US008036600B2

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Garrett et al.

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(45) **Date of Patent: Oct. 11, 2011**

(54) **USING A BLUETOOTH CAPABLE MOBILE PHONE TO ACCESS A REMOTE NETWORK**

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(73) Assignee: **Airbiquity, Inc.**, Seattle, WA (US)

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H04B 7/00 (2006.01)

(52) **U.S. Cl.** **455/41.2**

(58) **Field of Classification Search** 455/41.2, 455/41.3, 39; 370/328
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,742,463	A	6/1973	Haselwood
3,985,965	A	10/1976	Field et al.
4,595,950	A	6/1986	Lofberg
4,599,583	A	7/1986	Shimozono et al.
4,630,301	A	12/1986	Hohl
4,685,131	A	8/1987	Horne
4,776,003	A	10/1988	Harris
4,831,647	A	5/1989	D'Avello et al.
4,860,336	A	8/1989	D'Avello et al.
4,914,651	A	4/1990	Lusignan
4,926,444	A	5/1990	Hamilton et al.
4,965,821	A	10/1990	Bishop et al.
4,977,609	A	12/1990	McClure
5,036,537	A	7/1991	Jeffers et al.
5,043,736	A	8/1991	Darnell et al.
5,191,611	A	3/1993	Lang

(Continued)

FOREIGN PATENT DOCUMENTS

CA 2242495 1/2000

(Continued)

OTHER PUBLICATIONS

Ayanoglu, E., "Adaptive ARQ/FEC for Multitone Transmission in Wireless Networks" Global Telecommunications Conference, 1995. Conference Record. Communication Theory Mini-Conference, Globecom '95., IEEE Singapore Nov. 13-17, 1995, New York, NY, USA, IEEE, US Lnkd. vol. 3. Whole Document.

(Continued)

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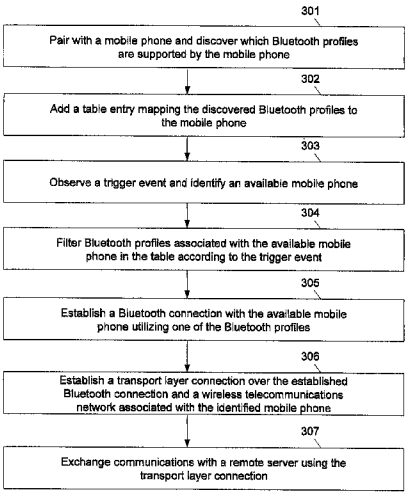
(57) **ABSTRACT**

In one example, a Bluetooth enabled mobile device discovers the Bluetooth profile capability of a plurality of mobile phones and stores the profile information in a database. Thereafter, when access to a remote network such as an Internet Protocol (IP) network is necessitated by an event, the Bluetooth enabled mobile device can establish a Bluetooth connection with an available mobile phone according to a comparison of the event to the stored profile information for that mobile phone. The Bluetooth enabled mobile device can then establish a transport layer connection that extends over the established Bluetooth connection and a wireless telecommunications network associated with the available phone and exchange data with a remote network using the established transport layer connection.

20 Claims, 4 Drawing Sheets



U.S. PATENT DOCUMENTS

5,201,071	A	4/1993	Webb
5,208,446	A	5/1993	Martinez
5,214,556	A	5/1993	Kilbel
5,218,618	A	6/1993	Sagey
5,235,633	A	8/1993	Dennison et al.
5,272,747	A	12/1993	Meads
5,365,450	A	11/1994	Schuchman et al.
5,388,147	A	2/1995	Grimes
5,396,653	A	3/1995	Kivari
5,422,816	A	6/1995	Sprague et al.
5,483,549	A	1/1996	Weinberg et al.
5,519,403	A	5/1996	Bickley et al.
5,539,810	A	7/1996	Kennedy, III et al.
5,546,445	A	8/1996	Dennison et al.
5,555,286	A	9/1996	Tendler
5,572,204	A	11/1996	Timm et al.
5,587,715	A	12/1996	Lewis
RE35,498	E	4/1997	Barnard
5,630,206	A	5/1997	Urban et al.
5,668,803	A	9/1997	Tymes
5,673,305	A	9/1997	Ross
5,680,439	A	10/1997	Aguilera et al.
5,686,910	A	11/1997	Timm et al.
5,687,215	A	11/1997	Timm et al.
5,687,216	A	11/1997	Svensson
5,691,980	A	11/1997	Welles, II
5,703,598	A	12/1997	Emmons
5,711,013	A	1/1998	Collett
5,712,619	A	1/1998	Simkin
5,712,899	A	1/1998	Pace, II
5,724,243	A	3/1998	Westerlage
5,726,893	A	3/1998	Schuchman et al.
5,726,984	A	3/1998	Kubler et al.
5,731,757	A	3/1998	Layson, Jr.
5,732,326	A	3/1998	Maruyama
5,734,981	A	3/1998	Kennedy, III
5,742,233	A	4/1998	Hoffman
5,748,083	A	5/1998	Rietkerk
5,748,084	A	5/1998	Isikoff
5,751,246	A	5/1998	Hertel
5,752,186	A	5/1998	Malackowski
5,752,193	A	5/1998	Scholefield
5,752,195	A	5/1998	Tsuji
5,754,554	A	5/1998	Nakahara
D395,250	S	6/1998	Kabler et al.
5,761,204	A	6/1998	Grob
5,761,292	A	6/1998	Wagner et al.
5,771,001	A	6/1998	Cobb
5,771,455	A	6/1998	Kennedy, III
5,774,876	A	6/1998	Woolley
5,781,156	A	7/1998	Krasner
5,784,422	A	7/1998	Heermann
5,786,789	A	7/1998	Janky
5,790,842	A	8/1998	Charles
5,794,124	A	8/1998	Ito
5,796,808	A	8/1998	Scott et al.
5,797,091	A	8/1998	Clise
5,804,810	A	9/1998	Woolley
5,805,576	A	9/1998	Worley, III
5,812,087	A	9/1998	Krasner
5,812,522	A	9/1998	Lee
5,815,114	A	9/1998	Speasl
RE035,916	E	10/1998	Dennison et al.
5,825,283	A	10/1998	Camhi
5,825,327	A	10/1998	Krasner
5,826,188	A	10/1998	Tayloe
5,831,574	A	11/1998	Krasner
5,832,394	A	11/1998	Wortham
5,835,907	A	11/1998	Newman
5,838,237	A	11/1998	Revell
5,841,396	A	11/1998	Krasner
5,841,842	A	11/1998	Baum
5,842,141	A	11/1998	Vaihoja
5,850,392	A	12/1998	Wang
5,856,986	A	1/1999	Sobey
5,864,578	A	1/1999	Yuen
5,864,763	A	1/1999	Leung
5,870,675	A	2/1999	Tuutijarvi
5,874,914	A	2/1999	Krasner
5,881,069	A	3/1999	Cannon
5,881,373	A	3/1999	Elofsson
5,884,214	A	3/1999	Krasner
5,886,634	A	3/1999	Muhme
5,890,108	A	3/1999	Yeldener
5,892,441	A	4/1999	Woolley
5,892,454	A	4/1999	Schipper
5,901,179	A	5/1999	Urabe
5,911,129	A	6/1999	Towell
5,912,886	A	6/1999	Takahashi
5,913,170	A	6/1999	Wortham
5,917,449	A	6/1999	Sanderford
5,918,180	A	6/1999	Dimino
5,930,340	A	7/1999	Bell
5,930,722	A	7/1999	Han
5,933,468	A	8/1999	Kingdon
5,936,526	A	8/1999	Klein
5,937,355	A	8/1999	Joong
5,940,598	A	8/1999	Strauss
5,945,944	A	8/1999	Krasner
5,946,304	A	8/1999	Chapman
5,946,611	A	8/1999	Dennison et al.
5,949,335	A	9/1999	Maynard
5,953,694	A	9/1999	Pillekamp
5,960,363	A	9/1999	Mizikovsky
5,961,608	A	10/1999	Onosaka
5,963,130	A	10/1999	Schlager
5,963,134	A	10/1999	Bowers
5,970,130	A	10/1999	Katko
5,978,676	A	11/1999	Guidri
5,991,279	A	11/1999	Haugli
5,999,124	A	12/1999	Sheynblat
5,999,126	A	12/1999	Ito
6,002,363	A	12/1999	Krasner
6,006,189	A	12/1999	Strawczynski
6,009,325	A	12/1999	Retzer
6,009,338	A	12/1999	Iwata
6,011,973	A	1/2000	Valentine
6,014,089	A	1/2000	Tracy
6,014,090	A	1/2000	Rosen
6,014,376	A	1/2000	Abreu
6,018,654	A	1/2000	Valentine
6,021,163	A	2/2000	Hoshi
6,024,142	A	2/2000	Bates
6,031,489	A	2/2000	Wyrwas
6,032,037	A	2/2000	Jeffers
6,038,310	A	3/2000	Hollywood
6,038,595	A	3/2000	Ortony
6,041,124	A	3/2000	Sugita
6,044,257	A	3/2000	Boling
6,049,971	A	4/2000	Petit
6,055,434	A	4/2000	Seraj
6,057,756	A	5/2000	Engellenner
6,067,044	A	5/2000	Whelan
6,067,457	A	5/2000	Erickson
6,069,570	A	5/2000	Herring
6,070,089	A	5/2000	Brophy
6,075,458	A	6/2000	Ladner
6,076,099	A	6/2000	Chen
6,081,523	A	6/2000	Merchant
6,091,969	A	7/2000	Brophy
6,097,760	A	8/2000	Spicer
6,101,395	A	8/2000	Keshavachar
6,121,922	A	9/2000	Mohan
6,122,271	A	9/2000	McDonald
6,122,514	A	9/2000	Spaur
6,131,067	A	10/2000	Girerd
6,131,366	A	10/2000	Fukuda
6,133,874	A	10/2000	Krasner
6,140,956	A	10/2000	Hillman et al.
6,144,336	A	11/2000	Preston et al.
6,151,493	A	11/2000	Sasakura
6,154,658	A	11/2000	Caci
6,166,688	A	12/2000	Cromer
6,169,497	B1	1/2001	Robert
6,173,194	B1	1/2001	Vanttila
6,175,307	B1	1/2001	Peterson
6,181,253	B1	1/2001	Eschenbach

6,195,736	B1	2/2001	Lisle	7,398,100	B2	7/2008	Harris
6,208,959	B1	3/2001	Jonsson	7,426,466	B2	9/2008	Ananthapadmanabhan
6,212,207	B1	4/2001	Nicholas	7,430,428	B2	9/2008	Van Bosch
6,226,529	B1	5/2001	Bruno et al.	7,477,906	B2	1/2009	Radic
6,236,652	B1	5/2001	Preston	7,483,418	B2	1/2009	Maurer
6,249,227	B1	6/2001	Brady	7,511,611	B2	3/2009	Sabino
6,266,008	B1	7/2001	Huston	7,512,098	B2	3/2009	Jiang
6,269,392	B1	7/2001	Cotichini	7,562,393	B2	7/2009	Buddhikot
6,272,315	B1	8/2001	Chang	7,583,959	B2 *	9/2009	Holmes 455/418
6,275,990	B1	8/2001	Dapper	7,593,449	B2	9/2009	Shattil
6,282,430	B1	8/2001	Young	7,606,555	B2	10/2009	Walsh
6,288,645	B1	9/2001	McCall	7,653,383	B2	1/2010	Natarajan
6,295,461	B1	9/2001	Palmer	7,701,954	B2	4/2010	Rabenko
6,300,863	B1	10/2001	Cotchini	7,856,240	B2 *	12/2010	Gunn et al. 455/509
6,300,875	B1	10/2001	Schafer	2002/0111167	A1	8/2002	Nguyen
6,301,480	B1	10/2001	Kennedy, III	2002/0122401	A1	9/2002	Xiang
6,304,186	B1	10/2001	Rabanne	2003/0016639	A1	1/2003	Kransmo
6,304,637	B1	10/2001	Mirasrafi	2003/0227939	A1	12/2003	Yukie
6,307,471	B1	10/2001	Xydis	2004/0034529	A1	2/2004	Hooper, III
6,308,060	B2	10/2001	Wortham	2004/0192345	A1	9/2004	Osborn
6,320,535	B1	11/2001	Hillman	2005/0090225	A1	4/2005	Muehleisen
6,321,091	B1	11/2001	Holland	2005/0111563	A1	5/2005	Tseng
6,326,736	B1	12/2001	Kang	2005/0147057	A1	7/2005	LaDue
6,327,533	B1	12/2001	Chou	2005/0187882	A1 *	8/2005	Sovio et al. 705/64
6,343,217	B1	1/2002	Borland	2005/0207511	A1	9/2005	Madhavan
6,345,251	B1	2/2002	Jansson	2005/0215228	A1	9/2005	Fostick
6,351,495	B1	2/2002	Tarraf	2005/0226202	A1	10/2005	Zhang
6,358,145	B1	3/2002	Wong	2006/0171368	A1	8/2006	Moinzadeh et al.
6,359,923	B1	3/2002	Agee	2006/0246910	A1	11/2006	Petermann
6,362,736	B1	3/2002	Gehlot	2007/0087756	A1	4/2007	Hoffberg
6,373,842	B1	4/2002	Coverdale	2007/0124625	A1	5/2007	Hassan
6,405,033	B1	6/2002	Kennedy, III	2007/0155360	A1	7/2007	An
6,430,176	B1	8/2002	Christie, IV	2007/0211624	A1 *	9/2007	Schmidt et al. 370/225
6,434,198	B1	8/2002	Tarraf	2007/0258398	A1	11/2007	Chesnutt
6,466,582	B2	10/2002	Venters	2007/0264964	A1	11/2007	Birmingham
6,470,046	B1	10/2002	Scott	2008/0025295	A1	1/2008	Elliott
6,477,633	B1	11/2002	Grimmett	2008/0039017	A1 *	2/2008	Kim 455/41.2
6,493,338	B1	12/2002	Preston et al.	2008/0056469	A1	3/2008	Preston
6,516,198	B1	2/2003	Tendler	2008/0107094	A1	5/2008	Borella
6,519,260	B1	2/2003	Galyas	2008/0132200	A1	6/2008	Shinoda
6,522,265	B1	2/2003	Hillman	2008/0143497	A1	6/2008	Wasson
6,526,026	B1	2/2003	Menon	2008/0182570	A1 *	7/2008	Kuhl 455/422.1
6,529,744	B1	3/2003	Birkler	2008/0212820	A1 *	9/2008	Park 381/370
6,611,804	B1	8/2003	Dorbecker	2008/0266064	A1	10/2008	Curran
6,614,349	B1	9/2003	Proctor	2008/0294340	A1 *	11/2008	Schmidt et al. 701/213
6,617,979	B2	9/2003	Yoshioka	2009/0055516	A1 *	2/2009	Zhodzishsky 709/220
6,628,967	B1	9/2003	Yue	2009/0077407	A1	3/2009	Akimoto
6,665,333	B2	12/2003	McCrady	2009/0110033	A1	4/2009	Shattil
6,677,894	B2	1/2004	Sheynblat	2009/0265173	A1	10/2009	Madhavan
6,681,121	B1	1/2004	Preston	2009/0298428	A1 *	12/2009	Shin 455/41.2
6,683,855	B1	1/2004	Bordogna	2009/0306976	A1	12/2009	Joetta
6,690,681	B1	2/2004	Preston et al.	2010/0211660	A1	8/2010	Kiss
6,690,922	B1	2/2004	Lindemann				
6,697,987	B2	2/2004	Lee				
6,700,867	B2	3/2004	Classon				
6,747,571	B2	6/2004	Fierro				
6,754,265	B1	6/2004	Lindemann				
6,771,629	B1	8/2004	Preston				
6,778,645	B1	8/2004	Rao				
6,799,050	B1	9/2004	Krasner				
6,836,515	B1	12/2004	Kay et al.				
6,845,153	B2	1/2005	Tiburtius				
6,917,449	B2	7/2005	Nakajima				
6,940,809	B2	9/2005	Sun				
6,981,022	B2	12/2005	Boundy				
6,993,362	B1	1/2006	Aberg				
7,092,370	B2	8/2006	Jiang				
7,103,550	B2	9/2006	Gallagher				
7,151,768	B2	12/2006	Preston				
7,164,662	B2	1/2007	Preston				
7,206,305	B2	4/2007	Preston				
7,206,574	B2	4/2007	Bright				
7,215,965	B2	5/2007	Fournier et al.				
7,221,669	B2	5/2007	Preston				
7,269,188	B2	9/2007	Smith				
7,283,904	B2	10/2007	Benjamin				
7,286,522	B2	10/2007	Preston				
7,317,696	B2	1/2008	Preston				
7,372,833	B2	5/2008	Kyronaho				

FOREIGN PATENT DOCUMENTS

DE	4424412		1/1996
EP	0242099		10/1987
EP	0512789		11/1992
EP	0528090		2/1993
EP	0545783		6/1993
EP	0 889 610	A2	1/1999
EP	0 896 442	A1	2/1999
EP	01 950 402		12/2004
EP	1 843 503	A2	10/2007
JP	11109062		4/1999
TW	2010/18163	A	5/2010
WO	8912835		12/1989
WO	9521511		8/1995
WO	9618275		6/1996
WO	WO 98/34164	A1	8/1998
WO	WO 98/34359	A1	8/1998
WO	9853573		11/1998
WO	WO 98/59256	A2	12/1998
WO	WO 98/59257	A1	12/1998
WO	WO 99/14885	A2	3/1999
WO	WO 99/56143	A1	4/1999
WO	WO 99/56144	A1	4/1999
WO	WO 99/36795	A1	7/1999
WO	9949677		9/1999
WO	0011893		3/2000

WO	WO 01/78249	A1	10/2001
WO	WO 01/99295	A2	12/2001
WO	WO 02/054694	A1	7/2002
WO	WO 03/034235	A1	4/2003
WO	WO 03/081373	A2	10/2003
WO	WO 2009/149356	A2	12/2009

OTHER PUBLICATIONS

Lemke A. C., et al.: "Voice Over Data and Data Over Voice: Evolution of the Alcatel 1000. Seamless Evolution of the Alcatel 1000 Switching System will Support the Move to Voice and Data Convergence." Electrical Communication, Alcatel. Brussels, BE, Apr. 1, 1999. Abstract; Figure 2.

Benelli G., et al.: "A Coding and Retransmission Protocol for Mobile Radio Data Transmission." Vehicluar Technology Conference, 1999. VTC 1999—Fall. IEEE VTS 50th Amsterdam Netherlands Sep. 19-22, 1999. Abstract Secion II.

Feher, Kamilo, "Modems for Emergin Digital Cellular-Mobile Radio System", IEEE Trans. on Vehicular Technology, vol. 40, No. 2, May 1991, pp. 355-365.

Brown et al., "A Reconfigurable Modem for Increased Network Capacity and Video, Voice, and Data Transmission over GSM PCS", IEEE Trans. on Circuits and Systems for Video Technology, vol. 6, No. 2, Apr. 1996, pp. 215-224.

Mueller, A.J. et al., "A DSP Implemented Dual 9600/7200 BPS TCM Modem for Mobile Communications Over FM Voice Radios," Proceedings of the 1997 6th IEEE Pacific Rim Conference on Communications, Computers and Signal Processing, vol. 2, Aug. 20-22, 1997, pp. 758-761, IEEE, New York, New York.

PCT International Search Report dated Nov. 27, 2000 for International Application No. PCT/US00/13288.

* cited by examiner

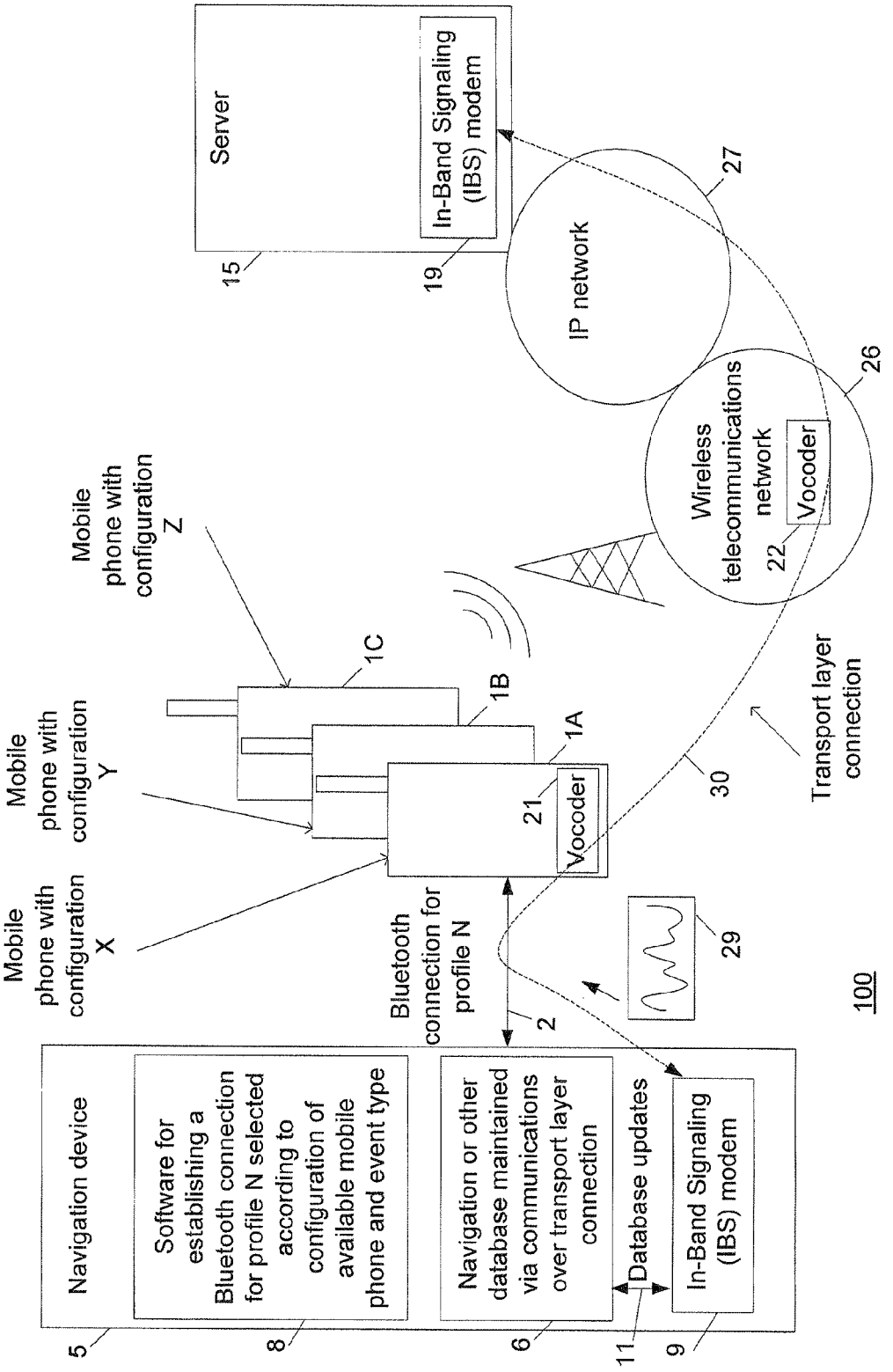

Server
15
In-Band Signaling (IBS) modem
19
IP network
27
Wireless telecommunications network
Vocoder
22
26
Mobile phone with configuration Z
Mobile phone with configuration Y
Mobile phone with configuration X
1C
1B
1A
21
Vocoder
30
Transport layer connection
Bluetooth connection for profile N
2
29
100
Navigation device
5
Software for establishing a Bluetooth connection for profile N selected according to configuration of available mobile phone and event type
8
Navigation or other database maintained via communications over transport layer connection
6
Database updates
11
In-Band Signaling (IBS) modem
9

FIG. 1

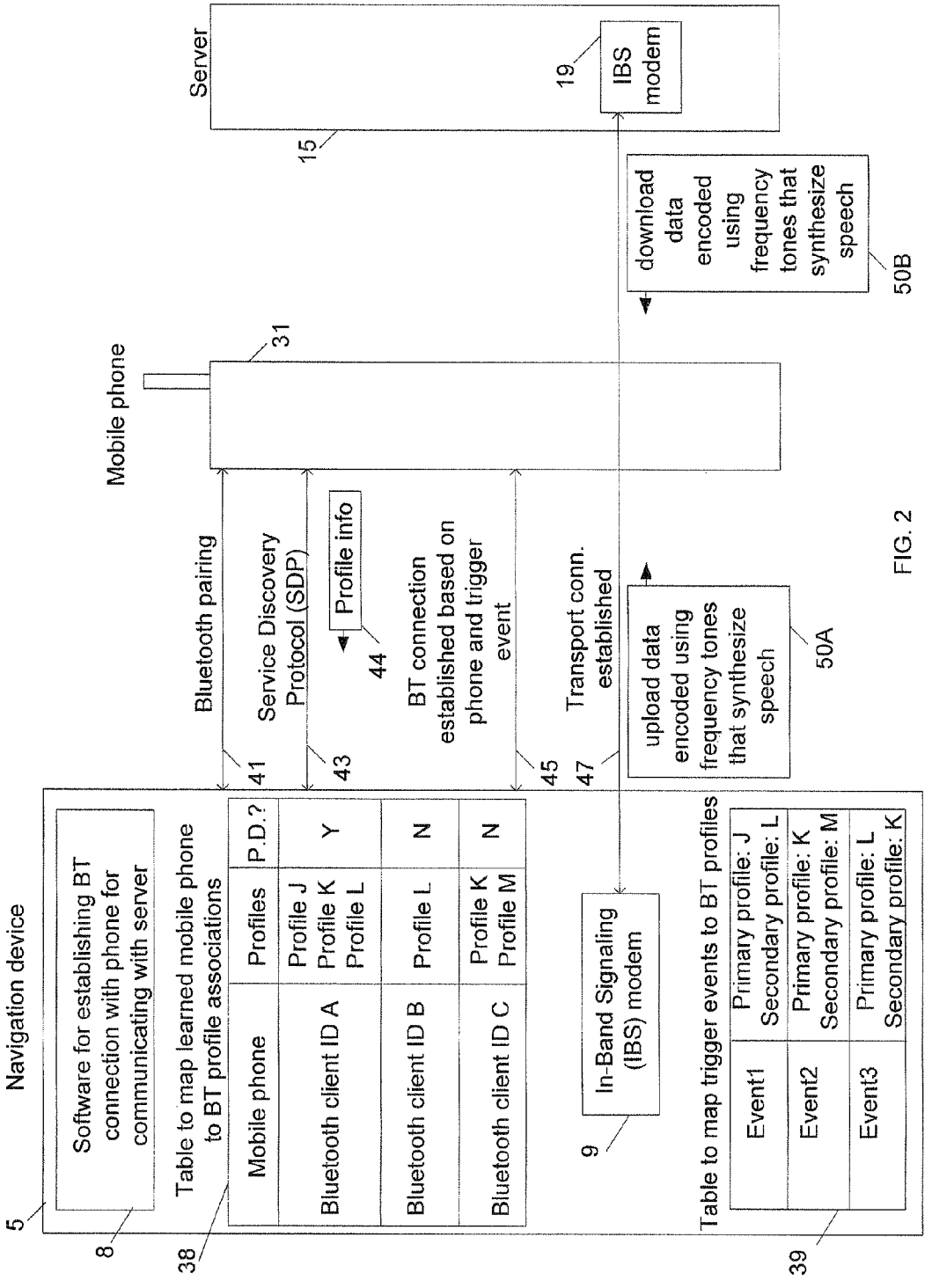

Server
15
19
IBS modem
download data encoded using frequency tones that synthesize speech
50B
Mobile phone
31
Bluetooth pairing
41
Service Discovery Protocol (SDP)
43
Profile info
44
BT connection established based on phone and trigger event
45
Transport conn. established
47
upload data encoded using frequency tones that synthesize speech
50A
Navigation device
5
Software for establishing BT connection with phone for communicating with server
8
Table to map learned mobile phone to BT profile associations
38
Mobile phone | Profiles | P.D.?
Bluetooth client ID A | Profile J Profile K Profile L | Y
Bluetooth client ID B | Profile L | N
Bluetooth client ID C | Profile K Profile M | N
9
In-Band Signaling (IBS) modem
Table to map trigger events to BT profiles
39
Event1 | Primary profile: J Secondary profile: L
Event2 | Primary profile: K Secondary profile: M
Event3 | Primary profile: L Secondary profile: K

FIG. 2

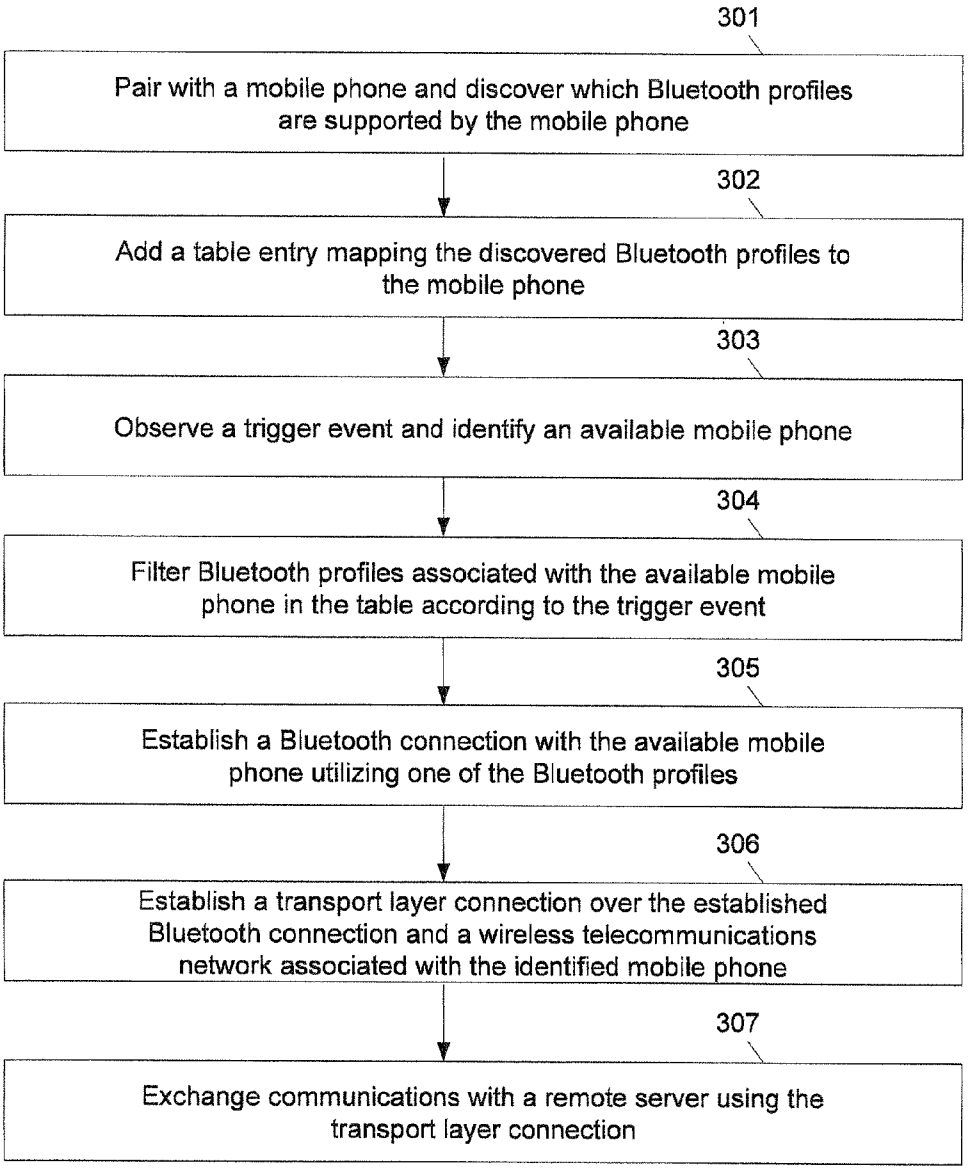

301
Pair with a mobile phone and discover which Bluetooth profiles are supported by the mobile phone
302
Add a table entry mapping the discovered Bluetooth profiles to the mobile phone
303
Observe a trigger event and identify an available mobile phone
304
Filter Bluetooth profiles associated with the available mobile phone in the table according to the trigger event
305
Establish a Bluetooth connection with the available mobile phone utilizing one of the Bluetooth profiles
306
Establish a transport layer connection over the established Bluetooth connection and a wireless telecommunications network associated with the identified mobile phone
307
Exchange communications with a remote server using the transport layer connection

FIG. 3

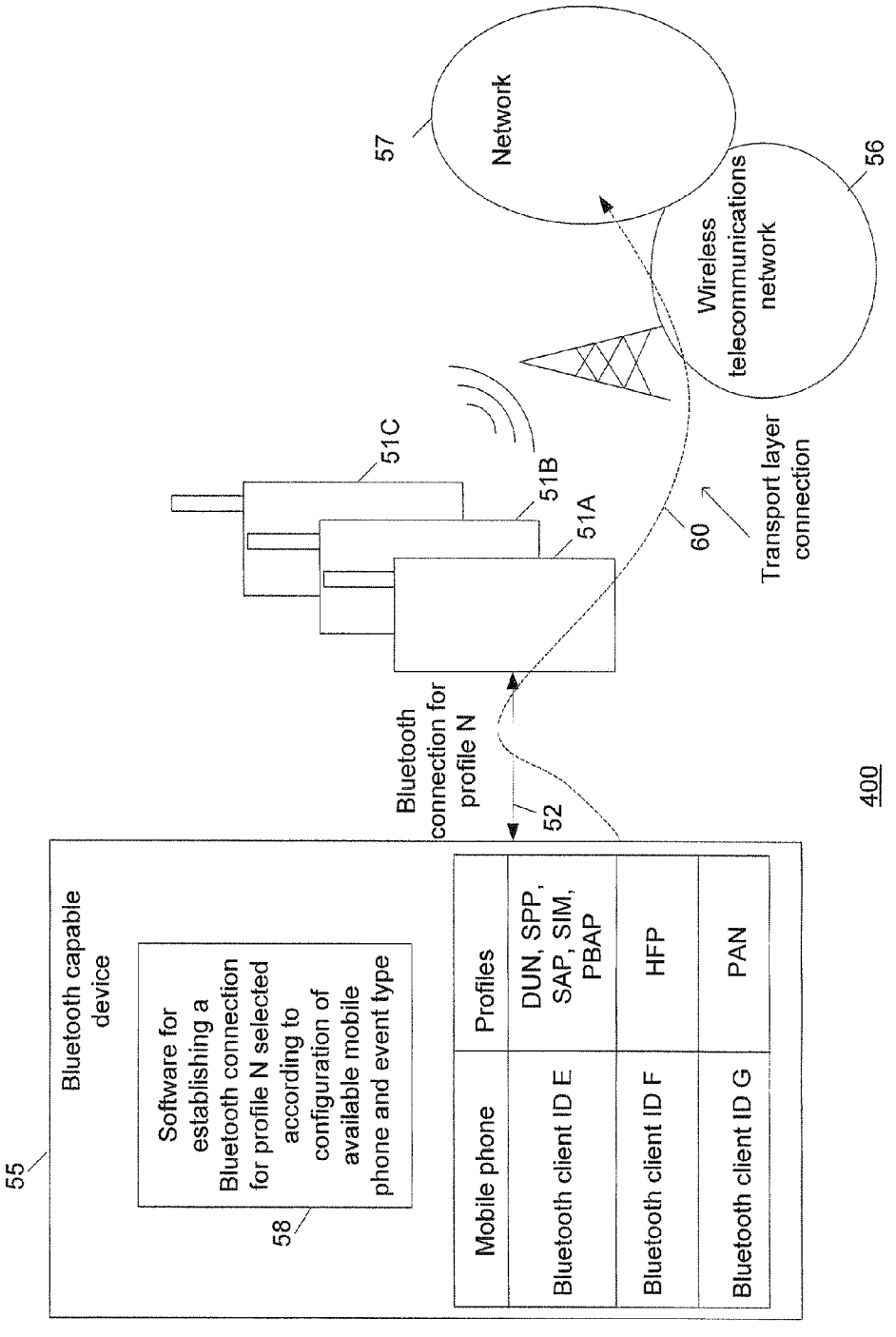

55
Bluetooth capable device
Software for establishing a Bluetooth connection for profile N selected according to configuration of available mobile phone and event type
58
Mobile phone
Profiles
Bluetooth client ID E
DUN, SPP, SAP, SIM, PBAP
Bluetooth client ID F
HFP
Bluetooth client ID G
PAN
Bluetooth connection for profile N
52
51C
51B
51A
60
Transport layer connection
Wireless telecommunications network
56
57
Network
400

FIG. 4

USING A BLUETOOTH CAPABLE MOBILE PHONE TO ACCESS A REMOTE NETWORK

This application is a non-provisional of U.S. Provisional Application No. 61/173,059 filed on Apr. 27, 2009, entitled: AUTOMATIC GAIN CONTROL IN A PERSONAL NAVIGATION DEVICE which is herein incorporated by reference in its entirety.

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BACKGROUND OF THE INVENTION

Navigation devices (including Personal Navigation Devices (PNDs) and in-car electronic devices) output information to a user based on a location of the navigation devices. These navigation devices generally utilize the Global Positioning System (GPS) to determine the location, and then use speakers and/or displays to output map information, directions, etc.

To continue expanding and/or improving the features provided by navigation devices, there is a need to maximize opportunities for navigation devices to obtain network access, such as to the Internet. The disclosure that follows solves this and other problems.

SUMMARY OF THE INVENTION

The following is a summary of the invention in order to provide a basic understanding of some aspects of the invention. This summary is not intended to identify key/critical elements of the invention or to delineate the scope of the invention. Its sole purpose is to present some concepts of the invention in a simplified form as a prelude to the more detailed description that is presented later.

In one example, a Bluetooth enabled mobile device discovers the Bluetooth profile capability of a plurality of mobile phones and stores the profile information in a database. Thereafter, when access to a remote network such as an Internet Protocol (IP) network is necessitated by an event, the Bluetooth enabled mobile device can establish a Bluetooth connection with an available mobile phone according to a comparison of the event to the stored profile information for that mobile phone. The Bluetooth enabled mobile device can then establish a transport layer connection that extends over the established Bluetooth connection and a wireless telecommunications network associated with the available phone and exchange data with a remote network using the established transport layer connection. Additional aspects and advantages of this invention will be apparent from the following detailed description of preferred embodiments, which proceeds with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** illustrates a system for accessing a remote server with a navigation device using a Bluetooth capable mobile phone.

FIG. **2** illustrates the navigation device shown in FIG. **1** as well as interactions between the navigation device and other devices.

FIG. **3** illustrates how the navigation device shown in FIGS. **1** and **2** accesses the remote server.

FIG. **4** illustrates a system for accessing a remote server with a Bluetooth capable device using a mobile phone.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

FIG. **1** illustrates a system for accessing a remote server with a navigation device using a Bluetooth capable mobile phone.

The system **100** includes a navigation device **5** configured to establish a Bluetooth connection **2** with an available one of the mobile phones **1**A-C according to stored profile information for that mobile phone. The navigation device **5** then establishes a transport layer connection to the server **15** (illustrated by the dashed line **30**) over the established Bluetooth connection **2**, which provides the navigation device with a communication path to the server **15**.

In order to maximize the opportunities for the navigation device **5** to communicate with the remote server **15**, it is preferable for the navigation device **5** to utilize a mobile phone without regard to whether the mobile phone supports a packet data service connection over its wireless telecommunication network. For example, the illustrated mobile phone **1**A does not support a packet data service connection (or, the mobile phone **1**A subscriber plan does not include packet data services over the wireless telecommunications network **26**), yet the mobile phone **1**A can be utilized by the navigation device **5** for Internet Protocol network access, as will be described in the next paragraph.

For this and other reasons, upload communications sent over the Bluetooth connection **2** can be modulated by the In-Band Signaling (IBS) modem **9** for transmission across a voice channel type transport of the wireless telecommunication network. The IBS modem **9** modulates received digital data into audio frequency tones. These frequency tones are selected to synthesize speech so that the frequency tones will pass with minimal attenuation or corruption through a vocoder **21** of the available one of the mobile phones **1**A-C and any vocoders **22** in the wireless telecommunication network **26** (other networks between network **26** and the server **15** could operate vocoders as well). Before encoding and modulation into audio tones, the digital data preferably is formatted into one or more packets. A packet formatter may prepend, for example, a header and a sync pattern prior to the payload. Error correction bits, checksums and other enhancements to the packet may be added as well. The navigation device **5** can then transmit the IBS modulated communications **29** over a Bluetooth connection for voice data, to be forwarded over a voice channel of the wireless telecommunications network, through any intervening networks such as the IP network **27**, received and demodulated by the IBS modem **19** (recovered into a bitstream), and then finally processed by the server **15**. Downloads from the server **15** to the navigation device **5** over the dashed line **30** are likewise modulated by the IBS modem **19** and recovered by the IBS modem **9**.

Through this communication exchange **29** over the transport layer connection **30**, applications on the navigation device **5** that are part of the navigation system can obtain location-based information in real time can obtain real-time location based information. For example, the navigation device **5** could obtain real-time information about traffic acci-

dents near a current location determined via GPS. The navigation device **5** can also download updates **11** to navigation database **6**, e.g. updating a stored map to information about a new route.

Furthermore, any other type of application on the navigation device **5** can also be provided with remotely stored data over the Bluetooth connection **2** and through the wireless telecommunications network **26**. This allows the feature set of the navigation device **5** to be expanded to other applications not necessarily related to navigation. For example, an application on the navigation device **5** could be used to obtain stock quotes or other information available via the Internet over the Bluetooth connection **2**. It should be understood it is possible for any type of application operating on the navigation device **5** to obtain access to any type of network over the Bluetooth connection **2** as well.

It should be apparent that these real-time information and network services described above can be accessed by the navigation device **5** without burdening the navigation device **5** with expensive satellite transceivers or other specialized transceivers that are generally more expensive and less compact than Bluetooth transceivers. Furthermore, it should be apparent that the operation of the navigation device **5** is not limited to mobile phones that support packet data service connections over their wireless telecommunication networks (such mobile phones are generally expensive to purchase and operate and in any case are not yet used ubiquitously).

It should be understood that communication between the navigation device **5** and the server **15** can bypass the IBS **9** and **19** in certain circumstances. For example, certain Bluetooth capable mobile phones support a high bandwidth packet data service connection over the wireless telecommunications network **26**. When such a mobile phone is available, as will be described in detail later, the navigation device **5** establishes the Bluetooth connection **2** with different characteristics so that data sent to the mobile phone triggers utilization of a packet data service connection. The high bandwidth provided by a packet data service is particularly useful if Internet access (such as web mail access) is needed for the navigation device **5**.

What follows in the next three paragraphs is a description of the system **100** including a high level overview of the operations of the navigation device **5** having the software **8**. Thereafter, with reference to FIGS. **2-3**, a more detailed example of the navigation device **5** is provided.

Referring still to FIG. **1**, the navigation device **5** learns the configurations X-Z of a plurality of mobile phones **1**A-C that the navigation device **5** pairs with over time. The configurations X-Z correspond to the respective software and/or hardware capabilities of the mobile phones **1**A-C including which Bluetooth profiles are supported by each mobile phone **1**A-C. A Bluetooth profile is a wireless interface specification for Bluetooth-based communication that rides on top of the Bluetooth Core Specification. The configurations X-Z can indicate other software and/or hardware capabilities of the mobile phones **1**A-C such as whether the mobile phone supports a packet data service connection over its wireless telecommunications network.

The software **8** stores this learned configuration information as it is obtained for subsequent analysis upon detecting a trigger event. A trigger event could be initiated by an application on the navigation device **5** (such as when a program operating on the navigation device **5** requests data available remotely) or initiated by from a user interface of the navigation device **5** (such as when a user presses a button on the navigation device **5**).

When a trigger event is detected, the software **8** identifies an available mobile phone and classifies the trigger event by type. The software **8** then establishes a Bluetooth connection **2** with the available one of the mobile phones **1**A-C. The Bluetooth connection **2** utilizes a profile N that is selected based on the known configuration X-Z of the available one of the mobile phones and the classified event type. The profile N can be a profile for transmitting voice data when the communications will be modulated into the frequency tones, as will be described later in greater detail. This profile N will be a different Bluetooth profile when the communications are packet data.

Transmission over the transport layer connection **30** can be tuned using the principles described in U.S. patent application Ser. No. 12/752,999 TBD; "AUTOMATIC GAIN CONTROL IN A PERSONAL NAVIGATION DEVICE", which is herein incorporated by reference in its entirety for all purposes. It should be understood that such tuning is entirely optional.

FIG. **2** illustrates the navigation device shown in FIG. **1** as well as interactions between the navigation device and other devices.

The navigation device **5** includes a table **38** to map learned mobile phone-to-Bluetooth profile associations. The table **38** is stored in a memory of the navigation device **5** and includes an entry for each mobile phone the navigation device **5** has paired with. Each entry identifies the respective mobile phone using any identifier for the mobile phone, such as a Bluetooth client identifier A-C identified during pairing **41**. Each entry in the table **38** also lists Bluetooth profiles, e.g. J, K, L or M, supported by the corresponding mobile phone as discovered during a Service Discovery Protocol (SDP) **43** or similar exchange to obtain the profile information **44**. Each entry in the table **38** can also indicate whether or not the corresponding mobile phone supports a packet data service connection over its wireless telecommunications network, which could be determined by the navigation device **5** using any known method including, but not limited to, a trial and error type learning process.

Upon detecting a trigger event, the software **8** compares the trigger event to the table **39** that maps known trigger events to known Bluetooth profiles. The entries in the table **39** can be predetermined prior to the navigation device **5** pairing with any mobile phones, and possibly updated from time to time as initiated by the server **15** or the navigation device **5**.

Also, the profile(s) associated with each event can be ranked in table **39** according to correspondence with the trigger event. For example, for events requiring a relatively large file size transfer, e.g. downloading a picture, a primary profile could include a Basic Imaging Profile (BIP). A secondary profile could include a Hands-Free Profile (HFP), which would enable the picture to be downloaded in the form of synthesized speech and then recovered via demodulation. For events requiring a relatively small file size transfer, e.g. flight information, a primary profile could include any Bluetooth profile for sending text messages. A secondary profile could include the HFP, which would enable the flight information to be downloaded in the form of synthesized speech and then recovered via demodulation. The ranking can be predetermined prior to the navigation device pairing with any mobile phones, and subsequently adjusted at any time.

Several factors may be used to rank known Bluetooth profiles for each event type. Such factors include the cost of in-band communications versus packet data communications, application requirements such as whether the trigger event is a high or low bandwidth application, or any other factors. The ranking could be dynamically adjusted to take

into account a user's preference, for example, if the user indicates that a connection is too slow the rankings could be adjusted. Also, certain mobile phones store manufacturer specifications for user experience, which could be accessed by the navigation device **5** and also used to dynamically adjust the rankings depending on which mobile phone is currently utilized.

The comparison of the trigger event to the table **39** identifies a ranked subset of the Bluetooth profiles. These identified ranked profiles are then compared to the table **38** entry that corresponds to the available phone. The highest ranked profile existing in the relevant table **38** entry is used to establish the Bluetooth connection in process **45**.

It should be understood that certain ones of supported Bluetooth profiles discovered using the SDP **43** may be excluded from the comparison described in the previous paragraph based on whether the corresponding mobile phone supports a packet data service connection (the far right column of the table). For example, if the mobile phone does not support a packet data service connection, then certain Bluetooth profiles, e.g. Basic Imaging Profile (BIP), may be excluded from the comparison even if the mobile phone supports this Bluetooth profile. This is to prevent the navigation device **5** from sending data to the mobile phone **31** in a format that the mobile phone **31** cannot communicate over its wireless telecommunication network.

Having established the Bluetooth connection in process **45**, the navigation device **5** can communicate with the remote server **15** in process **47**. As discussed previously, uploads **50**A and downloads **50**B can be modulated as frequency tones synthesizing speech to pass over a voice channel in the wireless telecommunications network using the IBS modems **9** and **19**. If sent over a Bluetooth connection for voice data as discussed above, these uploads **50**A and downloads **50**B will be passed through by the mobile phone **31** regardless of whether the mobile phone **31** is aware that the uploads **50**A and downloads **50**B do not represent actual speech. If the mobile phone i**31** s capable of establishing a packet data service connection over its telecommunication network, as discussed previously, such modulation may be bypassed.

In either case, a transport layer connection is established between the navigation device **5** and the remote server **15**. Underlying this transport layer connection is a plurality of lower layer connections, for example the Bluetooth connection between the navigation device **5** and the mobile phone **31**, and one or more lower layer connections to connect the mobile phone **31** the remote server **15**. The application layer rides on top of this transport layer connection.

FIG. **3** illustrates how the navigation device shown in FIGS. **1** and **2** communicates with the remote server.

In block **301**, the navigation device **5** pairs with a mobile phone and discovers which Bluetooth profiles are supported by the mobile phone. The navigation device **5** adds a table entry mapping the discovered Bluetooth profiles to the mobile phone in block **302**.

In block **303**, the navigation device **5** observes a trigger event and identifies an available phone. In block **304**, the navigation device **5** filters Bluetooth profiles associated with the available mobile phone in the table according to the trigger event. This process **304** may or may not include comparing the associated profiles to a ranked listing of Bluetooth profiles for the type of trigger event. The process **304** may or may not include determining whether the available mobile phone supports packet data service connections and filtering the associated profiles accordingly.

In block **305**, the navigation device **5** establishes a Bluetooth connection with the available mobile phone utilizing one of the filtered Bluetooth profiles. In block **306**, the navigation device **5** establishes a transport layer connection over the established Bluetooth connection and a wireless telecommunications network associated with the identified available mobile phone. In block **307**, the navigation device exchanges communications with a remote network using the transport layer connection.

As discussed previously, in one example the transport layer connection can be selected from at least a voice channel and a packet data connection to maximize transmission opportunities with a wide variety of mobile phones. If a voice channel is selected for the transport layer connection, an in-band signaling modem is used for the communication exchange.

FIG. **4** illustrates a system for accessing a remote server with a Bluetooth capable device using a mobile phone.

The principles discussed previously can be applied in other examples besides the example discussed with reference to FIGS. **1-3**. For example, the example system **400** includes a Bluetooth capable device **55** encoded with software **58** that is configured to establish a Bluetooth connection **52** with an available one of the mobile phones **51**A-C. The established Bluetooth connection **52** provides the device **55** with a communication path to the remote network **57**, as illustrated by the dashed line **60**.

The Bluetooth capable device **55** can be any type of device and in any case is not limited to a device configured for navigation. For example, the device **55** can be a Telematic Control Unit (TCU), a Hands Free Kit (HFK), an in-dash car entertainment system (regardless of whether the in-dash entertainment system has any navigation capability), etc. The principles described herein can be applied to Bluetooth capable devices regardless of whether such devices include an LBS.

The transport layer connection **60** can be any type of transport layer connection and in any case is not limited to an in-band connection. For example, the transport layer connection **60** can any known transport used in any type of network such as a circuit switched network or a packet switched network. The transport layer connection **60** can extend through a gateway operating between the wireless telecommunications network **56** and another network **57**, as shown in the figure. The transport layer connection **60** may not extend through such a gateway in other examples but may extend only to a device operating within the wireless communication network **56** of the mobile phone. The transport layer connection **60** could even extend from the device **55**, through the mobile phone **51**A, to another Bluetooth capable device in communication with the mobile phone **51**A.

As indicated in the previous two paragraphs, the transport layer connection can be established with any type of network device and need not terminate on an in-band signaling server. The principles described herein can be applied regardless of whether the system **400** includes an in-band server (or any other device containing an IBS modem for that matter).

As indicated by the variable N, the Bluetooth connection **52** can be established using any profile that is supported by the available mobile phone. As previously discussed, mobile phones often contain more than one Bluetooth profile and in this case the Bluetooth profile N used to establish the Bluetooth connection N is preferably established according to the transport layer connection to be used (which as previously discussed can be indicated by the trigger event type). For example, if the transport layer connection is a packet data transport (including transports associated with circuit switched networks), then N can be, for example, Dial-Up Networking (DUN). If the transport layer connection is an Short Message Service (SMS) transport, then N can be, for

example, DUN, HFP, Serial Port Profile (SPP), Subscriber Identity Module (SIM), SIM Access Profile (SAP), or Phone Book Access Profile (PBAP). If the transport layer connection is a transport used in Bluetooth area networks (between the mobile phone **51**A and another Bluetooth device), then N can be, for example, Personal Area Network (PAN). These examples are intended to be illustrative, not exhaustive.

It will be obvious to those having skill in the art that many changes may be made to the details of the above-described embodiments without departing from the underlying principles of the invention. The scope of the present invention should, therefore, be determined only by the following claims.

Most of the equipment discussed above comprises hardware and associated software. For example, the typical navigation device is likely to include one or more processors and software executable on those processors to carry out the operations described. We use the term software herein in its commonly understood sense to refer to programs or routines (subroutines, objects, plug-ins, etc.), as well as data, usable by a machine or processor. As is well known, computer programs generally comprise instructions that are stored in machine-readable or computer-readable storage media. Some embodiments of the present invention may include executable programs or instructions that are stored in machine-readable or computer-readable storage media, such as a digital memory. We do not imply that a "computer" in the conventional sense is required in any particular embodiment. For example, various processors, embedded or otherwise, may be used in equipment such as the components described herein.

Memory for storing software again is well known. In some embodiments, memory associated with a given processor may be stored in the same physical device as the processor ("on-board" memory); for example, RAM or FLASH memory disposed within an integrated circuit microprocessor or the like. In other examples, the memory comprises an independent device, such as an external disk drive, storage array, or portable FLASH key fob. In such cases, the memory becomes "associated" with the digital processor when the two are operatively coupled together, or in communication with each other, for example by an I/O port, network connection, etc. such that the processor can read a file stored on the memory. Associated memory may be "read only" by design (ROM) or by virtue of permission settings, or not. Other examples include but are not limited to WORM, EPROM, EEPROM, FLASH, etc. Those technologies often are implemented in solid state semiconductor devices. Other memories may comprise moving parts, such as a conventional rotating disk drive. All such memories are "machine readable" or "computer-readable" and may be used to store executable instructions for implementing the functions described herein.

A "software product" refers to a memory device in which a series of executable instructions are stored in a machine-readable form so that a suitable machine or processor, with appropriate access to the software product, can execute the instructions to carry out a process implemented by the instructions. Software products are sometimes used to distribute software. Any type of machine-readable memory, including without limitation those summarized above, may be used to make a software product. That said, it is also known that software can be distributed via electronic transmission ("download"), in which case there typically will be a corresponding software product at the transmitting end of the transmission, or the receiving end, or both.

Having described and illustrated the principles of the invention in a preferred embodiment thereof, it should be apparent that the invention may be modified in arrangement and detail without departing from such principles. We claim all modifications and variations coming within the spirit and scope of the following claims.

The invention claimed is:

1. A processor readable medium encoded with instructions that, if executed, result in:

pairing a navigation device with a mobile phone and discovering which Bluetooth profiles are supported by the mobile phone;

mapping an identifier for the mobile phone to the supported Bluetooth profiles in a memory of the navigation device;

filtering the Bluetooth profiles that are mapped in the memory according to a trigger event;

establishing a Bluetooth connection between the navigation device and the mobile phone utilizing one of the filtered Bluetooth profiles;

establishing a voice channel type transport layer connection over the established Bluetooth connection and a wireless telecommunications network associated with the mobile phone; and

modulating a received digital bitstream into an upload continuous audio signal that has different frequency tones for different bit values or demodulating a received download continuous audio signal that has the different frequency tones, wherein the frequency tones are selected to pass through a wireless voice channel of the wireless telecommunications network unobstructed by vocoders operating within the wireless telecommunications network, and wherein the upload or download continuous audio signal is to be communicated to or from a remote server over the established transport layer connection.

2. The processor readable medium of claim **1**, wherein the mapping is stored in an entry in the navigation device memory, and the instructions, if executed, result in:

whenever the navigation device is paired with a new mobile phone, discovering which Bluetooth profiles are supported by the new mobile phone; and

adding a new entry in the navigation device memory for the new mobile phone, the new entry mapping an identifier for the new mobile phone with the discovered Bluetooth profiles associated with the new mobile phone.

3. The processor readable medium of claim **2**, wherein the instructions, if executed, result in:

establishing a Bluetooth connection with a currently available one of the mobile phones, the Bluetooth connection established by selecting from Bluetooth profiles associated with the currently available mobile phone in the navigation device memory;

establishing the Bluetooth connection according to the selected Bluetooth profile; and

uploading or downloading information to or from the remote server using the established Bluetooth connection.

4. The processor readable medium of claim **1**, wherein the established Bluetooth connection comprises one of a plurality of lower layer connections enabling the transport layer connection between the navigation device and the remote server.

5. The processor readable medium of claim **4**, wherein another one of the lower layer connections include a lower layer connection extending from the mobile phone and through the wireless telecommunications network.

6. The processor readable medium of claim **1**, wherein the navigation device memory stores a table mapping trigger event types to Bluetooth profiles, and the instructions, if executed, result in:

comparing the trigger event to the trigger event types in the table to identify a Bluetooth profile ranking; and

filtering the discovered Bluetooth profiles using the identified Bluetooth profile ranking.

7. The processor readable medium of claim **6**, wherein the instructions, if executed, result in:

if an attempt to establish the Bluetooth connection using the highest ranked filtered Bluetooth profile fails, attempting to establish the Bluetooth connection using the next highest ranked filtered Bluetooth profile.

8. A method, comprising:

storing an identifier for a mobile phone in a memory of a Bluetooth capable device;

using the Bluetooth capable device, pairing with the mobile phone and discovering which Bluetooth profiles are supported by the mobile phone;

storing an indication for each of the supported Bluetooth profiles in the memory of the Bluetooth capable device, wherein the stored indications for the supported Bluetooth profiles are correlated to the stored identifier for the mobile phone in the memory of the Bluetooth capable device;

in response to a trigger event, identifying an available mobile phone and comparing an identifier for the available mobile phone to the memory of the Bluetooth capable device;

filtering Bluetooth profiles that are identified by the comparison according to the trigger event;

establishing a Bluetooth connection between the Bluetooth capable device and the mobile phone utilizing one of the filtered Bluetooth profiles;

establishing a transport layer connection that extends over the established Bluetooth connection and a wireless telecommunications network corresponding to the mobile phone; and

exchanging communications between the Bluetooth capable device and a remote network over the established transport layer connection.

9. The method of claim **8**, further comprising:

determining whether the mobile phone is capable of conducting a packet data service connection over the wireless telecommunications network;

if the packet data service connection is not enabled, modulating a received digital bitstream into an upload continuous audio signal that has different frequency tones for different bit values or demodulating a received download continuous audio signal that has the different frequency tones using an in-band signaling modem, wherein the frequency tones are selected to pass through a wireless voice channel of the wireless telecommunications network unobstructed by vocoders operating within the wireless telecommunications network, and wherein the upload or download continuous audio signal is to be communicated to or from a remote server over the established Bluetooth connection; and

if the packet data service connection is enabled, exchanging information with the remote server independently of the in-band signaling modem.

10. The method of claim **8**, wherein the instructions, if executed, result in:

comparing the trigger event to a table mapping trigger event types to Bluetooth profiles; and

filtering the Bluetooth profiles that are mapped in the memory according to a result of the comparison.

11. The method of claim **10**, wherein the filtering identifies a primary Bluetooth profile and a secondary Bluetooth profile.

12. A Bluetooth capable device encoded with instructions that, if executed, result in:

pairing with a mobile phone and discovering which Bluetooth profiles are supported by the mobile phone;

mapping an identifier for the mobile phone to the supported Bluetooth profiles in a memory of the Bluetooth capable device;

filtering the Bluetooth profiles that are mapped in the Bluetooth capable device memory according to a trigger event;

establishing a Bluetooth connection with the mobile phone utilizing one of the filtered Bluetooth profiles;

establishing a transport layer connection that extends over the Bluetooth connection and a wireless transport network corresponding to the mobile phone; and

receiving or transmitting communications from the Bluetooth capable device to a remote network over the established transport layer connection.

13. The Bluetooth capable device of claim **12**, wherein the instructions, if executed, result in:

establishing the Bluetooth connection using a Bluetooth profile for voice data according to whether the mobile phone is capable of establishing a packet data type transport connection over the network.

14. The Bluetooth capable device of claim **12**, wherein the instructions, if executed, result in:

whenever the Bluetooth capable device is paired with a new mobile phone, discovering which Bluetooth profiles are supported by the new mobile phone; and

adding a new entry in the Bluetooth capable device memory for the new mobile phone, the new entry mapping an identifier for the new mobile phone with the discovered Bluetooth profiles associated with the new mobile phone.

15. The Bluetooth capable device of claim **14**, wherein the instructions, if executed, result in:

establishing a Bluetooth connection with a currently available one of the mobile phones, the Bluetooth connection established by selecting from Bluetooth profiles associated with the currently available mobile phone in the Bluetooth capable device memory;

establishing the Bluetooth connection according to the selected Bluetooth profile; and

uploading or downloading the information to or from a remote server using the established Bluetooth connection.

16. The Bluetooth capable device of claim **12**, wherein the instructions, if executed, result in:

determining whether the mobile phone supports a packet data service connection over the network; and

filtering the Bluetooth profiles that are mapped in the Bluetooth capable device memory according to the determination.

17. The Bluetooth capable device of claim **12**, wherein the instructions, if executed, result in:

comparing the trigger event to a table that maps trigger events to Bluetooth profiles;

identifying a subset of the Bluetooth profiles according to the comparison; and

filtering the Bluetooth profiles indicated in the Bluetooth capable device memory as being supported by the mobile phone using the identified subset.

18. The Bluetooth capable device of claim **17**, wherein the instructions, if executed, result in:

identifying a ranked subset of the Bluetooth profiles according to the comparison; and

filtering the Bluetooth profiles indicated in the Bluetooth capable device memory as being supported by the mobile phone using the identified ranked subset.

19. The Bluetooth capable device of claim **12**, wherein the trigger event corresponds to an input received over a user interface of the Bluetooth capable device.

20. The Bluetooth capable device of claim **12**, wherein the trigger event is generated independently of any input received over a user interface of the Bluetooth capable device.

* * * * *