OSS Myths and Facts

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2023/12/01

Contents

Chapter 1

Executive Summary

We have selected six myths about the OSS community and have tested whether they are true or not.

The purpose of this report is to identify the lessons that can be learned from the development style of the OSS community and the issues that need to be addressed in order to achieve better Employee Experience (EX) in software development within companies and organizations. The OSS community has been led by a group of skilled developers known as hackers. We have great respect for the engineers and activities of the OSS community and aim to learn from them.

On the other hand, it is important to recognize that having high expectations can sometimes result in misunderstandings. When there are excessive expectations and concerns, misunderstandings (referred to as myths) can arise, particularly when individuals who are not practitioners rely on hearsay to understand the practices of practitioners.

We selected the myths to be tested based on a literature review and interviews. These myths are held by software development managers and customers who are not direct participants in the OSS community. We answered questions about each myth through: 1) Our own analysis of repository data, 2) A literature survey of data analysis conducted by previous studies, or 3) A combination of the two approaches.

Myth: Communication within the OSS is moderate.

Question: Does the OSS community have long intervals in their communication?
Fact: No matter the topic of discussion, developers communicate with each other within a span of 4 hours for about half of all communications.

Myth: OSS community never sleeps.

Question: Are working hours distributed among developers in the OSS community?
Fact: Developers tend to work during office hours in North America.

Myth: OSS community quickly halts their development.

Question: How much of the OSS community will continue?
Fact: Four years after adoption, half of the OSS community activities are still ongoing.

Myth: OSS community does not lose to crackers.

Question: Does the OSS community take less time to resolve vulnerabilities (security holes)?
Fact: A vulnerability resolution time of 3 months is not necessarily short.

Myth: OSS community responds quickly to requests.

Question: Is the resolution time for proposals, like bug reports and enhancements, short?
Fact: Most bug reports and feature requests are resolved within two weeks. However, at least a quarter of them take more than three months to resolve, indicating a variation in resolution time.

Myth: OSS community participants are top-notch developers.

Question: What roles do developers play in the OSS Community?
Fact: In the OSS community, there is a wide range of roles available.

Chapter 2

Introduction

2.1 Employee Experience (EX) in Software Development

We are conducting research and development with the goal of promoting the well-being of individuals involved in software development and enhancing the Employee Experience (EX). Our objective is to enable software development to be carried out by anyone, at any time, and from anywhere, by providing solutions that expand opportunities for diverse individuals to thrive. Remote work, which has been promoted due to COVID-19, is expected to broaden working conditions by expanding the choice of work locations. Many companies cite objectives such as "improving the well-being and health of employees," "accommodating individuals with commuting challenges," and "retaining talented individuals" as reasons for implementing remote work. All of these objectives contribute to creating a comfortable work environment for employees. Workers have expressed various benefits of remote work, including reduced commuting and travel time, increased free time, and the ability to better balance work with childcare and parenting responsibilities.

Traditionally, the workplace in software development, especially within companies, has been restricted to a specific location. This is partly because easy communication between clients and developers is believed to lead to successful software development. Additionally, having a fixed workplace facilitates information and worker management for companies.

2.2 OSS as a predecessor

"a world-class operating system could coalesce as if by magic out of part-time hacking by several thousand developers scattered all over the planet, connected only by the tenuous strands of the Internet" from The Cathedral and the Bazaar

Open Source Software(OSS) is a broad term that refers to software that allows users to use, study, reuse, modify, extend, and redistribute its source code for any purpose. It has gained significant attention for its advanced development style, which involves frequent releases and collaboration among contributors connected through the Internet. Much valuable software is created through the cooperation of developers from all over the world.

This fact has caught the attention of big tech, which also has something to learn from it. As the OSS

community grows, software developers and management are becoming increasingly interested in the state of the OSS community and product management.

2.3 Is the OSS Community a Utopia?

There are various opinions about the state of the OSS community and the involvement of developers in projects. It is important to consider that the opinions of clients and management are often subjective, influenced by the origins of the OSS community and other factors. Practitioners gain knowledge from their own experience, while the general population receives and interprets empirical information, sometimes with preconceived notions. Consequently, having overly high expectations can lead to disappointment or excessive concern. For instance, the term "agile" is perceived differently by developers who associate it with their own activities, and by management who view it as a means to an end.

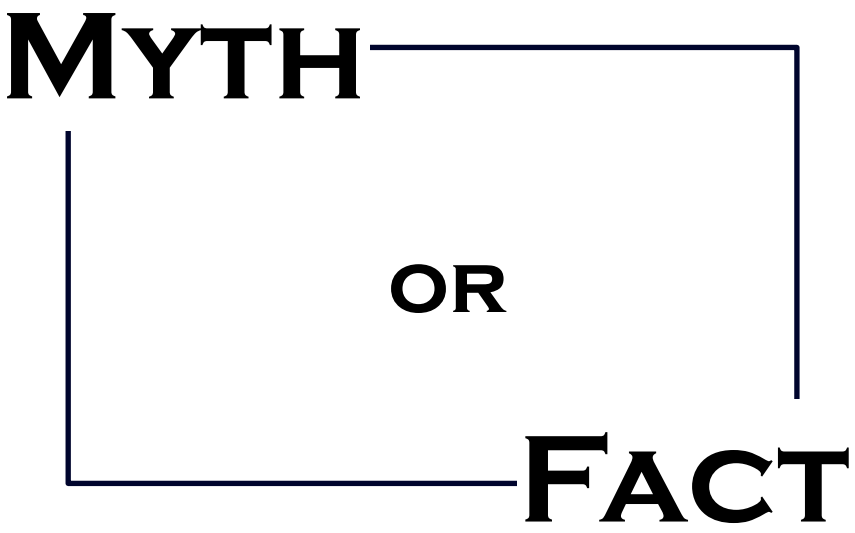
In this eBook, we will discuss six topics related to OSS and attempt to distinguish between data-based facts and fiction (myths).

2.4 Methodology

1. Topic Selection
    1. Gathering comments from software development clients and management.
        - Literature survey
        - Interview
    2. Organize interests and background
    3. 3 categories and topics
2. Study each topic
    1. Primary study: Literature survey
        1. Literature survey
        2. Decision
            - If the topic has already been discussed in previous papers, provide a summary of the discussion
            - Topics that have not yet been discussed or that can be further investigated are analyzed empirically
    2. Secondary study: Data analysis
        - Main target dataset
            - Libraries.io open data
        - Analysis target extraction procedure
            1. list the products include in dataset
            2. Remove non-github repositories
            3. Remove fork repositories
            4. Filter for each analysis
            5. Random sampling

Chapter 3

Myths



3.1 Communication within the OSS is moderate.

Question: Does the OSS community have long intervals in their communication?

Software development is a collaborative process where communication plays a key role. The pace of interactions between developers can significantly impact a project's progress. In basic software development, it's often considered best practice to physically locate developers close to each other for this interaction pace. However, this is not the case in the OSS community, where developers don't typically share the same location or working hours. This situation can make it challenging to initiate communication based on each team member's preferred timing, leading to longer communication intervals, but this is not justified by data. To investigate this myth, we analyze the communication interval within the OSS community.

Fact: No matter the topic of discussion, developers communicate with each other within a span of 4 hours for about half of all communications.

We detail the communication time interval on GitHub for long-standing OSSs [1]. Figure 1 illustrates the distribution of the time interval between a comment on an issue ticket and its subsequent reply. Figure 2 displays the time interval distribution for a pull request. The data suggest that the median time interval for issue discussion is approximately 4 hours, while for pull requests, it's less than 40 minutes. This suggests that communication within the OSS community occurs at rapid intervals [1].

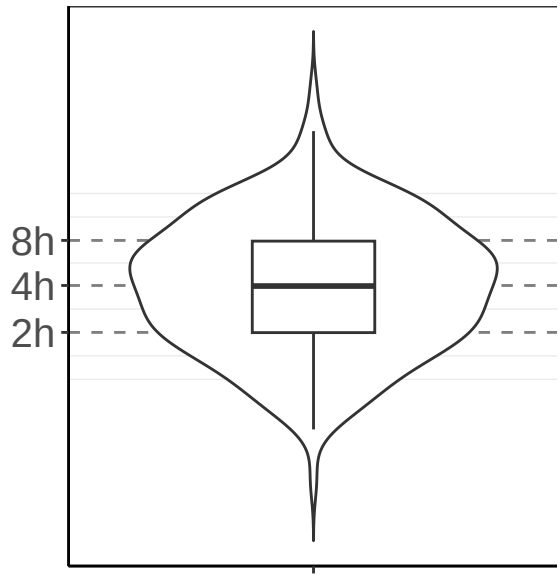


Figure1 The distribution of the time interval between a comment on an issue ticket

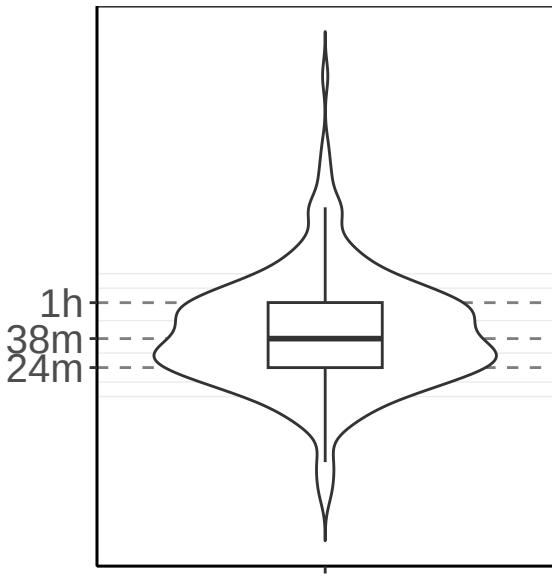


Figure2 The time interval distribution for a pull request

We infer that the brief response times are likely due to developers' preference for synchronous communication, even in an asynchronous environment (e.g., disparate locations and office hours). For instance, Microsoft has reported that developers favor communication involving numerous exchanges over a short duration. However, this could also indicate that developers feel pressured to respond promptly. If so, they might feel obligated to answer at any time, even when concentrating on other tasks, potentially negatively affecting their well-being.

Insight:

We observed that even the OSS community often operates in short time intervals. In an era that accommodates diverse work styles, including remote work, synchronous communication in corporate software development may negatively impact developers' well-being. If software development adopts more flexible communication, it could provide various benefits, such as enabling developers to choose work hours that suit their personal lifestyles.

References

1. Cockburn, Alistair, "Agile software development: the cooperative game.", Pearson Education, 2006.

3.2 OSS community never sleeps.

Question: Are working hours distributed among developers in the OSS community?

In basic distributed development, time and cultural differences can sometimes cause certain developers to be "overlooked" or "neglected," leading to confusion and discouragement [1]. Given that the open-source software (OSS) community includes developers worldwide [2], a question arises: do developers in the OSS community operate beyond time zone differences? If so, their working hours should span across various time zones, making the OSS community active round-the-clock. To examine this myth, we analyze the distribution of developers' working hours in the OSS community.

Fact: Developers tend to work during office hours in North America.

Figure 1 graphs the count of comments on an issue ticket, with the X-axis representing the time a comment was made in "Anywhere on Earth: AoE" time. The graph reveals a spike in activity during office hours (9:00 to 17:00) in AoE time. Similarly, Figure 2 presents the count of comments on pull requests, also indicating a concentration of activity during office hours in the AoE time zone.

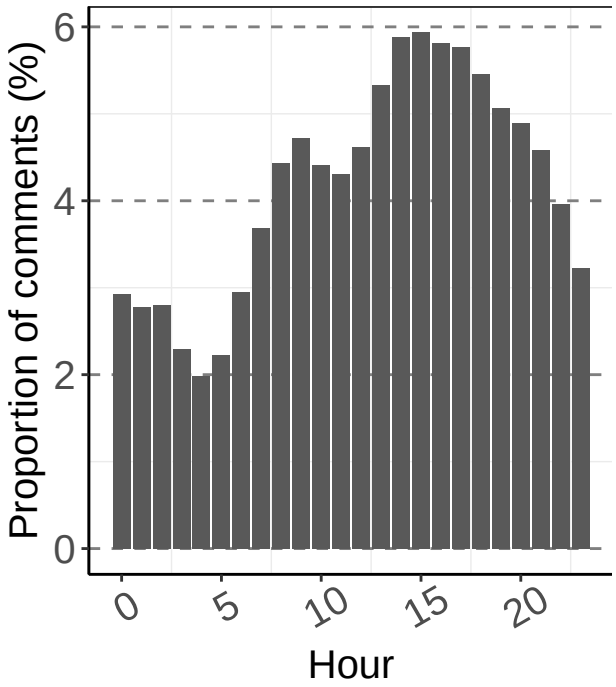


Figure1 The count of comments on an issue ticket

Bias in developers' activity may indicate an uneven distribution of developers, particularly highly active ones, across different geographical locations. A 2015 GitHub report revealed that a third of developers resided in North America. However, countries such as India and China have seen a significant increase in participation in recent years [1].

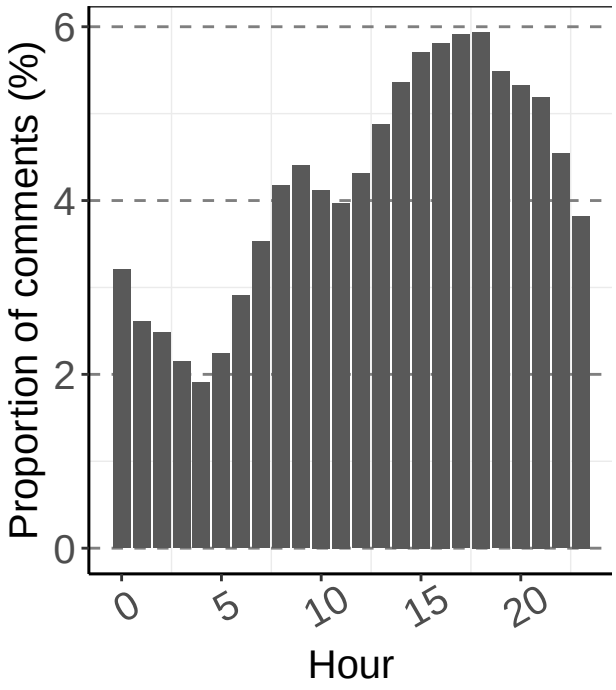


Figure2 The count of comments on pull requests

Alternatively, developers may adhere to AoE time regardless of their geographical location. For instance, Indian developers working on AoE office hours would be active from late night to early morning. This could imply that they are aligning their work schedule with different time zones to minimize the impact of time differences.

Insight:

Even within the OSS community, known for its asynchronous activities, synchronous tasks are still essential in software development. However, in today's world, where issues like pandemics can arise, it's important to explore asynchronous software development methods to prevent companies from halting their work. One possible approach is to implement a human-in-the-loop system using generative AI-based agents, which could potentially ease the load on developers.

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3.3 OSS community quickly halts their development.

Question: How much of the OSS community will continue?

It is true that popular open-source web and database servers have been continuously developed by the OSS community for many years.The traditional software development managers object that in software development it is really sustained effort over time and the degree to which customers can expect continuing investment in the product that matters, but the casualness with which project groups form and change and dissolve in the open-source.[1] Similar to the situation on GitHub, where over 85.7 million new repositories have been created and their number continues to increase by 20%, OSS communities are being created at a rapid pace. However, it is important to consider how many of these communities will eventually cease their activities on a yearly basis. In order to verify this myth, we will analyze the likelihood of OSS communities being able to sustain their activities in the long term.

Fact: Four years after adoption, half of the OSS community activities are still ongoing.

Figure 1 illustrates the probabilities for the duration of OSS survival time. It demonstrates that the probability of OSSs ceasing development is higher during the first three months compared to other periods, and the overall trend shows a linear decrease. The duration until half of the OSSs stop their development is 48 months. Figure 2 illustrates the impact of different features on the survival or cessation of OSS development. The vertical axis represents the degree of influence, with negative values indicating continued development and positive values indicating cessation. The horizontal axis represents the importance of the feature, with less important values approaching zero earlier. According to Figure 2, the number of time zones in which developers reside and the number of top-level directories in OSS have a significant influence on the continuity of OSS activities.

The decrease in the probability during the first three months is more severe compared to other intervals. This is because a certain percentage of the currently active OSS projects are newly created, and many of them quickly cease their development.

The finding that the diversity of time zones in which developers live has the greatest impact suggests that diverse OSS communities contribute to the longevity of OSS projects. Additionally, the number of top-level directories may also indicate that larger OSS projects tend to continue their development for a longer period of time in the future.

Insight:

Long-lived OSS is often cherished by a wide range of individuals. Data further supports the notion that long-lived OSS attracts developers from diverse residential areas. This suggests a potential correlation between participant diversity and the longevity of OSS projects. In the context of corporate development, enhancing the diversity of individuals engaged in the development process fosters knowledge sharing among developers and enhances project quality by incorporating varied perspectives. Ultimately, this

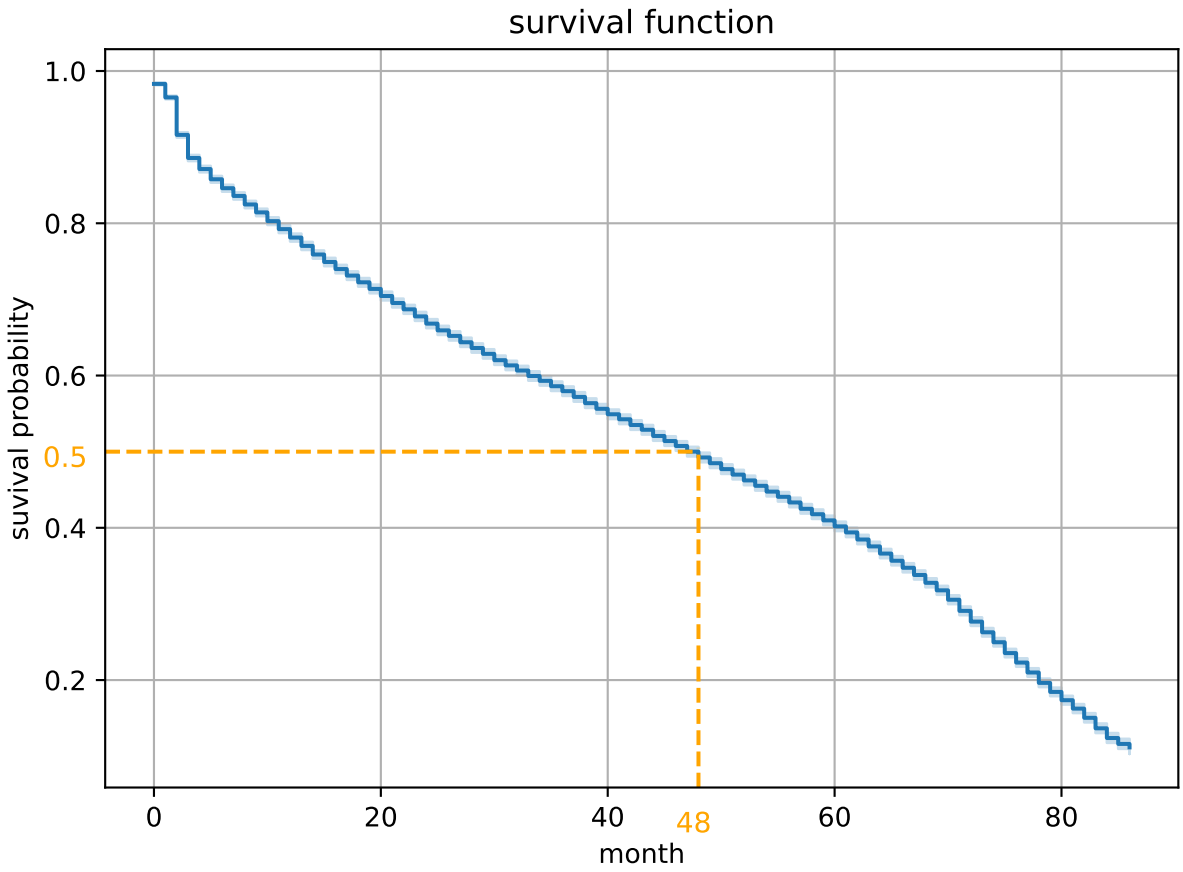

Figure1 The probabilities for the duration of OSS survival time

can result in the creation of products that resonate with a larger audience.

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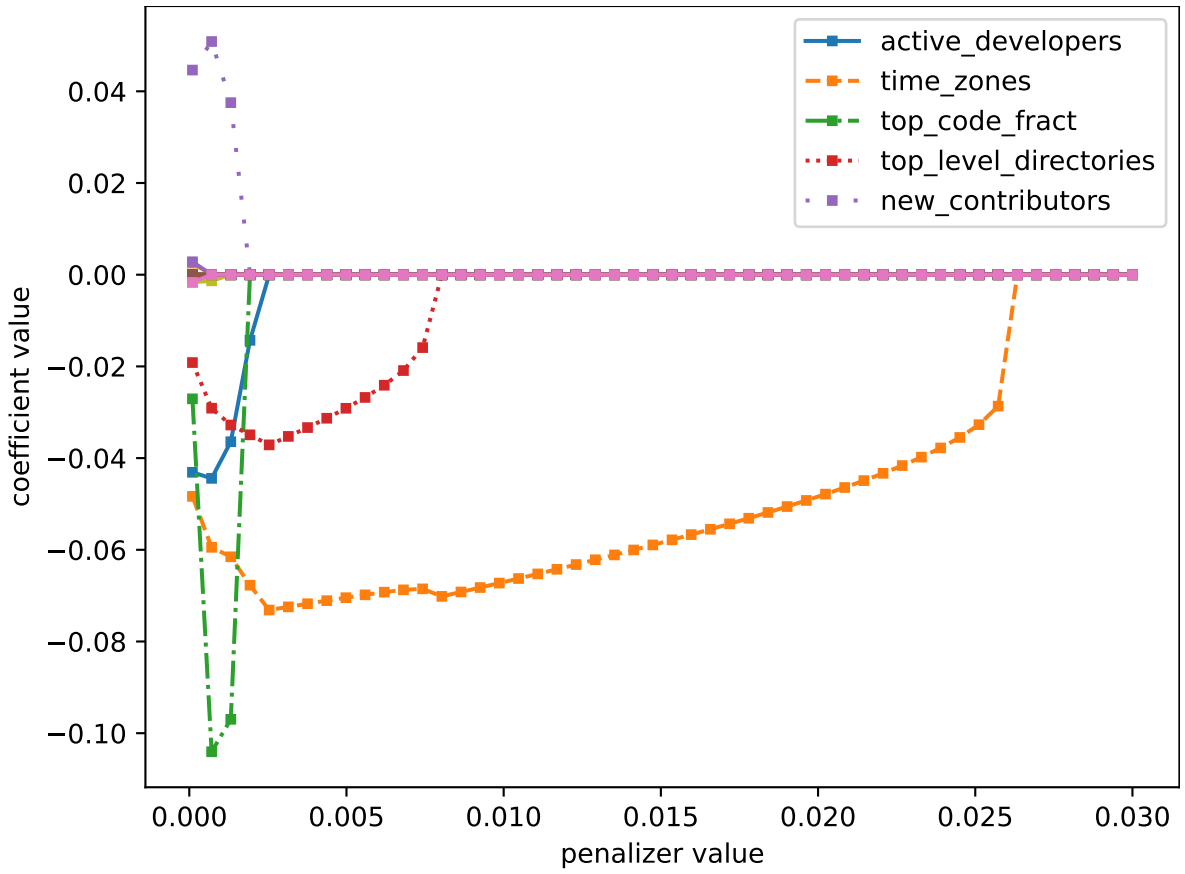

Figure2 The impact of different features on the survival or cessation

3.4 OSS community does not lose to crackers.

Question: Does the OSS community take less time to resolve vulnerabilities (security holes)?

The Cathedral and the Bazaar states Linus's law, which claims that "Given enough eyeballs, all bugs are shallow." This means that with a sufficient number of developers, all bugs will be found and fixed promptly, ensuring high software quality [1]. Since OSS source code is publicly available and the OSS community includes developers from all over the world, one might expect that all bugs in OSS will be discovered and resolved immediately. To verify this myth, we focused on several OSS projects and addressed vulnerabilities that are known to be more time-consuming to fix compared to common bugs. Our analysis aimed to determine the time required to fix these vulnerabilities.

Fact: A vulnerability resolution time of 3 months is not necessarily short.

We analyzed the response time to vulnerabilities in Hadoop and httpd, two Apache projects with the largest number of developers in OSS. Figure 1 presents the results, with the x-axis indicating the number of days it takes to fix the vulnerabilities, and the y-axis indicating the number of vulnerabilities fixed. The figure shows that vulnerabilities are typically resolved within 100 days. The median time for both projects is approximately 87 days, which is less than 3 months.

Although the x-axis in the figure has an upper limit of 500 days due to its size, in reality, some vulnerabilities took longer than this limit to be fixed. For instance, the httpd vulnerability that took the longest time to fix required 1,842 days, which is slightly over five years.

Even in projects with a large number of developers, the fact that it takes approximately three months to resolve vulnerabilities that significantly impact quality indicates that it may take time to fix bugs in OSS. It is worth noting that, although this is an exceptional case, there are vulnerabilities that have remained unresolved for over five years. For difficult-to-fix bugs, such as vulnerabilities, the involvement of multiple individuals may not necessarily speed up the resolution time.

The analysis conducted so far does not consider the time it takes to discover a bug. It focuses on the time elapsed after a bug has been discovered and reported. A previous study reported a median time of 200 days from bug introduction to bug fix [1], and our findings suggest that it may take approximately 100 days to discover a bug.

Insight:

In certain situations, companies keep developers who are familiar with the code in order to make post-release code modifications. The speed at which vulnerabilities are fixed in the OSS community is not particularly rapid. Nonetheless, the OSS community experiences a high turnover of developers and manages to address vulnerabilities, even when the developer who introduced the vulnerability is different from the one who fixes it. Companies can adopt from the OSS community practices for handling vulnerabilities in a collaborative manner, rather than relying solely on individuals.

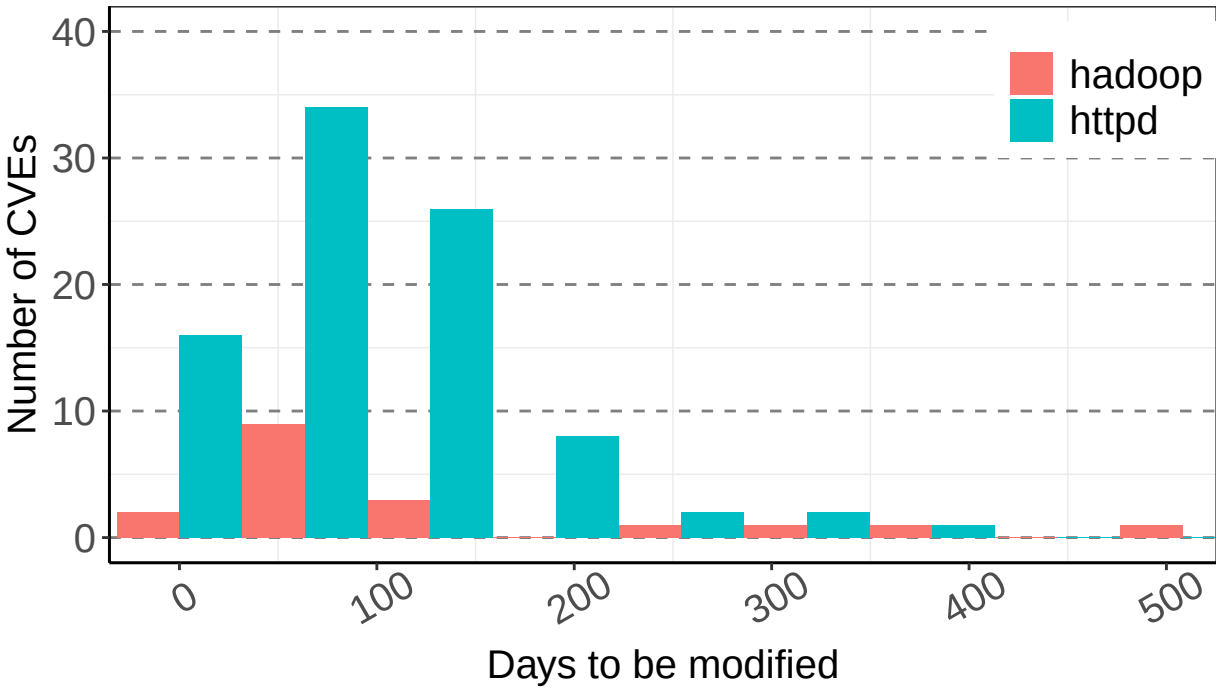

Figure1 The response time to vulnerabilities in Hadoop and httpd

References

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3.5 OSS community responds quickly to requests.

Question: Is the resolution time for proposals, like bug reports and enhancements, short?

The Cathedral and the Bazaar state that "Treating your users as co-developers is your least-hassle route to rapid code improvement and effective debugging." In OSS communities, anyone can report bugs and contribute to code fixes. Another characteristic of OSS is that ... [1]. These factors have led some to assume that any request for open-source software (OSS) will be addressed immediately. To verify this myth, we will examine the resolution time for two types of proposals: bug reports and feature requests.

Fact: Most bug reports and feature requests are resolved within two weeks. However, at least a quarter of them take more than three months to resolve, indicating a variation in resolution time.

Figure 1 illustrates the boxplot and violin plot for response times in bug reports. The median response time is 10 days, with the 75th percentile at 117 days. Figure 2 presents the boxplot and violin plot for response times in feature requests, with the median and 75th percentile at 14 and 146 days respectively. Half of both bug reports and feature requests are resolved within two weeks. However, 25% of bug reports and feature requests take more than three and four months to resolve respectively.

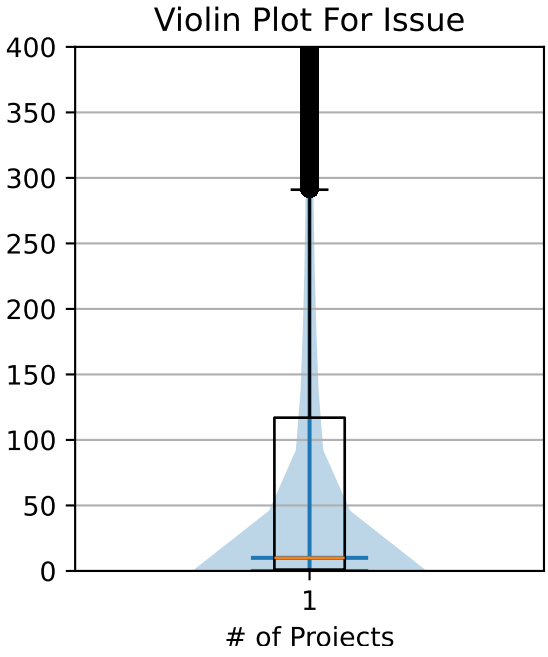

Figure1 Figure 1

Figure2 The response times in bug reports

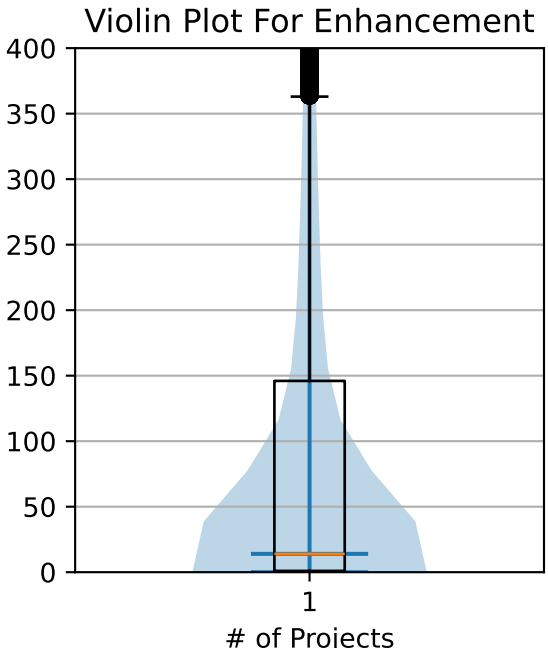

Figure3 The response times in feature requests

Although approximately half of bug reports and feature requests are resolved within two weeks, it takes more than four months to resolve three-quarters of them. This finding suggests that not all users who submit bug reports or feature requests actively contribute to development, and there may be a limited number of developers compared to the volume of incoming reports. Additionally, the effort required to resolve these reports and requests varies greatly. Some are closed without much discussion, while others require extensive deliberation before being resolved. With limited resources (developers), there is a constraint on the number of requests that can be addressed, making request triage crucial.

Insight:

Even in OSS development, which can gather developers from all over the world, it is challenging to immediately address all bug reports and feature requests. The findings of this study highlight this reality. Proper triage of requirements is crucial to maximize limited response capabilities. By appropriately triaging requirements, developers can manage their workload within a suitable range. Based on research on triage methods in OSS development, implementing these methods will optimize development in the enterprise.

References

1. Raymond, Eric. “The cathedral and the bazaar.” Knowledge, Technology & Policy 12.3 (1999): 23-49.

3.6 OSS community participants are top-notch developers.

Question: What roles do developers play in the OSS Community?

The OSS community is full of famous hackers. In recent years, developers and corporate recruiters have recognized that the talent of OSS developers often leads to employment and high salaries [1]. Consequently, there is a prevailing belief that engineers who actively participate in OSS communities are exceptionally talented and regarded as top-notch developers. As of January 2023, there are more than 100 million engineers using GitHub [2], and the OSS community is still growing. If the above belief is correct, does this large-sized OSS community also consist of top-notch developers? To verify this myth, we analyze the roles of developers participating in OSS communities.

Fact: In the OSS community, there is a wide range of roles available.

We conducted a survey of previous studies on the role of developers in OSS communities and the structure of these communities. In most of the previous studies, the existence of a core team has been assumed or observed as the structure of the communities [2]. Although the classification of developer roles varies from study to study, it has been assumed and observed that there are core developers who play a central role, episodic developers who participate on a limited basis by adding specific features, and new developers who are new to the community [3,4]. Additionally, there are other roles in OSS that differ from those in corporate development, such as reactors [5], who primarily provide reactive feedback (Figure 1).

Some OSS communities have implemented strategies to facilitate the involvement of developers with limited experience but a strong desire to participate. They label certain tasks, such as documentation updates and minor bug fixes, as "Good First Issues" to make them more accessible to newcomers. In addition, reactors in the community can provide valuable feedback regardless of their technical expertise, as long as their focus is not on designing new features, but rather on determining the desirability of specific features. It is important to note that the roles of developers in the OSS community are diverse, and participation in OSS development does not guarantee their technical skills.

Insight:

There was a time when companies focused on teams made up of only the best developers, such as Green Beret talent. On the other hand, developers participating in OSS development have a wide variety of skills and ways to contribute. We found that there are roles that are not considered important by companies, such as not only coding and documentation, but also responding to discussions. The diversity of roles in OSS may allow companies to learn new values.

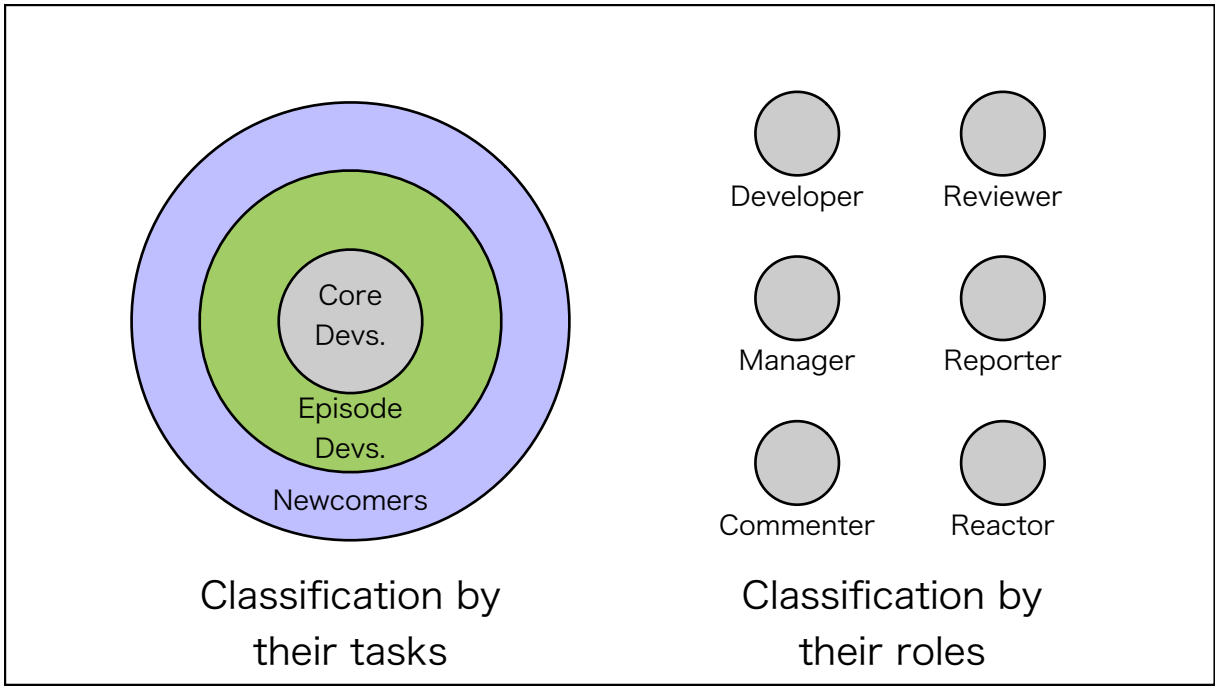

Figure1 The roles in OSS / corporate development

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Chapter 4

Takeaway messages

In Chapter 3, we discussed the six myths and evaluated their validity, as well as the insights they provide. In this chapter, we will summarize these myths from different perspectives and explore what can be learned from the development style of the OSS community. Additionally, we will address the key issues that need to be tackled in order to achieve Employee Experience (EX) in software development within companies and organizations.

Our main goal is to create more opportunities for individuals from diverse backgrounds to succeed in software development. We aim to make software development accessible to anyone, at any time, and from anywhere. Developers from all over the world are actively participating in the OSS community. However, there are still a few challenges that need to be addressed.

4.1 Does OSS allow everyone to participate in the community?

An actual situation in OSS: Based on the validation that "OSS community participants are top-notch developers," it appears that the contribution role is divided into the core team and others. While not all OSS communities are making efforts to reduce the cost of participation, some are actively working towards this goal. It is important to note that not everyone is involved, but steps are being taken to achieve greater inclusivity.

Challenge: The knowledge and skills required for software development are becoming more diverse. Instead of specializing in just one field, engineers with a wide range of knowledge and skills, such as full-stack engineers, are in high demand. The journey to becoming a developer and participating in projects is getting longer and longer.

Takeaway message: To incorporate OSS development styles, it is important to identify practices that allow every participant to contribute to the project using their knowledge and skills. It is also crucial to find ways to improve practical skills through active participation in the project. Analyzing how actions other than coding and testing (e.g., reactions) impact software and development projects can uncover new insights and values.

4.2 Is the OSS anytime/anywhere available to the community?

An actual situation in OSS: Based on the validation that "OSS community quickly halts their development," we have observed that the participants' various time zones may contribute to the project's continuous progress. The OSS community consists of developers from all over the world. Based on the validation that "OSS community never sleeps" and "Communication within the OSS is moderate," the activity time is concentrated within a specific time period, and it is observed that the communication was synchronous with short intervals. It appears that "anywhere" is generally achievable through the network, but the same cannot be said for "anytime".

Challenge: In software development projects, it is common practice to keep developers in close proximity to facilitate communication. Companies often assign fixed work locations for developers to manage confidential information found in source code and designs. While networks and tools have reduced the limitations of physical locations, they still persist. Furthermore, if a developer is unable to participate in communication during certain times of the day, they may be unable to fully engage in a software development project.

Takeaway message: To overcome communication delays and increase geographical freedom, it will be necessary to establish a new development style and tools that prioritize information management.

4.3 Product management in OSS

An actual situation in OSS: Based on the validation that "OSS community responds quickly to requests" and "OSS community does not lose to crackers," We have discovered that not all requests and bugs are resolved promptly in OSS.

Challenge: Even in companies, bugs and requests are coming in large numbers, not only from traditional channels but also from various sources such as social media and reviews. There are insufficient developers to address all of them.

Takeaway message: To effectively manage a large number of requirements and bug reports, it is important to learn how to triage them based on their priority and urgency. This involves identifying which issues need to be addressed first. Additionally, it may be beneficial to develop tools specifically designed for this purpose. In corporate software development, it can be effective to consider approaches like inner sourcing to encourage diverse contributions to non-critical requests and bugs.

Myths of OSS

2023/12/1 First edition issued