



# Integrated Virtual Environments for Collaborative Real-Time Activities: the Co.S.M.O.S. prototype

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This paper presents Co.S.M.O.S. (Social and Collaborative Multimedia Operating System), a prototype of a virtual environment to support real-time collaborative activities developed with the aim to meet the growing needs of users in terms of Knowledge Management, Collaboration, and Socialization. More precisely Co.S.M.O.S. is an integrated environment consisting of a WebOS, an environment for the realization of collaborative activities and a social network which can efficiently support real-time collaboration and thus facilitate the development of social communities through advanced sharing and cooperation in the process of Knowledge Management. Co.S.M.O.S. is easily accessible via a Java applet, embedded in a web page, offering users all its features.

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## 1 Introduction

The evolution of Internet is clearly demonstrated not only by the unstoppable spread of the net but also by the variety of applications and services that it offers increasingly to more diverse sectors of users. In fact, if initially, Internet was just used to support communication and as a “showcase” of institutions and enterprises, today it is the fundamental support for a variety of activities in areas such as health, trade, culture, education and training, entertainment.

Internet is a privileged place for global communication and the development and management of knowledge, this is not only due to the contributions of some “guru” of ICT, but it is also the result of the thrust provided by users and their needs well described by Maslow’s pyramid (Maslow, 1998). This model explains that the success of the network are linked to their own needs of auto-realization that takes place in Web through knowledge sharing, content creation, creation of groups and communities, and which is used to achieve the disparate goals, linked to various fields of interest, between work and fun.

The Internet’s user discovers new ways to participate and through application he/she has the ability to satisfy the need to create his/her own identity (Mican *et al.*, 2009). He/She assumes a new role: the user is the person who creates knowledge, evaluates and modifies it or simply he/she consults it by following his/her own paths of interest; in particular, this is most evident in the field of E-learning, in which it is passed from teacher-centered models of training to student-centered models and [focus] on the creation of a rate of collaborative activities and resources where each student making his/her own contribution to building knowledge and collaborates with others. So, not only the user holds the role of “prosumer” (producer and consumer) but becomes the center of a network which is connected to other nodes and through which he/she can acquire new skills by joining a “collective intelligence”; problem solving processes can be facilitated by collaboration between the network nodes.

By the analysis of this scenario, this article presents Co.S.M.O.S. (Social and Collaborative Multimedia Operating System), a prototype of a virtual environment designed and developed to promote the integrated use of tools for knowledge management, collaboration and socializing. More precisely Co.S.M.O.S. consists of a Web Operating System (WebOS), an environment for the realization of collaborative activities and a social network, making it possible to implement advanced forms of real-time collaboration.

## 2 Integrated Virtual Environments

The current development of virtual environments has resulted in the definition of common features that characterize it. A virtual environment is the re-

presentation, in text or graphics form, of a place that allows the users to engage activities in intuitive ways as is possible. The virtual environment must also be persistent and interactive. Persistence ensures that the environment does not end its life when the user leaves, but continues to live under the interactions developed within it. Interactivity ensures that every user accessing the environment has the opportunity to develop interactions with others by the network.

The development of an integrated virtual environment requires the establishment of specific guidelines for the design and the implementation. This activity is particularly complex because often, in the construction of this kind of environments, the requirements are not entirely clear and are associated with dynamic and changing needs of human beings. In this sense it is useful to consider the affordances, the possibilities offered to the user in terms of “what can be done” through a variety of tools are often very simple, but combined according to the needs of users can lead to new applications, it is possible that different users get different results than other through a recombination of the same set of tools.

## 2.1 Definition of the Environment

The definition of the environment is of great importance. The environment is the necessary place to identify the main different functional characteristics depending on the context in which it is used. It is necessary to make a choice about the right metaphor to use as interface. The interface should allow the user to interact with the environment and with other users in a simple and effective way. To encourage the use of the environment is widely recommended the use of a “help” that can be realized by the designers of the environment or it can be built by the users around a initial nucleus provided by the design, through the use a tool that allows users to exchange tips and advice on environment and tools (Bouras *et al.*, 2005).

## 2.2 System’s Agents

The design of the system requires also to address issues about affordance for the following system’s agents:

- individual users;
- groups;
- community.

### 2.2.1 Individual users

As it is necessary to find a suitable metaphor to represent the environment, it is also essential to find the right representation for the user, so that it brings

as much information as possible: physical appearance, tastes, the current state, fields of interest, the role it plays in the community, the privileges and any information that permit he/she to recognize himself/herself in the environment and at the same time allow others to recognize and perceive his/her presence and status. This representation can be a textual profile or a three-dimensional representation or it may consist in multiple modes of representation, but whatever the choice it must allow the user to manage his/her own digital identity. Last but not least, the designing of personal tools for editing, navigation, communication and for each activity that the user could play in the environment (Nova, 2007).

### *2.2.2 Groups*

The second agent in a virtual environment is the group. A group should be limited in size in order to make easier contents sharing and creation tasks, to use of tools to access, to create, to share and continuously improve ideas. Communities should emerge naturally and users should “identify and establish social contacts based on similar interests.” (Kahnwald N., 2008) To allow a natural surfacing of groups depends by the context in which the environment will be used: in an e-learning environment only users with higher roles and privileges can build groups (classes) while in a “social” environment it’s possible to allow any user to create thematic groups. It is necessary to provide groups with instruments to implement, at group level, the “architecture of participation”, which is typical of Web 2.0 and collaborative environments, with the cooperation (communication, coordination, collaboration) Chatti et al., 2007).

### *2.2.3 The Community*

This agent cannot be considered as a large group since dynamics of the community are very different from those of the group and require different reflections. In particular, it is necessary to underline that the community is not considered to be a container for users and groups but as the initial stage to create connections and networks. Therefore the most appropriate instruments at this level are those that allow a user to present himself to others enabling simple forms of communication.

## **2.3 Things to consider**

Some key issues can be applied to each agent environment are reported in the following.

### 2.3.1 Creation of networks

As mentioned above, users should “identify and establish social contacts based on similar interests”, so it is necessary to provide the virtual environment of features designed to support networks of users, facilitating the creation of connections between them.

### 2.3.2 Participation

In order to make a self-sustainable community it is essential to ensure the participation of users and ensure the continuous supply of new participants and the creation of new knowledge. Many tools are required to implement this “architecture of participation” (McLoughlin *et al.*, 2007), in particular tools should:

- allow to creation and generation of ideas, concepts and knowledge;
- make possible the sharing of ideas and of digital creations on various levels, (including individual, group, community);
- able to express opinions and judgments, and possibly allow to define rules and make decisions in a democratic way.

### 2.3.3 Communication

In order to ensure a successful development of user networks, some effective forms of communication are essential. An adequate support to the communication allows the user to feel a part of the community, to participate, to interact with others, to build relationships on different levels (personal, social, occupational, etc.). Depending on the use of the environment, synchronous and/or asynchronous communication tools, tools for peer-to-peer or group communication can be adopted (Koch & Gross, 2006).

### 2.3.4 Sharing Resources

Sharing resources is an important task that a virtual environment must support through the availability of tools that allow users to start collaborative activities. In fact, sharing any resources, such as a link or file, requires the availability of tools for viewing objects in various media formats, tools for social bookmarking, tools for managing metadata to tag resources and facilitate their cataloguing, research and use. The sharing process also requires tools that allow users to provide feedback in terms of comments and expressions of satisfaction about the shared resource. This aspect has great importance in training activities since publishing and presenting own work to a wide audience of learners, gives benefit for the opportunities to take control of new ideas, and thus improve and expand the production. Among other sharing tools, event

management systems and collaborative system for resources creation can include in addition to collaborative authoring tools and/or editing of documents, (McLoughlin *et al.*, *Op.cit.*).

### 3 Co.S.M.O.S: Collaborative Social and Multimedial Operating System

The Co.S.M.O.S. virtual environment is designed following the guidelines presented in the previous section. Co.S.M.O.S. provides WebOS typical tools that allow access to documents for viewing it and editing, retrieving documents and data stored in databases; the contents evaluation. The integration of a social network in Co.S.M.O.S. allows the user to enter into a social network in which to carry out operations such as to share files, messages and media; to exchange various kinds of information and events; to create groups. Finally, it is possible to use the knowledge management environment for knowledge sharing in different contexts, and independently by the social network functions, so it's possible to work on the same material at different times and from different places.

A single virtual environment offers tools in order to integrate personal users' scope to social and professional aspects, the user can choose the level of integration between the three areas: materials that are individually created can be of interest in a working group whose members can belong or not to own social network.

Through Co.S.M.O.S., the growth of a community it's favoured and the user is encouraged to achieve goals at personal, social and work areas through the acquisition of new knowledge by sharing. Moreover users can acquire more visibility through the possibility of show results of their work and thereby to gain the trust of other members and establish its reputation in the community by gathering consensus on their work.

From a functional point of view, Co.S.M.O.S. is a client - server application and its architecture schema is shown in Figure 1.

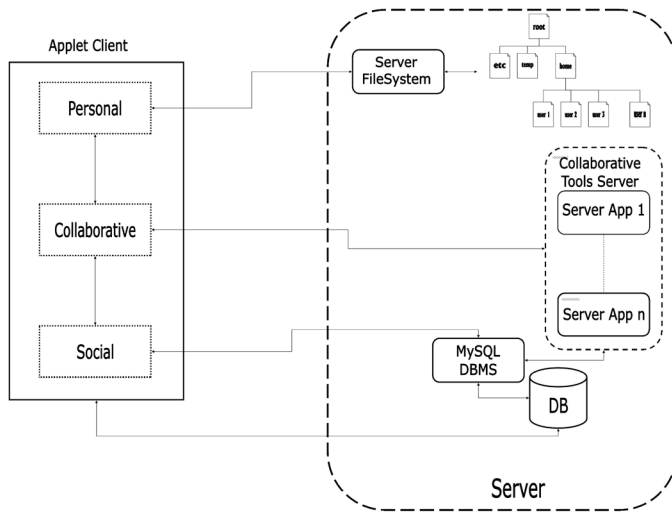


Fig. 1 - Co.S.M.O.S. Architecture

The client side of Co.S.M.O.S. offers three operating environments: “Personal”, “Collaborative” and “Social”. It presents an applet that is embedded in a web page and simulates a typical desktop of the most popular operating systems currently used (Figure 2, Figure 3).

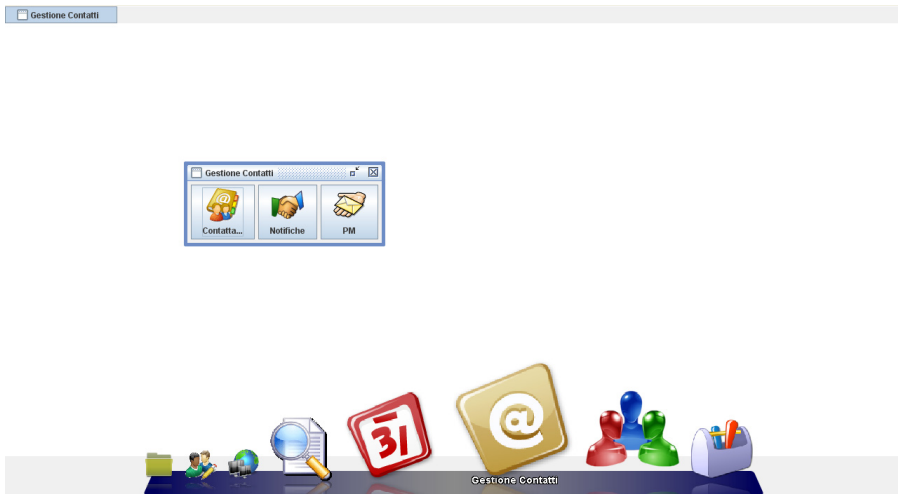


Fig. 2 -: Co.S.M.O.S. - Client Side

The main applications that are provided allow:

- productivity (text editor, spreadsheet, image editor, etc...);
- the view (viewers for various audio / video and images, PDF file viewers, etc.. ...);
- communication (instant messenger, email and rss reader, etc.. ...).

The “Personal” environment includes these applications and they refer to a “personal” file system. Each file is stored in an area of the server that collects the workspaces of every user.

The “Collaborative” environment includes the necessary tools to implement real-time collaborative activities, such as the creation of working groups, sharing of files and their modification (these transactions take place in an area completely separate from file system Personal users) or to make records, communication tools (such as a bulletin board, Figure 4) etc... Each instrument of this section refers to a server application that handles the communication and information exchanged between users who work within the same group.

TABLE 1  
COSMOS DB TABLE GROUPS TABLE

FIELD	DESCRIPTION
id_gruppo	Group id
nomegruppo	Group Name
descrizione	Group description
open	Indicates if the group is an open group or not. 0=reserved 1=open

In the “Social” area, applications allow users to access the social network. Co.S.M.O.S. refers to a MySQL DBMS to manage a database that contains all the tables necessary for storing information (eg registry of users, personal profile, contacts, private or shared files, information about groups, news from the Social network or working groups, etc.). Table 1 shows one of the tables used to manage the large amount of information necessary for the prototype functioning.

As shown in Figure 1, the server side includes various applications that implement the individual features of the server. This allows, in case of an application crash or a slowdown due to the number of connected users, to continue to work with the functionality of system that does not refer to server overloaded. For example, the chat server builds own connections, independently from those created by other servers. Even uploading files within groups for use in their collaborative activities is through a server for uploading and



downloading files to a different space than the personal file system. If the server that implements the personal file system is not working the user can still work on the files of the group.

Regarding the implementation issues, it must be pointed out that, since the client side of Co.S.M.O.S and the server side have been written in java so that the system is completely portable. In fact, the presence of a Java Virtual Machine allows the application to run on both the server computer and on the client. The user simply by accessing the web page that integrates the client applet, using browser, can actually access to all functionalities of Co.S.M.O.S. Nevertheless, the use of Java guarantees equal behaviour in the operation of the system with different browsers, thus avoiding possible confusion for users.

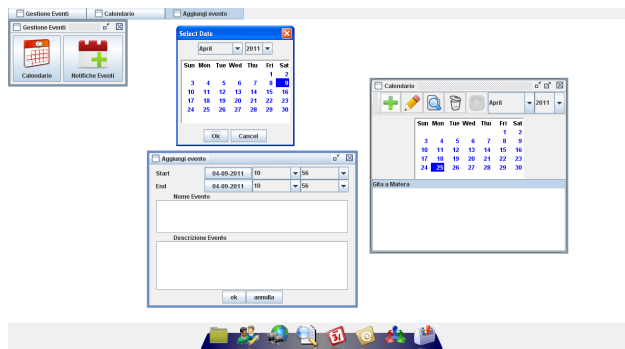


Fig. 3 - Co.S.M.O.S. - Application for event management

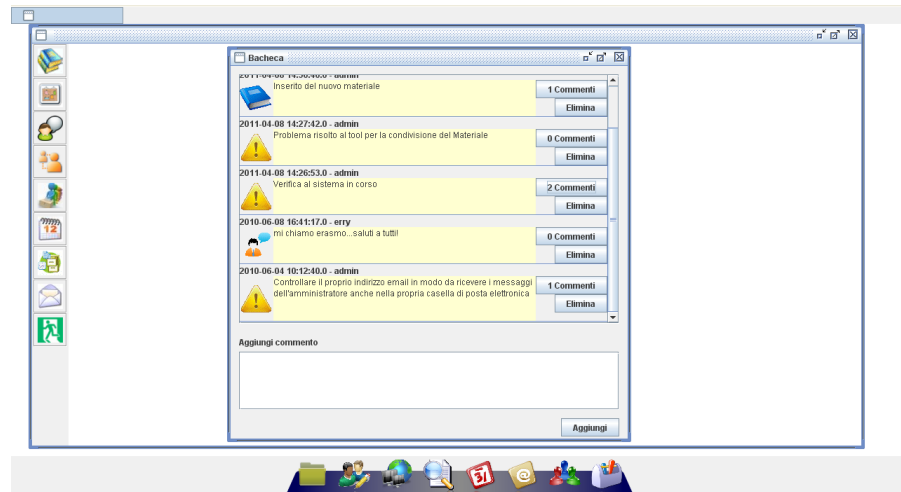


Fig. 4 - Co.S.M.O.S. - The Board of a group

## Conclusion

This article presents Co.S.M.O.S., an integrated virtual environment that consists of a WebOS, an environment for the collaborative activities development and a social network. Co.S.M.O.S. offers advanced features to support real-time collaborative activities through the use of tools for information sharing and collaboration among users. These actions are facilitated by the possibility to use the system anywhere and from any networked computer as Co.S.M.O.S. is perfectly portable.

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