

LOCATING A WIRELESS DEVICE BASED ON INFORMATION ABOUT BASE STATIONS BELONGING TO A PLURALITY OF NETWORKS

[0001] This application claims the benefit of and is a continuation in part of US Application Serial No. 10/877,205, filed on June 25, 2004, which is a non-provisional of US Provisional Application Serial No. 60/483,094, filed on June 27, 2003; and this application also claims the benefit of and is a continuation in part of US PCT Application Serial No. PCT/US04/20920, filed on 28 June 2004, which claims priority to US Provisional Application Serial No. 60/483,094, filed on June 27, 2003.

BACKGROUND

[0002] This disclosure relates in general to automated location determination and, more specifically, but not by way of limitation, to determining a location of a wireless device.

[0003] There is an ever growing desire to know geographic position of various mobile devices. For example, cellular phone operators are trying to comply with requirements to locate handsets for emergency purposes. Once position is known, emergency personnel can be dispatched to aid resolving the emergency. Knowing geographic location serves many other purposes such as geographic-tied advertising, child supervision, automated parolee supervision, reverse 911, fleet vehicle tracking, etc.

[0004] Conventional location techniques have difficulty accurately resolving location in certain situations. Satellite-based location systems suffer from inaccuracies when a clear view the sky is unavailable. Terrestrial-based systems require communication with several base stations that serve as known references during trilateration, but in some scenarios, since these systems were primarily designed for communication purposes there are not enough geographically dispersed base stations within communication range of the mobile device. Even when communication is possible to multiple base stations, multi-path induced inaccuracies can degrade the ability to resolve an accurate location.

[0005] Conventional location techniques have a wireless phone interacting with base stations associated with the service to which the wireless phone is subscribed. An almanac of base stations indicates to the wireless phone where the base stations are located. On most occasions, at least couple of base stations are visible to the wireless phone.

[0006] Cellular phones often have limited memory to store additional information. Base stations are constantly being added, removed or relocated in a cellular phone network. Almanacs of base stations are occasionally sent to cellular phones to aid in determining location. To communicate and store a large almanac is impractical on some cellular phones.

SUMMARY

[0007] A method and system that allow resolving the location of a wireless device are disclosed. Resolving the location in one embodiment relies upon accessing at least one cooperative base station and at least one uncooperative base station. The cooperative base station provides an almanac of base stations that are likely to be near the wireless device. Both cooperative and uncooperative base stations within range can be used to determine the location of the wireless device. The uncooperative base station is not generally available to the wireless device, but can be used to determine distance to the wireless device. An attempt by the wireless device to transport data or voice on the uncooperative base station may or may not be thwarted by the uncooperative base station.

[0008] In one embodiment, the population of base stations is reduced to produce a tailored almanac of base stations. The tailored almanac includes information to uniquely identify each base station, and may include location information for the base stations.

[0009] In another embodiment, any number of different base station types can be used. The base station could be a cellular phone base station, a wireless local area network, a wireless wide area network, a satellite, a terrestrial location beacon, or any other device that can wirelessly communicate in some mode with the wireless device in a manner that allows unique identification of the device and a distance measurement.

[0010] In a variety of other embodiments the general location of the wireless device is determined in different ways. Various embodiments might use the location function integral to the phone, the current cooperative base station and a presumed cell footprint, a number of base stations to find an overlapping cell footprint, a number of cooperative base stations to trilaterate the position, base stations and satellites to trilaterate the position, and/or one or more cooperative base stations that can determine range and angle. Different wireless devices have different capabilities, as do base stations, such that there could be a number of approaches used.

BRIEF DESCRIPTION OF THE DRAWING

[0011] The features, objects, and advantages of embodiments of the disclosure will become more apparent from the detailed description set forth below when taken in conjunction with the drawings, in which like elements bear like reference numerals. Further, various components of the same type may be distinguished by following the reference label by a dash and a second label that distinguishes among the similar components. If only the first reference label is used in the specification, the description is applicable to any one of the similar components having the same first reference label irrespective of the second reference label.

[0012] FIGS. 1A, 1B and 1C are a block diagrams of embodiments of a location determination system;

[0013] FIGS. 2A and 2B are diagrams of embodiments of a single-cell location system;

[0014] FIGS. 3A and 3B are diagrams of embodiments of a cell sector location system;

[0015] FIG. 4 is a diagram of an embodiment of an overlapping cell location system;

[0016] FIG. 5 is a diagram of an embodiment of a trilateration cell system;

[0017] FIG. 6 is a diagram of an embodiment of a hybrid trilateration system;

[0018] FIG. 7 is a diagram of an embodiment of an angular ranging system;

[0019] FIG. 8 is a flow diagram of an embodiment of a process for locating a position of a wireless device that has native location functions;

[0020] FIG. 9 is a flow diagram of another embodiment of a process for locating a position of a wireless device that has limited location functions;

[0021] FIG. 10 is a diagram of an embodiment of system that gathers location information from uncooperative base stations;

[0022] FIG. 11 is a flow diagram of an embodiment of a process for gathering location information from base stations; and

[0023] FIG. 12 is a diagram of another embodiment of system that gathers location information from uncooperative base stations.

DETAILED DESCRIPTION

[0024] Referring initially to FIG. 1A, a block diagram of an embodiment of a location determination system 100-1 is shown. The location determination system 100 allows wireless devices 120 to find their geographic location or be located by remote entities

by using satellites 152 (e.g., GLONASS, GPS, Galileo, EGNOS, Globalstar, IRIDIUM) and/or base stations 112,124 (e.g., cellular phone base station, a wireless local area network, a wireless wide area network, satellite phone, satellite Internet, or any other device that can be uniquely recognized and communicate with the wireless device 120). Cooperative base stations 112 are coupled to an almanac processor 122 by way of a wide area network (WAN) 110 in this embodiment, but other embodiments could use a local area network (LAN). The almanac processor 122 accesses a base station database 144 to tailor or customize an almanac according to the estimated location of the wireless device 120.

[0025] A wireless device 120 can communicate with any number of devices to provide location information. In this embodiment, the wireless device 120 is a cellular phone that may have any number or combination of communication modes (e.g., GSM, CDMA, TDMA, WCDMA, OFDM, GPRS, EV-DO, WiFi, Bluetooth, WiMAX, 802.xx, UWB, satellite, etc.) to transfer voice and/or data with cellular, satellite, wireless data, and/or mesh networks by way of their base stations 112,124. The wireless device 120 in other embodiments could be a tracking device, a child or parolee monitor, navigational device, wireless pager, wireless computer, PDA, asset tag, etc.

[0026] The supported communication modes for each wireless device 120 are stored in a device capability database 140 that includes information to help in determining an uncertainty factor for each location or distance measurement made by a particular wireless device 120 operating in any number of communication modes.

[0027] This embodiment shows cooperative base stations 112, uncooperative base stations 124 and a satellite location beacon 152 that could each have different communication modes. For example, cellular base stations 112,124 might support TDMA and GSM, a satellite base station might support only CDMA, or another satellite base station might support only TDMA.

[0028] Base stations 112,124 are defined herein to allow some sort of data and/or voice transport. Base stations 112,124 are often affiliated with some entity (e.g., cellular or WiFi service provider) such that only subscribers or subscribers to another system with a roaming agreement can communicate with the base station 112,124 to pass data and/or voice traffic. The base stations 112,124 may be connected to a WAN or LAN to get a tailored almanac, but only cooperative base stations 112 provide a tailored almanac. The various base stations 112,124 may have any number of or combination of communication modes (e.g., GSM, CDMA, TDMA, WCDMA, OFDM,

GPRS, EV-DO, WiFi, Bluetooth, WiMAX, 802.xx, UWB, satellite, etc.) to transfer voice and/or data with cellular, satellite, wireless data, and/or mesh networks.

[0029] There are cooperative and uncooperative base stations 112,124. An cooperative base station 112 is one that allows data and/or voice communication with the wireless device 120. In one example, voice communication can be supported by Voice over IP (VoIP). Uncooperative base stations 124 may not allow data and/or voice traffic, but do provide information useful in determining a location of the wireless device. Uncooperative base stations 124 provide some type of identifier and can often be used for ranging, which is a process where the distance between the base station 124 and the wireless device 120 is determined. The identifier in the case of a WiFi base station 124, for example, includes a station identifier and MAC address. Also, some uncooperative base stations 124 allow ranging measurements, received signal strength indications and beacon signaling capabilities that can all be used to determine distance.

[0030] The base station database 144 stores the identifier information that can be used to uniquely identify each base station in that class of base stations. For example, each WiFi base station could include a MAC address as identifier information. As another example, a CDMA base station identifier could include SID, NID and Base ID or SID, MSC ID and Base ID. Characteristics of the base station 112,124 could be used in uniquely identifying the base station 112,124. For example, if two base stations had the same station identifier, but only one supported a particular communication standard, the two could be uniquely identified. Typically, a wireless device 120 would support a subset of the various communication modes. Also stored in the base station database 144 is location information that is determined for each base station 112,124 by performing surveys of the area with the wireless devices.

[0031] In one embodiment, wireless devices 120 can be used to determine the location of each base station 112,124, thereafter the location is reported back to the almanac processor 112. The location information from various wireless devices 120 for each base station 112,124 is aggregated by the almanac processor 112 to update the base station database. As more location data points are gathered, they are weighted according to the accuracy of the location information provided by the wireless device 120 and used to resolve the location of the base station with ever increasing accuracy. The accuracy of each wireless device 120 could be stored in the device capability database 140, which could have different accuracies for the various ways that a wireless device 120 could gather the information. Any uncertainty that the wireless device 120

could have in knowing its location could also be reflected in the accuracy weighting for the base station database 144.

[0032] Various types of location beacons could be used by the wireless device 120 to aid in the location determination. This embodiment uses a satellite location beacon 152, but pseudolites and terrestrial beacon systems such as LORAN could also be used. The more location references, generally, the better the location of the wireless device 120 can be determined.

[0033] This embodiment shows the almanac processor 122 separate from the cooperative base stations 112, but each cooperative base station 112 or a class of cooperative base stations 112 could have an almanac processor 112 and/or databases 140,144 in other embodiments. Some embodiments could integrate the almanac processor 122 into the wireless device 120. The base station and/or device capability databases 144,140 could also be in the wireless device 120 and updated periodically.

[0034] Referring next to FIG. 1B, another embodiment of the location determination system 100-2 is shown. In some embodiments, the base station database 144 is centrally located, but the base station database 144 is distributed regionally or in portions relevant to each cooperative base station 112 or a class of cooperative base stations 112 as a local almanac 158 in the present embodiment. For example, a first base station 112-1, may store a portion of the base station database 114 for its footprint and all adjacent base station footprints in a first local almanac 158-1. As another example, the first local almanac 158-1 may contain the base station database for all or select set of CDMA base stations. In yet another example, the first almanac 158-1 may not be geographically organized but contain the base stations which are part of a particular service provider network. As the centrally-located base station database 144 is updated, those changes are propagated to the various local almanacs 158 that might use the new information.

[0035] This embodiment does not use a satellite location beacon 152 or other type of location beacon, but has one or more communication satellites base stations 154 for use in voice and/or data communication. This embodiment of the communication satellite base station 154 could, but does not, have a local almanac 158 and/or databases 140,144. The communication satellite base station 154 relies upon the almanac processor 122 to produce tailored almanacs. A satellite ground station 160 communicates with the almanac processor 122 by way of the WAN 110.

[0036] Referring next to FIG. 1C, yet another embodiment of the location determination system 100-3 is shown. In this embodiment, a cooperative base station 112 is coupled to a local area network (LAN) that is coupled to an almanac processor 122 and device capability and base station databases 140,144. The information in the device capability and base station databases 140,144 could be periodically updated or reconciled with remote master versions of these databases using a WAN or the like. The satellite base station 154 in this embodiment also includes an almanac processor 122 and device capability and base station databases 140,144, even though that level of detail is not shown in the figure.

[0037] With reference to FIGS. 2A and 2B, diagrams of embodiments of a single-cell location system 200 are shown. A cooperative base station 112 has a cell footprint 204 in which it can communicate with the wireless device 120. FIG. 2A shows the uncooperative wireless base station 124 within that cell footprint 204.

[0038] On occasion, the wireless device 120 is barely within the cell footprint 204 to communicate with the cooperative base station 112, but has the ability to communicate with uncooperative base stations 124 outside this cell footprint as shown in FIG. 2B. A cell buffer zone 208 would include uncooperative base stations 124 outside the range of the cooperative base station 112, but possibly within range of a wireless device 120 within range of the cooperative base station 112. An uncooperative base station footprint 212 is shown for a base station 124 outside the cell footprint, but within communication range of the wireless device 120. Including this base station 124 in the cell buffer zone 208 accommodates this scenario.

[0039] In this embodiment, the wireless device 120 is in communication range of a single cooperative base station 112. In the cell footprint 204 of the cooperative base station 112, there are eleven uncooperative base stations 124. The cell buffer zone 208 has two more uncooperative base stations 124. When the almanac processor 122 receives a request for a tailored almanac, information for the thirteen possible uncooperative base stations are included.

[0040] In one embodiment, the cooperative base station 112 may determine a range to the wireless device 120 and the almanac processor 122 could cull the list of thirteen to those that might fall within an annular ring around the cooperative base station 112. The ring would be as thick as the range of the wireless device 120 when talking to the various uncooperative base stations 124 in a particular mode plus some error factor from determining the range to the cooperative base station 112. For example, the wireless

device 120 may have a range from the cooperative base station 112 of fifty measurement units with an error factor of ten percent. In one communication mode, the range from the wireless device 120 is fifteen units. In this example, the annular ring would begin at a radius of thirty and extend to seventy measurement units. Any base station 112,124 understanding that communication mode and within that annular footprint would be included in the tailored almanac. Of course, if the annular ring extended beyond the cell buffer zone 208 the radius of the ring would be curtailed appropriately.

[0041] As the wireless device 120 may have different modes of communication to the various types of base stations, the thickness could be different for each type of base station communication mode. Further, the wireless device 120 may receive almanac information on other cooperative base stations 112 that the wireless device 120 was unaware of.

[0042] In another embodiment, the almanac processor 122 might cull the number of base stations 112,124 included in the tailored almanac. In some cases, the density of base stations 112,124 is so great that including additional base stations 112,124 that are in close proximity would be of little aid in resolving the location of the wireless device 120.

[0043] In some embodiments, the almanac processor 122 might exclude base stations 112,124 that don't have any way to uniquely identify them. For example, if two base stations had the same station identifier and did not provide any other codes to uniquely identify them, they both could be excluded from the tailored almanac. Often times, other identifiers in the communication protocol can be combined with identifiers to create a unique identifier that distinguishes the base stations 112,124. In some cases, two or more base stations 112,124 that cannot be uniquely identified are so geographically separate that a unique identifier can be formulated by knowing the geographic location of interest such that they could still be used. Only one would be included in any tailored almanac.

[0044] Referring next to FIGS. 3A and 3B, diagrams of embodiments of a cell sector location system 300 are shown. This embodiment has six cell sectors 304 for a cooperative base station 112, but other embodiments could have any number of cell sectors. The wireless devices 120 in the cell footprint 204 are divided among the cell sectors 304 such that the base station 112 knows which cell sector(s) 304 communicates with a particular wireless device 120. The cell sector(s) that might have the wireless

device 120 are forwarded to the almanac processor 122. Any base stations 112,124 within the cell sector(s) 304 are forwarded to the cooperative base station 112 for relay to the wireless device 120.

[0045] In the embodiment of FIG. 3A, a single cell sector 304 can communicate with the wireless device 120. The almanac processor 122 would include those base stations 112, 124 in that sector 304 along with those in a sector buffer zone 308. The embodiment of FIG. 3B shows the wireless device 120 close to the edge between two cell sectors 304 such that both can receive communication. The almanac processor 122 could provide the base stations 112,124 in those two cell sectors 304 and a sector(s) buffer zone 308 around them to any wireless device 120 within or nearby that area.

[0046] With reference to FIG. 4, a diagram of an embodiment of an overlapping cell location system 400 is shown. In this embodiment, two cooperative base stations 112 can communicate with the wireless device 120 such that the overlap in the cell footprints 204 is presumed to be the location of the wireless device 120. The almanac processor 122 would query the device capability and base station databases 140,144 to determine how to tailor an almanac for this overlapping region 404. A portion of the cell buffer zone 208 that overlaps the cell buffer zone 208 of the other cell footprint 204 and cell buffer zone 208 (and vice-versa) would also be analyzed for base stations 112,124 to include in any tailored almanac.

[0047] Referring next to FIG. 5, a diagram of an embodiment of a trilateration cell system 500 is shown. In this embodiment, the wireless device 120 can communicate with three or more cooperative base stations 112-1,112-2,112-3 that are geographically separate. A general location of the wireless device 120 is determined by analyzing ranging information gathered by or from a number of cooperative base stations 112. Time of arrival (TOA) readings from one cooperative base station 112 reduces the general location to a ring around that base station 112. Two cooperative base stations 112 generating time difference of arrival (TDOA) ranging readings reduce the location to a hyperbole. Three or more can resolve the general location even further. In this embodiment, time of arrival and/or time difference of arrival measurements are used in the trilateration process.

[0048] However small the area becomes, a buffer around that area is determined to compensate for the error in the determination and address the range of the wireless device 120 to base stations 112,124. The almanac processor 122 gathers information for

the base stations 112,124 likely to be in communication range for each communication mode supported by the wireless device 120.

[0049] With reference to FIG. 6, a diagram of an embodiment of a hybrid trilateration system 600 is shown. This embodiment shows trilateration with different types of communication modes. The wireless device 120 receives ranging information from a satellite location beacon 152 and communicates with two cooperative base stations 112-1,112-2. Between the three 152,112-1,112-2, the general location can be trilaterated and forwarded to one of the cooperative base stations 112 in exchange for a tailored almanac.

[0050] Referring next to FIG. 7, a diagram of an embodiment of an angular ranging system 700 is shown. The cooperative base stations 112 in this embodiment can estimate the angle of arrival (AoA) and distance to the wireless device. This ability allows determining a general location with a single cooperative base station 112. Where the cooperative base station 112 can only determine AoA and not range, two cooperative base stations 112-1,112-2 can determine a general location.

[0051] The above embodiments do not rely upon uncooperative base stations 124 to find an initial location estimate, but request a tailored almanac from cooperative base stations 112 for refined location estimations. Some embodiments could report the base stations 112,124 and location beacons seen and any ranging estimates to those as part of a location request. The almanac processor 112 could take this information and determine a location using the device capability, mode of operation and base station databases 140,144. In this embodiment, the initial gathering of location information is done without the benefit of a tailored almanac. Where the almanac processor 122 determines a more accurate location is required, a tailored almanac could be produced that indicates additional base stations 112,124 that are likely within range of the wireless device 120.

[0052] With reference to FIG. 8, a flow diagram of an embodiment of a process for locating a position of a wireless device 120 that has native location functions 800 is shown. The wireless device 120 could trilaterate to cooperative base stations 112 or satellite or ground location beacons to determine a general location in step 804. In step 808, the wireless device 120 reports the location estimate and requests a tailored almanac. Some wireless devices may store a base almanac of base stations 112,124 that is updated as new tailored almanacs are received.

[0053] In this embodiment, the location estimate could be further refined outside the wireless device in step 812. For example, the cooperative base station 112 may have some location information from time of arrival or time difference of arrival. The general location is forwarded to the almanac processor 112. In step 816, the almanac processor 112 tailors an almanac by finding all base stations 112,124 that might be close enough to use in determining a location of the wireless device 120. This takes into account all the modes of communication of the wireless device 120 that are compatible with the various base stations 112,124, the likely range in those modes, and the likely location of the wireless device 120. That tailored almanac is sent over the WAN 110 to the cooperative base station 112 and relayed to the wireless device in step 820.

[0054] In step 824, further location information is gathered by the wireless device 120. This location information uses the tailored almanac and could involve uncooperative base stations 124 as well as cooperative base stations 112. In this embodiment, the wireless device 120 analyzes the location information to refine the location estimate in step 828. The location estimate is reported to an cooperative base station in step 832. During the process of determining a location, the wireless device 120 may have location information for the base stations 112,124 in the tailored almanac or those not in the almanac yet. In step 836, this location information together with the almanac-related information such as the identifications of the observed base stations is reported to an cooperative base station 112 and forwarded to the almanac processor 122 for updating the base station database 144.

[0055] Referring next to FIG. 9, a flow diagram of another embodiment of a process 900 for locating a position of a wireless device 120 that has limited location functions is shown. Some wireless devices have limited ability to independently determine their location. This embodiment relies on other parts of the location determination system 100 to analyze location information. In step 908, the wireless device 120 requests a tailored almanac. The location is estimated by the various cooperative base stations 112 in step 912.

[0056] That location estimate is passed to the almanac processor 122 for tailoring of almanac information in step 816. In step 820, the tailored almanac is sent to the wireless device 120. Step 824 gathers further location information using the tailored almanac to find uncooperative base stations 124. In step 916, the gathered location information is forwarded to the cooperative base station 112. Step 928 refines the location estimate using the location information. The refinement may be performed in

the cooperative base station 112, the almanac processor 122 or any other location in communication with the cooperative base station 112. Any additional information gathered by the wireless device 120 is forwarded to the almanac processor 122 to refine the base station database 144.

[0057] With reference to FIG. 10, a diagram of an embodiment of system 1000 that gathers location information from uncooperative base stations 124 is shown. Once the tailored almanac is received by the wireless device 120, it attempts to locate those base stations listed in the almanac. Shown in the embodiment of FIG. 10 is a dual-mode wireless device 120 that supports two communication modes. One communication mode has a first footprint 1012-1 and the second has a larger footprint 1012-2. The tailored almanac would have all base stations 112,124 in the first footprint 1012-1 that use the first communication mode and all base stations 112,124 in the second footprint 1012-2 that use the second communication mode.

[0058] In some embodiments, the almanac processor could perform a motion estimation for the wireless device 120 such that footprints 1012 are adjusted for the likely position of the wireless device 120 when the tailored almanac would be used. Other embodiments, could just expand the footprint according the likely speed or maximum speed of the wireless device 120 should it travel in any direction. In yet other embodiments, a history of handoffs between various base stations can be used to tailor the almanac information.

[0059] Referring next to FIG. 11, a flow diagram of an embodiment of a process 1100 for gathering location information from base stations 112,124 is shown. The process 1100 begins in step 1104 where the wireless device 120 checks for base stations 112,124 in the tailored almanac. This could be done by randomly choosing base stations in the almanac 112,124. In some embodiments, the base stations 112,124 could be pre-randomized so that the wireless device 120 could take them in order.

[0060] In another embodiment, the almanac processor 122 could choose another scheme for organizing the base stations 112,124 to quickly find one. For example, they may be organized by communication mode and footprint 1012 size. The footprint of the almanac is more quickly covered by using communication modes with larger range.

[0061] Once one base station 112,124 in the almanac is found in step 1108, it may be possible to exclude some of the base stations 112,124 in the almanac. After running through the various base stations 112,124 to find those in range of the wireless device 120, the distance to each is estimated in step 1112.

[0062] Uncooperative base stations 124 still give some information even though data communication is not possible. They will identify themselves, which indicates the wireless device 120 is close enough to communicate. Some uncooperative base stations 124 will indicate signal strength of a received signal. Other uncooperative base stations 124 will acknowledge a message and that propagation time can be correlated to a distance traveled. The signal strength of a signal from the uncooperative base station 124 can intimate distance when the initial or expected signal strength can be determined.

[0063] In some embodiments, the wireless device 120 gathers information on base stations 112,124 not included in the almanac in step 1116. Often the base stations 112,124 self identify themselves. If resources are available, in step 1120 ranging may be performed to the unlisted base stations 112,124 for later report-back to the almanac processor. In other embodiments, the footprint of the base station or the overlaps of more than one footprint can be analyzed to determine the general location of the wireless device 120.

[0064] With reference to FIG. 12, a diagram of another embodiment of system 1200 that gathers location information from uncooperative base stations 124 is shown. The depicted uncooperative base stations 124 are those identified in a tailored almanac as likely to be in communication range. In this embodiment, three uncooperative base stations 124-1,124-4,124-5 operate in a first communication mode with first communication footprints 1212-1, 1212-4,1212-5; two uncooperative base stations 124-2,124-6 operate in a second communication mode with second communication footprints 1212-2,1212-6; and one uncooperative base station 124-3 operates in a third communication mode with a third communication footprint 1212-3. The current position of the wireless device 120 only allows communication with three uncooperative base stations 124-2,124-3,124-4. Even without ranging measurements, this can narrow down the location of the wireless device 120, but with ranging measurements, a very precise location can be determined.

[0065] The above description of the disclosed embodiments is provided to enable any person skilled in the art to make or use the disclosure. 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 without departing from the spirit or scope of the disclosure. Thus, the disclosure 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.

WHAT IS CLAIMED IS:

1. A system for locating a position of a wireless device, comprising:
means for determining a general location of the wireless device;
means for generating an almanac of base stations in range of said wireless device, said almanac being customized for the general location and including at least one uncooperative base stations that will not normally service the wireless device;
and
means for determining the position of the wireless device using said almanac.
2. The system of claim 1 wherein the means for determining the position further comprises means for determining a distance between the wireless device and the at least one uncooperative base station.
3. The system of claim 1 wherein the means for determining the general location comprises at least one of:
a location function integral to the wireless device,
one of the base stations and a presumed cell footprint,
a plurality of base stations to find an overlapping cell footprint,
a plurality of cooperative base stations,
base stations and location beacons, and
at least one base station that can determine an angle to the wireless device.
4. The system of claim 1 wherein the means for determining the general location does not involve uncooperative base stations, and the means for determining the position involves uncooperative base stations.
5. The system of claim 1 wherein the general location is less accurate than the position.
6. A system for locating a position of a wireless device, comprising:
a plurality of base stations in range of said wireless device, including:
an almanac of base station identifiers including a first identifier of a cooperative base station that will normally service the wireless device and send the

almanac to the wireless device, and a second identifier of an uncooperative base station that will not normally service the wireless device.

7. The system of in claim 6 wherein both the cooperative and uncooperative base stations allow interaction that allows determining distances between the wireless device and the cooperative and uncooperative base stations.

8. The system of claim 6 wherein at least one of the identifiers is created from a plurality of unique characteristics associated with a particular base station.

9. The system of claim 6 wherein the uncooperative base station prevents the wireless device from using the uncooperative base station from transporting voice or data signals.

10. A method of locating a position of a wireless device, comprising:
receiving a first signal including a first unique identifier from a first base station;

estimating a first distance between the wireless device and the first base station;

referencing a first location of the first base station, wherein the first location is previously determined;

receiving a second signal including a second unique identifier from a second base station;

estimating a second distance between the wireless device and the second base station;

referencing a second location of the second base station, wherein the second location is previously determined;

receiving a third signal including a third unique identifier from a third base station,

estimating a third distance between the wireless device and the third base station;

referencing a third location of the third base station, wherein the third location is previously determined;

wherein at least one of the first, second and third base stations is:
capable of communication to remote locations, and
unavailable to the wireless device for communication to remote
locations;
and calculating the position of the wireless device.

11. The method of claim 10 wherein said calculating comprises calculating the position of the wireless device using the first, second, and third distances and the first, second, and third locations.

12. The method of claim 10 wherein each of the estimating steps comprises:
determining if a base station is recognized by the wireless device; and
presuming a distance based upon at least one of: a base station footprint, a response delay, a signal strength, and a signal range.

13. The method of claim 10 further comprising receiving at least one of the first, second, and third location from at least one of the first, second and third, base stations.

14. The method of claim 10 further comprising receiving an almanac that includes at least one of the first, second, and third locations.

15. The method of claim 10 further comprising receiving an almanac that includes a base station communication mode.

16. The method of claim 10 further comprising receiving an almanac that includes a base station type.

17. The method of claim 10 further comprising a step of assigning a location of the wireless device.

18. The method of claim 10 wherein at least one of the estimating steps and the calculating step is performed by the wireless device.

19. The method of claim 10 wherein at least one of the first, second, or third base stations is a wireless local area network.

20. The method of claim 10 wherein at least one of the first, second, or third base stations is a cellular phone base station.

21. The method of claim 10 wherein the wireless device supports at least two different communication modes having different footprints.

22. The method of claim 10 wherein at least one of the first, second, or third base stations is a satellite.

23. The method of claim 10 wherein at least one of the first, second, or third base stations is a beacon.