

# Pre-Construction Contract Registry (PCR)

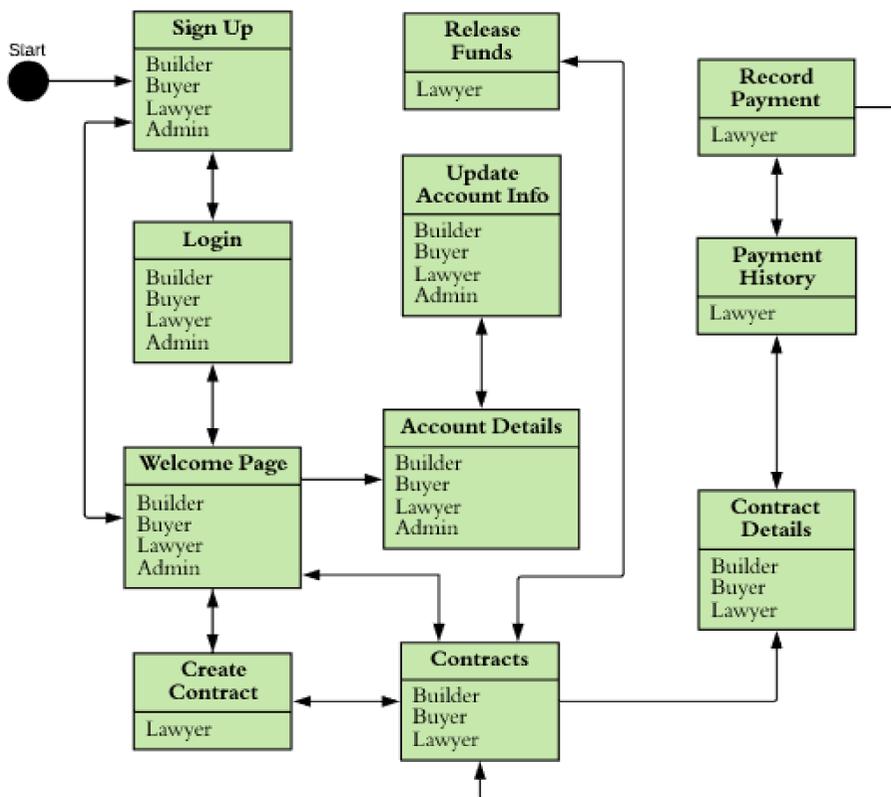
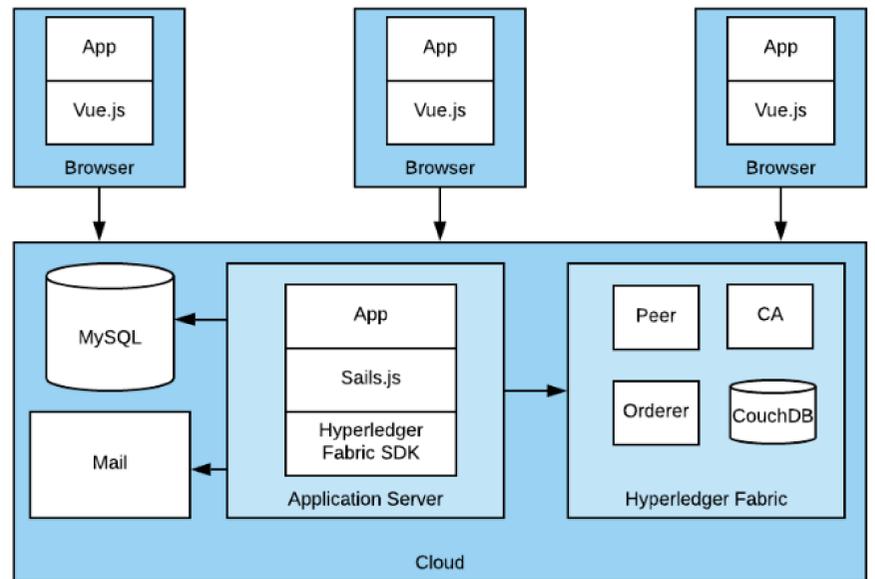
Atefeh Mashatan, Dave McKay, Annegret Henninger, Volodymyr Tanczak, Dawson Brown, Matthew Bush  
Cybersecurity Research Lab, Ted Rogers School of Information Technology Management, Ryerson University

## Introduction / Motivation

The **Pre-Construction Contract Registry (PCR)** is a proof of concept model, designed to reduce transaction costs and decrease opportunities for fraud, such as **paper flipping**. About 1/3 of homes bought in Canada are purchased from a builder. However, there is currently no system in place to register ownership of pre-construction homes. PCR will track pre-construction ownership and title transfers and in turn reduce opportunities for tax evasion.

**Paper flipping** occurs when a pre-construction home is purchased, but it is sold prior to taking ownership of the property. This gives the seller the opportunity to avoid taxes by not reporting profits made on the sale.

**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.



## Software and Frameworks

### Vue.js

Vue.js is the front-end JS framework used for the user interface and design.

### Sails.js

Sails.js is used to generate the application template. It is the main web framework used to develop the front and back end of the application. Sails.js enables development to be done using Javascript on both the front and back end.

### Hyperledger Fabric

Hyperledger Fabric is the main blockchain framework used to develop and maintain the chaincode. Hyperledger Fabric automatically manages the peer, certificate authority (CA), and the orderer to process the transactions and maintain the blockchain. CouchDB is a NoSQL database used to maintain the blockchain's current state.

### Hyperledger Fabric SDK

A Hyperledger Fabric SDK was used in the application server. The SDK is able to send and receive information directly with the blockchain. This was the method used for the application to interact with the blockchain.

### MySQL

MySQL is the DBMS used to store user data on the application server.

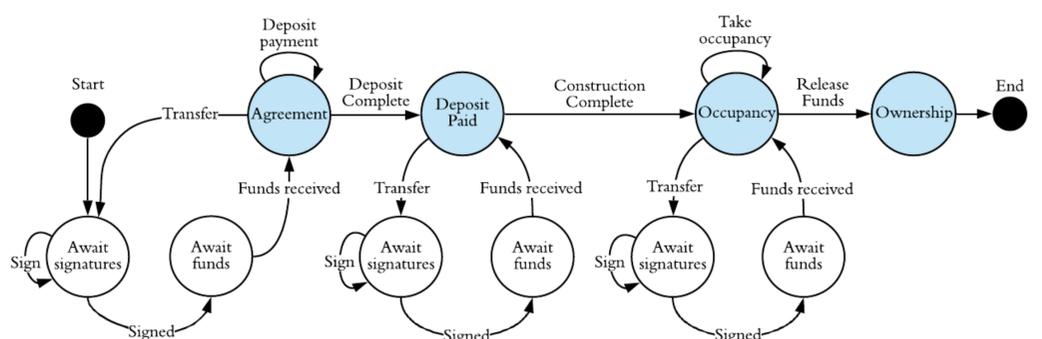
## Roles

The application uses a role-based permission system. Each web page has access restriction depending on the set roles for the page. Only certain roles can call chaincode, if a user with an unauthorized role tries to call chaincode or view a web page, their access will be restricted.

The application has 4 different roles:

- Administrator
- Lawyer
- Builder
- Buyer

## Contract State Diagram



## Implications

The **PCR** is built using a blockchain and creates a secure pre-construction registry utilizing smart contracts to automatically enforce terms of a purchase and in turn reduce fraud in the process.

This benefits all parties at risk in the current real estate market. The overall costs of real estate transactions will decrease, generated property taxes will increase, and certain forms of money laundering will be reduced.

## States

The above diagram represents the states the pre-construction contract moves between within the application, from the creation of the contract to the final transfer of ownership. At every state, the application checks all the parameters needed to move to the next state, and when those parameters are met the contract is moved to the next state.

At the "Deposit paid" and "Occupancy" state the contract is eligible to be re-assigned and transferred to another buyer if needed. When that occurs, the contract changes owners and this transfer is recorded on the blockchain.