Preface

'Life is beautiful if powered by wireless technology'

Congratulations. By opening this page you have become part of a great conversation. When I first proposed the 3Gwireless'2000 Conference back in 1998, lots of issues were unclear about this new technology. Now we are meeting at 3Gwireless'2002 where we have tremendous progress on this technology and the 3Gwireless system has been already deployed in some countries.

Wireless mobile communication normally has a ten-year evolution cycle, five years for research and development, and another five years for implementation and deployment. While 3Gwireless starts to deploy worldwide, research on next-generation mobile technology is already on track. The Delson Group's World Wireless Congress and Fourth-Generation Mobile Forum (4GMF) opened the door for this very hot 'beyond 3G' research and development in this planet.

When the first generation mobile phone came to the world, people greatly enjoyed its easy wireless communication. I still remember how much I loved the first mobile phone. It was like a brick, easy to stand-up and cost me a thousand dollars. In the early 90s, everyone talked about digital, and GSM (the second-generation mobile phone) came into life. The only difference for me to use GSM compared to the old one is more information displayed in the phone time, name and short message but it was still expensive for me in the early beginning. GSM is the product of our digitalised society and benefited a lot from it. GSM hand phone became the no. 1 fashion commodity in China. In many under-developed provinces in China, people worked hard every day just to get a GSM phone rather than buy anything else, and young people tried to save lunches to pay for the new phone though still over 20% of GSM phones have never been in service.

The Internet created lots of wealth as well as noise. Now we really cannot survive without the Internet, and cutting off e-mail is like cutting off our oxygen. Information exchange has become one of the most important parts of life.

The Internet pushed the mobile communication hard to the edge of technology because the voice-centric GSM does not have much capability to deliver value-added Internet traffic. Business is driven by the market and 3Gwireless was quickly rolled out into the market with huge investment and involvement from lots of engineers, researchers and marketing professionals.

The objective of 3Gwireless is very clear: to extend the Internet traffic to the mobile terminal and unwire the Internet. Therefore, the major improvement of 3Gwireless is on

the new air interface called Radio Transmission Technology (RTT) to support high data rate transmission over the radio link.

However, when people dream of the beautiful wireless future, one fundamental issue was brought to the table: where is the **spectrum** for all this activity?

While Internet networking business cooled down, most investors changed their focus to wireless, especially broadband wireless technologies which greatly promoted the development of short-range wireless products. Wireless Local Area Network, wireless Personal Area Network and broadband wireless access, etc. have just flooded the world. They work in the licensed bands or unlicensed bands, and they consume a huge amount of spectrum. So again, do we have enough spectrum?

From all over the world, every week, we have one wireless standard coming out whether it is international, national or just a local standard. By 2010, there may not be any standard at all because there are too many standards already in this small planet.

So, how can we survive in this wireless storm?

Convergence of wireless mobile and local wireless access is the only solution!

The next generation mobile terminal (4G Mobile or called 'Beyond 3G') should be a multi-band, multi-standard, multi-mode and multi-media personal communicator with an embedded converged broadband wireless system core. Whether you are in the office, home, airport or shopping centre, etc, the communicator will automatically connect to the broadband short range wireless access networks (i.e. Wireless LAN, etc) to provide high-speed wireless connections. If you are on the move and cannot reach these local wireless access systems, you will be automatically switched to the wireless mobile networks. If both wireless mobile and wireless access networks are available, the default connection mode is local wireless access. This converged wireless system has, at least, the following benefits:

- greatly increases the spectrum utilisation with spectrum sharing and reuse
- brings more bits to the wireless users as most broadband services are in the local wireless access domain
- integrated numbering, billing and enhanced security
- full use of wireless network resources
- guaranteed seamless wireless Internet communications

This is the concept of the fourth-generation mobile communications (4G Mobile), and the proposed vision of the Fourth-Generation Mobile Forum (4GMF) by the Delson Group.

From the user perspective this 4G Mobile vision can also be described as a multi-sphere level concept. In the first level the user connects all carried devices like a camera, phone, mirror glasses for images, watch, etc. in a PAN (Personal Area Network) by short range connectivity systems. The second level links the immediate environment like a TV, a PC, a refrigerator, etc. to the user. Level three ensures the direct communication to instant partners as other users and vehicles. Different radio access systems like terrestrial mobile systems, satellite systems and HAPS (High Altitude Platform Stations) are provided in level four for full area coverage. These levels are surrounded by the Cyber World (services and applications domain) in level five, where games, access to databases and the Internet, communication etc. are provided. Therefore, the different communication relations person-to-person and mainly machine-to-person and vice versa and machine-to-machine will determine mobile and wireless communications in the future.

This vision from the user perspective is the driving force for **seamless services** and applications via different access systems (air interfaces) for future developments. Due to the future-dominating role of IP-based data traffic and applications, networks and systems have to be designed for economic packet data transfer. The fixed Internet penetration is growing in parallel to the mobile radio penetration. About 80% of fixed Internet users are also using mobile communications. Therefore, these users want to get the same services on wireless terminals. These services require a high degree of asymmetry between uplink and downlink especially for Internet type services with much higher expected capacity on the downlink.

This 4G Mobile vision can be implemented by integration of these different evolving and emerging wireless technologies in a common flexible and expandable platform to provide a multiplicity of possibilities for current and future services and applications to users in a single terminal. The available, emerging and evolving radio transmission technologies have basically been designed in the classical vertical communication model that a system has to provide a limited set of services to users in an optimised manner. The 4G Mobile system will mainly be characterised by a horizontal communication model, where different air interfaces as cellular, cordless, WLAN type systems, short range connectivity and wired systems will be combined on a common platform to complement each other in an optimum way for different service requirements and radio environments. These wireless systems will be connected to a common, flexible and seamless converged core network. The mobility management will be part of a new Media Access System as interface between the core network and the particular wireless technology to connect a user via a single number for different systems to the network. This will correspond to a generalised access network. Global roaming for all wireless technologies is required. The interworking between these different systems in terms of horizontal and vertical handover and seamless services with service negotiation including mobility, security and QoS will be a key requirement, which will be handled in the newly developed Media Access Control System and the core network.

Let's back track to the purpose of this book. Why do we call it *Broadband Wireless Mobile*? People like the mobile phone much more because of its mobility than just because it is wireless. The mobile services continue to dominate the whole of wireless communications, and therefore, the fourth generation is still focused on the mobile business (called 4G Mobile). Meanwhile, W-LAN may become part of the mobile communications since each W-LAN base station can act as the mobile wireless router in terms of traffic management and access control.

The world changes too fast. When I first talked on 3Gwireless in 1995, only a few people attended my seminar. Now everyone is talking about "3G", "Beyond 3G" and 4G Mobile. My invited speech in Stanford attracted nearly one thousand wireless professionals and my recent talk in China witnessed over ten thousand people – unbelievable!

So, what's the conclusion? A New Wireless Storm is really coming!

Thanks Delson Group for great efforts in organising the 3Gwireless conferences and 4G Mobile Forum to help promote the education, research and business of this emerging wireless technology worldwide.

I hope you enjoy reading this book, and find it useful.

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