

DATABASE MANAGEMENT DEVICES

TECHNICAL FIELD

[0001] The present disclosure relates to the field of database management technologies, and in particular, to database management devices.

BACKGROUND

[0002] Databases are warehouses that organize, store and manage data based on data structures. In the existing technology, users usually purchase server nodes individually. After the server nodes are purchased, database software needs to be installed on the server nodes. However, during the user's installation process, the database software may encounter various problems when running on the server nodes, for example, the problems associated with software and hardware compatibility, causing some inconvenience and troubles to the users.

SUMMARY

[0003] Embodiments of the present specification provide database management devices that are more convenient for users to use.

[0004] An aspect of embodiments of the present specification provides a database management device. The database management device includes a rack, a switch installed in the rack, at least one database node installed in the rack, and a management and control node installed in the rack. Each database node is pre-installed with database software that the database node is responsible for running, and each database node includes a first network port, and the first network port is connected to the switch through a network. The management and control node is pre-installed with database management and control software that the management and control node is responsible for running. The management and control node includes a second network port, and the second network port is connected to the switch through a network, so that the management and control node is in communication connection with the at least one database node to manage and control the at least one database node.

[0005] According to the database management device in some embodiments of this specification, the management and control node and the at least one database node are interconnected through the switch and are jointly installed in the rack, and the database management and control software and the database software are respectively pre-installed in the management and control node and the at least one database node. In this way, combination of software and hardware implements the out-of-the-box feature of the database management device, shortens the delivery cycle, and further facilitates the user's operations, thereby avoiding the problems associated with software and hardware compatibility. Moreover, after the database management device in some embodiments of this specification is unpacked, database services can be automatically installed and deployed according to the user's needs and configurations.

[0006] According to the database management device in some embodiments of this specification, the management and control node manages the at least one database node, thereby managing and controlling the distributed relational database.

BRIEF DESCRIPTION OF DRAWINGS

[0007] FIG. 1 is a schematic structural block diagram illustrating a database management device, according to some embodiments of this specification; and

[0008] FIG. 2 is a schematic structural block diagram illustrating a database management device, according to other embodiments of this specification.

DESCRIPTION OF EMBODIMENTS

[0009] Example embodiments are described in detail here. When the following description relates to the accompanying drawings, unless specified otherwise, the same numbers in different accompanying drawings represent same or similar elements. Implementations described in the example embodiments do not represent all implementations consistent with the present specification. On the contrary, the implementations are only examples of apparatuses that are defined in the appended claims and consistent with some aspects of the present specification.

[0010] The terms used in the embodiments of the present specification are merely for illustrating specific embodiments, and are not intended to limit the present

specification. Unless otherwise defined, a technical term or a scientific term used in the embodiments of the present specification should have a general meaning understood by a person of ordinary skill in the art of the present specification. The "first", "second" and similar words used in this specification and the claims do not indicate any order, quantity or importance, but are only used to distinguish different components. Similarly, "one", "a/an", or a similar word does not indicate a quantity restriction, but indicates that at least one exists. "A plurality of" or "some" means two or more than two. "Including" or "comprising" or a similar word means that an element or a product preceding "including" or "comprising" covers an element or a product enumerated following "including" or "comprising" and an equivalence thereof, without excluding another element or product. "Connection", "interconnection", or a similar word is not restricted to a physical or mechanical connection, and can include an electrical connection, regardless of a direct connection or an indirect connection. The terms "a" and "the" of singular forms used in the present specification and the appended claims are also intended to include plural forms, unless otherwise specified in the context clearly. It should be further understood that the term "and/or" used in the present specification indicates and includes any or all possible combinations of one or more associated listed items.

[0011] Embodiments of the present specification provide a database management device. The database management device in some embodiments of this specification can be packaged as a cabinet as a whole to form a whole device in terms of appearance, which is convenient for users to use. The database management device in the embodiments of this specification can include a rack 101 (as shown in FIG. 1 and FIG. 2) forming a cabinet, and all nodes described below in the database management device can be installed in the rack 101. The rack 101 of the database management device can be made of metal, for example, a steel structure, and the rack 101 can alternatively be made of other materials such as acrylic. The physical appearance of the database management device is not limited in the present specification, and can be adjusted adaptively according to the number of nodes included in the database management device.

[0012] FIG. 1 is a schematic structural block diagram illustrating a database management device 100, according to some embodiments of this specification. As shown in FIG. 1, the database management device 100 in some embodiments of this specification can further include a switch 30 installed in the rack 101, at least one

database node 10 installed in the rack 101, and a management and control node 20 installed in the rack 101. The at least one database node 10 can include, for example, one, two, three, or more database nodes 10, such as database nodes 1–N. The number of database nodes 10 is not specifically limited in this specification. Only three database nodes 10 are shown in FIG. 1.

[0013] In some embodiments shown in FIG. 1, the database node 10 and the management and control node 20 can be, for example, a personal computer (PC) or a microcomputer.

[0014] Each database node 10 is pre-installed with database software that the database node 10 is responsible for running. Each database node 10 includes a first network port 14, and the first network port 14 is connected to the switch 30 through a network. The management and control node 20 is pre-installed with database management and control software that the management and control node 20 is responsible for running, and can be used to manage and control the at least one database node 10. The management and control node 20 includes a second network port 24, and the second network port 24 is connected to the switch 30 through a network. The first network port 14 of each database node 10 is in communication connection with the second network port 24 of the management and control node 20 through the switch 30, so that the management and control node 20 establishes a communication connection to each database node 10, so as to manage and control at least one database node 10. The management and control node 20 and each database node 10 in the database management device 100 can run an operating system independently.

[0015] The first network port 14 in each database node 10 and the second network port 24 in the management and control node 20 can include at least one of an electrical port, an optical port, and a wireless network port.

[0016] In some embodiments, the switch 30 includes an in-band switch 31, the first network port 14 in each database node 10 is connected to the in-band switch 31 through a network cable or a network, and the second network port 24 in the management and control node 20 is connected to the in-band switch 31 through a network cable or a network. The management and control node 20 is responsible for running the database management and control software, and completes functions of deployment, installation, monitoring, management, and software uninstallation of each database node 10 through the in-band switch 31.

[0017] When using the database management device 100, the user only needs to simply insert a network cable into the network port provided by the in-band switch 31, and then can access a service provided by each database node 10 through a network port.

[0018] According to the database management device 100 in some embodiments of this specification, the management and control node 20 and the at least one database node 10 are interconnected through the switch 30 and are jointly installed in the rack 101, and the database management and control software and the database software are respectively pre-installed in the management and control node 20 and the at least one database node 10. In this way, combination of software and hardware implements the out-of-the-box feature of the database management device 100, shortens the delivery cycle, and further facilitates the user's operations, thereby avoiding the problems associated with software and hardware compatibility. Moreover, after the database management device 100 in some embodiments of this specification is unpacked, database services can be automatically installed and deployed according to the user's needs and configurations.

[0019] Still referring to FIG. 1, each database node 10 includes at least a central processing unit (CPU) (which is referred to as a first central processing unit (that is, the first CPU)) 11, a memory (which is referred to as a first memory) 12, and a database storage 13. The first central processing unit 11 and the first network port 14 can be connected, for example, through a peripheral component interconnect express (PCIe) bus. The first CPU 11 is responsible for operation and calculation of a database. The first memory 12 is connected to the first CPU 11. For example, the first memory 12 and the first CPU 11 can be connected to the first memory 12 through a memory controller built in the first CPU 11. In some embodiments, the first central processing unit 11 and the database storage 13 can be connected, for example, through a PCIe bus. In other embodiments, the first central processing unit 11 and the database storage 13 can alternatively be connected through a serial advanced technology attachment (SATA) bus or a serial attached SCSI (SAS) bus. The first memory 12 is responsible for storing intermediate temporary data of the database. All data needs to be finally stored in the database storage 13 to implement persistent storage of the data. The database storage 13 can be used to store the data for a long time. Certainly, in some other embodiments of this specification, each database node 10 can additionally include another module as needed.

[0020] The management and control node 20 is in communication connection with the at least one database node 10. The management and control node 20 includes at least a CPU (which is referred to as a second central processing unit (that is, the second CPU)) 21, a memory (which is referred to as a second memory) 22, and a second storage 23 for data storage. The second central processing unit 21 and the second network port 24 can be connected, for example, through a PCIE bus. The second memory 22 is connected to the second CPU 21. For example, the second memory 22 and the second CPU 21 can be connected to the second memory 22 through a memory controller built in the second CPU 21. The second central processing unit 21 and the second storage 23 can be connected, for example, through a PCIE bus, an SATA bus, an SAS bus, etc. The second memory 22 is used to temporarily store data, and the second storage 23 is used to store data for a long time. Certainly, in some other embodiments of this specification, the management and control node 20 can additionally include another module as needed.

[0021] The first memory 12 in the database node 10 and the second memory 22 in the management and control node 20 can include but are not limited to, for example, a double data rate (DDR) memory.

[0022] The first CPU 11 in the database node 10 and the second CPU 21 in the management and control node 20 are devices with calculation, storage, and control functions, and generally include a logical operation unit, a control unit, a storage unit, etc.

[0023] According to the database management device 100 in some embodiments of this specification, the management and control node 20 and each database node 10 are provided with their respective CPUs and storages so that the calculation and storage functions are completed in the same node, thereby managing and controlling the distributed relational database.

[0024] FIG. 2 is a schematic block diagram illustrating a database management device 200, according to other embodiments of this specification. As shown in FIG. 2, the database management device 200 shown in FIG. 2 differs from the database management device 100 shown in FIG. 1 in that the switch 30 further includes an out-of-band switch 32, and each database node 10 further includes a first out-of-band manager 15. The first out-of-band manager 15 in each database node 10 is connected to the out-of-band switch 32, for example, through network communication. The management and control node 20 further includes a second out-of-band manager 25.

The second out-of-band manager 25 in the management and control node 20 is connected to the out-of-band switch 32, for example, through network communication. Therefore, the user can access the network port provided by the out-of-band switch 32 through a network cable, and can connect to the first out-of-band manager 15 of each database node 10 and the second out-of-band manager 25 of the management and control node 20 through a network port. In this way, the first out-of-band manager 15 and the second out-of-band manager 25 are used to independently manage and monitor each database node 10 and the management and control node 20 respectively. Each out-of-band manager can be used to monitor all the states of its entire node. For example, the out-of-band manager can monitor whether a CPU, a memory, a motherboard, a sensor, a power supply, a storage, etc. in the node are damaged.

[0025] In some embodiments shown in FIG. 2, the database node 10 and the management and control node 20 can be, for example, a server.

[0026] In some embodiments of this specification, the in-band switch 31 and the out-of-band switch 32 are shown in the form of two independent switches, that is, the in-band switch 31 and the out-of-band switch 32 are physically isolated from each other. However, in other embodiments of this specification, the in-band switch 31 and the out-of-band switch 32 can alternatively be made into one switch 30, and the in-band switch 31 and the out-of-band switch 32 are logically isolated within the switch 30, for example, using a VLAN, etc., so that IP addresses of the in-band switch 31 and the out-of-band switch 32 are not on the same segment, thereby implementing network isolation between the in-band switch 31 and the out-of-band switch 32.

[0027] In the database management device 100 shown in FIG. 1 and the database management device 200 shown in FIG. 2, the architectures of the management and control node 20 and at least one database node 10 can be mutually homogeneous, or the architectures of the management and control node 20 and at least one database node 10 can be heterogeneous.

[0028] The at least one database node 10 includes a plurality of database nodes 10, and the architectures of the plurality of database nodes 10 are all mutually homogeneous. For example, the plurality of database nodes 10 can all have an ARM architecture or all have an X86 architecture.

[0029] The plurality of database nodes 10 can form a distributed relational database, and each database node 10 executes its own transaction and assumes a different role. The database node 10 runs database software, and for data storage, a plurality of

copies are stored in the database storage 13 of each database node 10 through the distributed mechanism of the database software. The database software running in the database node 10 implements data consistency through a distributed protocol, such as raft/paxos. The plurality of database nodes 10 include at least one master replica node for executing a transaction and one or more slave replica nodes for synchronizing and storing data of the master replica node. The database management devices 100 and 200 shown in FIG. 1 and FIG. 2 include three data copies, and three copies of each piece of data are respectively stored on three database nodes 10. For example, the second database node 10 from the top serves as the master replica node, and the first database node 10 and the third database node 10 from the top serve as slave replica nodes. For example, the master replica node can be responsible for performing read and write operations. After the transaction of the master replica node is completed, the master replica node can synchronize its data to the first database node 10 and the third database node 10, for example, through logging or data transmission, notifying the first database node 10 and the third database node 10 of its own change. After knowing the change of the master replica node, the first database node 10 and the third database node 10 perform corresponding processing. Therefore, when one of the database nodes 10 is faulty, other database nodes 10 can still continue to run, thereby ensuring high scalability and high reliability of the database.

[0030] In some embodiments, the management and control node 20 can include, for example, one, two, three, or more management and control nodes 20. The number of management and control nodes 20 is not specifically limited in this specification. One management and control node 20 is shown in FIG. 1 and FIG. 2. Each management and control node 20 is in communication connection with each database node 10. When there are a plurality of management and control nodes 20, the plurality of management and control nodes 20 can form a master-slave relationship. For example, the plurality of management and control nodes 20 can include a master management and control node and a slave management and control node for backing up the master management and control node, thereby implementing reliable management and control of each database node 10.

[0031] In some embodiments, the database management devices 100 and 200 in this specification can be uniformly powered by an external power supply in a unified power supply method. In other embodiments, the database management devices 100 and 200 in this specification can further include a plurality of power modules (not

shown in the figure) for connecting to the external power supply. The switch 30 in the database management devices 100 and 200 and each of the at least one database node 10 and the management and control node 20 each include one power module, and a plurality of power modules can independently supply power to the switch 30 and each node respectively. The database management devices 100 and 200 in the embodiments of this specification do not impose a limitation on the power supply mode.

[0032] The database management devices 100 and 200 in one or more embodiments of this specification have the advantages of high performance and high availability, and can be used in an on-line transaction processing (OLTP) process system or a data warehouse (DW) system that requires high throughput, and can be targeted at small and medium enterprises, thereby solving the pain points of a long delivery cycle, a plurality of hardware compatibility problems, and inconsistent performance.

[0033] The description of the previous embodiments is only used to help understand the core idea of this specification. It should be noted that a person of ordinary skill in the art can further make some improvements and polishing to this specification without departing from the spirit and principle of this specification, and the improvements and polishing shall fall within the protection scope of the claims of this specification.

CLAIMS

What is claimed is:

1. A database management device, comprising the following:
 - a rack;
 - a switch, installed in the rack;
 - at least one database node, installed in the rack, wherein each database node is pre-installed with database software that the database node is responsible for running, and each database node comprises a first network port, and the first network port is connected to the switch through a network; and
 - a management and control node, installed in the rack, wherein the management and control node is pre-installed with database management and control software that the management and control node is responsible for running; the management and control node comprises a second network port, and the second network port is connected to the switch through a network, so that the management and control node is in communication connection with the at least one database node to manage and control the at least one database node.
2. The database management device according to claim 1, wherein each database node comprises a first central processing unit for database operation and calculation, a first memory connected to the first central processing unit, and a database storage for data storage; and the management and control node comprises a second central processing unit, a second memory connected to the second central processing unit, and a second storage used for data storage.
3. The database management device according to claim 2, wherein the first central processing unit is connected to the first network port through a PCIE bus, and the second central processing unit is connected to the second network port through the PCIE bus.
4. The database management device according to claim 2, wherein the first central processing unit is connected to the database storage through a PCIE bus, an SATA bus, or an SAS bus, and the second central processing unit is connected to the second storage through the PCIE bus, the SATA bus, or the SAS bus.
5. The database management device according to claim 1, wherein the first network port and the second network port comprise at least one of an electrical port, an optical port, and a wireless network port.

6. The database management device according to claim 1, wherein the switch comprises an in-band switch, the first network port is connected to the in-band switch through a network, and the second network port is connected to the in-band switch through a network.

7. The database management device according to claim 6, wherein the switch further comprises an out-of-band switch, each database node further comprises a first out-of-band manager, the first out-of-band manager is in communication connection with the out-of-band switch, the management and control node further comprises a second out-of-band manager, and the second out-of-band manager is in communication connection with the out-of-band switch.

8. The database management device according to claim 1, wherein architectures of the management and control node and the at least one database node are homogeneous or heterogeneous.

9. The database management device according to claim 1, wherein the at least one database node comprises a plurality of database nodes, and architectures of the plurality of database nodes are mutually homogeneous.

10. The database management device according to claim 1, wherein the rack is made of metal and/or acrylic material.

11. The database management device according to claim 1, wherein the database management device is uniformly powered by an external power supply.

12. The database management device according to claim 1, further comprising the following:

a plurality of power modules, connected to an external power supply, wherein

the switch and each of the at least one database node and the management and control node comprises one power module, and the plurality of power modules independently supply power to the switch and each node respectively.

13. The database management device according to claim 1, wherein the at least one database node comprises a plurality of database nodes, the plurality of database nodes form a distributed relational database, each database node executes its own transaction, and the plurality of database nodes comprise at least one master replica node for executing a transaction and one or more slave replica nodes for synchronizing and storing data of the master replica node.

14. The database management device according to claim 1, wherein the management and control node comprises a plurality of management and control nodes, each management and control node is in communication connection with the at least one database node, and the plurality of management and control nodes comprise a master management and control node and a slave management and control node for backing up the master management and control node.