

RESOURCE MANAGEMENT METHOD, HOST, AND ENDPOINT

TECHNICAL FIELD

- 5 The present invention relates to the computer field, and in particular, to a resource management technology.

BACKGROUND

A data center is a set of complex facilities, including a computer system and other auxiliary devices. To facilitate maintenance, these devices may be placed in a same
10 architecture. The data center can provide functions such as storage, calculation, and networking.

When processing data in a virtual local area network (Virtual LAN, VLAN), the data center may perform priority control at different levels on traffic in the VLAN, and may also perform priority control on data in different protocols in a same VLAN, so
15 as to preferentially allocate a resource to data with a high priority for use. For example, a priority of data in the Internet Small Computer Systems Interface (iSCSI) protocol is set to be higher than that of data in the Fibre Channel (Fibre Channel, FC) protocol.

A process is a data running operation unit. In the data center, different processes may
20 be corresponding to different services. However, in the prior art, it is difficult to ensure quality of service of each process, and a case in which some processes do not obtain sufficient resources or resources used by the processes do not reach requirements may occur.

adjusting a performance parameter of the virtual device according to the performance specification, where the adjusted virtual device satisfies a total requirement of performance specifications of all processes that use the endpoint; and receiving a resource access request, of the target process, for the virtual device by using the CPU interface, obtaining, from the I/O device, a resource that satisfies the performance specification of the target process, and providing the obtained resource to the target process by using the CPU interface. The endpoint in the fourth possible implementation manner of the present invention is consistent with the endpoint in the first possible implementation manner and in the solution in each aspect of the first possible implementation manner, and therefore may execute the foregoing operation steps, which has a corresponding beneficial effect.

A fifth possible implementation manner of the present invention provides a resource management apparatus in which a virtual device is disposed, where the resource management apparatus may be hardware or may be software, and is a structural description of an endpoint or software in an endpoint. The resource management apparatus includes: a receiving module, configured to receive a performance specification of a target process and a resource access request; a virtual device adjustment module, configured to adjust a performance parameter of the virtual device according to the performance specification, where the adjusted virtual device satisfies a total requirement of performance specifications of all processes that use the resource management device; and a resource acquiring module, configured to: after the receiving module receives the resource access request, of the target process, for the virtual device, obtain, from an I/O device, a resource that satisfies the performance specification of the target process, and provide the resource to the target process. The endpoint in the fifth possible implementation manner of the present invention has a function of the endpoint in the first possible implementation manner and in the solution in each aspect of the first possible implementation manner, which has a corresponding beneficial effect.

In a sixth possible implementation manner of the present invention, an internal structural endpoint of an endpoint is described, where the endpoint is connected to a CPU, and the endpoint includes: a CPU interface, configured to be connected to the CPU; an input/output I/O interface, configured to be connected to an I/O device; and a processing unit in which a virtual device is disposed, where the processing unit is connected to the CPU interface and the I/O interface, and is further configured to:

obtain a performance specification of a target process, and adjust a performance parameter of the virtual device according to the performance specification, where the adjusted virtual device satisfies a total requirement of performance specifications of all processes that use the endpoint; and receive a resource access request, of the target
5 process, for the virtual device by using the CPU interface, obtain, from the I/O device, a resource that satisfies the performance specification of the target process, and provide the obtained resource to the target process by using the CPU interface. The endpoint in the sixth possible implementation manner of the present invention is consistent with the endpoint in the first possible implementation manner and in the
10 solution in each aspect of the first possible implementation manner, and therefore may execute the foregoing operation steps, which has a corresponding beneficial effect.

BRIEF DESCRIPTION OF DRAWINGS

To describe the solutions in the embodiments of the present invention more clearly, the following briefly describes the accompanying drawings required for describing the
15 embodiments. The accompanying drawings in the following description show merely some embodiments of the present invention, and other drawings may still be derived from these accompanying drawings.

FIG. 1 is an internal topology diagram of a computer according to an embodiment of the present invention;

20 FIG. 2 is a topology diagram of a case in which two computers are interconnected according to an embodiment of the present invention;

FIG. 3 is a flowchart of a resource management method according to an embodiment of the present invention;

25 FIG. 4 is a flowchart of a process migration method according to an embodiment of the present invention;

FIG. 5 is a structural diagram of a resource management device according to an embodiment of the present invention; and

FIG. 6 is a structural diagram of an endpoint according to an embodiment of the present invention.

request to a vDev of an endpoint corresponding to the process may also be understood as: sending the resource access request to the endpoint to request the vDev of the endpoint to provide a resource.

5 The target process sends the resource access request. Specifically, the CPU sends the resource access request to the target endpoint, and the access request carries the PAS ID of the process, and may further carry an ID of the vDev.

10 In this embodiment of the present invention, an endpoint that receives the resource access request the first time is the target endpoint. The target endpoint may invoke a resource of an I/O device of the target endpoint for use by the target process. The target endpoint may further invoke an I/O device of another endpoint by using a switch between endpoints, which logically cancels a characteristic that an I/O device singly belongs to one endpoint. Specifically, resource utilization is improved by using a resource pool.

15 An optional manner is that a resource is directly obtained from the resource pool without considering an endpoint to which the I/O device belongs, and the resource may come from any I/O device. Another optional manner is that the endpoint preferentially invokes a resource provided by an I/O device of the endpoint, and when the resource of the I/O device of the endpoint is insufficient to satisfy a requirement, a remaining resource that is required is obtained from an I/O device of another endpoint. Compared with the former manner, in the latter manner, workload of the switch may be reduced, and a speed of invoking resource is improved. A homing relationship exists between the I/O device and the endpoint, and an I/O device possessed by an endpoint is an I/O device endpoint device that is directly connected to the endpoint.

25 It should be noted that, in this step, that the target process invokes the resource is used as an example. Actually, another process may also invoke the resource by using the target endpoint. The adjusted virtual device satisfies all the received valid SLAs. Therefore, in addition to the target process, if another process also has a permission to invoke the resource from the target endpoint, when running, the another process sends
30 a resource access request to the target endpoint at which the vDev is located, the target endpoint may also obtain, from the I/O device resource pool, a resource that satisfies an SLA requirement corresponding to the another process, and provide the resource to the another process for use. After this embodiment is used, the endpoint can satisfy demands for resource of all processes that use the endpoint.

CLAIMS

1. A resource management method, applied to a host, wherein the host comprises a CPU (11) and multiple endpoints (12) connected to the CPU, each endpoint is connected to at least one I/O device (13), a process is configured in the CPU; and the method comprises:

allocating, by the CPU (11), a target endpoint (12) from the multiple endpoints (12) to a target process, wherein a virtual device is disposed on the target endpoint (12);

obtaining, by the target endpoint (12), a performance specification of the target process, wherein the performance specification is a requirement for a type of performance in a service level agreement, SLA;

adjusting a performance parameter of the virtual device, by the target endpoint (12), according to the performance specification, wherein the performance parameter is a value of a type of performance of a resource, such that the

adjusted virtual device satisfies a total requirement of performance specifications of all processes that use the target endpoint (12); and

when the target process needs to access the resource, sending, by the CPU (11), a resource access request, of the target process, for the virtual device to the target endpoint; and after receiving the resource access request;

obtaining, from a resource pool, the resource that satisfies the performance specification of the target process, and providing the obtained resource to the target process for use;

wherein resources of the multiple I/O devices from the multiple endpoints form the resource pool together;

the adjusted virtual device satisfies a total requirement of performance specifications of all processes that use the target endpoint specifically comprises:

for performance that can be shared by multiple processes, satisfying a maximum requirement for this performance parameter in all performance specifications; and

for performance that cannot be shared by the multiple processes, satisfying a total requirement for performance parameters in all performance specifications.

2. The resource management method according to claim 1, wherein the obtaining, by the target endpoint (12), a performance specification of the target process is

specifically:

obtaining, by the target endpoint (12), the performance specification from the CPU (11).

3. The resource management method according to claim 1, wherein the obtaining,
5 by the target endpoint (12), a performance specification of the target process is specifically:

collecting, by the target endpoint (12), statistics about performance of a resource occupied when the target process runs in history, and generating the performance specification according to a statistical result.

10 4. The resource management method according to claim 1, wherein:
the target process runs in a virtual machine.

5. The resource management method according to claim 1, comprising:
performance that can be shared by multiple processes, comprising a latency time;
and

15 performance that cannot be shared by the multiple processes, comprising
input/output per second, IOPS and bandwidth.

6. The resource management method according to any one of claims 1 to 5,
wherein the method further comprises: migrating the process to another host, wherein
the another host comprises another CPU, another endpoint, and another I/O resource
20 pool, and specific steps of the migrating comprise:

sending, by the CPU, the performance specification of the process to the another
CPU;

sending, by the another CPU, the performance specification to the another
endpoint;

25 generating, by the another endpoint, another virtual device, wherein the another
virtual device satisfies the performance specification;

sending, by the CPU, description information of the process to the another CPU,
and generating, by the another CPU, a new process according to the description
information; and

30 sending, by the another CPU, another resource access request, of the new process,
for the another virtual device to the another endpoint when the new process needs to

access a resource; and after receiving the another resource access request, obtaining, by the another endpoint, a resource from the another I/O resource pool according to the performance specification, and providing the resource to the new process for use.

5 7. A host, comprising a CPU (11) and multiple endpoints (12), and configured to manage an I/O resource, wherein:

the CPU (11) is configured to run a process, and allocate a target endpoint (12) to the process, wherein the target endpoint (12) communicates with the CPU (11); and when a target process needs to access a resource, the CPU (11) sends a resource access request, of the target process, for a virtual device to the target endpoint (12); and

10 the target endpoint (12) is configured to generate the virtual device;

obtain a performance specification of the target process, wherein the performance specification is a requirement for a type of performance in a service level agreement, SLA; and

15 adjust a performance parameter of the virtual device according to the performance specification, wherein the performance parameter is a value of a type of performance of the resource, such that the

adjusted virtual device satisfies a total requirement of performance specifications of all processes that use the target endpoint (12); and is further configured to: be connected to an I/O device (13), obtain, after receiving the resource access request, an I/O resource from a resource pool according to the performance specification of the target process, and provide the resource to the target process for use;

20 wherein resources of the multiple I/O devices (13) multiple endpoints form the resource pool together;

the adjusted virtual device satisfies a total requirement of performance specifications of all processes that use the target endpoint (12) specifically comprises:

25 for performance that can be shared by multiple processes, satisfying a maximum requirement for this performance parameter in all performance specifications; and

for performance that cannot be shared by the multiple processes, satisfying a total requirement for performance parameters in all performance specifications.

30 8. The host according to claim 7, wherein that the target endpoint (12) is configured to obtain a performance specification of the target process is specifically:

the target endpoint (12) is configured to obtain the performance specification from the CPU (11).

9. The host according to claim 7, wherein that the target endpoint (12) is configured to obtain a performance specification of the target process is specifically:

the target endpoint (12) is configured to collect statistics about performance of a resource occupied when the target process runs in history, and generate the performance specification for the endpoint according to a statistical result.

10. The host according to claim 7, wherein:

the target process runs in a virtual machine, and the virtual machine runs in a hypervisor of the CPU (11).

11. The host according to claim 7, wherein:

the I/O device (13) comes from at least two endpoints, generates an I/O resource pool together, and provides a resource by using the I/O resource pool.

12. A system comprising a host according to any one of claims 7 to 11 and another host, wherein the host and another host constitute a resource management system, and the another host comprises another CPU, another endpoint, and another I/O resource pool, wherein

the CPU (11) is further configured to send performance specification of the process to the another CPU, and is further configured to send description information of the process to the another CPU;

the another CPU is configured to send the performance specification to the another endpoint, and is further configured to regenerate the process according to the description information;

the another endpoint is configured to generate another virtual device, wherein the another virtual device satisfies the performance specification; and

the another CPU is further configured to send another resource access request of the regenerated process for the another virtual device to the another endpoint when the regenerated process needs to access a resource; and after receiving the another resource access request, the another endpoint obtains a resource from the another I/O resource pool according to the performance specification, and provides the resource to the new process for use.