CFA LEVEL 1

Alternative Investments

Introduction to Digital Assets

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DISTRIBUTED LEDGER TECHNOLOGY

Big Picture Overview

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- **Distributed Ledger Technology (DLT)** underpins digital assets and blockchain.
- It **replaces central authorities** with decentralized systems for recording transactions.
- DLT offers **transparency, security, and immutability**, reshaping how data is trusted and verified.
- Understanding DLT is critical for grasping the **mechanics of cryptocurrencies, DeFi, and tokenization**.

What Is a Distributed Ledger?

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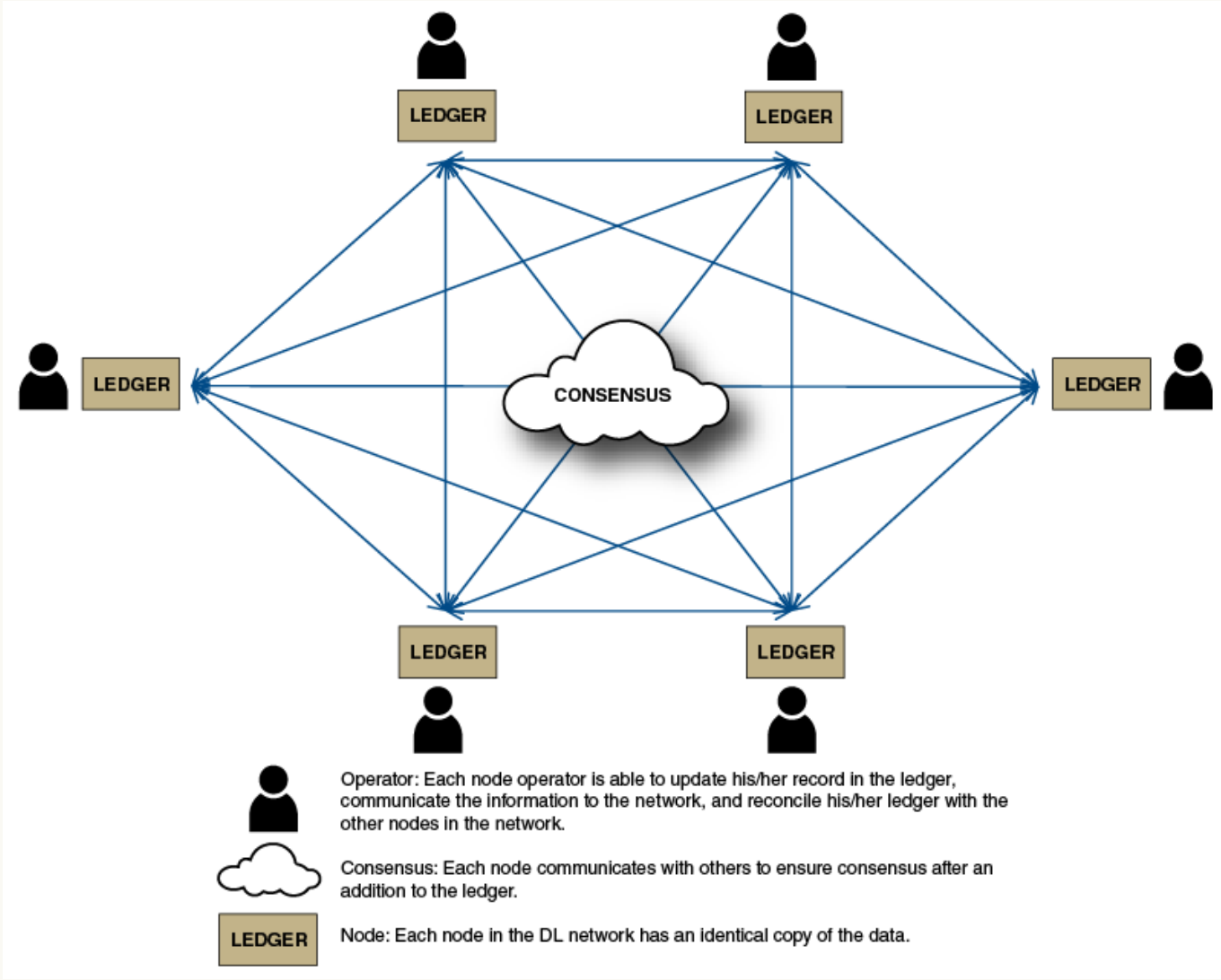
- A **distributed ledger** is a database **shared across multiple participants (nodes)**.
- Every node keeps a **copy of the ledger**, and changes must be validated by a **consensus mechanism**.
- No single point of control — DLT enhances **transparency and trust**.



Key Features of DLT

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- **Decentralization** – No central authority; all nodes share equal responsibility.
- **Immutability** – Once data is recorded, it cannot be altered without network consensus.
- **Transparency** – All participants see the same data at the same time.
- **Consensus Mechanisms** – Ensure agreement on data validity across nodes.

Blockchain as a Type of DLT

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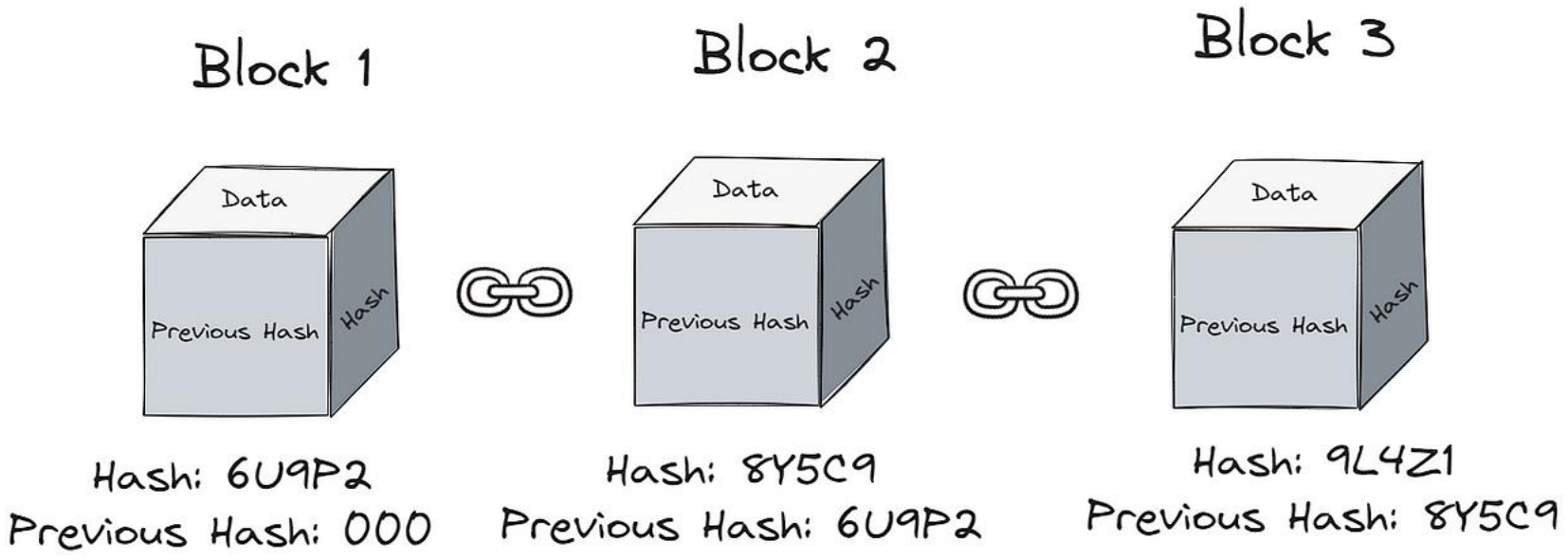
- **Blockchain** is a form of DLT where data is stored in **linked blocks**.
- Each block contains a **batch of transactions** and a **reference to the previous block** (hash).
- This creates a **chronological, tamper-resistant chain**.



Public vs Private Blockchains

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- **Public blockchains**: Anyone can participate (e.g., Bitcoin, Ethereum).
- **Private blockchains**: Access restricted to certain participants (e.g., enterprise blockchains).
- Public = **open and decentralized**
- Private = **controlled and permissioned**

Feature	Public Blockchain	Private Blockchain
Access	Open to all	Restricted access
Speed	Slower (more nodes)	Faster (fewer nodes)
Cost	High (energy + infrastructure)	Lower (but setup costs apply)
Governance	Decentralized, community-driven	Centralized, organization-driven
Use case example	Cryptocurrencies	Supply chain, banks

Nodes and Their Roles

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- **Nodes** are participants in the network that **store and validate** the ledger.
- Some nodes are **validators** or **miners**, depending on the network.
- Other nodes may be **observers** or **participants** that interact with the ledger.

Consensus Mechanisms

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- A **consensus mechanism** ensures all nodes agree on the state of the ledger.
- Popular methods include:
- **Proof of Work (PoW)** – Computational puzzle solving (used in Bitcoin).
- **Proof of Stake (PoS)** – Validators selected based on token ownership/stake.
- Consensus = **trust without a central authority**.

Advantages and Limitations of DLT

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Advantages:

- **Enhanced security** through decentralization
- **Auditability** via immutable records
- **Reduced reliance** on intermediaries

Limitations:

- **Scalability challenges**
- **High energy usage** (PoW systems)
- **Legal and regulatory uncertainties**

Types of Digital Assets

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Definition:

Digital assets are electronic records representing ownership or rights to use, buy, or sell assets. They can function as:

- **Currencies** (e.g. Bitcoin)
- **Securities** (e.g. security tokens)
- **Commodities or Properties** (e.g. tokenized real estate)

Types of Digital Assets

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Main Categories:

Cryptocurrencies:

Privately issued, decentralized, not backed by governments. Includes:

- Bitcoin
- Altcoins
  - Stablecoins
  - Memecoins
- Central Bank Digital Currencies (CBDCs)

Tokens:

Digital representations of ownership or rights:

- **Security Tokens** – digitized securities (e.g. via ICOs)
- **Utility Tokens** – access or pay for services within a network
- **Governance Tokens** – allow voting on network changes
- **Non-Fungible Tokens (NFTs)** – unique tokens tied to digital items

Key Characteristics of Digital Assets

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Cryptocurrencies

- Exist only in digital form (no physical equivalent)
- Enable peer-to-peer transactions without intermediaries
- Based on decentralized ledger systems (e.g., blockchain)
- High price volatility due to lack of clear valuation metrics

Tokens

- **Tokenization** streamlines transfer of real-world assets (e.g., real estate, art)
- **NFTs**: unique, not interchangeable; used in digital art and collectibles
- **Security Tokens**: improve post-trade processing and reduce reconciliation
- **ICOs**: faster, lower-cost fundraising—less regulated than IPOs
- **Utility Tokens**: pay for network services
- **Governance Tokens**: vote on blockchain protocol changes

Key Takeaways

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- Distributed Ledger Technology eliminates the need for **centralized record keepers**.
- Blockchain is the most popular form of DLT, powering **cryptocurrencies and DeFi**.
- Consensus mechanisms replace trust in intermediaries with **mathematical agreement**.
- DLT is still evolving, with **trade-offs in performance, privacy, and scalability**.

Practice Question 1

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Which of the following is a key feature of a distributed ledger?

A. Centralized control

B. Restricted transparency

C. Immutability

D. Manual reconciliation

Practice Question 1

CHARTER DOOZY

Which of the following is a key feature of a distributed ledger?

A. Centralized control

B. Restricted transparency

C. Immutability

D. Manual reconciliation

Correct Answer: C

Once data is recorded on a distributed ledger, it cannot be changed without consensus.

Practice Question 2

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Which of these best describes a public blockchain?

A. It is operated by a central bank

B. It allows only authorized users to read data

C. It is permissionless and open to anyone

D. It cannot process financial transactions

Practice Question 2

CHARTER DOOZY

Which of these best describes a public blockchain?

A. It is operated by a central bank

B. It allows only authorized users to read data

C. It is permissionless and open to anyone

D. It cannot process financial transactions

Correct Answer: C

Public blockchains allow unrestricted participation.

Practice Question 3

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The main function of a consensus mechanism is to:

A. Encrypt data using cryptography

B. Track ownership of tokens

C. Reduce energy consumption

D. Ensure agreement on data among network participants

Practice Question 3

CHARTER DOOZY

The main function of a consensus mechanism is to:

A. Encrypt data using cryptography

B. Track ownership of tokens

C. Reduce energy consumption

D. Ensure agreement on data among network participants

Correct Answer: D

Consensus ensures that all nodes have the same version of the ledger.

Practice Question 4

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Which of the following is TRUE about private blockchains?

A. They are open to anyone to join and validate

B. They are slower due to more participants

C. They are primarily used for cryptocurrencies

D. They are permissioned and controlled

Practice Question 4

CHARTER DOOZY

Which of the following is TRUE about private blockchains?

A. They are open to anyone to join and validate

B. They are slower due to more participants

C. They are primarily used for cryptocurrencies

D. They are permissioned and controlled

Correct Answer: D

Private blockchains restrict access and are typically managed by a known entity.

You Mastered

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What you now understand:

- What Distributed Ledger Technology is
- How blockchain works as a type of DLT
- The difference between public and private blockchains
- The role of nodes and consensus mechanisms

"The difference between winning and losing is most often not quitting."— Walt Disney