Enabling Tokenization Options on Hyperledger Fabric

September 8, 2021
Agenda

1. Tokenization Overview
2. Automated Token Chaincode Generation for Fabric
3. Oracle Blockchain Tokenization Customer Examples
4. Tokenization Demo
5. Summary and Q&A
What is Tokenization And Why it Matters for Enterprises?

Tokenizing an asset makes it trackable, increases its utility, supports automation

- Tokens can be self-describing, i.e., they can include the attributes, rights, and obligations pertaining to the asset, as well as the rules that apply to it
- Tokens can leverage blockchain- or DLT-based systems to support multi-party processes built around trusted, tamper-resistant, and tamper-evident data
- Smart contract-based tokens are programmable

Benefits of Asset Tokenization

- Tracking the digital asset or a digital twin of a physical asset across the enterprise, a B2B ecosystem, or B2C
- Control of the operations that digital systems can perform on the asset based on its state, agreed rules, and the actor attempting to make a change
- Transfer of ownership of, or rights to, the asset provably and securely

From a business perspective, tokenization can affect both the bottom line: process efficiencies and other benefits like fraud reduction and the top line: creating an opportunity for complete multi-party process redesign and new business models.
Tokenization Landscape Beyond Crypto

- First Blockchain – Bitcoin – was all about tokens, and only tokens
  - Plenty of crypto-currency chains, some more legitimate than others

- Ethereum pioneered programmable tokens based on smart contracts:
  - ERC-20 for Fungible Tokens (FT)
  - ERC-721 for Non-Fungible Tokens (NFT)
  - ERC-1155 combined FTs & NFTs

- New emerging networks, e.g., Flow, supporting NFT marketplaces
  - Digital art
  - Collectibles

- Enterprise use cases

<table>
<thead>
<tr>
<th>FT</th>
<th>NFT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loyalty programs</td>
<td>Tracking parts, ingredients, products, documents</td>
</tr>
<tr>
<td>Royalty tracking</td>
<td>Inventory finance</td>
</tr>
<tr>
<td>Payments, Funds transfer</td>
<td>IP monetization, rights mgmt, data marketplaces</td>
</tr>
<tr>
<td>Digital currency, Stablecoins, CBDC</td>
<td>ESG investments</td>
</tr>
</tbody>
</table>

- There’s no native token support in Hyperledger Fabric infrastructure
  - But tokens have been built at an application chaincode level by customers and partners, e.g., emulating ERC-20 (FT) or ERC-721 (NFT)
  - Common building block for some applications
Oracle Approach to Tokenization

• Oracle Blockchain Platform based on Hyperledger Fabric
  • Tokenization implementation can be provided as application chaincode, similar to ERC-20/ERC-721 implementations on Fabric
  • Requires some optimizations in core peer transaction validation logic to scale

• Make standardized application chaincode available as a building block
  • Use Blockchain App Builder to generate all necessary chaincode from specification
  • Leverage sample specification based on IWA’s open source Token Taxonomy Framework (TTF) token templates
  • Meta-model that defines base token type (e.g. Fungible), properties (e.g. SKU#), and behaviors (e.g. Transferable, Burnable)
  • Optimize peer logic when validating tokenization transactions

• Initial Oracle implementation released in June provided Fungible Tokens (FTs)
  • To be followed by Non-Fungible Tokens (NFTs)
TTF Model and Classification

- Token Type: Fungible or Non-Fungible.
- Token Unit: Fractional, Whole or Singleton.
- Value Type: Intrinsic or Reference indicates if the token itself is a value, like a crypto currency, or if it references a value elsewhere, like a property title.
- Representation Type: Common or Unique.
- Supply: Fixed, Capped-Variable, Gated or Infinite.
- Template Type: Single or Hybrid, is an indication of any parent/child relationships or dependencies between tokens.

https://github.com/InterWorkAlliance/TokenTaxonomyFramework
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Oracle Blockchain Platform Cloud Service

Comprehensive, production-ready BaaS for enterprise applications

Oracle SaaS

Pre-assembled

Open

Plug and play integrations

Enterprise-grade

Automated DevOps

Oracle Cloud Infrastructure and PaaS Services

Open Source Hyperledger Fabric

Confidentiality (Channels, Collections)

Consensus

REST APIs | SDKs for Go, Java, and Node.js | Enterprise Adapters (OIC)

Smart Contracts (Go, Node.js, Java)

Fine-grained access control

Membership Governance

Distributed Ledger

Oracle Cloud Managed BaaS
Oracle Blockchain Platform | Enterprise Edition

For customers who operate in industries and countries with data sovereignty or data residency requirements that prevent them from deploying on Oracle Cloud

- **Deploy Oracle Blockchain on-premises**
  - Choice of virtualization platforms: VMware, OLVM, Virtual Box
  - Enterprise-grade with HA and Dynamic Scale-up/Scale-out

- **Create Blockchain network with a few clicks**
  - Fully pre-assembled with Hyperledger Fabric 1.4, Blockchain Platform Manager, Operations Console, API/REST Proxy, LDAP/OID/OUD/AD integration

- **Feature parity with Blockchain Cloud**
  - Same APIs & portability of applications

- **Support for hybrid, multi-cloud networks**
  - Oracle Cloud, On-Premise, 3rd party Blockchains using Hyperledger Fabric
Blockchain App Builder | Developer Aids
Expedite chaincode development, testing and deployment

Two User Interfaces
• Easy to use, intuitive GUI delivered as Visual Studio Code Extension for interactive development
• A lightweight Command Line Interface for power users and CI/CD automation

Dev, Test, and Deployment Lifecycle
• Scaffold a chaincode project using a spec file
• Auto deployment of Hyperledger Fabric network
• Support for all chaincode lifecycle operations, such as package, install, instantiate, and upgrade
• Ability to deploy and test locally with line-by-line debugging when using local environment and VSC
• Deployment and test in remote OBP network (OBP Cloud Service or on-prem OBP Enterprise Edition)

Code Generation from Specification
• Chaincode generation in TypeScript (node.js) and Golang using model/controller and decorator patterns
• Automatic generation of CRUD methods, ability to add custom logic, and re-generate on update
Blockchain App Builder for Oracle Blockchain Platform
Automatic Chaincode Generation and Lifecycle Tools for Testing & Deployment

Scaffold Project, Generate Code
Add Custom Method Implementations
Deploy Smart Contract Locally
Test & Debug Smart Contract
Package & Deploy Smart Contract to OBP

Specification File
Smart Contract Project & Code
Smart Contract on Local Fabric
Smart Contract Deployed on OBP

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**Blockchain App Builder | Sample Token Specification File**

- YAML or JSON file that defines the asset types and their behaviors
- Specify new type of asset: **token**
  - Defines type and behaviors:
    - Divisible
    - Mintable (max quantity)
    - Transferable
    - Burnable
  - Role definition for minting security
- Custom properties can be added
- Specify the standard method types to generate
- Define any custom chaincode functions with API signature

```yaml
assets:
  - name: MyRedCoin
    type: token

anatomy:
  type: fungible
  unit: fractional

behaviour:
  - divisible:
    - decimal: 2
  - mintable:
    - max_mint_quantity: 1000
  - transferable
  - burnable
  - roles:
    minter_role_name: minter

properties:
  - name: currency_name
    type: string
  - name: token_to_currency_ratio
    type: number

customMethods:
  - executeQuery
```
Generated Tokenization Framework

**Token SDK**
- Supports Token Taxonomy Framework standard behaviours like divisible, mintable, transferable, burnable, roles and holdable
- Supports account based system
- Can be readily used in any custom functions

**Token Wrapper Functions**
- Supports 30+ out-of-the-box wrapper functions for token lifecycle implementation
- Capability to pass organization id and user id as function parameters
- Functions can be customized
- Embedded function-level security

**Built-in Security**
- Role-based security on token initialization and account creation
- Token roles support: Minter, burner & notary (escrow)
- Auto-identification of the caller in the function
## Supported Token Behaviors and SDK Functions

<table>
<thead>
<tr>
<th>#</th>
<th>Behavior</th>
<th>Property Example</th>
<th>Function (Standard Functions defined by TTF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Divisible</td>
<td>Decimal = 2 (always &gt;0 )</td>
<td>• GetDecimals()</td>
</tr>
</tbody>
</table>
| 2  | Roles    | Minter           | • Rolecheck (Account_ID)  
• GetRoleMembers ()  
• AddRoleMember (Role_Name, Account_ID)  
• RemoveRoleMember (Role_Name, Account_ID)  
• IsInRole (Role_Name, Account_ID) |
| 3  | Mintable  |                  | • Mint (Quantity) |
| 4  | Transferable |              | • Transfer (To, Quantity) |
| 5  | Holdable  |                  | • Hold (OperationID, To, Notary, Quantity, TimeToExpiration)  
• ExecuteHold (OperationID, Quantity)  
• ReleaseHold (OperationID) |
| 6  | Burnable  |                  | • Burn (Quantity) |
Token Lifecycle Management and Controller Functions

**Initialize Tokens**
- Initialize Tokens
- Update Token
- Add Admin
- Remove Admin
- Get Tokens By Name
- Get Token By Id
- Get Token Decimals
- Get All Tokens

**Manage Accounts**
- Create Account
- Get All Accounts
- GetUserByAccountId
- Get Account
- Get Account History
- Get Account Transaction History
- Get Account Balance
- Get Account On Hold Balance
- GetUserByAccountId

**Add Roles**
- Add Role
- Remove Role
- Get All Admins
- Get Accounts By Role
- Is In Role

**Minting**
- Issue Tokens
- Get Total Minted Tokens
- Get Net Tokens

**Transfer**
- Transfer Tokens
- Bulk Transfer Tokens

**Escrow**
- Hold Tokens
- Execute Hold Tokens
- Release Hold Tokens
- Get On Hold IDs
- Get On Hold Details With Operation ID
- Get On Hold Balance With Operation ID

**Burn**
- Burn Tokens

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Using Generated Tokenization Methods and APIs in Applications

<table>
<thead>
<tr>
<th>Initialize Tokens</th>
<th>Create Accounts</th>
<th>Add Role</th>
<th>Mint Tokens</th>
<th>Transfer Tokens</th>
<th>Hold Tokens</th>
<th>Burn Tokens</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Initialize Token</strong></td>
<td><strong>Create Accounts</strong></td>
<td><strong>Add Role</strong></td>
<td><strong>Mint Tokens</strong></td>
<td><strong>Transfer Tokens</strong></td>
<td><strong>Hold Tokens</strong></td>
<td><strong>Burn Tokens</strong></td>
</tr>
<tr>
<td>Capability to create multiple token IDs (e.g. VTOK-Euro, VTOK-USD etc.)</td>
<td>Create accounts based on Token ID, Org ID and User ID</td>
<td>Assign minter / burner / notary roles to various accounts</td>
<td>Mints fungible tokens with validations</td>
<td>Transfers fungible tokens with validations</td>
<td>Hold and ExecuteHold / ReleaseHold</td>
<td>Eliminates fungible tokens with validations</td>
</tr>
</tbody>
</table>
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### Customer & Partner Momentum

#### Tokenization Use Cases

<table>
<thead>
<tr>
<th>Rewards Programs (Fungible Tokens)</th>
<th>Digital Currency or Twins Representing Other Assets</th>
<th>Non-Fungible Tokens</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loyalty Programs &amp; Coins</td>
<td>Retail &amp; Wholesale Central Bank Digital Currency (CBDC)</td>
<td>NFT Marketplaces – IP Rights, Personalized Media</td>
</tr>
<tr>
<td>Agri supply chain sustainability tracking with Rewards for participation</td>
<td>Certified Supply Chain Tracking and Royalty Accruals for Patented Fabrics</td>
<td>Environmental, Social, and Governance (ESG) Auditability and Investing</td>
</tr>
<tr>
<td>CNC Factory Machines Data Collection w/Rewards for Predictive Maintenance</td>
<td>Insurance back-office payments accounting</td>
<td>Inventory Financing on Digital Exchanges</td>
</tr>
<tr>
<td></td>
<td>Freight Transportation Management Services</td>
<td></td>
</tr>
</tbody>
</table>
Decathlon loyalty program in Eastern Europe
A network that united the world of sports—enthusiasts, clubs, teams, and events—on one platform
Customers can earn tokens—called “medals” by shopping in any of the Decathlon stores in the region, and seamlessly redeem the rewards at one of the partners on the blockchain network.
Customers can track all their transactions in real time in a virtual wallet.
Encouraging Farmers’ Participation in Sustainable Ag Project

1. Registration
   - Participant Registration
   - GPS coordinate tracking
   - Static data updates

2. Farm to Mill Provenance
   - FFB tagging at farm
   - Dynamic data capture
   - Online and offline capability
   - Tracking from farm to Mill and beyond
   - Quality data capture
   - Anonymous farmer provision

3. Incentive Program
   - Incentive program to encourage digitize
   - Digital wallet to distribute funds
   - Accrual of digital wallet point for preferred practices
   - Farmer/Agent information system

4. Observe & Report
   - Ability to generate reports on Farmer behavior
   - Analyze Impact of Incentive programs
   - Analyze quality impact of trainings
   - Reporting of provenance

Solution Tenents
- Multi channel data capture (online and offline)
- REST based mobile connections enabling ease of integration
- All actors as registered organizations to enable visibility
- End-to-End cloud implementation to enable rapid organic growth
- Rewards program funded by oil mills to encourage reporting
Product Content and Royalties Tracking for Certified Manufacturing Ecosystem

Key Requirements in Certified Manufacturing for Performance Garments

- Validate the integrity of transactions and shipments across the supply chain.
- Enable multi-tier supply chain visibility of inventories and shipments using a distributed ledger for single source of truth.
- Track royalty earned from partner shipments, handle discrepancies with auditable dispute records, and reconcile royalty payments.

Functional Capabilities

- Tokenization of products and their ingredients to allow IP owner and supply chain partners to:
  - Track inventory and shipments of raw materials
  - Track intermediate and final products
  - Calculate the royalties accrued based on shipments
- “Track and Trace” interface enables tracking
  - Inventory of materials and products made and transferred among the partners
  - Timeline and product composition views
  - Shipments, disputes, and payments
- Smart contract calculates IP owner’s royalty earned from shipments and accrues it in partner accounts
- On-chain data synchronized to ADW is used in OAC visualizations of txn. history, inventory, shipments, royalties, company relationships, and product composition across the supply chain
Supermoney’s Securus Insurance Back-office Payments & Reconciliation on OBP

Key Issues in Insurance Accounts Reconciliation

- Discrepancies between accounting and settlement systems
- Significant effort and cost of manual reconciliation between insurers and insurance brokers across financial accounts
- Risk of human errors and fraud impacting regulatory compliance, re-insurance accounting and profitability when retrospectively reconciling book values with settlement values

Solution: Tokenization-based insurance back-office system with accounts reconciliation

- Multi-organization, multi-user permissioned-access platform for MGAs, Brokers and Underwriters
- Web interface user portal
  - Data upload by flat file or API integration
  - Bordereaux screen showing all lines of cover - live, lapsed, adjusted and cancelled
  - Filtration and sorting by cover metadata
  - Facility to add line(s) of cover to a single payment basket
- Generation of unique reference for bank payments
- Facility to acknowledge receipt of funds
- Real-time updates and reporting
- Partner contracts – commission rates, etc.
- Policy documentation issuance
Central Bank Digital Currency

- CB maintains the core ledger, sharded for scalability, distributed for resilience and tamper-proofing. It is the only entity capable of issuing CBDC.

- CBDC facilitates the separation of the 'value store' function provided by bank deposits from 'transmission' function.

- A new class of regulated entity, Transaction and Custody Institutions (TCIs) will service the public.

- TCIs maintain and services user accounts
  - They can’t lend money
  - They don’t pool deposits
  - They can’t monetize transactions

- TCIs can offer value-add overlay services, e.g., programmable money:
  - Conditional payments
  - Time-based payments
  - Exchange to/from fiat currency

- Contextual privacy – Trustees/Validators run MPC key escrow services to allow accountable de-anonymization of transactions for AML/CFT, sanctions enforcement, law enforcement investigations
NFT & Coin Use Cases

1. Live-event streaming and fan community platform.

It enables headline artists and site members (producers and event-subscribing creatives and fans) to co-create and experience interactive, live-streamed events.

2. Personalized video made up of fan and pro content

Including exclusive blockchain NFT registered video assets that are used to generate revenue for rights holders (concert performers, sports teams and leagues).

3. News media with massive content archives – iconic photos, stories, videos

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Demo Example: Airline Loyalty Program

Customer Journey

- Purchased flight ticket, Airline company rewarded 500 LoyalTOK tokens
- Rented a car with 300 LoyalTok tokens
- Exchanged 200 LoyalTOK tokens with Ethereum ERC20Coins
- Burn tokens to cash out

Tokens Transacted

- 500 LoyalTOK
- 300 LoyalTOK
- 200 LoyalTOK
- 60 ERC20Coin

Consumer Account Balance

- 500 LoyalTOK
- 200 LoyalTOK
- 0 LoyalTOK
- 60 ERC20Coin
Demo Example: Airline Loyalty Program – Use Case Flow

**Persona**

- **Admin of the Airline Company**
  - Utopian Airlines

- **Accounts Manager of Airline Company**
  - Utopian Airlines

- **Flight Traveler**
  - Michael Greg

- **Car Rental Company**
  - Fast Travels

**User ID**

- **admin**

- **AirlineManager**

- **CarRentalManager**

**Actions**

1. **Token Initialization**
2. **Account Creation for Merchants & Consumers**
3. **Add Roles (Minter)**
4. **List Partner/Consumer Accounts**
5. **Issue Tokens**
6. **Transfer Tokens**
7. **List Transaction History**
   - Rewards to consumer Michael Greg
8. **Transfer Tokens**
9. **List Transaction History**
   - Redeems for Car Rental with Fast Travels
10. **Burn Tokens to Cash Out**
11. **List Transaction History**
12. **Exchange LoyalTOK with Ethereum ERC20Coin**
   - Redeems Loyalty Tokens with Utopian Airline

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Hash Time-Locked Atomic Swap Procedure

1. Generate Secret
2. Lock Fiat Money Token
3. Send Hash
4. Lock ERC20
5. Claim ERC20 Coin
6. Retrieve the Secret
7. Claim OBP Tokens

Flight Traveler (Michael Greg)
Oracle Blockchain
Ethereum
AirlineManager Utopian Airlines

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Cross-Ledger Interoperability Leveraging Quant Networks

- OverLedger solution from Quant Networks available for OBP and deployed in Oracle Cloud
  - Middleware that enables interop across OBP, Corda, Quorum, Ethereum, Ripple, Bitcoin, Stellar, IOTA, EOS.

- Sample scenarios:
  - Cross DLT Asset Ownership Swap with cancellation and rollbacks
  - Dual DLT Logging (e.g., confirming Fabric txn’s on public blockchain)
  - More complex orchestrations (e.g., PO/Invoice matching on one DLT and issuing payment on a different DLT, with settlement confirmation to the original DLT)
Demo Components (Part I)
Demo Components (Part II)

Let’s Go to the Live Demo
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Summary

- Tokenization projects on permissioned blockchains are often hindered by lack of native tokens and complex development requirements or dearth of skilled chaincode developers

- Blockchain App Builder helps in three ways:
  - Improves developer productivity
  - Enables low-code approach to simple applications
  - Provides TTF fungible tokens chaincode on Hyperledger Fabric

- Oracle makes enterprise blockchain easy and quick with
  - Pre-assembled, managed BaaS infrastructure with built-in API gateway, identity management, operations console, etc.
  - Rapid development of blockchain applications using Blockchain App Builder
  - Built-in Tokenization SDK & APIs adaptable through declarative specifications
  - Optimizations in Fabric nodes for tokenization use cases
Oracle Blockchain Blog: blogs.oracle.com/blockchain

App Builder Video: https://www.youtube.com/watch?v=nO0AniQCzVg


Try OBP in Oracle Cloud Free Tier
https://www.oracle.com/blockchain/cloud-platform/

Once OBP Cloud instance has been provisioned, bring up the Console and navigate to Developer Tools tab to download the Blockchain App Builder for Oracle Blockchain Platform

Download OBP Enterprise

Videos: Demos & Customer Stories
- Youtube: Oracle blockchain channel
- Otube: https://video.oracle.com/search?q=blockchain%20platform

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Thank You!

Q & A

Oracle