Digital Ownership and Tokenization

ECOM215: Blockchain Economics and Digital Assets

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Today's Agenda

What is Tokenization?

Token Standards

The NFT Market: Rise and Fall

Real-World Asset (RWA) Tokenization

Security Tokens

Practical Applications

Challenges and Future

Summary

What is Tokenization?

The Big Picture

Core idea: Represent ownership of assets as tokens on a blockchain.

What can be tokenized?

- Digital art and collectibles (NFTs)
- Financial securities (stocks, bonds)
- Real estate
- Commodities
- Credentials and identity
- Virtually any asset with defined ownership

Why put ownership on-chain?

- **Programmability**: Automate dividends, royalties, compliance
- **24/7 trading**: No market hours, instant settlement
- **Fractional ownership**: Own 0.01% of a building
- **Transparency**: Verifiable ownership history
- **Global access**: Anyone with a wallet can participate

Fungible vs Non-Fungible Tokens

Fungible

Each unit is identical and interchangeable. One unit can be swapped for any other unit of the same type.

Examples: Bitcoin, ETH, USDC, company shares

Non-Fungible

Each token is unique and not interchangeable. Tokens have distinct properties or identifiers.

Examples: Digital art, event tickets, property deeds, credentials

Key insight: Fungibility is about *substitutability*. Can you swap one for another without caring which specific one you have?

What Does a Token Actually Contain?

A token on a blockchain typically contains:

On-chain (stored directly on blockchain):

- Token ID (unique identifier)
- Owner address
- Contract address
- Transfer history

Off-chain (stored elsewhere, linked via URI):

- Image/media file
- Description and attributes
- Additional metadata

Critical point: Most NFTs don't store the actual image on-chain—too expensive. They store a *link* to the image.

Risk: If the server hosting the image goes down, you own... a broken link.

Metadata Storage Options

Storage	Pros	Cons
On-chain	Permanent, decentralised	Very expensive, size limits
IPFS	Decentralised, content-addressed	Needs pinning, can disappear
Centralised server	Cheap, flexible	Single point of failure
Arweave	Permanent, paid once	Cost, smaller ecosystem

IPFS (InterPlanetary File System): Decentralised storage where files are addressed by their content hash, not location.

Best practice: Use IPFS or Arweave for important metadata. Many early NFT projects used centralised servers—some images are already lost.

Token Standards

Why Standards Matter

Token standards define:

- How tokens are created (minted)
- How ownership is tracked
- How transfers work
- What functions wallets and marketplaces can expect

Interoperability: A standard means any wallet or marketplace can interact with any token following that standard.

Main Ethereum standards:

- **ERC-20**: Fungible tokens (most cryptocurrencies)
- **ERC-721**: Non-fungible tokens (unique items)
- **ERC-1155**: Multi-token standard (both fungible and non-fungible)

Other chains have equivalent standards (e.g., SPL on Solana).

ERC-20: Fungible Tokens

The standard for fungible tokens on Ethereum (2015).

Key functions:

- `totalSupply()`: How many tokens exist?
- `balanceOf(address)`: How many does this address own?
- `transfer(to, amount)`: Send tokens to another address
- `approve(spender, amount)`: Allow another contract to spend your tokens

Examples: USDC, USDT, UNI, LINK, most DeFi tokens

Why it matters: ERC-20 enabled the ICO boom, DeFi composability, and standardised how tokens work across the ecosystem.

ERC-721: Non-Fungible Tokens

The standard for NFTs on Ethereum (2018).

Key differences from ERC-20:

- Each token has a unique `tokenId`
- `ownerOf(tokenId)`: Who owns this specific token?
- `tokenURI(tokenId)`: Where is this token's metadata?
- Tokens are indivisible—you can't send 0.5 of an NFT

Examples: CryptoPunks, Bored Apes, most digital art NFTs

Limitation: Each token type requires a separate transaction. Minting 10,000 NFTs = 10,000 transactions (expensive).

ERC-1155: Multi-Token Standard

A more efficient standard that supports both fungible and non-fungible tokens in one contract (2019).

Key advantages:

- Batch transfers: Send multiple token types in one transaction
- Mixed fungibility: Some IDs can be fungible, others unique
- Gas efficient: Significantly cheaper for games and collections

Use case: Gaming

- Token ID 1: Gold coins (fungible—1 million exist)
- Token ID 2: Health potions (fungible—10,000 exist)
- Token ID 3: Legendary sword (non-fungible—only 1 exists)

All managed in one contract, transferable in batches.

Token Standards Comparison

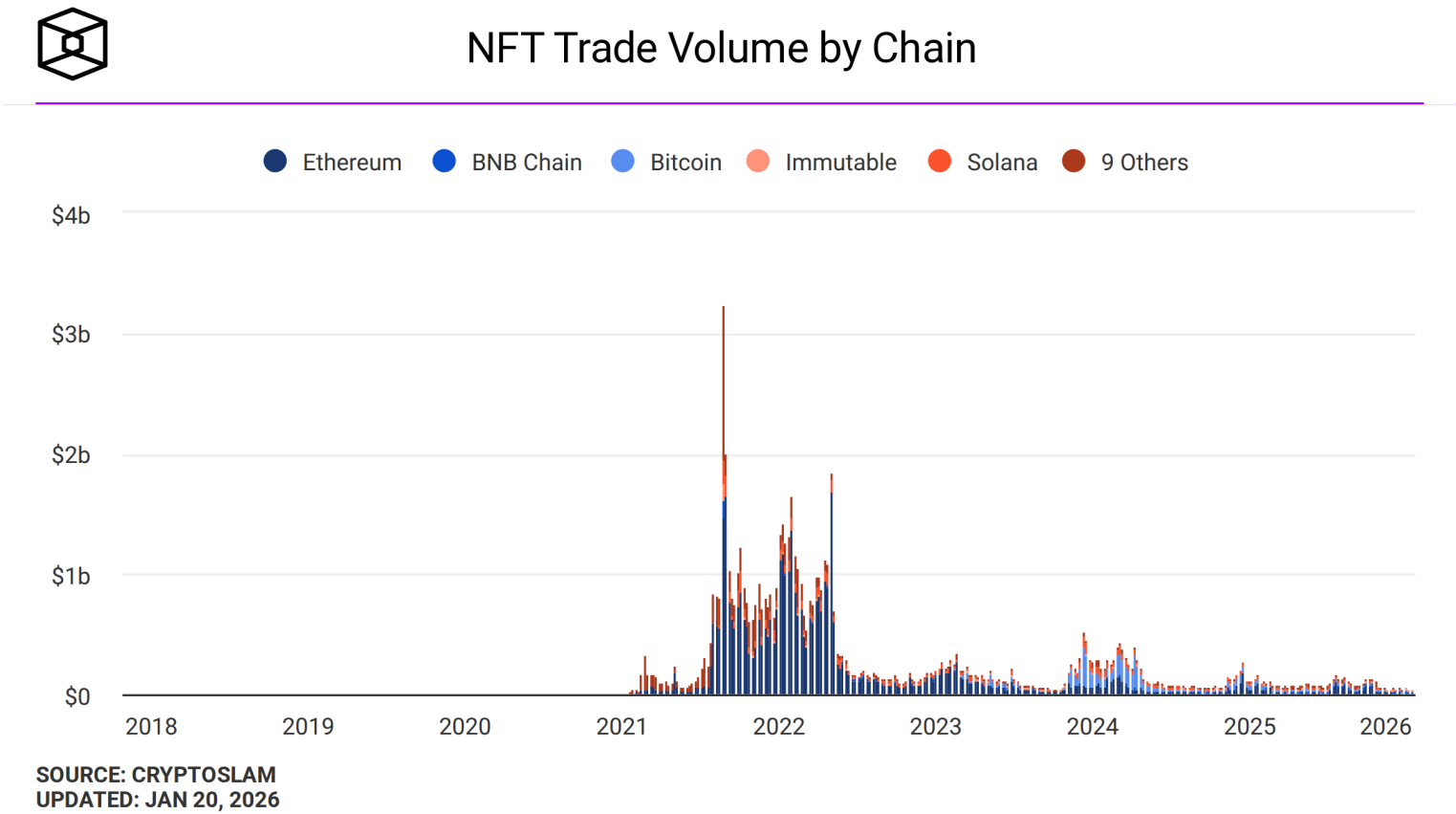
	ERC-20	ERC-721	ERC-1155
Fungibility	Fungible	Non-fungible	Both
Divisible	Yes	No	Configurable
Batch transfer	No	No	Yes
Gas efficiency	Medium	Low	High
Use case	Currencies, shares	Art, collectibles	Gaming, mixed

Choosing a standard:

- Simple fungible token? $\rightarrow$ ERC-20
- Unique collectibles? $\rightarrow$ ERC-721
- Gaming or mixed collections? $\rightarrow$ ERC-1155

The NFT Market: Rise and Fall

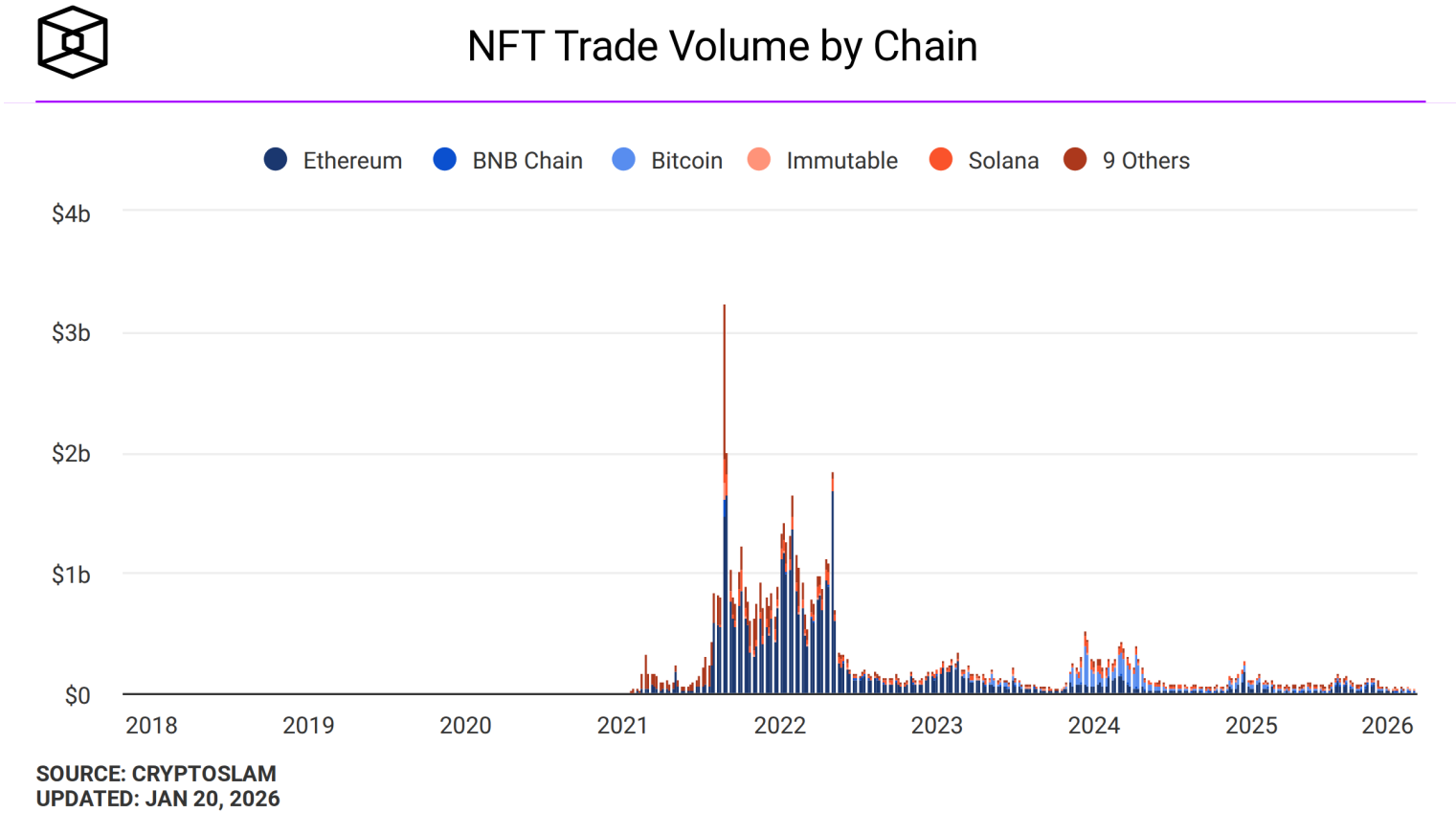
The 2021–22 NFT Boom



What drove the boom:

- Crypto bull market (wealth effect)
- Social signalling (profile-picture culture)
- Speculation and "greater fool" dynamics
- FOMO and media hype

The 2023 NFT Crash



What drove the crash:

- Crypto winter reduced speculative capital
- Utility promises (games, metaverse) did not materialise
- Wash trading exposed—volumes were inflated
- Oversupply: too many collections, not enough buyers

The Wash Trading Problem

Wash Trading

Buying and selling an asset to yourself (or colluding parties) to create fake trading volume.

Why it happened in NFTs:

- Marketplace rewards (tokens, airdrops) based on volume
- Create appearance of liquidity and demand
- Manipulate "floor price" for collection
- Tax loss harvesting (in some jurisdictions)

Scale: studies estimate 40–80% of NFT volume was wash trading at peak.

Detection: Same wallet on both sides, circular transactions, economically irrational patterns, funded from same source.

NFT Pricing: The Fundamental Challenge

How do you value a unique asset with no cash flows?

Traditional valuation doesn't apply:

- No dividends $\rightarrow$ No DCF
- No earnings $\rightarrow$ No P/E ratio
- Unique items $\rightarrow$ No comparable sales (exactly)

What drives NFT prices:

- Rarity of traits (verifiable on-chain)
- Artist/creator reputation
- Collection brand and community
- Historical sales of similar items
- Social signaling value
- Speculation on future demand

Result: Prices are highly subjective and volatile—more art market than financial market.

Lessons from the NFT Bubble

What went wrong:

- Speculation overwhelmed utility
- "Community" and "roadmap" promises were often empty
- Royalties weren't technically enforceable
- Legal status of ownership unclear
- Most buyers were speculators, not collectors

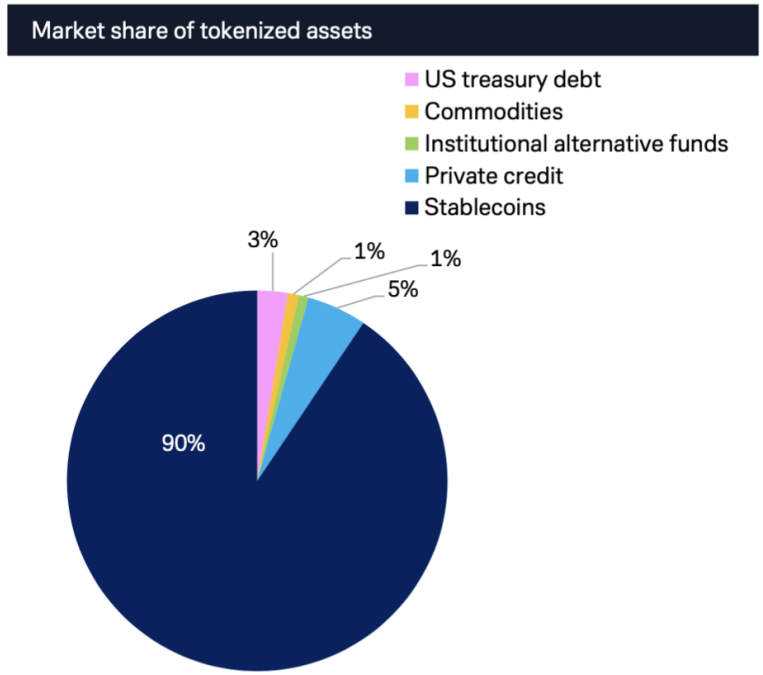
What remains valuable:

- The *technology* of provable digital ownership
- Creator royalties *concept* (even if enforcement failed)
- On-chain provenance and authenticity
- Programmable ownership rights

The infrastructure is useful. The 2021 use case (speculative JPEGs) was not sustainable.

Real-World Asset (RWA) Tokenization

The Institutional Pivot



Sources: Deutsche Bank Research, RWA Database. Corporate bonds, stocks, non-US gov bonds, private equity, real estate, actively managed strategies all account for less than 0.80%. Figures taken on November 17.

What is being tokenized: US Treasury bills, corporate bonds, money market funds, real estate, private credit, and commodities.

Key players entering: BlackRock (BUIDL fund), Franklin Templeton (on-chain money market fund), JPMorgan (Onyx platform), and Goldman Sachs (Digital Asset Platform).

Tokenized Treasuries: The Killer Use Case?

What it is: US Treasury bills represented as tokens on a blockchain.

How it works:

1. Issuer (e.g., BlackRock) buys T-bills
2. Issues tokens representing shares in the T-bill portfolio
3. Token holders receive yield (distributed on-chain)
4. Tokens can be transferred 24/7

Why it matters:

- DeFi protocols can hold yield-bearing collateral
- 24/7 settlement (vs T+1 for traditional)
- Programmable: Auto-reinvest, use as collateral
- Global access to US government debt

Market size (2024): ≈\$1.5 billion in tokenized treasuries.

Case Study: BlackRock BUIDL

BUIDL (BlackRock USD Institutional Digital Liquidity Fund)

Launched March 2024 on Ethereum.

Structure:

- Invests in T-bills, repos, cash
- Each BUIDL token = $1 (stable NAV)
- Daily accrued dividends (paid monthly)
- Tokenised by Securitize

Requirements:

- Qualified purchasers only ($5M+ investable assets)
- $5 million minimum investment
- KYC/AML through Securitize

Significance: World's largest asset manager tokenizing products on public blockchain. Signal of institutional legitimacy.

Why Tokenize Real-World Assets?

	Traditional	**Tokenized**
Settlement	T+1 or T+2	Near-instant
Trading hours	Market hours	24/7/365
Minimum investment	Often $1,000+	Can be $1
Fractional ownership	Limited	Native
Cross-border	Complex, expensive	Simplified
Transparency	Periodic reports	Real-time on-chain
Programmability	None	Smart contracts

The promise: More efficient capital markets with lower friction, broader access, and automated compliance.

RWA Tokenization Challenges

Legal and regulatory:

- What does the token legally represent?
- Securities law compliance
- Cross-jurisdictional recognition
- Bankruptcy treatment

Technical:

- Oracle problem: Who verifies the off-chain asset exists?
- Custody of underlying assets
- Blockchain scalability and costs
- Interoperability between chains

Market structure:

- Liquidity fragmentation
- Need for qualified custodians
- Integration with existing financial infrastructure

Tokenization doesn't eliminate counterparty risk—it just moves it.

Security Tokens

What Are Security Tokens?

Security Token

A token that represents ownership in a regulated security—equity, debt, or investment contract—and is subject to securities law.

Key distinction:

- **Utility token**: Access to a product/service (maybe not a security)
- **Security token**: Investment contract, ownership stake (definitely a security)

The Howey Test (US): Is it an "investment of money in a common enterprise with expectation of profits from efforts of others"?

If yes $\rightarrow$ It's a security $\rightarrow$ Must comply with securities law.

Initial Coin Offerings (ICOs)

Initial Coin Offering (ICO)

A fundraising method where a project sells newly created tokens to investors in exchange for cryptocurrency (usually ETH or BTC), typically before the product is built.

How it worked (2017 boom):

1. Project publishes a "whitepaper" describing the idea
2. Investors send ETH to a smart contract
3. Investors receive new tokens in return
4. Tokens trade on exchanges (often immediately)

The 2017 ICO boom:

- Over $6 billion raised in 2017 alone
- Many projects had no working product
- Anyone could participate—no investor protections
- Examples: EOS ($4B), Tezos ($232M), Filecoin ($257M)

The problem: Most ICO tokens were likely **unregistered securities**.

The ICO Regulatory Crackdown

SEC position (2017-2018): Most ICO tokens are securities.

The DAO Report (July 2017): SEC ruled that DAO tokens were securities, signaling that securities laws apply to token sales.

Enforcement actions:

- Munchee (2017): Shut down, returned $15M to investors
- Paragon, Airfox (2018): $250K penalties each
- Block.one/EOS (2019): $24M settlement
- Telegram/TON (2020): $1.2B returned, project cancelled
- Ripple/XRP (2020): Ongoing lawsuit

Result: ICO market collapsed. Projects seeking compliant fundraising turned to **Security Token Offerings (STOs)**.

Security Token Offerings (STOs) vs ICOs

	ICO (2017)	STO
Regulatory status	Often unclear/non-compliant	Registered or exempt
Investor requirements	Anyone	Often accredited only
Disclosure	Whitepaper (variable quality)	Prospectus/offering memo
Investor protection	Minimal	Securities law applies
Secondary trading	Unregulated exchanges	Licensed platforms

US exemptions used for STOs:

- Reg D (accredited investors only)
- Reg A+ (mini-IPO, up to $75M)
- Reg S (non-US investors)

Security Token Infrastructure

Issuance platforms: Securitize, Polymath, Harbor

Key requirements:

- KYC/AML verification of all token holders
- Transfer restrictions (only to verified wallets)
- Compliance with holding periods (e.g., Reg D lockup)
- Cap table management
- Reporting and disclosure

How it works technically:

- Whitelist of approved addresses
- Transfer function checks compliance before executing
- Forced transfers possible (for legal requirements)
- Dividend/interest distribution automated

This is *permissioned* tokenization—not the "anyone can participate" ethos of DeFi.

Security Tokens: Current State

What's been tokenized:

- Real estate (commercial and residential)
- Private company equity
- Fund shares
- Corporate bonds
- Revenue-sharing agreements

Challenges:

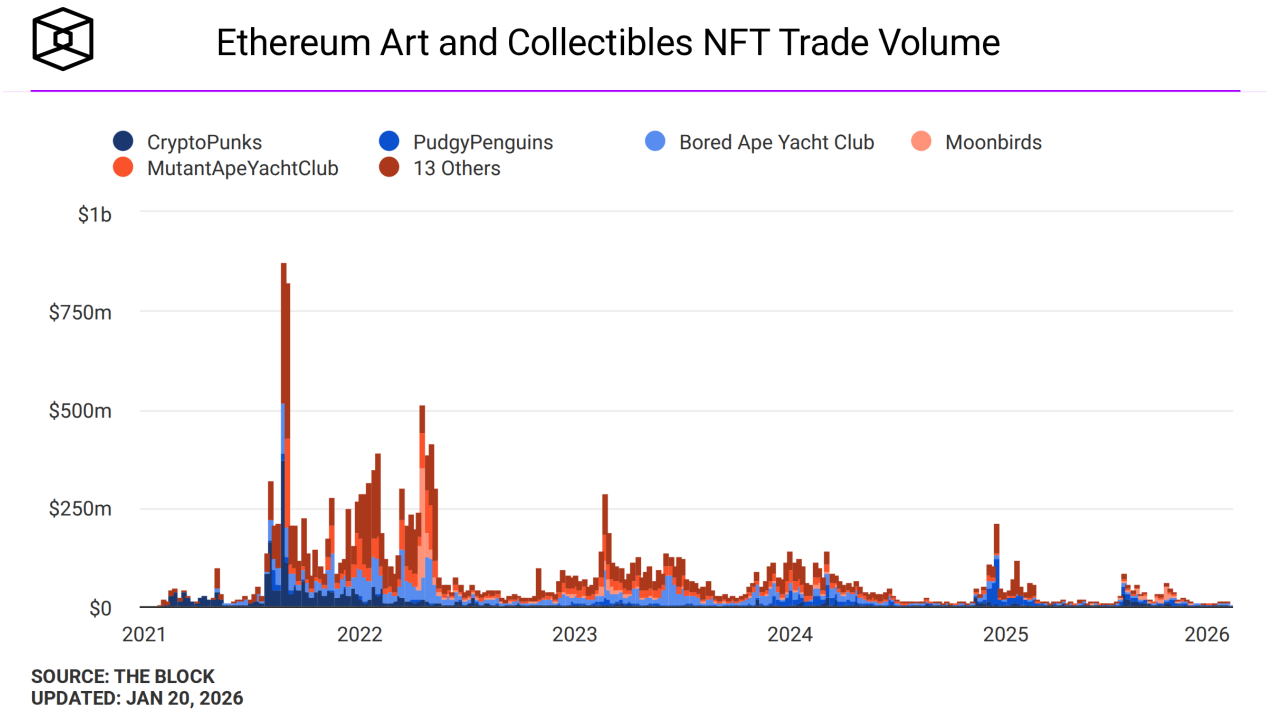
- Limited secondary market liquidity
- High compliance costs relative to deal size
- Fragmented regulatory landscape globally
- Chicken-and-egg: Need liquidity to attract issuers, need issuers to build liquidity

Outlook: Security tokens are growing but remain niche. Institutional adoption (BlackRock, etc.) may be the catalyst for broader growth.

Practical Applications

Digital Art and Collectibles

The original NFT use case—still relevant, but with caveats.



- **What works**: Provenance tracking for digital art, direct artist-to-collector sales, global market access
- **What doesn't**: Speculation-driven pricing, copyright isn't transferred (usually), right-click-save "problem" (social, not technical)

Supply Chain and Provenance

Use case: Track products from origin to consumer.

Examples:

- Luxury goods authentication (LVMH's Aura)
- Food traceability (Walmart + IBM Food Trust)
- Pharmaceutical supply chain
- Conflict mineral tracking

How it works:

- Each product gets a unique token/identifier
- Each handoff recorded on-chain
- Consumer can verify full history

Limitation: The oracle problem again. Blockchain can't verify that the physical item matches the digital record. Still requires trusted inputs.

"Garbage in, garbage out"—immutably recorded on a blockchain.

Fractional Ownership

Idea: Tokenize expensive assets, sell fractions.

Examples:

- Real estate: Own 0.1% of a building
- Art: Own shares in a Picasso
- Collectibles: Fractional sports memorabilia

Benefits:

- Lower minimum investment
- Diversification possible
- Liquidity for illiquid assets

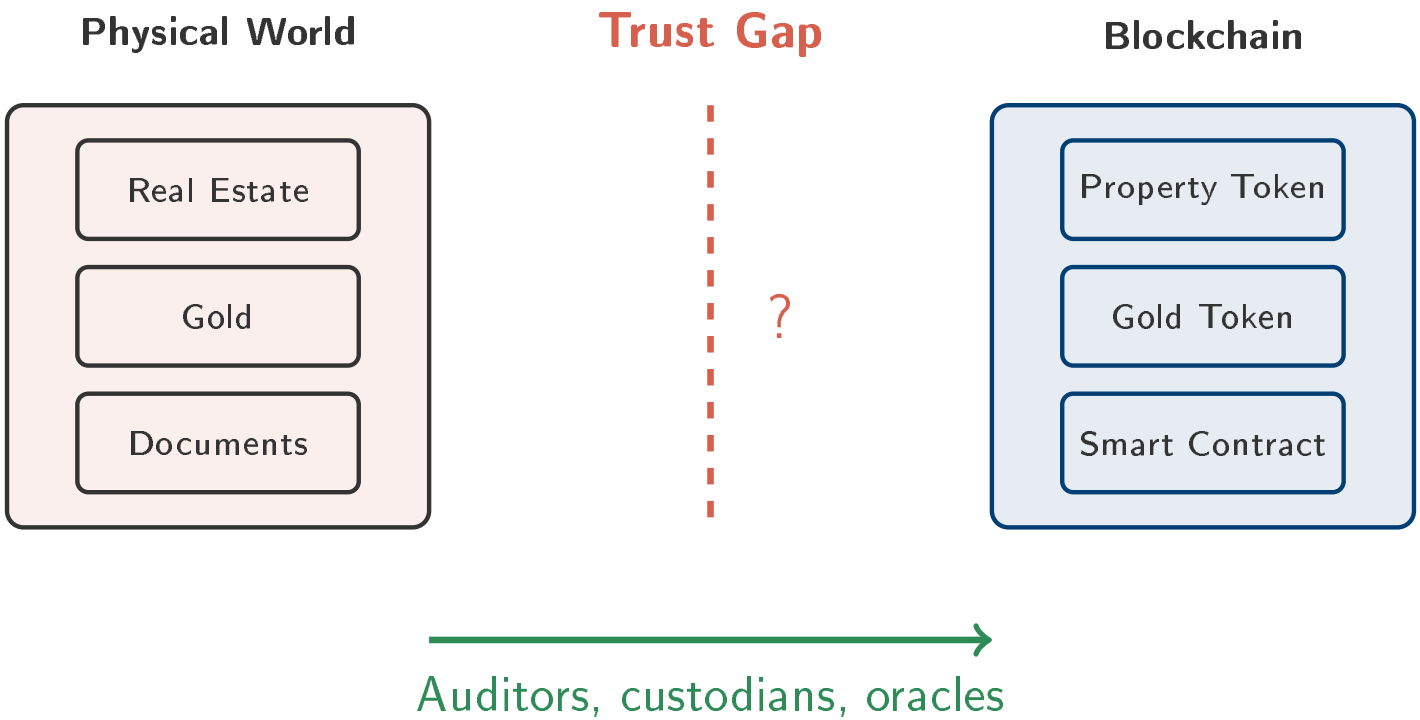
Challenges:

- Securities law applies (usually)
- Governance: Who decides to sell the underlying?
- Custody and insurance of physical asset
- Thin secondary markets

Reality: Fractionalization has existed pre-blockchain (REITs, art funds). Tokenization adds programmability and potentially broader access.

Challenges and Future

The Oracle Problem (Again)



Fundamental challenge: Blockchains can only verify on-chain data.

For tokenized real-world assets, someone must verify: Does the asset exist? Is it authentic? Who owns it legally?

Tokenization doesn't eliminate trust—it shifts it.

Legal Status of Tokenized Ownership

Key questions (often unresolved):

- Does the token holder have legal title to the underlying?
- What happens in bankruptcy?
- Which jurisdiction's law applies?
- How are disputes resolved?
- Is the token itself property?

Current approaches:

- Token represents contractual claim (not direct ownership)
- SPV structure: Token = shares in entity that owns asset
- Legal wrapper with token as "digital twin"

Regulatory developments:

- MiCA (EU): Framework for crypto-assets
- UK Law Commission: Recognising digital assets as property
- Wyoming: DAO and digital asset laws

Interoperability and Fragmentation

Problem: Assets tokenized on different chains can't easily interact.

Current state:

- Ethereum dominates but has high fees
- L2s (Arbitrum, Optimism, Base) growing
- Alternative L1s (Solana, Avalanche) have separate ecosystems
- Private/permissioned chains for institutions

Bridging solutions:

- Cross-chain bridges (but security risks)
- Multi-chain token deployments
- Interoperability protocols (Chainlink CCIP, LayerZero)

For RWA tokenization: Institutions may prefer private chains for control, but this limits composability with DeFi.

The Future of Tokenization

Near-term (2-5 years):

- Tokenized treasuries and money market funds scale
- More traditional asset managers enter
- Regulatory clarity improves (MiCA implementation)
- Security token infrastructure matures

Medium-term (5-10 years):

- Broader asset classes tokenized (private equity, real estate)
- Integration with traditional financial infrastructure
- CBDCs potentially interoperating with tokenized assets
- Credentials and identity (SBTs) gain adoption

Key question: Will tokenization happen on public blockchains (Ethereum) or private/permissioned systems? The answer affects decentralisation, access, and composability.

Summary

Key Takeaways

1. **Tokenization = digital ownership on blockchain**
   - Fungible (ERC-20) vs non-fungible (ERC-721) vs multi-token (ERC-1155)
2. **NFT speculation crashed, but technology remains**
   - Wash trading, hype, and unsustainable economics
   - Provable digital ownership is still valuable
3. **Real-world asset tokenization is growing**
   - Tokenized treasuries: BlackRock, Franklin Templeton
   - Security tokens: Regulated, compliant, but limited liquidity
4. **Practical applications beyond speculation**
   - Credentials (SBTs), supply chain, fractional ownership
5. **Challenges remain**: Oracle problem, legal status, interoperability

What's Next

Topic 7: Cryptocurrency Investment

- Market structure and trading venues
- Valuation approaches (or lack thereof)
- Risk factors and portfolio considerations
- ETFs and institutional products

Preparation:

- Think about: How would you value Bitcoin? Is it like gold, a currency, a tech stock, or something else entirely?
- Explore: Look at Bitcoin and Ethereum ETF flows since approval

Questions?