

"Broadband Wireless Technology"

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Abstract

Our ultimate goal is to communicate any type of information with anyone, at anytime, from anywhere. This is only possible with the aid of wireless technology. For the last two decades, wireless communication technologies have enhanced our communication networks by providing an important capability, i.e., mobility. In line with the increasing popularity of Internet (multimedia) communications in fixed networks, cellular systems are evolving from simply providing traditional voice and fax communications services to providing Internet services. Convergence of wireless communications, computing and Internet will be the driving force towards a wireless multimedia society. In Feb. 2003, over 80% of cellular phones in Japan are equipped with Internet communication functions. It seems that a cellular phone is not just for voice conversation, but is a communication tool. Since the present cellular communication systems (often referred to as 2G systems) are optimized for real-time voice services, they have quite limited capabilities in providing broadband multimedia services because of their low data transfer rates and small displays on the portable phones.

Broadband multimedia services will soon be in full force in fixed networks based on the next generation Internet technology. Information transferred over the Internet will become increasingly rich. Demands for downloading of ever increasing volumes of information will become higher and higher. The IMT-2000 systems, called the 3rd generation (3G) systems, are under deployment with much faster data rates and better representation than present 2G systems. Recently, wireless LAN with much faster data transport and roaming capabilities is also gaining popularity for nomadic services. Wireless LAN covers hot spot areas, e.g., homes, shopping areas, railway stations, airports, hotels, for accessing Internet. Although the 3G systems and wireless LANs are designed to provide data rates up to 2Mbps (currently 384kbps in service) and 54Mbps, respectively, the capabilities of 3G systems and present wireless LAN systems will sooner or later be insufficient to cope with the ever-increasing demands for broadband communications. Giga-bit wireless technology (up to 1G bps) will be required that is optimized to broadband IP packet transport over the air. This will be the task of the next generation (4G) wireless systems.

In this presentation, we will overview today's standards of 3G cellular and wireless LAN systems and foresee how the different wireless systems will evolve into a global wireless system. We will look at the frequency efficient broadband wireless technology that will be the core of 4G wireless systems. As for the wireless access, very high spectrum efficiency requirement is of paramount importance because of very limited available bandwidths. There may be two approaches to realize Giga-bit wireless: from DS-SS and from MC-SS. Since wireless links are severely power-limited for such a Giga-bit wireless, adoption of the well-known and long-time used cellular concept may not be applied. Adoption of the virtual cell concept that allows flexible installation of micro base stations may be a better solution.

I would like to emphasize that very difficult but interesting technical challenges are waiting for us before the realization of the broadband wireless technology.