

## Lessons Learned from Multilingual Collaboration in Global Virtual Teams

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### Abstract

The scale of developments in global virtual teams, which consist of the members around the world to cooperate for a specific purpose, is increasing in the growing network environments. In this paper, we discuss the facilities required for the tools supporting collaboration in virtual teams, which includes problems on the language and physical distribution of members. We have developed a communication tool and a document sharing tool with multilingual and distribution features, and then have observed the problem with using multilingual collaboration support system from an intercultural cooperative software development experiment. The observations show that multilingual environment with translation facility may be appropriate for the overall and abstract discussions but may not be appropriate for the detailed discussions in cooperative works.

## 1 Introduction

Globalization via the growing network environment facilitates communication between people in many countries and cultures. Jarvenpaa and Leidner mentioned global virtual teams (GVT) that consist of members in a variety of physical locations and cultures and hire computer-mediated communication tools among members (Jarvenpaa and Leidner, 1998). The scale of developments in GVT is increasing in various application fields, such as software development.

There are many difficulties facing people working in GVT, such as language problems. Normally, a single language, English in many cases, is used for the communication in the team in case the members have different mother languages. However, in a GVT where the members use English as the communication language, people who do not use English in everyday life will have disadvantages to communicate with other members. Even if they can use English for the natural communication, most of them think in their mother languages so that the handicap still remains. In this paper, we discuss the possibilities for GVT members to communicate in their own languages. In following sections, we describe the required functions of tools for supporting software developments in multilingual GVT and lessons learned from the experiment in which the support tools are implemented.

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## **2 Tools for intercultural collaboration**

In this section, we consider tools required for collaboration in multilingual GVT and the functions that should be implemented in the tools. The most basic methods to be supported in virtual teams are communication and document sharing. First, communication tools, e.g., email, discussion forums, instant messaging, teleconference, and videoconference, are used for the discussions in GVT. While we are focusing on the collaboration, where discussions among a group on a specific topics are important, group communication tools like discussion forum are the best way to be incorporated rather than personal communication tools like email. Second, document sharing tools are used for the exchange of the documents that they write in personal or within group activities. Therefore, communication tools and document sharing tools are considered to be extended for the multilingual GVT to cope with the language and physical distribution problems.

In a GVT consisting of members who use different languages, translation will be required for the discussions and document exchanging. With tools that incorporate translation facility, members can work in their mother language if they want to commit to the project fluently. The physical distribution of the members should be considered because the network bandwidth is still insufficient, especially for international traffic, in spite of the growing internet infrastructure. For global collaboration support, distribution architecture where the hosts communicate asynchronously should be implemented for the usability. We are developing collaboration support tools for GVT to cope with consideration to language and network bandwidth barriers. As the first implementation, we have developed TransBBS, a multilingual discussion forum on WWW, and TransWEB, a multilingual document sharing interface; both are designed to incorporate translation and distribution facilities.

### **2.1 TransBBS and TransWEB**

TransBBS is a WWW based discussion forum that hosted in multi locations that enables users to read and write articles in their mother languages. When a user wants to post an article written in the mother language, the article is at first translated into the languages of other members, posted to the TransBBS, and showed to the user. The posted articles are synchronized periodically among TransBBS servers so that the posters do not need to wait the distribution of the article. TransWEB is implemented as a WWW page translation gateway that translate a page from the writer's mother language to the reader's mother language. When members write a development document in their mother language and stores it on a HTTP server in their own site, other members read the document translated by using TransWEB.

In multilingual collaboration, the communications among members heavily depend on the translation systems although the qualities of the translation systems are not sufficiently high. Therefore, the users will often have trouble to read the messages. The facilities to support the readers' understanding to the article will be required in the communication tools. We have incorporated two annotation functions to TransBBS, the semantic tagging by the writers and the translation rating by the readers. The semantic tagging is the function for writers to annotate the position of the articles they will post. The posters should annotate the article such as "Approach" or "Response".

A translation rating method is required because the readers cannot write whether the translated article is understandable through the translation again. The translation rating by readers is

implemented as three buttons named "terrible translation", "translation is OK" and "cool opinion". Readers can instantly annotate the translation quality for the writers and the writers also have the method to modify the article once posted to adopt the translation services.

### 3 Experiment

We have conducted a set of intercultural collaboration experiments, ICE2002 to test the benefit and usages of GVT support systems (Nomura et al, 2003). In ICE2002, members from four countries in Asia: China, Korea, Japan, and Malaysia, collaborate to develop an integrated software product with multilanguage collaboration support systems. In the experiment, members were divided into four subteams so that each subteam includes people from one country only to develop a module of the product. During the experiment, members of each subteam were instructed to engage in discussions using TransBBS, create development documents periodically, and read the documents written by other subteams via TransWEB. Translation between five languages, Chinese, Korean, Japanese, Malay, and English, was incorporated in TransBBS and TransWEB, using the translation services via the net<sup>1</sup>.

The experiment consists of two tracks, where each consists of two four-week phases: design phase and implementation (coding) phase. At track I, a simple version of TransBBS where the translation and post are done in one action was used. In the version, users who want to write a message only "post" the article; if all the users cannot understand language other than their own mother language, this method will be simple and efficient. Track II uses another version of TransBBS, where translation and post are divided into two methods. Users can view the translation result before they post the article and they can be aware of the translation qualities. In addition to dividing translate and post, the translation rating method is incorporated at the design phase and then the semantic tagging by the posters is also incorporated at the implementation phase.

Table 1 shows the numbers of user actions on TransBBS for each four-week phase of the experiment for each track, where "read" method represents the explicit reload of the articles to check the new article. The methods "post" and "translate" are merged at the first track where the users translate and post in one action. In case of a translation error occurs, members can read the article by "retranslate", the re-request of the translation. We see the numbers of methods are decreased from the first (designing) phases and the second (implementation) phases both in track I and track II. The reasons will be complicated: motivations of the users toward the experiment,

**Table 1:** Number of user actions on TransBBS through ICE2002 for each four weeks.

Track-Phase	#read	#post	#translate	#retranslate	TransBBS version
I-1	2635	320	-	333	One action to translate and post
I-2	1865	208	-	98	
II-1	6332	481	1608	155	Translation rating by the readers
II-2	3239	274	806	54	Semantic tagging by the writers

user's adoption to the system, or the communication modes described in the next section.

<sup>1</sup> Translation services used in ICE2002 were arcnet/sangenjaya (<http://sangenjaya.arc.net.my/>) and J-server (<http://www.j-server.com/>).

## 4 Lessons Learned in Multilingual GVT

As the results of the experiment, software modules at the subteams but no integrated software was not completed. We found several problems at the simple support system to the multilingual GVT s.t. described in this paper. The reasons of the failure are mainly on the misuse of the system at inappropriate situations and the infrastructures. Communication support systems where the users discuss about their opinions, such as TransBBS, are not used every stages of the entire cooperative work. In general, member's communication patterns differ in the modes of collaboration; members change the communication styles according to the situations. It is a misuse of support system according to communication modes.

### 4.1 Communication in Modes of Collaboration

Schümmer and Haake have classified the modes of programming into eight classes from offline mode, where members work without interruptions from others, to the tightly coupled mode, where members are co-located and working together seeing the same object (Schümmer & Haake, 2001). Here, we consider the three phases, design phase, coding phase, and integration phase. In system design phase, from the overall design to the specifications, communication among members are important to discuss the various levels of system and module designs. In coding phase, members code in isolated environment based on the specification, fluent communication is not required other than the checking the development progress within the subteams. In integration phase, developed modules are integrated into a single system, thus the communication between the integrator and the module constructors will be important.

In ICE2002, members have communicated somewhat often at the design phase. Many communications are for the overall design where members discuss the facilities of the software to be developed. However, there are less discussions about the detailed design, for example, software used for the database management, platform, nor programming language have not enough discussed although the aim of the experiment is to develop an integrated system. In other words, they have discussed about "what to build" but not discussed about "how to build".

This may be the result of both from language and engineering problems. As the language problem, members should make agreement for each paragraph or sentence in the documentation in detailed design phase. Obviously, it is very difficult to make the agreement with no misunderstandings in members of the group. This problem is still remains even if the translation quality will be increased. To have an agreement in a group about the technical document such as specifications, there should be a facility to support the decrease the misunderstandings on the document. An agreement construct tool should be a basic tool on multilingual GVT support system.

As the software engineering problem, the main task in discussions in detailed design is that all members have the common image of the integrated software. There are no topic list or roadmap in the design phase in ICE2002 settings. The discussions will be better if the roadmap is supplied from the organizer of the GVT from the view of engineering problem. If there is a development model on multilingual or intercultural GVT, it will be a useful framework for the collaboration at GVT.

For more consideration about the modes of collaboration, TransBBS, an asynchronous communication tool, is not appropriate for the instant communications. Members sometimes wanted to communicate with others instantly; of course the face-to-face meeting is the best way of

communication if possible. This implies that a synchronous communication tools is also required according to the collaboration modes.

## 4.2 Infrastructure Problems

The collaborations with multilingual systems heavily depend on the translation quality. Unfortunately, the translation quality is not sufficiently high for the discussions on TransBBS, especially in technical terms. Moreover, another problem at the multilingual collaboration is the accesses to the translation services. TransBBS and TransWEB heavily depend on the translation services so that the high quality and stable translation services are required for fluent communication and document exchange. We have used the translation services via the net; the translation turn around time is easily affected by the network status. In ICE2002, translation requests have sometimes failed because of the connection failure to the translation services and the collaboration is affected.

## 5 Conclusions

We have considered the multilingual GVT support systems, prepared basic tools with translation and distribution features, and tested on an intercultural environment. The observations show that the multilingual support systems are efficient only in very limited phases in development, e.g., the overall system design phase. The multilingual system cannot work efficiently for the detailed design phase that requires the strict description of the system specifications. More advanced communication styles may be suggested in multilingual or intercultural collaborations. For example, construct an agreement for the system design with translation will be a valuable infrastructure of cooperative works.

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