Real Time Collaborative Code–Editor using Conflict – Free Replicated Datatype Algorithm

Vasu Goel[1] and Sachin Garg[2]

[1]B. Tech Scholar, Department of I.T., Maharaja Agrasen Institute of Technology, New Delhi, India
[2]Assistant Professor I.T., Maharaja Agrasen Institute of Technology, GGSIPU, New Delhi, India

Abstract: We all are going through a global pandemic situation which has brought a great change in the lifestyle of the people. People were not at all prepared for such kind of a situation. Hence, it has been a difficult situation to face for each and every person. But, as we know the life goes on, people have brought a change in their lifestyle and adapted according to the current ongoing situation. Hence, internet and online applications has now become one of the most important aspect for the working environment of people. People now are highly dependent on online applications for their work. Hence, the basic idea is easing the difficulties that the programmers are facing in the IT Sector of the industry. The idea is making a collaborative code-editor using which programmers can work collaboratively on a project without facing any difficulty. To ensure this, the Conflict-Free Replicated Datatype Algorithm is used to provide an efficient and non-obstructing way to collaboratively work on projects.

INTRODUCTION

While working on development projects, many programmers work on the project by team. Any programmer who has the access to the project can create, change, and add code inside the same project file. So synchronization process is required between programmers to avoid code duplication, and to solve this synchronization problem integrated real-time collaboration is needed in a single environment. The Integrated Development Environment (IDE) is focused to provide collaborative setting for programming teams which has the ability to do real-time text editing. The ability for editing text in

real-time allows multiple users to work together while editing a document and

display the changes directly to other users who has the ability to access the same document. There are a number of free applications that support real-time text editing feature, such as Google Docs. This feature not only makes excellent collaboration for common users, but can also very effective in programming. There are also a wide variety of web-based systems that provide collaboration. For example, Ether Pad that allows real-time text editing.

Ace, Code Mirror and Monaco – Editor are web-based text editing component which designed to be embedded into the IDE or application. Project or software development requires the coordination and collaboration between programmers, so that the collaboration systems are very useful to improve the efficiency in making project. The effectiveness of collaboration in programming

can improve the productivity and quality of project or software. Collaborative programming in real-time support programmers to work on the same programming file. Real-time system will automatically combine the code typed by a programmer without manual command from the programmer (such as update, commit). Multiple programmers enable to access and edit the same source code directory, even at the same time. In real-time sessions programmer can collaborate with other programmers by joining and leaving a session of real-time during collaborative programming. There are steps to join and leave the session using the join protocol with two-way client to receive a request from a new client who wants to join.

A **collaborative real-time editor** is a type of collaborative software or web application which enables **real-time collaborative editing**, **simultaneous editing**, or **live editing** of the same digital document, computer file or cloud-stored data – such as an online spreadsheet, word processing document, database or presentation – at the same time by different users on different computers or mobile devices, with automatic and nearly instantaneous merging of their edits. Hence Real-Time Collaboration Code- Editor using CRDT Algorithm can help users collaborate while working on a project efficiently even in Offline Mode.

METHODOLOGY

1. CRDT assigns a unique ID to every character. These characters are then maintained in a doubly linked list.

2. The unique IDs are Lamport Timestamps. They consist of a unique user identifier and a logical clock that increases with each character insertion.

3. When a user types the content "ABC" from left to right, it will perform the following operations insert(0, "A") • insert(1, "B") • insert(2, "C")

4. If a user copy/pastes a lot of content into the document, the inserted content is represented by a single Item.

5. Editors like Monaco Code-Editor, Code-Mirror can be used to implement the Real-Time functionality.

6. After Understanding the concepts of CRDT Algorithm and understanding the working of the open source editor, the CRDT Algorithm can be integrated into the open source code editor.

7. Offline Editing is a useful feature which can be implemented with the help of CRDT Algorithm in which the user can keep working on the code editor even if the user is disconnected from the internet.
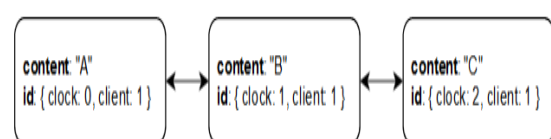

content: "A"
id: { clock: 0, client: 1 }
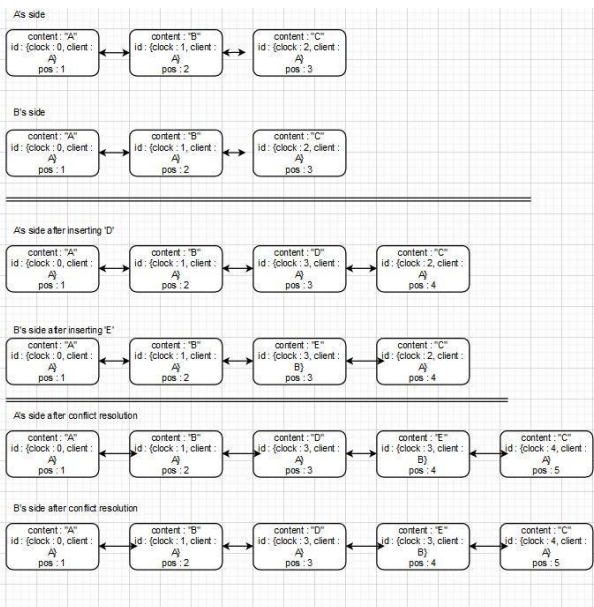
content: "B"
id: { clock: 1, client: 1 }

content: "C"
id: { clock: 2, client: 1 }

Fig 1: CRDT Node Representation

Fig 2: Multiple Users at same placeinsertion

Fig 3: Result of the Project

RESULTS

Successfully implemented the Real-Time functionality into the Monaco Code - Editor using the Conflict-free Replicated Datatype Algorithm and also added the offline editing functionality into the code-editor. This code- editor can be really useful in today's pandemic situation as Real Time

Collaboration saves time of the users as many users can work on a single Project at a same time and can exchange ideas and share thought process with other users. This will save the time the user spends on first reaching the venue for an offline meeting and make it a really efficient way of working. It encourages people working from home or remote locations to be more productive, since everything is done through the Internet, all the user needs is a good Internet.

Implementation of features like offline functionality in the Code-Editor is a really useful and a helpful feature in case when the user has a unstable internet connection, the user can keep working on the project and as soon as the user is reconnected to the internet,

REFERENCES

1. Introduction to Conflict free Replicated Datatype Algorithm https://en.wikipedia.org/wiki/Conflict-free_replicated_data_type

2. M. Ahmed-Nacer, C.-L. Ignat, G. Oster, H.-G. Roh,and P. Urso. Evaluating CRDTs for Real-timeDocument Editing. In Proceedings of the 11th ACMsymposium on Document engineering, pages 103–112.ACM New York, 2011

3. EuroSys Workshop on Social Network Systems - SNS2009, pages 46–52, N¨urnberg, Germany, March 2009.ACM Press.[3] B. Collins-Sussman, B. W. Fitzpatrick, and C. M.Pilato. Version control with Subversion. O'Reilly &Associates, Inc., 2004.

4. C. A. Ellis and S. J. Gibbs. Concurrency Control inGroupware Systems. SIGMOD Record : Proceedings ofthe ACM SIGMOD Conference on the Management ofData - SIGMOD '89, 18(2):399–407, May 1989.

5. N. Fraser. Differential Synchronization. In Proceedingsof the 9th ACM Symposium on Document engineering- DocEng 2009, pages 13–20, Munich, Germany,September 2009. ACM Press.

6. V. Grishchenko. Deep Hypertext with EmbeddedRevision Control Implemented in Regular Expressions.In Proceedings of the 6th International Symposium onWikis and Open Collaboration - WikiSym 2010, pages1–10, Gda´nsk, Poland, July 2010. ACM Press.

7. A. Imine, P. Molli, G. Oster, and M. Rusinowitch.Proving Correctness of Transformation Functions inReal-Time Groupware. In Proceedings of the EuropeanConference on Computer-Supported Cooperative Work- ECSCW 2003, pages 277–293, Helsinki, Finland,September 2003. Kluwer Academic Publishers.