ENHANCED ELECTRONIC DATABASE MANAGEMENT SYSTEM WITH REDUCED DATA REDUNDANCY

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims the benefit of U.S. Provisional Pat. App. No. filed , which is incorporated herein by reference.

TECHNICAL FIELD

[0002] This specification generally relates to databases, and, in one example implementation, specifically relates to an enhanced recordkeeping system that implements an improved data standardization technique.

BACKGROUND

[0003] Data standardization is the process of bringing data into a uniform format that allows consumers of the data to analyze, process and generally utilize the data. In statistics, standardization refers to the process of putting different variables on the same scale in order to compare scores between different types of variables. A similar standardization concept, i.e., identifying and capturing the relationships among different data items in a given data set, may be applied to record keeping systems to improve their efficiency and their ability to share data across heterogeneous systems performing functionally adjacent processes. In the absence of this form of standardization, unique, customized, non-standard interfaces must be built and maintained for data to be shared across heterogeneous systems. Such interfaces are costly to develop/maintain and are often prone to error due in part to their limited application.

[0004] Conventional electronic recordkeeping systems often store dramatically more information in these databases than is necessary, wasting precious storage space, and they process this information in an inefficient manner, wasting valuable computational resources.

SUMMARY

[0005] According to one example implementation, this specification describes an enhanced recordkeeping system that, as a result of a standardization approach that scales dependent data items, e.g., the unit holder's uncontributed commitment, to an independent data item, i.e., the

holder's number of units, reduces the amount of storage that is required for each illiquid drawdown vehicle holder, that reduces the number of calculations that are required in the allocation to unit holders of illiquid drawdown vehicle gains, fees, and expense and determinations of illiquid drawdown vehicle resource calls and returns, that generally reduces the amount of computer processing that is required to administer co-mingled vehicles which utilize resource calls (i.e., drawdown vehicles), including via distributed parallel reporting using industry standard interfaces which generally reduces the need for centralized computing resources, and that, as a result of the relationship enforced between units owned and other items reflecting a holder's vehicle interest, enables more computationally efficient transfers among holders of their vehicle interests, which could be executed using digital tokens, via functionally adjacent systems implemented using blockchain technology. These improvements can be obtained by reducing data redundancy within the data recorded to reflect each illiquid drawdown vehicle holder's ownership as well as illiquid drawdown vehicle resource calls and resource returns, via use of each holder's number of units owned as the independent data item to which other data items are scaled in various collections of data as described below.

[0006] As an approach to data standardization, in some collections of data, well defined relationships, applicable to each individual data set within the collection, can be identified as existing between items within a data set. Such relationships (e.g., scaling factors) may be stored only once for the entire collection and within each data set, only the independent or reference data item need be stored. For each data set, the data items dependent on the reference data item need not be stored, but can be derived when needed, given the associated independent data item and the standardized scaling relationship applicable across the collection of data. This approach provides the benefits of (1) reducing the storage space required for each data set and therefore for the entire collection of data, (2) reducing the amount of data required to be copied or transmitted when working with multiple data sets from the collection, (3) standardizing on the use of independent reference data item(s) by the data assembling system so that each complete data set, including dependent data items can be correctly interpreted and applied by functionally adjacent heterogeneous data consuming systems and (4) facilitating distributed parallel processing and reporting of data sets, which can be conducted given the established data standardization.

[0009] The vast majority of co-mingled investment vehicles available to the public, such as mutual funds and exchange traded funds (ETFs) are administered and reported on the basis of units. For a given vehicle, each holder's broker or advisor maintains the number of units owned by the holder. The vehicle's administrator scales the Net Asset Value (NAV) of the vehicle according to the number of vehicle units and publishes the vehicle's unit NAV using industry standard interfaces, allowing the holder's broker or advisor to independently calculate and report the value of the holder's interest in the vehicle. Co-mingled investment vehicles which invest in illiquid assets have typically been operated as drawdown vehicles and administered as limited partnerships, with each limited partner having their own multi-component holder account, instead of being issued units. Individual holder accounts are used in this circumstance in part to capture and track the uncontributed commitment associated with each holder. When applied in the broader context of retail holders, the individual holder account approach is non-standard and requires that unique, customized interfaces be developed in the functionally adjacent reporting systems of brokers and financial advisors in order for the value of such investment holdings to be reported to their respective client holders.

[00010] To report retail holdings in comingled vehicles that use individual multi-component holder accounts and are therefore not unitized (i.e., not scaled to the number of units), financial

intermediaries such as Fidelity, Goldman Sachs and others have developed and employed customized interfaces. Within these customized interfaces, the reporting firm often assigns a fictional unit NAV of $1 to the investment vehicle and a fictional quantity of units to each holder. These fictional amounts are such that when the (fictional) quantity of units is multiplied by the (fictional) unit NAV within the core reporting system, in the industry standard calculation, the correct value of the individual's holding is derived. In subsequent data transfers provided to reporting firms in order for them to issue revised valuation reports to holders, the customized, non-standard interface inserts a fictional increase or decrease in the quantity of units in order to create the revised valuation. These fictionalized increases and decreases are reported to the holder as "units added" or "units removed", which is misinformation since these vehicles employ individual holder accounts and don't issue units at all. These non-standard interfaces therefore result in inaccurate holder reporting, ineffective customer service and on-going holder confusion. The enhanced recordkeeping system described by this specification, by using each holder's number of units as the independent data item to which other data items are scaled in various data collections, avoids the need for individual multi-component holder accounts and the associated customized, non-standard interfaces to functionally adjacent reporting systems and enables reporting of valuations and other metrics in an industry standard form, scaled to the number of units. The standardization and efficiencies provided by this implementation are intended to make co-mingled investment vehicles that invest in illiquid assets available to a larger population of holders, which will in turn benefit all holders with greater economies of scale.

[00011] Another example implementation includes a computer-implemented method for enhanced recordkeeping of co-mingled private market investment vehicles over at least one network. The method includes storing data and instructions in at least one computer memory and accessing the stored instructions and executing the stored instructions with at least one computer processor to perform multiple operations. The method also includes operations for processing and recording subscriptions in the form of uncontributed commitments, converting accepted subscribers to holders by issuing units, as well as processing and recording redemptions which may consist in part of non-cash, cash equivalent proceeds. The method includes operations for issuing, tracking and processing resource calls, and returning previously called resource, possibly with distributions of gains, to unit holders. The method also includes operations for tracking and processing vehicle accounting data including portfolio holdings and related resource actions,

portfolio valuations and financial balances in order to monitor a vehicle's underlying uncontributed commitments, determine whether appropriate to call resource from unitholders or distribute previously contributed resource to unitholders and measure the vehicle's portfolio diversification. The method includes electronic interactions with other systems used in the administration of unitized collective investment vehicles, including Vehicle Accounting and Transfer Agency systems. The method further includes sending electronic notifications to and receiving electronic notifications from subscribing participant systems over the network, including notifications related to subscriptions, redemptions, resource calls and resource returns.

[00012] Assets other than cash, i.e., cash equivalents, may sometimes be used as cash. These assets generally have a stable value relative to the cash currency in which they are denominated. Money market fund units and U.S. treasury bills are long standing examples. More recently, tokenized digital currencies have developed that have a stable relationship to the U.S. dollar. These "stablecoins" are becoming currencies of choice for transactions on blockchain systems. For example, USDT (also known as Tether) and USDC stablecoins had collective values of more than $70B and $31 billion respectively, as of September 2021. The potential to use these and/or other cash equivalent assets as a medium of transaction wholly or partially in place of cash, in each case with a quantity of tokens, bills, etc. of equivalent value to the cash replaced, is to be assumed in the processes documented herein.

[00013] This example implementation reduces data redundancy within the data recorded to reflect each illiquid drawdown vehicle holder's ownership by recognizing and maintaining a well-defined relationship between the number of units held by each holder and the holder's uncontributed commitment (UHC). This well-defined relationship is encapsulated in an uncontributed commitment per unit (unit UHC). On the basis of this relationship, each individual holder's uncontributed commitment need not be stored or transmitted to other systems which consume the vehicle's holder data. In addition, reporting of each holder's uncontributed commitment can be performed on a distributed parallel basis, reducing the amount of centralized computing resource required, and consistent with the industry standard per unit approach used to report other metrics, by multiple systems each positioned closer to a subset of holders. Similarly, this implementation reduces data redundancy within the data recorded to reflect the vehicle's resource calls and resource returns by recognizing and maintaining a well-defined relationship between the number of units held by each holder and the holder's resource call and resource

return amounts. These well-defined relationships are encapsulated respectively in a unit resource call amount and a unit resource return amount. As a result, each individual holder's resource call and resource return amounts need not be stored for any resource call or resource return, nor transmitted to systems that participate in the resource call or resource return processes. In addition, reporting of resource calls and resource returns can be performed on a distributed, parallel, industry standard per unit basis, by multiple systems each positioned closer to a subset of holders, thereby reducing the amount of centralized computing resource required. Finally, by scaling these relationships to a single unit, i.e., "unitizing", the implementation makes units interchangeable. This fungibility is a requisite characteristic of digital tokens, such as those maintained via blockchain technology. Thus, units administered by this implementation along with other related items reflecting a holder's vehicle interest, such as the holder's uncontributed commitment, could be reflected in a digital token, where each token might reflect a quantity or portion of a unit interest, and transferred among holders by functionally adjacent, blockchain based systems.

[00045] Collective investment vehicles are needed which combine the resource cycle management features of evergreen vehicles and the resource efficiency of vintage vehicles. These collective investment vehicles would: a) facilitate the flow of assets from liquid to illiquid, i.e., employed in private markets, and back, reflecting the changing levels of resource use by the illiquid private market portfolio, b) provide a method to limit dilution and c) have a variable life-

span operating over the course of a single vintage, multiple vintages or indefinitely, as an evergreen vehicle does. While existing systems could be used to administer such collective investment vehicles, existing systems were not designed and developed to support these features. The enhanced recordkeeping system described by this specification enables the administration of such collective investment vehicles in a manner that is more efficient than available via current systems. For instance, the enhanced recordkeeping system described by this specification allows calculations to be performed, or allows calculations to be performed using fewer computing resources, by placing and maintaining data in a standardized format, regardless of the format that the data was supplied by constituent systems.

[00046] Legacy systems used in the administration of vintage vehicles maintain individual multi-component accounts for each subscribing partner, with each account containing the holder's amounts of resource committed, resource contributed, and resource not yet contributed (i.e., the holder's uncontributed resource commitment). Maintaining holder accounts in this way enables the vintage vehicle practice of uncontributed resource commitments while also providing for individualized holder treatment (e.g., individually tailored advisory fee calculations). Within the context of a typical vintage vehicle, where the number of holders is no more than a few hundred, the desire for the flexibility to individually tailor a holder's treatment outweighs the associated complexity in operation and reporting. Within legacy vintage vehicle administration systems, resource calculations (including resource calls and returns), allocation of vehicle gains, fees and other expenses are performed individually for each holder. Furthermore, all holder reporting is centrally produced (since each holder can receive individualized treatment) and transfers of vehicle ownership interests among holders are complex (since each holder's ownership interest may have unique characteristics).

[00047] In contrast, evergreen vehicles are intended to support tens of thousands or more holders. As such, individualized holder treatment would be extremely inefficient as well as operationally unwieldy for evergreen vehicles to administer. Instead, evergreen vehicles fashion their treatment of holders around a single unit and a holder's treatment is based on the number of units they own. This approach allows evergreen vehicles to be administered using systems which segregate processing specific to individual holders from processing which impacts the holders collectively. The individual holder processing is generally housed in a Transfer Agent system, while the collective vehicle processing is housed in a Vehicle Accounting system. Processing

which impacts an individual evergreen vehicle holder's units is the purview of a Transfer Agent system. Processing that impacts every evergreen vehicle unit (or at least every unit within a pre-defined class of units) is the purview of a Vehicle Accounting system. Such processing includes allocations of vehicle gains, fees and expenses. Under this approach, the value of each holder's interest in the vehicle is equal to the vehicle's (or vehicle unit class's) unit NAV multiplied by the individual holder's number of units. Neither current Vehicle Accounting nor current Transfer Agent systems address a holder's uncontributed resource commitment, which is a critical feature addressed by the system described herein to facilitate the flow of assets from liquid to illiquid and vice-versa and provide a means to limit dilution within the needed collective investment vehicles.

[00048] The enhanced recordkeeping system described by this specification occupies a functional space between current Vehicle Accounting and Transfer Agent systems. When employed, the enhanced recordkeeping system enables the efficient administration of an illiquid drawdown vehicle 10 with holdings comprised of illiquid private market assets 16. The enhanced recordkeeping system is employed in processing subscriptions to and redemptions from this form of unitized collective investment vehicle, as well as reporting on the implications of a variety of such vehicle's other activities. Also, the enhanced recordkeeping system enforces standardization, e.g., by applying unitization (i.e., scaling to a number of units) to each resource transaction that occurs when liquid assets are called by the drawdown vehicle to support the illiquid private market portfolio, and when liquid assets are returned from the drawdown vehicle. Such an approach may change data from a non-standardized format, in which each holder's individual resource call and resource return amounts must be specified and communication, to a standardized format which is capable of more efficient processing, in which unitized resource call and return amounts apply uniformly to the population of holders and their individual amounts may be determined by distributed systems according to each holder's number of units.

[00049] Additionally, the transactional and reporting capabilities offered to holders in unitized form through the system are consistent with the longstanding industry standard approach for co-mingled vehicles and provide an electronically accessible platform for accessing private market assets, thereby facilitating investment from a significantly expanded population.

[00050] As noted previously, the enhanced recordkeeping system is intended for use in administering commingled investment vehicles which a) facilitate the flow of assets from liquid

to illiquid and back, b) provide a method to limit dilution and c) have a variable life-span operating over the course of a single vintage, multiple vintages or indefinitely. Use of the system in this context provides significant efficiencies over current systems, including those numbered i), ii), iii), iv), v), vi), vii), viii) and ix) below, by eliminating redundant data within several collections of data, including holder data, resource call data and resource return data. Current systems used to administer co-mingled private market, illiquid drawdown vehicles require storage of individual accounts for each holder which contain the holder's amounts of resource committed, resource contributed, resource not yet contributed and other unique, differentiating holder data. The enhanced recordkeeping system described herein, by enforcing a well-defined relationship between the number of units held by each holder in an illiquid drawdown vehicle 10 and the holder's UHC, i) eliminates the need to store each illiquid drawdown vehicle holder's uncontributed commitment, and makes illiquid drawdown vehicle units interchangeable, which in turn ii) eliminates the calculations required to the allocate illiquid drawdown vehicle 10 gains, fees and expenses to holders individually, as current systems used to administer co-mingled private market drawdown vehicles require. This is because the Vehicle Accounting system 50 allocates those items to the entire collection of units at once. Additionally, the interchangeability of illiquid drawdown vehicle units iii) enables simplified, more efficient transfers among holders of fungible units, which could be executed using digital securities via functionally adjacent systems implemented using blockchain technology. Such efficient transfers are not possible when individual ownership interests are stored with unique, non-standard, differentiating data as per current systems used to administer co-mingled private market drawdown vehicles. Similarly, by establishing, in a unit resource call amount, a defined scaled relationship between the number of units owned by a holder and their resource call amount, the system iv) eliminates the calculations required by current systems to individually allocate a holder's resource call amount based on the vehicle resource call amount, the vehicle uncontributed commitment and the holder's specific uncontributed commitment and v) eliminates the need to store and transmit each holder's resource call amount associated with each resource call, freeing precious computer memory resources. Likewise, by establishing, in a unit resource return amount, a defined scaled relationship between the number of units owned by a holder and their resource return amount, the system vi) eliminates the calculations required by current systems to individually allocate a holder's resource return amount based on the vehicle resource return amount, the total vehicle

equity value and the holder's specific equity value and vii) eliminates the need to store and transmit each holder's resource return amount associated with each resource return, freeing computer resources such as disk and computer memory space for other uses.

[00051] Taken in aggregate, by eliminating redundant data within several collections of data, including holder data, resource call data and resource return data, the system viii) facilitates illiquid drawdown vehicle 10 reporting on an industry standard basis and ix) allows holder reporting to be performed on a parallel, distributed basis by adjacent systems (such as those employed by retail brokers and financial advisors) positioned more closely to holders, thereby reducing the amount of centralized computing resources needed. These adjacent systems need only to have the holder's number of units (the independent data item) and the applicable unit UHC, unit resource call amount or unit resource return amount (the defined relationship), in order to report a holder's uncontributed commitment, resource call amount or resource return amount (dependent data items), respectively.

[00052] In order to provide a means to limit dilution, the enhanced recordkeeping system may include the ability to designate illiquid drawdown vehicle subscriptions as part of a "commitment vintage", with a different unit UHC than other commitment vintages. A commitment vintage with a higher unit UHC will result in fewer units being issued at the time of drawdown vehicle subscription and therefore contribute relatively less diluting resource when the subscription is accepted and relatively more resource subsequently when resource is called by the illiquid drawdown vehicle for investment and other purposes. As such, when commitment vintages are in use, drawdown vehicle units will be associated with a given commitment vintage, interchangeable only within that vintage, and each commitment vintage will have its own unit UHC, scaled to the number of units associated with the commitment vintage to reflect the uncontributed holder commitment of the commitment vintage. Additionally, to enforce this form of standardization, when a drawdown vehicle with multiple commitment vintages issues a resource call, each commitment vintage will have its own unit resource call amount, scaled according to the number of units associated with the commitment vintage. However, over time as resource is called and the unit UHC of given vintages approaches parity, the vehicle may collapse two vintages into a single vintage in order to simplify operations and increase fungibility of units.