Analysis of Donations in the Eclipse Project

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***Abstract*—Although development activities, such as submitting patches and working with bug reports, are common contributions in open source software (OSS) projects, making donations is also an important contribution. Some OSS development projects actively collect donations by preparing benefits for donors who promote donations. In this research, we study the Eclipse project to analyze donations. We analyzed donor lists and release dates, and found the following: (1) benefits can be motivations for donations, (2) although the number of developers is small in all donors, they donated more than others, and (3) new releases are triggers of donations, but bugs negatively affect the amount of donations.**

I. Introduction

Open Source Software (OSS) is freely available software. Many companies, government agencies, and individuals use it. If we want to improve OSS projects, we must participate in OSS development. Reporting bugs, writing documents, reviewing code, and submitting patches are typical activities in OSS projects. However, these activities require relatively high skills of software development. For example, 56-60% of submitted patches were rejected because of suboptimal solutions or incomplete fixes [6]. It is not easy to provide informative bug reports for people who do not have software development knowledge [9]. Compared to those activities, the donation is another contribution that does not require skills.

Many OSS projects collect donations. The Document Foundation (TDF), famous for LibreOffice, donated US$830,312[1] in 2015[2]. The donations were used for the server cost, the domain name cost, and conference holding fees. In addition, the donations were used for the salary of full-time developers. Therefore, OSS organizations are actively collecting donations. For example, they have made a special donation web page, which provides various ways of donating (credit card, PayPal, Bitcoin, Flattr, check and so on). Additionally, some OSS organizations distribute giveaways to people who made donations. JUnit made a donation campaign using INDIEGOGO in August 2015. Initially, they set the target amount as US$27,500[1], but collected US$59,330[1] in the end. In other words, they received more than twice the amount requested.

For now, OSS organizations are collecting donations in various ways. However, how to collect effective donations has not been clarified. If the donors' motivations are revealed, it will be possible to propose effective collecting donation methods. In this research, we study the Eclipse project as the analysis target because in addition to Eclipse being famous in OSS projects, Eclipse has benefits for donors and provides details of donor lists, e.g., the amounts of donations, dates, and names.

This paper extends a previous technical report [5] by adding the analysis of the distributions of donors and the analysis of the number of bug report contributions and the number of donors on Bugzilla.

II. Donations and Benefits

The Eclipse Foundation has collected donations since December 2007[3]. They stated that "the donations will be used to help fund the operations of the Eclipse community, such as extra hardware for open source projects, increase bandwidth and sponsorship of Eclipse community events."[3] Fig. 1 shows the donation web page of Eclipse. People who want to support Eclipse can donate from this page. As of December 2016, Eclipse preset the amount of donations (US$5, US$10, US$35, US$50 and US$100). People can donate as much as they want. People who want to donate can use either PayPal or Bitcoin. If they pay with PayPal, they can donate one-time, monthly, or yearly. When they make a donation, donors can enter their name and e-mail addresses, but it is optional and can be anonymous. These names and the amount of donations will be shown on the donor list. If donors want to be anonymous, their name in the donor list becomes "Anonymous".

The Eclipse Foundation prepares benefits for those donors. They call donors who donated over US$35 in one year a "Friend of Eclipse." As of December 2016, donors who donated over US$35 in one year were provided the right to access faster servers, the "Friend of Eclipse" logo and the right to buy books at a discount[4]. They also received a badge on Bugzilla showing that they donated to the community.

Fig. 2 displays the badge on Bugzilla. The box A in Fig. 2 is a donor who donated over US$35. The badge is shown next to their screen name. In addition, this badge has a link to donation web page. "Friend of Eclipse" logos are attached next to the name of those donors on the donor list. In addition, people who donated more than US$100 in one year are called "Best Friend." A special list has been created for "Friend of Eclipse" and "Best Friend," and donors can post their profile images. Previously, donors who donated over US$50 in one year were provided the Eclipse T-shirt and an EclipseCon discount as

[1] calculated €1 = US$1.1 (2015 average exchange rate)
[2] https://wiki.documentfoundation.org/File:Statement-2015-01.ods
[3] http://www.eclipse.org/org/press-release/20071203_donatecb.php
[4] O'Reilly discounts: 40% off prints and 50% off ebooks on oreilly.com

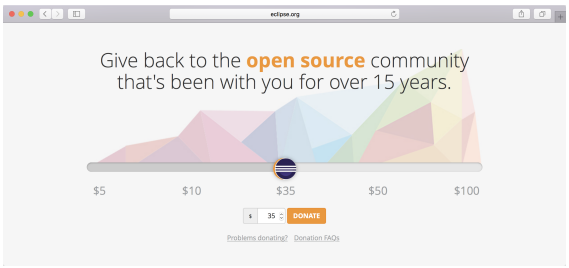

Fig. 1. Donation web page of Eclipse

Fig. 2. Badge displayed on Bugzilla

of August of 2016[5]. EclipseCon refers to Eclipse community events. Benefits are often changed and the amount of donations requires changes. Moreover, a donor who donated more than US$100 in one year could get an Eclipse T-shirt as of August of 2015. As of December 2016, the EclipseCon discount was no longer provided.

III. Research Questions

In this paper, we analyze the donations in the Eclipse project in view of the following three research questions:

RQ1: Do benefits affect the amount of donations?

We investigate donor lists and find out whether benefits affect donors' behaviors (i.e., the number of donations and amount). Many OSS organizations provide benefits to donors who donated a certain amount of money. However, it is not clear how benefits affect donors' behaviors. If benefits affect the motivation of donors, the OSS organizations may be able to receive more donations by providing benefits. On the other hand, another way to promote donations mights also be considered.

RQ2: What are the characteristics of donations from developers?

We investigate developers' donations and find an effective method to collect donations. Considering the developers' needs for benefits may improve the amount of donations. For example, if there are many donations from developers, an Eclipse event participation discount may be suitable. If there are only a few donations from developers, donations might be gathered more effectively by providing benefits for end-users.

RQ3: Do releases and bugs affect the amount of donations?

We investigated the impacts of releases and bugs for donations. If an increase of donations is related to the release dates, OSS organizations may be able to collect more donations by hoding donation campaigns at the release time. In addition, we analyzed the relation between the number of bugs and the amount of donations. It is possible that the motivation of the donor might be affected by serious bugs. For example, when the software has a lot of serious bugs, users may no longer be motivated by donations, or users may encourage development by increasing donations. We investigate the relationship between serious bugs and the increase or decrease of donations by using Bugzilla data.

IV. Dataset

Eclipse had main releases every year at the end of June. Before June 2016, they released the service release (SR) at the end of September (SR1) and at the end of February or in the beginning of March (SR2)[6]. The SR mainly contained the bug fixes. SRs have been released three times since June 2016. In this research, we investigate whether the main release and SR affects the increase or decrease of donations.

We analyze data from the donor list[7], the Git repository[8] and Bugzilla[9] of the Eclipse project.

A. Donor list

The Eclipse Foundation has published the donor list since December 30, 2007. The donor list consists of the names of donors, messages, dates, and the amount of donations. In this research, we used 28,349 records from 30 December 2007 to 30 June 2016.

B. Git repository

In order to clarify the characteristics of developers' donations, we investigated the development history of the Git repositories of Eclipse projects. We collected developer information from 912 repositories managed by the Eclipse Foundation and analyzed the histories from the initial dates to 30 June 2016.

C. Bugzilla

On Bugzilla, developers manage the priority of issues, which are from P1 to P5 in the descending order of priority. We define P1 and P2 as serious bugs. Although the Eclipse Foundation also manages Eclipse-related OSS projects such as the Eclipse plug-in, we target only the Eclipse product. We analyzed bug reports from version 3.3 SR2 to version 4.6 SR1 (as of 14 October 2016). Bugzilla distinguishes bug report contributors of "Friend of Eclipse" with badges. We collected all issues on Bugzilla from 2 December 2016 to 5 December 2016. We analyzed bug report contributions for one year from 3rd December 2015 and counted whether they donated US$35 or more than US$35 from 21 December 2015 to 21 December 2016.

[5]https://events.eclipse.org/

[6]https://wiki.eclipse.org/Simultaneous_Release

[7]https://eclipse.org/donate/donorlist.php

[8]https://git.eclipse.org/c

[9]https://bugs.eclipse.org/bugs/

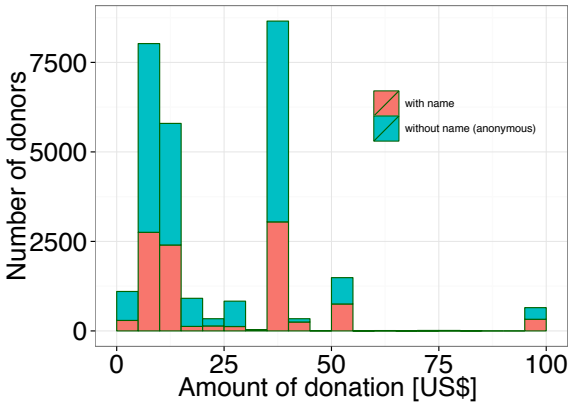

Fig. 3. Distribution of donations

TABLE I
A BREAKDOWN LIST OF DONATIONS

All	$35 or more (Percentage)	$35 (Percentage)
28,358	11,314 (39.9%)	8,623 (30.4%)

V. Analysis and Results

A. RQ1: Do benefits affect the amount of donations?

We examined the distribution of donations. Then we investigated the percentage of people who donated more than US$35 in the total number of donations.

Fig. 3 shows a histogram of the donations. The red bar shows donations from anonymous and the blue bar from onymous. There were many small donations from US$5 to US$10 and many US$35 donations.

Table I shows the total number of records in the donor list, the number donated by the US$35 donors and the number of donations of US$35 or more. There were 11,314 donations of US$35 or more out of 28,358 total records. 40% of the donations were granted benefits. The number of donations of exactly US$35 out of the donations of US$35 or more was 8,623. Therefore, these donors donated the lowest limit amount to which the benefit will be granted.

Fig. 4 shows contributors in the Eclipse project. This figure excluded anonymous donors. This research question discusses the field of Donors and $35 and more. Next research question discusses the field of Committers and Bug report contributors. The field of donors indicates the number of donors and sum of donations. The field of $35 and more indicates the number of donors who donated more than US$35 at a time and received benefits and sum of donations from them. Donors who received benefits from all donors account for 81% of the sum of donations.

Consequently, we infer that benefits affect the donation amount based on the above results.

B. RQ2: What are the characteristics of donations from developers?

We compare the distribution of developers who donate to Eclipse and all of the donations. Then we examine the number of people who match the names in the donor list out of the names of all committers. In addition, we compare the distribution of the amount of developers' donations and the distribution of the amount of all donations. This is to investigate how much the developer donates.

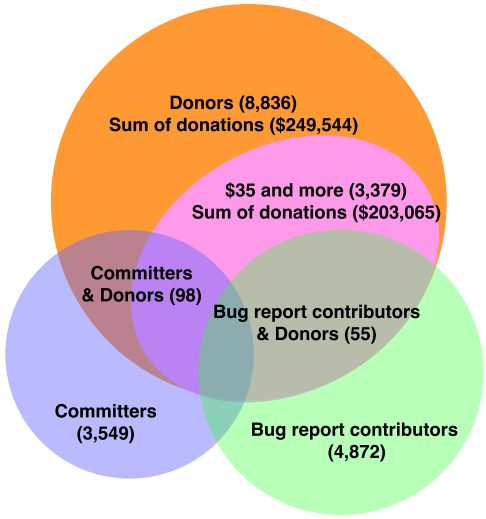

Fig. 4. Contributors in the Eclipse project

The Eclipse Foundation provides the badge "Friend of Eclipse" on Bugzilla. We counted the number of bug report contributors who donated to Eclipse. We speculated that developers will also report bugs or comments on Bugzilla. We compared the number of bug report contributors who donated to Eclipse against all donors.

Fig. 3 shows a distribution of many the amount of small donations. Fig. 5 is a histogram of developers who donated to Eclipse. This histogram excluded anonymous donors. Fig. 5, on the other hand, shows only a few distributions of small donations.

Fig. 4 shows contributors in the Eclipse project. Primarily, this research question discusses the field of Committers and Bug report contributors. The field of Committers shows the number of people who committed to the Git repository, the number of committers' names found in the donor list, and the number of names on the donor list. Committers & Donations show that 3,549 people were committers out of all people and donors of committers were 98 (2.7%). Moreover, 1% of all donors were developers. This is because the number of all donors was 8,836 and the donors of committers was 98.

The field of Bug report contributors shows the number of "Friend of Eclipse" donors on Bugzilla, and the number of bug report contributors whose donors reported to Eclipse. Bug report contributions & donations shows that few bug report contributors donated to Eclipse. In 4,872 bug repot contributors, there were only 55 contributors In other words, just a few bug report contributors donated to Eclipse. The benefit of the badge with which bug report contributors distinguish "Friend of Eclipse" on Bugzilla, therefore, does not affect the amount of donations. Additionally, the number of bug

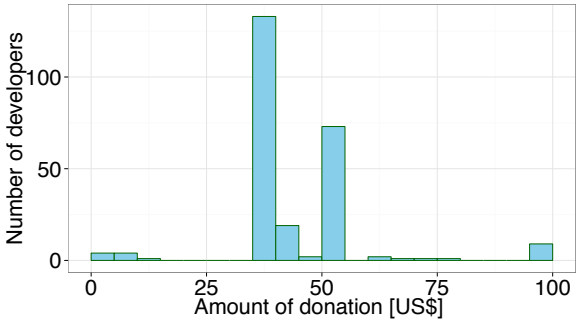

Fig. 5. Distribution of donations from developers

report contributions was 117,659, and the number of bug report contributions of the donors was 7,830. The donors amoung the reporters was only 1.1%, but bug report contributions of the donor were 6.7%.

In summary, we found that donors who were committers generally donate more money than other donors, and bug report contributors who were donors generally make more bug report contributions than other bug report contributors.

C. RQ3: Do releases and bugs affect the amount of donations?

In order to investigate the relationship between release date and the amount of donations, we counted the amount of donation every 30 days. Concretely, we counted the amount of donations received in 30 days with the 25th as the midpoint. For example, assuming that 25 December is the midpoint, we counted the amount of donations received from 11 December to 10 January. Fig. 6 shows a summary of donations by donors on a monthly basis in a line graph and the number of bug reports each version. The vertical axis is the amount of donations tabulated for each month, and the horizontal axis is the month. This graph is a graph from 30 December 2007 to 30 June 2016 when the Eclipse Foundation began collecting donations. Fig. 6 shows that the amount of donations increased from the previous month for the main release, which is held every June. Therefore, the number of donations is affected by the main release. Immediately after version 4.2 was released, the amount of donations increased. However, despite being a large update, it was an increase that was not different from the regular main update. We can guess that the quality of software is important.

Fig. 6 shows Eclipse release dates and serious bugs for each version. The serious bugs status is not filtered. Table 6 shows that the number of serious bugs that decreased for each main release until version 3.7. There were 132 serious bugs in version 3.4, but 77 in version 3.7. When version 4.2 was released there were 107 serious bugs, and more serious bugs were reported than in version 3.7. We can assume that the amount of donations increased just after the release of version 4.2 SR2. Although there were many serious bugs, we believe that the evaluation was raised because the version was corrected. At the time of the release of version 4.2 SR1, the amount of donations had not increased much. In the previous SR, there were just a few serious reports (from five to nine) , but when it was version 4.2 SR1, the number of serious bug reports was 27. The actual number of the serious bug reports in version 4.2 SR2 was 3, and it is likely that many of the serious bugs have been fixed. This is because the quality of the software at the time of the update had an influence on the amount of donations. In addition, the amount of donations was high at the beginning (December 2007) when the Eclipse Foundation began collecting donations.

The total donation amount was found to be affected by the main release date of the software, the service release when most of the bug fixes were completed, and the start of collecting donations.

VI. Threats to validity

Internal validity. Anonymous donors (whose names only consist of spaces or 'anonymous') in the donation list may affect our result for RQ2 because their role in the community cannot be identified. We intentionally excluded 17,963 donation records (63% of the total) of anonymous donors to mitigate the risk. From Fig. 3, we see there are few differences in the distribution of donation. Therefore, we assume that the effect of excluding anonymous donors from our result is small.

The results of RQ3 may be affected by an official campaign of calls for donations by the Eclipse Foundation, which we did not consider. There is a possibility that the campaign will be carried out in accordance with the main release of software and affect the amount of donations. Future work needs to consider the PR activities of Eclipse Foundations on their web page, SNSs, and release notes.

Time-series analysis might be affected by a change in the share of Eclipse IDEs compared to other IDEs. For example, surveys by the software company (ZeroTurnaround) reported that Intellij IDEA was the most often used IDE by developers in 2016[10]. They also reported that the share of IntelliJ IDEA was lower than the Eclipse IDE in 2011 and 2012[11]. These changes in the share might affect the number of users and also the number of donors of the Eclipse projects.

External validity. Since we conducted a survey limited to only one OSS organization, the generalizability of our result might also be limited. In particular, the Eclipse Foundation is a large, successful, and well-structured OSS organization. Hence, it might be difficult to apply our results to much smaller OSS organizations. Future work should target OSS organizations whose characteristics are different from the Eclipse Foundation.

VII. Related work

Previous analysis of how to contribute to OSS development includes the following work: Zimmermann et al. reported bug reports of analysis. They revealed that the developers' expected reports were different from the actual reports [9]. McIntosh et al. reported a code review of analysis. They revealed that poorly reviewed code has a negative impact on

[10] https://zeroturnaround.com/rebellabs/java-tools-and-technologies-landscape-2016/

[11] https://zeroturnaround.com/rebellabs/developer-productivity-report-2012-java-tools-tech-devs-and-data/

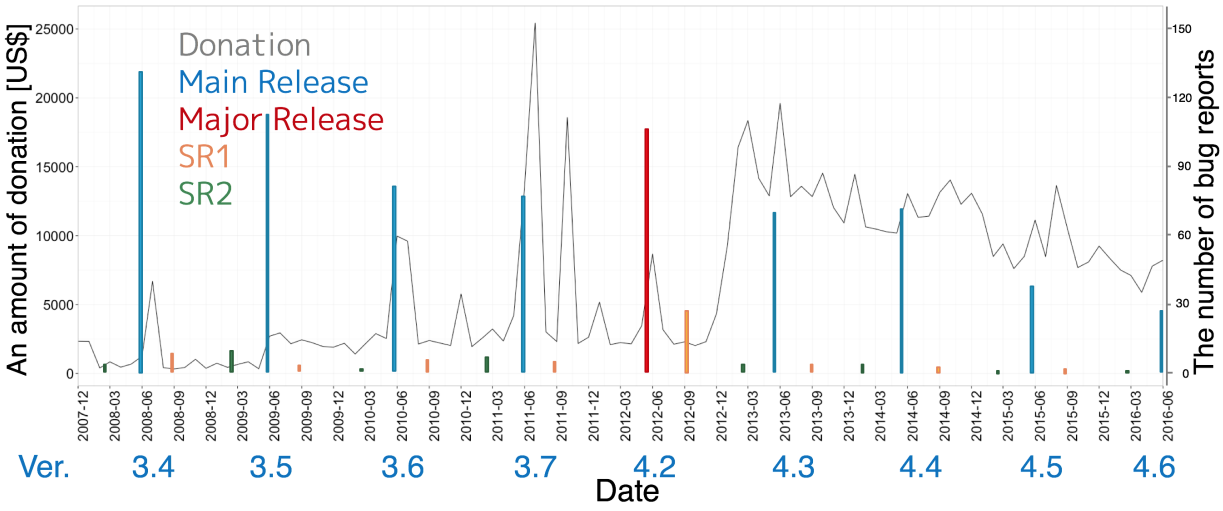

Fig. 6. Amount of donations by month (a line graph) and the number of bug reports (a bar chart)

software quality in large systems using modern reviewing tools [4].

Previous analysis of finance support to OSS development includes the following: West and Gallagher claimed that firms involved in open-source software often make investments that will be shared with real and potential rivals [7]. Zhou et al. found that full control mechanisms and a high intensity of commercial involvement were associated with a decrease of external inflow and with improved retention. However, a shared control mechanism was associated with increased external inflow contemporaneously with the increase of commercial involvement [8]. Franck and Jungwirth argued that the basic institutional innovation in open source has been the crafting of a governance structure, which enables rent-seeking without crowding out donations [1]. Krishnamurthy et al. address a central challenge to the sustainability of OSS-developers acceptance of monetary rewards. They explain why some OSS developers accept monetary rewards and others do not [2]. Krishnamurthy and Tripathi studied the donations in Sourceforge.net, and reported that the length of association with the platform and relational commitment affects donation levels [3]. Compared to this, our research focuses on investigating donation benefits, and on release and software quality with the datasets of the Eclipse project.

VIII. Conclusion

We analyzed the donations in Eclipse, which is a famous OSS. Our findings are (1) benefits can be motivations for donations, (2) although the number of developers is small in all donors, they donated more than others, and (3) new releases are triggers for donations, but bugs negatively affected the amount of donations.

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