Day 3: Cryptographic Foundations
Building Trust Without Institutions

Digital Finance Introduction

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Digital Finance

2025

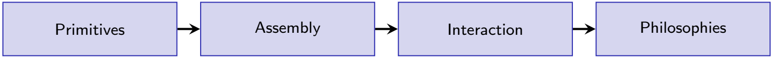
Day 3 Overview

Morning Sessions

1. **3.1 Cryptographic Building Blocks**
   Hashing, Keys, Digital Signatures
2. **3.2 Blockchain Mechanics**
   Consensus, Blocks, Trilemma

Afternoon Sessions

3. **3.3 Wallets & Transactions**
   User Experience Gap
4. **3.4 Bitcoin vs. Ethereum**
   Two Design Philosophies



Day Arc: From smallest building blocks to highest-level design philosophy

Agenda

1. 3.1 Cryptographic Building Blocks
2. 3.2 Blockchain Mechanics
3. 3.3 Wallets, Transactions & UX Gap
4. 3.4 Bitcoin vs. Ethereum

Connecting to Day 1: The Trust Problem

Remember from Day 1:

- Financial systems require **trust** between parties
- Traditional solution: Trusted intermediaries (banks, clearinghouses)
- Digital alternative: Mathematical/cryptographic guarantees

Today we explore HOW cryptography provides trust:

- Hash functions → Data integrity verification
- Digital signatures → Identity and authorization
- Blockchain → Tamper-evident, distributed ledgers

Note: This material is more technical than Days 1-2. Take your time with the concepts.

Key Technical Terms

Definitions you'll encounter today:

Turing-complete A system that can compute anything computable (like a general-purpose computer). Ethereum is Turing-complete; Bitcoin is not.

Byzantine fault tolerant A system that works correctly even when some participants are malicious or fail. Named after the "Byzantine Generals Problem."

Nonce "Number used once" – a value that changes to produce different hash outputs.

Gas Ethereum's unit for measuring computational work. More complex operations cost more gas.

Don't worry if these feel abstract now—they'll make more sense as we work through examples.

3.1 Cryptographic Building Blocks

The Trust Problem in Digital Systems

Traditional Trust Model

- Banks verify your identity
- Courts enforce contracts
- Governments back currency
- Intermediaries everywhere

Problem: Single points of failure

Cryptographic Trust Model

- Mathematics verifies identity
- Code enforces agreements
- Network backs value
- Trust is distributed

Solution: Trust through verification

Key Insight: Cryptography lets us replace “trust me” with “verify this”

Three Cryptographic Primitives

Hash Functions

Digital fingerprints

Public-Key Crypto

Identity without authority

Digital Signat

Unforgeable pro

Integrity
Data hasn't changed

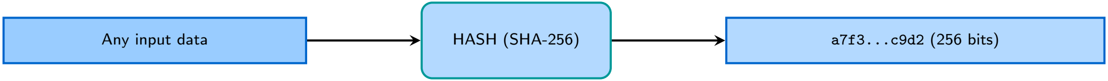
Identity
You are who you claim

Non-repudiatio
You can't deny sig

Focus: What these tools *guarantee*, not how the math works

These three primitives are the atoms of decentralized trust

Hash Functions: Digital Fingerprints



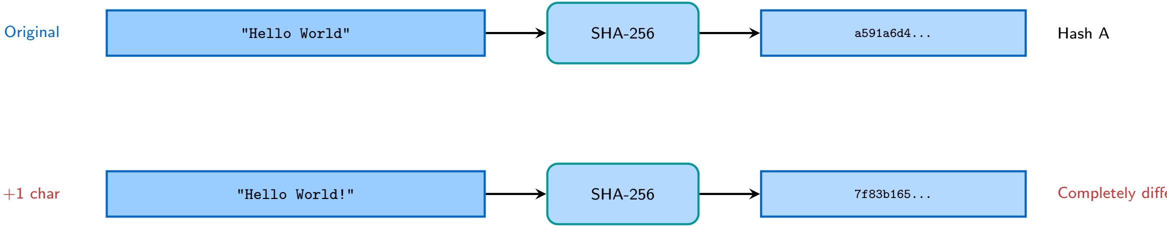
Deterministic: Same input → same output, always

One-way: Cannot reverse to find input

Collision-resistant: Practically impossible to find two inputs with same hash

Avalanche effect: Tiny change → completely different output

Hash Function Visualization: The Avalanche Effect



Original "Hello World" → SHA-256 → a591a6d4... Hash A

+1 char "Hello World!" → SHA-256 → 7f83b165... Completely diffe

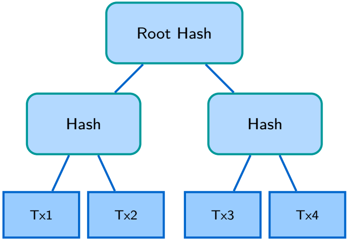
Why this matters for blockchain:

- Change one transaction → entire block hash changes
- This change cascades through all subsequent blocks
- Tampering becomes immediately detectable

What Hash Functions Guarantee

Use Cases in Blockchain

- **Data integrity:** Verify nothing changed
- **Block linking:** Each block contains hash of previous
- **Transaction IDs:** Unique identifier for every transaction
- **Mining puzzles:** Finding hashes with specific properties
- **Merkle trees:** Efficiently verify large data sets

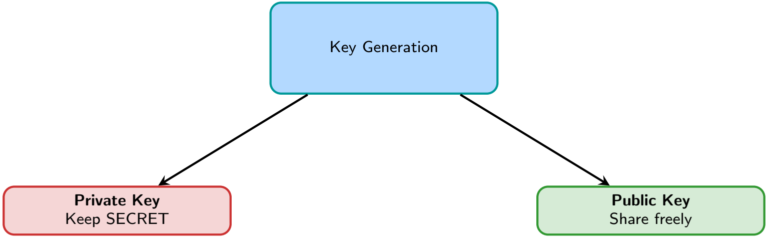


Merkle Tree
Verify any transaction with $O(\log n)$ hashes

The Guarantee

If two hashes match, the data is identical (with overwhelming probability).

Public-Key Cryptography: Identity Without Authority



Mathematical relationship: Public key is *derived* from private key

Easy: Private → Public Impossible: Public → Private

Public-Key Cryptography: How It Works

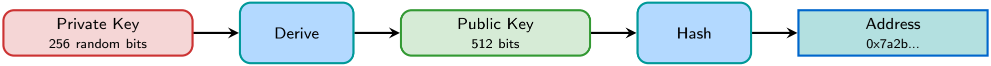
Alice
Private Key A
Public Key A
Bob
Private Key B
Public Key B

To send encrypted message to Bob:

1. Alice encrypts with Bob's public key
2. Only Bob can decrypt with his private key

Key insight: Only the person with the private key can decrypt

From Public Key to Blockchain Address



What You Control

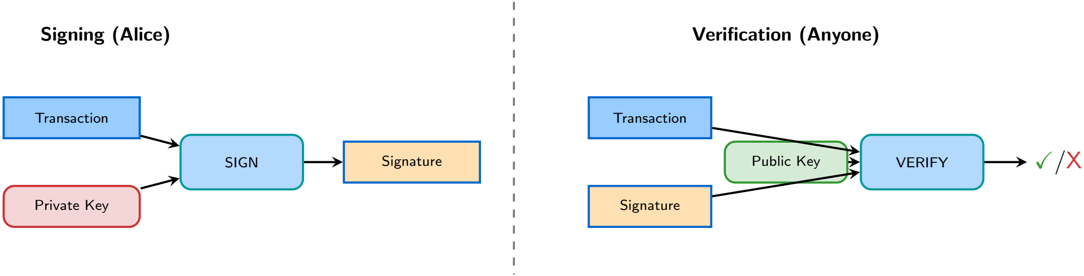
- Private key = your identity
- Whoever has it controls the funds
- Lose it = lose everything
- Share it = share everything

What You Share

- Address = your “account number”
- Safe to share publicly
- Used to receive payments
- Cannot derive private key from it

“Not your keys, not your coins” – a fundamental principle of crypto

Digital Signatures: Unforgeable Proof



What Digital Signatures Guarantee:

- **Authentication:** Only private key holder could create this signature
- **Integrity:** The message hasn't been altered
- **Non-repudiation:** Signer cannot deny having signed

Digital Signatures in Blockchain

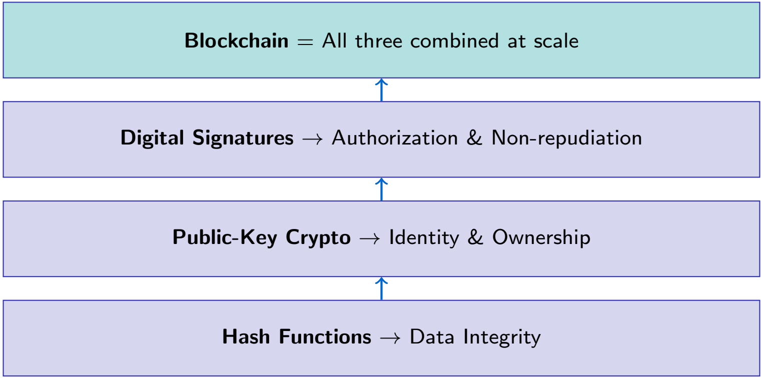
Every blockchain transaction includes a digital signature proving authorization:

Field	**Value**
From	0x7a2b...9f3c
To	0x9c4d...e8f2
Value	1.5 ETH
Nonce	42
Gas Limit	21,000
Gas Price	50 gwei
Signature	*v, r, s (proves authorization)*

How it works in practice:

1. Alice creates transaction: "Send 1.5 ETH to Bob"
2. Alice signs with her private key
3. Network verifies signature using Alice's public key
4. If valid: transaction is processed. If invalid: rejected

Summary: The Cryptographic Trust Stack



Blockchain = All three combined at scale

Digital Signatures → Authorization & Non-repudiation

Public-Key Crypto → Identity & Ownership

Hash Functions → Data Integrity

Key Takeaway

Cryptography transforms trust from “believe the institution” to “verify the math.” No bank, government, or third party needed – just mathematics.

Hands-on: NB05 – Hash, sign, and verify in the Colab notebook

3.2 Blockchain Mechanics

What Is a Blockchain?

"A blockchain is a distributed ledger that is append-only, cryptographically linked, and maintained by consensus."

Distributed

- No central server
- Thousands of copies
- No single point of failure

Append-Only

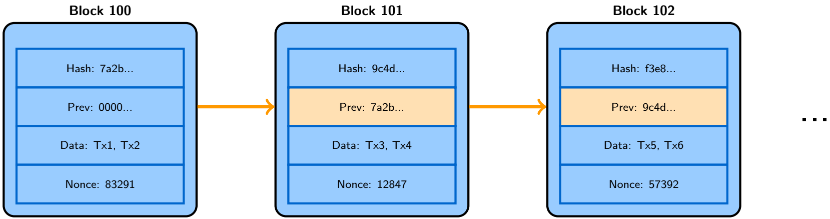
- Can only add data
- Cannot modify history
- Immutable record

Consensus-Based

- Network agrees on state
- No trusted authority
- Rules enforced by code

Simple analogy: A shared Google Doc that everyone can read, only append to, and no one can delete from

Blockchain Structure: Blocks Linked by Hashes



The chain property: Each block contains the hash of the previous block
Why this matters: Change Block 100 → its hash changes → Block 101's "Prev" becomes invalid → cascading invalidity

This is why blockchain history is considered immutable

Why Tampering Is Detectable

Original Chain	Tampered Chain
Block 100: Hash = 7a2b...	Block 100: Hash = x9f2...
↓ (valid link)	↓ (broken link!)
Block 101: Prev = 7a2b...	Block 101: Prev = 7a2b... X
↓ (valid link)	↓ (broken link!)
Block 102: Prev = 9c4d...	Block 102: Prev = 9c4d... X
✓Valid	X Invalid

To tamper with history, attacker must:

1. Change the target block's data
2. Recalculate that block's hash
3. Recalculate *every subsequent block's hash*
4. Do this faster than the honest network adds new blocks

Practically impossible once blocks are deep in the chain

The Consensus Problem

The Challenge

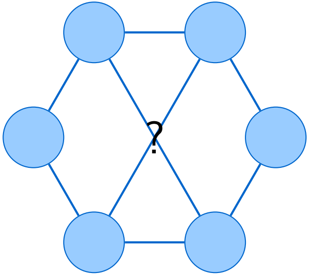
In a decentralized network:

- No central authority
- Nodes don't trust each other
- Messages can be delayed or lost
- Some nodes may be malicious

The Question

How do thousands of strangers agree on:

- Which transactions are valid?
- What order do they go in?
- What is the "true" history?

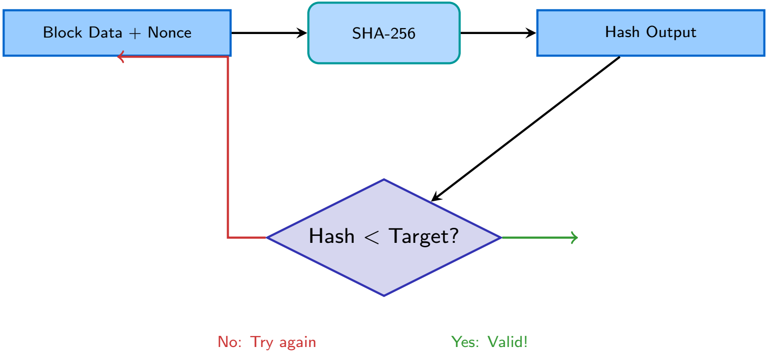


Who decides the truth?

Consensus Mechanism

A set of rules that allows a distributed network to agree on a single version of truth, even in the presence of faulty or malicious participants.

Proof of Work (PoW): Bitcoin's Answer



The "work" in Proof of Work:

- Find a nonce that makes the block hash start with many zeros
- Requires billions of guesses (brute force)
- Easy to verify: just hash once and check
- Hard to produce: requires massive computation

Proof of Work: Security Through Energy

Why It Works

- Attack requires controlling 51% of computing power
- This costs billions in hardware + electricity
- Rational: mining honestly is more profitable
- Economic security: attack cost > potential gain

Advantages

- Battle-tested (Bitcoin since 2009)
- Highly secure
- Truly decentralized

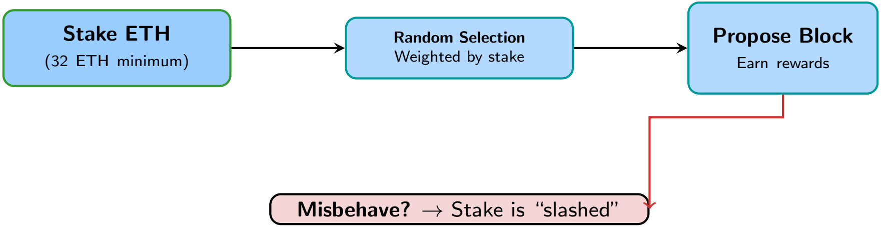
Criticisms

- Enormous energy consumption
- Bitcoin uses more electricity than some countries
- Environmental concerns
- Hardware arms race (specialized ASICs)

Bitcoin Network:
$\approx$ 150 TWh/year
(more than Argentina)

PoW trades energy for security – the “work” is the cost of attack

Proof of Stake (PoS): Ethereum's Answer



Stake ETH
(32 ETH minimum)

Random Selection
Weighted by stake

Propose Block
Earn rewards

Misbehave? → Stake is "slashed"

The "stake" in Proof of Stake:

- Lock up cryptocurrency as collateral
- More stake = higher chance to be selected as validator
- Honest behavior = earn rewards
- Malicious behavior = lose your stake ("slashing")

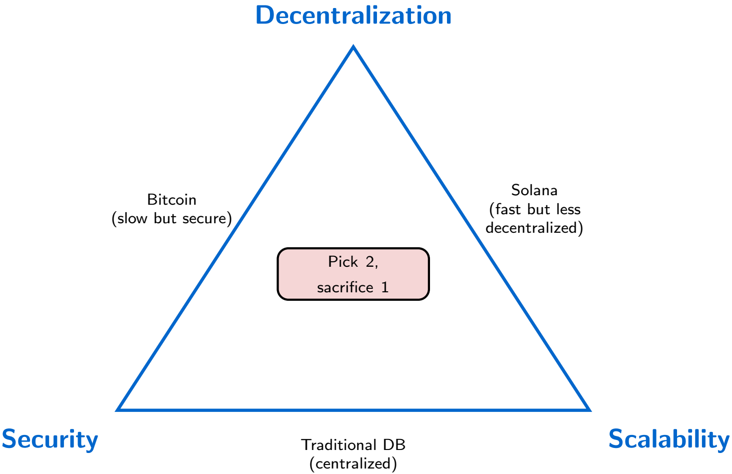
PoW vs. PoS: Head-to-Head Comparison

Aspect	Proof of Work	Proof of Stake
Security basis	Computational power	Economic stake
Energy usage	Very high	Low (∼99.9% less)
Hardware required	Specialized (ASICs)	Standard computers
Entry barrier	High (equipment cost)	High (32 ETH)
Attack cost	Hardware + electricity	Acquire 51% of stake
Decentralization	Mining pool concentration	Wealth concentration
Finality	Probabilistic	Faster, more definite
Examples	Bitcoin, Dogecoin	Ethereum, Cardano, Solana

Key insight: Neither is “better” – they make different tradeoffs

Ethereum transitioned from PoW to PoS in Sept 2022 (“The Merge”)

The Blockchain Trilemma



The Trilemma Explained

Decentralization

- Many independent validators
- No single point of control
- Censorship resistant
- Geographic distribution

Tradeoff: More nodes = slower

Security

- Resistant to attacks
- Immutable history
- Byzantine fault tolerant
- Economic finality

Tradeoff: More verification = slower

Scalability

- High throughput (TPS)
- Low latency
- Low fees
- Handle demand spikes

Tradeoff: Speed often requires centralization

System	TPS	Finality	Validators
Bitcoin	7	60 min	∼15,000 nodes
Ethereum	15-30	12-15 min	∼500,000 validators
Solana	65,000	0.4 sec	∼1,900 validators
Visa	24,000	seconds	1 (centralized)

Scaling Solutions: Breaking the Trilemma?

Layer 1 Solutions

Improve the base blockchain

- Larger blocks (more data per block)
- Faster block times
- More efficient consensus
- Sharding (parallel processing)

Examples:

- Ethereum 2.0 (sharding planned)
- Solana (parallel processing)
- Near Protocol (sharding)

Layer 2 Solutions

Build on top of base layer

- Process transactions off-chain
- Settle on main chain periodically
- Inherit security from L1
- Much higher throughput

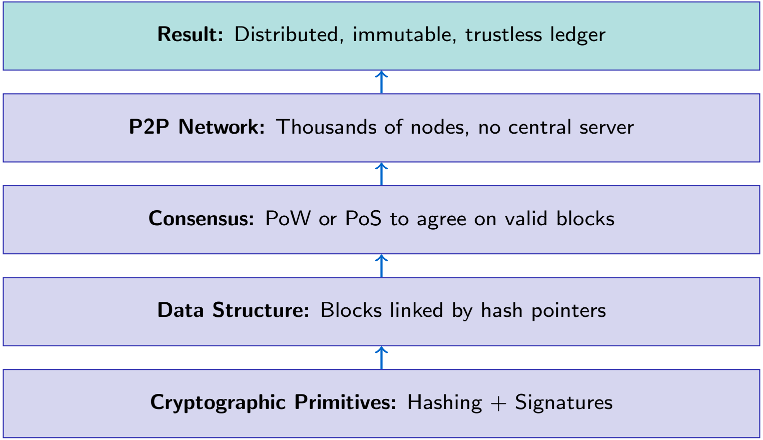
Examples:

- Lightning Network (Bitcoin)
- Optimism, Arbitrum (Ethereum)
- Polygon (Ethereum)

Key Insight

Layer 2 solutions let blockchains scale WITHOUT sacrificing decentralization or security at the base layer.

Summary: How Blockchains Work



Result: Distributed, immutable, trustless ledger

P2P Network: Thousands of nodes, no central server

Consensus: PoW or PoS to agree on valid blocks

Data Structure: Blocks linked by hash pointers

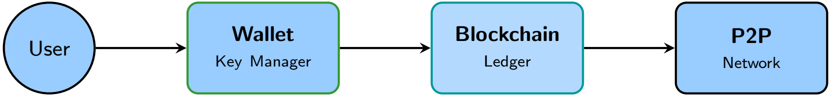
Cryptographic Primitives: Hashing + Signatures

The fundamental tradeoff: Blockchains sacrifice efficiency for trust minimization. When you need trustless coordination among strangers, this tradeoff is worth it.

Hands-on: NB06 – Build a mini-blockchain and simulate tampering

3.3 Wallets, Transactions & UX Gap

From Theory to Practice: How Users Interact



Key insight: Users never interact with the blockchain directly.
The **wallet** is the interface – it manages keys, signs transactions, and broadcasts them to the network.

Common Misconception

Wallets don't “store” cryptocurrency. The blockchain stores balances.
Wallets store *keys* that prove you can spend those balances.

What Is a Wallet, Really?

A wallet is a key management tool
It does three things:

1. **Stores private keys** (securely, hopefully)
2. **Signs transactions** using those keys
3. **Broadcasts transactions** to the network

It does NOT:

- Store cryptocurrency
- Connect you to a bank
- Know your identity
- Require permission to create

Wallet Contents

Private Key 1

0x7a2b...secret

Address 1: 0x9c4d...

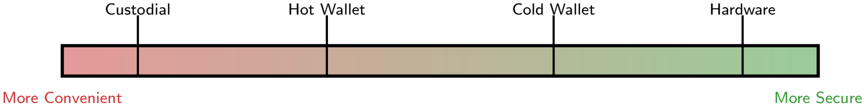
Address 2: 0xf3e8...

Balance: 1.5 ETH

(queried from blockchain)

Types of Wallets: A Spectrum of Tradeoffs

Security vs. Convenience Tradeoff



Type	Key Control	Example	Risk
Custodial	Exchange holds keys	Coinbase, Binance	Exchange hack
Hot Wallet	You hold, online	MetaMask	Malware, phishing
Cold Wallet	You hold, offline	Paper wallet	Physical loss
Hardware	You hold, secure chip	Ledger, Trezor	Device failure

Custodial vs. Non-Custodial: Who Holds the Keys?

Custodial (Exchange) Wallet
You → Exchange → Blockchain

- Easy to use
- Password recovery possible
- Fiat on/off ramps
- You don't control keys
- Exchange can freeze funds
- Exchange can be hacked

Non-Custodial (Self-Custody)
You → Your Wallet → Blockchain

- Full control
- No counterparty risk
- Censorship resistant
- You are responsible
- Lose keys = lose funds
- No customer support

"Not your keys, not your coins"
FTX collapse (2022): $8B in customer funds lost

Anatomy of a Blockchain Transaction

Ethereum Transaction Structure

Field	**Value**	**Purpose**
From	0x7a2b...9f3c	Sender's address
To	0x9c4d...e8f2	Recipient's address
Value	1.5 ETH	Amount to transfer
Nonce	42	Tx count (prevents replay)
Gas Limit	21,000	Max computation units
Gas Price	50 gwei	Price per gas unit
Signature	v, r, s	Proves authorization

The signature covers ALL fields above it – proving the sender authorized this exact transaction.

Understanding Gas: The Cost of Computation

What is Gas?

- Unit measuring computational work
- Each operation has a gas cost
- Simple transfer: 21,000 gas
- Smart contract call: varies (100K+)

Gas Economics

$$\text{Fee} = \text{Gas Used} \times \text{Gas Price}$$

Example:

- Gas used: 21,000
- Gas price: 50 gwei
- Fee = 21,000 × 50 gwei = 0.00105 ETH

Why Gas Exists

1. Prevents infinite loops
2. Compensates validators
3. Prioritizes transactions
4. Allocates scarce block space

Network Congestion

High demand →
Higher gas prices →
Higher fees

(Supply and demand)

Gas prices fluctuate wildly – from cents to hundreds of dollars per transaction

The User Experience Gap

What crypto asks users to understand:

Traditional Banking

- Username and password
- "Forgot password?" link
- Customer support
- FDIC insurance
- Fraud protection
- Clear error messages

Forgiving of mistakes

Cryptocurrency

- 24-word seed phrase
- Lose phrase = lose everything
- No customer support
- No insurance (usually)
- Irreversible transactions
- Cryptic error: "insufficient gas"

Unforgiving of mistakes

The UX Problem

Crypto's security model requires users to be their own bank.
Most people don't want that responsibility.

Common User Errors (And Their Consequences)

Error	Consequence	Recovery?
Lost seed phrase	Permanent loss of funds	No
Sent to wrong address	Funds gone forever	No
Wrong network (ETH to BSC)	Funds stuck/lost	Sometimes
Insufficient gas	Transaction fails	Yes, retry
Approved malicious contract	Wallet drained	No
Phishing attack	Keys stolen	No
Didn't verify contract	Funds stolen	No

Scale of the problem:

- $3.8 billion lost to crypto hacks in 2022 (Chainalysis)
- Estimated 20% of Bitcoin permanently inaccessible (lost keys)
- Phishing remains the #1 attack vector

Improving Crypto UX: Current Efforts

Technical Solutions

- **Account abstraction:** Smart contract wallets with recovery
- **Social recovery:** Trusted friends can help recover
- **Multi-sig:** Require multiple keys to transact
- **Hardware wallets:** Secure key storage
- **ENS names:** Human-readable addresses

UX Improvements

- **Transaction simulation:** Show what will happen before signing
- **Clear warnings:** “This will drain your wallet”
- **Gas estimation:** Show fees in dollars
- **Address books:** Saved, verified addresses
- **Better error messages:** Human-readable explanations

The Goal

Make self-custody as easy as using a bank app, without sacrificing security or decentralization.

Hands-on: NB07 – Construct and examine transactions on a testnet

Summary: The Wallet Landscape

Decision tree for choosing a wallet:

1. **Who holds the keys?**
   - Exchange holds them → **Custodial** (easy, but risky)
   - You hold them → Continue to step 2
2. **Is it connected to the internet?**
   - Yes → **Hot wallet** (MetaMask) – convenient for daily use
   - No → **Cold/Hardware wallet** (Ledger) – secure for savings

Key Takeaway: Wallet choice = tradeoff between convenience and security.
Most users need *both*: hot wallet for daily use, cold storage for savings.

3.4 Bitcoin vs. Ethereum

Two Visions of Blockchain

Bitcoin

"Digital Gold"

- Store of value
- Fixed supply (21M)
- Minimal, robust
- Conservative changes
- "Don't break what works"

Goal: Sound money that no one can inflate or censor

Ethereum

"World Computer"

- Platform for applications
- Programmable money
- Feature-rich, flexible
- Active development
- "Move fast, iterate"

Goal: Decentralized platform for any application

Historical Context

Year	Event
2009	Bitcoin launches
2012	Colored coins on Bitcoin (limited tokens)
2013	Ethereum whitepaper (Vitalik Buterin)
2015	Ethereum launches
2022	Ethereum transitions to Proof of Stake

Vitalik Buterin's insight (2013):
Bitcoin's scripting language was too limited. He proposed a blockchain with a **Turing-complete** programming language – one that could run any program, not just simple transactions.

The Key Difference

Bitcoin: "Is this a valid payment?" (simple yes/no)
Ethereum: "Run this arbitrary code and tell me the result" (general computation)

Technical Comparison: Head to Head

Feature	Bitcoin	Ethereum
Launch	2009	2015
Consensus	Proof of Work	Proof of Stake (since 2022)
Block time	∼10 minutes	∼12 seconds
Supply cap	21 million BTC	No hard cap
Issuance	Halving every 4 years	Dynamic (can be deflationary)
Scripting	Limited (Bitcoin Script)	Turing-complete (EVM)
Primary use	Value transfer, store of value	Smart contracts, DeFi, NFTs
TPS	∼7	∼15-30

Key insight: These aren't competing for the same use case.
Bitcoin optimizes for *security and immutability*.
Ethereum optimizes for *programmability and flexibility*.

Bitcoin: The Sound Money Thesis

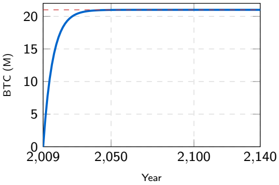
Core Properties

- **Fixed supply:** 21 million, ever
- **Predictable issuance:** Halving every 210,000 blocks
- **Decentralized:** No one controls it
- **Censorship resistant:** Anyone can transact
- **Immutable:** Rules don't change

The Narrative

- "Digital gold" – scarce, durable
- Hedge against inflation
- Separation of money and state
- Base layer for financial system

Bitcoin Supply Curve



Asymptotically approaches 21M

Bitcoin maximalists: "We already have one neutral, global money. Why do we need more?"

Ethereum: The World Computer Thesis

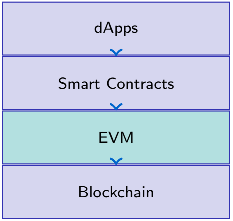
Core Properties

- **Smart contracts:** Self-executing code
- **EVM:** Ethereum Virtual Machine
- **Programmable:** Any logic possible
- **Composable:** Contracts call contracts
- **Tokens:** Create new assets easily

The Narrative

- Platform for decentralized apps
- “DeFi” – finance without banks
- NFTs, DAOs, and more
- Base layer for Web3

Ethereum Stack



Apps built on contracts on EVM

Ethereum enables “programmable money” – money with built-in rules

What Are Smart Contracts?

Traditional Contract

1. Legal document
2. Human interpretation
3. Court enforcement
4. (Maybe) execution

Requires: lawyers, courts, trust

Smart Contract

1. Code on blockchain
2. Automatic execution
3. No intermediaries
4. Guaranteed outcome

Requires: only the code

Definition

A smart contract is code stored on a blockchain that automatically executes when predetermined conditions are met. **Key property:** Once deployed, the code cannot be changed. “Code is law.”

Smart Contract Example: Escrow

Traditional Escrow

1. Buyer sends money to escrow agent
2. Seller ships goods
3. Buyer confirms receipt
4. Escrow agent releases funds to seller

Problems:

- Trust the escrow agent
- Agent takes a fee
- Disputes are slow
- Counterparty risk

Smart Contract Escrow

1. Buyer sends ETH to contract
2. Contract holds funds
3. Buyer calls `confirmReceipt()`
4. Contract automatically sends to seller

Advantages:

- Trust the code (auditable)
- Minimal fees (just gas)
- Instant execution
- No counterparty risk

Key insight: Smart contracts replace trusted intermediaries with verified code.

What “Programmable Money” Enables

DeFi

- Lending/borrowing
- Decentralized exchanges
- Yield farming
- Derivatives

NFTs/Tokens

- Digital ownership
- Tokenized assets
- Loyalty programs
- Gaming items

DAOs

- Decentralized governance
- Treasury management
- Collective ownership
- Voting systems

All built on Ethereum’s programmable foundation

The Power of Composability

Smart contracts can call other smart contracts. This means DeFi protocols can be combined like Lego blocks – creating entirely new financial products.

The Tradeoff: Flexibility vs. Security

Bitcoin's Approach

- Limited scripting = fewer bugs
- Simple = easier to secure
- Ossification as a feature
- "If it ain't broke..."

Security record:

- Never been hacked
- No major protocol bugs
- Predictable behavior
- 15+ years of uptime

Ethereum's Approach

- Full programmability = more power
- Complex = more attack surface
- Continuous improvement
- "Move fast, fix things"

Security record:

- Many contract hacks
- The DAO hack (2016): $60M
- Ongoing exploits in DeFi
- "Code is law" cuts both ways

The Fundamental Tradeoff

More programmability = more capability = more things that can go wrong

Market Positioning

Chain	Programmability	Market Cap	Niche
Bitcoin	Low	#1	Store of value
Ethereum	High	#2	Smart contract platform
Solana	High	#5	High-speed DeFi
Cardano	High	#9	Academic approach

Different chains, different niches:

- Bitcoin: Store of value, “digital gold”, settlement layer
- Ethereum: Smart contract platform, DeFi hub
- Other L1s: Compete on speed, cost, specific use cases

Key insight: It’s not “which chain wins” – it’s “which chain for which use case”

Discussion Questions

1. **Store of value vs. programmability:** Can Ethereum also be “sound money”? Can Bitcoin add smart contracts?

2. **The DAO hack:** Ethereum’s response (hard fork to reverse the hack) violated “code is law.” Was this the right call?

3. **Energy debate:** Bitcoin’s PoW energy use is criticized, but it’s also what makes it secure. Ethereum moved to PoS – did it sacrifice anything?

4. **Maximalism:** Many believe only one blockchain will “win.” Others see room for many. What’s your view?

5. **Regulation:** How might different design philosophies affect regulatory treatment? Is ETH a security?

Summary: Two Philosophies

Bitcoin

- **Philosophy:** Minimalism
- **Goal:** Sound money
- **Priority:** Security, decentralization
- **Approach:** Conservative
- **Scripting:** Limited by design
- **Consensus:** Proof of Work
- **Supply:** Fixed at 21M

Ethereum

- **Philosophy:** Generality
- **Goal:** World computer
- **Priority:** Programmability
- **Approach:** Progressive
- **Scripting:** Turing-complete
- **Consensus:** Proof of Stake
- **Supply:** Dynamic

Not competitors – different tools for different jobs
Understanding both is essential for Digital Finance

Day 3: Key Takeaways

1. **Cryptographic primitives** (hashing, public-key crypto, signatures) are the building blocks of trustless systems
2. **Blockchains** combine these primitives with consensus mechanisms to create distributed, immutable ledgers
3. **The trilemma** (decentralization, security, scalability) forces every blockchain to make tradeoffs
4. **Wallets** are key managers, not coin containers – "not your keys, not your coins"
5. **UX remains a major barrier** to mainstream crypto adoption
6. **Bitcoin and Ethereum** represent fundamentally different visions: sound money vs. programmable platform

Tomorrow: Smart contracts, DeFi protocols, and tokenization (Days 4-5 bridge)

Hands-On Labs for Day 3

Notebook	Topic	You Will...
NB05	Cryptographic Primitives	Hash data, generate keys, sign & verify
NB06	Mini-Blockchain	Build blocks, link them, simulate tampering
NB07	Transactions	Construct, examine, and analyze tx on testnet

Lab Goals:

- Make abstract cryptography tangible through hands-on coding
- See blockchain data structures in action
- Experience the UX challenges firsthand

Remember: Focus on WHAT these tools guarantee,
not HOW the underlying math works

Preview: Day 4

Programmable Finance

Smart Contracts, DeFi, and Tokenization

- How smart contracts enable DeFi protocols
- Lending, borrowing, and trading without intermediaries
- Tokenization: bridging traditional and crypto finance
- Real-world asset tokenization
- Risks and opportunities in DeFi

Day 3: Foundations → Day 4: Applications → Day 5: Integration