A Taxonomy of Digital Assets

KATE GOLDMAN AND ARNAV KUMAR
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EXECUTIVE SUMMARY

Taxonomies are a tool used for visually understanding complex topics through hierarchical and categorical relationship-mapping based on key defining characteristics. As digital and financial services continue to expand, taxonomies are a valuable resource for understanding the nomenclature and visualizing how emerging terminology fits within a given ecosystem. In biology, animal taxonomy structures the hierarchy from most general, the animal’s domain, to most specific, its species. In this digital asset taxonomy, a similar structure has been used, classifying the assets most generally as either a digital or a virtual currency and then organizing them down to specific digital asset examples.

INTRODUCTION

In the digital asset ecosystem, semantics and broad generalizations of terminology are counterproductive for technology entrepreneurs, investors, regulators, and consumers. For stakeholders, a common language provides clarity and nuance to discussions of digital assets. For regulators and technologists, it is important to understand how digital assets vary by their defining characteristics. The relationships among the various digital assets described in the following taxonomy will be helpful in both identifying and solving emerging questions. The digital asset taxonomy intends to spur meaningful conversations that help yield productive outcomes.

Digital Asset Taxonomy

On page 3, you will find the centerpiece of this publication, the digital asset taxonomy dendrogram (Fig. 1). This is a tool for policymakers and practitioners to understand better how digital assets—such as cryptocurrencies, stablecoins, central bank digital currencies (CBDCs), and non-fungible tokens (NFTs)—vary based on characteristics including convertibility, fungibility, underpinning distributed ledger technology, legal tender status, and more. The diagram has been designed so that readers can easily identify a specific asset (e.g., ether) and move upwards to see its characteristics. Equally, a top-down approach allows the reader to see which characteristics lead to certain assets. Either way, the diagram is intended to facilitate a clearer understanding of how nuanced characteristics separate the functionality and design of digital assets commonly cited in daily news.
Digital Asset Table

Page 4 of the document presents the same content as the preceding page but in tabular format. The left-hand column of the table lists specific digital assets (e.g., bitcoin, ether, USDC), while the top row of the table identifies specific characteristics and technologies. As such, this is intended as a tool to scan the attributes that do and do not apply to a particular digital asset, such as in the case of a reader who simply wants to see whether the Diem stablecoin is commodity pegged or fiat pegged. The aim is to provide a quick reference tool in situations when the reader may need clarity on the characteristics of a given digital asset.

Definitions

On pages 5–15, definitions of terms used in the taxonomy have been aggregated from reputable sources such as government agencies or dictionaries. This section will clarify language used in the taxonomy while also demonstrating how definitions used by government agencies and nongovernmental organizations (NGOs) may vary significantly. The digital assets space is evolving, and the public sector and nonprofits are still trying to understand how such assets are defined and used in their domains. With time, there will be more concordance in the political and economic spheres of digital assets. In the interim, these definitions offer a snapshot of a rapidly evolving space.
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Source: Milken Institute (2021)
DEFINITIONS

Blockchain
Government

Department of Homeland Security
"Blockchain is a cryptographically-secured distributed ledger that records transactions chronologically, permanently, and unalterably. Blockchains vary in transactional throughput and cost depending on numerous factors, including the choice of consensus mechanism and permission status."

Bank for International Settlements
"The blockchain is a distributed ledger that is updated in groups of transactions called blocks. Blocks are then chained sequentially via the use of cryptography to form the blockchain. This concept has been adapted to countless other cryptocurrencies."

Securities and Exchange Commission
"The term distributed ledger refers to databases that maintain information across a network of computers in a decentralized or distributed manner. These networks commonly use cryptographic protocols to ensure data integrity and consensus mechanisms to ensure data congruity. Blockchains are one type of distributed ledger, and they are often used to issue and transfer ownership of digital assets that may be securities, depending on the facts and circumstances."

National Institute of Standards and Technology
"Blockchains are tamper evident and tamper resistant digital ledgers implemented in a distributed fashion (i.e., without a central repository) and usually without a central authority (i.e., a bank, company, or government). At their basic level, they enable a community of users to record transactions in a shared ledger within that community, such that under normal operation of the blockchain network no transaction can be changed once published."

National Institute of Standards and Technology
"Blockchains are distributed digital ledgers of cryptographically signed transactions that are grouped into blocks. Each block is cryptographically linked to the previous one (making it tamper evident) after validation and undergoing a consensus decision. As new blocks are added, older blocks become more difficult to modify (creating tamper resistance). New blocks are replicated across copies of the ledger within the network, and any conflicts are resolved automatically using established rules."
**Coin**

*Government*

**International Monetary Fund**

“[D]igital tokens used for payments”

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**Convertible Virtual Currency**

*Government*

**Financial Crimes Enforcement Network**

“The term ‘virtual currency’ refers to a medium of exchange that can operate like currency but does not have all the attributes of ‘real’ currency, as defined in 31 CFR § 1010.100(m), including legal tender status. CVC is a type of virtual currency that either has an equivalent value as currency, or acts as a substitute for currency, and is therefore a type of ‘value that substitutes for currency.’”

**Financial Action Task Force**

“Convertible (or open) virtual currency has an equivalent value in real currency and can be exchanged back-and-forth for real currency. Examples include: Bitcoin; e-Gold (defunct); Liberty Reserve (defunct); Second Life Linden Dollars; and WebMoney.”

**Commodity Futures Trading Commission**

“Virtual currency that has an equivalent value in real currency, or that acts as a substitute for real currency, is referred to as ‘convertible’ virtual currency. Bitcoin is one example of a convertible virtual currency.”

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**Cryptocurrency**

*Government*

**Financial Action Task Force**

“Cryptocurrency refers to a math-based, decentralised convertible virtual currency that is protected by cryptography—i.e., it incorporates principles of cryptography to implement a distributed, decentralised, secure information economy. Cryptocurrency relies on public and private keys to transfer value from one person (individual or entity) to another, and must be cryptographically signed each time it is transferred. The safety, integrity and balance of cryptocurrency ledgers are ensured by a network of mutually distrustful parties (in Bitcoin, referred to as miners) who protect the network in exchange for the opportunity to obtain a randomly distributed fee (in Bitcoin, a small number of newly created bitcoins, called the ‘block reward’ and in some cases, also transaction fees paid by users as decentralized incentive for miners to include their transactions in the next block).”
**Internal Revenue Service**

"Cryptocurrency is a type of virtual currency that utilizes cryptography to validate and secure transactions that are digitally recorded on a distributed ledger, such as a blockchain."

**Securities and Exchange Commission**

"Speaking broadly, cryptocurrencies purport to be items of inherent value (similar, for instance, to cash or gold) that are designed to enable purchases, sales and other financial transactions. They are intended to provide many of the same functions as long-established currencies such as the U.S. dollar, euro or Japanese yen but do not have the backing of a government or other body. Although the design and maintenance of cryptocurrencies differ, proponents of cryptocurrencies highlight various potential benefits and features of them, including (1) the ability to make transfers without an intermediary and without geographic limitation, (2) finality of settlement, (3) lower transaction costs compared to other forms of payment and (4) the ability to publicly verify transactions. Other often-touted features of cryptocurrencies include personal anonymity and the absence of government regulation or oversight. Critics of cryptocurrencies note that these features may facilitate illicit trading and financial transactions, and that some of the purported beneficial features may not prove to be available in practice."

**National Institute of Standards and Technology**

"A digital asset/credit/unit within the system, which is cryptographically sent from one blockchain network user to another. In the case of cryptocurrency creation (such as the reward for mining), the publishing node includes a transaction sending the newly created cryptocurrency to one or more blockchain network users. These assets are transferred from one user to another by using digital signatures with asymmetric-key pairs."

**Federal Trade Commission**

"Cryptocurrency is a type of digital currency that generally only exists electronically. There is no physical coin or bill unless you use a service that allows you to cash in cryptocurrency for a physical token. You usually exchange cryptocurrency with someone online, with your phone or computer, without using an intermediary like a bank. Bitcoin and Ether are well-known cryptocurrencies, but there are many different cryptocurrency brands, and new ones are continuously being created."
Non-Governmental Organization

North American Securities Administrators Association
“Cryptocurrencies are digital assets created by companies or individuals that take the form of a virtual coin or token. Anyone can create a cryptocurrency. Cryptocurrencies are intangible and exist only on the internet. Central banks and other governmental authorities do not insure or control cryptocurrencies. You cannot always exchange them for other fiat currencies (i.e., currencies declared ‘legal tender’ by governments), such as the U.S. or Canadian dollar or Mexican peso.”

Digital Asset
Government

Securities and Exchange Commission
“The term ‘digital asset’ refers to an asset that is issued and/or transferred using distributed ledger or blockchain technology (‘distributed ledger technology’), including, but not limited to, so-called ‘virtual currencies,’ ‘coins,’ and ‘tokens.’

Financial Industry Regulatory Authority
“The term ‘digital asset’ refers to cryptocurrencies and other virtual coins and tokens (including virtual coins and tokens offered in an initial coin offering (ICO or pre-ICO)), and any other asset that consists of, or is represented by, records in a blockchain or distributed ledger (including any securities, commodities, software, contracts, accounts, rights, intangible property, personal property, real estate or other assets that are ‘tokenized,’ ‘virtualized’ or otherwise represented by records in a blockchain or distributed ledger).”

Congressional Research Service
“Digital assets are assets issued and transferred using distributed ledger or blockchain technology. They are often referred to as crypto asset, cryptocurrency, or digital token, among other terminology. Digital assets can be securities, currencies, properties, or commodities. Although market participants use different terms to describe them, financial regulators have stated that—regardless of what they are called—financial activities, services, and market participants must adhere to applicable laws and regulations. In the case of digital assets, depending on their characteristics, this can include securities laws and regulations. One key difference between digital and traditional assets is an asset’s ownership and exchanges of ownership. Whereas traditional assets are generally recorded in private ledgers maintained by central intermediaries, digital assets’ ownership and exchange are generally recorded on a decentralized digital ledger.”
Non-Governmental Organization

American Bar Association
“A ‘digital asset’ is an electronic record in which an individual has a right or interest. The term does not include an underlying asset or liability unless the asset or liability is itself an electronic record. In the words of SEC Director William Hinman, ‘the digital asset itself is simply code.’ Digital assets are distinguished from physical assets because the digital asset itself does not exist in physical form. For example, a bitcoin is a digital asset because it is an electronic record that is created and stored exclusively on the Bitcoin blockchain.”

Digital Currency

Government

Bank for International Settlements
“[D]igital currencies are assets with their value determined by supply and demand, similar in concept to commodities such as gold. However, in contrast to commodities, they have zero intrinsic value. Unlike traditional e-money, they are not a liability of any individual or institution, nor are they backed by any authority. As a result, their value relies only on the belief that they might be exchanged for other goods or services, or a certain amount of sovereign currency, at a later point in time. The establishment or creation of new units (i.e., the management of the total supply), is typically determined by a computer protocol.”

Her Majesty’s Treasury
“The call for information document defined a digital currency scheme as one which incorporates both a decentralized payment system and a related currency. It was noted that digital currency systems can achieve consensus through a variety of means, including proof-of-work and trust-based consensus. The document focused in particular on decentralized digital currency schemes because of interest in the potential benefits of the distributed ledger technology.”

International Telecommunication Union
“It is a tokenized, digital representation of a sovereign currency. It may be distributed by a monetary authority—case in which it is a central bank digital currency (CBDC)—or by a private entity—case in which is often backed on central bank money, becoming e-money.”

Financial Action Task Force
“Digital currency can mean a digital representation of either virtual currency (non-fiat) or e-money (fiat) and thus is often used interchangeably with the term ‘virtual currency’. In this paper to avoid confusion, only the terms ‘virtual currency’ or ‘e-money’ are used.”
Non-Governmental Organization

World Economic Forum
"Typically used to refer to a currency that exists in digital or electronic form and that may or may not be available in physical form. Digital currencies often have some, but not all the characteristics of a currency, but may also have characteristics of a commodity or other asset."

Fungible

Government

Commodity Futures Trading Commission
"The characteristic of interchangeability. Futures contracts for the same commodity and delivery month traded on the same exchange are fungible due to their standardized specifications for quality, quantity, delivery date, and delivery locations."

European Central Bank
"A characteristic of securities which are substitutable on account of their being identical"

National Institute of Standards and Technology
"[A] data representation or abstraction that assigns interchangeable units, or account balances, to blockchain addresses with programmable supply management."

National Institute of Standards and Technology
"Refers to something that is replaceable or interchangeable (i.e., not uniquely identifiable)."

Non-Governmental Organization

Merriam Webster
"Being something (such as money or a commodity) of such a nature that one part or quantity may be replaced by another equal part or quantity in paying a debt or settling an account."
Hedera
Non-Governmental Organization

Hedera.com
"Hedera is the only public ledger that uses hashgraph consensus, a faster, more secure alternative to blockchain consensus mechanisms. Hashgraph works efficiently to verify transactions while ensuring the highest standard of security to prevent malicious attacks. Hashgraph achieves high-throughput with 10,000+ cryptocurrency transactions per second today and low-latency finality in seconds from its innovative gossip about gossip protocol and virtual voting. Once consensus is reached, the transaction is immutable and available on the public ledger for everyone to transparently see."

Pegged
Government

Commodity Futures Trading Commission
"The price at which a commodity has been fixed by agreement."

Commodity Futures Trading Commission
"Effecting transactions in an instrument underlying an option to prevent a decline in the price of the instrument shortly prior to the option's expiration date so that previously written put options will expire worthless, thus protecting premiums previously received."

International Monetary Fund
"The value of the currency is maintained within certain margins of fluctuation of more than ±1 percent around a fixed central rate or the margin between the maximum and minimum value of the exchange rate exceeds 2 percent. As in the case of conventional fixed pegs, reference may be made to a single currency, a cooperative arrangement, or a currency composite. There is a limited degree of monetary policy discretion, depending on the band width."

Non-Governmental Organization

Cambridge Dictionary
"[A] currency whose value is controlled so that it stays at a particular level in relation to another."
Stablecoin

Financial Stability Board
"So-called 'stablecoins' are a type of crypto-asset or, more broadly, digital asset. Stablecoins may be used for different purposes. Some stablecoin projects have the stated ambition to facilitate payments, especially crossborder retail payments, which have remained relatively slow and expensive. A stablecoin, particularly if linked to a fiat currency or a basket of currencies, may become a widely used store of value. The use of stablecoins can evolve over time, particularly so that a stablecoin initially intended to be used as means of payment could also be increasingly used as a store of value."

Office of the Comptroller of the Currency
"Generally, a stablecoin is a type of cryptocurrency designed to have a stable value as compared with other types of cryptocurrency, which frequently experience significant volatility. One type of stablecoin is backed by an asset such as a fiat currency. Reports suggest stablecoins have various applications, including the potential to enhance payments on a broad scale, and are increasingly in demand."

Congressional Research Service
"Stablecoin is a digital asset designed to maintain a stable value by linking its value to another asset or a basket of reserve assets. In policy discussions, some suggest applying ETF regulatory frameworks to certain stablecoins; others argue for more disclosure of reserve asset breakdowns to expose potential deceptive activities."

National Institute of Standards and Technology
"A stablecoin is a fungible token that is pegged to or redeemable for one or more underlying assets (e.g., a fiat currency). Redeemable or convertible stablecoins are backed by a collateral or reserve and grant redemption value for the underlying assets. Alternatively, synthetic stablecoins are designed to track the price of one or more underlying assets but do not grant any redemption value for these assets. Their reserve may comprise multiple assets distinct from the tracked assets, and their peg is maintained with a specific responsiveness level. In general, protocol-level mechanisms may be used to stabilize the value by dynamically managing the token supply and maintaining the collateralization ratio at a certain rate or range target with either partial, full, or surplus reserve."
**Token**

**Government**

**Federal Reserve**

"Current concepts of tokens and tokenization likely originate from their usage in the context of Ethereum, a large public blockchain that offers a robust programming capability in the form of so-called smart contracts. An early use case for this flexible programmability was the definition of custom assets, and the Ethereum community proposed a standard for fungible units of value termed ‘tokens’ shortly after its public launch. The widespread adoption of the ERC-20 standard has likely helped shape the notion of a ‘cryptocurrency token’ as a custom asset issued on top of a blockchain through the use of smart contracts. Other blockchain platforms which have followed Ethereum's lead in offering flexible programming capability, such as Eos, Cardano, Tezos, and Stellar, all allow for the issuance of custom assets that the cryptocurrency community terms tokens."

**European Central Bank**

"Digital tokens exist within a variety of network forms including the traditional ‘hub and spoke’ architecture in which a central entity maintains token network activity; however, the primary interest of this definition is the particular subset of digital tokens that exists within distributed or decentralized networks popularly referred to as ‘crypto assets’.

**Public Broadcasting Service**

"[T]okens can outsource their ownership accounting systems, attaching them to preexisting blockchain ledgers. This in effect creates a new subledger, say of the Ethereum network’s ledger, just for that particular token. Every user who sends a token that is tracked and recorded on Ethereum pays a small transaction fee to the Ethereum network to validate the transaction."

**National Institute of Standards and Technology**

"A representation of a particular asset that typically relies on a blockchain or other types of distributed ledgers."

**National Institute of Standards and Technology**

"At their core, tokens are entries in distributed ledgers that are assigned to blockchain accounts and for which transactions require authorization, ensuring authenticity and preventing modification and tampering without consent. Once authorized by the associated accounts, token transactions are validated, encapsulated, and published to the ledger into blocks by blockchain nodes. In general purpose smart contract platforms, accounts are either internal to the blockchain (i.e., smart contracts) or external and owned through public-key cryptography (i.e., end user-controlled). In the latter case, authorizations are provided by signing the blockchain transactions with the owner’s private key(s), which are generally held in custody in digital wallets."
International Monetary Fund
“[D]igital representation of a claim, either on a specific issuer or on underlying assets or funds, or some other right or interest, that can be transferred over a peer-to-peer system without necessarily going through a central party to effect settlement.”

Non-Governmental Organization

Royal Society Open Science
We make an essential distinction that some cryptos are ‘coins’ (which operate on their own independent network) and others ‘tokens’ (which operate on top of a coin network as a platform).”

Virtual Currency

Government

Internal Revenue Service
“Virtual currency is a digital representation of value that functions as a medium of exchange, a unit of account, and/or a store of value. In some environments, it operates like ‘real’ currency (i.e., the coin and paper money of the United States or of any other country that is designated as legal tender, circulates, and is customarily used and accepted as a medium of exchange in the country of issuance), but it does not have legal tender status in the U.S.”

Office of Foreign Asset Control
“Virtual currency is a digital representation of value that functions as (i) a medium of exchange; (ii) a unit of account; and/or (iii) a store of value; is neither issued nor guaranteed by any jurisdiction; and does not have legal tender status in any jurisdiction.”

Consumer Financial Protection Bureau
“A kind of electronic money. It’s a digital representation of value that is not issued by a government, such as a central bank or a public authority, but is accepted as a means of payment and can be transferred, stored, or traded electronically.”
Financial Action Task Force

“Virtual currency is a digital representation of value that can be digitally traded and functions as (1) a medium of exchange; and/or (2) a unit of account; and/or (3) a store of value, but does not have legal tender status (i.e., when tendered to a creditor, is a valid and legal offer of payment) in any jurisdiction. It is not issued nor guaranteed by any jurisdiction and fulfils the above functions only by agreement within the community of users of the virtual currency. Virtual currency is distinguished from fiat currency (a.k.a. ‘real currency,’ ‘real money,’ or ‘national currency’), which is the coin and paper money of a country that is designated as its legal tender; circulates; and is customarily used and accepted as a medium of exchange in the issuing country. It is distinct from e-money, which is a digital representation of fiat currency used to electronically transfer value denominated in fiat currency. E-money is a digital transfer mechanism for fiat currency—i.e., it electronically transfers value that has legal tender status.”
CONCLUSION

The digital assets space is not a monolith. It employs a new language that is constantly evolving. This taxonomy is designed to encourage and lay the groundwork for a more objective standard for evaluating digital assets’ terms and attributes. Policymakers should use this taxonomy to avoid conflating technologies (for example, terms such as “virtual” and “digital” are not interchangeable) and to make writing and evaluating legislation easier. It will help them, and anyone interested in this dynamic space, to communicate with the assurance that they are speaking about the same thing.

The Milken Institute intends that this project will help lay the foundation for the next wave of economic opportunity and advancement in the digital world.

APPENDIX

A. For this taxonomy, the primary distinguishing characteristic of digital assets is whether they do or do not have government-authorized legal tender status. In this taxonomy, digital currency is categorized as a subset of digital assets that have legal tender status, or the digital representation of fiat currency. Virtual currency is categorized as a subset of digital assets that do not have legal tender status.

B. Bitcoin is identified in this taxonomy as both a virtual currency and a digital currency. In the United States, Bitcoin does not have any legal tender status and is thus categorized as a virtual currency. In El Salvador, Bitcoin has received legal tender status from the central government and is accordingly classified as a digital currency in this taxonomy.

C. The Milken Institute does not intend to endorse one definition over another. These definitions are provided to give further explanation into the hierarchical structure of the taxonomy. Each definition contained in this taxonomy has been aggregated from reliable and objective sources. The singular exception to this is the definition for Hedera, a type of distributed ledger technology (DLT.) Reputable sources have not defined Hedera, so it is important to understand the source of this definition might not match the scrutiny applied to every other definition in the taxonomy. Still, explaining the fundamental differences between a blockchain and a hedera is a valuable service for readers.

D. While this taxonomy makes a concerted effort to capture many different kinds of digital assets, it is in no way meant to be an exhaustive list of digital assets. The digital asset space is constantly growing and evolving, and so, too, will the taxonomy and the Milken Institute’s work on digital assets.
ACKNOWLEDGMENTS

This taxonomy was created in consultation with FDITech, the Federal Deposit Insurance Corporation’s Office of Innovation. The authors appreciate and value the ongoing support from FDITech to continue exploring the digital asset space. Thank you to our Milken Institute colleagues, the Blockchain Association, and Solidus Labs for their valued support and feedback.

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