Simulated co-location in distributed software development: An experience report

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Abstract — Distributed software development imposes challenges because of geographical, temporal and the cultural differences in which distributed teams live in. The advances in telecommunication, media, and technology have allowed companies to develop ways to simulate physical proximity in a real-time fashion. For instance, the sharing of a real-size screen can be used to promote the feeling that people on the other side of the screen are physically co-located with those in a certain site. The adoption of tools, methods, and technologies that simulate physical proximity aims to minimize the well-known challenges faced by distributed teams. The goal of this paper is to present the experience of a multinational Brazilian company in adopting technology to simulate co-location to support their software development processes. The benefits of such simulation, such as improved communication, and challenged faced, such as infrastructure problems, are also described.

Keywords — Distributed Software Development; Real Time Simulated Co-location; Simulated Co-location;

I. INTRODUCTION

The business globalization and the technological advances observed in the last decades allowed companies to expand their operations, to explore new markets and to acquire new customers in non-thinkable countries. Software development followed the observed trend. Distributed software development (DSD) seeks to increase productivity and to reduce risks in order to obtain competitive advantages associated with cost, quality, qualified labor, and continuous development [1] [2].

Despite the benefits, DSD imposes challenges because of the geographical, temporal, and cultural differences in which distributed teams live in. In Brazil, for example, the time zone overlap with North America and Europe facilitates dense synchronous communications and helps to foster warm relationships between the Brazilians and their foreign partners [3]. Collaborative technologies (e.g., groupware) are intended to assist collaborative work, helping team members to share knowledge and expertise, and to automate activities, creating an organizational memory. Such technologies allow for the team members to be distributed in different locations [4].

The study entitled “Does Time Zone Proximity Matter for Brazil? A Study of the Brazilian I.T. Industry”, by Carmel and Prikladnicki [3] identified that Brazilian sites have different degrees of collaboration intensity, ranging from lowest level, when the individuals are emailing back and forth, to the highest level, called RTSC (Real Time Simulated Co-location), characterized when the distributed sites collaborate as if they were on the same physical space (co-located). The report also indicates that the overlap (with minor changes in working hours), collaboration technologies (with shared context), culture of team cohesion across sites, and the mastery of a common language among the participants are key elements to enable simulated co-location.

In this context, simulated co-location adopts communication, collaboration, and coordination technologies aiming to reduce the effects caused by the separation of the team members. Tools that allow team members to interact in real time with audio, video and text, in a language that is common to the all the participants despite where they are can be used [5] [6].

IT organizations are seeking to make use of the simulated co-location, to reduce the impacts and challenges that were observed when separating the teams, and making team members to communicate, collaborate, and coordinated in a similar manner to that performed in co-located environments. In order to understand how these organizations are using such tools, methods and technologies, we conducted a case study of a Brazilian IT company that employs the simulated co-location in distributed software development. In addition to observing team members to work from one of the development sites, we also interviewed participants of 4 projects in order to identify their perception about the efficiency of such simulation. This paper aims to describe the experience learned by this company.

The remainder of this paper is organized as follows. Section II presents the theoretical concepts involved in this study. Section III presents the research methodology adopted in our case study. The reporting of the observed experience about the simulated co-located implementation is presented and discussed in Section IV. Just as the benefits identified and challenges faced by the company are presented.

II. LITERATURE REVIEW

A. Distributed Software Development

Aiming to reduce the costs, to maintain the quality product, to increase the productivity, and the global competitiveness, some companies have decided to distribute their development processes [2]. The distribution level can be classified as:

- With the same physical localization (co-located): the meetings occur without difficulties and the team can interact face-to-face. Time zone and cultural differences rarely exist;
- National distance: the members are located within one single country, being able to gather together in short
that team members have a few hours of the day to interact might not have overlapping working hours. Ideally, it is wished while codification and tests can be run in another country. An alternative to distribution of the activities. For example, development this trend has also been observed, being a viable more presents in day-by-day organization tasks. In software and time zone differences, to the technology, management and engineering, to the people, as for example, trust and cultural has some inherent challenges to the process, as requirements D. Distributed software development is characterized by the contribution between the departments of the organizations through the creation of global developer’s teams. They can belong to different nationalities, have distinct cultures, and work from different time zones, in a project that has common objectives to all locations [7] [8]. Some of the factors that have contributed to the increase adoption of distributed development are [9] [10]: The need to capitalize on the global resource pool to successfully and cost-competitively use scarce resources, wherever located; The business advantages of proximity to the market, including knowledge of clients and local conditions, as well as the good will engendered by local investment; The quick formation of virtual corporations and virtual teams to exploit market opportunities; Severe pressure to improve time-to-market by using time zone differences in “round-the-clock” development; and The need for flexibility to capitalize on merger and acquisition opportunities wherever they present themselves. As well in the co-located software development, DSD also has some inherent challenges to the process, as requirements engineering, to the people, as for example, trust and cultural differences, to the technology, management and communication, which are related to the geographic dispersion and time zone [2]. B. Simulated Co-location Due to the business globalization, where local markets became global, collaboration technologies (e.g., groupware) are more presents in day-by-day organization tasks. In software development this trend has also been observed, being a viable alternative to distribution of the activities. For example, requirements analysis can be performed in a certain country while codification and tests can be run in another country. Depending on the level of distribution of a team, it might or might not have overlapping working hours. Ideally, it is wished that team members have a few hours of the day to interact synchronously with their remote colleagues [6]. However, when overlapping hours are not an option, team members lack the opportunity to interact with others during working hours. Communication media such as e-mail and wikis allow team members to asynchronously work with their remote colleagues without needing overlapping hours. A study conducted in Brazil found evidence that the country benefits from the time zone overlapping with countries in North America and Europe [3]. It is known that methods, tools and technologies can be adopted in distributed software development aiming to assist communication, collaboration practices [11] [12] [13] [14] [15]. The simulated co-location through the use of these tools is intended to offer the perception that those involved in software development are close to each other even when they are an ocean apart. The goal is to promote interaction between the team members, increasing the frequency of communication and the trust among members that would not meet otherwise [16]. Although there is communication, collaboration and coordination between teams that working in distributed settings, no studies were found in literature about the adoption of simulated co-location in software development.

III. RESEARCH METHODOLOGY

We conducted a case study to develop the understanding of how simulated co-location is being adopted in real-case scenarios. We investigated one large Brazilian IT company that has offices around the globe. In this section we report on the findings of our case study, highlighting the benefits and difficulties faced by the project teams at this company. We also present the solutions adapted by the teams to certain situations regarding the use of simulated co-location.

A. Data Collection and Analysis

Semi-structured interview was the method adopted to collect data in our case study. We designed two semi-structured scripts to guide the interviews. One script focused in collecting organization decisions in the adoption of this resource and perceptions of the benefits about simulated co-location. The second script focused in collecting technical information about how simulation co-location is adopted in practice by the development teams. Questions about challenges faced and benefits perceived were collected from developers, testers, and other technical roles in a project. A total of 12 interviews were conducted in the company headquarters in Brazil in March of 2012. Three senior managers were interviewed representing the organizational perspective and nine technical people (4 developers, 2 requirements analysts, and 3 project managers) were interviewed representing the development team. The interviews were voice recorded for future transcriptions.

Data were analyzed through the process of transcribing the interviews, identifying keywords and themes, and grouping the findings as they emerged in the analysis process. Since this study reports on the identification of how simulated co-location is adopted in practice, reporting on the experience of a certain company, statistical analysis or more in-depth analysis techniques were not considered necessary.


B. Characterization of the Organization

We investigated a Brazilian multinational company that has software development centers in China and Argentina, and offices that attend customers in the United States, England, and Japan. The organization has over 1400 collaborators working around the globe. Agile methodologies and Lean principles are adopted to guide software development and the maintenance of legacy systems as well as the services provided in customizing SAP products and creating business intelligence solutions. The company also provides cloud computing and mobile solutions.

C. Research participants

All the respondents have a degree in the Information Technology (IT) area. They are 30 years-old in average with an average experience of 12 years of work with IT, and of 4 years working in distributed settings. They have been working, in average, for 3 years with agile methods and for 5 years, in average, in the company.

IV. FINDINGS FROM THE STUDY

We present here the identified ways simulated co-location has been adopted in the company. We also report and discuss the benefits and challenges faced by the project teams.

A. The adoption

The company has some projects that already used and others that still are using the simulated co-location. Its application occurs in different forms and to attend different objectives different. Table 1 presents the projects investigated in our interviews. We indicate he current status (in use or stopped), the infrastructure used in the project, the time simulated co-location has been adopted for the project.

<table>
<thead>
<tr>
<th>ID</th>
<th>Current status</th>
<th>Distribution</th>
<th>Infrastructure</th>
<th>Time of use</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>In use</td>
<td>Brazil and Argentina</td>
<td>Computer and webcam</td>
<td>8 months</td>
</tr>
<tr>
<td>C2</td>
<td>Stopped</td>
<td>Brazil and Argentina</td>
<td>TV and camera</td>
<td>5 months</td>
</tr>
<tr>
<td>C3</td>
<td>In use</td>
<td>Brazil</td>
<td>TV and camera</td>
<td>2 months</td>
</tr>
<tr>
<td>C4</td>
<td>Stopped</td>
<td>Brazil and United States</td>
<td>Computer, webcam and iPad</td>
<td>3 months</td>
</tr>
</tbody>
</table>

The customer (C1) has four teams, three located in Brazil offices and a new team that is being assembled in Argentina, adopt simulated co-location for about 8 months with the goal to offer more agility to support the work that has to be performed and to reduce the costs of phone calls among the sites. It is also used to know if the other teams members are present and, to facilitate communication intended to clarify requests between the teams.

Currently the team has one monitor and one webcam located in the wall in front of the team. The team members sit one front of another in a way that all members can see the camera and the monitor screen. For the conversation between sites they use Skype that offers a limited number of participants in the calls. Skype also has problems with suddenly stopping transmitting the video stream and of abruptly interrupting the exchange of messages. When these problems occur, they end the call and initiate another one. They have previously tried Microsoft Live Messenger (MSN) and Oovoo for voice and video conferences but have decided to adopt Skype despite the eventual issues faced during the calls.

The development team of the client (C2) has a project distributed between Brazil and Argentina and has approximately 30 collaborators in each office. In this project, simulated co-location was used during 5 months. Although its use has started about 1 month after the beginning of the project, the simulated co-location was used to introduce people to each other, to help team members to clarify questions, to highlight important issues, and control the project backlog.

The software development teams of this project had a TV with a camera, located in a wall next and that almost all of the tables of the collaborators. Skype was the software adopted to support communication in this project. Sometimes the team held meetings in a distinct room avoiding to disturb the developers’ work. When the subject discussed was supposed to be known to a few members only, they also booked another room to discuss the matter. The equipment is currently turned off, therefore they are not being used for the teams.

Simulated co-location is being also used for the monitoring and tracking of four projects of a national client (C3). For these projects, simulated co-location has been adopted for about 2 months. The use one TV with a camera that is located next to the development team, and another TV and camera that are installed in a conference room located in the client, possessing a 3G modem to connect to internet. Because of the infrastructure settings, in these projects, the equipment is used for scheduled meetings only.

After the installation of the equipment in the client, the responsible for each of the four projects have tested the equipment without a manual or how to guide. For specific meetings also it is used a conference room in the headquarters of the company. In these situations, a notebook and a projector are used.

At first, because the customer (C4) did not know who was on the other side of the call, he felt uncomfortable speaking at the meetings. To fix it, the company proposed the adoption of simulated co-location in this project. The Brazilian development team started to use one computer with a webcam, while the project manager located in the USA used his iPad to make the calls and manage the project. This change made the customer satisfied with the new configuration.

Although has been acquired a TV with camera of better resolution for the meetings between the development team and the project manager of C4, the use of simulated co-location had its frequency diminished until it stopped after 3 months of adoption. They stopped adopting it because the client could not always be connected the project schedule was tight.
B. Benefits

To have the visibility of the work environment of another team, observing the absence of one collaborator or then if this is busy in the telephone or talking with another person, are the positive points verified from the adoption of simulated co-location in the company. The findings suggest that the simulated co-location was beneficial for the distributed teams. Some reasons mentioned by the team members, among others, are: a more efficient communication process, saving time, optimizing coordination needs and facilitation work overall.

The communication between the distributed teams using simulated co-location allowed the sound reproduction and image to be clearer. Because they have more room than the desktop, it is possible to make signs, gesticulate, and describe in a richer way concepts, making things clearer and more concise. It is possible to observe the reactions of the collaborators or clients. For instance, people can perceive if their colleagues are understanding or not what is being said from their face reactions. The fact to visualize an error or one existing problem accurately as this occurs in the client environment also is a practical example of perceived benefit from the use of simulated co-location in the DSD.

With regard to collaboration between distributed teams, the respondents indicated that there was an increase in the interaction between the employees after their saw each other on the TV screen. Although the use of simulated co-location has been discontinued in some projects, it was noted that the use of Skype has become more effective and increased interactivity between the employees after their saw each other on Skype. This demonstrates that the adoption of Skype has not replaced the presence meetings.

As reported, the use of simulated co-location for DSD has enabled decision-making and problem solving. Managers and project leaders benefited from quickly delegating activities and responsibilities to others during the meetings. The adoption of such resource allowed the teams to easy coordination and communication as if they were physically co-located.

C. Challenges

The occurrence of delay in the transmission of image, the difficulties with the connection of the 3G modem, and the localization of the equipment, that does not allow visualizing all the participants or the work environment, have been the main problems identified during the simulated co-location. These problems are associated directly to the infrastructure, which is the main obstacle for accomplishing simulated co-location with distributed. Technological evolution has enabled many innovations in the recent years, but these are still not available in all markets, for example, the 4G network in Brazil.

In presenting the idea to use the simulated co-location, for a client or to an internal team, it is important to present the features and benefits that add business value and increases productivity. Moreover, is necessary to encourage their use in day to day, even in the most critical moments that occur during software development cycle. In this sense, the participation of a person with experience in simulated co-location to propose the use in certain activities and encourage the use is valid, both the beginning and when the schedule is tight. For the client it is important to show that simulated co-location is a tool to assist and not replace the presence meetings.

V. CONCLUSIONS

Although there are no studies to our knowledge that report on the use the simulated co-location in software development, this study showed that this idea is valid for distributed teams and that have small differences of time zone. Give the perception to that these teams are close to each other, stimulates these collaborators to interact more and to communicate with more clarity, avoiding misunderstandings. Simulated co-location can also be adopted to discuss issues in the client environment. The infrastructure problems faced still are challenges to be overcome.

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REFERENCES


