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(54) **SYSTEM AND METHOD FOR HANDLING DATA TRANSFERS**

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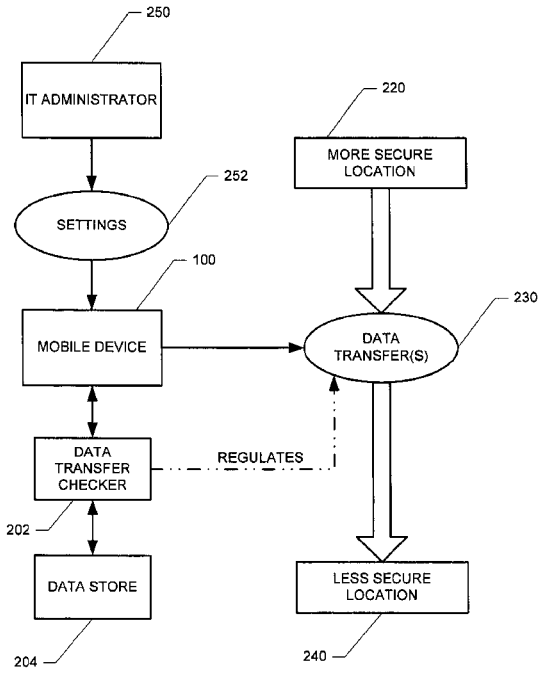
(57) **ABSTRACT**

Systems and methods for managing data transfers between a secure location and a less secure location. A data transfer checker operating on a mobile device determines whether an attempted data transfer between two locations is permitted. If it is not permitted, then the data transfer is prevented and the user may be notified of the data transfer prevention.

25 Claims, 11 Drawing Sheets



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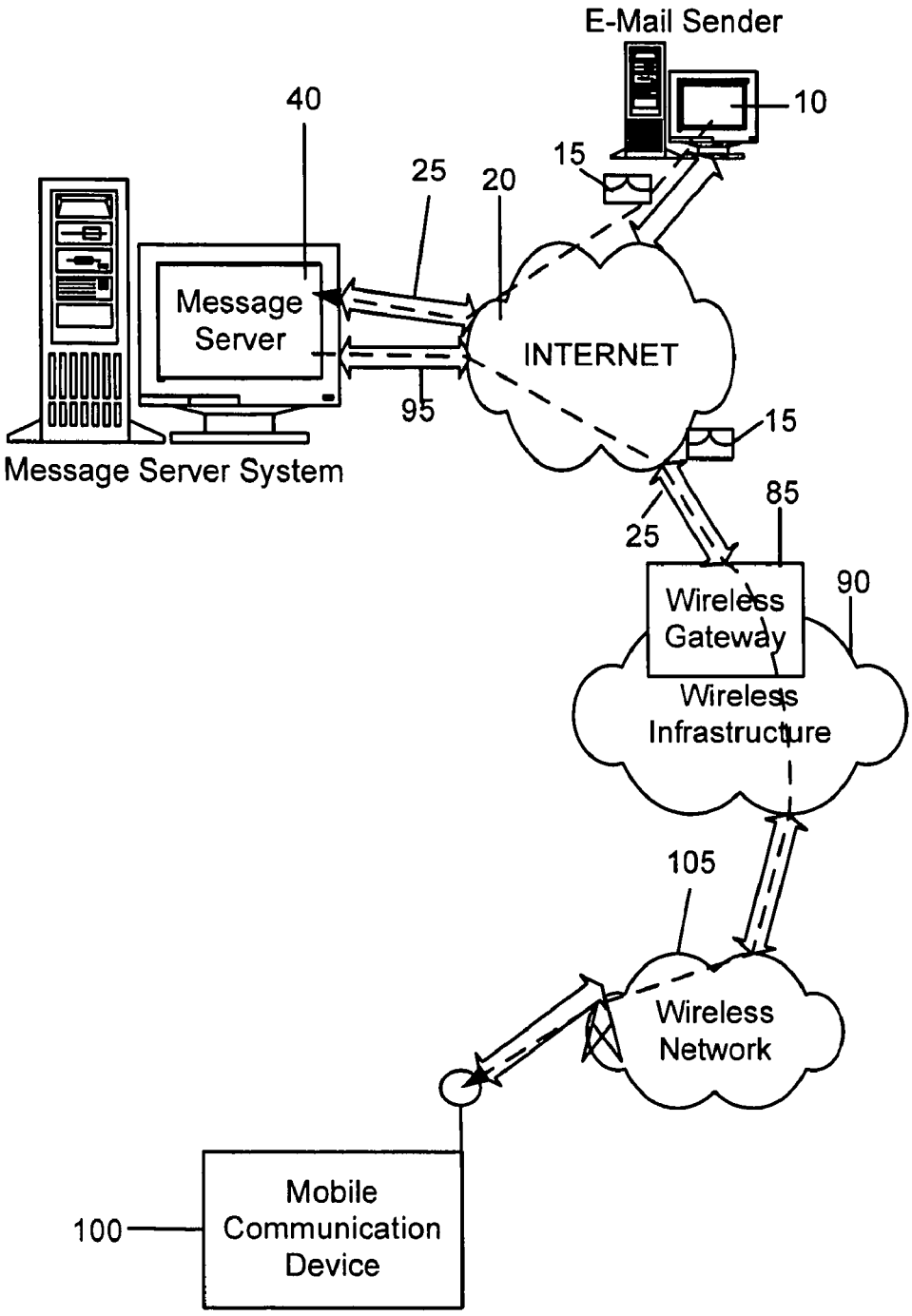

E-Mail Sender
10
40
15
25
20
Message Server
INTERNET
95
15
Message Server System
85
25
90
Wireless Gateway
Wireless Infrastructure
105
Wireless Network
Mobile Communication Device
100

FIG. 1

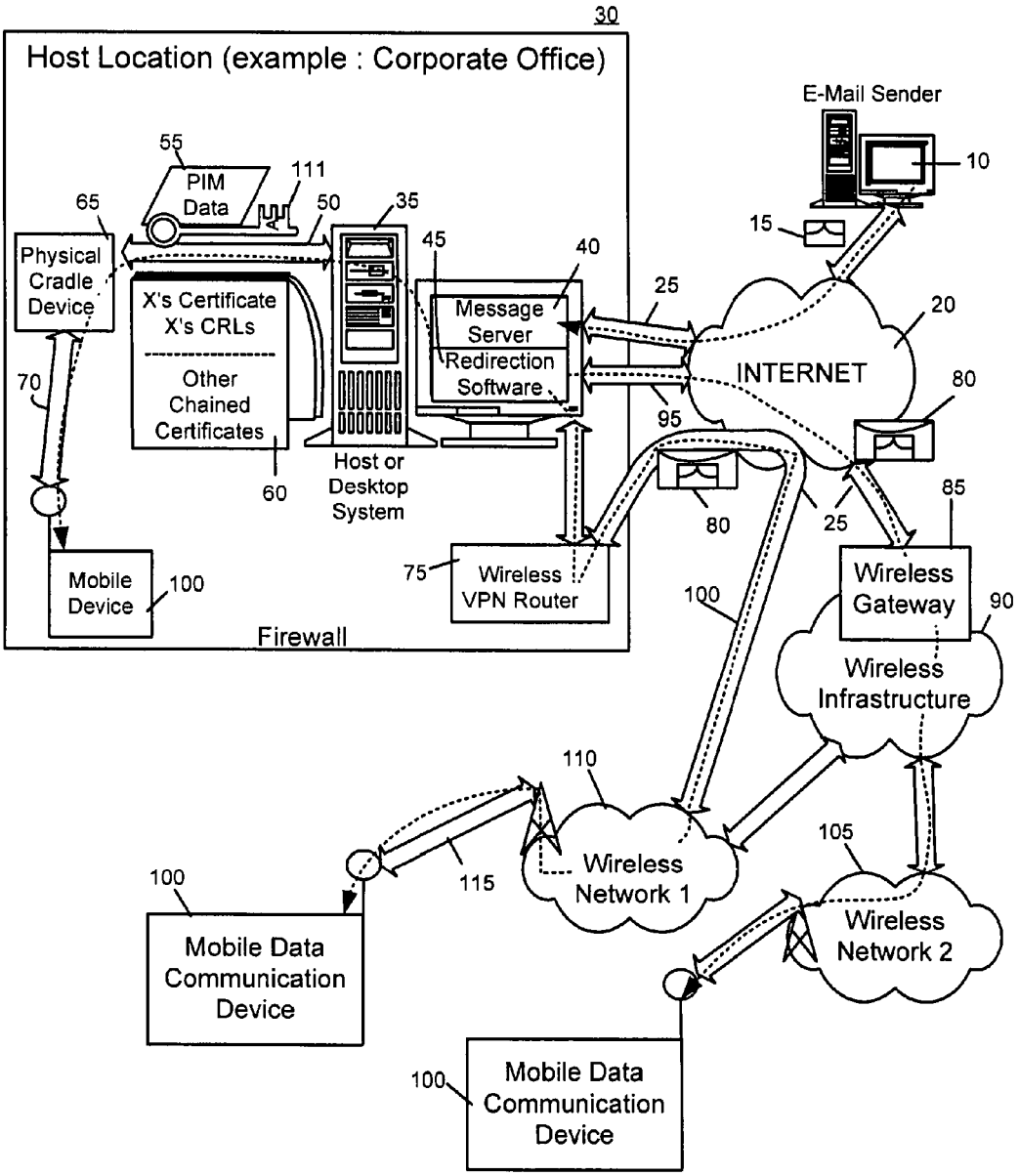

30
Host Location (example : Corporate Office)
E-Mail Sender
10
55
PIM Data
111
50
35
65
45
40
15
Physical Cradle Device
X's Certificate
X's CRLs
Other Chained Certificates
Message Server
Redirection Software
25
20
INTERNET
70
95
80
60
Host or Desktop System
80
85
25
Mobile Device
100
75
Wireless VPN Router
100
Wireless Gateway
90
Firewall
Wireless Infrastructure
110
105
100
115
Wireless Network 1
Wireless Network 2
Mobile Data Communication Device
100
Mobile Data Communication Device

FIG. 2

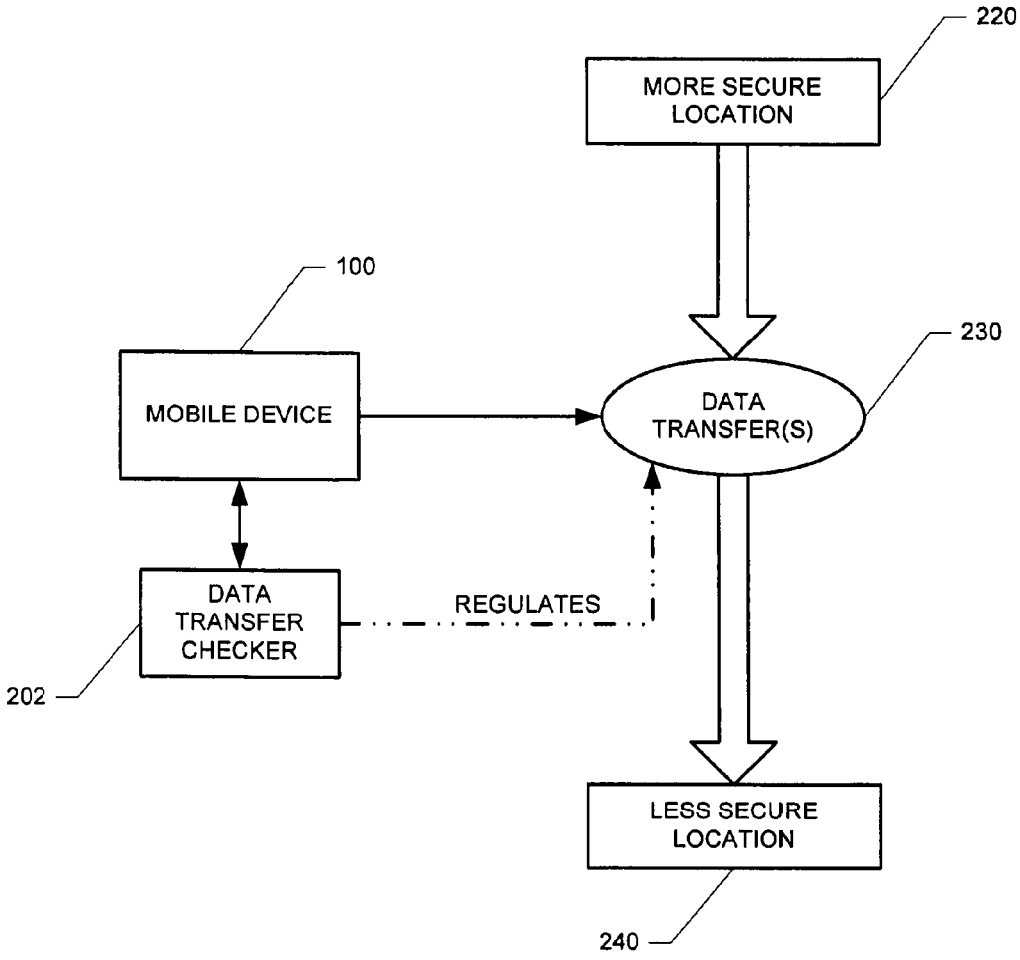
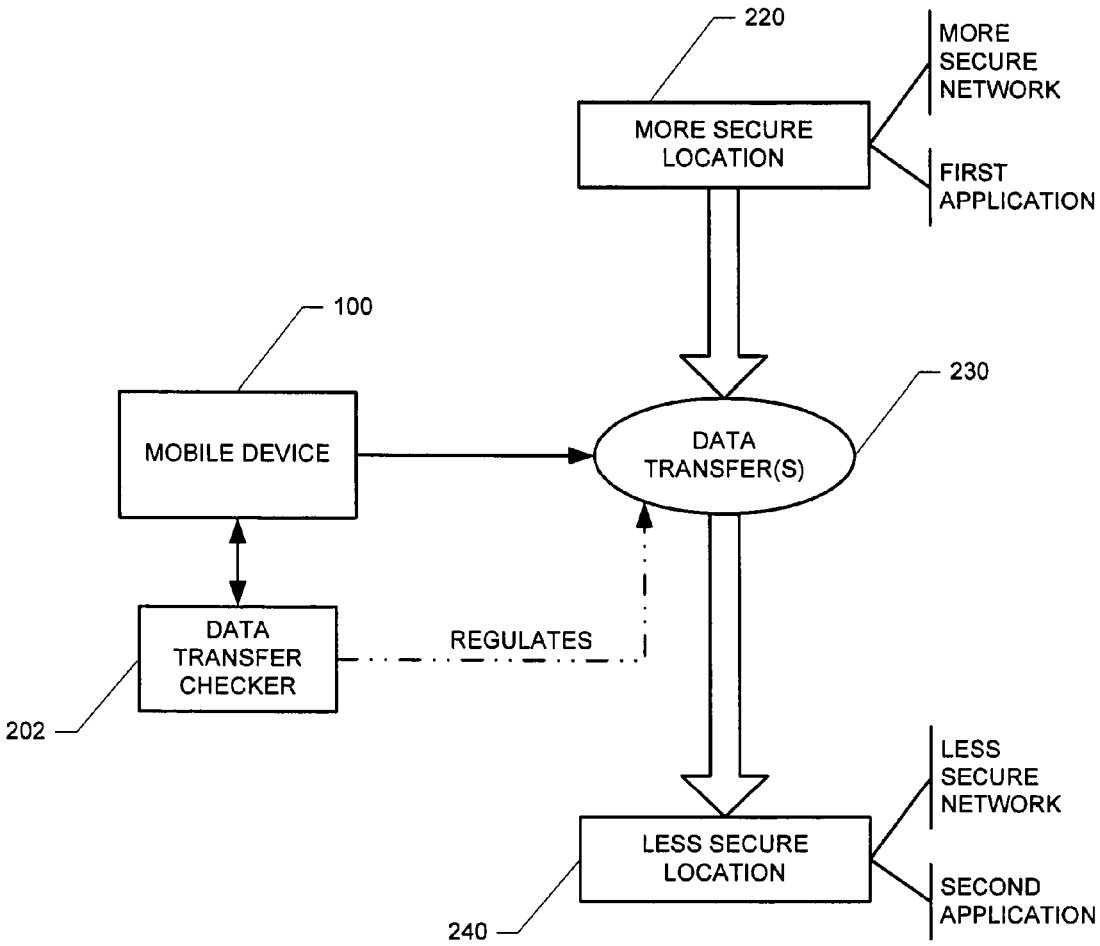

220
MORE SECURE LOCATION
100
MOBILE DEVICE
230
DATA TRANSFER(S)
DATA TRANSFER CHECKER
REGULATES
202
LESS SECURE LOCATION
240

FIG. 3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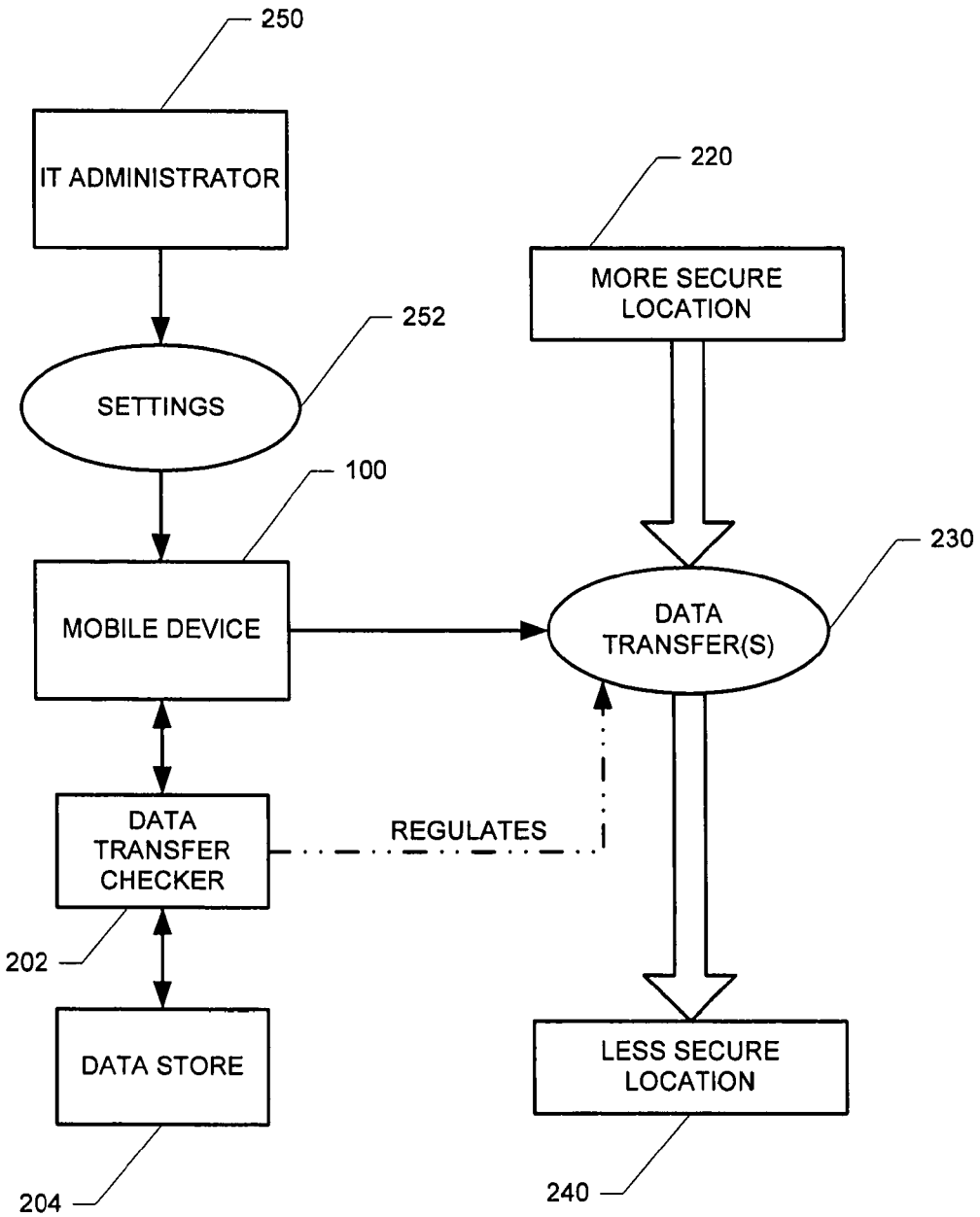
MORE SECURE NETWORK
MORE SECURE LOCATION
FIRST APPLICATION
100
230
MOBILE DEVICE
DATA TRANSFER(S)
DATA TRANSFER CHECKER
REGULATES
202
LESS SECURE NETWORK
LESS SECURE LOCATION
SECOND APPLICATION
240

FIG. 4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IT ADMINISTRATOR
220
MORE SECURE LOCATION
252
SETTINGS
100
MOBILE DEVICE
230
DATA TRANSFER(S)
DATA TRANSFER CHECKER
REGULATES
202
DATA STORE
LESS SECURE LOCATION
204
240

FIG. 5

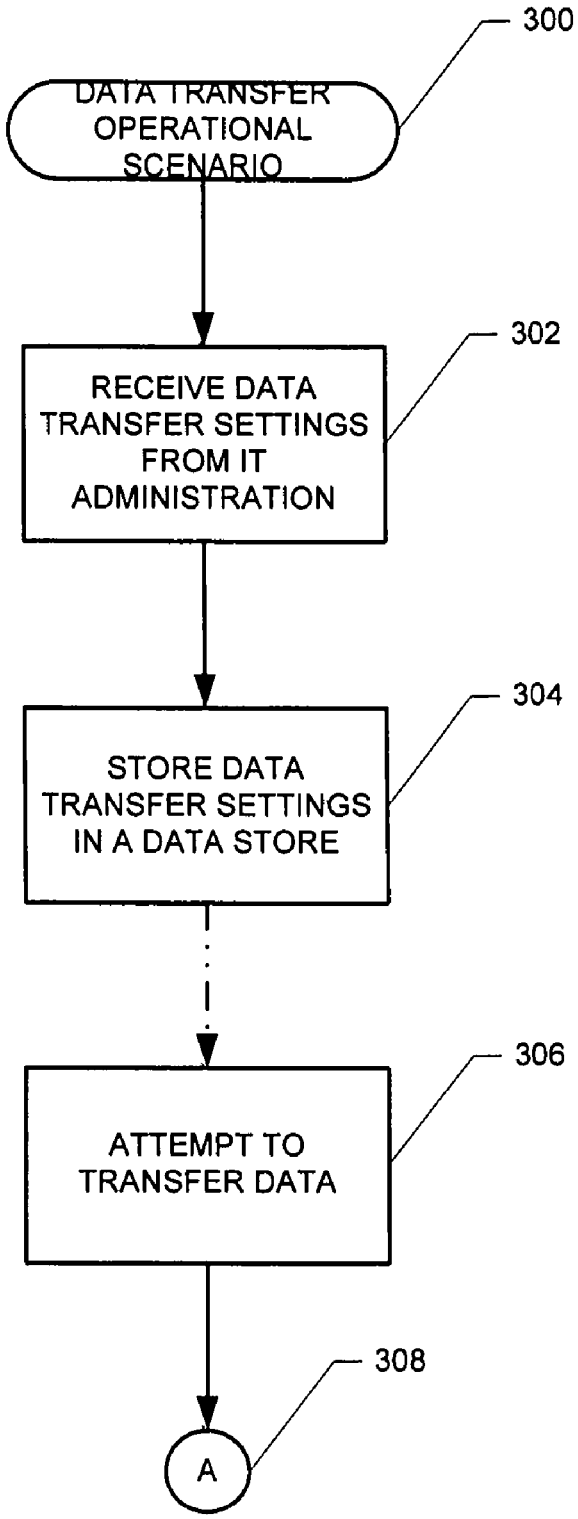
300
DATA TRANSFER OPERATIONAL SCENARIO
302
RECEIVE DATA TRANSFER SETTINGS FROM IT ADMINISTRATION
304
STORE DATA TRANSFER SETTINGS IN A DATA STORE
306
ATTEMPT TO TRANSFER DATA
308
A

FIG. 6

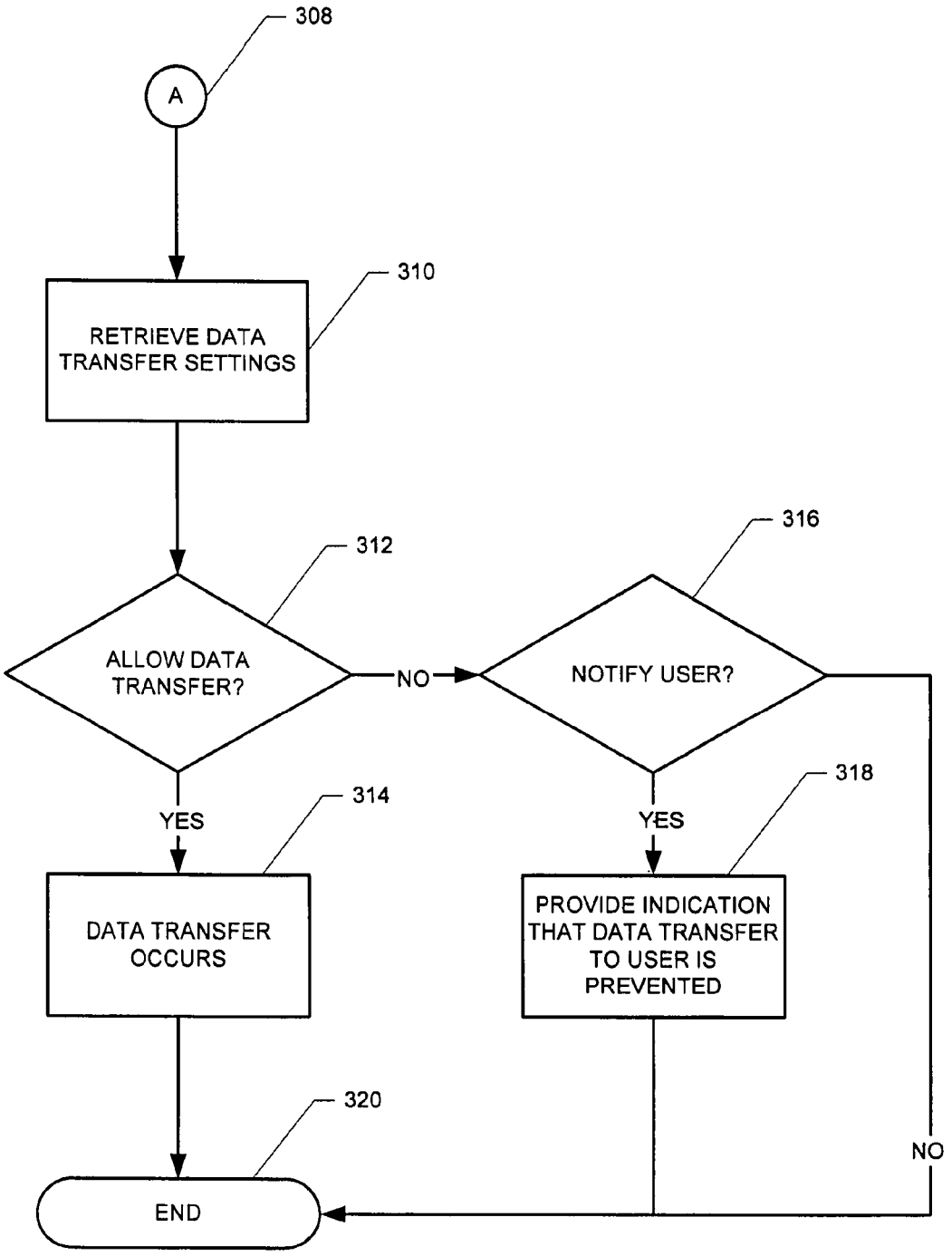
308
A
310
RETRIEVE DATA TRANSFER SETTINGS
312
ALLOW DATA TRANSFER?
NO
316
NOTIFY USER?
YES
314
DATA TRANSFER OCCURS
YES
318
PROVIDE INDICATION THAT DATA TRANSFER TO USER IS PREVENTED
NO
320
END

FIG. 7

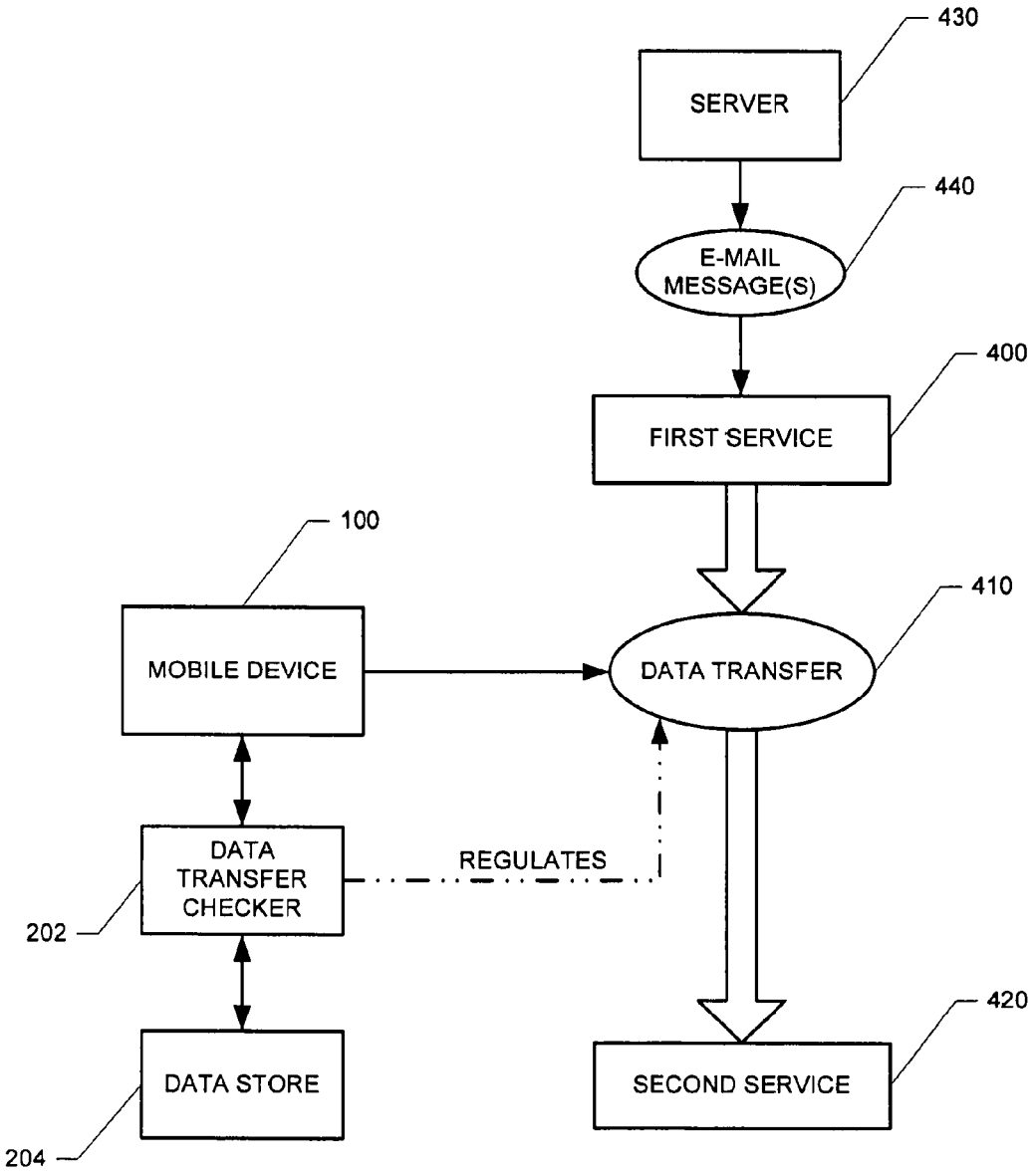
430
SERVER
440
E-MAIL MESSAGE(S)
400
FIRST SERVICE
100
MOBILE DEVICE
410
DATA TRANSFER
DATA TRANSFER CHECKER
REGULATES
202
DATA STORE
204
420
SECOND SERVICE

FIG. 8

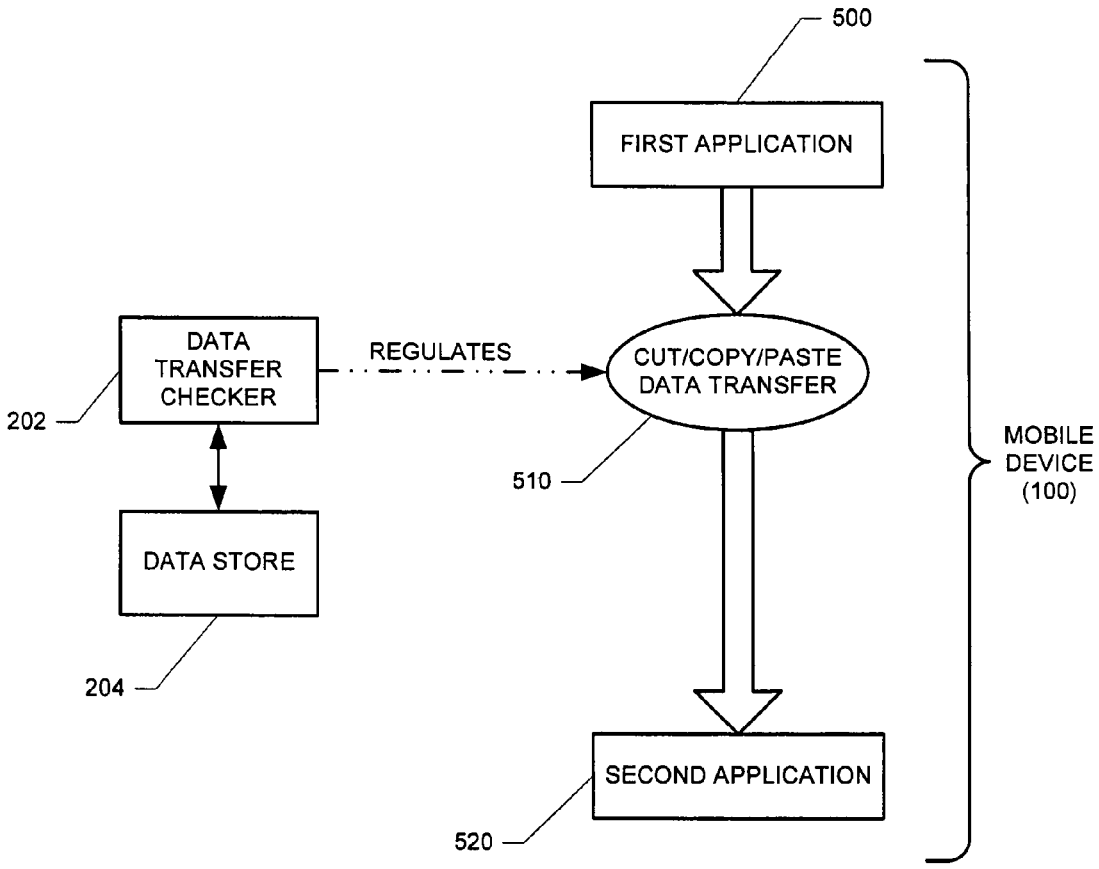
500
FIRST APPLICATION
DATA TRANSFER CHECKER
202
REGULATES
CUT/COPY/PASTE DATA TRANSFER
510
DATA STORE
204
SECOND APPLICATION
520
MOBILE DEVICE (100)

FIG. 9

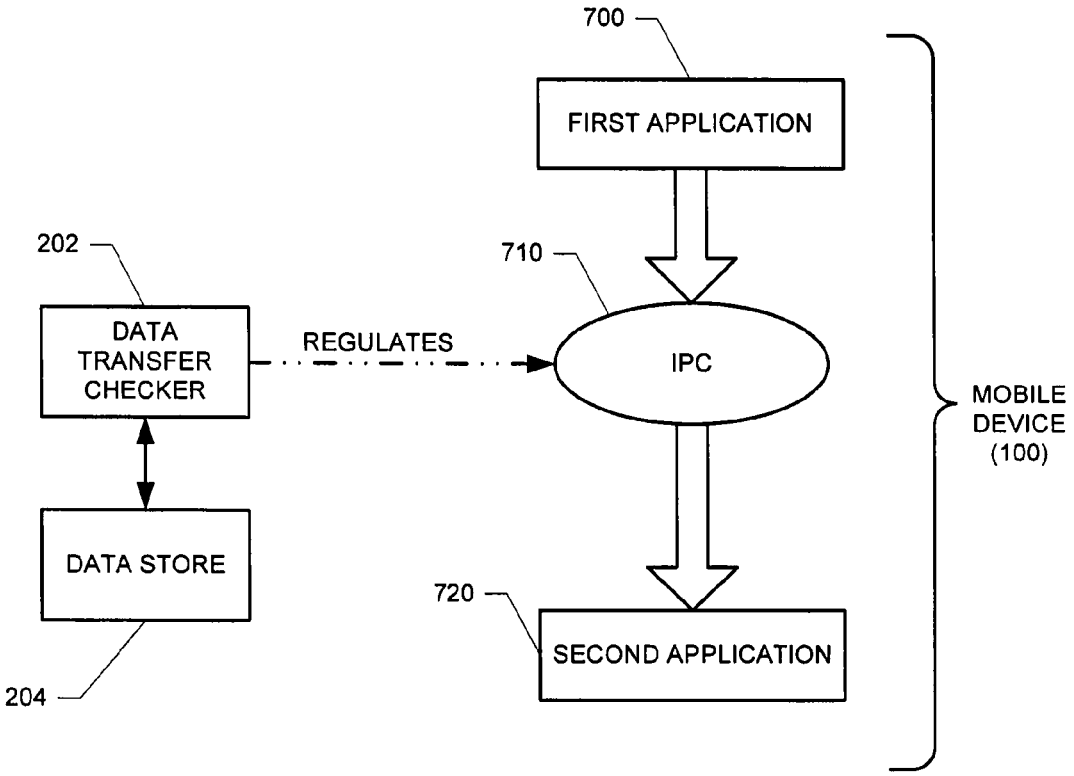
700
FIRST APPLICATION
202
710
DATA TRANSFER CHECKER
REGULATES
IPC
MOBILE DEVICE (100)
DATA STORE
720
SECOND APPLICATION
204

FIG. 10

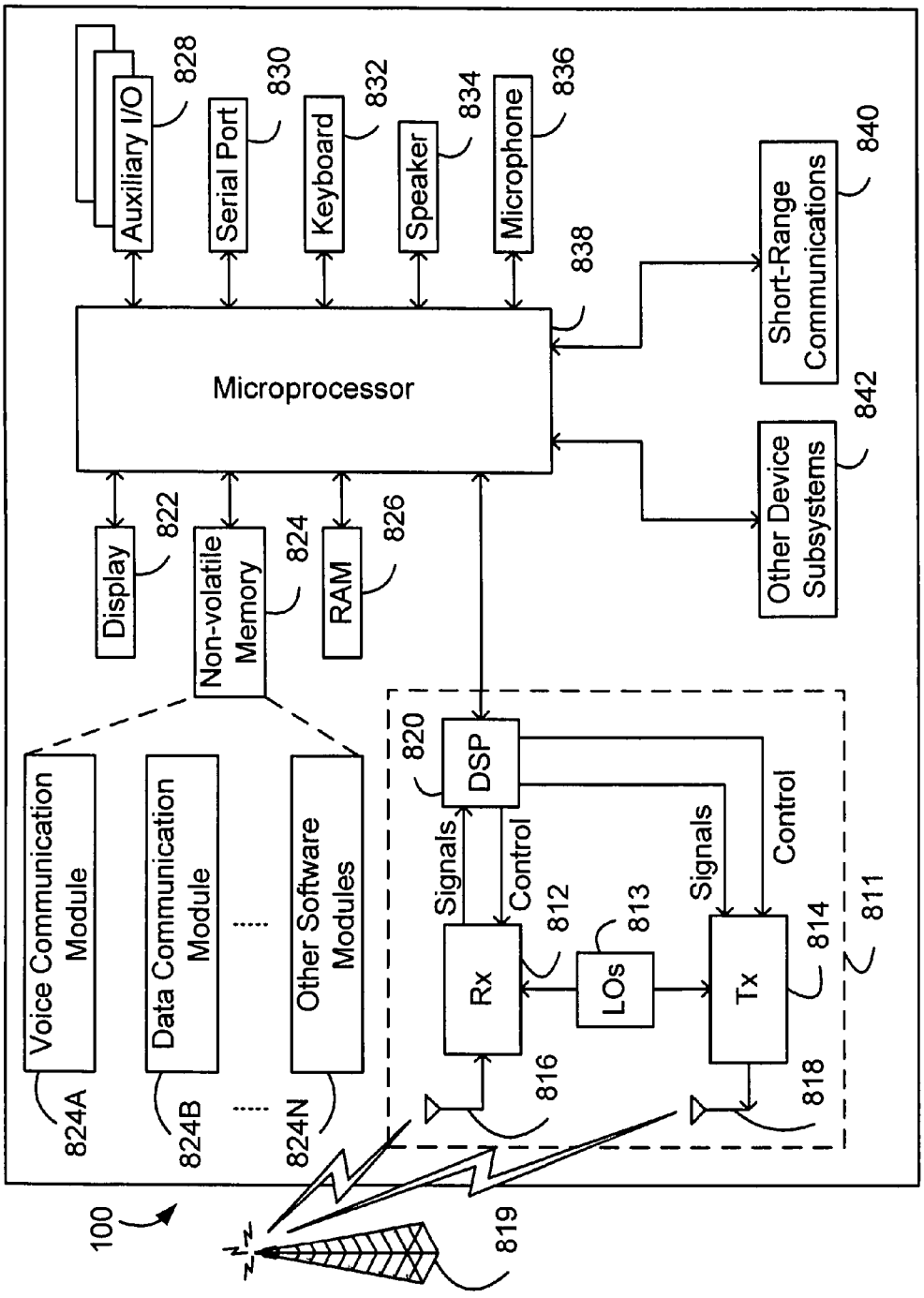
Auxiliary I/O
828
Serial Port
830
Keyboard
832
Speaker
834
Microphone
836
838
Microprocessor
Short-Range Communications
840
Other Device Subsystems
842
Display
822
Non-volatile Memory
824
RAM
826
Voice Communication Module
Data Communication Module
Other Software Modules
824A
824B
824N
820
DSP
Signals
Control
812
Rx
LOs
813
Signals
Control
814
Tx
811
816
818
819
100

FIG. 11

SYSTEM AND METHOD FOR HANDLING DATA TRANSFERS

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue; a claim printed with strikethrough indicates that the claim was canceled, disclaimed, or held invalid by a prior post-patent action or proceeding.

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation reissue application of U.S. application Ser. No. 14/163,416, filed on Jan. 24, 2014, which is a continuation reissue application of reissue application Ser. No. 13/490,956, filed on Jun. 7, 2012, and is a reissue of U.S. Pat. No. 8,005,469.

This application is a continuation of the U.S. patent application Ser. No. 11/118,791, filed Apr. 29, 2005, entitled "SYSTEM AND METHOD FOR HANDLING DATA TRANSFERS." This application and the '791 application claim priority to and the benefit of commonly assigned U.S. Provisional Application having Ser. No. 60/567,293, filed on Apr. 30, 2004, entitled "SYSTEM AND METHOD FOR HANDLING DATA TRANSFERS." All of these are hereby incorporated into this application by reference.

BACKGROUND

1. Technical Field

This document relates generally to the field of communications, and in particular to handling data transfers that involve mobile wireless communications devices.

2. Description of the Related Art

Some companies or governments have different types of networks based on different levels of security. Some of the networks are more secure than others and provide additional levels of security, as well as different procedures for using that network. It is a security concern for data to move between the networks, specifically from a more secure network to a weaker network. An additional problem is how to prevent a malicious application from siphoning data from inside a corporation's firewall to outside the firewall.

For example the government may have a secret network and a non-secret network. The workstations on the secret network may not even be connected to the non-secret network to explicitly prevent data siphoning. To prevent data siphoning between these networks for mobile communications, the government would have to deploy two separate PDAs to each employee that uses both of the networks. This is a costly approach.

As another example, an organization may wish to deploy handhelds to employees, which connect to their corporate network as well as their personal (home) email accounts. It would be detrimental for an employee to siphon data between their corporate secure network to their personal accounts.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an overview of an example communication system in which a wireless communication device may be used.

FIG. **2** is a block diagram of a further example communication system including multiple networks and multiple mobile communication devices.

FIGS. **3** and **4** are block diagrams depicting management of data transfers between a secure location and a less secure location.

FIG. **5** is a block diagram depicting an IT administrator providing data transfer settings to a mobile device.

FIGS. **6** and **7** are flowcharts depicting a data transfer operational scenario.

FIG. **8** is a block diagram depicting a data transfer prevention feature wherein data forwarding between service books is prevented.

FIG. **9** is a block diagram depicting a data transfer prevention feature wherein cut/copy/paste operations are disabled for applications on a mobile device.

FIG. **10** is a block diagram depicting a data transfer prevention feature wherein Inter-Process Communication (IPC) are disabled between applications operating on a mobile device.

FIG. **11** is a block diagram of an example mobile device.

DETAILED DESCRIPTION OF THE DRAWINGS

FIG. **1** is an overview of an example communication system in which a wireless communication device may be used. One skilled in the art will appreciate that there may be many different topologies, but the system shown in FIG. **1** helps demonstrate the operation of the encoded message processing systems and methods described in the present application. There may also be many message senders and recipients. The simple system shown in FIG. **1** is for illustrative purposes only, and shows perhaps the most prevalent Internet e-mail environment where security is not generally used.

FIG. **1** shows an e-mail sender **10**, the Internet **20**, a message server system **40**, a wireless gateway **85**, wireless infrastructure **90**, a wireless network **105** and a mobile communication device **100**.

An e-mail sender system **10** may, for example, be connected to an ISP (Internet Service Provider) on which a user of the system **10** has an account, located within a company, possibly connected to a local area network (LAN), and connected to the Internet **20**, or connected to the Internet **20** through a large ASP (application service provider) such as America Online (AOL). Those skilled in the art will appreciate that the systems shown in FIG. **1** may instead be connected to a wide area network (WAN) other than the Internet, although e-mail transfers are commonly accomplished through Internet-connected arrangements as shown in FIG. **1**.

The message server **40** may be implemented, for example, on a network computer within the firewall of a corporation, a computer within an ISP or ASP system or the like, and acts as the main interface for e-mail exchange over the Internet **20**. Although other messaging systems might not require a message server system **40**, a mobile device **100** configured for receiving and possibly sending e-mail will normally be associated with an account on a message server. Perhaps the two most common message servers are Microsoft Exchange™ and Lotus Domino™. These products are often used in conjunction with Internet mail routers that route and deliver mail. These intermediate components are not shown in FIG. **1**, as they do not directly play a role in the secure message processing described below. Message servers such as server **40** typically extend beyond just e-mail sending and receiving; they also include dynamic database storage

engines that have predefined database formats for data like calendars, to-do lists, task lists, e-mail and documentation.

The wireless gateway **85** and infrastructure **90** provide a link between the Internet **20** and wireless network **105**. The wireless infrastructure **90** determines the most likely network for locating a given user and tracks the user as they roam between countries or networks. A message is then delivered to the mobile device **100** via wireless transmission, typically at a radio frequency (RF), from a base station in the wireless network **105** to the mobile device **100**. The particular network **105** may be virtually any wireless network over which messages may be exchanged with a mobile communication device.

As shown in FIG. **1**, a composed e-mail message **15** is sent by the e-mail sender **10**. located somewhere on the Internet **20**. This message **15** is normally fully in the clear and uses traditional Simple Mail Transfer Protocol (SMTP), RFC822 headers and Multipurpose Internet Mail Extension (MIME) body parts to define the format of the mail message. These techniques are all well known to those skilled in the art. The message **15** arrives at the message server **40** and is normally stored in a message store. Most known messaging systems support a so-called "pull" message access scheme, wherein the mobile device **100** must request that stored messages be forwarded by the message server to the mobile device **100**. Some systems provide for automatic routing of such messages which are addressed using a specific e-mail address associated with the mobile device **100**. In a preferred embodiment described in further detail below, messages addressed to a message server account associated with a host system such as a home computer or office computer which belongs to the user of a mobile device **100** are redirected from the message server **40** to the mobile device **100** as they are received.

Regardless of the specific mechanism controlling the forwarding of messages to the mobile device **100**, the message **15**, or possibly a translated or reformatted version thereof, is sent to the wireless gateway **85**. The wireless infrastructure **90** includes a series of connections to wireless network **105**. These connections could be Integrated Services Digital Network (ISDN), Frame Relay or T1 connections using the TCP/IP protocol used throughout the Internet. As used herein, the term "wireless network" is intended to include three different types of networks, those being (1) data-centric wireless networks, (2) voice-centric wireless networks and (3) dual-mode networks that can support both voice and data communications over the same physical base stations. Combined dual-mode networks include, but are not limited to, (1) Code Division Multiple Access (CDMA) networks, (2) the Groupe Special Mobile or the Global System for Mobile Communications (GSM) and the General Packet Radio Service (GPRS) networks, and (3) future third-generation (3G) networks like Enhanced Data-rates for Global Evolution (EDGE) and Universal Mobile Telecommunications Systems (UMTS). Some older examples of data-centric network include the Mobitex™ Radio Network and the DataTAC™ Radio Network. Examples of older voice-centric data networks include Personal Communication Systems (PCS) networks like GSM, and TDMA systems.

FIG. **2** is a block diagram of a further example communication system including multiple networks and multiple mobile communication devices. The system of FIG. **2** is substantially similar to the FIG. **1** system, but includes a host system **30**, a redirection program **45**, a mobile device cradle **65**, a wireless virtual private network (VPN) router **75**, an additional wireless network **110** and multiple mobile communication devices **100**. As described above in conjunction with FIG. **1**, FIG. **2** represents an overview of a sample network topology. Although the encoded message processing systems and methods described herein may be applied to networks having many different topologies, the network of FIG. **2** is useful in understanding an automatic e-mail redirection system mentioned briefly above.

The central host system **30** will typically be a corporate office or other LAN, but may instead be a home office computer or some other private system where mail messages are being exchanged. Within the host system **30** is the message server **40**, running on some computer within the firewall of the host system, that acts as the main interface for the host system to exchange e-mail with the Internet **20**. In the system of FIG. **2**, the redirection program **45** enables redirection of data items from the server **40** to a mobile communication device **100**. Although the redirection program **45** is shown to reside on the same machine as the message server **40** for ease of presentation, there is no requirement that it must reside on the message server. The redirection program **45** and the message server **40** are designed to co-operate and interact to allow the pushing of information to mobile devices **100**. In this installation, the redirection program **45** takes confidential and non-confidential corporate information for a specific user and redirects it out through the corporate firewall to mobile devices **100**. A more detailed description of the redirection software **45** may be found in the commonly assigned U.S. Pat. No. 6,219,694 ("the '694 patent"), entitled "System and Method for Pushing Information From A Host System To A Mobile Data Communication Device Having A Shared Electronic Address", and issued to the assignee of the instant application on Apr. 17, 2001 which is hereby incorporated into the present application by reference. This push technique may use a wireless friendly encoding, compression and encryption technique to deliver all information to a mobile device, thus effectively extending the security firewall to include each mobile device **100** associated with the host system **30**.

As shown in FIG. **2**, there may be many alternative paths for getting information to the mobile device **100**. One method for loading information onto the mobile device **100** is through a port designated **50**, using a device cradle **65**. This method tends to be useful for bulk information updates often performed at initialization of a mobile device **100** with the host system **30** or a computer **35** within the system **30**. The other main method for data exchange is over-the-air using wireless networks to deliver the information. As shown in FIG. **2**, this may be accomplished through a wireless VPN router **75** or through a traditional Internet connection **95** to a wireless gateway **85** and a wireless infrastructure **90**, as described above. The concept of a wireless VPN router **75** is new in the wireless industry and implies that a VPN connection could be established directly through a specific wireless network **110** to a mobile device **100**. The possibility of using a wireless VPN router **75** has only recently been available and could be used when the new Internet Protocol (IP) Version 6 (IPV6) arrives into IP-based wireless networks. This new protocol will provide enough IP addresses to dedicate an IP address to every mobile device **100** and thus make it possible to push information to a mobile device **100** at any time. A principal advantage of using this wireless VPN router **75** is that it could be an off-the-shelf VPN component, thus it would not require a separate wireless gateway **85** and wireless infrastructure **90** to be used. A VPN connection would preferably be a Transmission Control Protocol (TCP)/IP or User Datagram Protocol (UDP)/IP connection to deliver the messages

directly to the mobile device **100**. If a wireless VPN **75** is not available then a link **95** to the Internet **20** is the most common connection mechanism available and has been described above.

In the automatic redirection system of FIG. **2**, a composed e-mail message **15** leaving the e-mail sender **10** arrives at the message server **40** and is redirected by the redirection program **45** to the mobile device **100**. As this redirection takes place the message **15** is re-enveloped, as indicated at **80**, and a possibly proprietary compression and encryption algorithm can then be applied to the original message **15**. In this way, messages being read on the mobile device **100** are no less secure than if they were read on a desktop workstation such as **35** within the firewall. All messages exchanged between the redirection program **45** and the mobile device **100** preferably use this message repackaging technique. Another goal of this outer envelope is to maintain the addressing information of the original message except the sender's and the receiver's address. This allows reply messages to reach the appropriate destination, and also allows the "from" field to reflect the mobile user's desktop address. Using the user's e-mail address from the mobile device **100** allows the received message to appear as though the message originated from the user's desktop system **35** rather than the mobile device **100**.

With reference back to the port **50** and cradle **65** connectivity to the mobile device **100**, this connection path offers many advantages for enabling one-time data exchange of large items. For those skilled in the art of personal digital assistants (PDAs) and synchronization, the most common data exchanged over this link is Personal Information Management (PIM) data **55**. When exchanged for the first time this data tends to be large in quantity, bulky in nature and requires a large bandwidth to get loaded onto the mobile device **100** where it can be used on the road. This serial link may also be used for other purposes, including setting up a private security key **111** such as an S/MIME or PGP specific private key, the Certificate (Cert) of the user and their Certificate Revocation Lists (CRLs) **60**. The private key is preferably exchanged so that the desktop **35** and mobile device **100** share one personality and one method for accessing all mail. The Cert and CRLs are normally exchanged over such a link because they represent a large amount of the data that is required by the device for S/MIME, PGP and other public key security methods.

FIG. **3** depicts a system wherein data transfers **230** between a secure location **220** and a less secure location **240** is managed on a mobile device **100** by a data transfer checker **202**. A data transfer checker **202** can be implemented on a mobile device **100** as a software routine or in hardware or firmware. FIG. **4** provides several examples of locations **220** and **240**. For example, location **220** may be a top-secret or secure network and location **240** may be an unrestricted network.

As another example, location **220** may be a first application that has received sensitive or confidential information. An attempt to transfer data from the first application to a second application may be prevented by the data transfer checker **202** because if the data transfer is successful to the second application, then the second application might be used to disseminate the sensitive data to an unsecured location.

FIG. **5** depicts an IT (information technology) administrator **250** (or its agent) providing data transfer criterion or settings **252** to a mobile device **100**. The settings **252** can indicate what data transfers **230** are permitted and which ones are not permitted. The settings **252** can be stored in a data store **204** located on the mobile device **100** for access by a data transfer checker **202**.

The IT administrator **250** can specify data transfer settings **252** to one or more devices. The settings **252** may be provided to the mobile device **100** over a network (or other data connection mechanism) in order to update the data store **204** on the mobile device **100**. The mobile device **100** can be preprogrammed with the settings and can be updated by the IT administrator **250** or can have the initial settings provided by the IT administrator **250**.

This provides, among other things, companies with the capability to customize data transfer settings to suit their needs. Also, an IT administrator **250** can provide the same settings to all mobile devices of the company, thereby ensuring that company mobile devices adhere to a consistent IT policy.

An IT policy can be enforced upon mobile devices in many ways, such as through the approaches described in the following commonly assigned United States patent application which is hereby incorporated by reference: "System And Method Of Owner Control Of Electronic Devices" (Ser. No. 10/732,132 filed on Dec. 10, 2003). This document illustrates how a user of the mobile device can be prevented from altering or erasing owner control information (e.g., data transfer settings **252**) specified by an IT administrator **250**.

FIGS. **6** and **7** illustrate a data transfer operational scenario **300**. At step **302** in the operational scenario, data transfer settings can be provided to one or more mobile devices by IT administration personnel. A company's IT policy can specify that many different data transfer-related features can be enabled/disabled. As an illustration, the data transfer settings can enable/disable such security-related aspects associated with data transfers as the following:

- whether data forwarding between service books should be allowed.
- whether cut/copy/paste operations between applications should be allowed.
- whether applications should be prevented from opening an internal and an external connection.
- whether IPC (interprocess communication) should be allowed between applications.

Using one or more of these features, the company can help ensure that their private data is kept secure. The data transfer settings are stored at step **304** in one or more data stores that are located on the mobile device.

At step **306**, there is an attempt in this operational scenario to transfer data from a first location to a second location. Step **310** retrieves the data transfer settings, and decision step **312** examines whether the data transfer should occur in view of the data transfer settings. If the data transfer should occur as determined by decision step **312**, then the data transfer occurs between the first location and the second location, and processing for this operational scenario terminates at end block **320**.

However, if decision step **312** determines that the data transfer should not be allowed in view of the settings, then decision step **316** determines whether the user should be notified that the data transfer is not permitted. If the user is not to be notified (e.g., because the settings do not allow a feedback message), then processing for this operational scenario terminates at end block **320**. However, if the user is to be notified as determined by decision block **316**, then an indication is provided at step **318** to the user that the data transfer is being prevented. Processing for this operational scenario terminates at end block **320**.

It should be understood that similar to the other processing flows described herein, the steps and the order of the steps in the flowchart described herein may be altered, modified and/or augmented and still achieve the desired outcome.

FIG. **8** illustrates a data transfer prevention feature mentioned above wherein data transfer **410** between services (**400**, **420**) is prevented. Exemplary services comprise a company email service, a user's personal e-mail service, and an instant messaging service. This data transfer prevention feature allows the company to disable improper forwarding/replying between services. For example, if a user receives an email message via a first service **400**, the user is unable to forward it to another email account via a second service **420** (such as a personal e-mail account of the user). Optionally, messages **440** that arrive via a source e-mail server **430** must be replied to or forwarded back through the same source e-mail server **430** from which the message **440** arrived.

FIG. **9** illustrates a data transfer prevention feature mentioned above wherein cut/copy/paste operations **510** are disabled for all or designated applications on the handheld mobile device **100**. As an illustration, even if the forwarding between applications or services is disabled, a determined user may copy messages from one application **500**, compose a new message in a different application **520** and send it through the different application **520**. Disabling cut/copy/paste operations makes this much more difficult for the user to siphon data because they would be forced to retype the entire message or data.

FIG. **10** illustrates a data transfer prevention feature mentioned above wherein Inter-Process Communication (IPC) **710** can be disabled between applications (**700**, **720**) that operate on a mobile device **100**. As is known to one skilled in the art, an application may initiate one or more processes in order to accomplish certain tasks on the handheld mobile device **100**. This data transfer prevention feature would prevent two malicious applications (**700**, **720**) working together to siphon data. As an example, one application **700** could open up a connection inside the firewall, and another application **720** could open a connection outside the firewall. Then using IPC **710**, they could transfer data between the two applications (**700**, **720**) and effectively siphon data. Disabling IPC between the applications (**700**, **720**) prevents this type of attack from occurring.

The data transfer prevention provided by a data transfer checker **202** would inadvertently prohibit IPC between an e-mail program and an address book that are operating on the mobile device **100**. Thus, a company can additionally choose which applications are allowed to use IPC, as some applications, such as the e-mail program and the address book, may have a valid use for it.

The systems and methods disclosed herein are presented only by way of example and are not meant to limit the scope of the invention. Other variations of the systems and methods described above will be apparent to those skilled in the art and as such are considered to be within the scope of the invention. For example, a system and method can be configured to include the following. A data transfer checker operating on a mobile device determines whether an attempted data transfer between two locations is permitted. If it is not permitted, then the data transfer is prevented and the user may be notified of the data transfer prevention.

As another example of a system and method, a system and method can receive a data transfer request to transfer data from a first location to a second location, wherein the first location is more secure than the second location. Data transfer settings are retrieved from a data store responsive to receiving the data transfer request. The data transfer settings indicate whether a data transfer is to occur based upon a security-related aspect associated with the data transfer. The data transfer settings are used to determine whether to transfer the data from the first location to the second location based upon the data transfer settings. The data is transferred responsive to the determining step.

A system and method may be configured to consider one or more different data transfer security-related aspects, such as level of security associated with the destination of the data transfer. As other examples, a security related aspect can include the type of communication operation to be performed between the first location and the second location such as the type of communication to occur. The type of data transfer operation could include data forwarding between service books, opening an internal and an external connection, an Inter-Process Communication (IPC) between applications, and/or a cut-copy-paste type operation between applications.

As another example, the systems and methods disclosed herein may be used with many different computers and devices, such as a wireless mobile communications device shown in FIG. **11**. With reference to FIG. **11**, the mobile device **100** is a dual-mode mobile device and includes a transceiver **811**, a microprocessor **838**, a display **822**, non-volatile memory **824**, random access memory (RAM) **826**, one or more auxiliary input/output (I/O) devices **828**, a serial port **830**, a keyboard **832**, a speaker **834**, a microphone **836**, a short-range wireless communications sub-system **840**, and other device sub-systems **842**.

The transceiver **811** includes a receiver **812**, a transmitter **814**, antennas **816** and **818**, one or more local oscillators **813**, and a digital signal processor (DSP) **820**. The antennas **816** and **818** may be antenna elements of a multiple-element antenna, and are preferably embedded antennas. However, the systems and methods described herein are in no way restricted to a particular type of antenna, or even to wireless communication devices.

The mobile device **100** is preferably a two-way communication device having voice and data communication capabilities. Thus, for example, the mobile device **100** may communicate over a voice network, such as any of the analog or digital cellular networks, and may also communicate over a data network. The voice and data networks are depicted in FIG. **11** by the communication tower **819**. These voice and data networks may be separate communication networks using separate infrastructure, such as base stations, network controllers, etc., or they may be integrated into a single wireless network.

The transceiver **811** is used to communicate with the network **819**, and includes the receiver **812**, the transmitter **814**, the one or more local oscillators **813** and the DSP **820**. The DSP **820** is used to send and receive signals to and from the transceivers **816** and **818**, and also provides control information to the receiver **812** and the transmitter **814**. If the voice and data communications occur at a single frequency, or closely-spaced sets of frequencies, then a single local oscillator **813** may be used in conjunction with the receiver **812** and the transmitter **814**. Alternatively, if different frequencies are utilized for voice communications versus data communications for example, then a plurality of local oscillators **813** can be used to generate a plurality of frequencies corresponding to the voice and data networks **819**. Information, which includes both voice and data information, is communicated to and from the transceiver **811** via a link between the DSP **820** and the microprocessor **838**.

The detailed design of the transceiver **811**, such as frequency band, component selection, power level, etc., will be dependent upon the communication network **819** in which the mobile device **100** is intended to operate. For example, a mobile device **100** intended to operate in a North American market may include a transceiver **811** designed to operate with any of a variety of voice communication networks, such as the Mobitex or DataTAC mobile data communication networks, AMPS, TDMA, CDMA, PCS, etc., whereas a mobile device **100** intended for use in Europe may be configured to operate with the GPRS data communication network and the GSM voice communication network. Other types of data and voice networks, both separate and integrated, may also be utilized with a mobile device **100**.

Depending upon the type of network or networks **819**, the access requirements for the mobile device **100** may also vary. For example, in the Mobitex and DataTAC data networks, mobile devices are registered on the network using a unique identification number associated with each mobile device. In GPRS data networks, however, network access is associated with a subscriber or user of a mobile device. A GPRS device typically requires a subscriber identity module ("SIM"), which is required in order to operate a mobile device on a GPRS network. Local or non-network communication functions (if any) may be operable, without the SIM device, but a mobile device will be unable to carry out any functions involving communications over the data network **819**, other than any legally required operations, such as '911' emergency calling.

After any required network registration or activation procedures have been completed, the mobile device **100** may the send and receive communication signals, including both voice and data signals, over the networks **819**. Signals received by the antenna **816** from the communication network **819** are routed to the receiver **812**, which provides for signal amplification, frequency down conversion, filtering, channel selection, etc., and may also provide analog to digital conversion. Analog to digital conversion of the received signal allows more complex communication functions, such as digital demodulation and decoding to be performed using the DSP **820**. In a similar manner, signals to be transmitted to the network **819** are processed, including modulation and encoding, for example, by the DSP **820** and are then provided to the transmitter **814** for digital to analog conversion, frequency up conversion, filtering, amplification and transmission to the communication network **819** via the antenna **818**.

In addition to processing the communication signals, the DSP **820** also provides for transceiver control. For example, the gain levels applied to communication signals in the receiver **812** and the transmitter **814** may be adaptively controlled through automatic gain control algorithms implemented in the DSP **820**. Other transceiver control algorithms could also be implemented in the DSP **820** in order to provide more sophisticated control of the transceiver **811**.

The microprocessor **838** preferably manages and controls the overall operation of the mobile device **100**. Many types of microprocessors or microcontrollers could be used here, or, alternatively, a single DSP **820** could be used to carry out the functions of the microprocessor **838**. Low-level communication functions, including at least data and voice communications, are performed through the DSP **820** in the transceiver **811**. Other, high-level communication applications, such as a voice communication application **824**A, and a data communication application **824**B may be stored in the non-volatile memory **824** for execution by the microprocessor **838**. For example, the voice communication module **824**A may provide a high-level user interface operable to transmit and receive voice calls between the mobile device **100** and a plurality of other voice or dual-mode devices via the network **819**. Similarly, the data communication module **824**B may provide a high-level user interface operable for sending and receiving data, such as e-mail messages, files, organizer information, short text messages, etc., between the mobile device **100** and a plurality of other data devices via the networks **819**.

The microprocessor **838** also interacts with other device subsystems, such as the display **822**, the RAM **826**, the auxiliary input/output (I/O) subsystems **828**, the serial port **830**, the keyboard **832**, the speaker **834**, the microphone **836**, the short-range communications subsystem **840** and any other device subsystems generally designated as **842**.

Some of the subsystems shown in FIG. **11** perform communication-related functions, whereas other subsystems may provide "resident" or on-device functions. Notably, some subsystems, such as the keyboard **832** and the display **822** may be used for both communication-related functions, such as entering a text message for transmission over a data communication network, and device-resident functions such as a calculator or task list or other PDA type functions.

Operating system software used by the microprocessor **838** is preferably stored in a persistent store such as non-volatile memory **824**. The non-volatile memory **824** may be implemented, for example, as a Flash memory component, or as battery backed-up RAM. In addition to the operating system, which controls low-level functions of the mobile device **810**, the non-volatile memory **824** includes a plurality of software modules **824**A-**824**N that can be executed by the microprocessor **838** (and/or the DSP **820**), including a voice communication module **824**A, a data communication module **824**B, and a plurality of other operational modules **824**N for carrying out a plurality of other functions. These modules are executed by the microprocessor **838** and provide a high-level interface between a user and the mobile device **100**. This interface typically includes a graphical component provided through the display **822**, and an input/output component provided through the auxiliary I/O **828**, keyboard **832**, speaker **834**, and microphone **836**. The operating system, specific device applications or modules, or parts thereof, may be temporarily loaded into a volatile store, such as RAM **826** for faster operation. Moreover, received communication signals may also be temporarily stored to RAM **826**, before permanently writing them to a file system located in a persistent store such as the Flash memory **824**.

An exemplary application module **824**N that may be loaded onto the mobile device **100** is a personal information manager (PIM) application providing PDA functionality, such as calendar events, appointments, and task items. This module **824**N may also interact with the voice communication module **824**A for managing phone calls, voice mails, etc., and may also interact with the data communication module for managing e-mail communications and other data transmissions. Alternatively, all of the functionality of the voice communication module **824**A and the data communication module **824**B may be integrated into the PIM module.

The non-volatile memory **824** preferably also provides a file system to facilitate storage of PIM data items on the device. The PIM application preferably includes the ability to send and receive data items, either by itself, or in conjunction with the voice and data communication modules **824**A, **824**B, via the wireless networks **819**. The PIM data items are preferably seamlessly integrated, synchronized and updated, via the wireless networks **819**, with a corre-

sponding set of data items stored or associated with a host computer system, thereby creating a mirrored system for data items associated with a particular user.

Context objects representing at least partially decoded data items, as well as fully decoded data items, are preferably stored on the mobile device **100** in a volatile and non-persistent store such as the RAM **826**. Such information may instead be stored in the non-volatile memory **824**, for example, when storage intervals are relatively short, such that the information is removed from memory soon after it is stored. However, storage of this information in the RAM **826** or another volatile and non-persistent store is preferred, in order to ensure that the information is erased from memory when the mobile device **100** loses power. This prevents an unauthorized party from obtaining any stored decoded or partially decoded information by removing a memory chip from the mobile device **100**, for example.

The mobile device **100** may be manually synchronized with a host system by placing the device **100** in an interface cradle, which couples the serial port **830** of the mobile device **100** to the serial port of a computer system or device. The serial port **830** may also be used to enable a user to set preferences through an external device or software application, or to download other application modules **824**N for installation. This wired download path may be used to load an encryption key onto the device, which is a more secure method than exchanging encryption information via the wireless network **819**. Interfaces for other wired download paths may be provided in the mobile device **100**, in addition to or instead of the serial port **830**. For example, a USB port would provide an interface to a similarly equipped personal computer.

Additional application modules **824**N may be loaded onto the mobile device **100** through the networks **819**, through an auxiliary I/O subsystem **828**, through the serial port **830**, through the short-range communications subsystem **840**, or through any other suitable subsystem **842**, and installed by a user in the non-volatile memory **824** or RAM **826**. Such flexibility in application installation increases the functionality of the mobile device **100** and may provide enhanced on-device functions, communication-related functions, or both. For example, secure communication applications may enable electronic commerce functions and other such financial transactions to be performed using the mobile device **100**.

When the mobile device **100** is operating in a data communication mode, a received signal, such as a text message or a web page download, is processed by the transceiver module **811** and provided to the microprocessor **838**, which preferably further processes the received signal in multiple stages as described above, for eventual output to the display **822**, or, alternatively, to an auxiliary I/O device **828**. A user of mobile device **100** may also compose data items, such as e-mail messages, using the keyboard **832**, which is preferably a complete alphanumeric keyboard laid out in the QWERTY style, although other styles of complete alphanumeric keyboards such as the known DVORAK style may also be used. User input to the mobile device **100** is further enhanced with a plurality of auxiliary I/O devices **828**, which may include a thumbwheel input device, a touchpad, a variety of switches, a rocker input switch, etc. The composed data items input by the user may then be transmitted over the communication networks **819** via the transceiver module **811**.

When the mobile device **100** is operating in a voice communication mode, the overall operation of the mobile device is substantially similar to the data mode, except that received signals are preferably be output to the speaker **834** and voice signals for transmission are generated by a microphone **836**. Alternative voice or audio I/O subsystems, such as a voice message recording subsystem, may also be implemented on the mobile device **100**. Although voice or audio signal output is preferably accomplished primarily through the speaker **834**, the display **822** may also be used to provide an indication of the identity of a calling party, the duration of a voice call, or other voice call related information. For example, the microprocessor **838**, in conjunction with the voice communication module and the operating system software, may detect the caller identification information of an incoming voice call and display it on the display **822**.

A short-range communications subsystem **840** is also included in the mobile device **100**. The subsystem **840** may include an infrared device and associated circuits and components, or a short-range RF communication module such as a Bluetooth™ module or an 802.11 module, for example, to provide for communication with similarly-enabled systems and devices. Those skilled in the art will appreciate that "Bluetooth" and "802.11" refer to sets of specifications, available from the Institute of Electrical and Electronics Engineers, relating to wireless personal area networks and wireless local area networks, respectively.

The systems' and methods' data may be stored in one or more data stores. The data stores can be of many different types of storage devices and programming constructs, such as RAM, ROM, Flash memory, programming data structures, programming variables, etc. It is noted that data structures describe formats for use in organizing and storing data in databases, programs, memory, or other computer-readable media for use by a computer program.

The systems and methods may be provided on many different types of computer-readable media including computer storage mechanisms (e.g., CD-ROM, diskette, RAM, flash memory, computer's hard drive, etc.) that contain instructions for use in execution by a processor to perform the methods' operations and implement the systems described herein.

The computer components, software modules, functions and data structures described herein may be connected directly or indirectly to each other in order to allow the flow of data needed for their operations. It is also noted that a module or processor includes but is not limited to a unit of code that performs a software operation, and can be implemented for example as a subroutine unit of code, or as a software function unit of code, or as an object (as in an object-oriented paradigm), or as an applet, or in a computer script language, or as another type of computer code. The software components and/or functionality may be located on a single computing device or distributed across multiple computing devices depending upon the situation at hand.

What is claimed is:

[1. A method of handling data transfers on a device, comprising:

receiving, from an application that accesses data associated with a first location, a request to open a connection with a second location;

retrieving, from a data store on the device, one or more data transfer settings responsive to receiving the request;

wherein the one or more data transfer settings are indicative of a security-related policy for data transfers associated with the first location; and

determining whether to permit the request or not permit the request based upon the one or more data transfer settings.]

[2. The method of claim 1, wherein the first location comprises a server, wherein the second location comprises a server, and wherein the request is to open the connection via a network.]

[3. The method of claim 1, wherein the application is a first application, wherein the second location comprises a second application, wherein the request is to open the connection for Inter-Process Communication (IPC) from the first application to the second application.]

[4. The method of claim 1, wherein the determining comprises using a level of security associated with the first location, and using a level of security associated with the second location.]

[5. The method of claim 1, wherein receiving the request comprises receiving a request to transfer data from the application running on the device to another application on the device.]

[6. The method of claim 1, wherein receiving the request comprises receiving a request to transfer data from the device to another device.]

[7. The method of claim 1, further comprising:

receiving the one or more data transfer settings from a server via a wireless network.]

[8. A device, comprising:

a data store that stores a data transfer setting, wherein the data transfer setting is indicative of a security-related policy for data transfers associated with a first location; and

a processor configured to perform operations comprising:

receiving, from an application that accesses data associated with the first location, a request to open a connection with a second location;

retrieving, from the data store, the data transfer setting responsive to receiving the request; and

determining whether to permit the request or not permit the request based upon the data transfer setting.]

[9. The device of claim 8, wherein the first location comprises a server, wherein the second location comprises a server, and wherein the request is to open the connection via a network.]

[10. The device of claim 8, wherein the application is a first application, wherein the second location comprises a second application, wherein the request is to open the connection for Inter-Process Communication (IPC) from the first application to the second application.]

[11. The device of claim 8, wherein the determining comprises using a level of security associated with the first location, and using a level of security associated with the second location.]

[12. The device of claim 8, wherein receiving the request comprises receiving a request to transfer data from the application running on the device to another application on the device.]

[13. The device of claim 8, wherein receiving the request comprises receiving a request to transfer data from the device to another device.]

[14. The device of claim 8, the operations further comprising:

receiving the data transfer setting from a server via a wireless network; and

storing the data transfer setting in the data store.]

[15. A computer storage device encoded with a computer program, the program comprising instructions that when executed by a communication device cause the communication device to perform operations comprising:

receiving, from an application that accesses data associated with a first location, a request to open a connection with a second location;

retrieving, in response to receiving the request, one or more data transfer settings, which are indicative of a security-related policy for data transfers associated with the first location; and

determining whether to permit the request or not permit the request based upon the one or more data transfer settings.]

[16. The computer storage device of claim 15, wherein the first location comprises a server, wherein the second location comprises a server, and wherein the request is to open the connection via a network.]

[17. The computer storage device of claim 15, wherein the application is a first application, wherein the second location comprises a second application, wherein the request is to open the connection for Inter-Process Communication (IPC) from the first application to the second application.]

[18. The computer storage device of claim 15, wherein the determining comprises using a level of security associated with the first location, and using a level of security associated with the second location.]

[19. The computer storage device of claim 15, wherein receiving the request comprises receiving a request to transfer data from the application running on the communication device to another application on the communication device.]

[20. The computer storage device of claim 15, wherein receiving the request comprises receiving a request to transfer data from the communication device to another communication device.]

[21. The computer storage device of claim 15, the operations further comprising:

receiving the one or more data transfer settings from a server via a wireless network.]

22. A method of handling data transfers on a device, comprising:

receiving a request to transfer data from a first application on the device to a second application on the device, wherein the first application is associated with an enterprise service and the second application is associated with a personal service;

retrieving, from a data store on the device, one or more data transfer settings responsive to receiving the request;

determining that the request to transfer data from the first application on the device to the second application on the device is not to be executed based on the one or more data transfer settings, wherein the one or more data transfer settings represent a security policy that indicates whether data transferring from the enterprise service to the personal service on the same device is enabled or disabled; and

prohibiting the requested data transfer in response to the determining.

23. The method of claim 22, wherein the first application is associated with a company e-mail service and the second application is associated with a personal e-mail service.

24. The method of claim 22, wherein the data transfer includes pasting data cut or copied from the first application to the second application.

25. The method of claim 22, wherein the data transfer includes communicating using Inter-Process Communication (IPC) between the first application and the second application.

26. The method of claim 22, wherein the determining is based on a first security level associated with the first application and a second security level associated with the second application.

27. The method of claim 22, wherein prohibiting the data transfer comprises preventing the first application from establishing a connection with a first network while the second application is connected with a second network.

28. The method of claim 27, wherein the first network has a first security level higher than a second security level of the second network.

29. The method of claim 22, wherein prohibiting the data transfer comprises preventing transfer of the data between a first service book associated with the first application and a second service book associated with the second application.

30. A device, comprising:

a memory; and

at least one hardware processor communicatively coupled with the memory and configured to:

receive a request to transfer data from a first application on the device to a second application on the device, wherein the first application is associated with an enterprise service and the second application is associated with a personal service;

retrieve, from a data store on the device, one or more data transfer settings responsive to receiving the request;

determine that the request to transfer data from the first application on the device to the second application on the device is not to be executed based on the one or more data transfer settings, wherein the one or more data transfer settings represent a security policy that indicates whether data transferring from the enterprise service to the personal service on the same device is enabled or disabled; and

prohibit the requested data transfer in response to the determination.

31. The device of claim 30, wherein the first application is associated with a company e-mail service and the second application is associated with a personal e-mail service.

32. The device of claim 30, wherein the data transfer includes a paste of data cut or copied from the first application to the second application.

33. The device of claim 30, wherein the data transfer includes a communication that uses Inter-Process Communication (IPC) between the first application and the second application.

34. The device of claim 30, wherein the determination is based on a first security level associated with the first application and a second security level associated with the second application.

35. The device of claim 30, wherein the prohibition of the data transfer comprises preventing the first application from establishing a connection with a first network while the second application is connected with a second network.

36. The device of claim 35, wherein the first network has a first security level higher than a second security level of the second network.

37. The device of claim 30, wherein the prohibition of the data transfer comprises preventing transfer of the data between a first service book associated with the first application and a second service book associated with the second application.

38. A non-transitory computer-readable medium containing instructions which, when executed, cause a device to perform operations comprising:

receiving a request to transfer data from a first application on the device to a second application on the device, wherein the one or more data transfer settings represent a security policy that indicates whether data transferring from the enterprise service to the personal service is enabled or disabled;

retrieving, from a data store on the device, one or more data transfer settings responsive to receiving the request;

determining that the request to transfer data from the first application on the device to the second application on the device is not to be executed based on the one or more data transfer settings, wherein the one or more data transfer settings represent a security policy that indicates whether data transferring from the enterprise service to the personal service on the same device is enabled or disabled; and

prohibiting the requested data transfer in response to the determining.

39. The non-transitory computer-readable medium of claim 38, wherein the first application is associated with a company e-mail service and the second application is associated with a personal e-mail service.

40. The non-transitory computer-readable medium of claim 38, wherein the data transfer includes pasting data cut or copied from the first application to the second application.

41. The non-transitory computer-readable medium of claim 38, wherein the data transfer includes communicating using Inter-Process Communication (IPC) between the first application and the second application.

42. The non-transitory computer-readable medium of claim 38, wherein the determining is based on a first security level associated with the first application and a second security level associated with the second application.

43. The non-transitory computer-readable medium of claim 38, wherein prohibiting the data transfer comprises preventing the first application from establishing a connection with a first network while the second application is connected with a second network.

44. The non-transitory computer-readable medium of claim 43, wherein the first network has a first security level higher than a second security level of the second network.

45. The non-transitory computer-readable medium of claim 38, wherein prohibiting the data transfer comprises preventing transfer of the data between a first service book associated with the first application and a second service book associated with the second application.

46. A method of handling data transfers on a device, comprising:

receiving a request to transfer data from a first application on the device to a second application on the device, wherein the first application is associated with an enterprise service and the second application is associated with a personal service;

retrieving, from a data store on the device, one or more data transfer settings responsive to receiving the request;

determining that the request to transfer data from the first application on the device to the second application on the device is to be executed based on the one or more data transfer settings, wherein the one or more data transfer settings represent a security policy that indicates whether data transferring from the enterprise service to the personal service on the same device is enabled or disabled; and

allowing the requested data transfer in response to the determining.

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