DIVISION OF COMPUTER SCIENCE

WISE (World Wide Integrated Software Engineering): A Summary of Work in Progress

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Abstract

The WISE project, which is a collaboration between the University of Hertfordshire in the UK and Xerox International Software Operations (XISO), is investigating current practice in XISO global distributed project teams with the aim of improving the efficiency of global work practices. We have focused initially on how globally distributed projects operate, and on identifying hypotheses regarding good and bad practice. We are currently using information drawn from several different sources using a number of different approaches to validate our initial findings. The method we have used has provided a large corpus of data and number of recurring problems and examples of good practice have already been identified.

1 Introduction

The WISE project is a cooperation between the University of Hertfordshire (UH) in the UK and Xerox International Software Operations (XISO). The project is funded jointly by XISO and the UK Department of Trade and Industry. WISE is concerned with the investigation of current practice in XISO global distributed project teams and the development of tools, techniques and working practices that will improve their effectiveness.

Multi-national software organisations are increasingly reliant on the use of geographically distributed development and maintenance teams. Work may often be passed to teams at remote locations because staff in a particular location have knowledge relevant to the release of a product in their own geographical region, or because staff with the expertise needed on a particular project are only available on certain sites. The findings from this research should be of interest to all organisations that use geographically distributed software teams.

The two partners in the WISE project have different, but complementary, objectives. These objectives are explained, in overview, below.

1.1 The XISO perspective

XISO consists of four centres, one each in Brazil, India, Singapore and the UK. There is also a centre of operations in El Segundo, California. Increasingly XISO project teams are distributed across these centres. XISO is currently reviewing a number of its procedures as part of a quality initiative relating to the SEI Capability Maturity Model. As part of this review, XISO is interested in analysing the activities of global distributed projects to determine the way in which global projects currently operate, and to make recommendations for increasing efficiency within such projects. The analysis is expected to uncover examples of good practice that could be applied throughout XISO, and recurring problems which could be addressed by the development of tools, techniques and procedures.

1.2 The UH perspective

For the University of Hertfordshire team, the project represents an opportunity to investigate in depth those factors and issues that affect software development and maintenance in distributed project teams. It was expected that such issues might include:

- cultural issues that affect cooperation & communication
- exacerbation of well known project problems due to restrictions in communication bandwidth
- problems to do with team members working in different time zones
- the effectiveness of various communication modes from telephone, email and fax to video conferencing for various project purposes.

2 Method

Research so far has been aimed at discovering the way in which globally distributed projects are operating, and identifying hypotheses regarding good and bad practice for further investigation. A number of approaches have been used including unstructured interviews, structured interviews, structured analysis of email logs, and questionnaires.

2.1 Unstructured Interviews

An initial investigation of the UK centre (XWSC) was carried out using an unstructured interview approach with a core of the experienced staff. The emphasis in these interviews was on:

- the nature of the work, and identification of typical tasks
- methods of communication with other sites, and related problems
- 'critical incidents', or examples of things going badly wrong
- examples of good practice
- perceived problems with global working

The data derived from this approach was used to build a domain model for the centre. It was also used to derive working hypotheses about problems to do with existing practice.

2.2 Structured Interviews

The domain model and the working hypotheses were used to develop a structured interview that was administered to all staff at XWSC. The purpose of the structured interview was to test the existing working hypotheses and gain further information. Interviews typically took 2 hours and most were written up within the following 24 hours. The resulting corpus of data, consisting of 13 in depth interview transcripts is still being analysed. However, after an initial analysis, the following issues have emerged:

- **issues to do with standard procedures:** eg. There may be a need for more clearly defined procedures for accessing information about other centres, for collecting examples of good practice from other projects, and for supporting staff on temporary assignment to other centres
- **issues to do with management (other than project management):** eg. There was a perception that it is not always clear why management decisions were made. Interviewees managed from a remote centre reported feelings of isolation and lack of consultation which may be a result of impoverished communication.
- **project management issues (including issues to do with teams and resources):** eg. Staff may be reluctant to pass work in progress on to others at remote locations. One interviewee said: "your code is your baby, you don't want to give it away". On the other hand, another interviewee said, "There may be a tendency to pass the buck to other centres".
- **issues to do with communications between sites (including technical and usage issues):** eg. Email is sometimes not answered. When an answer is provided, not all issues raised are answered, and there is a narrow window in which to carry out live communication with other centres because of the time zone difference. This coupled with not having adequate information about who to contact about particular issues can cause serious delays to projects.
- **issues to do with software tools (excluding communications tools):** eg. Problems with version control in distributed software libraries, and the fact that some tools may only be accessible to some centres.

• **differences in local conditions:** eg. Some centres are more process oriented than others. If communications are sent to a highly process driven site and the communication does not match standard inputs to the process it may be neglected.

• **cultural issues:** eg. There are indications of differences in perception of disagreement and whether disagreement is permissible or desirable. There is anecdotal evidence of a greater perceived need to conform to local behavioural norms at some centres.

A number of examples of good practice on projects have also been collected. For example, one large distributed project provided key project information (such as: the current architecture for the project, standard procedures to be followed, project personnel) on a intranet web site.

Useful though this data is, we have two concerns: the data is based entirely on the activities of one centre which may not be representative of others; it is also highly subjective, and may be subject to bias in a variety of ways. To address these problems, two further approaches have been used:

1. The subjective survey data is being supplemented with an analysis of project artefacts. In particular the complete email record for two global distributed projects is being analysed.
2. Using the structured interview as a starting point, a questionnaire was designed. This questionnaire is currently being administered to all other centres in XISO.

2.3 Analysis of Email Logs

Currently we have tackled only one project email record and a second pass analysis is required.
For this project, the email record represents a large and complex collection of data. It comprises 342 mail messages sent during the period covered from 24th January to 15th May 96. Each mail message in itself may consist of several subsidiary messages each with their own topic. It was estimated that the whole corpus referred to 142 topics many of which recurred. Eighteen individuals were involved in the communications and the project was distributed across four sites.

The email record was read independently by three researchers. In a focus group meeting they negotiated and agreed the following categories of communication act: request, response, reminder, instruction and politeness (e.g. Thanks for information). It was decided that a communication could be usefully described, for the purpose of this project, as consisting of a communication act category (eg. Request) and a topic (eg. Schedule information). The whole corpus was then analysed, and instances of these communication acts and the topics to which they applied were identified. This made it much easier to trace request response chains for particular topics. Having done this analysis, it was relatively straightforward to determine the time typically taken for a first response to be made to a request for information. Our findings are displayed in the chart below. Responses made on the same day (shown as 0 days in the chart) or the next day (shown as 1 day) are deemed acceptable. Longer response times are cause for some concern and suggest the need for tools or procedures which might facilitate a faster turn-around.

Time to first response
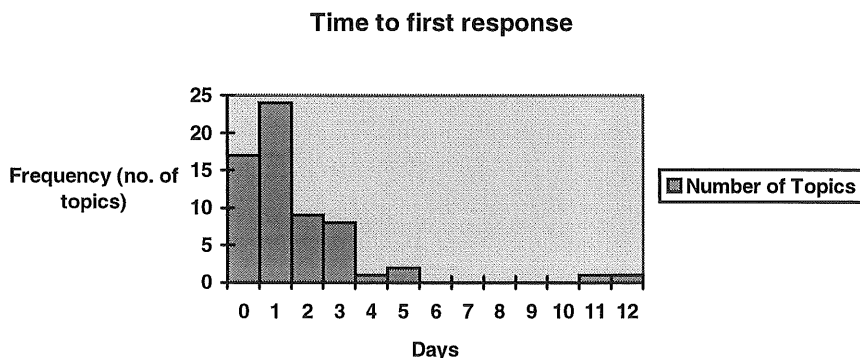
We have also collated the data on a topic by topic basis in order to determine whether some topics were dealt with more effectively than others. Data presented in the chart below show the total time taken to deal

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with 10 sample topics, the average time taken to respond to messages relating to that topic, and the time taken between the initial message and the first response.

Analysis of email for 10 typical mail topics
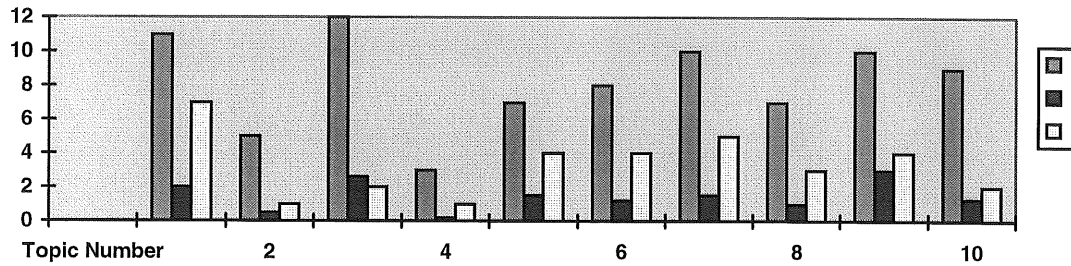
Having identified these general issues in relation to email response times we are now concentrating work in the following areas:

- examining 'breaks in the email chain' - occasions on which there was a long time between a request and a response - and looking for the reasons for this, possibly relating to issues identified by the structured interviews;
- examining long-running topics to identify why the initial questions took so long to answer;
- examining the effectiveness of prioritization and escalation procedures as a way of improving response times in critical areas.

3 Conclusions and Future Directions

A number of recurring problems and examples of good practice have already been identified. The research method outlined above has provided a large corpus of data, and we believe that the use of information drawn from several different sources using a number of different approaches will provide an important means of validating our findings.

From the early returns of the questionnaires sent to the three non-UK XISO centres, it appears that there is some difficulty in motivating staff on remote sites to participate fully in the study. A number of approaches may help here. We have already identified personnel at each centre responsible for coordinating questionnaire completion. We are exploring ways of getting fuller information about the project and its aims to each centre via their management. We are also considering training for the centre coordinators and the involvement of other research establishments nearer to each centre. Finally, it is worth noting that the research method has so far revealed less than we had hoped for in relation to cultural issues. We believe that to gain access to cultural factors that may influence communication, cooperation and the effectiveness of distributed teams, it may be useful to involve researchers who are themselves closer to the other cultures involved.