



BLOCKCHAIN in SUPPLY CHAIN

ACMA4022- Supply Chain Informatics
Runnarin Siwapimon

Session Overview

01

Concepts of blockchain

What is blockchain?
Characteristics of blockchain
How does blockchain work?

02

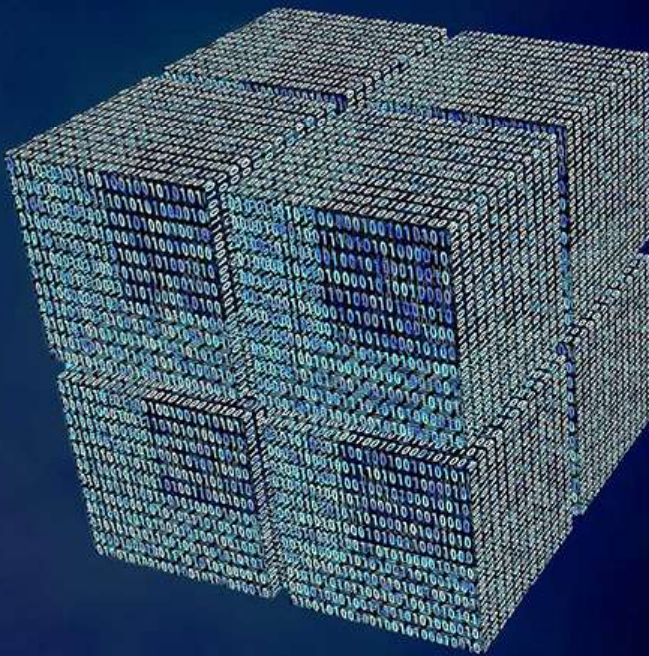
Benefits & Challenges

Advantages of blockchain in supply chain & Logistics
Blockchain challenges in supply chain & Logistics

03

Blockchain use cases

Today's challenges in supply chain & logistics
Blockchain examples across industries
Blockchain adaptations in supply chain & Logistics



Blockchain

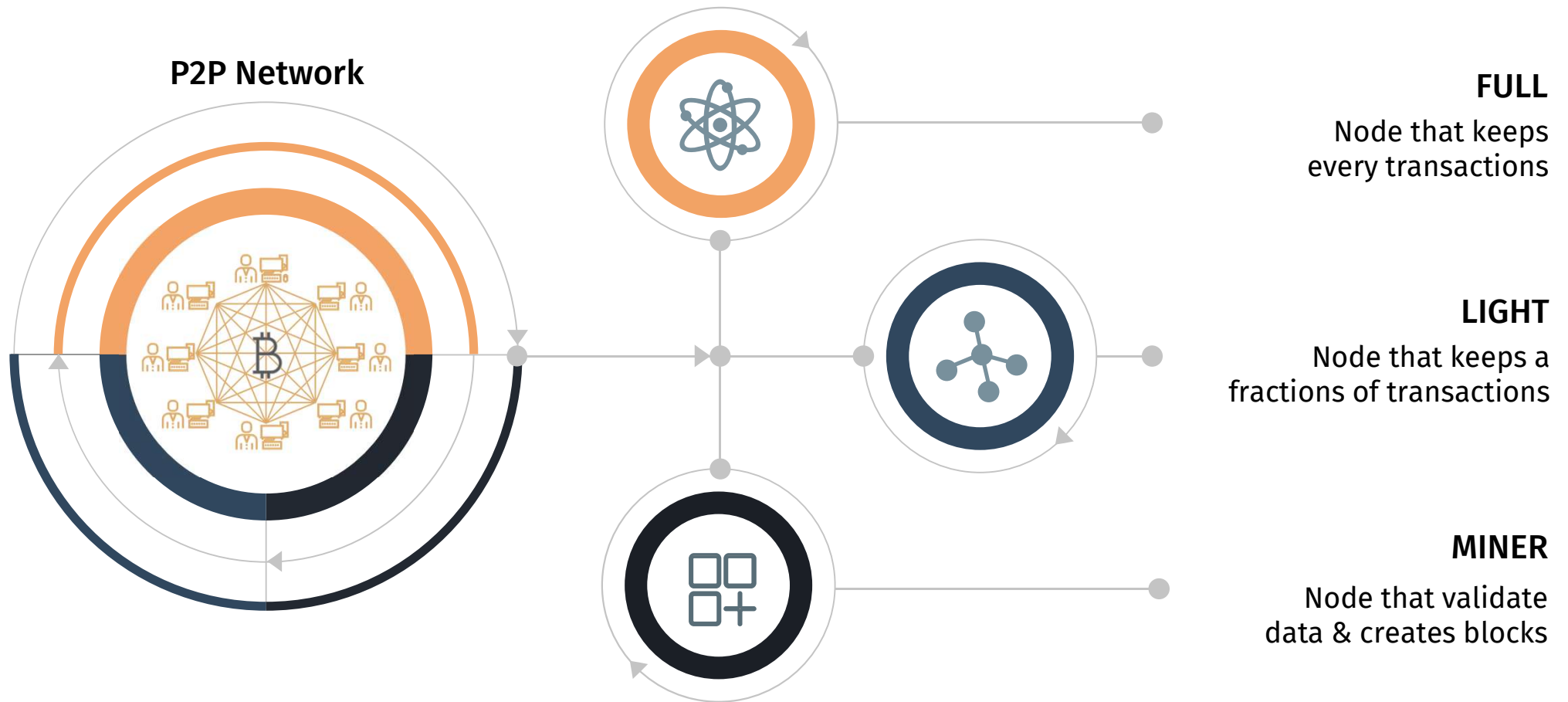
A **decentralized** transactional digital ledger technology managing **highly-secured** transactions validation across participants **without intermediaries** (aka nodes).

Transactions bundled into **encrypted blocks**.
A block link to the previous block. These links form the blockchain.

In business, blockchain increases data management efficiency & transparency among trusted partners.



Types of node in blockchain



Key attributes of blockchain

Decentralization

Data is distributed among several nodes or participants in P2P network



Consensus

Transactions are validated with consensus & transparently processed

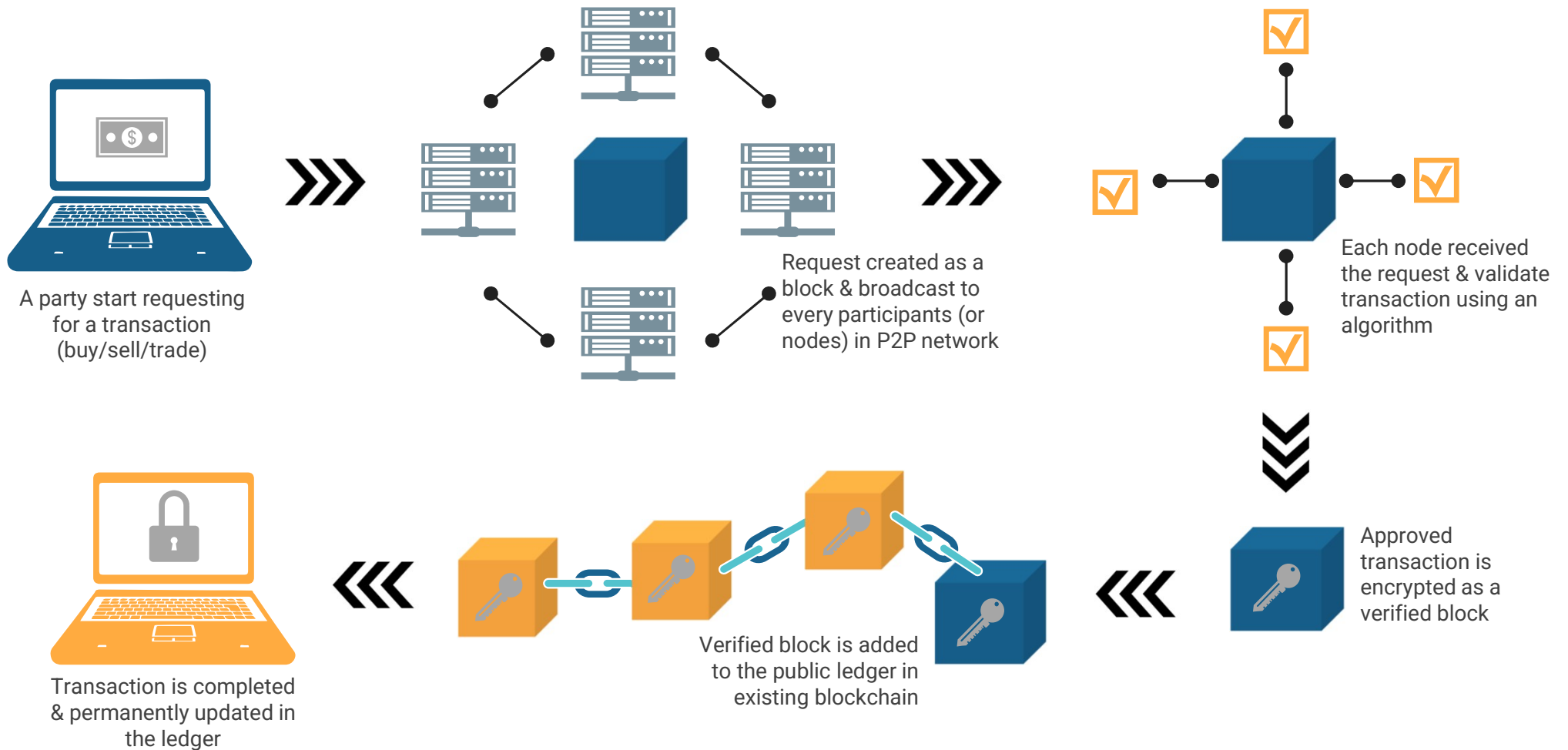


Immutability

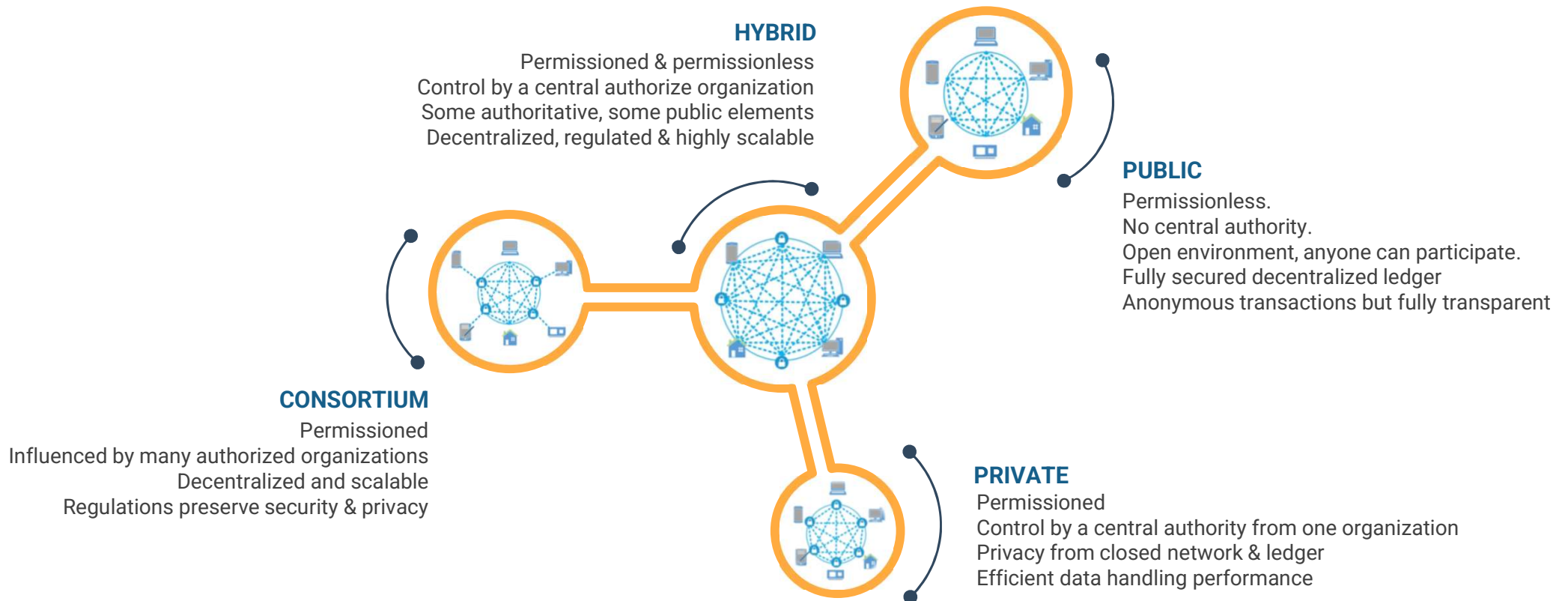
Data is encrypted, secured, tamper-proof, unchangeable, irreversible



How does blockchain work?



Types of blockchain network



Blockchain vs Database

WHAT IS BLOCKCHAIN?

Blockchain is a peer-to-peer decentralized distributed ledger technology. It was first introduced in 2009.



WHAT IS A DATABASE?

Databases are centralized ledger which stores data in a structured way and is managed by an administrator.



BLOCKCHAIN V/S DATABASE

Blockchain is decentralized and has no centralized approach. However, there are private blockchains that may utilize some form of centralization.

AUTHORITY

Databases are controlled by the administrator and are centralized in nature.

Blockchain uses a distributed ledger network architecture.

ARCHITECTURE

Database utilizes a client-server architecture.

Blockchain utilizes Read and Write operations.

DATA HANDLING

The database supports CRUD (Create, Read, Update and Delete).

Blockchain data supports integrity.

INTEGRITY

Malicious actors can alter database data.

Public blockchain offers transparency.

TRANSPARENCY

Databases are not transparent. Only the administrator decides which the public can access data.

Blockchains are comparatively harder to implement and maintain.

COST

The database being an old technology is easy to implement and maintain.

Blockchain is bobbed down by the verification and consensus methods.

PERFORMANCE

Databases are extremely fast and offer great scalability.

Cryptography In Blockchain

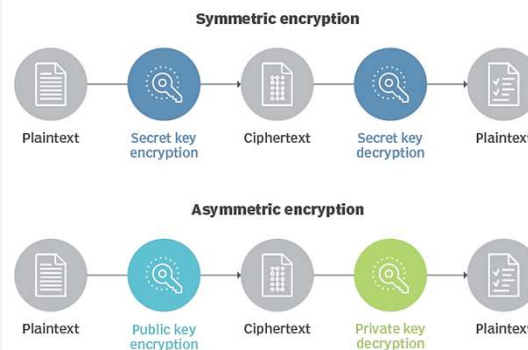
The fundamental components of blockchain technology are digital encryption techniques, which emphasize the importance of blockchain **cryptography**.

Cryptography is a method of using codes to protect information and only the people whom information is intended can access, read and process it.

Blockchain employs key cryptography to protect the information by **encrypting** information into **ciphertext** which then can be **decrypted** back as cleartext.



Symmetric vs. asymmetric encryption



- **Symmetric-key or Single-key**
Same secret key shared by the sender and the recipient
- **Public-key or Asymmetric-key**
Public key using by sender, recipient use associated private key to decrypt

Roles of cryptography In blockchain

- **Security** : Cryptography is mainly used for protecting user privacy, transactional information, and data consistency.
- **Scalability** : Cryptography hash functions can support several transactions within a single hash, provide endless scalability.
- **Reliability** : Hashed transactions are irreversible, secretly encrypted, temper-alteration. So participants can ensure the accuracy & reliability of data within the ledger.

A form of digital asset protected
by highly secured unique
cryptographic algorithms

All monetary transactions can be conducted & stored instantly within
blockchain decentralized network without any intermediaries e.g.
government agencies, financial institutions or banks.

A glowing Bitcoin chip is the central focus of the image. It is a square, dark-colored chip with a prominent Bitcoin symbol (a stylized 'B' with two vertical lines) in the center. The chip is surrounded by a complex network of glowing orange and yellow lines, representing circuitry or data flow. The background is a dark blue, textured surface with numerous small, glowing orange dots, giving the impression of a digital or technological environment.

Cryptocurrency
New paradigm of money within blockchain

A stack of three Bitcoin coins is shown on a dark, reflective surface. The top coin is in sharp focus, showing the Bitcoin logo and the word 'BITCOIN'. The coins below it are slightly out of focus. The background is dark and textured.

Integration of Cryptocurrencies in business

Bitcoin is the very first cryptocurrency invented by *Satoshi Nakamoto* in 2009. Now there are more than 4,000 cryptocurrencies using in blockchains.

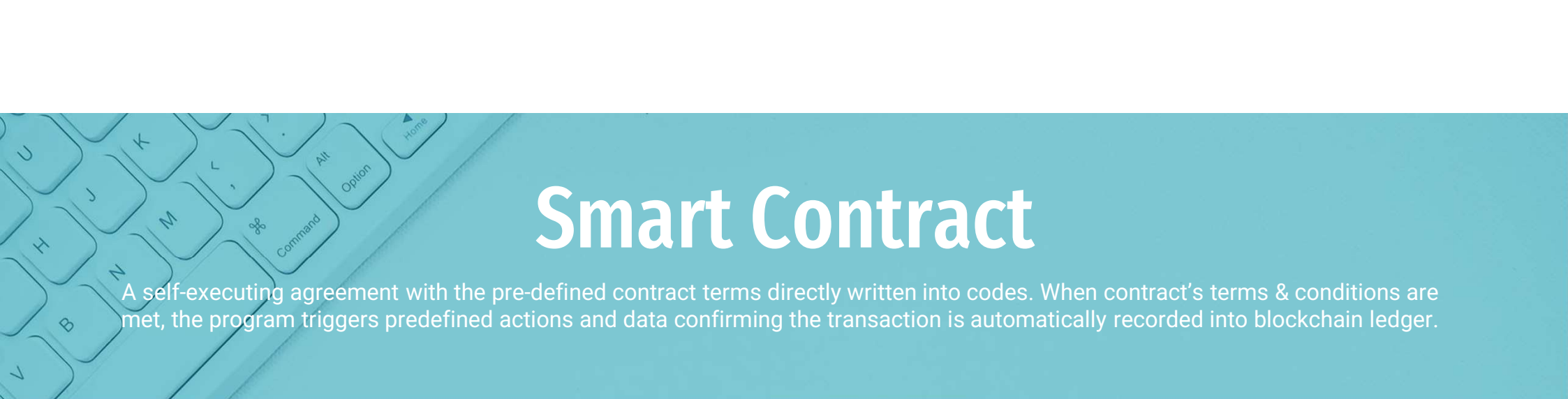
Timestamp saved in each block indicates the time a block is validated and uploaded into blockchain ledger. Cryptocurrencies use this system for verification without any intermediary.

Unlike fiat payments such as a credit card or bank account, cryptocurrency don't associate with any personal information. A cryptocurrency transaction relies on cryptography **keys** which individuals can use and store in a **crypto wallet**.

A **wallet** stores and transferring cryptocurrency within blockchain, while a payment **gateway** facilitates crypto payments or exchange crypto for a fiat currency.

Cryptocurrencies e.g. **Ethereum** are used as virtual digital money in industries for trading, lending, borrowing, cross-border payments and remittances, facilitated by smart contracts.

By bypassing traditional banking systems, cryptocurrencies can reduce transaction costs and times, eliminating the need for currency conversions and facilitating quicker settlements.



Smart Contract

A self-executing agreement with the pre-defined contract terms directly written into codes. When contract's terms & conditions are met, the program triggers predefined actions and data confirming the transaction is automatically recorded into blockchain ledger.



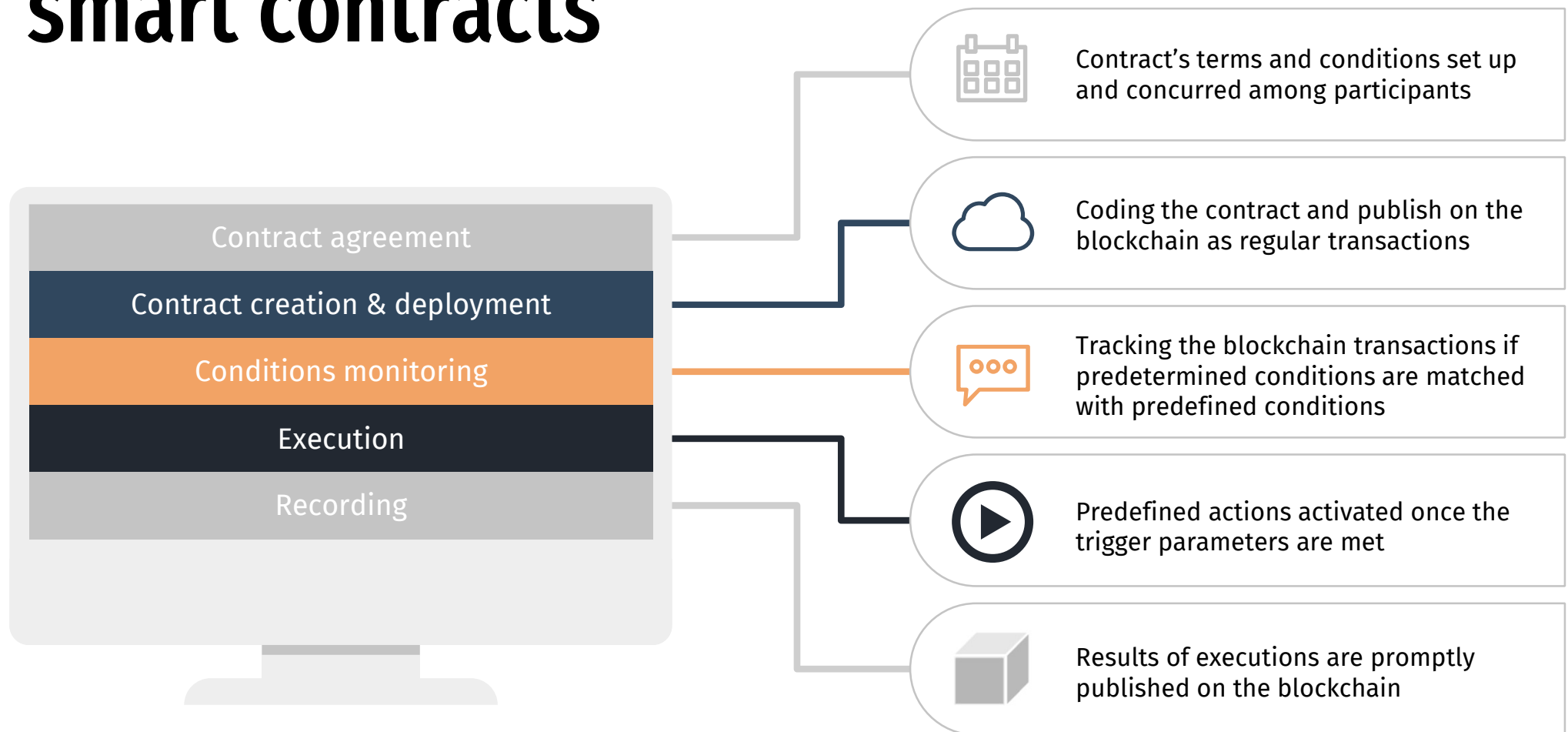
B L O C K C H A I N

Smart contract is designed to digitally facilitate, verify, or enforce the performance of an agreement without 3rd party involvement.

Key characteristics are : Self-enforcement, self-verification and tamper-proof with trackable and irreversible transactions.

Ethereum is the world's first and one of the best smart contract platforms running on application that enable all parties to carry out their part of a transaction, referred to as “decentralized applications” or “**dapps**”.

Steps needed for the functioning of smart contracts



Blockchain meets ERP



Enhance transparency to end-to-end visibility

Track the processes in real-time in every part of the supply chain processes, especially with the obscured upstream.

Promoting trustworthy information

Every information in the system is visible for everyone without any human interference in data processing

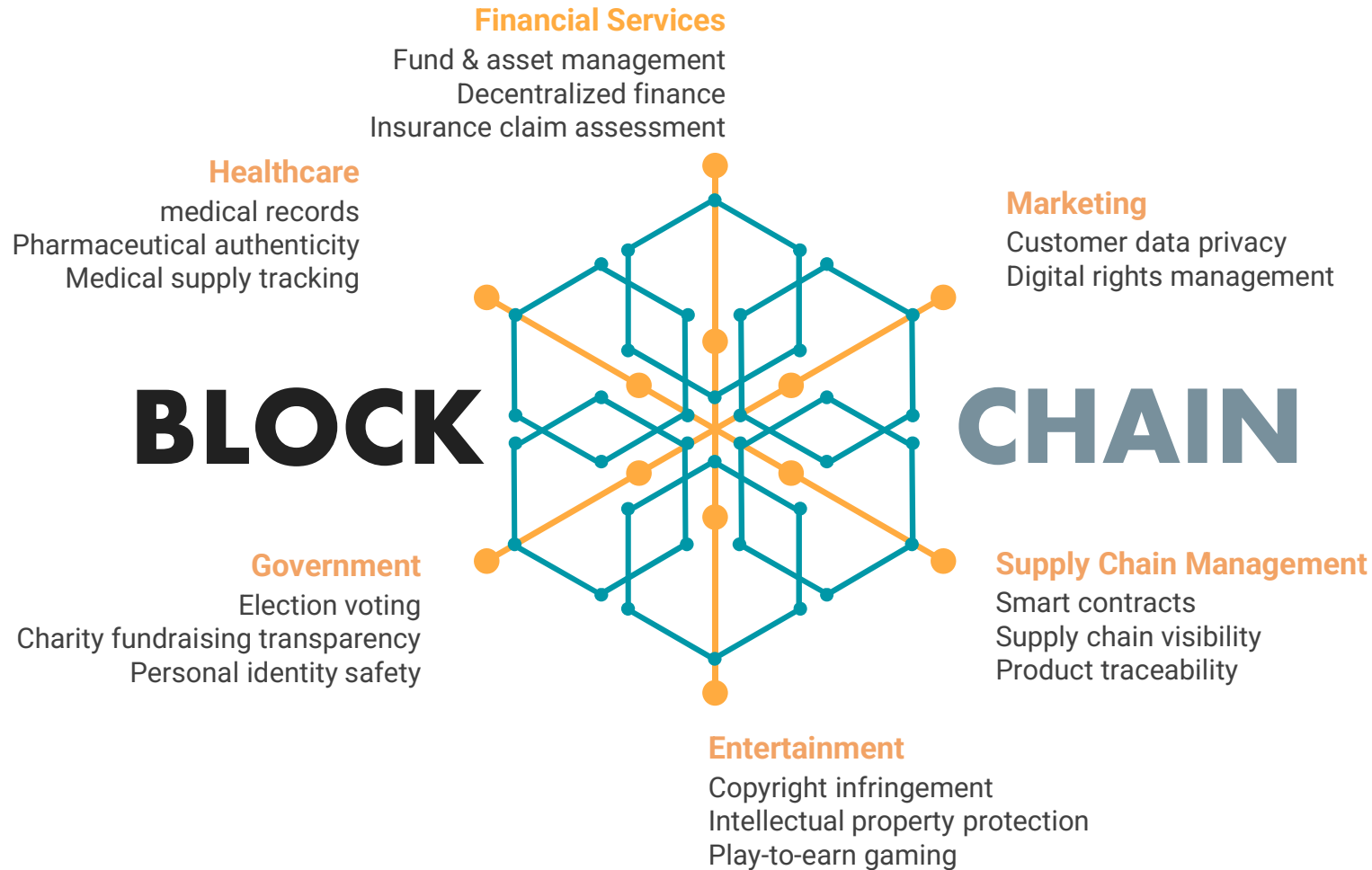
Enable smart contract for payments automation

Once the pre-defined rules are met, the contract will initiate itself automatically and process the transactions.

Real-time data security

Cryptography prevent data leakage, detect security threats or loopholes, and detect unauthorized activities in real-time.

Useages of blockchain



Challenges in supply chain management

PAYMENT

Transferring money internationally, currency fluctuations, paper-base documentations are increasingly complex when dealing with global supply chain



TRACEABILITY

Increasing parties means increasing hand-overs, impact both material flow & information flow. Keeping track of every stages is more challenging.



TRUST

Many supply chains are facing trust issue and limited collaboration impact to information reliability & transparency for efficient planning.



MULTI-PLAYERS

More direct & indirect parties involving in supply chain, lead to more logistics complexity, inefficient communication & end-to-end visibility



SPEED

Narrower delivery window requirement, Shorter time-to-market to compete with global competitiveness require supply chain to keep up with faster lead time at every stages of the supply chain



Blockchain as a part of SCM



Supply chain with & without blockchain



Expected Benefits of Blockchains in Supply Chains

Distributed Digital Ledger



Sequence of Blocks

Creation and transfer of unique digital objects in a decentralized structure



Digital Trust

Encryption, transparency, verifiability and immutability



Smart Contracts

Programmable actions that can be traced



Open Source

Accessibility and inclusiveness

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Velocity of Supply Chains

Faster transactions.
Less latency, improving cash flow and inventory carrying costs.



Supply Chain Visibility (Tracking)

Track shipments along an intermodal transport chain and identify issues causing delays.
Create a market where service providers bid to handle "blocs".



Supply Chain Security (Tracing)

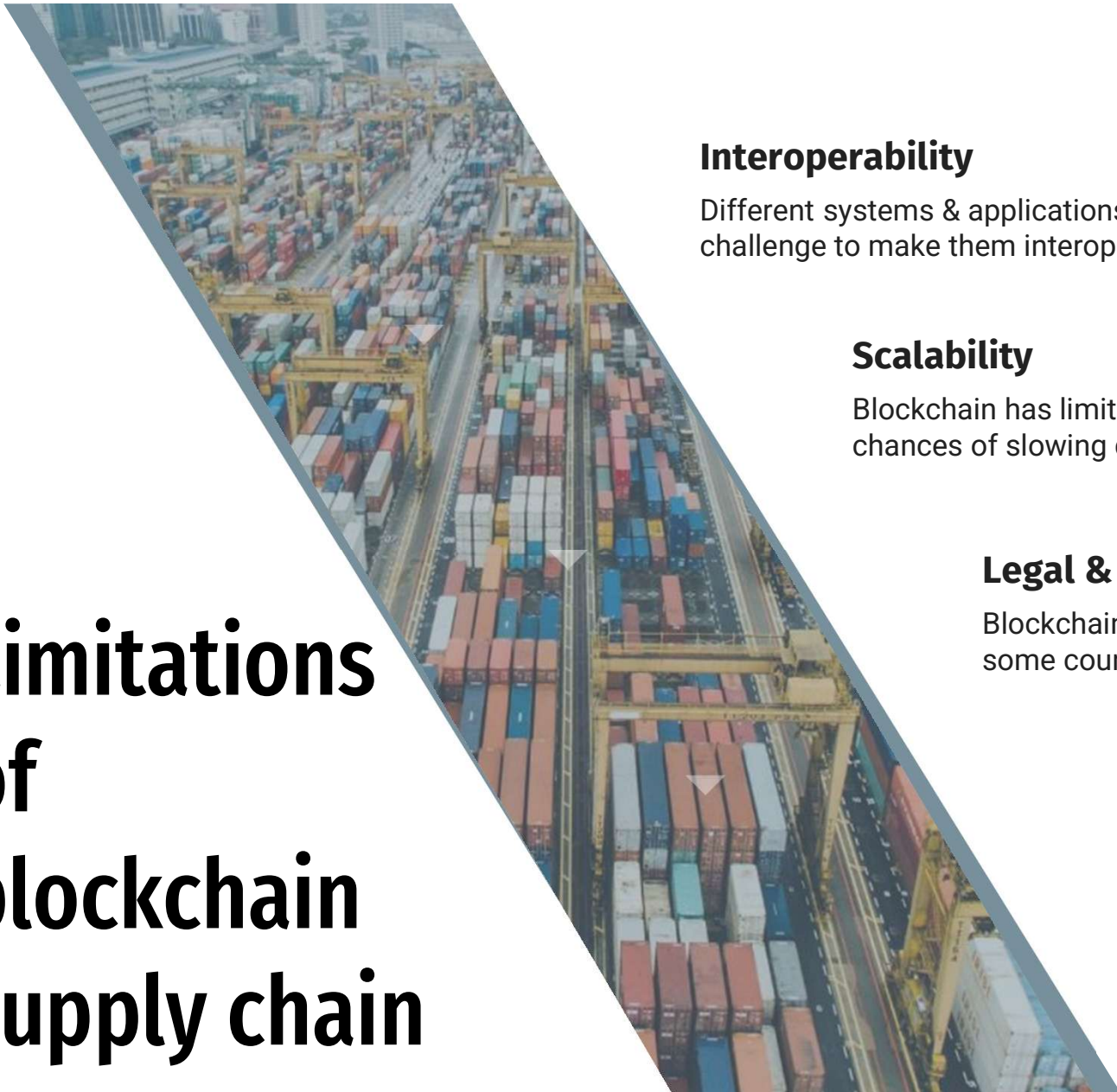
See where, when and how a specific event took place (e.g. cold chain logistics).
Counterfeiting and the use of sub-par materials easier to detect.



Standards and Certification Compliance

Proof that cargo was handled by specific modes, carriers and distribution centers.
Calculate accurately energy use and environmental impacts (e.g. CO2 footprint).

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Limitations of blockchain supply chain

Interoperability

Different systems & applications using across the supply chain participants. It is a challenge to make them interoperable & link with blockchain network effectively.

Scalability

Blockchain has limitation to scale as the more participants, the chances of slowing down is more from larger consensus mechanism.

Legal & regulation compliance

Blockchain may not be compliance with the legislation of some countries.

High implementation cost

Despite many open sources, there are also costs associated with hiring developers, licensing costs & the associated maintenance cost.

Blockchain readiness checklist

SCM BLOCKCHAIN READINESS

Supply chain parties need to evaluate whether the blockchain technique is really required to apply in the supply chain.

The more lists are true, the more likely applicable the blockchain is



Multiple parties share data

multiple participants need views of common information



Multiple parties update data

multiple participants take actions that need to be recorded and change the data



Requirement for verification

participants need to trust that the actions that are recorded are valid



Intermediaries add complexity

removal of intermediaries can reduce cost and complexity



Time sensitive interactions

reducing delay has business benefits

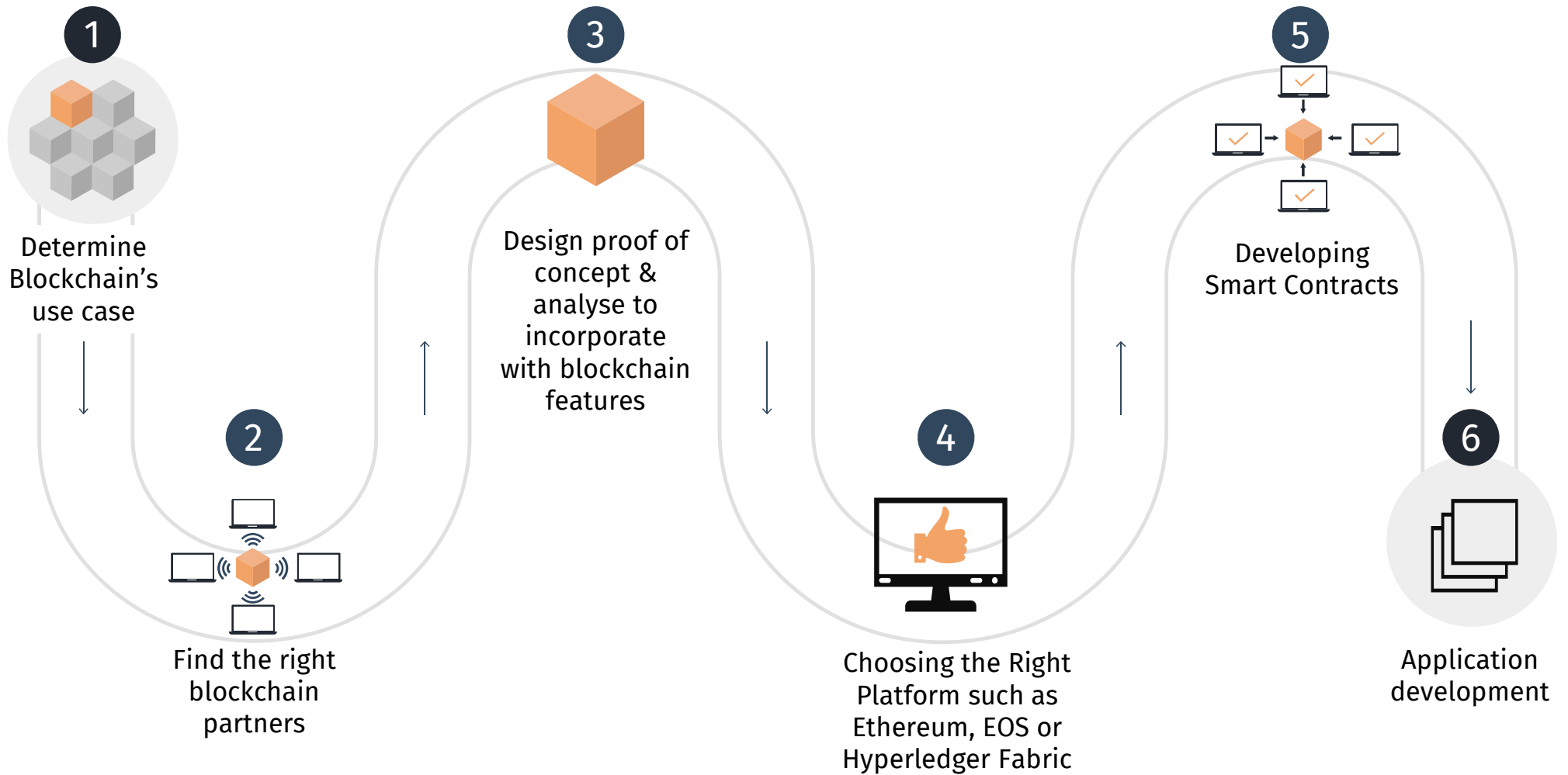


Transactions interact

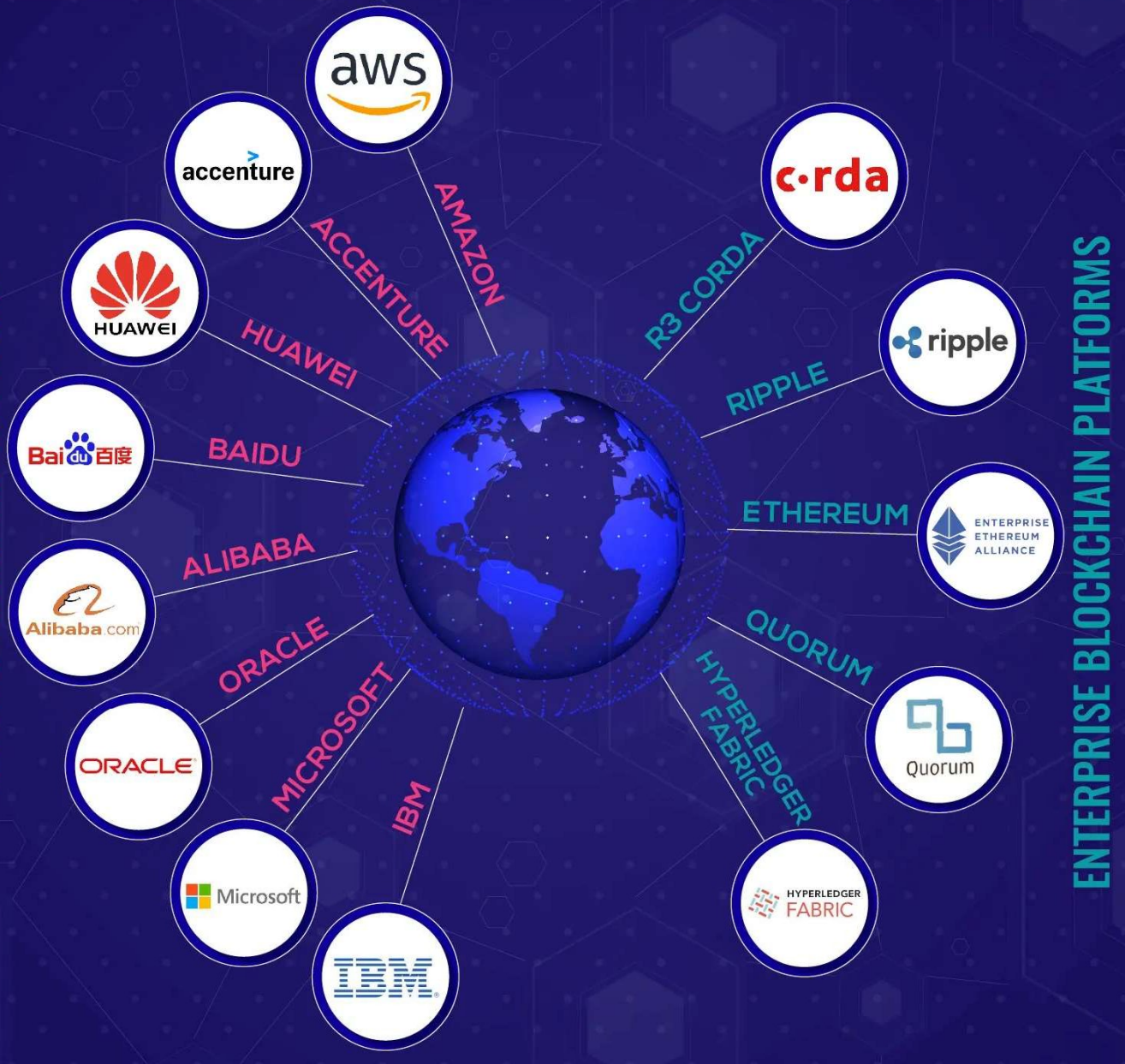
transactions created by different participants depend on each other



Blockchain implementation



VENDORS THAT PROVIDE BAAS



BAAS Vendors and Popular Platforms

Blockchain-as-a-Service providers

BaaS is the development & management of cloud-based networks by 3rd party providers for firms can utilize to host & develop blockchain decentralized apps or smart contracts. These providers manage the back-end infrastructure operations for blockchain apps or platforms.

Enterprise blockchain platforms

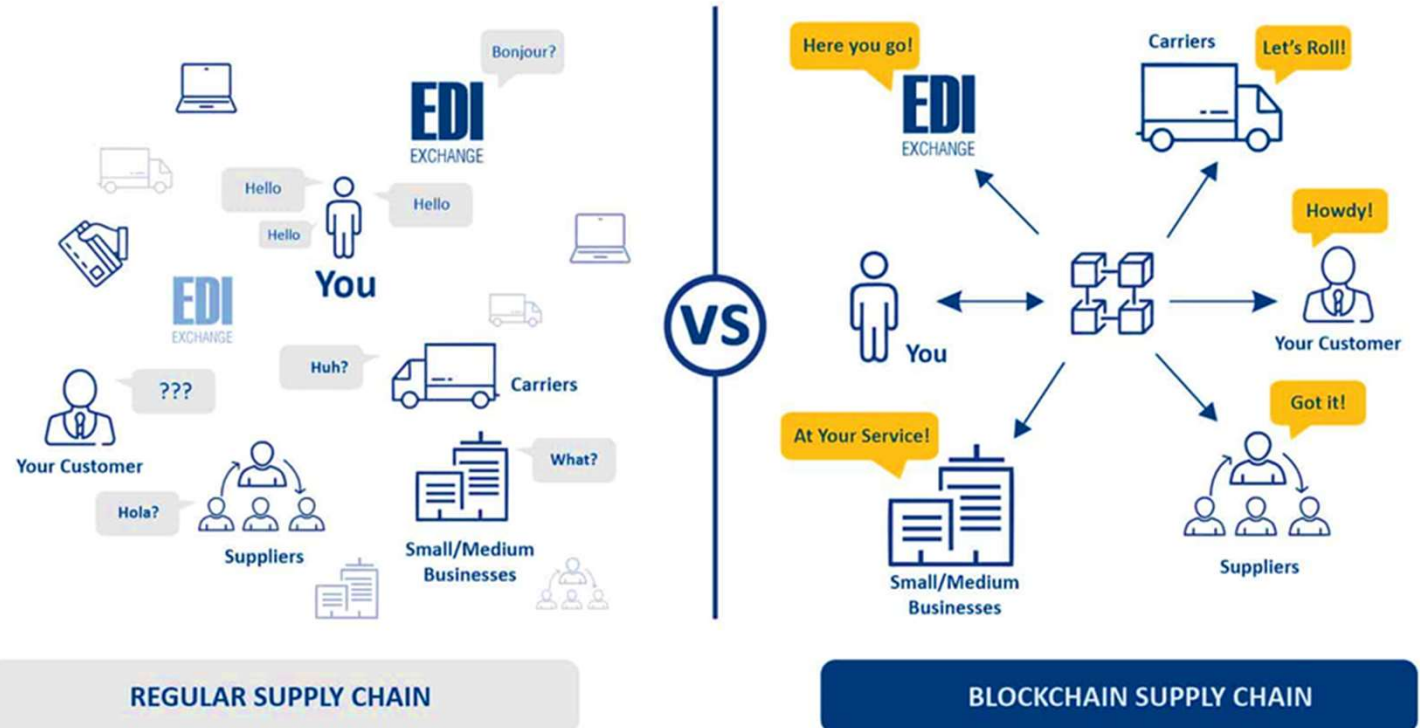
Refer to decentralized platforms bound by corporate smart contracts, enabling participants to interact directly without trusted governance intermediary. Blockchain platform for business is built on a shared, immutable ledger that is permissioned to increase efficiency among trusted partners.

SCM BLOCKCHAIN

How blockchain
transform supply chain
& Logistics processes

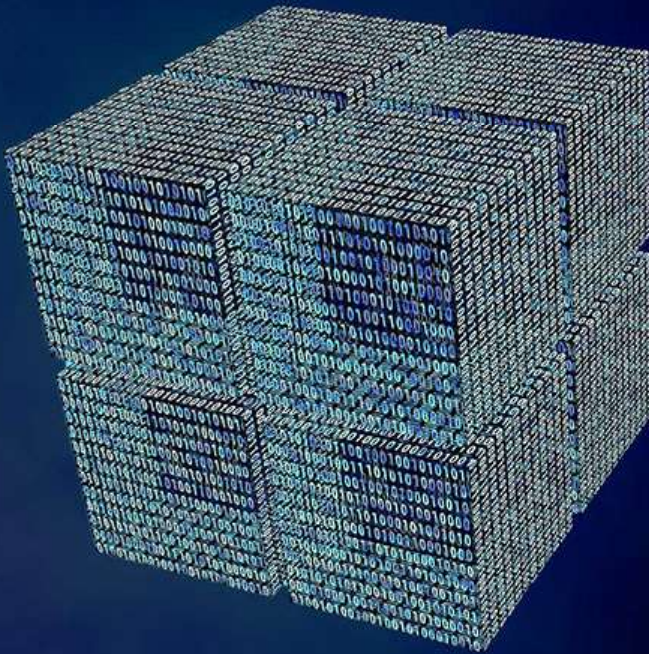
BLOCKCHAIN IN SCM

facilitates easy collaboration, communication and coordination



BaaS for food/beverage provenance

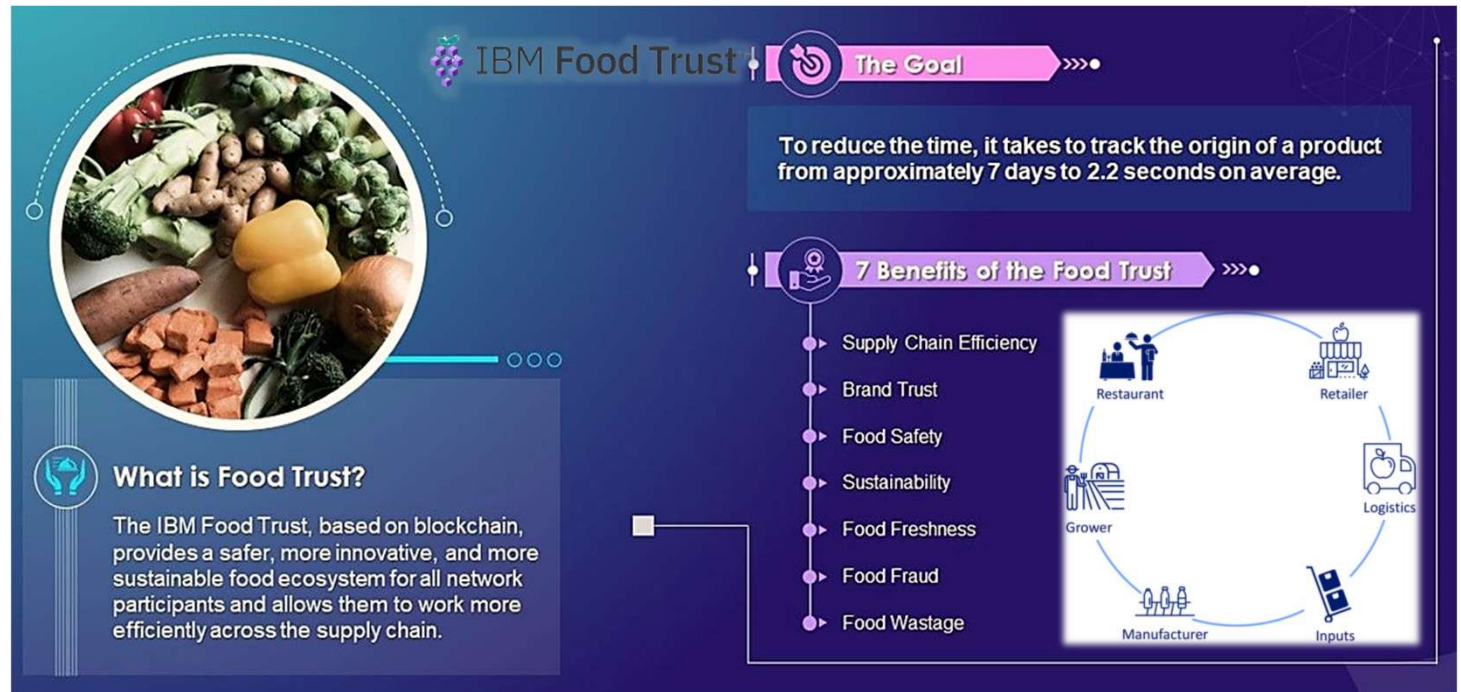
BANQU:



Provenance & Recall management

Example:

Complete trusted food system blockchain solution from data entry to manage certifications



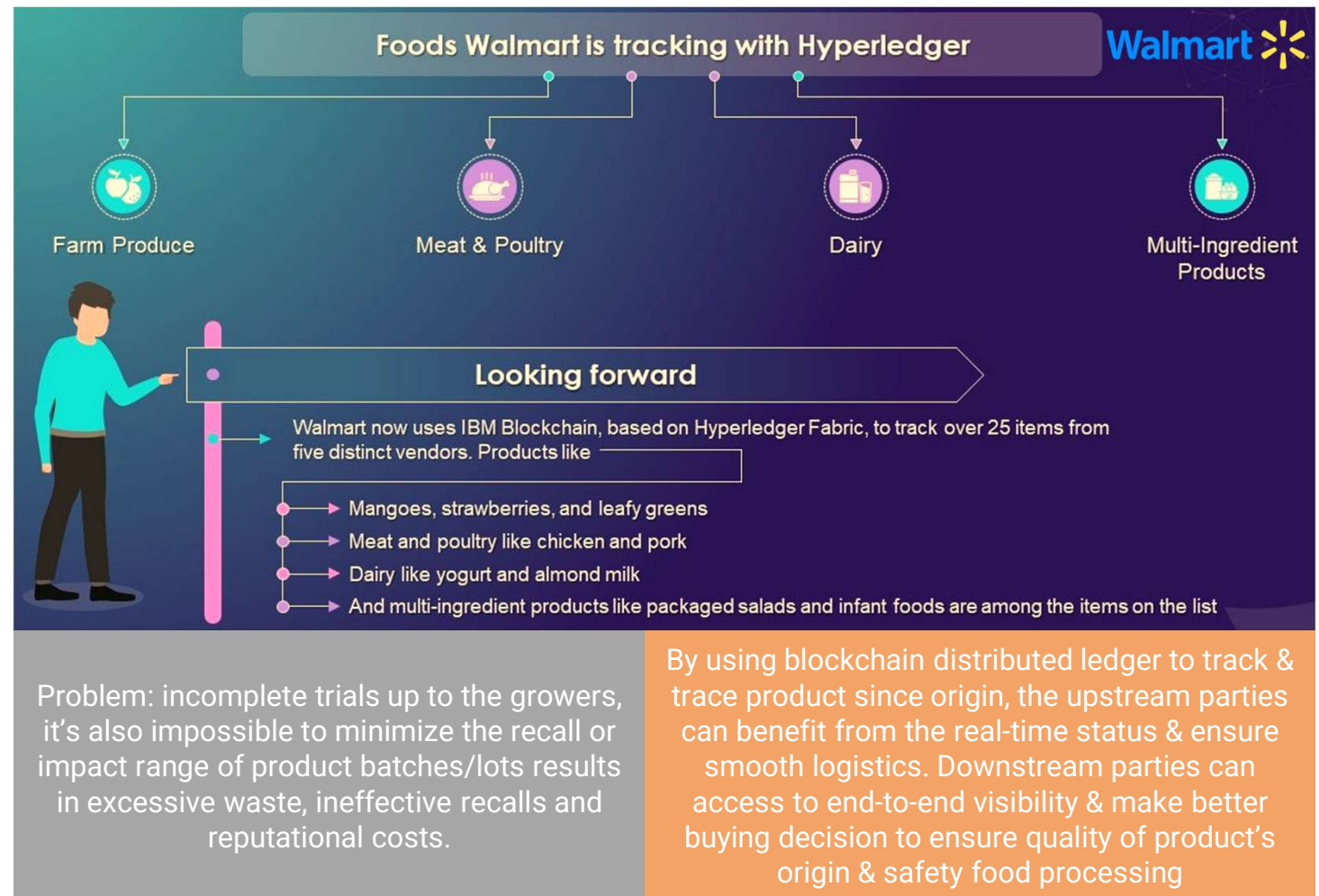
IBM Food Trust solution provides authorized users with immediate access to actionable food supply chain data, from farm to store and ultimately the consumer. Complete history and current location of any food item along with its accompanying information (i.e. certifications, test data, temperature data) can be readily available in seconds. The project currently includes Nestle, Unilever, Walmarts and Tyson

Provenance & Recall management

Example:

Enable provenance of raw materials

Tamper-proof of recording data on the documents that verify their origin and quality

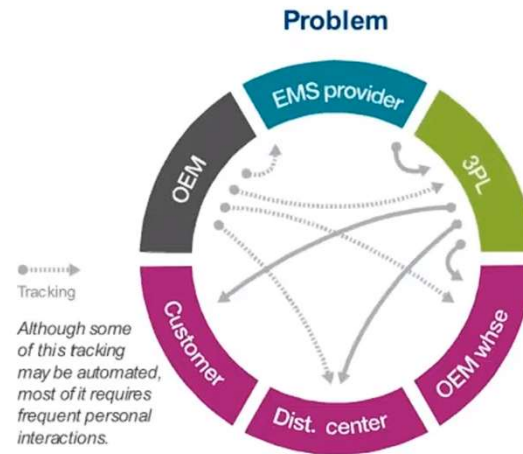


Transparency and visibility

Example:

Visibility across the supply chain

Record trail and audit every product-trade transaction



OEMs working with EMS providers can spend a large amount of time trying to track & determine exactly what are the status of their products as EMS providers can make shipments to many stakeholders



By using blockchain distributed ledger to track & trace product all the way from EMS's production line to each possible shipping destinations

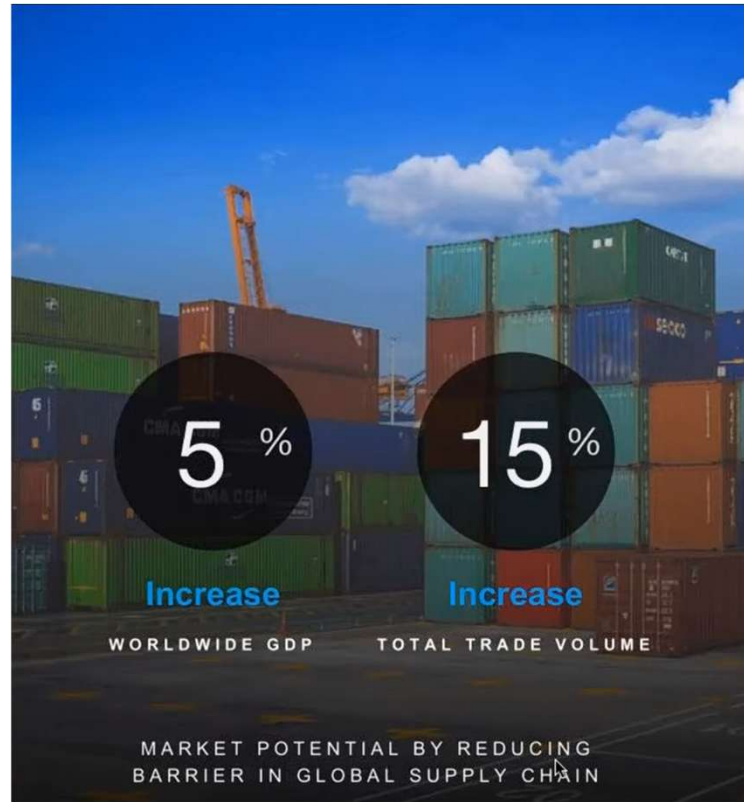
Blockchain can provide information at any point & anytime

- ▶ Blockchain provides an immutable, trusted and shared record of transaction data with timestamp & all relevant details.
- ▶ With its verifiable and decentralized nature, everyone can track the origin and location of a product at any point along the supply chain at any given time.

Tracking and traceability

Example:

Real-time tracking of in-transit shipments between ports



Blockchain can improve ability to manage inventory while it's in transit including whether it's on a truck sitting at customs or physically on a ship crossing an ocean.



MAERSK

PROBLEM | LIMITED VISIBILITY IN THE PAPER TRAIL

Improving in-transit inventory management

Real-time tracking shipment of goods across multiple global supply chain checkpoints

Digitizing the end-to-end supply chain process to increase transparency and security among all trading partners, reduce fraud and errors, decrease product time spent in the transit, and lower waste and cost.

Other examples usage of blockchain in SCM



The background is a complex, abstract pattern of concentric circles. Each circle is composed of many small, light blue squares that are slightly offset from each other, creating a 3D effect of depth and movement. The squares are arranged in a way that they seem to spiral inward toward the center. The overall color palette is a range of blues, from light to dark, with some white highlights on the edges of the squares.

**THANK
YOU**