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Method and system for merging telephone switching office databases
Verfahren und System zur Zusammenführung von Vermittlungsstellen-Datenbanken
Procédé et système pour combiner des bases de données de centraux téléphoniques

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References cited:
WO-A-96/25715 NL-C-1 007 462

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Description

Background Of The Invention

[0001] This invention relates to computer controlled telephone switching systems. More particularly, this invention relates to a method and an apparatus for merging a database from one computer controlled switching system with a database from a second computer controlled switching system to create a third database for use with a new switching system the functionality of an old system.

[0002] Telephone switching systems used in today are largely computer controlled. These computer controlled systems require immense databases wherein key information about the system permits a computer to efficiently manage switching system resources.

[0003] The telephone network in the United States has become a critical resource in that the telephone network not only carries key economic information but is also essential to public safety agencies. Telephone service providers now routinely design into their systems redundancy whereby one switching system might be tasked with handling the calls of a switching system that has failed.

[0004] A problem with merely providing a backup switching system is that such a system will not function unless it is properly programmed. Programming a large telephone switching system to handle the calls of a failed system would require copying thousands, perhaps millions, of records into the replacement system. If a telephone switching system were to fail or be destroyed, bringing even a replacement system back online would still require weeks, perhaps months, of effort to re-program the new system.

[0005] Any method or apparatus that would reduce the time necessary to bring a new switching system back online would be an improvement over the prior art. Accordingly, it is an object of the present invention to provide a method and apparatus by which a database from one telephone switching system can be automatically modified to be made to work in another switching system.

[0006] NL-C-1 007 462 provides a method of merging a first source database "Storingensysteem" and a second source database "Klachtensysteem" into a target database having a generic structure. The first source database and the second source database are scanned for data elements for entry into the third database. The target database obtains the data elements via a projection operation.

Summary Of The Invention

[0007] The structure and organization of a database used with a particular computer controlled telephone switching system is known. In order to make a new switching system operational, vast amounts of data required by the new system must be copied into the database for the new system.

[0008] To make a new switching system work in place of a failed system, operational data from the failed system must be made to work into the database for the new system. Such information would include among other things; incoming signaling characteristics, outgoing signaling characteristics, base traffic number, echo suppression indicator, circuit identification number, trunk subgroup number, and routing domain, all of which are well-known to those skilled in the art.

[0009] Rarely will the hardware in a backup switching office have the exact same hardware or hardware configuration as the hardware in an office that has failed or has been destroyed. When bringing a backup system on line to replace an office that has failed or is otherwise out of service, the operational data from the first system, including for example incoming and outgoing trunk termination data, and switching office hardware, must be made to work in the second, i.e. the backup system. Alternatively, the database of the old system must be merged with information for the new system to form a third database for the new system.

[0010] A method and system according to the present invention are set out in independent claims 1 and 4, to which the reader is now referred. Preferred features are laid out in dependent claims 2-3 and 5-7.

The method taught herein is a bottom up procedure. The structure of the resultant database is known. The requisite components are obtained by searching the two pre-existing, databases. By searching both of the previous databases for data elements required to fill out the new database, the two previous databases can be merged in a bottom up procedure. By changing the rules of construction of the database or the required structure, the two databases can be merged in different ways.

Brief Description Of The Drawings

[0011] Figure 1 shows a simplified block diagram of a computer controlled switching system controlled in part by a computer database.

Figure 2 shows a simplified data structure for a database used in a switching system shown in Figure 1.

Figure 3 shows how components of a first data structure from pre-existing switching system are combined with data elements for a new switching system to form the elements of a data structure for use with a switching system, such as the system shown in Figure 2.

Figure 4 shows a simplified flow chart of the process by which two bases for different switching systems can be merged.
Detailed Description Of The Preferred Embodiment

[0012] In Figure 1, a computer controlled switching system 100, such as Lucent Technologies, Inc. No. 4 ESS switching system, is comprised of switching system circuitry (not shown) controlled indirectly by a first processor 110 such as the 3B processor manufactured and sold by Lucent Technologies, Inc. The processor 110 controls another, second processor 112, such as the 1B processor, also manufactured and sold by Lucent Technologies, Inc. The first processor 110 controls the second processor 112 by means of commands sent and received over a communications bus 114 linking the two processors 110, 112. The first processor 110, with or without the second processor 112, can be considered to be a control computer for the controlled switching system 100. The communications bus 114 coupling the first processor 110 and the second processor 112 used in the No. 4 ESS switching system is well known in the art.

[0013] In the No. 4 ESS, the 1B processor 112 controls a variety of tasks of a switching system 100 including the provisioning and configuration of the switching systems and circuitry not shown. The 3B processor 110 controls the activity of the 1B processor 112 using programs and data stored on the disk (or disk resources) 116. The program files for the processor 112 and the data files on disk 116 are accessed by the 3B processor 112 through a data bus 118. One portion of the disk resource 116 is reserved for the Office Dependent Data (ODD) 120. The ODD 120 is database that contains the data structures which control and describe the hardware and services that can be provided by a given switching system 100.

[0014] Figure 2 shows a data structure (200) that is used in a computer controlled switching system, such as the switching system shown in Figure 1. The data structure (200) is comprised of two components or logical data areas (210, 220). The trunk characteristics data area, header, (210) is comprised of eight bytes of data followed by the trunk address data area which is comprised of 24 bytes of data (220). The data structure shown (200) would typically be stored within the disk (116), within the ODD (120) portion thereof as shown in Figure 1.

[0015] The eight bytes of data in the header field (210) data specify trunk characteristics for telephone trunks the addresses of which are listed in the subsequently 24 bytes of data in the trunk address field (220). The data structure (200) is used by a computer program controlling a telephone switching system (100) comprised of incoming and outgoing trunks. When the data structure (200) shown in Figure 2 is properly filled with data, the information therein is used by the computer program controlling the switching system to identify characteristics of trunks into and out of the switching system, such as base traffic number, echo suppression indicator, circuit identification number, trunk subgroup number, and routing domain, all of which are well-known to those skilled in the telecommunications art.

[0016] Figure 3 shows a simplified block diagram of how the header fields (210, 220) of the data structure (200) shown in Figure 2 are obtained from two preexisting data structures (300, 310). As shown in Figure 3, the eight-byte header field (320) of the end or product data structure (330) is obtained from a header field (340) of a data structure from a preexisting switching system. The 24-bytes of trunk address data (350) in the new data structure (330) is copied from the address data field (360) of the third data structure (310). The contents of both the header field (320) and the data field (350) can be alternatively considered to be data elements that might represent a variety of switching system features, functions, parameters or capabilities.

[0017] When used to provision a new or backup switching system to that is to functionally emulate a failed or out of service system, there might be thousands of data structures that need to be filled with data for the old system and the new system. The merger of the data from the old and new systems must produce a compatible set of data structures for use in the new, replacement system.

[0018] In an actual application, data structures from the preexisting switching system (100) would contain information required for the preexisting system to operate. The data in such a system would include, for example, information on where incoming trunks to the switch originate from and where outgoing trunks terminate. Other information stored in these data structures might include a tally of the hardware components physically present and in-service in the preexisting switching system.

[0019] In order to replicate the functionality of a failed switching system in another, backup switch, the functionality of the failed system must be replicated in the other, backup switch. Operational information (300) from a first database needs to be merged with available equipment information (310) in a second database. In addition to the aforementioned trunking information, other customer specific information would also have to be merged into the new system.

[0020] Inasmuch as the structure and organization of the information (310) of a second database is known and the information it lacks to give the system the functionality of a different, preexisting system, is also known (i.e., the missing information is known), the missing information is first obtained from the database of the preexisting system by scanning or sorting the first database. Whenever possible, the proper data from the first database is copied into the appropriate fields of the database for the replacement system.

[0021] Scanning or reading data from a database will frequently entail locating a data element using a pointer to a memory location where a particular data element can be found. A particular data element within a data structure can be read using a mask to isolate particular data fields.

[0022] In application, data required but missing for each field of the new database (320, 350) must be known in advance. The location of this data (300) in the preexisting database must also be known or otherwise be de-
terminable algorithmically. If requisite data (300) can be found in the preexisting switch database, locating and merging that data can be accomplished using any appropriate searching and sorting algorithm on a machine with a copy of the first database or access thereto. In an actual telephone switching office database merge, numerous data structures would have to be combined from both the preexisting switch and the new switch.

[0023] Figure 4 shows a simplified block diagram (400) of the steps of the method taught herein.

[0024] First, a data element required for a data structure is located by searching the first database (410). If the data element is identified or determined by a rule (420) the rule is used to identify or determine the data element (430). If the data element can be read directly from the first database, the data element is copied from the first database to the second database.

[0025] Some data elements required for the first element previously located as set forth above can be located in the second database merely by searching the second database (440). If a required element from the second database cannot be directly copied from the second database but requires a rule to be identified, calculated or derived (460) any rule of construction to determine the second data element is executed (480) after which the data element is written to the new database (490).

[0026] In the preferred embodiment, each data field (320, 350) of each data block or data structure (330) is populated with new data from a preexisting switch and a replacement switch database using specified, predetermined rules for each data element of each data structure. These rules define the data required for each field of the data block or data structure (330) in the database and permit the data structures of a database to be determined algorithmically.

[0027] Merging two databases can be achieved by following the rules by which the missing data is defined. Data elements from the first database of a system to be replaced can be algorithmically determined as well as data elements of the switch that is to emulate a preexisting switch. Instead of merely copying data elements from one database to another, data elements can be derived or determined by following the aforementioned rules. Of course, as the size and complexity of the database and its data structures increases, the number of rules increases as well. By defining data required for fields in a data structure, such data can be obtained from preexisting databases and merged with one or more databases to form a new database. The new data block or data structure (330) so formed can be used to replicate the functionality of a switching system using new hardware components. By automating the search and assembly process, the creation of a new database for a complex switching system replicating the functionality of another system can be achieved in significantly less time than manually re-entering data.

[0028] The actual automated merging of the databases that is described above is carried out by a suitably programmed digital computer. In the preferred embodiment, a single Sun Microsystems workstation was programmed to scan databases resident on disk resources accessible to the workstation. Alternate embodiments would include using multiple workstations and scanning multiple disk resources containing the databases being merged. Merging databases using one or more off-line or dedicated computers such as a workstation allows more robust computer resources to expedite the merging process. After the databases are so merged, the resultant database can be appropriately copied into the target system for use by the target system. A Lucent Technologies, Inc. 3B computer for example, might also be programmed to scan databases for both a failed switching system copied onto its disk resource and a database for switching equipment to replace the failed system although such an embodiment would likely require the 3B computer to perform call processing tasks as well.

[0029] While the preferred embodiment of the invention contemplates that a single computer will scan databases for both switching systems, i.e. the database of the failed system and the database for the replacement system, or copies thereof, alternate embodiments of the invention would include implementations wherein a computer resident in, on, or at a failed or failing system, scans its own data base for particular data records and sends such records to the computer or disk resource for a replacement switching system. Such an embodiment would include sending of an appropriate command to the computer for the failed or failing system causing it to begin searching for a particular record or records, i.e. the scanning might be done remotely and results then sent to the computer or system that initiated the scan.

[0030] In such an alternate embodiment, once a proper record is found, it can be returned to the replacement system for merger with the database of the replacement system. There is no necessity or requirement that the databases be co-located on a single computer, computer resource, or be geographically co-located. The respective databases could reside with the respective systems. Data records from a first system, to be merged with records from a second system need only to be received at the second system where they are combined with data elements of the second system to form a third database for the second system.

[0031] Alternate embodiments of the invention would of course include using another computer, such as a suitably programmed work station or personal computer for example, to merge switching system databases together.

[0032] Those skilled in the art will also recognize that while the embodiment disclosed herein has been with reference to a particular computer controlled switching system, the method and apparatus disclosed herein could be used with other data bases. Inventory control systems, accounting systems, and other large data bases having functionally related data structures from two data bases could be combined by the aforementioned method. Of course the rules of merging data structures
or portions thereof would need to be customized for the
databases being merged.

As set forth above, the computer performing the merger
operations need only have access to data records com-
prising the respective databases, components of which
are to be combined. Thus, a single computer, i.e. either
computer disclosed in the figures, merely having access
to data records, could perform the operations necessary
to merge two databases. Those skilled in the art will also
recognize that while two databases have been disclosed,
several databases could be scanned for functionally re-
lated components necessary to assemble a useable da-
tabase. In such an instance, elements required to form
a working, useable database might be obtained from sev-
eral different databases by searching the several data-
bases for the required data elements.

Claims

1. A method of merging data elements from a first com-
puter database used by a first computer-controlled
system with elements of a second computer data-
base used by a second computer-controlled system
to form a third computer database, the first computer
database comprised of a plurality of data elements
arranged in a first set of data structures (300) and
the second computer database comprised of a plu-
rality of data elements arranged in a second set of
data structures (310), the method comprising the
steps of:

a) at a first computer having access to at least
a portion of said first computer database, obtaining
therefrom at least a first predetermined data
element (410) from said first computer data-
base;
b) scanning at least a portion of said second
computer database by said first computer for a
second predetermined data element function-
ally (450) related to said first predetermined data
element from said first computer database;
c) merging said first data element and said sec-
ond data element by said first computer to form
a first data element record (490) in a third data-
base, whereby operational information (300)
from said first computer-controlled system
stored in said first computer database is merged
with available equipment information (310) from
said second computer-controlled system stored
in the second computer database to provide the
third database with the operational information
of said first computer database and the available
equipment information of the second computer
database.

2. The method of claim 1 wherein said step a) of ob-
taining therefrom at least a first predetermined data

3. The method of claim 1 wherein said step a) of ob-
taining therefrom at least a first predetermined data

4. A first computer controlled switching system having
a first computer database comprised of a plurality of
data elements arranged in a first set of data struc-
tures, said first computer database missing a plural-
ity of required data elements to be obtained from and
merged with data elements from a second database
for a second computer controlled switching system,
said first computer controlled switching system com-
prised of:

a) means for scanning said first computer data-
base for at least one first predetermined data
element (410);
b) means for scanning said second database for
a second predetermined data element function-
ally (450) related to and to be merged with said
first predetermined data element;
c) means for merging said first data element and
said second data element to form a first data
element record (490) in said first computer
database that is obtained by scanning said first
computer database while said first computer is at a
first location and said second database is at a
second location.

5. The system of claim 4 where said means for scan-
ing said first computer database is a computer.

6. The system of claim 4 where said means for scan-
ing said second database for a second predeter-
mined data element is a computer.

7. The system of claim 4 where said means for merging

8. The system of claim 4 where said means for scanning
said first computer database includes the step of:

i) receiving at said first computer at least a first
predetermined data element from said first com-
puter database that is obtained by scanning said
first computer database by said first computer.
said first data element and said second data element to form a first data element record in said first computer database for said first switching system is a computer.

Patentansprüche


a) in einem ersten Computer mit Zugang zu mindestens einem Teil der ersten Computer-Datenbank, Erhalten daraus mindestens ein erstes vorbestimmtes Datenelement (410) aus der ersten Computer-Datenbank;

b) Scannen mindestens eines Teils der zweiten Computer-Datenbank durch den ersten Computer nach einem funktional (450) mit dem ersten vorbestimmten Datenelement aus der ersten Computer-Datenbank in Beziehung stehenden zweiten vorbestimmten Datenelement; 


2. Verfahren nach Anspruch 1, wobei Schritt a) des Erhaltens daraus mindestens eines ersten vorbestimmten Datenelementes aus der ersten Computer-Datenbank den folgenden Schritt umfaßt:


3. Verfahren nach Anspruch 1, wobei Schritt a) des Erhaltens daraus mindestens eines ersten vorbestimmten Datenelements aus der ersten Computer-Datenbank den folgenden Schritt umfaßt:


a) einem Mittel zum Scannen der ersten Computer-Datenbank nach mindestens einem ersten vorbestimmten Datenelement (410);

b) einem Mittel zum Scannen der zweiten Datenbank nach einem funktional (450) mit dem ersten vorbestimmten Datenelement in Beziehung stehenden und mit diesem zusammenzuführenden zweiten vorbestimmten Datenelement;


5. System nach Anspruch 4, wobei das Mittel zum Scannen der ersten Computer-Datenbank ein Com-

7. System nach Anspruch 4, wobei das Mittel zum Zusammenführen des ersten Datenelements und des zweiten Datenelements, um einen ersten Datenelement-Datensatz in der ersten Computer-Datenbank für das erste Vermittlungssystem zu bilden, ein Computer ist.

Revendications

1. Procédé de fusion d’éléments de données d’une première base de données informatique utilisée par un premier système commandé par ordinateur avec des éléments d’une deuxième base de données informatique utilisée par un second système commandé par ordinateur afin de former une troisième base de données informatique, la première base de données informatique étant composée d’une pluralité d’éléments de données agencés dans un premier ensemble de structures de données (300) et la deuxième base de données informatique étant composée d’une pluralité d’éléments de données agencés dans un deuxième ensemble de structures de données (310), le procédé comprenant les étapes suivantes :

   a) au niveau d’un premier ordinateur ayant accès à au moins une partie de ladite première base de données informatique, obtention à partir de celui-ci d’au moins un premier élément de données prédéterminé (410) de ladite première base de données informatique ;
   b) balayage d’au moins une partie de ladite deuxième base de données informatique par le dit premier ordinateur à la recherche d’un deuxième élément de données prédéterminé (450) lié fonctionnellement au dit premier élément de données prédéterminé de ladite première base de données informatique ;
   c) fusion dudit premier élément de données et dudit deuxième élément de données par ledit premier ordinateur afin de former un premier enregistrement d’élément de données (490) dans une troisième base de données, par laquelle des informations opérationnelles (300) dudit premier système commandé par ordinateur mémorisées dans ladite première base de données informatique sont fusionnées avec des informations d’équipements disponibles (310) dudit deuxième système commandé par ordinateur mémorisées dans ladite deuxième base de données informatique afin de fournir à ladite troisiè-
première base de données informatique dudit premier système de commutation, par lequel des informations opérationnelles (300) dudit deuxième système de commutation commandé par ordinateur mémorisées dans ladite deuxième base de données sont fusionnées avec des informations d’équipements disponibles (310) dudit premier système de commutation commandé par ordinateur mémorisées dans ladite première base de données informatique, dans lequel lesdites informations opérationnelles comprennent des données d’informations de liaisons entrantes et sortantes.

5. Système selon la revendication 4, dans lequel ledit moyen pour balayer ladite première base de données informatique est un ordinateur.

6. Système selon la revendication 4, dans lequel ledit moyen pour balayer ladite deuxième base de données à la recherche d’un deuxième élément de données prédéterminé est un ordinateur.

7. Système selon la revendication 4, dans lequel ledit moyen pour fusionner ledit premier élément de données et ledit deuxième élément de données afin de former un premier enregistrement d’élément de données dans ladite première base de données informatique dudit premier système de commutation est un ordinateur.
FIG. 4

1

SEARCH DB1 FOR DATA ELEMENT 410

EXECUTE RULE ON DATA ELEMENT 430

YES

RULE ? 420

NO

WRITE ELEMENT TO MERGE DB 440

SEARCH DB2 FOR DATA ELEMENT 450

EXECUTE RULE ON DATA ELEMENT 480

YES

RULE ? 460

NO

WRITE ELEMENT TO MERGE DB 490

DERIVE DATA ELEMENTS VIA RULES 500

1