V2Soft Viki Software

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Document Description:

This document contains data of Bluetooth Research which is made to get fundamental knowledge about wireless networks and Bluetooth architecture. We would use this information for Restaurant software project RAS-2005. It is not intended as a specification and items presented here are subject to change by the Viki Software team.

V2Soft RAS-2005 Project proposal						
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The original idea behind the Bluetooth was get rid of the cables between devices. Then, scope of it was expanded to the area of wireless LANs. In this document, we firstly investigate wireless networks; then give brief information about Bluetooth technology.

1.) WIRELESS NETWORKS :

Wireless technologies, in the simplest sense, enable one or more devices to communicate without physical connections—without requiring network or peripheral cabling. Wireless technologies use radio frequency transmissions as the means for transmitting data, whereas wired technologies use cables. Wireless technologies range from complex systems, such as Wireless Local Area Networks (WLAN) and cell phones to simple devices such as wireless headphones, microphones, and other devices that do not process or store information. They also include infrared (IR) devices such as remote controls, some cordless computer keyboards and mice, and wireless hi-fi stereo headsets, all of which require a direct line of sight between the transmitter and the receiver to close the link.

WLANs allow greater flexibility and portability than do traditional wired local area networks (LAN). Unlike a traditional LAN, which requires a wire to connect a user's computer to the network, a WLAN connects computers and other components to the network using an access point device. An access point communicates with devices equipped with wireless network adaptors; it connects to a wired Ethernet LAN via an RJ-45 port. Access point devices typically have coverage areas of up to 300 feet (approximately 100 meters). This coverage area is called a cell or range. Users move freely within the cell with their laptop or other network device. Access point cells can be linked together to allow users to even "roam" within a building or between buildings.

Ad hoc networks such as Bluetooth are networks designed to dynamically connect remote devices such as cell phones, laptops, and PDAs. These networks are termed "ad hoc" because of their shifting network topologies. Whereas WLANs use a fixed network infrastructure, ad hoc networks maintain random network configurations, relying on a masterslave system connected by wireless links to enable devices to communicate. In a Bluetooth network, the master of the piconet controls the changing network topologies of these networks. It also controls the flow of data between devices that are capable of supporting direct links to each other. As devices move about in an unpredictable fashion, these networks must be reconfigured on the fly to handle the dynamic topology. The routing that protocol Bluetooth employs allows the master to establish and maintain these shifting networks.

Wireless technologies conform to a variety of standards and offer varying levels of security features. The principal advantages of standards are to encourage mass production and to allow products from multiple vendors to interoperate. WLANs follow the IEEE 802.11 standards. Ad hoc networks follow proprietary techniques or are based on the Bluetooth standard, which was developed by a consortium of commercial companies making up the Bluetooth Special Interest Group (SIG). [1]



Figure 1. Wireless Local Loop (WLL)



Figure 2. Wireless Network Schema [2]

2.) BLUETOOTH TECHNOLOGY :

Bluetooth has emerged as a very popular ad hoc network standard today. The Bluetooth standard is a computing and telecommunications industry specification that describes how mobile phones, computers, and PDAs should interconnect with each other, with home and business phones, and with computers using short-range wireless connections. Bluetooth network applications include wireless synchronization, e-mail/Internet/intranet access using local personal computer connections, hidden computing through automated applications and networking, and applications that can be used for such devices as hands-free headsets and car kits. The Bluetooth standard specifies wireless operation in the 2.45 GHz radio band and supports data rates up to 720 kbps. It further supports up to three simultaneous voice channels and employs frequency-hopping schemes and power reduction to reduce interference with other devices operating in the same frequency band. The IEEE 802.15 organization has derived a wireless personal area networking technology based on Bluetooth specifications v1.1.

2.1) Bluetooth Architecture and Components :

As with the IEEE 802.11 standard, Bluetooth permits devices to establish either P2P networks or networks based on fixed access points with which mobile nodes can communicate. In this document, however, we only discuss the ad hoc network topology. This topology is meant to easily interconnect mobile devices that are in the same area (e.g., in the same room). In this architecture, client stations are grouped into a single geographic area and can be inter-networked without access to the wired LAN (infrastructure network). The basic Bluetooth topology is depicted in Figure 3. As shown in this piconet, one of the devices would be a master, and the other two devices would be slaves.



Figure 3. Bluetooth and Ad Hoc Topology

Unlike a WLAN that comprises both a wireless station and an access point, with Bluetooth, there are only wireless stations or clients. A Bluetooth client is simply a device with a Bluetooth radio and Bluetooth software module incorporating the Bluetooth protocol stack and interfaces.

2.1.1-Range :

Bluetooth provides three different classes of power management. Class 1 devices, the highest power devices, operate at 100 milliwatt (mW) and have an operating range of up to 100 meters (m). Class 2 devices operate at 2.5 mW and have an operating range of up to 10 m. Class 3, the lowest power devices, operate at 1 mW and have an operating range of from 1/10 meter to 10 meters. These three levels of operating power are summarized in Table 1.

Power	Power Level	Operating Range
High	100 mW (20 dBm)	Up to 100 meters (300 feet)
Medium	2.5 mW (4 dBm)	Up to 10 meters (30 feet)
Low	1 mW (0 dBm)	0.1-10 meters (less than 30 feet)
	High Medium Low	High 100 mW (20 dBm) Medium 2.5 mW (4 dBm) Low 1 mW (0 dBm)

Table 1. Device Classes of Power Management

The three ranges for Bluetooth are depicted in Figure 4. As shown, the shortest range may be good for applications such as cable replacement (e.g., mouse or keyboard), file synchronization, or business card exchange. The high-powered range can reach distances of 100 m, or about 300 ft. Additionally, as with the data rates, it is anticipated that even greater distances will be achieved in the future.



Figure 4. Bluetooth Operating Range

2.1.2-Bluetooth Frame Structure :

There are several frame formats, the most important of which is shown in Figure 5. It begins with an access code that usually identifies the master so that slaves within radio range of two masters can tell which traffic is for them. Next comes a 54-bit header containing typical MAC sublayer fields. Then comes the data field, of up to 2744 bits (for a five-slot transmission). For a single time slot, the format is the same except that the data field is 240 bits.



Figure 5. A typical Bluetooth data frame [3]

2.2) Benefits :

Bluetooth offers five primary benefits to users. This ad hoc method of undeterred communication makes Bluetooth very attractive today and can result in increased efficiency and reduced costs. The efficiencies and cost savings are attractive for the home user and the enterprise business user. Benefits of Bluetooth include—

• **Cable replacement**—Bluetooth technology replaces cables for a variety of interconnections. These include those of peripheral devices (i.e., mouse and keyboard computer connections), USB at 12 Mbps (USB 1.1) up to 480 Mbps (USB 2.0); printers and modems, usually at 4 Mbps; and wireless headsets and microphones that interface with PCs or mobile phones.

• Ease of file sharing—Bluetooth enables file sharing between Bluetooth-enabled devices. For example, participants of a meeting with Bluetooth-compatible laptops can share files with each other. In another example, a Bluetooth-compatible mobile phone acts as a wireless modem for laptops. Using Bluetooth, the laptop interfaces with the cell phone, which in turn connects to a network, thus giving the laptop a full range of networking capabilities without the need of an electrical interface for the laptop–to–mobile phone connection.

• Wireless synchronization—Bluetooth provides automatic wireless synchronization with other Bluetooth-enabled devices. For example, personal information contained in address books and date books can be synchronized between PDAs, laptops, mobile phones, and other devices.

• Automated wireless applications—Bluetooth supports automatic wireless application functions. Unlike synchronization, this typically occurs locally, automatic wireless applications interface with the LAN and Internet. For example, an individual working offline on e-mails might be outside of their regular service area—on a flight, for instance. To e-mail the files queued in the inbox of the laptop, the individual, once back in a service area (i.e., having landed), would activate a mobile phone or any other device capable of connecting to a network. The laptop would then automatically initiate a network join by using the phone as a modem and automatically send the e-mails after the individual logs on.

• Internet connectivity—Bluetooth is supported by a variety of devices and applications. Some of these devices include mobile phones, PDAs, laptops, desktops, and fixed telephones. Internet connectivity is possible when these devices and technologies join together to use each other's capabilities. For example, a laptop, using a Bluetooth connection, can request a mobile phone to establish a dial-up connection; the laptop can then access the Internet through that connection. Bluetooth is expected to be built into office appliances (e.g., PCs, faxes, printers, and laptops), communication appliances (e.g., cell phones, handsets, pagers, and headsets), and home appliances (e.g., DVD players, cameras, refrigerators, and microwave ovens). Applications for Bluetooth also include vending machines, banking and other electronic payment systems; wireless office and conference rooms; smart homes; and in-vehicle communications and parking.

REFERENCES :

- *[1] : WLANA, "Introduction to Wireless LANs"
- *[2] : Erina FERRO, "Wireless Networks"
- *[3] : Andrew S. TANENBAUM, "Computer Networks"