CARGOCHAIN™

TECHNOLOGY

COLLABORATE.
SHARE.
INNOVATE.

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WHAT IS CARGOCHAIN?

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CargoChain is a cargo information sharing and innovation platform and can be thought of as the information backbone to the physical supply chain. It supports the distribution of previously unavailable cargo information, and the development of third-party applications that will redefine the global information supply chain.

CargoChain consists of an Information Sharing Protocol underpinned by blockchain, and a Platform containing deep supply chain functionality.

Our aspiration is to be the world's largest repository of rich cargo information providing a single source of the truth to all supply chain actors.

CargoChain will achieve this by being the foundation of all supply chain applications. By providing communities of application developers with pre-built supply chain functionality and the ability to access and share rich cargo information, the CargoChain Platform enables the delivery of cost-effective supply chain solutions. This democratises the information supply chain, powering applications that allow all participants, regardless of size, to make better business decisions.

In the way the Apple App Store revolutionised the delivery of inexpensive consumer apps, the CargoChain Web Store will be the industry standard for access to inexpensive third-party applications, designed to solve any participant's supply chain problems.
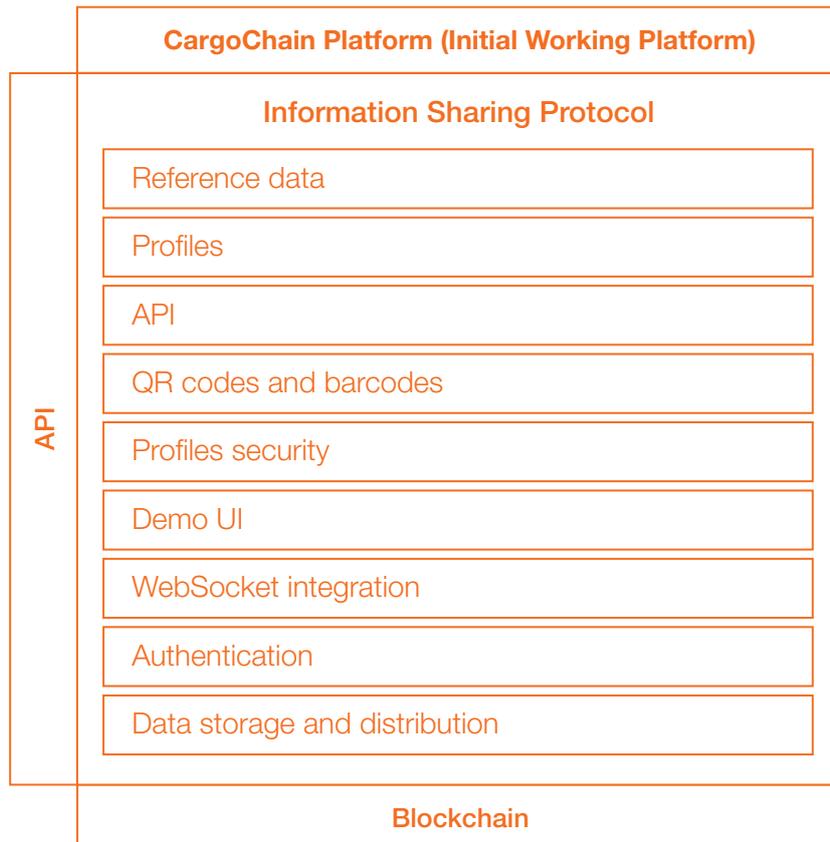
" **INFORMATION ABOUT THE PACKAGE IS JUST AS IMPORTANT AS THE PACKAGE ITSELF** "

FREDERICK W. SMITH, FEDEX CEO.

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DEVELOPMENT ROADMAP
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The CargoChain Platform and Information Sharing Protocol is already an Initial Working Platform (IWP), allowing seamless sharing of cargo information and the development of third-party applications. A substantial amount of development has already been completed to reach an IWP; this has set the foundation for the next stage of CargoChain's development, including the CargoChain Web Store and supporting infrastructure.

Completed development:

CargoChain Platform (Initial Working Platform)
Information Sharing Protocol
Reference data
Profiles
API
QR codes and barcodes
Profiles security
Demo UI
WebSocket integration
Authentication
Data storage and distribution
Blockchain

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Future development:

Full Working Platform

Infrastructure
Extend cloud deployment.

Trust and Security
Extend bank-level security by appointing third-party authentication provider.

Establish customer verification process.

Network and infrastructure proactive security and maintenance.

Organisation Management Module
Create and manage organisations.
Ability to generate API keys.
Create user accounts.
Establish organisational hierarchy.

Software Development Kits
Sandbox environment for testing applications.

Web Store SDK.

Enterprise SDK.

IoT SDK.

Accounting and Billing Module
Expose payment gateway and develop billing engine.
Consider blockchain integration.
Create payment plans.

Web Store Module
Allow users to browse, buy, rate and comment on CargoChain applications.

Enable developers to access/download SDK and publish applications.

Customer Business Support
Develop module to provide advanced advice to trusted customers.

Marketplace Module
Customers can publish services and enter trade together.

Analytics
Extract and aggregate application usage and cargo profile data.

Please note: This is not a chronological representation as most items are interdependent and will be developed in parallel as required.

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CargoChain has ambitious business objectives, including plans for high-scale growth as we continue to build our network of Platform users and aggregate increasing volumes of data. We have therefore designed the Platform in a way that provides the flexibility and capability to support this vision.

The CargoChain technology philosophy is to use open, modern technologies, to scale for unlimited growth, maintain complete availability, and provide the most trusted and secure environment.

The CargoChain technology stack consists of four key layers:

Web Store
Integration
CargoChain Platform and API
Storage and blockchain

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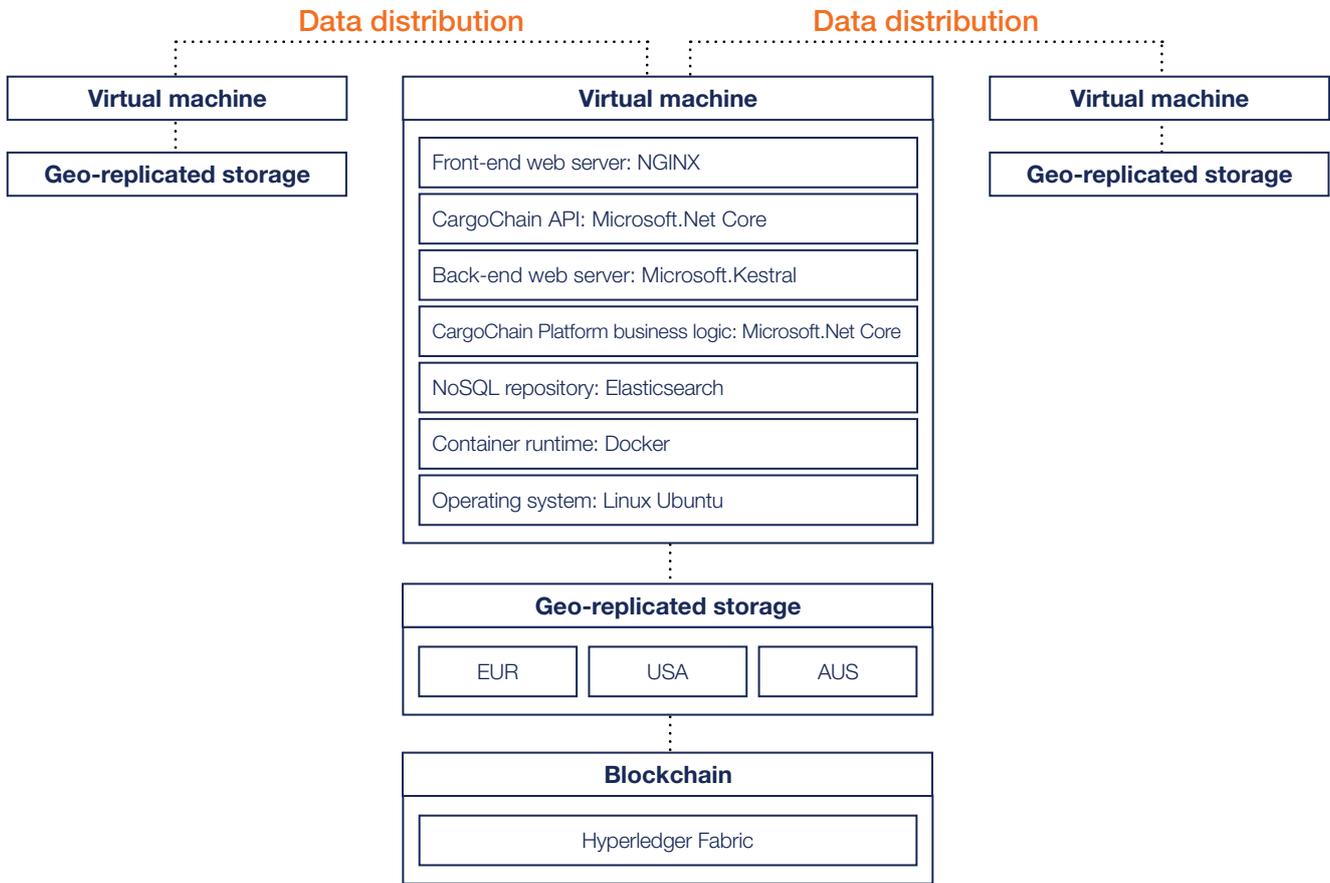
1. Storage and blockchain

CargoChain's storage infrastructure consists of decentralised blockchain nodes, geo-replicated storage, virtual machines, load balancers and scalable public IPs.

CargoChain's infrastructure is designed to be able to operate simultaneously on any cloud provider. Information stored by each provider is replicated in three separate locations ensuring complete geo-replicated storage. In each location, information is replicated across three separate virtual machines meaning that information is essentially replicated nine times.

Blockchain nodes will be distributed among a consortium of service partners and other interested parties in the CargoChain ecosystem.

This approach provides complete resilience and guaranteed availability of the CargoChain Platform and protects against any data loss. A multi-vendor approach also mitigates the risk of cost increases that can arise by being tied to a single vendor.

DNS

cargochain.com

Public IPs

Load balancers

Virtual network

Geo-replicated storage

Blockchain nodes

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Data distribution   **Data distribution**

| **Virtual machine** |
| **Geo-replicated storage** |

| **Virtual machine** |
| Front-end web server: NGINX |
| CargoChain API: Microsoft.Net Core |
| Back-end web server: Microsoft.Kestral |
| CargoChain Platform business logic: Microsoft.Net Core |
| NoSQL repository: Elasticsearch |
| Container runtime: Docker |
| Operating system: Linux Ubuntu |

| **Virtual machine** |
| **Geo-replicated storage** |

| **Geo-replicated storage** | | |
| EUR | USA | AUS |

| **Blockchain** |
| Hyperledger Fabric |

All CargoChain nodes are uniform virtual machines; they are 100% identical and as such are easy to deploy, maintain and upgrade. Similar to major peer-to-peer systems, nodes discover themselves, spread and replicate information automatically.

This underlying architecture allows us to scale rapidly and indefinitely.

CargoChain is actively following the evolution of new distributed technologies such as InterPlanetary File System (IPFS) as this could, when mature, allow CargoChain to distribute nodes, not only in the cloud, but also allow customers to securely host nodes on their existing premises.

As technology continues to evolve, other blockchain technologies will be considered to complement Hyperledger in anticipation that some partners may prefer to use Microsoft or Ethereum. This will allow the maintenance of one public blockchain replicated over multiple technologies.

HYPERLEDGER FABRIC IS CURRENTLY USED TO STORE ALL INFORMATION RELATED TO CARGO EVENTS ON-CHAIN

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2. Platform and API

The Platform consists of CargoChain's Information Sharing Protocol, deep supply chain functionality and its API.

The Platform operating system is Linux Ubuntu, and Docker is used to combine all of the above into independent deployment units (nodes). Elasticsearch is the NoSQL repository.

All Platform supply chain logic, the API and SDKs are written in Microsoft .NET Core.

NGINX is our technology of choice for servicing our API.

Platform security: CargoChain nodes operate in a hermetic private network with extremely tight security. CargoChain only has two accessible doors to the network of nodes.

1. Only a set of dedicated private machines can be used to deploy CargoChain via specific SSH encrypted tunnels. These machines are turned off when not deploying, so most of the time this door is 'closed'.

2. Users and the SDK communicate with CargoChain's underlying infrastructure via our public API. This door uses Network Address Translation (NAT) to our private network via NGINX, with all communications SSL encrypted.

Platform authentication: Authentication processes between the CargoChain API, applications and AuthProvider are using the OAuth 2.0 industry standard patterns.

Our aim is to provide Swiss-bank-level security, so we have developed a completely separate system for providing authentication on CargoChain. Both systems communicate via a dedicated Virtual Private Network (VPN) tunnel so that their communications cannot be intercepted.
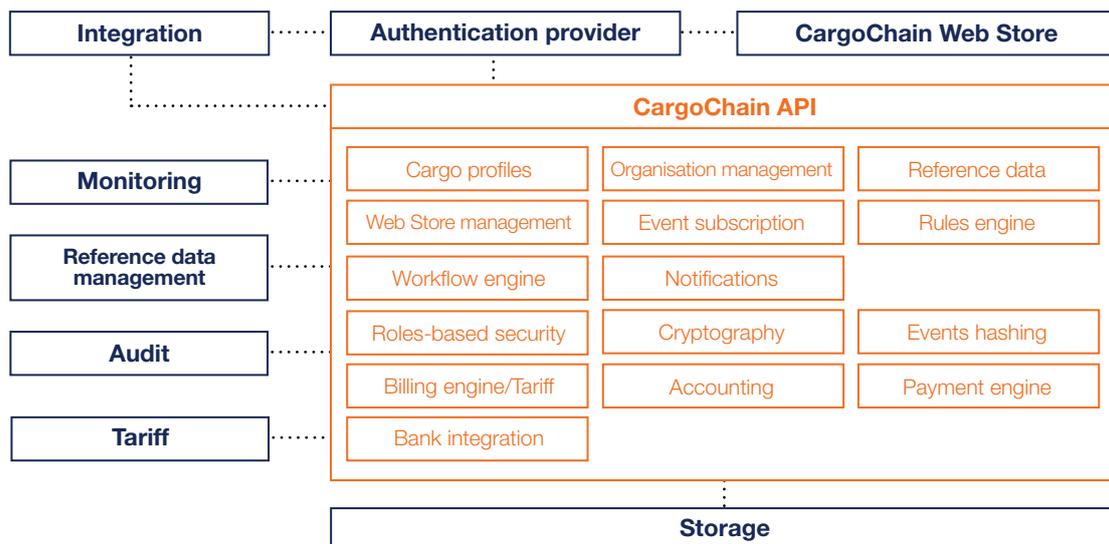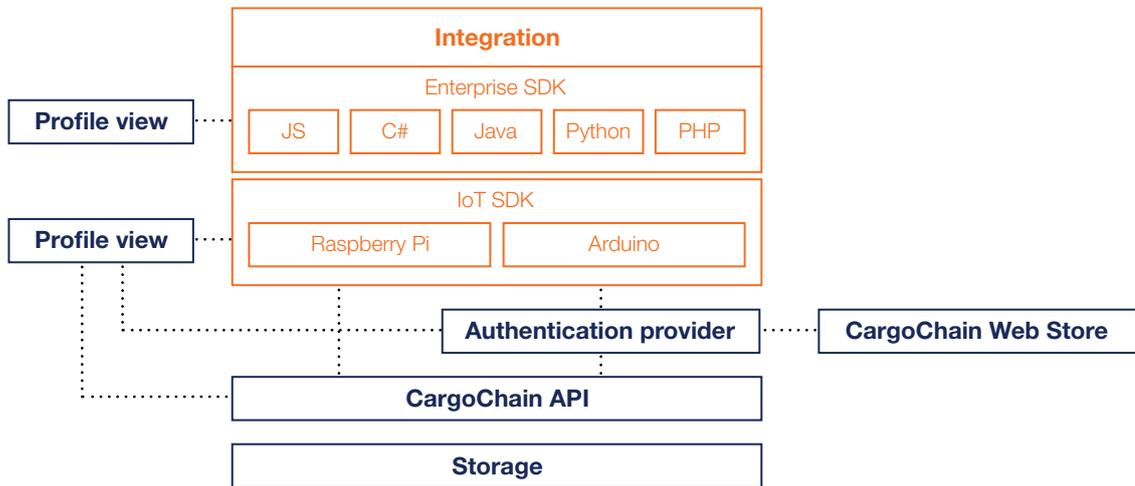

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3. Integration

Developers using the SDK and application users, communicate with CargoChain's underlying infrastructure via our public API.

CargoChain's API is 100% accessible over a set of HTTPS REST calls using the widespread JSON format, making CargoChain open to any other Internet-capable technology. For those who demand maximum speed or want to develop modern SPAs (Single-Page Applications), our API is also 100% exposed via WebSocket technology.

Integration to applications, IoT devices and the CargoChain Web Store will be via one of CargoChain's SDKs. The SDKs will expose all CargoChain features, providing a seamless way to interact with the API.

4. CargoChain Web Store

React is the framework for developing native applications in the CargoChain Web Store.

Although some key technology decisions have been made to date, the entire CargoChain Platform has been designed in a modular fashion to allow for evolution and scale as business objectives, customer requirements or technology demands change. As such, technology decisions may be revisited throughout the project.

CargoChain Web Store

Web Store SDK (JS)

| Data client | React components (UI) |

CargoChain styles (CSS)

Apps

System apps (native)	User apps (native)
App store	Cargo acceptance
User management	Cargo handling
Billing	Mover
Rules manager	Workflow
Assets manager	Cargo tracking
Profile view	Profile batch manager
Developer-specific apps: Publish app Download SDK Get API keys	

Third-party apps

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