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(54) Title: INTERFACE SELECTION FROM MULTIPLE NETWORKS
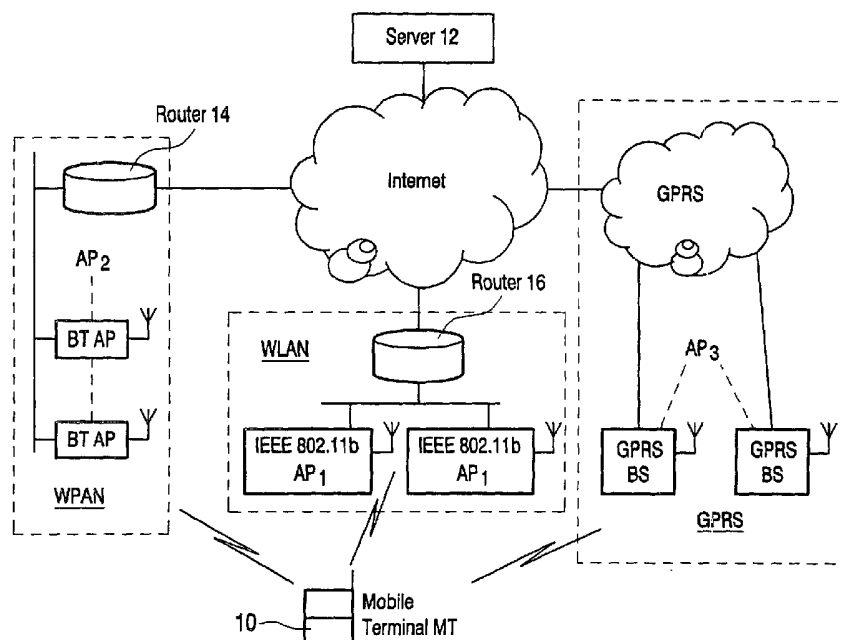
(57) **Abstract:** An arrangement is disclosed that enables a mobile device to manage multiple network interfaces in order to be substantially always reachable on the Internet. Wired LAN, Wireless LAN, Wireless PAN and cellular systems are technologies that are employed in the exemplary embodiment described. Scanning of the available network infrastructures is performed by a specific software agent implemented in a mobile device. User mobility profiles, power consumption, cached context information and application requirements are taken into account so that the end user can always communicate through the most appropriate network interface without explicit manual intervention.

INTERFACE SELECTION FROM MULTIPLE NETWORKS

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The present invention relates to interface selection from multiple
networks, especially wireless networks, and in particular, but not exclusively, to
interface selection by a mobile device from among a plurality of networks, especially
wireless networks, that may be periodically available at least temporarily in a
10   communications system.

Wireless local area networks (WLAN) are becoming popular nowadays,
not only in indoor environments but also in outdoor spaces. By means of wireless access
points, mobile/client devices can use networking services without a wired connection in
similar fashion to use of a wired LAN. General information on wireless LAN protocols
15   and systems may be found in "Wireless LANs", by Jim Geier, Macmillan Technical
press, 1999. One problem with WLAN is power consumption, which can become an
issue for portable devices like a personal digital assistant (PDA). Wireless Personal
Area Network (WPAN) technologies like Bluetooth^{TM} can offer wireless network
connectivity at a lower bandwidth but with significantly reduced power consumption.
20   When neither WLAN nor WPAN access infrastructure is available, a mobile device
would require a functionality which allows it to use other wireless systems, if available,
e.g. outdoor cellular systems like General Purpose Packet Radio System (GPRS) to
generate a new connection or possibly to stay connected with the Internet or with a
corporate intranet. If properly adapted, the same mobile device could be plugged into a
25   wired LAN when put into its docking station when coming back to office. At this point,
the device may well be stationary, but it will be appreciated that it may still be
considered a mobile device in reflection of portability or facility to change location.
The mobile device should therefore have multiple network interfaces
30   available, at least temporarily, that provide connectivity in a variety of contexts. Such a
terminal is described as a multi-mode terminal. These interfaces could be either

embedded in the device or can be manually inserted by the user, as in for example the case of plug-in cards. One device of this general type is disclosed in GB-2362237, in which a PDA has a base unit with at least a battery holder and a number of changeable modules which slot, slide or clip into the base unit. This prior art arrangement proposes

5   a card module that Implements radio frequency (RF) circuitry, link control and baseband functions for implementing wireless links, although there is no disclosure of how a selection could be made or implemented between a plurality of network interfaces which might become available for choice from time to time.

          To date, in cases where multiple options exist, there is no universal

10   solution to automatically decide which network interface any particular device should use at a particular time. In fact, some chipset and card manufacturers are announcing proposals for combination products ("combo' chipsets") that embed multiple wireless transmission standards and some of these already exist on the market. However, without supporting software, the user must always manually select one network interface to

15   connect to the Internet or to a corporate Intranet. This is the case for most operating systems like Windows CE and Windows XP as supplied by Microsoft Inc. USA or Linux.

          In order to use a specific wireless interface, a corresponding network infrastructure that provides access to a backbone network must be present and a

20   discovery procedure for available networks access must be provided. This discovery process can be time and energy consuming. Even scanning for all the frequencies of one system is so power consuming that mobile terminals for cellular systems conventionally do not do this but only scan a limited number of frequencies. Scanning for a specific wireless network infrastructure (e.g. WLAN) may result in a list of usable access points

25   to which the mobile device can connect. In case a WLAN infrastructure (as in the previous example) is not found, the WLAN interface in the mobile device cannot provide network connectivity and another one has to be investigated.

          Depending on the environment in which the user finds himself, it is probable, especially in the future, that there are multiple network infrastructures

30   available, at least temporarily. The prior art arrangements can therefore be seen to be deficient in the automation of discovering whether and which wireless network infrastructures are available and in consequently activating the proper network

interfaces. This may lead to deficiencies in a mobile device meeting a user's connectivity expectations, for example in terms of cost, convenience, power consumption and bandwidth. A user of currently disclosed arrangements may therefore experience difficulty in establishing or maintaining a location independent connection

5   to a backbone network like the Internet. This is the case with current arrangements, at least without manual intervention which may be considered as inefficient and generally undesirable.

It is an object of the present invention to provide improved network

10   selection from multiple networks and in particular, but not exclusively, to provide improved interface selection by a mobile device from among a plurality of networks, especially wireless access networks, that may be periodically available at least temporarily in a communications environment.

An automatic network interface selection mechanism would provide

15   benefits for the end user in terms of usability. Accordingly, the present invention provides a wireless client device for use in an Internet Protocol compatible communications network, said client device being adapted to communicate with said network in accordance with one of a plurality of communications standards and to make a selection for connection to said network from among a plurality of network interfaces,

20   said device being arranged in use to make a said selection automatically and according to a predetermined network interface selection policy implemented in said client device. Such a device may be called a multi-mode terminal. A client device may be a user terminal such as a mobile terminal.

A said network interface selection policy may be selected for

25   implementation by user intervention or by said client device itself from among a predefined set of said selection policies stored therein.

A said network interface selection policy may include a consideration of at least one of location or context awareness, preferably including a mobility parameter indicative of whether a said location or context is dynamic or static and/or an indication

30   of how such information has been gathered.

Said client device may be adapted to change automatically between network interface selection policies under predetermined circumstances, authority to

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