# Introduction

The concept of blockchain was introduced in 2008 with the Bitcoin whitepaper. Since then, many enterprises have explored ways to use blockchain to improve their business processes. This included applications like supply chain, food safety, and identity/credentials management.

When businesses look at blockchain technology, one of the key applications was to improve transparency and traceability across an ecosystem of partners and stakeholders. This increases trust within the network and reduces the need for intermediaries.

However, Bitcoin or even Ethereum as a technology was seen to be insufficient for enterprise use. Privacy factors were often cited to be a concern, although this is often criticized as counterintuitive to the spirit of decentralization. Regardless, this gave rise to multiple efforts at creating a blockchain technology for enterprise use, notably Hyperledger foundation's technologies such as Fabric and Besu; and Corda from R3. These technologies enable several initiatives in industries such as food manufacturing, shipping, supply chain, trade finance, and more. Usually started as POCs by a lead company, this then leads to the creation of consortiums and a spin-off company (if the POC is successful). Unfortunately, 2022 saw a slew of announcements about the shutdown of such projects. Notable examples are TradeLens and we.Trade. Common reasons cited include the lack of commitment of consortium members and reluctance to share data.

Even with privacy features offered by permissioned blockchain technologies such as Hyperledger and Corda, enterprises are still apprehensive about sending their data into a shared and replicated database. An alternative approach that Dedoco has taken is to separate the document/data from the blockchain evidence/provenance. This means that sensitive documents that need to be trusted and shared within the ecosystem are not directly stored on the blockchain. Instead, we only store the document hashes and all business processes that are applied to the document. This alternative approach ensures that only the document holders can get access to the information contained within the document and also verify its audit trail.

If we look back to fundamentals and think about what businesses want to do with blockchain, one common feature was the ability to make a document tamper-proof. This feature by itself can foster trust in the digital document. Yet, this functionality is not something that a normal business can access. Even if they use a public blockchain like Ethereum to do so, they would need to be able to support smart contracts and deal with cryptocurrency. The Dedoco Trust Engine is designed with the intention of creating an easy-to-use set of APIs for any business to be able to tap into

blockchain features via smart contracts. Any application will be able to integrate with these APIs without having to deal with the blockchain components. Users can have a choice of public blockchain networks or to connect to a private permissioned blockchain of their choice.
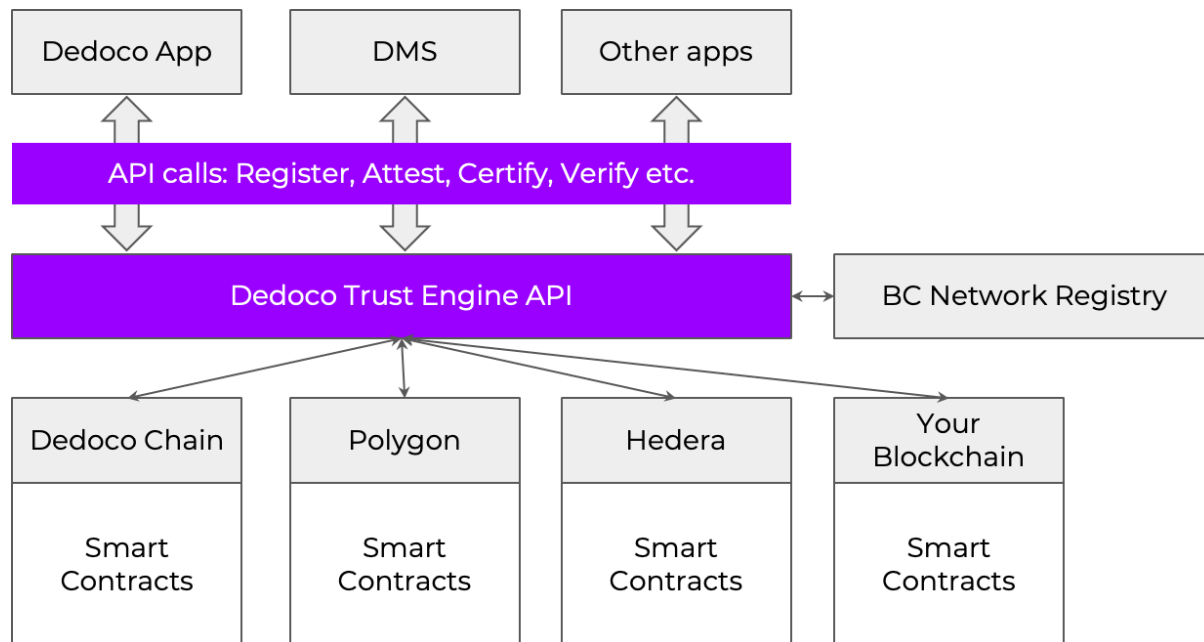


**Figure 1. The Dedoco Trust Engine Infrastructure**

## Dedoco Trust Engine

The Dedoco Trust Engine is designed with the intention of creating an easy-to-use set of APIs for any business to be able to tap into blockchain features via smart contracts. The Dedoco Trust Engine is also a set of smart contracts (deployed on multiple blockchains). The Trust Engine orchestrates between business applications and blockchain functionality. Any application will be able to integrate with these APIs without having to deal with the blockchain components. Users can have a choice of public blockchain networks or to connect to a private permissioned blockchain of their choice.

The Dedoco Trust Engine also acts as a moderator to the API requests, using indexed data, it posts and retrieves the information to the various connected blockchain networks. This allows the verification of documents on Dedoco across different networks using one single API.

This not only upgrades the Dedoco Saas Platform to be able to provide more blockchain options but also allows third parties to integrate to Dedoco's blockchain functionalities.

**Dedoco Trust Engine (Data)**
DTE Data is the first iteration of the DTE to be released. It contains 2 main features:

**1. Dedoco Trust Engine APIs**
This is an API service that will be deployed on cloud servers. Business applications (Dedoco SaaS and other external apps) will be able to call the API service with different requests to write and read the blockchain data. This service will also be indexing/consolidating the blockchain data such that it will be easy to query. The Dedoco Trust Engine will act as a moderator to the API requests, using indexed data, it posts and retrieves the information to the various connected blockchain networks. This allows the verification of documents on Dedoco across different networks using one single API.

The API service will also:
-manage information exchange and generate zero-knowledge proofs on the server
-operate services that prove real-world identity (and association with a public key)

The APIs service will also contain a Blockchain Network registry that points to gateways or endpoints in each designated blockchain network and its respective smart contracts.

**2. Smart Contracts and Deployments on multiple blockchain platforms**
Smart contracts that are required for business processes include document hashing, transaction signing, business attestations, certificate issuance, ownership transfers, revocations, and verification. Customizations may be needed for different blockchain protocols/networks. For this stage, we are looking at deployment on the Polygon Matic network and Hedera Hashgraph. Users of the trust engine will not need to interface with this layer and will use these functions via the APIs. In the future, consortiums can also link their own private chains to DTE APIs.

## Use Cases: Creating Trust Boundaries within an Ecosystem

DTE Data allows applications to on-ramp to Web3 by recording document-centric business processes to blockchain. We can consider such documents to be non-fungible as each business process is unique and thus verifiable. In the process of recording the business processes (such as issuance, updates, acknowledgments, or attestations), the digital document becomes an NFD (non-fungible document). These features can be used to create trust boundaries within an ecosystem. By making the document process verifiable, we create trust within an ecosystem of partners. Below are some examples:

### Document Signing

This is the fundamental use case for the Dedoco SaaS solution. By using blockchain to store business processes for document signing, the SaaS provides a bring-your-own storage value proposition. DTE makes the document and process tamper-proof. Third parties can independently verify and obtain evidence of signing via DTE.

### Certified Documents

Many certifications issued by authorities are still paper-based as digital copies are hard to authenticate. Blockchain-based digital certifications such as Open Attestation and Blockcerts address this issue. DTE adds to this by allowing for pre and post-certification processes to be recorded to the blockchain as well.

### Track and Trace

The supply chain management industry has seen a rise in demand for product traceability due to various reasons. Firstly, regulatory requirements are becoming more stringent in some industries and mandate unit-level tracking of sensitive goods, such as pharmaceuticals and medical devices. Secondly, countries are imposing stricter ESG requirements across various industries to ensure the sustainability of each product. Additionally, the circular economy model is gaining prominence, particularly in the pre-loved luxury goods industry, which is challenged by counterfeit goods.

Enterprises are currently utilizing asset tagging technologies such as QR codes or RFID tags to assign a unique identifier to each individual product. DTE can be integrated into these existing systems seamlessly by creating a digital certificate for each identifier on the blockchain and certifying its authenticity and recording an immutable audit trail of the product's journey through the supply chain.

Examples of key benefits DTE presents to enterprises include:

1. Establish distributor and channel route visibility to enhance the optimization of supply chain management.
2. Provide transparent data for demand forecasting and inventory planning.
3. Help companies to comply with regulatory and trade restrictions.

While all types of goods are applicable, the track and trace use case is particularly synergistic for high-value goods, such as luxury goods, automobiles, and machinery, as well as highly sensitive and regulated goods such as pharmaceutical and bio-sensitive materials.

## DTE Version 2, Privacy

The next phase for the Dedoco Trust Engine will focus on privacy. There are strict data privacy requirements for enterprise systems. With blockchains, these systems face an inherent trade-off between privacy and verifiability.

Because of this, uses of DTE Data are generally limited to data that can be exposed to the public. To extend the value proposition of DTE to private data we will need to explore new technology. In the next phase, we will look into zero-knowledge protocols to eliminate the need to trade off between privacy and verifiability. This can enable trusted work processes between counterparties and open up many other possibilities.