UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

DeFi Education Fund

Petitioner

v.

True Return Systems, LLC

Patent Owner

# DECLARATION OF HUDSON JAMESON

***IPR2023-01388***

## TABLE OF CONTENTS

I, Hudson Jameson do hereby declare as follows:

## I. Introduction

1. I am currently Vice President of Polygon Labs, a blockchain research and development company.

2. I have been retained by Edell, Shapiro and Finnan, LLC (hereinafter "the Edell Firm"), to provide various opinions regarding U.S. Patent No. 10,025,797 ("the ’797 patent" or "Fonss"). I understand that my declaration is being submitted in connection with a Petition for Inter Partes Review in an *inter partes* review of Fonss. Unless otherwise noted, the statements made herein are based on my personal knowledge and, if called to testify with regards to this declaration, I could and would do so competently and truthfully.

3. I have been retained in this matter by the Edell Firm as a technical expert in the field of blockchain technology, particularly within the context of the historical progression of blockchain technical development and adoption. I am being compensated for my work in this matter at my usual and customary rate. I have no personal or financial stake or interest in the outcome of the *inter partes* review or any related action. My compensation in no way depends upon my testimony or the outcome of the *inter partes* review.

4. I have been advised that the Edell Firm represents the Defi Education Fund (hereinafter "Petitioner") in this matter and that True Return Systems, LLC

(hereinafter "Patent Owner") is the assignee of Fonss. I have no personal or financial stake or interest in Patent Owner, Petitioner, or Fonss.

5. I reserve the right to supplement and/or amend my opinions in this declaration based on future positions taken by Patent Owner or its experts, additional documents, testimony or other information provided by Patent Owner or its witnesses, any orders from the Board, or as otherwise necessary.

## II. Qualifications

6. My qualifications for forming the opinions set forth in this expert report are summarized here and explained in more detail in my *curriculum vitae* which is attached as Exhibit A to this report. Exhibit A also includes a full list of my publications and other professional contributions and achievements, and a list of the cases in which I have testified at deposition, hearing, or trial.

7. I have been actively involved in areas of blockchain and cryptocurrency research since 2011. Between 2011 and 2014, I participated in the Bitcoin and Darkcoin (now Dash) communities, taking a particular interest in consensus mechanism design in both technologies. I received an undergraduate degree in computer science from the University of North Texas in 2014. From 2014-2016, I was a developer and blockchain researcher at United Services Automobile Association (USAA), an American financial services company. This role had me

perform deep research into all major blockchain protocols and the applicability/shortfalls of blockchain use cases.

8. I hold 5 patents relating to blockchain technology including, U.S. Patent No. 11,361,286 ("Identifying negotiable instrument fraud using distributed ledger systems"); U.S. Patent No. 10,762,506 ("Token device for distributed ledger based interchange"); U.S. Patent No. 10,521,780 ("Blockchain based transaction management"); U.S. Patent No. 9,514,293 ("Behavioral profiling method and system to authenticate a user"); and U.S. Patent No. 10,423,938 ("Identifying negotiable instrument fraud using distributed ledger systems").

9. From 2016-2021, I was employed by the Ethereum Foundation where I gained a deep understanding of Ethereum at all levels from the deep protocol specifics, to application layer use cases and construction, to governance and community. Roles I performed at the Ethereum Foundation include:

- Ethereum Improvement Proposal (EIP) standards editor and coordination lead
- Protocol Development and Network Upgrade Coordinator
- Protocol Event Incidence Response Lead
- Spearheading the growth of the Ethereum StackExchange technical Q&A website for developers
- Documentation Coordinator

- Head of Community
- Communications
- DevOps Lead
- Director of OrgSec

10. Between 2017-2018, I co-founded Oaken Innovations, an IoT blockchain start-up, where I was the COO and Lead Smart Contract Engineer. From 2017-2021, I was a technical advisor for Chainlink, a blockchain oracle network technology, where I worked with the founders on various aspects of their incentives research around oracle designs. From 2019-2021, I was a member of the inaugural technical steering committee for the Baseline Protocol, an open-source enterprise initiative that combines advances in cryptography, messaging, and blockchains to enhance private business processes and mainstream blockchain adoption. From 2019-2021, I was twice elected to the Zcash Community Grants board which solicits and processes grants related to improvement of the Zcash private cryptocurrency project and related privacy technology to enhance Zcash's mission. I was employed by Flashbots, an advanced blockchain and incentives R&D group, from 2021-2022. Flashbots primarily handles research and development around the illumination and minimization of "major extractable value (MEV)" problems that occur via unavoidable incentive misalignment and the nascent state of blockchain design.

From 2021-2023, I was an advisor of Polygon Labs, an organization which facilitates the building of the Polygon Layer 2 blockchain network. That advising role transitioned in 2023 to a full-time role as VP of Governance and Community where I work on the cutting-edge systems designs of Polygon's technologies as well as coordinate internal teams and external contributors working on the Polygon protocol. I am currently an advisor with Ernst and Young (EY) in their EY Blockchain division where I help curate strategies to gain more public exposure and understanding of their Nightfall and Starlight enterprise blockchain privacy products.

11. For the last decade I have focused on educating people on topics relating to blockchain technology, privacy technology, and governance. I have spoken at over 20 blockchain or distributed ledger technology events over the past decade and have been featured in articles from the International Business Times, Fortune, and Forbes. In both my professional endeavors and my public education initiatives, I draw upon my wealth of knowledge over the last 12 years in the industry to provide historical context on the progression of blockchain technology innovation and applicability.

## III. Legal Standards

### a) Claim Construction

12. I understand that claim terms are to be interpreted from the point of view of a person of ordinary skill in the art (also referred to herein as the "skilled artisan") at the time the application leading to the patent was filed. I further understand that claim terms are generally to be given their ordinary meaning, considered in light of the claim language, patent specification, and prosecution history. I further understand that a patentee may act as its own lexicographer and depart from the ordinary and customary meaning by defining a term with reasonable clarity, deliberateness, and precision, but that there is a presumption that a claim term carries its ordinary and customary meaning.

**b) Person of Ordinary Skill in the Art**

13. I understand that a person of ordinary skill in the art is a hypothetical person who is presumed to have known the relevant art at the time of the invention. He or she is a person of ordinary creativity who understands the scientific and engineering principles applicable to the pertinent art. I am familiar with the knowledge and capabilities of one of ordinary skill in the art in the field of Fonss at the time of the effective filing date of the patent.

14. I understand that whether a patent claim would have been obvious is determined through the point of view of a person of ordinary skill in the art at the time of the invention. I have applied this standard in my analysis.

**c) Validity**

15. I understand that the Petitioner must show that there is a reasonable likelihood of success as to any of the claims challenged. I understand that the Petitioner bears the burden of proving any instituted grounds of invalidity by a preponderance of the evidence. I understand that a "preponderance" means "more likely than not." I understand that general and conclusory assertions, without underlying factual evidence, may not support a conclusion that something is "more likely than not." Rather, the preponderance of the evidence standard requires that a reasonable finder of fact be convinced that the existence of a specific material fact is more probable than the non-existence of that fact. The preponderance of the evidence standard does not support speculation regarding specific facts, and is instead focused on whether the evidence more likely than not demonstrates the existence or non-existence of specific material facts. Here, I understand that Petitioner has argued that the claims at issue are obvious over different grounds.

16. I also understand that, in performing a proper unpatentability analysis, an expert must do more than simply provide quotes from the evidentiary record along with conclusory allegations of unpatentability. To the contrary, an expert's conclusions regarding unpatentability must be supported by actual analysis and reasoning set forth in the expert declaration, such that the theoretical and factual foundation for the expert's conclusions can be properly evaluated.

17. I understand that a patent claim may be found unpatentable as obvious under 35 U.S.C. § 103 only if the Petitioner establishes by a preponderance of the evidence that, as of the priority date, the subject matter of the claim, considered as a whole, would have been obvious to a person having ordinary skill in the field of the technology (the "art") to which the claimed subject matter belongs.

18. I understand that the analysis of whether a claim would have been obvious depends on a number of necessary factual inquiries, for example, (1) the scope and content of the prior art; (2) the differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) objective evidence of nonobviousness.

19. I understand that the claimed invention must be considered as a whole in analyzing obviousness or nonobviousness. In determining the differences between the prior art and the claims, the question under the obviousness inquiry is not whether the differences themselves would have been obvious, but whether the claimed invention as a whole would have been obvious. Relatedly, I understand that it may be appropriate to consider whether there is evidence of a "teaching, suggestion, or motivation" to combine the prior art teachings in the prior art, the nature of the problem or the knowledge of a person having ordinary skill in the art.

20. I have also been informed that some examples of rationales that may support a conclusion of obviousness include:

a) Combining prior art elements according to known methods to yield predictable results;

b) Simply substituting one known element for another to obtain predictable results;

c) Using known techniques to improve similar devices (or product) in the same way (e.g., obvious design choices);

d) Applying a known technique to a known device (or product) ready for improvement to yield predictable results;

e) Choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success—in other words, whether something is "obvious to try";

f) Using work in one field of endeavor to prompt variations of that work for use in either the same field or a different one based on design incentives or other market forces if the variations are predictable to one of ordinary skill in the art; and

g) Arriving at a claimed invention as a result of some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine prior art reference teachings.

21. I have also been informed that other rationales to support a conclusion of obviousness may be relied upon, for instance, that common sense (where

substantiated) may be a reason to combine or modify prior art to achieve the claimed invention.

22. I understand that one indicator of nonobviousness is when prior art "teaches away" from combining certain known elements. For example, a prior art reference teaches away from the patent's particular combination if it leads in a different direction or discourages that combination, recommends steps that would not likely lead to the patent's result, or otherwise indicates that a seemingly inoperative device would be produced.

23. I understand that an obviousness determination also requires that a person of ordinary skill in the art would have had a reasonable expectation of success in making any modifications to the cited references.

24. I further understand that certain objective indicia can be important evidence regarding whether a patent is obvious or nonobvious, including the existence of a long-felt but unsolved need, unexpected results, commercial success, copying, and industry acceptance or praise. Evidence of such objective indicia must be considered when present. It is generally an error to reach a conclusion on obviousness before considering the evidence of secondary considerations, and then evaluating the latter solely in terms of whether it may fill any gaps in the initial conclusion on obviousness. On the other hand, such evidence is not a requirement

for patentability, and the absence of such evidence is a neutral factor in the analysis of obviousness or nonobviousness.

25. I also understand that a prior art reference must be enabled to anticipate a patent. That is, I understand that the prior art reference's description must be such that a person of ordinary skill in the field of the invention can practice the subject matter based on the reference without undue experimentation.

26. Finally, I understand that the obviousness analysis cannot be based on "hindsight." The skilled artisan may view prior art at the time the invention was made and without using the disclosure of the subject patent as a guide.

## IV. Background and State of the Art

27. Modern blockchain technology has an intriguing if relatively short history, spanning a little over a decade. Modern blockchain technologies found their genesis in the creation of Bitcoin, the first and most well-known cryptocurrency. In October 2008, a person or group of people using the pseudonym "Satoshi Nakamoto" published the Bitcoin whitepaper titled "Bitcoin: A Peer-to-Peer Electronic Cash System." EX1011[1]. This document outlined a decentralized digital currency that

[1] The white paper has been hosted at https://bitcoin.org/bitcoin.pdf since the day of its release, with a few small exceptions. The original announcement of the

would operate on a blockchain, a public ledger to record all transactions without the need for a trusted intermediary.

28. A blockchain is a distributed and decentralized digital ledger that records transactions in a trustless and transparent manner.[2] It is maintained by a network of computers (nodes) that work together to validate and add new transactions to the ledger. Each block in the blockchain contains a batch of transactions, and once a block is added to the chain, it becomes immutable and cannot be altered retroactively. This immutability and the consensus mechanism used to validate transactions make blockchain a robust and tamper-resistant system.

29. Timestamps are used to order and validate the sequence of transactions or blocks added to a blockchain. Timestamps are used to record the exact time when a transaction is created or when a block is mined, ensuring that the chronological order of events is maintained within the blockchain network, resulting in a time-sequenced set of transactions within a blockchain.

---

paper asking for feedback was on the cypherpunk mailing list: https://satoshi.nakamotoinstitute.org/emails/cryptography/ (see first entry).

[2] For completeness, I note that with the advent of zero knowledge proofs (and even earlier with mixnet solutions like Monero), blockchain transactions are now able to be private depending on the architecture of the blockchain.

**a) Blockchain Storage Challenges**

30. Shortly after the introduction of Bitcoin and its associated blockchain, work began on blockchain applications outside of the digital currency context. These applications included medical record storage and distribution (EX1009), Internet-of-Things (IoT) data storage and indexing (EX1010), and decentralized service marketplaces (EX1008), among others. One challenge faced in applying blockchain technologies to these use cases is data storage, well summarized as follows:

> Data storage on blockchains is extremely expensive due to full replication in the peer-to-peer network. … Additionally, since all data in a blockchain is stored on every node in the network, it is publicly visible.

EX1008 at 4.

31. However, these challenges were solved many times over in the art prior to the earliest priority date for the Fonss:

> This thesis proposes MedRec: a novel, decentralized record management system to handle EHRs (Electronic Health Records), using blockchain technology. … MedRec accomplishes record management without creating any centralized data repositories; **a modular system design integrates with providers' existing, local data storage solutions**, facilitating interoperable data exchange between data sources and the patients.

EX1009 at Abstract (emphasis added).

> We now introduce a set of off-chaining patterns identified, which can be used individually or in combination to **move computation and data off the blockchain**. Each pattern aims at maintaining the key properties of blockchains and includes techniques to ensure that they are not compromised to an unwanted degree.

EX1008 at 7 (emphasis added).

> We propose a blockchain-based access control management to address [challenges in providing auditable storage]. This provides us with an independent network that maintains a distributed ledger of access control permissions. Inspired by recent blockchain-based technologies, **we combine the blockchain with an off-chain storage, for a scalable secure data storage** …

EX1010 at 2 (emphasis added).

32. In fact, entire new file storage technologies were developed to address the storage challenges presented when blockchain technologies are used in non-currency applications:

- IPFS or the Interplanetary File System was introduced in a 2014 and allows linking between IPFS off-chain storage and blockchain smart contracts (EX1021);
- SIA, introduced in a whitepaper in 2014, provides for a blockchain-based network that aims to create a secure, private, and decentralized cloud storage system (EX1022);

- Storj, introduced in a whitepaper in 2016, provides a decentralized cloud storage platform that utilizes blockchain and peer-to-peer technology to create a secure, private, and cost-effective storage solution(EX1023); and
- Swarm, introduced in a whitepaper in 2016, provides a decentralized and distributed file storage system that was part of the Ethereum ecosystem[3] that offers a decentralized storage solution for smart contracts (EX1024).

33. The simple fact of the matter is that blockchain storage challenges were addressed prior to 2017 through new technologies (e.g., IPFS, Sia, Storj, Swarm, etc.) and implemented in numerous systems well in advance of the invention of Fonss.

**b) Blockchain External Data Challenges**

34. As blockchain technology matured and gained attention beyond cryptocurrency transactions, developers started to recognize the limitations of the blockchain's isolation from external data. This led to the introduction of blockchain

[3] As of today, Swarm is separate from Ethereum at this stage in its development.

oracles that provide external data (exogenous data in the language of Fonss) integration with blockchain transactions, including smart contracts.

35. A blockchain oracle is a mechanism that enables communication and data exchange between a blockchain and the outside world. To use an analogy, a blockchain itself is similar to a standalone application like Excel. The blockchain cannot natively access outside data unless it includes a plugin. Blockchains are closed systems unless specialized plugins are created to import the data to the blockchain. A blockchain oracle serves as a bridge that connects smart contracts or decentralized applications (DApps) on the blockchain with off-chain data, systems, or events. Like off-chain storage, blockchain oracles were well established before the earliest priority date for Fonss. For example, in 2017 Steve Ellis, Ari Juels and Sergey Nazarov presented a whitepaper entitled "ChainLink: A Decentralized Oracle Network" (EX1020) which describes a decentralized network that serves as a bridge between smart contracts on the blockchain and external data sources or systems. The disclosed oracle enables blockchain smart contracts to access and utilize real-world data in a secure, reliable, and trustless manner. By connecting blockchain-based smart contracts with off-chain data, the oracle expands the capabilities and use cases of blockchains and DApps.

36. As with the storage challenges, the challenge of providing blockchains with access to external or exogenous data was solved and well-established prior to the priority date of Fonss.

### c) The Person of Ordinary Skill in the Art

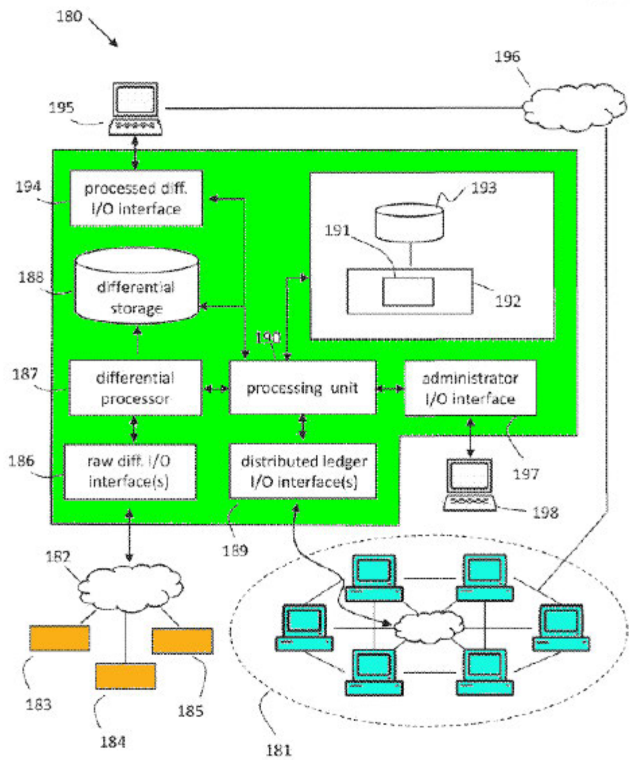
37. It is my opinion that the person of ordinary skill in the art would have an undergraduate degree in computer science and 2-4 years of experience with distributed system design or blockchain protocol design.

## V. SUMMARY OF THE '797 PATENT AND THE CITED ART

### a) The '797 Patent

38. It is my understanding that Fonss was filed on March 16, 2018 as U.S. Application No. 15/923,317 (the '317 application), claiming priority to U.S. Provisional Application No. 62/634,321 (the '321 provisional), which was filed on February 23, 2018. Therefore, I understand that the earliest priority date for Fonss is February 23, 2018.

39. Based on my reading, it is my understanding that Fonss purports to describe "A non-conventional method and system used with computerized ledgers [that] provides advantages of computing efficiencies, data security, and universal use." EX1001 at Abstract. Based on work I have done for this proceeding, I understand that True Returns Systems describes Fonss as follows:




The systems and methods of the '797 Patent can be generally understood with reference to the exemplary embodiment depicted in Figure 18 of the '797 Patent, which is reproduced in annotated form below [sic above].

An exemplary differentials processing/storage system (in green) includes a differentials computer node (item 191) and a differential storage unit (item 188) linked to one or more electronically published time-sequenced data streams or descriptive differentials (items 183, 184, 185, in orange). The system processes (187) data from the data stream / descriptive differentials (183, 184, 185) and stores the processed data on the differential storage unit (188). For example, the system may process logistical data provided by a shipping network, financial data and market prices provided by an exchange, or information provided by a news outlet.

The differentials processing/storage system (in green) is also linked to a base distributed computer ledger ("DCL," 181, in cyan) that includes one or more transaction records. The system processes (187, 190, 191) differential data (188) to link the differential data (188) to the DCL, which can then, e.g., update a transaction record of the DCL (181) according to the differential data (188).

This system improves over the prior-art distributed computerized ledgers in several ways including moving certain functionality and storage off the DCL while simultaneously allowing the DCL to utilize exogenous data to update transaction records on the DCL. This is possible because the differentials processing/storage system links the DCL to the exogenous data while keeping and implementing certain computing-intense processes and storage-intense data so that the DCL is not burdened with such. This provides several technological advantages. For instance, processing and storage constraints inherent to a DCL are overcome by shifting certain processing and storage to a differentials processing/storage system. Similarly, security issues related to exposing DCL processes to the public are ameliorated by shifting processes to the differentials processing/storage node. Through a layered or parallel architecture, system access, processing, and storage can be performed more efficiently, and distributed ledgers such as blockchains can realize increased functionality.

EX1016 at ¶¶ 24-27.

40. The description provided above is focused on exogenous or external sources of descriptive differentials. However, based upon my reading of Fonss, an exogenous source for the descriptive differentials is not required by either the specification or claims of Fonss. Instead, I understand Fonss as reciting differentials sourced from external sources and other differentials are alternatives within the claims and techniques of Fonss. For example, as noted in the specification, "descriptive differentials may be utilized with or without data stream differentials." EX1001, 9:37-39. It is my understanding that this alternative aspect of the differentials is reflected in the claims of Fonss as well:

> a value through the at least one electronic parallel storage of the differences layer, **the value from a group comprising of at least one time-sequenced electronically published data stream and at least one descriptive differential**.

EX1001, Claim 1.

41. It is my understanding, based on the use of "or" ("electronically published time-sequenced data streams ***or*** descriptive differentials.") that the "electronically published time-sequenced data streams" and the "descriptive differentials" are recited in the alternative in the claims of Fonss, which is completely consistent with how they are described in the specification of Fonss.

42. It is further my understanding that Patent Owner has indicated that it considers oracles as examples of the data stream differentials. *See, e.g.,* EX1017, 4-6.

43. It is further my opinion that there is little substantive difference, from a patentability standpoint, between differentials derived from "time-sequenced electronically published data streams" and differentials derived from elsewhere. First, "time-sequenced electronically published data streams" were notoriously well known in the prior art prior to the priority date of Fonss, an example of which is U.S. Pre-Grant Publication No. 2017/0352027, discussed in detail below. Fonss is not directed to how differentials derived from "time-sequenced electronically published data streams" are incorporated into the disclosed PSDLs. Furthermore, once stored in a PSDL, differentials derived from "time-sequenced electronically published data streams" do not operate or function any differently than any other differential. Accordingly, distinguishing differentials derived from "time-sequenced electronically published data streams" from other differentials is really a distinction without a difference, from a functional perspective.

**b) U.S. Pre-Grant Publication No. 2017/0005804**

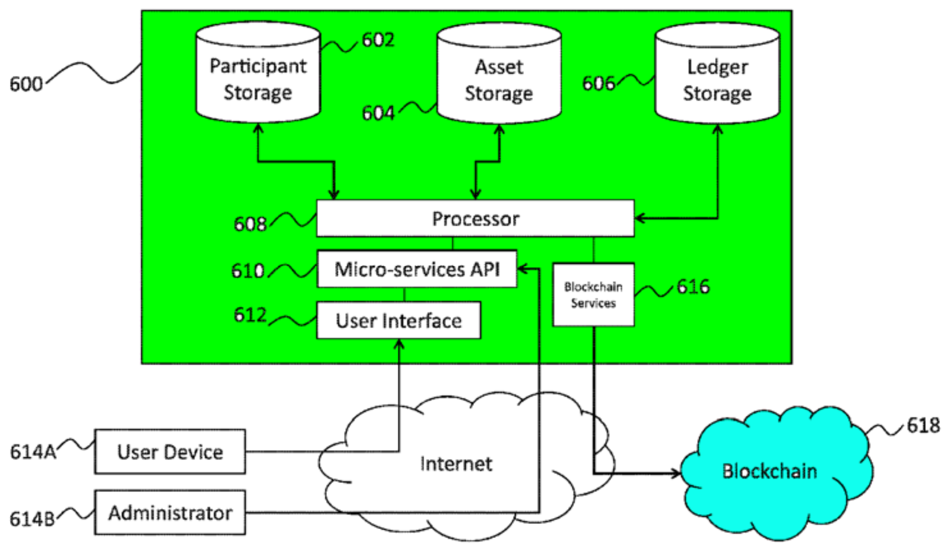
44. U.S. Pre-Grant Publication No. 2017/0005804 ("the '804 publication" or "Zinder") published on January 5, 2017, more than a year prior to the filing of the '321 provisional. EX1004. Therefore, I understand that Zinder is prior art to Fonss.

Based on my reading of the publication, it is my understanding that the techniques described therein are directed to a computer system, specifically a digital asset repository computer system 600, which provides storage in parallel with blockchain 618. Through the use of digital asset repository computer system 600 operating in parallel with blockchain 618, the functionality of blockchain 618 is increased to provide a computer system for buyers and sellers to connect and trade privately issued assets. The functionality of the blockchain is further increased to provide fully auditable records of every transaction in the blockchain 618, and to allow for editing and changing of the data contained in the parallel storage independent of the data contained in the transactions on the blockchain.

45. The parallel storage provided by digital asset repository computer system 600 takes the form of participant storage 602, which stores data about the participants or users of the system, asset storage 604, which stores information about the assets traded using the system, and ledger storage 606 which stores additional information about the transactions contained in the blockchain 618. The data contained in asset storage 604 and ledger storage 606 is linked to specific transactions in blockchain 618 using asset and transaction identifiers.

46. It is my opinion that the techniques of Zinder mirror those of Fonss, which I will attempt to show through a description of Zinder that mirrors Patent Owner's description of Fonss. As shown through the description below, it is my

opinion that Zinder provides essentially identical systems and methods to those described in Fonss.




47. The systems and methods of Zinder can be generally understood with reference to the exemplary embodiment depicted in Figure 1 of Zinder, which is reproduced in annotated form above.

48. An exemplary digital asset repository computer system 600 (in green) includes a processor 608, participant storage 602, asset storage 604 and ledger storage 606 linked to blockchain 618. The digital asset repository computer system 600 stores data in asset storage 604 and ledger storage 606 describing financial transactions associated with, for example, privately issued assets. EX1004 at ¶ [0037]. For example, the system may store "a rule 144 date of the asset transaction, the price per share of the asset transaction, the investment value of the asset

transaction, conditions associated with the asset transaction, etc." EX1004 at ¶ [0037].

49. The digital asset repository computer system 600 (in green) is linked to a blockchain 618 (in cyan) that implements a distributed ledger (*e.g.,* EX1004 at ¶ [0128]) that includes one or more transaction records (*e.g.,* EX1004 at ¶ [0035]). The digital asset repository computer system 600 processes the data contained in asset storage 604 and ledger storage 606 to link the stored data to the blockchain 618, which can then, e.g., update a transaction record of the blockchain 618 according to the stored data.

50. This system improves over the prior-art distributed computerized ledgers in several ways including moving certain functionality and storage off the blockchain 618 while simultaneously allowing the blockchain to utilize data stored in asset storage 604 and ledger storage 606 to update transaction records on the blockchain 618.

**c) U.S. Pre-Grant Publication No. 2017/0230189**

51. U.S Pre-Grant Publication No. 2017/0230189 ("the '189 publication" or "Toll") published on August 10, 2017, and is the publication of U.S. Application No. 15/423,668, which was filed on February 3, 2017. Therefore, it is my understanding that Toll is prior art to Fonss. Like Zinder, Toll is assigned to a Nasdaq entity, Nasdaq Technology AB. Based on my reading of Toll, it is my understanding that

Toll, like Zinder, is directed a computer system which interfaces with a blockchain in which blockchain transactions are used to record asset transactions:

> [A] computer system is configured to communicate with a distributed blockchain computer system … [T]he computer system is configured to store trades and positions that are based on match messages. In certain instances, the trades and/or positions may be aggregated from the various blockchain transactions that are recorded to the blockchain.

EX1005 at ¶¶ [0006]-[0007].

52. It is further my understanding that, like Zinder, Toll provides for parallel storage that includes data associated with the blockchain transactions that is not also included in the blockchain:

> The clearing house computer system also includes an internal database 118 (e.g., database 520 in FIG. 4). Database 118 may be a traditional relational or centralized database that stores information that is not submitted to the blockchain. … In certain examples, master data 118 may keep a copy of data that is submitted to the blockchain for verification.

EX1005 at ¶¶ [0006]-[0007].

53. I understand from the text of Toll that it "incorporate[s] the blockchain techniques" of Zinder, which it incorporates by reference in its entirety. EX1005 at ¶ [0025]. Accordingly, it is my opinion that the skilled artisan would read Toll as

explicitly teaching that the techniques of Toll may be applied to and implemented within the system described in Zinder, and vice versa.

54. Toll also explains that its computer system 100 may serve as an oracle for blockchain transactions:

> [T]he techniques used herein may use a trusted oracle technique where the blockchain (or more particularly the smart contracts on the blockchain) only trust events (e.g., blockchain transactions) from a "trusted" source (e.g., **the CHC system 100** or another computer system or source).

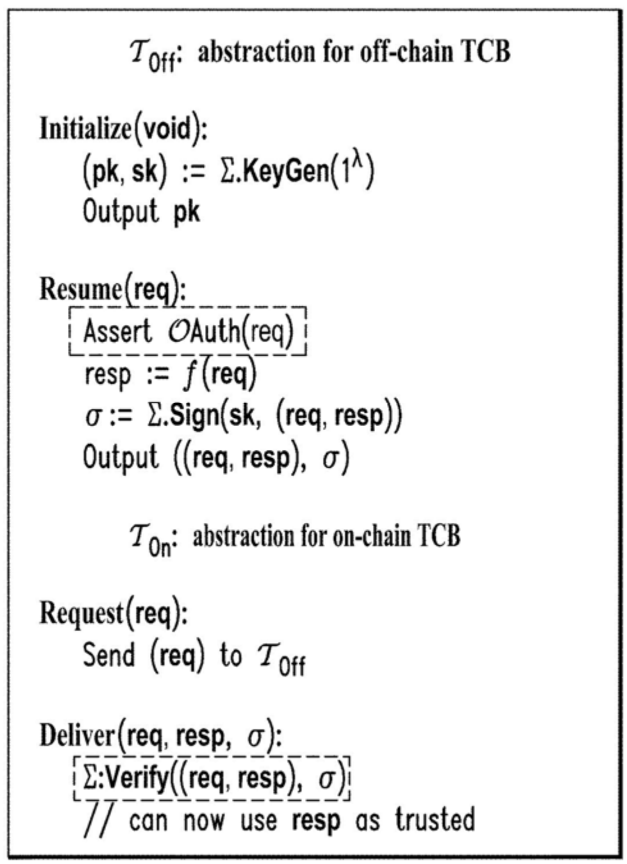
EX1005 at ¶ [0039] (emphasis added).

**d) U.S. Pre-Grant Publication No. 2017/0352027**

55. U.S. Pre-Grant Publication No. 20170352027 ("the '027 publication" or "Zhang") was published on December 7, 2017, and is the publication of U.S. Application No. 15/615,216, which was filed on June 6, 2017, and claims priority to U.S. Provisional Application No. 62/346,604, which was filed on June 7, 2016. Therefore, it is my understanding that Zhang is prior art to Fonss. Zhang is an early example of an oracle related patent that uses a combination of blockchain technology and secured hardware to enhance the security and anti-tampering qualities of oracles under the term "trusted bridge". Fig 4. in Zhang visually demonstrates enhanced oracle components consisting of a TCB (Trusted Computing Base) interaction with an oracle and is described as follows:

FIG. 4 illustrates abstractions for both off-chain and on-chain TCB components. To distinguish these abstractions from formal ideal functionalities, we use $\mathcal{T}$ (for trusted component), rather than $\mathcal{F}$. We model the authentication of on-chain messages by an oracle $\mathcal{O}_{\text{Auth}}$, which returns true if an input is a valid blockchain transaction.

*FIG. 4*




56. Zhang explains how an oracle, such as the oracle provided by the computer system 100 of Toll, receives external data from electronic data sources,

such as stock ticker data. EX1006 at ¶¶ [0072],[0116], [0117] . As explained in Zhang:

> The processing platform implements a trusted bridge configured for at least temporary coupling between one or more data sources and a smart contract program of a blockchain.

EX1006 at ¶ [0006].

57. The data received by the trusted bridge comes from electronically published data streams, such as "stock ticker data" (EX1006 at ¶ [0072]) received from hypertext transfer protocol data streams (EX1006 at ¶ [0082]). Once received at the trusted bridge, the data from the data streams may be used in conjunction with blockchain transactions. EX1006 at ¶ [0006].

## VI. Claim Construction

58. It is my understanding that the claims in an inter partes review are construed in accordance with their ordinary and customary meaning as understood by a person of ordinary skill in the art ("POSITA" or "skilled artisan"). *Id.* The person of ordinary skill in the art is deemed to read the claim term in the context of the entire patent, including the specification and prosecution history. It is further my understanding that the claims must be construed so as to be consistent with the specification. With this understanding, I provide my opinion as to the correct construction of specific claim terms as follows.

**i. "electronic parallel storage of a differences layer"**

59. Based on my reading of Fonss, and in view of the claim construction principles discussed herein, it is my opinion that an "electronic parallel storage of a differences layer," found in independent claims 1, 7, and 19, would be understood by the skilled artisan to mean "a storage system that stores supplementary data, linked to a transaction record stored on a distributed computer ledger (DCL), whose value expresses time-variable data related to or descriptive characteristics of the transaction record." I note that a skilled artisan would not recognize "DCL" as a term of art with a known definition to skilled artisans. Accordingly, my construction of the term is based on the specification of Fonss, as I describe in detail below.

60. Fonss explains that:

> The disclosed embodiment is directed at separating the processes and storage of DCL computers, networks and systems, where only those items required for transaction record keeping are maintained in the fully distributed ledger, and **all other data, functionality, and processing is stored in a system of decentralized or centralized storage and processing, linked to the distributed ledger through a combination including timestamps, cryptographic strings, cryptographic nonces, or identifying keys**.

EX1001 at 5:13-21 (emphasis added).

> [T]he disclosed embodiment operates at least one parallel, modular, and separate linked computer storage which accesses one or more **exogenous published variables or at least one descriptor**

> **difference** for the purpose of creating new functionality to a base DCL or other computerized ledger.

EX1001 at 6:6-11 (emphasis added).

> [T]he parallel storage of differences is indicated by parallel storage of difference layer (PSDL) 12 and PSDL 13.
>
> …
>
> Each PSDL will store at least one system written and system accessible **time sequenced differential or descriptor**, where differentials are created by the system from exogenous and electronically published data streams."
>
> …
>
> Differentials recorded on a PSDL may also include **descriptive differentials which can indicate difference types, grades, timeframes or other discriminatory identifiers; descriptive differentials may be utilized with or without data stream differentials**.

EX1001 at 9:25-39 (emphasis added).

> The differences residing on a PDSL are applied to the units (or interests) of a DCL upon a system occurrence of an action or process including a value polling, a distribution, a resolution or settlement, or other processes requiring the **supplementary data** in the PSDL.

EX1001 at 9:46-50 (emphasis added).

> As illustrated in the example of the column entitled "DIFl", the differentials stored and processed by the system may be the actual string values **which differ within the set of values (i.e. the differential descriptor)**. As illustrated in example of the column entitled "DIF2",

> the differentials stored and processed may be an indicator, flag, or binary string which indicates a value out of a set; where the set is comprised of 6 values.

EX1001 at 15:58-65 (emphasis added).

61. These passages of Fonss would indicate to the POSITA that the "electronic parallel storage of a differences layer" stores "supplementary data" that is linked to a basic transaction record on a distributed computer ledger (DCL). It is my opinion that the word "differences" is used in the term "electronic parallel storage of a differences layer" to include two distinct types of supplementary data that can be stored in the layer: 1) a time-sequenced "difference" or "differential" whose value can change over time to reflect time-varying fluctuations in time-sequenced data from an electronically published data stream; and 2) a "descriptive differential" or "descriptive difference" whose value is one of a set of possible values, with each different value in the set representing a different descriptive characteristic of the transaction record. Based on the Fonss specification, it is my understanding that examples of such a time-sequenced data stream based differences or differentials described in Fonss include time-varying market prices, equity market indexes, currency exchange rates, trade flows, and economic variables. *See*, e.g., EX1001 at 14:50-53, 14:63-67, 17:5-7. It is further my understanding that examples of descriptive differences or differentials described in Fonss include types or grades of commodities in a transaction, timeframes or other discriminatory identifiers,

"attributable" and "discriminatory properties" of transactions such as a bespoke financial instrument, and transaction settlement particulars such as volumes, dates, and payment and delivery details. *See*, e.g., EX1001 at 5:35-38, 9:41-45, 11:5-7, 12:4-33.

**ii. "distributed computer ledger" (DCL)**

62. Based on my reading of Fonss, and in view of the claim construction principles discussed herein, it is my opinion that the term "distributed computer ledger" (DCL), a novel term apparently coined by Patent Owner and found in independent claims 1, 7, and 19, would be understood by the skilled artisan to mean a "database of transaction records maintained by consensus of a network of independently connected computers."

63. The Background section of the Fonss explains that:

> Generally, **<u>computerized ledgers are databases operated on one or more servers by a specialized computer, or operated on a specialized network and controlled by separate computers</u>**. A computerized ledger records encrypted or otherwise secured records of transactions
>
> …
>
> A distributed computerized ledger (DCL) system is where **<u>all nodes are independently connected to each other</u>**, and the management and modifications to the computerized ledger in a distributed environment are generally performed by separate computers and **<u>each computer usually stores its own official copy of the</u>**

> **<u>computerized ledger which is proofed for accuracy by a consensus system</u>** running on the decentralized network.

EX1001 at 1:29-48 (emphasis added).

64. While the specification introduces "DCL" as the acronym for "distributed computerized ledger," the claims use "DCL" to stand for "distributed computer ledger," i.e., the words "computerized" and "computer" are used interchangeably in this context. Dependent claims 2-6 drop any reference to "DCL" or "distributed computerized ledger" and instead refer to "the distributed electronic ledger" without antecedent basis. Regardless, Fonss describes "DCLs" and "distributed electronic ledgers" as well-known mechanisms for securely maintaining transaction records, including prior art blockchain implementations that use "homogeneous" blocks to record cryptocurrency transactions. *See*, e.g., EX1001 at 2:24-45, 2:66-67, 7:67-8:6, 14:8-15.

**iii. "difference(s)" and "differential(s)"**

65. The words "difference(s)" and "differential(s)" are used in several claim terms, including: "descriptive differential," "measurement differences," "descriptive differences," and "measured differential" in independent claims 1, 7, and 19. Based on my reading of Fonss, and in view of the claim construction principles discussed herein, it is my opinion that these claim terms all describe the supplementary data stored in the PSDL. Whether in the context of creation, storage, accessing, or processing, the specification of Fonss uses the words "difference(s)" and

"differential(s)" interchangeably. The passage in Fonss that first introduces these words in connection with the figures is exemplary:

> "[T]he parallel **storage of differences** is indicated by parallel storage of difference layer (PSDL) 12 and PSDL 13. An implementation of the system includes at least one PSDL. Each PSDL will **store** at least one system written and system accessible **time sequenced differential or descriptor**, where differentials are created by the system from exogenous and electronically published data streams, and where at least one differences processing engine running on the system computes and **stores time sequenced differences** from values in the published data stream. **Differentials recorded** on a PSDL may also include **descriptive differentials** which can indicate difference types, grades, timeframes or other **discriminatory identifiers**; **descriptive differentials** may be utilized with or without **data stream differentials**. In certain implementations, a **descriptive differential** is an indirect reference to electronically published data streams

EX 1001 at 9:25-41 (emphasis added).

66. The specification is replete with other examples in which "difference(s)" and "differential(s)" are used interchangeably in the same context. A sampling of passages describing storage of "difference(s)" includes: "differences, measurements, or descriptors are stored in parallel," "differences storage array," "parallel storage of differences," "differences residing on a PSDL," "differences (on the PSDL)," "PDSL stored differences," "stored (and operative) differences," and

"stored difference." *See*, EX1001 at 6:23-24, 6:63, 6:65-66, 9:25-26, 9:46, 10:14, 10:31, 10:45-46, 15:10. A comparable sampling of passages describing storage of "differential(s)" includes: "stored and processed differentials," "stored differentials," "storage array of values and differentials," "storage array of differentials," "differential array storage," "differentials storage," "separated parallel storage of differentials," "differentials recorded on a PSDL," "differentials stored," and "storage of differentials." *See*, EX1001 at 5:27, 6:50-53, 6:58, 6:61, 7:2, 7:19, 8:58-59, 8:65, 9:35, 10:67, 15:7, 15:40-41, 15:59, 15:62-63, 16:46-47, 16:50-51. Further, the specification repeatedly refers to "time sequenced" "difference(s)" and "differential(s)" without distinction and, similarly, "value(s)" of "difference(s)" and "differentials(s)" are described interchangeably. *See*, EX1001 at 9:29-30, 9:34, 12:44, 12:45-46, 12:47-48, 12:51, 12:52-53, 12:57, 12:58-59, 14:19-20, 14:31. Likewise, the terms "descriptive difference(s)" and "descriptive differential(s)" are used synonymously throughout the specification. *See*, EX1001 at 12:9, 12:13, 12:17, 12:22, 12:29, 14:35, 14:53-54, 14:49, 14:63-64. As described below, the tendency of Fonss to use the words "difference(s)" and "differential(s) interchangeably carries over to the use of these terms in the claims.

#### iv. "time-sequenced electronically published data stream"

67. Based on my reading of Fonss, and in view of the claim construction principles discussed herein, it is my opinion that a "time-sequenced electronically

published data stream," found in independent claims 1, 7, and 19,would be understood by the skilled artisan to mean "a stream of data, from an available electronic source, indicating a changeable value at points in time."

68. Fonss explains the meaning of an electronically published data steam through specific examples:

> "Examples of the time sequenced exogenous and electronically published data include: (i) the **prices of computer memory storage devices**, (ii) **prices of crude oil of differing grades**, at different delivery points, denominated in different currencies, (iii) voter counts in statewide election by demographic, party affiliation, and geographic location."

EX1001 at 9:55-61 (emphasis added).

> "The value of differences is generated by the system from one of more internet data streams, and where practical, the values of differences are generated, stored, and linked with a frequency which matches or exceeds the frequency used for appending transactions records to the base DCL 11 **during periods in which the values of difference published in an internet data streams are changing**. In each case, the value differences illustrated for TYPE W, TYPE B, TYPE D, EUR, USD, and SGD are **differences in percentage changes from the immediately preceding period; in alternate implementations, absolute values or other measured changes may be generated, stored and applied**."

EX1001 at 12:45-57 (emphasis added).

> [A]n example of a raw differential I/O interface(s) 186 is connected through an internet connection 182 for the purposes of retrieving one or more time-sequenced electronically published data streams or a descriptive differentials, **where a time-sequenced data stream may relate to prices, trade flows, trade variables, shipping details, economic variables, performance measures or other numerical or descriptive data**. Examples of source nodes connected to the internet include: **(i) a commercial trade, tracking, or shipping network run by a company, industry group, or governmental entity 183, (ii) an electronic exchange 184 which publishes a price data stream of changing market prices, and (iii) an electronic news outlet 185 which publishes electronic data relating to changing news**.

EX1001 at 17:1-14 (emphasis added).

69. The skilled artisan would understand these passages of Fonss as explaining that a "time-sequenced electronically published data stream" provides a sequence of data values from an available electronic (e.g., internet) source, where changes in the value of the data over time represent fluctuations in any of a wide variety of time-variable information, such as markets prices, an equity market index, currency exchange rates, trade flows, and economic variables. *See*, e.g., EX1001 at 14:52, 14:64, 17:5.

**v. "measurement differences" and "measured differential"**

70. Based on my reading of Fonss, and in view of the claim construction principles discussed herein, it is my opinion that "measurement differences" and "measured differential," found in independent claims 1, 7, and 19, would be understood by the skilled artisan to mean "supplementary data stored on the PSDL that relates to the time-sequenced electronically published data stream."

71. As I explained in the preceding section, the words "difference(s)" and "differentials(s)" are use substantially interchangeably throughout the specification of Fonss to refer to the supplementary data that can be stored on the PSDL. As I explain above, in general, such supplementary data can be either time-sequenced value that can change over time to reflect time-varying fluctuations in time-sequenced data from an electronically published data stream or a "descriptive differential" or "descriptive difference" whose value is one of a set of possible values, with each different value in the set representing a different descriptive characteristic of the transaction record on the DCL.

72. Based on my reading of Fonss, the terms "measurement differences" and "measured differential" do not appear *verbatim* in the specification of Fonss. However, it is my opinion that the context within which these terms are use in the claims, juxtaposed with the "descriptive" supplementary data, and the instances where the words "measurement" and "measured" appear in the specification indicate

that the claim terms "measurement differences" and "measured differential" relate to time-sequenced "difference(s)" or "differential(s)" from a published data stream rather than descriptive supplementary data. See, e.g., EX1001 at 6:22-25, 12:53-57, 13:56-61,

**vi. "descriptive differential," "descriptive differences," and "descriptive identifier"**

73. Based on my reading of Fonss, and in view of the claim construction principles discussed herein, it is my opinion that the terms "descriptive differential," "descriptive differences," and "descriptive identifier," found in independent claims 1, 7, and 19, would be understood by the skilled artisan to mean "supplementary data stored on the PSDL that relates to a descriptive characteristic of the transaction record."

74. As I explain above, the words "difference(s)" and "differentials(s)" are use substantially interchangeably throughout the specification of Fonss to refer to the supplementary data that can be stored on the PSDL. The terms "descriptive differential," "descriptive differences," and "descriptive identifier" all refer to the descriptive type of supplementary data whose value is one of a set of possible values, with each different value in the set representing a different descriptive characteristic of the transaction record on the DCL.

75. Based on my reading of Fonss, it is my understanding that the term "descriptive identifier" is not present in the specification of Fonss. However, the following passages mentioning "identifier(s)" further indicate that a "descriptive identifier" refers to descriptive supplementary data stored on the PSDL.

> Differentials recorded on a PSDL may also include descriptive differentials which can indicate difference types, grades, timeframes or **other discriminatory identifiers**; descriptive differentials may be utilized with or without data stream differentials.

EX1001 at 9:35-39 (emphasis added).

> Table 111 indicates an example of a particular record where the fields are indicated as "**identifier**", "timestamp(0)", timestamp(t)" "val(0)", "val(t)", "dif(t)", and "cond". **Identifier** is an example of **an encoding** which is used to identify the subject of the stored differentials or descriptors.

EX1001 at 15:2-7 (emphasis added).

**vii. "differences processing engine running on a specialized computer system"**

76. Based on my reading of Fonss, and in view of the claim construction principles discussed herein, it is my opinion that the phrase "differences processing engine running on a specialized computer system" would be understood by the skilled artisan to mean "a computer processor that performs operations to enable a PSDL to store supplementary data."

> Each PSDL will store at least one system written and system accessible **time sequenced differential or descriptor**, where differentials are created by the system from exogenous and electronically published data streams, and where **at least one differences processing engine running on the system computes and stores time sequenced differences from values in the published data stream**.

EX1001 at 9:28-35 (emphasis added).

> Continuing to the differential processor 187, the differential processor 187 **assimilates at least one value or descriptive differential through a computer or mathematical operation, forming the data into a useable format where it can be stored on differential storage unit 188**, for simultaneous or subsequent application to the units or interests of a base DCL with network 181.

EX1001 at 17:15-21 (emphasis added).

77. Based on my reading of Fonss, the term "differences processing engine" appears only once in the specification, but based on that passage and the description of the "differential processor" in Fig. 18, the claim passage "differences processing engine running on a specialized computer system" simply refers to a computer processor tasked with carrying out specific operations that enable a PSDL to function. As I explain above, a PSDL functions to store at least one of two types of supplementary data related to a transaction record on the DCL: a time-sequenced "difference" or "differential" and a descriptive "difference" or "differential."

**viii. "group" claim language**

78. It is my understanding that some of the claim language in Fonss includes recitations structured as "Markush groups," which are interpreted in a particular way. It is my understanding that such groups specify that a claimed element is one of group of possible items and uses the phrase "from a/the group consisting of" to demark the Markush group. For example, the passage "a fastener from a group consisting of glue and tape" means that the fastener comprises either glue or tape.

79. It is my understanding that independent claims 5 and 19 use substantially standard Markush group claim language (i.e., "from a group consisting of") to define two Markush groups. For example, claim 19 recites:

> wherein the at least one electronic parallel storage of the differences layer accesses and stores values **from a group consisting of** at least one time sequenced electronically published data stream and a list of descriptive differentials, and
>
> wherein at least one differences processing engine running on a specialized computer system creates and stores parameters **from a group consisting of** measurement differences and descriptive differences

EX1001 at 20:22-30 (emphasis added).

80. Consistent with the conventional meaning of Markush group language, as well as how a skilled artisan would understand Fonss, it is my opinion that these

passages mean that the PSDL accesses and stores values either from "at least one time sequenced electronically published data stream" or from "a list of descriptive differentials." Likewise, the differences processing engine creates and stores parameters either from measurement differences or descriptive differences. In other words, it is my opinion that the Markush group language does not require the "values" to include both time sequenced data and descriptive data and does not require the "parameters" to include both measurement differences and descriptive differences in order to meet the claim limitations. It is further my understanding that the use of the term "consisting of" in Markush language defines a closed group, meaning that the claim element must be one of the listed items in the group.

81. Like claim 19, independent claims 1 and 7 also recite "group" language in relation to the "value" and the "parameters." However, it is my understanding that these claims do not recite the typical Markush language "from a group consisting of." For example, claim 7 recites "from a group comprising of" in both instances. EX1001 at 19:24-27. Claim 1 recites, in one instance, "from a group comprising of" (in relation to the "value") and "from a group comprised of" (in relation to the "parameters"). EX1001 at 18:13-19. Regardless, it is my opinion that the skilled artisan would nevertheless still understand from the specification of Fonss that the "value" and "parameters" limitations are met by only one item in their respective listed groups. This opinion is based on the numerous passages within Fonss in which

the elements of the group language of these claims is discussed in the alternative. *See, e.g.,* EX1001 at 9:28-39, 17:15-19, 6:11-13, 10:14-16, 6:22-24.

## VII. Summary of Opinions

82. As I explain above, the Fonss techniques are intended to provide new functionality on blockchains through supplementary data residing on the parallel storage of differences layer, including the sale of financial instruments. EX1001 at 9:45-46; 11:5-7 ("The differences residing on a PDSL are applied to the units (or interests) of a DCL … where differentials relate to any number of objects or transactions including … **a bespoke financial instrument**.")(emphasis added). It is my opinion that this is the same functionality provided by the repository computer system 600 of Zinder. EX1004 at ¶ [0037] ("Certain example embodiments provide a digital asset repository computer system for buyers and sellers to connect and trade **privately issued assets**.") (emphasis added). It is, therefore, further my opinion that Zinder teaches or would have rendered obvious, at the time of invention, all aspects of claim 1 of Fonss.

83. To be frank, I am surprised that Fonss was ever issued at all. Simply put, Fonss claims nothing more than a relational database general ledger in which the ledger table is replaced with a blockchain ledger. For example, illustrated below is a conventional relational database system from U.S. Patent 7,899,712 ('712 patent) in which transactions are stored in ledger table 660 and linked to supplemental data

contained in the accounting record table 650, the user table 610 and the payment instrument tables 670. Or, as explained in the '712 patent:

> A ledger table 660 is linked to the accounting record table 650, the user table 610 and the payment instrument tables 670. A ledger record contains information on an actual fund transfer between a user and the online payment service 120. The funds transfer may be a debit (e.g., a charge to a buyer's credit card) or a credit (e.g., a disbursement to a seller's checking account).

EX1007 at 5:46-55.

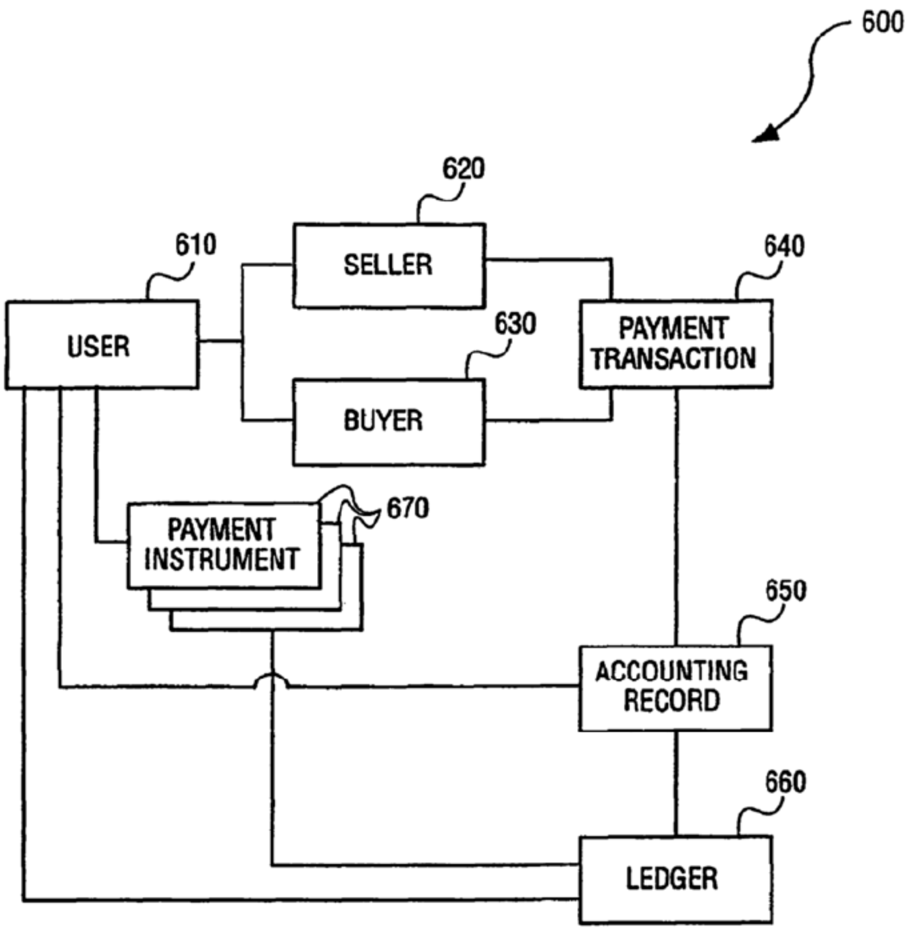



FIG. 6

84. To assist in organizing my analysis I have labeled the recitations of the claims of Fonss as follows:

| Claims Language | Recitation Label |
|---|---|
| *1. A computer based method comprising:* | *Preamble 1* |
| *creating at least one electronic parallel storage of a differences layer linked to a distributed computer ledger (DCL); the DCL contains an electronic transaction record by a time-sequenced value or a time-sequenced string;* | *1a* |

| | |
|---|---|
| *accessing and storing a value through the at least one electronic parallel storage of the differences layer, the value from a group comprising of at least one time-sequenced electronically published data stream and at least one descriptive differential, wherein at least one differences processing engine running on a specialized computer system creates and stores parameters from a group comprised of a measurement differences and a descriptive differences;* | *1b* |
| *storing the DCL containing an electronic transactions record on at least one of a distributed network of connected independent computers or a decentralized network of computers wherein the electronic transaction record is time sequenced, and a writing or an appending of the electronic transaction records is performed on the distributed network of connected independent computers or the decentralized network of computers;* | *1c* |
| *storing the at least one electronic parallel storage of the differences layer on at least one of a centralized storage device controlled by the specialized computer system or a decentralized storage device controlled by the specialized computer system for increasing functionality and utility of the DCL, reducing data storage requirements, eliminating transmission of redundant data, and improving data security;* | *1d* |
| *linking the electronic transaction record in the DCL to records of the at least one electronic parallel storage of the differences layer utilizing at least one time sequenced value, string, code, or key; and* | *1e* |
| *imputing at least one measured differential with a descriptive identifier or at least one descriptive identifier to the electronic transaction record of the DCL through data storage and processing on the at least one electronic parallel storage of the differences layer.* | *1f* |
| | |
| *2. The method of claim 1, wherein records of the at least one electronic parallel storage of the differences layer are written and stored separately from the distributed electronic ledger containing electronic transaction records,* | *2a* |

| | |
|---|---|
| *where the records of the at least one electronic parallel storage of the differences layer are encoded for time-sequenced alignment with the electronic transaction records when values from a group comprised of the at least one time-sequenced electronically published data stream and the at least one descriptive differential change in value or specification.* | *2b* |
| | |
| *3. The method of claim 1, wherein values and descriptors from a group comprised of the at least one time-sequenced electronically published data stream and the at least one descriptive differential alter the functionality and transactional value of the electronic transaction records of the distributed electronic ledger.* | *3* |
| | |
| *4. The method of claim 1, wherein values and descriptors from a group comprised of the at least one time-sequenced electronically published data stream and the at least one descriptive differential define the functionality and operative entitlement of the electronic transaction records of the distributed electronic ledger.* | *4* |
| | |
| *5. The method of claim 1, wherein values from a group consisting of at least one time-sequenced electronically published data stream and at least one descriptive differential are linked to the electronic transaction records within the distributed electronic ledger and the electronic transaction records are homogeneous on the distributed electronic ledger as identified by a timestamp or other unique record identifier.* | *5* |
| | |
| *6. The method of claim 1, wherein layers of the at least one electronic parallel storage of the differences layer linked are modular and changeable independent of the distributed electronic ledger containing electronic transaction records.* | *6* |
| | |
| *7. A system comprising:* | *Preamble 7* |
| *a system having a memory device, the memory device further including a Random Access Memory (RAM);* | *7a* |

| | |
|---|---|
| *a processor connected to the memory device, the processor is configured to:* | *7b* |
| *create at least one electronic parallel storage of a differences layer linked to a distributed computer ledger (DCL), both the electronic parallel storage of the differences layer and the DCL containing a respective electronic transaction record, a time-sequenced value, or a time-sequenced string;* | *7c* |
| *access a value from a group comprising of at least one time-sequenced electronically published data stream and at least one descriptive differential;* | *7d* |
| *store the values from a group comprising of at least one time-sequenced electronically published data stream and at least one descriptive differential on the at least one electronic parallel storage of the differences layer;* | *7e* |
| *align and link a stored value record of the at least one electronic parallel storage of the differences layer to the electronic transaction record of the DCL utilizing at least one time sequenced value, string, code, or key; and* | *7f* |
| *impute at least one measured differential with a descriptive identifier or at least one descriptive identifier to the electronic transaction record of the DCL.* | *7g* |
| | |
| *8. The system of claim 7, wherein the memory device includes a separation of storage of the differences layer.* | *8* |
| | |
| *9. The system of claim 8, wherein the separation of storage is between the electronic transaction record of the DCL and the differences layer.* | *9* |
| | |
| *10. The system of claim 9, wherein a plurality of differences layer is parallel stored to create a parallel storage of differences layer (PSDL).* | *10* |
| | |
| *11. The system of claim 7, wherein the difference layer is stored on a centralized storage or a decentralized storage apart from the electronic transaction record of the DCL.* | *11* |
| | |

| | |
|---|---|
| *12. The system of claim 11, wherein the electronic transaction record of the DCL is impacted by a parallel storage of differences layer.* | *12* |
| | |
| *13. The system of claim 12, wherein impact is done from each of the parallel storage of differences layer (PSDL) in an individual manner.* | *13* |
| | |
| *14. The system of claim 13, wherein the parallel storage of differences layer (PSDL) has a time-sequence entry, and each time-sequenced entry is independent in the PSDL.* | *14* |
| | |
| *15. The system of claim 12, wherein impact is done from the parallel storage of differences layer (PSDL) in a cumulative manner, or a compounding manner, wherein impact is cumulative based on a time indicator.* | *15* |
| | |
| *16. The system of claim 15, wherein the parallel storage of differences layer (PSDL) has a time-sequence entry, and each time-sequenced entry is independent or dependent in the PSDL.* | *16* |
| | |
| *17. The system of claim 7, wherein the difference layer is stored on a distributed network, a centralized network, or a decentralized network, and wherein the difference layer is stored apart from the electronic transaction record of the DCL.* | *17* |
| | |
| *18. The system of claim 17, wherein the electronic transaction record of the DCL is impacted by the differences layer.* | *18* |
| | |
| *19. A non-transitory computer readable storage medium, comprising storage, retrieval, modification, and linking system software which instructs at least one computer processor residing on a specialized computer system to implement a process to:* | *19a* |

| | |
|---|---|
| *create at least one electronic parallel storage of a differences layer linked to a distributed computer ledger (DCL) containing an electronic transaction record arranged by a time-sequenced value or time-sequenced string, wherein the at least one electronic parallel storage of the differences layer accesses and stores values from a group consisting of at least one time-sequenced electronically published data stream and a list of descriptive differentials, and wherein at least one differences processing engine running on a specialized computer system creates and stores parameters from a group consisting of measurement differences and descriptive differences;* | *19b* |
| *store the DCL containing the electronic transactions records on at least one of a distributed network of connected independent computers or a decentralized network of computers wherein the electronic transaction records are time sequenced, and the writing or appending of the electronic transaction records is performed on the distributed network of connected independent computers or the decentralized network of computers;* | *19c* |
| *store the at least one electronic parallel storage of the differences layer on at least one of a centralized storage device controlled by the specialized computer system or a decentralized storage device for increasing functionality and utility of the DCL, reducing data storage requirements, eliminating transmission of redundant data, and improving data security;* | *19d* |
| *link the transaction records in the DCL to the at least one electronic parallel storage of the differences layer utilizing at least one time sequenced value, string, code, or key; and* | *19e* |
| *impute at least one measured differential with a descriptive identifier or at least one descriptive identifier to the electronic transaction records of the DCL, wherein a data storage and a processing of the imputing resides on a centralized device or a decentralized device controlled by the specialized computer system.* | *19f* |
| | |
| *20. The non-transitory computer readable storage medium of claim 19, wherein the difference layer is stored* | |

| | |
|---|---|
| *apart from the electronic transaction record of the DCL, and the electronic transaction record of the DCL is impacted by the differences layer.* | |

## VIII. Analysis of the claims

### a) Ground 1

#### i. Claim 1

##### 1. Claim Recitation 1a.

| |
|---|
| *creating at least one electronic parallel storage of a differences layer linked to a distributed computer ledger (DCL); the DCL contains an electronic transaction record by a time-sequenced value or a time-sequenced string;* |

*The distributed computer ledger containing the time-sequenced value or time-sequenced string*

85. As I explain above, the skilled artisan would understand that a distributed computer ledger (DCL) refers to a "database of transaction records maintained by consensus of a network of independently connected computers." As further explained in Fonss, DCLs include "blockchain implementations of cryptocurrencies (including Bitcoin, Ethereum and the like)." EX1001 at 2:35-40; *see also* 3:21-35; 14:9-15. First, it is my understanding that Fonss concedes that such DCLs were known in the art prior to the alleged invention claimed in Fonss. *See, e.g.,* EX1001, 3:62-4:3. This is undeniably the case. For example, Fonss uses the Bitcoin and Ethereum blockchains as example DCLs. EX1001 at 2:30-45. These DCLs were known well in advance of the priority date for Fonss, with the Bitcoin blockchain first being described in 2008. EX1011.

86. Furthermore, it is my opinion that Zinder provides this feature of claim 1 through its implementation of a blockchain, of which a Bitcoin blockchain is an example:

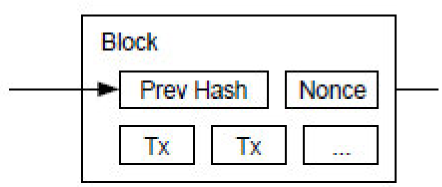
> [0061] In certain example embodiments, and as shown in FIG. 2A, creating a new asset may also involve an initial blockchain transaction "to" the unique identifier for the asset in the form of an amount of cryptographic currency. For example, a blockchain transaction that moves an amount of **bitcoin (or other cryptographic currency)** from the digital wallet associated with the digital asset repository computer system 600 (e.g., a unique identifier for that digital wallet)
>
> [0062] **As shown in FIG. 2A, after creation of the asset and its corresponding data, then a blockchain transaction 701 is generated to initialize and/or enable "asset" 708 to issue new shares.** Blockchain transaction 701 thus "sends" an amount of crypto-currency from the unique identifier associated with the private exchange 700 to the unique identifier that was created for the asset 708. This transaction 701 includes the public key of the private exchange 700 and is digitally signed by the private key of the private exchange 701 **(e.g., as with a normal blockchain transaction)**. As a result of blockchain transaction 701, an amount of crypto-currency (**e.g., satoshis in a bitcoin example**) is associated with the unique identifier of the asset (e.g., as an unspent output). The asset, by using its associated private key, may then "issue" a quantity of the newly created asset by having the crypto-currency amount "carry" (e.g., as a colored coin or the like) the asset as part of the blockchain transaction. In certain

> example embodiments, transaction 701 may be added to the ledger store 606. However, in other embodiments it is not added to the ledger store 606 because this transaction does not move the asset from one entity or participant (e.g., the unique identifiers associated with that entity) to another.

EX1004 at ¶¶ [0061]-[0062].

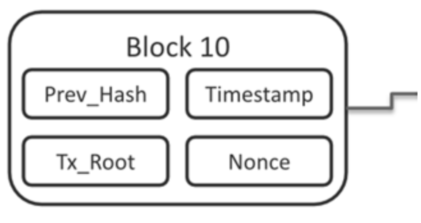
87. Accordingly, Zinder uses blockchains, and the bitcoin blockchain in particular, which are DCLs according to Fonss.

88. It is also my opinion that "an electronic transaction record by a time-sequenced value or a time-sequenced string" would have been obvious from Zinder. Illustrated below is a detail of a figure from Nakamoto, "Bitcoin: A Peer-to-Peer Electronic Cash System" (2008) (incorporated by reference in Zinder at ¶ [0034], among other prior art references[4]). This figure illustrates a block from the Bitcoin blockchain originally described by Nakamoto back in 2008.




[4] *See, e.g.,* EX1012 at ¶ [0018] (published 10/13/2016); EX1013 at ¶ [0061] (filed 12/14/2017); EX1014 at ¶ [0077] (published 10/01/2015); EX1015 at ¶ [0209] (filed 02/01/2018)

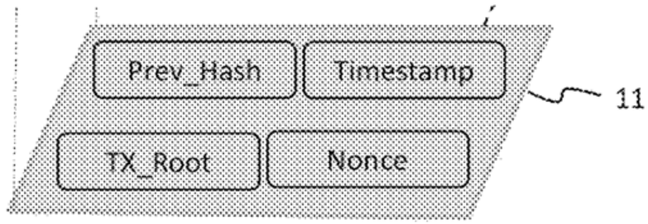
89. As explained by Nakamoto, the Bitcoin network "network timestamps transactions by hashing them into an ongoing chain of hash-based proof-of-work, forming a record that cannot be changed without redoing the proof-of-work." EX1011, 1. The skilled artisan would understand that included in the block above would be a timestamp. In fact, subsequent illustrations of the Bitcoin block explicitly include this timestamp. For example, reproduced below is an illustration of the Bitcoin blockchain block data structure from the Bitcoin Wikipedia page[5] which was publicly available prior to the earliest priority for Fonss[6] :




90. The Bitcoin data structure is identical to that illustrated in FIG. 4 of Fonss:

[5] https://en.wikipedia.org/wiki/Bitcoin

[6] https://meshedinsights.com/2015/12/18/what-is-a-blockchain/; *see also* https://web.archive.org/web/20160218064913/http://meshedinsights.com/2015/12/18/what-is-a-blockchain/




EX1001 at FIG. 4.

91. Accordingly, it is my opinion that the use of the Bitcoin blockchain in Zinder would have rendered obvious the use of "a DCL contain[ing] an electronic transaction record by a time-sequenced value or a time-sequenced string" at the time of invention. More specifically, it would have been obvious, at the time of invention, to use a "DCL contain[ing] an electronic transaction record by a time-sequenced value or a time-sequenced string" in the Zinder techniques because Zinder explicitly teaches the use of the Bitcoin blockchain, which is itself a "DCL contain[ing] an electronic transaction record by a time-sequenced value or a time-sequenced string." Furthermore, it is my opinion that using a "DCL contain[ing] an electronic transaction record by a time-sequenced value or a time-sequenced string" is "the predictable use of prior art elements according to their established functions," and is therefore, an obvious use of the Bitcoin blockchain, which I understand to be a hallmark of obviousness. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 401, 127 S. Ct. 1727, 1731, 167 L. Ed. 2d 705 (2007).

*The parallel storage of differences layers linked to a distributed computer ledger*

92. As discussed above, a parallel storage of a differences layer refers to "a storage system that stores supplementary data, linked to a transaction record stored on a distributed computer ledger (DCL), whose value expresses time-variable data related to or descriptive characteristics of the transaction record." It is my opinion that such parallel storage is provided by one or both of asset storage 604 and ledger storage 606 of the repository computer system 600 of Zinder. Asset storage 604 includes information regarding the assets tracked by the blockchain 618, including a specific asset type. EX1004 at ¶ [0057]. More specifically, asset storage 604 includes information regarding assets that is not stored on the blockchain and that is linked to the blockchain via a unique identifier:

> Asset storage 604 (sometimes also referred to as resource storage) includes records of all of the assets or resources tracked by digital asset repository computer system 600. For example, each class of share issued by a company may be a separate resource record in asset storage 604. An asset or resource record may include the participant identifier (e.g., for a corresponding company) that the asset is associated with, a unique identifier that is used to **uniquely identify the asset on the blockchain (e.g., which may be, for example, a 160 bit hash value of a public key associated with the asset**), a public key that may be used to generate the unique identifier, a private key that may be used to generate the public key (e.g., via elliptical curve cryptography or the like), attributes that define the type of asset (e.g., asset type, class of shares, specific issuance), a number of shares that

> <u>have been issued for this asset type, when the asset was created, etc. . .</u>
>
> <u>.</u>
>
> EX1004 at ¶ [0057] (emphasis added).

93. As noted above, asset storage 604 includes the same kinds of data as embodiments of the claims of Fonss, such as the type of asset associated with a blockchain transaction. For example, Fonss notes that examples of the parameters include: <u>**type**</u>" and Zinder notes that an "asset or resource record may include … attributes that define <u>**the type of asset**</u>." EX1001, 5:42-46; EX1004 at ¶ [0057]. Accordingly, it is my opinion that asset storage 604 is an "electronic parallel storage of a differences layer linked to a distributed computer ledger (DCL)."

94. It is further my opinion that ledger storage 606 is also an "electronic parallel storage of a differences layer linked to a distributed computer ledger (DCL)." Ledger storage 606 includes information regarding the asset transactions recorded on blockchain 618 not stored on the blockchain, but linked thereto:

> Ledger storage 606, in conjunction with blockchain services 616, interfaces with the blockchain 618 to store records of validated (or to-be-validated) blockchain transactions. A record in ledger storage 606 may include source and destination identifiers that are mapped back to respective participants (e.g., stored in participant storage 602), a blockchain transaction ID, the unique identifier for the asset, an asset transaction quantity, a transaction date (e.g., when the transaction was submitted to the blockchain), a validation date (e.g., when this

> transaction was ultimately validated by the blockchain), a price per share, and/or a price of the asset transaction, etc. . . .
>
> **Other data that corresponds to the transaction may be added to ledger storage 606 and linked to the created blockchain transaction**.

EX1004 at ¶¶ [0058], [0087].

95. The data stored in ledger storage 606 includes the same kinds of data as embodiments of the claims of Fonss, such as timeframes, prices, and values. For example, Fonss describes the differentials stored in the PSDLs as follows:

> Differentials recorded on a PSDL may also include descriptive differentials which can indicate difference types, grades, **timeframes** or other discriminatory identifiers; descriptive differentials may be utilized with or without data stream differentials. In certain implementations, a descriptive differential is an indirect reference to electronically published data streams; for example a descriptive differential which indicates a certain type of steel of a certain grade to a DCL unit imparts a delivery obligation or **value** which aligns with one or more electronically published data streams.

EX1001, 9:35-45 (emphasis added).

96. Zinder stores this same type of data in ledger storage 606:

> Other data that corresponds to the transaction may be added to ledger storage 606 and linked to the created blockchain transaction. Such information may include the information represented in fields 712 shown in FIG. 2C. For example, whether the transaction has been validated on the blockchain, what block in the chain the validation is

> associated with, **a rule 144 date of the asset transaction**, the price per share of the asset transaction, **the investment value of the asset transaction**, conditions associated with the asset transaction, etc. . . . It will be appreciated that these fields may vary based on what type of asset is being transacted and the type of transaction (issuance, transfer, re-classification, cancelation, etc. . . . )

EX1004 at ¶ [0087] (emphasis added).

97. As indicated in the above-quoted language, ledger storage 606 may store a rule 144 date, which indicates a timeframe after which the holder of a security may sell the security without restriction or limitation pursuant to SEC rule 144. *See* 17 C.F.R. § 230.144. Such a value would be a descriptive differential as a "timeframe" according to Fonss. As also indicated in the above-quoted language, ledger storage 606 may store an "investment value of the asset transaction," which would be a "value" a descriptive differential according to Fonss.

98. Accordingly, it is my opinion that Zinder would have rendered "creating at least one electronic parallel storage of a differences layer linked to a distributed computer ledger (DCL); the DCL contains an electronic transaction record by a time-sequenced value or a time-sequenced string" obvious at the time of invention.

#### 2. Claim Recitation 1b

| |
|---|
| *accessing and storing a value through the at least one electronic parallel storage of the differences layer, the value from a group comprising of at least one time-sequenced electronically published data stream and at least one descriptive* |

| |
|---|
| *differential, wherein at least one differences processing engine running on a specialized computer system creates and stores parameters from a group comprised of a measurement differences and a descriptive differences;* |

*Accessing and storing a value through the at least one electronic PSDL*

99. It is my opinion that recitation 1b adds little to that of 1a, simply stating that the PSDL stores data for its intended purpose. As shown above, the asset storage 604 and the ledger storage 606 of Zinder both store values of the same type of data as the PSDLs of Fonss. *See, e.g.,* EX1004 at ¶¶ [0057], [0087]. Accordingly, it is my opinion that asset storage 604 and ledger storage 606 each "access[] and stor[e] a value through the at least one electronic parallel storage of the differences layer."

*The value from a group comprising of at least one time-sequenced electronically published data stream and at least one descriptive differential*

100. First, it is my opinion that "the value from a group comprising of at least one time-sequenced electronically published data stream and at least one descriptive differential" recites the "time-sequenced electronically published data stream" and the "descriptive differential" in the alternative. Therefore, it is my understanding that to meet this requirement of claim 1, it needs to be shown only that Zinder provides one of these two alternatives. Accordingly, for this ground, I direct my opinion primarily to the "descriptive differential" alternative. "Descriptive differential" values are clearly stored in asset ledger 604 and transaction ledger 606. As explained above, a descriptive differential refers to a "supplementary data stored on the PSDL that relates to a descriptive characteristic of the transaction record." As

explained in Fonss "descriptive differentials … can indicate difference **types**, grades, **timeframes** or other discriminatory identifiers." EX1001 at 9:35-45 (emphasis added). Asset storage 604 stores asset records that include "attributes that define the **type** of asset" associated with a blockchain record. EX1004 at ¶ [0057] (emphasis added). Therefore, it is my opinion that asset storage 604 stores a "value from a group comprising … at least one descriptive differential."

101. Ledger storage 606 stores records that include "**a transaction date** (e.g., when the transaction was submitted to the blockchain), [and] **a validation date** (e.g., when this transaction was ultimately validated by the blockchain)." EX1004 at ¶ [0058] (emphasis added). Accordingly, transaction ledger 606 stores values that indicate "timeframes," and therefore, it is my opinion that these values are descriptive differentials as claimed in Fonss. Also, as discussed above, ledger storage 606 stores a rule 144 date, which is a timeframe descriptive differential.

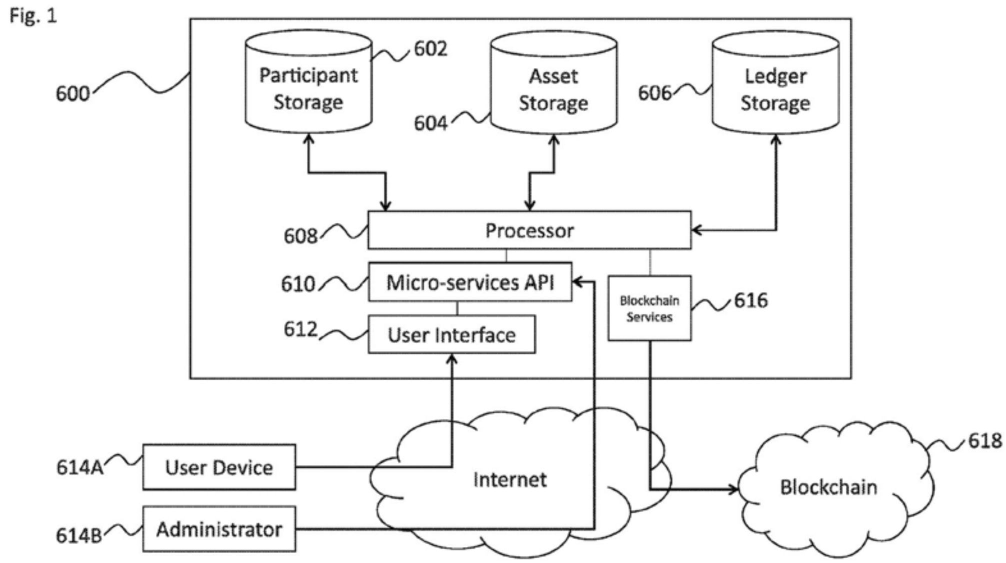
102. Accordingly, it is my opinion that the values stored in asset storage 604 and ledger storage 606 are values "from a group comprising … at least one descriptive differential."

103. As discussed above, only a "descriptive differential" needs to be taught by Zinder to meet the requirements of this recitation, and others, of claim 1. However, I would be remiss if I failed to mention that the use "the value from a group comprising of at least one time-sequenced electronically published data

stream" would have been obvious at the time of invention from the teachings of the Zinder. It was well understood at the time of invention that financial asset price data could be received via "time-sequenced electronically published data streams." *See, e.g.,* EX1006. Fonss simply stores and applies such data to its PSDL. Where that value comes from provides no functional difference to the claimed system.

*At least one differences processing engine running on a specialized computer system creates and stores parameters from a group comprised of a measurement differences and a descriptive differences*

104. As explained above, "at least one differences processing engine running on a specialized computer system creates and stores parameters from a group comprised of a measurement differences and a descriptive differences" refers to "a computer processor that performs operations to enable a PSDL to store supplementary data." It is my opinion that Zinder provides such as specialized computer system through digital asset repository computer system 600, illustrated below in FIG. 1 from Zinder.




105. As explained in Zinder, digital asset repository computer system 600 is a specialized computer system configured to "maintain[] an accurate digital ledger of asset ownership":

> FIG. 1 illustrates a non-limiting example function block diagram of a computer-implemented digital asset repository computer system (also referred to herein as a digital resource repository computer system) 600 that interfaces with blockchain 618 according to certain example embodiments. **The digital asset repository computer system 600 may include a combination of software and hardware interfaces, programmed business logic, processing resources, and electronically addressable storage. The digital asset repository computer system 600 is responsible for tracking and executing computer programs for the purpose of maintaining an accurate digital ledger of asset ownership**.

EX1004 at ¶ [0038] (emphasis added).

106. Accordingly, "digital asset repository computer system 600 is responsible for tracking and executing computer programs for the purpose of maintaining an accurate digital ledger of asset ownership," which is accomplished through the records contained in asset storage 604 and ledger storage 606 based on operations performed by processor 608. EX1004 at ¶¶[0038], [0041], [0045], [0052], [0057]-[0064], [0078]-[0080], [0083], [0088]. The records are created and stored in asset storage 604 and ledger storage 606 are the descriptive differentials of claim 1. EX1004 at ¶¶ [0038], [0057]-[0058]. Accordingly, it is my opinion that Zinder teaches recitation 1b of claim 1 of Fonss through the operations performed by processor 608, micro-services API 610, and blockchain services 616 to create and maintain records digital asset repository computer system 600 in maintaining asset storage 604 and ledger storage 606.

### 3. Claim Recitation 1c

| |
|---|
| *storing the DCL containing an electronic transactions record on at least one of a distributed network of connected independent computers or a decentralized network of computers wherein the electronic transaction record is time sequenced, and a writing or an appending of the electronic transaction records is performed on the distributed network of connected independent computers or the decentralized network of computers;* |

*Storing the DCL containing an electronic transactions record on at least one of a distributed network of connected independent computers or a decentralized network of computers wherein the electronic transaction record is time sequenced*

107. First, it is my opinion that Zinder concedes that a DCL as recited here is Patent Owner admitted prior art. *See e.g.,* EX1001 at 1:29-3:47. It is my opinion that the entire point of the Fonss techniques is to take a conventional DCLs and store

supplemental information in parallel therewith. *See, e.g.,* EX1001 at 4:1-2. Put differently, recitation 1c is nothing more than a restatement of the conventional DCL. *See, e.g.,* EX1001 at 1:29-47. Accordingly, PO concedes that this recitation of claim 1 is known in the prior art.

108. It is my opinion that the techniques of Zinder utilize a "DCL containing an electronic transactions record on at least one of a distributed network of connected independent computers or a decentralized network of computers wherein the electronic transaction record is time sequenced," as recited in claim 1 of Fonss. As illustrated in FIG. 1, from Zinder (reproduced above), the techniques of Zinder implement a blockchain 618. As discussed above, it is my opinion that blockchain 618 is a DCL as used in the claims of Fonss. Furthermore, Zinder explains that blockchain 618 contains an electronic transactions record on at least one of a distributed network of connected independent computers or a decentralized network of computers:

> **<u>The blockchain 618 is maintained, stored, and updated, by multiple different computer nodes</u>** that each operate to "mine" and thereby validate transactions submitted to the blockchain 618. Generally, only one of the nodes needs to "receive" a transaction that has been submitted from a client (e.g., the computer system 600). Once one node receives a transaction it may propagate the transaction to other nodes within **<u>the distributed computer system that provides the blockchain 618</u>**. **<u>In certain examples, different entities may control</u>**

> **different ones of the computer nodes that are responsible for maintaining the blockchain.** For example, the issuer of an asset may have one node, an auditor may have another node, a regulator (e.g., the SEC) may have another node, the entity that controls the computer system 600 may supply block generator nodes (e.g., that are dedicated to performing the cryptographic calculations of the blockchain).

EX1004 at ¶¶ [0042], [0043] (emphasis added).

109. As indicated from the above-quoted text, blockchain 618 includes electronic transactions and is implemented on a "distributed computer system" in which "different entities may control different ones of the computer nodes." Furthermore, as explained above, Zinder teaches the use of the Bitcoin blockchain in which the transaction are time sequenced. Accordingly, it is my opinion that Zinder teaches "storing the DCL containing an electronic transactions record on … a distributed network of connected independent computers wherein the electronic transaction record is time sequenced." It is further my opinion that the use of the Bitcoin blockchain as described in Zinder either describes or would have rendered obvious this recitation of claim 1. *See, e.g.,* EX1011 at 1 ("In this paper, we propose a solution to the double-spending problem using a peer-to-peer **distributed** timestamp server to generate computational proof of the chronological order of transactions.") (emphasis added).

*A writing or an appending of the electronic transaction records is performed on the distributed network of connected independent computers or the decentralized network of computers*

110. First, it is my opinion that this recitation is nothing more than a description of how convention DCLs operate, and is PO admitted prior art. EX1001 at 1:29-47. Accordingly, it is further my opinion that this recitation of claim 1 cannot be relied upon to show the patentablity of the claim.

111. It is also my opinion that the blockchain 618 of Zinder is also configured such that "writing or an appending of the electronic transaction records is performed on the distributed network of connected independent computers or the decentralized network of computers." As explained in Zinder:

> **The blockchain 618 is maintained, stored, and updated, by multiple different computer nodes that each operate to "mine" and thereby validate transactions submitted to the blockchain 618.** Generally, only one of the nodes needs to "receive" a transaction that has been submitted from a client (e.g., the computer system 600). **Once one node receives a transaction it may propagate the transaction to other nodes within the distributed computer system that provides the blockchain 618**.

EX1004 at ¶¶ [0042], [0043] (emphasis added).

112. In other words, when a new transaction is submitted to blockchain 618, the transaction is validated and stored as a new transaction on the blockchain. The new transaction may also be propagated from the receiving node to other nodes

within the distributed computer system. Accordingly, it is my opinion that Zinder teaches a DCL configured such that "a writing or an appending of the electronic transaction records is performed on the distributed network of connected independent computers or the decentralized network of computers."

#### 4. Claim recitation 1d

| |
|---|
| *storing the at least one electronic parallel storage of the differences layer on at least one of a centralized storage device controlled by the specialized computer system or a decentralized storage device controlled by the specialized computer system for increasing functionality and utility of the DCL, reducing data storage requirements, eliminating transmission of redundant data, and improving data security;* |

*Storing the at least one electronic parallel storage of the differences layer on at least one of a centralized storage device controlled by the specialized computer system or a decentralized storage device controlled by the specialized computer system*

113. As I explain above with reference to recitation 1c, asset storage 604 and ledger storage 606 are under the control of the specialized computer system comprising processor 608, micro-services API 610, and blockchain services 616 of computer system 600. As illustrated in FIG. 1 of Zinder, asset storage 604 and ledger storage 606 are stored on storage devices of computer system 600. EX1004 at ¶¶[0042], [0043] ("the storage repositories of the digital asset repository computer system 600 are located in-memory and/or on separate logical **or physical devices**.")(emphasis added). Accordingly, it is my opinion that the storage of the supplemental data in asset storage 604 and ledger storage 606 is controlled by specialized computer system 600.

114. Furthermore, Zinder describes digital asset repository 600 as being under the control of a particular entity. *See, e.g.,* EX1004 at ¶¶ [0043], [0068]. Accordingly, it is my opinion that the skilled artisan would understand that digital asset repository 600, including asset storage 604 and ledger storage 606 are contained as part of a centralized system. Put differently, a decentralized system is one that is not under the control of any central authority. *See, e.g.,* EX1011 at 4 ("there is no central authority to issue [Bitcoins]"). A centralized system, on the other hand, would be one under the control of a centralized authority. Because digital asset repository 600 is under the control of a particular entity, the skilled artisan would under the system to be part of a centralized storage device. Furthermore, Zinder specifically discloses that the asset storage 604 and ledger storage 606, as well as participant storage 602 are stored on devices within the centralized asset repository computer system 600;

> Digital asset repository computer system **600** includes at least three data repositories. These three repositories may be included as part of a single database (e.g., a relational database), may be separate databases, or may be stored by using other techniques (e.g., a flat file, or other data structure). In certain examples, the storage repositories of the digital asset repository computer system **600** are located in-memory and/or on separate logical ***or physical devices***.

EX1004 at ¶¶ [0042], [0043] (emphasis added).

115. Of course, this recitation of claim 1 recites "a centralized storage device controlled by the specialized computer system" and "a decentralized storage device controlled by the specialized computer system" in the alternative. Therefore, even if one were to assume that digital asset repository 600 does not utilize a centralized storage device, a decentralized storage device would be essentially the only other option to a skilled artisan, rendering its use obvious.

116. Accordingly, it is my opinion that Zinder teaches "storing the at least one electronic parallel storage of the differences layer on at least one of a centralized storage device controlled by the specialized computer system or a decentralized storage device controlled by the specialized computer system."

*Increasing functionality and utility of the DCL, reducing data storage requirements, eliminating transmission of redundant data, and improving data security*

117. Claim recitation 1d includes a list of benefits, mainly "increasing functionality and utility of the DCL, reducing data storage requirements, eliminating transmission of redundant data, and improving data security." It is my opinion that all of these benefits would be inherent in the Zinder techniques as Zinder implements or renders obvious the same functionality disclosed in Fonss. Nevertheless, it is my understanding that Zinder explicitly describes each of these benefits.

118. Zinder describes increased functionality through the ability to trade privately issued assets:

> Certain example embodiments **provide a digital asset repository computer system for buyers and sellers to connect and trade privately issued assets**.

EX1004 at ¶ [0009] (emphasis added).

119. Zinder describes increased functionality through the ability to update data not directly stored on the blockchain:

> In certain examples, the metadata that is stored in the ledger storage may be updated independently of the blockchain transaction that is associated with it. For example, the SEC rule 144 date may be a data field that only exists in ledger storage. **Thus, the rule 144 date may be updated without reference to the corresponding blockchain transaction**. Other fields in ledger or asset storage may be similarly updated.

EX1004 at ¶ [0116] (emphasis added).

120. Zinder describes reducing data storage requirements and eliminating the transmission of redundant data by having some information stored off of the blockchain:

> A new blockchain transaction is generated and published to the blockchain. In correspondence with publishing to the blockchain, the transaction storage is updated with information that makes up the blockchain transaction and **some information that was not included as part of the blockchain transaction**.

EX1004 at Abstract (emphasis added).

> In certain examples, the metadata that is stored in the ledger storage may be updated independently of the blockchain transaction that is associated with it. For example, the SEC rule **144** date may be **a data field that only exists in ledger storage**.

EX1004 at ¶ [0116] (emphasis added).

121. It is my opinion that because there is information included in asset storage 604 and ledger storage 606, and not in blockchain 618, the Zinder techniques eliminate the need to transmit and store this information in the blockchain, reducing data storage requirements and eliminating the transmission of redundant data to the nodes on which the blockchain is stored.

122. Zinder describes increased security by storing confidential information off of the blockchain:

> Accordingly, secure digital provenance is provided for the information that is contained in the blockchain transaction because of the cryptographic immutability of the records contained in blockchain. **Other information (e.g., that may be confidential in nature) is stored outside of the blockchain thus securing information that is related to the blockchain transaction** that is on the blockchain.

EX1004 at ¶ [0009] (emphasis added), *see also* ¶¶ [0013], [0033], [0147]. .

123. Accordingly, it is my opinion that Zinder teaches "increasing functionality and utility of the DCL, reducing data storage requirements, eliminating transmission of redundant data, and improving data security."

### 5. Claim Recitation 1e

*linking the electronic transaction record in the DCL to records of the at least one electronic parallel storage of the differences layer utilizing at least one time sequenced value, string, code, or key; and*

124. It is my opinion that Zinder explicitly describes "linking the electronic transaction record in the DCL to records of the at least one electronic parallel storage of the differences layer utilizing at least one time sequenced value, string, code, or key." For example, Zinder provides for the following:

> A record in ledger storage 606 may include source and destination identifiers that are mapped back to respective participants (e.g., stored in participant storage 602), **a blockchain transaction ID**, the unique identifier for the asset, an asset transaction quantity, a transaction date (e.g., when the transaction was submitted to the blockchain), a validation date (e.g., when this transaction was ultimately validated by the blockchain), a price per share, and/or a price of the asset transaction, etc. . .
>
> …
>
> The information stored in ledger storage may include **the blockchain transaction ID,** a reference to the source and destination digital wallets (or the unique identifiers), an asset identifier, and an amount of the asset that is subject to the transaction. **Other data that**

**corresponds to the transaction may be added to ledger storage 606 and linked to the created blockchain transaction**. …

…

the electronic resource tracking and storage computer system comprising:

a computer storage system configured to store

a transaction repository that includes **a plurality of blockchain transaction identifiers that correspond to blockchain transactions** submitted to the distributed blockchain computing system;

EX1004 at ¶¶ [0058], [0087], claim 1 (emphasis added).

125. Such a transaction identifier is precisely the type of "string, code or key" disclosed in Fonss:

> The disclosed embodiment departs from consensus in that it is based on alternative storage processes and architecture. The disclosed embodiment is directed at separating the processes and storage of DCL computers, networks and systems, where only those items required for transaction record keeping are maintained in the fully distributed ledger, and all other data, functionality, and processing is stored in a system of decentralized or centralized storage and processing, linked to the distributed ledger through a combination including timestamps, cryptographic strings, cryptographic nonces, or **identifying keys**.

EX1001, 5:11-21 (emphasis added).

126. Accordingly, it is my opinion that Zinder teaches "linking the electronic transaction record in the DCL to records of the at least one electronic parallel storage

of the differences layer utilizing at least one time sequenced value, string, code, or key."

### 6. Claim Recitation 1f

| |
|---|
| *imputing at least one measured differential with a descriptive identifier or at least one descriptive identifier to the electronic transaction record of the DCL through data storage and processing on the at least one electronic parallel storage of the differences layer.* |

127. It is my understanding that the plain and ordinary meaning of "impute" is to "attribute or ascribe." Accordingly, "imputing at least one measured differential with a descriptive identifier or at least one descriptive identifier to the electronic transaction record of the DCL through data storage and processing on the at least one electronic parallel storage of the differences layer" refers to attributing or ascribing a descriptive identifier to the DCL transaction record using the values stored in the PSDLs.

128. Based on my reading of Fonss, it is my understanding that "descriptive identifier," a term used only in the claims of Fonss, refers to descriptive supplementary data stored on the PSDL. For example, if a PSDL stores a descriptive differential as a numerical value, the descriptive identifier would refer to a natural language version of the descriptive differential. *See, e.g.,* EX1001, 12:29-32 ("where −1 may be used to indicate a delivery obligation, and where +1 may be used to indicate an obligation to take delivery"). However, Fonss also notes that a descriptive identifier may be identical to the value stored on the PSDL as a

descriptive differential. *See, e.g.,* EX1001, 6:23-25 ("the **differences, measurements, or descriptors** are stored in parallel, modular and linked arrangements and not within the transaction records."); 10:66-67 ("modular layer three (31) are system generated stored **differentials or descriptors**"); 15:5:7 ("Identifier is an example of an encoding which is used to identify the subject of the stored **differentials or descriptors**."). Accordingly, it is my opinion that recitation 1f simply refers to the ascribing or attributing of a descriptive differential stored on the PSDL to a transaction record stored on the DCL.

129. Finally, it is my understanding that the sole use of "impute" in Fonss indicates that "imputing" may be performed through linked storage systems:

> The disclosed embodiment is a departure in systems, storage, method, and data architecture. The disclosed embodiment changes design and methods of data storage and the functionality of a DCL. The disclosed embodiment is partially based on the concepts: (i) electronic transactions within a DCL can be independent and separately processed from the data items required to specify a value, disposition, distribution, or resolution of a unit of the DCL, (ii) direct processing of a DCL and available network and system capacity must be directed at the highest levels of transaction and execution speed, rather than DCL internal specification, and (iii) many real world applications of DCL will relate to already specified real world objects, and the articulation of those items can generally be dynamically **imputed to the DCL interests through linked and modular storage systems**.

EX1001, 8:43-57 (emphasis added).

130. Accordingly, it is my opinion that Zinder teaches the imputation of descriptive identifiers to electronic transaction records of a DCL through the linkage of asset storage 604 and/or ledger storage 606 to blockchain 618:

> Asset storage 604 (sometimes also referred to as resource storage) includes records of all of the assets or resources tracked by digital asset repository computer system 600. For example, each class of share issued by a company may be a separate resource record in asset storage 604. An asset or resource record may include the participant identifier (e.g., for a corresponding company) that **the asset is associated with, a unique identifier that is used to uniquely identify the asset on the blockchain (e.g., which may be, for example, a 160 bit hash value of a public key associated with the asset),** a public key that may be used to generate the unique identifier, a private key that may be used to generate the public key (e.g., via elliptical curve cryptography or the like), attributes that define the type of asset (e.g., asset type, class of shares, specific issuance), a number of shares that have been issued for this asset type, when the asset was created, etc. . . .
>
> EX1004 at ¶ [0057].
>
> The information stored in ledger storage may include the blockchain transaction ID, a reference to the source and destination digital wallets (or the unique identifiers), an asset identifier, and an amount of the asset that is subject to the transaction. **Other data that corresponds to the transaction may be added to ledger**

> **storage 606 and linked to the created blockchain transaction**. Such information may include the information represented in fields **712** shown in FIG. 2C. For example, whether the transaction has been validated on the blockchain, what block in the chain the validation is associated with, a rule **144** date of the asset transaction, the price per share of the asset transaction, the investment value of the asset transaction, conditions associated with the asset transaction, etc. . . . It will be appreciated that these fields may vary based on what type of asset is being transacted and the type of transaction (issuance, transfer, re-classification, cancelation, etc. . . . )

EX1004 at ¶ [0087] (emphasis added).

131. Zinder also describes "imputing" of descriptive differentials to electronic transactions stored on the DCL through user interfaces that provide user displays of blockchain transactions with the data stored in asset storage 604 and ledger storage 606. For example, Zinder includes screenshots in FIGs. 7A-7H which "are example screen shots of user interfaces that show how **blockchain transactions and their associated data** may be displayed for consumption by a user according to certain example embodiments."

132. Accordingly, it is my opinion that Zinder teaches "imputing at least one measured differential with a descriptive identifier or at least one descriptive identifier to the electronic transaction record of the DCL through data storage and processing on the at least one electronic parallel storage of the differences layer."

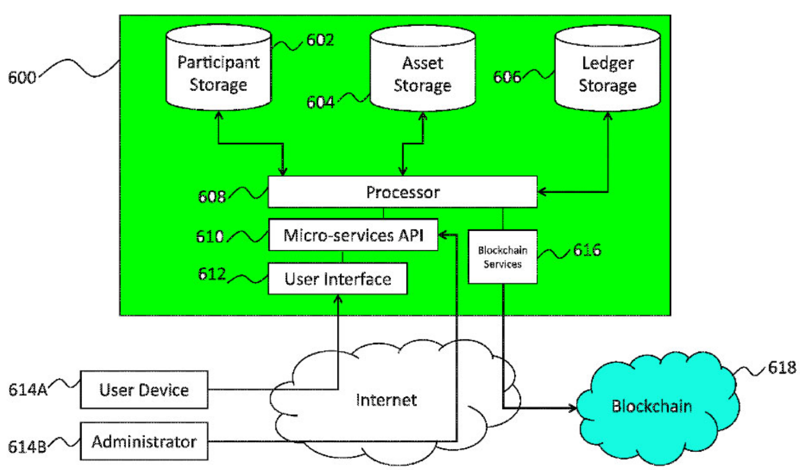
133. In view of the above, it is my opinion that every recitation of claim 1 would have been obvious from Zinder at the time of invention.

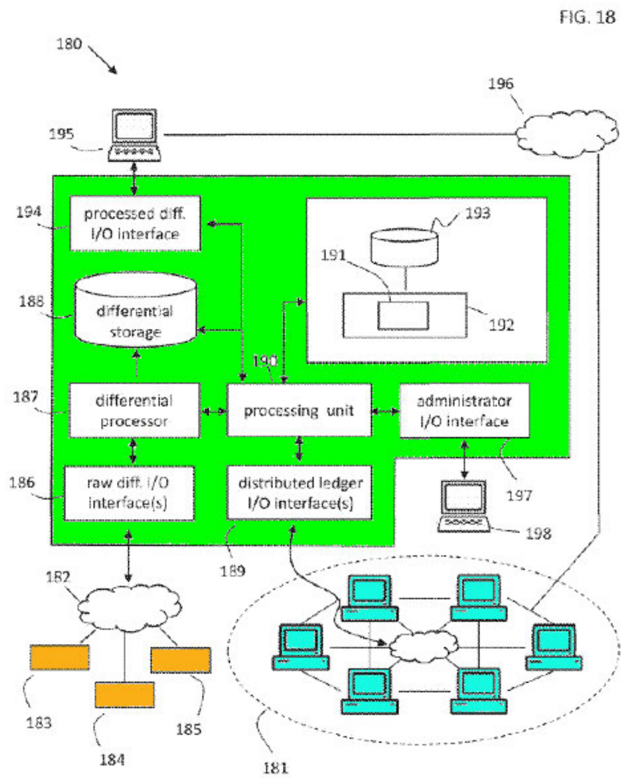
**i. Claim 2**

**1. Claim Recitation 2a.**

| |
|---|
| *2. The method of claim 1, wherein records of the at least one electronic parallel storage of the differences layer are written and stored separately from the distributed electronic ledger containing electronic transaction records,* |

134. As illustrated in the annotated version of FIG. 1 from Zinder, the blockchain 618 is stored separately from asset storage 604 and ledger storage 606 in precisely the same way that differential storage 188 is stored separately from DCL 181, as illustrated in the annotated version of FIG. 18 from Fonss. *See also* EX1001 at ¶ [0013] ("Accordingly, the provenance information that is stored outside of the blockchain (**e.g., in a separate database**) may be represented on the blockchain without including it on the blockchain. ")(emphasis added).






135. Accordingly, it is my opinion that Zinder teaches "wherein records of the at least one electronic parallel storage of the differences layer are written and stored separately from the distributed electronic ledger containing electronic transaction records."

### 2. Claim Recitation 2b.

| |
|---|
| *the records of the at least one electronic parallel storage of the differences layer are encoded for time-sequenced alignment with the electronic transaction records when values from a group comprised of the at least one time-sequenced electronically published data stream and the at least one descriptive differential change in value or specification.* |

136. As explained in Fonss, "through a computer generated timestamp, a timestamp sequenced key, a unique character string, a cryptographic nonce, or similar unique identifier; records of the modular layers which differ in value or

descriptor and time will have a unique alignment with records in the base DCL." As explained in Zinder, the entries in ledger storage 606 are linked to the transactions in blockchain 618:

> Other data that corresponds to the transaction may be added to ledger storage 606 and linked to the created blockchain transaction.

EX1004 at ¶ [0087].

137. Furthermore, the data contained in *at least* ledger storage 606 is time sequenced:

> A record in ledger storage 606 may include source and destination identifiers that are mapped back to respective participants (e.g., stored in participant storage 602), a blockchain transaction ID, the unique identifier for the asset, an asset transaction quantity, a **transaction date (e.g., when the transaction was submitted to the blockchain), a validation date (e.g., when this transaction was ultimately validated by the blockchain)**, a price per share, and/or a price of the asset transaction, etc. . .

EX1004 at ¶¶ [0058], [0087], claim 1 (emphasis added).

138. Finally, the values in ledger storage 606 may change, and such changes are recorded in the ledger storage 606 such that they remain in time-sequence alignment with the values in blockchain 618:

> In certain examples, **the metadata that is stored in the ledger storage may be updated independently of the blockchain transaction that is associated with it.** For example, the SEC

> rule 144 date may be a data field that only exists in ledger storage. Thus, the rule 144 date may be updated without reference to the corresponding blockchain transaction. Other fields in ledger or asset storage may be similarly updated.

EX1004 at ¶ [0116] (emphasis added).

139. Accordingly, it is my opinion that the data contained in *at least* ledger storage 606 "are encoded for time-sequenced alignment with the electronic transaction records when values from a group comprised of the at least one time-sequenced electronically published data stream and the at least one descriptive differential change in value or specification."

140. In view of the above, it is my opinion that every recitation of claim 2 would have been obvious from Zinder at the time of invention.

**ii. Claim 3**

| |
|---|
| *3. The method of claim 1, wherein values and descriptors from a group comprised of the at least one time-sequenced electronically published data stream and the at least one descriptive differential alter the functionality and transactional value of the electronic transaction records of the distributed electronic ledger.* |

141. Based on my reading, it is my opinion that the disclosed techniques of Fonss alter the functionality of the DCL from simply implementing a cryptocurrency to providing additional functionality:

> Known computerized ledgers are principally designed and built for electronic currencies, which did not previously exist, and only exist within the framework of the DCL block chain. Known systems and methods have attempted to extend the DCL to other types of items and

> applications, most of which require a high degree of detailed specification and data overhead. Systems developers are finding that extending the known DCL methods to applications requiring specification requires overly complex bespoke solutions for each application, and that the bespoke solutions create material burdens on networks.
>
> The disclosed embodiment is a departure in systems, storage, method, and data architecture. The disclosed embodiment changes design and methods of data storage and the functionality of a DCL.

*See, e.g.,* EX1001, 8:20-46 (emphasis added).

142. The Zinder techniques also alter the functionality of, for example, the Bitcoin blockchain to "provide a digital asset repository computer system for buyers and sellers to connect and trade privately issued assets." *E.g.,*'EX1004 at ¶ [0015]. Furthermore, the functionality of the digital asset repository computer system 600 of Zinder system provides functionality beyond the sale of such assets, including correcting values that would otherwise be included in an immutable form in the blockchain:

> <u>**In certain examples, an asset transaction may be corrected by the digital asset repository computer system 600**</u>. In certain instances, this may involve creating another blockchain transaction that effectively cancels out the previously submitted blockchain transaction. In certain examples, the metadata that is stored in the ledger storage may be updated independently of the blockchain transaction that is associated with it. <u>**For example, the SEC rule 144 date may be a data**</u>

> **field that only exists in ledger storage. Thus, the rule 144 date may be updated without reference to the corresponding blockchain transaction.** Other fields in ledger or asset storage may be similarly updated. In certain example embodiments, a hash of the information that is not stored as part of the blockchain transaction may be incorporated into the blockchain transaction. For example, each of the extra fields may be concatenated and then hashed. The resulting hash value may be added to the blockchain transaction. This additional verification may prevent changing data fields that are not directly incorporated into the blockchain

EX1004 at ¶ [0116] (emphasis added).

143. According to Fonss, values refer to numerical values while descriptors refer to textual values. *See, e.g.,* EX1001, 13:9-13. Zinder utilizes numerical and textual values to provide the "altered" blockchain functionality I describe above. *E.g.,* EX1004, ¶¶[0083], [0087]. Values such as dates and price information alter the function of the blockchain to provide for the sale of privately issued assets. *See, e.g.,* EX1004, ¶[0087]. Zinder also utilizes descriptors, such as asset types and participant identifiers to provide for the sale of provide for the sale of privately issued assets. *See, e.g.,* EX1004, ¶¶[0083], [0087]. Accordingly, it is my opinion that Zinder discloses that "values and descriptors from a group comprised of the at least one time-sequenced electronically published data stream and the at least one descriptive differential alter the functionality and transactional value of the electronic transaction records of the distributed electronic ledger."

144. In view of the above, it is my opinion that every recitation of claim 3 would have been obvious from Zinder at the time of invention.

**iii. Claim 4**

| |
|---|
| *4. The method of claim 1, wherein values and descriptors from a group comprised of the at least one time-sequenced electronically published data stream and the at least one descriptive differential define the functionality and operative entitlement of the electronic transaction records of the distributed electronic ledger.* |

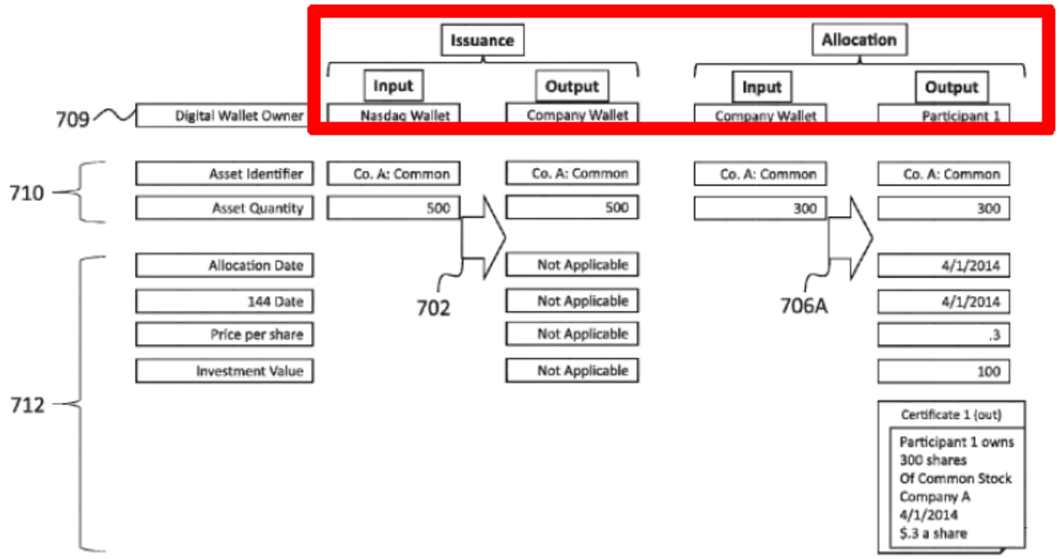
145. As explained in Fonss, an "operative entitlement" refers to how a particular participant is obligated to provide or entitled to receive an asset with respect to a particular asset:

> PSDL **52** is an example where the exogenous data streams are Type B (Brent Crude Oil), and U.S. Dollars currency (USD), and a descriptive difference of +1, where +1 may indicate **an obligation (or operative entitlement) to take delivery of Brent Crude Oil** denominated in USD. PSDL **53** is an example where the exogenous data streams are Type D (Dubai Crude Oil), and Singapore Dollars currency (SGD), and **a descriptive difference of −1, where −1 may indicate an obligation (or operative entitlement) to make delivery of Dubai Crude Oil denominated in SGD.**

EX1001 at 12:15-24 (emphasis added).

146. As illustrated in FIG. 2C of Zinder (annotated below), the descriptive data included in ledger storage 606 includes an indication of the function of a transaction as well as the party issuing an asset (i.e., an obligation) and the party allocated an asset (an operative entitlement):

Fig. 2C




*See also* EX1004, ¶¶ [0046], [0058] ("A record in ledger storage 606 may include source and destination identifiers that are mapped back to respective participants … A record in ledger storage 606 may include source and destination identifiers that are mapped back to respective participants").

147. Accordingly, it is my opinion that the digital asset repository computer system 600 provides for "at least one descriptive differential [that] define[s] the functionality and operative entitlement of the electronic transaction records of the distributed electronic ledger."

148. In view of the above, it is my opinion that every recitation of claim 4 would have been obvious from Zinder at the time of invention.

**iv. Claim 5**

| |
|---|
| *5. The method of claim 1, wherein values from a group consisting of at least one time-sequenced electronically published data stream and at least one descriptive differential are linked to the electronic transaction records within the distributed electronic ledger and the electronic transaction records are homogeneous on the distributed electronic ledger as identified by a timestamp or other unique record identifier.* |

149. As explained above, it is my opinion that asset storage 604 of Zinder is linked to the blockchain via a unique identifier, as is ledger storage 606. Accordingly, the digital asset repository computer system 600 of Zinder includes "values from a group consisting of at least one time-sequenced electronically published data stream and at least one descriptive differential [that] are linked to the electronic transaction records within the distributed electronic ledger."

150. It is also the case that DCL that "are homogeneous on the distributed electronic ledger as identified by a timestamp or other unique record identifier" are notoriously well known in the prior art. First, the homogenous nature of the DCL was admitted to by the Patent Owner in Fonss. EX1001 at 2:46-50 ("Most decentralized electronic ledgers (including those used for electronic currencies) are limited in functionality in that their representational blocks are homogenous and their use of timestamped sequencing is limited to curing the "double spend" problem"). Zinder also provides such electronic transaction records. For example, explained in Zinder, data contained in the blockchain 618 remains the same while the data contained in ledger storage 606 may change. Illustrated in FIG. 2C is the data 710 that is included in the blockchain 618:

> Referring to FIG. 2C**, a blockchain transaction may be created based on a combination of the information represented in fields 709 and 710. The created blockchain transaction is submitted, through blockchain services 616, to the blockchain 618** for validation by blockchain computing nodes that digitally "mine" the transaction. Once validated, the submitted transaction becomes part of an immutable record (the distributed blockchain ledger) that represents creation of this asset.

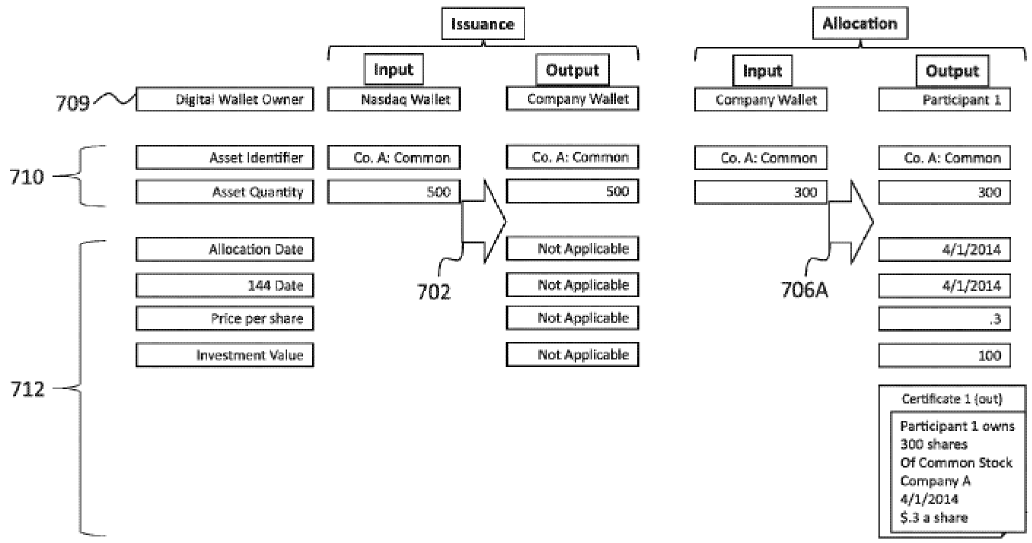
EX1004 at ¶ [0085] (emphasis added).

151. Also illustrated in FIG. 2C is the data 712 included in ledger storage 606:

> **Other data that corresponds to the transaction may be added to ledger storage 606 and linked to the created blockchain transaction. Such information may include the information represented in fields 712 shown in FIG. 2C**. For example, whether the transaction has been validated on the blockchain, what block in the chain the validation is associated with, a rule **144** date of the asset transaction, the price per share of the asset transaction, the investment value of the asset transaction, conditions associated with the asset transaction, etc. . **. . It will be appreciated that these fields may vary based on what type of asset is being transacted and the type of transaction (issuance, transfer, re-classification, cancelation, etc. . . . )**

EX1004 at ¶ [0087] (emphasis added).

Fig. 2C




152. As indicated in the above-quoted language, the information on the blockchain transactions, which is data 710, remains the same, while the data contained in ledger storage 606 "vary based on what type of asset is being transacted and the type of transaction (issuance, transfer, re-classification, cancelation, etc. . . . )." Accordingly, it is my opinion that the digital asset repository computer system 600 provides for "electronic transaction records [that] are homogeneous on the distributed electronic ledger as identified by a timestamp or other unique record identifier."

153. In view of the above, it is my opinion that every recitation of claim 5 would have been obvious from Zinder at the time of invention.

v. **Claim 6**

*6. The method of claim 1, wherein layers of the at least one electronic parallel storage of the differences layer linked are modular and changeable independent of the distributed electronic ledger containing electronic transaction records.*

154. As explained in Fonss, the use of the term "modular" refers to different layers or levels of PSDLs:

> FIG. 3 diagram **30** illustrates an example where multiple modular layers of stored (and operative) differences (the PSDLs) are time sequenced, and where time sequences are aligned with system writing and appending of transaction records in the base DCL individually or in groups (or blocks). **Diagram 30 is an example of the modularity of the system and an illustration in the system's efficiency in storage operations.** The system's PSDLs are modular, and implementations of the system can create entirely new computerized storage of entirely new functional electronic ledger items using already implemented or new DCLs.

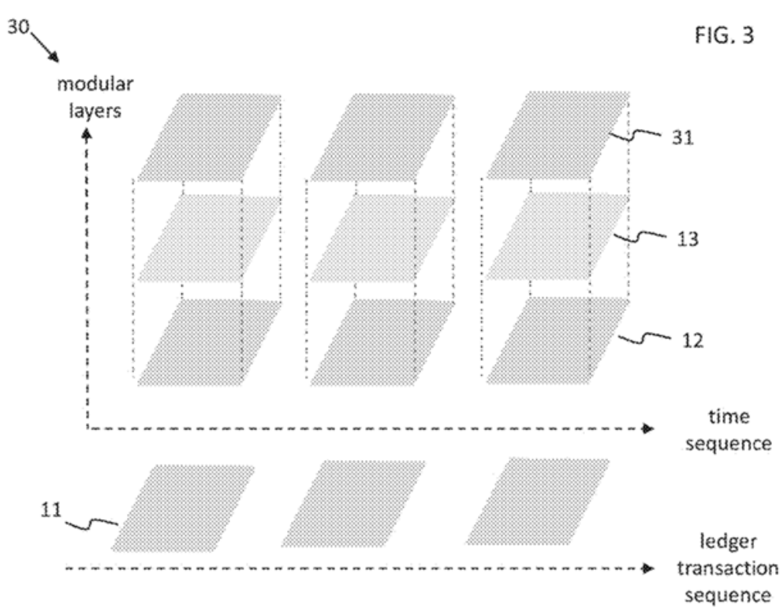



FIG. 3

155. It is my opinion that the techniques of Zinder also provide for modular layers of parallel storage through, for example, asset storage 604 providing a first modular layer of parallel storage and ledger storage 606 providing a second modular layer of parallel storage. Similarly, the different fields of each of asset storage 604 and ledger storage 606 similarly provide modular layers of parallel storage. *See, e.g.,* EX1004, FIG. A-C, ref. num. 712.

156. According to the techniques of Zinder the content of ledger storage 606 is also "changeable" independent of the blockchain 618:

> **In certain examples, an asset transaction may be corrected by the digital asset repository computer system 600**. In certain instances, this may involve creating another blockchain transaction that effectively cancels out the previously submitted blockchain transaction. **In certain examples, the metadata that is stored in the ledger storage may be updated independently of the blockchain transaction that is associated with it. For example, the SEC rule 144 date may be a data field that only exists in ledger storage. Thus, the rule 144 date may be updated without reference to the corresponding blockchain transaction.** Other fields in ledger or asset storage may be similarly updated. In certain example embodiments, a hash of the information that is not stored as part of the blockchain transaction may be incorporated into the blockchain transaction. For example, each of the extra fields may be concatenated and then hashed. The resulting hash value may be added to the blockchain transaction.

> This additional verification may prevent changing data fields that are not directly incorporated into the blockchain

EX1004 at ¶ [0116] (emphasis added).

157. Accordingly, Zinder discloses that "layers of the at least one electronic parallel storage of the differences layer linked are modular and changeable independent of the distributed electronic ledger containing electronic transaction records."

158. In view of the above, it is my opinion that every recitation of claim 6 would have been obvious from Zinder at the time of invention.

**vi. Claim 7**

159. Claim 7 is generally directed to a system claim whose recitations are analogous to those of claim 1.

**1. Claim Recitation 7a**

| |
|---|
| *a system having a memory device, the memory device further including a Random Access Memory (RAM);* |

160. It is my opinion that Zinder includes a memory device further including a RAM, as described as follows:

> FIG. 8 is a block diagram of an exemplary computing system 800 according to certain example embodiments (e.g., a digital asset repository computer system as described in FIGS. 1-6, a user device as shown in FIG. 1, 2B, 3A, or 4, a computing node that is part of a distributed computing system used to process and maintain a blockchain, one computing system out of multiple computing systems

> that make up a computer system—such as the digital asset repository computer system as described herein, etc. . . . ). Computing system 1300 includes a processing system 1302 with CPU 1, CPU 2, CPU 3, CPU 4, a system bus 1304 that communicates with **RAM 1306,** and storage 1308. The storage 1308 can be magnetic, flash based (e.g., for a mobile client device), solid state, or other storage technology. The system bus1304 communicates with user input adapter 1310(e.g., PS/2, USB interface, or the like) that allows users in input commands to computing system 1300 via a user input device 1312 (e.g., a keyboard, mouse, touch panel, or the like). The results of the processing may be displayed to a user on a display 1316 (e.g., an LCD) via display interface 1314 (e.g., a video card or the like).

EX1004 at ¶ [0146] (emphasis added).

### 2. Claim Recitation 7b

| |
|---|
| *a processor connected to the memory device,* |

161. It is my opinion that Zinder also provides for a processor connected to the memory device:

> FIG. 8 is a block diagram of an exemplary computing system 800 according to certain example embodiments (e.g., a digital asset repository computer system as described in FIGS. 1-6, a user device as shown in FIG. 1, 2B, 3A, or 4, a computing node that is part of a distributed computing system used to process and maintain a blockchain, one computing system out of multiple computing systems that make up a computer system—such as the digital asset repository computer system as described herein, etc. . . . ). **Computing system 1300 includes a processing system 1302 with CPU 1, CPU 2, CPU**

> **<u>3, CPU 4, a system bus 1304 that communicates with RAM 1306,</u>** and storage 1308. The storage 1308 can be magnetic, flash based (e.g., for a mobile client device), solid state, or other storage technology. The system bus1304 communicates with user input adapter 1310(e.g., PS/2, USB interface, or the like) that allows users in input commands to computing system 1300 via a user input device 1312 (e.g., a keyboard, mouse, touch panel, or the like). The results of the processing may be displayed to a user on a display 1316 (e.g., an LCD) via display interface 1314 (e.g., a video card or the like).

EX1004 at ¶ [0146] (emphasis added).

### 3. Claim Recitation 7c

| |
|---|
| *create at least one electronic parallel storage of a differences layer linked to a distributed computer ledger (DCL), both the electronic parallel storage of the differences layer and the DCL containing a respective electronic transaction record, a time-sequenced value, or a time-sequenced string;* |

162. Recitation 7c is analogous to recitation 1a, and therefore, is disclosed by Zinder as set forth above in my discussion of recitation 1a.

### 4. Claim Recitations 7d and 7e

| |
|---|
| *access a value from a group comprising of at least one time-sequenced electronically published data stream and at least one descriptive differential;* |
| *store the values from a group comprising of at least one time-sequenced electronically published data stream and at least one descriptive differential on the at least one electronic parallel storage of the differences layer;* |

163. Recitations 7d and 7e are analogous to recitation 1b, and therefore, are disclosed by Zinder as set forth above in my discussion of recitation 1b.

### 5. Claim Recitation 7f

| |
|---|
| *align and link a stored value record of the at least one electronic parallel storage of the differences layer to the electronic transaction record of the DCL utilizing at least one time sequenced value, string, code, or key; and* |

164. Recitation 7f is analogous to recitations 1d and 1e, and therefore, is disclosed by Zinder as set forth as set forth above in my discussion of recitations 1d and 1e. .

#### 6. Claim Recitation 7g

*impute at least one measured differential with a descriptive identifier or at least one descriptive identifier to the electronic transaction record of the DCL.*

165. Recitation 7g is analogous to recitation 1f, and therefore, is disclosed by Zinder as set forth as set forth above in my discussion of recitation 1f.

166. In view of the above, it is my opinion that every recitation of claim 7 would have been obvious from Zinder at the time of invention of Fonss.

### vii. Claim 8

*the memory device includes a separation of storage of the differences layer.*

167. As discussed above with reference to claim 2, the blockchain 618 is stored separately from asset storage 604 and ledger storage 606 in precisely the same way that differential storage 188 is stored separately from DCL 181. Therefore, Zinder provides a "memory device [that] includes a separation of storage of the differences layer."

168. In view of the above, it is my opinion that every recitation of claim 8 would have been obvious from Zinder at the time of invention.

### viii. Claim 9

*the separation of storage is between the electronic transaction record of the DCL and the differences layer.*

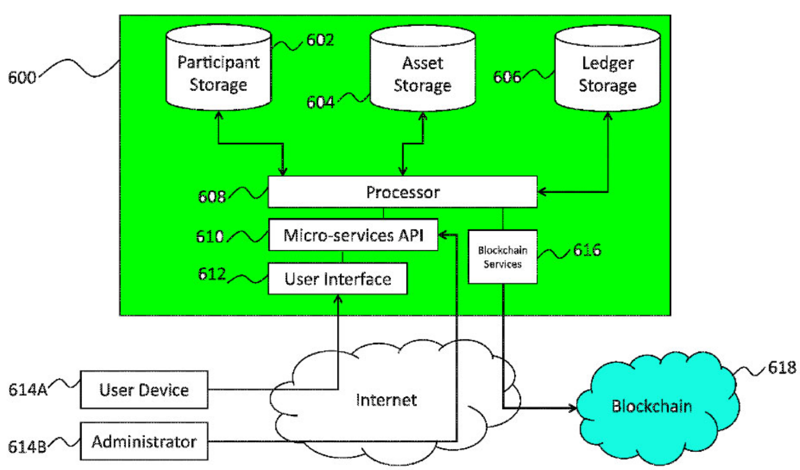
169. As discussed above with reference to claim 2, the blockchain 618 is stored separately from asset storage 604 and ledger storage 606 in precisely the same way that differential storage 188 is stored separately from DCL 181. Therefore, Zinder provides a "separation of storage [that] is between the electronic transaction record of the DCL and the differences layer."

170. In view of the above, it is my opinion that every recitation of claim 9 would have been obvious from Zinder at the time of invention.

**ix. Claim 10**

| |
|---|
| *a plurality of differences layer is parallel stored to create a parallel storage of differences layer (PSDL).* |

171. As illustrated in the annotated version of FIG. 1 from Zinder, asset storage 604 and ledger storage 606 are stored in parallel. Accordingly, the digital asset repository computer system 600 of Zinder provides "a plurality of differences layer is parallel stored to create a parallel storage of differences layer (PSDL)."



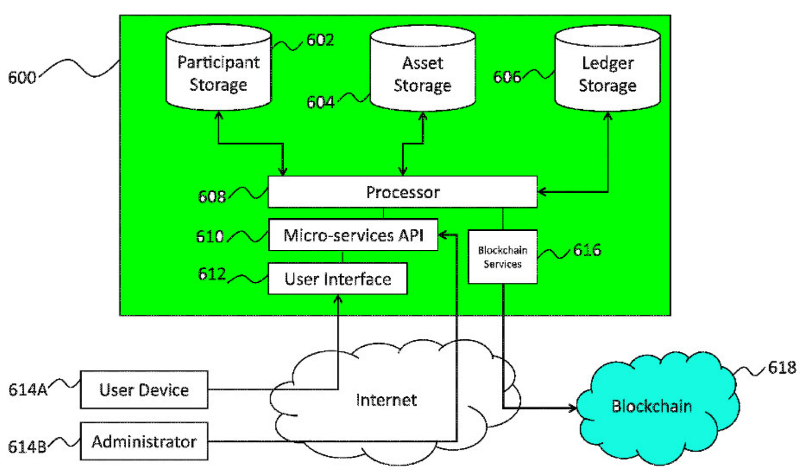
*See also* EX1004 at ¶¶ [0052], [0057]-[0058], (describing asset storage and ledger storage providing a parallel, fully auditable record of every interaction on blockchain 618). Similarly, the different fields of each of asset storage 604 and ledger storage 606 are parallel stored to create "a parallel storage of differences layer (PSDL)." *See, e.g.,* EX1004, FIG. A-C, ref. num. 712.

172. In view of the above, it is my opinion that every recitation of claim 10 would have been obvious from Zinder at the time of invention.

**x. Claim 11**

| |
|---|
| *the difference layer is stored on a centralized storage or a decentralized storage apart from the electronic transaction record of the DCL.* |

173. As illustrated in the annotated version of FIG. 1 from Zinder, the blockchain 618 is stored separately from asset storage 604 and ledger storage 606 in precisely the same way that differential storage 188 is stored separately from DCL 181, as illustrated in the annotated version of FIG. 18 from Fonss.



174. Furthermore, Zinder discloses "a centralized computer system that interfaces with a blockchain according to certain example embodiments. *See, e.g.,* EX1004 at ¶¶ [0050], [0056], [0058], [0080], [0085], [0088], [0098]-[0101]. Accordingly, Zinder provides a "difference layer [that] is stored on a centralized storage or a decentralized storage apart from the electronic transaction record of the DCL."

175. In view of the above, it is my opinion that every recitation of claim 11 would have been obvious from Zinder at the time of invention.

**xi. Claim 12**

| |
|---|
| *the electronic transaction record of the DCL is impacted by a parallel storage of differences layer.* |

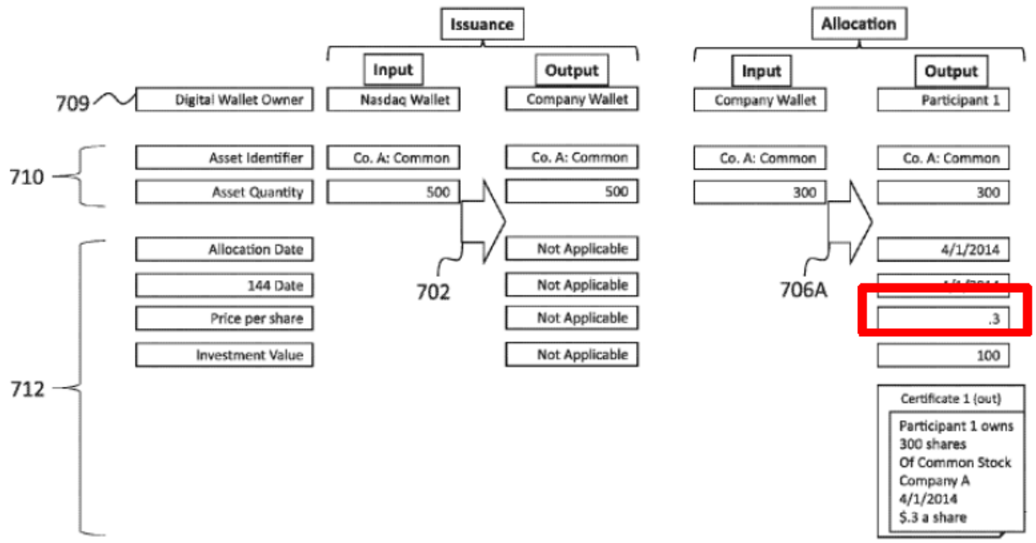
176. As described in Fonss, the PSDLs impact the DCL by applying values on the PSDL to the DCL transactions, such as by performing some type of operation on a value stored in the DCL based on the value stored in the PSDL:

> Continuing with FIG. 6 diagram **60**, one example of applying a PSDL to the units of the base DCL **11** is through the use of computer mathematic operators, where each layer's numerical difference storage layer is applied to produce an aggregate impact.

EX1001 at 12:64-13:1.

177. As illustrated in FIG. 2C, the data 712 contained in ledger storage 606 is applied to the blockchain transaction data 710 to indicate the impact of the ledger storage data 606, in this particular example, the price-per-share of the transaction.

Fig. 2C




178. For example, the price per share value in ledger storage 606 operates on the asset quantity value stored in blockchain 618 via multiplication to indicate a total value of the transaction such that the "the electronic transaction record of the DCL is impacted by a parallel storage of differences layer." *See, e.g.*, EX1004 at ¶ [0087].

179. Accordingly, Zinder provides an "electronic transaction record of the DCL [that] is impacted by a parallel storage of differences layer."

180. In view of the above, it is my opinion that every recitation of claim 12 would have been obvious from Zinder at the time of invention.

### xii. Claim 13

| |
|---|
| *The system of claim 12, wherein impact is done from each of the parallel storage of differences layer (PSDL) in an individual manner.* |

181. As illustrated in FIG. 2C from Zinder, numerous values from data 712 are applied to the blockchain transaction data 710 in an individual manner, separate from other data values. For example, the validation date and 144 date values are applied to the blockchain transaction data 710 in an individual manner. *See, e.g.,* EX1004 at ¶¶ [0058], [0087], [0116]. Accordingly, Zinder provides "impact [that] is done from each of the parallel storage of differences layer (PSDL) in an individual manner."

182. In view of the above, it is my opinion that every recitation of claim 13 would have been obvious from Zinder at the time of invention.

**xiii. Claim 14**

| |
|---|
| *14. The system of claim 13, wherein the parallel storage of differences layer (PSDL) has a time-sequence entry, and each time-sequenced entry is independent in the PSDL.* |

183. The data contained in *at least* ledger storage 606 is time sequenced:

> A record in ledger storage 606 may include source and destination identifiers that are mapped back to respective participants (e.g., stored in participant storage 602), a blockchain transaction ID, the unique identifier for the asset, an asset transaction quantity, a **<u>transaction date (e.g., when the transaction was submitted to the blockchain), a validation date (e.g., when this transaction was ultimately validated by the blockchain)</u>**, a price per share, and/or a price of the asset transaction, etc. . .

EX1004 at ¶¶ [0058], [0087], claim 1 (emphasis added).

184. Additionally, each entry in ledger storage 606 is individually and independently linked to a blockchain transaction in blockchain 618:

> **Other data that corresponds to the transaction may be added to ledger storage 606 and linked to the created blockchain transaction. Such information may include the information represented in fields 712 shown in FIG. 2C**.

EX1004 at ¶ [0087] (emphasis added).

185. Accordingly, transaction ledger 606 provides a "parallel storage of differences layer (PSDL) [that] has a time-sequence entry, and each time-sequenced entry is independent in the PSDL.

186. In view of the above, it is my opinion that every recitation of claim 14 would have been obvious from Zinder at the time of invention.

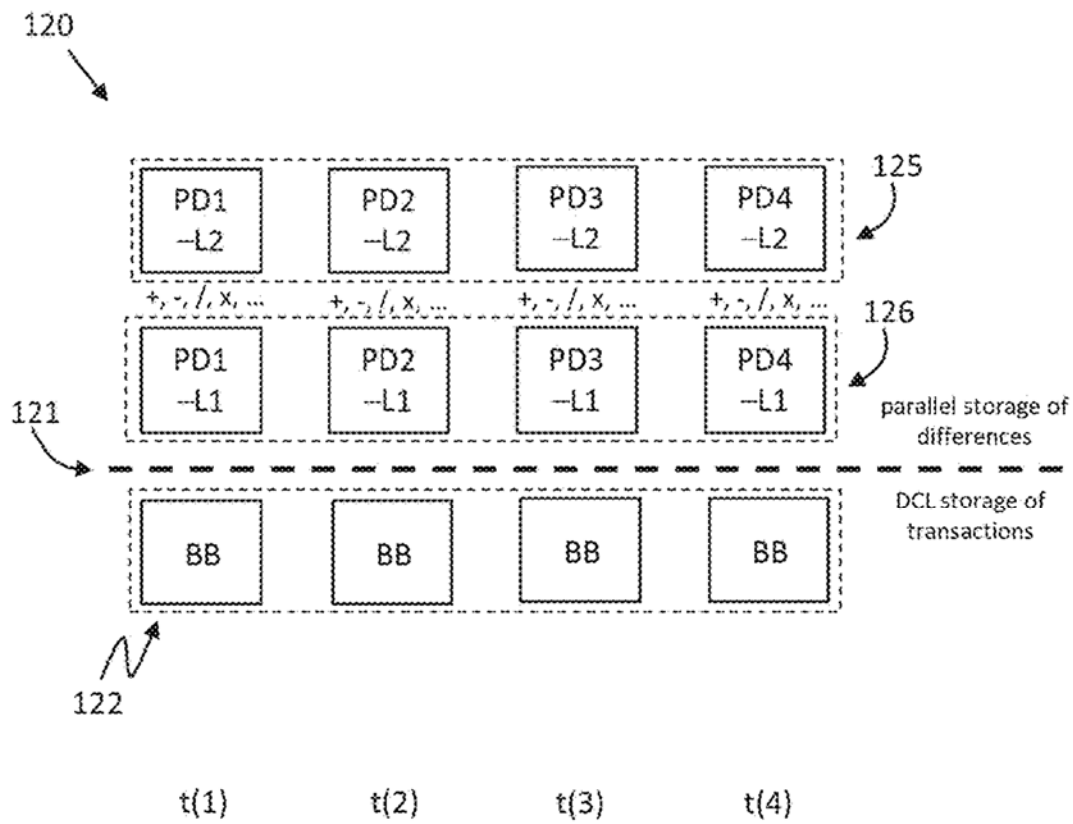
### xiv. Claim 15

| |
|---|
| *15. The system of claim 12, wherein impact is done from the parallel storage of differences layer (PSDL) in a cumulative manner, or a compounding manner, wherein impact is cumulative based on a time indicator.* |

187. As explained in Fonss, a "cumulative impact … based on a time indicator" refers to a PSDL impact that cumulates as time moves "from left to right" in FIG. 12 (reproduced below), while a compounding impact refers to two an impact generated from two or more PSDL differentials. *See, e.g.,* EX1001, 15:40:53. It is my understanding that claim 15 can be shown to be invalid if only one of these types

of impacts is shown to be in the prior art. Nevertheless, it is my opinion that ledger storage 606 provides both "cumulative" and "compounding" impacts.

FIG. 12




188. As explained in Zinder, "A record in ledger storage 606 may include … a transaction date (e.g., when the transaction was submitted to the blockchain), a validation date (e.g., when this transaction was ultimately validated by the blockchain)." EX1004, ¶ [0058]. These descriptive differences provide a "cumulative impact … based on a time indicator" to show the time it took the transaction to be validated on the blockchain. As also explained in Zinder, "A record

in ledger storage 606 may include … an asset transaction quantity, … a price per share." EX1004, ¶ [0058]. By applying these descriptive differences to the transaction records in the blockchain 618, ledger storage 606 may provide a compounding impact to derive, for example, a total value of a transaction. Another example of a cumulative impact provided by Zinder is the description of how computer system 600 may be used to "show the full timeline of a given resource, asset, or equity that is being transferred among the listed participants." EX1004 at ¶ [0070]. In other words, the contents of asset storage 604 and ledger storage 606 are applied cumulatively to illustrate a cumulative impact of their contents on a particular asset and multiple blockchain transactions.

189. In view of the above, it is my opinion that every recitation of claim 15 would have been obvious from Zinder at the time of invention.

**xv. Claim 16**

| |
|---|
| *16. The system of claim 15, wherein the parallel storage of differences layer (PSDL) has a time-sequence entry, and each time-sequenced entry is independent or dependent in the PSDL.* |

190. It is my opinion that claim 16 essentially covers every embodiment of time sequenced entries in a PSDL – the entries will either be dependent or

independent (i.e., not dependent).[7] Regardless, the entries in ledger storage 606 are each independently linked to a transaction in blockchain 618. *See, e.g.,* EX1004 at ¶¶ [0058], [0087], claim 1 (indicating time-sequenced entries in ledger storage 606). Therefore, it is my opinion that the elements of claim 16 are disclosed in Zinder.

191. In view of the above, it is my opinion that every recitation of claim 16 would have been obvious from Zinder at the time of invention.

**xvi. Claim 17**

*17. The system of claim 7, wherein the difference layer is stored on a distributed network, a centralized network, or a decentralized network, and wherein the difference layer is stored apart from the electronic transaction record of the DCL.*

192. Claim 17 is analogous to claim 11, and therefore, Zinder discloses the features of claim 17 for analogous reasons. In view of the above, it is my opinion that every recitation of claim 17 would have been obvious from Zinder at the time of invention.

**xvii. Claim 18**

*18. The system of claim 17, wherein the electronic transaction record of the DCL is impacted by the differences layer.*

---

7 See, e.g., https://en.wikipedia.org/wiki/Law_of_excluded_middle ("In logic, the law of excluded middle (or the principle of excluded middle) states that for every proposition, either this proposition or its negation is true.")

193. Claim 18 is analogous to claim 12, and therefore, Zinder discloses the features of claim 18 for analogous reasons. In view of the above, it is my opinion that every recitation of claim 18 would have been obvious from Zinder at the time of invention.

**xviii. Claim 19**

194. Claim 19 is a software claim that is analogous to claims 1 and 7.

**1. Recitation 19a**

| |
|---|
| *19. A non-transitory computer readable storage medium, comprising storage, retrieval, modification, and linking system software which instructs at least one computer processor residing on a specialized computer system to implement a process to:* |

195. Zinder teaches the use of software to implement the disclosed techniques. EX1004 at ¶ [0146].

196. Therefore, it is my opinion that Zinder teaches the elements of recitation 19a.

**2. Recitation 19b**

| |
|---|
| *create at least one electronic parallel storage of a differences layer linked to a distributed computer ledger (DCL) containing an electronic transaction record arranged by a time-sequenced value or time-sequenced string, wherein the at least one electronic parallel storage of the differences layer accesses and stores values from a group consisting of at least one time-sequenced electronically published data stream and a list of descriptive differentials, and wherein at least one differences processing engine running on a specialized computer system creates and stores parameters from a group consisting of measurement differences and descriptive differences;* |

197. Recitation 19b is generally analogous to recitations 1a and 1b. Recitation 19b differs from 1a and 1b in that it recites "**a list** of descriptive

differentials," as opposed to the "at least one descriptive differential" recited in recitation 1b. As used in Fonss, a "list of descriptive differentials" refers to a set of possible descriptive differential values. *See, e.g.,* EX1001 at 14:38-40, 15:55-58. It is my opinion that Zinder provides for such a set of possible descriptive differentials, such as series A or series B asset types. *E.g.,* EX1004 at ¶¶[0057], [0060], [0071]

198. Therefore, it is my opinion that Zinder discloses the features of recitation 19b for analogous reasons.

### 3. Recitation 19c

| |
|---|
| *store the DCL containing the electronic transactions records on at least one of a distributed network of connected independent computers or a decentralized network of computers wherein the electronic transaction records are time sequenced, and the writing or appending of the electronic transaction records is performed on the distributed network of connected independent computers or the decentralized network of computers;* |

199. Recitation 19c is analogous to recitation 1c. Therefore, it is my opinion that Zinder discloses the features of recitation 19c for analogous reasons.

### 4. Recitation 19d

| |
|---|
| *store the at least one electronic parallel storage of the differences layer on at least one of a centralized storage device controlled by the specialized computer system or a decentralized storage device for increasing functionality and utility of the DCL, reducing data storage requirements, eliminating transmission of redundant data, and improving data security;* |

200. Recitation 19d is analogous to recitation 1d. Therefore, it is my opinion that Zinder discloses the features of recitation 19d for analogous reasons.

### 5. Recitation 19e

> *link the transaction records in the DCL to the at least one electronic parallel storage of the differences layer utilizing at least one time sequenced value, string, code, or key; and*

201. Recitation 19e is analogous to recitation 1e. Therefore, it is my opinion that Zinder discloses the features of recitation 19e for analogous reasons.

**1. Recitation 19f**

> *impute at least one measured differential with a descriptive identifier or at least one descriptive identifier to the electronic transaction records of the DCL, wherein a data storage and a processing of the imputing resides on a centralized device or a decentralized device controlled by the specialized computer system.*

202. Recitation 19f is analogous to recitation 1f with the added language that "a data storage and a processing of the imputing resides on a centralized device or a decentralized device controlled by the specialized computer system." As described above with reference to recitation 1d, asset repository computer system 600 of Zinder, which provides the linking corresponding to the "imputing" of recitation 19e resides on a centralized computer system. *See, e.g.,* EX1004 at ¶¶ [0042], [0043]

203. Therefore, it is my opinion that Zinder discloses the features of recitation 19f for reasons analogous to those presented above with respect to recitations 1d and 1f.

**xix. Claim 20**

204. Claim 20 is analogous claims 17 and 18. Therefore, it is my opinion that Zinder discloses the features of claim 20 for analogous reasons.

**b) Ground 2**

205. As discussed above in ground 1 with respect to claim 1, the "at least one time-sequenced electronically published data stream" and the "at least one descriptive differential" are recited in the alternative. As explained above, both alternatives would have been obvious from Zinder, but Ground 1 focuses on the "at least one descriptive differential." For completeness, I provide the following second ground based on Zinder in view of Toll and Zhang, which focuses on the "at least one time-sequenced electronically published data stream" element.

**i. Obviousness Rationale**

206. As an initial matter, I shall address the obviousness rationale for combining the teachings of the Zinder, Toll and Zhang. As discussed in the background section above, both Zinder and Toll are Nasdaq publications directed to computer systems for recording financial instrument transactions in blockchains. EX1004 at ¶¶ [0037], [0146]; EX1005 at ¶¶ [0006]-[0007]. Moreover, Toll explicitly teaches that its system may implement the techniques of Zinder, and in fact, incorporates the contents of Zinder by reference:

> Certain example embodiments described herein may incorporate the blockchain techniques discussed in U.S. Application No. 62/270,560 and U.S. Publication No. 2017/0005804, the entire contents of which are hereby incorporated by reference.

EX1005 at ¶[0025].

207. Accordingly, even if it is assumed *arguendo* that Toll does not already contain all the teachings of Zinder, it is undeniable that it would be obvious to the skilled artisan to combine the teachings of the two references due *at least* to the explicit instruction in Toll to do so.

208. As also discussed in the background section above, Toll teaches that its clearing house computer (CHC) system 100 may serve as an oracle for financial instrument price information, a trusted entity that provides external data, including external data received from electronically published data streams, to blockchains. EX1005 at ¶[0039]. According to the specific examples discussed in Toll, the data provided to the blockchain via the CHC system 100 may include financial instrument price information. *Id.* Or, as described in the reference:

> **[T]he techniques used herein may use a trusted oracle technique** where the blockchain (or more particularly the smart contracts on the blockchain) only trust events (e.g., blockchain transactions) **from a "trusted" source (e.g., the CHC system 100** or another computer system or source). This may be accomplished by having the CHC system 100 validate and/or sign all of the events that are submitted (e.g., as blockchain transactions) to the blockchain 114. In the running example, the smart contract may thus have additional programmatic logic to only accept events if such events have been signed by the private key of the CHC system 100. **Events that are provided by a trusted oracle may include** a current margin fee, the current weather, **the current price of an instrument traded on an**

> **external system**, a closing price of an index or other instrument, and the like. In certain examples, multiple trusted oracles may be used, with each trusted source being responsible for certain types of events.

EX1005 at ¶[0039] (emphasis added).

209. In other words, the CHC system 100 of Toll serves as an oracle for certain use cases, particularly for providing financial instrument price information to blockchain transactions. Absent from Toll is a description of how the CHC system 100 receives the external data that it provides as an oracle. However, Zhang is directed to how a blockchain data source, such as an oracle, couples external financial instrument price data streams to blockchain transactions:

> The processing platform implements a trusted bridge configured for at least temporary **coupling between one or more data sources and a smart contract program of a blockchain**.
>
> …
>
> We provide three examples that demonstrate TC's capabilities: (1) A financial derivative (cash-settled put option) that consumes stock ticker data
>
> …
>
> We model the authentication of on-chain messages by an oracle.

EX1006 at Abstract, ¶¶ [0116], [0136].

210. Furthermore, as I explain in the background section above, Zhang is, in fact, directed to oracles, and simply uses the term "oracle" sparingly or describes

oracles with other terms due to the early priority date for the publication relative to other oracle disclosures.

211. Accordingly, it is my opinion that it would have been obvious to combine the teachings of Zhang with those of Zinder and Toll as providing an example of how the oracle of Toll receives data from external data sources. Specifically, Zhang discloses established functions for how an oracle, such as the oracle provided by the CHC system in Toll, provides an interface between external data sources and blockchain transaction. In other words, combining the teachings of Zhang with those of Zinder and Toll is nothing more "than the predictable use of prior art elements according to their established functions" – something I understand to be the hallmark of an obvious combination. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 401 (2007) ("A court must ask whether the improvement is more than the predictable use of prior art elements according to their established functions.").

**ii. Claim 1**

**1. Claim Recitation 1a.**

| |
|---|
| *creating at least one electronic parallel storage of a differences layer linked to a distributed computer ledger (DCL); the DCL contains an electronic transaction record by a time-sequenced value or a time-sequenced string;* |

212. As explained above in my discussion of Ground 1, Zinder discloses these features of claim 1 through its blockchain 618, asset storage 604 and ledger storage 606. Furthermore, Toll and Zhang provide additional descriptions of blockchains, which provide "an electronic transaction record by a time-sequenced

value or a time-sequenced string." *E.g.,* EX1005 *passim;* EX1006, *passim.* Accordingly, it is my opinion that this recitation would have been obvious from Zinder, Toll and Zhang, whether considered alone or in combination.

### 1. Claim Recitation 1b

| |
|---|
| *accessing and storing a value through the at least one electronic parallel storage of the differences layer, the value from a group comprising of at least one time-sequenced electronically published data stream and at least one descriptive differential, wherein at least one differences processing engine running on a specialized computer system creates and stores parameters from a group comprised of a measurement differences and a descriptive differences;* |

*Accessing and Storing a Value Through the at least one Electronic PSDL*

213. As explained above in Ground 1, Zinder teaches "accessing and storing a value through the at least one electronic parallel storage of the differences layer" through asset storage 604 and ledger storage 606.

*The Value from a Group Comprising of at least One Time-Sequenced Electronically Published Data Stream and at least One Descriptive Differential*

214. For purposes of this ground of rejection, I focus my opinion on the alternative claim language of "the value from a group comprising of at least one time-sequenced electronically published data stream." However, because Zinder is included in this ground, this ground also discloses all of the features of claim 1 directed to the "at least one descriptive differential" for all of the reasons set forth above in ground 1.

215. As explained in the claim construction section above, "at least one time-sequenced electronically published data stream" would be understood by the skilled

artisan to mean "a stream of data, from an available electronic source, indicating a changeable value at points in time." As explained in Fonss "a time-sequenced data stream may relate to **prices**, trade flows, trade variables, shipping details, economic variables, performance measures or **other numerical or descriptive data**." EX1001 at 17:5-8 (emphasis added).

216. Ledger storage 606 of Zinder stores prices … and/or other numerical or descriptive data":

> A record in ledger storage 606 may include source and destination identifiers that are mapped back to respective participants (e.g., stored in participant storage 602), a blockchain transaction ID, the unique identifier for the asset, an asset transaction quantity, a transaction date (e.g., when the transaction was submitted to the blockchain), a validation date (e.g., when this transaction was ultimately validated by the blockchain), **a price per share, and/or a price of the asset transaction**, etc. . . .

EX1004 at ¶ [0058] (emphasis added).

217. The CHC system 100 of Toll, which "incorporate[s] the blockchain techniques discussed in [Zinder]" unsurprisingly stores "prices … and/or other numerical or descriptive data" that are applied to blockchain transactions:

> Events that are provided by a trusted oracle may include a current margin fee, the current weather, th**e current price of an instrument** traded on an external system, **a closing price of an index** **or other instrument**, **and the like**. In certain examples, multiple trusted oracles

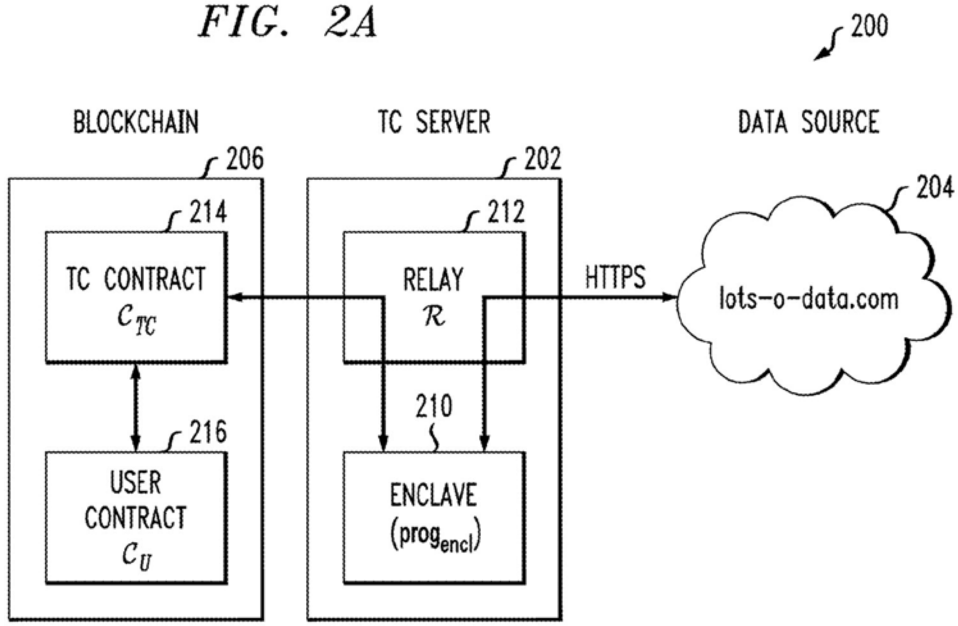
may be used, with each trusted source being responsible for certain types of events.

EX1005 at ¶ [0039] (emphasis added).

218. To complete this analysis, it should be determined whether it would have been obvious for the "prices … and/or other numerical or descriptive data" used in the digital asset repository computer system 600 of Zinder and the CHC system 100 of Toll to have come from "an electronically published data stream." It is my opinion that these features would have been obvious from Zhang.

219. Reproduced below is FIG. 2A from Zhang which illustrates how TC server 202 receives data from a data stream data source and serves as an oracle providing this data stream to a blockchain system. Specifically, TC server 202 receives data from data source 204 using the secure hypertext transfer protocol (HTTPS). EX1006 at ¶ [0029]. HTTPS is an internet communication protocol, and therefore, represents electronic data. *See also* EX1006 at ¶¶ [0029], [0060], [0062], [0078], [0082].

*FIG. 2A*




220. Furthermore, Zhang explicitly describes the data received via HTTPs as coming in the form of data streams:

> TC exploits an important feature of HTTPS, namely that it can be partitioned into interoperable layers: an HTTP layer interacting with web servers, a TLS layer handling handshakes and secure communication, and a Transmission Control Protocol (TCP) layer **providing reliable data streams**.

EX1006 at ¶ [0082] (emphasis added).

221. Finally, Zhang explicitly describes receiving "prices … and/or other numerical or descriptive data" in the form of "time-sequenced" data. Specifically, Zhang provides an example in which its electronic data source is a "stock ticker data." EX1006 at Abstract, ¶¶ [0116], [0136]. It is my opinion that the skilled artisan would understand that "stock ticker data" is a report of the price for certain

securities, updated continuously throughout the trading session by the various stock exchanges. Accordingly, it is my opinion that it would have been obvious from Zhang for the "prices … and/or other numerical or descriptive data" the digital asset repository computer system 600 of Zinder and the CHC system 100 of Toll to have been acquired from the same "time-sequenced electronically published data stream" used in Zhang.

*at least one differences processing engine running on a specialized computer system creates and stores parameters from a group comprised of a measurement differences and a descriptive differences*

222. As explained in my claim construction section above, a "measurement difference" relates to time-sequenced "difference(s)" or "differential(s)" from a published data stream rather than descriptive supplementary data. Accordingly, it is my opinion that "a specialized computer system creates and stores parameters from a group comprised of a measurement differences and a descriptive differences" refers to a computer system configured to create and store, in the PSDL, "the value from … at least one time-sequenced electronically published data stream." Zinder provides such as specialized computer system through digital asset repository computer system 600 which stores "prices … and/or other numerical or descriptive data" in ledger storage 606:

> A record in ledger storage 606 may include … **a price per share, and/or a price of the asset transaction**, etc. . . .

EX1004 at ¶ [0058] (emphasis added).

223. As discussed above, it is my opinion that it would have been obvious for the digital asset repository computer system 600 to have acquired this "prices … and/or other numerical or descriptive data" from the time-sequenced electronically published data stream utilized by TC server 202 of Zhang. Accordingly, "at least one differences processing engine running on a specialized computer system creates and stores parameters … of a measurement difference[]" would have been obvious at the time of invention from the teachings of Zinder, Toll and Zhang.

### 1. Claim Recitation 1c

> *storing the DCL containing an electronic transactions record on at least one of a distributed network of connected independent computers or a decentralized network of computers wherein the electronic transaction record is time sequenced, and a writing or an appending of the electronic transaction records is performed on the distributed network of connected independent computers or the decentralized network of computers;*

224. As explained with respect to recitation 1c in Ground 1, Zinder discloses these features of claim 1 through its blockchain 618, asset storage 604 and ledger storage 606.

### 1. Claim recitation 1d

> *storing the at least one electronic parallel storage of the differences layer on at least one of a centralized storage device controlled by the specialized computer system or a decentralized storage device controlled by the specialized computer system for increasing functionality and utility of the DCL, reducing data storage requirements, eliminating transmission of redundant data, and improving data security;*

225. As explained with respect to recitation 1d in Ground 1, Zinder discloses these features of claim 1 through its blockchain 618, asset storage 604 and ledger storage 606.

**1. Claim Recitation 1e**

*linking the electronic transaction record in the DCL to records of the at least one electronic parallel storage of the differences layer utilizing at least one time sequenced value, string, code, or key; and*

226. As explained with respect to recitation 1e in Ground 1*,* Zinder discloses these features of claim 1 through its blockchain 618, asset storage 604 and ledger storage 606.

**1. Claim Recitation 1f**

*imputing at least one measured differential with a descriptive identifier or at least one descriptive identifier to the electronic transaction record of the DCL through data storage and processing on the at least one electronic parallel storage of the differences layer.*

227. As explained in Fonss, "imputing" may be performed through linked storage systems:

> The disclosed embodiment is a departure in systems, storage, method, and data architecture. The disclosed embodiment changes design and methods of data storage and the functionality of a DCL. The disclosed embodiment is partially based on the concepts: (i) electronic transactions within a DCL can be independent and separately processed from the data items required to specify a value, disposition, distribution, or resolution of a unit of the DCL, (ii) direct processing of a DCL and available network and system capacity must be directed at the highest levels of transaction and execution speed, rather than DCL internal specification, and (iii) many real world applications of DCL will relate to already specified real world objects, and the articulation of those items can generally be dynamically **<u>imputed to the DCL interests through linked and modular storage systems.</u>**

EX1001, 8:43-57 (emphasis added).

228. Accordingly, it is my opinion that Zinder teaches the imputation of measured differentials (e.g., "prices … and/or other numerical or descriptive data") to electronic transaction records of a DCL through the linkage of asset storage 604 and/or ledger storage 606 to blockchain 618:

> The information stored in ledger storage may include the blockchain transaction ID, a reference to the source and destination digital wallets (or the unique identifiers), an asset identifier, and an amount of the asset that is subject to the transaction. **Other data that corresponds to the transaction may be added to ledger storage 606 and linked to the created blockchain transaction**. Such information may include the information represented in fields **712** shown in FIG. 2C. For example, whether the transaction has been validated on the blockchain, what block in the chain the validation is associated with, a rule **144** date of the asset transaction, **the price per share of the asset transaction, the investment value of the asset transaction**, conditions associated with the asset transaction, etc. . . . It will be appreciated that these fields may vary based on what type of asset is being transacted and the type of transaction (issuance, transfer, re-classification, cancelation, etc. . . . )

EX1004 at ¶ [0087] (emphasis added).

229. Accordingly, it is my opinion that Zinder teaches "imputing at least one measured differential with a descriptive identifier or at least one descriptive identifier to the electronic transaction record of the DCL through data storage and

processing on the at least one electronic parallel storage of the differences layer." However, Zinder does not explicitly indicate that this "price per share" information, for example, comes from an electronically published data stream. While such a source for this information would have been obvious (as explained above throughout ground 1) Toll and Zhang explicitly illustrate that it would have been obvious for computing system 600 of Zinder to receive this data from an electronically published data stream, as explained above in the obviousness rationale provided above and as discussed with recitation 1b.

230. In view of the above, it is my opinion that every recitation of claim 1 would have been obvious at the time of invention from the combination of Zinder, Toll and Zhang.

**iii. Claims 2-6**

231. With respect to claims 2-6, it is my opinion that the elements of these claims are taught or would have been rendered obvious by the combination of Zinder, Toll, and Zhang for reasons analogous to those presented with respect Ground 1 directed to claims 2-6.

**iv. Claims 7**

**1. Claim Recitation 7a**

232. It is my opinion that Zinder, Toll and Zhang would have rendered recitation 7a obvious for reasons analogous to those presented above in the rejection of claim 1 in Ground 2.

#### 2. Claim Recitation 7b

233. It is my opinion that Zinder, Toll and Zhang would have rendered recitation 7b obvious for reasons analogous to those presented above in the rejection of claim 7 in Ground 1.

#### 3. Claim Recitation 7c-7f

234. It is my opinion that recitations 7c-7f would have been rendered obvious by Zinder, Toll and Zhang for reasons analogous to those set forth above for the rejection of claim 1 in Ground 2 with respect to recitations 1a-e.

#### 1. Claim Recitation 7g

235. It is my opinion that it is my opinion that Zinder, Toll and Zhang would have rendered this recitation obvious at the time of invention for reasons analogous to those presented above in the rejection of claim 7 in Ground 1.

### v. Claims 8-18

236. With respect to claims 8-18, it is my opinion that the elements of these claims would have been rendered obvious by the combination of Zinder, Toll, and Zhang for reasons analogous to those presented with respect Ground 1 directed to claims 8-18.

### vi. Claim 19

237. Claim 19 is a software claim that is analogous to claims 1 and 7. Therefore, it is my opinion that Zinder, Toll and Zhang would have rendered this claim obvious at the time of invention for reasons analogous to those presented with respect to claims 1 and 7.

**1. Recitation 19a**

238. It is my opinion that Zinder teaches the use of software to implement the disclosed techniques. EX1004 at ¶ [0146]. Therefore, it is my opinion that Zinder, Toll and Zhang would have rendered this recitation obvious at the time of invention.

**2. Recitations 19b-19f**

239. Recitation 19b is analogous to recitations 1a and 1b. Recitation 19c is analogous to recitation 1c. Recitation 19d is analogous to recitation 1d. Recitation 19e is analogous to recitation 1e. Recitation 19f is analogous to recitation 1f. Therefore, it is my opinion that Zinder, Toll and Zhang would have rendered these features obvious for analogous reasons.

**vii. Claim 20**

240. Claim 20 is analogous claims 17 and 18. Therefore, it is my opinion that the combination of Zinder, Toll and Zhang would have rendered claim 20 obvious for reasons analogous to those presented with respect to claims 17 and 18, above.

## IX. Conclusion

241. Based on my review of the Zinder, Toll and Zhang, and Fonss and for the reasons stated herein, it is my opinion that grounds 1 and 2 presented above would have, at the time of invention, rendered claims 1-20 of Fonss obvious to one of skill in the art.

I declare under penalty of perjury under the laws of the United States that the foregoing is true and correct. Executed: September 6, 2023

Hudson Jameson

# EXHIBIT A

# Hudson Jameson

hudson@hudsonjameson.com | LinkedIn

## Summary

Hudson is a **renowned expert on blockchain technology** with specializations in Ethereum, Zcash, decentralized governance, and privacy technology. He has spoken at dozens of conferences around the world on a variety of blockchain topics. He has served at **a number of organizations and boards**, including advisory roles at Chainlink and Polygon. As a **community builder** and **educator**, his unique mix of **technical and communication skills** has proved to be valuable in ecosystems that he participates in.

## Work Experience

### Polygon Labs

VP Governance and Community | March 2023-Present | Remote

- Engaged in a **cross-functional overhau**l of the internal and external **culture** to better align with the values and optics of blockchain communities such as Ethereum. Basically, **making Polygon less corporate** so they can be more successful.
- Led the Polygon governance team in the development and execution of **governance structures** in the Polygon protocol stack with a focus on community involvement and **cutting edge systems design**.
- Engaged with the community via many **public facing interactive experiences** including appearances at conferences, on YouTube live streams, and Twitter Spaces events to **strengthen Polygon's image** and commitment to its values.

### Flashbots

Operations | August 2021-February 2022 | Remote

- Recruited for Flashbots **blockchain/MEV research** organization.
- Wrote policies to **foster a positive working environment**.
- Connected Flashbots team with other ecosystem participants to enable greater **strategic partnerships**.

### Ethereum Foundation

DevOps/Security Lead/Community Lead | July 2016-April 2021 | Remote

- Led and **moderated** the bi-weekly "core developer" calls that served to guide Ethereum in future protocol upgrades.
- Responsible for the **planning and communication** of the majority of **Ethereum hard forks/network upgrade**s from 2016-2021.
- Led the response for multiple **security incidents** including large scale attacks on the Ethereum Foundation and on the Ethereum network itself, which involved **setting up IR rooms and blog and social media communications**.
- Managed a team in charge of **developer infrastructure** such as servers and coding repositories.

- Assigned as **lead EIP (Ethereum Improvement Proposal) editor** to help optimize the way **Ethereum specifications** were written and organized.
- Co-Founded Ethereum Cat Herders volunteer organization.

### Oaken Innovations

Co-Founder/COO/Smart Contract Lead | February 2017-February 2018 | Dallas, TX

- Co-founded an **IoT blockchain startup** designed to provide unique applications for blockchain technology in the automotive industry.
- Won the $100k global hackathon for our **automated smart contract solution** to toll road payments.
- Wrote the **Solidity smart contracts** for prototypes built for Toyota intending to serve as a decentralized car rental agency.

### USAA Bank and Insurance Company

Lead Blockchain SME | June 2014-July 2016 | Dallas, TX

- Active participant in the **blockchain working group** in support of finding the best uses for enterprise blockchain based applications at USAA.
- Designated **blockchain subject matter expert** at USAA.
- Lead a team of 6 people to 3rd place out of 10 teams in the Zero Preventable Fraud Code as Ice competition to create a **new authentication module** using **seamless OTC concepts** and **2 way mobile push**.
- Participating as one of few core team members for the **ASPIRE grassroots organization** inside of USAA to support women in IT.
- Submitted or was a contributor on a total of **9+ patents** through the USAA IP program (see patents in other section).
- Lead a team in the 2015 Hackathon Competition at USAA to build a **decentralized blockchain solution** to the check representment problem in order to **save USAA millions of dollars**. Placed Honorable Mention in the competition.

## Professional Associations & Qualifications

---

### Board Seats and Advisory Positions

- Polygon Advisor - Layer 2 Ethereum technology (2021-2023)
- Chainlink Advisor - Blockchain Oracle Network Technology (2017-2021)
- Zcash Community Grants Board - Grant organization for Zcash blockchain (2019-2021)
- Baseline Enterprise Blockchain Technology Technical Steering Committee (2019-2021)

### Skills and Knowledge

- Experience with Solidity smart contract language and programming languages
- Bitcoin, Ethereum, Blockchain, Layer 2 Technologies, Privacy Technologies, Dapps, Zcash

## Education

- B.S Computer Science from the University of North Texas (Denton, TX)

## Patents

- *Identifying negotiable instrument fraud using distributed ledger systems*
  US 11361286B1 · Issued Jun 14, 2022
- *Token device for distributed ledger based interchange*
  US 10762506B1 · Issued Sep 1, 2020
- *Blockchain based transaction management*
  US 10521780B1 · Issued Dec 31, 2019
- *Behavioral profiling method and system to authenticate a user*
  US 9514293 · Issued Sep 24, 2019
- *Identifying negotiable instrument fraud using distributed ledger systems*
  US 10423938B1 · Issued Sep 24, 2019