

An Idea of a Globally Distributed Software Engineering Class

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Abstract: To planning, developing and managing a globally distributed software engineering course is very difficult task. Though, effective communication, team coordination and collaboration, and overall project planning are keys for any software development. Initiative has been taken in collaboration with 12 universities in South America, Europe and Africa. In India such type of course will be very helpful by providing more job opportunities to computer literates. For understanding significance of this course we give a simple assignment in distributive manner. The main objective of this course to demonstrate the significance of management and planning challenges in distributed software development.

Key Words: communication, management, group, DOSE, distributed, global, software, challenges.

INTRODUCTION:

Software engineering course may be global adopted practices. These courses introduce students about technical and management difficulties. As actual development experiences, projects in SE courses demonstrates the importance of SE methods and practices. These courses also develop team building, team coordination capabilities.

In recent years, some SE courses have incorporated globally distributed projects [17, 1, 15]. In these cases, all projects are developed by distributive manner. All projects are spread out globally. Though, various software companies are working in distributive manner from a long time. Various stages of any SE project are implemented in different-different places, as coding is done in USA, testing is done in Bangluru , database is created in Hyderabad.

Globally distributed projects are very interesting and student friendly. Students can learn more about software engineering phases in detail. They also understand risks and challenges in current software development scenarios. Despite the clear barriers that cultural, time zone and language differences constitute, many students still tend to underestimate the criticality of effective management and planning.

Problems of software project development can be overcome by using a globally distributed contest. It is carried out in the context of a distributed software development course, called DOSE, organized in collaboration with 19 universities located in 17 countries in South America, Europe, Australia Africa, and Asia. The contest neither include any programming and nor related to the project development activities. It shows that, how tasks are completed by collaborative team work. If tasks are not correctly solved or, not completed in deadline then it shows lack of unite team work [14]. There may be various members located in 2-3 countries.

The first main goal of the contest is to aware students about communication and project management issues, so that students could be able to find better ways of organizing a group. The second main goal is to uniting the group members those are located in different countries[16]. Though, students have not known to each other yet before this activity, but they collaborative perform this activity, this develops trust to each other.

In this paper we describe the contest and its evaluation performed in DOSE 2012 and in DOSE 2011. I believe this contest can also be organized in India between various states universities. This course will be very helpful for increasing students' knowledge and will reduce discrimination by enhancing trust and will also develop

team coordination. It will be great achievements, if IIT's, NIT's and central universities students agree to join this course.

DOSE: A GLOBALLY DISTRIBUTED COURSE:

ETH has been conducting a course about “Distributed and Outsourced Software Engineering” (DOSE). This course targets to master students those have good knowledge of programming and SE. About 19 universities has been joined in this course of South America, Europe, Africa, Australia and Asia [17, 13, 8]. In 2012, the project was developed in collaboration with the following universities:

1. ETH Zurich, Switzerland
2. Cairo University, Egypt
3. Hanoi University of Science and Technology, Vietnam
4. ITMO National Research University, Russia
5. IT University of Copenhagen, Denmark
6. Innopolis University, Russia
7. Korea Advanced Institute of Science and Technology, Republic of Korea
8. Odessa Polytechnic National University, Ukraine
9. Politecnico di Milano, Italy
10. Pontificia Universidad Catolica do Rio Grande do Sul (PUCRS), Brazil
11. State University of Nizhny Novgorod, Russia
12. The University of Adelaide, Australia
13. University of Crete, Greece
14. University of Delhi, India
15. University of Debrecen, Hungary
16. University of Rio Cuarto, Argentina
17. University of Zurich
18. Universidad Politecnica de Madrid, Spain
19. Wuhan University, China

A multi-player card games were played, in which players had choices to playing any game in DOSE 2012 project. A group was formed by 2-3 teams, located in 2-3 different countries. In this project, logic of game was implemented by one team and other teams implemented GUI interface and network setup. This project had 4 phases as:- 1) Scope of project(2-weeks) 2) Requirements identification(2-weeks) 3) Interface specification (2 week) 4) Implementation and Testing (6 weeks).

CONTEST FORMATION:

For participation in this contest, each group (6 members) had assigned a specific role. For this, A, B, C, D, E, F roles were decided. A was called as a group manager located in any country and students in roles B,C are located in two different countries, similarly students in roles D,E,F were located in at least two different countries

The contest was started in third week of DOSE project by using email and Skype as communication tools. Registrations of students were taken place one week before of contest starting. When the competition started, each participating student received his role card by e-mail, containing: (1) a description of the contest, (2) a list of tasks to solve, (3) an array of integers, and (4) a comic.

A role card was given to each member of different length and it had contained a different array (named by the role card) of a different length, a comic and a list of tasks to solve. Focus of mainly cards was executing computation on array. This array had 32-38 randomly generated integers ranges from 1 to 150. The comic was different for each student, and it was used to uniting all team members. The task was only to finding girl's name in comic. Every task had an unique identifier and it might have been assigned to more than one student in a group. If one member of group completes the task, then task was assumed to be completed of that group.

Such 17 different tasks, distributed in the six role cards were completed without conveying student's tasks to each other. All works were saved into an array. All tasks were very simple as finding maximum element in an array of roles B, C, D. Most complex task was to find element at 12th position in a sorted array. Array was sorted in an ascending order.

It was mentioned on all role cards that solution was provided by member of role A. All role cards were describing same information except A; Because A had information about his own card. About 8 of 17 tasks had to be completed. Only one task was assigned to each group and a combined sorted array A+B+C+D was created. The call for participation and the role cards can be found at

http://se.inf.ethz.ch/people/nordio/papers/dose_contest.

DOSE ASSESSMENT:

A. CONTEST RESULT

List of groups those participated in the contest is displayed below. Initially, 20 minutes estimation was assumed for completion of task. In the case of the use of text chat for communication, the table also shows the total number of messages (# MSG), total number of characters without spaces (# CHAR) and the number of messages per minute (# MSG PER MIN). Most of the groups solved the exercises in about 45–100 minutes and more than 8 tasks. It was noticed that average number of messages per minute was 4-5 in most cases. This means that every member had read and sometimes written a message in every 15–30 seconds.

Table 1 show that about one third of the groups reported at least one wrong result. This wrong result was reported in the more complex tasks, which requested to sort a combined array, for example D+E+F.

Table 1: Contest Outcome in DOSE 2012.

| # | COUNTRIES | TIME | SOLVED | | TOOLS | # MSG | # CHAR | #MSG PER MIN |
|----|-----------------------------------|--------|------------------|-------------|---|-------|--------|--------------|
| | | | #CORRECT ANSWERS | MORE TASKS? | | | | |
| 1 | Greece and Italy | 0:44hs | 8 | yes | text chat | 184 | 8,794 | 4.2 |
| 2 | Brazil, Spain and Switzerland | 1:02hs | 8 | yes | text chat | 161 | 17,347 | 2.6 |
| 3 | Brazil and Greece | 1:03hs | 8 | no | text chat, web docs, e-mail, dropbox | 282 | 16,154 | 4.5 |
| 4 | Brazil and Greece | 1:05hs | 8 | yes | voice chat, text chat | 69 | 4,982 | 1.1 |
| 5 | Argentina and Brazil | 1:07hs | 8 | yes | voice chat | n/a | n/a | n/a |
| 6 | Argentina, Brazil and Greece | 1:30hs | 8 | yes | voice chat, text chat, e-mail | 172 | 7,229 | 2.0 |
| 7 | Argentina and Greece | 1:37hs | 8 | no | voice chat, text chat, web docs, e-mail | 207 | 12,866 | 2.1 |
| 8 | Argentina and Brazil | 1:43hs | 8 | yes | text chat, web docs, e-mail | 115 | 7,579 | 1.2 |
| 9 | Argentina, Greece and Switzerland | 0:29hs | 7 | yes | voice chat, text chat, web docs, e-mail | 83 | 4,205 | 2.8 |
| 10 | Argentina and Italy | 0:51hs | 7 | no | text chat, web docs | 213 | 11,376 | 4.2 |
| 11 | Egypt, Greece and Italy | 1:26hs | 7 | yes | text chat | 173 | 12,048 | 2.0 |
| 12 | Argentina and Italy | 0:44hs | 6 | yes | text chat, web docs, e-mail | 180 | 10,310 | 4.1 |
| 13 | Argentina and Italy | 0:51hs | 5 | yes | text chat | 147 | 7,992 | 2.9 |
| 14 | Argentina and Greece | 1:19hs | 5 | yes | text chat, web docs | 197 | 10,627 | 2.5 |

B. GROUPS COORDINATION FOR SOLVING THE TASKS:

It was noticed that more than 60% of groups had not completed their assigned tasks. Each group member solved his own tasks independently, and just requested the necessary data from the other members. Due to not performing job of A appropriately, some tasks were not completed.

Students gave a feedback report as:

- Each member wanted to finish his job immediately
- To keep updated in all time was very hard task
- It was not clear that which particular task will be done first

The process of solving tasks was as following:

In first step all the tasks were collected and added to a web document, or broadcasted to all the members via text chat. Then, each member took one task to solve, and started to work on that task. Only one person was working on each task. All tasks after completion were added into an array (shared document) and he/she started work on new task. It was noticed that all tasks were done sequentially not by splitting.

DISTRIBUTED PROJECTS IMPACTS:

For evaluating impact of contest, we conducted an online question answer session, in this session all answers were given by participants. All members were informed by e-mail that how well their groups had performed. Full scenario of contest was also explained to members. It was observed that for question Q1 which was that how long time was taken before noticing by role A, 75% members participated in contest, 30% students had to wait at least 10 minutes and 13% had to wait more than 30 minutes before their task assigned. This delay had shown a high impact of group performance. Similarly, for other questions, we have also found out interesting results.

Table 2: Students' ratings of the contest

| Question | Mean | μ | σ |
|--|------|-------|----------|
| Did contest demonstrate challenges of communication? | 3.9 | 4 | 0.9 |
| Did contest show importance of group management? | 3.9 | 4 | 1.0 |
| Was contest enjoyable? | 4.0 | 4 | 1.1 |

Overall contest results are displayed in table2. Results show a very good impact on participants. Our main goal to awaking students about communication and project management challenges had been fulfilled. It was noticed that 67% members had participated in contest, 42% gave positive feedback of learning group management and 40% indicated that exercise was very helpful to understanding globally distributed communication challenges. Feedback of this report was as shown below-

Importance of central body as role A in contest.

- Significance of team coordination.
- Communication was very pretty under pressure.
- Project management is an essential thing for successful any contest.

DOSE PROJECT IMPACT:

In the 2010 DOSE contest, when it was asked to members to need a group manager, then most of them denied to it. But in 2012 DOSE contest, when the same question was asked again, then most of them replied “yes”. Thus importance of group manager was demonstrated. So a main role was assigned to a specific group and other groups had reported to it. DOSE 2010 contest was mandatory while DOSE 2012 contest was optional. Like in 2010 group structures were re-organized but first time various meetings were organized between groups. Main goal of these meetings were to make an agreement for a project manager and to understand complete contest structure.

In 2012, 14 groups participated while 7 groups did not participate. It was noticed that 93% groups who participated in contest successfully implemented their tasks. Project successes were measured by assigning special values to each developed applications. For this some demos were also provided to members. The degree of success was measured as- 1. Project failed: No demos were demonstrated and application was not compiled or run; 2. Partial success: demos were demonstrated but sub parts of application were not properly integrated; 3-5. Full Success: demos were demonstrated and sub parts of application were properly integrated, value 3 was assigned to simpler projects 4 to good projects and 5 to very good projects.

Table 3: Outcome of the 2012 as well as 2011-2012 projects

| | 2012 | | | | | 2011-2012 | | | | |
|---|------|-------|---|------|----------|-----------|-------|---|------|----------|
| | m | μ | M | Mean | σ | m | μ | M | Mean | σ |
| Groups participating in the contest | 1 | 4 | 5 | 3.57 | 1.02 | 1 | 4 | 5 | 3.57 | 1.02 |
| Groups not participating in the contest | 1 | 1 | 3 | 1.57 | 0.79 | 1 | 3 | 4 | 2.56 | 1.09 |

In table 3 the reports of minimum (m), median (μ), maximum (M), mean and standard deviation (σ) has to be represented. For identifying significance we performed a t-test. Significance level was set as 0.005. If p-value is measured as 0.0001, then significant was accepted as 95% probability. In 2011 and 2012, we found out significant level as 0.007, which was also better.

LITERATURE REVIEW:

A lot of work has been done of creating global software engineering class. There are many courses for global teaching, but DOSE had a good impact compared to them [11,12,10,1]. Many projects were developed by using this course.

Gotel et al. [10] made a report, which was focusing that how project was developed by three universities students located in US, India and Cambodia. They present the problems faced in the projects including cultural aspects, project planning and communication. In first four years, project was developed by using waterfall model and in last two years project was developed by using agile process model. Though in overall DOSE project waterfall model was used[19].

A similar teaching experience was presented by Bosnic et al[1]. He included Croatia and Sweden students. Damien et al. reported a teaching experience by including students located in Canada, Australia and Italy. Bruegge et al. [2] shown teaching experience by combining universities of United States and Germany. Richardson et al. [18] presented teaching experience by including universities of United States, Germany, Ireland, and India [9, 20, 11]. Nordio et al. [15] described our first experiences in distributed software development by using DOSE project.

CONCLUSION:

This paper focuses on awaring students about challenging scenario of globally software development. Students understand about technical, management, planning issues. He/She recognized that team coordination and team spirit are how significant.

We introduce in this paper about global software development course as DOSE, which is very popular course and various universities have joined to it. A lot of projects have been made by using approach. Initially main goal was of this course was only made to work together by students of various countries and different-different timing zones. A case study of DOSE project performed in 2011 and 2012 has been evaluated. Results of this report encourages us , because we found out significant level more satisfactory.

It was also noticed that complex projects can be done very easily by working as a team work. This is also realizes that, this type of course may be very helpful in countries as India, where discrimination has been take place in contrast with religion, gender, higher post, higher qualification etc. I am assured, this course will be reduced some prejudices by combining students of various states, religions, castes by agreeing them for working together.

The other aspect of such type of course may be that if IIT's like institutes concur for this project, it will be very fruitful to those students who are not part of any institute but want to join software industry, except this, who belong to some private institutions and want a better guidance for software project development.

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