

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG ELECTRONICS CO., LTD., and
SAMSUNG ELECTRONICS AMERICA, INC.,

Petitioners

v.

FOUR BATONS WIRELESS, LLC,

Patent Owner

Case IPR2025-00494

U.S. Patent No. 8,073,436

**DECLARATION OF DR. MICHAEL KOTZIN IN SUPPORT
OF PETITION FOR INTER PARTES REVIEW
OF U.S. PATENT NO. 8,073,436**

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I. INTRODUCTION

1. I have been retained by Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc. (“Samsung” or “Petitioners”) as an independent expert consultant in this proceeding before the United States Patent and Trademark Office (“PTO”).

2. I am aware that IMS Consulting & Expert Services, LLC is billing my time at a rate of \$545/hour for my services in this proceeding.

3. My compensation is in no way contingent on the nature of my finding, the presentation of my findings in testimony or this declaration, or the outcome of this or any other proceeding. I have no other interest in this proceeding.

4. I have been asked to consider whether certain references disclose and/or suggest the features recited in claims 1-17 and 19 of U.S. Patent No. 8,073,436 (“the ’436 patent”) (Ex. 1001) and whether one or more references, alone or in combination, renders those claims obvious to a person of ordinary skill in the art.¹ My opinions are set forth below.

¹ Where appropriate, I refer to exhibits which I understand will be attached to the petition for *inter partes* review of the ’436 patent (the “Petition”).

II. BACKGROUND AND QUALIFICATIONS

5. I am an independent consultant. All of my opinions stated in this declaration are based on my own personal knowledge and professional judgment. In forming my opinions, I have relied on my knowledge and experience in electrical engineering, computer science, and wireless communication technology.

6. I am over 18 years of age and, if I am called upon to do so, I would be competent to testify as to the matters set forth herein. A copy of my current curriculum vitae, which details my education and professional and academic experience, is included as Ex. 1003 in this proceeding. The following provides an overview of some of my experience that is relevant to the matters set forth in this declaration.

7. I expect to testify regarding my background, qualifications, and experience relevant to the issues in this litigation. I have a Ph.D. in Electrical Engineering and Computer Science from Northwestern University. In fact, I hold the following four degrees from Northwestern University in Evanston, Illinois and the University of Illinois in Urbana, Illinois:

- Ph.D. in Electrical Engineering and Computer Science from Northwestern University, 1981;
- M.S. in Electrical Engineering from Northwestern University, 1977;

- B.S. in Electrical Engineering from the University of Illinois, 1975;
and
- B.S. in Chemistry from the University of Illinois, 1975.

8. As noted above, in 1975, I received a Bachelor of Science in Electrical Engineering and a Bachelor of Science in Chemistry from the University of Illinois at Urbana. In 1977, I received a Masters of Science in Electrical Engineering from Northwestern University in Evanston, Illinois. My master's project was entitled "Digital Filter Implementation Using Cascaded Microprocessors." At the time, microprocessors were a nascent technology and there was great interest in using them to perform useful digital signal processing operations especially those useful for wireless communications such as digital filtering. Practical speeds of single microprocessors were very limited, and there was great interest utilizing multiple devices simultaneously to collaboratively perform processing functions. My project demonstrated a design and hardware prototype for digital filtering of a signal utilizing three Motorola MC6800 microprocessors simultaneously to take advantage of a nearly three-fold increase in processing speed.

9. Also as noted above, in 1981, I received a Ph.D. in Electrical Engineering and Computer Science from Northwestern University in Evanston, Illinois. My dissertation was entitled "Short Range Communication Using Diffusely Scattered Infrared Radiation." This research was related to the use of infrared light

to provide communication within an enclosed area. While I focused on communicating speech, the method is also applicable for data communications, for example, as a wireless local area network. The research included a study of scattered light propagation, as well as circuit and system techniques for providing speech supporting multiple simultaneous users. A time division multiple access (TDMA) system with four timeslots was prototyped, providing the capability for two full duplex speech channels.

10. My professional experience begins immediately after I earn my undergraduate degrees in 1975. At Motorola, I spent the first 15 years working in various research labs as a bench engineer. Almost all of my work during this time period focused on innovating and inventing new technology relating to or using radiocommunication systems, including cellular, public safety and private mobile systems.

11. Throughout this period, I was involved in what might be termed the transition of analog land mobile radio systems to digital technology. I was researching new systems including new radio access and modulation technologies. Several proposals were designed and prototyped for use with private land mobile radio. These proposals were contemporary with the initial investigations which were a precursor of the first digital cellular system standard occurring in Europe, namely GSM.

12. A key objective of my projects during this period was to provide new radio systems having an extremely high degree of spectrum efficiency. In other words, it was desired to serve the largest population of mobile users using as little spectrum as possible. Since reuse of existing spectrum allocations was necessary, maintaining the existing channel spacing that had already been deployed was a critical design factor. Our proposed solutions to addressing these issues involved the use of digital speech coding, both constant envelope and linear modulation techniques and, again, TDMA. I was actively involved in the design and building of several of these prototype systems. Ultimately, this early work evolved into what became Motorola's successful proprietary dispatch and telephone system called iDEN, which was widely deployed by Nextel.

13. In 1989, I joined the Cellular Infrastructure and Networks Business of Motorola. In this capacity, I was responsible for ensuring the highest level of performance of Motorola's cellular infrastructure deployments. The first two years here were directed specifically to addressing unique technology issues facing the GSM product development communities. While I was in the infrastructure group, this team embraced a much broader systems view and thus addressed problems that would also be of significance to the group developing the mobile devices as well. Activities undertaken were often relevant to both the infrastructure and mobile development camps. For example, my participation in the channel equalizer

activities provided results which were utilized in both base and mobile stations equipment.

14. Following the GSM activity, I became involved in numerous other digital cellular systems throughout the remainder of my career at Motorola. These include USDC (IS-54 and IS-136), CDMA (IS-95), W-CDMA (also known as 3G or UMTS) as well as LTE (Long Term Evolution also known as eUTRA [evolved UMTS Terrestrial Radio Access] and often characterized as 4G). From time to time either I, or engineers reporting to me, participated in various standards activities, both domestic and international.

15. This work transitioned in the early 1990s to digital cellular applied research and development on cellular infrastructure and mobile devices. As a senior technologist and leader, first in the cellular infrastructure division and subsequently the mobile device division at Motorola, I was a significant participant and contributor to the development of new and evolving digital systems. Some of these evolutions included the adoption of functional improvements, continuing quality improvements, system generation advancement, etc.

16. As a senior level technologist, I was personally working on technology to advance, evolve, and improve the various digital cellular systems deployed throughout the world. I was also directing several worldwide research organizations working on digital cellular technology to create novel and enhanced cellular

communications products and techniques. In 1997 I became the Vice President of Technical Staff and Director of Research and Advanced Technology in Motorola's Cellular Infrastructure and Networks division.

17. In 1998 I transferred organizations at Motorola to become Vice President of the Technical Staff, Office of the Chief Technology Officer, in the mobile devices business. In this role, I provided leadership and strategic directions for the adoption and creation of new technology for handheld devices. In this position, in addition to providing ongoing technology proposals for advancing and improving digital cellular performance and functionality, I formulated strategy for the creation and adoption of new technologies relevant to mobile devices and wireless systems generally. I directly supervised and worked with engineers in the United States and Europe in developing technology focused on radio layer and signaling protocols. As part of this work, we developed and provided technical contributions to industry standards organizations.

18. In 2006, I accepted a position at Motorola as Vice President of the Technical Staff, Corporate Law Department, Patent Operations. In this role, my responsibilities included working with technology teams throughout Motorola to create, manage and maintain strategically important technology, patent portfolios and patent review committees. This included responsibility for decision making on patent filings, annuities, acquisitions and divestitures; formulating technology patent

portfolio strategy; and continuing to oversee the protection of intellectual property across all Motorola's business entities. In this role, I created technology portfolio strategy across businesses including quantitative goals for new and retained intellectual property assets. I also managed processes and corporate-wide teams related to creating and maintaining patent portfolios. I served in this position until I left Motorola in 2009.

19. As part of my activities over the years at Motorola, I served as a chairman or member of several patent review committees. Patent committees are groups of the most senior technologists from within an organization or technology area. These committees are charged with the responsibility to evaluate patentable ideas submitted from all engineers and make recommendations about whether the idea warrants the large investment for it to be pursued to obtain a patent.

20. While at many times during my Motorola career I was responsible for supervising other engineers, my key responsibilities were always more technology-related than managerial. My primary responsibilities were always to be actively engaged in technological innovation and, as possible, to provide technical leadership for those individuals I supervised.

21. I received several awards and recognitions within Motorola. I was designated an Associate of the Science Advisory Board in 1982. In 1990, I was recognized as a Dan Noble Fellow, which is the highest recognition given by

Motorola to a technologist. I received the Distinguished Innovator Award, Master Innovator Award, a Special Intellectual Property Award for Defensive Contributions, and several "Patent of the Year" awards. "Patent of the Year" awards are presented to Motorola inventors whose patents are demonstrated to have had significant business impact, such as resulting in significant patent licensing revenue or a major business impacting product improvement.

22. At various times during my Motorola employment, I was also an active TIA and 3GPP standards organization participant representing Motorola. I received several standards impact awards.

23. I created MDK Consulting, Inc. in 2009 when I left Motorola. As President of MDK Consulting, Inc., I serve as a consultant and expert regarding intellectual property analysis, portfolio management and technology strategy relating to aspects of wireless communications technology including systems and products. In addition to my consulting activities, I have served as an expert for a variety of patent-related litigations and arbitrations relating to various aspects of wireless communications technology.

24. I have been a member of the Institute of Electrical and Electronics Engineers (IEEE) for 43 years. In 1995, I received the IEEE Vehicular Technology Society's "Avant Garde" recognition "for pioneering leadership and continuing contributions in promoting new technology in the field of vehicular communications

and electronics." In 2005, I was designated a Fellow of the IEEE "for contributions to cellular mobile radio communications." I am also a member of the Eta Kappa Nu and Tau Beta Pi engineering honors societies. In addition to my industry experience, I have taught electrical engineering courses at Northwestern University as an Adjunct Professor in various wireless technologies.

25. I am a listed inventor on approximately 134 issued U.S. patents and over 500 issued patents worldwide in areas including signal processing, data compression, communications, and wireless systems. I have also authored published articles and presented at several public conferences.

26. Additional detailed information regarding my background, experience, and professional qualifications may be found in the attached Curriculum Vitae. My Curriculum Vitae (Ex. 1003) lists my publication record in archival journals, international conferences, and workshops and further includes a list of granted patents.

27. My technical background has addressed private/public wireless systems, base/mobile hardware and software, algorithms, networking and protocols, signal processing, software/hardware design methodologies, antennas and cybersecurity. Based on my experience and education, I consider myself to be an expert at least in the fields of telecommunications, cellular networking, infrastructure, and mobile devices, including network selection architecture for

mobile devices. As of the earliest priority date of the '436 patent, I was at least a person of ordinary skill in the art, and I had personal knowledge of the technologies utilized therein.

28. Through these and other experiences, I am very familiar with the technologies at issue in this matter.

III. MATERIALS REVIEWED

29. The opinions contained in this declaration are based on the documents I reviewed, my professional judgment, as well as my education, experience, and knowledge regarding network communication protocols.

30. In forming my opinions expressed in this declaration, I reviewed the following materials:

- the '436 patent (Ex. 1001)
- the file history of the '436 patent ("*File History*") (Ex. 1004)
- U.S. Patent Application Publication 2005/0239497 ("*Bahl*") (Ex. 1005)
- U.S. Patent Application Publication 2004/0165563 ("*Hsu*") (Ex. 1006)
- U.S. Patent Application Publication 2003/0130001 ("*Weisshaar*") (Ex. 1007)
- U.S. Patent No. 7,539,175 ("*White*") (Ex. 1008)

- U.S. Patent Application Publication US2003/0081657 (“*Ranta*”) (Ex. 1009)
- L. Magalhaes et al., End-to-End Inverse Multiplexing for Mobile Hosts, J. Braz. Comp. Soc. 7 (2001) (“*Magalhaes*”) (Ex. 1010)
- U.S. Patent No. 6,983,162 (“*Kotzin* ’162”) (Ex. 1011)
- Microsoft Windows® 2000 Server Operations Guide (ISBN 1-57231-805-8) (2000) (“*WINDOWS Guide*”) (Ex. 1012)
- U.S. Patent Application Publication No. 2004/0053624 (“*Frank*”) (Ex. 1013)
- U.S. Patent No. 6,826,406 (“*Vialen*”) (Ex. 1014)
- U.S. Patent Application Publication No. 2005/0198350 (“*Tan*”) (Ex. 1015)
- U.S. Patent No. 5,737,703 (“*Byrne*”) (Ex. 1016)
- U.S. Patent No. 6,791,968 (“*Kotzin* ’968”) (Ex. 1017), and any other materials I refer to in this declaration in support of my opinions.

31. All of the opinions contained in this declaration are based on the documents I reviewed and my knowledge and professional judgment. My opinions have also been guided by my appreciation of how a person of ordinary skill in the art would have understood the claims and the specification of the ’436 patent at the time of the alleged invention, which I have been asked to consider as early as

January 31, 2006. My opinions reflect how one of ordinary skill in the art would have understood the '436 patent, the prior art to the patent, and the state of the art at the time of the alleged invention.

32. It is my opinion that certain references disclose and/or suggest all the features recited in claims 1-17 and 19 ("Challenged Claims") of the '436 patent, as I discuss in detail below.

IV. LEVEL OF ORDINARY SKILL IN THE ART

33. I have been informed and understand that, in the context of an invalidity analysis, a person having ordinary skill in the art is a hypothetical person who looks to prior art at the time of the invention. I further understand that the factors that may be considered in determining the level of ordinary skill include: (1) the problems encountered in the art; (2) the prior art solutions to the problems encountered in the art; (3) the rapidity of innovation; (4) the sophistication of the technology; and (5) the education level of individuals actively working in the field. I understand that these factors need not all be considered for the analysis and that one or more of these factors may control.

34. I was asked to provide my opinion on the level of one of ordinary skill in the art with respect to the alleged invention of the '436 patent by January 31, 2006. Based on my consideration of the factors above, I believe a person of ordinary skill in the art would have had at least a Bachelor's Degree (or equivalent)

in electrical engineering, computer science, or a similar field and two years of experience in the design of wireless communication technology. A greater amount of professional education could compensate for fewer years of work experience, and vice versa.

35. As of January 31, 2006, I met, and in fact exceeded, the qualifications of a person of ordinary skill in the art. To be clear, all of my opinions in this declaration are from the perspective of one of ordinary skill in the art as I have defined it here during the relevant timeframe.

V. RELEVANT LEGAL STANDARDS

36. I am not an attorney and offer no legal opinions, but in the course of my work, I have had experience studying and analyzing patents and patent claims from the perspective of a person skilled in the art.

37. For the purposes of this declaration, I have been informed about certain aspects of the law that are relevant to forming my opinions. My understanding of the law is as follows.

38. Petitioners' counsel has informed me that a patent claim can be considered to have been obvious to a person having ordinary skill in the art at the time the application was filed. I am informed that this means that, even if all of the requirements of a claim are not found in a single prior art reference, the claim is not patentable if the differences between the subject matter in the prior art and the

subject matter in the claim would have been obvious to a person having ordinary skill in the art at the time of the invention.

39. I have been informed by Petitioners' counsel that a determination of whether a claim would have been obvious should be based upon several factors, including, among others:

- the level of ordinary skill in the art at the time the application was filed;
- the scope and content of the prior art;
- what differences, if any, existed between the claimed invention and the prior art; and
- any "secondary indicia" of non-obviousness, if they are of record.

40. I have been informed by Petitioners' counsel that a single reference can render a patent claim obvious if any differences between that reference and the claims would have been obvious to a person having ordinary skill in the art.

Alternatively, I understand that the teachings of two or more references may be combined in the same way as disclosed in the claims, if such a combination would have been obvious to one having ordinary skill in the art. In determining whether a combination based on either a single reference or multiple references would have been obvious, the following are examples of approaches and rationales that may be considered:

- whether the teachings of the prior art references disclose known concepts combined in familiar ways, and when combined, would yield predictable results;
- whether a person of ordinary skill in the art could implement a predictable variation, and would see the benefit of doing so;
- whether the claimed elements represent one of a limited number of known design choices, and would have a reasonable expectation of success by those skilled in the art;
- whether a person of ordinary skill would have recognized a reason to combine known elements in the manner described in the claim;
- whether there is some teaching or suggestion in the prior art to make the modification or combination of elements claimed in the patent; and
- whether the innovation applies a known technique that had been used to improve a similar device or method in a similar way.

41. I understand that “secondary indicia” of non-obviousness may include certain objective factors, such as: commercial success of products practicing the claimed invention; long-felt but unsolved need; teaching away; unexpected results; copying; and praise by others in the field. These factors are generally referred to as “secondary considerations” or “objective indicia” of non-obviousness. I

understand, however, that for such objective evidence to be relevant to the (non)obviousness of a claim, there must be a causal relationship (called a “nexus”) between the claim and the evidence and that this nexus must be based on a novel element of the claim rather than something in the prior art. I also understand that even when they are present, secondary considerations may be unable to overcome primary evidence of obviousness (such as motivation to combine with predictable results) that is sufficiently strong.

42. I have been informed by Petitioners’ counsel that one of ordinary skill in the art has ordinary creativity and is not an automaton. Petitioners’ counsel has also informed me that in considering obviousness, obviousness may not be determined using the benefit of hindsight, including hindsight derived from the patent being considered.

VI. SUMMARY OF OPINIONS

43. For the reasons I discuss below, it is my opinion that claims 1-17 and 19 of the ’436 patent are rendered obvious by the prior art.

VII. OVERVIEW OF THE ’436 PATENT

44. The ’436 patent is titled “Applications and/or situation responsive utilization of silent periods.”

45. The '436 patent is directed to “systems and methods for improved utilization of silent periods in wireless devices” having multiple network interfaces. '436 patent at Abstract, 1:14-16.

A. Wireless Devices Having Multiple Interfaces

46. The '436 patent provides background information on wireless devices having multiple interfaces. For example, the specification of the '436 patent explains that:

Wireless networks can incorporate a variety of types of mobile devices, such as cellular and wireless telephones, laptop computers, wearable computers, cordless phones, pagers, headsets, and PDAs (Personal Digital Assistants). Such mobile devices may include network interfaces to enable fast wireless transmission and reception of voice and/or data over the wireless network. Typical mobile devices include some or all of the following components: a transceiver (i.e., a transmitter and a receiver, including single chip transceivers having integrated transmitters and receivers); an antenna; a processor; one or more audio transducers (for example, a speaker or a microphone); a data storage medium (such as ROM, RAM, EPROM, hard disk, etc); operational memory; a full chip set or integrated circuit; and interfaces (such as USB, CODEC, UART, PCM, etc.).

'436 patent at 1:19-33.

47. The specification of the '436 patent further explains that:

Mobile devices may be pre-equipped with wireless hardware or a user may install a separate piece of hardware, such as a card, that may include an antenna. In addition, Multiple Interface Devices (MIDs) may be utilized in some wireless networks. MIDs may contain two or more independent network interfaces, such as Bluetooth interface and an 802.11 interface, thus allowing the MID to participate on two separate networks as well as to interface with dedicated Bluetooth devices.

'436 patent at 1:44-53.

48. The specification of the '436 patent also explains that:

Once again, emerging mobile devices are being equipped with multiple interfaces allowing users to take advantage of heterogeneous radio technologies (such as, by way of example, cellular networks and wireless LANs). For purposes of illustration and explanation, some examples may be described, e.g., with respect to a mobile device with a WiFi or other high energy-consuming network interface. Throughout the remainder of the disclosure, for purposes of simplicity, the term WiFi is used to represent a high energy-consuming interface on a mobile device. The mobile device also may have additional network interfaces such as cellular network interfaces (e.g., GPRS, CDMA2000, 3GPP, 3GPP2). Examples of such mobile devices include WiFi phones and PDAs, and WiFi-cellular dual-mode phones and PDAs.

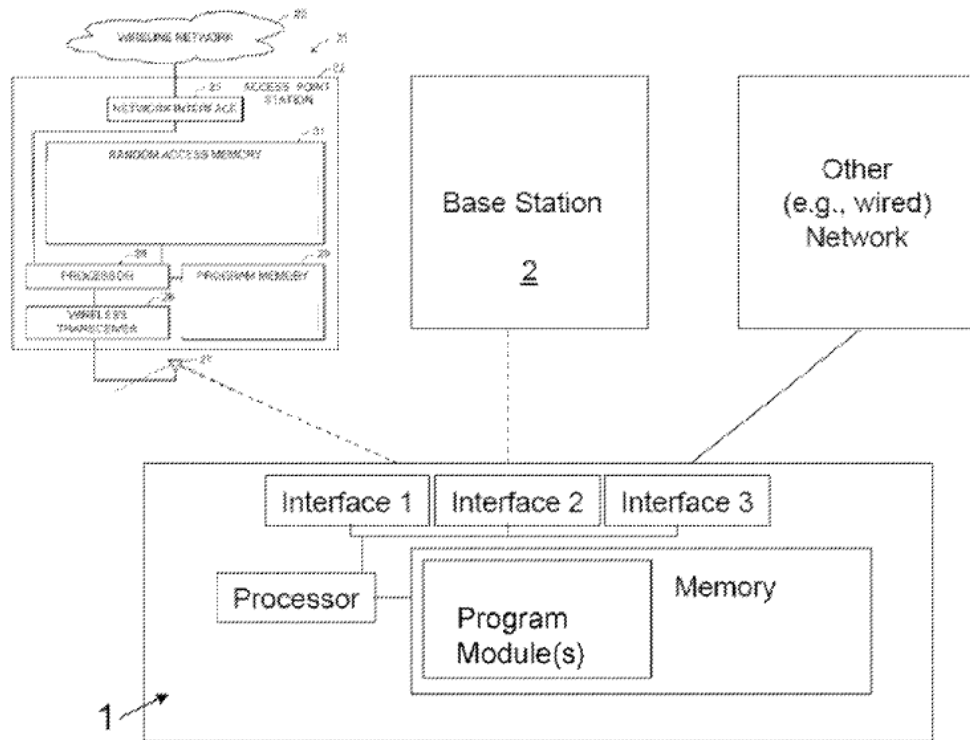
It is contemplated that future wireless networks will use multiple radio technologies to meet different communication needs. For example, short-range radio technologies (e.g., Bluetooth) may be used to connect nearby devices (e.g., devices carried by a person or inside an office, vehicle, or home); private or public wireless LANs (e.g., IEEE 802.11) for continuous coverage throughout a building, a campus, an airport, a shopping mall, and cellular radio systems (e.g., GSM, GPRS, cdma2000, WCDMA) for wide-area coverage. Therefore, mobile devices (also referred to herein as mobiles) are being equipped with multiple radio interfaces, each supporting a different radio technology.

'436 patent at 5:42-67.

49. Fig. 1(B) of the '436 patent, shown below, is an “architectural diagram depicting an illustrative environment in which a mobile device having a plurality of interfaces communicates with a plurality of networks, and also illustrating some components of an illustrative mobile device and an illustrative access point with which the mobile device communicates in a first network[.]”

'436 patent at 5:4-9.

FIG. 1(B)



'436 patent at Fig. 1(B).

50. Fig. 1(B) is described in the '436 patent as follows:

With reference to FIG. 1(B), in some illustrative examples a mobile device 1 can include a plurality of interfaces. In the illustrated example, three interfaces are shown: Interface 1; Interface 2 and Interface 3. However, in various embodiments any number of interfaces can be employed. In illustrative embodiments, a mobile device can include, e.g., portable computers, personal desk-top computers, PDAs, portable voice-over-IP telephones and/or other devices. Typically, such mobile devices will include a transceiver

(including an antenna for communication with the access point), a processor, memory (including, e.g., program memory and Random Access Memory). As also shown, the memory can include programs or modules for carrying out functionality as described herein-below. In various embodiments, processes to be carried out by the mobile device can be performed via software, hardware and/or firmware as may be appropriate based on circumstances.

In an illustrative embodiment shown in FIG. 1(B), a mobile device **1** is shown that is capable of communicating via a plurality of networks, such as, e.g., via Interface **1-3**. For example, the mobile device can communicate via the Access Point **22** or via a Base Station **2**, similar to that shown in FIG. 1(B). Additionally, FIG. 1(B) also schematically depicts an example in which the mobile device **1** can also communicate with another network, such as, e.g., another wireless network or a wired networks. With reference to FIG. 1(B), in some illustrative and non-limiting embodiments, the access point **22** can be within a wireless local area network (WLAN) connected to a wireline network **20**. In some examples, the wireline network **20** can include the Internet or a corporate data processing network. In some examples, the access point **22** can be a wireless router. In some embodiments, the access point **22** can have a network interface **25** linked to the wireline network **21** and a wireless transceiver in communication with the mobile device **1** and with other mobile devices. By way of

example, the wireless transceiver **26** can include an antenna **27** for radio or microwave frequency communication with the mobile devices. The access point **22** preferably also has a processor **28**, a program memory **29**, and a random access memory **31**.

'436 patent at 6:15-54.

51. Fig. 2 of the '436 patent, shown below, "is a block diagram of a network-enabled mobile communication device according to one embodiment of the present invention." '436 patent at 5:10-12.

52. Fig. 2 is described in the '436 patent as follows:

FIG. 2 is a block diagram of a generic mobile device **40** of an illustrative type that may incorporate one or more of the concepts and features of embodiments of the present invention. In this illustrative example, the device **40** includes a processor **42** and storage medium **44** in the form of a disk, ROM, RAM, flash memory, etc. The storage medium may store processor-executable application instructions for performing the silent period prediction according to the invention as described above. The device **40** further includes a power supply **46** and network interface device **48**, which may be an internal Network Interface Card (NIC), external network interface device or integrated network interface. Power supply **46** provides power to the processor **42** and to the network interface device, as well as to other components of the mobile device (not shown).

'436 patent at 6:55-7:2.

53. The specification of the '436 patent further states that “[t]he term MID used in this document may mean the device itself, or the user who is processing an MID. Also, in this disclosure, the term MID presents (i.e., encompasses) solitary as well as a plurality.” '436 patent at 6:55-7:2.

B. Silent Periods

54. The '436 patent provides background information on “silent periods.” For example, the specification of the '436 patent explains that:

Emerging mobile devices are being equipped with multiple interfaces allowing users to take advantage of heterogeneous radio technologies. However, more advantage could be reaped if the mobile uses its network interfaces according to the applications and situations responsiveness. We perceive that the needs of the devices are different when they are running real-time applications as compared to when they are running non-real-time Applications. Furthermore, the needs of the device may be different when it is on the move as compared to when it is stationary. More precisely when the devices are running applications such as voice-over-IP (VoIP) or streaming media they are bombarded with continuous or heavy data; perhaps without much pause or break thus not leaving long and useable mute periods. Under this situation devices may use multiple interfaces for Bandwidth or Quality of Service (QoS) enhancement. Whereas while running non-real-time

applications, they are not heavily flooded with continuous stream of data, rather the data flow is bursty and thus there may appear intervals when the devices can take a momentary pause (i.e., the Device has no traffic to send or receive). These short pauses are dubbed in available literature as “Silent Periods”.

'436 patent at 2:41-67.

55. The specification of the '436 patent further explains that:

Once again, over time more and more emerging mobile devices will be equipped with multiple interfaces, such as, e.g., Wireless Local Area Networks, abbreviated as WLANs (such as, e.g., IEEE 802.11 family) and Wide Area Networks, abbreviated as WANs (such as, e.g., GSM, GPRS, cdma2000, WCDMA, WiMax). These Multiple Interface Devices (MID) allow users to take advantage of heterogeneous radio technologies—for example, they may use WLANs for higher data rates and WANs for better coverage. However, more advantage could be reaped if the MID use its network interfaces in response to the Application running on and or Situations they are operating in. For example, the response of the MID should be different when they are running Real-time Applications (RTA) as compared to when they are running non-Real-time Applications (NRTA). For example, when the devices are running applications such as VoIP or streaming media, it should be appreciated that the MID is overwhelmed with heavy data. Under this situation, it may use the multiple interfaces for Bandwidth/QoS enhancement. Whereas, while running NRTA, the MID is not heavily flooded

with bits and bytes, and there may appear intervals when the MID can take a brief pause (e.g., in which the mobile has no traffic to send or receive). These unoccupied brief intervals are referred to as “Silent Periods.” Depending on the application, the duration of these silent periods may vary.

’436 patent at 7:6-34.

56. I also understand that the prosecution history of the ’436 patent states that:

[T]he present application clearly sets forth the meaning of the terminology Silent Periods as used in the present application at, e.g., page 9 of the application. In particular, page 9 recites that:

“[W]hile running NRTA [non-Real-Time Applications], the MID [Multiple Interface Device] is not heavily flooded with bits and bytes, and there may appear intervals when the MID can take a brief pause (e.g., in which there is the mobile has no traffic to send or receive). These *unoccupied brief intervals are referred to as “Silent Periods.”* Emphasis added for reference.

To even further clarify the recitations in the claims, independent claims 1, 18 and 20 are further amended to more distinctly recite: *“said silent periods being brief intervals during which an application running on said mobile has no application traffic to send or receive.”*

Ex. 1004,167 (emphasis in original).

C. Use of Silent Periods

57. I understand that the '436 patent concedes that “[u]se of Silent Periods has been suggested in [the inventors’] previous work for (i) Performing Proactive Handoff Actions (see Reference [1] cited above) and (ii) Energy Saving (see Reference No. [2] cited above). However, how to make use of silent periods based on application’s needs and in a situation awareness manner has not been discussed in prior arts.” ’436 patent at 3:8-14.

58. For example, the '436 patent states that:

Depending on the application, the length of silent periods may vary. If the silent periods exist and are of sufficient lengths and the device can predict their lengths, they can be used to perform several tasks. For example, if the Device is moving at pedestrian speeds, it can use the silent periods for connecting to target neighboring networks temporarily and performing proactive handoff actions. These actions may involve connecting to a target network for acquiring IP-layer and/or high layer information necessary to connect to or authenticate with a target network. And, if the Device is stationary, it can use these silent periods for either Battery Life Saving or for chatting with fellow devices for sharing information.

’436 patent at 2:63-3:8.

59. The '436 patent also provides the following examples illustrating use of “silent periods”:

(a). Consider a moving MID inside the overlapping radio coverage areas of multiple radio networks. It desires session continuity, with minimum packet loss, when it hands off from one radio Access Point to another. Under this condition, if it could get the necessary IP and higher layer parameter values necessary to connect to or authenticate with a target network in advance, it could conduct a quick handoff. To get the required information in advance, it may use the silent periods to connect to target neighboring networks temporarily i.e., only during these silent periods and use the temporary connectivity to get the desired information and perform key actions needed for handoff into the target network.

(b). Consider an MID is Stationary. When a device is stationary, and if one network interface provides sufficient support for the applications running on the device, the device may power off the other network interfaces to save battery energy. Furthermore, if the device could accurately predict the silent periods, it may also power off the network interface it is currently using to transport application traffic during the silent periods. Powering down an interface during silent periods will not lead to missing or delaying any traffic that needs to come into and go out of this interface.

(c). Consider an MID is Stationary and Electrical Power is Not a Constraint. If the device is stationary and power saving is not a real concern (e.g., because the device is connected to the power outlet, or it has additional batteries), the MID may use silent

periods to chat with other MIDs to share the information they collected about the networks they visited in the past. For example, a MID visited a Network “A” in the past and learned the parameters needed by a MID to authenticate with that network (from the radio signals it received from “Network-A” or as a result of connecting to the “Network-A”). It preserved the information, primarily for its own future use, and carried this information with it into a neighboring network “Network-B”. Here it can share the information directly, in a peer-to-peer fashion, with those who wish to know that sort of information. Thus the interested devices obtain the desired information through chatting with peer MIDs without actually connecting to any network. These devices can save the shared information for future use for accessing services or for performing pre-handoff processing to Network-B, if they happen to visit Network-B.

(d). Consider MID is stationary and is running real-time application say for example using WLAN, MID perceives that available bandwidth does not meet the present need of his time sensitive applications (because, e.g., several users are contending for the WLAN bandwidth and the Silent periods are unacceptably long). To cope with this situation, MID may turn WAN interface ON in addition to WLAN for bandwidth increment. Turning ON WAN in addition to WLAN would require (i) having dual addresses one for WAN and one for WLAN, (ii) binding association of both the addresses with home network, (iii) informing home network about preferred packet

forwarding policy on two different paths/addresses. (iv) and having coverage of both WLAN and WAN. Thus using multiple interfaces (Multiple Addresses or in other words multiple data paths), the MID will lead to enhance bandwidth.

'436 patent at 7:35-8:26.

D. Use of Network Interfaces Based On Applications and/or Operating Situations

60. In addition to the use of “silent periods,” I understand that the inventors of the '436 patent contend that “more advantage could be reaped if the mobile uses its network interfaces according to the applications and situations responsiveness.” '436 patent at 2:43-45, 7:14-17 (“[M]ore advantage could be reaped if the MID use its network interfaces in response to the Application running on and or Situations they are operating in.”).

61. Specifically, the '436 patent states that “[t]he present inventors have found that if a MID becomes aware of the applications running on it, and also the situation it is operating in, most of the complex processes, circuitries, and algorithms running in the device, including radio interfaces, can be either run more efficiently or used for watchful multitasking.” '436 patent at 9:9-14.

62. The '436 patent further states that “[i]n the preferred embodiments of the present invention, situations under consideration (e.g., ‘Application Type’, ‘Device Mobility’ and ‘Battery Health’) lead MID to operate in following Four Modes according to the preferred embodiments.” '436 patent at 9:16-20.

63. The “Four Modes according to the preferred embodiments” are (i) “QoS Enhancement Through Multiple Address Mode (abbreviated as QEM)” (discussed in ’436 patent at 9:59-11:14); (ii) “Network Discovery/Proactive Handoff Mode (abbreviated as NDM)” (discussed in ’436 patent at 11:17-12:33); (iii) “Energy Saving Mode, (abbreviated as ESM)” (discussed in ’436 patent at 12:35-59); and (iv) “Chat with Devices Mode (abbreviated as CDM)” (discussed in ’436 patent at 12:61-13:31).

VIII. OVERVIEW OF THE PRIMARY PRIOR ART REFERENCE

64. U.S. Patent Application Publication 2005/0239497 (“*Bahl*”), which is entitled “Selecting a wireless networking technology on a device capable of carrying out wireless network communications via multiple wireless technologies,” is directed to a network interface selection and coexistence driver architecture for devices having multiple wireless network interfaces. For example, *Bahl*’s Abstract provides:

Criteria-driven methods and a framework are disclosed that facilitate configuration/selection of one or more wireless network interfaces/networks for carrying out wireless communications on a computing device. The wireless network interface selection and coexistence driver architecture described herein facilitates automated selection of a particular mode of network access based upon status information provided by a set of network interface drivers associated with particular network

interfaces and wireless technologies. Furthermore, a criteria-driven interface/network selection framework is described that is potentially invoked in a variety of situations including, but not limited to, when an application is invoked or to select another interface/network to avoid detected interference.

Bahl, Abstract.

65. *Bahl* also states that:

Having described a general architecture of a coexistence driver that facilitates creation of virtual coexistence drivers for handling interference between two or more sources of wireless data transmission interference, attention is directed to a wireless network/interface selection scheme. Such scheme can be used at any of a variety of circumstances during the operation of a computing device that includes one or more wireless network interfaces capable of connecting to any one of multiple differing networks. For example, such selection scheme is potentially used to establish an initial connection. Furthermore, the selection scheme is utilized, after establishing an initial connection, to establish a new connection to a different network in accordance with changed operating parameters. While avoiding interference, addressed extensively herein above, is one reason to invoke the wireless selection method described below, the selection method is applicable to a variety of situations where two or more suitable networks/interfaces are available for reaching a particular resource. The selection scheme and resulting defined criteria potentially include factors such as: policy, network SSID, speed,

congestion, interference, throughput, battery life, range, connectivity, security, cost per bit, and application throughput requirements. Each of these factors is described herein below with reference to FIG. 9. The exemplary wireless technology selection scheme described herein contemplates selecting a wireless technology based upon a variety of factors, regardless of whether the selection was necessitated by interference.

Bahl, [0090].

66. *Bahl*'s "wireless technology selection scheme" selects "a wireless technology based upon a variety of factors[,]" (*id.*) such as the factors shown in Figure 9 below:

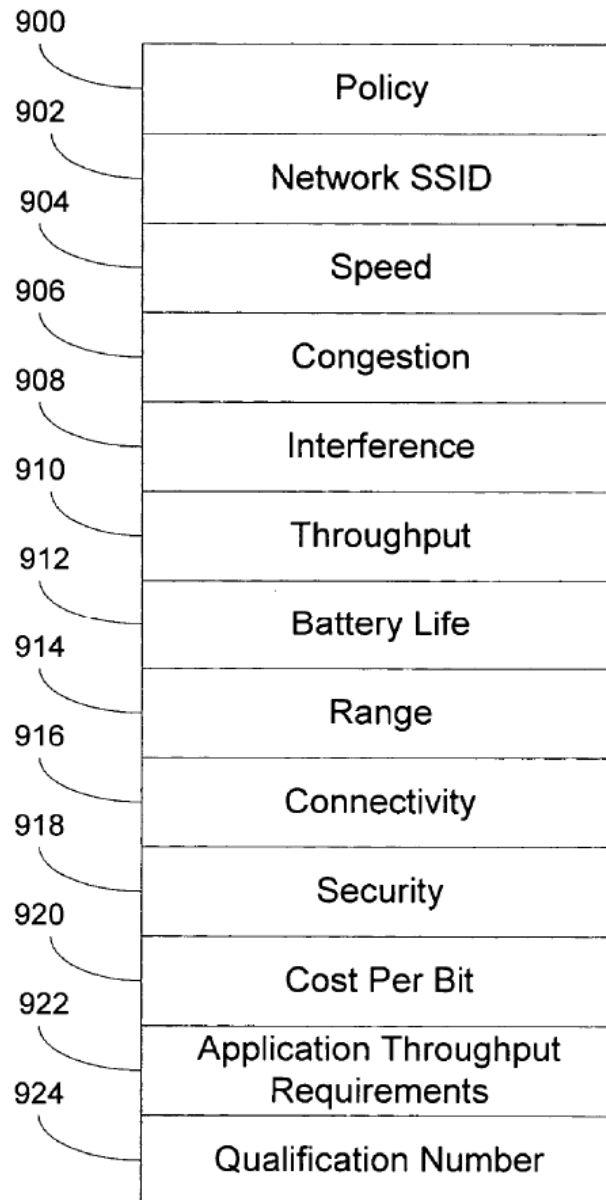


FIG. 9

67. Each of these factors are described in *Bahl* as follows.

68. Policy 900 specifies:

a set of criteria available to a user/client to decide between technologies/interfaces/networks. A criterion within the set of criteria specify one or more factors and associated weights for making a selection. The policy **900**, by way of example, is downloaded as part of

client provisioning. In the absence of policy provisioning, a default policy is used.

Bahl, [0116].

69. Network SSID 902 specifies:

a network identification. The station acquires an SSID of a network from a beacon periodically transmitted by an access point, or from a probe response sent by the wireless AP to a probe request from the STA. The SSID identifies a network. In a simple interface/network selection criterion, if the STA receives a same SSID on 802.11a and 802.11b channels, then all else being equal, the 802.11a channel is selected.

Bahl, [0117].

70. Speed (SPD) 904 specifies:

a theoretical maximum speed offered by a particular wireless technology. In a simple criterion wherein only the speed **904** is considered, then if a selection is made between 802.11a and b technologies, then 802.11a is selected over 802.11b—even if an excessive number of current 802.11a users results in greater individual throughput via the 802.11b technology. However, the present invention contemplates/supports significantly more complex/robust decision-making involving multiple factors that avoid such short-sighted decision-making.

Bahl, [0118].

71. Congestion (CNG) 906 specifies:

a congestion value on a particular wireless technology of interest.

If Ncap **802** or Nbap **804** for a particular wireless technology is large and if both Pretppsta **824** and Pretppap **808** are large, then it is likely that there is a relatively high level of congestion on the particular wireless technology/network combination. In other words, if the access point associated with a particular wireless technology/network is heavily loaded, i.e. it is handling a large number of connections or processing a large amount of traffic from existing connections, and the number of retries for packets at the AP and STA are high, then it is very likely that the network is congested. If the same access point provides 802.11b and 802.11a service, both 802.11a and 802.11b will likely be equally affected by the load. In this case, Pretppsta **824** and Pretppap **808** determine the congestion state of the network. A WCW value of 1 indicates, for example, a lowest congestion state, 5 is normal (medium), and 10 is the highest (network is stressed) level of congestion.

Bahl, [0119]. *Bahl* further explains that (i) Ncap 802, referenced above, specifies “a number of connections serviced in the last ‘t’ units of time by an access point” (*Bahl*, [0104]); (ii) Nbap 804, referenced above, specifies “a number of bytes processed in the last ‘t’ units of time by the access point” (*Id.*); (iii) Pretppsta 824, referenced above, specifies “an average number of retries per packet seen by the network interface card during the last ‘t’ seconds” (*Bahl*, [105]); (iv) Pretppap 808, referenced above, specifies “an average number of retries in the last ‘t’ seconds per

packet by the AP across all nodes that it is servicing” (*Bahl*, [0104]); and (v) a WCW value, referenced above, specifies “[a] wireless criterion factor weight represents the relative priority/importance assigned to a criterion factor.” (*Bahl*, [112]).

72. Interference (INTF) 908 specifies:

a level of interference. If both Ncap **802** and Nbp **804** are small but either one or both of Pretppsta **824** and Pretppap **808** are high, then a high level of interference likely exists. In other words, if the access point is not heavily loaded, i.e., the number of connections and the level of traffic processed by the access point is low to medium, but a larger than normal number of packet errors and retries exist at both the access point and the STA, then it is likely that interference exists on the network from other sources. Sources of such interference potentially include cordless phones, microwaves, and other devices using the same band as Wi-Fi technology under consideration. A WCW value of 1 indicates a lowest level of interference, 5 is normal (medium), and 10 is the highest (excessive interference).

Bahl, [0120].

73. Throughput (THRPT) 910 specifies:

throughput of a particular wireless technology. If both SSap and SSsta (signal strengths for the AP and STA) are low, then data throughput, by implication, is low. If both are high, the data throughput is high. If throughput on 802.11a is less than it is on

802.11b, then the throughput factor **910** favors the 802.11b wireless technology. In an exemplary embodiment of the invention, a weight (WCW) is given to the throughput **910** parameter based on the requirements of particular applications running on the STA. For example, if Audio/Video streaming applications are running, a higher weight than normal should be used. A factor value (WCV) of 1 indicates low throughput, 5 is normal, and 10 is high. By way of example, under ideal conditions, when comparing 802.11b and 802.11a technologies, 802.11b technology (highest theoretical speed can be 11 Mbps) receives a value of 5 and 802.11a (highest theoretical speed can be around 25-30 kbps) receives a value of 8, or even a value of 10 for turbo mode with highest theoretical speed of around 50 kbps.

Bahl, [0121]. *Bahl* further explains that (i) SSap “specifies a signal strength seen by the access point” and (ii) SSsta “specifies a signal strength seen by the network interface card.” *Bahl*, 105]

74. Battery life (BL) **912** specifies:

battery charge available for a STA. By way of example, when comparing power drain from wireless network interfaces, an 802.11a NIC, for the same work load, consumes more power than an 802.11b NIC. Therefore, a low battery power is assigned greater (negative) weight for the NIC that consumes more power. Furthermore, if battery charge level on a STA is low, then the weight (WCW) given to the battery life **912** factor is raised

regardless of the technology—reflecting the increased importance of this factor. The value (WCV) assigned to the battery life **912** goes from highest (least negative) to lowest (most negative) across UWB, BT, 802.11b, 802.11a wireless technologies.

Bahl, [0122].

75. Range (RNG) **914** specifies:

a relative distance for each technology. 802.11b's range is 150-300 feet and 802.11a's range is roughly a quarter of 802.11b's range. As a result a STA that is moving will experience more handoffs if the 802.11a wireless technology is used. Handoff, in turn, affects latency, jitter, and packet loss. Fast handoff schemes are employed to make handoff as seamless as possible. However, low limits on latency, jitter, and packet loss for Voice over IP and A/V streaming applications require minimal handoffs for optimal user experience. A proper weight (WCW) is given to the range **914** factor based on the requirements of applications running on the station and the kind of mobility of the computing device (STA) itself. As an example, for a wireless, non-mobile, desktop machine the Range **914** factor has minimal, if any, weight. On the other hand, the Range **914** is given a higher weight for a handheld (highly mobile STA) computing device that is currently running either a VoIP or A/V streaming application.

Bahl, [0123].

76. Connectivity (CON) 916 specifies:

a measure of connectedness to resources via a wireless interface. If a STA is aware, from earlier saved experience, of the kind of connectivity provided by certain 802.11a and 802.11b networks at a particular location, it can select (or apply a high factor value to) a network that provides better connectivity. In the absence of any indications to the contrary, two Wi-Fi technologies such as 802.11a and 802.11b advertising the same SSID offer similar connectivity. For the case where a station is already using an 802.11a NIC or an 802.11b NIC for ad-hoc communication or for connectivity to a different SSID, it can not re-use the same NIC for the SSID to which it seeks to connect. In such circumstances, the choice is clear.

Bahl, [0124].

77. Security (SEC) 918 specifies:

a relative level of security available via a particular technology/network combination. The STA can determine the security offered by a wireless network by piecing together the following information: privacy bits on the beacon and the security mechanism offered at the data link and network layer. If the security offered by the 802.11b network is conformant to a policy on the STA while that offered by 802.11a is not, then the 802.11b network is selected. In other instances, security 918 is a factor, but not an overriding factor in a selection criterion. In a particular example of a selection criterion, if the security offered

by both 802.11a and 802.11b is conformant to the policy on the client, then the particular Wi-Fi technology that employs a more preferred security mechanism is preferred.

Bahl, [0125].

78. Cost per bit (CST) 920 specifies:

a cost for using a particular access point/link. The CST **920** may be indicated, for example, in a beacon sent by an access point or, alternatively, by a higher layer protocol used by an edge server (an access server sitting on the critical data path behind access points) or by a provisioning server. In an exemplary criterion, the CST **920** is an important factor (i.e., it is designated as having a high weight or alternatively receives an overriding or critical logical designation). Therefore if CST for 802.11a is unacceptable and CST for 802.11b is an acceptable value, and no other factor overrides this determination, then the 802.11b interface is selected.

Bahl, [0126].

79. Application throughput requirements APPTHRPT 922 specifies:

a throughput needed by one or more particular active applications on a computing device to ensure proper operation of the applications on the device (STA) that will utilize the selected wireless technology. The STA determines the throughput requirements of the applications running on it based on quality of service attributes set by the applications. By way of example,

in an energy conservation mode of operation, a criterion specifies that if the throughput requirements of the applications can be satisfied by 802.11b and there is no other factor, such as CST for instance, overriding this factor, then the 802.11b wireless technology is selected.

Bahl, [0127].

80. Qualification Number (QN) 924 specifies:

an overall measure of the quality of a wireless technology/network combination. The $QN = \sum WCW[i] * WCV[i]$ i.e. the sum of weighted WCVs of the different criteria. The QN 924 value is determined using a selection algorithm specifying, by way of example, any of the above factors and corresponding weighting for each (including potential overriding factors). Once the QN 924 value of each available wireless technology/network combination has been determined, the technology with the highest QN is used. Alternatively, a criterion comprises a set of logical filters that result in a set of qualified combinations. Thereafter, a QN is generated for each qualified combination to determine a final selection of technology/interface/network combination for carrying out wireless communications for the device.

Bahl, [0128]. *Bahl* further explains that (i) a WCW value, referenced above, specifies “[a] wireless criterion factor weight represents the relative

priority/importance assigned to a criterion factor” and (ii) a WCV value, referenced above, specifies an “observed value of a criterion factor.” *Bahl*, [112].

81. With respect to the QN number above, *Bahl* provides that:

In an embodiment of the invention, a limit is placed upon the frequency with which the computing device generates new QN values for the computing device. The QN is determined periodically (according to a configurable repetition period) and on the occurrence of any significant event such as media connect/disconnect, a significant change in data received from a network interface card regarding an access point, or the start of a particular application. As will be explained further herein below with reference to FIG. 11, upon the occurrence of such events, the selection logic is invoked to re-evaluate a previous technology/interface/network combination selection in view of potentially new information element data and resulting factor values/weights.

Bahl, [0129].

82. *Bahl* also describes various example scenarios using its network selection method and the factors enumerated above. Specifically, *Bahl* discusses “[a] series of four scenarios ... that highlight the advantages provided by the proposed selection scheme when incorporated into a computing device capable of communicating via multiple differing interfaces with potentially multiple, differing networks.” *Bahl*, [0091]. These example scenarios are:

- (i) A user comes to work. He resumes his laptop running OUTLOOK and INTERNET EXPLORER. The WINDOWS operating system determines that it is in the vicinity of an overloaded 802.11a infrastructure network and an underused 802.11b network advertising the same network SSID (i.e., both offer connectivity to a same network). The operating system determines that the throughput requirements of the currently running applications are better met using the underutilized 802.11b than the overburdened and congested 802.11a access point. The operating system therefore utilizes an 802.11b network interface rather than an 802.11a network interface.

Bahl, [0093].

- (ii) A user opens a laptop in a packed airline lounge with many people using the lounge's 802.11a wireless network access point. The lounge also has an 802.11b network access point. Both network access points are free for the use by people in the lounge and provide the same kind of connectivity. The user is running OUTLOOK and IE on the laptop machine. The operating system senses that the 802.11a network/access point is overloaded and congested. Also, the battery on the Patrick's laptop is running low. In response to the low battery power and the congested state of the 802.11a access point, the operating system selects the 802.11b connection to which it will connect. At some later time, the airline lounge empties,

and the 802.11a network access point is no longer overloaded or congested. Furthermore, the battery has been charged, and power is no longer an issue because the user has plugged the laptop into a power socket. The operating system senses the changed environment, decides that 802.11a network offers the best service, and so changes wireless technology usage from 802.11b to 802.11a to take advantage of the higher bandwidth offered by the 802.11a connection.

Bahl, [0095]

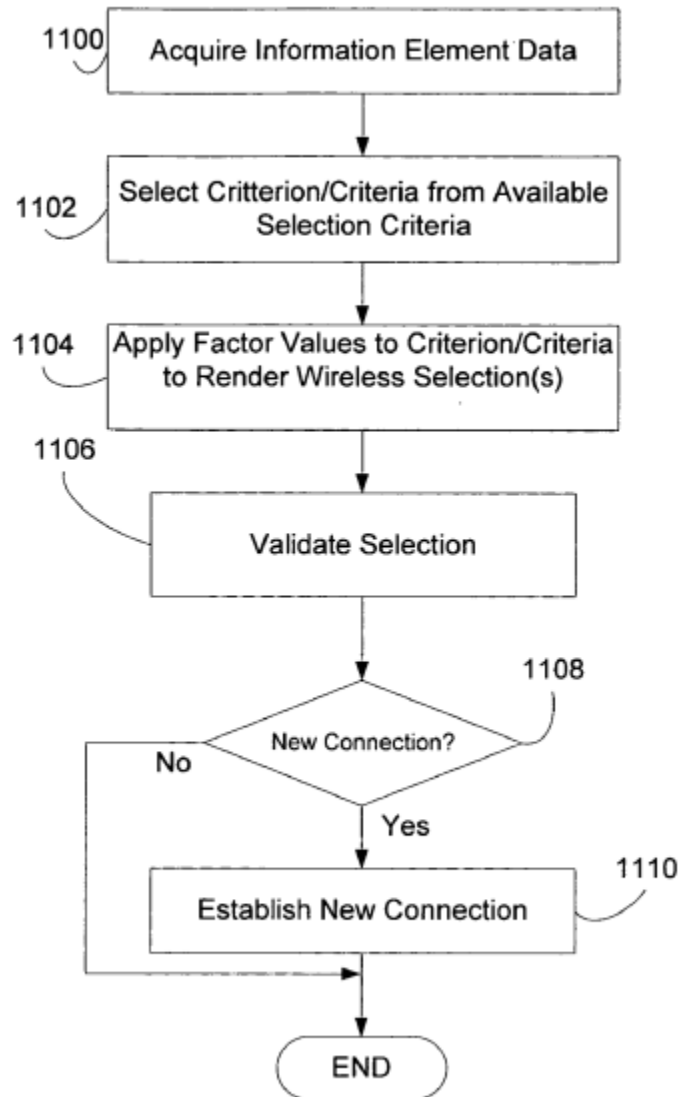
- (iii) Two laptop users are in a cab on their way to a business meeting. They open their laptops and resume their Windows sessions. On resuming their sessions, they form an ad hoc group over a Wi-Fi network to share presentation material. The operating system on the first user's machine senses that there are two GPRS networks available for Internet connectivity; one is directly through a GPRS adapter in the laptop and the other one is through the first user's Bluetooth phone. The operating system selects the GPRS network through the Bluetooth phone since the policy on the first user's machine prefers that. However on using it the operating system senses interference on the Bluetooth connection to the phone arising from the Wi-Fi ad hoc network. The operating system therefore switches to the direct GPRS network in preference to the one through the Bluetooth phone.

Bahl, [0097].

- (iv) A user brings a laptop to the local library. The library offers Wi-Fi connectivity for browsing the library web site. There is no connectivity to the Internet. The user's laptop switches from the Wi-Fi to the GPRS network through the GPRS card in the laptop to gain access to the Internet.

Bahl, [0099].

83. Figure 11 provides a “set of steps carried out by a computing device to implement wireless technology/interface/connection selection in accordance with an exemplary embodiment of the present invention”:



Bahl, [0026], Fig. 11.

84. *Bahl* describes Step 1100 of Fig. 11 as follows:

Initially, during step **1100** the computing device acquires information elements that form the basis for generating factor values. While depicted as a single step, in an embodiment of the invention step **1100** is performed at many points in time

through the operation of a variety of information element sources.

Bahl, [139].

85. *Bahl* describes Step 1102 of Fig. 11 as follows:

At step **1102** one or more of the multiple available selection criteria are selected. In an embodiment of the invention the section is driven by a user interface. However, in other embodiments, the selection step **1102** is performed, at least in part, by criterion selection logic that responds to particular sensed information to select an appropriate criterion (including factor weights that complete the criterion specification).

Bahl, [140].

86. *Bahl* describes Step 1104 of Fig. 11 as follows:

At step **1104** factor values, derived from the information elements acquired during step **1100**, are applied to one or more criteria selected during step **1102** for each available technology/interface/network combination. In an embodiment of the invention, step **1104** is interrupted and a dialog box is generated to resolve logic errors that prevent completing a decision-making process for selecting a particular technology/interface/network combination for a connection. Such errors include, for example, the presence of two factors within an applied criterion (or criteria) that give conflicting selections. Based upon the results from applying the acquired information to the criterion/criteria (and potentially further user

input), one or more of the available technology/interface/network combinations is/are designated.

Bahl, [141].

87. *Bahl* describes Step 1106 of Fig. 11 as follows:

In an embodiment of the invention, at step **1106** a user is requested to validate the criteria-based selection. By way of example, such notification is provided in the form of a dialog box that contains one or more suggested selections. In the case where multiple suggestions are provided, the choices are ranked according to the results of step **1104**. In an alternative embodiment of the invention, step **1106** is by-passed. In that case, the selection is automatically carried out without validation by a user.

Bahl, [142].

88. *Bahl* describes Step 1108 of Fig. 11 as follows:

Thereafter, at step **1108**, if the selected technology/interface/network selection differs from one currently being used by the computing device (which includes no current connection), then control passes to step **1110** wherein a new connection is established based upon the previous selection. Implementation of step **1108** can occur in any of a number of ways and should not be viewed as limiting the invention in any way. However, to the extent available, such connection creation operations are automated to the greatest degree possible to provide the best user experience. Control then passes to the End.

If however, the existing connection is the same as the one validated at step **1106**, then control passes from step **1108** to the End (there is no need to establish a new connection).

Bahl, [143].

89. *Bahl* further provides an example in pseudo-code demonstrating “how to use the above-described information elements and factors to implement wireless technology/network selection criteria.” *Bahl*, [0145]. As *Bahl* explains, the following example shows selection between 802.11a/b wireless technologies. *Id.* However, *Bahl* expressly “contemplates specifying criteria selecting between a variety of technologies including, by way of a further example, selecting between 802.11a and UWB wireless technologies and corresponding networks embodying these technologies.” *Id.*

90. The pseudo-code example referenced above is reproduced for reference below:

```
HPOWC - higher priority OWC
INT SelectBestWiFi( )
{
//
//there has to be a match with the SSID
//
if (both 802.11a && 802.11b offer the desired SSID)
{
  QNb = 0; QNa = 1; // QNs reflects speed (SPD)
                    //advantage of 802.11a over 802.11b
```

```

//
//if 802.11a is already in use, it is not considered
//
if (CON of 802.11a) == ADHOC
{
    QNb = 1; QN = 0;
    if (CON is HPOWC) return; //802.11b qualifies
}
else //either of the Wi-Fi technologies can be used
{
    //
    //if SEC of 802.11a is non-conformant,
    //
    if SECa is non-conformant
    {
        if SECb is conformant
            QNb++; QNa = 0;
        else
            QNa = QNb = 0; //both are non-conformant
    }
    else // SECa is conformant
    {
        if SECb is non-conformant
            QNa++; QNb = 0;
        else //both SECa and SECb are conformant
        {
            QNa++; QNb++;
        }
    }
}
if (SEC is CWC && (QNa == 0 || QNb == 0)) return; //let QN values decide;
//if both QNs are 0; let user
//decide

//
//If congestion on 802.11b is less than on 802.11a
//
if (CNGa - CNGb) > acceptable difference
    QNb++;
else
    QNa++;
if (CNS is HPOfRemOWC) // if CNG is the highest priority
    return;

//
//If interference on 802.11b is less than on 802.11a. The acceptable threshold takes
//into account the inherent bias against 802.11b on account of the crowded spectrum
//
if (INTFa - INTFb) > acceptable difference
    QNb++;
else
    QNa++;
if (INTF is HPOfRemOWC)
    return;

//
//If throughput on 802.11b is less than on 802.11a.
//
if (THRPTa > THRPTb) QNa++;
else if (THRPTb > THRPTa) QNb++;
if (THRPT is HPOWC) //NYCP is not yet considered parameters
    return;

//
// If battery life left is low, reflect that in QN
//
if (BL is low) QNb++;

//
// Reflect range advantage of 802.11b for interactive, voice, and a/v streaming apps in
//the QN
//
if (APP is INTERACTIVE or A/V and STA is MOBILE) QNb++;

//
//If cost for using 802.11a is more as determined from the network, reflect that in QN
//
if (CSTa >> CSTb) QNb++;
else if (CSTb >> CSTa) QNa++;

//
//If app throughput requirements are satisfied by throughput on 802.11b, select it
//

```

```
if (APPTHRPT < THRPTb)
{
  QNb++;
}
else
{
  if (APPTHRPT < THRPTa)
  {
    //
    //Since APPTHRPT can not be met by THRPTb, QNb goes down
    // significantly
    //
    QNb -= 2
  }
}
}
else //one or both do not offer the desired SSID
{
  QNa = QNb = 0; //start with a clean state
  //
  //select technology that provides the desired SSID
  //
  if (SSIDa == desired SSID) {QNa++; QNb = 0;}
  else if (SSIDb == desired SSID) {QNb++; QNa = 0;}
}
return;
} //end of SelectBestWi-Fi
```

Bahl, [0146].

IX. CLAIM CONSTRUCTION

91. I have given all the claim terms their plain and ordinary meaning, as would have been understood by a person having ordinary skill in the art at the time of the alleged invention, which I understand is January 31, 2006, having taken into consideration the language of the claims, the specification, and the prosecution history of record. I reserve the right to respond to any construction questions that may be raised in the matter.

X. SPECIFIC GROUNDS FOR CHALLENGE

92. In the sections below, I explain in detail how claims 1-17 and 19 of the '436 patent are not patentable over the prior art. More particularly:

- (i) **Ground 1** challenges claims 1-8 and 10-14 as obvious over *Bahl* in view of *Hsu* and *Weisshaar*.²
- (ii) **Ground 2** challenges claim 13 as obvious over *Bahl* in view of *Hsu*, *Weisshaar*, and *White*.
- (iii) **Ground 3** challenges claims 9, 15-17, and 19 as obvious over *Bahl* in view of *Hsu*, *Weisshaar*, and *Ranta*.

XI. GROUND 1: *BAHL* IN VIEW OF *HSU* AND *WEISSHAAR* RENDER OBVIOUS CLAIMS 1-8, 10-14

A. *Bahl in View of Hsu and Weisshaar*

1. *Hsu* (Ex. 1006)

93. U.S. Patent Application Publication 2004/0165563 ("*Hsu*"), which is entitled "Wireless local access network system detection and selection," is directed to a mobile device and methods for detecting the availability of a wireless access

² To the extent my declaration refers to prior art references other than those recited in the above-listed grounds 1-3, I am using such references as evidence supporting what I believe would have been known to a person of ordinary skill in the art at the time of the alleged invention, for example, about the state of the art and/or the benefits and advantages of certain design choices.

medium (e.g., cdma2000, WLAN, etc.) and selecting an access medium for transporting application contents. For example, *Hsu*' Abstract provides:

Method and apparatus for detection and selection of Wireless Local Area Network (WLAN) service. A remote station, which may be in conjunction with a wireless computing device, may scan for a cellular paging indicator and a WLAN beacon using one or two tuners. When WLAN coverage is available, a packet data session may be transferred thereto.

Hsu, Abstract.

94. *Hsu* explains that users desire access to local WLANs to enhance reception and data rates of communications through a wireless device. *Hsu*, [0007]. However, according to *Hsu*, a problem existed in detecting and selecting WLAN systems. *Hsu*, [0007]. Specifically, *Hsu* explains that:

Wireless Local Access Networks (WLANs) provide wireless access to a communication network within a local geographical area, such as a building or in a cybercafe. WLANs are currently considered by many cellular carriers to alleviate loading of a cellular system, so as to increase capacity. Additionally, users desire access to local WLANs to enhance reception and data rates of communications through a wireless device. A problem exists in detecting and selecting WLAN systems. The purpose of system detection is to detect the availability of a wireless access medium (e.g., cdma2000, WLAN, etc.). The purpose of system selection is to select an access medium for transporting

application contents. System selection may be based on the availability of access media, preference policy, application status, user intervention, etc., or a combination thereof.

Hsu, [0007].

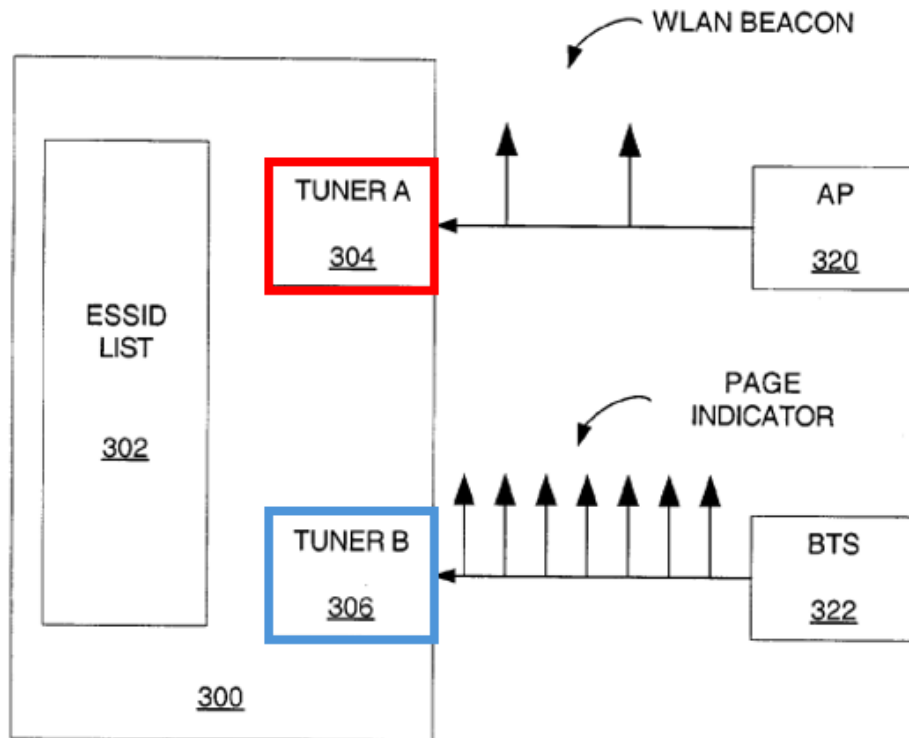
95. *Hsu* further explains that:

Typically, a cellular system transmits a paging indicator periodically to page a mobile station when there is a pending communication. Similarly, a WLAN may be advertised by a beacon transmitted by the WLAN. Both the paging indicator and the beacon require the mobile station to scan for the transmitted signal. As the mobile station often has little information as to the location and accessibility of a WLAN, the mobile station may scan for the WLAN periodically expending considerable power. There is a need therefore for an efficient, accurate method of system detection and selection.

Hsu, [0008].

96. *Hsu* discloses methods of detecting and selecting WLAN systems through two embodiments: (i) a “Mobile Station (MS)” with one tuner used for communication with both a cellular system and a WLAN system (*Hsu*, [0059]) and (ii) a MS with two tuners that can tune to a cellular frequency and the WLAN frequency simultaneously (*i.e.*, Tuner A is configured for communication with a WLAN and Tuner B 306 is configured for communication with a wireless cellular network). *Hsu*, [0077].

97. MS 300, shown below, is the two-tuner embodiment. The WLAN interface (Tuner A) is annotated in **red** and the cellular interface (Tuner B) is annotated in **blue**.



Annotated *Hsu*, Fig. 6

98. With respect to the one-tuner embodiment, *Hsu* provides that:

When the Mobile Station (MS) has one tuner for communication. In such a device, the single tuner is used for communication with both the cellular system and the WLAN system. The MS detects WLAN coverage and performs system selection between WLAN and cellular system, wherein the MS may only tune to one system (WLAN or cellular) at a given time.

Hsu, [0059].

99. *Hsu* further explains that the single-tuner mobile station performs system selection and detection in various scenarios. Specifically:

MS performs system detection and selection in the following scenarios: (1) the MS is idle (not active in communication) with respect to the cellular network, having no dedicated channel, and desires to scan for WLAN; (2) the MS has an active packet data session with the cellular network, having a dedicated channel, and desires to scan for WLAN; (3) the MS is tuned to the WLAN, and desires to receive cellular pages; and (4) the MS is tuned to the WLAN but with low signal strength.

Hsu, [0060].

100. With respect to scenario (1), *Hsu* explains that:

In scenario (1) described above, ***if the MS is idle in the cellular network (i.e., no dedicated channel), the MS may decide to scan for WLAN coverage*** based on one or more factors, e.g., user command, pre-configured preference, WLAN availability advertisement as received from the cellular network, etc. The MS tunes to the cellular network during each assigned paging slot interval. In this way, the MS is able to receive any page indicator from the cellular network. Once the MS monitors for cellular page indicator, the MS then is able to tune to the WLAN frequencies and use passive or active scanning to detect WLAN coverage.

Hsu, [0061].

101. With respect to scenario (2), *Hsu* explains that:

In scenario (2) described above, ***the MS has an active packet data session in the cellular network (i.e., with dedicated channel). The MS may choose not to scan for WLAN while active data session in the cellular network.*** In this case, while the MS is active in the cellular network, the MS does not switch to WLAN even though it could access to WLAN. Although the MS might not be able to take the advantage of high-speed WLAN access, the MS would not experience service interruption. After the MS becomes idle in the cellular network, the MS tunes away from the cellular network to scan for the WLAN.

Hsu, [0062].

102. With respect to scenario (3), *Hsu* explains that:

According to scenario (3) the MS is currently tuned to the WLAN. If the MS is not transmitting or receiving frames over the WLAN, the MS periodically tunes back to the cellular network and monitors the Paging Indicator on the Quick Paging Channel. If the Paging Indicator is “0,” then there is no page for the MS, and the MS immediately tunes back to the WLAN frequency. In this case, the time the MS spent on the cellular frequency is minimal (in the order of ms). If the Paging Indicator is “1,” then the MS monitors the Paging Channel for its paging slot. In a cdma2000 type network, the Paging Indicator occurs at most 100 ms before the MS's paging slot. The paging slot is 80 ms. Paging Indicator of “1” does not guarantee that the page is

for the MS because a second MS's International Mobile Subscriber Identity (IMSI) may be hashed coincidentally to the same Paging Indicator as the first MS. Thus, the MS may spend a maximum of 180 ms on the paging channel for nothing. If the page is for the MS, it will reply with Paging Response and stay in the cellular network to receive the incoming circuit-switched voice call.

At the time the MS is scheduled to monitor the cellular network paging, *if the MS is in the middle of transmitting or receiving frames over the WLAN, the MS should stay in the WLAN to complete the data delivery* and thus skip a paging cycle. Potentially, the MS could miss a page, and the call set-up time of an incoming circuit-switched voice call increases.

Hsu, [0068]-[0069].

103. With respect to scenario (4), *Hsu* explains that:

According to scenario (4), if the MS is tuned to the WLAN *but detects the signal strength has dropped below an acceptable threshold*, the MS may tune to the cellular network and proceeds to handover the packet data session to cellular network.

Hsu, [0072].

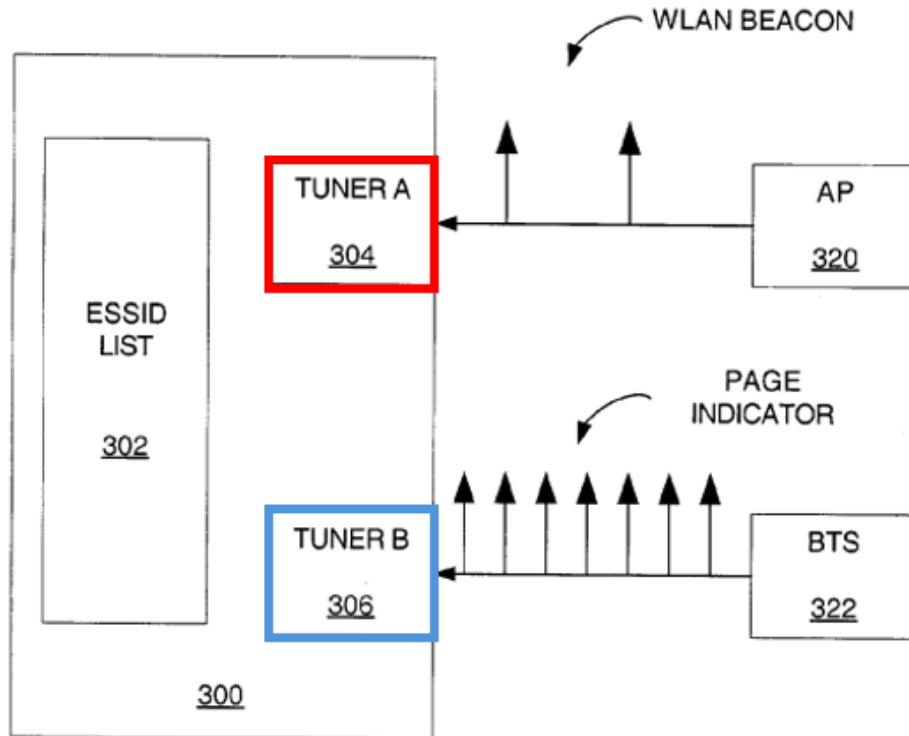
104. With respect to the one-tuner embodiment, *Hsu* provides that:

In the following example, the Mobile Station (MS) has two tuners that can tune to a cellular frequency and the WLAN frequency simultaneously. A MS **300** is illustrated in FIG. 6

having an ESSID list **302**, which is stored in memory, a first tuner, tuner A **304**, and a second tuner, tuner B **306**. Tuner A is configured for communication with a WLAN. Tuner B **306** is configured for communication with a wireless cellular network. As illustrated, when MS **300** is within range of accessing AP **320**, tuner A **304** scans for a WLAN beacon transmitted by AP **320**. The WLAN beacon is transmitted periodically and identifies the WLAN supported by AP **320**. Tuner B **306** scans for a paging indicator from the cellular network transmitted by Base station Transceiver System (BTS) **322**. In this way, the MS **300** may scan for WLAN coverage while also scanning for cellular pages. Thus, the MS **300** detects WLAN coverage and performs system selection between WLAN and the cellular system using one tuner for each access medium.

Hsu, [0059].

105. For reference, the annotated version of Figure 6 shown in Paragraph 97, which shows MS 300 with the WLAN interface (Tuner A) annotated in **red** and the cellular interface (Tuner B) annotated in **blue**, is reproduced below:



Annotated *Hsu*, Fig. 6

106. In addition to the example embodiment of a two-tuner mobile station shown in Fig. 6, *Hsu* explains that MS 300 may be implemented in any of a variety of physical configurations. Specifically:

MS 300 may implement any of a variety the physical configurations. For example, a “Type A” device is a single handheld device (e.g., phone, Personal Digital Assistant (PDA)) having a built-in WLAN tuner and a cellular network tuner, or a slotted-in WLAN tuner card and cellular tuner card (e.g., CDMA2000 card). Additionally, a “Type B” device is a laptop computing device, such as a personal computer, having a WLAN tuner card, wherein the laptop computing device is connected to

a cellular handset, such as a handset supporting cdma2000 communications.

For a type A device, the MS **300** is a single physical device (e.g., handset, PDA) that supports both WLAN and cellular network protocols. The MS **300** has two Radio Frequency (RF) tuners: a first for the cellular network; and a second for the WLAN.

...

Note that a wireless device may include multiple tuners, wherein each tuner is adapted for communication with a different access medium, e.g., WLAN and cellular network. Alternately, a wireless device may be coupled to another wireless device, wherein each includes a tuner, and the combination results in multiple tuners. In one such configuration, a laptop (computing device) operates together with a cellular handset. The laptop includes a WLAN card or built-in WLAN port, while the handset supports cellular communications. WLAN information (e.g., ESSID) is provisioned in the laptop to scan for WLAN coverage.

Hsu, [0078]-[0079], [0092].

107. In my opinion, a person of ordinary skill in the art would have understood that regardless of whether MS 300 is implemented as a single handheld device having two-tuners or two devices coupled together, each having a tuner (such as laptop 600 and MS 602), the functionality disclosed by *Hsu* – *i.e.*, network detection and selection – is the same.

108. For example, with respect to network detection, *Hsu* provides that MS 300 and laptop 600 may decide to scan for WLAN coverage based on receipt of a WLAN availability advertisement. Specifically:

<i>Hsu</i> , [0082] (Single Device Embodiment)	<i>Hsu</i> , [0094] (Coupled Device Embodiment)
<i>The MS 300 may decide to scan for WLAN coverage based on one or more factors, e.g., user command(s), pre-configured preference(s), application status (e.g., on-going packet data session), WLAN availability advertisement as received from the cellular network, etc. One WLAN protocol defined by IEEE 802.11, and referred to herein as “802.11,” allows the MS 300 to scan for WLAN coverage passively or actively. In passive scanning, the MS 300 listens for the WLAN beacon sent by the AP 320 on WLAN frequencies. The WLAN beacon contains the ESSID of AP 320, referred to as ESSID (AP 320). If the ESSID(AP 320) matches an ESSID stored in the MS 300 ESID list 302, this</i>	<i>In the configuration illustrated in FIG. 9, the laptop 600 is currently processing a packet data session with the cellular network 606 through the MS 602. During the packet data session, when the MS 602 receives a WLAN availability advertisement from the cellular network 606, the MS 602 may notify the laptop 600 via a signaling protocol defined between the MS 602 and the laptop 600. On receipt of such notification the laptop 600 may choose to scan for WLAN coverage. The laptop 600 may then perform system selection based on WLAN signal strength and acquire a WLAN signal from AP 604. The laptop 600 and the AP 604 then authenticate the connection. Once authentication is completed, the laptop</i>

is an indication that the MS 300 has detected WLAN coverage, and that such coverage is provided by the MS 300 service provider. In active scanning, the MS 300 transmits a Probe Request that contains the ESSID of the MS 300. If the AP 320 receives the Probe Request and the ESSID of the MS 300 matches the ESSID of the AP 320, the AP 320 transmits a Probe Response to the MS 300. If the MS has a list of multiple ESSIDs, the MS may transmit a Probe Request containing an ESSID having the highest preference. The ESSID preference may be stored as a system selection parameter in the Preference Database (described hereinabove).	600 disconnects from the cellular network through the MS 602. The MS 602 then disconnects the packet data session with the cellular network 606. From this point, the packet data session is processed between the laptop 600 and the AP 604.
--	--

109. As a further example, with respect to network selection, *Hsu* explains that MS 300 and laptop 600 may wait for a pending packet data session to go dormant before selecting a network. Specifically:

<i>Hsu</i>, [0085] (Single-Device Embodiment) After the MS 300 detects WLAN coverage, receives the WLAN beacon,	<i>Hsu</i>, [0096] (Coupled-Device Embodiment) Alternatively, <i>the laptop may switch to the WLAN if the packet data session</i>
---	---

the MS 300 uses certain criteria to handover a packet data session from the cellular network to the WLAN. The criteria may include whether the MS is idle in cellular network (i.e., no dedicated channel) or whether the WLAN signal strength is stable, etc. <i>The MS 300 may wait for a pending packet data session to go dormant in the cellular network. The MS 300 d then performs packet data session handover (i.e., sending Mobile IP registration via WLAN).</i> This may be useful to minimize service interruption. Similarly, the MS 300 may perform packet data session handover when the WLAN signal strength is above an acceptable threshold for a specified period of time. In this way, the MS 300 ensures that access to the WLAN is sustainable. The measure may be any measure of channel quality and/or signal strength. The threshold may be predetermined or may dynamically be adjusted based on the actual performance of the communication.	<i>currently has no data pending transfer so as to minimize service interruption (e.g., downloading a file).</i> Upon detecting a strong WLAN signal, the laptop 600 waits for a given time period (e.g., several seconds) to detect any activity of data transfer. <i>If no activity is detected, the laptop 600 performs WLAN access authentication, followed by Mobile IP registration via the WLAN,</i> and finally release of the cellular packet data service option, as described above.
---	--

This may be useful to avoiding any ping-pong effect whereby the MS 300 switches between WLAN access and cellular network access due to changing conditions or signal strength that is at the margin of tolerance for operation. Still further, upon detection of the WLAN, the MS 300 may notify the user and wait for the user to manually select WLAN.	
---	--

2. *Weisshaar* (Ex. 1007)

110. U.S. Patent Application Publication 2003/0130001 (“*Weisshaar*”), which is entitled “Method of enabling the transmission of data in a wireless communication network,” is directed to “monitoring a plurality of communication interfaces; determining that a communication interface of the plurality of communication interfaces has become available; informing an application that the communication interface has become available; and transmitting data associated with the application on the communication interface.” *Weisshaar*, Abstract.

111. *Weisshaar* explains that “[a]s telematics communication systems continue to evolve, a telematics communication unit of a vehicle will have a greater number of communication interfaces.” *Weisshaar*, [0007]. Although *Weisshaar* provides examples relating to a “telematics communication unit of a

vehicle[,]” *Weisshaar* further explains that “services provided by telematics systems are not restricted to vehicle-based subscribers, and they can also be provided to subscribers at home, at work, or elsewhere.” *Weisshaar*, [0006].

Specifically, *Weisshaar* provides that:

The services provided by telematics systems are not restricted to vehicle-based subscribers, and they can also be provided to subscribers at home, at work, or elsewhere.

As telematics communication systems continue to evolve, a telematics communication unit of a vehicle will have a greater number of communication interfaces. As more applications are developed for the transmission of data from a telematics communication unit of a vehicle, the applications enable an increasing amount of data to be transmitted. However, as more applications are vying for communication interfaces to transmit data, it would be useful to inform applications of the availability of a communication interface in the event that the application could use the communication interface to transmit data. Accordingly, there is a need for a method of informing an application that a communication interface is available to enable the transmission of data in a wireless communication device.

Weisshaar, [0006], [0007].

112. As stated in the excerpt above, *Weisshaar* provides that “as more applications are vying for communication interfaces to transmit data, it would be useful to inform applications of the availability of a communication interface in the

event that the application could use the communication interface to transmit data.”

Weisshaar, [0007]. “Accordingly, there is a need for a method of informing an application that a communication interface is available to enable the transmission of data in a wireless communication device.” *Weisshaar*, [0007].

113. To inform an application that a communication interface is available, *Weisshaar* provides for the use of a “connection manager 336[,]” which performs various functions relating to monitoring communication interfaces and informing applications regarding the status of the communication interfaces. Specifically,

Finally, *connection manager 336 manages connection(s) of the client platform 300 to one or more networks*, such as geographically distributed cellular and server networks. *It ensures continuity of sessions across physical and/or logical network interfaces. It can require security (e.g. authentication, encryption, etc.) as a precondition to a connection. It can ensure that low bandwidth connections are used efficiently. More specifically, the connection manager manages multiple interfaces and reports concurrent use of more than one interface, either by the same or different applications.* The connection manager also enables an interface to be used for both streams and datagrams at the same time. In particular, the transport layer enables the flow of data between two hosts for an application. Streams are transmitted by the connection oriented transmission control protocol (TCP) which enables the reliable flow between two hosts by dividing data into blocks and

receiving acknowledgments when the data is received. In contrast, datagrams are transmitted by the less reliable user datagram protocol (UDP), which is also well known in the art.

Weisshaar, [0051].

114. An example of how *Weisshaar* manages communication interfaces is further provided with respect to Figure 6. Figure 6 of *Weisshaar* is “a flow chart showing a method for enabling the transmission of data in a wireless communication network according to the present invention.” *Weisshaar*, [0013].

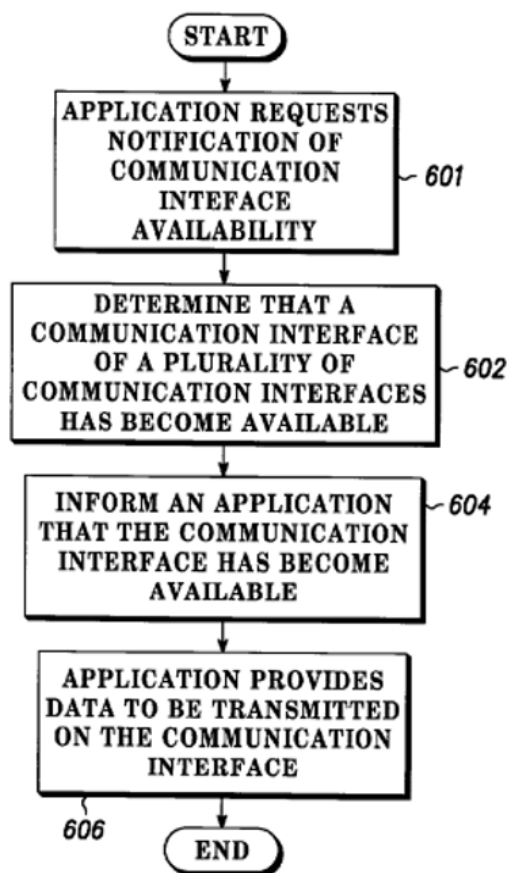


FIG. 6

Weisshaar, Fig. 6.

115. With respect to Figure 6, *Weisshaar* provides:

Turning now to FIG. 6, a flow chart shows a method of enabling transmission of data in a wireless communication network according to the present invention. In particular, an application, such as one of the applications described in reference to FIG. 3, requests notification of the availability of a communication interface at a step **601**. For example, an application of FIG. 3 could request that the connection manager **336** notify it when a communication interface meeting certain criteria becomes available. *The communication interface could be any communication interface described in reference to FIG. 2. It should be noted that the applications may have varying requirements which could be met by different interfaces, while a number of different communication interfaces may be acceptable for a given application.*

It is determined that a communication interface of a plurality of communication interfaces has become available at a step 602. An application is then informed that a desirable communication interface has become available at a step 604. The application then provides data to be transmitted on the communication interface at a step 606. Accordingly, an application is informed of the availability of a communication interface and can determine whether it desires to make data available for transmission when a particular communication interface is available.

Weisshaar, [0055], [0056].

3. *Bahl, Hsu, and Weisshaar* are Analogous Art to the '436 Patent

116. I have analyzed *Bahl, Hsu, and Weisshaar* and it is my opinion that these prior art references are analogous to the '436 patent because *they* are from the same field of endeavor as the alleged invention of the '436 patent and are reasonably pertinent to the problem faced by the inventors of the '436 patent.

a. *Bahl, Hsu, and Weisshaar* are from the Same Field of Endeavor as the '436 Patent

117. The '436 patent provides that “[e]merging mobile devices are being equipped with multiple interfaces allowing users to take advantage of heterogeneous radio technologies.” '436 patent at 2:41-43. As an example, Multiple Interface Devices (MIDs) “may use WLANs for higher data rates and WANs for better coverage.” '436 patent at 7:13-14. The '436 patent also provides that “more advantage could be reaped if the MID use its network interfaces in response to the Application running on and or Situations they are operating in.” '436 patent at 7:14-17.

118. *Bahl, Hsu, and Weisshaar* (like the '436 patent) also relate to using one or more network interfaces (such as WLAN or cellular) in response to application needs and sensed operating conditions, as discussed below.

119. With respect to *Bahl*, *Bahl* provides, for example, “a method for selecting a wireless technology from among multiple available wireless

technologies on a computing device” based on various factors. In particular, *Bahl* states:

The present invention comprises a method and framework for selecting wireless technologies/interfaces/networks. In particular the present invention comprises a method for selecting a wireless technology from among multiple available wireless technologies on a computing device for establishing a network connection. The method includes the steps of maintaining a wireless technology selection framework comprising a set of factors. One or more of the factors within the set of factors are incorporated into specified wireless technology selection criteria. A computing device incorporating the present invention acquires information regarding the status and/or capabilities associated with each available wireless technology supported by network interfaces on the computing device. Thereafter, the computing device renders factor values for ones of the set of factors based upon the set of information acquired for each available wireless technology. After calculating factor values, the computing device renders a wireless technology selection based at least in part upon applying the calculated factor values to the wireless technology selection criteria. The present invention thus facilitates implementing dynamic network interface/network selection on a computing device in response to a variety of sensed conditions that affect the values assigned to factors incorporated into specified wireless selection criteria.

Bahl, [0013].

120. As *Bahl* further provides, these factors include criteria such as application throughput requirements and battery life. In particular, *Bahl* provides:

Having described a general architecture of a coexistence driver that facilitates creation of virtual coexistence drivers for handling interference between two or more sources of wireless data transmission interference, attention is directed to a wireless network/interface selection scheme. Such scheme can be used at any of a variety of circumstances during the operation of a computing device that includes one or more wireless network interfaces capable of connecting to any one of multiple differing networks. For example, such selection scheme is potentially used to establish an initial connection. Furthermore, the selection scheme is utilized, after establishing an initial connection, to establish a new connection to a different network in accordance with changed operating parameters. While avoiding interference, addressed extensively herein above, is one reason to invoke the wireless selection method described below, the selection method is applicable to a variety of situations where two or more suitable networks/interfaces are available for reaching a particular resource. *The selection scheme and resulting defined criteria potentially include factors such as: policy, network SSID, speed, congestion, interference, throughput, battery life, range, connectivity, security, cost per bit, and application throughput requirements. Each of these factors is described herein below with reference to FIG. 9. The exemplary wireless technology*

selection scheme described herein contemplates selecting a wireless technology based upon a variety of factors, regardless of whether the selection was necessitated by interference.

Bahl, [0090].

121. With respect to *Hsu*, *Hsu* provides, for example, a mobile station with two tuners (*i.e.*, WLAN and cellular) (*Hsu*, [0077]) that selects between a WLAN and cellular network “based on the availability of access media, preference policy, application status, user intervention, etc., or a combination thereof.” *Hsu*, [0007].

122. In particular, *Hsu* provides in its Background section that:

Wireless Local Access Networks (WLANs) provide wireless access to a communication network within a local geographical area, such as a building or in a cybercafe. WLANs are currently considered by many cellular carriers to alleviate loading of a cellular system, so as to increase capacity. Additionally, users desire access to local WLANs to enhance reception and data rates of communications through a wireless device. A problem exists in detecting and selecting WLAN systems. The purpose of system detection is to detect the availability of a wireless access medium (e.g., cdma2000, WLAN, etc.). The purpose of system selection is to select an access medium for transporting application contents. *System selection may be based on the availability of access media, preference policy, application status, user intervention, etc., or a combination thereof.*

Hsu, [0007].

123. *Hsu* further describes factor-based system selection in the context of a mobile station with two tuners:

In the following example, the Mobile Station (MS) has two tuners that can tune to a cellular frequency and the WLAN frequency simultaneously. A MS **300** is illustrated in FIG. 6 having an ESSID list **302**, which is stored in memory, a first tuner, tuner A **304**, and a second tuner, tuner B **306**. Tuner A is configured for communication with a WLAN. Tuner B **306** is configured for communication with a wireless cellular network. As illustrated, when MS **300** is within range of accessing AP **320**, tuner A **304** scans for a WLAN beacon transmitted by AP **320**. The WLAN beacon is transmitted periodically and identifies the WLAN supported by AP **320**. Tuner B **306** scans for a paging indicator from the cellular network transmitted by Base station Transceiver System (BTS) **322**. In this way, the MS **300** may scan for WLAN coverage while also scanning for cellular pages. ***Thus, the MS 300 detects WLAN coverage and performs system selection between WLAN and the cellular system using one tuner for each access medium.***

...

After the MS 300 detects WLAN coverage, receives the WLAN beacon, the MS 300 uses certain criteria to handover a packet data session from the cellular network to the WLAN. The criteria may include whether the MS is idle in cellular network

(i.e., no dedicated channel) or whether the WLAN signal strength is stable, etc. The MS 300 may wait for a pending packet data session to go dormant in the cellular network. The MS 300 d then performs packet data session handover (i.e., sending Mobile IP registration via WLAN). This may be useful to minimize service interruption. Similarly, the MS 300 may perform packet data session handover when the WLAN signal strength is above an acceptable threshold for a specified period of time. In this way, the MS 300 ensures that access to the WLAN is sustainable. The measure may be any measure of channel quality and/or signal strength. The threshold may be predetermined or may dynamically be adjusted based on the actual performance of the communication. This may be useful to avoiding any ping-pong effect whereby the MS 300 switches between WLAN access and cellular network access due to changing conditions or signal strength that is at the margin of tolerance for operation. Still further, upon detection of the WLAN, the MS 300 may notify the user and wait for the user to manually select WLAN.

Hsu, [0077], [0085].

124. With respect to *Weisshaar*, *Weisshaar* provides, for example, a user node 108 with a connection manager 336 that informs application(s) of an application “could request that the connection manager 336 notify it when a communication interface meeting certain criteria becomes available.” *Weisshaar*, [0055]. Specifically, *Weisshaar* provides that:

Turning now to FIG. 6, a flow chart shows a method of enabling transmission of data in a wireless communication network according to the present invention. In particular, an application, such as one of the applications described in reference to FIG. 3, requests notification of the availability of a communication interface at a step 601. *For example, an application of FIG. 3 could request that the connection manager 336 notify it when a communication interface meeting certain criteria becomes available.* The communication interface could be any communication interface described in reference to FIG. 2. *It should be noted that the applications may have varying requirements which could be met by different interfaces, while a number of different communication interfaces may be acceptable for a given application.*

Weisshaar, [0055].

125. Accordingly, as discussed above, it is my opinion that *Bahl*, *Hsu*, and *Weisshaar* are from the same field of endeavor as the '436 patent.

b. *Bahl*, *Hsu*, and *Weisshaar* are Reasonably Pertinent to the Problems Addressed by the '436 Patent

126. The '436 patent states that “more advantage could be reaped if the mobile uses its network interfaces according to the applications and situations responsiveness.” '436 patent at 2:43-45. The '436 patent further states that “how to make use of silent periods based on application’s needs and in a situation

awareness manner has not been discussed in prior arts.” ’436 patent at 3:12-14.

Bahl, *Hsu*, and *Weisshaar* are both reasonably pertinent to these problems.

127. For example, as I discuss above, *Bahl* and *Weisshaar* provide a solution to mobile devices not using their network interfaces according to applications and situation responsiveness by providing a framework for selecting network interfaces according to application needs and sensed operating conditions. *Bahl*, [0090]; *Weisshaar*, [0055].

128. Likewise, *Hsu* provides, for example, a solution for making use of periods where a packet data session currently has no data pending transfer (*i.e.*, a “silent period”) to change network interfaces with minimized service (if any) interruption. Specifically, *Hsu* states that a:

[L]aptop may switch to the WLAN ***if the packet data session currently has no data pending transfer so as to minimize service interruption (e.g., downloading a file)***. Upon detecting a strong WLAN signal, the laptop **600** waits for a given time period (e.g., several seconds) to detect any activity of data transfer. If no activity is detected, the laptop **600** performs WLAN access authentication, followed by Mobile IP registration via the WLAN, and finally release of the cellular packet data service option, as described above.

Hsu, [0096]. As a further example, *Hsu* states that:

After the MS **300** detects WLAN coverage, receives the WLAN beacon, the MS **300** uses certain criteria to handover a packet data session from the cellular network to the WLAN. The criteria may include whether the MS is idle in cellular network (i.e., no dedicated channel) or whether the WLAN signal strength is stable, etc. *The MS 300 may wait for a pending packet data session to go dormant in the cellular network.* The MS **300** then performs packet data session handover (i.e., sending Mobile IP registration via WLAN). This may be useful to minimize service interruption. Similarly, the MS **300** may perform packet data session handover when the WLAN signal strength is above an acceptable threshold for a specified period of time. In this way, the MS **300** ensures that access to the WLAN is sustainable. The measure may be any measure of channel quality and/or signal strength. The threshold may be predetermined or may dynamically be adjusted based on the actual performance of the communication. This may be useful to avoiding any ping-pong effect whereby the MS **300** switches between WLAN access and cellular network access due to changing conditions or signal strength that is at the margin of tolerance for operation. Still further, upon detection of the WLAN, the MS **300** may notify the user and wait for the user to manually select WLAN.

Hsu, [0085].

129. Accordingly, as discussed above, it is my opinion that *Bahl*, *Hsu*, and *Weisshaar* are reasonably pertinent to the problems expressed by the '436 patent.

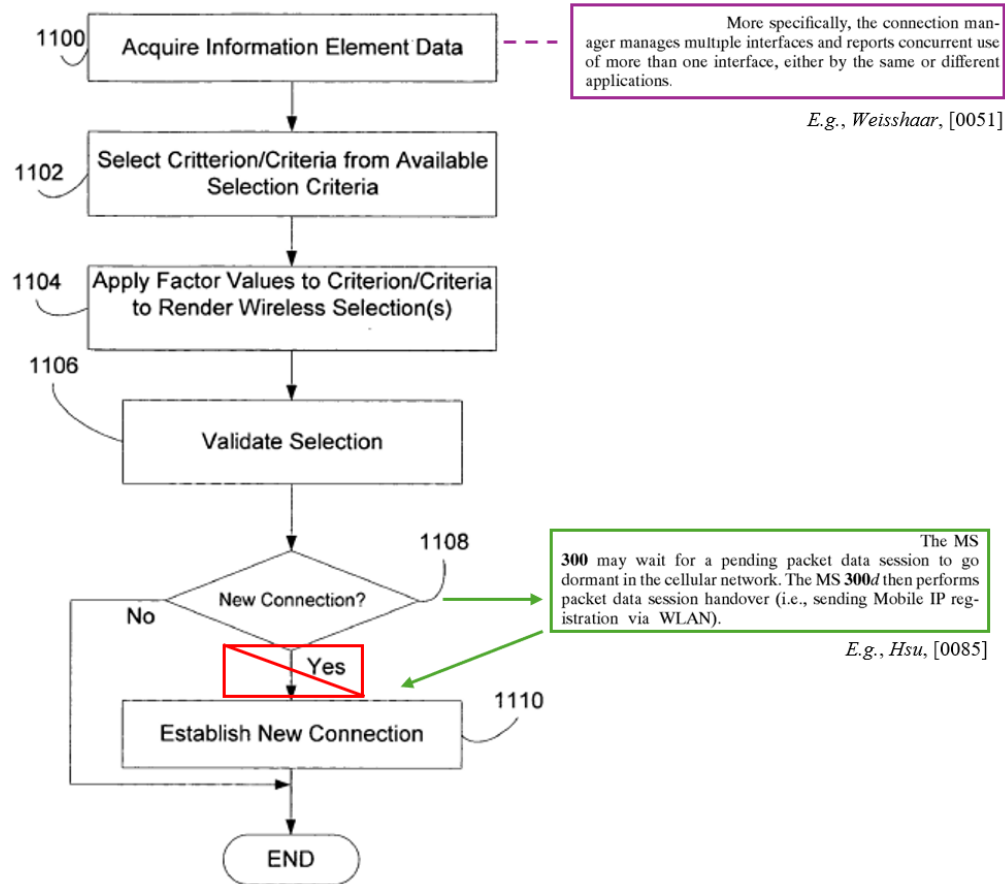
4. Overview of the *Bahl-Hsu-Weisshaar* Combination

130. As I explain below, *Bahl* expressly discloses all of the challenged limitations of the claims in Ground 1 except “having said mobile control processes ... during silent periods” and “having said mobile control use of said interfaces by using a second interface, during a silent period of a second application running on said mobile and using said second interface, to support a first application running on said mobile and using a first interface that is heterogeneous to said second interface such as to use both said first and second heterogeneous interfaces concurrently during said silent period to support said first application.” *See* Section XI.B–M, *infra*.

131. Relatedly, *Hsu* discloses a method for controlling use of heterogeneous radio interfaces (*e.g.*, WLAN and cellular) during periods where a packet data session has no data pending transfer (*i.e.*, “silent periods”). *See* Section XI.B.5.b, *infra*.

132. And, *Weisshaar* discloses managing multiple interfaces and “report[ing] concurrent use of more than one interface, either by the same or different applications.” *See* Section XI.B.6, *infra*.

133. In my opinion having reviewed *Bahl*, *Hsu*, and *Weisshaar*, the combined *Bahl-Hsu-Weisshaar* network selection method would be as follows:



Modified and Annotated *Bahl*, Fig. 11

134. Specifically, *Bahl*'s Figure 11 "summarizes a set of steps carried out by a computing device to implement wireless technology/interface/connection selection in accordance with an exemplary embodiment of" *Bahl*. *Bahl*, [0026].

135. *Bahl* explains that:

Initially, during step **1100** the computing device acquires information elements that form the basis for generating factor values. While depicted as a single step, in an embodiment of the invention step **1100** is performed at many points in time

through the operation of a variety of information element sources.

Bahl, [0139].

136. In the combined *Bahl-Hsu-Weisshaar* network selection method, the computing device acquires information regarding the concurrent use of more than one interface, either by the same or different applications, as taught by *Weisshaar*, which informs, among other things, when the *Bahl* network selection method should be initiated and the extent to which an available network is congested. In this way, it is my opinion that *Weisshaar* fits squarely into *Bahl*'s network selection framework.

137. With respect to informing when the *Bahl* network selection method should be initiated, *Bahl* explains that network selection may occur during a significant event, such as a significant change in data received from a network interface card regarding an access point or the status of an application currently executing on a computing device:

In an embodiment of the invention, a limit is placed upon the frequency with which the computing device generates new QN values for the computing device. *The QN is determined periodically (according to a configurable repetition period) and on the occurrence of any significant event such as media connect/disconnect, a significant change in data received from a network interface card regarding an access point, or the start*

of a particular application. As will be explained further herein below with reference to FIG. 11, upon the occurrence of such events, the selection logic is invoked to re-evaluate a previous technology/interface/network combination selection in view of potentially new information element data and resulting factor values/weights.

Bahl, [0129], claim 15 (“The method of claim 14 wherein the detected event corresponds to a change to a status of an application currently executing upon the computing device.”).

138. *Bahl* further explains that such events are monitored by a notification service:

In an embodiment of the invention, the coexistence driver **300**, or alternatively a separate decision-making module that provides connection selection services, acquires the information from the multiple sources and generates a selection. Furthermore, it is noted that in exemplary embodiments of the invention, acquiring the information element data and executing the selection procedures are event driven. *Such events are generated in response to status changes monitored by the coexistence driver 300 (or some other notification service).* In other cases, the events are driven by a periodically invoked task registered, by way of example, with a “timer driven” task scheduling service provider in the operating system. Furthermore, the weights assigned to various factors within selection criteria are reassigned in response to events (e.g., de-installation or disabling

of an application, battery power running low, a change in the number or types of available networks, a change in congestion/interference parameter values, a change in connectivity of a network, etc). After completing the reassignment, an event is registered thereby prompting re-applying a criterion to each of a set of currently available network interfaces/networks.

Bahl, [0137].

139. *Weisshaar* provides such a monitoring and/or notification service, namely connection manager 336. For example, “the connection manager manages multiple interfaces and reports concurrent use of more than one interface, either by the same or different applications.” *Weisshaar*, [0051].

140. Relatedly, *Weisshaar* discloses that connection manager 336 further provides notifications regarding the availability of communication interfaces based on their use. For example, *Weisshaar* explains that “an application of FIG. 3 could request that the connection manager 336 notify it when a communication interface meeting certain criteria becomes available.” *Weisshaar*, [0055].

141. A person of ordinary skill in the art would understand that such availability in view of the disclosure of *Weisshaar* includes whether an interface is available because it is not currently in use. For example, *Weisshaar* states that:

At least one communication interface is then polled by an application, such as an application described in reference to FIG.

3, at a step **904**. It is then determined whether the at least one communication interface is available at a step **906**. For example, assuming that the wireless communication device is within range of the communication network associated with an acceptable communication interface, *it is determined whether the communication interface is already in use by another application*. If the at least one communication interface is available, the at least one communication interface is acquired at a step **908** and data is transmitted on the communication interface at a step **910**.

Weisshaar, [0060], claim 13 (claiming the monitoring whether “a communication interface of said plurality of communication interfaces has become available” by “determining that said communication interface is not transmitting data[.]”).

142. With respect to providing information concerning the extent to which an available network is congested, *Weisshaar* teaches that information regarding concurrent use of more than one interface, either by the same or different applications, is useful for ensuring that low bandwidth connections are used efficiently. Specifically, *Weisshaar* provides that:

Finally, connection manager **336** manages connection(s) of the client platform **300** to one or more networks, such as geographically distributed cellular and server networks. It ensures continuity of sessions across physical and/or logical network interfaces. It can require security (e.g. authentication, encryption, etc.) as a precondition to a connection. *It can ensure*

that low bandwidth connections are used efficiently. More specifically, the connection manager manages multiple interfaces and reports concurrent use of more than one interface, either by the same or different applications.

Weisshaar, [0051].

143. Related to *Weisshaar*'s management of low bandwidth connections, *Bahl* considers whether a network is congested in its network selection framework. Specifically, *Bahl* states that:

Having described a general architecture of a coexistence driver that facilitates creation of virtual coexistence drivers for handling interference between two or more sources of wireless data transmission interference, attention is directed to a wireless network/interface selection scheme. Such scheme can be used at any of a variety of circumstances during the operation of a computing device that includes one or more wireless network interfaces capable of connecting to any one of multiple differing networks. For example, such selection scheme is potentially used to establish an initial connection. Furthermore, the selection scheme is utilized, after establishing an initial connection, to establish a new connection to a different network in accordance with changed operating parameters. While avoiding interference, addressed extensively herein above, is one reason to invoke the wireless selection method described below, the selection method is applicable to a variety of situations where two or more suitable networks/interfaces are available for reaching a particular

resource. *The selection scheme and resulting defined criteria potentially include factors such as:* policy, network SSID, speed, *congestion*, interference, throughput, battery life, range, connectivity, security, cost per bit, and application throughput requirements. Each of these factors is described herein below with reference to FIG. 9. The exemplary wireless technology selection scheme described herein contemplates selecting a wireless technology based upon a variety of factors, regardless of whether the selection was necessitated by interference.

Bahl, [0090], [0119] (“[I]f the access point associated with a particular wireless technology/network is heavily loaded, i.e. it is handling a large number of connections or *processing a large amount of traffic from existing connections*, and the number of retries for packets at the AP and STA are high, then it is very likely that the network is congested.”).

144. A person of ordinary skill in the art would understand that bandwidth and congestion are directly correlated. For example, the ’436 patent itself describes a multi-interface device that “perceives that available bandwidth does not meet the present need of his time sensitive applications (because, e.g., several users are contending for the WLAN bandwidth and the Silent periods are unacceptably long).” ’436 patent at 8:10-16.

145. Moreover, in the combined *Bahl-Hsu-Weisshaar* network selection method, the computing device the computing device may further “wait for a pending

packet data session to go dormant in the cellular network[.]” as taught by *Hsu*. For at least the reasons discussed below, it is my opinion that *Hsu* – like *Weisshaar* – also fits squarely into *Bahl*’s (and the *Bahl-Weisshaar*) network selection framework.

146. *Bahl* explains with respect to *Bahl* Fig. 11 above that:

[A]t step 1108, if the selected technology/interface/network selection differs from one currently being used by the computing device (which includes no current connection), then control passes to step 1110 wherein a new connection is established based upon the previous selection. Implementation of step **1108** can occur in any of a number of ways and should not be viewed as limiting the invention in any way. However, to the extent available, such connection creation operations are automated to the greatest degree possible to provide the best user experience. Control then passes to the End. If however, the existing connection is the same as the one validated at step **1106**, then control passes from step **1108** to the End (there is no need to establish a new connection).

Bahl, [0143].

147. As noted in the excerpt above, “[i]mplementation of step **1108** can occur in any of a number of ways[.]” *Bahl*, [1043]. *Hsu* teaches one implementation that waits for a pending packet data session to go dormant in order to minimize service interruption:

After the MS **300** detects WLAN coverage, receives the WLAN beacon, the MS **300** uses certain criteria to handover a packet data session from the cellular network to the WLAN. The criteria may include whether the MS is idle in cellular network (i.e., no dedicated channel) or whether the WLAN signal strength is stable, etc. *The MS 300 may wait for a pending packet data session to go dormant in the cellular network.* The MS **300** then performs packet data session handover (i.e., sending Mobile IP registration via WLAN). This may be useful to minimize service interruption. Similarly, the MS **300** may perform packet data session handover when the WLAN signal strength is above an acceptable threshold for a specified period of time. In this way, the MS **300** ensures that access to the WLAN is sustainable. The measure may be any measure of channel quality and/or signal strength. The threshold may be predetermined or may dynamically be adjusted based on the actual performance of the communication. This may be useful to avoiding any ping-pong effect whereby the MS **300** switches between WLAN access and cellular network access due to changing conditions or signal strength that is at the margin of tolerance for operation. Still further, upon detection of the WLAN, the MS **300** may notify the user and wait for the user to manually select WLAN.

Hsu, [0085].

148. Accordingly, the combined *Bahl-Hsu-Weisshaar* network selection method considers, among other things, information regarding the concurrent use of

more than one interface, either by the same or different applications (as taught by *Weisshaar*), and once a selection is made, may wait until a pending packet data session goes dormant in the network before switching to a new network (as taught by *Hsu*).

5. A person of ordinary skill in the art Would Have Found It Obvious to Combine *Bahl*, *Hsu*, and *Weisshaar*

149. A person of ordinary skill in the art would have been motivated to combine the complementary teachings of *Bahl*, *Hsu*, and *Weisshaar* for several reasons.

150. *Bahl*, *Hsu*, and *Weisshaar* each relate to the same field of invention, network selection methods for devices containing heterogeneous radio interfaces (e.g., WLAN and cellular).

151. For instance, *Bahl* provides:

Criteria-driven methods and a framework are disclosed that facilitate configuration/selection of one or more wireless network interfaces/networks for carrying out wireless communications on a computing device. The wireless network interface selection and coexistence driver architecture described herein facilitates automated selection of a particular mode of network access based upon status information provided by a set of network interface drivers associated with particular network interfaces and wireless technologies. Furthermore, a criteria-driven interface/network selection framework is described that is

potentially invoked in a variety of situations including, but not limited to, when an application is invoked or to select another interface/network to avoid detected interference.

Bahl, Abstract.

152. *Bahl* further provides that:

This invention generally relates to the area of computer systems. More particularly, the present invention concerns methods and systems for selecting, configuring, and/or controlling wireless network communications on computing devices. Even more particularly the present invention is directed to decision-making within computing devices for addressing and/or avoiding wireless signal transmission interference.

Bahl, [0001].

153. Relatedly, *Hsu* provides a:

Method and apparatus for detection and selection of Wireless Local Area Network (WLAN) service. A remote station, which may be in conjunction with a wireless computing device, may scan for a cellular paging indicator and a WLAN beacon using one or two tuners. When WLAN coverage is available, a packet data session may be transferred thereto.

Hsu, Abstract.

154. Likewise, *Weisshaar* provides:

Turning now to FIG. 6, a flow chart shows a method of enabling transmission of data in a wireless communication network

according to the present invention. In particular, an application, such as one of the applications described in reference to FIG. 3, requests notification of the availability of a communication interface at a step 601. For example, an application of FIG. 3 could request that the connection manager 336 notify it when a communication interface meeting certain criteria becomes available. The communication interface could be any communication interface described in reference to FIG. 2. It should be noted that the applications may have varying requirements which could be met by different interfaces, while a number of different communication interfaces may be acceptable for a given application.

Weisshaar, [0055].

155. *Bahl*, *Hsu*, and *Weisshaar* also each disclose factor-based methods for selecting between heterogeneous radio interfaces.

156. For example, *Bahl* provides:

Having described a general architecture of a coexistence driver that facilitates creation of virtual coexistence drivers for handling interference between two or more sources of wireless data transmission interference, attention is directed to a wireless network/interface selection scheme. Such scheme can be used at any of a variety of circumstances during the operation of a computing device that includes one or more wireless network interfaces capable of connecting to any one of multiple differing networks. For example, such selection scheme is potentially used

to establish an initial connection. *Furthermore, the selection scheme is utilized, after establishing an initial connection, to establish a new connection to a different network in accordance with changed operating parameters.* While avoiding interference, addressed extensively herein above, is one reason to invoke the wireless selection method described below, the selection method is applicable to a variety of situations where two or more suitable networks/interfaces are available for reaching a particular resource. *The selection scheme and resulting defined criteria potentially include factors such as: policy, network SSID, speed, congestion, interference, throughput, battery life, range, connectivity, security, cost per bit, and application throughput requirements. Each of these factors is described herein below with reference to FIG. 9. The exemplary wireless technology selection scheme described herein contemplates selecting a wireless technology based upon a variety of factors, regardless of whether the selection was necessitated by interference.*

Bahl, [0090].

157. *Hsu* further provides:

Wireless Local Access Networks (WLANs) provide wireless access to a communication network within a local geographical area, such as a building or in a cybercafe. WLANs are currently considered by many cellular carriers to alleviate loading of a cellular system, so as to increase capacity. Additionally, users desire access to local WLANs to enhance reception and data rates

of communications through a wireless device. A problem exists in detecting and selecting WLAN systems. The purpose of system detection is to detect the availability of a wireless access medium (e.g., cdma2000, WLAN, etc.). ***The purpose of system selection is to select an access medium for transporting application contents. System selection may be based on the availability of access media, preference policy, application status, user intervention, etc., or a combination thereof.***

Hsu, [0007].

158. *Weisshaar* further provides:

Turning now to FIG. 6, a flow chart shows a method of enabling transmission of data in a wireless communication network according to the present invention. In particular, an application, such as one of the applications described in reference to FIG. 3, requests notification of the availability of a communication interface at a step 601. ***For example, an application of FIG. 3 could request that the connection manager 336 notify it when a communication interface meeting certain criteria becomes available.*** The communication interface could be any communication interface described in reference to FIG. 2. It should be noted that the applications may have varying requirements which could be met by different interfaces, while a number of different communication interfaces may be acceptable for a given application.

Weisshaar, [0055]. Relatedly, *Weisshaar* also states that:

If there is additional data associated with a second application to be sent, it is then determined whether the additional data can be sent on the first communication interface at a step **508**. That is, assuming that the user node **108** is within range of the wireless communication network associated with the communication interfaces, it is determined whether the available bandwidth, latency, bit rate, error rate, cost or other channel parameters are acceptable to transmit data associated with the second application.”

Weisshaar, [0053].

159. In my opinion, a person of ordinary skill in the art would have been motivated to use *Hsu*’s known technique for detecting and selecting networks during periods where a “packet data session currently has no data pending transfer” to improve a similar method (the *Bahl* network selection method) in a similar way to obtain predictable results (minimizing packet loss and service interruption).

160. For example, *Bahl* teaches that network selection may be periodic and event-driven. Specifically, *Bahl* provides that:

A Qualification Number (QN) **924** is an overall measure of the quality of a wireless technology/network combination. The $QN = \sum WCV[i] * WCV[i]$ i.e. the sum of weighted WCVs of the different criteria The QN **924** value is determined using a selection algorithm specifying, by way of example, any of the above factors and corresponding weighting for each (including potential overriding factors). Once the QN **924** value of each

available wireless technology/network combination has been determined, the technology with the highest QN is used. Alternatively, a criterion comprises a set of logical filters that result in a set of qualified combinations. Thereafter, a QN is generated for each qualified combination to determine a final selection of technology/interface/network combination for carrying out wireless communications for the device.

In an embodiment of the invention, a limit is placed upon the frequency with which the computing device generates new QN values for the computing device. The QN is determined periodically (according to a configurable repetition period) and on the occurrence of any significant event such as media connect/disconnect, a significant change in data received from a network interface card regarding an access point, or the start of a particular application. As will be explained further herein below with reference to FIG. 11, upon the occurrence of such events, the selection logic is invoked to re-evaluate a previous technology/interface/network combination selection in view of potentially new information element data and resulting factor values/weights.

Bahl, [0128], [0129].

161. As shown by the above description, *Bahl* explains that a Qualification Number (QN) 924 is measured as part of its network selection framework and the wireless technology with the highest QN is chosen. *Bahl*, [0128]. *Bahl* teaches that a limit is placed upon the frequency with which the device generates a QN. *Bahl*,

[0128]-[0129]. Specifically, *Bahl* teaches that the QN may be determined on the “occurrence of any significant event,” such as – for example – “*a change to a status of an application currently executing upon the computing device.*” *Id.*, claim 15 (“The method of claim 14 wherein the detected event corresponds to a change to a status of an application currently executing upon the computing device.”).

162. *Bahl*, however, does not expressly state that the status of an application includes the absence of application traffic to send or receive. In my opinion, however, *Hsu* teaches that “application status” includes the absence of application traffic. For example, *Hsu* provides:

The MS **300** may decide to scan for WLAN coverage based on one or more factors, e.g., user command(s), pre-configured preference(s), application status (e.g., on-going packet data session), WLAN availability advertisement as received from the cellular network, etc. One WLAN protocol defined by IEEE 802.11, and referred to herein as “802.11,” allows the MS **300** to scan for WLAN coverage passively or actively. In passive scanning, the MS **300** listens for the WLAN beacon sent by the AP **320** on WLAN frequencies. The WLAN beacon contains the ESSID of AP **320**, referred to as ESSID (AP **320**). If the ESSID(AP **320**) matches an ESSID stored in the MS **300** ESID list **302**, this is an indication that the MS **300** has detected WLAN coverage, and that such coverage is provided by the MS **300** service provider. In active scanning, the MS **300** transmits a Probe Request that contains the ESSID

of the MS **300**. If the AP **320** receives the Probe Request and the ESSID of the MS **300** matches the ESSID of the AP **320**, the AP **320** transmits a Probe Response to the MS **300**. If the MS has a list of multiple ESSIDs, the MS may transmit a Probe Request containing an ESSID having the highest preference. The ESSID preference may be stored as a system selection parameter in the Preference Database (described hereinabove).

Hsu, [0082].

163. As a further example, *Hsu* provides:

After the MS **300** detects WLAN coverage, receives the WLAN beacon, the MS **300** uses certain criteria to handover a packet data session from the cellular network to the WLAN. The criteria may include whether the MS is idle in cellular network (i.e., no dedicated channel) or whether the WLAN signal strength is stable, etc. The MS **300** may wait for a pending packet data session to go dormant in the cellular network. The MS **300** then performs packet data session handover (i.e., sending Mobile IP registration via WLAN). This may be useful to minimize service interruption. Similarly, the MS **300** may perform packet data session handover when the WLAN signal strength is above an acceptable threshold for a specified period of time. In this way, the MS **300** ensures that access to the WLAN is sustainable. The measure may be any measure of channel quality and/or signal strength. The threshold may be predetermined or may dynamically be adjusted based on the actual performance of the communication. This may be useful to avoiding any ping-pong

effect whereby the MS **300** switches between WLAN access and cellular network access due to changing conditions or signal strength that is at the margin of tolerance for operation. Still further, upon detection of the WLAN, the MS **300** may notify the user and wait for the user to manually select WLAN.

Hsu, [0085].

164. As another example, *Hsu* provides that “the laptop may switch to the WLAN if the packet data session currently has no data pending transfer so as to minimize service interruption (e.g., downloading a file).” *Hsu*, [0096].

165. As a final example, *Hsu* claims:

1. A method for identifying a Wireless Local Area Network (WLAN) comprising:

scanning for a cellular paging indicator;

scanning for a WLAN beacon;

determining if the WLAN is accessible;

if the WLAN is accessible, registering with the WLAN.

4. The method as in claim 1, further comprising:

if the remote station has a current packet data session active in a cellular network:

detecting the WLAN beacon;

waiting for a the current packet data session to become dormant;

performing packet data session handover to the WLAN.

166. In my opinion, a person of ordinary skill in the art would have recognized that *Bahl*'s network selection method would be improved by waiting for the status of an application to have "no data pending transfer" prior to handoff to obtain the predictable result of minimizing packet loss and service interruption.

167. For example, *Bahl*'s network selection method was ripe for improvement because, as *Bahl*, recognized, handoffs between networks can result in packet loss, which, in turn, can impact application performance:

Range (RNG) **914**: specifies a relative distance for each technology. 802.11b's range is 150-300 feet and 802.11a's range is roughly a quarter of 802.11b's range. As a result a STA that is moving will experience more handoffs if the 802.11a wireless technology is used. *Handoff, in turn, affects latency, jitter, and packet loss. Fast handoff schemes are employed to make handoff as seamless as possible. However, low limits on latency, jitter, and packet loss for Voice over IP and A/V streaming applications require minimal handoffs for optimal user experience.* A proper weight (WCW) is given to the range **914** factor based on the requirements of applications running on the station and the kind of mobility of the computing device (STA) itself. As an example, for a wireless, non-mobile, desktop machine the Range **914** factor has minimal, if any, weight. On the other hand, the Range **914** is given a higher weight for a handheld (highly mobile STA) computing device

that is currently running either a VoIP or A/V streaming application.

Bahl, [0123].

168. *Hsu* directly addresses the issue of packet loss during handover. Specifically, as explained above, *Hsu* teaches that waiting for a pending packet data session to go dormant may be useful to minimize service interruption:

After the MS **300** detects WLAN coverage, receives the WLAN beacon, the MS **300** uses certain criteria to handover a packet data session from the cellular network to the WLAN. The criteria may include whether the MS is idle in cellular network (i.e., no dedicated channel) or whether the WLAN signal strength is stable, etc. The MS **300** may wait for a pending packet data session to go dormant in the cellular network. The MS **300** then performs packet data session handover (i.e., sending Mobile IP registration via WLAN). This may be useful to minimize service interruption.

Hsu, [0085].

169. Moreover, it is my opinion that a person of ordinary skill in the art would have had a reasonable expectation of success in implementing *Hsu*'s teachings into *Bahl*'s network selection method because *Bahl* and *Hsu* implemented their techniques in software. *See Bahl*, [0033] ("The invention may be described in the general context of computer-executable instructions, such as program modules, being executed by a computer."); *Hsu*, [0101] ("The steps of a method or algorithm

described in connection with the embodiments disclosed herein may be embodied directly in hardware, in a software module executed by a processor, or in a combination of the two.”).

170. A person of ordinary skill in the art would understand that processes, such as those disclosed in *Bahl* and *Hsu*, which can be implemented in software readily allow for modification in a predictable way. For example, *Bahl* provides an example network selection algorithm in the form of pseudo-code that can be readily modified by a person of ordinary skill in the art. *Bahl*, [0146]. As a further example, *Bahl* claims computer-executable instructions that can be readily modified by a person of ordinary skill in the art to select a network based on the status of an application:

17. A computer readable media including computer-executable instructions that facilitate selecting a wireless technology among multiple available wireless technologies on a computing device for establishing a network connection, the computer-executable instructions facilitating performing the steps of:

maintaining a wireless technology selection framework comprising a set of factors, wherein one or more of the factors are incorporated into wireless technology selection criteria;

acquiring a set of information regarding the status and/or capabilities associated with each available wireless technology;

rendering factor values for ones of the set of factors based upon the set of information acquired for each available wireless technology; and

rendering a wireless technology selection based at least in part upon applying the factor values to wireless technology selection criteria.

27. The computer-readable medium of claim 17 wherein the rendering a selection step is performed in response to an event.

28. The computer-readable medium of claim 27 wherein the event comprises expiration of a period.

29. The computer-readable medium of claim 27 wherein the rendering a selection step is performed in response to an event associated with reassigning a weight to a factor referenced within a wireless technology selection criterion.

30. The computer-readable medium of claim 29 wherein the reassigning a weight is carried out in response to a detected event.

31. The computer-readable medium of claim 30 wherein the detected event corresponds to a change to a status of an application currently executing upon the computing device.

171. Relatedly, as evidenced by the disclosures in *Bahl* and *Hsu* regarding the implementation of its teachings through software and consistent with my professional experience, the programming implementing *Hsu*'s teachings into

Bahl's network selection method was within a person of ordinary skill in the art's ordinary skill and would produce predictable results.

172. In my opinion, a person of ordinary skill in the art would have likewise been further motivated to combine *Weisshaar* with *Bahl* and *Hsu* to improve a known method ready for improvement (*Bahl*'s and *Hsu*'s management of multiple heterogeneous interfaces, including the concurrent use of heterogeneous interfaces) to yield predictable results (utilizing a second heterogeneous interface, during a silent period of a second application that is using that second interface, to support a first application that is also using a first heterogeneous interface so as to use both the first and second heterogeneous interfaces concurrently to support the first application during a silent period of the second application).

173. *Bahl* and *Hsu* disclose devices making concurrent use of interfaces. For example, *Bahl* discloses making concurrent use of Wi-Fi and GPRS:

Two laptop users are in a cab on their way to a business meeting. They open their laptops and resume their Windows sessions. On resuming their sessions, they form an ad hoc group over a Wi-Fi network to share presentation material. ***The operating system on the first user's machine senses that there are two GPRS networks available for Internet connectivity***; one is directly through a GPRS adapter in the laptop and ***the other one is through the first user's Bluetooth phone. The operating system selects the GPRS network through the Bluetooth phone since***

the policy on the first user's machine prefers that. However on using it the operating system senses interference on the Bluetooth connection to the phone arising from the Wi-Fi ad hoc network. The operating system therefore switches to the direct GPRS network in preference to the one through the Bluetooth phone.

See, e.g., Bahl, [0097].

174. As a further example, *Hsu* discloses that “the Mobile Station (MS) has two tuners that can tune to a cellular frequency and the WLAN frequency simultaneously.” *Hsu*, [0077], [0086] (“After the MS **300** performs the handover of the packet data session to the WLAN, the MS **300** may receive data via the WLAN as well as incoming circuit-switched voice calls via the cellular network.”).

175. Neither *Bahl* nor *Hsu*, however, disclose making concurrent use of more than one heterogeneous interface, such as a cellular interface and a Wi-Fi interface, to support a first application during a silent period of a second application. *Weisshaar*, however, teaches “report[ing] concurrent use of more than one interface, either by the same or different applications” for managing connections to one or more networks. *Weisshaar*, [0051].

176. *Weisshaar* further teaches that knowledge of concurrent use of more than one interface by the same or different applications ensures, among other things, “continuity of sessions across physical and/or logical network interfaces” and that “low bandwidth connections are used efficiently”:

Finally, connection manager **336** manages connection(s) of the client platform **300** to one or more networks, such as geographically distributed cellular and server networks. It ensures continuity of sessions across physical and/or logical network interfaces. It can require security (e.g. authentication, encryption, etc.) as a precondition to a connection. It can ensure that low bandwidth connections are used efficiently. More specifically, the connection manager manages multiple interfaces and reports concurrent use of more than one interface, either by the same or different applications.

Weisshaar, [0051].

177. In fact, as *Weisshaar* expressly describes, “as more applications are vying for communication interfaces to transmit data, it would be useful to inform applications of the availability of a communication interface in the event that the application could use the communication interface to transmit data.” *Weisshaar*, [0007], claim 13 (“The method of claim 11 wherein said step of detecting that a communication interface of said plurality of communication interfaces has become available comprises determining that said communication interface is not transmitting data for a second application.”).

178. Accordingly, in my opinion, a person of ordinary skill in the art reviewing *Bahl* and *Hsu* would have been motivated to combine *Weisshaar* with *Bahl-Hsu* to utilize *Weisshaar*’s reporting of use of interfaces by applications to

allow a first application to concurrently use multiple heterogeneous interfaces during a silent period of a second application using one of those interfaces.

179. Doing so would lead to improved performance because of the capability of the *Bahl-Hsu-Weisshaar* device to use an un-utilized network interface to provide, for example, increased bandwidth for a first application.

180. Indeed, it was well-known prior to the time of the invention that combining un-utilized network interfaces together increase bandwidth. As background, I am an inventor on U.S. Patent No. 6,983,162, which was filed on May 27, 2002 and published on January 13, 2005. In this publication, which is U.S. Patent Application Publication 2005/0009524 A1, I explained that it is “known that linking cellular communication units directly together, using for example the Opportunity Driven Multiple Access (ODMA) mode proposed in UMTS (TDD mode), may provide enhanced data rates.” *Kotzin* ’162, [0017].³

181. Relatedly, I further explained that in “a group of independent wireless devices,” such devices are “identified and coordinated (aggregated) using, for example in a wireless domain a short-range wireless system such as provided in the

³ To be clear, here, I am relying on *Kotzin* ’162 as evidence of a person of ordinary skill in the art’s knowledge and the state of the art. *Kotzin* ’162 is not part of unpatentability Ground 1.

adjunct Bluetooth system.” *Kotzin* ’162, [0062]. “By forming a ‘dynamic’ group based on proximal location via a short-range adjunct bluetooth system, any of the users UEs **1-11** may then benefit from using the capabilities of one or more of the other subscriber units within the group.” *Kotzin* ’162, [0063]. “The provision, in the second embodiment, of such a larger communication ‘pipe’ for use by any of the UEs in a group leads to, inter-alia, increased efficiency, for example, using a higher peak data-rate over the air interface for a packet data transmission.” *Kotzin* ’162, [0064]. “Using a discovery and coordination protocol on a short-range adjunct channel, these users become part of an aggregated group that can be used for such increased data rate transmissions.” *Kotzin* ’162, [0068]. In other words, “if we assume for simplicity that each member is also limited to a maximum transmission rate of 64 kbps, the effective maximum is 640 kbps. It is also within the contemplation of the invention that UE-**1 112** may also transmit information in a substantially simultaneous manner to the network increasing the effective maximum data-rate to 704 kbps.” *Kotzin* ’162, [0069].

182. Elaborating on the above, I described the following example:

[I]n FIG. 2, UE-**1 112** may decide to upload a very large file to the network. In normal circumstances, UE-**1 112** would be limited to its maximum transmission rate of say, 64 kbps. Instead, utilising the inventive concepts herein described, UE-**112** forms a dynamic group of idle UEs **2-11** and distributes the

information for transmission to all the users of the aggregated group using the adjunct Bluetooth channel. Such a distribution of information may take place during UE-1 112's periods of inactivity on its primary-communication UMTS system.

Kotzin '162, [0068].

183. It was also known that the advantages described above were equally applicable to multi-mode communication units and/or multiple of single (but different) mode communication units:

The inventors of the present invention further envisage applying the aforementioned functionality enhancement capability to multi-mode communication units and/or multiple of single (but different) mode communication units. In the latter case, two communication units supporting two different multiple access schemes would be combined to provide a single multi-mode communication service for the duration of the time that they are combined.

Kotzin '162, [0120].

184. In fact, with respect to multiple of single (but different) mode communication units, which function for purposes of the above features the same as multi-mode communication units, I taught that “ it is assumed that one user employs, for example a GSM phone and another user a UMTS phone (or a software definable radio (SDR)). It is envisaged that the GSM user can utilise the capabilities of the

UMTS communication unit to obtain higher throughput and/or a better quality of service.” *Kotzin* ’162, [0121].

185. Moreover, a person of ordinary skill in the art would have had a reasonable expectation of success of implementing *Weisshaar*’s teachings into the *Bahl-Hsu* network selection method because *Weisshaar*, *Bahl* and *Hsu* implemented their techniques in software for the same reasons explained above in Paragraph 169-171. For example, *Weisshaar* further states that “[a]rchitecturally, the user node 108 comprises a software-based client platform 300 that supports a wide range of applications and services.”

B. Claim 1

186. In my opinion, *Bahl* in view of *Hsu* and *Weisshaar* renders obvious claim 1.

1. “A method of controlling a wireless mobile having multiple interfaces, comprising:”⁴

187. I understand that “[a] method of controlling a wireless mobile having multiple interfaces, comprising:” is the preamble of claim 1 of the ’436 patent. I have been asked to assume that the preamble is a claim limitation. Under this assumption, in my opinion, *Bahl* discloses or suggests this feature. For example, *Bahl* discloses

⁴ The specific claim language is reproduced above in the Listing of Challenged Claims.

methods for selecting one or more wireless network interfaces on a “computing device”:

Criteria-driven methods and a framework are disclosed that facilitate configuration/selection of one or more wireless network interfaces/networks for carrying out wireless communications on a computing device. The wireless network interface selection and coexistence driver architecture described herein facilitates automated selection of a particular mode of network access based upon status information provided by a set of network interface drivers associated with particular network interfaces and wireless technologies. Furthermore, a criteria-driven interface/network selection framework is described that is potentially invoked in a variety of situations including, but not limited to, when an application is invoked or to select another interface/network to avoid detected interference.

Bahl, Abstract, Figs. 9, 11.

188. In my opinion, a person of ordinary skill in the art would have understood that *Bahl*’s “computing device” and a “wireless mobile” generally refer to the same type of device for at least a few reasons.

189. ***First***, *Bahl* expressly discloses that the computing device may be a “mobile” computing device:

The present invention is potentially incorporated into both mobile and non-mobile computing devices/machines used in a variety of dynamic networking environments and executing a

variety of tasks. In such environments, the availability of certain channels/frequencies potentially changes as the set of active wireless media changes. This in turn can have an adverse effect upon the quality of service on particular wireless media. The present invention facilitates configuring and/or regulating traffic to wireless network interfaces to reduce interference between wireless network interfaces that use overlapping frequency ranges. An embodiment of the present invention also accommodates interference arising from external sources (e.g., a cordless phone system, a microwave oven, a Bluetooth device transmitting to another computing device, etc.) over which a computing device has no control. Furthermore, selection criteria are used to select/suggest a particular one of multiple available wireless network technologies supported by a computing device.

190. ***Second***, as stated above, *Bahl* discloses that the “mobile” computing device has one or more wireless network interfaces “for carrying out wireless communications”:

Criteria-driven methods and a framework are disclosed that facilitate configuration/selection of one or more wireless network interfaces/networks for carrying out wireless communications on a computing device. The wireless network interface selection and coexistence driver architecture described herein facilitates automated selection of a particular mode of network access based upon status information provided by a set of network interface drivers associated with particular network

interfaces and wireless technologies. Furthermore, a criteria-driven interface/network selection framework is described that is potentially invoked in a variety of situations including, but not limited to, when an application is invoked or to select another interface/network to avoid detected interference.

Bahl, Abstract.

191. At least in view of the above disclosures, it is my opinion that *Bahl* discloses a “wireless mobile” device.

192. Accordingly, *Bahl* discloses or suggests a method for selecting (“a method of controlling”) one or more wireless network interfaces on a mobile computing device (“a wireless mobile having multiple interfaces”).

2. “having said mobile be aware of its applications running on it;”

193. In my opinion, *Bahl* discloses or suggests this feature.

194. *Bahl*’s methods for facilitating selection of one or more wireless network interfaces comprises a set of factors, including the throughput needed by “one or more particular ***active applications*** on a computing device”:

Application throughput requirements APPTHRPT **922**: specifies ***a throughput needed by one or more particular active applications on a computing device*** to ensure proper operation of the applications on the device (STA) that will utilize the selected wireless technology. The STA determines the throughput requirements of the applications running on it based

on quality of service attributes set by the applications. By way of example, in an energy conservation mode of operation, a criterion specifies that if the throughput requirements of the applications can be satisfied by 802.11b and there is no other factor, such as CST for instance, overriding this factor, then the 802.11b wireless technology is selected.

Bahl, [0127], Fig. 9.

195. As a further example, *Bahl* provides:

In a second aspect, the particular criterion governing wireless interface/network selections is dynamically configured according to sensed operating conditions (e.g., battery power high/low). In a first example of dynamically configuring a criterion, a criterion selection rule/algorithm determines which criterion, of a set of wireless selection criteria, will be used to select an interface/network to which a wireless connection will be established/maintained. Thus, by way of example, a first criterion is used when a computing device is operating with a substantially high level of stored battery energy, a second criterion is used when a battery's stored energy is low. ***In a second example of dynamically configuring a criterion, weights attributed to various factors within a criterion change based upon sensed operating conditions. Thus, by way of example, a set of factor weights are specified for a particular application. When the application is launched, the factor weights are loaded into a criterion shell. Thereafter, factor***

values are applied to a resulting application-specific criterion to render an interface/network selection.

Bahl, [0103].

196. As another example, *Bahl* discloses the following scenario describing a laptop using the WINDOWS operating system that selects a network based on the needs of currently running applications:

A user comes to work. He resumes his laptop running OUTLOOK and INTERNET EXPLORER. The WINDOWS operating system determines that it is in the vicinity of an overloaded 802.11a infrastructure network and an underused 802.11b network advertising the same network SSID (i.e., both offer connectivity to a same network). *The operating system determines that the throughput requirements of the currently running applications* are better met using the underutilized 802.11b than the overburdened and congested 802.11a access point. The operating system therefore utilizes an 802.11b network interface rather than an 802.11a network interface.

Bahl, [0093].

197. It was well-known prior to the time of the invention that the WINDOWS operating system was aware of the applications running on it, as evidenced by the WINDOWS Task Manager. *WINDOWS Guide*, 250 (“Task Manager provides information about applications currently running on your

system[.]”).⁵ Thus a person of ordinary skill in the art would understand that the laptop referenced in *Bahl* would have been aware that OUTLOOK and INTERNET EXPLORER were running on it.

198. A person of ordinary skill in the art would have also understood that *Bahl*’s laptop comprises a “wireless mobile” at least because the ’436 patent expressly identifies a “laptop computer” as a “type[] of mobile device[.]” ’436 patent at 1:19-22.

199. Accordingly, *Bahl* discloses or suggests a mobile computing device (“said mobile”) using the WINDOWS operating system that is aware of the applications currently running on it (“be aware of its applications running on it”).

3. “having said mobile be aware of its operating situation;”

200. In my opinion, *Bahl* discloses or suggests this feature. As explained in Section XI.B.2, *Bahl* describes a network selection method comprising a set of factors. *Bahl* further provides that “the particular criterion governing wireless interface/network selections is dynamically configured according to *sensed operating conditions (e.g., battery power high/low)*”:

⁵ To be clear, here, I am relying on the *WINDOWS Guide* as evidence of a person of ordinary skill in the art’s knowledge and the state of the art. The *WINDOWS Guide* is not part of unpatentability Ground 1.

In a second aspect, the particular criterion governing wireless interface/network selections is dynamically configured according to sensed operating conditions (e.g., battery power high/low). In a first example of dynamically configuring a criterion, a criterion selection rule/algorithm determines which criterion, of a set of wireless selection criteria, will be used to select an interface/network to which a wireless connection will be established/maintained. *Thus, by way of example, a first criterion is used when a computing device is operating with a substantially high level of stored battery energy, a second criterion is used when a battery's stored energy is low.* In a second example of dynamically configuring a criterion, weights attributed to various factors within a criterion change based upon sensed operating conditions. Thus, by way of example, a set of factor weights are specified for a particular application. When the application is launched, the factor weights are loaded into a criterion shell. Thereafter, factor values are applied to a resulting application-specific criterion to render an interface/network selection.

Bahl, [0103], Fig. 9; see also [0095] (“[T]he battery on the Patrick's laptop is running low. In response to the low battery power and the congested state of the 802.11a access point, the operating system selects the 802.11b connection to which it will connect.”).

201. Accordingly, *Bahl* discloses or suggests a mobile computing device (“said mobile”) that senses its operating conditions, such as high or low battery power (“be aware of its operating situation.”).

4. “said multiple interfaces including heterogeneous radio interfaces, and”

202. In my opinion, *Bahl* discloses or suggests this feature. For example, *Bahl* discloses a computing device that is able to maintain “simultaneous wireless network connections via *distinct network interface cards (NICs)* installed on the computing device.” *Bahl*, [0003].

203. *Bahl* further discloses various technologies that “receive[]/transmit[] *radio frequency waves*[,]” such as IEEE 802.11a/b/g and Bluetooth (“BT”). *Bahl*, [0002]-[0003], Figs. 1-3 (showing “NETWORK INTERFACES/MODEMS” and a wireless mobile device utilizing cellular, 802.11a/b, and/or BT technologies).

204. Accordingly, *Bahl* discloses a mobile computing device having distinct network interface cards that receive and transmit radio frequency waves for various wireless network interfaces (“said multiple interfaces including heterogeneous radio interfaces”).

5. **“having said mobile control processes, including use of said heterogeneous radio interfaces, of said mobile during silent periods based on one or more of its application awareness and its operating situation awareness, said silent periods being brief intervals during which an application running on said mobile has no application traffic to send or receive;”**

205. In my opinion, *Bahl* in view of *Hsu* discloses or suggests this feature as shown below.

- a. **“having said mobile control processes, including use of said heterogeneous radio interfaces, of said mobile”**

206. In my opinion, *Bahl* discloses or suggests this feature. As discussed in Sections XI.B.1-XI.B.3, *supra*, *Bahl* discloses methods for facilitating selection (“having said mobile control processes”) of one or more wireless network interfaces (*e.g.*, cellular, 802.11a/b, and/or BT interfaces) that receive and transmit radio frequencies (“including use of said heterogeneous radio interfaces, of said mobile”).

- b. **“during silent periods based on one or more of its application awareness and its operating situation awareness, said silent periods being brief intervals during which an application running on said mobile has no application traffic to send or receive”**

207. In my opinion, *Bahl* in combination with *Hsu* discloses or suggests this feature for at least the reasons discussed below.

208. **First**, *Bahl* discloses having a mobile computing device control use of wireless network interfaces based on both the needs of applications running on it and its sensed operating conditions (“based on one or more of its application awareness and its operating situation awareness”).

209. With respect to “application awareness,” *Bahl* describes, for example, a WINDOWS laptop that determines the throughput requirements of “currently running applications” and selects a network interface based on those requirements:

A user comes to work. He resumes his laptop running OUTLOOK and INTERNET EXPLORER. The WINDOWS operating system determines that it is in the vicinity of an overloaded 802.11a infrastructure network and an underused 802.11b network advertising the same network SSID (i.e., both offer connectivity to a same network). The operating system determines that the throughput requirements of the currently running applications are better met using the underutilized 802.11b than the overburdened and congested 802.11a access point. The operating system therefore utilizes an 802.11b network interface rather than an 802.11a network interface.

Bahl, [0093], [0031] (“In exemplary embodiments these basic concepts are implemented by dynamically acquired network information and statically as well as dynamically defined criteria that are designated and modified (e.g., weighting of factors) based upon currently sensed status information and application/user requirements.”).

210. *Bahl*’s description of a mobile computing device controlling use of wireless network interfaces based on the needs of applications running on it extends to whether the device is running a real-time or non-real-time application. For example, *Bahl* considers one or more of the following factors:

Throughput (THRPT) **910**: specifies throughput of a particular wireless technology. If both SSap and SSsta (signal strengths for the AP and STA) are low, then data throughput, by implication, is low. If both are high, the data throughput is high. If throughput on 802.11a is less than it is on 802.11b, then the throughput factor **910** favors the 802.11b wireless technology. In an exemplary embodiment of the invention, a weight (WCW) is given to the throughput **910** parameter based on the requirements of particular applications running on the STA. For example, if Audio/Video streaming applications are running, a higher weight than normal should be used. A factor value (WCV) of 1 indicates low throughput, 5 is normal, and 10 is high. By way of example, under ideal conditions, when comparing 802.11b and 802.11a technologies, 802.11b technology (highest theoretical speed can be 11 Mbps) receives a value of 5 and 802.11a (highest theoretical speed can be around 25-30 kbps) receives a value of 8, or even a value of 10 for turbo mode with highest theoretical speed of around 50 kbps.

See Bahl, [0121].

Application throughput requirements APPTHRPT **922**: specifies a throughput needed by one or more particular active applications on a computing device to ensure proper operation of the applications on the device (STA) that will utilize the selected wireless technology. The STA determines the throughput requirements of the applications running on it based on quality of service attributes set by the applications. By way of example,

in an energy conservation mode of operation, a criterion specifies that if the throughput requirements of the applications can be satisfied by 802.11b and there is no other factor, such as CST for instance, overriding this factor, then the 802.11b wireless technology is selected.

See Bahl, [0127].

211. As shown below as a further example, *Bahl* considers whether the throughput of a potential network meets or exceeds the application throughput requirements for an active application running on the computing device:

```
//  
//If app throughput requirements are satisfied by throughput on 802.11b, select it  
//  
    if (APPTHRTPT < THRPTb)  
    {  
        QNb++;  
    }  
    else  
    {  
        if (APPTHRTPT < THRPTa)  
        {  
            //  
            //Since APPTHRPT can not be met by THRPTb, QNb goes down  
            // significantly  
            //  
            QNb -= 2  
        }  
    }  
}
```

Bahl, [0146], [0130] (“At step 1102 one or more of the multiple available selection criteria are selected.”).

212. With respect to “operating situation awareness,” *Bahl* discloses, for example, a laptop that senses that its battery is running low and, “in response to the low battery power and the congested state of the 802.11a access point, the operating system selects the 802.11b connection to which it will connect” *Bahl*, [0095]. *Bahl* then discloses that when the battery has been charged and power is no longer an issue, “[t]he operating system senses the changed environment” and selects a different network interface. *Id*; *Bahl*, [0103] (“[T]he particular criterion governing wireless interface/network selections is dynamically configured according to ***sensed operating conditions (e.g., battery power high/low)***.”). In particular, *Bahl* describes the following example scenario:

A user opens a laptop in a packed airline lounge with many people using the lounge's 802.11a wireless network access point. The lounge also has an 802.11b network access point. Both network access points are free for the use by people in the lounge and provide the same kind of connectivity. The user is running OUTLOOK and IE on the laptop machine. The operating system senses that the 802.11a network/access point is overloaded and congested. Also, the battery on the Patrick's laptop is running low. In response to the low battery power and the congested state of the 802.11a access point, the operating system selects the 802.11b connection to which it will connect. At some later time, the airline lounge empties, and the 802.11a network access point is no longer overloaded or congested. Furthermore, the battery

has been charged, and power is no longer an issue because the user has plugged the laptop into a power socket. The operating system senses the changed environment, decides that 802.11a network offers the best service, and so changes wireless technology usage from 802.11b to 802.11a to take advantage of the higher bandwidth offered by the 802.11a connection.

Bahl, [0095].

213. ***Second***, *Hsu* discloses having a wireless device control use of wireless network interfaces during periods where a packet data session has no data pending transfer and several seconds have passed without detection of any activity of a data transfer (“during silent periods, ... said silent periods being brief intervals during which an application running on said mobile has no application traffic to send or receive”).

214. For example, *Hsu* discloses that “[t]he MS 300 may wait for a pending packet data session to go dormant in the cellular network. The MS 300 *d* then performs packet data session handover (i.e., sending Mobile IP registration via WLAN). This may be useful to minimize service interruption.” *See also* Paragraphs 162-166, *supra*.

215. In my opinion, a person of ordinary skill in the art would have understood this disclosure to provide performing network selection between cellular and WLAN, and thus controlling use of heterogeneous radio interfaces, during a “silent period” because a pending packet data session going dormant is equivalent

to a period where an application has no application traffic to send or receive. *See* Section VII.B, *supra*.

216. Moreover, *Hsu* explains that “[t]he purpose of system selection is to select an access medium for ***transporting application contents***.” *Hsu*, [0007]. *Hsu* further defines “***application*** status” as including whether there is an “on-going packet data session.” *Hsu*, [0082]. Accordingly, I understand that a packet data session, as discussed in *Hsu*, to refer to an application that is transmitting data.

217. *Hsu* provides other examples of having a wireless device control use of heterogeneous radio interfaces during a “silent period.” For instance, *Hsu* discloses that:

[T]he laptop may switch to the WLAN if the packet data session currently has no data pending transfer so as to minimize service interruption (e.g., downloading a file). Upon detecting a strong WLAN signal, the laptop 600 waits for a given time period (e.g., several seconds) to detect any activity of data transfer. If no activity is detected, the laptop 600 performs WLAN access authentication, followed by Mobile IP registration via the WLAN, and finally release of the cellular packet data service option, as described above.

Hsu, [0096]; Section XI.A.1 (where I explain that the functionality of MS 300 and laptop 600 is the same).

218. For the same reasons discussed above with respect to MS 300, a person of ordinary skill in the art would have understood that a packet data session that “currently has no data pending transfer” discloses the claimed “silent period.” For example, compare the following disclosures from *Hsu* and the ’436 patent:

<i>Hsu</i>	’436 Patent
[T]he laptop may switch to the WLAN <i>if the packet data session currently has no data pending transfer</i> so as to minimize service interruption (e.g., downloading a file). Upon detecting a strong WLAN signal, the laptop 600 waits for a given time period (e.g., several seconds) to detect any activity of data transfer. If no activity is detected, the laptop 600 performs WLAN access authentication, followed by Mobile IP registration via the WLAN, and finally release of the cellular packet data service option, as described above. <i>Hsu</i>, [0096].	Furthermore, the needs of the device may be different when it is on the move as compared to when it is stationary. More precisely when the devices are running applications such as voice-over-IP (VoIP) or streaming media they are bombarded with continuous or heavy data; perhaps without much pause or break thus not leaving long and useable mute periods. Under this situation devices may use multiple interfaces for Bandwidth or Quality of Service (QoS) enhancement. Whereas while running non-real-time applications, they are not heavily flooded with continuous stream of data, rather the data flow is bursty and thus <i>there may appear intervals when the devices can take a momentary pause (i.e., the Device has no traffic to send</i>

	<i>or receive</i>). These short pauses are dubbed in available literature as “Silent Periods”. ’436 patent at 2:41-67. ... said silent periods being brief intervals during which <i>an application running on said mobile has no application traffic to send or receive</i>; ’436 patent at claim 1.
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219. Relatedly, a person of ordinary skill in the art would have understood that the “several seconds” laptop 600 waits to “detect any activity of data transfer” prior to switching to WLAN discloses the claimed “brief interval[] during which an application running on said mobile has no application traffic to send or receive.”

220. A “brief interval” is not a term of art that a person of ordinary skill in the art would be familiar with. This is particularly the case where, as here, the adjective “brief” is not tied or apparently limited to any technical metric, such as the time it takes to handover from one interface to another. Rather, the term “brief” is tied to an “interval during which an application running on said mobile has no application traffic to send or receive,” which technically could be seconds, minutes, hours, days, weeks, months, years, and so on. Accordingly, it is my opinion that a

person of skill in the art would not apply a technical meaning to the word brief, and thus, would understand that the “several seconds” of application inactivity described in *Hsu* discloses or suggests a “brief interval.”

221. Accordingly, the *Bahl-Hsu-Weisshaar* network selection method discloses or suggests methods for facilitating selection (“having said mobile control processes”) of one or more wireless network interfaces (*e.g.*, cellular, 802.11a/b, and/or BT interfaces) that receive and transmit radio frequencies (“including use of said heterogeneous radio interfaces, of said mobile”) during a period (*e.g.*, several seconds) where the status of an application has no data pending transfer (“during silent periods... said silent periods being brief intervals during which an application running on said mobile has no application traffic to send or receive”) based on the requirements of currently running applications and sensed operating conditions (“based on one or more of its application awareness and its operating situation awareness”).

6. **“further including having said mobile control use of said interfaces by using a second interface, during a silent period of a second application running on said mobile and using said second interface, to support a first application running on said mobile and using a first interface that is heterogeneous to said second interface such as to use both said first and second heterogeneous interfaces concurrently during said silent period to support said first application.”**

222. In my opinion, *Bahl* in combination with *Hsu* and *Weisshaar* discloses or suggests this feature.

223. For example, *Weisshaar* discloses:

Finally, connection manager **336** manages connection(s) of the client platform **300** to one or more networks, such as geographically distributed cellular and server networks. It ensures continuity of sessions across physical and/or logical network interfaces. It can require security (e.g. authentication, encryption, etc.) as a precondition to a connection. It can ensure that low bandwidth connections are used efficiently. ***More specifically, the connection manager manages multiple interfaces and reports concurrent use of more than one interface, either by the same or different applications.*** The connection manager also enables an interface to be used for both streams and datagrams at the same time. In particular, the transport layer enables the flow of data between two hosts for an application. Streams are transmitted by the connection oriented transmission control protocol (TCP) which enables the reliable flow between two hosts by dividing data into blocks and receiving acknowledgments when the data is received. In contrast, datagrams are transmitted by the less reliable user datagram protocol (UDP), which is also well known in the art.

Weisshaar, [0051].

224. In my opinion, based on the above disclosure, a person of ordinary skill in the art would have understood that *Weisshaar* discloses two scenarios: (i) use of more than one interface by different applications (“a second application running on said mobile and using said second interface”/“a first application running on said

mobile and using a first interface”) and (ii) concurrent use of more than one interface to support an application (“using a second interface... to support a first application running on said mobile and using a first interface that is heterogeneous to said second interface such as to use both said first and second heterogeneous interfaces concurrently during said silent period to support said first application.”).

225. *Weisshaar*, however, does not disclose “using a second interface, during a silent period of a second application[.]” *Hsu*, on the other hand, expressly discloses that “[s]ystem selection may be based on ... application status.” *Hsu*, [0007].

226. A person of ordinary skill in the art reviewing *Hsu* would understand that “application status” may be an active or dormant packet data session. For example, *Hsu* provides that:

The MS 300 may decide to scan for WLAN coverage based on one or more factors, e.g., user command(s), pre-configured preference(s), application status (e.g., on-going packet data session), WLAN availability advertisement as received from the cellular network, etc. One WLAN protocol defined by IEEE 802.11, and referred to herein as “802.11,” allows the MS 300 to scan for WLAN coverage passively or actively. In passive scanning, the MS 300 listens for the WLAN beacon sent by the AP 320 on WLAN frequencies. The WLAN beacon contains the ESSID of AP 320, referred to as ESSID (AP 320). If the ESSID(AP 320) matches an ESSID stored in the MS 300 ESID

list **302**, this is an indication that the MS **300** has detected WLAN coverage, and that such coverage is provided by the MS **300** service provider. In active scanning, the MS **300** transmits a Probe Request that contains the ESSID of the MS **300**. If the AP **320** receives the Probe Request and the ESSID of the MS **300** matches the ESSID of the AP **320**, the AP **320** transmits a Probe Response to the MS **300**. If the MS has a list of multiple ESSIDs, the MS may transmit a Probe Request containing an ESSID having the highest preference. The ESSID preference may be stored as a system selection parameter in the Preference Database (described hereinabove).

Hsu, [0082].

227. As a further example, *Hsu* alternatively provides that:

After the MS **300** detects WLAN coverage, receives the WLAN beacon, the MS **300** uses certain criteria to handover a packet data session from the cellular network to the WLAN. The criteria may include whether the MS is idle in cellular network (i.e., no dedicated channel) or whether the WLAN signal strength is stable, etc. *The MS 300 may wait for a pending packet data session to go dormant in the cellular network.* The MS **300** then performs packet data session handover (i.e., sending Mobile IP registration via WLAN). This may be useful to minimize service interruption. Similarly, the MS **300** may perform packet data session handover when the WLAN signal strength is above an acceptable threshold for a specified period of time. In this way, the MS **300** ensures that access to the

WLAN is sustainable. The measure may be any measure of channel quality and/or signal strength. The threshold may be predetermined or may dynamically be adjusted based on the actual performance of the communication. This may be useful to avoiding any ping-pong effect whereby the MS **300** switches between WLAN access and cellular network access due to changing conditions or signal strength that is at the margin of tolerance for operation. Still further, upon detection of the WLAN, the MS **300** may notify the user and wait for the user to manually select WLAN.

Hsu, [0082].

228. As a further example, referring also to *Hsu*'s teachings with respect to the use of a single tuner to provide additional context regarding *Hsu*'s use of the term "application status" and "on-going packet data session," *Hsu* describes various scenarios where the single tuner does *not* perform network detection and selection when the "application status" is ongoing:

In scenario (2) described above, the MS has an active packet data session in the cellular network (i.e., with dedicated channel). The MS may choose not to scan for WLAN while active data session in the cellular network. In this case, while the MS is active in the cellular network, the MS does not switch to WLAN even though it could access to WLAN. Although the MS might not be able to take the advantage of high-speed WLAN access, the MS would not experience service interruption. After the MS becomes idle

in the cellular network, the MS tunes away from the cellular network to scan for the WLAN.

Hsu, [0062].

At the time the MS is scheduled to monitor the cellular network paging, ***if the MS is in the middle of transmitting or receiving frames over the WLAN, the MS should stay in the WLAN to complete the data delivery*** and thus skip a paging cycle. Potentially, the MS could miss a page, and the call set-up time of an incoming circuit-switched voice call increases. If the MS receives a page for an incoming circuit-switched voice call, the MS may respond as follows.

Hsu, [0069].

229. Accordingly, the *Bahl-Hsu-Weisshaar* network selection method discloses or suggests using a second interface during a period where the interface is not being used by a second application (“having said mobile control use of said interfaces by using a second interface, during a silent period of a second application running on said mobile and using said second interface”) to support a first application using a first interface where the two interfaces are heterogeneous (“to support a first application running on said mobile and using a first interface that is heterogeneous to said second interface such as to use both said first and second heterogeneous interfaces concurrently during said silent period to support said first application”).

C. Claim 2

1. **“The method of claim 1, further including having said mobile control processes based on both of said application awareness and said operating situation awareness.”**

230. In my opinion, *Bahl* in combination with *Hsu* and *Weisshaar* discloses or suggests the features of claim 2 for the reasons discussed in Section XI.B.5, *supra*.

231. Specifically, *Bahl* discloses having a mobile computing device control use of wireless network interfaces based on both the needs of applications running on it and its sensed operating conditions. For example, *Bahl* describes a network/interface selection scheme that considers a throughput needed by one or more particular active applications and the sensed battery charge of a mobile computing device:

The selection scheme and resulting defined criteria potentially include factors such as: policy, network SSID, speed, congestion, interference, throughput, ***battery life***, range, connectivity, security, cost per bit, and ***application throughput requirements***. Each of these factors is described herein below with reference to FIG. 9. The exemplary wireless technology selection scheme described herein contemplates selecting a wireless technology based upon a variety of factors, regardless of whether the selection was necessitated by interference.

Bahl, [0090], [0122] (“Battery life (BL) **912**: specifies battery charge available for a STA.”), [0127] (“Application throughput requirements APPTHRPT **922**: specifies a

throughput needed by one or more particular active applications on a computing device”).

D. Claim 3

1. **“The method of claim 1, further including having said mobile control radio interface processes based on one or more of said application awareness and said operating situation awareness.”**

232. In my opinion, *Bahl* in combination with *Hsu* and *Weisshaar* discloses or suggests the features of claim 3 for the reasons discussed in Section XI.B.5, *supra*.

233. Specifically, *Bahl* discloses having a mobile computing device control use of wireless network interfaces based on one or both of the needs of applications running on it and/or its sensed operating conditions. For example, *Bahl* describes a network/interface selection scheme that considers a throughput needed by one or more particular active applications and the sensed battery charge of a mobile computing device:

The selection scheme and resulting defined criteria potentially include factors such as: policy, network SSID, speed, congestion, interference, throughput, ***battery life***, range, connectivity, security, cost per bit, and ***application throughput requirements***. Each of these factors is described herein below with reference to FIG. 9. The exemplary wireless technology selection scheme described herein contemplates selecting a wireless technology based upon a variety of factors, regardless of whether the selection was necessitated by interference.

Bahl, [0090], [0122] (“Battery life (BL) **912**: specifies battery charge available for a STA.”), [0127] (“Application throughput requirements APPTHRPT **922**: specifies a throughput needed by one or more particular active applications on a computing device”).

E. Claim 4

- 1. “The method of claim 3, further including having said mobile control radio interface processes based on both of said application awareness and said operating situation awareness.”**

234. In my opinion, *Bahl* in combination with *Hsu* and *Weisshaar* discloses or suggests the features of claim 4 for the reasons discussed in Section XI.B.5, *supra*.

235. Specifically, *Bahl* discloses having a mobile computing device control use of wireless network interfaces based on both the needs of applications running on it and its sensed operating conditions. For example, *Bahl* describes a network/interface selection scheme that considers a throughput needed by one or more particular active applications and the sensed battery charge of a mobile computing device:

The selection scheme and resulting defined criteria potentially include factors such as: policy, network SSID, speed, congestion, interference, throughput, ***battery life***, range, connectivity, security, cost per bit, and ***application throughput requirements***. Each of these factors is described herein below with reference to FIG. 9. The exemplary wireless technology selection scheme described herein contemplates

selecting a wireless technology based upon a variety of factors, regardless of whether the selection was necessitated by interference.

Bahl, [0090], [0122] (“Battery life (BL) **912**: specifies battery charge available for a STA.”), [0127] (“Application throughput requirements APPTHRPT **922**: specifies a throughput needed by one or more particular active applications on a computing device”).

F. Claim 5

1. “The method of claim 4, further including having said mobile make use of silent periods based on needs of applications running on said mobile.”

236. In my opinion, *Bahl* in combination with *Hsu* and *Weisshaar* discloses or suggests the features of claim 5 for the reasons discussed in Section XI.B.5, *supra*.

237. Specifically, *Bahl* discloses selecting a network/interface based on needs of applications running on a mobile computing device. *See, e.g., Bahl*, [0127] (“Application throughput requirements APPTHRPT **922**: specifies a throughput needed by one or more particular active applications on a computing device”).

238. Moreover, as discussed in Section XI.B.5, *supra*, a person of ordinary skill in the art would have been motivated to select a network/interface based on needs of applications running on a mobile computing device during periods where a packet data session has no data pending transfer, as taught by *Hsu*, because doing so would “minimize service interruption.” *Hsu*, [0085].

G. Claim 6

- 1. “The method of claim 4, further including having said mobile make use of silent periods based on the operating situation of said mobile.”**

239. In my opinion, *Bahl* in combination with *Hsu* and *Weisshaar* discloses or suggests the features of claim 6 for the reasons discussed in Section XI.B.5, *supra*.

240. Specifically, *Bahl* discloses selecting a network/interface based on sensed operating conditions of a mobile computing device. *See, e.g., Bahl*, [0103] (“[T]he particular criterion governing wireless interface/network selections is dynamically configured according to sensed operating conditions (e.g., battery power high/low).”); [0095] (“In response to the low battery power and the congested state of the 802.11a access point, the operating system selects the 802.11b connection to which it will connect.”).

241. Moreover, as discussed in Section XI.B.5, *supra*, a person of ordinary skill in the art would have been motivated to select a network/interface based on the sensed operating conditions of a mobile computing device during periods where a packet data session has no data pending transfer, as taught by *Hsu*, because doing so would “minimize service interruption.” *Hsu*, [0085].

H. Claim 7

- 1. “The method of claim 1, further including having said mobile make use of silent periods based on needs of applications running on said mobile.”**

242. In my opinion, *Bahl* in combination with *Hsu* and *Weisshaar* discloses or suggests the features of claim 7 for the reasons discussed in Section XI.B.5, *supra*.

243. Specifically, *Bahl* discloses selecting a network/interface based on needs of applications running on a mobile computing device. *See, e.g., Bahl*, [0127] (“Application throughput requirements APPTHRPT 922: specifies a throughput needed by one or more particular active applications on a computing device”).

244. Moreover, as discussed in Section XI.B.5, *supra*, a person of ordinary skill in the art would have been motivated to select a network/interface based on needs of applications running on a mobile computing device during periods where a packet data session has no data pending transfer, as taught by *Hsu*, because doing so would “minimize service interruption.” *Hsu*, [0085].

I. Claim 8

- 1. “The method of claim 1, further including having said mobile control processes of said mobile during silent periods based on said mobile running a non-real-time application thereon or a real-time application thereon.”**

245. In my opinion, *Bahl* in combination with *Hsu* and *Weisshaar* discloses or suggests the features of claim 8. For example, *Bahl* discloses having a mobile computing device select a network interface based on whether the mobile computing

device is running a real-time-application or a non-real-time application. *See* Paragraphs 210-211, *supra*.

246. As a further example, *Bahl* discusses various scenarios expressly considering network selection where non-real time applications (*i.e.*, OUTLOOK and INTERNET EXPLORER) are in use. For instance:

A user comes to work. ***He resumes his laptop running OUTLOOK and INTERNET EXPLORER.*** The WINDOWS operating system determines that it is in the vicinity of an overloaded 802.11a infrastructure network and an underused 802.11b network advertising the same network SSID (*i.e.*, both offer connectivity to a same network). ***The operating system determines that the throughput requirements of the currently running applications*** are better met using the underutilized 802.11b than the overburdened and congested 802.11a access point. The operating system therefore utilizes an 802.11b network interface rather than an 802.11a network interface.

Bahl, [0093].

247. And, as I discussed in Paragraphs 210-211, *supra*, *Bahl* further contemplates the throughput and application throughput requirements of various networks, which are weighted differently depending on whether the mobile computing device is running a streaming (or real-time) application or a non-real-time application:

Throughput (THRPT) **910**: specifies throughput of a particular wireless technology. If both SSap and SSsta (signal strengths for the AP and STA) are low, then data throughput, by implication, is low. If both are high, the data throughput is high. If throughput on 802.11a is less than it is on 802.11b, then the throughput factor **910** favors the 802.11b wireless technology. In an exemplary embodiment of the invention, a weight (WCW) is given to the throughput **910** parameter based on the requirements of particular applications running on the STA. *For example, if Audio/Video streaming applications are running, a higher weight than normal should be used.* A factor value (WCV) of 1 indicates low throughput, 5 is normal, and 10 is high. By way of example, under ideal conditions, when comparing 802.11b and 802.11a technologies, 802.11b technology (highest theoretical speed can be 11 Mbps) receives a value of 5 and 802.11a (highest theoretical speed can be around 25-30 kbps) receives a value of 8, or even a value of 10 for turbo mode with highest theoretical speed of around 50 kbps.

Bahl, [0121], *see also* [0127], [0146].

248. Moreover, as I discussed in Section XI.B.5.b, Hsu discloses selecting a wireless network interface during a period where the status of an application has no data pending transfer to minimize packet loss and service interruption.

249. Accordingly, the *Bahl-Hsu-Weisshaar* network selection method discloses or suggests having a mobile computing device select a network interface (“having said mobile control processes of said mobile”) during a period where the

status of an application has no data pending transfer (“during silent periods”) based on whether the mobile computing device is running a real-time-application or a non-real-time application (“based on said mobile running a non-real-time application thereon or a real-time application thereon”).

J. Claim 10

- 1. “The method of claim 1, further including having said mobile switch to a certain process automatically based on an output from a mobility detector and/or PHY layer parameters.”**

250. In my opinion, *Bahl* in combination with *Hsu* and *Weisshaar* discloses or suggests the features of claim 10. As discussed, *Bahl* discloses a wireless network interface selection architecture that “facilitates automated selection of a particular mode of network access based upon status information provided by a set of network interface drivers associated with particular network interfaces and wireless technologies”:

Criteria-driven methods and a framework are disclosed that facilitate configuration/selection of one or more wireless network interfaces/networks for carrying out wireless communications on a computing device. The wireless network interface selection and coexistence driver architecture described herein facilitates automated selection of a particular mode of network access based upon status information provided by a set of network interface drivers associated with particular network interfaces and wireless technologies. Furthermore, a criteria-

driven interface/network selection framework is described that is potentially invoked in a variety of situations including, but not limited to, when an application is invoked or to select another interface/network to avoid detected interference.

Bahl, Abstract.

251. *Bahl* further explains that:

The factor values, in an embodiment of the invention, are derived from information elements of many types. Turning to FIG. 8, an exemplary set of information element types is enumerated. A network SSID **800** identifies a network. An Ncap **802** specifies a number of connections serviced in the last ‘t’ units of time by an access point. A connection is a synonym for an active association. A computing device communicates using a connection. An Npap **804** specifies a number of bytes processed in the last ‘t’ units of time by the access point. A Perrpap **806** specifies a percentage of packet errors in the last ‘t’ units of time in received packets by the access point. A Pretppap **808** specifies an average number of retries in the last ‘t’ seconds per packet by the AP across all nodes that it is servicing. A CPUap **810** parameter specifies a level of CPU utilization at the access point. A TPap **812** specifies a transmission power, in milliwatts, being used by the access point. A DLSec **814** specifies a wireless data link security type provided on the wireless network.

The set of parameters potentially used by a wireless technology/network selection criterion includes information elements associated with a wireless network interface card through which a connection is potentially established with a network. An SSap **816** specifies a signal strength seen by the access point. An SSsta **818** specifies a signal strength seen by the network interface card. A Perrpsta **820** specifies a percentage of packet errors in packets received by the network interface card. A TPsta **822** specifies a transmission power used by the network interface card. A Pretppsta **824** value specifies an average number of retries per packet seen by the network interface card during the last ‘t’ seconds. In the above, description of the parameters, the value “t” is a period interval specified in seconds.

Bahl, [0104], [0105].

252. A person of ordinary skill in the art would understand that at least the following factors constitute PHY (or Physical) layer factors: “Speed,” “Congestion,” “Interference,” “Throughput,” “Range,” “SSap 816,” “SSsta 818,” “TPap 812,” and “TPsta 822.” *Bahl*, [0104]-[0105], [0118]-[0121], [0123].

253. The PHY (or Physical) layer is a layer in the Open Systems Interconnect model created by the International Standards Organization. The physical layer is the first and lowest layer most closely associated with the physical connection between devices, such as the network interface(s) of a device. *See, e.g.*,

Frank, Fig. 1a.⁶ The physical layer provides the mechanical, electronic and operational characteristics for connecting to a physical transmission link. *See, e.g., Vialen*, 6:11-34.⁷

254. Accordingly, a person of ordinary skill in the art would have understood that the network interface parameters enumerated above constitute physical layer parameters. For example, “Throughput” specifies a level of throughput of a particular wireless technology based on measurements of signal strength as seen by the access point and signal strength as seen by the network interface card. *Bahl*, [0105], [0121]. As a further example, “TPsta 822” specifies a transmission power used by the network interface card.

255. Accordingly, the *Bahl-Hsu-Weisshaar* network selection method discloses or suggests having a computing device automatically select a network (“having said mobile switch to a certain process automatically”) based on

⁶ To be clear, here, I am relying on *Frank* as evidence of a person of ordinary skill in the art’s knowledge and the state of the art. *Frank* is not part of unpatentability Ground 1.

⁷ To be clear, here, I am relying on *Vialen* as evidence of a person of ordinary skill in the art’s knowledge and the state of the art. *Vialen* is not part of unpatentability Ground 1.

information elements associated with a wireless network interface card (*e.g.*, throughput, TPsta 822) (“based on an output from a mobility detector and/or PHY layer parameters”).

K. Claim 11

- 1. “The method of claim 1, further including having said mobile activate a secondary interface to offer enhanced bandwidth during said silent period if either an application needs additional bandwidth or data reception is not at a desired level.”**

256. In my opinion, *Bahl* in combination with *Hsu* and *Weisshaar* discloses or suggests the features of claim 11.

257. As I discussed in Section XI.B.5.b, *supra*, the *Bahl-Hsu-Weisshaar* network selection method discloses or suggests methods for facilitating selection of one or more wireless network interfaces (*e.g.*, cellular, 802.11a/b, and/or BT interfaces) during a period where the status of an application has no data pending transfer based on the requirements of currently running applications.

258. The network selection method comprises a set of factors. One factor is the “Application throughput requirements” factor, which “specifies a throughput needed by one or more particular active applications on a computing device to ensure proper operation of the applications on the device (STA) that will utilize the selected wireless technology.” *Bahl*, [0127].

259. Another factor is “Congestion,” which considers whether a network is heavily loaded and processing a high number of retries for packets:

Congestion (CNG) **906**: specifies a congestion value on a particular wireless technology of interest. If Ncap **802** or Nbap **804** for a particular wireless technology is large and if both Pretppsta **824** and Pretppap **808** are large, then it is likely that there is a relatively high level of congestion on the particular wireless technology/network combination. In other words, if the access point associated with a particular wireless technology/network is heavily loaded, i.e. it is handling a large number of connections or processing a large amount of traffic from existing connections, and the number of retries for packets at the AP and STA are high, then it is very likely that the network is congested. If the same access point provides 802.11b and 802.11a service, both 802.11a and 802.11b will likely be equally affected by the load. In this case, Pretppsta **824** and Pretppap **808** determine the congestion state of the network. A WCW value of 1 indicates, for example, a lowest congestion state, 5 is normal (medium), and 10 is the highest (network is stressed) level of congestion.

Bahl, [0119].

260. A person of ordinary skill in the art would have understood that congestion relates to data reception, which deteriorates in view of congestion. *Bahl*, [0113] (“[A] high value for ‘Congestion’ is bad[.]”). For example, U.S. Patent

Application No. 2005/0198350 A1 explains how congestion negatively impacts data reception:

The situation in which a router is discarding packets because the packet arrival rate exceeds the retransmission rate is termed congestion. While congestion does not necessarily prevent a packet from reaching the proper destination, the process of retransmission does greatly delay packet transfer. Further, there is a limit on the number of times the sending node will attempt to retransmit a packet before deciding that the connection no longer exists and giving up on the transfer.

Tan, [0029].⁸

261. *Bahl* explains how the “Application throughput requirements” and “Congestion” factors can be utilized, as follows:

The operating system determines that the throughput requirements of the currently running applications are better met using the underutilized 802.11b than the overburdened and congested 802.11a access point. The operating system therefore utilizes an 802.11b network interface rather than an 802.11a network interface

Bahl, [0093].

⁸ To be clear, here, I am relying on *Chaskar* as evidence of a person of ordinary skill in the art’s knowledge and the state of the art. *Chaskar* is not part of unpatentability Ground 1.

262. Moreover, as discussed in Section XI.B.5.b, *Hsu* discloses selecting a wireless network interface during a period where the status of an application has no data pending transfer to minimize packet loss and service interruption.

263. Accordingly, the *Bahl-Hsu-Weisshaar* network selection method discloses or suggests selecting a different network interface (“having said mobile activate a secondary interface to offer enhanced bandwidth”) during a period where the status of an application has no data pending transfer (“during said silent period”) when the current network interface does not meet application throughput requirements and/or is congested (“if either an application needs additional bandwidth or data reception is not at a desired level”).

L. Claim 12

- 1. “The method of claim 11, further including having said mobile compare one or more parameters for both a primary interface and a secondary interface of said mobile and determining if the secondary interface qualifies to assist.”**

264. In my opinion, *Bahl* in combination with *Hsu* and *Weisshaar* discloses or suggests the features of claim 12.

265. As discussed in Section XI.B.5.b, *supra*, the *Bahl-Hsu-Weisshaar* network selection method selects a network interface based upon a variety of factors. For example, *Bahl* explains that:

The exemplary interface/network selection framework and its variations, presented herein below comprise a wireless

technology selection framework that is based upon acquired information elements, factor values, and selection criteria. ***The selection framework derives factor values from acquired information elements (e.g., network status/capabilities) relating to multiple combinations of interface/network combinations available to a computing device.*** The factor values derived for each of the available combinations are then applied to an interface/network selection criterion. The criterion, by way of example, comprises a logical/arithmetic combination of weighted factor values. Applying the derived factor values for each interface/network option to the selection criterion renders a resulting interface/network selection for wireless network communications. In an exemplary embodiment, factor values are applied to an interface/network selection criterion to select between two Wi-Fi technologies, 802.11a and 802.11b supported by a portable (e.g., notebook) computing device. However, the disclosed selection framework is suitable for selecting between any of a variety of wireless technologies, including for example, selecting between Wi-fi (e.g., 802.11a/b/g) and GPRS interfaces/networks.

Bahl, [101], [0099] (comparing Wi-Fi to the GPRS network to determine which provides connectivity to the Internet and choosing the network that provides connectivity to the Internet), [0121] (explaining that if Audio/Video streaming applications are running, a higher weight to the throughput factor should be used and comparing the throughput of 802.11b and 802.11a technologies), [0122] (explaining

that if battery charge level on a STA is low, then the weight given to the battery life factor is raised and comparing the power drain from 802.11a NIC and 802.11b NIC), [0126] (“[I]f CST for 802.11a is unacceptable and CST for 802.11b is an acceptable value, and no other factor overrides this determination, then the 802.11b interface is selected.”), [0146] (pseudo code showing example network selection algorithm comparing 802.11a and 802.11b).

266. As a further example, *Bahl* explains that the network selection method may include a “Critical Criterion Factor (CWC)”:

Critical Criterion Factor (CWC)—This is a critical criterion factor to the decision process that results in a wireless interface/network selection. ***If a wireless technology does not have an acceptable value for this criterion factor, it is eliminated from consideration.*** A critical criterion factor by definition is the most preferred overriding criterion factor. There can be only one critical criterion factor.

Bahl, [0111].

267. Accordingly, the *Bahl-Hsu-Weisshaar* network selection method discloses or suggests comparing various factors for two network interfaces (“having said mobile compare one or more parameters for both a primary interface and a secondary interface of said mobile”) and determining whether a network is acceptable (“determining if the secondary interface qualifies to assist”).

M. Claim 13

- 1. “The method of claim 1, wherein said first and second heterogeneous interfaces are used concurrently during said silent period to support application traffic of said first application for enhanced bandwidth support by transmitting packetized application traffic for said first application concurrently over both said first and second heterogeneous interfaces.”**

268. In my opinion, *Bahl* in combination with *Hsu* and *Weisshaar* discloses or suggests the features of claim 13. As discussed in XI.B.6, *Weisshaar* discloses concurrent use of more than one interface to support an application.

269. Although *Weisshaar* does not expressly explain that one of the benefits of transmitting packetized application traffic concurrently over both said first and second heterogeneous interfaces is to enhance the bandwidth available for the application, a person of ordinary skill in the art consulting *Weisshaar* would have known and understood this to be one of the benefits.

270. This is because it was well-known at the time of the invention that a primary reason to transmit packetized application traffic for an application over two or more interfaces was to provide enhanced bandwidth, and this was well-known in the art.

271. For example, as discussed in Section XI.A.5, *supra*, I am an inventor on U.S. Patent No. 6,983,162, which was filed on May 27, 2002 and published on January 13, 2005. In this publication, which is U.S. Patent Application Publication

2005/0009524 A1, I explained that multi-mode communication units could be used to exceed the transmission rates of any single unit by creating a dynamic group that distributes the information for transmission in an aggregated group:

[I]n FIG. 2, UE-1 **112** may decide to upload a very large file to the network. In normal circumstances, UE-1 **112** would be limited to its maximum transmission rate of say, 64 kbps. Instead, utilising the inventive concepts herein described, UE-**112** forms a dynamic group of idle UEs **2-11** and distributes the information for transmission to all the users of the aggregated group using the adjunct Bluetooth channel. Such a distribution of information may take place during UE-1 **112**'s periods of inactivity on its primary-communication UMTS system.

Kotzin '162, [0068], [0120] (“The inventors of the present invention further envisage applying the aforementioned functionality enhancement capability to multi-mode communication units and/or multiple of single (but different) mode communication units.”).

272. Other publications predating the alleged invention also confirm that it was known that a primary reason to transmit packetized application traffic for an application over two or more interfaces was to provide enhanced bandwidth. *See Magalhaes*, 792 (disclosing methods for inverse multiplexing for aggregating

bandwidth using heterogeneous network interfaces)⁹; *White*, 8:15-23 (teaching that a “traffic load can be shared across a number of network connections” by transmitting multiple packets to the same destination over multiple network paths.”).

273. Accordingly, a person of ordinary skill in the art reviewing *Weisshaar* would have known that enhanced bandwidth would be a result of concurrent use of more than one interface to support packetized application traffic.

274. Moreover, as management of application traffic in each of *Bahl*, *Hsu*, and *Weisshaar* are implemented using software, a person of ordinary skill in the art could have pursued this approach with a reasonable expectation of success. *See* Paragraphs 169-171, 185.

⁹ To be clear, here, I am relying on *Magalhaes* as evidence of a person of ordinary skill in the art’s knowledge and the state of the art. *Magalhaes* is not part of unpatentability Ground 1.

N. Claim 14

1. **“The method of claim 1, wherein said second interface is used during said silent period to perform network discovery functions, which network discovery functions are used for handover of said mobile to a new network, transparent to and without interference to operation of said first application that concurrently uses said first interface during said network discovery.”**

275. In my opinion, Bahl in combination with Hsu and Weisshaar discloses or suggests the features of claim 14 for the reasons discussed in Section XI.B.6, *supra*. Specifically, the *Bahl-Hsu-Weisshaar* network selection method discloses or suggests having a mobile use, *e.g.*, a WLAN tuner to scan for WLAN availability during a period where the WLAN tuner is not in an active packet data session and a cellular tuner is in an active packet data session with a cellular network to support handover of an application from one network interface (*e.g.*, cellular) to another (*e.g.*, WLAN). *See* Section XI.B.6, *supra*.

276. Bahl further discloses:

Switching between technologies is transparent to a user. Therefore, if 802.11b is selected as the preferred connectivity technology based on a value for the QN **924**, and it is later determined, as indicated by a change in the value of the QN **924**, that 802.11a should be used (or vice versa), *the computing device seamlessly transitions to the selected technology. Regardless of whether or not the two wireless technologies provide connectivity to the same subnet, the migration process*

from one wireless technology to another are transparent to applications running on the computing device. If the wireless technologies connect the computing device to different subnets, mobility support within the operating system, if existent, keeps the transition from one subnet to the other transparent to the applications. In an exemplary embodiment, whether to switch on the fly between different subnets, assuming it is known from historical data that the wireless technologies connect to different subnets, is part of the policy.

Bahl, [0127], [0123] (“Fast handoff schemes are employed to make handoff as seamless as possible.”).

277. In my opinion, a person of ordinary skill in the art would have understood that a “seamless” transition from one network interface to another is a handoff that allows a user’s communication session to remain active without interruptions so that a first application that was using a first interface during network discovery can use a second interface based on the handoff.

278. This understanding is consistent with my experience at Motorola working on handovers and other publications published before the date of the invention. For example, U.S. Patent No. 5,737,703, filed over a decade before the provisional application for the ’436 patent, explains that a “seamless handover” is a

handover that makes “a connection to a new radio telephone system is made before breaking the existing connection with the old system.” *Byrne*, 8:20-22.¹⁰

279. Accordingly, the *Bahl-Hsu-Weisshaar* network selection method discloses or suggests having a mobile scan for and/or measure characteristics of a network interface (“said second interface is used during said silent period to perform network discovery functions”) and perform handoffs between network interfaces seamlessly and transparently to applications running on the computing device (“which network discovery functions are used for handover of said mobile to a new network, transparent to and without interference to operation of said first application that concurrently uses said first interface during said network discovery”).

XII. GROUND 2: *BAHL* IN VIEW OF *HSU*, *WEISSHAAR* AND *WHITE* RENDER OBVIOUS CLAIM 13

280. I have reviewed *Bahl*, *Hsu*, *Weisshaar*, and *White*, and as described below, it is my opinion that *Bahl*, *Hsu*, *Weisshaar*, and *White* disclose or suggest all of the features of claim 13.

A. *Bahl* in view of *Hsu*, *Weisshaar*, and *White*

281. As I discussed above in Section XI.A, it would have been obvious to a person of ordinary skill in the art to combine *Bahl*, *Hsu*, and *Weisshaar*.

¹⁰ To be clear, here, I am relying on *Byrne* as evidence of a person of ordinary skill in the art’s knowledge and the state of the art. *Byrne* is not part of unpatentability Ground 1.

282. To the extent that Patent Owner argues that the *Bahl-Hsu-Weisshaar* combination would not, “during said silent period,” “transmit[] packetized application traffic for said first application concurrently over both said first and second heterogeneous interfaces” “to support application traffic of said first application for enhanced bandwidth,” it is my opinion that it would have been further obvious to incorporate the teachings of *White* into multi-interface devices utilizing the *Bahl-Hsu-Weisshaar* network selection method for the reasons I discuss below.

1. *White* (Ex. 1008)

283. U.S. Patent No. 7,539,175 (“*White*”), which is entitled “Multi-access terminal with capability for simultaneous connectivity to multiple communication channels,” is directed to a “multi-access terminal that automatically and dynamically establishes and maintains simultaneous connections over multiple heterogeneous networks, creating aggregated communications pipes to one or more destinations.” *White*, 3:3-8.

284. Of relevance to my analysis, *White* teaches that “the traffic load can be shared across a number of network connections” by transmitting multiple packets to the same destination over multiple network paths. *White*, 8:15-23. *White* explains that by load sharing in this manner, the network connections can provide “broadband capacity, beyond the capability of any individual network connection.” *White*, 8:15-23.

2. *White* is Analogous Art to the '436 Patent

285. In my opinion, *White* is analogous art to the '436 patent because *White* is from the same field of endeavor as the alleged invention of the '436 patent and is reasonably pertinent to the problem faced by the inventors of the '436 patent.¹¹

a. *Bahl, Hsu, Weisshaar, and White* are from the Same Field of Endeavor as the '436 Patent

286. Like the '436 patent, *White* relates to using one or more network interfaces in response to application and operating condition factors. For example, *White* provides that:

An apparatus is disclosed for permitting a mobile terminal having multiple, heterogeneous network connections (e.g., multiple wired or wireless transceivers of various types) to set up and maintain virtual connections over multiple networks to either the same or to multiple destinations. The mobile terminal can “load-share” traffic, i.e., it can distribute segments of traffic over a full set of heterogeneous networks, significantly improving the reliability and availability of communications. In a first embodiment, a mobile terminal is configured with multiple radio frequency (RF) transceivers. ***Operating system software is provided for dynamically establishing and maintaining traffic flow for user applications over multiple communications paths,***

¹¹ *Bahl, Hsu, and Weisshaar* are likewise analogous art to the '436 patent for the reasons discussed above in Section VIII.A.3.

and for automatically adapting to variations in the networking environment, application traffic flow requirements, end user preferences, or mobility. In a second embodiment, a software-defined radio is used to implement the physical layer protocols for each desired network, eliminating the need for multiple transceivers.

White, Abstract.

287. As such, it is my opinion that *White* is from the same field of endeavor as the alleged invention of the '436 patent.

b. *Bahl, Hsu, Weisshaar, and White* are Reasonably Pertinent to the Problems Addressed by the '436 Patent

288. *White* is reasonably pertinent to addressing the problem with which the inventors of the '436 patent were involved, namely gaining an advantage from “the mobile us[ing] its network interfaces according to the applications and situations responsiveness.” '436 patent at 2:43-45. As discussed above, *White* also provides a solution by providing a framework for selecting one or more network interfaces in response to application and operating condition factors. *White*, Abstract.

289. Accordingly, it is my opinion that *White* is reasonably pertinent to the problems purportedly with which the inventors of the '436 patent were involved.

3. A person of ordinary skill in the art Would Have Found It Obvious to Combine *Bahl, Hsu, Weisshaar, and White*

290. As discussed in Section XI.A.5, it is my opinion that a person of ordinary skill in the art would have been motivated to combine the complementary teachings of *Bahl, Hsu, and Weisshaar*. In addition, a person of ordinary skill in the art would have been further motivated to combine *Bahl, Hsu, and Weisshaar* with *White* for the following reasons.

291. *White* belongs to the same field of endeavor as *Bahl, Hsu, and Weisshaar*, network selection methods for devices containing heterogeneous radio interfaces:

An apparatus is disclosed for permitting a mobile terminal having multiple, heterogeneous network connections (e.g., multiple wired or wireless transceivers of various types) to set up and maintain virtual connections over multiple networks to either the same or to multiple destinations. The mobile terminal can “load-share” traffic, i.e., it can distribute segments of traffic over a full set of heterogeneous networks, significantly improving the reliability and availability of communications. In a first embodiment, a mobile terminal is configured with multiple radio frequency (RF) transceivers. ***Operating system software is provided for dynamically establishing and maintaining traffic flow for user applications over multiple communications paths, and for automatically adapting to variations in the networking environment, application traffic flow requirements, end user***

preferences, or mobility. In a second embodiment, a software-defined radio is used to implement the physical layer protocols for each desired network, eliminating the need for multiple transceivers.

White, Abstract; Section XI.A.5.

292. A person of ordinary skill in the art would have also been motivated to combine *White* with *Bahl*, *Hsu*, and *Weisshaar* because *White*'s known bandwidth enhancement technique would improve known multi-interface devices, such as the multi-interface devices disclosed by *Bahl*, *Hsu*, and *Weisshaar*, in a similar way to obtain predictable results (enhanced bandwidth).

293. In particular, each of *Bahl*, *Hsu*, *Weisshaar*, and *White* are directed to methods of controlling multi-interface devices. *Bahl*, [0045] (“[A] personal computer 214 located proximate to the notebook computer 200 is equipped with multiple wireless network technology interfaces.”); *Hsu*, [0077] (“[T]he Mobile Station (MS) has two tuners that can tune to a cellular frequency and the WLAN frequency simultaneously.”); *Weisshaar*, [0051] (“[T]he connection manager manages multiple interfaces and reports concurrent use of more than one interface, either by the same or different applications.”); *White*, Abstract. Accordingly, the multi-interface devices disclosed by *Bahl*, *Hsu*, *Weisshaar*, and *White* are each functionally-equivalent base devices for purposes of incorporating *White*'s teachings.

294. Moreover, *White* teaches that bandwidth for an application of a multi-interface device can be enhanced by transmitting multiple packets simultaneously to the same destination over multiple networks to “sum” capacity:

Still another application of the transmission architecture shown in FIG. 2 is that the multiple packets 74 *a*-74 *f* can be transmitted simultaneously to the same destination over the multiple network connection paths 72 *a*-72 *f*, thereby summing the capacity over the multiple network connection paths 72 *a*-72 *f* so as to provide broadband capacity, beyond the capability of any individual network connection. In this manner, the traffic load can be shared across a number of network connections.

White, 8:15-25.

295. As *White* explains, in this way, “users could ‘sum’ capacity across a set of networks to realize the bandwidth needed for high quality images or video, i.e. a mobile terminal can operate over multiple channels at the same time.” *White*, 22:6-9.

296. For example:

The present invention has several advantages over prior art wireless communication methods. Equipped with the multi-access terminal of the present invention, civilian and military first responders (and ordinary consumers) would have improved coverage, permitting them to roam within military/police bands and/or across commercial cellular and unlicensed bands. The first responders (and ordinary consumers) can load-share

bandwidth capacity across a set of available networks to improve reliability. For example, if a network fades, data could be relocated to a network with better performance without the need for user intervention in a way similar to handoffs between base stations for user of wireless cellular networks. Similarly, users could “sum” capacity across a set of networks to realize the bandwidth needed for high quality images or video, i.e. a mobile terminal can operate over multiple channels at the same time. An officer in a remote part of a metropolitan area could receive the same high quality images of suspects as his/her colleagues that are within range of a police WiFi network. Users would have coverage wherever any wireless network, including satellites, exists. This would provide wireless users with the performance and reliability currently experienced only by wire line users. Another advantage of the present invention is that the provisioning of access to multiple types of networks in a given area can be done without the need for re-development of the existing wireless base station infrastructure, significantly reducing costs and delays in introducing broadband services.

White, 21:61-22:21.

297. Relatedly, as each of *Bahl*, *Hsu*, *Weisshaar*, and *White* are directed to controlling similar devices with multiple network interfaces, a person of ordinary skill in the art could and would have applied this improvement in the same way to obtain predictable results (*i.e.*, enhanced bandwidth). For example, as shown below,

White likewise has multiple interfaces (*i.e.*, Tx/Rx 1-6) and a processing unit (*i.e.*, CPU 90).

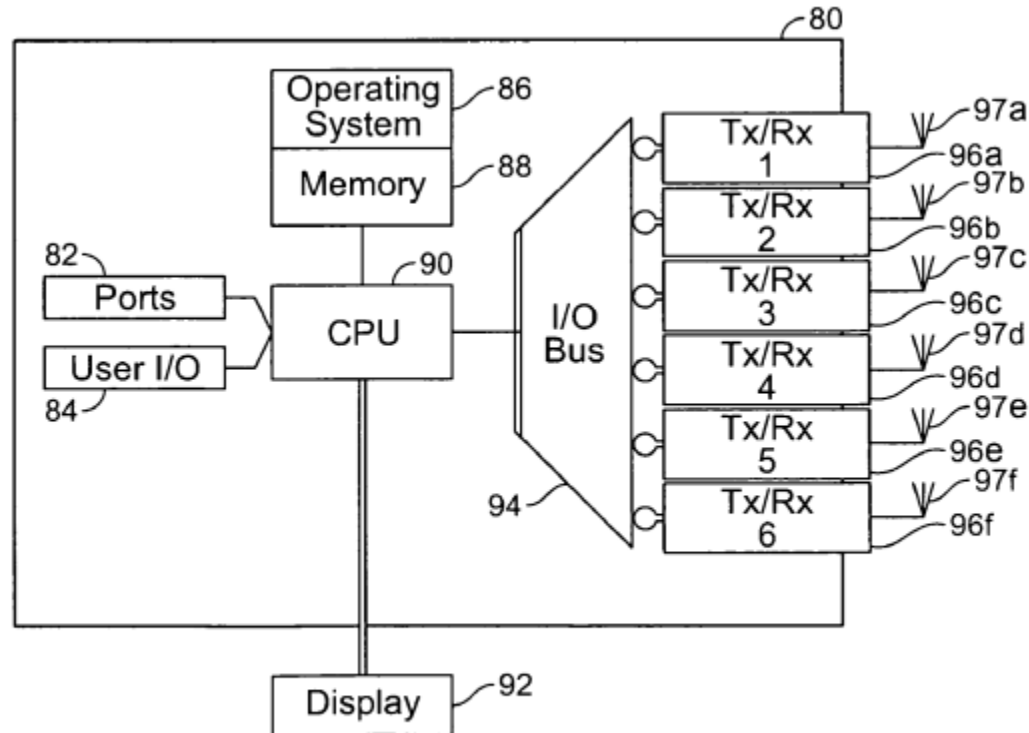


FIG. 3

298. Relatedly, like *Bahl*, *Hsu*, and *Weisshaar*, *White*'s techniques are applied through software. *White*, Abstract ("Operating system software is provided for dynamically establishing and maintaining traffic flow for user applications over multiple communications paths[.]"); Paragraphs 169-171, 185. The programming implementing *White*'s teachings were thus within the person of ordinary skill in the art's ordinary skill and would produce predictable results. *See* Paragraphs 169-171, 185.

B. Claim 13

- 1. “The method of claim 1, wherein said first and second heterogeneous interfaces are used concurrently during said silent period to support application traffic of said first application for enhanced bandwidth support by transmitting packetized application traffic for said first application concurrently over both said first and second heterogeneous interfaces.”**

299. In my opinion, *Bahl* in combination with *Hsu*, *Weisshaar*, and *White* discloses or suggests the features of claim 13.

300. For example, *White* discloses that “multiple packets 74 a-74 f can be transmitted simultaneously to the same destination over the multiple network connection paths 72 a-72 f, thereby summing the capacity over the multiple network connection paths 72 a-72 f so as to provide broadband capacity, beyond the capability of any individual network connection.” *White*, 8:15-25. In this way, “users could ‘sum’ capacity across a set of networks to realize the bandwidth needed for high quality images or video, i.e. a mobile terminal can operate over multiple channels at the same time.” *White*, 22:6-9.

301. Moreover, *White* explains that the multiple network connection paths can be heterogeneous network connection paths. *White*, Abstract (“The mobile terminal can “load-share” traffic, i.e., it can distribute segments of traffic over a full set of heterogeneous networks, significantly improving the reliability and availability of communications.”).

302. Relatedly, it is my opinion that a person of ordinary skill in the art would have understood that the above disclosures are directed to increasing the bandwidth of a single application, *e.g.*, an application for downloading/streaming “high quality” video. For example:

Similarly, users could “sum” capacity across a set of networks to realize the bandwidth needed for high quality images or video, *i.e.* a mobile terminal can operate over multiple channels at the same time. ***An officer in a remote part of a metropolitan area could receive the same high quality images of suspects as his/her colleagues that are within range of a police WiFi network.*** Users would have coverage wherever any wireless network, including satellites, exists. This would provide wireless users with the performance and reliability currently experienced only by wire line users. Another advantage of the present invention is that the provisioning of access to multiple types of networks in a given area can be done without the need for re-development of the existing wireless base station infrastructure, significantly reducing costs and delays in introducing broadband services.

White, 22:6-21.

303. Moreover, a person of ordinary skill in the art would have been motivated to use *White*’s bandwidth enhancement technique during a period in which one of the network connection paths was not transmitting or receiving application traffic for the reasons discussed in Section XI.B.6, *supra*.

304. Accordingly, the *Bahl-Hsu-Weisshaar-White* method discloses or suggests summing capacity across a set of networks (“wherein said first and second heterogeneous interfaces are used concurrently”) during a period where one of the network connection paths is not transmitting or receiving application traffic (“during said silent period”) to provide increased bandwidth for a currently active application (“to support application traffic of said first application for enhanced bandwidth support by transmitting packetized application traffic for said first application concurrently over both said first and second heterogeneous interfaces”).

XIII. GROUND 3: *BAHL* IN VIEW OF *HSU*, *WEISSHAAR* AND *RANTA* RENDER OBVIOUS CLAIMS 9, 15-17 AND 19

305. I have reviewed *Bahl*, *Hsu*, *Weisshaar*, and *Ranta*, and as described below, it is my opinion that *Bahl*, *Hsu*, *Weisshaar*, and *Ranta* disclose or suggest all of the features of claims 9, 15-17 and 19.

A. *Bahl* in view of *Hsu*, *Weisshaar*, and *Ranta*

306. As I discussed in Section XI.A, it would have been obvious to a person of ordinary skill in the art to combine *Bahl*, *Hsu*, and *Weisshaar*.

307. For the reasons I discuss below, it would have been further obvious to incorporate the teachings of *Ranta* into multi-interface devices utilizing the *Bahl-Hsu-Weisshaar* network selection method.

1. Ranta (Ex. 1009)

308. U.S. Patent Application Publication 2003/0081657 A1 (“Ranta”), which is entitled “Use of received signal strength indicator (RSSI) and global positioning system (GPS) to reduce power consumption in mobile station,” is directed to a “mobile station system (5) and a method for operating a mobile station (100) to reduce the power consumption thereof as a function of a presence or absence of motion, and as a function of a duration of a period over which motion above a motion threshold is not detected”:

Disclosed is mobile station system (5) and a method for operating a mobile station (100) to reduce the power consumption thereof as a function of a presence or absence of motion, and as a function of a duration of a period over which motion above a motion threshold is not detected. The system includes cellular system reception circuitry and circuitry implementing a cellular system positioning function and a satellite-based positioning function (GPS). The circuitry includes a controller (120) that operates in accordance with a stored program for obtaining and combining a plurality of received signal-derived parameters of the cellular system, a position of the mobile station derived from the cellular system positioning function, and a position of the mobile station derived from the satellite-based positioning function to derive a value that is indicative of a presence or absence of motion of the mobile station. The controller compares the value to a motion threshold

and, when an absence of motion is detected, the controller is responsive for reducing the power consumption of the mobile station by selectively decreasing the usage of the mobile station cellular system reception circuitry, the cellular system positioning function and the satellite-based positioning function. The received signal-derived parameters of the cellular system include received signal parameters for a currently serving cell and for at least one adjacent cell, and include one or more of a received signal strength indicator (RSSI), a signal to interference ratio (SIR), a received signal code power (RSCP), a block error rate (BLER) and a bit error rate (BER).

Ranta, Abstract, [0001].

309. Specifically, *Ranta* teaches that “[o]ne significant power consuming operation of mobile stations is a requirement to make measurements of signals received from base stations or base sites of neighboring cells when operating within a currently serving cell”:

One significant power consuming operation of mobile stations is a requirement to make measurements of signals received from base stations or base sites of neighboring cells when operating within a currently serving cell. In a typical case the mobile station periodically receives a list of neighboring cells from the serving cell base station and then makes measurements, such as received signal strength measurements for radio channels from the neighboring cells. The results of these signal strength measurements are reported back to the base station of the serving

cell. These signal strength measurements are useful in determining candidate cells for handoff and reselection purposes. As can be appreciated, these received signal measurement and reporting operations consume some amount of mobile station power.

Ranta, [0003].

310. *Ranta* further provides that:

It is known to reduce mobile station power consumption by detecting the motion of the mobile station using GSM (Global System for Mobile Communications) measurements, and reducing the number or frequency of adjacent cell measurements based on the detected motion. In this case the underlying rationale is that if the mobile station is stationary or moving only slowly that the previously made neighbor cell measurements most likely remain valid, and need not be re-measured.

Ranta, [0004].

311. In view of the above background, *Ranta* provides a “method for operating a mobile station (100) to reduce the power consumption thereof as a function of a presence or absence of motion, and as a function of a duration of a period over which motion above a motion threshold is not detected.” *Ranta*, Abstract.

312. *Ranta* explains that its power consumption reduction method may be applied to a “mobile station (MS),” which may be embodied as “any device capable

of bidirectional communication with a wireless network,” including a “handheld cellular telephone,” “a vehicle-installed cellular telephone,” “a personal data assistant (PDA) device having wireless communication capabilities,” and a “laptop”:

Referring first to FIG. 1 there is illustrated a simplified block diagram of an embodiment of a wireless communications system **5** that is suitable for practicing these teachings. The wireless communications system **5** includes at least one mobile station (MS) **100**. The MS **100** may be embodied as a handheld cellular telephone, a vehicle-installed cellular telephone, a personal communication device, a personal data assistant (PDA) device having wireless communication capabilities, a wireless communication module installable within or with a computer, such as a PCMCIA or similar type of card or module that is installed during use within a portable data processor, such as a laptop or notebook computer, or even a computer that is wearable by the user. In general, the MS **100** may be any device capable of bidirectional communication with a wireless network.

Ranta, [0018].

313. Relatedly, *Ranta* explains that the mobile station transmits data in accordance with a predetermined “air interface standard,” which can “conform to any standard that enables voice and/or packet data transmissions to occur to and from the mobile station 100, such as packet data transmissions enabling Internet 70 access and web page downloads”:

FIG. 1 also shows an exemplary network operator or cellular system **10** having, for example, a GPRS Support Node (GSN) **30** for connecting to a telecommunications network, such as a Public Packet Data Network or PDN. The GPRS, or General Packet Radio Service, is a GSM phase **2+** service in which radio resources for data transfer are allocated on a per block basis, as opposed to a circuit-switched basis. The network operator **10** also includes at least one base station controller (BSC) **40**, as well as a plurality of base stations or base transceiver stations (BTS) **50** that transmit in a forward or downlink direction both physical and logical channels to the mobile station **100** in accordance with the predetermined air interface standard. A reverse or uplink communication path also exists from the mobile station **100** to the network operator, and conveys mobile originated access requests and traffic.

...

The air interface standard can conform to any standard that enables voice and/or packet data transmissions to occur to and from the mobile station 100, such as packet data transmissions enabling Internet 70 access and web page downloads. In the presently preferred embodiment of these teachings the air interface may support WCDMA operation, or Time Division Multiple Access (TDMA) operation. Multiple different types of operations may also be supported by the MS **100** (e.g., WCDMA/GSM), and may also include an advanced GSM protocol and air interface. It is assumed that the air interface of the cellular system **10** supports some type of mobile station

location function, such as the well-known observed time difference (OTD) or the extended OTD (EOTD) of GSM.

Ranta, [0019], [0021].

314. *Ranta* explains that its power consumption reduction method has “two major aspects”:

The basic principle of operation has two major aspects. The first aspect pertains to the calculation of a motion indicator that is descriptive of an amount of motion, if any, of the MS 100, and that takes into account an amount of time that the MS 100 is motionless. The motion indicator is calculated using information from several sources. In the presently preferred embodiment these sources include the GPS 300, a cellular system-based positioning system such as the above-mentioned EOTD of GSM, and the normal received signal properties of the cellular system base stations 50 (for both serving and adjacent cells).

The second aspect of these teachings relates to the optimization of the power consumption of various systems, subsystems and operations of the MS 100 in accordance with the calculated motion indicator.

Ranta, [0029], [0030].

2. *Ranta* is Analogous Art to the '436 Patent

315. *Ranta* is analogous art to the '436 patent because *Ranta* is from the same field of endeavor as the alleged invention of the '436 patent and is reasonably pertinent to the problem faced by the inventors of the '436 patent.¹²

a. *Bahl, Hsu, Weisshaar, and Ranta* are from the Same Field of Endeavor as the '436 Patent

316. Like the '436 patent, *Ranta* relates to using network interfaces in response to sensed operating conditions. For example, *Ranta* discloses entering into a “‘reduced’ operating mode,” which means using a “minimal set of positioning functions when there is a high probability that the MS 100 is stationary”:

The positioning function “normal” operating mode refers to normal operation without additional power saving functions. ***The positioning function “reduced” operating mode means a minimal set of positioning functions when there is a high probability that the MS 100 is stationary.*** In those terrestrial positioning systems based on the cellular system **10**, the position determining operations may be shut down almost totally. Timing tracking may be reduced to an amount necessary to track those changes caused by clock inaccuracies and drift. In the satellite-based GPS system, satellite tracking is necessary at all times, but the amount of tracking can be reduced as the GPS

¹² *Bahl, Hsu, and Weisshaar* are likewise analogous art to the '436 patent for the reasons discussed above in Section VIII.A.3.

subsystem 300 can predict the position of each satellite 400 using stored orbital parameters, and from that prediction the timing of each satellite 400 can be estimated. *In the “reduced” mode, both positioning systems (i.e., the terrestrial or cellular positioning system and the GPS positioning subsystem 300) output their position vectors less frequently than in the “normal” mode. After a longer period of immobility, both the cellular and the GPS positioning systems may be totally shut down.*

Ranta, [0057].

317. As such, it is my opinion that *Ranta* is from the same field of endeavor as the alleged invention of the '436 patent.

b. *Bahl, Hsu, Weisshaar, and Ranta* are Reasonably Pertinent to the Problems Addressed by the '436 Patent

318. The '436 patent also explains that “more advantage could be reaped if the mobile uses its network interfaces according to the applications and situations responsiveness.” '436 patent at 2:43-45.

319. *Ranta* is reasonably pertinent to this problem. For example, *Ranta* provides a solution by teaching that network interfaces could be used more efficiently when “there is a high probability that the MS 100 is stationary”:

The positioning function “normal” operating mode refers to normal operation without additional power saving functions. *The positioning function “reduced” operating mode means a*

minimal set of positioning functions when there is a high probability that the MS 100 is stationary. In those terrestrial positioning systems based on the cellular system **10**, the position determining operations may be shut down almost totally. Timing tracking may be reduced to an amount necessary to track those changes caused by clock inaccuracies and drift. In the satellite-based GPS system, satellite tracking is necessary at all times, but the amount of tracking can be reduced as the GPS subsystem **300** can predict the position of each satellite **400** using stored orbital parameters, and from that prediction the timing of each satellite **400** can be estimated. In the “reduced” mode, both positioning systems (i.e., the terrestrial or cellular positioning system and the GPS positioning subsystem **300**) output their position vectors less frequently than in the “normal” mode. After a longer period of immobility, both the cellular and the GPS positioning systems may be totally shut down.

E.g., Ranta, [0057].

320. Accordingly, it is my opinion that *Ranta* is reasonably pertinent to the problems purportedly faced by the inventors of the '436 patent.

3. A person of ordinary skill in the art Would Have Found It Obvious to Combine *Bahl, Hsu, Weisshaar, and Ranta*

321. As I discussed in Section XI.A.5, a person of ordinary skill in the art would have been motivated to combine the complementary teachings of *Bahl, Hsu, and Weisshaar*.

322. In addition, a person of ordinary skill in the art would have been further motivated to combine *Bahl*, *Hsu*, and *Weisshaar* with *Ranta* for the following reasons.

323. Each of *Bahl*, *Hsu*, *Weisshaar*, and *Ranta* share a common concern for optimizing power consumption of mobile devices. For example, *Bahl* describes an energy conservation mode:

Application throughput requirements APPTHRPT 922: specifies a throughput needed by one or more particular active applications on a computing device to ensure proper operation of the applications on the device (STA) that will utilize the selected wireless technology. The STA determines the throughput requirements of the applications running on it based on quality of service attributes set by the applications. *By way of example, in an energy conservation mode of operation, a criterion specifies that if the throughput requirements of the applications can be satisfied by 802.11b and there is no other factor, such as CST for instance, overriding this factor, then the 802.11b wireless technology is selected.*

Bahl, [0117].

324. *Hsu* likewise discusses the importance of an energy conservation and a related energy conservation mode:

Typically, a cellular system transmits a paging indicator periodically to page a mobile station when there is a pending communication. Similarly, a WLAN may be advertised by a

beacon transmitted by the WLAN. Both the paging indicator and the beacon require the mobile station to scan for the transmitted signal. *As the mobile station often has little information as to the location and accessibility of a WLAN, the mobile station may scan for the WLAN periodically expending considerable power. There is a need therefore for an efficient, accurate method of system detection and selection.*

Hsu, [0008], *see also*, e.g., [0081] (“Power conservation is an important design criterion in system detection and selection. Conservation of power at the mobile device is highly desirable to extend the operational time of the device between recharging the battery. If the MS **300** decides to scan for WLAN coverage, it is desirable to minimize power consumption during such scan while still monitoring cellular paging.”), [0083] (“For conserving power, it is desirable to maximize a sleep mode for MS **300**. In other words, it is desirable to maximize the time when MS **300** is using reduced power, or is in a sleep mode.”).

325. *Weisshaar* also describes an energy conservation mode:

Power manager **338** provides power status change events to applications, such as “power on”, “power off”, “sleep/accessory mode”, etc. *It can enforce a low-power mode in emergency situations, reserving power to the highest priority functions. It can also monitor power consumption to identify elements that may be consuming unreasonable amounts of power.*

Weisshaar, [0047].

326. Finally, *Ranta*, as discussed above, is directed to energy conservation:

These teachings relate generally to wireless communication terminals or mobile stations, such as powered cellular telephones, and more specifically relate to techniques to optimize the power consumption of portable, battery powered mobile stations.

[0001].

327. A person of ordinary skill in the art would have also been motivated to combine *Ranta* with *Bahl*, *Hsu*, and *Weisshaar* because *Ranta*'s known power conservation technique would improve the mobile devices disclosed by *Bahl*, *Hsu*, and *Weisshaar* in a similar way to obtain predictable results (*i.e.*, optimized power consumption).

328. Each of *Bahl*, *Hsu*, *Weisshaar*, and *Ranta* are directed to methods of controlling network-connected devices, including mobile devices. *Bahl*, [0041] ("Selection criteria are used to select/suggest a particular one of multiple available wireless network technologies supported by a computing device."); *Hsu*, [0082] ("The MS 300 may decide to scan for WLAN coverage based on one or more factors, e.g., user command(s), pre-configured preference(s), application status (e.g., on-going packet data session), WLAN availability advertisement as received from the cellular network, etc."); *Weisshaar*, [0051] ("[C]onnection manager 336 manages connection(s) of the client platform 300 to one or more networks, such as geographically distributed cellular and server networks."); *Ranta*,

[0001] (“[T]echniques to optimize the power consumption of portable, battery powered mobile stations.”).

329. As each device is a controllable, network-connected device, it is my opinion that the network-connected devices disclosed by *Bahl*, *Hsu*, *Weisshaar*, and *Ranta* are each functionally-equivalent base devices for purposes *Ranta*’s teachings.

330. Moreover, *Ranta* teaches that power consumption of a mobile station can be optimized by controlling use of network interfaces, such as by “selectively decreasing the usage of the mobile station cellular system reception circuitry, the cellular system positioning function and the satellite-based positioning function” when “an absence of motion is detected”:

Disclosed is mobile station system and a method for operating the mobile station to reduce the power consumption thereof as a function of a presence or absence of motion, and as a function of a duration of a period over which motion above a motion threshold is not detected. The system includes cellular system reception circuitry and circuitry implementing a cellular system positioning function and a satellite-based positioning function. The circuitry includes a controller that operates in accordance with a stored program for obtaining and combining a plurality of received signal-derived parameters of the cellular system, a position of the mobile station derived from the cellular system positioning function, and a position of the mobile station derived from the satellite-based positioning function to derive a

value that is indicative of a presence or absence of motion of the mobile station. The controller compares the value to a motion threshold and, when an absence of motion is detected, the controller is responsive for reducing the power consumption of the mobile station by selectively decreasing the usage of the mobile station cellular system reception circuitry, the cellular system positioning function and the satellite-based positioning function.

Ranta, [0011].

331. As *Bahl*, *Hsu*, *Weisshaar*, and *Ranta* are directed to network connected devices, a person of ordinary skill in the art could have applied this improvement in the same way to obtain predictable results (*i.e.*, optimized power consumption).

332. In my opinion, a person of ordinary skill in the art would have understood that at least two alternative implementations of *Ranta*'s power conservation technique could be made to the *Bahl-Hsu-Weisshaar* network selection method with a reasonable expectation of success.

333. The first implementation would be to incorporate *Ranta*'s teaching of measuring whether a mobile station is moving or stationary into the variety of factors used by *Bahl*, *Hsu*, and *Weisshaar* for network selection.

334. A person of ordinary skill in the art would understand that a motion factor is complementary, but not redundant, to the example factors explicitly

disclosed in *Bahl*. For example, *Bahl* describes a “Range (RNG)” factor that is concerned with the mobility of a wireless computing device:

Range (RNG) **914**: specifies a relative distance for each technology. 802.11b's range is 150-300 feet and 802.11a's range is roughly a quarter of 802.11b's range. As a result a STA that is moving will experience more handoffs if the 802.11a wireless technology is used. Handoff, in turn, affects latency, jitter, and packet loss. Fast handoff schemes are employed to make handoff as seamless as possible. However, low limits on latency, jitter, and packet loss for Voice over IP and A/V streaming applications require minimal handoffs for optimal user experience. A proper weight (WCW) is given to the range **914** factor based on the requirements of applications running on the station and *the kind of mobility of the computing device (STA) itself. As an example, for a wireless, non-mobile, desktop machine the Range 914 factor has minimal, if any, weight. On the other hand, the Range 914 is given a higher weight for a handheld (highly mobile STA) computing device that is currently running either a VoIP or A/V streaming application.*

Bahl, [0123].

335. The second implementation would be to incorporate *Ranta*'s teaching of making efficient use of network interfaces as a complementary means for conserving power on devices applying the *Bahl-Hsu-Weisshaar* network selection method.

336. For example, *Bahl* describes a “Battery life (BL) factor that:

[S]pecifies battery charge available for a STA. By way of example, when comparing power drain from wireless network interfaces, an 802.11a NIC, for the same work load, consumes more power than an 802.11b NIC. ***Therefore, a low battery power is assigned greater (negative) weight for the NIC that consumes more power.*** Furthermore, if battery charge level on a STA is low, then the weight (WCW) given to the battery life **912** factor is raised regardless of the technology—reflecting the increased importance of this factor. The value (WCV) assigned to the battery life **912** goes from highest (least negative) to lowest (most negative) across UWB, BT, 802.11b, 802.11a wireless technologies.

Bahl, [0122].

337. Either of these implementations would have had a reasonable expectation of success because, like *Bahl*, *Hsu*, and *Weisshaar*, *Ranta*’s techniques are applied through software:

The mobile station **100** includes a controller, such as a microcontrol unit (MCU) **120** having an output coupled to an input of a display **140** and an input coupled to an output of a keyboard or keypad **160**. The MCU **120** is assumed to include or be coupled to some type of a memory **130**, including a read-only memory (ROM) for storing an operating program, as well as a random access memory (RAM) for temporarily storing required data, scratchpad memory, received data, data to be transmitted

and the like. A separate, removable SIM (not shown) can be provided as well, the SIM storing, for example, a preferred Public Land Mobile Network (PLMN) list and other subscriber-related information. The ROM is assumed, for the purposes of this invention, to store a program enabling the MCU **120**, in cooperation with a DSP **180** described below, to execute the software routines, layers and protocols required to implement an improved mobile station motion determination function in accordance with the teachings herein. A suitable user interface (UI) is typically also provided via display **140** and keypad **160**. Although not shown, a microphone and speaker are typically provided for enabling the user to conduct voice calls in a conventional manner.

Ranta, [0023]; *see also* Paragraphs 169-171, 185, 298.

338. The programming implementing *Ranta*'s teachings likewise were within the person of ordinary skill in the art's ordinary skill and would produce predictable results for the same reasons discussed in Paragraphs 169-171, 185, 298.

B. Claim 9

- 1. "The method of claim 1, further including having said mobile control processes of said mobile during silent periods based on said mobile moving or not moving."**

339. In my opinion, *Bahl* in combination with *Hsu*, *Weisshaar*, and *Ranta* discloses or suggests the features of claim 9.

340. For example, *Ranta* discloses that a mobile station can be optimized by controlling use of network interfaces, such as by "selectively decreasing the usage

of the mobile station cellular system reception circuitry, the cellular system positioning function and the satellite-based positioning function” when “an absence of motion is detected”:

Disclosed is mobile station system and a method for operating the mobile station to reduce the power consumption thereof as a function of a presence or absence of motion, and as a function of a duration of a period over which motion above a motion threshold is not detected. The system includes cellular system reception circuitry and circuitry implementing a cellular system positioning function and a satellite-based positioning function. The circuitry includes a controller that operates in accordance with a stored program for obtaining and combining a plurality of received signal-derived parameters of the cellular system, a position of the mobile station derived from the cellular system positioning function, and a position of the mobile station derived from the satellite-based positioning function to derive a value that is indicative of a presence or absence of motion of the mobile station. The controller compares the value to a motion threshold and, when an absence of motion is detected, the controller is responsive for reducing the power consumption of the mobile station by selectively decreasing the usage of the mobile station cellular system reception circuitry, the cellular system positioning function and the satellite-based positioning function.

Ranta, [0011], [0057] (“In the “reduced” mode, both positioning systems (i.e., the terrestrial or cellular positioning system and the GPS positioning subsystem **300**) output their position vectors less frequently than in the “normal” mode.”).

341. As a further example, *Ranta* discloses a “power conservation algorithm” that includes the variable MOTION_THRESHOLD, which is the “limit between the decision as to whether the MS 100 is stationary or is moving”:

```
//Initialization steps//
n = 0;
stationary_time = 0;
Set the use of the searcher 180B to SEARCHER_USAGE(0);
Set the finger allocation of the rake receiver 180A to "normal";
Set the positioning function operating mode to "normal";
LOOP FOREVER
    Wait for and receive a paging block and make the measurements;
    Calculate the combined motion indicator C(n) in accordance with Equations
    1 and 2;
    IF C(n) > MOTION_THRESHOLD THEN
        Set the use of the searcher to SEARCHER_USAGE(0);
        Set the finger allocation to "normal";
        Set positioning function operating mode to "normal";
        stationary_time = 0; //MS 100 not stationary, normal operation//
    ELSE
        stationary_time = stationary_time + 1;
    ENDIF
    FOR k = 1 TO N_OF_STEPS DO
        If stationary_time = MOTION_TIMEOUT(k) THEN
            Reduce the use of the searcher 180B to SEARCHER_USAGE(k);
        ENDIF
        IF stationary_time = FINGER_TIMEOUT THEN
            Reduce the finger allocation of rake 180A to "minimized";
        ENDIF
        IF stationary_time = POSITIONING_TIMEOUT1 THEN
            Set positioning function operating mode to "reduced";
        ENDIF
        IF stationary_time = POSITIONING_TIMEOUT2 THEN
            Shut down the positioning functions;
        ENDIF
    ENDFOR
    n = n + 1;
ENDLOOP
```

Ranta, [0048].

342. Moreover, a person of ordinary skill in the art would have understood that a “mobile station cellular system reception circuitry” refers to a network interface. This is because an interface, such as a cellular interface, is reception circuitry for a cellular system. For example, *Weisshaar* describes a “communication

interface having a transmitter/receiver for transmitting and receiving communications via a wireless link 144 among the various nodes depicted in FIG. 1, also facilitates communications among other devices via wireless link 159, for example, satellite 110, and the like.” *Weisshaar*, [0023].

343. Moreover, a person of ordinary skill in the art would have been motivated to use *Ranta*’s optimized power consumption technique during a period in the network interface was not transmitting or receiving application traffic for the reasons discussed in Section XI.B.6, *supra*.

344. Accordingly, the *Bahl-Hsu-Weisshaar-Ranta* method discloses or suggests decreasing network interface usage (“having said mobile control processes of said mobile”) during a period in the network interface was not transmitting or receiving application traffic (“during silent periods”) when an absence of motion is detected (“based on said mobile moving or not moving”).

C. Claim 15

345. In my opinion, *Bahl* in view of *Hsu*, *Weisshaar* and *Ranta* renders obvious claim 15.

1. “A method of controlling a wireless mobile having multiple interfaces, comprising:”

346. As discussed above, I understand that “[a] method of controlling a wireless mobile having multiple interfaces, comprising:” is the preamble of claim 15 of the ’436 patent. I have been asked to assume that the preamble is a claim

limitation. Under this assumption, in my opinion, *Bahl* discloses or suggests this feature for the reasons discussed in Section XI.B.1, *supra*, with respect to claim 1's preamble.

2. “having said mobile be aware of its applications running on it;”

347. In my opinion, *Bahl* in combination with *Hsu*, *Weisshaar* and *Ranta* discloses or suggests the features of this claim limitation for the reasons discussed in Section XI.B.2, *supra*, with respect to claim 1.

3. “having said mobile be aware of its operating situation, and”

348. In my opinion, *Bahl* in combination with *Hsu*, *Weisshaar* and *Ranta* discloses or suggests the features of this claim limitation for the reasons discussed in Section XI.B.3, *supra*, with respect to claim 1.

4. “having said mobile control processes of said mobile during silent periods based on one or more of its application awareness and its operating situation awareness;”

349. In my opinion, *Bahl* in combination with *Hsu*, *Weisshaar* and *Ranta* discloses or suggests the features of this claim limitation for the reasons discussed in Section XI.B.5.a, b, *supra*, with respect to claim 1.

5. **“further including having said mobile control processes of said mobile during silent periods based on said mobile running a non-real-time application thereon or a real-time application thereon;”**

350. In my opinion, *Bahl* in combination with *Hsu*, *Weisshaar* and *Ranta* discloses or suggests the features of this claim limitation for the reasons discussed in Section XI.I, *supra*, with respect to claim 8.

6. **“further including having said mobile perform certain processes based on: a) if it is running a real-time application and it is stationary; b) if it is running a non-real-time application and it is moving; c) if it is running a non-real-time application and it is stationary; and d) if it is stationary and power consumption is not an issue.”**

351. In my opinion, *Bahl* in combination with *Hsu*, *Weisshaar* and *Ranta* discloses or suggests the features of this claim limitation.

352. As discussed in Sections XI.B.5 and XI.I, *supra*, *Bahl* discloses having a mobile computing device select a network interface based on whether the mobile computing device is running a real-time-application or a non-real-time application. For example, *Bahl* considers one or more of the following factors:

Throughput (THRPT) **910**: specifies throughput of a particular wireless technology. If both SSap and SSsta (signal strengths for the AP and STA) are low, then data throughput, by implication, is low. If both are high, the data throughput is high. If throughput on 802.11a is less than it is on 802.11b, then the throughput factor **910** favors the 802.11b wireless technology. In an exemplary embodiment of the invention, a weight (WCW) is

given to the throughput **910** parameter based on the requirements of particular applications running on the STA. For example, if Audio/Video streaming applications are running, a higher weight than normal should be used. A factor value (WCV) of 1 indicates low throughput, 5 is normal, and 10 is high. By way of example, under ideal conditions, when comparing 802.11b and 802.11a technologies, 802.11b technology (highest theoretical speed can be 11 Mbps) receives a value of 5 and 802.11a (highest theoretical speed can be around 25-30 kbps) receives a value of 8, or even a value of 10 for turbo mode with highest theoretical speed of around 50 kbps.

See Bahl, [0121].

Application throughput requirements APPTHRPT **922**: specifies a throughput needed by one or more particular active applications on a computing device to ensure proper operation of the applications on the device (STA) that will utilize the selected wireless technology. The STA determines the throughput requirements of the applications running on it based on quality of service attributes set by the applications. By way of example, in an energy conservation mode of operation, a criterion specifies that if the throughput requirements of the applications can be satisfied by 802.11b and there is no other factor, such as CST for instance, overriding this factor, then the 802.11b wireless technology is selected.

See Bahl, [0127].

353. As shown below as a further example, *Bahl* considers whether the throughput of a potential network meets or exceeds the application throughput requirements for an active application running on the computing device:

```
//
//If app throughput requirements are satisfied by throughput on 802.11b, select it
//
    if (APPTHRTPT < THRPTb)
    {
        QNb++;
    }
    else
    {
        if (APPTHRTPT < THRPTa)
        {
            //
            //Since APPTHRPT can not be met by THRPTb, QNb goes down
            // significantly
            //
            QNb -= 2
        }
    }
}
```

354. *Bahl*, [0146], [0130] (“At step 1102 one or more of the multiple available selection criteria are selected.”).

355. Moreover, as discussed in Section XIII.A.3, *supra*, a person of ordinary skill in the art would have found it obvious to further incorporate *Ranta*’s teaching of measuring whether a device is moving or stationary into the variety of factors used by *Bahl*, *Hsu*, and *Weisshaar* in determining whether to select a network interface.

356. Finally, *Bahl* discloses having a mobile computing device select a network interface based on whether power consumption is an issue. For example, *Bahl* discloses that:

A user opens a laptop in a packed airline lounge with many people using the lounge's 802.11a wireless network access point. The lounge also has an 802.11b network access point. Both network access points are free for the use by people in the lounge and provide the same kind of connectivity. The user is running OUTLOOK and IE on the laptop machine. The operating system senses that the 802.11a network/access point is overloaded and congested. Also, ***the battery on the Patrick's laptop is running low. In response to the low battery power*** and the congested state of the 802.11a access point, ***the operating system selects the 802.11b connection to which it will connect.*** At some later time, the airline lounge empties, and the 802.11a network access point is no longer overloaded or congested. Furthermore, ***the battery has been charged, and power is no longer an issue because the user has plugged the laptop into a power socket. The operating system senses the changed environment, decides that 802.11a network offers the best service, and so changes wireless technology usage from 802.11b to 802.11a to take advantage of the higher bandwidth offered by the 802.11a connection.***

Bahl, [0095].

357. Accordingly, the *Bahl-Hsu-Weisshaar-Ranta* network selection method discloses or suggests selecting a network interface ("having said mobile

perform certain processes”) based on combinations of whether a mobile computing device is running a real-time or non-real-time application, is moving or stationary, and if power consumption is an issue (“based on: a) if it is running a real-time application and it is stationary; b) if it is running a non-real-time application and it is moving; c) if it is running a non-real-time application and it is stationary; and d) if it is stationary and power consumption is not an issue.”).

D. Claim 16

358. In my opinion, *Bahl* in view of *Hsu*, *Weisshaar*, and *Ranta* renders obvious claim 16.

1. “The method of claim 15, further including having said mobile perform: e) QoS enhancement if it is running a real-time application and it is stationary;”

359. In my opinion, *Bahl* in view of *Hsu*, *Weisshaar*, and *Ranta* renders obvious this claim limitation.

360. *Bahl* discloses performing QoS enhancement as part of its network selection method. For example, *Bahl* discloses:

Application throughput requirements APPTHRPT 922: specifies a throughput needed by one or more particular active applications on a computing device to ensure proper operation of the applications on the device (STA) that will utilize the selected wireless technology. *The STA determines the throughput requirements of the applications running on it based on quality of service attributes set by the applications.* By way of example,

in an energy conservation mode of operation, a criterion specifies that if the throughput requirements of the applications can be satisfied by 802.11b and there is no other factor, such as CST for instance, overriding this factor, then the 802.11b wireless technology is selected.

Bahl, [0127].

361. A person of ordinary skill in the art would have understood that selection of an interface based on the quality of service attributes set by an application constitutes QoS enhancement. Such information ensures that throughput, among other things, are acceptable for the applications running on a mobile device, and if not, the wireless interface can be changed.

362. I have discussed such quality of service requirement data as an inventor on U.S. Patent No. 6,791,968, which published over a year before the date of invention. As I explained below, this data considers, among other things, an acceptable communication bit rate:

Quality of service requirement data includes, but is not limited to, data representing an acceptable delay period that the information stream may be amenable to, an acceptable communication bit rate, and an acceptable accuracy level such as a frame erasure rate. For example, some information may need to be low delay, as may be the case for an interactive speech communication.

Kotzin '968, 4:34-46.¹³

363. Moreover, as discussed in Section XIII.C.6, *supra*, the *Bahl-Hsu-Weisshaar-Ranta* network selection method discloses or suggests selecting a network interface based on combinations of whether a mobile computing device is running a real-time or non-real-time application, is moving or stationary, and if power consumption is an issue. A person of ordinary skill in the art would thus have understood that the *Bahl-Hsu-Weisshaar-Ranta* network selection method discloses or suggests selecting a network interface based on if a mobile computing device is running a real-time application and it is stationary.

364. Accordingly, the *Bahl-Hsu-Weisshaar-Ranta* network selection method discloses or suggests performing QoS enhancement by selecting a network interface based on the quality of service attributes set by an application running on a mobile computing device (“having said mobile perform: e) QoS enhancement”) based on whether the mobile computing device: is running a real-time application (“if it is running a real-time application”) and is stationary (“and it is stationary”).

¹³ To be clear, here, I am relying on *Kotzin* '968 as evidence of a person of ordinary skill in the art's knowledge and the state of the art. *Kotzin* '968 is not part of unpatentability Ground 2.

2. “f) network discovery if it is running a non-real-time application and it is moving;”

365. In my opinion, *Bahl* in view of *Hsu*, *Weisshaar* and *Ranta* renders obvious this claim limitation.

366. *Hsu* describes performing network discovery functions. For example, *Hsu* discloses that “the MS 300 detects WLAN coverage and performs system selection between WLAN and the cellular system using one tuner for each access medium.” *Hsu*, [0077].

367. *Hsu* further discloses that the “MS 300 may decide to scan for WLAN coverage based on one or more factors, e.g., user command(s), pre-configured preference(s), application status (e.g., on-going packet data session), WLAN availability advertisement as received from the cellular network, etc.” *Hsu*, [0082].

368. The '436 patent also explains that, as part of the disclosed “Network Discovery/Proactive Handoff Mode (NDM),” “select[ing] a target network to which the MID may switch to next.” '436 patent at 11:43-45.

369. In view of at least the above descriptions, a person of ordinary skill in the art would have understood that determining which network to select constitutes “network discovery.”

370. As discussed in Section XIII.C.6, *supra*, the *Bahl-Hsu-Weisshaar-Ranta* network selection method discloses or suggests determining a network to select based on combinations of whether a mobile computing device is running a

real-time or non-real-time application, is moving or stationary, and if power consumption is an issue. A person of ordinary skill in the art would thus have understood that the *Bahl-Hsu-Weisshaar-Ranta* network selection method discloses or suggests selecting a network based on if a mobile computing device is running a non-real-time application and it is moving.

371. Accordingly, the *Bahl-Hsu-Weisshaar-Ranta* network selection method discloses or suggests performing network scanning and/or selection (“network discovery”) if the mobile computing device is running a non-real-time application and it is moving (“if it is running a non-real-time application and it is moving”).

3. “g) energy conservation if it is running a non-real-time application and it is stationary; and”

372. In my opinion, *Bahl* in view of *Hsu*, *Weisshaar* and *Ranta* renders obvious this claim limitation.

373. For example, *Bahl* discloses a scenario in which a user’s laptop switches to a lower power consuming network when the laptop battery is low and the laptop is running two non-real-time applications:

A user opens a laptop in a packed airline lounge with many people using the lounge's 802.11a wireless network access point. The lounge also has an 802.11b network access point. Both network access points are free for the use by people in the lounge and provide the same kind of connectivity. The user is running

OUTLOOK and IE on the laptop machine. The operating system senses that the 802.11a network/access point is overloaded and congested. Also, the battery on the Patrick's laptop is running low. In response to the low battery power and the congested state of the 802.11a access point, the operating system selects the 802.11b connection to which it will connect. At some later time, the airline lounge empties, and the 802.11a network access point is no longer overloaded or congested. Furthermore, the battery has been charged, and power is no longer an issue because the user has plugged the laptop into a power socket. The operating system senses the changed environment, decides that 802.11a network offers the best service, and so changes wireless technology usage from 802.11b to 802.11a to take advantage of the higher bandwidth offered by the 802.11a connection.

Bahl, [0095], [0122] (Battery Life (BL) factor), [0127] (“[I]n an energy conservation mode of operation, a criterion specifies that if the throughput requirements of the applications can be satisfied by 802.11b and there is no other factor, such as CST for instance, overriding this factor, then the 802.11b wireless technology is selected.”).

374. Moreover, *Ranta* discloses that “[t]he controller compares the value to a motion threshold and, ***when an absence of motion is detected***, the controller is responsive for reducing the power consumption of the mobile station by selectively decreasing the usage of the mobile station cellular system reception circuitry, the cellular system positioning function and the satellite-based positioning function.”

Ranta, Abstract.

375. Accordingly, the *Bahl-Hsu-Weisshaar-Ranta* network selection method discloses or suggests performing energy conservation (“energy conservation”) if the mobile computing device is running a non-real-time application and is stationary (“if it is running a non-real-time application and it is stationary”).

4. “h) information sharing if it is stationary and power consumption is not an issue.”

376. In my opinion, *Bahl* in view of *Hsu*, *Weisshaar* and *Ranta* renders obvious this claim limitation.

377. *Bahl* discloses information sharing using an ad hoc network connection between devices. *See Bahl*, [0097] (“[T]hey form an ad hoc group over a Wi-Fi network to share presentation material.”).

378. A person of ordinary skill in the art would have understood that sharing presentation materials constitutes “information sharing,” including in view of the ’436 patent’s specification, which provides that types of information shared between devices in a “Chat with Devices Mode” include information of “Device” or “Human” interest:

The information may be of Device Interest (e.g., the addresses of the radio access points and the parameters needed to connect to them, the IP addresses of the IP access routers, the DHCP server, the authentication server and authentication protocols supported, local content, and other network) or of Human interest (e.g.,

Location based information about Restaurants, or Gas Stations
etc).

'436 patent at 13:8-15.

379. Relatedly, as discussed in Section XIII.C.6, *supra*, the *Bahl-Hsu-Weisshaar-Ranta* network selection method discloses or suggests determining a network to select based on combinations of whether a mobile computing device is running a real-time or non-real-time application, is moving or stationary, and if power consumption is an issue. A person of ordinary skill in the art would thus have understood that the *Bahl-Hsu-Weisshaar-Ranta* network selection method discloses or suggests selecting a network based on if a mobile computing device is stationary and power consumption is not an issue.

380. Accordingly, the *Bahl-Hsu-Weisshaar-Ranta* network selection method discloses or suggests making ad hoc connections between devices where devices may share information (“information sharing”) if the mobile computing device is stationary and power consumption is not an issue (“if it is stationary and power consumption is not an issue”).

E. Claim 17

- 1. “The method of claim 15, further including having said mobile switch to a certain process automatically during said silent periods based on an output from a mobility detector and/or PHY layer parameters, and wherein said silent periods are brief intervals during which an application running on said mobile has no application traffic to send or receive.”**

381. In my opinion, *Bahl* in combination with *Hsu*, *Weisshaar* and *Ranta* discloses or suggests the features of claim 17 for the reasons discussed in Sections XI.B.5.b, XI.J, *supra*, with respect to claims 1 and 10.

F. Claim 19

382. In my opinion, *Bahl* in view of *Hsu*, *Weisshaar* and *Ranta* renders obvious claim 19.

- 1. “A mobile apparatus, comprising:”**

383. As discussed above, I understand that “[a] mobile apparatus, comprising:” is the preamble of claim 15 of the ’436 patent. I have been asked to assume that the preamble is a claim limitation. Under this assumption, in my opinion, *Bahl* discloses or suggests this feature for the reasons discussed in Section XI.B.1, *supra*, with respect to claim 1’s preamble.

- 2. “a plurality of heterogeneous network interfaces;”**

384. In my opinion, *Bahl* in combination with *Hsu*, *Weisshaar* and *Ranta* discloses or suggests the features of this claim limitation for the reasons discussed in Section XI.B.1, *supra*, with respect to claim 1’s preamble.

3. “a processor;”

385. In my opinion, *Bahl* in combination with *Hsu*, *Weisshaar* and *Ranta* discloses or suggests the features of this claim limitation.

386. For example, *Bahl* describes “a suitable operating environment 100 for a computing device (e.g., a notebook computer, an appliance such as access point, etc.)” that contains a processing unit, as shown below in Fig. 1. *Bahl*, [0032].

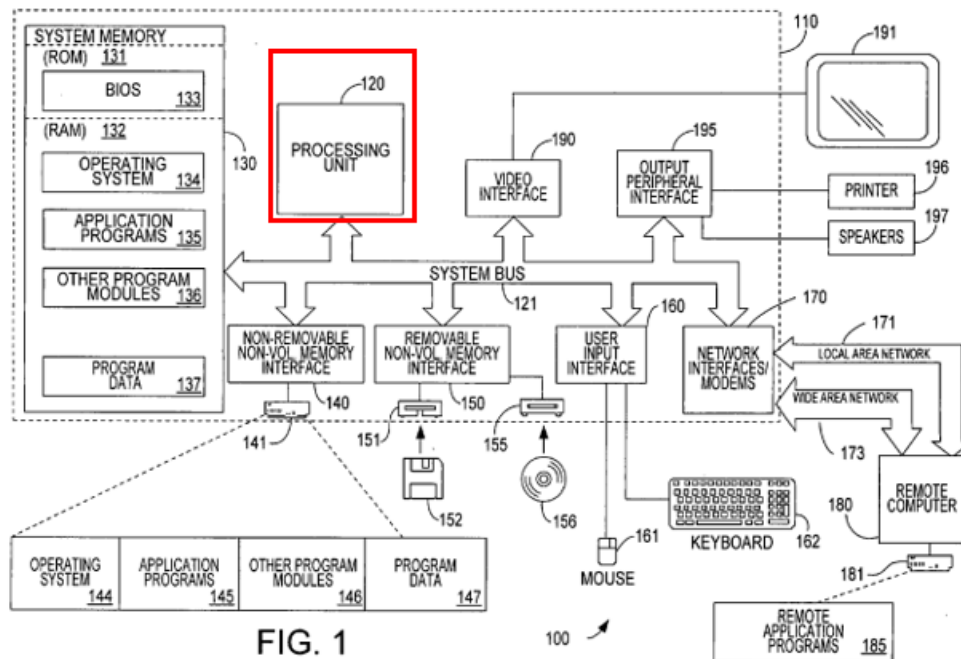


FIG. 1

Annotated *Bahl*, Fig. 1

387. Accordingly, *Bahl* discloses a computing device with a processing unit (“a processor”).

4. **“said mobile being configured to monitor applications running on it, including real time or non real time nature of said applications;”**

388. In my opinion, *Bahl* in combination with *Hsu*, *Weisshaar* and *Ranta* discloses or suggests the features of this claim limitation for the reasons discussed in Sections XI.B.2, XI.I, *supra*, with respect to claims 1 and 8.

5. **“said mobile being configured to monitor its operating situation, including moving or non moving status; and”**

389. In my opinion, *Bahl* in combination with *Hsu*, *Weisshaar* and *Ranta* discloses or suggests the features of this claim limitation for the reasons discussed in Sections XI.B.3, XIII.B, *supra*, with respect to claims 1 and 9.

6. **“said mobile being configured to control processes, including use of said heterogeneous network interfaces, of said mobile during silent periods based on one or more of its application awareness and its operating situation awareness, said silent periods being brief intervals during which an application running on said mobile has no application traffic to send or receive;”**

390. In my opinion, *Bahl* in combination with *Hsu*, *Weisshaar* and *Ranta* discloses or suggests the features of this claim limitation for the reasons discussed in Section XI.B.5, *supra*, with respect to claim 1.

7. **“wherein said mobile is configured to switch between modes of operation of based on said application awareness and said situation awareness, including to switch between one or more of the following modes of operation QoS enhancement through multiple address mode, network discovery mode, energy saving mode, and chat with devices mode.”**

391. *Bahl* in combination with *Hsu*, *Weisshaar* and *Ranta* discloses or suggests the features of this claim limitation.

392. For example, *Bahl* describes an energy conservation mode (“energy saving mode”). Specifically, *Bahl* discloses that in an “energy conservation mode of operation,” if “a criterion specifies that [] the throughput requirements of the applications can be satisfied by 802.11b and there is no other factor, such as CST for instance, overriding this factor, then the 802.11b wireless technology is selected.” *Bahl*, [0127].

393. Moreover, *Bahl* discusses switching into an energy conservation mode based on the needs of the applications running on a mobile computing device and its sensed operating conditions (“said mobile is configured to switch between modes of operation of based on said application awareness and said situation awareness, including to switch between one or more of the following modes of operation ... energy saving mode”).

394. For example, *Bahl* describes a scenario where a user’s laptop switches to a lower power consuming network when the laptop battery is low and the laptop is running two non-real-time applications:

A user opens a laptop in a packed airline lounge with many people using the lounge's 802.11a wireless network access point. The lounge also has an 802.11b network access point. Both network access points are free for the use by people in the lounge and provide the same kind of connectivity. The user is running OUTLOOK and IE on the laptop machine. The operating system senses that the 802.11a network/access point is overloaded and congested. *Also, the battery on the Patrick's laptop is running low. In response to the low battery power and the congested state of the 802.11a access point, the operating system selects the 802.11b connection to which it will connect.* At some later time, the airline lounge empties, and the 802.11a network access point is no longer overloaded or congested. *Furthermore, the battery has been charged, and power is no longer an issue because the user has plugged the laptop into a power socket. The operating system senses the changed environment, decides that 802.11a network offers the best service, and so changes wireless technology usage from 802.11b to 802.11a to take advantage of the higher bandwidth offered by the 802.11a connection.*

See Bahl, [0095].

395. For context on the above scenario, *Bahl* describes the “Battery life (BL)” factor as follows:

Battery life (BL) **912**: specifies battery charge available for a STA. By way of example, when comparing power drain from wireless network interfaces, an 802.11a NIC, for the same work load, consumes more

power than an 802.11b NIC. Therefore, a low battery power is assigned greater (negative) weight for the NIC that consumes more power. Furthermore, if battery charge level on a STA is low, then the weight (WCW) given to the battery life **912** factor is raised regardless of the technology—reflecting the increased importance of this factor. The value (WCV) assigned to the battery life **912** goes from highest (least negative) to lowest (most negative) across UWB, BT, 802.11b, 802.11a wireless technologies.

Bahl, [0122].

396. A person of ordinary skill in the art reviewing the above disclosures would have understood that the laptop switches into an energy conservation mode based on application awareness and situation awareness for at least the following reasons.

397. The above disclosure expressly identifies that the laptop is running OUTLOOK and IE. *Bahl*, [0095].

398. Moreover, a person of ordinary skill in the art would have understood that reference to the congested state of the access point and the laptop's decision that "802.11a network offers the best service" contemplates the applications running on the laptop. *Bahl*, [0095].

399. For example, *Bahl* discloses that this scenario "highlight[s] the advantages provided by the proposed selection scheme when incorporated into a

computing device capable of communicating via multiple differing interfaces with potentially multiple, differing networks.” *Bahl*, [0091].

400. As a further example, *Bahl*’s network selection scheme considers throughput as well as an application’s throughput requirements:

Throughput (THRPT) **910**: specifies throughput of a particular wireless technology. If both SSap and SSsta (signal strengths for the AP and STA) are low, then data throughput, by implication, is low. If both are high, the data throughput is high. If throughput on 802.11a is less than it is on 802.11b, then the throughput factor **910** favors the 802.11b wireless technology. In an exemplary embodiment of the invention, a weight (WCW) is given to the throughput **910** parameter based on the requirements of particular applications running on the STA. For example, if Audio/Video streaming applications are running, a higher weight than normal should be used. A factor value (WCV) of 1 indicates low throughput, 5 is normal, and 10 is high. By way of example, under ideal conditions, when comparing 802.11b and 802.11a technologies, 802.11b technology (highest theoretical speed can be 11 Mbps) receives a value of 5 and 802.11a (highest theoretical speed can be around 25-30 kbps) receives a value of 8, or even a value of 10 for turbo mode with highest theoretical speed of around 50 kbps.

...

Application throughput requirements APPTHRPT **922**: specifies a throughput needed by one or more particular active

applications on a computing device to ensure proper operation of the applications on the device (STA) that will utilize the selected wireless technology. The STA determines the throughput requirements of the applications running on it based on quality of service attributes set by the applications. By way of example, in an energy conservation mode of operation, a criterion specifies that if the throughput requirements of the applications can be satisfied by 802.11b and there is no other factor, such as CST for instance, overriding this factor, then the 802.11b wireless technology is selected.

Bahl, [0121], [0127].

401. *Bahl* also expressly discloses that “the particular criterion governing wireless interface/network selections is dynamically configured according to sensed operating conditions (e.g., battery power high/low).” *Bahl*, [0103].

402. Accordingly, *Bahl* in combination with *Hsu*, *Weisshaar* and *Ranta* discloses or suggests a mobile computing device that switches into an energy conservation mode (“wherein said mobile is configured to switch between modes of operation ... including to switch between one or more of the following modes of operation ... energy saving mode”) based on the needs of currently running applications and sensed operating conditions (“wherein said mobile is configured to switch between modes of operation of based on said application awareness and said situation awareness”).

XIV. CONCLUSION

403. I declare that all statements made herein of my knowledge are true, and that all statements made on information and belief are believed to be true, and that these statements were made with the knowledge that willful false statements and the like are made punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Date: January 30, 2025

Respectfully submitted,


Dr. Michael Kotzin