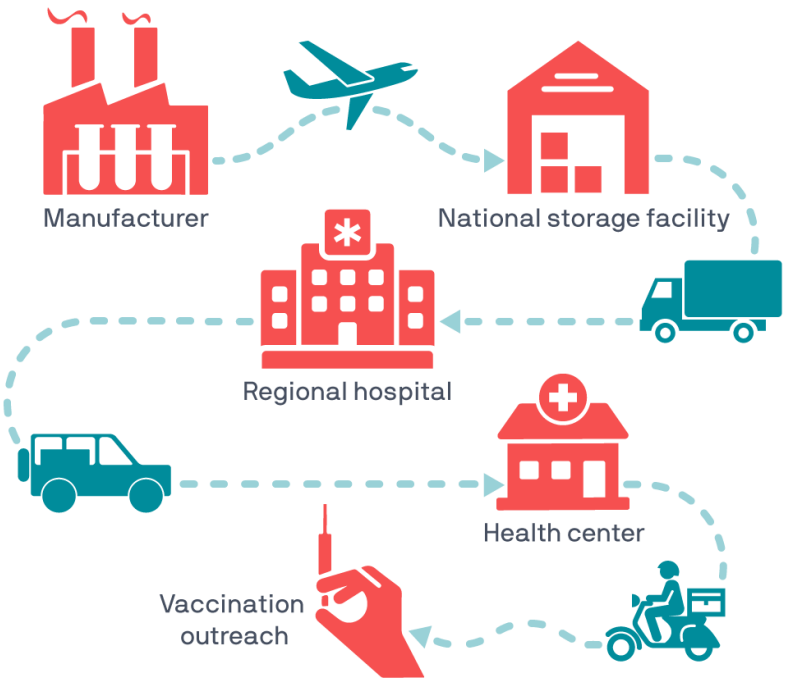
Blockchain Supply Chain POC: COVID-19 Vaccine Passports

1] Goal

Design and implement a system that solves a known problem of trust in the COVID-19 vaccine supply chain.

2] Requirements Gathering

2.1] Vaccine Cold Chain



Source: [Vaccine cold chain Q&A]

2.2] System Actors

1. **Manufacturer**
    - process raw materials into vaccines
2. **Distributor**
    - transports vaccines between locations
3. **Inspector**
    - performs quality checks on vaccines

    - performs quality checks on manufacturing plants
4. **Storage Facility**
    - store vaccines in cold temperatures
5. **Immunizer** (the doctors, nurses
    - vaccinates people
    - provides vaccine passport/certificates
6. **Traveller** (the patient)**:**
    - receives vaccine
    - receives vaccine certificate
    - presents vaccine certificate at the border of the destination country
7. **Border Agent**
    - verifies the vaccine certificates/passports

2.3] Problem-Solution Map

No.	Problems	Affected Actors	Proposed Solutions
1	Vaccine passports can be falsified	• Border Agent	• Cryptographically verify using on-chain data
2	Key facilities may not meet quality standards	• All	• Publish inspection results to blockchain • Verify presented inspection results
3	Vaccine passports may not be recognized by destination countries	• Distributor • Traveller • Immunizer	• Verify signatures in presented certificates

2.4] Why Blockchain?

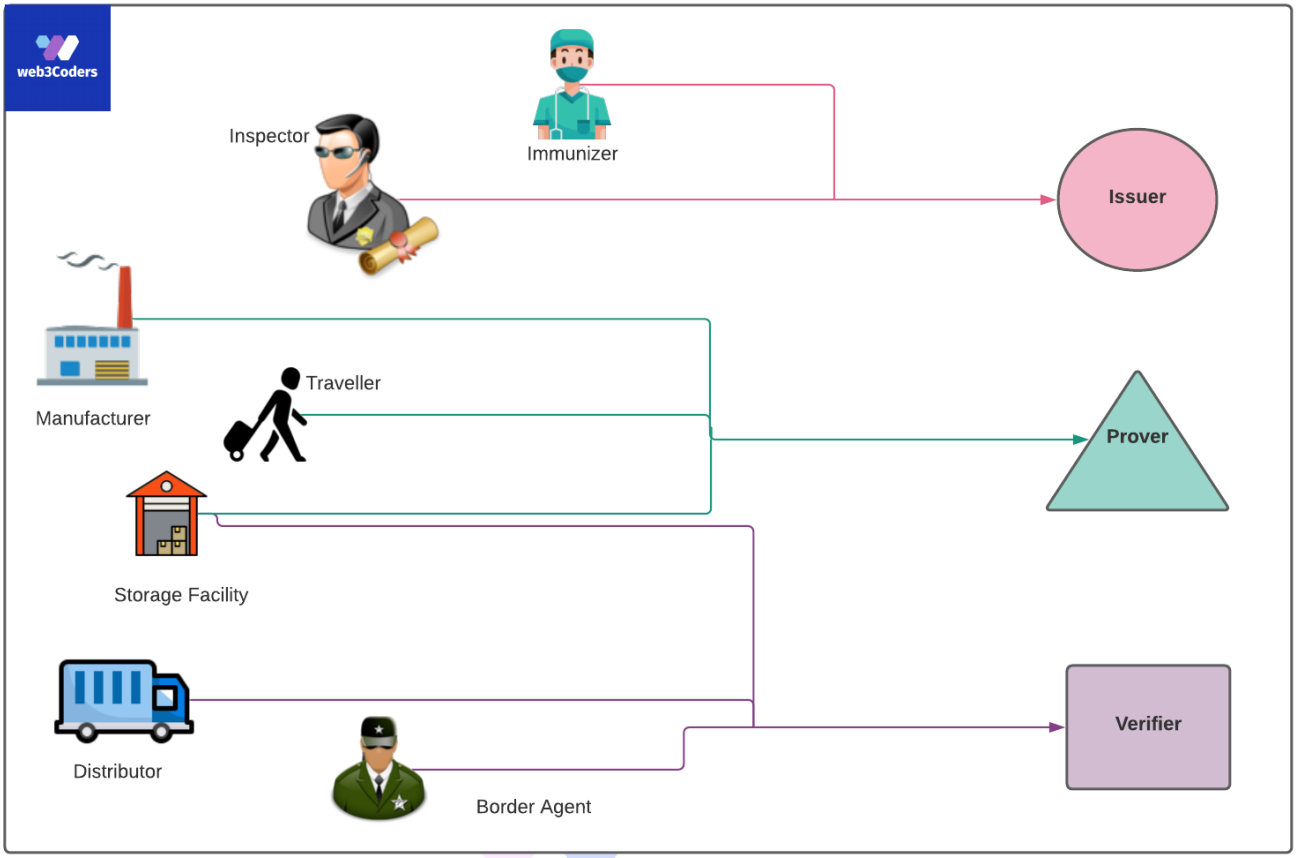
1. **Tamper-Proof Provenance**
    - does the label on the vaccine's vial accurately represent its contents?
    - did the vaccine come from an inspected batch?
2. **Credential Issuance & Verification**
    - cryptographic signatures that are easily verified with on-chain identities
3. **Data Redundancy**
    - the data can't be lost even if a Traveller "misplaces" their device
    - the data can't be lost even if the vials are damaged

3] System Design

3.1] Flow

1. Inspector issues certificate for batch to Manufacturer
2. ***<batch status updated to MANUFACTURED>***
3. Manufacturer presents certificate to Distributor
4. Distributor verifies each certificate
5. ***<batch status updated to DELIVERING_INTERNATIONAL>***
6. Distributor presents updated certificate to Storage Facility
7. Storage Facility verifies each batch certificate
8. ***<batch status updated to STORED>***
9. Storage Facility presents certificates to Distributor
10. Distributor verifies each certificate
11. ***<batch status updated to DELIVERING_LOCAL>***
12. Distributor presents updated certificate to Immunizer
13. Immunizer verifies certificates
14. ***<batch status updated to DELIVERED>***
15. Immunizer vaccinates Traveller and issues vaccine passport
16. ***<certificate issued with status VACCINATED>***
17. Traveller presents vaccine passport to Border Agent
18. Border Agent verifies vaccine passport

3.2] User Classifications



3.3] Use Cases

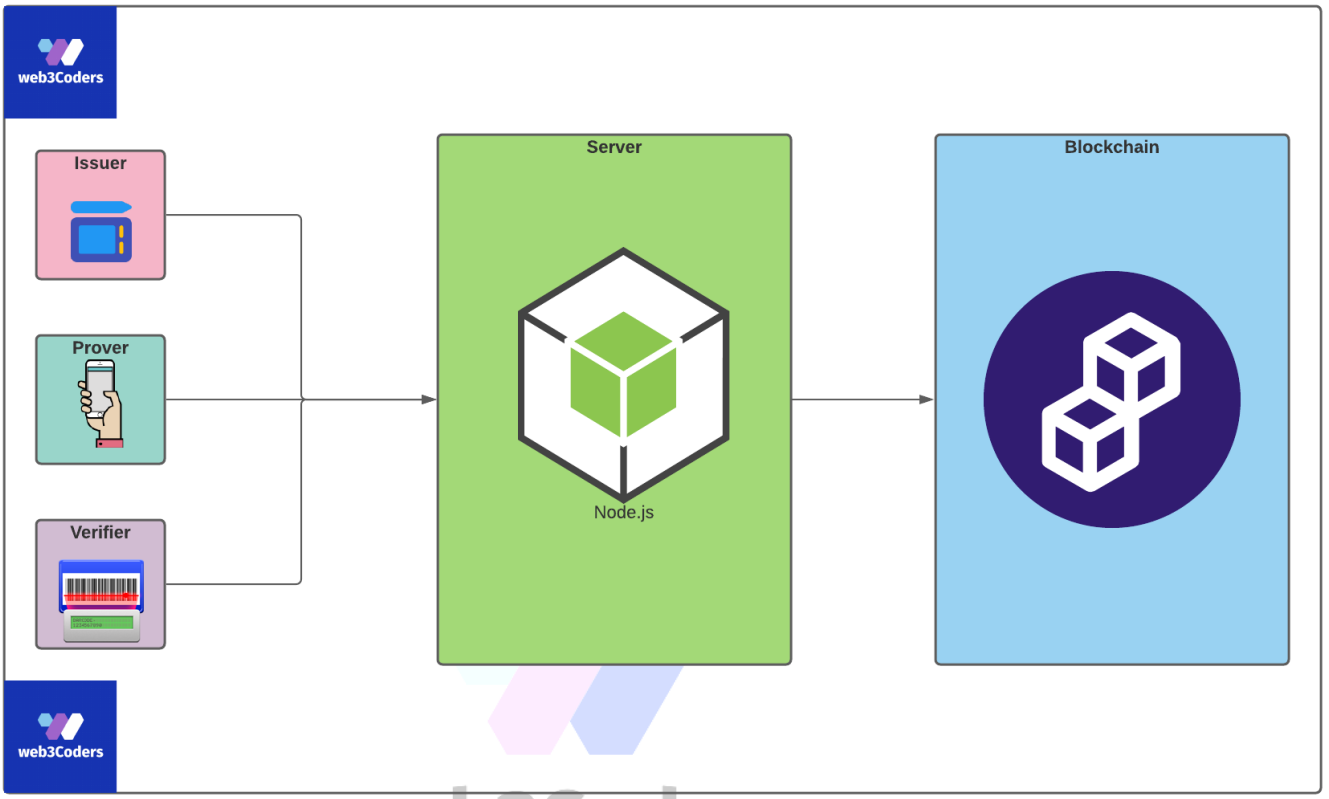
1. As an ***Issuer***, I can issue a signature representing a digital certificate for a manufacturer's plant or storage facility
2. As a ***Prover***, I can present a certificate/signature issued to me
3. As a ***Verifier***, I can validate the signature on the blockchain for a vaccine

3.3.1] Out of Scope

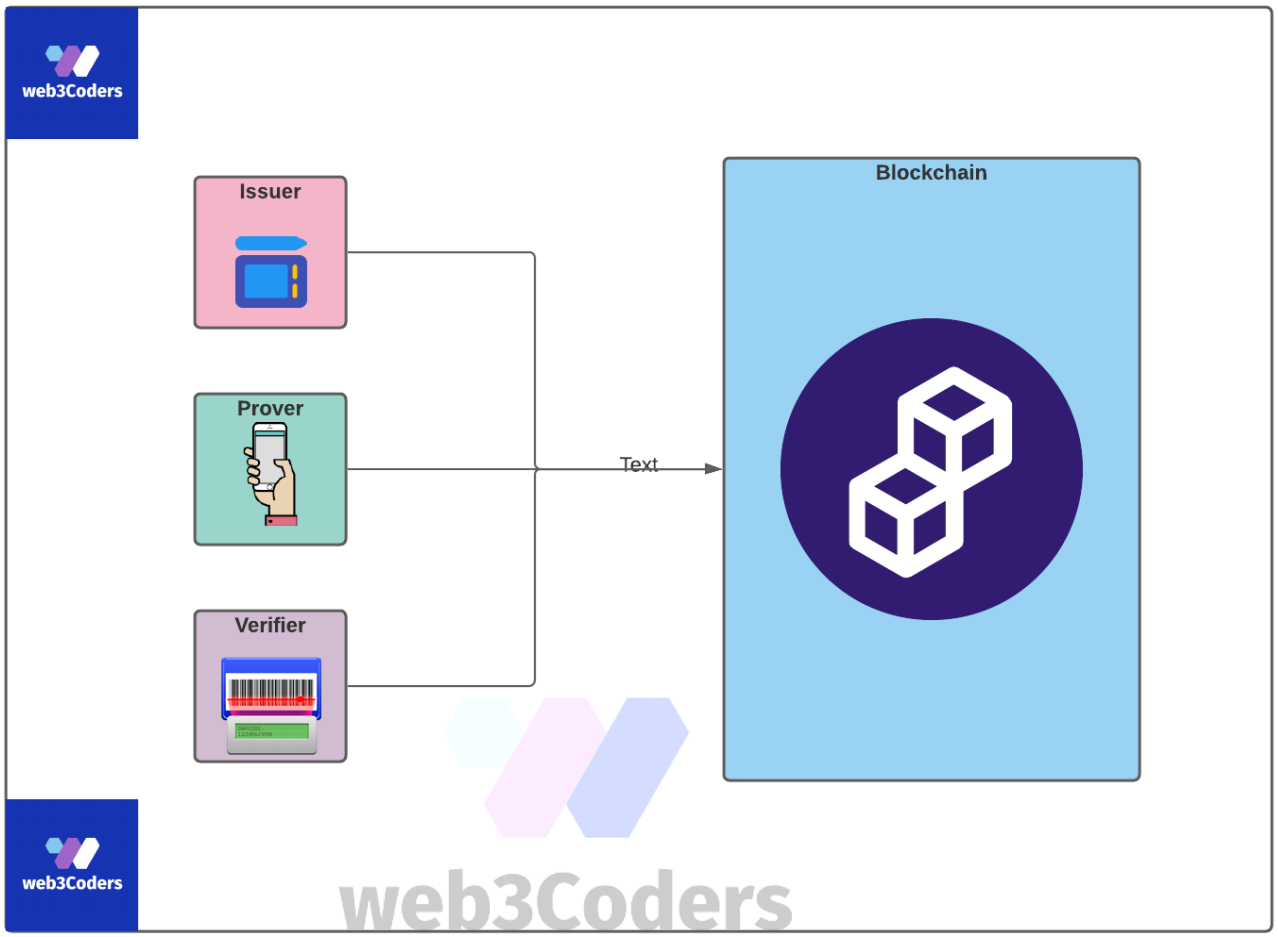
- Payments between system agents;
- Dishonest doctors/immunizers;
- Suppliers of raw materials to the manufacturers;
- Image capture & QR code scanning;
- Scalability;
- Distribution to areas without internet access;
- IoT;
- Machine learning;
- Regulatory compliance (e.g. GDPR, HIPAA, etc.); and
- Anything not addressed in this video.

3.4] High-level Diagram

3.4.1] 3-Tiered Architecture



3.4.2] 2-Tiered “dApp” Architecture



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