

Real-time Collaborative Resolving of Merge Conflicts

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Introduction

Along with the Web becoming a viable application platform, the use of *collaborative real-time* editors has increased. They enable multiple people to edit the same document simultaneously and see each others changes in real time.

Why not use real-time collaboration to write software? Admittedly, there are some unsolved questions related to version control, debugging and testing in real-time collaborative development environment. As a first step, real-time collaboration could be used in the parts of software projects having a particular need for closer collaboration — such as *resolving merge conflicts*.

Merging is the act of combining two branches of work into one. Merges can be divided into three rough categories based on their difficulty:

1. Automatic merge.

- Done by the version control system. No user input needed.

2. Simple merge conflict.

- Can be resolved by the person initiating the merge, possibly by using a merge visualization tool.

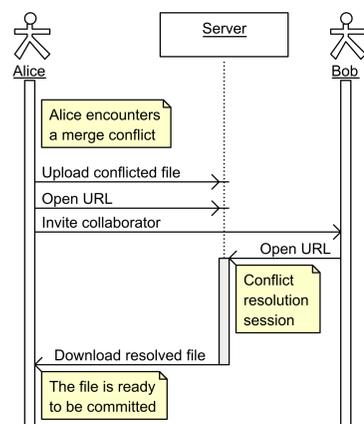
3. Difficult merge conflict.

- Cannot be satisfactorily resolved by the merge initiator.
- Our solution: **utilize the collective knowledge of team members by using a real-time collaboration to resolve the merge conflict.**

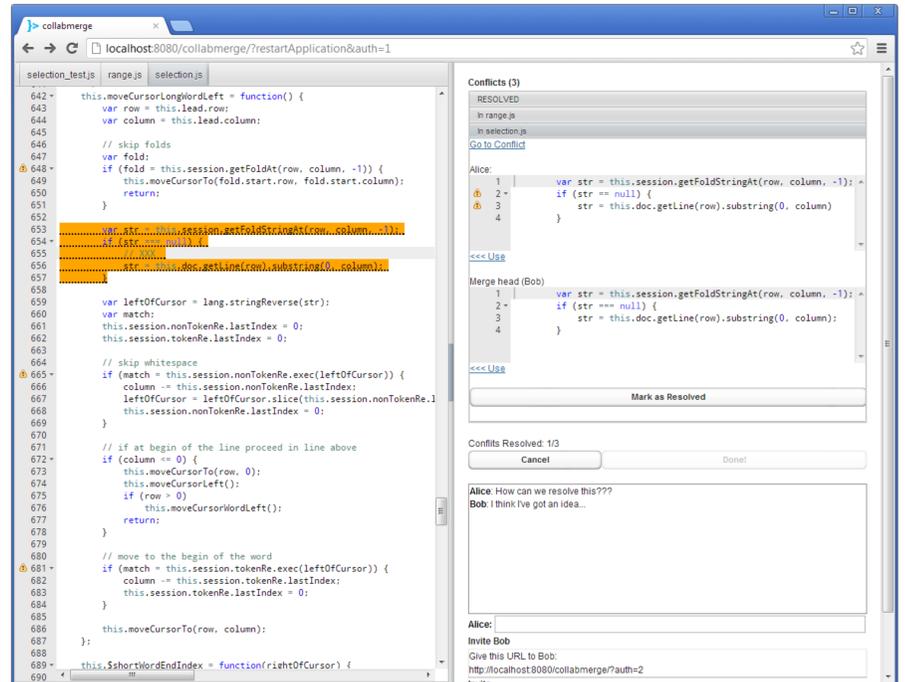
Resolving Merge Conflicts Using Real-time Collaboration

Let us say that Alice developed a feature *A* while Bob concurrently developed a feature *B*. After both finished, Alice tried to merge her changes with those of Bob. The features *A* and *B* overlapped each other somehow, thus the attempt to merge resulted in a conflict. In this case, it would be beneficial if both Alice and Bob could participate in the conflict resolution process. In some cases, it would be useful to even involve another developer, Chuck, who have been working in the same part of the project earlier.

In such a case, Alice can initiate a collaborative conflict resolution session by launching a tool that automatically uploads the conflicted part of the project to the server for all the collaborators to edit. Alice can invite Bob and Chuck who need nothing more than a web browser and the URL provided by Alice to take part in the conflict resolution. During the session, all the collaborators can edit the files and see each others edits in real time. After a successful session, Alice can commit the merged files.



Workflow of collaborative conflict-resolving.



Screenshot of collaborative conflict-resolution tool.

Implementation

Our implementation enables real-time collaborative resolving of conflicts occurring in the Git version control system.

- The web application is built using Vaadin framework (<http://vaadin.com>)
- Collaborative editor based on CoRED [2]
 - Real-time collaboration achieved using differential synchronization algorithm [1]
- Integrated with Git (<http://git-scm.com>) version control system
 - A Git *mergetool* written in Python
 - Usable with other sources of merge conflicts with little effort
- Released as open source

Future

Resolving merge conflicts is just one of many possible uses for real-time collaboration in software development and programming. A little modification to the described approach could allow developers to, for example, request help to a difficult programming task or to conduct an interactive code review session. Our longer term goal is to build a complete web-based real-time collaborative software development environment and study its use.

[1] N. Fraser. Differential synchronization. In *Proceedings of the 9th ACM symposium on Document engineering*, DocEng '09, pages 13–20, New York, NY, USA, 2009. ACM.

[2] J. Lautamäki, A. Nieminen, J. Koskinen, T. Aho, T. Mikkonen, and M. Englund. Cored: browser-based collaborative real-time editor for java web applications. In *Proceedings of the ACM 2012 conference on Computer Supported Cooperative Work*, CSCW '12, pages 1307–1316, New York, NY, USA, 2012. ACM.

More information at
<http://cored.cs.tut.fi/collabmerge>