Shopping Lists on the Cloud

Large Scale Distributed Systems

This project will explore the creation of a local-first shopping list application. The application has code that runs in the user device and can persist data locally, and also has a cloud component to share data among users and provide backup storage.

Users can create a new shopping list via the user interface. After creation and until a list is deleted, it exists under a unique ID (e.g., a URL) that can be shared with other users. Users who know that ID should always be allowed to add and delete items to the list. Each item can be associated with a flag, checked after the item is acquired, or with a target quantity that decreases as items are acquired. Since users can concurrently change the list and we aim for high availability, it is suggested to first use Last-Writer-Wins with local clocks and later evolve to use Conflict-free Replicated Data Types (CRDTs).

Aiming for millions of users, you should carefully design the cloud-side architecture to avoid data access bottlenecks. Notice that each list is independent and that data can be sharded. It is suggested that you look at the architecture in the Amazon Dynamo paper.

- Choice of language is free. You can use also libraries/frameworks not part of the core of the language you choose for messaging, including message serialization, and persistency, e.g., a local database. Your application should explicitly handle the replication of the shopping lists, including the consistency of the replicas. E.g., if you use CRDTs, the CRDT implementation must be yours.
- Groups should have three/four participants;
- Groups must use Git to make the code available to the staff as well as to submit deliverables;
- Before your lab class in week 9 (November 6 through 8), groups must submit two pages with their planned design. This is worth 10% out of the 45% of the project grade. Each group's design will be discussed in its lab class of that week.

- Groups must submit a slide deck with the main design challenges and choices by the project's submission deadline.
- Before presentation day, every student must fill out the self- and peer-evaluation form that will be made available closer towards the submission deadline.
- On the presentation day, each group will do a 10-minute presentation and show a pre-recorded 5-minute demo to the class. This will be followed by a discussion.
- The remaining 35% out of the 45% project grade will result from the evaluation of the project's complexity, presentation, and discussion.
- Except for libraries or frameworks you use, all code should be authored by only the group members.

The following papers/links can be useful as starting points:

- Local-first: `https://www.inkandswitch.com/local-first/`
- CRDTs: `https://crdt.tech/papers.html`
- Dynamo: `https://www.allthingsdistributed.com/files/amazon-dynamo-sosp2007.pdf`