# FUND ASSOCIATION RELATIONSHIP DETERMINING METHODS AND APPARATUSES BASED ON FINANCIAL TRANSACTION SEQUENCE DIAGRAM

## TECHNICAL FIELD

**[0001]** Embodiments of this specification generally relate to the field of graph computing technologies, and in particular, to fund association relationship determining methods and apparatuses based on a financial transaction sequence diagram.

## BACKGROUND

**[0002]** In a financial payment system, financial transactions of hundreds of billions occur every day. These financial transactions are linked to transaction relationships between personal accounts, merchant accounts, and financial institution accounts, thus forming a complex transaction relationship network. By abstracting key information in each financial transaction, such as a transfer-in account, a transfer-out account, a transaction time, a transaction ID, and a transaction amount, a financial transaction sequence diagram can be constructed. Graph computing is performed on the constructed financial transaction sequence diagram based on a predetermined fund association policy in order to compute a fund association relationship between transaction funds of each financial transaction and further determine a complete sequence flow path of each transaction fund. A fund association policy is used to describe a fund association policy/rule between a transfer-in fund and a transfer-out fund of a financial account.

**[0003]** The financial transaction sequence diagram includes various financial transaction scenarios. Fund association policies of different financial transaction scenarios are different. How to efficiently and flexibly undertake a differentiated fund association policy in a large-scale financial transaction scenario becomes a key factor that affects accuracy and stability of sequence diagram computing.

## SUMMARY

**[0004]** In view of the descriptions above, embodiments of this specification provide fund association relationship determining methods and apparatuses that are based on a financial transaction sequence diagram. By using the methods and the apparatuses, fund association relationships between financial transactions can be established based on the financial transaction sequence diagram in accordance with actual business scenarios to implement transaction fund association in large-scale financial transaction scenarios, thereby obtaining global fund flow relationships of fund transactions of all financial transactions occurring in the financial transaction scenarios.

**[0005]** According to one aspect of the embodiments of this specification, a fund association relationship determining method based on a financial transaction sequence diagram, including: obtaining, in response to determining a fund association relationship of a first financial transaction of a current financial transaction, current fund association relationships of all second financial transactions of the current financial transaction, where a first financial transaction of each financial transaction is a transfer-out transaction, in the financial transaction sequence diagram, that is initiated from a transaction start point of the financial transaction and whose transaction time is immediately before a transaction time of the financial transaction, and a second financial transaction of each financial transaction includes a transfer-in transaction, in the financial transaction sequence diagram, that uses a transaction start point of the financial transaction as a transaction end point and that serves as a prior transaction of the financial transaction; determining whether the second financial transaction has an associated financial transaction of the current financial transaction; determining, in response to that the second financial transaction has an associated financial transaction of the current financial transaction, a fund association relationship of the current financial transaction based on a fund association relationship of a determined associated financial transaction and transaction information of the current financial transaction, and adjusting the fund association relationship of the associated financial transaction based on the transaction information of the current financial transaction; and transferring the fund association relationship of the current financial transaction to a transaction end point of the current financial transaction.

**[0006]** Optionally, in an example of the above-mentioned aspect, the fund association

relationship determining method can further include the following: determining, in response to that the second financial transaction has no associated financial transaction of the current financial transaction, the fund association relationship of the current financial transaction based on the transaction information of the current financial transaction.

**[0007]** Optionally, in an example of the above-mentioned aspect, the determining whether the second financial transaction has an associated financial transaction of the current financial transaction can include the following: determining a fund association policy of the current financial transaction in response to that the second financial transaction has multiple second financial transactions; and determining, based on the fund association policy, whether the second financial transaction has the associated financial transaction of the current financial transaction.

**[0008]** Optionally, in an example of the above-mentioned aspect, the determining a fund association policy of the current financial transaction in response to that the second financial transaction has multiple second financial transactions can include the following: determining a fund association policy that matches a transaction scenario of the current financial transaction in a fund association policy library as the fund association policy of the current financial transaction in response to that the second financial transaction has multiple second financial transactions.

**[0009]** Optionally, in an example of the above-mentioned aspect, fund association policies in the fund association policy library have priorities. The determining a fund association policy that matches a transaction scenario of the current financial transaction in a fund association policy library as the fund association policy of the current financial transaction can include the following: obtaining, from the fund association policy library, a fund association policy that matches the transaction scenario of the current financial transaction; and when the matched fund association policy includes multiple fund association policies, determining a fund association policy with a highest priority as the fund association policy of the current financial transaction.

**[0010]** Optionally, in an example of the above-mentioned aspect, the determining a fund association policy of the current financial transaction in response to that the second financial transaction has multiple second financial transactions can further include the following: when no fund association policy that matches the transaction scenario of the current financial transaction exists in the fund association policy library, determining a default fund association policy as the fund association policy of the current financial transaction.

**[0011]** Optionally, in an example of the above-mentioned aspect, the determining whether the

second financial transaction has an associated financial transaction of the current financial transaction can further include the following: in response to that the second financial transaction has a single second financial transaction, determining, based on the single second financial transaction and the transaction information of the current financial transaction, whether the single second financial transaction is the associated financial transaction of the current financial transaction.

**[0012]** Optionally, in an example of the above-mentioned aspect, the fund association relationship includes root fund association relationship ID information, parent fund association relationship ID information, fund association relationship ID information, transaction ID information, a total transaction fund amount, and a transaction fund balance of a financial transaction. The determining, in response to that the second financial transaction has an associated financial transaction of the current financial transaction, a fund association relationship of the current financial transaction based on a fund association relationship of a determined associated financial transaction and transaction information of the current financial transaction, and adjusting the fund association relationship of the associated financial transaction based on the transaction information of the current financial transaction can include the following: in response to that the second financial transaction has an associated financial transaction of the current financial transaction, determining, based on root fund association relationship ID information and parent fund association relationship ID information in the fund association relationship of the determined associated financial transaction, root fund association relationship ID information and parent fund association relationship ID information in the fund association relationship of the current financial transaction, generating a fund association relationship ID, and determining transaction ID information, a total transaction fund amount, and a transaction fund balance in the fund association relationship of the current financial transaction based on the transaction information of the current financial transaction; and adjusting, based on a transaction amount in the transaction information of the current financial transaction, a transaction fund balance in the fund association relationship of the associated financial transaction.

**[0013]** Optionally, in an example of the above-mentioned aspect, the associated financial transaction includes multiple associated financial transactions. The fund association relationship determining method can further include the following: determining a share of funds of each associated financial transaction in the transaction amount of the current financial transaction. The

adjusting, based on a transaction amount in the transaction information of the current financial transaction, a transaction fund balance in the fund association relationship of the associated financial transaction can include the following: adjusting, based on the share of funds of each associated financial transaction in the transaction amount of the current financial transaction, a transaction fund balance in a fund association relationship of the corresponding associated financial transaction.

**[0014]** Optionally, in an example of the above-mentioned aspect, the determining a share of funds of each associated financial transaction in the transaction amount of the current financial transaction can include the following: determining the share of funds of each associated financial transaction in the transaction amount of the current financial transaction based on a predetermined share of funds determining rule.

**[0015]** Optionally, in an example of the above-mentioned aspect, the predetermined share of funds determining rule can include one of the following rules: a predetermined share determining rule based on last-in first-out; a predetermined share determining rule based on equal distribution; and a predetermined share determining rule based on weighted distribution.

**[0016]** Optionally, in an example of the above-mentioned aspect, the transaction scenario includes at least one of the following transaction scenarios: a merchant settlement scenario, a fund purchase scenario, and a gift voucher expense scenario.

**[0017]** According to another aspect of the embodiments of this specification, a fund association relationship determining apparatus based on a financial transaction sequence diagram is provided, including: a fund association relationship acquisition unit, configured to obtain, in response to determining a fund association relationship of a first financial transaction of a current financial transaction, current fund association relationships of all second financial transactions of the current financial transaction, where a first financial transaction of each financial transaction is a transfer-out transaction, in the financial transaction sequence diagram, that is initiated from a transaction start point of the financial transaction and whose transaction time is immediately before a transaction time of the financial transaction, and a second financial transaction of each financial transaction includes a transfer-in transaction, in the financial transaction sequence diagram, that uses a transaction start point of the financial transaction as a transaction end point and that serves as a prior transaction of the financial transaction; an associated-financial-transaction determining unit, configured to determine whether the second financial transaction has an associated financial

transaction of the current financial transaction; a fund association relationship determining unit, configured to determine, in response to that the second financial transaction has an associated financial transaction of the current financial transaction, a fund association relationship of the current financial transaction based on a fund association relationship of a determined associated financial transaction and transaction information of the current financial transaction, and adjust the fund association relationship of the associated financial transaction based on the transaction information of the current financial transaction; and a fund association relationship transfer unit, configured to transfer the fund association relationship of the current financial transaction to a transaction end point of the current financial transaction.

**[0018]** Optionally, in an example of the above-mentioned aspect, the fund association relationship determining unit determines, in response to that the second financial transaction has no associated financial transaction of the current financial transaction, the fund association relationship of the current financial transaction based on the transaction information of the current financial transaction.

**[0019]** Optionally, in an example of the above-mentioned aspect, the associated-financial-transaction determining unit includes a fund association policy determining module, configured to determine a fund association policy of the current financial transaction in response to that the second financial transaction has multiple second financial transactions; and an associated-financial-transaction determining module, configured to determine, based on the fund association policy, whether the second financial transaction has the associated financial transaction of the current financial transaction.

**[0020]** Optionally, in an example of the above-mentioned aspect, the fund association policy determining module determines a fund association policy that matches a transaction scenario of the current financial transaction in a fund association policy library as the fund association policy of the current financial transaction in response to that the second financial transaction has multiple second financial transactions.

**[0021]** Optionally, in an example of the above-mentioned aspect, fund association policies in the fund association policy library have priorities. The fund association policy determining module obtains, from the fund association policy library, a fund association policy that matches the transaction scenario of the current financial transaction; and when the matched fund association policy includes multiple fund association policies, determines a fund association policy with a

highest priority as the fund association policy of the current financial transaction.

**[0022]** Optionally, in an example of the above-mentioned aspect, when no fund association policy that matches the transaction scenario of the current financial transaction exists in the fund association policy library, the fund association policy determining module determines a default fund association policy as the fund association policy of the current financial transaction.

**[0023]** Optionally, in an example of the above-mentioned aspect, in response to that the second financial transaction has a single second financial transaction, the associated-financial-transaction determining unit determines, based on the single second financial transaction and the transaction information of the current financial transaction, whether the single second financial transaction is the associated financial transaction of the current financial transaction.

**[0024]** Optionally, in an example of the above-mentioned aspect, the fund association relationship includes root fund association relationship ID information, parent fund association relationship ID information, fund association relationship ID information, transaction ID information, a total transaction fund amount, and a transaction fund balance of a financial transaction. In response to that the second financial transaction has an associated financial transaction of the current financial transaction, the fund association relationship determining unit determines, based on root fund association relationship ID information and parent fund association relationship ID information in the fund association relationship of the determined associated financial transaction, root fund association relationship ID information and parent fund association relationship ID information in the fund association relationship of the current financial transaction, generates a fund association relationship ID, and determines transaction ID information, a total transaction fund amount, and a transaction fund balance in the fund association relationship of the current financial transaction based on the transaction information of the current financial transaction; and adjusts, based on a transaction amount in the transaction information of the current financial transaction, a transaction fund balance in the fund association relationship of the associated financial transaction.

**[0025]** Optionally, in an example of the above-mentioned aspect, the associated financial transaction includes multiple associated financial transactions. The fund association relationship determining unit further determines a share of funds of each associated financial transaction in the transaction amount of the current financial transaction; and adjusts, based on the share of funds of each associated financial transaction in the transaction amount of the current financial transaction,

a transaction fund balance in a fund association relationship of the corresponding associated financial transaction.

**[0026]** According to another aspect of the embodiments of this specification, a fund association relationship determining apparatus based on a financial transaction sequence diagram is provided, including: at least one processor; a storage coupled to the at least one processor; and a computer program stored in the storage, where the at least one processor executes the computer program to implement the fund association relationship determining method.

**[0027]** According to another aspect of the embodiments of this specification, a computer-readable storage medium is provided, where the computer-readable storage medium stores an executable instruction, and when the instruction is executed, a processor is enabled to perform the fund association relationship determining method.

**[0028]** According to another aspect of the embodiments of this specification, a computer program product is provided, including a computer program, where the computer program is executed by a processor to implement the fund association relationship determining method.

## BRIEF DESCRIPTION OF DRAWINGS

**[0029]** The essence and advantages of the content of this specification can be further understood by referring to the following accompanying drawings. In the accompanying drawings, similar components or features can have the same reference numerals.

**[0030]** FIG. 1 is an example schematic diagram illustrating a financial transaction sequence diagram according to some embodiments of this specification;

**[0031]** FIG. 2A is an example schematic diagram illustrating a financial transaction according to some embodiments of this specification;

**[0032]** FIG. 2B is another example schematic diagram illustrating a financial transaction according to some embodiments of this specification;

**[0033]** FIG. 3 is an example schematic diagram illustrating a fund association relationship determining process according to some embodiments of this specification;

**[0034]** FIG. 4 is an example flowchart illustrating a fund association relationship determining method according to some embodiments of this specification;

**[0035]** FIG. 5 is an example flowchart illustrating an associated-financial-transaction

determining process according to some embodiments of this specification;

**[0036]** FIG. 6 is an example schematic diagram illustrating a fund association policy library according to some embodiments of this specification;

**[0037]** FIG. 7A and FIG. 7B are respectively example schematic diagrams illustrating a fund purchase scenario and a corresponding fund association policy according to some embodiments of this specification;

**[0038]** FIG. 8A and FIG. 8B are respectively example schematic diagrams illustrating a merchant settlement scenario and a corresponding fund association policy according to some embodiments of this specification;

**[0039]** FIG. 9A and FIG. 9B are respectively example schematic diagrams illustrating a gift voucher expense scenario and a corresponding fund association policy according to some embodiments of this specification;

**[0040]** FIG. 10 is an example schematic diagram illustrating a fund association relationship based on a default fund association policy according to some embodiments of this specification;

**[0041]** FIG. 11 is an example schematic diagram illustrating a financial transaction sequence diagram and a corresponding final fund association relationship output according to some embodiments of this specification;

**[0042]** FIG. 12 is an example schematic diagram illustrating a case in which a fund association relationship of each financial transaction changes over time in a financial transaction sequence diagram according to some embodiments of this specification;

**[0043]** FIG. 13 is an example block diagram illustrating a fund association relationship determining apparatus according to some embodiments of this specification;

**[0044]** FIG. 14 is an example block diagram illustrating an associated-financial-transaction determining unit according to some embodiments of this specification; and

**[0045]** FIG. 15 is an example schematic diagram illustrating a fund association relationship determining apparatus implemented based on a computer system according to some embodiments of this specification.

## DESCRIPTION OF EMBODIMENTS

**[0046]** The subject matter described in this specification will now be discussed with reference

to example implementations. It should be understood that these implementations are merely discussed to enable a person skilled in the art to better understand and implement the subject matter described in this specification, rather than limiting the protection scope described in the claims, applicability, or examples. Functions and arrangements of elements under discussion can be changed without departing from the protection scope of the content of this specification. In the examples, various processes or components can be omitted, replaced, or added as needed. For example, described methods can be performed in an order different from a described order, and steps can be added, omitted, or combined. In addition, features described relative to some examples can also be combined in other examples.

**[0047]** As used in this specification, the term "include" and its variant represent open terms, meaning "including but not limited to". The term "based on" means "at least partially based on". The terms "one embodiment" and "an embodiment" represent "at least one embodiment". The term "another embodiment" means "at least one other embodiment". The terms "first", "second", and the like can refer to different objects or the same object. The following can include other definitions, whether explicit or implicit. Unless expressly stated in the context, the definition of one term is consistent throughout this specification.

**[0048]** With reference to the accompanying drawings, the following describes methods and systems for implementing fund association between financial transactions in financial scenarios according to some embodiments of this specification.

**[0049]** FIG. 1 is an example schematic diagram illustrating a financial transaction sequence diagram according to some embodiments of this specification.

**[0050]** The financial transaction sequence diagram shown in FIG. 1 is a directed graph obtained by abstracting financial transactions. In the directed graph shown in FIG. 1, each directed edge represents one financial transaction. Vertices of directed edges are users, for example, user A, user B, user C, and user D. In this specification, a user may refer to a financial account, for example, a personal account, a merchant account, or a financial institution account. Each directed edge further has an edge attribute. The edge attribute is used to indicate transaction information of a financial transaction, such as a transaction time and a transaction amount.

**[0051]** As shown in FIG. 1, transaction information of a financial transaction from user A to user C is "18:00, 30 RMB", to be specific, a transaction time is 18:00, and transaction amount is 30 RMB. Transaction information of a financial transaction from user C to user D is "18: 05, 30

RMB", to be specific, a transaction time is 18:05, and transaction finance is 30 RMB. In addition, multiple financial transactions occurring at different times can exist between two users. Each user can conduct financial transactions with multiple different users. Optionally, transaction information of a financial transaction may further include a transaction ID. The transaction ID is used to uniquely identify the financial transaction in massive financial transactions in a financial scenario.

**[0052]** In addition, in some cases, transaction information of a financial transaction can further include a transaction scenario and/or fund association policy information. The transaction scenario can be represented by using a transaction scenario name or a transaction scenario ID. Examples of the transaction scenario, for example, can include but are not limited to a fund purchase scenario, a merchant settlement scenario, and a gift voucher expense scenario. The fund association policy information can be represented by using a fund association policy name or a fund association policy ID.

**[0053]** FIG. 2A is an example schematic diagram illustrating a financial transaction according to some embodiments of this specification. In the example of FIG. 2A, a transaction start point of the financial transaction is user A, a transaction end point of the financial transaction is user B, and transaction information of the financial transaction includes a transaction ID, a transaction time, a transaction scenario, and a transaction amount. Specifically, the transaction ID is "E1", the transaction time is "18:00", the transaction scenario is "YU'E BAO purchase", and the transaction amount is "30 RMB".

**[0054]** FIG. 2B is another example schematic diagram illustrating a financial transaction according to some embodiments of this specification. In the example of FIG. 2B, a transaction start point of the financial transaction is user A, a transaction end point of the financial transaction is user B, and transaction information of the financial transaction includes a transaction ID, a transaction time, a transaction scenario, a transaction amount, and a fund association policy. Specifically, the transaction ID is "E1", the transaction time is "18:00", the transaction scenario is "YU'E BAO purchase", the transaction amount is "30 RMB", and the fund association policy is "fund association policy 1".

**[0055]** After the financial transaction sequence diagram is obtained, graph computing can be performed based on the financial transaction sequence diagram to determine a fund association relationship between transaction funds of each financial transaction. For each financial transaction

in the financial transaction sequence diagram, a fund association relationship can be determined by using a transaction start point of the financial transaction, and the determined fund association relationship can be transferred to a transaction end point. During fund association relationship determining, a fund association relationship processing process can be started at the transaction start point, provided that a start condition for fund association relationship determining is satisfied.

**[0056]** FIG. 3 is an example schematic diagram illustrating a fund association relationship determining process according to some embodiments of this specification; In the example of FIG. 3, user A initiates two financial transactions, namely, transaction 1 and transaction 2, to user B. User B initiates two financial transactions, namely, transaction 3 and transaction 5, to user D. User B initiates one financial transaction, namely, transaction 7, to user E. User B initiates two financial transactions, namely, transaction 4 and transaction 8, to user F. User C initiates one financial transaction, namely, transaction 6, to user B. In addition, a transaction time sequence of transaction 1 to transaction 8 is as follows: transaction 1 → transaction 2 → transaction 3 → transaction 4 → transaction 5 → transaction 6 → transaction 7 → transaction 8. During fund association relationship determining, fund association relationships between transaction 3, transaction 4, transaction 5, transaction 7, and transaction 8 are determined by a transaction start point (that is, user B).

**[0057]** Specifically, for transaction 3, because transfer-in transactions of user B are transaction 1, transaction 2, and transaction 6, and transaction 6 occurs after transaction 3, after user B receives a current fund association relationship between transaction 1 and transaction 2 from user A, a fund association relationship determining process can be started for transaction 3. In the fund association relationship determining process for transaction 3, if transaction 3 has an associated financial transaction, a current fund association relationship of the associated financial transaction is dynamically adjusted.

**[0058]** Transaction 4 occurs after transaction 3. Therefore, for transaction 4, user B can start a fund association relationship determining process for transaction 4 only after fund association relationship determining is completed for transaction 3. Transaction 5 occurs after transaction 4. Therefore, for transaction 5, user B can start a fund association relationship determining process for transaction 5 only after fund association relationship determining is completed for transaction 4.

**[0059]** Transaction 7 occurs after transaction 5 and transaction 6. Therefore, for transaction 7,

user B can start a fund association relationship determining process for transaction 7 only after fund association relationship determining is completed for transaction 5 and a fund association relationship of transaction 6 is received. Transaction 8 occurs after transaction 7 and transaction 6. Therefore, for transaction 8, user B can start a fund association relationship determining process for transaction 8 only after fund association relationship determining is completed for transaction 7 and a current fund association relationship of transaction 6 is received.

**[0060]** FIG. 4 is an example flowchart illustrating a fund association relationship determining method 400 according to some embodiments of this specification. A fund association relationship determining process shown in FIG. 4 is a fund association relationship determining process for a current financial transaction.

**[0061]** As shown in FIG. 4, at 410, a fund association relationship determining process of a first financial transaction corresponding to the current financial transaction is monitored, and at 420, it is determined whether the fund association relationship determining process of the first financial transaction is completed. In this specification, a first financial transaction of each financial transaction is a transfer-out transaction, in a financial transaction sequence diagram, that is initiated from a transaction start point of the financial transaction and whose transaction time is immediately before a transaction time of the financial transaction. For example, for the example in FIG. 3, transaction 3 is a first financial transaction of transaction 4, transaction 4 is a first financial transaction of transaction 5, transaction 5 is a first financial transaction of transaction 7, and transaction 7 is a first financial transaction of transaction 8. If the fund association relationship determining process of the first financial transaction is not completed, the process returns to 410 to continue the above-mentioned monitoring process. Here, the current financial transaction refers to a transfer-out financial transaction initiated by a current vertex (user).

**[0062]** In response to determining a fund association relationship of the first financial transaction of the current financial transaction, at 430, current fund association relationships of second financial transactions of the current financial transaction are obtained. In this specification, a second financial transaction of each financial transaction includes a transfer-in transaction, in the financial transaction sequence diagram, that uses a transaction start point of the financial transaction as a transaction end point and that serves as a prior transaction of the financial transaction. For example, for the example in FIG. 3, transaction 1 and transaction 2 are second financial transactions of transaction 3, transaction 4, and transaction 5. Transaction 1 and

transaction 2 are second financial transactions of transaction 3, transaction 4, transaction 5, transaction 7, and transaction 8. Transaction 6 is a second financial transaction of transaction 7 and transaction 8. Transaction 1 and transaction 2 are determined by their transaction start point (namely, user A) and transferred to user B. Transaction 6 is determined by its transaction start point (namely, user C) and transferred to user B.

**[0063]** In this specification, the term "current fund association relationship" can refer to a fund association relationship of a financial transaction at a current moment, or can refer to a fund association relationship stored by a user (graph node) at a current moment. For example, if it is determined that the second financial transaction is not an associated financial transaction of the current financial transaction in the fund association relationship determining process for the current financial transaction, a current fund association relationship of the second financial transaction remains unchanged. If it is determined that the second financial transaction is an associated financial transaction of the current financial transaction in the fund association relationship determining process for the current financial transaction, the current fund association relationship of the second financial transaction is dynamically adjusted. A fund association relationship obtained after adjustment is used as a current fund association relationship in a fund association relationship determining process for a next financial transaction.

**[0064]** At 440, it is determined whether the current fund association relationships of all the second financial transactions of the current financial transaction have been obtained. If a fund association relationship of a second financial transaction has not been obtained, the process returns to 430 to wait for acquisition of the current fund association relationship of the second financial transaction, for example, wait for receiving of a current fund association relationship that is transferred from a transaction start point of the second financial transaction.

**[0065]** After the fund association relationships of all the second financial transactions in the current financial transaction are obtained, at 450, it is determined whether the obtained second financial transaction has an associated financial transaction of the current financial transaction.

**[0066]** FIG. 5 is an example flowchart illustrating an associated-financial-transaction determining process 500 according to some embodiments of this specification.

**[0067]** As shown in FIG. 5, at 510, it is determined whether multiple second financial transactions exist. If only a single second financial transaction exists, at 520, it is determined whether the single second financial transaction is an associated financial transaction of the current

financial transaction. For example, in some embodiments, whether the single second financial transaction is related to the current financial transaction can be further determined based on transaction information of the single second financial transaction and the transaction information of the current financial transaction. In this case, if the transaction information of the single second financial transaction matches the transaction information of the current financial transaction, it is determined that the single second financial transaction is related to the current financial transaction, and it is determined that the single second financial transaction is an associated financial transaction of the current financial transaction. If the transaction information of the single second financial transaction does not match the transaction information of the current financial transaction, it is determined that no associated financial transaction of the current financial transaction exists.

**[0068]** If multiple second financial transactions exist, at 530, a fund association policy of the current financial transaction is determined. In some embodiments, the transaction information of the current financial transaction includes a fund association policy, as shown in FIG. 2B. Therefore, the fund association policy can be obtained from the transaction information of the current financial transaction.

**[0069]** In some embodiments, a fund association policy library can be created in advance. A correspondence between a fund association policy and a transaction scenario is pre-stored in the fund association policy library. In some embodiments, the correspondence between a fund association policy and a transaction scenario can include a one-to-one mapping relationship, that is, each transaction scenario corresponds to one fund association policy. In this case, a transaction scenario can be obtained from the transaction information of the current financial transaction, and a fund association policy that matches a transaction scenario of the current financial transaction in the fund association policy library is determined as the fund association policy of the current financial transaction.

**[0070]** In some embodiments, the correspondence between a fund association policy and a transaction scenario can also include a one-to-many mapping relationship or a many-to-many mapping relationship. In other words, each fund association policy can correspond to multiple transaction scenarios, and/or each transaction scenario corresponds to multiple fund association policies. In this case, priorities can be allocated to fund association policies in the fund association policy library. FIG. 6 is an example schematic diagram illustrating a fund association policy library according to some embodiments of this specification. In the fund association policy library shown

in FIG. 6, fund association policy A has a highest priority, and a default fund association policy has a lowest priority. During fund association policy determining, a fund association policy that matches the transaction scenario of the current financial transaction is first obtained from the fund association policy library. Then, when the matched fund association policy includes multiple fund association policies, a fund association policy with a highest priority is determined as the fund association policy of the current financial transaction.

**[0071]** After the fund association policy is determined as described above, whether the second financial transaction of the current financial transaction has an associated financial transaction of the current financial transaction is determined based on the determined fund association policy.

**[0072]** Specifically, when the determined fund association policy is a customized fund association policy, at 550, whether the second financial transaction of the current financial transaction has an associated financial transaction of the current financial transaction is determined based on the customized fund association policy. When the determined fund association policy is the default fund association policy, at 560, whether the second financial transaction of the current financial transaction has an associated financial transaction of the current financial transaction is determined based on the default fund association policy.

**[0073]** In some embodiments, for some specific transaction scenarios, a corresponding fund association policy can be customized, and can be released online by using a process release policy such as research and development→pilot running→release→registration for use to determine a fund association relationship. By using the above-mentioned process release policy, customized fund association policies can be constantly added to the fund association policy library, so that an online transaction scenario can be truly restored. Therefore, fund association relationships between financial transactions can be established based on graph computing in accordance with actual business scenarios, thereby obtaining global fund flow relationships of fund transactions of all financial transactions occurring in the business scenarios.

**[0074]** In some embodiments, examples of the transaction scenario, for example, can include but are not limited to a fund purchase scenario, a merchant settlement scenario, and a gift voucher expense scenario. Matched fund association policies can be separately customized for the above-mentioned transaction scenarios.

**[0075]** FIG. 7A and FIG. 7B are respectively example schematic diagrams illustrating a fund purchase scenario and a corresponding fund association policy according to some embodiments of

this specification.

**[0076]** In the example shown in FIG. 7A, a transaction scenario is a YU'E BAO purchase scenario, and account C has the following graph structure:

GraphStruct {

A→C [Scene: "transfer", time: "18:00", amt:30] as E1; //A→C transfer

C→D [Scene: "YU'E BAO purchase", time: "18:05", amt:30] as E2; //C→D YU'E BAO purchase

B→C [Scene: "transfer", time: "18:03", amt:5] as E3; //B→C transfer

}

**[0077]** For the YU'E BAO purchase scenario, a customized fund association policy is shown in FIG. 7B, that is, (1) a transaction scenario of a current financial transaction (transfer-out transaction) is a fund purchase scenario (YU'E BAO purchase scenario); (2) a transaction time of an associated financial transaction (transfer-in transaction) is before a transaction time of the current financial transaction, and a transaction time interval between the two transactions is less than a predetermined time interval; and (3) a transaction amount of the associated financial transaction is equal to a transaction amount of the current financial transaction.

**[0078]** According to the above-mentioned fund association policy, for a transaction E2 initiated by account C to account D in FIG. 7A, it is determined that a transaction E1 initiated by account A to account C is an associated financial transaction.

**[0079]** FIG. 8A and FIG. 8B are respectively example schematic diagrams illustrating a merchant settlement scenario and a corresponding fund association policy according to some embodiments of this specification.

**[0080]** In the example shown in FIG. 8A, a transaction scenario is a merchant settlement scenario, and account C has the following graph structure:

GraphStruct {

A→C [Scene: "expense", time: "11:12 11/11", amt:100, logID: "0001"] as E1; //A→C expense

C→D [Scene: "merchant settlement", time: "11:12 25/11", amt:98.1, logID: "0001"] as E2; //C→D merchant settlement

B→C [Scene: "expense", time: "11:15 25/11", amt:20, logID: "0002"] as E3;//B→C expense

C→E [Scene: "merchant settlement", time: "11:15 08/12", amt:19.5, logID: "0002"] as E4; //C→E merchant settlement

}.

**[0081]** For the merchant settlement scenario, a customized fund association policy is shown in FIG. 8B, that is, (1) a transaction scenario of an associated financial transaction (transfer-in transaction) is expense (that is, merchant collection), and a transaction scenario of a current financial transaction is the merchant settlement scenario; (2) a transaction time of the associated financial transaction is before a transaction time of the current financial transaction; and (3) a transaction ID of the associated financial transaction and a transaction ID of the current financial transaction point to the same order.

**[0082]** It should be noted that, in a merchant settlement scenario, transaction information of a financial transaction further includes transaction ID information, and the transaction ID information includes order mapping information used to map an order.

**[0083]** According to the above-mentioned fund association policy, for a transaction E2 initiated by account C to account D, it is determined that a transaction E1 initiated by account A to account C is an associated financial transaction. For a transaction E4 initiated by account C to account E, it is determined that a transaction E3 initiated by account B to account C is an associated financial transaction.

**[0084]** FIG. 9A and FIG. 9B are respectively example schematic diagrams illustrating a gift voucher expense scenario and a corresponding fund association policy according to some embodiments of this specification.

**[0085]** In the example shown in FIG. 9A, a transaction scenario is a gift voucher scenario, and account C has the following graph structure:

GraphStruct {

A→C [Scene: "gift voucher recharge", time: "11:12 01/12", amt:200] as E1; //A→C gift voucher recharge

B→C [Scene: "gift voucher recharge", time: "11:14 01/12", amt:200] as E2; //B→C gift voucher recharge

D→C [Scene: "gift voucher recharge", time: "11:15 01/12", amt:200] as E3; //D→C gift voucher recharge

E→C [Scene: "transfer", time: "11:16 01/12", amt:1000] as E4; //E→C transfer

F→C [Scene: "transfer", time: "11:17 01/12", amt:180] as E5; //F→C transfer

C→G [Scene: "gift voucher expense", time: "11:19 01/12", amt:600] as E6; //C→G gift voucher expense

C→H [Scene: "expense", time: "13:30 01/12", amt:100] as E7; //C→H expense

}.

**[0086]** For the gift voucher scenario, a customized fund association policy is shown in FIG. 9B, that is, (1) a transaction scenario of an associated financial transaction (transfer-in transaction) is a gift voucher recharge scenario, and a transaction scenario of a current financial transaction (transfer-out transaction) is a gift voucher expense scenario; (2) a time of the associated financial transaction is before a transaction time of the current financial transaction; (3) a transaction ID of the associated financial transaction and a transaction ID of the current financial transaction point to the same merchant.

**[0087]** According to the above-mentioned fund association policy, for a transaction E6 initiated by account C to the account G, it is determined that a transaction E1 initiated by account A to account C, a transaction E2 initiated by account B to account C, and a transaction E3 initiated by account D to account C are associated financial transactions. For a transaction E7 initiated by account C to account H, it is determined that a transaction E4 initiated by account E to account C and a transaction E5 initiated by account F to account C are associated financial transactions.

**[0088]** In this specification, the default fund association policy usually uses a fund last-in first-out method for fund association.

**[0089]** FIG. 10 is an example schematic diagram illustrating a fund association relationship based on a default fund association policy according to some embodiments of this specification. As shown in FIG. 10, according to the fund last-in first-out policy, an associated financial transaction of the transaction E2 corresponding to "expense 20 RMB" and the transaction E3 corresponding to "transfer 20 RMB" is the transaction E1 corresponding to "recharge 100 RMB". An associated financial transaction of the transaction E5 corresponding to "expense 450 RMB" is the transaction E4 corresponding to "transfer 500 RMB". Associated financial transactions of the transaction E6 corresponding to "expense 100 RMB" is the transaction E4 corresponding to "transfer 500 RMB" and the transaction E1 corresponding to "recharge 100 RMB".

**[0090]** Still referring to FIG. 4, in response to that an associated financial transaction is determined, at 460, a fund association relationship of the current financial transaction is

determined based on a fund association relationship of the determined associated financial transaction and transaction information of the current financial transaction, and a fund association relationship of each associated financial transaction is adjusted based on the transaction information of the current financial transaction.

**[0091]** In some embodiments, the fund association relationship includes root fund association relationship ID information, parent fund association relationship ID information, fund association relationship ID information, transaction ID information, a total transaction fund amount, and a transaction fund balance of a financial transaction. In this case, during fund association relationship determining, root fund association relationship ID information and parent fund association relationship ID information in the fund association relationship of the current financial transaction are determined based on root fund association relationship ID information and parent fund association relationship ID information in the fund association relationship of the determined associated financial transaction In addition, a fund association relationship ID is generated, and transaction ID information, a total transaction fund amount, and a transaction fund balance in the fund association relationship of the current financial transaction are determined based on the transaction information of the current financial transaction. It should be noted that, the generated fund association relationship ID is a unique ID. For example, the fund association relationship ID can be generated in sequence or uniquely generated by using another algorithm during fund association relationship determining. In addition, a transaction fund balance in the fund association relationship of the associated financial transaction is adjusted based on a transaction amount in the transaction information of the current financial transaction.

**[0092]** FIG. 11 is an example schematic diagram illustrating a financial transaction sequence diagram and a corresponding final fund association relationship output according to some embodiments of this specification.

**[0093]** In the example of FIG. 11, the financial transaction sequence diagram includes six users (graph nodes), that is, user X, user A, user B, user C, user D, and user E. User X initiates financial transactions E1 and E2 to user B. User A initiates a financial transaction E3 to user B. User B initiates financial transactions E4 and E5 to user C and user D. User C initiates financial transaction E6 to user E. User D initiates financial transaction E7 to user F. A transaction time sequence of the financial transactions is as follows: E1→E2→E6→E3→E4→E5.

**[0094]** In an obtained fund association relationship illustration, p indicates a parent fund

association relationship ID of a financial transaction, r indicates a root fund association relationship ID of the financial transaction, uuid indicates fund association relationship ID information, logid indicates a transaction ID of the financial transaction, total indicates a total transaction fund amount of the financial transaction, and remain indicates a transaction fund balance of the financial transaction.

**[0095]** When the determined associated financial transaction is a single financial transaction, the fund association relationship of the current financial transaction can be determined based on the fund association relationship of the associated financial transaction and the transaction information of the current financial transaction, and the fund association relationship of the single associated financial transaction can be adjusted based on the transaction information of the current financial transaction.

**[0096]** When the determined associated financial transaction includes multiple financial transactions, the fund association relationship of the current financial transaction is determined based on the fund association relationship of each associated financial transaction and the transaction information of the current financial transaction. In addition, before adjusting the fund association relationship of each associated financial transaction based on the transaction information of the current financial transaction, a share of funds of each associated financial transaction in the transaction amount of the current financial transaction further needs to be determined. Then, based on the share of funds of each associated financial transaction in the transaction amount of the current financial transaction, a transaction fund balance in a fund association relationship of the corresponding associated financial transaction is adjusted.

**[0097]** For example, for the example in FIG. 11, after user B receives a current fund association relationship R1 of the financial transaction E1 and a current fund association relationship R2 of the financial transaction E2 from user X and receives a current fund association relationship R3 of the financial transaction E3 from user A, determining of a fund association relationship of the financial transaction E4 is started. In this case, the current fund association relationship R1 of the financial transaction E1 is "p=null, r=0009, uuid=0009, total=10, remain=10, logid=10001", the current fund association relationship R2 of the financial transaction E2 is "p=null, r=0010, uuid=0010, total=18, remain=18, logid=10002", and the current fund association relationship R3 of the financial transaction E3 is "p=null, r=0001, uuid=0001, total=100, remain=100, logid=10003". After associated-financial-transaction determining is performed, it is determined

that the financial transaction E3 is an associated financial transaction of the financial transaction E4. Therefore, a fund association relationship of a current financial transaction is determined based on a fund association relationship of the associated financial transaction E3 and transaction information of the financial transaction E4. Therefore, a fund association relationship R4 of the financial transaction E4 is "p=0001, r=0001, uuid=0002, total=50, remain=50, logid=10004". It can be learned from the description above that, in the fund association relationship R4 of the financial transaction E4, the parent fund association relationship ID "p=0001" and the root fund association relationship ID "r=0001" are determined based on the fund association relationship of the associated financial transaction E3. The fund association relationship ID "uuid=0002" of the financial transaction E4 is generated when the fund association relationship is determined. For example, the fund association relationship ID is generated in sequence or is uniquely generated based on an ID generation algorithm. The transaction ID information "logid=10004", the total transaction fund amount "total=50", and the transaction fund balance "remain=50" are determined based on the transaction information of the financial transaction E4. In addition, a transaction fund balance in the current fund association relationship of the associated financial transaction E3 is adjusted based on a transaction amount in the transaction information of the financial transaction E4. To be specific, the transaction amount of the financial transaction E4 is subtracted from "remain=100", and therefore the transaction fund balance is adjusted to "remain=50". After the fund association relationship R4 of the financial transaction E4 is determined as described above, user B transfers the fund association relationship R4 of the financial transaction E4 to user C.

**[0098]** After the fund association relationship of the financial transaction E4 is determined as described above, a fund association relationship of the financial transaction E5 can be further determined. After associated-financial-transaction determining is performed, it is determined that the financial transaction E1, the financial transaction E2, and the financial transaction E3 are associated financial transactions of the financial transaction E5. Therefore, the fund association relationship of the financial transaction E5 is determined based on the current fund association relationships of the financial transaction E1, the financial transaction E2, and the financial transaction E3 and transaction information of the financial transaction E4. In this case, the current fund association relationship R1 of the financial transaction E1 is "p=null, r=0009, uuid=0009, total=10, remain=10, logid=10001", the current fund association relationship R2 of the financial transaction E2 is "p=null, r=0010, uuid=0010, total=18, remain=18, logid=10002", and the current

fund association relationship R3 of the financial transaction E3 is "p=null, r=0001, uuid=0001, total=100, remain=50, logid=10003", and the transaction information of the financial transaction E5 is "amt:78, time:11:11:00, tid:0003,0004,0005, logid:10005". Therefore, for the financial transaction E5, three fund association relationships are output, that is, a fund association relationship R5, a fund association relationship R6, and a fund association relationship R7. The fund association relationship R5 is "p=0001, r=0001, uuid=0003, total=50, remain=50, logid=10005", the fund association relationship R6 is "p=0010, r=0010, uuid=0004, total=18, remain=18, logid=10005", and the fund association relationship R7 is "p=0009, r=0009, uuid=0005, total=10, remain=10, logid=10005". Similarly, in the fund association relationship R5 of the financial transaction E5, the parent fund association relationship ID "p=0001" and the root fund association relationship ID "r=0001" are determined based on the fund association relationship of the associated financial transaction E3. The fund association relationship ID "uuid=0003" is generated when the fund association relationship is determined. The transaction ID information "logid=10005" is determined based on the transaction information of the financial transaction E5. The total transaction fund amount "total=50" and the transaction fund balance "remain=50" are determined based on a transaction fund balance of the associated financial transaction E3 and the transaction information of the financial transaction E5. In the fund association relationship R6 of the financial transaction E5, the parent fund association relationship ID "p=0010" and the root fund association relationship ID "r=0010" are determined based on the fund association relationship of the associated financial transaction E2. The fund association relationship ID information "uuid=0004" is generated when the fund association relationship is determined. The transaction ID information "logid=10005" is determined based on the transaction information of the financial transaction E5. The total transaction fund amount "total=18" and the transaction fund balance "remain=18" are determined based on a transaction fund balance of the associated financial transaction E2 and the transaction information of the financial transaction E5. In the fund association relationship R7 of the financial transaction E5, the parent fund association relationship ID "p=0009" and the root fund association relationship ID "r=0009" are determined based on the fund association relationship of the associated financial transaction E1. The fund association relationship ID "uuid=0005" is generated when the fund association relationship is determined. The transaction ID information "logid=10005" is determined based on the transaction information of the financial transaction E5. The total transaction fund amount "total=10" and the

transaction fund balance "remain=10" are determined based on a transaction fund balance of the associated financial transaction E1 and the transaction information of the financial transaction E5. In addition, the transaction fund balances in the current fund association relationships of the associated financial transactions E1, E2, and E3 are adjusted based on the transaction amount in the transaction information of the financial transaction E5. To be specific, a partial transaction amount "10" of the financial transaction E5 is subtracted from "remain=10" in the fund association relationship R1 of the associated financial transaction E1, and therefore the transaction fund balance is adjusted to "remain=0"; a partial transaction amount "18" of the financial transaction E5 is subtracted from "remain=18" of the fund association relationship R2 of the associated financial transaction E2, and therefore the transaction fund balance is adjusted to "remain=0"; and a partial transaction amount "50" of the financial transaction E5 is subtracted from "remain=50" of the fund association relationship R3 of the associated financial transaction E3, and therefore the transaction fund balance is adjusted to "remain=0". After the fund association relationship R5 of the financial transaction E5 is determined as described above, user B transfers the fund association relationship R5 of the financial transaction E5 to user D.

**[0099]** For the financial transaction E6, because a transaction time of the financial transaction E6 is before a transaction time of the financial transaction E4, the financial transaction E6 does not have an associated financial transaction, that is, does not have a parent transaction. Therefore, a fund association relationship R8 of the financial transaction E6 is determined based on transaction information of the financial transaction E6, and the obtained fund association relationship R8 is "p=null, r=0006, uuid=0006, total=50, remain=50, logid=10006".

**[0100]** For a financial transaction E7, after associated-financial-transaction determining is performed, it is determined that the financial transaction E5 is an associated financial transaction of the financial transaction E7. Therefore, a fund association relationship of the financial transaction E7 is determined based on the current fund association relationship of the financial transaction E5 and transaction information of the financial transaction E7. In the above-mentioned example, the financial transaction E5 has three corresponding fund association relationships. In this case, the fund association relationship that matches the financial transaction E7 can be determined from the three fund association relationships R5, R6, and R7 corresponding to the financial transaction E5. For example, it can be determined, based on a determining principle of fund last-in first-out, that the fund association relationship R5 is a fund association relationship

that matches the financial transaction E7. Therefore, a fund association relationship R9 of the financial transaction E7 can be obtained as follows: "p=0003, r=0001, uuid=0007, total=50, remain=50, logid=10007". Similarly, if more than one fund association relationship matches the financial transaction E7, one fund association relationship corresponding to the financial transaction E7 is determined for each fund association relationship.

**[0101]** In some embodiments, the share of funds of each associated financial transaction in the transaction amount of the current financial transaction can be determined based on a predetermined share of funds determining rule. Examples of the predetermined share of funds determining rule can include but are not limited to, a predetermined share determining rule based on last-in first-out; a predetermined share determining rule based on equal distribution; and a predetermined share determining rule based on weighted distribution.

**[0102]** In the example of FIG. 10, the financial transaction E6 has two associated financial transactions, namely, the financial transaction E1 initiated by account A and the financial transaction E2 initiated by account B. In this case, a fund association relationship of financial transaction E6 is determined based on the current fund association relationships of the associated financial transactions E1 and E2 and the transaction information of the financial transaction E6. For example, it is assumed that a fund association relationship ID of the associated financial transaction E1 is "0001" and a transaction ID thereof is "10001". A fund association relationship ID of the associated financial transaction E2 is "0002" and a transaction ID thereof is "10002". A fund association relationship ID of the financial transaction E6 is "0006" and a transaction ID thereof is "10006". The obtained current fund association relationship R1 of the associated financial transaction E1 is "p=null, r=0001, uuid=0001, total=100, remain=60, logid=10001", the obtained current fund association relationship R2 of the associated financial transaction E2 is "p=null, r=0002, uuid=0002, total=500, remain=50, logid=10002", and the transaction information of the financial transaction E6 is "a transaction ID is 10006, and a transaction amount is 100". Therefore, it is learned that the financial transaction E6 has two fund association relationship outputs, that is, the fund association relationships R6 and R7. The fund association relationship R6 is "p=0001, r=0001, uuid=0006, total=50, remain=50, logid=10006", and the fund association relationship R7 is "p=0002, r=0002, uuid=0007, total=50, remain=50, logid=10006".

**[0103]** In addition, during adjustment of a fund association relationship of an associated financial transaction, shares of funds of the associated financial transactions E1 and E2 in the

transaction amount of the financial transaction E6 are first determined. In accordance with the predetermined share determining rule based on last-in first-out, the transaction fund balance of the associated financial transaction E2 is first used up, and then the transaction fund balance of the associated financial transaction E1 is used. As such, it is determined that the shares of funds of the associated financial transactions E1 and E2 in the transaction amount of the financial transaction E6 are 50 and 50, respectively. Then, based on the determined shares of funds, the "transaction fund balances" of the financial transactions E1 and the E2 in the current fund association relationships of the financial transaction E6 are separately adjusted, and therefore, the adjusted current fund association relationship R1 of the financial transaction E1 is "p=null, r=0001, uuid=0001,total=100,remain=10, logid=10001", and the adjusted current fund association relationship R2 of the financial transaction E2 is "p=null, r=0002, uuid=0002, total=500, remain=0, logid=10002".

**[0104]** In response to that no associated financial transaction is determined, at 470, the fund association relationship of the current financial transaction is determined based on the transaction information of the current financial transaction. For example, for the financial transaction E6 in FIG. 11, no associated financial transaction is determined after associated-financial-transaction determining. Therefore, the fund association relationship of the financial transaction E6 is determined based on the transaction information of the financial transaction E6, and is "p=null, r=0006, uuid=0006, total=50, remain=50, logid=10006".

**[0105]** After the fund association relationship of the current financial transaction is determined as described above, at 480, the fund association relationship of the current financial transaction is transferred to a transaction end point of the current financial transaction.

**[0106]** The fund association relationship determining method according to some embodiments of this specification is described above with reference to FIG. 1 to FIG. 11. According to the above-mentioned fund association relationship determining method, a fund association relationship of each financial transaction in the financial sequence diagram changes with time.

**[0107]** FIG. 12 is an example schematic diagram illustrating a case in which a fund association relationship of each financial transaction changes over time in a financial transaction sequence diagram according to some embodiments of this specification. As only a transaction fund balance changes over time in a fund association relationship, FIG. 12 shows only a total transaction fund amount and a transaction fund balance in a fund association relationship.

**[0108]** As shown in FIG. 12, at a moment "11:12 01/12", a fund association relationship is determined for a financial transaction E1. Because the financial transaction E1 has no associated financial transaction, a current fund association relationship R1 of the financial transaction E1 is obtained based on transaction information of the financial transaction E1. In this case, in the fund association relationship R1, "total=100" and "remain=100". At a moment "11:20 01/12", a fund association relationship is determined for a financial transaction E2, and the financial transaction E1 is an associated financial transaction of the financial transaction E2. Therefore, the current fund association relationship R1 of the financial transaction E1 is adjusted based on transaction information of the financial transaction E2. In this case, the fund association relationship R1 is adjusted to "total=100" and "remain=80". In addition, in a fund association relationship R2 of the financial transaction E2, "total=20" and "remain=20".

**[0109]** At a moment "11:30 01/12", a fund association relationship is determined for a financial transaction E3, and the financial transaction E1 is an associated financial transaction of the financial transaction E3. Therefore, the current fund association relationship R1 of the financial transaction E1 is adjusted based on transaction information of the financial transaction E3. In this case, the fund association relationship R1 is adjusted to "total=100" and "remain=60". In addition, in a fund association relationship R3 of the financial transaction E3, "total=20" and "remain=20".

**[0110]** At a moment "11:45 01/12", a fund association relationship is determined for a financial transaction E4. Because the financial transaction E4 has no associated financial transaction, a current fund association relationship R4 of the financial transaction E4 is obtained based on transaction information of the financial transaction E4. In this case, in the fund association relationship R4, "total=500" and "remain=500".

**[0111]** At a moment "11:48 01/12", a fund association relationship is determined for a financial transaction E5, and the financial transaction E4 is an associated financial transaction of the financial transaction E5. Therefore, the current fund association relationship R4 of the financial transaction E4 is adjusted based on transaction information of the financial transaction E5. In this case, the fund association relationship R4 is adjusted to "total=500" and "remain=50". In addition, in a fund association relationship R5 of the financial transaction E5, "total=450" and "remain=450".

**[0112]** At a moment "11:50 01/12", a fund association relationship is determined for a financial transaction E6, and the financial transactions E1 and E4 are associated financial transactions of the financial transaction E6. Therefore, the current fund association relationship R1 of the financial

transaction E1 and the current fund association relationship R4 of the financial transaction E4 are adjusted based on transaction information of the financial transaction E6. In accordance with a share of funds distribution rule of last-in first-out, shares of funds of the financial transactions E1 and E4 are 50 and 50, respectively. Therefore, the fund association relationship R1 is adjusted to "total=500" and "remain=10", and the fund association relationship R4 is adjusted to "total=500" and "remain=0". In addition, in a fund association relationship R6 of the financial transaction E6, "total=100" and "remain=100".

**[0113]** After the fund association relationship of each financial transaction in the financial sequence diagram is determined as described above, for a specified transaction fund, a complete fund flow path of the specified transaction fund can be constructed based on the determined fund association relationship. As such, fund tracing processing can be implemented based on the fund flow path, so that when a financial risk occurs, a risk source can be found in time, or a financial risk warning can be provided in advance. In addition, the constructed fund flow path can be further applied to user intention guessing to improve a hit rate of user intention guessing.

**[0114]** By using the above-mentioned fund association relationship determining method, fund association relationships between financial transactions can be established based on the financial transaction sequence diagram in accordance with actual business scenarios to implement transaction fund association in large-scale financial transaction scenarios, thereby obtaining global fund flow relationships of fund transactions of all financial transactions occurring in the financial transaction scenarios.

**[0115]** By using the above-mentioned fund association relationship determining method, a fund association policy can be customized and injected into the fund association policy library. Such practice can resolve a fund association policy differentiation problem in diversified scenarios and maintain good scalability.

**[0116]** FIG. 13 is an example block diagram illustrating a fund association relationship determining apparatus 1300 according to some embodiments of this specification. As shown in FIG. 13, the fund association relationship determining apparatus 1300 includes a fund association relationship acquisition unit 1310, an associated-financial-transaction determination unit 1320, a fund association relationship determining unit 1330, and a fund association relationship transfer unit 1340.

**[0117]** The fund association relationship acquisition unit 1310 is configured to obtain, in

response to determining a fund association relationship of a first financial transaction of a current financial transaction, current fund association relationships of all second financial transactions of the current financial transaction, where a first financial transaction of each financial transaction is a transfer-out transaction, in a financial transaction sequence diagram, that is initiated from a transaction start point of the financial transaction and whose transaction time is immediately before a transaction time of the financial transaction, and a second financial transaction of each financial transaction includes a transfer-in transaction, in the financial transaction sequence diagram, that uses a transaction start point of the financial transaction as a transaction end point and that serves as a prior transaction of the financial transaction. For an operation of the fund association relationship acquisition unit 1310, reference can be made to the operation described above with reference to 430 in FIG. 4.

**[0118]** The associated-financial-transaction determining unit 1320 is configured to determine whether the second financial transaction has an associated financial transaction of the current financial transaction. For an operation of the associated-financial-transaction determining unit 1320, reference can be made to the operation described above with reference to 450 in FIG. 4.

**[0119]** FIG. 14 is an example block diagram illustrating an associated-financial-transaction determining unit 1400 according to some embodiments of this specification. As shown in FIG. 14, the associated-financial-transaction determining unit 1400 includes a fund association policy determining module 1410 and an associated-financial-transaction determining module 1420.

**[0120]** The fund association policy determining module 1410 is configured to determine a fund association policy of the current financial transaction in response to that the second financial transaction has multiple second financial transactions. For an operation of the fund association policy determining module 1410, reference can be made to the operation described above with reference to 530 in FIG. 5.

**[0121]** In some embodiments, the fund association policy determining module 1410 can determine a fund association policy that matches a transaction scenario of the current financial transaction in a fund association policy library as the fund association policy of the current financial transaction in response to that the second financial transaction has multiple second financial transactions. When no fund association policy that matches the transaction scenario of the current financial transaction exists in the fund association policy library, the fund association policy determining module 1410 determines a default fund association policy as the fund

association policy of the current financial transaction.

**[0122]** In some embodiments, fund association policies in the fund association policy library have priorities. In this case, the fund association policy determining module 1410 is configured to obtain, from the fund association policy library, a fund association policy that matches the transaction scenario of the current financial transaction; and when the matched fund association policy includes multiple fund association policies, determine a fund association policy with a highest priority as the fund association policy of the current financial transaction.

**[0123]** In response to determining a fund association policy, the associated-financial-transaction determining module 1420 determines, based on the determined fund association policy, whether the second financial transaction has an associated financial transaction of the current financial transaction.

**[0124]** In addition, in response to that the second financial transaction has a single second financial transaction, the associated-financial-transaction determining unit 1400 determines, based on the single second financial transaction and the transaction information of the current financial transaction, whether the single second financial transaction is the associated financial transaction of the current financial transaction.

**[0125]** The fund association relationship determining unit 1330 is configured to determine, in response to that the second financial transaction has an associated financial transaction of the current financial transaction, a fund association relationship of the current financial transaction based on a fund association relationship of a determined associated financial transaction and the transaction information of the current financial transaction, and adjust the fund association relationship of the associated financial transaction based on the transaction information of the current financial transaction. In addition, the fund association relationship determining unit 1330 determines, in response to that the second financial transaction has no associated financial transaction of the current financial transaction, the fund association relationship of the current financial transaction based on the transaction information of the current financial transaction. For an operation of the fund association relationship determining unit 1330, reference can be made to the operations described above with reference to 460 and 470 in FIG. 4.

**[0126]** In some embodiments, the fund association relationship includes root transaction ID information, parent transaction ID information, transaction ID information, a total transaction fund amount, and a transaction fund balance of a financial transaction. In this case, in response to that

the second financial transaction has an associated financial transaction of the current financial transaction, the fund association relationship determining unit 1330 determines, based on root transaction ID information and transaction ID information in the fund association relationship of the determined associated financial transaction, root transaction ID information and parent transaction ID information in the fund association relationship of the current financial transaction, and determines transaction ID information, a total transaction fund amount, and a transaction fund balance in the fund association relationship of the current financial transaction based on the transaction information of the current financial transaction; and adjusts, based on a transaction amount in the transaction information of the current financial transaction, a transaction fund balance in the fund association relationship of the associated financial transaction.

**[0127]** In some embodiments, the associated financial transaction includes multiple associated financial transactions. In this case, the fund association relationship determining unit 1330 determines the fund association relationship of the current financial transaction based on a fund association relationship of each associated financial transaction and the transaction information of the current financial transaction. In addition, the fund association relationship determining unit 1330 further determines a share of funds of each associated financial transaction in the transaction amount of the current financial transaction; and adjusts, based on the share of funds of each associated financial transaction in the transaction amount of the current financial transaction, a transaction fund balance in a fund association relationship of the corresponding associated financial transaction.

**[0128]** After the fund association relationship of the current financial transaction is determined as described above, the fund association relationship transfer unit 1340 transfers the fund association relationship of the current financial transaction to a transaction end point of the current financial transaction for subsequent use to determine a fund association relationship.

**[0129]** The fund association relationship determining method and the fund association relationship determining apparatus according to the embodiments of this specification are described above with reference to FIG. 1 to FIG. 14. The above-mentioned fund association relationship determining apparatus can be implemented by hardware, software, or a combination of hardware and software.

**[0130]** FIG. 15 is a schematic diagram illustrating a fund association relationship determining apparatus 1500 implemented based on a computer system according to some embodiments of this

specification. As shown in FIG. 15, the fund association relationship determining apparatus 1500 can include at least one processor 1510, a storage (for example, a non-volatile storage) 1520, a memory 1530, and a communications interface 1540, and the at least one processor 1510, the storage 1520, the memory 1530, and the communications interface 1540 are connected together by using a bus 1560. The at least one processor 1510 executes at least one computer-readable instruction (to be specific, the above-mentioned element implemented in a software form) stored or encoded in the storage.

**[0131]** In an embodiment, a computer-executable instruction is stored in the storage, and when the computer-executable instruction is executed, the at least one processor 1510 is enabled to obtain, in response to determining a fund association relationship of a first financial transaction of a current financial transaction, current fund association relationships of all second financial transactions of the current financial transaction, where a first financial transaction of each financial transaction is a transfer-out transaction, in a financial transaction sequence diagram, that is initiated from a transaction start point of the financial transaction and whose transaction time is immediately before a transaction time of the financial transaction, and a second financial transaction of each financial transaction includes a transfer-in transaction, in the financial transaction sequence diagram, that uses a transaction start point of the financial transaction as a transaction end point and that serves as a prior transaction of the financial transaction; determine whether the second financial transaction has an associated financial transaction of the current financial transaction; determine, in response to that the second financial transaction has an associated financial transaction of the current financial transaction, a fund association relationship of the current financial transaction based on a fund association relationship of a determined associated financial transaction and transaction information of the current financial transaction, and adjust the fund association relationship of the associated financial transaction based on the transaction information of the current financial transaction; and transfer the fund association relationship of the current financial transaction to a transaction end point of the current financial transaction.

**[0132]** It should be understood that, when executed, the computer-executable instruction stored in the storage enables the at least one processor 1510 to perform the above-mentioned operations and functions described with reference to FIG. 1 to FIG. 14 in the embodiments of this specification.

**[0133]** According to an embodiment, a program product such as a machine-readable medium

(for example, a non-transient machine-readable medium) is provided. The machine-readable medium can have an instruction (to be specific, the above-mentioned element implemented in a software form). When executed by a machine, the instruction enables the machine to perform the above-mentioned operations and functions described with reference to FIG. 1 to FIG. 14 in the embodiments of this specification. Specifically, a system or an apparatus equipped with a readable storage medium can be provided, and software program code for implementing the functions in any of the above-mentioned embodiments is stored in the readable storage medium, so that a computer or a processor of the system or the apparatus reads and executes the instruction stored in the readable storage medium.

**[0134]** In this case, the program code read from the readable medium can implement the functions in any of the above-mentioned embodiments. Therefore, the machine-readable code and the readable storage medium that stores the machine-readable code form a part of the present invention.

**[0135]** Embodiments of the readable storage medium include a floppy disk, a hard disk, a magneto-optical disc, an optical disc (for example, a CD-ROM, a CD-R, a CD-RW, a DVD-ROM, a DVD-RAM, a DVD-RW, or a DVD-RW), magnetic tape, a non-volatile memory card, and a ROM. Alternatively, the program code can be downloaded from a server computer or a cloud over a communications network.

**[0136]** According to an embodiment, a computer program product is provided, where the computer program product includes a computer program, and when the computer program is executed by a processor, the processor is enabled to perform the above-mentioned operations and functions described with reference to FIG. 1 to FIG. 14 in the embodiments of this specification.

**[0137]** A person skilled in the art should understand that variations and modifications can be made to the embodiments disclosed above without departing from the essence of the present invention. Therefore, the protection scope of the present invention shall be subject to the appended claims.

**[0138]** It should be noted that not all steps and units in the above-mentioned processes and system structural diagrams are mandatory, and some steps or units can be ignored according to an actual requirement. An execution sequence of the steps is not fixed, and can be determined as needed. The apparatus structure described in the above-mentioned embodiments can be a physical structure, or can be a logical structure. In other words, some units can be implemented by the same

physical entity, or some units can be implemented by multiple physical entities or implemented jointly by some components in multiple independent devices.

**[0139]** In the above-mentioned embodiments, the hardware units or modules can be implemented by using a mechanical method or an electrical method. For example, a hardware unit, module or processor can include a permanent dedicated circuit or logic (for example, a dedicated processor, FPGA, or ASIC) to complete corresponding operations. The hardware unit or processor can further include programmable logic or a programmable circuit (for example, a general-purpose processor or another programmable processor), so that software can perform temporary settings to complete corresponding operations. Specific implementations (mechanical methods, dedicated permanent circuits, or temporarily disposed circuits) can be determined based on cost and time considerations.

**[0140]** The specific implementations illustrated above with reference to the accompanying drawings describe example embodiments, but do not represent all embodiments that can be implemented or fall within the protection scope of the claims. The term "example" used throughout this specification means "used as an example, an instance, or an illustration" and does not mean "preferred" or "advantageous" over other embodiments. For the purpose of providing an understanding of the described technologies, specific implementations include specific details. However, these technologies can be implemented without these specific details. In some instances, well-known structures and apparatuses are shown in block diagrams to avoid causing difficulties in understanding the concepts of the described embodiments.

**[0141]** The above-mentioned descriptions of the present disclosure are provided to enable any person of ordinary skill in the art to implement or use the present disclosure. Various modifications made to the present disclosure are clear to a person of ordinary skill in the art. In addition, the general principles defined in this specification can also be applied to other variants without departing from the protection scope of the present disclosure. Therefore, the present disclosure is not limited to the examples and designs described in this specification, but is consistent with the widest scope of principles and novelty features that conform to this specification.

## CLAIMS

What is claimed is:

1. A fund association relationship determining method based on a financial transaction sequence diagram, comprising:

obtaining, in response to determining a fund association relationship of a first financial transaction of a current financial transaction, current fund association relationships of all second financial transactions of the current financial transaction, wherein a first financial transaction of each financial transaction is a transfer-out transaction, in the financial transaction sequence diagram, that is initiated from a transaction start point of the financial transaction and whose transaction time is immediately before a transaction time of the financial transaction, and a second financial transaction of each financial transaction comprises a transfer-in transaction, in the financial transaction sequence diagram, that uses a transaction start point of the financial transaction as a transaction end point and that serves as a prior transaction of the financial transaction;

determining whether the second financial transaction has an associated financial transaction of the current financial transaction;

determining, in response to that the second financial transaction has an associated financial transaction of the current financial transaction, a fund association relationship of the current financial transaction based on a fund association relationship of a determined associated financial transaction and transaction information of the current financial transaction, and adjusting the fund association relationship of the associated financial transaction based on the transaction information of the current financial transaction; and

transferring the fund association relationship of the current financial transaction to a transaction end point of the current financial transaction.

2. The fund association relationship determining method according to claim 1, further comprising:

determining, in response to that the second financial transaction has no associated financial transaction of the current financial transaction, the fund association relationship of the current financial transaction based on the transaction information of the current financial transaction.

3. The fund association relationship determining method according to claim 1, wherein the

determining whether the second financial transaction has an associated financial transaction of the current financial transaction comprises the following:

determining a fund association policy of the current financial transaction in response to that the second financial transaction has multiple second financial transactions; and

determining, based on the fund association policy, whether the second financial transaction has the associated financial transaction of the current financial transaction.

4. The fund association relationship determining method according to claim 3, wherein the determining a fund association policy of the current financial transaction in response to that the second financial transaction has multiple second financial transactions comprises the following:

determining a fund association policy that matches a transaction scenario of the current financial transaction in a fund association policy library as the fund association policy of the current financial transaction in response to that the second financial transaction has multiple second financial transactions.

5. The fund association relationship determining method according to claim 4, wherein fund association policies in the fund association policy library have priorities, and the determining a fund association policy that matches a transaction scenario of the current financial transaction in a fund association policy library as the fund association policy of the current financial transaction comprises the following:

obtaining, from the fund association policy library, a fund association policy that matches the transaction scenario of the current financial transaction; and

when the matched fund association policy comprises multiple fund association policies, determining a fund association policy with a highest priority as the fund association policy of the current financial transaction.

6. The fund association relationship determining method according to claim 4, wherein the determining a fund association policy of the current financial transaction in response to that the second financial transaction has multiple second financial transactions further comprises the following:

when no fund association policy that matches the transaction scenario of the current financial transaction exists in the fund association policy library, determining a default fund association policy as the fund association policy of the current financial transaction.

7. The fund association relationship determining method according to claim 1, wherein the

determining whether the second financial transaction has an associated financial transaction of the current financial transaction further comprises the following:

in response to that the second financial transaction has a single second financial transaction, determining, based on the single second financial transaction and the transaction information of the current financial transaction, whether the single second financial transaction is the associated financial transaction of the current financial transaction.

8. The fund association relationship determining method according to claim 1, wherein the fund association relationship comprises root fund association relationship ID information, parent fund association relationship ID information, fund association relationship ID information, transaction ID information, a total transaction fund amount, and a transaction fund balance of a financial transaction; and

the determining, in response to that the second financial transaction has an associated financial transaction of the current financial transaction, a fund association relationship of the current financial transaction based on a fund association relationship of a determined associated financial transaction and transaction information of the current financial transaction, and adjusting the fund association relationship of the associated financial transaction based on the transaction information of the current financial transaction comprises the following:

in response to that the second financial transaction has an associated financial transaction of the current financial transaction,

determining, based on root fund association relationship ID information and parent fund association relationship ID information in the fund association relationship of the determined associated financial transaction, root fund association relationship ID information and parent fund association relationship ID information in the fund association relationship of the current financial transaction, generating a fund association relationship ID, and determining transaction ID information, a total transaction fund amount, and a transaction fund balance in the fund association relationship of the current financial transaction based on the transaction information of the current financial transaction; and

adjusting, based on a transaction amount in the transaction information of the current financial transaction, a transaction fund balance in the fund association relationship of the associated financial transaction.

9. The fund association relationship determining method according to claim 8, wherein the

associated financial transaction comprises multiple associated financial transactions, and the fund association relationship determining method further comprises the following:

determining a share of funds of each associated financial transaction in the transaction amount of the current financial transaction; and

the adjusting, based on a transaction amount in the transaction information of the current financial transaction, a transaction fund balance in the fund association relationship of the associated financial transaction comprises the following:

adjusting, based on the share of funds of each associated financial transaction in the transaction amount of the current financial transaction, a transaction fund balance in a fund association relationship of the corresponding associated financial transaction.

10. The fund association relationship determining method according to claim 9, wherein the determining a share of funds of each associated financial transaction in the transaction amount of the current financial transaction comprises the following:

determining the share of funds of each associated financial transaction in the transaction amount of the current financial transaction based on a predetermined share of funds determining rule.

11. The fund association relationship determining method according to claim 10, wherein the predetermined share of funds determining rule comprises one of the following rules:

a predetermined share determining rule based on last-in first-out;

a predetermined share determining rule based on equal distribution; and

a predetermined share determining rule based on weighted distribution.

12. The fund association relationship determining method according to claim 4, wherein the transaction scenario comprises at least one of the following transaction scenarios: a merchant settlement scenario, a fund purchase scenario, and a gift voucher expense scenario.

13. A fund association relationship determining apparatus based on a financial transaction sequence diagram, comprising:

a fund association relationship acquisition unit, configured to obtain, in response to determining a fund association relationship of a first financial transaction of a current financial transaction, current fund association relationships of all second financial transactions of the current financial transaction, wherein a first financial transaction of each financial transaction is a transfer-out transaction, in the financial transaction sequence diagram, that is initiated from a transaction

start point of the financial transaction and whose transaction time is immediately before a transaction time of the financial transaction, and a second financial transaction of each financial transaction comprises a transfer-in transaction, in the financial transaction sequence diagram, that uses a transaction start point of the financial transaction as a transaction end point and that serves as a prior transaction of the financial transaction;

an associated-financial-transaction determining unit, configured to determine whether the second financial transaction has an associated financial transaction of the current financial transaction;

a fund association relationship determining unit, configured to determine, in response to that the second financial transaction has an associated financial transaction of the current financial transaction, a fund association relationship of the current financial transaction based on a fund association relationship of a determined associated financial transaction and transaction information of the current financial transaction, and adjust the fund association relationship of the associated financial transaction based on the transaction information of the current financial transaction; and

a fund association relationship transfer unit, configured to transfer the fund association relationship of the current financial transaction to a transaction end point of the current financial transaction.

14. A fund association relationship determining apparatus based on a financial transaction sequence diagram, comprising:

at least one processor;

a storage coupled to the at least one processor; and

a computer program stored in the storage, wherein the at least one processor executes the computer program to implement the fund association relationship determining method according to any one of claims 1 to 12.

15. A computer-readable storage medium, wherein the computer-readable storage medium stores an executable instruction, and when the instruction is executed, a processor is enabled to perform the fund association relationship determining method according to any one of claims 1 to 12.

16. A computer program product, comprising a computer program, wherein the computer program is executed by a processor to implement the fund association relationship determining

method according to any one of claims 1 to 12.