

3G

by

Chaelynn M. Wolak
wolakcha@scsi.nova.edu

A paper submitted in fulfillment of the requirements
for DISS 740 - Assignment Three, Task One

School of Computer and Information Sciences
Nova Southeastern University

December 9, 1998

Abstract

You never leave home without it. It is one piece of the electronic world that keeps you in touch with your family, friends, and even work. It is your mobile communication device (i.e. cellular phone). Mobile communications are about to undergo another major advancement. Third generation (3G) wireless technology is up and coming. This research paper takes a look at the basics of 3G and the problems associated with the development of it.

3G

The time has come, you have entered the new dimension. Cords, cables and wires are nonexistent. It is space where no man (or woman) has gone before. No, I am not talking aliens, space creatures, or even the Twilight Zone but the wireless zone.

Communication is entering a new phase of life based on the initiatives in wireless technology. Changes in the marketplace are creating a mass consumer electronic market focusing on the wireless industry. Personal communications systems (PCS), wireless email, wireless interactive television are just some of the inventiveness. However, the time has come for a new universal, global standard called 3G.

3G is abbreviated for third generation. It is the next mobile data communication phase in the wireless world. It is a vision where a new generation of services is available. Data rates at the speed of 2 Mbps, web browsing, seamless videoconferencing, and an array of multimedia applications in one global wireless network are just some of the inspirational concepts behind this vision.

Today, inviting pricing schemes and vast improvements to handheld devices have made wireless strategies more practical and compelling than ever. “Wireless data can no longer be passed off as a highly specialized tool for vertical applications – in this incredibly competitive business landscape, being at a loss for up-to-the-minute information can mean being at a loss for business” (Surkan, 1998).

It looks as though 3G might be the charm. However, there is still much work to be done. “To deliver all the services and content enjoyed by desktop users to mobile users, application developers need to create efficient wireless applications and wireless service providers need to make higher bandwidth capacity available to their users” (Bethoney, 1998). This research paper takes a look at the basics of 3G and the problems associated with the development of it.

The Basics

Global roaming among multiple countries with a smorgasbord of computer ‘bells and whistles’ is just some of the highlights of 3G. 3G is being developed by the International Telecommunications Union <<http://www.itu.org>>, through its International Mobile Telecommunications 2000 initiative (IMT-2000). “IMT-2000 is an ITU initiative which aims to provide wireless access to the global telecommunication infrastructure through a combination of satellite, terrestrial, fixed and mobile systems. It is being developed on the basis of a ‘family of systems’ concept defined as a federation of systems providing IMT-2000 service capabilities to users of all family members in a global roaming offering” (ITU Press..., 1998).

Reasons for 3G

This initiative is a result of the mobile communication boom that is taking place. One of the main drivers for this new standard is the requirement for voice telephony, one-to-one speech communication. “Since the launch of the first mobile phones just two decades ago, mobile telephony has achieved outstanding success with the consumer. No longer the play things of the rich or the tools of high-powered business men or women, cellular phones have evolved to become an everyday accessory” (ITU Press..., 1998).

First generation cellular phones were based on Advanced Mobile Phone Service (AMPS). It is an analog technology utilizing circuit-switched services. It is currently being replaced by second generation mobile technology. Second generation wireless communication includes the following: Code Division Multiple Access (CDMA), Time Division Multiple Access (TDMA), Personal Communications Services (PCS), High Speed Circuit Switched Data (HSCSD) and General Packet Radio Services (GPRS). These current second generation technologies have their limitations. “For a start, they are simply not capable of supporting the high bandwidth applications which characterize the kinds of systems users will demand as we move into the next century. Today’s cellular phone generally operate a speeds of just 9.6kbps – very slow by comparison with wireline communications, and certainly nowhere near fast enough to support applications like audio and video e-mail, real-time videoconferencing or high-speed Internet connection” (ITU Press..., 1998).

Another big push into 3G is the current complicated maze of mobile standards utilized in different countries and regions around the world. “First and second generation mobile systems were not designed to be global systems but rather nation or at best regional. At present, many mobile phone users are frustrated by the fact that even though they can enjoy international roaming within their own region, their phone simply does not function in certain countries. This means either losing contact while travelling in certain regions, or having to go through a complicated procedure of renting a special phone with a new phone number” (ITU Press..., 1998).

Lastly, equipment vendors are urging for a new set of mobile communication standards. “So far, the big impetus for 3G has come mainly from the vendors, who have pushed for standards in the hope they can both promote their own technologies and avoid falling behind to competitors and to network computing vendors that have developed a keen interest in the growth potential of wireless data” (O’Keefe, 1998). All of these reasons have led to the development of 3G.

3G Description

3G presents a huge architectural design challenge. Trying to build multiband and multimode capability into pocketsize devices has put extreme pressure on developers. “Developers must decide on the number and types of IC cores in embedded or

ASIC/system-on-chip architectures, as well as software/hardware partitioning schemes and operating systems. One pressing question is how to get at least an order of magnitude more Mips out of DSPs and CPUs without exceeding power, space and cost constraints” (Thryft, 1998).

3G has two different processor requirements. The first one consists of the physical communication link. Since 3G has a much larger bandwidth, the digital signal processor (DSP) requirement increases dramatically. “Second, the host processor may either do less than before in a net-centric wireless mobile unit where applications are run on the server, or it may do considerably more, if it must run video and graphic applications” (Thryft, 1998).

Processor requirements are not the only differences from existing first and second generation technologies but so is the signal processing. 3G needs an increase in error correction since it has the capability to handle mobile data. “For voice, a bit error rate of 10^{-3} or 10^{-4} is sufficient, using Viterbi error correction, said Kevin Stone, ZSP’s product marketing engineer. But for data, you must get the bit rate down to 10^{-6} by using additional correction techniques” (Thryft, 1998).

3G’s architecture is still being worked out. Some developers believe 3G requires more than one central processor. The architecture could consist of more than one RISC microprocessor and/or microcontroller cores. However, the ideal situation is to have one powerful central processor that would manage the air interface, protocol stack and modem, and handle real-time tasks, as well as application-layer programs. “While standards groups are attempting to resolve the differences by the end of the year, equipment developers are facing a tight deadline. Deployment schedules call for roll out of 3G services as soon as 2001 in Japan and 2002 in Europe leaving little time for lab tests and field trials” (Mayer, 1998).

3G promises to be the personal communication of choice. “This hybrid ‘personal computer’ will combine a wide range of different functions in a single, pocket or purse-sized unit. It will be voice activated, obviating the need for clunky number pads. It will come with a flexible, pullout screen for video telephony or for viewing pages on the World Wide Web. It will serve as a portable computer which can connect seamlessly and quickly to the remote corporate environment; a communications device capable of sending and receiving data, voice, sound and images; and an electronic secretary which reminds us of our daily schedule, books our meetings, dials our routine calls for us and automatically connects us to the virtual meetings via-audio and videoconferencing functions” (ITU Press..., 1998). However, in creating this euphoria of supreme wireless communication technology, come its problems.

The Problems

As with all new generation technologies, come the growing pains. “The most prolific battle to emerge has been over air interface standards, and manufacturer and carriers supporting competing technologies have waged political wars over which standards should be forwarded to the ITU for consideration” (O’Keefe, 1998). The number of specifications set forth to ITU is by 15 different candidates. Each one of them has their own variations of 3G. Out of the 15, one that was selected by ITU will not license its technology to other manufacturers. Qualcomm recently announced it would not license its wideband CDMA technology. As a result, ITU is now looking at European Telecommunications Standards Institute. “European Union members are pushing for adoption of an approach based on the Global System for Mobile (GSM) communications. If that happens, insist some U.S. competitors, led by developer of rival code division multiple access (CDMA) technology, they would effectively be locked out of most of the European market” (Leopold, 1998).

This one issue is being driven more by political and economic means rather than technology. So much so, now the U.S. Senate is involved. “Earlier this month, the U.S. Senate approved a Sense of the Senate Resolution supporting the concept of multiple 3G standards” (Gohring, 1998). However, not all advocates of 3G feel this way. Perry LaForge, executive director of CDMA development group stated “It’s incumbent on the U.S. to see convergence of the specifications” (Meyers, 1998). The battle over this is still ongoing. One analyst feels that if the standards debate continues, it will threaten the market opportunity for 3G systems. “The delay and the infighting is a bad thing for the whole industry,’ said Andrew Cole, senior manager at Renaissance Worldwide. The economies of scale aren’t there with multiple standards. It creates a discord for the U.S. vs. the rest of the world” (Meyers, 1998).

Another major problem resides here in North America. “Unlike Europe, where digital wireless was rolled out with a global system for mobile communications five years ago, and many Third World nations, which have no existing infrastructure and will likely leapfrog directly to 3G services, second generation wireless is still nascent in the United States” (O’Keefe, 1998). Phillip Redman, telecommunication analyst, believes it will be awhile before the United States sees 3G. “He predicts serious 3G deployment won’t hit these shores for at least five years, primarily because build-out of second-generation digital networks is occupying most U.S. carriers’ time” (Parker, 1998).

Many individuals feel the real issues surrounding 3G lie in the areas of migration. “Beyond much of the hype about the multimedia capabilities of 3G, the migration path from one generation to the next is far from clear” (O’Keefe, 1998). Spectrum problems plague the 3G development. The 230 MHz of spectrum around the 2 GHz band allocated for 3G services in the United States is not enough. Industry and government agencies are scrambling to find the required spectrum space. “One problem, U.S. officials said, is that spectrum allocated by European regulators for 3G services has been claimed in the

United States by the Defense Department and NASA” (Leopold, 1998). Federal agencies are expected to be key in sorting these spectrum disputes with ITU members.

The problems listed above are just a few of the major concerns over the development of 3G. The visionaries need to work out the details soon in order to market 3G in the required time frame. Otherwise, 3G could go down in history as the great communication utopia.

Conclusion

“In less than twenty years the global wireless communications subscriber base has reached over 200 million customers, a figure which forecasts predict will exceed half a billion by the early years of the 21st century” (ITU Press..., 1998). As the new Millennium approaches, the demand for ‘more’ in digital wireless communication is exponential. It looks as though wireless is here to stay.

The vision of 3G is years ahead of the clunky old phones from the first generation cellular technologies. Even though 3G is experiencing growing pains such as one common standard, second generation technology build-out, and spectrum allocation, it still has great potential. 3G presents enormous advantages with its global roaming, video conferencing, Internet access, and most of all its electronic secretary. I wonder if the electronic secretary comes with a housecleaning option too.

Reference List

- Berendt, A. & McClure, B. (1998, September). Third generation growing pains. *Telecommunications*, 32, 28.
- Bethoney, H. (1998, October 19). Wireless has a bright future. *PC Week Labs*.
- Gohring, N. (1998, June 8). AT&T pursues 3G. *Telephony*, 234, 86.
- Gohring, N. (1998, September 28). 3G standard battle rages on. *Telephony*, 235, 34.
- Gohring, N. (1998, October 5). 3G pushes open networks. *Telephony*, 235, 14.
- ITU Press & Public Information Services. (1998, October 15). ITU leads the way in third generation evolution.
- ITU Press & Public Information Services (1998, October 17). The ITU takes mobile into the third millennium.
- Leopold, G. (1998, August 31). 3G-wireless debate shifts to spectrum management. *Electronic Engineering Times*, 1023, 4.
- Mayer, J. H. (1998, November). Get ready to test 3G wireless technology. *Test & Measurement World*, S5.
- Meyers, J. (1998, October 5). Guilt by association. *Telephony*, 235, 60.
- O'Keefe, S. (1998, August). Wireless data: The "generation gap". *Telecommunications*, 32, 57.
- Parker, T. (1998, September 21). 3G or not 3G: When is question. *Twice*, 13, 37.
- Subramanian, R. & Tanurhan, Y. (1998, October 26). 3G wireless specs to reshape industry. *Electronic Engineering Times*, 1032, 67.
- Surken, M. (1998, October 19). The wireless connection. *PC Week Labs*.
- Thryft, A. R. (1998, July 27). '3G' wireless terminals challenge architectures. *Electronic Engineering Times*, 1018, 69.