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(54) **SYSTEM AND METHOD FOR MIGRATING AGENTS BETWEEN MOBILE DEVICES**

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G06F 9/48	(2006.01)
H04L 29/08	(2006.01)

(52) **U.S. Cl.**

CPC ***G06F 9/4862*** (2013.01); ***H04L 67/18*** (2013.01)

(58) **Field of Classification Search**

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USPC 455/456.3
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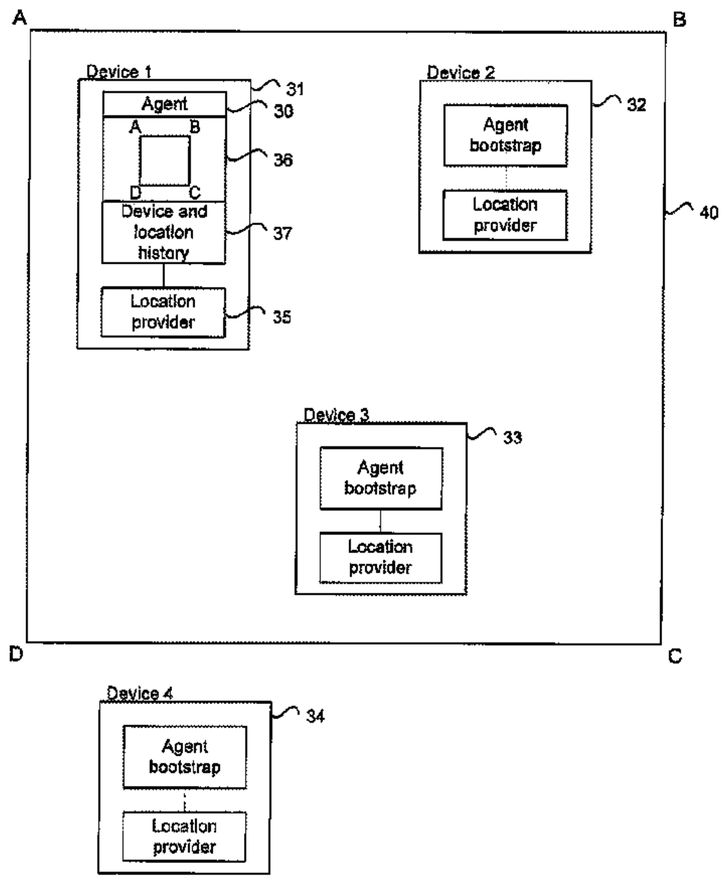
(74) *Attorney, Agent, or Firm* — Schwabe, Williamson & Wyatt

(57) **ABSTRACT**

Mobile agents can be deployed to location aware mobile devices within specific regions of interest to achieve specific goals in respect of events occurring in the region of interest. In order to ensure that the agent can persist within the region of interest until the agent goals are achieved, the agent is configured to locate other devices within the region of interest and to propagate itself, by moving or copying itself, to those other devices. When a device hosting the agent exits the region of interest, the agent is terminated, thereby freeing device resources.

35 Claims, 6 Drawing Sheets



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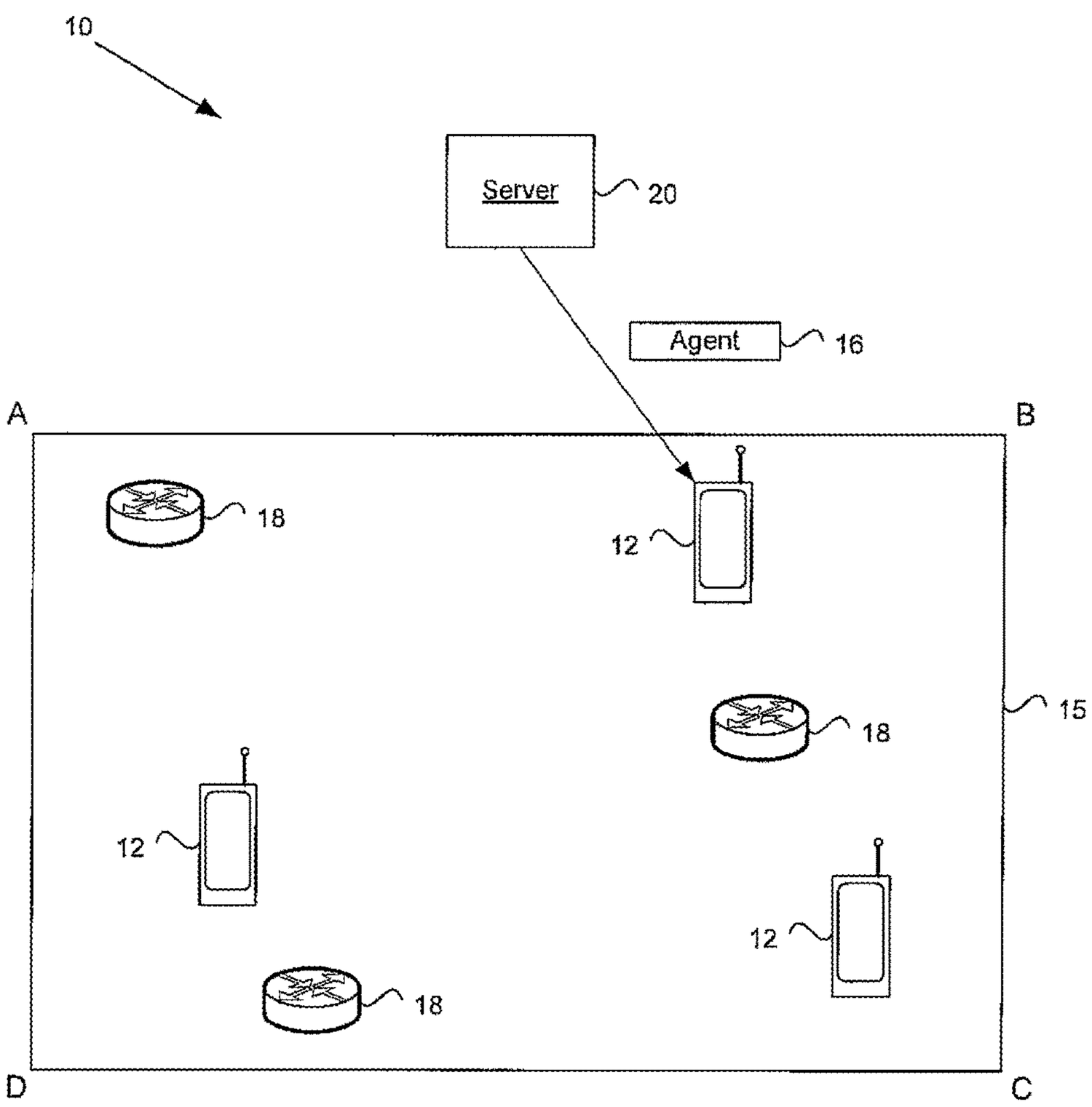

Figure 1

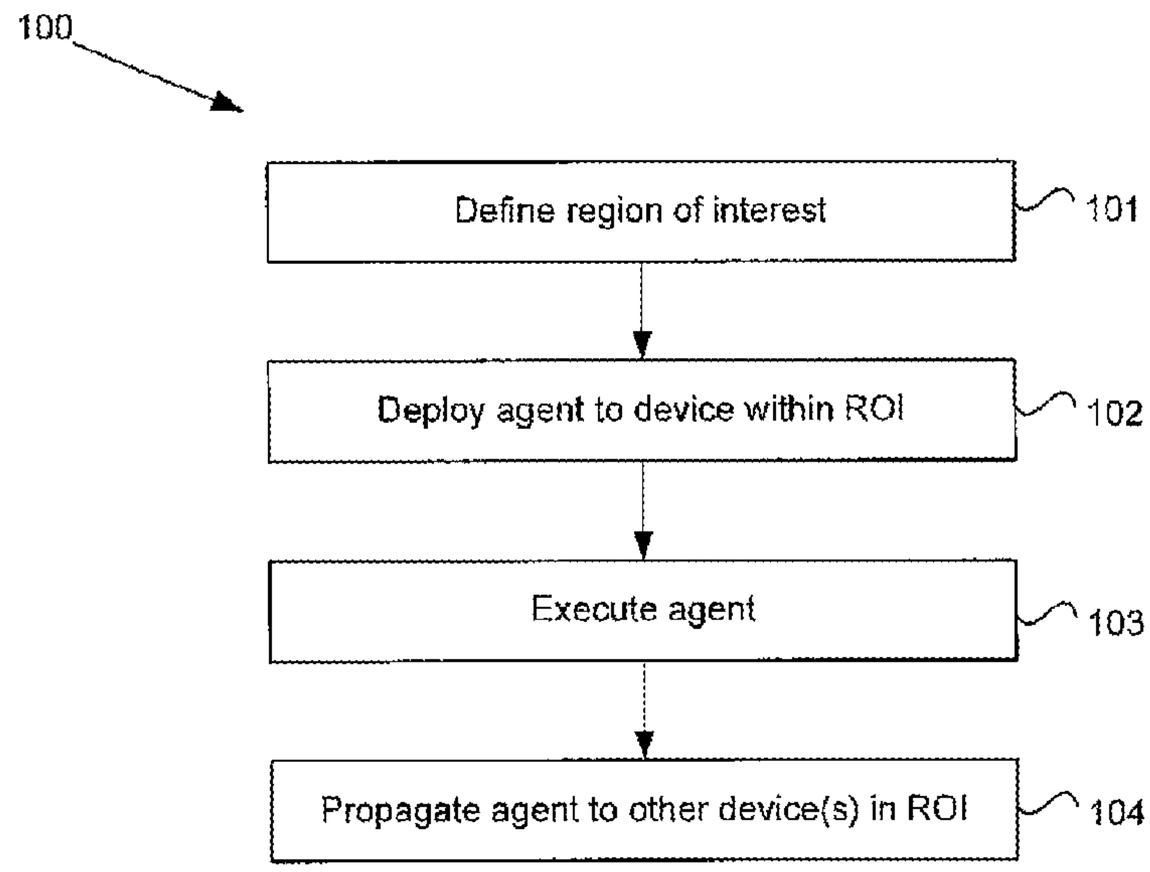

Figure 2

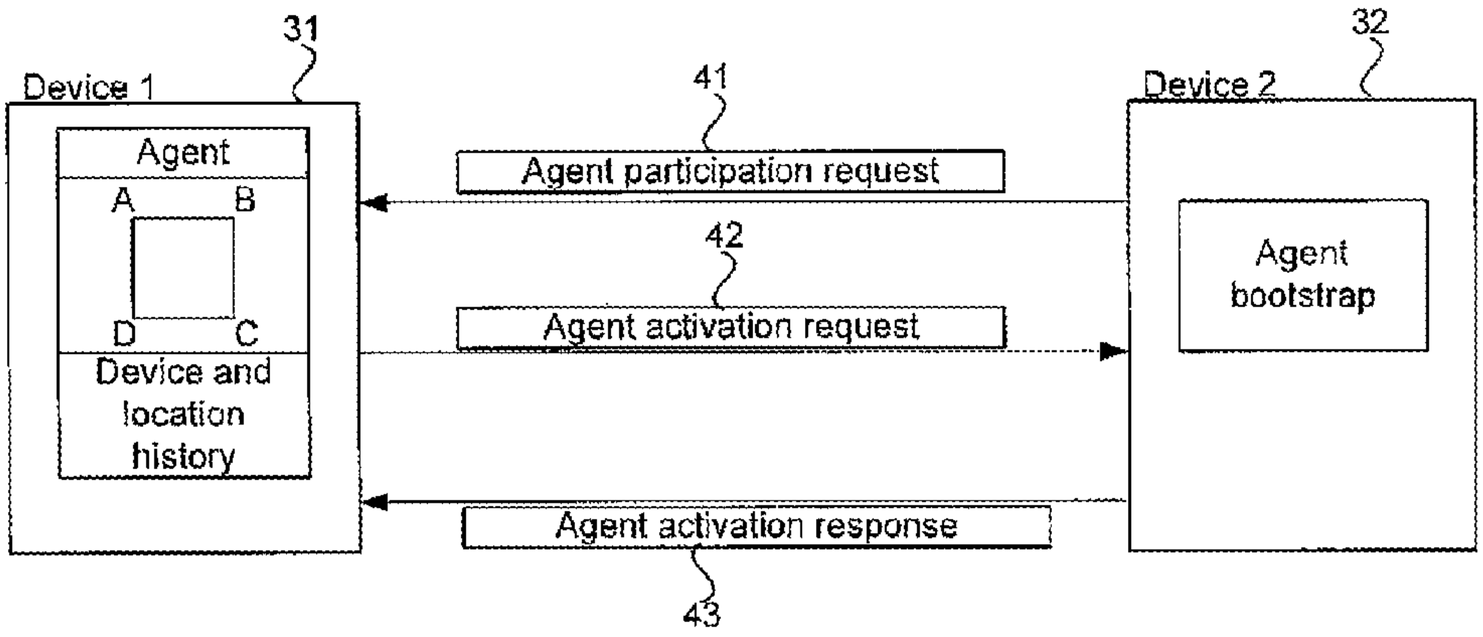

Figure 4

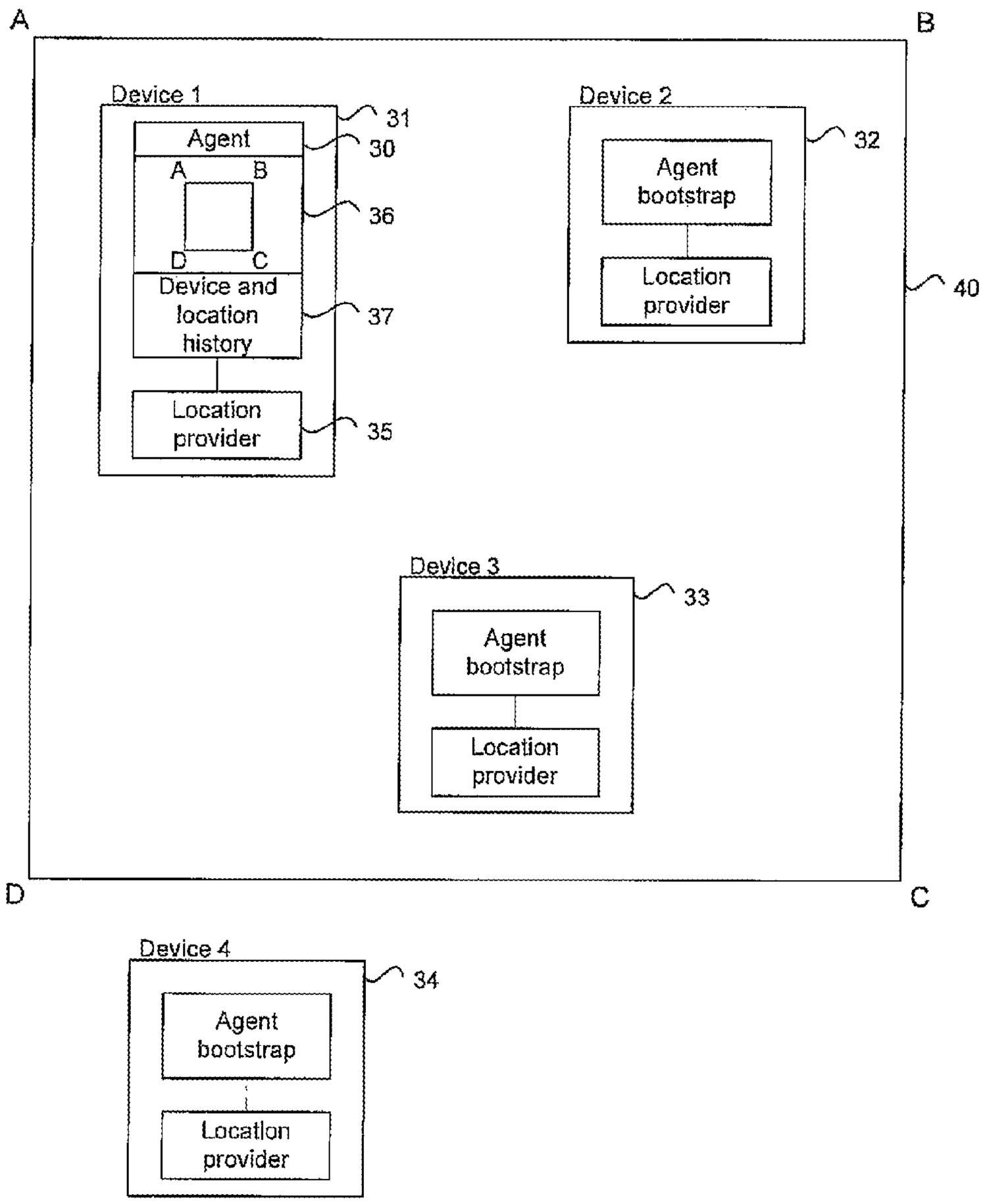
A
B
Device 1
31
Agent
30
A
B
36
D
C
Device and location history
37
Location provider
35
Device 2
32
Agent bootstrap
Location provider
40
Device 3
33
Agent bootstrap
Location provider
D
C
Device 4
34
Agent bootstrap
Location provider

Figure 3

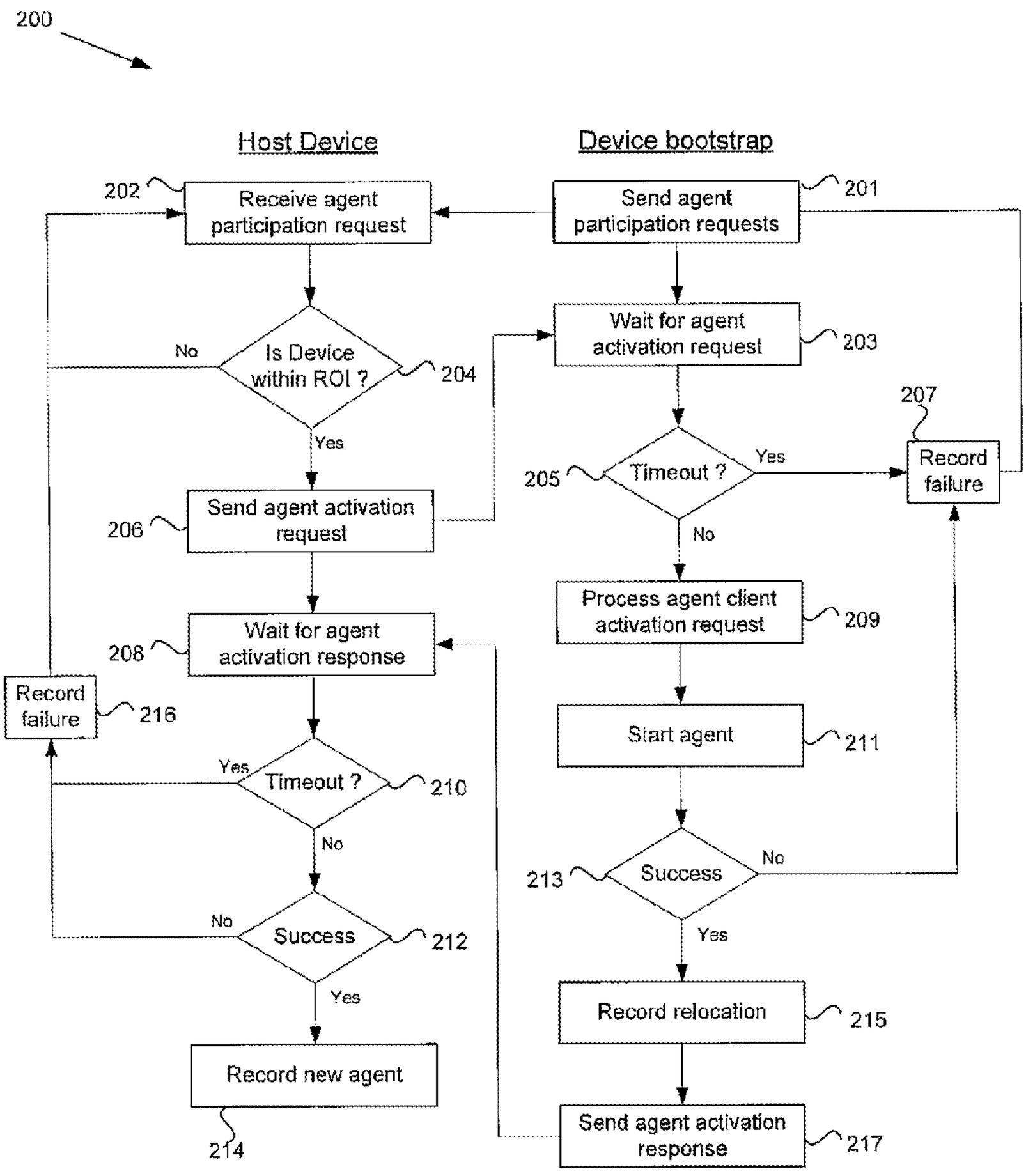
200
Host Device
Device bootstrap
202
Receive agent participation request
Send agent participation requests
201
Wait for agent activation request
203
No
Is Device within ROI ?
204
Yes
207
205
Timeout ?
Yes
Record failure
Send agent activation request
206
No
Process agent client activation request
209
208
Wait for agent activation response
Start agent
211
Record failure
216
Yes
Timeout ?
210
213
Success
No
No
Success
212
Yes
Yes
Record relocation
215
Record new agent
Send agent activation response
217
214

Figure 5

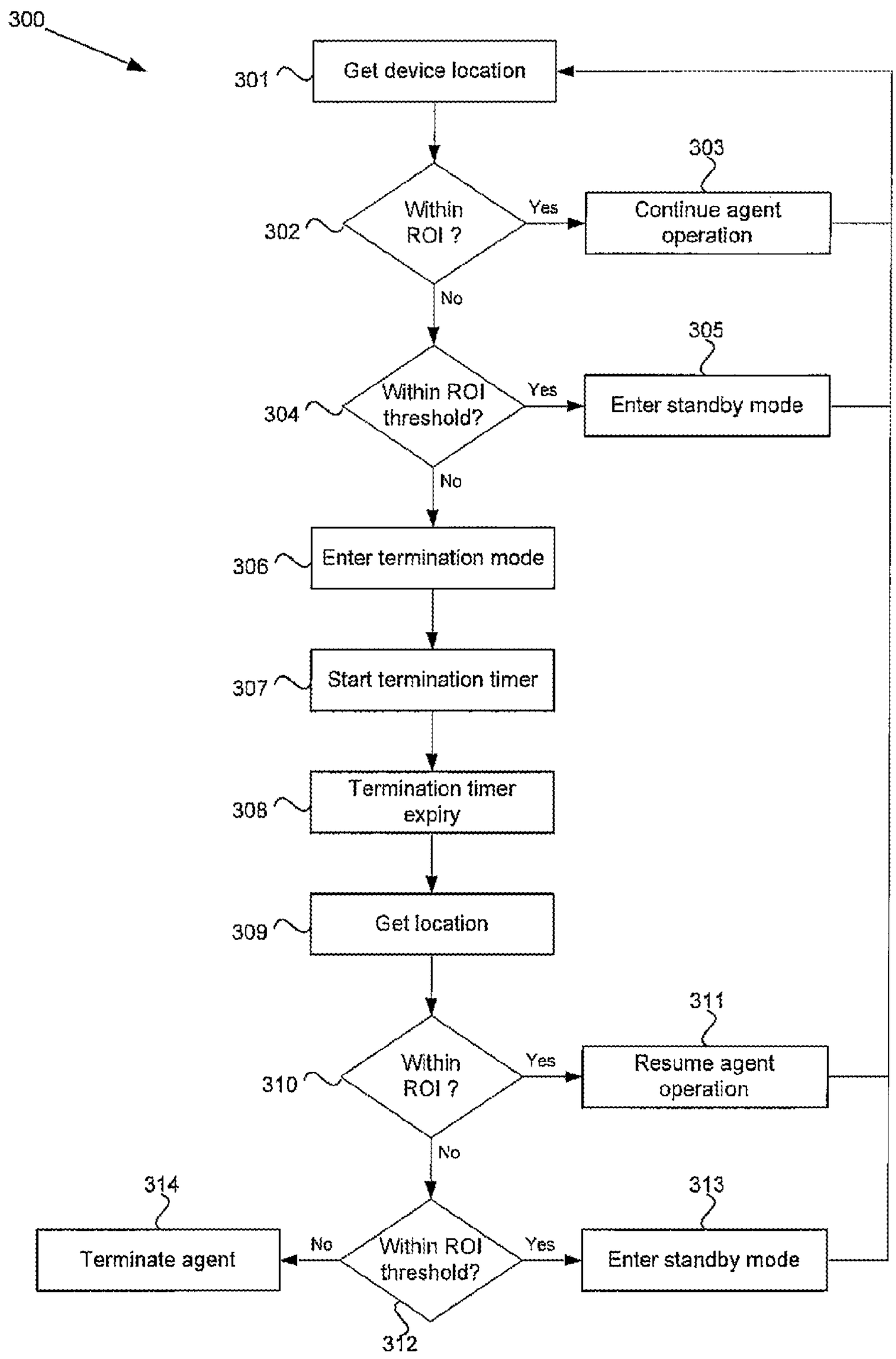
300
301
Get device location
302
Within ROI ?
Yes
303
Continue agent operation
No
304
Within ROI threshold?
Yes
305
Enter standby mode
No
306
Enter termination mode
307
Start termination timer
308
Termination timer expiry
309
Get location
310
Within ROI ?
Yes
311
Resume agent operation
No
312
Within ROI threshold?
No
314
Terminate agent
Yes
313
Enter standby mode

Figure 6

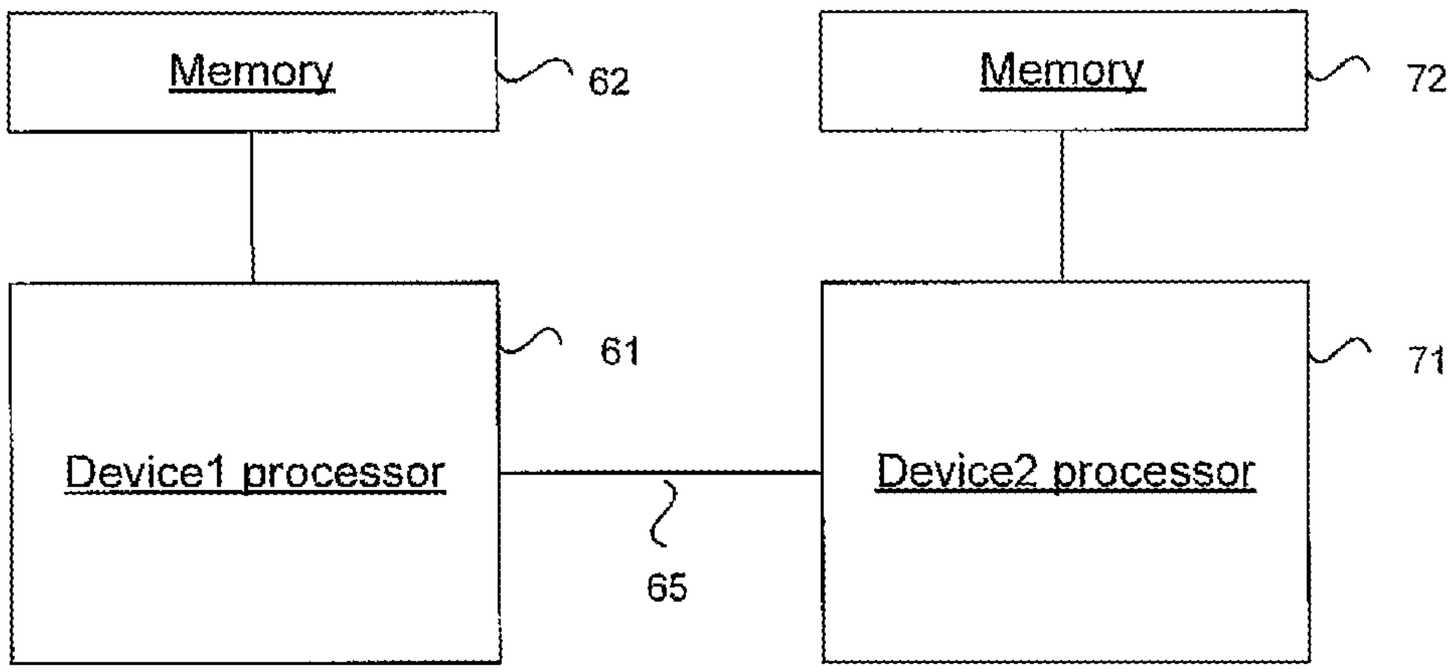

Figure 7

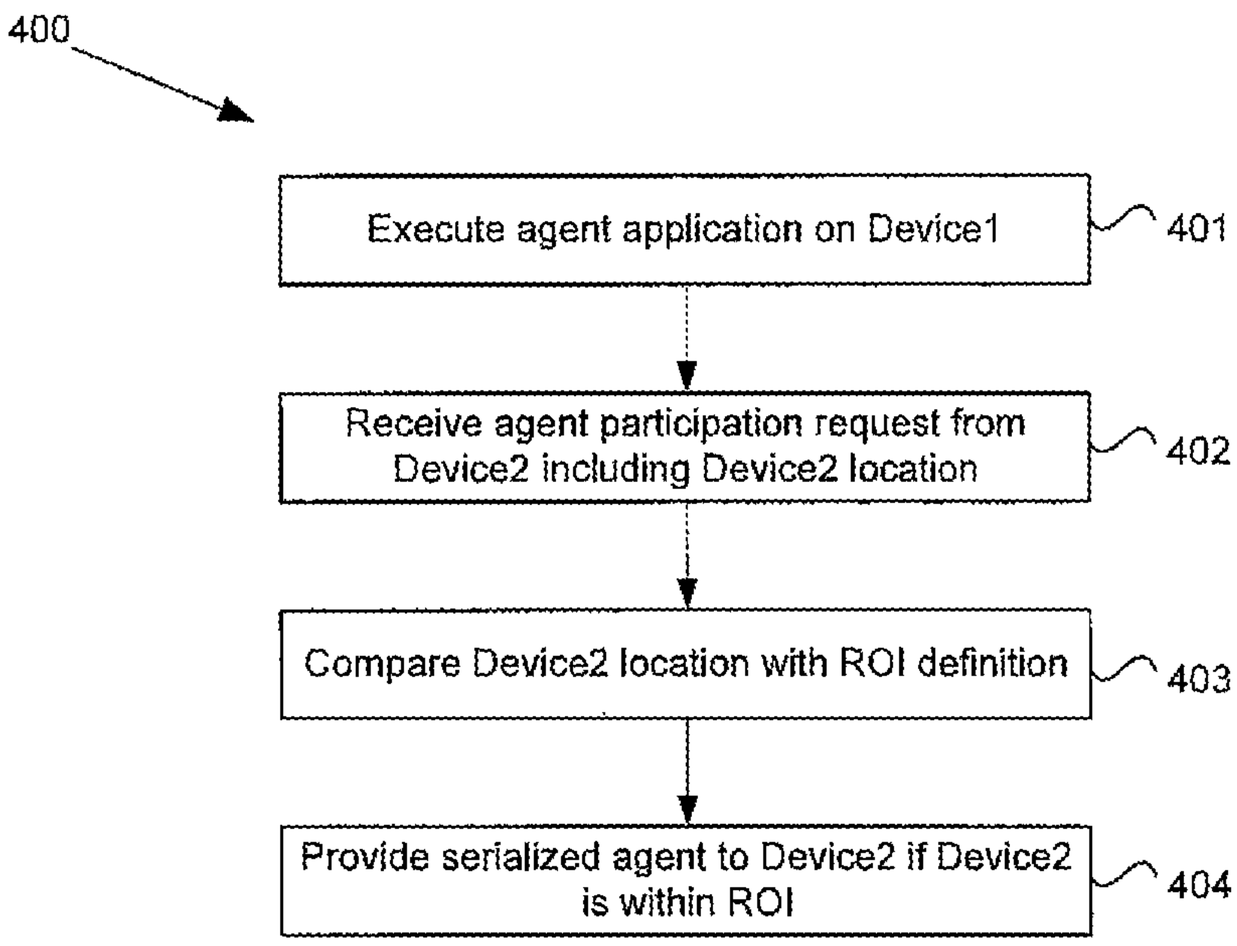

Figure 8

SYSTEM AND METHOD FOR MIGRATING AGENTS BETWEEN MOBILE DEVICES

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue; a claim printed with strikethrough indicates that the claim was canceled, disclaimed, or held invalid by a prior post-patent action or proceeding.

RELATED APPLICATIONS

This application is *a reissue of U.S. application Ser. No. 14/252,670, filed Apr. 14, 2014, now U.S. Pat. No. 8,965,408, which is* a divisional of and claims priority benefit to U.S. patent application Ser. No. 12/629,926, filed Dec. 3, 2009, **[**issued as**]** *now* U.S. Pat. No. 8,744,490, **[**all**]** *each* of which is incorporated herein in its entirety.

FIELD OF THE INVENTION

This disclosure relates to the deployment and execution of agents to mobile devices.

BACKGROUND OF THE INVENTION

In mobile communications, mobile devices may be configured to receive and support mobile agents for performing various tasks. However, the value of a ubiquitous network of mobile sensory input has yet to be leveraged in the marketplace. Today, there is an increase in low cost, low power micro-electronics, sensors and wireless technologies. For example, the user of a location-aware mobile device may encounter or identify a real-world event. The user can choose to download and execute an intelligent agent-based software application to the mobile device to achieve a specific goal with or for the user.

The user will need to eventually leave the event or have some other need that requires termination of the Agent on the device. This could happen before the Agent goal is completed. In prior art applications, this will typically mean that the agent software is not able to continue to achieve its goal.

What is required is an improved system and method that enables mobile agents to persist.

SUMMARY OF THE INVENTION

In one aspect of the disclosure, there is provided a method for deploying an agent to a mobile device comprising defining a region of interest (ROI), deploying an agent to a first mobile device, executing the agent on the first mobile device within the region of interest, and propagating the agent from the first mobile device to at least one second mobile device within the region of interest.

In one aspect of the disclosure, there is provided a server configured to deploy an agent application to at least one mobile device. The agent application may be configured to execute on the at least one mobile device when the at least one mobile device is within a region of interest, perform at least one agent function with respect to the region of interest, locate at least one other mobile device within the region of interest, and replicate the agent on the at least one other mobile device within the region of interest.

In one aspect of the disclosure, there is provided a computer-readable medium comprising computer-executable instructions for execution by a first processor of a first device, that, when executed, cause the first processor to execute an agent application, receive an agent participation request from a second processor of a second device, the agent participation request indicating a location of the second device, compare the location of the second device to a definition of a region of interest and provide the agent application to the second processor if the second device is within the region of interest.

BRIEF DESCRIPTION OF THE DRAWINGS

Reference will now be made, by way of example only, to specific embodiments and to the accompanying drawings in which:

FIG. **1** illustrates a network serving a region of interest;

FIG. **2** illustrates a process for deploying a mobile agent into the region of interest;

FIG. **3** illustrates a state of the network of FIG. **1** with a device executing an agent application;

FIG. **4** illustrates a message flow when a device copies an agent to a second device;

FIG. **5** illustrates a process for copying an agent from a first device to a second device;

FIG. **6** illustrates a process for terminating an agent on a device;

FIG. **7** illustrates a processor and memory of first and second devices; and

FIG. **8** illustrates an instruction set that can execute on the processor of the first device of FIG. **7**.

DETAILED DESCRIPTION OF THE INVENTION

In FIG. **1**, there is shown a network **10** that includes a server **20** and any number of mobile devices **12**. The mobile devices may communicate with the server **20** through any suitable communications protocol. The network **10** supports peer-to-peer communication but otherwise, the state or type of the network is not relevant to the essence of the disclosure. The mobile devices **12** may communicate with the server **20** and with each other through one or more base stations **18**. Typically, the devices **12** may be of many types including cellular phones, personal digital assistants (PDA), netbooks, laptops, and the like.

The mobile devices **12** are generally configured to support dynamic, executable content through the network and may receive content from the server **20**. In particular, the server **20** may deploy an agent application **16** to a mobile device **12**, for example in response to a request from the device **12**. As described above, agents **16** may be made applicable to particular events within a region of interest. The server **20** is thus able to define a boundary of the region of interest in order to characterize where the event is taking place. In one embodiment, the region of interest may be defined by a series of latitude/longitude points or some similar array of coordinates. Alternatively, a region of interest may be defined as being within communication range of a particular base station **18** or set of base stations.

In the present embodiments, the agent **16** may require its host device to be location aware. Awareness of location may be determined by an in-built system, such as a GPS or similar, which is able to provide the device with its present location to a required degree of accuracy. Alternatively or in addition, a device may be location aware by receiving information from the server or via communications with the base stations **18**.

A user at a mobile device **12** is able to download an agent **16** from the server **20** and to execute the agent **16** on the device **12** in order to achieve a particular goal. The goal may be in respect of a particular event occurring within a region of interest **15** covered by the network **10**. Examples of applications and goals of the agent are provided in more detail below.

As described above, there can be contention when the user needs to leave the ROI or have some other need that requires termination of the agent on the device before the goals of the agent have been achieved. In order to strike a balance between the user's needs and the agent's needs on the device, the agent software should be deployed so that it is able to persist its presence within the ROI to service others who enter the ROI.

A method for deployment of the agent into the ROI is illustrated in the flowchart **100** of FIG. **2**. At step **101**, an ROI is defined for a particular agent application **16**. The agent application **16** is then deployed to at least one mobile device **12** (step **102**), for example in response to a request from the mobile device **12**. The agent then executes (step **103**) and as part of the execution of the agent, the agent may propagate itself to one or more other agents within the ROI (step **104**), thereby ensuring that the agent can persist until the agent functions are completed.

Initially, the mobile device need not be in the ROI when it receives the agent but when the device **12** moves into the ROI the agent will detect that the device is within the event boundaries and begin execution. Similarly, when the device **12** leaves the event boundary defined by the ROI, the agent may terminate or place itself into a stand-by mode.

Agent propagation may occur by moving or copying the Agent between participating devices within the ROI. In either scenario, the Agent's motivation is to remain actively executing within the ROI. This serves to flood the ROI with Agents that act independently from each other and function toward the same goal.

Copying of the agent will now be described with reference to FIGS. **3** to **5**. FIG. **3** illustrates a state of the network **10**, FIG. **4** illustrates communications between two devices during the copying and the process is shown in the flowchart **200** of FIG. **5**. In FIG. **3**, an ROI **40** is defined with a nominal boundary as depicted. Device_**1** **31**, Device_**2** **32** and Device_**3** **33** are operating within the geographic limits of the ROI **40** while Device_**4** **34** is operating outside of the ROI **401**. It is considered that each of the devices **31-34** is capable of supporting agent applications and thus each executes the agent bootstrap code. In addition, each of the devices **31-34** is considered to be location aware by respective location providers of the devices **31-34**. The network connectivity may be via Internet Protocols or may be isolated from the Internet with the type and state of the connectivity being largely irrelevant for the purposes of the present disclosure.

At commencement, it is considered that Device_**1** has had an agent **30** deployed to it, either from the server **20** (FIG. **1**) or from other prior devices within the ROI. The agent includes an ROI definition **36** as well as a device and location history of the agent **37**.

Devices **32-34** which are executing the agent bootstrap code send participation requests (step **201**), e.g. by broadcast, multicast or by direct communication to receptive devices, and then wait for agent activation requests (step **203**). The agent participation request **41** provides the device identity and the current location of the device. At step **202**, Device_**1** **31**, which is currently hosting the agent **30**, receives agent participation requests **41** from the various

other devices **32-34**. At step **204**, Device_**1** **31** determines from the agent participation request whether the requesting device is within the ROI **40**. For example, the agent on Device_**1** would compare the location of Device_**4** **34** indicated in an agent participation request with the ROI defined within the agent **36** and determine that Device_**4** **34** is outside of the region of interest **40**. In this case, the agent would return to step **202** and await a next agent participation request. Processing of an agent participation request from Device_**2** **32** however would show that Device_**2** is located in the ROI and thus the agent **30** would proceed to step **206** and send an agent activation request **42** to Device_**2** **32**. The agent activation request would return the device ID of Device_**2** as well as an agent ID and a serialized version of the agent including both a definition of the ROI and a location of device history of the agent. Device_**1** would then proceed to step **208** and await an agent activation response. At Device_**2** **32**, if a timeout occurs (step **205**) while awaiting the agent activation request, a failure is recorded (step **207**) and Device_**2** **32** returns to step **201** to send another agent participation request. Otherwise, if no timeout occurs, the agent activation request is processed (step **209**). That is, the agent is deserialized and activated and the ROI and agent history is stored prior to starting the agent (step **211**). If the agent cannot be successfully started as determined at step **213**, then a failure is recorded **207** and Device_**2** **32** returns to step **201**. Otherwise, the copying of the agent is recorded (step **215**), e.g. by adding Device_**2** **32** to the location and device history. Device_**2** **32** then sends an agent activation response **43** to Device_**1** **31** which indicates the device ID of Device_**2** **32**, the agent ID and a success or fail indicator.

If Device_**1** **31** receives the agent activation response **43** before a timeout (step **210**) and the agent activation response **43** indicates that the agent has been successfully started on Device_**2** (step **212**), then agent on Device_**1** records the new agent (step **214**). Otherwise, the agent on Device_**1** records a failure (step **216**).

At the conclusion of the process **200**, the agent is actively executing on Device_**1** **31** and on Device_**2** **32**. Either of Device_**1** or Device_**2** may then continue replicating the agent to other devices within the ROI, such as Device_**3** **33** following the process as described above.

The agent ID identifies the agent, and may be used by Device_**2** to determine if the agent is already available on the device. If Device_**2** doesn't have an agent with a matching agent ID, Device_**2** must retrieve the correct agent from an external source, e.g., Device_**1**.

As an alternative to copying the agent, the agent **30** may be configured to move from one device to another. The process for moving may be similar to the process **200** shown in FIG. **5**. However, the step of recording the new agent (step **214**) may be replaced with the step of terminating the agent on the host device, i.e. Device_**1**, once indication of a successful activation on Device_**2** is received.

Copying or moving of the agent may be triggered by the receipt of an agent activation request from another device within the ROI. Alternatively or in addition, the host device may only become receptive to moving or copying the agent under certain conditions, such as when the device is being shut down, low battery power conditions, exiting the ROI, reduced signal strength, a specific command from the user, and the like.

EXAMPLES

A real-world event could be an unplanned emergency event (such as a fire, flash flood, traffic accident, shooting,

etc) or a planned non-emergency event (such as a concert, fair, road repair, sporting event, etc) or a combination (such as traffic congestion, road repair and a traffic accident). The origination of the agent and the ROI is not relevant to this disclosure but can differ based on each scenario. Individual examples are detailed in the following paragraphs.

Disaster search and rescue missions could drop in mobile Base Transceiver Stations (BTS) pre-programmed with a specific ROI and Agents to facilitate propagation to other mobiles that are in or enter the ROI. The agent copies itself to devices as they enter the ROI of the search and rescue effort. The agent might provide response leaders with command and control, enabling the command post to identify each participant, observe the location of each participant, assign search tasks to selected participants, and notify participants of status changes. The agent may change status or cease operating when a participant enters a rest area, departs the ROI, or in some other manner ceases to participate in the search and rescue mission. [0035] A 911 dispatcher could submit an Agent and a ROI to a caller's mobile in response to a traffic accident. The participant can use the camera or various other sensor inputs of the mobile device to indicate the type of injury (or injuries) involved. The police and medical responders can use this information, carried by the agent as it copies itself to additional devices as they enter the region, to quickly facilitate their actions (e.g., will CareFlight be needed because of traffic congestion?, etc). When the agent determines that the participant has exited the ROI, e.g., by comparing the device's current location with the ROI boundary, the agent moves to another device that is entering the ROI, stops participating in the ROI related to the traffic accident and waits for the next event, or ceases operation. The act of copying or moving to a device that is entering the ROI is an example of the agent achieving the goal of persistence within the ROI. [0036] A mobile user can create an Agent and ROI at a crowded concession stand at a sporting event in order to quickly understand the demands for hot dogs drinks, etc based on the crowd's demands. As customers depart the service counter, the agent detects the movement and either moves to a device approaching the concession stand that isn't already running the agent, or if no such device is available, stops operating.

Other scenarios would be apparent to the skilled addressee from the foregoing embodiments and examples.

In the above examples, the point-to-point communication within a region of interest can help to promote a direct, expedient exchange of information between agents. When an agent detects that its host device has left the ROI, it may terminate the agent. An agent's motivation to stay within a specified ROI, e.g. by moving or copying itself to other agents, allows the device to free up resources acquired by the agent after a power cycle or once the device leaves the ROI boundary.

In one embodiment, there may be defined one or more threshold conditions that enable the agent to provide a graceful termination on a device. In one embodiment, a threshold of the ROI may be defined as a second series of coordinates that define a threshold boundary immediately outside of the ROI boundary. Devices at a location between the threshold boundary and the ROI boundary may be considered to be within the threshold.

In one embodiment, a threshold of the ROI may be defined by signal strength. For example, where a ROI is defined by proximity to base stations a device with a signal strength of less than 20% with a base station within the ROI may be considered to be operating within a threshold region. The signal strength may be used to as a threshold condition irrespective of how the ROI is defined, e.g. by coordinates, base stations or by other means. The choice of threshold signal strength, e.g. 20% is presented herein as an example with any suitable threshold being chosen dependent on the application and implementation.

In a further embodiment, a device may be considered to be operating in a threshold region if the battery life of the device is below a required level, e.g. 20%.

A process for terminating the agent on a device is shown in the flowchart **300** of FIG. **6**. At step **301**, the agent is periodically updating the device location. If the agent determines that the device is still comfortably within the ROI (step **302**) then normal agent operation continues (step **303**). Otherwise the agent may determine if the device is in a geographic threshold region (step **304**) and, if so, the agent enters a standby mode (step **305**) where the agent actively monitors the device location (step **301**) but other agent functions such as data gathering and processing are suspended. In the standby mode, the agent may continue to propagate itself to other devices within the ROI. If step **304** shows the device to be outside of the threshold, then the agent enters a termination mode (step **306**) and an optional termination timer is started (step **307**). The termination timer provides a final opportunity for the device to re-enter the ROI.

Upon expiry of the termination timer (step **308**), or if the termination timer is disabled, a final check of the device location is made (step **309**). If the device has re-entered the ROI as determined at step **310**, then agent operation is resumed (step **311**). If the agent has not re-entered the ROI but is within the ROI threshold, as determined at step **312**, then the agent enters the standby mode (step **313**). Otherwise, the agent is terminated (step **314**), at which time a termination notification message may be broadcast/multicast/unicast to known agents within the ROI.

Where non-geographic threshold conditions are employed, such as based on signal strength and/or device battery power, the agent may enter a standby mode even if the device is within the ROI. Further, more stringent threshold conditions can be applied, such as battery power less than 5%, to cause the agent to enter a termination mode.

The components of the system **10** may be embodied in hardware, software, firmware or a combination of hardware, software and/or firmware. In a hardware embodiment, a mobile device such as Device_**1** **31** may include a processor **61** operatively associated with a memory **62** as shown in FIG. **7**. The memory **62** may store an instruction set **400** executable by the processor **61** which may include the bootstrap code described above. The bootstrap code allows the processor **61** to receive an agent application, either from the server **20** or from another mobile device. The instruction set **400**, shown in FIG. **8**, may include instructions that, when executed, causes the processor **61** to execute the agent application (step **401**) which may include storing a definition of the region of interest in the memory **62**. When executing, the agent application can receive an agent participation request from a second processor **71** of a second device (step **402**), e.g. Device_**2** **32** (FIG. **3**). The agent participation request may be received through a suitable communications link **65**, such as a peer-to-peer link or via one or more base stations and/or a server. From the agent participation request, the processor **61** can determine the location of the second device and compare the second device's location with a definition of the region of interest (step **403**). If the second device is shown to be within the region of interest, the processor **61** can provide a serialized version of the agent application to the second processor **71** (step **404**). The

second processor **71**, upon receiving the serialized agent application, may deserialize the agent application, store the ROI definition in its respective memory **72** and activate the agent application.

Although embodiments of the present invention have been illustrated in the accompanied drawings and described in the foregoing description, it will be understood that the invention is not limited to the embodiments disclosed, but is capable of numerous rearrangements, modifications, and substitutions without departing from the spirit of the invention as set forth and defined by the following claims. For example, the capabilities of the invention can be performed fully and/or partially by one or more of the blocks, modules, processors or memories. Also, these capabilities may be performed in the current manner or in a distributed manner and on, or via, any device able to provide and/or receive information. Further, although depicted in a particular manner, various modules or blocks may be repositioned without departing from the scope of the current invention. Still further, although depicted in a particular manner, a greater or lesser number of modules and connections can be utilized with the present invention in order to accomplish the present invention, to provide additional known features to the present invention, and/or to make the present invention more efficient. Also, the information sent between various modules can be sent between the modules via at least one of a data network, the Internet, an Internet Protocol network, a wireless source, and a wired source and via plurality of protocols.

The invention claimed is:

1. A computer-readable medium comprising computer-executable instructions, that when executed by a processing device, cause the processing device to:

receive, from a first device, an agent activation request comprising a first copy of an agent application executing on the first device;

execute the first copy of the agent application based at least in part on receiving the agent activation request;

transmit, to the first device, a first agent activation response based at least in part on executing the first copy of the agent application;

receive, from a second device, an agent participation request providing a location of the second device;

compare the location of the second device to a region of interest;

provide, to the second device, a second copy of the agent application based at least in part on the comparison;

receive, from the second device, a second agent activation response based at least in part on the second copy of the agent application executing on the second device; and

record that the second copy of the agent application is executing successfully on the second device based at least in part on receiving the second agent activation response from the second device within a predetermined amount of time.

2. The computer-readable medium of claim **1**, wherein the first agent activation response comprises at least one of a first device identification, an agent application identification, and a success indicator.

3. A device, comprising:

a memory configured to store a first copy of an agent application received from a first device; and

a processing device configured to:

execute the first copy of the agent application based at least in part on receiving an agent activation request from the first device, the agent activation request comprising the first copy of the agent application;

transmit, to the first device, a first agent activation response based at least in part on executing the first copy of the agent application;

receive, from a second device, an agent participation request providing a location of the second device;

compare the location of the second device to a region of interest;

provide, to the second device, a second copy of the agent application based at least in part on the comparison;

receive, from the second device, a second agent activation response based at least in part on the second copy of the agent application executing on the second device; and

record that the second copy of the agent application is executing successfully on the second device based at least in part on receiving the second agent activation response from the second device within a predetermined amount of time.

4. The device of claim **3**, wherein the processing device is further configured to trigger storing the region of interest or agent history in the memory in response to the agent activation request.

5. The device of claim **3**, wherein the first agent activation response comprises at least one of a device identification, an agent application identification, and a success indicator.

6. A mobile device, comprising:

a memory device configured to store instructions; and

a processing device configured to execute the instructions stored in the memory device to:

activate a first copy of an agent application based at least in part on receiving the first copy of the agent application in an agent activation request from a first device;

transmit, to the first device, a first agent activation response based at least in part on activating the first copy of the agent application;

receive, from a second device, an agent participation request providing a location of the second device;

compare the location of the second device to a region of interest;

provide, to the second device, a second copy of the agent application based at least in part on the comparison;

receive, from the second device, a second agent activation response based at least in part on the second copy of the agent application executing on the second device; and

record that the second copy of the agent application is executing successfully on the second device based at least in part on receiving the second agent activation response from the second device within a predetermined amount of time.

7. The mobile device of claim **6**, wherein the processing device is configured to execute the instructions stored in the memory device further to transmit the first agent activation response based at least in part on activating the first copy of the agent application after receiving the agent activation request.

8. The mobile device of claim **6**, wherein the processing device is configured to execute the instructions stored in the memory device further to terminate execution of the first copy of the agent application in response to detecting that the mobile device is leaving the region of interest.

9. The mobile device of claim **6**, wherein the processing device is configured to execute the instructions stored in the memory device further to receive the agent activation

request based at least in part on a comparison of a location of the mobile device to the region of interest being within a predetermined threshold.

10. The mobile device of claim **9**, wherein the predetermined threshold is based at least in part on a distance between the mobile device and a base station that serves the region of interest.

11. The mobile device of claim **9**, wherein the predetermined threshold is based at least in part on a battery power of the mobile device.

12. A method, comprising:

activating a first copy of an agent application based at least in part on receiving the first copy of the agent application from a first device;

[transmitting, to the first device, an agent activation response based at least in part on successfully activating the first copy of the agent application;**]**

transmitting, to the first device, a first agent activation response based at least in part on activating the first copy of the agent application;

receiving, from a second device, an agent participation request providing a location of the second device;

comparing the location of the second device to a region of interest;

providing, to the second device, a second copy of the agent application based at least in part on the comparison;

receiving, from the second device, a second agent activation response based at least in part on the second copy of the agent application executing on the second device; and

recording that the second copy of the agent application is executing successfully on the second device based at least in part on receiving the second agent activation response from the second device within a predetermined amount of time.

13. The method of claim **12**, further comprising transmitting the first agent activation response based at least in part on activating the first copy of the agent application after receiving the first copy of the agent **[**activation request**]** *application*.

14. The method of claim **12**, further comprising terminating execution of the first copy of the agent application in response to detecting that the mobile device is leaving the region of interest.

15. The method of claim **12**, further comprising determining that the location of the second device is within a predetermined threshold distance of the region of interest.

16. The method of claim **15**, wherein the predetermined threshold distance is based at least in part on a distance between the mobile device and a base station that serves the region of interest.

17. The method of claim **15**, wherein the predetermined threshold distance is based at least in part on a battery power of the mobile device.

18. A mobile management device, comprising a processor configured to:

propagate an agent to a first device in response to detecting the first device being located in a region of interest;

receive an agent participation request from a second device, the agent participation request indicating a location of the second device;

provide an agent activation request comprising deploying the agent to the second device based at least in part on the second device being located in the region of interest; and

terminate the agent executing on the first device based at least in part on the agent successfully executing on the second device or place the agent executing on the first device into a stand-by mode based at least in part on the agent successfully executing on the second device.

19. The mobile management device of claim 18, wherein the processor is further configured to:

compare a location of the second device to the region of interest; and

provide the agent to the second device based at least in part on the comparison.

20. The mobile management device of claim 23, wherein the processor is further configured to:

terminate the agent executing on the first device based at least in part on detecting that the first device is no longer located in the region of interest.

21. A system, comprising:

a first processor configured to:

propagate an agent to a first mobile device in response to detecting the first mobile device being located in a region of interest;

receive an agent participation request from a second mobile device, the agent participation request indicating a location of the second mobile device; and

provide an agent activation request comprising deploying the agent to the second mobile device based at least in part on the second mobile device being located in the region of interest; and

a second processor configured to activate the agent on the second mobile device before providing an agent activation response to the first mobile device.

22. The mobile management device of claim 18, wherein the processor is further configured to:

propagate the agent to the first device in response to detecting the first device being located in the region of interest within a predetermined threshold.

23. A mobile management device, comprising a processor configured to:

propagate an agent to a first device in response to detecting the first device being located in a region of interest within a predetermined threshold;

receive an agent participation request from a second device, the agent participation request indicating a location of the second device;

provide an agent activation request comprising deploying the agent to the second device based at least in part on the second device being located in the region of interest; and

determine the predetermined threshold based at least in part on a distance between the first device and a base station that serves the region of interest.

24. A mobile management device, comprising a processor configured to:

propagate an agent to a first device in response to detecting the first device being located in a region of interest within a predetermined threshold;

receive an agent participation request from a second device, the agent participation request indicating a location of the second device;

provide an agent activation request comprising deploying the agent to the second device based at least in part on the second device being located in the region of interest; and

determine the predetermined threshold based at least in part on a battery power of the first device.

25. A mobile device, comprising a processor to execute instructions stored in a memory to:

execute an agent on a first device in response to detecting the first device being located in a region of interest;

receive an agent participation request from a second device, the agent participation request indicating a location of the second device;

provide the agent to the second device based at least in part on the second device being located in the region of interest; and

record that the agent is executing successfully on the second device based at least in part on receiving an agent activation response from the second device within a predetermined amount of time.

26. The mobile device of claim 25, wherein the processor is further configured to:

provide the agent to the second device comprised in an agent activation request.

27. The mobile device of claim 25, wherein the processor is further configured to:

compare a location of the second device to the region of interest; and

provide the agent to the second device based at least in part on the comparison.

28. The mobile device of claim 25, wherein the processor is further configured to:

terminate the agent executing on the first device based at least in part on the agent successfully executing on the second device.

29. The mobile device of claim 25, wherein the processor is further configured to:

terminate the agent executing on the first device based at least in part on detecting that the first device is no longer located in the region of interest.

30. The mobile device of claim 25, wherein the processor is further configured to:

activate the agent on the second device before providing the agent activation response.

31. The mobile device of claim 25, wherein the processor is further configured to:

propagate the agent to the first device in response to detecting the first device being located in the region of interest within a predetermined threshold.

32. The mobile device of claim 31, wherein the processor is further configured to:

determine the predetermined threshold based at least in part on a distance between the first device and a base station that serves the region of interest.

33. The mobile device of claim 25, wherein the processor is further configured to:

determine the predetermined threshold based at least in part on a battery power of the first device.

34. The mobile management device of claim 21, wherein the first processor is further configured to:

compare a location of the second device to the region of interest; and

provide the agent to the second device based at least in part on the comparison.

35. The mobile management device of claim 24, wherein the processor is further configured to:

terminate the agent executing on the first device based at least in part on detecting that the first device is no longer located in the region of interest.

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