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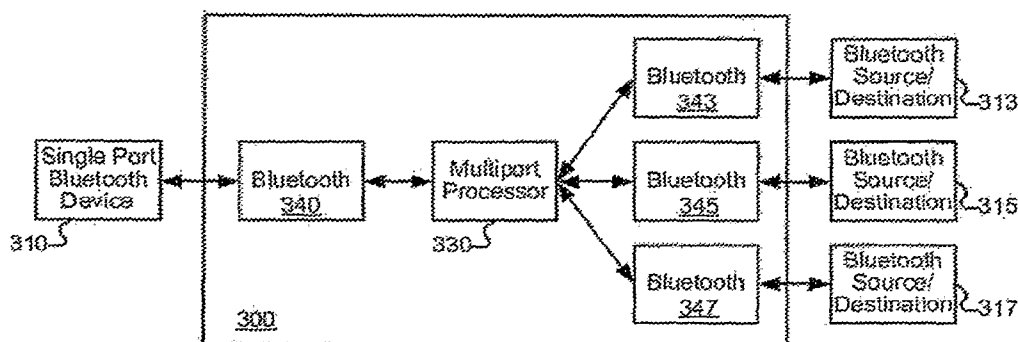
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(57) Abstract: Various systems and methods for distributing multiple Bluetooth data streams are discussed herein. As one example, a method for communicably coupling a single point Bluetooth device to multiple Bluetooth devices is taught. The method includes providing a multiport Bluetooth distributor that includes two or more Bluetooth protocol interfaces and a multiport processor. The multiport processor is operable to communicably couple one of the Bluetooth protocol interfaces to another Bluetooth protocol interface. The method further includes identifying at least two Bluetooth devices within range of the multiport Bluetooth distributor, and assembling a service offering based on the identified Bluetooth devices. The service offering includes a plurality of service types including at least a first service type and a second service type.

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Systems and Methods for Multiport Communication Distribution

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] The present application claims priority to (is a non-provisional filing of) US Provisional Patent Application No. 60/806,610, entitled "SYSTEMS AND METHODS FOR MOBILE DATA STORAGE AND ACQUISITION" and filed July 5, 2006 by Al-Refaee et al.; US Provisional Patent Application No. 60/829,007, entitled "SYSTEMS AND METHODS FOR MOBILE DATA STORAGE AND ACQUISITION" and filed October 11, 2006 by Al-Refaee et al.; and US Provisional Patent Application No. 60/869,453, entitled "SYSTEMS AND METHODS FOR MOBILE DATA STORAGE AND ACQUISITION" and filed December 11, 2006 by Al-Refaee et al. Each of the aforementioned applications is assigned to an entity common hereto and is incorporated herein by reference for all purposes.

[0002] Further, the present application is related to the following patent applications filed on a date even herewith: PCT Application No. _____ (Attorney Reference No. AGERE-001210PCT), entitled "Systems and Methods for Implementing Hands Free Operational Environments" and filed by Bahram et al.; PCT Application No. _____ (Attorney Reference No. AGERE-001230PCT), entitled "Systems and Methods for Power Management in Relation to a Wireless Storage Device" and filed by Warren et al.; PCT Application No. _____ (Attorney Reference No. AGERE-001240PCT), entitled "Systems and Methods for Enabling Consumption of Copy-Protected Content Across Multiple Devices" and filed by Al-Refaee et al.; PCT Application No. _____ (Attorney Reference No. AGERE-001260PCT), entitled "Systems and Methods for Multi-user Access to a Wireless Storage Device" and filed by Al-Refaee et al.; and PCT Application No. _____ (Attorney Reference No. AGERE-001270PCT), entitled "Systems and Methods for Mobile Data Storage and Acquisition" and filed by Warren et al. All of the aforementioned related applications are assigned to an entity common hereto and are incorporated herein by reference for all purposes.

BACKGROUND OF THE INVENTION

[0003] The present invention is generally related to devices and methods for distributing data, and in particular to systems and methods for distributing data in a wireless mobile environment.

[0004] A variety of wireless communication protocols have been developed over the years including BluetoothTM and Wi-Fi. Each of the protocols was developed with an eye toward a particular end user segment that was to be served. Thus, for example, Wi-Fi uses radio frequency transmission in a way that provides high bandwidth transfer rates with a relatively high power consumption and relatively complex setup requirements. These criteria were selected to address the current home and office networking requirements. In contrast, BluetoothTM uses the same radio frequency transmission approach, but offers lower bandwidth and power consumption. Further, BluetoothTM offers a very simple setup where a user need not worry about network addresses, permissions and other considerations that must be addressed when configuring a Wi-Fi network. Typically, a user may implement both a Wi-Fi and a BluetoothTM network and use the two protocols simultaneously to provide a broad range of networking capability.

[0005] In part because of the simplicity of BluetoothTM networks, they have found broad acceptance in consumer electronics devices such as cellular telephones. As one example, many cellular telephones include a single connection BluetoothTM port that allows the cellular telephone to communicate with a single peripheral device such as a wireless headset. Thus, such BluetoothTM devices provide a low cost, low bandwidth single point to single point connection. In some cases, however, there is a desire to have more than a single point to a single point connection. However, extending BluetoothTM to serve additional paths would increase the costs of a large number of consumer electronic devices where the need is limited to only a few of the consumer electronic devices.

[0006] Hence, for at least the aforementioned reasons, there exists a need in the art for advanced systems and methods for extending the utility of the BluetoothTM protocol that does not generally increase the costs of consumer devices implementing BluetoothTM functionality.

BRIEF SUMMARY OF THE INVENTION

[0007] The present invention is generally related to devices and methods for distributing data, and in particular to systems and methods for distributing data in a wireless mobile environment.

[0008] Various embodiments of the present invention provide storage devices that include three or more Bluetooth protocol interfaces and a multiport processor. The multiport processor is operable to communicably couple one of the Bluetooth protocol interfaces to one or more of the other Bluetooth protocol interfaces. In some instances of the aforementioned embodiments, one or more of the Bluetooth protocol interfaces include a FIFO memory. Such a FIFO memory provides an ability to smooth data transfer between Bluetooth protocol interfaces. In some cases of the aforementioned embodiments, communicably coupling a Bluetooth protocol interface to another Bluetooth protocol interface is done based at least in part on a data type received via the connected Bluetooth protocol interface and a service type offered by a Bluetooth device communicably coupled to another of the connected Bluetooth protocol interface. In one particular case, the aforementioned service type may be, but is not limited to, an audio player, a video player, a graphics display, a data storage element, an audio receiver, and a video receiver. In various instances of the aforementioned embodiments, the storage device further includes a hard disk drive.

[0009] Other embodiments of the present invention provide methods for communicably coupling a single point Bluetooth device to multiple Bluetooth devices. Such methods include providing a multiport Bluetooth distributor that has at least two Bluetooth protocol interfaces and a multiport processor. The multiport processor is operable to communicably couple one of the Bluetooth protocol interfaces to another of the Bluetooth protocol interfaces. The methods further include identifying at least two Bluetooth devices within range of the multiport Bluetooth distributor, and assembling a service offering based on the identified Bluetooth devices. The service offering includes a plurality of service types. A Bluetooth device offering one service is associated with one Bluetooth protocol interface, and another Bluetooth device offering another service is associated with another Bluetooth protocol interface.

[0010] In some cases, the methods further include receiving a transmission from one of the Bluetooth devices. The transmission includes a data set. The methods further include identifying the type of communication received from one of the Bluetooth devices; identifying a recipient device, that is one of the identified Bluetooth devices that is capable of receiving and utilizing the type of communication; and transmitting the data set to the recipient device. In some particular cases, the Bluetooth devices may be, but are not limited to, an audio player, a video player, a graphics display, a data storage device, an audio receiver, and a video receiver.

[0011] Various embodiments of the present invention provide an intelligent data repository that is capable of binding to a variety of devices and performing data storage and retrieval in relation to the bound devices. Such an approach increases the autonomy of the data repository when compared with the traditional computer architecture where the data repository is completely governed by a processor in the local device. Indeed, in some cases, such an approach eliminates or reduces the need for sophisticated processor control in various interoperating consumer devices that are bound to the intelligent data repository. Thus, in contrast to the standard architecture where a local processor oversees operation, various embodiments of the present invention provide control from the central repository directing a processor local to a particular device.

[0012] In some cases of the aforementioned embodiments, transmission from the intelligent data repository is accomplished via a wireless interface allowing for increased interoperability and user friendliness. In particular instances, a single antenna is provided such that wireless communication is limited to one interoperable device at a time. In other instances, multiple antennae are provided such that interoperability can be performed in relation to multiple devices at any given time. In yet other instances, a single antenna is used along with a time division multiplexer circuit that allows the antenna to operate in relation to multiple devices in a seemingly simultaneous fashion.

[0013] In various cases of the aforementioned embodiments, the intelligent data repository is a highly mobile stand alone device with capability to auto-detect, bind and authorize devices that come into proximity to the intelligent repository. As such, various instances of the aforementioned embodiments are deployed as stand alone devices that may be used in relation to any number of different interoperable devices. In other cases, an intelligent repository in

accordance with one or more embodiments of the present invention is deployed in relation to a particular consumer device. For example, an intelligent repository may be deployed as part of a cell phone. As such, the ubiquitous nature of a cell phone is attributed to the intelligent data repository. Based on the disclosure provided herein, one of ordinary skill in the art will appreciate a myriad of devices with which an intelligent data repository in accordance with one or more embodiments of the present invention may be deployed.

[0014] This summary provides only a general outline of some embodiments according to the present invention. Many other objects, features, advantages and other embodiments of the present invention will become more fully apparent from the following detailed description, the appended claims and the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] A further understanding of the various embodiments of the present invention may be realized by reference to the figures which are described in remaining portions of the specification. In the figures, like reference numerals are used throughout several to refer to similar components. In some instances, a sub-label consisting of a lower case letter is associated with a reference numeral to denote one of multiple similar components. When reference is made to a reference numeral without specification to an existing sub-label, it is intended to refer to all such multiple similar components.

[0016] Fig. 1 depict various UMCS devices in accordance with some embodiments of the present invention;

[0017] Fig. 2 depicts an exemplary UMCS device in accordance with some embodiments of the present invention;

[0018] Fig. 3 shows a multiport Bluetooth data distribution system in accordance with some embodiments of the present invention;

[0019] Figs. 4a-4b show multiport Bluetooth routers in accordance with various embodiments of the present invention;

[0020] Fig. 5 is a flow diagram depicting operation of a multiport Bluetooth data distribution system in accordance with one or more embodiments of the present invention;

[0021] Figs. 6a-6b shows a graphical cross-connect menu that may be used in relation to various embodiments of the present invention; and

[0022] Fig. 7 is a flow diagram depicting operation of another multiport Bluetooth data distribution system in accordance with one or more embodiments of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0023] The present invention is generally related to devices and methods for distributing data, and in particular to systems and methods for distributing data in a wireless mobile environment.

[0024] Turning to Fig. 1, a diagram depicts an exemplary content usage network 100 in accordance with various embodiments of the present invention. Exemplary content usage network 100 includes a UMCS 110 at the core thereof. UMCS 110 is able to receive content from one or more online and wireless content providers as well as from various self maintained application devices such as, for example, audio recorders and video recorders. In some cases, UMCS 110 may be intermittently wired to a personal computer 115 via a cable 117. In such cases, UMCS 110 may be configured via personal computer 115 using the standard I/O interfaces associated with personal computer 115.

[0025] Wireless network 120 may be any wireless network known in the art. Thus, for example, wireless network 120 may be, but is not limited to, a BluetoothTM network as is known in the art. As indicated above, the word "Bluetooth" is a trademark of Bluetooth SIG, Inc. For clarity, later use of the word Bluetooth is done without the customary trademark designation. It should be noted that while UMCS 110 may be configured across wireless network 120 using the user interface of another application device, and it may also be configured using other approaches. Thus, for example, UMCS 110 may be self configuring. In such a case, UMCS 110 is implemented with enough intelligence to auto detect an available wireless network as well as devices attached via the wireless network. As a particular example, UMCS 110 may be implemented such that when power is applied to the device it automatically scans for Bluetooth

devices that are within range of UMCS 110. Based on the detected Bluetooth devices, UMCS 110 may form a service offering as is more fully discussed below.

[0026] UMCS 110 is capable of interacting with various devices and classes of devices via wireless network 120. For example, in some cases, UMCS 110 is operable to interact directly with UMCS enabled application devices via wireless network 120. Such UMCS enabled application devices include capability to authenticate to UMCS 110 and to accept and transfer information from/to UMCS 110, and to provide digital rights management whereby content is secured not only in the transfer between UMCS 110 and the UMCS enabled application device, but is also maintained secure within the UMCS enabled application device. In the situation where wireless network 120 is a Bluetooth network, the aforementioned UMCS enabled application devices would include Bluetooth capability.

[0027] In various cases, UMCS 110 is operable to interact directly with non-UMCS enabled application devices via wireless network 120. In such cases, either UMCS 110 includes capability to tailor output and receive input from the non-UMCS enabled application device, or the non-UMCS enabled application devices may interact with UMCS 110 via a specialized UMCS converter that is tailored for operation with a class of devices. Thus, for example, where wireless network 120 is a Bluetooth network, the UMCS converter may be enabled to receive from and provided information to a non-UMCS enabled application device via any one of a number of communication approaches, and to communicate the information to/from UMCS 110 using a Bluetooth protocol. As an example, UMCS 110 may interact with digital audio devices (e.g., a digital audio player 151 and a digital audio recorder 152) via a UMCS digital audio converter 150. As another example, a cellular telephone 161 or personal digital assistant (not shown) may interact with UMCS 110 either directly or via a UMCS audio/video converter 160. As yet another example, UMCS 110 may interact with video devices (e.g., a set top box 166, a video cassette player 167, a digital video recorder 168 and a television 169) via a UMCS digital video converter 165. As yet a further example, UMCS 110 may interact with still image devices such as a digital still camera 171 or a printer (not shown) via a UMCS digital image converter 170. As yet another example, UMCS 110 may interact with a GPS receiver/display 176 via a UMCS GPS converter 175.

[0028] In various cases, UMCS 110 is operable to interact directly with non-UMCS enabled application devices via a UMCS composite converter 140. UMCS composite converter 140 is operable to provide for UMCS interaction with multiple classes of recipient devices. Thus, for example, where wireless network 120 is a Bluetooth network, UMCS composite converter 140 may be enabled to receive from and provided information to different classes of non-UMCS enabled application devices via any one of a number of communication approaches, and to communicate the information to/from UMCS 110 using a Bluetooth protocol. As an example, UMCS composite converter 140 may couple UMCS 110 to, for example, a digital audio player 141, a digital video recorder 142, a television 143, a set top box 144, a digital still camera 145, a video cassette player 146, a digital audio recorder 147, a cellular telephone 148, and a GPS receiver 149, or some combination of the aforementioned device classes. In such cases, decoding of content accessed from a storage medium included in UMCS 110 is done using a decoder provided in UMCS composite converter 140. Thus, the content is unwrapped by UMCS 110 and the unwrapped content is provided to the UMCS composite converter 140 via wireless network 120. UMCS composite converter 140 decodes the content and provides it to the appropriate recipient device while at the same time assuring that any demanded digital rights management is maintained. In some cases, UMCS composite converter 140 may be implemented as a dongle associated with one or more recipient devices.

[0029] Further discussion of content usage networks including UMCS devices is provided in the patent application entitled "Systems and Methods for Mobile Data Storage and Acquisition" that was previously incorporated herein by reference for all purposes.

[0030] Turning to Fig. 2, an exemplary UMCS 200 in accordance with some embodiments of the present invention is depicted. As shown, UMCS 200 includes a storage component 210. Storage component 210 may be, but is not limited to, a hard disk drive, a block of flash memory, and InPhase Holographic memory, Random Access Memory, combinations of the aforementioned, and/or the like. Based on the disclosure provided herein, one of ordinary skill in the art will recognize other memory types that may be utilized in accordance with various embodiments of the present invention. UMCS 200 further includes a file system manager 220 that is operable to control reads from and writes to storage component 210. UMCS 200 includes a Bluetooth wireless interface. Bluetooth wireless interfaces provide for short-range

communications intended to replace the cables connecting portable and/or fixed electronic devices. The key advantages of Bluetooth wireless interfaces are robustness, low power, and low cost. A typical Bluetooth interface includes an antenna 290 that operates as an RF transceiver, a baseband protocol processor 240, and a Bluetooth enhanced data rate PHY 250. A Bluetooth interface offers services that enable the connection of Bluetooth enabled devices, and the exchange of a variety of data classes between the connected devices. The Bluetooth interface includes one or more Bluetooth ports and software/firmware that allows UMCS 200 to operate as a hub/router for all connections in and out of storage component 210, and as more fully described below, as a hub/router for a variety of connected Bluetooth devices that may or may not interact with storage component 210. UMCS 200 may also be configured via the above mentioned Bluetooth interface.

[0031] UMCS 200 also includes a flash or SDRAM cache 230 that may be used to reduce latency in accessing storage component 210. Where storage component 210 is implemented in Flash or SDRAM, cache 230 may be eliminated. The combination of storage component 210 and a flash cache may be used to reduce power consumption by UMCS 200. Various approaches for reducing power consumption are discussed in the patent application entitled “Systems and Methods for Power Management in Relation to a Wireless Storage Device” that was previously incorporated herein by reference for all purposes. Yet further, UMCS 200 includes a USB port 260 that allows for access to storage component 210 and/or configuration of UMCS 200. UMCS 200 may also include a power controller 270 and a mobile power source 280. Baseband protocol processor 240 may include ports and software/firmware that allows it to operate as a hub/router for all connections in and out of storage component 210.

[0032] In some embodiments of the present invention, UMCS 200 is augmented to include a multiport Bluetooth router. Such a multiport Bluetooth router allows for the cross connect of a number of Bluetooth devices. This can be particularly useful where a number of single port Bluetooth devices are to be used together in an overall system. Thus, as just one example, a typical cellular telephone includes a Bluetooth interface capable of connecting to a single Bluetooth device at a time. This interface has traditionally been used to transfer audio data to/from a single headset. It may be desirable, however, to not only transfer audio data to/from a headset, but to also provide an audio output to a car stereo, and to receive dialing information

from a personal digital assistant. Such a configuration is not practical as the above mentioned cellular telephone can only support one single Bluetooth connection at a time, and changing between devices connected via the single Bluetooth port is cumbersome. Where the multiport Bluetooth router is incorporated into UMCS 200, UMCS 200 may be connected to the cellular telephone via one Bluetooth protocol interface supported by UMCS 200, and that Bluetooth protocol interface may be cross connected to one or more other Bluetooth protocol interfaces that are in turn connected to respective Bluetooth devices. This allows for practical implementation the above mentioned exemplary configuration involving the cellular telephone, car stereo and personal digital assistant. Among other things, such an approach offers an advantage in a wireless communications market skewing toward low-priced, basic-featured cellular telephones. Based on the disclosure provided herein, one of ordinary skill in the art will recognize other applications for multiport Bluetooth routers in accordance with one or more embodiments of the present invention. Further, it should be noted that while multiport Bluetooth routers in accordance with various embodiments of the present invention may be incorporated with a UMCS device, other embodiments of the present invention provide multiport Bluetooth routers that do not include one or more features of a UMCS device as described herein.

[0033] Turning to Fig. 3, a multiport Bluetooth router 300 in accordance with one or more embodiments of the present invention is depicted. As previously discussed, multiport Bluetooth router 300 may be integrated into a UMCS device. Alternatively, multiport Bluetooth router 300 may be integrated into another electronic device, or may be developed as a stand alone device. Based on the disclosure provided herein, one of ordinary skill in the art will recognize a variety of uses and implementations for multiport Bluetooth router 300. Multiport Bluetooth router 300 includes a number of Bluetooth pipes 340, 343, 345, 347 that are each coupled to a multiport processor 330. Each of the Bluetooth pipes includes a Bluetooth protocol interface that allows for the transfer of data to/from a connected Bluetooth device. For example, Bluetooth pipe 343 is communicably coupled to a Bluetooth source/destination 313. As used herein, a “Bluetooth source/destination” is any device that is capable of transferring data to and/or from another Bluetooth device. Similarly, Bluetooth pipe 345 is communicably coupled to a Bluetooth source/destination 315, and Bluetooth pipe 347 is communicably coupled to a Bluetooth source/destination 317. Bluetooth pipe 340 is communicably coupled to a single port Bluetooth device 310. As used herein, a “single port Bluetooth device” is any device that supports

connection with only one other Bluetooth device at a time. An example of such a single port device is a low cost cellular telephone that is implemented with only a single Bluetooth port. As will be appreciated by one of ordinary skill in the art upon reading this disclosure, low cost single port Bluetooth devices may be extended to function as multiport Bluetooth devices where a stand alone multiport Bluetooth router/hub is used in concert with the single port device. It should be noted that while multiport Bluetooth router 300 is shown with four Bluetooth pipes, that other implementations of a multiport Bluetooth router may be implemented with more than four or fewer than four Bluetooth pipes in accordance with different embodiments of the present invention.

[0034] Turning to Fig. 4a, a detailed block diagram of a multiport Bluetooth router 400 in accordance with various embodiments of the present invention is shown. Multiport Bluetooth router 400 includes a multiport processor 450, a random access memory 480, a flash memory 492 including an enumeration of a preferred service environment 490, and an enumeration of preferred devices 495, a number of Bluetooth pipes (respectively outlined by dashed lines) 420, 430, 440, and each electrically coupled to a respective RF transceiver 409, 410, 411. Bluetooth pipes 420, 430, 440 each offer a Bluetooth protocol interface that includes status indicators, FIFOs, and a transceiver. In particular, Bluetooth pipe 420 includes a Bluetooth protocol interface with a Bluetooth receiver 421 and a Bluetooth transmitter 422. A receiver status indicator 423 indicates status from Bluetooth receiver 421 to multiport processor 450, and a FIFO 424 smooths data transfer from Bluetooth receiver 421 to multiport processor 450. A transmitter status indicator 425 indicates status from multiport processor 450 to Bluetooth transmitter 422, and indicates status to multiport processor 450 from Bluetooth transmitter 422. A FIFO 426 smooths data transfer from multiport processor 450 to Bluetooth transmitter 422. Similarly, Bluetooth pipe 430 includes a Bluetooth protocol interface with a Bluetooth receiver 431 and a Bluetooth transmitter 432. A receiver status indicator 433 indicates status from Bluetooth receiver 431 to multiport processor 450, and a FIFO 434 smooths data transfer from Bluetooth receiver 431 to multiport processor 450. A transmitter status indicator 435 indicates status from multiport processor 450 to Bluetooth transmitter 432, and indicates status to multiport processor 450 from Bluetooth transmitter 432. A FIFO 436 smooths data transfer from multiport processor 450 to Bluetooth transmitter 432. Bluetooth pipe 440 includes a Bluetooth protocol interface with a Bluetooth receiver 441 and a Bluetooth transmitter 442. A

receiver status indicator 443 indicates status from Bluetooth receiver 441 to multiport processor 450, and a FIFO 444 smoothes data transfer from Bluetooth receiver 441 to multiport processor 450. A transmitter status indicator 445 indicates status from multiport processor 450 to Bluetooth transmitter 442, and indicates status to multiport processor 450 from Bluetooth transmitter 442. A FIFO 446 smoothes data transfer from multiport processor 450 to Bluetooth transmitter 442.

[0035] Multiport processor 450 provides for cross-connecting the above mentioned Bluetooth pipes. In some instances of the embodiment, multiport processor 450 is a microprocessor that executes software instructions that cause it to perform the cross-connect function discussed above. The software instructions include, but are not limited to, a path multiplexing module 453, a communication matrix control module 455, and a Bluetooth registration control module 457. Bluetooth registration control module 457 includes software instructions executable to scan for and enumerate Bluetooth devices within communication range of multiport Bluetooth router 400. Communication matrix control module 455 includes software instructions executable to direct the transfer of information to/from Bluetooth pipes 420, 430, 440, and combinations thereof. Path multiplexing module 453 includes software instructions executable to provide for the appropriate data transfer between FIFOs and/or Random Access Memory 480. It should be noted that while multiport Bluetooth router 400 is shown with three Bluetooth pipes, that other implementations of a multiport Bluetooth router may be implemented with more than three or fewer than three Bluetooth pipes in accordance with different embodiments of the present invention.

[0036] Turning to Fig. 4b, a detailed block diagram of a multiport Bluetooth router 401 in accordance with various other embodiments of the present invention is shown. Multiport Bluetooth router 401 is similar to Bluetooth router 400, except that a single antenna is used to support multiple Bluetooth pipes that are time division multiplexed by a time division multiplexed Bluetooth receiver/transmitter 452. In the case of Bluetooth router 401, three Bluetooth pipes 428, 438, 448 each using a common time division multiplexed Bluetooth receiver/transmitter 452 and a common antenna 412. Bluetooth pipes 428, 438, 448 each offer a Bluetooth protocol interface that includes status indicators, FIFOs, and a multiplexed transceiver. In operation, the transmission stream to/from antenna 412 is organized as packets or time slices.

As is known in the art, time division multiplexed Bluetooth receiver/transmitter 452 organizes data received and transmitted using antenna 412 into a sequence of data packages. The incoming data packages are directed to the input FIFO 424, 434, 444 of the appropriate Bluetooth pipe, and updates the status indicator for the same Bluetooth pipe. On the other side, data from the output FIFOs 426, 436, 446 are inserted into the appropriate packets by time division multiplexed Bluetooth receiver/transmitter 452 and passed to antenna 412 where the data is transmitted. Again, it should be noted that while multiport Bluetooth router 401 is shown with three Bluetooth pipes, that other implementations of a multiport Bluetooth router may be implemented with more than three or fewer than three Bluetooth pipes in accordance with different embodiments of the present invention.

[0037] As communications are ongoing, one or more Bluetooth devices share a physical radio frequency supported by antenna 412, and are synchronized to a common clock and frequency hopping pattern as is more fully discussed in the Bluetooth specification(s). The Bluetooth device providing the frequency hopping reference is referred to as the master device, and all other Bluetooth devices are referred to as slave devices. A group of Bluetooth devices synchronized to the same clock may be referred to as a piconet. Within the piconet, data is transferred between devices via multiport Bluetooth router 401 as detailed in the Bluetooth specification(s).

[0038] The overall operation of both multiport Bluetooth router 400 and multiport Bluetooth router 401 is discussed with specific reference to multiport Bluetooth router 400. It should be noted that from an operational standpoint, the only difference is the use of multiple independent Bluetooth pipes of multiport Bluetooth router 400 compared with the time division multiplexed Bluetooth pipes of multiport Bluetooth router 401. Thus, based on an operational discussion of multiport Bluetooth router 400, one of ordinary skill will appreciate the operation of multiport Bluetooth router 401.

[0039] In operation, multiport Bluetooth router 400 scans for Bluetooth devices that are in communication range. Once a device is identified, an inquiry is issued to request identification information about the identified Bluetooth devices. In response to the inquiries, the identified Bluetooth devices provide identification and status information. This identification and status information is assembled into a list by Bluetooth registration control module 457. The

identification and status information may include, but is not limited to, the Device Name, the Device Class, List of Services supported by the device, and Technical Information about the device. The technical information may include, but is not limited to, device features, manufacturer, Bluetooth specification compliance, and clock offset.

[0040] The services offered by the various devices are considered by communication matrix control module 455 to assemble a service offering. In some cases, a preferred service offering or environment is programmed into flash memory 490, and where possible that service offering is assembled from the identified Bluetooth devices. Thus, for example, where a number of audio output devices are identified as available, one of the multiple identified devices that provides the particular service is selected. In some cases, a list of preferred devices maintained in flash memory 495 is used to select between multiple available devices.

[0041] In some cases, the preferred service offering may identify a particular set of Bluetooth profiles that would be desirable. Such Bluetooth profiles are known in the art and are used to define the applications available through use of a particular Bluetooth application device. Bluetooth profiles are general behaviors through which Bluetooth enabled devices communicate with other Bluetooth application devices. Bluetooth technology defines a wide range of profiles that describe many different types of use cases. Such Bluetooth profiles define, for example, dependencies on other profiles, suggested user interface formats, and specific parts of the Bluetooth protocol stack used by the profile.

[0042] Some examples of Bluetooth profiles include Advanced Audio Distribution Profile (A2DP), Audio / Video Control Transport Protocol (AVCTP), Audio / Video Distribution Transport Protocol (AVDTP), Audio/Video Remote Control Profile (AVRCP), Basic Imaging Profile (BIP), Basic Printing Profile (BPP), Common ISDN Access Profile (CIP), Cordless Telephony Profile (CTP), Dial-up Networking Profile (DUN), Extended Service Discovery Profile (ESDP), Fax Profile (FAX), File Transfer Profile (FTP), Generic Access Profile (GAP), General Audio/Video Distribution Profile (GAVDP), Generic Object Exchange Profile (GOEP), Hands-Free Profile (HFP), Hard Copy Cable Replacement Profile (HCRP), Headset Profile (HSP), Human Interface Device Profile (HID), Intercom Profile (ICP), Object Exchange (OBEX), Object Push Profile (OPP), Personal Area Networking Profile (PAN), RFCOMM, Service Discovery Protocol (SDP), Service Discovery Application Profile (SDAP), SIM Access

Profile (SAP), Serial Port Profile (SPP), Synchronization Profile (SYNC), Telephony Control Specification (TCS-Binary or TCP), Video Distribution Profile (VDP), WAP Over Bluetooth Profile (WAP). Other Bluetooth profiles exist, and yet others will be developed. Such additional Bluetooth profiles may also be used in accordance with the various embodiments of the present invention.

[0043] Once the preferred device is selected, it is paired with one of the Bluetooth pipes (i.e., Bluetooth protocol interfaces). Pairing between the Bluetooth device and the selected Bluetooth protocol interface may be accomplished by sharing a passkey (either automatically or by user input) between the paired devices. In some cases, encrypted or non-encrypted data transfer between the paired devices may be selected. In addition to pairing or binding the selected Bluetooth device to multiport Bluetooth router 400, a “recipient” (i.e., a device supporting one or more services of the selected device) may be identified by communication matrix control module 455 to transfer information to/from the selected device. Together, the selected devices provide a service offering (i.e., a collection of devices providing a cross section of desired services). This service offering will then be used to perform the functions that are to occur in a particular communication system. The service offering is dynamically modified as one or more Bluetooth devices may come in and out of range of multiport Bluetooth router 400. Once the service offering is complete, path multiplexing module 453 then directs transfer of data received from one Bluetooth device in the service offering to a paired Bluetooth device in the service offering.

[0044] Turning to Fig. 5, a flow diagram 500 shows a method for preparing a service offering and establishing a cross-connect between devices included in the service offering. Following flow diagram 500, a multiport Bluetooth router 400 scans for devices that are within communication range (block 510). The scan process is performed using the Bluetooth device discovery procedures known in the art. Such device discovery procedures may include multiport Bluetooth router 400 transmitting inquiry messages and listening for responses in order to discover the other Bluetooth enabled devices within the coverage area. As each Bluetooth device responds to the inquiry, it is assembled in a list of available devices (block 520). The list of devices not only identifies the device, but may also include the services supported by the device. In some cases, the device is also identified by one or more profiles that it supports. Thus, for example, the supported profiles may be one or more of Some examples of: (1)

Advanced Audio Distribution Profile (A2DP), (2) Audio / Video Control Transport Protocol (AVCTP), (3) Audio / Video Distribution Transport Protocol (AVDTP), (4) Audio/Video Remote Control Profile (AVRCP), (5) Basic Imaging Profile (BIP), (6) Basic Printing Profile (BPP), (7) Common ISDN Access Profile (CIP), (8) Cordless Telephony Profile (CTP), (9) Dial-up Networking Profile (DUN), (10) Extended Service Discovery Profile (ESDP), (11) Fax Profile (FAX), (12) File Transfer Profile (FTP), (13) Generic Access Profile (GAP), (14) General Audio/Video Distribution Profile (GAVDP), (15) Generic Object Exchange Profile (GOEP), (16) Hands-Free Profile (HFP), (17) Hard Copy Cable Replacement Profile (HCRP), (18) Headset Profile (HSP), (19) Human Interface Device Profile (HID), (20) Intercom Profile (ICP), (21) Object Exchange (OBEX), (22) Object Push Profile (OPP), (23) Personal Area Networking Profile (PAN), (24) RFCOMM, Service Discovery Protocol (SDP), (25) Service Discovery Application Profile (SDAP), (26) SIM Access Profile (SAP), (27) Serial Port Profile (SPP), (28) Synchronization Profile (SYNC), (29) Telephony Control Specification (TCS-Binary or TCP), (30) Video Distribution Profile (VDP), (31) WAP Over Bluetooth Profile (WAP). Other Bluetooth profiles exist, and yet others will be developed. Such additional Bluetooth profiles may also be used in accordance with the various embodiments of the present invention.

[0045] The following Table 1 is an exemplary list of devices identified in an inquiry performed by multiport Bluetooth router 400.

Number	Device Name	Profile(s)	Services Supported
1	Cellular Phone	GAP GAVDP	Voice Transmission (Cell Network)
			Audio Input (Microphone)
			Audio Output (Speaker)
			Graphical Output (Display)
2	Car Stereo	GAVDP	Audio Output (Speaker)
			Graphical Output (Display)
3	PDA	GAP GAVDP A2DP AVRCP AVDTP AVCTP	Graphical Output (Display)
			Audio Input (Microphone)
			Data Storage (Memory)
			Voice Recognition Number Selector
4	GPS	GAP	Location Data Output
5	Headset	HSP GAVDP	Audio Input (Microphone)
			Audio Output (Speaker)
6	MP3 Player	GAVDP	Audio Input (Microphone)
			Audio Output (Speaker)

Table 1 – List of Identified Devices

It should be noted that the enumerated profiles and device names are merely exemplary. Based on the disclosure provided herein, one of ordinary skill in the art will recognize a variety of device names and/or profiles that may be utilized in accordance with one or more embodiments of the present invention.

[0046] The list of offered services is used to determine devices that will be communicably coupled to multiport Bluetooth router 400 in an effort to offer a broad range of services (block 530). In some cases, a user of multiport Bluetooth router 400 has programmed it to include a preferred service environment (e.g., flash memory 490). Where such is available, devices providing the services identified in the preferred services environment are selected for inclusion. Further, in some cases, a user programs multiport Bluetooth router 400 to include a list of preferred devices (e.g., flash memory 495). Thus, for example, the cellular telephone and the car stereo may be included in the preferred device list. Where available, the preferred device list is used to select devices for connection to multiport Bluetooth router 400. As an example, where the preferred services environment enumerates an Audio Input service, an Audio Output service,

a Voice Transmission service, a Data Storage Service and a Voice Recognition Number Selector service, devices offering those services are selected. At the outset, the preferred devices are selected. This provides the cellular telephone and the car stereo together providing the desired Audio Input service, Audio Output service, and Voice Transmission service. In addition, the PDA is selected as it offers the desired Data Storage Service and a Voice Recognition Number Selector service. The assembled services constitute the service offering. Each of the selected devices (in this case, the cellular telephone, the car stereo and the PDA) are selected to be communicably coupled to respective Bluetooth protocol interfaces of multiport Bluetooth router 400 (block 540). With this in place, a programmed option relying on the configured communication system can be executed effectively.

[0047] The programmed option first causes the communication matrix to be established (block 550). This includes selecting the service from the appropriate devices to act as a supplier of certain data types and/or a recipient device for other data types. Once this is done, appropriate cross connection using multiport processor 450 can be implemented. Thus, for example, where the programmed option is an in car telephone system, the following available services may be utilized: the Voice Transmission Service of the cellular telephone, the Audio Output service of the car stereo, and the Audio Input service and Voice Recognition Number Selector service of the PDA. Thus, communication matrix control module 455 establishes that Audio Output data received by multiport Bluetooth router 400 is routed to the car stereo, all audio input data is routed to the cellular telephone, and telephone number data is routed to the cellular telephone. With this system design, the selected devices are bound or paired to the respective Bluetooth protocol interfaces of multiport Bluetooth router 400 (block 560). With this in place, the communication is established to receive and initiate telephone calls in the car environment. It should be noted that the preceding environment is merely exemplary and that based on the disclosure provided herein, one of ordinary skill in the art will recognize a myriad of communication environments and/or applications that may be developed which rely on multiport Bluetooth router 400 to establish a communication network.

[0048] In other embodiments of the present invention, a simplified like profile to like profile connection can be established. In such a case, Bluetooth router 400 supports a number of different profiles. Thus, Bluetooth router 400 is able to bind itself to the various devices

identified in Table 1 above. Once bound, cross-connections can then be established. Where only two of each profiles are identified to Bluetooth router 400, a logical connection can be automatically made. Alternatively, where more than two of the same profiles exist, a preferred cross-connect can be applied based on pre-programmed desires of a user. This is the case in the example of Table 1 where a simple cross-connect between GAVDP and GAVDP would lead to a confusion of cross connected devices. As yet another alternative, where more than two common profiles are identified, a user may be presented a graphical cross-connect via a graphical user interface of another device wirelessly connected to Bluetooth router 400. This may be done using one or more approaches set forth in the patent application entitled "Systems and Methods for Mobile Data Storage and Acquisition" that was previously incorporated herein by reference for all purposes. A similar graphical approach may also be done using a graphical user interface integrated into Bluetooth router 400 where such a graphical user interface is available. One example of such a graphical cross-connect is shown in Figs. 6a-6b.

[0049] Turning to Fig. 6a, a cross connect menu 700 is shown that includes all of the possible devices (cellular phone 711, car stereo 712, PDA 713, GPS 714, headset 715, MP3 player 716) as both possible sources 710 and destinations 720. Further, a cross connect network 730 includes a number of possible connections (shown as dashed lines) based on common supported profiles between the source device and destination device. Thus, for example, cellular telephone 711 can provide data to car stereo 712 using GAVDP, to PDA 713 via either GAP or GAVDP, to GPS 714 via GAP, to headset 715 via GAVDP, and to MP3 player 716 via GAVDP. As shown in Fig. 6b, a completed connection map 750 is shown where the possible interconnects are resolved to define the cross-connect of Bluetooth router 400. In particular, the audio output of cellular telephone 711 is directed to car stereo 712 as shown by a line 751. A data output of PDA 713 is directed to cellular telephone 711 as indicated by a line 752. A data output from GPS 714 is provided to PDA 713 as shown by a line 753. An audio output of headset 715 is provided to cellular telephone 711 as shown by a line 754. In addition, the audio output from headset 715 is provided to PDA 713 as shown by a line 755. The audio output of MP3 player 716 is provided to car stereo 712 as shown by a line 756. After this manual cross-connect has been developed, a command reflecting the desired cross connect is provided to Bluetooth router 400 where it is used to establish the cross-connect.

[0050] Turning to Fig. 7, a flow diagram 600 shows a method in accordance with one or more embodiments of the invention for distributing data using multiport Bluetooth router 400 once the overall communication system including Bluetooth devices has been established (i.e., the processes of Fig. 5 have been completed). Following flow diagram 600, data transmission from one of the communicably coupled Bluetooth devices is received by multiport Bluetooth router 400 via an associated Bluetooth protocol interface (block 605). The received data is stored to memory (block 610). This may include passing the received data through a FIFO and then into a larger memory associated with multiport Bluetooth router 400. Using a particular example, when data is received via Bluetooth pipe 420, the received data is passed from Bluetooth receiver 421 to FIFO 424. In addition, receiver status indicator 423 signals multiport processor 450 that data is being received and the number of words stored to FIFO 424. Based on this input, multiport processor 450 transfers the data from FIFO 424 to Random Access Memory 480. As it transfers the data, it identifies the data type that has been received (block 615). In addition, multiport processor 450 determines if a recipient device for the received data has been established (block 620). This is done by querying communication matrix control module 455.

[0051] Where a recipient device has already been established using the processes discussed in relation to Fig. 5 above (block 620), the data that was received is accessed from Random Access Memory 480 (block 650). This data is routed to the Bluetooth pipe that the recipient device is coupled to, and the data is transmitted to the device (block 655). Thus, for example, where the recipient device is coupled to Bluetooth pipe 430, the previously received data is transferred from Random Access Memory 480 to FIFO 436. Further, multiport processor 450 indicates to transmitter status indicator 435 the number of words transferred to FIFO 436. In turn, Bluetooth transmitter 432 transmits the data to the connected Bluetooth device via antenna 410. In this way, the received data is transferred from a sending device communicably coupled to one Bluetooth protocol interface to a recipient device communicably coupled to another Bluetooth Protocol interface.

[0052] Alternatively, where a recipient device either has not yet been established or has moved out of range of multiport Bluetooth router 400 (block 620), a scan is performed to identify a Bluetooth device within range that provides a service capable of receiving and utilizing the received data (block 625). Where an appropriate device is not found (block 630), the data is

simply maintained in Random Access Memory (block 660) for a period while the scan process occasionally updates to determine if an appropriate recipient device is within range (block 665). Alternatively, where an appropriate recipient device is detected (block 630), the detected device is associated with an available Bluetooth protocol interface (block 635) and the communication matrix control module is updated to reflect the new recipient device (block 640). With this done, the received data is accessed from the memory (block 650) and transmitted to the newly identified device (block 655) as previously discussed.

[0053] As a more concrete example, the preceding exemplary system for receiving and initiating telephone calls in a car environment is continued. However, it should be noted that the example is just that, exemplary. Again, based on the disclosure provided herein, one of ordinary skill in the art will recognize a myriad of communications systems and execution thereof that may be implemented using multiport Bluetooth router 400 in accordance with a variety of embodiments of the present invention. Following the example, a telephone call may be received by the cellular telephone resulting in call status information being received. This status information is transferred to the PDA where it is displayed. The user seated in the car may verbally request that the call be answered. In this case, the voice recognition system of the PDA receives the request to answer the call and a corresponding request to answer the call is transferred from the PDA via multiport Bluetooth router 400.

[0054] In conclusion, the present invention provides novel systems, devices, methods and arrangements for mobile data storage and acquisition. While detailed descriptions of one or more embodiments of the invention have been given above, various alternatives, modifications, and equivalents will be apparent to those skilled in the art without varying from the spirit of the invention. Therefore, the above description should not be taken as limiting the scope of the invention, which is defined by the appended claims.

WHAT IS CLAIMED IS:

1. A storage device, wherein the storage device comprises:
a first Bluetooth protocol interface;
a second Bluetooth protocol interface;
a third Bluetooth protocol interface;
a multiport processor, wherein the multiport processor is operable to communicably couple the first Bluetooth protocol interface to one or more of the second Bluetooth protocol interface and the third Bluetooth protocol interface.
2. The storage device of claim 1, wherein the second Bluetooth protocol interface is electrically coupled to a first FIFO memory, and wherein the third Bluetooth protocol interface is electrically coupled to a second FIFO memory.
3. The storage device of claim 1, wherein communicably coupling the first Bluetooth protocol interface to one or more of the second Bluetooth protocol interface and the third Bluetooth protocol interface is done based at least in part on a data type received via the first Bluetooth interface and a first service type offered by a first Bluetooth device communicably coupled to the second Bluetooth protocol interface and a second service type offered by a second Bluetooth device communicably coupled to the second Bluetooth protocol interface.
4. The storage device of claim 3, wherein:
the first service type is selected from a group consisting of: an audio player, a video player, a graphics display, a data storage element, an audio receiver, and a video receiver;
and
the second service type is selected from a group consisting of: an audio player, a video player, a graphics display, a data storage element, an audio receiver, and a video receiver.
5. The storage device of claim 1, wherein the storage device further comprises:
a storage medium.

6. A method for communicably coupling a single point Bluetooth device to multiple Bluetooth devices, the method comprising:

providing a multiport Bluetooth distributor, wherein the multiport Bluetooth distributor includes:

a first Bluetooth protocol interface;

a second Bluetooth protocol interface; and

a multiport processor, wherein the multiport processor is operable to communicably couple the first Bluetooth protocol interface to the second Bluetooth protocol interface;

identifying at least two Bluetooth devices within range of the multiport Bluetooth distributor, wherein each of the identified Bluetooth devices supports a service type;

assembling a service offering based on the identified Bluetooth devices, wherein the service offering includes a plurality of service types including at least a first service type and a second service type; and

associating one or more of the Bluetooth devices to respective ones of the first Bluetooth protocol interface and the second Bluetooth protocol interface.

7. The method of claim 6, wherein the method further comprises:

receiving a transmission from one of the Bluetooth devices, wherein the transmission includes a data set;

identifying the type of communication received from the one of the Bluetooth devices; and

identifying a recipient device, wherein the recipient device is one of the identified Bluetooth devices that is capable of receiving and utilizing the type of communication; and transmitting the data set to the recipient device.

8. The method of claim 6, wherein a first of the at least two Bluetooth devices is a wireless headset, and wherein a second of the at least two Bluetooth devices is a personal digital assistant.

9. The method of claim 6, wherein a first device of the at least two Bluetooth devices supports the first service type, wherein a second device of the at least two Bluetooth

devices supports the first service type, and wherein only one of the first device and the second device is included in the service offering.

10. The method of claim 6, wherein:

the first service type is selected from a group consisting of: an audio player, a video player, a graphics display, a data storage device, an audio receiver, and a video receiver; and

the second service type is selected from a group consisting of: an audio player, a video player, a graphics display, a data storage element, an audio receiver, and a video receiver.

11. The method of claim 6, wherein at least one of the identified Bluetooth devices supports two or more service types.

12. The method of claim 11, wherein the at least one of the identified Bluetooth devices is a cellular telephone, and wherein the cellular telephone supports the following service types: an audio player and an audio receiver.

13. The method of claim 11, wherein the audio player is a speaker integrated with the cellular telephone, wherein the audio receiver is a microphone integrated with the cellular telephone.

14. The method of claim 9, wherein the at least one of the identified Bluetooth devices is a car stereo, and wherein the car stereo supports the following service types: an audio player and a graphics display.

15. A multiple device Bluetooth communication system, the system comprising:

a multiport Bluetooth distributor, wherein the multiport Bluetooth distributor includes:

- a first Bluetooth protocol interface;
- a second Bluetooth protocol interface;
- a third Bluetooth protocol interface; and

a multiport processor, wherein the multiport processor is operable to communicably couple the first Bluetooth protocol interface to at least one of the second Bluetooth protocol interface and the third Bluetooth protocol interface

a single port Bluetooth device, wherein the single port Bluetooth device is wirelessly coupled to the first Bluetooth protocol interface;

a first Bluetooth device, wherein the first Bluetooth device is wirelessly coupled to the second Bluetooth protocol interface; and

a second Bluetooth device, wherein the second Bluetooth device is wirelessly coupled to the third Bluetooth protocol interface.

16. The system of claim 15, wherein the single port Bluetooth device is a cellular telephone.

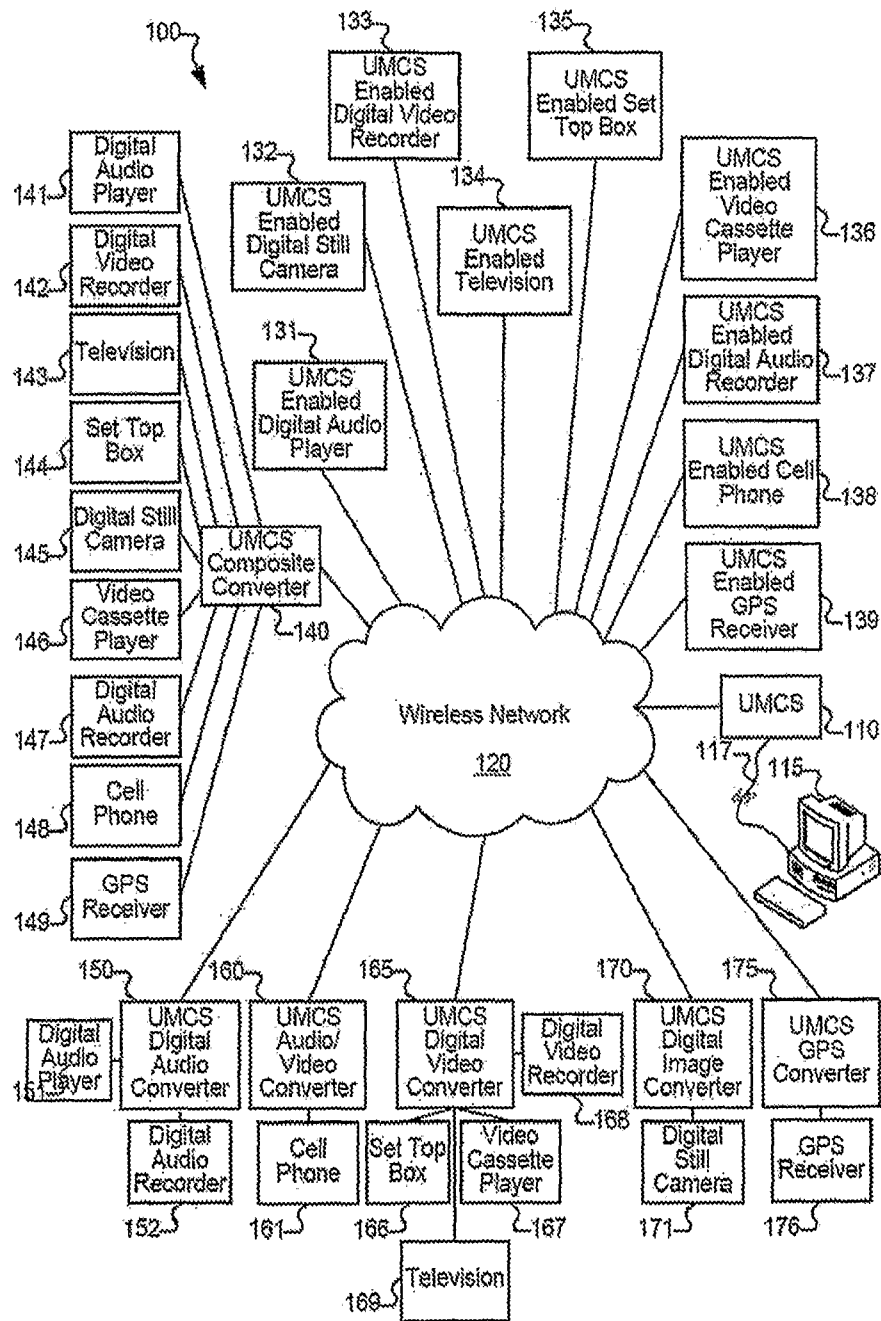
17. The system of claim 16, wherein the first Bluetooth device is a car stereo, and wherein the second Bluetooth device is a microphone.

18. The system of claim 17, wherein the car stereo includes a graphical display, wherein the graphical display is operable to display caller identification associated with an incoming call, and wherein the caller identification is provided to the car stereo from the cellular telephone via a combination of the first Bluetooth protocol interface and the second Bluetooth protocol interface.

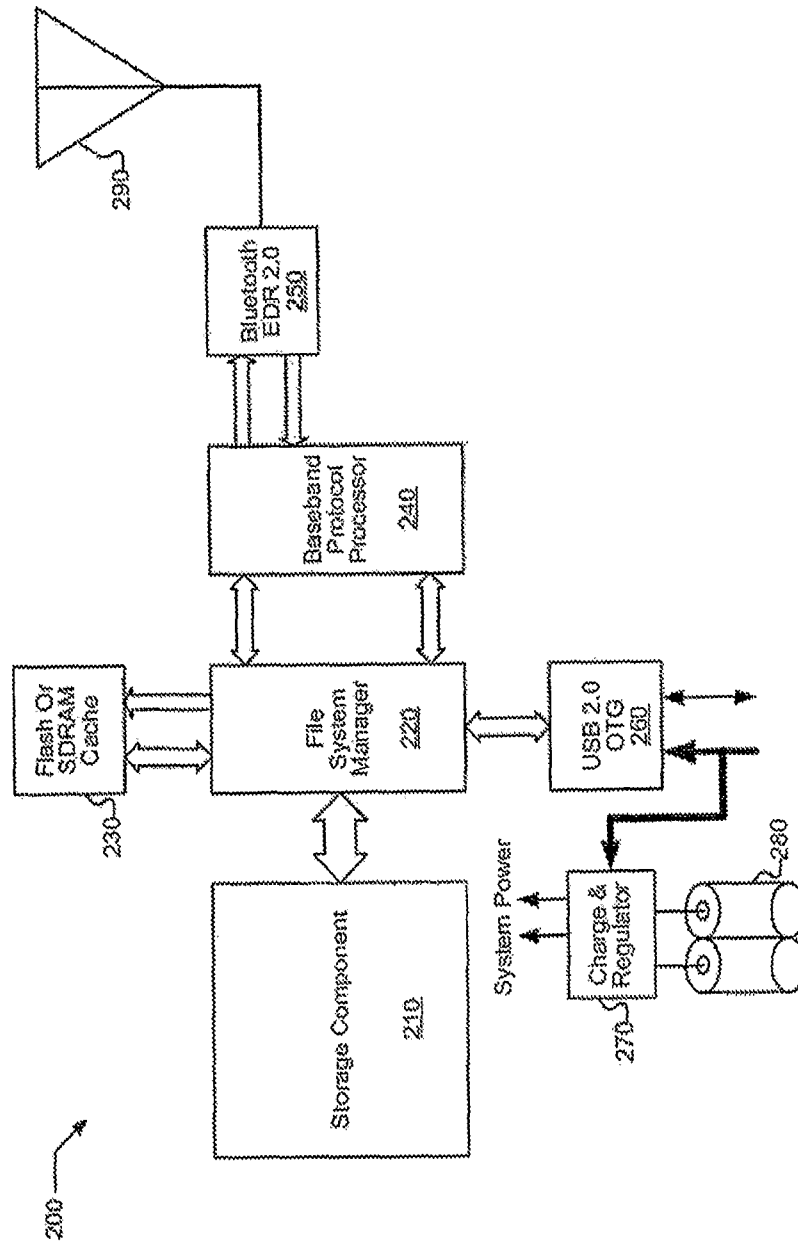
19. The system of claim 16, wherein the first Bluetooth device is a wireless headset, and wherein the second Bluetooth device is a personal digital assistant.

20. The system of claim 19, wherein the personal digital assistant is operable to provide outgoing call information to the cellular telephone via a combination of the first Bluetooth protocol interface and the second Bluetooth protocol interface.

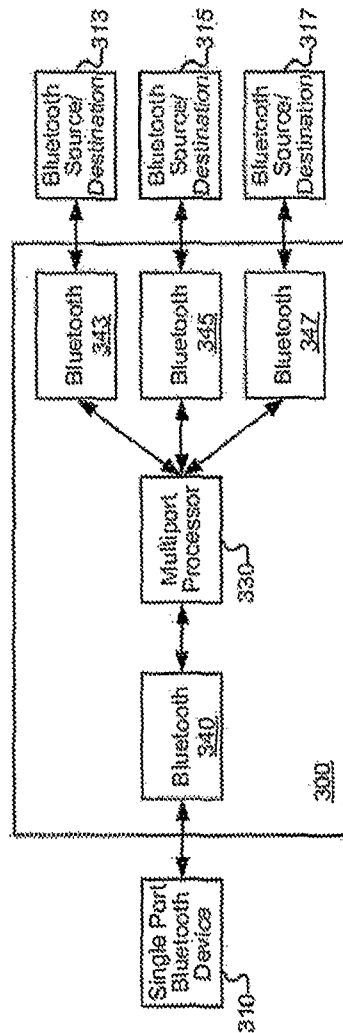
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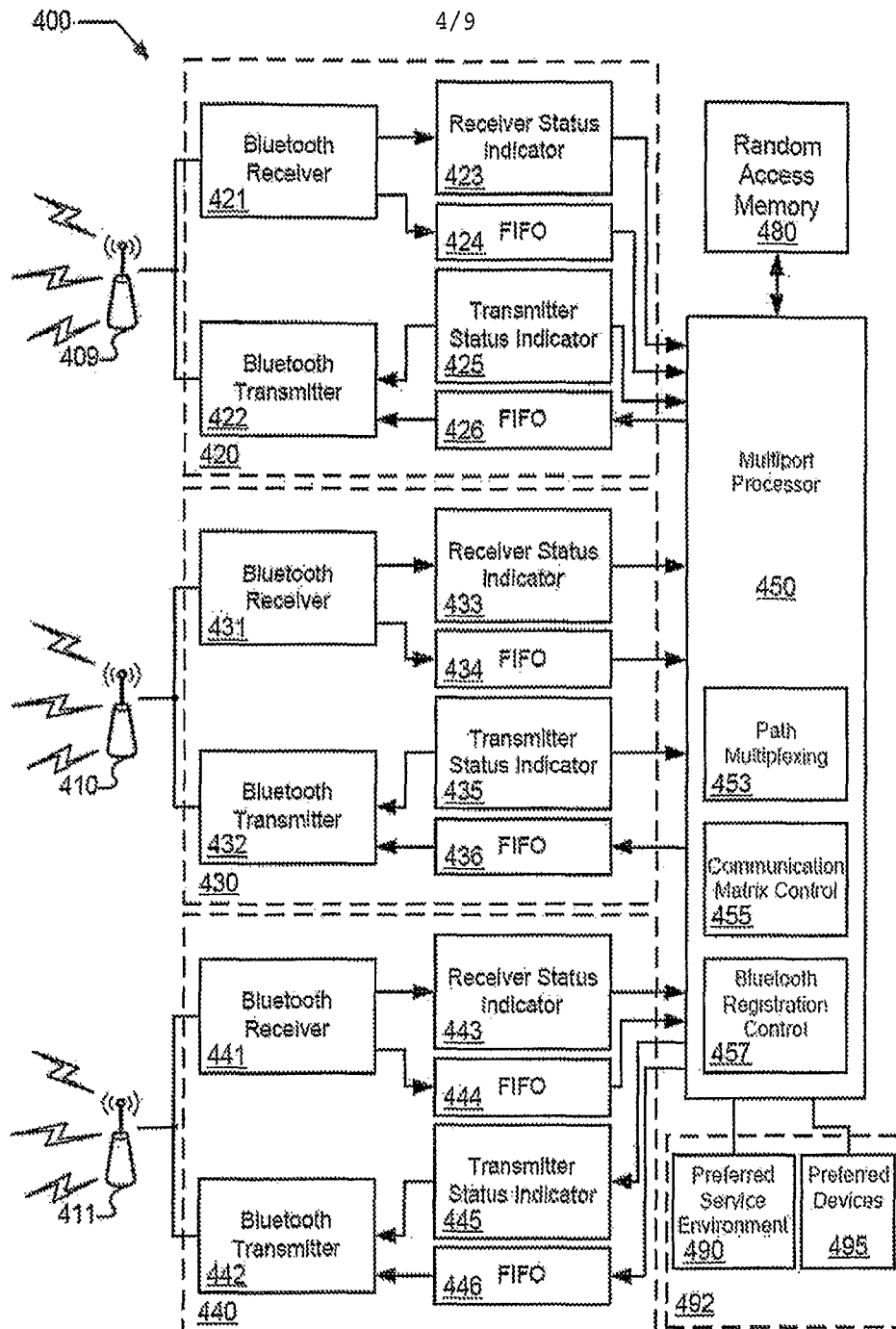


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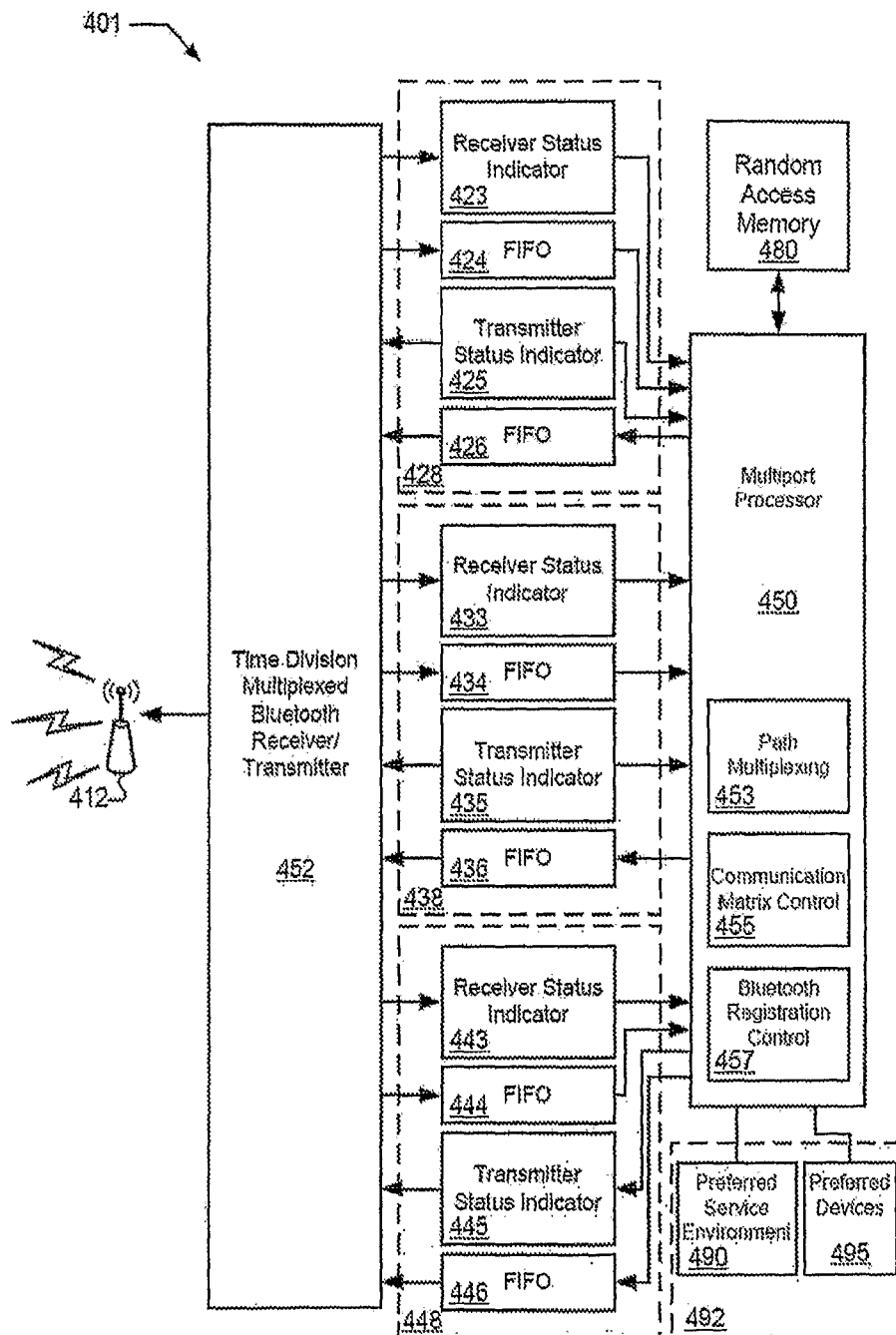


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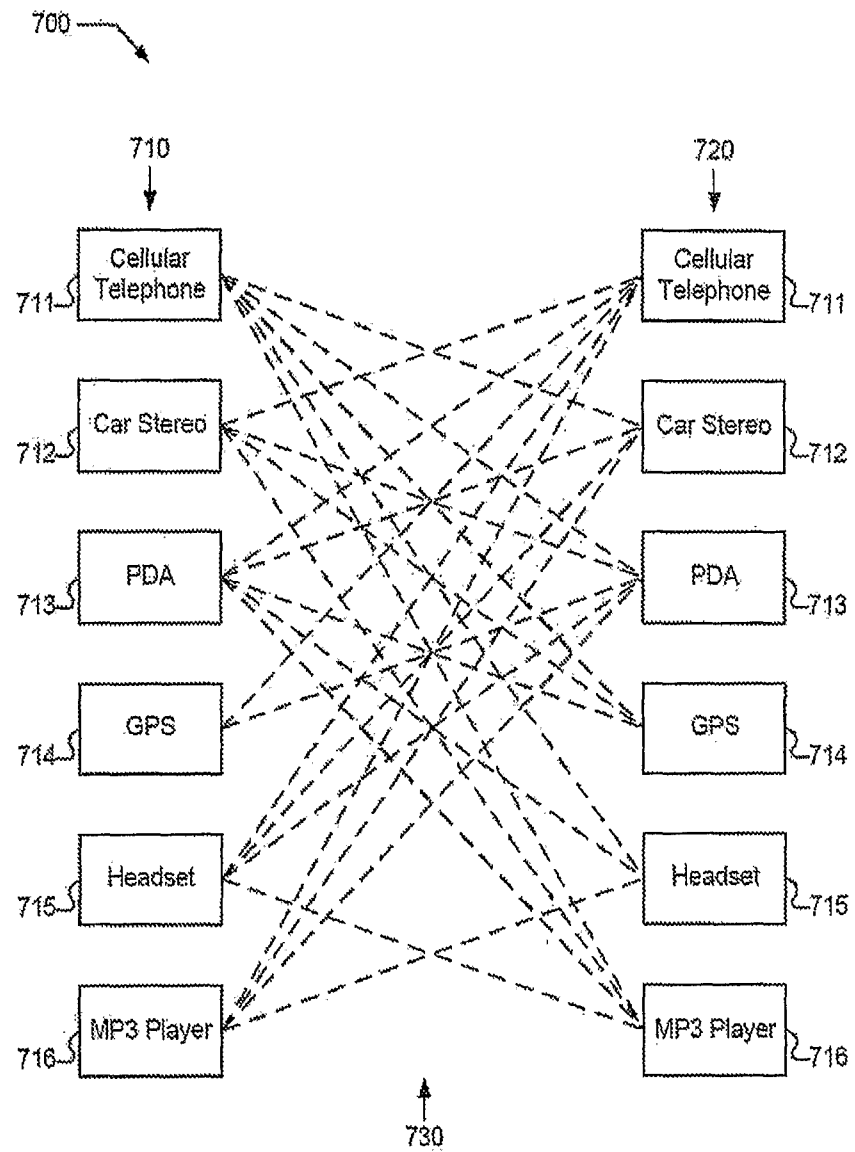




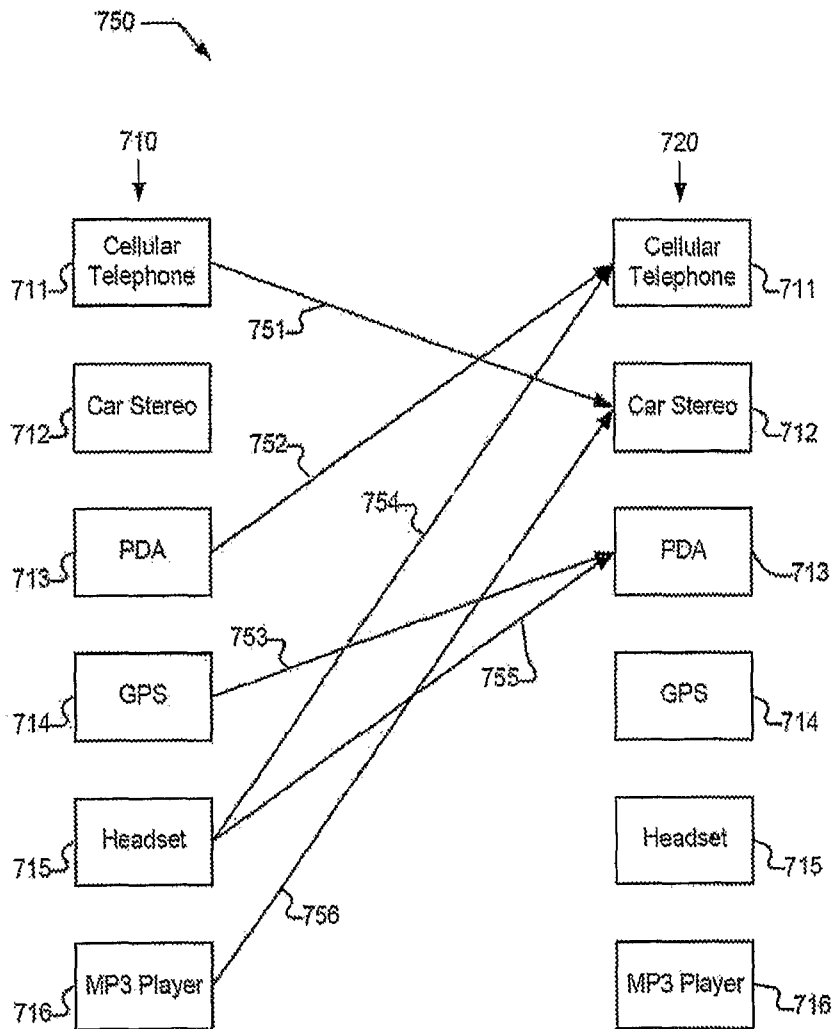
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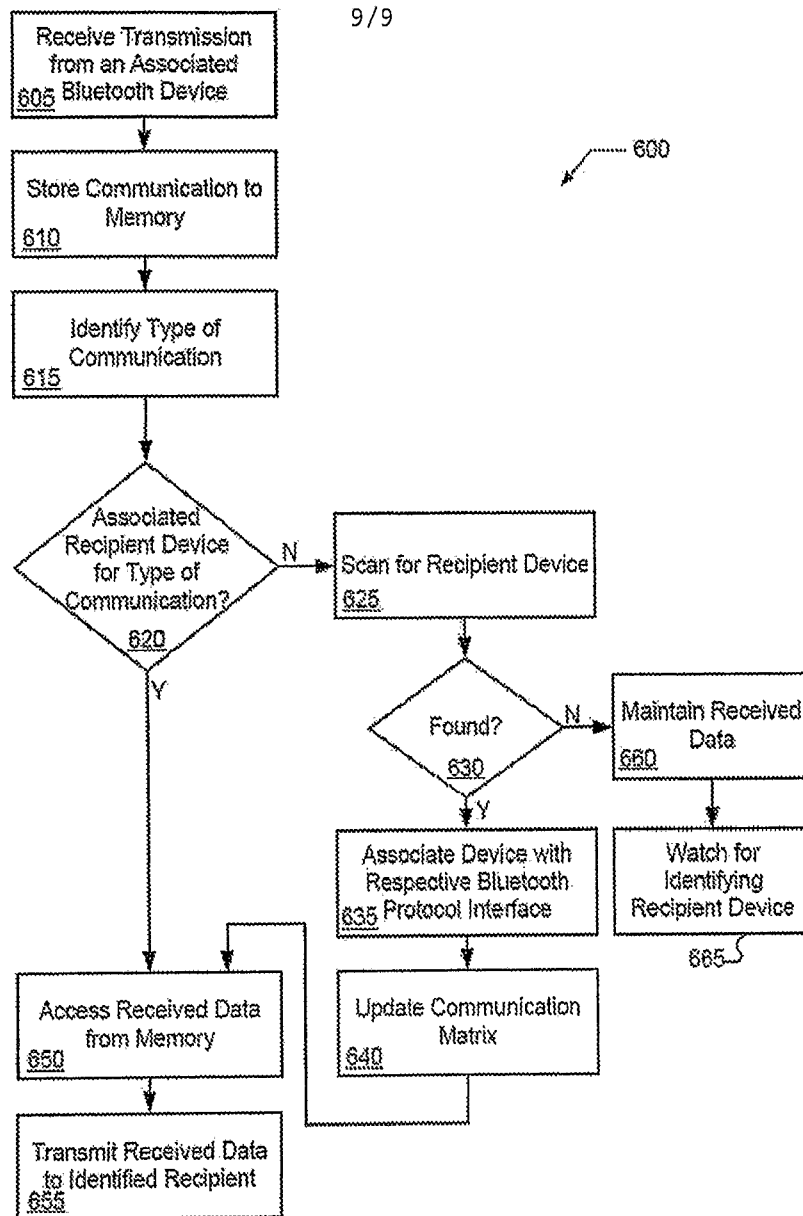
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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 07/71991

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - G06F 13/00 (2007.10)

USPC - 711/149

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

USPC - 711/149

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
USPC - 711/100, 147, 149, 455/3.01, 403

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

PubWEST (USPT, PGPB, EPAB, JPAB); Google Scholar

Search Terms Used: Bluetooth, protocol interface, multiple, data streams, multiport processor, FIFO memory etc.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 7,058,734 B2 (Chen et al.) 06 June 2006 (06.06.2006) entire document, especially Abstract; col. 4, ln. 6-39; col. 4, ln. 56-67; col. 9, ln. 40-64; col. 10, ln. 1-13; col. 11, ln. 1-15; col. 12, ln. 1-20; col. 12, ln. 43-48	1-20
Y	US 6,625,157 B2 (Niu et al.) 23 September 2003 (23.09.2003) entire document, especially Abstract; col. 3, ln. 60-66; col. 6, ln. 17-38	1-20
A	US 2005/0073522 A1 (Aholainen) 07 April 2005 (07.04.2005)	1-20
A	US 2004/0204063 A1 (Van Erlach) 14 October 2004 (14.10.2004)	1-20
A	US 2003/0110484 A1 (Famolari) 12 June 2003 (12.06.2003)	1-20

☐ Further documents are listed in the continuation of Box C.

* Special categories of cited documents:

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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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

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

"&" document member of the same patent family

Date of the actual completion of the international search

31 October 2007 (31.10.2007)

Date of mailing of the international search report

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