Ada Timestamp Technical Whitepaper

Amsterdam Node

Abstract

Throughout history, humans have gone to exceptional lengths to create a legacy. Some have children, some make art, and some have achieved their way into ubiquity. All of us, in our different ways, work our whole lives to leave behind a mark on the world that says "I was here".

To help with the process of being remembered AdaTimeStamp (ATS) aims to create a decentralized timeline for everyone, sustained by the Cardano community. A digital space where the memorable, entertaining and/or meaningful messages are recorded and safeguarded by the Cardano blockchain and carried into the future.

This paper sets out the principles by which AdaTimeStamp will be constructed to become a third generation NFT. Built on scientific principles to realize security, scalability and decentralization that will safeguard any legacy. It will focus on detailing the approach to:

- Minting time
- Security
- Technical aspects of forging community trust
- Ensuring long term sustainability
- AdaTimeStamp governance and use of funds
- Future functionalities

1 Introduction

AdaTimeStamp (ATS) has the goal to create a lasting and evolving timeline. To do so we must reliably mint Non-Fungible Tokens (NFTs) not just once, but continuously and in a trusted manner. This is no small feat, but our answer lies in Cardano's own protocol: 'Ouroboros'.

Each ATS NFT will, as closely as possible, represent one UTC calendar day, defined in terms of Cardano's Ouroboros protocol.[1] This assures that every moment on Cardano's blockchain is only ever linked to one ATS NFT.

[1] Aggelos Kiayias et al. *Ouroboros: A Provably Secure Proof-of-Stake Blockchain Protocol*. Available at `https://eprint.iacr.org/2016/889.pdf`. 2019.

Along with being inextricably linked to a moment in time on the Cardano block chain, each ATS NFT will hold the rights to write a message on its uniquely defined part of the Cardano timeline. Meaning the owner of an ATS NFT will be able to add content to the timeline that will become part of Cardano's decentralized history. Alongside long term governance and security standards, it is this creative application of using the innate utility of NFTs that makes ATS a third generation NFT project.

Cardano time is split into eras, named after people who contributed to society. Byron, Shelley, Goguen, Basho and Voltaire. These era's are split into epochs (five UTC days), and slots (at the time of writing one UTC second long). We leverage this relationship between the Cardano timeline (epochs and slots) and Coordinated Universal Time (UTC) to inextricably link ATS NFTs to singularly defined moments in time. It should be noted that the temporal relationship between Cardano time (epochs and slots) and UTC can change. For example, slots last one second at the time of writing, but in the Byron era each slot represented 20 seconds. The impact of this change in relationship can be seen in Fig 1. A further discussion of the detailed process behind the definition of the ATS NFTs can be found in the Minting Time section.

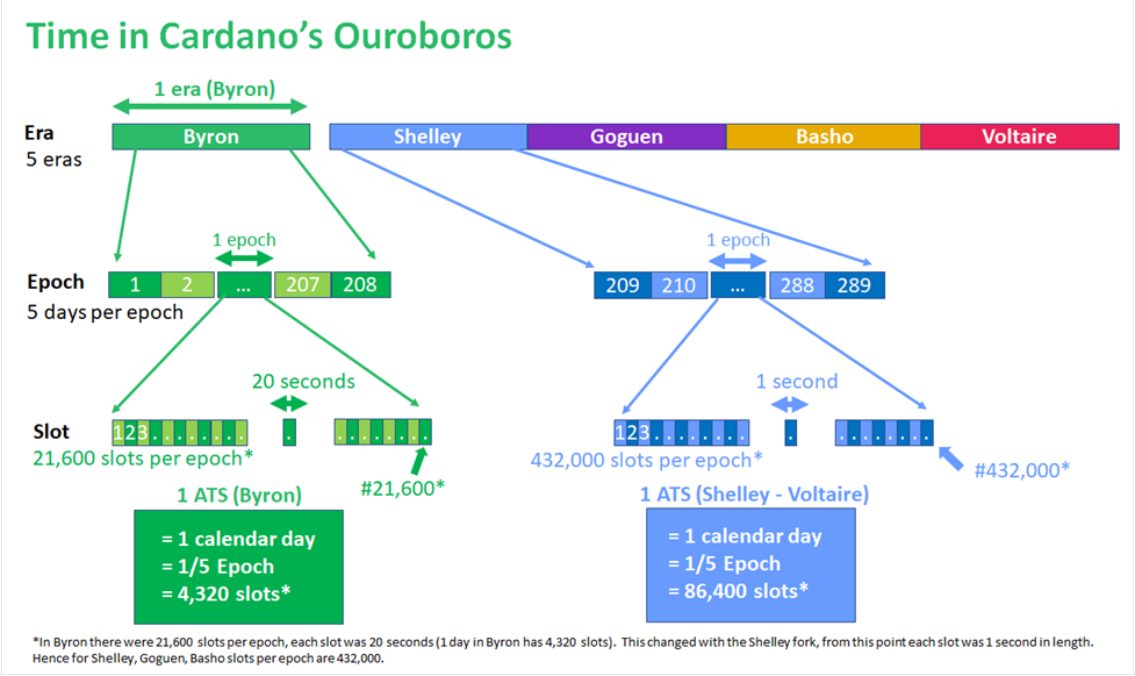

Figure 1: Time in Cardano's Ouroboros

Using the ATS platform, Individuals will be able to post messages that can stand timelessly alongside the names of Ada Lovelace, Cardano, Byron, Shelley, Goguen, Basho and Voltaire. We seek to create a place where today's individuals can post insightful, beautiful, funny, humane and enlightening messages to positively influence tomorrow's individuals and society.

AdaTimeStamp aligns closely with the Cardano roadmap, celebrating methodological approaches, simplicity, artwork and individuals who contributed to the world in some manner. It is our mission to inspire to do good through these timeless messages.

Each ATS NFT grants the owner rights to:

1. A unique piece of art, for the Byron era created by Cardano roadmap's artist Dimitris Ladopoulos.
2. A moment in Cardano's timeline defined in terms of the Ouroboros protocol.
3. Rights to write their message to the Cardano blockchain.
4. Governance votes to determine the direction of the project.
5. Be part of the positive impact made through NFT sales.

2 Building ATS to last for generations

As this project is destined to run for as long as it is possible, it is essential to define a standard for the ATS that will stand the test of time. Each NFT holds 5 pieces of critical information:

a. A name that uniquely identifies the ATS NFT in question.

b. The definition of the period covered by the NFT according to the Ouroboros protocol, demarcated in epochs and slots.

c. A link to the visual original stamp, also stamped with its moment in time, immutable and stored on IPFS (Inter-Planetary File Storage).

d. Definition of the timestamp interval as represented in UTC.

e. A tag to identify the generation and type of AdaTimeStamp NFT.

f. The Policy ID, each unique to identify the era and/or type of ATS NFT timespan.

3 Minting Time

Time is a continuum, but NFTs are discrete. This poses a problem for the methodology of recording time through NFTs. ATS has chosen to base its technical architecture on the Cardano blockchain and thus uses 'Cardano time'. This means instead of years, months, days, and hours we operate in Eras, Epochs, and Slots. In order to bridge the semi continuous nature of Cardano time with the discrete character of NFTs, ATS will mint NFTs that represent spans of time, demarcated in slots and epochs. In doing so, Ouroboros itself has been defined by ATS as the oracle that puts a hard limit on the number of NFTs that can be minted.

ATS will start minting spans of one fifth of an epoch (approximately one day). This will mean that each NFT will be book-marked by a start and end Epoch and Slot (see fig 1). This book-marking will be aligned, as closely as possible, to UTC calendar dates. It should be noted that in order to do this, the first and last ATS NFTs of each era will represent a shorter time than the majority of the NFTs. This is because the Cardano network was initiated (Epoch 0 Slot 0) on 2017/09/23 at 21:47:51 UTC. Thus, the first ATS will contain the slots from Epoch 0 Slot 0 upto and including Epoch 0 Slot 405 (in UTC it will span from 2017/09/23 21:47:51 to 2017/09/24 00:00:11[2]). Likewise, the last Byron era ATS NFT ended with the Shelley Hard Fork on 2020/07/29, at 21:44:51 UTC.[3] Thus the final Byron ATS NFT will contain the slots from epoch 207 slot 17686 to epoch 207 slot 21599 (in UTC it will span from 2020/07/29 00:00:11 to 2020/07/29 21:44:51). In general, the i^{th} ATS interval, T_i, is defined by a start time t_i and end time t_{i+1}. The time allocated to T_i will therefore be t_i t ¡ t_{i+1}, the next ATS, T_{i+1} will contain t_{i+1} t ¡ t_{i+2}, etc. Thus, the first ATS will span Epoch 0 Slot 0 to Epoch 0 Slot 405 (in UTC 2017/09/23 21:47:51 to 2017/09/24 00:00:11) and the subsequent ATS NFT will span from Epoch 0 to Slot 406 up

[2]IOHK. *Cardano Explorer*. Available at `https://explorer.cardano.org/en/epoch?number=0&page=2159&perPage=10`. 2022.

[3]IOHK_Tim. *The Shelley hard fork: all you need to know*. Available at `https://forum.cardano.org/t/the-shelley-hard-fork-all-you-need-to-know/36553`. 2020.

to and including Epoch 0 Slot 4725 (in UTC 2017/09/24 00:00:11 to 2017/09/25 00:00:11).

It should be noted that ATS is defined by the Ouroboros Protocol, and this means there are some peculiarities in its time accounting. As context it is important to remeber that during the Byron era the length of a slot was 20 seconds. This in turn defines the highest degree of granularity that we can align with a UCT calendar day, the result being that the UTC start and end times of the ATS NFTs will not be contained within a single UCT day. For example, the start of the second ATS NFT, aligned with the 24th of September 2017 started at Epoch 0 Slot 406 or 2017/09/24 00:00:11 and ends at 2017/09/25 00:00:11 Epoch 0 Slot 4725, thus the start and end times of each Bryron ATS NFT are in different days. This is due to the fact that we are primarily concerned with accounting for time in terms of Ouroboros, and our time quantum is defined by the length of an Ouroboros Slot. This peculiarity of the time covered by an ATS in UTC will not be present in the eras following Bryon as the UTC length of a slot has since become 1 UTC second. This is illustrated in Fig 2.

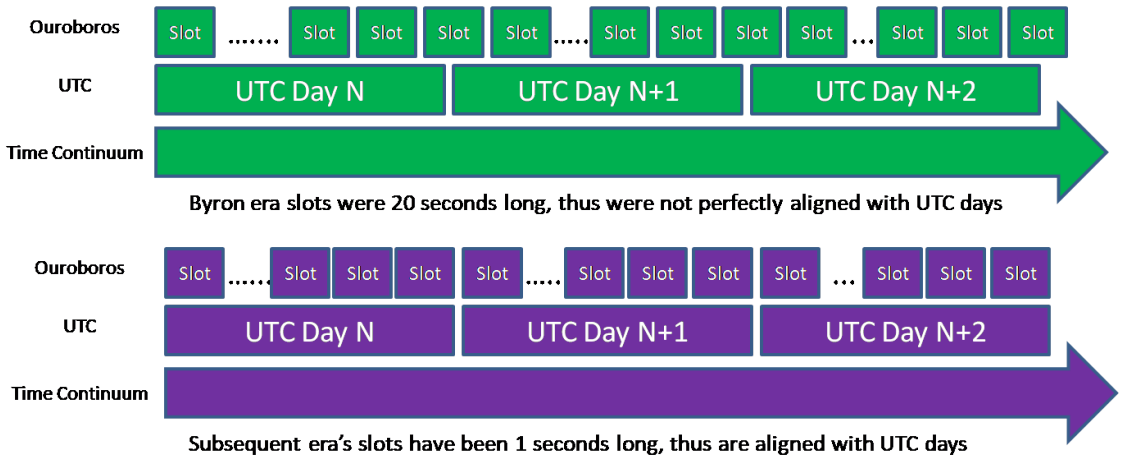

Figure 2: An illustration of the mismatch between Ouroboros slots and the start and end of UTC days in the Byron era.

4 Keeping it secure

The standard of security we set for ATS depends directly on Cardano's security principles, as well as our own policies and protocols developed during the running of our stake pool

(Amsterdam Node: AMS). Although ATS as a product differs in many ways from stake pool operation, such as running relay nodes, and block producing nodes, the underlying principles remain the same. For example, we include the same VPC architecture as used for the pool, ports locked down behind firewalls, nothing runs with all root privileges, ssh is only available outside of the default port. Data is offloaded to protected databases and is not shared with any third party unless absolutely necessary for the functioning of the platform, which will be transparently communicated.

5 Forging and retaining trust

The ATS project will launch with the sale of the ATS starting with ATS NFTs from 2017-09-23 21:44:51. This is the launch time of the Cardano network and therefore, for ATS, this is the time the 'clock started ticking'. We will be offering these ATS by sequentially minting ATS tokens for each of the past eras, from 2017-09-23 21:44:51 up until today. Each era that has passed at the time of launch will be minted with a unique Policy ID. This will be crucial for proving the originality and uniqueness of an ATS. Once these 'historical' NFTs have been offered for sale, we will begin minting for the present era. This poses a challenge, as the era is ongoing; thus, we will have to keep the policy open as we will be minting new ATS as time passes. That being said, to ensure the security of our systems we will start with keeping policy IDs open for a maximum of 3 months (approximately 18 epochs)- this will mean for eras where ATS is minting along with the passage of time (presumably the Basho / Voltaire Eras) there will be more than one Policy ID associated with an era.

In addition to having predictable intervals for opening and closing Policy IDs it is important to create the tools and systems to show that ATS are never being over-minted, thus ensuring transparency and trust amongst all ATS users. When somebody purchases an AdaTimeStamp we must ensure the uniqueness of the represented unit of time on the Cardano Blockchain.

For this reason, we will be maintaining a public access ledger that can be used to investigate the owners of specific ATS. This means that the uniqueness of the ATS will always be clearly visible and transparent for the ATS community.

ATS builds on the foundations of transparency, long term thinking and simplicity. It

is AdaTimeStamps principled methodology that will stand the test of time and forge its resilience.

6 Building it to last

Our museum functionality is all about writing a personal message into an interval of time. This means that ATS must stand the test of time. In order for this to happen, we are taking steps to ensure the long term integrity of the project. This consist of five key areas:

1. Use the Cardano's ledger(s) itself as a core mechanism for storing and handling data, for example EUTxO metadata, NFTs, smart contracts and side chains.

2. Create backup ledgers and records of the ATS stamps, ownership records, and added content on our own hardened, dedicated servers.

3. Using the distributed nature of third party storage providers such as the 'Inter Planetary File Storage System' (IPFS) to make sure the content does not get lost.

4. Standards of security with hardened (offline and online) servers for the operation and backup of the ATS systems.

5. Establish minting criteria that are dependable and future proofed for changes in the Cardano network and additions to the ATS system functionality.

To counter offensive messages, ATS will need to develop forms of scanning and moderation. The governance over "what constitutes unacceptable messages" will at first be set by ATS core team, and then voted on by the ATS community. ATS will together write a "constitution of content", which will be amended as the project evolves as ultimately voted by the user base.

The goal of ATS is to eventually move critical systems and data storage onto decentralized systems. Initially (and realistically to a continued extent) ATS will need to rely on traditional centralized datastores to support some of our systems (although critical elements such as the NFT image will always be hosted on IPFS- from the beginning). As we develop and mature our systems and protocols we will progressively move our systems

onto decentralized platforms like IPFS, the Cardano blockchain, and relinquish control to the ATS community .

7 ATS Governance

For the successful longevity of the spirit of the Cardano roadmap and AdaTimeStamp, the setting of standards for content (for example excluding pornography), minting of NFTs and transparent principles of prioritization that drive the visualization engine of ATS writings.

There are multiple options available in terms of good governance structures. The founding team will establish the direction in more detail after gaining feedback from the community. For more detail see the marketing paper.

8 Use of ATS Funds

The funds from the initial sale are crucial for being able to grow the team to be able to develop the functionalities that will make ATS an essential part of the history keeping for the Cardano community. Following this initial sale, the funds that result from future sales will go to maintaining the servers, backups, and team to be able to ensure that ATS can continue serving the community and provide the record keeping services that are needed to be able to document the Cardano Timeline.

In addition, a portion of funds has been set aside, primarily for creating a positive impact in alignment for our mission to conserve, and secondarily to put the decentralized legacy of our community on an epic journey. We refer you to our marketing paper for further details.

9 ATS Rarity

Although each moment in time is unique, there are some moments that are more commonly valued than others. As certain moments will emerge as valuable for the community we have established a fundamental rank of rarity. We refer you to our marketing paper for further details.

10 Future Functionality

The successful launch of ATS will serve as a jumping off point for developing and introducing additional functionality to the project. The first of these will be:

10.1 *Writing*

This is key for enabling the community to maintain and curate their own history. ATS will provide a 'cohesive' history viewer as well as reach out to wallet visualization services (PoolTools, n.d.) for possibilities to visualize different methods by which to store immutable data. User customizable data will initially start with simple data types such as text and images. Moments in time represented by the digital museum will be editable by the controller of the wallet that contains the NFT in question. This will occur through our own proprietary system that utilizes coded wallet transactions to verify ownership and data input requests. The system also will store data input from the previous owners of the ATS for posterity purposes, effectively meaning each owner of the NFT is able to leave their mark on their ATS forever.

The intent is to create a decentralized process by which owners of ATS can execute a smart contract that allows them to append the text, image or other data types they wish to attach to their particular ATS. Using a combination of IPFS, Smart Contracts, and the ATS systems we will be able to make sure this writing process is robust, and serves as a timeless record for generations to come.

With regard to the curation process the team will emulate the staking reward process. Where the process is staggered (similar to epochs staggering staking mechanism).

11 Conclusion

ATS is creating a revolutionary new model for people to become part of a decentralized digital legacy. In order to stand the test of time we will design an accurate, reliable and community run ledger of digital artifacts. Stored on the Cardano network, to keep safe, and in so doing extending the purpose of Ouroboros to protect meaningful memories. Only time will tell what a fantastic tapestry of history will be created by the ATS community, that will help support and galvanize our digital ecosystem.

12 Disclaimer

B.V. (owner of AdaTimeStamp and Ada's Timeline) reserves the right to change, and make any corrections as it sees fit. The AdaTimeStamp team is taking an empirical and iterative approach to its community-influenced product delivery and technical development to better understand limitations, evaluate tradeoffs, and fine-tune parameters in order to converge to an optimal solution. None of this content should be used to make any form of financial, tax, or legal decisions. This paper is for the benefit of the public and to foster open discussion and collaboration within the art, history and decentralized community.

References

IOHK. *Cardano Explorer*. Available at `https://explorer.cardano.org/en/epoch?number=0&page=2159&perPage=10`. 2022.

IOHK_Tim. *The Shelley hard fork: all you need to know*. Available at `https://forum.cardano.org/t/the-shelley-hard-fork-all-you-need-to-know/36553`. 2020.

Kiayias, Aggelos et al. *Ouroboros: A Provably Secure Proof-of-Stake Blockchain Protocol*. Available at `https://eprint.iacr.org/2016/889.pdf`. 2019.

