Evolving Wireless

Evolving Technologies Committee 2000

Wireless today might be defined as the insane need to reach everyone, anytime, from anywhere, instantly, along with the rush to access the Internet similarly. Its evolution is interesting because of its haunting parallels with the historical development of wireless radio technologies.

The military began tinkering with the first wireless information technology, audio communication using electromagnetic radiation, during the 1880s. Then, telegraphic communications were tried in areas where lines were geographically unfeasible--across oceans, for example. While there were some early private efforts to broadcast news, concerts, or an occasional story, the concentration of early research and progress on the Marconi invention can be credited to the U.S. Navy. The goals were to develop a useful communications service for tracking ships at sea as well as emergency weather conditions. Greater progress in radio engineering by the government occurred when cease and desist orders interrupted the use of privately owned radio transmitters during the early years of World War I. [U.S. Early Radio History]

The Internet evolution, a primary force behind current wireless communications, is a dazzling story of both chaos and cooperation between the government and private industry. The Internet's original objective was to act as an invincible communications defense system for the Department of Defense. It came about in 1964, when Mr. Paul Baran of the Rand Corporation, answered a difficult strategic question proposed by the U.S. military, i.e., how the U.S. communications systems could survive a nuclear attack. The goal was to replace a central hub concept with equal decentralized communication nodes. Funded primarily by the Pentagon's Advanced Research Projects Agency (ARAPA) it was quickly dubbed as the Internetting project. [POINT]

Another interesting parallel, was the wild investment fervor that precipitated commonplace radio. Wrote Victor H. Laughter in 1909, "It will only be a matter of time before all the 'get rich quick' wireless concerns will be forced out of existence, due to the fact that the investors will demand some proof of the concerns being able to substantiate their claims and show actual operating stations". Ninety years later, in *Internet and IPO Mania*, John C. Dvorak writes, "We all watch the Internet IPO (initial public offering) market with awe as a variety of companies, run by every imaginable executive type from newbie, to pimple-faced kids, to sharp operators, sell their corporate stock. These are companies that are unlikely to ever make any money, but which are now worth more, insofar as market capitalization is concerned, than many long established Fortune 500 companies. It's hilarious to watch these stocks fly high." [Operator's Wireless Telegraph and Telephone Hand-Book] [Online Boardwatch]

All oracles of demise, whether from the time of the earliest technologies to the most current, seem unmoved by the public's insatiable appetite for faster communications and customized information. Even the highly static output (sine waves, the stuff of amplitude [am]) of early wireless communications, amazed the population when incredible news of the times, such as the sinking of the Titanic, were broadcasted as early as 1919. By the mid 1920s, one out of every six homes owned a radio and both networks and program content effused. During the 1940s, frequency radio (fm) technology was invented, but was not incorporated into the consumer market until the 1970s. And while some predicted its doom, radio has endured as a priceless cultural commodity, post TV. [U.S. Early Radio History]

The burgeoning of wireless computing and telecommunications in information technology no doubt causes us some degree of dismay as we ponder on the size of our computer networks, the closets, and all the tangled wires beneath our desks. And then there are the staggering costs associated with connecting our universities over the past decade. Well don't throw out all the wires yet. While many university network managers are already fairly well versed in the technical aspects of wireless, the business drivers are more obscure. It is going to take some practice managing wireless within your environment. While the convergence of voice and data are driving business decisions, working with a multitude of carrier options that change on a weekly basis, as well as daily innovations may become the most frustrating piece of going wireless.

On the horizon, 3G-like performance, ever-decreasing power consumption, radio-frequency architectural enhancements such as cryogenics, improved clarity through ever-shrinking silicon chips, etc., are just some of the technologies that will reduce costs and improve wireless performance very quickly. Current bandwidth limitations of 1MB to a shaky. But rumors among vendors believe that 11MB is operational and the numbers are moving up quickly. [Wireless Week] [Planet Analog]

Wireless technology is now encompassing a broad spectrum of *non-mobile* devices, i.e., satellites, digital TV, base stations, and wireless network connections. While some of these technologies may intersect various needs within specific college departments or university businesses, it appears that the major change on the campuses will be through applications involving *mobile* wireless.

Today, the development of a new radio chip technology called "Bluetooth" is big, and difficult to compare to any evolving technology in our recent past history. There is, indeed, a massive rush to collaborate, standardize, partner, and build specifications around Bluetooth among large computing and communications companies such as IBM, Ericsson, Nokia, Toshiba, Lucent, Intel, Microsoft, 3Com, and Motorola to name a few. Bluetooth engineering opens the door to wireless interactive communication among and between multiple devices, (portable computers, cell phones, palms, etc.) in a chaotic non-networked environment. Concurrently, there is a drive to standardize wireless technologies globally.

Bluetooth allows the wireless computer to update the palm that receives messages from the cells or pager and vice versa. Static or interference are already conquered within current ranges and unlike the infrared technology, used with, for example, some palmtops, Bluetooth radio frequencies do not require a direct line of sight. The demand is high for improved screen performance, improved Web access with portal options, speech-recognition software, video transmission, a smart calendar, an infinite global directory service, and multiple filter options. [Fortune 500] [GSM Data Knowledge]

How quickly bandwidth will grow to an acceptable level before decision-makers in universities jump on the wireless band-wagon is probably a rhetorical question. A piconet today is surely the giga-net of next week. Piconets (imagine a LAN within a room or floor that has no wires) are encoded and secured against eavesdropping. In some instances, the networking structure is circumvented by other technological creations, a simple add-on that allows wireless to work in wired environments.

Why Wireless on a Campus?

Using the new wireless technologies in universities will follow typical business cases. One case may be that without wireless access, the students will not come. Another case is that productivity improvement can be associated with wireless offices portable devices. The first area is best illuminated in a February 04, 2000, by K. Dulaney, R. Egan, and E. Purchase, entitled, *How to Build a Wireless Office: The Next Wireless Revolution*. They state that, "Good investments in wireless networking and mobile workers will pay significant dividends for enterprises. Even today, the extra productivity of workers who use notebook computers at home (typically for three to five hours per week) more than makes up for the additional support costs. Investing in effective wireless technology will likely make mobile workers up to 30 percent more productive. [Gartner Group]

In a more recent May 10th document, a Gartner Group Strategic Planning Assumption, *Wireless Value: A Killer Attitude, Not a Killer Application,* states that, "Wireless applications will not be driven by a single killer application but by an overall killer attitude: "I can do anything, anywhere, at any time. Through 2004, growth in the use of consumer-oriented mobile services will be driven more by consumers creating value than by service providers delivering it (0.6 probability).

When Should You Begin to Take Wireless Seriously?

At least one wireless classroom may be the norm for most universities today. Teaching and wireless seem to be a natural. The advantages are many, especially, financial savings and unfettered classrooms. "Johns Hopkins University already uses a wireless network for laptop computers on a few floors in its School of Public Health. Ross McKenzie, director of Information Systems for the school, said the cost savings with wireless came to about $15,000 per room, when compared to a standard wired network. ...The school has drawn attention because it's one of the largest higher education institutions not just studying a wireless network, but using it."

The real issues surround bandwidth and how soon wireless devices can support true university collaborative research. Researchers already have a pretty accurate idea on how far they can push out the technologies to apply large scale, real time, network applications. For example, multicasting, multistreaming applications, and synchronous communications technologies are necessary tools for successful electronic learning and instructional collaboration, truly functional digital libraries, telemedicine, and virtual research laboratories. In brief, you cannot have true collaboration if the Internet allows you to see or transfer another's data or formula, but does not allow you to interact with it in real time. In other words without current delays in audio or visual transmission; when both can share the same data base in real time on a split computer screen; access the same data through a shared application, and interface at the same time, i.e., on yet another split screen, and share a white board that both can write on just as if they were sitting across the table from each other in the same room—wirelessly, then research will have experienced another sea change.

We only can imagine what community benefits might come from sharing real time medical imaging, laboratory experiments, or satellite data among professionals during a virtual conference--over wireless. It seems then, that wireless is not quite ready for prime-time research.[POINT]

The Culture Pushing the Change

On Thursday, July 06, in eWEEK, Carmen Nobel and Scott Berinato write that the, "…numbers indicate that the number of wireless devices accessing the Internet will soon surpass that of

PCs. International Data Corp. predicts 50 million handheld devices will be in the work force by 2003, a good portion of them with wireless capabilities. IGI Consulting foresees an 88 percent increase in the number of smart phones produced by 2003, jumping to 330 million units. And Forrester Research Inc. expects that 57 percent of the total work force will be mobile within two years.[PC WEEK]

Writes David Lake in, *Wireless Net: Not Yet*, "Only 6 million people will surf the Net via mobile devices in 2000. Optimistic forecasts say this number will rocket to 484 million in five years. The Gartner Group outlines specific predictions according to the expected match between consumer demand and wireless services. "The critical issue for mobile access is latency--the sum of all interrelated, end-to-end service connections, search, and delivery times. Many users will become frustrated more by problems of latency and time than by bandwidth shortage." Is the optimism in sync with the reality? Do either matter as universities make choices? Maybe not as much as matching great new solutions to current needs as they arise across an enterprise. [The Standard]

Each university must evaluate, strategically, how they want to handle computing enterprise-wide for the next five years or so. Sample the University of Wisconsin's "Project 1.6 - Wireless Campus". Their approach: "a change from port-based to MAC-based authentication so that users can 'plug-in' from anywhere on campus, a plan must be developed to also eliminate the 'plug' and proceed to a wireless campus." The timeline they are working from is two to five years out with an approximate cost of $1,500 per classroom and $600 per computer.

How Should Wireless Be Approached?

Governance and university regulations are many and may be used to propel broader wireless use and acceptance or turn out to be real sticky wickets that obstruct implementations and acceptance. For example, the U.S. Federal Communications Commissions E911regulation requires that wireless network operators must pass a caller's phone number cell site and cell sector location to a public safety answering point if personal wireless connectivity is used to call 911. Those universities with medical schools and hospitals will enjoy incredible opportunities around just this one application. Each medical staff could track, through verifiable *Location Based* applications, the site of a medical emergency. Immediately available to ambulance services are navigation instructions, the extent of the emergency needs and other services being called, rescue teams, roadside services, weather conditions, etc.

We only can imagine what community benefits might come from sharing real time medical imaging, laboratory experiments, or satellite data among professionals during a virtual conference. The anytime, anywhere concept completely changes communications when there are accidents, crimes, storms or other natural disasters. Communication and data input during archeological digs or ecological adventures in rain forests are examples of why academics will treasure wireless.

Recent news from the Advanced Networking Project with Minority-Serving Institutions (AN-MSI) describes how tribal colleges and universities will soon benefit from a project to test wireless technology to provide multi-service IP--enabling voice, data, and video. ….One objective for the project is to explore the effectiveness of wireless technology as a solution to data transmission problems. Project Director Tom Davis notes that wireless technology can help address long-term inequities, such as the lack of telephone access to significant portions of tribal areas. He adds that as information technology is becoming central to economic activity, "those places without access to such technology are, most likely, going to be relegated to second class economic status within this country and the world." [AN-MSI]

Do unwired connections, however, also change communication policies? Most universities have a set of policies governing the correct access and use of information technology, covering faculty, staff, and students. Assume that in five years, most communications completely circumvent the *ownership* of communications hardware, and consequently, the rules and regulations of a university. Ergo, a look at a partial statement from one of Emory's policies as an example.

> "Electronic Information Technology Systems at Emory University are essential and indispensable tools for learning, research and administration. It is the policy of the University that its computing, telecommunications, video, and associated network facilities be used ethically and legally, in accord with applicable licenses and contracts, and according to their intended use in support of the University's mission. Any use that would impede teaching and research, hinder the functioning of the University, violate an applicable license or contract, or damage community relations or relations with institutions with whom we share responsibility, is a violation of this policy."

Tracking the use of wireless communications is not obvious. Will a university license with providers be interpreted as one of "its networked" facilities, especially if the student is using personal equipment that he or she pays for using the same globally accessible towers? Since broad security is still nebulous within the wireless world of development, university policies may need a quick look-see to cover privacy, authorization, disclosure, access, discrimination, and conduct.

For EduCause 2000 – Evolving Technologies Committee

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Planet Analog: *Signal Processing Future of computer design lies beyond CPU*

by Chappell Brown
EE Times
July 17, 2000 (2:45 p.m. EST)

It is now possible to put the computational power of former supercomputers on a tiny chip of silicon and embed that system in virtually any household product. In that sense, the future of computing has already arrived.

However, the electronics industry, and the public along with it, have become a bit blinded by the success of this single technology. Other critical areas of information technology have not developed as fast. Displays, chip and system packaging, interconnect within and between systems, power supplies-in short, everything needed to build a workable product-have not enjoyed the blazing development speed of circuit technology. July 17, 2000
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