

Applicazione basata sulla tecnologia blockchain per i processi di certificazione ISO



**Politecnico
di Torino**

Relatore

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Tutor aziendale

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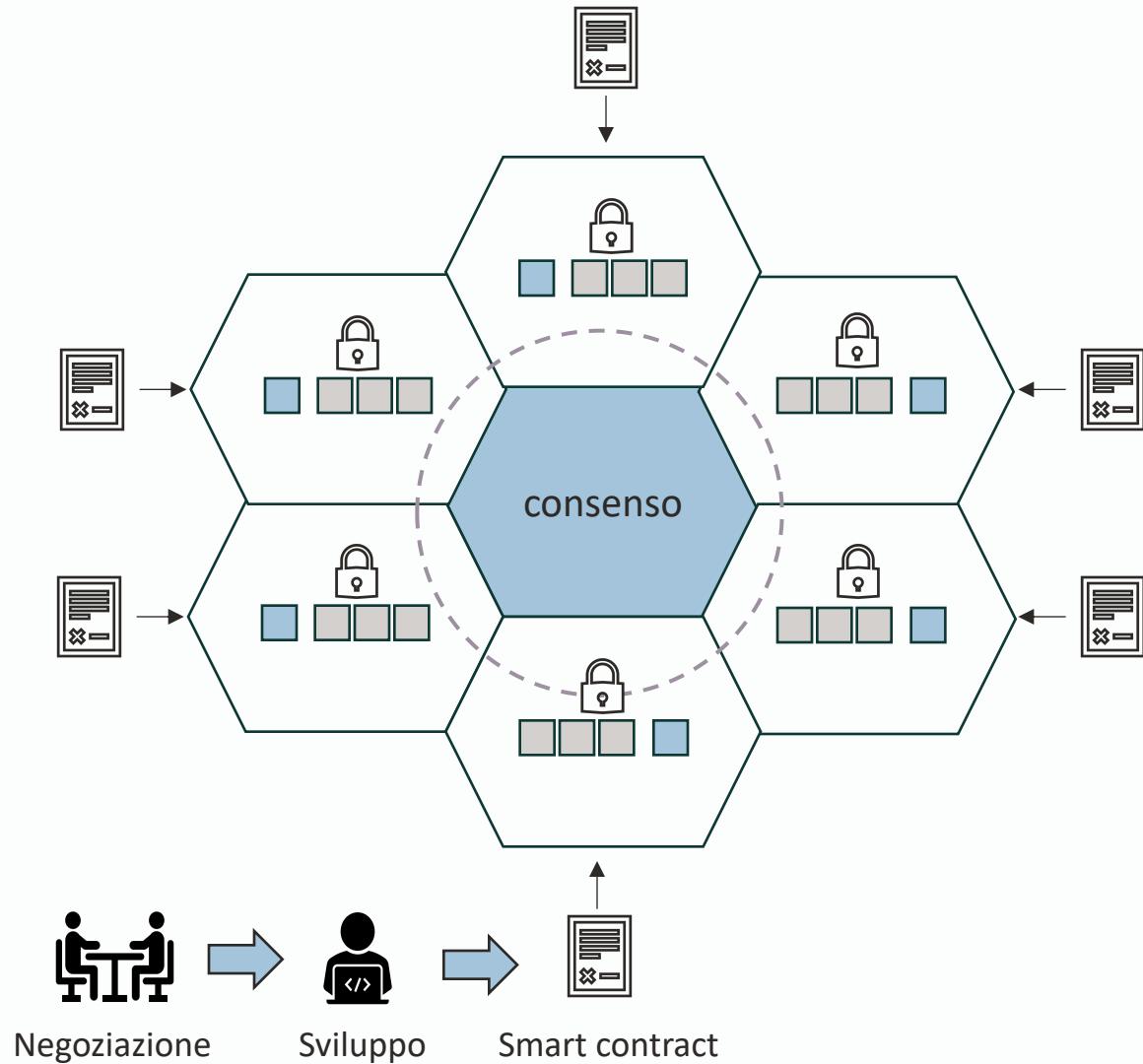
Candidato

Stefano **SURACI**

Introduzione

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Blockchain

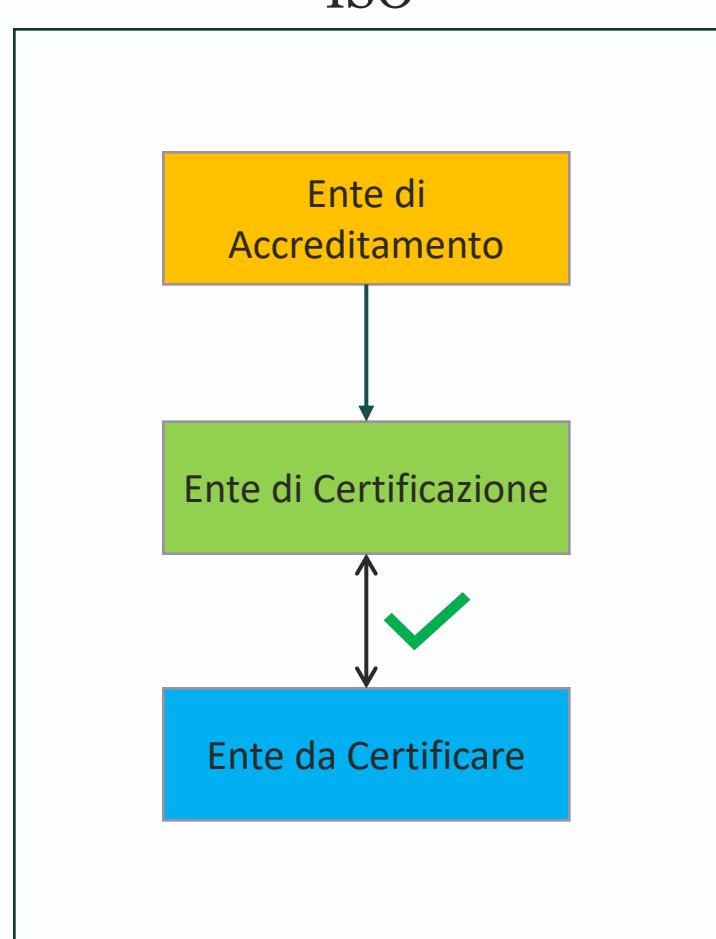


ASPETTI FONDAMENTALI:

- Decentralizzazione
- Autorità decentralizzata
- Logica centralizzata

VANTAGGI:

- ✓ Sistema neutro
- ✓ Affidabile



CASO DI STUDIO

- Interazione tra enti di certificazione ed enti da certificare

Definizione del modello astratto

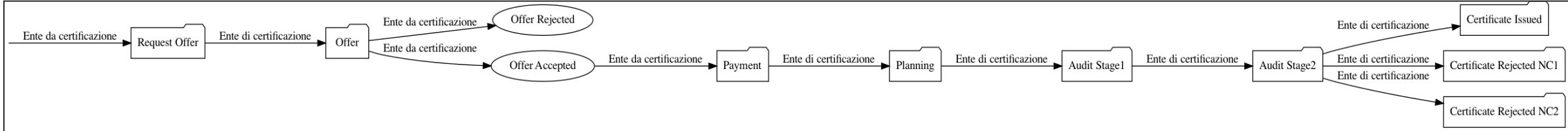
NOTAZIONE:

○ : stato che non richiede un documento

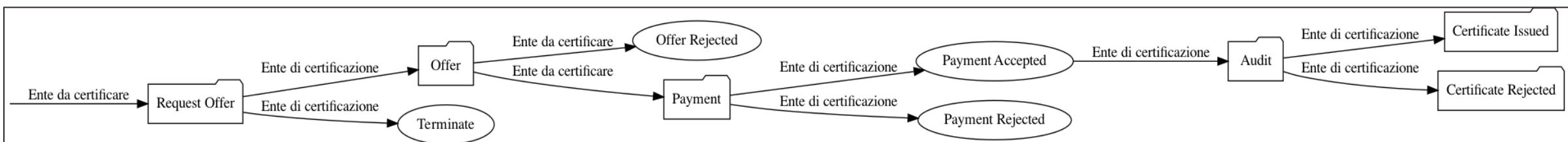
□ : stato che richiede un documento allegato

→ : transazione da uno stato «i» ad uno stato «i+1»

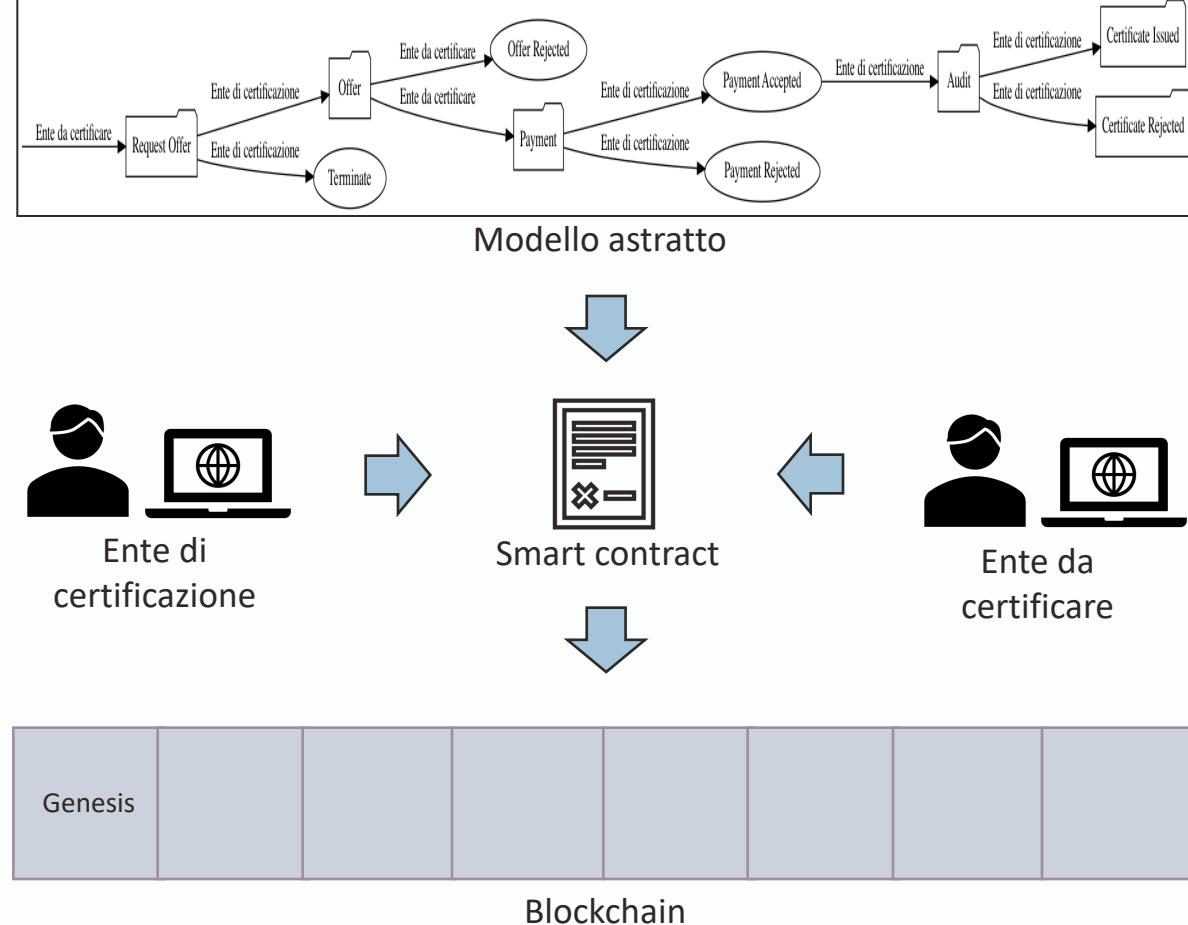
PROCESSO DI CERTIFICAZIONE ISO 9001:



MODELLO ASTRATTO:



Scopo della tesi: blockchain per certificazioni ISO



PRINCIPALI MOTIVAZIONI:

- Transizione digitale
- Sicurezza dei dati
- Maggiore fiducia nello strumento di accreditamento

IMPLEMENTAZIONE:

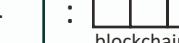
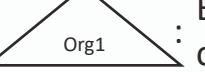
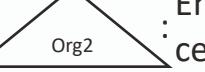
- Inserimento del modello astratto nella logica dello smart contract
- Realizzazione di un'applicazione web per la comunicazione tra enti di certificazione e da certificare

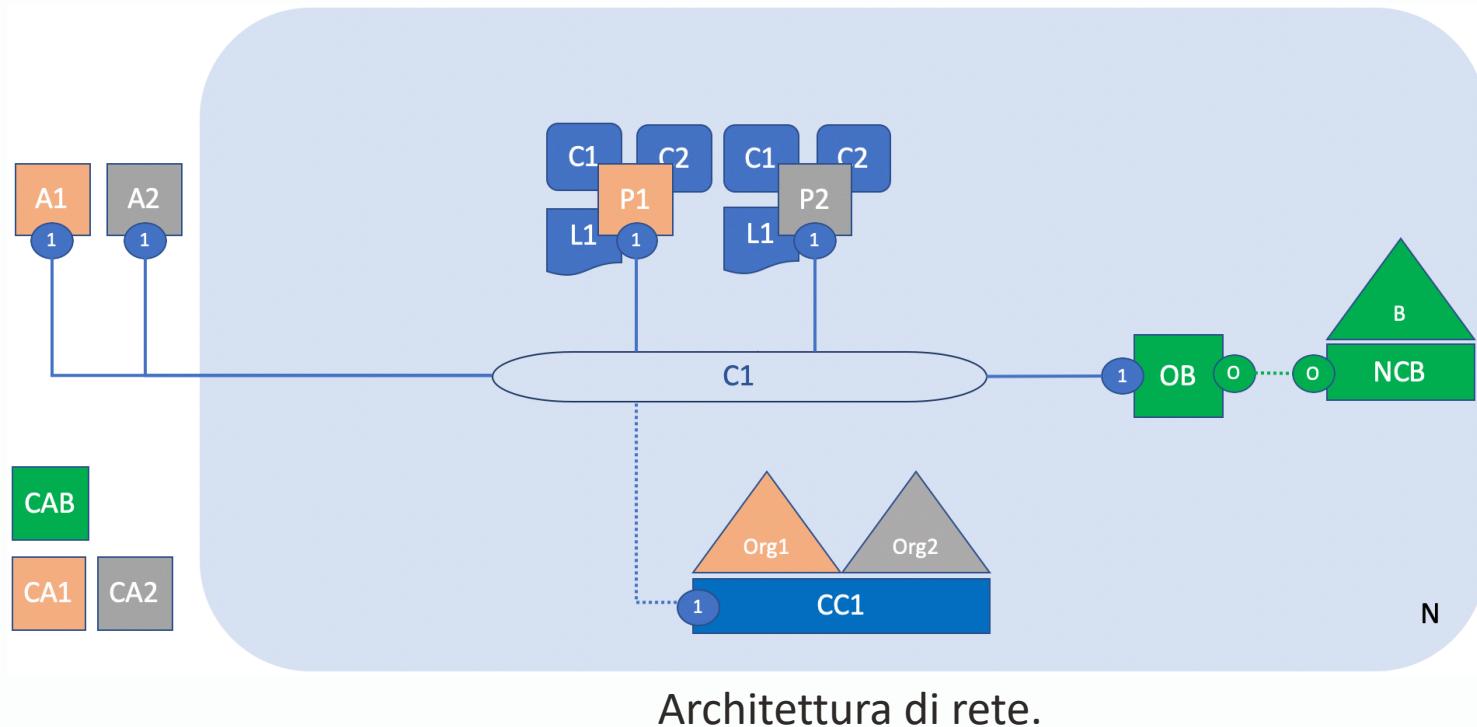
Contributi personali

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Architettura di rete

NOTAZIONE:

| | | | | | | | | | | | |
|---|-------------|---|----------------|--|---|--|---|---|--------------------------|---|------------------------------|
| P | : nodo Peer | O | : nodo Orderer | NC | : conf. Rete | CC | : conf. Canale | A | : applicazione | CA | : autorità di certificazione |
| B | : Bechain | C | : canale | L | :  +  | C | : S1 + S2 |  | : Enti di certificazione |  | : Enti da certificare |



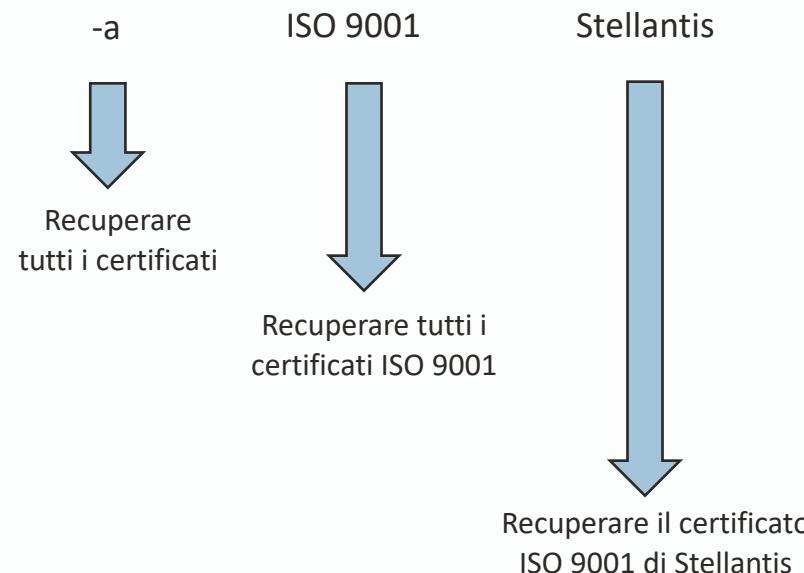
ASPETTI PRINCIPALI:

- Hyperledger Fabric
- Blockchain permissioned
- Controllo degli accessi
- Comunicazione privata tra enti di certificazione e da certificare
- World states: chaincode namespaces
- Riservatezza tra enti di certificazione
- Endorsement Policy: P1 e P2

Oggetto aziendale

State

| Key | | | Value | | | | |
|-----|-------------------|---------------|---------|-------------|---------|------------|-------------------|
| a- | ISO contract name | Client's name | TransID | DeclarantID | StatelD | NextStates | Attached HashDoc. |



VANTAGGI:

- ✓ Verifica identità enti da certificare
- ✓ Interrogazione efficiente del database di stato
- ✓ Informazioni generiche per ogni documento
- ✓ L' hash garantisce la privacy nei confronti di Bechain

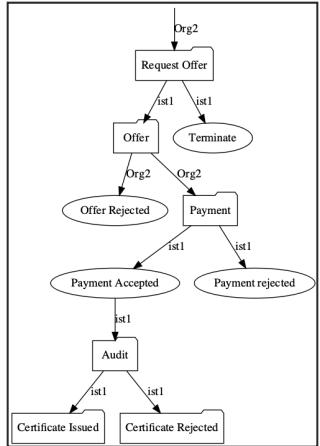
Strumenti di supporto



```
⑥ test.gv
* ~/Desktop/test.gv ◊
graph TD
    Start([Start]) --> RequestOffer1[Request Offer]
    RequestOffer1 --> Offer1[Offer]
    Offer1 --> Payment1[Payment]
    Payment1 --> Accepted1[Accepted]
    Accepted1 --> CertificateIssued1[Certificate Issued]
    CertificateIssued1 --> Rejected1[Rejected]
    Rejected1 --> Audit1[Audit]
    Audit1 --> Terminate1[Terminate]
    Terminate1 --> Start

    RequestOffer2[Request Offer] --> Offer2[Offer]
    Offer2 --> Payment2[Payment]
    Payment2 --> Accepted2[Accepted]
    Accepted2 --> CertificateIssued2[Certificate Issued]
    CertificateIssued2 --> Rejected2[Rejected]
    Rejected2 --> Audit2[Audit]
    Audit2 --> Terminate2[Terminate]
    Terminate2 --> Start
```

Output *createGraphviz* script



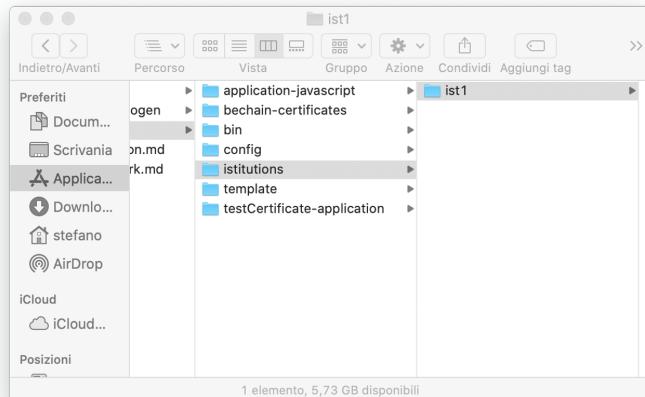
Macchina a stati

- ## VANTAGGI:

- ✓ Creazione di un modello astratto generico
 - ✓ Non richiede abilità di programmazione

```
Last login: Sat May 21 07:43:19 on ttys000
stefano@srtefano ~ % cd /Applications/XAMPP/xamppfiles/htdocs/Hyperledger/fabric-samples/template/esempi
stefano@srtefano esempi % dot -Tsvg stateMachine.gv -o ISO9000.svg
stefano@srtefano esempi % dot -Tplain stateMachine.gv -o ISO9000.plain
stefano@srtefano esempi % cd ..
stefano@srtefano template % python3 createContracts.py ist1
```

createContracts script



Chaincode

- ## VANTAGGI:

- ✓ Generazione automatica degli smart contracts
 - ✓ Non richiede abilità di programmazione

Risultati

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Pagina iniziale

World State ente di certificazione «ist1»

→

BeChain

Dashboard ist1

Clients ▾ Certificates ▾

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All

| Actions | Key | TransactionID | DeclarantID | StateID | Next States | Attached | Hash Document |
|---------|---------------------|---------------|-------------|------------------|--|----------|---------------|
| Process | ISO10095-Hyundai | TxId | Hyundai | Request Offer | Offer, Terminate | 1 | Hash |
| Process | ISO10095-Stellantis | TxId | ist1 | Payment Rejected | none | none | Hash |
| Process | ISO9001-Stellantis | TxId | ist1 | Audit | Certificate Issued, Certificate Rejected | 1 | Hash |
| Process | ISO9001-Toyota | TxId | ist1 | Terminate | none | none | Hash |
| Process | ISO9001-Volkswagen | TxId | Volkswagen | Offer Rejected | none | none | Hash |

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Processo di certificazione

Visualizzazione
del processo di
certificazione ISO
9001 Stellantis



BeChain

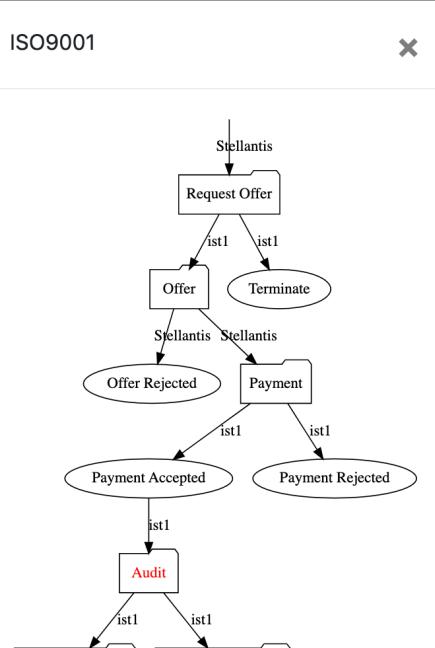
Clients ▾ Certificates ▾

Search..

All

| Actions | Key | TransactionID |
|---------|---------------------|---------------|
| Process | ISO10095-Hyundai | TxId |
| Process | ISO10095-Stellantis | TxId |
| Process | ISO9001-Stellantis | TxId |
| Process | ISO9001-Toyota | TxId |
| Process | ISO9001-Volkswagen | TxId |

ISO9001



```

graph TD
    RO[Request Offer] -- ist1 --> O[Offer]
    O -- Stellantis --> OR[Offer Rejected]
    O -- Stellantis --> P[Payment]
    OR --> T[Terminate]
    P -- ist1 --> PA[Payment Accepted]
    P -- ist1 --> PR[Payment Rejected]
    PA -- ist1 --> A[Audit]
    PR -- ist1 --> A
    A -- ist1 --> CI[Certificate Issued]
    A -- ist1 --> CR[Certificate Rejected]
  
```

Next States Attached Hash Document

| | | |
|--|------|------|
| Offer, Terminate | 1 | Hash |
| none | none | Hash |
| Certificate Issued, Certificate Rejected | 1 | Hash |
| none | none | Hash |
| none | none | Hash |

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By Author



Cronologia delle transazioni

Visualizzazione
dell'oggetto
aziendale ISO
9001 Stellantis
nella blockchain



BeChain Menu ▾

Dashboard

ist1

[Clients](#) [Certificates](#)

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ISO9001-Stellantis blockchain history

| Certifid | Txid | DeclarantId | StateId | NextStates | Attached | HashDocs | Timestamp | IsDelete |
|--------------------|--------|-------------|--------------------|--|----------|----------|-----------------------------------|----------|
| ISO9001-Stellantis | [Txid] | ist1 | Audit | Certificate Issued, Certificate Rejected | 1 | [Hash] | 2022-07-24 17:14:25.97 +0000 UTC | false |
| ISO9001-Stellantis | [Txid] | ist1 | Certificate Issued | none | 1 | [Hash] | 2022-07-24 17:14:22.94 +0000 UTC | false |
| ISO9001-Stellantis | [Txid] | ist1 | Audit | Certificate Issued, Certificate Rejected | 1 | [Hash] | 2022-07-24 17:14:19.751 +0000 UTC | false |
| ISO9001-Stellantis | [Txid] | ist1 | Payment Accepted | Audit | none | [Hash] | 2022-07-24 17:14:13.396 +0000 UTC | false |
| ISO9001-Stellantis | [Txid] | Stellantis | Payment | Payment Accepted, Payment Rejected | 1 | [Hash] | 2022-07-24 17:13:50.946 +0000 UTC | false |
| ISO9001-Stellantis | [Txid] | ist1 | Offer | Offer Rejected, Payment | 1 | [Hash] | 2022-07-24 17:13:44.978 +0000 UTC | false |
| ISO9001-Stellantis | [Txid] | Stellantis | Payment | Payment Accepted, Payment Rejected | 1 | [Hash] | 2022-07-24 17:13:41.88 +0000 UTC | false |
| ISO9001-Stellantis | [Txid] | ist1 | Offer | Offer Rejected, Payment | 1 | [Hash] | 2022-07-24 17:13:14.22 +0000 UTC | false |
| ISO9001-Stellantis | [Txid] | Stellantis | Request Offer | Offer, Terminate | 1 | [Hash] | 2022-07-24 17:13:11.222 +0000 UTC | false |
| ISO9001-Stellantis | [Txid] | ist1 | Offer | Offer Rejected, Payment | 1 | [Hash] | 2022-07-24 17:13:08.047 +0000 UTC | false |
| ISO9001-Stellantis | [Txid] | Stellantis | Request Offer | Offer, Terminate | 1 | [Hash] | 2022-07-24 17:12:29.753 +0000 UTC | false |
| null | [Txid] | null | null | null | null | [Hash] | 2022-07-24 17:12:26.133 +0000 UTC | true |
| ISO9001-Stellantis | [Txid] | Stellantis | Request Offer | Offer, Terminate | 1 | [Hash] | 2022-07-24 17:12:22.872 +0000 UTC | false |

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Conclusioni

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Conclusioni



CONCLUSIONI:

- ✓ I risultati riflettono le scelte implementative
 - Necessità di convalidare la logica degli smart contracts e in generale dei processi che governano la blockchain



Grazie per l'attenzione!

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