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Art Data as Assets: Securely Storing Cultural Object Information

or "You Have Stored Your Artworks, Now Store Their Valuable Data"

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ABSTRACT

It is long established that artwork information (or information describing any cultural object) is highly important when determining the art object's value. How old is the artwork? Who is the artist? What is the chain of custody? What other identifying information indicates its authenticity? What is the story behind it?

That information will vary among artworks and cultural objects depending on what information is available and verifiable. The artwork owner is motivated to take responsibility to collect and make available that information.

Just as important is how and where that information is stored. Given the variability in available information, how can that information be stored in a standardized way across the art community?

Ensuring the information is secure and unalterable will improve its value. The information must be protected against loss due to a system failure or attack and, at the same time, readily available when desired. On the other hand, the information should be private if the artwork owner so desires. Finally, the methodology for storing the data and access to it must endure even if the entity operating the storage facility disappears or goes "belly up."

Uniquely, the Domain Name System (DNS), coupled with blockchain technology, provides two distributed independent, secure databases in answer to each of these needs. The DNS, developed through global-consensus, provides a 50-year-old tried and true information storage and retrieval platform that is counted upon by four billion DNS users. The evolving blockchain technology is ready built to store transactions that record art provenance and smart contracts that enable transactions.

In addition, each of these formats might be used to gain revenue streams from artworks while owned.

The .ART domain registry (https://art.art/digital-twin/) is uniquely (in the true sense of the word) positioned to utilize both the DNS and blockchain to create a secure, stable and resilient data storage facility particularly suited for keeping and disclosing valuable artwork information. The .ART Digital Twin (Certificate + Metadata).

CREATE
MONETIZE
SHARE

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THE VALUE OF INFORMATION

*"That is a beautiful painting, I'll pay you **$1000** for it."*

"It is over 200 years old."
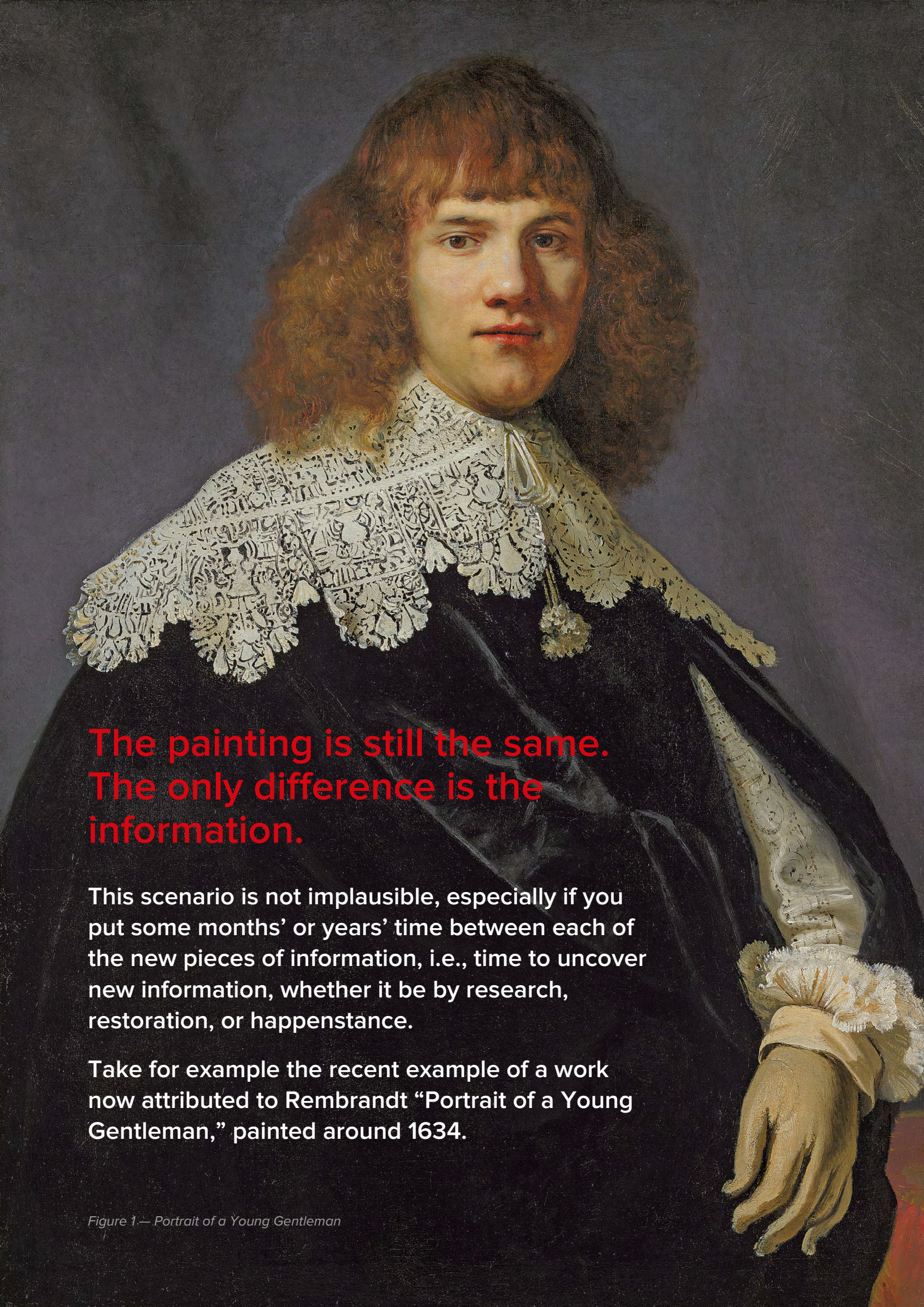
*"I didn't know that, **$10,000**."*

"Actually, it dates to the 17th Century, you can see it is from the school of Rembrandt."

*"Oh gosh, I will pay **$100,000**."*

*"See this document here, it was done by a direct student of Rembrandt's." "In that case, I will pay **$1,000,000**."*

*"New information proves that it was done by Rembrandt himself." "**$10,000,000**."*

What's changed over the time and course of this discussion?

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The painting is still the same. The only difference is the information.

This scenario is not implausible, especially if you put some months' or years' time between each of the new pieces of information, i.e., time to uncover new information, whether it be by research, restoration, or happenstance.

Take for example the recent example of a work now attributed to Rembrandt "Portrait of a Young Gentleman," painted around 1634.

Figure 1.— Portrait of a Young Gentleman

The painting's value increased remarkably as new information came to light.

1. The portrait was acquired by Sir Richard Neave, 1st Bt. (1731-1814), or his son, Sir Thomas Neave, 2nd Bt. (1761-1848), Dagnam Park, Essex, and by decent to the present owner. Its provenance prior to that is unknown.

2. The portrait, an undated and unsigned oil painting attributed to the "Circle (i.e., School) of Rembrandt van Rijn," was put up for auction by the Neave's decendants at a Christie's London Old Masters Day Sale in December of 2016.

3. The pre-sale estimate of the then-unidentified painting was set by Christie's at £15,000 — £20,000 ($20,000 — $27,000).

4. Dutch art dealer Jan Six noticed it and its resmblance to Rembrandt's works. He also realised that, when painted in 1634, Rembrandt was too young to have a "Circle" or "School."

5. Bendor Grosvenor, a British art dealer known for discovering old master "sleepers", bid on the painting at Christie's as well. He sought to partner with Jan Six but Six instead bid on the painting alone and anonymously.

6. Jan Six purchased the painting at a Christie's auction in London in 2016 for 137,000 GBP, or about $185,000.

7. Mr. Six spent 18 months doing historical and technical analysis of the painting, including paint sample analysis, X-radiography and other scanning technologies. He has lined up 15 curators and art historians in the Netherlands and abroad who vouch for the painting's authenticity as a Rembrandt.

8. The painting has been endorsed as genuine by Ernst van de Wetering, the world's leading Rembrandt authority. With this attribution, Mr. van de Wetering places the "Portrait of a Young Gentleman" as Rembrandt painting No. 342. Other experts said that they were not yet ready to weigh in on the attribution.

9. The portrait was on view at the Hermitage Museum in the Dutch Master's hometown of Amsterdam for a brief celebratory run.

10. Jan Six published a book in 2018, "Rembrandt's portrait of a Young Gentleman," describing the findings and the remaining mysteries of the artwork, further increasing interest (and value).

11. The artist's highest price at auction, according to artnet's Price Database was for Rembrandt's signed Portrait of a Man With Arms Akimbo (1658) sold for £20,201,250 ($33,258,562) at Christie's London in 2009.

12. Conservators at the Rijksmuseum examined the painting using macro X-ray fluorescence scanning, comparing its pigments with a pair of Rembrandt pendants, "Marten Soolmans and Oopjen Coppit", which the museum purchased along with the Louvre in 2015 for $180 million.
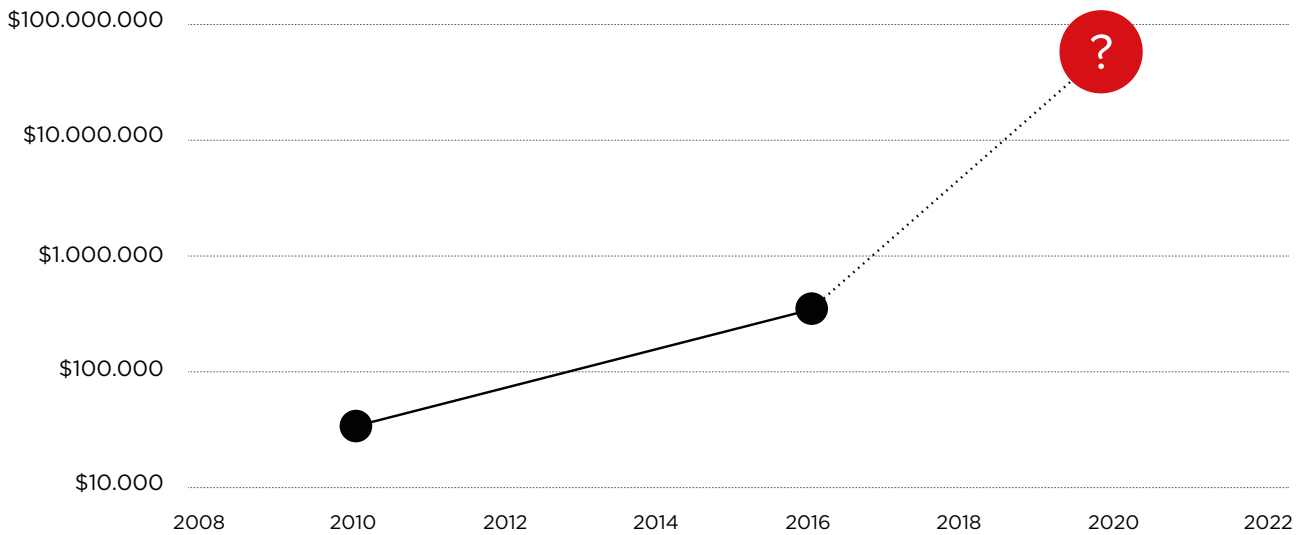
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Figure 2 – «Portrait of a Young Gentleman» value over time, as information changed

Did each new piece of information in this brief tale affect your perception of the value? Jan Six's brief detective work in the time leading up to the auction increased the value about ten-fold. The subsequent research and attestations increased the value over 100 times again. Even the scandal coming from the anonymous bidding and the mysteries described in the book tend to increase interest and value.

From the most famous to the more pedestrian works of art, these types of information can add value:

A verifiable chain of custody

A notarization

HD A high-definition image or "digital fingerprints'

An expert attestation

Art works accompanied by such evidence of authenticity will command higher prices.

Artwork information can be converted into value. With the advent of digital data processing, cloud storage, blockchain and artificial intelligence, how can that best be done?

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INFORMATION STORAGE

Deciding where to store information about an artwork is just as important as collecting it. The problem is as old as art itself. Not too long ago (especially in "the-history-of-art time") information had to be stored on paper, either in written or typewritten form, sketches, images or photos. Just as with the artwork itself, each of these records started out as a blank sheet of paper, and the records that were created could take on any form. The variability in content, form and format would tend to denigrate the value of the documentation. There might or might not be a record of which artworks are on loan to a museum or friend.

Then that information had to be stored. Private collectors might keep artwork provenance in the upper-left hand drawer of the nearby desk. Those desks might be located in different homes or galleries and maybe with an agent or in a bank deposit box. Fire and theft were risks. Changes to information might be haphazardly made on separate sheets of paper stored elsewhere.

With, the advent of the so-called third and fourth versions of the industrial revolution (introducing computer technology and artificial intelligence, respectively), the situation has changed, presented a new set of opportunities and challenges.

Many services offer data storage of artwork provenance using proprietary hardware, software, and systems. To be effective, those systems must balance the flexibility required by different genres, art forms and artwork owners against the degree of standardization required to make the information easily understandable and valuable. Data stored must be immutable,

resilient and secure. I.e., under what, if any, conditions are changes permitted? Can the data base withstand "denial of service" attacks or theft attempts? What happens if the owner of the data servers goes out of business?

These questions are not new — even to the art community where art is increasingly available online, moving from museums to PC screens.

The Metropolitan Museum of Art, for example, has digitized and made public about 400,000 items of its collection. With the development of digital technologies, more and more cultural and art objects are created in digital form.

Equally important is the ease of posting additional materials: photos of the author, videos of the creation process, copies of various certificates and certificates. Publication of this information in an easily viewable, standard, secure form can increase the value of the artwork.

The publication of digital copies of paintings, sculptures, musical compositions and audio archives, video clips, etc. and their associated information is an important issue for intellectual property owners.

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THE BEST OF NEW AND OLD(ISH) TECHNOLOGY

It turns out that the conditions necessary to provide the stability, security, resiliency, flexibility and economy necessary for a data storage system can be fashioned by an adroit but straightforward combination of well-established and newly developed technological tools: domain names and blockchain.

The DNS – Domain Names

The Domain Name System (DNS) is a decentralized naming system for computers, services, and other resources. It associates information with a domain name. Most importantly, it translates more readily memorized domain names to the numerical IP addresses that are needed for locating and identifying computer servers that contain the information.

Typically, domain names are associated with people (http://shenwei.art) or organizations (https://pushkinmuseum.art and http://cleveland.art/). However, .ART Digital Twin (Certificate + Metadata) (hereinafter, .ART Digital Twin) links domain names to artworks in order to store information demonstrating authenticity, provenance, and artwork value. How does that work?

First, understand that domain names can be used to store two different types of data:

1. **DNS records** contain the types of information you and I associate with domain names – think of websites.

   For example, we can create a web page, store images, generate digital certificates, store data files for a 3-D printout of the artwork, and create written, oral or video histories of the artwork. A new generation of technological tools can provide (and the DNS can store) "digital fingerprints" of the artwork. See, https://artmyn.com.

   In other words, the artwork owner can store whatever information or data s/he thinks will demonstrate the authenticity, provenance and value of the artwork.

2. **Registration Data**, often called "Whois," is the information provided by the domain name owner when the domain is registered. Typically, it includes the domain owner's name, address, contact information, as well as the IP addresses of name servers that host the website and other DNS records. This data set is fixed for every domain name globally.

   The .ART Digital Twin team has a unique agreement with the global overseer of the DNS (Icann) to add registration data fields specifically to identify the artwork. In other words, only .ART can employ registration data to identify artworks due to its position as a domain name registry and the permission it has received from the regulatory body to augment the registration data set.

   Seeking to take advantage of work that had already been done, the data fields chosen to

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identify artworks mirror those in the Object ID™ standard for identification of artwork that was created by the Getty Foundation and ICOM. See, http://archives.icom.museum/objectid/about.html, and http://www.getty.edu/publications/virtuallibrary/0892365722.html.

Object ID™ has been adopted by Council for the Prevention of Art Theft, UNESCO, and major law enforcement agencies, including the FBI, Scotland Yard, Interpol. See, https://www.getty.edu/news/press/online/objectid.html.

.ART Digital Twin calls this additional data set "WhatIs™." Here is a partial view of the Registration Data display for the domain https://ateliersovetski.art/certcard/ with the "WhatIs" information highlighted.

DNS Whois + Whatis

Domain Name: ATELIERSOVETSKI.ART
Registry Domain ID: D156469081-CNIC
Registrar WHOIS Server: whois.aliyun.com
Registrar URL: http://www.alibabacloud.com
Updated Date: 2020-03-19T11:42:14.0Z
Creation Date: 2019-12-27T11:51:55.0Z
Registry Expiry Date: 2029-12-27T23:59:59.0Z
Registrar: ALIBABA.COM SINGAPORE E-COMMERCE PRIVATE LIMITED
Registrar IANA ID: 3775
Domain Status: ok https://icann.org/epp#ok
Registrant Organization: Ulvi Kasimov
Registrant State/Province: London

...

Whatis

Art Record - Type of Object: Video installation
Art Record - Materials & Techniques: Video installation on 8 monitors
Art Record - Measurements: Duration: loop
Art Record - Title: Atelier Sovetski
Art Record - Date or Period: 2014
Art Record - Features: Edition 2/3 + 1AP
Art Record - Maker: Orkhan Huseynov
Art Record - Features: Edition 2/3 + 1AP
Art Record - Reference: 0x3a34cBc3a7a4dBe06244A7268d7C0C87fE3c149B

Figure 3 — Registration data including new data fields identifying artwork

To briefly reiterate, .ART Digital Twin's use of domain names affords the artwork owner (who also owns the domain name) the opportunity to store two types of information:

• **Registration Data**, using an industry-wide adopted set of descriptors of the artwork in a standard format recognized globally, and

• **DNS records** (including web pages), that can be used with great flexibility by the artwork owner to describe the artwork and demonstrate its authenticity and provenance in any number of ways, using any number of formats.

Digital Twin's creator, UK Creative Ideas Ltd, has been awarded a patent by the U.S. Patent &

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Trademark Office for its use of registration data and the DNS to store artwork information.
The Art Records fields can be seen by using any terminal emulator, Whois lookup service or entering the domain name registered as a Digital Twin into your browser search bar, e.g., [your-artwork].art.
An example: https://ateliersovetski.art.

Also stored in this same "cert card" is the history of any changes to the artwork metadata or ownership in the "REGISTRY DATA DIRECTORY HISTORY" tab. The Digital Twin registration creates a record of provenance, i.e., the chain of custody. As described below, the information can be stored in the blockchain associated with an account, providing a reliable form of provenance.

In addition to accommodating the artwork owners' requirements, .ART Digital Twin (Certificate + Metadata) also offers standardized Certificates of Authenticity. Each certificate provides a Reference Number to the corresponding blockchain transaction and also carries a Certificate Number, the date the Certificate was issued, and the date downloaded by any viewer.

Figure 4 — Standard Certificate of Authenticity offered by .ART

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Other than what's already been discussed, domain names as a storage for artwork information offers many incomparable advantages.

- The DNS is decentralized and operated under a set of protocols developed and maintained through a broad global consensus, relied upon daily by over 4 billion internet users. This means that the artwork owner's data is not dependent on servers (computers) operated by any one entity using semi-proven or proprietary software. Data accessibility does not depend on the well-being of the firm or is not risked on a dispute between parties.
  Once the domain name is registered, the data is accessible through the operation of the DNS in a resilient, secure and stable way, without regard to third-party contracts and not dependent on third party software or servers.

- When the artwork is sold or transferred, the domain name ownership transfers with it. Artwork provenance can be demonstrated through the domain name chain of custody (more on this below). The registration data describing the artwork remains constant through a set of owners, providing additional evidence of authenticity.

- The DNS is a well-settled, tried and true technology that reacts predictably every time in every set of circumstances. The first protocol development is nearly 50 years old and the DNS has been in regular public use since 1985. Geographic diversity of facilities guarantee resiliency against attack or failure. In rare instances of individual failures, data escrow and other backstops ensure that domains and the associated data have always been recoverable. Domain names are known and easily findable for all internet users. The DNS is ubiquitous, a global development, and not an individually developed tool, such as an "app," or a developing technology, such as blockchain.

Art object information stored in the DNS is secure, stable and resilient — and easily findable with no learning curve for those seeking artwork information because domain name usage is a tool known and routinely employed by all internet users.

Blockchain

A blockchain is, most simply, a digital record of transactions. The individual records, called blocks, are linked together in single list, called a chain. (Think about a spreadsheet where each transaction is one line in the matrix.)

A valuable feature provided by blockchain is that each record, transaction, or block contains a cryptographic hash of the previous transaction, a timestamp, and the transaction data. Therefore, by design, each of the blockchain transactions is reliably linked in the chain and is resistant to modification. Due to the way the transactions are recorded, through a set of inputs from independent sources, we are assured that the recording is equivalent to what the entering party intended. In addition, the transactions are recorded redundantly (i.e., in a number of databases) ensuring the security and resiliency of the recording.

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There are extended uses of blockchain, to accommodate "smart contract." This opportunity will be briefly discussed below.

The attributes of the blockchain make it particularly useful to record artwork transactions. To determine what comprises a transaction, consider the domain name that is registered and linked to the artwork. The domain name is registered in the name (person or entity) of the artwork owner. In addition, we have recorded the Getty Foundation / ICOM-developed Object ID™ information in the registration data.

In the .ART Digital Twin model, a domain registration can also trigger a blockchain transaction, so that each domain name registration used to record artwork data is accompanied by a corresponding transaction. In one implementation, just as .ART is delegated in the DNS, (making it the unique entity enabled to provide the additional registration data fields to identify the artwork), .ART is also deployed at the "top level" of the Ethereum Naming Services so that it can directly offer and publicly display these blockchain transactions.

In this implementation, a blockchain search at app.ens.domains can be made by tying the domain (e.g., ateliersovetski.art) into the look-up bar.

As blockchain platforms evolve, .ART will provide access to additional platforms to take advantage of pricing, accessibility, environmental concerns, and new functionality.

For example, if research shows that the "circa 1700" painting was actually created in 1654, we amend the information in the registration data in the domain name. This creates a new blockchain transaction. Subsequently, if it is reliably found that the painting thought to have been done by Titus van Rijn was actually done by his dad Rembrandt, that change also forms a new blockchain transaction.

Similarly, when I sell my artwork and domain name for $10,000,000, the new artwork owner will be recorded in another in another blockchain transaction (and I will no longer be required to write articles).

In addition, with each transaction, the artwork owner can also update the domain name web page to provide additional explanation about the research done to authenticate the painting or to provide evidence of the legitimate sale of the artwork.

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Date	27 Aug 19	25 Aug 19
Owner	Gannon House Gallery	Kurt Pritz
Object Type	Aboriginal Painting	Aboriginal Painting
Mat'l	Acrylic on Canvas	Acrylic on Canvas
Meas	122 x 90 cm	122 x 90 cm
Title	My Country Yam Seed	My Country Yam Seed
Created	1 Jul 19	1 Jul 19
Maker	Anna Petyarre Pitjara Price	Anna Petyarre Pitjara Price

Ethereum naming service

MY-COUNTRY-YAM-SEED.ART

Blockchain establishes chain of custody

Figure 5 — Successive blockchain transactions establishing chain of custody

NFT

NFTs are tokens that we can use to represent ownership of unique items. For an excellent description of non-fungible tokens, see, https://ethereum.org/en/nft/ (although the industry is rapidly evolving

As physical and digital objects of culture and art are unique, so are the NFTs that digitally represent them. In Digital Twin, unique domain names correspond to unique NFTs, making the two technologies (the 50-year-old stable DNS and the newly born and evolving blockchain) complementary.

Digital Twin has created an intuitive NFT minting process, enabling you to first create a wallet for storing blockchain transactions, and then minting the NFT that stores your artwork metadata and images. Those NFTs are readily visible on commonly used platforms such as Opensea and Rarible. These are marketplaces for the exchange of NFTs and their corresponding artworks, and the execution of Smart Contracts. There are several "famous" stories regarding the early sales of NFTs that will be outpaced and out done by the time of this article publication.

Records of Digital Twin-minted NFTs are stored right on the domain website. For example, visit https://ateliersovetski.art and click on the NFT icon at the upper left.

To briefly mention smart contracts and how they might fit in: blockchain can also store code as part of transactions. That code can be written conditionally, (i.e., in the form of a contract) so that if one

party completes a set of conditions (e.g., make a bitcoin deposit into a certain account), then the requisite response (e.g., transfer of the artwork ownership) is automatically performed. The same sorts of 'contracts' can be established for artwork loans to museums or restoration efforts. .ART Digital Twin and the rest of the art-community-servicing world will be using sophisticated tools such as smart contracts as they can be adapted for reliable use in blockchain technology.

Therefore, the combination of domain names and blockchain creates a tapestry or full set of secure information that can be utilized to demonstrate artwork authenticity and provenance.
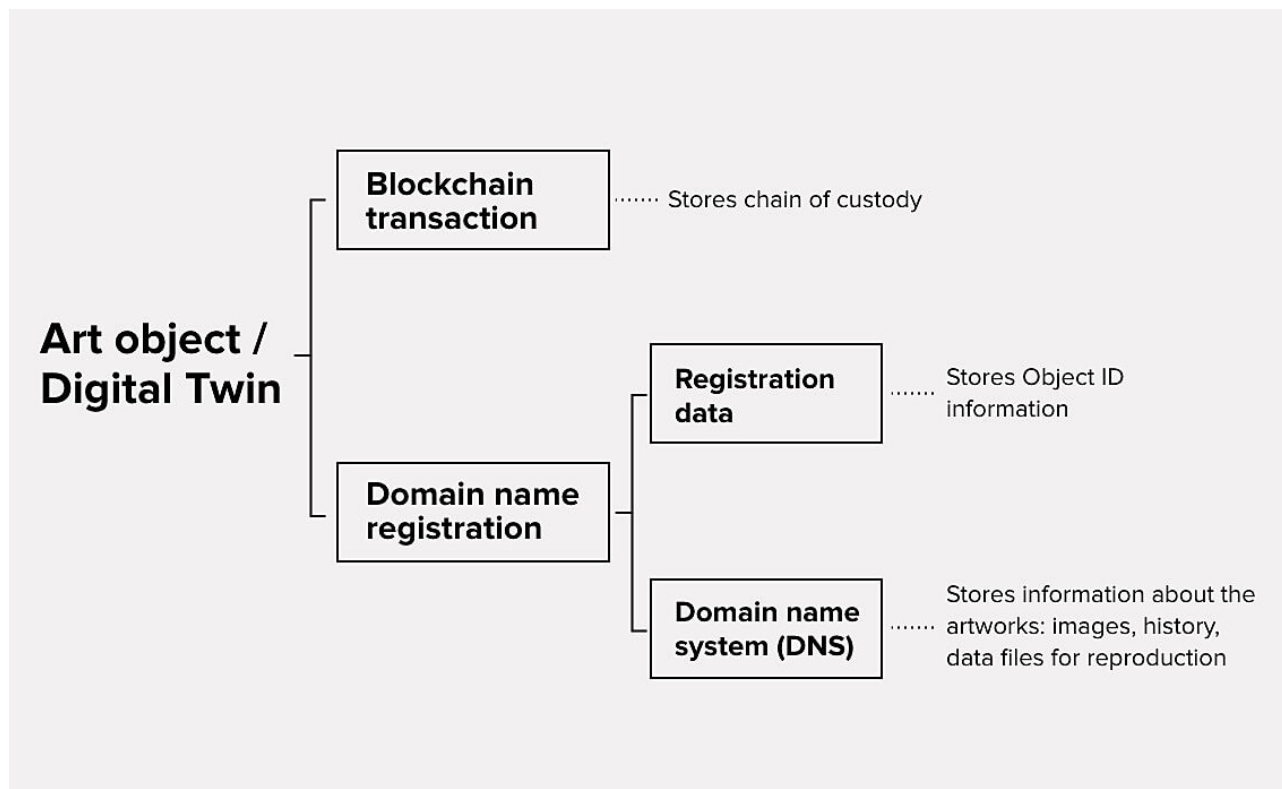

Figure 6 — How Digital Twin employs the DNS, Registration Data and Blockchain to store information

Many commonly used art data management and storage platforms use cloud storage systems, as we currently know them, rely on large, centralized databases. Cloud storage represents a reasonable trade-off between reliability and convenience when storing large amounts of data. The cloud is distinguished by reliability, information backup and high-speed access to the media stored in them around the world. However, there have been cases demonstrating these data are vulnerable to privacy and security breaches.

Digital Twin's unique combination of DNS and blockchain (combined with cloud storage) makes data safer by removing failure points and creates cost effective storage options.

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A (SIMPLE) EXAMPLE

I acquired an aboriginal artwork, My Country Yam Seed from the Gannon House Gallery in The Rocks area of Sydney.

Shortly thereafter, I acquired the domain name https://my-country-yam-seed.art from a registrar that made prototypes of .ART Digital Twin domain names available (https://ip.art). I entered the required registration data, including the Object ID™ information describing the artwork.
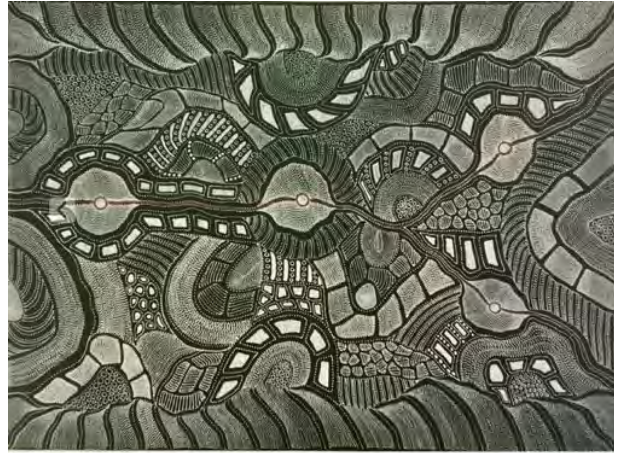

Figure7 — My Country Yam Seed by Petyarre Pitjara Price

That information can be found via a Whois lookup on a terminal or at any domain name registrar:

$ whois my-country-yam-seed.art
nserver: A.NIC.ART 194.169.218.49 2001:67c:13cc:0:0:0:1:49 nserver: B.NIC.ART 185.24.64.49 2a04:2b00:13cc:0:0:0:1:49 nserver: C.NIC.ART 212.18.248.49 2a04:2b00:13ee:0:0:0:0:49 nserver: D.NIC.ART 212.18.249.49 2a04:2b00:13ff:0:0:0:0:49 ds-rdata: 29485 8 1 6FD8A6CB40 CAC76B1EAC4EE69075360D5C5EEA8E ds-rdata: 29485 8 2 BF041A7EC6CA857F5D85151C66F 561DEB9C863B98E05670C345C9CF9ED199AEE

whois: whois.nic.art
status: ACTIVE
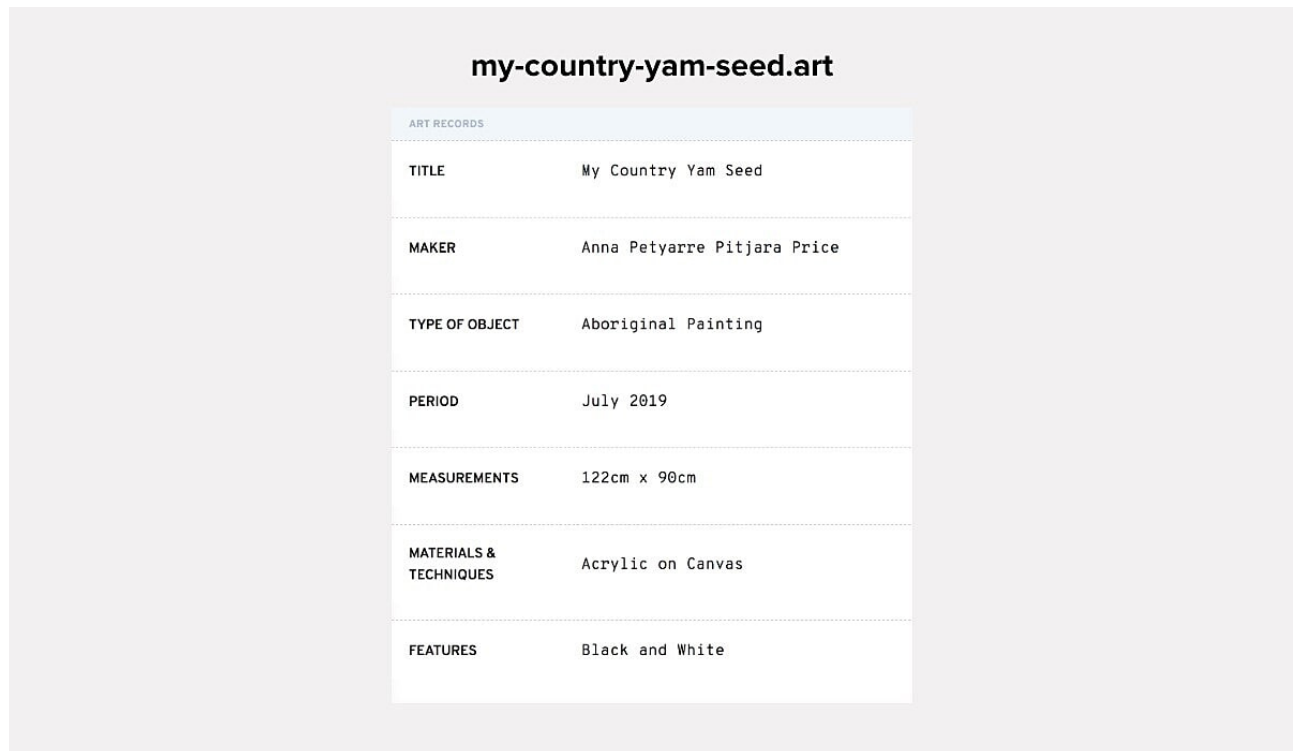created: 2016-06-09 changed: 2018-07-23
source: IANA

Domain Name: MY-COUNTRY-YAM-SEED.ART
Registry Domain ID: D136315920-CNIC
Registrar WHOIS Server: whois.aliyun.com
Registrar URL: http://www.alibabacloud.com
Updated Date: 2019-11-15T11:51:45.0Z Creation Date: 2019-10-18T12:21:40.0Z

Art Record - Date or Period: July 2019
Art Record - Measurements: 122cm x 90cm
Art Record - Features: Black and White
Art Record - Maker: Anna Petyarre Pitjara Price
Art Record - Materials & Techniques: Acrylic on Canvas
Art Record - Type of Object: Aboriginal Painting
Art Record - Reference: 0x3a34cBc3a7a4dBe06244A7268d7C0C87fE3c149B
Art Record - Title: My Country Yam Seed

ⓘ Note the grayed area that indicates the additional data fields that describe the artwork.

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The simple website that is automatically created is at https://my-country-yam-seed.art. This website provides a downloadable Certificate, as well as pull-down menus for the artwork description, certificate details, and registration data history.

The blockchain transaction can be viewed using https://app.ens.domains/ and typing the domain "my-country-yam-seed.art" into the query bar. The blockchain transaction is listed along with the blockchain transaction data.

Figure 8 — Response to Domain Query in Ethereum showing information stored in blockchain

There are actually four blockchain transactions associated with each domain registration, to:

1. claim domain at ENS registry
    Transaction: 0x34f4dc472469c72eaf52d5dae3160e46e4aa7b5cfa53969a24fbfdf7b48f89d3

2. set the resolver for the domain
    Transaction: 0x745b30cf5df08562ccb64ba88f7dbccb4545ea22f8bb2911da318d967b02affc

3. put registrant info into resolver
    Transaction: 0x356f3e1f58c5fc46476203b67a3ade6fb87a4ffeabb8ec0cb36c5e5af164b587

4. put artwork info into resolver
    Transaction: 0xd8cc24f565af6b331bd1011a3d640c5082a725ea2b9bb1fa43ab9d3429d34596

Recall fig. 6, describing how domain name registrations, DNS Records, web pages, registration data and blockchain combine to form and store a tapestry of information to enhance the value of artwork, we show how My Country Yam Seed occupies those diversified data bases.
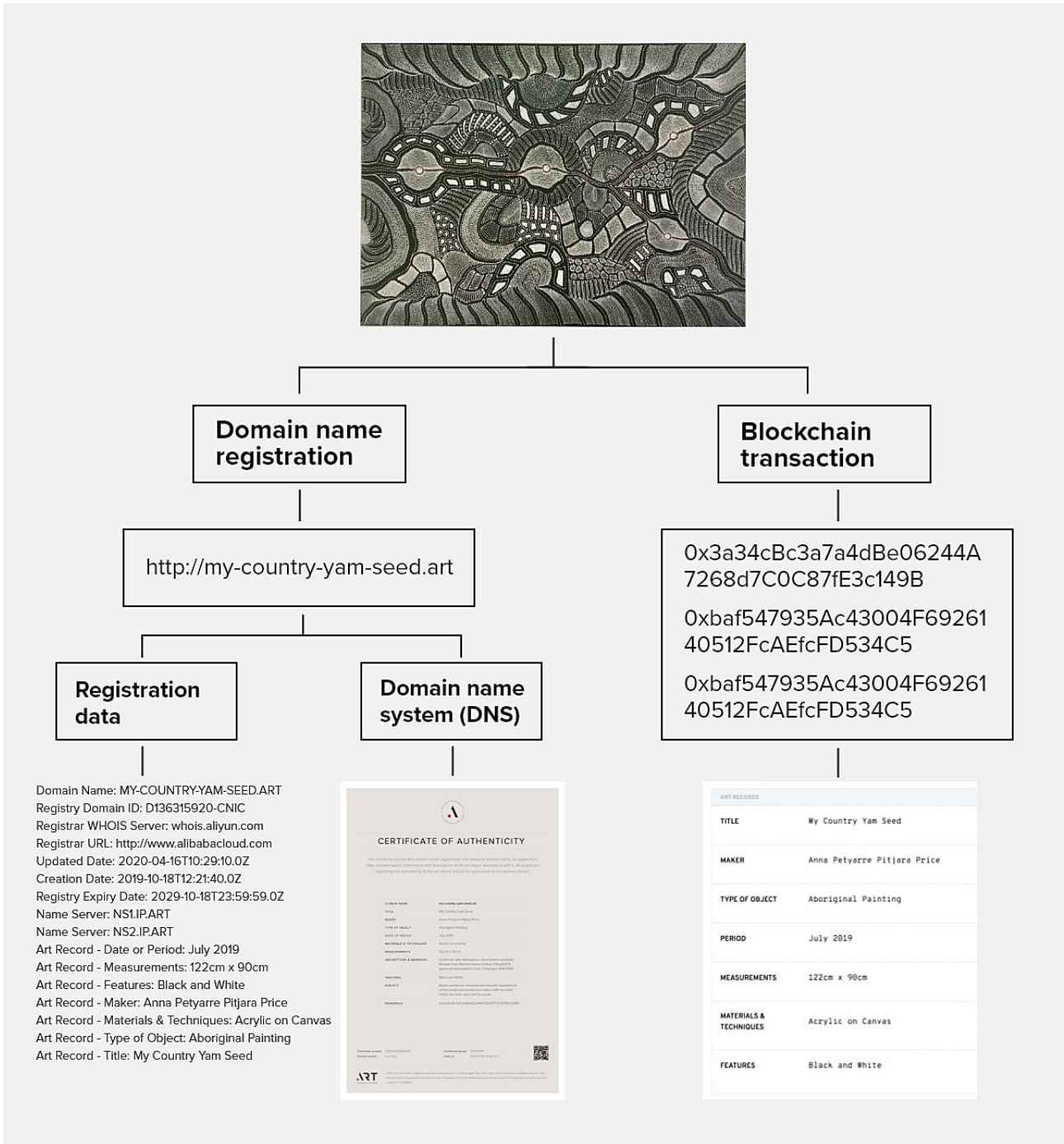
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Figure 9 — My Country Yam Seed data stored using DNS and blockchain

You can study another example by yourself at https://karlbrullov.art/certcard/ This Digital Twin is created for an album of hand drawings by the famous Russian artist Karl Bryullov, works in which date back 1828-1832 years. The album itself was presented by the author to Countess Wittgenstein in 1832, as evidenced by Bryullov's own inscription on the title page. This detail is also reflected in one of the fields ArtRecords.

APPLICATION NOTES (BRIEFLY)

Monetization and digital transformation

The opportunities provided by Digital Twin will benefit a wide variety of people and organizations related to art.

Are you an artist, musician or creator?
Digital Twin is a great opportunity to publish your creation, complementing it with a history of creation, other additional materials. This will help you find a buyer, a cartridge, a gallery for an exhibition or a performance platform, as well as increase the possible price of your work. The NFT token to your Digital Twin will allow you to put up work for online auction at one of the specialized exchanges of NFT tokens. Add new content to Digital Twin: videos, photos, documents and other interesting information. This is a convenient online container for storing your creations, the contents of which you can supplement and edit at any time.

Are you a collector?
Make your gallery available online! Save with Digital Twin the provenance of your cultural and art objects in a secure digital repository and give it access to all interested persons. Add additional materials: research, certificates of authenticity. Surround your work with layers of additional data and see how it increases its price and demand in the market.

Do you represent the museum?
You will be interested in the opportunity to show the world the treasures of your storerooms, publish additional materials to the unique items of your collections and thus attract new visitors both offline and online. A QR code with a link to Digital Twin will help guests of your halls learn more about the works of interest to them, as well as a link to Digital Twin in the virtual gallery will provide the same service to visitors to the website of your museum.
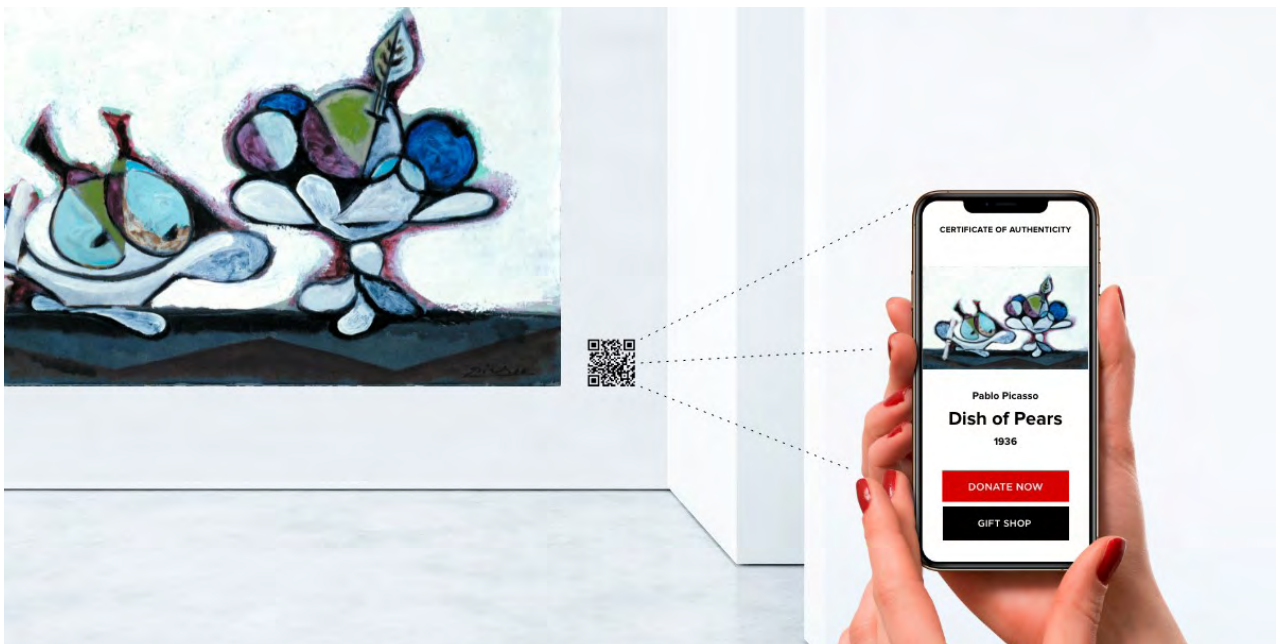

Figure 10 — Visualization of a typical Museum app that might use Digital Twin to increase donations and revenue

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Preservation of World Heritage — A Tale of Two Cities

Within a relatively short time span, two global heritage sites suffered a major catastrophe. In the first, The Museu Nacional in Brazil completely burned. Complete sets of aboriginal heritage and even language scripts were lost. Shortly thereafter, the Notre-Dame de Paris was burned in a way that destroyed much of its architectural heritage, as well as the interior artifacts.

In the case of Notre-Dame, there were already complete digital copies of artifacts and billions of dollars were donated to repair and replace the loss. For the Museu Nacional, not so much — ample budget did not exist and there was no allocation for digitization. There was no rush of donation afterward.

Figure 11 — Notre-Dame de Paris

Figure 12 — Museu Nacional

While the processes of digitization and donation solicitation are well developed, .ART Digital Twin can help in the quest for preservation of cultural heritage. Because .ART Digital Twin records exist in easyto-find domain names in a technology familiar to everyone and because digital files can easily be stored in the DNS and blockchain, UNESCO, ICOM or other organizations might use .ART Digital Twin to Crowdfund efforts to:

• provide for digitization of World Heritage relics and art objects, and

• replace / restore artifact and art in event of disaster.

Figure 13 — Notre-Dame de Paris

Figure 14 — Museu Nacional

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