

**Evaluation Form – Technical Review Paper**

**Student Name/Project Section:** Jonathan King / L01

**Team Name:** The Cartel

**Team Members:** David Esiobn, Brandon Chong,

Mark Nfodzo, Christopher Pan

\_\_\_\_\_ / 30 Technical Content

- Current state-of-the-art and commercial products
- Underlying technology
- Implementation of the technology
- Overall quality of the technical summary

\_\_\_\_\_ / 30 Use of Technical Reference Sources

- Appropriate number of sources (at least six)
- Sufficient number of source types (at least four)
- Quality of the sources
- Appropriate citations in body of text
- Reference list in proper format

\_\_\_\_\_ / 40 Effectiveness of Writing, Organization, and Development of Content

- Introductory paragraph
- Clear flow of information
- Organization
- Grammar, spelling, punctuation
- Style, readability, audience appropriateness, conformance to standards

\_\_\_\_\_ / 100 **Total - Technical Review Paper**

## Wi-Fi Communication

### Introduction

Wi-Fi is the wireless technology that conforms to the IEEE 802.11 standards and is approved by the Wi-Fi Alliance [1]. The main application of Wi-Fi is for allowing internet access to mobile users. This paper looks into the current commercial applications of Wi-Fi, the way this technology works, and the way it is implemented.

### Commercial Applications of Wi-Fi

The main commercial application for Wi-Fi is network routers. This is because routers are the central hub of communication for all Wi-Fi devices and allow them to gain internet access. Without internet access, most Wi-Fi devices would not function. Some of the main manufacturers of these devices are Netgear, Belkin, and Linksys. They all have models in the same price range that perform comparably the same. Netgear produces the WPN824 model which costs \$99.99. Belkin produces the model F5D7231-4 which costs \$151.99, and Linksys produces the WRT54 GX model which costs \$129.99.

Another major commercial application for Wi-Fi is the Wi-Fi network Card. These cards allow desktops and laptops to access the Wi-Fi networks. The main manufacturers for these devices are the same as for the routers: Netgear, Belkin, and Linksys. The average cost is about \$25.00 for one Wi-Fi network card.

A newer commercial device that takes advantage of Wi-Fi is the broadband phone. Broadband phones enable phone calls to be placed over an internet connection. These devices implement Wi-Fi in order to allow them to be functional throughout a building. Some manufacturers of these devices are Vonage, ZyXel, and Samsung. The Vonage F1000BRB phone costs \$129.99. The ZyXel Prestige 200W costs \$249.99, and the Samsung SMT-W6100 costs \$299.99 [2]. These phones perform the same basic functions, but the price difference is for advanced features such as the phone's design.

### Underlying Technology of Wi-Fi

Wi-Fi products are WLAN devices that are based on the IEEE 802.11 standards. A WLAN uses either spread-spectrum or OFDM (Orthogonal Frequency-Division Multiplexing) modulation technology that is based on radio waves to allow devices to communicate with each other. The IEEE 802.11 standard that Wi-Fi conforms to uses Orthogonal Frequency-Division

Multiplexing modulation [3]. It also specifies that the network operates in the 5 GHz and 2.4 GHz public spectrum bands; most are on the 2.4 GHz public spectrum band.

In the 2.4 GHz spectrum band, the band is divided into 14 overlapping, staggered channels with all the center frequencies being 5 MHz apart. However, not all 14 channels are typically usable. Each country has different regulations that typically restrict which channels can be used. In the USA, the FCC regulations allow channels from 1 to 11 to be used for 802.11b operations.

The IEEE 802.11 standard also specifies the physical and MAC layers that are needed to communicate through Wi-Fi. The IEEE 802.11 standard includes three different physical layer implementations: diffuse infrared, frequency-hopping spectrum, and direct-sequence spread spectrum. The MAC standard for Wi-Fi is based on Carrier Sense Multiple Access with Collision Avoidance but includes some provisions to help minimize collisions.

IEEE 802.11 also specifies two basic modes of operation. Wi-Fi can either operate in Ad hoc mode which enables peer-to-peer communications between mobile users, or it operates in infrastructure mode which has each mobile user communicate through a central access point [4]. This central access point is typically connected to a wired LAN that provides internet access to the mobile devices. The 802.11 standard also includes the following two shared-key encryption mechanisms to help secure a WLAN: WEP (wired equivalent privacy) and WPA (Wi-Fi Protected Access) [5].

### **Building Blocks of Wi-Fi**

In order to implement a Wi-Fi network, both hardware and software is needed. The hardware required depends on which of the two network modes are being used. If Ad hoc is being used, no access point is needed. However if an infrastructure mode is being implemented, then an access point is needed. The access point is typically a wireless router that implements the IEEE 802.11 standards. The other hardware needed is an IEEE 802.11 card. These cards perform the MAC and physical layer communications for a device [6]. They are needed for all devices that want to access a Wi-Fi network and are typically embedded into the device.

The software required for implementing a Wi-Fi network is the drivers that interface the IEEE 802.11 card to the device's operating system. Typically this software is already written and embedded into the device being used. However for devices such as laptops and desktops, the drivers must be installed before they can interact with the Wi-Fi network.

## References

- [1] D. Lavery, "What is WiFi? An Introduction to Wireless Networks for the Small/Medium Enterprise (SME)" [online], [cited Sept. 1, 2007], available from World Wide Web: <<http://www.openextra.co.uk/articles/wifi-introduction.php>>.
- [2] F. Pilato, "Zyxel Prestige 2000W WiFi VoIP Phone Review" [online], [cited Sept. 1, 2007], available from World Wide Web: <<http://www.mobilemag.com/content/100/335/C4843/>>.
- [3] H. Labiod, H. Afifi, and C. De Santis. *Wi-Fi, Bluetooth, Zigbee and WiMax*. New York: Springer, 2007.
- [4] E. M. Royer and C.-K. Toh. "A review of current routing protocols for ad-hoc mobile wireless networks". *IEEE Personal Communications Magazine*, pages 46–55, April 1999.
- [5] D. Lavery, "WPA vs WEP: How your choice affects your wireless network security" [online], [cited Sept. 1, 2007], available from World Wide Web: <<http://www.openextra.co.uk/articles/wpa-vs-wep.php>>.
- [6] Linksys Technical Staff, *WMP11 Data Sheet*, Linksys, 2003.