Framework for Collaborative Web Applications

Ioakim Makis Marmaridis and Athula Ginige

AeIMS Research Group, School of Computing and IT,
University of Western Sydney, Sydney, Australia
makis@cit.uws.edu.au, a.ginige@uws.edu.au

Abstract. Traditionally organisations have been collaborating to complement one another's capacity and capability. The nature of these collaborations has been long-term, taking a long time to establish, and leading to fairly rigid IT infrastructure to support these. Now organisations are beginning to collaborate on specific short-term projects, established in a short time and are highly volatile driven by varying degrees of trust and need. A new IT framework for collaborative web applications is needed to support this type of dynamic, short term, opt-in and opt-out approach to collaboration. Building on our previous work on a peer to peer architecture for Dynamic eCollaboration, we propose a framework that allows web applications to be exposed to business partners by enabling selective information and business logic sharing. This information sharing is end-user driven, easy to perform and secure. We believe this framework effectively addresses the needs of Dynamic eCollaboration bringing us closer to realizing its full potential.

1 Introduction

Today's marketplace is extremely competitive, and the survival and growth of an organisation is very much linked to its ability to be agile, to sense and respond to market changes and be able to obtain efficiencies where others fail.

Traditionally, organisations have found that collaborating and building strong business relationships has been an effective way of surviving and growing in the market [1]. We define collaboration as "to work together, especially in a joint intellectual effort" [2]. This is by no means a new term and it is not even directly relevant to information technology. Collaboration has been well known to happen many centuries before computers were invented, or even electricity for that matter. With the advent of computers in businesses, the term eCollaboration was born to mean "the use of internet based technologies to enable continuous automated exchange of information between suppliers, customers and intermediaries" [3].

In the recent past a new type of collaboration has emerged that is now termed as Dynamic eCollaboration. Contrary to eCollaboration as discussed previously, Dynamic eCollaboration involves very flexible relationships between business partners and facilitates common work on typically short to medium term projects. New relationships can be created almost ad-hoc, and taken down just as fast with organisations being able to realise a truly distributed "sense and respond" approach in their business operations.

In the course of working with a group of SME Toolmakers, helping them embrace Dynamic eCollaboration, we have identified the lack of necessary ICT framework

that can support this and other similar collaborative efforts [4]. We have identified the specific features required by such framework and how Trust and Need influence those features. Based on our experience of working with the Toolmakers, in this paper, we present a new framework that facilitates sharing of information and business logic. It is based on a pure peer to peer (P2P) [5] [6] architecture for Dynamic eCollaboration [7] and it is end-user driven, simple to operate and secure.

2 Drivers and Need for Dynamic eCollaboration

Dynamic eCollaboration depends on and is driven by two distinct factors – Trust and Need. Although these are not new in Dynamic eCollaboration, they greatly influence the degree of information exposure and sharing of applications in collaborative projects. After both Trust and Need are established, a suitable IT infrastructure must also be in place to facilitate the actual sharing process. However what is suitable from an IT point of view to support traditional eCollaboration falls well short of the requirements for supporting Dynamic eCollaboration. Here change is constant while projects are short term and participation to those nearly ad-hoc, the time frames are compressed and therefore the impact of fluctuations in the levels of Trust and Need are exaggerated placing new requirements and demands upon the underlying IT infrastructure supporting the Dynamic eCollaboration effort.

2.1 IT Infrastructure Issues in Dynamic eCollaboration

There are some fundamental differences between eCollaboration and Dynamic eCollaboration projects. They both have different characteristics that put particular requirements upon their respective support IT Infrastructure. The following table summarises those differences.

Table 1. Characteristics of eCollaboration projects versus Dynamic eCollaboration projects

Characteristic	eCollaboration	Dynamic eCollaboration
Project startup time	Significant. Enough to allow infrastructure setup by IT staff and exchange of data formats, applications, access control etc.	Very short. IT infrastructure must be mostly in place ahead of time and used with minimum configuration.
Project duration	Long enough to warrant the involvement of expert IT staff to manage the infrastructure.	Very short term. Impractical to involve IT staff. Low overhead and fast action needed.
Upfront knowledge of sharing requirements	Mostly well known and communicated to IT staff in order to configure systems accordingly.	Not known. They will be influenced by fluctuations in Trust and will be discovered as the project progresses.
Project value (\$)	Sufficient to cover IT staff expenses for setting up and managing the infrastructure.	Not very big. Can not justify the ongoing involvement of IT staff.
Timeframe for addressing changes to project needs	Medium to long term. Enough for the supporting rigid IT infrastructure to be adjusted.	Short term. Changes to requirements must be addressed immediately. No room for unproductive time.

As the table above clearly shows, Dynamic eCollaboration has got some very unique characteristics. In traditional eCollaboration IT staff is in charge of establishing and maintaining each project as well as enabling the actual data sharing between parties. They achieve this typically through using a mix of technologies such as VPN, FTP and DB exports or in some cases special purpose frameworks [8-10]. This proves not effective enough to cater for Dynamic eCollaboration however where the continuous involvement of IT staff imposes a large overhead in both time and cost. Therefore, business staff must be enabled to establish and maintain their own projects directly, assisted by an intelligent technology framework that can take care of lower lever issues, such as sharing protocols, enforcing security decisions and more. Section 3 that follows discusses our proposed framework and how we believe it can support Dynamic eCollaboration Projects.

3 A Framework for Dynamic eCollaborative Web Applications

There are four major subsystems that make up the framework that facilitates Dynamic eCollaboration. Figure 1 shows the relationships between these four subsystems.

Fig. 1. Subsystems of the framework for Dynamic eCollaboration and their relationships

The functions of these subsystems are as follows:

- **Dynamic eCollaboration Project Orchestration** – This subsystem is responsible for interfacing with the business users as they initiate, define and setup collaborative projects. It also features fail-safe checks and balances to actions requested by business staff safeguarding the security and integrity of the collaboration.
- **Network Connectivity and Synchronisation** – This subsystem enables the respective IT systems to establishing a secure communication channel over standard network communication protocols. It is able to transparently handle the distribution and caching of shared information and business logic access. It also has in-built caching mechanisms for better fault-tolerance and can intelligently work across a range of protocols such as SOAP, XML_RPC, HTTP and HTTPS or even integrate to an Enterprise Messaging Bus (EMB).
- **Unified Security and Remote Access** – This subsystem provides a unified view of the parties and individuals involved in a particular collaborative project for the purposes of security, cross systems access and information flow management.

Through the concept of virtual team mates, all participants to a project can be managed and have access rights to information given or taken from them. It features per project granular role based access control (RBAC) and offers hooks for programmatic access by applications developers.

- Information and Applications Sharing – This subsystem is capable of offering different views of the applications that can be shared throughout the project while supporting ad-hoc changes to the shared views at all times. Business users are thus empowered to expose and share different parts of their applications as this is required by the goals that they are trying to achieve in the project.

The next section describes a typical usage scenario and how the framework makes this possible.

4 A Verification of the Architecture for the Framework

The framework described in this paper has come about as a result of our intense work with several SMEs in the toolmaking industry while attempting to help them embrace Dynamic eCollaboration and increase their competitiveness. Through this work so far we have identified the lack of a suitable ICT framework for Dynamic eCollaboration, defined the requirements for such framework and have created a suitable architecture for it – all of which we have presented in this paper. The framework proposed has been verified against the overall requirements for Dynamic eCollaboration. It also fulfils the processes that the Toolmakers wish to use. Finally, the architecture of this framework is flexible and we think can fulfill similar requirements by other companies in different sectors as well.

Here are the steps we identified as necessary to carrying out a typical project using Dynamic eCollaboration:

- Project establishment – Where the interested parties agree to collaborate and use their respective DeCS to establish a computer to computer secure channel of communication and the virtual team of users for the particular project.
- Sharing a large job amongst the different SMEs – This is where by exposing parts of their web based job management application, the SME that has the relationship with the customer, will be able to facilitate the break-down of the job to its smaller parts. Once the other parties agree on who takes what part, these decisions will be recorded in the job management application and through sharing they will be available to all the parties involved.
- Quoting for each part of the job – Putting a joint or individual quote together still requires collaboration, to ensure the prices quoted are suitable and to get overall agreement for the final price. Through their respective DeCS, each SME will be able to indicate the time and materials charges, markup and final price for their part of the work. Sharing this information with the others means that each will have a complete view of the quote and its constituent parts. A view that will be dynamically updated as parts of it change.
- Tracking the job progress after winning the bid – Each SME through their own DeCS will be able to mark their progress for the part they are responsible for and share that information with the rest of the group. The sharing will be dynamic, so

any changes made to the status will be automatically reflected to the shared copies accessible by the other partners in the collaboration.

5 Conclusions and Future Work

From working with a group of Toolmakers who wanted to share some large toolmaking jobs that they are getting we identified a process that they can use. We also found that the level of information sharing can vary with time depending on the level of trust among the collaborating partners. After studying the process Toolmakers wanted to use to collaborate, we developed a generalised architecture for a Web based system that can support sharing of the information required for this and other similar Dynamic eCollaboration projects. A special feature of this architecture is that each end user can vary the depth and breadth of information they are going to expose to the collaborating partners depending on the need and the level of trust that exist at the time. We defined the four subsystems of the framework and verified the operation of each using some of the collaborative processes the Toolmakers want to use. We are now extending one of our existing technology frameworks into incorporating the ability to server as a platform for Dynamic eCollaboration.

The main contribution made in this research project was to identify the specific features required for a web based Dynamic eCollaboration system and to develop an architecture that can meet the requirements of a group of Toolmakers who want to collaborate with each other to gain a competitive advantage.

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