Shared Message Boards for Smart Enterprises

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Abstract. Shared Message Boards foster communication practices within restricted groups that typically do not emerge in traditional social networks. In this article, we describe an experiment in which a Shared Message Board technology was employed to support carpooling activities in a large company in Brazil. Based on the results extracted from the platform and from two user studies, we identified important elements influencing the adoption of this technology as well as other activities where it can be effectively used in order to promote the development of smart enterprises.

1 Introduction

Nowadays, it is possible to observe the existence of a large number of technologies supporting group communication. In particular, general-purpose solutions such as WhatsApp, Google Hangouts, Twitter, Facebook, and Google+ became so popular that they are used in virtually every communication-oriented activity. However, there are scenarios for which privacy and context-based features provided by these application are still unsatisfactory. Simultaneously, there is an increasing demand for highly personalized tools (such as Google Now) which are heavily dependent on contextually rich data.

This setting motivates the investigation of community-oriented tools, since applications tailored for restrict groups are more prone to adoption and able to nurture the emergence of special kinds of communication elements within the target audience. Consequently, they have the potential to generate context-specific data that cannot be easily extracted from general-purpose social networks. Another important research question consists of the identification of use cases where such tools could be more easily adopted.

Previously, we presented a Shared Message Board technology tailored for low-income communities [18]. In this work, we report the experiences we had with this application tailored as a carpooling tool for employees of a large company in Brazil. A qualitative field research showed that this topic was not appealing for the target audience, and a quantitative survey was conducted to support the identification of topics for which this technology can be more successfully applied.

This article is structured as follows. In Section 2 we present practical motivations for this research and discuss related work. Section 3 describes the Shared Message Board technology used in the experiment. Section 4 describes our carpooling case study as

well as follow-up qualitative and quantitative studies. We discuss lessons learned on Section 5 and finally conclude with potential directions for future work in Section 6.

2   Motivation and Related Work

This work is part of an extended research effort to investigate how computer-mediated communication tools can be employed in the enterprise. Namely, we are interested in understanding how individuals can use this technology to collaborate and socialize more effectively, and in providing better support to context-specific group tasks in the workplace.

Our research builds on previous findings in social media for local communities. In particular, this work was initially influenced by the Community Resource Messenger [15], a platform that has been implemented and deployed at shelters for homeless individuals. In another relavant effort, a system called Mobicomics [16] enabled people to create content for panels displayed in public locations using mobile phones. An important finding was that the solution fostered collaborative activities although it was not primarily designed for that.

Some articles have focused on the exploration of digital board applications on public displays. Brignall and Rogers [10] investigated challenges on the adoption of shared message boards. The authors indicated that a big barrier for citizen engagement with public displays is social embarrassment, and based on practical experiments they proposed models of interaction with such systems. Panorama [20] was created as a public display system designed to foster playfully-mediated social awareness of staff members in a department, and presents information about the environment like pictures on a virtual gallery. The Notification Collage [13] allows for co-located and distributed members of a community to publish media elements (*e.g.* pictures, videos and sticky notes) on a shared virtual board accessible on both public and personal displays.

Other interesting articles have addressed the use of text messaging for group communication. Battestini *et al.* [4] performed a large scale study on the use of text messages by teenager students in the United States. Their results indicated that students communicate with a large number of contacts for extended periods of time, engage in simultaneous conversations with many contacts, and often use text messaging as a method to switch between a variety of communication mediums. More recently, Church and Oliveira [11] investigated the motives and perceptions of using the WhatsApp mobile messaging application compared to traditional SMS. They found that while WhatsApp offers benefits such as cost, sense of community, and immediacy, SMS was still considered a more reliable, privacy preserving technology for mobile communication.

Finally, a large body of research has been dedicated to study the use of different communication tools – email, blogs, wikis, microblogging, social networks etc. – in the modern workplace ([3], [14], [19], [21]). In this work we go a step further by not just assessing existing communication tools but also reporting on the use of a shared message board implementation in a company over a 5-month period.
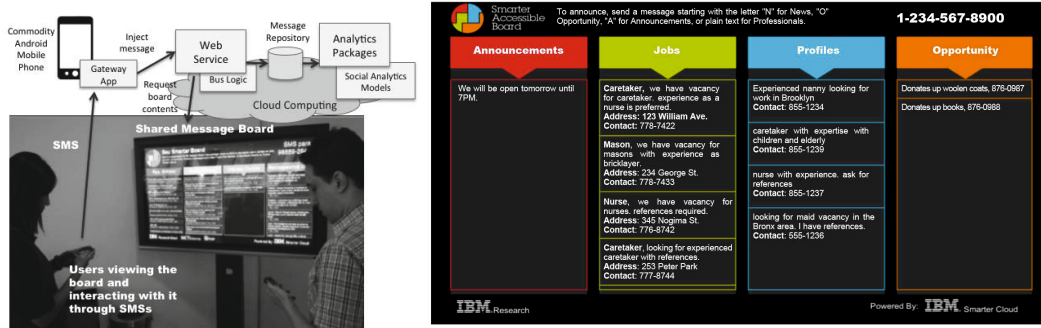
Fig. 1. On the left, an example of interaction with the Shared Message Board; on the right, a Shared Message Board interface customized for a job-seeking scenario

3   The Shared Message Board

In [18], we introduced a Shared Message Board tool whose main goal was to support ethnographic studies involving groups of people with disabilities in Brazil. The main conceptual goals guiding its design were the following: (i) enable easy technology absorption; (ii) incite meaningful social interactions; and (iii) facilitate the engagement community members. Since the proportion of individuals with difficulties to deal with technology within these groups is relatively large, this technology was designed to be easy to deploy and to allow for SMS-based user interaction. In this article, we discuss the application of this tool to the enterprise environment.

The Shared Message Board is a web-based tool whose goal is to foment community communication in the form of a digital board to be placed in open areas where it can be visualized by the target audience. It is embodied as a physical display, running a *public panel* specially tailored for that community; the interface design was conceived for Smart TVs due to their popularity and large screen space, but it is also suitable for traditional desktop monitors.

A public panel comprises a list of topics organised as *columns* (up to 4). Each column contain *messages* – contributions from community members – which are automatically refreshed with a slow scroll down animation to display all content. Messages are sent to the system through SMS, submitted to an unique phone number associated to this public panel. Users can choose which column to post on by adding an *identification character* (see example in Figure 1) in the beginning of the SMS message; a "default" column collects the messages without valid identification characters. Finally, the platform also provides a *user notification functionality* that can be used to inform contributors about new content relevant for them.

The system modules further include the *management portal*, the *gateway*, and the *back-end services*. The management portal allows for system administrators to fully configure and tailor boards to target communities, encompassing functions such as message filtering, user white/black-listing (determining which phone numbers can or cannot post), visual/content customization (*e.g.*, titles and icons), message aging (the "lifetime" of a message before it disappears), and column moderation flag (whether messages should be approved before being displayed). The gateway is a lightweight

Android app that intercepts each SMS message sent by users to the platform and injects it on the platform's back-end through HTTP over WiFi. Moreover, the gateway periodically polls the web server in order to verify if there are notifications to be forwarded to users (again, via SMS). Lastly, the back-end is a Java system that provides RESTful services to the gateway application, the public board's web interface, and the management portal, besides maintaining all database operations.

Our platform can be delivered as a cloud service, but cheap alternatives are also possible. In our experiment, we deployed the main services on a minimally equipped Raspberry Pi and the performance was satisfactory, showing that the system configuration and installation is simple and relatively cheap.

4   Case Study

We conducted an experiment by placing a Shared Message Board in the cafeteria of a large company in Brazil (see Figure 1). Initially, it was configured with the following four columns: **News** ("Notícias"), **Ride Offers** ("Ofereço Carona"), **Ride Requests** ("Busco Carona"), and **Open Forum** ("Fala, IBMista!"). Each column was associated to a key character ('n', 'o', 'b', and 'f', respectively), and messages that did not use them were posted in the open forum column. After a couple of months, the News column was substituted for **Classifieds** ("Classificados"), through which users could advertise things to sell or trade.

This initiative sought to promote interaction between the corporation's employees, to provide a new channel through which they could publicly express their opinions and feelings, and, more important, to facilitate the identification of potential carpooling partners. For this last feature, the back-end service was enriched with a *matchmaking logic* that takes carpooling request messages and tries to identify potential matching offers by checking co-occurrence of names indicating locations (marked by hashtags in the messages).

A relatively large number of messages were posted over the first weeks (specially in a day where a storm took place in the city), but then we observed a significant reduction in usage. Namely, the columns associated with the carpooling functionality received very few messages after the first two weeks. In order to understand why the adoption of our tool was so low, we decided to perform a qualitative approach, through which we tried to identify the profile of potential users, assess their experience with the Board, and verify what could motivate the tool's use.

4.1   Qualitative Approach

We employed two main methodologies for qualitative data collection: user observation and contextual inquiry interviews [8]. In our case study, we were interested in their social interactions at the cafeteria during their break times, so we adapted the methodology to our needs. We conducted 10 interviews with passers by in the area where the board was installed; 7 of them worked in the building, 1 worked for the same company in the same city but in a different location, 1 worked for the same company in another country, and 1 was a client visiting the building for the first time. The interviewees were between 21 and 54 years old, and all of them had smartphones.

To make sense of the data collected during the interviews, we used an Affinity Map, also known as the KJ Method [6,17], to infer interrelationships in the subjects' discourse by looking for patterns and common themes, opinions, and points of view. Two major groups of users emerged from this analysis: *insiders*, composed of individuals who work in the building where the tool was installed; and *outsiders*, whose opinions were neutral and therefore were not considered in this work.

The insiders were further divided in four categories: group **A**, with individuals who actually used the board, but only to follow news; group **B**, with users who did not use the board but had suggestions for improvements; group **C**, with users who did not use the board but liked the topic; and group **D**, with people who did not use the board and were unsatisfied with the topic. We employ this classification in order to organize opinions and suggestions from users below.

The main reason why users in groups **B**, **C** and **D** did not use the tool was the *topic*. Those in **D** explicitly mentioned this fact and said that, although the Board was visually appealing, carpooling was not interesting for them. Individuals in category **C** thought that carpooling is interesting but did not see themselves as potential users. Users in group **B** liked the tool, but were demotivated by the topic.

Interviewee #1, from group **B**, mentioned that the focus on carpooling might have decreased the interest people had in the technology and suggested that *it could be used to substitute a physical classified board* that was placed nearby and was typically used by employees to sell things. Interviewee #10, also from group **B**, conjectured that more people could have used the tool if *users were given the possibility to create topics*, *i.e.*, to create their own instances of the board. Other concerns transmitted by users in group **B** evolve around three elements: *location, technology*, and *communication*.

Complains about *technology* clearly emerged from the fact that all the respondents had smartphones and would rather use Internet messages instead of SMS. This fact was reinforced by the quantitative analysis presented in Section 4.2 and remarks the main difference between the original target audience — individuals using entry-level cellphones — and the corporate environment.

Regarding *location*, for many respondents, the place where the panel was positioned was not ideal. Interviewee #7 said that it should be located not only in the cafeteria, but also in other areas where the flow of people is more intense. Other individuals suggested certain specific places that, in their opinion, would have fostered more participation.

Another issue was *communication*, in the sense that some users thought that the tool was focused solely on carpooling. That is, they were not aware of the existence of the other columns offered by the Board. Moreover, after a couple of months, the column that was used for news was substituted for another that were aimed at classified advertisements, but few people actually used it. Our quantitative and qualitative results suggest that more messages could have been posted if this change had been broadcasted in the building, so communication clearly plays an important role for technology adoption.

Group **A** shows that the Board had a large passive audience, composed of individuals who do not post messages but read what is being posted. Interviewee #4 was an interesting example of this group, since the person was able to discover that a former

colleague who worked on the same department was actually living nearby her home and managed to get a ride just by checking the content posted in the board, that is, without sending a text message to the platform.

Finally, since we did not have access to active users, we analyzed the posts submitted to the platform in order to identify the topics that spontaneously emerged from interaction with the tool. Therefore, we considered only the messages that were posted in the Open Forum column. We employed context analysis [5] to make this classification and identified three main categories of messages according to their targets: a particular person or group of people; everybody who was reading the Board; and, finally, those who were actually submitted to the wrong column.

The existence of posts that were clearly placed in the wrong columns shows that the use of identification character is not intuitive and that an automatic message classifier should have been used instead. In particular, we believe that Latent Semantic Analysis [12] and Topic Modeling [9] probably would have produced satisfactory results.

Within the messages directed to the public, we identified four subtopics:

1. Greeting messages, such as "have a nice day" or "have a nice week";
2. "Check-in" messages, used by people to announce their break time and to say who was with them;
3. Contextual messages, talking about the weather or traffic conditions;
4. Messages about the Board.

Finally, the words appearing more frequently were "coffee" and "selling". The earlier shows that the Board location influenced message content, and the latter highlights the usability issues of the identification character.

4.2   Quantitative Approach

The feedback obtained from the qualitative studies indicated several issues in our deployment, specially with the choice of communication technology and theme. Nonetheless, we also observed that a range of other topics actually flourished in the space, leading us to believe that the Shared Message Board technology might be more valuable for purposes other than carpooling. To better understand this question, we conducted a survey focused on unveiling how professional communication takes place for other use cases. Through electronic forms, we solicited anonymous feedback from several subjects subscribed to internal and external mailing lists concerning their communication habits on work.

We collected data from 72 participants (25 female). Among them, 80% ranged between 18-35 years old, 15% between 36-55 and the remaining 5% above 56 years old; also 42% had between 0-5 years of work experience, 25% had 5-10, and 32% had over 10 years.

The questionnaire contained two main parts. The first consisted of reporting the usage frequency of a list of professional communication and peer exchange means – Facebook, LinkedIn, Twitter, e-mail, phone calls, instant messaging, SMS, face-to-face, enterprise notice/advertisement shared boards and intranet – on a scale of 1 (never use) to 5 (always use). The second part consisted of informing which of these means are employed in the following situations: *sharing hobbies*, *sharing an external event*, *looking for a new apartment*, *selling personal items to colleagues*, and also, *looking for a ride*.

In the first part of the survey, we tried to identify which communication tools are more generally used in the enterprise. The results show that there is a clear preference for *emails*, *phone calls*, *instant messaging*, and *face-to-face meetings*. Conversely, the usage rates of platforms such as Facebook, LinkedIn, and Twitter for the purpose were very low, suggesting that *informal means of communication are typically not employed in the enterprise*. This is an expected result, since these tools typically do not provide the level of privacy required by many companies.

In the second part, we assessed preferred communication channels in the enterprise for a number of purposes:

Sharing Interest about Hobbies: Facebook was a clear winner in this topic (preferred by 23%), followed by personal meetings (19%), and instant messaging (15%). Although apparently contradictory, given the answers to the first part of the survey, these results suggest that there is still a strong correlation between Facebook and instant messaging tools to personal activities.

Notifying Colleagues about External Events of Professional Interest: Email (27%) and Facebook (20%) where the tools of choice for this type of message. Companies employ mailing lists in order to facilitate the broadcast of this kind of information, so the prevalence of email is not surprising. Facebook "walls" are also suitable for notifications, since can be simultaneously visualized by several other users.

Looking for a New Apartment: In this case we had again major preference for Facebook (21%), personal meetings (16%), and instant messaging (16%). These results reinforce the association between Facebook and instant messaging with messages that have a stronger personal touch.

Looking for a Ride: Most users preferred personal meetings (19%) and instant messaging (17%). Twitter (13%), Facebook (12%), and Enterprise shared boards (11%) had smaller adoptions, while SMS (5%) was considerably lower. Carpooling clearly has a stronger personal aspect than the other elements, since it implies in personal meetings with a relatively long duration. Therefore, it is natural to expect that participants would be willing to know each other to a certain extent, and the results suggest that personal meetings and instant messaging are the best options according to most people. The fact that people were sharing the same work environment was not enough to overcome this barrier, and is most likely why the tool was not effective.

Selling Personal Items to Colleagues: For this type of activity, usage was nearly tied between Facebook (19%) and Enterprise shared boards (18%), followed by personal meetings (14%). Classifieds are more "asynchronous" and "impersonal", and also enable passive observation from people that are not necessarily acquainted with the users posting the content.

5   Discussion and Lessons Learned

The experiment, the interviews, and the survey allowed us to identify several important aspects associated to the use of shared message boards in the enterprise. Below, we discuss the results and extract some lessons we learned with this work.

Usage data extracted directly from the platform show that *community engagement is driven by need*. Shortly after the installation of the board, a storm occurred in the city where the company is placed. Since this phenomenon was correctly predicted by weather forecast services, people were aware of it beforehand. A couple of weeks later, we observed that this day registered the largest number of messages submitted to the platform. This fact suggests that certain events might nurture technology adoption once they are seen as the standard solutions to address them.

Regarding in-group communication for the enterprise, the results of our study show that *SMS-based communication is not adequate for corporate environments*. Since virtually every company is equipped with WiFi, *there is a clear preference for web-based applications*. Moreover, most people currently have smartphones, there is virtually no incentive for typically charged SMS services in the enterprise.

Additionally, we conclude that *shared message boards are not effective to support carpooling in Brazil*, since we observed that users still want to better know the people they are riding with. We initially believed that the proximity of being in the same company would overcome this barrier, but the results strongly suggest that this is not the case. It is important to remark that this might reflect a local cultural aspect, since there are relatively popular websites in other countries, such as Germany, providing this kind of service[1].

Finally, suggestions given during the interviews and the results of the survey indicate that *there are situations in which shared message boards might be an adequate communication tool for the enterprise*. In particular, we believe that shared message boards might reach higher adoption levels if used to broadcast non-personal information about topics that are not directly related with professional activities, such as classified advertisements.

6   Conclusions and Future Work

In this work, we presented and discussed the results of an experimented conducted in a large company in Brazil involving the use of a shared message board technology to support carpooling between its employees. Interviews and surveys helped us to identify the challenges and opportunities for this kind of tool in the enterprise.

The identification of use cases where shared message boards can be largely adopted in the enterprise and in other restricted communities is essential for the creation of personalized recommender systems, since they are able to generate a kind of human-generated data that is not being produced by the most popular communication tools, such as Facebook and Twitter. In particular, classified advertisement in the enterprise seems to be a promising application, so we believe that it would be interesting to conduct experiments with shared message boards applied to this usage.

Our ultimate goal is to apply analytics techniques (see [1,7]) to in-group and peer-based messages in order to identify the sentiments and learn the needs and requirements of restricted communities communities. Social Network Data Analytics tools [2] could be used to extract social intelligence from these interactions. In particular, we would like

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[1] For example, *Mitfahrgelegenheit* (`www.mitfahrgelegenheit.de`) and *Mitfahrzentrale* (`www.mitfahrzentrale.de`).

to identify the main factors that influence technology adoption for in-group communication and the correlation between local context factors and communication behavior.

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