Design Document Version 1.0

Team: May1639

A Web-based Q&A Platform for Collecting and Indexing Publicly Available Information About Common Java Libraries

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1 Project Statement

In the world of software development, specifications inform both humans and computers alike how software is intended to behave, and are highly important to the verification process. Checkable, understandable, useful formal specifications can significantly help minimize the cost of developing software which is secure, assured, and reliable. However, such specifications are not widely available.

Interest in formal specifications, or more precisely behavioral interface specifications, lies primarily in their capability to verify the functionality of software in addition to guaranteeing the behavior of an API. Outside of academia, concern often falls on the observable functionality of code over the explicit guarantees offered by formal specifications. There is little motivation for developers to take the time to write formal specifications for their code, due to the time and difficulty involved. As a result, within an academic setting or any environment that requires strict verification of software, there is a noticeable lack of such specifications for commonly available libraries, and available specifications are not necessarily easily accessible.

A solution offered by Rajan et al. proposes the use of data mining to retrieve formal specifications from sites such as Stack Overflow and consolidate them on a web platform. These specifications may then be approved or modified by users of the platform, and missing specifications may be added manually. This project involves the development of a web platform in Question and Answer (Q&A) discussion format to host and to answer questions regarding formal specifications for commonly used Java libraries.

2 Deliverables

1st Semester

- A prototype of the code specification forum
- Proof-of-concept implementation of the forum's main features
    - Extracting and embedding source code on the corresponding forum pages
    - Implement the Stack Exchange API on the forum
    - Query Stack Overflow and retrieve discussion threads to populate a related posts section for each subforum.

2nd Semester

- Full implementation of the forum.
    - Complete implementation of the features from the first semester.
    - Allow users to post new specifications for methods.
    - Integrate features developed by team May1620.

3 System Requirements

Dr. Rajan has indicated that he will define more requirements for the second semester of development. The requirements already specified, including those to receive primary developmental focus during the first semester, are listed below.

Functional Requirements

- The system will display and allow traversal of a library/class/method hierarchy for supported libraries.
- The system will allow for upvoting/favoriting of specifications that are considered correct.
- The system will facilitate creating/editing specifications with manual input.
- The system will allow users to create and contribute to discussions.
- The system will display relevant discussions for currently selected libraries/classes/methods.
- The system will display source code for currently selected classes and methods.
- The system will support additional features as needed to mimic desirable functionality of a Stack Exchange site, with emphasis on Stack Overflow.

Non-Functional Requirements

- The system shall implement the Stack Exchange API, allowing for back-end programming such as that under development by team May1620 to access information.
- The system shall be extensible, allowing for the addition of new features both during and after development.
- The system shall be maintainable, allowing the project to be appropriately managed in the event control is transferred to other parties.

4 System Analysis

1 High-Level

The components of the project and their purposes are as follows:

- MyBB Client Forum
    - The front end display of the project, in the form of a question and answer discussion forum created using the MyBB forum software.
- Web Server
    - The intermediate module responsible for assembling the client forum using the information in the project file system and in the project database. In addition, the web server is responsible for performing all interactions with external modules.
- Database
    - A MySQL database that stores information regarding forums, posts, users, and website templates.
- File System
    - The module which stores all resources overseeing the construction and management of the forum. These resources include all PHP files, images, source code files, and specifications.
- Stack Overflow
    - The Stack Exchange website concerning programming. The web server queries Stack Overflow for posts and discussions related to a currently selected class or method.
- External Interfaces
    - External sources may query the project forums for posts using an identical REST API to that provided by Stack Exchange.

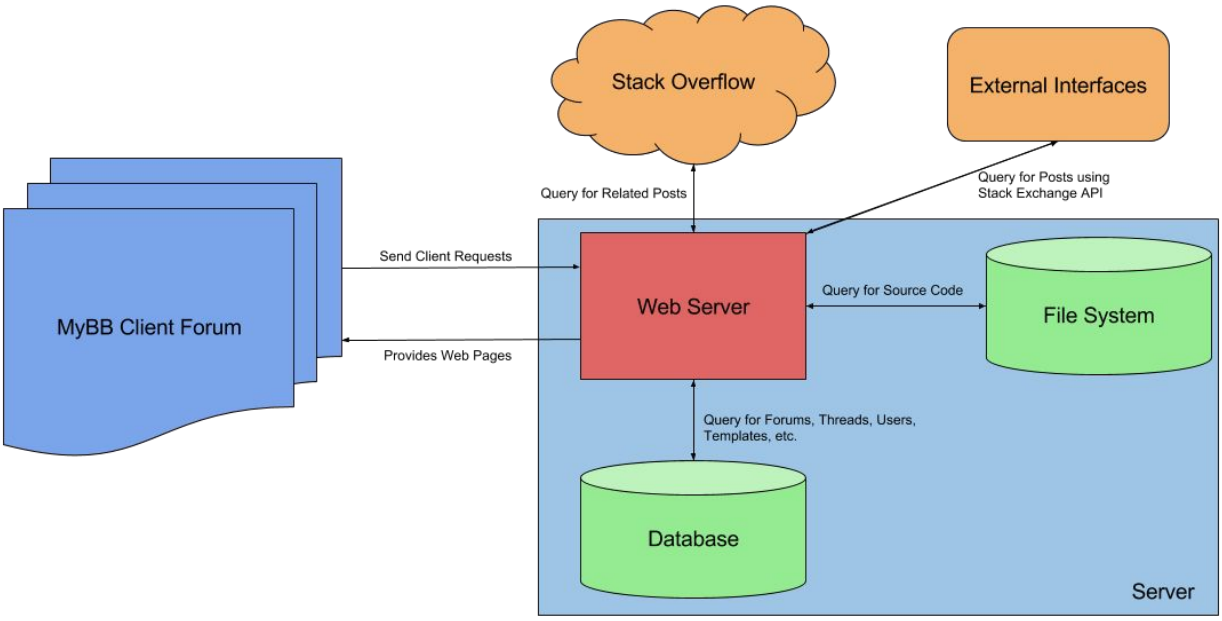

Figure 1: A high-level diagram of the overall structure of the project forum.

2 Interface

The major components of the forum interface for this project can be broken down as follows:

- Forum Index - The forum homepage.
    - Provides a list of all libraries supported by the forum. Selecting a library navigates to the Library View.
- Library View - Displays relevant information for the currently selected library.
    - Provides a list of all classes in the currently selected library. Selecting a class navigates to the Class View.
- Class View - Displays relevant information for the currently selected class.
    - Provides a list of all methods in the currently selected class. Selecting a method navigates to the Method View.
    - Related Discussions - Provides a list of links to Stack Overflow discussions relevant to the currently selected class.
    - Source Code - Displays the source code of this class.
    - Specifications - Displays the currently approved specifications for this class.
- Method View - Displays relevant information for the currently selected method.
    - Provides a list of all discussions concerning the currently selected method. Selecting a discussion navigates to the Discussion View.
    - Related Discussions - Provides a list of links to Stack Overflow discussions relevant to the currently selected method.
    - Source Code - Displays the source code of this method.

    - Specifications - Displays the currently approved specifications for this method.
- Discussion View - Displays the currently selected discussion.
    - Provides a list of all posts in this discussion.

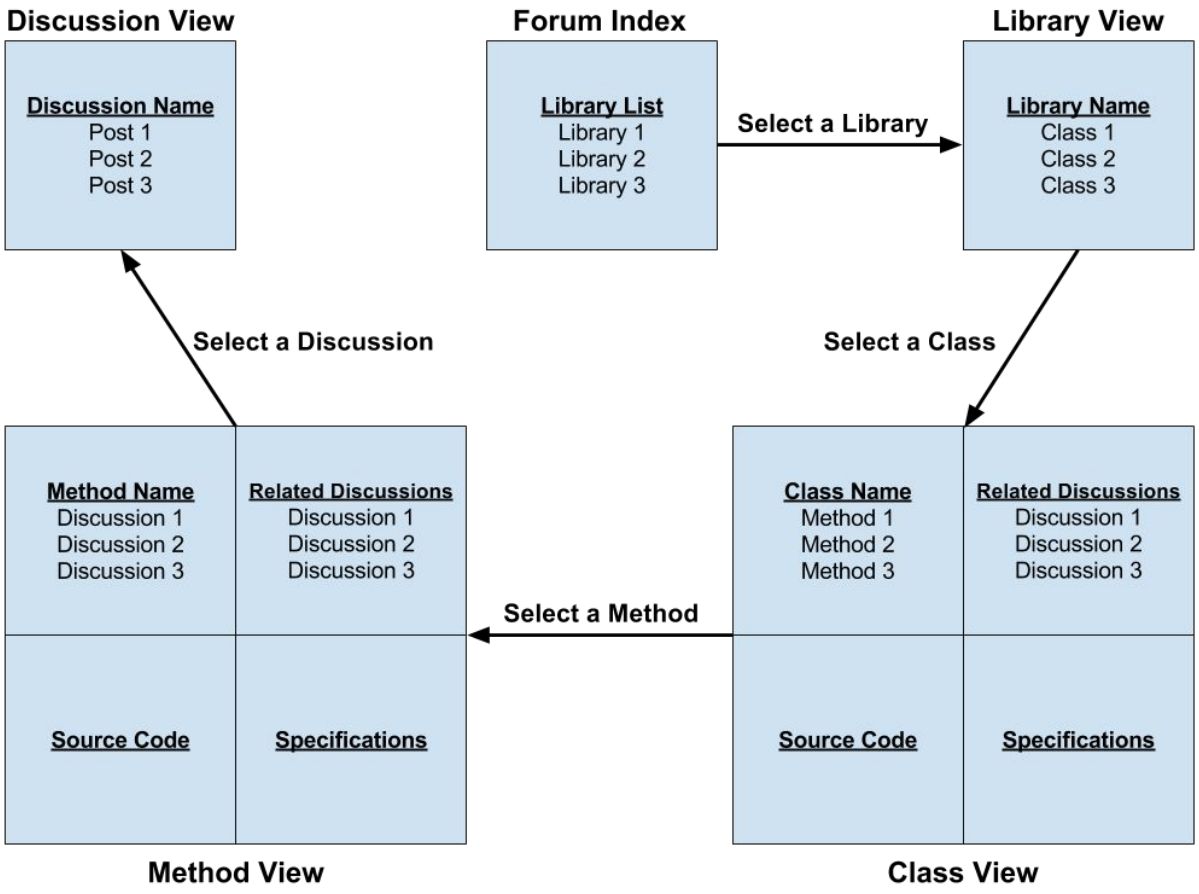

Figure 2: A simplified diagram of the eventual structure of the web platform interface system.

5 Software Specifications

The only software required by this project is the MyBB forum software, version 1.8. MyBB requires:

- PHP 5.2+
    - SimpleXML Extension
    - Multibyte String Extension
    - GD Extension
    - MySQL Extension
- MySQL 5.0+

6 Testing

After implementing the forum's core features, testing will begin by uploading an entire Java library and checking to see if the project's requirements are met. The following checks will be run:

- Check if the source code displays correctly for all classes and methods
- Check if the generated list of related discussions make sense given the currently selected class or method.
- Check if the links to the related discussions lead to the correct pages on stack overflow.
- Test each function in the implementation of the Stack Exchange API to determine whether they give the expected results.
- Manually submit and approve new specifications for classes and methods and check if they are properly updated.

7 Implementation Issues and Challenges

Currently, development is impeded by several challenges.

One challenge concerns Java parsers. The forum requires the source code of Java methods and classes, so this information must be extracted from source files. There are a number of third-party parsers available, including Eclipse JDT, Refactorit, and JavaParser. Currently, the project will continue with Eclipse JDT, but this introduces the issue of not only learning the functionality of the parser, but also the issue of determining how to run the parser for source code stored on the server.

A second major challenge concerns the direct programming of the MyBB forum software. Documentation regarding the means to directly edit forum functionality is lacking. Most likely, this status is due to the nature of the software. MyBB and other free forum software are available for the creation of basic discussion sites. This project requires implementing a large amount of custom functionality, including a copy of the Stack Exchange API for use on the project forums. While the open source nature of most free forum softwares allows for extensive functional modification, it is not an option pursued by most users. Thus, development will require effort on the part of the developers to completely learn the MyBB structure.

8 Conclusion

The direct result of this project will be a web platform to host formal specifications for commonly used Java libraries. In addition, the platform will be of a Q&A format allowing human users to validate and edit existing or computer generated specifications as well as propose and manually create new specifications. The platform is planned for use past the departure of the developing senior design students, and development will proceed with the intention of passing the work on to the community for future upkeep and extension.

Currently, there are no such services that meet the needs outlined above, so in addition to providing a working platform with the described functionality, it will also serve as a proof of concept that such platforms are feasible, ideally prompting further development in the area of formal specifications.