connections [9].

Individuals do not only adopt and act more efficiently in the redesigned collaborative environment, but their results also involve the process of active learning within these communities of practice [17].

Virtual Communications and Collaborative Systems continue to gain popularity as organizations are becoming more engaged in global business operations, and technology for facilitating collaborative work is becoming more readily available [9]. Nevertheless, collaboration represents a structured process where two or more people interact together toward a common goal by sharing knowledge, learning and building consensus [1].

3 Architecture challenges of the collaborative tools

Organizations do not necessarily have to face key situations like recession or unpredictable social and economic conditions in order to seek and develop cost-effective strategies, although these have turned out to be the milestones in most cases.

With technologies ranging from Microsoft SharePoint to social media platforms, organizations are seeking the ability to easily share documents and collaborate on projects without expensive content management systems or lengthy business process engineering initiatives.

Global and localized collaborative architectures do not only identify the nature of complex relationships encountered in the collaborative environment, but decide their length and the number of participants that are involved; therefore, these aspects have been taken in consideration when deciding that one of the main challenges related to

the coordination of collaborative activities is to develop coordination mechanisms that are, at the same time, global and localized [3].

The economic environment permanently faces the need of reducing-costs strategies and perceives this situation as a starting point in future organizational planning processes [18].Therefore, by placing needs and expectations on a simulated timeline, approaches based on cutting costs are more often encountered than the ones based on improving alternative solutions to overcome their increasing.

The seeking, matching and validation of information in any organizational environment lead to inefficiency and inadaptability of adjusting business processes to the organizational dynamic itself [16]. The absence of a vital resource as information almost involuntarily leads to seeking for an immediate crisis solution which on the contrary rarely happens when facing the case of losing information due to a damaged knowledge management.
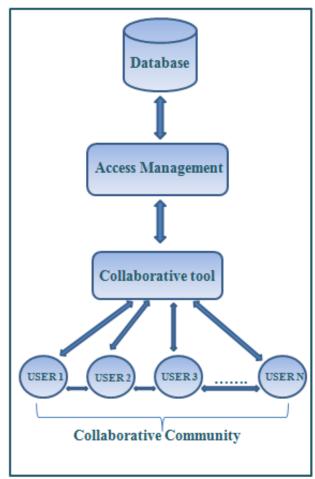

Fig. 2 – Communication structure (Source adaptation: [7])

Collaboration overcomes borders of interactions between its members, regardless of geographical

boundary with the use of a specific collaborative software implementation. Effective teamwork is an essential part of any engineering process, and collaborative capabilities represent an important support for these teams.

When referring to knowledge based organizations it is essential to mention their intelligent and adaptive feature, by means of bridging together members, applications and processes; the efficiency of the adaptive organizations towards environmental changes, provides problem solving solutions and the ability of creating business value [14].

The success or failure of a collaborative tool implementation does not differ much from any usual software implementation, but takes in consideration the traditional point of view regarding the human alike pattern as a feature of the tool. Creating a powerful tool, with full functionality and adjustment to user's need represents a real challenge.

The technology behind any collaboration tool is based on a mechanism that enables a user to send updates to other users about the interactions that are made in the shared environment (Fig. 2).

The user must be allowed to give feedback of the result-expectation ratio, by both interacting and supervising the actual process behind the collaborative tool. In addition to verbal communication, collaborators can add video, share desktops, share slides and flowcharts, and browse the Internet in a group.

Aspects like inappropriate interface, drastic changes of hardware infrastructure or the inability of client server applications to connect with web based applications are crucial when it comes to appreciating the success of an implementation. When people are asked to define or suggest collaboration tools, audio conference systems and videoconferencing software are typically at top of the list, reflecting a traditional view that collaboration tools should mimic face-to-face meetings in front of a chalkboard [9].

Participants can connect and communicate through more and richer channels to augment conversation and efficiently mime a real interaction [12]. Collaboration requires individuals working together in a coordinated fashion, towards a common goal. Accomplishing the goal is the primary purpose for bringing the team together. Collaborative software helps facilitate action-oriented teams working together over geographic distances by providing tools that aid communication, collaboration and the process of problem solving. Additionally, collaborative software may support project management functions, such as task assignments, time-managing deadlines, and shared calendars. The aggregated efforts made by learners and collaborators to manage knowledge, to expand the knowledge domain, and to provide each other with accumulated domain-related knowledge represent the core of the continuous growth in virtual communities [11].

In addition to facilitating traditional collaborative relationships between parties that know one another, collaborative tools also facilitates the interactions between users that are not members of a certain community. Interested parties can find and identify one another based on common interests and shared affiliations [9].

The main design idea of the remote experimentation system is to use the World Wide Web as communication structure and a Web browser as user interface. The Web browser provides a platform for transmitting information as well as an environment to run the client software. A Web Server mediates the interface between users and provides the infrastructure to exchange the necessary information [13].

One factor contributing to the adoption problem for collaboration tools is the technology design processes being used within companies that create these tools.

When designing a collaborative tool, the aggregated needs of the entire community are being addressed taken in consideration with a heavier impact on the future application than the need of individual. If groups of collaborators are the intended users of collaboration tools, then the tools should be designed by specific types of collaborations [20].

4 Designing the collaborative prototype

In this paper we have developed a prototype collaborative tool which allows users to interact within a shared document, follow the latest updates performed by other members of the team and set access permissions to all involved contacts. It might often be difficult to associate a high score to the necessity of implementing a collaborative solution in organizations, as it appears more as a concept that involves convergent thinking, speeding up the problem-response and stimulation of creativity.

Software development is a result of a collaborative team effort as well [10]. Both in the context of open source software development projects and in organizations that develop corporate products, more and more developers need to

communicate and liaise with colleagues in geographically distant areas about the software product that they are conceiving, designing, building, testing, debugging, deploying and maintaining [21].
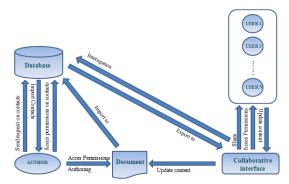

Fig. 3 – Prototype functionality architecture

Collaborative software refers to computer software designed to allow people involved in a common task to achieve their goals. It is usually designed for individuals not physically co-located, but work together across an internet connection. It can also include remote access storage systems for archiving common use data files that can be accessed, modified and retrieved by the distributed workgroup members.

Our prototype focuses on an Internet-enabled environment that is meant to facilitate the utilization and the collaboration among users by enabling remote control capabilities. The concept stands as a dashboard where documents are created, shared and updated in real time and enables users to play different roles within the framework.

The importance of such a collaborative module regards the possibility of real-time tracking within members of a team. Our purpose is to create a versatile, user-friendly module that is intended to support flexibility and communication between members.

Our prototype follows a logical schema (Fig. 3) which is divided into four entities that encounter a patterned interaction. The four entities are: the SQL database, the collaborative interface, the author of the document and the rest of the users seen as a separate entity.

By summarizing the architecture of the prototype, we can determine the following connections:

- One user creates a document and becomes the author of that document;
- The author imports another user (contact) or a list of other users from the database

- The author establishes the restriction upon the document for each imported user;
- The restrictions upon the document are sent to the database;
- The database exports the shared document and its restriction to the collaborative interface, as a result of an interrogation;
- The collaborative interface shares the document with other members within the group;
- The other users have access to the shared document and make updates according to their established access permissions;
- The collaborative interface receives the updates, applying the updates on the shared document;
- The document is sent as an intermediary version back to the database.
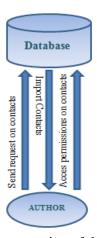

Fig. 4 – Interrogation of the database

Our prototype has been developed using a SQL Server Management Studio and Visual Studio for the collaborative interface.

All four entities described above enhance interaction, but we will present the most important of all, meaning the ones that are suitable for designing other basic collaborative prototypes.

The architecture of the prototype has its core running on a server that acts like a compute engine, by retaining tasks from clients, running the tasks and returning the results. In this collaborative system, the clients of the server are represented by the users of the prototype. The users can have direct or remote access to the application through the user interface which they have to connect to. Finally the SQL database is linked to the server and retains the results of the tasks deployed by the server, or provides the results of the interrogations.

The application and its functionality are seen from a certain user's point of view, called author; he

is the author of a document that is going to be shared within a group of users, so that the first steps towards the future collaborative process are made (Fig. 4).

It is optional whether the author should first import a list of desired contacts to share the document with, or whether he should first create the document itself. Of course, if a contact list has not been previously imported, the author cannot start the collaborative process, as he has no one to share information with. Therefore, the interaction with the SQL database consists of searching users by a simple interrogation of the database, receiving the response and importing the contacts.
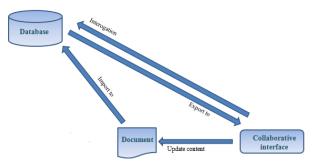

Fig. 5 – Informational flow between collaborative tool and the SQL database

Another interaction that occurs at this moment between these two entities represents the establishment of the access permissions for the imported contacts. The author has now the possibility of setting up the way each user will be able to perceive the future shared document and this information will be stored in the database (Fig. 12).
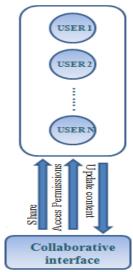

Fig. 6 – Interaction between the collaborative tool and its users

Another pair of entities that encounters interactions consists of the collaborative interface and the database (Fig. 5). As expected, the collaborative interface imports the document from the database and shares it with its related restrictions. When creating and authoring the document, the author establishes the desired restrictions upon the document which are sent to the database as well.

The interaction regarding the aggregated entity formed by the other users is characterized by an informational exchange between this entity and the collaborative tool. We mention that in the scheme from Fig. 6, there is no other informational exchange that is provided by other users, except the updates they perform upon the shared document. This happens because if one user from the n users represented in the related schema creates another document, he automatically becomes an author and the functionality pattern is resumed from the beginning.

Enabling remote control capabilities are vital to a collaborative tool, no matter its number of users; they must not only feel the virtualized experience of a real interaction, but the ability of the tool to reach out and predict encountered needs. Another important aspect is to transport the feeling of a real experiment to the remote user. A video and audio broadcast can provide the remote user with the feeling of being physically present at the location of the real experiment [4].

Many web based tools are already providing new features towards collaboration; knowledge creation, and collective intelligence, traditional collaborative activities are also being enhanced by these tools.

Collaborative environments performing new strategies and business competitiveness based on specific instruments are oriented towards the maximization of communication results and manage to provide a large amount of possibilities for the members of one community. The traditional approaches regarding efficient collaboration face the increase of information blockages, wrong knowledge dissemination and loss of valuable time.

First, the user must log in to the application interface by providing the username and password (Fig. 7).

It is vital for the members of a collaborative environment to have the same perspective of the application in real time.

The application interface is logically split into two panels (Fig. 8): the left panel provides the possibility of creating a plain document with a subject and a body message and gathers the actions a user can take before starting collaboration (Fig. 9).

The right panel refers to the collaborative aspect of the application, namely which document the user chooses to share, who he/she shares it with and what kind of access permissions are established for each contact (Fig 10).

Fig. 7 – Login window

The user can start creating a document note by simply clicking "Start a new Note" button and all the fields remain empty; after creating the note, the three buttons below body message allow a few basic activities like saving the note, printing it or exporting it as a PDF file (Fig. 8).
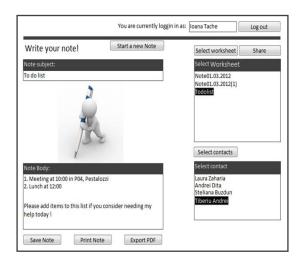

Fig. 8– Main window interface

This step marks the end of the member based application and reveals the beginning of the community-based processes. If the user does not have any configured imported clients so far (Fig. 12), then the concept of collaboration cannot be implemented and the purpose of the application itself loses its significance.

Collaborating groups are based on attributing roles to individuals and the dynamics in changing these roles must be also taken in consideration when designing any kind of collaborative tool. One should also not ignore the needs, goals and intermediate roles of the individuals according to each collaboration phase and must be defined in the designing process framework.
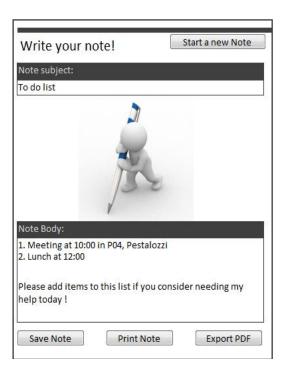

Fig. 9– Creating a note document

Typical learning services for collaboration in virtual learning communities are content, access of certain learning subjects; making study notes and annotations on learning subjects; group discussion, brainstorming for knowledge creation and sharing [11]. Members tend to work independently, though the community may initiate sub-groups to accomplish goals like organizing meetings to share best practices, managing the community's shared knowledge base or organizing community-related events.

Next step in following a collaborative approach in our example consists of importing contacts from a database, by typing their name and pressing the "Add contact" button (Fig. 10).
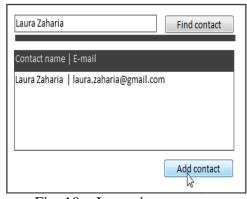

Fig. 10 – Importing contacts

The user is being provided a document that has been created, a list of contacts that has been imported from the database and the possibility to

decide the access permission for each contact. The permissions include the "Read Only" values, "Modify" value and "No action" value.

Dealing with the traditional process of editing a document within a team, a collaborative tool allows synchronised real-time interactions between members and gains popularity when it comes to reducing time laps between different drafting stages of the document. Co-writing a shared document in real time can prove an effective tool for brainstorming and collectively articulating ideas [9].

Fig. 11 – Selecting the note and the contacts to share it with

The sharing of information allows members to spontaneously reveal aspects of themselves, thus flexibility as the main future of interactions determines social oriented tools to gain popularity [9].

Next step to performing collaborative behaviour is to choose which document to share and the constraints for other users' access (Fig. 11).
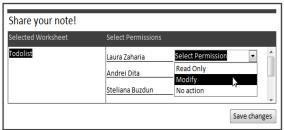

Fig. 12 – Establishing the access permission for all contacts

The document is now shared with other users chosen by the author of the note. To continue the collaborative process, we will simulate logging into the application by another user that has been selected by the author to be part of the collaboration and is allowed to modify the document (Fig. 13).

Fig. 13 – User status detail

As we have mentioned before, all users deal with the same application interface although this must also allow for the particularities of each member.

Fig. 14 – Connection to a group shared note

For example, when logging in as a user that is not the author of the document, but is allowed to change and update the content, the "Save Note" button is enabled; on the contrary, for users that are allowed only to read the content of the note, the "Save Note" button is disabled but the rest of the buttons are still available, thus printing and exporting under another format are allowed (Fig. 14).

Whether it is about refining, renewing or editing a document of any kind with the rest of the members in a group/organization/community, the prototype we have developed in this paper is able to bring effectiveness in the process of collaboration. The members can contribute to the activities of the community by offering their time, their work and by providing valuable resources such as their own knowledge. The middle point we have mentioned at the beginning of our paper regarding the boundary an employee faces when embracing an ideology and the organization's position towards it, is related to this exact kind of situation described above.

When the implementation of a collaborative approach turns out to be a failure, then the organizational structure will stay on the same non-flexible hierarchy based on control and command. In these situations, it is difficult to find the root of the failure regarding which of the elements had deflected the course of a normal implementation.

Situations when choosing a collaborative tool for an organization that is not ready yet to embrace a

new ideology, lead most of the time to the failure of evolution towards an intelligent and collaborative environment. On the other hand, it turns out to be a wrong approach when the organization expects that the collaborative tool creates a collaborative environment. Collaboration represents a concept that must be accepted and adopted by the members of an organization, while the collaborative tool is just a support that allows processes to happen in an effective manner.

The collaborative solution must always be perceived as an extension to an organizational culture that has already adopted collaboration as a valuable strategy [12].

5 Conclusion

Due to the fact that it might be difficult to quantify the results of a collaborative implementation seen as a result of drastically reducing the loss of knowledge, organizations adopt a different perspective: value creation [6]. Many companies and organizations are aware of the benefits when adopting collaborative technologies and integrate unified communications among members, web conferences or simulations on virtualized environments.

Regardless of the fact that there is usually a strong connection between a member of an organization and the organization itself, it is difficult to maintain a perfect collaboration; it is not extremely relevant if over time it is the organization which defines the profile of its members or it is the other way around. The loss of possible valuable knowledge among members is better translated into the fact that the collaborative environment they perform in has probably not found the right software implementation.

The proposed prototype encourages teamwork, no matter where the team members are located; all team members have access to the documents, according to their specific rights that are established by the author of the note.

Users can create unlimited worksheets and share them with other users, enabling the file sharing process and providing the necessary collaborative environment for the members, by keeping track of the evolution of the documents.

Usually the assessment of results has a high level of complexity even when dealing with calculations and revenue predictions and it gets even more difficult when dealing with strategies that focus mainly on a different ideology approach [5]. Nevertheless, the collaborative processes in a certain organization allow fragmentation into separate layers and the possibility of a dispersed result evaluation.

When choosing which collaborative tool to implement, it is wise to integrate it into the informational system that already exists in the organization; the possibility of mixing elements like in a puzzle game is exactly the fundamental aspect of collaboration, so that regardless of the ability to mime face to face interaction, the implemented tool might also provide valuable support in product development, design and production.

Of course, the large open source solution market must not be ignored even by the companies that can afford an aggregated platform; the organization might face the situation in which many layers of one collaborative solution provides the exact same results as an open source, meaning loss of resources which would interfere with the collaborative essence of reducing any kind of informational loss.

On the other hand, although it might sound like the best idea, the implementing of unified communication tools can lead to mixed content and confusion among users; the organization may expect people to make appointments with leaders and schedule meetings. In contrast, unified communications gives everybody immediate access to everybody else regardless of level, role, region, function, or business unit.

Another aspect when choosing a collaborative tool regards its necessity. Environments that are still based on a large amount of formalities do not encourage the enthusiasm members can face for example in a brainstorming session, which usually reveals and stimulates creativity. Thus, in such an environment, achieving tools that provide videoconferencing, instant messaging or voice calls might turn out to be useless if the cultural boundary does not allow collaboration to happen [19].

We believe that society cannot properly function unless it stands upon ideologies, although at the same time it cannot be abridged from the concrete solution when it comes to a successful implementation of concepts in the organizational culture. Technology has always proven to be the most important mediator when it comes to transferring a less understandable notion into a strong, friendly application that users can understand and efficiently work with.

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