System Supporting Network Enterprise Business Activities via Electronic Communication

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Abstract

Email repositories and an email activity are valuable assets for any modern internet based business organization. In order to achieve organizational objectives or to successfully run business activities in any organization need to be communicated. Communication is important part of a business process and collaboration. In most of internet oriented businesses, email is considered as a primary medium for information exchange, and email also plays a major role in an SME business process. In this paper we describe how to create framework above email infrastructure which supports various business activities (enterprise resource planning, customer relational management, workflows and document flow). Innovation lies in not changing way of doing business activities in organization and context sensitive information delivery.
Keywords: email, collaboration, business process, knowledge sharing, ontologies

1. Introduction

Email repositories and an email activity are valuable assets for any modern internet based business organization. In order to achieve organizational objectives or to successfully run a business process, goals, tasks or actions in any organization need to be communicated. Communication is important part of a business process and collaboration. According to Habermas's work [1], the categories of communication goals in organizations are:

- Commanding a specific action;
- Managing Collective Action;
- Influencing;
- Providing Information for Future Action; and
- Seeking Information for Future Action.

Therefore business email communication is action oriented, communication is clear and short and thus partially understandable for computers after text processing and an analysis.

Building a knowledge management system (KM), the users need and want to have knowledge in a situation when solving a problem, without extensive searching in organizational knowledge. In addition, the user does not have to know whether the organization has some knowledge in the KM system for the current problem, and when collaborating and sharing knowledge, it is necessary to know the current user needs. For this reason the user's current context must be detected. When storing knowledge provided by a user, the context of this information or knowledge has to be detected. The context of the user can be represented by the current user task/activity, business process, and other related parameters. In most of internet oriented businesses, email is considered as a primary medium for information exchange, and email also plays a major role in an enterprise business process. According to statistics, email is the second most used service of the internet after WWW. Therefore email can be considered as a good medium for detection of the user context/problem, business process, task, customer or other related data.

In the KM system it is important to answer the question "How can we best keep

knowledge dynamic, use it in action-oriented situations, and make it the backdrop for creativity?" The answer is through e-mail, the quintessential Internet application. Consider the following [2]:

- Any organization, without exception, will have an e-mail infrastructure before it reaches the stage of developing an organizational memory (OM).
- E-mail communication in a modern organization is over 78% action-oriented, according to a recent study [3]. Organizations must converge to action, and communication is perhaps the foundation for most organizational action [4].
- Managers, and knowledge workers of all kinds, interact with their e-mail systems on a daily basis - it is a standard operating procedure. This means that using email as the window into an organizational memory gives us the smallest change in an organization's daily activities.
- Managers are motivated to achieve successful communication. They want their instructions to be understood and their answers to queries to be effective.

When building a solution on top of email communication, an organization does not have to change the way of doing its business, when such a solution is installed and set up in the organization. Users simply receive emails in the same way as before, but with attached relevant knowledge to the problem which the email represents.

Some work to connect knowledge with emails has been done in several projects such as the kMail system [2], which integrates e-mail communication with organizational memories, but also forces users to use a special email client and lacks a closed knowledge cycle loop. Other related tool is Zimbra[1], which offers web based client with functionality to detect objects such as phone numbers or addresses and allows doing some actions on these objects. Similarly as kMail, Zimbra forces user to use their email client and server application and thus change existing ICT infrastructure in organization on both client and server side. Gmail[2], a webmail developed by Google, shows content sensitive advertisements and some actions as "add event to calendar" within the email. The approach - ACoMA system - presented in this paper intends to connect emails with similar hints based on organizational knowledge, which are linked to organizational resources and systems. ACoMA system was developed in scope of national project RAPORT[3]. We have evaluated system on administrative application.

1.1 Innovation

The main innovations can be the following.

- The central role of emails. These are ubiquitous and strongly linked to business processes, though their content is unstructured. The innovation lies in tying email *content to business context*, so as to analyze and understand the current context and relate it to knowledge in the organizational memory.
- A use of email enables to have an "active" knowledge sharing and information provision channel, since a user does not have to search extensively for knowledge needed to accomplish business activities. Shared knowledge is delivered within the email – the current business activity being solved by the user. This means to deliver *information in context*

2 Overview of the Approach

Use of emails gives us possibility to provide knowledge in a context. Email serves as context provider. By attaching

[1] http://www.zimbra.com/

[2] http://www.gmail.com/

[3] http://raport.ui.sav.sk/

organizational or task knowledge to email, we give user possibility to access knowledge directly when needed.

The ACoMA system is connected to email server and process relevant email communication. A user receives email with additional information (text or html attachments) at the end of the email message (see Figure 2). This information contain relevant information and knowledge, hints or links to business resources needed for detected business context such as document repositories, databases or information systems. Furthermore some suggestions for a user concerning possible next activities to be taken could be presented to the user if such knowledge is available in organization in form of notes [5].

Business context was detected from email using semi-automatic semantic annotation based on ontology and predefined regular expressions patterns [6].

Please note that text attachments are directly displayed in most of email clients and they appear as part of an email message, however they do not change the email message itself. Text attachments can appear as an addition which does not reduce user overhead because users have to read such attachment to have information, but this information should mainly provide links between relevant organizational resources.

After email is received at the mail server, ACoMA performs analysis of email message using semantic annotation [6] and sends received context to EMBET tool [5] in the form of elements from ontological application model. Based on the context received, EMBET tool retrieves all the relevant information from the organizational memory and sends them back to ACoMA tool. This information is then formatted by ACoMA tool and attached to email message. Email with attached information is retained on the server. When checking new emails, a user will receive changed email message, with embodied information. Sending emails works in similar cycle (see Figure 1).

In RAPORT project we distinguish two kinds of emails: portal-generated emails (formal) and emails created by a user (informal). Formal emails are sent by a portal automatically (based on the activity in the business process), or they are sent based on the user requirements arising from the work on the portal (again based on the activity in the business process). Informal emails are written by users participating in the business process (urgencies, confirmation of sending documents, etc.).

Formal emails are also present in many system-to-person communications for example when purchasing or ordering goods or services on the internet. On such formal email with not changing structure it is easier to analyze email content and provide relevant information in content. This can be achieved via pattern based semantic annotation method [6] described also in chapter 3.1.

2.1 Evaluation

In tested administrative application the main information and knowledge linked to email communications where links to related forms or produced documents from repositories related to business process and activity. The other type of information was expertise shared among users for current business activity. We did not measured end user satisfaction yet, but from preliminary use of software we consider positive user feedback. This is mainly because user does not have to change way of working. They simply receive and send emails as before but in case of need they can use attached knowledge or information.

3. ACoMA Architecture

On Figure 1 we can see architecture of the system. ACoMA tool consists of two main components:

- ACoMA Core
- ACoMA E-Mail

ACoMA Core is the main component of ACoMA tool. It provides analysis of email using semantic annotation [6] and sends received context to EMBET tool [5] in the form of elements from ontological application model. Knowledge is sent and received through XML-RPC[4].

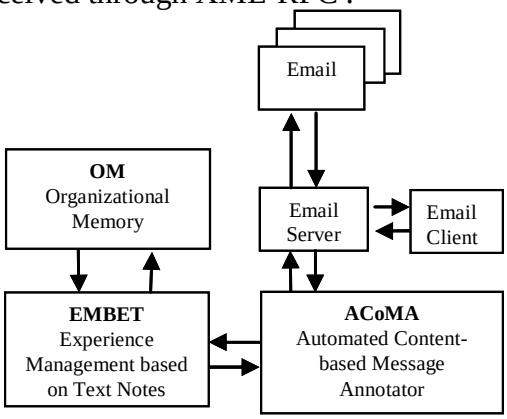

***Figure 1**: ACoMA architecture*

ACoMA E-Mail is designed for receiving, creating and sending emails with relevant information appended based on the email context. ACoMA tool uses JavaMail API[5] to work with emails. HTML attachments are created using XSLT[6] transformation of text notes received from organizational memory by EMBET tool to HTML document. This document is then attached to existing email using JavaMail API.

EMBET tool [5] consists of three main components:

- EMBET Core
- EMBET GUI
- System Memory

EMBET Core represents the main functionality of EMBET tool. It looks for knowledge based on the email context and retrieves it from its organizational memory in the form of text notes. Retrieved knowledge is sent to ACoMA tool through XML-RPC.

Interface to organizational memory is used to store and retrieve knowledge. It is based on RDF/OWL[7] work with data and it uses Jena API[8].

EMBET GUI is not present, because ACoMA tool provides GUI in scope of *ACoMA E-Mail* component.

On Figure 2 we can see example of an email with attached knowledge in form of notes with associated links to resources. Knowledge is provided in form of HTML attachment inside of email message.

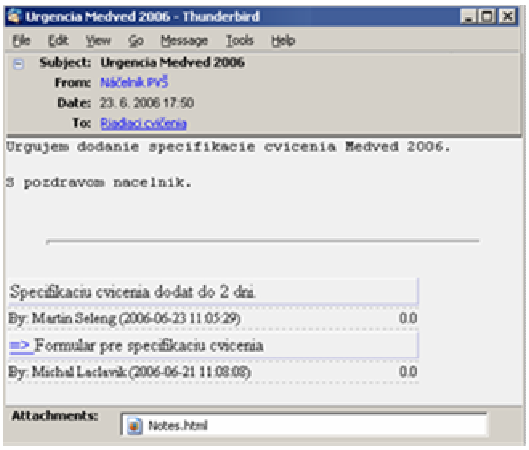

***Figure 2**: Processed email with attached information and knowledge*

3.1 Semantic Annotation

Semantic annotation used by ACoMA Core is one of most important tasks of email processing. It is build on top of Ontea [6] pattern based semantic annotation tool. The idea is that regular expression patterns are applied on text, to identify semantic elements in the text. For example we can define regular expression patterns to identify objects such as email addresses, company names, contact persons or telephone numbers to be matched with contacts in our knowledge base or to identify problem or activities description by identifying activity relevant keyword. As already mentioned, semantic annotation based on regular expressions can be well applied also on formal email communication used to communicate business tasks between organizations.

[4] http://www.xmlrpc.com/
[5] http://java.sun.com/products/javamail/
[6] http://www.w3.org/TR/xslt/
[7] http://www.w3.org/TR/owl-features/
[8] http://jena.sourceforge.net/

4. Conclusion

Knowledge sharing platforms and tools are mainly “passive” and provide static knowledge sharing functionality. The possibility of “active” and “pro-active” intervention on communication channels, to provide real “interaction” with the experience formation and use process, is not widely considered.

The paper proposes also an active collaboration approach to support, and even enable, enterprises to perform their business activities overcoming geographical, technological and organizational barriers. The direct intervention on communication channels – based on e-mail message processing – is the distinguishing aspect, which addresses knowledge extraction and discovery as well as proactive provision of support to users. The generic ACoMA platform envisaged includes shared knowledge representation, business services provision and e-mail analysis and processing to extract knowledge and provide support in terms of annotation, information integration and suggestions.

Three main barriers hampering ICT adoption by SMEs can be addressed by such platform: economic, by delivering a lightweight platform able to interact with simple networked environments (e-mail); shortage of skill, by addressing self-adaptive and automatic organization knowledge base creation and maintenance; and cultural, by integrating with normal ways of working.

The developed ACoMA system was tested in administrative application where it helped users to collaborate and interoperate with external and internal parties. The main advantage was acceptance by cooperating people and not forcing involved external collaborating parties to install new interoperability solutions.

In a future work we will try to extend solution with easy user interface for setting up application specific patterns used for semantic annotation of communication. Now it needs to be done only by experts.

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References

[1] J. Habermas: The Theory of Communicative Action; Beacon, Boston, 1981.

[2] David G. Schwartz and Dov Te’eni, Bar-Ilan University: Tying Knowledge to Action with kMail; MAY/JUNE 2000 , IEEE Knowledge Management, p 33-39

[3] D. Te’eni and D.G. Schwartz: Contextualization in Computer-Mediated Communication; Information Systems—The Next Generation, L. Brooks and C. Kimble, eds., McGraw-Hill, New York, 1999, pp. 327–338

[4] C.A. O’Reilly and L.R. Pondy: Organisational Communication; Organisational Behavior, S. Kerr, ed., Grid, Columbus, Ohio, 1979, pp. 119–150.

[5] Laclavík, M., Gatial, E., Balogh, Z., Habala, O., Nguyen, G., Hluchý, L.: Experience Management Based on Text Notes (EMBET); Proc. of eChallenges 2005, Innovation and the Knowledge Economy, Volume 2, Part 1; Paul Cunnigham and Miriam Cunnigham (Eds.); IOS Press, pp.261-268. ISSN 1574-1230, ISBN 1-58603-563-0.

[6] Michal Laclavik, Martin Seleng, Emil Gatial, Zoltan Balogh, Ladislav Hluchy: Ontology based Text Annotation - OnTeA; Information Modelling and Knowledge Bases XVIII. IOS Press, Amsterdam, Marie Duzi et al. (Eds.), Frontiers in AI and App., Vol. 154, February 2007, pp.311-315. ISBN 978-1-58603-710-9, ISSN 0922-638