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

Case Study of a Sequence CRDT : LogootSplit

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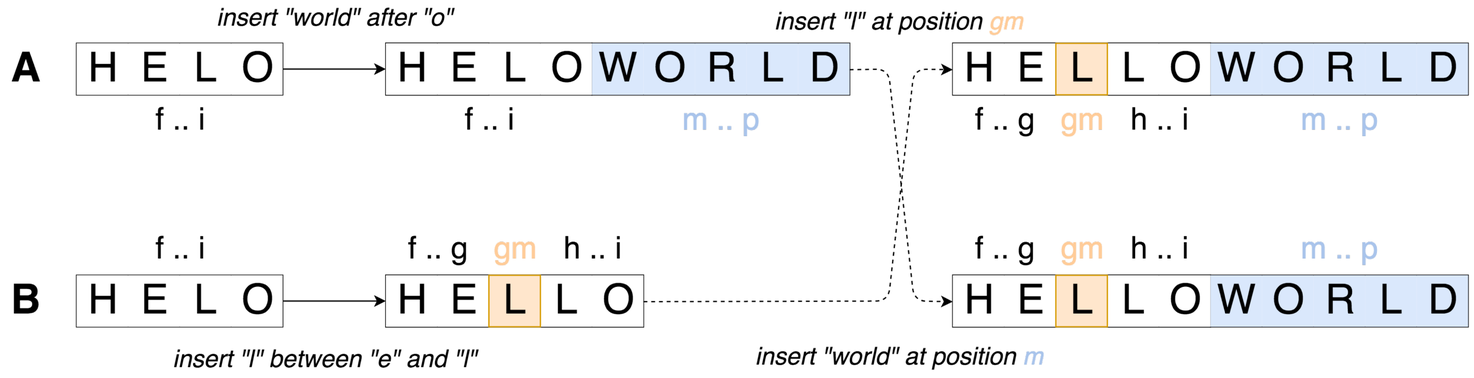
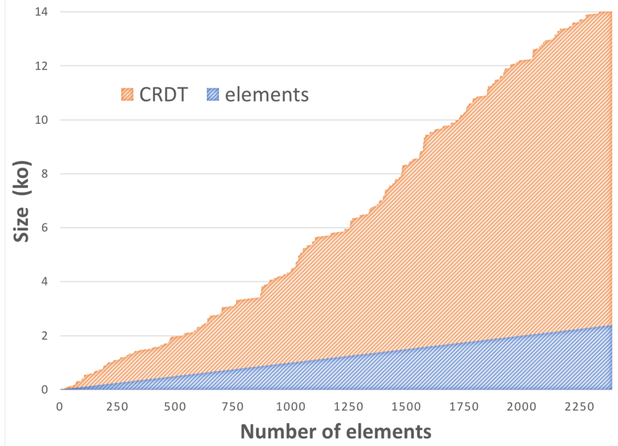
CRDTs [1]

- Replicated data structure
- Updates performed without coordination
- **Strong Eventual Consistency** [1]



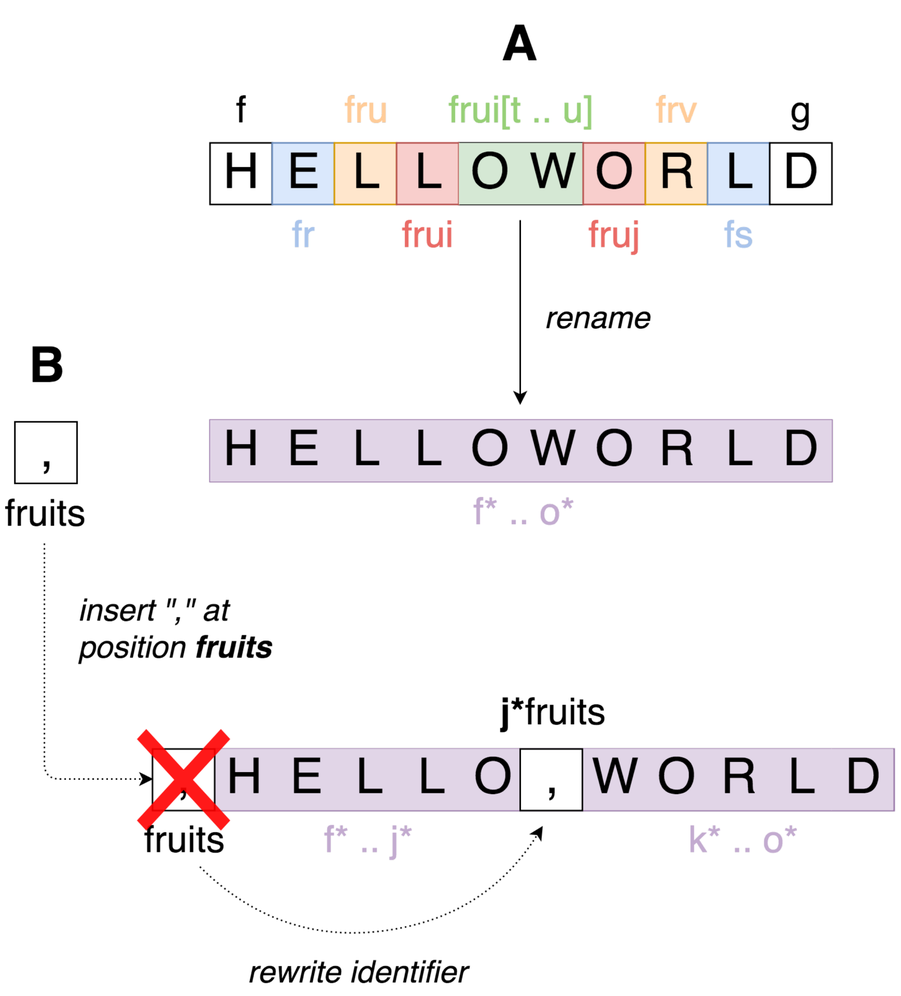
Limits

- 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
- Can be performed without coordination

Rewriting rules

- Can not apply concurrent *insert* or *delete* as such
- Define rewriting rules to handle concurrent updates

Concurrent *rename* operations

- Proposed *rename* operation not commutative
- Define a total order on *rename* operations to solve conflicts
- Pick a “winner” operation between concurrent *renames*
- Add rewriting rules to *undo* effects of “losing” ones

Propose a fully distributed renaming mechanism for LogootSplit [2]

- Designed the *rename* operation
- Defined rewriting rules to deal with concurrent updates
- Implemented in MUTE (https://coedit.re/)

- Benchmarking its performances (Memory, CPU, Bandwidth, …)

- Prove formally the correctness of the renaming mechanism
- Design strategies to trigger *rename* operations while minimizing conflicts

[1] 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.

[2] 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*.

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