Shopping Lists on the Cloud

Large Scale Distributed Systems

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Project Requirements

- Local-first shopping list application
- Each list has a unique ID
- Users can create a list
- All users with list ID can edit list
- Users can add/remove items from a list
- Items have dynamic target amounts
- Lists use CRDTs
- Lists are sharded

Technologies Used

Client

Implements the CRDTs;

Registers creation/deletion of list and items;

UUID to ensure unique list IDs

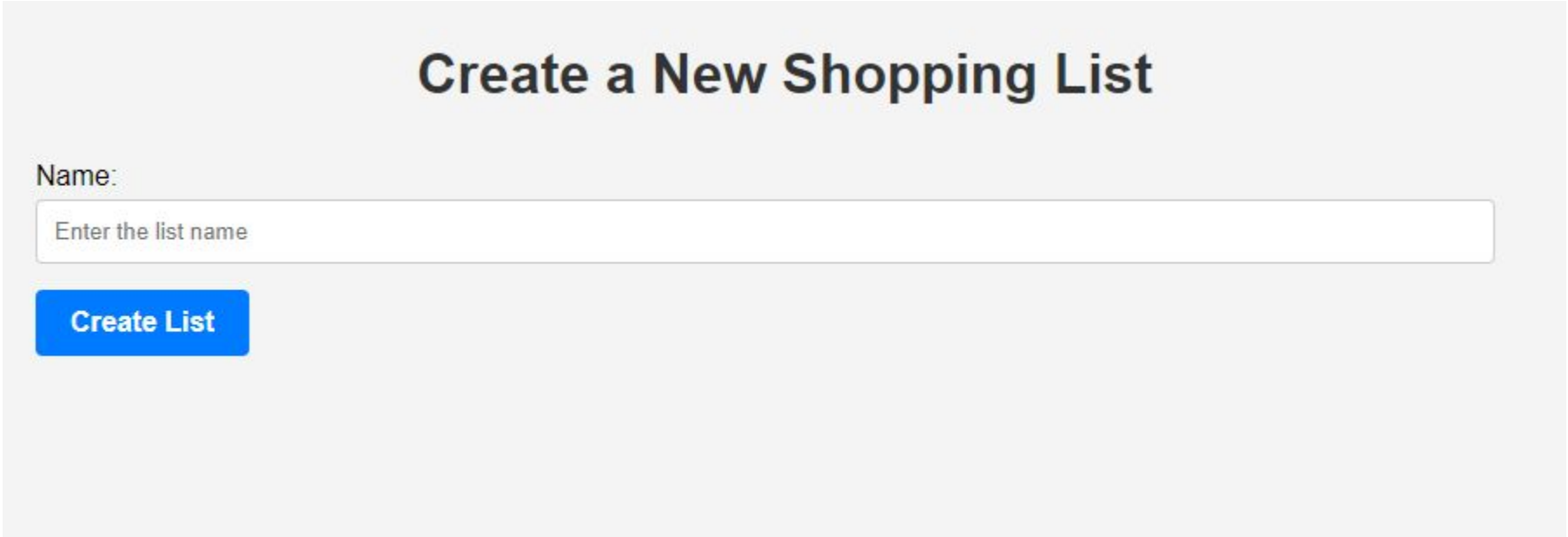
Allows accessing other users' lists by URL;

Sends changes to proxy;

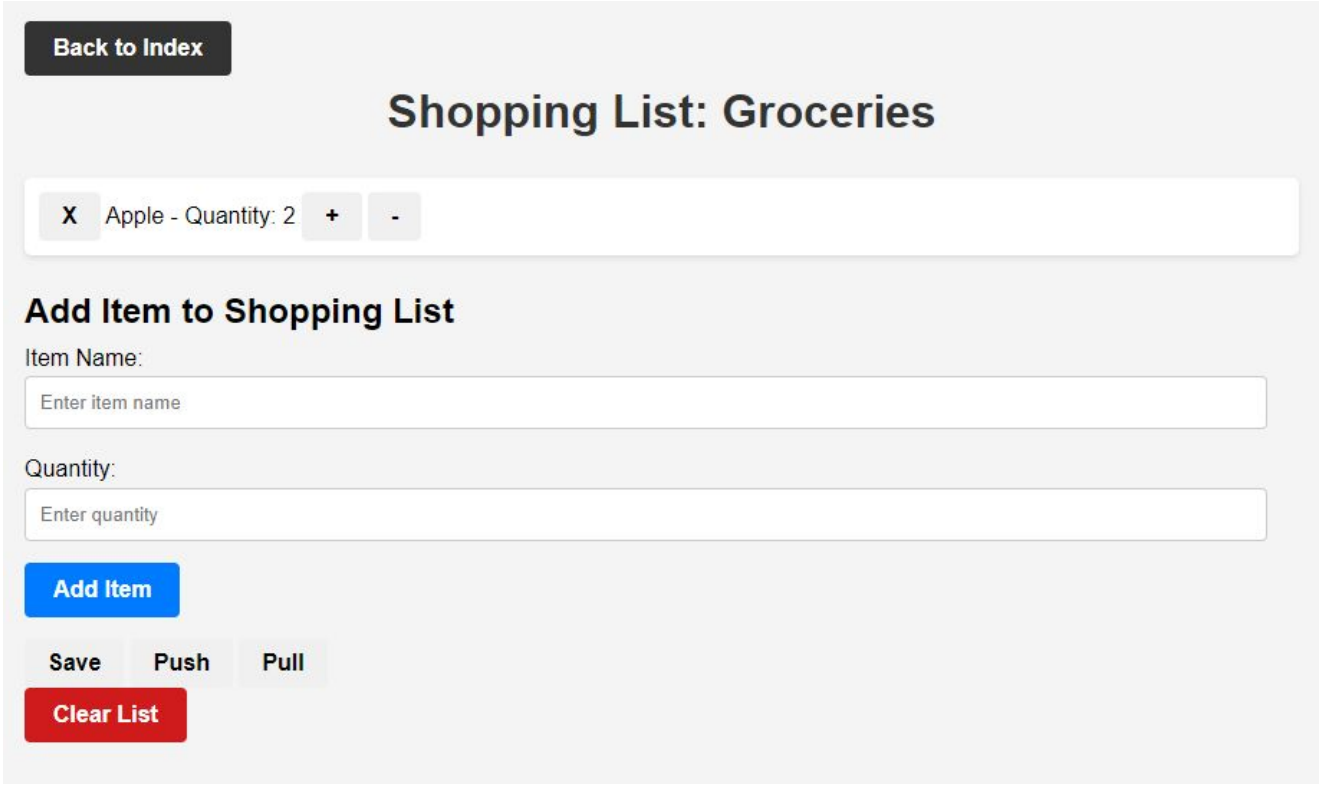
Changes to server list are made manually through push and pull buttons;

Offline changes can be made by saving the list locally

Client : Frontend



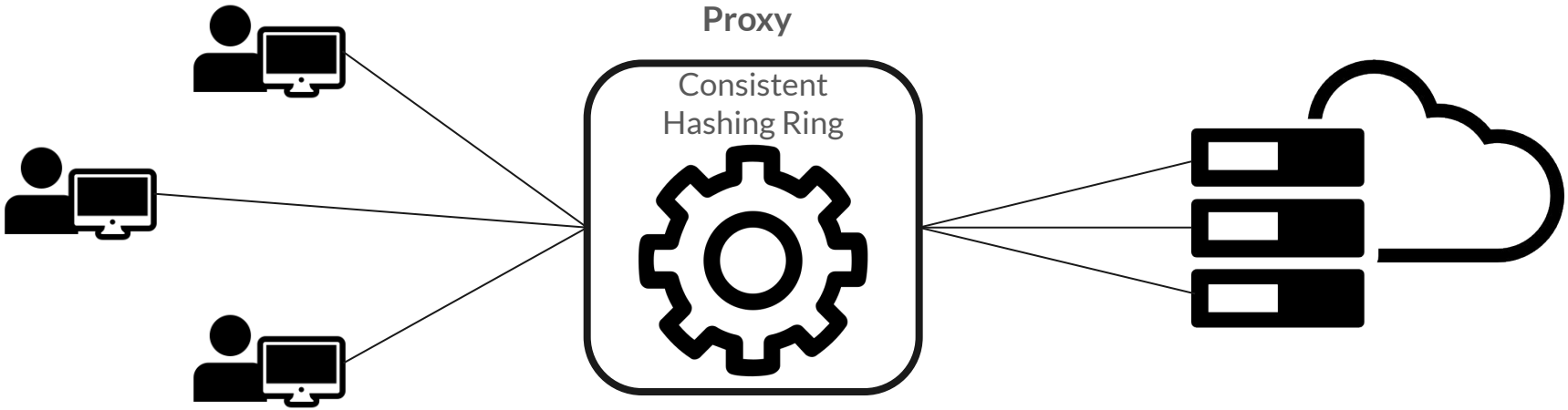
Client : Frontend



Proxy

Receives changes from clients and distributes to servers

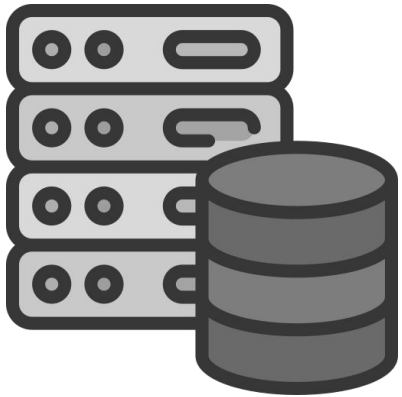
Uses consistent hashing to decide which lists should be stored where



Server

Handles requests from client

Maintains lists in memory using CRDTs, registering them to a SQLite database every 8 seconds.



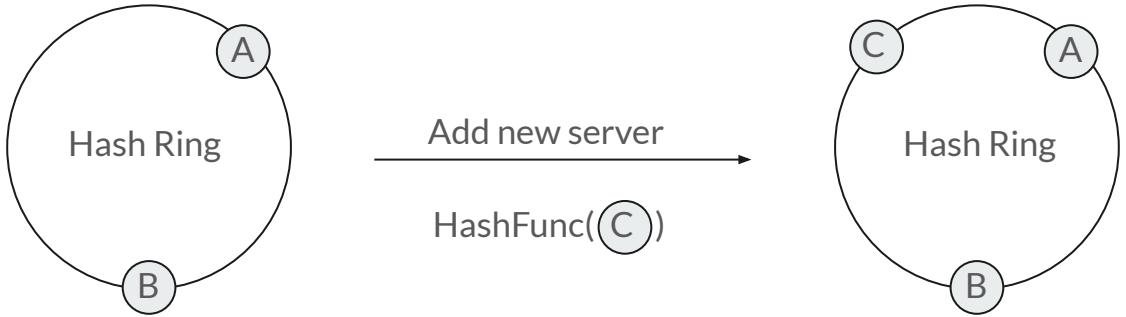
Consistent Hashing

Used for load balancing/sharding.

Distributes lists through servers in a ring structure;

Allows for dynamically adding servers and mapping keys to servers consistently across the ring;

Hashing done with hashlib python library



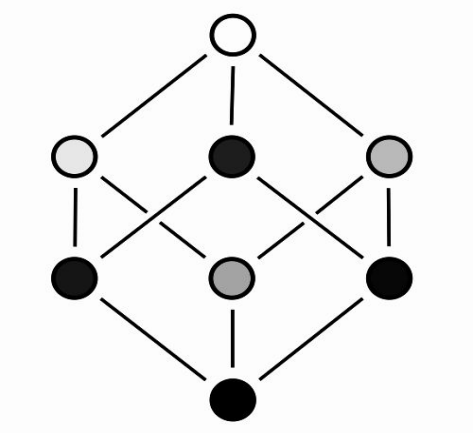
Conflict Resolution & CRDTs

Delta CRDTs are used.

Lists use AWORMap CRDTs to link items and target amounts.

CRDTs are used to resolve lists conflicts.

For item target amount, a “last-writer-wins” policy is used.



Limitations

Counter CRDTs could have been used for item target amounts, instead of a “last-writer-wins” policy.

Data replication is not implemented, so if any server had a fatal error, the information stored in it would forever be lost.

Client pushes and pulls to server must be done manually.

The client does not have a frontend indication when the server is offline.

Demo