# Two Novel Use-Cases for Non-Fungible Tokens (NFTs)

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Abstract: Non-Fungible Tokens (NFTa) can either represent an original digital artwork, or act as a digital reference to the actual work. In both as digital references to the actual work. In both cases the record in the distributed ledger, mostly a blockchain-based database, intends to serve as a proof of ownership or transfer of rights. NFTs might also add a further purpose, which in blockchain terms is referred to as "a utility", such as access to special websites, chats or clubs in emerging metaverse platforms. This use-case paper presents a first introduction of two early stage demonstrators, set outside the common use of art images or images of historical events as NFTs. The first case shows how educational credentials can be created, in which different teachers contribute to assessment achievements. We elaborate how these partial achievements are verified separately within the actual credentials. In the second case study, we build on previous research in regard to NFTs in the music industry and show the combination of physical vinyl record special editions, in our case vinyls signed by the band, and the ownership certificate as NFT. For both demonstrators we used, in different settings, the crypto art platform NFTmagic and the blockchain-token wallet Sigbro. We developed and tested the results within the setting of a roleplay as a group and show how blockchain technologies and especially NFTs can be made useful in new ways, inspired by the ongoing process of discovering risks and opportunities in 'crypto art', thus initiating discussion on the topic and effectively bridging the cybersecurity and (digital) art communities.

Keywords: NFT, blockchain, non-fungibile-tokens, cybersecurity

# 1. Introduction

The white paper "Bitcoin: A Peer-to-Peer Electronic Cash System" by Satoshi Nakamoto (2008), a pseudonymous author, is regarded as one of the foundations for today's blockchain technologies. Bitcoin is an example of a public blockchain: the same digital record is replicated at many locations (nodes), and each node is managed by a different individual or corporation, at least in theory. Because the decentralized system allows for consensus, none of these people or businesses need to know or agree with each other directly. When it comes to having a tamper-proof recording of a transaction, this is accurate. But blockchain cannot verify anything other than that, such as any information provided in the attached text message or ownership of tokens besides the fact that they are stored in a legitimate blockchain wallet. A blockchain's storage mechanism is based on the constant production of fresh data blocks that are cryptographically linked to each other. The specific technique differs depending on the blockchain system in use. Some blockchain systems can do more than solely handle transactions, such as allowing users to create their own tokens and contracts (Grech and Camilleri, 2017).

In our use cases, we want to combine two worlds. The storage of data in a form where users have the possibility of data-ownership in combination with a secure digital identity. After all, what good is a secure database solution, if we cannot verify who entered the data, at least in such a way that the data was entered by a legitimate person or institution without revealing personal data?

To do so, we use the webapp NFTMagic.art<sup>1</sup> and the native app Sigbro.app<sup>2</sup>, which are both facilitating the Ardor<sup>3</sup> blockchain, for our demonstrators. This blockchain system is a descendant of the Nxt<sup>4</sup> blockchain. We have two motives for this: the Ardor blockchain uses the Proof of Stake (POS) consensus algorithms, which is

<sup>&</sup>lt;sup>1</sup> https://nftmagic.art/

<sup>&</sup>lt;sup>2</sup> https://www.sigbro.app

https://www.jelurida.com/ardor

<sup>&</sup>lt;sup>4</sup> https://www.jelurida.com/nxt

considered environmentally friendly and secondly, the Ardor blockchain's Ignis<sup>5</sup> childchain provides the ability to execute smart transactions. With Nxt's smart transactions (which are implemented in the Ignis childchain), the code that is executed is actual software that runs in the node server. The scripts have already been incorporated into the network nodes. The user only sets those parameters that are required for the transaction or operation that he or she is attempting. As a result, Nxt may be viewed as a platform that allows developers with little or no experience with blockchain technologies to create a variety of safe decentralized services, applications, and tokens (Abctcm & APenzl, 2016). Furthermore, we have the possibility of phasing, which allows certain safe transaction to be created with conditional deferred execution based on specifically applied approval models (APenzl, 2016). With this function, we can set conditions, allowing our NFTs and utility tokens to be only sent to another account under certain conditions, thus enabling us to further greenlist all accounts in the ecosystem. This enables several possibilities to prevent fraud in our planned applications.

#### 2. Method

The platform Nftmagic.art offers three different ways to mint the blockchain token (as NFT):

- 1. A unique token is generated for each individual case, which contains completely different asset properties and other meta data. This is the most widely accepted definition, and application, of an NFT.
- 2. However, it is also possible to generate several items, from two upwards, with the same asset properties and the same asset ID. In this case, there are only differences in the meta data (message, if attached) when the token is sent.
- 3. A third, innovative solution is to create a series of tokens (here we take the inspiration from seriality of blockchain-based art (Jutel, 2021)). This is a hybrid of both existing solutions where each token is a unique asset as in the first example, but at the moment of creation of the token it can share asset properties with other unique tokens, allowing each token to still have its own asset ID.

In all cases we have on the one hand the blockchain-based asset storing the legal data and acting as ownership certificate and on the other hand the media file, which is on an IPFS<sup>6</sup> server which is using a peer-to-peer hypermedia protocol provided by the platform with the possibility to clone the file with the user's very own IPFS Node. Once the asset is created (or in blockchain terms the NFT is minted), we use our Ardor Full Node to access the childchain Ignis and implement the necessary phasing conditions and approval models.

Another important feature of Nftmagic.art for our demonstrator is the Twitter verification procedure. Twitter users can apply to have a verified account on the platform which can be considers a low-level form of identity verification, following the concept of an E-ID Wallet for utility tokens from Pfeiffer and Bugeja (2020). The E-ID utility wallet's concept is based on the idea that each user can keep their utility tokens and NFTs in an easy-to-use app and combine them with digital ID in a variety of formats (if necessary). Furthermore, the user should be able to see the information about the tokens and NFTs without having any prior knowledge of blockchain technologies, and the tokens should be able to be used to securely communicate information with third parties who require read-only access to the data. To this extent, the Sigbro app acts as E-ID wallet within the demonstrated use-cases.

Figure 1 shows a schematic representation of the E-ID Wallet. You can see the wallet on the far right, in our case the Sigbro app. This app is able to hold utility tokens and display them separately in a dedicated tab, independent of the cryptocurrencies in the same wallet. At the same time, using NFTMagic and a bot technology that interacts with Twitter, we can connect the Ardor wallet address of the respective Sigbro wallet to a Twitter account. This works in such a way that you receive a private message with a QR code in Twitter. This needs to be confirmed and signed using the Sigbro app. This process takes place offline on the smartphone. Only a confirmation token is sent for verification. On NFTMagic, on the other hand, the Sigbro app is connected to the web app using a toolbox in the header. Also, via an offline signature process as described above. NFTMagic is then set up as a tool for creating and displaying NFTs.

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<sup>&</sup>lt;sup>5</sup> https://www.jelurida.com/ignis

<sup>&</sup>lt;sup>6</sup> https://ipfs.io/

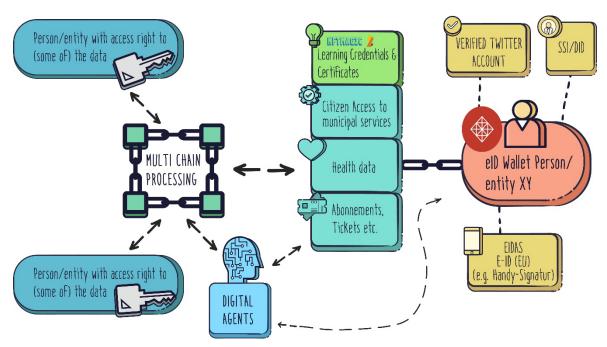


Figure 1: E-ID Wallet illustration

# 3. Presentation and discussion of the developed demonstrator

# 3.1 Use-case A: A learning certificate which provides the possibility to check the authenticity of every mark separately

The goal is to create a certificate of completion of a module which consists of two sub-modules. Each of these sub-modules is taught and graded by a different teacher. The final certificate contains a reference to these two deliverables. This means that it is now possible to see exactly how the module was completed. This is particularly interesting, when a final certificate contains achievements not only from different people but from different institutions, or for example, in the case when the final performance is based on micro credentials (Pfeiffer, 2021).

In our case, there are two partial performance certificates. Hilde Pfeiffer certifies the subject Art and Alexander Pfeiffer certifies the subject Technology. The account of the Center for Applied Game Studies then creates the final certificate based on this and sends it to the student Natalie Denk.

# Sequence of the role play and transactions of the demonstrator:

ARDOR-BGWS-RQDY-KFWQ-35JST | Alexander Pfeiffer | created asset 122034870596446986647 ARDOR-R7F7-R2D4-E9JE-FBCV7 | Hilde Pfeiffer | created asset 8603955761278446316

These two assets are linked to the respective PDF, which certifies the successful completion of the corresponding module. The PDF of Alexander Pfeiffer was also provided with the A-Trust citizen card signature to show how further trust can be established via using the official digital signatures following the EIDAS regulation8.

The respective certificate can now either remain on the account of the individual teacher or be sent to the institution for which the examination was administered. In our role play, we left the certificates with the specific teacher, as read permission can be obtained via the asset IDs. In a real-life use-case, the files would have to be encrypted and the read permissions would have to be granted with shared keys or similar in addition to the asset ID.

<sup>&</sup>lt;sup>7</sup> https://nftmagic.art/view?asset=12203487059644698664

<sup>8</sup> https://eur-lex.europa.eu/legal-content/DE/TXT/?uri=celex%3A32014R0910

ARDOR-ADH6-T5U9-L75S-4NG92 | which is the official account of the Center for Applied Game Studies created the certificate of completion including the asset-id and IPFS information (Figure 2) from both subjects completed. This certificate has been sent to the verified account of the student Natalie Denk (3). In this case a public message has been included saying "your certificate as a token". This shows the possibility that a message can be added to each transfer. With different options: encrypted or unencrypted and stored on the blockchain as long as it exists or if the message should no longer be processed after a certain block height (i.e., point in time). The message is not a fixed part of the NFT itself, it is only linked to the transaction ID, which is created uniquely for each transaction.



Figure 2: Screenshot certificate of completion from the NFTMagic.art webapp

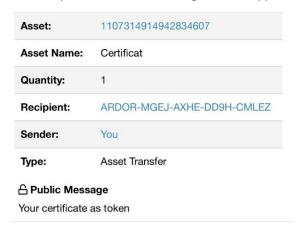


Figure 3: Transfer of the NFT from the applied games wallet to the wallet of the student

ARDOR-MGEJ-AXHE-DD9H-CMLEZ | Natalie Denk | as a student has access to this certificate via the Sigbro App on her mobile phone. (see figure 4).

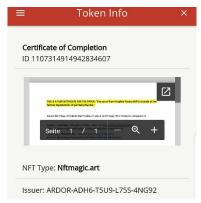


Figure 4: Screenshot of the Sigbro App from Natalie Denk, holding the certificate and the relevant meta data

As already stated for this use-case all files are readable by anyone, however in a real-world context, only the accounts involved would see the PDFs messages and the respective private data, while all other accounts can only follow transaction IDs and read the account property descriptions. Also, the certificates should not be visible on the NFTmagic.art art page, instead there would have to be an iteration of this page, possibly with secure subdomains or directories for customers to be able to use the tool as an NFT creator and a customized branded file repository.

The Ardor Blockchain offers the possibility of integrating a chat functionality between accounts. Al-assisted automation processes could be considered at this point. These could make processes faster, for example to validate whether certain requirements for completing a grade or issuing a certificate have been met. Furthermore, work steps could be defined more transparently and fraud around the topic of grades and certificates could be minimized. Finally, the biggest advantage lies in the simple verification of the final certificate, due to the digital signatures and IDs used in the process. However, this is not a technical innovation and has already been implemented by various organisations.

# 3.2 Use-case B: Securing records on a blockchain basis with NFTs

This use-case is a presentation of the current status and continuation of the work presented at ECCWS21 "Use of Blockchain Technologies Within the Creative Industry to Combat Fraud in the Production and (Re)Sale of Collectibles." In the conclusion of this paper, we stated as future work:

"With regard to the development of the demonstrator further possibilities offered by the Ignis blockchain will be explored in further iterations of the demonstrator, such as the division into 2 token systems for the same collectible. One token will contain the private owner data (encrypted) and another token the public data around the vinyl. Both tokens can only be sent together, which is guaranteed by the corresponding approval model."

In collaboration with the NFTMagic team, we were permitted to use the latest, not yet publicly available features to create NFTs for this second demonstrator. We described those features in the introduction of this paper. The system allows the possibility to design tokens as a series, which share an IPFS file and most of the meta data in the asset properties. This series can be then connected to each other in a collection. In addition, the two other NFT types can also be included in the same collection. This leads to completely new and interesting possibilities when it comes to mapping and managing the ownership, utilisation and usage rights of rare collectibles. What was described in the conclusion of last year's paper as two blockchain tokens, is now a blockchain token on the one hand and the public file on the IPFS server on the other. We created a collection (Figure 5) consisting of a series of three assets representing a vinyl each signed by Pfeiffer, a series of two representing a vinyl each signed by two band members, and a singleton asset (NFT of one piece) representing a single copy of a vinyl signed be all bandmembers.



Figure 5: The full collection displayed on a mobile device

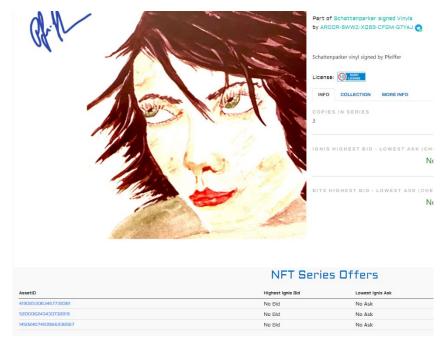


Figure 6: The Series of 3 assets representing the vinyl signed by Pfeiffer

Figure 6 shows the detailed view of the series of 3 representing the vinyls signed by Pfeiffer. On the top the account which minted (created) the NFT is visible. This is the most trustable account on the NFTMagic.art platform:

ARDOR-5WW2-XQ63-CFGM-G7YAJ , the account of the co-founder "thewiremaster". Clicking on "more info" would display the current owner, which is the verified address of Alexander Pfeiffer, member of the band and person who signed the vinyl. The license under which the NFT is issued and the other assets IDs of vinyls belonging to the same series can be seen. Now let's take a look how the asset properties that are displayed:

Asset ID: 520006243430732819

Schattenparker signed by Pfeiffer||3|Schattenparker signed Vinyls|1|QmdgZvqkmgHCFeJVD2Yn2kPgYnLiZW46TiZC5Kcizi1rTR

Asset ID: 4190853063467738381

Schattenparker signed by Pfeiffer||3|Schattenparker signed Vinyls|2|QmdgZvqkmgHCFeJVD2Yn2kPgYnLiZW46TiZC5Kcizi1rTR

Asset ID: 14502407493566936567

Schattenparker signed by Pfeiffer||3|Schattenparker signed Vinyls|3|QmdgZvqkmgHCFeJVD2Yn2kPgYnLiZW46TiZC5Kcizi1rTR

The public information includes the respective Asset ID, the name of the series, the number within the series, the name of the collection, the total number of different assets within the collection, and the shared IPFS-CID. This demonstration with the Schattenparker vinyl in different variations is ready for a real-life application in the near future. The presented use-case, unlike the ones in education, is not exotic to the essence of the NFTMagic.art platform. In fact, it should be possible for companies and professional partners, to create a separate section for their musical works of art collector's editions. It would also be necessary to create a user-friendly possibility for the companies to choose directly in the backend from various common approval models how the digital assets may be transferred. This should also allow to deactivate the trading place with crypto assets. The goal of this development must ultimately be to secure the rights of use of real vinyls and collectibles with the help of NFTs and blockchain technology to make them trustworthy and tradable on the basis of NFT technology and to make the NFTs usable in existing online and offline shops via API interfaces. It is essential that the users themselves do not need any knowledge of blockchain technology and also do not need to hold any cryptocurrencies (in the case of this use-case the blockchain currency Ignis). Only the professional partners

handle the crypto-asset, which varies depending on the blockchain system used and is necessary for the transaction fees and mint fees of the NFTs. In our specific case, a light version of the Sigbro.app would be desirable, which only shows the NFTs, separated by collection and series, but does not offer any other features of a classic wallet. Experienced crypto users, however, should be able to see and use the NFTs in their regular wallet.

#### 4. Conclusion

In conclusion, both use-cases presented in this paper are very promising. While the use-case in the education industry is still far away from real use and is rather an inspiration, the use-case in the music industry can be put into practice much more quickly. The pervasive problem remains in choosing the right blockchain system. This must be considered individually for each use-case and the advantages and disadvantages of the different systems must be evaluated in detail and systematically.

As described in this paper, the ideal implementation would be one where end users do not need to know anything about blockchain technologies or cryptocurrency. Interested users can view transactions and can find out what benefits this offers them. This leads to many other issues such as the management of the private keys of the blockchain wallets. In the discussion among the group of authors, it was pointed out that the assets are addressed via user and password, maybe via access-tokens and that the full management is not in the hands of the end users for the time being. However, the users can apply to take over full responsibility and transfer the assets to their existing wallet. Further research is needed on both the technical process (again the correct setting of approval models) and the legal situation.

With regard to which blockchain system is chosen, one must also take into consideration whether it should be used privately, as a consortium, publicly or as a combination of these options. The consensus algorithm of the chosen blockchain is just as important as the architecture if tokens are to be created. If transaction fees are to be paid, the crypto market should be observed and calculations made as to how they can be paid optimally and in the long term. In addition, due attention must be paid to the key figures of these cryptocurrencies: number of transactions per day, amount of volume calculated in FIAT money per day and in average the last year, number of addresses that actively use and transfer assets and cryptocurrencies, number of (decentralised) apps already build on the platform and, above all, where can these cryptocurrencies be obtained and how trustworthy are the respective exchanges. Finally, it is very important whether one can operate a full node and thus not only strengthen the network, but also guarantee the respective customers that the data is accessible. This applies both to the blockchain assets and to the IPFS infrastructure used in our example.

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#### **Author contribution**

Alexander Pfeiffer, Natalie Denk, Thomas Wernbacher and Stephen Bezzina developed the demonstrator and conducted the role play and discussion, while conducting the blockchain transfers.

Alexander Pfeiffer, Natalie Denk, Thomas Wernbacher and Stephen Bezzina wrote and edited the paper.

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