Hyperledger Mentorship Project Presentation

November 2021

Blockchain Integration for Climate Emissions Data with Fabric and Cactus

- **Introduction**
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  - **Location:** Gopalganj, Bihar, India
  - **University:** Indian Institute of Technology, Patna
  - **Mentor(s):** Si Chen, Peter Somogyvari, Kamlesh Nagware
  - **Hyperledger Project**: hyperledger-labs/blockchain-carbon-accounting, hyperledger/cactus

Blockchain Integration for Climate Emissions Data with Fabric and Cactus

- **Project Description**:
- Blockchain Carbon Accounting is part of Climate Action SIG project. It contains
  - Utility Emissions Channel : A permissioned Hyperledger Fabric channel where an auditor calculates the emissions of a customer's electricity based on its utility bill.
  - Net Emissions Tokens Network : A ethereum smart contract which converts emission data present in utility emissions channel into a tradable emissions token.
- HL Cactus is pluggable, decentralized blockchain integration tools which allow user to securely integrate multiple blockchains.
- Tech Stack: Typescript, Node.js, Express, Docker, HashiCorp Vault

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- **Project Objectives**:
  - Obj 1: Carbon accounting server should use HL cactus to integrate Utility Emissions Channel (HL Fabric) and Net Emissions Tokens Network (ethereum).
  - Obj 2: Fabric client's Private Key Management with hashicorp vault.
  - Obj 3: Prevent double minting of emission token problem.

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- **Project Deliverables:**
  - Deliverable 1: Replace direct dependence of carbon accounting application on fabric-node-sdk and ethers pkg with cactus packages.
  - Deliverable 2: Add Support for signing of HL Fabric Transactions with private key stored as transit key in vault server.
  - Deliverable 3: Prevent double minting of emissions token during `record audited emissions token` operation.
  - Deliverable 4: Vault Identity management server for the carbon accounting application.

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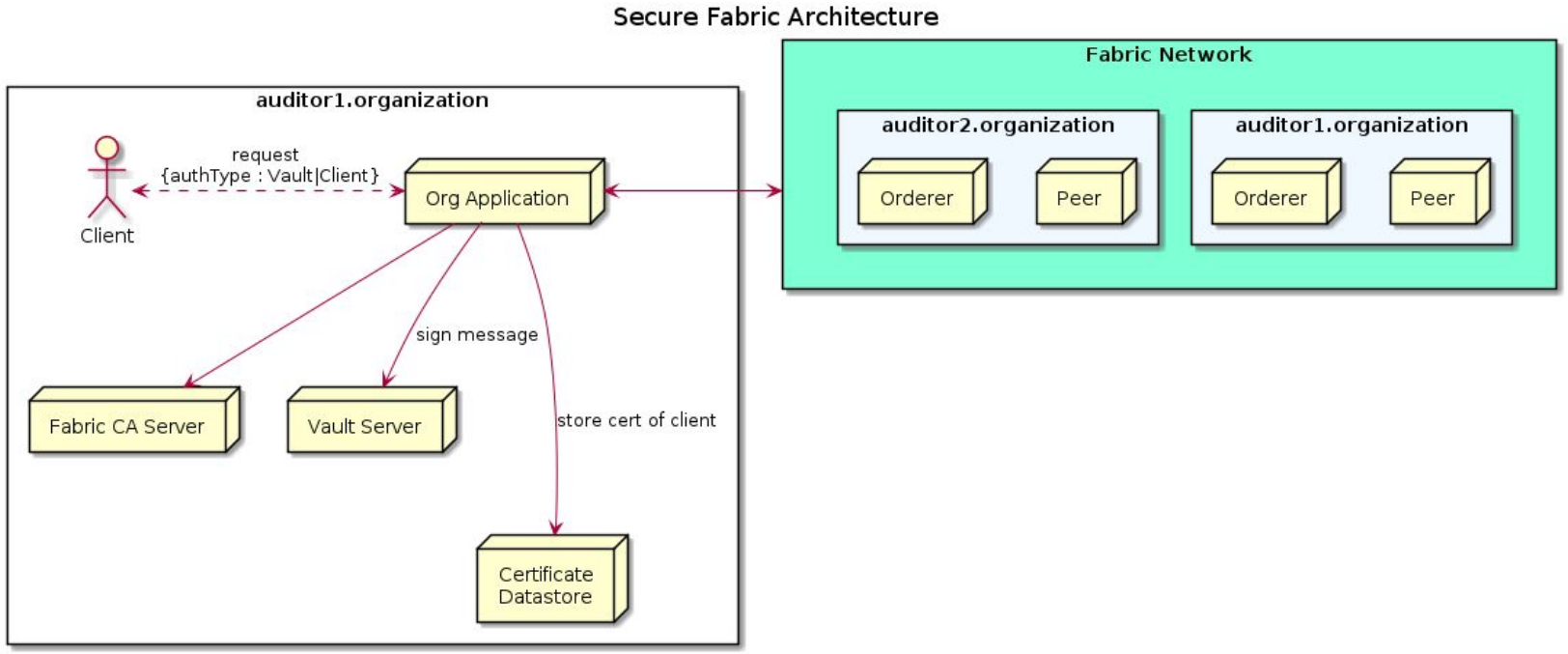
- **Project Execution & Accomplishments:**
- Deliverable 1: https://github.com/hyperledger-labs/blockchain-carbon-accounting/pull/289
- Deliverable 2: https://github.com/hyperledger/cactus/issues/1212



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- **Project Execution & Accomplishments:**
- https://github.com/hyperledger/cactus/pull/1243 : add support for vault transit secret engine
- https://github.com/hyperledger-labs/blockchain-carbon-accounting/pull/287 : integration of vault signing in carbon accounting application


```
{
   "type":"Vault-X.509",
   "mspId":"----",
   "credentials":
      {
         "certificate":"-----BEGIN CERTIFICATE--------\n-----END CERTIFICATE-----\n"
      }
}
```


Fig : Data stored in certificate datastore

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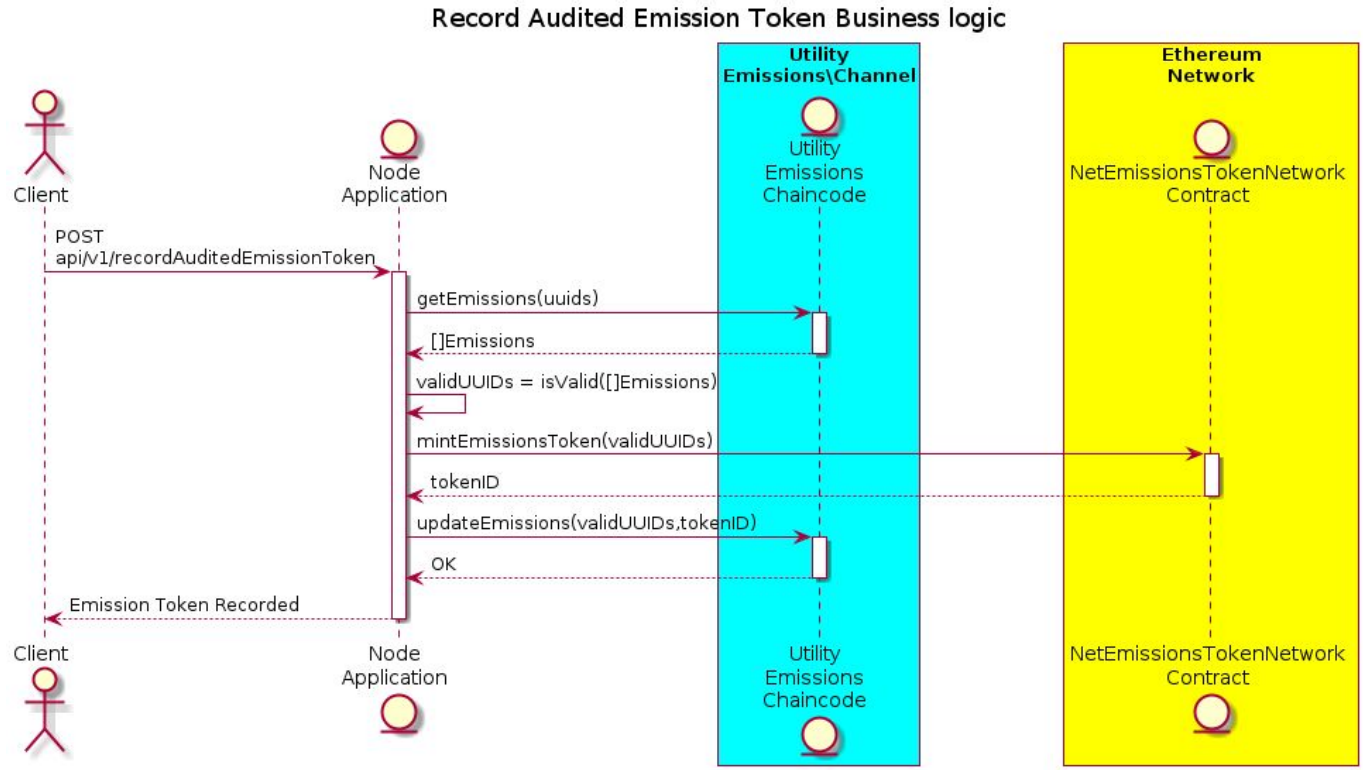
- **Project Execution & Accomplishments:**
- Deliverable 3 : https://github.com/hyperledger-labs/blockchain-carbon-accounting/pull/290



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- **Project Execution & Accomplishments**:
- Deliverable 4: https://github.com/hyperledger-labs/blockchain-carbon-accounting/pull/326
- Most proud: proposal and implementation of vault identity for HL Fabric.
- Most challenging:
  - Understanding cactus's architecture.
  - Understanding Hashicorp vault server.

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- **Recommendations for future work:**
- 1. Design and implement ethereum transactions signing with vault's transit key.
- 2. Build UI for carbon accounting project which uses api server.

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- **Project Output or Results**:
- Carbon Accounting api server is now production ready with good number of test case to increase the maintainability of the codebase.
- Better fabric client's private key management with vault transit engine.
- Double minting of token is prevented with fabric dataLock chaincode.

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- **Insights Gained**:
- Learnt about workflow of a community driven open source projects.
- Working with peer developers from across the globe.

- **Advice**:
- Design and plan before jumping into the coding part.
- Set daily or weekly targets.
- Document daily progress.
- Reach out to mentors, community member to seek advice and feedback


THANK YOU!