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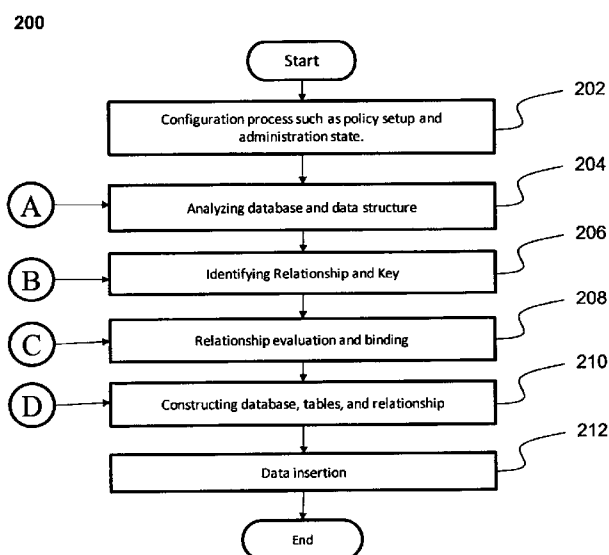
(54) **Title:** AUTOMATIC TRANSFORMATION OF NON-RELATIONAL DATABASE INTO RELATIONAL DATABASE

FIG. 2.0

(57) **Abstract:** The system and method of the present invention provides for automatic transformation of non-relational database into relational database that is self-reliant. The system of the present invention comprising at least one data analyzer (102); at least one relationship builder (104); and at least one data transformer (106) for automatically transforming non-relational database into relational database. Execution of the present invention begins with the data analyzer (102) wherein the at least one data analyzer (102) is called to perform database analysis to produce draft of database structure. Thereafter, the other component of the system; the relationship builder (104) confine the database structure and convert the draft database structure to a confirm structure. Upon confirmation of the database structure, data transformer (106) will automatically transform and realize the structures and thereafter export data from source to target. In short, the methodology of the present invention comprising steps of initializing configuration of transformation process (202); analyzing non-relational database and data structure to form database tree (204); identifying relationship and key and further associating it with database tree to form draft database structure (206); evaluating relationship binding to produce confine database structure (208); creating database by constructing database, tables and relationship into relational database (210); and performing data insertion with key identification and valid data format for database transformation (212).



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AUTOMATIC TRANSFORMATION OF NON-RELATIONAL DATABASE INTO RELATIONAL DATABASE

FIELD OF INVENTION

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The present invention relates to a system and method for automatic transformation of non-relational database into relational database that is self-reliant.

BACKGROUND ART

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Legacy system contains unstructured data as there are different tables, files, or database which is using different format or structure. Data transformation in legacy system remains a hassle task as there is no existence of relationship between the data. In addition, the format of data is defined differently by users. Therefore, more time is required to
15 synchronize data definition and error may occur during data transformation due to invalid definition. The database of legacy system may store corrupted data due to the wrongly defined data format.

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The presently available data transformation system is time consuming in defining the data process, in data structure analysis and data transformation as it requires human
intervention. Accuracy of the presently available system is low and thus requires more resources in amending the data. Hence, current solutions are yet to improve the level of trust for analysis and decision making.

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The present invention proposes a system and method that automatically creates relationship between data structures in a system whereby no relationship exist during transformation; to synchronize the structures, type and format between unknown data
structures for relationship binding between the data structures and automatically create table and data relationship and perform data transformation without the need for human
30 intervention thus having self-reliant transformation process with higher accuracy of data relationship.

The approach as proposed in the present invention performs automatic transformation of non-relational DBMS (Database Management System) to RDBMS (Relational DBMS)

- whereby no relations or key is defined or declared. It consists of a method to perform database analysis on DBMS; mainly but not limited to non-relational DBMS and flat-file; using LA (Lexical Analysis) and AI (Abstract Interpretation). The proposed solution will then incorporate a method to identify and construct the relationship between non-relational
- 5 data using DFA (Data Flow Analysis) techniques together with the result from the previous method. Finally, the solution will automatically create a database, correct and harmonize tables and its structure, and perform data insertion with accurate key identification with a valid data and format.
- 10 The subject matter claimed herein is not limited to embodiments that solve any disadvantages or that operate only in environments such as those described above. Rather, this background is only provided to illustrate one exemplary technology area where some embodiments described herein may be practice.

SUMMARY OF INVENTION

The present invention provides a system and method for automatic transformation of non-relational database into relational database that is self-reliant. One aspect of the present invention provides a system for automatic transformation of non-relational database into relational database that is self-reliant. The system comprising at least one data analyzer (102); at least one relationship builder (104); and at least one data transformer (106) for automatically transforming non- relational database into relational database. The at least one data analyzer (102) having means for analyzing non-relational database and data structure to form database tree while the at least one relationship builder (104) having means for identifying relationship and key and further associating it with database tree to form draft database structure; and evaluating relationship binding to produce confine database structure.

One aspect of the present invention provides for the at least one data transformer (106) for automatically transforming non-relational database into relational database. The at least one data transformer (106) having means for creating database by constructing database, tables and relationship into relational database; and performing data insertion with key identification and valid data format for database transformation. The said non-relational database is in DBMS (Database Management System) format and relational database is in RDBMS (Relational Database Management System) format.

Preferably, the present invention provides a method (200) for automatic transformation of non-relational database into relational database that is self-reliant. The method comprising steps of initializing configuration of transformation process (202); analyzing non-relational database and data structure to form database tree (204); identifying relationship and key and further associating it with database tree to form draft database structure (206); evaluating relationship binding to produce confine database structure (208); creating database by constructing database, tables and relationship into relational database (210); and performing data insertion with key identification and valid data format for database transformation (212).

Another aspect of the present invention describes the further steps of the method for analyzing non-relational database and data structure to form database tree. The said

method further comprising steps of reading non-relational database to search for DBMS file (302); extracting table structure from at least one identified DBMS file (304); analyzing source code using AI (Abstract Interpretation) to locate complete table structures which may include field size, type and format (306); and generating AST (Abstract Syntax Tree) using extracted table structure obtained from at least one identified DBMS file and table structure obtained from analysis of source code (308).

Preferably, the present invention provides the further steps of the method for identifying relationship and key and further associating it with database tree to form draft database structure. The said method further comprising steps of constructing and loading AST into database tree (402); analyzing at least one identified DBMS file identified in (step 302) with LA (Lexical Analysis) to obtain table references and key (404); generating at least one reference and at least one key based on results obtained through LA in (step 404) wherein a plurality of keys with identical names with different format, type and length is generated; and tagging at least one reference and at least one key obtained to generated database tree to form draft database structure.

A further aspect of the present invention provides further steps of the method for evaluating relationship binding to produce confine database structure. The said method further comprising steps of reading and loading at least one DBMS file into memory (502); performing flow analysis on results obtained through LA in (step 404, 406) using DFA (Data Flow Analysis) to obtain data flow, relationship and field format (504); binding relationship with AST generated in (step 308) and database tree generated from DFA in (step 504) (506); and synchronizing and aligning table structure to produce a confine database structure (508).

Preferably, the present invention provides further steps for creating database by constructing database, tables and relationship into relational database. The said method further comprising steps of generating database scripts from generated AST (602); generating keys based on AST (604); generating relationship script based on DFA and AST (606); and executing database creation based on complete and structured table (608).

The present invention consists of features and a combination of parts hereinafter fully described and illustrated in the accompanying drawings, it being understood that various changes in the details may be made without departing from the scope of the invention or sacrificing any of the advantages of the present invention.

BRIEF DESCRIPTION OF ACCOMPANYING DRAWINGS

To further clarify various aspects of some embodiments of the present invention, a more particular description of the invention will be rendered by references to specific
5 embodiments thereof, which are illustrated in the appended drawings. It is appreciated that these drawings depict only typical embodiments of the invention and are therefore not to be considered limiting of its scope. The invention will be described and explained with additional specificity and detail through the accompanying drawings in which:

10 FIG. 1.0 illustrates the block diagram of the architecture of present invention in comparison with the architecture of the legacy system.

FIG. 2.0 is a flowchart illustrating the method for automatic-transformation of non-relational
15 database into relational database that is self-reliant.

FIG. 3.0 is a flowchart illustrating the method for analyzing non-relational database and
data structure to form database tree.

20 FIG. 4.0 is a flowchart illustrating the method for identifying relationship and key and further associating it with database tree to form draft database structure.

FIG. 5.0 is a flowchart illustrating the method for evaluating relationship binding to produce
confine database structure.

25 FIG. 6.0 is a flowchart illustrating the method for creating database by constructing database, tables and relationship into relational database.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention provides a system and method for automatic transformation of non-relational database into relational database that is self-reliant. Hereinafter, this specification will describe the present invention according to the preferred embodiments. It is to be understood that limiting the description to the preferred embodiments of the invention is merely to facilitate discussion of the present invention and it is envisioned without departing from the scope of the appended claims.

Reference is first being made to FIG. 1.0 and FIG. 2.0 respectively. FIG. 1.0 illustrates the block diagram of the architecture of present invention in comparison with the architecture of the legacy system and FIG. 2.0 is a flowchart illustrating the method for automatic-transformation of non-relational database into relational database that is self-reliant. As illustrated in FIG. 1.0, the system of the present invention comprising at least one data analyzer (102); at least one relationship builder (104); and at least one data transformer (106) for automatically transforming non-relational database into relational database. The present invention is applicable in any database transformation and in any environment provided that the source and target are available and accessible by the solution. The system as proposed in the present invention can be invoked from any defined host and connect to any database as long as it is permitted to execute with administrator's privileges. Execution of the present invention begins with the data analyzer (102) wherein the at least one data analyzer (102) is called to perform database analysis to produce draft of database structure. Thereafter, the other component of the system; the relationship builder (104) confine the database structure and convert the draft database structure to a confirm structure. Upon confirmation of the database structure, the remaining component of the system; the data transformer (106) will automatically transform and realize the structures and thereafter export data from source to target. The details of the function of each of the components will be described in detail together with the methodology of the present invention.

As illustrated in FIG. 2.0, the methodology of the present invention for automatic transformation of non-relational database into relational database is first executed by initializing configuration of transformation process (202) wherein policy setup and administration state is being configured. Thereafter, the at least one data analyzer (102)

performs database analysis by analyzing non-relational database and data structure to form database tree (204). The relationship builder (104) confine the database structure and convert the draft database structure to a confirm structure by identifying relationship and key and further associating it with database tree to form draft database structure (206); and evaluating relationship binding to produce confine database structure (208). Subsequently, the at least one data transformer (106) creates database by constructing database, tables and relationship into relational database (210); and data insertion is performed with key identification and valid data format for database transformation (212). The said non-relational database is in DBMS (Database Management System) format and relational database is in RDBMS (Relational Database Management System) format.

Reference is now being made to FIG. 3.0. FIG. 3.0 is a flowchart illustrating the method for analyzing non-relational database and data structure to form database tree. As illustrated in FIG. 3.0, the at least one data analyzer (102) starts analyzing non-relational database and data structure to form database tree by reading non-relational database to search for DBMS file (302) and accordingly extracts table structure from at least one identified DBMS file (304). The said method continues with source code analysis using AI (Abstract Interpretation) to locate complete table structures (306) wherein the complete table structures may include field size, type and format. Thereafter, AST (Abstract Syntax Tree) or database tree will be generated with extracted table structure obtained from at least one identified DBMS file and table structure obtained from analysis of source code (308).

Reference is now being made to FIG. 4.0. FIG. 4.0 is a flowchart illustrating the method for identifying relationship and key and further associating it with database tree to form draft database structure. Upon completion of database analysis by the data analyzer, the methodology for automatic transformation of non-relational database into relational database continues with identifying relationship and key and further associating it with database tree to form draft database structure. The said method starts by constructing and loading AST into database tree (402) and continues by analyzing at least one identified DBMS file identified in (step 302) with LA (Lexical Analysis) to obtain table references and key (404). Thereafter, at least one reference and at least one key is generated based on results obtained through LA in (step 404) (406). A plurality of keys with identical names with different format, type and length may be generated during the process of key generation based on results obtained through LA in (step 404). Upon generating at least

one reference and at least one key, the at least one reference and the at least one key will be tagged to generated database tree to form draft database structure (408).

Reference is now being made to FIG. 5.0. FIG. 5.0 is a flowchart illustrating the method for evaluating relationship binding to produce confine database structure. Upon completion of creation of draft database structure, evaluation and binding of relationship is performed to produce a confine database structure. As illustrated in FIG. 5.0, the system will first read and load at least one DBMS file into memory (502). Thereafter, flow analysis is performed on results obtained through LA in (step 404, 406) using DFA (Data Flow Analysis) to obtain data flow, relationship and field format (504). The method continues with relationship binding with AST generated in (step 308) and database tree generated from DFA in (step 504) (506). Unwanted keys or relations are removed during relationship binding. Subsequently, table structures are synchronized and aligned to produce a confine database structure (508).

Reference is now being made to FIG. 6.0. FIG. 6.0 is a flowchart illustrating the method for creating database by constructing database, tables and relationship into relational database. As illustrated in FIG. 6.0, creation of database starts by generating database scripts from generated AST (602). Keys based on AST will be generated (604) and the database scripts will be added with said key generation scripts. Once completed, relationship generation script will be generated based on DFA and AST (606) and database creation will be executed based on complete and structured table (608). Upon creation of said database, data insertion is performed with key identification and valid data format for database transformation wherein data transformer transform and realize the structure and export data from source to target.

As described and illustrated in the relevant figures, the present invention provides a system and method for automatic transformation of non- related data into RDBMS format wherein the present invention automatically creates relationship between data structures in a system whereby there is no existence of relationship during transformation; synchronize structures, type and format between unknown data structures for relationship binding between the data structures; and automatically creates table and data relationship and performing data transformation without or with minor intervention thus having a self-reliant transformation process with higher accuracy of data relationship. The

distinctiveness of the present invention lies in the techniques of relationship generation using Abstract Interpretation (AI), Lexical Analysis and Data Flow Analysis for automatic transformation of non- related data into RDBMS format.

- 5 The present invention may be embodied in other specific forms without departing from its essential characteristics. The described embodiments are to be considered in all respects only as illustrative and not restrictive. The scope of the invention is, therefore indicated by the appended claims rather than by the foregoing description. All changes, which come within the meaning and range of equivalency of the claims, are to be embraced within their
- 10 scope.

CLAIMS

1. A system (100) for automatic transformation of non-relational database into relational database that is self-reliant, the system comprising:

at least one data analyzer (102) having means for analyzing non-relational database and data structure to form database tree;

at least one relationship builder (104) having means for identifying relationship and key and further associating it with database tree to form draft database structure; and evaluating relationship binding to produce confine database structure; and

at least one data transformer (106) for automatically transforming non-relational database into relational database having means for creating database by constructing database, tables and relationship into relational database; and performing data insertion with key identification and valid data format for database transformation

characterized in that

the at least one data analyzer (102) having means for analyzing non-relational database and data structure to form database tree further having means for:

reading non-relational database to search for DBMS file (302);
extracting table structure from at least one identified DBMS file (304);

analyzing source code using AI (Abstract Interpretation) to locate complete table structures (306); and

generating AST (Abstract Syntax Tree) using extracted table structure obtained from at least one identified DBMS file and table structure obtained from analysis of source code (308).

2. A system according to Claim 1, wherein said non-relational database is in DBMS (Database Management System) format and relational database is in RDBMS (Relational Database Management System) format.

3. A method (200) for automatic transformation of non-relational database into relational database that is self-reliant; the method comprising steps of:

initializing configuration of transformation process (202);

analyzing non-relational database and data structure to form database tree (204);

identifying relationship and key and further associating it with database tree to form draft database structure (206);

evaluating relationship binding to produce confine database structure (208);

creating database by constructing database, tables and relationship into relational database (210); and

performing data insertion with key identification and valid data format for database transformation (212)

characterized in that

analyzing non-relational database and data structure to form database tree (204) further comprises steps of:

reading non-relational database to search for DBMS file (302);

extracting table structure from at least one identified DBMS file (304);

analyzing source code using AI (Abstract Interpretation) to locate complete table structures (306); and

generating AST (Abstract Syntax Tree) using extracted table structure obtained from at least one identified DBMS file and

table structure obtained from analysis of source code (308).

4. A method according to Claim 3, wherein complete table structures include field size, type and format.

5. A method according to Claim 3, wherein identifying relationship and key and further associating it with database tree to form draft database structure further comprising steps of:

constructing and loading AST into database tree (402);

analyzing at least one identified DBMS file identified in (step 302) with LA (Lexical Analysis) to obtain table references and key (404);

generating at least one reference and at least one key based on results obtained through LA in (step 404) (406); and

5 tagging at least one reference and at least one key obtained to generated database tree to form draft database structure (408).

6. A method according to Claim 5, wherein generating at least one reference and at least one key based on results obtained through LA in (step 404) further
10 comprising generating a plurality of keys with identical names with different format, type and length.

7. A method according to Claim 3, wherein evaluating relationship binding to produce confine database structure further comprising steps of:

15 reading and loading at least one DBMS file into memory (502);
performing flow analysis on results obtained through LA in (step 404, 406) using DFA (Data Flow Analysis) to obtain data flow, relationship and field format (504);

20 binding relationship with AST generated in (step 308) and database tree generated from DFA in (step 504) (506); and

synchronizing and aligning table structure to produce a confine database structure (508).

8. A method according to Claim 3, wherein creating database by constructing
25 database, tables and relationship into relational database further comprising steps of:

generating database scripts from generated AST (602);

generating keys based on AST (604);

generating relationship script based on DFA and AST (606); and

30 executing database creation based on complete and structured table (608).

100

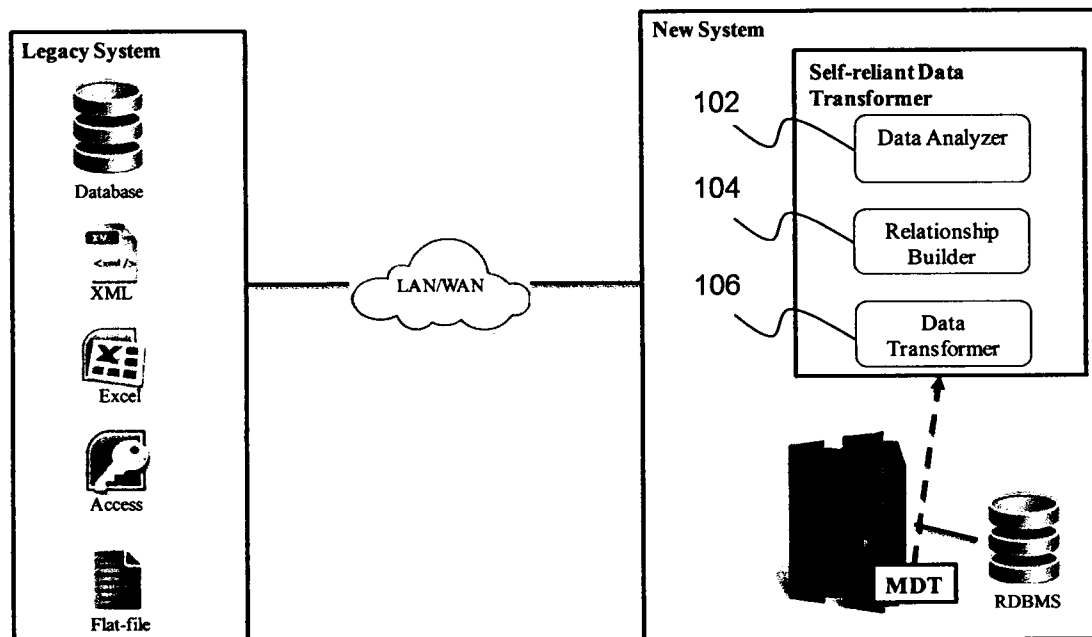


FIG. 1.0

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200

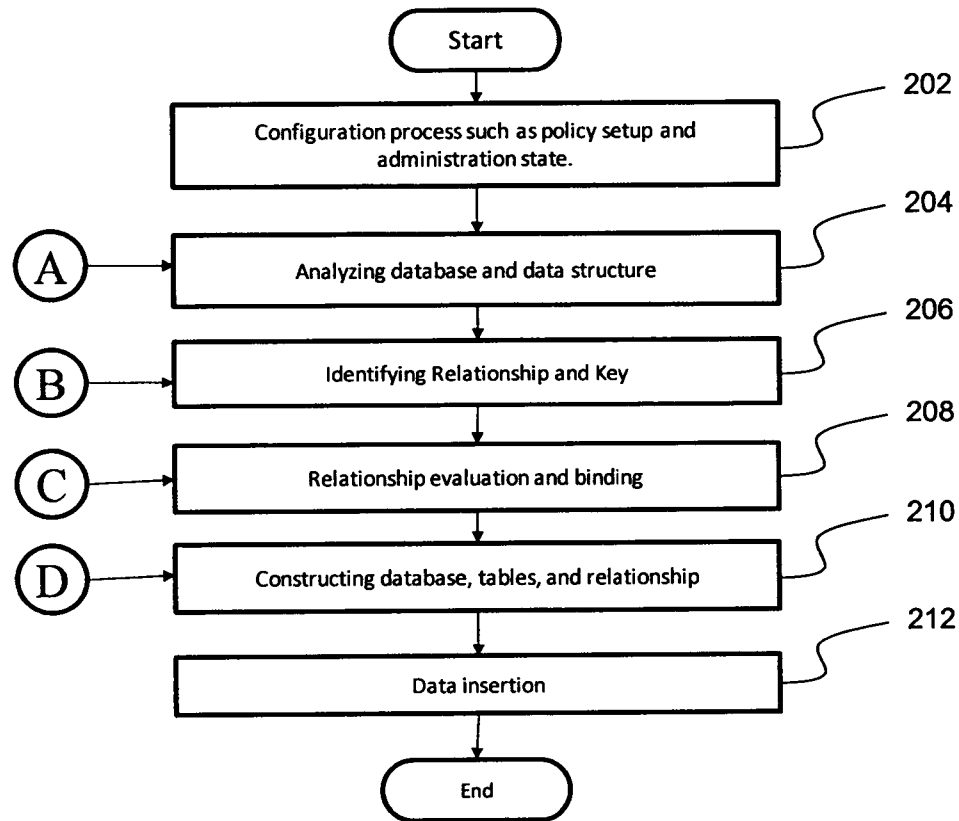


FIG. 2.0

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300

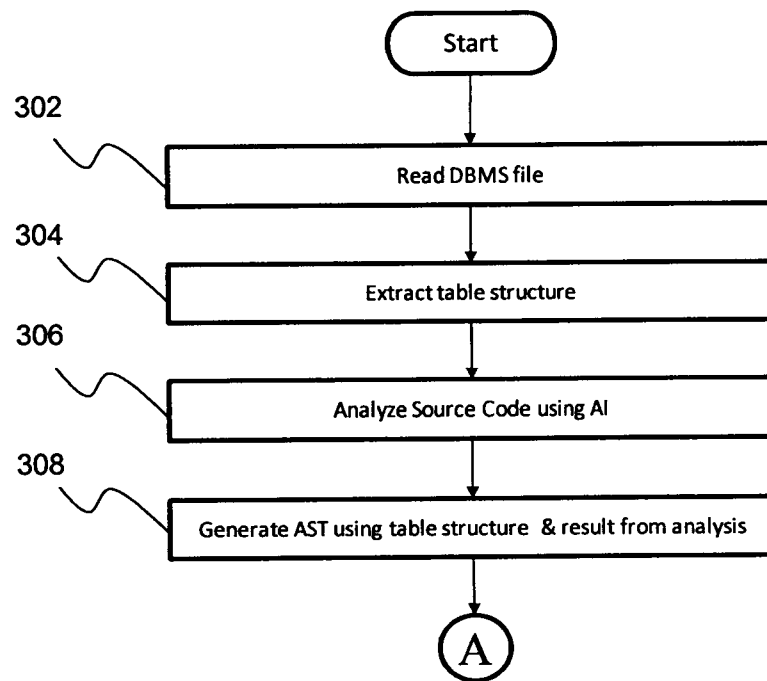


FIG. 3.0

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400

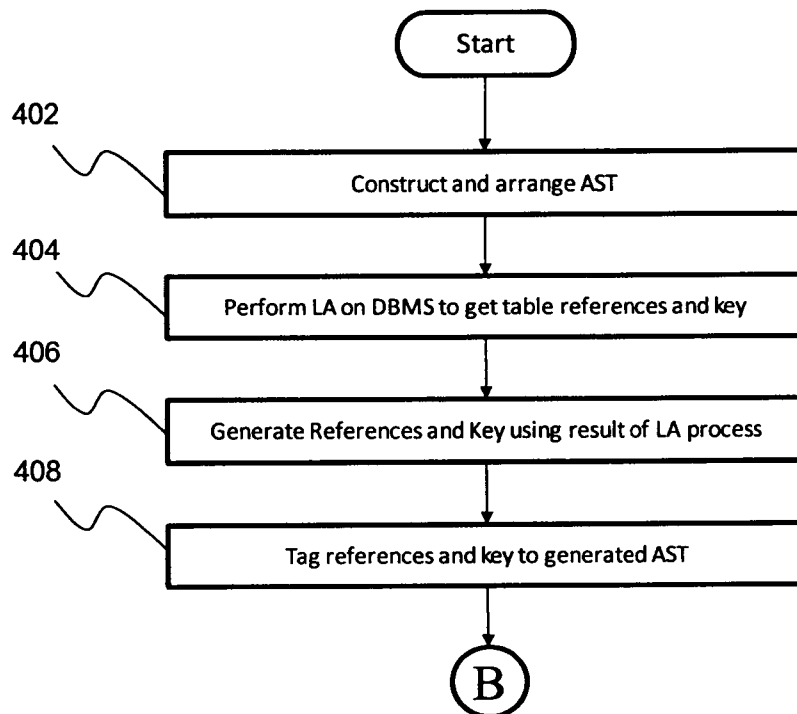


FIG. 4.0

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500

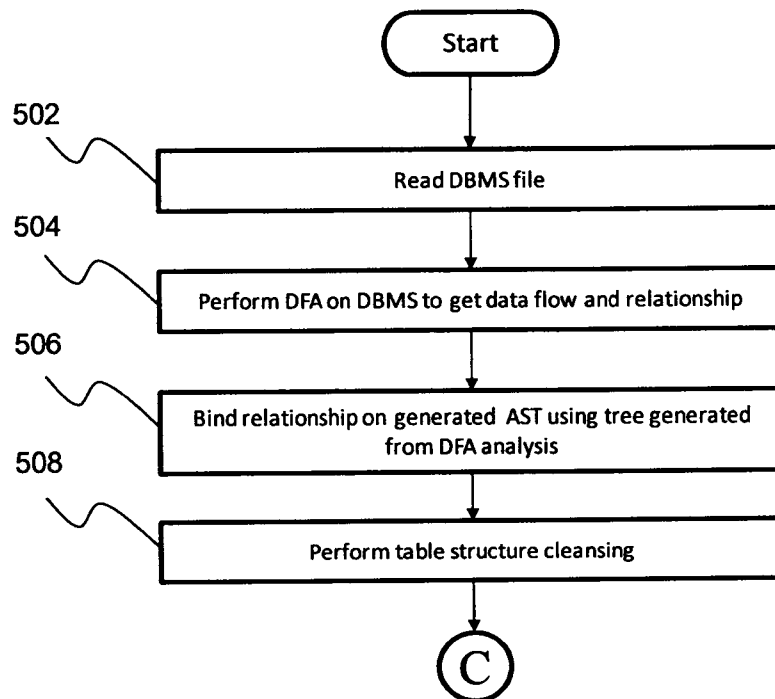


FIG. 5.0

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600

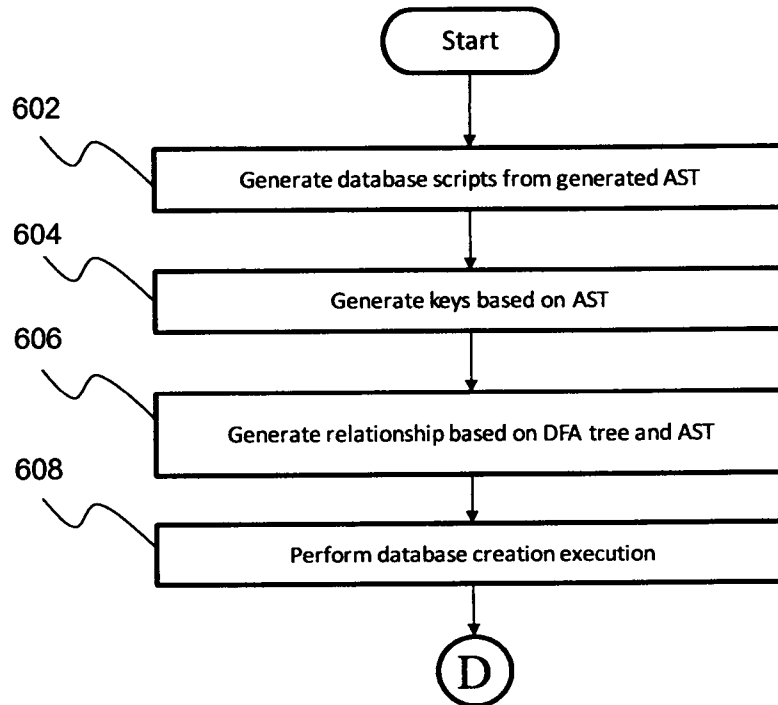


FIG. 6.0