

# Smart Property Ledger (SPL)

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## Introduction / Motivation

The **Smart Property Ledger (SPL)** is a proof of concept model, designed to reduce transaction costs and some instances of title fraud. A **title search** can be time-consuming and costly. An easily searchable system would help to reduce the burden of finding and verifying the actual owner of a property.

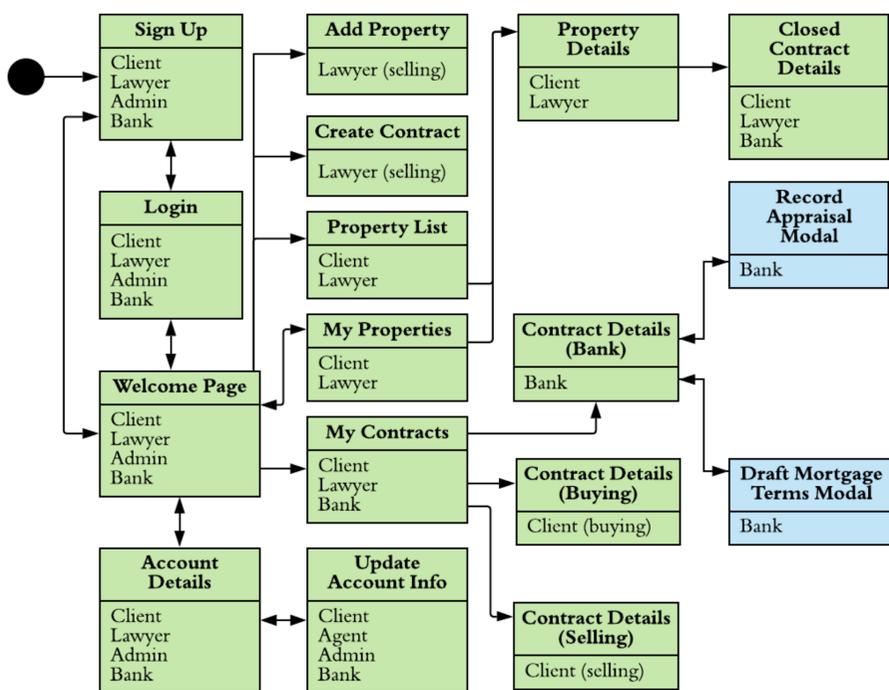
**Blockchain technology** is suitable for the real estate market, because it can add transparency, handle the complex transaction process, is designed to prevent fraudulent behaviour and supports strict ownership protection.

## Web App Interfaces and Roles

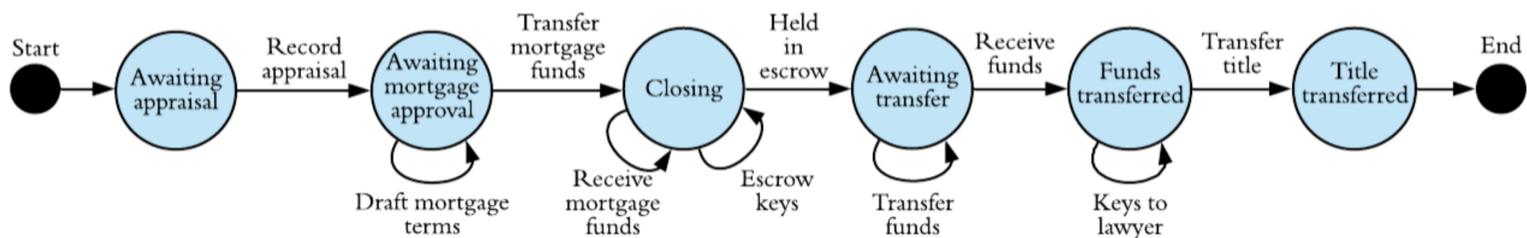
There are many roles involved in a real estate transaction. In order to keep various functions secure, we added **role-based permissions** and different pages for specific users. The basic roles are **client**, **lawyer**, and **bank**.

Clients are **read-only** for the most part but as evidenced below, lawyers can visit the **create contract** page and only banks can **draft mortgage terms**. There is an additional layer of security at the **chaincode** level which prevents the wrong user from performing certain actions.

SPL Web App Interfaces



Contract State Diagram



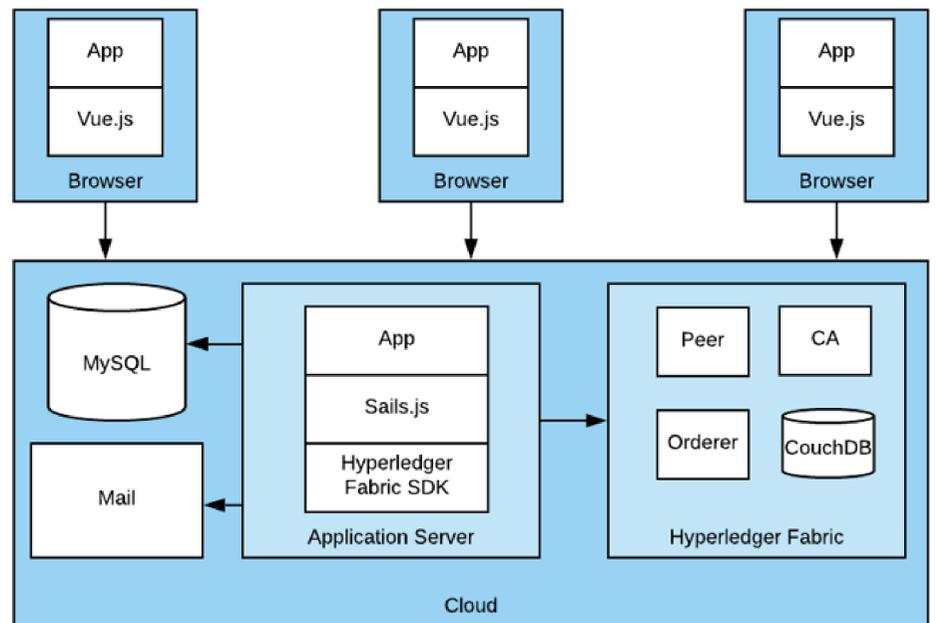
## Changing States

The state diagram represents the state of a **smart contract** moving through the title transfer process. The state is represented by a single field on the smart contract and is able to change based on transactions that invoke **chaincode**. Each state is represented by a bubble and the transactions necessary to change state are represented by arrows.

For example, the chaincode for **record appraisal** will not only store the appraisal data for the contract but also change the state of the contract from **awaiting appraisal** to **awaiting mortgage approval**.

The CouchDB will store the current state of the smart contract but the blockchain will keep track of all changes to made to the smart contract.

## Tech Stack



## Application Architecture

- Front-End**
  - The front-end of the SPL is responsible for everything a user can see and do from the browser
  - Vue.js** is a framework on top of Sails.js that allows for better integrated front-end designs
- Application Server (Back End)**
  - The application server is responsible for communicating with non-blockchain databases and the mail server, performing application logic, and processing data before it is given to the blockchain
  - It is built using **Sails.js** which allows both the front-end and the backend to be written in JavaScript
  - All requests to interact with the blockchain are handled by the **Hyperledger Fabric Software Development Kit (SDK)**
- Hyperledger Fabric (Back End)**
  - Interacting with the blockchain requires processing and work from multiple nodes
  - A **Certificate Authority (CA)** is responsible for validating and registering users
  - Peer nodes** are responsible for hosting and executing chaincode
  - The **Orderer** is responsible for how transactions are ordered before they are committed to the blockchain
  - The **CouchDB** is responsible for maintaining the current state of the blockchain

## Implications

The **SPL** helps to create an immutable and easily searchable chain of title. The transfer process is transparent and simple to audit, removing many opportunities for fraud.

The benefits of such an application will be felt the most by lawyers required to conduct a title search, and the true owners of a property who will have less reason to worry about title fraud.

Future research should focus on where a system would be best implemented, what can be done to maximize ease of use, and how to further reduce cases of fraud. Future iterations should also include additional information such as security interests in a property.