Time(keeping) and Crypto-Economics draft

Bryant Joseph GILOT, MD CM DPhil MSc

Abstract. Economic systems with flexible monetary policies force the evaluation of time as part of many economic decisions. Common time, defined as the indefinite continued sequence of apparently irreversible events from the past through the present and into the future, is used to compute the time value of money. Until now, timekeeping has been based on predictable astronomical events or by observing a defined number of repetitions of a standard cyclical event. Such measurements of elapsed time are adequate where monetary policy and inflation are unpredictable. In contrast, crypto-economic systems possessing predictable monetary policies and inflation are rigidly and directly related to a standard cyclical event with a variable and unpredictable interval. This event, block creation, is tightly bound to all crypto-economic events. The creation of blocks rather than the interval between them is the fundamental unit of time when making crypto-economic economic decisions. The comparison of cryptographic assets not existing simultaneously requires the consideration of the total number of blocks created between the existence of the first and the existence of the second cryptographic asset. To facilitate decision making, a temporal measurement system without the need for intercalation, reflective of crypto-economic conditions, with standard nomenclature and with standard enumeration is proposed in the form of a calendar and clock.

1. Introduction

Satoshi Nakamoto[1] mined the Genesis Block (Block #0). Appending a block with a valid proof of work to the longest chain is the fundamental cyclic event in Bitcoin. Non-Genesis blocks sequentially added to the longest chain are enumerated sequentially in whole numbers with an increment of 1 beginning with Block #1 and continuing until no further blocks are mined. The first interval between blocks is that between Block #0 and Block #1. At the appending of Block #(X+1) to the longest chain (BlockHeight X); one block (the fundamental cyclic event) has elapsed. The dominant monetary policy economic event in Bitcoin is the reduction of the Block Reward by half occurring every 210,000 blocks. An elapsed second shall be defined as the interval between the previous block and the newly appended block. An elapsed year shall be defined as the interval between every subsequent 210,000 blocks. All other economic events in Bitcoin are encapsulated within blocks with satisfactory proofs of work. Representations of crypto-economic time (CET) shall be expressed in a whole number of elapsed blocks (seconds). A calendar and clock system was

conceived to offer simple interpretation of the current crypto-economic conditions between two distant blocks within the longest chain. Every block (past, present or future) shall have a representation of elapsed crypto-economic time in seconds^{CET}, minutes^{CET}, hours^{CET}, days^{CET}, weeks^{CET}, months^{CET}, terms^{CET} and years^{CET} easily computed by counting from the Genesis Block. Each standard period^{CET} is useful to describe the distance or time^{CET} between any two blocks on the longest chain either from the Genesis Block or an arbitrary block. A standard calendar^{CET} based on these periods^{CET} is described by which an arbitrary block is assigned a date^{CET}, term name^{CET}, month name^{CET}, day name^{CET}, hour^{CET}, minute^{CET}, and second^{CET}.

2. Methods

The first year^{CET} began with the Genesis Block (Block # 0). The last block with a Block Reward of 50 XBT was Block #209,999 at which point the first year^{CET} elapsed. The second year^{CET} began with Block #210,000 which was the first second^{CET} of the second year^{CET} and the first with a Block Reward of 25 XBT. The third year^{CET} will begin with Block #420,000 which will be the first second^{CET} of the third year^{CET} and will be the first with a Block Reward of 12.5 XBT. The yearly pattern repeats every 210,000 blocks.

Each year^{CET} is equally subdivided into 12 months^{CET} (17,500 blocks) as well as 3 terms^{CET} (70,000 blocks). A term^{CET} is equally subdivided into 4 months^{CET}. Each month^{CET} is equally subdivided into 10 weeks^{CET} (1,750 blocks). Each week^{CET} is equally subdivided into 7 days^{CET} (250 blocks each). Each day^{CET} is equally subdivided into 10 hours^{CET} (25 blocks each). Each hour^{CET} is equally subdivided into 5 minutes^{CET} (5 blocks each). Each minute^{CET} is equally subdivided into 5 seconds^{CET} (1 block each).

3. Calendar

The universal date and time format of a given Block #X is defined as the elapsed time^{CET} between the Genesis block and Block #X. For example, Block #194,789, has a universal date of 0 years^{CET}, 11 months^{CET}, 1 week^{CET}, 2 days^{CET}, 1 hour^{CET} and 4 seconds^{CET} which is equivalent to the elapsed time^{CET} since the Genesis Block. Exactly one year^{CET} later, Block #404,789 had a universal date of 1 years^{CET}, 11 months^{CET}, 1 week^{CET}, 2 days^{CET}, 1 hour^{CET} and 4 seconds^{CET} which is equivalent to the elapsed time^{CET} since the Genesis Block.

The universal numerical notation format of Block #X is defined as: year^{CET}:month^{CET}:day^{CET}:hour^{CET}:minute^{CET}:second^{CET}. The first four months^{CET}: fall into the first

term[CET] where the last four months[CET] belong to the final term[CET] of the year[CET]. According to the numbering system, all periods[CET] begin with the whole zero (0) number. The first year[CET] is enumerated as year[CET] zero (0). The first term[CET] is enumerated as month[CET] zero (0) with a total of 3 terms[CET] per year[CET] ending in term[CET] number 2. The first of 12 months[CET] per year[CET] is enumerated as month[CET] zero ending in month[CET] eleven. There are a total of 10 weeks[CET] per month[CET] the first enumerated as week[CET] zero ending in week[CET] nine. Each week[CET] has 7 days[CET] beginning with day[CET] zero and ending in day[CET] 6. The same pattern holds for hours[CET], minutes[CET] and seconds[CET]. This universal time[CET] is easily computed and does not require intercalation to accurately reflect the current crypt-economic conditions of a given date into perpetuity. In the terrestrial timekeeping system, intercalation (in the form of leap years, leap days and leap seconds) is required to prevent the drifting of the actual summer solstice from the calendar date assigned to it.

For human readability and comprehension, the zero year[CET] may be referred to as the Genesis year[CET]. The three terms[CET], twelve months[CET] and seven days[CET] shall be assigned human readable names.

4. Named Periods

The following cyclical periods are given localized named. Arbitrarily as follows:

Month Number	Month Name	Term Name
0	January	Readjustment
1	February	Readjustment
2	March	Readjustment
3	April	Readjustment
4	May	Stability
5	June	Stability
6	July	Stability
7	August	Stability
8	September	Preparation
9	October	Preparation
10	November	Preparation
11	December	Preparation

Day Number	Day Name
0	Saturday
1	Sunday
2	Monday
3	Tuesday
4	Wednesday
5	Thursday
6	Friday

In this standard, the day on which the Block Reward is reduced by half will always be on the first day of the year[CET] which will always be in the month[CET] of January, in the term[CET] of Readjustment and on the day[CET] of Saturday without need for intercalation.

5. Conclusion

A standard calendar and clock is currently lacking in current crypto-economic systems. The fundamental cyclic event in these systems is the mining of new blocks. All economic events are rigidly bound to the ongoing mining of blocks. The Genesis block launched the Bitcoin Network. Block Rewards are reduced by half every 210,000 blocks. The Coinbase transaction (a special transaction without a formal input) is included as the first transaction of every block and rewards the miner they are not permitted to spend for at least 100 blocks. All other economic events (i.e. transactions) are encapsulated within valid blocks which are or will become part of the longest chain.

Where time is a necessary input for prudent economic and financial decision making, common terrestrial timekeeping is poorly correlated with changes in crypto-economic conditions. Establishing the appending of new blocks to the longest chain as the fundamental cyclical event by which crypto-economic time is measured is natural. Although the interval between new blocks is variable and unpredictable, the blockchain is the final arbiter of all new information added to the historical record.

A shift from common terrestrial time to crypto-economic time allows for a more sophisticated approach to crypto-finance with a better informed view of the dynamic nature of cryptographic assets and cryptographic liabilities over crypto-economic time under crypto-economic conditions of different uncertainty and risk.

Interest calculations, derivative valuations and options pricing are currently difficult to compute crypto-economic system such as bitcoin. Currently miners are the most creditworthy entities in crypto-economic systems. Miners have a need for operating capital, a history of block production & block rewards, and a measurable probability that a miner will produce X number of blocks over the next Y number of future blocks with a probable expected block reward of Z. Creditors may wish to provide miners with immediate liquidity while assuming the risk of default in exchange for a given return (interest) on the sum of bitcoin loaned to a miner.

Establishing such a market for miner financing could allow the crypto-economic community to discover what a key interest rate in a crypto-economic system is. We could call this the Miners Funds Rate. Obviously in this case, crypto-economic time more relevant than common terrestrial time.

Discovering these key rates may allow us progress from measuring the value of cryptographic assets against fiat currencies to a point where value may be commonly and independently expressed in the cryptographic asset alone.

References

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