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(54) **Title:**
APPARATUS AND METHODS FOR ESTABLISHING CLIENT-HOST ASSOCIATIONS WITHIN A WIRELESS NETWORK

(57) **Abstract:**
33 ABSTRACT APPARATUS AND METHODS FOR ESTABLISHING CLIENT-HOST ASSOCIATIONS WITHIN A WIRELESS NETWORK In embodiments, a one-to-one association is established between a client and a host in a wireless network, such as a wireless local area network or a wireless personal communication network. The client may be a display device. The host may be a cellular telephone. Active association corresponds to the host exclusively using a shared resource of the client. When the association is solid, requests from other hosts to establish an active association are denied. When the association is fragile, such requests are granted. In the case of a semi-solid association, a request from another host to establish an active association causes the client to generate a query to the host currently owning the active association. If the host currently owning the association grants a release, a new active association is established between the requesting host and the client. Otherwise, the request from the other host is denied. Figure 2

ABSTRACT

APPARATUS AND METHODS FOR ESTABLISHING CLIENT-HOST ASSOCIATIONS WITHIN A WIRELESS NETWORK

In embodiments, a one-to-one association is established between a client and a host in a wireless network, such as a wireless local area network or a wireless personal communication network. The client may be a display device. The host may be a cellular telephone. Active association corresponds to the host exclusively using a shared resource of the client. When the association is solid, requests from other hosts to establish an active association are denied. When the association is fragile, such requests are granted. In the case of a semi-solid association, a request from another host to establish an active association causes the client to generate a query to the host currently owning the active association. If the host currently owning the association grants a release, a new active association is established between the requesting host and the client. Otherwise, the request from the other host is denied.

Figure 2

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APPARATUS AND METHODS FOR ESTABLISHING CLIENT-HOST ASSOCIATIONS WITHIN A WIRELESS NETWORK

BACKGROUND

Field

[0001]   The present invention relates generally to communications. More particularly, in aspects the invention relates to establishing and changing one-to-one client-host associations in a wireless network.

Background

[0002]   Portability and functionality of wireless communication devices continue to improve, contributing to the proliferation of wireless communication networks. Many conventionally-wired connections are being replaced with wireless connections, including *ad hoc* connections made when one wireless device moves into the connectivity area of another wireless device. Of some interest are wireless local area networks (wireless LANs or WLANs), such as wireless networks under the various IEEE 802.11 standards. Of some interest are also wireless personal area networks (wireless PANs or WPANs), which are networks that are often used for communication between or among devices close to one person. The reach of WLANs and WPANs is typically of the order of ten meters, although some networks operate over distances three, ten, or even thirty times as long.

[0003]   A wireless LAN or PAN network may be used for communications between or among personal devices, or for communications between such personal devices and higher level networks, including the Internet. A wireless network may be implemented using infrared data association (IrDA), Bluetooth, ultra-wide band (UWB), ZigBee, and the IEEE 802.11 standard technologies.

[0004]   Wireless body area networks may be considered a subset of personal area networks. A wireless body area network may include wireless sensors for monitoring various body parameters and functions.   The sensors may transmit real-time data to a base station located, for example, in a person's home.

[0005]   Links between two wireless devices in a wireless network may be established for one-to-one communication between the two devices. One of the devices – the client – may provide over a link use of a resource exclusively to the other device – the host. An

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example of such a resource is a display device that can be operated wirelessly from a personal computer, personal digital assistant, or a cellular telephone with wireless capability in addition to cellular connectivity.

[0006]   A need exists in the art for apparatus, methods, and articles of manufacture that facilitate establishing links in wireless networks, including wireless LANS and wireless PANs. A need also exists for apparatus, methods, and articles of manufacture that facilitate changing availability of resources from one host to another in wireless networks.

SUMMARY

[0007]   Embodiments disclosed herein may address one or more of the above stated needs by providing apparatus, methods, and articles of manufacture for establishing one-to-one wireless network associations in different categories.

[0008]   A method for providing use of a shared resource of a client over a wireless network is described. The method includes establishing a passive association between the client and a first host for communications over the wireless network. The passive association does not allow use of the shared resource by the first host. The method also includes receiving at the client a request from the first host to establish an active association allowing exclusive use of the shared resource by the first host. The request is received over the wireless network. The method further includes determining at the client whether an active association allowing exclusive use of the shared resource by a second host exists (*i.e.*, whether any previously-established active association with any other host exists), which step is performed in response to the request from the first host. If there is no active association with the second (*i.e.*, any other) host, the method further includes establishing the active association with the first host and allowing the first host exclusive use of the shared resource.

[0009]   A wireless network client device is described. The client device includes a shared resource, a memory, a receiver of the wireless network, a transmitter of the wireless network, and a controller. The controller is coupled to the receiver, the transmitter, the shared resource, and the memory. The controller is configured to establish a passive association between the client device and a first host for communications over the wireless network. The passive association does not allow use of the shared resource by the first host. The controller is also configured to receive over

the wireless network a request from the first host to establish an active association allowing exclusive use of the shared resource by the first host. The controller is further configured to determine, in response to the request from the first host, whether an active association allowing exclusive use of the shared resource by a second host exists. (That is, determine whether any previously-established active association with any other host exists.) If the active association allowing exclusive use of the shared resource by the second host does not exist, the controller is configured to establish the active association with the first host and allow the first host exclusive use of the shared resource.

[0010]   A machine-readable medium storing instructions is described. When the instructions are executed by at least one processor of a client device having a shared resource and configured to receive and transmit over a wireless network, the instructions cause the client device to perform a number of steps. The steps include establishing a passive association between the client device and a first host for communications over the wireless network. The passive association does not allow use of the shared resource by the first host. The steps also include receiving over the wireless network a request from the first host to establish an active association allowing exclusive use of the shared resource by the first host. The steps further include determining, in response to the request from the first host, whether an active association allowing exclusive use of the shared resource by a second host exists. (That is, determining whether any previously-established active association with any other host exists.) If the step of determining whether an active association allowing exclusive use of the shared resource by the second host exists results in a determination that there is no active association with the second host, the steps further include establishing the active association with the first host and allowing the first host exclusive use of the shared resource.

[0011]   Another client device is described having a shared resource means, a means for storing data, a means for receiving information over a wireless network, a means for transmitting information over the wireless network, and a controller means for controlling the shared resource means, the means for storing data, the means for receiving, and the means for transmitting. The controller means is configured to establish a passive association between the client device and a first host for communications over the wireless network. The passive association does not allow use of the shared resource means by the first host. The controller means is also configured

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to receive over the wireless network a request from the first host to establish an active association allowing exclusive use of the shared resource means by the first host. The controller means is further configured to determine, in response to the request from the first host, whether an active association allowing exclusive use of the shared resource means by any other host exists. If the active association allowing exclusive use of the shared resource means by any other host does not exist, the controller means is further configured to establish the active association with the first host and allow the first host exclusive use of the shared resource means.

[0012]   These and other aspects of the present invention will be better understood with reference to the following description, drawings, and appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013]   Figure 1 illustrates selected components of a wireless network, including a host and a client;

[0014]   Figure 2 illustrates selected steps and decision of a process for establishing a passive association and handling a request for an active association between a client and a host;

[0015]   Figure 3 illustrates details of selected steps and decisions of the process of Figure 2 in the presence of a previously-established active solid association;

[0016]   Figure 4 illustrates details of selected steps and decisions of the process of Figure 2 in the presence of a previously-established active semi-solid association; and

[0017]   Figure 5 illustrates details of selected steps of the process of Figure 2 in the presence of a previously-established active association that may fall within different categories.

DETAILED DESCRIPTION

[0018]   In this document, the words "embodiment," "variant," and similar expressions are used to refer to particular apparatus, process, or article of manufacture, and not necessarily to the same apparatus, process, or article of manufacture. Thus, "one embodiment" (or a similar expression) used in one place or context may refer to a particular apparatus, process, or article of manufacture; the same or a similar expression in a different place may refer to a different apparatus, process, or article of manufacture. The expressions "alternative embodiment," "alternatively," and similar phrases may be

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used to indicate one of a number of different possible embodiments. The number of possible embodiments is not necessarily limited to two or any other quantity.

[0019]   The word "exemplary" may be used herein to mean "serving as an example, instance, or illustration." Any embodiment or variant described herein as "exemplary" is not necessarily to be construed as preferred or advantageous over other embodiments or variants. All of the embodiments and variants described in this description are exemplary embodiments and variants provided to enable persons skilled in the art to make and use the invention, and not necessarily to limit the scope of legal protection afforded the invention.

[0020]   The word "association" relates to a communication link established between a client device where a resource resides and a host device that wishes to use the resource. The communication link may be over a wired or wireless medium. An "association" is a temporary relationship established between the corresponding application entities on the host and client devices, where either entity can initiate the association and negotiate the service parameters (quality of service, for example) and/or communication parameters. An "active" association is an association that provides for exclusive use of a shared resource residing at a client or otherwise available through the client. A "passive" association allows negotiation of communication (and possibly other) parameters, but does not provide for the use of the shared resource available at the client. Under a passive association, periodic monitoring messages may be passed between the host and the client (either uni-directionally or bi-directionally), so that the devices are aware of each other's presence within the communication distance of the wireless network; and communication parameters may be maintained or periodically changed depending on various circumstances, such as availability of power, computational resources, and presence of other hosts in the wireless network. Certain aspects of associations are described in a commonly-assigned U.S. provisional patent application serial number 60/951,919, filed on July 25, 2007, entitled Wireless Architecture for a Traditional Wire-Based Protocol.

[0021]   Figure 1 illustrates selected components of a client 120 and a host 140 in a one-to-one association within a wireless network 100. The client 120 includes a processor 122, a memory 124, a shared resource 126 that is capable of providing one or more services to the host 140 and to one or more other hosts one at a time, a receiver 128 for receiving communications from devices of the wireless network 100, and a transmitter

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130 for sending communications to the devices of the wireless network 100. The memory 124, the shared resource 126, the receiver 128, and the transmitter 130 are coupled to the processor 122, which can configure, read, and/or write to these devices.

[0022]   The host 140 similarly includes a processor 142, a memory 144, a receiver 148 for receiving communications from devices of the wireless network 100, and a transmitter 150 for sending communications to the devices of the wireless network 100. The host 140 also has a human interface output block 152, and a human interface input block 154. The memory 144, the receiver 148, the transmitter 150, the human interface output block 152, and the human interface input block 154 are coupled to the processor 142, which can configure, read, and/or write to these devices.

[0023]   Each of the processors 122 and 142 may include, for example, one or more controllers, one or more microprocessors, one or more digital signal processors, one or more state machines, or a combination of such devices. Each of the memories 124 and 144 may be internal or external to the corresponding processor (122 or 142), and may include random access memory (RAM), read-only memory (ROM), programmable ROM (PROM), erasable PROM (EPROM), electrically erasable EPROM (EEPROM), dynamic RAM (DRAM), synchronous DRAM (SDRAM), double data rate SDRAM (DDR SDRAM), enhanced SDRAM (ESDRAM), Synchlink DRAM (SLDRAM), direct Rambus RAM (DRRAM), magnetic storage, and/or other memory devices.

[0024]   In some variants, the communications within the wireless network 100 may span up to ten meters, up to thirty meters, up to one hundred meters, or up to three hundred meters. The communications may be conducted in conformity with the WiMedia standard, the ECMA-368/369 standards, the Bluetooth standard, the IrDA standard, the UWB standard, the ZigBee standard, or one of the IEEE 802.11 standards. (This list is not exclusive.) Accordingly, the receivers 128/148 and the transmitters 130/150 are configured to operate under the applicable standard or standards.

[0025]   The shared resource 126 may be, for example, a display, such as a projector, a television display, or a computer display. In some variants, the shared resource 126 includes a display device with Mobile Display Digital Interface (MDDI) capabilities. The shared resource 126 may be sound reproduction equipment, such as one or more speakers. It may also be a storage device configured to store and/or provide data. It may be a gateway to another network, such as a wireless or wired network; the other network may be or may connect to the Internet or a telephone network. The shared

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resource 126 may also be electronic gaming equipment, with the host 140 performing the function of a game controller when an active association between the host 140 and the client 120 is in existence. The shared resource 126 may also be a personal or other computer with preloaded software, allowing the host 140 essentially to perform user input and output functions for the computer using the preloaded software. The shared resource may also be a human interface input, such as a keyboard or a pointing device (mouse, trackball, and similar devices). Still further, the shared resource may include mechanical and optical devices.

[0026]   The human interface input block 154 may be, for example, a keyboard, a touchpad, and/or a pointing device. The human interface output block 152 may be, for example, a display device, a speaker, and/or a headset. The human interface input and out blocks may also be combined, for example, in a touchscreen.

[0027]   An association between the client 120 and the host 140 may be established in a variety of ways. A passive association, for example, may be established automatically when the two devices are within communication range (of the wireless network) of each other. The responsibility for automatic discovery of the other device or devices may lie with either the client 120, the host 140, or with each of these devices simultaneously. An active association may be established as a result of a request generated by the user of the host 140, for example, following establishment of a passive association between the two devices.

[0028]   Either the client 120, the host 140, or each of these devices may have additional elements, including receivers and/or transmitters designed to communicate with other wireless networks, or with networks other than wireless networks, including cellular networks. The cellular networks may operate, for example, under UTRAN or UMTS Terrestrial Radio Access Network standards, including code division multiple access (CDMA) and Global System for Mobile Communication (GSM) network standards.

[0029]   Figure 2 illustrates selected steps of a process 200 for establishing first a passive and then an active association between a client, such as the client 120, and a requesting host, such as the host 140. In case a previously-established association between the client and another host exists, the other host may be identical, analogous, similar, or different from the requesting host.

[0030]   At flow point 201, the host and the client are operational.

[0031]   At step 205, at least one of the devices detects the other device within a distance that allows wireless network communications between them. The detecting device may be the client or the host.

[0032]   At step 210, the client and the host negotiate or otherwise determine communication parameters for a passive association between them. The parameters may include medium access control (MAC) and physical layer (PHY) communication parameters. This step may be performed automatically in response to the detection of the step 205.

[0033]   At step 215, the host receives a command from its user to establish an active association with the client for exclusive use of the shared resource of the client. The host may receive the command, for example, through the human interface input block of the host.

[0034]   At step 220, the host sends a request to the client to establish an active association. The request may include introductory information, such as text, audio, video, or other information. The introductory information may identify the operator or owner of the host.

[0035]   At step 225, the client receives the request.

[0036]   At decision block 230, the client checks for existence of a previously-established active association with any other host. If such a previously-established active association is currently in existence, process flow branches to steps collectively designated with a reference numeral 235, where such situation may be handled as will be described further below.

[0037]   If there is no previously-established active association currently in existence, process flow advances to step 280, in which the client grants the requesting host's request and additional parameters are negotiated or otherwise determined for the active association between the host and the client, and the association then becomes active. Previously-determined parameters applicable to communications between the client and the host (e.g., communication parameters determined in the step 210) may be kept, or they may be re-negotiated or otherwise changed.

[0038]   The additional parameters may include, for example, quality of service (QoS) to be provided by the shared resource to the host. For a display, for example, resolution of the display may be such a parameter. For a connection to another network through the client, the parameters may include QoS of such connection (e.g., bandwidth and

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latency). A payment for the use of the shared resource may be transferred or authorized by the user as part of the step 280, and a visual or audio indication may signal the user of the availability of the resource. The visual or audio indication may be generated by the host (*e.g.*, from the host's human interface output block), or by the client.

[0039]   At step 285, the user of the host proceeds to use exclusively the shared resource of the client. The process then terminates at a flow point 299.

[0040]   One category of active association may be a "solid' association that does not allow any other host to interrupt the association. In other words, the client does not entertain requests for active association in the presence of a previously-established active solid association. Returning to the decision block 230 of the process 200, existence of a previously-established solid association causes a rejection in the steps 235 of the association requested by the user. On the other hand, if the user manages to establish a solid association in the step 280, requests from other hosts for an active association will be rejected outright, without asking the user of the host with the current ownership of the active solid association whether the solid association may be released. The user with the solid association may or may not be notified of the request by another user.

[0041]   Figure 3 illustrates selected steps 235A corresponding to the existence of a previously-established solid association. The process flow of the process 200 may proceed to the steps 235A where it is determined in the decision block 230 that a previously-established active association is currently in existence. The steps 235A may include a decision block 237A for checking whether the previously established association is a solid one, and a step 239A in which the client sends to the requesting host a message with an outright rejection of the request. If the request to establish an active association received in the step 225 included introductory information (text, video, or audio, for example), the steps 235A may include sending all or some of the introductory information to the host owning the previously-established active association. The host owning the previously-established active association may render (via display, indicator light, or sound, for example) to its user all or part of the introductory information, or some derivative of the introductory information. In this way, the user of the host owning the previously-established active association may become informed that another person is seeking the use of the shared resource.

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[0042]   Another category of association may be a "semi-solid" association that generates a request to the (first) host with the current active association to release the association for acquisition by the requesting (second) host. Figure 4 illustrates selected steps 235B corresponding to this scenario. The process flow of the process 200 may proceed to the steps 235B after determining in the decision block 230 that a previously-established semi-solid active association is currently in existence. As shown in Figure 4, the steps 235B corresponding to this scenario may include a decision block 241B for checking whether the previously-established active association is a semi-solid one, and a step 243B in which the client sends to the host owning the previously-established association a message (query) with a request to authorize release of the previously-established active association.

[0043]   If the host owning the previously-established association grants the request prior to timeout, as determined in decision blocks 245B, 246B, and 247B, the previously established association is dropped or transformed into a passive association, at step 249B. Process flow then goes to the steps 280 and 285 (shown in Figure 2) to establish a new active association between the client and the host requesting the active association, and the requesting host then uses the new association.

[0044]   The request to authorize release may include information describing the association sought to be established, such as the category of the association (solid, semi-solid, or another category). If the request to establish an active association received in the step 225 included introductory information, the query may include all or some of the introductory information. The host owning the previously-established active association may render to its user the introductory information or some derivative of the introductory information.

[0045]   The host granting or denying the request to release may be preprogrammed to grant or deny the request automatically without regard to other circumstances (e.g., always grant or always deny), it can request an authorization from its user via the human interface blocks (e.g., display "enter YES to grant the request and release the projector"), or it can do so automatically depending on some circumstances, such as the length of the period through which its user has not used the resource.

[0046]   Still another category of association may be a soft or fragile association, whereby the client upon receipt of a request for an active association automatically

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releases the previously-established active association (or downgrades it to a passive association) and grants the newly-received request.

[0047]   Associations may combine the properties of different association categories on a temporal basis. One example of such combined association is an active association that is solid for a predetermined period of time following its establishment, and then transitions to a fragile or a semi-solid association. The time period may be configurable by the user at a host when the association is requested.

[0048]   Figure 5 illustrates selected steps 235 that incorporate processing of different categories of active associations, including solid active associations, semi-solid active associations, and fragile active association. Recall that the process 200 of Figure 2 may proceed to the steps 235 when it determines in the decision block 230 that a previously-established active association is currently in existence.

[0049]   In decision block 237, the client determines whether the previously-established active association is a solid active association, as is described above. If so, the client rejects in step 239 the request for an active association outright, that is, without querying the host that owns the previously-established association.

[0050]   Otherwise, process flow proceeds to decision block 255. Here, the client determines whether the previously-established active association is a fragile active association, as is also described above. If the previously-established active association is a fragile one, that association is released in step 249. Releasing the association may free all or some of the resources dedicated to that association (the shared resource, computational resources, storage resources, and/or possibly other resources). The release may also transform that association into a passive one, by freeing the shared resource and possibly other resources, but keeping a communication link open to the host that owns that association.

[0051]   From the step 249, process flow continues to the steps 280 and 285 (shown in Figure 2), where a new active association is established with the requesting host, and the requesting host uses the new association.

[0052]   Returning now to the decision block 255, if the determination made indicates that the previously-established association is not a fragile one, process flow proceeds to decision block 241 to determine whether the previously-established active association is a semi-solid association, as is also described above. If the previously-established association is not semi-solid, additional association categories are processed in a manner

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analogous to the processing of solid, fragile, and semi-solid association. If the association is a semi-solid one, the client advances to step 243 to send a query to the host that owns the previously-established association.

[0053] The query may cause a message to be generated at that host asking whether the association may be released. The request may include all or part of the introductory information, or information derived from the introductory information.

[0054] Note that if there are only these three categories of association (that is, solid, fragile, and semi-solid), the decision block 241 may not be needed, because the negative determinations made in the decision blocks 237 and 255 imply that the previously-established active association must be a semi-solid association.

[0055] From the step 243 the process flow proceeds to decision block 245 to determine whether the owner of the previously-established association authorized its release. If the owner authorized the release, the process flow advances to step 249, releasing the previously-established association. From the step 249, the process continues to the steps 280 and 285, establishing the requested association and allowing the requesting host to use the resource.

[0056] If, however, release has not yet been authorized as determined in the decision block 245, the client determines whether a negative response to the query has been received, in decision block 246. If the negative response has been received, the client proceeds to the step 239 to reject the request for the new active association.

[0057] If the host that owns the previously-established active association has not yet responded (either in the affirmative or in the negative), timeout condition is tested in decision block 247. The timeout condition may be an expiration of a timer defining the period of time from the query until a permission to release is received. If the timer expires, the timeout condition essentially indicates that permission to release the previously-established active association has been constructively denied. The client then proceeds to the step 239 to reject the request for the new active association. If timeout has not taken place, the client returns to the decision block 245, effectively looping until a response to the query is received or timeout takes place.

[0058] A different connection scheme resembles the semi-solid association, but with the request to release the previously-established association being transmitted directly from the requesting host to the host that owns the previously-established active association. Here, the previously-established association may be a solid one. When a new host

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requests an active association, the client rejects the request, indicating that an active association is in existence. The message with the rejection may contain sufficient information for the requesting host to contact the owner of the previously-established active association directly. Alternatively, the requesting host may identify over the wireless network one or all hosts within its communication distance (or identify these hosts by other means, such as a query through a different network, which may be a cellular network). Once the requesting host identifies the owner of the previously-established association, it sends a request to release the previously-established association directly to that host, either using the same wireless network or different means, such as the other network. The request may identify the requesting host. Alternatively, the requesting host may broadcast the request to release, multicast the request to release, or send multiple requests to release to different wireless network devices.

[0059]   When the owner of the previously established association receives the request to release from the requesting host, it may allow its user to authorize or deny release of the association; it may also authorize, deny, or ignore the request automatically, for example, based on its configuration, preprogramming, or conditions (such as use or non-use of the previously-established association within a predetermined time period). If the host decides to release the association, it may send a release message directly to the client. In some variants, the release message is non-specific, that is, it does not identify the requesting host. In some variants, the release message specifies the requesting host. In the latter case, the client may attempt to establish an active association with the requesting host, or the client may provide a time window for the requesting host to re-request the active association. Requests from other hosts during this time window may be denied outright.

[0060]   Although steps and decision blocks of various methods may have been described serially in this disclosure, some of these steps and decisions may be performed by separate elements in conjunction or in parallel, asynchronously or synchronously, in a pipelined manner, or otherwise. There is no particular requirement that the steps and decisions be performed in the same order in which this description lists them, except where explicitly so indicated, otherwise made clear from the context, or inherently required. It should be noted, however, that in selected variants the steps and decisions are performed in the particular sequences described above and/or shown in the

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accompanying Figures. Furthermore, not every illustrated step and decision may be required in every system in accordance with the invention, while some steps and decisions that have not been specifically illustrated may be desirable or necessary in some systems in accordance with the invention.

[0061]   Those skilled in the art would understand that the concepts described in this document are applicable to various networks, including wireless local area networks, such as networks operating under the IEEE 802.11 standards, and wireless personal area networks.

[0062]   Those of skill in the art would also understand that information and signals may be represented using any of a variety of different technologies and techniques. For example, data, instructions, commands, information, signals, bits, symbols, and chips that may be referenced throughout the above description may be represented by voltages, currents, electromagnetic waves, magnetic fields or particles, optical fields or particles, or any combination thereof.

[0063]   Those of skill would further appreciate that the various illustrative logical blocks, modules, circuits, and algorithm steps described in connection with the embodiments disclosed herein may be implemented as electronic hardware, computer software, or combinations of both. To show clearly this interchangeability of hardware and software, various illustrative components, blocks, modules, circuits, and steps may have been described above generally in terms of their functionality. Whether such functionality is implemented as hardware, software, or combination of hardware and software depends upon the particular application and design constraints imposed on the overall system. Skilled artisans may implement the described functionality in varying ways for each particular application, but such implementation decisions should not be interpreted as causing a departure from the scope of the present invention.

[0064]   The various illustrative logical blocks, modules, and circuits described in connection with the embodiments disclosed herein may be implemented or performed with a general purpose processor, a digital signal processor (DSP), an application specific integrated circuit (ASIC), a field programmable gate array (FPGA) or other programmable logic device, discrete gate or transistor logic, discrete hardware components, or any combination thereof designed to perform the functions described herein. A general purpose processor may be a microprocessor, but in the alternative, the processor may be any conventional processor, controller, microcontroller, or state

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machine. A processor may also be implemented as a combination of computing devices, *e.g.*, a combination of a DSP and a microprocessor, a plurality of microprocessors, one or more microprocessors in conjunction with a DSP core, or any other such configuration.

[0065]   The steps of a method or algorithm that may have been described in connection with the embodiments disclosed herein may be embodied directly in hardware, in a software module executed by a processor, or in a combination of the two. A software module may reside in RAM memory, flash memory, ROM memory, EPROM memory, EEPROM memory, registers, hard disk, a removable disk, a CD-ROM, or any other form of storage medium known in the art. An exemplary storage medium is coupled to the processor such that the processor can read information from, and write information to, the storage medium. In the alternative, the storage medium may be integral to the processor. The processor and the storage medium may reside in an ASIC. The ASIC may reside in an access terminal. Alternatively, the processor and the storage medium may reside as discrete components in an access terminal.

[0066]   The previous description of the disclosed embodiments is provided to enable any person skilled in the art to make or use the present invention. Various modifications to these embodiments will be readily apparent to those skilled in the art, and the generic principles defined herein may be applied to other embodiments. Thus, the present invention is not intended to be limited to the embodiments shown herein, but is to be accorded the widest scope consistent with the principles and novel features disclosed herein.

CLAIMS

1.   A method for providing use of a shared resource of a client over a wireless network, the method comprising steps of:

establishing a passive association between the client and a first host for communications over the wireless network, the passive association not allowing use of the shared resource by the first host;

receiving at the client a request from the first host to establish an active association allowing exclusive use of the shared resource by the first host, the step of receiving being performed over the wireless network;

in response to the request from the first host, determining at the client whether an active association allowing exclusive use of the shared resource by a second host exists;

if the step of determining whether an active association allowing exclusive use of the shared resource by the second host exists results in a determination that there is no active association with the second host, establishing the active association with the first host and allowing the first host exclusive use of the shared resource.

2.   The method of claim 1, wherein the wireless network is a wireless local area network (WLAN).

3.   The method of claim 1, further comprising a step of detecting when the client and the first host are within the wireless network communication distance of each other, and the step of detecting is performed before the step of establishing the passive association.

4.   The method of claim 1, further comprising a step of detecting when the client and the first host are within the wireless network communication distance of each other, and the step of establishing the passive association is performed automatically in response to the step of detecting.

5.   The method of claim 1, further comprising steps of:
releasing the active association with the second host;

establishing the active association with the first host; and

allowing the first host exclusive use of the shared resource over the wireless network.

6.   The method of claim 1, wherein if the step of determining whether an active association allowing exclusive use of the shared resource by the second host exists results in a determination that the active association allowing exclusive use of the shared resource by the second host exists, the method further comprises:

determining a category of the active association allowing exclusive use of the shared resource by the second host;

if the active association allowing exclusive use of the shared resource by the second host belongs to a solid category, (1) sending the first host a message over the wireless network rejecting the request from the first host, and (2) allowing the second host exclusive use of the shared resource over the wireless network after the step of sending the first host the message rejecting the request.

7.   The method of claim 1, wherein if the step of determining whether the active association allowing exclusive use of the shared resource by the second host results in a determination that the active association allowing exclusive use of the shared resource by the second host exists, the method further comprises:

determining a category of the active association allowing exclusive use of the shared resource by the second host; and

if the active association allowing exclusive use of the shared resource by the second host belongs to a semi-solid category,

sending a message to the second host, the message comprising a query to authorize release of the active association allowing exclusive use of the shared resource by the second host,

determining whether the second host authorized release of the active association allowing exclusive use of the shared resource by the second host,

if the step of determining whether the second host authorized release results in a determination that the second host authorized release of the active association allowing exclusive use of the shared resource by the second host, releasing the active association allowing exclusive use of the shared resource by

the second host, establishing the active association with the first host over the wireless network, and allowing the first host exclusive use of the shared resource over the wireless network, and

if the step of determining whether the second host authorized release results in a determination that the second host denied to authorize release of the active association allowing exclusive use of the shared resource by the second host, sending the first host a message over the wireless network rejecting the request from the first host, and allowing the second host exclusive use of the shared resource over the wireless network after the step of sending the first host the message rejecting the request.

8.   The method of claim 7, wherein the request from the first host comprises introductory information, and the query comprises at least a part of the introductory information.

9.   The method of claim 1, wherein if the step of determining whether an active association allowing exclusive use of the shared resource by the second host results in a determination that the active association allowing exclusive use of the shared resource by the second host exists, the method further comprises:

determining a category of the active association allowing exclusive use of the shared resource by the second host; and

if the active association allowing exclusive use of the shared resource by the second host belongs to a semi-solid category,

sending a message to the second host, the message comprising a query to authorize release of the active association allowing exclusive use of the shared resource by the second host,

determining whether the second host authorized release of the active association allowing exclusive use of the shared resource by the second host,

if the step of determining whether the second host authorized release results in a determination that the second host authorized release of the active association allowing exclusive use of the shared resource by the second host, releasing the active association allowing exclusive use of the shared resource by the second host, establishing the active association with the first host, and

allowing the first host exclusive use of the shared resource over the wireless network, and

if the step of determining whether the second host authorized release does not result within a predetermined timeout period in a determination that the second host authorized release of the active association allowing exclusive use of the shared resource by the second host, sending the first host a message over the wireless network rejecting the request from the first host, and allowing the second host exclusive use of the shared resource over the wireless network after the step of sending the first host the message rejecting the request.

10. The method of claim 1, wherein if the step of determining whether an active association allowing exclusive use of the shared resource by the second host results in a determination that the active association allowing exclusive use of the shared resource by the second host exists, the method further comprises:

determining a category of the active association allowing exclusive use of the shared resource by the second host; and

if the active association allowing exclusive use of the shared resource by the second host belongs to a fragile category, releasing the active association allowing exclusive use of the shared resource by the second host, establishing the active association with the first host, and allowing the first host exclusive use of the shared resource over the wireless network, wherein the step of releasing is performed without requesting by the client from the second host an authorization to release.

11. The method of claim 1, wherein if the step of determining whether an active association allowing exclusive use of the shared resource by the second host results in a determination that the active association allowing exclusive use of the shared resource by the second host exists, the method further comprises:

determining a category of the active association allowing exclusive use of the shared resource by the second host;

if the active association allowing exclusive use of the shared resource by the second host belongs to a fragile category, releasing the active association allowing exclusive use of the shared resource by the second host, establishing the active

association with the first host, and allowing the first host exclusive use of the shared resource over the wireless network;

if the active association allowing exclusive use of the shared resource by the second host belongs to a solid category, sending the first host a message over the wireless network rejecting the request from the first host, and allowing the second host exclusive use of the shared resource over the wireless network after the step of sending the first host the message rejecting the request;

if the active association allowing exclusive use of the shared resource by the second host belongs to a semi-solid category,

  sending to the second host a message comprising a query to authorize release of the active association allowing exclusive use of the shared resource by the second host,

  determining whether the second host authorized release of the active association allowing exclusive use of the shared resource by the second host,

  if the step of determining whether the second host authorized release results in a determination that the second host authorized release of the active association allowing exclusive use of the shared resource by the second host, releasing the active association allowing exclusive use of the shared resource by the second host, establishing the active association with the first host, and allowing the first host exclusive use of the shared resource over the wireless network, and

  if the step of determining whether the second host authorized release results in a determination that the second host denied to authorize release of the active association allowing exclusive use of the shared resource by the second host, sending the first host a message over the wireless network rejecting the request from the first host, and allowing the second host exclusive use of the shared resource over the wireless network after the step of sending the first host the message rejecting the request.

12. The method of claim 11, wherein the shared resource comprises a video display.

13. The method of claim 11, wherein the shared resource comprises a game terminal and the first host is configured as a game controller for the game terminal.

14.   The method of claim 11, wherein the shared resource comprises a computational resource with software.

15.   The method of claim 11, wherein the shared resource comprises a gateway to another network.

16.   The method of claim 11, wherein the shared resource comprises a gateway to another wireless network.

17.   The method of claim 11, wherein the shared resource comprises sound reproduction equipment.

18.   The method of claim 11, wherein the first host comprises a personal digital assistant.

19.   The method of claim 11, wherein the first host comprises a cellular telephone.

20.   The method of claim 11, wherein the shared resource comprises a game terminal, the first host is configured as a first game controller for the game terminal, and the second host is configured as a second game controller for the game terminal.

21.   The method of claim 1, wherein the wireless network is a wireless personal area network (WPAN).

22.   A client device comprising:
        a shared resource;
        a memory;
        a receiver of a wireless network;
        a transmitter of the wireless network;
        a controller coupled to the receiver, the transmitter, the shared resource, and the memory, the controller is configured to:

establish a passive association between the client device and a first host for communications over the wireless network, the passive association not allowing use of the shared resource by the first host;

receive over the wireless network a request from the first host to establish an active association allowing exclusive use of the shared resource by the first host;

in response to the request from the first host, determine whether an active association allowing exclusive use of the shared resource by a second host exists;

if the active association allowing exclusive use of the shared resource by the second host does not exist, establish the active association with the first host and allow the first host exclusive use of the shared resource.

23. The client device of claim 22, wherein the wireless network is a wireless local area network (WLAN).

24. The client device of claim 22, wherein the controller is further configured to detect when the client device and the first host are within the wireless network communication distance of each other before establishing the passive association.

25. The client device of claim 22, wherein the controller is further configured to detect when the client device and the first host are within the wireless network communication distance of each other, and to establish the passive association automatically in response to detecting the first host within the wireless network communication distance of the client device.

26. The client device of claim 22, wherein the controller is further configured to:
release the active association with the second host;
establish the active association with the first host; and
allow the first host exclusive use of the shared resource over the wireless network.

27. The client device of claim 22, wherein if the active association allowing exclusive use of the shared resource by the second host exists, the controller is further configured to:

determine a category of the active association allowing exclusive use of the shared resource by the second host;

if the active association allowing exclusive use of the shared resource by the second host belongs to a solid category, (1) send to the first host a message over the wireless network rejecting the request from the first host, and (2) allow the second host exclusive use of the shared resource over the wireless network after sending to the first host the message rejecting the request.

28.   The client device of claim 22, wherein if the active association allowing exclusive use of the shared resource by the second host exists, the controller is further configured to:

determine a category of the active association allowing exclusive use of the shared resource by the second host; and

if the active association allowing exclusive use of the shared resource by the second host belongs to a semi-solid category,

send to the second host a message comprising a query to authorize release of the active association allowing exclusive use of the shared resource by the second host,

determine whether the second host authorized release of the active association allowing exclusive use of the shared resource by the second host,

if the second host authorized release of the active association allowing exclusive use of the shared resource by the second host, release the active association allowing exclusive use of the shared resource by the second host, establish the active association with the first host over the wireless network, and allow the first host exclusive use of the shared resource over the wireless network, and

if the second host denied to authorize release of the active association allowing exclusive use of the shared resource by the second host, send the first host a message over the wireless network rejecting the request from the first host, and allow the second host exclusive use of the shared resource over the wireless network after sending the first host the message rejecting the request.

29. The client device of claim 28, wherein the request from the first host includes introductory information and the controller is further configured to include the introductory information in the query.

30. The client device of claim 22, wherein if the active association allowing exclusive use of the shared resource by the second host exists, the controller is further configured to:

determine a category of the active association allowing exclusive use of the shared resource by the second host; and

if the active association allowing exclusive use of the shared resource by the second host belongs to a semi-solid category,

send to the second host a message comprising a query to authorize release of the active association allowing exclusive use of the shared resource by the second host,

determine whether the second host authorized release of the active association allowing exclusive use of the shared resource by the second host,

if the second host authorized release of the active association allowing exclusive use of the shared resource by the second host, release the active association allowing exclusive use of the shared resource by the second host, establish the active association with the first host, and allow the first host exclusive use of the shared resource over the wireless network, and

if the second host does not authorize release of the active association allowing exclusive use of the shared resource by the second host within a predetermined time period, send the first host a message over the wireless network rejecting the request from the first host, and allow the second host exclusive use of the shared resource over the wireless network after sending the first host the message rejecting the request.

31. The client device of claim 22, wherein if the active association allowing exclusive use of the shared resource by the second host exists, the controller is further configured to:

determine a category of the active association allowing exclusive use of the shared resource by the second host; and

if the active association allowing exclusive use of the shared resource by the second host belongs to a fragile category, release the active association allowing exclusive use of the shared resource by the second host without requesting from the second host an authorization to release, establish the active association with the first host, and allow the first host exclusive use of the shared resource over the wireless network.

32.   The client device of claim 22, wherein if the active association allowing exclusive use of the shared resource by the second host exists, the controller is further configured to:

determine a category of the active association allowing exclusive use of the shared resource by the second host;

if the active association allowing exclusive use of the shared resource by the second host belongs to a fragile category, release the active association allowing exclusive use of the shared resource by the second host, establish the active association with the first host, and allow the first host exclusive use of the shared resource over the wireless network;

if the active association allowing exclusive use of the shared resource by the second host belongs to a solid category, send the first host a message over the wireless network rejecting the request from the first host, and allow the second host exclusive use of the shared resource over the wireless network after sending the first host the message rejecting the request;

if the active association allowing exclusive use of the shared resource by the second host belongs to a semi-solid category,

send to the second host a message comprising a query to authorize release of the active association allowing exclusive use of the shared resource by the second host,

determine whether the second host authorized release of the active association allowing exclusive use of the shared resource by the second host,

if the second host authorized release of the active association allowing exclusive use of the shared resource by the second host, release the active association allowing exclusive use of the shared resource by the second host,

establish the active association with the first host, and allow the first host exclusive use of the shared resource over the wireless network, and

if the second host denied to authorize release of the active association allowing exclusive use of the shared resource by the second host, send the first host a message over the wireless network rejecting the request from the first host, and allow the second host exclusive use of the shared resource over the wireless network after sending the first host the message rejecting the request.

33. The client device of claim 32, wherein the shared resource comprises a video display.

34. The client device of claim 32, wherein the shared resource comprises a game terminal.

35. The client device of claim 32, wherein the shared resource comprises a computational resource with software.

36. The client device of claim 32, wherein the shared resource comprises a gateway to another network.

37. The client device of claim 32, wherein the shared resource comprises a gateway to another wireless network.

38. The client device of claim 32, wherein the shared resource comprises sound reproduction equipment.

39. The client device of claim 22, wherein the wireless network is a wireless personal area network (WPAN).

40. A machine-readable medium comprising instructions, wherein when the instructions are executed by at least one processor of a client device comprising a shared resource and being configured to receive and transmit over a wireless network, the instructions cause the client device to perform steps comprising:

establishing a passive association between the client device and a first host for communications over the wireless network, the passive association not allowing use of the shared resource by the first host;

receiving a request from the first host to establish an active association allowing exclusive use of the shared resource by the first host, the step of receiving being performed over the wireless network;

in response to the request from the first host, determining whether an active association allowing exclusive use of the shared resource by a second host exists;

if the step of determining whether an active association allowing exclusive use of the shared resource by the second host exists results in a determination that there is no active association with the second host, establishing the active association with the first host and allowing the first host exclusive use of the shared resource.

41. The machine-readable medium of claim 40, wherein:

the steps further comprise detecting when the client and the first host are within the wireless network communication distance of each other; and

the step of detecting is performed before the step of establishing the passive association.

42. The machine-readable medium of claim 40, wherein:

the steps further comprise detecting when the client and the first host are within the wireless network communication distance of each other; and

the step of establishing the passive association is performed automatically in response to the step of detecting.

43. The machine-readable medium of claim 40, wherein the steps further comprise:

releasing the active association with the second host;

establishing the active association with the first host; and

allowing the first host exclusive use of the shared resource over the wireless network.

44. The machine-readable medium of claim 40, wherein if the step of determining whether an active association allowing exclusive use of the shared resource by the

second host exists results in a determination that the active association allowing exclusive use of the shared resource by the second host exists, the steps further comprise:

determining a category of the active association allowing exclusive use of the shared resource by the second host;

if the active association allowing exclusive use of the shared resource by the second host belongs to a solid category, (1) sending the first host a message over the wireless network rejecting the request from the first host, and (2) allowing the second host exclusive use of the shared resource over the wireless network after the step of sending the first host the message rejecting the request.

45. The machine-readable medium of claim 40, wherein if the step of determining whether the active association allowing exclusive use of the shared resource by the second host results in a determination that the active association allowing exclusive use of the shared resource by the second host exists, the steps further comprise:

determining a category of the active association allowing exclusive use of the shared resource by the second host; and

if the active association allowing exclusive use of the shared resource by the second host belongs to a semi-solid category,

sending a message to the second host, the message comprising a query to authorize release of the active association allowing exclusive use of the shared resource by the second host,

determining whether the second host authorized release of the active association allowing exclusive use of the shared resource by the second host,

if the step of determining whether the second host authorized release results in a determination that the second host authorized release of the active association allowing exclusive use of the shared resource by the second host, releasing the active association allowing exclusive use of the shared resource by the second host, establishing the active association with the first host over the wireless network, and allowing the first host exclusive use of the shared resource over the wireless network, and

if the step of determining whether the second host authorized release results in a determination that the second host denied to authorize release of the

active association allowing exclusive use of the shared resource by the second host, sending the first host a message over the wireless network rejecting the request from the first host, and allowing the second host exclusive use of the shared resource over the wireless network after the step of sending the first host the message rejecting the request.

46.   The machine-readable medium of claim 40, wherein if the step of determining whether an active association allowing exclusive use of the shared resource by the second host results in a determination that the active association allowing exclusive use of the shared resource by the second host exists, the steps further comprise:

determining a category of the active association allowing exclusive use of the shared resource by the second host; and

if the active association allowing exclusive use of the shared resource by the second host belongs to a semi-solid category,

sending a message to the second host, the message comprising a query to authorize release of the active association allowing exclusive use of the shared resource by the second host,

determining whether the second host authorized release of the active association allowing exclusive use of the shared resource by the second host,

if the step of determining whether the second host authorized release results in a determination that the second host authorized release of the active association allowing exclusive use of the shared resource by the second host, releasing the active association allowing exclusive use of the shared resource by the second host, establishing the active association with the first host, and allowing the first host exclusive use of the shared resource over the wireless network, and

if the step of determining whether the second host authorized release does not result within a predetermined timeout period in a determination that the second host authorized release of the active association allowing exclusive use of the shared resource by the second host, sending the first host a message over the wireless network rejecting the request from the first host, and allowing the second host exclusive use of the shared resource over the wireless network after the step of sending the first host the message rejecting the request.

47.   The machine-readable medium of claim 40, wherein if the step of determining whether an active association allowing exclusive use of the shared resource by the second host results in a determination that the active association allowing exclusive use of the shared resource by the second host exists, the steps further comprise:

determining a category of the active association allowing exclusive use of the shared resource by the second host; and

if the active association allowing exclusive use of the shared resource by the second host belongs to a fragile category, releasing the active association allowing exclusive use of the shared resource by the second host, establishing the active association with the first host, and allowing the first host exclusive use of the shared resource over the wireless network, wherein the step of releasing is performed without requesting by the client from the second host an authorization to release.

48.   The machine-readable medium of claim 40, wherein if the step of determining whether an active association allowing exclusive use of the shared resource by the second host results in a determination that the active association allowing exclusive use of the shared resource by the second host exists, the steps further comprise:

determining a category of the active association allowing exclusive use of the shared resource by the second host;

if the active association allowing exclusive use of the shared resource by the second host belongs to a fragile category, releasing the active association allowing exclusive use of the shared resource by the second host, establishing the active association with the first host, and allowing the first host exclusive use of the shared resource over the wireless network;

if the active association allowing exclusive use of the shared resource by the second host belongs to a solid category, sending the first host a message over the wireless network rejecting the request from the first host, and allowing the second host exclusive use of the shared resource over the wireless network after the step of sending the first host the message rejecting the request;

if the active association allowing exclusive use of the shared resource by the second host belongs to a semi-solid category,

sending to the second host a message comprising a query to authorize release of the active association allowing exclusive use of the shared resource by the second host,

determining whether the second host authorized release of the active association allowing exclusive use of the shared resource by the second host,

if the step of determining whether the second host authorized release results in a determination that the second host authorized release of the active association allowing exclusive use of the shared resource by the second host, releasing the active association allowing exclusive use of the shared resource by the second host, establishing the active association with the first host, and allowing the first host exclusive use of the shared resource over the wireless network, and
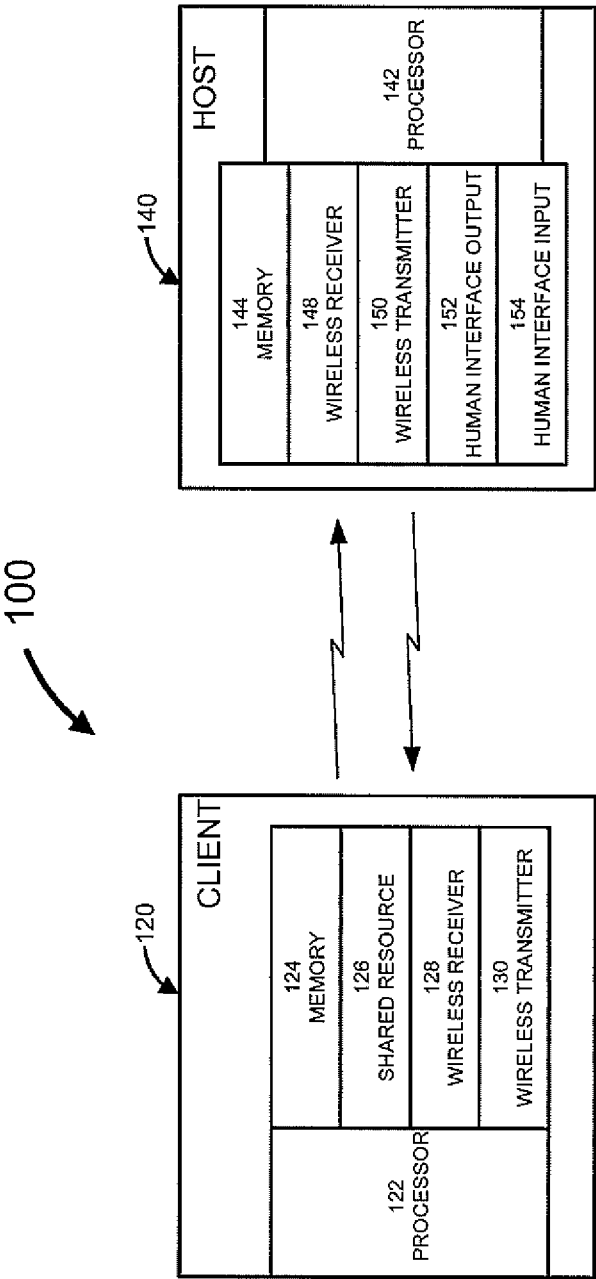
if the step of determining whether the second host authorized release results in a determination that the second host denied to authorize release of the active association allowing exclusive use of the shared resource by the second host, sending the first host a message over the wireless network rejecting the request from the first host, and allowing the second host exclusive use of the shared resource over the wireless network after the step of sending the first host the message rejecting the request.

49. A client device comprising:

a shared resource means;

a means for storing data;

a means for receiving information over a wireless network;

a means for transmitting information over the wireless network;

a controller means for controlling the shared resource means, the means for storing data, the means for receiving information, and the means for transmitting information, wherein the controller means is configured to:

establish a passive association between the client device and a first host for communications over the wireless network, the passive association not allowing use of the shared resource means by the first host;

receive over the wireless network a request from the first host to establish an active association allowing exclusive use of the shared resource means by the first host;

in response to the request from the first host, determine whether an active association allowing exclusive use of the shared resource means by a second host exists;

if the active association allowing exclusive use of the shared resource means by the second host does not exist, establish the active association with the first host and allow the first host exclusive use of the shared resource means.
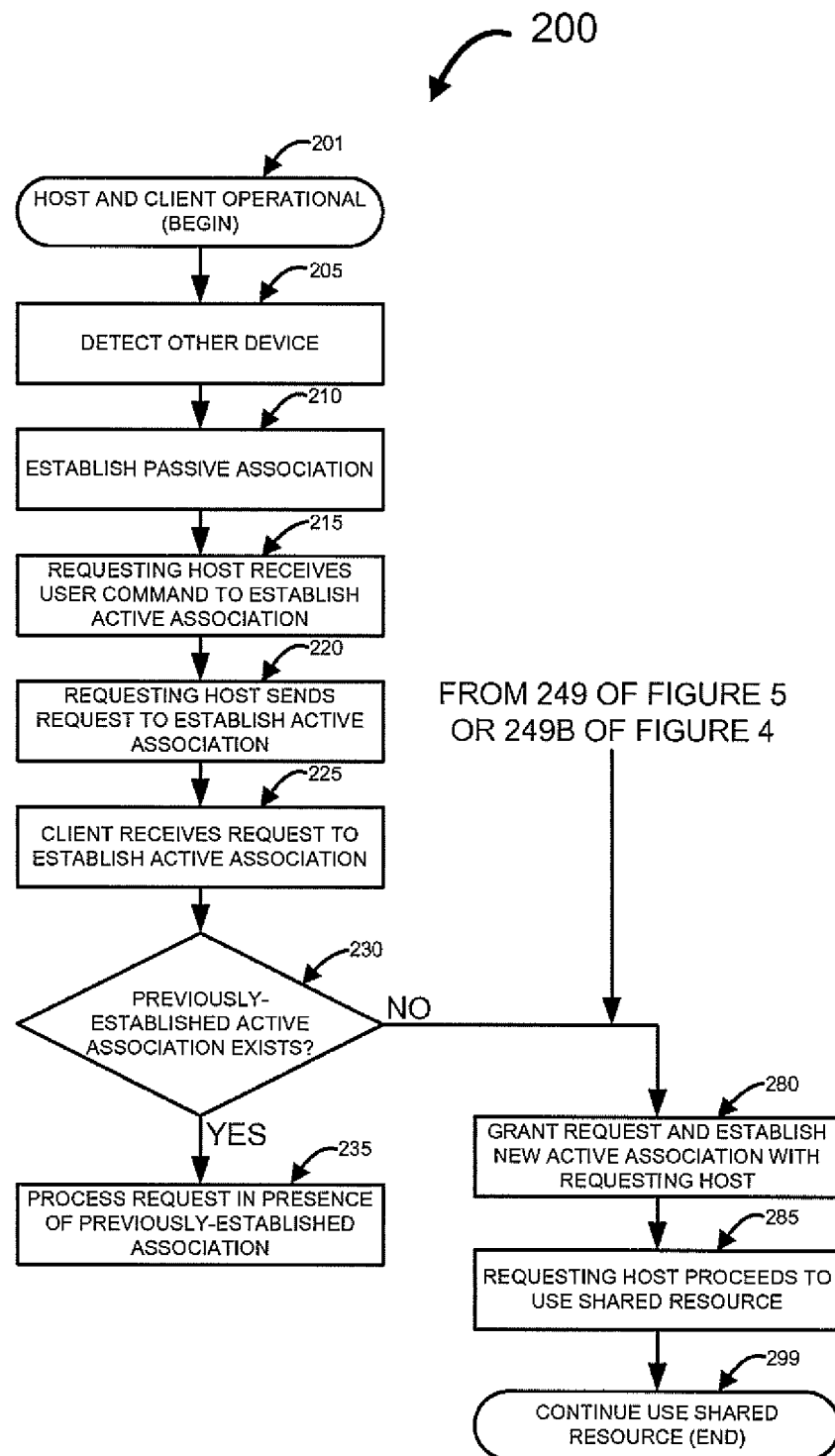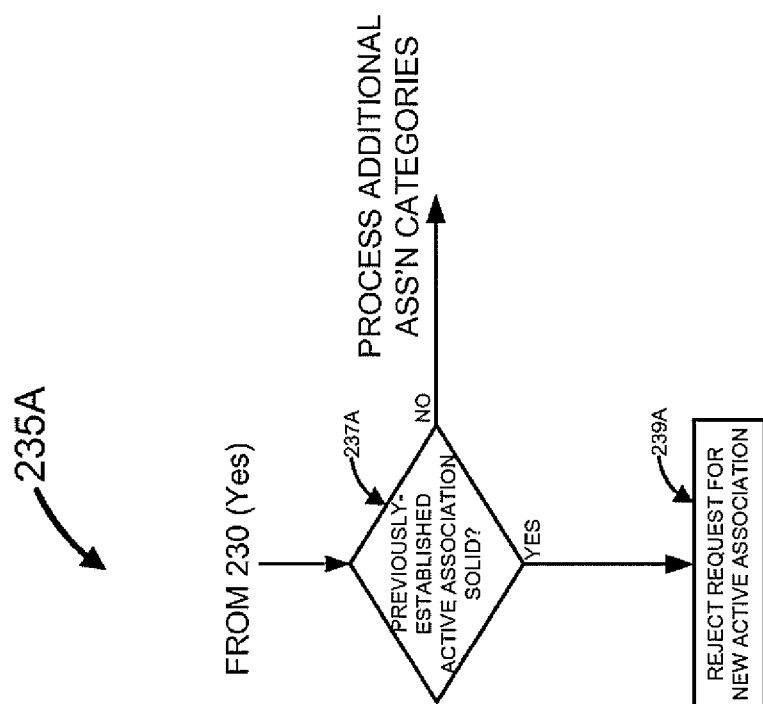
FIG. 1

FIG. 2
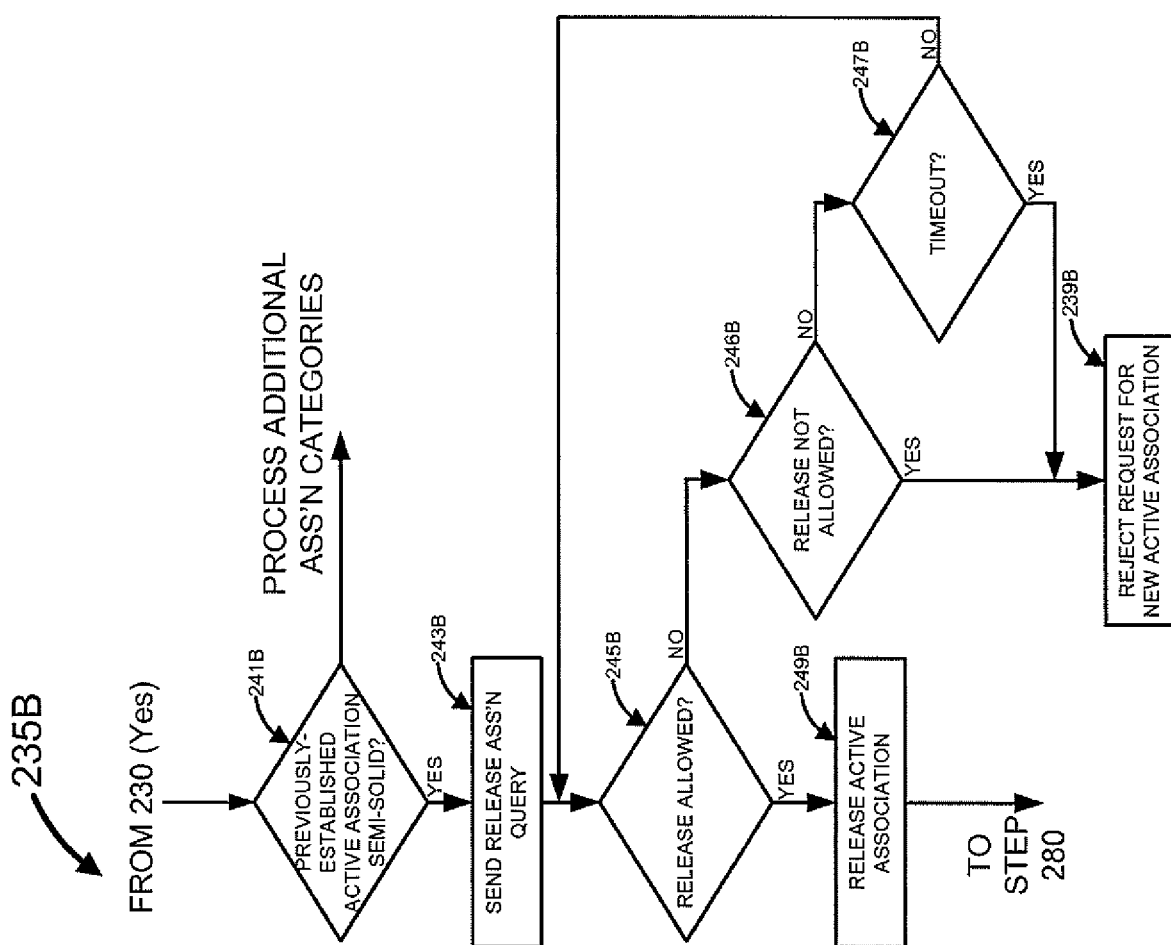
235A

FROM 230 (Yes)

237A

PREVIOUSLY-
ESTABLISHED
ACTIVE ASSOCIATION
SOLID?

NO

PROCESS ADDITIONAL
ASS'N CATEGORIES

YES

239A

REJECT REQUEST FOR
NEW ACTIVE ASSOCIATION

FIG. 3

FIG. 4

FIG. 5