ABOUT CREATIVITY IN COLLABORATIVE SYSTEMS
Why it Matters and How it can be Supported

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Abstract: Collaboration is about creating a shared understanding and build on sparks of dissent. Generate insight, new ideas or new artifacts is the rationality behind collaboration. Collaboration is based on communication, coordination and cooperation but extra components are still missing in order to allow team members to express their creativity. Creativity is goal bounded and requires that alternatives are analyzed and relevant ones selected and followed. It requires externalization objects to store mental efforts and form the basis for critique and negotiation. This aspect of collaboration requires tools like project and risk management and especially a flexible and integrated method of handling content.

1 INTRODUCTION

The term collaboration is used often when one refers to quite different aspects of working together, like co-operation or even communication. Collaboration derives from the Latin *collaborare* that means to work together and can be seen as a process of shared creation. In a general sense collaboration represents the act of working with other persons in order to accomplish a common goal. The act of collaboration can be viewed from multiple perspectives depending on the aspects on which we focus our attention.

Collaborative systems handle collaboration mainly without taking one essential characteristic into consideration, namely creativity and creative insight. Collaboration is based on building a shared understanding starting from different points of view and uses consensus building to negotiate the content. This process requires tools to organize the work, but requires also an integrated content management solution so flexible that will serve users as an extension of their thinking process. In this paper we will analyze the requirements for such a collaborative system and provide an overview of our model that handle these issues.

The paper is organized as follows. Section 2 identifies what collaboration represents and what does it mean efficient collaboration. It also discusses one main drive element, namely creativity and its prerequisites. Based on these findings, Section 3 will prese-

nt our model of collaborative system, and discuss the identified components. Section 4 draws some conclusions and describes future plans for the model.

2 COLLABORATION

In this section we will present some definitions for collaboration and identify elements that represent the backbone of collaborative processes and focus our attention on one particularly element, creativity.

2.1 Defining Collaboration

Focusing on national programs that involve agencies David Osher in (Osher, 2002) identifies collaboration as being the most sophisticated level of relationship because it requires efforts to unite people and organizations in order to achieve common goals that could not be achieved by any single individual or organization acting alone.

On the other hand, in (Camarinha-Matos and Af-sarmanesh, 2008) collaboration is regarded from a more project management oriented point of view focusing on the elements required to achieve this level of relationship. Collaboration is identified as a process in which entities share information, resources and responsibilities to jointly plan, implement, and evaluate a program of activities to achieve a common goal. Following this author, collaboration is a process

of shared creation that involves mutual engagement of participants to solve a problem together and implies sharing risks, resources, responsibilities, and rewards. Sharing risks, resources, responsibilities, and rewards can also give the group to an outside observer the image of a joint identity.

This approach implies that collaboration is more than what will later see that is identified as cooperation by adding joint identity and novelty to the goal. Michael Schrange in his Shared Minds (Schrage, 1990) focuses especially on this novelty of the group's goal. Schrange considers collaboration as a process of shared creation: two or more individuals with complementary skills interacting to create a shared understanding that none had previously possessed or could have come to on their own.

Collaboration is often confused with cooperation. Because for many people the two terms are indistinguishable (Camarinha-Matos and Afsarmanesh, 2008), in the following we will take a closer look at what collaboration is and how can it be attained. One general accepted model that describes what is collaboration and what are its main components is the 3C Collaboration Model (Camarinha-Matos and Afsarmanesh, 2008). This model states that collaboration is attainable by implementing three main processes: communication (networking), coordination and cooperation.

Communication (Fuks et al., 2008) is the starting process in each collaborative process. It is a general belief that efficient or so to say "ideal" communication will provide better common understanding or agreement but when people communicate accurately they realize more precisely the differences that exist on their perspectives of the concepts in use (Denise, 1999). Different types of agreement tend to mask the differences in perception that accurate communication would uncover.

The second process required by the 3C model is coordination. Coordination refers to (Fuks et al., 2008) the management of people, their activities and resources. Coordination allows team members to manage conflicts and activities in order to increase the efficiency of communication and cooperation efforts. Networking or communication is used as a foundation (Wolff, 2005) but involves also altering activities for mutual benefit and for a common goal. It also increases resource usage efficiency and the ability to meet the targets.

Cooperation refers to the interaction among group members in order to produce, manipulate, and organize information, or build and refine cooperation objects like documents, spreadsheets etc. (Fuks et al., 2008) This process requires a shared workspace that

should provide the required tool in order to manage these artifacts, tools like version and access control and authorization. The shared workspace is very important because it allows group members to count on group memory and it provides also some basic awareness mechanisms.

Cooperation, coordination and collaboration are often used interchangeably, but they should be describing different stages in the transformation of the relationship between groups and organizations (Osher, 2002). The backbone of collaboration is not the process of relationship but the strict following of a specific result (Denise, 1999).

2.2 Creativity

The rationality behind collaboration is creativity. Creativity, and especially scientific creativity, is a process of achieving an outcome that is recognized as innovative by the relevant community. As defined by Csikszentmihalyi in (Csikszentmihalyi, 1997), this process does not happen inside one person's head, but in the interaction between that person's thoughts and a socio-cultural context.

Creativity can refer to the work of artists, but can also refer to everyday problem-solving abilities. This type of creativity is essentially equally important because enables people to become more productive and create better results. Farooq (Farooq et al., 2005) identified as essential requirements for creativity the followings:

1. support divergent and convergent thinking;

2. support development of shared objectives;

3. support reflexivity: obtaining immediate feedback is essential in having complete involvement in the task at hand (Csikszentmihalyi, 2008). In the context of a group this refers to the extent to which members collectively reflect on the group's objectives. This process is known as reflexivity and consists of three elements: reflection, planning and action or adaptation.

Reflection is based on critical thinking because it implies evaluating what divergent thinking offers, filters it using acceptability criteria and selects the ideas that will be further taken in consideration. Planning creates conceptual readiness for relevant opportunities and guides group member' attention towards actions and means to accomplish goals. In order to provide support for this issue, tools from project management must be implemented. Action or adaptation refers to the continuously renegotiation of group's reality during interaction between group members, and members and environment. Adaptation consists in

goal-directed behaviors that are relevant to achieving the required changes in group objectives, strategies and processes identified by the group during the stage of reflection. An integrated risk management approach can take care of the details implied by adaptation.

Externalization objects are essential to collaboration (Arias et al., 2000) because they *a)* create and store a record of our mental efforts, record that is outside the memory; and *b)* represent artifacts that provide us information and form the basis for critique and negotiation. Very important assets for a group or organization are not only the results but also the way people think, the way they get to god results. It is a great challenge to try to capture the thinking process in tools that are very easy and intuitive to use.

3 THE FOURTH "C"

Following what we have discussed earlier, we consider that an extra element must be added to the 3C model of collaboration, namely "Creativity". In order to support creativity in collaborative systems we consider that *a)* integrated light-weight project and risk management, and *b)* flexible content management tools have to be implemented.
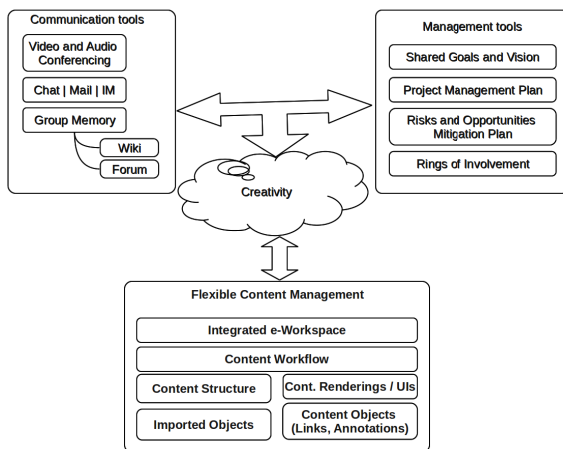

Figure 1: The 4C Collaboration model.

In order to discuss about collaboration, a key prerequisite must be satisfied, namely having a joint/ compatible goal or problem to solve (it is not enough that parties have their own individual goals) (Camarinha-Matos and Afsarmanesh, 2008). A vision specifies the scope and extent of these benefits but does not provide the means to attain them. Project management is a tool used to provide a team the capabilities required to produce the benefits defined by vi-

sion (Hilson, 2006). Vision delineates a *strategy* and project management sets the *tactics* by detailing the steps required to put it in practice. Teams can successfully implement their vision if they can bind it with the tactics.

Divergent and convergent thinking is one essential requirement for creativity and since full consensus may not always be achievable and sometimes has to be replaced by informed compromises, some aspects from risk management can be used to support the collaborative process. Hilson (Hilson, 2006) identified that a "zero risk" zone not also that it does not exist, but it is not even desirable because the available benefits are determined by the degree of risk it is confronted. Risk is defined as (PM Institute, 2008) "any uncertain event or set of circumstances that, should it occur, would have an effect on one or more objectives". Thus an uncertainty that does not effect the objectives is not a risk, but it can even be an opportunity. Risk management it is an important component in defining the relationship between risks, uncertainty and objectives thus contributing to the chances of success in the execution of a project.

On the other hand, creativity is based on externalization objects to create and store mental effort records and form the basis for critique and negotiation. A shared workspace that integrates different tools to manage these artifacts is also required. We consider that a flexible content management solution can satisfy these prerequisites.

Project management is about making complexity manageable and it is important to collaboration because it provides teams an organized way of keeping in touch with their goals. As defined by The Project Management Institute (PMI) (PM Institute, 2008), project management is "the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements".

Project risk management provides approaches by which uncertainty can be understood, assessed, and managed within projects. One of the key prerequisites of success in implementing risk management is to have a proactive approach. This process must supplement project management and must follow a holistic approach. Risk management will not provide great benefits to the teams using it if their practices fall under two limitations: focus on tactics and focus on threats (Hilson, 2006).

Content management is the process of creating, updating and publishing content on-line (Bartlang, 2010). Content management systems (CMS) represent solutions that manage the life cycle of content and has to ensure that the integrity and meaning of the content is not altered by the system. A flexible content

management component is an essential requirement for a collaborative system. Such a component must be focused on intelligent content (Rockley, 2011).

Our model of content management states that such a system must include the followings:

- a mechanism to define the structure of the document;

- a mechanism to create renderings for the content;

- access control;

- content workflow;

- a mechanism that would allow users to import content from different sources;

- provide a packaging mechanism to group structure, renderings and workflows in a single object so that they can be exchanged, reviewed and updated;

- a mechanism to integrate web services that handle content import from different formats and the display of special content (e.g. protein structure).

We consider that a framework that implements the aforementioned requirements using the XML stack of technologies can serve as a flexible externalization mechanism in order to support creative insight in collaboration and together with management tools increase the teams changes in reaching their goals.

4 CONCLUSIONS

The rationality behind collaboration is creativity. Collaboration uses communication, coordination and cooperation as a backbone but it is seen as something more than that. It is about creating shared understanding that no member could achieve on his own and in order to generate insight, new ideas or new artifacts it is a necessity to bring together different and often controversial points of view.

Collaboration can be achieved if defined in a goal oriented framework and should use knowledge from project and risk management to increase the chances or obtaining the envisioned deliverables. These tools can lead to successful achievement of objectives, but they are not sufficient.

Externalizations are of great importance because they create a record of the mental process and represent artifacts that form the basis for critique and negotiation. Using a flexible approach toward content management externalization objects can be created. In order to be able to focus on the creative aspect of collaboration an emphasis on "intelligent content" has to be placed.

Our next steps will represent finishing the implementation and do an analysis of its efficiency by using it for some projects in our university and parter universities.

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