UNITED STATES DISTRICT COURT
DISTRICT OF MASSACHUSETTS

SKYHOOK WIRELESS, INC., Plaintiff, v. GOOGLE INC., Defendant.	)	CIVIL ACTION NO. 1:10-cv-11571-RWZ
GOOGLE INC., Counterclaim-Plaintiff, v. SKYHOOK WIRELESS, INC., Counterclaim-Defendant.	)	

DECLARATION OF ANTHONY S. ACAMPORA., PH.D.

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I, Anthony S. Acampora, declare as follows:

1. I am over 18 years of age. I have personal knowledge of the facts stated herein, except those stated on information and belief, and, if called upon, could and would testify competently to them. I make this declaration in support of Google Inc.'s Memorandum of Law in Support of its Motion for Summary Judgment of Indefiniteness and, in the Alternative, Opening Claim Construction Brief.

2. I have been engaged as an expert to review issues relating to patents owned by plaintiff Skyhook Wireless, Inc. ("Skyhook"), including the asserted patents, U.S. Patent Nos. 7,414,988 ("the '988 patent"), 7,433,694 (" the '694 patent"), 7,474,897 ("the '897 patent), and 7,305,245 ("the '245 patent") (collectively, "the Asserted Patents") and for this declaration to offer my opinion as to how a person of ordinary skill in the art would understand the Asserted Patents.

3. I discuss in this Declaration the meaning of certain language used in the claims of the Asserted Patents. In forming my opinions as expressed below, I have relied primarily upon the text of the claims and specifications of the Asserted Patents, their prosecution histories, certain related patents and patent applications assigned to Skyhook, including their prosecution histories, and exhibits to the Declaration of Susan Baker Manning In Support of Google Inc.'s Motion for Summary Judgment of Indefiniteness and, in the Alternative, Opening Claim Construction Brief, as well as my background, knowledge and experience in the field.

I. QUALIFICATIONS AND ENGAGEMENT

4. I have been asked to review the Skyhook patents and for purposes of claim construction provide my opinions about what one of ordinary skill in the art would understand terminology used in the claims of the patents to mean.

5. In general, the patents relate to the collection of readings from wireless access points and using those readings to map position information for the access points and using the

readings and position information to determine the location of wireless devices. I have extensive experience with wireless communications systems, including the location and characterization of signals from wireless systems and use of such information to determine position.

6. I received my Bachelor of Science, Master of Science, and Doctor of Philosophy degrees, all in Electrical Engineering, from the Polytechnic Institute of Brooklyn in 1968, 1970, and 1973, respectively. Both my Master's thesis and my Ph.D. dissertation involved theoretical aspects of electromagnetic wave propagation in plasma and gaseous media.

7. From June 1968 through September 1988, I was employed at AT&T Bell Laboratories in various engineering, research, and managerial positions, all in the general area of telecommunications.

8. My initial work at Bell Laboratories (1968-1974) involved high power radar design and development, and signal design and processing for extraction of pertinent information from radar target returns, both focused on anti-ballistic missile defense applications.

9. My next assignment at Bell Laboratories (1974-1981) was in the Radio Research Laboratory, an organization responsible for basic research, where I was involved in new discovery and proposals involving novel approaches for communication satellite systems. My contributions to the communication satellite state-of-the-art included (1) strategies to efficiently encode and recover digital information sent to and from the satellites via high capacity radio beams; (2) novel systems and on-board satellite switching approaches that use multiple radio beams (so-called spot beams), each focused on a small portion of Earth, to vastly increase the capacity of a communication satellite by enabling the radio spectrum to be re-used among the spot beams; (3) strategies to acquire and maintain synchronization of radio signals sent to and from a satellite; and (4) a novel approach to overcome the effects of rain-induced attenuation of

the radio beams that dynamically adapts the modulation and assigns available radio resources to those spots on Earth where rain attenuation is instantaneously most severe.

10. I was promoted to Supervisor of the Data Theory Group at Bell Laboratories in 1981, with responsibility for exploratory development of local area data networks. These are packet-switching networks intended to enable very high speed computer, voice, and video communications via on-demand capture of a shared transmission channel.

11. In 1984, I was promoted to Head of the Network Systems Research Department (one of several departments within the Radio Research Laboratory, later to become the Communications Systems Laboratory at Bell Laboratories) with responsibility for new architectures for packet switching, multi-wavelength optical networks, wireless networks for broadband local access, and integrated voice/data wireless networks. My contributions included (1) a system architecture for using a raster of focused radio beams to deliver broadband service to a large number of buildings from a central location within a city; (2) a novel packet switching architecture for Internet-like wide area packet networks; and (3) a multi-wavelength multimedia networking strategy to enable access to the enormous information-bearing capacity potential of optical fiber cabling.

12. I was promoted to Director of the Transmission Technology Laboratory in 1987, a group of approximately 80 people with a broad charter for exploratory development of (1) transmission and switching systems for next-generation Internet-like packet-based networks; and (2) applications for digital signal processing in telecommunications.

13. I left AT&T Bell Laboratories in September 1988 to become Professor of Electrical Engineering and Director of the Center for Telecommunications Research at Columbia University. Here, my responsibilities were three-fold: (1) education of students in the field of telecommunications; (2) pursuit of a program of independent research in the area of

telecommunications; and (3) management of a National Science Foundation Engineering Research Center devoted to many aspects of telecommunications and founded for the express purpose of improving American economic competitiveness through research, education, and transfer of relevant technical findings from academia to the telecommunications industry. Research programs at the Center for Telecommunications Research were focused on multi-wavelength fiber optical networks, wireless communications, image and video communications, network management and control, and underlying photonic and electronic devices and materials. My contributions included (1) laboratory implementation and feasibility demonstration of the world's first multi-wavelength packet switched optical network; (2) new approaches for randomly accessing a shared radio channel; (3) strategies for enabling rapid handoff among radio cells in a high capacity cellular network; (4) a rigorous understanding of multi-wavelength optical network capabilities and limitations; and (5) algorithms for the efficient resource management and control of packet based multimedia networks.

14. In August 1995, I left Columbia University to become Professor of Electrical and Computer Engineering and Director of the Center for Wireless Communications at the University of California, San Diego (UCSD). My responsibilities were three-fold: (1) education of students in the field of wireless communications; (2) pursuit of a program of independent research in the area of wireless communications; and (3) management of an industrially funded research center devoted exclusively to wireless communications. My contributions included: (1) strategies for allowing the use of so-called "smart" antennas in cellular-based packet radio networks; (2) a proposal for a new city-wide network based on a wireless mesh-based approach using either focused wireless beams of light or focused radio beams, intended to deliver broadband services to buildings and/or to connect wireless radio cells with the worldwide fiber-optic backbone network; and (3) mobility management strategies for high speed packet-based wireless networks. The second of these contributions has served as the technical foundation for at least two new venture-backed telecommunications equipment companies, one of which I co-

founded. In addition, I conducted further research on the subject of multi-wavelength optical networks.

15. In December 1999, I resigned as Director of the Center for Wireless Communications to pursue full-time research and education as a Professor of Electrical and Computer Engineering at UCSD, and on January 1, 2008, I became Professor of Electrical and Computer Engineering, Emeritus, maintaining an active research program and teaching an advanced graduate-level course on wireless networks.

16. At UCSD, I have taught courses on (1) probability; (2) random processes; and (3) wireless networks. My current research is focused on (1) broadband wireless networks for local access to homes, schools, and businesses; (2) wireless spaces to enable ubiquitous voice, data, and video wireless communications within buildings; and (3) so-called ad-hoc (self organizing) networks of wireless sensor nodes for business and homeland security applications.

17. Over the course of my career, I have published (individually or with collaborators) over 170 original papers in scholarly journals and professional conference proceedings. I am the named inventor or co-inventor on 39 U.S. patents. I wrote one of the world's first textbooks devoted to broadband telecommunications, titled *An Introduction to Broadband Networks*.

18. I have lectured extensively on telecommunications, in general, and wireless communications in particular. I have regularly attended, and continue to attend, numerous worldwide professional conferences. I have chaired several major telecommunications conferences, and I have chaired numerous professional conference technical sessions. I read the technical literature extensively and subscribe to several leading journals in the field of telecommunications, in general, and wireless communications in particular. Over the years, I have delivered many three-to-five-day intensive short courses on telecommunications and

wireless communications to professional audiences of practicing engineers and others. In 1988, I was elected to the grade of Fellow of the Institute of Electrical and Electronics Engineers, cited for contributions to high-capacity digital satellite systems and broadband local communication networks.

19. My curriculum vitae, which summarizes my professional background, experience and publications, is attached as Exhibit 1 hereto.

II. THE PATENTS-IN-SUIT

A. Background and Description of the Claimed Invention.

20. The patents-in-suit generally address the creation and application of a database tied to a geographic area that might be used to determine the location of the user of a Wi-Fi device. The inventors rely on the creation and updating of a database, by systematically scanning for access points, that contains the estimated locations of all Wi-Fi access points within some geographically dispersed target region. Then, by responding to user queries reporting the identities of those access stations that are observable to the user of a Wi-Fi device, the database provides location information for the access points used to estimate the location of the Wi-Fi device itself.

21. It appears that the inventors were unhappy with the existing systems and methods for accomplishing these same two objectives: creation of, and application of, a database of Wi-Fi access points within some target region. Their "discovery," if any, appears to be a deliberate, and possibly unachievable, effort to improve the accuracy with which the location of a Wi-Fi device might be determined by improving the collection process to only scan Wi-Fi access points as described in the patents. What they apparently believe that they "discovered" is what they describe as a more accurate way to create a database of Wi-Fi access point locations by deliberately taking measurements in some sort of systematic fashion. It would appear from the disclosure that they believe that they accomplished this by intentionally only scanning for access

points along every street within the target region using an algorithm to determine the most efficient route along every street.

22. The specification is dominated by a single method for creating the database, which involves driving a vehicle in a systematic manner along every street, and scanning for "beacons" broadcast from surrounding access points. The scanning is performed using a Chinese Postman format to drive each street a minimum number of times, and preferably only once to avoid introducing a bias toward certain streets. Each beacon identifies the access point from which it was broadcast. The signal strength of the observed beacon is also recorded, as is the precise location of the vehicle at the time that the beacon observation and measurement was made. This precise location is obtained from Global Positioning System (GPS) equipment installed in the vehicle.

23. The beacon sent by a particular access point may be observed several times as the van travels along every street in the target region. For each beacon observation and signal strength measurement, the location of the access point is assumed to be the GPS location of the vehicle. Then, using a process that the inventors refer to as "reverse triangulation," an estimated location of the access point is computed by doing an average of the recorded GPS locations, with each GPS location weighted in a nonlinear fashion by the signal strength of the accompanying measurement. The only description of this "reverse triangulation" appears to be the set of equations appearing in column 12 of the '694 patent. These equations also appear in the '245 and '988 patents. Absent these equations, one of skill in the art would not know what is meant by "reverse triangulation" as the term is used in the patents. The desirability of deleting anomalous access point location measurements before reverse triangulation is discussed.

24. To determine the location of a Wi-Fi device, the device first listens to beacons sent by surrounding access points. The device then queries the database, which provides the estimated locations of the corresponding access points. These estimated access point locations,

along with the observed signal strengths of the measured beacons, are used in another application of "reverse triangulation" to produce a computed location of the Wi-Fi device. Once again, the only description of this process appearing in the patents are the set of equations appearing in column 12 of the '694 patent; as previously noted, these equations also appear in the '245 and '988 patents.

B. The asserted claims.

25. It is my understanding that Skyhook accuses Google of infringing claims 1-3 of the '988 patent; claims 1 and 2 of the '694 patent; claims 1-4 of the '897 patent; and claims 1, 2, 4-6, and 8 of the '245 patent. Those claims recite:

The '988 patent

> 1. A Wi-Fi location server, comprising:
>
> a database of Wi-Fi access points for at least one target area having a radius on the order of tens of miles,
>
> said database being recorded in a computer-readable medium and including database records for substantially all Wi-Fi access points in the target area,
>
> each record including identification information for a corresponding Wi-Fi access point and calculated position information for the corresponding Wi-Fi access point,
>
> wherein said calculated position information is obtained from recording multiple readings of the Wi-Fi access point at different locations around the Wi-Fi access point so that the multiple readings have reference symmetry relative to other Wi-Fi access points in the target area and so that the calculation of the position of the Wi-Fi access point avoids arterial bias in the calculated position information; and
>
> computer-implemented logic to add records to the database for newly-discovered Wi-Fi access points said computer logic including logic to recalculate position information for Wi-Fi access points previously stored in the database to utilize position information for the newly-discovered readings of previously stored Wi-Fi access points.
>
> 2. The server of claim 1 further including computer-implemented clustering logic to identify position information based on error prone GPS information.

3. The server of claim 2 wherein the clustering logic includes logic to determine a weighted centroid position for all position information reported for an access point and logic to identify position information that exceeds a statistically-45 based deviation threshold amount away from the centroid position and excludes such deviating position information from the database and from influencing the calculated positions of the Wi-Fi access points.

The ‘694 patent

1. A database of Wi-Fi access points for at least one target area having a radius on the order of tens of miles,

said database being recorded in a computer-readable medium and including database records for substantially all Wi-Fi access points in the target area,

each record including identification information for a corresponding Wi-Fi access point and calculated position information for the corresponding Wi-Fi access point,

wherein said calculated position information is obtained from recording multiple readings of the Wi-Fi access point at different locations around the Wi-Fi access point so that the multiple readings avoid arterial bias in the calculated position information of the Wi-Fi access point, and

wherein the database records for substantially all Wi-Fi access points in the target area provide reference symmetry within the target area.

2. The database of claim 1 having database records for a plurality of target areas, said database records being organized by target areas.

The ‘897 patent

1. In a location-based services system for WiFi-enabled devices, a method of calculating the position of WiFi-enabled devices comprising the acts of:

a) a WiFi-enabled device communicating with WiFi access points within range of the WiFi-enabled device so that observed WiFi access points identify themselves;

b) accessing a reference database to obtain information specifying a recorded location for each observed WiFi access point;

c) using the recorded location information for each of the observed WiFi access points in conjunction with predefined rules

to determine whether an observed WiFi access point should be included or excluded from a set of WiFi access points;

d) using the recorded location information of only the WiFi access points included in the set and omitting the recorded location information of the excluded WiFi access points to calculate the geographical position of the WiFi-enabled device.

2. The method of claim 1 further including recording signal strength information for WiFi access points included in the set and using the signal strength information when calculating the geographical position of the WiFi-enabled device.

3. The method of claim 1 wherein the predefined rules include rules to determine a reference point and to compare the recorded location information for each of the observed WiFi access points to the reference point, and wherein WiFi access points having a recorded location within a predefined threshold distance of the reference point are included in the set and wherein WiFi access points having a recorded location in excess of the predefined threshold distance of the reference point are excluded from the set.

4. The method of claim 3 wherein the reference point is determined by identifying a cluster of WiFi access points and determining an average position of the WiFi access points in the cluster.

The ‘245 patent

1. A method of locating a user-device having a Wi-Fi radio, comprising:

providing a reference database of calculated locations of Wi-Fi access points in a target area;

in response to a user application request to determine a location of a user-device having a Wi-Fi radio, triggering the Wi-Fi device to transmit a request to all Wi-Fi access points within range of the Wi-Fi device;

receiving messages from the Wi-Fi access points within range of the Wi-Fi device, each message identifying the Wi-Fi access point sending the message;

calculating the signal strength of the messages received by the Wi-Fi access points;

accessing the reference database to obtain the calculated locations for the identified Wi-Fi access points;

based on the number of Wi-Fi access points identified via received messages, choosing a corresponding location determination

algorithm from a plurality of location determination algorithms, said chosen algorithm being suited for the number of identified Wi-Fi access points;

using the calculated locations for the identified Wi-Fi access points and the signal strengths of said received messages and the chosen location-determination algorithm to determine the location of the user-device.

2. The method of claim 1 wherein the calculated locations for the identified Wi-Fi access points are filtered to determine if the corresponding Wi-Fi access points have moved since the time the information about the Wi-Fi access points was included in the reference database.

4. The method of claim 1 wherein the reference database is located remotely relative to the user-device.

5. The method of claim 1 wherein the location of the user device is provided with latitude and longitude coordinates.

6. The method of claim 1 wherein the plurality of location-determination algorithms includes a simple signal strength weighted average model.

8. The method of claim 1 wherein the plurality of location-determination algorithms includes a triangulation technique.

C. The asserted patents' familial relationship to each other.

26. The Asserted Patents are all closely related and three claim priority to a common provisional patent as discussed below. Each identifies the same four individuals as inventors (Russel Kipp Jones, Farshid Alizadeh-Shabdiz, Edward James Morgan, and Michael George Shean), and each states on its face that it is assigned to plaintiff Skyhook Wireless, Inc.

27. On their face, the '988, '694 and '245 patents each claims priority to U.S. Provisional Application No. 60/623,108, which was filed with the U.S. Patent and Trademark Office on October 29, 2004. The applications that later issued as the '988, '694 and '245 patents were filed on October 28, 2005.

28. In addition to each claiming priority to the same provisional application, the '988, '694 and '245 patents each state that they are related to the others, as well as to the unasserted

‘762 patent. *See* ‘988 patent at Col. 1, lines 12-22; ‘694 patent at Col. 1, lines 11-32; and ‘245 patent at Col. 1, lines 14-19.

29. The ‘897 patent is also part of the same patent family. It issued from a February 22, 2006 application that claims priority as a continuation-in-part of the application that issued as the ‘245 patent. The ‘897 patent includes similar language identifying the relationship to the other family members: U.S. Provisional Application No. 60/654,811 (filed on February 22, 2005); U.S. Provisional Application No. 60/658,481 (filed on Mar. 4, 2005); the application that issued as the ‘988 patent (asserted); the application that issued as the ‘694 patent (asserted); the application that issued as the ‘245 patent (asserted); the application that issued as U.S. Patent No. 7,403,762 (unasserted); the application that issued on February 19, 2009 as the U.S. Patent No. 7,493,127 (unasserted); and pending U.S. Patent App. No. 11/359,154 (filed Feb. 22, 2006).

D. The alleged invention of the asserted claims—”Arterial Bias,” “Reference Symmetry,” and “Chinese Postman.”

30. Generally speaking, the ‘988 and ‘694 patents both claim a database of calculated position information for Wi-Fi access points in a target area. As recited in the claims, and as taught in the specification, that calculated position information is derived from raw scanning data that was collected using a certain driving methodology. Although the claims and specifications of the ‘988 and ‘694 patents are profoundly unclear in important respects, as I discuss in greater detail below, the general concept appears to be that the “Chinese Postman” routing methodology taught and claimed addresses the problem of “arterial bias” described in the specifications, and is related to the provision of “reference symmetry” as also taught and claimed.

31. Claim 1 of the ‘988 is similar to claim 1 of the ‘694 patent. As shown in the side-by-side comparison below, the first three limitations of each are identical. The fourth limitation of claim 1 of the ‘988 shares much of the same language as the fourth and fifth limitations of claim 1 of the ‘694 patent, although they are not identical in every respect. The fifth limitation

of claim 1 of the '988 recites requirements for claimed "computer-implemented logic" that is not paralleled in claim 1 of the '694 patent.

988/1	694/1
A Wi-Fi location server, comprising:	
a database of Wi-Fi access points for at least one target area having a radius on the order of tens of miles,	A database of Wi-Fi access points for at least one target area having a radius on the order of tens of miles,
said database being recorded in a computer-readable medium and including database records for substantially all Wi-Fi access points in the target area,	said database being recorded in a computer-readable medium and including database records for substantially all Wi-Fi access points in the target area,
each record including identification information for a corresponding Wi-Fi access point and calculated position information for the corresponding Wi-Fi access point,	each record including identification information for a corresponding Wi-Fi access point and calculated position information for the corresponding Wi-Fi access point,
wherein said calculated position information is obtained from recording multiple readings of the Wi-Fi access point at different locations around the Wi-Fi access point so that the multiple readings have reference symmetry relative to other Wi-Fi access points in the target area and so that the calculation of the position of the Wi-Fi access point avoids arterial bias in the calculated position information; and	wherein said calculated position information is obtained from recording multiple readings of the Wi-Fi access point at different locations around the Wi-Fi access point so that the multiple readings avoid arterial bias in the calculated position information of the Wi-Fi access point, and
computer-implemented logic to add records to the database for newly-discovered Wi-Fi access points said computer logic including logic to recalculate position information for Wi-Fi access points previously stored in the database to utilize position information for the newly-discovered readings of previously stored Wi-Fi access points.	wherein the database records for substantially all Wi-Fi access points in the target area provide reference symmetry within the target area.

32. The specification of the '988 patent is very similar to that of the '694 patent. *See* Ex. K .[1] The two patents share the same eleven figures. The two detailed descriptions of the inventions are identical, using exactly the same language to describe collection of Wi-Fi access point data using the "Chinese Postman" routing methodology to obtain reference symmetry

[1] Unless otherwise indicated, all cited exhibits are attached to the Declaration of Susan Baker Manning.

while avoiding arterial bias. Ex. K at 6-10; Ex. C at Fig. 2, Fig. 11, 8:28-34, 8:44-59, 9:64-10:4. They also describe in the same way processing and quality checking the data to be added to the database of Wi-Fi access points. Ex. K at 12-14 & Ex. C at 11:46-14:7.

33. The ‘245 patent relates to a method of locating a user-device by using a reference database of Wi-Fi access points. It also discloses a method of building the reference database by collecting Wi-Fi access point information while driving a “Chinese Postman” route to avoid arterial bias and maintain reference symmetry.

34. The specification of the ‘245 patent is likewise very similar to that of the ‘988 and ‘694 patents, though they are not identical in that the summaries of the inventions and discussions of related art differ. In other respects they are the same, sharing the same figures and detailed descriptions, including details regarding collection of Wi-Fi access point data using the “Chinese Postman” routing methodology to try to differentiate collection methods acknowledged in the prior art. Ex. L.

35. The ‘897 patent contains additional disclosures beyond the ‘245 patent from which it claims priority, and both the ‘897 patent and the ‘245 patent relate to a method of calculating the position of a Wi-Fi enabled user device using a reference database. The ‘897 patent reiterates that a fault with prior art systems is the arterial bias introduced when data is collected by individuals who do not follow designed scanning routes. The claims of both patents disclose methods of calculating position information. The patents claim slightly different aspects of the process of determining location of a Wi-Fi enabled device; the ‘897 patent claims pre-defined rules for including and excluding observed access points from a set used to determine location, while the ‘245 patent claims a method of choosing amongst algorithms for location determination. The specification of the ‘245 patent discloses the use of the same “Chinese Postman” routing methodology for collection of access point data disclosed in the ‘694 and ‘988

patents, while the '897 lists arterial bias and lack of reference symmetry among reference points as drawbacks in the related art.

E. The Prosecution History of the '988 Patent

36. On November 30, 2007, the Examiner rejected pending claim 1 in the application for the '988 patent as obvious in light of U.S. Patent App. Pub. No. 2005/0164710 (Beuck) in view of U.S. Patent App. Pub. No. 2005/0037775 (Moeglein). Ex. G at GSHFED200-12. The Examiner also objected to claim 1 because the term "radius on the order of tens of miles" "leaves the claim open ended." *Id*. at GSHFED202. The Examiner also rejected pending claims 2 and 3 as unpatentable in light of the Beuck reference in view of Moeglein and U.S. Patent No. 5,940,825 (Castelli). *Id*. at GSHFED207-10.

37. In response, the applicants amended the last two limitations of claim 1:

> A Wi-Fi location server, comprising:
>
> A database of Wi-Fi access points for at least one target area having a radius on the order of tens of miles,
>
> said database being recorded in a computer-readable medium and including database records for substantially all Wi-Fi access points in the target area,
>
> each record including identification information for a corresponding Wi-Fi access point and calculated position information for the corresponding Wi-Fi access point,
>
> wherein said calculated position information is obtained from recording multiple readings of the Wi-Fi access point at different locations around the Wi-Fi access point so that the multiple readings have ~~to provide~~ reference symmetry relative to other Wi-Fi access points in the target area ~~when calculating~~ and so that the calculation of the position of the Wi-Fi access point ~~and to~~ avoids arterial bias in the calculated position information; and
>
> computer-implemented logic to add records to the database for newly-discovered Wi-Fi access points said computer logic including logic to recalculate position information for Wi-Fi access points previously stored in the database to utilize position information for the newly-discovered readings of previously stored Wi-Fi access points.

Ex. G at GSHFED183.

38. The amendments are all directed to obtaining the claimed "calculated position information." As amended, the limitation both specifies that the "calculated position information" has certain characteristics, and specifies how the data used to calculate the location of Wi-Fi access points is collected. According to the claim language, the "calculated position information" must "avoid arterial bias." To obtain the data used to calculate the location of the Wi-Fi access points one must "record[] multiple readings of the Wi-Fi access point at different locations around the Wi-Fi access point." According to the claim, this collection method results in the "multiple readings hav[ing] reference symmetry relative to other Wi-Fi access points in the target area."

39. The applicants also provided detailed remarks in which they argued that the amended claims were patentable over the prior art. Ex. G at GSHFED185-91. In particular, the applicants argued that the prior art, unlike the invention, was silent as to the methodology of determining the location of the Wi-Fi access points.

> In contrast to the cited references, applicants' claim 1 is directed to a Wi-Fi location server that includes position information for Wi-Fi access points without arterial bias. Specifically, the calculated position information for the Wi-Fi access points is obtained from recording multiple readings of the Wi-Fi access point at different locations around the Wi-Fi access point. These multiple readings have reference symmetry relative to other Wi-Fi access points in the target area. Thus, the calculation of the position of the Wi-Fi access point avoids arterial bias in the calculated position information. This technique of gathering readings from Wi-Fi access points results in higher quality estimates of access point locations and more complete information about the access points in the area. Consequently, devices using the calculated access point locations to determine their position have more accurate estimations of their locations. See Application at ¶¶ 41-44.
>
> As set forth above, **none of the cited reference teach or suggest conducting an audit of an area to build a reference database of the locations of Wi-Fi access points in a target area so as to provide reference symmetry and avoid arterial bias**. As stated in the application, amateur scanners ("wardrivers") have attempted to collect access point location data for use in location estimation

systems. However, the **methods employed by wardrivers suffer from several drawbacks. Namely, as described in the application, the location data collected by the wardrivers is often inaccurate, incomplete, and grows organically rather than being collected in a systematic fashion to purposefully avoid arterial bias. See Application at ¶¶ 15-17.**

As explained in greater detail in the application, significant errors in position calculation can result when the reference points used for the calculation lack symmetry around the physical location of the device performing the calculation. **Unsymmetrical location data (or "arterial bias") occurs when individuals (e.g., wardrivers) collect location data for Wi-Fi access points without following designated scanning routes.** Such data tends to aggregate around heavily traffic areas (or "arteries"). Attempting to use arterially biased data to estimate the location of a mobile device causes a "location pull" towards the main arteries regardless of where the user is currently located. This causes substantial accuracy errors in the location estimation. Figures 5 and 6 of the application illustrate this effect. See Application at ¶¶ 15 and 44.

Collecting multiple readings of Wi-Fi access points in a systematic fashion, as described in the application, provides reference symmetry within the target area. Thus, the distribution of reference points (i.e., Wi-Fi access point locations) is symmetric. By using a collection of location data that is symmetric, a mobile device attempting to calculate its location typically encounters physical locations in which there are numerous access point locations on all sides of the device within range of the device's Wi-Fi radio. Therefore, a position calculation performed by the mobile device will have reduced location bias and will be more accurate as a result. See Application at ¶ 44.

Unlike the cited references and known methods described in the background of the application, applicants' claim 1 clearly recites the calculated position information is obtained from recording multiple readings of the Wi-Fi access point at different locations around the Wi-Fi access point so that the multiple readings have reference symmetry relative to other Wi-Fi access points in the target area and so that the calculation of the position of the Wi-Fi access point avoids arterial bias in the calculated position information. The application describes the discovery of the arterial bias problem and the advantages of the solutions devised by applicants. Namely, **by performing a planned audit, and avoiding arterial bias, applicants at least achieve more complete information about access points in the target area, higher quality estimates of access point locations, and reference symmetry. See Application at ¶¶ 47-51.**

None of this is taught or suggested by the cited references. Thus, applicants submit that claim 1 is patentable over the cited references.

Ex. G at GSHFED0000187-89 (emphasis added).

40. In light of these remarks—and also consistent with the specification and the amendments—it would be apparent to a person of ordinary skill that Skyhook's claims were not intended to cover unsystematic methods of collecting information about Wi-Fi access points.

41. Consistent with that teaching, the applicants emphasized to the Examiner that the invention solved the problem of arterial bias, and ensured reference symmetry, due to the method by which the data is collected. The data cannot be collected in a random manner.

- The applicants twice referred to an "audit" or "planned audit," which itself clearly conveys that the target area is to be traversed systematically. *See* Ex. G at GSHFED0000187; *id.* at GSHFED0000189.
- The applicants also twice referred to collecting the location information in a "systematic fashion." *See* Ex. G at GSHFED0000188.
- Scanning is done by a "fleet of vehicles [that] perform their scanning routines while driving their pre-designed routes." Ex. C at 11:49-50.
- The applicants criticized data collection "without following designated scanning routes" as leading to arterial bias. *See* Ex. G at GSHFED0000188.

42. The specification also criticizes the "Random Scanning Model" at length. *See, e.g.*, Ex. C at 2:44-3:27, Figs. 3 &11. It describes the "Random Scanning Model" as leading to the problem of inaccurate location calculations due to arterial bias; systematic location data collection by following a Chinese Postman route is the applicants' solution to that problem. *See id.* 8:28-59, 9:6-21, 9:57-10:4.

43. The claims and prosecution history each teach that avoidance of arterial bias must be a specific goal of the data collection method:

- "wherein said calculated position information is obtained from recording multiple readings of the Wi-Fi access point at different locations around the Wi-Fi access point ***so that*** the multiple readings have reference symmetry relative to other Wi-Fi access points in the target area and so that the calculation of the position of the

Wi-Fi access point avoids arterial bias in the calculated position information" ('988 patent, claim 1);

- "[N]one of the cited reference teach or suggest conducting an audit of an area to build a reference database of the locations of Wi-Fi access points in a target area ***so as to*** provide reference symmetry and avoid arterial bias." Ex. G at GSHFED0000187 (emphasis added); and

- "[A]s described in the application, the location data collected by the wardrivers is often inaccurate, incomplete, and grows organically ***rather than being collected in a systematic fashion to purposefully avoid arterial bias***. See Application at ¶¶ 15-17.[2]" Ex. G at GSHFED0000188 (emphasis added).

44. The Examiner allowed the claims on May 5, 2008. In doing so, he did not give any detailed reasoning, merely stating that amended claim 1, which he quoted verbatim, was patentable over two prior art references. He did not comment on his earlier rejection of claim 1 as "open ended."

45. The term "calculated position information" and similar terminology used in the patents is used to refer to data that is collected for access points and used to determine a location for each access point. One of ordinary skill in the art would understand from reading the '988 patent and related patents that:

a. "calculated position information" must be based on raw scanning data (but is not the raw scanning data itself, per "calculated")

b. "calculated position information" is about the physical location (lat & long) of the Wi-Fi access point

c. The raw scanning data must have been collected during an audit of the target area in which drivers followed a Chinese Postman route.

[2] Paragraphs 15-17 of the Application for the '988 patent correspond to unamended claims 1-3, which are recited in the Summary at column 4, lines 28-57. The applicants thus directly tied the concepts of systematic data collection and purposeful avoidance of arterial bias to the claims.

d. The collection of the raw scanning data must have been intended to avoid arterial bias in the calculated location.

e. The raw scanning data cannot have been collected by end-users.

f. The raw scanning data cannot have been collected by the random scanning method disparaged in the specification, and distinguished during prosecution.

These principles apply equally to '694 patent (in which the term "calculated position information" also appears), as well as to the construction of "calculated locations" in the related '245 patent and "recorded location information" in the related '897 patent.

46. As to the Examiner's objection to the "radius on the order of tens of miles" limitation as "leav[ing] the claim open ended," the Applicants argued that the limitation "clearly communicates that the claimed target area is larger than, for example, a single floor of a building, such as might be found in an indoor positioning system. See Application at ¶ 16. Applicants describe throughout the application an embodiment that includes position information for Wi-Fi access points within a large metropolitan area." Ex. G at GSHFED190.

47. The Examiner issued a Notice of Allowability on May 21, 2008. Ex. G at GSHFED168-72. The '988 patent issued on August 19, 2008.

F. The Prosecution History of the '694 Patent

48. During the prosecution of the '694 patent, the Examiner rejected claims 1 and 2 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent Application Publication No. 2004/0039520 (Khavakh) in view of U.S. Patent Application Publication No. 2004/0058640 (Root). Ex. H at GSHFED311. Khavakh teaches a database of Wi-Fi access points recorded on a computer-readable medium, each record containing calculated position information for each Wi-Fi access point, and calculated position information obtained from multiple readings of Wi-Fi access points to provide reference symmetry and to avoid arterial bias. *Id.* Root teaches having a radius on the order of tens of miles. *Id.* The examiner determined that it would have been obvious to provide the teaching of Root into the system of Khavakh to predict events within a

particular special range of a particular dynamic special location; therefore claim 1 was rejected. Ex. H at GSHFED312. Claim 2 was rejected because the combination of Khavakh and Root teaches the database of claim 1 having records for a plurality of target areas, organized by target areas. *Id.*

49. On April 7, 2008, the Applicants apparently held a telephonic interview with the Examiner. Ex. H at GSHFED298.

50. One day later, on April 8, 2008, the Applicants amended claim 1 to "more particularly recite characteristics of the calculated position information," and submitted that the amendments overcome the rejection. Ex. H at GSHFED295-99. Specifically, the Applicants amended the fourth limitation of claim 1 of the '694 patent (regarding the avoidance of arterial bias) and added the fifth limitation (regarding the provision of reference symmetry):

> A database of Wi-Fi access points for at least one target area having a radius on the order of tens of miles,
>
> said database being recorded in a computer-readable medium and including database records for substantially all Wi-Fi access points in the target area,
>
> each record including identification information for a corresponding Wi-Fi access point and calculated position information for the corresponding Wi-Fi access point,
>
> wherein said calculated position information is obtained from recording multiple readings of the Wi-Fi access point at different locations around the Wi-Fi access point so that the multiple readings ~~to provide reference symmetry when calculating the position of the Wi-Fi access point and to~~ avoid arterial bias in the calculated position information of the Wi-Fi access point, and
>
> wherein the database records for substantially all Wi-Fi access points in the target area provide reference symmetry within the target area.

Ex. H at GSHFED297.

51. According to the Applicants' Remarks accompanying the Amendment, "During the telephone call, applicants submitted that the cited references do not teach or suggest these features [*i.e.*, the claims as amended]. Examiner Danh stated that the amendments overcome the cited references." Ex. H at GSHFED298.

52. The Examiner issued a Notice of Allowability on June 16, 2008. Ex. H at GSHFED282-284. The '694 patent issued on October 7, 2008.

G. The Prosecution Histories of the '245 and '897 Patents

53. The Examiner allowed both the '245 and '897 patents to issue with the original claims as-filed. Ex. I at GSHFED87-90 (September 12, 2007 Notice of Allowabilty re '245 patent); Ex. J at GSHFED392-95 (August 14, 2008 Notice of Allowabilty re '897 patent).

54. In allowing the '245 patent, Examiner Le identified the limitation "based on the number of Wi-Fi access points identified via received messages, choosing a corresponding location-determination algorithm from a plurality of location-determination algorithms, said chosen algorithm being suited for the number of identified Wi-Fi access points" as the point of novelty over seven identified U.S. patents or published applications (Masouka, Krumm, Meunier, Patil, Sheynblat, Vesuna, and Reeves). *See* Ex. I at GSHFED0000089-90.

55. In allowing the '897 patent eleven months later, Examiner Le identified steps c) and d) of claim 1 as the point of novelty over the prior art. *See* Ex. J at GSHFED0000394-95 (noting the Choti, Agrawa, Orwant, Biffar, Nagda, and Zellner references). Those limitations recite:

> c) using the recorded location information for each of the observed WiFi access points in conjunction with predefined rules to determine whether an observed WiFi access point should be included or excluded from a set of WiFi access points
>
> d) using the recorded location information of only the WiFi access points included in the set and omitting the recorded location information of the excluded WiFi access points to calculate the geographical position of the WiFi-enabled device

‘897 patent, claim 1.

III. SUMMARY OF STIPULATED AND DISPUTED CLAIM CONSTRUCTIONS.

56. I am advised that Google and Skyhook agree that the following constructions should be adopted in this case:

Claim language	Stipulated construction:	Appears in Asserted Claims
“Wi-Fi access points”	Devices operating consistent with the IEEE 802.11 standard to provide network connectivity.	‘988/1, 3 ‘694/1 ‘245/1, 2 ‘897/1, 3, 4
“a radius on the order of tens of miles”	A radius of ten miles or more but fewer than a hundred miles.	‘988/1 ‘694/1
“identification information for a corresponding Wi-Fi access point”	An identifier (*e.g.*, a MAC address) for a corresponding Wi-Fi access point. *See* “Wi-Fi access points.”	‘988/1 ‘694/1
“triggering the Wi-Fi device to transmit a request to all Wi-Fi access points within range of the Wi-Fi device”	Causing the Wi-Fi device to actively search for Wi-Fi access points. The Wi-Fi device transmits a request to all Wi-Fi access points within range of the Wi-Fi device to identify themselves. *See* “Wi-Fi access points.”	‘245/1
“WiFi access points having a recorded location within a predefined threshold distance of the reference point”	WiFi access points having a recorded location that is within a certain distance of the reference point. That distance was previously defined. *See* “WiFi access points.”	‘897/3
“WiFi access points having a recorded location in excess of the predefined threshold distance of the reference point”	WiFi access points having a recorded location that exceeds a certain distance from the reference point. That distance was previously defined. *See* “WiFi access points.”	‘897/3

57. I am advised that Google and Skyhook do not agree as to the proper construction of the following terms:

Claim language	Appears in asserted claims
"target area"	'988/1 '694/1, 2 '245/1
"substantially all Wi-Fi access points" / "for substantially all Wi-Fi access points in the target area"	'988/1 '694/1
"calculated position information"	'988/1 '694/1
"reference symmetry"	
"arterial bias"	'988/1 '694/1
"recording multiple readings of the Wi-Fi access point at different locations around the Wi-Fi access point so that the multiple readings have reference symmetry relative to other Wi-Fi access points in the target area"	'988/1
"recording multiple readings of the Wi-Fi access point at different locations around the Wi-Fi access point … so that the calculation of the position of the Wi-Fi access point avoids arterial bias in the calculated position information"	'988/1
"avoid arterial bias" /"avoids arterial bias"	'988/1 '694/1
"logic to recalculate position information for Wi-Fi access points previously stored in the database to utilize position information for the newly-discovered readings of previously stored Wi-Fi access points"	'988/1
"computer-implemented logic to add records to the database for newly-discovered Wi-Fi access points"	'988/1
"computer-implemented clustering logic to identify position information based on error prone GPS information"	'988/2
"logic to determine a weighted centroid position for all position information reported for an access point"	'988/3
"a weighted centroid position"	'988/3
"logic to identify position information that exceeds a statistically-based deviation threshold amount away from the centroid position"	'988/3
"calculated positions of the Wi-Fi access points"	'988/3

Claim language	Appears in asserted claims
“the clustering logic … excludes such deviating position information from the database and from influencing the calculated positions of the Wi-Fi access points”	‘988/3
“recording multiple readings of the Wi-Fi access point at different locations around the Wi-Fi access point so that the multiple readings avoid arterial bias in the calculated position information of the Wi-Fi access point”	‘694/1
“wherein the database records for substantially all Wi-Fi access points in the target area provide reference symmetry within the target area”	‘694/1
“a user-device having a Wi-Fi radio”	‘245/1
“providing a reference database of calculated locations of Wi-Fi access points in a target area”	‘245/1
“calculated locations”	‘245/1, 2
“in response to a user application request to determine a location of a user-device having a Wi-Fi radio”	‘245/1
“said chosen algorithm being suited for the number of identified Wi-Fi access points”	‘245/1
“simple signal strength weighted average model”	‘245/6
“triangulation technique”	‘245/8
“a WiFi-enabled device communicating with WiFi access points within range of the WiFi-enabled device so that observed WiFi access points identify themselves”	‘897/1
“using the recorded location information for each of the observed WiFi access points in conjunction with predefined rules to determine whether an observed WiFi access point should be included or excluded from a set of WiFi access points”	‘897/1
“recorded location information”	‘897/1, 3
“rules to determine a reference point and to compare the recorded location information for each of the observed WiFi access points to the reference point”	‘897/3

IV. CLAIM CONSTRUCTION PRINCIPLES

58. It is my understanding that the claim construction process is governed by a number of legal principles. Although I am not a lawyer, I have been advised on the relevant legal principles, and have used them in considering whether the disputed limitations in Skyhook's patents reasonably can be given any definition, and if so what the appropriate definition would be.

A. The Level of Ordinary Skill in the Art

59. It is my understanding that words in the claims of a patent are to be interpreted according to their meaning to one of ordinary skill in the art, unless the terms have been given a special meaning in the patent or in related documents such as the prosecution history.

60. In this case, it is my opinion that one of ordinary skill in the art would be one with a bachelor's degree in electrical engineering or computer science and 3 – 5 years of experience working in wireless communications hardware and software design.

61. In forming my opinion regarding the education, skill level and background of a person of ordinary skill in the relevant art, I considered a number of factors including the field of the purported invention of the patents-in-suit, the skill required for implementing wireless communications hardware and software, and my experience in wireless communications. This opinion, like all of my opinions expressed in this report, is also based on my background, education, and experience in the field of wireless communications.

B. Specification, Prosecution History

62. It is my understanding that the person of skill in the art is presumed to have read and understood the claim terms and the specification. Although the claims, and not the specification, define the scope of the patented invention, the specification is highly relevant to the proper understanding of the claims. In fact, I understand that the courts have declared that the specification is the single best guide to the meaning of a disputed term. Properly understood, the ordinary meaning of the claim terms is therefore not their ordinary meaning in some abstract

sense, but rather their ordinary meaning in the context of the entire patent, including the text of the specification, the figures and the other claims. As discussed below, I have therefore carefully considered the specifications of Skyhook's patents, and what they indicate about the inventions claimed in the various patents.

63. I understand that any proper analysis of the meaning of the claims also requires one to consider the prosecution history of the patent. I am also informed that it is appropriate to consider the prosecution histories of patents that are related to the patent being considered to the extent that such related prosecution histories shed light on the particular terms at issue. It is my understanding that statements made by a patent applicant to the U.S. Patent and Trademark Office can bear directly on the meaning of claim terms. For example, if the applicant described his or her invention as including something or not including something then the claims are to be interpreted accordingly. The basic principle, as I understand it, is that the claims are to be interpreted consistently with applicant's description of his or her invention during prosecution.

C. Means-plus-function claiming.

64. I understand that a patentee may express a claim limitation as a means for performing a given function without specifying the structure that performs the function. These kinds of terms are called "means-plus-function" terms, and are subject to special rules of claim construction.

65. Essentially, a structural limitation says what something is, while a functional limitation says what it does. I understand that one determines whether a claim term is in means-plus-function form by considering whether the claims disclose a structure, or whether the limitation speaks in purely functional terms. A term that uses words like "means for" is presumed to be in means-plus-function form, while a term that does not use similar "means" phrasing is presumed not to be in means-plus-function form. Those are only presumptions, however, and the true test is whether the claim recites sufficient structure. I am advised that, as

an aid in determining whether sufficient structure is recited in the claim, the Federal Circuit has considered "whether the 'term, as the name for a structure, has a reasonably well understood meaning in the art.'"

66. It is my understanding that means-plus-function limitations are construed to "cover the corresponding structure, material, or acts described in the specification and equivalents thereof." 35 U.S.C. § 112, ¶ 6. Means-plus-function limitations are construed using a two-step process. First, the court uses ordinary principles of claim construction to determine the function explicitly set forth in the claims. Second, the court determines from the perspective of a person of ordinary skill in the art, what structure, if any, disclosed in the specification corresponds to the claimed function. Any such structure must be clearly associated with the performance of the function.

D. Indefiniteness

67. I also have been informed on legal principles concerning patent validity, including the definiteness requirement, and have used those principles in forming my opinions.

68. I understand that in order for a patent to be valid, it must satisfy the statutory definiteness requirement. The definiteness requirement provides that the patent specification must conclude with one or more claims particularly pointing out and distinctly claiming the subject matter that the applicant regards as the invention. In determining whether a patent claim is indefinite, a court must consider whether one skilled in the art would understand the bounds of the claim when read in light of the specification. Whether one skilled in the art would understand the claim is dependent on whether the claim can be construed to the extent necessary to resolve any dispute between the parties.

69. In the case of means-plus-function limitations, it is my understanding that if a corresponding structure for performing the function is not set out in the specification, then the claim is indefinite.

V. SEVERAL TERMS IN THE PATENTS-IN-SUIT ARE INDEFINITE

A. The "Reference Symmetry" Limitations are Indefinite.

70. Claim 1 of the '988 patent requires: "recording multiple readings of the Wi-Fi access point at different locations around the Wi-Fi access point so that the multiple readings have reference symmetry relative to other Wi-Fi access points in the target area."

71. Claim 1 of the '694 patent requires that "the database records for substantially all Wi-Fi access points in the target area provide reference symmetry within the target area." It is my opinion that both "reference symmetry" limitations are indefinite.

72. "Reference symmetry" is not a term that has an established meaning in the art. I have therefore looked to the specifications and prosecution histories for any information they might have about what "reference symmetry" means.

73. The patents describe "reference symmetry" in a context where there is significant error in a location calculation caused by either too few reference points or by reference points that lack balance or symmetry around the user. *See* Ex. C at 1:53-57, 2:53-57 (describing "[t]he classic example" of a situation lacking reference symmetry as "along the shoreline" where there are no access points in the water); Fig. 5 (entitled "Lack of Reference Symmetry" and showing access points on only one side of a user); *id*. at 9:55-10:4 (describing Chinese Postman routing resulting in a situation "in which there are numerous access point locations [602] on all sides of the user [601] within the range [604] of the device's 802.11 radio"); and Fig. 6 (showing access points distributed around the user); *id*. at 9:49-10:4 (section entitled "Reference Symmetry"); Ex. G at GSHFED188. The patent specification and figures thus seem to suggest that "reference symmetry" has some relationship to a "balanced" or symmetrical distribution of numerous Wi-Fi access points on all sides of the user device and within range of the user device's Wi-Fi radio. What that means in practical terms, however, is unclear.

74. Unless the target region is intentionally, and densely, seeded with access points, there is simply no way to know whether reference symmetry has been provided in a given target area. Symmetry of access points relative to a user is a function of the actual locations of the access points relative to a user, and one-of-skill-in-the-art would have no way of knowing whether a condition of "reference symmetry" does or does not exist. None of the asserted patents contain any mention of intentional seeding. Access points may be distributed more or less evenly, or in random and uneven ways. For example, a multi-tenant residential building may have hundreds of access points on one block and there may be no other access points for several blocks. Moreover, the patent would not even teach one of skill in the art when an objective measure of the density or symmetry of access point deployment is such that "reference symmetry" is achieved. Thus, there is a fundamental lack of any objective standard for determining when the distribution of Wi-Fi access points might have reference symmetry with regard to a user.

75. Importantly, the claims do not require that Wi-Fi access points might have reference symmetry with regard to a user—the only kind of reference symmetry discussed in the specification. In the claims, there is no point of reference.

76. In claim 1 of the '988 patent, it is the raw scanning data that must have "reference symmetry" and the data must have it relative to other Wi-Fi access points in the target area. '988 patent, claim 1 ("calculated position information is obtained from recording multiple readings of the Wi-Fi access point at different locations around the Wi-Fi access point so that *the multiple readings* have reference symmetry *relative to other Wi-Fi access points in the target area*") (emphasis added). In claim 1 of the '694 patent, "the database records for substantially all Wi-Fi access points in the target area provide reference symmetry within the target area." The claim language is vague and uncertain because there is no workable frame of reference for the symmetry. In the '988 patent, the symmetry apparently involves measurements around each Wi-

Fi access point relative to some other Wi-Fi access points. It is not clear what the relationship is or what the symmetry looks like.

77. In claim 1 of the '694 patent, "the database records for substantially all Wi-Fi access points in the target area provide reference symmetry within the target area." The claims do not identify what within the target area is provided with "reference symmetry" by the database records. Nor is it clear when the database provides such reference symmetry, how to measure it, and how to distinguish it from prior art databases or allegedly infringing databases. There is no objective measure for the analysis.

B. "Arterial bias" and "avoid(s) arterial bias."

78. The inventors appear to believe that their proposed database creation technique of deliberately taking measurements along every street will reduce a source of Wi-Fi device location error that they refer to as "arterial bias." I do not believe that this term has a recognized technical meaning. Rather, I believe the meaning of "arterial bias" and "avoid arterial bias"/ "avoids arterial bias" found in the claims must be obtained from reading the patent and prosecution history.

79. Based on my review of the specification and prosecution history, it is my opinion that the term "arterial bias" standing alone can be understood to mean "the deviation of the calculated position information for a Wi-Fi access point toward heavily trafficked roads and away from the actual geographic location of the access point due to the tendency of random scanning to result in a greater number of scans from heavily trafficked roads."

80. I note that Skyhook's own proposed construction is similar, although it does not agree with the phrase "due to the tendency of random scanning to result in a greater number of scans from heavily trafficked roads." That is an important part of how the inventors described "arterial bias." Both the specification and relevant prosecution history emphasize the inventors' belief arterial bias results from using the Random Model of data collection. *See* Ex. C at

Abstract, 3:12-18, 4:4-9, 5:24-37, 7:55-63, 8:6-13, 8:24-27, 9:57-61, Figs. 3 & 5; Ex. G at GSHFED00000187-88. The inventors' solution to the problem of arterial bias is the method of scanning to collect Wi-Fi access points by driving along a Chinese Postman route. This avoids random data collection and unsystematic data collection that the Skyhook patents criticize.

81. The claim language in claim 1 of the '988 and '694 patents "avoid[s] arterial bias" does not, however, appear to me to be capable of any sort of objective determination. Avoidance of arterial bias appears to be a relative measure; it is not clear what it is relative to. Based on the claims and specification, one of skill-in-the-art would not know whether a particular database creation technique, or a Wi-Fi device location calculation, will in fact have achieved such "avoidance" within a given target area.

82. There are several reasons for the difficulty in resolving this term and knowing whether any particular database meets this term: (i) there is no criteria for measuring the degree of bias toward streets in the target area; (ii) Chinese postman itself includes driving certain streets more than once and therefore shows the very collection bias sought to be avoided (*see* Figure 4 of the '988, '645 and '245 patents, showing driving every perimeter street twice); and (iii) many access points in the target area may have a street on only one or two sides thus biasing measurements to those streets. Accordingly, merely driving a measurement vehicle along every street in a deliberate fashion does not necessarily "avoid arterial bias" and it is unclear whether or to what extent this requirement is met or could be objectively measured in any given target area. The determination might involve the efficiency of the route followed, the number of measurements taken on each street segment, speed of the vehicle during scanning, the location of each access point relative to streets, and the comprehensiveness of the scanning, to list some of the factors to consider. Even with all of this information, it is unclear how one would use it to determine whether or not there is an arterial bias. As such, it is my opinion that the claims in which the phrase "avoid arterial bias" appears are indefinite; one of skill-in-the art simply would

not know whether a particular system or method actually "avoids arterial bias" in a given target area.

83. If it means anything, "avoids arterial bias" means "eliminate arterial bias." The clearest ordinary meaning of "avoid" is "eliminate." *See, e.g.*, Exhibit P at GSHFED4446. However, even this definition is problematic, for the reasons discussed above. Because each recorded location of an access point always coincides with an actual GPS location of the measuring vehicle, the measurements may be skewed toward the locations at which measurements are actually made—toward the arteries and streets of the target area. Thus, if the vehicle drives along only the streets within the service area, the estimated locations of the access points contained in the database can be expected to be skewed toward those streets. Since these serve as the basis for the computed location of a Wi-Fi device, these computations will also be skewed.

C. The "Logic" Terms.

84. Each asserted claim of the '988 patent recites limitations that require "logic" for performing a particular recited function. Specifically, the claims of the '988 patent require:

- "logic to recalculate position information for Wi-Fi access points previously stored in the database to utilize position information for the newly-discovered readings of previously stored Wi-Fi access points" ('988/1);
- "computer-implemented logic to add records to the database for newly-discovered Wi-Fi access points" ('988/1);
- "computer-implemented clustering logic to identify position information based on error prone GPS information" ('988/2);
- "logic to determine a weighted centroid position for all position information reported for an access point" ('988/3);

- "logic to identify position information that exceeds a statistically-based deviation threshold amount away from the centroid position" ('988/3); and

- "the clustering logic … excludes such deviating position information from the database and from influencing the calculated positions of the Wi-Fi access points" ('988/3).

85. I am informed that in a means-plus-function claim in which the relevant structure is a computer or microprocessor programmed to carry out an algorithm, the disclosed structure has to be more than a general purpose computer. Rather, I understand that the corresponding structure is the computer or microprocessor *as programmed* to carry out an algorithm. If the specification does not disclose with sufficient specificity how the computer is programmed to carry out the particular function stated in the claim, it is my understanding that there is then no corresponding structure disclosed and the limitation should be considered indefinite.

86. As discussed below, I have considered the claims, and it is my opinion that "logic" is not a structure, and that these terms are therefore means-plus-function terms. I have reviewed the disclosure of the '988 patent, and for the reasons discussed below, it is my opinion that it does not disclose corresponding structures capable of performing the functions stated in the "logic" limitations.

1. The "logic" terms are functional.

87. "Logic" is not a structural term. It is not clear from the claims what the relevant "logic" actually is, only what it does. A person of ordinary skill in the art would understand "logic" to mean a series of defined steps for performing a function as opposed to a structure. The steps of the function cannot be determined simply by stating a concept that may be logical – the steps themselves must be provided in order for a structure to be disclosed.

2. The claims and specification of the ‘988 patent do not disclose any corresponding structures for the “logic” terms.

88. I have looked at the various logic elements found in the claims of the ‘988 patent, and find that there is not any structure such as an exemplary algorithm that is disclosed (in either the claims themselves or in the specification) that performs the function corresponding to the means. It is therefore my opinion, that each of the “logic” terms in the ‘988 patent are indefinite.

a. “logic to recalculate position information for Wi-Fi access points previously stored in the database to utilize position information for the newly-discovered readings of previously stored Wi-Fi access points” (claim 1)

89. For example, in the case of

> logic to *recalculate position information for Wi-Fi access points previously stored in the database to utilize position information for the newly-discovered readings of previously stored Wi-Fi access points*

the recalculating function associated with “logic” means is italicized. The specification, however, fails to clearly disclose an algorithm that performs this function. In its proposed construction, presented in the table below, Skyhook appears to suggest that the corresponding structure is an algorithm that “would include a weighting value based on the age of the records.” However, the specification nowhere provides an example of how this is implemented and in particular says nothing about how the existing access points are repositioned or how the weighted average model is built. My understanding, therefore, is that the structure has not been sufficiently disclosed.

90. It is my understanding that the parties have exchanged constructions and taken the following positions with regard to this limitation:

Google's Position	Skyhook's Position
This limitation is indefinite in violation of 35 U.S.C. § 112, ¶ 2 because the specification does not disclose a structure corresponding to the claimed "logic" capable of performing the recited function of "recalculat[ing] position information for Wi-Fi access points previously stored in the database to utilize position information for the newly-discovered readings of previously stored Wi-Fi access points."	Software and/or hardware to recalculate position information for Wi-Fi access points previously stored in the database. This recalculation utilizes new position information for such Wi-Fi access points calculated using scans taken after the previously stored Wi-Fi access points were stored. See "Wi-Fi access points." This is not a means plus function claim element. If the Court were to construe this claim element as a means plus function claim element, then Skyhook identifies the following corresponding structure: *12:24–38* "An additional enhancement to the algorithm would include a weighting value based on the age of the records such that new records represent a more significant indication of the present location for a given access point. Once the parsing process has been completed the central network system . . . begins processing the new data. . . . 2) existing access points are repositioned based on any new data recorded by the scanners. The . . . algorithm factors in the number of records and their associated signal strengths to weight stronger signal readings more than weaker signals with a quasi weighted average model."

91. Skyhook's proposed structure is not "logic" capable of recalculating the positions of a previously stored Wi-Fi access point based on a new reading of those same Wi-Fi access point. The description given is too general, and as noted below, contradicts other descriptions of the process given in the specification. Ex. C at 12:31-38. In addition, although there is a set of equations in columns 12 and 13 of the '988 patent that appear to describe calculations for estimating positions for a number of readings, the specification does not provide an explanation of how to combine these calculations with the requirements identified by Skyhook as the required structure.

92. The specification presents, at best, contradictory information regarding what steps would need to be carried out to perform such "logic." The technique to **avoid erroneous data** in determining the Wi-Fi positions and the technique to **use newly-discovered position information** to improve the quality of previously gathered and determined position information introduced in the '988 specification (Ex. C) at 5:37-41 are in contradiction to each other. With regards to avoiding erroneous data, the specification explains that erroneous information is "removed by the filter" "if 90% of the readings are within 200 meters of each other but the remaining 10% of the readings are 5 kilometers" and "the centroid is recalculated with the remaining location records," Ex. C at 12:8-19. The specification attempts to reconcile the addition of "newly-discovered position information" by explaining that "the error records may be the result of an access point that has moved," and confusingly explains that "[i]n this instance, the centroid for the access points will quickly 'snap' to the new location based on the preponderance of records," Ex. C at 12:21-28.

93. However, these statements run contrary to common sense. First, if records for access points that are moved farther than a threshold distance are filtered out of a calculation, it is unclear how the calculated centroid would move when the new recordings are not considered in the calculation. In addition, one of skill in the art would assume that the "preponderance of records" would favor an older location rather than a new location—presumably an access point that has remained in one place for some time and then suddenly moved would have more records in its original location than in its new location because the newer the location, the fewer the readings associated with that location. This is acknowledged by the specification, which identified problems in prior art databases where "the data across the databases are not contemporaneous; some of the data is new while other portions are 3-4 years old. The age of the access point location is important since over time access points can be moved or taken offline." Ex. C at 3:3-6.

94. The specification attempts to resolve this ambiguity by adding the descriptions claimed by Skyhook to disclose the necessary structure. First, the specification states "[a]n additional enhancement to the algorithm [that] would include a weighting value based on the age of the records such that new records represent a more significant indication of the present location for a given access point." Ex. C at 12:21-28. Unfortunately, no specific value is given for the appropriate weight that would be assigned to each record based on age, even if the information was not filtered out of the data as described earlier in the specification. Next, the specification goes on to describe an algorithm where "existing access points are repositioned based on any new data recorded by the scanners" by "factor[ing] in the number of records and their associated signal strengths to weight stronger signal readings more than weaker signals with a quasi weighted average model," Ex. C at 12:29-38. However, the specification does not explain, for example, how to ensure that new readings with weak signal strengths for an access point would interact with old readings with strong signal strength when determining position—there is no "logic" described, merely disconnected factors. Nor does the specification explain the logical differences between a quasi weighted average model and the criticized rudimentary weighted average model.

95. Finally, the specification discloses that the algorithm would include a "weighting value" but does not disclose *how* the records would actually be recalculated. It says nothing about how the existing access points are repositioned, or how the weighted average model is built. Simply stating what an algorithm may include does not sufficiently disclose it in such a manner that one skilled in the art would know and understand what structure corresponds to the limitation.

96. Furthermore, Skyhook asserts that the construction should be "[s]oftware and/or hardware to recalculate position information for Wi-Fi access points previously stored in the database." However, as stated above, the disclosed structure must include the claimed algorithm.

Skyhook has not identified in its proposed construction or in its cited corresponding structure the algorithm for which the software/hardware is programmed.

b. "computer-implemented logic to add records to the database for newly-discovered Wi-Fi access points" (claim 1)

97. In the case of

> computer-implemented logic to *add records to the database for newly-discovered Wi-Fi access points*

the recalculating function associated with "logic" means is italicized. The specification, however, fails to clearly disclose an algorithm that performs this function. Skyhook appears to suggest that the corresponding structure includes an algorithm that "factors in the number of records and their associated signal strengths to weight stronger signal readings more than weaker signals with a quasi weighted average model." However, the specification nowhere provides an example of how this is implemented, how the formula is adjusted for the number of records, or how the weighted average model is built. My understanding, therefore, is that the structure has not been sufficiently disclosed.

98. It is my understanding that the parties have taken the following positions with regard to this limitation:

Google's Position	Skyhook's Position
This limitation is indefinite in violation of 35 U.S.C. § 112, ¶ 2 because the specification does not disclose a structure corresponding to the claimed "computer-implemented logic" capable of performing the recited function of "add[ing] records to the database for newly-discovered Wi-Fi access points."	Computer-implemented software and/or hardware to add data records to the database for newly-discovered Wi-Fi access points. See "Wi-Fi access points" and "database records." This is not a means plus function claim element. If the Court were to construe this claim element as a means plus function claim element, then Skyhook identifies the following corresponding structure: *12:29–38* "Once the parsing process has been completed

Google's Position	Skyhook's Position
	the central network system . . . begins processing the new data. During this process 1) new access points are added to the database and their physical location is calculated . . . . The . . . algorithm factors in the number of records and their associated signal strengths to weight stronger signal readings more than weaker signals with a quasi weighted average model."

99. The recited function is "add[ing] records to the database for newly-discovered Wi-Fi access points." Skyhook contends that the corresponding structure includes an algorithm that "factors in the number of records and their associated signal strengths"; however, the specification nowhere provides any further details on *how* the algorithm accounts for changes in the numbers of records or signal strengths. The specification discloses that the algorithm would include a "quasi weighted average model" (discussed below) but does not disclose *how* the records would actually be added. It lacks information about how each new access point is added or used in a weighted average.

100. Furthermore, Skyhook asserts that the construction should be "[c]omputer-implemented software and/or hardware to add data records to the database for newly-discovered Wi-Fi access points." However, the disclosed structure must include the claimed algorithm. Skyhook has not, in its proposed construction or in its cited corresponding structure, identified a definite algorithm for which the software/hardware is programmed.

101. The specification criticizes prior art databases that "include the calculated position of scanned access points rather than the raw scanning data obtained by the 802.11 hardware" where each of the databases "calculates the access point location differently and each with a rudimentary weighted average formula," Ex. C at 3:18-22. However, the explanation that "new access points are added to the database and their physical location is calculated," and that the

"algorithm factors in the number of records and their associated signal strengths to weight stronger signal readings more than weaker signals with a **quasi weighted average model**" is not specific enough to inform a person of ordinary skill in the art of the differences between the formula criticized by the patentees and the proposed method. Ex. C at 12:32-38. The specification does not explain why a "rudimentary weighted average formula is distinct from the "quasi-weighted average model" disparaged a few paragraphs earlier and in particular does not provide an explanation of the logical differences between them. The specification also describes a calculated, final $\{Lat_i, Long_i\}$, a "calculation" that "is then used as the final centroid value for the location of that access point" and is "stored in the database," but does not distinguish why this storage of this calculation is an improvement over the calculations disparaged in the prior art. Ex. C at 13:26-30, *cf.* 3:18-22. There is therefore nothing in the specification, nor in the art, that explains in any definite way logic intended by the inventors for adding newly discovered access points to the claimed database.

c. "computer-implemented clustering logic to identify position information based on error prone GPS information" (claim 2)

102. In the case of

> computer-implemented clustering logic to *identify position information based on error prone GPS information*

the recalculating function associated with "logic" means is italicized. The specification, however, fails to clearly disclose an algorithm that performs this function. Skyhook appears to suggest that the corresponding structure includes an algorithm that "uses a definable threshold based on the sigma of this distribution to filter out access points that are in error." However, other than one very specific example the specification nowhere provides an example of how this is implemented, and in fact contains contradictory descriptions of how this process would be carried out. My understanding, therefore, is that the structure has not been sufficiently disclosed.

103. It is my understanding that the parties have taken the following positions with regard to this limitation:

Google's Position	Skyhook's Position
This limitation is indefinite in violation of 35 U.S.C. § 112, ¶ 2 because (1) it does not apprise one skilled in the art of the bounds of the claim, and in particular fails to apprise the person of ordinary skill in the art what constitutes "error prone GPS information"; and (2) in violation of 35 U.S.C. § 112, ¶ 2 because the specification does not disclose a structure corresponding to the claimed "computer-implemented clustering logic" capable of performing the recited function of "identify[ing] position information based on error prone GPS information."	Computer-implemented software and/or hardware to identify when position information for a Wi-Fi access point based on GPS readings is likely to be erroneous. The software and/or hardware identifies position information that is not located within a certain threshold distance of other position information for the Wi-Fi access point. This is not a means plus function claim element. If the Court were to construe this claim element as a means plus function claim element, then Skyhook identifies the following corresponding structure: *12:1-12:10* "In some cases the GPS receiver may record erroneous or error records for some period of time, which could negatively affect the final access point location calculation. The parser and filter process identifies these bad records and either corrects them or removes them from the system. The filtering process users clustering techniques to weed out error prone GPS readings. For example, if 90% of the readings are within 200 meters of each other but the remaining 10% of the readings are 5 kilometers away then those outliers are removed by the filter . . . ."

104. The recited function is "identify[ing] position information based on error prone GPS information." The specification fails to clearly link corresponding structure to the recited recalculating position information function. Although Skyhook contends that the corresponding structure is a filtering process that uses "clustering techniques to weed out error prone GPS readings," the specification does not provide further details anywhere. The specification

discloses that the algorithm uses "clustering techniques," but does not disclose what that technique is. It only refers to an exemplary concept.

105. Further, Skyhook asserts that the construction should be "[c]omputer-implemented software and/or hardware to identify when position information for a Wi-Fi access point based on GPS readings is likely to be erroneous." As with its other constructions of this type, Skyhook has not identified the specific algorithm in the specification for which the software/hardware is programmed in its proposed construction and therefore has not identified structure corresponding to the claimed "logic."

106. With regards to "computer-implemented clustering logic to identify position information based on error prone GPS information" limitation (found in claim 2 of the '988 patent) and "the clustering logic … excludes such deviating position information from the database and from influencing the calculated positions of the Wi-Fi access points" limitation discussed below (found in claim 3 of the '988 patent) among other ambiguities, in the only place outside of the claims or the summary where the specification discusses "clustering," the specification describes "calculat[ing] the weighted centroid for the access point using all reported data . . . then determin[ing] the standard deviation based on the distribution of the reported locations" and "us[ing] a definable threshold based on the sigma of this distribution to filter out access points that are in error." Ex. C at 12:14-20. However, only one example of a "threshold" is given "if 90% of the readings are within 200 meters of each other but the remaining 10% of the readings are 5 kilometers away then those outliers are removed by the filter." Ex. C at 12:6-11. The specification fails to define what threshold, other than the specific example given, would indicate access points that are in error.

107. In addition, as discussed above with respect to the "logic to recalculate position information for Wi-Fi access points previously stored in the database to utilize position information for the newly-discovered readings of previously stored Wi-Fi access points"

limitation found in claim 1 of the '988 patent, the specification fails to describe any logic for how new data on "moved" access points would be accounted for in instances where an access point moves outside a threshold distance. Furthermore, the patent fails to identify what errors are caused by GPS errors as opposed to other types of errors. *See generally* Ex. C at 12:1-20, *cf.* 12:21-28 ("[n]ote that the error records may be the result of an access point that has moved").

d. "the clustering logic … excludes such deviating position information from the database and from influencing the calculated positions of the Wi-Fi access points" (claim 3)

108. Skyhook does not propose a construction for this term. The specification generalizes the concept in a summary. Ex. C at 12:16-17 ("For example, if 90% of the readings are within 200 meters of each other but the remaining 10% of the readings are 5 kilometers away then those outliers are removed by the filter . . . The system uses a definable threshold based on the sigma of this distribution to filter out access points that are in error. Once these error records are marked, the centroid is recalculated with the remaining location records to determine the final centroid."). The key points of the concept are not disclosed, such as how the threshold, sigma, and centroid are calculated.

109. Therefore, because the means-plus-function "logic" claims of the '988 patent lack corresponding structures, they are indefinite.

e. "logic to determine a weighted centroid position for all position information reported for an access point" (claim 3)

110. In the case of

> logic to *determine a weighted centroid position for all position information reported for an access point*

the recalculating function associated with "logic" means is italicized. The specification, however, fails to clearly disclose an algorithm that performs this function. Skyhook appears to suggest that the corresponding structure includes an algorithm that "calculates the weighted centroid for

the access point using all reported data." However, the specification nowhere provides an example of how this is implemented. My understanding, therefore, is that the structure has not been sufficiently disclosed.

111. It is my understanding that the parties have taken the following positions with regard to this limitation:

Google's Position	Skyhook's Position
This limitation is indefinite in violation of 35 U.S.C. § 112, ¶ 2 because the specification does not disclose a structure corresponding to the claimed "logic" capable of performing the recited function of "determine[ing] a weighted centroid position for all position information reported for an access point."	Software and/or hardware to determine a weighted centroid position for a Wi-Fi access point. The weighted centroid position is determined using all position information reported for that Wi-Fi access point. See "weighted centroid position" and "Wi-Fi access points." This is not a means plus function claim element. If the Court were to construe this claim element as a means plus function claim element, then Skyhook identifies the following corresponding structure: *12:11–13* "In particular, the system first calculates the weighted centroid for the access point using all reported data." *12:34–44* "The . . . algorithm factors in the number of records and their associated signal strengths to weight stronger signal readings more than weaker signals with a quasi weighted average model. During data gathering, a WPS user is equipped with a Wi-Fi receiver device which measures Received Signal Strength (RSS) from all the available Wi-Fi access points, and then extracts location information of corresponding access points."

112. The recited function is "determine a weighted centroid position for all position information reported for an access point." The specification fails once again to clearly link corresponding structure to the claimed recalculating position information function. Skyhook contends that the corresponding structure is an algorithm that "factors in the number of records and their associated signal strengths to weight stronger signal readings more than weaker signals with a quasi weighted average model." But while it is true that the specification discloses that the "system first calculates the weighted centroid for the access point using all reported data," critically, it does not disclose what that calculation is. As discussed above at paragraph 87, simply naming a conceptual algorithm does not sufficiently disclose the steps of the algorithm in such a manner so as to disclose a structure.

113. In particular, despite the applicants' initial criticism that "each of the databases calculates the access point location "with a rudimentary weighted average formula," Ex. C at 3:18-22, they do not offer any alternative. The specification of the '988 patent states that "the system first calculates the weighted centroid for the access point using all reported data" without any other detail about how the weighted centroid position is calculated, Ex. C at 12:11-13, failing to distinguish it from a "rudimentary" weighted average formula. The specification then states that "the centroid is recalculated with the remaining location records to determine the final centroid," with no further explanation of the initial weighted centroid.. As with the "computer-implemented logic to add records to the database for newly-discovered Wi-Fi access points" limitation found in claim 1 of the '988 patent, the inventors fail to explain why a "rudimentary weighted average formula" is distinct from a "quasi-weighted average model," and in particular the specification provides no explanation of the logical differences between them. There is

therefore nothing in the specification, nor in the art, that explains what is meant by "logic to determine a weighted centroid position for all position information reported for an access point."

114. Further, Skyhook asserts that the construction should be "[s]oftware and/or hardware to determine a weighted centroid position for a Wi-Fi access point." Skyhook has not identified the specific algorithm for which the software/hardware is programmed in its proposed construction.

f. "logic to identify position information that exceeds a statistically-based deviation threshold amount away from the centroid position" (claim 3)

115. Finally, in the case of

> logic to *identify position information that exceeds a statistically-based deviation threshold amount away from the centroid position*

the recalculating function associated with "logic" means is italicized. The specification, however, fails to clearly disclose an algorithm that performs this function. Skyhook appears to suggest that that the corresponding structure includes the same algorithm that it earlier describes for "identify position information based on error prone GPS information," namely "uses a definable threshold based on the sigma of this distribution to filter out access points that are in error." However, other than that one very specific example referenced above at paragraph 106, the specification nowhere provides an example of how this is implemented, and in fact contains contradictory descriptions of how this process would be carried out. My understanding, therefore, is that the structure has not been sufficiently disclosed.

116. It is my understanding that the parties have taken the following positions with regard to this limitation:

Google's Position	Skyhook's Position
This limitation is indefinite in violation of 35 U.S.C. § 112, ¶ 2 because the specification does not disclose a structure corresponding to the claimed "logic" capable of performing the recited function of "identify[ing] position information that exceeds a statistically-based deviation threshold amount away from the centroid position."	The software and/or hardware excludes such deviating position information from being stored in the database of WiFi access points. Such deviating position information is not used to determine the calculated positions of the Wi-Fi access points. See "computer-implemented clustering logic . . . "and "Wi-Fi access points." This is not a means plus function claim element. If the Court were to construe this claim element as a means plus function claim element, then Skyhook identifies the following corresponding structure: *12:1–12:19* "In some cases the GPS receiver may record erroneous or error records for some period of time, which could negatively affect the final access point location calculation. The parser and filter process identifies these bad records and either corrects them or removes them from the system. The filtering process users clustering techniques to weed out error prone GPS readings. For example, if 90% of the readings are within 200 meters of each other but the remaining 10% of the readings are 5 kilometers away then those outliers are removed by the filter . . . . In particular, the system first calculates the weighted centroid for the access point using all reported data. It then determines the standard deviation based on the distribution of the reported locations. The system uses a definable threshold based on the sigma of this distribution to filter out access points that are in error. Once these error records are marked, the centroid is recalculated with the remaining location records to determine the final centroid . . . ."

117. The recited function is "identify[ing] position information that exceeds a statistically-based deviation threshold amount away from the centroid position." The specification again fails to clearly link corresponding structure to the recited recalculating

position information function. Skyhook contends that the corresponding structure is a filtering process that employs "clustering techniques to weed out error prone GPS readings" by calculating a weighted centroid, determining the standard deviation, and using a definable threshold based on the sigma of the distribution of the reported locations. As explained above at 108, the specification again does not provide enough detail into calculating the weighted centroid, the standard deviation, or the definable threshold to allow one skilled in the art to know and understand what structure corresponds to the limitation.

118. Skyhook also asserts here that the construction should be "software and/or hardware [that] excludes such deviating position information from being stored in the database of WiFi access points." For the same reasons as for Skyhook's similar constructions, explained at 96, 100, 105, 114, Skyhook has failed to identify the specific algorithm for which the software/hardware is programmed in its proposed construction.

D. "Predefined Rules" and "Rules" ('897 patent, claims 1 and 3)

119. In claim 1 of the '897 patent, the inventors claim the step of "using the recorded location information for each of the observed WiFi access points in conjunction with *predefined rules* to determine whether an observed WiFi access point should be included or excluded from a set of WiFi access points" (emphasis added).

120. In dependent claim 3 of the '897 patent, the "predefined rules" are "*rules* to determine a reference point and to compare the recorded location information for each of the observed WiFi access points to the reference point."

121. In my opinion, these terms provide no real guidance or description to a person of ordinary skill in the art, and a person with ordinary skill in the art cannot use these terms to determine what the claims do or do not cover. In the context of a computer database, almost

anything could be a "rule," and it would necessarily be "predefined" prior to the relevant operation being executed.

122. Although the '897 patent refers to clustering and filtering algorithms, *see, e.g.*, Ex. F at 9:11-15, I understand that Skyhook contends these limitations should be construed more broadly than the disclosed algorithms. In my opinion, these limitations do not clearly define what is or is not within the scope of the claims.

E. "Being suited" ('245 patent, claim 1)

Claim 1 of the '245 patent requires "based on the number of Wi-Fi access points identified via received messages, choosing a corresponding location-determination algorithm from a plurality of location-determination algorithms, said chosen algorithm being suited for the number of identified Wi-Fi access points."

123. The term "being suited" as used in the '245 patent I find to be ambiguous and subjective. It is applied apparently to different types of equations or algorithms that can be used for different numbers of access points. But the patent does not teach any objective way to determine which equations are suitable and which are not, or even give particular criteria by which suitability might be judged. And, given that the patent is supposed to be teaching one of skill in the art how to determine location, the ambiguity here goes to the thrust of what should have been provided in the patent. Accordingly, I find this term subjective and ambiguous. In my opinion, it is indefinite.

VI. THE PROPER CONSTRUCTION OF CERTAIN DISPUTED CLAIM TERMS

A. "Target area"

124. Claim 1 in each of the '988 and '694 patents requires "a database of Wi-Fi access points for at least one target area having a radius on the order of tens of miles" and the database must "includ[e] database records for substantially all Wi-Fi access points in the target area."

Claim 1 of the ‘245 patent similarly requires “a reference database of calculated locations of Wi-Fi access points in a target area.”

125. It is unsurprising that the majority of the claims require a “target area.” As discussed above, the common specification is dominated by a single method for creating the database, which involves driving a vehicle in a systematic manner along every street. The ‘988 patent explains that following the most efficient planned route through the entire target area is important not only to acquire as many access points as possible, but also to achieve the inventors’ key goals of avoiding arterial bias and achieving reference symmetry.

126. The necessary first step in programmatically gathering information about Wi-Fi access points is to identify the “target area” in which to plan a scanning route. Ex. C at 8:41-44 (“Preferred embodiments of the invention include a methodology for identifying a target region for coverage and then using the Chinese Postman routing algorithm for planning the vehicle route.”) & *id*. at 8:28-59; Ex. G at GSHFED187-189; Ex. H at GSHFED297-298. Without a pre-identified “target area,” it would be impossible to “plan[] the vehicle route,” Ex. C at 8:43-44, or “perform[] a planned audit … following designated scanning routes,” Ex. G at GSHFED189 (also discussing a “systematic” traverse of the target area). In simple terms, you cannot plan a route if you do not know where you are going.

127. The patent and prosecution history also confirm that once the relevant geographic region is identified, the shortest possible route must be pre-planned for traversing all drivable roads. *See, e.g.,* Ex. C at 7:37-44 (“These vehicles 201 follow a programmatic route through target scan areas to gather data in the most optimal fashion producing the highest quality data. The target scan areas typically represent a large metropolitan area including *every single drivable street* in 15-20 mile radius”) (emphasis added); Ex. G at GSHFED188 (criticizing failure in the prior art to “follow[] designated scanning routes”); *id*. (“Collecting multiple readings of Wi-Fi

access points *in a systematic fashion, as described in the application,* provides reference symmetry within the target area."); Ex. G at GSHFED187-89.

128. In light of the specification and the prosecution history, it is my opinion that "target area" should be defined as "a pre-identified geographic region throughout which a shortest route is planned along all drivable roads."

129. I have considered Skyhook's proposal that a "target area" should be defined as a "targeted geographic area." It is my opinion that Skyhook's proposed definition is incorrect. Skyhook's definition provides no clarity whatsoever. Although a "target area" is clearly a "geographic area," that is not all that it is. As explained above, to receive any benefit from the invention as described in the patent, the "target area" must be pro-actively identified in advance of data collection so that the route can be planned. You cannot decide what the "target area" is after scanning is complete. Skyhook's construction also is in error because it disregards the teaching of the patents and prosecution history that the claimed "target area" is an area that is traversed efficiently, for example, by using the Chinese Postman method.

B. The Location Terms: "calculated position information" ('988/1 & '694/1); "calculated positions of the Wi-Fi access points" ('988/3); "calculated locations" ('245/1 & 2); "recorded location information" ('897/1 & 3)

130. In every patent, each of the asserted claims requires a database of calculated Wi-Fi access point locations. The patents-in-suit use several phrases for the same concept: "calculated position information" for the Wi-Fi access point ('988/1 and '694/1), "calculated positions of the Wi-Fi access points" ('988/3), "calculated locations" ('245/1 and 2), and "recorded location information" ('897/1 & 3) are all synonymous. It is my opinion that each of these terms should be defined as:

> The physical location (*i.e.*, latitude and longitude) attributed to each Wi-Fi access point determined mathematically from readings recorded along a shortest planned route throughout all drivable roads in the target area (*i.e.*, by following the Chinese Postman routing algorithm). The "calculated position information" cannot

> be based on randomly, or non-systematically, collected readings of Wi-Fi access points.

In reaching this opinion, I have relied on the language of the claims themselves, the specification, and the applicants' own characterization of their invention in their correspondence with the PTO during prosecution.

131. These sources indicate that the calculated position of a Wi-Fi access point is its estimated physical location as determined based on scanning data that was recorded. *See* Ex. C at 4:28-40. But they also indicate to a person of ordinary skill that the claimed "calculated position information" cannot be based on just any scanning data.

132. Instead, a person of ordinary skill would understand that the claimed calculated position information must be based on data gathered while systematically and efficiently traversing all drivable roads in the target area using a Chinese Postman routing algorithm in order to avoid arterial bias, and cannot be based on Wi-Fi access point readings collected randomly, or non-systematically. The inventors criticized the Random Model, and the problem of arterial bias, that they believe results from it, extensively in their patent. Ex. C at 3:12-18, 7:52-8:27, 9:57-61; Figs. 3, 5. They also directly contrasted the Random Model with their own solution:

> Another approach is develop routing algorithms that include every single street in the target area so as to avoid arterial bias in the resulting collection of data thus producing a more reliable positioning system for the end users. FIG. 4 describes an optimized routing algorithm known as the Chinese Postman to calculate the most efficient driving route for covering every single street in a target area.

Ex. C at 8:28:34; *see also id*. at 7:37-44 ("These vehicles 201 follow a programmatic route through target scan areas to gather data in the most optimal fashion producing the highest quality data. The target scan areas typically represent a large metropolitan area including *every single*

drivable street in 15-20 mile radius"), Ex. C at 9:12-19 (discussing advantages of Chinese Postman), Ex. C at 9:64-10:4 (same).

133. In forming my opinion regarding the proper construction of the "location" terms, I have also considered the inventors' statements to the PTO during prosecution of the '988 and '694 patents.[3] I note that Skyhook emphasized to the Examiner that the prior art of record was "completely silent regarding any method of determining the location of Wi-Fi access points" and "silent regarding any particular route or scheme taken or used by the mobile station to gather location information about wireless access points." Ex. G at GSHFED185 & GSHFED186. As they did in the specification, the applicants contrasted random, or, non-systematic, data collection with their invention:

> [N]one of the cited reference teach or suggest conducting an audit of an area to build a reference database of the locations of Wi-Fi access points in a target area so as to provide reference symmetry and avoid arterial bias. … Namely, as described in the application, the location data collected by the wardrivers is often inaccurate, incomplete, and grows organically *rather than being collected in a systematic fashion to purposefully avoid arterial bias*. See Application at ¶¶ 15-17.

Ex. G at GSHFED187-88. The cited paragraphs 15-17 of the Application correspond to unamended claims 1-3 as recited in the Summary of the '988 patent at column 4, lines 28-57. *See* Ex. G at GSHFED234.

134. I also think it quite relevant that the applicants emphasized their method of "[c]ollecting multiple readings of Wi-Fi access points *in a systematic fashion*, as described in the

[3] Although I have also reviewed the prosecution histories of the '245 and '897 patents, I did not identify any discussion in those documents between the applicants and the PTO that is relevant to the meaning of the "location" terms.

application," and the resulting improvement in the calculated location information. Ex. G at GSHFED188 (emphasis added). The applicants described this as their "solution[]" to "the arterial bias problem": "by performing *a planned audit*, and avoiding arterial bias, applicants at least achieve more complete information about access points in the target area, higher quality estimates of access point locations, and reference symmetry." Ex. H at GSHFED298 (emphasis added).

135. I also note that during prosecution of the '694 patent, the applicants stated they were "amending claim 1 to more particularly recite characteristics of the calculated position information." Ex. H at GSHFED298. This would indicate to a person of ordinary skill in the art that the nature of the claimed "calculated position information" depends on the inventor's comprehensive and systematic method of collecting the underlying data.

C. "substantially all Wi-Fi access points in the target area"

136. Both of the independent claims of the '988 and '694 patents require that the database "includ[e] database records for substantially all Wi-Fi access points in the target area." *See* '988 patent, claim 1; '694 patent, claim 1. The applicants stressed that the point of their purported invention was to capture as many access points as possible, and preferably all of them. *See, e.g.*, Ex. C at 8:44-47 ("The scanning vehicle [401] follows the optimal route according to the algorithm … ensuring that all observable access points are detected and mapped by the system."); Ex. G at GSHFED188 ("[B]y performing a planned audit … applicants at least achieve more complete information about access points in the target area[.]"). Based on the specification, a person of skill in the art would understand that "substantially all" access points are required to serve the purpose of "achiev[ing] more complete information about access points in the target area." While not a concrete numerical standard, this in essence means "all but an insignificant number of Wi-Fi access points in the target area."

137. Skyhook's proposal does not conform to the applicants' stated goal of collecting "more complete information." By rewriting the claim to insert "observed" into "substantially all Wi-Fi access points so that it becomes "substantially all *observed* Wi-Fi access points," Skyhook is divorcing the methodology disclosed in the specification—collecting access points using a planned route—from the intended result of the method—"to fully explore and cover the streets of a target region" in order to gather *more* access points than would be achieved through random collection. *See, e.g.*, Ex. C at 5:24-37. Skyhook's rewriting would exclude the purpose of the disclosed collection method from the boundaries of the claim. For example, a "target area" might be scanned and 500 Wi-Fi access points included in the database of the claims. Six months later, there might now be 1,000 WiFi access points in that same target area. If the target area had not been rescanned during that time, the database would still have 500 access points, and would still have "substantially all *observed* Wi-Fi access points" simply because no observations had been made during a time in which the actual number of Wi-Fi access points present changed dramatically. Skyhook's proposed construction would destroy the usefulness of the allegedly improved location system. Ex. C at 5:24-27.

138. Skyhook's proposed construction differs from the specification in another important way. As noted above, the specification discuses how to "ensur[e] that all *observable* access points are detected and mapped by the system." Ex. C at 8:44-47 (emphasis added). *Observable* access points are different from *observed* access points. The inventor's goal was to ensure that as many access points as possible were included in the database because the more access points it has, the better the system is likely to be at determining the location of mobile devices. But the claim does not require that each and every access point in the target area be included in the database. The claim phrase "substantially all" accounts for the possibility that some *de minimus* number of WiFi access points could be excluded from the database, whether because they are unobservable of for some other reason. (The number of unobservable access points is likely to be quite small relative to the total number of access points in the target area. A

Wi-Fi access point that cannot be seen by devices with Wi-Fi radios cannot be used by them, and the purpose of an access point is to provide network connectivity.)

D. "providing a reference database of calculated locations of Wi-Fi access points in a target area"

139. Claim 1 of the '245 patent requires "providing a reference database of calculated locations of Wi-Fi access points in a target area." Consistent with my opinion regarding the proper construction of "calculated locations," the database of the '245 patent will contain information about the physical location (*i.e.*, latitude and longitude) attributed to each Wi-Fi access point determined mathematically from readings recorded along a shortest planned route throughout all drivable roads in the target area (*i.e.*, by following the Chinese Postman routing algorithm), and cannot be based on randomly, or non-systematically, collected readings of Wi-Fi access points. *See above* at ¶¶ 130 - 135. For the same reasons the calculation of the WiFi access point location excludes randomly, or non-systematically, collected readings of Wi-Fi access points, so too must "a reference database of calculated locations" exclude such readings.

140. In my opinion, the proper construction of "providing a reference database of calculated locations of Wi-Fi access points in a target area" is therefore: "A database that contains calculated locations for all the Wi-Fi access points collected in the pre-identified target area by scanning a shortest planned route along all drivable roads. The database does not include information about Wi-Fi access points gathered using random or end-user based collection methods."

E. "a WiFi-enabled device communicating with WiFi access points within range of the WiFi-enabled device so that observed WiFi access points identify themselves"

141. A device may use either active or passive scanning to discover the existence of nearby access points. An "active" scan is done by broadcasting multiple requests to any wireless access points in range and recording the responses, which are typically a unique identifier such as a MAC address. *See, e.g.*, Ex. F at Fig. 2, Fig. 5, 6:53-59, 7:12-26. In contrast, a "passive"

scan does not broadcast a request, but merely records data sent out by any nearby wireless access points that are both in range and broadcasting. Although both forms of scanning take a fraction of a second to complete, passive scanning takes longer because the scanning device must wait for signals sent out by APs at a set rate, rather than prompting a beacon to send a reply. Therefore, active scanning is about ten times as fast as passive scanning but uses more overhead (*e.g.*, battery power, bandwidth); the response time is generally 10 ms for active versus 100 ms for passive scanning. *See, e.g.*, Ex. BB, Leary et al., "Wireless LAN Fundamentals: Mobility," Jan. 9, 2004, *available at* http://www.ciscopress.com/articles/article.asp?p=102282&seqNum=2

142. One of ordinary skill in the art would understand the term "a WiFi-enabled device communicating with WiFi access points within range of the WiFi-enabled device so that observed WiFi access points identify themselves" in claim 1 of the '897 patent to mean "a user device having a Wi-Fi radio actively searching for Wi-Fi access points by transmitting a signal to all Wi-Fi access points within range and receiving a response that includes a unique identifier (*e.g.*, a MAC address) from each such Wi-Fi access point."

143. Skyhook asserts that the claim term does not require active searching for access points, but rather encompasses passive scanning as well. I disagree. The language of the claim itself specifically says the Wi-Fi access points identify themselves in response to a communication from a Wi-Fi enabled device: "a WiFi-enabled device communicating with WiFi access points within range of the WiFi-enabled device *so that* observed WiFi access points identify themselves." '897, claim 1 (emphasis added). This is the explicit definition of active scanning under the IEEE 802.11 standard (a standard that is expressly cited in the patent itself); *see also id*. at 7:15-19 ("The 802.11 radio sends out a probe request to all 802.11 access points [204] within range. According to the 802.11 protocol, those access points in receipt of a probe request will transmit a broadcast beacon containing information about the access point."); Fig. 2. A person of ordinary skill in the art would understand the act of communicating with an access

point so that it responds to be the sending a probe request and receiving a response as disclosed in the patent, and discussed in the 802.11 standard.

F. "in response to a user application request to determine a location of a user-device having a Wi-Fi radio"

144. The second step of clam in the '245 patent is triggering a request to all Wi-Fi access points within range "in response to a user application request to determine a location of a user-device having a Wi-Fi radio." I understand that Skyhook contends an operating system is a "user application" within the meaning of the '245 patent. I do not agree.

145. An operating system is not a user application—user applications run on an operating system. *See, e.g.*, the definitions of "application," "utility"/"utility program," and "operating system" in the *Microsoft Computer Dictionary* (Ex. R at 31, 378, 544) and *Webster's New World Computer Dictionary* (Ex. S at 23, 264-265, 387). The '245 patent itself does not list operating systems among applications. Consistent with this well-understood meaning in the art, the exemplary applications useful on mobile devices listed in the '245 patent are all applications that run on an operating system: "[m]obile email, walkie-talkie services, multi-player gaming and call following," keeping track of individuals or vehicles, and finding specific stores or services near to the end user. *See* Ex. E at 1:31-42.

146. The '245 patent also distinguishes between user applications, an operating system, hardware, and the interfaces that support these. For example, Fig. 9, and the portion of the specification that describes Fig. 9, describes separately user applications such as "an application or service [901] that utilizes location readings," an application programming interface (Fig. 9, element 910) (commonly called an "API"), and other software including the "positioning software 103" that interacts with the device hardware and other software to actually determine the location as requested by the end-user facing application. Ex. E at 6:12-19; Fig. 1 (*esp.* elements 101, 103); Fig. 9 (esp. elements 901, *cf.* 910, box 103).

147. An API is an interface between different software programs, and is typically used by an application program to communicate with the OS or some other program to direct the

performance of another program. *See, e.g.*, Ex. AA *PC Magazine Encyclopedia* (definition at "API") *available at* http://www.pcmag.com/encyclopedia_term/0,2542,t=API&i=37856,00.asp. As this definition suggests, an operating system or program does not to need an API to mediate interactions with itself. In the '245 patent, the API delivers location information to the "location application." Ex. E at 6:52-56; Fig. 9.

148. A "user" or "end user" is commonly understood to be the consumer who is using a device to perform tasks. *See, e.g.*, the definitions of "end user" and "user" in the *Microsoft Computer Dictionary* (Ex. R at 193) and *Webster's New World Computer Dictionary* (Ex. S at 129 and 387). Furthermore, within the '245 patent, "users" are referred to as consumers or end-users of mobile devices. *See* Ex. E at 1:36-40 (parents, supervisors, and business travelers are examples of "users" who "demand/seek applications" that are location aware), Ex. E at 8:27, 9:10, 9:54-55.

149. In my opinion, it is therefore appropriate to construe the term "in response to a user application request to determine a location of a user-device having a Wi-Fi radio" in claim 1 as "in response to a request made by an end-user facing application, *i.e.*, not by the operating system, to determine the location of an end user-device using a Wi-Fi radio."

G. "a user-device having a Wi-Fi radio"

150. As described immediately above, the "users" referred to in the '245 patent are consumers or end-users of mobile devices. *See also*, Ex. E at 1:36-40; 8:27; 9:10; 9:54-55. Accordingly, the term "a user-device having a Wi-Fi radio" in claim 1 should be construed as "an end-user or consumer device having a Wi-Fi radio."

H. "simple signal strength weighted average model"

151. Claim 6 of the '245 requires that one of "the plurality of location determination algorithms includes a simple signal strength weighted average model." The specification discloses determining a device's location by "compar[ing] the list of observed access points along with their calculated signal strengths to weight the location" of the device user ('245

patent, 7:1-3) and suggests several weighting methods including "triangulation techniques" and "simple signal strength weighted average models" (*see* '245 patent 7:3-12). Weighting methods based on signal strengths are described only once in the '245 specification, defined as taking the average location of access point readings and using their associated signal strengths "to weight stronger signal readings more than weaker signals." *See* Ex. E at 12:29-32. *See also* Ex. T at GSHFED_0004595 ("signal strength"), Ex. P at GSHFED_0004470 ("weighted average"), Ex. U at GSHFED_0004431 ("weighted"). Specific mathematical calculations that would average positions weighted by their associated signal strengths are shown in the '245 patent at 12:45-60 and 13:1-17; these are the only discussions of weighted average of signal strengths in the specification.

152. Although there is one mathematical formula in the specification for taking the average of a location weighted by signal strength, it should be noted that this description in the specification is made in the context of determining the position of a Wi-Fi access point—not in the context of determining the location of a user device as in claim 6 of the '245 patent.

153. Nevertheless, a person of ordinary skill in the art would understand a model to be a mathematical formula, and a weighted average to be an average in which each component is multiplied by a factor to give it its proper importance, where the sum of the factors equals one. *See* Ex. T at GSHFED_0004594 ("model"), Ex. T at GSHFED_0004597 ("weighted average"), Ex. P at GSHFED_0004448 ("to calculate" is "to . . .determine by arithmetical or mathematical reckoning."), Ex. P at GSHFED_0004470 ("weighted average"), Ex. U at GSHFED_0004431 ("weighted"), Ex. O at GSHFED_0004434 ("algebra"), Ex. V at GSHFED_0004442 ("calculate"), and Ex. W at GSHFED_0004479 ("algorithm"). Therefore a person of ordinary skill in the art would understand the correct construction of "a simple signal strength weighted average model" to be "a calculated average of signal strength measurements resulting from the multiplication of each measurement by a numeric or algebraic factor to weight stronger signal readings more than weaker signals, used to determine the location of a user device."

I. "triangulation technique"

154. Dependent Claim 8 of the '245 states: "The method of claim 1 wherein the plurality of location-determination algorithms includes a triangulation technique." The specification describes a triangulation technique as one possible method "to weight the location of" the device user. *See* Ex. E 6:67-7:12. The only "triangulation" described in the specification are the techniques used to determine location would have been known to a person of ordinary skill in the art at the time the application that became the '245 patent was filed. *See generally* '245 patent at 1:61–63 and 2:7–9, GSHFED_0004592 ("algorithm"), GSHFED_0004596 ("triangulation"), GSHFED_0004466-67 ("triangulate"), GSHFED_0004430 ("triangulate" and "triangulation").

155. It is my opinion that a person of ordinary skill in the art would therefore understand the construction of "triangulation technique" to be "calculating the physical location of a user device by using the strength of signals received from two or more Wi-Fi access points whose locations have been calculated, by the formation of triangles having the user device and each such Wi-Fi access point as the vertices."

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge, information and belief.

Executed on September 14, 2011, in New York, NY.

Anthony S. Acampora, Ph.D.