SHOPPING LIST CLOUD APPLICATION

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Problem Description and Requirements

Project context and requirements for the application.

Technical Solution

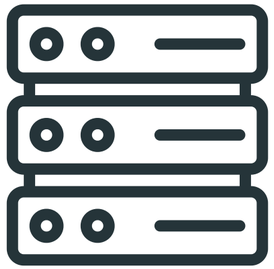
Main components description (Client, Cloud and Router/Load Balancer) and CRDT approach.

Solution Evaluation / Reflection

Identification of the limitations of the developed solution.

PROBLEM DESCRIPTION

Local-First Approach



Users can share their lists for collaborative editing via cloud

Development of a shopping list sharing application

Users can create and edit their lists locally, and backup in the cloud

REQUIREMENTS

Local First Approach

- Operating locally on the user’s computer.
- Be able to operate on lists, even if offline.
- Synchronization with the cloud when the connection is available.

Cloud

- Use of sharding to decompose the Cloud in several servers.
- Load distribution across available servers
- Replication of the lists in the several servers.

Share Shopping Lists

- Share the list code, so that other people can collaborate concurrently.
- Edit and update lists with other people's changes.

Conflict-Free Replication Data Types

- Implementation of a CRDT to deal with concurrent changes.
- Deal with increments/decrements of quantities and additions/removals

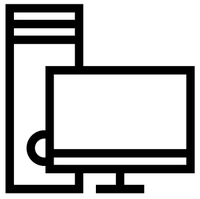
User Interface

- Ability to operate on shopping lists on the browser, with a basic graphical user interface.

TECHNICAL SOLUTION

CLIENT

- Runs on a port chosen at launch
- Continuously tries to connect to Router, if it is not available
- Creates and edits local lists
- Responsible for all the system interaction
- Communicates with the Router to perform Cloud-related client requests

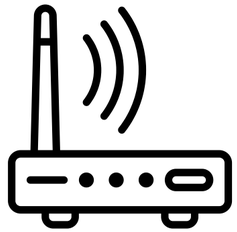


SERVER

- Runs on a port passed by argument at launch
- When connecting to Router, sends the current number of lists stored, and their codes
- If it receives a list code, checks if the corresponding list exists and forwards it to the Router if found
- If it receives a list from the Router, rewrites if it already exists in the cloud or creates a new one

ROUTER / LOAD BALANCER

- Forwards messages between Servers and Clients
- Has two Maps:
  - 1) elements: key = listCode and value = { } of servers with a replica of that list
  - 2) elements: key = serverCode and value = [serverConnection, numberOfLists]
- When it needs to backup a new list, searches for the two servers with the least amount of lists stored



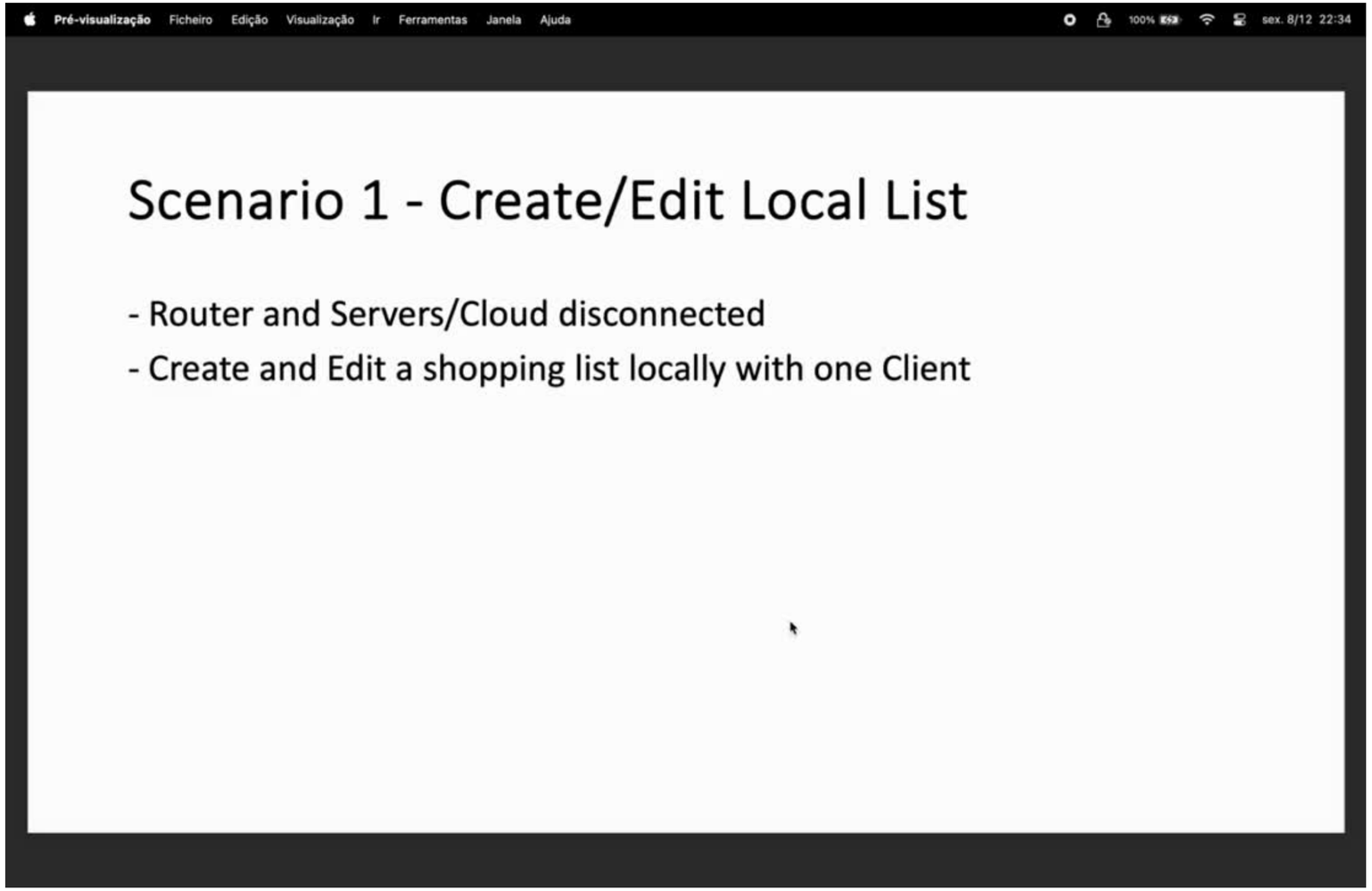
CRDT

- Use of PNCounter to the desired quantity
- Map of elements <listCode<string>, {addCounter<int>, removeCounter<int>}>
- Merge function that compares the additions and removals counters
- Add item operation increments the respective addCounter
- Remove item operation increments the respective removeCounter

PROJECT LIMITATIONS

- Only one Router available, but it is easily scalable
- When the Router shuts down after valid connections, we need to restart the Servers and the Clients
- Synchronization like git with merge actions, instead of automatic synchronization
- Only stores two replicas of each list in the Cloud, at the moment

DEMO VIDEO



link: https://github.com/JozeRamos/SDLE/blob/main/docs/demo/demo.mp4