A Collaborative Editor in Ur/Web

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Ur/Web

- Type-safe
  - Prevents segmentation faults, null pointers, and other type errors
- Secure
  - Automatically protects against cross-site scripting, most types of cross-site request forgery, and SQL injection attacks
- Ur/Web will never treat data as the wrong type
- Efficient

Design Goals

- Users are able to open and edit documents, which are saved on the server
- Any user's changes are seen by all other users in real time
- Users are prevented from editing the same area at the same time
- Editor integrates with larger course management system, allowing greater collaboration between students
- Editor will be open source, designed for code editing

Front End

- Compiled automatically from Ur/Web to Javascript
- Interfaces with the open-source CodeMirror editor using Ur/Web's Javascript FFI
- Necessary to break Ur/Web's document model in order to interface correctly with CodeMirror
- Automatically pushes and receives changes to and from the server

Back End

- Stores document data including title, body text, and permissions
- Keeps track of the users viewing each document
- Sends updates to clients about changes made

Relational Databases

Identification Number	Name	Birth Year
5	Michael Smith	1983
9	Bill Johnson	1979
10	Andrew Li	1988
12	Sarah Taber	1988
13	Taylor Simmons	1967
17	Christopher McMann	1972
25	Jane Sullivan	1975

Relational Databases

- We use relational databases to store data because they integrate extremely well with Ur/Web
- A limitation is that tables columns cannot be created on the fly for security reasons, so we have to declare all our columns while writing the code

Concurrent Editing

- Concurrent editing requires the server to update users on the edits of others
- We are using a system to locking to prevent editing conflicts
- Editing requires a lock on the line being edited
- A lock expires after a few seconds

Storing Text

- Originally we used a single string to store the text of each document
- Using a single string does not allow us to have different locks on each line
- Instead, we now use a linked list for each document: each line points to the next

Sending Updates to Clients

- We use Ur/Web's built-in "channels"
- Channels allow the server to send messages to clients, updating them instantly
- Each client gets its own channel, so we keep track of them with a database

Future Work

- Concurrency strategy
- Server-to-client updates
- Visual style