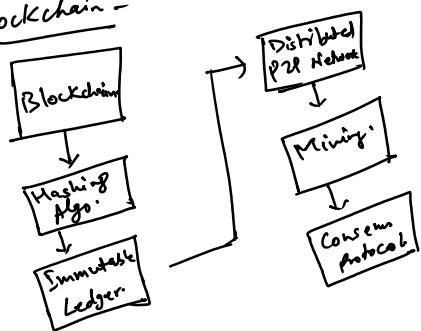


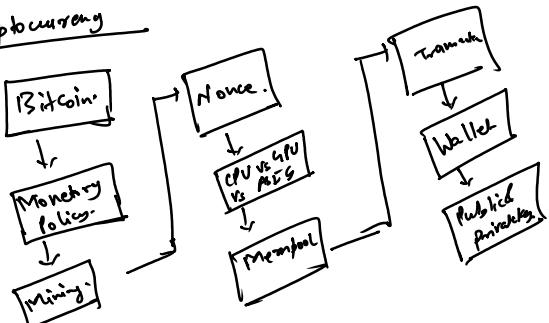
- Blockchain Consensus Mechanisms in Depth
- Basic understanding of blockchain concepts
- Smart Contracts and Their Advanced Features
- Blockchain Networks, Privacy, and Interoperability
- Blockchain Development Tools and Frameworks
- Decentralized Finance (DeFi) and NFT Ecosystems
- Blockchain Scaling, Governance, and Future Trends

- ① Blockchain
- ② Cryptocurrency
- ③ Smart Contract

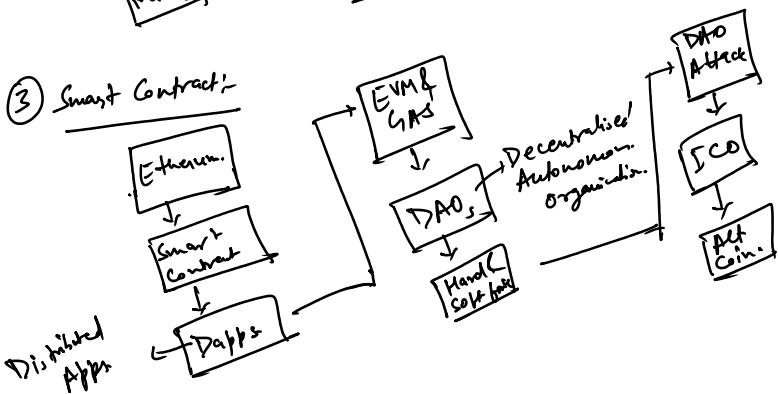
① Blockchain :-



② Cryptocurrency

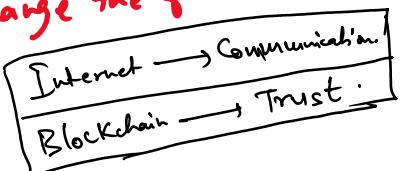


③ Smart Contract :-



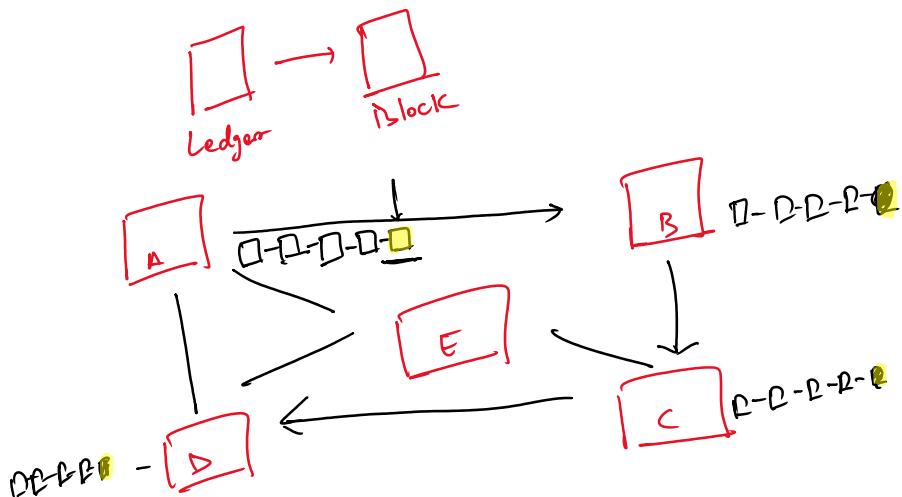
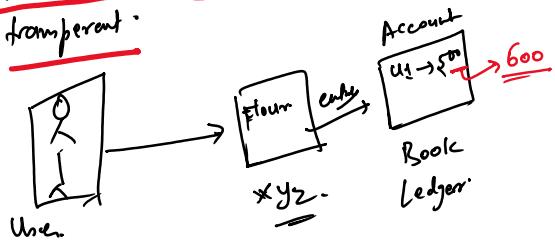
- ① Why is Blockchain?
- Disruptive technology

Technology that change the full traditional approach.



- ① Stuart Haber & W. Scott
- ② Distributed immutable ledger which is completely transparent

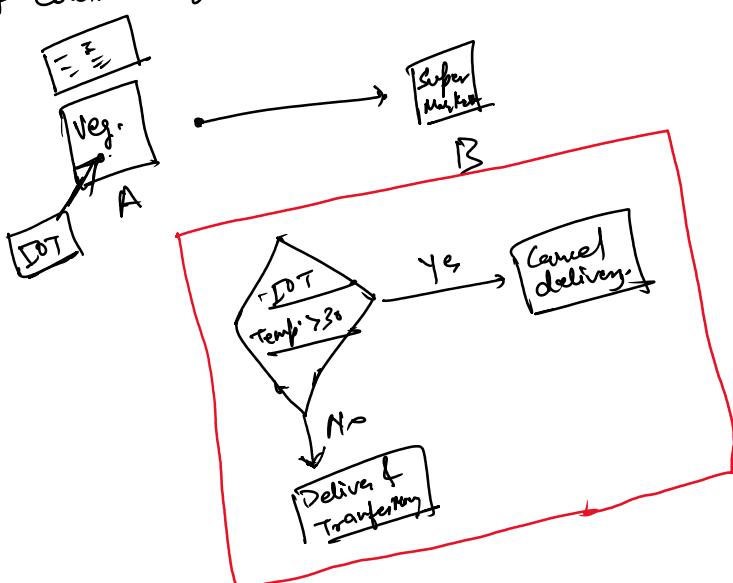
- (1) > run
 (2) Distributed immutable ledger with
transperant



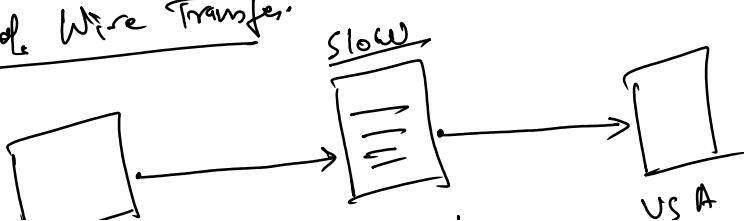
Application of Blockchain:-

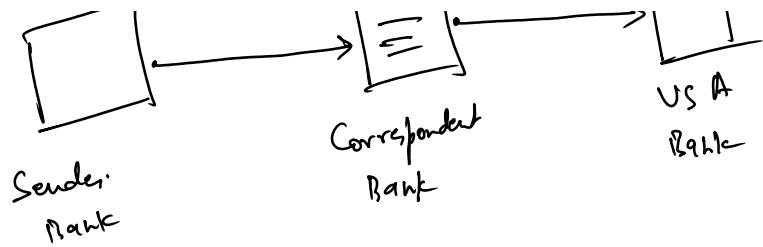
- (4) International wire transfer.

- (1) Product Tracking.
- (2) Health Care System.
- (3) Smart Contract Program - Programming language.

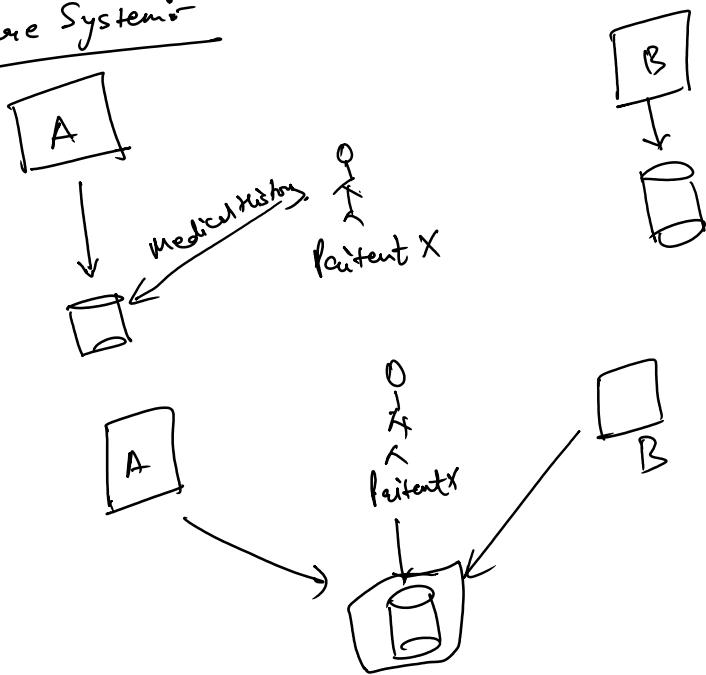


- (3) International Wire Transfer.

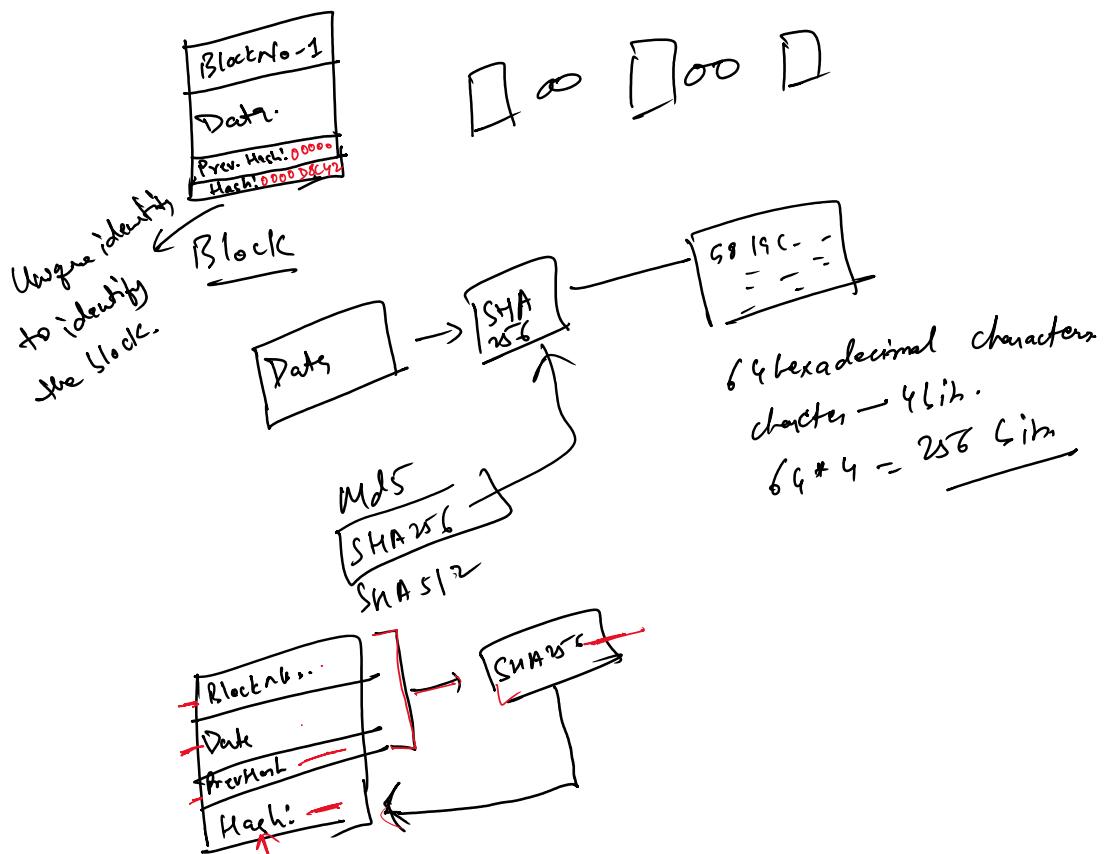




(4) Healthcare System:-

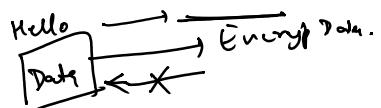


Hashing Algorithm:-



5 Res.

① One way



ABC → 845

② Deterministic.

③ Fast Computation.

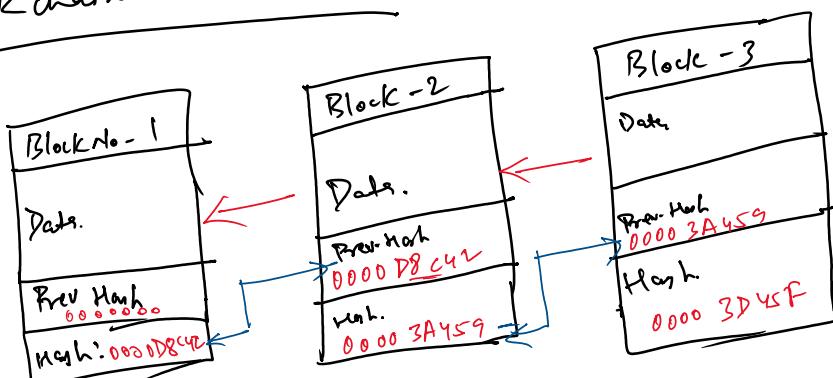
④ Collision.

⑤ Avalanche Effect.

Hello → 45 ABC DE

Hello → 56 ZX C Y A

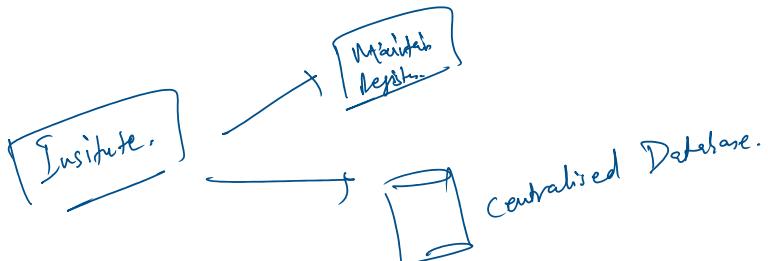
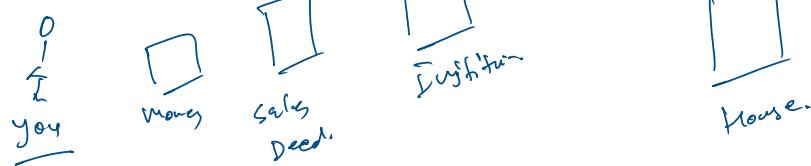
Blockchain Formation



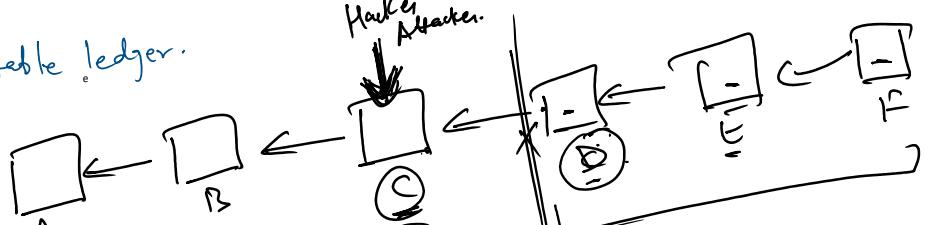
Genesis Block

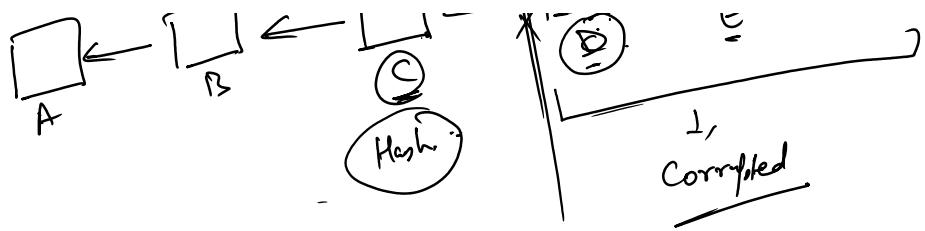
Blockchain

Immutable Ledger



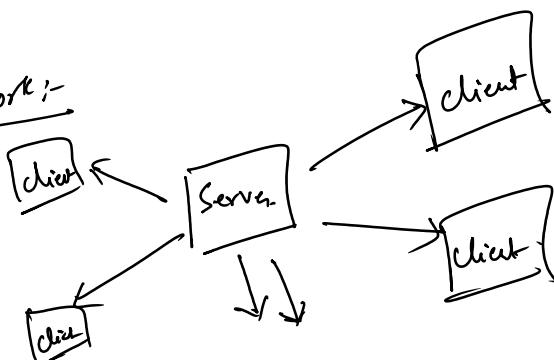
Mutable ledger





P2P Network :-

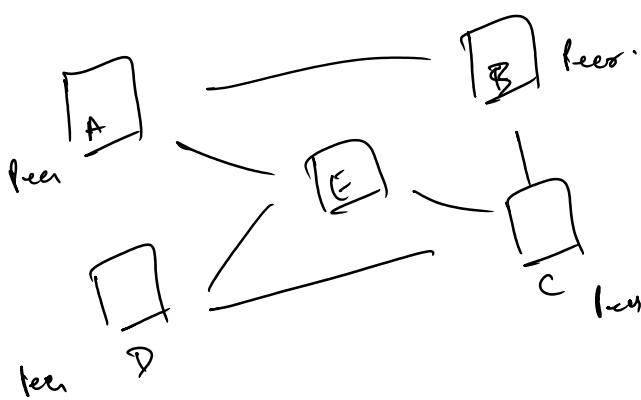
Centralised Network :-



P2P Network :- Peer to Peer Network.

Decentralised Network

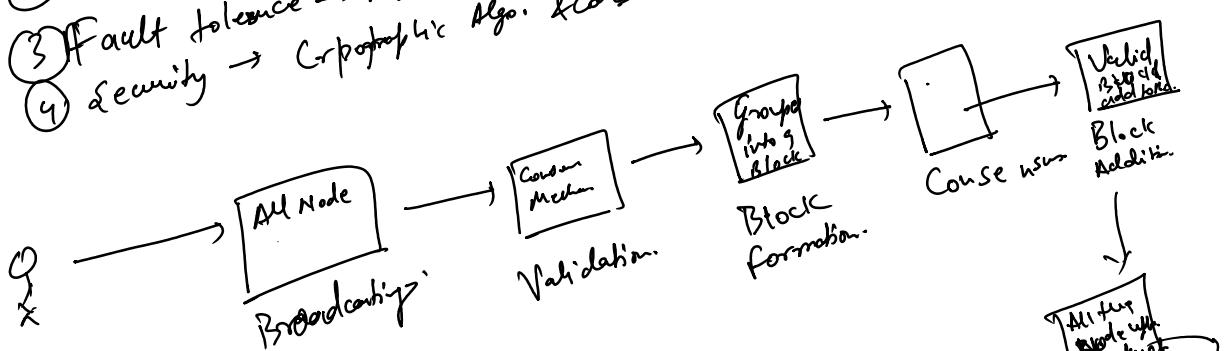
every Node → Act as a client & a server.
Data is being stored, w/o central authority

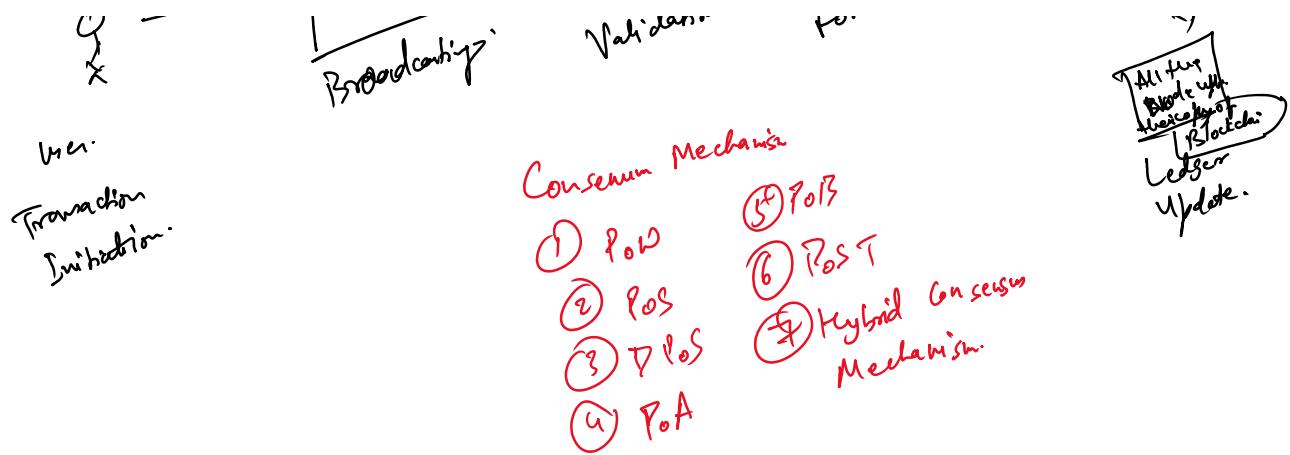


- ① Blockchain - Bitcoin, Ethereum.
- ② BitTorrent, Napster.
- ③ DApps
- ④ P2P Lending Platform.

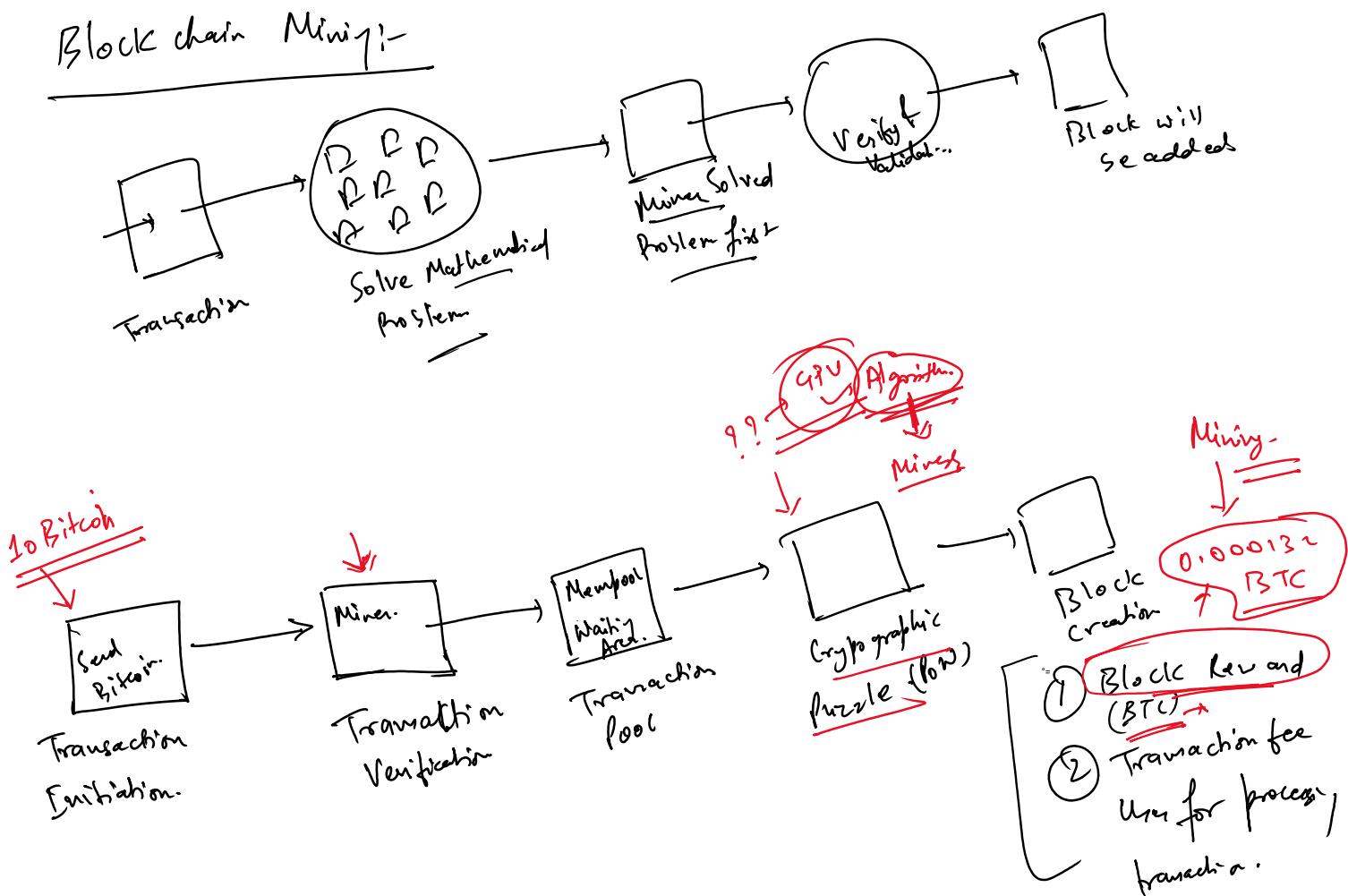
Key characteristics

- ① Decentralization → No Central Server.
- ② Transparency → Every Node has copy of entire blockchain ledger.
- ③ Fault tolerance → Any node got failed, still the operation.
- ④ Security → Cryptographic Algo. & Consensus Mechanism.



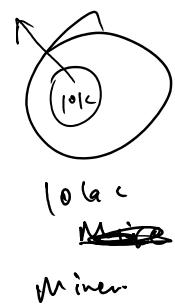


Blockchain Mining:-



Consensus mechanism in Mining:-

- ① PoW (Proof of Work): - Used in Bitcoin.
- Bitcoin, Litecoin, Dogecoin.
- ② PoS (Proof of Stake): - Used in Ethereum 2.0
Faster, energy efficient
... they stake.



② PoS (Proof of Stake)

- Faster, energy efficient
- Amount of cryptocurrency they stake.
ex- Ethereum, Cardano (ADA), Polkadot (DOT)

③ DPoS - Delegated Proof of Stake.

- More Democratic but slightly centralized
- ex- EOS, TRON (TRX)

Hardware:-

① CPU

- Not used anymore.

- High processing power

ex- Ethereum

② GPU

- Application specific Integrated

Circuit

ex- Bitcoin miners

③ ASIC

- custom built for mining

ex- highly efficient

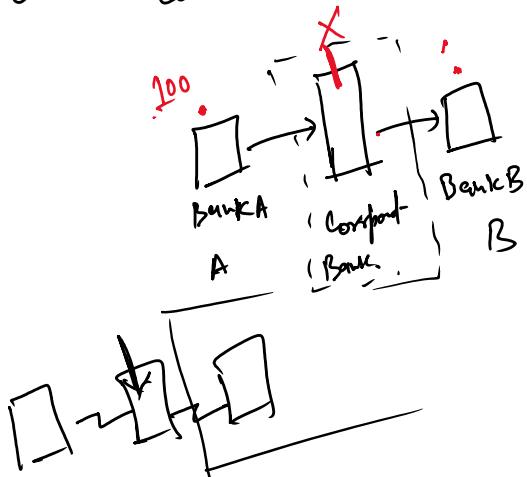
1. Smart Contracts
2. DeFi & NFT Ecosystem.
3. Blockchain Network, Privacy & Interoperability.
4. Blockchain Dev. Tool Framework.
5. Blockchain Scaling, Governance & Future Trends.

① Smart Contract → Digital Contract Stored on a Blockchain
Executed Automatically when predetermined condition are met.
Automate → execution of an agreement

Nick Szabo in 1994
Advent of Ethereum (Solidity) → Develop Complex Smart Contract.

Key features:

- ① Automation -
- ② Trustless Transaction.
- ③ Transparency -
- ④ Security
- ⑤ Cost & Time Efficiency
- ⑥ Immutability.
- ⑦ Decentralization - Avoid Single point of failure.



Adv. feature of Smart contract

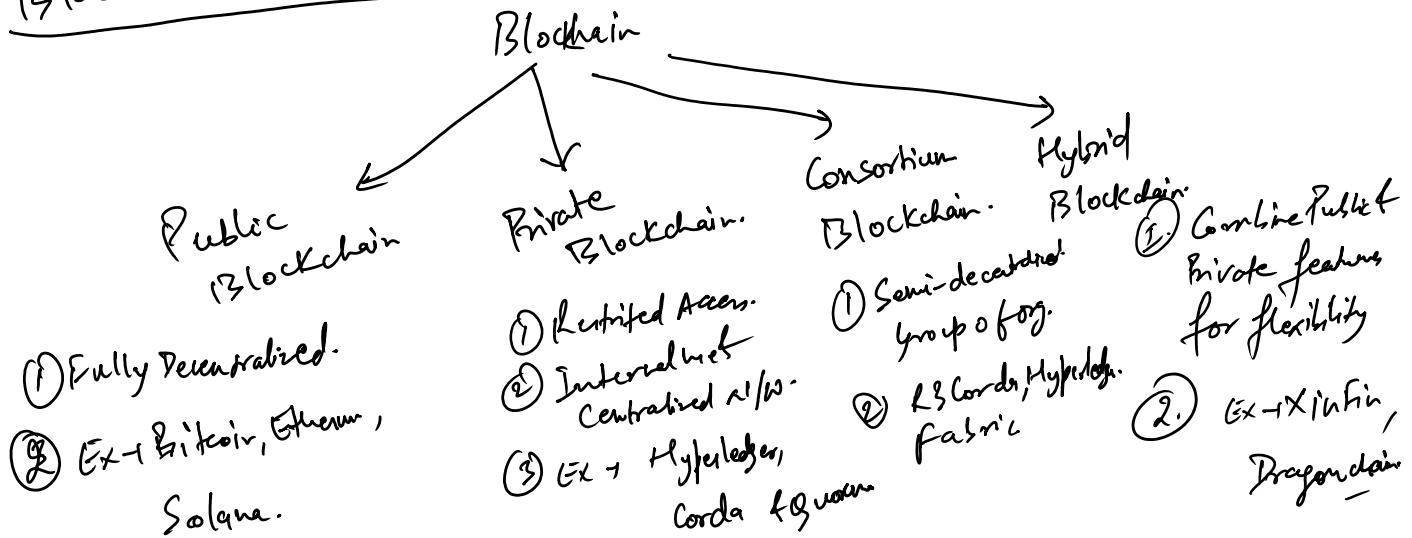
- ① Oracles: Bridging On-chain & Off-chain
- ② Multi-Signature (Multi-sign) Contract
- ③ Upgradable Smart Contract
- ④ Cross chain Smart Contract

Real World Case

Real World Case's

- (1) DeFi
- (2) Supply chain management.
- (3) Gaming & Metaverse.

② Blockchain Networks, Privacy and Interoperability:-



Components:-

- (1) Node - Computes / Validate / Store transaction
- (2) Consensus Mechanism - Algo. ensuring agreement to the ledger state
- (3) Smart Contract - Self-executing Agreement stored on the Blockchain.
- (4) cryptographic security - Data Integrity & Immutability.

Challenges:-

- (1) Scalability -
- (2) Energy consumption -
- (3) Regulatory uncertainty

③ Privacy in Blockchain Network

~ ~ ~ ~ ~ Blockchain Interoperability:- Ability of Different Blockchain interaction

④ Blockchain Interoperability: - Ability of Different Blockchain to communicate, share data & perform transaction.

Seemlessly.

Challenges:

- ① Lack of standardization.
- ② Security Risk.
- ③ Liquidity Fragmentation.

- Solutions:
- ① Cross Chain Bridge. - Wormhole, Avalanche Bridge
 - ② Interoperable Smart Contract -
 - ③ Atomic Swaps - Bitcoin-Ethereum via lightning N/W
 - ④ Layer 2 Scalability - Polygon, Optimism
 - ⑤ Interoperability Platform - Quant M/W, Cosmostation

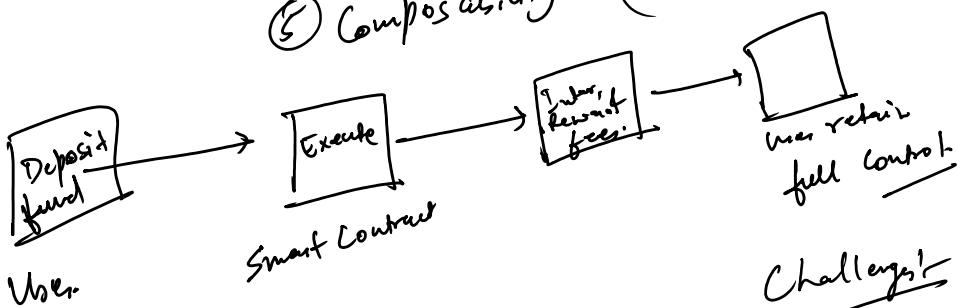
DeFi (Decentralised Finance)

NFT (Non-fungible Tokens)

Feature:

DeFi (Decentralized Finance): - ① Permissionless & open access.

- ② Smart Contracts - Automate transaction w/o intermediaries.
- ③ Liquid Pools -
- ④ Yield Farming & Staking -
- ⑤ Composability - (Aave + Uniswap) Protocol.



Challenges:

- ① Cost
- ② Security Risk.

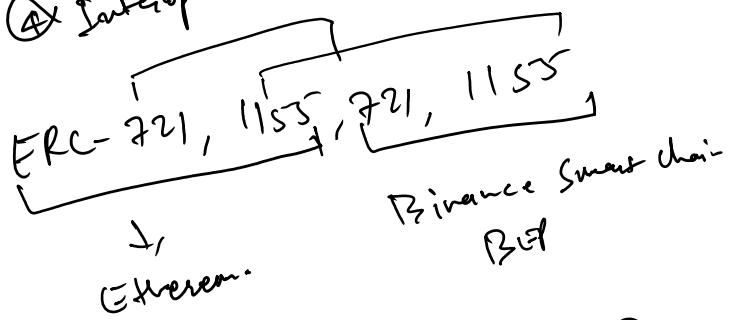
- ① Cost
- ② Security Risk.
- ③ Regulatory Concerns

Future:-

- ① Layer 2 Scaling
- ② Multi-chain DeFi
- ③ AI-powered Defi Risk Management
- ④ DeFi 2.0

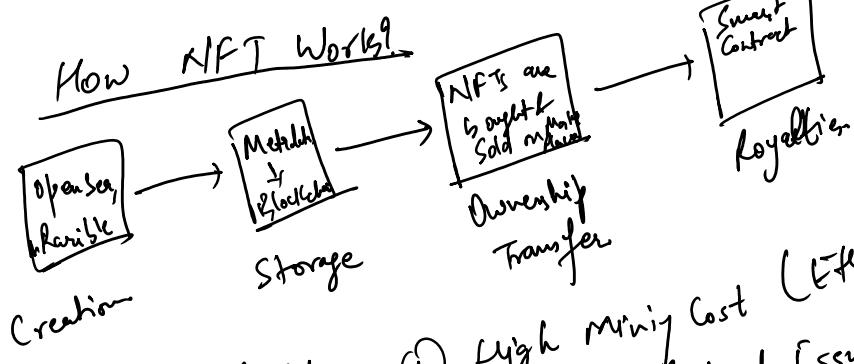
NFT Ecosystem:- Non-Fungible Token

- ① Uniqueness.
- ② Ownership Verification.
- ③ Indivisibility.
- ④ Interoperability — Across Multiple Platforms.
- ⑤ Programmability
↓
Smart Contracts enable automated royalties.



0.00013 BTC

- ① Gaming
- ② Virtual Real Estate
- ③ Digital Art
- ④ Collectibles
- ⑤ Domain Names (ENS)



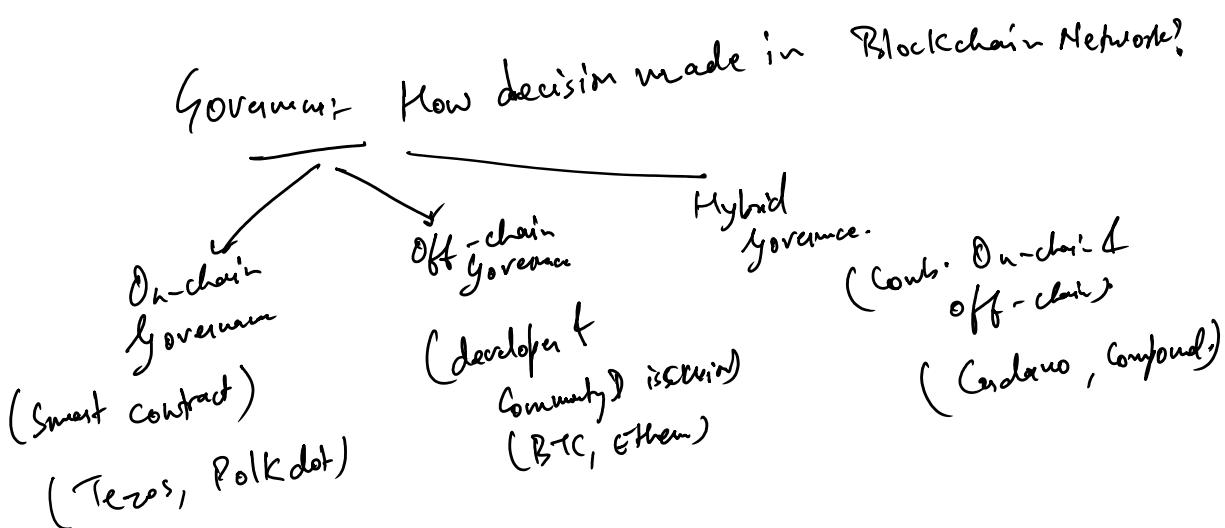
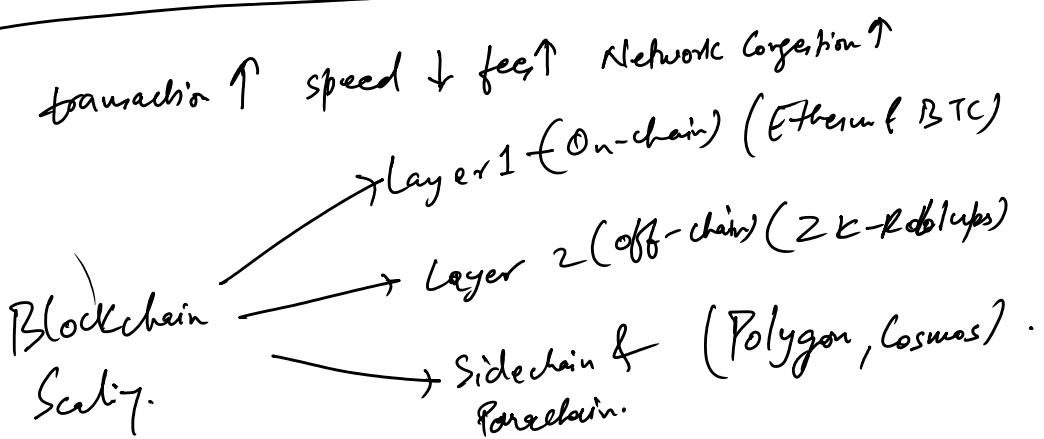
NFT Challenges

- ① High mining cost (Extreme Gas Fees).
- ② Copyright & legal issues. (Ownership Dispute)
- ③ Market speculation (Price Volatility)

Future of NFTs

- ① NFT-Fi (NFT-Defi)
- ② Metaverse Intg.
- ③ AI-generated NFTs.

④ Blockchain Scaling, Governance & Future Trends:-



Future Trend in Blockchain:-

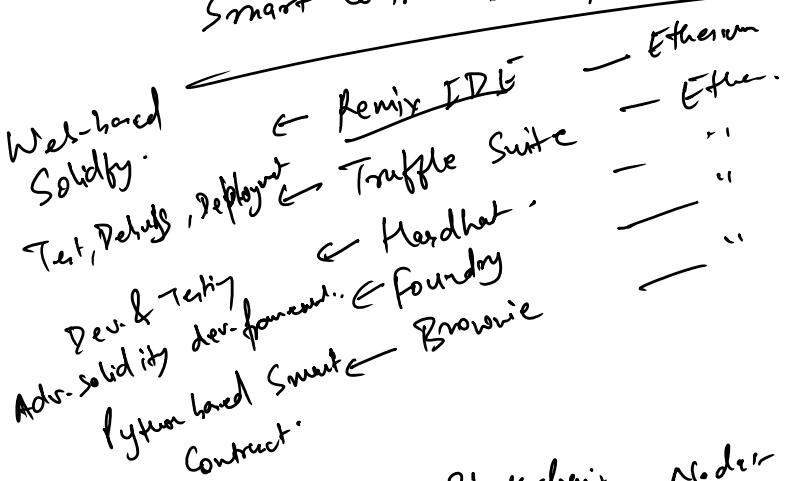
- ① P2P
- ② AI & Blockchain Integration
- ③ Cross chain Interoperability
Blockchain, BlackRock Tokenized Bonds.

- ③ Cross chain Interoperability
- ④ JP Morgan - Onyx Blockchain, BlackRock Tokenized Bonds.

(5) Block chain Development Tools & frameworks:-

- Ethereum → Turing Complete lang. - DeFi, NFTs, dApps
- Corda → Financial Institution
- Quorum → Asset tokenization
- Polkadot → Interoperability framework

Smart Contract Development Tool:-



Run Block chain Node:-

- ① Alchemy
- ② Infura
- ③ Quicknode
- ④ Ganache

Web3 Dev. Tool:-

- ① Web3.js
- ② ethers.js
- ③ IPFS
- ④ Filcoin

⑤ The Graph:-

- Test & Debug:-
- ① Solidity Coverage
- ② Tenderly
- ③ Manticore

Block chain Analysis:-

Analytics

- Blockchain Analytics
- (1) EtherScan
 - (2) BSC Scan
 - (3) Dune Analytics

- Security & Audit Tools
- (1) MythX
 - (2) Slither
 - (3) Certik

- Interoperability Tools
- (1) Chainlink
 - (2) Polkadot
 - (3) Cosmos
 - (4) Wormhole
 - (5) LayerZero