

19

possible within the scope of the innovation. Accordingly, the innovation is not to be restricted except in light of the attached claims and their equivalents.

What is claimed is:

1. A storage system that stores data for a client component, the system comprising:

a communication interface including hardware for communication with the client component over an interconnect;

a processor;

a solid state memory configured in an address space addressable by the processor, the solid state memory including a storage volume, wherein data blocks are stored at corresponding memory locations in the storage volume; and

a memory controller configured to perform a memory write operation on the solid state memory independently of the processor in response to a request to perform the write operation received over the communication interface, wherein the request is compliant with a memory access protocol instead of a storage protocol and includes an address of a memory location in the solid state memory at which a data block is stored in the storage volume, and the address is in the address space addressable by the processor.

2. A client component comprising:

a communication interface including a physical communications interface for communication with a storage device, the storage device including a solid state memory for storage of data received from the client component via the communication interface, the solid state memory configured in an address space addressable by a processor of the storage device, the solid state memory including a storage volume, wherein the storage volume maps data blocks to corresponding memory locations in the solid state memory;

a memory controller in communication with the communication interface;

a processor in communication with the memory controller; and

client memory comprising client logic executable with the processor to cause the memory controller to initiate, via the communication interface, a request to perform a write operation on the solid state memory of the storage device, the request compliant with a memory access protocol instead of a storage protocol, wherein the request includes an address to a memory location in the solid state memory at which the data block is stored in the storage volume, and the memory location is in the address space addressable by the processor of the storage device, wherein the write operation is performed independently of the processor of the storage device.

3. The client component of claim 2, wherein the memory access protocol is Remote Direct Memory Access (RDMA) and the communication interface includes an RDMA controller.

4. A non-transitory tangible computer-readable storage medium encoded with computer executable instructions, the computer executable instructions executable with a processor in a storage device, the computer-readable medium comprising:

instructions executable to identify at least one attribute of a memory access operation, wherein the memory access operation is performed on a storage volume by a communication interface of the storage device independently of the processor in response to receipt by the communication interface of a request to perform the

20

memory access operation, the storage volume is included in a memory of the storage device, the memory is in an address space addressable by the processor, the storage volume maps data blocks to corresponding memory locations in the memory of the storage device, and the request is compliant with a memory access protocol in which the corresponding memory locations in the memory are addressed instead of the data blocks; and instructions executable to perform an action related to the memory access operation based on the at least one attribute of the memory access operation.

5. The computer-readable storage medium of claim 4, wherein the memory access operation is a Remote Direct Memory Access (RDMA) operation.

6. The computer-readable storage medium of claim 4, wherein the instructions to identify the at least one attribute of the memory access operation are configured to execute after the memory access operation is completed.

7. The computer-readable storage medium of claim 4, wherein the request includes data indicative of the at least one attribute of the memory access operation, and the instructions executable to identify the at least one attribute of the memory access operation are executable to identify the at least one attribute from the data included in the request.

8. The computer-readable storage medium of claim 4, wherein the instructions executable to identify the at least one attribute of the memory access operation are further executable to identify the at least one attribute from a notification message received at the communication interface before the request to perform the memory access operation is received.

9. The computer-readable storage medium of claim 4, wherein the instructions executable to identify the at least one attribute of the memory access operation are further executable to identify the at least one attribute from a notification message received at the communication interface after the request to perform the memory access operation is received.

10. The computer-readable storage medium of claim 4, wherein the instructions executable to identify the at least one attribute of the memory access operation are further executable to monitor an area of the memory for data indicative of the at least one attribute, the memory access operation is a first memory access operation, and the data indicative of the at least one attribute of the first memory access operation is written to the area of the memory in response to a request to perform a second memory access operation.

11. A computer-implemented method to identify memory access operations from data received at a communication interface of a storage system, the method comprising:

receiving a request to perform a memory access operation on a memory, the request being received at the communication interface;

performing the memory access operation with the communication interface on a portion of the memory in response to the request, the memory access operation being performed by the communication interface independently of a processor included in the storage system, the portion of the memory being included in a storage volume, the storage volume being included in the memory, the memory being in an address space addressable by the processor, the storage volume including a map of data blocks to corresponding memory locations in the memory of the storage device, and the request being compliant with a memory access protocol in which the corresponding memory locations in the memory are addressed in the request instead of the data blocks;

21

identifying at least one attribute of the memory access operation with the processor; and performing an action related to the memory access operation with the processor.

12. The method of claim 11, wherein the memory access operation completes before the action related to the memory access operation is performed.

13. The method of claim 11, wherein the memory access operation completes before the at least one attribute of the memory access operation is identified.

14. A storage system that stores data for a client component, the system comprising:

a communication interface including a physical communications interface for communication with the client component;

a processor;

a solid state memory for storage of data received over the communication interface, the solid state memory configured in an address space addressable by the processor, the solid state memory including a storage volume, wherein the storage volume maps data blocks to corresponding memory locations in the solid state memory, the communication interface configured to:

receive a request to perform a memory access operation on the solid state memory, the request compliant with a memory access protocol instead of a storage protocol, wherein the request addresses a memory location of a portion of the solid state memory instead of a data block included in the data blocks corresponding to the memory locations, the portion of the solid state memory is included in the storage volume, and the memory location is in the address space addressable by the processor; and

perform the memory access operation independently of the processor, in response to the request, on the portion of the solid state memory included in the storage volume; and

22

observer logic configured to identify at least one attribute of the memory access operation and to perform an action related to the memory access operation in response to identification of the at least one attribute of the memory access operation, the communication interface being further configured to complete the memory access operation on the solid state memory without waiting for the observer logic.

15. The storage system of claim 14, wherein the solid state memory is a first memory, the storage system comprises a storage device that includes the communication interface, the first memory, and the observer logic, and wherein the memory access protocol is a communication protocol for transfer of data between a second memory included in the client component and the first memory included in a storage device, and the transfer of data is independent of central processing units (CPU) included in the client component and storage device.

16. The storage system of claim 14, wherein the solid state memory comprises, in addition to all data blocks of the storage volume, volume information about the data blocks.

17. The storage system of claim 14, wherein the action related to the memory access operation includes a determination of statistics about memory access operations.

18. The storage system of claim 14, wherein the action related to the memory access operation includes an identification of a region of the solid state memory affected by the memory access operation.

19. The storage system of claim 18, wherein the action related to the memory access operation further comprises a duplication of the region of the solid state memory to a backing store.

20. The storage system of claim 14, the solid state memory comprising the observer logic, the observer logic being executable with the processor, the communication interface being further configured to perform the memory access operation on the solid state memory independently of the processor.

* * * * *