Physical Blockchain: A blockchain use case for the physical internet

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Physical Blockchain

Conclusions 1

- The current state of the art of the present system handles a Physical Blockchain based Mezcal crate cross-border trade from Mexico to Germany.
- The system is based on the Hyperledger Fabric, an architecture comprised of data models, smart contacts and access controls for blockchains participants.

Physical Blockchain

Conclusions 2

- The full system consists of three blockchains:
  1. A mainchain of the Physical Internet cross-border logistics and payouts across participants
  2. A sidechain for auctions where goods, Incoterms, and additional transport and delivery specifications are described; and where the transfer of funds from the customer to the mainchain occurs
  3. A sidechain for chain of custody where information is produced and transfer to the mainchain in exchange of transfer of funds from the mainchain

- To do list:
  1. The first mainchain: will be extended to include in payouts penalties and rewards based on service level KPIs, such as: fill rates, order accuracy, lead time, etc.
  2. The second sidechain: will be upgraded to include in the auction algorithm non-physical goods/assets, and futures markets.
  3. The third sidechain: will be extended to include π_nodes, π_transport, and π_containers where orders are located, as well as the status of the cargo, such as in unloading/loading bays, crossdocking, (de/re)consolidation, sorting, storage, inspection, quarantine, transport, etc

Why a Physical Blockchain?

A piece of which world do we want?

- Do we need to stress the need for the importance of the PI?
  - Economies of scale, scope, speed, and space.
  - Standardized π-containers; π-nodes, π-transport/routes
  - Optimization, synchronization, automation
- Do we need to stress the technological possibilities of the Blockchain?
  - Blockchain 1.0: cryptocurrencies
  - Blockchain 2.0: Smart contracts and “black letter” rules.
  - Blockchain 3.0 & X.0: scalability; interchain operability; cloud & big data; on&off operability, security & governance; digitalization and IoT

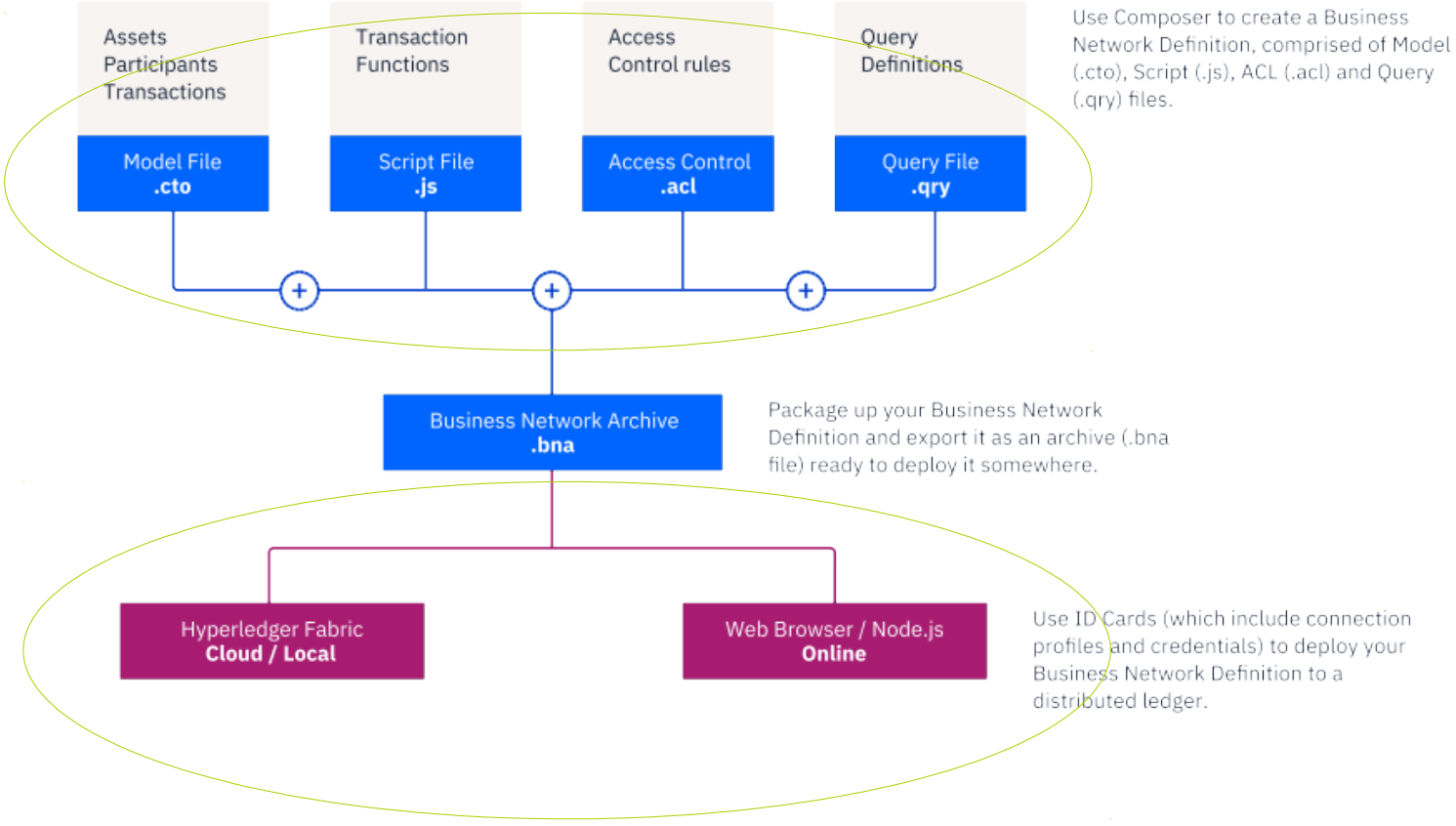
Lets get our hands dirty

A classical physical internet

- Mexico supplies a Mezcal crate to Germany
  - Oaxaca, Mexico receives an purchase order from Germany
  - The exporter places the Mezcal in π-packs and a π-box
  - The π-box is placed in a π-container and loaded in the LSP's π-transport
  - The π-container passes through a regional π-node, and international π-node in Mexico for air transport to Germany
  - The π-container arrives to an international π-node in Germany and passes though a regional π-node, and a last mile delivery π-node in Hamburg.

Lets get our hands dirty

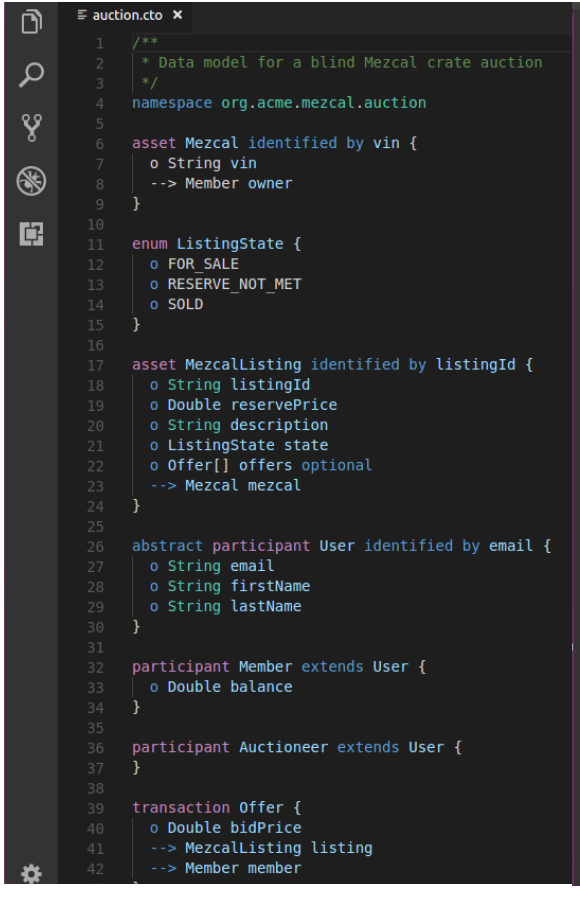
A hyperledger fabric architecture to handle the physical internet



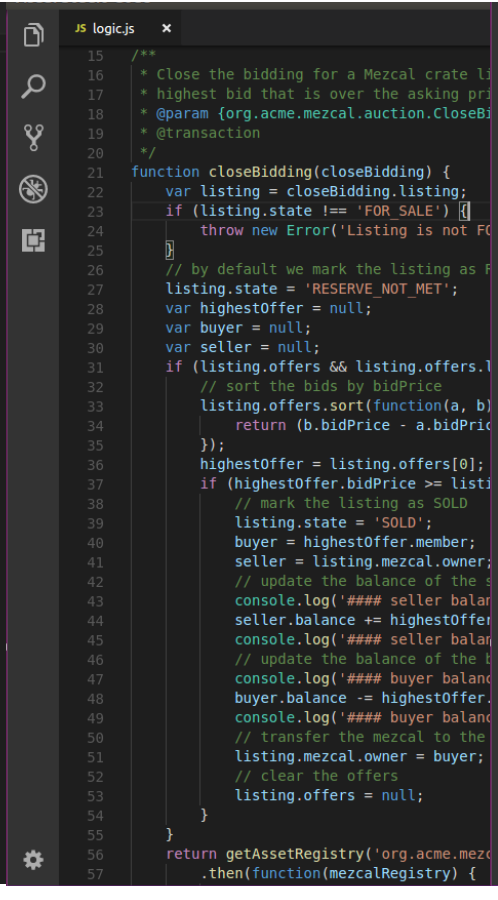
Lets get our hands dirty

A hyperledger fabric architecture to handle the physical internet

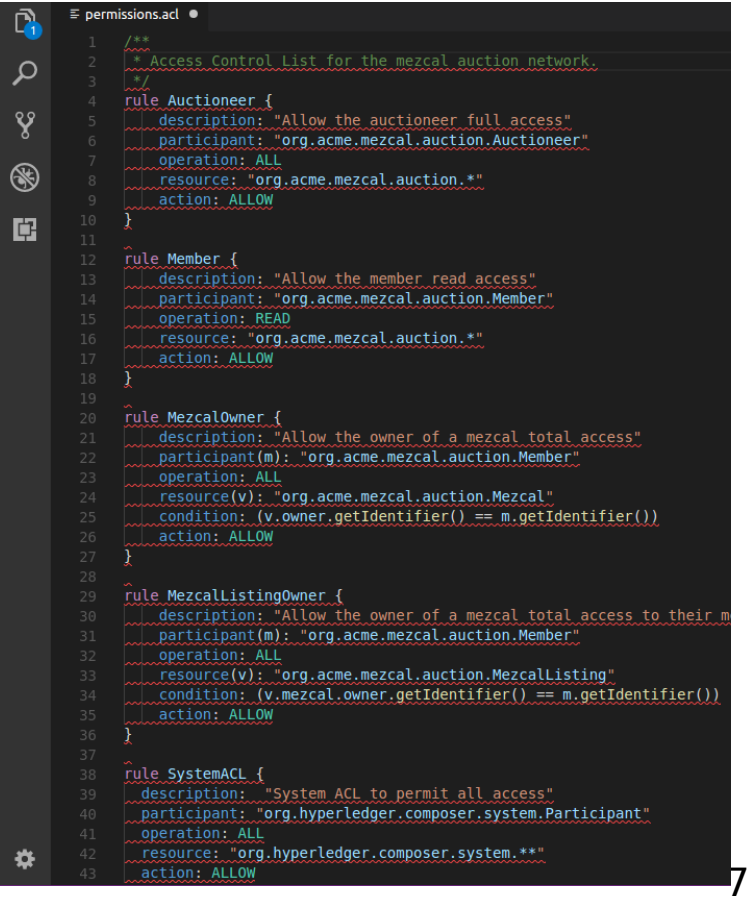
Data model



Script file



Access Control List



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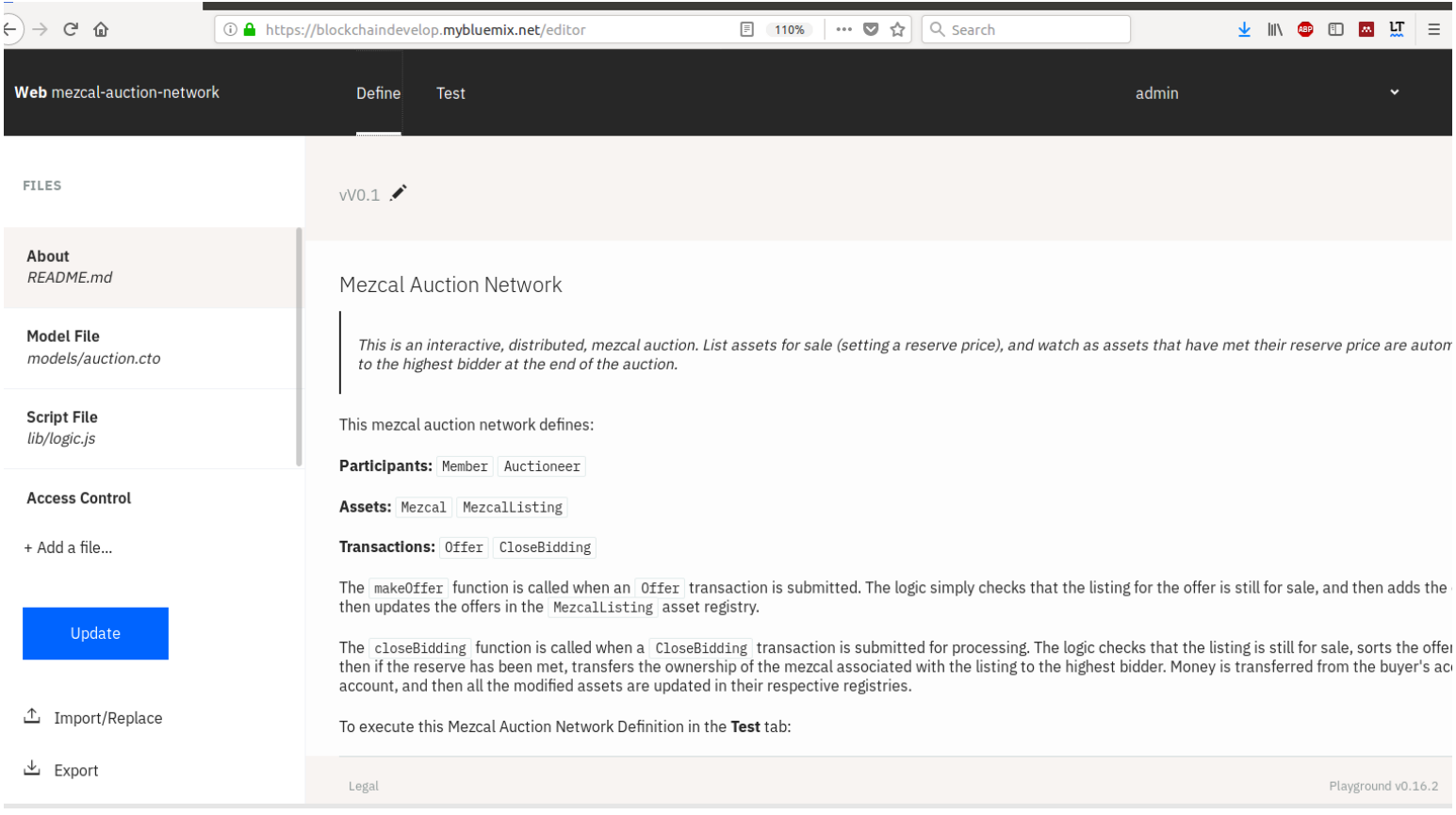
A hyperledger fabric architecture to handle the physical internet

Network definition Execution IDs and Timestamps



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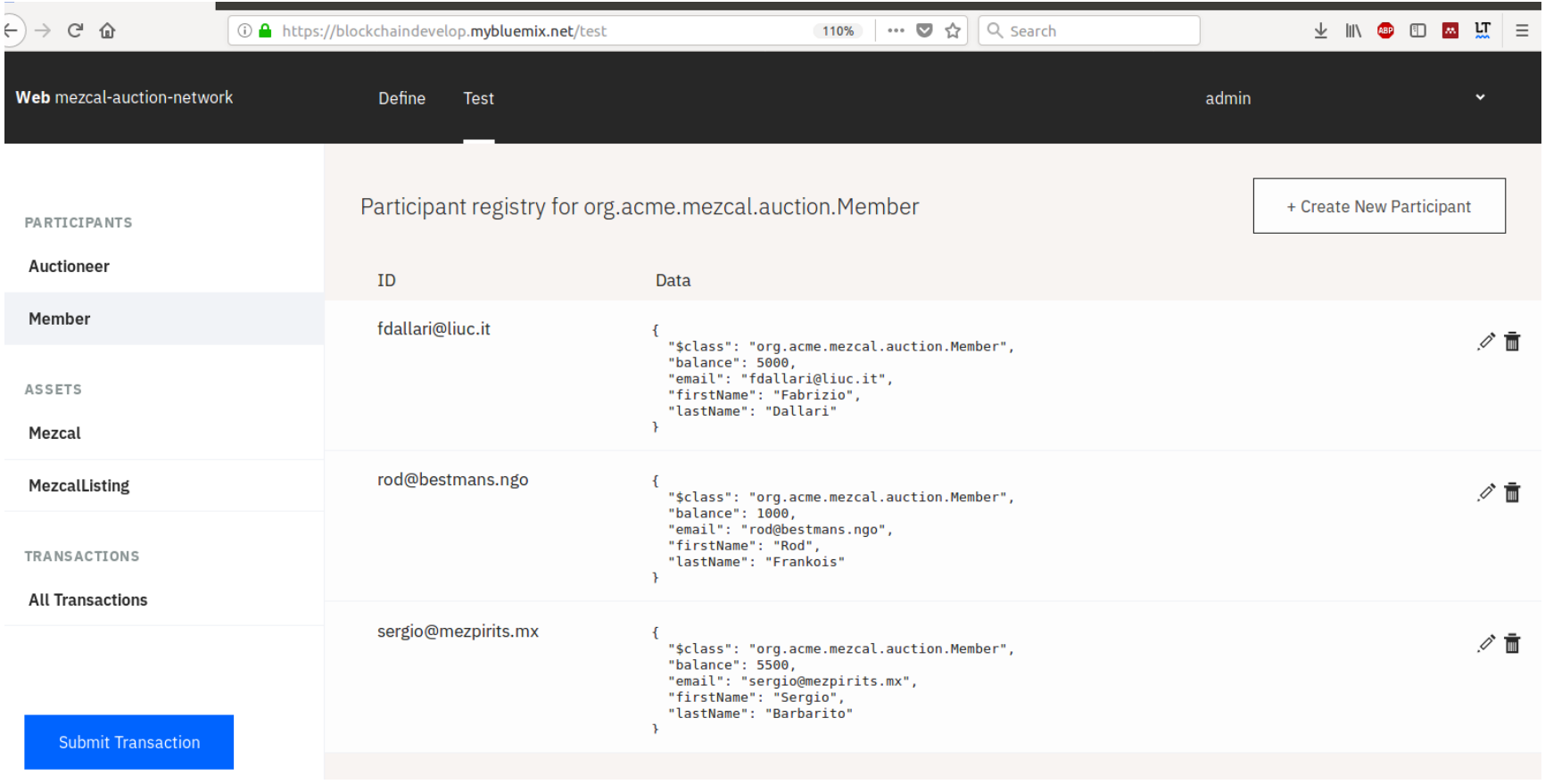

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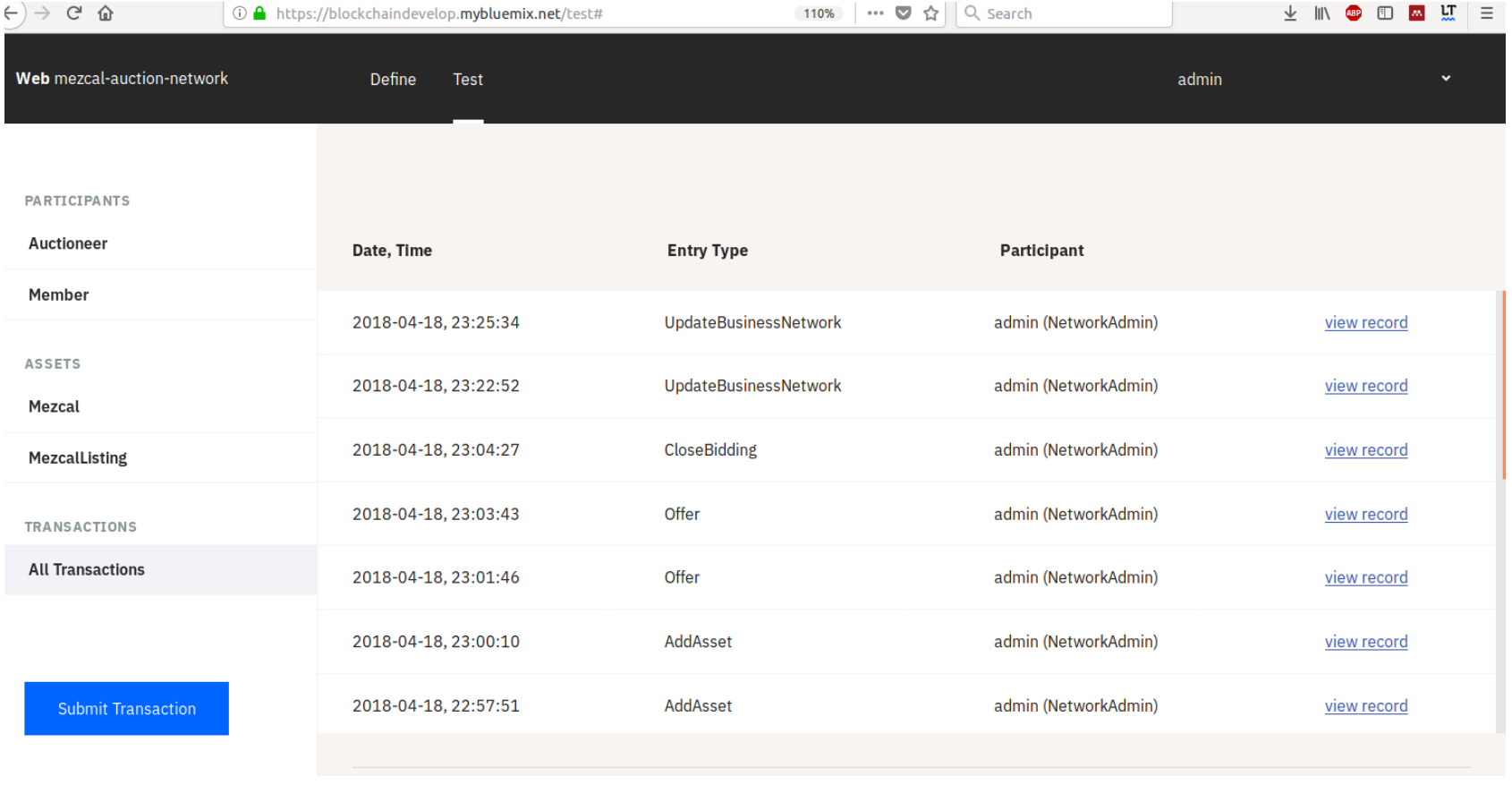


Lets get our hands dirty

3 Blockchains

Mezcal crate auction

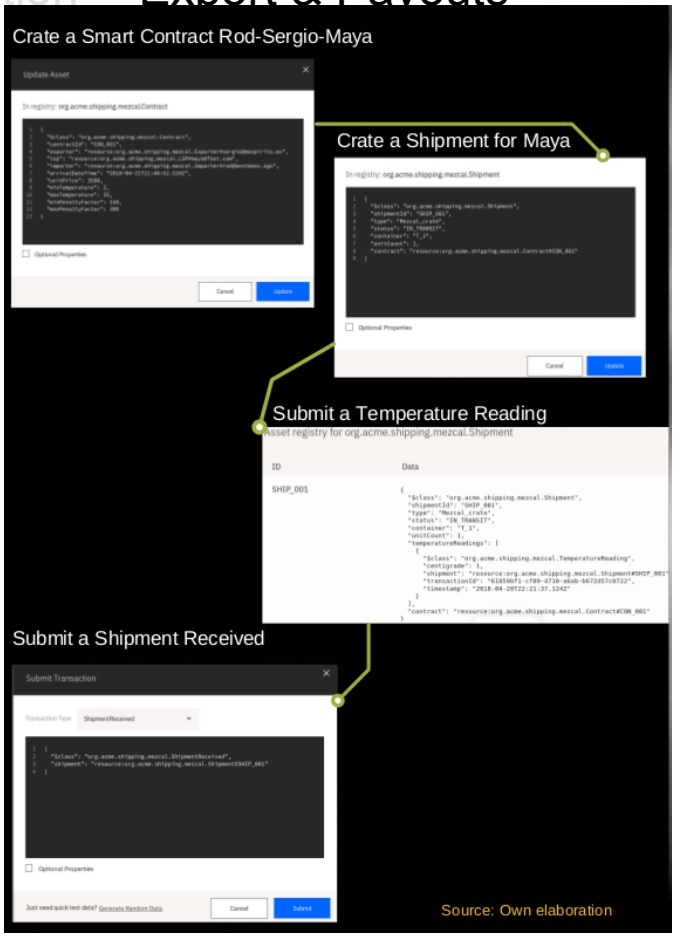
Export & Payouts

Block(chain) of custody

Lets get our hands dirty

3 Blockchains

Mezcal crate auction | Export & Payouts | Block(chain) of custody



Lets get our hands dirty

3 Blockchains

Mezcal crate auction Export & Payouts

Block(chain) of custody

Final remarks

Physical Blockchain capability Requirements

- Descentralised Autonomous Organizations (DAOs) and smart devises
- Measurement and analytics
- Distributed marketplace
- Mainchain and sidechains integration
- Plugging-in non-blockchain systems
- Embedded optimisation algorithms in smart contracts
- Traditional, crypto, and virtual currencies and assets

Final remarks

Living labs?

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Thank you!
Suggestions!
Lets talk!

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