The following is intended to outline our general product direction. It is intended for information purposes only, and may not be incorporated into any contract. It is not a commitment to deliver any material, code, or functionality, and should not be relied upon in making purchasing decisions. The development, release, timing, and pricing of any features or functionality described for Oracle’s products may change and remains at the sole discretion of Oracle Corporation.

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Oracle Delivers an Enterprise-ready Blockchain

1. Adopt a Permissioned Blockchain offering
2. Make it (really) Enterprise-Ready
3. Offer it as a Service
4. Connect with Applications

- Easy-to-Deploy
- Easy-to-Integrate with back-office
- Easy-to-Control Member Access
- Easy-to-Monitor and Manage
- Easy-to-Add Members in Cloud and On-Prem

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Key Components of a Blockchain System

Applications
- Register users
- Invoke smart contracts to update or query data
- Consume events

Smart Contracts
- Business logic to update the ledger
- Query data
- Publish events

Blockchain Infrastructure
- Network of validating nodes
- Distributed Ledger
- Membership services (for permissioned)
Oracle Blockchain Platform
Hardened for enterprise applications

Oracle Blockchain Platform Cloud Service

- 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
- Confidentiality (Channels, Collections)

- Open Source Hyperledger Fabric
- Consensus (Kafka)

Oracle Cloud Infrastructure and PaaS Services

- Container Services
- Identity Management
- Events
- Management Services
- Data Services

Oracle-managed PaaS

Pre-Assembled
Open
Plug and Play Integrations
Enterprise-Grade
Automated DevOps

Hyperledger Fabric Peers in customer data centers or 3rd party clouds

On-Premises Apps

OBP Enterprise Edition
On-premise nodes for private ledger data

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**Major OBP Added Value In and Around Hyperledger Fabric**

**Provisioning & Integration in Oracle Cloud**
- Pre-assembled, template-based provisioning
- Incorporates infrastructure dependencies via Oracle Cloud Services (managed containers, VMs, identity management, block and object storage, Kafka)

**Oracle Managed Service**
- Oracle operations monitoring
- Managed patching/updates
- Embedded ledger and configuration backups

**IDCS Integration**
- User/role management
- Authentication for BCS Console, REST Proxy, CA

**Object Store Integration**
- Configuration backup, archiving ledger blocks

**REST Proxy**
- Supports rich set of Fabric APIs via REST calls
- Enables synchronous invocation as well as events/callbacks and DevOps operations
- Simplifies integration and insulates applications from underlying changes in transaction flow

**Management/Operations Console**
- Automates many administration tasks
- Dynamic configuration with server restart
- Monitoring and troubleshooting

**Ledger DB replaced by Berkeley DB**
- CouchDB rich query support at LevelDB performance
- SQL-based rich query support and results validation at commit time

**Rich history database**
- Shadows transaction history to DBaaS and hooks up with Analytics/BI (e.g., OAC or 3rd party tools)
Identities in Oracle Blockchain Platform

- Identities stored in Oracle Identity Cloud Service (IDCS)
- Application roles (approles) determine REST permissions
  - Who can access console, use REST Proxy, etc.
- Identities can have attributes, key/value pairs
- Ultimately results in an enrollment certificate
  - Typically issued by Fabric-CA
  - Used to sign messages
  - Includes attributes
Fine Grained Access Control

- Upcoming feature in OBP
- Allows defining:
  - Identity patterns – X.509 fields, OU, CN, e.g. CN="Todd Little"
  - Groups of identity patterns
  - Resources – arbitrary application named entities
  - Access control lists
    - List of identity patterns that can or cannot perform some operation on a resource
- Information stored in world state
  - Makes it persistent and auditable
- Enforcement up to chaincode, not the platform!
Creating a Rich History Database

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.

The Rich History DB is just an index.

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.
Oracle Blockchain Platform Enterprise Edition

On-premise blockchain solution for customers who must meet data sovereignty or data residency regulations

• **Deploy Oracle Blockchain in your data center**
  – Choice of virtualization platforms: VMware, OLVM
  – Enterprise-grade with HA and Dynamic Scalability

• **Create Blockchain network with a few clicks**
  – Fully pre-assembled with Hyperledger Fabric 1.4, Blockchain Platform Manager, Operations Console, REST Proxy, Identity Management

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

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Open, Flexible Deployment Options
On-Premise, Multi-Cloud, & Hybrid

Private Deployment
On-Premises Blockchain Network

Cloud Service
Multi-Cloud Blockchain Network

Cloud Service
Hybrid Blockchain Network

OBP Enterprise Edition
Hyperledger Fabric open source

HLF in a 3rd Party Cloud

OBP Cloud Service in OCI

OBP Enterprise Edition in a 3rd Party Cloud

HLF in a 3rd Party Cloud

HLF in a 3rd Party Cloud

OBP Enterprise Edition

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Flexible, Global Blockchain Network Topologies

**Available**
- Mumbai
- Toronto
- Seoul
- Tokyo
- London
- Phoenix, AZ
- Frankfurt
- Ashburn, VA

**In Plan**
- Zurich
- Sao Paolo
- Sydney
- Jeddah
- Osaka

**Oracle Cloud Datacenters**

**Customer Datacenters**
- Oracle Blockchain Platform Enterprise Edition (on-premise)

Open source deployed on-premises or on a 3rd party cloud

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# Oracle Blockchain Platform Roadmap

<table>
<thead>
<tr>
<th>Q1, CY20</th>
<th>Q2, CY20</th>
<th>Q3, CY20 &amp; Beyond</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OBP Enterprise</strong></td>
<td><strong>OBP Cloud &amp; Enterprise</strong></td>
<td><strong>OBP Cloud</strong></td>
</tr>
<tr>
<td>• Support for Active Directory and Oracle Directory in addition to OpenLDAP</td>
<td>• Fine-grained access control</td>
<td>• Fabric 1.4.4 &amp; RAFT</td>
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<tr>
<td></td>
<td>• Enhanced compatibility with CouchDB query</td>
<td>• Granular, on-demand scalability</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Instance deployment across multiple ADs for better HA/DR</td>
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<td></td>
<td></td>
<td>• OCPU based pricing model</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Multi-region HA &amp; DR</td>
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<td></td>
<td></td>
<td>• Migration across platforms</td>
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<tr>
<td></td>
<td></td>
<td>• Ability to stop/restart an instance</td>
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Oracle and Partner Ecosystem Investments

Recent Oracle Solutions

- Intelligent Track & Trace (ITT)
- Frictionless Intermodal Transit (FIT)
- FLEXCUBE Blockchain Adapters

Oracle SaaS
Oracle Intelligent Track and Trace Vertical GBU Apps

Oracle Blockchain Platform

- Consensus
- Smart Contracts
- Distributed Ledger
- Confidentiality
- App Integrations
- Data Repository
- Off-chain Sync
- DevOps
- Governance
- Access Control
- Interoperability

Oracle Cloud Infrastructure

On-Premises Deployment

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Oracle and Partner Ecosystem Investments

- **Custom Applications**
- **Oracle SaaS**
- **Oracle Intelligent Track and Trace Vertical GBU Apps**
- **Oracle BlockChain Platform**
- **SI Solution Accelerators**
- **Recent Solutions**
  - **TechM**
    - Aviation Records Management
  - **Deloitte**
    - Intercompany Reconciliation & Settlement;
      Digital bio seal and tax stamp tracking in manufacturing
  - **Infosys**
    - Sustainable Agriculture w/Rewards System

**Oracle Cloud Infrastructure**

**On-Premises Deployment**

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Oracle and Partner Ecosystem Investments

Oracle Cloud Infrastructure

- On-Premises Deployment

Oracle SaaS
- Oracle Intelligent Track and Trace
- Vertical GBU Apps

Custom Applications

- Health Insurance
- Retail
- Health Sciences
- Mobility

Audience Data Cloud

SI Solution Accelerators

ISV Applications

Oracle Blockchain Platform

- Consensus
- Smart Contracts
- Distributed Ledger
- Confidentiality
- App Integrations
- Data Repository
- Off-chain Sync
- DevOps
- Governance
- Access Control
- Interoperability

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Oracle Blockchain Solution Providers and ISVs

- **Sydema**: Non-performing Loans Marketplace
- **TradeFin**: Order-to-Cash
- **ICS**: Core banking connector
- **norbloc**: Bank KYC
- **Neurosoft**: Invoice Factoring; Health Records Sharing underbanked & unbanked

- **Seres**: Franchise document exchange
- **Dhimahi**: Sports Team Loyalty Solution
- **PRAVICI**: Multi-brand Loyalty Systems & Mobility
- **eMcrey**: Point-of-Sales On-boarding
- **kompany**: Business KYC Information Register

- **Circular**: Conflict minerals & sustainable supply chain traceability
- **retraced**: Supply Chain Traceability in Fashion
- **HEALTHSYNC**: Remote Patient Vitals Monitoring
- **origintrail**: Trusted supply chain exchanges
- **sofbang**: Contracts Mgmt.

- **Wiscoin**: 3rd party Certification Authority
- **Chainlink**: Middleware for integrating “oracles”
- **Hacera**: DAML-on-Fabric SDK; Cross-blockchain Integrations
- **O-chain**: Decentralized off-chain storage platform

**EduChain** — a personal certification ledger for Higher Ed

**Business Solutions**

**Technology Solutions**

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1. Customer being onboarded supplies data to solarisBank
2. solarisBank uses the kompany API to request data and documents for KYC
3. kompany takes metadata of the request and adds a certified timestamp
4. kompany fulfills the request by contacting the relevant company register
5. kompany takes metadata of the response and adds a certified timestamp
6. kompany passes a hash of the request and response metadata and timestamps to an Oracle Cloud Infrastructure based service which stores it on an Oracle Cloud based Blockchain
7. kompany passes the KYC response and the hash to solarisBank
8. solarisBank stores the data and the hash and passes the decision to the customer

The whole process ensures that there is an irrefutable audit trail of the onboarding checks performed by solarisBank including proof of the request contents and timing, and proof of the response contents and timing.
Oracle Database Blockchain Tables
Insert-only table type with cryptographically-linked rows
What is a Blockchain Table?
Highly tamper-resistant persistence option in Oracle Database

Blockchain Table is an insert-only Oracle table that is highly tamper-resistant:

- New CREATE BLOCKCHAIN TABLE and ALTER TABLE DDL, PL/SQL packages, and SYS-owned dictionary tables
- Rows in blockchain tables cannot be updated or deleted via DML or internal API’s
- Chains rows via a cryptographically secure hash (using previous row’s hash and current row contents), which enables detection of tampering (fraudulent updates or deletes by other users or administrators)

Provides higher levels of tamper-resistance by:

- Periodically copying cryptographic hashes to external stores
- Allows parties to sign row contents (including its hash) after it’s inserted using user’s private key
## Comparing Blockchain Table to Oracle Blockchain Platform

<table>
<thead>
<tr>
<th>Capability or Feature</th>
<th>Oracle Blockchain Table</th>
<th>Oracle Blockchain Platform</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chained, append-only data</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Digitally signed updates</td>
<td>Optionally, PKI-signed rows</td>
<td>PKI-signed transactions</td>
</tr>
<tr>
<td>Distributed, replicated store</td>
<td>Centralized store model, with external copies</td>
<td>Fully distributed ledger (DLT)</td>
</tr>
<tr>
<td>Data pruning, archiving</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Multi-signature, decentralized</td>
<td>No</td>
<td>Yes, multi-party endorsements</td>
</tr>
<tr>
<td>trust</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Programming Model</td>
<td>SQL &amp; PL/SQL</td>
<td>Smart Contracts</td>
</tr>
<tr>
<td>Open Standards</td>
<td>SQL-based access in Oracle Database</td>
<td>Open source-based implementation using Linux Foundation’s Hyperledger Fabric</td>
</tr>
<tr>
<td>Infrastructure required</td>
<td>Oracle Database 20c</td>
<td>Pre-assembled Oracle Blockchain Platform (Cloud Service or On-Premises)</td>
</tr>
<tr>
<td>Application integration</td>
<td>SQL, PL/SQL, JDBC, etc.</td>
<td>REST APIs and client SDKs</td>
</tr>
<tr>
<td>Use Case Examples</td>
<td>Centralized immutable txn log/audit trail, compliance data (e.g., SOX 404), financials / accounting ledger tables, legal hold data, centralized chain of custody or provenance</td>
<td>Decentralized record keeping/audit trail, supply chain provenance &amp; authenticity, multi-party exchange transactions, digital identity, multi-party matching &amp; reconciliation</td>
</tr>
</tbody>
</table>

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Recommended Reading & Learning

Oracle Blockchain Quick Start Guide
A practical approach to gain Blockchain prowess in an Enterprise

Expert Insight
Robert van Mölken
Blockchain across Oracle
Understand the details and implications of the Blockchain for Oracle developers and customers

What you will learn
- Describe Business Blockchain and Distributed Ledger Technologies to audiences with varying experience
- Blockchain impact and potential for change around the world
- Demonstrate some of the immediate blockchain use cases in technology, business, and enterprise products and institutions
- Gain familiarity with current Hyperledger projects and cross-industry use cases