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(54) **MODULAR CELL PHONE FOR LAPTOP COMPUTERS**

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(51) **Int. Cl.**

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H04M 1/72	(2006.01)
H04M 1/725	(2006.01)
H04B 1/38	(2006.01)

(52) **U.S. Cl.**

CPC ***H04B 1/3816*** (2013.01); ***H04M 1/7253*** (2013.01); ***H04M 1/72527*** (2013.01)

USPC **455/556.1**; 455/41.2; 455/426.1

(58) **Field of Classification Search**

USPC 455/41.2, 556.1, 553.1

See application file for complete search history.

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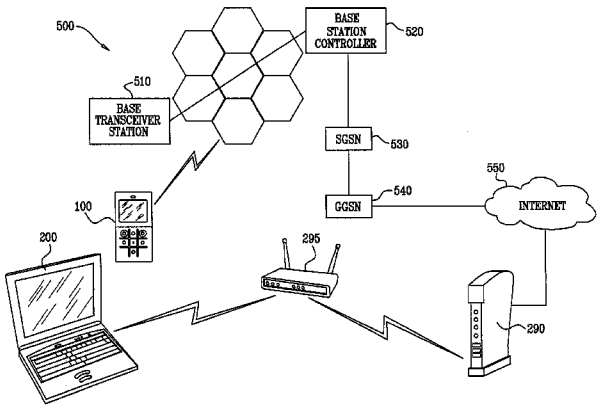
(57) **ABSTRACT**

A communication system including a wireless communicator including a baseband modem for connecting to the Internet via a cellular network, and a connector for physically connecting the wireless communicator to a laptop computer port, and a laptop computer including a wireless modem for communicating in a wireless mode with the wireless communicator, a port for physically connecting the wireless communicator to the laptop computer and for communicating in a wired mode with the wireless communicator, and a connection wedge, wherein the laptop computer connects to the Internet via a link between the laptop computer and the wireless communicator, and wherein the connection wedge selectively uses the wired mode or the wireless mode for the link according to whether or not the wireless communicator is physically connected to the laptop computer, respectively. A method is also described and claimed.

17 Claims, 9 Drawing Sheets



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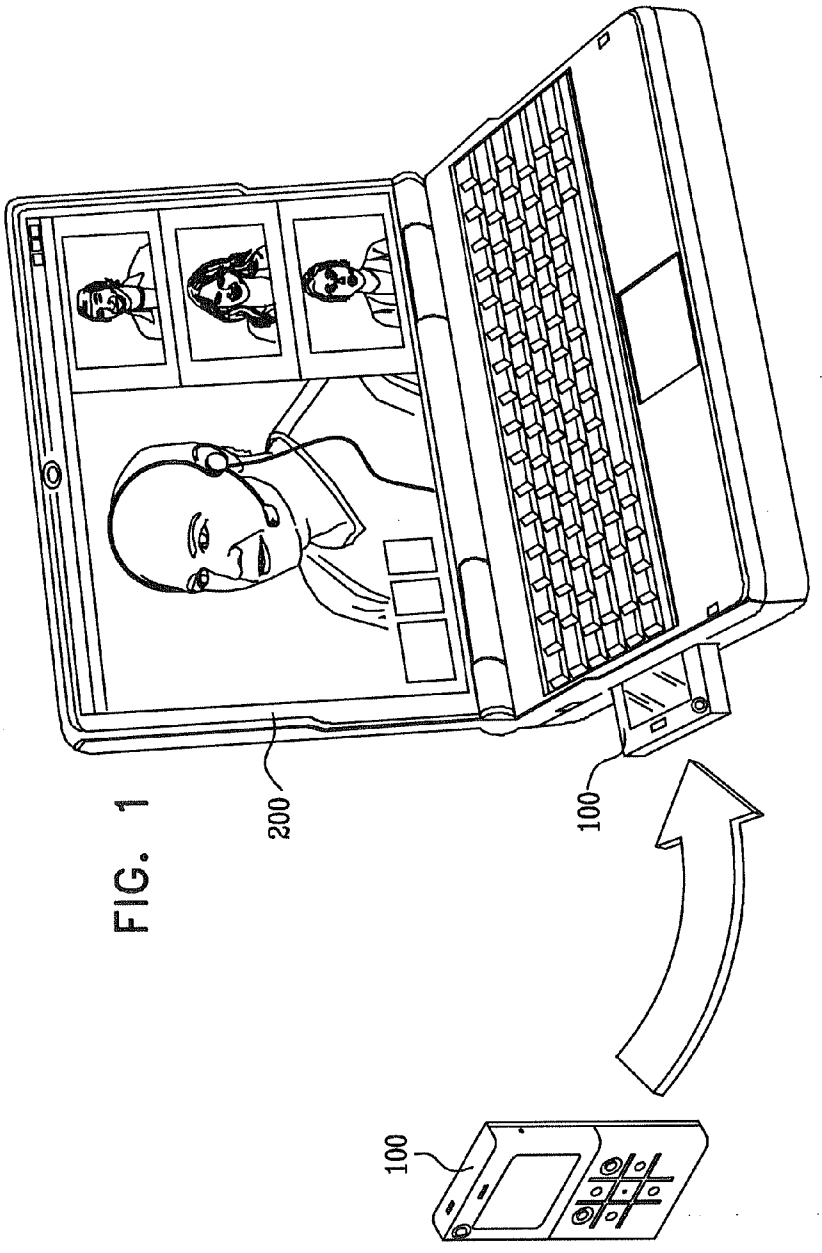


FIG. 1

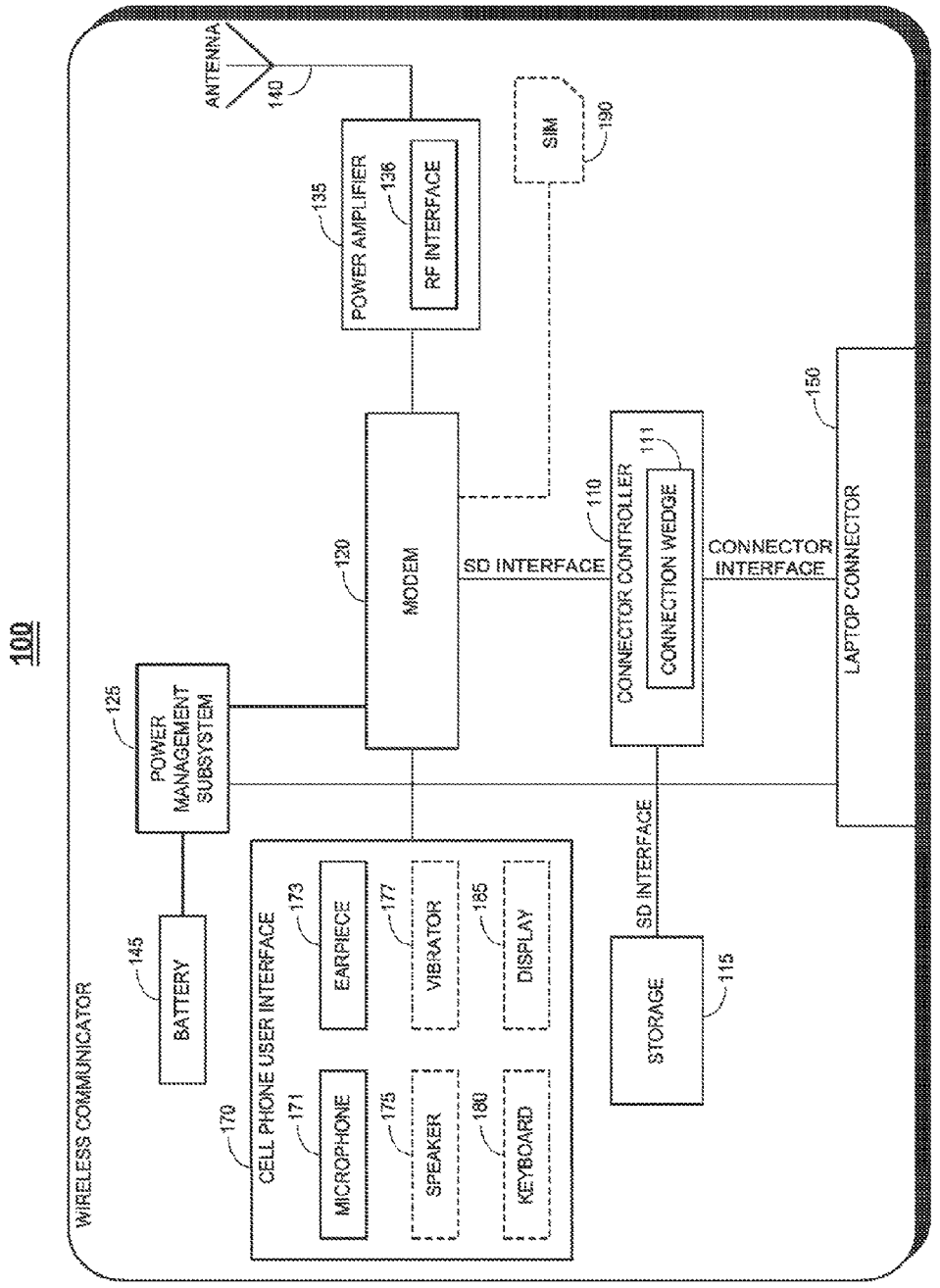
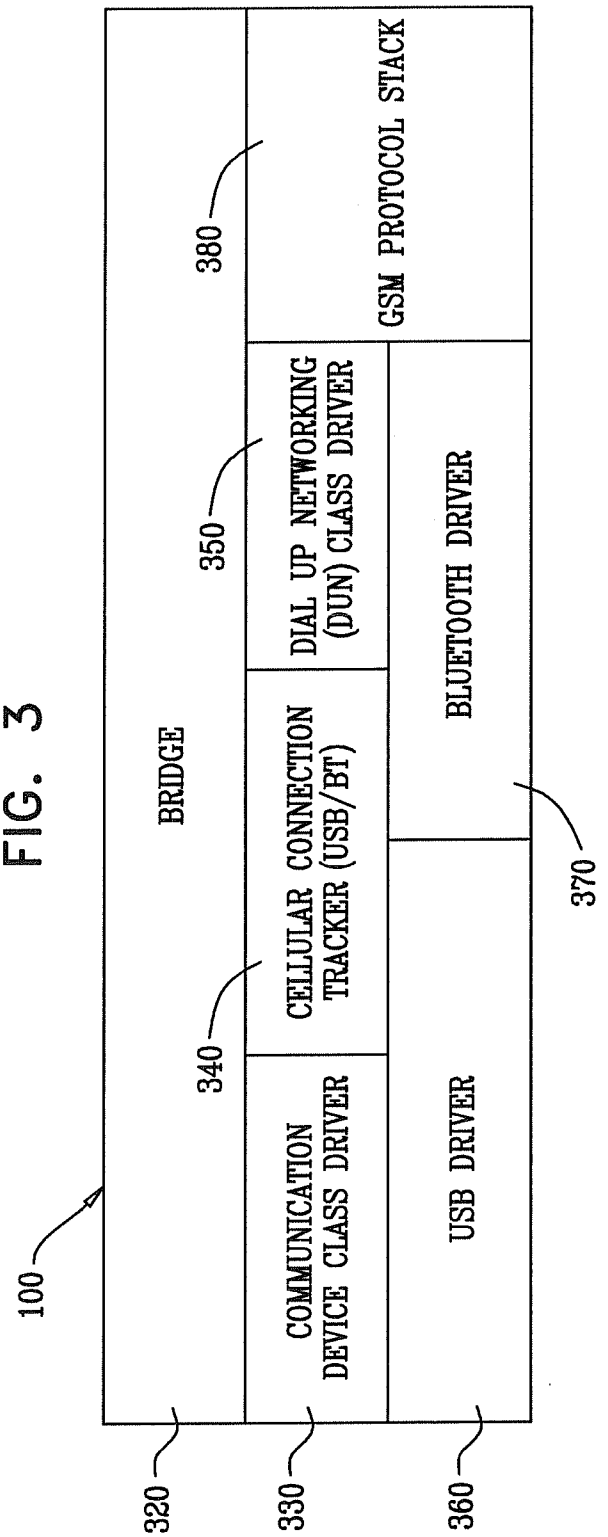

100
WIRELESS COMMUNICATOR
ANTENNA
140
SIM
190
POWER AMPLIFIER
135
RF INTERFACE
136
MODEM
120
SD INTERFACE
CONNECTOR CONTROLLER
110
CONNECTION WEDGE
111
CONNECTOR INTERFACE
LAPTOP CONNECTOR
150
POWER MANAGEMENT SUBSYSTEM
125
BATTERY
145
CELL PHONE USER INTERFACE
170
MICROPHONE
171
EARPIECE
173
SPEAKER
175
VIBRATOR
177
KEYBOARD
180
DISPLAY
185
SD INTERFACE
STORAGE
115

FIG. 2

FIG. 3


100
BRIDGE
320
COMMUNICATION DEVICE CLASS DRIVER
330
340
CELLULAR CONNECTION TRACKER (USB/BT)
USB DRIVER
360
350
DIAL UP NETWORKING (DUN) CLASS DRIVER
BLUETOOTH DRIVER
370
380
GSM PROTOCOL STACK

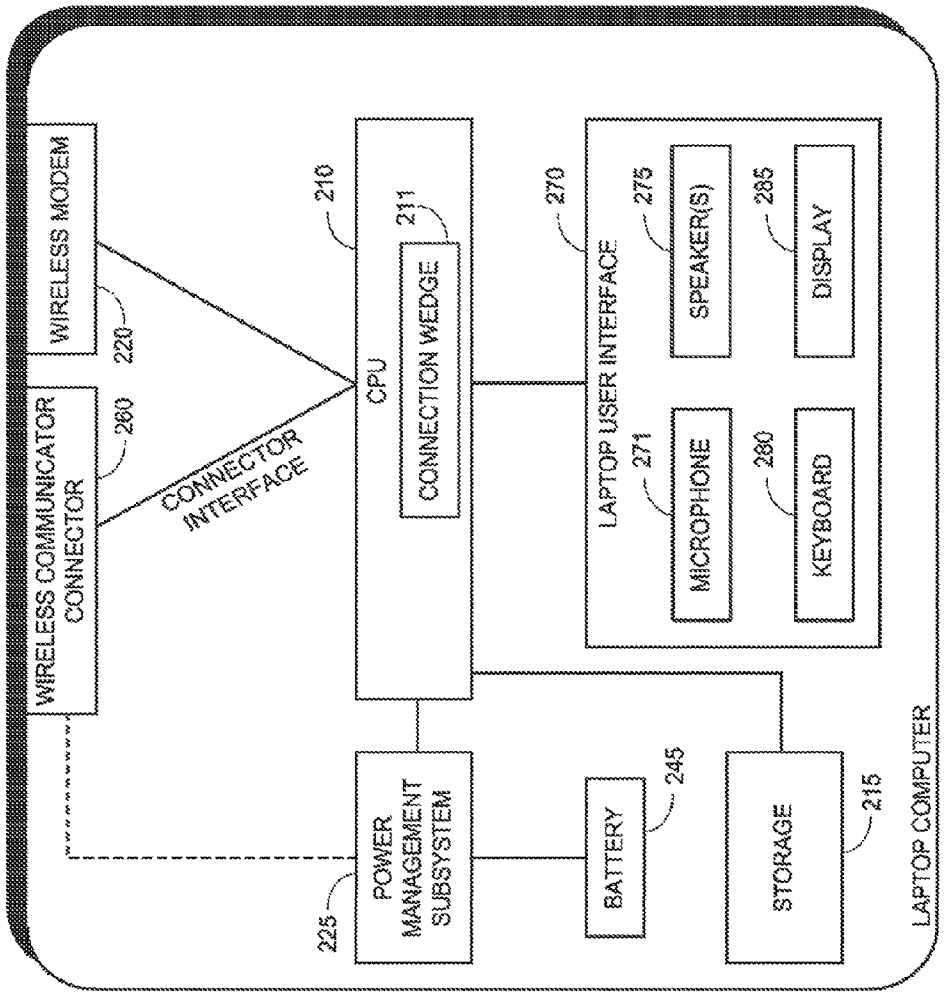

WIRELESS MODEM
220
WIRELESS COMMUNICATOR CONNECTOR
260
CONNECTOR INTERFACE
210
CPU
211
CONNECTION WEDGE
270
LAPTOP USER INTERFACE
271
MICROPHONE
275
SPEAKER(S)
280
KEYBOARD
285
DISPLAY
225
POWER MANAGEMENT SUBSYSTEM
BATTERY
245
STORAGE
215
LAPTOP COMPUTER
200

FIG. 4

FIG. 5

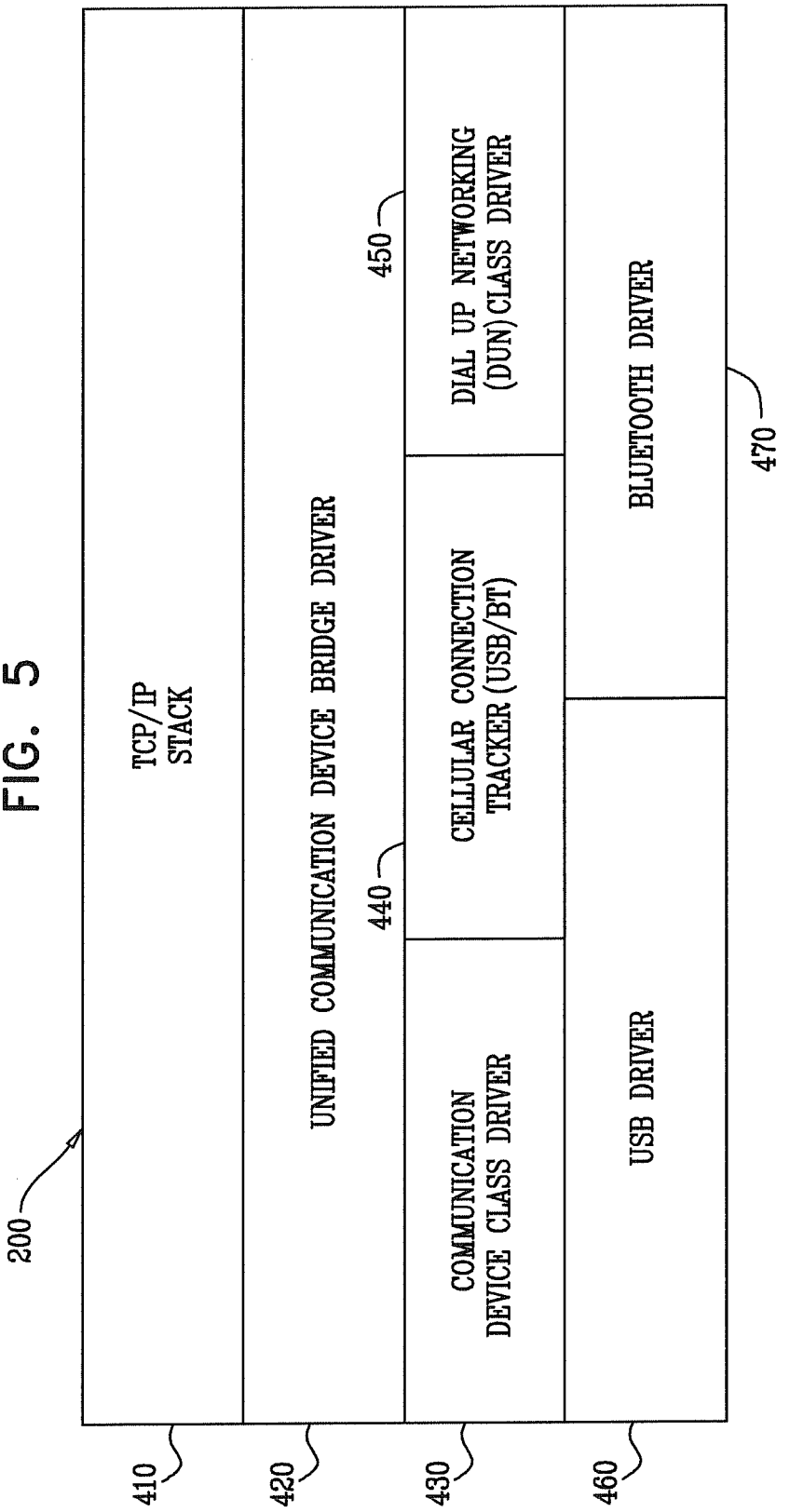

200
TCP/IP STACK
UNIFIED COMMUNICATION DEVICE BRIDGE DRIVER
440
450
COMMUNICATION DEVICE CLASS DRIVER
CELLULAR CONNECTION TRACKER (USB/BT)
DIAL UP NETWORKING (DUN) CLASS DRIVER
USB DRIVER
BLUETOOTH DRIVER
470
410
420
430
460

FIG. 6

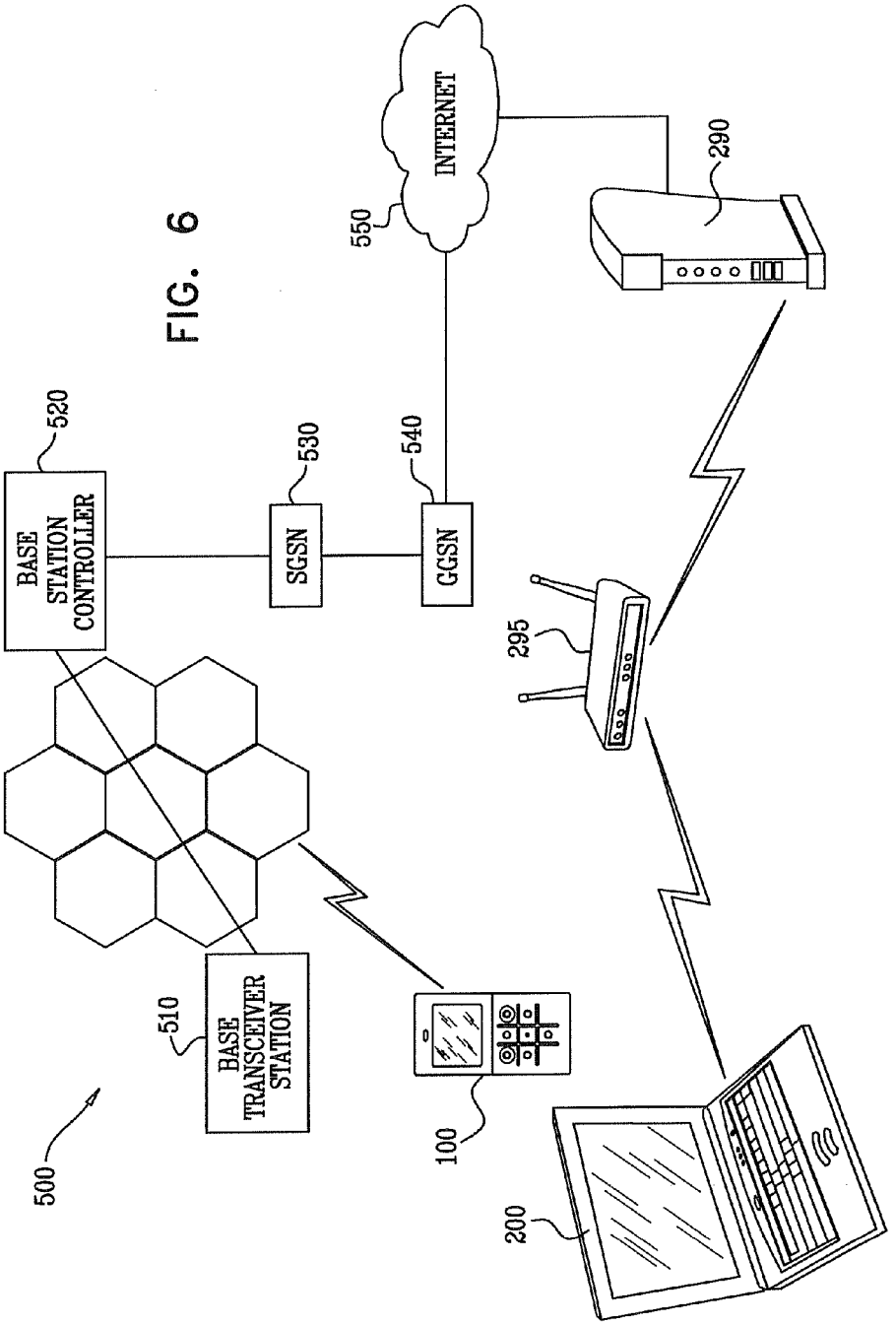

INTERNET
550
290
520
530
540
BASE STATION CONTROLLER
SGSN
GGSN
295
510
BASE TRANSCEIVER STATION
500
100
200

FIG. 7

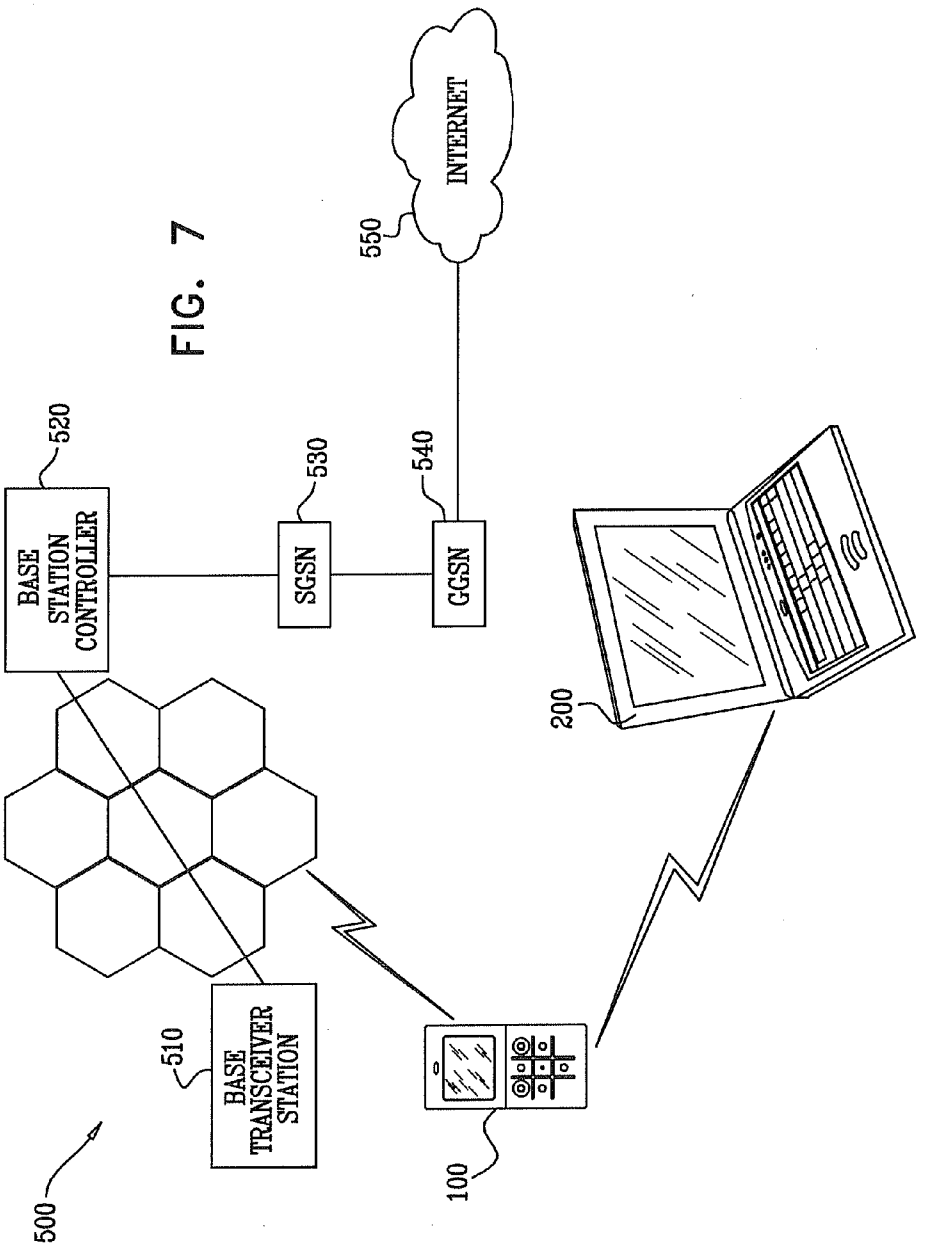

INTERNET
550
520
530
540
BASE STATION CONTROLLER
SGSN
GGSN
200
510
BASE TRANSCEIVER STATION
500
100

FIG. 8

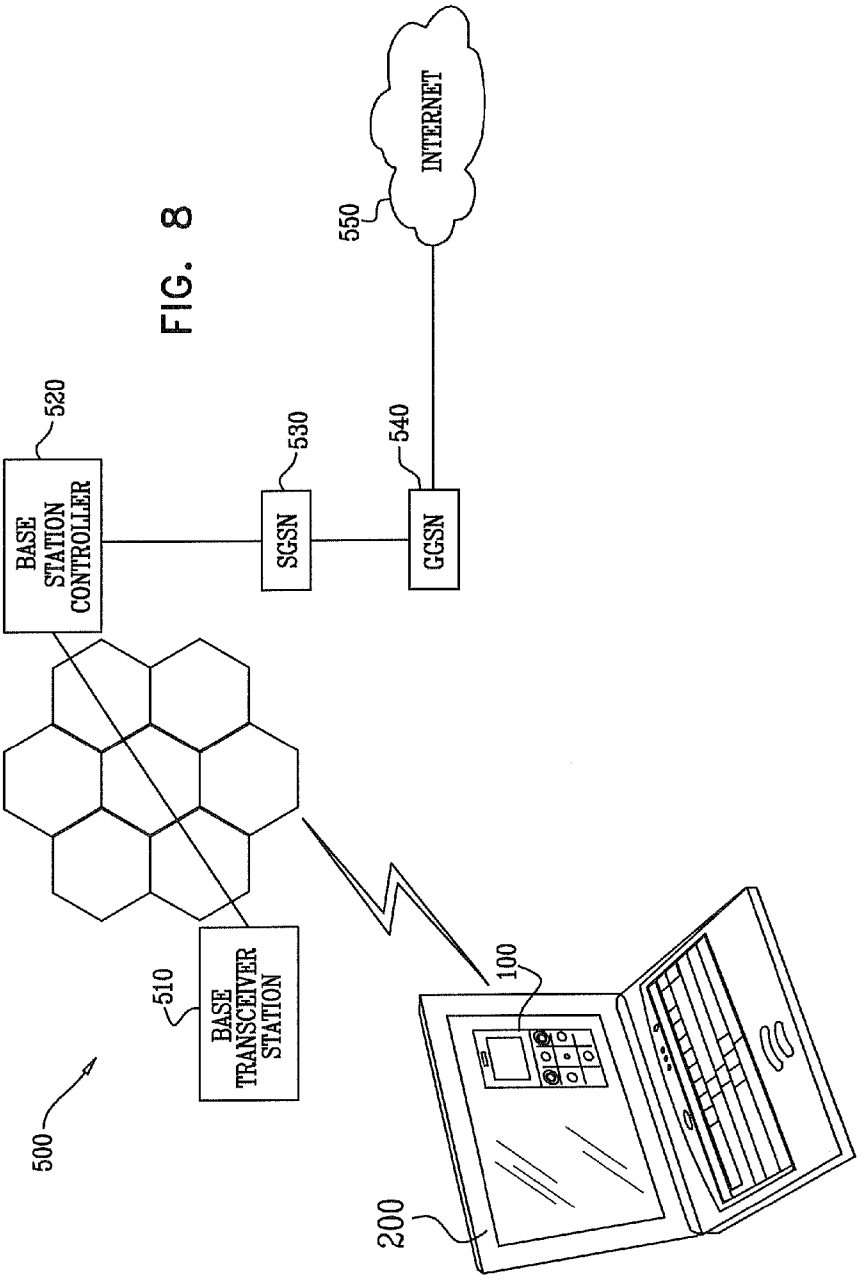
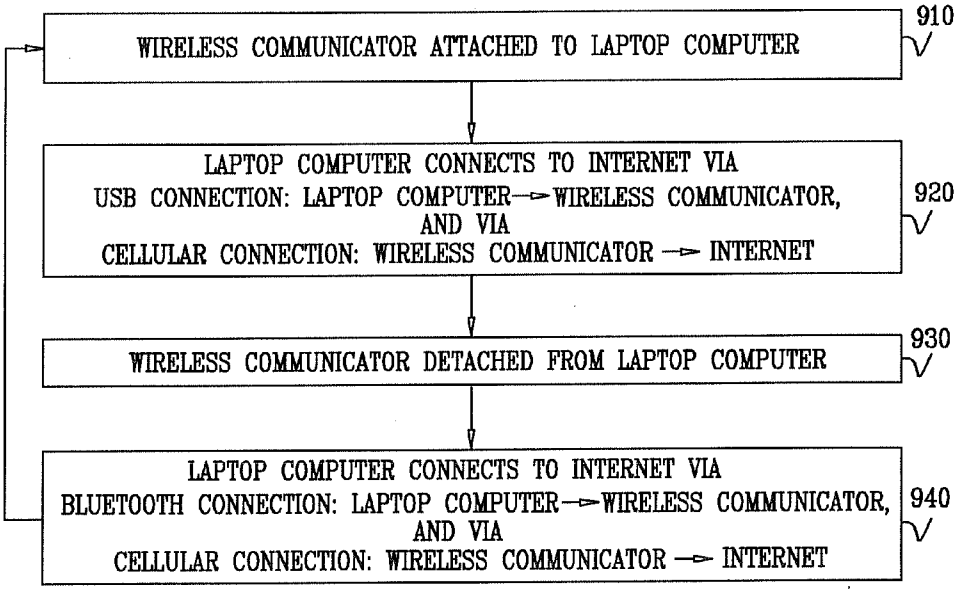

INTERNET
550
BASE STATION CONTROLLER
520
SGSN
530
GGSN
540
BASE TRANSCEIVER STATION
510
100
200
500

FIG. 9


WIRELESS COMMUNICATOR ATTACHED TO LAPTOP COMPUTER
910
LAPTOP COMPUTER CONNECTS TO INTERNET VIA
USB CONNECTION: LAPTOP COMPUTER → WIRELESS COMMUNICATOR,
AND VIA
CELLULAR CONNECTION: WIRELESS COMMUNICATOR → INTERNET
920
WIRELESS COMMUNICATOR DETACHED FROM LAPTOP COMPUTER
930
LAPTOP COMPUTER CONNECTS TO INTERNET VIA
BLUETOOTH CONNECTION: LAPTOP COMPUTER → WIRELESS COMMUNICATOR,
AND VIA
CELLULAR CONNECTION: WIRELESS COMMUNICATOR → INTERNET
940

MODULAR CELL PHONE FOR LAPTOP COMPUTERS

PRIORITY REFERENCE TO RELATED APPLICATIONS

This application is a divisional of U.S. application Ser. No. 12/151,079, now U.S. Pat. No. 8,260,348, entitled MODULAR CELL PHONE FOR LAPTOP COMPUTERS, filed on May 3, 2008 by inventor Itay Sherman. U.S. application Ser. No. 12/151,079 is a non-provisional of U.S. Provisional Application No. 61/069,987, entitled MODULAR CELL PHONE FOR LAPTOP COMPUTERS, filed on Mar. 19, 2008 by inventor Itay Sherman.

FIELD OF THE INVENTION

The field of the present invention is cellular communication.

BACKGROUND OF THE INVENTION

Conventional laptop computers generally connect to the Internet using an internal or an external modem, such as a dial-up or a cellular modem. The connection between a laptop computer and an external modem may be via network cable, USB, PCMCIA or wireless.

Despite ubiquitous connectivity available today, situations still abound where a laptop computer-does not have Internet connectivity, or where a laptop computer loses Internet connectivity during an ongoing Internet session. In such situations, a user may use his cell phone as a link to connect his laptop computer to the Internet via a cellular communication network. However, using standard connection protocols, such as Dynamic Host Configuration Protocol (DHCP), if a laptop computer's Internet connection is changed during an ongoing Internet session from linking to the Internet via a physical (wired) modem to linking via a wireless modem connection, or vice versa, a new IP address must be allocated. Allocating a new IP address disrupts the ongoing Internet connection session.

It would thus be of advantage if a user could use his cell phone to connect his laptop computer to the Internet in such a way that the same IP address persists when his Internet connection is handed over from a physical link to a wireless link, or vice versa, during an ongoing Internet connection session.

SUMMARY OF THE DESCRIPTION

Aspects of the present invention relate to a wireless communicator that connects with a laptop computer by a physical USB connection and by a short range wireless Bluetooth connection, and to methods and systems that maintain the same IP address when switching from the USB over to the Bluetooth connection, and vice versa, during an ongoing Internet session. The laptop computer uses the wireless communicator as a link to connect to the Internet. When the wireless communicator is physically attached to the laptop computer, the laptop computer may use either the USB connection or the Bluetooth connection, or both connections, to transfer data to and from the wireless communicator. When the wireless communicator is not physically attached to the laptop computer, the laptop computer uses the Bluetooth connection to transfer data to and from the wireless communicator.

Embodiments of the present invention provide a unified driver, referred to herein as a connection wedge, that selectively uses one or both of the USB and Bluetooth connections, according to whether or not the wireless communicator is physically attached to the laptop computer. In one embodiment the connection wedge is implemented as a software driver wedged between Bluetooth and USB low level communication drivers and the laptop computer's networking stack.

In addition to providing a link to the Internet via the wireless communicator, the connection wedge is also advantageous in automatic Bluetooth pairing of the wireless communicator with the laptop computer. The connection wedge is further advantageous in instructing the Bluetooth connection to operate in a low power mode when the USB connection is active.

More generally, embodiments of the present invention relate to a laptop computer that uses a cell phone for Internet connections, and that has both a physical connection and a wireless connection to the cell phone. The physical connection is active when the cell phone is attached to the laptop computer. The wireless connection is active when the cell phone is in proximity of the laptop computer, whether or not the cell phone is physically attached thereto. Internet connections of the laptop computer are persisted during a connection session before, during and after attachment of the cell phone to the laptop computer and detachment of the cell phone from the laptop computer, without reallocation of IP address.

There is thus provided in accordance with an embodiment of the present invention a communication system including a wireless communicator including a baseband modem for connecting to the Internet via a cellular network, and a connector for physically connecting the wireless communicator to a laptop computer port, and a laptop computer including a wireless modem for communicating in a wireless mode with the wireless communicator, a port for physically connecting the wireless communicator to the laptop computer and for communicating in a wired mode with the wireless communicator, and a connection wedge, wherein the laptop computer connects to the Internet via a link between the laptop computer and the wireless communicator, and wherein the connection wedge selectively uses the wired mode or the wireless mode for the link according to whether or not the wireless communicator is physically connected to the laptop computer port, respectively.

There is additionally provided in accordance with an embodiment of the present invention a method of communication, including opening a data connection from a laptop computer to the Internet via a wireless communicator, wherein the wireless communicator connects to the Internet over a cellular network and wherein the laptop computer connects to the wireless communicator over a short range wireless link, a physical link, or both a short range wireless link and a physical link, selectively using at least one appropriate link between the laptop computer and the wireless communicator according to whether or not the wireless communicator is physically attached to the laptop computer, and maintaining integrity of the data transmitted over the data connection before, during and after the selectively using.

There is further provided in accordance with an embodiment of the present invention a laptop computer including a wireless modem for communicating in a wireless mode with a wireless communicator, a port for physically connecting the wireless communicator to the laptop computer and for communicating in a wired mode with the wireless communicator, and a connection wedge, wherein the laptop computer connects to the Internet via a link between the laptop computer and the wireless communicator, and wherein the connection wedge selectively uses the wired mode or the wireless mode

for the link according to whether or not the wireless communicator is physically connected to the laptop computer port, respectively.

There is further provided in accordance with an embodiment of the present invention a communication system including a wireless communicator including a baseband modem for conducting a phone call via a cellular network, a microphone for providing audio input during the phone call, a speaker for providing audio output during the phone call, a connector for physically connecting the wireless communicator to a laptop computer port, and a laptop computer including a microphone for providing audio input, at least one speaker for providing audio output, a port for physically connecting the wireless communicator to the laptop computer, and an audio bridge, for using the laptop computer microphone instead of the wireless communicator microphone to provide audio input during the phone call, and for using the laptop computer at least one speaker instead of the wireless communicator speaker to provide audio output during the phone call, when the wireless communicator is physically connected to the laptop computer port.

There is moreover provided in accordance with an embodiment of the present invention a method of communication, including detecting, by a laptop computer, that a wireless communicator has been physically attached to the laptop computer during an ongoing phone call being conducted via the wireless communicator, channeling audio input from the laptop computer microphone to the wireless communicator when the detecting occurs, and channeling audio output from the wireless communicator to one or more speakers of the laptop computer when the detecting occurs.

There is additionally provided in accordance with an embodiment of the present invention a laptop computer including a microphone for providing audio input, at least one speaker for providing audio output, a port for physically connecting a wireless communicator to the laptop computer, and an audio bridge, for using the laptop computer microphone to provide audio input during an ongoing phone call being conducted via the wireless communicator, and for using the laptop computer at least one speaker to provide audio output during the ongoing phone call, when the wireless communicator is physically connected to the laptop computer port during the ongoing phone call.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be more fully understood and appreciated from the following detailed description, taken in conjunction with the drawings in which:

FIG. **1** is an illustration of a wireless communicator that attaches to a laptop computer, in accordance with an embodiment of the present invention;

FIG. **2** is a simplified block diagram of the wireless communicator of FIG. **1**, in accordance with an embodiment of the present invention;

FIG. **3** is a simplified diagram of a stack of communication drivers for the wireless communicator of FIG. **1**, in accordance with an embodiment of the present invention;

FIG. **4** is a simplified block diagram of the laptop computer of FIG. **1**, in accordance with an embodiment of the present invention;

FIG. **5** is a simplified diagram of a stack of communication drivers for the laptop computer of FIG. **1**, in accordance with an embodiment of the present invention;

FIG. **6** is a simplified block diagram of the wireless communicator and the laptop computer of FIG. **1** operating independently of one another, whereby the wireless communicator uses a cellular network and the laptop computer uses an Internet connection, in accordance with an embodiment of the present invention;

FIG. **7** is a simplified block diagram of the wireless communicator and the laptop computer of FIG. **1** operating jointly within the cellular network when the wireless communicator is not physically attached to the laptop computer, in accordance with an embodiment of the present invention;

FIG. **8** is a simplified block diagram of the wireless communicator and the laptop computer of FIG. **1** operating jointly within the cellular network when the wireless communicator is physically attached to the laptop computer, in accordance with an embodiment of the present invention; and

FIG. **9** is a simplified flowchart of switching an Internet connection between the laptop computer and the Internet, according to whether the wireless communicator is physically or wirelessly connected with the laptop computer, in accordance with an embodiment of the present invention.

DETAILED DESCRIPTION

Aspects of the present invention relate to a wireless communicator that interoperates with a laptop computer. In this regard, reference is now made to FIG. **1**, which is an illustration of a wireless communicator **100** that connects to a laptop computer **200**, in accordance with an embodiment of the present invention. As shown in FIG. **1**, wireless communicator **100** may be physically attached to laptop computer **200**, or not physically attached but in proximity of short range wireless communication. Whether wireless communicator **100** and laptop computer **200** are connected physically or wirelessly, wireless communicator **100** enhances the capabilities of laptop computer **200**, and laptop computer **200** enhances the capabilities of wireless communicator **100**, as described hereinbelow.

Reference is now made to FIG. **2**, which is a simplified block diagram of wireless communicator **100**, in accordance with an embodiment of the present invention. Wireless communicator **100** includes six primary components, as follows: a connector controller **110**, a memory storage **115**, a base band modem **120** for sending and receiving voice and data communications, a power management subsystem **125**, a power amplifier **135** and a user interface **170**.

Connector controller **110** executes programmed instructions that control the data flow between wireless communicator **100** and laptop computer **200**. Modem **120** controls the wireless communication functionality of wireless communicator **100**. In addition to enabling cellular communication, modem **120** also enables wireless communicator **100** with short range wireless communication, including inter alia one or more of Dedicated Short Range Communication (DSRC), Bluetooth, WiFi, ZigBee, Radio Frequency Identification (RFID) and Near Field Communication (NFC).

Power management subsystem **125** includes charging circuitry for charging a battery **145**. Power amplifier **135** includes a radio frequency (RF) interface **136**, and is connected to an internal antenna **140**. User interface **170** includes a microphone **171** and an earpiece **173**. User interface **170** also includes an optional speaker **175**, an optional vibrator **177**, an optional keyboard **180** and an optional display **185**. It will be appreciated by those skilled in the art that user interface **170** may include additional components.

Wireless communicator **100** includes a laptop connector **150** for physically connecting wireless communicator **100** to laptop computer **200**. Laptop connector **150** may be inter alia a USB connector, or a proprietary connector that includes

USB signal lines. Wireless communicator **100** optionally includes a subscriber identification module (SIM) **190**.

In accordance with an embodiment of the present invention, the interface between connector controller **110** and storage **115**, and the interface between connector controller **110** and modem **120** are SD interfaces. The interface between connector controller **110** and laptop connector **150** is a special purpose connector interface.

In accordance with an embodiment of the present invention connector controller **110** includes a connection wedge **111** for selecting a physical mode of connection or a wireless mode of connection between wireless communicator **100** and laptop computer **200**, according to whether or not wireless communicator **100** is physically connected to laptop computer **200** via connector **150**, respectively.

In this regard, reference is made to FIG. **3**, which is a simplified diagram of a stack of communication drivers for wireless communicator **100**, in accordance with an embodiment of the present invention. As shown in FIG. **3**, wireless communicator **100** includes drivers **360** and **370** for low level physical and wireless communication protocols, such as USB and Bluetooth, respectively.

Connection wedge **111** is implemented as a bridge driver **320**. Bridge driver **320** operates above a communication device class driver **330**, a dial up networking class driver **350**, and a GSM protocol stack **380**, which in turn operate above the communicator's USB and Bluetooth drivers **360** and **370**, respectively.

In accordance with an embodiment of the present invention, a cellular connection tracker **340** notifies connection wedge **111** of a connection state from the physical and wireless low level communication drivers **360** and **370**, respectively. The connection state represents whether the physical and wireless connections are active or inactive. Each driver **360** and **370** detects whether or not there is a corresponding connection. Connection tracker **340** tracks and reports to connection wedge **111** which connections are available at a given moment. Based on the connection state, connection wedge **111** routes packets coming into and going out from the wireless communicator's networking stack to the appropriate one of the physical and wireless low level communication drivers **360** and **370**, respectively. In accordance with an embodiment of the present invention, bridge driver **320** and/or connection tracker **340** includes logic for prioritizing which connection to use.

In one embodiment of the present invention, connection wedge **111** provides priority to the physical connection. As such, if both connections are active, when wireless communicator **100** is attached to laptop computer **200**, connection wedge **111** uses the physical connection for data transmission. Data received at either the physical or the wireless communication is routed to the networking stack.

In another embodiment of the present invention, connection wedge **111** enables both physical and wireless communication to operate when the physical and wireless connections are both active.

Reference is now made to FIG. **4**, which is a simplified block diagram of laptop computer **200**, in accordance with an embodiment of the present invention. Laptop computer **200** includes five primary components, as follows: a laptop controller **210**, a memory storage **215**, a wireless modem **220**, a power management system **225** and a battery **245**. Laptop computer **200** includes a wireless communicator connector **260** for physically connecting wireless communicator **100** to laptop computer **200**.

Laptop computer **200** includes a user interface **270** including a microphone **271**, mono or stereo speakers **275**, a keyboard **280** and a display **285**. It will be appreciated by those skilled in the art that user interface **270** may include additional components.

In accordance with an embodiment of the present invention laptop controller **210** includes a connection wedge **211** for selecting a physical mode of connection or a wireless mode of connection between laptop computer **200** and wireless communicator **100**, according to whether or not wireless communicator **100** is physically connected to laptop computer **200** via connector **260**, respectively. Specifically, laptop computer **200** includes drivers for low level physical and wireless communication protocols, such as USB and Bluetooth, respectively, which serve as bridges to the laptop computer's networking stack. The specific low level communication protocols implemented in laptop computer **200** are transparent to the laptop computer's networking stack.

In this regard reference is made to FIG. **5**, which is a simplified diagram of a stack of communication drivers for laptop computer **200**, in accordance with an embodiment of the present invention. Connection wedge **211** is implemented as a unified communication device bridge driver **420** that is wedged between the laptop computer's physical and wireless drivers **460** and **470**, respectively, and the laptop computer's networking stack **410**. Unified bridge driver **420** operates above a communication device class driver **430** and a dial up networking class driver **450**, which in turn operate above the laptop computer's USB and Bluetooth drivers **460** and **470**, respectively.

In accordance with an embodiment of the present invention, a cellular connection tracker **440** notifies connection wedge **211** of a connection state from the physical and wireless low level communication drivers **460** and **470**, respectively. The connection state represents whether the physical and wireless connections are active or inactive. Each driver **460** and **470** detects whether or not there is a corresponding connection. Connection tracker **440** tracks and reports to connection wedge **211** which connections are available at a given moment. Based on the connection state, connection wedge **211** routes packets coming into and going out from the laptop computer's networking stack to the appropriate one of the physical and wireless low level communication drivers **460** and **470**, respectively. In accordance with an embodiment of the present invention, unified bridge driver **420** and/or connection tracker **440** includes logic for prioritizing which connection to use.

In one embodiment of the present invention, connection wedge **211** provides priority to the physical connection. As such, if both connections are active, when wireless communicator **100** is attached to laptop computer **200**, connection wedge **211** uses the physical connection for data transmission. Data received at either the physical or the wireless communication is routed to the networking stack.

In another embodiment of the present invention, connection wedge **211** enables both physical and wireless communication to operate when the physical and wireless connections are both active.

In yet another embodiment of the present invention, connection wedge **211** instructs the wireless connection to transfer to a low power state, such as Sniff or Park, in order to minimize power consumption. If the physical connection becomes unavailable, then connection wedge **211** resumes regular operation of the wireless connection.

Connection wedge **211** is advantageous in reducing latency and complexity of the Bluetooth pairing process. By using the physical connection, connection wedge **211** communicates with wireless communicator **100** and provides wireless communicator **100** with the necessary information

for pairing with the laptop computer's wireless transceiver. Such information may include inter alia a PIN code and timing data, thereby simplifying the manual intervention required for pairing.

The following logic is an exemplary connection prioritization logic, based on the discussion hereinabove.

TABLE I

Exemplary USB/Bluetooth connection priority logic

Connection State	Prioritization
One connection available	Use available connection
Both connections available	Use USB connection and transfer Bluetooth connection to park/sniff
Bluetooth connection is available and USB connection becomes available	Wait approximately 30 seconds before transferring to the USB connection
USB connection is available and Bluetooth connection becomes available	Use USB connection and perform Bluetooth pairing to prepare Bluetooth connection

Connection wedge **211** may be preinstalled on laptop computer **200**, or may be stored on wireless communicator **100** and then automatically installed on laptop computer **200** when wireless communicator **100** is attached thereto. Wireless communicator **100** connects as a USB mass storage device to laptop computer **200**, with AutoRun capability for automatic installation of connection wedge **211**.

Each of wireless communicator **100** and laptop computer **200** is able to operate independently Of the other. Wireless communicator **100** operates as a cell phone, and laptop computer **200** operates as a computer with an Internet connection. In this regard, reference is now made to FIG. **6**, which is a simplified block diagram of wireless communicator **100** and laptop computer **200** operating independently of one another, whereby wireless communicator **100** uses a cellular network **500** and laptop computer **200** uses an Internet connection, in accordance with an embodiment of the present invention.

Cellular network **500** includes a base transceiver station (BTS) **510**, which terminates an over-the-air interface over which subscriber traffic is communicated to and from wireless communicator **100**. Cellular network **500** also includes a base station controller (BSC) **520**, which is a switching module that provides handoff functions and power level control in base transceiver stations.

BSC **520** controls the interface between a serving GPRS support note (SGSN) **530** and BTS **510**. SGSN **530** services cellular communicator **100** by sending or receiving packets via BSC **520**. SGSN **530** is responsible for delivery of data packets to and from wireless communicator **100**, within a service area. SGSN **530** also performs packet routing and transfer, mobility management, local link management, authentication and charging functions.

Cellular network **500** also includes a gateway GPRS support note (GGSN) **540**, which serves as a gateway to Internet **550**.

As shown in FIG. **6**, wireless communicator **100** connects to Internet **550** via cellular network **500**. Laptop computer **200** connects to the Internet either (i) via a modem **290**, or (ii) via a router **295** and modem **290**. In the former case, laptop computer **200** is physically connected to modem **290** via an Ethernet cable. In the latter case, laptop computer **200** is connected to router **295** via a wireless connection, such as a WiFi connection, and router **295** is physically connected to modem **290**.

Although cellular network **500** as shown in FIGS. **6-8** is a General Packet Radio Service (GPRS) network it will be appreciated by those skilled in the art that the present invention may be employed with other wireless networks, including inter alia Code Division Multiple Access (CDMA) networks and IEEE 802.11b WiFi networks.

Although laptop computer **200** can operate independently of wireless communicator **100**, when laptop computer **200** does not have its own connectivity it can use wireless communicator **100** to provide connectivity. In this regard, reference is now made to FIG. **7**, which is a simplified block diagram of wireless communicator **100** and laptop computer **200** operating jointly within cellular network **500** when wireless communicator **100** is not physically attached to laptop computer **200**, in accordance with an embodiment of the present invention. When wireless communicator **100** is not attached to laptop computer **200**, the two devices communicate using a short range wireless connection. As such, laptop computer **200** connects to Internet **550** via a combination of its short range wireless-connection with wireless communicator **100**, and the cellular connection between wireless communicator **100** and Internet **550**.

Reference is now made to FIG. **8**, which is a simplified block diagram of wireless communicator **100** and laptop computer **200** operating jointly within cellular network **500** when wireless communicator **100** is physically attached to laptop computer **200**, in accordance with an embodiment of the present invention. When wireless communicator **100** is attached to laptop computer **200**, the two devices communicate using a physical connection. As such, laptop computer **200** connects to Internet **550** via a combination of its physical connection with wireless communicator **100**, and the cellular connection between wireless communicator **100** and Internet **550**.

In accordance with an embodiment of the present invention, when laptop computer **200** connects to Internet **550** with wireless communicator **100** attached thereto, the connection between laptop computer **200** and Internet **550** switches seamlessly, without reallocation of IP address, from the physical connection mode of FIG. **8** to the wireless mode of FIG. **7** when wireless communicator **100** is detached from laptop computer **200**. Similarly, when wireless communicator **100** is detached from laptop computer **200**, the Internet connection switches seamlessly, without reallocation of IP address, between the wireless mode of FIG. **7** to the physical connection mode of FIG. **8** when wireless communicator **100** is re-attached to laptop computer **200**. In this regard, reference is now made to FIG. **9**, which is a simplified flowchart of switching the connection between laptop computer **200** and Internet **550**, according to whether wireless communicator **100** is physically or wirelessly connected with laptop computer **200**, in accordance with an embodiment of the present invention.

At step **910** wireless communicator **100** is attached to laptop computer **200**, by attaching connectors **160** and **260**. Data is transferred between the two devices using a physical connection, as indicated in FIG. **8**.

At step **920** connection wedge **211** uses the physical communication mode of FIG. **8**. Laptop computer **200** thus connects to Internet **550** using an Internet connection that goes physically from laptop computer **200** to wireless communicator **100**, and wirelessly from wireless communicator **100** to Internet **550**.

At step **930** wireless communicator **100** is detached from laptop computer **200**. Data is transferred between the two devices using a short range wireless communication, as indicated in FIG. **7**.

At step **940** connection wedge **211** uses the wireless communication mode of FIG. **7**. Laptop computer **200** switches to

an Internet connection that goes wireless from laptop computer **200** to wireless communicator **100**, and wirelessly from wireless communicator **100** to Internet **550**. Since the low level communication protocol is transparent to the networking stack, the switch from using the physical communication mode of FIG. **7** to using the wireless communication mode of FIG. **8** is a seamless switch. The connection between laptop computer **200** and Internet **550** persists, and the integrity of the data transfer between laptop computer **200** and Internet **550** is maintained before, during and after the switch.

After step **940**, processing in FIG. **9** returns to step **910** when wireless communicator **100** is re-attached to laptop computer **200**. As above, since the low level communication protocol is transparent to the networking stack, the switch at step **920** from using the wireless communication mode of FIG. **8** to using the physical communication mode of FIG. **7** is again a seamless switch.

In reading the above description, persons skilled in the art will realize that there are many apparent variations that can be applied to the methods and systems described. Thus it may be appreciated that wireless communicator **100** may also be used in conjunction with audio I/O of laptop computer **200**. As such, a phone call may be initiated via wireless communicator **100**, using microphone **171** and speaker **175** for audio I/O. If wireless communicator **100** is attached into laptop computer **200** during the call then the audio I/O for the call switches over to microphone **271** and speakers **275**. I.e., the audio input of microphone **271** is channeled to wireless communicator **100**, and the audio output from wireless communicator **100** is channeled to speakers **275**. While wireless communicator **100** is attached to laptop computer **200**, wireless communicator **100** provides cellular connectivity, such as GSM connectivity, and laptop computer **200** provides a user interface. In addition to its microphone and speakers, the laptop computer's keyboard **280** and display **285**, and optionally a camera, may also be functional for use with the phone call.

When wireless communicator **100** is detached from laptop computer **200**, but in communication therewith via short range wireless communication, such as Bluetooth communication, then wireless communicator **100** acts as a Bluetooth earpiece for laptop computer **200**. In addition, wireless communicator **100** may be used for dialing.

In general, Bluetooth devices use a headset profile for defining properties of audio gateway devices and headset devices. An "audio gateway" serves as a gateway for audio input and output. A "headset" serves as the audio gateway's remote audio input and output mechanism. In accordance with an embodiment of the present invention, wireless communicator **100** is programmed to act as a Bluetooth earpiece, by using a headset profile that defines laptop computer **200** to be an audio gateway, and defines wireless communicator **100** to be a headset.

If wireless communicator **100** is detached from laptop computer **200** during the call, and not in wireless communication therewith, then the audio I/O for the call switches back to microphone **171** and speaker **175**.

It may also be appreciated that although the description above concerns a scenario where wireless communicator **100** provides connectivity for laptop computer **200**, the present invention applies to an opposite scenario where laptop computer **200** provides connectivity for wireless communicator **100**.

In the foregoing specification, the invention has been described with reference to specific exemplary embodiments thereof. It will, however, be evident that various modifications and changes may be made to the specific exemplary embodiments without departing from the broader spirit and scope of the invention as set forth in the appended claims. Accordingly, the specification and drawings are to be regarded in an illustrative rather than a restrictive sense.

What is claimed is:

1. A communication system comprising:

a cellular phone module comprising:

a microphone for providing audio input;

a speaker for providing audio output;

a connector for physically connecting the cellular phone module to a laptop computer port;

a modem for wirelessly connecting the cellular phone module to the laptop computer; and

a keypad for dialing an Internet-based phone call via the laptop computer; and

a laptop computer comprising:

a port for physically connecting said cellular phone module to the laptop computer;

a network adapter for Internet phone call communication;

a microphone for providing audio input during an ongoing Internet-based phone call, while said cellular phone module is physically connected to said laptop computer port;

at least one speaker for providing audio output during the ongoing Internet-based phone call, while said cellular phone module is physically connected to said laptop computer port;

a modem for wirelessly connecting said cellular phone module to the laptop computer; and

a communication bridge, for channeling audio input for the ongoing Internet-based phone call from said cellular phone module microphone to the laptop computer via said modem, and for channeling audio output for the ongoing Internet-based phone call from the laptop computer to said cellular phone module speaker, when said cellular phone module is physically disconnected from said laptop computer port during the ongoing Internet-based phone call, thereby enabling said cellular phone module to continue the ongoing Internet-based phone call wirelessly via said laptop computer,

wherein said laptop computer connects to the Internet via said cellular phone module, when said cellular phone module is physically connected to said laptop computer.

2. The communication system of claim **1** wherein said port comprises a USB port.

3. The communication system of claim **2** wherein said cellular phone module connects as a USB mass storage device for said laptop computer via said USB port.

4. The communication system of claim **3** wherein said communication bridge is stored on said cellular phone module, and is installed on said laptop computer from said cellular phone module when said cellular phone module is connected to said USB port.

5. The communication system of claim **1** wherein said laptop computer further comprises a wireless communication driver, and wherein said communication bridge comprises a connection tracker for detecting that said wireless communication driver is active.

6. The communication system of claim **5** wherein said wireless communication driver is a BLUETOOTH® driver.

7. The communication system of claim **6** wherein said communication bridge transmits BLUETOOTH® information from said laptop computer to said cellular phone module via said laptop computer port while said cellular phone module is connected to said laptop computer port, for use with

Bluetooth pairing of said laptop computer and said cellular phone module via said BLUETOOTH® driver when said cellular phone module is physically disconnected from said laptop computer port.

8. The communication system of claim **5** wherein said laptop computer further comprises a networking stack, and wherein said communication bridge is wedged between said wireless communication driver and said networking stack.

9. The communication system of claim **5** wherein said laptop computer further comprises a communication device class driver and a dial up networking class driver, and wherein said communication bridge operates above said communication device class driver and said dial up networking class driver.

10. The communication system of claim **9** wherein said communication device class driver and said dial up networking class driver operate above said wireless communication driver.

11. The communication system of claim **1** wherein said communication bridge instructs said laptop computer modem to transition to a low power state while said cellular phone module is connected to said port.

12. The communication system of claim **1** wherein said communication bridge channels audio input for the ongoing Internet-based phone call to said laptop computer microphone, and channels audio output for the ongoing Internet-based phone call to said laptop computer at least one speaker, when said cellular phone module is physically re-connected to said laptop computer port during the ongoing Internet-based phone call, thereby enabling said laptop computer to continue the ongoing Internet-based phone call.

13. The communication system of claim **1** wherein said laptop computer is connected to the Internet during the ongoing Internet-based phone call via either or both of a router and a modem.

14. A method of communication, comprising:

initiating an Internet-based phone call via a laptop computer in response to keypad dialing instructions received from a cellular phone module;

using microphone and speaker of the laptop computer to conduct the Internet-based phone call;

detecting that the cellular phone module is physically disconnected from the laptop computer port during the ongoing Internet-based phone call via the laptop computer;

in response to said detecting, channeling audio input for the ongoing Internet-based phone call from the cellular phone module to the laptop computer;

in response to said detecting, channeling audio output for the ongoing Internet-based phone call from the laptop computer to the cellular phone module via a wireless modem of the laptop computer, thereby enabling the cellular phone module to continue the ongoing Internet-based phone call via the laptop computer;

further detecting that the cellular phone module is physically connected to the laptop computer port; and

in response to said further detecting, enabling the laptop computer to connect to the Internet via the cellular phone module.

15. The method of claim **14**, further comprising transmitting BLUETOOTH® information from the laptop computer to the cellular phone module while the cellular phone module is connected to the laptop computer, for use with Bluetooth pairing of the laptop computer and the cellular phone module when the cellular phone module is physically disconnected from the laptop computer.

16. The method of claim **14** further comprising:

further detecting that the cellular phone module is physically re-connected to the laptop computer port during the ongoing Internet-based phone call;

in response to said further detecting, channeling audio input for the ongoing Internet-based phone call to the laptop computer; and

in response to said further detecting, channeling audio output for the ongoing Internet-based phone call to the laptop computer, thereby enabling the laptop computer to continue the ongoing Internet-based phone call.

17. The method of claim **14** further comprising instructing the cellular phone module modem to transition to a low power state while the cellular phone module is connected to the laptop computer.

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