The Decision Making Process of Integrating Wireless Technology into Organizations

Assion Lawson-Body
University of North Dakota, USA

Glenda Rotvold
University of North Dakota, USA

Justin Rotvold
Techwise Solutions, LLC, USA

INTRODUCTION

With the advancement of wireless technology and widespread use of mobile devices, many innovative mobile applications are emerging (Tarasewich & Warkentin, 2002; Varshney & Vetter, 2002; Zhang, 2003). Wireless technology refers to the hardware and software that allow transmission of information between devices without using physical connections (Zhang, 2003). Understanding the different technologies that are available, their limitations, and uses can benefit companies looking at this technology as a viable option to improve overall organizational effectiveness and efficiency.

A significant part of the growth in electronic business is likely to originate from the increasing numbers of mobile computing devices (Agrawal, Kaushal, & Ravi, 2003; Anderson & Schwager, 2004; Varshney & Vetter, 2000). Ciriello (as cited in Smith, Kulatilaka, & Venkatramen, 2002, p. 468) states that "Forecasts suggest that the number of worldwide mobile connections (voice and data) will grow from 727 million in 2001 to 1,765 million in 2005." With the huge growth anticipated in the utilization of wireless technologies, businesses are going to be increasingly faced with decisions on what wireless technologies to implement.

The objective of this article is to examine and discuss wireless technologies followed by presentation and discussion of a decision model that was formed to be used in determining the appropriate wireless technology. Technologies appropriate for both mobile and wide area coverage are discussed followed by technologies such as WLANs, which are used in more local, confined areas with short to medium range communication needs.

This article is organized as follows. The first section contains the various generations of Wireless Technology; in the second, WLANs are examined. The following section describes a decision model. In the next section, technology concerns are discussed, and the final section presents the conclusion.

WIRELESS TECHNOLOGY: GENERATIONS

There has been an industry-wide understanding of different "generations" regarding mobile technology (Varshney & Jain, 2001). Currently, there are also several technologies within each classification of generations, but the technologies are not necessarily finite in these generations.

First Generation

First generation (1G) contains analog cellular systems and does not have the capability to provide data services. The only service is voice service that can be provided to mobile phones. Two technologies worth noting are advance mobile phone service (AMPS) and frequency division multiple access (FDMA). AMPS is a first generation analog cellular phone system standard that operates in the 800 Mhz band. AMPS uses FDMA (an access/multiplexing technology) which separates the spectrum into 30 kHz channels, each of which can carry a voice conversation or, with digital service, carry digital data. FDMA allows for

multiple users to "access a group of radio frequency bands" and helps eliminate "interference of message traffic" (Dunne, 2002).

Second Generation

Second generation (2G) is a digital wireless telephone technology that uses circuit-switched services. This means that a person using a second generation-enabled device must dial in to gain access to data communications. "Circuit-switched connections can be slow and unreliable compared with packet-switched networks, but for now circuit-switched networks are the primary method of Internet and network access for wireless users in the United States" (Dunne, 2002). In this generation one will find Global System for Mobile communications (GSM) which is a network standard, in addition to time division multiple access (TDMA) and code division multiple access (CDMA), which are multiplexing technologies. The 2G technology that is most widely used is GSM (a standard with the highest use in Europe) with a data rate of 9.6 kilobits per second (Tarasewich, Nickerson & Warkentin, 2002). TDMA works with GSM while CDMA does not, but CDMA is more widely used in the United States (Dunne, 2002).

TDMA allows many users to use the same radio frequency by breaking the data into fragments, which are each assigned a time slot (Dunne, 2002). Since each user of the channel takes turns transmitting and receiving, only one person is actually using the channel at any given moment and only uses it for short bursts. CDMA on the other hand, uses a special type of digital modulation called Spread Spectrum, which spreads the user's voice stream bits across a very wide channel and separates subscriber calls from one another by code instead of time (Agrawal et al., 2003). CDMA is used in the U.S. by carriers such as Sprint and Verizon (Dunne, 2002).

Two and One-Half Generation

There is a half generation that follows 2G. 2.5G exhibits likenesses of both 2G and 3G technologies. 2G wireless uses circuit switched connections while 3G uses high-speed packet switched transmission. Circuit-switching requires a dedicated, point to point physical circuit between two hosts where the bandwidth is reserved and the path is maintained for the entire session. Packet switching, however, divides digitized messages into packets, which contain enough address information to route them to their network destination. The circuit is maintained only as long as it takes to send the packet resulting in cost savings.

High-speed circuit-switched data (HSCSD), enhanced data GSM environment (EDGE), and general packet radio service (GPRS) exist in this generation. HSCSD is circuit switched, but can provide faster data rates of up to 38.4 Kbps, which sets it apart from 2G. EDGE separates itself from 2G by being a version of GSM that is faster and is designed to be able to handle data rates up to 384 Kbps (Tarasewich et al., 2002). GPRS uses packet switching. GPRS, a service designed for digital cellular networks, utilizes a packet radio principle and can be used for carrying end users' packet data protocol such as IP information to and from GPRS terminals and/or external packet data networks. GPRS is different by being a packet data service. A packet data service provides an "always-on" feature so users of the technology do not have to dial in to gain Internet access (Tarasewich et al., 2002). Although this technology is packet based, it still is designed to work with GSM (Dunne, 2002).

Third Generation

This generation is what will occur next. Although 3G has recently been deployed in a few locations, it is now in the process of being deployed in additional regions. This process of installation and migration to 3G will take time to completely implement on a widespread basis across all areas of the globe. There will be high-speed connections and increasing reliability in this generation that will allow for broadband for text, voice, and even video and multimedia. It utilizes packet-based transmissions as well giving the ability to be "always-on." 3G is capable of network convergence, a newer term used to describe "the integration of several media applications (data, voice, video, and images) onto a common packet-based platform provided by the Internet Protocol (IP)" (Byun & Chatterjee, 2002, p. 421). Whether or not the protocol used for packet-based transfer (on a handheld or smart phone) is the Internet Protocol, depends on the devices.

A derivative of CDMA, a wideband CDMA is expected to be developed that will require more bandwidth than CDMA because it will utilize multiple