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(54) Title: METHOD OF JOINING CO-LOCATED BSS

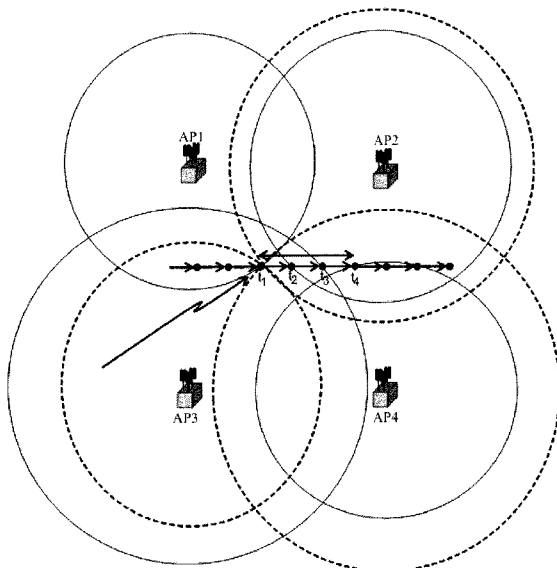


Fig. 1

(57) Abstract: A method for a multiple BSSID environment in a wireless location area network (WLAN) is proposed. A first wireless device obtains basic service set (BSS) information of a plurality of BSSs. The first wireless device then sends a fine time measurement (FTM) frame containing the BSS information to a second wireless device. The second wireless device joins at least one of the BSS according to the BSS information.

WO 2015/183199 A1

METHOD OF JOINING CO-LOCATED BSS

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority under 35 U.S.C. §119 from U.S. Provisional Application Number 62/003,238 entitled "FTM and co-located BSSs," filed on May 27, 2014, the subject matter of which is incorporated herein by reference.

TECHNICAL FIELD

[0002] The disclosed embodiments relate generally to local wireless area network (WLAN) communications, and, more particularly, to direct finding and positioning in wireless local area networks (WLANs).

BACKGROUND

[0003] IEEE 802.11 is a set of media access control (MAC) and physical layer (PHY) specification for implementing wireless local area network (WLAN) communication, in the unlicensed (2.4, 5, and 60 GHz) frequency bands. The standards and amendments provide the basis for wireless network products using the IEEE 802.11 frequency bands. IEEE 802.11 plays an important role in the growing application of Indoor/Outdoor Location. The key applicable technology is that of ranging using time-of-flight (TOF) ranging measurements defined in IEEE 802.11v. Once the

distance between devices is measured, the information can be used to determine device location.

[0004] In IEEE 802.11-REVmc, Fine Timing Measurement (FTM) protocol is proposed for Indoor Location. Based on FTM, an initiating station exchanges FTM frames during an FTM session with a responding station to measure the time-of-flight (TOF) or the Round Trip Delay (RTD/2). The initiating station then computes its range to the responding station after receiving timing measurements (i.e., timestamps corresponding to the departure time and arrival time of the FTM frames) from the responding station. To calculate a station position, the station performs ranging measurements with multiple access points (APs) via FTM frame exchange and obtains AP's positions. FTM positioning requires the initiating station to exchange FTM frames with multiple responding APs for TOF measurements in order to determine its absolute location. For 3D positioning, the station needs to exchange FTM frames with four or more APs in order to determine its absolute location.

[0005] However, for managed/controlled environments like airports, enterprise, or department stores, it is common to have many Basic Service Sets (BSSs) or Service Set Identifiers (SSIDs) at close locations, i.e. co-located, as shown in Fig. 1. Therefore, it is no benefit for a station (STA) to initiate FTMs with co-located BSSs, because the STA will get the same location and round trip time (RTT). The APs might as well get overloaded with the FTMs. Ideally, STAs would identify co-located BSSs and avoid doing FTM with co-located BSSs. The STA should consider whether co-located BSSs of different capability can provide different level of location information, such as security,

accuracy, etc, and whether there are more than one set of location information with respect to the same AP with different accuracy through different BSSs.

[0006] One of the conventional method is using multiple BSSID (mBSSID) to signal in beacons which BSSIDs are co-located. The MAC addresses for the co-located BSSs have to be contiguous, otherwise the feature cannot be used. However, the co-located BSSs may be administered by different entities, thus it is not possible to perform coordination between the co-located BSSs.

[0007] Another known method is when multiple BSSs are co-located, only one of the BSSs can advertise FTM capability. But this method requires co-ordination between the BSSs. If a STA is associated with one of the BSSs which does not advertise FTM support, it may need to go off the channel to do FTM with the BSS that indicates the support for it. Besides, this method does not allow the BSSs to provide FTM with different resolutions, add-on features, etc. Moreover, if the BSSs belong to different operators, it would be hard to agree which one to advertise FTM support.

[0008] Hence, there's a need for a solution for simplified FTM advertising.

SUMMARY

[0009] It is therefore a object of the present invention to provide a method for a multiple BSSID environment. In this method, a first wireless device obtains basic service set (BSS) information of a plurality of BSSs. The first wireless device then sends a fine time measurement (FTM) frame containing the BSS information to a second wireless device.

[0010] In one embodiment, the BSS information is co-located BSS information.

[0011] In another embodiment, the FTM frame is an unicast frame.

[0012] In yet another embodiment, the second wireless device wirelessly joins to one of the plurality of BSS according to the BSS information.

[0013] Other embodiments and advantages are described in the detailed description below. This summary does not purport to define the invention. The invention is defined by the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] Figure 1 illustrates the geometry of AP positions.

[0015] Figure 2 illustrates a frame in accordance with one novel aspect.

DETAILED DESCRIPTION

[0016] Reference will now be made in detail to some embodiments of the invention, examples of which are illustrated in the accompanying drawings.

[0017] According to an embodiment of the present invention, the co-located BSSs can advertise freely and independently about the FTM support that each BSS has. Therefore, a first wireless device such as the access points (APs) in each of the BSS, can receive the co-located BSS information. The AP can then send FTM frames that includes mBSSID or MAC addresses of the co-located BSSs, such as the frame shown in Fig. 2. The FTM frame 200 includes the BSSID 201 of co-located BSS#1 until the BSSID 202 of co-located BSS#n.

[0018] Compared to sending mBSSID in beacon that used in prior arts, the present embodiment does not overload the

beacon, and the FTM frame can indicate a list of BSSIDs as it is unicast. Therefore, when a second wireless device, such as a station (STA), receives the FTM frame that contains the mBSSID or MAC addresses of the co-located BSSs, the STA can select one of the BSSs to join and to perform FTM function.

[0019] In another example, the FTM frame can contain multiple mBSSID elements instead of a list of BSSIDs. This embodiment does not require coordination between the co-located BSSs. It only needs the MAC addresses information of co-located BSSs. And the BSSs can learn this information from each other.

[0020] According to another embodiment of the present invention, an indication can be added to the beacon to show that this BSS is co-located with other BSSs. The indication may be only one bit in size. In other words, the beacon provides the capability for a STA to obtain the list of co-located BSSs' MAC addresses when the STA receives such beacons from different BSSs. According to an embodiment of the present invention, a new Access Network Query Protocol (ANQP) element can be defined to ask the BSS about the MAC addresses of the co-located BSSs. Therefore, the STA can do FTM with only one BSSID from the list received. Similarly, this embodiment does not require coordination between the co-located BSSs. It only needs the MAC addresses information of co-located BSSs. And this information can be learned or shared from each other.

[0021] According to yet another embodiment of the present invention, an indication can be added to the beacon to show that this BSS is co-located with other BSSs. The indication may be only one bit in size. In other words, the beacon provides the capability for a STA to obtain the

list of co-located BSSs' MAC addresses when the STA receives such beacons from different BSSs. According to an embodiment of the present invention, the STA can send a FTM Request Frame including one bit that is used to request the list of BSSIDs of the co-located BSSs. So an AP provides a FTM Frame to contain the list of co-located BSSIDs when requested in the FTM Request Frame.

[0022] Although the present invention has been described in connection with certain specific embodiments for instructional purposes, the present invention is not limited thereto. Accordingly, various modifications, adaptations, and combinations of various features of the described embodiments can be practiced without departing from the scope of the invention as set forth in the claims.

CLAIMS

What is claimed is:

1. A method comprising:
 - obtaining by a first wireless device a plurality of basic service set (BSS) information;
 - sending by the first wireless device a fine time measurement (FTM) frame to a second wireless device;
 - wherein the FTM frame contains the BSS information.
2. The method of claim 1, wherein BSS information are co-located BSS information.
3. The method of claim 1, wherein the FTM frame is an unicast frame.
4. The method of claim 1, further comprising
 - the second wireless device joining at least one of the plurality of BSS according to the BSS information in the FTM frame.
5. The method of claim 1, wherein the BSS information comprise MAC addresses of a plurality of co-located BSS.
6. The method of claim 1, wherein the BSS information comprise multiple BSSID of a plurality of co-located BSS.

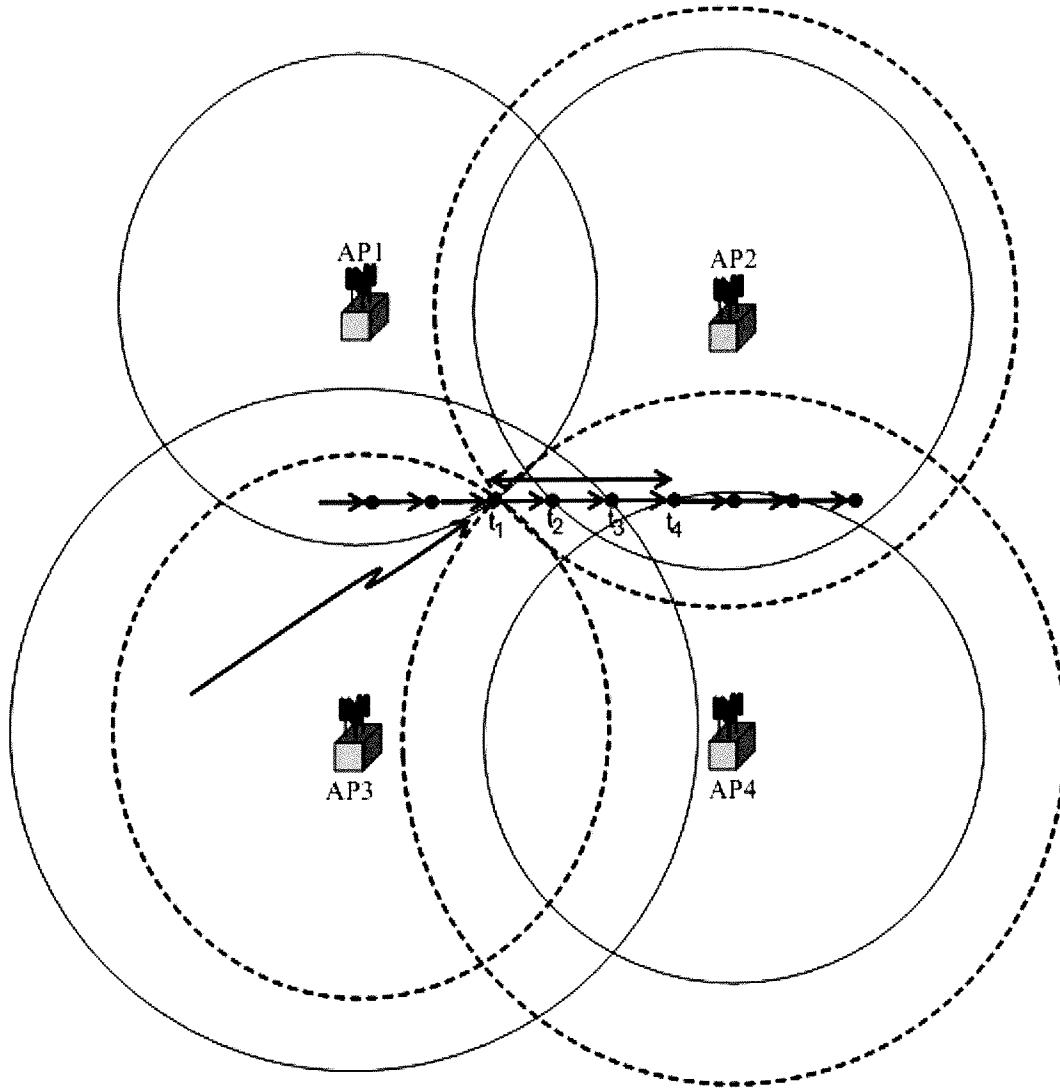


Fig. 1

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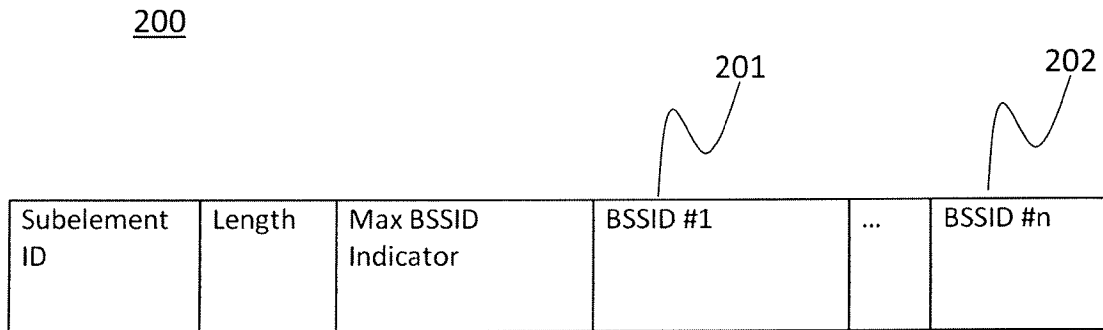


Fig. 2

A. CLASSIFICATION OF SUBJECT MATTER**H04W 56/00(2009.01)i, H04W 84/12(2009.01)i**

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H04W 56/00; H04Q 7/24; H04B 7/00; H04W 48/08; H04W 48/16; G01S 19/05; H04W 48/02; H04W 84/12

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & keywords: BSS information, FTM frame, co-located BSS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2008-0144591 A1 (JARI JOKELA) 19 June 2008 See paragraphs [0048]-[0052]; figures 9-11; and claim 1.	1-6
Y	US 2012-0229334 A1 (DERIC WAYNE WATERS et al.) 13 September 2012 See paragraphs [0032]-[0052]; figures 3-5; and claim 1.	1-6
Y	WO 2014-045004 A1 (BRITISH TELECOMMUNICATIONS PUBLIC LIMITED COMPANY) 27 March 2014 See page 7, lines 25-28.	5
A	US 2007-0081477 A1 (PADMANABHA C. JAKKAHALI et al.) 12 April 2007 See paragraph [0037]; and figure 3.	1-6
A	WO 2014-027838 A1 (LG ELECTRONICS INC.) 20 February 2014 See paragraphs [0140]-[0152]; and figure 9.	1-6

 Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents:

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"P" document published prior to the international filing date but later than the priority date claimed

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

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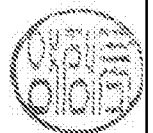
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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