

Efficient Renaming in Conflict-Free Replicated Data Types (CRDTs)

Case Study of a Sequence CRDT : LogootSplit

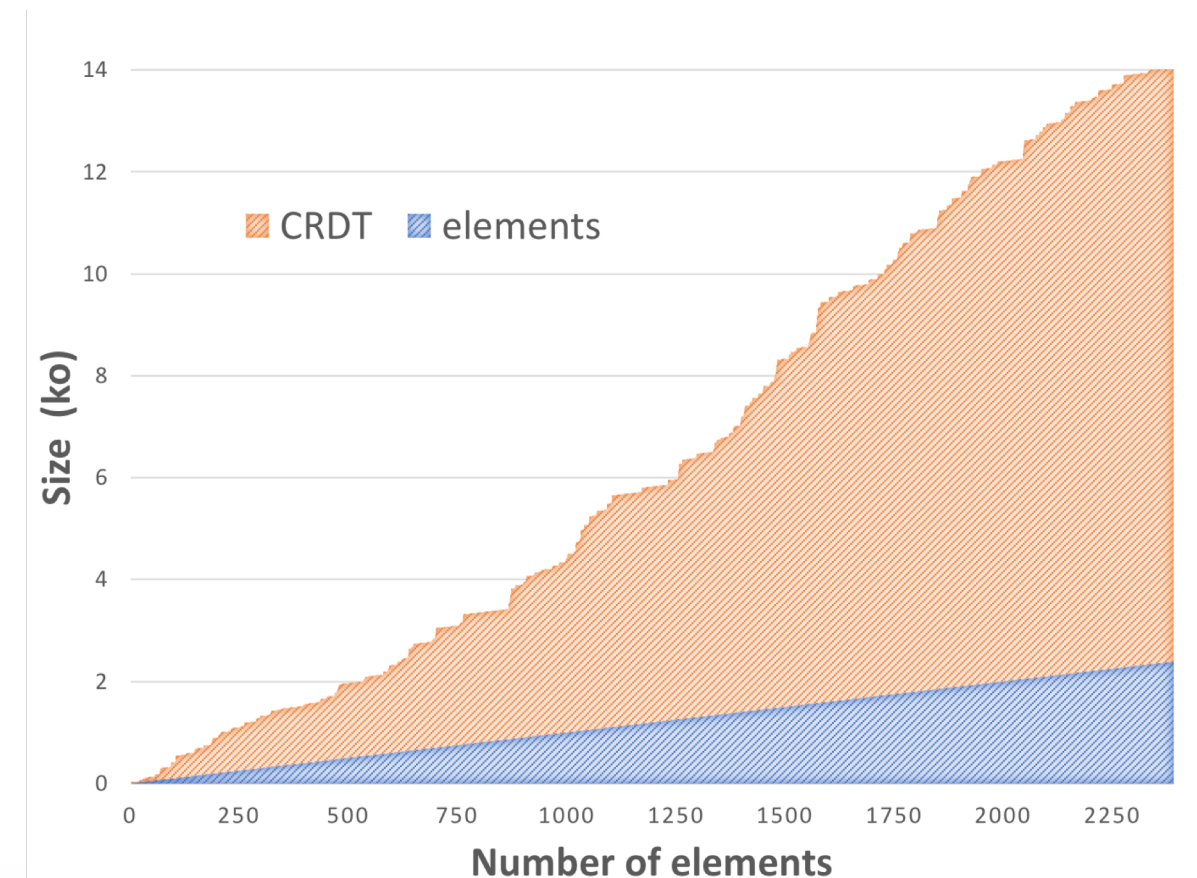
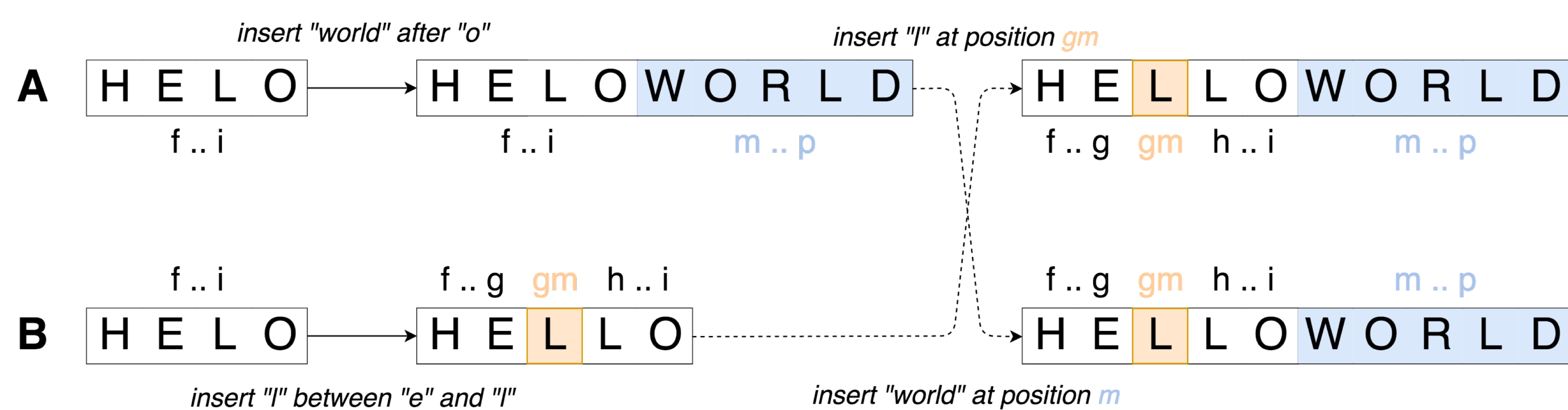
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CRDTs [2]

- Replicated data structure
- Updates performed without coordination
- **Strong Eventual Consistency [2]**

Limits

- Attach an identifier to each element
- **Size of identifiers not bounded**
- **Overhead of the data structure increasing over time**



How to reduce the overhead introduced by the data structure ?

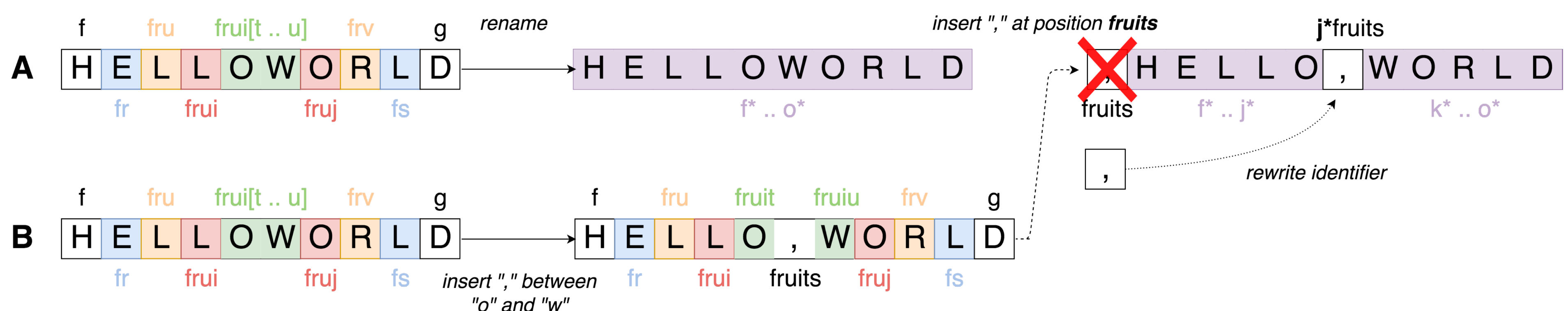
Reassign shorter identifiers in a fully distributed manner

Rename operation

- Reassign shorter identifiers to whole current state

Rewriting rules

- Concurrent *insert* or *delete* can not be applied as such
- Define rewriting rules for concurrent updates



Concurrent rename operations

- Define a total order on *rename* operations
- Pick a “winner” operation between concurrent *renames*
- Add rewriting rules to *undo* effects of “losing” ones

Propose a fully distributed renaming mechanism for LogootSplit [1]

- Designed the *rename* operation
- Defined rewriting rules to deal with concurrent updates
- **WIP:** Implementation in MUTE (<https://coedit.re/>)
- **WIP:** Design the strategy to trigger the renaming
- Prove formally its correctness
- Benchmark its performances

Next Steps

- **Generalize the approach** to other CRDTs
 - To other Sequence CRDTs
 - To other types (Counter, Set, ...)

References

- [1] L. André, S. Martin, G. Oster, and C.-L. Ignat. Supporting adaptable granularity of changes for massive-scale collaborative editing. In *International Conference on Collaborative Computing: Networking, Applications and Worksharing - CollaborateCom 2013*.
- [2] M. Shapiro, N. M. Preguiça, C. Baquero, and M. Zawirski. Conflict-free replicated data types. In *Proceedings of the 13th International Symposium on Stabilization, Safety, and Security of Distributed Systems, SSS 2011*.