ORACLE

Web3 Technologies Enabling New Enterprise & Government Solutions

September, 2023

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Oracle

Agenda

1. Key Web3 building blocks and why they matter
2. Oracle Blockchain Platform/Extending Hyperledger Fabric
3. Portable digital assets (a.k.a., tokenization)
4. Decentralized identity/verified credentials
5. Summary, Q & A, and additional materials

Bruno Faviero @Bfaviero · 10h
Replying to @sonofalli
Ownership.
1 39

ownership
1 16

Blueprint DeFi @Blueprint4Defi · 10h
Replying to @sonofalli
Decentralized
5

Mickey (Cephalopod#8465) @cephalopod_8 · 10h
Replying to @sonofalli
community

or identity
1 10

Codi @codi_si · 4h
Replying to @sonofalli
Self-sovereignty

Particularly over identity and personal data. Also worth noting most of that data won't live on-chain (since a lot of people seem to equate web3 strictly with blockchain or cryptocurrencies).
1 4

0xLux.eth @0xLux · 8h
Replying to @sonofalli
exit-liquidity
1 21

Grit Agricole @GritGrowthCap · 6h
Replying to @sonofalli
Grift
1 21

Brotoshi @realbrotoshi · 4h
Replying to @sonofalli
Rug
2 16

Tao @taodejing2 · 2h
Replying to @sonofalli
Delusion
17

alli
@sonofalli

describe web3 in 1 word

12:54 AM · Apr 14, 2022 · Twitter for iPhone

Hello @itsastatue · 3h
Replying to @sonofalli
Transactional. The one thing that bothers me the most with web3 is it turns every transaction into a financial transaction. I think it ends up dividing us from having deeper relationships
1 2

Influences and Outcomes

Decentralization
Dis-intermediation

Next-generation of P2P, B2C, B2B, and G2P, G2B Interactions

Enables and leverages a complex set of services and on-demand capabilities, such as digital identities, wallets, smart contracts, off-chain and edge computing

Powered by blockchain and artificial intelligence tools

+

Amplified by virtual, augmented and extended reality

Portable Digital Assets

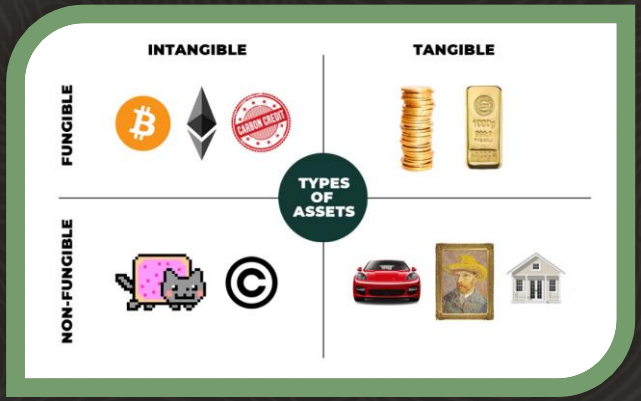
Decentralized Identities

Decentralized Storage

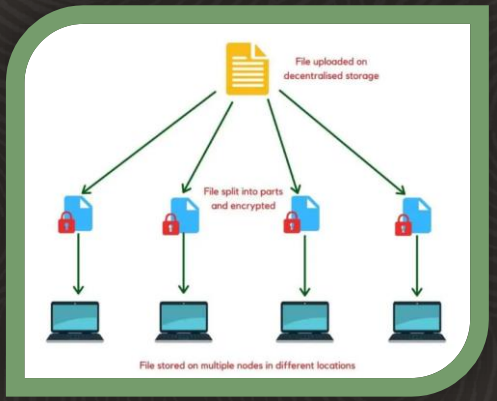
Decentralized Governance

Enabling Technologies

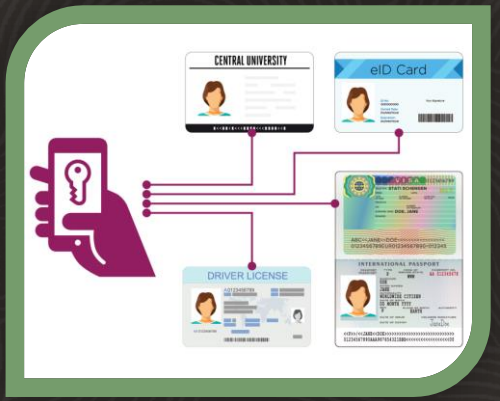
Key Web3 Building Block Technologies…



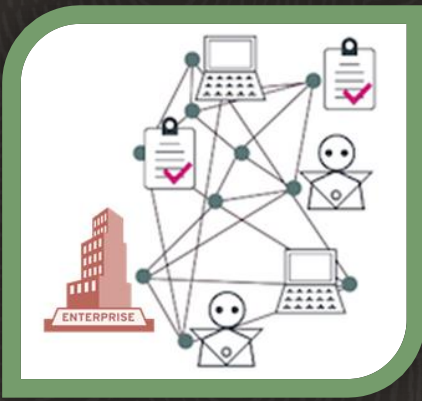
Portable digital assets



Decentralized data storage



Decentralized Identity

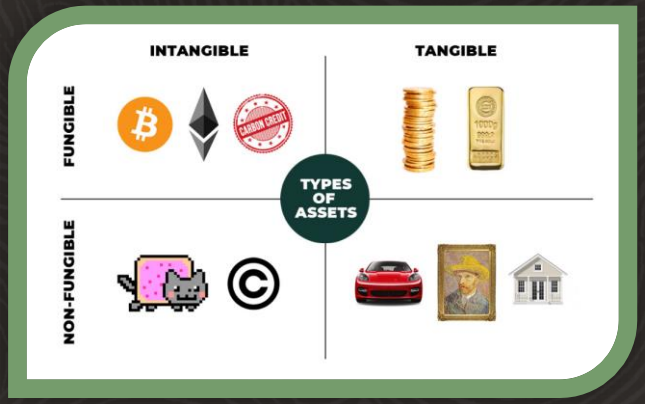


Decentralized Governance

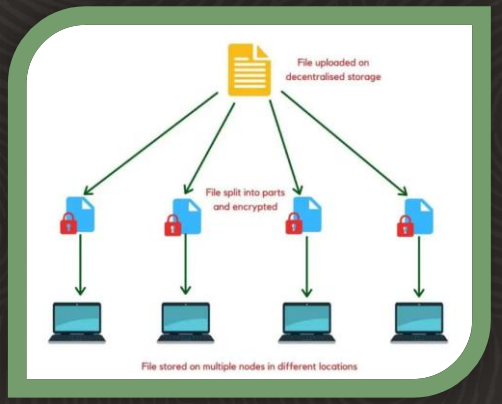
RELEVANT TECHNOLOGIES or STANDARDS

ERC-20, ERC-721, ERC-1155, … Token Taxonomy Framework	IPFS, 0Chain, …	DID, DID Document, W3C Verified Credentials	Consensus mechanisms, DAOs (programmable)

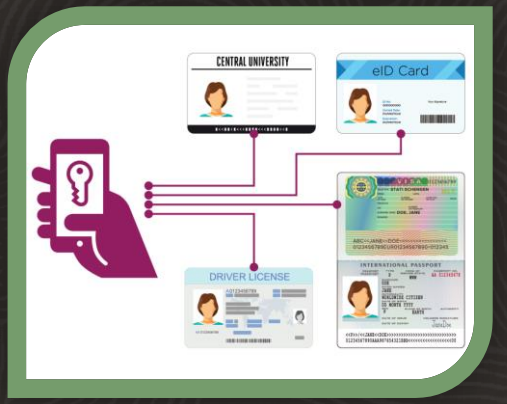
… and Why They Matter



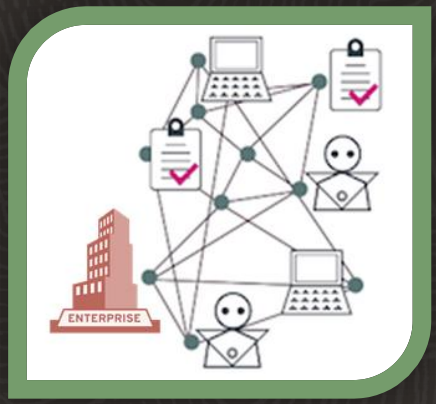
Portable digital assets



Decentralized data storage



Decentralized Identity



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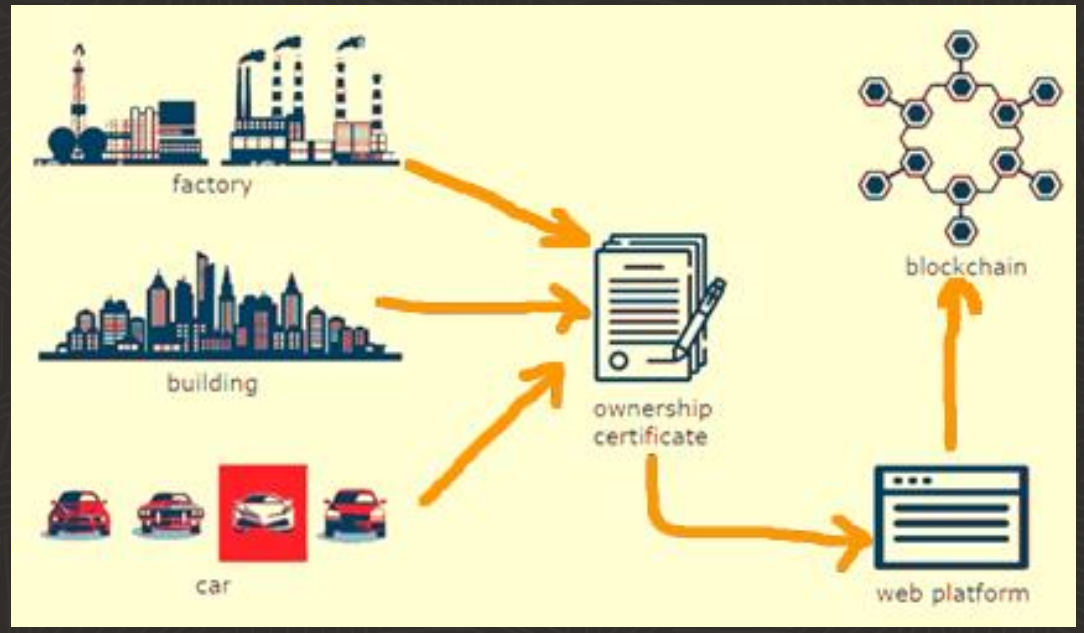
BENEFITS

• Financial transactions without intermediaries • Protects IP ownership • Traceable history of lifecycle transactions (mint/issue, transfer, burn/terminate)	• No censorship • Privacy compliance • Transparent sharing	• User control & greater privacy • Granular claims • Trusted interactions • Reduced credentials and document fraud	• Enables collaboration with diverse stakeholders • Automation & speed via smart contracts • Transparent & auditable decision making

Benefits of Asset Tokenization in Enterprise

- Transfer ownership of, or usage rights to the asset
- Provably and securely verify ownership history without intermediaries
- Allow fractional ownership of an asset to increase liquidity and enable greater participation
- Tracking the digital asset or a digital twin of a physical asset across the enterprise, B2B transactions, or B2C engagements
- Control operations that digital systems can perform on the asset based on its state, agreed rules, and the actor attempting to make a change



Tokens representing a pre-existing real asset

- Exist and trade both *"on-chain"* and *"off-chain"*
- Types of assets
  - **Financial assets**: any conventional security transferred on DLT
  - Non-financial assets (e.g. real estate, art)
  - Commodities (e.g. gold)
  - In Theory: everything
- Backed by real assets existing outside the ledger

❖ ***Tokenised vs. Securitised (ABS)***

Tokens "native" to the blockchain

- Exist and trade *"on-chain"* (1)
- **Financial assets**: issued on DLTs
  - Debt securities (easier as bearer instruments)
  - Equity securities
  - STOs marketed as "regulatory compliant" successor of ICOs, depending on the specific issuance? (2)
- Defined by their existence on the ledger
  - Independent of conventional part of the markets

❖ ***Tokenised vs. Dematerialised***

OECD (2020), The Tokenisation of Assets and Potential Implications for Financial Markets, OECD Blockchain Policy Series, www.oecd.org/finance/The-Tokenisation-of-Assets-and-PotentialImplications-for-Financial-Markets.htm

Tokenization Moving Beyond Crypto and DeFi

First Blockchain – Bitcoin – was all about tokens, and only tokens

- Plenty of crypto-currency chains, some more legitimate than others

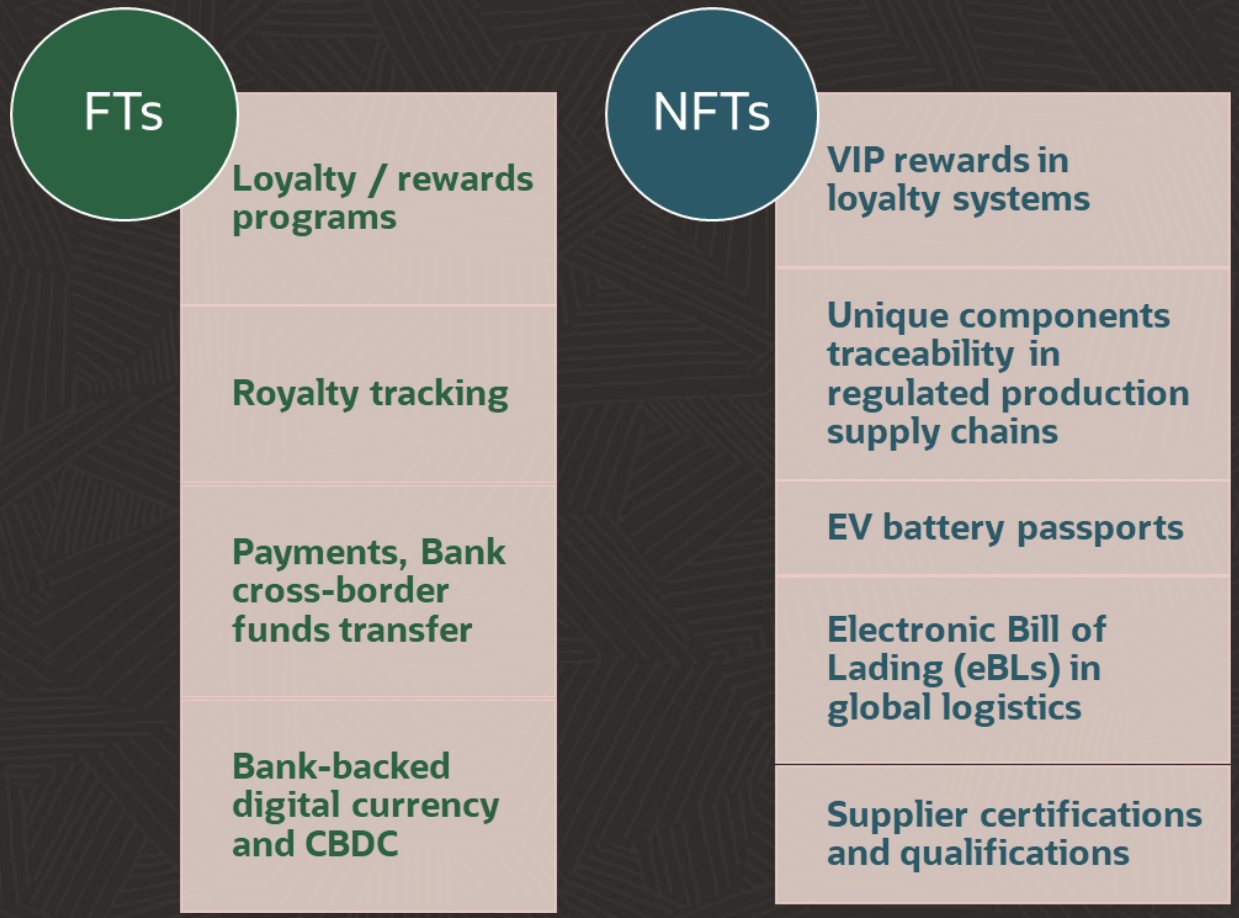
Ethereum pioneered programmable tokens based on smart contracts:

- ERC-20 for Fungible Tokens (FT)
- ERC-721 for Non-Fungible Tokens (NFT)
- ERC-1155 combined FTs & NFTs
- ERC-1400 for standard tokenisation of securities

New emerging networks, e.g., Flow, supporting NFT marketplaces

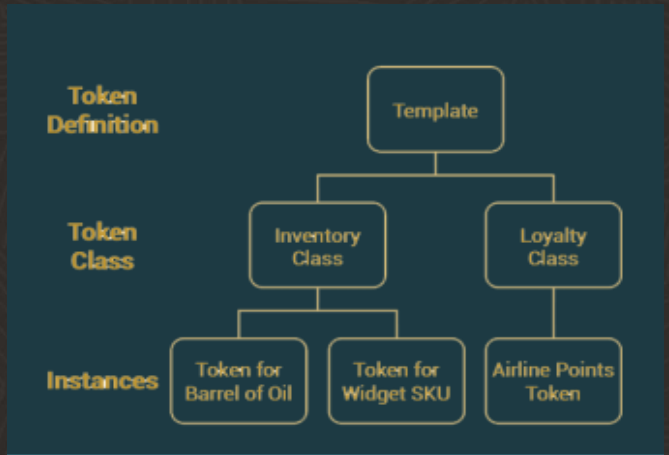
- Digital art, Collectibles, Fan club memberships

Emerging Enterprise Tokenization Use Cases



Oracle's Approach to Tokenization on Hyperledger Fabric

- 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)
- Making standardized tokenization chaincode available as building blocks
  - Use low-code Blockchain App Builder to generate all necessary chaincode from a specification
  - Leverages a standard based on IWA's open source Token Taxonomy Framework (TTF) token templates
    - Meta-model that defines base token type (e.g. Fungible, Non-Fungible), properties (Whole, Fractional), behaviors (e.g. Transferable, Burnable), and custom properties relevant to the asset
    - Provided Fungible Tokens (FTs) as specification template with automated lifecycle chaincode generation in Blockchain App Builder
    - Optimized Hyperledger Fabric peer logic for validating tokenization transactions to avoid MVCC conflicts
  - Extended with support for Non-Fungible Tokens (NFTs)
    - ERC-721 (Whole Non-Fungible)
    - ERC-1155 (Non-Fungible & Fungible, Whole & Fractional)



Token classification hierarchy used in Token Taxonomy Framework

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Enterprise Systems and Front-end Apps

Integration

Adapters

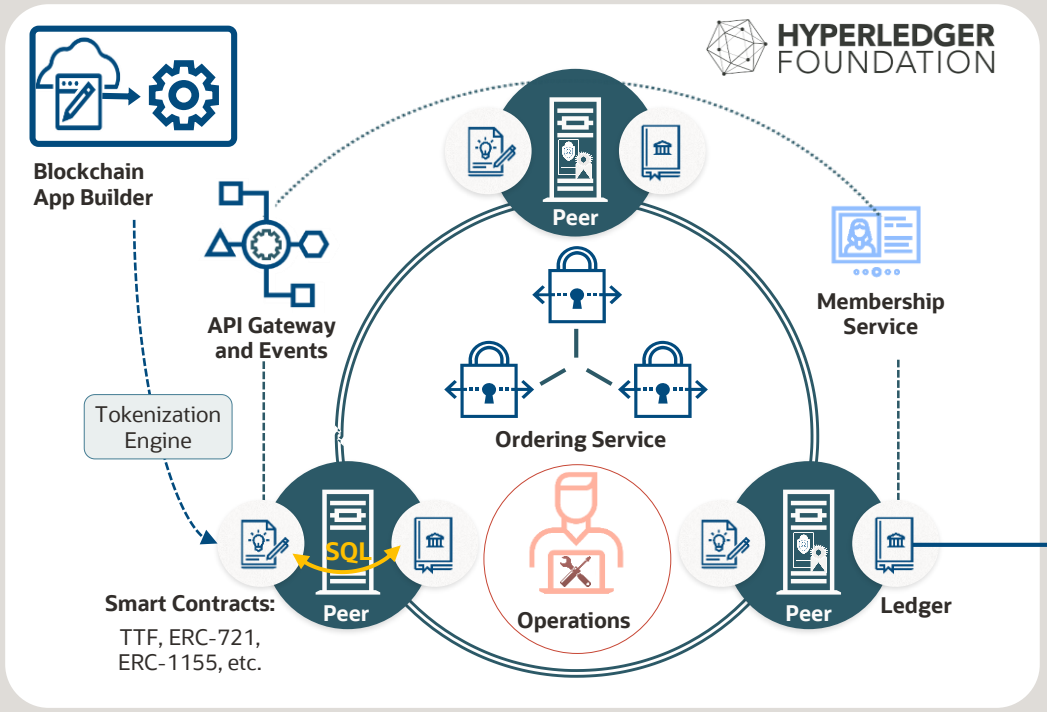
REST APIs

Reliable Events

Hyperledger

Client SDKs

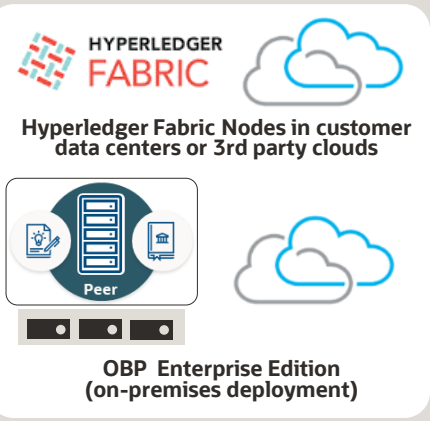
OCI Blockchain Platform



1. Oracle Cloud ERP/CRM/HCM/CX
2. 3rd Party SaaS & Custom Apps
3. On-Premises Oracle and 3rd Party Apps
4. Custom Web and Mobile Apps

1. Hyperledger Fabric Peer Nodes, Ordering Service Nodes, Membership Service
2. Oracle REST API Gateway, reliable event services, Oracle operations console, and state database (embedded Key/Value store using Berkeley DB)
3. Pre-assembled container management, high availability, dynamic scaling, identity management, ops. management, zero-downtime patching/upgrades
4. Enhance confidentiality and auditability: fine-grained access control in chaincodes via on-chain ACLs, on-chain configuration audit log, block integrity verification

Other Nodes



Off-Chain Storage and Live Analytics

1. Rich history DB connection streams blockchain transaction history to Oracle Database, optionally into Blockchain Tables
2. Live analytics for dashboards, data visualizations, AI/ML

https://www.oracle.com/blockchain/

OBP Innovation History

Infrastructure

- Built-in HA provisioning and dynamic scaling
- IdM integration with federation, role-based
- Managed operations, patching, updates
- Indexing DB (queries, live analytics, etc.)
- BDB State DB with SQL Select for rich queries in chaincodes
- On-chain fine-grained ACLs for chaincodes
- Block integrity verification with REST API

Integrated API Gateway

- Discovery and txn orchestration across fabric-ca, peers, and orderers in multi-instance/multi-cloud networks
- REST APIs for synchronous & asynchronous transaction invocation
- Events subscription and reliable callback delivery with REST API
- 2PC atomic transaction coordination with REST API and XA RM for external transaction managers
- Ethereum interop (Ethereum, Polygon, BESU, other EVMs) with atomic transactions using 2PC+LRC

OBP Enterprise Edition

- On-Prem/3rd party Cloud
- Blockchain Platform Mgr (CP)
- IdM integration with external LDAP/MS AD

Operations Management

- Web Admin/Configuration, Org onboarding, channel/ledger browser, chaincode wizard
- Monitoring Dashboards
- State DB querying
- On-chain audit trail using ledger transactions for all config operations
- Web UI + rich set of DevOps & stats APIs
- Dev tools portal

Blockchain App Builder

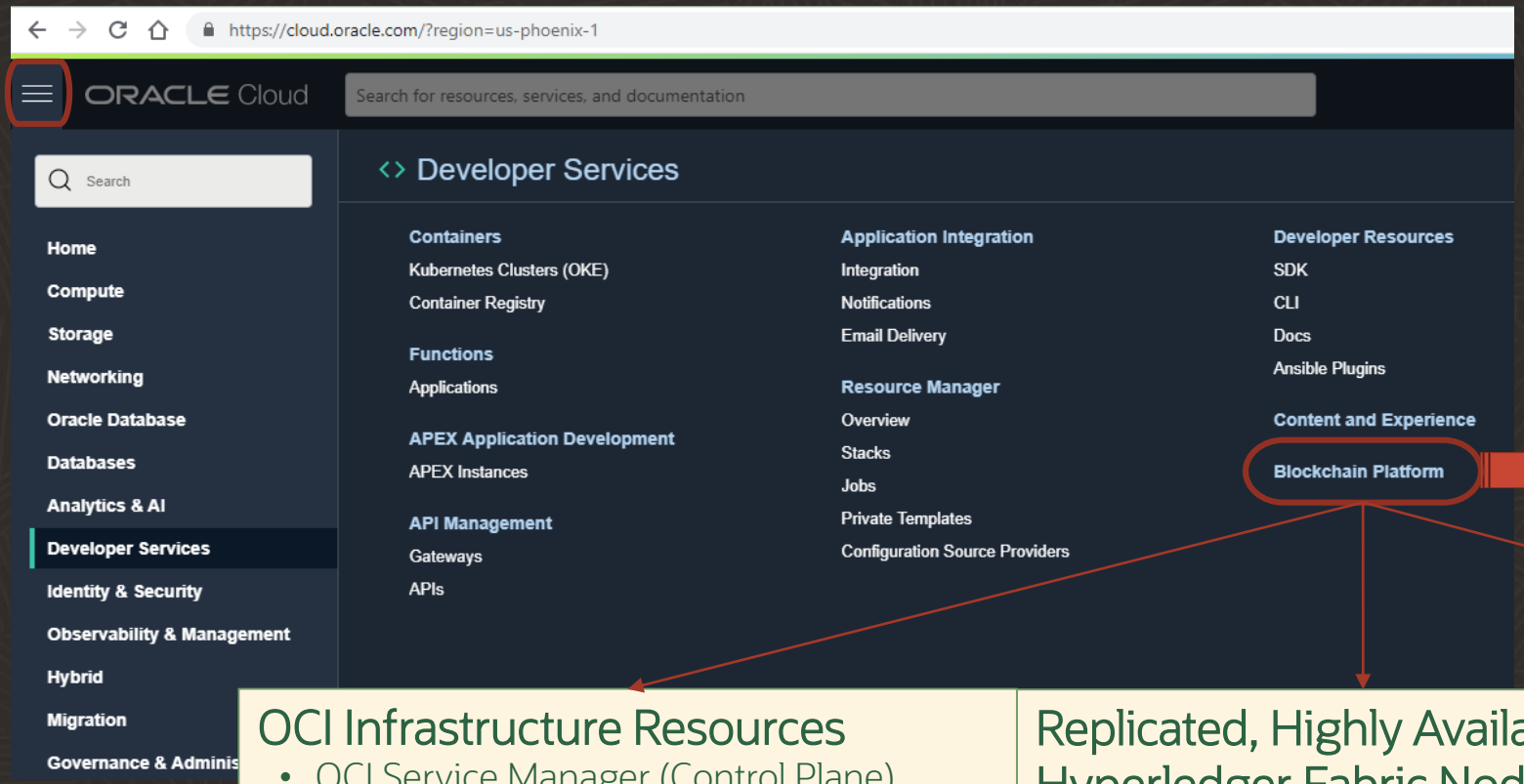
- Integrated Dev/Build/Deploy/Test environment: GUI & CLI
- Low-code: Template based auto-generation of scaffolding and chaincodes
- Local and remote deployment options
- Tailorable specification templates for variety of generic and specialized use cases
- Role-based and function-based security models in the generated chaincode

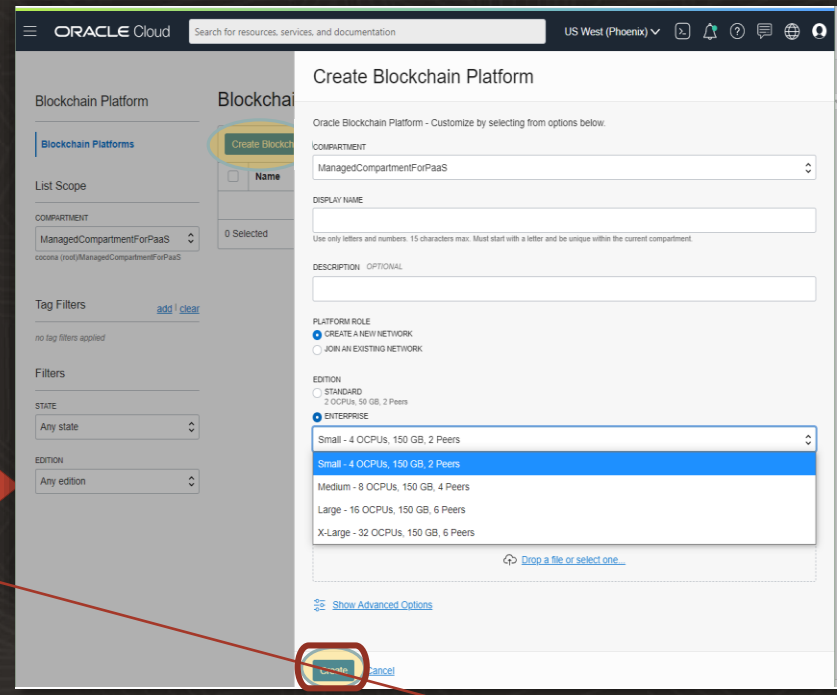
Tokenization/Digital Assets

- FT & NFT smart contracts & REST APIs based on TTF, ERC-721, and ERC-1155
- Liquidity (exchange) pools for FT chaincodes to support multi-currency use cases
- CBDC sandbox infrastructure, tokenization engine, Interbank CBDC web app & APIs

Simple Provisioning of Blockchain Cloud Platform Instance

Everything you need to get going in a managed service





OCI Infrastructure Resources

- OCI Service Manager (Control Plane)
- Manager VMs (range of shapes)
- Block storage
- Load balancer service (LBR)
- Web tier security service (WTSS)
- Metadata repository for config. data
- Oracle Secrets for private keys

Replicated, Highly Available Hyperledger Fabric Nodes

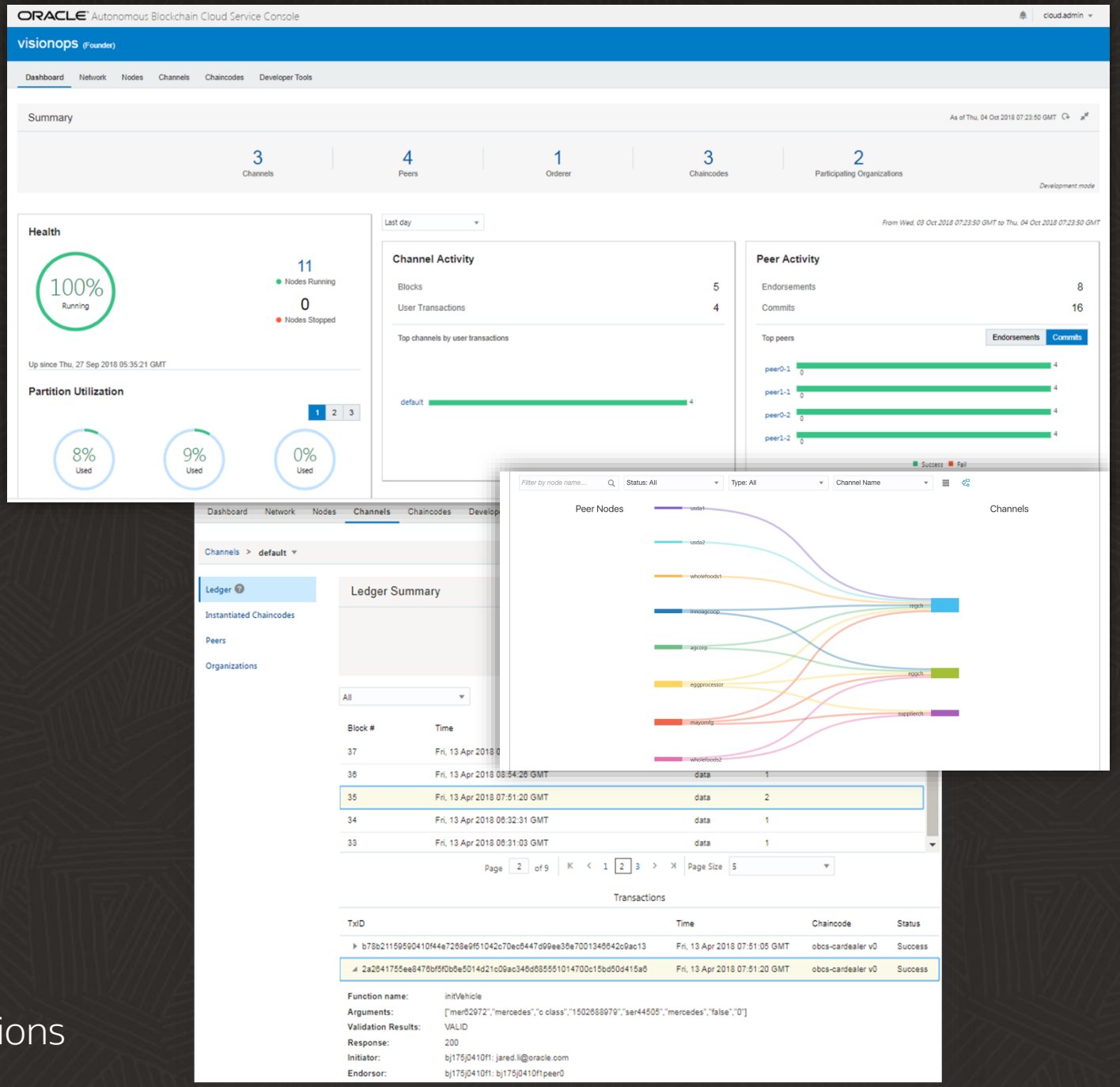
- Peer nodes (up to 16 per instance)
- Ordering nodes with unrestricted channels
- Membership service (fabric-ca)
- Chaincode build & runtime containers

Oracle add-on components

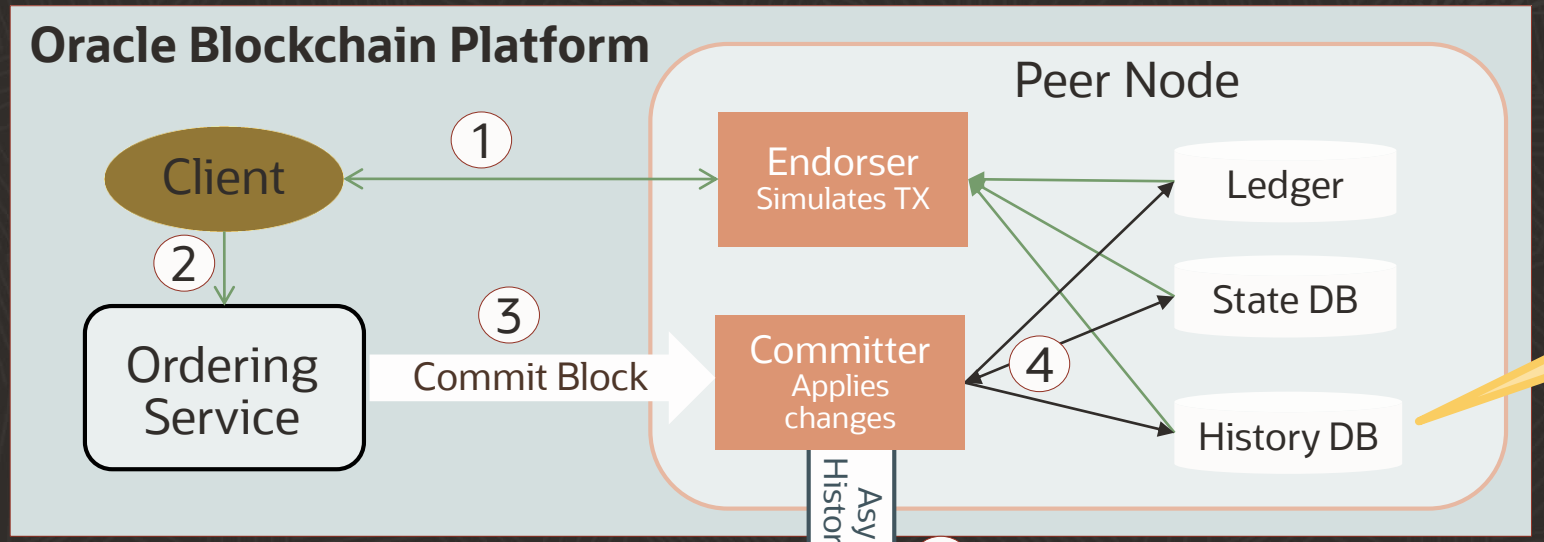
- Administration/Operations Console: Web UI & APIs
- API GW w/REST Proxies & Events
- Integration with IDCS Identity mgmt.
- Dynamic scale-up/scale-out wizard
- Management service (Oracle Ops)

Unified OBP Admin Console: Cloud and On-Premises

- Admin/Config tasks
  - Bring up/down blockchain network and manage nodes (peers, orderers, CA)
  - Configure network channels and members
  - Add nodes (peers), VMs, etc.
  - Edit channel policies & ACLs
  - Query State DB
- Smart contracts LCM
  - Blockchain App Builder
  - Deploy/Instantiate/Expose/Upgrade
  - Set endorsement policies
  - Define private data collections
  - Map transient data
- Monitoring & troubleshooting
  - View network topology
  - Monitor status of peers, orderers and other network components
  - Monitor operations metrics
  - View ledgers blocks & drill down to transactions



Indexing Database/Off-Chain Synchronization to Oracle DB



The Rich History DB is updated with details about each transaction in the block. All details become readily available for analysis in the external repository.

Rich History can be enabled/disabled on individual channels and can be configured to use a different external repository by different peer nodes and/or organizations.

Analytics based on Blockchain transaction rich history and state of the world

Visualizations/Dashboards/KPIs/Reports

Solving Transaction Atomicity in Complex Applications

Updating data across multiple channels

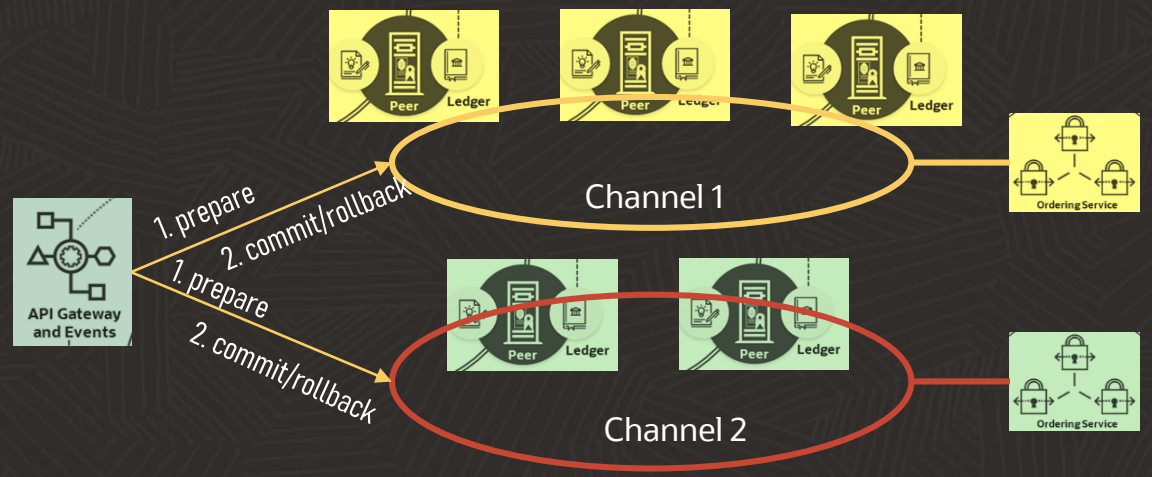
- 2 Phase Commit implemented in Peer nodes with orchestration in API Gwy
  - E.g., trading marbles on channel *goods* and paying for them on channel *wallet*
- Single REST API call specifies an array of transactions across multiple channels

```
{
 "transactions": [
  {"chaincode":"obcs-marbles","args":["transferMarble", "marble1", "smith"],"timeout":0, "channel":"goods"},
  {"chaincode":"obcs-example02","args":["pay", "smith", "garcia", "50"],"timeout":0, "channel":"wallet"} ],
}
```

- Examples:
  - Submit service request on one channel and pay for it on another channel
  - Coordinate updates between two separate ledgers atomically

Under the covers

1. Prepare a transaction for commit: Stage the changes and possibly lock K/V pairs until the transaction is actually committed or rolled back
2. Commit a previously prepared transaction: Apply the changes previously staged and release the associated locks (if any)
3. Rollback a previously prepared transaction: Abandon the previously staged changes and release the associated locks (if any)



How does blockchain benefit my industry?

Example customer use cases

Read the eBook (pdf)

https://bit.ly/oracle_blockchain_ebook

Banking and Financial Services

- Accelerating cross-border funds transfer
- e-KYC for rapid customer on-boarding
- Intercompany financial reconciliation
- Secure real-time AML/CFT Watch/Sanctions list updates
- Asset tokenization in wealth management securities services
- Mutual funds-to-Brokerage window transfers
- Automated parametric insurance issuance and claims processing
- Insurance Back-office Payments and Reconciliation

Food, agriculture, and CPG

- Authenticity of protected origin or geographical indication products
- Farm product pricing using smart contracts & provenance traceability
- FDA Food Safety Modernization Act (FSMA) traceability
- Tracking cattle genomics and CO2 emissions
- Trusted value chain for CPG product sustainability and provenance certification

Retail

- Authenticated provenance for luxury goods
- Ethical and verified sourcing for fashion products
- Real-time retail rewards linked across ecosystem
- Franchise ecosystem invoicing & inventory tracking
- Traceable sourcing of recycled plastics used in making consumer and industrial goods.

Manufacturing and Logistics

- Product content and royalties tracking for certified manufacturing ecosystem
- Sustainable and ethical sourcing of critical and conflict minerals
- Intercompany billing and reconciliation
- B2B platform for inventory visibility, SLA enforcement, geo-origin and authenticity
- Optimizing overall equipment effectiveness and predictive maintenance
- Maritime shipping logistics and documentation
- Export/Import Secure Logistics Document Exchange

Healthcare and Life Sciences

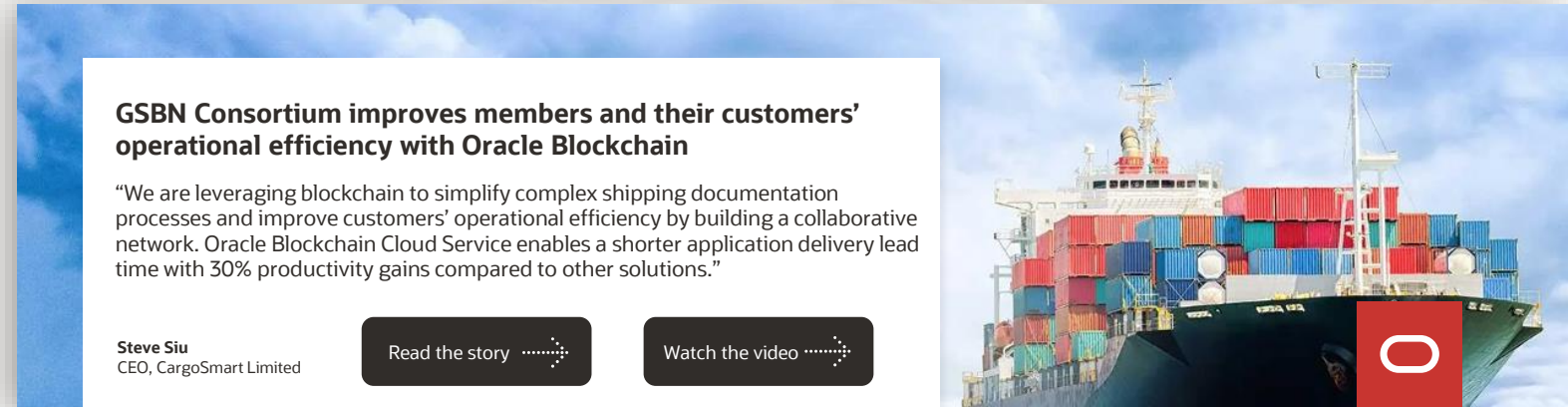
- Immutable and verifiable rapid testing results sharing for public health agencies
- Remote tracking of patient vitals for distributed healthcare team
- Electronic Health Records (EHR) sharing
- Anti-fraud tracking in pharmaceuticals distribution
- Pharmacological supplies traceability in clinical studies
- Verifiable immunity and test status certification

Government and Public Services

- Export license issuance and excise tax tracking
- Forensic evidence verifiable chain of custody across agencies
- Immigration document and visa tracking
- Verifiable country-of-origin and other trade certifications
- Verifiable lottery tickets and winnings redemption ledger
- Multi-tiered grants distribution and tracking
- Local decision-making and voting by citizens residing abroad

Education and Training

- Smart education credentials in Higher Ed & Continuous Education
- Transcript sharing and transfer credit & articulation
- Study abroad matching and certifications
- Employment training certification



GSBN Consortium improves members and their customers' operational efficiency with Oracle Blockchain

"We are leveraging blockchain to simplify complex shipping documentation processes and improve customers' operational efficiency by building a collaborative network. Oracle Blockchain Cloud Service enables a shorter application delivery lead time with 30% productivity gains compared to other solutions."

Steve Siu
CEO, CargoSmart Limited

Read the story

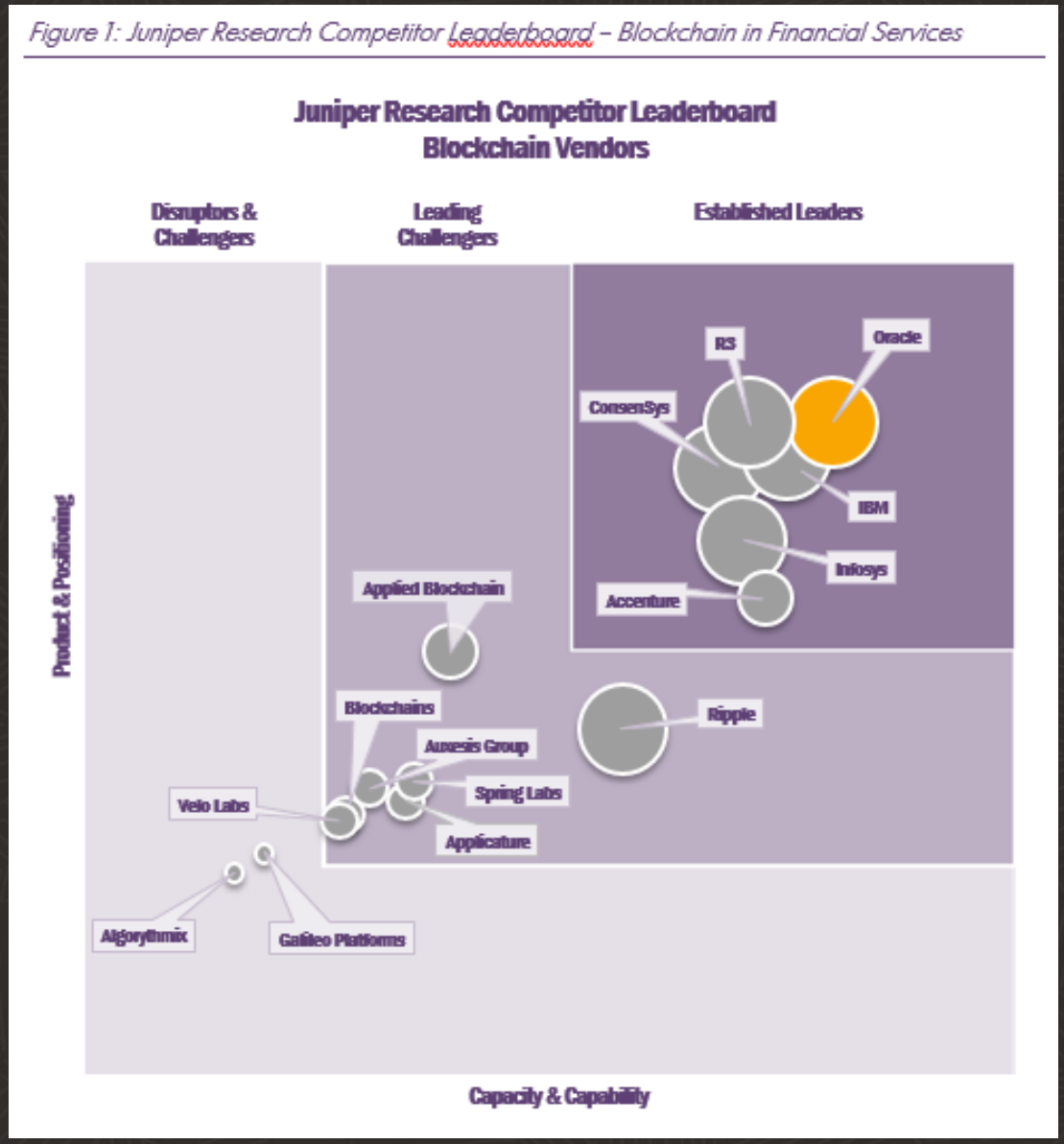
Watch the video

Top of the Juniper Research Leaderboard

https://bit.ly/Juniper_blockchain_report

"Oracle continues to innovate in the provision of blockchain services, including the launch of blockchain table; improving its offering and making it a go-to enterprise blockchain provider for an increasing number of businesses.

Oracle has leveraged the growing opportunities within the financial services space and has seen in recent years increased deployment, with a number of PoCs in advanced pilot or full production."

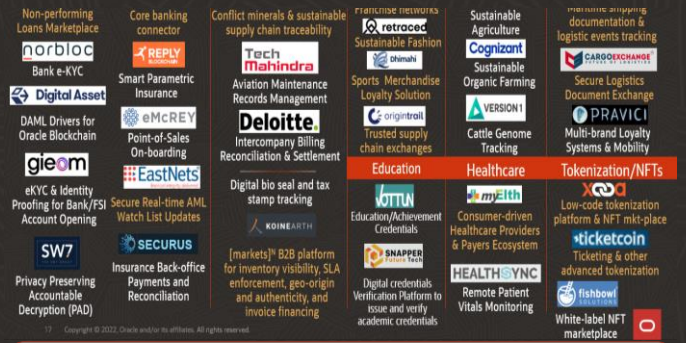


BLOCKCHAIN IN FINANCIAL SERVICES
Juniper Research Leaderboard

Simplifying Blockchain Adoption with Apps & Tooling

Partner solutions and superior developer experience help to speed up time-to-value

Blockchain Applications



Growing Portfolio of Industry Solutions

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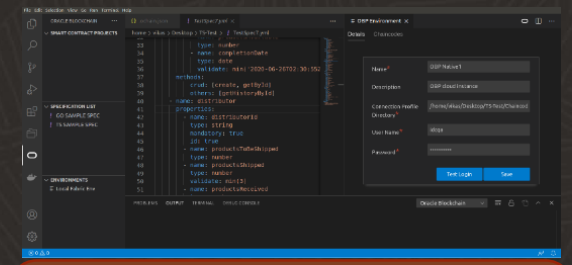

Low-code Dev Tooling for Custom Applications

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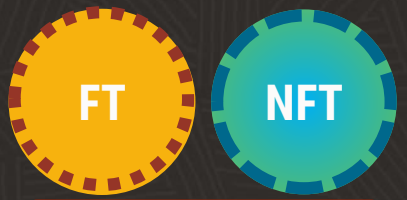


Built-in Tokenization

Blockchain App Builder for OBP

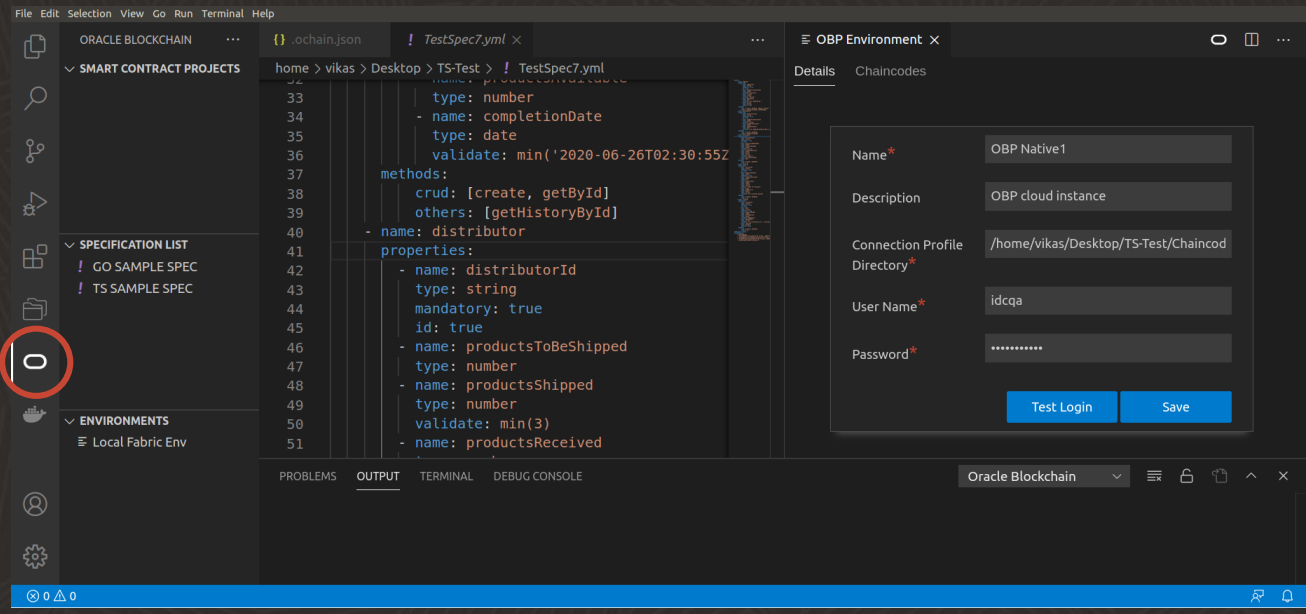
Can automatically generate smart contracts from declarative specs and aids in development, testing, deployment. Now includes Fungible Token (FT – like ERC-20) and Non-Fungible Tokens (NFTs – like ERC-721).

Production-Ready Blockchain Platform

- Easy-to-Deploy
- Easy-to-Integrate with back-office SORs
- Easy-to-Secure
- Easy-to-Run, Monitor and Manage in Operations
- Easy-to-Add New Members On-Prem and In the Cloud

Blockchain App Builder | Low-code Developer Tooling

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

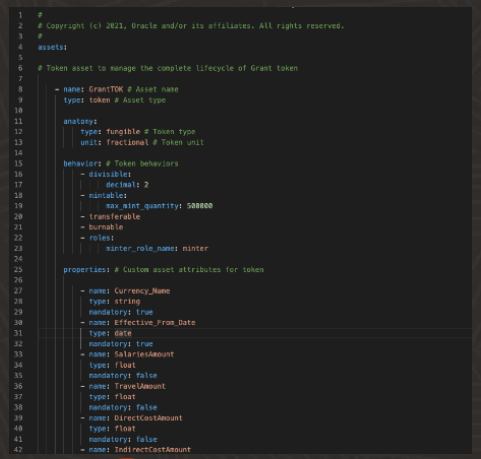
Dev, Test, and Deployment Lifecycle

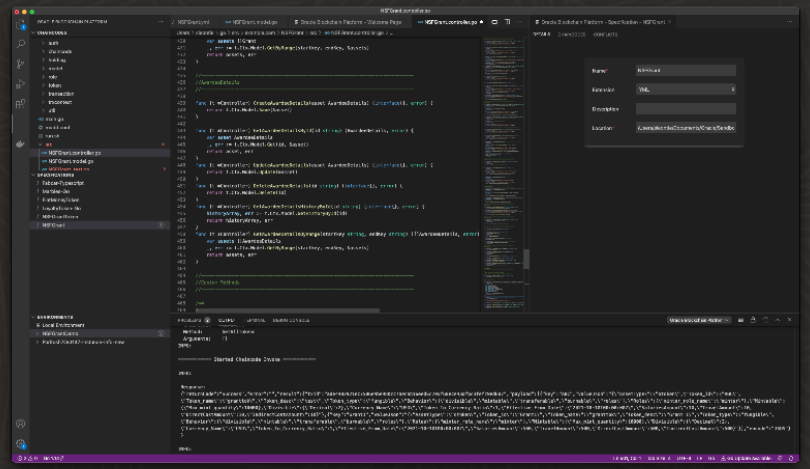
- Scaffold a chaincode project using a spec file
- Auto deployment of Hyperledger Fabric network
- Support for all chaincode lifecycle operations, such as package, install, instantiate, and upgrade
- Ability to deploy and test locally with line-by-line debugging when using local environment and VSC
-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

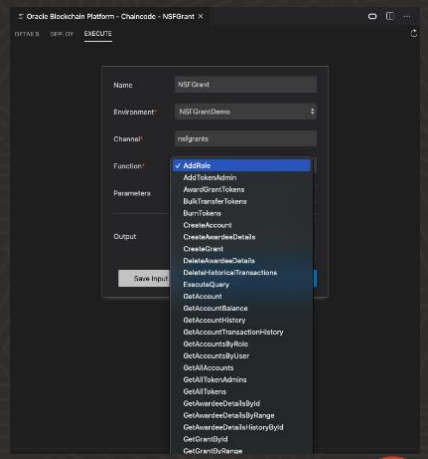
Automate Smart Contract Generation from Specifications

- Chaincode generation in TypeScript (node.js) and Golang using model/controller and decorator patterns
- Automatic generation of CRUD & token lifecycle methods, ability to add custom logic, and re-generate on update

Blockchain App Builder: Auto Generation of Token Life Cycle







1 Automatic Code Generation

Scaffold Project, Generate Code

3 Easy Customization

Add Custom Method Implementations

4 Faster Deployment

Deploy Smart Contract Locally

5 Quick Testing

Test & Debug Smart Contract

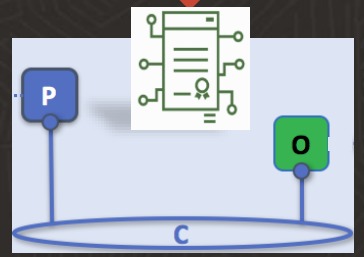
6 Readily Available REST APIs

Package & Deploy Smart Contract to OBP

Specification File

2 Readily Available Method Level Authorization

Smart Contract Project & Code



Smart Contract on Local Fabric

7 Integration with Identity Services

Smart Contract Deployed on OBP

Agenda

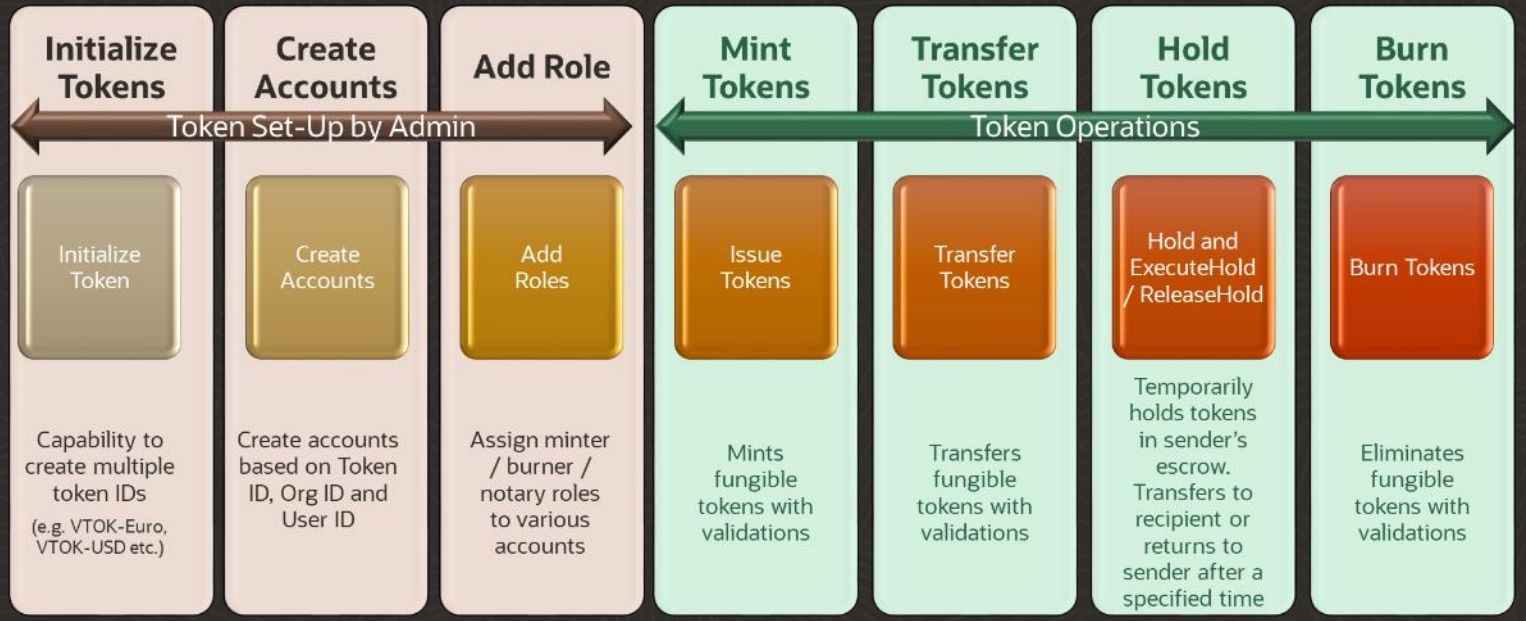
1. Key Web3 building blocks and why they matter
2. Oracle Blockchain Platform/Extending Hyperledger Fabric
3. Portable digital assets (a.k.a., tokenization)
4. Decentralized identity/verified credentials
5. Summary, Q & A, and additional materials

Blockchain App Builder Flexible Tokenization Support

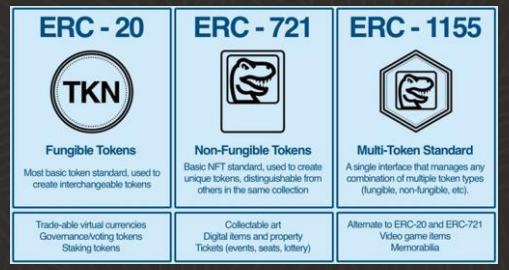
Extended Blockchain App Builder to generate code & APIs from TTF and ERC token specifications

- Meta-model that defines base token type (e.g. Fungible), behaviors (e.g. Mintable, Transferable, Burnable), and custom properties (e.g., Currency, Exchange Rate, SKU, etc.)
- Templates for Fungible (FT) and Non-Fungible tokens (NFTs)
- Auto-generation of token lifecycle chaincodes, local testing, and remote deployment capabilities
- Integrated identity management and REST API Gateway
- Supports liquidity pools mechanism to exchange fungible tokens based on exchange rates set through an API


```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 Engine



Token SDK

- Supports Token Taxonomy Framework standard behaviours like divisible, mintable, transferable, burnable, roles and holdable
- Supports ERC-721 and ERC-1155 frameworks for NFTs
- Leverages an account based system for custodial wallets
- Can be readily used in any custom functions

Token Wrapper Functions

- Supports 30+ out-of-the-box wrapper functions for token lifecycle
- Capability to pass organization id and user id as function parameters
- Extends ERC-721 & ERC-1155 data models and lifecycle functionality
- 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
- Extensible with fine-grained ACLs through chaincode APIs

- Can be used directly via exposed REST APIs
- Can be extended with custom chaincode methods for more complex needs
- Can be invoked from other smart contracts via cross-chaincode invocation

Sample Templates for Non-Fungible Tokens

ERC-721 and ERC-1155 NFTs

```yaml
assets:
  - name: ArtCollection
    type: token
    symbol: ART          # mandatory
    standard: erc721+
    anatomy:
      type: nonfungible
      unit: whole
    behavior:
      - indivisible                # mandatory
      - singleton                  # mandatory
      - mintable:                  # mandatory
          max_mint_quantity: 20000
      - transferable               # mandatory
      - burnable
      - roles:
          minter_role_name: minter
    properties:
      - name: price
        type: number
      - name: on_sale_flag
        type: boolean
    metadata:
      - name: painting_name
        type: string
      - name: description
        type: string
      - name: image
        type: string
      - name: painter_name
        type: string

customMethods:
  - executeQuery
  - "createAccountByConsumers(org_id: string, user_id: st
  - "sell(token_id: string, selling_price: number)" # Pos
  - "buyWithTokens(from_org_id: string, from_user_id: st
  - "buyWithDirectPayment(from_org_id: string, from_user_
```

```yaml
assets:
  - name: ArtCollection #Asset name
    type: token #Asset type
    standard: erc1155+   # Token standard
    anatomy:
      type: nonfungible # Token type
      unit: whole  #Token unit
    behavior:
      - indivisible
      - mintable:
          max_mint_quantity: 20000
      - transferable
      - burnable
      - roles:
          minter_role_name: minter

    properties:  # Custom asset attributes for non-fungible token

      - name: price # Custom asset attribute to set the price of a non-f
        type:
      - name: on_sale_flag # Custom asset attribute maintains non-fungib
        type: boolean

    metadata: # To maintain the metadata on-chain, this tag will be used.
      - name: painting_name
        type: string
      - name: description
        type: string
      - name: image
        type: string
      - name: painter_name
        type: string

  - name: Loyalty # Asset name
    type: token  # Asset type
    standard: erc1155+   # Token standard
    anatomy:
      type: fungible # Token type
      unit: fractional # Token unit
    behavior: # Token behaviors
      - divisible:
          decimal: 2
      - mintable:
          max_mint_quantity: 10000
      - transferable
      - burnable
      - roles:
          minter_role_name: minter

    properties:
      - name: currency_name # Custom attribute to represent the token in
        type: string
      - name: token_to_currency_ratio # Custom attribute to specify the
        type: number

customMethods:
  - executeQuery
  - "sell(token_id: string, selling_price: number)" # Post the non-fungibl
  - "buyWithEthCoin(from_org_id: string, from_user_id: string, to_org_id:
```

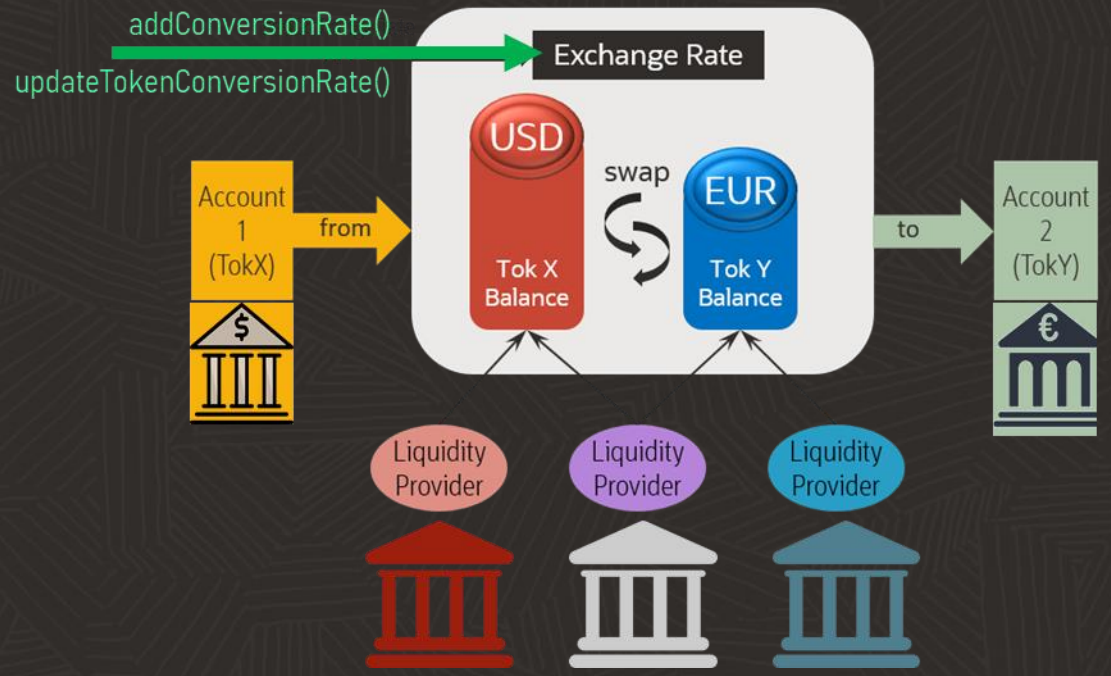
```yaml
assets:
  - name: RealEstateProperty #Asset name
    type: token #Asset type
    standard: erc1155+   # Token standard

    anatomy:
      type: nonfungible # Token type
      unit: fractional  #Token unit

    behavior:
      - divisible:
      - mintable:
      - transferable
      - roles:
          minter_role_name: minter

    properties:  # Custom asset attributes for non-fungible token.

      - name: propertySellingPrice # Custom asset attribute to set the r
        type: number

      - name: propertyRentingPrice # Custom asset attribute maintains th
        type: number

    metadata: # To maintain the metadata on-chain, this tag will be used.

      - name: propertyType
        type: string

      - name: propertyName
        type: string

      - name: propertyAddress
        type: string

      - name: propertyImage
        type: string

customMethods:
  - executeQuery
  - "setPropertySellingPrice(tokenId: string, propertySellingPrice: number
  - "setPropertyRentingPrice(tokenId: string, propertyRentingPrice: number
  - "buyProperty(fromOrgId: string, fromUserId: string, toOrgId: string, t
```

Fungible Tokens Exchange Using Built-in Liquidity Pools

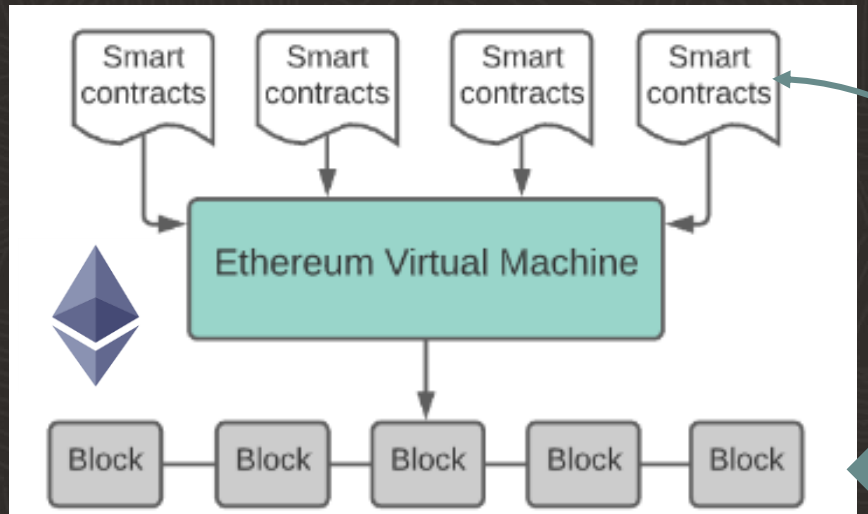
A liquidity pool is a collection of funds (token accounts for different token IDs) in a tokenization smart contract, which automates token exchanges by crediting and debiting different accounts based on API-controlled exchange rates. FT-FT exchanges are used in multi-currency CBDC, multi-brand loyalty/rewards solutions and other scenarios where multiple tokens are used within the same platform.

Generating TTF-based FT token in Blockchain App Builder now adds exchange pool methods:

- Set up/manage exchange pool accounts:
  - initializeExchangePoolUser, createExchangePoolAccounts, getExchangePoolUser
- Set/update/query exchange rates:
  - addConversionRate, getConversionRate, updateTokenConversionRate, getConversionRateHistory
- Fund exchange pool:
  - mintWithFundingExchangePool or regular transferToken methods
- Convert Tokens:
  - tokenConversion (TokX, TokY, to_org, to_userID, 100)
- Check exchange pool account balance or get history:
  - getAccount, getTokenConversionHistory



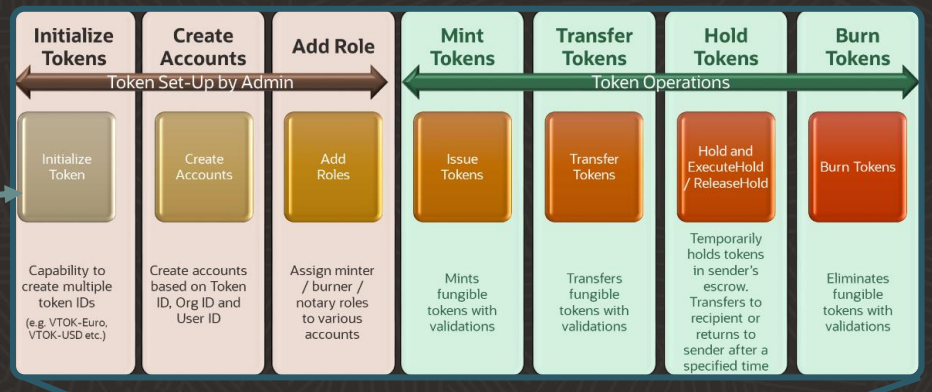
Ethereum Interop with Atomic Cross-Ledger Transaction Orchestration

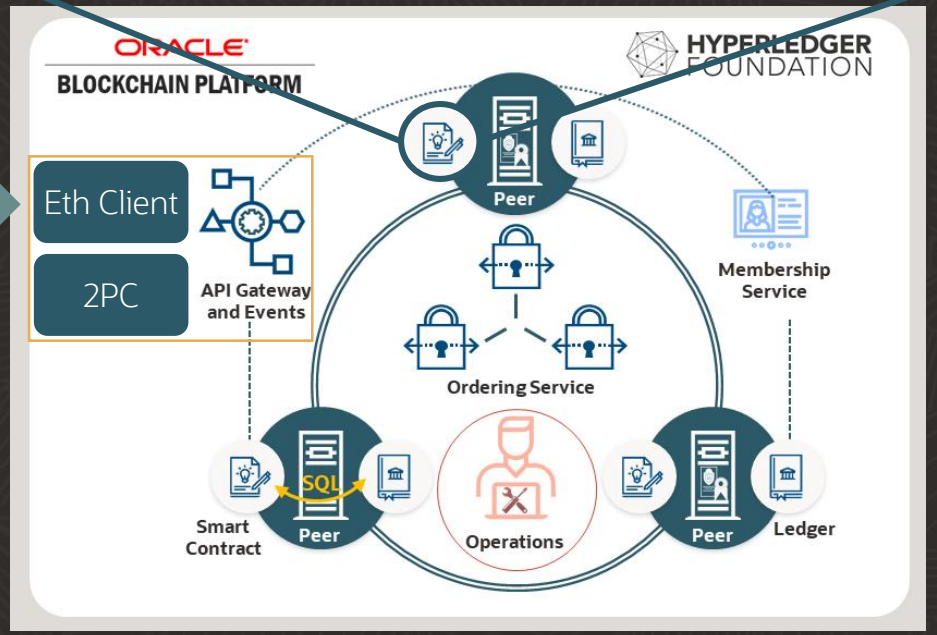


Ethereum or EVM-compatible blockchain

2. Commit
2a. Verify
1. Prepare
3. Commit or Rollback

2PC/LRC Optimization





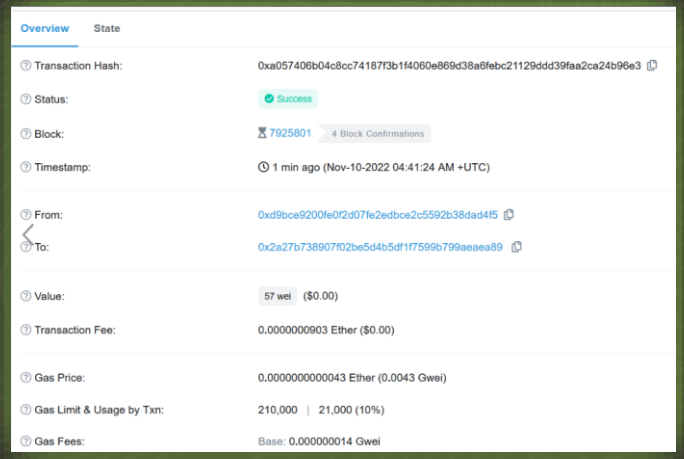
2PC
Two-Phase Commit
Transaction Orchestration Protocol

- Safety – If one commits, no one aborts
  – If one aborts, no one commits
- Liveness – If no failures and A and B can commit, action commits
  – If failures, reach a conclusion ASAP

Ethereum Interop with Atomic Cross-Ledger Transactions

Request:

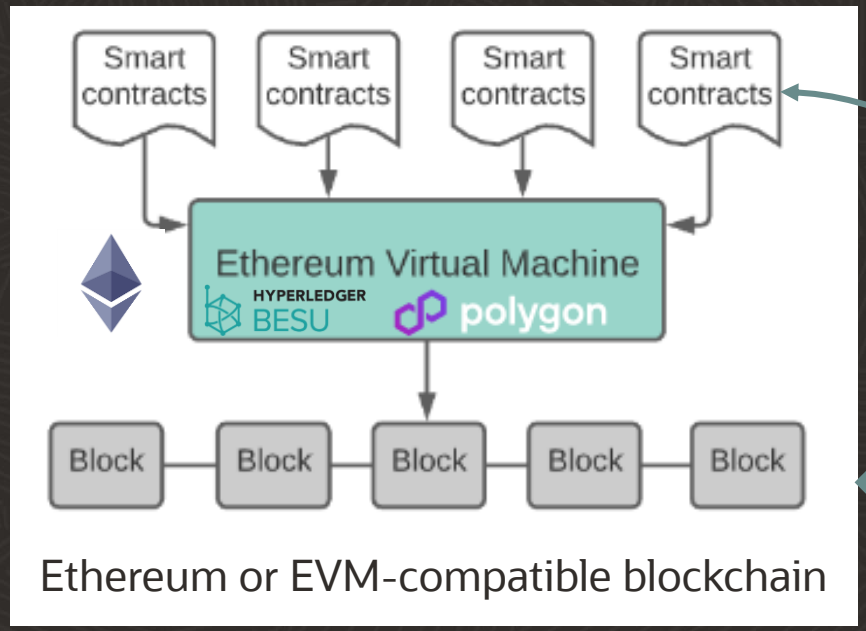

```
{
  "transactions": [
    {
      "chaincode": "ftneetu3", "args": ["CreateAccount","test8thnov01","neetu saini","fungible"], "channel": "default"
    }
  ],
  "lrc": {
    "ethReq": {
      "url": "https://goerli.infura.io/v3/eb25b8a0687942309609b9ee00644abf",
      "chainId": 5,
      "unsignedReq": {
        "type":0,
        "privateKey": "86834456584 93d2426101a4aa434d0f4fa450f9c16dbba912e827a7694539aea",
        "ethValue": "57",
        "gasLimit": 210000,  "gasPrice": "4300000",
        "gasTipCap": "35000000000", "gasFeeCap": "92180915700",
        "toAddress": "0x2a27b738907f02bE5D4B5DF1f7599B799aeAEA89"
      },
      "pendingTimeout": 400,
      "finalityParams": {
        "checkFinality": false,
        "blocksToWait": 40,
        "secondsToWait": 20
      }
    }
  },
  "isolationLevel": "serializable",
  "prepareTimeout": 120,
  "sync": false
}
```

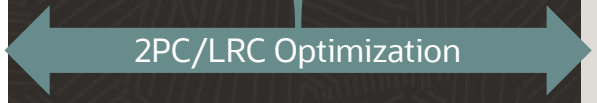



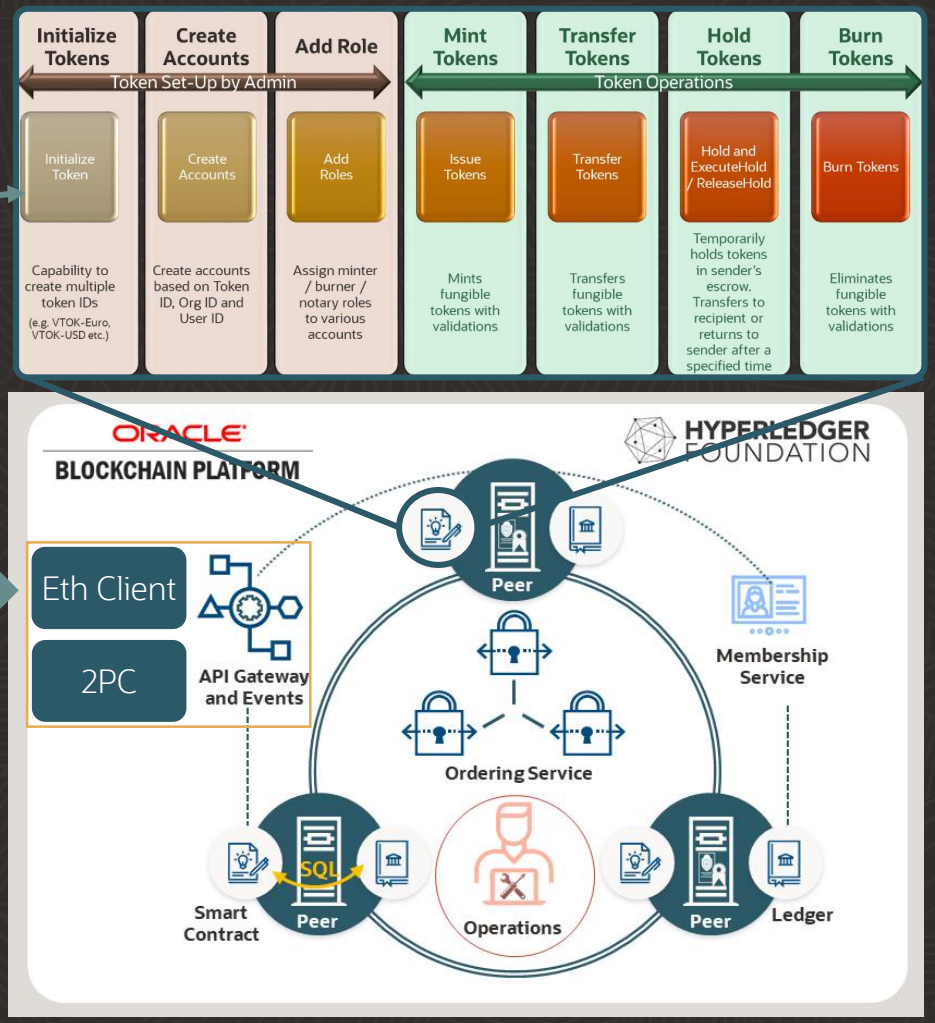
Response :


```
{
  "returnCode": "Success",
  "error": "",
  "result": {
    "transactions": [
      {
        "channel": "default",
        "chaincode": "ftneetu3",
        "txstatus": "Committed",
        "prepare": {
          "txid": "c3a4abb84a73cce8ef952cd2a95641438eac939315d7a41fe17bb54df0cf22f2"
        },
        "commit": {
          "txid": "77a7685d4fc890a8c65fed955d16886f0b82fdb9f15f34183ae4ebb40ba86bbd"
        },
        "rollback": {}
      }
    ],
    "lrc": {
      "ethResp": {
        "block": 7925801,
        "txHex": "0xa057406b04c8cc74187f3b1f4060e869d38a6febc21129ddd39faa2ca24b96e3"
      },
      "txstatus": "Committed"
    },
    "globalStatus": "Success",
    "globalTxid": "25771f01-5e5e-42b2-bd55-3cf7ef9cd523",
    "txStartTime": "2022-11-10T04:41:05.055112274Z"
  }
}
```

Ethereum Interop with Atomic Cross-Ledger Transaction Orchestration







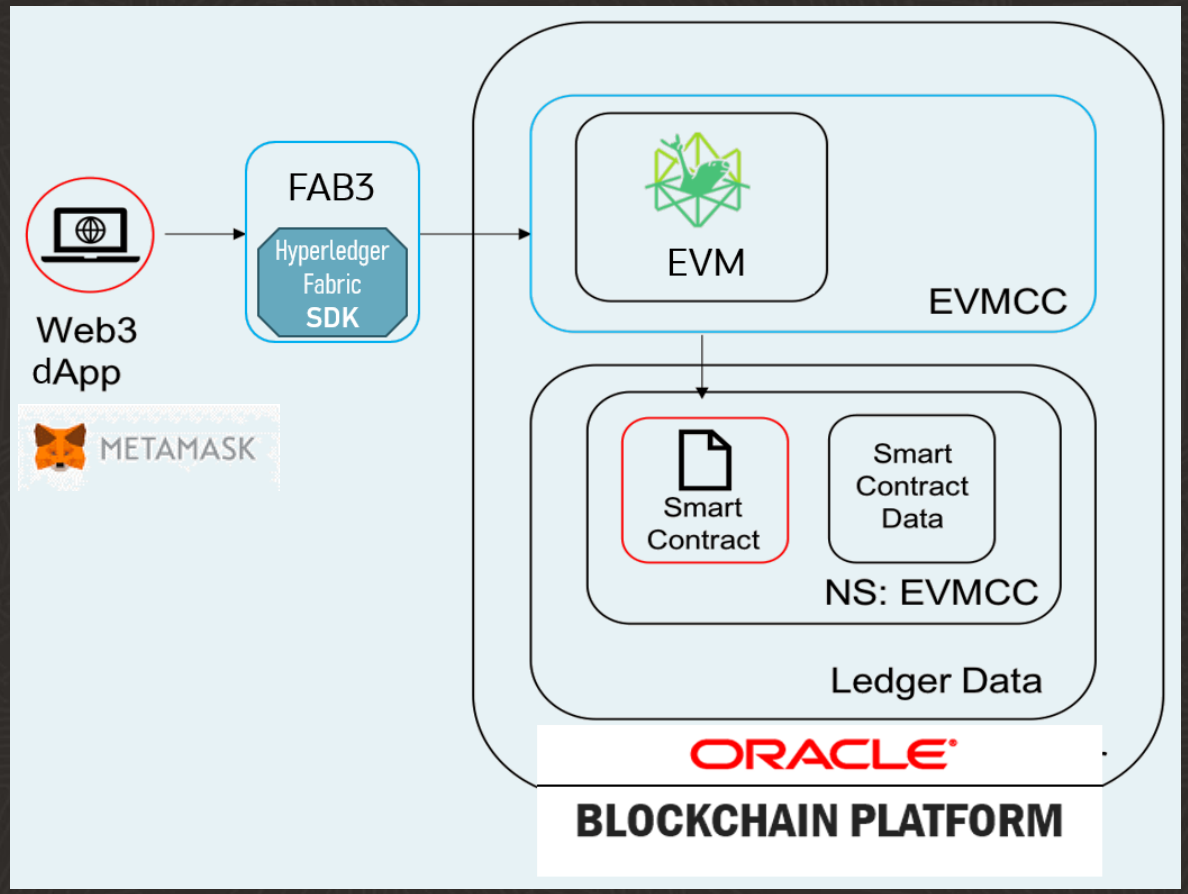
Example Scenarios

- Atomic asset exchange, e.g.:
  - Pre-fund OBP fungible tokens using ETH or ERC-20 tokens
  - Use ETH or ERC-20 tokens to pay for NFTs minted and traded on Oracle Blockchain
  - Prepare and mint NFT on Hyperledger Fabric, lock or burn and re-mint with transactions history on Ethereum or any EVM-based network for secondary market
- Use OBP tokens to track public chain token balances across multiple ledgers or marketplaces
- OBP transaction generating an event that triggers an Ethereum smart contract, e.g., to process payment
- OBP transaction has its hash published on Ethereum as public proof without disclosing any transaction details

Web3 API Support

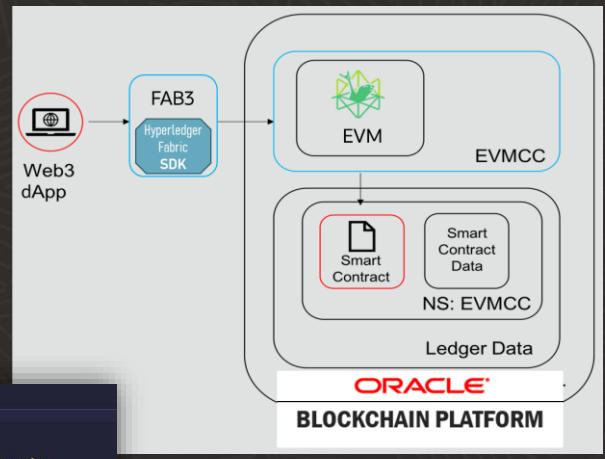
Extending Solidity/EVM support on Oracle Blockchain with Fab3 provider for Web3 JSON-RPC API

- Web3 API refers to the APIs used by the open source web3.js library
  - A collection of modules that allow you to interact with a local or remote Ethereum node or one emulated by an Ethereum Virtual Machine (EVM).
  - Previously Solidity/EVM users on OBP had a choice to interact with smart contracts via a Remix IDE or OBP REST API
- Most wallets and dApps in Web3 world today use Web3 JSON-RPC API
  - The latest OBP release certifies Fab3 provider from Hyperledger, which exposes Web3 APIs and maps them to OBP Solidity chaincode using HL Fabric client SDK
  - Can use Metamask and other wallets to interact with Solidity contracts on OBP

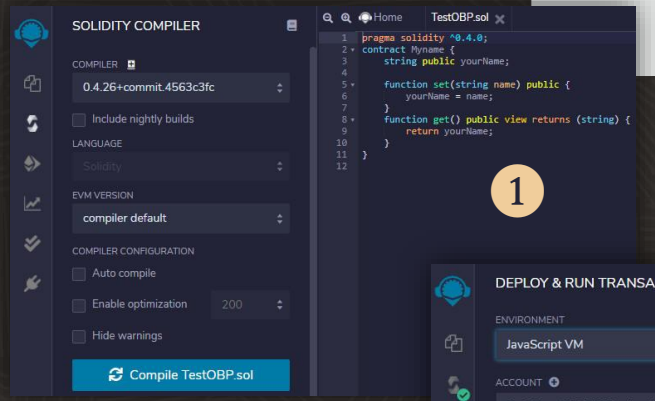


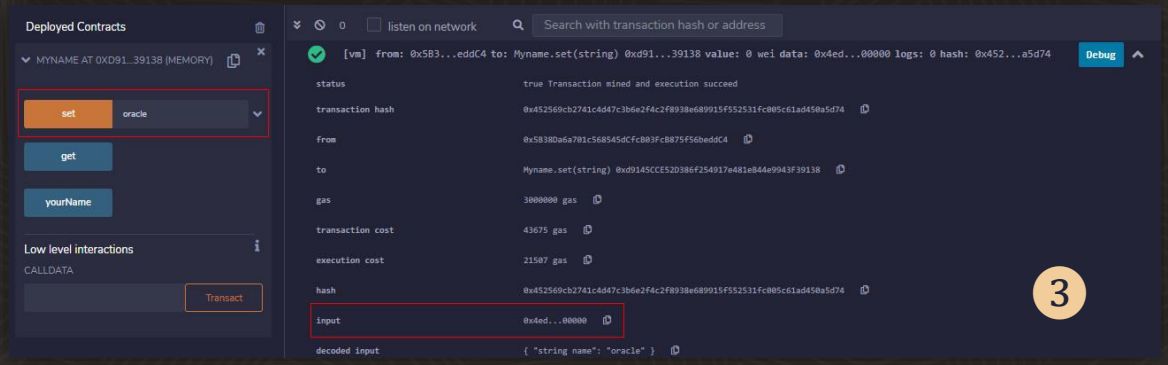
Re-use Ethereum Solidity Smart Contracts on OBP

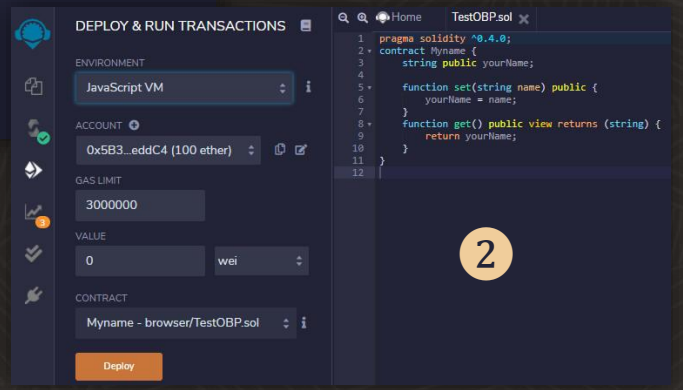
Leveraging EVM on Fabric Nodes



- Set up the EVM chaincode zip file and deploy it on OBP
- Create and Compile Your Solidity Smart Contract, e.g., using Remix IDE:
  https://remix.ethereum.org/
  - You can import existing smart contracts into Remix (1)
  - Deploy smart contract using Remix (2)
- Invoke Smart Contract (3)







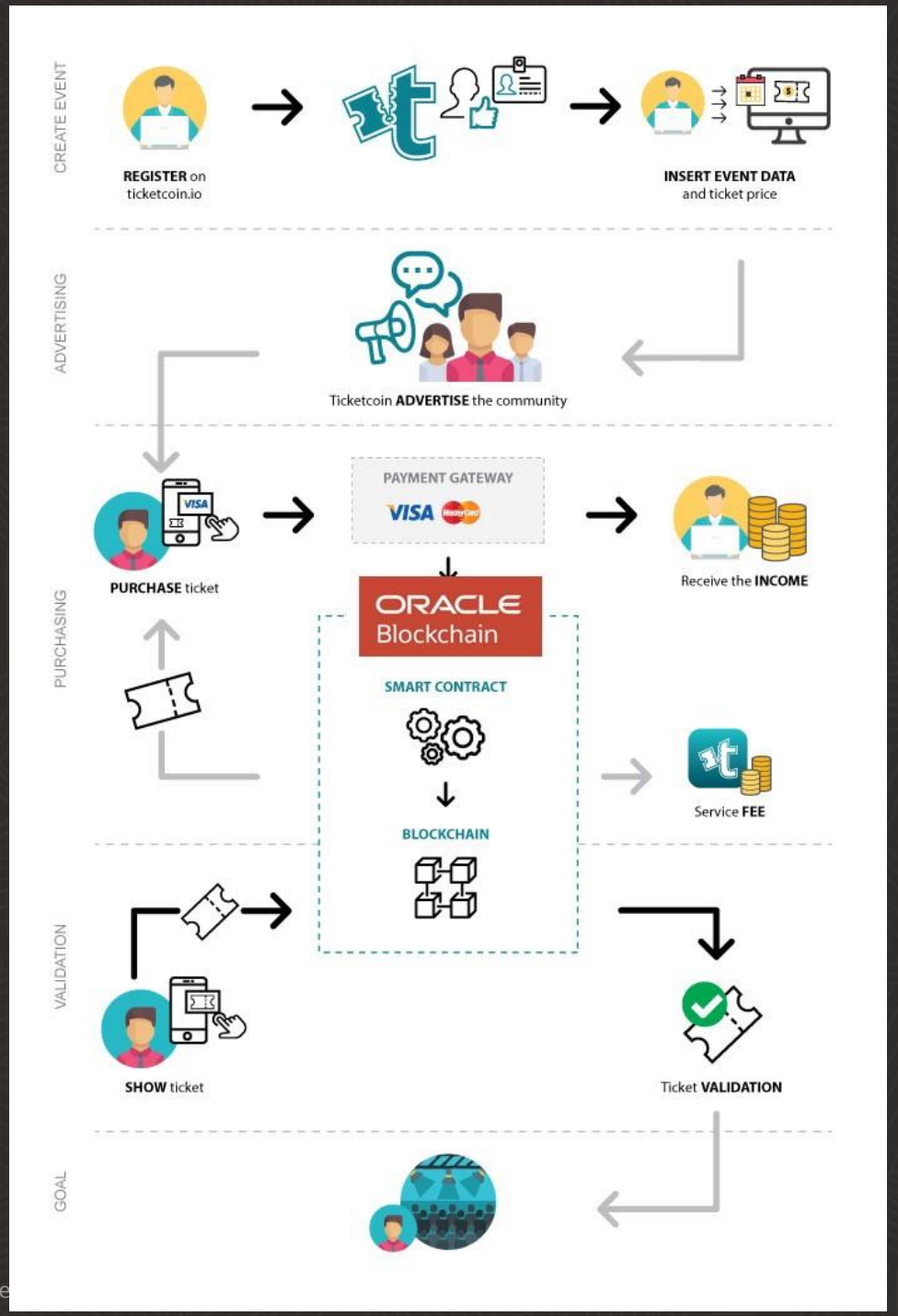
- Can also invoke using Oracle Blockchain REST API
  - --data-raw '{"chaincode":"<chaincodename>","args":["<contractaddress>","<setfunctionexecutionhash>"]}'
- Support for Fab3 – a *web3* provider that implements a subset of the Ethereum compliant JSON RPC interfaces

Industries and Use Case Categories

BFSI	Retail	Manufacturing / Supply Chain	Global Trade & Logistics	Web3 and NFTs
Funds Transfer (cross-org, cross-border)	Authenticated Provenance	Supply chain tracking	Country of origin and related certifications	NFT creation for consumers (NFT)
eKYC and business client on-boarding	Ethical Sourcing & Sustainability	Contract manufacturing (NFT)	Export/Import documentation exchange	Data assets virtualization and trading (FT, NFT)
Cross-ERP reconciliation	Rewards programs (FT, NFT)	EV battery passports (NFT)	Maritime shipping consortium	Decentralized identity
Digital currency/CBDC (FT)		Certified recycled plastics	Freight services automation platform (FT)	
Renewable energy certificates & allowances (FT, NFT)		SCOPE 3 emissions traceability	Specialty commodities marketplace with logistics and ESG-tracking (NFT)	
Alternative investment products derived from trusted company KPI data (NFT)				

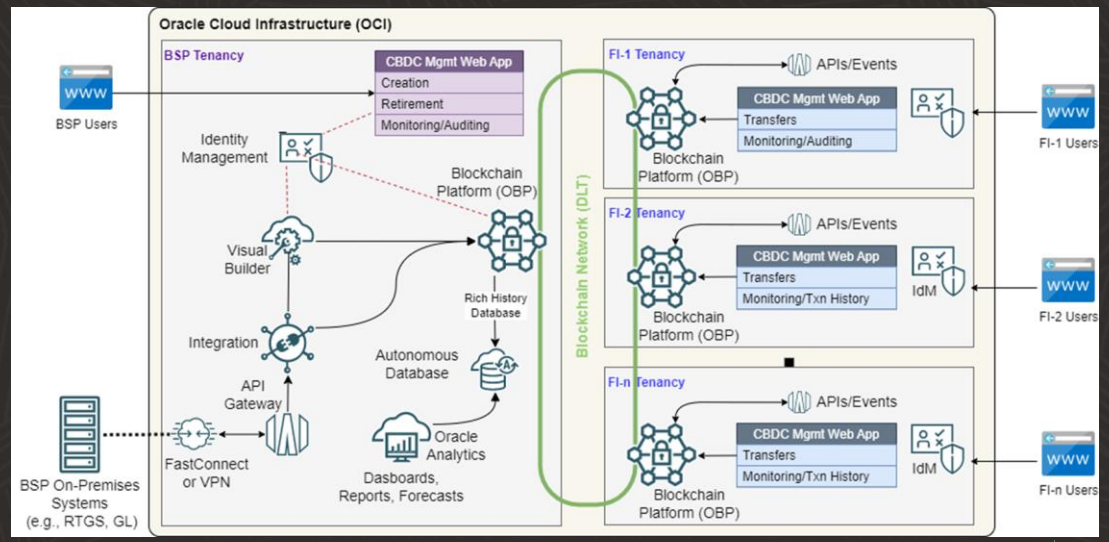
Ticketing & Engagement

TicketCoin solution has been chosen by the organizers of the Luci sul Trasimeno event in Castiglione del Lago to guarantee maximum security and real-time monitoring of the number of people within the route, in full compliance with the COVID-19 regulations



Interbank CBDC Sandbox

CBDC Sandbox Architecture



Key OCI Services
Oracle Blockchain Platform (OBP)
OCI Integration and Visual Builder (VBCS)
Autonomous Database and Oracle Analytics
Identity and Access Management
API Gateway and Web Application Firewall
OCI FastConnect or VPN Service

Extensible Interbank CBDC Web Application

Onboarding
- CB can open CBDC accounts for CB users and Banks/FIs
- CB can assign roles (admin, minter, burner)

Money Supply
- Central Bank can issue (create) and burn (destroy) money
- Central Bank can monitor system status and statistics to inform monetary policy

Payment Transactions
- System participants can all send money between accounts (both intra and inter shard)
- Integrate with backend banking system and custodial wallets

Fraud prevention and AML/CFT detection
- Transaction history and meta-data can be monitored by the CB and/or Financial Regulator

API Layer

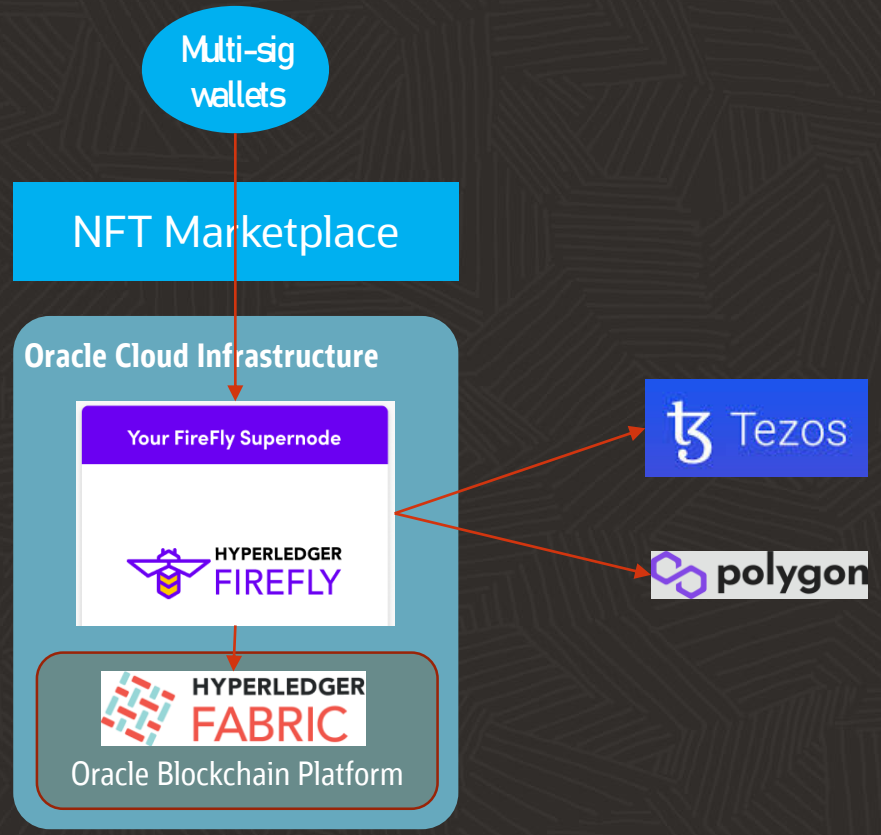
Initialize Tokens	Create Accounts	Add Role	Mint Tokens	Transfer Tokens	Hold Tokens	Burn Tokens
Token Set-Up by Admin			Token Operations			
Initialize Token	Create Accounts	Add Roles	Issue Tokens	Transfer Tokens	Hold and ExecuteHold / ReleaseHold	Burn Tokens
Capability to create multiple token IDs (e.g. VTOK-Euro, VTOK-USD etc.)	Create accounts based on Token ID, Org ID and User ID	Assign minter / burner / notary roles to various accounts	Mints fungible tokens with validations	Transfers fungible tokens with validations	Temporarily holds tokens in sender's escrow. Transfers to recipient or returns to sender after a specified time	Eliminates fungible tokens with validations

Extensible Tokenization Engine on Oracle Blockchain Platform

OneOf.com – Music NFT Platform with Multi-chain NFT Marketplace for Enterprise Loyalty/Rewards Programs

Turbocharge loyalty, drive revenue, and meet the needs of the modern consumer.

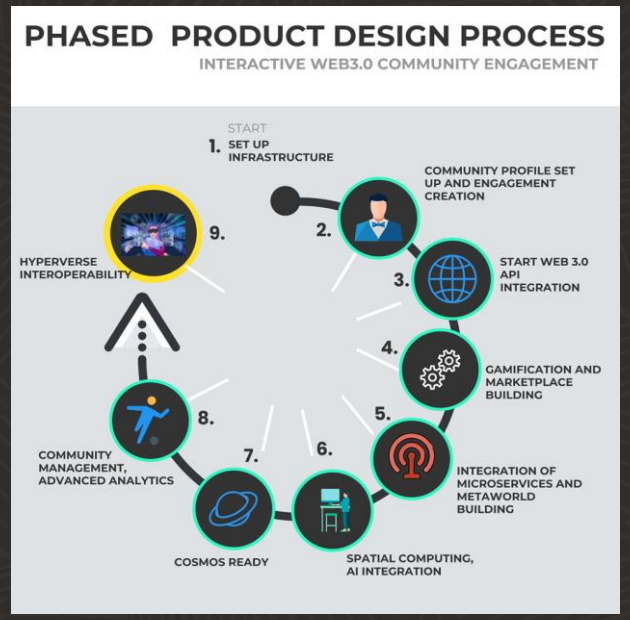
- Enterprise-grade software suite for next-generation rewards programs
  - NFT Marketplace across multiple chains
  - Decentralized identity with Verified Credentials against loyalty system back-ends
- WMGRewards – Rewards platform for music lovers
  - Users can earn tokens and digital badges for free by engaging with Warner Music artists in various ways and then redeem them for rewards by completing challenges.
  - A challenge is a set of specific Badges you must collect in order to unlock a reward.
  - Reward can be anything from a limited-edition Badge, a gift card, or VIP tickets to a show.

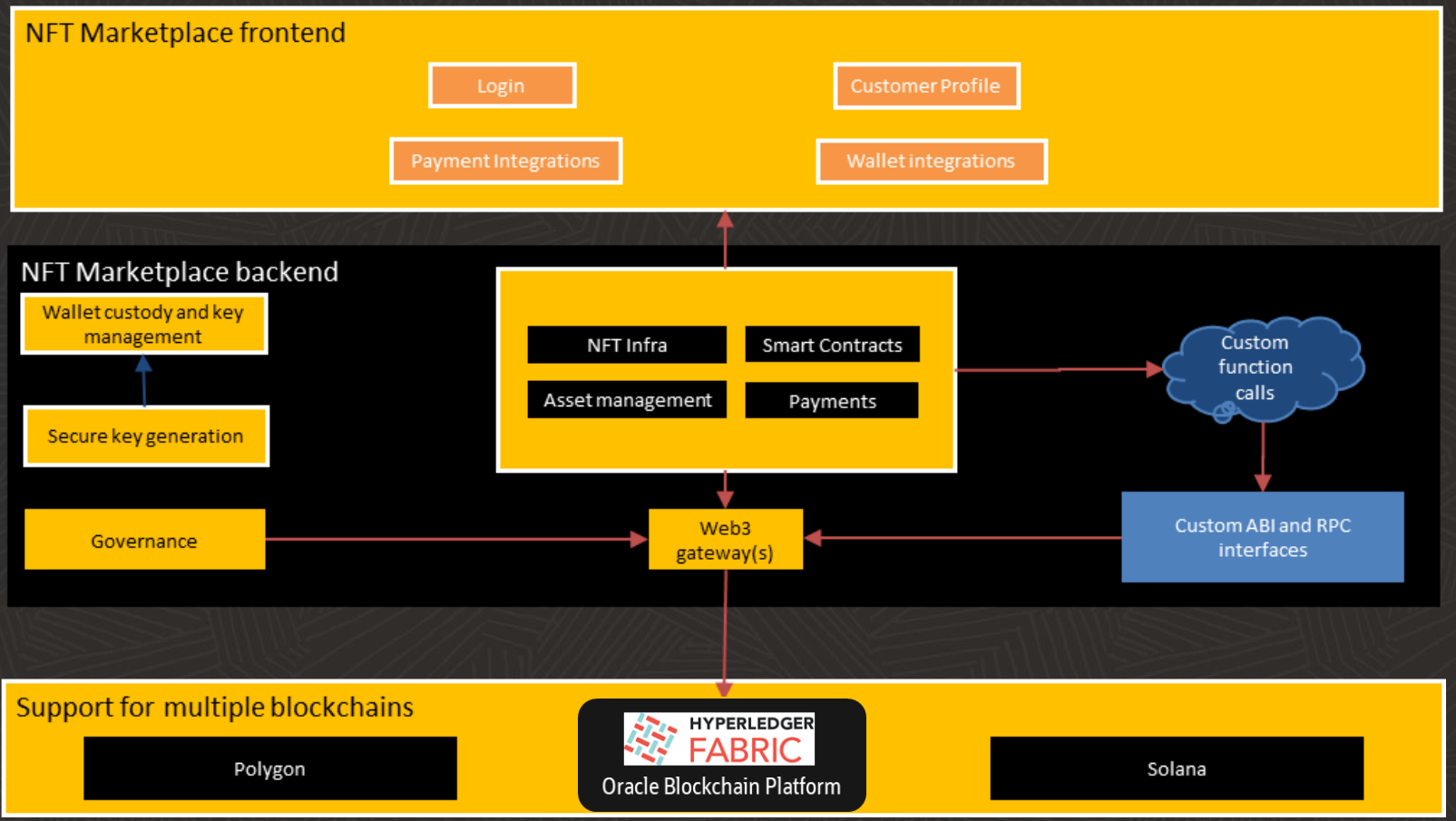


Custom NFT Marketplaces with Gamification and Immersion

Web3 API framework for quick creation of NFT solutions with business utility

- Adapted to use Oracle Blockchain as a back-end ledger for dynamic NFTs
- Enterprise-focused NFT solutions
  - Digital asset solutions
  - Rewards programs
  - 3D virtual ecosystem / Metaverse for fan engagement, HR onboarding, etc.



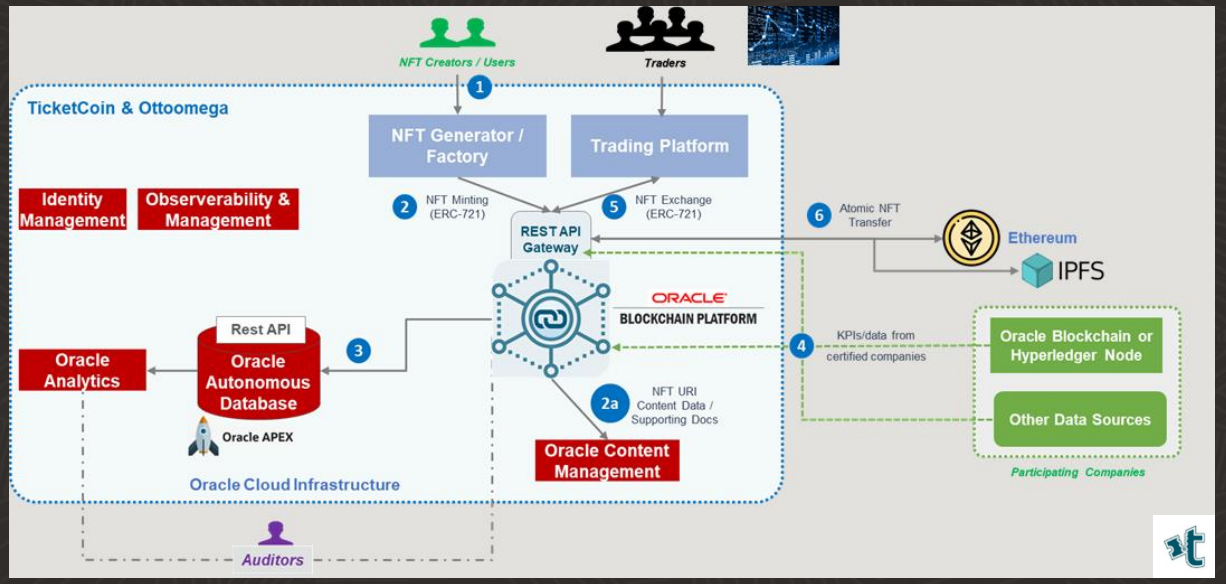


NFT Marketplaces

Structuring data-driven investment products by virtualizing company's KPIs to expand investible universe across regulated & unregulated trading venues

Data-driven engineering, pricing & exchange of Virtual Assets

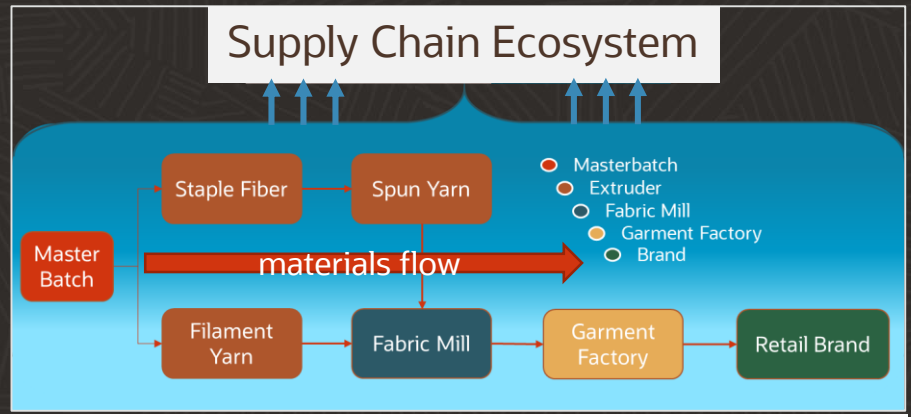
- DLT & AI/ML to gather price-sensitive data & publish information
- Open source algorithms to price a new breed of investment instruments, either fungible or non-fungible
- Blockchain allows for data validation, tokenization with asset portability, immutability as well as wallet profiling (also decentralized) & rating
  - Reliable and transparent flow of KPI data from participating companies
- Initial release functionality
  - Smart contracts deployment
  - NFTs generator Factory
  - Rich History Database for Analytics
  - Integration with listing & first auction
  - Integration with secondary trading



Product Content and Royalties Tracking for Certified Manufacturing Ecosystem

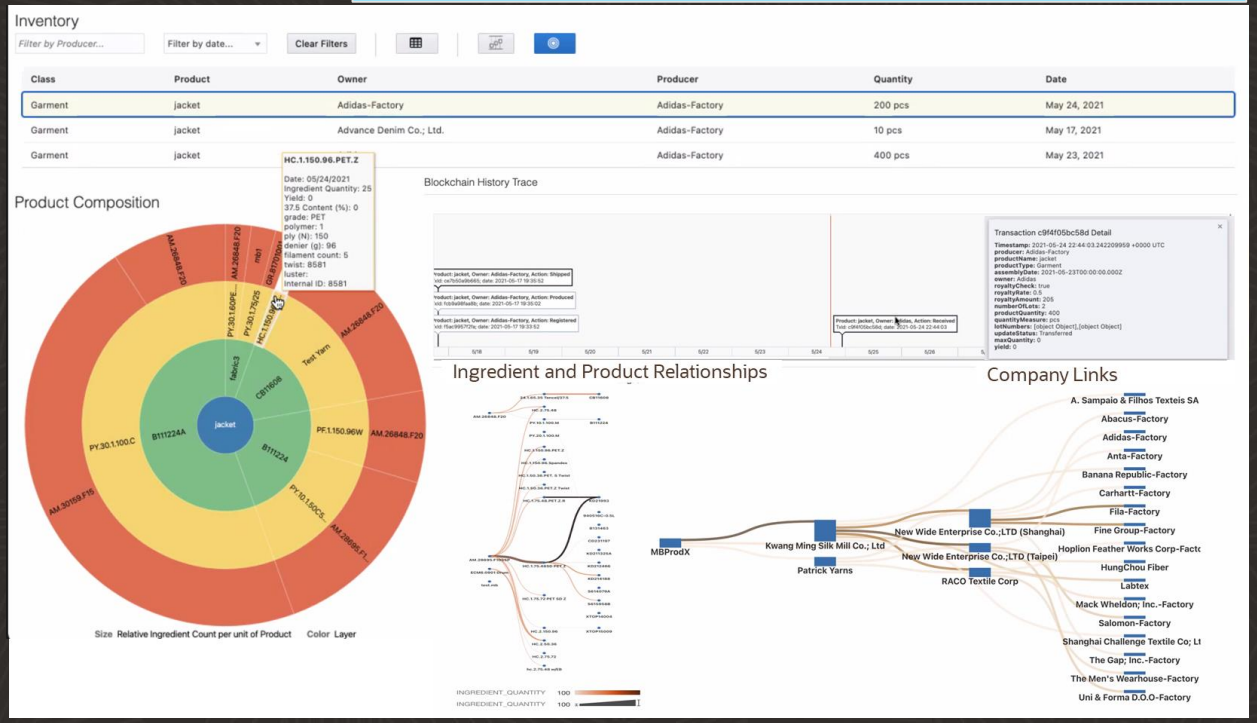
Key Requirements in Certified Manufacturing for Performance Garments

- 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

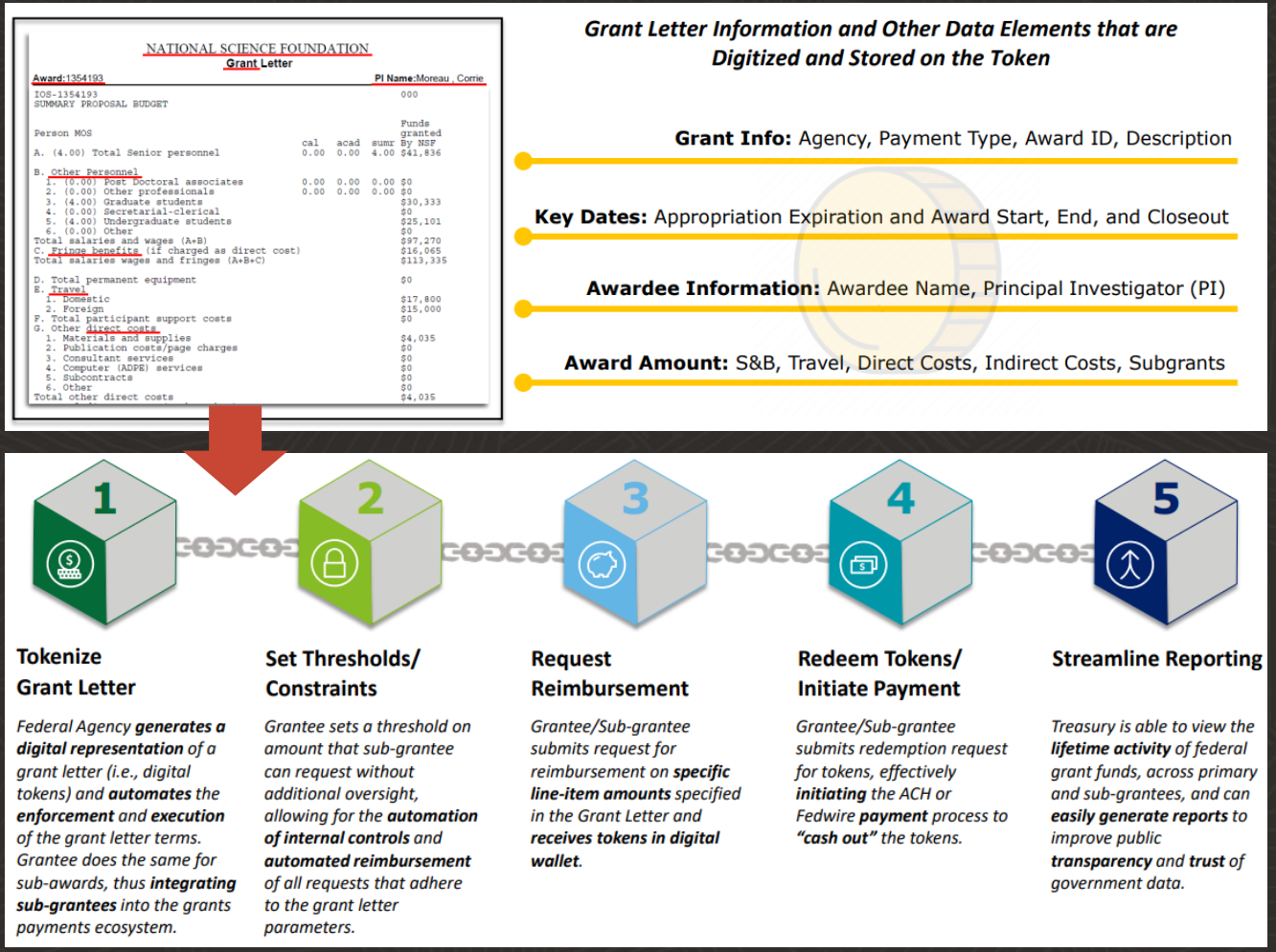


- On-chain data synchronized to ADW is used in OAC visualizations of txn. history, inventory, shipments, royalties, company relationships, and product composition across the supply chain

Multi-Tier Government Grants Program Payments and Tracking

Currently prime recipients have to navigate multiple, redundant Letter of Credit platforms and Federal agencies have little visibility into the identity or spending information of sub-recipients

Using DLT to tokenize value and track it across the network of *Prime Grantees* and *Sub-grant recipients*

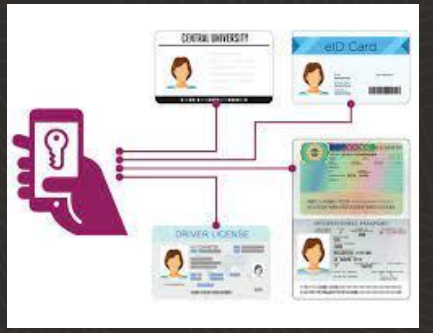


- **Smart contracts for**
  - Digital representations of a contract or grant letter agreements
  - Automation of the enforcement and execution of the agreement (including transaction thresholds and payment requests).
- **Decentralized consensus** mechanisms and **digital wallets**.
- **NFTs** used to represent award letters and **FTs** for tracking funds disbursements
- Tamper-proof **DLT history** reduces compliance reporting burdens and increases audit efficiencies

Agenda

1. Key Web3 building blocks and why they matter
2. Oracle Blockchain Platform/Extending Hyperledger Fabric
3. Portable digital assets (a.k.a., tokenization)
4. Decentralized identity/verified credentials
5. Summary, Q & A, and additional materials

What is Decentralized Identity And Why it Matters?

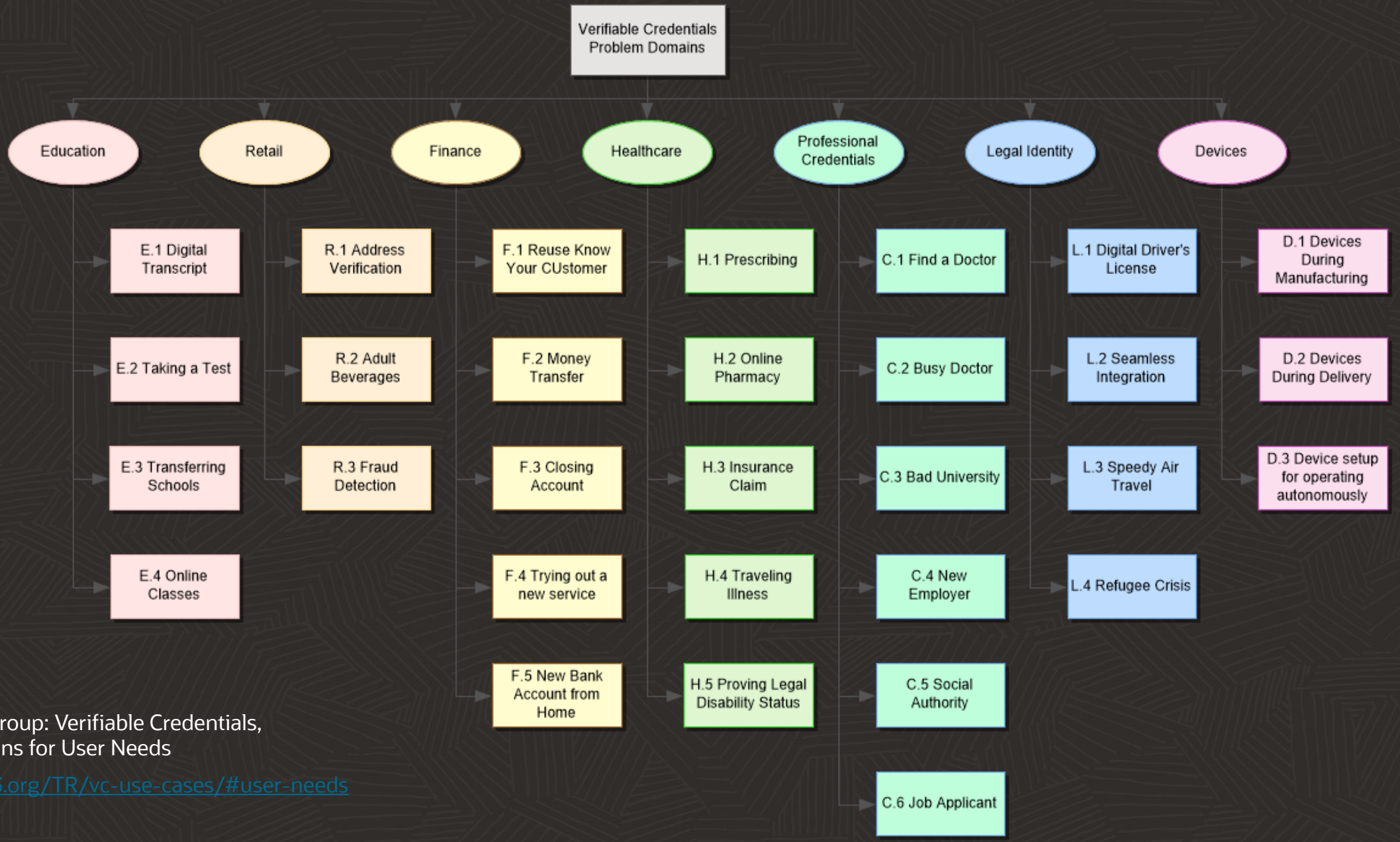


Decentralized identity, also referred to as Self-Sovereign Identity (SSI), is an open-standards based identity framework with digital identifiers and verifiable credentials that are self-owned, independent, and enable trusted data exchange.

- Putting control back in the hands of users
  - Users get to decide what information they disclose and to whom
- Greatly reduces threat of data breaches
  - User info is in wallets, no central location to hack
- Increases trust and reduces fraud
  - Verification uses cryptography and blockchain
- Transparency
  - User knows who the data was shared with
- Interoperability and Portability
  - Data formats are portable across devices and systems based on schemas defined on the blockchain ledger

- Decentralized identity advantages for enterprises and other organizations:
  - Faster verification process at a much lower cost
  - Prevents credential fraud
  - Improves data and identity security with public-key cryptography
  - Reduces the risk of being targeted for cyber attacks by storing less user data
  - Reduces compliance effort and cost

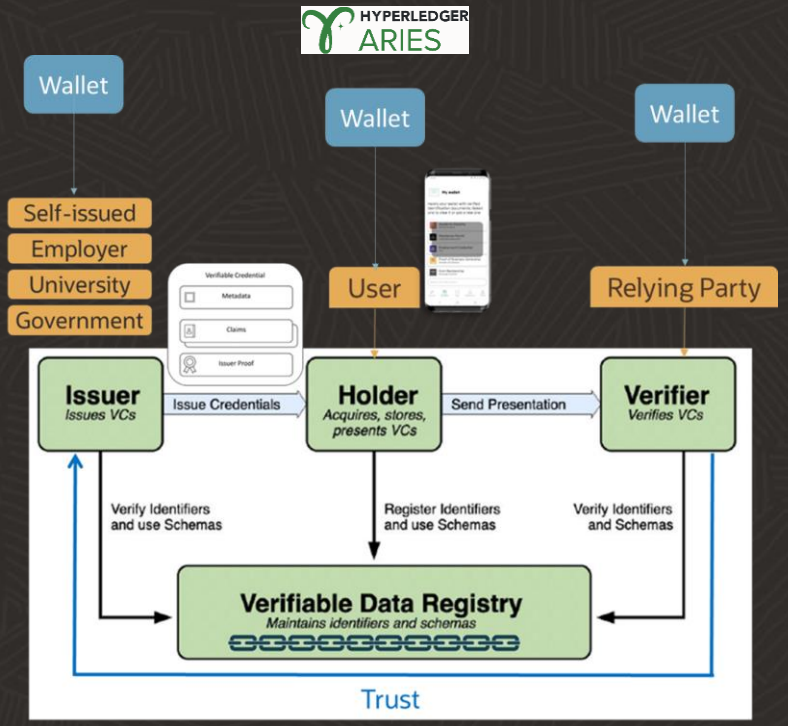
Where it Works?



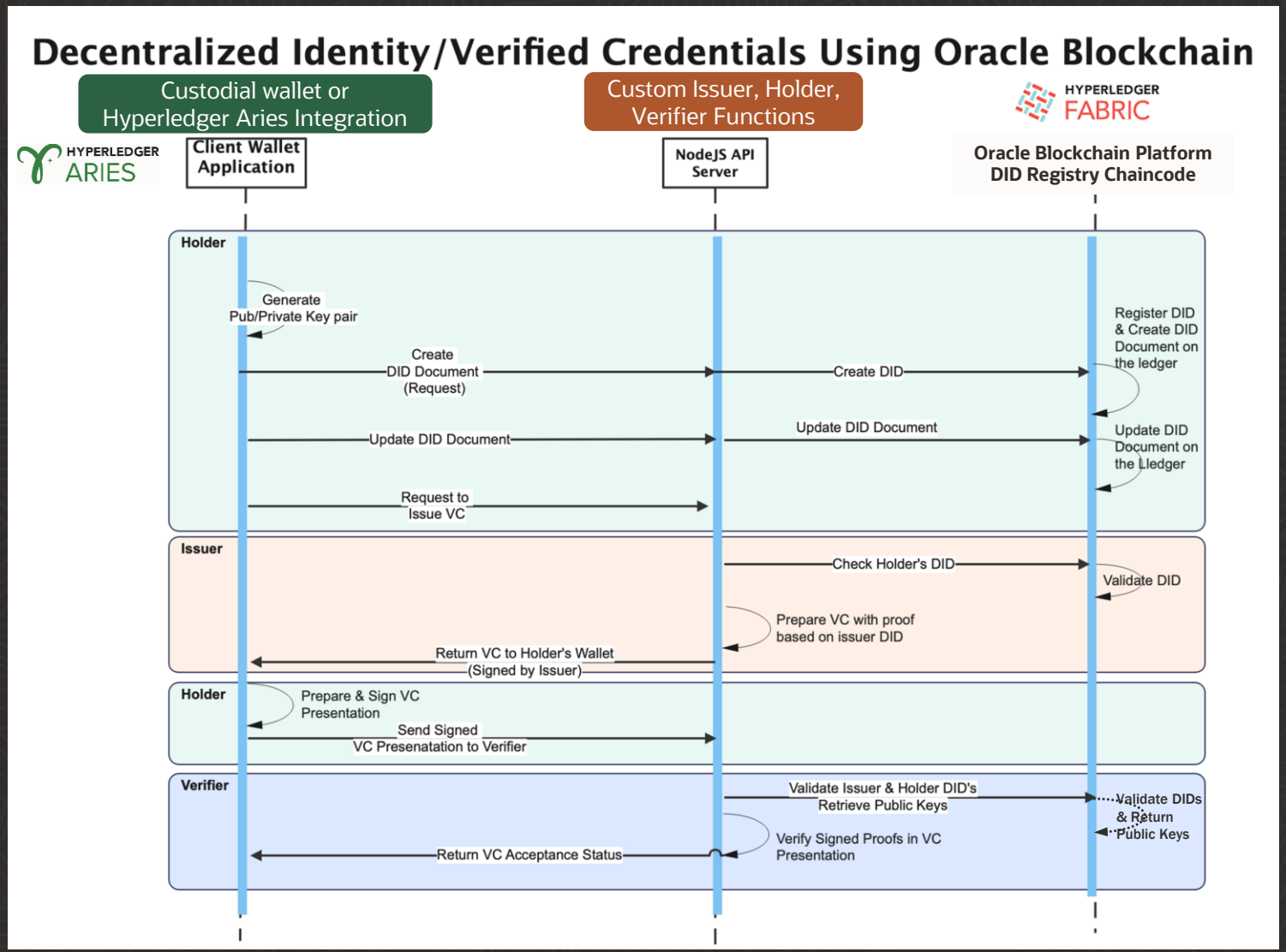
W3C Working Group: Verifiable Credentials, Example Domains for User Needs

https://www.w3.org/TR/vc-use-cases/#user-needs

Decentralized Identity on Oracle Blockchain/Hyperledger Fabric



1. Users (Holders) and Issuers register DIDs and DID documents on the blockchain data registry as URIs to their cryptographic (PKI) proof materials
2. A user (Holder) requests and receives credentials proving their identity or specific claims from multiple Issuers (e.g., Government, Employer, University etc.) and stores them in a digital wallet.
3. The user (Holder) can then present proofs of their claims as signed credentials to anyone they choose to share them with (Verifiers), and these organizations can verify that the proofs are true via DIDs in a blockchain-based registry.

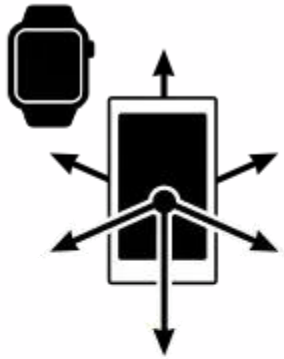


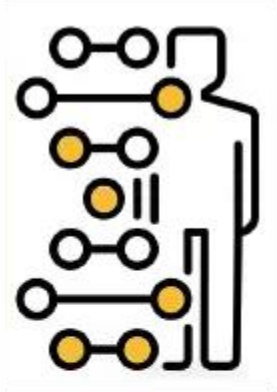
Biometric Identification

IPTOKI
ADVANCED IDENTIFICATION INTELLIGENCE

Trusted Third-Party Verification

IOS OR ANDROID APP





BEHAVIORAL BIOMETRICS

MOTION, GESTURE, GAIT

CREATES A UNIQUE SIGNATURE

CONTINUOUS AUTHENTIFICATION

- **Strong identity**
- **Multi-Modal**
  - Gait
  - Gesture
  - Motion
  - Keystroke Dynamics
- **Non-intrusive** : smartphones, wearables
- **Continuous** verification
- **Passive verification** (no action required by user)

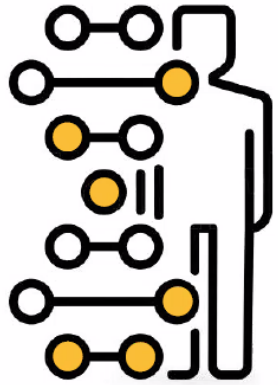
- **Secured** through distributed ledgers
- **Complex Deep Learning** algorithms insuring a high level of security
- **Interoperability** – Open Standards (e.g. W3C Verifiable Credentials)
- **User-centric**

BLOCKCHAIN

ORACLE IPTOKI

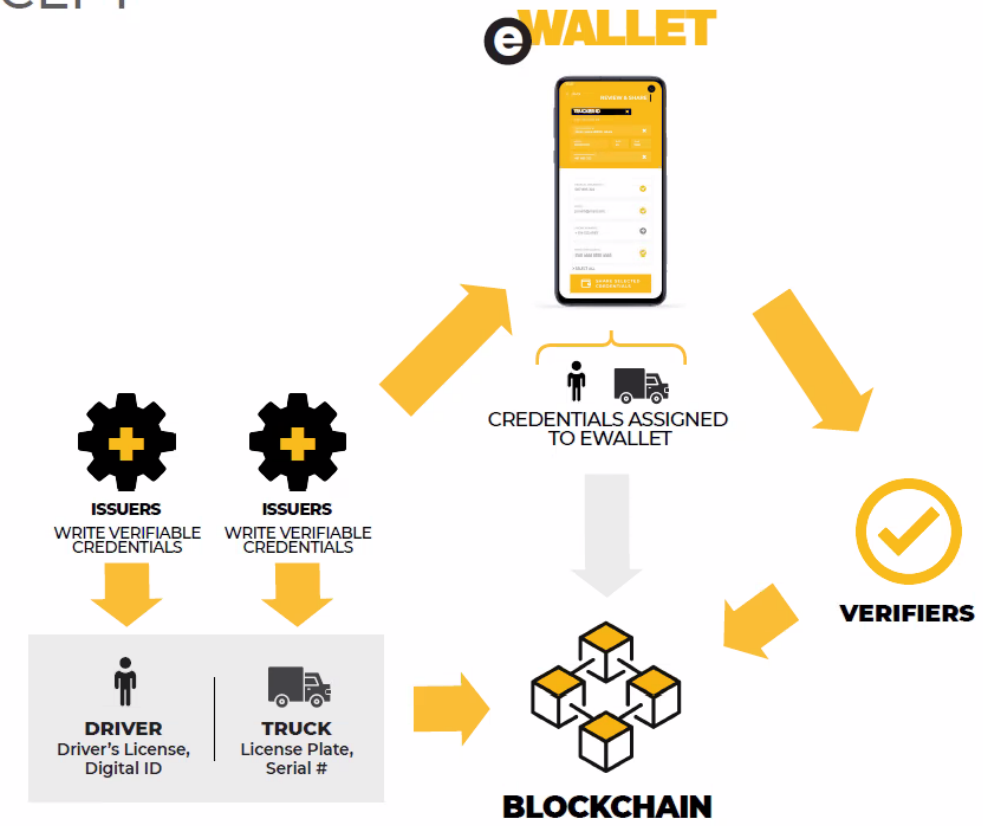
SUPPLY CHAIN

PROOF OF CONCEPT



DIGITAL ID

ACQUIRED WITH BEHAVIOURAL BIOMETRICS



IDENTITY ACCESS MANAGER (IAM)

Verified Credentials Momentum in Government RFPs/RFIs

Decentralized Identity and Verified Credentials in State Licensing and Certifications Initiatives

- State-wide DID Registry
- Enables agencies to issue Verified Credentials
- Utah Pilot Program focused on the potential candidates for the Pilot Project: Food Handler's Permit, OHV Operator Permit, or Alcohol Service Certification
- Rhode Island Pilot Program focused on credentialing Certified Public Accountants (CPAs)

U.S. Customs and Border Protection

RFI on DLT for modernization of Automated Commercial Environment (ACE) 2.0

- Key Objectives
  - Improved Trade Facilitation
  - Enhanced Data Sharing and Integration
  - Increased Supply Chain Transparency
  - Improved Trade Enforcement Management
  - Enhanced Anomalous Trade Detection
- DID/VC Focus
  - Framework to identify legitimate actors
  - Verify **trade document claims presented as Verified Credentials** (W3C CCG Traceability Vocabulary)
  - Enable a privacy-protected international exchange of trade information

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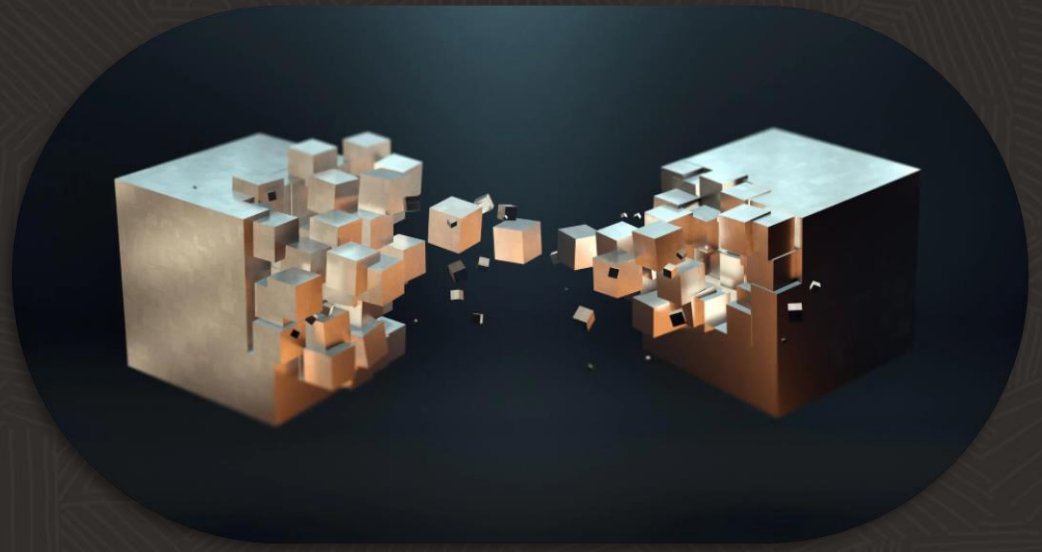
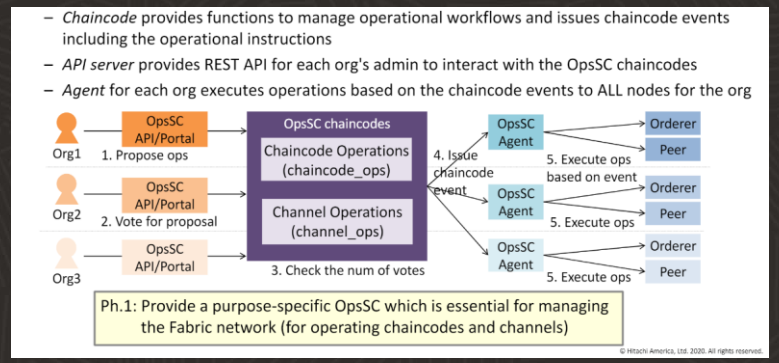
Concluding Thoughts on Technology Cross-Pollination

- Web3 technologies – tokenization, decentralized identity, decentralized governance – have value in enterprises and government organizations
- These technologies are not inherently limited to specific blockchains
  - Tokenization is possible without Bitcoin or Ethereum
  - Decentralized identity is possible without Hyperledger Indy
- Their adoption in enterprises, in part, depends on enterprise-focused blockchain infrastructure delivering these capabilities, meeting enterprise IT requirements
- Enterprise blockchain success depends on supporting Web3 technologies, but also providing:
  - Cross-ledger interoperability
  - Stronger mechanisms for asset portability across ledgers
  - Flexible governance controlled by configurable policies rather than hardwired in the architecture



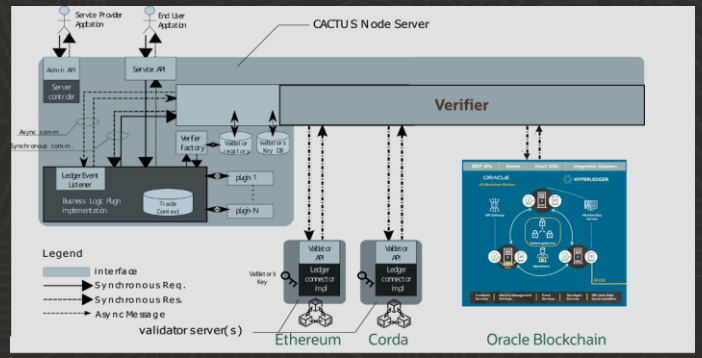
Exploring Other Hyperledger Projects

Operations Smart Contract (OpsSC) Hyperledger Lab



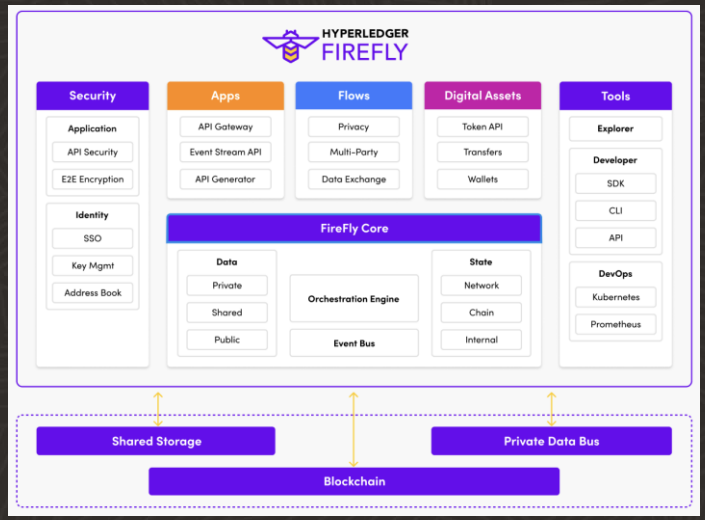
- Initially focused on governance of deployment or upgrade of smart contracts
- Can be extended to cover broader range of governance needs
  - Who can join as members of the consortium?
  - What can members do?
  - How can members be added or removed?
  - Who can create channels?
  - Who must approve new member joining a channel?
- Asymmetric voting rights, veto capabilities
- All proposals, votes, decisions and actions must be recorded in a ledger

HYPERLEDGER CACTI



- Cross-Ledger integration "service bus" with ledger-specific connectors
- Leverage as integration orchestration layer in front of Oracle Blockchain
- Extend with 2PC/XA transactions support

HYPERLEDGER FIREFLY

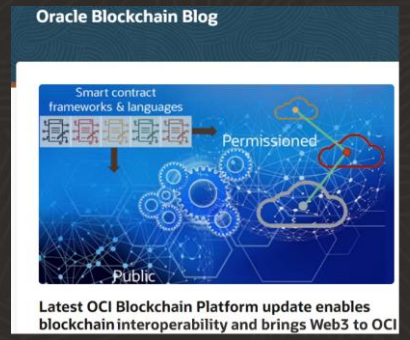


- Consortium orchestration and Web3 gateway mode for public chains
- Enables hybrid architectures using public + permissioned chains
- Abstracts out Web3 gateway functions across multiple public chains via FireFly Transaction Manager (EVM connector) and FireFly Signer (using non-custodial private keys)

Related Blog Posts & Solution Materials

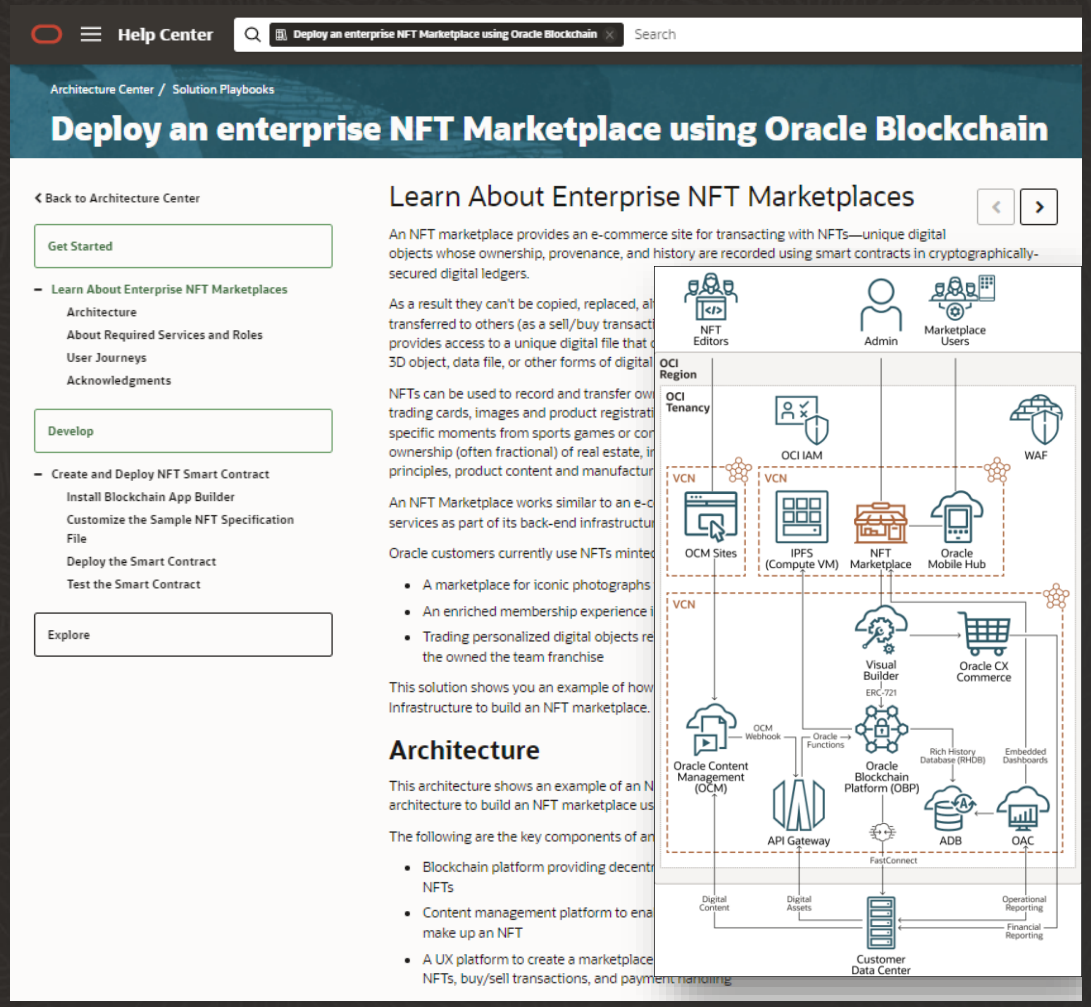
https://blogs.oracle.com/blockchain/post/announcing-nft-support-for-oracle-blockchain-platform

https://blogs.oracle.com/blockchain/post/how-to-implement-nfts-on-oracle-blockchain



https://blogs.oracle.com/blockchain/post/blockchain-interoperability-is-the-focus-of-december-obp-update

Solution Playbook on OCI Architecture Center
https://bit.ly/oracle_blockchain_livelab



Getting Started

Learn

http://oracle.com/blockchain
http://developer.oracle.com/blockchain

Try

30-Day Free Trial

Free credits you can use for Blockchain & other OCI services:
https://www.oracle.com/cloud/free

30-min Experience

1. Create account/OCI tenancy
2. Provision OBP instance
3. Deploy Sample Token Chaincode
4. Mint/Transfer via UI or REST APIs

Additional Resources

Oracle Blockchain Blog & News:
blogs.oracle.com/blockchain

Oracle Blockchain Videos:
Youtube: Oracle blockchain channel

App Builder Documentation:
https://docs.oracle.com/en/cloud/paas/blockchain-cloud/usingoci/using-chaincode-development-tools.html

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.

Download OBP Enterprise
https://www.oracle.com/blockchain/blockchain-platform-enterprise-edition/

Q & A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