US008200265B2

(12) **United States Patent**
**Carlton et al.**

(10) **Patent No.: US 8,200,265 B2**
(45) **Date of Patent: Jun. 12, 2012**

(54) **DATA TRANSFER BETWEEN WIRELESS DEVICES**

(75) Inventors: **Alan G. Carlton**, Mineola, NY (US); **Alexander Reznik**, Titusville, NJ (US)

(73) Assignee: **InterDigital Patent Holdings, Inc.**, Wilmington, DE (US)

( * ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 217 days.

(21) Appl. No.: **12/644,948**

(22) Filed: **Dec. 22, 2009**

(65) **Prior Publication Data**

US 2010/0165965 A1 Jul. 1, 2010

**Related U.S. Application Data**

(60) Provisional application No. 61/140,126, filed on Dec. 23, 2008.

(51) **Int. Cl.**
***H04W 88/02*** (2009.01)

(52) **U.S. Cl.** ..... **455/509**

(58) **Field of Classification Search** ..... 455/73, 455/75, 436, 509, 522; 370/311, 328, 330, 370/331, 335, 338; 375/146
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

| | | | | |
|---|---|---|---|---|
| 5,544,321 | A | 8/1996 | Theimer et al. | |
| 7,877,494 | B2 * | 1/2011 | Carlton et al. | 709/229 |
| 2006/0234762 | A1 * | 10/2006 | Ozluturk | 455/552.1 |
| 2006/0293063 | A1 | 12/2006 | Corrion | |
| 2007/0146347 | A1 | 6/2007 | Rosenberg | |
| 2007/0177729 | A1 | 8/2007 | Reznik et al. | |
| 2007/0271379 | A1 * | 11/2007 | Carlton et al. | 709/225 |
| 2011/0119702 | A1 * | 5/2011 | Jang et al. | 725/32 |
| 2011/0119710 | A1 * | 5/2011 | Jang et al. | 725/41 |
| 2011/0126237 | A1 * | 5/2011 | Lee et al. | 725/46 |
| 2011/0138334 | A1 * | 6/2011 | Jung | 715/841 |

FOREIGN PATENT DOCUMENTS

| | | |
|---|---|---|
| EP | 1 513 262 | 3/2005 |
| EP | 1513262 | 3/2005 |
| WO | 03/081373 | 10/2003 |

OTHER PUBLICATIONS

Hazas et al., "A Relative Positioning System for Co-located Mobile Devices," International Conference on Mobile Systems, Proceedings of the 3rd International Conference on Mobile Systems, Applications and Services, Seattle, Washington, 2005, pp. 177-190.

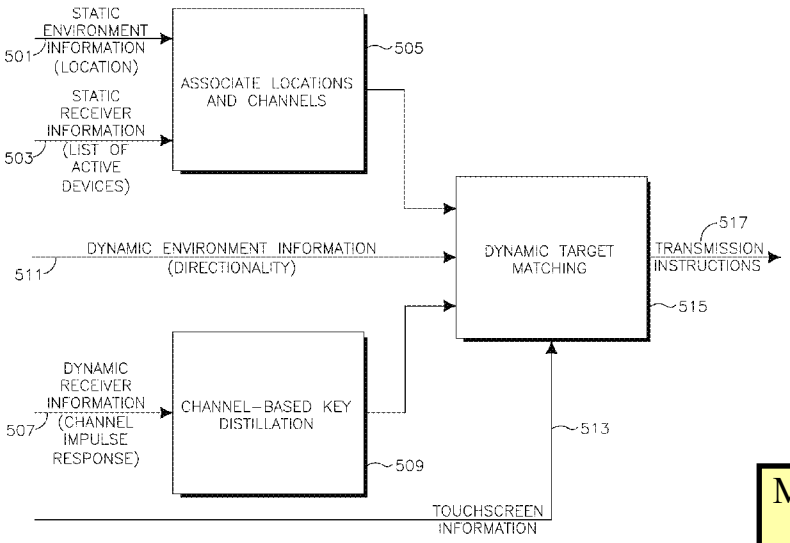
* cited by examiner

*Primary Examiner* — Diane Mizrahi
(74) *Attorney, Agent, or Firm* — Volpe and Koenig, P.C.

(57) **ABSTRACT**

A method of data transfer between wireless transmit/receive units (WTRUs) is performed by a sending communication device soliciting environment information relating to active communication devices operating within the local area of the WTRU. The local area of the WTRU may be determined by an environment variable that may be configured to indicate a search radius. Within the local area, information relating to active candidate WTRUs is received through a communication peripheral. User actions on the user interface are converted to electromechanical signals which act as an input along with the environment information to select a target WTRU from the candidate WTRUs to receive the data transfer. The environment information and user input are used to uniquely discriminate the target WTRU as the intended recipient of the data transfer. Transmission instructions are generated based on the solicited information and the user input.

**23 Claims, 9 Drawing Sheets**




MICROSOFT CORP.
EXHIBIT 1049

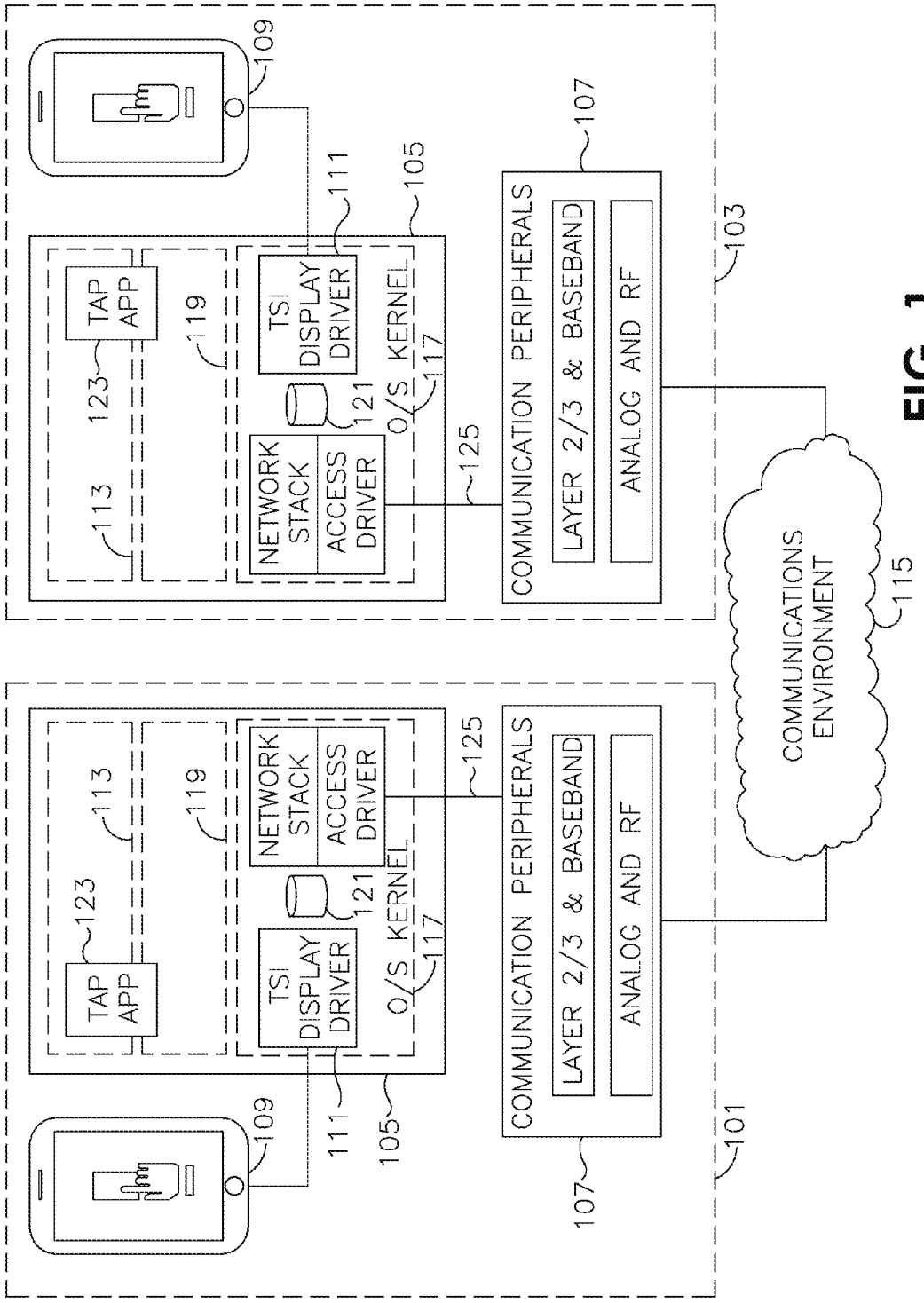

109
TAP APP
123
113
119
TSI DISPLAY DRIVER
111
105
O/S KERNEL
117
NETWORK STACK
ACCESS DRIVER
121
125
COMMUNICATION PERIPHERALS
107
LAYER 2/3 & BASEBAND
ANALOG AND RF
103
COMMUNICATIONS ENVIRONMENT
115
101

FIG. 1

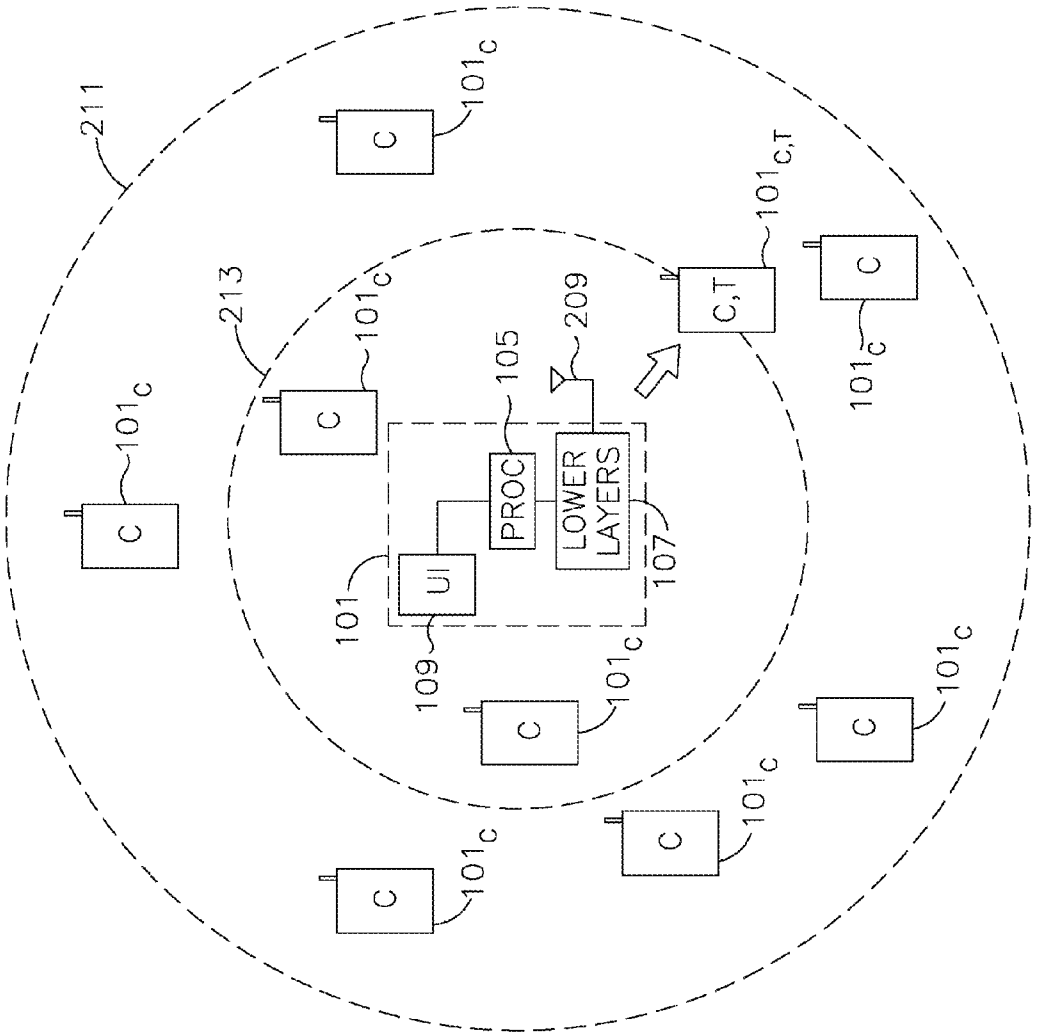

211
213
C
$101_C$
$101_{C,T}$
C,T
209
105
PROC
LOWER LAYERS
107
UI
101
109

FIG. 2

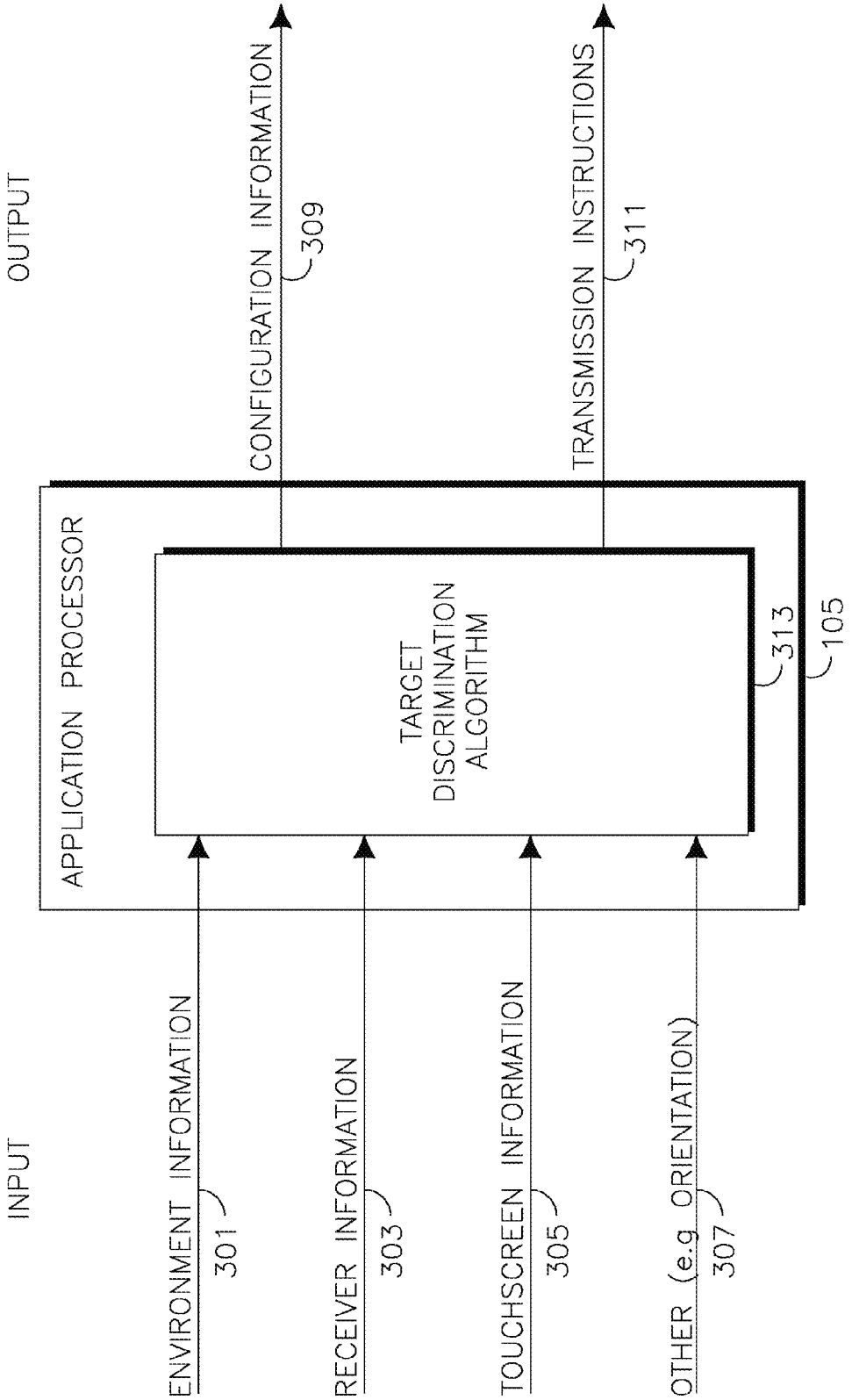

INPUT
ENVIRONMENT INFORMATION
301
RECEIVER INFORMATION
303
TOUCHSCREEN INFORMATION
305
OTHER (e.g ORIENTATION)
307
APPLICATION PROCESSOR
TARGET DISCRIMINATION ALGORITHM
313
105
OUTPUT
CONFIGURATION INFORMATION
309
TRANSMISSION INSTRUCTIONS
311

FIG. 3

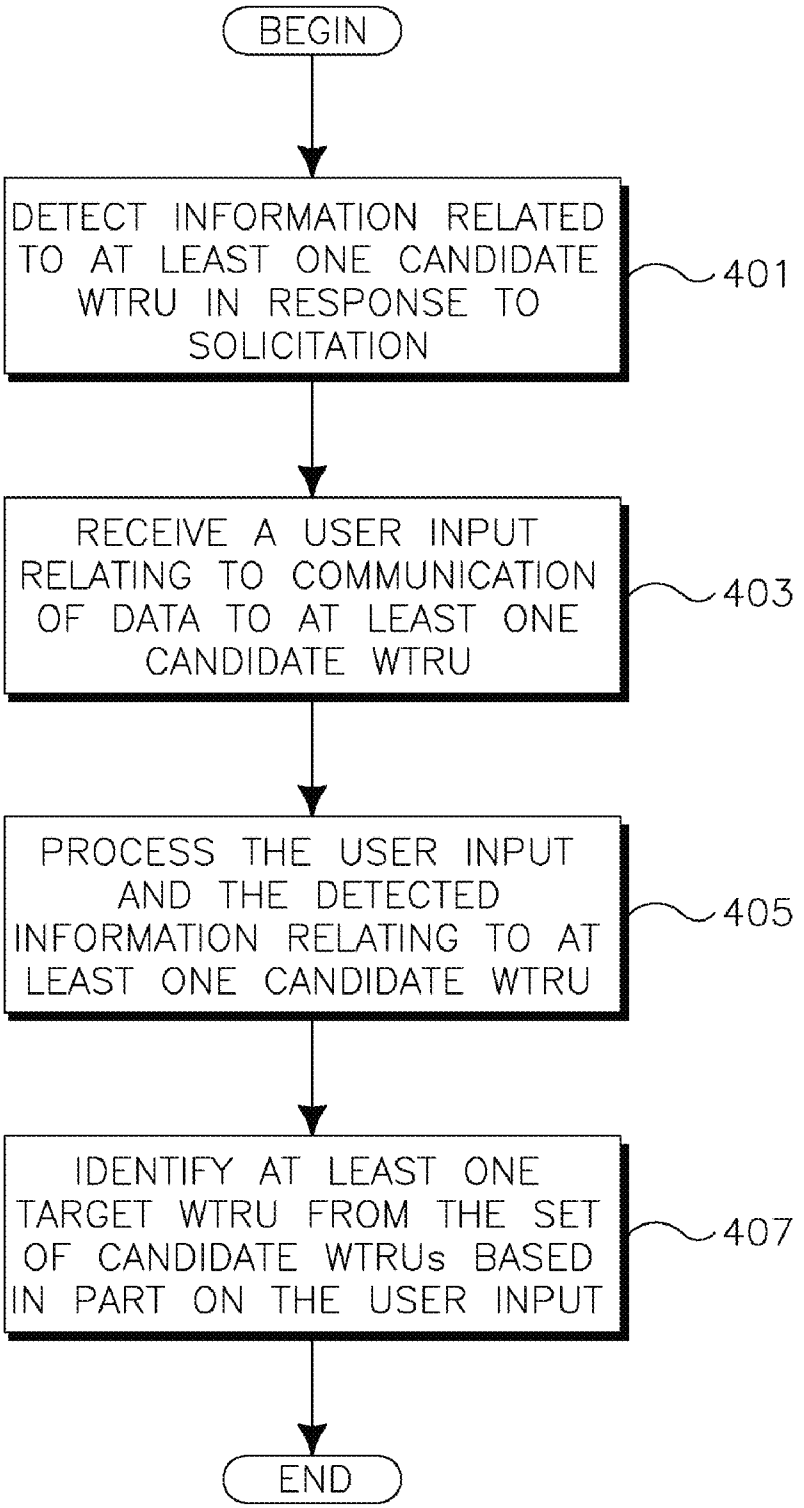

BEGIN
DETECT INFORMATION RELATED TO AT LEAST ONE CANDIDATE WTRU IN RESPONSE TO SOLICITATION
401
RECEIVE A USER INPUT RELATING TO COMMUNICATION OF DATA TO AT LEAST ONE CANDIDATE WTRU
403
PROCESS THE USER INPUT AND THE DETECTED INFORMATION RELATING TO AT LEAST ONE CANDIDATE WTRU
405
IDENTIFY AT LEAST ONE TARGET WTRU FROM THE SET OF CANDIDATE WTRUs BASED IN PART ON THE USER INPUT
407
END

FIG. 4

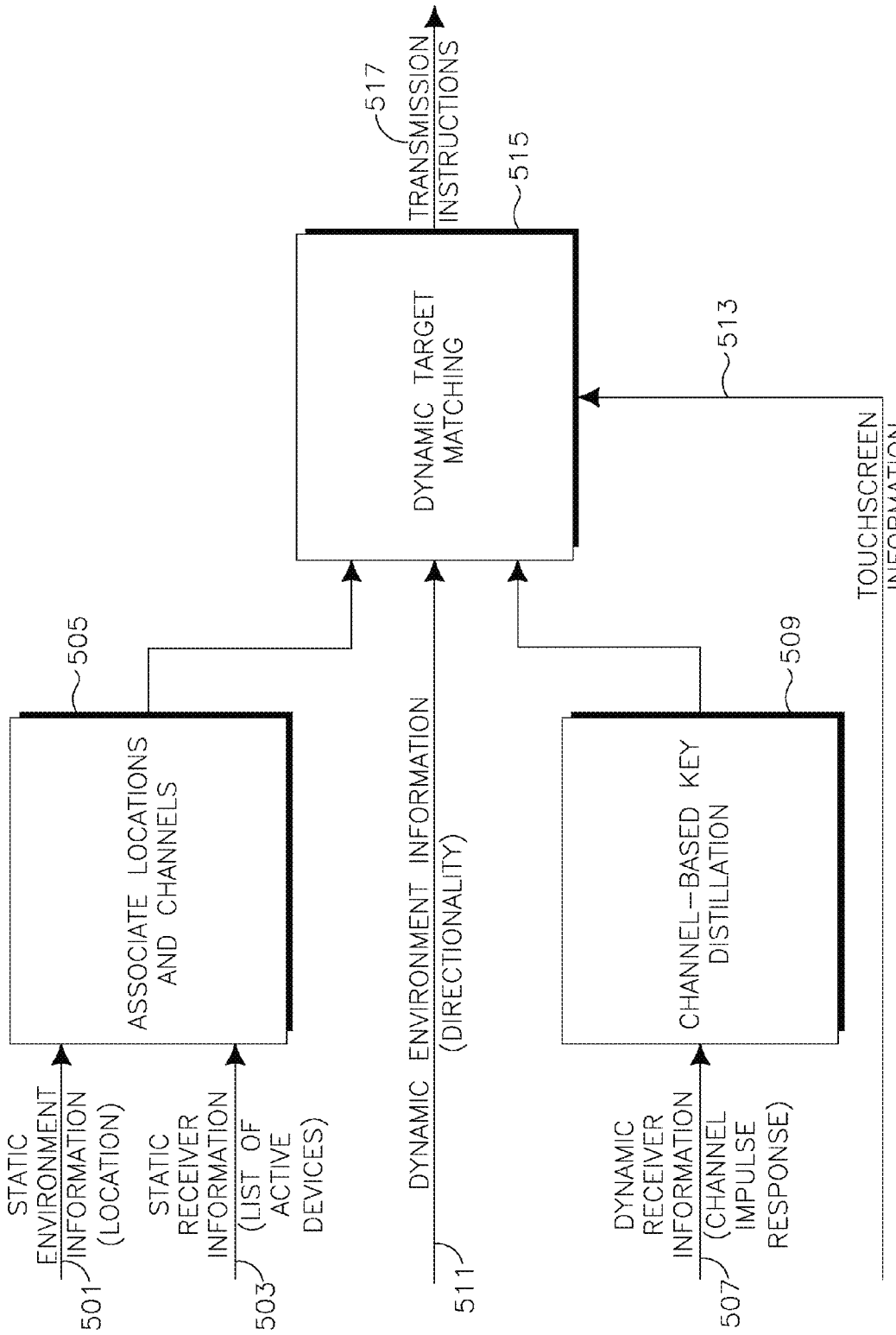

STATIC ENVIRONMENT INFORMATION (LOCATION)
501
STATIC RECEIVER INFORMATION (LIST OF ACTIVE DEVICES)
503
ASSOCIATE LOCATIONS AND CHANNELS
505
DYNAMIC ENVIRONMENT INFORMATION (DIRECTIONALITY)
511
DYNAMIC RECEIVER INFORMATION (CHANNEL IMPULSE RESPONSE)
507
CHANNEL-BASED KEY DISTILLATION
509
TOUCHSCREEN INFORMATION
513
DYNAMIC TARGET MATCHING
515
TRANSMISSION INSTRUCTIONS
517

FIG. 5

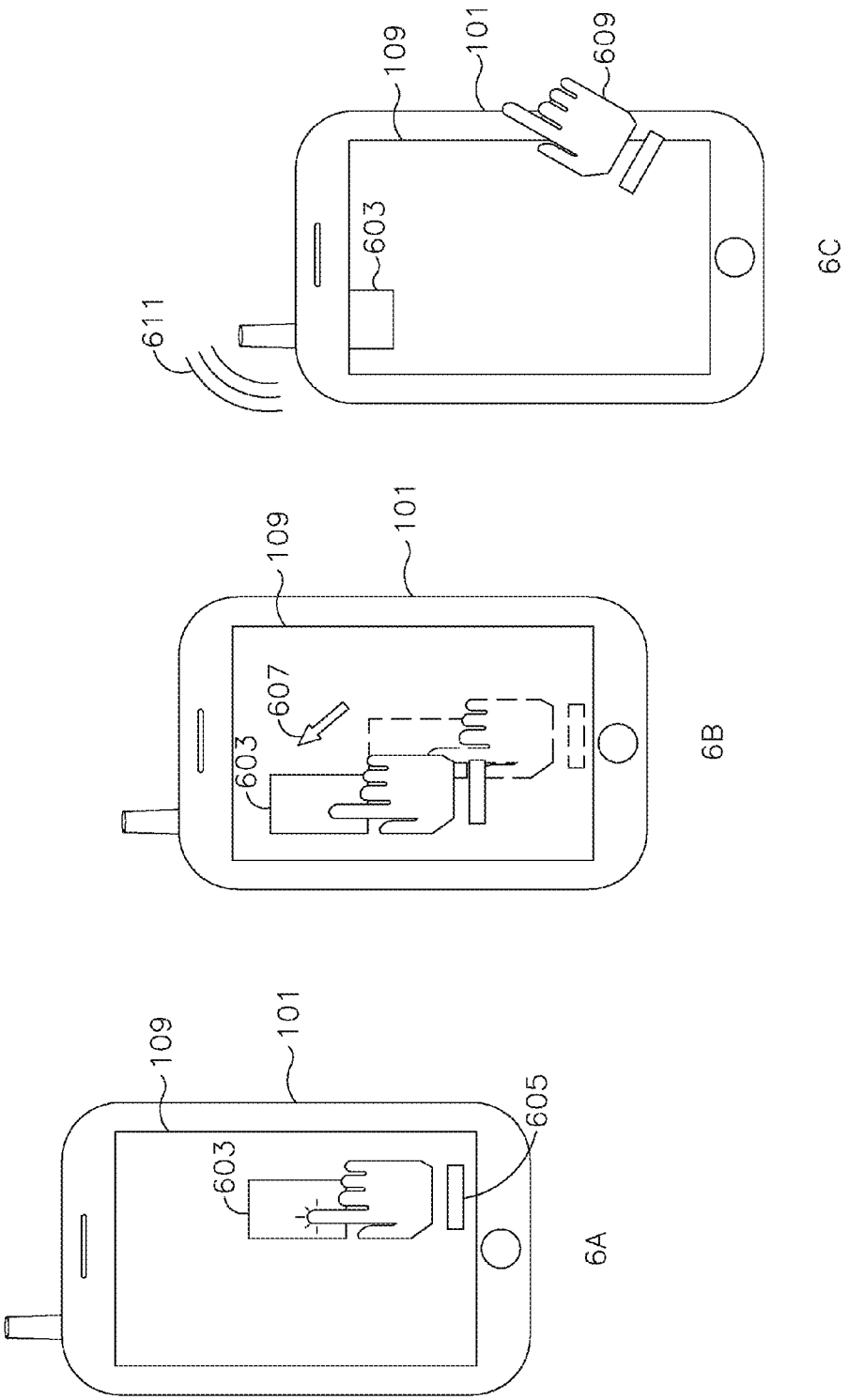



FIG. 6

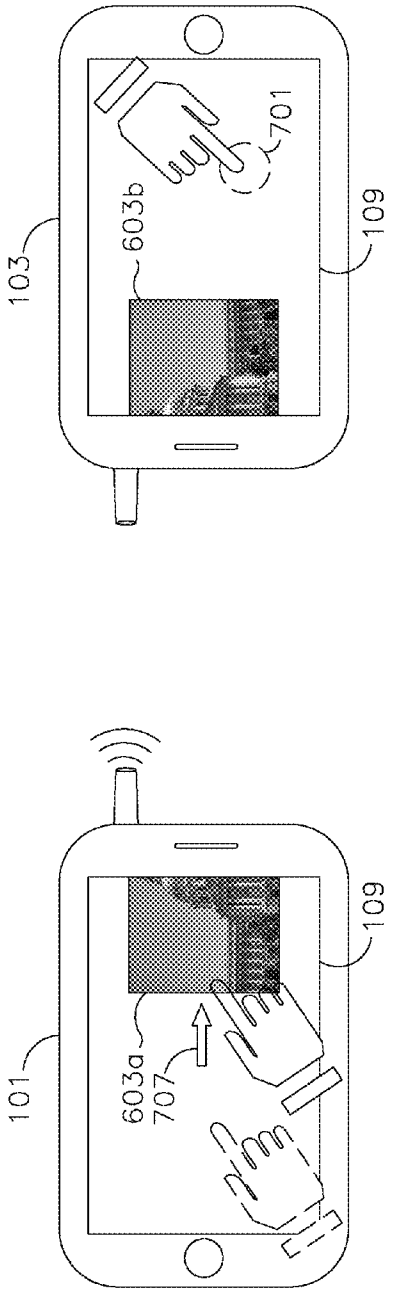



FIG. 7A

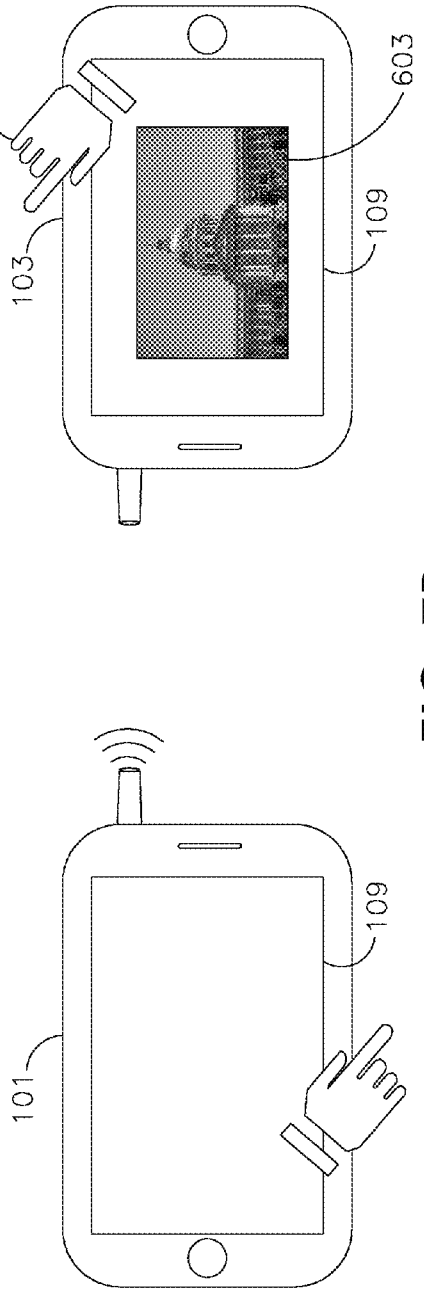



FIG. 7B

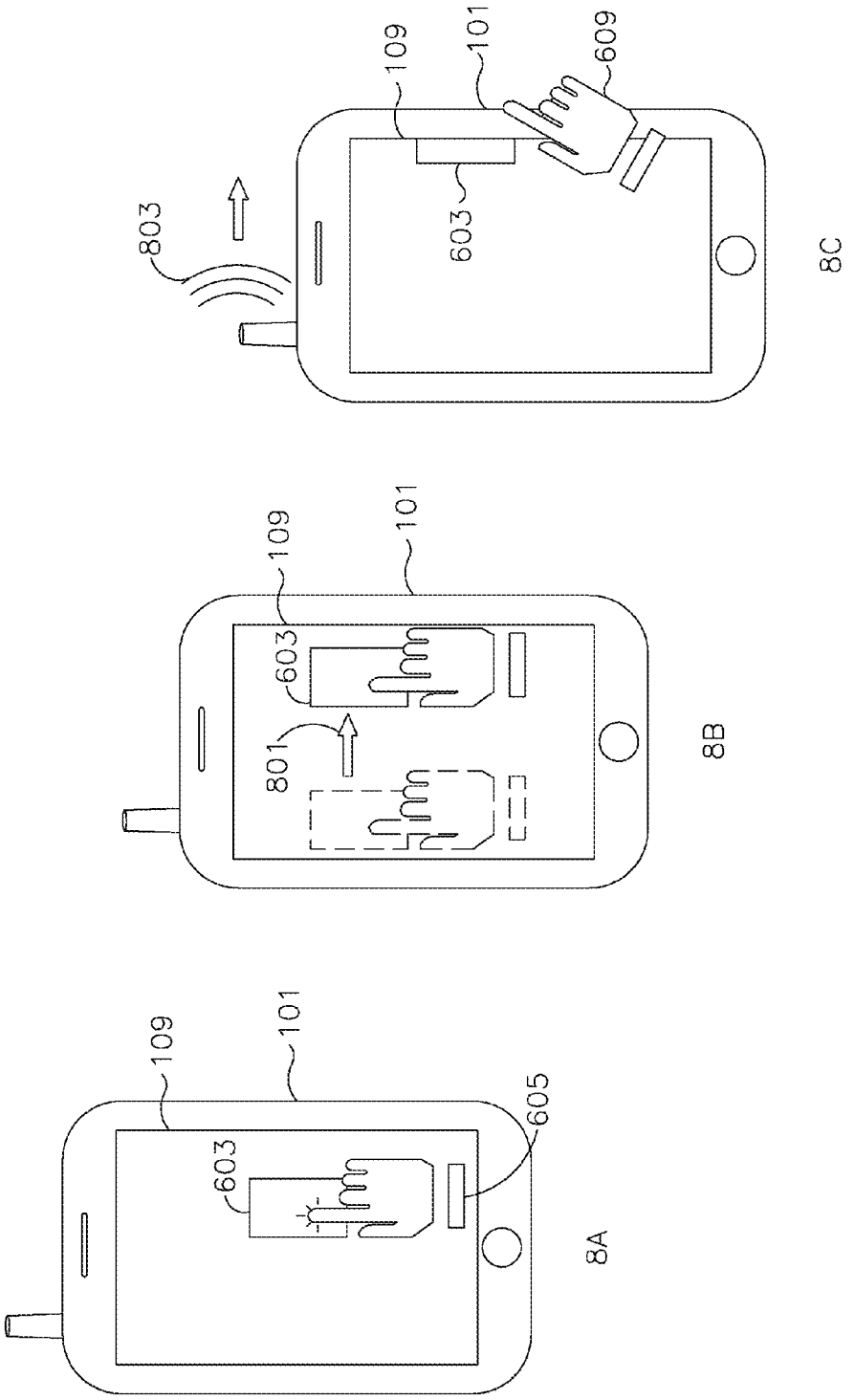
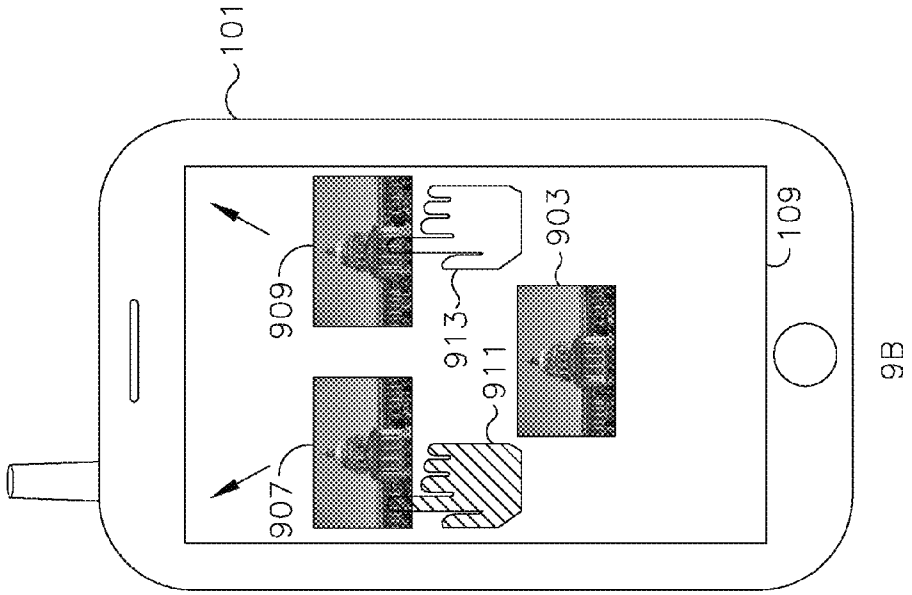



FIG. 8



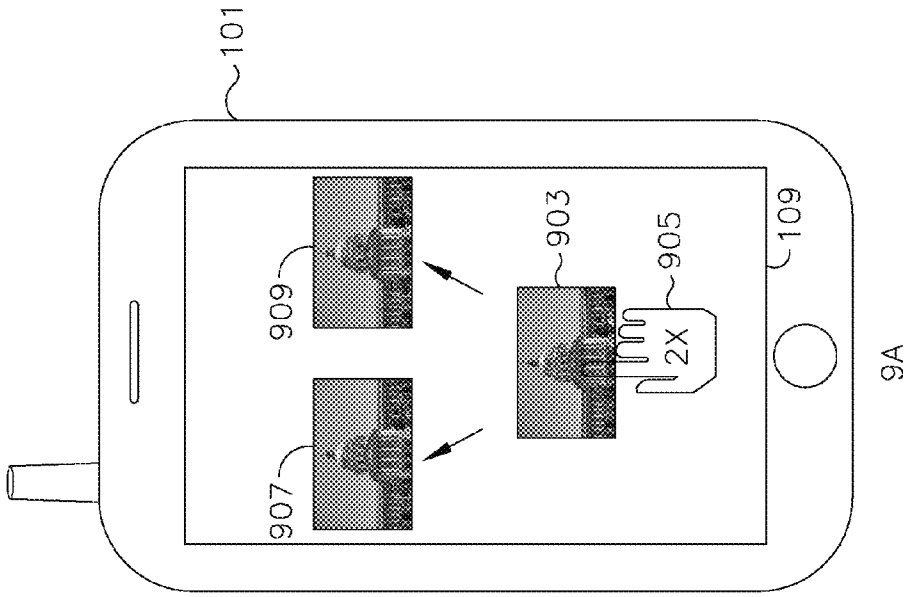




FIG. 9

# DATA TRANSFER BETWEEN WIRELESS DEVICES

## CROSS REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of U.S. provisional application No. 61/140,126 filed Dec. 23, 2008 which is incorporated by reference as if fully set forth herein.

## FIELD OF INVENTION

This application is related to wireless communications.

## BACKGROUND

In current communications, functionality that allows the transfer of data (such as files or digital media) between devices in both fixed and wireless environments is commonplace. Currently, data transfers may be performed using applications such as electronic mail, or multimedia message services (MMS) with the data being transmitted from one device to another through suitable technologies, for example, General Packet Radio Service (GPRS) or Wireless Local Area Network (WLAN). As the sophistication of user interfaces supporting data transfers has developed (for example, the emergence of touch screen and multi-touch technology), the user experience has been simplified considerably. These advances in user interface technology may be seen in devices such as the Apple® iPhone® and iPod Touch®.

Despite these advances, however, file transfers may still be a cumbersome, multi-step task requiring adaptation between multiple implementations. For example, many technologies involve a fragmented approach to access and manipulation of files such as attachments. These hurdles inhibit the more regular use of file transfer schemes in spontaneous situations. A simplified and more intuitive approach to data transfer between devices is therefore required.

## SUMMARY

A method for controlling communication of data in wireless communications, implemented in a wireless transmit/receive unit (WTRU) detects environment information relating to at least one candidate WTRU operating in a local area associated with the WTRU. A user input is received via a user interface, wherein the user input relates to a selection of data for transfer between the WTRU and at least one of the candidate WTRUs an to an identified target WTRU. The user input is processed as well as the information relating to the at least one candidate WTRU. At least one target WTRU is identified from the at least one candidate WTRU based in part on the user input. Information relating to candidate WTRUs is solicited through a lower layer. Environment information is used to identify the target WTRU and transmission instructions are generated to enable transmission of data to the target WTRU.

## BRIEF DESCRIPTION OF THE DRAWINGS

A more detailed understanding may be had from the following description, given by way of example in conjunction with the accompanying drawings wherein:

FIG. **1** shows a sending and receiving wireless transmit/receive unit (WTRU) that may be used for data transfer between devices;



FIG. **2** shows a wireless communication environment for data communication between devices;

FIG. **3** shows a target discrimination algorithm for identifying a target WTRU;

FIG. **4** is a block diagram of a method of communicating data between wireless devices;

FIG. **5** is a block diagram of physical layer security for data communication between devices;

FIG. **6** shows a user input for transferring a data file between devices;

FIGS. **7**A and **7**B show a user experience during a data communication between devices at a sending device and a receiving device;

FIG. **8** shows a user input for transferring a data file to a target device, where the user input includes a directional indication of the location of the target device; and

FIG. **9** shows a user input for transferring a data file from a sending device to multiple receiving devices.

## DETAILED DESCRIPTION

When referred to hereafter, the terminology "wireless transmit/receive unit (WTRU)" includes but is not limited to a user equipment (UE), a communications device, a mobile station, a fixed or mobile subscriber unit, a pager, a cellular telephone, a personal digital assistant (PDA), a computer, or any other type of device capable of operating in a wireless environment. When referred to hereafter, the terminology "base station" includes but is not limited to a Node-B, a site controller, an access point (AP), or any other type of interfacing device capable of operating in a wireless environment.

FIG. **1** is an illustration of a sending WTRU **101** and a receiving WTRU **103** whereby data is transferred between the WTRUs. The sending WTRU **101** and the receiving WTRU **103** are similarly equipped. The sending WTRU **101** and receiving WTRU **103** are separated by a communications environment **115** that may include other similarly equipped WTRUs which are not shown for simplicity. In general, WTRU **101**, and WTRU **103** are each minimally comprised of an application processor **105**, a communication peripheral **107**, and a touchscreen/display peripheral **109**. The communication peripheral **107** may be implemented as a wireless personal area network (WPAN) device, for example Bluetooth®, Wireless Universal Serial Bus (W-USB) or WiFi® in ad-hoc mode. The application processor **105** may be equipped with software such as an operating system (O/S)/kernel **117** (for example, Linux® or Windows®), middleware **119**, and applications **113**. The O/S may include necessary drivers to provide support for the touchscreen **109** and the communication peripheral **107** in addition to a file system **121** for storing media. An application **123** (hereinafter referred to as "TapAPP") may include application software configured to implement a method of data transfer between WTRU **101** and WTRU **103**. TapAPP **123** may run on the application processor **105** running a high-end O/S such as Linux® or Windows®, for example. The communication peripherals **107** may include technologies such as a third generation partnership (3GPP) second or third generation standards (2G/3G) modem, Bluetooth® or WiFi®. Any combination or all of these communication technologies may be implemented in a single component design. Other peripherals such as a touchscreen/display **109**, may also be supported. Peripherals **107**, **109** may be operationally coupled to the application processor **105** through a physical interface **125** which, by way of example, may be a serial peripheral interface (SPI) or shared

memory. The application processor **105** may provide support for the peripherals **107**, **109** through drivers or general application software.

TapAPP **123** may run on either or both of the sending **101** and receiving **103** WTRUs. TapAPP **123** may run on any communications device, and may be run in a send or receive mode. TapAPP **123** runs on the embedded O/S **117** and may be implemented as a native application, a Java® application or any other suitable type of application on the WTRUs **101**, **103**. TapAPP **123** may be a stand alone application **113** or may be tightly bound to middleware **119** thereby providing a background process, giving the user an "always on" usage experience. Additionally or alternatively, TapAPP **123** may be implemented as a plug-in application that may be launched by a user as needed in a manner known in the art. TapAPP **123** may provide display features to indicate a current state of the application (i.e. send or receive mode). For example, while in send mode, TapAPP **123** may allow the user to access and display a media file, such as a digital photograph for transfer, on the touchscreen/display **109**. In one representation of receive mode, TapAPP **123** may provide a touch point on the screen **109** or illuminate a touch point upon the user touching the touchscreen **109**, thereby enabling the user to access the underlying functionality of TapAPP **123** and receive the data transfer from the sending WTRU **101**. The underlying mechanics and technologies of touchscreens and displays are beyond the scope of this disclosure and are therefore omitted for the sake of clarity.

Referring to FIG. **2**, a WTRU **101** configured for communicating data to target WTRU $\mathbf{101}_{c,t}$ is shown. The WTRU **101** comprises a user interface (UI) **109**, a processor **105**, a communication peripheral **107**, and an antenna **209**. Other components located within the WTRU **101**, for example, are a transmitter and receiver, but are not shown to avoid obfuscating the data communication illustration of FIG. **2**. The communication peripheral **107** operates in the lower layers, for example, the physical (PHY) communication layer. The communication peripheral **107** receives and processes information relating to the electromagnetic environment in which the WTRU **101** is operating. The electromagnetic environment (hereafter referred to as local areas **211**, **213**) contains information being provided by the energy emanating from other WTRUs $\mathbf{101}_c$ operating within the local areas **211**, **213** of the WTRU **101**.

The local area in which WTRU **101** is operating may be configured to be a smaller radius of communication as identified by **213**, or the local area may be configured to be a larger radius as identified by **211**. The radius that defines the local areas **211**, **213** may be configured at the WTRU **101** by a user-defined variable that defines a search radius with respect to the WTRU **101**. Additionally, the local area in which the WTRU **101** is operating may be defined by any other appropriate manner. The communication peripheral **107** receives and maintains the environment information relating to the WTRUs $\mathbf{101}_c$ operating within the local areas **211**, **213**.

WTRUs $\mathbf{101}_c$ operating within the local areas **211**, **213** of WTRU **101** are referred to as candidate WTRUs $\mathbf{101}_c$ because they are potential recipients of data to be communicated by WTRU **101**. As shown in FIG. **2**, there may be more than one candidate WTRU $\mathbf{101}_c$ as indicated by the WTRUs denoted with a "c". Candidate WTRUs $\mathbf{101}_c$ may be WTRUs similarly equipped like WTRU **101**. From the candidate WTRUs $\mathbf{101}_c$, at least one target WTRU $\mathbf{101}_{c,t}$ will be selected. FIG. **2** shows only one target WTRU $\mathbf{101}_{c,t}$, but there may be more than one target WTRU $\mathbf{101}_{c,t}$ selected from the candidate WTRUs $\mathbf{101}_c$. For example, one WTRU **101** configured to communicate data to another WTRU, may communicate data to one or a multitude of other WTRUs selected from a set of candidate WTRUs $\mathbf{101}_c$.

WTRU **101** comprises a UI **109** which may allow a user to provide user input to the WTRU **101**. Through the UI **109**, the user may provide user preferences relating to the communication of data from the WTRU **101**. The UI **109**, may be implemented, for example, in a touchscreen/display. Using a touchscreen display, the user may provide gestural actions to indicate user preferences. The user's gestures may be directed to some visual depiction displayed on the touchscreen/display. The user may manipulate the visual depiction through a pre-defined gesture that is indicative of the user's preferences regarding the data communication. For example, the visual depiction may identify a selected media element stored in the WTRU **101**. The user may manipulate the visual depiction of the media element to indicate the movement of the media element through the local areas **211**, **213**, in which the WTRU **101** is operating. Such movement, for example, may include distance denoted by the speed at which the visual depiction is moved across the UI **109**, or alternatively by the pressure exerted on the surface of the UI **109** by the user. Other gestural inputs may be defined to indicate user preferences. Direction of a data communication within the local areas **211**, **213** where the WTRU **101** is operating may be indicated by a movement of the visual depiction in the direction to indicate the direction of the data communication. Thus, for example, if the user wishes a data communication to occur between the user's WTRU **101** and another WTRU operating in local areas **211**, **213** (i.e. the user has identified a desired target WTRU $\mathbf{101}_{c,t}$), the user may provide a gesture via the UI **109** that is representative of the distance and direction of the selected target WTRU $\mathbf{101}_{c,t}$ with respect to the sending WTRU **101**.

WTRU **101** includes a processor **105** that is configurable to process information from the UI **109** and the communication peripheral **107**. Electromechanical signals from the UI **109** are provided as inputs to the processor **105**. Processor **105** may be configurable to execute machine readable instructions stored in any type of memory. Processor **105** is also configured to receive environment information stored by the communication peripheral **107**. The environment information and the user input are then used as inputs to the processor **105** and are processed to identify a target WTRU $\mathbf{101}_{c,t}$. The electromechanical inputs from the UI **109**, which may include for example, an indication of direction and distance, are then correlated to the environment information stored at the lower layers by the communication peripheral **107**. Based on the correlation, a identification of at least one target WTRU $\mathbf{101}_{c,t}$ is determined and a data communication from the WTRU **101** may be transmitted to the identified target WTRU $\mathbf{101}_{c,t}$.

The lower level information is provided to the application processor **105** according to the communication technology being used. For example, the information available to the application processor **205** may vary based on an implementation using a Third Generation Partnership Project (3GPP) technology, an Institute of Electronic and Electrical Engineers (IEEE) standard such as WiFi, or some other communication technology. For example IEEE 802.21 standard may be used where the TapAPP may register with an 802.21 client or other proprietary client to access and process lower layer information. Specific information relevant to the TapAPP's identification of a target WTRU $\mathbf{101}_{c,t}$ may be provided from the communications peripheral **107**.

FIG. **3** shows inputs that may be used to drive a target discrimination algorithm **313** that uniquely identifies a target WTRU for transfer of data. Possible inputs include environment information **301**, receiver information **303**, touchscreen

information **305** and other information **307**, such as WTRU **101** orientation for example where the WTRU **101** includes an accelerometer and supporting drivers. After processing the available inputs **301**, **303**, **305**, and **307** by the application processor **105** through a target discrimination algorithm **313**, configuration information **309** and transmission instructions **311** are generated as outputs.

The environment information **301** may, for example, be generated as follows. The application processor **105** may process instructions to periodically solicit information from the communication peripheral **107** relating to candidate WTRUs $\mathbf{101}_c$ operating in the local areas **211**, **213** of a communicating WTRU **101**. A configuration variable may be provided that allows the end user to define a search radius (e.g. 2-3 m) in which to solicit information. Devices outside the configured search radius will be excluded from received environment information. Throughout the timeframe that the application processor **105** is running a data communication application, the solicited information will be regenerated or updated. Upon receiving a user input indicating a data communication is desired, the solicited environment information **301** may be refreshed. The information collected regarding the candidate WTRUs $\mathbf{101}_c$ is included in the environment information **301** and may be used as an input to the target discrimination algorithm **313**. In an embodiment, environment information **301** may be solicited by a localization method. For example, in a mesh network or a sensor network, the solicitation may include both the neighboring devices as well as independent device elements that enable the location and identity of each candidate WTRU to be determined accurately. Such a network may be comprised of independent sensors that respond to the communication peripheral **107** of the communicating WTRU **101**, or may include the candidate WTRUs $\mathbf{101}_c$, operating in the local areas **211**, **213** of the communicating WTRU **101**.

The environment information **301** may be gathered via a service discovery protocol (SDP) such as currently available in protocols such as Bluetooth®, for example. This protocol allows the WTRU **101** to discover the services (e.g. TapAPP as described herein) that are supported by other WTRUs operating in the local environment. An application such as TapAPP described above may invoke SDP functionality to discover all of the TapAPP enabled WTRUs operating in a particular location. For example, a Bluetooth® connection may be used to implement a SDP for this purpose. A radio dialog between the WTRU **101** and one or more candidate WTRUs $\mathbf{101}_c$ is established according to the defined SDP. Information received in the radio dialog may be analyzed and filtered (e.g. power level, or quality of a received signal) to determine the individual candidate WTRUs $\mathbf{101}_c$ or set of candidate WTRUs $\mathbf{101}_c$ in a local proximity. When a set of candidate WTRUs $\mathbf{101}_c$ is determined, a second level of search radius granularity may be applied by further defined radio dialogs between the WTRU **101** and a subset of candidate WTRUs $\mathbf{101}_c$. In addition to the SDP information directly discoverable by the WTRU $\mathbf{101}_c$ each candidate WTRU $\mathbf{101}_c$ may exchange additional locally gathered information (e.g. GPS, or other location information gathered via a localization scheme) with other candidate WTRUs $\mathbf{101}_c$. On a condition that a sufficient number of candidate WTRUs $\mathbf{101}_c$ are identified by the SDP, triangulation mechanisms may be implemented to establish a view of relative locations between a set of identified candidate WTRUs $\mathbf{101}_c$. The entire environment discovery procedure may be implemented continuously and in real-time while the TapAPP is running on all the candidate WTRUs $\mathbf{101}_c$ with the TapAPP capabilities to update and maintain a real-time local map that is preserved in each instance of the TapAPP.

The receiver information **303**, may be generated according to the following example. During data communication, send and receive operations are initiated between a sending WTRU **101** and a target WTRU $\mathbf{101}_{c,t}$. The user of the sending WTRU **101** initiates, through a user input, a send operation for a selected media element. On the receiving side, the target WTRU $\mathbf{101}_{c,t}$ user may touch and hold the touchscreen of the target WTRU $\mathbf{101}_{c,t}$ for all or part of the transfer process. The user input of the target WTRU $\mathbf{101}_{c,t}$ may result in the target WTRU $\mathbf{101}_{c,t}$ transmitting a radio signal to the sending WTRU **101**, for example, an acknowledgement signal, the radio signal may be reported to the application processor **105**. This receiver information **303** may serve as an input to the target discrimination algorithm **313**.

A user input received from the UI **109**, for example a touchscreen/display, may be translated into application signals by the touchscreen/display **109** or processor **105**. This touchscreen information **305** is input to the target discrimination algorithm **313** to identify a target WTRU $\mathbf{101}_{c,t}$. Touchscreen information **305** may include a file reference, speed, pressure, acceleration, timing information, direction, etc. File reference information may be used to identify a selected media element stored in the file system of the sending WTRU **101** that is the object of the data communication.

Directional inputs provided by the user via the touchscreen/display **109** may be synthesized to establish relative orientation to the real-time local map and select a target WTRU $\mathbf{101}_{c,t}$ from the identified group of candidate WTRUs $\mathbf{101}_c$ to establish a one-to-one communication between the transmitting WTRU **101** and the target WTRU $\mathbf{101}_{c,t}$ or a selected one-to-many communication to a plurality of target WTRUs $\mathbf{101}_{c,t}$. In an example of a user input, an accelerometer associated with the WTRU **101** may provide input regarding the orientation of the WTRU **101** with respect to the real-time local map. For example, if the WTRU **101** was held upside-down, the real-time local map would be referenced and applied upside-down as dictated by the orientation of the sending WTRU **101**.

Other information **307** may be used as an input to the target discrimination algorithm **313**. For example, if the sending WTRU **101** device is equipped with an accelerometer and supporting drivers, the orientation of the sending WTRU **101** may be used as input information **307**. Any type of other information **307** germane to the selection of a target WTRU $\mathbf{101}_{c,t}$ may be used as an input to the target discrimination algorithm **313**.

Configuration information **309** may include settings for attributes such as power level, antenna orientation, security parameters and the like. Transmission instructions **311** may include information regarding the data to be communicated and the identity of the target WTRU $\mathbf{101}_{c,t}$ as well as instructions for implementing the transfer through specific components in the communication peripheral. The configuration information **309** and transmission instructions **311** may be delivered to the communication peripheral **107**. The configuration information **309** and transmission instructions **311** may impact the configuration of the Layer 2/3 baseband components, (e.g., the power settings), and/or the analog and radio frequency components, (e.g., antenna orientation of the communication peripheral **107**). The application processor **105** in the sending WTRU **101** may control the manner in which the data is transferred to the target WTRU $\mathbf{101}_{c,t}$, for example, by breaking the data into blocks corresponding to the manner in which the visual depiction of the data should appear at the

target WTRU $101_{c,t}$. This control may involve the appending of some segmentation/display guidance information to the file blocks that may be used at the target WTRU $101_{c,t}$ receiver to help render the visual depiction in a synergistic manner which is described in more detail hereinafter with respect to FIG. **7**.

FIG. **4** shows a method of identifying a target WTRU $101_{c,t}$ for a data communication with multiple WTRUs. Environment information **301** is solicited and information related to at least one candidate WTRU $101_c$ operating in the local area of the sending WTRU **101** is detected **401**. A user input is received **403**, for example, through a touchscreen/display UI **109**, wherein the user input is related to the communication of data from the sending WTRU **101** to at least one candidate WTRU $101_c$. The user input and the environment information relating to the candidate WTRUs $101_c$ is processed simultaneously **405**. For example, in a target discrimination algorithm **313** as described in FIG. **3**. At least one target WTRU $101_{c,t}$ is identified from the set of candidate WTRUs **407**. The target WTRU $101_{c,t}$ is identified at least in part on the user input received and the environment information **301** detected.

Physical layer security mechanisms may be applied to establish the environment information **301** as well as securing the data for short range data communication between WTRUs **101**. The data may be transferred only as far as is necessary to reach a minimal set of users in the local environment of the sending WTRU **101**. The target discrimination algorithm **313** may be configured to secure the file from beyond a local group (i.e. the local environment of the sending WTRU **101**) and excluding others. One example of achieving this is a secure data transfer based on the reciprocity of the wireless channels between the sending WTRU **101** and the target WTRU $101_{c,t}$. The uniqueness and reciprocity of the wireless channel may be utilized to accomplish this in two steps. First, the location information for a particular WTRU **101** is associated with a channel impulse response (CIR) from that WTRU **101**, which is unique, albeit variable. The CIR may be used to generate a secret key stream for that location. A more detailed description of such a secret key encryption may be found in U.S. patent application Ser. No. 11/339,958 which is herein incorporated by reference. A common cipher source, for example, Advanced Encryption Standard (AES), may be seeded with the key, and the information for the target WTRU $101_{c,t}$ is encrypted with it. Alternatively or in addition, the CIR based information may be used to authenticate the message. The result is that only the selected target WTRU $101_{c,t}$ may receive the data, because only the target WTRU $101_{c,t}$ has the required channel-based key.

FIG. **5** shows an implementation of physical layer security for data communication between multiple WTRUs **101**. The static (or slowly changing) physical location **501** of WTRUs **101** operating in the local areas **211**, **213** and their respective radio channels **503** are input to a locations and channels association unit **505** that associates the locations **501** and the channels **503** of each WTRU **101** operating in the local areas **211**, **213**. Dynamic receiver information **507** relating to the CIR of each communicating WTRU **101** is used by channel-based key distillation unit **509**, which continuously generates channel-based encryption keys for each WTRU **101** in the local environment. When required by a user, as indicated by touchscreen information **513**, a target WTRU $101_{c,t}$ may be identified from an available listing of candidate WTRUs $101_c$ by the dynamic target matching algorithm **515**. The dynamic target matching algorithm **515**, receives input from the locations and channels association unit **505**, the channel-based encryption keys **509**, and the touchscreen information **513**, and the directional information **511** of the sending WTRU as inputs to identify one or more target WTRUs $101_{c,t}$ as the recipient(s) of the data communication. Transmission instructions **517** are generated to facilitate the data transfer to the target WTRUs $101_{c,t}$.

Referring now to FIG. **6**, a user input action for sending a file to another device is shown. The data transfer may take place from a sending WTRU **101** as shown in FIG. **1**. The sending WTRU **101** may use an application such as TapAPP **123** to facilitate the data transfer. The sending WTRU **101** may have a touchscreen/display device **109** through which an end user may provide input information to the sending WTRU **101**. The transfer application (TapAPP **123**) may be running on the sending WTRU **101**. As an example, TapAPP **123** may be configured to receive a simple three step hand (or finger) motion to enable the data transfer. The three steps include a tap **6**A, a push action **6**B, and a release action **6**C. Referring to **6**A, the user taps **605** the touchscreen **109** at a location on the touchscreen **109** where a visual depiction **603** of a media element to be transferred is displayed. Without lifting the finger used to tap **605** the visual depiction **603**, the user then pushes the visual depiction **603** of the media element across the touchscreen **109** as shown by the directional arrow **607** in FIG. **6**B. In an embodiment, the direction in which the user pushes the visual depiction **603** may simulate the direction of a target receiving WTRU $101_{c,t}$ which is the intended recipient of the media element to be transferred. The media element may be any type of data file capable of being stored on the WTRU **101**, for example, the media element may be a digital photograph, a video file, a word processing document or the like. When the user has pushed the visual depiction **603** of the media element in the direction the user would like the media element to be transferred, the user then releases **609** contact with the visual depiction **603** to initiate the data transfer. The three user actions **6**A, **6**B, and **6**C, provide inputs to the touchscreen **109**, which may be converted to electromechanical signals through mechanisms known in the art. The electromechanical signals may serve as input to the TapAPP **123** application, which may generate environmental information and transmission instructions relating to a target WTRU $101_{c,t}$ selected by TapAPP in a manner explained above with respect to FIG. **3**. The environmental information **301** and transmission instructions **311** are then processed by the WTRU **101** and the media element is transmitted **611**.

FIGS. **7**A and **7**B are an illustration of a data transfer depicted from the perspective of both a sending WTRU **101** and a receiving WTRU **103**. The data transfer is a process between two or more WTRUs. For example, the data transfer may originate from one sending WTRU **101** and be directed toward one or more receiving WTRUs **103**. As seen in FIG. **7**A, the media element being transferred in this example is a digital photograph. A visual depiction **603** may be displayed on the touchscreen/display **109**. The sender may touch the touchscreen **109** and push **707** the visual depiction **603** of the digital photograph in the direction of the intended receiving WTRU **103**. A receiving WTRU **103** may run TapAPP **123** to enable the receiving WTRU **103** to receive the transferred data. The receiving WTRU **103**, for example, may be running TapAPP **123** in a receive mode. The TapAPP **123** provides an indication **603***b* or a prompt that a data transfer is ready for receiving. To receive a file, the user may touch **701** the touchscreen **109** to initiate reception of the data transfer. The user may touch **701** the touchscreen **109** for the entire time the data transfer is taking place, or the user may touch **701** the touchscreen **109** for some portion of the time the data transfer is occurring.

During the transfer, the visual depiction **603** may be configured to display the progress of the data transfer to the user

at one or both of the sending WTRU **101** and the receiving WTRU **103**. As shown in FIG. **7**A on the sending WTRU **101** as visual depiction **603***a*, the portion of the data transfer remaining to be sent may be displayed on the touchscreen/display **109** of the sending WTRU **101** as a partial visual depiction **603***a* of the digital photograph. As the data transfer progresses, the visual depiction **603***a* is updated to indicate the remaining amount of data to be transferred. Similarly, at the receiving WTRU **103**, a visual depiction **603***b* may be displayed on the touchscreen/display **109** of the receiving WTRU **103** to indicate to a user the amount of the data transfer that has been transmitted to the receiving WTRU **103**. As shown in FIG. **7**B, when the data transfer is complete, the visual depiction **603** is displayed in its entirety at the receiving WTRU **103**. Upon receipt of the file, the user of the receiving WTRU **103** may release the touchscreen **109** and the receiving WTRU **103** may send an application level acknowledgment to the sending WTRU **101**. Thus, as shown in FIGS. **7**A and **7**B, the user may observe the visual depiction **603***a* disappearing from the sending WTRU **101** while the visual depiction **603***b* is emerging on the receiving WTRU **103** in such manner that the overall visual depiction **603** is preserved for the duration of the data transfer. The underlying data transfer mechanism may prioritize the transfer of data file elements to enable this user experience. In an alternate embodiment, this user experience may be provided at the application level. The file may be transferred as a whole, but the rendering aspect of the application on both the send and receive sides of the data transfer creates the appearance of a progressive and contiguous data transfer.

FIG. **8** is an illustration of the user experience while sending a data transfer in a direction of a targeted recipient. The same three step process described in FIG. **6** is utilized where the sender taps **605** a visual depiction **603** of the selected media element. As shown in FIG. **8**B, the sender then pushes the visual depiction **603** of the media element to the right **801** which may simulate the physical direction with relation to the sending WTRU **101** where an intended receiving WTRU **103** (not shown) is operating. Based on the input information of the user, including the direction **801** in which the sender pushed the visual depiction **603** of the media element, the sending WTRU **101** may be configured to transmit the data transfer in a direction **803** matching the direction of the user action direction **801**. The visual depiction **603** may be configured to indicate the progress of the data transfer and may accomplish this by causing the visual depiction **603** to disappear from the touchscreen/display **109** in the same direction as the user action direction **801**. Antenna orientation may be utilized to control the transmission direction **803**.

FIG. **9** shows an illustration of a UI **109** being used to perform a data communication to multiple receiving WTRUs. The user may tap on a visual depiction **903** of a media element selected for communication to a receiving WTRU as shown in FIG. **9**A. As shown, the user may tap on the visual depiction **903** multiple times **905**. While in the example of FIG. **9**A, the user taps the visual depiction **903** twice, the user may tap the visual depiction **903** any number of times corresponding to the intended number of receiving WTRUs. Upon performing a multiple tap **905**, the master visual depiction **903** will be split into a number of secondary visual depictions **907**, **909** equal to the number of taps **905** of the user. This action by the user will lock the master visual depiction **903** while allowing the secondary visual depictions **907**, **909** to be manipulated by the user via the UI **109**. For example, with respect to FIG. **9**B, a user may use a two-hand, two finger motion to move secondary visual depiction **907** in the direction of a first target WTRU, while simultaneously moving secondary visual depiction **909** in the direction of a second target WTRU. The user may also use a single-hand, single finger motion to move each secondary visual depiction **907**, **909** sequentially. Upon release of the secondary visual depiction **907**, **909**, the data is communicated to a target WTRU identified by the process described herein regarding FIG. **2**. The secondary visual depictions **907**, **909** may be smaller than the master visual depiction **903**, or the secondary depictions may be the same size as the master depiction. Alternatively, the secondary depictions **907**, **909** may have a visually distinguishing feature that distinguishes them from the master depiction **903** to the user.

Although features and elements are described above in particular combinations, each feature or element can be used alone without the other features and elements or in various combinations with or without other features and elements. The methods or flow charts provided herein may be implemented in a computer program, software, or firmware incorporated in a computer-readable storage medium for execution by a general purpose computer or a processor. Examples of computer-readable storage mediums include a read only memory (ROM), a random access memory (RAM), a register, cache memory, semiconductor memory devices, magnetic media such as internal hard disks and removable disks, magneto-optical media, and optical media such as CD-ROM disks, and digital versatile disks (DVDs).

Suitable processors include, by way of example, a general purpose processor, a special purpose processor, a conventional processor, a digital signal processor (DSP), a plurality of microprocessors, one or more microprocessors in association with a DSP core, a controller, a microcontroller, Application Specific Integrated Circuits (ASICs), Field Programmable Gate Arrays (FPGAs) circuits, any other type of integrated circuit (IC), and/or a state machine.

A processor in association with software may be used to implement a radio frequency transceiver for use in a wireless transmit receive unit (WTRU), user equipment (UE), terminal, base station, radio network controller (RNC), or any host computer. The WTRU may be used in conjunction with modules, implemented in hardware and/or software, such as a camera, a video camera module, a videophone, a speakerphone, a vibration device, a speaker, a microphone, a television transceiver, a hands free headset, a keyboard, a Bluetooth® module, a frequency modulated (FM) radio unit, a liquid crystal display (LCD) display unit, an organic light-emitting diode (OLED) display unit, a digital music player, a media player, a video game player module, an Internet browser, and/or any wireless local area network (WLAN) or Ultra Wide Band (UWB) module.

What is claimed is:

**1**. A method for controlling communication of data in wireless communications, implemented in a wireless transmit/receive unit (WTRU), the method comprising:

detecting, at the WTRU, environment information relating to at least one candidate WTRU operating in a local area associated with the WTRU;

receiving, at the WTRU, user input that indicates at least a direction and a selection of data for transfer between the WTRU and a target WTRU;

processing, at the WTRU, the user input and the environment information;

identifying, at the WTRU, at least one candidate WTRU as the target WTRU based at least in part on the user input; and,

transmitting the data to the target WTRU.

**2**. The method of claim **1**, wherein detecting environment information comprises:

detecting, at the WTRU, a service supported by the at least one candidate WTRU;

establishing a radio dialog between the WTRU and the at least one candidate WTRU;

analyzing, at the WTRU, a signal received from the candidate WTRU; and

transmitting or receiving, at the WTRU, detected service information to or from and the at least one candidate WTRU.

**3**. The method of claim **2**, wherein the service is detected by a Service Discovery Protocol (SDP).

**4**. The method of claim **3**, wherein analyzing the signal received by the candidate WTRU is based on the power level of the received signal.

**5**. The method of claim **3**, wherein analyzing the signal received by the candidate WTRU is based on the quality of the received signal.

**6**. The method of claim **1**, wherein detecting environment information further comprises:

performing, at the WTRU, a first radius search, wherein a first number of candidate WTRUs are detected;

performing, at the WTRU, a second radius search based on the detected first number of candidate WTRUs; and

selecting, at the WTRU, a subset of the first number of candidate WTRUs, wherein the subset is selected based on service supported by each of the first number of candidate WTRUs.

**7**. A method of communicating data in wireless communications, implemented in a wireless transmit/receive unit (WTRU), the method comprising:

receiving, at the WTRU, user input;

soliciting information, at the WTRU, related to at least one candidate WTRU operating in a local area of the WTRU;

constructing a real-time local map including relative position information for the at least one candidate WTRU;

identifying, at the WTRU, a target WTRU based at least in part on the user input, the real-time local map, and the solicited information from the at least one candidate WTRU;

generating, at the WTRU, environment information based on the target WTRU;

generating, at the WTRU, transmission instructions based on the target WTRU; and

transmitting data to the target WTRU based on the environment information and the transmission instructions.

**8**. The method of claim **7** wherein the real-time local map includes relative location information relating to the at least one candidate determined through a triangulation procedure.

**9**. The method of claim **7**, wherein the real-time local map includes relative location information relating to the at least one candidate WTRU established through Global Positioning System (GPS) information.

**10**. The method of claim **7**, wherein the real-time local map is determined by a radio dialog defined by a service discovery protocol.

**11**. A method of transmitting data implemented in a wireless transmit/receive unit (WTRU), the method comprising:

receiving, at the WTRU, a gestural user input, wherein the gesture is directed toward a desired receiving WTRU;

analyzing, at the WTRU, an electromagnetic spectrum in a local area of the WTRU;

identifying, at the WTRU, at least one candidate WTRU operating in the electromagnetic spectrum and the local area of the WTRU;

processing, at the WTRU, the user input to select a target WTRU from the identified at least one candidate WTRU; and

transmitting data to the target WTRU.

**12**. A method of data transfer implemented in a wireless transmit/receive unit (WTRU), the method comprising:

soliciting, at the WTRU, environment information relating to active communication devices in a local area of the WTRU;

selecting, at the WTRU, a media element stored in a file system of the WTRU;

receiving, at the WTRU, a physical input from a user

converting, at the WTRU, the physical input to an electromechanical signal;

selecting, at the WTRU, a target WTRU based on the electromechanical signal and the environment information;

generating configuration information and target transmission instructions based on the selected media element; and

transmitting the selected media element to the selected target WTRU based on the generated configuration information and target transmission instructions.

**13**. The method of claim **12**, wherein the soliciting information is based on a configuration variable which indicates a search radius defining the local area of the sending communication device.

**14**. The method of claim **12**, wherein the soliciting information is obtained periodically and on a condition that the sending communication device enters a send operation.

**15**. The method of claim **12**, wherein soliciting information relating to active communication devices is performed through a mesh network or a sensor network.

**16**. The method of claim **12**, wherein receiving a physical input from the user is performed through a touchscreen.

**17**. The method of claim **12**, wherein receiving a physical input from the user comprises:

detecting the user touching a user interface;

sensing a motion of the user's touch;

detecting a release of the user's touch.

**18**. The method of claim **17**, wherein detecting the user touching the user interface includes detecting the user touching a visual representation of the identified media element.

**19**. The method of claim **17**, wherein selecting a receiving communication device comprises:

receiving an electromechanical signal, which indicates a direction of the motion of a the user', touch by the user;

analyzing the solicited information based on active communication devices in the local area of the sending communication device;

identifying a target receiving device located in a direction of the motion of the user's touch; and

selecting the target receiving device for transmitting the selected media element.

**20**. A wireless transmit/receive unit (WTRU) comprising:

a processor configured to detect environment information relating to at least one candidate WTRU operating in a local area associated with the WTRU;

a display configured to receive user input that indicates at least a direction and a selection of data for transfer between the WTRU and a target WTRU;

the processor configured to:

process the user input and the environment information; and

identify at least one candidate WTRU as the target WTRU based at least in part on the user input; and

a transmitter configured to transmit the data to the target WTRU.

**21**. The WTRU of claim **20**, wherein the user input is a gestural input.

**22**. The WTRU of claim **21**, wherein the gestural input indicates the at least one direction, and the at least one direction is directed towards the target WTRU.

**23**. The WTRU of claim **20**, wherein the display is a touchscreen.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

# CERTIFICATE OF CORRECTION



PATENT NO. : 8,200,265 B2
APPLICATION NO. : 12/644948
DATED : June 12, 2012
INVENTOR(S) : Carlton et al.

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

At Claim 2, column 11, line 8, after "to or from", delete "and".

At Claim 12, column 12, line 6, after "input from a user", insert --;--.

At Claim 19, column 12, line 38, after "motion of a", delete "the user',".

Signed and Sealed this
Second Day of April, 2013

Teresa Stanek Rea
*Acting Director of the United States Patent and Trademark Office*