

## MARKET PERSPECTIVE

# Blockchain Platform as a Service Getting Traction in Europe: A Deep Dive on Leading BPaaS Players

Carla La Croce

Radoslav Dragov

## EXECUTIVE SNAPSHOT

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### FIGURE 1

#### Executive Snapshot: Blockchain Platform as a Service Getting Traction in Europe – A Deep Dive on Leading BPaaS Players

This IDC Market Perspective examines the four biggest cloud providers in light of providing blockchain platform-as-a-service (BPaaS) solutions. The flexibility of a BPaaS solution is enormously valuable. By favoring this model, companies can take advantage of the benefits of blockchain technologies without having to develop their own blockchain infrastructures, avoiding the need of developing, maintaining, and upgrading their own systems and software.

#### Key Takeaways

- BPaaS has gained significant traction in recent years among established global players. With this model, customers will be able to focus more on core business functionalities and strategies while relying on the PaaS partner to manage the blockchain infrastructure and performance.
- PaaS is the most suitable delivery mode for blockchain. It can be attractive because providers can manage and develop the IT infrastructure and the software that runs it.
- IBM, Microsoft, and Oracle are setting the pace in Europe for many BPaaS features analyzed in this document, while AWS is catching up in different areas such as interoperability and multicloud deployment.

#### Recommended Actions

- **Provide a complete, full-stack, modular, and easy-to-use solution.** Since enterprises are demanding full-stack enterprise services, it is important to identify what clients need and provide them a flexible full-stack platform.
- **Collaborate with competitors to have interoperability and multicloud support as common standards.** Start thinking about how to collaborate to surpass some lock-in features that can act as obstacles for clients.
- **Enrich industry and use-case coverage.** As blockchain becomes more well known and adopted, offerings should evolve in terms of possible use case coverage.

Source: IDC, 2020

## NEW MARKET DEVELOPMENTS AND DYNAMICS

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The successful features of blockchain accelerated its adoption in the past few years. According to the *IDC European Tech and Industry Pulse Survey, 2019-2020*, there has been a significant increase in terms of adoption of blockchains and distributed ledger technologies (DLTs) in all industries and countries. The percentage of companies not familiar with blockchains and DLTs was very high in the past several years. IDC stressed the importance and need for education on blockchains and DLTs, the benefits they can bring, and their suitability for business purposes. Survey results were very positive, because companies not familiar with the technology – and companies that don't understand it – decreased significantly. Companies now understand more clearly if blockchain can address their business needs or if there are other more suitable solutions for their issues. Although the need for education is still present, blockchain adoption increased within many industries, from the financial sector to manufacturing and transport, especially in the past two years. Before the COVID-19 pandemic, IDC's Worldwide Semiannual Blockchain Spending Guide 2H19 forecast that European blockchain spending would reach \$1.4 billion in 2020, with a healthy 58% compound annual growth rate (CAGR) to 2023; the financial sector will account for nearly 40% of the market, growing more than the average in 2020. COVID-19 exerted some pressure on blockchain investments, with some projects paused (particularly those not related to short-term ROI) for the meantime. But according to the latest IDC Worldwide Semiannual Blockchain Spending Guide, published in August 2020, blockchain spending in Europe remains healthy (48% CAGR in 2024) despite being affected in 2020 by the COVID-19 crisis; 2020 growth is expected to be 57% (from 78% pre-COVID-19).

Blockchain matters because no business operates in isolation. It is a fundamental ecosystem technology that has been able to create synergy among partners within the same ecosystem. Open source organizations, consortia, developers, and institutions pushed for continuous innovation to make blockchain ready for enterprise and create new transformative business models.

### Blockchain Platform-as-a-Service Solutions

Despite the growing popularity and awareness of blockchain in the business world, there are still some barriers to blockchain adoption. For example, technical complexities and costs connected to creating, configuring, and maintaining a blockchain infrastructure are often seen as a barrier.

The development of and support for modern software applications can be very complex. Companies need to regularly update the app to address security issues and improve features to meet customer demand. Maintaining and upgrading the platform for the app (i.e., operating systems, servers, networks, and so on) as well increases complexity. A platform-as-a-service (PaaS) solution can help in this direction, as it helps companies focus on developing software or providing other services to customers without having to manage, update, and maintain the platform that hosts the application.

This is also happening in the blockchain space with blockchain as a service (BaaS), originally defined by IDC as the provision of infrastructure, platform, and software services (PaaS, infrastructure as a service or IaaS, and software as a service or SaaS) by a third party to assist clients with the development and/or management of their blockchain initiatives. In this document, we will focus on the provision of BPaaS, a model that enables companies to build and develop blockchain-based applications by accessing a blockchain provider's services.

BPaaS has gained significant traction in recent years among established global players as it enables customers to focus on core business functionalities and strategies while relying on PaaS partners to manage the blockchain infrastructure and performance. Blockchain technology has moved well beyond its best-known use in cryptocurrency transactions and found wider application in multiple industries. Therefore, there is a demand for hosting services.

BPaaS makes blockchain adoption easier as it enables a third party to install and maintain blockchain networks. BPaaS has generated great interest, pushing main cloud providers to expand their cloud offerings. In the next section, we will describe the advantages of choosing a BPaaS solution.

## Advantages of Choosing a Blockchain PaaS Solution

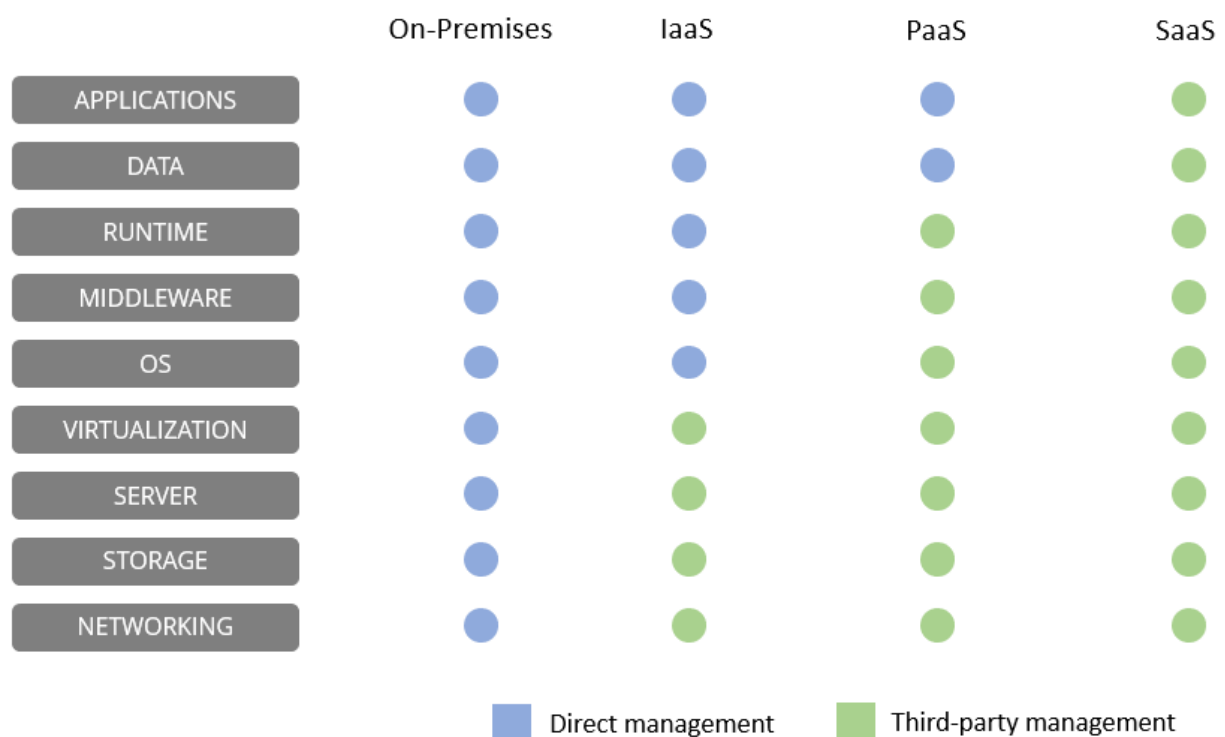
The three common models of cloud service are IaaS, PaaS, and SaaS.

- IaaS delivers cloud computing infrastructure, including servers, network, operating systems, and storage, through virtualization technology. With IaaS, clients are responsible for managing applications, runtime, operating systems, middleware, and data.
- PaaS solutions enable software creation, giving developers the opportunity to build software without managing operating systems, software updates, storage, or infrastructure.
- SaaS solutions provide software via the web, eliminating the need to download and install applications on each device. Everything is managed by a third party.

Figure 2 presents differences between companies' IT systems and process.

**FIGURE 2**

### Differences Between Deployment Modes



Source: IDC, 2020

Among these solutions, PaaS is the most suitable delivery mode for blockchain. It can be attractive because providers can manage and develop the IT infrastructure and the software to run it. PaaS is most often built on top of an IaaS platform to reduce the need for system administration. This unlocked the area of BPaaS, giving businesses the opportunity to experiment with blockchain apps and smart contracts while service providers managed the network. BPaaS helps companies focus on software development or the provision of other services to customers without managing, updating, and maintaining the platform that hosts the application. Since the PaaS model grants service providers

control over the infrastructure, it requires some degree of centralization and simplification (for use by developers).

For many businesses, the flexibility of a BPaaS solution is enormously valuable. With this model, companies can take advantage of the benefits of blockchain technologies (e.g., improved transparency and accountability, data security, and trust) without developing their own blockchain infrastructures, managing software updates or security patches, or investing in expensive in-house computing resources.

BPaaS is becoming very common in the blockchain market as it is a fast and cost-effective solution. It is a suitable solution for developers to create unique applications, avoiding the need of developing, maintaining, and upgrading their own system and software. The benefits of BPaaS include:

- **Time-effectiveness.** You can test and implement quickly, saving time.
- **Cost-effectiveness.** Since you do not have to maintain, upgrade, or replace systems and software, you save money.
- **Ease.** Users can run BPaaS without extensive system administration knowledge.
- **Scalability.** The provider can enable a more robust infrastructure if customers it and scale back when demand is low.
- **Accessibility.** Blockchain is accessible anywhere.
- **Availability (with virtually no downtime).** Everything the customer needs in a platform – operating systems, server software, firewall, and security systems – is managed and available all the time.
- **Third-party management.** As blockchain frameworks (primarily open source-based) evolve very rapidly, PaaS vendors take care of upgrades, compatibility, and other issues that customers would otherwise have to deal with on their own. With rapidly evolving open source-based solutions, letting major vendors do it frees up customers from a lot of effort and complexity.

BPaaS creates a secure platform for B2B collaboration based on a high-performance cloud platform. As long as BPaaS providers continue to make the use of blockchain easy and the implementation cost effective and time effective, blockchain adoption will remain healthy.

However, companies should assess downsides and limits before deciding to adopt a PaaS solution, such as the following:

- Since the PaaS model grants control over the infrastructure to the service provider, clients need to enable a certain degree of centralization, as transactions would need to pass through the host platform's blockchain services.
- When data resides in a third-party server, clients may be limited as they will not have direct access to security configuration systems.
- Clients risk losing internal know-how.
- If the provider has not provisioned migration policies or interoperability among different providers, clients may be locked in with no alternative options.
- Legacy systems would need to be customized to work with the PaaS service, thus requiring significant economic investment.

## Leading BPaaS Providers: A European Overview

The BPaaS market is broad, with several providers of different dimension providing their own solutions. BaaS providers include Alibaba Cloud, Amazon Web Services (AWS), Microsoft Azure, Hewlett Packard Enterprise (HPE), IBM, Jelurida, MultiChain, Oracle, SAP, Sovrin, and VMware.

The selection of a BPaaS provider is linked to the choice of cloud computing vendor partner, which maintains and runs the infrastructure. What distinguishes vendors is the ability to offer remote access to the cloud. Large technology companies (Amazon, IBM, Microsoft, Oracle) already offer blockchain services in different ways (either PaaS or SaaS, or both) so that clients can easily use this technology without facing high costs.

For the purpose of this document, we investigate the solutions offered by big cloud providers – AWS, IBM, Microsoft, and Oracle – that, considering their complete blockchain cloud PaaS offerings, are taking the lion's share in the BPaaS European landscape.

For this analysis, we assess some key features of BPaaS, such as:

- **Blockchain framework.** This document identifies the framework (e.g., Hyperledger, Ethereum) supported by the provider.
- **Cloud deployment and interoperability maturity.** This document determines the kinds of deployment (on-premises, public cloud, hybrid cloud) the vendor uses and analyzes its interoperability capabilities. Interoperability refers to the ability of disparate blockchain platforms to share, see, and access information and exchange assets with one another.
- **Scalability and security.** This document assesses the level of scalability the solution can reach and its security features.
- **European industry coverage.** This document highlights the key European industries the vendor focuses on and the use cases to which the BPaaS solution is applied.

## Amazon Managed Blockchain (AWS)

At the end of 2018, Amazon launched a managed blockchain service, which it opened for general availability in the second quarter of 2019. Amazon Managed Blockchain is a fully managed service that facilitates the creation and management of blockchain networks. It also eliminates the overhead required to create the network and security components, so that customers can create their blockchain networks that span multiple AWS accounts. This enables a group of members to execute transactions and share data without a central authority.

AWS partnered with the ConsenSys company Kaleido to provide a full-stack enterprise blockchain platform that supports the full blockchain life cycle, from exploration and proof of concept to production-ready business solutions. The aim is building complete enterprise blockchain solutions.

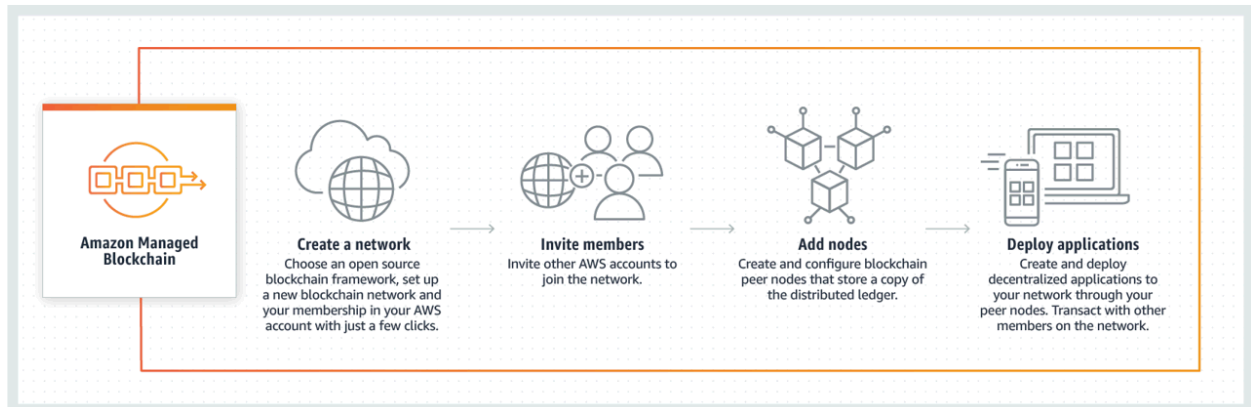
Amazon Managed Blockchain aims to remove some of the blockchain complexities, taking care of provisioning nodes, setting up the network, managing certificates and security, and scaling the network to meet increasing demand for millions of transactions. Amazon Managed Blockchain also monitors the network and automatically replaces poorly performing nodes.

In addition, Amazon Managed Blockchain can create an immutable copy of blockchain network activity into a fully managed ledger database, Amazon Quantum Ledger Database (QLDB), enabling users to analyze network activity outside the network and gain insights into trends.

Amazon provides full replication of blockchain network activity into the QLDB. Amazon QLDB keeps the complete history of all transactions in the blockchain network and enables customers to track data and gain information on network activity.

**FIGURE 3**

## Overview: Amazon Managed Blockchain



Source: Amazon, 2020

### *Supported Blockchain Frameworks*

Amazon Managed Blockchain supports the open source Hyperledger Fabric (available now) and Ethereum (available soon) frameworks. Clients can select their preferred framework and add members and their permissions to the network while Amazon manages the rest. AWS supports limited configurations (i.e., restrict networks to max of 14 members or three peer nodes each) at the moment, with expansion plans under consideration.

- Hyperledger Fabric is well suited for applications that require stringent privacy and permission controls with a known set of members.
- Ethereum is well suited for highly distributed blockchain networks where transparency of data for all members is important.

Alternatively, companies can also participate in a public Ethereum blockchain network.

### *Cloud Deployment and Interoperability Maturity*

Amazon Managed Blockchain runs on AWS Cloud. It enables users to launch blockchain networks using the Hyperledger Fabric open source framework, so it presumably provides some compatibility with other solutions using the same framework, though Amazon has not specified this detail. The same will apply for Ethereum once Amazon launches support for it.

### *Scalability and Security*

Amazon Managed Blockchain can scale a blockchain network as the usage of applications on the network grows over time. When a network member needs extra capacity to create and validate transactions, the member can add a new peer node using Amazon Managed Blockchain's APIs. Amazon Managed Blockchain provides a selection of instance types that encompass different combinations of CPU and memory to enable the flexibility to choose the appropriate mix of resources for the current workload. Amazon Managed Blockchain claims that its blockchain networks can automatically scale to handle thousands of applications running millions of transactions.

Amazon Managed Blockchain secures users' network certificates with AWS Key Management Service (KMS) technology, eliminating the need for customers to set up their own secure key storage. KMS is a managed service that enables users to easily create and control keys used for cryptographic operations. It enables clients to identify who is responsible for securing data across the AWS service. Through KMS, developers that need to encrypt data in applications or digitally sign/verify data using



asymmetric keys could also identify who is responsible for proving data security for regulatory or compliance purposes. KMS provides a highly available key generation, storage, management, and auditing solution for clients to encrypt or digitally sign data within their own applications or control data encryption across AWS services.

## ***European Industry Coverage and Use Cases***

### **Process Manufacturing: Food Origin Tracking**

Transparency in supply chains from manufacturers to consumers is increasingly important. Using Amazon Managed Blockchain, such businesses can implement a blockchain across their supply chain networks, providing greater transparency and real-time recording and tracking of goods from one party to another. For example, Nestlé has begun to release information on its supply chain for coffee. Using blockchain technology, it has enabled more precise tracking.

### **Discrete Manufacturing: Automotive Asset Provenance**

The automotive industry's international supply chains are highly complex. They generally involve numerous players at different delivery stages and often undergo rapid changes. For this reason, considerable effort may be needed to clearly track a component's origin. Since transparency is fundamental when it comes to the supply of batteries or batteries' components, BMW Group has combined blockchain and cloud technologies by using Microsoft Azure and AWS to track the provenance of a component without permitting any manipulation, leveraging Amazon QLDB for maintaining data integrity.

### ***IBM Blockchain Platform (IBM)***

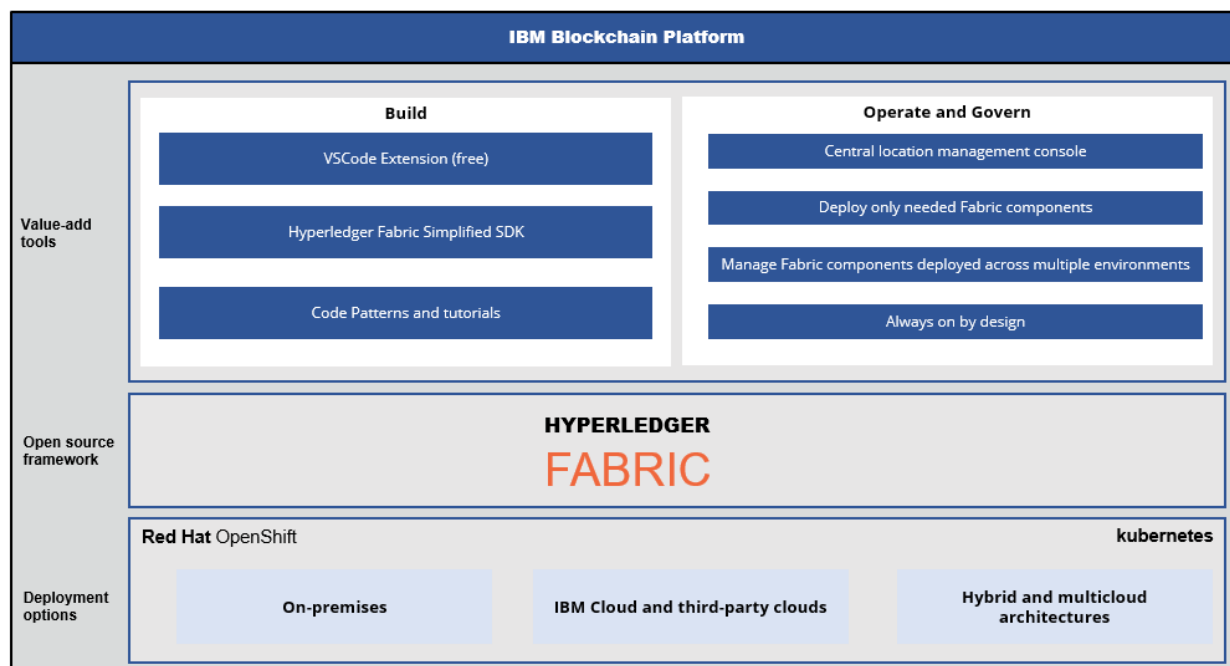
The IBM Blockchain Platform provides a managed, full-stack blockchain-as-a-service offering. It enables customers to create a blockchain network, providing an easy-to-use interface to manage networks, channels, and smart contracts. It also offers customers the performance and security necessary for demanding use cases in regulated industries.

IBM's platform is founded on Hyperledger Fabric, which in turn was established under the Linux Foundation; IBM is a founding member of the Linux Foundation Hyperledger Project. Open source gives consortium members the chance to develop their own client applications to interact with the blockchain networks on the platform. The IBM Blockchain Platform builds on Hyperledger Fabric by providing a fully managed and supported, full-stack blockchain-as-a-service offering delivered with flexible deployment options. It provides the ability to deploy and connect components across different cloud environments, such as IBM Cloud, on-premises, and third-party clouds.

As Figure 4 shows, the IBM Blockchain Platform was designed using Kubernetes container architecture, making it easy to deploy a blockchain solution into any public cloud or on-premises infrastructure. The IBM Blockchain Platform is also optimized for Red Hat OpenShift, which helps developers create applications that can be run on hybrid or multicloud environments.

**FIGURE 4**

## Overview: IBM Blockchain Platform



Source: IBM, May 2020

### *Supported Blockchain Frameworks*

IBM Blockchain Platform is a commercial distribution of the Hyperledger Fabric framework, enabling members to model, create, and operate networks with the performance and security necessary for many use cases in regulated industries.

### *Cloud Deployment and Interoperability Maturity*

The IBM Blockchain Platform enables customers to deploy and maintain peers and other Hyperledger components in different computing environments. The IBM Blockchain Platform supports public and private clouds, such as IBM Cloud, clients' own datacenters, and third-party public clouds.

This multicloud capability helps connect different organizations regardless of infrastructure, thus empowering the blockchain business ecosystem.

In 2019, IBM revealed several upgrades to the IBM Blockchain Platform, most significantly that the next generation of the platform can run on multiple cloud networks such as AWS and Microsoft Azure. With IBM's "blockchain anywhere" strategy, networks running Hyperledger Fabric-based IBM Blockchain Platform can operate nodes across multiple cloud providers.

The first option, IBM Blockchain Platform on IBM Cloud, gives customers control over deployments and certificates and provides multicloud flexibility, as it connects nodes running in any environment (on-premises, public, hybrid clouds).

The second option, IBM Blockchain Platform for hybrid and multicloud, enables clients to run some workloads in their own datacenters or private clouds, behind their own firewalls or in third-party clouds.

IBM Blockchain Platform provides freedom of action over the network, enabling interoperability with other vendors that provide Hyperledger; this addresses the need for interoperability among a set of



platform offerings from different providers. Customers that have already chosen their cloud or blockchain platform providers could ask to join a different blockchain platform provider using open source Hyperledger Fabric.

IBM Blockchain Platform seeks to preserve interoperability by not modifying the core components of Hyperledger Fabric. Customers that use the IBM Blockchain Platform to deploy and operate their blockchain nodes can still connect to other Fabric networks.

- IBM and Oracle have worked to make their Fabric blockchain nodes interoperable and have achieved this in live networks such as MiPasa.org.
- IBM and Microsoft are adopting data standards developed by GS1 to enforce interoperability in their blockchain applications for supply chains.

## ***Scalability and Security***

Blockchain users across industries need solutions that scale as they move from initial explorations and proofs of concept to production projects.

Many aspects of scalability depend on network configuration of consensus, membership, and security, and Hyperledger Fabric enables scalability and consensus for production networks. The IBM Blockchain Platform leverages Hyperledger Fabric, which was built to support increasing demand from growing business networks that require more participants and handle more transactions.

## ***European Industry Coverage and Use Cases***

### **Transportation: Trade and Shipping**

A paper-intensive sector will undergo changes thanks to the TradeLens consortium. TradeLens aims at transforming container logistics by freeing companies from legacy data systems and manual document handling. Danish shipping conglomerate Maersk announced to have other major shippers such as CMA CGM and Mediterranean Shipping Company (MSC) coming on board. TradeLens consortium now encompasses almost half of the world's cargo container shipments.

### **Process Manufacturing: Food Origin Tracking**

IBM Food Trust is IBM's blockchain solution applied to food supply chains. For example, Nestlé, Coop Italia, and Gruppo Grigi are using IBM Food Trust to bring transparency to their supply chains. QR codes in product packaging enable customers to read the full history of the product. Carrefour also plans to implement this solution.

### **Banking: Trade Finance**

In financial services, IBM has become a shareholder in we.trade, the trade finance platform jointly owned by 12 European banks. The platform, which went live in 2018, was formed to help European small and medium-sized enterprises (SMEs) gain better access to trade finance. IBM has been the project's technology partner from inception. More banks and insurance companies are expected to join the consortium. The platform is also developing interoperability with a peer Asian platform, eTradeConnect, the trade finance blockchain consortium facilitated by the Hong Kong Monetary Authority (HKMA).

### **Discrete Manufacturing: Mineral Provenance Validation**

iPoint-systems GmbH is a software and consulting service for product compliance and sustainability. It started a pilot on IBM Cloud to launch a blockchain network that validates the provenance of minerals used in manufacturing and trace minerals from mines in conflict-affected and high-risk areas. Blockchain technology can help in this use case by providing an immutable record and a digital twin of resources as they move through the supply chain.

## Azure Blockchain Services (Microsoft)

Microsoft is a pioneer in providing blockchain services. Overall, the Microsoft Azure blockchain offering is a fully managed ledger service that enables users the ability to build, govern, and expand blockchain networks at scale in Microsoft's Azure cloud computing service.

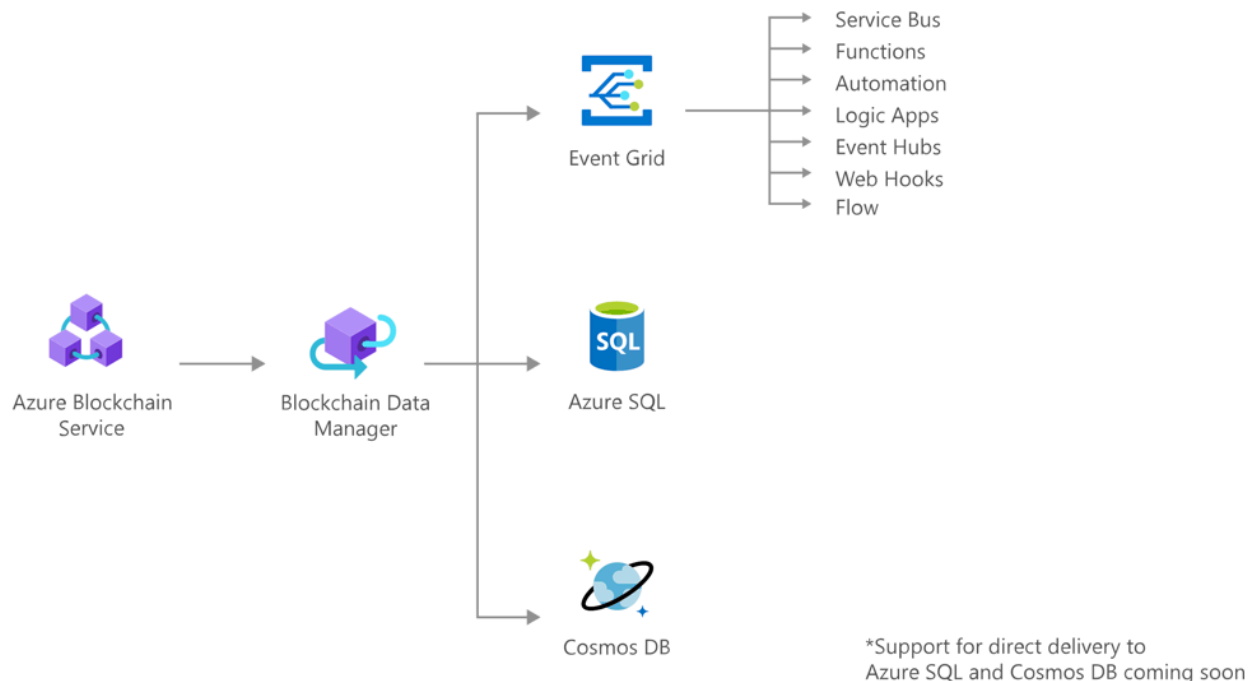
Microsoft Azure blockchain products and services include three products:

- **Azure Blockchain Service.** This is the starting point for prototyping applications. It enables users to create their own consortium networks and applications using prebuilt networks and software.
- **Azure Blockchain Workbench.** This is the foundation for building, governing, and deploying fully managed blockchain networks and applications at scale, reducing the time for development with respect to creating an in-house solution. This includes automatic ledger deployment, network construction, and pre-built blockchain commands.
- **Azure Blockchain Development Kit.** This is a comprehensive GitHub repository of developer blockchain content, including code samples and accelerators.

Overall, Azure Blockchain Service provides network deployment and operations, built-in consortium management, and the ability to develop smart contracts with familiar development tools.

FIGURE 5

### Overview: Azure Blockchain Service



Source: Microsoft, 2020

### Supported Blockchain Frameworks

A distinguishing feature of Microsoft Azure Blockchain Service is the extended framework support. It supports four prominent blockchain frameworks: Ethereum, Quorum, Corda, and Hyperledger Fabric.

It is also not limited to these frameworks, as Azure Blockchain is set to add support for other ledger protocols. So far, Microsoft Azure Blockchain Service offers the largest variety of frameworks.

### ***Cloud Deployment and Interoperability Maturity***

Azure Blockchain Service builds on Azure Cloud. Below are some of the latest developments in terms of its cloud deployment and interoperability maturity:

- In 2019, Microsoft and SAP announced a blockchain technology partnership. The partnership provides greater flexibility to construct and implement blockchain solutions that leverage SAP Cloud Platform Blockchain service on Microsoft Azure's cloud infrastructure and link with the Azure Blockchain Service. Integration between the two blockchain consortium solutions makes it easy for customers to form consortiums with companies running either Azure Blockchain Service or SAP Cloud Platform Blockchain solutions.
- In June 2019, Microsoft and Oracle jointly announced a cloud interoperability partnership that enables customers to take advantage of low-latency, high-throughput direct connection between Oracle Cloud and Azure datacenters. The connection between datacenters improves the performance of blockchain networks that span Hyperledger Fabric instances across the two companies' cloud infrastructures. This partnership will be particularly useful for partners that already have significant investments in Oracle and Microsoft products and services for supply chain management – the two companies' cloud interoperability partnership brings advantages to sticking with the vendors they know rather than changing platforms.
- Microsoft and IBM are adopting data standards developed by GS1 to enforce interoperability in their blockchain applications for supply chains.

### ***Scalability and Security***

Azure Blockchain Workbench was introduced with tools that establish a scalable and integrated blockchain development environment. Moreover, identity management is ensured with the help of the Azure Active Directory. Transaction nodes are secured through firewall rules and require configuration for access. All transaction nodes encrypt data in motion via Transport Layer Security (TLS), which provides privacy and data integrity.

### ***European Industry Coverage and Use Cases***

#### **Farming: Tracking Crops from Farm to Fork**

Family-owned Swiss company Bühler wanted to track crops from farm to fork with new levels of food safety, traceability, transparency, and data intelligence. The company is doing that by combining the power of its thought leadership in food processing with Microsoft's expertise on intelligent cloud technologies, including artificial intelligence (AI), Internet of Things (IoT), and blockchain. Bühler started with Whitworth Brothers, a well-known miller in the U.K.; the miller will use Microsoft Azure Blockchain Workbench to digitize a largely paper-based manual process to transport grains safely so all players along the supply chain can ensure crops are digitally verified.

#### **Finance: Marine Insurance**

Blockchain is also used to solve the marine insurance problem through its unique features such as transparency and immutability. Insurwave, a SaaS platform provider that connects insurance buyers, brokers, and sellers, was created by big players (including EY, Guardtime, Maersk, and R3) to offer the world's first marine insurance blockchain platform.

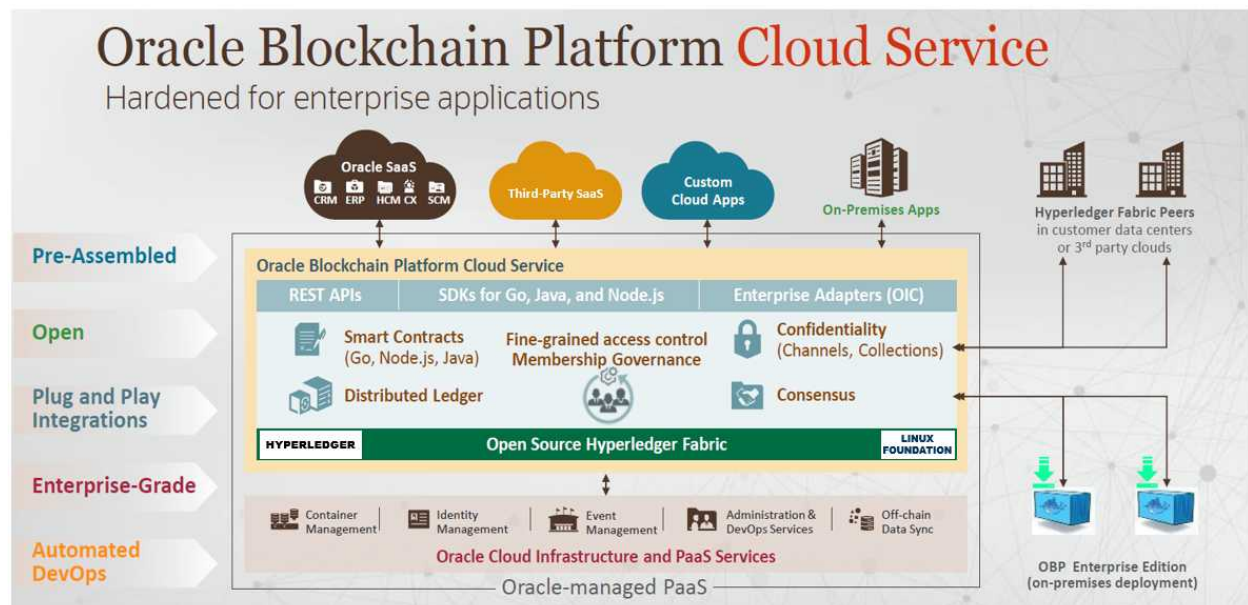
### ***Oracle Blockchain Platform (Oracle)***

Oracle launched Oracle Blockchain Platform (OBP) PaaS in mid-2018. Oracle Blockchain Platform is a pre-assembled complete, production-ready platform that provides customers with everything required to create a secure and trusted blockchain network. It is based on the Hyperledger Fabric architecture.

Oracle Blockchain Platform is designed for continuous operation as a secure, resilient, and scalable platform with continuous monitoring and automated recovery of all network components and continuous replication of configuration changes. It can integrate with Oracle SaaS and third-party apps, as well as other Oracle Cloud Platform services or other blockchain networks. This makes it easy for customers to attach smart contracts and tamper-proof distributed ledgers to a larger business process or workflow. After initial provisioning of an OBP instance, customers can extend the blockchain network by adding other members running their own OBP instances or a compatible Hyperledger Fabric release outside of Oracle Cloud. Figure 5 provides an overview of the Oracle Blockchain Platform managed PaaS offering.

**FIGURE 6**

### Overview: Oracle Blockchain Platform



Source: [www.oracle.com](http://www.oracle.com)

Moreover, Oracle developed the Blockchain Platform Enterprise Edition (OBP EE) in mid-2019. The OBP EE is provided as a virtualized software appliance that can be deployed on premises or in a third-party cloud. It provides an enterprise blockchain solution for customers that want to meet data sovereignty or data residency requirements but operate in industries and countries where they can't deploy blockchain instances on Oracle Cloud. OBP EE gives them a pre-assembled platform for building and running smart contracts and maintaining a tamper-proof distributed ledger using an independently installable version of Oracle Blockchain Platform.

Oracle Blockchain Platform includes the following features:

- It has **business-ready blockchain applications** from Oracle and ISV partners.
- It is **pre-assembled**. It includes all the required blockchain network components and their dependencies (compute, storage, containers, identity management, events, etc.) with an integrated blockchain operations console and comprehensive API Ggateway with REST APIs and event-driven architecture for bidirectional integration. It reduces the time to setup.
- It is **open**. It is based on the open source Hyperledger Fabric and interoperates with other Fabric nodes from third-party vendors or other open source frameworks.

- It supports **plug-and-play integration**, leveraging many enterprise adapters available in Oracle Cloud for easy integration with Oracle apps and third-party applications (such as ERP, SCM, and CRM).
- It is **enterprise grade**, with 99.95% SLA support. It is ready for production enterprise applications with high availability and resilience and dynamic scalability for individual components or entire PaaS instances. It also provides integrated identity management and role-based security.
- It is **easy to use and manage** with an intuitive operations console and many DevOps REST APIs. In addition to the comprehensive Blockchain Console Web UI, OBP can be managed using Oracle Cloud Command Line Interface (CLI), SDKs, Ansible modules, and extensive REST APIs.
- It provides **Blockchain App Builder** to aid in development, testing, and deployment of smart contracts. It can generate chaincode from declarative specifications to support low-code/no-code needs.

### *Supported Blockchain Frameworks*

Hyperledger Fabric is the foundation for a complete cloud platform that includes infrastructure services along with embedded development resources such as compute, containers, storage, identity management network, and event streaming. Oracle Blockchain Platform can also stream transaction history updates on Oracle Database, including its Autonomous Data Warehouse (ADW), and provide powerful dashboards, visualizations, and reports using Oracle Analytics Cloud.

### *Cloud Deployment and Interoperability Maturity*

Oracle provides cloud and on-premises offerings for customers and developers that want to build their own solutions. Its offerings include:

- Cloud Blockchain-as-a-Service platform, which can be run in Oracle Cloud and can participate in a multicloud blockchain network by linking with third-party nodes
- On-Premises Blockchain Platform, which helps develop networks outside of Oracle Cloud or hybrid networks, including on-premises and cloud nodes
- Intelligent Track and Trace SaaS application, a ready-to-use SCM application for business users built on Oracle Blockchain Platform
- Oracle Database Blockchain Tables, which provide tamper-evident storage characteristics of blockchain through insert-only tables with hash-linked rows and optional user signatures

Instances can be created for other organizations and joined into the Oracle blockchain network. This network can interoperate with other Hyperledger Fabric nodes outside Oracle Cloud as long as their versions are compatible.

Interoperability has been a focus area from the initial release and remains a priority on Oracle's road map. Today, interoperability across Fabric nodes is available based on work done in the Hyperledger Interoperability Working Group. Oracle also supports use of DA's interoperable DAML-based smart contracts on its platform, enabled by DAML SDK with enterprise privacy enhancements provided by Oracle partner HACERA. Oracle aims to support cross-network events among multiple Fabric-based networks and broader interoperability with other blockchain frameworks such as Ethereum, Quorum, and Corda.

Oracle has done full testing with IBM and SAP in the Hyperledger Interoperability Working Group to enable different vendor nodes to join networks created in the other clouds. If a customer or a consortium wants to run a network that mixes Oracle, IBM, and other Fabric nodes, Oracle can show them the process that is tested and certified.

In June 2019, Microsoft and Oracle jointly announced a cloud interoperability partnership that could affect deployments of the Hyperledger Fabric-based Oracle Blockchain Platform – previously only

available on Oracle Cloud – although customers have been able to join with external (cloud and on-premises) instances of other vendors' compatible Hyperledger Fabric versions. This doesn't mean that Oracle Blockchain Platform customers can run that service in another cloud (i.e., Azure), but the partnership enables customers to take advantage of low-latency, high-throughput direct connections between Oracle Cloud and Azure datacenters to improve the performance of blockchain networks that span Hyperledger Fabric instances across the two companies' cloud infrastructures.

## ***Scalability and Security***

Oracle Blockchain Platform offers a Standard and Enterprise SKU. The latter features high availability by automatically replicating its components across the three Availability Domains or Fault Domains in Oracle Cloud. It also enables dynamic scalability to handle evolving workloads by increasing the resources currently allocated to the nodes, adding more OBP nodes or scaling out by adding more VMs to run additional nodes. Oracle Blockchain Platform has been enhanced by adding dynamic scalability, so customers can dynamically scale out and scale up their configurations to better match their changing workloads. Using Raft-based consensus in the ordering service also increases availability by supporting geo-redundant ordering clusters. OBP provides greater scalability by enabling different channels to be hosted by different groups of the ordering service nodes.

To ensure security and data integrity within a permissioned blockchain network with enrolled members, all organizations use certificates for their identity and exchange digitally signed messages. Built-in encryption protects against any access at the network or storage level outside the blockchain containers. User authentication in the cloud for the console and REST APIs is performed by Oracle Identity Cloud Service (IDCS). In-transit data encryption on all transactions is enforced via TLS and data at-rest encryption is provided by Oracle Cloud Block storage, in addition to other comprehensive Oracle Cloud security measures, including fully isolated compute environments segregating customer chaincode execution (for example) and Oracle's platform code. In addition to supporting Private Data Collections, OBP also added fine-grained on-chain access control inside the blockchain in its latest release. This enables chaincode developers to manage and verify on-chain Access Control Lists (ACLs) for permissions to access and operate on any ledger data or smart contract functions.

## ***European Industry Coverage and Use Cases***

### **Healthcare: Single Source of Truth**

Healthcare infrastructures rely on siloed data, with institutions keeping independent records of the same information. For example, poor coordination of care and a lack of real-time monitoring create the need to securely share processes and data and to give the right data to the right people at the right time. HealthSync, a healthcare technology company building a digital platform for the healthcare sector, aims to address this need with the HealthSync Platform – a healthcare network as a service (HNaaS). Oracle Blockchain Platform enables the HealthSync Platform to aggregate data in a distributed ledger, giving healthcare providers a secure, single source of truth for better decision making.

### **Banking: Fund Transfers and eKYC Profiles**

Cross-border funds transfer is one of the earliest blockchain use cases, with banks being able to provide same-day fund availability and full end-to-end visibility, which is often impossible with correspondent banking networks. This led Arab Jordan Investment Bank and Jordan Kuwait Bank to rely on Oracle Blockchain Platform to enable real-time fund transfers with full core-banking integration and anti-money laundering (AML) rules verification.

Onboarding new customers is often a long process for banks, requiring many documents and in-person verifications. In the current environment, where "touchless" is the preferred means of doing business, Jordan Ahli Bank has developed an eKYC solution for instant account opening, leveraging Oracle Blockchain Platform.



## Transportation: Shipping and Logistics Across Oceans

An industry that needs to cut costs and increase efficiency while improving visibility on goods being shipped and reams of documentation involved in these shipments has found a natural answer in blockchain. Spurred by CargoSmart, a solution developed on Oracle Blockchain Platform, nine ocean carriers and terminal operators – CMA CGM, COSCO Shipping Lines, COSCO Shipping Ports, Hapag-Lloyd, Hutchison Ports, OOCL, Port of Qingdao, PSA International, and Shanghai International Port Group (SIPG) – have signed an agreement indicating their intention to become shareholders of the proposed Global Shipping Business Network (GSBN). In preparation for the establishment of the GSBN, CargoSmart has conducted several proofs of concept, such as its POC with eTradeConnect and another with Tesla (to streamline the cargo release process and speed up its cargo pick-up procedures).

## Food: Authenticated Provenance and Cattle Tracing

Authenticity of products' protected designation of origin (PDO) or protected geographical indication (PGI) is increasingly threatened by fraud. Italian extra virgin olive oil is a good example of an industry that has struggled with mislabeled products that are neither Italian nor extra virgin. Certified Origins tackled this problem with an authenticated provenance solution on Oracle Blockchain Platform to provide transparency and traceability to consumers.

The Irish Cattle Breeding Federation (ICBF) needed a way to link each newborn calf's genomics information to ongoing tracking of its carbon dioxide emissions and the taste of the meat products reported by consumers. To do this, the ICBF used an application built on Oracle Blockchain Platform.

## Retail: Ethical Sourcing in Fashion

A key problem in modern fashion involves identifying working conditions at factories and gaining visibility on the supply chain – knowing who makes products, from which materials, and under what conditions. German start-up retraced developed a supply-chain transparency application powered by Oracle Blockchain Platform and Oracle Autonomous Database to help apparel, footwear, jewelry, and other fashion brands show customers that their products are ethically and sustainably sourced.

## Supply Chain: Intercompany Billing Reconciliation

With three-quarters of all B2B transactions globally taking place between affiliated parties (e.g., subsidiaries of the same parent company), ensuring these transactions are executed timely, accurately, and transparently is a major concern for CFOs and CEOs. With increasing industry consolidation and globalization leading to more complex multinational value chains, intercompany transactions are also attracting more scrutiny from auditors and regulators. This is causing more companies to run into serious and costly accounting problems. General Electric, a conglomerate with multiple business units, wanted to replace its inflexible legacy system with one built on Oracle Blockchain Platform's distributed ledger. OBP provides a degree of independence to different business units while supporting real-time processing, validation rules, and business controls codified in smart contracts, robust integration with diverse ERP systems, auditable exception/dispute management process, and improved netting-based settlement.

## Automotive: Raw Materials Tracking and Transparency in Supply Chain

Increasing demand for consumer electronics and electric vehicles (EVs) drives increased demand for raw materials such as cobalt, tantalum, and tungsten, which are critical to battery manufacturing. Large quantities of these minerals come from Central Africa, where extremely bad working conditions cannot be visible. Volvo Cars decided to enforce sustainable and ethical sourcing on cobalt and other minerals used by its suppliers, such as Contemporary Amperex Technology Co., Ltd. (CATL), in the production of the EV batteries using Circulor, a traceability-as-a-service provider for responsible sourcing. Oracle Blockchain Platform enables Circulor to transparently record and share the sources of all mined and recycled sources of cobalt procured by CATL. It links these sources to EV battery



units sent to Volvo Cars using a distributed ledger, preventing unethically sourced minerals from passing through the supply chain.

### **Retail: Loyalty Points Tracking in Sporting Goods**

When Decathlon, the world's largest sporting goods retailer, started thinking about a loyalty program in Eastern Europe, the company wanted more than just a solution that its customers could use within stores. Decathlon envisioned 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 Decathlon store in the region and seamlessly redeem rewards at a partner store on the blockchain network. Built on Oracle Blockchain Platform by Dhimahi, a software consulting firm and Oracle Partner with a specialization in blockchain, the loyalty system has more than 200 partners on the exchange and provides real-time reconciliation across multiple countries and currencies.

### **Highlighting Differences Among Providers**

A key difference between the analyzed providers is that only Microsoft offers a broad and flexible interaction among frameworks. Microsoft is working on interoperability with different providers; announcements in 2019 by Microsoft and Oracle highlight the two companies' cloud interoperability partnership. This partnership has a clear focus on providing distinct advantages to operators of any compatible Hyperledger Fabric blockchain network (whether under Oracle Blockchain Platform or hosted on Microsoft Azure under a BaaS solution), where they select to run these networks across Oracle Cloud and Azure. This approach will push customers to stick with vendors that they know rather than change platforms – it will be useful for companies that already made significant investments in Oracle and Microsoft products and services. Geographic coverage remains a key problem, as interoperability is confined to some U.S. areas. Opportunities for companies whose networks span different geographical regions will be higher as geographical coverage increases. Until then, the interoperability partnership's blockchain benefits (for European customers, at least) remain confined to single sign-on capabilities.

In contrast, IBM offers more cloud options (deployment in IBM's own public cloud, containerization on private clouds, or deployment on public clouds from AWS and Microsoft Azure) – similar to Oracle. This makes its approach more connected to the blockchain platform rather than to the choice of cloud (relying on IBM Blockchain Platform to provide the differentiation). This approach is more attractive for solutions built on IBM Blockchain Platform (custom applications or services such as TradeLens and Food Trust).

All providers offer highly secure and scalable solutions.

Use cases provided by most of these vendors cover different applications in different industries, although more focus is given to supply chains in different subindustries such as food (e.g., IBM Food Trust solution), pharma, resources, oil and gas, and automotive (Oracle's collaboration with Circulor and Volvo).

High visibility is given to solutions for transport and logistics (IBM TradeLens, Oracle's GSBN) and trade finance (IBM's we.trade). This is not necessarily a negative feature, as supply chain is one of the areas where blockchain finds fertile application. IBM has already built its reputation as a leader among blockchain service providers, while Microsoft enumerates big clients using its blockchain offering (despite more in other regions than Europe). Oracle has also set its reputation in the market working with a variety of clients and having a growing number of production deployments. AWS is catching up in different areas (i.e., interoperability and multi-cloud deployment).

**FIGURE 7****BPaaS Vendors Assessment**

	Supported Blockchain Frameworks	Cloud Deployment and Interoperability Maturity	Scalability and Security	European Use Cases	Distinguishing Features
<b>AWS</b>	<ul style="list-style-type: none"> <li>Hyperledger</li> <li>Ethereum</li> </ul>	<ul style="list-style-type: none"> <li>Running on AWS Cloud</li> <li>No interoperability information available so far</li> </ul>	<ul style="list-style-type: none"> <li>Provides API for quick node creation</li> <li>AWS Key Management Service</li> </ul>	<ul style="list-style-type: none"> <li>BMW Group: Automotive asset provenance</li> <li>Nestlé: Food origin tracking</li> </ul>	<ul style="list-style-type: none"> <li>Increasing interaction among frameworks</li> </ul>
<b>IBM</b>	Hyperledger	<ul style="list-style-type: none"> <li>On-premises, public, hybrid clouds</li> <li>Interoperability projects in place</li> </ul>	SecureKey Technologies	<ul style="list-style-type: none"> <li>iPoint-Systems: Mineral provenance validation</li> <li>Nestlé, Coop Italia, Gruppo Grigi: Food origin tracking</li> <li>Tradelens: Trade and shipping</li> </ul>	<ul style="list-style-type: none"> <li>Wide cloud deployment coverage</li> <li>Interoperability</li> </ul>
<b>Microsoft</b>	<ul style="list-style-type: none"> <li>Hyperledger</li> <li>Quorum</li> <li>Ethereum</li> <li>Corda</li> </ul>	<ul style="list-style-type: none"> <li>On-premises, public, hybrid clouds</li> <li>Interoperability projects in place</li> </ul>	High with all Microsoft products: firewalls and Transport Layer Security	<ul style="list-style-type: none"> <li>Crop tracking from farm to fork</li> <li>Marine insurance</li> </ul>	<ul style="list-style-type: none"> <li>Broad and flexible interaction among frameworks</li> <li>Interoperability</li> </ul>
<b>Oracle</b>	Hyperledger	<ul style="list-style-type: none"> <li>On-premises, public, hybrid clouds</li> <li>Interoperability already available (MiPasa, DAML)</li> </ul>	<ul style="list-style-type: none"> <li>Scalability on VMs</li> <li>Certificates for identity</li> <li>Digitally signed messages</li> <li>Built-in encryption protection</li> </ul>	<ul style="list-style-type: none"> <li>Certified Origins: Food provenance</li> <li>CargoSmart: Shipping and Logistics</li> <li>Retraced: Ethical sourcing of fashion</li> <li>Decathlon: Loyalty points tracking in retail</li> <li>HealthSync: Healthcare information tracking</li> </ul>	<ul style="list-style-type: none"> <li>Wide industry coverage</li> <li>Interoperability</li> </ul>

Source: IDC, 2020

**ADVICE FOR THE SERVICES PROVIDER**

BPaaS makes blockchain adoption easier as it enables a third party to install and maintain blockchain networks. For many businesses, the flexibility of a BPaaS solution is enormously valuable. Through this model, companies can take advantage of the benefits of blockchain technologies without having to develop their own blockchain infrastructures, managing software updates or security patches, or investing in expensive in-house computing resources. It is a suitable solution for developers to create unique applications, avoiding the need of developing, maintaining, and upgrading their own systems and software.

**Provide a Complete, Full-Stack, Modular, and Easy-to-Use Solution**

BPaaS is becoming very common in the blockchain market as it is a fast and cost-effective solution. Since enterprises are demanding full-stack enterprise services, it is important to remember that enterprise-grade solutions will require a holistic approach to create enterprise-ready blockchains, which means providing more than templates and node management services. It is important to identify what clients need and provide them a flexible, full-stack platform with the following characteristics:

- Provides interoperability at different levels (among multiple frameworks and between providers)
- Deploys rigid security measures to verify identities and network transactions
- Scalable
- Easy and seamless to deploy
- Has broad industry coverage with a wide use-case provision

**Collaborate with Competitors to Have Interoperability and Multicloud Support as Common Standards**

BPaaS environments are becoming popular and there are several players in the market (either directly or indirectly providing their cloud solutions), thus increasing competition. Since there is no single vendor dominating the market and each one has its own features, peculiarities, and client affiliations, it

is crucial to start thinking how to collaborate to surpass some "lock in" features that can act as obstacles for clients. Work with your competitors on interoperability and multicloud solutions to provide flexible solutions for end users.

## Enrich Industry and Use-Case Coverage

Only a few providers have a wide industry focus. Major BPaaS providers focus on a limited number of industries/use cases, as most efforts are on trade, finance, supply chain, traceability, and food. As blockchain becomes known and adopted, offerings should expand in terms of possible industries/use cases covered. There are also real opportunities in other industries, so it's key to develop broad industry and use-case coverage, including industries such as telecom, media, and energy, which are showing sweet spots.

## LEARN MORE

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### Related Research

- *The Importance of Interoperability for the Development of the European Blockchain Industry* (IDC #EUR145774120, October 2020)
- *The Future of Trust: Are We Nearly There Yet?* (IDC #EUR146879720, September 2020)
- *European Blockchain Spending Forecast, 2019-2023* (IDC #EUR145774020, August 2020)
- *How Blockchain Can Enhance Cybersecurity Across Multiple Digital Scenarios* (IDC #EUR145774520, July 2020)
- *Blockchain in Europe: Navigating the Market in Times of Change* (IDC #EUR145774220, July 2020)
- *Blockchain in Supply Chain: Rethinking Transparency and Data Exchange* (IDC #EUR145774420, June 2020)
- *IDC Market Glance: Blockchain in Europe, 2Q20* (IDC #EUR145773920, April 2020)
- *Future of Trust: Defining Trust* (IDC #US46185920, April 2020)
- *Barriers to Blockchain Adoption in Europe* (IDC #EUR145773720, March 2020)
- *Blockchain Adoption in Europe, 2020: Awareness and Growth by Country and Industry* (IDC #EUR145773520, March 2020)
- *Oracle's Opportunities in the \$250B European Emerging Technology Space* (IDC #EUR146110720, March 2020)

### Synopsis

This IDC Market Perspective discusses blockchain platform-as-a-service solutions. The development and support of modern software applications can be very complex. Companies have to regularly update their apps to address security issues and improve features to meet customer demand. Maintaining and upgrading the platform for the app (i.e., operating systems, servers, networks, and so on) as well increases complexity.

There are similar difficulties in the blockchain space. BPaaS solutions can help in this regard, as they enable companies to build and develop blockchain-based applications by accessing a blockchain provider's services.

BPaaS has gained significant traction in recent years among established global players, as it enables customers to focus more on core business functionalities and strategies while relying on their PaaS partners to manage the blockchain infrastructure and performance.

"Blockchain platform as a service may be the catalyst for widespread adoption of blockchain technology. It makes blockchain adoption easier as it enables a third party to install and maintain

blockchain networks," said Carla La Croce, senior research analyst, European Blockchain Practice. "BPaaS has generated great interest, driving major cloud providers to expand their cloud offerings."

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## IDC Italy

Viale Monza, 14  
20127 Milan, Italy  
+39.02.28457.1  
Twitter: @IDCItaly  
[idc-insights-community.com](http://idc-insights-community.com)  
[www.idcitalia.com](http://www.idcitalia.com)

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