TITLE

DETERMINING AN AVAILABILITY OF A DATA CENTER

BACKGROUND

[0001] A data center, DC, typically includes a group of computing devices that provide computing power for executing applications, or functions of such applications. For example, DCs may be used where it may not be feasible or practical to execute one or more resource intensive applications on an individual computing entity, such as a personal computer. In this case, the resource intensive applications, or the functions of those applications, may instead be executed at the DC, thereby taking advantage of the computing power at the DC. Alternatively, or additionally, DCs may be used where it is beneficial that the latency of communications between a computing device executing one or more applications and a further computing device is kept to a minimum. In this case, computing devices of a DC co-located with the further computing device may be used to execute the applications. This minimizes the physical separation of the computing devices and hence inherently minimizes latency of communications between the computing devices. In either case, operation of the applications at the DC may be controlled by one or more computing entities external to the DC.

SUMMARY

[0001a] According to a first aspect, there is provided a method including: determining, by a computing system, a first status of a first set of one or more communications connections between a first data center and a second data center; determining, by the computing system, a second status of a second set of one or more communications connections between the first data center and a third data center different to the second data center; and determining, by the computing system, based on the first status and the second status, an indication of an availability of the first data center to one or more computing entities external to the first data center.

[0001b] According to a second aspect, there is provided a computing system, including: a memory; and one or more processors configured to: determine a first status of a first set of one or more communications connections between a first data center and a second data center; determine a second status of a second set of one or more communications connections between the first data center and a third data center different to the second data center; and determine, based on the first status and the second status, an indication of an availability of the first data center to one or more computing entities external to the first data center.

[0001c] According to a third aspect, there is provided a tangible computer-readable storage medium including instructions that, when executed, cause one or more processors of a computing system to: determine a first status of a first set of one or more communications connections between a first data center and a second data center; determine a second status of a second set of one or more communications connections between the first data center and a third data center different to the second data center; and determine, based on the first status and the second status, an indication of an availability of the first data center to one or more computing entities external to the first data center.

BRIEF DESCRIPTION OF THE DRAWINGS

[0002] Certain embodiments are disclosed with reference to the following drawings.

[0003] FIG. 1 is a block diagram showing a computing device according to certain embodiments.

[0004] FIG. 2 is a block diagram showing an example system in which certain embodiments may be implemented.

[0005] FIG. 3 is a block diagram showing an example system in which an example method of controlling applications at a data center may be implemented.

[0006] FIG. 4 is a flow diagram showing an example method for determining an availability of a data center.

[0007] FIG. 5 is a block diagram showing an example of an electronic trading system in which certain embodiments may be employed.

CLAIMS

1. A method including:

determining, by a computing system, a first status of a first set of one or more communications connections between a first data center and a second data center;

determining, by the computing system, a second status of a second set of one or more communications connections between the first data center and a third data center different to the second data center; and

determining, by the computing system, based on the first status and the second status, an indication of an availability of the first data center to one or more computing entities external to the first data center.

2. The method of claim 1, wherein the method includes:

determining a third status of a third set of one or more communications connections between the first data center and a fourth data center different to the second data center and the third data center; and

wherein the determining of the indication of the availability of the first data center is based on the third status.

3. The method of claims 1 or 2, wherein:

the determining of the indication of the availability of the first data center includes determining, responsive to the respective statuses of each of the sets of communications connections indicating that each of the sets of communications is inoperative, that the first data center is unavailable to the one or more computing entities external to the first data center.

4. The method of any of claims 1 to 3, wherein:

for each given set of the sets of communications connections, the determining of the status of the given set is based on respective statuses of the one or more communications connections of the given set.

5. The method of any of claims 1 to 4, wherein:

each of the sets of communications connections includes two or more communications connections, wherein:

determining the status of a given one of the sets of communications connections includes determining respective statuses of the two or more communications connections of the given set and determining the given set to be inoperative responsive to determining that each of the two or more communications connections of the given set is inoperative.

6. The method of any of claims 1 to 5, wherein:

each of the sets of communications connections includes a respective first communications connection for receiving heartbeat messages from a given one of the data centers; and

for each given set of the sets of communications connections, determining the status of the given set includes determining a status of the first communications connection of the given set by monitoring receipt of the heartbeat messages, wherein the first communications connections each include a subscription to one or more multicast channels over which the heartbeat messages are transmitted.

7. The method of any of claims 1 to 6, wherein:

each of the sets of communications connections includes a respective second communications connection for allowing inspection of a location at a given one of the data centers; and

for each given set of the sets of communications connections, determining the status of the given set includes determining whether the location at the given one of the data centers can be successfully inspected by use of the respective second communications connection.

8. The method of any of claims 1 to 7, wherein the determining of the respective statuses of each of the sets of communications connections and the determining of the availability of the first data center are performed at the first data center, wherein the method includes:

responsive to determining that the first data center is unavailable to the one or more computing entities external to the first data center, initiating one or more of:

a shut-down process to shut down one or more applications running at the first data center; or

a disaster recovery process to cause one or more applications running at the first data center to operate in a disaster recovery mode.

9. The method of any of claims 1 to 7, wherein the determining of the respective statuses of each of the sets of communications connections and the determining of the availability of the first data center are performed at a data center different to the first data center.

10. The method of claim 9, wherein:

for at least one given set of the sets of communications connections, determining the status of the given set includes:

obtaining, from the data center which is connected to the first data center by the one or more communication connections of the given set, information regarding the one or more communications connections of the given set; and

determining the status of the given set based on the obtained information.

11. The method of claim 9 or 10, wherein the method includes:

responsive to determining that the first data center is unavailable to the one or more computing entities external to the first data center, initiating a failover process for failing over functionality of the first data center to a failover data center, wherein the initiating of the failover process includes:

sending, from the data center which determines that the first data center is unavailable, a message to the failover data center to instruct the failover data center to fail over the functionality of the first data center.

12. The method of claim 11, wherein the failover process includes, for each of one or more applications running at the first data center, one or more of:

running the application at the failover data center; and

modifying the operation of an existing application at the failover data center to include one or more functions of the application.

13. The method of any of claims 9 to 12, wherein the data center different to the first data center, at which the determining of the respective statuses of each of the sets of communications connections and the determining of the availability of the first data center are performed, performs the determinations responsive to a determination that another data center is unavailable to perform the determinations.

14. A computing system, including:

a memory; and

one or more processors configured to:

determine a first status of a first set of one or more communications connections between a first data center and a second data center;

determine a second status of a second set of one or more communications connections between the first data center and a third data center different to the second data center; and

determine, based on the first status and the second status, an indication of an availability of the first data center to one or more computing entities external to the first data center.

15. A tangible computer-readable storage medium including instructions that, when executed, cause one or more processors of a computing system to:

determine a first status of a first set of one or more communications connections between a first data center and a second data center;

determine a second status of a second set of one or more communications connections between the first data center and a third data center different to the second data center; and

determine, based on the first status and the second status, an indication of an availability of the first data center to one or more computing entities external to the first data center.