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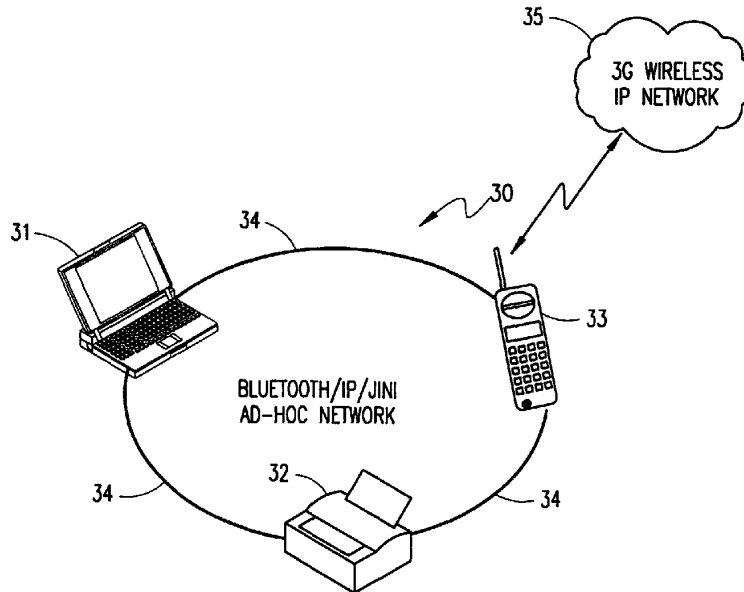
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(54) Title: AD-HOC NETWORK AND GATEWAY



(57) Abstract: A Bluetooth Piconet (30) includes a plurality of devices (31-33) having Bluetooth chipsets that are linked by a Bluetooth radio link. The Piconet is extended into an Internet Protocol (IP) wireless LAN (35) in order to utilize JINI technology for the sharing of services between devices in the Piconet. A Lookup Service (22) is implemented to make services available to the plurality of devices in the Piconet. A mobile phone (33) is configured as a gateway that provides a call-control interface between the wireless



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AD-HOC NETWORK AND GATEWAY

BACKGROUND OF THE INVENTION

Technical Field of the Invention

5 This invention relates to telecommunication systems and, more particularly, to an ad-hoc network and a gateway that provides an interface between external wireless IP networks and devices in the ad-hoc network.

Description of Related Art

10 Around the world, people are connecting more than ever. Cellular phones, personal digital assistants (PDAs), and Internet-enabled computers are commonplace in both businesses and homes. Even where a formal network is not recognized, users want their devices to communicate, and they want easy access to the services made possible by network technology. For example, there are networks in the home connecting audio/visual equipment such as televisions and stereo equipment to home office computers. There are also devices to control networks such as security surveillance systems and temperature-control thermostats.

15 A problem arises in today's environment because traditional networks are much too complex to set up, expand, and manage. For example, adding hardware or software to an office environment usually requires a network administrator to load drivers and configure systems. Even in a home environment, connecting all of the components of a home entertainment system can be a daunting task for the average consumer. Networks today are also too brittle and inflexible. A slight change in a network can cause havoc that can be extremely difficult to fix. From the consumer's perspective, what is needed is a simple way to connect digital devices into impromptu, expandable networks for immediate access to a wide variety of services.

20 New technologies are being developed to make it easier to network multiple devices. Bluetooth, for example, is a wireless communication technology for data and voice. It is based on a low-cost short-range radio link that operates in the unlicensed ISM band at 2.4 GHz. Bluetooth is a layer 1 (physical layer) and layer 2 (data link layer) technology that allows one universal short-range radio link to replace many proprietary cables that are currently required to connect one device to another. The

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physical layer provides transmission of signals and the activation and deactivation of physical connections, while the data link layer may include signal synchronization, error correction, sequencing, and flow control. This layer may also provide a data transmission link across one or several physical connections. Bluetooth, however, does not have any knowledge of the upper level network, transport, session, or application layers.

The Bluetooth wireless technology allows users to make effortless, wireless, and instant connections between various communication devices such as mobile phones and desktop and laptop computers. Transfer of both voice and data is real-time, and the transmission mode provides security of data and protection from interference. A small chipset is utilized to implement Bluetooth radio technology in a communication device. Two power levels are provided, a lower power level that is sufficient to cover the area within a single room, and a higher power level that can cover a medium range such as within a home. Each chipset includes software controls and identity coding that ensure that only those devices preset by the user can communicate over the radio link.

A Piconet consists of a collection of devices connected via Bluetooth technology in an ad-hoc fashion. A Piconet may comprise as few as two connected devices, such as a computer and a printer, and may comprise as many as eight connected devices (a "master" device and seven "slave" devices). Both point-to-point and point-to-multipoint connections are supported. When first establishing a Piconet, one device acts as a master and the other devices act as slaves for the duration of the Piconet network establishment. Thereafter, the devices behave as peer units. All devices in the same Piconet have priority synchronization, but other devices can be set to enter at any time. Multiple independent and non-synchronized Piconets form a Scatternet.

A JINI system is a Java-technology-centered, distributed software system designed for simplicity, flexibility, and federation. The JINI architecture provides mechanisms for machines or programs to enter into a federation where each machine or program offers resources to other members of the federation and uses resources as needed. The design of the JINI architecture exploits the ability to move Java

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programming language code from machine to machine, and it unifies, under the notion of a service, the user, the software, and the hardware components of the machines themselves.

JINI connection technology simplifies the processes of establishing, configuring, and controlling a network. From the user's perspective, JINI technology makes connecting to new levels of services as simple as turning on a light switch. From the traditional service provider's perspective, JINI connection software simplifies delivery and management of services. When a PC connects to a Local Area Network (LAN), for example, it uses an IP multicast mechanism to find a server. The server then assigns an IP address to the PC and provides the address of a JINI Lookup Service (LUS). The LUS contains a list of available services provided by other devices on the network. The LUS is also used by the PC to publish the services that it can provide to other devices on the network. Services are invoked by transferring a small amount of code written, for example, in Java code. Devices announce not only value-added services, but also their attributes and capabilities to the network. JINI technology “communities” are resilient, and adapt very quickly to changes as users come and go.

The Session Initiation Protocol (SIP) is an application-layer control protocol that can establish, modify, and terminate sessions or calls. These multimedia sessions include multimedia conferences, distance learning, Internet telephony, and similar applications. H. 323 is another call control protocol for IP telephony defined by the International Telecommunications Union (ITU).

Utilizing existing technologies, the following scenario can be realized. A user creates an ad hoc network based on Bluetooth technology (i.e., a Bluetooth Piconet). There are three Bluetooth devices in the Piconet: a third generation Internet Protocol (3G IP) mobile telephone, a Personal Digital Assistant (PDA), and a multimedia laptop computer. The mobile phone is the master unit, and the PDA and laptop are slaves to the mobile phone. Neither the PDA nor the laptop have a cellular radio modem or call control client software (H.323 or SIP) installed. Thus, neither the PDA nor the laptop know anything about the cellular IP network. Therefore, a problem arises when the user wants to establish a video call from his laptop.

Today, the only way to solve this problem is to insure that each device contains

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