

a flash memory device, a computer-readable tape, a CD-ROM, a DVD-ROM, a Blu-Ray, HD-DVD, UMD, or other optical storage medium.

The storage medium **600** contains instructions for establishing a location-based leaderboard **601** configured to implement a method for establishing a location-based leaderboard by a computer game system in accordance with the method described above with respect to FIG. 1B. In particular, the instructions for establishing a location-based leaderboard **601** may optionally include partitioning globe into region/sub-region instructions **603** that are used to partition the globe into a set of regions and sub-regions using a hierarchical spatial data structure, wherein the regions and sub-regions are arranged according to a hierarchy, each sub-region being encompassed by a higher-level sub-region or region, and two or more highest-level sub-regions being encompassed by a region. The size of each sub-region may vary depending on the user's physical location and the population density of the area surrounding that location, as discussed above.

The instructions for establishing a location-based leaderboard **601** may also include assigning user location/statistic instructions **605** that are used to assign a location of a user of the computer game system along with one or more statistics associated with the user to a smallest sub-region created by the hierarchical spatial data structure.

The instructions for establishing a location-based leaderboard **601** may additionally include determining user rank instructions **607** that are used to determine a rank of the user within a region or sub-region encompassing the smallest sub-region to which the user's location was assigned, wherein the rank is determined using the one or more statistics associated with the user.

Embodiments of the present invention allow a computer system to generate more useful and interesting leaderboards, thereby enhancing the value of the computer system to its users.

While the above is a complete description of the preferred embodiment of the present invention, it is possible to use various alternatives, modifications, and equivalents. Therefore, the scope of the present invention should be determined not with reference to the above description, but should, instead be determined with reference to the appended claims, along with their full scope of equivalents. Any feature described here, whether preferred or not, may be combined with any other feature described herein, whether preferred or not. In the claims that follow, the indefinite article "A" or "An" refers to a quantity of one or more of the item following the article, except where expressly stated otherwise. The appended claims are not to be interpreted as including means-plus-function limitations, unless such a limitation is explicitly received in a given claim using the phrase "means for".

What is claimed is:

1. A computer-implemented method for establishing a location-based leaderboard by a computer system, comprising:

- a) associating a location of a user of the computer system in a virtual world to a smallest sub-region of the virtual world with the computer system, wherein the virtual world is partitioned into a set of regions and sub-regions using a hierarchical spatial data structure, wherein the regions and sub-regions are arranged according to a hierarchy, each sub-region being encompassed by a higher-level sub-region or region, and two or more highest-level sub-regions being encompassed by a region created by the hierarchical spatial data structure;
- b) obtaining a rank of the user within a region or sub-region encompassing the smallest sub-region to which the

user's location was assigned, wherein the rank is determined using one or more statistics associated with the user, wherein the size of the sub-regions or regions created by the hierarchical spatial data structure are established based on population density for the region or sub-region, and wherein a region or sub-region is subdivided if the population density of the region or sub-region is above a threshold.

2. The method of claim **1**, further comprising partitioning the world into the set of regions and sub-regions with the computer system using the hierarchical spatial data structure.

3. The method of claim **1**, further comprising displaying, storing, or transmitting the rank obtained in b) with the computer system.

4. The method of claim **1**, wherein the location of the user is determined by a global positioning system (GPS) in the computer system.

5. The method of claim **1**, wherein the computer system is a computer game system.

6. The method of claim **5**, wherein the one or more statistics associated with the user include a number of computer game trophies earned.

7. The method of claim **5**, wherein the one or more statistics associated with the user include a number of levels completed by the user for a particular game title.

8. The method of claim **5**, wherein the one or more statistics associated with the user include a high score earned by the user for a particular game title.

9. The method of claim **1**, wherein the hierarchical spatial data structure is a geodesic grid, a quad tree, or an R-tree.

10. A system for implementing a location-based leaderboard, comprising:

- a processor;
- a memory; and
- computer coded instructions embodied in the memory and executable by the processor, wherein the computer coded instructions are configured to execute a method for implementing a location-based leaderboard, comprising:

a) associating a location of a user of the computer system in a virtual world to a smallest sub-region of the virtual world with the computer system, wherein the virtual world is partitioned into a set of regions and sub-regions using a hierarchical spatial data structure, wherein the regions and sub-regions are arranged according to a hierarchy, each sub-region being encompassed by a higher-level sub-region or region, and two or more highest-level sub-regions being encompassed by a region created by the hierarchical spatial data structure;

b) obtaining a rank of the user within a region or sub-region encompassing the smallest sub-region to which the user's location was assigned, wherein the rank is determined using one or more statistics associated with the user, wherein the size of the sub-regions or regions created by the hierarchical spatial data structure are established based on population density for the region or sub-region, and wherein a region or sub-region is subdivided if the population density of the region or sub-region is above a threshold.

11. The system of claim **10**, wherein the computer-coded instruction further comprise instructions for partitioning the world into the set of regions and sub-regions with the computer system using the hierarchical spatial data structure.

12. The system of claim **10**, wherein the computer-coded instruction further comprise instructions for displaying, storing, or transmitting the rank obtained in b).