An Empirical Study on the Characteristics of Question-Answering Process on Developer Forums

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ABSTRACT

Developer forums are one of the most popular and useful Q&A websites on API usages. The analysis of API forums can be a critical step towards automated question and answer approaches. In this poster, we empirically study three API forums: Twitter, eBay, and AdWords, to investigate the characteristics of question-answering process. We observe that +60% of the posts on all forums were answered with API method names or documentation. +85% of the questions were answered by API development teams and the answers from API development teams drew fewer follow-up questions. Our results provide empirical evidence in future work to build automated solutions to answer developer questions on API forums.

CCS CONCEPTS

• **Software and its engineering → Software maintenance tools**;

KEYWORDS

Question answering; API documentation

1 INTRODUCTION

Recently, developer question and answering (Q&A) websites have become critical and essential on-line resources where developers seek for the solutions on API usages, share and learn knowledge of using APIs, and even make discussions on the design of APIs [6].

Two main types of developer Q&A websites (DQA) have become popular: The general-purpose Q&A websites, e.g., Stack Overflow [7], and the API Q&A forums maintained by the libraries' providers, e.g., Twitter [4]. The main differences between them are: (1) An API forum is maintained by an API provider and has the development team to answer questions only relevant to the APIs. However, StackOverflow tends to deem the valid questions yet specific to a particular library as off-topic questions [8]. The

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API development teams on API forums can offer fast and right-to-the-point responses to the API specific questions [9]; and (2) The general-purpose DQA provides incentivesto improve the credibility of responders and their public answers [10]. A question or an answer can be modified multiple times on SO, while the API Q&A forums often do not allow developers to modify others' questions or answers. Due to those major differences, it is necessary to help API development teams answer more questions, and provide high-quality and right-to-the-point answers on API forums.

Extensive research [1, 5, 11] has studied StackOverflow (SO). However, despite the importance of API forums, little research has focused on API-specific forums. In this poster, we investigate the process of question-answering on such forums. We empirically studied three popular API Q&A forums, Twitter [4], eBay [2], and Google AdWords [3], to answer the following research questions:
RQ1. How are the questions answered?
RQ2. Who answer the questions?
RQ3. What is the quality of answers?

2 EMPIRICAL STUDY DESIGN

Data Collection and Processing. Our empirical study was on Twitter, eBay, and AdWords. We built a tool to crawl all of the questions and their answers from each Q&A forum. Table 1 shows that over 50% of the questions on each forum were not answered.

Table 1: Statistics of Each library-specific Q&A Forum.

	Twitter	eBay	AdWords
Total # of questions	16,874	6,204	23,731
# of questions with answers	8,910	3,524	12,364
# of questions without answers	7,964	2,680	11,367
% of questions without answers	52.8%	56.8%	52.1%

Analysis Approach for RQs. We analyzed the answered questions on each forum to study how the questions were answered and who answered them. Using the confidence level 95% with an interval 5%, we randomly selected 368, 346, and 373 out of 8,910, 3,524, and 12,364 questions having answers on Twitter, eBay, and AdWords, respectively. For each selected question, we manually studied the question and its answers to classify the question based on the question context and how it was answered. There can be many metrics for measuring the answer quality. For simplicity, we use the number of follow-up questions on an answer as one indicator to evaluate the quality of an answer in RQ3.
Results of RQs. Let us present the results.

(RQ1.) The majority of the questions were answered with providing API method names (or sometimes links to API web pages). Figure 1 shows that we identified 8 categories of questions based on how they were answered. The *API Docs* indicates the percentage of the questions were answered with an API document. On
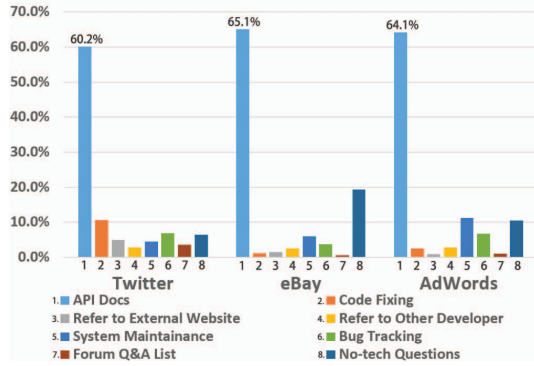
Figure 1: Eight Categories of Questions.

average, 63% of the questions were answered by using API documentation. The *Code Fixing* shows the percentage of the questions for code errors, and not relevant to the API usages. The *Refer to External Website* refers to the percentage of the questions that cannot be answered by API documents and need the information from other external websites. The *Refer to Other Developer* means the percentage of the questions that have been referred to a specialized developer to answer. The *System Maintenance* shows the percentage of the questions caused by system maintenance. The *Bug Tracking* indicates the percentage of the questions causing by a bug. The *Forum Q&A List* means the percentage of the questions already covered by forum Q&A list. The *Non-tech Questions* shows the percentage of the questions that are not technical.
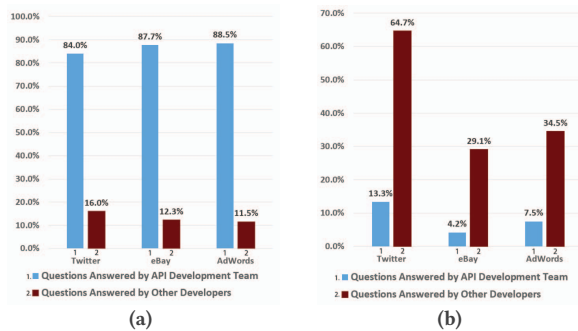

(a) (b)

Figure 2: (a) Comparison between the Percentage of Questions Answered by API Development Team and Other Developers. (b) Comparison between the Percentage of Questions Answered by API Development Team and Other Developers, Receiving Follow-up Questions.

(RQ2.) The majority of the studied questions were answered by API development teams. Figure 2a shows that 84%-88.5% of the questions were answered by API teams on three forums.

(RQ3.) The answers from API development teams have drawn fewer follow-up questions than other developers. For example, Figure 2b shows that only about 13% of the questions answered by the Twitter API development team drew follow-up questions, while about 65% of the questions answered by other developers. The other API forums share the same phenomenon.

3 DISCUSSION

Our three preliminary RQs show that it is important to assist API development teams to answer developer questions, as on average,

+85% of the questions were answered by the API development team and fewer follow-up questions were triggered up after an answer was provided by an API development team member. Furthermore, on average, +60% of the questions were answered using API document links or direct API method names. Thus, recommending relevant API documents to answer a question can be very useful.

4 THREATS TO VALIDITY

Manual Analysis of API forum posts. During the labeling process, most answers can clearly show the relevant APIs. However, some answers can contain outdated links for API documents, which makes it very difficult to determine the relevant APIs. We discarded such answers to try our best to minimize the bias. Our process might bring bias to our results since we are not familiar with the APIs from the development teams.

Selection of API forums. There are many API forums for different websites. In our research, we only focused on three very popular API forums, Twitter, eBay, and AdWords. Thus, we cannot claim that the results are general for all API forums.

5 RELATED WORK

There has been extensive research devoted to analyzing Stack Overflow, such as analyzing obsolete answers [11], discussing best-answer prediction models [1], learning to answer SO questions [5].

6 CONCLUSION

Our empirical results show that it is necessary to build automated solutions to help the API development teams to answer developers' questions. We plan to conduct further analysis on API forum posts and eventually propose solutions using NLP models to automatically answer developer questions on API forums.

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