

The Legal Ramifications of Digital Tokenization

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The Legal Ramifications of Digital Tokenization

DENIS AVRILIONIS, Compellio SA, Luxembourg. denis@compell.io

THOMAS HARDJONO, MIT Connection Science, USA. hardjono@mit.edu

Today there is considerable interest in the tokenization of assets within blockchain-based networks. Aside from the current lack of interoperability among these blockchain networks there is also the challenge of the interoperability of these digital assets across different legal jurisdictions around the world. In this paper, we discuss some of the challenges in automating the processing of tokenized assets. A primary concern in that context is the clear definition of legal aspects related to the issuance and the terms of use of digital assets.

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1 INTRODUCTION

Digital tokens - representing physical or digital assets - introduce several new challenges that previously did not exist in the world of paper-recorded assets (e.g., certificate papers in depositories). The advances in blockchains and distributed ledger technology (DLT) permit the author of a token (e.g., non-fungible token or NFT) to also craft the set of operations or behaviors permitted on the token. Notably, the permitted operations are often colloquially referred to as “smart contracts” and convey the idea of the automation of processing which is part of the vision of the code-on-chain paradigm.

A recent landmark event was the launch of the *HumanOne* token from Beeple. The composition and construction of *HumanOne* is instructive in the sense that it offers a glimpse into the design thinking of its creators and offers us some pointers regarding a better design for future NFTs.

However, the current tokenization paradigm – as exemplified best by Beeple’s *HumanOne* – suffers from a number of drawbacks that affect the viability of the model as it is understood today. We start this paper with a short analysis of *HumanOne*, discuss the relevant elements of a digital asset, and discuss the notion of a standardizable *profile* for digital assets.

2 AN ANALYSIS OF BEEPLE HUMANONE NFT

We chose the example of Beeple’s *HumanOne* as this one of the highest valued NFTs so far and because it is sufficiently complex through its incorporation of both physical and digital elements.

2.1 The structure of the NFT

The structure of the *HumanOne* contains three elements as depicted below (see Figure 1):

- The NFT is an Ethereum-based ERC721 smart contract deployed on Ethereum mainnet accessible at:
<https://etherscan.io/address/0xa4c38796c35Dca618FE22a4e77F4210D0b0350d6>.
- The Artwork is the MPEG4 video file stored at location:
https://nft.human-one.xyz/Ukraine_22b55e18faae73ad86ce32cd.mp4.

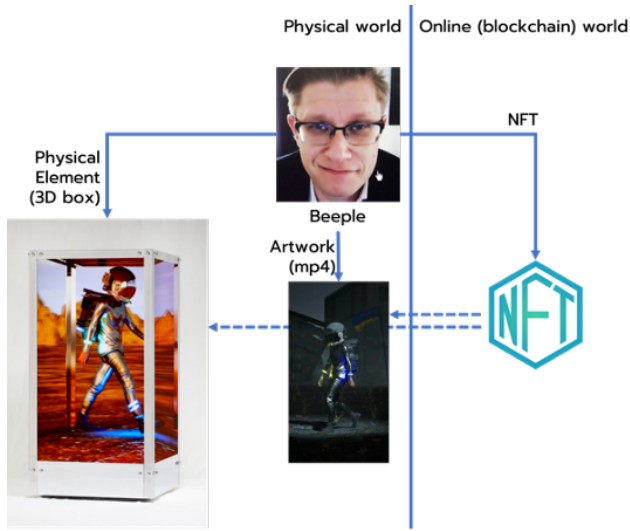


Fig. 1. The HumanOne from Beeple

- The physical element is a kinetic video sculpture, consisting of four physical LCD screens (16k resolution LCD) arranged in a box-like structure, with polished aluminum metal, mahogany wood frame, and dual media servers.

2.2 The Terms of the Agreement

The *HumanOne* example is interesting because it highlights the possible misunderstandings to the prospective buyer, stemming from the conflation of the legal aspects of assets in general with the legal meaning of copyright in the case of artwork. Buyers may not fully understand the nuances regarding artwork and copyright.

According to the Beeple Sculpture and NFT terms¹ although the NFT and Physical Element are "sold" to the purchaser, the "artwork is licensed and not sold to such purchaser". The Artwork is neither stored nor embedded in the NFT, but is accessible through the NFT.

In other words, the purchaser does not own the intellectual property or the copyright of the artwork. Instead, as stated in the terms:

"Beeple hereby grants to the holder of the NFT and/or Physical Element a non-exclusive, perpetual license, subject to these Terms, to access, perform and/or display the Artwork using the NFT and/or the Physical Element". As stated in the terms, "except for the [granted] license, Beeple and its affiliates retain all right, title and interest in and to the Artwork".

Moreover, the license does not allow the holder to use the NFT and/or Physical Element for commercial purposes; provided, however, if the holder is a museum, it will not be restricted from selling admission tickets or passes to the public in connection with its exhibition of the Artwork.

Finally, the terms state that

"The NFT and Physical Element may be separated and owned by different persons. However, if you are the holder of the NFT or Physical Element, you may transfer the NFT

¹<https://www.christies.com/en/lot/lot-6345173>

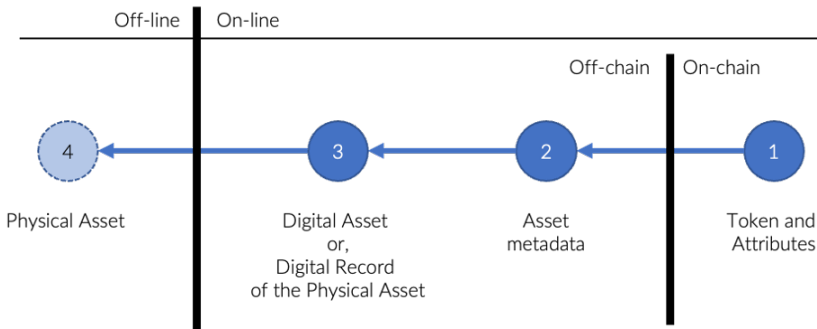


Fig. 2. Overview of the relationship between physical assets, the metadata representing them and the token construct

or Physical Element to a third party, but, after you do so, your license to the Artwork will immediately terminate”.

3 ELEMENTS OF A DIGITAL ASSET

Looking at the *HumanOne* example, there are several components of a tokenized asset that we believe need to be standardized both at the technical level and the legal domain.

As presented in Figure 2 we can distinguish four distinct components of a tokenized asset:

- (1) *Token and attributes*: This part is usually managed by a smart contract and is stored on-chain. The token (typically an NFT) is usually traded in a marketplace over public or private DLTs. Remunerations and commissions are decided by the marketplace. Conditions may change at any moment by the marketplace provider. See for example Magic Eden which made creator royalties optional² or Apple Store which decided to apply a 30 percent tax levy on NFT transactions³.
- (2) *Asset metadata*: This is the information about the asset, usually stored off-chain in a given data format (e.g JSON). Currently, the most often quoted storage mechanism is the decentralized IPFS (Inter-Planetary File System). However, we must emphasize that IPFS is a protocol that does not imply (guarantee) decentralized storage. The way storage is deployed depends on the developers of the application. The use of IPFS does not always imply decentralization⁴.
- (3) *Digital Asset or Digital Record of the (Physical) Asset*: This is the asset in digital form (e.g. namely the artwork in the case of *HumanOne*). Usually, the asset is maintained in a centralized location and depending on the sensitivity of the content, the policies related to accessing the asset could vary (e.g., from ”strict access control” to ”freely accessible asset”). In the case of *HumanOne* the asset is freely accessible via the domain `nft.human-one.xyz`.

²Langston Thomas, “Magic Eden Makes Creator Royalties Optional”, NFT Now, 20 October 2022. <https://nftnow.com/features/magic-eden-makes-creator-royalties-optional/>

³Maria Gracia Santillana Linares, “Apple Allows In-App NFTs In App Store, But Slaps Its 30% Levy On Transactions”, Forbes 25 October 2022. <https://www.forbes.com/sites/mariagraciasantillanalinares/2022/10/25/apple-allows-nft-in-app-store-apps-but-slaps-its-30-levy-on-transactions/>

⁴Kyle Tut, “The Centralized Secret How Ethereum dApps rely on centralized IPFS hosting out of necessity”, Medium 12 September 2018. <https://medium.com/pinata/the-centralized-secret-c7de795ddd9f>

- (4) *Physical Asset*: This is a physical product related to the token. For example, a luxury item, a physical piece of art, a consumer product, bearer instruments conveying financial value, etc. Physical assets may be kept in warehouses or other storage forms managed by asset custodians (nb. the latter is common in finance for physical assets like gold, bearer bonds, etc.).

4 DISCUSSION: ASSETS, TOKEN AND EXECUTABLE CODE

As illustrated in Figure 2, the area of Non-Fungible Tokens (NFT) may cut across several dimensions, including physical assets that are located offline. Additionally, the type of asset in question – either the type of the physical asset or type of digital asset – may introduce legal questions beyond that of the current commercial and trade regulations. More specifically, the inclusion of digital artworks, motion pictures or sound recording files necessitates the enforcement of the various claims (e.g., royalty shares) that the rights holder may demand.

There are several technical challenges related to the way (non-fungible) tokens are constructed and traded today:

- *Availability and persistence of metadata*: A key issue with the design of *HumanOne* is the lack of guarantees for the persistence of the metadata information. In the case of *HumanOne*, the claim of its authors is that a distributed storage service carries the metadata (by "metadata" we refer to the "asset metadata" element as shown in Fig 2 above). However, there is no stated mechanism in the token to handle errors at the file level (e.g., broken metadata URL, missing metadata file, etc.).
- *Access control to the digitized asset*: In the design of *HumanOne*, the asset is defined to be an MPEG4 file. This means that there is an additional requirement for the MPEG4 file to be protected against unauthorized access and copying by entities who are not the owner of the NFT⁵. Moreover, there is currently no mechanism on-chain that can ensure correct access control to resources that are off-chain.

The present situation may introduce some legal and regulatory challenges, such as the following:

- *Legal limitations*: As we mentioned above, the *HumanOne* asset takes the form of an artwork that is represented digitally as an MPEG4 file. Possession of the MPEG4 file does not render the possessor with other rights associated with artwork (e.g. exclusive copyright). Without exclusive copyright there is nothing preventing the same digital artwork from being minted as a different NFT elsewhere. Similarly, in the case that an NFT that carries (points to) a sound recording file, the holder of the NFT does not automatically obtain mechanical rights and performance rights over the sound recording⁶.
- *Physical asset verification and accountability*: In the case of an NFT that is a digital representation of a physical asset (see Fig 2 above) there is the challenge of ensuring that the physical asset is in safe custody in the manner that (i) prevents the legal owner from transferring the physical asset to a different owner without synchronizing the on-chain NFT, and (b) prevents the severance of the connection between the physical asset and the NFT.

⁵At the moment of writing a simple "HumanOne" search at OpenSea shows the Artwork available at prices as low as 1ETH (if compared to the original value of the artifact).

⁶See Hardjono et al., *Open Music: Towards an Open and Scalable Music Metadata Layer*, MIT & Berklee – Open Music Initiative (OMI), <https://doi.org/10.48550/arXiv.1911.08278>. Also see George Howard, *Everything In Its Right Place: How Blockchain Technology Will Lead To A More Transparent Music Industry*, Giant Steps Books, 2018.

5 ASSETS DEFINITIONS AND INSTANCES OF DIGITAL ASSETS

One key issue with the *HumanOne* example – and other similar NFTs on blockchains – today is the lack of a legal foundation for the *definition* of the digital asset that is manifested as an NFT on a blockchain. This is relevant for the future Web3 global digital asset ecosystem because a common legal foundation permits digital assets to possess economic value and retain this value (i.e., medium of value-store) over time. Without human agreement regarding a common legal framework to accord value to digital assets there is an increase in risk for users to purchase those assets. The legal constructs largely already exists today, but many of the blockchain-based asset management and trade platforms do not use these legal tools to their fullest extent – which in the case of cross-jurisdiction transactions would increase the technical complexity of the platform.

It is useful to distinguish between the entity who is *authoritative to define* a specific class/type of digital assets, and the entities who *issue instances* of the asset in digital or tokenized form based on the asset definition. A more colloquial term for the asset definition could be “asset profile”⁷ which expresses the make-up of the asset in the same manner as prospectus documents are used to express various financial instruments today.

One contentious issue with the new digital assets – notably cryptocurrencies – is the source of the value associated with the on-chain tokens. Here the notion of an *endogenous* digital asset⁸ is useful because it conveys the core idea that the economic value emerged after a digital representation (e.g. token) was created at a specific time on the decentralized asset network or blockchain. An example of this would be cryptocurrencies that are self-emergent (self-declared) on the blockchain, including Bitcoin and others.

The term *exogenous* digital asset is therefore used to mean that the economic value of the asset existed outside the blockchain prior to its tokenization on the blockchain. Thus, strictly speaking, it can be argued that most (all) digital artwork that are created by the human labor are in fact exogenous because the artwork file (e.g. JPEG file; MPEG file) must exist before a hash of the file can be incorporated into a token on the blockchain. Human beings accord economic value to the artwork file independent of (and prior to) the blockchain, even if at minimum they accord only labor costs expended by the artist.

In order for NFTs to be useful generally as a means to represent assets of various origins and ownerships, a more rigorous and disciplined approach is required. As a minimum, this would require defining what constitutes a digital asset within a given legal jurisdiction (e.g., not all financial instruments today are legally acceptable in all jurisdictions of the world).

In the following we begin to provide some definition of the entities involved in the asset ecosystem (see Figure 3):

- *Digital Asset Definition Authority*: The entity that has recognized legal authority in a jurisdiction to define the legally acceptable form and composition of a specific type/class of digital assets, based on endogenous and/or exogenous value.
- *Digital Asset Profile*: The “prospectus” document published by the Asset Definition Authority regarding a regulated digital asset that includes information and resources describing the asset. This includes, among other the attributes, the asset name/code, the issuing authority, its denomination of value, date of issue, the intended systems of circulation, jurisdictions, or the URLs and mechanisms to validate the information.

⁷The term “asset profile” is used in the context of the IETF Secure Asset Transfer Protocol Working Group to define the type (or class) of an asset. See also: <https://datatracker.ietf.org/wg/satp/about/>

⁸See Primavera De Filippi and Aaron Wright, *Blockchain and the Law: The Rule of Code*, Harvard University Press 2018.

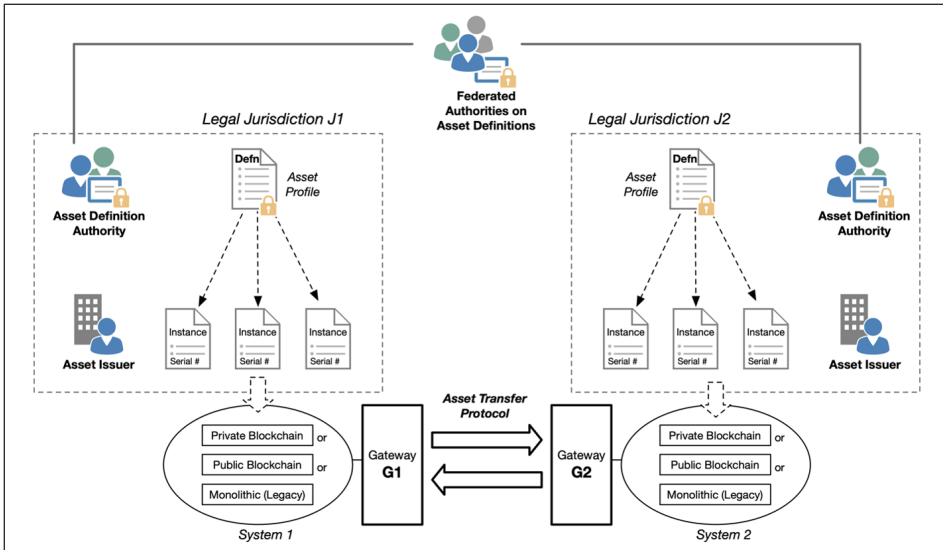


Fig. 3. Overview of the role of Asset Definition Authorities and Asset Issuers in a given legal jurisdiction

The asset profile (e.g. JSON file) itself must have a globally unique identifier, and must be digitally signed by its Asset Definition Authority (i.e. to provide content integrity and source-authentication). The asset profile can be a standalone document (e.g. signed JSON) which can be stored off-chain or on-chain.

- *Digital Asset Issuer*: The entity who creates on a blockchain one or more instances of the digital asset following the specifications of a given asset profile.
- *Asset Instances*: A digital representation of economic value based on a published asset profile. A given asset instance must incorporate the identity of the issuer entity, regardless of which digital form the instance is created. For blockchain-based systems today, the Issuer's digital signature is recorded as part of the introduction of the asset instance onto the blockchain (i.e. initially a self-addressed asset). As the instance changes ownership, the records on the ledger of the blockchain provide a trace of the history of ownerships of the asset instance. For standalone asset instances (non-blockchain), such as those using the standalone X509 certificate format, other archival mechanisms are needed to track the history of ownership of the asset instance as well as the related validation certificate(s).
- *Digital Asset Validator*: An independent entity that can validate a given asset instance, trace the history of the asset instance and verify the authenticity and legal standing of the corresponding asset profile.

Other entities may also be introduced into this framework, such as the insurance providers who may seek to provide asset-insurance products to holders, based on the evaluation performed by asset validators (combined off-chain and on-chain)⁹.

⁹See Hardjono et al., *Wallet Attestations for Virtual Asset Service Providers and Crypto-Assets Insurance*, <https://doi.org/10.48550/arXiv.2005.14689>.

6 TOWARDS THE INTEROPERABILITY OF DIGITAL ASSETS

The interoperability of assets based on compatible asset profiles is a fundamental issue, currently addressed by several global initiatives, including the IETF Secure Asset Transfer Protocol (SATP) Working Group¹⁰ which is reusing the proven *cross-domain gateways* operational model that is a fundamental building block of the Internet Architecture for the past three decades. In this IETF SATP model, all asset networks are bounded by gateways (special nodes) and cross-domain (cross-chain) transfers of assets are performed using gateway nodes in the origin network that is peered dynamically to other gateways in the destination network.

In our framework model¹¹ the asset interoperability can be addressed as follows (refer to items in Section 3):

- The attributes in the Token and Attributes (1) element in Section 3 above should be created in such a way that allows unambiguous interpretation of their semantics.

For example, no matter how the token is programmed in the underlying smart contract (e.g., ERC721 in Ethereum, or FA2 in Tezos), the attributes of the token shall define a standardized way to access the asset metadata (2) element.

- The Asset Metadata (2) must be based on (and carry a reference to) a well-defined Asset Profile. Ideally, an asset profile should also act as an “asset schema” describing the way to interpret the Asset Metadata (2), and the terms of use of the token.

Asset profiles should be based on open standards to allow the creation of open-source components that manipulate the metadata of the asset. Having Asset Metadata (2) defined in a standardized way would allow better discovery and indexing of assets, therefore, enabling better automation of asset-related services including custody, trading, and others.

In summary, it should be possible to write standard-based open-source software code that: (a) accesses the Token and its Attributes (2) on-chain, (b) fetches the Asset Metadata (2), and (c) interprets the Asset Metadata (2) following a well-defined Asset Profile “schema”.

It should then be possible to package such code in microservices and make it available to any Web2 or Web3 application.

7 CONCLUSION

In this paper, we discuss some of the challenges in automating the processing of tokenized assets. A primary concern in that context is the clear definition of legal aspects related to the issuance and the terms of use of digital assets.

In order to streamline the digitalization and tokenization of assets we define a conceptual framework based on a rigorous definition of the structure of digital assets. In our framework *Asset Profiles* define the structure of the digital assets and contain important legal information and technical references. An asset profile is validated by the *Asset Definition Authorities* that confer legal value to the asset profile for given legal jurisdictions where that authority is recognized. The *Asset Issuers* create tokenized assets that conform to specific asset profile.

One important aspect introduced in this paper is that of the interoperability of digital assets across physically distinct networks that may be operating under different legal jurisdictions. Here, we use the standardization effort being conducted by the IETF SATP Working Group where each

¹⁰For a detailed description of the Secure Asset Transfer Protocol please refer to the IETF SATP Working Group <https://datatracker.ietf.org/wg/satp/about/>

¹¹See previous work in Hardjono et al., “A Contract Service Provider Model for Virtual Assets,” *The Journal of FinTech*, Vol. 1, No. 2 (2021). <https://doi.org/10.1142/S2705109921500048>.

distinct asset network interacts with each other via the peered gateways model and utilizing a standard secure asset transfer protocol. The transfer of digital assets across networks must be performed using these gateway nodes, which also acts as jurisdictions-based *policy enforcement points* with regards to digital assets.

Asset interoperability can be achieved by standardizing the structure of attributes stored on-chain, irrespective of the smart contract interface defined by a target blockchain. Moreover, the structure of the asset profiles and asset metadata (stored off-chain) should be based on open standards to facilitate the creation of software for the automation of asset-related services including custody, trading, etc.